

Powertrain Requirement Specifications Part III

Electrical Components, Control Technology and Production- Oriented IT Systems

Version 2021

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1 General Information

1.1 Preface

All new procurement projects at Daimler AG are characterized by very demanding cost-reduction targets and by extremely high requirements with regard to the productivity of the production equipment.

In addition to the manufacturing-related optimization of the workpieces, there is an ongoing detailed revision of the technical standards of the production equipment.

The results are recorded in the following specifications:

➤ Powertrain Requirement Specifications Part I	General Information
➤ Powertrain Requirement Specifications Part II	Mechanical Components
➤ Powertrain Requirement Specifications Part III	Electrical Components, Control Technology and Production-Oriented IT Systems
➤ Powertrain Requirement Specifications Part IV	Production Equipment
➤ Powertrain Requirement Specifications Part V	Documentation
➤ Powertrain Requirement Specifications Part VI	IT Security
➤ Powertrain Requirement Specifications	Workpiece-Specific Scope (created individually by the planner)

As a basic rule, any suggestions from our suppliers to improve the availability of production equipment or provide potential savings will be given careful consideration. Should you have any such suggestions, please do not hesitate to submit these to Daimler AG. The contact for this purpose is the representative of the relevant project.

1.2 Validity and Obligations

These requirement specifications define the production equipment specifications "Electrical Components, Control Technology and Production-Oriented IT Systems" for all production-sites and centers in the divisions

- Mercedes-Benz Cars Powertrain (abbreviated as "MO") of Mercedes-Benz AG and
- Daimler Trucks Powertrain (abbreviated as "Trucks") of Daimler Truck AG and jointly referred to as "Daimler" in the following.

**Compliance with the requirement specifications is binding and shall be confirmed in the bids.
The requirement specifications and project handbooks of the product partners applicable at the time of contract award are binding.**

The requirements of MBN 9666 shall be met. The specifications in these requirement specifications supplement the requirements of MBN 9666.

If the vendor feels that deviations are required with regard to individual points, this shall be indicated in the bid and approved individually in writing by Daimler.

The contractor shall ensure that all parties involved in the contract adhere to the latest Daimler regulations.

This tender document may not be disclosed to third parties without the prior consent of Daimler!

1.3 Record of Revisions

Version:	Last revised:	Chapter:	Changed by:
15.0		<ul style="list-style-type: none"> • 2.1.8 DGUV-V3 Measurement: Details on execution • 2.4.3 Pneumatic Valve Clusters: New Appendix 11 on use of I/O extension modules • 3.5.1.3 Limitation of the average PLC cycle time in production mode • 3.5.2.3 and 3.5.2.4 Energy Efficiency: Partitioning in measures for energy saving (energy manager) and specifications on recording energy and substance consumption • 4.12.1 Virtual Commissioning: Details on execution • Appendix 11: New appendix on use of I/O extension modules • Appendix 16a (DMC for machine suppliers): Addition of plausibility check • Appendices 40, 41 (styleguides for the SW templates for S7/300 and 1500): Deletion and transfer to Supplier Portal/SFX (see Appendix 42) 	Project SLA "Standard Major Assemblies Requirement Specifications," AP 1.3
2020	1.7.2020	<ul style="list-style-type: none"> • 2.1.3 Machine Electric Circuits: Inaccessible disconnect device in front of main switch • 2.3.7 Machine Cooling and Switch Cabinet Cooling: max. 45°C • 2.4.4 Cables and Wiring: Line safety switch without LED • 2.4.4.1.3 Moving Lines: Formatting error corrected • 2.7.1 Safety Switch with Lock: Illuminated push button switch corrected • 2.7.2.3 Portable Press to Run Device: Number of plug-in points • 3.5.1.3 General Software Specifications: max. PLC cycle time S7-1500 • 3.5.1.3.4 Training on Powertrain S7 Template: Revised • 3.5.2.3 Energy-Saving Measures – Energy Manager: Revised • 3.5.2.4 Recording of Energy and Substance Consumption Rates – Energy Data Monitoring: Revised • 4.9.2.4 Exhaust Flap: Revised • 4.12.2 Internet of Things (IoT): Revised • IT Security Specifications: Updated • Appendix 02: Operating mode concept updated • Appendix 30: Profinet specifications updated • Appendix 36 removed (Normative References) • Appendix 43: Virtual commissioning revised • Appendix 44: IoT specifications adapted • Fanuc project book: Revised • SEW project book: Revised • Siemens project book: Restructuring • Robots: General revision • Welding technology: General revision • IT Interface List: New update status 	Project SLA "Standard Major Assemblies Requirement Specifications," AP 1.3

Version:	Last revised:	Chapter:	Changed by:
		<ul style="list-style-type: none"> Cell system: Adaptation of the standard telegrams in the assembly process 	
2021	22.3.2021	<ul style="list-style-type: none"> 1.3.1.3 Component Approvals via DEEP: Newly added 1.7 Software Update: Reference changed to Part VI and nomenclature for versioning template library and blocks added 2.1.1 Power Supply: Reference to missing Appendix 22 removed 2.1.6 Machine Shutdown Management: Documentation references updated 2.3.4 Service Sockets and Interfaces: Network connection design change 2.3.5: Hardware Firewall/Network Connection/Router: Figure for Gaggenau plant changed 2.4.4 Cables and Wiring: 4-pin actuator/sensor lines no longer permissible and halogen-free lines required in the field installation in the case of increased fire load 2.6.1.1 Profinet: Reference to Indu-Sol inspector added and M12 Power L coding without FE preferred 2.7.2.3 and Appendix 2, 1.1.3: Specification of the max. line length and portable enabling device stated more precisely: Minimum number of HT8s defined 3.5.1.3 General Software Specifications: Binding use of the software template 3.5.1.4 NC Programs: Omission of NCPA tool and NC sample program 3.5.1.5 Data Backup: Scope extended 4 Systems: Detailed messages from subsystems stated more precisely and use of IPCs according to hardware basket 4.2 Path-Measuring Systems: Omission of measuring system deselection and reference to Siemens extranet 5.1 General Information: Reference to IT boundary conditions removed 5.2 PRISMA MDA/PDA SCADA System: Acceptance process stated more precisely <p>Appendices:</p> <ul style="list-style-type: none"> Appendix 10 - Overview of Product Partners: BoschRexroth screwing systems approved Appendix 15a – RCD Regulation: Revised Appendix 30 - PROFINET Specifications: Revised Appendix 36 - Normative References: Omission Appendix 37 - Safety Switches: Distance from protective door switch to control panel corrected Appendix 43 – Virtual Commissioning: Revised Appendix 46 - Plant 010 System Firewall: Deleted Appendix 47 - IoT Truck: Newly added 	Project SLA "Standard Major Assemblies Requirement Specifications," AP 1.3

Version:	Last revised:	Chapter:	Changed by:
		<p>Project books:</p> <ul style="list-style-type: none">• Apex project book: Revised• Fanuc project book: Revised• Project book: Indu-Sol Profinet/network diagnosis newly added• SEW project book: Revised• Siemens project book: Revised• Robot requirement specifications: Revised• Welding Technology: Revised <p>IT Systems:</p> <ul style="list-style-type: none">• IT Interface Catalog: No changes• Cell System: No changes• Quality Alarm: No changes	

1.3.1 Changes from Version 2020 to Version 2021

Any changes in the Function Descriptions and significance from the previous version are indicated as follows:
Newly added text is underlined (and also displayed in blue in the file).

Deleted text is ~~crossed-out~~.

In both cases, the lines / paragraphs concerned are marked at the left margin by a vertical line.
Changes made for editorial reasons are not marked.

1.3.1.1 Component Approval Systems (BFS)

Use of the respective component approval systems (BFS) must be requested from the person responsible for the project management when the bid is awarded. At the moment, the MDM and DEEP systems are available to the Powertrain plants from Daimler.

1.3.1.2 Material Approval List for Electrical Components (MFL-E) via the "Material Data Manager (MDM)" Online Database

The current component part approvals are accessible online via the Internet database "MDM – Material Data Manager" in "MFLs – Material Approval Lists" – Link: www.materialdatenmanager.de

The following applies to all Powertrain MO sites:

- The approved components are stored in the relevant project. These projects are found under Structure / Project structure / Daimler plants / Plant XXX / Shop / Building / Manufacturer / EQ number / if necessary Sub-EQ - number. This structure can vary depending on requirements.
- Enablement is required to view the project. This shall be requested from and set via the representative. If the project has not yet been clearly defined, access is possible using a token. This is provided by the representative.
- The parts lists shall be transferred from the joint CAD project Electrical components/Fluid with Eplan P8 via the EPLAN/MDM interface 2 into the MDM. The check on approval and the requesting of the special approvals shall be done by the contractor in the MDM.
- The parts lists for the mechanical components shall be uploaded via Excel. (In the MDM, in the strap parts list, there is a template.)
- All deviations for the approved component parts in the project require a special approval that call for the power train MO sites via the MDM in the project structure.
- All component part manufacturers that are represented in the parts list shall be documented in the MDM and have an assignment. The error "Manufacturer not found" shall not occur.
- For each parts list import, the accompanying plan shall be uploaded in the MDM as a navigable, searchable PDF.

-
- For the circuit diagram approval, the parts lists shall be uploaded and marked "valid"; changes in the ongoing process shall be updated Once the design engineer has uploaded and checked the BOM, a BOM task shall be created for the recipients responsible. This represents the start of their check.

Caution: Should you see data records in the "Material approvals" structure or in the "Project structure" structure written in italics, they are not approved. (The same also applies for viewing the catalog in the "Component Part Manufacturer Including Accompanying Data" view.)

In the Truck area, the procedure is different. Work is performed either in the MFL structure or – as described above – in the project structure. Please clarify this at the project start.

1.3.1.3 Component Approvals Using DEEP (Digital Engineering Equipment Portal)

The currently applicable component part approvals are accessible online via the DEEP Internet database
Link to DEEP via the Supplier Portal

- The approved components are stored in the relevant project. These projects can be found in the DEEP structure. This structure can vary depending on requirements.
- The contractor can invoke DEEP through the Daimler Supplier Portal and will then be assigned the access details and roles applicable to its order.
- The parts lists must be transferred from the joint CAD project Electrical components/Fluid with Eplan P8 via the device lists and SLE into the DEEP database. The check on approval and the requesting of the special approvals shall be done by the contractor on DEEP.
- The parts lists for mechanical, electrical components and fluid power systems are to be merged in the SLE database.
- Any deviations from the approved component parts in the project require special approval. These special approvals must be applied for via DEEP.
- For each special material approval application, the current E-Plan must be uploaded to DEEP as an accessible, searchable PDF.
- For circuit diagram approval, the circuit diagrams themselves and the associated device lists must be available on DEEP.

The complete material approval list/documentation guideline will be provided by Daimler upon request.

1.4 Contacts

For general, content-related questions regarding understanding of the requirement specifications, send an e-mail to the address below:

LH3-Elektrik@daimler.com

Please contact – in accordance with the further processing/data processing-compliant procedure – the representative specified on the client's side in the case of order-specific questions.

1.5 Identifications for Sites and/or Scopes of Validity

Unless otherwise indicated, the chapters/sections are valid for all sites and/or scopes of validity.

Examples:

The chapter on power packs for supply and disposal systems has a limited scope:

...

Power pack for supply and disposal systems

|

5

...

- The text passage applies to one site only:

...

In deviation from Appendix 22, a current measurement facility to be agreed upon separately shall be implemented for systems larger than 100 kVA.
current measuring setup is to be agreed upon separately, unlike with Appendix 22.

Y

...

- The blank or missing identification field on the right indicates text that applies from here on to all sites and all scopes of validity:

...

2.1.1.1 Machine Connections

...

1.5.1 Sites

In the case of limited validity, the sites to which the chapter/section **applies** are identified as follows.

Code	Meaning
A	Plant 010 (throughout)
E	Plant 040, Berlin (MO/PT)
F	Plant 068, Hamburg (MO/PT)
G	Not assigned
W	Not assigned
X	Plants 030, 034, in Gaggenau, Axle production center/production center for converters, parts, sheet metal/Transmission production center (Trucks)
Y	Plant 069, Kassel, Axle PC (Trucks)
Z	Plant 020, Mannheim, Engine production center (Trucks), Foundry production center (Trucks)

1.5.2 Scope of Validity

If the scope of validity is limited, the corresponding chapters / sections are identified as follows:

Code	Meaning
1	Mechanical production incl. machine linkages
2	Assembly incl. machine linkages
3	Test stands
4	Handling technology, sorting magazines, stock, shipping
5	Supply and disposal systems
6	Standard production equipment with workpiece-bound equipment and additional automation <ul style="list-style-type: none">• Clock-pulse controlled, automatically controlled installation, with impact on K factor• Using large and medium standard control panels and control panel interface for connection to MDE/BDE SCADA system
7	Standard production equipment with workpiece-bound equipment and additional automation <ul style="list-style-type: none">• Clock-pulse controlled, automatically controlled installation, with impact on K factor
8	Standard production equipment
9	Washing machines

The range of validity of the requested machines has to be taken from the request for quotation or requested from Daimler.

Codes 1 to 5 comply with the specifications for all special machines as per MBN 9666.

1.6 Special Components

If components are used due to a special approval, it shall be ensured that these or 100%-compatible components can still be procured for a period of 10 years after the acceptance. If the component is no longer available, the supplier shall designate a component that is compatible in terms of function/connection.

If this is not possible, Daimler reserves the right, even after such a period has elapsed, to charge the machine supplier for the conversion costs which become necessary owing to the non-availability of replacement parts.

If the subsequent machining of purchased and standard parts cannot be avoided, then the component in question shall be correspondingly identified in the parts list and the production/modification drawing shall be supplied.

Excerpt from MBN 9666

"... If components are subject to customer protection at the manufacturer, they shall be replaced by standard components. If this is not possible for technical reasons, such protection shall be lifted to allow us to procure replacement parts. The affected component parts shall be listed separately and submitted for approval. ..."

1.7 Software Update

The machine and production facility suppliers are obliged to carry out software updates. These shall be implemented per component even after contract award up to the time of acceptance (flawless condition as per acceptance test report) max. 2x free of charge.

The client and contractor shall agree in writing on the need and point in time of an update.

This does not include updates due to identified IT security vulnerabilities. If necessary, these shall also be carried out multiple times and quickly by the contractor (for specifications for this, refer to Requirement Specifications Part VI).

The components in detail:

HMI (project DVD pilot statuses shall be upgraded to the release versions even after the acceptance)

Daimler S7 template (HMI and PLC)*

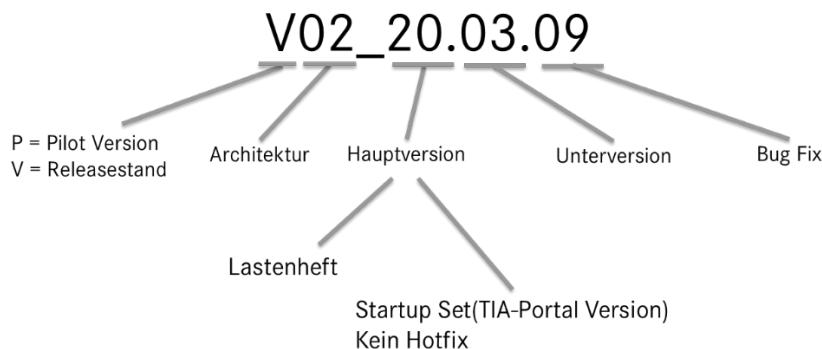
Daimler robotics template*

Engineering tools from our product partners (updates regarding versions and service packs)

* Definition regarding updates on Daimler templates:

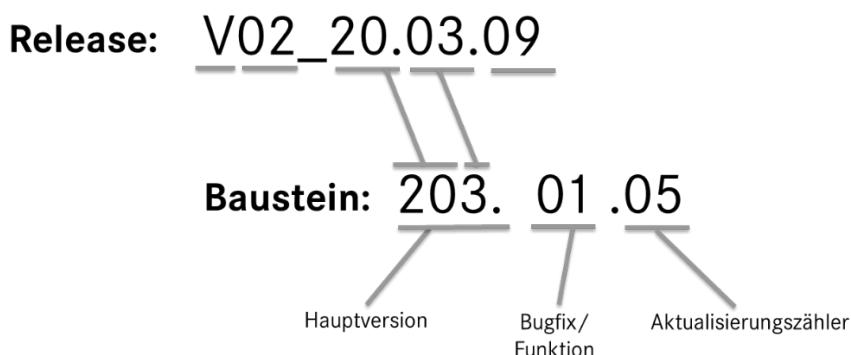
Bug fixes (3rd digit in version) in individual blocks of the Daimler templates are not counted as updates. "Update" (2nd digit in version) refers to the upgrading of the entire Daimler templates to a new sub- or main version

Library template version nomenclature



A pilot version (test version) shall not be used productively and shall always be upgraded to a release status prior to release.

Block template version nomenclature



1.8 Machine Options

All options that are not used shall be deleted from the documentation as well as from the hardware and software. This also applies e.g. to HMI graphics that are not required.

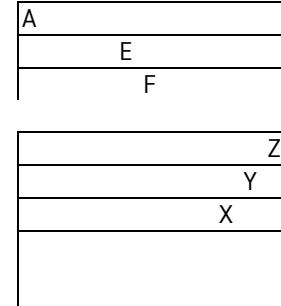
2 Installation

The specifications of "Appendix_06_-_Assembly Notes_Complete" shall be complied with.

2.1 Electrical Supply

Machine connection is from (site-dependent):

Plant 10	below
Plant 40	above
Plant 68	below
Supply/disposal systems	below
Plant 020.....	below
Plant 069	below
Plant 030	below



2.1.1 Power Supply

A central supply point shall be provided for the electrical power supply (if appropriate: the distribution cabinet).

The location of the power supply cabinet shall be laid down.

Power infeeds and main distribution systems may only be loaded to 90% of the permissible rated values as specified in DIN EN60204 / VDE 0113.

The main connection will be implemented in a 5-conductor system (TN-S)

Within the switch cabinet, implementation of a 4-conductor system (TN-S) is obligatory.

Appropriate measures shall be provided to prevent uncontrolled movements in the case of voltage loss (working/service brake, Siemens CMS module or comparable).

At the Kassel plant, power supplies larger than 10 mm² are partly connected in the 4-conductor system; the machines shall therefore be supplied with a PEN bridge.

2.1.1.1 Machine Connections

The electrical power supply to the machines is via the internal 0.4 kV network.

Supply throughout is by 5-connector TN-S system

Exception: direct connection of a frequency converter/inverter shall be done WITHOUT "N" conductor (neutral). If a 5-core cable is used, at each end the "N" conductor shall be permanently connected to the "PE" conductor (ground).

Symmetrical three-phase connections shall be used.

Single-phase loading may be up to 10% of the connected capacity. If there is more than one single-phase load, these loads shall be distributed equally over the three phases.

Voltage dips of less than 200 ms may not result in machine outages.

To ensure conformity according to Section 3 of the German Electromagnetic Compatibility Act, EMVG, status June 2008, the supplier of machines and devices is obliged to clarify the physical ambient and operating conditions incurred at the installation location in its design engineering and design principles (DIN EN 60204-1:2007-06, Safety of Machinery - Electrical Equipment of Machines) with Daimler AG prior to planning, to take these into consideration, and therefore to ensure lawful operation.

The machine or equipment representative responsible or the operator at MBC and Trucks will provide the supplier (manufacturer and/or commissioning engineer) with the required physical ambient and operating conditions at the installation location (connecting point and/or network node). The Electromagnetic Compatibility Act considers all electrical and electronic instruments, systems, facilities and networks containing electrical or electronic components to be equipment.

For the design of the electrical equipment of the machine(s) or equipment, the values for immunity (interference immunity) and emissions (interference emission) specified in the interface agreement on "Electricity & EMC" apply according to point 4.3 of EN 60204-1:2007-06 and there supersede Appendix B. The physical environmental and operating conditions detailed there (DIN EN 60204-1:

2007-06, Section 4.4) apply vis-à-vis the interface agreement in Appendix 23 as a legally binding product agreement for the requirement and/or technical specifications and shall be checked and documented at

(system) commissioning or at the time of the operational system + inspection.

Stress data specified by the client in the interface agreement that cannot be confirmed by the contractor shall be approved by the client. The contractor shall agree to supplementary data.

For specifications on the connected load of the object of delivery (ramp-up characteristics, balanced characteristics) the total loads entering in the contractor's overall work order always apply; simultaneity factors shall be kept in mind. Actual-nominal deviations greater than +/-30% from the connected load specified by the client are charged proportionately to the contractor according to the incurred costs (reserve capacity / expanded capacity).

If a machine is connected via several single wires per phase, this shall be communicated to the representative responsible.

2.1.1.2 Implementation

The supplier shall provide appropriate connection options with sufficient space and strain relief. Switch cabinet grommets can be found in the material approval list (in the MDM).

The minimum clearances to the connection terminals are:

Cross-section	min. clearance to switch cabinet base cable entry
up to 6mm ²	200mm
up to 25 mm ²	250 mm
up to 50 mm ²	350 mm
up to 120 mm ²	500 mm
up to 240 mm ²	800 mm

If the machine has to be connected via parallel cables, terminals or rails as needed shall be provided.

The connection terminals shall be dimensioned with a matching cross-section.

The cable gland (threaded connection/grommet) required for the energy supply shall be provided by the machine manufacturer.

The connection will be performed by Daimler.

Maximum 120mm²

X Y

2.1.2 Supply Voltages

Definition:

Control voltage ON: corresponds to main switch ON

Load voltage ON: corresponds to machine ON

The control voltage and the voltage for the EMERGENCY STOP circuits is 24 V DC.

The 24 V power supply for

- Sensor system
- Actuators

shall be separately fused from each other. Separate fuse modules shall be provided for the actuators and sensor systems.

A distinction is made between buffered and non-buffered consumers. Buffering is only necessary in the case of PLC systems if communication with an order system is carried out or data are handled e.g. using shift registers in the system/machine.

Power pack:

- Buffered: PLC-CPU (for PLC systems), CNC buffering via CMS module of Siemens -> see project handbook of Siemens. The components can be found in the MFL (in the MDM).
- Non-buffered: ID systems, amplifiers, HMI, PC systems, network components, bus electronics, sensor system, actuator system, safety circuits, remote operation actuator system and sensor system
- Separate fuse protection for:
 - Control panel + machine control panel
 - PLC-CPU
 - Switches in the switch cabinet
 - Corded hand-held scanners

Power pack for supply and disposal systems

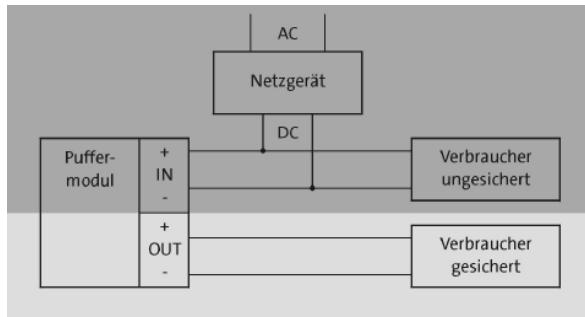
- Buffered: PLC-CPU, control voltage, bus components

5

Power pack 2:

Space shall be reserved in the switch cabinet incl. fuses

Basic wiring diagram for power supply unit: 24 V supply buffering:



On all equipment supplied with power at 400 V and 24 V, these circuits shall be reliably separated (PELV specification).

This applies likewise to plug and socket connectors and cables. If necessary, switching relays/optical couplers shall be installed.

It should be ensured that overcurrent trips in the secondary circuit interrupt the power by means of electronic fuses in the event of overcurrent. The tripping behavior of cable protection switches shall be ensured by controlled switching power packs. Manufacturers' instructions shall be complied with.

Tripping shall be recorded individually, displayed on the control panel in plain text, and forwarded to the MDA/PDA system.

Control and power supplies shall be fused separately inside and outside of the installation compartment. In doing so, ensure that functional groups and components are logically bundled together.

2.1.3 Machine Electric Circuits

Voltages upstream of the mains disconnector device:

A shutoff device that is externally inaccessible and located in the switchgear cabinet shall be available.

Contrary to the MBN, single wires (up to 2.5 mm²) and sheathed cables shall be made orange for the entire length upstream of the main switch. Single wires >2.5 mm² shall be given an orange marking of at least 5 cm at the connecting points.

- Service sockets
- Switch cabinet lighting
- Safety circuits for interlinked systems
- Screwdriver voltage supply
- PC systems except system control panels
- Ink-based marking systems
- Maintenance room/work room lighting
- Energy measurement components

Voltages after the main switch, before "machine on"/load voltage ON:

- System control panels
- Switching cabinet cooling systems
- Voltage supply for robots
- PLC controller incl. I/O bus, sensors
- Complete safety circuits, including safety door operation
- Activation of cooling water valves
- Remote operation (see Appendix 7b)

Voltages after "machine on"/load voltage ON:

- Load circuits downstream of safety circuit
Comment: Load circuit reaction to interruption of the safety function
All hazardous movements and energies shall be prevented.
- Cut-in or major consumers (e.g. servo drives, motors, frequency inverters, line filters, etc.)

2.1.4 Bus Bar Systems Outside the Switch Cabinet

When using bus bar systems, the scope of delivery of the machine manufacturer shall be observed:

Distribution cabinet with main switch (black handle), busbar with the necessary outgoing modules to each unit/station, including the power supply and any subdistribution boards at units/substations.

**For the safety of the single busbar sections and units/stations, lockable circuit breakers shall be used.
The structure of the distribution shall be agreed with Daimler.**

Robots and measuring stations, etc. integrated into units/stations are supplied from the unit/station switch cabinets. For safety, appropriate automatic circuit breakers shall be provided. The wiring is included in the scope of delivery of the machine supplier. It shall be possible to isolate the unit/station switch cabinets from the access level by means of a single disconnecting switch (black, unless it has an EMERGENCY STOP function).

2.1.5 Disconnecting Switch

Notes on execution:

The main switch and the supply line shall not hide any components on the assembly board

It shall be possible for the supply line to be spatially separately laid without wiring ducts on the assembly board having to be used or crossed

Bars for mounting a strain relief for the connection line shall be provided

The PE bar shall be installed near the connection of the outer conductors so that the PE conductor can be directly put on top

The installation of the circuit breaker is to be coordinated for the specific machine.

For front installations with door cutout, the assembly aids as per the material approval list (in the MDM) shall be used; however, these are non-preferred by Daimler

Installation in the side wall is possible; make sure that no components are covered

No circuit breakers with door couplings are allowed.

Whereas the main switch acts directly to switch off the load disconnecting switch, switching off via the "Machine OFF" button shall be logically connected with the machine's operating states.

It shall be possible to switch a flexible cell on and off on the load side by way of the central control system.

2.1.6 Machine Shutdown Management

The current Daimler energy manager shall be used.

The switching principle for the remote ON/OFF of machines and the sample circuit can be taken from Appendix 7b.

A current description and blocks shall be obtained from the control system manufacturer.

(The blocks are already contained in the Daimler template)

The current project engineering documents and descriptions can be found on the Siemens extranet.

For trucks, the energy components shall be installed as per Appendix 22.

X Y Z

2.1.7 Machine Linkages

The following scope shall be equipped with separate main switches
linkage belts

belts for incoming and outgoing workpieces

magazines, gantries and transverse belts

For subsystems belonging to the functional scope of a machine or assembly station, power supply is by way of the machine or assembly station concerned.

2.1.8 DGUV-V3 Measurement

The DGUV-V3 measurement shall be performed by the contractor on delivery of the machine to Daimler.

2.2 Operating Components

2.2.1 Control Consoles

The specifications in "Appendix_39_Control Console Edge Guard" shall be complied with.

2.2.2 Illuminated Signals

Equipped with LEDs

The indicator lamp test shall be performed by the software via the PLC outputs.
An indicator lamp test using diodes is not permitted.

2.2.3 Key-Operated Switches

The number of key-operated switches shall be kept as low as possible.

If at all, then the following shall be used:

the EKS System supplied by Euchner -> see Appendix 2 with the following to be used only in certain agreed exceptional cases

Employ locks (e.g. type CES/SSG 10 with command devices).

2.2.4 Guard Posts

Illuminated bollards in accordance with the attached table shall be used to signal malfunctions and warnings.

The components to be used can be found in the material approval list (in the MDM). No other colors are permitted for signal lamps. Functions that are not required for the machine may be omitted.

Illuminated bollard colors at machines			
Pos./color:	EXTINGUISHED	FLASHES	LIGHTS UP
Pos. 1 top RED	There is no malfunction or alarm.	NOK check/NOK component	Fault or alarm at the machine.
Pos./color:	EXTINGUISHED	FLASHES	LIGHTS UP
Pos. 2 YELLOW	No alert	Logistical fault Waiting for loading or unloading	Alert (process-specific, consult production)
Red/Yellow		Assembly option: throughput	
Pos. 3 GREEN	Machine not in interlinked operation or in sleep mode.	Start / inching actuated (start initiated but not yet active).	Machine in automatic linked mode (machine running).
Pos. 4 bottom BLUE	No quality alarm	Quality alarm (Q alarm)	Quality stop (Q stop)

Installation locations shall be agreed on with the representative after the commissioning of the (production) lines.

Number of lamps:

1 2 3 4 6 7 8 9

2x per transfer line and rotary transfer machine, 1x per machining center and various other machines in case of individual installation, provided that they can be inspected once per OP

1x per assembly automatic station

By agreement

Omni-directional beacons and warning horns:

Clearly visible rotating beacons in **orange** and horns if necessary (see material approval list (in the MDM) shall be used to indicate faults in the supply and disposal systems and at "hidden" transport sections (e.g. intermediate levels) and as an activation warning for machines for which a clear overview is not possible.

Quantity and installation locations shall be agreed on with the representative after the commissioning of the (production) lines

1	6	7	8	9
2	6	7	8	
3	4	5	6	7

2.2.4.1 Lamp Column Definition for Loaders with Assigned Machining Centers

The lamp column according to the table below shall be used to indicate malfunctions and alerts; this definition applies to concatenated systems in which only one lamp column is used per OP (loader with assigned machines). The components to be used can be found in the material approval list (in the MDM). No other colors are permitted for signal lamps. Functions that are not required for the machine may be omitted.

Lamp column color definition: Permanent illumination takes priority over flashing

Pos./color:	EXTINGUISHED	Illuminated (loader)	Flashing (machine)
Pos. 1 top RED	There is no malfunction or alarm.	Fault	Malfunction or alarm at the subordinate machine (accompanying loader).
Pos. 2 YELLOW	No alert	Logistical message	Alert (process-specific, consult production)
Pos. 3 GREEN	Machine not in interlinked operation or in sleep mode.	All OP machines in automatic mode (OP loader and assigned machines)	At least one machine not in concatenated mode.
Pos. 4 bottom BLUE	No quality alarm	Quality alarm (Q alarm)	Quality stop (Q stop)

Installation locations shall be agreed with the operator after initial start-up of the lines.

1	2	3	4	6	7	8	9
---	---	---	---	---	---	---	---

2.3 Installation in Electrical Compartments

2.3.1 Design of Switch Cabinets

Supplements to MBN 9666

Switch cabinets shall be set up on switch cabinet platforms with base if there is no intermediate floor. Setup only on the floor grating of the platform without a base is not permissible.

Circuit diagram pocket: Format DIN A3, metal, not glued; number of pockets depends on the volume of the electrotechnical documentation

Switch cabinet lighting for each cabinet compartment ahead of main switch; Types as per material approval list (in the MDM). The lighting shall be controlled by means of a separate door contact switch on the leading door and have a cold-start design. Versions with motion detectors are also approved, i.e. the door contact is omitted for the lighting.

For each switch cabinet transportation unit, a service connection socket shall be installed upstream of the main switch on the assembly plate

It is not permitted to install electrical components behind longitudinal bars if switch cabinets have more than one door.

Cable entry via terminal adapters and cable gland systems as per material approval list (in the MDM)

Convection over assemblies shall not be obstructed by lines, cable ducts, etc.

The set-up requirements as described in Appendix 09 "7 Mortal Sins in Switch Cabinet Construction" are to be

implemented.

All switchgear cabinet and switchbox locks shall be designed using a Daimler locking system or VDE locking system (key with lock cylinder subject to consultation only)

Assembly without safety fuse, see MBN 9666

All inductive consumers shall be provided with snubbers

A separate temperature guard shall be used to monitor the maximum permissible switchgear cabinet temperature (Appendix 19). The limits must be adjustable.

Addition to MBN 9666. The switch cabinet or equipment reserve can be reduced to 10% (instead of 20%).

Halogen-free conductors within the switch cabinet are not required.

Lines subject to movement relative to switch cabinet doors shall be routed in slotted hoses, e.g. Murrplastik EXW-LS. These can be found in the material approval list (in the MDM).

2.3.2 Terminal Boxes

The use of multiple screwed connections shall be agreed with Daimler.

Unused lead-in holes shall be plugged.

Terminal boxes shall be permanently labeled on the outside with an engraved aluminum plate which contains the terminal strip number.

It is imperative that the ambient conditions are observed (cooling lubricant etc.).

If an active assembly is used in the terminal box, the assembly identification and node address shall be given.

Plastic distributing boxes are not permissible.

During automatic operation, junction boxes shall be accessible without the need to dismount machine parts.

Terminal strips shall be equipped with components from the material approval list (in the MDM).

Only metal screwed connections shall be used, preferably Skintop® connections, if there is no connector on the end of the cable.

2.3.3 Wiring Requirements

Moving at the I/O level is only permitted with intermediate clamping or with push-lock terminal adapters

The line routing between door and cabinet shall be implemented by means of a hose which is divisible in the longitudinal direction

Duct wiring is required.

Control elements and sensors shall not be interconnected.

For switching devices, DC 0 V shall be implemented as a ring line.

For command devices, DC 24 V shall be implemented as a ring line.

2.3.4 Service Sockets and Interfaces

In addition to the mains outlet in the switchgear cabinet that is required as per MBN 9666, a 230 V grounding-contact socket (orange; with cap, Daimler locking system, and "Service" label) shall be installed on the outside in the vicinity of the control panel.

Separate fusing with 6 amps and identification of the service socket with "Service"

No use of FI, if the service outlet is only accessible for service personnel.

Upstream of the main switch or section switch

Service interfaces shall be provided at the control console/switch cabinet. The products to be used shall be taken from the material approval list (in the MDM). All interfaces shall be labeled with their function. Interfaces that are not used shall be covered.

At the control console/switchgear cabinet, the network connections shall be routed out as RJ45 (see product partners' control system concept)

In the case of CNC control systems, additionally the X127 interface in RJ45

USB (production)

230 V mains socket

Prerequisites for forgoing RCD (fault current safety system; refer to Appendix 15a or 15b (Plant 68) for details):

Within the context of a danger assessment, an equivalent protection shall be ensured

The installer (manufacturer) shall agree to the omission

Continuous monitoring by an EFK shall be ensured

The measuring technology monitoring by a qualified person shall be ensured

Damage shall be rectified immediately by an EFK
 The operational owner (layperson) shall be notified
 or if it is ensured that only specific office tools can be connected (for example, by special sockets and plugs)

2.3.5 Hardware Firewall / Network Connection / Router

2.3.5.1 General Information

In the interest of IT security, a hardware firewall shall be installed as shown in the diagram below in order to protect the individual pieces of production equipment. Coordination as regards the design shall be carried out with the representative. Plant-specific specifications (IT) are to be taken into account.

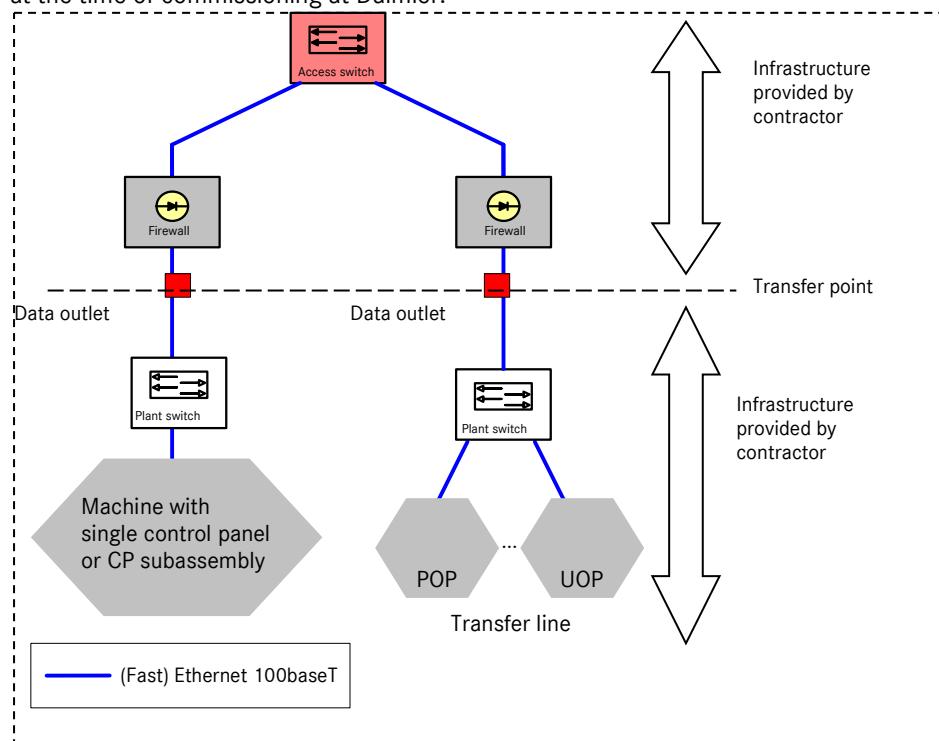
The data socket (transfer point) belongs to the provisions on site.

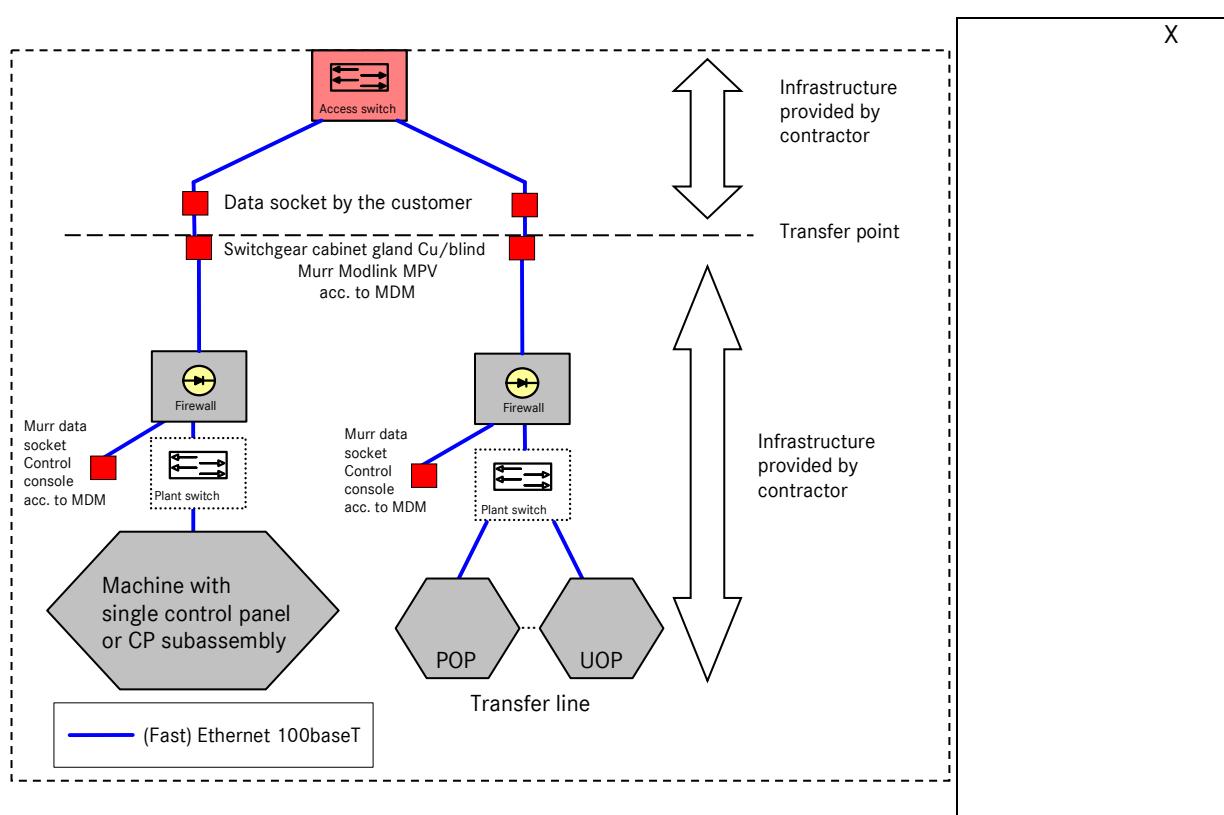
The machine manufacturer shall take into account that only certain network connections as approved by Daimler are permissible. If additional communication links are needed, the machine manufacturer shall document these and submit them to Daimler for approval.

Data required for this are: source address, destination address, protocol, service or port, as well as a description. Ensure that all communication links are listed, in particular those that are seldom needed, e.g. for taking inventory, servicing, etc.).

Unknown communication links will be suppressed by the firewall and can result in greater outlay for commissioning and operation, to be borne by the contractor.

For this reason, all communication links shall be tested and documented by the machine manufacturer at the time of commissioning at Daimler.





See Appendix 33 IT Settings for Gaggenau

2.3.5.2 System-Specific Communication

Refer to the product partners' control system concepts for system-specific communication between the system and plant network (e.g. 1:1 router).

System networking (more than one machine, flexible line) shall be defined for the specific project at the Kassel plant.

The implementation and parameterization is the task of the production facility supplier in consultation with the representative.

2.3.6 Infeed of Lines into Installation Compartment

- Lines shall be routed in the switch cabinet by means of divisible grommets as per the material approval list (in the MDM).
- It is not permissible to use sponge rubber.
- The cable infeed shall have a compact design (at least IP 54). Cable grommets as per the material approval list (in the MDM) shall also be used for larger cross-sections.
- In exceptional cases, routing may be from the side if a drip loop with appropriate sealing or protection class is used (only permitted outside the wet area).
- For components positioned on the cabinet roof with special approval, no cable entries in the switch cabinet are allowed from above.

2.3.7 Machine Cooling and Switch Cabinet Cooling

Installation requirements can be taken from the Powertrain Requirement Specifications, Part II, Mechanical Components.

Electrical connection and signals per cooling unit, see Appendix 19 switchgear cabinet air/water heat exchanger and cooling units as per material approval list (in MDM).

The thermal calculation of the switch cabinet forms part of the documentation.

A central cooling water supply is already available in part. Use air-water heat exchangers to the extent possible
Individual agreement with the representative responsible is required.

Minimum clearance from bottom of chilling units to shop floor: 70 cm.

A tank for catching condensation water shall be installed, if condensation drainage is available.

If the switch cabinet door is opened, the cooling units shall switch off automatically.

The integrated temperature monitor in the cooling units shall be used for regulating switch cabinet temperature.

The integrated safety contact shall be used as an alert signal.

Diagnostic outputs on the unit side shall be evaluated via the control system as a collective fault signal.

Permissible inside temperature of the switch cabinet: 10% below the maximum permissible operating temperature of the component part most sensitive to temperature in the switch cabinet. However, 45°C shall not be exceeded.

Cooling air shall be so directed through the switch cabinet that air will sweep through or round the main heat sources:

- When installed at ground level: Ambient temperature of the air according to DIN EN 60204
- If mounted on switch cabinet platform: max. ambient temperature 55°C.
- If mounted on switch cabinet platform in PTU: max. ambient temperature 65°C.

2.3.8 Wire-end Sleeves

Cable end sleeves with insulation collars shall be used.

In the case of terminal block modules with cage tension springs, wire-end sleeves can be forgone.

Wire-end sleeves can also essentially be forgone in the case of ultrasonically welded strands.

Double wire-end sleeves are only permissible if individual wire cores cannot be reliably clamped together in pairs, e.g. for safety switching devices (box terminals).

2.4 Installation on Site

Controls and sensors shall not be interconnected!

2.4.1 Actuators, Sensors and Multi-Connection Distributors

Actuators, sensors, connecting lines and multiple-plug distributors shall be used as per the material approval list (in the MDM). The multi-connection distributor shall be of the pluggable type.

The length of sensor/actuator lines shall be limited to max. 5 m. 10 meters shall not be exceeded in supply and disposal systems. Longer line lengths are possible subject to consultation.

An intermediate connection is not permitted

Installation shall be decentralized, avoiding large concentrations of input/output points so as not to obstruct access to the machines.

Media flaps to be monitored shall be queried by means of dual sensors and a contactless transponder safety switch (see material approval list (in the MDM)).

As per DBL 9666, pneumatic movements shall always be interrogated directly. All end positions shall be detected at the part to be moved by means of sensors as per the material approval list (in the MDM). If this is mechanically not possible and the movement does not pose any danger, the end positions can be detected at the cylinder.

All switches with proximity function shall be mounted using clamping brackets (metal sleeve with end stop and hexagonal clamping nuts) so that the precise position is maintained in the event of sensor exchange. This also applies for cylindrical light scanners and light scanners with a 90° output.

If non-equivalent components are used, both signals shall be analyzed.

Installing inductive proximity switches with their active surface on top is not permissible to avoid spurious switching, for example due to swarf.

Damping of inductive proximity switches shall be so designed that these will be reliably switched for 50% Sn.

If cylindrical proximity switches are used, the size M12 shall be used if structurally possible.

Weld-proof all-metal switches are to be used for querying non-ferrous materials and in the welding area (factor 1).

2.4.2 Limit Switches and Light Barriers

Limit switches and light barriers shall be used as per the material approval list (in the MDM).

For **laser light barriers**, ensure that the laser beam will not endanger the operator. Suitable measures shall be coordinated with Daimler. If technically feasible, laser devices of laser class 1 shall be used

Limit switches in series shall **not be permitted**.

Mechanical limit switches shall **not be permitted**. (Exception: if motions carried out by a three-phase asynchronous motor are to be stopped directly; components after consultation with Daimler).

1 2 3 4 5 6 7 9

2.4.3 Pneumatic Valve Clusters

See also Powertrain Requirement Specifications, Part II, Mechanical Components.

Field bus node-controlled valve clusters are permitted as per the material approval list. As per Appendix 11 the use criteria are described with I/O extension modules.

ISO valves shall be connected using a central M12x1 connector.

2.4.4 Cables and Wiring

10% reserve wires do not refer to single multi-core cables but to a joint cable feeder, e.g. from the central switch cabinet to a unit or a station or to a control panel. (Supplement, see MBN 9666)

Cable straps are permitted for fastening.

Lines shall be installed in such a way that no-one can step on them and shall be adapted to the ambient conditions.

Plug connectors may not be located inside closed installation ducting.

They shall be clearly visible.

Prefabricated lines as per the material approval list (in the MDM) and product partner components shall be used as the lead/extension/connection to the servomotors, transmitters, valves, proximity initiators, etc. and may not be modified.

Measuring lines shall have a highly flexible design (types as per the material approval list (in the MDM)).

Due to the local setup in the IP65 level, only actuator/sensor lines up to 5 m are approved. Every equipment connection shall be designed with an M12x1 bushing and the specified LEDs. Actuator/sensor lines in 4-pin design with PE/FE are not approved.

Lines without LEDs shall be used for safety switch.

No additional screwed couplings may be mounted on standard pin connectors (Harting or similar), i.e. they may not be misused as junction boxes.

Excess lengths, too, shall be neatly laid in such a way that they cannot be damaged.

Motor cables from controlled drives shall be shielded as per the project planning regulations.

Halogen-free lines shall be used outside of a switchgear cabinet in areas with increased fire load (battery assembly departments or shall be coordinated with Daimler in the project).

2.4.4.1 Cable Routing

The machine supplier is responsible for:
planning (the cables shall always be laid in consideration of the local conditions and as agreed with Daimler.)
procurement
Line installation (e.g. ducts, lines, rail systems).

Green lines shall be used for production facility-internal Ethernet/Profinet network connections.
All lines upstream from the NAT router shall be blue in color and supplied.

It is not permissible to use closed protection hoses.

2.4.4.1.1 Connecting Lines

Switch cabinets, control panels and units separate from the machine shall be connected by connecting lines pluggable at both ends.

At switch cabinets, connecting lines may not be pluggable if they do not have to be disconnected from the machine for transport purposes.

All connector contacts shall also be connected.

Connectors shall be coded to prevent mixups.

If **plug-and-socket devices** are used, the following shall be observed:

The line routing between the switchgear cabinet transport units and the line outlets to the machine are realized via connector cabinets (width 200 or 400 mm) or alternatively via cable gland systems in "pluggable terminals" (products can be found in the material approval list (in the MDM)), whereby these shall always be grouped and designated per line. The following restrictions for the terminal adapters also apply here.

For the control lines, 24-pin or 16-pin plug-in terminal adapters shall be provided.

For power lines <= 31 A (6 mm²) 6-pin plug-in terminal adapters shall be provided.

2.4.4.1.2 Cable Ducts

Lines shall not be routed in the machine bed and frame or in profiles.

Steel armor/plastic conduits and plastic ducts shall not be used.

The maximum section length is 2000 mm.

The cable ducts shall be routed as agreed with Daimler.

Requirements for **cable ducts**:

Sheet metal and wire ducts with snap-fitted covers, galvanized, uncoated

Installation shall be safe to step on

In cable ducts, only cable fasteners may be used.

Ensure the type used has edge protectors.

2.4.4.1.3 Moving Lines

The transition from movable to fixed line routing shall be plug-connected.

If there are several short, movable sections within one cable, not every movable section need be separately pluggable, but the cable in its total length shall be pluggable at both ends.

Moreover, it is permissible for cables in freely suspended cable installations, for example at traversing slides, to be led directly into unit switch cabinets, provided they can be rapidly changed out.

2.4.4.1.3.1 Freely Suspended Flexible Lines (Monkey Swings)

Monkey swings are preferred if damage to the cables is not to be expected.

2.4.4.1.3.2 Energy Management Chains

See MDM and MBN 9666.

Supplementary requirements:

Relieve strain on electric cables at both ends by means of individual clamps. For hose lines, use bulkhead connections.

Each energy management chain shall be coherently documented, including all components (cables, hoses, connectors, plugs, etc.), to allow for reconstruction.

All cross ribs and necessary separating webs shall be installed.

Access to the opening mechanism of the cross ribs shall be ensured.

Manufacturers, types and parts shall be used as per the material approval list (in the MDM).

2.4.4.1.3.3 Lines Carried by Flexible Cable Carriers (for 3D movements)

Manufacturers, types and parts shall be used as per the material approval list (in the MDM).
Installation specifications: chains shall be properly caught and held

2.4.4.1.3.4 Use of Cable Protecting Tubes:

Only closed hoses shall be used in the cooling lubricant environment if necessary (in the working area) (e.g. Murrplastik EXW PAE) (for approvals, see material approval list (in the MDM)).

All other protective hoses on the machines shall, where necessary, have a slotted design (e.g. Murrplastik EXW PAE-LS) (for approvals, see material approval list (in the MDM)).

2.4.5 Interior Lighting of Machines

2.4.5.1 Walk-in Machine Room

Firmly installed interior machine illumination for maintenance work shall be planned in machine rooms (e.g. on complete encapsulation of washing machines or machining centers). It is switched using a door switch. The illumination can be foregone if the workplace lighting limit value is adhered to following installation at Daimler.

2.4.5.2 Working Compartment

The lamps shall be used as per the material approval list (in the MDM) and shall be switched via lamp toggle switches.

2.5 Electric Drives / Motors

Installed PTC thermistor sensors shall be evaluated during frequency converter operation of drives >= 11 kW

2.5.1 Standard Motors

- Types according to the material approval list (in the MDM).
- The motors shall be connected as shown in the table below.
- Only motors with insulating material class F are permitted.
- The ErP directive shall be complied with.

Table of connection types:

Motor frame size; Rated output	Connection type
< 80 0.09 to 0.37 kW	Connector housing HAN 3a or similar made of metal with 5-pin insert plus PE; on use of a brake, 7-pin plus PE (Wiring diagram, see MBN 9666)
≥ 80 to ≤ 132 0.55 to 7.5 kW	Pin connector HAN 10ES (male) / HAN 10ESS (female) with cross-clip (like gear motors)
>132 > 7.5 kW	Direct connection

2.5.2 Pump and Fan Drive Units

- Motors exceeding size 132 (>7.5 kW) shall be permanently connected. For other specifications see "Standard Motors".
- To optimize the energy consumption, motors with efficiency class IE2 (EFF1) or better shall be used.

2.5.3 Geared Motors

- As regards manufacturer and types, gear motors supplied by the stipulated product partner shall be used.
See Appendix 10 and the project documentation of the respective product partner.
- Connectors HAN 10 ES (male) and HAN 10 ESS (female), with one cross-clip. Pin assignment, see MBN 9666.
- If gear motors outside the range of approved types are required, frequency converters shall be used.

-
- The approval workflow, see product partner project book, shall be adhered to.

2.5.4 Frequency Converters

The frequency converters (manufacturers and types) of a specified product partner are to be used. See Appendix 10 and the project documentation of the respective product partner.

Frequency inverters shall be used
on soft starting
with milling cutter and drilling spindle drives
on adaptation of gear motors to the specific application
to save energy in processes with changeable power requirements as of a power of 7.5 kW
shall be used.

With drives > 30 kW:

Electronic soft starters as per the material approval list (in the MDM) shall be used.
After soft starting, the motors shall be switched to a contactor unless operated with
a frequency inverter.

As far as permissible and as makes sense from an energy point of view, inverter systems are to be used
with active front ends (infeed/regenerative feedback units).

Where frequency converters are used, an output that is >20% above the
rated output of the drive unit shall not be exceeded. The control voltage of
the frequency converters shall
be separately fused.

5

2.5.5 Grounding-Contact Sockets in the Field

When 230 V grounding-contact sockets are used in the field, observe the following:

Identification of grounding-contact socket with the assigned production equipment and service identification.

Use of sockets with tumbler arrangement.

Unused sockets shall be closed off

Omission of an RCDs (ground fault circuit interrupter) according to Appendix 15a or 15b (Plant 68)

2.6 Bus Systems

2.6.1 Field Bus

For bus leads, the label at the cable start shall state the subsequent nodes and at the cable end it shall state the preceding ones.

All diagnostic signals provided by bus nodes shall be evaluated and displayed.

A network overview/NW topology shall be submitted to, and coordinated with, the client by the supplier prior to the implementation phase. Connection of the planned production system to the superordinate IT infrastructure shall be coordinated with the client. The network topology shall be implemented as described in the control system technology product partner's project book.

2.6.1.1 Profinet

Application: See project book of product partner

Adherence to the relevant installation requirements in the PNO and in Appendix 30 is mandatory.

M12 Power L coding without FE shall preferably be used for the energy supply outside of the switchgear cabinet;
alternatively, 7/8" can also be used.

The Profinet nodes shall be identified with the production equipment ID, IP address and node name. This identification shall not be located on the node. The I/O addresses shall be placed on the component and matched to the respective slots.

The Profinet lines shall be identified with source and destination designations (production equipment ID/connecting point) at the start and end of the lines.

The following shall also be noted on use of safety modules:

- The safety modules shall be identified with the F address
- For Siemens NC machines, the NC variables (Insep/Outsep) shall also be assigned to the assemblies in addition to the I/O addresses

Implementation of the naming convention described in

"Anlage_01_Namensgebung_Netzwerkteilnehmer_Anlagen_Feldnetz" shall be binding

The Indu-Sol project book shall be noted on use of a Profinet inspector.

2.6.2 Wireless LAN

Use only after consultation with and approval by Daimler.

2.6.3 Other Bus Systems in Automation Systems

Use only after consultation with and approval by Daimler.

2.7 Engineered Safeguards

Sistema data record/project for determining the PL in accordance with EN13849 shall be submitted to Daimler at the milestone for operational system + acceptance.

2.7.1 Safety Switches with Lock

Types according to the material approval list (in the MDM), operating specifications as per Appendix 37

The LEDs shall be connected via the evaluation of safety-circuit and monitoring-circuit contacts by way of the PLC.

Assignment of the safety door operating states to LEDs/buttons:

The following applies to safety switches with red and green status LEDs:

- | | |
|--------------------------------------|-----------------------|
| • Safety door open: | Red LED on |
| • Safety door closed and not locked: | Red and green LEDs on |
| • Safety door locked: | Green LED on |

The following applies to door safety switches with keypad:

- | | |
|--|--|
| • Stop at end of cycle and locking plate inactive requested | Yellow illuminated push button switch actuated and flashing |
| • Stop at end of cycle achieved, door locking plate inactive | Yellow illuminated push button switch steady light, white off |
| • Protective doors close and locking plate active | Yellow illuminated push button switch actuated and off |
| • Automatic mode started | White illuminated push button switch actuated and steady light |

If the control panel is more than 3 m from the safety door, or if it is not visible from there, then the door safety switch shall be provided with a keypad.

All lockable safety switches shall be equipped with manual quick releases that require no tools and that can be lead-sealed.

The power supply to the safety door shall not be interrupted with the safety circuits and machine/unit OFF, which means that the safety doors can still be operated electrically even with load voltage switched off.

For the "Setting" mode of operation, it shall be ensured that the safety doors can be unlocked electrically.

The conditions for interlocking safety doors may not be implemented by saving to a memory, as there is a danger of personnel locking themselves in.

The load voltage for the safety switches may only be interrupted by "Main switch off".

The position of the safety doors and the interlock of the safety door switches shall be additionally shown in the tool-changing picture and the system overview.

2.7.2 Safety Functions

2.7.2.1 EMERGENCY STOP

An emergency stop shall be set such that its effective range is clearly recognizable/assignable. A sufficient number of emergency stop devices shall be provided after consultation with the representative and the involvement of Workplace Safety.

Guards to be opened, e.g. loading door/hatch of machine, shall be used for the connection of the emergency stop. In other words, the signal only affects the machine, loader, etc., when the guard is open.

If there is no guard between adjacent protected areas (e.g. machines), the emergency stop shall be wired upstream of the main switch.

Workpiece feed conveyor belts, the feed and discharge of workpieces, storage conveyor belts as well as loading gantries shall be integrated into the EMERGENCY STOP circuit of the machine or assembly station.

The safety circuits shall be realized in stop category 1 according to EN 60204.

After an emergency stop, the operator shall be able to start the machine.

An emergency stop is acknowledged by means of the collective acknowledgment function of the PLC (not with a separate button).

Emergency stop pushbuttons shall be provided on all control panels where operations or motions are performed or initiated.

External loading of production equipment / workpiece transfer:

Technical implementation of emergency stop circuit linkage:

The linkage supplier is responsible for any necessary conversion of signals.

The emergency stop in the case of external loading or workpiece transfer shall be executed with double contact both by the machine supplier and also by the gantry supplier; the wiring of the second contact (and, if required, also of the third contact) shall be provided with external voltage.

2.7.2.2 Traversing with Open Safety Door

In this regard, see Chapter 3.4 as well as Appendices 2 and 32

2.7.2.3 "Portable Press to Run Device"

Standard components from the control system manufacturers shall be used as a "portable press to run device"; if necessary, these shall be connected to all LCPs and MCPs. The interface on the machine control panel shall always be operational.

Further boundary conditions:

The enabling function of the hand control unit shall only be accessible when a safety door is open. If more than one safety door is open, a message stating: "Enabling mode not possible with more than one safety door open" shall be displayed.

If all safety doors are closed then the enabling function shall not be used.

In opposite or neighboring units, simultaneous bridging is possible if the design agreements for mobile safety units (see chapter under this title) are met.

The number, type, line length, and design of the "portable press to run devices" as well as the insertion points shall be adapted to the use case and monitoring case, shall be coordinated with Daimler, and shall be provided. However, at least 1 "portable press to run device" per line/OP/subsection. The line shall have a max. length of 10 m (the line length of the robot manual operating units shall be coordinated with Daimler). Receiver fixtures for the lines and operating unit shall be planned. Sufficient insertion points shall be planned to ensure that no lines have to be routed over or through system parts.

2.7.2.3.1 Basic Operation

Releasing the permissive button may not result in a malfunction, which means that permissive operation shall be restored when the permissive button is again actuated.

2.7.2.3.2 Tool Transfer (e.g. in machining centers)

It shall be possible to set and measure tool transfer as a minimum for operating mode 3 (Appendix 2) with the associated safety doors and loading ports/doors open.

2.7.2.3.3 Workpiece Transfer (loader/machine)

It shall be possible to execute all motions of the machine required for loading and unloading the workpiece (such as clamping and unclamping, retracting and advancing centering tips, lowering/raising machine trays) in permissive mode in Operating Mode 3 (Appendix 2) by means of the enable button of the loader.

2.7.2.4 Mobile Protective Units

A distinction is made between stationary protective devices in the rear area of the units (service door, to be opened with a tool) and the mobile protective devices or safety doors in the front machining or assembly area. The most cost-effective design for the mobile protective units shall be realized, i.e. **the simplest protective device in each individual case shall be selected** based on the required standards and regulations and also considering the danger for the operator.

The following order can be established for the electrical installation of the safety doors on the basis of increasing costs:

1. Simple protective circuit acting on the respective unit without locking, unlocking
2. Simple protective circuit (like 1.) with locking and unlocking (e.g. magnetic unlocking)
3. Costly interlock across machines with shutdown of opposite units or of units on the right and left
4. Sophisticated interlock across machines (like 3) with locking and unlocking (e.g. magnetic unlocking)

In the event of magnetic locks on safety and maintenance doors not within the immediate vicinity of the control panel, a push-button box with the following functions is to be provided on the doors:

Design agreements:

The safety doors described in 3. or 4. are to be omitted in favor of 1. and 2. if the access distance to adjacent and opposite units is more than 800 mm. If the access distance is less than 800 mm, sheet metal partitions shall be installed where possible, so that this precondition can be met (interlocks across machines to be omitted in this case).

In this case, switching units (as per the material approval list (in the MDM)) shall be mounted on the outside on the safety door

In general, the magnetic interlocks for personal protection shall be wired and locked **in de-energized state**, as was previously the case.

In the case of fire or an emergency, it shall be possible to mechanically unlock the protective device quickly from the outside.

2.7.2.5 Other Safety Measures

Manual locating facilities for securing vertical units shall electrically poll as regards their presence at their storage location (switch-on condition for machine).

2.8 Identification

All devices connected to the I/O level shall contain the absolute address of the PLC in their name.

The following have priority (in this order):

the output address over the input address

the lowest address in the case of several addresses on the component

the first connected component according to the wiring rule

in the case of safety modules, the F address shall be marked on the module; in the case of NC control systems, the safety variables shall also be marked on the I/O module.

subsequently connected components shall be indexed in ascending order.

2.8.1 Within the Electrical Compartment

2.8.1.1 Device Identification

All devices shall be clearly and durably (service life of machine) identified by tags on a wire above or below the component part.

Axle modules shall additionally be labeled in plain text with the axle designation.

2.8.1.2 Wire Core Identification

All conductors/cores which are routed to terminals shall be identified with the terminal number.

Plug-on, captive marking tags or, alternatively, printed lines are to be used, provided they are easy to read and permanent.

With all devices (e.g. contactors and relays), the individual cores shall be identified with the terminal designation of the device.

There is no need for cores to be identified in the case of devices which have plug-in connections.

2.8.2 Outside of the Electrical Compartment

2.8.2.1 Execution of Marking Tags

The marking tags outside of switchgear cabinets shall be fastened on one side as tags in light design (aluminum or comparable), shall be resistant to oil and cooling lubricant, and shall be permanently marked with black, imprinted, engraved or laserered lettering (lifetime of the machine). They shall be screwed or riveted in the case of individual components (neither inserted nor bonded) and attached with cable ties or as "dog tags" in the case of lines.

Plastic nameplates are permitted as an alternative to aluminum nameplates outside the working area, if these comply with the requirements (material thickness and material properties) as per the material approval list (in the MDM). The plastic tags shall be supplied in laserered format.

For special nameplates for fire extinguishing systems and leak sensors, see Appendix 17.

2.8.2.2 Attachment of Marking Tags

1. Each device shall be labeled in the direct vicinity of the installation location and at the end of the cable. The marking tags shall not be attached to the component.
2. Hidden marking tags shall be additionally duplicated outside of covers so as to be clearly visible.
3. Model plates of the motors and measuring systems shall be duplicated so as to be clearly visible next to the component. Subject to consultation, the duplicate tags can be mounted on the inner side of the switch cabinet door, specifying the station and axis designation and the production equipment ID. This can also be carried out in laminated format.
4. Each end of the line shall be clearly identified according to the elec. documentation
5. All three-phase motors shall bear directional arrows at motor-independent points

Each control panel shall be equipped with a general configuration plan of a station or machine in a protective film. It contains the components of the functions which are controlled from this control panel. It shall also be supplied as a component of the CAD documentation. It shall be structured in two parts.

Part 1 contains a schematic representation of the station with the installation locations of the electrical components. Here, the components are labeled with the component identification.

Part 2 contains a listing in table form of the components with station number, component identification, component name, function, type and remarks.

2.8.2.3 Special Contents of the Marking Tags

The following generally applies to all designation plates: Identification of production equipment and connecting point of the component part.

of the axis servo motors shall contain the associated station and axis designation (X, Y, Z, ...).

If available, the motors (model plate) shall contain the hardware and software version of the motor.

The decentralized bus nodes shall be identified with the production equipment identification and the bus address.

This identification is to be placed below the bus node. The I/O addresses shall be placed on the component and matched to the respective slots.

The bus nodes shall be identified with the source and destination designations at the line ends, i.e. the production equipment identification code and the connecting point of the component part.

The software settings shall additionally be contained for data interfaces (protocol and baud rate).

(e.g. RS 232, 9600 8 N 1). Individual signal leads shall be documented in the circuit diagram (RxD, TxD etc.) of the axis configuration of the machine – location and orientation of axes as symbolic graphics – shall be attached near the control panel

2.9 Safety Concept

The production facility supplier shall carry out a risk assessment for every production facility. Based on this evaluation, the supplier is obliged to create a safety concept based on PROFIsafe (details can be found in the project handbooks of the product partners).

3 Automation

3.1 Product Partners for Automation

Project-specific product partnerships have been specified by MBC and Trucks for the following automation technology components:

- Display, control and drive technology
- Electric screwdriver systems including manual screwdrivers
- Geared motors
- Frequency converters

Project-specific product partnerships.

The product partners currently defined can be found in Appendix 10.

Product partner contracts with special conditions have been agreed on with each product partner.

The main contractors are obliged to specify the Daimler project reference both during the bid solicitation and when ordering.

The respective product partners will be contracted to be jointly responsible for the current project work.

The machine suppliers will be obliged to use exclusively electric components of the product partner companies for the specifically defined product range.

1 2 3 4 5 6 7 9

3.1.1 Project Books and Component Lists of Product Partners

Each product partner shall provide their own project handbook that shall be complied with; they are responsible for maintaining this in agreement with Daimler.

The automation concepts, mounting instructions, etc. to be implemented based on the components specified in the material approval list (in the MDM) are contained in this.

These project books will be matched to the further technical developments and kept updated.

The product range to be used shall be taken from the component lists in the material approval list (in the MDM). These lists are mandatory. Any deviations shall be submitted to Daimler with an application for an exception ruling.

The control system specifications for logistics systems can be taken from Appendix 5 and the document "Steuerungstechnische Vorgaben Logistiklanlagen" (Control System Specifications for Logistics Systems) from the Siemens project handbook.

1 2 3 4 5 6 7 9

3.1.2 Areas of Responsibility and Tasks of the Product Partners

The areas of responsibility and tasks of the product partners are defined in detail in a product partner contract between Daimler and the product partners.

This contract defines, among other things, the co-responsibility for:
meeting the specifications of all electric components used
cost-efficient realization of all control and electric concepts
required definitions of the interfaces between machines and components
production of project-specific component lists for the Material Data Manager (MDM)
advising and supporting the machine suppliers.

1 2 3 4 5 6 7 9

3.1.3 Boundary Between Machine Supplier ↔ Product Partner

The overall responsibility for the machines to be procured lies with the machine supplier. However, the product partners guarantee their full support in order to meet their liabilities regarding their areas of responsibility and tasks in all respects.

This does not affect any contracts and supply agreements between the product partners and the machine suppliers.

1 2 3 4 5 6 7 9

3.1.4 Orders with the Product Partner

Purchase orders to the product partner shall be clearly marked with "**Use at Daimler AG – Mercedes-Benz Cars/Truck Powertrain**" and the project name or location code.

3.1.5 Specifications for Screwdriving Technology

See Chapter 4.11.

3.2 Other Unique Product Specifications

3

3.2.1 Pressure Measurement Technology (Test Stands)

Strain gage sensors shall be used in 6-conductor technology (system of protection IP67). Electrical connection is by way of a permanent connection lead, 3 m in length, and an attached 7-pin connector. The hook-up to the instrumentation amplifier is by way of a corresponding connector socket, but with this lead installed only locally fixed in position. Attention shall be paid to the manufacturer's instructions particularly regarding protection from interference.

The measuring range, accuracy class and type of load cell will be specified depending on the machine during the project.

Due to the highly dynamic measurement tasks, DC instrument amplifiers shall be used. These shall be mounted directly adjacent to the test computer. Hook-up to the instrument amplifier is via a pin connector. It shall be possible to calibrate the load cell with the instrument amplifier installed. The use of adapter cards is not permissible. It shall be possible to measure the output signal, with a built-in instrument for doing so preferred.

Connection to the process control computer shall be electrically isolated. If the output stage of the instrument amplifier is not so designed, isolating amplifiers shall be used. For measurement purposes, it shall be possible to easily connect corresponding measuring instruments during operation (for a power interface, provide corresponding plug-in bridges/disconnect terminals).

Approved makes:

Load cell: HBM P6A
Instrument amplifier: HBM MGA II
Accuracy class: 0.1

3.2.2 In-Process Tool Monitoring

An in-process tool monitoring system can be used in the event of economic advantages or technical necessity. Economic efficiency compared with a conventional, mechanical solution is to be accounted for in the bid and coordinated with the planning department.

For approved components, see material approval list (in the MDM) and project handbooks of component suppliers

A E F

MB Cars Powertrain (MO)

- Prometec
- Montronix

X Y Z

MB Truck Powertrain:

- Prometec
- Company Artis

Which of these suppliers shall be used in the specific procurement case shall be specified in coordination with Daimler. Refer to Powertrain Requirement Specifications Part IV – Production Equipment for further requirements.

Necessary external operating functions shall be integrated in the standard user interface. Details are defined according to the specific order.

	1	2	3	4	5	6	7	8	9
	1	2	3	4	5	6	7	8	9

3.3 Operation and Observation

3.3.1 Control Panels

The control panel shall be used only for the following functions:

Operation and monitoring

Monitoring (e.g. camera systems, tool monitoring system etc.)

All the WEBServer-based systems located in the production facility and field network shall be integrated in the HMI softkey structure

When using monitor screens, screen-savers (to blank them) shall be used.

In the event of signals or fault alarms, the monitor shall be activated automatically.

All front devices without studs shall be fixed by means of threaded studs.

As far as technically possible, machine operating instructions shall be integrated into the control panels.

The center of the screen shall be arranged 165 cm from the access level.

If the control panel fails, automatic operation shall not be interrupted.

No device mandatory for the operation of the machine may be permanently operated via the USB interface.

Dongles may never be used.

1	2	3	4	5	6	7	8	9
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3.3.1.1 Classification of Control Panels

Control panels are divided into defined performance classes.

The following applies:

LCPs and MCPs are the standardized, PC-based control panels for Daimler/Powertrain incl. MDA/PDA interface, customer 3rd party), data backup

SCP are small displays (e.g. plain text displays) with a limited scope of functions

PCP are portable and plug-in control panels allowing the operation of large systems requiring lots of space (e.g. loader systems) with central control at different points

Specification of equipment types for the control panels is as given in the project book of the product partner concerned. The project-specific implementation shall be coordinated with Daimler.

3.3.1.2 Package Prices of Product Partners

1	2	3	4	5	6	7	8	9
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3.3.1.2.1 Siemens Package Prices for LCP

Daimler has negotiated net prices for the machine and system suppliers. The control panel packages shall be selected as per the material approval list (in the MDM). A detailed description of the control unit packages has been placed on the Siemens Extranet.

The software for tie-in to PRISMA is generally included.

The control panels needed shall be **specified in the tender by type and number**.

Detailed component lists and technical details shall be taken from the material approval list (in the MDM).

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A				E	F	

3.3.1.3 Tool Service Life Recording System WVS on the Control Panels (MBC only)

Daimler uses the WVS-Operate system for tool service life administration and to optimize the number of tool applications. WVS-Operate administers the number of tool applications for the individual tools and generates tool change recommendations.

WVS-Operate informs the worker about due tool changes through configurable alert limits. Completed tool changes are documented and transmitted to the overlaid control system PRISMA or MTM. Detailed evaluations can be created on the office PC in the MTM or PRISMA.

WVS-Operate shall be integrated into the standard user interface under the relevant soft key (see image tree). The respective software components shall be distributed with the product partner's project DVDs.

The specifications are enclosed as Appendix 35 WVS Operate. Please address any questions to the representative responsible.

1 2 3 4 6 7 8

3.4 Operating Modes to Be Implemented

Implementation of the operating modes:

Safe operation according to Appendix 2

Technical implementation according to Appendix 32 (Appendix 32 has been implemented in an operating mode module by the product partners – use of this shall be binding.)

The corresponding application of the electronic key system (EKS, 2-channel solution) from Euchner shall be implemented in accordance with Appendix 2b.

This also describes how the electronic keys required for the machine supplier can be procured.

Kassel plant: Two operating modes. If more operating modes are required, these shall be determined specifically for each machine.

3.5 Control

3.5.1 Control Concept

1 2 3 4 5 6 7 9

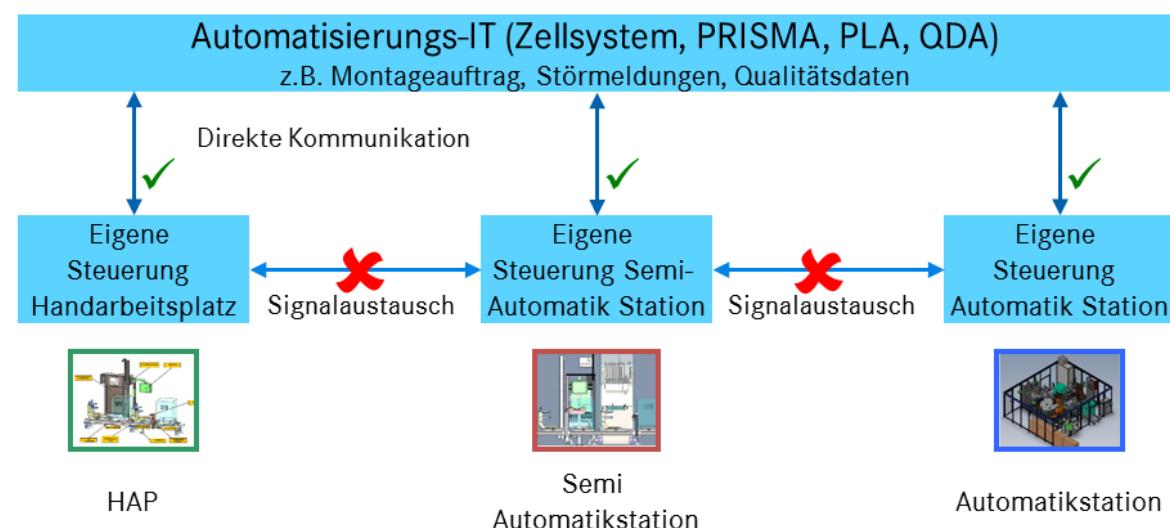
3.5.1.1 Control Concept Release

The final specifications for the detailed control concept will be set by Daimler, after the contract has been awarded, by means of the **manufacturing approval**.

1 2 3 4 5 6 7 9

3.5.1.2 Decentralized Control Structure

Every station shall be equipped with its own control panel and control system. Cross communication between individual stations shall be prevented.



A **decentralized control structure with decentralized field bus peripherals IP67** shall be realized.

The IP addresses of all nodes in the system network and its periphery shall be taken from the product partners' project books. Appendix 33 shall additionally be observed for the Gaggenau plant.

The central unit may comprise central switch cabinets for power supply and control in the principal control panel for the complete machine (machining section) or the central CPU scopes on the basis of a PC system in case of assembly machines.

Conveyors for interlinkage and for entry and output of workpieces as well as magazines and gantries for loading/unloading together with drives, singling devices, cross-rams, robots, etc. shall be fitted with their own control systems.

Gantries shall be equipped with servo-drives. Exceptional cases shall be coordinated with Daimler.

For robot cells, the loading and unloading functions, safety technology and materials handling technology shall be implemented using the system's control system, i.e. not the robot's control system.

3.5.1.3 General Software Specifications

To obtain clearly structured, easy-to-manage and comprehensible PLC programs for production, they need to be compiled according to specified rules. Exceptions and deviations from the rules shall be coordinated with Daimler.

Detailed diagnosis shall be implemented and shall ensure the following:

Pair error monitoring

Runtime errors in both movement directions; one error message per direction

Permanent monitoring of the terminal position: One error message each in the event of loss

Pair errors and end position monitoring also in manual/setup mode

Indication of missing releases for manual functions in setup mode

Missing indexing conditions and interlocks shall be indicated

Graphical programming (S7-Graph) can be omitted for machine tools if the manufacturer proves that detailed diagnosis as in S7-Graph is ensured.

The creation of a PLC sequence program and/or the detailed diagnosis is only permitted with the programming tools approved by the control system manufacturer.

The structure of the software shall be documented in flowcharts and overviews of its main and subsidiary programs as well as its functions.

The supplier is responsible, prior to the milestone of operational system + acceptance, for contacting the pertinent representative so that Maintenance can activate the PLC password as specified by Daimler.

Variables are declared in English. Remarks, notes, comments on all structural points shall be created in German; in the case of locations abroad, after consultation with Daimler.

The program documentation shall provide the user of the software with sufficient support.

Specific items (to be prepared by supplier) important for the structure include:

Overview of programs: main and subsidiary programs, organizational modules

Description of processing, in the form of flowcharts

Descriptions, explanations and use of programs, subroutines, routines and functions in the module head

Structuring and specification of program assignments to, for example, units, stations, conveying subsectors, clamping devices, return conveyors, etc. To illustrate these, overviews of the installation shall be produced to include the designations of the assigned units as well as the variable names used.

Meaningful and understandable variable names (separate list)

Meaningful and understandable interfaces with peripheral systems (I/O names, separate list)

Workpiece formulation management is not permissible on the PLC if a control panel is used

For use of an S7-1500/300, a CPU (PLC system) approved in the MDM shall be selected that is adequately high-performing for the requirements of the station and for connection to the overriding IT systems (e.g. PRISMA, cell system, quality data, etc.).

The average PLC cycle time in production operation shall not be greater than 15 ms with an S7-300, with S7-1500 not greater than 25 ms.

A software check shall occur prior to shipment acceptance and at the milestone of operational system + acceptance.

3.5.1.3.1 S7-300 Software Specifications

The following specifications shall be complied with for PLC projects with S7-300 in Production:

- Designs and specifications shall be taken from the project handbooks of the control system product partners

For PLC projects with S7-300 in Assembly, the following specifications shall be complied with:

- Style Guide for Software Creation S7-300 Daimler Powertrain
- Powertrain S7-300 template

The documents can be found in the Daimler Template SharePoint; see requirement specifications Appendix 42.

The blocks provided in the template shall be used by the supplier. Missing blocks and functional scopes that are not covered by the template scope shall be created by the system supplier itself subject to consultation with Daimler and programmed according to the corresponding software style guide.

3.5.1.3.2 S7-1500 Software Specifications

The following specifications shall be complied with for PLC projects with S7-1500:

- Daimler Powertrain S7-1500 Software Creation Style Guide; Powertrain S7-1500 Template

The documents can be found in the Daimler Template SharePoint; see requirement specifications Appendix 42.

The blocks provided in the template shall be used by the supplier. Missing blocks and functional scopes that are not covered by the template scope shall be created by the system supplier itself subject to consultation with Daimler and programmed according to the corresponding software style guide.

3.5.1.3.3 Note on Use of Powertrain Template

The software modules contained in the Daimler AG library are offered as a development template and guideline for PLC software development as per IEC 61131-3. The developers do not offer a functional guarantee and explicitly rule out any corresponding liability. As the software modules contained in the library are provided free of charge, no warranty whatsoever exists to the extent that this is legally permitted. Unless explicitly agreed on in writing, the copyright owners and/or third parties provide the software modules "as they are" without any warranty, either explicit or implicit, including - but not limited to - market maturity or usability for a specific purpose. The user bears the full risk and full responsibility with regard to the quality, freedom from errors and performance of the software modules. If the library or parts of the library prove to be defective, the user shall bear the costs for any service, repair and/or correction. If parts or the entire library are used for the creation of application software or used in software projects, the

user is liable for the freedom from errors, the function and the quality of the application. Any liability of Daimler AG is fundamentally excluded. The user of the Daimler AG library shall ensure via suitable tests, approvals and quality assurance measures that no damage can arise due to possible errors in the Daimler AG library. The aforementioned license conditions and liability exclusions apply equally to the software library, even if this is not explicitly mentioned.

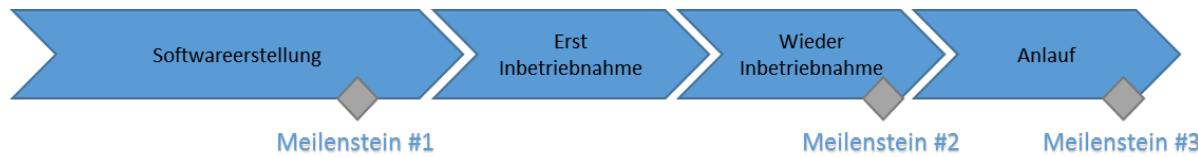
3.5.1.3.4 Training on Powertrain S7 Template

Given the use of the Powertrain S7 Template, the contractor undertakes to train the programmers engaged in the project (incl. sub-suppliers) on the use of the template and to present training certificates at the client's request. Training courses are offered by Daimler for this; information on the training course offers can be requested from the representative.

3.5.1.3.5 Software Acceptances

The supplier shall perform software checks to check the specifications from the requirement specifications and style guides. This shall take place regardless of the Powertrain S7 template.

The software checks shall be performed for the following milestones:



Milestone #1: Acceptance of sample station or virtual model

- Initial test of selected stations
- Milestone #2: Operational system + acceptance of the system

- 100% check of all stations

Milestone #3: Absence of defects

- Elimination of residual defects

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3.5.1.4 NC Programs

To obtain standardized, easy-to-manage, high-performance and comprehensible NC programs for production, they need to be compiled according to specified rules.

NC programming rules: See Appendix 31

3.5.1.5 Data Backup

3.5.1.5.1 Source Project Data Backup

The data backup shall always be submitted in the format in which it was created by the engineering tools. Tools for data backup of all applications, user programs (TLC, NC, etc.) of the operational software as well as for backups of the hard disks (image files) shall be used and included in the delivery shipment (licenses). If third-party devices are used (e.g. tool breakage/wear monitoring, frequency converters etc.), the supplier shall also provide network-capable data backup software and hardware (e.g. cables). Machine operating panel: at the operational system + acceptance milestone of the system/machine, Maintenance shall check the new installation at selected control panels. The following installation steps shall be ensured:

1. Installation of the project DVD of the product partner (Ghost)
2. Installation of machine-specific scopes
3. Configuration of the networks

The installation routine shall be described in detail and enclosed with the documentation. In addition, a batch file (add-on installation) shall be created and integrated so that items 2 and 3 can be run through with max. yes/no questions. Sample files shall be taken from the descriptions of the product partners.

Other PC-based systems: A description and batch file shall be provided for the reinstallation.

Hard-drive backups (images) shall also be created. The tool shall be requested from and agreed on with the representative.

A detailed description as to how the reinstallation and/or recommissioning should take place after hardware replacement (INI files, setup, etc.) shall be provided.

See also specifications and definitions in the project books of the partner companies and Powertrain Requirement Specifications Part V Documentation.

3.5.1.5.2 Online Data Backup

For all the data and software components (tool data, PLC and NC programs, drive unit data, additional software, etc.) installed on our production equipment (PLC, NCs, switches, robots, process control computers, etc.), the technical requirements shall be in place for the unsupervised/automatic data backup of components in ongoing production.

It shall be possible to restore this data backup using the usual engineering tools.
It shall also be possible to carry out the unsupervised/automatic data backup using the standard backup tool (currently Versiondog from Auvesy).

3.5.2 Control Functions

3.5.2.1 Additional Function Modes/Functions for Automatically Loaded Machines

For automatically loaded machines, the following additional operating modes shall be provided:

- Automatic run-to-empty of machine.
- Production with manual loading/unloading of the machine; suitable work safety measures shall be implemented for this operating mode.
- A query as to whether a workpiece is available shall be provided at the picker at the storage/handover positions.

3.5.2.2 Standard Interface for Handling Technology

The Daimler standard interface description "Handling Technology" (see Appendix 4) is binding and only valid for coupling individual machines; otherwise, the product partner's control system concept (see product partner product book) shall be implemented.

Key points:

Fine-tuning by handling supplier with production facility supplier and Daimler representative.

Description of the individual design (documentation) by handling supplier

Interface via plug connector with cross-clip (type: Harting HAN xxE (e.g. HAN 24E) or a compatible brand. For number of connectors and pins, see table.

Interface cable to be delivered by handling supplier

Mating connector (clamp adapter) to be supplied by the machine supplier

It shall be ensured that the axles of the loading gantry in the machine can be calibrated and tested, with the safety doors open (if necessary considering the chapter "Portable press to run device")

Depending on the risk assessment of the handling/machine supplier, the following interface versions are possible:

		1 or 2-channel & field bus (Appendix 4)
Connector		1 x 24-pin & field bus

3.5.2.3 Energy-Saving Measures – Energy Manager

3.5.2.3.1 Unscheduled Production Breaks

Deactivation after a parameterizable run-on time (default setting: 2 min) shall be provided for all major assemblies – where possible without impairing the machine and safety functions or operational reliability.

Documentation and project planning are contained in the Siemens startup set or available through Fanuc.

The parameterization specified in the design phase is recorded in Part III/Form 02 (energy manager parameterization).

Examples:

- Hydraulic supply
- Cooling lubricant and high-pressure cooling lubricant
- Spindle motors
- External ventilation of motors
- Conveyor belts (the machine-linkage interface shall be agreed on and implemented in coordination between the machine supplier and linkage supplier)
- Chip conveyor
- Compressed air supply (not sealing air)
- Coolant and coolant supply

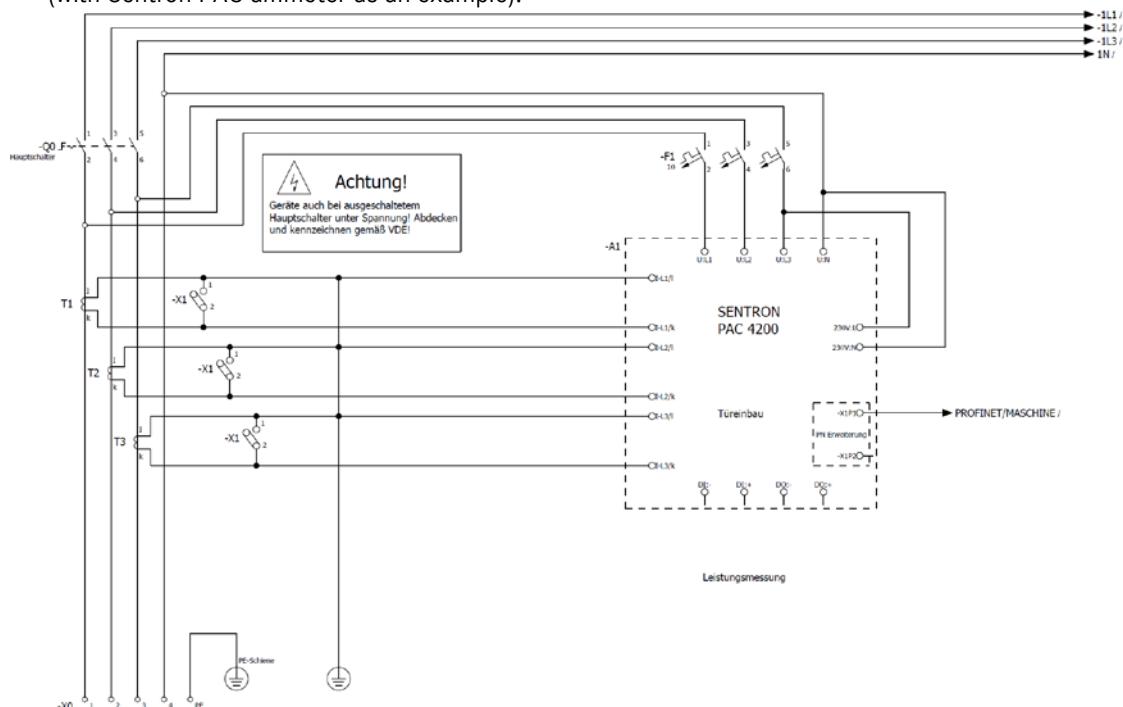
For machine and material flow failures, the cooling lubricant shall basically be switched off.

3.5.2.3.2 Unscheduled Production Breaks

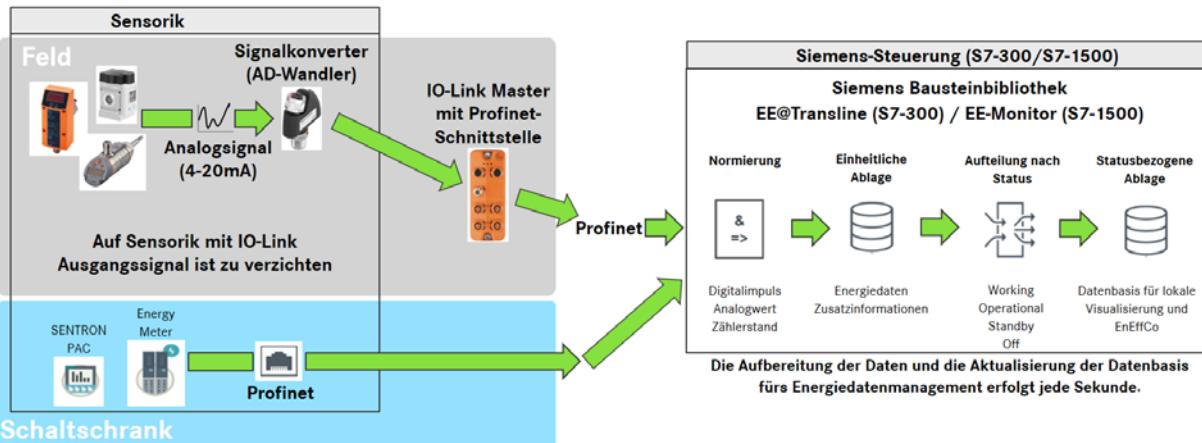
Machines shall be switched off and on again at scheduled production breaks via PRISMA remote signal (see Appendix 7b) – this depends on the type of production system; implementation shall be coordinated with the representative.

3.5.2.4 Recording of Energy and Substance Consumption Rates – Energy Data Monitoring

- For determining the energy consumption and energy efficiency of the production system, the total compressed air consumption and total power consumption of the machine shall be recorded by means of suitable sensors on the basis of VDMA 34179 and displayed on the machine. To this end the site-specific specifications on measurement technology as per MFL (in the MDM) shall be considered.
- The overall current consumption shall be recorded upstream of the main switch; see following circuit diagram (with Sentron PAC ammeter as an example):



- If additional energy carriers are required for operating the system, recording them shall be coordinated with the representative (see also Requirement Specifications Powertrain Part I, General, Chap. 2.3: Specifications for Energy Saving and Increasing Energy Efficiency).
- The software module EE@Transline or EE Monitor with S7-1500 is included in the control panel package from Siemens and forms the database for the overlaid energy data monitoring system (in MO: EnEffCo). Through this database the measurement values are normalized and linked to the operating states. The PLC makes the data available for the overlaid monitoring system. The document with the description of the configuration, commissioning and acceptance inspection is currently in preparation. The contractor shall contact the representative in this regard.



- In systems having combined individual processes (lines/transfer line/production islands/combined systems), sensors shall be installed on each single machine.
- In systems with a connected load of less than 10 kVA, consultation shall occur with the representative as to whether sensors need to be installed.
- The installed sensory system will be used during the operational system + acceptance phase for verifying the data specified in the energy checklist.

3.5.2.5 Interface Signals

All connections to the supply and disposal systems shall be designated in plain text specifying the precise location (installation identification code, floor, coordinates, etc.).

Any bridges which may be necessary up to the activation of the interfaces shall be visible.

All described supply and disposal warning messages shall be in the form of parameterizable keep-alive messages which are flashed up e.g. every 2 minutes on all control panels, but only if no other warning messages are active at that time.

If several supply and disposal warning messages occur simultaneously, the display shall be prioritized according to the below-given order.

Interface signals that communicate via the field bus with other equipment shall be visualized at the production facilities control panel.

3.5.2.5.1 Fire Protection / Fire Extinguishing Systems

For specifications on fire protection for machines and installations, see Chapter 4.9.

The supplier shall provide a potential-free contact (at least in performance level (PLr)= b according to DIN EN ISO 13849 and DIN EN ISO 19353) routed to terminals as a group message (door safety switches of working area) for gaseous extinguishing systems.

3.5.2.5.1.1 Monitoring of Machine Extraction System

The availability of the machine extraction system is monitored as described in Part II Mechanical Components, item 20.3.3. The electrical interface is designed as described in Appendices 18a/18b.

If an automatic valve is available, its operating efficiency shall be tested.

3.5.2.5.2 Compressed Air Signal

For machines requiring compressed air, the machine manufacturer shall monitor the compressed air as follows. A pressure switch (as per the material approval list (in the MDM)) shall be installed downstream of the machine-side locking mechanism.

In case of failure (drop in pressure after shut-off device), the machine shall:
output a warning message on the control panel
generate a message to the MDE/BDE SCADA system

take appropriate measures as required (immediate stop, stop at end of cycle, etc.)

Release of the safety doors shall not be issued until after the pressure has been sufficiently reduced. This shall also be monitored by means of the pressure switch.

3.5.2.5.3 Monitoring of Coolant-lubricant/Washing, Works and DI Water

In the case of machines connected to a central substance supply, the machine manufacturer shall monitor the availability of the substances.

An additional pressure switch as per the material approval list (in the MDM) shall be installed in the inlet **upstream** of the automatic, machine-side locking mechanism.

If the trigger medium fails, the shut-off device shall close automatically.

Pressure surges in the supply lines shall be prevented.

Momentary pressure fluctuations in the supply line (approx. 5 seconds) shall be ignored.

In the case of a pressure drop in the substance before the shut-off device, the machine shall:

output a warning message on the control panel,

generate a message to the MDE/BDE SCADA system,

take appropriate measures as required (immediate stop, stop at end of cycle, etc.),

close the shut-off device. Re-opening of the shut-off device shall only be initiated after the required system pressure is reached.

an admission of the respective substance to return systems shall be prevented after the end of the cycle.

3.5.2.5.4 Interface for Back-Pump Stations (Individual Machine Disposal))

The interface to the back-pump station shall be implemented via a 10-pin Harting connector HAN module (pin assignment and functioning: see Appendix 3).

1 2 3 4 6 7 9

3.5.3 Warning, Fault and Checkback Signals

All system errors and signals shall be evaluated, displayed and, as far as appropriate, an adequate machine response shall be initiated (e.g. stop at cycle end).

Evaluation of any diagnostic and fouling signals from sensors (M12X1 connector, pin 2) shall involve a save operation and shall be displayed at the control panel as an operational signal. Programming of this is as set out in the project book of the respective product partner.

If spindle temperature measurement is stipulated in the Mechanical Engineering specifications, it shall be recorded analogously in the PLC. For evaluation in the PLC and for display of the spindle temperature at the monitor, a separate window is planned, to be coordinated with Daimler.

Collective messages are not permitted.

The checkback signal (operational notification) from drives shall be transmitted via the respective contactor.

5

4 Systems

- It shall be ensured that the same system is always used per production area (card reader, embosser, laser system, measuring instrument, etc.).
- If process control computers (e.g. measurement computers, test bench computers, etc.) are used, the current MDM approvals shall be observed. For a better overview, a slide set (hardware basket) can be requested from the representative. The operating system shall be coordinated with Daimler.
- The measurement technology for SPC measuring stations is specified (measurement software, measurement boxes and measuring sensors, also see Chapter 5.4 Quality Systems).
-
- Detailed error messages from subsystems that have no separate PRISMA connection (image processing systems, ...) shall be transferred to and visualized on the main control panel and shall be reported to PRISMA. The scope of the messages shall be coordinated.

4.1 Robots

For specific orders, inquiries are to be made of the articulated arm robot make provided by Daimler.
Prisma connection for robot units: Whether a direct interface is necessary shall be clarified in consultation with the operator.

All bids shall include the item "Robots provided by Daimler".

The warranty is coordinated by OEM.

Designs of robots are as given in the respective project books of the robot suppliers.

Portal and swivel arm robots require an approval in coordination with the representative.

The design of the hose packages shall be agreed on with the representative.

With regard to control and programming, the following points are binding in addition to the other high-level regulations for gantry, rotary arm and articulated arm robots:

Actuation of the robot gripper technology shall be carried out exclusively using the robot control system.

Actuation of gripper functions using the superordinate control system technology is not planned.

If the robot cell's safety guards are open, it shall be ensured that the grippers can be operated in operating mode T1 in combination with the enable button on the robot.

Signal exchange shall be executed using the field bus of the robot control system as defined in the relevant project.

Robot system, sequence, and peripheral faults (no collective messages) shall be reported via the XML interface to PRISMA and displayed on the robot programming device. If Production is of the opinion that no direct Prisma interface is required, then error messages shall be reported to Prisma via the PLC.

It shall be possible to visualize the actuators/sensors of the robot peripherals by means of the setup images of the station control panel.

Once the "home position" button on the control panel of the station control system is actuated, the robots immediately move to their home position (to be individually defined).

An emergency strategy (e.g. deselection of individual robots) shall be coordinated with Daimler.

The robot programs shall be commented on in an as detailed manner as possible

so that the programming is self-explanatory (incl. process diagram and program structure).

A PLC integrated in the robot control system may not be used.

4.2 Path-Measuring Systems

So as to be able to quickly reset an NC axis following change of a measuring system, please note the following:

A vernier scale shall be attached in the basic position to the axis in a position where it can be easily read.

The reference position to be entered shall likewise be marked legibly on the vernier scale
(alternatively in the switch cabinet with reference to the axis). An engraved sign shall be used.

A drawing of the position of the vernier scale and the associated reference dimension, including machine data, shall be included with the documentation.

Measuring systems and sensing head shall be exchangeable by means of a mounting aid,
e.g. fixed stops, with no need for adjustment using dial gages.

Measuring systems may not be installed directly in the wet area.

Longitudinal measuring systems shall be so attached that the sealing lips point to the side away from the spray water. If necessary, an additional mechanical cover shall be provided.

To protect the measuring systems against cooling/lubrication spray mist, compressed air according to ISO 8573-1 shall be supplied by means of a suitable filter combination.

For all machining axes of rotary cycling machines and transfer lines, direct path measurement systems shall be provided.

4.3 Identification Systems on Workpiece Supports

The components of the respective product partner shall be used.

The assignment of the data carriers shall be undertaken in detailed agreement with Daimler.

The contractor presents a proposal and updates the data carrier assignment up to the milestone of operational system + acceptance.

The assignment shall, among other things, have the following structure:

The initialization state of the data carrier corresponds to NOK (not OK) of all stations.

The workpiece carrier number shall be stored twice on the data storage medium and the two entries compared to each another at each automatic station. In the event of a discrepancy, the workpiece carrier shall receive the status "NOK without further processing". At the next rework station a corresponding error message shall be generated and the data carrier corrected by manual input. The workpiece carrier number may not be written at other points. The first workpiece carrier number is only for the plausibility check. The second workpiece carrier number is used for system queries, displays etc.

Type management shall be done centrally by way of a higher ranking system.

Each station and each workplace outputs a station OK or NOK for each suboperation as well as - for example in the case of multiple screwdrivers - individual OK or NOK and NOK criteria, such as tightening torque too low or exceeded.

Measurement results only if these are evaluated in the subsequent stations.

The current overall status of the workpiece, that is total OK or NOK, as well as the station code of the station which has output this logic result shall be included.

A special image on the control panel shall make it possible to read out data storage media via each connected read/write head, to manipulate the data, and then to write them (maintenance personnel only).

The data carrier content shall be output in plain text, e.g. processing of station 4: OK. The relevant texts shall be saved in a text file on the control panel in ASCII format and added to the documentation.

The user shall be able to select whether the contents of the data medium will be displayed in binary, decimal, hexadecimal or ASCII form.

4.4 Specifications for Use of Data-Matrix-Code

If designation and/or identification of parts using data-matrix code is foreseen, the specifications regarding: coding

labeling systems

cameras and reading systems

prerequisites for implementation

Plausibility checks

as set out in Appendix 16 are binding.

Within a project the same laser systems, camera systems, etc. shall be used.

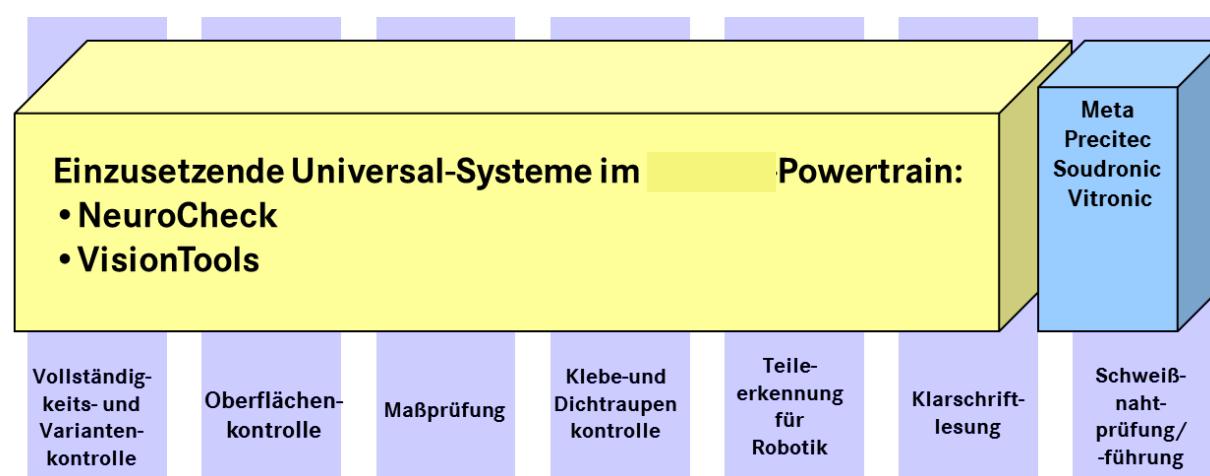
The components to be used shall be agreed on with Daimler.

4.5 Image Processing Systems

NeuroCheck and Vision Tools are the standard systems at Daimler, the use of which is mandatory. If these systems are not possible for certain applications, the use of a special system is possible after consultation with the representative. A written position statement and recommendation by the standard suppliers or experts at Daimler are required.

Software licenses, such as dongles, shall be included (for NeuroCheck the Premium Dongle) in order to enable adjustments to the camera systems. The number and functionality of the dongles to be supplied shall be determined in consultation with Daimler.

Supplier overview where image processing systems are used:



4.6 Press-Fit Technology

All process information, like set/actual values, measured curves, etc. shall be displayed on a monitor or LCD display.

The measuring system shall be programmable using a built-in keyboard.

The parameter input shall be blocked via the EKS system. Systems that do not have a corresponding interface shall be protected using a freely programmable password.

In the case of changes, there shall be a time stamp (logbook).

The measuring system shall be a stand-alone functional unit independent of the station PLC, consisting of instrument amplifier, processor, input/output unit, visualization and power supply.

Signals are exchanged via Profinet. and optionally with a hookup to the I/O level.

For data backup and for uploading programs/parameters, a PC interface (V24, TCP/IP,USB) shall be provided.

Complete data backup shall be possible without password.

Statistical evaluation of force and path shall be possible. The I/O level shall be shown on the monitor.

Rechargeable batteries used for data backup shall be without memory effect.

It shall be easy to perform the calibration/counter-measurement via suitable measures/devices. An operating mode for calibrating the pressing (without component) shall be provided at the operator console. At least 3 force application points and 3 displacement points shall be freely programmable and approachable through the PLC program or press control program. There shall be a description of how calibration is to be performed. Separate operating mode like for the screw-driving equipment.

Components as per material approval list (in the MDM). A restricted validity for sites and specific measuring procedures shall be observed.

If a PLC function module is offered by the system supplier for the PLC < - > measuring system interface, this shall be used and may not be modified.

Existing ID features, like production or motor number, shall be transmitted via the bus link to the measurement control system.

The list of requirements (see Appendix 38) shall be complied with

4.6.1 Description of Self-Monitoring Process, Emergency Stop

Before commencing each cycle, the program no. shall be defined by the PLC and a self-test started in the measuring equipment. which then checks the sensors (measurement chains) and analyses the results (duration: max. 0.5 sec): offset and amplification (manufacturer-dependent 80% or 100%) for force sensors and zero point for path-measuring sensors.

If this test is not satisfactory (not OK), an error message is issued by the PLC. The press-in stroke shall then not even start.

If this test is satisfactory, the PLC may start the measurement and initiate the press-in stroke. The measuring instrument now records the force/path value pairs as a curve.

In parallel, the emergency stop - insertion process monitor - becomes active to prevent tool breakage.

For this purpose, the instrument evaluates the force "live" as a path section is traversed. If the permissible force

is exceeded, a "live" output is immediately set and the measurement is stopped, with the PLC setting an error message.

To terminate a normal measurement, a "stop measurement" signal is needed. This will be offered either by the PLC or generated by the instrument itself. In this respect, the strategies of the equipment manufacturers differ. After recording the graph, it is then evaluated on the basis of the parameters and limits from the initially selected series of set values (program no.).

Finally, the OK/not OK evaluation is set and the result displayed.

Prior to implementation, signal exchange shall be described to and clarified with Daimler. The feed shutdown is to be independent of the PLC cycle.

4.6.2 Hydraulic or Pneumatic/Hydraulic Press-Fit with Additional Force-Path Measuring System

Should it be necessary to establish the quality of a press-connection, this can only be done during the press-fit process itself. For quality control, a suitable force-path measurement system shall be provided. The press-fit process can be by hydraulic or pneumatic/hydraulic (force converter) means. For components, see material approval list (in the MDM).

4.6.2.1 Force Sensor

Calibrated in kN with test report.

Sensor technologies:

Strain-gage operating principle

full bridge (e.g. 350 ohms), normalized to 1 mV/V or 2 mV/V

Piezo technology

Only calibrate force measuring elements may be used (fully installed and pre-stressed load cells).

The measuring range of the sensor shall be greater than the maximum occurring forces, even in case of a fault.

Only highly insulating coaxial cables with low capacitance may be used as connecting cables, which generate only very little frictional electricity when moving.

An external load amplifier may only be installed outside the switch cabinet after consultation with the representative responsible.

Co-traversing sensors shall be pluggable ahead of the first and after the last traversing positions. Cables permanently attached to the sensors shall be executed as cable coils to safeguard them against damage.

The connecting cables for piezo-electrical sensors in drag chains shall moreover be protected by appropriate measures against kinking and small radii (e.g. through protective hoses). The connectors shall not be strained by pulling, compression or twisting. Strain-relief clamps shall be planned. Measuring cables shall not be laid parallel to live cables; if possible use separate cable duct.

Components as per material approval list (in the MDM). A restricted validity for sites and specific measuring procedures shall be observed.

4.6.2.2 Path-Measuring Sensor

As a spring-loaded sensing device – A mechanical coupling may only be used after consultation with the representative.

The probe shall have an adequately high spring force to avoid spurious measurements in the event of vibrations or mechanical shock

Measurement probes with in-line amplifier in the connection cable shall not be used.

Co-traversing sensors shall be pluggable ahead of the first and after the last traversing positions. Cables

permanently attached to the sensors shall be executed as cable coils to safeguard them against damage.

Components as per material approval list (in the MDM). A restricted validity for sites and specific measuring procedures shall be observed.

4.6.3 Electric-Motor Press-Fit with Integrated Force-Path Measuring System

Press-fit spindles (with Profibus connection) may be used only after consultation.

Components as per material approval list (in the MDM). A restricted validity for sites and specific measuring

procedures shall be observed.

A price comparison of the hydraulic and electromotive systems is required

4.7 Process Monitoring and Control Systems

4.7.1 General Information

The term "process monitoring and control systems", called measurement control systems in the following, is used to define all additional procedures that are not directly part of processing but which additionally register, influence or correct the processing process. They are used predominantly in mechanical production. Usually, direct references are made to physical parameters.

Excluded from this are screwdriver control units and press-fit devices (see separate chapters).

Pre-process, **in-process** and **post-process** measurement controls can be used in machines for:
extremely precise processes which do not allow for any re-machining at all or only at considerable effort and expense (e.g. finish-grinding)
adjustable tools (adjustment for wear)
machining processes which change other characteristics through the machining process (e.g. runout of the crankshaft during hardening)
process controls which are managed by statistical methods

Additionally to measurement control, the following other process monitoring and controlling systems can be used if agreed on:

leakage test, leakage measurements
for in-process tool monitoring, (see Chapter 3.2.3)
power/energy/cosφ monitoring
balancing control.

4.7.2 Design

4.7.2.1 Measuring Station and Measurement Control

The measuring station shall be shielded from the mechanical machining unit, which means no entry of coolant-lubricant or chips into the measuring station. The measuring lines (pneumatic, electric) shall be installed without an energy management chain in a festoon arrangement ("monkey swing") without trailing cables. Intermediate plugging of the measuring lines can be dispensed with in the case of freely laid lines up to 52 m. Accessibility for calibrating and setting purposes shall be guaranteed for all probes and gages.

4.7.2.2 Hardware

PC-based hardware with standard operating systems (the IT boundary conditions shall be complied with). Only approved PC hardware from the material approval list (in the MDM) shall be used.

Requirements:

Ambient temperature according to DIN EN 60204. If set up on the switch cabinet platform in PGS: maximum ambient temperature 65°C

Resistant to oil, water, polluted air in the shop.

Min. protection class IP 54.

Impact- and vibration-proof installation.

Color displays in flat screen design (e.g. TFT or comparable flat screens), with at least 12" screen diagonal shall be used.

The housings shall be designed in such a way that no active cooling facility is required

Keyboard units shall be provided for the above-mentioned application location in Production

4.7.2.3 Software

The software shall comply with the IT boundary conditions. If necessary, consult with Daimler AG. Detailed error messages shall be transferred as plain text to the machine control unit, where they shall be evaluated, displayed and reported to the MDE/BDE SCADA system.

4.7.2.3.1 Measuring Programs

The characteristics shall conform to the physical measuring task (drawing) and shall be assignable. For service purposes, test programs for internal and external parameters shall be provided (I/O, AD converter, carrier frequency, etc.). Non-linearized probe values shall be displayed individually for calibration purposes.

The operation of the measuring software shall be self-explanatory and logically configured in a menu structure. It shall be possible to edit and change the linkage control of the measuring program. Each intervention shall be traceable (by: change index, date stamp, user ID). For each program (measuring program, sequence control, interface control, etc.), at least one comment line per program line shall be documented and provided to describe the operations executed in the program in the source code.

The workpiece types shall be transferred from the machine control to the measurement control. For each workpiece type, a separate measuring program shall be programmed indicating the active type on the control panel of the measurement control. Missing probes or invalid characteristics shall not be pre-assigned or stored or approved as NOK (Not OK) or error. Different variants shall be taken into consideration per workpiece type and may later be activated or released by Daimler AG.

4.7.2.3.2 Interfaces

The measurement controls shall be able to communicate with higher-ranking PCs or LAN via defined interfaces (e.g. Ethernet, TCP/IP, or field bus).

An interface shall be provided for data backup. Measurement values for the machine control system can be transferred using potential-free BCD-coded I/Os (DC 24 V), analog signals (4-20 mA or 0-10 V) or field bus. All interfaces shall be clearly described in the documentation both on the measuring device side and on the machine side. Data exchange shall be programmed with plausibility checks and bidirectionally with handshake and error bit evaluation. A retry shall automatically be triggered in case of a faulty transmission. System errors shall be traceable and saved in an error log or protocol file (at least 100 errors with system date and time). Error messages, warnings shall be stored in a cyclic memory and shall not use up system resources (e.g. fill up hard disk capacity).

4.7.2.4 Measurement Processes, Measuring Pickups, Encoders

Non-contact measuring procedures shall be used. If this is impossible, low-wear procedures, such as

pneumatic nozzle plug gages or

differential probes with diamond tips

are the alternative. Standard probes shall be used.

Not permitted are:

strain gages in the case of measuring probes

resistance path probes

buffer boxes

PE converters integrated into the plug gage

4.7.2.4.1 Pneumatic Measuring Methods

PE converters shall be provided with measuring connections for pneumatic and electrical systems.

For pneumatic nozzle plug gages, fine particle air filtering shall be provided at each measuring station. Per gage, a separate pressure control unit shall be installed. Air deficiencies shall be detected and reported (pressure switch for each gage).

When switching the machine off, the air supply to the plug gages shall be maintained by means of a pneumatic run-on time. The pneumatic air losses shall be kept as low as possible. An energy-saving circuit shall be provided

that shuts off the measurement air when the machine is powered off or not ready for operation (lack of parts, workpiece jam, no cooling lubricant available, etc.).

4.7.3 Documentation

System-internal and -external documentation shall be supplied. The same applies to function and sequence descriptions of the installed hardware and software (documentation on AD converter cards, interface cards, PE converters, special cards, operating system software, measuring software, etc.). All non-commercially available components shall be provided explicitly with internal circuit diagrams, configuration drawings and component mounting diagrams.

4.7.3.1 Identification

All components of the measurement control shall follow the identification system of the machine (location codes, etc.). An engraved overview/assignment plate (or similar) is to be attached on site with all measurement tasks with specification of tolerances, probes, criteria and reference measuring surfaces.

4.7.4 Operation

It shall be possible for the measurement control to be switched off or deselected by the machine control for operational or test purposes. It shall also be possible to mask individual characteristics.

The machine shall be able to operate without measurement control within a certain scatter band. The maximum deviations caused by this shall be specified separately (operating instructions).

4.7.4.1 Corrections

The results determined by the measurement control (deviations) leading to corrections within the machine shall be transmitted to the machine control as raw data (no manipulated reference values). The calculation of the individual values shall be executed in the user program (NC program) (e.g. by way of user cycle, subprogram, R parameters). In this way, any correction is traceable by the operator at any time.

An operationally safe, bidirectional data exchange between measurement control and machine control systems with plausibility check (e.g. data valid, within the measuring range, measurement in progress, end of measuring cycle, etc.) shall be set up.

4.7.5 Optimization, Maintenance

4.7.5.1 Adjustment of Measuring Pickups

The operator shall be able to replace and adjust standard measuring probes without help from specialists. Access to the measuring probes shall be guaranteed. It shall be possible to operate the station for testing, calibration or restart, should this be necessary.

4.7.5.2 Setup for Service

The measuring station shall be installed and configured in such a way that individual probes and gages can be replaced without completely disassembling the device. Gage replacement, including resumption of operation, shall be possible within a quarter hour. without special tools and without complex auxiliary devices which need to be mounted separately.

4.7.5.3 Calibration

The templates (min/max templates) shall be integrated into the machine. These templates shall be provided with dowels plus name plates specifying the parameters to be measured. For calibration purposes, it shall be possible to easily remove them from the machine.

Calibration using the setting templates is always necessary after:

a change of probe

probe adjustment

system start

prolonged downtime of the machine

freely parameterizable times (e.g. after shift change). These times shall be proposed by the machine manufacturer and shall be explained in the operating instructions.

At all times, it shall be possible to start a calibration manually. The deviations of each calibration shall be stored; furthermore, it shall be possible to evaluate them just like measuring parameters (e.g. for measuring device capability checks).

Calibration instructions shall be submitted for construction release.

4.7.5.4 Data Backup

Data backup shall be performed in accordance with the Powertrain Requirement Specifications, Part V, "Documentation".

The measured data shall not use up the system resources of the installed storage media in the course of time. Cyclic memories with a capacity (FIFO) of at least 1 year on the basis of 3-shift operation/7 days per week shall be provided.

Tools for the targeted user-defined deleting/editing/modifying of the source data shall be supplied.

In the case of data loss, it shall be possible to reinstall the system and application software within a maximum of ½ hour, e.g. using a system CD. A detailed description of reinstallation or restart after a change of hardware (INI files, setup, etc.) shall be supplied. **This point shall be checked at the milestone of operational system + acceptance by Daimler (hard disk formatting)!**

4.8 Laser Systems

4.8.1 General Information

This chapter is valid for all independently usable laser systems.

Color scheme: component suppliers' standard colors are permitted.

Laser systems are generally to be implemented as Blue PCs.

If vapors occur during the laser process, these shall be extracted with a monitored extraction facility.

The extraction systems of laser systems shall be wired such that the laser cannot activate in the case of failure/malfunction of in the extraction system (extraction system OFF or malfunctioning = laser operation blocked).

4.8.2 Standardization and Selection of Suppliers for Labeling Lasers

For this purpose, see material approval list (in the MDM) or Appendix 16a: "Machine Supplier Specifications" on the data matrix code

In addition:

In each production area, lasers shall be standardized. Make and type shall be requested from Daimler AG.

4.8.3 Design

The laser enclosure shall be designed such that the laser corresponds to class 1 when installed.

The laser station shall be shielded from coolant-lubricants. These shieldings shall be installed such that they can be disassembled without extensive work and without special tools for adjustment and service purposes and that the accessibility is ensured. This does not apply for the (safety) enclosure of the laser.

Sufficient work room and protected areas shall be included in the planning.

Contrary to the other specifications, service doors shall be treated like safety doors, that is they shall be interlocked.

For installation in the production line, the protection class IP54 is sufficient. However, the controller cabinet shall be set up on a plinth at least 20 cm high.

4.8.4 (Omitted)

4.8.5 Cooling System

The standard housing as per the material approval list (in the MDM) shall be used.

4.8.6 Maintenance

It shall be possible to operate the laser equipment even with the machine switched off for maintenance and inspection purposes (e.g. for measurements on the activated laser). This shall be possible without bridging or bypassing safety devices.

4.8.7 (Omitted)

4.8.8 (Omitted)

4.8.9 Extraction

The extraction system shall be positioned in the immediate vicinity of the removal point (processing point). The component part approvals can be found in the material approval list (in the MDM). The extraction system shall be provided with a flow monitor.

4.9 Machine and Plant Fire Protection

4.9.1 General

The following specifications apply for all types of fire extinguishing systems, fire alarm installations and radio alarm systems, Irrespective of whether the fire protection equipment is installed by the machine supplier or by Daimler.

Alternative fire protection equipment and fire protection technologies (e.g. high-pressure water mist) are possible in coordination with the representative (see Chapter 1.4, Representative).

4.9.1.1 Scope of Protection

The scope of protection for a machine arises from the machine risk assessment (machine and system definition according to MRL or DIN EN ISO 12100).

4.9.2 Machine Supplier's Scope of Delivery and Interface between Machine and Fire Protection Equipment

The machine's interface to the fire protection equipment is included in the complete scope of delivery of the machine. This includes all control functions, pin connectors with plugs and sockets, the display on the machine control panel and other scopes of supply which belong to the interface on the machine side.

4.9.2.1 Interface

The interface between the fire protection equipment and the machine consists of a connector. The make and type depend on the applicable materials approval list.

The connection cable between the fire protection equipment and the machine is included in the scope of delivery of the fire extinguishing system supplier. The mounting of the connecting cable at the connector is part of the scope of delivery of the fire extinguishing system supplier.

Design of the interfaces:

Machine: HAN 24 plug connection

Fire protection equipment: Fixed connection via terminal strip as per Appendix 17

4.9.2.2 Function Description

4.9.2.2.1 Fire Alarm

The exhaust air flap is to be closed by means of the machine control system and the machine shall be immediately set to a safe condition in the event of a fire alarm (see Interface, Appendix 17/1). All ignition sources and easily flammable substances and substances that could jeopardize fire extinguishing shall be switched off.

A display appears on the control panel of the machines concerned.

For display texts, see operating instructions and Appendix 17/1.

4.9.2.2.2 Radio Alarm

The required deactivation mechanisms of the machine/production facilities shall be agreed on with the representative responsible taking into account the preventive fire protection and with the involvement of the operator.

4.9.2.2.3 Operational Readiness of the Fire Protection Equipment

If the fire protection equipment is not operational and not able to extinguish fires, the machine moves to the end of the tool set. A display appears on the control panel of the machine concerned.

For display texts, see Appendix 17/1.

4.9.2.2.4 Operational Readiness of the Radio Alarm System

The operating requirements of the machine or system will no longer be fulfilled in the event of an inoperable radio alarm system. The machine/system shall be immediately set to a safe condition. A message is sent to a constantly staffed location and to the automation system of the machine/production facilities.

It is displayed on the control panel of the respective machine/system.

For display texts, see Appendix 17/1.

4.9.2.2.5 Ballcock (manually operated)

The ballcock installed in the extinguishing agent line/control line serves to shut this off. The ball cock positions are monitored electrically and indicated to the machine via the interface.

The stopcock positions: open, closed and undefined as well as their display texts are described in Appendix 17/1. The ball cock position signals shall not be acknowledged on the machine. For the undefined position, a suitable time period shall be allowed for suppression of the fault signal. The open and closed ball cock positions are signaled to the machine control system without delay via the fire-fighting center.

In center position or with closed ball valve (see Interface Appendix 17/1)
operational readiness of the machine is not possible – exception: manual mode.

4.9.2.2.6 Door Monitoring (machine)

The machine delivers a cumulative message to all door contacts in the extinguishing area: Door Not Closed. If a door is open, automatic triggering of the extinguishing system will be suppressed electrically via the central fire alarm system. With respect to its extinguishing capability, the extinguishing system is then not operational (extinguishing system not operational).

The interlinkage with the machine's door contact is not a personal safety device and therefore does not replace the actuation of the ballcock for protecting the personal safety of workers.

Even in case of - Door Not Closed - an active fire alarm will be forwarded via the central fire alarm system to the permanently manned post.

The safety function shall be designed by the machine manufacturer as well as the fire extinguishing system supplier in a cross-interface manner with at least performance level (PLr=) b as per DIN EN ISO 13849 and DIN EN ISO 19353. Achievement of the Performance Levels shall be demonstrated accordingly in the documentation.

The machine shall deliver a continuous signal relaying the position of the doors. When the machine is switched off (main switch turned to OFF or power failure), it shall be decided whether the – Door Not Closed – signal is present or not. Based on a risk assessment, each Daimler site shall decide whether or not the extinguishing system is to be active when the machine is switched off.

4.9.2.3 Electrical Design

For the electrical design, refer to Appendix 17/1 in the Specifications.

4.9.2.3.1 Connector Assignment

The connector assignment for the interface between the machine and the extinguishing system is described in Appendix 17/1.

- Version at machine: Harting connector
- Version at the extinguishing system: Fixed connection via terminal distributor

4.9.2.3.2 Potential Equalization

For implementation of potential equalization, see Appendix 17/1, Section 3.9 et seqq.
The checklist is to be attached to the acceptance report.

4.9.2.4 Exhaust Flap

For the functionality and technical design of the ventilation air valve, the rulings in the Part II of the Specifications, Mechanical Engineering, apply.

Technical requirements:

- Closing time: < 1.5 s
- Temperature resistance: min. 900°C

The ventilation air valve is included in the scope of delivery of the machine supplier. This refers to supply, mechanical and electrical installation, documentation and functionality of the ventilation air valve. In addition, in case of a fire the ventilation air valve shall be closed by the machine control system. It shall not automatically open when the extinguishing system is reset. It is enabled by way of the machine control system.

For process reasons, e.g. the required minimum exhaust air speed into the scavenge line of the central extraction system, the vent flap shall be kept open at all times as per VDI3802 sheet 2. In case of fire alarm the vent flap shall be closed.

The exhaust air flap is to be checked regularly for working order. The flap inspection shall be conducted at least once a week and each time the machine is switched on (in parallel to the emergency stop test).

The exhaust air flap's functionality is to be checked and ensured as follows:

- Check of whether the end positions are open or closed
- Check of the runtime for opening and closing of the flap
- Check of the end positions, pair monitoring

The function test shall be conducted automatically in the machine control. The machine shall not be put into operation in the event of faulty functions.

4.9.2.5 Installation of Fire Detectors in the Machine/Production Facilities

All jigs, fixtures and auxiliary constructions for the installation of fire detectors in the machine/system are included in the machine supplier's scope of delivery. The adapter pieces for the installation of the fire detectors in the machine's air extraction system (design according to Appendix 17/1) are also included in the machine supplier's scope of delivery.

4.9.2.6 Power Supply of the Fire Protection Installation via the Machine and Equipment Control

See Chapter 4.9.3.6.2 Power supply of the fire protection installation

4.9.3 Fire Protection Equipment

4.9.3.1 General Information

The fire protection equipment is installed in compliance with the currently valid version of the VdS guidelines. The extinguishing systems require system approval by the VdS.

All components that can be changed out shall be freely accessible, to perform maintenance speedily and without hindrance.

All attachments and bores at the machine are to be coordinated with the machine supplier.

4.9.3.2 Extinguishing Agents

Depending on the machining operation, appropriate extinguishing agents shall be used:

Aluminum and steel machining: CO₂ fire extinguishing systems

Magnesium machining: Argon fire extinguishing systems.

The use of alternative extinguishing agents is possible with the approval of the representative.

In this connection, the different system approvals of VdS Schadenverhütung GmbH shall be observed depending on the object to be protected. Additionally, the regulations and recommendations of the German employers' liability association shall be complied with.

4.9.3.3 Fire Monitoring

Depending on the risk evaluation, one fire monitoring system may be sufficient for a machine or system.

The fire alarm technology shall comply with the description in Chapter 4.9.3.6.

4.9.3.4 Approved Installers of Fire Protection Systems

Approved installer makes:

	Fire detection system	Inert gas extinguishing system	Radio alarm systems	
Minimax	X	X	X	
TotalWalther	X	X	X	
Wagner	X	X	-	
Siemens	X	X	X	
Grecon	-	-	X	
				W Y Z
Kraft & Bauer	-	X	-	
Securiton	X	-	X	

4.9.3.5 Components and Design of the Extinguishing System – Mechanical Components

The extinguishing gas is stored in bottles set up in the immediate vicinity of the facilities to be protected. The locations shall be coordinated with Daimler!

Maximum permissible sizes for extinguishing gas cylinders:

- CO₂ systems: 10 kg
- CO₂ systems: 40 ltr./30 kg
- CO₂ systems: 50 kg
- Argon: 67 ltr./23.9 kg

WX Y Z

Setting up the bottles within the machine or within the machine enclosure is not permissible.

The individual cylinder systems / cylinder banks are to be protected against unauthorized access. Furthermore, the extinguishing system is to be positioned in such a manner so that no hoists or cranes are required to transport the cylinders. It is not permitted to install the extinguishing system on platforms. Free access to the central fire alarm system or fire-fighting center shall be ensured.

The extinguishing system shall be included in the machine layout (FAPLIS system).

4.9.3.5.1 Design of the Extinguishing Systems as Compact Systems

The individual cylinder system is installed in a compact cabinet together with the fire-fighting center. The compact cabinet (W/H/D: 800/2000/600 mm) shall be designed for two 30 kg extinguishing gas cylinders. The blocking ball cock can be installed in the compact cabinet or in the extinguishing gas line outside it. The ball cock should always be installed in the compact cabinet on the front.

This includes: Door cutout and substructure for the ball cock box.

These scopes are always included in the scope of delivery of the extinguishing systems.

The assembly cutout is to be closed with a sheet if the ball cock is installed externally.

The installation position of the ball cock can be announced by the client two weeks prior to the start of installation at the earliest.

In the compact extinguishing system cabinet, 2 single-zone extinguishing systems with, in each case, an extinguishing agent volume of 30 kg or one single-zone extinguishing system with max. 2 fire extinguisher cylinders with, in each case, 30 kg.

4.9.3.5.2 Locks

All central fire alarm systems, firefighting centers, radio alarm centers as well as enclosures and compact cabinets are to be provided with a profile half cylinder lock. The half profile cylinder is provided by the customer.

Lock at Plant W10: 3-3-98

Lock at Plant W68: as agreed

Lock at Plant W40: Group 99

Lock at Plant W20: KESO 200/5

Lock at Plant W27: KESO 200/5

Lock at Plant W69: as agreed

Lock at Plant W24/30/34: Zeiss Ikon 41 HN 140

A
F
E
Z
Z
Y
X

4.9.3.6 Components and Design of the Extinguishing System – Electrical Components

4.9.3.6.1 Fire Alarm and Firefighting Center

The systems always require a VdS approval.

System recognition with the employed extinguishing technology

The firefighting center contains:

mains power supply, emergency power supply (72 hours) and battery charger

mains power supply, emergency power supply (30 hours) and battery charger

all plug-in units needed for operation and monitoring of the extinguishing system

A	E	F	W	Y	Z
				X	

All lines of the fire extinguishing control center (primary, monitoring and trigger lines) shall be monitored for breaks, short-circuit and ground faults.

The fault alarm signals of the fire-fighting center are to be displayed separately on the display or as LEDs.

The fault alarm signals are to be forwarded externally as signals via dry contacts.

The unauthorized operation of the fire alarm/fire-fighting station shall be protected by a cover with lock or by a password.

4.9.3.6.2 Power Supply of the Fire Protection Installation

The power supply of the extinguishing system and radio alarm center shall have its own electric circuit with separate, specially identified fuse protection (red circuit breaker). The power supply shall be tapped upstream of the main switch of the machine control (see Appendix 17, Scope of Delivery of the Machine Supplier).

The connecting cable for the power supply between the machine's switch cabinet and the switch cabinet of the extinguishing system / radio alarm center is part of the scope of delivery of the system suppliers.

An additional isolating switch with its own base-mounted housing shall be installed in the area of the extinguishing system / radio alarm center (see Appendix 17).

4.9.3.6.3 Compact Extinguishing System

The central fire alarm system / fire-fighting center is integrated in the compact cabinet. It can monitor and control a maximum of two extinguishing areas.

Unauthorized operation of the system is to be prevented by a cover with lock or a password.

4.9.3.6.4 Radio Alarm Center

The radio alarm center meets the requirements for the aforementioned fire alarm and firefighting center and requires a system approval from VdS.

Unauthorized operation of the system is to be prevented by a cover with lock or a password.

4.9.3.6.4.1 Switch-off of Signal Lines of the Radio Alarm Center

All shut down signal lines are to be signaled to DAIMLER's safety host computer. The message "Signal line switched off" is sent simultaneously to the machines (e.g. extraction system). The machine (e.g. extraction system) is then shut down, since no operation enable is present.

If the radio alarm center is unable to report the shut down signal lines individually to the DAIMLER safety host computer, the information shall be integrated in the collective fault of the radio alarm center. The single message is given preference. This shall be agreed on with the representative responsible before the installation of the spark detection system.

4.9.3.6.4.2 Maintenance Input in the Radio Alarm Center

A maintenance switch on the control panel of the machine (e.g. extraction system) suppresses the through-connection of all visual detectors / visual signal lines to the Daimler safety host computer. Operating the maintenance switch shuts down the machine (e.g. extraction system). Operation of the maintenance switch is not signaled to the DAIMLER safety host computer.

The maintenance switch shall be designated by the following text:
"Maintenance switch for optical fire signal lines".

The maintenance switch has 2 positions (without zero position) and 2 floating contacts, and is included in the machine supplier's scope of delivery.

4.9.3.6.5 Fire Detection

The number and type of fire detection elements shall be selected depending on workpiece machining operation, material of workpieces, coolant-lubricant mist and machine size. All fire detection elements not sent to the security control center as individual signal shall be equipped with an individual signal display.

Fire alarms shall be equipped with a threaded connection that can be rapidly (<5 min) removed from the outside for inspection purposes to check the fire alarm (without interruption) during ongoing machine operation.

4.9.3.6.5.1 Thermal Detectors

Heat detectors are to be used in single-line dependency unless any other agreement has been made. The activation temperature shall be coordinated with the machine supplier.

Design:

Heat sensors with glass trigger vessels, e.g. ESTI switches, are only permissible in consultation with Daimler in special cases.

Thermal detectors shall ideally be installed in the exhaust air connection of the machine. The distance between the work room of the machine and the heat detector shall not exceed 0.5 m. For the installation of the heat detector, the adapter illustrated in Appendix 17/1 is to be supplied and installed for the installation of the fire sensors.

Electrics:

Connection via extinguishing section junction box, for terminal assignment within the box, refer to Appendix 17/1.

4.9.3.6.5.2 Flame and Smoke Detectors

Function:

Depending on the machine type and work room atmosphere, suitable flame detectors (e.g. infrared fire-eyes) and smoke detectors may be used in two-line/detector dependency.

Combinations of alarm types, for example:

Heat detector – flame detector

Heat detector – smoke detector

Smoke detector – flame detector

are possible.

Design:

Fire detection equipment with VdS certification and system certification for the fire extinguishing technology. The system and detector approvals of VdS Schadenverhütung GmbH shall be observed for the use of optical detectors, smoke detectors and combinations of detector types.

The following services are to be provided by the machine supplier if flame detectors with purging devices are used.

Compressed air of 6 bar at the pressure reducer

Installation of a pressure reducer with control valve and throttle valve for the compressed air

Activation of the control valve as follows

- Machining cycle running → Scavenging air on
- Machining cycle off → Scavenging air off

The following services are to be provided by the extinguishing system supplier if flame detectors with purging device are used.

Adapter for mounting the flame detector with integrated purging adapter with air quantity setting option.

Connecting line between flame detectors and pressure reducer consisting of a red (similar to RAL3000) plastic hose.

Electrics:

Connection via extinguishing section junction box, for terminal assignment within the box, refer to Appendix 17/1.

4.9.3.6.6 Radio Alarms

Function: 2 alarm stages are assigned to every spark monitoring area.

Alarm 1: Alarm 1 is output as soon as a spark event is received by the central spark alarm system. This does not result in the deactivation of the machine/production facilities. Information is sent to the automation system of the machine/production facilities via the interface.

Alarm 2: Alarm 2 is output as soon as a spark alarm is present at the central spark alarm system. This leads to the immediate shutdown of the machine/production facilities. The alarm is reported to the fire service and to the automation system of the machine/production facilities.

Design:

Radio alarms with VdS certification and a system approval with the corresponding radio alarm system. A warning sign shall be placed on the installation location of the radio alarm, noting that the alarm is light-sensitive.

The sign shall be coordinated with the client.

Maintenance opening for light-sensitive alarms

Design of the maintenance opening, see Appendix 17/1, section 3.7

Electrics: Connection via the section terminal box

Note: The adjusting value for alarm 2 (number of spark events in period X) shall be agreed on with the client and documented in the acceptance test report.

4.9.3.6.7 Manual Triggering for Machines with Fire Extinguishers

Function:

Manual triggering occurs by means of the yellow pushbutton alarm. The manual triggering executes the same shutdown, triggering and alarm functions as alarm triggering (CO₂ triggered).

Larger machines can require multiple manual triggering facilities. The installation locations shall in general be specified with the representative.

The manual triggering always results in the activation of the fire extinguishing system.

Design:

Yellow pushbutton alarm with VdS certification.

Alarm labeling: Manual extinguishing system

Electrics:

Connection via extinguishing section junction box, for terminal assignment within the box, refer to Appendix 17/1.

4.9.3.6.8 Manual Fire Detectors for Machines with Pure Fire Monitoring

Function:

Alarms are triggered by means of the red pushbutton alarm. Alarms cause the same shutdown, actuation and signal functions as manual triggering of the extinguishing system.

Larger machines can require manual triggering many times.

The installation locations shall in general be specified with the representative.

Design:

Red pushbutton alarm with VdS certification.

Labeling of the alarm: Fire alarm

Electrics:

Connection via the section terminal box for terminal assignment within the box, refer to Appendix 17/1.

4.9.3.6.9 Terminal Box

General requirements:

All terminal boxes shall be protected against unauthorized opening, by means of a lock screw connection.

Type of lock screw connection: TORX screw connection with inside pin

For each extinguishing section, an extinguishing section terminal box shall be installed on the compact extinguishing system. The terminal box assignment is given in Appendix 17/1!

The terminal box (Rittal KL 1533, 500x200x120) or one of the same design shall be used!

4.9.3.6.10 Signaling of Fire and Fault Alarms

4.9.3.6.10.1 Forwarding Signal to Firefighting Department (Fire Alarm Technology and Extinguishing Systems)

Function:

The following alarms are transmitted to the firefighting department:

Basic signals per firefighting center for multi-section systems:

Extinguishing system triggered

Collective fault

alarm group switched off

Fire alarm per extinguishing area

Basic signals for individual and compact extinguishing systems:

Extinguishing system triggered

Collective fault

alarm group switched off

Design:

Hardware interface at the terminal box of the firefighting center. The signals are passed by the firefighting center to a terminal box.

Electrics:

Connection via the terminal box at the firefighting center; for terminal assignment in the terminal box, see Appendix 17/1.

4.9.3.6.10.2 Signal Forwarding to the Fire Service (radio alarm system)

Function:

The following alarms are transmitted to the firefighting department:

Basic signals per radio alarm center or per radio alarm sector:

Alarm 2

Collective fault

Design:

Hardware interface in the radio alarm center as terminal strip. The signals are forwarded via dry changeover contacts.

Electrics:

Design of the interface for signal forwarding to the fire service:

Designation of the terminal strip: XWF

Design: 3 terminals per signal or signal line

Design of the interface for linking the system, machine

Designation of the terminal strip: XV

Design: 3 terminals per signal or signal line

At the radio alarm center all contact connections of the circuit relay (base point, N.O. contact and N.C. contact) are made to the terminal strip.

The incoming supply voltage is looped through to the terminal from the external end.

Wire color in the radio alarm center for external voltages: orange

4.9.3.6.10.3 Forwarding Signals to a Constantly Occupied Center

Hardware interface in the terminal box. The signals are forwarded via dry changeover contacts.

4.9.3.6.10.4 Shrinkage Monitoring for Extinguishing Agents

Function:

The extinguishing gas cylinders shall be visually and electrically monitored for (weight) loss via approved equipment (e.g. weighing equipment) and shown in the firefighting center. Furthermore, this signal is forwarded as collective fault from the fire-fighting center to the constantly occupied center.

Design:

Shrinkage monitoring with VdS certification.

Electrics:

Connection via extinguishing section junction box, for terminal assignment within the box, refer to Appendix 17/1.

4.9.3.6.10.5 Triggering the Extinguishing System

Operation:

Depending on the fire extinguishing system version, the cylinders are triggered electrically or pneumatically - pyrotechnical triggering is not permitted - as per BGI 888.

Design:

Triggering the extinguishing system with VdS certification.

The presence of the triggering means shall be electrically monitored.

Electrics:

Connection via extinguishing section junction box, for terminal assignment within the box, refer to Appendix 17/1.

4.9.3.6.10.6 Local Signaling

4.9.3.6.10.6.1 Red Flashing Light

Function:

The fire alarm at the machine is displayed by a red flashing light

Design:

Red flashing light with VdS certification. Design: illuminated bollard in combination with the yellow flashing light is permissible. Not permissible in combination with the machine operating state lamp. The illuminating effect shall be 360° easy to observe.

Electrics:

Connection via extinguishing section junction box, for terminal assignment within the box, refer to Appendix 17/1.

4.9.3.6.10.6.2 Yellow Flashing Light

Function:

Once the ball valve exits the "open" control position.

Design:

Yellow flashing light. Design: illuminated bollard in combination with the red flashing light is permissible. Not permissible in combination with the machine operating state lamp. The illuminating effect shall be 360° easy to observe.

Electrics:

Connection via extinguishing section junction box, for terminal assignment within the box, refer to Appendix 17/1.

4.9.3.6.10.6.3 Electrical Horn

Function:

Triggering of the fire alarm at the machine is signaled by an electrical horn.

Design:

Horn, 24V to DIN 33404, with VdS certification.

The permissible sound pressure level may exceed the minimum specifications of BGR134/BGI 888 and VdS by no more than 2 dB.

Electrics:

Connection via extinguishing section junction box, for terminal assignment within the box, refer to Appendix 17/1.

4.9.3.6.10.6.4 Pneumatic Horn

Function:

Triggering of the fire alarm at property protection systems is additionally signaled by a pneumatic horn if supplementary personnel protection installations to BGR (rules of the German Employers Liability Insurance Association) are used.

It shall be possible to shut off and deactivate the pneumatic horn manually. The fittings required for this purpose are located within the fire extinguishing system enclosure.

Design:

Pneumatic horn with VdS certification. The permissible sound pressure level may exceed the minimum specifications of BGR134/BGI 888 and VdS by no more than 2 dB.

4.9.3.7 Personnel Protection

4.9.3.7.1 Facility Protection Systems

On facility protection systems in which personnel could be endangered, the warning time is 0 seconds.

If a warning time is set, this shall be documented in the acceptance report with the reason. The warning time shall be entered in the operating instructions.

Facility protection systems in which personnel could be endangered shall be equipped with a delaying device as well as the required audible alarm equipment, certified by VdS.

The alert time shall be fixed to suit the particular case, depending on the emergency escape routes.

It shall be ensured that any persons in the extinguishing sector shall be able to leave this within the alert time.

Delay times shall be configured as per VdS, BGR134/BGI 888 and location-related operating instructions for production facilities and agreed on in all cases with the representative! All extinguishing systems shall be marked with the current plant-internal operating instructions, with the alert time to be specially shown in the operating instructions (e.g. pre-warning time 12 s).

4.9.3.7.2 External Mechanical Shut-off of the Extinguishing Line

Function:

External mechanical shutoff is by way of a ballcock installed in the extinguishing agent line / control gas line, with its two end positions monitored electrically. This ball cock is to be protected against actuation by unauthorized persons. Installation of a ballcock in the extinguishing agent line is only permissible with an additional safety valve to discharge the pressurized medium into a safe area.

The fire detection, fire alarm triggering, local alarm triggering, shutdown functions and external alarm triggering (e.g. constantly occupied center) remain activated when the extinguishing agent line/control gas line is shut off.

Design:

The ballcock may be installed in the extinguishing agent line or in the pneumatic control line of the extinguishing system. The ballcock requires certification for the extinguishing system installed.

The ball cock protection requires three brackets for padlocks for the closed and at least one for the open condition.

4.9.3.8 Acceptance of the Fire Protection Equipment

4.9.3.8.1 Production Equipment Acceptance / Handover of Fire Protection Equipment

Following completion of the extinguishing system, the supplier shall inform the representative that it is ready for operational system + acceptance and handover.

The extinguishing system is activated at the time of handover under the following conditions (readiness for protection function):

The fire protection equipment is operational.

No safety-relevant deficiencies

Documented active through-connection to a constantly staffed location (e.g. plant fire service; master safety computer).

The operator and the plant fire service shall be instructed on the extinguishing system by the extinguishing supplier at the latest at the operational system + acceptance stage. The instruction is to be documented on the acceptance report.

At the operational system + acceptance stage, the following participants are essential, and all participants shall sign the acceptance report:

Erection company

Machine supplier of new systems

Machine operator (production)

Technical planner of the extinguishing system (Daimler AG)

Plant fire service

Operator of the fire extinguishing equipment

4.9.3.8.2 Dates: Acceptance / Expert Acceptance / Defect-free Handover to the Operator

Acceptance by the authorized expert shall be included in the scope of services of the fire extinguishing system supplier.

The following timeline shall be complied with after the acceptance/handover of the fire extinguishing system incl. work documentation:

Submission of the documentation 14 days prior to operational system + acceptance stage

Acceptance of fire extinguishing system by an approved appraiser as per VdS guidelines within 8 weeks after acceptance with the involvement of the representative

Presentation of the defect-free specialist test report no later than 3 weeks after specialist acceptance

Defect-free handover to operator and acceptance at the latest 5 weeks after acceptance by the appraiser

Summary:

Starting from the acceptance deadline, the fire extinguishing system shall be handed over within 13 weeks in a defect-free state (incl. documentation).

4.9.3.9 Documentation

4.9.3.9.1 Scope of Documentation

The scope of the documentation is set out in Appendix 17/2.

One copy of the complete documentation and one version on an electronic data storage medium shall be submitted.

The documentation shall be submitted in folders in accordance with Appendix 17/2 and comply with the

structure of the tabs. The documentation shall be handed over at least 14 days before the production equipment acceptance and handover of fire extinguishing system to the fire extinguishing system representative.

A	E	F	W	X	Y	Z

4.9.3.9.2 Operating Instructions as per EN 13478

The fire extinguishing system supplier shall create operating instructions as per EN 13478 together with the representative. The operating instructions shall be handed over to the machine representative, who shall

acknowledge receipt via his/her signature. All functions of the fire protection equipment are to be described in accordance with the requirement specifications in the operating manual. The representative shall include the operating instructions in the machine documentation.

4.9.3.10 Scope of Supplies and Services

The scope of delivery of the fire extinguishing system covers the following:

Assembly planning and design of installation

supply and fitting of extinguishing system, with both mechanical and electrical components

supply and fitting of terminal boxes

cabling of extinguishing system and terminal boxes

guard mesh for extinguishing gas bottles/batteries

acceptance by certified expert as per VdS regulations

handover to be plant operator of mechanical and electrical components in accordance with Daimler specifications

instructions for plant operator, machine personnel and maintenance personnel

4.9.3.10.1 CE Mark

The extinguishing system is governed by the Pressure Equipment and Low Voltage Directive.

A declaration of conformity shall be issued for the "Pressure Equipment (Extinguishing System)" assembly and a model plate shall be affixed to the system.

The extinguishing system receives a CE mark based on the Pressure Equipment Directive and the Low Voltage Directive.

The following documentation results:

CE mark to be affixed to the extinguishing system

Manufacturer's declaration

Conformity declaration

Preventative maintenance, maintenance and scheduled inspection plans

4.9.3.11 Designation of Fire Extinguishing Systems

For designation of the electrical and mechanical production equipment, the rulings of these Specifications apply. Additionally, Appendix 17/3 contains specific regulations for the designation of fire extinguishing systems.

4.9.3.12 Electrical Installation

The electrical installation is to be implemented in accordance with these requirement specifications.

4.9.4 Small Extinguishing Systems

Given written approval by the Daimler client and the technical operator of the extinguishing system, small extinguishing systems as per DIN 14497 may also be used. The aforementioned regulations apply to the functionality and designation of the extinguishing system, in particular to the interfaces to the machine and ballcock (cutoff of extinguishing gas line).

4.10 Chip Conveyor Systems Integrated in Machines

In addition to a motor protection switch, the conveyor motor loading shall also be monitored, with the option of setting upper and lower limits.

For repair mode, the corresponding functions such as set-up, forwards/backwards have to be implemented via the HMI.

1 2 3 4 5 6 7

4.11 Specifications for Screwdriving Technology

- Cables for hand-guided multiple screwdrivers shall be run through cable carriers, e.g. "ROBOTRAX" (without stainless steel cable). For hand-guided single screwdrivers, cables shall be managed by means of "monkey swings".
- Actuator/sensor lines used within the screwdriving system shall also be used as per the material approval list (in the MDM).

- The preferred position to install air conditioning for the screwdriver switch cabinet is at the side.
 - The screwdriving program (software) shall be submitted to the representative responsible for approval (reduction of programs and processes).
 - For all components with automatic identification by way of a memory chip, data that differs between the chip and the screwdriver control system may only be accepted following manual acknowledgment and entry of a password.
 - It shall be possible to completely deselect automatic identification by way of a memory chip through programming actions.
 - An operating mode for calibrating/verifying the screwdriver without a component shall be provided. For operation, an appropriate image shall be created on the control panel of the station.
 - The not OK strategy shall be specified specifically for each station prior to award of contract, for example what happens if individual screwdriving positions are deselected.
 - The PLC functional module, provided free of charge, of the product partner for the PLC <-> screwdriver control interface shall be used, and no changes may be made to it
 - With multiple spindles it shall be possible to repeat a screw application at a single spindle (NOK case treatment).
 - Existing ID features, like production or motor number, shall be transmitted via bus link to the screwdriver control system.
- "Appendix_20_-_Type Approval_EC Screwdriver" shall be observed.

The remaining specifications are as given in the documents of the product partners for screwdriving technology.

4.12 Industry 4.0

4.12.1 Virtual Commissioning

Virtual commissioning serves the validation of the software quality and functional checking of the program and process flow. This gives the supplier and Daimler the advantage of a shortened commissioning time.

The performance of virtual commissioning in interlinked systems or interconnected stations is mandatory in all projects.

The implementation of virtual commissioning is specified for stand-alone stations/stand-alone machines in the run-through of the bid. In case of non-implementation of virtual commissioning with stand-alone stations/stand-alone machines, the supplier shall submit proof of the implementation of programming specifications and functionality.

The scope of virtual commissioning shall be coordinated with the representative during the bidding phase. Appendix 43 regulates the requirements and execution for all virtual commissionings of a project in the Powertrain area.

4.12.2 Internet of Things (IoT)

As part of the bidding phase, it shall be defined whether and in which form an IoT connection for production equipment shall be implemented.

4.12.3 Edge Device

For future expansions regarding I4.0, space shall be reserved next to the NAT router in the switch cabinet; a precise agreement with the Daimler representative is required. It shall be ensured that a Siemens IPC427E (in maximum expansion) can be installed.

- Voltage supply
- 1 free port in the plant network
- Reserved space
- Thermal calculation
- ...

"Anlage_47_-_IoT_Truck" shall be observed in the Truck unit

A	E	F
	X	Y Z

If MQTT communication with the edge device occurs, the specifications from Appendix 44 shall be observed.

5 Processor and Production-Oriented IT Systems

5.1 General Information

The basic definitions and procedures specified in the Powertrain Requirement Specifications, Part I "General/Acceptance" should be observed.

The use of dongles is prohibited

W020: standard industrial computers from Daimler should always be provided and equipped with the standard software package (operating system, antivirus program,...).

Z

The provision takes place after consultation with the representative.

W069: the layout is according to the agreement on the basis of the operating concept and the NAV compatibility of the applications. Printers are provided, where technically possible, in coordination with the representative.

Y

The following IT systems are to be additionally considered for Daimler Trucks:

IT system	Short description	Documentation
PRISMA	Machine and production data acquisition	IT interface catalog
SISAM	Information for final assemblies, assembly line control system	design_SISAM_XML_ToolInterface
MLS	Assembly guidance system	IA-MLS2 Communication Concept
SAP-AM	ERP system (order processing)	Kassel SLA Standard Requirement Specifications
KomServ	Communication server	Kassel SLA Standard Requirement Specifications
ELAM	Long-term archiving of safety-relevant assembly data	Kassel SLA Standard Requirement Specifications
MASIS	Q data acquisition for pre-assemblies	S7 UDT description
QDE	IT connection of integrated measuring systems	Requirement Specifications for Connection of Integrated Measuring Systems to the IT Network in Kassel

X Y Z

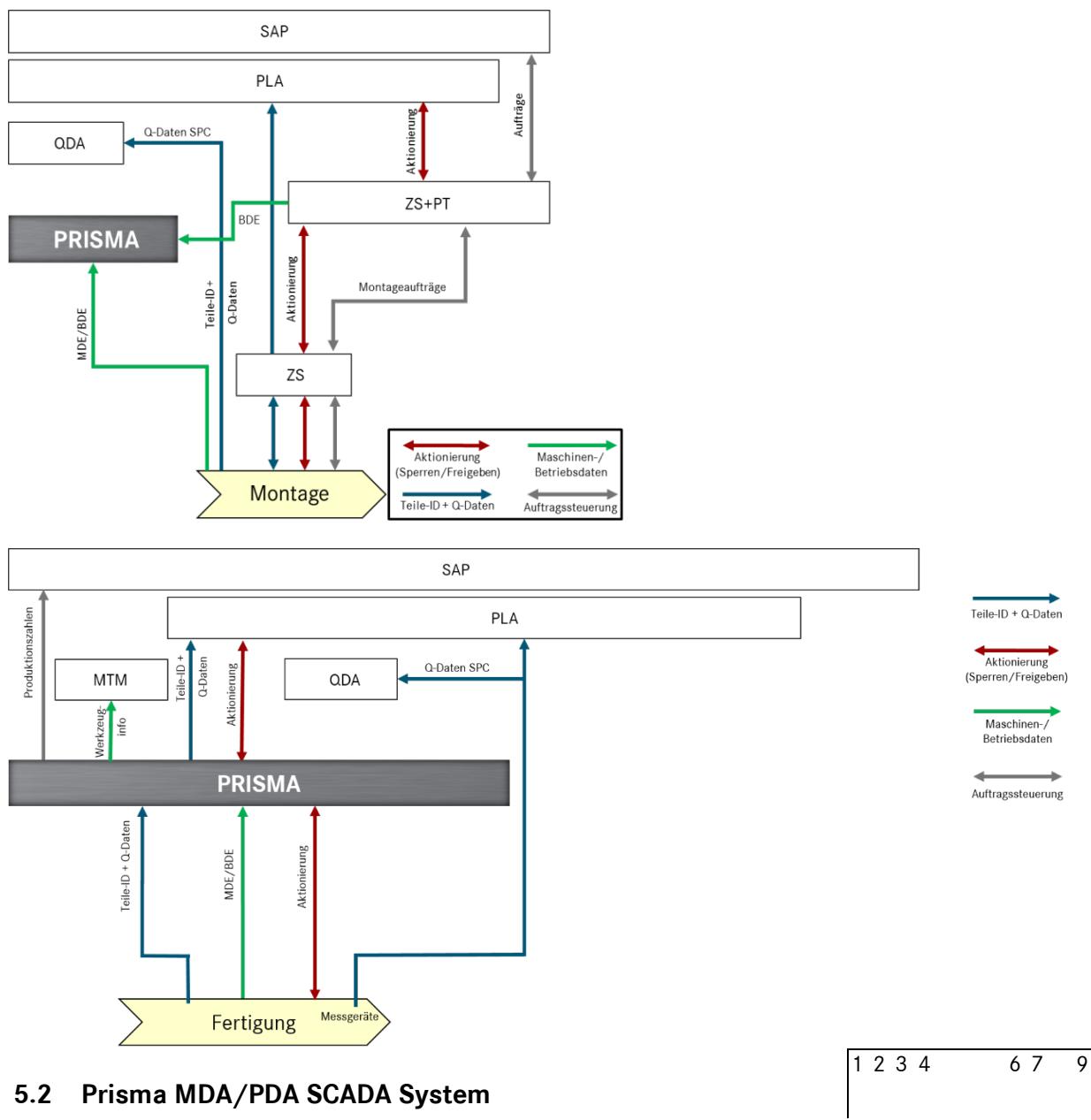
Y Z

X

Y

The related documentation shall be requested from the representative as part of the order processing.

The following system connection applies for Plant 10:



5.2 Prisma MDA/PDA SCADA System

At Daimler/Powertrain, the PRISMA SCADA system is used for the acquisition of machine and production data (MDA/PDA).

For each item of production equipment, an MDA/PDA interface as per the Daimler AG specification shall be implemented.

Each station or each process reports autonomously to PRISMA.

For this purpose, various options are available to the supplier, e.g. control panel interface with virtual stations, PLC interface, robot interface.

More detailed information can be found in the IT interface catalog.

Before the start of the implementation, the contractor shall create a PRISMA signal logic as well as a complete interface list for the entire system and agree on this with the client.

The PRISMA signal logic shall be created based on a layout and submitted to Daimler AG for approval.

The PRISMA interface shall be programmed by the production equipment supplier up to acceptance and shall be accepted by the client. Separate PRISMA acceptance is subdivided into three categories (static acceptance, dynamic acceptance 1, dynamic acceptance 2). Unless expressly agreed otherwise, all 3 PRISMA acceptances

shall take up to the acceptance of the production equipment and shall therefore be fully programmed. It can only be necessary in exceptional cases due to project-specific specifications for dynamic acceptances 1+2 to take place following the acceptance of the production equipment. This shall be agreed in coordination with the representative and documented in the acceptance test report.

The respective interface descriptions shall be taken from the currently applicable IT interface catalog (Appendix to Powertrain Requirement Specifications, Part III).

The following documents are available:

- IT interface catalog (technical description of interfaces)
- Process type catalog with decision tree for operational messages (with templates for signal logic, signal behavior, standardized symbols, interface list)
- Acceptance catalog (acceptance checklists and scenarios)
- Handbook for creation of signal logic
- Project-specific PRISMA documentation (specification of signal logic/station designations)

The process type catalog contains standardized process types with the same signal behavior with regard to operating states and production data.

Here an extract:

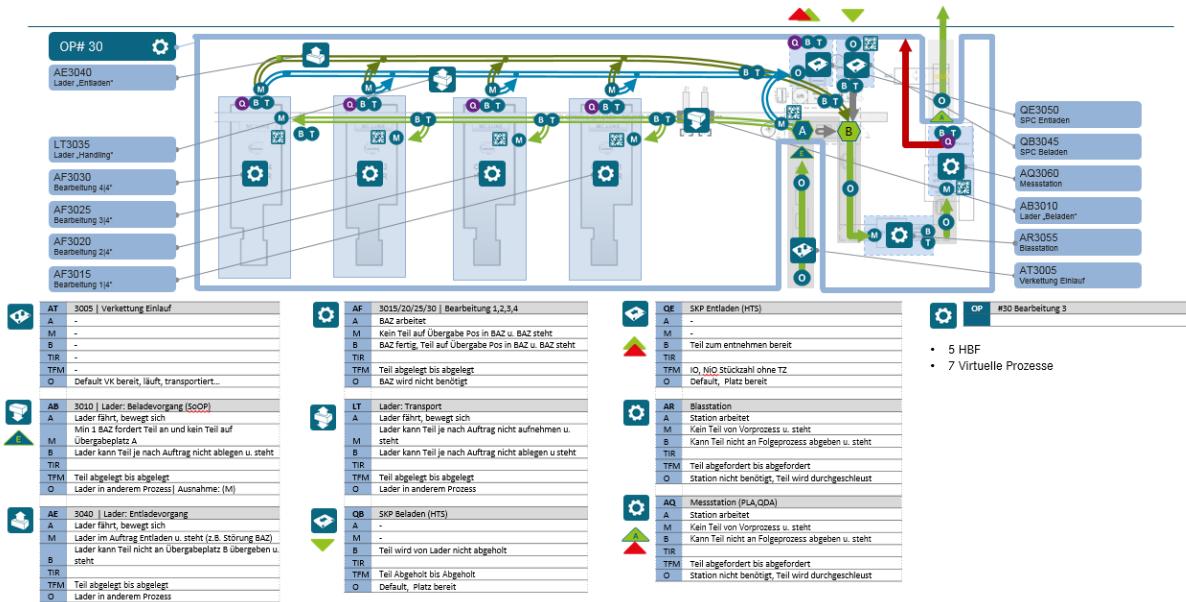
PRISMA Prozessarten MASTERLISTE																
Prozess No	Icon	Typ	Funktion	Prozesstyp	Beschreibung	= 1 Standard										
						Automatik A	Manuell L	Teleautomatik T	ohne Bedienung O	ein Tam M	Aufbauabgleich B	Zulieferermangel Z	Störung S	Hand H	Befehlen F	inaktiv mehrfach D-Zero O
1	G	A-Z	Automatik Prozess (starr verketten, getaktet)		Wertschöpfende Prozesse (Bearbeiten, Schrauben, Umformen, Gießen, Schweißen...) Starr Verkettet oder getaktet (Rundstücktische, Fließfertigung...) (M) nur bei ersten Prozess, (S) nur bei letzten, bei den dazwischenliegenden Prozessen wird (O) für (M) & (B) gemeldet.	●	○	●	●	○	○	○	●	●	○	●
2	A	A-Z	Automatik Prozess		Wertschöpfende Prozesse (Bearbeiten, Schrauben, Umformen, Gießen, Schweißen...) Entkoppelt.	●	○	●	●	●	●	○	●	●	○	●
3	S	A-Z	Semi-Automatikprozess		Wertschöpfende Prozesse mit Anteilen aus Automatikprozessen und Manuellen Mitarbeiterabhängigen Prozessen.	●	○	●	●	●	●	○	●	●	○	●
4	M	A-Z	Manueller Prozess		Prozesse die von Mitarbeitern durchgeführt werden (Montage durch Mitarbeiter)	○	●	●	●	●	●	○	●	●	○	●
5	R,L	B	Belade Prozess (Roboter, Lader...)		"Beladen" -> von einem Nicht Wertschöpfenden Prozess zu einem Wertschöpfenden.	●	●	●	●	●	●	○	●	●	○	●
6	R,L	H	Handlungs Prozess (Roboter, Lader...)		"Handling" -> von einem Nicht Wertschöpfenden Prozess zu Nicht Wertschöpfend oder von einem Wertschöpfenden Prozess zu Wertschöpfenden (M) & (B) wechselt die Richtung	●	●	●	●	○	○	●	●	○	●	
7	R,L	E	Entlade Prozess (Roboter, Lader...)		"Entladen" -> von einem Wertschöpfenden Prozess zu einem Nicht Wertschöpfenden.	●	●	●	●	●	●	○	●	●	○	●
8	T	A-Z	Transport, Zuführung, Nacharbeit		Teiletransport, Verkettungen, Transporteinrichtungen (z.B Medienzuführung, Heizgerät, SPC, Nacharbeit...)				●	○	○	○	●	●	○	●
9	T	E	Einschleusen (nicht Geradeauslauf)		Einschleusen in Prozess, nicht im Geradeauslauf (Sonderprozesse wie manuelle Beladung)				●	●	○	●	●	●	○	●
10	T	A	Ausschleusen (nicht Geradeauslauf)		Ausschleusen aus Prozess, nicht im Geradeauslauf (Sonderprozesse wie manuelle Entladung)				●	●	●	○	●	●	○	●
11	IR	1-99	Direkte Roboterschnittstelle		XML mit Nummerierung bei mehreren Robotern	●	●	○	●	●	●	○	●	●	●	●

A template for the creation of an interface list is also contained here as well as standardized symbols for the creation of the signal logic.

Link to acceptance catalog with acceptance checklists and scenarios:
<http://www.factorysuite.de/digitale-abnahmen.html>

Example of a created signal logic:

Beispiel PRISMA Meldelogik - Layout mit Prozessbeschreibung



Instructions on the procedure for the specification of the signal logic can be found in the handbook.

In a project, the main contractor is responsible for the signal logic of the entire line. Individual suppliers specify the signal logic in their respective area of responsibility, in each case in coordination with the responsible representative.

Recommended approach:

1. Creation of an interface list by the OEM (in case of a GC, the GC creates this list), with individual suppliers, each is responsible for its system scope with the corresponding appropriate standard process type.
2. Specification and visualization of the signal logic by the OEM for single machines and/or the entire line.
3. Selection of project-specific data types by OEM (operating states, production data). Check of "white optional" items and use of decision tree for specification of required production data.
4. Completion by the OEM of the coordinated project-specific PRISMA documentation prefilled by Technical Planning.
5. Implementation of specified data types in the respective PRISMA interfaces by the OEM (programming/parameterization), take the sample signal behavior for the telegram sequences from the acceptance scenarios.
6. Acceptance as per defined acceptance scenarios.

5.3 Product Service Life File PLA

The PLA is used at Daimler/Powertrain for the documentation of the service life and for tracing parts.

In general, a corresponding service life shall be documented for every item of production equipment; this takes place as standard in the machining section via the MDA/PDA interface and in Assembly via the Cell System interface. For all production equipment, the measuring controllers (screwdrivers, press-in controllers, measuring computers, etc.) shall transfer their data directly to a high-availability PLA loader.

The data from the assembly and test stations are coded XML compliant. The following methods are intended for transmitting the data:

- IBM MQ Series – Message Queue
- The data are saved in a file on the PLA server. This can be realized by means of FTP or file transfer to a released directory
- The data are transferred in the form of a string via RPC (remote procedure call) by means of DCE
- The data are transferred via socket interface (TCP)

- If the host computer or network is not available and/or the file cannot be transferred, the data shall be stored locally on a temporary basis. Once the network is available again, the buffered data shall be automatically transferred
- Depending on the area, after consulting the relevant maintenance department, a fault message shall be displayed locally on the screen.
- Special considerations with direct transfer of the Q data from the controller: the measurement controllers (Kistler, APEX, BOSCH Rexr. screwdrivers, measuring computers, etc.) shall buffer the Q-data, if the CAQ SM or PLA loader cannot be reached.
- The buffer size of the measuring controllers shall be large enough to accommodate a production shift (8 h).
- A fault message shall appear in the main control panel at the affected production facility part and the station shall stop in a defined manner (HNT) if a parameterizable "loading value 1" is exceeded in the measuring controller.
- It shall be possible to acknowledge the fault message using a corresponding EKS level. The production facility continues to run.
- The fault may only appear once (otherwise it would need to be acknowledged every cycle...) and solely serves for the worker to commission Maintenance.
- The fault message shall be transferred as a peripheral fault to PRISMA.
- The production facility/production facility part affected shall stop in a defined manner with a fault message in the main control panel (HNT) if a parameterizable "loading value 2" (memory almost full) is reached in the measuring controller.
- It shall not be possible to acknowledge the fault so long as the measuring controller has not fallen below the critical loading again.
- The fault message shall be transferred as a malfunction to PRISMA.

The connection shall be established/disconnected on a cyclical basis for the storage of the quality data of Windows-based systems on the PLA network drive. Connecting once during the system start-up is not enough! The contents of the minimum requirements of Appendix 12 apply in general to the standardized data connection to the PLA; these are not only relevant for Production but for all production equipment in coordination with the responsible Production Engineering representative.

The PLA interface description shall be taken from the ITP SST catalog.

At the Kassel plant, the ELAM system is used for PLA generation. Use shall be coordinated on an order-specific basis.

5.4 Quality Systems

QDA is a Computer-Aided Quality Assurance (CAQ) system. It is used in Powertrain MBC to ensure the quality and acquire the data from measuring devices across the entire production line. QDA stands for quality data analysis, and involves collecting and evaluating data.

For all production equipment, the measuring controllers (screwdrivers, press-in controllers, measuring computers, etc.) shall transfer their data directly in Q-DAS format.

The boundary conditions and requirements for the production facilities and also for the measuring controllers for the direct connection to the QDA can be found in the ITP interface catalog.

For the acquisition of quality data, a distinction shall be made between the following cases:

Integrated measurement control systems in production equipment (cases 1a and 1b),
Integrated and separate PLC processors or measuring units with evaluation units (case 2) and
Separate coordinate measuring machines (case 3).

In some cases, separate interface descriptions exist for the above-mentioned cases; these are however older and thus should be known to the manufacturers – in particular to the measuring device manufacturers.

Please contact the representative responsible (see Chapter 1.4) if you want to request such descriptions.

Case 1a:

A distinction is made:

Measurement controls or measuring facilities which measure via the path-measuring systems of the machining machines and which are integrated directly in the PLC of the machining machine and thus have no electronics of their own, shall be provided with a V24 interface (DIN standard). This applies also to test facilities which are equipped only with a PLC, e.g. leak test facilities.

This interface shall be designed according to the following description:

The data shall be prepared using Q-DAS format 3.0 (Q-DAS ASCII transfer format from Version 3.0) and shall be transmitted via TCP/IP.

The precise specification of Q-DAS data format 3.0 can be viewed at <http://www.q-das.de/datenformate.htm> in the section "Data Format Manual".

Cases 1b and 2:

Where SPC computers, SPC devices, measuring devices with evaluation units, measuring controllers, measuring equipment with its own electronics or automatic measuring systems integrated in the production equipment are used, the latest version of the measuring software and measuring hardware (measuring boxes) from, in each case, one of the following companies shall be used: Komeg, Marposs, Promess or Stotz.

The associated measuring computer (IPC) with operating system shall be agreed on with the representative.

The specifications of the IT boundary conditions and also the current MDM approvals shall be observed.

Marposs, Hirt, Tesa, Solartron and Heidenhain are approved as manufacturers of measuring probes.

Any deviation, e.g. taking into account of old stocks, requires a special approval from the Maintenance department responsible.

The supplier shall be coordinated for the specific order within Trucks.

Case 3:

Concerning the procurement of separate coordinate measuring machines and other general-purpose measuring devices, the following description is binding:

The data shall be processed in the form of the Q-DAS data format (Q-DAS ASCII transfer format from version 3.0 and higher) and transferred via TCP/IP to a fileshare, see also "qs-STAT Format Requirement" as an appendix in the IT boundary conditions.

The exact specification of Q-DAS data format can be seen at the <http://www.q-das.de/datenformate.htm> in the "Manual of data formats" section. Here, there is also an overview document with a general description of the automobile industry standard for the interchange format for quality data AQDEF.

The suppliers are obliged to verify the applicable interfaces in each case in coordination with the representative responsible.

5.5 Cell System

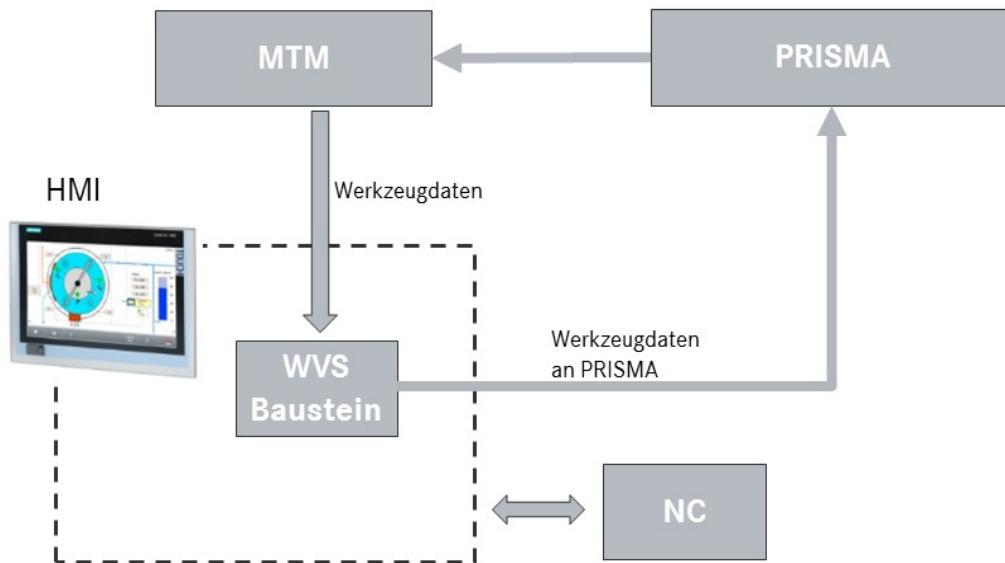
The Powertrain cell system requirement specifications describe the technical and functional requirements with regard to the connection of the assembly lines to the operational assembly control system (for short Cell System or ZS).

The control of the material flow and the activities to be performed in the individual work stations takes place via standardized processes and the rule-based parameterization of technical order data. For this purpose, the production facility supplier creates - based on the production facility data together with the representative after consultation with the operator and the IT area responsible - the production facility master data on whose basis the cell system configuration is then created.

Detailed requirement specifications and the associated appendices can be found under "IT Interfaces and Systems" - "Cell System".

5.6 MTM – Manufacturing Tool Management

MTM stands for Manufacturing Tool Management and is only used in Production. In MTM, the tool data of the machining centers are uploaded and evaluated. In the difference list, you can see which tools need to be replaced and how. Tools lists are available for flexible production operations. Depending on the requirements, the entire stock in Production can be made transparent. Reordering then takes place for the total inventory. Another reason is the replacement of worn tools after a specific operating time. The figure shows the data flow between the MTM, HMI and PRISMA.



The MTM is provided with tool data from all production systems. The tool management system (WVS) is a module that is installed in the HMI and obtains data from the MTM. The tool data that arise during processing are transmitted to the IT system PRISMA. PRISMA in turn transmits all relevant data to the MTM.

5.7 Major Unit Test Stand Systems

Test stand systems in the Powertrain area includes test stands and leak test stands.

In addition to the below-given requirements, project-specific specifications apply to these test stand systems.

5.7.1 Major Unit Leakage Test

The leak test stand (for assembly diagram, see project-specific requirement specifications) is treated like a major unit test stand.

Therefore, please see "Main Unit Test Stands" for details.

Configuration:

Identification data carrier system

Reading and labeling station

PLC

Leakage test device with measuring cards and direct leakage test server via test stand processor and shop network

Screen, mouse and keyboard, switchable for test stand computer and diagnostic PC

Specification for Plant 10 (*transmissions, axles, foundry/forge) and Plant 68:

Included within the overall responsibility of the leakage tester supplier is the purchase and implementation of the leakage test server scope as a UNIPAS server from PWT/VEP.

Specification for engine locations (*plants 10, 40, Kölleda):

The leakage test server shall be offered by the leakage test supplier.

2 3 6 7 8 9

A	F
*	
A	E
*	

Difference to Plant 40: See project-specific requirement specifications; for representative, see Chapter 1.4

Difference to W20: Project-specific Requirement Specifications apply to the leak test devices at W20

E

Z

3 6 7 8 9

5.7.2 Major Unit Test Stands

For assembly diagram, see project-specific requirement specifications;

Scope covers cold test, hot test (operating run) and performance test (quality assurance).

Difference to Plant 40: See project-specific requirement specifications; for representative, see Chapter 1.4

Difference to W20: The scope additionally applies to the FunctionPowerTest (combined test stand for cold test, power test and hot test).

E

Z

2 3 6 7 8 9

5.7.2.1 Mobile Data System

The sample (main unit) shall be loaded onto the test stand using a workpiece carrier. An identification data carrier system shall be mounted on the workpiece carrier. Easy loading/unloading is mandatory.

It shall be possible to read the identification data carrier system with a reading and labeling station in the test stand.

Good accessibility shall be kept in mind.

The reading and labeling station should transfer its data to the PLC of the test rig for subsequent processing (not directly at the test stand computer).

3 6 7 8 9

5.7.2.2 PLC Control Unit

The test stand shall be equipped with a PLC control unit, including control panel, in accordance with the specifications of the project book of the project partner for Control Systems.

3 6 7 8 9

5.7.2.3 Test Stand Processor

Measured value processing shall be performed on a processor. This processor shall be designed as an industrial PC. If so permitted by the measuring task and the environment, a standard PC shall be used. Hardware and software shall be designed in line with the IT boundary conditions.

A currently released anti-virus program shall be installed.

When selecting the hardware, the upgradability of the PC for further additional measuring tasks shall be taken into consideration.

In the bid, the PC selected by the vendor shall be described in detail, i.e. listing of all assemblies and components including measuring cards is necessary. After contract award, the PC as an independent assembly requires the prior approval of Daimler.

A spare package of PCs shall already be offered in the initial bid.

The scope of delivery of the vendor shall include the necessary plug-in boards and the required software for the shop network connection and for the local test stand network.

The additional connection between test stand computer and measuring technology as well as PLC shall be implemented as a field bus in accordance with Daimler specifications.

A maintenance concept (hardware and software) shall also be offered.

3 6 7 8 9

5.7.2.4 Diagnostic PC – Engine Control Unit

For the readout of the engine data from the engine control unit, a stand-alone PC shall be used; the latter shall conform to the specifications by Daimler (PWT/VEP).

Deviations from W20

PLD and MR2 control units

Z

No independent PC is used for reading out and writing the motor-specific data. The hardware components used for control unit communication (e.g. SSK2 from AFT) are specified by Daimler (TM/MPE) and are to be installed on the test rig in a 19" rack.

The connection to the test stand computer is established by means of ETHERNET.

MCM control units

For performance reasons, an independent PC can be used to read out and write the motor-specific data.

The hardware components used for the control unit communication (e.g. CAESAR Part C PCI) are specified by Daimler (TM/MPE)

The diagnosis software (currently VEDIAMO) is installed by PWT/VEP.

The connection between the diagnostic PC and the engine control unit is made via a CAN or K line (according to PWT/VEP); it is only via CAN or K line that actuator operation and variant coding can be realized.

Deviations, Plant 20:

Z

PLD and MR2 control units

The diagnostics software consist of a DLL (e.g. EcuInterface.dll from AFT), which is integrated in the test stand computer.

MCM control units

The diagnostic software (currently G3T module MCM control unit) is specified by Daimler and installed in cooperation with TM/MPE and ITC/TA.

The connection between diagnostic PC and test rig computer shall be implemented via a network (TCP/IP protocol).

3 6 7 8 9

5.7.2.5 Image Processing PC

If image processing is employed at the test stand, the image processing PC shall be connected via the local test stand network to the test stand computer.

Additionally, a connection to the shop network shall be provided.

The associated hardware plug-in cards and software drivers shall be provided by the test stand supplier.

For representative at Daimler, see Chapter 1.4

Requirement specifications can also be obtained via the representative.

3 6 7 8 9

5.7.2.6 Noise Testing PC

If a PC is used at the test stand for noise testing, the image processing PC shall be connected via the local test stand network to the test stand computer.

Additionally, a connection to the shop network shall be provided.

The associated hardware plug-in cards and software drivers shall be provided by the test stand supplier.

The testing software from PWT/VEP (MESAM4), by Medav (ANOVIS) and JAKrause is approved.

The test software permitted in each case shall be agreed on with the representative responsible.

For representative at Daimler, see Chapter 1.4

3 6 7 8 9

5.7.2.7 Repair (FAS), Archiving and Office PCs

The PCs for repair (FAS) and the office will be made available by Daimler.

The corresponding repair software and office software for managing the test program shall be provided by the manufacturer of the test rig and installed by Daimler's and PC user service; with Daimler also providing scanners for the repair PCs.

If necessary, separate archiving PCs are used, depending on the project. The hardware is provided accordingly by Daimler and the software by the manufacturer.

The test results are made available in a database for their evaluation for a period of at least 3 months.

Available as file server for the test stands is at least 4 GB memory capacity.

The server PC is linked to the test stands and PLA via TCP/IP. A 100 Mbit connection shall be provided.

Agreement shall be reached with Daimler on data transmission between test stand computer, test stand server and PLA (synchronization, instrumentation channels, updating and harmonization for expansions). It is required of the vendor that the data be transmitted in XML syntax.

For direct linkage of the test stands to the PLA, the data can be supplied either directly as an XML file or per DCE/RPC.

The XML format to be supplied is defined in the PLA-SST description (ITP SST catalog).

For queries relating to these interfaces in Powertrain, please contact the representative responsible (see Chapter 1.4).

The suppliers are obliged to verify the applicable interfaces in each case in coordination with the representative responsible.

The availability and response times of the test field server are specified as per the IT boundary conditions (Chapter "Availability of the application system" and "Application system response times (only online function)") with category B.

3 6 7 8 9

5.7.2.8 Local Test Stand Networks

The local network within a test stand shall be executed by the test stand supplier as a data connection with Ethernet between
test stand processor
diagnostic PC
image processing and
noise test

The local network shall be designed with a clock rate of 100 Mbit/s.

3 6 7 8 9

5.7.2.9 PC Hardware Configuration

As to the **basic configuration without measuring cards**, all PCs – with the exception of the server PC – shall be 100% compatible.

In the test stand, the PCs shall be installed in switch cabinets on sliding drawers and shall be accessible from the front and rear. It shall be possible to replace the plug-in boards from the operator side.

A matching network card shall be provided for each PC or other processor – independent of the local network – and space shall be reserved for a separate network connection (data outlet in the switch cabinet).

The specification for this is to be found in the ITP interface catalog under Chapter 4.

3 6 7 8 9

5.7.2.10 Measuring Device Interfaces

For all external intelligent measuring devices, **one** interface shall be used. The vendor is required to use the ASAM interface (standardized instrumentation interface).

This does not apply to measuring devices for which it can be proved that no ASAM driver exists.

In this case, appropriate measuring devices with ASAM driver shall be selected or, alternatively, special permission shall be requested.

The entire measuring concept shall be approved by Daimler.

3 6 7 8 9

5.7.2.11 Screen, Mouse and Keyboard Switching

It shall be possible to switch screen, mouse and keyboard between the equipment items: test stand computer and diagnostics PC.

Soft toggle switches shall be used. To save space, 17" TFT monitors shall be used.

2 3 6 7 8 9

5.8 Engine Test Bay

For engine test bays, the respective project-specific requirement specifications also apply.

For representative, see Chapter 1.4

5.9 Transmission Test Stand

The respective project-specific specifications apply additionally to transmission test stands.

For representative, see Chapter 1.4

5.10 Axle Test Stand

The respective project-specific specifications apply additionally to axle test stands.

For representative, see Chapter 1.4

5.11 Automatic Call Button

An automatic call button shall be implemented by means of the PLC-SAP interface, the boundary conditions as well as the technical detail can be taken from Appendix 13.

5.12 LogCC NewGen Dispatch System

The standard dispatch IT system in Powertrain is LogCC NewGen from Siemens.

For related descriptions, see the folder "IT Interfaces and Systems/Dispatch System".

5

6 Process and Environmental Technology Systems

Changes in Chapter 6 (Process and Environmental Protection Systems) may only be carried out in coordination with the representative responsible – see Chapter 1.4 (Untertürkheim plant).

5

6.1 General Information

Process and environmental protection systems are all systems for the central supply and disposal of cooling lubricants, washing water and oils, all systems for chip disposal and chip processing.
As well as machine exhaust air and wastewater systems:

Additional specifications can be taken from the Powertrain requirement specifications Part II, Mechanical Systems.

5 X

6.2 Control Technology

No PC-based control systems shall be used.

The checkback signal (operation signal) from drive units shall be routed via the respective contactor.

Automatically operating equipment shall have the possibility of manual control of all production equipment – valves, motors, etc. – for testing and setting.

If production equipment is switched to manual mode, the previous operating state of the production equipment shall be taken over.

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If a speed-controlled drive is switched over, the speed set before switching over is applied in manual mode.

A pre-defined speed is switched to in Gaggenau.

- On switching back to automatic mode, the operating state intended for the process or the planned speed shall be applied to the production equipment.

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All faults in the equipment shall be acquired as individual messages and displayed accordingly:

Motor protection switches, circuit breakers etc.

A rotating beacon/flashing light and a horn shall be installed for fault display. The horn and rotating beacon/flashing light are deactivated using a "Horn OFF" button. When a new fault is triggered, the horn and rotating beacon/flashing light shall be switched on again. The horn shall be programmed for pulsing / interval timing.

For supply and disposal units allocated to machines, only illuminated bollards shall be used for status signaling.

6.3 Emergency Stop

An emergency stop shall be set such that its effective range is clearly recognizable/assignable. A sufficient number of emergency stop devices shall be provided after consultation with the representative with the involvement of the operator and Workplace Safety.

The safety circuits shall be realized in stop category 0 as per EN 60204.

The emergency stop function shall be designed as follows:

The production facility is shut down as per stop category 0 (EN 60204).

The production facility loses its operating mode "ON", "run-on" or "standby".

The production facility switches to "OFF"

The production facility automatically switches to "Location"

A release of the emergency stop devices shall not result in the independent startup of the production facility.

Emergency stop devices shall be mounted such that an unintentional activation is prevented (EN 13850) and a mix-up with other production facilities is excluded.

Every emergency stop shall trigger a fault message with a unique location designation.

The emergency stop is acknowledged via the collective acknowledgment function of the PLC (not via a separate button).

5

6.4 Electric Circuit of Production Facilities

Voltages upstream of the system isolation unit (in front of main switch):

PC systems and production facility control panels

Switching cabinet cooling systems

PLC control unit incl. I/O bus

Complete safety circuits, including safety door operation

Activation of cooling water valves

Service sockets

Switch cabinet lighting

Safety circuits for interlinked systems

Contrary to the MBN, single wires (up to 2.5 mm²) and sheathed cables shall be made orange for the entire length upstream of the main switch. Single wires >2.5 mm² shall be given an orange marking of at least 5 cm at the connecting points.

Energy measurement components

Signal circuits for leak detection

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6.5 Interfaces

See Appendix 3.2

5

6.6 Control Concept

After the contract award, the contractor shall submit the control system concept and the bus topology before the creation of the circuit diagram.

5

6.7 Process Measuring Installations

Process measuring installations shall be executed fail-safe. Faults in the measuring equipment or measuring transducers shall be displayed singly in plain text. In the event of a fault, the facility shall be switched in individual cases to a safe condition.

Switching points in the PLC system shall be generated using analog 4-20 mA inputs. For each analog input it shall be possible to set 8 switching points. It should be ensured that the input fields are subjected to plausibility checks during the parameterization process. This means that it shall not be possible to make entries which would lead to damage to a machine component or would result in unstable or dangerous machine conditions.

Flow rate measurements shall always be undertaken using a plausibility check

For systems not equipped with a PLC, all analog values shall be applied to a terminal strip as 4- 20 mA floating signals by means of a coupling module. In this connection, a coupling module as per the material approval list (in the MDM) shall be used. For parameterizing the switching points, the manufacturer of the measurement technology shall employ evaluation and electronic switching equipment.

In general, when an analog value is transmitted to external control systems, it shall be electrically isolated.

All analog signals shall be directed into the PLC systems. Faults in the measuring systems shall be switched to the PLC systems.

The measuring transducer or pickup shall be selected to match the anticipated measuring values such that maximum measurement accuracy is obtained on the basis of the measuring range.

Devices with HART technology shall ideally be used as transducers and/or sensors (selection as per material approval list (in the MDM)).

Measuring transducers and pickups shall be connected using appropriate resistance terminals.

All analog values shall be directly connected in the main switch cabinet.

If settings are required, these shall be undertaken at the sensor. Not in the PLC program.

In the case of the failure of a controlled variable, the production facility shall be switched to a safe production facility condition.

Backup of the measuring transducer data forms a part of the documentation (on paper and data storage medium)

6.8 Overfill Safety Device/Leak Sensor

Overfill safety devices are prescribed for storage facilities. For all other systems, overfill safety devices/leak sensors shall also be used at (one or more) suitable locations. All overfill safety devices/leak sensors shall be equipped with a binary contact.

Gaggenau plant: see Appendix 3.4

6.9 (Omitted)

6.10 Check of Overfill Safety Devices/Leak Sensors

The periodic inspection of the overfill safety devices shall be undertaken via an evaluation unit of the measuring probe and/or via the associated operator station.

Where an overfill safety device is used as per the invitation to tender, this shall be checked based on the approval regulations.

For every overfill safety device used, a separate initial commissioning report shall be created with the following minimum content:

Production facility designation, production facility number, EQ no.

Site, building, production facility coordinates

Designation (equipment identifier) of protection device

Functional part with type approval (make, device designation, type)

Description/list of production facility reactions to be checked

Date and signature of tester

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6.11 Ambient Conditions

When using electrical components, in addition to the ambient conditions set out in EN 60204, the following may be expected. The electrical components shall be designed accordingly.

relative humidity, max. 95%

ambient temperature 40°C

oil vapors.

5

6.12 Programming

As far as technically possible, functions shall be programmed as process sequences in accordance with DIN 40719 Part 6. The programs shall always be structured as per the software guide (Appendix 3 – Process Technology).

5

6.13 Operating Instructions

The operating manual shall contain in addition to DIN EN ISO 12100 the following information:

When using monitors or graphic displays, for each screen a color printout of sheet size A 4 is required.

The parameter images after commissioning shall be stored in the documentation with real process values

5

5

6.14 Selection of Control and Display

The minimum requirements for control and display are as shown in the following table.

Number of signals	Conventional control	PLC system required	Group signal to PLT	Single signal to PLT	Control panel with display	On-site visualization with touch panel and PC
< 15	X		X			
< 15		X		X		
15 – 25		X		X	X	
>25		X		X		X

Definition of signals:
all operating, status and fault signals

6.15 Control Structure with Conventional Technology

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(< 15 signals without individual signal to an PLT supply and disposal)

If the production facility control is made from conventional technology, the messages shall be routed to a connected terminal strip (24 V DC) and reported by means of an intelligent Ethernet terminal (individual messages, type will be indicated by representative) or hardware contacts (collective message) to the PLT. The on-site messages are output by means of the illuminated event display field and/or illuminated mimic display panel.

6.16 Control System Structure with PLC without Visualization

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A E F Y Z

(< 15 signals and individual signal to an PLT supply and disposal)

For a production facility control with PLC, the above-mentioned messages are reported via Ethernet to the control system. Preparation of the data points for supply and display in the PLT shall take place in the data module sector.

The data areas in which the messages shall be stored are specified.

The on-site messages are output by means of the illuminated event display field and/or illuminated mimic display panel.

6.17 Control System Layout with PLC and On-site Visualization via a Control Panel

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(15-25 messages and individual message to supply+disposal PLT)

Individual plants are represented by individual displays. These displays shall be prepared under process and functional aspects. In doing so, it is to be noted that drive units, e.g. pumps and valves, as well as filling levels etc. shall be displayed in more than one individual display. The individual displays shall be so configured that the operator can easily assimilate the information presented at the operator interface.

The data areas in which the messages shall be stored are specified.

5

6.18 Control System Layout with PLC and On-site Visualization via a Touch Panel

(> 25 signals and signal to PLT supply and disposal covering full scope)

Individual plants are represented by individual displays. These displays shall be prepared under process and functional aspects. In doing so, it is to be noted that drive units, e.g. pumps and valves, as well as filling levels

etc. shall be displayed in more than one individual display. The individual displays shall be so configured that the operator can easily assimilate the information presented at the operator interface.

From each individual display it shall be possible to call up a further individual display. These individual displays are listed in the menu window.

From each overview display – menu display – it shall be possible to branch into the individual displays.

Essentially, the overview image is as follows:

overview image

fault signal display

legend keys (symbol definitions and text descriptions specific to plant items)

Parameter images

operating times (filter/separator runtimes, machine requirements)

maintenance parameters

graphs

individual flow diagrams

Bus overview display for distributed intelligence or if decentralized peripherals used. By reversing the colors of the symbols in the bus overview, operation and faulted conditions are indicated. The installation locations of the bus participants shall be noted by the symbols (building, axis and plain text).

5

6.19 Visualization Guidelines

The type and implementation is specified in a project-specific manner. Where implemented with on-site visualization,

the "Project Planning Guideline for Visualization of Supply+Disposal" shall be observed. This is available from the representative.

5

6.20 Graphs

All analog values required for easy operation of the facility shall be shown in separate windows by means of graphs depending on time of day, with a history of at least 24 hours. The appearance and content of these images shall be agreed on after contract award together with the representative responsible. The respective sampling rate of the measured values shall be taken from the visualization as per the project planning handbook.

5

6.21 Individual Images

The following conditions shall be shown in the individual displays on the visualization system:

At each drive unit, current mode of operation shall be indicated.

Operating states of drive units are identified by color change.

Faults are highlighted by color reversal of device symbols.

End positions are indicated by color reversal.

Filling levels are represented with variable bar charts and percentage values.

Switching points of analog measuring installations are indicated by color reversal.

Analog values of temperature, pressure etc. are displayed in the respective physical unit (e.g. 34°C, 6.2 bar).

New value signals of faults are shown in the individual displays.

The display mode on the visualization system shall be agreed on after contract award with the representative responsible.

For parameter images, it shall be agreed on with the representative which parameter is assigned which user level/password level.

In the case of decentralized systems, the production facility parts shall be provided with building/axis/story identifiers

Basic information, e.g. coloring of operation status displays or media lines, shall be taken from the project planning handbook of the visualization system

5

6.22 Fault Message Display/Operating Message Display

Shown in the fault signal display are individual fault signals, functional group fault signals as well as operating modes, like manual, off or automatic. These signals are made up as follows. These signals break down as follows:

- incoming signal
- outgoing signal
- message duration
- signal number
- fault location
- cause
- electrical designation
- paging key

as well as plant/equipment number, part of factory, building

For the generation of fault messages, it shall be ensured that the software blocks corresponding follow-up messages. Only the actual fault signal shall appear in the display.

5

6.23 Process Control for Supply and Disposal

The system to be used for process control shall be taken from the service specifications and/or the material approval list (in the MDM).

The supply and disposal system is connected via a bus installation to a process control system. The required communication modules and processing of the data lie within the scope of delivery of the supplier. The client is responsible for the wiring of the switches to be used by the supplier for the control system.

The plant is switched on and off by way of the process control system "supply and disposal, remote". For further plant-specific signal circuit configurations, see the section on control configuration and requirements functional notes of the relevant performance.

5

6.24 System Standby (Operational Readiness of the System)

In the "SYSTEM STANDBY" state, the control system monitors all measured values, automatic cutouts of motor circuit breakers, production facility states, etc. If the production facility is in the "Standby" operating mode, it shall still be possible to operate the drive units, all control elements, etc. via the "MANUAL" operating mode. The operating state "Standby" is signaled using a white indicator lamp.

5

6.25 Preselection Options / Operating States

The following preselection options for operating the equipment shall be provided:

operating mode FIELD

operating mode PLT

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6.26 Description of Operating Mode "FIELD"

Switching on and off can only be done at the equipment (switching on via time model "PLT" is not possible). After a voltage recovery or an emergency stop, the "Location" operating mode is automatically preselected.

5

6.27 Description of Operating Mode "PLT"

Activation/deactivation of the production facility (production facility part) only via PLT working time model/production time model "PLT".

Switching takes place however only in the timeframe approved in the PLT working time model/production time model "PLT".

Switching on and off of the equipment in the field is only possible after selection of operating mode "Field".

5

6.28 Operating Modes in General

If a different operating mode is switched to, the currently pending operating state of the production facility remains unchanged. this applying when changing to all operating modes. This means that if the plant (plant

component) was switched on, it remains on if the operating mode is changed. If it was OFF, the production facility remains in standby. The system is not switched until the next switching pulse of the operating mode set now arrives (see Appendix 3.2 for switching examples).

5

6.29 Degree of Decentralization for Process Plants

Individual components that interact functionally with each other are grouped in terminal boxes, provided with external peripherals (in accordance with the product partner for control systems) or with actuator/sensor boxes. The motors are supplied from the central switch cabinet.

Chip conveyors are grouped in the centralized switch cabinets referred to levels. Installed for each of these is a CPU with associated peripherals.

5

6.30 Safety Installations and Alarm Paths

See Appendix 3.3

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6.31 Emergency Stop at Operating Boxes

The emergency stop button of the respective control boxes within a process production facility acts as an overall emergency stop for the entire production facility.

This ruling does not apply for physically segregated functional groups, e.g. pass-over equipment. These functional groups shall be provided with their own emergency stop controls for this function group.

5

6.32 Power Supply to Switch Cabinet

The feed, current distribution, control voltages, etc. shall be designed such that all production equipment can be operated together at 100% of the rated output of the production facility.

Exception:

If a plant has, for example, two drive units, only one of which can be put into operation, the supply is dimensioned for just one drive unit.

If within a plant, several power supply lines are required, each of these will be provided with its own main switch and its own electricity distribution. If several main switches are installed, these shall be mutually interlocked (not mechanically). At each item of plant equipment, just one point of actuation is permissible for all main switches.

5

6.33 Function Descriptions

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6.33.1 Valves, Dampers and Manual Valves

All solenoid and electric valves as well as powered valves shall be equipped with limit switches. When valves are opened and closed, these shall be individually time monitored.

Pair monitoring shall be implemented for all movements monitored with more than one end position switch. For monitoring of manual valves, refer to the mechanical tender documents or the function description of the plant.

5

6.33.2 Pumps

In parts of the plant to which are assigned two pumps, during automatic operation, these pumps shall be switched in alternately. Anti-restart locks are to be displayed accordingly.

5

6.33.3 (Omitted)

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6.33.4 System Pumps / Filter System Pumps

The system pumps shall be switched on and off depending on the throughflow rate or upstream pressure. If N system pumps are in the "Automatic" operating mode, max. N-1 system pumps can thus be operated simultaneously.

When switching on the plant, the system pump that has been switched off the longest starts running. If a further system pump is requested by way of the throughflow rate or upstream pressure, then again the pump that has been switched off longest starts running, etc.

If by way of the throughflow rate or the upstream pressure, a system pump is to be switched off, the one that has been running longest is switched off.

In the event of faults or a change of operating mode, a further system pump cuts in directly.

The system feeds shall be released via a toggle switch at the control console

With the filter system in the operating mode "PLT", the individual system run-ups shall be enabled through the process control system.

5

6.33.5 Filters and Filter Pumps

The filters are cyclically passed through similar to the system pumps for ON and OFF.

During normal operation, the level of the clean tank does not drop to less than about 80% below L4 (the switching point L4 is determined during commissioning and represents the level that is obtained in the worst case during regeneration of a filter). If level L4 is undershot, an additional filter is activated. If level L5 is exceeded, the filter with the longest running regeneration is deactivated (not for settling filter). The signal "Level below L4" is treated like a fault signal and can only be reset by acknowledgment.

Filters can be individually set to "Automatic" at the control console. Regeneration can be initiated optionally from the main or from the field control panels.

At the field control panel, the filter can be set to the operating mode "Manual". All functional steps and individual drive units can be actuated by way of a selection switch and pushbuttons.

During manual operation, safeguards remain functional. When initiating manual operation, it shall be ensured that the filter chamber is drained.

The variable times (e.g. filter time, blowout time, etc.) shall be set via the keyboard at the operating system.

5

6.33.6 Pressure Belt Filter (PBF)

The basic position of a DBF is:

filter valves (agreement shall be reached with the project manager for mechanical engineering on the home position of the filter valves)

inlet valve closed

Manual operation / taking out of operation

The filter has an option for field manual operation. Via a selection switch, the filter can be switched from automatic to manual operation.

With switchover from automatic to manual, the following are initiated automatically:

filter pumps are switched off

inlet valve closed

filter chamber is drained (time, pressure)

Manual operation is then possible.

During manual operation, all production equipment assigned to the filter can be actuated.

For belt traversing, an inching switch shall be installed at the outlet for the filter compacted fabric.

The filter can be switched to manual or automatic at the plant's control panel.

In the manual mode, the filter is taken out of operation.

At switchover to manual, the filter is regenerated if it is not in its basic position.

All adjustable times shall be shown on the operating system with actual and specified values. The specified value can be modified via the operating system.

The PBF shall be designed for operation with compacted fabric and reverse switching of the belt drive.

Space shall always be reserved (reversing operation) for a contactor etc. in the switch cabinet.

Forward running or reversing of the belt drive can be entered.

5

6.33.7 Monitoring of Regeneration

Regeneration monitoring shall encompass:

damage to compacted filter fabric, e.g. hole in the fabric or endless belt

excessive fouling of fabric

defective pressure measurement probe

increased number of regenerations due to a change of filter medium

Regeneration monitoring shall be done as follows:

If the filter is regenerated outside of the normal filter period, this regeneration is recorded. If the number of recorded regenerations is the same as the set monitoring number, a corresponding fault signal is issued.

The fault signal is issued, for example, if:

filter 3 time between regenerations is too short

filter 3 time between regenerations is too long

For fault signals to be issued, a precondition is that the recorded regenerations take place sequentially. This fault signal can only be acknowledged in the field. When this signal is issued, the counter of recorded regenerations is reset to 0 → monitoring of regeneration starts again from the beginning.

The monitoring number can be variably set between 2 and 4 via the operating system.

5

6.33.8 Filter Selection

If, for example, all filters are set to automatic and are ready for operation, then depending on the system pumps they are cycled through. If a filter is no longer in automatic mode, it is removed from the sequence.

If a filter is no longer required, it is switched off and the filter time is stopped (Project Manager for Mechanical Engineering shall be consulted).

The filter is regenerated under the following criteria:

filter time

regeneration pressure (project manager for mechanical engineering shall be consulted).

excess pressure

Production facility in standby (if filter is not in home position)

filter switched to manual.

5

6.33.9 Centrifuges

Centrifuge motors are always directly connected. The use of brake power units is still preferred to reverse current braking. The contractor shall agree on the type of brake application with the centrifuge manufacturer. Braking takes place under the following conditions:

Emergency stop

Upon request (e.g. manual mode by means of additional illuminated pushbutton)

Imbalance (manufacturer-specific)

5

6.33.10 Worm Conveyors

The worm conveyors shall be monitored with motor load monitors in addition to the motor protection switch, with the possibility for setting upper and lower limits. The load monitor shall be selected in line with the drive unit output. Each worm conveyor shall be provided in the field with a repair switch (see description of repair switch).

The mounting location of the repair switch shall always be agreed on with the representative.

A time interval control shall be provided for worm conveyors.

It shall be possible to set the running and idle times.

5

6.33.11 Scraper Conveyors (SC), Scrapers of Discharge Tanks and Slat-Band Chain Conveyors

In addition to a motor protection switch, the conveyor motor loading shall also be monitored, with the option of setting upper and lower limits. The load monitor shall be selected in line with the drive unit output. In addition, a rotation control shall be mounted on the deflection side in the case of scrapers of discharge tanks.

Each conveyor shall be provided in the field with a repair box switch (see description of repair switch).

The mounting location of the repair switch shall always be agreed on with the representative.

A time interval control shall be provided for scrapers of discharge tanks.

After the repair switch is switched off at a discharge scraper, a monitoring time of up to 120 minutes is started in the software. Following this time, and if the repair switch is not switched back on, a fault signal (repair switch monitoring time passed) is generated. This fault signal can be acknowledged at the plant only by switching the repair switch back on. The horn or omni-directional beacon can be acknowledged. In this case the fault message loses its "new message" status. Appropriate safety devices shall ensure that the conveyor chains do not tear even as a result of manual operation.

For chip conveyors that exceed an inspectable length, two repair switches shall be provided.

The equipment of a chip conveyor with two repair switches shall be agreed on in advance with the representative.

5

6.33.12 Repair Switches

Solely repair switches as per the material approval list (in the MDM) shall be used.

The repair switch shall be lockable, with all poles switchable to: positions 1 - 0 - 2.

position 1 = normal operation

position 0 = repair (drive unit does not run)

position 2 = repair operation and inching reverse (not extraction fan)

In positions " 0 " and " 2 ", the repair signal shall be issued. When switching from position " 0 " to " 2 ", the repair signal shall not be interrupted.

Operation at repair switches can be done at any time in manual and automatic modes.

Following a repair intervention and switching of the repair switch to position "1", after a short time, the previously switched on plant component automatically resumes operation.

At position " 0 " an acknowledgment pulse for the associated production equipment shall be generated.

5

6.33.13 Circulation / Weekend Operation

Circulation mode/weekend mode is automatically activated where the production facility is in standby.

For circulation operation, a possibility shall be provided for setting interruption breaks and running times via the operator display.

5

6.33.14 Decentralized Production Facility Parts (distance > 100 m)

Decentralized production facility parts at a distance > 100 m shall always be connected with fiber-optics cables.

All diagnosis options of the bus components used shall be evaluated individually.

See Appendix 3.x (Control System Concept).

5

6.33.15 Lifting Pump Stations

If lifting pump stations are present in connection with central systems, the following function sequence shall be implemented. The connection from the central system to the associated lifting pump station(s) is implemented by means of (redundantly routed) fiber-optic cables. All analysis options of the OLMs shall be evaluated and output as a fault message.

For L8 Max Alarm of a lifting pump station, the associated shutoff device in the system feed closes. The shutoff devices in the system feed are additionally checked for leaks; in this case, a flow should no longer be present when the device is closed. For L9 of a lifting pump station, the entire system feed switches off. If no bus connection exists to one or all lifting pump stations, the system feed also switches off. Deviating functions only in consultation with the representative responsible.

5

6.33.16 Suction Stations for Vacuum Chip Removal

Before implementation, detailed consultation with the representative responsible is required.

Suction stations with their own switch cabinet shall be provided with an interface as per Appendix 3.4.

X

6.34 Specifications for Gaggenau Plant

Appendices 24, 25, 26, 27 and 28 shall be observed.

7 Tests

7.1 General

All tests stipulated in the overriding regulations are to be conducted and documented as specified in Powertrain Requirement Specifications, Part V "Documentation" (test reports = measurement and test reports).

That applies to the inspections according to

EN60204

2 3 4 5 6 7 8 9

The measuring points shall be documented as per form 01 ("Test Report for Elec. Test of Stationary Work Equipment"). Examples are entered in the existing file. The template shall be completely filled out for documentation of the measuring points and delivered as a file and signed in paper form.

AwVS (Ordinance on Installations for the Handling of Substances Hazardous to Water)

The initial commissioning tests for contactless protection devices shall be performed by a qualified person in accordance with Industrial Safety Ordinance §10 at the installation site.

To prepare for operational system + acceptance, here are some notes on what will be tested by Daimler:

Documentation: review of completeness and correctness, The latter to be checked by random sampling only.

Data backup: Master reset of the system and booting of the software supplied as original with a programming device from the client.

Function: Check of (e.g.)

home position traverse

restart characteristics, including after emergency stop or main switch OFF/ON

error messages and transmission to the MDE/BDE control system

Safety Technology: The contractor shall supply a description of the safety equipment and circuits. The initial commissioning check list of the contractor including the required tests shall be supplied filled in and signed.

7.2 Brake Test

If the brake test is negative, it shall be possible to move all of the axes to a repair position with the protective doors closed. Opening the protective doors shall only be possible with the red and blue EKS keys.

7.3 Periodic Function Test for Safety Devices

A "periodic function test for safety devices" image shall be implemented to inform users of upcoming periodic function tests for safety devices.

a screen "Periodic function test of safety system" shall be implemented. A standard image is under development. Until this is available, an image shall be created via the variable layout. The standard image will be provided in the future via the project DVD.

All safety devices (e.g. emergency stop, safety doors, BWS...) shall be listed.

The time of the test cycle and the pre-warning times shall be agreed on with the department.

Once the pre-warning limit is reached, an HMI message is output.

If the test cycle is exceeded, a stop at the end of the cycle shall be initiated and a fault message sent to PRISMA.

The test cycle shall in each case be automatically reset when a protective device is actuated so that only the unused devices have to be checked.

8 Documentation

8.1 General

- Unless otherwise required in the following, the documentation shall always be supplied in electronic form (CD, DVD).
- Manuals shall be supplied in PDF format on CD/DVD.
- Operating instructions and current flow diagrams shall additionally be supplied 1x as printouts on paper.

8.2 Software

- All software employed by the OEM must be supplied on CD/DVDs with licenses
- The PLC project, networking, etc., shall be included on CD
- At the end of commissioning, an up-to-date, operational Ghost copy shall be handed over to Maintenance
- For computer systems, detailed reinstallation instructions (operating system, drivers, licenses, application...) shall be delivered in addition to the hard-drive image. Software components are part of the scope of delivery of the machine

9 Pricing and Appendix

9.1 Pricing of the Tender for Electrical Equipment

9.1.1 Preparation of Bid

All required control and electrical concepts shall be offered in as cost-saving a way as possible while taking due account of the stipulated components and concepts.

Bids shall discuss the technical requirements in detail.

If some of the technical or organizational requirements as stated in the specifications are not explicitly discussed in the bid, Daimler will assume that these requirements are met by the vendor and that they are accepted and will be executed as defined.

Tenders shall give binding confirmation of general compliance with the specifications.

Bids for the electrical equipment shall include the following documents:

layout of the machine or assembly system;

control concept/structure (involving the product partners);

control hardware specifying the number of inputs/outputs;

location and functional subdivision of the switch cabinets, specifying the necessary cooling units;

information on the connected load (in kVA) and the simultaneity factors (for each machine or assembly station).

9.2 Appendices to Part III of the Powertrain Requirement Specifications 2021

The following appendices shall be observed:

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9.3 Forms for Part III of the Powertrain Requirement Specifications 2021

The following forms shall be observed:

Form 1	Electrical Testing of Stationary Operating Equipment	4
Form 2:	Energy Manager Parameterization	1
Form 3:	Approval List for Using Electric Motors (Untertürkheim plant, Engines)	2

Technical Definition

Naming of Network Devices, in Plant and Field Networks

Version 2.2

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1. General Information

1.1 Preface

This Technical Definition regulates the naming of network devices in the plant network and field networks. The name is assigned according to a specified algorithm and is binding for the system design for the system suppliers.

The information makes no claim to completeness and the technical boundary conditions shall be coordinated with Daimler AG in the corresponding project phase in individual cases, if necessary.

1.2 Record of Revisions

Version:	Last revised:	Chapter:	Changed by:
1.0	05.01.2012	<i>New draft</i>	Ehleiter, Jürgen
1.1	15.10.2012	<i>Supplement</i>	Lauxmann, Thomas (Siemens)
1.5	04.04.2014	<i>Supplement</i>	Hofacker, Bernd/Kerner, Horst
1.6	10.12.2015	<i>Supplement</i>	Imredi, Endre/Klozenbücher, Kai
1.7	17.11.2016	<i>Extension for S7-1500</i>	Lauxmann, Thomas (Siemens)
2.0	29.1.2018	<i>Extension for S7-1500, field network</i>	Heim, Jochen
2.2	1.4.2019	<i>Deleted: 1.2 Contact Persons at Daimler Revision of examples Spell check</i>	Heim, Jochen

2. Naming Convention

2.1 Plant, Production, Field and Plant Network

The separation between field and plant networks is currently only provided in connection with an S7-1500. If there is no field network (S7-300), all the devices are in the plant network.

No distinction is made in naming terms between the plant network and the production network.

If a device is connected to different networks, for example via several lines or via NAT, and only one device name can be set on this device, the higher-priority name must be used.

Priority:

1. Names of the plant and production networks
2. Name of the plant network
3. Name of the field network

On a Siemens S7 - 1500 controller, device names shall be assigned separately for each interface

Examples of production and plant network names

- Windows measuring computer in the plant network connected to plant network via NAT
- Windows measuring computer connected in production network and plant network
- Control panel X1 in the plant network via NAT in the plant network and X2 in the field network
- Robot in the plant network via NAT in the plant network and in the field network
- NAT router

Examples of plant network names

- Switches in the plant network
- PN/PN coupler in plant network

Examples of field network (S7-1500 only)

- ET200pro
- ET200sp
- MPP1500
- Switches in the field network

3. Groups in the Naming Convention

3.1 Factory Network and Production Network

The factory network and production network is a network that spans the entire Daimler Group.

In this context, names must be unique at a worldwide level.

The structure of the network name can be obtained from the contact persons.

3.2 Plant Network

The plant network can span several stations, and the name must be unique within a line.

The characters of the naming convention are divided into the following informal blocks.

- | | | |
|--------------------------|---------------|--------------|
| • OP / station number | Planning /OEM | 6 characters |
| • ID of technical object | | 4 characters |
| • Device class | | 2 characters |
| • Devices | | 3 characters |

3.3 Field Network

A field network is a local network that is assigned to a station (controller) and has no connection to other networks (neither physical nor via NAT). The name must be unique within the field network (station), but can occur repeatedly in different field networks.

The characters of the naming convention are divided into the following informal blocks.

- | | |
|--------------------------|--------------|
| • ID of technical object | 4 characters |
| • Device class | 2 characters |
| • Devices | 3 characters |

3.4 OP/Station Number

Plant	Designation	Additional information
Specification from Daimler (Planner/OEM)	Two letters followed by four numbers aaxxxx	Example: <i>op0010</i> or for station <i>as1020, mm3050, aq0815, etc.</i>

3.5 Overview of Technical Objects

Technical Object	Designation	Additional information
Robot	irxx	Industrial robot leading no., beginning with "01" (corresponds to no. in the layout)
NC	ncxx	NC controller, example: <i>nc01</i>
PLC	spxx	PLC controller, example: <i>sp01</i>

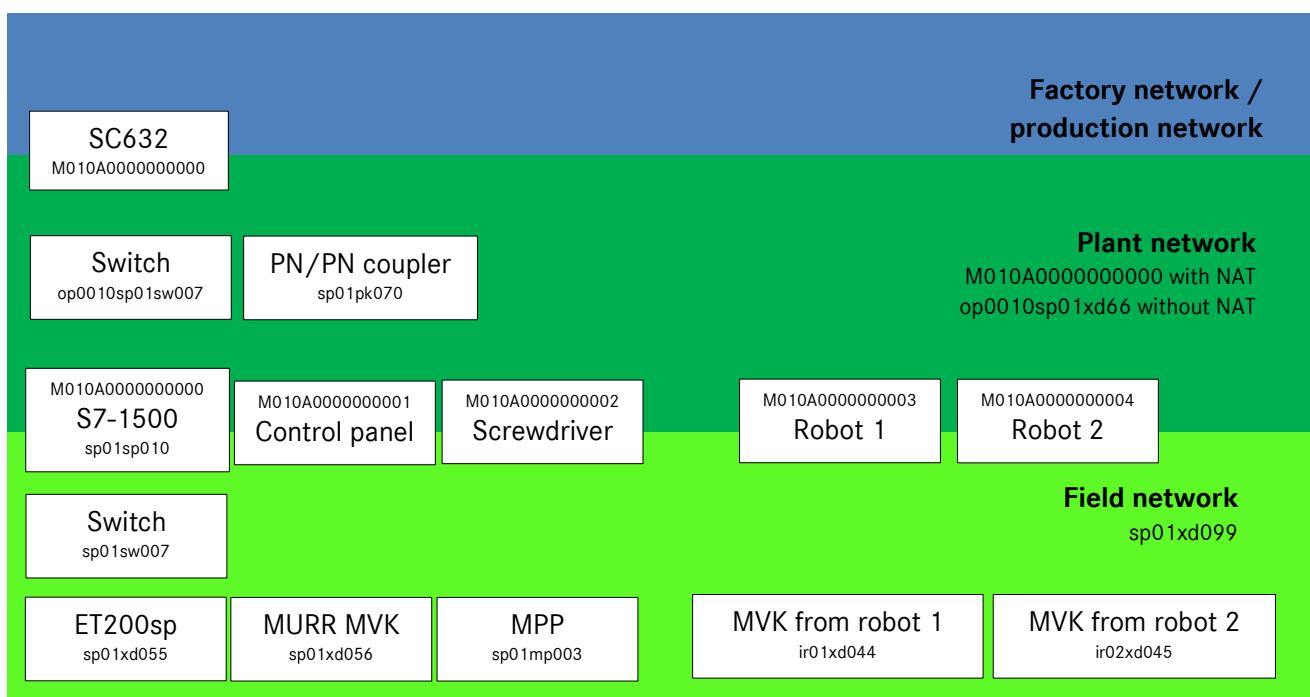
3.6 Overview of Device Classes

Device class	Designation	Additional information
Input/output devices (digital or analog)	xd	ET200sp, ET200pro, MVK
Welding current source	sq	
Image processing	bv	
Bolting control	sr	
Adhesive bonding controller	ks	Also sealing compound application
Laser controller	ls	
Additional axis controller	za	Not additional axis of robot manufacturer
Measuring system	MS	
TSC maintenance unit	ts	Welding torch station
DMC	dm	
FU	fu	Frequency converters
CU	cu	CU310, CU320
PN/PN Coupler	pk	
i-Device (Siemens)	id	Note: Sources designation for i-Device
Managed switch	sw	
Machine control panel	mp	PushButtonPanel, MPP, MCP (Siemens)
Control panel	bf	e.g. IPC277
Robot	ir	Robot controller
NC	nc	NC controller
PLC	sp	PLC controller
Profinet analyzer	pa	e.g.: Indusol Inspector, Barny,
RFID transmitter-receiver-system	rf	e.g.: RF180C
Other Profinet devices	pt	
Other ethernet devices	et	

3.7 Devices

Technical Object	Numbering	Additional information
<p>Serial no. of the devices (technical objects) The number corresponds to the 4th decade of the IP address and is equal to BMK.</p> <p>With a Siemens controller, the IP address (4th decade) is equal to the device number of the hardware configuration.</p>	Three numbers xxx	Example :001

4. Example



5. Plant Network IP Address Assignment

For a detailed description, see "Plant Network Address Assignment" in the Siemens project book.

Requirements on the Safe Operation of Machines and Systems

Production technology, especially manufacturing technology, and the related operational requirements, are subject to constant change and continued development (dimensional accuracy, surface quality, micro-lubrication, chip formation, quality of coatings and adhesive joints, joining accuracy, residual dirt requirements for workpieces, innovative welding and other joining technologies, etc.).

To allow our employees to safely operate production processes as well as to safely repair and to permanently prevent the manipulation of safety systems, suitable options are required to allow processes to be observed, even under realistic conditions (feed rates, rotational speeds, cutting speeds, etc.).

Production systems and machines, e.g. machining centers, transfer lines or assembly systems, consisting of mechanical machining and/or assembly units, e.g. NC-controlled slide units with their relevant transfer facilities for workpiece transportation, are constructed according to standard specifications in the MB Powertrain plants. A uniform control and access concept shall therefore be implemented there.

Together with the details in Table 2, Table 1 specifies the operating modes to be achieved by the manufacturer by machine types. The necessity for Daimler arises from years of past operating experience, **particularly in loading/unloading/clamping processes as well as the assembly of workpieces**, in combination with the machine types listed in Table 2. The manufacturer shall ensure that it does not become necessary to manipulate safety systems throughout all machine life cycle phases. Operating mode 5 shall therefore always be accepted if the manufacturer has to implement it due to the above specified reasons.

The requirements on operating modes in accordance with the relevant machine-specific safety standards apply to the following machine types.

- Presses (hydraulic presses DIN EN 693, mechanical presses DIN EN 692)
- Core shooters (DIN EN 710)
- Metal die-casting systems (DIN EN 869)
- Injection molding machines (DIN EN 201)
- Machining lasers (laser processing machines DIN EN ISO 11533)
- Surface treatment systems, e.g. hardening ovens, soldering ovens (DIN EN 746), shot-peening equipment (EN 1248)
- Process and environmental technology systems plus technical building equipment systems

Supply processes for the above specified machine types, e.g. workpiece handling, shall be implemented as per the requirements of Table 2.

If no operating modes are described in the machine-specific safety standards for the respective machine type or no corresponding machine-specific safety standard exists, the manufacturing company is nevertheless obliged to plan operating modes for the respective machine which e.g. enable safe setup, maintenance, troubleshooting, and repairs without necessitating the manipulation of a safety system.

All movements shall always be possible, at least in BA2 (setup), also in BA3 if necessary in the case of complex movements, with an open safety door if the environmental conditions permit. If necessary, these shall first be established (e.g. a hardening oven shall first cool down).

Deviations from the operating modes specified for the above listed machines shall be coordinated with Daimler for the specific project or system.

1. Concept for Access to and Operation of Machines and Systems in Production

1.1. Design of Guards

The view from the outside into the system for the purpose of observing the processes shall be restricted by the guard as little as possible, e.g. *through the installation of inspection glasses*.

If the options required for monitoring the process from the outside cannot be achieved adequately, suitable substitute measures shall be planned, e.g. *a suitable camera system, simulation programs*. These measures shall be coordinated with Daimler for the specific project.

Segregated machine and equipment zones, e.g. assembly cells, machine tools and lifters shall allow at least one safe access point at each level (electrically protected safety door).

1.1.1. Fixed Guards

Design according to DIN EN ISO 14120 "Guards", e.g. impact resistance, rigidity, material resistance, stability

- The means of fastening shall remain connected to the guard or the machine after removal of the guard
- If there is a danger of parts being thrown out, implementation according to DIN EN 12417 No. 17.2 "Machining centers"
- Safety distances according to DIN EN ISO 13857 "Safety of machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs"
- It shall only be possible to loosen or remove the fastenings of fixed guards with tools (special tool in coordination with Daimler only; guards with quick-release fasteners are not permitted).
- Once the fixings have been removed, the barriers should not be left in the guard position.
- If movements have to be undertaken with the guard removed, the protective element shall be electrically protected (without locking plate)

In exceptional cases, doors (hinged or sliding in guides) may be used if

- this is necessary for the employee due to ergonomic reasons, e.g. due to space constraints, the high weight of the guard or poor guard handling and
- the risk potential of the zone to be safeguarded is low or direct access to danger areas is not possible after removal of the guard, e.g. at the drive end of the machining unit of a transfer line

The maintenance doors shall be designed so that they

- close immediately in the protection position (vertical bar locks),
- can be opened from the inside (emergency release),
- can only be opened with tools or a tool-like key, e.g. a square wrench,
- are provided with the safety note: "Caution: Only open at a standstill!"

Maintenance doors that cannot be seen from the control station for accessible machine and system areas shall be secured with a safety switch.

1.1.2. Movable Guards

Regular opening, e.g.

- Changing tools, jigs and fixtures
- Troubleshooting on tools, jigs, fixtures or transfer equipment
- Observing machining and motions
- Weekly maintenance work in accordance with operating instructions
- Cleaning work

The movable guards are electrically interlocked by safety switches with guard locking.

If a person can be locked in within the machine and system area, a suitable emergency release for the safety switch shall be installed inside (*MRL 2006/42/EC No. 1.5.14*). The unlocking facility is also required for additional mechanical locking, e.g. on washing machines.

1.1.3. Operating Stations and Units

With the safety door open, movements in accordance with Tables 1 and 2 can be undertaken with a mobile operating unit. Release shall only be issued by an authorized EKS transponder depending on operating mode. No more than one safety door in the affected protection area shall be open in this case.

The prerequisite for the initiation, execution, and maintenance of movements is actuation of the enabling device (PL_d according to ISO 13849) followed by an assigned function button (one safety door must be open).

If electro-sensitive protective devices (e.g. safety light curtain, floor scanner) are used, they shall be considered like a safety door and correspondingly integrated in the operating mode concept.

The operating mode concept shall always be implemented (e.g. in human-robot collaboration, HRC), even if no disconnecting or electro-sensitive protective devices are used.

If the safety sensor system must be deactivated (for example in HRC applications) for the setup, this shall be displayed. Any additional safety precautions shall be described.

[JOHEIM1]

If more than one operating station is present in a protection area, e.g. fixed control panel and mobile operating unit (including robots), only one operating station shall be active or movements shall only be executed from there.

1.2. Operating Modes and Operation Authorization

Operation authorization for movements with the safety door open is administered using the EKS transponder system. This is enabled at the control panel using color-coded transponders which are individually assigned to persons (not transferable to other persons). To obtain this transponder the employee shall meet a minimum qualification profile (see Appendix 2b). This is related to the objective of consistently preventing tampering with monitored safety doors and restricting access to specific functions to correspondingly qualified employees (Prevention of foreseeable incorrect application according to No. 1.1.2 Machinery Directive 2006/42/EC). Movement of robots shall only be possible with robot rights on the EKS key (in systems with EKS system).

The manufacturer of the overall system as defined in Machinery Directive 2006/42/EC or the integrator* according to DIN EN 11161 "Integrated Manufacturing Systems" is responsible for the implementation of cross-system or cross-control system operating modes of an integrated manufacturing system, e.g. for placing a workpiece into a machine through a loading portal.

*Manufacturer which designs and provides an integrated manufacturing system or has it manufactured or assembled and which is responsible for the safety strategy including the safety precautions, control system interfaces, and control system connections.

This manufacturer shall obtain the required agreements and present the operating mode concept to Daimler in the planning phase.

If it is discovered during system operation that the operating mode concept is inadequately implemented or insufficient, the manufacturer is obliged to adapt it immediately.

Note:

Daimler additions for the safe operability of machines and systems to the operating modes described in the machine safety standards are permissible since the application of standards is optional (see Section 4 (1) Equipment and Product Safety Act) and represent an extension of the requirement from harmonized standards in line with Machinery Directive 2006/42/EC. The operating modes shall therefore be adopted by the machine manufacturer as regards content.

Organizational measures:

In its operating instructions, the manufacturer shall exhaustively describe which procedures or functions the operating modes include for performing movements with the safety door open and which have been blocked in operating modes 3 and 5 because they are not required for process monitoring. Procedures which can lead to unexpected hazards shall never be undertaken, e.g. tool exchange during machining.

The danger zones and the protective measures to be applied shall be documented in the operating instructions. The procedures shall be defined in the project phase and demonstrated as part of dispatch release.

Daimler shall ensure that the operating instructions are created and the involved employees receive instruction regularly.

The employees are also requested in the operating instructions to observe the specifications in the manufacturer's operating instructions, and to carry out operation with reduced rotational speeds and speeds if possible, particularly when guards are open.

Table 1: Operating modes

Operating mode	Specific MB Powertrain operating requirements based on the requirements of European standards, e.g. EN 12417 or EN 13128	Function mode NC operating mode
1	<p><u>Automatic/manual operation of the machine with closed or locked safety systems</u></p> <p>Prerequisites for performing movements in BA1:</p> <ul style="list-style-type: none"> • Operating mode 1 and the respective function mode are selected. On NC machines, axis selection and JOG operation possible. • With robot operating modes (RB BA) "Manually reduced speed" (T1) as of EKS green incl. RB bit • With robot operating modes (RB BA) "Manually high speed" (T2) as of EKS black incl. RB bit • All safety systems shall be active or closed (e.g. safety door, light barrier). • All functions shall also be operable from the hand control unit (HBG). • Function mode VK, ES, EB: <ul style="list-style-type: none"> ◦ A movement is initiated with the start or home position button. • Function mode ER: <ul style="list-style-type: none"> ◦ A movement is initiated and maintained by actuating the respective button (jog mode). ◦ If one of the above specified prerequisites for performing movements is no longer met, the movement shall stop even if the end position is not yet reached. <p><u>RB BA:</u></p> <p>"Manually reduced speed" operating mode: Design according to DIN EN 10218-1 No. 5.7.3 (e.g. T1 for KUKA) "Manually high speed" operating mode: Design according to DIN EN 10218-1 No. 5.7.4 (e.g. T2 for KUKA)</p>	VK, EB, ES, ER, RB BA, JOG ¹

¹ With NC only

Operating mode	Specific MB Powertrain operating requirements based on the requirements of European standards, e.g. EN 12417 or EN 13128	Function mode NC operating mode
2	<p>Manual operation of a movement for troubleshooting, malfunction elimination, adjustment operations, function testing, etc. (no robot axis movements permissible) with safety system deactivated</p> <p>Examples: Troubleshooting, adjustment and testing after actuator/sensor exchange, axis referencing, etc.</p> <p>Prerequisites for performing movements in BA2:</p> <ul style="list-style-type: none"> • EKS green or inserted higher. • Operating mode 2 selected - function mode ER automatically becomes active. On NC machines, axis selection and JOG operation possible. • Eliminated protection effect of a movable or electro-sensitive guard in the visible area (e.g. an open safety door). • If several command devices (operating panels or manual operating units) are present, only one device may be functional. • Hand control unit (HBG), in addition to the HBG interface: Enabling device on the standard control panel if visibility is ensured. Project-specific release by the specialist Maintenance and Work Safety units is required. <p>Three-stage enabling device actuated in center position. Substance supply/load is switched-in. No movement shall take place on actuation or release of the enabling device.</p> <ul style="list-style-type: none"> • A movement is initiated and maintained by constantly actuating the enabling device and constantly actuating the respective button (jog mode). • If a prerequisite is not met, the movement shall stop even if the end position is not yet reached. A message shall be output on the HMI without malfunction. <p>The following functions shall be realized:</p> <ul style="list-style-type: none"> • Individual electric axis movements reduced to max. 2 m/min or in steps of max. 10 mm with button or electronic handwheel. Exception: Jog mode without enabling device in the case of grinding machines only, e.g. for scratching due to a technological requirement. • Spindle speed reduced to 50 rpm, e.g. for dial gage use under consideration of stopping power (2 revolutions) • Specifications on pneumatic and hydraulic movements can be found in the Requirement Specifications Part 2 – Mechanical Components. <p>If hazardous movements are present according to the manufacturer's risk assessment, further risk-minimizing measures shall be coordinated project-specifically, e.g. provision of safe standing areas.</p> <ul style="list-style-type: none"> • Movements of machine-integrated chip conveyors. • The maximum limits for rotational speeds and operating speeds shall be monitored on systems with return value (e.g. NC axis). On systems without return value (e.g. frequency converter without return), the input values for the maximum specified value shall be limited insofar as the risk assessment permits. <p>If a limit is exceeded a controlled stop (cat. 1 as per DIN EN 60204-1) must be triggered.</p>	ER, JOG ²

Operating mode	Specific MB Powertrain operating requirements based on the requirements of European standards, e.g. EN 12417 or EN 13128	Function mode NC operating mode
3	<p><u>Performance of specified and defined movements / sequences / processes with a deactivated safety system</u></p> <p>Manual operation of a movement for process monitoring. Examples: Troubleshooting, function testing after repair, etc.</p> <ul style="list-style-type: none"> Movements shall be coordinated project-specifically with the specialist unit. If necessary, these shall be subdivided into sensible sub-processes for process monitoring. <i>Hazardous parallel sub-processes</i> which are not urgently required for the monitoring or production process shall be blocked, e.g. tool change, pallet change, high coolant pressure, chip conveyor. <p>Prerequisites for performing movements in BA3:</p> <ul style="list-style-type: none"> EKS black or higher inserted. Robotic operation: see Table 3 in this document. Operating mode 3 selected - function mode EB automatically becomes active. ES can be selected. MDA, auto, single step, single block can be selected on NC machines. Eliminated protection effect of a movable or electro-sensitive guard in the visible area (e.g. safety door). If several command devices (operating panels or manual operating units) are present, only one device may be functional. Hand control unit (HBG), in addition to the HBG interface: Enabling device on the standard control panel if visibility is ensured. Project-specific release by the specialist Maintenance and Work Safety units is required. Three-stage enabling device actuated in center position. Substance supply/load is switched-in. No movement shall take place on actuation or release of the enabling device. A movement is initiated and maintained by constantly actuating the enabling device and one-off actuation of the start/home position button. The override should be active during all movements. If a prerequisite is not met, the movement shall stop even if the end position is not yet reached. A message shall be output on the HMI without malfunction. Two options shall be available for continued operation of the machine: <ul style="list-style-type: none"> The movement shall be continued on renewed actuation of the enabling device and start button. Movement to the home position shall be executed on renewed actuation of the enabling device and home position button. 	<p>ES, EB, RB BA, (MDA, auto, single step, single block)³</p>

² With NC only

³ With NC only

Operating mode	Specific MB Powertrain operating requirements based on the requirements of European standards, e.g. EN 12417 or EN 13128	Function mode NC operating mode
3	<p>The following functions shall be realized:</p> <ul style="list-style-type: none"> • All electric axis movements reduced to a maximum of 5 m/min; robots limited to 250 mm/s • Spindle speed reduced to 50 rpm and limited through stopping power (braking within five revolutions) • The maximum limits for rotational speeds and operating speeds shall be monitored on systems with return value (e.g. NC axis). On systems without return value (e.g. frequency converter without return), the input values for the maximum specified value shall be limited insofar as the risk assessment permits. <p>If a limit is exceeded a controlled stop (cat. 1 as per DIN EN 60204-1) must be triggered.</p> <ul style="list-style-type: none"> • Specifications on pneumatic and hydraulic movements can be found in the Requirement Specifications Part 2 – Mechanical Components. • For safe operation by a single person, e.g. during process monitoring, cross-control system procedures shall be integrated in an HBG, e.g. workpiece transfer to machine tool with robot/machine loader in clamping device <p>RB BA:</p> <p>"Manually reduced speed" operating mode: Design according to DIN EN 10218-1 No. 5.7.3 (e.g. T1 for KUKA)</p> <p>"Manually high speed" operating mode: Design according to DIN EN 10218-1 No. 5.7.4 (e.g. T2 for KUKA)</p> <p>Auto external: The movements shall only be maintained through constant actuation of the enabling device and constant actuation of the start button (jog mode). The machine control panel/HBG override also acts on the robot movement.</p>	ES, EB, RB BA, (MDA, auto, single step, single block) ⁴
4	<p>Operating mode without constant actuation of an enabling device. For applications in which continuous operation of a permissive device is not feasible because of the settings to be made or for ergonomic reasons.</p> <p>Not implemented in Powertrain.</p>	-

⁴ With NC only

Operating mode	Specific MB Powertrain operating requirements based on the requirements of European standards, e.g. EN 12417 or EN 13128	Function mode NC operating mode
5	<p><u>Execution of defined procedures and processes up to the operating speed of controlled axes possible with a deactivated safety system</u></p> <p>Examples: Monitoring of procedures and processes if reduced speed is not possible due to the process, see also Table 2</p> <ul style="list-style-type: none"> Implementation shall be defined according to Table 2 or, if necessary, project-specifically as part of the risk assessment, and movements shall be coordinated with the specialist Maintenance unit. If necessary, these shall be subdivided into sensible sub-processes for process monitoring. <i>Hazardous parallel sub-processes and functions</i> which are not urgently required for the monitoring or production process shall be blocked, e.g. tool change, pallet change, high coolant pressure, chip conveyor. Action must be taken to ensure safe zones for users (i.e. maintenance engineers) in places that are close to potentially hazardous movements. Safe standing areas in the system area shall be marked if necessary. <p>Prerequisites for performing movements in BA5:</p> <ul style="list-style-type: none"> EKS red inserted. Operating mode 5 selected - function mode VK automatically becomes active. EB can be selected. Auto is automatically selected in the case of NC machines. Eliminated protection effect of a movable or electro-sensitive guard in the visible area (e.g. safety door). Hand control unit (HBG), in addition to the HBG interface: Enabling device on the standard control panel if visibility is ensured. Project-specific release by the specialist Maintenance and Work Safety units is required. Three-stage enabling device actuated in center position. Substance supply/load is switched-in. No movement shall take place on actuation or release of the enabling device. A movement is initiated and maintained by constantly actuating the enabling device and constantly actuating the start/home position button (jog mode). The override should be active during all movements. If a prerequisite is not met, the movement shall stop even if the end position is not yet reached. A message shall be output on the HMI without malfunction. Two options shall be available for continued operation of the machine: <ul style="list-style-type: none"> The movement shall be continued on renewed actuation of the enabling device and start button. Movement to the home position shall be executed on renewed actuation of the enabling device and home position button. <p>The following functions shall be realized:</p> <ul style="list-style-type: none"> All axis movements (in steps or continuous) up to working speed For safe operation by a single person, e.g. during process monitoring, cross-control system procedures shall be integrated in an HBG, e.g. workpiece transfer with machine loader to machine tool clamping device. 	VK, EB, Auto ⁵

⁵ With NC only

Table 2: Machine list, implementation of operating modes

Note: Where a production system consists of several machine types (e.g. grinding machine with a machine loader nos. 7 + 17), all the specific versions of the operating modes must be taken into consideration.

no.	Machine type	BA1	BA2	BA3	BA5	Specific implementation of the operating mode
1	Bending machine	x	x	(x)	x	
2	Brushing machine	x	x	x		BA 3: Workpiece transportation (No. 32), no machining (in the offset), hydraulic clamping procedure, no coolant, no blow-off processes
3	Machining center/transfer line	x	x	x		BA 3: Workpiece transportation (No. 32), primarily without machining, e.g. in the offset, hydraulic clamping procedure, tool change if necessary, no coolant, no blow-off processes
4	Drilling machine	x	x	x		BA 3: Workpiece transportation (No. 32), primarily without machining, e.g. in the offset, hydraulic clamping procedure, no coolant, no blow-off processes
5	Lathe	x	x	x		BA1: The maximum permissible spindle speed shall be monitored in automatic mode (see ISO 23125). BA2: <i>Power-driven revolver heads may only be turned in steps at reduced speed (see ISO 23125).</i> BA 3: Workpiece transportation (No. 32), primarily without machining, e.g. in the offset, hydraulic clamping procedure, no coolant, no blow-off processes, spindle speed shall be monitored. <i>The requirements "Service Mode" (Nos. 5.2.4.5. ISO 23125) additionally apply</i>
6	Milling machine	x	x	x		BA 3: Workpiece transportation (No. 32), primarily without machining, e.g. in the offset, hydraulic clamping procedure, no coolant, no blow-off processes
7	Grinding machine	x	x	x		BA2: control of movements with function buttons in inching mode, e.g. scratching without enabling switch only following coordination with Daimler BA 3: Workpiece transportation (No. 32), primarily without machining, e.g. in the offset, hydraulic clamping procedure, cooling lubricant supply blocked
8	Finishing machine	x	x	x		BA3: Without finishing process, without cooling lubricant, workpiece transportation (No. 32) and clamping procedures shall be depicted.
9	Materials handling technology in the working and traffic area e.g. roller conveyors, friction conveyors	x	(x)	(x)		See Appendix 5 Logistical Systems & Materials Handling Technology BA2: For turners, rotating tables, swiveling stations (see also materials handling technology standard) if the system parts are not designed intrinsically safe. (EKS then required) BA3: If BA2 is insufficient for malfunction elimination

10	Maintenance area materials handling technology (separately secured area)	<i>Maintenance personnel require a personally assigned key for the materials handling technology level.</i>			See Appendix 5 Logistical Systems & Materials Handling Technology It shall be ensured that the maintenance personnel is able to execute movements with an enabling device.
11	Hardening system	x	x	x	BA 3: Workpiece transportation (No. 32), hydraulic clamping procedure, no electrical energy at the tool
12	Lifts in the working and traffic area	x	x	x	See Appendix 5 Logistical Systems & Materials Handling Technology BA3 (not with unsecured workpieces / transfer bar shall be empty / chain or electrical voltage of supplying conveyor shut off): Complete procedure, monitoring shall be implemented from all levels, secure location for use of a mobile operating device
13	Maintenance area lifts (separately secured area)	<i>Maintenance personnel require a personally assigned key for the materials handling technology level.</i>			See Appendix 5 Logistical Systems & Materials Handling Technology It shall be ensured that the maintenance personnel is able to execute movements with an enabling device.
14	High-pressure deburring system	x	x	x	BA 3: Workpiece transportation (No. 32), hydraulic clamping procedure, swiveling units. High pressure securely shut off
15	Honing machine	x	x	x	BA 3: Workpiece transportation (No. 32), no machining (in the offset), hydraulic clamping procedure, no coolant, no blow-off processes
16	In-process measuring machine	x	x	x	BA3: Workpiece transportation (No. 32), hydraulic clamping procedure incl. contacting measuring sensor, without measuring program if necessary
17	Machine loaders (<i>incl. other similar workpiece loading systems, e.g. slewing exchangers</i>)	x	x	x	X* BA 3/5: Full functional sequence, e.g. workpiece exchange with safety door of the machine to be loaded open. *Forgoing operating mode 5 shall be technically justified by the manufacturer and documented as per the form with functional approval by Daimler.
18	Measuring machine	x	x	x	BA3: Workpiece transportation (No. 32), hydraulic clamping procedure incl. contacting measuring sensor, without measuring program if necessary
19	Assembly system (semi-/automatic station)	x	x	x	(x) BA3: Workpiece transportation (No. 32), assembly process (e.g. screwing/pressing-in processes in real time), operating speeds limited to 5 m/min, danger due to parts being flung out shall be ruled out BA5: If process operating speed > 5 m/min required
20	Test stands	x	x	x	BA3: Workpiece transportation (No. 32), adaptation procedures, clamping procedures, test run if necessary
21	Storage and retrieval device (high bay storage facility)				See Appendix 5 Logistical Systems & Materials Handling Technology According to DIN EN 528
22	Storage and retrieval devices (max. 3 meters) e.g. decoupling modules	x	x	x	See Appendix 5 Logistical Systems & Materials Handling Technology BA 3: Secure location for use of a mobile operating device, transfer procedures

23	Friction welding system	x	x	x		BA 3: Workpiece transportation (see 32 below), hydraulic clamping procedure, swiveling units.
24	Robot	x	-	x	-	<p>BA3: Authorization via EKS request (robot bit) for operation at "manually reduced or high speed (T1/T2)" (incl. gripper movements) using robot hand control unit</p> <p><i>- Partially automated operation for process monitoring if cross-control system procedures cannot be implemented at "manually reduced speed (T1)": Movements using machine control system hand control unit (robot in Auto_external with max. 250 mm/s)</i></p> <p><i>- Operation at "high speed" (T2) is required for some processes such as e.g. arc-welding, bead application. The respective use shall be coordinated with the specialist unit during the design engineering phase.</i></p>
25	Broaching machine	X	X	(x)		BA 3: Workpiece transportation (No. 32), clamping procedures
26	Sawing machine	x	x	(x)		BA 3: Workpiece transportation (No. 32), clamping procedures
27.1	Welding system	x	x	x	(x)	BA 5: If BA 3 is insufficient for process monitoring
27.2	Laser welding systems	x	x	x		BA 3: Workpiece transportation (No. 32), hydraulic clamping procedure, no electrical energy at the tool
28	Rotary swaging machine (<i>radial cold forming</i>)	x	x	(x)	x	<p>BA 3: Workpiece transportation (No. 32)</p> <p>BA 5: Monitoring (listening) of the processing process (no workpiece handling) within the noise protection booth, as the process cannot be implemented in BA 3</p>
29	Upsetting machine	x	x	(x)	(x)	<p>BA 3: Workpiece transportation (No. 32), mashing process</p> <p>BA 5: If it cannot be implemented in BA3 due to the process Coordination of implementation with the specialist Maintenance unit is mandatory</p>
30	Rolling machine	x	x	x		BA3: Workpiece transportation (No. 32), hydraulic clamping procedure, swiveling units, forming process if required by the operator
31	Washing machine (<i>with internal movement processes</i>)	x	x	x		BA 3: Workpiece transportation (No. 32), hydraulic clamping procedure, swiveling units. Washing medium supply securely blocked
32	Workpiece transport	x	x	x		BA 3: It shall be possible to perform all machine movements required for loading and unloading the workpiece (such as e.g.: Clamping/unclamping, centering tip forwards/back, stowage boxes up/down) in workpiece loading enable mode. The complete procedure shall be performed with a hand control unit.
33	Balancing machine	x	x	x		BA3: Workpiece transportation (No. 32), clamping procedures without machining

x: Required (x): Poss. required, check in coordination with the specialized department and operator

Table 3: Design of operating modes incl. example for selection of green EKS with robot authorization in T1

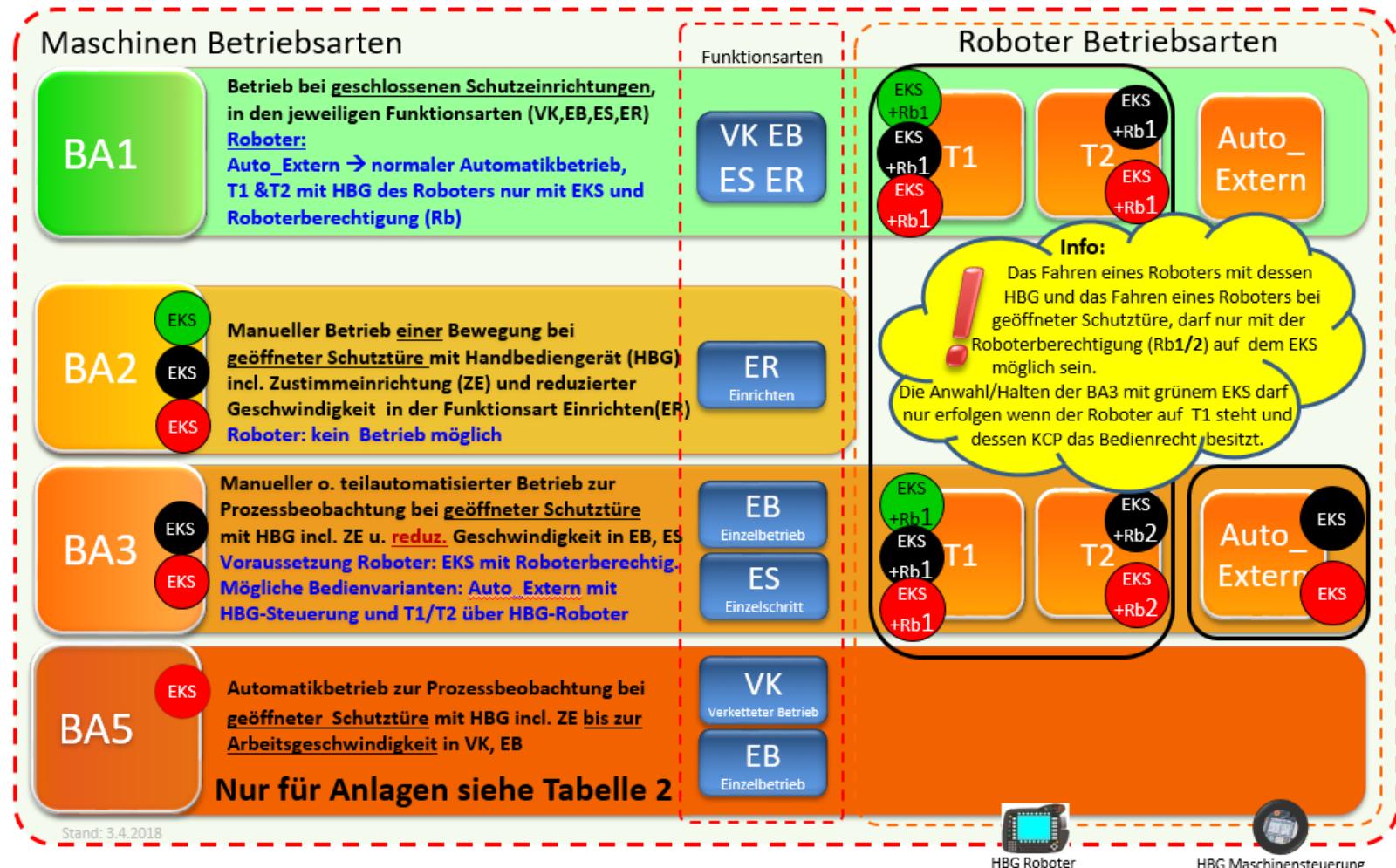
Zuordnung der Maschinen Betriebsarten (BA), Roboter BA, Funktionsarten, Electronic-Key-System

Betriebsarten: BA1, BA2, BA3, BA5

Roboter-BA (am Beispiel Kuka): Automatik (Auto_Extern), Manuell mit reduzierter Geschwindigkeit (T1), Manuell bis zur Arbeitsgeschwindigkeit (T2)

Funktionsarten : Verketteter Betrieb (VK), Einzelbetrieb (EB), Einzelschritt (ES), Einrichten (ER)

Electronic-Key-System (EKS): ohne Chip/weiß (Maschinenbediener), grün (Bediener mit Befähigung zum Einrichten), schwarz (Systemführer), rot (Instandhalter), blau (Lieferant, der Lieferant ist für die freigegeben Funktionen des blauen EKS eigenverantwortlich)



Legende

Abkürzungen:

BA Betriebsart

VK Verketteter Betrieb (Ist die Funktionsart für den Serienbetrieb/Automatik)

EB Einzelbetrieb (Ein kompletter Arbeitszyklus)

ES Einzelschritt . Die Maschine wird schrittweise durchgefahren, durch Betätigung der Start-Taste wird:

- die jeweils folgende **Bewegung** eingeleitet (Single Block) [ggf. mit M-Funktion]
- die Zeilenweise Abarbeitung des NC-Programms (Single-Step)

ER Einrichten (Jede beliebige Einzelbewegung der Maschine kann gefahren werden)

HBG Handbediengerät

HBF Hauptbedienfeld

KCP Roboter Handbediengerät (Fa. Kuka)

ZE Zustimmeinrichtung

EKS (Electronic-Key-System) Transpondersystem Fa. Euchner, für Zugangs- und Sicherheitsfunktionen an Produktionsmitteln. EKS Farbabstimmung (grün= Werker, schwarz= Systemführer, rot= Instandhalter, blau= Lieferant)

Rb1/2 Roboterbit **1** auf EKS (DB59.DBX**23.4**), Roboterbit **2** auf EKS (DB59.DBX**23.7**),
Berechtigt das Fahren mit dem Roboter für geschulte/unterwiesene Mitarbeiter,
je nach Roboterbit in „Manuell reduzierte (**Rb1/2**)/ hoher (**Rb2**) Geschwindigkeit“

Auto_Extern Roboter Betriebsart „Automatik“*

T1 Roboter Betriebsart „Manuell reduzierte Geschwindigkeit“*

T2 Roboter Betriebsart „Manuell mit hoher Geschwindigkeit“*

*Anwahl über den Roboter Betriebsartenwahlschalter

Zum Beispiel: BA3 Anwahl grüner EKS mit Roboterberechtigung 1 (Rb1) in T1

Aktion bei nicht gestarteter Maschine	Bedienrecht			Maschinen Betriebsarten				Roboter Betriebsarten			HMI Bildschirm Ausgabe		BA3
	HBF	HBG	Roboter	EKS	BA1 Lampe	BA2 Lampe	BA3 Lampe	BA5 Lampe	T1	T2	Auto_extern	HMI Popup Meldung	
BA3 Taste betätigen Zustand vorher: BA1	x	x	x	ohne	leuchtet	aus	aus	aus	x	x	x	keine ausreichende EKS Berechtigung für BA3	(:(
BA3 Taste betätigen Zustand vorher: BA1	x	x	x	EKS	leuchtet	aus	aus	aus	x	x	x	keine ausreichende EKS Berechtigung für BA3	(:(
BA3 Taste betätigen Zustand vorher: BA1	x	x	x	EKS +Rb1	aus	aus	leuchtet	aus	x	x	x		:)
BA3 Taste betätigen Zustand vorher: BA1 aktiv, Auto_Extern,	x	x	x	EKS +Rb1	aus	aus	leuchtet	aus			x	Keine Bedienung der Anlage möglich	(:(
BA3 Taste betätigen Zustand vorher: BA1 aktiv, T1 angewählt, Bedienrecht am Roboter			x	EKS +Rb1	aus	aus	leuchtet	aus	x				:)
BA3 Taste betätigen Zustand vorher: BA1 aktiv, T2 angewählt, Bedienrecht am Roboter			x	EKS +Rb1	aus	aus	leuchtet	aus		x		Keine Freigabe für den Roboter	(:(



Wenn mit dem grünen EKS die BA 3 erfolgreich angewählt wurde (Voraussetzung EKS grün mit Roboter-Bit), darf nur der jeweilige Roboter in T1 bewegt werden. Maschinenbewegungen sind grundsätzlich nicht erlaubt.



EKS grün ohne Roboterberechtigung



EKS grün mit Roboterberechtigung 1 "Manuell reduzierte Geschwindigkeit"



Guideline for Implementing Operating Mode Concept

AG Operating Modes (PT/SUM, PP/PTM, PT/GIH, PT/MIH)
18.03.2020



Mercedes-Benz

Content

1. Background
2. Basic Principles
3. Risk Assessment
4. Excerpts of Relevant Laws, Standards and Publications
5. Safety Concept Modules
6. Examples of Implementation
7. Examples of Implementation of User Guidance in BA3

1. Background

- The Powertrain operating mode concept is used for standardized operation of our machines and systems in Production for owners and maintenance personnel.
- The concept is standardized and extended by operation-specific requirements, e.g.: Operating mode process monitoring from safety-related standards, particularly regulations for manufacturing systems (ISO 11161....)
- The **manipulation** of protective facilities, e.g. safety switches, must be reliably **prevented** through the implementation of the operating modes. This applies to all operating states and the entire service life of the machines.

Due to several severe accidents at work, numerous machines were retrofitted and experiences collated for a suitable operating mode concept in 2005 – 2008.

- The implementation of the operating modes leads to an **acceptable residual risk** when operating the machine.
- The manufacturer's risk assessment shall result in a complete operating mode concept.



2. Basic Principles

- The operator shall be able to protect himself/herself using an enable button (mobile operating unit) or shut the process down (not by a second person on the control panel). The simultaneous activation of different operating units shall be technically prevented.
- The adequate qualification of the employee shall be ensured through the issue of an EKS key by the operational manager. The greater the risk, the higher the **user's qualification** shall be. A robot bit is stored on the EKS chip for operating robots.
- The risk increases with the complexity and speed of the procedures.
- Procedures which can lead to **unexpected hazards** shall never be undertaken, e.g. tool change during machining. The danger zones shall be documented in the operating instructions. The procedures shall be defined in the project phase and demonstrated as part of the **dispatch releaseshipping acceptance**.
- The application of operating modes and procedures with a higher residual risk by the employee is permissible if measures with a lower residual risk are not possible, e.g. the **lowest required speed** shall always be used. The reduction of speeds shall be monitored by the machine.
- MBC operating instruction No. 634 regulates the procedural guidelines for safe application of the operating modes, and its familiarization in training shall be mandatory.
- If it is discovered during system operation that the operating mode concept is inadequately implemented or insufficient, the manufacturer is obliged to adapt it immediately.

3. Risk Assessment

- The operating mode concept defines activities in the acceptance risk range.

Risk



Performing movements with dismantled guard cover without enabling device
(standing **in** the system)



Performing movements with dismantled guard cover without enabling device
(standing **in front of** the system)

Acceptable risk



Performing defined procedures with enabling device with EKS authorization, e.g. EB in BA3



Performing individual movements with enabling device with EKS authorization (ER in BA 2)



Activity

4. Excerpts of Relevant Laws, Standards and Publications

- **ISO 12100 No. 5.6.4:** *For the permanently safe operation of a machine, it is important that the safety precautions enable easy use of the machine and do not affect proper use. There is otherwise the possibility that safety precautions could be bypassed to achieve maximum usability of the machine.*
- **Machinery Directive 2006/42/EC No. 1.2.5:** *If, for certain operations, the machinery must be able to operate with a guard displaced or removed and/or a protective device disabled, the control or operating mode selector shall simultaneously: Disable all other control or operating modes; permit operation of hazardous functions only by control devices requiring sustained action; permit the operation of hazardous functions only in reduced risk conditions while preventing hazards from linked sequences; prevent any operation of hazardous functions by voluntary or involuntary action on the machine's sensors.*
- **Operating Safety Ordinance, Appendix 2 No. 2.3:** *On use of the equipment, the protective facilities shall be used and shall not be disabled.*
- **DGUV Information Sheet No. 22:** *The protective facilities on 30% of all machines in Germany have been manipulated!.... The assessment of accidents from the perspective of manipulation shows that a great deal of action is required as regards this topic.....Focusing on the topic of "manipulation", this means that the manufacturer shall construct machine with an adequate safety and operating concept for the owner, and that the owner shall then also operate the machine properly – without manipulation – throughout its service life*
- **ISO 11161 No. 8.6.2:** *If protective facilities are disabled, further safety precautions shall offer an adequate level of protection determined through risk assessment.*

Examples of further safety precautions include: Protective facility which necessitates continuous actuation (e.g. two-hand switch, enable facility); reduced speed; reduced torque; selection and provision of one or more safe positions and safe access for the performance of fault elimination tasks

5. Safety Concept Modules

- Only authorized persons shall perform motions with one open safety door deactivated safety system (release via EKS).
- Only one person shall obtain access or release via EKS per danger zone.
- Only one mobile operating unit shall be active. Cross-control system procedures shall be performed with one operating unit. Switching operating units in operating modes 3/5 for process monitoring shall be avoided.
- On implementation of robot process monitoring, the robot-specific functional (operating) modes T1 and T2 shall be preferred. The technical necessity of performing cross-control system procedures via AutoExtern by robots in manufacturing systems shall be checked in the operating concept and explained in the event of non-implementation. Addition: sequences across control systems shall be implemented with the hand control unit of the overriding control system.
- The user shall always select the safest form of implementation:
 1. *Execution outside of the danger zone or equivalent system, e.g. camera, simulation programs*
 2. *Setup in operating mode 2 (individual movements, e.g. JOG mode)*
 3. *Procedures in operating mode 3 at reduced speed (controlled drives only)*
 4. *Procedures at the lowest possible technologically required speed (operating mode 5, in technological exceptional cases only)*
- The manufacturer shall selectively list the procedures and functions in the control panel in a sensible sequence, oriented towards the process. In the case of multiple selection, the procedures and functions shall be gradually started automatically in a sensible sequence. (They shall not run in parallel.)

6. Examples of Implementation

Partitioning of process flow in cylinder head assembly, valve seat ring_valve guide (M 274)

EKS
authorization

Open safety
door

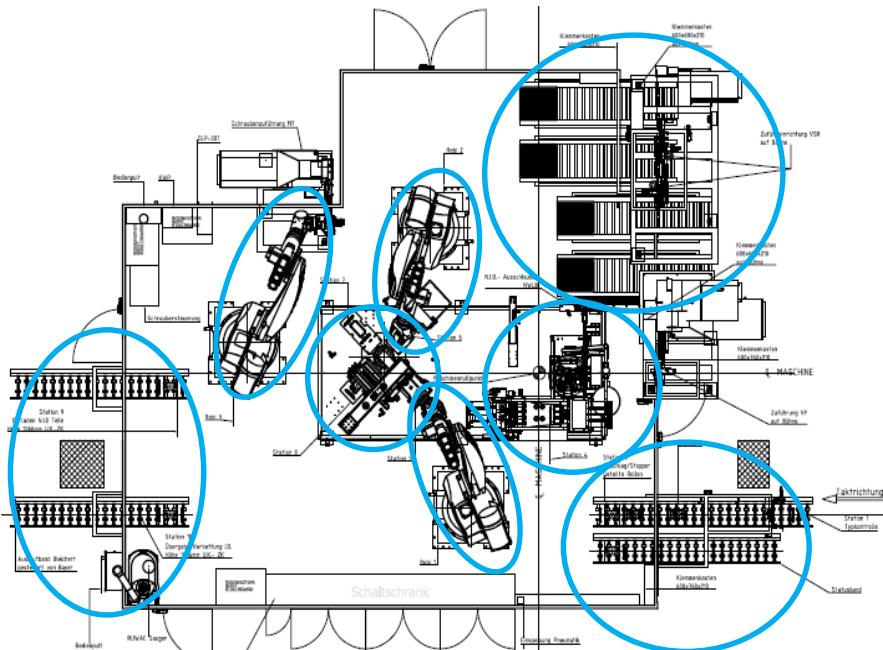


In enable
mode



**Subdivide system
into sensible,
individual sections.**

- The respective sections are selected/activated using the control panel.
- Sub-processes can be monitored with the HBG with the enable button actuated.



7. Examples of Implementation of User Guidance in BA3

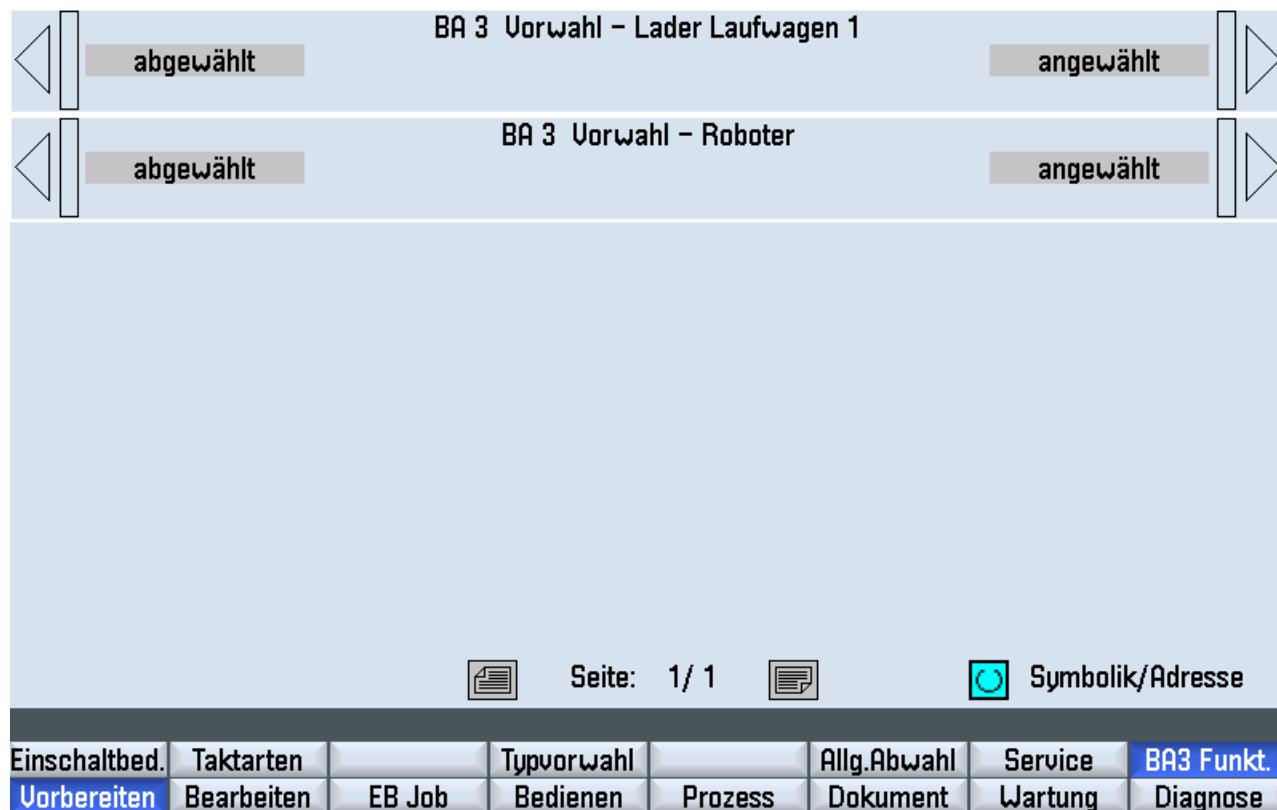
In BA3 all dangerous parallel sub-processes and functions, which are not mandatory for the monitoring and/or production process, must be **blocked**. **Relevant sub-processes shall be defined in the BA3 in the project for the system and coordinated with the departments.**

During operation, an incentive for manipulating a safety system shall be prevented as far as possible. For this purpose, it must be ensured when implementing the protection and operating concept that no unnecessary restrictions result for the employees at the plant. Here it is irrelevant whether the activity at the machine is carried out frequently or only very seldom.

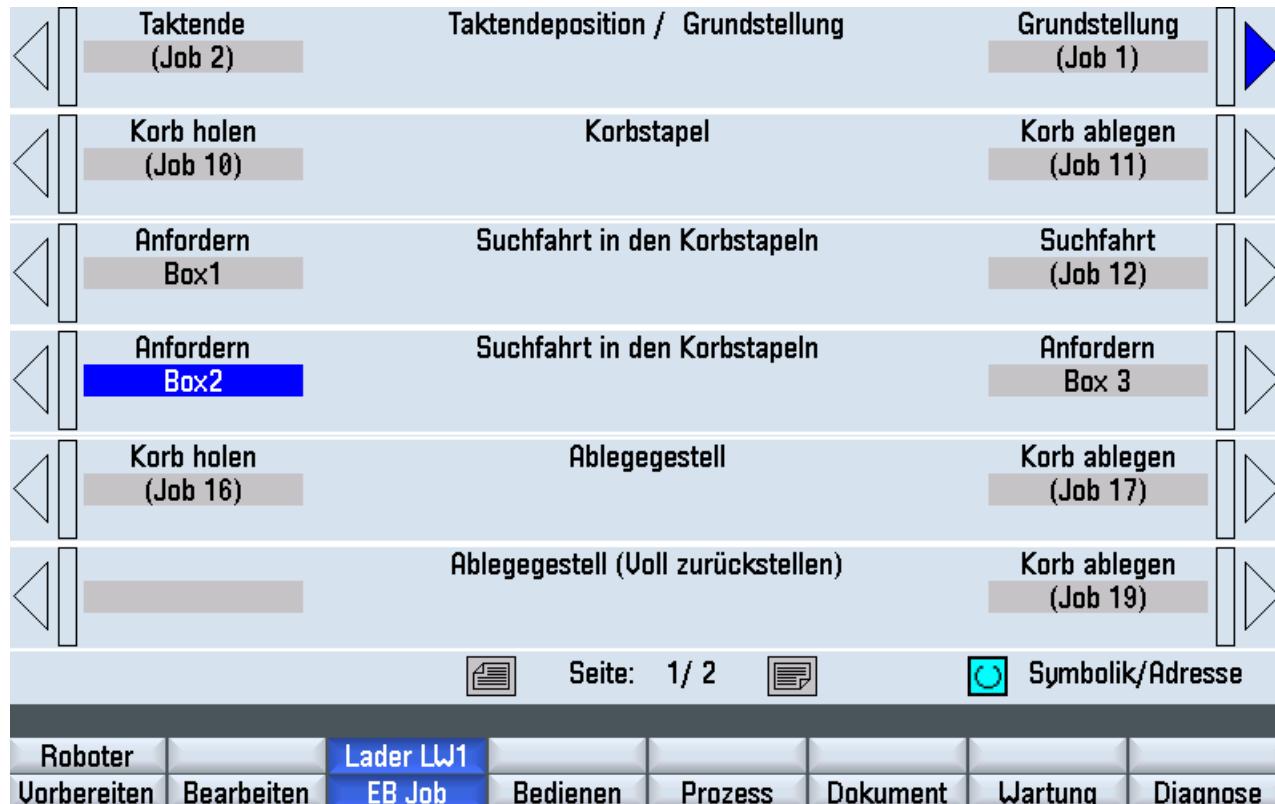
For this purpose, the following examples shall be viewed as "best practice" for the implementation of the BA3:

- Variant 1 – User guidance in BA3:
 - After selecting the BA3 (all conditions met), the HMI screen for the BA3 must be displayed. The system/machine part to be monitored (e.g. Loader 1) is selected. The respective sub-processes or jobs (e.g.: loading, unloading Loader 1 at Machine 1 or 2) are listed and can be selected on a separate screen.
 - The respective sub-processes can also be selected in BA1 (EB, ES).
 - General user guidance are the executability arrows in the HMI.
 - If possible, the sub-processes in the HMI screen shall be shown in the process sequence.
 - After the subprocess has been carried out, the following options shall be available:
Continued movement to the next subprocess, automatic or home position traverse in BA1 or BA3.

Variant 1 – User guidance in BA3:
Selection of BA3 areas



Variant 1 – User guidance in BA3:
The respective sub-processes can also be selected in BA1 (EB, ES).



7. Examples of Implementation of User Guidance in BA3

- Variant 2 – Preselection of subprocesses in BA3:

- System stopped in home position.
- Manual selection of the BA3 HMI screen (all conditions met, e.g. EKS black and higher)
- Selection of the sub-process for process monitoring including status display.
- In BA1 the system is started and stopped automatically before the selected sub-process (jump-in point) including status display.
- Process monitoring can be started at the jump-in point after selecting BA3.
- After the subprocess has been carried out, the following options shall be available:
Continued movement to the next subprocess, automatic or home position traverse in BA1 or BA3.

Variant 2 – Preselection of predefined subprocesses for process monitoring in BA3:

Stationsvorwahl für Betriebsart 3

Allgemeine Hinweise zu BA3 :

Benötigte EKS Schutzstufe: 1-4

Es kann immer nur eine Station in BA3 gefahren bzw. angewählt werden !

Zugang nur über entsprechende Tür möglich.

Vorgehensweise : Nach Anwahl BA3 und entsprechender Stationsvorwahl fährt die Station bei Betätigung der Zustimmtaste und Cycle Start in Grundstellung. Anschliessend kann mit Cycle Start der Automatikbetrieb gestartet werden. Mit Cycle Stop oder loslassen der Zustimmung wird gestoppt.

Einschaltb.	Taktarten		Typvorwahl		Setting	Allgem.Ab.	BA 3
Vorbereiten	Bearbeiten	Status	Bedienen		Dokument	Wartung	Diagnose



Mercedes-Benz

Requirement Specifications for
Powertrain, Part III, Appendix 2b



Electronic Key System EKS Specification for Access and Safety Functions of Production Equipment

Stoermer, PT/PP4.0
Date: April 6th 2021
Version: 2021

EKS is Used for Various Personal Protection Purposes

- Personal safety
 - Only authorized persons and groups of people have access to safety-relevant operating functions and operating modes
 - Secured "process observation" operating state in conjunction with an approval button (replacement for shifting tongue use)
- Machine safety
 - Only authorized persons and groups of people have access to operating functions and operating modes which require a relevant qualification in order to prevent machine damage
- Data security
 - Only authorized persons and groups of persons have access to processing and system programs and operating system functions

Electronic Key System (EKS) by Euchner - Connection to the central EKM server at Daimler AG

- **General:**

- EKS is used to control access to PCs and controls in the industrial environment. The owner of an electronic key is given significantly more responsibility compared with the allocation of a password. This provides protection against unauthorized access to operating and visualization systems. Connection to the PC or control is in the form of a serial, USB, Ethernet or Profibus interface.

- **Server connection:**

- The files on the central EKM server (**if an OP12 control panel is not used**) must be compared/updated by the machine supplier.

- **EKM (Electronic Key Manager) database / Daimler scope**

- With the Electronic Key Manager EKM, we offer a flexible, software that can be designed to suit the application for the programming and managing of electronic keys (see EKS product description) on the PC. The freely programmable memory area on the key can be structured completely individually using EKM. EKM is based on a client-server architecture with an integrated database.

- **Functions:**

- Programming the electronic key
- Key management
- Client/server application with integrated database

- **EKS reader:**

- **Robust and suitable for industrial use**
- **Can be integrated into an operating panel**
- Serial interface, Profibus DP, USB, Ethernet

- **EKS key:**

- Electronic key without a battery, electronic key engages in the receiver, receiver contains evaluation electronics
- The data carrier in the electronic key is equipped with a combined memory area:
 - 116 byte E²PROM (programmable) plus additional
 - 8-byte ROM (serial number)





Specifications for MBC/Powertrain (1/4): Key Assignment

	Field name	Type	Start byte	Length in bytes	DB59	Application and values	Evaluation in control panel	Evaluation in PLC	Content of CSV file	Content of CSV file: other company
1										
2	Occupancy of transponder:									
3	Plant	String	70	3	not relevant	Storing of three-place plant ID number: for MBC/Powertrain: - 010 = Untertürkheim - 040 = Berlin-Marienfelde - 068 = Hamburg - 999 = other company	No application at present	No application at present		
4	Sub_plant	String	73	3	not relevant	Used only at Untertürkheim site (Plant 010): - 001 = Untertürkheim, - 002 = Hedelfingen, - 004 = Mettingen, - 007 = Zuffenhausen - 008 = Cannstatt - otherwise enter 000	No application at present	No application at present		
5	Department	String	76	8	not relevant	DAI employees: - save HPC; format = wwwhhh (www = 3-place plant ID number, see above; hhh = 4-place company post code (e.g. E522) For other companies: - 000FREMD	No application at present	No application at present		
6	Cost_center	String	84	4	not relevant	Cost center in which access is permitted: - xxxx => access only within cost center xxxx - 7777 => higher-level access; can be blocked via HMI as a rule for employees from other companies - 8888 => higher-level access with no restrictions	Access only if: - xxxx corresponds to cost center saved in the HMI - cost center = 7777 and access not blocked through HMI - cost center = 8888	Access only if: - xxxx corresponds to cost center saved in the PLC - cost center = 7777 or 8888		
7	Date_end	DateAscii	88	8	not relevant	"Expiry date" of key: - format YYYYMMDD in ASCII	Compare dates and refuse access if key is past expiry date	Compare dates and refuse access if key is past expiry date		2099
8	Protection_level	Byte	96	1	DB59,DBB14	Authorization level as per key definition: for Siemens control system: "1" to "7" BCD coding bit 2 1 0 0 0 1 - security level 1 0 1 0 - security level 2 0 1 1 - security level 3 1 0 0 - security level 4 1 0 1 - security level 5 1 1 0 - security level 6 1 1 1 - security level 7 Other company as a rule security level 1	Corresponding lockout of HMI screens, forwarding to PLC.	Corresponding lockouts.	CSV value Decimal display	1



Specifications for MBC/Powertrain (2/4): Key Assignment

	Field name	Type	Start byte	Length in bytes	DB59	Application and values	Evaluation in control panel	Evaluation in PLC	Content of CSV file	Content of CSV file: other company
1										
9	Validity:									
10	Worker_Ident	Blank Filled String	97	7	DB59.DBB15-2	Plant ID or personnel number; use to be decided on depending on application For other companies: 0000000	If appropriate, assignment of ID to quality and message telegrams	If appropriate, assignment of ID to quality and message telegrams		0 0 0 0 0 0 0
11	Safe operating modes:	Byte	104		DB59.DBB22					
12	Safety_operating_mode	Byte	104	1		BCD coding bit 2 1 0 0 0 1 - safe operating mode (SOM) 1 0 1 0 - SOM 2 0 1 1 - SOM 3 1 0 0 - SOM 4 1 0 1 - SOM 5 Other company: as a rule SOM 5	Only forwarded to PLC, where corresponding lockout will be activated.	Corresponding lockouts.	CSV value Decimal display	5
13	Special functions:	Byte	105	7	DB59.DBB23					
14	So_rework	Bit 0	105	1 bit	DB59.DBX23.0	Special function "Repair": - use to be decided on depending on application - occupancy (if used): - value "0" = repair not authorized - value "1" = repair authorized Other company: as a rule, repair authorized	Lock out operating screens correspondingly. Forward to PLC, where corresponding lockout activated as appropriate.	Corresponding lockouts.		1
15	So_operating_system	Bit 1	105	1 bit	DB59.DBX23.1	Special function "Access to operating system": - use to be decided on depending on application - occupancy (if used): - value "0" = access to PC-OS not authorized - value "1" = access to PC-OS authorized Other company: as a rule, access to PC-OS authorized	If appropriate, lock out access to PC operating system. (implementation at DAI standard operating panels still being processed)	No function		1
16	So1_Reserve2	Bit 2	105	1 bit	DB59.DBX23.2	Reserve for standardized special functions. Occupancy/use only through SPPA AP 1.3 Other company: occupancy with 1	Up to occupancy open; forwarding to PLC.	Up to occupancy open.		1
17	So1_Reserve3	Bit 3	105	1 bit	DB59.DBX23.3	-	Up to occupancy open; forwarding to PLC.	Up to occupancy open.		1
18	Robotfreigabe 1	Bit 4	105	1 bit	DB59.DBX23.4	Roboterauthorisation 1 - value "0" = not authorized value "1" = authorized	-			0



Specifications for MBC/Powertrain (3/4): Key Assignment

	Field name	Type	Start byte	Length in bytes	DB59	Application and values	Evaluation in control panel	Evaluation in PLC	Content of CSV file	Content of CSV file: other company
1										
19	So1_Reserve5	Bit 5	105	1 bit	DB59.DBX23.5	"-	Up to occupancy open; forwarding to PLC.	Up to occupancy open.		0
20	So1_Reserve6	Bit 6	105	1 bit	DB59.DBX23.6	"-	Up to occupancy open; forwarding to PLC.	Up to occupancy open.		0
21	Robifreigabe 2	Bit 7	105	1 bit	DB59.DBX23.7	Roboterauthorisation 2 - value "0" = not authorized - value "1" = authorized	Up to occupancy open; forwarding to PLC.			0
22	Batterie Qualifikation HV_K2	Bit0	106	1 bit	DB59.DBX24.0	Batterie Qualifikation HV_K2 - value "0" = not authorized - value "1" = authorized	Up to occupancy open; forwarding to PLC.	Up to occupancy open.		255
23	Batterie Qualifikation HV_K3	Bit1	106	1 bit	DB59.DBX24.1	Batterie Qualifikation HV_K3 - value "0" = not authorized - value "1" = authorized	Up to occupancy open; forwarding to PLC.	Up to occupancy open.		255
24	Batterie Qualifikation Efk-HV / HV-F3	Bit2	106	1 bit	DB59.DBX24.2	Batterie Qualifikation Efk-HV / HV-F3 - value "0" = not authorized - value "1" = authorized	Up to occupancy open; forwarding to PLC.	Up to occupancy open.		255
25	Batterie Qualifikation AuS	Bit3	106	1 bit	DB59.DBX24.3	Batterie Qualifikation AuS - value "0" = not authorized - value "1" = authorized	Up to occupancy open; forwarding to PLC.	Up to occupancy open.		255
26	Batterie Freigabe Qualifikationen	Bit4	106	1 bit	DB59.DBX24.4	Batterie Freigabe Qualifikationen - value "0" = not authorized - value "1" = authorized	Up to occupancy open; forwarding to PLC.	Up to occupancy open.		255
27	So2_Reserve5	Bit 5	106	1 bit	DB59.DBX24.5	"-	Up to occupancy open; forwarding to PLC.	Up to occupancy open.		0
28	So2_Reserve6	Bit 6	106	1 bit	DB59.DBX24.6	"-	Up to occupancy open; forwarding to PLC.	Up to occupancy open.		0
29	So2_Reserve7	Bit 7	106	1 bit	DB59.DBX24.7	"-	Up to occupancy open; forwarding to PLC.	Up to occupancy open.		0
30	So3_ReserveByte3	Byte	107	1	DB59.DBB25	"-	Up to occupancy open; forwarding to PLC.	Up to occupancy open.		255
31	So4_ReserveByte4	Byte	108	1	DB59.DBB26	"-	Up to occupancy open; forwarding to PLC.	Up to occupancy open.		255
32	So5_ReserveByte5	Byte	109	1	DB59.DBB27	"-	Up to occupancy open; forwarding to PLC.	Up to occupancy open.		255
33	So6_ReserveByte6	Byte	110	1	DB59.DBB28	"-	Up to occupancy open; forwarding to PLC.	Up to occupancy open.		00
34	So7_ReserveByte7	Byte	111	1	DB59.DBB29	"-	Up to occupancy open; forwarding to PLC.	Up to occupancy open.		00
35	So8_ReserveByte8	Byte	112	1	DB59.DBB30	"-	Up to occupancy open; forwarding to PLC.	Up to occupancy open.		00
36	So9_ReserveByte9	Byte	113	1	DB59.DBB31	"-	Up to occupancy open; forwarding to PLC.	Up to occupancy open.		00
37	KeyCRC	CRC	114	2	not relevant	Check sum	Validity safeguard	No evaluation at present		
38	KeyID		116	8	not relevant	Unique key serial number.	Reconciliation with online database or (if there is no network link) with the last valid offline CSV file	No function		



Specifications for MBC/Powertrain (4/4): Key Assignment

Field name	Type	Start byte	Length in bytes	DB59	Application and values	Evaluation in control panel	Evaluation in PLC	Content of CSV file	Content of CSV file: other company
1									
39	Additional data in database:								
40	Surname	String		20	Documentation in the database				
41	First_name	String		15	Documentation in the database				
42	External_company	String		20	Time of last change in database - format hh:mm:ss				
43	Date_issue	Date		8	Time of key issue - format IEEE 754				
44	Date_modification	Date		8	Time of key issue - format IEEE 754				
45	Information	Memo			Documentation in the database. Saving current changes and individual specific data in plain language				
46	Key_administrator	string		20	Documentation in the database. Saving who issued the key.				

Process for MBC/Powertrain: Management and Key Issuing for Machine Suppliers

- Management and key issuing of blue keys for machine suppliers (Order No. 097369; Type: EKS-A-K1BUWT32-DC):
- The machine supplier requests a complete set of EKS keys with all operating modes and protection levels for initial startup.
→ Please contact the responsible representative for this purpose.
- Required specifications for key requests by machine suppliers:
 - Company (full address)
 - Number of keys
 - Person responsible for each individual key with complete address data. Alternatives:
 - Assignment by name to an individual employee (preferred)
 - Transferable key with responsible person at machine supplier saved.
- Technical consulting is provided by Euchner



Preset Protection Levels for the Siemens Control Panel; Available from HMI Version 5.04

SIEMENS

Schutzstufendefinition im SetupTool.

The screenshot shows a Windows application window titled "TRANSLINE 2000 HMI PRO CS". The main area displays a grid of protection levels (W, G, S, R, B, Y) for various functions like "Einschaltbe.", "Taktarten", "Teilbearbei", etc. A legend on the right explains the color coding: W = weiß (white), G = grün (green), S = schwarz (black), R = rot (red), B = blau (blue), and Y = gelb (yellow). The background features a globe image.

Die Angaben unter den Softkeys definieren die spezifischen Schutzstufen.

W = weiß = ohne Chip 7

G = grün = Maschinenführer 6

S= schwarz = Systemführer 4

R= rot = Instandsetzer 1

B= blau = Fremdfirma

G= gelb = Sonderfunktion

Übersicht

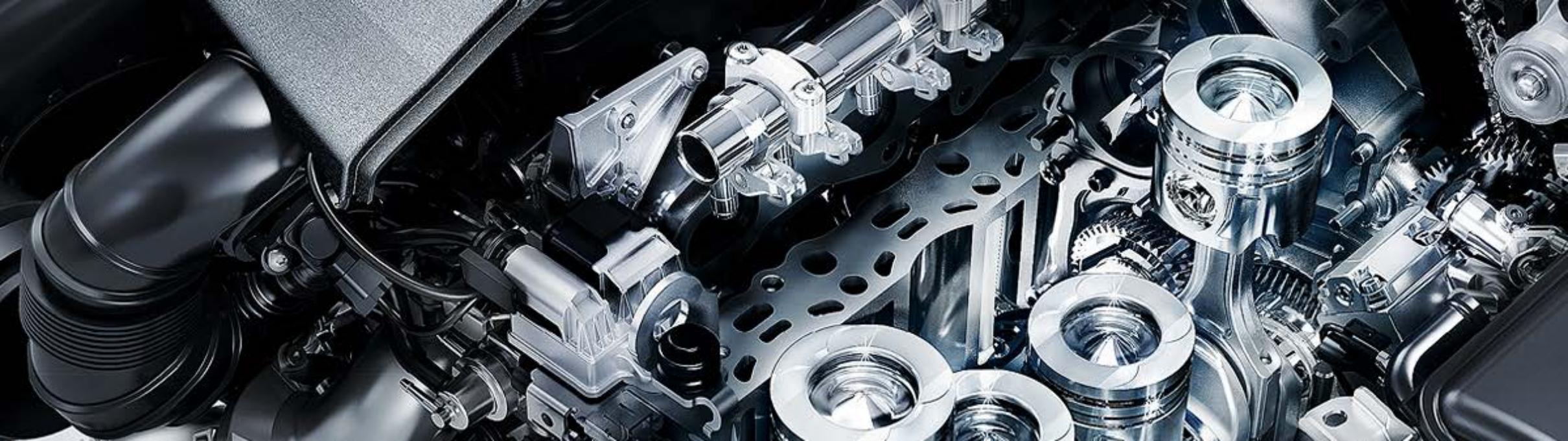


Operating Mode / Machine Function EKS Key (Color) / Protection Level

Attention - standard default assignment pictured!

Operating mode	Name	Machine function	Key (color)				Who?	Protection level						
1	Automatic mode ("shut off all movements when safety devices are on the protection setting")	VK, EB, ES, ER	wt	gr		rd	bl	Operator (wt)						7
2	Setup mode ("machine operates when protective function is suspended...")	ER		gr		rd	bl	Operator with setup authorization						6 7
3	Manual or partly automatic operation with an open operating door	EB, ES				rd	bl	System operators				4	5	6 7
5	Automatic mode with open operating door in connection with suitable protective measures	VK				rd	bl	Maintenance (rd) Contractor (bl)	1	2	3	4	5	6 7

- The assignment of key colors to protection levels is stated in the requirement specifications
- The assignment of the permitted operating modes to key colors is detailed in the description of the keys (standard assignment (see above))



Appendix 03: Process-Specific and Environmental Systems

Powertrain Requirement Specifications Part III



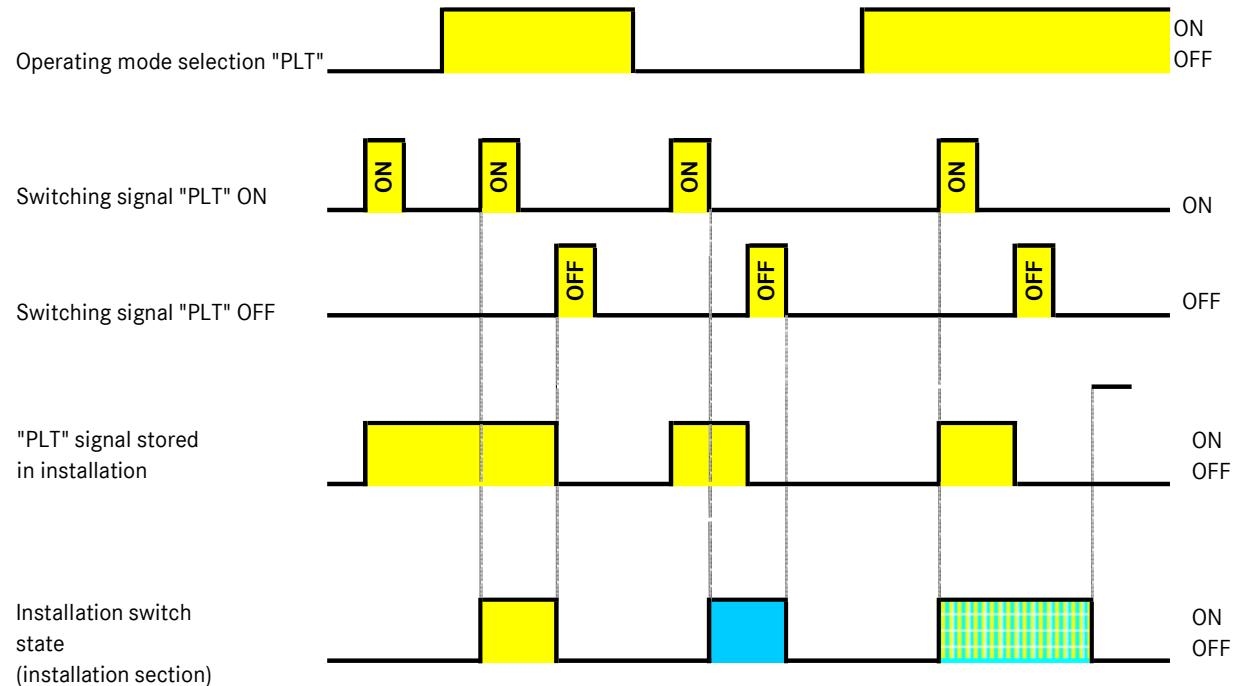
Mercedes-Benz
Das Beste oder nichts.

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- Appendix 03/1: Operating Status, Switching Examples PLT
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- Appendix 03/3: Safety Installations and Alarm Signal Paths for Process Installations
- Appendix 03/4: Implementation Guidelines for WHG Detectors at Gaggenau Plant

- Appendix 03 / 1: Operating Status, Switching Examples PLT

Operating Status, Switching Examples

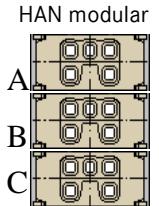


- Appendix 03/2: Vacuum Chips Disposal Station Interface / Machine Hardware

Assignment of Harting Connector on HAN Modular Interface Non-integrated Suction Stations for Vacuum Chip Removal

General

- The interface shall be designed in HAN modular format.
- Contacts shall be designed as normally open contacts. All signals are present statically.
- The 10-pin connecting cable is included in the suction station's scope of delivery.

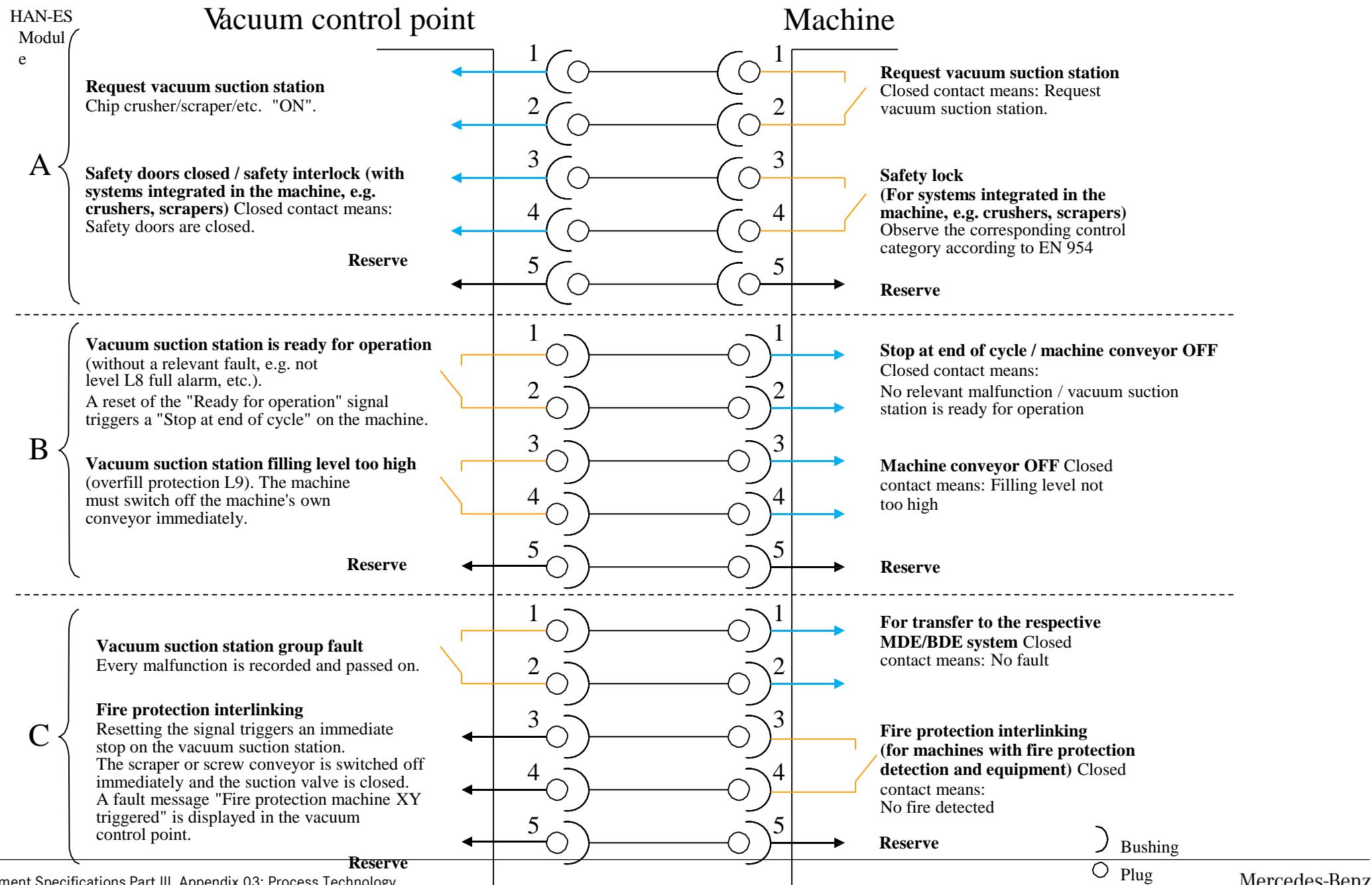


Decentralized chip removal / vacuum suction station:

- Housing attachment with plastic cap (09300100301); hinged frame for 3 module printing A...F (09140100303);
- Grommet housing with 2 brackets on the housing lower part - lateral cable outlet on sideways installation (09300101521)
Grommet housing with 2 brackets on the housing lower part - straight cable outlet with installation location from below (09300101421) are the preferred choice
- Metal cable gland M25 (19000005092) Modules:
- HAN ES module socket insert with cage clamp (09140052716) / socket insert with cage clamp (09140052616)
- The modules shall be arranged in the sequence A..C from top to bottom (lateral installation); A...C from left to right (installation from below)

Machining tool:

- The attached housing shall be installed in the installation space designated for this purpose.
- The signal "Request vacuum suction station" must be canceled if the machine conveyor is switched off. The machine conveyor shall be switched off if the machining tool is in standby position (>5 min.).
- All signals concerning the decentralized chip disposal shall be suppressed if no request signal is issued.



- Appendix 03/3: Safety Installations and Alarm Signal Paths for Process Installations

**Safety Installations and Alarm Paths
for Substances Hazardous to Water and
Dangerous Gases
PP/PTU standard**

Level Monitoring for Substances Hazardous to Water

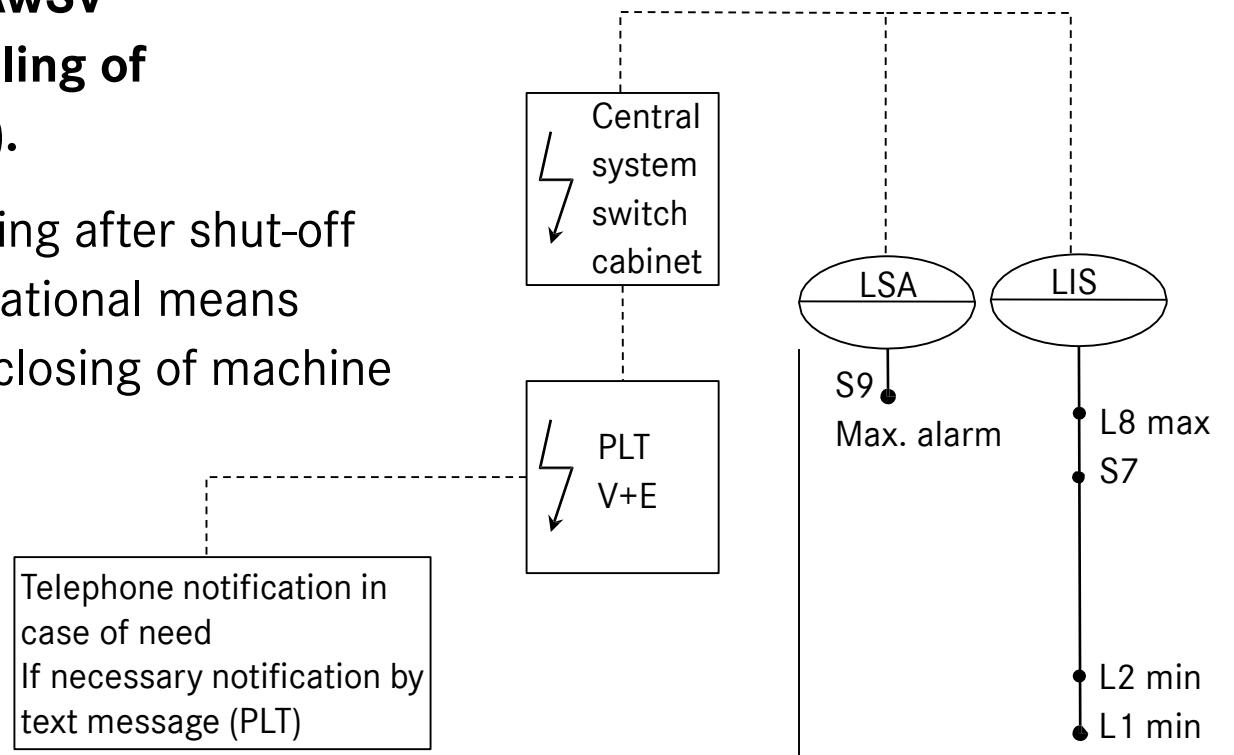
1. Installations without Fire Brigade Notification
2. Installations with Fire Brigade Notification
3. Pump Sump without Fire Brigade Notification
4. Pump Sump with Fire Brigade Notification
5. Ambient Monitoring of Hazardous Gases

1. Installations Without Fire Brigade Notification

As a general rule:

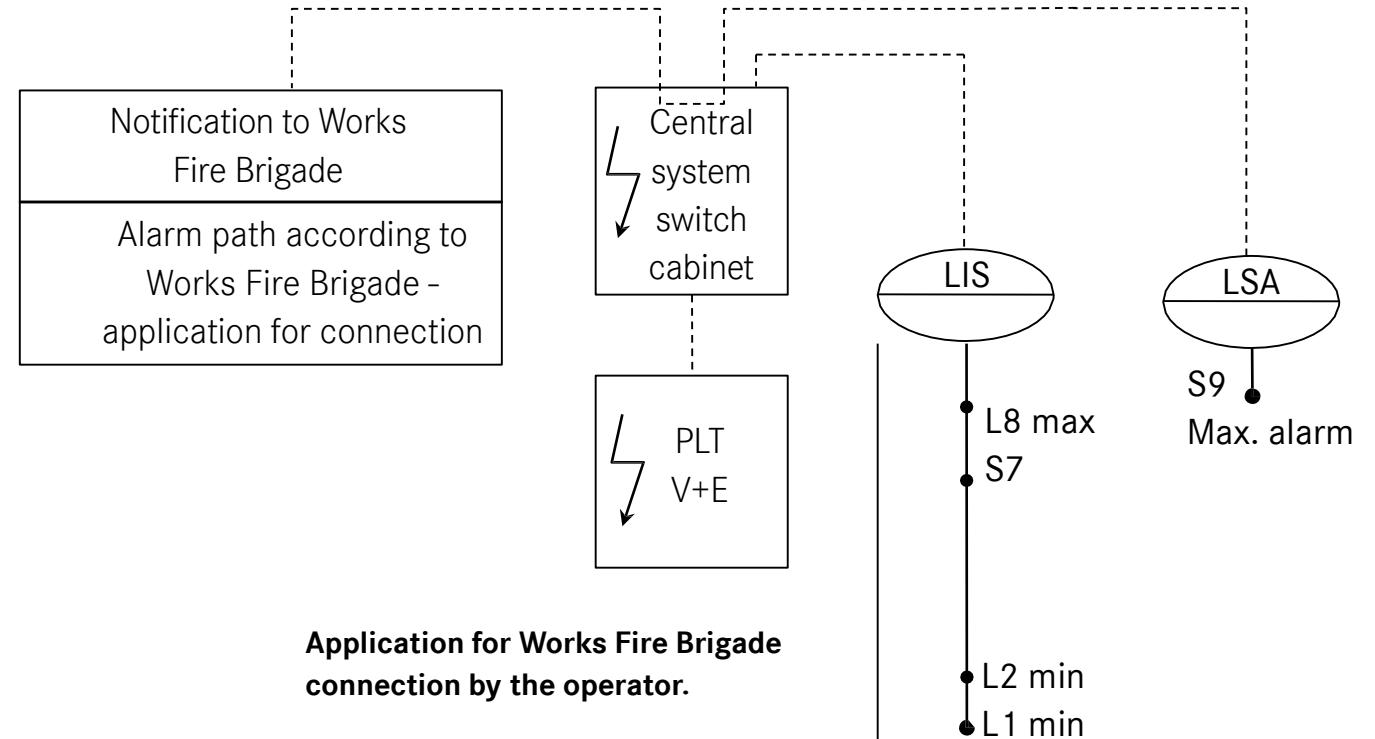
**It must be ensured that the required retention volume
is provided in accordance with Sec. 18 AwSV
(Ordinance on Installations for the Handling of
Substances Hazardous to Water (AwSV)).**

Overfilling of the tank with liquids still draining after shut-off
must be prevented by technical and organizational means
(inlet valves, design of the storage volume, closing of machine
inlets, switching off of system pumps, etc.).

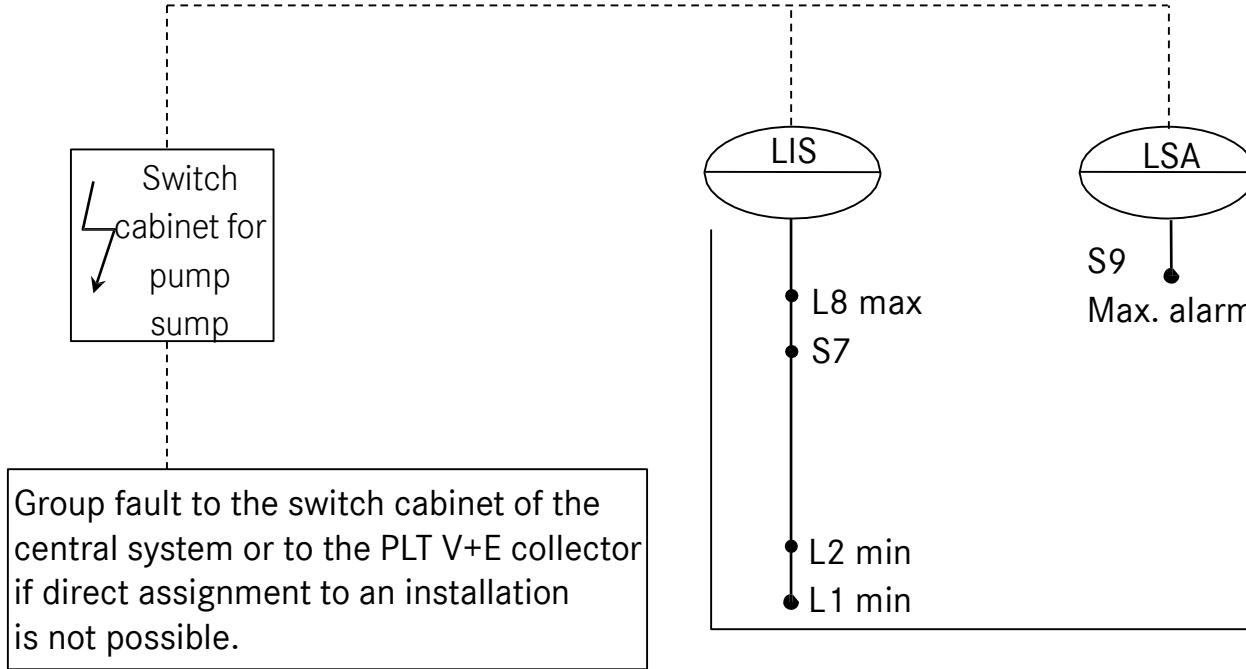


2. Installations with Fire Brigade Notification

**Overfilling of the tank with liquids
still draining after shut-off must
be prevented by technical and
organizational means (inlet valves,
design of the storage volume,
closing of machine inlets, switching
off of system pumps, etc.).**



3. Pump Sump without Fire Brigade Notification



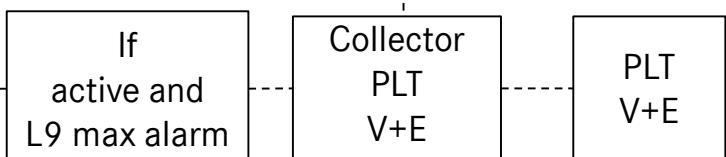
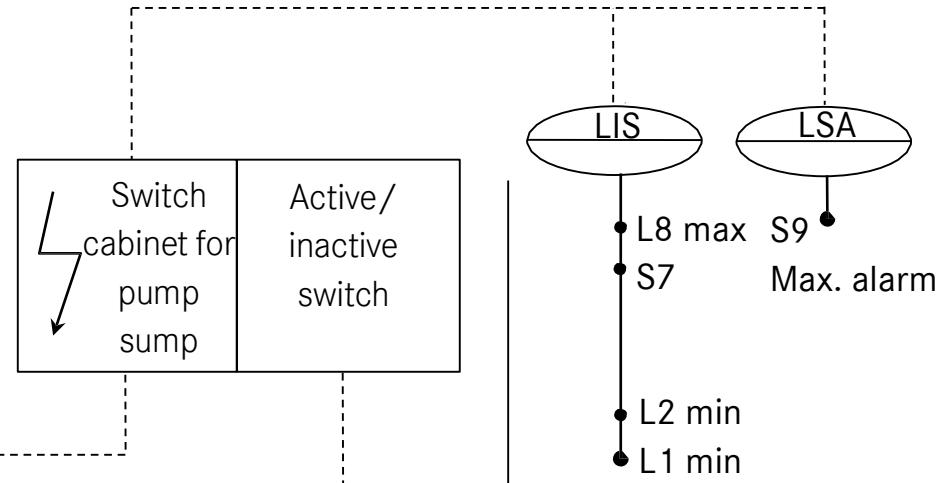
4. Pump Sump with Notification to Fire Brigade

At least one sump of this category shall be provided per retention area (to enable rapid leakage detection).

Alarm path according to Works Fire Brigade - application for connection

Group fault to the switch cabinet of the central system or to the PLT V+E collector if direct assignment to an installation is not possible.

Notification to Works Fire Brigade
Alarm path according to Works Fire Brigade - application for connection



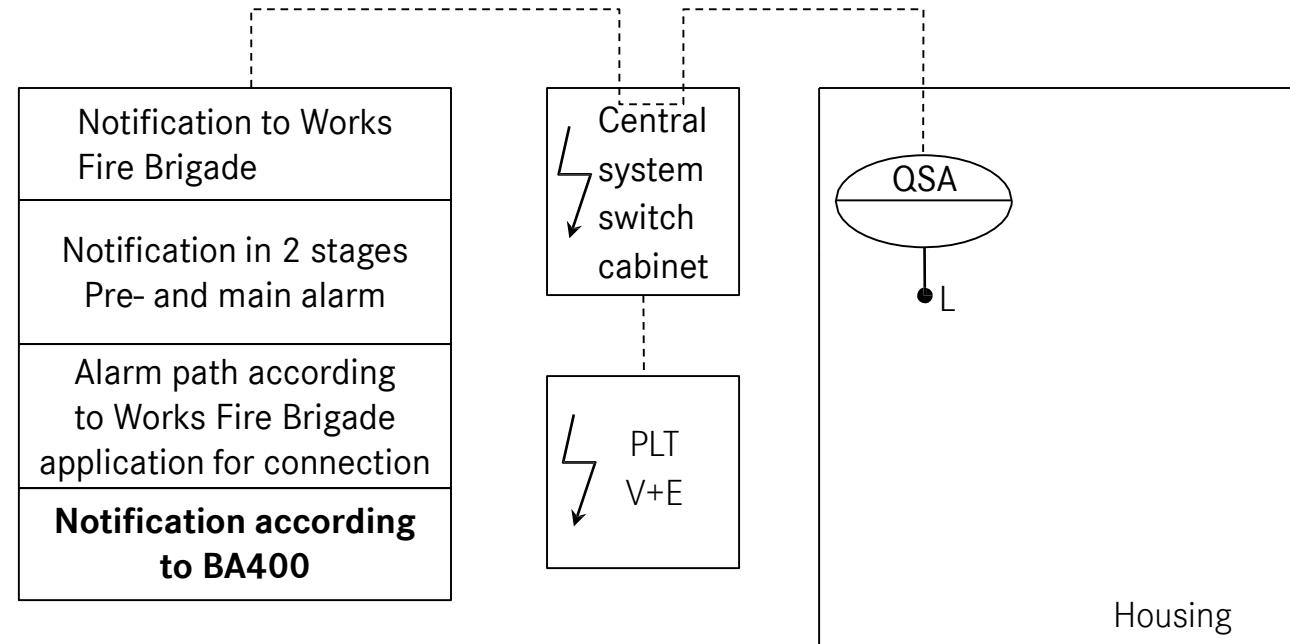
Application for Works Fire Brigade connection by the operator.

5. Gas Warning with Notification to Fire Brigade

Applicable to installations (e.g.):

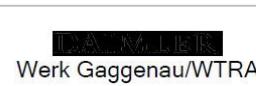
with ammonia

with flammable liquids



- Appendix 03/4: Implementation Guidelines for WHG Detectors at Gaggenau Plant

WHG Notification - Standard Regarding the Installation of WHG Detectors (1/2)



Abt:
TST

WHG detectors and level limit switches (overfill protection)

According to the applicable WHG regulations (Water Resources Act) and AwSV (Installation Ordinance), any leakages in areas exposed to substances hazardous to water (e.g. oils, emulsions, solutions, alkalies, electrolyte liquids, etc.) must be immediately and reliably detectable. Since this requirement is not met everywhere in the Gaggenau and Rastatt plants, the installation of liquid sensors ("WHG" detectors or level limit switches as overfill protections) is necessary. In view of the background of existing contamination at the Gaggenau plant, these water protection measures are unavoidable. Alternatively, these areas can of course also be made visible and accessible at any time. However, it must also be ensured that any leaks that occur (e.g. over weekends or on days without shifts) are reliably detected and properly eliminated.

==> This standard does not apply to underground tanks!!!

General note on applicability: Priority 1 alarm:

The notification is processed by WSF without delay; WSF attends the site and informs the operator and the maintenance technicians; detailed action must be clarified on site.

Priority 2 alarm:

WSF does not immediately attend; WSF notifies the maintenance technician or, at weekends, the operator; the maintenance technician or operator decides with WSF on the necessary action; feedback must be provided to WSF.

The following areas must be equipped with WHG detectors or overfill protections (see next slide):

WHG Notification - Standard Regarding the Installation of WHG Detectors (2/2)

	Inaccessible or non-viewable areas:	Individually supplied machines and containers with capacity > 1,000 liters:	Centrally supplied machines without own container capacity:
Priority 1 - alarm 	Machine pits; pits in sewers these machines or containers containing pipes with substances hazardous to water; Pump sumps (generally double-walled design and leakage monitored);	Drip collecting pans under	
Priority 2 - alarm 		e.g. also washing machines, stations, broaching machines, cooling lubricant systems etc.; double-walled, (leak-) monitored containers;	e.g. return pump etc.;



This standard is to be applied and implemented via the form published by TS for the presentation of WHG notifications.

Information on the technical design of WHG detectors and level limit switches (overfill protection) can be found in the TDS requirement specifications (via Intranet).

What is to be done?

Define the installations on the basis of the existing standard requirements report using the above-mentioned form sent to TS-BAE, Mr. Maier

The form can also be printed out by selecting the peripheral unit.

Processing information:

Mr. Dusko Remus (dusko.remus@daimler.com)

**Interface Description
for Handling Technology
(2-Channel with Profinet)**

**Specifications
Interface**

Machine Loader – Machine
24-pin Hardware for Loading Gantry ↔ Machine
Bus Coupler Software for Loading Gantry ↔ Machine

Version Revision/Status

Listed here are the pages that are

- new
- to be exchanged
- to be removed for the revision of the Interface Description.

Each recipient can now check the completeness of his documentation.

Version	Date	New pages	To be exchanged	To be removed	Remarks
1.0	30.08.01	1-31			Interface template
1.1	27.09.01		22 and 26		Reset condition of signal "Enable removal of finished workpiece" changed
1.2	12.10.01		8		Chapter 1.7 Bus Coupler Power Supply
1.3	19.02.02		All		Transmission of workpiece code to machine added
1.4	12.04.02		19-21		Transmission of workpiece code to machine changed
1.5	11.06.02		4, 19 and 20		Workpiece code increased to 36 characters
1.6	08.07.02		18, 23 and 24		Function of keep-alive bit changed
1.7	15.04.03		All		Power supply for safety circuit Signals A12,E20 and E21 for cycling until empty as option
1.8	13.2.08				Area protection by means of electronic safety switches must be planned. That is, the safety doors of the machine do not act on the loader when the loader is not standing above the area of the machine.
2.0	23.05.14				Gen.: Switch to Profinet Chapter 1.7 Connectors between Loader and Machine(s) Chapter 1.8 Scope of Delivery

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1 General Description

1.1 Regulations

In general, work must comply with the **Requirement specifications from Daimler**. In cases of doubt and if there is any uncertainty, Daimler and/or the handling equipment suppliers must be consulted.

1.2 Coordination of Interfaces

Detailed coordination of interfaces (**system-specific signals**) with all participating companies will be done by the handling equipment suppliers.

The basis for coordination is the following control signals of the standard interface description.

1.3 Significance and Classification of the Interface Description

This Interface Description serves as the basic design document for the electrical equipment.

This description sets out the exact exchange of signals between the interface partners. All participants must check this description for agreement with previously issued documents and follow-up agreements, and must immediately notify us of any inconsistencies, deviations and objections.

This applies likewise to all design documents issued by us, like circuit diagrams.

Only if this is done will it be possible to proceed with planning and design with full quality assurance.

1.4 Safety

The safety functions must comply with the Machinery Directives and associated European standards.

For all **safety-relevant** circuits, safety relays in accordance with the **approval lists** must be used.

The hard-wired emergency off function and the safety door interlock circuit must be active even if the main switch is switched off.

1.5 Emergency Off

The hard-wired and software signals for the emergency off made available at the interface must be evaluated and processed by the respective machine manufacturer depending on the applicable standards and guidelines.
(Safety doors opening in synchronization with the machine cycle, like the machine loading door, may not be used for overriding the emergency off signal.)

If the emergency off signal via the interface from the machine to the loader has to be implemented by safety relays, these must be kept supplied with power even when the machine is switched off at its main switch.
The 24 V DC voltage at connector pins 13 and 14 may be used for this purpose.

The checkback signal from the loader to the machine is sent via the contact of a safety relay.

The circuit is interrupted in the case of emergency off. It is configured in two channels (machine, loader), and floating in both directions (see connector pins 3-4, 5-6, 19-20, 21-22).

1.6 Loader and Machine Safety Door Installations

The hard-wired and software signals for the safety door made available at the interface must be evaluated and processed by the respective machine manufacturer depending on the applicable standards and guidelines.

Upon opening one or more of the safety door installations, the safety circuit is opened. It is configured in two channels and floating in both directions, i.e. machine and loader (see connector pins 7-8, 9-10, 15-16, 17-18).

The safety contacts of the machine's safety door system must be a combination of operating door and loading port.

If the safety door signal via the interface from the machine to the loader has to be implemented by safety relays, these must be kept supplied with power even when the machine is switched off at its main switch. The 24 V DC voltage at connector pins 13 and 14 may be used for this purpose.

If loading ports are not breach-proof, area protection by means of electronic safety switches must be additionally planned. I.e. the machine's safety circuits do not act on the loader when the loader is not standing above the area of the machine.

1.7 Plug Connection between Loader and Machine(s)

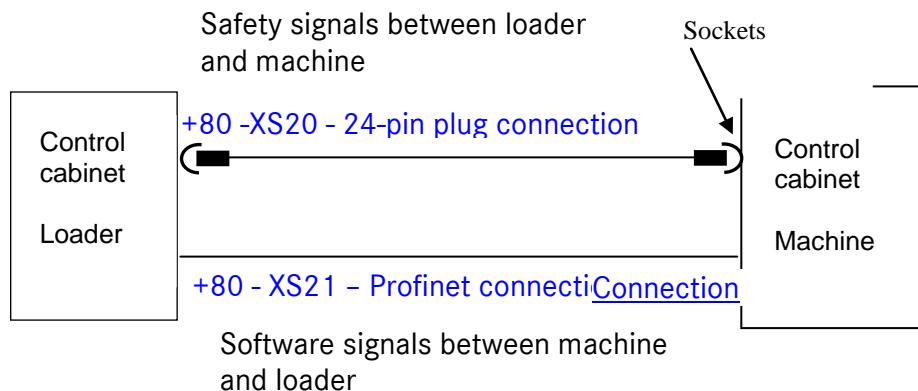
For the safety signal interface, in general **a 24-pin plug connector with screw connection and cross strap** (type: refer to MLF-E Chapter 9.3.2.2, but with screw connection).

Shielded ProfiNet~~Profinet~~ lines as per MDM shall be used for the software signals.
~~The software signals consist of a shielded two-wire line.~~

The PN/PN coupler in the machine control cabinet shall be supplied with voltage upstream of the main switch. The 24 V DC voltage at connector pins 13 and 14 may be used for this purpose.

For the pin connector in the control cabinet, the machine manufacturer must use sockets as the pin connector receptacle.

If more than one machine is linked to the loader, the group designator "+80" is incremented by 1 for each, with the connector designators XS20, XS21 being retained.



Subject to consultation with the department, the safety signals can also be transmitted via ProfiNet (ProfiSafe).

1.8 Scope of Delivery

Scope of delivery of handling equipment supplier

Terminal adapter XS20 mounted at including connector XS20 and laying from the control cabinet or the handling equipment supplier to the machine control cabinet, belong to the LU loading gantry. The ProfiNet line ~~The bus cable~~, routing to the machine switch cabinet and conversion of the PN line ~~bus cable~~ on the machine side at the PN/PN DP/DP coupler also form part of the

^{lc} Handling device
Control cabinet

terminal adapter XS20 mounted at the control cabinet, the PN/PN coupler and the connectors form part of the machine's scope of delivery.

ProfiNet line

PN/PN Coupler

1.8.1 Loading Gantry

- Hard-wired signal cables connected to the terminal adapter in the control cabinet
- Documentation of agreed signal and conductor designations, including cross-references in the circuit diagram: with terminal and device identification of the first connected device at the interlock partner.
- Cable for hard wiring with pin connectors at each end
- ProfiNet line ~~bus cable~~, on the machine side without connector
- Laying of cables, including cable duct
- Conversion of the ProfiNet line ~~bus cable~~ on the machine side at the PN/PN coupler

1.8.2 Machine

- Hard-wired signal cables connected to the terminal adapter in the control cabinet
- Documentation of agreed signal and conductor designations, including cross-references in the circuit diagram: with terminal and device identification of the first connected device at the interlock partner.
- From terminal adapter XS20, wire the wire lines for the current supply to the loader part of the PN/PN coupler
- ProfiNet connector on the machine side
- Siemens PN/PN coupler

The cable connectors at the loader and machine ends have pins, so the terminal adapters at the control cabinets must be configured to match.

1.8.3 Order Numbers of Bus Coupler

See material data manager

1.9 Fault/Emergency Strategy

1.9.1 Loading Gantry Switched Off

In order to be able to operate the machine even with the loading gantry switched off:

- The loading gantry → machine emergency off interlock shall be activated even when the loading gantry main switch is off;
- the loading gantry → machine safety door interlock shall be activated even when the loading gantry main switch is off;
- on the machine side, the loading gantry → machine software interlock signal "**Loading gantry not in machine collision zone**" shall be overridden by a suitable arrangement.

1.9.2 Machine Switched Off

In order to be able to operate the loading gantry even with the machine switched off:

- the machine → loading gantry emergency off interlock shall be activated even when the machine main switch is off;
- the machine → loading gantry safety door interlock shall be activated even when the loading gantry main switch is off;

1.9.3 Loading Gantry in Machine when Fault Occurs

If the loading gantry is within the machine and a fault occurs at the machine that cannot be rectified, then it must be possible at any time to move the loading gantry under jog operation – ignoring the software interlock signals – out of the machine. But then it is obligatory that any machine motions that could be hazardous for the loading gantry may only be executed if the machine receives the interlock signal "**Loading gantry not in machine collision zone**".

2 Safety Signals

2.1 Safety Signals between Loader and Machine "XS20"

2.1.1 24 V DC Supply from Machine

"Pin 1"

This +24 V DC voltage is used for the checkback signals from the loader control system.

This power supply circuit must have a minimum current carrying capacity of 5A.

2.1.2 +0 V Reference Potential from Machine

"Pin 2"

2.1.3 No Emergency Off from Loader (Channel 1) "Pin 3 - 4"

The Emergency Off signal is transmitted potential-free to the machine via pins 3 - 4.

2.1.4 No Emergency Off from Loader (Channel 2) "Pin 5 - 6"

The Emergency Off signal is transmitted potential-free to the machine via pins 5 - 6.

2.1.5 Safety Device (Loading Port) – Loader Closed (Channel 1) "Pin 7 - 8"

If all safety-relevant safety devices (loading port) of the loader are closed, this signal is transmitted potential-free to the machine control system via pins 7+8

2.1.6 Safety Device (Loading Port) – Loader Closed (Channel 2) "Pin 9 - 10"

Once all safety-relevant safety devices (loading port) of the loader are closed, this signal is transmitted potential-free to the machine control system via pins 9+10

2.1.7 Reserve "Pin 11"**2.1.8 Reserve "Pin 12"****2.1.9 +24 V DC Supply for Safety Circuit to Machine "Pin 13"**

This power supply must be generated at the loading gantry independently of the main switch and may be used for supply of the safety circuits from the machine.

Loading of this power supply circuit may not exceed 0.5 A!

2.1.10 0 V Reference Potential from Loader "Pin 14 "

2.1.11 Operating Doors/Loading Doors of Machine Closed (Channel 1) "Pin 15-16"

As soon as all operating or loading doors providing a mechanical safeguard against traversing through are closed, this signal is transmitted potential-free to the loader control system via pins 15+16.

2.1.12 Operating Doors/Loading Doors of Machine Closed (Channel 2) "Pin 17-18"

If all operating or loading doors providing a mechanical safeguard against traversing through are closed, this signal is transmitted potential-free to the loader control system via pins 17+18.

2.1.13 No Emergency Off from Machine (Channel 1) "Pin 19-20"

The Emergency Off signal is transmitted potential-free to the loader via pins 19 – 20.

2.1.14 No Emergency Off from Machine (Channel 2) "Pin 21-22"

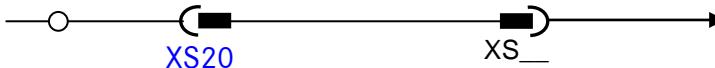
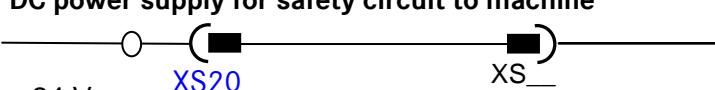
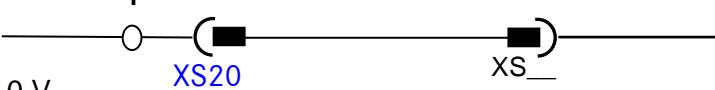
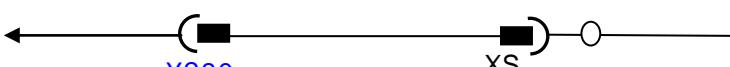
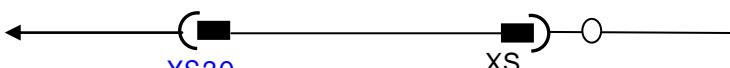
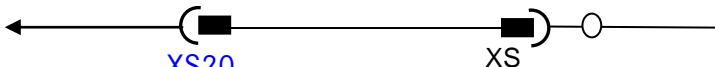
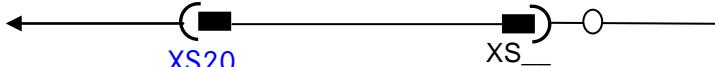
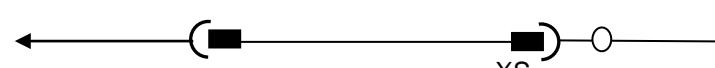
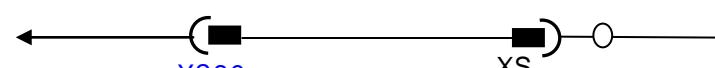
The Emergency Off signal is transmitted potential-free to the loader via pins 21 - 22.

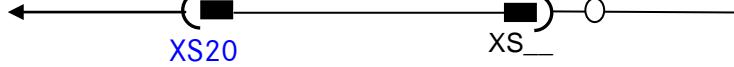
2.1.15 Reserve "Pin 23 "

2.1.16 Reserve "Pin 24"

2.2 Contact Assignment "CONNECTOR XS20" Loader - Machine

	<u>Loader</u>	<u>Machine</u>
PIN 1	24 V DC power supply from machine	
		+ 24
PIN 2	+ 0 V Reference potential from machine	
		0V
PIN 3	No Emergency Off from loader (channel 1)	
PIN 4		
PIN 5	No Emergency Off from loader (Channel 2)	
PIN 6		
PIN 7	Safety device (loading port) – loader closed (channel 1)	
PIN 8		
PIN 9	Safety device (loading port) – loader closed (channel 2)	
PIN 10		

		<u>Loader</u>	<u>Machine</u>
PIN 11	Reserve		
			
PIN 12	Reserve		
PIN 13	+24 V DC power supply for safety circuit to machine		
			
PIN 14	+ 0 V reference potential from loader		
			
PIN 15	Operating doors or loading doors of machine closed (channel 1)		
PIN 16			
			
PIN 17	Operating doors/loading doors of machine closed (Channel 2)		
PIN 18			
			
PIN 19	No Emergency Off from machine (channel 1)		
PIN 20			
			

	<u>Loader</u>	<u>Machine</u>
PIN 21	No Emergency Off from machine (Channel 2)	
PIN 22		
		
		
PIN 23	Reserve	
PIN 24	Reserve	

3 Software Signals

3.1 Software Signals from Loader to Machine

3.1.1 Loader Ready for Operation

"A 01"

As soon as the loader is ready for operation with no faults, the signal "Loader ready for operation" becomes active.

3.1.2 No Emergency Off from Loader

"A 02"

As soon as there is no Emergency Off active at the loader, this signal becomes active.

3.1.3 Loader Safety Device (Loading Port) Closed

"A 03"

If all safety-relevant safety devices (loading port) of the loader are closed, this signal becomes active.

3.1.4 Loader Out of Machine Collision Zone "A 04"

This signal is generated via software dogs.

The output supplies a high signal if the loading gantry has left the machine working envelope.

3.1.5 Reserve "A 05"**3.1.6 Reserve** "A 06"**3.1.7 Reserve** "A 07"**3.1.8 Reserve** "A 08"**3.1.9 Finished Workpiece Removed** "A 09"

If the loader has removed the finished workpiece from the gripper and it is outside the gripper's interference zone, the signal "**Finished workpiece removed**" is issued and remains active until the signal "**Feed raw workpiece**" from the machine is present.

3.1.10 Start to Machine – Workpiece Change Completed "A 10"

If the loader has put the new raw workpiece in the machine and left the machine again, the start command is issued. This signal remains active until the signals from the machine "**Enable workpiece change**" and "**Feed raw workpiece**" are no longer present.

3.1.11 Pre-signal to Machine – Workpiece Change Completed "A 11"

As soon as the loader has placed the new raw workpiece in the machine and has left the collision zone of the clamping device, a pre-signal can be issued. This signal remains active until the signals from the machine "**Enable workpiece change**" and "**Feed raw workpiece**" are no longer present.

3.1.12 Operate until Empty (Optional) "A 12"

The loading gantry is in the operating mode "Operate until empty", which can be initiated via the loading gantry and from the machine. The signal "Operate until empty" remains in condition -1- until the machine issues the signal "**Operate until empty completed**".

3.1.13 Reserve "A 13"

3.1.14 Reserve "A 14"

3.1.15 Enable Opening of Safety Door "A 15"

If the machine issues the signal "Request opening of safety door", opening of the safety door is enabled. This signal is set if all motions are completed and the gantry is in its home position with the controller enables of the gantry's NC axes canceled.

3.1.16 Reserve "A 16"

3.1.17 Release Gripper "A 17"

After the finished workpiece has been gripped by the loader in the machine for workpiece change, the signal "**Release gripper**" is issued until the checkback signal "**Gripper released**" becomes active.

3.1.18 Actuate Gripper "A 18"

When feeding the raw workpiece into the machine, as soon as the loader attains the correct transfer position, the signal "**Actuate gripper**" is issued at the machine until the checkback signal "**Gripper actuated**" becomes active.

3.1.19 Reserve "A 19"

3.1.20 Reserve "A 20"

3.1.21 Reserve**"A 21"****3.1.22 Reserve****"A 22"****3.1.23 Life Bit****"A 23"**

The loading gantry sends this signal if communication with the counterpart is possible. This signal is set and reset. **The interlock counterpart must issue, in response to an edge change at its input signal, an edge change at its output signal.** If within a time period of approx. 500 ms no edge change takes place, the interface is no longer alive and **all interface signals transmitted from the loading gantry or that are present lose their validity.**

3.1.24 Check Enable Signal "Enable" to Machine**"A 24"**

The loader transmits first the type numbers with the parity bit, together with the workpiece code and the "Enable" signal to the machine. This signal from the machine remains active until the signal "Acknowledge" is issued.

3.1.25 Binary Value - 2 to Power 0 (1) Workpiece Number**"A 25"****3.1.26 Binary Value - 2 to Power 1 (2) Workpiece Number****"A 26"****3.1.27 Binary Value - 2 to Power 2 (4) Workpiece Number****"A 27"****3.1.28 Binary Value - 2 to Power 3 (8) Workpiece Number****"A 28"**

3.1.29 Binary Value - 2 to Power 4 (16) Workpiece Number "A 29"

3.1.30 Binary Value - 2 to Power 5 (32) Workpiece Number "A 30"

3.1.31 Binary Value – 2 to Power 6 (64) Workpiece Number "A 31"

3.1.32 Parity Even "A 32"

The workpiece type is given as a six-bit code and the parity bit supplements the number of bits to "even".

3.1.33 Workpiece Code STRING[36] "A 33 – A 320"

The workpiece code consists of 36 characters and is transmitted as STRING[36]. The individual characters are represented in ASCII format. The workpiece code is transmitted together with the workpiece number to the machine.

3.2 Software Signals from Loader to Machine

No.		Address	Description
01		A X0.0	Loader ready for operation
02		A X0.1	No Emergency Off from loader
03		A X0.2	Loading port closed from loader
04		A X0.3	Loader out of machine collision zone
05		A X0.4	
06		A X0.5	
07		A X0.6	
08		A X0.7	
09		A X1.0	Finished workpiece removed
10		A X1.1	Start to machine – workpiece change completed
11		A X1.2	Pre-signal to machine – workpiece change completed
12		A X1.3	Operate until empty
13		A X1.4	
14		A X1.5	
15		A X1.6	Enable opening of safety door
16		A X1.7	
17		A X2.0	Release gripper
18		A X2.1	Actuate gripper
19		A X2.2	
20		A X2.3	
21		A X2.4	
22		A X2.5	
23		A X2.6	Keep-alive bit
24		A X2.7	Check enable signal "Enable" to machine ->
25		A X3.0	Binary value - 2 to power 0 (1) Workpiece number ↑
26		A X3.1	Binary value - 2 to power 1 (2)
27		A X3.2	Binary value - 2 to power 2 (4)
28		A X3.3	Binary value - 2 to power 3 (8)
29		A X3.4	Binary value - 2 to power 4 (16)
30		A X3.5	Binary value - 2 to power 5 (32)
31		A X3.6	Binary value - 2 to power 6 (64)
32		A X3.7	Parity even ↓
33-320		AB X4 -AB X39	Workpiece code STRING[36]

3.3 Software Signals from Machine to Loader**3.3.1 Machine Ready for Operation "E 01"**

If the machine is ready for operation with no faults, the signal "**Machine ready for operation**" becomes active.

3.3.2 No Emergency Off from Machine "E 02"

As soon as there is no Emergency Off active at the machine, this signal becomes active.

3.3.3 Operating/Loading Doors of Machine Closed "E 03"

If operating or loading doors providing a mechanical safeguard against traversing through are closed, this signal becomes active.

3.3.4 Loading Port Fully Open "E 04"

Upon issuance of the signal "**Loading port fully open**" the loader is enabled to traverse into the machine's working envelope. If this signal changes to 0 during automatic part change within the machine, the loader stops immediately with "**Stop feed**" and the fault message "**Loading port not open**".

3.3.5 Reserve "E 05"**3.3.6 Reserve "E 06"****3.3.7 Reserve "E 07"****3.3.8 Reserve "E 08"**

3.3.9 Enable Workpiece Change at Machine**"E 09"**

If the machine is ready for unloading and loading by the loader, the signal "**Enable workpiece change at machine**" becomes active. This signal remains active until the signal "**Start to machine**" is issued by the loader. If during the unload / load cycle, this signal changes to 0, the loader stops immediately with "**Stop feed**" and the fault signal "**Machine fault**" is activated. This signal must include all key machine interlocks needed for safe workpiece change at the machine.

3.3.10 Remove Finished Workpiece**"E 10"**

Following completion of workpiece machining, the signal "**Remove finished part**" is output and remains active until the feedback signal "**Finished part removed**" is output by the loader.

3.3.11 Feed Raw Workpiece**"E 11"**

With "**Feed raw workpiece**" a signal is issued to the loader that the machine is ready to accept a raw workpiece. Rinsing or spindle positioning (where present) has been completed. This signal remains active until the loader issues the signal "**Start to machine – workpiece change completed**".

3.3.12 Pre-signal – Workpiece Change**"E 12"**

This signal is set by the machine during automatic operation if within the machine or on the machine tray there is a workpiece or a workpiece has been finish machined to about 80-90%. This signal must remain set until the loading gantry has canceled the signal "Out of collision zone with machine".

3.3.13 Reserve**"E 13"****3.3.14 Reserve****"E 14"****3.3.15 Request Opening of Safety Door****"E 15"**

If at the machine a safety door is to be opened and it is not possible to safeguard the machine interior against the loading gantry with a suitable loading door, the machine must set this request. This signal must remain active until all machine safety doors, and thus the safety door circuit that communicates to the loading gantry via the hardware interface, have been closed again. If this signal is set at the loading gantry, automatic operation is no longer possible. The machine safety doors may not be opened until the loading gantry permits this by issuing the signal "**Enable opening of safety door**". If before opening the operating door a suitable loading door is closed, this request may not be set. It must be possible to reset this signal at a control element at the machine.

3.3.16 NOK Workpiece from Machine (Optional)**"E 16"**

If after completing machining the workpiece is not in order, the signal "**NOK workpiece from machine**" is issued together with the signal "**Remove finished workpiece**" and remains active until the checkback signal "**Finished workpiece removed**" is issued from the loader.

3.3.17 Gripper Released**"E 17"**

The signal "**Gripper released**" remains active as long as the gripper is in its released position.

3.3.18 Gripper Actuated**"E 18"**

The signal "**Gripper actuated**" remains active as long as the gripper is in its actuated position.

3.3.19 Reserve**"E 19"****3.3.20 Operate until Empty (Optional)****"E 20"**

The machine requests operation until empty. In this case, it is only the machine and not the complete installation that cycles until empty. This signal must remain active until the loader responds with the signal "**Operate until empty**".

3.3.21 Operate until Empty Completed (Optional)**"E 21"**

The machine signals to the loading gantry that all workpieces that were in the machine have been unloaded. This signal is a component for creating the condition installation operated until empty. This signal must remain active as long as the "**Operate until empty**" signal from the loading gantry is present.

3.3.22 Reserve**"E 22"****3.3.23 Keep-alive Bit****"E 23"**

The machine gantry sends this signal if communication with the counterpart is possible. This signal is set and reset. **The interlock counterpart must issue, in response to an edge change at its input signal, an edge change at its output signal.** If within a time period of approx. 500 ms no edge change takes place, the interface is no longer alive and **all interface signals transmitted from the machine or that are present lose their validity.**

3.3.24 Acknowledgment – Workpiece Type "E 24"

Upon the "**Enable**" signal from the loader becoming active, the machine checks the transmitted workpiece type. If the machine is ready for this type, the operation is terminated with the signal "**Acknowledgment**". The loader then withdraws the "Enable" signal, and the machine then withdraws the "**Acknowledgment**" signal.

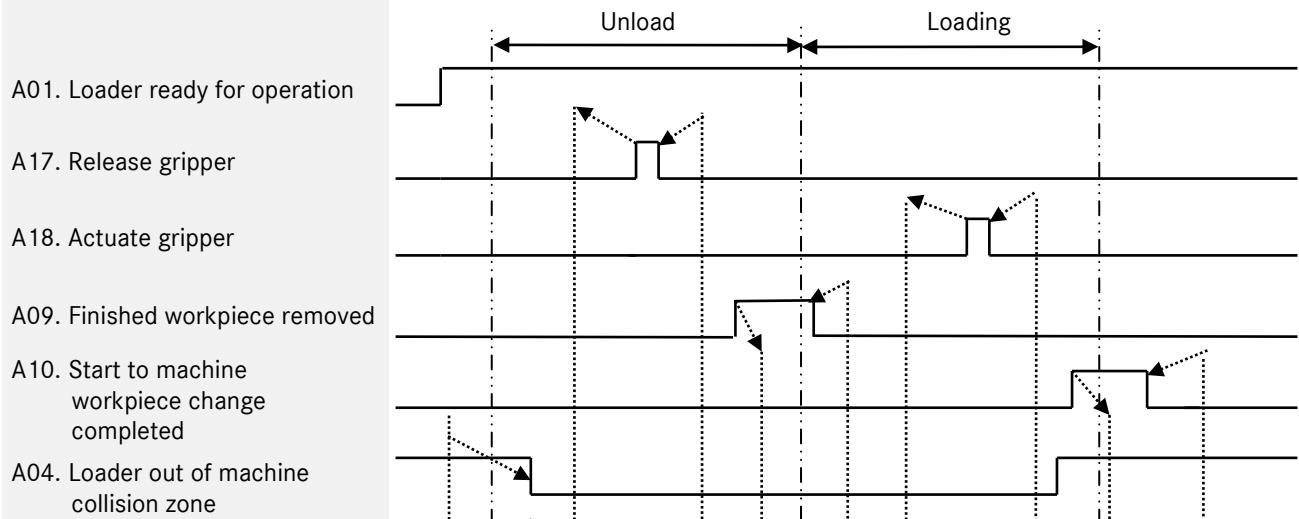
3.3.25 Reserve "E 25"**3.3.26 Reserve "E 26"****3.3.27 Reserve "E 27"****3.3.28 Reserve "E 28"****3.3.29 Reserve "E 29"****3.3.30 Reserve "E 30"****3.3.31 Reserve "E 31"****3.3.32 Reserve "E 32"**

3.4 Software Signals from Machine to Loader

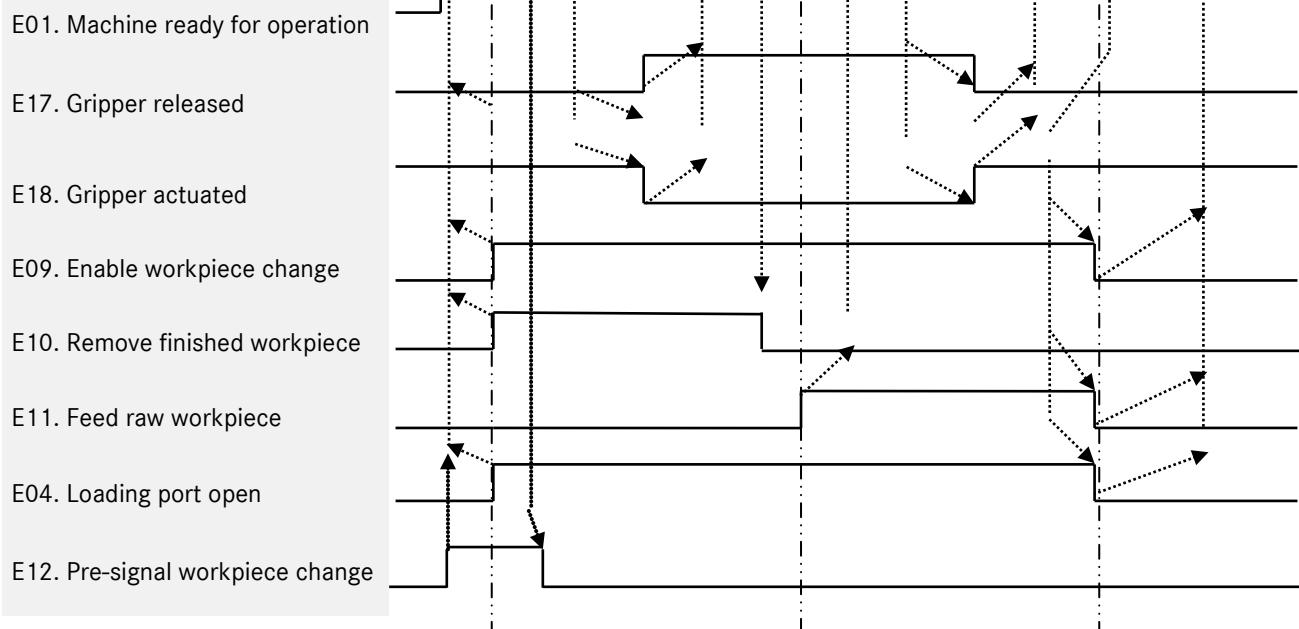
No.		Address	Description
01		E X0.0	Machine ready for operation
02		E X0.1	No Emergency Off from machine
03		E X0.2	Operating / loading door of machine closed
04		E X0.3	Loading port fully open
05		E X0.4	
06		E X0.5	
07		E X0.6	
08		E X0.7	
09		E X1.0	Enable workpiece change at machine
10		E X1.1	Remove finished workpiece
11		E X1.2	Feed raw workpiece
12		E X1.3	Pre-signal – workpiece change
13		E X1.4	
14		E X1.5	
15		E X1.6	Request opening of safety door
16		E X1.7	NOK workpiece from machine
17		E X2.0	Gripper released
18		E X2.1	Gripper actuated
19		E X2.2	
20		E X2.3	Operate until empty
21		E X2.4	Operation until empty completed
22		E X2.5	
23		E X2.6	Keep-alive bit
24		E X2.7	Acknowledgment – workpiece type
25		E X3.0	
26		E X3.1	
27		E X3.2	
28		E X3.3	
29		E X3.4	
30		E X3.5	
31		E X3.6	
32		E X3.7	

4 Interface Chart

4.1 Signals from Loader to Machine



4.2 Signals from Machine to Loader



5 Plausibility Check of Workpiece Numbers (OPTIONAL)

5.1 General Description

This function is implemented using the existing signals (A25 -A32).

The loader transmits the type number with one parity bit to the machine in binary code. In doing so, just one number is used to specify the type.

The machine acknowledges the code if data transmission was error-free, that is, the received signals have resulted in an even numerical value, and the transmitted type number agrees with the machine.

Each workpiece type is identified by a number from 1 to e.g. 63.

Signal exchange at the loader is initiated for each automatic start and each workpiece change.

If transfer of the type number has been successful, workpiece change is executed.

5.2 Workpiece Table (example)

Workpiece Type	No.	2^5	2^4	2^3	2^2	2^1	2^0	Parity
	0	0	0	0	0	0	0	0
	1	0	0	0	0	0	1	1
	2	0	0	0	0	1	0	1
	3	0	0	0	0	1	1	0
	4	0	0	0	1	0	0	1
	5	0	0	0	1	0	1	0
	6	0	0	0	1	1	0	0
	7	0	0	0	1	1	1	1
	8	0	0	1	0	0	0	1
	9	0	0	1	0	0	1	0
	10	0	0	1	0	1	0	0
	11	0	0	1	0	1	1	1
	12	0	0	1	1	0	0	0
	13	0	0	1	1	0	1	1
	14	0	0	1	1	1	0	1
	15	0	0	1	1	1	1	0

6 Specifications

7 Appendix

7.1 Machine Safety Door Circuit

7.1.1 Closing Loading Door

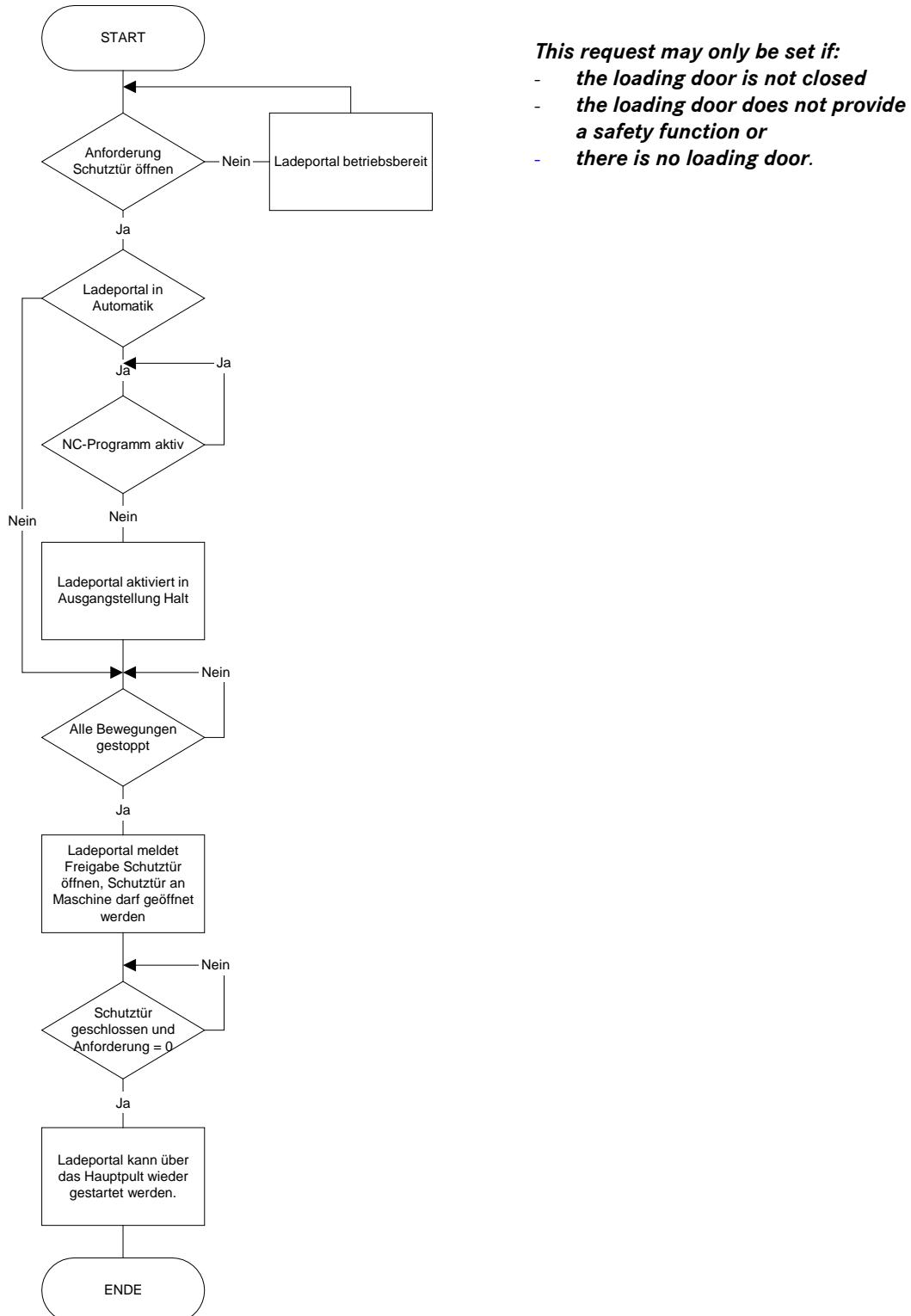
The machine loading door may be closed only if the machine receives the interlock signal "**Loading gantry out of machine collision zone**".

7.1.2 Opening of Machine Safety Doors

The machine safety doors that are signaled via a hardware interface to the loading gantry may be opened only if one of the following two conditions is fulfilled.

1. The loading door is closed and interlocked. With a closed and interlocked loading door, the machine safety doors can be opened independently of the loading gantry. **For this purpose, the loading door must have a mechanical safeguard to prevent penetration of the loading gantry.**
2. If there is a request to open the machine safety doors without it being possible to fulfill the first condition, the safety door may not be opened until, via the interface, the loading gantry signals "**Enable opening of safety door**". For this purpose, the machine must set the signal "**Request opening of safety door**". This selectively stops the gantry. Restarting of the loading gantry is done in this case via the principal operating panel of the loading gantry.

7.1.3 Description of Shake-Hand Sequence for Opening Machine Safety Door



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1. General

1.1 Preface

To meet the requirements of "materials handling technology systems", these requirement specifications have been produced for the specific aspects of materials handling technology. These requirement specifications supplement the PP/PTM Requirement Specifications, Part III Electrics.

1.2 Validity and Obligations

These requirement specifications define the production equipment specifications for "control system technology for materials handling technology systems" for all production locations and centers in the Daimler AG (shortened to Daimler in the following) Mercedes-Benz Cars/Powertrain (MBC) and Daimler Trucks/Powertrain (Trucks) divisions.

Compliance with the requirement specifications is binding and shall be confirmed in the bids.
The requirement specifications valid at the time of the contract award are binding.
If the tenderer feels that deviations are required with regard to the individual points, this shall be indicated in the tender and approved in writing by DAIMLER.

The contractor shall ensure that all parties involved in the contract adhere to the latest Daimler regulations.

This tender document may not be disclosed to third parties without the prior consent of Daimler!

1.3 Revision Directory/Documentation Status

Version	Last revised	Change	Name
0.9	29.10.2013	Drafted	Frank Strobel
1.0	04.03.2013	Drafted	Frank Strobel
2.0	14.07.2015	Var. Changes	Frank Strobel
2.2	18.07.2016	Revision of operating modes, function modes	Markus Noack
2.3	17.08.2016	Integration of IPC477 for OP12 and IPC277	Markus Noack
2.3	08.09.2016	Designation scheme revision	Markus Noack
2.4	05.10.2016	Designation scheme revision Integration of SUM notes Finalization	Markus Noack
2.5	14.12.2017	Integration of SUM/WIH notes	Markus Noack
3.0	13.03.2018	Updating to TIA - LH14 Integration of SUM notes lift guard door upper level	Markus Noack

2. Task Description

Functional requirements on the automation system

2.1 Short Description of the Task Definition/Scope

The previous PP/PTM requirement specifications, which were also used for the materials handling technology, do not describe the actual and also different requirements of the materials handling technology. These requirement specifications have therefore been designed to better define the specific materials handling technology aspects.

These requirement specifications shall be regarded as a supplement to the PP/PTM requirement specifications, and refer to independent conveying systems with the following materials handling technology:

- Overhead monorail conveyor
- Power and Free systems
- Floor conveyor system
- Lift
- Storage and retrieval devices
- Distribution truck
- Robot transfers

DTS/AGV and materials handling technology within machines are handled according to Appendix 2.

3. Operating Modes

3.1 Machine Type List with Operating Modes and Operating Mode Version

no.	Machine type	BA 1	BA 2	BA 3	BA 4	BA 5	Version of the Operating mode
1.1 •	Materials handling technology, floor conveyor system, electric overhead conveyor, Power & Free systems in the maintenance area (separately secured area)						No operating modes (BA) as per requirement specifications. Maintenance personnel require a personally assigned key to the materials handling technology area. It shall be ensured that the maintenance personnel is able to undertake movements with an enabling device with soft key button. With the enabling device actuated, the movement is not released via the safety circuit
1.2 •	Storage and retrieval device with lift cage	X	X ^{*2}	-	-	-	<p>^{*2} Important: Special operating mode – travel in the protection area with closed guard doors. Only ever one person in the lane.</p> <p>Traveling in the co-traveling lift cage:</p> <ul style="list-style-type: none"> - Movement of all axes possible - Operation at all other control points prevented - Lane key inserted in lift cage - Lane doors closed - Lift cage door closed - EKS inserted in lift cage - Operation via HMI, in switch cabinet in lift cage. - Corresponding function mode selected. - Speeds reduced, depending on function mode - Brake bleeding function shall be planned for axes X and Z. <p>Travel outside of lift cage in lane</p> <ul style="list-style-type: none"> - Lane doors closed - Lift cage door closed - EKS inserted in plug-in station box - Hand control unit inserted in plug-in station box - Lane key inserted in plug-in station box - Operation at all other control points prevented

							<ul style="list-style-type: none"> - X axis travel at maximum speeds monitored as per DIN EN 528, height of lifting cage safe for walking beneath and lifting cage empty. - Y axis travel at maximum speeds monitored as per DIN EN 528, storage and retrieval device - X position in maintenance position only. - Maintenance position as safe location shall be shown in the operating instructions. - Y axis movement range only so that height of lifting cage is safe for walking beneath. - Z axis travel at maximum speeds monitored as per DIN EN 528, storage and retrieval device - X position only measurement bay approachable, Y axis max. measurement bay height, but at least safe for walking beneath, both sides possible - If additional persons (maintenance personnel) are required in the lane for special cases of malfunction elimination and defined maintenance work, a second manually- or foot-operated enable button shall be planned for the second person. Example of cable exchange: Employee 1 moves drum with hand control unit, employee 2 guides cable with second foot-operated enable button. Enable button in plug-in design; evaluation is carried out only when button is inserted, otherwise bridged. It shall be ensured organizationally that enable button is inserted by 2nd employee. - EKS "inserting" employee is responsible for all persons leaving the lane
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1.3 •	Storage and retrieval device without lift cage and distribution truck with lifting function	X	X ^{*2}	-	-	-	<p>^{*2} Important: Special operating mode – travel in the protection area with closed guard doors. Only ever one person in the lane.</p> <p>Traveling in the lane</p> <ul style="list-style-type: none">- Lane doors closed- EKS inserted in plug-in station box- Hand control unit inserted in plug-in station box- Lane key inserted in plug-in station box- Operation at all other control points prevented- X axis travel at maximum speeds monitored as per DIN EN 528, height of lifting cage safe for walking beneath and lifting cage empty.- Y axis travel at maximum speeds monitored as per DIN EN 528, storage and retrieval device – X position in maintenance position only.- Maintenance position as safe location shall be shown in the operating instructions.- Y axis movement range only so that height of lifting cage is safe for walking beneath.- Z axis travel at maximum speeds monitored as per DIN EN 528, storage and retrieval device – X position only measurement bay approachable, Y axis max. measurement bay height, but at least safe for walking beneath, both sides possible- If additional persons (maintenance personnel) are required in the lane for special cases of malfunction elimination and defined maintenance work, a second manually- or foot-operated enable button shall be planned for the second person. Example of cable exchange: Employee 1 moves drum with hand control unit, employee 2
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							guides cable with second foot-operated enable button. Enable button in plug-in design; evaluation is carried out only when button is inserted, otherwise bridged. It shall be ensured organizationally that enable button is inserted by 2nd employee. - EKS "inserting" employee is responsible for all persons leaving the lane
1.4 •	Distribution truck without lifting function with materials handling technology Area is declared as IS area.	X	X* ²	-	-	-	* ² important: Special operating mode – travel in the protection area with closed guard doors. Traveling in the lane - EKS inserted in plug-in station box - Hand control unit inserted in plug-in station box - Lane key inserted in plug-in station box - Operation at all other control points prevented - X axis travel at maximum speeds monitored as per DIN EN 528 - Movement of materials handling technology (roller conveyors, chain conveyors), with hand control unit, enabling device up to working speed ≤24 m/min
1.5 •	Distribution truck without lifting function with friction roller materials handling technology, intrinsically safe	X	X	X	-	-	See operating mode concept Appendix 2 - BA3 only if technically required

1.6 •	Overhead monorail conveyor lift	X	X ^{*1}	-	-	-	Lift area in maintenance area (upper level)
							<ul style="list-style-type: none"> - Selection of corresponding function modes - EKS inserted - Opening shall be prevented at the lower guard door - It shall be ensured that the maintenance personnel is able to undertake movements with an enabling device - Operation at a fixed control console without enabling device - Movements only possible with lower guard door closed - Operation at all other control points prevented - Exchange/setting of components from safe standing area - In the case of lifts with special ambient situations, e.g. lack of visibility from outside of the protective system, several stations and/or complex technology on the lifting cage, BA2 shall also be planned with a corresponding access and safety concept in the maintenance area. <p>Lift area in traffic area (lower level) *1) BA2 is only possible here</p> <ul style="list-style-type: none"> - Guard door opening only with lift in safe position at bottom. - If lift cannot come down, access only possible with EKS blue/red and with Buhl pin engaged - BA2 selection only possible if lift is in lower end position - BA2 selection only possible with an open guard door. - Selection of BA2 not possible if cargo can fall, e.g. jammed or suspended cargo - Operation at all other control points prevented - In the case of lifts in the machine area, operation of the machine shall be prevented if the lower plug-in station of the lift has the operation right

							<ul style="list-style-type: none"> - Y travel max. 3 m/min monitored, only in area +500 mm above lower end position - Bolting facility travel with hand control unit and enabling device not monitored up to working speed ≤ 4 m/min - Entry/exit of trolley unit/material to be conveyed from the safe standing area, with hand control unit with enabling device without reduced speeds - Exchange/setting/movement of components from safe standing area, shown in layout
1.7 •	Lift with materials handling technology	X	X* ¹				<p>Lift area in maintenance area (upper level)</p> <ul style="list-style-type: none"> - Implementation as in overhead monorail conveyor lift <p>Lift area in traffic area (lower level) *¹) BA2 is only possible here</p> <ul style="list-style-type: none"> - Implementation as in overhead monorail conveyor lift - If frequency converters are used, the speeds shall be reduced - If frequency converters are used, it shall be possible to select the non-reduced speed by soft key
1.8 •	Lifts in which work by the operator is necessary in the vicinity of the moved vertical axis with the protective system open or which cannot be avoided.						This is a special situation that shall be assessed using a risk assessment. In this case, special technical and labor organizational safety precautions shall be defined.
1.9 •	Stackers / unstackers						See 1.1
1.10 •	Robot transfer as separate cell / island						<p>For robots, see operating mode concept Appendix 2</p> <p>For materials handling technology part of the system:</p> <ul style="list-style-type: none"> - BA3 only if technically required
• Robot	X X	X X	X X	-	-		

	<ul style="list-style-type: none"> • Materials handling technology part of the system 					<ul style="list-style-type: none"> - Selection of BA2 / BA3 for materials handling technology part of the system with EKS red/blue only - With BA2/BA3 selected for materials handling technology part of the system, additional persons (maintenance personnel) are permissible in the cell for special cases of malfunction elimination. - EKS "inserting" employee is responsible for all persons leaving the cell - BA2 and BA3 for materials handling technology part only for conveyors in the cell and feed conveyors which extend beyond the protection area boundary. - Lifting gear eccentric lifting platforms no reduced speed – rollers/chain conveyors reduced speed - Reduced speeds not monitored for materials handling technology part in the cell - Pneumatically driven facilities not reduced and not monitored
1.11	Assembly overhead monorail conveyor	No operating modes (BA) as per requirement specifications. Maintenance personnel require a personally assigned key to the materials handling technology area.				Safe speeds shall be implemented in the working and traffic area

4. Function Modes

The following function modes shall be planned for controlling, operating and diagnosing kinematic system functions:

4.1 Conveyor Technology

4.1.1 Automatic Linked Operation VK (Automatic Mode)

- All system functions run automatically, without operator intervention
- System parameters such as e.g. end positions, releases, etc. are monitored automatically
- Automatic mode is interrupted by machine outage
- Automatic synchronization after starting VK in each position

4.1.2 Setup Mode ER with Interlocking (Manual Mode with Safeguards)

- In setup mode, all possible operating functions are started manually
- Possible operating functions are displayed
- Security polls are active
- All prerequisites for executing an operating function are checked
- After reaching the nominal terminal positions, drives shut off (functions inline with automatic mode)

4.1.3 Setup Mode ER without Interlocking (Manual Mode without Safeguards)

- ER mode without/with interlocking can be selected using control panel
- Can only be selected/operated with EKS protection level 1
- In manual mode without interlocking, all operating functions are started manually
- All operating functions are displayed
- Security polls are not active
- None of the prerequisites for executing an operating function are checked
- This function mode is used to clear the system following machine outage

4.2 Lift

4.2.1 Automatic Linked Operation VK (Automatic Mode)

- All system functions run automatically, without operator intervention
- System parameters such as e.g. end positions, releases, etc. are monitored automatically
- Automatic mode is interrupted by machine outage
- Automatic synchronization after starting VK in each position

4.2.2 Setup Mode ER with Interlocking (Manual Mode with Safeguards)

- In setup mode, all possible operating functions are started manually
- Possible operating functions are displayed
- Security polls are active
- All prerequisites for executing an operating function are checked
- After reaching the nominal terminal positions, drives shut off (functions inline with automatic mode)

4.2.3 Setup Mode ER without Interlocking (Manual Mode without Safeguards)

- ER mode without/with interlocking can be selected using control panel
- Can only be selected/operated with EKS protection level 1
- In manual mode without interlocking, all operating functions are started manually
- All operating functions are displayed
- Security polls are not active
- None of the prerequisites for executing an operating function are checked
- This function mode is used to clear the system following machine outage

4.2.4 Notes

- The function mode is selected using the local manual control console.

4.3 Storage and Retrieval Device with Co-Traveling Control Station

4.3.1 Automatic Linked Operation VK (Automatic Mode)

- All system functions run automatically, without operator intervention
- System parameters such as e.g. end positions, releases, etc. are monitored automatically
- Automatic mode is interrupted by machine outage

4.3.2 Single Step Operation ES (Semiautomatic Mode)

- Function available in the lift cage, with hand control unit inserted outside of the lane, operation externally, not available with hand control unit inserted within the lane
- The collection and distribution of load carriers is processed automatically in the individual cycle.
- Source and destination are manual inputs
- Prior to fork play, confirmation by operator necessary
- Locators on lifting device open and close automatically
- System parameters such as e.g. end positions, releases, etc. are monitored automatically
- Semiautomatic mode is interrupted by machine outage

4.3.3 Setup Mode ER (Manual Mode)

- In setup mode, all possible operating functions are started manually
- Possible operating functions are displayed
- Security polls are active
- All prerequisites for executing an operating function are checked
- After reaching the nominal end positions, drives shut off (functions as in automatic linked operation)
- Selection and movement to basic position

4.3.4 Setup Mode ER (Manual Mode without Safeguards)

- Not selectable if hand control unit inserted at external plug-in station
- Like setup mode, but security polls are not active
- None of the prerequisites for executing an operating function are checked
- Selection and movement to basic position
- This operating mode is used to clear the system following malfunction situations
- Can only be selected/operated with EKS protection level 1

4.3.5 Notes

- The key concept is defined in standard EN528.
- A storage and retrieval device with control station can only be operated with the protection area closed. Operation can take place from the control console in the control station, or can be started from the external control console. The guard doors shall be closed for this; the key indicates operating sovereignty

4.4 Storage and Retrieval Device without Co-Traveling Control Station and Distribution Truck

4.4.1 Automatic Linked Operation VK (Automatic Mode)

- All system functions run automatically, without operator intervention
- System parameters such as e.g. end positions, releases, etc. are monitored automatically
- Automatic mode is interrupted by machine outage

4.4.2 Single Step Operation ES (Semiautomatic Mode)

- Function available with hand control unit inserted outside of the lane, operation externally, not available with hand control unit inserted within the lane
- The collection and distribution of load carriers is processed automatically in the individual cycle.
- Source and destination are manual inputs
- Prior to fork play, confirmation by operator necessary
- Locators on lifting device open and close automatically
- System parameters such as e.g. end positions, releases, etc. are monitored automatically
- Semiautomatic mode is interrupted by machine outage

4.4.3 Setup Mode ER (Manual Mode)

- In setup mode, all possible operating functions are started manually
- Possible operating functions are displayed
- Security polls are active
- All prerequisites for executing an operating function are checked
- After reaching the nominal end positions, drives shut off (functions as in automatic linked operation)
- Selection and movement to basic position

4.4.4 Setup Mode ER (Manual Mode without Safeguards)

- Not selectable if hand control unit inserted at external plug-in station
- Like setup mode, but security polls are not active
- None of the prerequisites for executing an operating function are checked
- Selection and movement to basic position
- This operating mode is used to clear the system following malfunction situations
- Can only be selected/operated with EKS protection level 1

4.4.5 Notes

- The key concept is defined in standard EN528.

4.5 Stackers/Unstackers

4.5.1 Automatic Linked Operation VK (Automatic Mode)

- All system functions run automatically, without operator intervention
- System parameters such as e.g. end positions, releases, etc. are monitored automatically
- Automatic mode is interrupted by machine outage
- Automatic synchronization after starting VK in each position

4.5.2 Setup Mode ER with Interlocking (Manual Mode with Safeguards)

- In setup mode, all possible operating functions are started manually
- Possible operating functions are displayed
- Security polls are active
- All prerequisites for executing an operating function are checked
- After reaching the nominal terminal positions, drives shut off (functions inline with automatic mode)

4.5.3 Setup Mode ER without Interlocking (Manual Mode without Safeguards)

- ER mode without/with interlocking can be selected using control panel
- In manual mode without interlocking, all operating functions are started manually
- All operating functions are displayed
- Security polls are not active (including security polls)
- None of the prerequisites for executing an operating function are checked
- This function mode is used to clear the system following machine outage
- After reaching the nominal end positions, drives shut off

4.6 Transport Overhead Monorail Conveyor

Within an overhead monorail conveyor system, function modes are subdivided according to firmly installed system areas and trolley units

4.6.1 Switches, Maintenance Stations, Block Stations, Automatic Stations

4.6.1.1 Automatic Linked Operation VK (Automatic Mode)

- All system functions run automatically, without operator intervention
- System parameters such as e.g. terminal positions, releases, etc. are monitored automatically
- Automatic mode is interrupted by machine outage
- Direction specification is carried out prior to registration of the trolley unit
- Zones and stacking areas are processed automatically

4.6.1.2 Setup Mode ER with Interlocking (Manual Mode with Safeguards)

- In setup mode, all possible operating functions are started manually
- Possible operating functions are displayed (if possible)
- Security polls are active
- All prerequisites for executing an operating function are checked
- After reaching the nominal terminal positions, drives shut off (functions inline with automatic mode)
- Control modules can be optionally operated using buttons, remote control, etc.
- Lifting stations and the inspection and maintenance section are operated using the local manual control console control points

4.6.1.3 Notes

- The function mode is selected using the local manual control console.

4.6.2 Trolley Units

4.6.2.1 Automatic Linked Operation VK (Automatic Mode)

- All trolley unit functions run automatically, without operator intervention
- Trolley unit parameters such as e.g. end positions, releases, etc. are monitored automatically
- Automatic mode is interrupted through trolley unit malfunctions

4.6.2.2 Notes

- Function mode selection is carried out on the trolley unit
- Trolley unit has the status on (VK)/off.
- Trolley unit drive can be coupled – pushing the trolley unit

4.7 Assembly Overhead Monorail Conveyor

Within an overhead monorail conveyor system, function modes are subdivided according to firmly installed system areas and trolley units

4.7.1 Switches, Maintenance Stations, Block Stations, Automatic Stations

4.7.1.1 Automatic Linked Operation VK (Automatic Mode)

- All system functions run automatically, without operator intervention
- System parameters such as e.g. terminal positions, releases, etc. are monitored automatically
- Automatic mode is interrupted by machine outage
- Direction specification is carried out prior to registration of the trolley unit
- Zones and stacking areas are processed automatically

4.7.1.2 Setup Mode ER with Interlocking (Manual Mode with Safeguards)

- In setup mode, all possible operating functions are started manually
- Possible operating functions are displayed (if possible)
- Security polls are active
- All prerequisites for executing an operating function are checked
- After reaching the nominal terminal positions, drives shut off (functions inline with automatic mode)
- Control modules can be optionally operated using buttons, remote control, etc.
- Lifting stations and the inspection and maintenance section are operated using the local manual control console control points

4.7.1.3 Notes

- The function mode is selected using the local manual control console.

4.7.2 Trolley Units

4.7.2.1 Automatic Linked Operation VK (Automatic Mode)

- All trolley unit functions run automatically, without operator intervention
- Trolley unit parameters such as e.g. end positions, releases, etc. are monitored automatically
- Automatic mode is interrupted through trolley unit malfunctions
- Trolley unit in assembly line in the communication area to the MFS

4.7.2.2 Setup Mode ER (Manual Mode without Safeguards)

- Operation without EKS
- In setup mode, trolley unit is controlled using infrared remote control.
- The individual movement type is selected
- In setup mode, all possible operating functions are started manually
- Control modules can be optionally operated using buttons, remote control, etc.
- Like setup mode, but security polls are not active

-
- None of the prerequisites for executing an operating function are checked
 - This operating mode is used to clear the system following malfunction situations

4.7.2.3 Notes

- Function mode selection is carried out on the trolley unit
- Trolley unit has the status on (VK)/local mode (ER)/off.
- Trolley unit drive can be coupled – pushing the trolley unit

4.8 Robot Transfer

4.8.1 Robot

4.8.1.1 Function Modes

- ER, ES, EB, VK implementation as per operating mode concept Appendix 2

4.8.2 Materials Handling Technology Part of the System

4.8.2.1 Automatic Linked Operation VK (Automatic Mode)

- All system functions run automatically, without operator intervention
- System parameters such as e.g. end positions, releases, etc. are monitored automatically
- Automatic mode is interrupted by machine outage
- Automatic synchronization after starting VK in each position

4.8.3 Single Step Operation ES (Semiautomatic Mode)

- The conveying of load carriers is processed automatically in the individual cycle.
- Operator release is required after each single step
- System parameters such as e.g. end positions, releases, etc. are monitored automatically
- Semiautomatic mode is interrupted by machine outage

4.8.3.1 Setup Mode ER with Interlocking (Manual Mode with Safeguards)

- In setup mode, all possible operating functions are started manually
- Possible operating functions are displayed
- Security polls are active
- All prerequisites for executing an operating function are checked
- After reaching the nominal terminal positions, drives shut off (functions inline with automatic mode)

4.8.3.2 Setup Mode ER without Interlocking (Manual Mode without Safeguards)

- ER mode without/with interlocking can be selected using control panel
- In manual mode without interlocking, all operating functions are started manually
- All operating functions are displayed
- Security polls are not active
- None of the prerequisites for executing an operating function are checked
- This function mode is used to clear the system following machine outage

5. Requirements on the System Technology

5.1 System Network Profinet

Design as per current version of control engineering specifications for logistics systems (Appendix to component-specific requirement specifications).

5.2 Software

5.2.1 Visualization Software

- HMI-Pro sl and IPC
- WinCC comfort (V13 or higher).

The version shall be coordinated with the representative with the involvement of the respective specialized department.

5.2.2 Application Software

The software and version shall be coordinated with the representative with the involvement of the respective specialized department.

5.2.3 Programming Language

The structure of the programs shall be designed according to TRANSLINE 2000, General Software Guide. The implementation of IL, indirect addressing or graphical programming languages (S7-Graph) shall be coordinated with the representative with the involvement of the respective specialized department.

5.3 Hardware

5.3.1 Process Data Recording

Prisma, further monitoring systems shall be coordinated with the representative with the involvement of the specialist unit.

5.3.2 Operation, Monitoring, Logging

Released components of MFL 23 (logistics systems) from the Material Data Manager (MDM) shall basically be used for operation and visualization.

Floor conveyor system, lifts:

- Area/central control system: IPC (monitoring only and for EKS and PRISMA server connection)
- Operation and monitoring using mobile panel/panel KTP/TP/KP

Electric overhead conveyor, Power and Free system:

- Area/central control system: IPC (monitoring only and for EKS and PRISMA server connection)
- Operation and monitoring of function groups (points, station, etc.) using switches, illuminated pushbuttons, remote control, etc., mobile panel/panel KTP/TP/KP

Storage and retrieval device with co-traveling control station

- IPC in the co-traveling switch cabinet
- Additionally with mobile operation of hand control unit

Storage and retrieval device without lift cage and distribution truck with/without lifting function

- IPC next to guard door in lane fencing
- Poss. further hand control unit plug-in station at second lane door
- Plug-in station box for hand control unit co-traveling on distribution truck

Robot transfer:

- IPC
- Additionally with mobile operation of hand control unit
- Materials handling technology part of the system special considerations as per Section 3.1

The following points shall be observed on use of the KP/TP series:

The operating concept shall be designed in such a way that several panels can be operated simultaneously on one control system/station. Mutual interlock on simultaneous operation of a function group shall be mandatory. It shall only be possible to operate the visible area.

The programming shall be created exclusively by the manufacturer.

KP/TP series displays:

- Start screen with system designation
- System overview with current function mode of the individual function groups (virtual stations)
- Monitoring of system states
- Step sequence diagnosis per function group and per function group module
- Interface signals from/to other control systems
- Data memory, codes, etc. from e.g. load/goods carriers/workpieces
- Current fault, warning and operational signals

KP/TP series operation options:

- Operating mode changeover if available
- Function group-related function mode changeover
- Function group-related operation of the individual conveyors/modules
- Resetting of zones and stack flags (for the operable and visible area only)
- Reading out data memories, codes, etc.

The following points shall be observed on use of mobile panel KTP:

The operating concept shall be designed in such a way that several panels can be operated simultaneously on one control system/station. Mutual interlock on simultaneous operation of a function group shall be mandatory. In the case of lifts, a plug-in station or a stationary panel shall be planned at each level. It shall only be possible to operate the visible area. The programming shall be created exclusively by the manufacturer.

Mobile panel displays:

- Start screen with system designation and plug-in station
- System overview with current function mode of the individual function groups (virtual stations)
- Monitoring of system states
- Step sequence diagnosis per function group and per function group module
- Interface signals from/to other control systems
- Data memory, codes, etc. from e.g. load/goods carriers/workpieces
- Current fault, warning and operational signals

Mobile panel operating options:

- Operating mode changeover if available
- Function group-related function mode changeover
- Function group-related operation of the individual conveyors/modules
- Resetting of zones and stack flags (for the operable area only)
- Reading out data memories, codes, etc.

The following points shall be observed on use of IPC:

In combination with KP/TP and/or mobile panel, the IPC is used exclusively for monitoring and for connection to the PRISMA and EKS server. Mixed operation of HMI Pro and WinCC shall be avoided. One IPC shall be implemented per control system.

IPC displays (partly standard pictures HMI Pro):

- Subnet Profinet diagnosis
- Interface signals from/to other control systems
- Data memory/codes
- Malfunction, warning and operational signals (current and buffered)
- EKS and Prisma information
- Diagnosis and parameterization screens
- Operation: Reading out data memories and codes

5.3.3 Central System Visualization and Monitoring

The conveying systems shall be connected to the central monitoring and visualization systems implemented at the location. If no central systems are available, visualization of the system status shall be set up on a KP/TP series panel.

5.3.4 Data Transmission

The router as per MDM reliably separates the plant network from the system network. Subscribers (PLCs, robots, IPCs, etc.) that communicate with systems in the plant network shall be assigned using NAT tables in the router. The subscribers shall be listed in tabular form.

5.3.5 Example of Control System Architecture

Design as per current version of control engineering specifications for logistics systems (Appendix to component-specific requirement specifications).

Example of transport overhead monorail conveyor system:

Design as per current version of control engineering specifications for logistics systems (Appendix to component-specific requirement specifications).

Example of Assembly overhead monorail conveyor system:

Design as per current version of control engineering specifications for logistics systems (Appendix to component-specific requirement specifications).

Transport areas as in transport overhead monorail conveyor

5.4 System Labeling

5.4.1 Designation Scheme

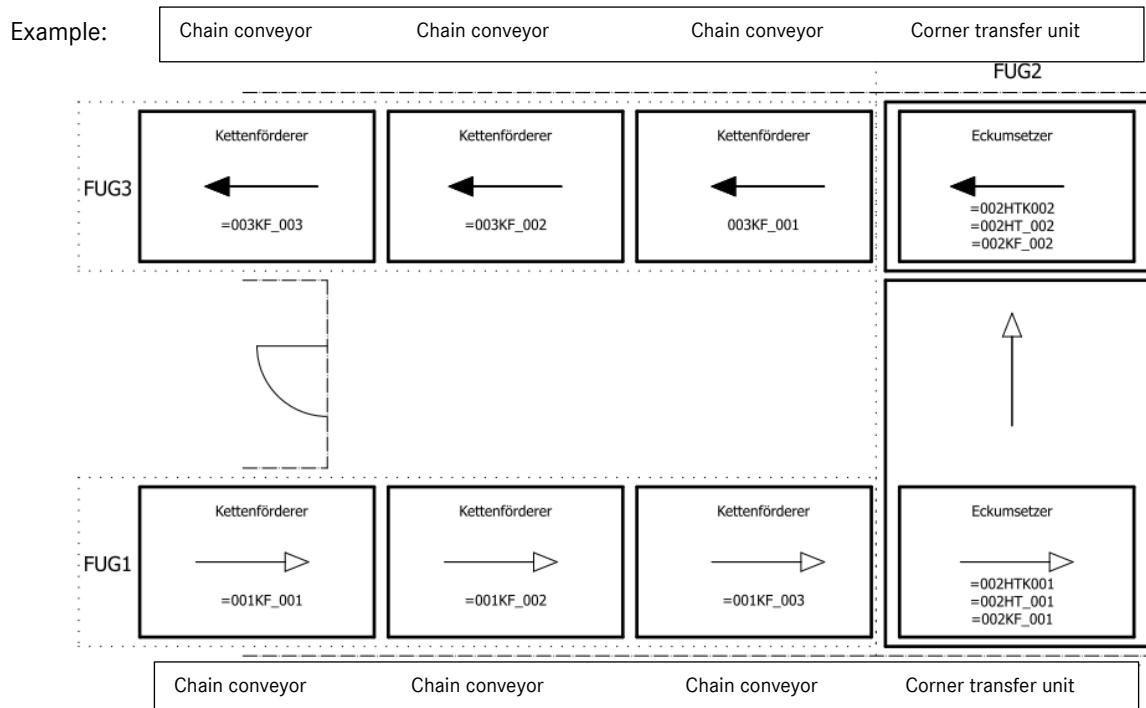
The electrical documentation for the hardware shall be created according to the currently valid standards; in this regard, see also PP/PT requirement specifications, Part 5, Chapter 10.

According to DIN EN 81346-1, Chapter 5.3, the wiring diagram of a materials handling technology system has both a location-related and a function-related structure.

The function-related structure is reflected in the materials handling technology system's control and operation, which is structured according to function groups and module numbers.

Function group codes ("AAA") can be defined for specific sub-systems; a few examples follow:

ALG	General topics/information	HT_	Lifting platform
ANL	System overview/proximity switch location plan	KF_	Chain conveyor
BS_	Operating stations (consoles, button housings)	MU_	Signaling and monitoring
BUS	Profibus overview	MUE	Power supply signaling and monitoring
DGB	Barcode	NET	Profinet/Ethernet bus overview
DGS	Scanner	NH_	Emergency stop
EB_	Cabinet lighting/service sockets	RB_	Robot interface
EE_	Power supply/energy distribution	RF_	Roller conveyor
EEB	Power supply/energy distribution in the field	SA_	Swivel arm
EHT	EHB disconnect module	PLC	Programmable Logic Controller
EK_	Switching on	SPX	Decentralized PLC modules (local)
EP_	Power supply upstream of area switch	ST_	Stopper
ES_	24 VDC power supply	STA	Stacking unit
EV_	(Third-party) system interface	STU	Guard door
FX_	Location	TRR	Roll-up door
GPS	Design of Switch Cabinets	VW_	Sliding truck
HE_	Lift	WEH	Maintenance unit



The system is additionally subdivided into installation locations using location IDs ("+"). The following installation locations are subdivided as standard:

- +H01/+H02/+Hxx: Switch cabinets
- +Kxx: Terminal boxes
- +Pxx: Control consoles
- +WK: Switch box
- +KS: Curve control system
- +US: Transfer station
- +X: Locations outside of cabinets, terminal boxes and consoles

The complete operating equipment of a device within a part of the system ("==") consists of the function ("="), the installation location ("+") and the product.-(,,-)

The product (mode ID/function/count number) is identified according to DIN EN 81346-2 Table 1. In addition to the code letter from DIN EN 81346-2 Table 1, each product is defined using a function-related number. This enables the assignment of a clear function to sensors, for example.

Examples of the clear function of sensors are:

Conveyor technology		Overhead monorail conveyor
-B10	Location check	-B2 Login straight
-B20	Fast/slow changeover	-B3 Straight end position
-B3x	Location occupied at front/rear	-B4 Straight output line acknowledgment
-B4x	Bottom/center end position	-B5 Straight stack
-B50	Top end position	-B12 Login branch off
-B7x	Front/rear end position	-B13 Branch-off end position
-B8x	Front/rear gap check	-B14 Output line branch-off acknowledgment
		-B15 Branch-off stack

The function reference can differ in various systems, and shall be firmly defined at the beginning.

System identifier

== System = function + location – production equipment
Ingenuity for life

Designation structure according to DIN EN 81346-1/DIN EN 81346-2

[==] System identifier
Siemens AG designation system
Structure: Function group/building/system ID

Implementation: Max. 14 characters/N = numbers/A = letters

Number of characters	1 2 3 4 5 6 7 8 9 10 11 12 13 14
Characteristic	== N N N G N N A A A A A N N N
Example	== 1 1 8 G 0 3 M T E B S 0 0 1

The plant identifier describes the control system membership of the assemblies contained in the circuit manual.
The system identifier is used as the project name in the documentation system

117 -> Storage and retrieval device
118 -> Monorail overhead conveyor
133 -> Materials handling technology
160 -> Robot/special systems

MTEBS -> Assembly transport monorail overhead conveyor area control system
MTEHE -> Assembly transport monorail overhead conveyor lift control system
MTEML -> Assembly transport monorail overhead conveyor assembly line control system
MTEEM -> Assembly transport monorail overhead conveyor final assembly control system
MTELW -> Assembly transport monorail overhead conveyor carriage

001 -> Sequential system numbering with assignment to the line

Function group identifiers

== System = function + location – production equipment

Designation structure according to DIN EN 81346-1/DIN EN 81346-2

Ingenuity for life

[=] Function group identifier
 Siemens AG designation system
 Structure: Function number/function group abbreviation/element place number
 Implementation: Max. 9 characters/N = numbers/A = letters

Number of characters	K	1	2	3	4	5	6	7	8	9
	=	N	N	N	A	A	A	N	N	N
Characteristic	=	0	0	2	V	E	M	2	0	3

The function group describes the membership of functionally interacting assemblies in the circuit manual.

Emergency stop area2 -> 002VEM203 Feed-in area 3 -> 003EE_001	EE_ -> Feed-in VEM -> Distributor module WEA -> Exit switch WEE -> Entry switch PLB -> Power line booster SPX -> Decentralized PLC assemblies	Distributor module switch 203 -> 002VEM203 Feed-in area 3 rail 1 -> 003EE_001
--	--	--

Location code

== System = function + location – production equipment

Designation structure according to DIN EN 81346-1/DIN EN 81346-2

Ingenuity for life

[+] Location code
 Siemens AG designation system
 Structure: ID letter/count numbe

Implementation: Max. 4 characters/N = numbers/A = letters

Number of characters	K	1	2	3	4
	+	A	N	N	N
Characteristic	+	X	0	1	4

The location code describes the installation location of the assemblies contained in the circuit manual.

H... -> Control cabinets
 K... -> Terminal boxes
 P... -> Operating points
 X... -> System field

Production Equipment

== System = function + location – production equipment
Designation structure according to DIN EN 81346-1/DIN EN 81346-2

Ingenuity for life

[–] Production equipment identifier
Siemens AG designation system
Structure: Type ID/function ID

Implementation: Max. 4 characters/N = numbers/A = letters

Number of characters	K	1	2	3	4
	-	A	N	N	N
Characteristic		B	0	3	0
Example					

B... -> Position switch/proximity switch
C... -> Power switch/isolating switch/contactor
T... -> Power transformer/measuring transducer
F... -> Fuse/circuit breaker
Appendix 5 describes the unique function ID of the production equipment.
Designation signs describe the complete production equipment identifier with the respective PLC input/output.

The production equipment identifier describes the assembly name with ID letter of the assemblies contained in the circuit manual.

Example:
Designation sign with PLC address

133G028EHB001
=400WEA403
-B002
E1453.4

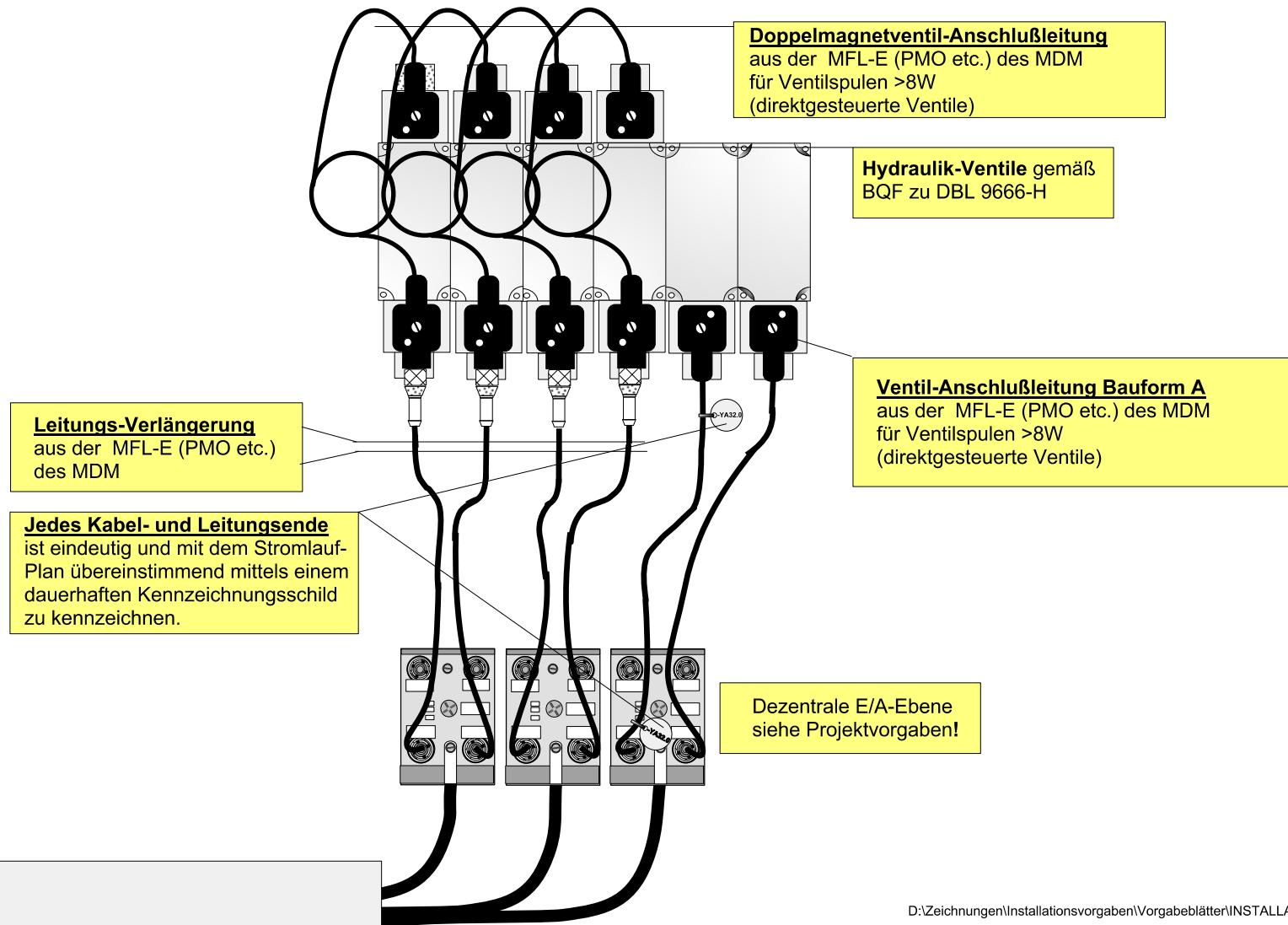
ben SPS Ein- / Ausgang.

Montagehinweise zum PPA-Lastenheft Teil III

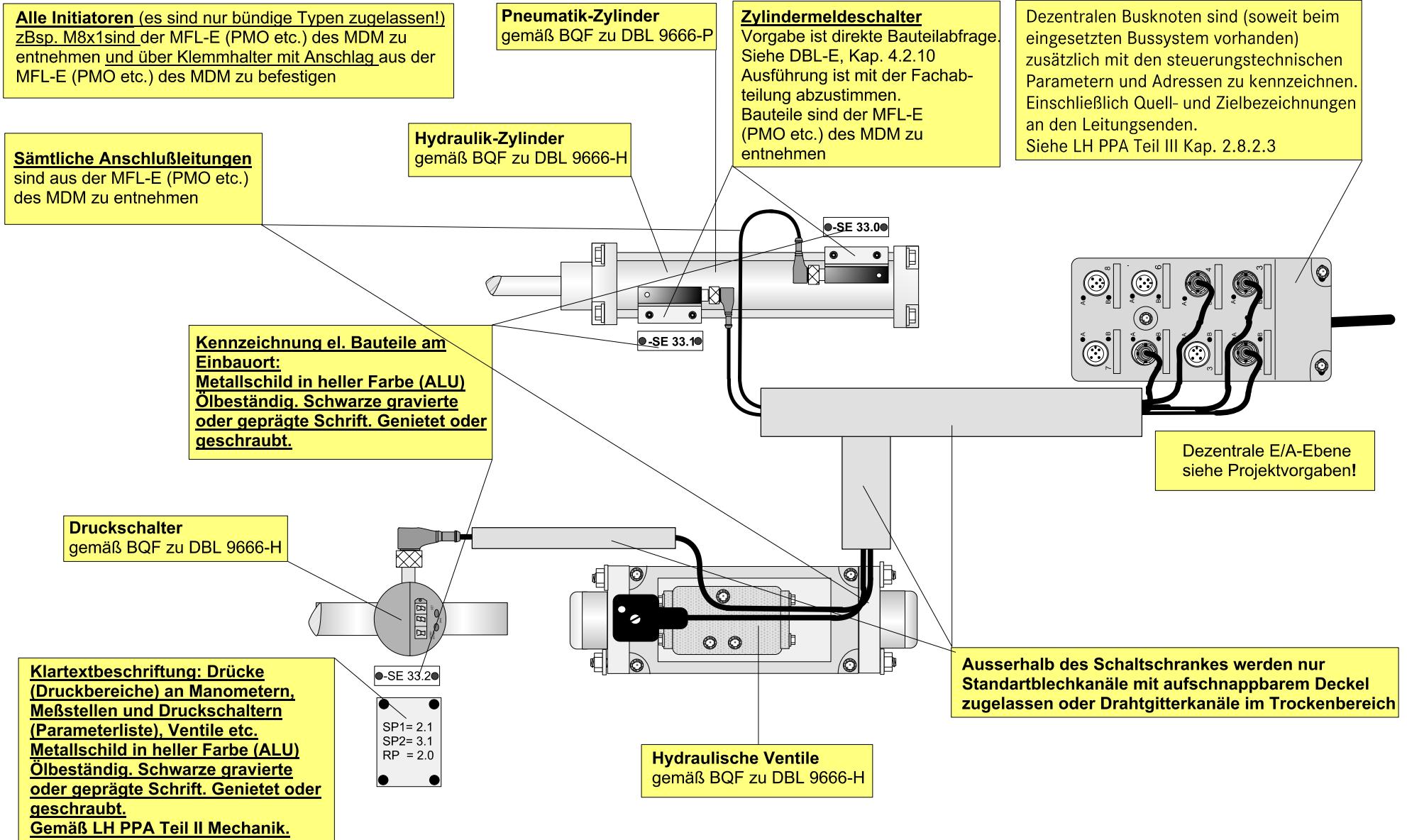
1. Beispiel 1 zur elektrischen Anlageninstallation:
Dezentrale Installation mittels Komponenten der MFL-E (PMO etc.) des MDM (Hydraulikventile größer 8 Watt Leistung).
2. Beispiel 2 zur elektrischen Anlageninstallation:
Dezentrale Installation mittels Komponenten der MFL-E (PMO etc.) des MDM.
3. Beispiel 3 zur elektrischen Anlageninstallation:
Dezentrale Installation mittels Komponenten der MFL-E (PMO etc.) des MDM.
4. Beispiel 4 zur elektrischen Anlageninstallation:
Dezentrale Installation mittels Komponenten der MFL-E (PMO etc.) des MDM (Pneumatikventile und Low-Watt Ventile).
5. Beispiel 5 zur elektrischen Anlageninstallation:
Schaltschrankvorgaben 1 (Generelle Vorgaben).
6. Beispiel 6 zur elektrischen Anlageninstallation:
Schaltschrankvorgaben 2 (Generelle Vorgaben).
7. Beispiel 7 zur elektrischen Anlageninstallation:
Schaltschrankvorgaben 3 (Generelle Vorgaben).
8. Beispiel 8 zur elektrischen Anlageninstallation:
Schaltschrankvorgaben (Zuleitungsanschluß).
9. Beispiel 9 zur elektrischen Anlageninstallation:
Schaltschrankvorgaben (Durchbruch in der Schaltschranktür für Hauptschalter-Handhabe).
10. Beispiel 10 zur elektrischen Anlageninstallation:
Schaltschrankvorgaben (Fehler bei der Schaltschrankkühlung).
11. Beispiel 11 zur elektrischen Anlageninstallation:
Schaltschrankvorgaben (Vorgaben Schaltschrankkühlung).
12. Beispiel 12 zur elektrischen Anlageninstallation:
Installation in Feld (Energieführungsketten).
13. Beispiel 13 zur elektrischen Anlageninstallation:
Installation in Feld (Affenschaukeln).
14. Beispiel 14 zur elektrischen Anlageninstallation:
Installation in Feld (Drehstromnorm-Motoren).
15. Beispiel 15 zur elektrischen Anlageninstallation:
Installation in Feld (Portale und Lader).
16. Beispiel 15 zur elektrischen Anlageninstallation:
Installation in Feld (Hydraulikaggregat).
17. Beispiel 17 zur elektrischen Anlageninstallation:
Installation in Feld (Roboter).

Beispiel 1 zur elektrischen Anlageninstallation

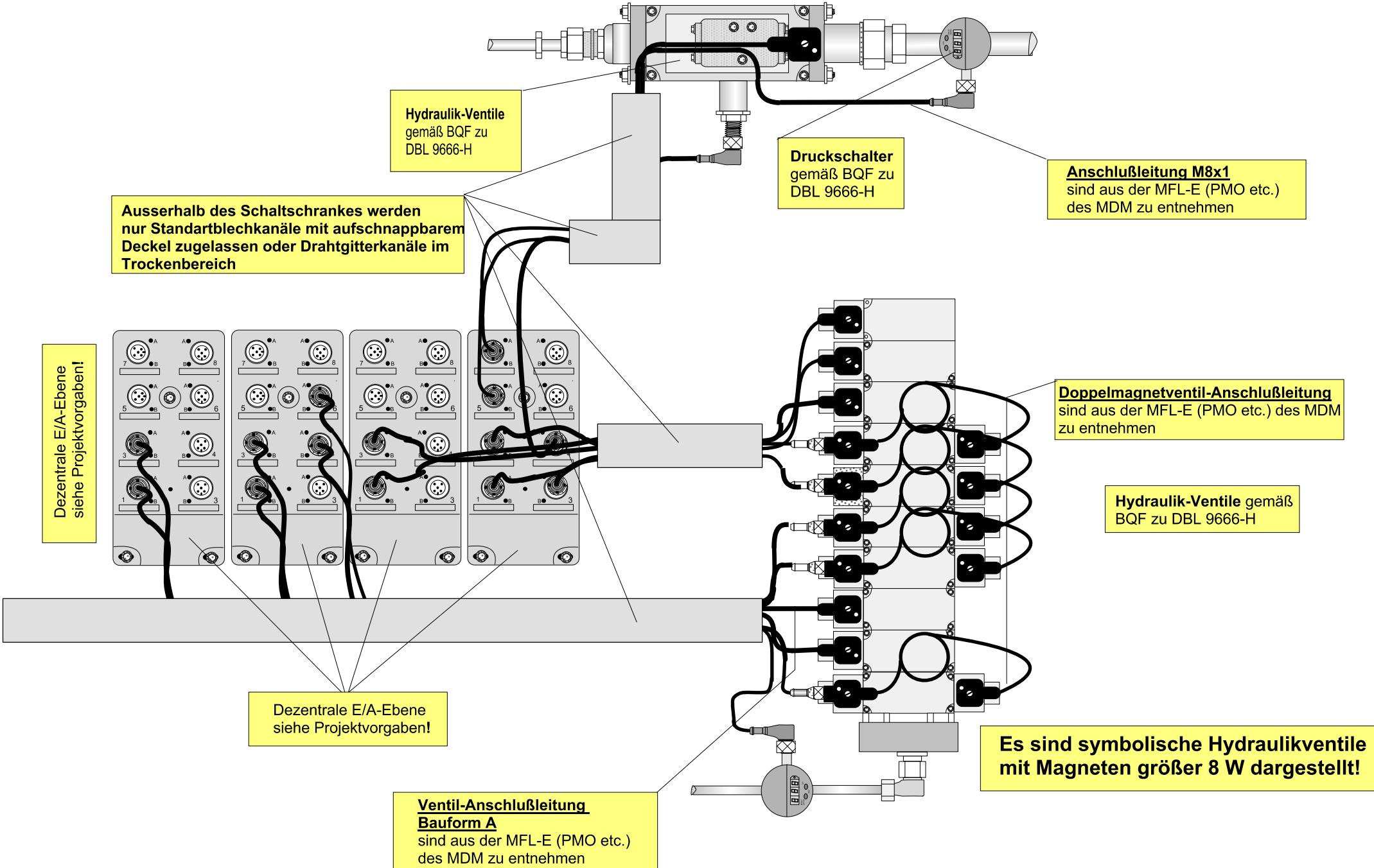
Es sind hier Hydraulik-Ventile mit Magneten größer 8W dargestellt. Alle anderen Ventile der Hydraulik und Pneumatik werden über M12x1 Zentralstecker angefahren!!!



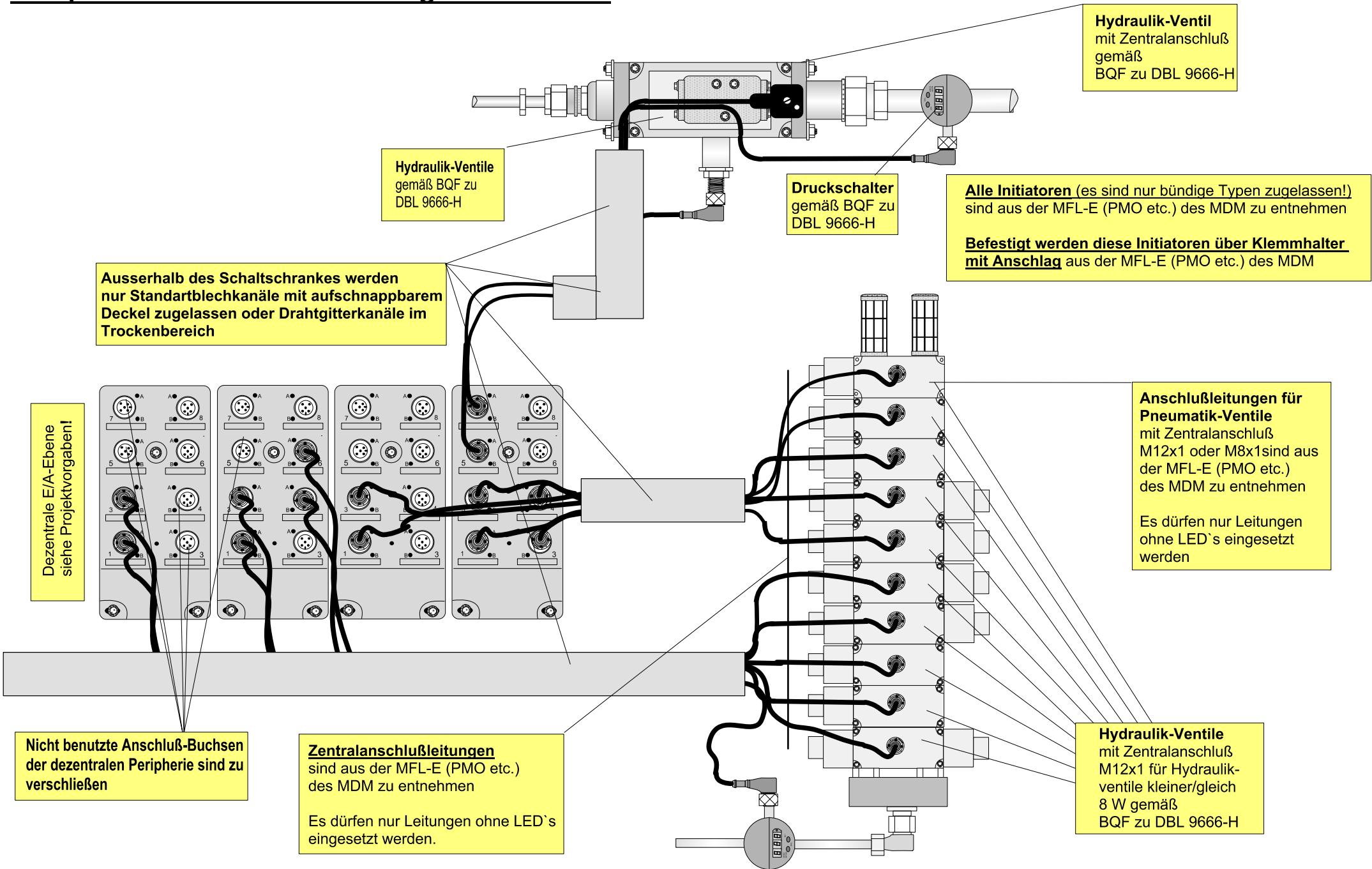
Beispiel 2 zur elektrischen Anlageninstallation



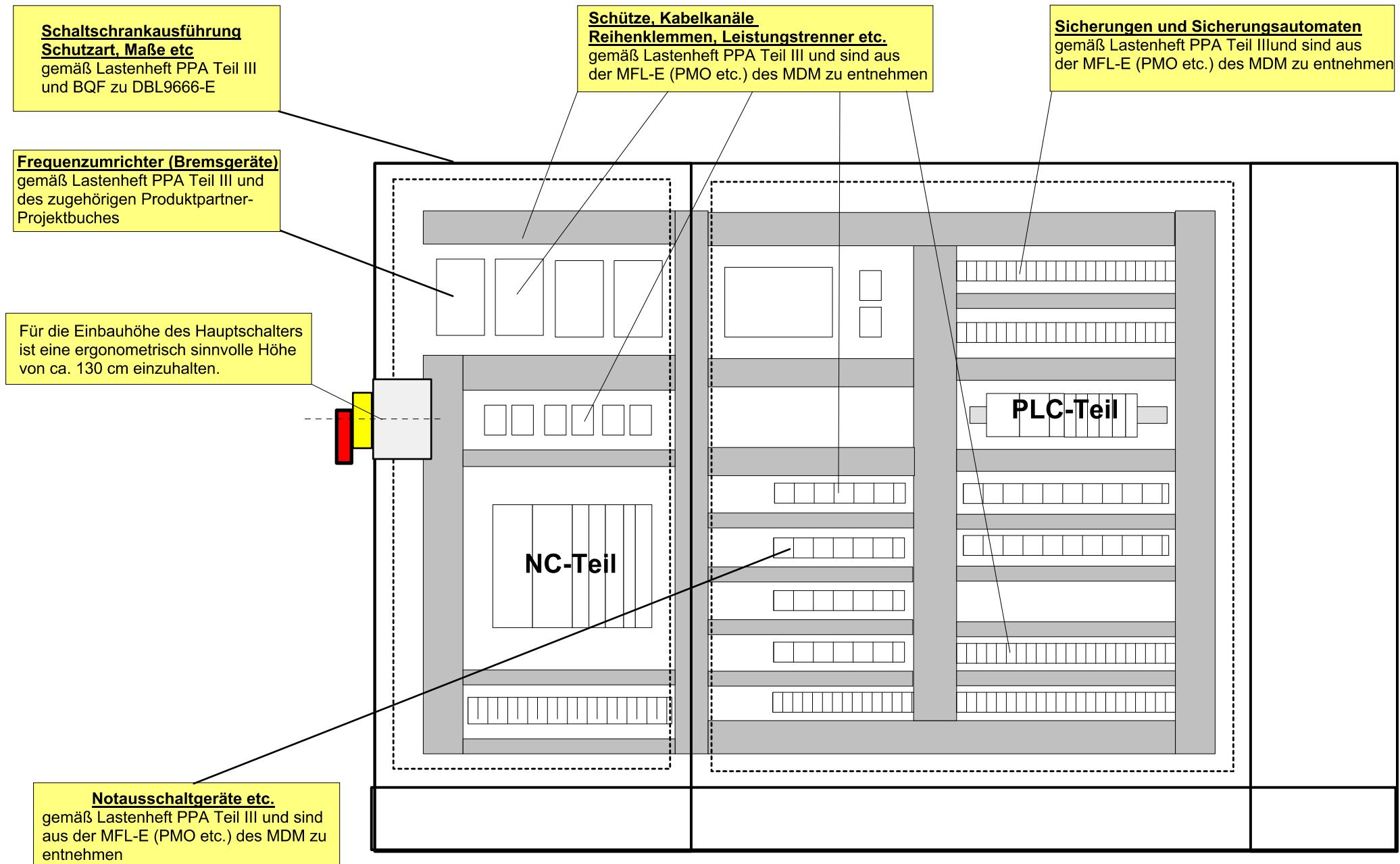
Beispiel 3 zur elektrischen Anlageninstallation



Beispiel 4 zur elektrischen Anlageninstallation



Beispiel 5 zur elektrischen Anlageninstallation



Beispiel 6 zur elektrischen Anlageninstallation (Schalschrankaufbauvorgaben)

Schließung von Schalschränken, Steuertafeln, Klemm- und Steckerkästen:

- unter 800 mm Umfangslänge der Türe: Schnellverschlüsse
- ab 800 mm Umfangslänge der Türe: Drehriegel
- über 1000 mm Türhöhe: Schubstangen mit Rollen und Mittenverriegelung u. Griff und Daimlerschließung
gemäß BQF zu DBL 9666-E Kap. 11.2

Installationsraum für elektrische Einbauten zw. 0,4 m bis 2,00 m von Zugangsebene gemäß EN 60204-1 Kap 12.2.1

Leitungsrangierung bei von der Maschine getrennte stehenden Schalschränke sind über Steckerschränke mit Klemmadapter auszuführen gemäß Lastenheft PPA Teil III Kap. 2.4.4.1.1

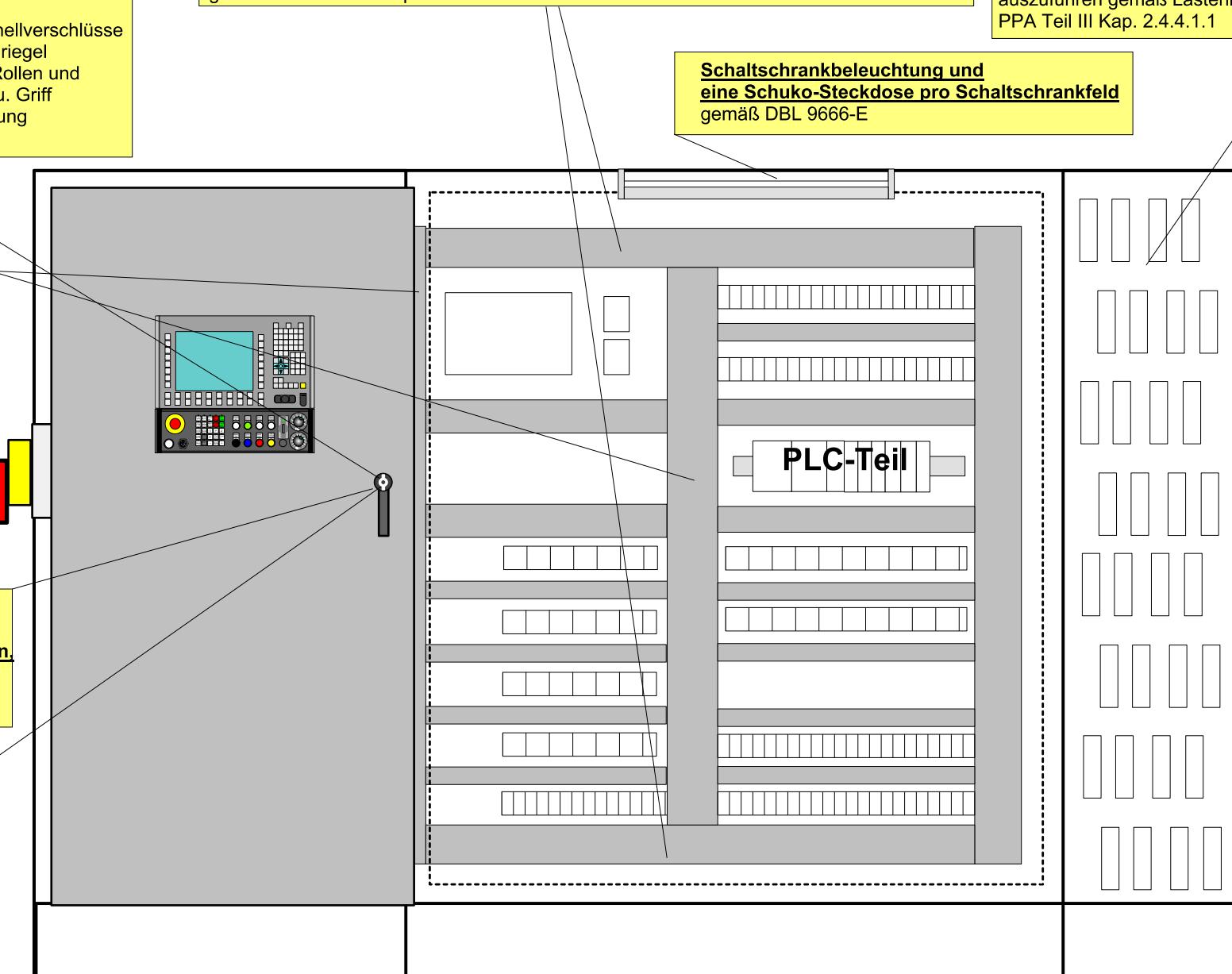
Schalschrankbeleuchtung und eine Schuko-Steckdose pro Schalschrankfeld gemäß DBL 9666-E

Hinter Längsholmen mehrflüglicher Schalschränke dürfen keine elektrischen Bauteile verbaut werden, es sind nur Kabelkanäle etc. zugelassen, gemäß Lastenheft PPA Teil III

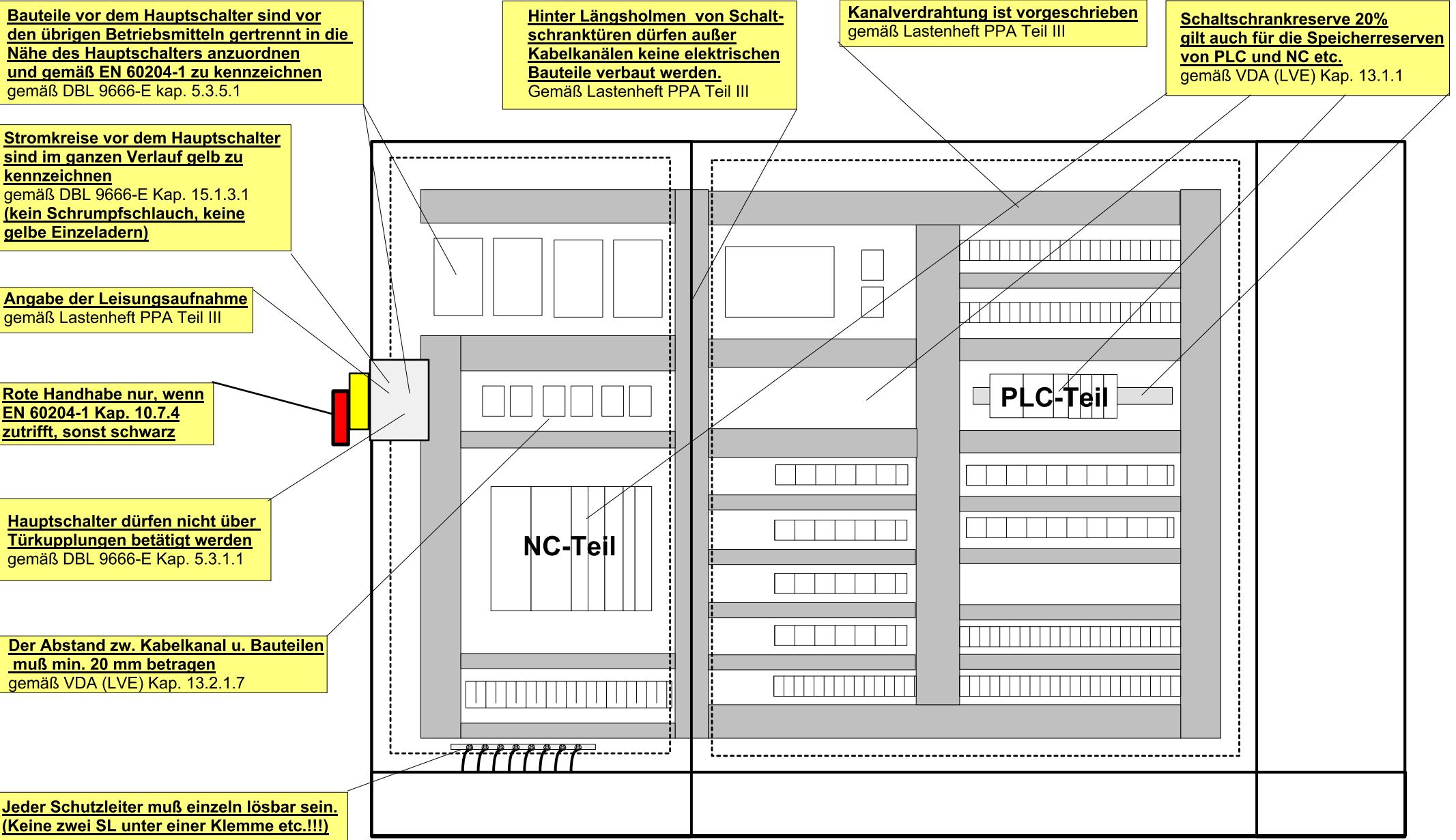
Das Öffnen des Schalschranks muß mit Schalschrank-Schlüssel und ohne Abschalten des Hauptschalters möglich sein, gemäß EN 60204-1, Kap. 6.2.1.c, da alle aktiven Teile gegen direktes Berühren geschützt sind.

Türschließung gemäß BQF zu DBL9666-E Kap. 11.02: Verschlußkappe DIN 18252, DIN 1303 Profilhalbzylinder 40mm

Moosgummi darf im Schalschrank nicht verwendet werden, siehe LH PPA Teil III Kap. 2.3.6



Beispiel 7 zur elektrischen Anlageninstallation (Schaltschrankaufbauvorgaben)



Beispiel 8 zur elektrischen Anlageninstallation

Gerätekennzeichnung:

Alle Geräte im Schaltschrank sind eindeutig und dauerhaft mittels Reiter an einer Ader über- oder unterhalb des Bauteils zu kennzeichnen.

DC-Netzteile sind der MFL-E (PMO etc.) des MDM zu entnehmen

Achsmodule sind zusätzlich im Klartext mit dem Achsnamen zu bezeichnen.

Der Hauptschalter sollte, wenn möglich in die Seitenwand verbaut werden, da er dann ohne Zwischenklemmung mit der Zuleitung angefahren werden kann.
(Preiswerteste und sicherste Lösung)

Maschinenanschluß:

In die Nähe des Anschlußpunktes muß die Anschlußmöglichkeit für den PE vorhanden sein.

In die Seitenwand sollte eine Schiene zum mech. Abfangen der Zuleitung verbaut werden.

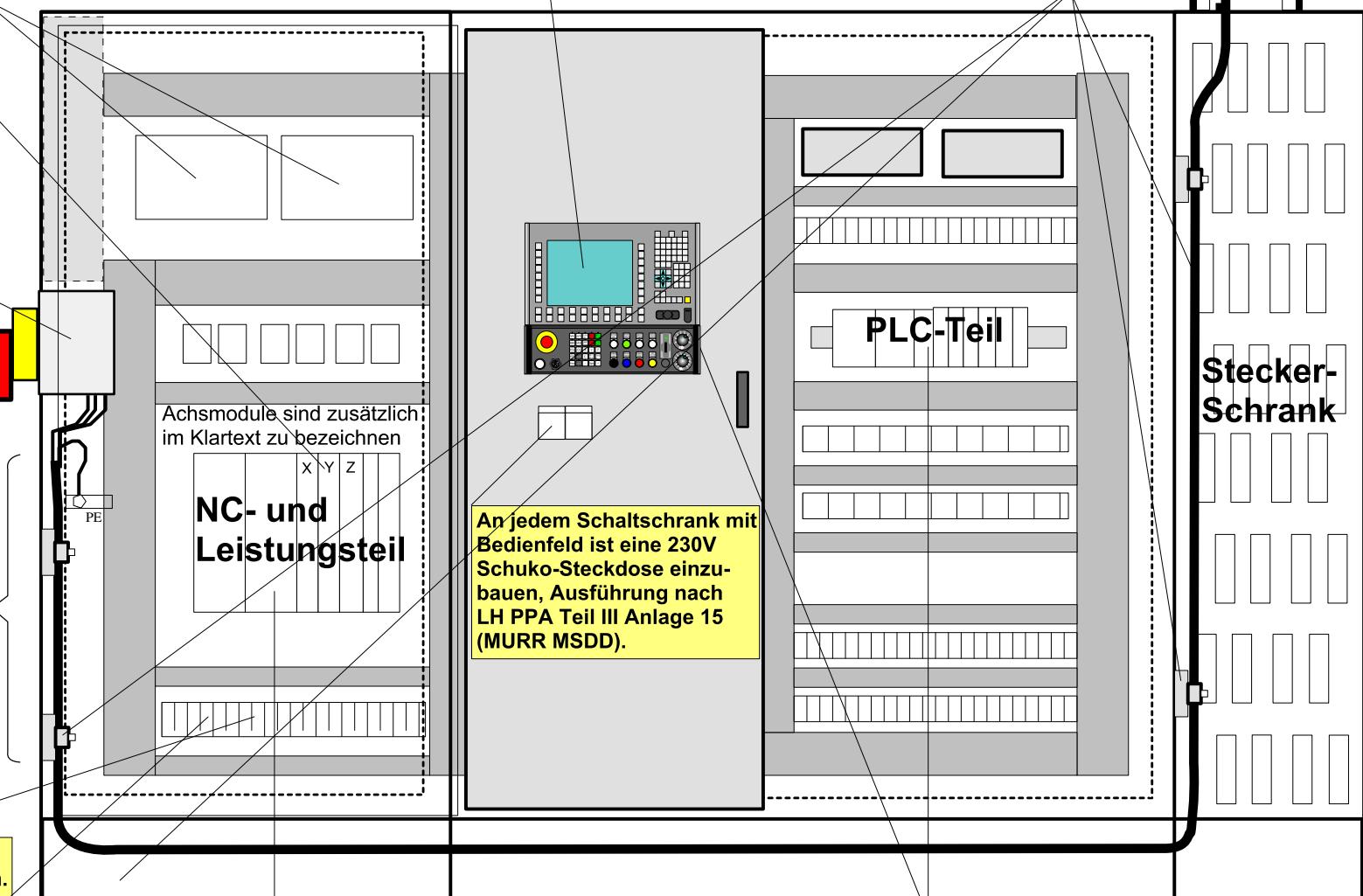
Der Lieferant hat entsprechende Anschlussmöglichkeiten - mit ausreichendem Platz und Zugentlastung - vorzusehen

Siehe LH PPA Teil III Kap.2.1.1, 2.1.1.4 und 2.1.6.

- Der Einbau von Fronteinbaugeräten muß über Gewinde bzw. Gewindenieten erfolgen um einen einfachen Ein- und Ausbau zu ermöglichen.
- Die ergonomische Höhe von 1,65 m Mitte Bildschirm ist einzuhalten!
- Die Leitungsführung zw. Tür und Schaltschrank ist mittels einem teilbaren Schlauch auszuführen. Gemäß LH PPA Teil III.

Die Zuführung der elektrischen Zuleitung erfolgt von oben. Auf dem Schaltschranksdach muß ein freier Platz für eine Steigtrasse vorhanden sein. Die Schaltschränkeinführung darf aber nur von oben erfolgen, wenn sie absolut dicht ausführbar ist (mit ICOTEK-Einführelemente aus der MFL-E (PMO etc.) des MDM zu entnehmen).

Für die elektrische Zuleitung muß, entsprechend ihrem Querschnitt, einausreichender Rangieraum, innerhalb des Schaltschranks vorhanden sein.



Keine zwei Drähte unter einer Klemme.

Alle Adern die auf Klemmen geführt werden sind mit der Klemmennummer zu bezeichnen.

PLC- und NC-Baugruppen etc. und Zubehör, sind der Komponentenliste des Produktpartners im Lastenheft PPA Teil III zu entnehmen. Die einzusetzenden Softwaremodule und die zugehörigen Softwarestände sind ebenfalls dem Produktpartnerprojektbuch zu entnehmen. Die Aktualisierungen der Softwarestände sind gemäß LH PPA Teil III bis zur Endabnahme kostenfrei nachzuführen!

Beispiel 9 zur elektrischen Anlageninstallation (Schaltschrankaufbauvorgaben)

Hauptschalter in der Schaltschranktür

Schließung von Schaltschränken, Steuertafeln, Klemm- und Steckerkästen:

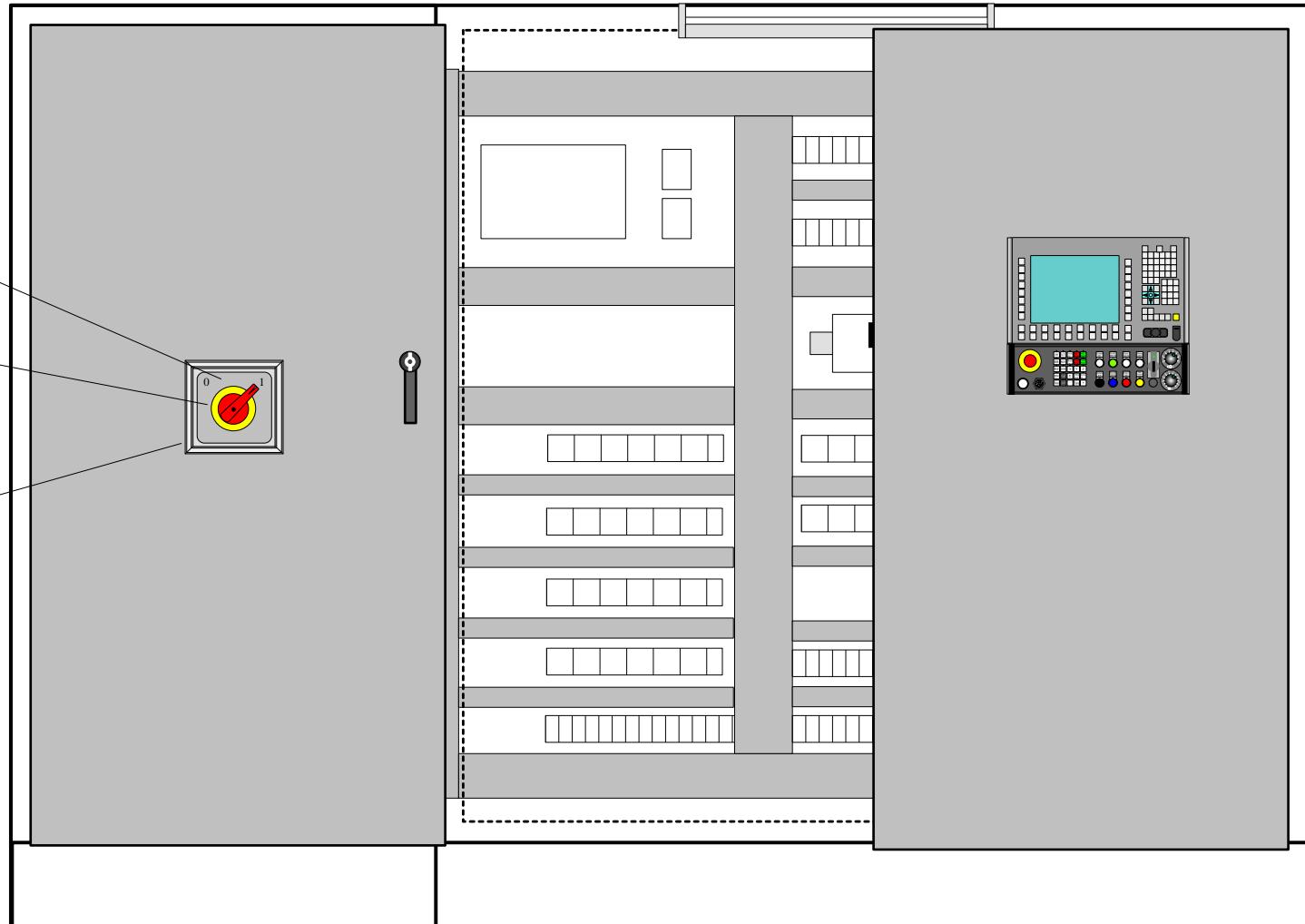
-unter 800 mm Umfangslänge der Türe: Schnellverschlüsse
-ab 800 mm Umfangslänge der Türe: Drehriegel
-über 1000 mm Türhöhe: Schubstangen mit Rollen und
Mittenverriegelung u. Griff
und Daimlerschließung
gemäß BQF zu DBL 9666-E Kap. 11.2

Hauptschalter großer Leistung:
Hauptschalter vorgebaut auf der Montageplatte mittels Adapter und Hauptschalter-Befestigung der Fa. Häwa.

Schaltschranktür mit Durchbruch für die Hauptschalter-Handhabe

Abdichtung des Türdurchbruchs zur Erreichung der geforderten Schutzart mittels der Türabdeckung der Fa. Häwa

Türsachließung gemäß BQF zu DBL 9666-E
Kap. 11.02: Verschlußkappe DIN 18252,
DIN 1303 Profilhalbzylinder 40mm



Beispiel 10 zur elektrischen Anlageninstallation (Fehler beim Einsatz von Schaltschrankkühlung - Felder mir roter Umrahmung)

Seitenanbau Luftwasser-Wärmetauscher gemäß der MFL-E (PMO etc.) des MDM.

Installationsvorgaben gemäß Teil II des Lastenheftes PPA, Kap. Maschinenkühlung.

Durch das im Schaltschrank vorgebaute Gerät ergibt sich ein thermischer Kurzschluß, so daß keine Wärmeleistung aus dem Schaltschrank abgeführt wird.

Durch die Einbaulage des Wärmetauschers kann die Kühlung die Leistungsmodule nicht umströmen, da der Luftauslass über der Unterkante der Leistungsmodule sitzt. Abhilfe schaffen hier eventuell Luftpfeibleche.

NC-Teil

Dachaufbau Luftwasser-Wärmetauscher gemäß der MFL-E (PMO etc.) des MDM.

Installationsvorgaben gemäß Teil II des Lastenheftes PPA, Kap. Maschinenkühlung.

Luftaustritt

Lufteintritt

Vorbauendes Gerät.

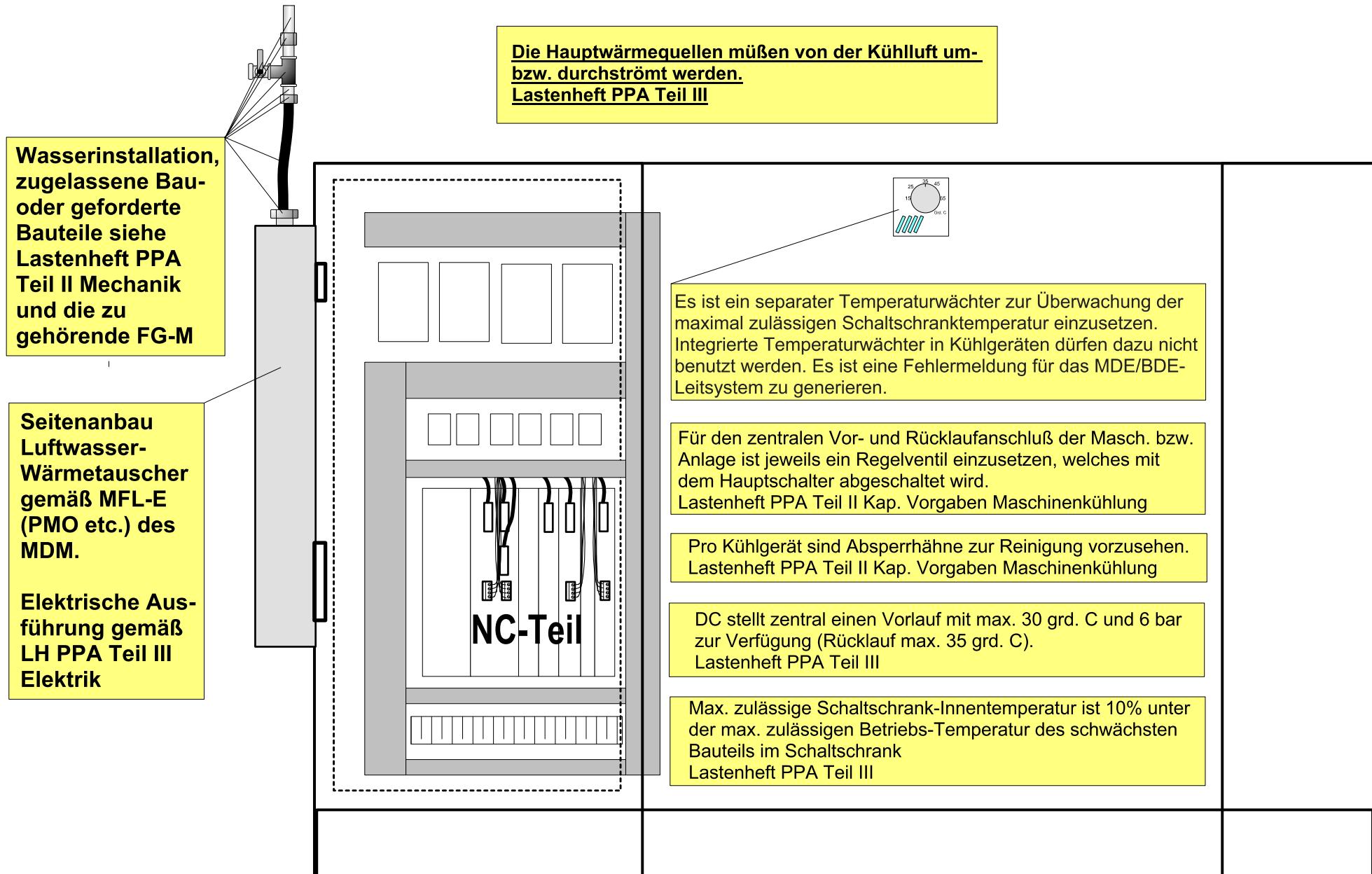
PLC-Teil

Die abgehenden Leitungen sind über die Leistungsmodule geführt. Der thermische Konvektionsraum der Module wird verbaut und die Leitungen werden durch die Abwärme der Leistungsmodule über ihre zulässige Temperatur erhitzt.

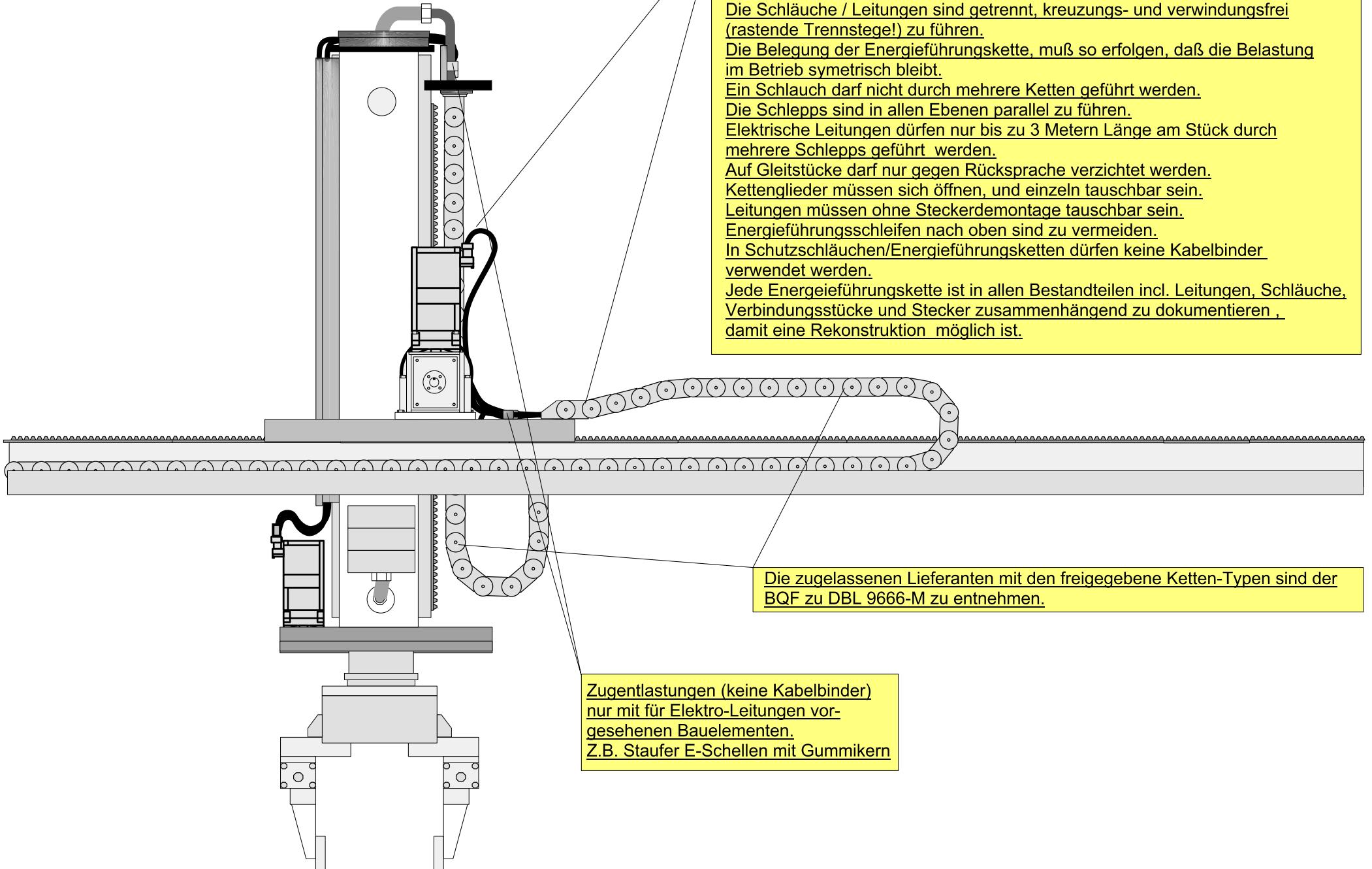
Die Leitungen sind am Konvektionsraum der Module vorbeizuführen. Ein umlaufender Kabelkanal oberhalb der Module hat sich bewährt.

Beispiel 11 zur elektrischen Anlageninstallation

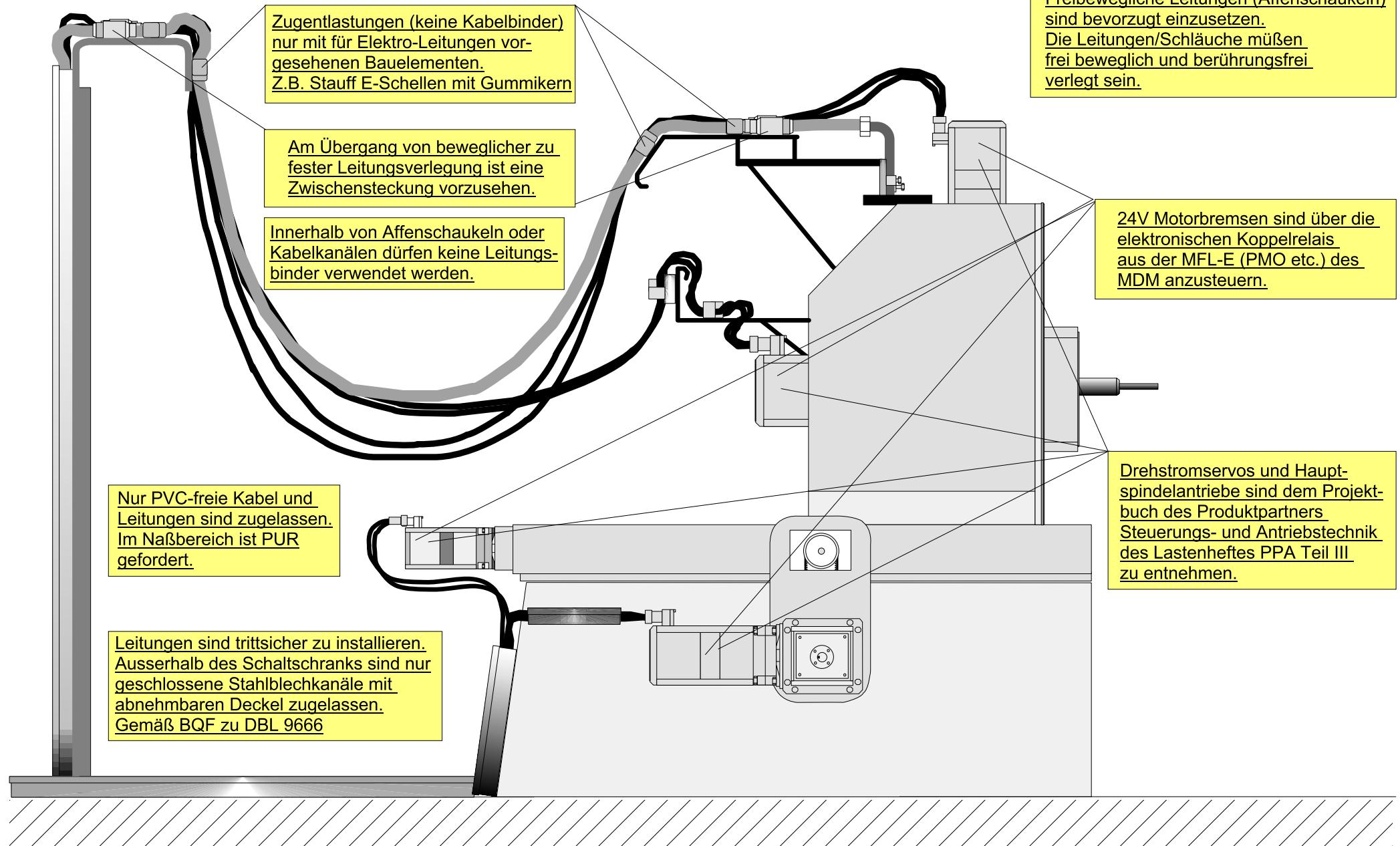
Schaltschrankkühlung



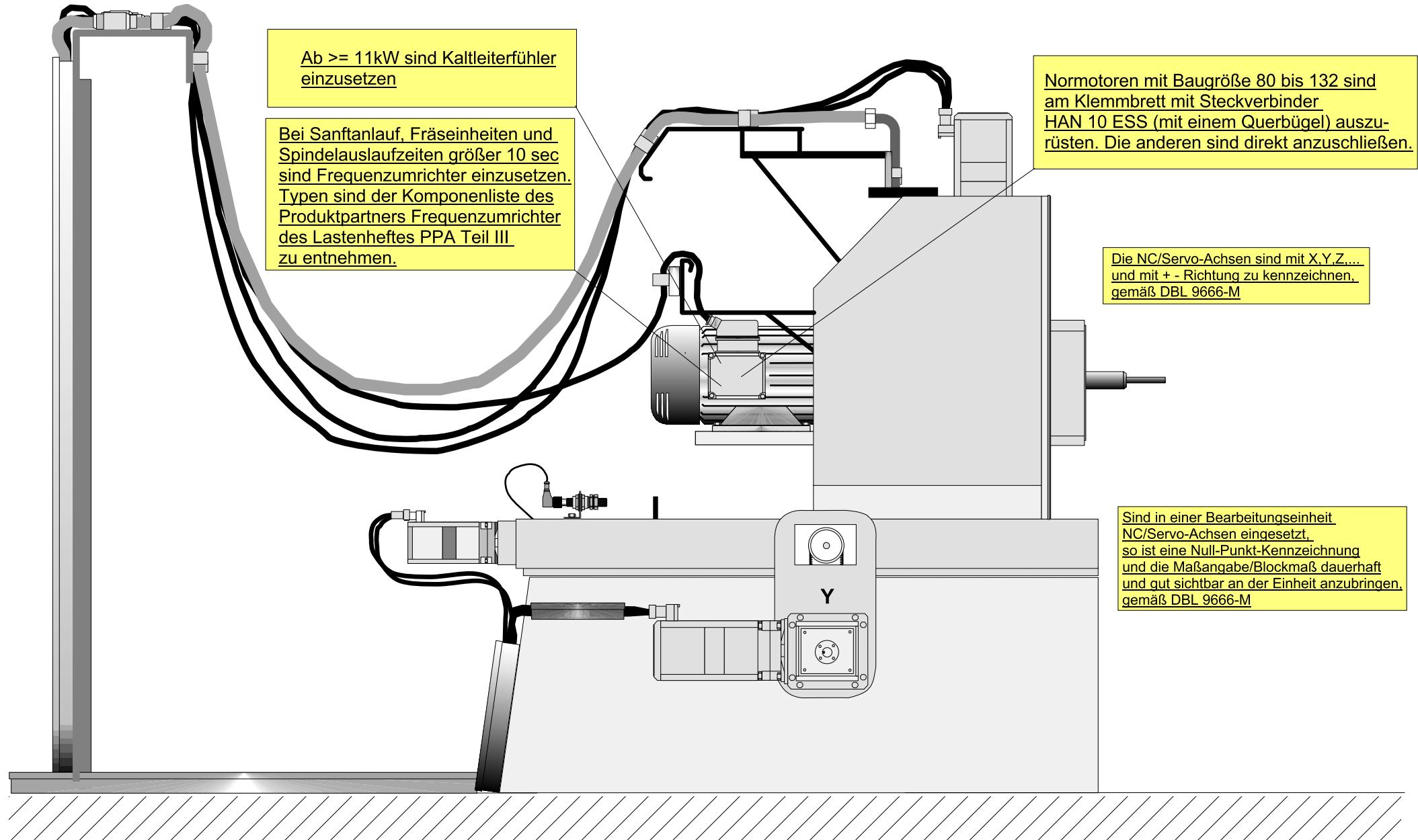
Beispiel 12 zur elektrischen Anlageninstallation (Energieführungsketten)



Beispiel 13 zur elektrischen Anlageninstallation (Affenschaukeln)

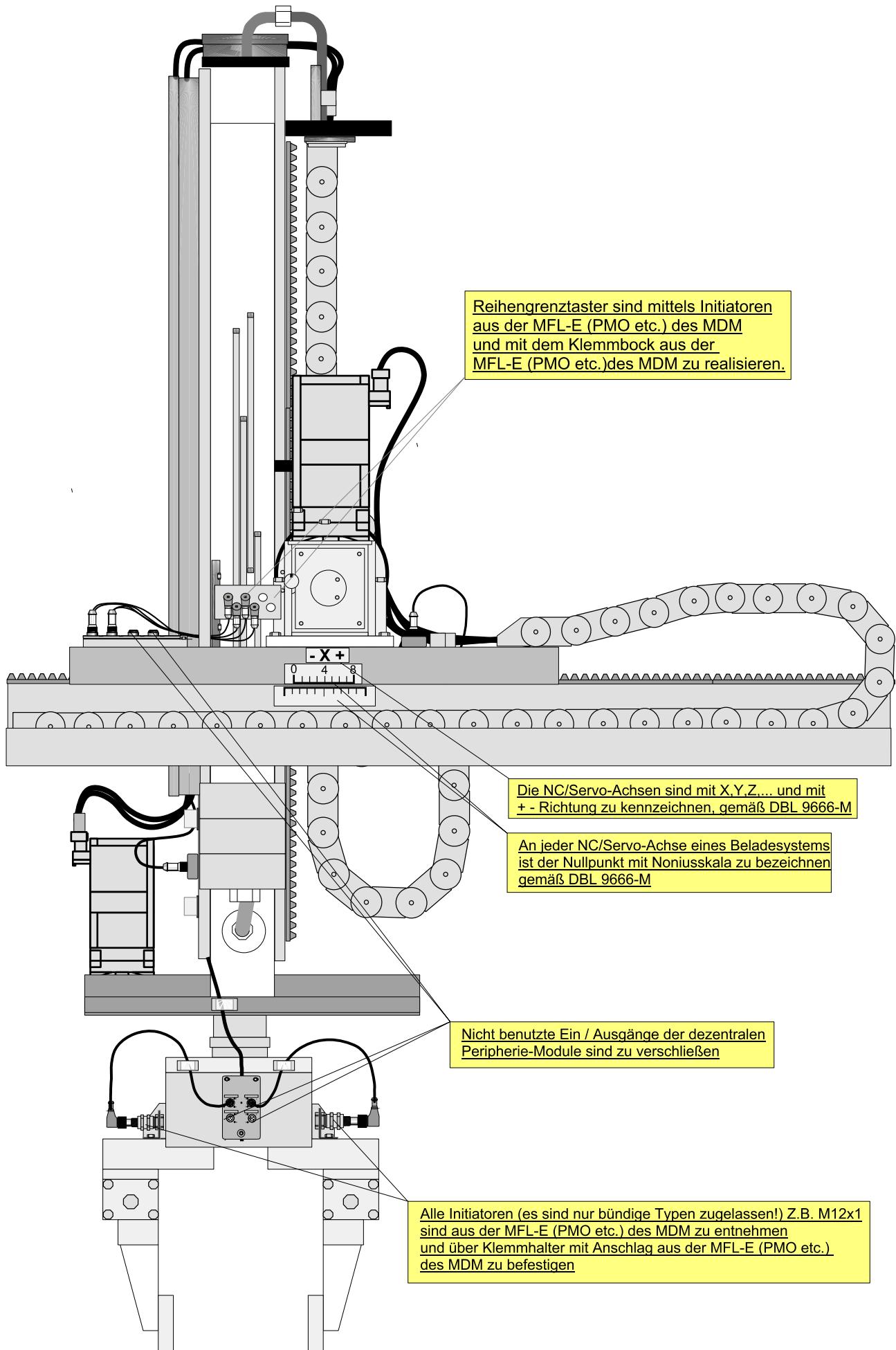


Beispiel 14 zur elektrischen Anlageninstallation (Drehstromnormmotoren)

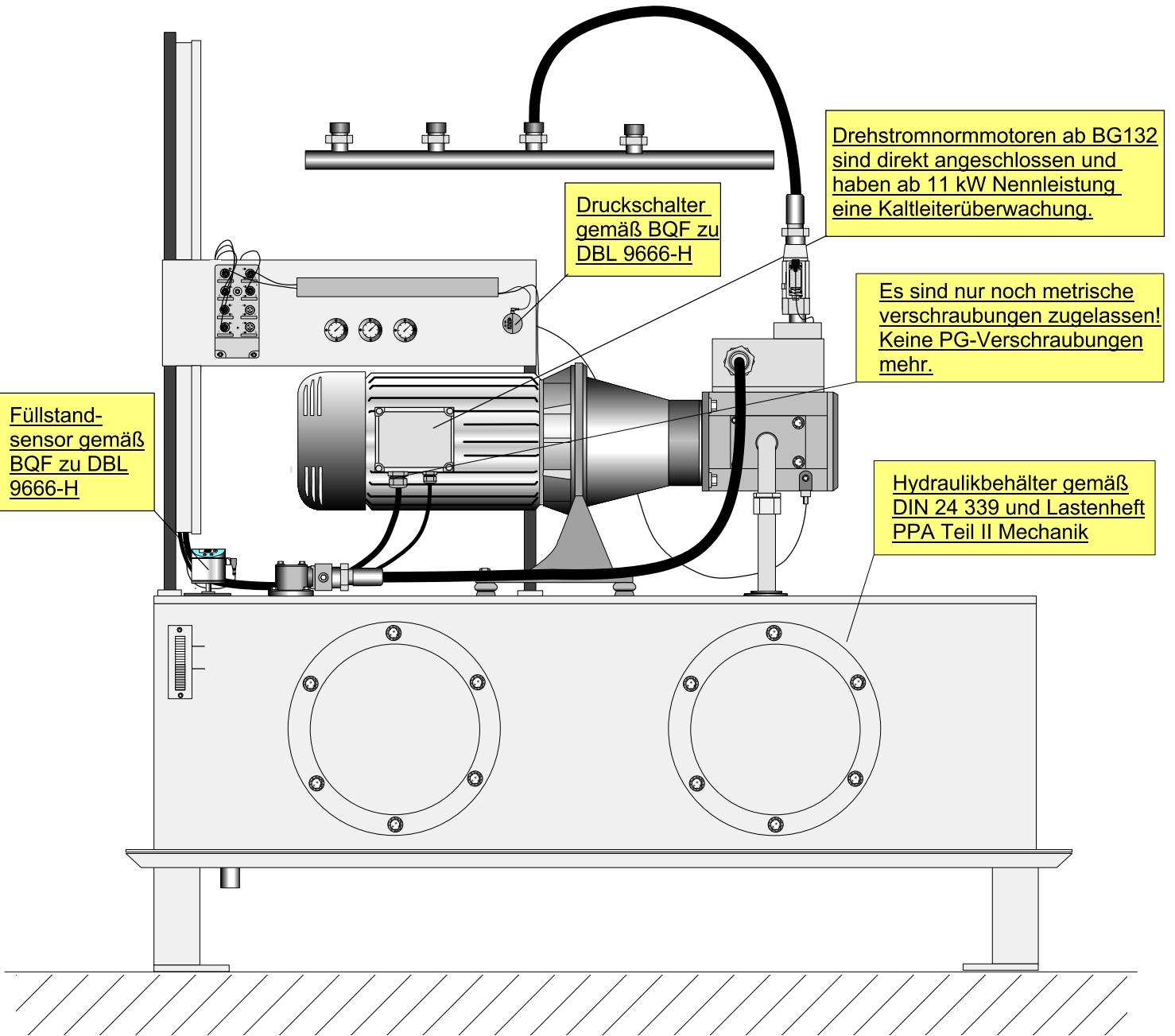


Beispiel 15 zur elektrischen Anlageninstallation

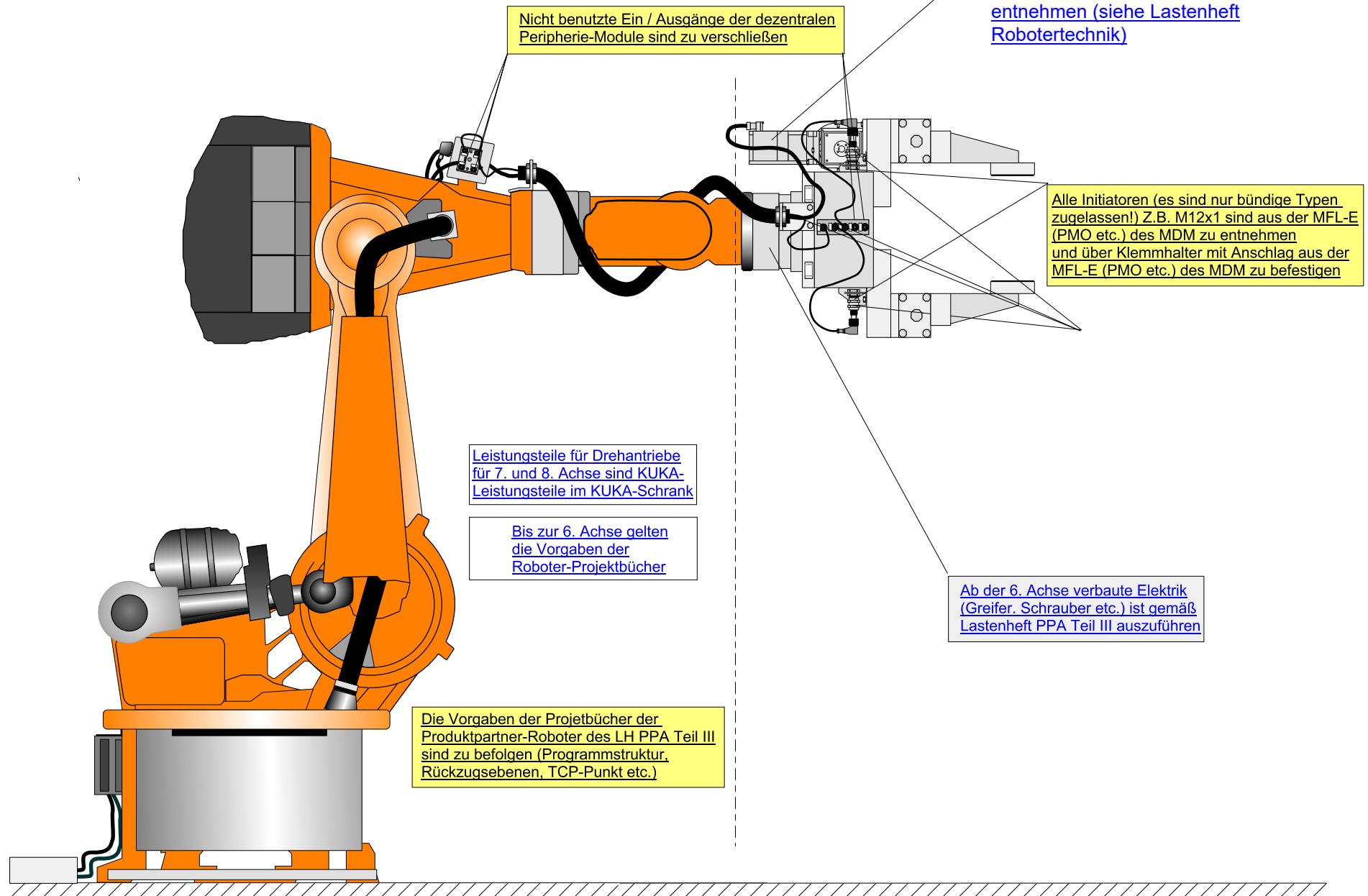
(Portale und Lader)



Beispiel 16 zur elektrischen Anlageninstallation



Beispiel 17 zur elektrischen Anlageninstallation (Roboter)



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Powertrain Requirement Specifications

Part III Appendix 7b

Switch Principle: Switching Machines On/Off Remotely

Version 1.3

Version	1.3	Number of pages	4
Last revised	05/2014		
File / template	Appendix 07b - Switch Principle - Remote Switch Machines On Off [en].docx		

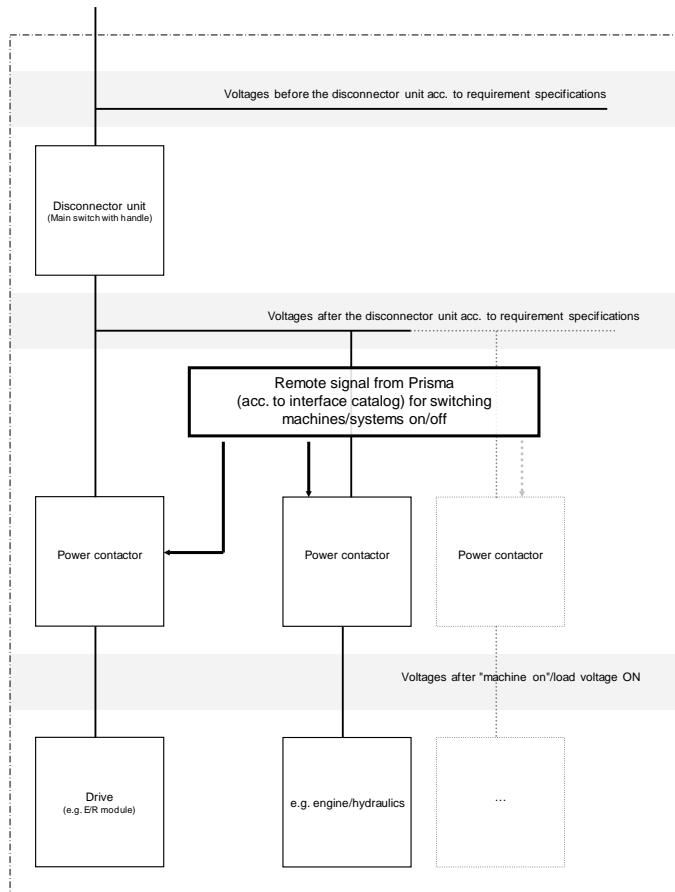
Table of Contents

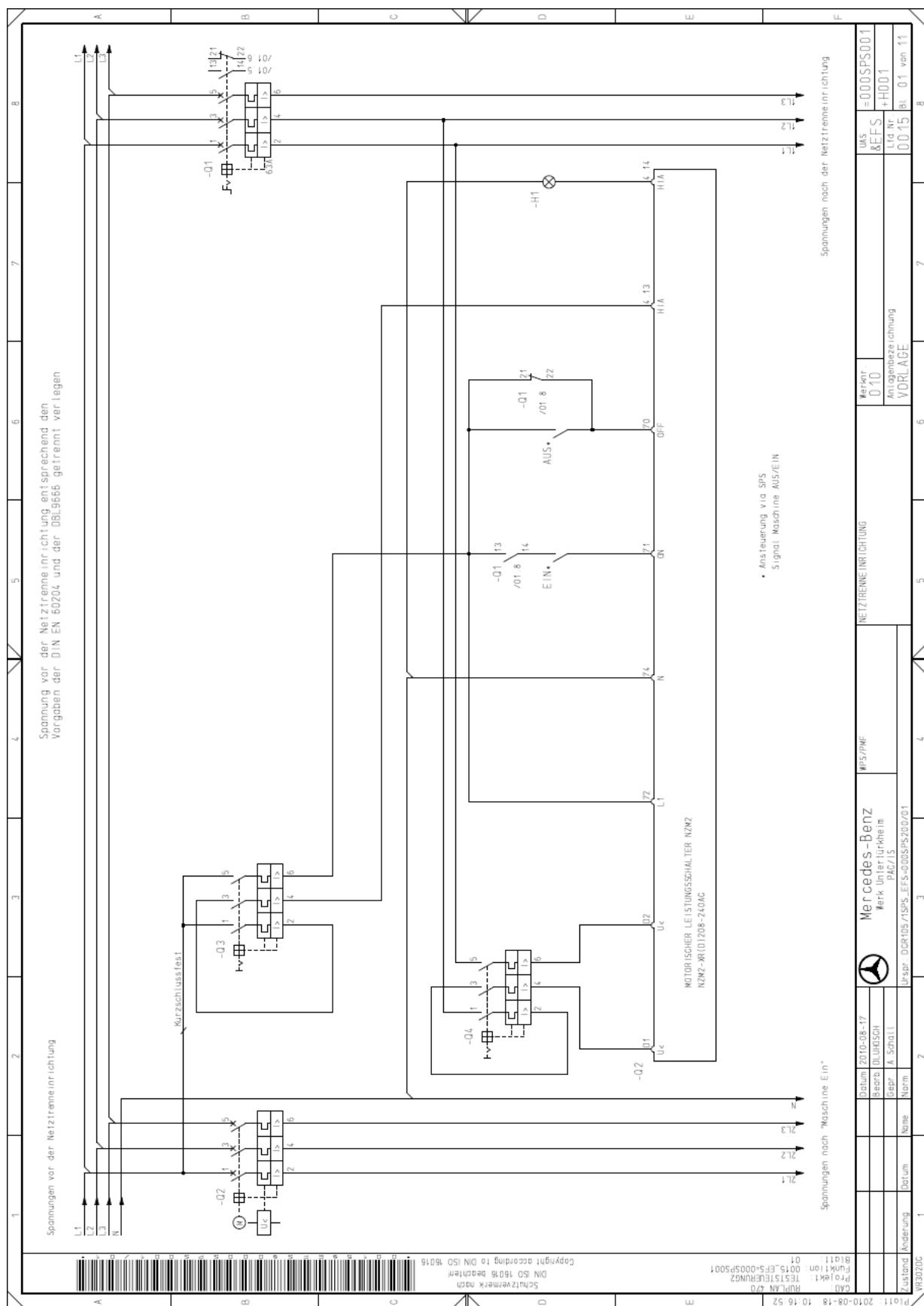
1	Record of Revisions.....	3
2	Switch Principle: Switching Machines On/Off Remotely	4

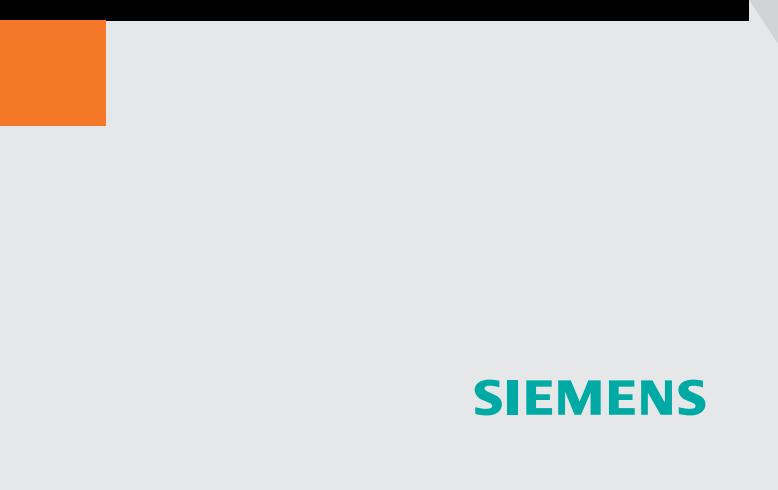
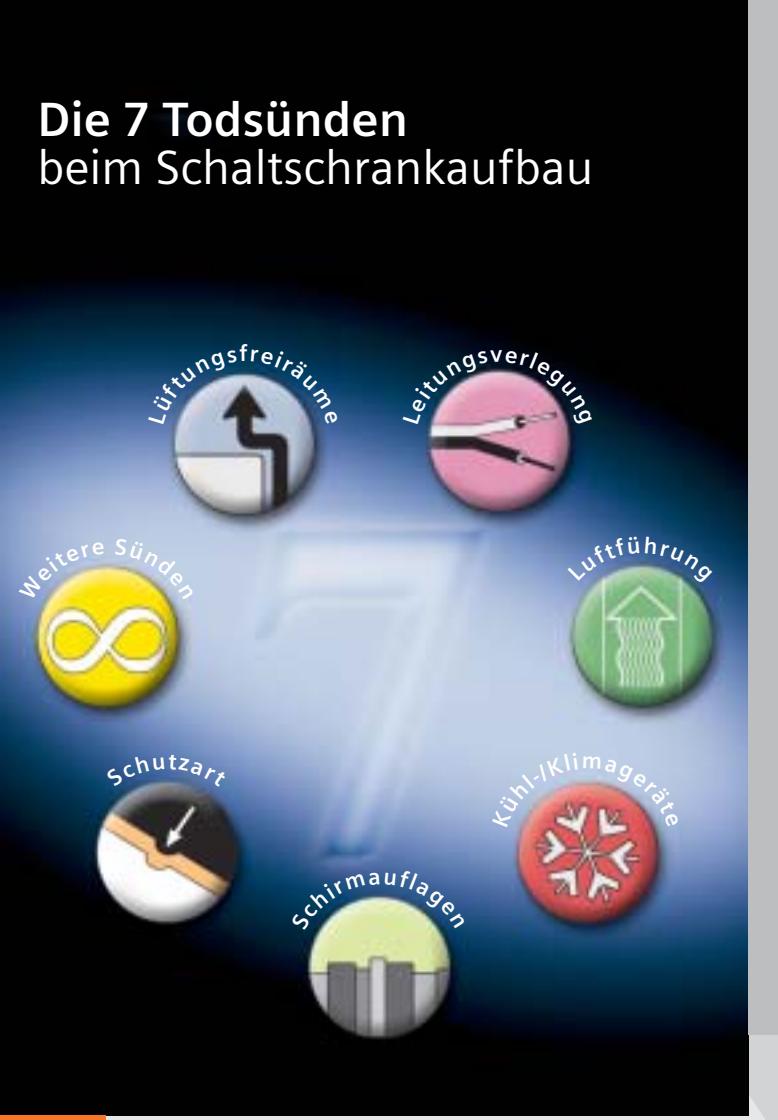
1 Record of Revisions

Version:	Last revised:	Chapter:	Revised by:
1.0	29.09.11	General revision	Daniel Moch
1.2	23.07.12	Loading strategy added	Daniel Moch
1.3	26.05.14	Update	Frank Erdle

2 Switch Principle: Switching Machines On/Off Remotely







SIEMENS

Die 7 Todsünden beim Schaltschrankaufbau

Inhalt Content



Werden die Projektierungsvorschriften für unsere Geräte im Schaltschrank nicht eingehalten, so führt dies zu einer deutlichen Reduzierung der Lebensdauer von Bauteilen und es kommt zu Frühausfällen bei den Komponenten!

Failure to observe the configuration guidelines for devices in the switchgear cabinet can significantly reduce the lifetime of components or cause them to fail prematurely.

Achtung Important

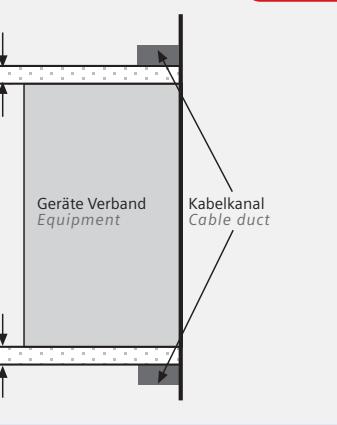
Beim Schrankaufbau sind die in der technischen Dokumentation beschriebenen Hinweise unbedingt zu beachten.

The instructions in the technical documentation should be adhered to when installing components in the switchgear cabinet.



Lüftungsfreiräume oben und unten Ventilation space Top and bottom

FALSCH WRONG

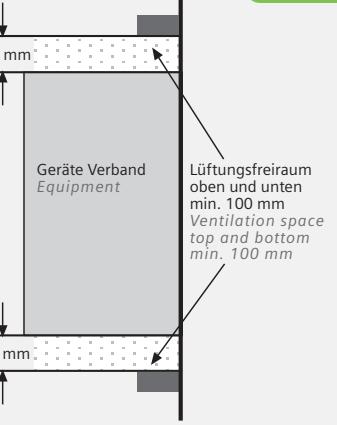


Leitungsverlegung Wiring

WRONG FALSCH



RICHTIG RIGHT



RIGHT RICHTIG



Zulufttemperatur max. 40 °C, bei höheren Temperaturen (max. 55 °C) muss eine Leistungsreduzierung erfolgen. Siehe Projektierungsanleitung „Klimatische Umgebungsbedingungen“.

Intake air temperature max. 40 °C. For higher temperatures (max. 55 °C), derating is necessary. See the configuration manual under "Climatic conditions"

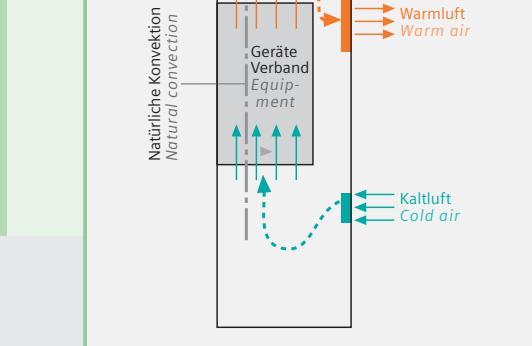
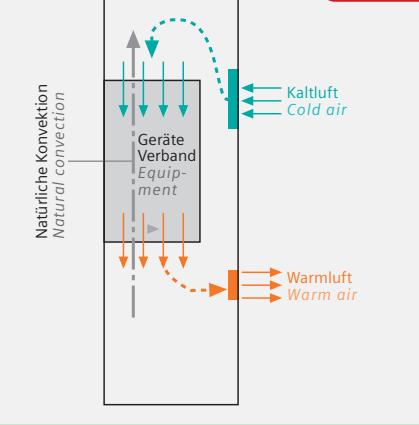
Es dürfen keine Leitungen auf den Geräten verlegt werden, die Lüftungsgitter müssen frei bleiben. Besonders kritisch sind die 50 mm schmalen Geräte. Verriegelungselemente an Steckern sind anzuschrauben/einzurasten. Leistungs- und Signalleitungen sind räumlich getrennt zu verlegen.

Cables must not be placed on top of devices. The ventilation slots must be kept clear. This is especially important for the 50 mm wide devices. The locking mechanisms on connectors must be screwed down or snapped into place. Power and signaling cables must be routed separately.



Luftführung Air circulation

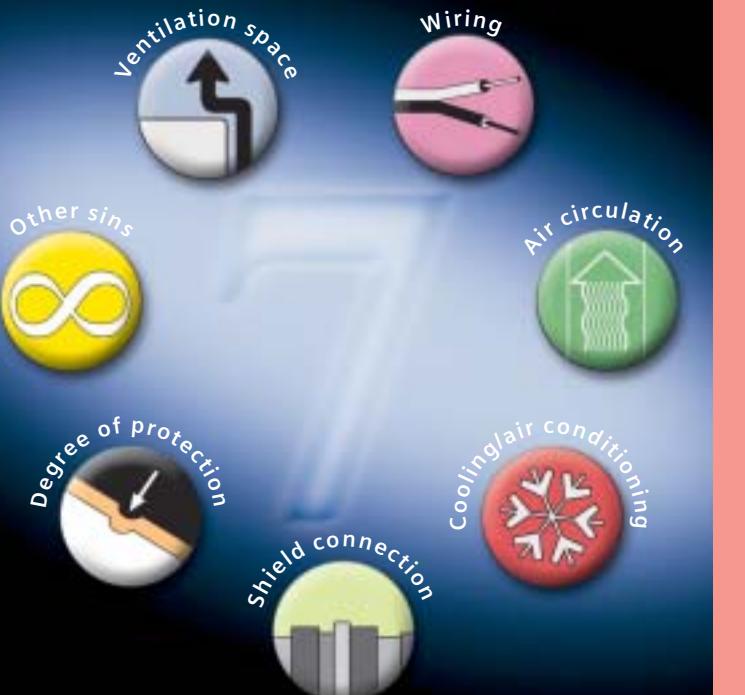
FALSCH WRONG



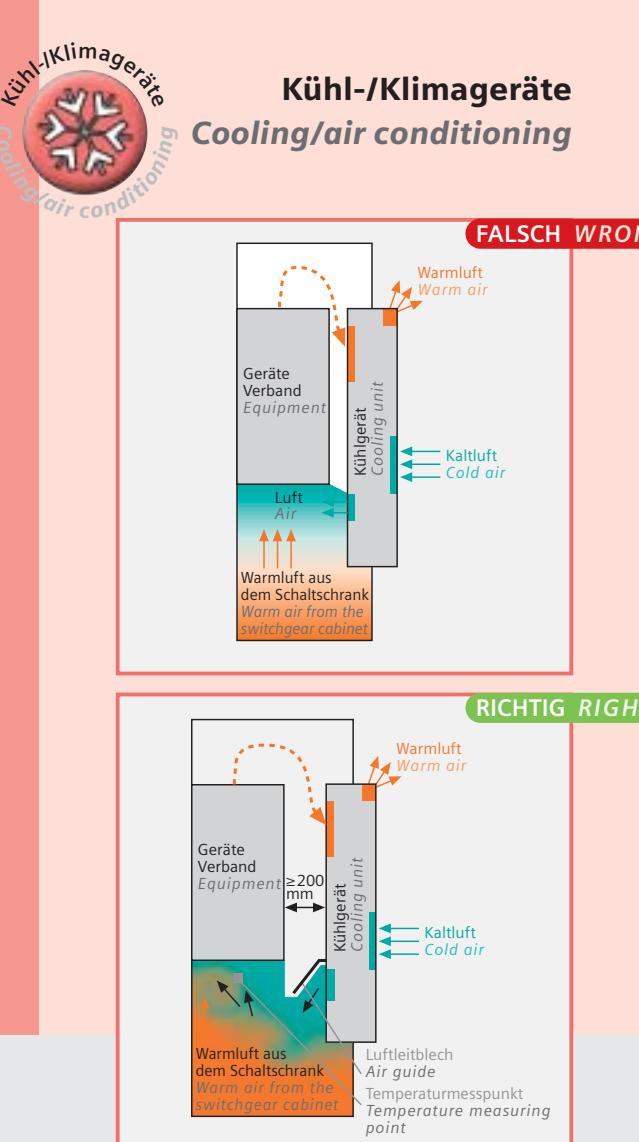
Die Luftführung in den Geräten muss gemäß natürlicher Konvektion von unten nach oben sein.

The air circulation must flow from the bottom to the top in accordance with natural convection.

Important installation instructions in switchgear cabinet installation

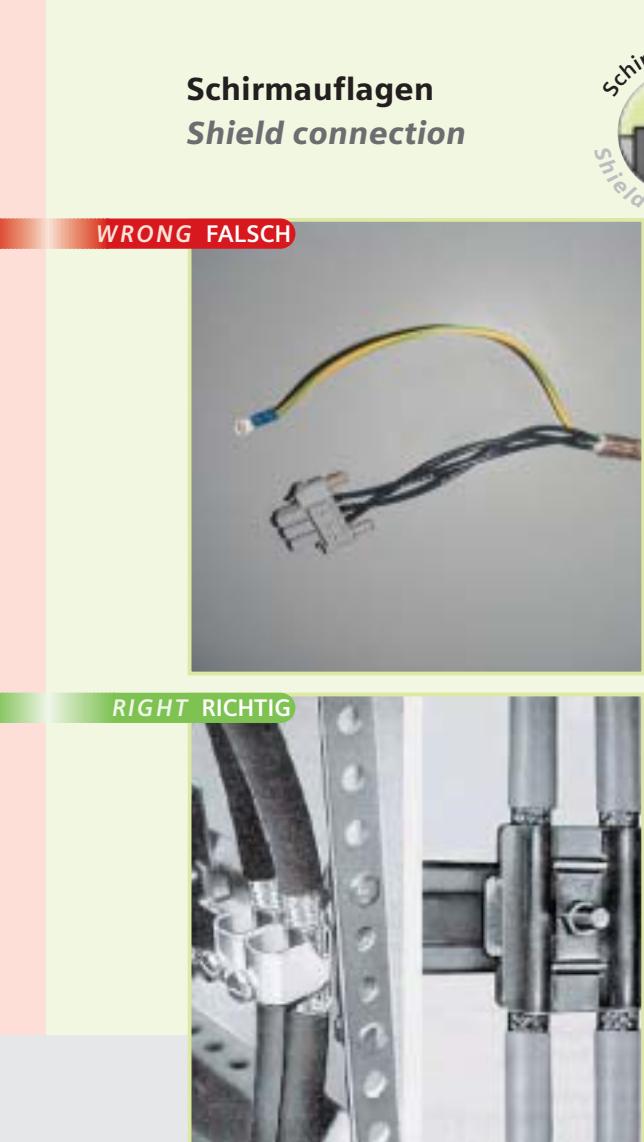


SIEMENS



Beispiel: Eine als angenehm empfundene Hallentemperatur hat 25 °C mit 60% relativer Luftfeuchte. Die im Schaltschrank eingeschlossene Luft erreicht beim Abkühlen auf 20 °C die kritische Grenze von 80% relativer Luftfeuchte in der angeblasenen Luft. Beim weiteren Abkühlen auf 16 °C wird bereits der Taupunkt erreicht.

Example: A shop floor temperature of 25 °C with 60% humidity is perceived as pleasant. The air enclosed in the switchgear cabinet reaches the critical limit of 80% relative humidity in the blown air on cooling down to 20 °C. If the air cools down even further to 16 °C, the dew point is reached.



Die Schirme sind großflächig aufzulegen.
Die Verwendung von „Schirm-Schwänzchen“ setzt die Schirmwirkung deutlich herab.

The shields must be connected over a large surface area.
If "shield tails" are used, the effectiveness of the shield is significantly reduced.



Nachträgliche Arbeiten an der Außenhaut von Schaltschränken, z.B. neue Kabeleinführungen, können die Schutzart deutlich herabsetzen. Dadurch dringt Feuchtigkeit, Schneidöl, leitfähiger Schmutz oder ionisierte Luft in den Schaltschrank ein. Als Folge muss mit Ausfällen von Komponenten durch Isolationsversagen gerechnet werden.

Subsequent work on the outer casing of a switchgear cabinet, e.g. creating new cable inlets, can reduce the degree of protection significantly. This can cause moisture, cutting oil, conductive dirt or ionized air to enter the switchgear cabinet which can result in component failures due to insulation breakdown.



- Falsche Schalterstellung am DIP-Schalter
 - Block „Sinus“
 - Netzspannung 480 V/400 V
- Schrauben nicht angezogen an Klemmen bzw. Zwischenkreis
- Falsches Drehfeld der externen Lüfter
- Incorrect DIP switch position
 - Block "Sine-wave"
 - Mains voltage 480 V/400V
- Loose screws on terminals or intermediate circuit
- Incorrect rotating field of external fan



Product Partnerships for Automation Technology MBC/Powertrain										
Plant	Berlin	Hamburg	Untertürkheim/Kölleda/Arnstadt/Kamenz/Jawor/Sebes/Beijing plant sections						All	
Center			Axle Production/Foundry and Forge (PT/S)	Transmission Production (PT/G)	Battery installation	Engine Production (PT/M)				All
Projects	All *	All *	All *	All *	All *	All *				Supply/disposal central
Production:										
PLC and CNC control systems incl. I/O components	Siemens	Fanuc	Siemens	Fanuc	Siemens	Fanuc	Siemens	Fanuc	Siemens	Siemens
Field bus system	Profinet		Profinet		Profinet		Profinet		Profinet	
Servo drives (feed/main spindle drive)	Siemens	Fanuc	Siemens	Fanuc	Siemens	Fanuc	Siemens	Fanuc	Siemens	Siemens
Visualization systems	Siemens		Siemens	Fanuc	Siemens	Fanuc	Siemens	Fanuc	Siemens	Siemens
Programming tool	Simatic Manager/S7 Graph		Simatic Manager/S7 Graph		Simatic Manager/S7 Graph		Simatic Manager/S7 Graph		Simatic Manager/S7 Graph	**
Assembly (S7-1500):										
PLC control systems incl. I/O components	Siemens		Siemens		Siemens		Siemens		Siemens	Siemens
Field bus system	Profinet		Profinet		Profinet		Profinet		Profinet	
Visualization systems	Siemens		Siemens		Siemens		Siemens		Siemens	
Programming tool	TIA Portal/S7 Graph		TIA Portal/S7 Graph		TIA Portal/S7 Graph		TIA Portal/S7 Graph		TIA Portal/S7 Graph	**
Electrical screwdriver systems and electr. Manual screw/nutdriver	Apex		Bosch-Rexroth		Apex	BoschRexroth	BoschRexroth		Apex	Apex
Frequency converters and gear motors	SEW		SEW		SEW		SEW		SEW	SEW
Trucks/Powertrain										
Plant	Gaggenau	Mannheim	Kassel							
Projects	All *	All *	All *							
Production:										
PLC and CNC control systems incl. I/O components	Siemens	Fanuc	Siemens	Fanuc	Siemens	Fanuc	Siemens	Fanuc	Siemens	Siemens
Field bus system	Profinet		Profinet		Profinet		Profinet		Profinet	
Servo drives (feed/main spindle drive)	Siemens	Fanuc	Siemens	Fanuc	Siemens	Fanuc	Siemens	Fanuc	Siemens	
Visualization systems	Siemens		Siemens		Siemens		Siemens		Siemens	
Programming tool*	Simatic Manager/S7 Graph		Simatic Manager/S7 Graph		Simatic Manager/S7 Graph		Simatic Manager/S7 Graph		Simatic Manager/S7 Graph	
Assembly:										
PLC control systems incl. I/O components	Siemens		Siemens		Siemens		Siemens		Siemens	
Field bus system	Profinet		Profinet		Profinet		Profinet		Profinet	
Visualization systems	Siemens		Siemens		Siemens		Siemens		Siemens	
Programming tool**	S7-300: Simatic Manager/S7 Graph S7-1500: TIA-Portal/S7 Graph		S7-300: Simatic Manager/S7 Graph S7-1500: TIA-Portal/S7 Graph		S7-300: Simatic Manager/S7 Graph S7-1500: TIA-Portal/S7 Graph		S7-300: Simatic Manager/S7 Graph S7-1500: TIA-Portal/S7 Graph		S7-300: Simatic Manager/S7 Graph S7-1500: TIA-Portal/S7 Graph	
Electrical screwdriver systems and electr. Manual screw/nutdriver	Apex	Bosch Rexroth	Apex	Bosch Rexroth	Apex	Bosch Rexroth	Apex	Bosch Rexroth	Apex	Apex
Frequency converters and gear motors	SEW		SEW		SEW		SEW		SEW	SEW

Remark: If two or more product partners are approved per location, Daimler will specify the product partner on a project-specific basis.

Legend:

* To be determined with the individual RFQ which column or which product partner applies

** Project-specific specification

Technical Definition

**Use of Additional
I/O Modules at
Approved Valve
Clusters**

Version 1.0

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1.1 Preface	1
1.2 Record of Revisions.....	1
2. Technology.....	2
2.1 Additional I/O Modules.....	2
2.2 Assumptions	2

1. General Information

1.1 Preface

The present technical definition governs the use of additional I/O modules at approved valve clusters.

The information makes no claim to completeness and the technical boundary conditions shall be coordinated with Daimler AG in the corresponding project phase in individual cases, if necessary.

1.2 Record of Revisions

Version:	Last revised:	Chapter:	Changed by:
1.0	05.03.2019	<i>New draft</i>	Weiss, Mangone

2. Technology

2.1 Additional I/O Modules

The following modules may be used on the valve cluster if required:

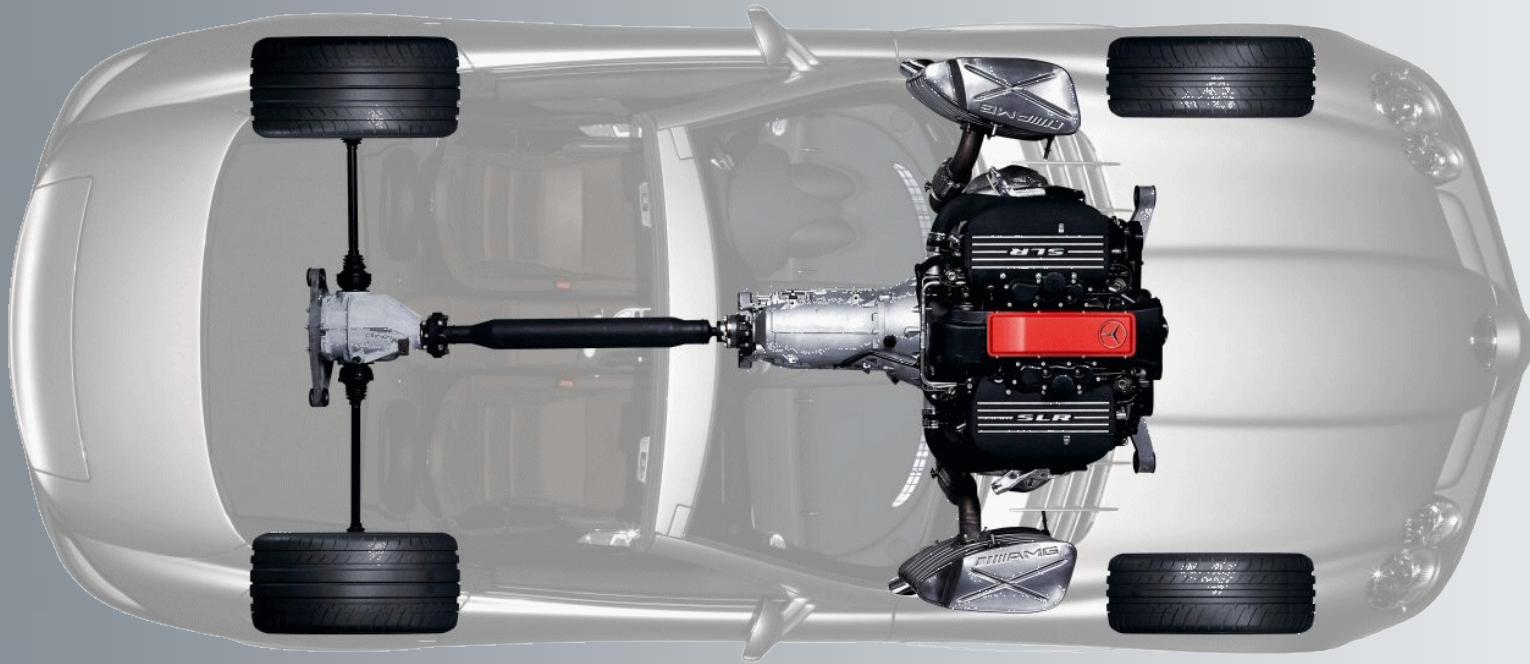
- | | |
|-----------------|------------------------------|
| → Input module | TN 550202, CPX-16DI-D; Festo |
| → Output module | TN 550204, CPX-8DA-H; Festo |

2.2 Assumptions

- Generally the specifications from the PPA LH for fluid and control engineering including installation guidelines shall be complied with
- Input and output modules may not be used without valves
- A maximum of two input modules for PT per valve cluster
- A maximum of one output module for PT per valve cluster
- Component selection, type and limitation via valve cluster configurator
- The output module may be used only for pneumatic actuators (e.g. cut-in valve of the air transformer)



Mercedes-Benz



Basic Requirement of Standardized Data Acquisition in PLA

Last revised: August 2010

Basic requirement of standardized data acquisition in PLA



All requirements apply to both assembly and production!

- Stations, operation steps and characteristics must be given descriptive names.
- Every station, operation step or characteristic message must contain a status (OK, not OK, not selected, inactive) generated by the system.
- Completed ID acquisitions (DMC, barcode, RFID) must be listed in the station messages as characteristics, displayed as plain text and saved as installation.
- If electronically controlled devices (power screwdriver, cameras, installer sleeves, etc.) are used at the station, a characteristic must be created from this.
- Characteristics which represent measurement values (tightening torque, press-in force, etc.) shall only be transmitted if the limit values have been violated (not OK).
- Standby positions only report to PLA when they are required, otherwise the message is “INACTIVE”.
- Standby positions must display what has been reworked.
The not OK characteristic from the automatic station must be adopted.

Basic requirement of standardized data acquisition in the PLA



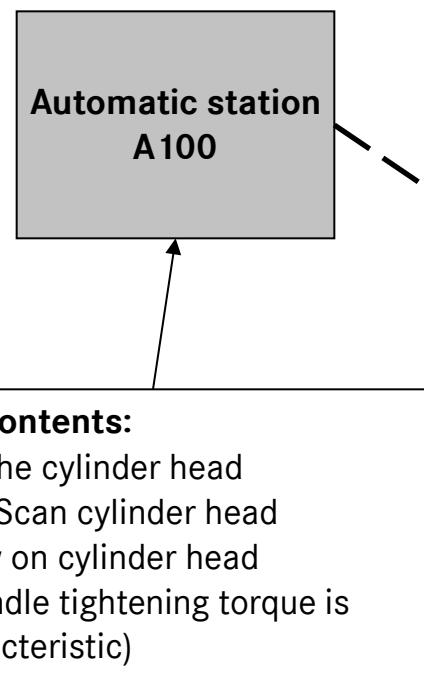
Additional requirement for D characteristics

- Regardless of the station type, the processing status, the current value, the target value and the current tolerances must be saved as characteristic values for D characteristics. These characteristics must also be given a “D identifier”.
- The “D identifier” must be delivered by the system in the station message at stations at which characteristics with “D identifiers” are processed.

Additional or deviating requirements can be defined for specific projects. These requirements must be documented in the production control plan (PLP).



Station messages from automatic stations



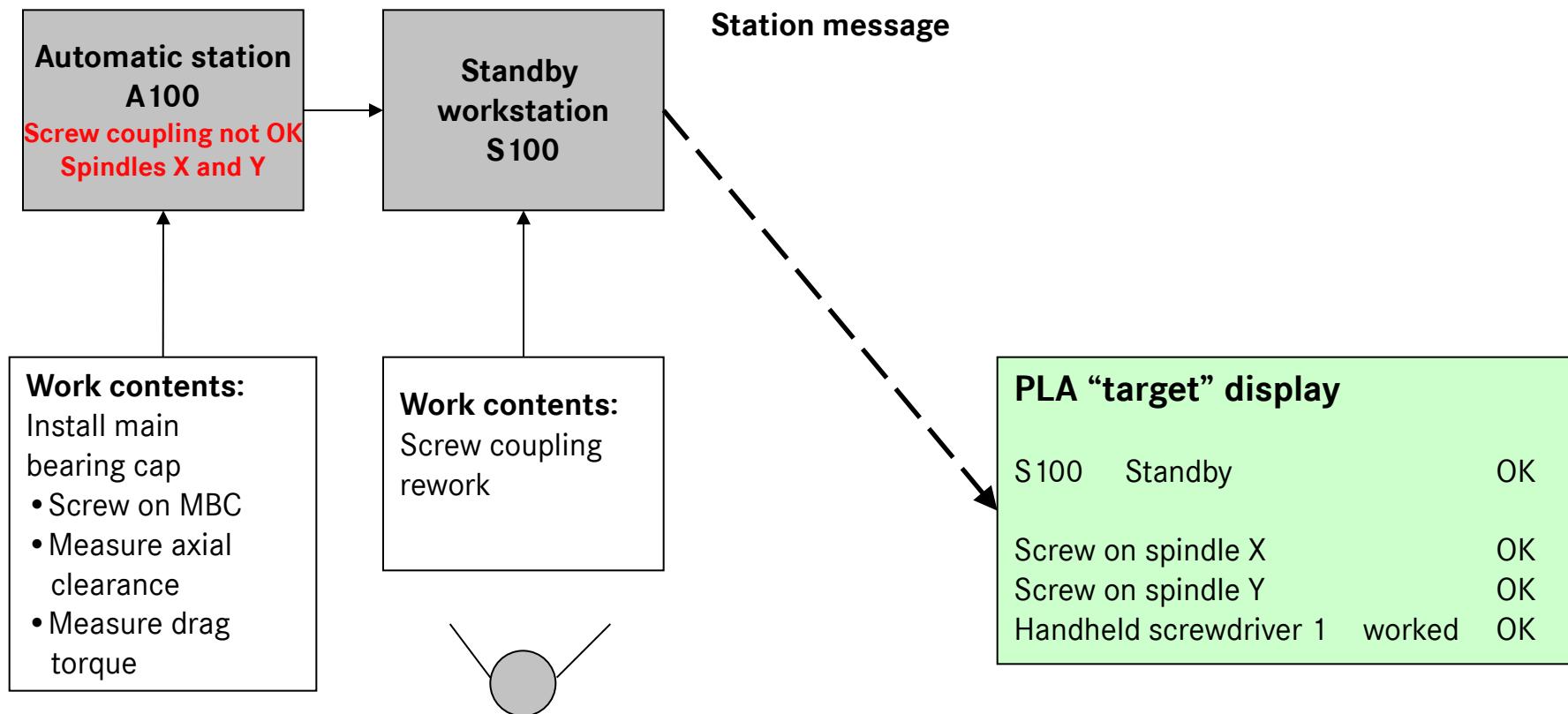
Station message

PLA “target” display					
A100	Install cylinder head OK		DS		
DMC Scan CH	12345678921455447*		OK		
Screwing on CH			OK	DS	
MD spindle1	10.00	9.00	11.00	10.25	OK
MD spindle2	10.00	9.00	11.00	10.17	OK
MD spindle3	10.00	9.00	11.00	10.36	OK
MD spindle4	10.00	9.00	11.00	10.56	OK
MD spindle5	10.00	9.00	11.00	10.52	OK
MD spindle6	10.00	9.00	11.00	10.35	OK
MD spindle7	10.00	9.00	11.00	10.51	OK
MD spindle8	10.00	9.00	11.00	10.24	OK
MD spindle9	10.00	9.00	11.00	10.11	OK
MD spindle10	10.00	9.00	11.00	10.13	OK
MD spindle11	10.00	9.00	11.00	10.26	OK
MD spindle12	10.00	9.00	11.00	10.59	OK
					DS

* Also as “installation message”

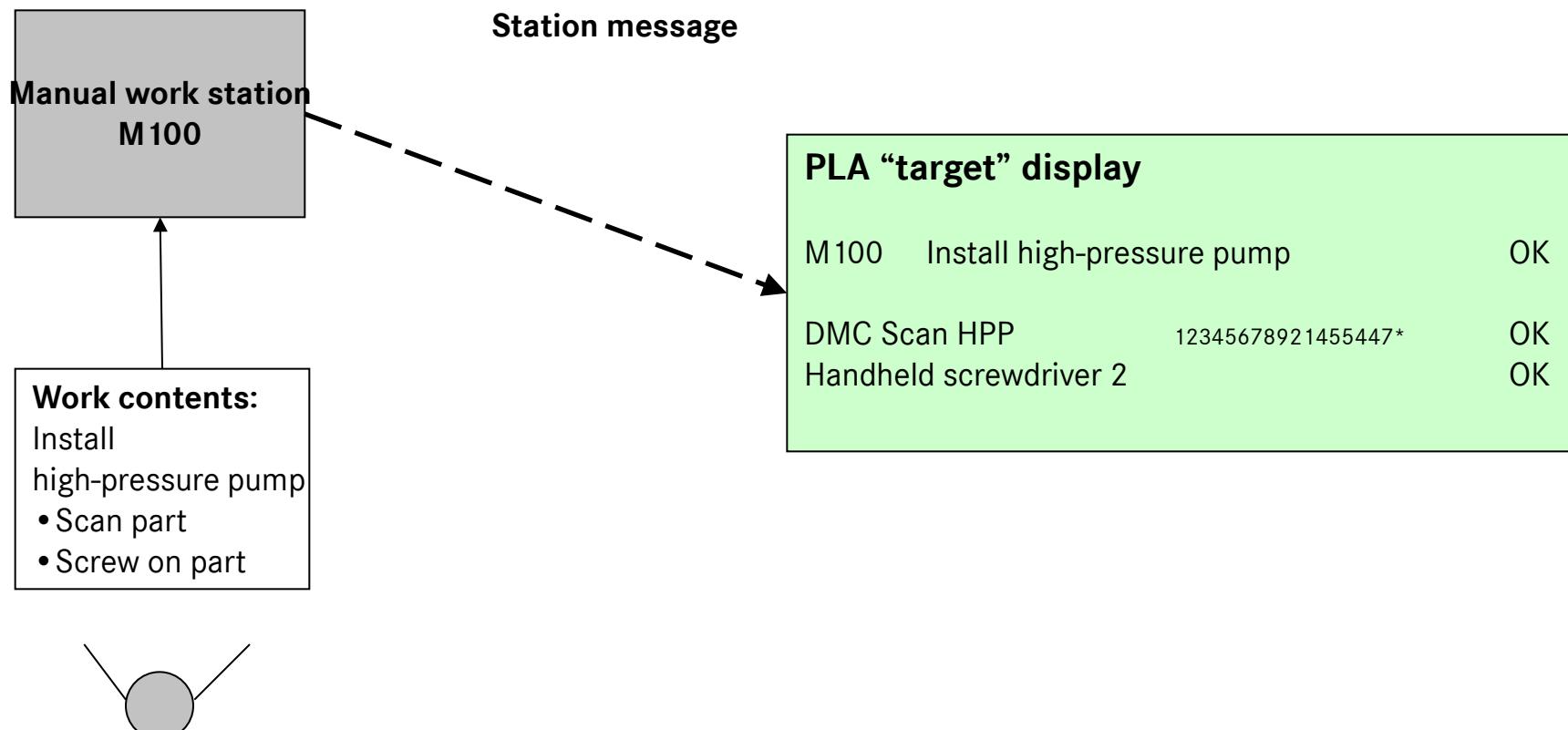


Station messages from standby workstations





Station messages from manual work stations



DAIMLER

Powertrain Requirement Specifications

Part III

Appendix 13

Automatic Button Call-off for Material Replenishment Control

Version 1.0

Version 1.0 Number of Pages : 15
Status 14.4.2014
File / template: Appendix 13 - Automatic Button Call-off for Material Replenishment Control v1.0 [en].docx /
Vorlage_Lastenhefte_PT_V 3 0.dot

Author:	Signature	Approved by
Endre Imrédi / PPA/M HPC 3181 70546 Stuttgart Phone +49 (0)711 / 17 -59062 Fax +49 (0)711 / 17 -50409 E-mail endre.imredi@daimler.com		

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1. General

1.1 Record of Revisions

Version:	Last revised:	Chapter:	Revised by:
1.0	14.04.2014	New version	Imrédi

1.2 Contacts at Mercedes-Benz plants

	Berlin plant:	Hamburg plant:	Untertürkheim plant:
Address:	Mercedes-Benz Berlin Plant (Plant 040) Department xxx D-12274 Berlin	Mercedes-Benz Hamburg Plant (Plant 068) Department xxx D-21160 Hamburg	Mercedes-Benz Plant Untertürkheim (Plant 010) HPC xxx D-70546 Stuttgart
	Basic tel. no. +49 30 7491	Basic tel. no. +49 40 7920	Basic tel. no. +49 711 17
	Gaggenau plant:	Mannheim plant:	Kassel plant:
Address:	Mercedes-Benz Werk Gaggenau (W 030) Department xxx D-76568 Gaggenau, Germany	Mercedes-Benz Werk Mannheim (W020, W027) Department / HPC D-68299 Mannheim, Germany	Mercedes-Benz Werk Kassel (W 069) Department xxx D-34117 Kassel, Germany
	Basic tel. no. +49 7225 61	Basic tel. no. +49 621 393	Basic tel. no. +49 561 802

1.3 General

Automatic material call-off involves automatically triggered messages due to inventory undershoot in system shelves or material bays.

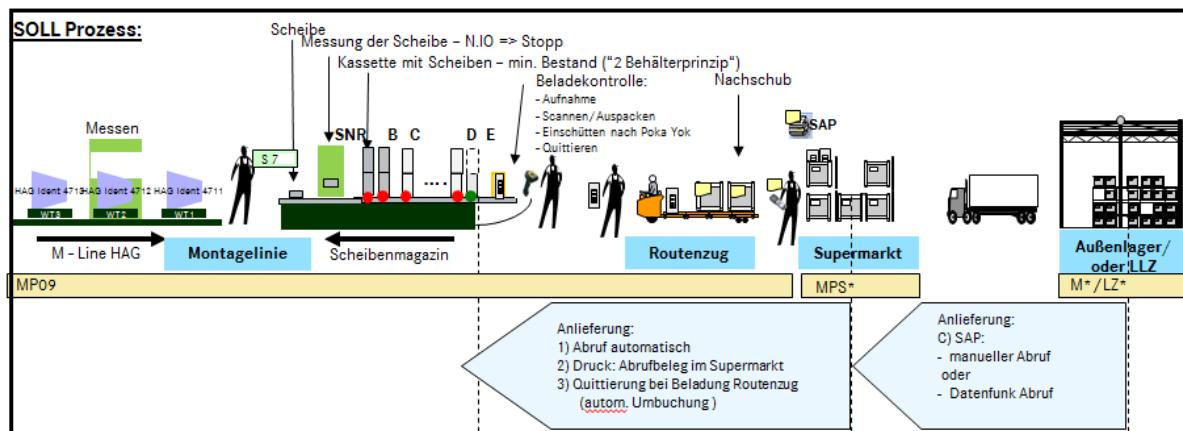
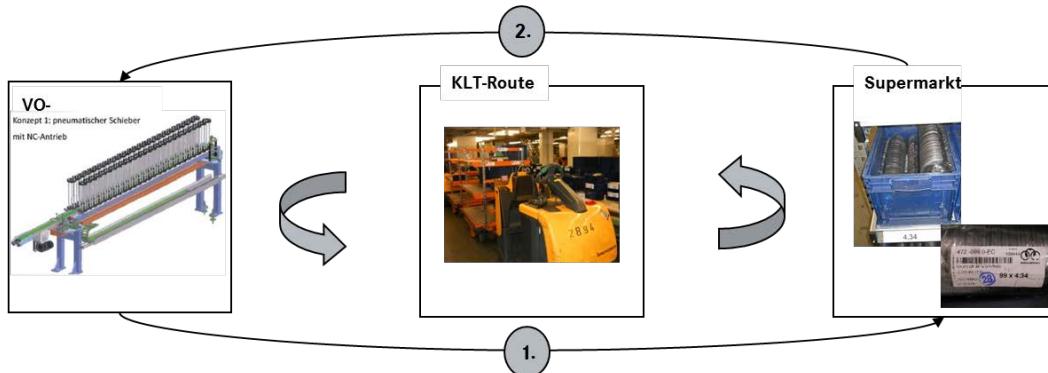
These messages are transferred by the system's control systems to the SAP system, which triggers a material call-off in the corresponding warehouse.

Note:

- This functionality can only be implemented in combination with the assembly guidance system ZS+PT and the functionality "pick by light".
- The basis is the communication principle defined for SAP-PI communication in the Integra standard and the required PLC modules.

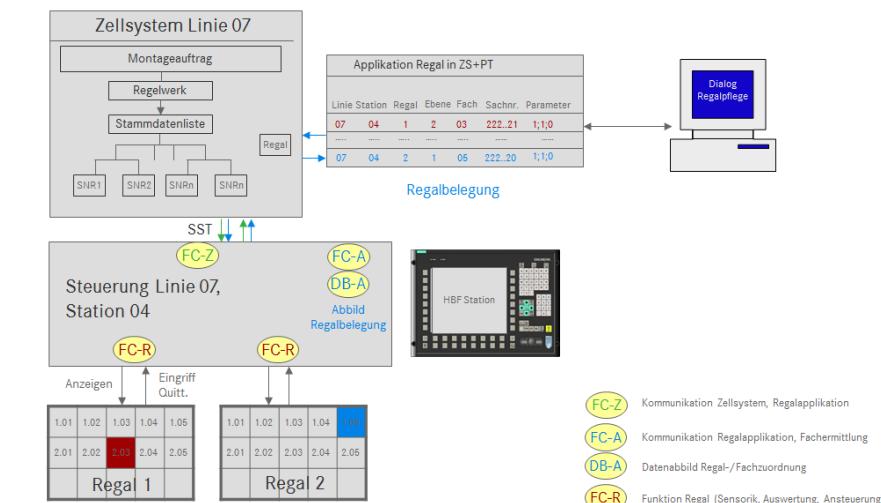
1.3.1 Functional Principle of Automatic Button Call-off:

1. Bedarfssignal Digital: automatisch generiertes Bedarfssignal wenn min. Füllstand erreicht. → automatisch erstellter Fahrauftrag an LOG / EDL im Supermarkt. Routenfahrer kommissioniert seinen Routenzug gem. Fahrauftrag / Materialbedarf.
2. Anlieferung der Ware in Bereitstellregal „Zigarettenautomat“; Plausicheck sowie Quittierung mittels Handscanner.



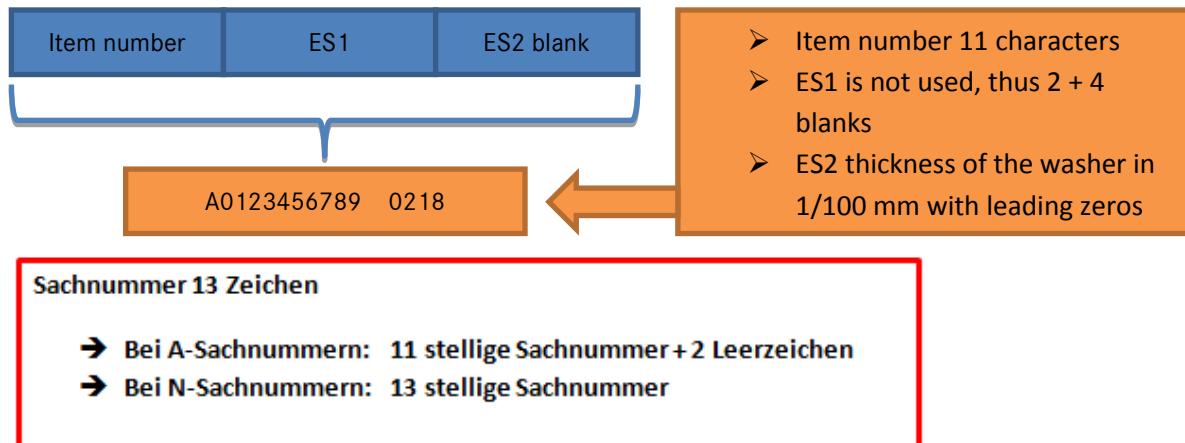
1.3.2 System Description

Systemdarstellung Regalbelegung in ZS bzw. ZS+PT integriert

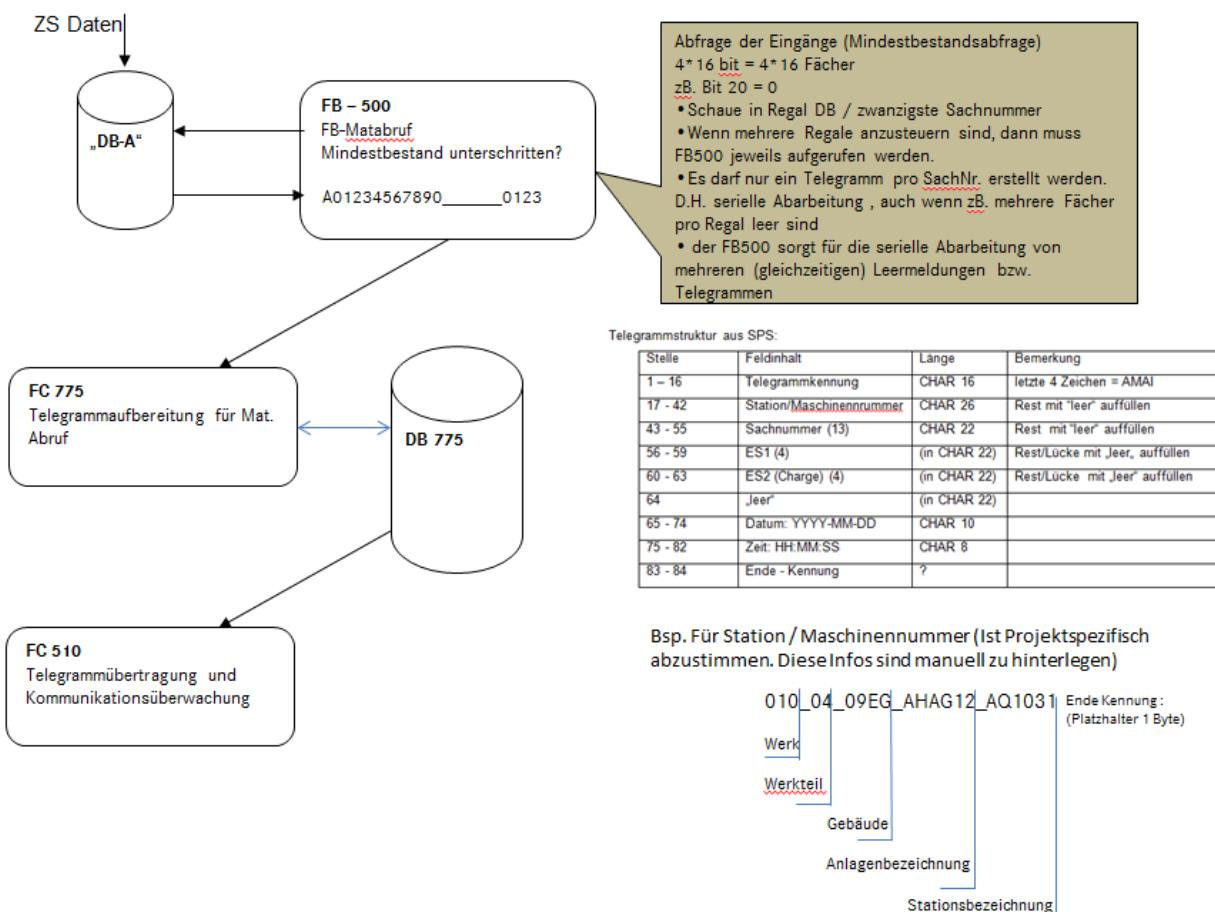


- The modules FC-A, FC-Z, DB-A, etc... are described in the Powertrain Requirement Specifications Part III, Appendix 14 (IT standard "pick by light").

1.3.3 Item Number Logic Using the Example of Spacer Washers



1.3.4 Software Description



1.3.5 Reference to Supplementary Documents

1. ITP Interface Catalog - ZS Communication (in LH – SPPA)
2. FK_2693_V2 IDOC mapping - SAP-PI communication
3. FC169_FG_COM_TLG_PN_V40.02.pdf - description of the Integra module FC169

2. Modules for Automatic Material Call-off

The function FC774 is the module from which further function modules and program parts for automatic material call-off are called.

Module structure FC774: FC510 (with FB510-513), 2x FB500 (each with 4x FB501), FC775 :

[-] <input type="checkbox"/> SNR_aus_Regal (FC774)	[126]	FUP	NW	13
[+] <input type="checkbox"/> FG_COM_TLG_PN (FC510)	[332]	KOP	NW	1
<input type="checkbox"/> FGDB_COM_TLG_PN (DB510)	[126]	KOP	NW	1
<input type="checkbox"/> DB_AQ1031 (DB2163)	[126]	KOP	NW	1
[+] <input type="checkbox"/> FB_MATABRUF (FB500), DB_MAT...	[220]	KOP	NW	3
[+] <input type="checkbox"/> FB_MATABRUF_LEER (FB501)	[250]	KOP	NW	2
[+] <input type="checkbox"/> FB_MATABRUF_LEER (FB501)	[250]	KOP	NW	3
[+] <input type="checkbox"/> FB_MATABRUF_LEER (FB501)	[250]	KOP	NW	4
[+] <input type="checkbox"/> FB_MATABRUF_LEER (FB501)	[250]	KOP	NW	5
<input type="checkbox"/> BLKMOV (SFC20)	[220]	KOP	NW	16
<input type="checkbox"/> DB?	[220]	AWL	NW	17
<input type="checkbox"/> DB_Matabruf (DB776)	[126]	KOP	NW	3
[+] <input type="checkbox"/> FB_MATABRUF (FB500), DB_MAT...	[220]	KOP	NW	5
[+] <input type="checkbox"/> FB_MATABRUF_LEER (FB501)	[250]	KOP	NW	2
[+] <input type="checkbox"/> FB_MATABRUF_LEER (FB501)	[250]	KOP	NW	3
[+] <input type="checkbox"/> FB_MATABRUF_LEER (FB501)	[250]	KOP	NW	4
[+] <input type="checkbox"/> FB_MATABRUF_LEER (FB501)	[250]	KOP	NW	5
<input type="checkbox"/> BLKMOV (SFC20)	[220]	KOP	NW	16
<input type="checkbox"/> DB?	[220]	AWL	NW	17
<input type="checkbox"/> BLKMOV (SFC20)	[126]	KOP	NW	6
<input type="checkbox"/> BLKMOV (SFC20)	[126]	KOP	NW	6
<input type="checkbox"/> FGDB_TLG_ANFR_ANTW (DB775)	[126]	KOP	NW	7
[+] <input type="checkbox"/> FG_TLG_ANFR_ANTW (FC775)	[184]	KOP	NW	9
[+] <input type="checkbox"/> FC_SYSTEMZEIT_LESEN (FC600)	[228]	FUP	NW	1

Figure 1: Module structure of the main program module FC774

The following modules are required in total for automatic material call-off:

Component	Name	Function
FB500	FB_MATABRUF	Empty messages for shelf material call-off
DB500	DB_MATABRUF_LEER_1	Instance DB empty messages 1 for material call-off
DB501	DB_MATABRUF_LEER_2	Instance DB empty messages 2 for material call-off
FB501	FB_MATABRUF_LEER	16 empty messages for material call-off
DB510	FGDB_COM_TLG_PN	FGDB TCP/IP communication via telegrams
DB511	DB_SELI_COM_TLG	Send list TCP/IP communication via telegrams
DB512	DB_EMLI_COM_TLG	Receive list TCP/IP communication via telegrams
FB510	FB_ASY000 TSEND	Send data (compatible S7-300/S7-400) (corresponds to Siemens module FB63)
FB511	FB_ASY000 TRCV	Receive data (compatible S7-300/S7-400) (corresponds to Siemens module FB64)
FB512	FB_ASY000 TCON	Establish communication link (corresponds to Siemens module FB65)
FB513	FB_ASY000 TDISCON	End communication link (corresponds to Siemens module FB66)
FC510	FG_COM_TLG_PN	FG communication by telegrams via TCP native PN
FC774	SNR_aus_Regal	Item no. seek an empty bay
DB774	DB_Matabruf	Automatic material call-off data
FC775	FG_TLG_ANFR_ANTW	FG for general request/response telegrams
DB775	FGDB_TLG_ANFR_ANTW	FGDB for general request/response telegrams

Table 1: Modules required for automatic material call-off

The modules shall be adapted to the specific system:

- Alignment of number of shelves,
- Alignment of number of bays per shelf,
- Alignment of input bits

2.1 FC510 Coupling with SAP/R3

The FC510, which is used for coupling with an IT computer, is located in first place in the FC774. In the Powertrain application described here, this is the PI system (PI = process integration), which represents an interface between the system software and SAP.

The FC510 uses the Step7 system modules FB63-FB66 for TCP/IP communication. These have been taken over from the STEP7 standard library "Standard Library/Communication Blocks" with changed module numbers.

The following renumbering has been performed:

- FB63 > FB510 Send Data
- FB64 > FB511 Receive Data
- FB65 > FB512 Connect
- FB66 > FB513 Disconnect

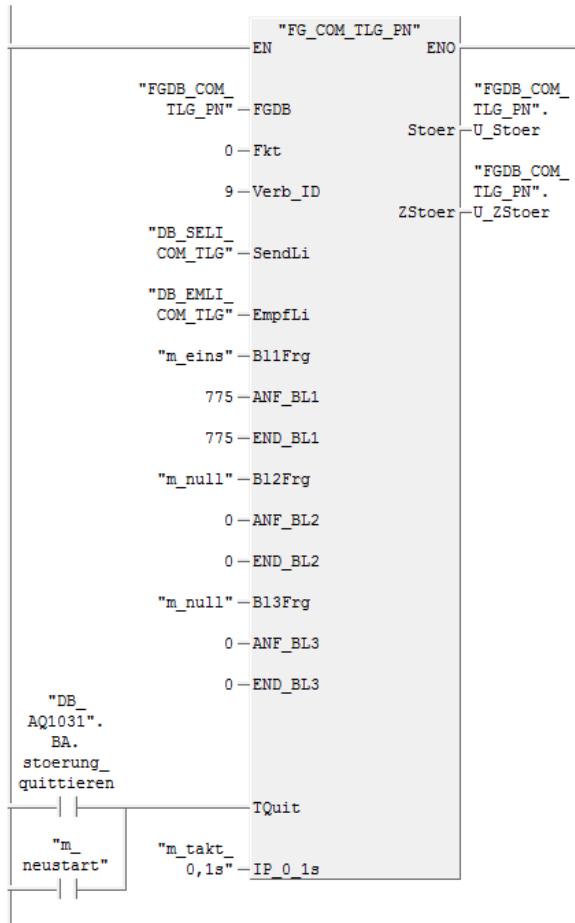
A separate, exhaustive function description is available for the FC510 function:

"FC169_FG_COM_TLG_PN_V40.02". This refers to the FC169, which has merely been renamed FC510 in the Powertrain application.

2.1.1 FC510 Call

Netzwerk 1: Kommunikation mit SAP (über Prozessintegration PI)

Kommentar:



Symbolinformation:

"DB_AQ1031".BA.stoerung_quittieren	DB2163.DBX0.5	-- Störung quittieren
m_neustart	M0.5	-- Neustartmerker
FG_COM_TLG_PN	FC510	-- FG Communication by telegrams via TCP native PN
FGDB_COM_TLG_PN	DB510	-- FGDB Communication by telegrams via TCP native PN
DB_SELICOM_TLG	DB511	-- Send list TCP/IP communication via telegrams
DB_EMLICOM_TLG	DB512	-- Receive list TCP/IP communication via telegrams
m_eins	M0.1	-- Merker hat immer Status 1
m_null	M0.0	-- Merker hat immer Status 0
m_takt_0,1s	M1.0	-- Taktmerker

Figure 2: Module for TCP/IP communication

2.1.2 FC510 Parameter Switching

Name	Type	Comment
Input parameter		
FGDB	BLOCK_DB	FGDB TCPIP communication
Fkt	INT	No function (reserve)

Name	Type	Comment
ID	INT	Connection number value range 1 to 4095 Plan unique connection number. Connection number ID shall match the connection number in the connection data sector "FGDB.DBW1508"! (In integer format!)
SendLi	BLOCK_DB	Send list
EmpfLi	BLOCK_DB	Receive list
BI1Frg	BOOL	Release for telegram block 1
ANF_BL1	INT	First DB no. for block 1 telegrams
END_BL1	INT	Last DB no. for block 1 telegrams
BI2Frg	BOOL	Release for telegram block 2
ANF_BL2	INT	First DB no. for block 2 telegrams
END_BL2	INT	Last DB no. for block 2 telegrams
BI3Frg	BOOL	Release for telegram block 3
ANF_BL3	INT	First DB no. for block 3 telegrams
END_BL3	INT	Last DB no. for block 3 telegrams
TQuitt	BOOL	Acknowledgment of a present fault
Output parameter		
Stoer	BOOL	Collective fault message
ZStoer	BOOL	Collective additional fault message

Table 2: FC510 parameters

FC510 parameters relevant to the Powertrain application:

FGDB:	DB510	FGDB TCPIP communication
Verb_ID:	9	Connection number
SendLi:	DB511	Send list
EmpfLi:	DB512	Receive list
BI1Frg:	M0.1	Logical one
ANF_BL1:	775	DB775 for block 1 telegrams
END_BL1:	775	DB775 for block 1 telegrams
TQuit:	Station reset button	
Stoer :	Collective fault message	

Comment on the fault message:

"Stoer" is used to trigger the message "Automatic material call-off communication faulty". This message is only displayed, and does not disrupt the system's automatic sequence.

DB775 is parameterized at ANF_BL1 and END_BL1, and contains the following telegram structure for a material call-off:

Digit	Field content	Length	Remark
1 - 16	Message ID	CHAR 16	Last 4 characters = AMAI
17 - 42	Station/machine number	CHAR 26	Fill remainder with "blanks"
43 - 55	Item number (13)	CHAR 22	Fill remainder with "blanks"
56 - 59	ES1 (4)	(in CHAR22)	Fill remainder/gap with "blanks"
60 - 63	ES2 (batch) (4)	(in CHAR22)	Fill remainder/gap with "blanks"
64	"Blank"	(in CHAR22)	
65 - 74	Date: YYYY-MM-DD	CHAR 10	
75 - 82	Time: HH:MM:SS	CHAR 8	
83 - 84	End - ID	?	

Table 3: Telegram structure for a material call-off

2.1.3 FC510 Modules

Called modules:

Address	Symbol	Comment
SFC24	TEST_DB	Test data block
FB510	TSEND	Send TCP/IP data
FB511	TRCV	Receive TCP/IP data
FB512	TCON	Establish TCP/IP connection + status
FB513	TDISCON	Establish TCP/IP connection

Table 4: Modules called in FC510

2.1.4 Parameterization of TCP/IP with OC Wizard

The OC Wizard (Open Communication Wizard) can be used to comfortably configure the TCP/IP connection. In this case, the connection data are automatically entered in DB510.

The OC Wizard can be obtained free of charge from Siemens. After being installed, it can be started under Extras in the SIMATIC Manager with OC Wizard. Starting opens the screen below. On use of all of the modules listed in 2. (see above), the DB510 with its connection data is contained, etc.

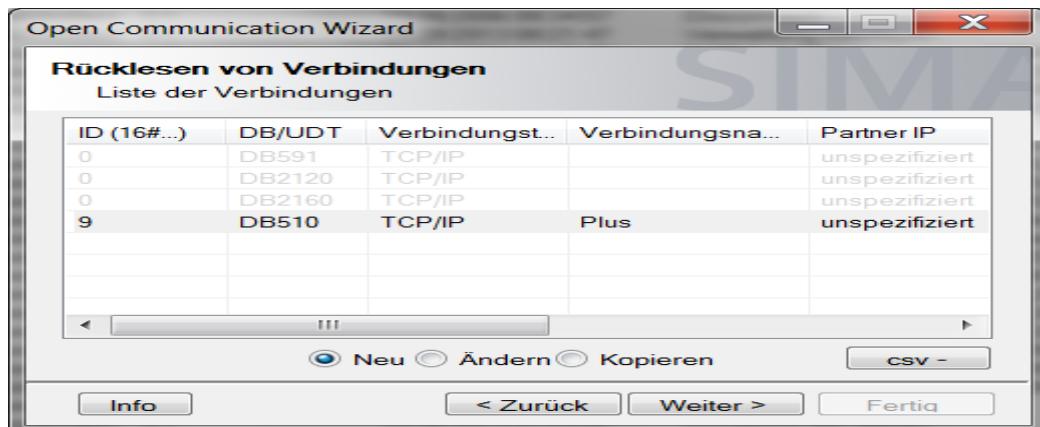


Figure 3: OC Wizard: Connection readback

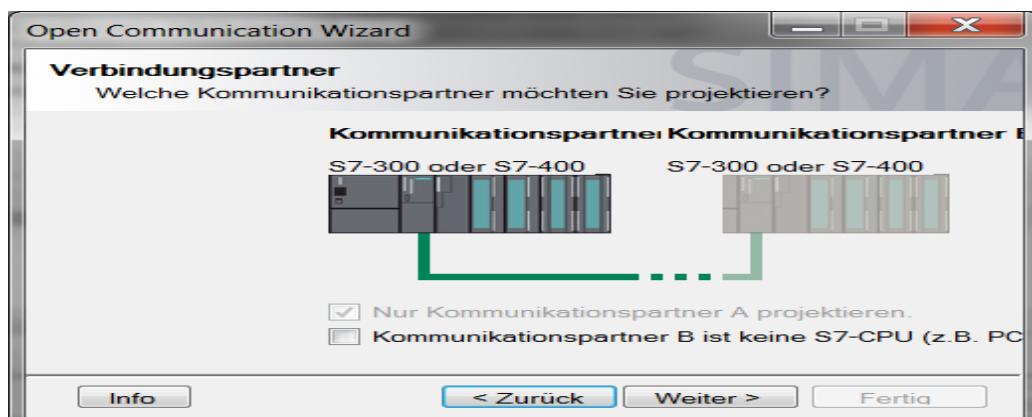


Figure 4: OC Wizard: Connection partners (1)

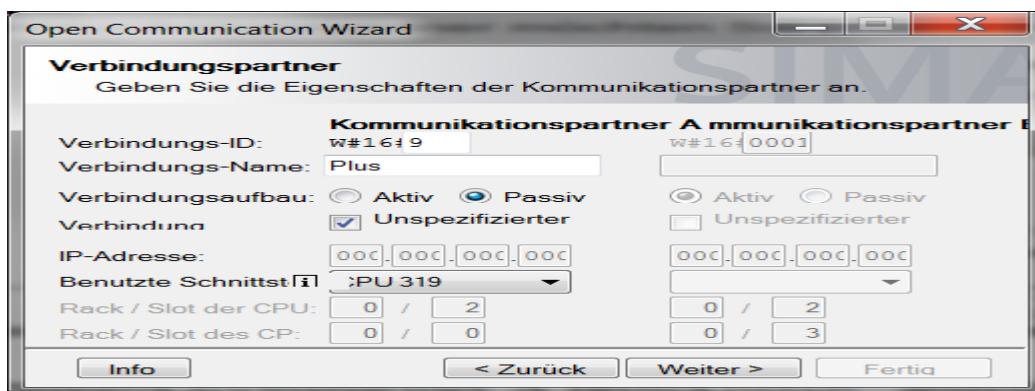


Figure 5: OC Wizard: Connection partners (2)

The "Connection-ID" entered here shall match the ID on the FC510.

A "Connection name" shall be entered.

"Connection establishment" is "Passive".

The "Connection" is "Non-specific"; no IP address shall therefore be specified.

The appropriate CPU type shall be selected under "Used interface".

The port shall also be specified in the next screen:

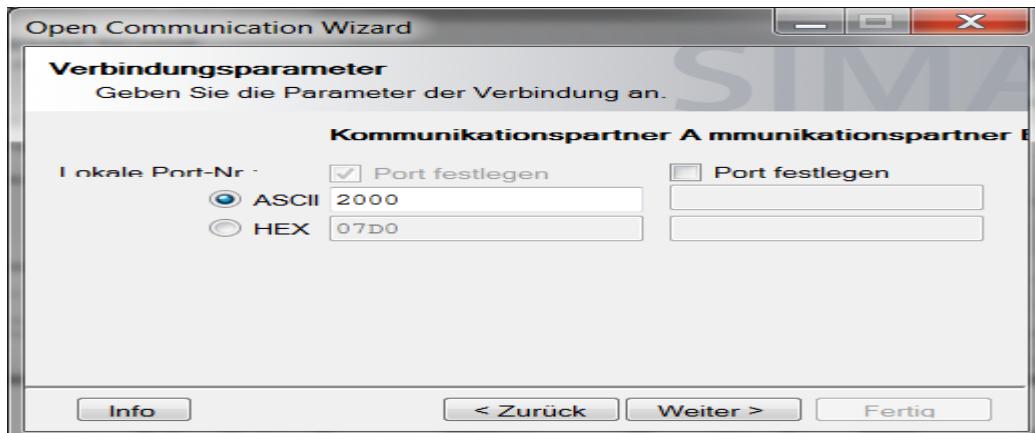


Figure 6: OC Wizard: Connection partners (3)

Then click on ""Continue" until "Finished" can be activated.

The necessary, poss. changed, connection data are therefore entered in the DB510!

In the S7 hardware configuration, established connections are shown as follows in the CPU online status (under Communication / Diagnosis):

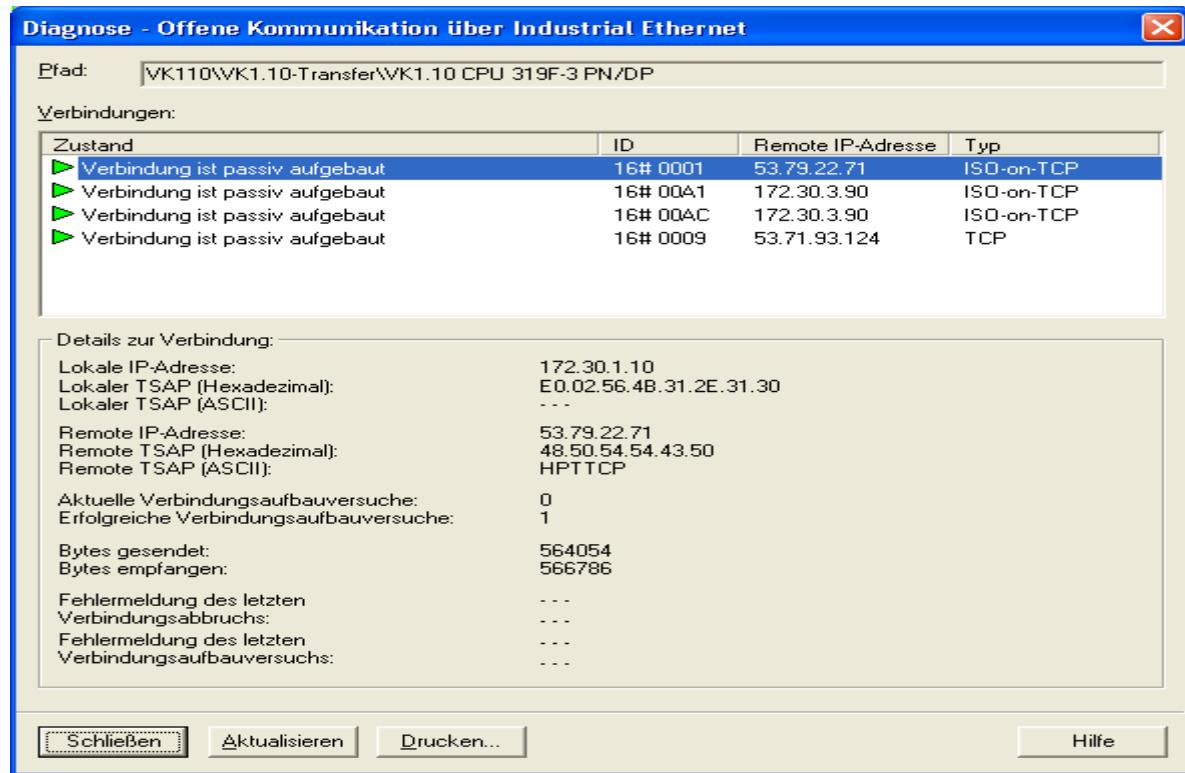


Figure 7: Programmed connections

The connection with the ID 0009 belongs to the automatic material call-off.

2.2 FB500 Determination of Empty Stocks

FB500 determines the item number of an empty bay.

The statuses of the shelf bay fill level sensors are transferred using the input parameters _Leermeld_1 ..._4.

The _Leermeld_1 ..._4 variables are of "Struct" type and each contain two bytes: Byte_0 and Byte_1.

A total of 64 fill levels can thus be parameterized. Unused signals shall be set to "1"! The accompanying item number is determined from the DB containing the shelf assignment on the basis of an empty message.

FB500 shall be called once for each shelf, as each shelf has a separate shelf assignment DB, which is transferred as a parameter to the FB500.

If several bays become empty at exactly the same time, a material call-off is first implemented for the bay with the lowest number (resulting from the sequence in _Leermeld_1...4).

2.2.1 FB500 Call with Empty Message Parameterization

Netzwerk 2: Leermeldungen 1-16 Typ 183

Kommentar:

```

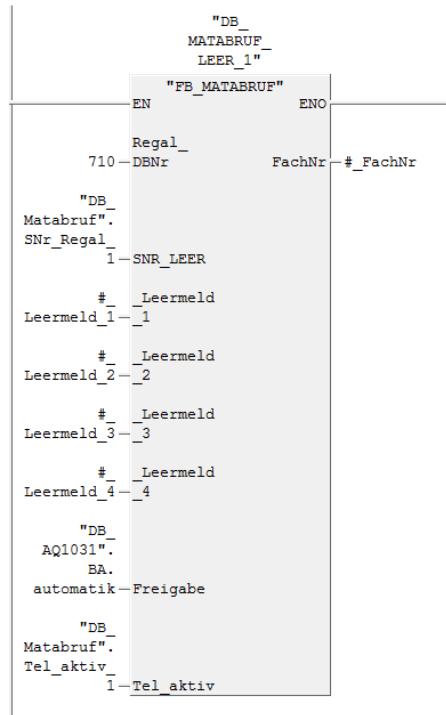
L      EB    108
T      #_Leermeld_1.Byte_0      #_Leermeld_1.Byte_0
L      EB    110
L      128
OW
T      #_Leermeld_1.Byte_1      #_Leermeld_1.Byte_1
//nicht benutzte Bits auf 1 !!!
L      255
T      #_Leermeld_2.Byte_0      #_Leermeld_2.Byte_0
T      #_Leermeld_2.Byte_1      #_Leermeld_2.Byte_1
T      #_Leermeld_3.Byte_0      #_Leermeld_3.Byte_0
T      #_Leermeld_3.Byte_1      #_Leermeld_3.Byte_1
T      #_Leermeld_4.Byte_0      #_Leermeld_4.Byte_0
T      #_Leermeld_4.Byte_1      #_Leermeld_4.Byte_1

```

Figure 8: Fill level sensor transfer to the "empty message" variables

Netzwerk 3: Ermittlung der Sachnummern von Leerfächern des Regals 1

Kommentar:



Symbolinformation:

FB_MATABRUF	FB500	-- Leermeldungen für Materialabruf Regal
DB_MATABRUF_LEER_1	DB500	-- Instanz-DB Leermeldungen 1 für Materialabruf
"DB_Matabruf".SNR_Regal_1	P#DB774.DBX24.0	-- Sachnummer Regal 1
#_Leermeld_1	#_Leermeld_1	-- Leermeldungen 01-16
#_Leermeld_2	#_Leermeld_2	-- Leermeldungen 17-32
#_Leermeld_3	#_Leermeld_3	-- Leermeldungen 33-48
#_Leermeld_4	#_Leermeld_4	-- Leermeldungen 49-64
"DB_AQ1031".BA.automatik	DB2163.DBX0.0	-- In Automatik
"DB_Matabruf".Tel_aktiv_1	DB774.DBX0.0	-- Telegrammübertragung Regal 1 aktiv
+ FachNr	+ FachNr	-- Fachnummer im Regal/Scheibenautomat

Figure 9: Module FB500 for determining the item number of an empty bay

2.2.2 FB500 Parameter Switching

Name	Type	Comment
Input parameter		
Regal_DBNr	INT	Number of the shelf DB
SNR_LEER	Any	Item number for empty bay
Leermeld_1-4	Struct	Empty messages 1-4
	BOOL	Release empty message to SAP
Input/output parameter		
Tel_aktiv	BOOL	Activate telegram transfer

Table 5: FB500 parameters

2.2.3 FB500 Modules

Called modules:

Address	Symbol	Comment
FB 501	FB_MATABRUF_LEER	16 empty messages for material call-off
SFC 20	BLKMOV	Copy variables
SFB 4	TON	Generate an on delay

Table 6: Modules called in FB500

2.3 FC775 Telegram Preparation

With the item number received from FB500, the telegram for the material call-off is established with FC775. The entire telegram is stored in DB775 and has the following structure:

Adresse	Name	Typ	Anfangswert	Kommentar
0..0		STRUCT		
+0..0	Anfrage	STRUCT		Sendefach Anfrage
+0..0	Sende	STRING[4]	'SEND'	
+6..0	DS	INT	0	Dialogstatus 1= senden
+8..0	LEN_MAX	INT	82	Maximale Telegrammlänge in Bytes Telegrammkennung + Nutzdaten (ohne EK)
+10..0	LEN_AKTUELL	INT	82	Aktuelle Telegrammlänge in Bytes Telegrammkennung + Nutzdaten (ohne EK)
+12..0	reserviert	INT	0	Reserve
+14..0	Tel	STRUCT		
+0..0	TK	STRING[16]	'BBBBBLLLNLNSRAMAI' !* Telegrammkennung VCVC eintragen	
+18..0	MNr	ARRAY[1..26]	'0', '1', '0', ''	Maschinennummer
*1..0		CHAR		
+44..0	SNr	ARRAY[1..22]		Sachnummer mit ES1+ES2
*1..0		CHAR		
+66..0	DATUM	ARRAY[1..10]		Datum YYYY-MM-DD
*1..0		CHAR		
+76..0	ZEIT	ARRAY[1..8]		Zeit HH:MM:SS
*1..0		CHAR		
+84..0	EK	BYTE	B#16#0	Platzhalter für Endekennung
=86..0		END_STRUCT		
=100..0		END_STRUCT		
+100..0	SNr	ARRAY[1..22]		Sachnummer
*1..0		CHAR		
=122..0		END_STRUCT		

Figure 10: DB775 module for material call-off telegram

2.3.1 FC775 Call

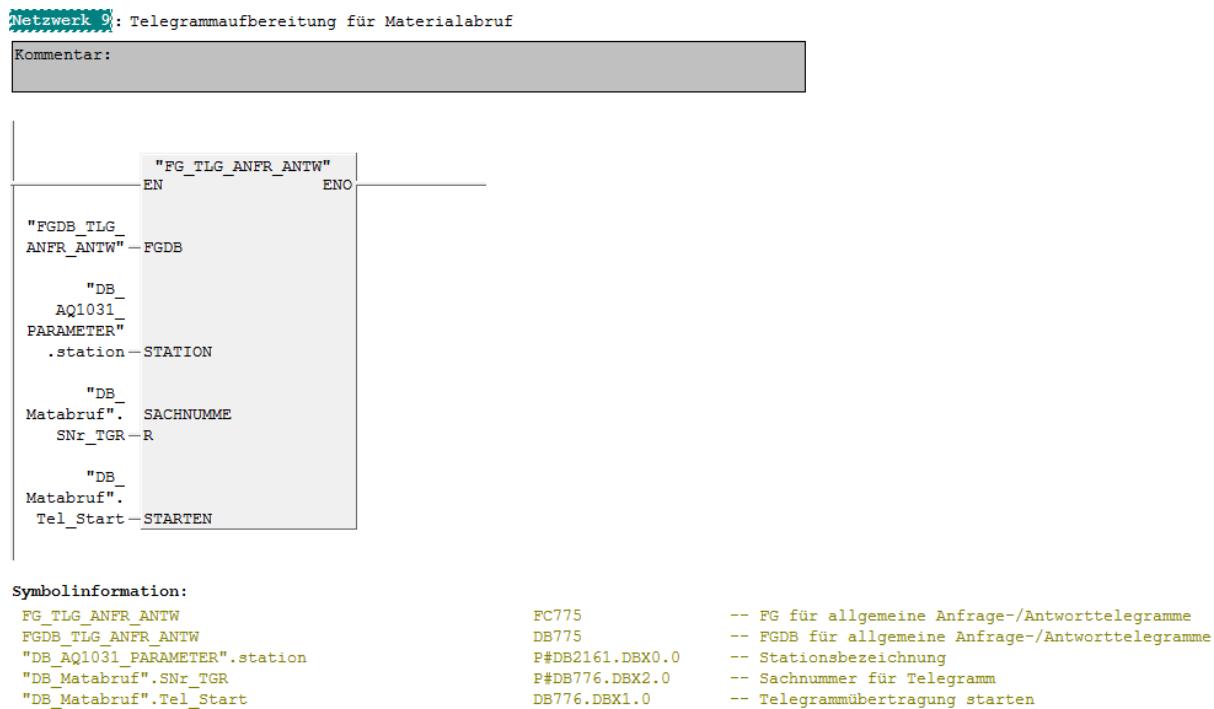


Figure 11: FC775 module for telegram preparation

2.3.2 FC775 Parameter Switching

Name	Type	Comment
Input parameter		
FGDB	BLOCK_DB	FGDB for general request/response telegrams
STATION	Array [1..6] of char	Station name (e.g. AQ1031)
SACHNUMMER	Array [1..22] of char	Item number with ES1+2
Input/output parameter		
STARTEN	BOOL	Start telegram

Table 7: FC775 parameters

Explanation of the FC775 parameters:

- FGDB: DB775 FGDB for general request/response telegrams
 STATION: Station name for telegram
 SACHNUMMER: Item number for telegram
 STARTEN: With this signal, 1 is written to DB775.DBW6

With the "STARTEN" signal, DB775.DBW6 =1, as a result of which a material call-off telegram is sent to SAP. Sending itself is undertaken by FC510, to which the module number 775 for DB775 is transferred as an input parameter! For this, DB775 contains the telegram content described in 2.3.



Residual Current Circuit Devices

(RCD: **R**esidual-**C**urrent **C**ircuit **D**evice)

Regulation for Handling RCD Circuit Breakers
at the Plant 010 and 040 Sites

22.03.2021



General Normative Regulation (DIN VDE 0100-410)

411.3.3 Additional Protection for Final Circuits for the External Area and Sockets

In AC voltage systems, additional protection through residual current circuit devices (RCDs) according to 415.1 shall be planned for:

- Sockets with a rated current no greater than 20 A, which are intended for use by laypersons and for general use
- Final circuits for portable production equipment used outdoors with a current rating not exceeding 32 A. [1]

Scope of the Standard

There is no general obligation to retrofit RCD/ground fault circuit breakers for final circuits in existing systems. The requirements of DIN VDE 0100-410 apply exclusively to new systems.

DIN VDE 0100-410 (VDE 0100-410):2007-06 applies to new systems to be installed. No retrofitting obligation shall be derived from the normative requirements for existing systems. Modifications to and extensions of existing systems shall be implemented according to DIN VDE 0100-410 (VDE 0100-410):2007-06. [2]

Permissible Exceptional Regulations 1/3

An exception may be made under the following conditions:

- Sockets that are monitored exclusively by electrics specialists or persons instructed in electrical engineering and for which it can be simultaneously ensured that **laymen cannot use these sockets**
- Sockets that are intended for use by laymen and for general use subject to the prerequisite that they are constantly **monitored with measuring technology** and that the detection of faults and damage in good time is ensured. It shall be ensured that the **immediate rectification of faults/damage** by an electrics specialist, including on the connected electrical devices/equipment/production equipment, is ensured. This necessitates organizational measures for fault rectification
 - The following applies to Plant 040: Sockets that are intended for use by laymen and for general use are NOT permissible in Plant 040. Sockets available in the building (protected with RCD/ground fault circuit interrupters) shall be employed for use by laymen and for general use

Permissible Exceptional Regulations 2/3

An exception may be made under the following conditions:

- or sockets set up for the connection of just one "specific device/item of equipment/production equipment" [2]
 - The following applies to Plant 040: Insofar as these sockets are located in an installation space that is accessible only to electrics specialists or are designed as "non-grounding-contact sockets" in the system (if not located within an electrical installation space)

Permissible Exceptional Regulations 3/3

In the commercial and industrial sector, deviation from the normative specifications of DIN VDE 0100-410 (VDE 0100-410):2007-06 can be justifiable in the opinion of UK 221.1 as per Section 2.3 of VDE 0022:2008-08 if the planner/**client and installer** of an electrical system can ensure **alternative, at least equivalent, protection** as part of a risk assessment. According to the Industrial Safety and Health Ordinance (BetrSichV), the intended protection specified by the Health & Safety at Work Act must also be permanently ensured during operation. [2]

Consequence:

As this involves an AND link, the installer can arrive at a different opinion as part of his/her risk assessment, and can decide that an RCD shall be used. In this case, the installation of an RCD cannot be refused by the client.

Test Periods

Wherever RCD circuit breakers are implemented, a test shall be performed as per DGUV Regulation 3 (previously Employers' Liability Association A3) as follows:

Function test:

Stationary systems every 6 months

Non-stationary systems each working day (mobile operating equipment)

Measuring technology test:

Once per year

Prerequisites for forgoing RCDs

The following requirements shall be met:

- Equivalent protection shall be ensured as part of a hazard assessment
- The installer (manufacturer) shall agree to the omission
- Continuous monitoring by an EFK shall be ensured
- The measuring technology monitoring by a qualified person shall be ensured
- Damage shall be rectified immediately by an EFK
- The operational owner (layperson) shall be notified

or if it is ensured that only specific operating equipment can be connected
(e.g. through special sockets and connectors)

Regular RCD Testing

- As long as no intervention into the switch cabinet is required, the function test can be performed by the operational owner as part of owner holistic plant management
- The function test with intervention into the switch cabinet and the measuring technology test shall be performed by an electrics specialist during another annual maintenance measure
- Test contents and intervals have been defined as part of the hazard assessment for the electrical testing of stationary operating equipment

Interpretation DIN EN 60204-1 Chapters 7.2.5 and 15.1

In coordination with the manufacturer, the use of RCDs may not be required for grounding-contact sockets in the closed electrical installation space if used exclusively by electrics specialists. This is explained through the higher qualification of the electrics specialists as per TRBS 1203 "Qualified Persons" and the qualification requirements for electrics specialists arising from DIN VDE 0105-100.

The following specifications therefore result for the MBN:

7.2.5 Socket Circuits and Their Respective Conductors

- If an intelligent control system with service data interface is available in a cabinet compartment, an AC 230 V grounding-contact socket (or comparable depending on installation location) shall be planned. The sockets shall be labeled with the voltage values/overcurrent protection.
- Grounding-contact sockets that are not used constantly (or comparable depending on installation location) shall be fused with 6 A.
- For equipment parts (e.g. printers, PCs) of a machine that are e.g. connected using grounding-contact plugs, the plug shall be located within the switchgear cabinet or in a terminal box.

Service sockets as described in Chapter 7.2.5 of DIN EN 60204-1 shall always be inaccessible to laymen.

15.1 Sockets for Accessories

- No final circuits/plugs shall be planned for mobile production equipment/accessories outside of the switchgear cabinet and terminal boxes.
- If it is necessary to plan final circuits/plugs for mobile production equipment/accessories outside of the switchgear cabinet and terminal boxes in individual cases, these shall be equipped with RCDs.

This results in the following variants in the scope of DIN EN 60204-1:

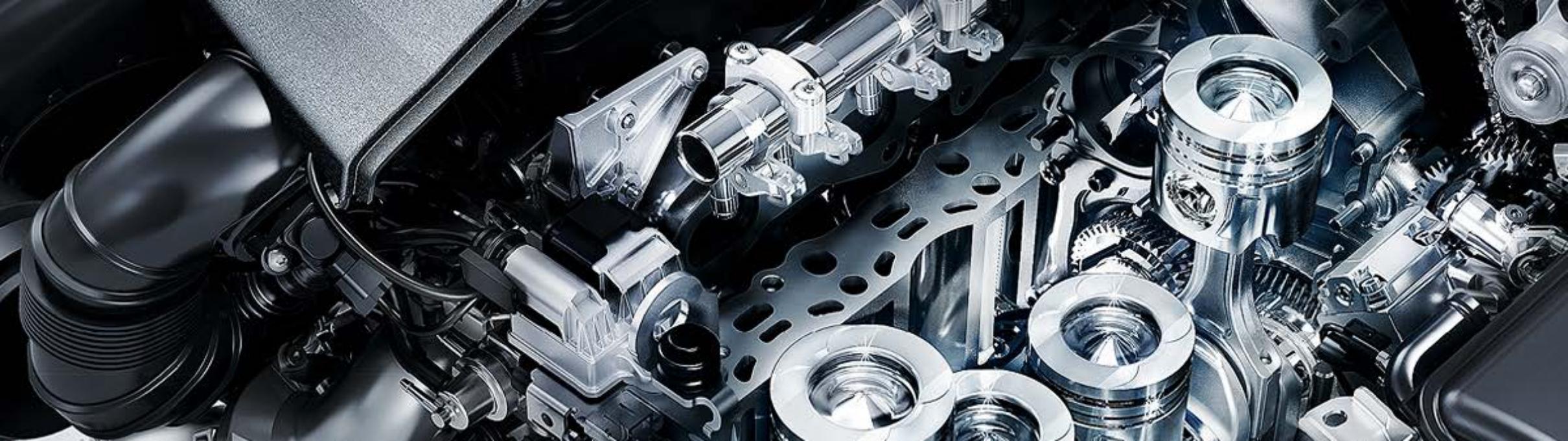
	Type of socket	Group of Persons	RCD
	Grounding-contact sockets, for sporadic use, in the elec. installation space (closed)	For electrics specialists only	No
	Grounding-contact sockets, for sporadic use, accessible from outside	Electrical engineering laymen	Yes
	Grounding-contact sockets, for connecting permanently installed devices, in the elec. installation space (closed)	For electrics specialists only	No
	Grounding-contact sockets, for connecting permanently installed devices, accessible from outside	Electrical engineering laymen	Yes

If the manufacturer arrives at a different assessment based on its risk assessment, the use of RCDs cannot be contradicted.

Electrical Testing of Stationary Operating Equipment

Sources

- [1] DIN VDE 0100-410 (VDE 0100-410):2007-06, Low-voltage electrical installations –
Part 4-41: Protection for safety - Protection against electric shock
- [2] Statement on DIN VDE 0100-410 (VDE 0100-410):2007-06, German Commission
for Electrical, Electronic & Information Technologies, DKE/UK 221.1



Appendix 15b: Residual Current Protective Devices in Plant 068

Powertrain Requirement Specifications Part III

VEFK Hamburg Plant, Spode PT/HIH 20.03.2018



Mercedes-Benz
Das Beste oder nichts.

General Normative Regulation (DIN VDE 0100-410)

411.3.3 Additional Protection for Final Circuits for the External Area and Sockets

In AC voltage systems, additional protection must be provided by residual current protective devices (RCDs) in accordance with 415.1 for:

- Sockets with a rated current no greater than 20 A, which are intended for use by laypersons and for general use
- Final circuits for portable operating equipment used outdoors with a current rating not exceeding 32 A.

Scope of the Standard

There is no general obligation to retrofit RCD/ground fault circuit breakers for final circuits in existing installations. The requirements of DIN VDE 0100-410 apply only to new installations.

DIN VDE 0100-410 (VDE 0100-410):2007-06 applies to new systems to be installed.

No obligation to retrofit existing installations can be derived from the normative requirements.

Modifications to and extensions of existing systems are to be carried out in accordance with

DIN VDE 0100-410 (VDE 0100-410):2007-06.

Electrical Equipment in Conductive Areas

When using electrical equipment, there may be an increased electrical hazard for persons employed in conductive areas.

Not every available protective measure guarantees sufficient safety under the above conditions in the event of a fault.

When assessing the hazard, the following areas are distinguished:

- Conductive areas with limited freedom of movement
- Other conductive areas.

For the areas mentioned above, DGUV-I 203-004 (BGI 594) recommends measures for protection against electric shock under fault conditions (fault protection). Electrophysiological experience is taken into account.

Stationary Work Equipment

3.2.2.1 Stationary electrical equipment must be operated in accordance with the protective measures specified in VDE 0100-410.

However, the use of additional protection by residual current protective devices (RCD) in accordance with section 412.5 VDE 0100-410 is recommended.

Electric circuits with plug-and-socket connectors where $IN \leq AC\ 32\ A$ must be operated through RCDs where $I_{\Delta N} \leq 30\ mA$.

An IT system with insulation monitoring is also permissible for these circuits ($IN \leq AC\ 32\ A$).

Mobile Work Equipment

3.2.2.2 Mobile electrical equipment shall be operated using one of the following systems:

- Safety extra low voltage (SELV) in accordance with Section 411.1 VDE 0100-410. Only equipment of protection class III may be used, which, however, must have an ingress protection rating of at least IP 2X, irrespective of
- the rated voltage, i.e. must be insulated or have insulated sleeves to prevent finger contact with pins.
- Protective isolation in accordance with Sections 413.5.1 and 413.5.3 VDE 0100-410.
- Protection by automatically triggered shut-off of the power supply via permanently installed RCDs with $I_{\Delta N} \leq 30 \text{ mA}$.

New Systems

The requirements of DIN VDE 0100-410 (VDE 0100-410):2007-06 **in Section 411.3.3 "Additional protection for outdoor final circuits and sockets"** and residual current protective devices (RCDs) with a rated differential current not exceeding 30 mA to be used in accordance with Section 415.1, apply without restriction to single-phase or multi-phase AC voltage systems at Plant 68.

Possible deviations according to the opinion of UK 221.1 to section 2.3 of VDE 0022:2008-08 are not applicable in Plant 68, as the prerequisites and conditions cannot be met permanently and additional hazards in conductive areas according to DGUV-I 203-004 must be observed. According to the Industrial Safety and Health Ordinance (BetrSichV), the intended protection specified by the Health & Safety at Work Act must also be permanently ensured during operation.

Test Periods

Wherever RCD circuit breakers are implemented, a test shall be performed as per DGUV Regulation 3 (previously Employers' Liability Association A3) as follows:

Function test:

Stationary systems every 6 months

Non-stationary systems each working day (mobile operating equipment)

Measuring technology test:

Once per year

Regular RCD Testing

- As long as no intervention into the switch cabinet is required, the function test can be performed by the operational owner as part of owner holistic plant management
- The function test with intervention into the switch cabinet and the measuring technology test shall be performed by a specialist electrician during another annual maintenance measure
- Test contents and intervals have been defined as part of the hazard assessment for the electrical testing of stationary operating equipment

Powertrain Requirement Specifications Part III

Parts Identification and Traceability
Appendix 16a: Machine Supplier
Specifications DMC and Barcode
Version 1.13

Version	1.13	Number of pages	7
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1. Preface

The traceability of component parts through the complete supplier chain from the manufacturer to the production charge is the basis for continuous process documentation. Parts already installed in major units can then be identified by a database request using the part ID.

The Appendices on traceability have been subdivided into two parts:

- 16a: General and Machine Supplier Specifications for DMC/Bar Code
 -
 -
 - 16d: Machine Supplier RFID Specifications

1. The following main requirements on parts identification have been determined as part of the "Standardization in PP/PT" project: Flexible and hybrid manufacturing systems necessitate parts identification which enables the assignment (traceability) of quality characteristics to each individual machine.
 2. In particular, a large number of variants in assembly necessitates the variant-exact marking of in-house and purchased parts, allowing variant-exact installation of these parts.
 3. Warranty and goodwill costs can be reduced through more effective and targeted campaigns.

Note for bar code:

If applicable, all specifications for DMC also apply to bar codes.

This does not refer to content specifications.

These shall be coordinated in a project-related manner.

The valid specifications of other documents and standards shall also be observed for bar codes.

2. Scope

The present document defines the mandatory standard on "Part Identification and Traceability" at the time of the release.

The present standard is mandatory for all machine and component suppliers, production sites and centers within the scope of the model series management for major units / components (Powertrain) and must be implemented in current major unit planning.

Deviations from the standard and details shall always be coordinated with the Daimler representative. For test components, different marking rules apply and these will also be discussed in this document.

3. References to Standards

The following standards shall be used:

- MBN 10007 Mercedes-Benz Standard 10007
 - MBN 10534-2 Traceability of Powertrain Component Parts (valid for Daimler Trucks Powertrain)

4. (Omitted)

5. Component Part Identification with the Data Matrix Code (DMC)

5.7. Installation Requirements

The accessibility of the cameras shall be guaranteed (cleaning, camera exchange, adjustment).

The following measures shall be adhered to as protection against soiling:

- Camera orientation downwards wherever possible
- Position not directly in soiling areas (e.g. extraction area, coolant/lubricant spraying area)
- Safety glass in front of lens if necessary
- Scavenging air if necessary

The measures shall be coordinated with Daimler AG. The contractor shall provide the hardware, such as stationary cameras, hand scanners incl. wall mounts, and shall integrate it into the process and parameterize it.

5.7.1. Stationary Camera Mounting

It shall be possible to adjust the cameras in all directions and angles; sufficient stability shall also be ensured to prevent unintentional misadjustment of the camera position (e.g. during cleaning). For camera change-out, so as to easily restore the desired position, non-erasable markings, mechanical stops, intermediate adapters or the like shall be provided.

5.7.2. Illumination

Primarily, the LED lamps integrated into the DMC scanning cameras or the LED lamps supplied for this purpose as original equipment shall be used. Should this not be possible because of mounting difficulties or for optical reasons, only LED lamps are permissible that guarantee a lamp service life of at least 50,000 h. Halogen lamps, fluorescent tubes, cold-light sources etc. are not permissible.

Note: For DMCs placed on rounded surfaces, additional external lighting is generally required. This shall be verified by testing and/or defined in consultation with the camera supplier.

External light influences shall be ruled out through suitable construction measures (e.g. housing).

5.7.3. Connection of Stationary Cameras to Ethernet / Profinet

Stationary cameras shall be integrated in the plant network or in the field network, depending on communication. Coordination is carried out with the Daimler representative. The live images from the camera shall be displayed on the machine control panel for parameter setting and diagnosis and incorporated into the image tree.

5.7.4. Storage of Error Images

If there is a read failure from the stationary cameras, it must be possible to store the relevant images locally in the camera or on the control panel. In the case of local storage (on camera), it should be possible to save images using the ring buffer memory principle (i.e. after saving the final image, image 1 is overwritten again).

5.8. Reliability of Process and Reading

Check reading must always occur for validating the lettering quality and shall be done as soon as possible after labeling. Only read parts with correct content may be kicked into the process.

This shall be ensured as follows:

1. Cyclical check (verification) by Q department in accordance with ISO/IEC TR 2158
2. Trend check (validation) of each part based on ISO/IEC TR 2158

In the case of systems in which the DMC quality can be changed in subsequent processes (e.g. washing machine, shot-peening), items 1-3 shall also be checked again.

The cycle (item 1) shall be coordinated with Daimler AG.

A process control system shall be coordinated with the corresponding representative at Daimler.

The following plausibility checks shall be performed by the supplier:

- Check of legibility and completeness – the DMC contains an ident number with 36 readable numbers
- Check for multiple allocation (assurance of ident number uniqueness)

- The read production number (12th-21st character) is different from the last read production numbers
- Check of the quality of the control reading as equal to or better than B (3)
- Check of part number (2nd-11th character)
-

For these checks a PLC module is provided with use of the Powertrain template for the S7-1500. If the template is not used, the aforementioned plausibility checks shall be programmed by the supplier.

For VeDoc designations no PLC module can be provided – the supplier shall itself program the aforementioned plausibility checks.

5.8.1. Application: Process Control, Comparison of Variants

A minimum of 99.9% labeling and reading reliability must be demonstrated throughout the entire production process.

The selected camera shall resolve a module with at least 8x8 pixels. The effective resolution of the readers shall be stated in the machine documentation.

Non-readable parts must be ejected from the production process immediately following a faulty reading.

6. (Omitted)

7. (Omitted)

8. (Omitted)

9. (Omitted)

10. Inspection of the Write/Read Process

The reading rate shall be stable and

- greater than 99.9% for process steering (variant comparison) and
- greater than 99.5% for parts tracing

for over at least 1000 consecutively produced parts. Verification shall be coordinated with the representative. For the operational system + acceptance, the parameterization software and all parameter sets shall be transferred to Daimler.

The cleaning intervals for systems and suitable cleansing agents shall be indicated to the operator.

11. Supplier Selection

Suppliers for labeling systems, cameras and reading systems shall be taken from the MDM.

The selection of a sufficiently powerful laser shall be made following consultations with the laser suppliers and Daimler. The suitability of the foreseen laser for the application with respect to laser performance, lettering time and quality, etc., shall be demonstrated by the machine supplier. Sample parts shall be submitted as proof.

12. Operating Conditions for Wireless Hand-Held Scanners

12.1. Operating Conditions for Wireless Hand-Held Scanners

Primarily cable-connected units shall be used. Use of a wireless handheld scanner is possible for technically justified exceptional cases and following agreement with Daimler. Throughout the area of operation, appropriate measures shall ensure that the unit complies with ITI/GN guidelines for use. Each wireless scanner application shall be reported to the representative. The equipment to be used shall be as set out in Chapter 9 (Cameras and Reading Systems).

Approval Conditions for Version 1.2 and 2.0 Bluetooth Units as Secondary Users in the 2.4 GHz Band: see

Daimler AG
ITM IT Infrastructure Global Network ([ITT/FN](#))
Version 1.0
March 12, 2007

The following conditions must be met in order to be granted exemption approval for operating Version 1.2 or 2.0 Bluetooth units.

12.1.1. Product-Specific Approval Conditions

The test specifications laid down by [ITT/FN](#) will be handed over to the manufacturer or supplier. Should there be any queries regarding the approval conditions or test specifications, the manufacturer shall contact [ITT/FN](#) directly. It is the responsibility of the manufacturer to undertake these tests itself or to commission an independent institute for this purpose. Compliance with permissible interference limits shall also be ensured for software and hardware updates.

The manufacturer or supplier shall ensure:

1. The maximum transmission power amounts to 2.5 mW (corresponding to Bluetooth Class 2)
2. During normal operation, there may be no measurable interference of the WLAN.
3. During off-normal operation, e.g. when switching on or moving out of the range of the counterpart station, interference of the WLAN may not last for more than 10 seconds.

12.1.2. Application-Specific Approval Conditions

On the part of the Daimler department where the unit is to be used, the following is to be observed:

1. Final approval for operation of Bluetooth units can only be granted by the IT officer of the operating site concerned.
2. The respective WLAN operator must be informed of the locations where Bluetooth units are used.
3. Appropriate measures shall ensure that, as far as possible, the Bluetooth unit will always be in normal operation. This can be done, for example, by:
 - Instructing the staff that units may not be removed from their place of use or, if this is done, they must be switched off.
 - Do not use jigs and fixtures that could favor the removal of the unit from its place of use, for example a belt holster or similar for stowing the handheld scanner.

13. (Omitted)

DAIMLER

Powertrain Requirement Specifications

Part Identification and Traceability

Appendix 16d: RFID Specifications for Machine Suppliers

Version 1.9

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1. Preface

The traceability of component parts through the complete supplier chain from the manufacturer to the production charge is the basis for continuous process documentation. Parts already installed in major units can then be identified by a database query using the part ID.

The Appendices on traceability have been subdivided into four parts:

- 16a: General and Machine Supplier Specifications for DMC/Bar Code
-
-
- 16d: Machine Supplier RFID Specifications

The following main requirements on part identification were determined as part of the "Powertrain Standardization" project:

1. Flexible and hybrid production systems necessitate part identification markings which allow the assignment (tracking) of the quality characteristics to each individual machine.
2. In particular, a large number of variants in assembly necessitates the variant-exact marking of in-house and purchased parts, allowing variant-exact installation of these parts.
3. Warranty and goodwill costs can be reduced through more effective and targeted campaigns.

2. Scope

The present document defines the mandatory standard on "Part Identification and Traceability" at the time of the release.

The present standard is mandatory for all machine and component suppliers, production sites and centers within the scope of the model series management for major units / components (Powertrain) and must be implemented in current major unit planning.

Deviations from the standard and details shall always be coordinated with the Daimler representative. For test components, different marking rules apply and these will also be discussed in this document.

3. Documentation Types

Daimler AG proposes two types of documentation of identification markings that differ in the degree to which they distinguish between parts.

Single Part Identification Marking can afford precise demarcation of the individual units, i.e. traceability is ensured for each individual component. The marking is applied directly to the product.

In the *Delivery Note Procedure* (Charge Identification), on the other hand, only the volume of an entire delivery counts. The quality data is assigned to the delivery note according to the simultaneity of events: time of delivery, validity of limit values for a certain point in time, time of the packaging and the compilation of a delivery.

Which documentation procedure is used shall always be defined with the representative at Daimler.

4. Single-Part Identification Marking with RFID

4.1. General Information

For the marking and tracing of parts, RFID technology represents an alternative to DMC that can be used across the complete process chain and for all manufacturing stations. The use of this technology is not restricted to tracing applications, but may in consultation with Daimler also be used in manufacturing and assembly processes.

4.2. Characteristics of Ultra High Frequency (UHF) RFID Technology

4.2.1. Fundamentals of UHF and Differences to HF

High-frequency (HF) RFID systems have a long tradition of use in the automation field. They function very reliably, are easy to configure and operate, and offer a large amount of user memory on the data carriers. Most HF systems have a range of only a few decimeters, which prohibits their use in many applications.

In the HF range, a high-frequency magnetic field is used to carry energy and data. The reader device and the transponder are coupled to one another in much the same fashion as a transformer with a very large air gap. The following diagram illustrates the main modules that make up such a system:

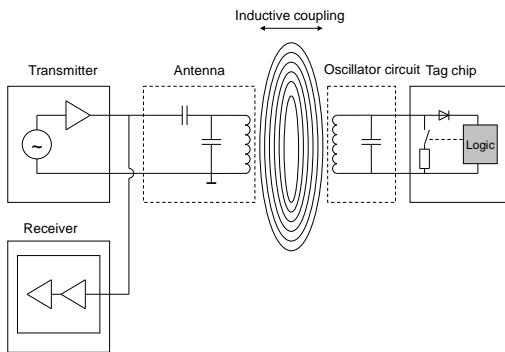


Figure 1: Design of an HF RFID system

The inductive coupling used means that no overshoot can occur, since the intensity of a magnetic field fades very rapidly (proportional to third power). For this reason, the radio signal path in HF systems is very precise and reproducible.

In UHF systems by contrast, the wave is completely spread out just as in other radio-signal systems (radio, TV, etc.). Here we are dealing with both magnetic and electrical field components.

The following diagram depicts the design of a UHF system. Characteristic is the construction of the transponder, which differs greatly from that of HF systems, for example in the implementation of a dipole or helix antenna..

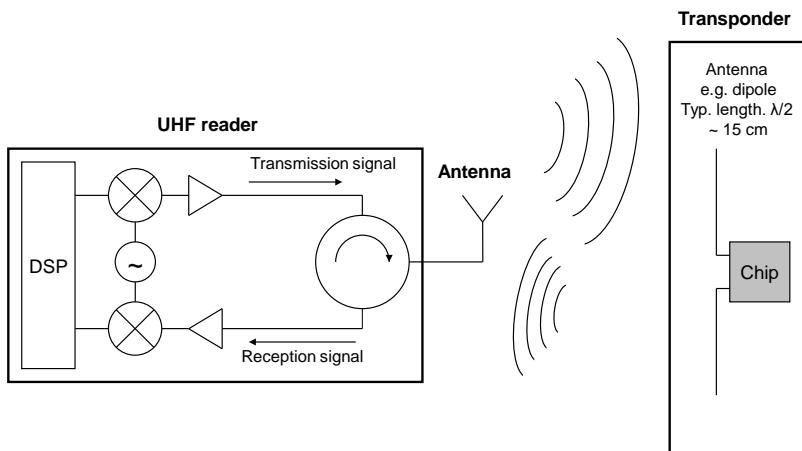


Figure 2: Design of a UHF RFID system

The propagation of electromagnetic waves results in the following effects:

- Diffraction and absorption of the wave
- Cancellation of two waves through propagation on different paths due to reflectance (comparable to fading effects in a car radio, e.g. noise when vehicle is stationary)
- Overshoots produced due to reflective objects and surfaces.

This phenomenon is often illustrated by comparing it to the visual effects seen in a hall of mirrors.

The signal sent out by the reader is reflected multiple times by the metallic walls of the enclosure and this can result in undesired cancellation effects and hence reading errors. It can therefore happen that a static transponder cannot be picked up even though it is well within range of the reading device.

As described in detail below in the "Engineering / Implementation / Measures" chapter, the following actions represent some of the ways that we can counteract these cancellation effects.

- Changing the frequency on the reader
- Moving the transponder
- Altering the antenna orientation

Describing measures which counteract the specified cancellation effects.

In addition, further boundary conditions are described that allow for the reliable implementation of a UHF system into a process.

When employing UHF in industrial applications it is critical that these effects be taken into careful account so as not to jeopardize the reliability of the overall system.

4.2.2. Planning of UHF Expertise

The aforementioned technical boundary conditions must be taken into account early on starting with the planning phase.

This requires that sufficient specialized UHF expertise be available at each OEM / system supplier. For support from Siemens, please get in touch with your Siemens contact person.

4.2.2.1. OEM Perspective

The following measures are mandatory and shall be implemented in order to impart or provide expertise to participating OEMs:

- Instruction / training of OEMs in the technology at the start of the project (prior to start of design and engineering at OEMs)

- Individual review of OEM-specific applications
- Targeted support and targeted know-how advancement at OEMs (benefit: in-house knowhow)

4.2.2.2. Overall Project Perspective

The entity bearing overall responsibility for the project (DAIMLER) will appoint one individual to assume across-the-board responsibility for the overall coordination of all RFID installations in the current project and within the production facility.

This shall be taken into account in the following project phases:

- Design
- Sample acceptance, 1st machine by Daimler
- System commissioning at Daimler

4.3. Hardware

4.3.1. Readers / Antennas / Cables

The interaction of the write/read devices and the communication modules is illustrated in the following figure:

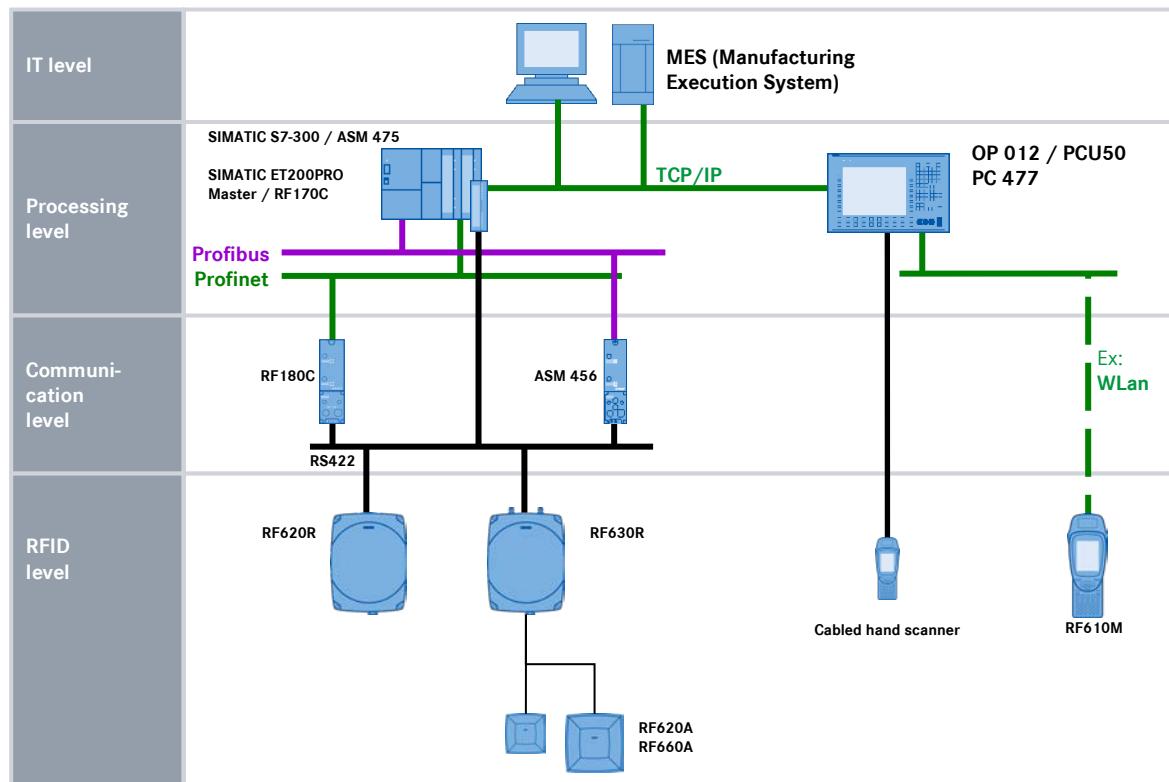


Figure 3: Sample integration chart.

Details pertaining to the hardware integration are provided in the relevant project book of the product partner. Approved components are listed in the MDM.

Reader:

The UHF midrange readers SIMATIC RF620R / RF630R read out the tag data and make it available to downstream automation systems via the RS422 system interface. This is done via the direct connection to one of the available communication modules, SIMATIC RF170C, SIMATIC RF180C or ASM 456.

The compact SIMATIC RF620R reader is equipped with an integrated antenna. No further antennas can be connected to this reader.

Proper operation of the SIMATIC RF630R requires connecting at least one and at most two external antennas from the SIMATIC RF600 line.

The correct Siemens antennas and interface cables shall always be used.

For further information on configuration, runtime behavior of the SIMATIC RF620R and SIMATIC RF630R and integration of both UHF readers into the SIMATIC control system, please refer to the respective hardware documentation.

The configuration of the readers is done by selecting predefined profiles and through use of the FB45 and FC55 function modules. These are found on the Siemens CD "RFID Systems Software & Documentation".

Antennas:

The UHF antennas of the SIMATIC RF600 line are used in a wide variety of production, material flow and logistics applications. Their robust construction and high protection rating make them suitable for use in heavy-duty industrial applications.

The SIMATIC RF620A antenna features an extremely compact housing. It is used primarily for production applications, for example on assembly lines or conveying systems.

A universal type UHF antenna, the SIMATIC RF660A is suitable for numerous production and logistics applications requiring a greater range or narrower read field.

Compared to the SIMATIC RF660A, the range of the SIMATIC RF620A is significantly smaller.

Cables/Accessories:

The cables and accessories listed in the MDM shall be used.

- Interface cable RS422, for connection to ASM 456, RF170C, RF180C, lengths of 2/5/10/20/50m
- Recommended antenna cable for RF620A: Length 3m
- Recommended antenna cable for RF660A: Length 3/10/20m
- Antenna mounting kit for flexible mounting of RF620R reader and RF660A antenna

Detailed technical properties can be found in the RF600-system manual.

4.3.2. Data Carriers / Tags

Transponder:

The SIMATIC RF630T screw tag for industrial applications is robust and highly resistant to cleaning agents. It is designed to be placed on electrically conductive metal surfaces by means of an M6 threaded pin. The transponder is designed passive and maintenance-free, and is based on the UHF Class 1 Gen2 technology for storing the 96-bit / 240-bit "Electronic Product Code" (EPC). The data carrier also has a user memory of 64 bytes. Two version of this transponder will be available with a frequency of 868 MHz (Europe) or 915 MHz (USA).

4.3.3. Integration

Various communications modules (ASMs) are available for integrating the SIMATIC RF into SIMATIC, SINUMERIK, PROFIBUS and PROFINET systems.

The integration is identical with the integration of the MOBY systems.

System	Module	Available software
SIMATIC S7-300, PC with SIMATIC WinAC, via ET 200pro	RF170C	FC/FB45; FC/FB55 (multitag)
PROFIBUS DP-V1 ¹⁾ (SIMATIC S7; PC, any systems)	ASM 456	FC/FB45 for S7-300, FC/FB55 (multitag, only ASM 456), FB101/116/132 (only ASM 456)

4.4. Engineering / Implementation / Measures

As described in Planning of UHF Expertise, the OEMs / system suppliers will be informed of the current engineering specifications and boundary conditions during the suppliers' conference prior to the start of the project. Attendance is mandatory for the OEMs.

The fact that UHF technology represents a higher degree of technical complexity compared to HF means that greater diligence and caution need to be exercised during the configuration phase.

4.4.1. Planning for the RFID System

The following chapters describe the proper planning of read points and point to the measures required to contribute to process-consistent operation.

4.4.1.1. Detailed Examination of Each Read Point

The basic rule is that each read point must be examined both on its own and as part of an array.

The following aspects need to be optimally tuned to one another as part of the detailed examination:

- Reader (built-in antenna, external antenna)
- Antenna line (length, losses)
- Transmission or radiated power
- Antenna (gain, spread angle)
- Transponder (antenna characteristics, installation conditions)
- Further accessories that affect the installation conditions (e.g. absorbers)
- Integration of read point into the machine process (e.g. determination of read point location depending on mechanical interference contours)

Comparison of these aspects shall be done such as to achieve precisely the desired aim, for example to read and write a defined amount of data at a particular speed.

This means that in dynamic applications, the speed of conveyance must permit a certain dwell time in which the tag is within the transmission field. If this dwell time is too short, it may not be sufficient to successfully complete the write/read operations.

In static applications, the transponder is located in a defined position. In this case it must be ensured that local field cancellation caused by reflectance (see Fundamentals of UHF and Differences to HF) is reliably prevented.

Eliminating reflectance can be achieved by implementing the following measures.

MEASURES:

- Targeted and reproducible orientation of the antenna in correlation with the tag position
- RFID optimized positioning of the read point (implement special stop position if required)
- The use of plastics for enclosures (avoidance of metallic tunnels)
- Use of absorber material where metal enclosures are absolutely necessary (to line interior)
- Implementation of static/dynamic reading depending on the application. (Examples to help in choosing are given in Reproducible Installations / Acquisition Classes)

In addition to this, a read point must be planned such that

- reliable processing is possible taking account of parameter fluctuations (e.g. changing boundary conditions)
- no unnecessary range reserves are implemented (e.g. excessive performance settings). These could cause interference with nearby read points.

4.4.1.2. Interdependencies of Read Points in an Array

When examining multiple read points in an array, the following aspects need to be considered:

Reader-to-Reader Interference

Under the applicable regulation (ETSI EN 302208) in the EU, four UHF frequencies are available which are used by ALL readers of one installation. It can therefore happen that multiple readers operate on the same channel. This is not a problem as long as it is taken into account during configuration.

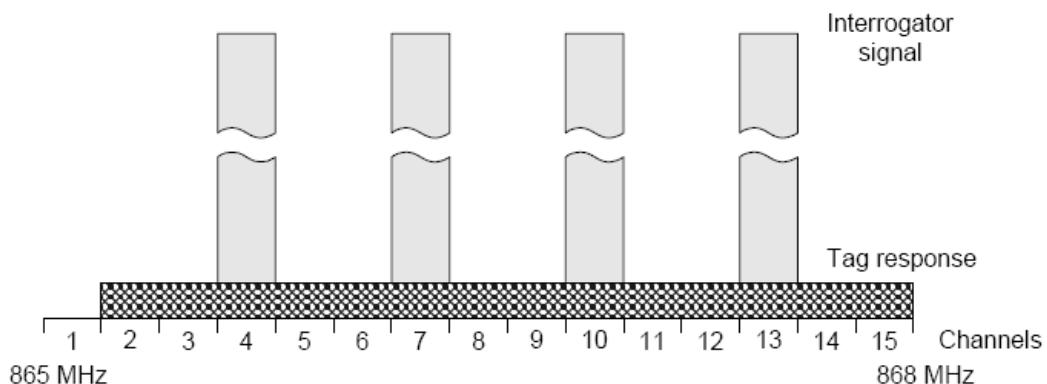


Figure 4: Available channels in the UHF spectrum (EU)

Multiple readers can use the same radio-frequency channel as long as they are not operated too closely to one another. If the distance is less than the minimum prescribed in the configuration manual, the readers will interfere with one another. The overall system will then not operate in a process-consistent manner.

MEASURES:

Implementing the following measures can remedy this problem:

- Physically separating the readers (increase distance between readers if possible).
- Screening the readers from one another (e.g. with shield plates and absorbers)
- Frequency-dependent separation (for information on channel management, see Chapter Selective Channel Management).

All of these measures serve to protect a reader's sensitive receiver from picking up too much interference from a nearby reader.

Undesired Reading by Transponders Due to Overshoot (Cross Reading)

Causes of overshoot may include

- Configuration with too much reserve (e.g. excessive transmitter power or oversized antenna).
- Metallic objects that adversely reflect the signal.
- Multiple reflection in tunnels, shafts, etc. (waveguide effect).

Such cross reads manifest themselves when reads are made by undesired transponders, such as those operating

on an adjacent line or picked up by another read point.

Whereas inappropriate configuration settings can be resolved by changing the parameters, reflections can only be reduced or minimized through structural alterations. The important thing here is to recognize the effects taking place and to implement the correct countermeasures.

MEASURES:

Implementing the following measures can remedy this problem:

- Enclosures for installation parts shall ideally be made of plastic.
 - Alternatively, absorber material can be applied to enclosures to minimize reflectance of UHF frequencies.

If properly taken into account during the planning phase of the installation, the use of absorber material can significantly shorten the initial startup phase and give the RFID system a high degree of reliability.

In addition, minimum distances must be maintained between the transponders to allow for clear-cut reading depending on the location of the installed read points (see Figure 5: Dependencies of read point and tag locations).

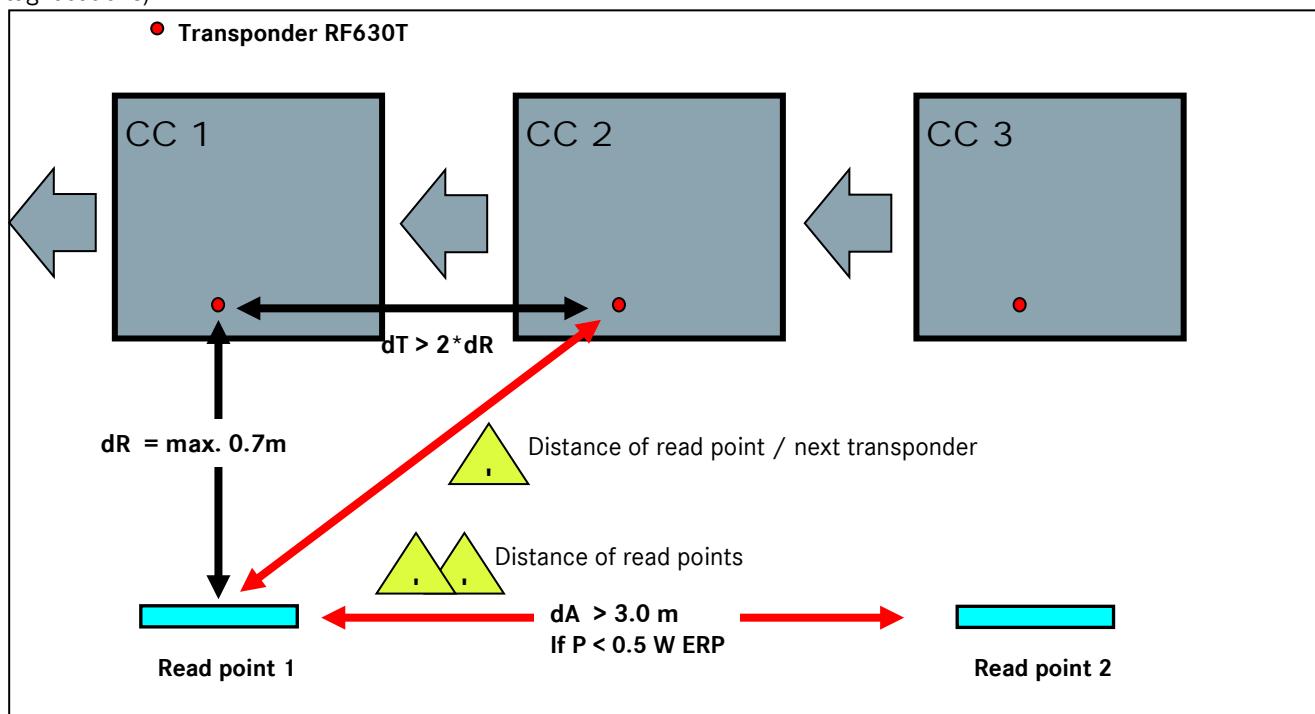


Figure 5: Dependencies of read point and tag locations

Note:

- The values shown here are guideline values and may deviate depending on boundary conditions.
 - The read points are defined by the antenna position of the associated reader.

4.4.1.3. Reproducible Installations / Acquisition Classes

The following acquisition classes (RFID identification points) serve to provide a rough illustration of how installations can be structured and point to the measures that must be implemented to ensure process-consistent installation of the read points.

The distances given assume the use of an RF630T screw-in transponder. Details must be considered specifically for each installation.

Class 1a	
Area:	Production
Installation:	Defined read points on conveyor belt with low number of structural degrees of freedom for the read point, read distance < 15 cm
Typical components	<ul style="list-style-type: none"> • Reader: RF630A • Antenna line: 3m • Antenna: RF620A
Properties for acquisition class	<ul style="list-style-type: none"> • Machine enclosures – also personal / handle protection • Component stopper for defined stop point where identification takes place (static application) • Individual reading of components
Measures	<ul style="list-style-type: none"> • Use of absorber material or of nonmetallic machine enclosures • Smallest possible distance between data carrier and antenna • Optimum orientation of antenna to tag • Use lowest possible power setting
Class 1b	
Area:	Production
Installation:	Defined read points on conveyor belt with low number of structural degrees of freedom for the read point, read distance < 40 cm
Typical components	<ul style="list-style-type: none"> • Reader: RF620R
Properties for acquisition class	<ul style="list-style-type: none"> • Machine enclosures – also personal / handle protection • Component stopper for defined stop point where identification takes place (static application) • Selective reading of components • Increased distance to following component
Measures	<ul style="list-style-type: none"> • Use of absorber material or of nonmetallic machine enclosures • Smallest possible distance between data carrier and antenna • Optimum orientation of antenna to tag • Use lowest possible power setting
Class 2	
Area:	Production
Installation:	Defined read points on SPC stations with low number of structural degrees of freedom for the read point, read distance < 80 cm
Typical components	<ul style="list-style-type: none"> • Reader: RF630A • Antenna line: 3m • Antenna: RF660A

Properties for acquisition class	<ul style="list-style-type: none"> Machine enclosures – also personal / handle protection Mechanical component holders for one or more components Selective reading of components Interference contour due to gantry loader
Measures	<ul style="list-style-type: none"> Use of absorber material or of nonmetallic machine enclosures Smallest possible distance between data carrier and antenna Optimum orientation of antenna to tag Multitag functionality for simultaneous reading of multiple tags in SPC station Process and logistical modifications to ensure the removal/feed of ONLY one component. Allows, for example, for identification of removed component Use lowest possible power setting

Class 3	
Area:	Production
Installation:	Defined read points in area of load/unload station of a gantry loader. Modifiable machine enclosure (e.g. drawers, cover) with low number of structural degrees of freedom for read point, read distance < 80 cm
Typical components	<ul style="list-style-type: none"> Reader: RF630A Antenna line: 3m Antenna: RF660A or RF620R
Properties for acquisition class	<ul style="list-style-type: none"> Machine enclosures – also personal / handle protection Partially also dynamic enclosure (drawer, loading hatch, etc.) Component stopper for defined stop point where component is identified Selective reading of components Interference contour due to gantry loader
Measures	<ul style="list-style-type: none"> Use of absorber material or of nonmetallic machine enclosures Smallest possible distance between data carrier and antenna Optimum orientation of antenna to tag Use lowest possible power setting

Class 4	
Area:	Assembly
Installation:	Defined read point on an assembly line. Component located on a workpiece carrier, read distance < 80 cm
Typical components	<ul style="list-style-type: none"> Reader: RF630A Antenna line: 3m Antenna: RF660A or RF620R
Properties for acquisition class	<ul style="list-style-type: none"> Stopper for workpiece carrier on which component is identified or dynamic reading without stopper Selective reading of components Increased read distance due to interference contour of workpiece carrier

Measures	<ul style="list-style-type: none">Smallest possible distance between data carrier and antennaOptimum orientation of antenna to tagUse lowest possible power setting
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4.4.2. Preliminary Studies

As described in the chapter on "Planning for UHF Expertise", the structural and process-related boundary conditions must be taken into account already in the concept phase. This permits an optimized integration of the RFID functionalities into the actual machine process.

If possible, physical tests should be performed at comparable installations in order to study the effects of the specific arrangement and to initiate the necessary actions.

4.4.3. Mandatory Specifications

Since UHF signals propagate in the form of electromagnetic waves, the signals can spread many times farther than the actual intended read distance.

The following mechanisms are implemented in the UHF systems to reduce such overshooting:

- Four usable radio-frequency channels
- High suppression of co-channel and adjacent-channel interference

Where a high density of readers exist, spurious signals from several devices may nonetheless add up and produce read errors on the affected device. It is important to remember that the cause of such sporadic errors lies in the interactions within the overall system and not in the individual components.

It is therefore essential to institute and maintain "radio discipline" just as with other radio-frequency services. A reader (transmitter) should only ever be switched on when this is truly necessary ("efficient use of spectrum").

4.4.3.1. Triggering of Readers

Readers are to be operated in the triggered mode. The reader is to be activated via a digital input/signal only when a transponder is supposed to be read or written to.

The reader is to be deactivated again once the write/read operation has been successfully completed.

4.4.3.2. Parameterization: Use Lowest Possible Transmission Power

The transmission power of each individual reader is to be set to a value that ensures reliable detection of the transponder. Unnecessary reserve power due to excessive power settings shall be avoided (see Undesired Reading by Transponders Due to Overshoot (Cross Reading)).

The transmission power shall not be set to either the minimum or maximum value.

Interface measure and channel management

4.4.3.3. Synchronization via Data Interface

Where readers are installed very close to one another, a logic can be implemented to ensure that only one affected reader can ever be activated at any one time. This prohibits parallel reader operation and thus reduces susceptibility to malfunction.

This approach can be implemented even where multiple OEMs are involved through the use of data interfaces. In such cases, however, it is essential to take account of the process requirements (e.g. cycle time).

4.4.3.4. Selective Channel Management

Another option that can allow for the use of two or more readers in close proximity is that of selective channel allocation. Here, readers are during configuration assigned to only selected channels within the 4-channel spectrum.

This ensures that no two readers can conflict on the same channel.

It must be remembered, however, that restricting channel availability may also impair error compensation achieved through dynamic channel switching. For this reason, the measure described here should only be used in very special circumstances.

4.4.4. OEM Interfaces

With respect to the mechanical and data interfaces between two successive manufacturing areas, responsibilities pertaining to the clarification of UHF dependencies are allocated as follows:

- The OEM of the upstream manufacturing area shall clarify the dependencies with the OEM of the downstream manufacturing area. The flow of material is the determining factor here. The contents of Chapter "Mandatory Specifications" et seqq. shall be observed here.
- Where fully interlinked mechanical systems and gantry loaders are used, the OEM of the interlinked system shall be responsible for coordinating with the OEMs of the individual manufacturing areas downstream.

4.4.5. Initial Startup / Diagnosis

For the RFID reader there are three levels of diagnosis available:

1. The three color status LED uses flash codes to indicate the device status. Additional information is available in the SIMATIC RF600 system manual.
2. The status of the reader can be viewed in the SIMATIC S7 control system via SLG-Status. Additional Information is available in the SIMATIC RF620R/RF630R parameterization handbook.
3. RFID diagnosis on the system control panel:
 - The RFID diagnosis screen shall be integrated on the control panel
 - Display of how many RFID tags are located within the reading range
 - Display of antenna power (range)
 - Setting of antenna power
 - Antenna reset
 - Start of write/read operation by means of manual function
4. A diagnostic tool provided by Siemens can be used via the RF-MANAGER software. For this, the RFID reader is connected directly via an RS422-RS232 converter to a PC.
The diagnostic tool delivers results on the performance of the connected read point relative to the data carriers located within the field.
For example, the change in read/write results produced by a change in the position of the mechanical antenna can be used to help set up and optimize the read point.

The diagnostic tool (project in the RF MANAGER) is to be installed on the PC.

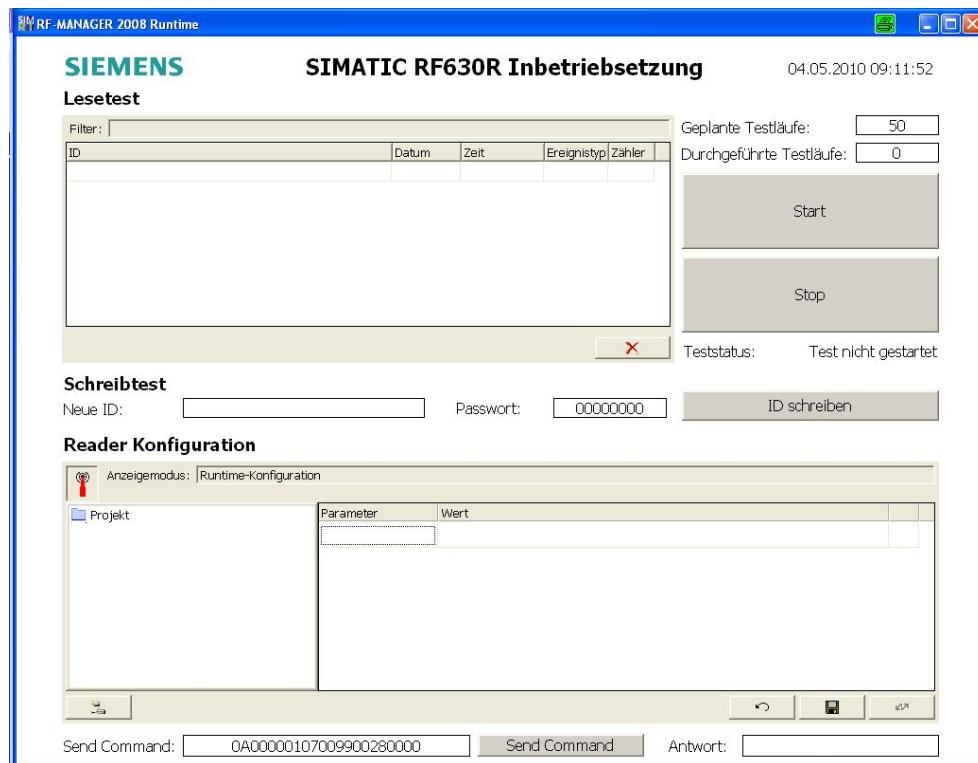


Figure 6: Screenshot of diagnostic tool in the RF Manager

4.5. Data Structure

The data structure of the RF630T is divided into two memory areas:

- EPC memory (96 bit)

This area serves to uniquely identify the data carrier and may be used but not written to by the OEM.

The following functions are to be implemented at the initialization station:

- Initialization of the EPC area
- Performance of a check reading and verification of correct data content

- User memory (512 bit)

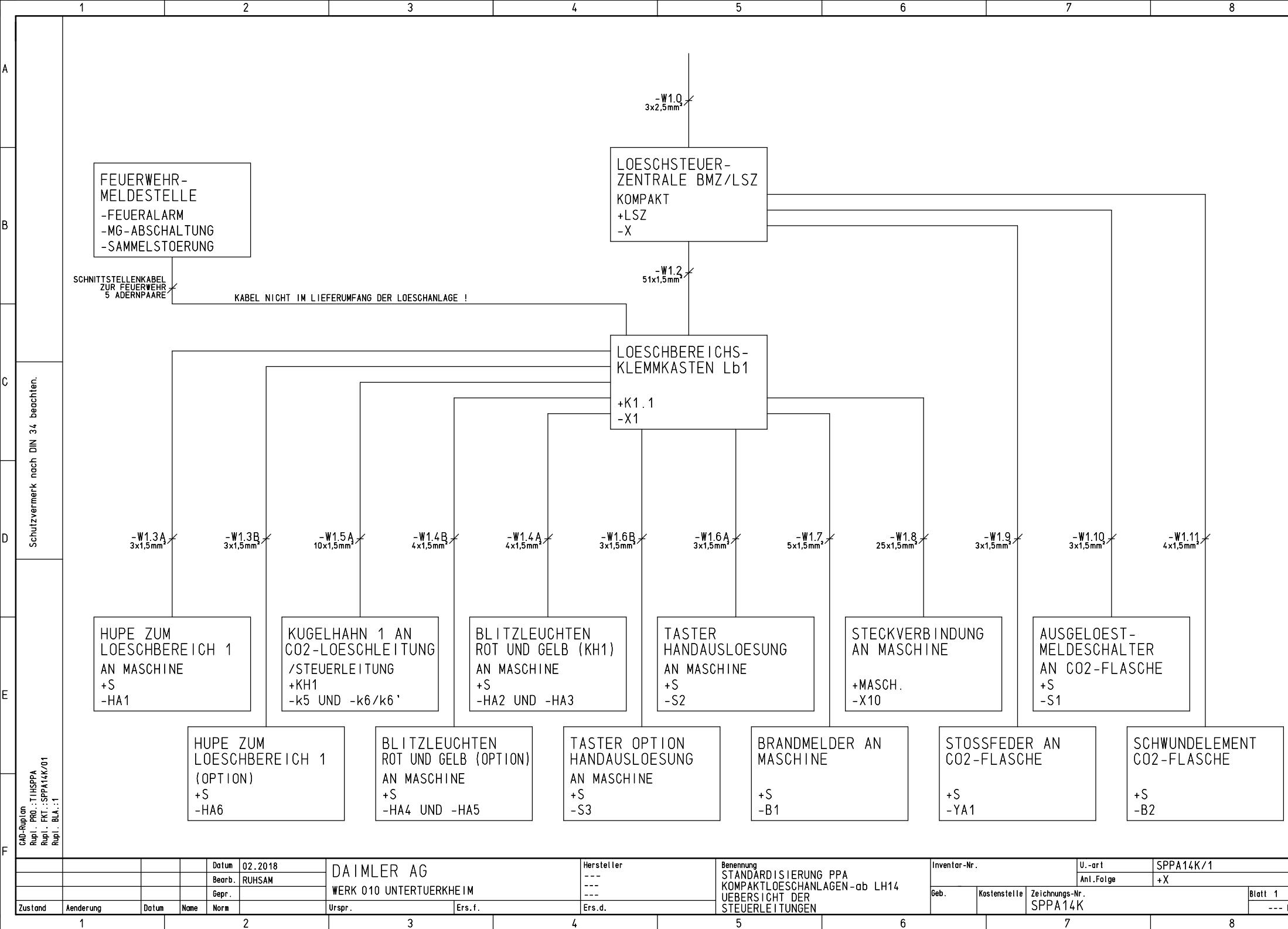
The memory area (bit 0 -144) contains the complete data content of the DMC specification and may be used but not written to by the OEM.

The following functions are to be implemented at the initialization station:

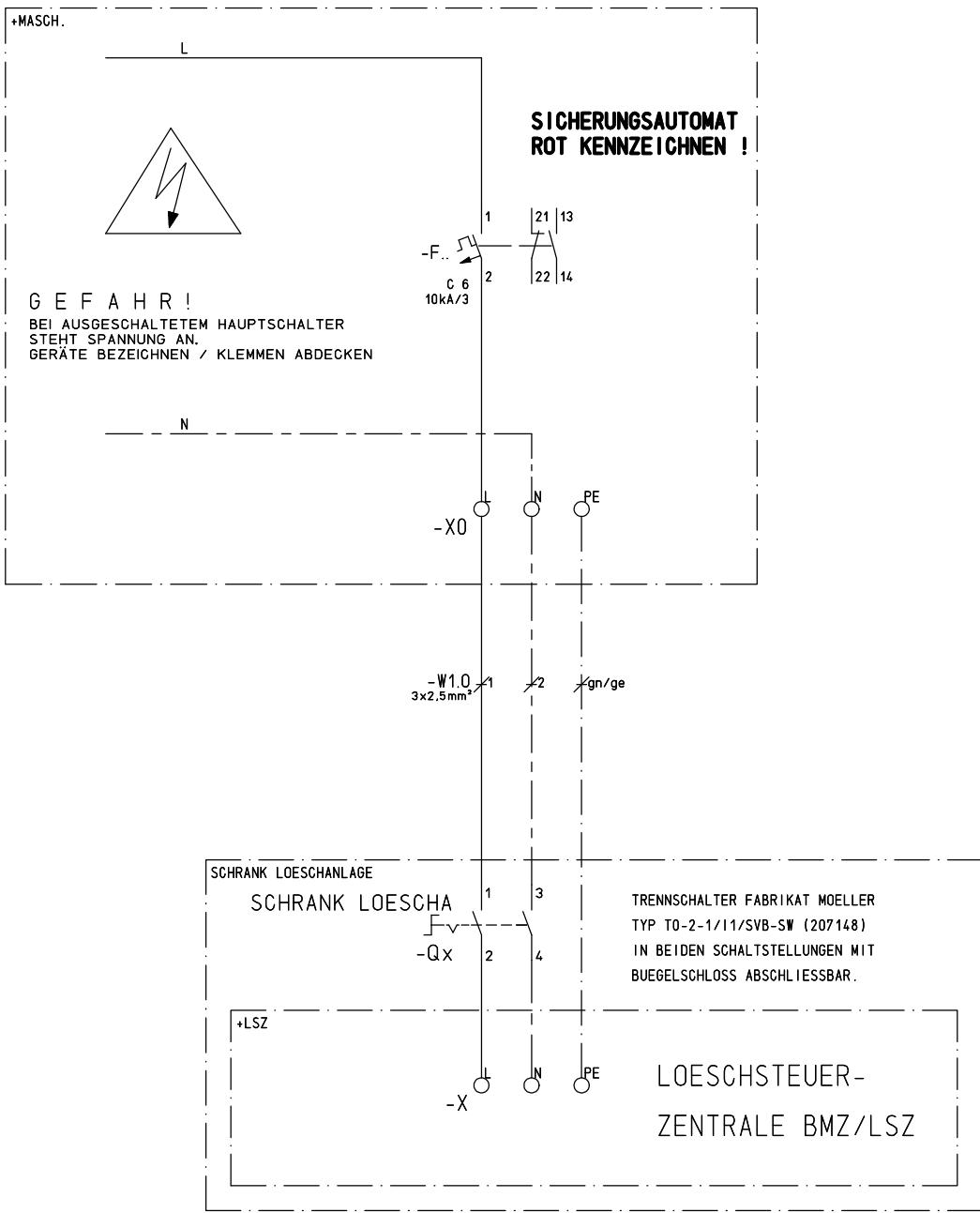
- The counter value is to be incremented by one for each data carrier initialization.
- It must be possible to separate out data carriers depending on a variable counter value.
- Initialization of the user memory area (bit 0-96)
Performance of a check reading and verification of correct data content. Following a write operation, a reading check is done. The antenna absolutely must be briefly switched off between the write and read operation.

OEM-specific production data are stored starting at bit 145 and can be written to and read by every OEM.
 The detailed configuration of the data structure is done on a project-specific basis.

The current data structure must be obtained from Daimler and supplemented on a project-specific basis.



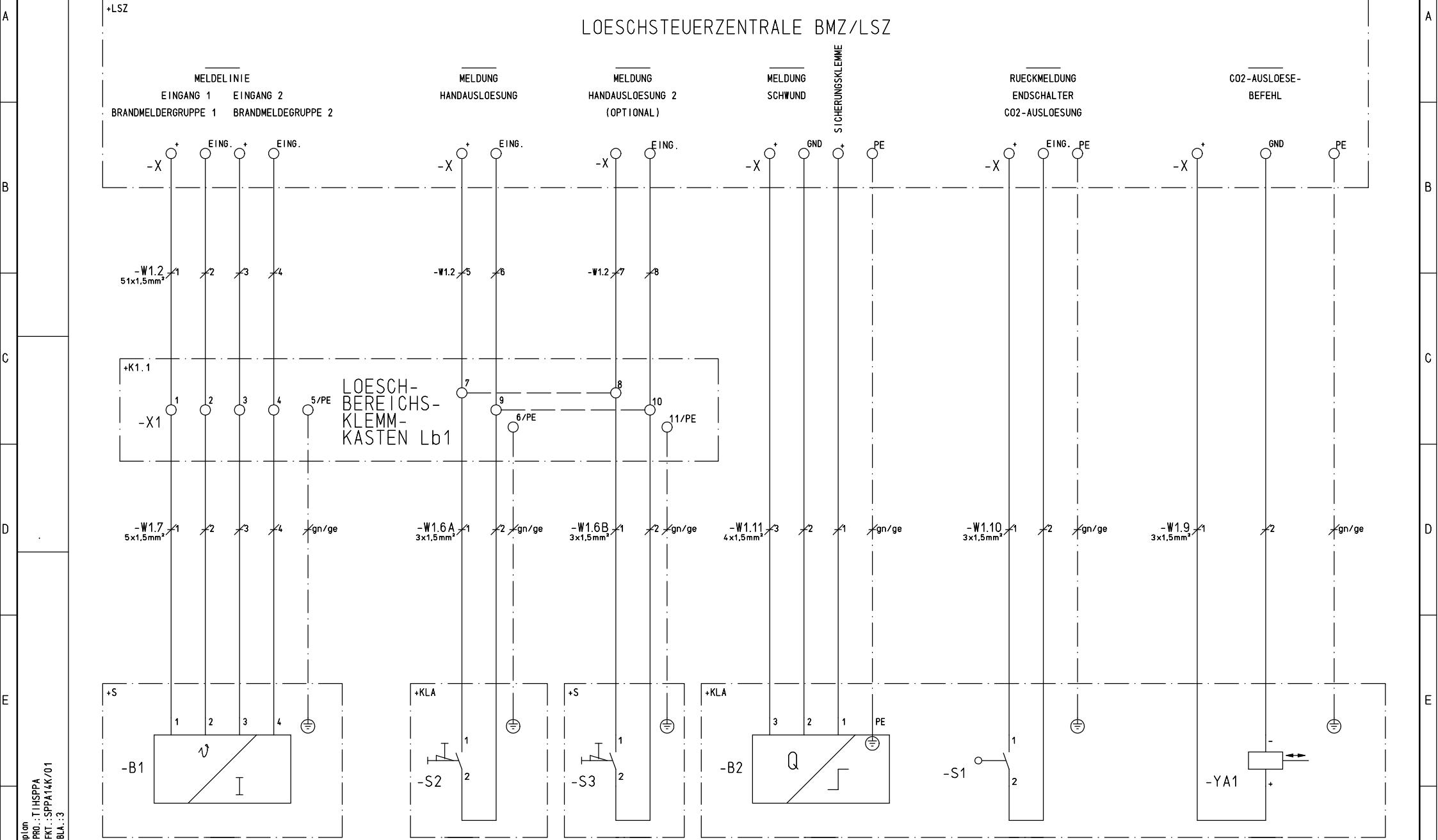
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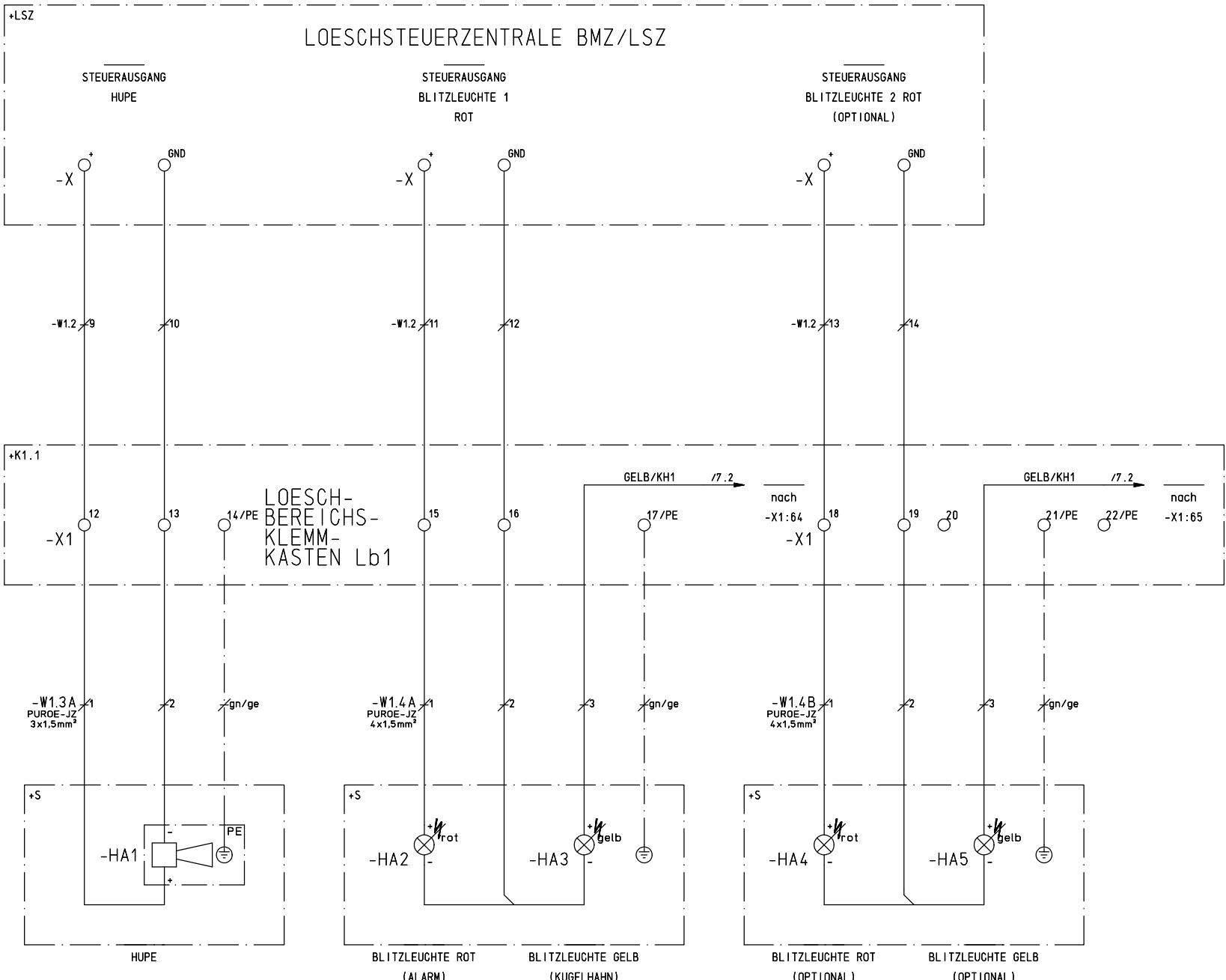
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MASCHINE.
ANSCHLUSS VOR DEM HAUPTSCHALTER (ORANGE).

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GROESSER ALS 63 A, IST DER LEITUNGSSCHUTZ-
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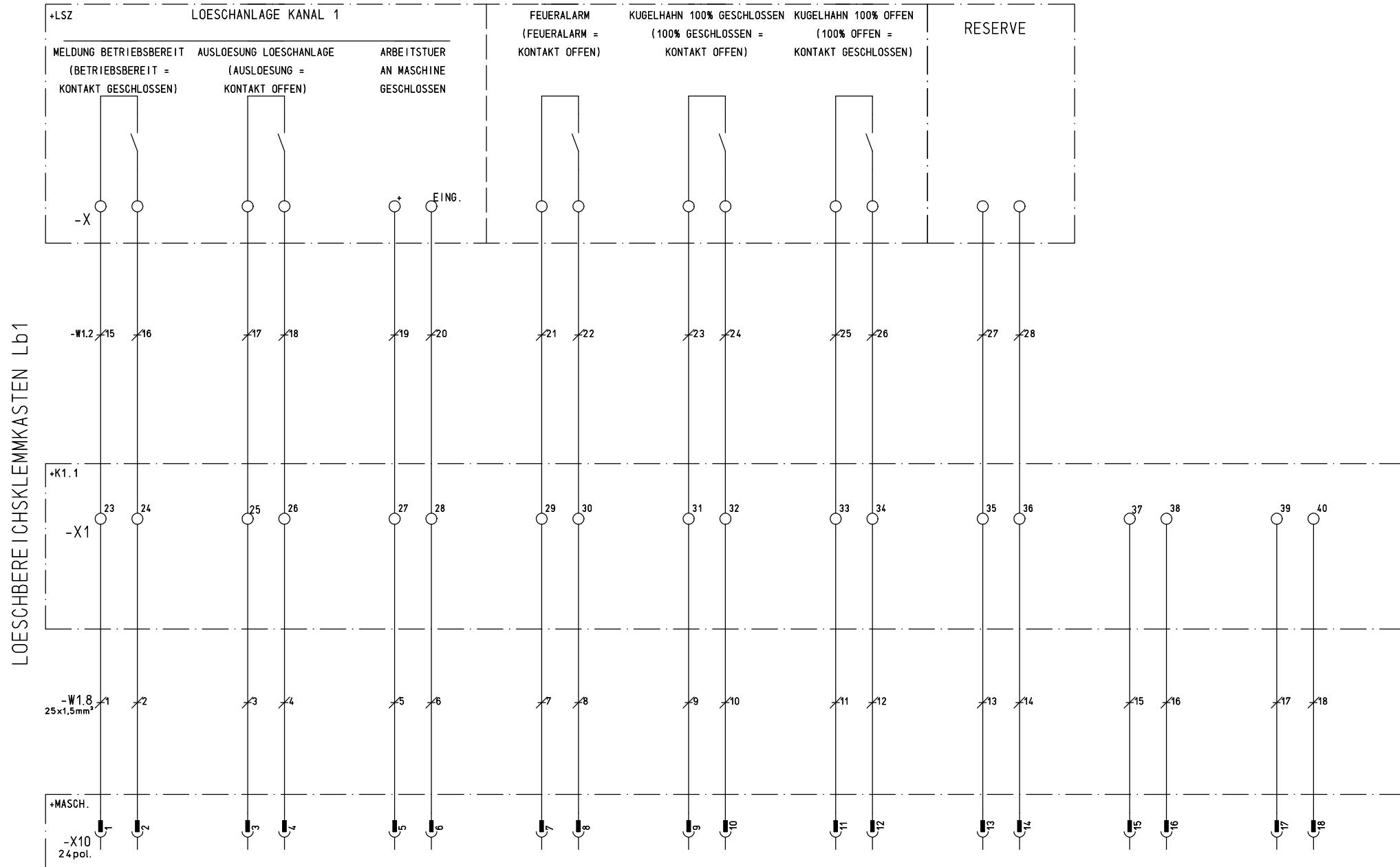


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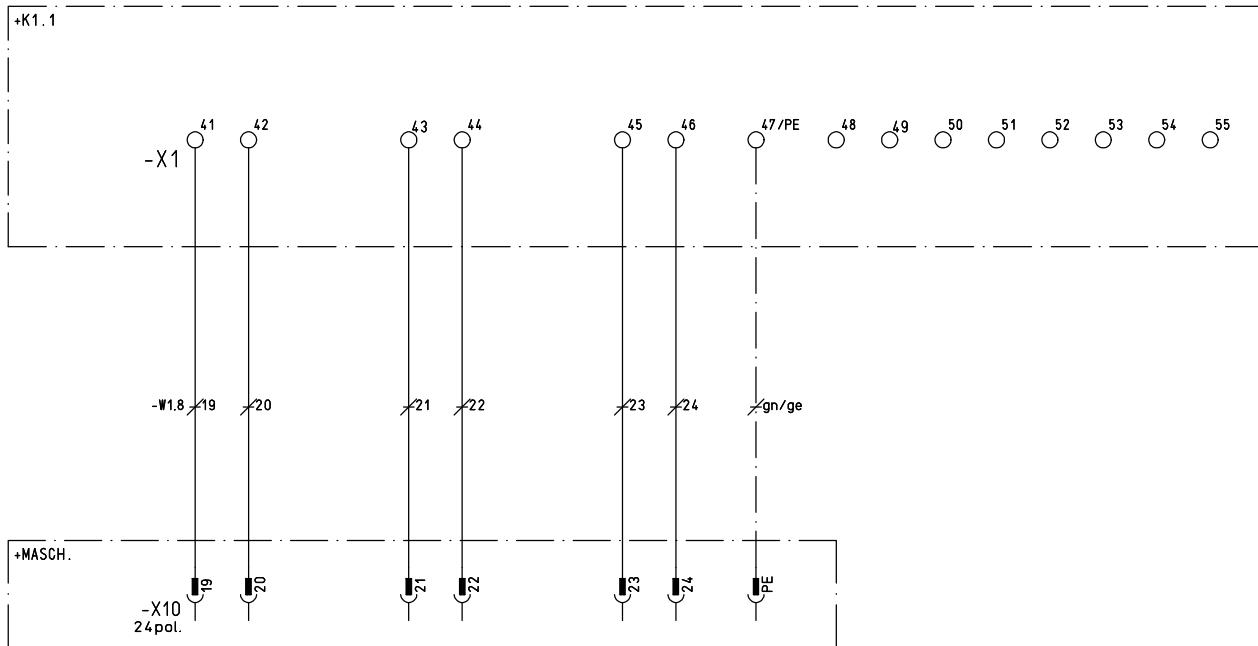


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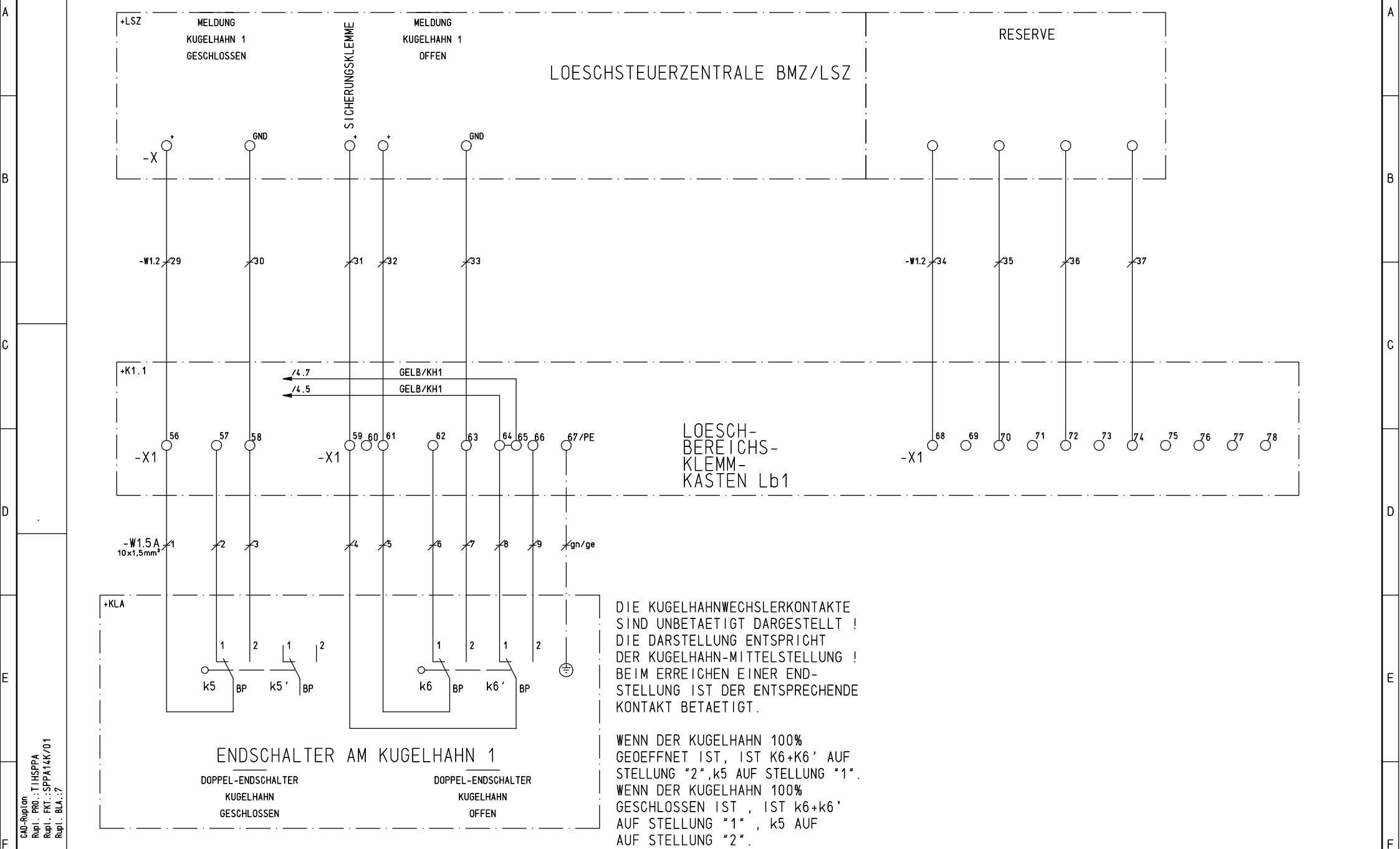
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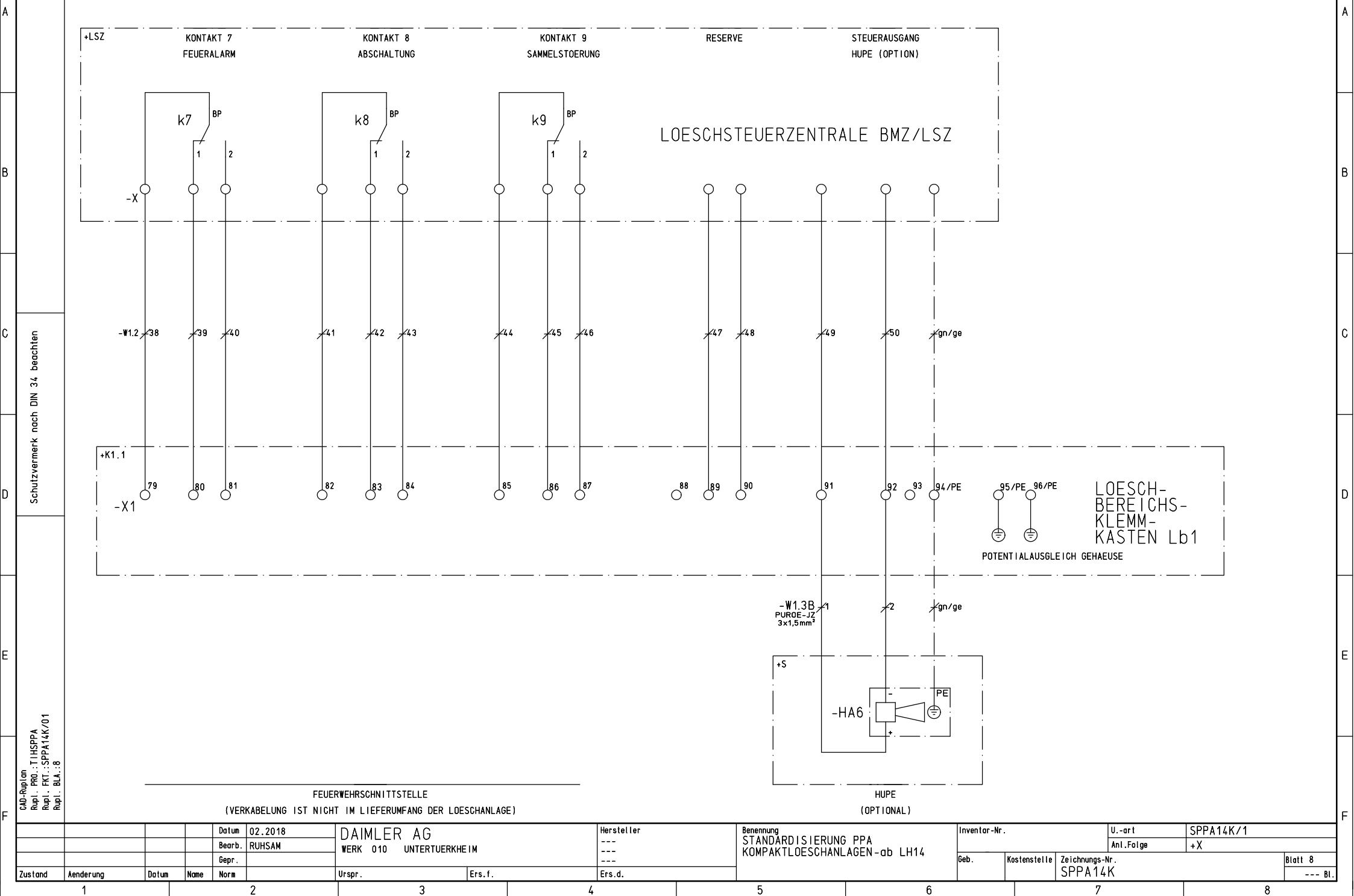
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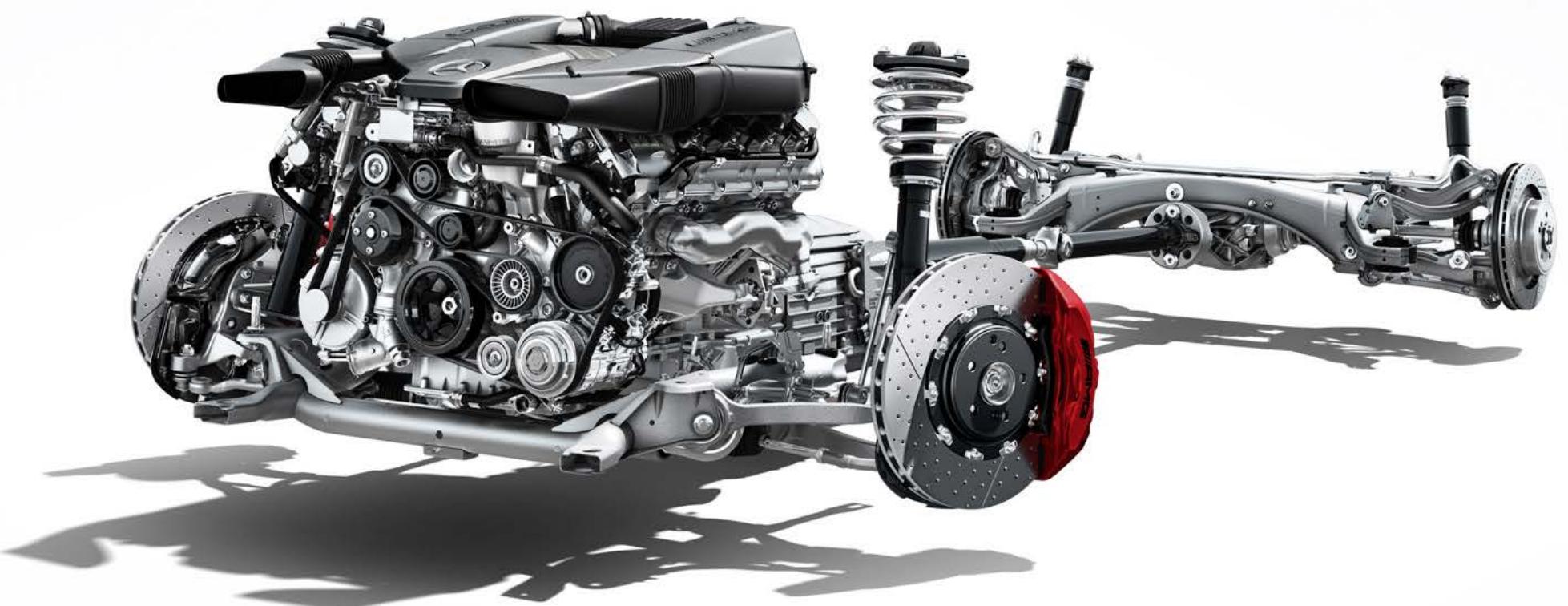
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Fire Protection in Powertrain III Requirement Specifications

Appendix 17 to Chapter 4.9 Machine and Installation Fire Protection



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Appendix 17/2: Documentation

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Mercedes-Benz

Fire Protection in Powertrain III Requirement Specifications

Appendix 17/1: Technical Design



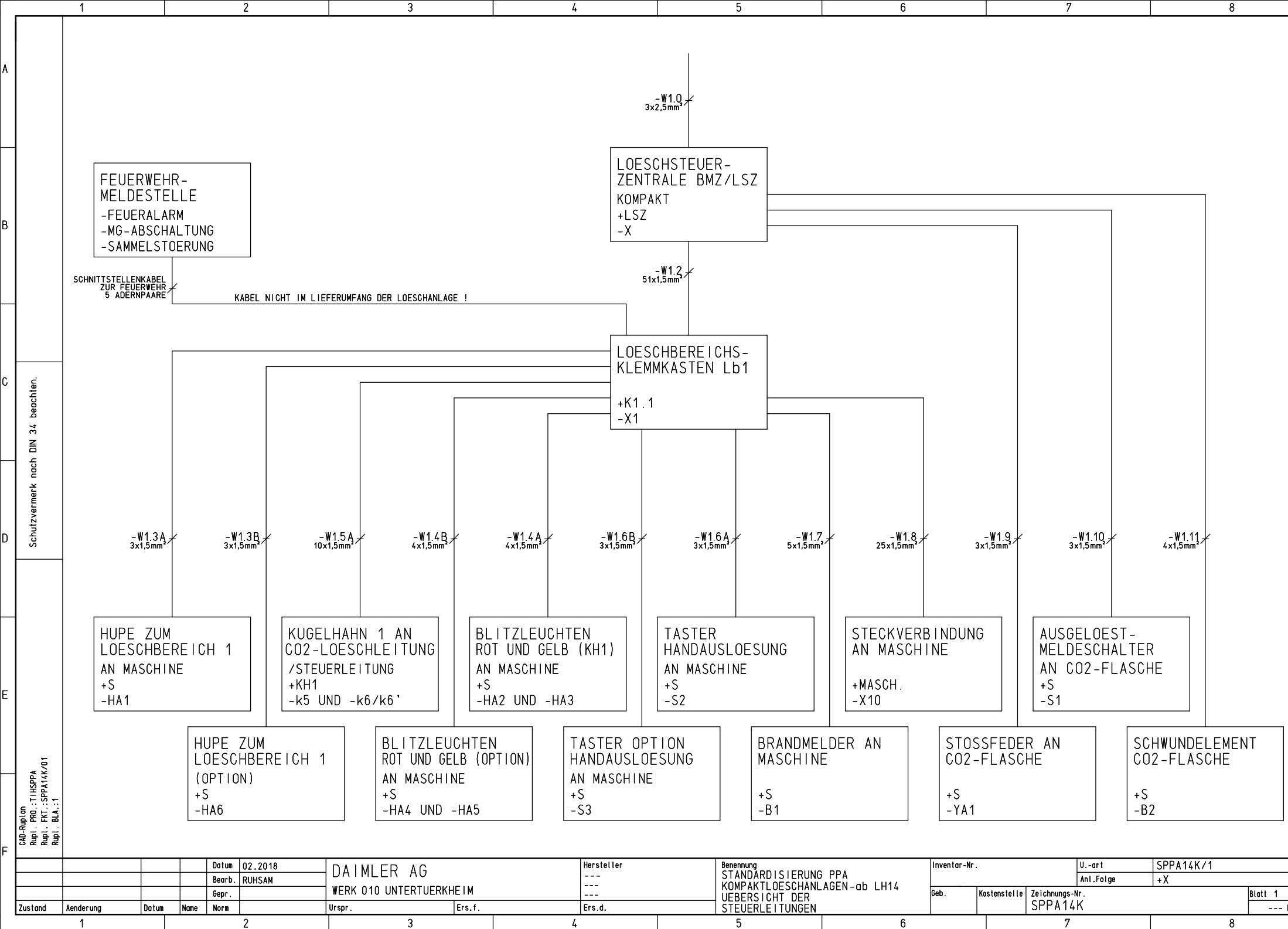
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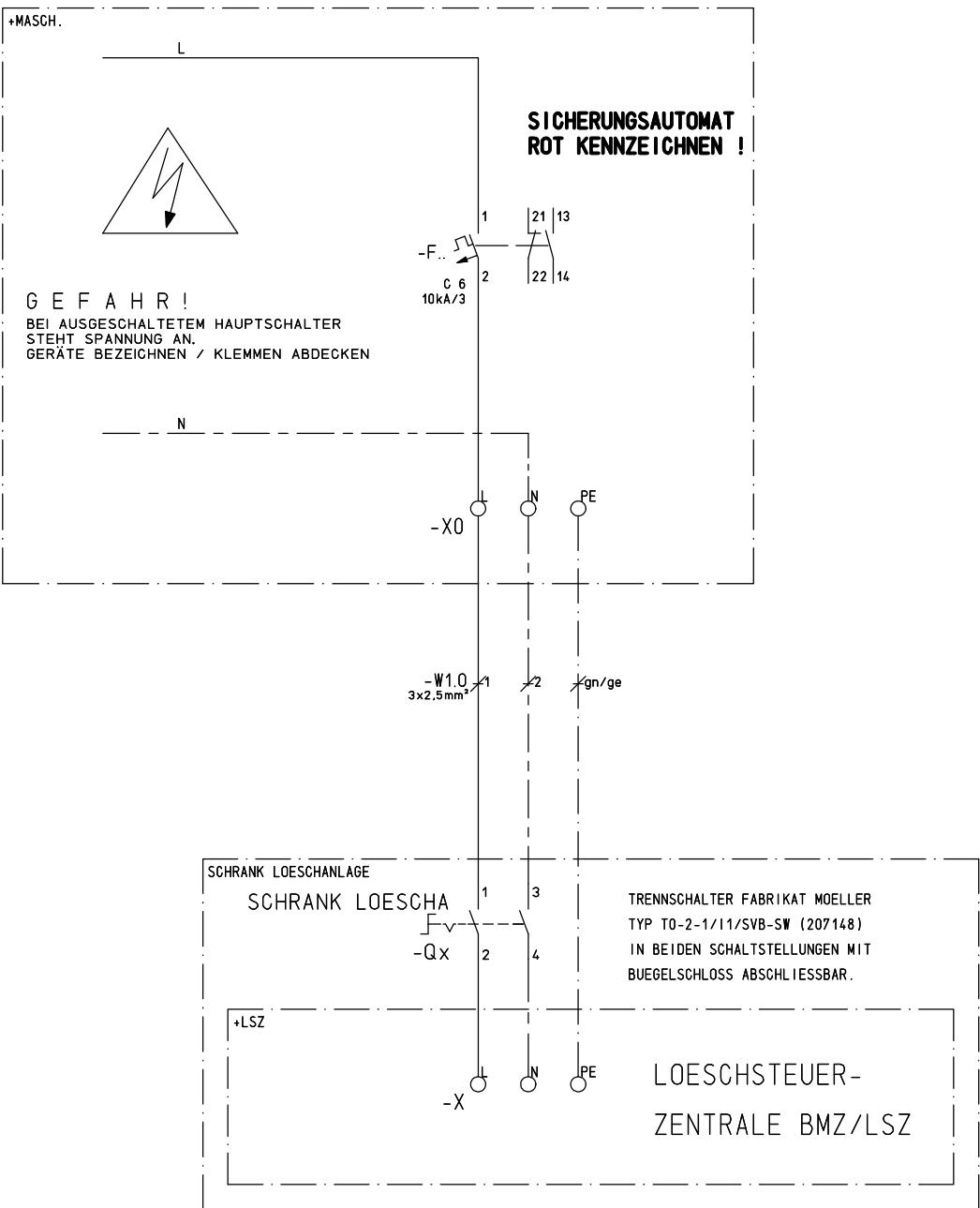
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1.1 Circuit Diagram for a Compact Extinguishing System

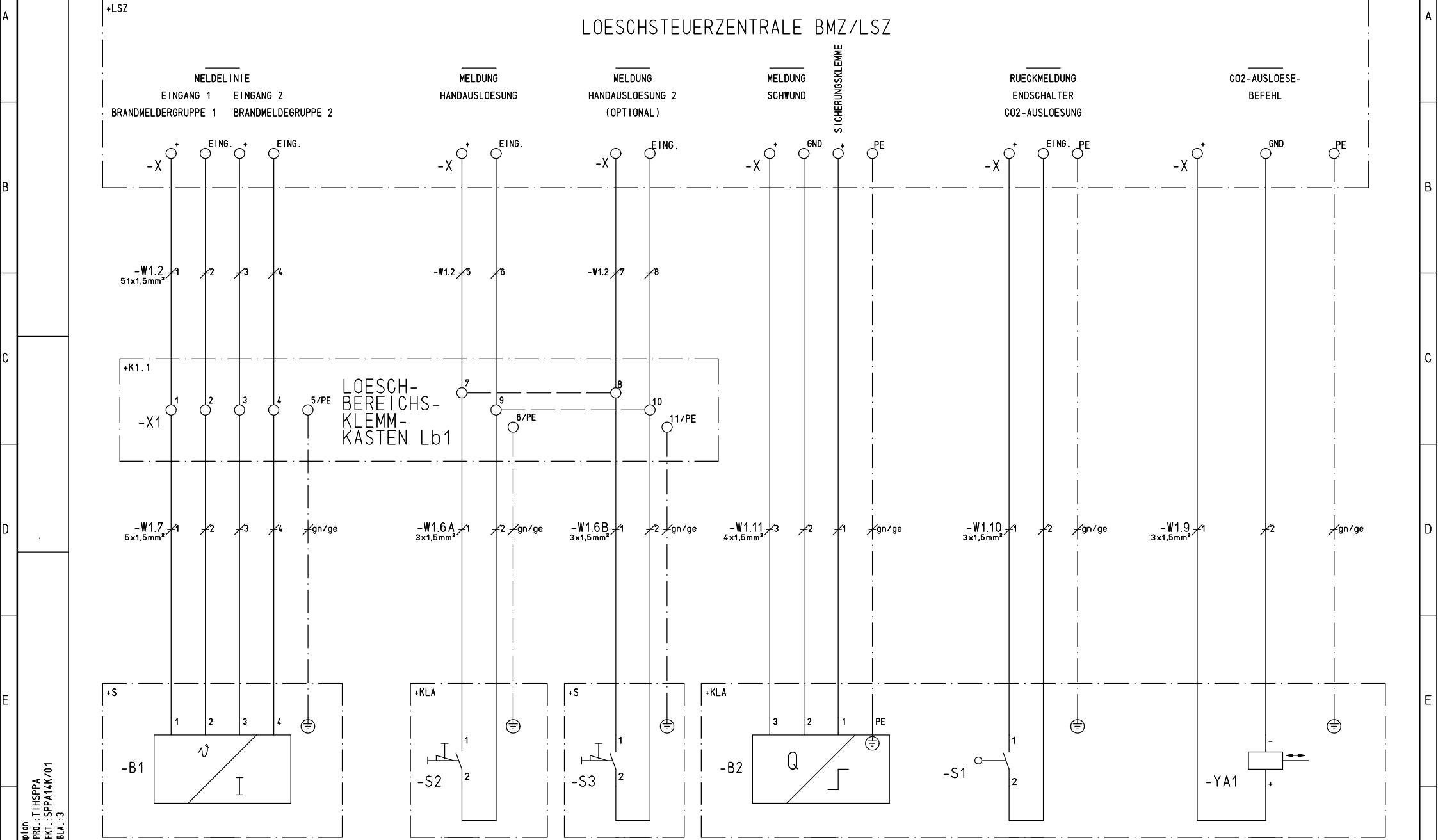
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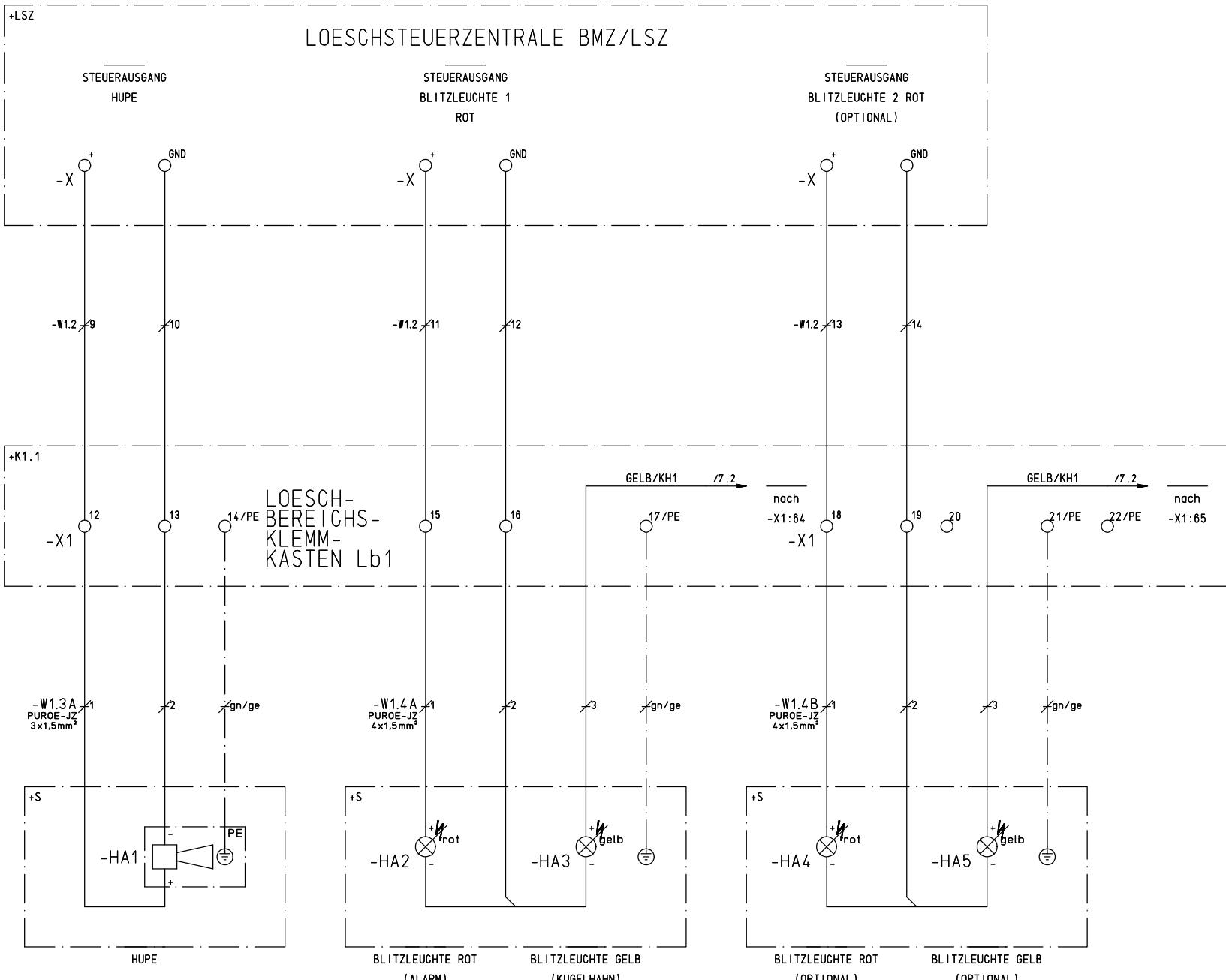


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ANSCHLUSS VOR DEM HAUPTSCHALTER (ORANGE).

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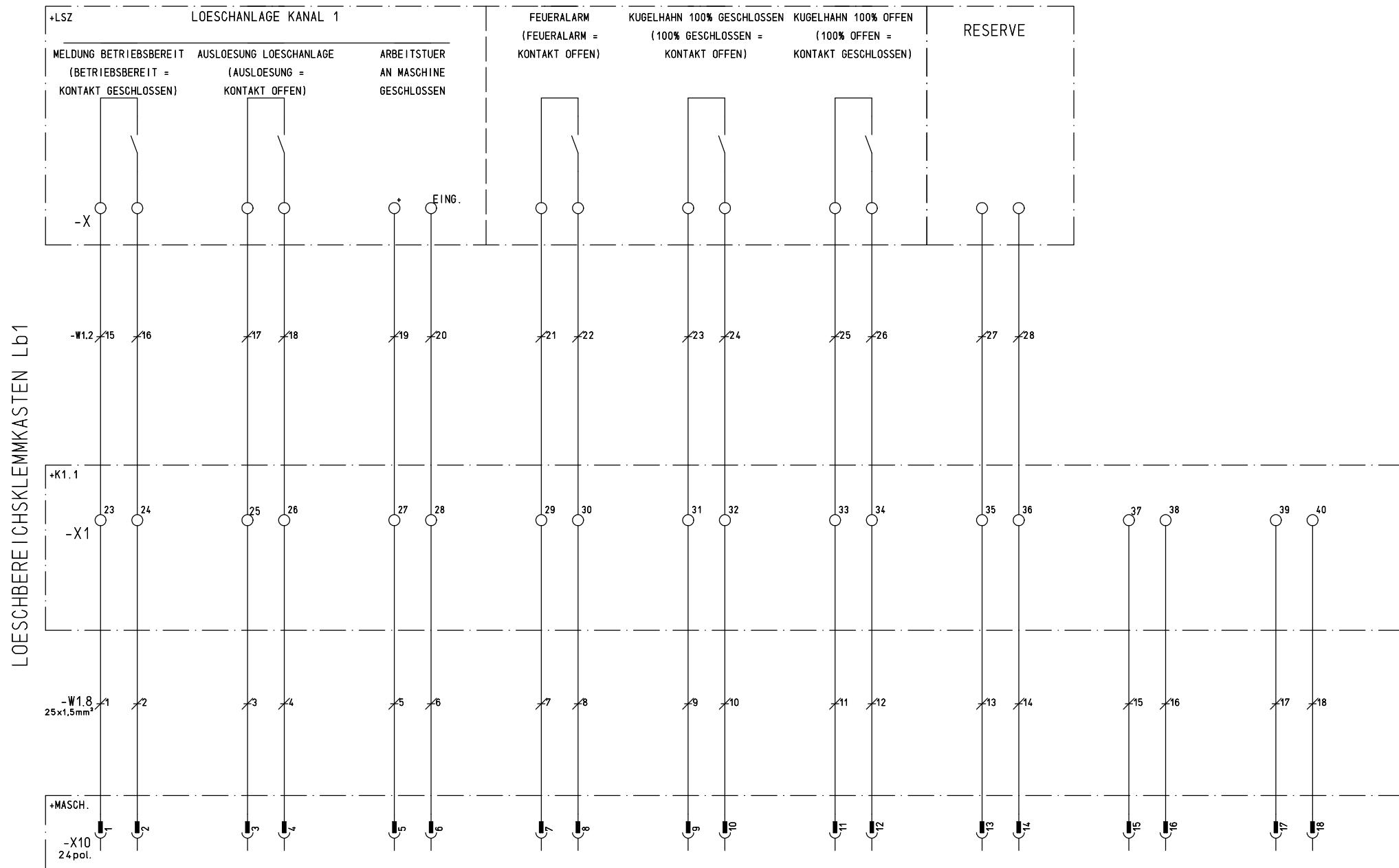


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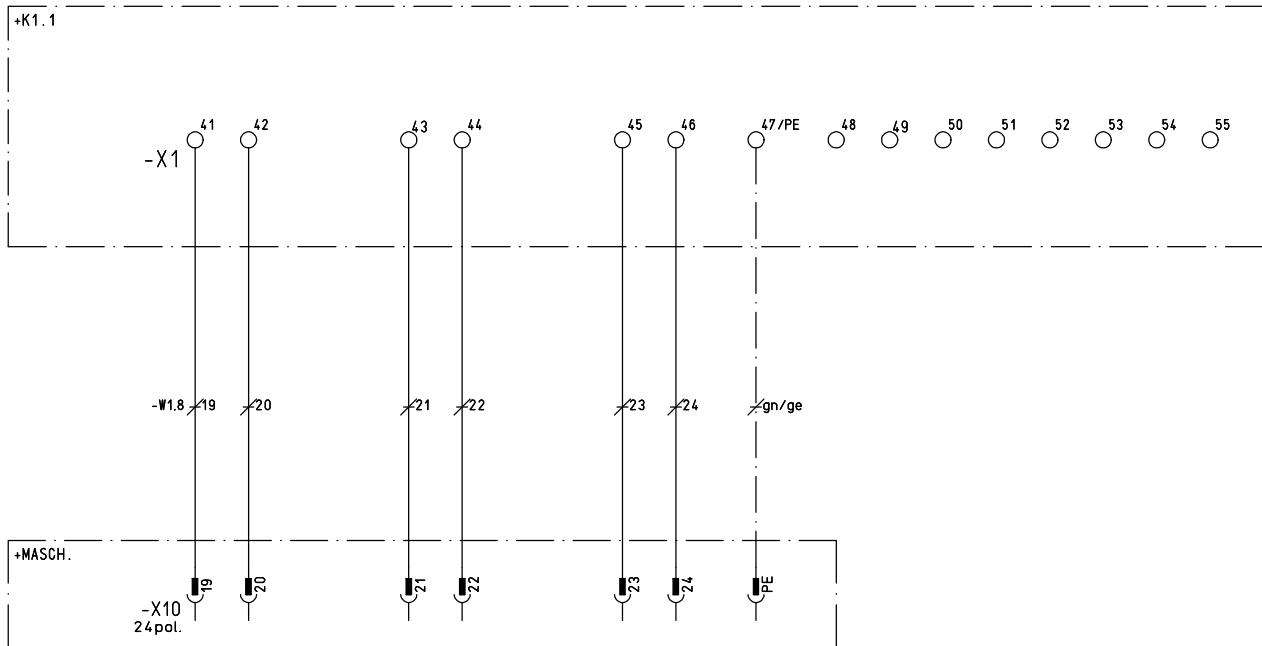


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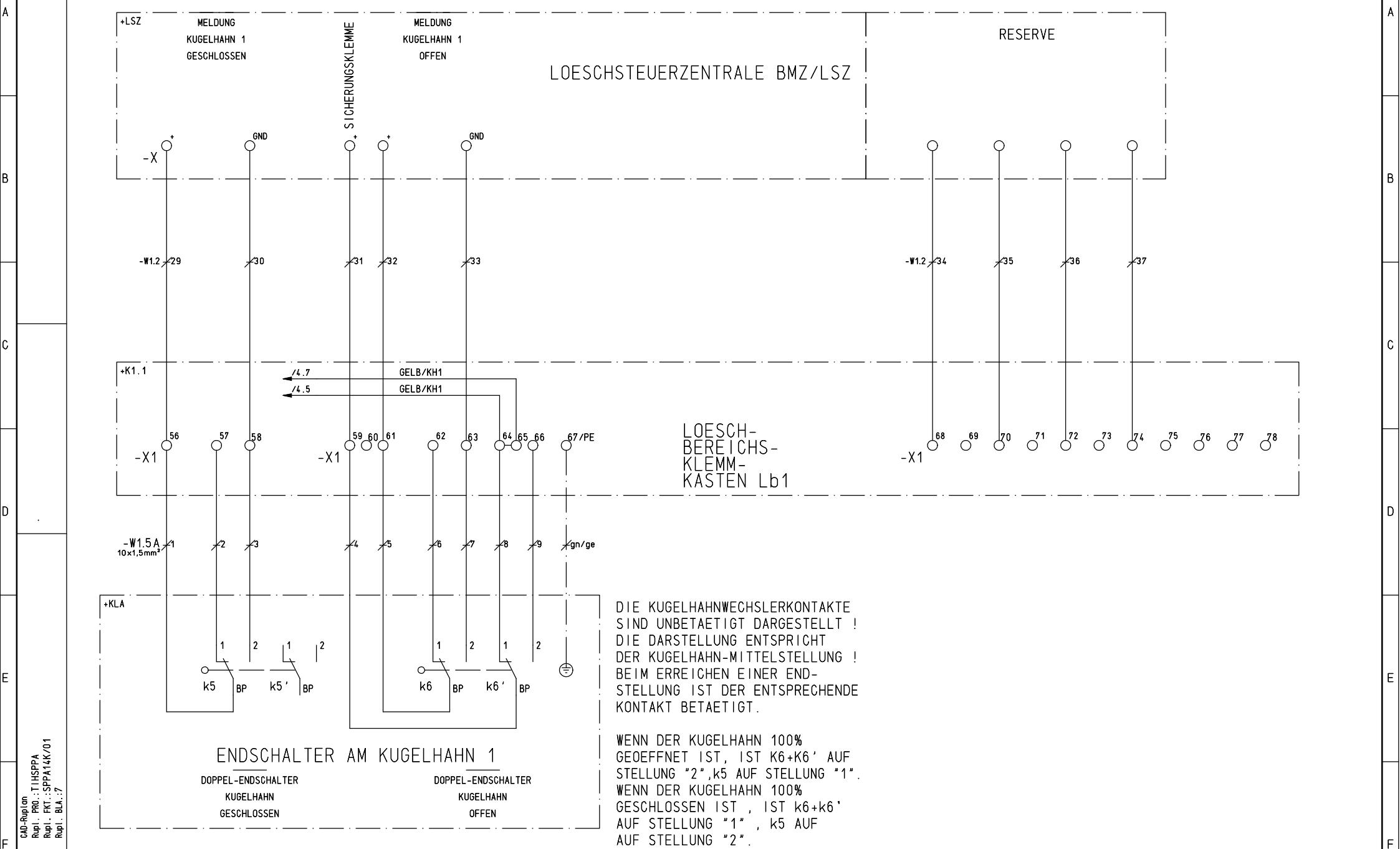
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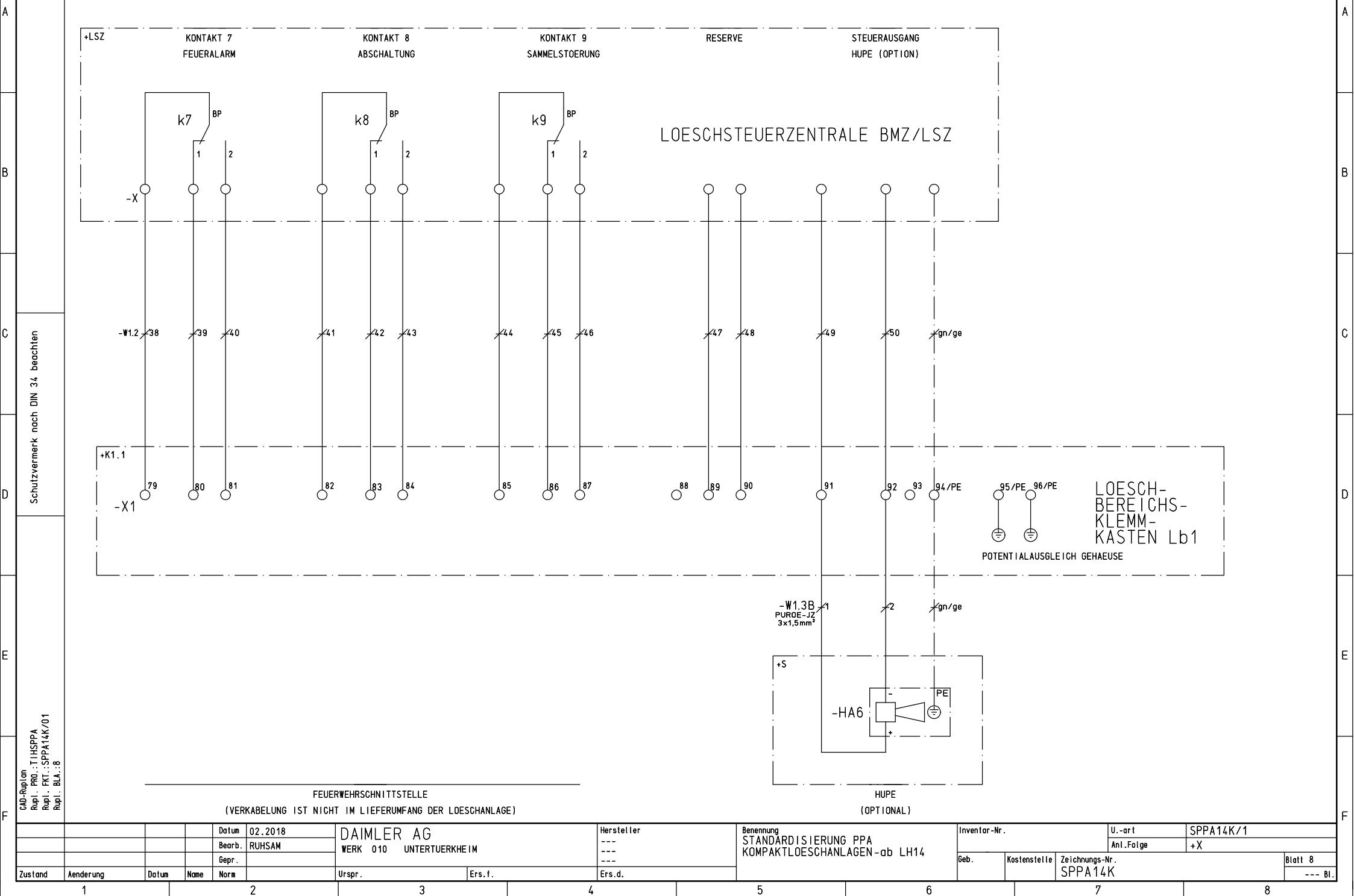
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Compact Extinguishing System: Switching Status Overview

Readiness for operation	Ball valve closed	Ball valve open	Fire alarm	Triggering	Display text on machine control panel	
1=LSZ no voltage	1=Ball valve not closed	1=Ball valve not open	1=No fire alarm	1=LSZ not tripped	Must stay there as long as the state exists	BLZ
2=LSZ ready for operation	2=Ball valve closed	2=Ball valve open	2=Fire alarm	2=LSZ tripped	Self-acknowledging with multiple displays	yel-low red
1	Not relevant	Not relevant	Not relevant	Not relevant	Fault in extinguishing System	
2	1	1	1	1	Fault in extinguishing system - Position of ball valve, end position not reached	
2	1	1	1	2	Extinguishing system triggered	
2	Not relevant	Not relevant	2	1	Fire alarm	
2	Not relevant	Not relevant	2	2	Extinguishing system triggered	
2	2	2	1	1	Fault in extinguishing system - Position of ball valve, end position not reached	
2	1	2	1	1		
2	2	1	1	1	Fault in extinguisher system - ball valve closed	

AN if "Ball valve open" = 1
 AN if fire alarm or trip = 1

LSZ = firefighting center

KH = ball valve with limit switch

BLZ = beacon

1.2 Interface Description

See following pages

Machine Interface

The control signals (safety technology) are transmitted between the extinguishing system and the processing machine by the "Han-System" provided by Harting. This series is designed for industrial applications with a rated voltage of 500 V at 16 A. The contacts are equipped with screw terminals (Han E®).

Implementation

The connectors consists essentially of the following components. See also appendix.

- Housing with lateral PG cable outlet 09 30 024 0521
- 24-pin screw-in insert, (M) 09 33 024 2601
- Metal threaded cable gland PG2909 00 000 5096

There is a cover cap on the plug which has to be attached to the cable by means of the eyelet.

- Metal cover cap 09030 024 5422

When attaching directly to the machine, at least the following components (counterpart) must be attached to the machine, further parts may be necessary:

- Terminal housing with lateral locking 09 30 024 0301
- 24-way crew-on bush insert, (F) 09 33 024 2701 or
- 24-way crimping bush insert, F 09 33 024 2702

Optional:

The following PG coupling with the corresponding cable outlet must be used for adaptation purposes:

- Coupling housing 03 30 024 1731

All part numbers given were taken from the parts list supplied by the manufacturer as of Nov. 2011:

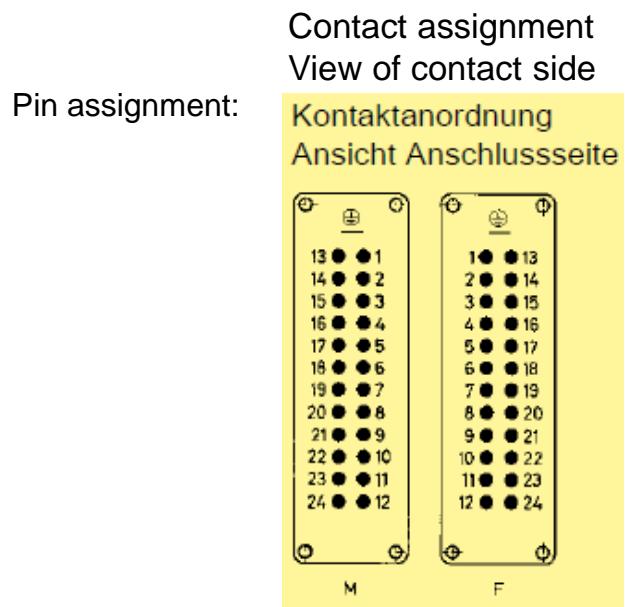
See also: <http://www.harting-deutschland.de/products/>

Machine Interface 1/2

Pin	Direction*	Short designation	Signal effects/remarks	Operating symbols
1	L >> M	Extinguisher system a ready for operation	This is a potential-free contact which signals that the complete extinguishing system is in its operational readiness state and is ready for extinguishing action. In the event of a group fault, open working chamber door or ball valve not 100% open, the installation is not ready for operation. The contact is closed when the extinguishing system is ready for operation and open when the extinguishing system is de-energized or not ready for operation.	
2	L >> M	Extinguisher system b ready for operation		
3	L >> M	Triggering of the extinguishing system a	This is a potential-free contact which signals the triggering of the extinguishing system (pendant control actuated). The contact is closed during operation and is opened when the extinguishing system is triggered. The prerequisite for this is that the work area door is closed. This signal can be activated by one or more fire detectors tripping as a function, or by manual actuation. It is the same signal that is used to open the bottles.	
4	L >> M	Triggering of the extinguishing system b		
5	L << M	Extinguishing is prevented by work area door a being open	This is a potential-free contact that transmits a signal from the machine as to whether the work area door is closed and enabled which means automatic extinguishing is possible. The contact is open when the work area door is closed. If the work area door is not closed, this contact is closed and must prevent the system from extinguishing automatically. Manual release must still be possible. The extinguishing system is therefore no longer ready for operation. This contact may only be opened again if the work area door is closed and enabled again. The contact must have a load capacity of at least 24 V DC/300 mA and be protected with 2 A medium-lag fuse. A power failure in the machine causes the contact to close, thus preventing automatic extinguishing.	
6	L << M	Extinguishing is prevented by work area door b being open		 Monitored input
7	L >> M	Fire alarm from fire detection system a	This is a potential-free contact which signals the triggering of an automatic or manual detector. The contact is closed during operation and is opened as soon as a detector trips. This is also signaled when the work area door is open.	
8	L >> M	Fire alarm from fire detection system b	This signal is also signaled on the safety control center.	
9	L >> M	Ball valve 100% closed a	This is a potential-free contact which indicates whether the ball valve is 100% closed. The contact is opened when the ball valve is 100% closed and thus signals the end position of the ball valve and safe closure of the extinguishing or control line. displays on the control panel according to specifications.	
10	L >> M	Ball valve 100% closed b		
11	L >> M	Ball valve 100% open a	This is a potential-free contact which indicates whether the ball valve is 100% open. The contact is closed when the ball valve is 100% open and thus signals the end position of the ball valve. If the ball valve is not 100% open, the extinguishing system signals that it is not ready for operation/extinguishing. displays on the control panel according to specifications.	
12	L >> M	Ball valve 100% open b		
13		Reserve		
14		Reserve		
15		Reserve		

Machine Interface 2/2

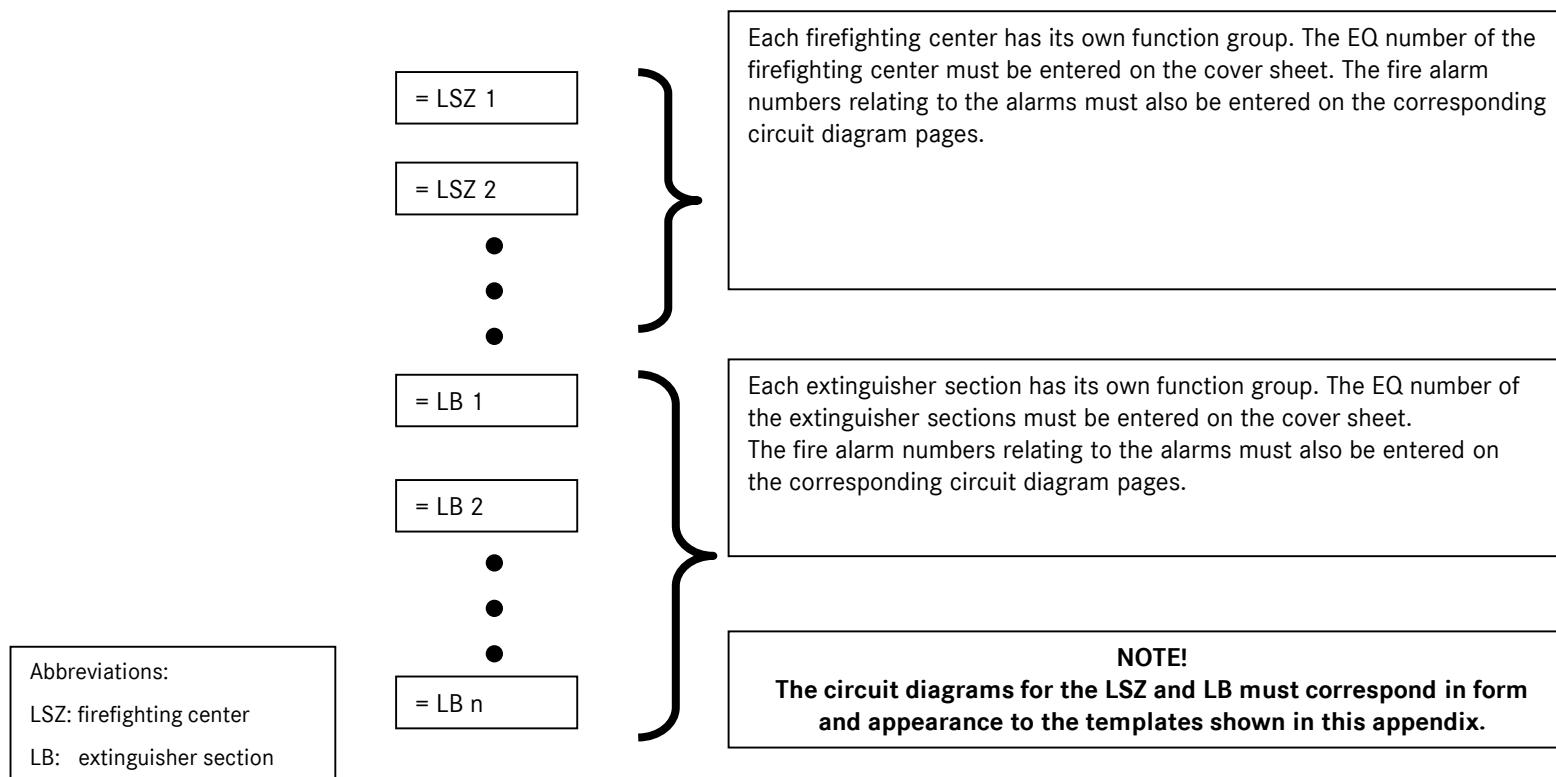
Pin	Direction*	Short designation	Signal effects/remarks	Operating symbols
16		Reserve		
17		Reserve		
18		Reserve		
19		Reserve		
20		Reserve		
21		Reserve		
22		Reserve		
23		Reserve		
24		Reserve		
Housing			Protective ground conductor	



1.3 Structure of the Electrical Documentation (Circuit Diagram)

The circuit diagrams are drawn up according to the standard in the Powertrain requirement specifications.

The circuit diagram is to be divided into function groups. One function group must be created for each firefighting center and each extinguisher section.



2. Display Texts on the Machine Control Panel

2.1 Display Texts for Machines with Extinguishing Systems

Message/status Display texts on the machine operating panel

No operational readiness of the fire extinguishing system	Fault in fire extinguishing system
Ball valve neither closed nor open	Extinguishing system - ball valve end position not reached
Ball valve closed	Extinguishing system - ball valve closed
Ball valve open	-
Extinguisher system trip	Extinguishing system triggered
Fire alarm	Fire alarm
Machine room door not closed	Machine room door open, extinguishing system out of operation

All the above-mentioned messages must be auto-acknowledged on the machine as soon as the signal goes low.

2.2 Display Texts for Machines with Fire Monitoring Only

Message/status Display texts on the machine operating panel

Fire monitoring not operational	Fire monitoring malfunction
Fire alarm	Fire alarm

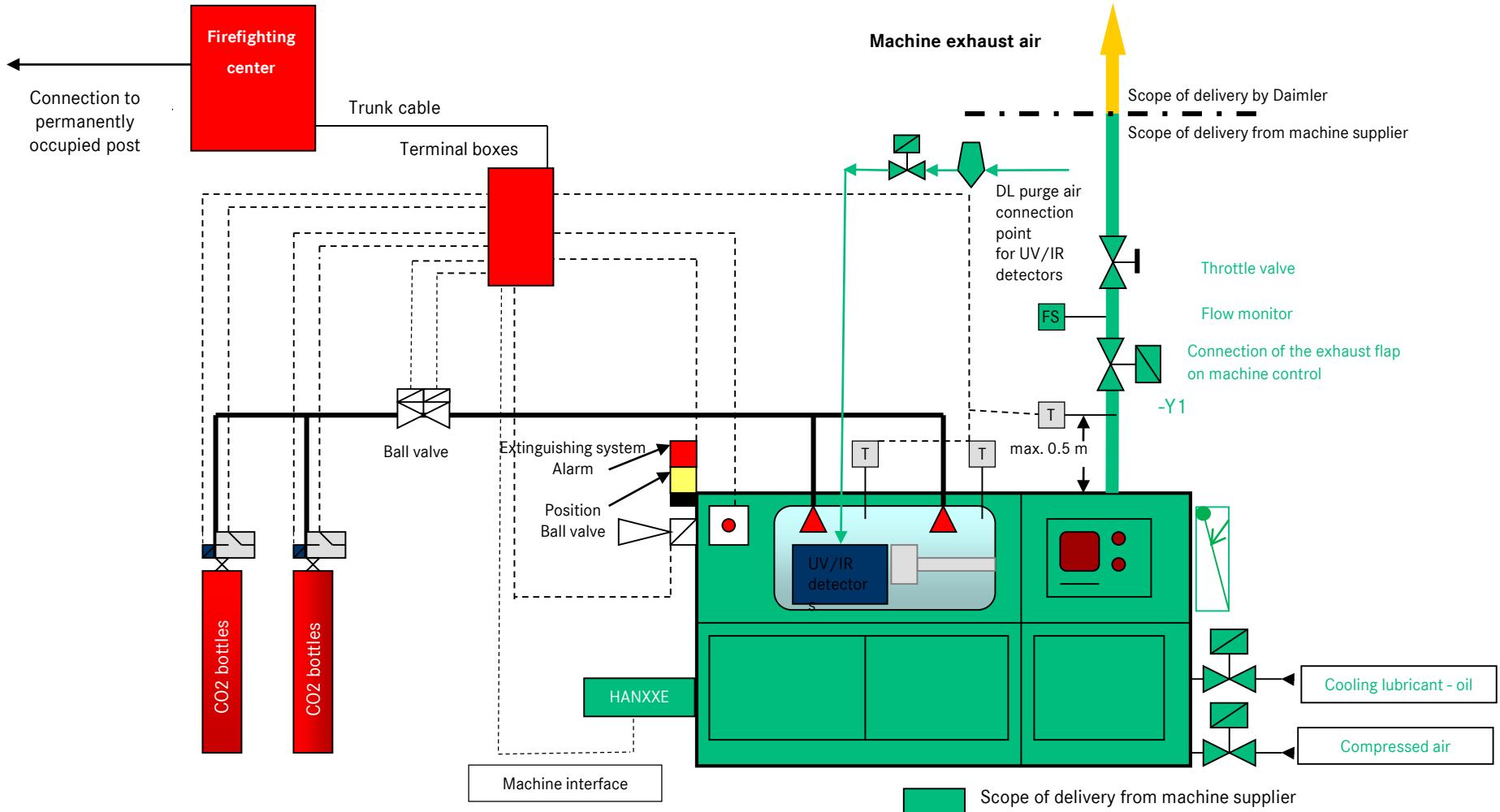
2.3 Display Texts for Machines with Spark Detectors

Message/status Display texts on the machine operating panel

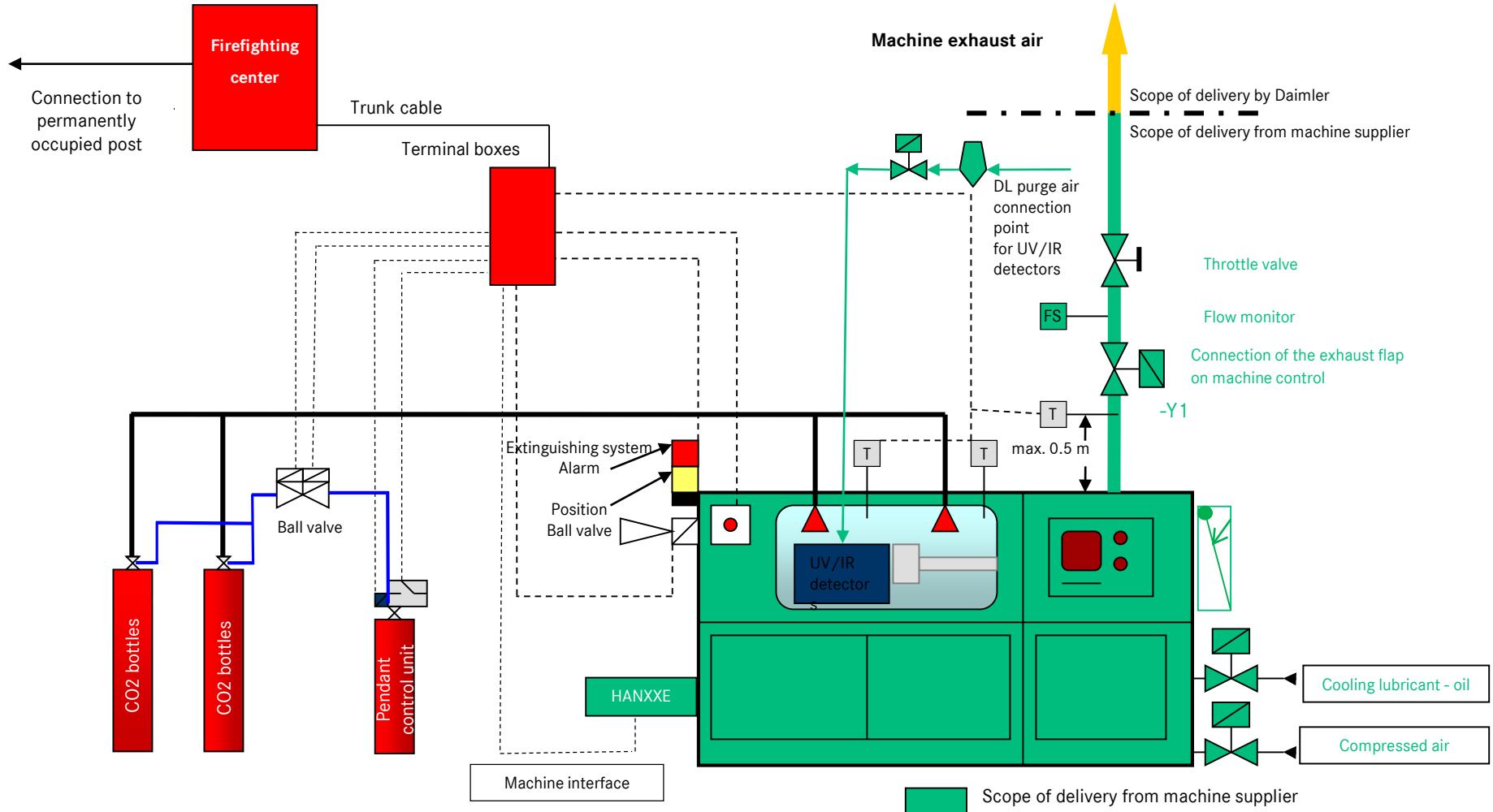
No operational readiness of spark detection system	Malfunction in spark detection system
Alarm 1	Spark detection
Alarm 2	Fire alarm

All the above-mentioned messages must be auto-acknowledged on the machine as soon as the signal goes low.

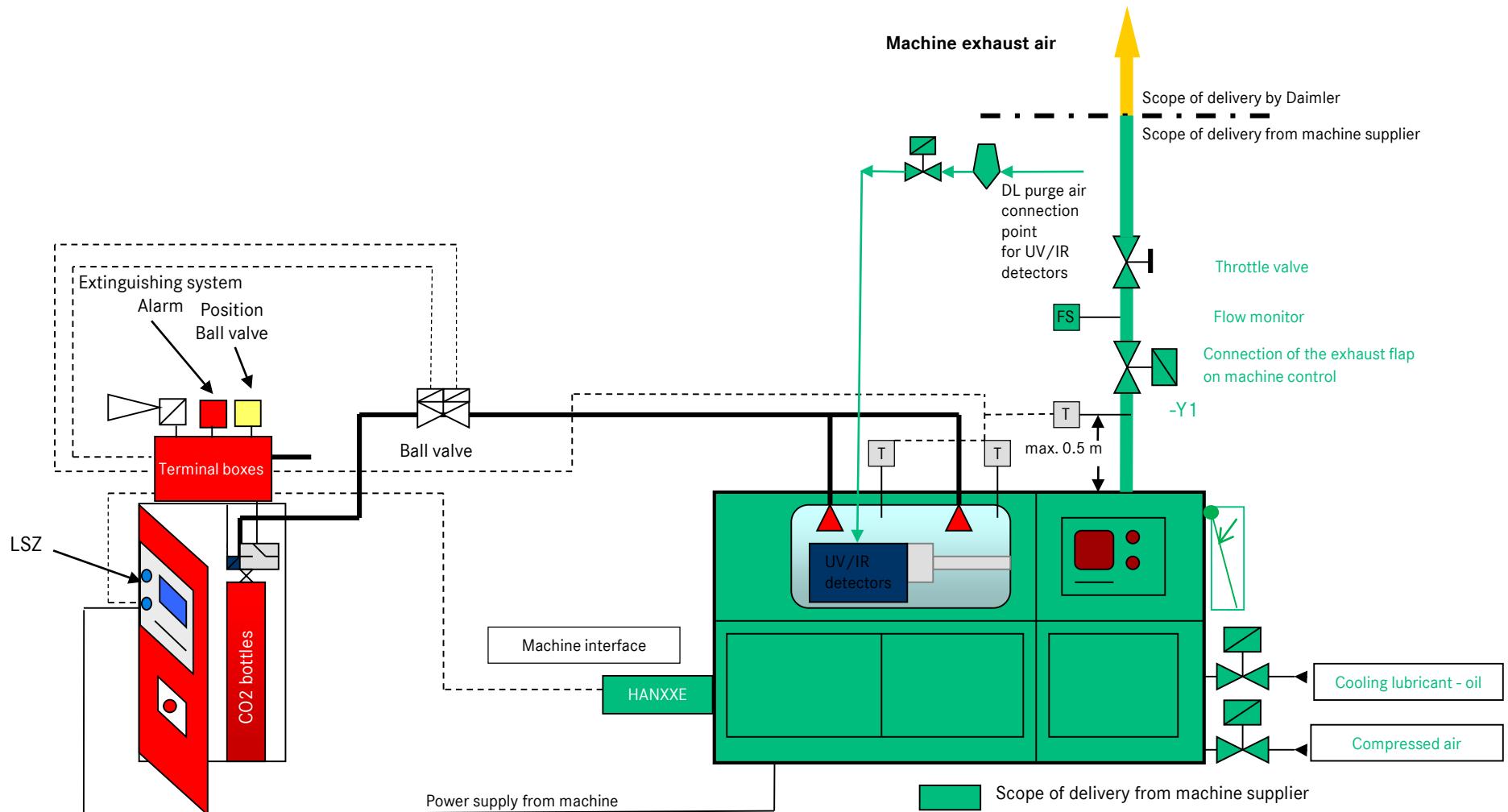
3.1 Overview of the Machine and Extinguisher System



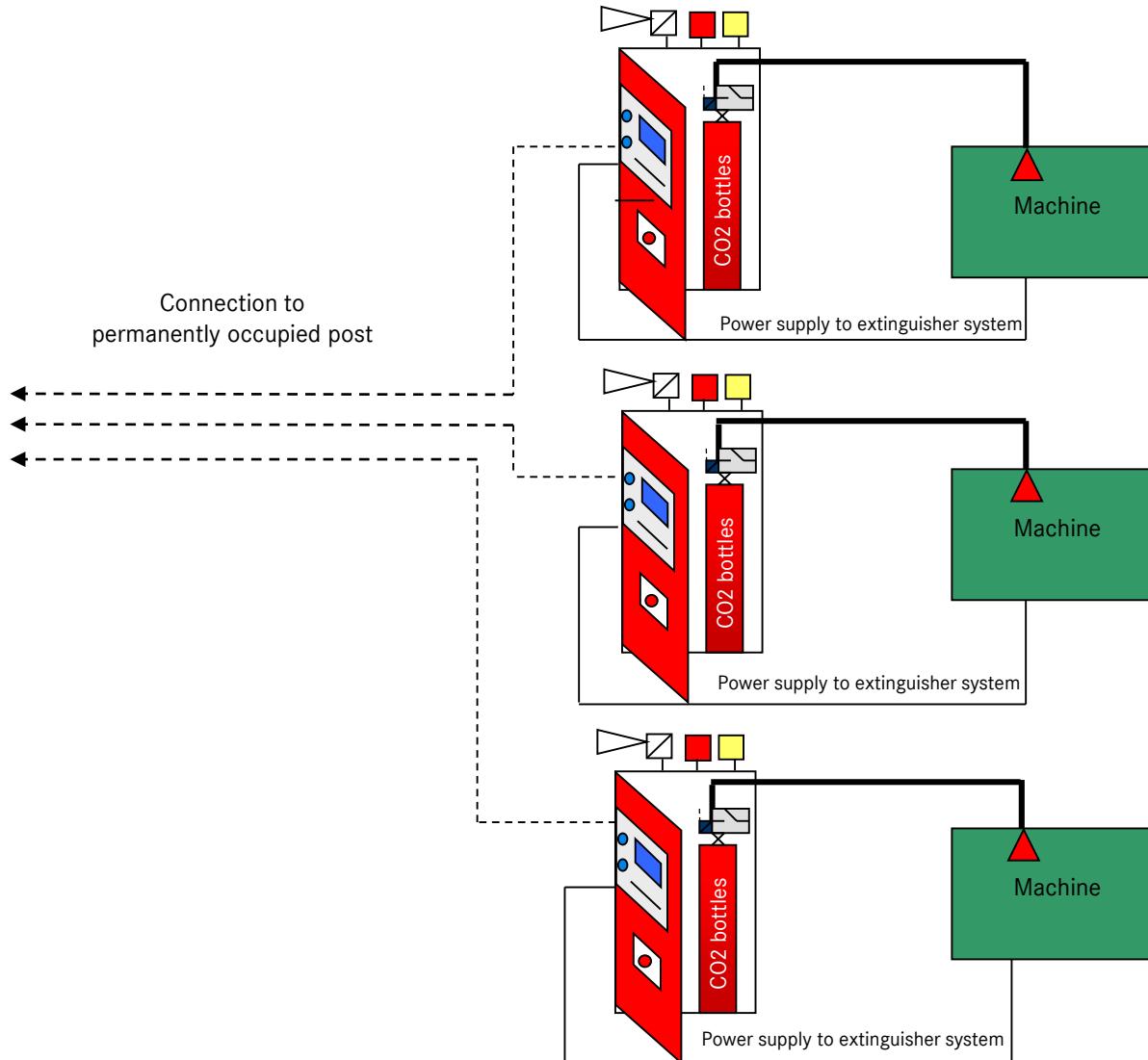
3.2 Overview of the Machine and Extinguisher System with Pendant Control Unit



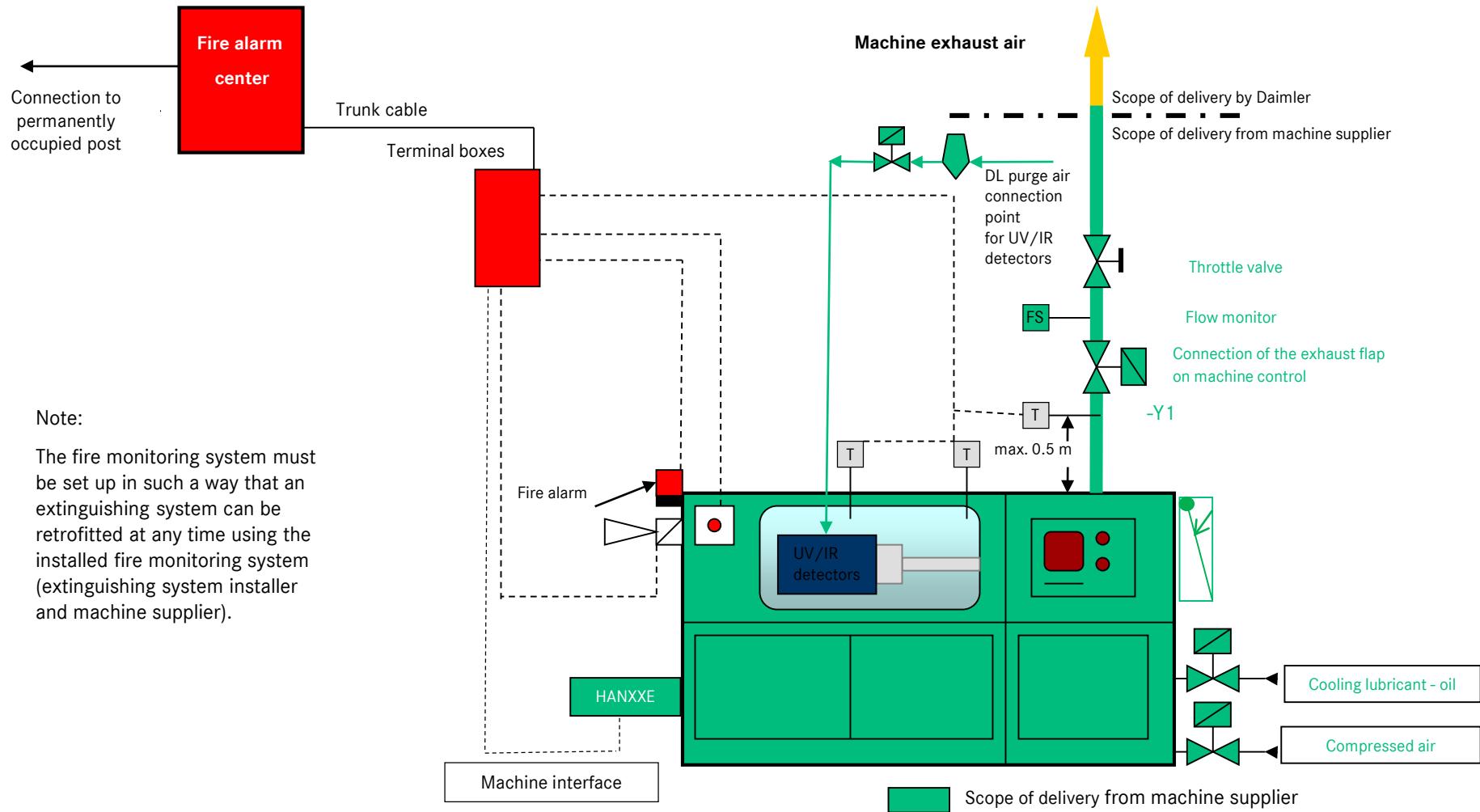
3.3 Overview of the Machine and Compact Extinguisher System



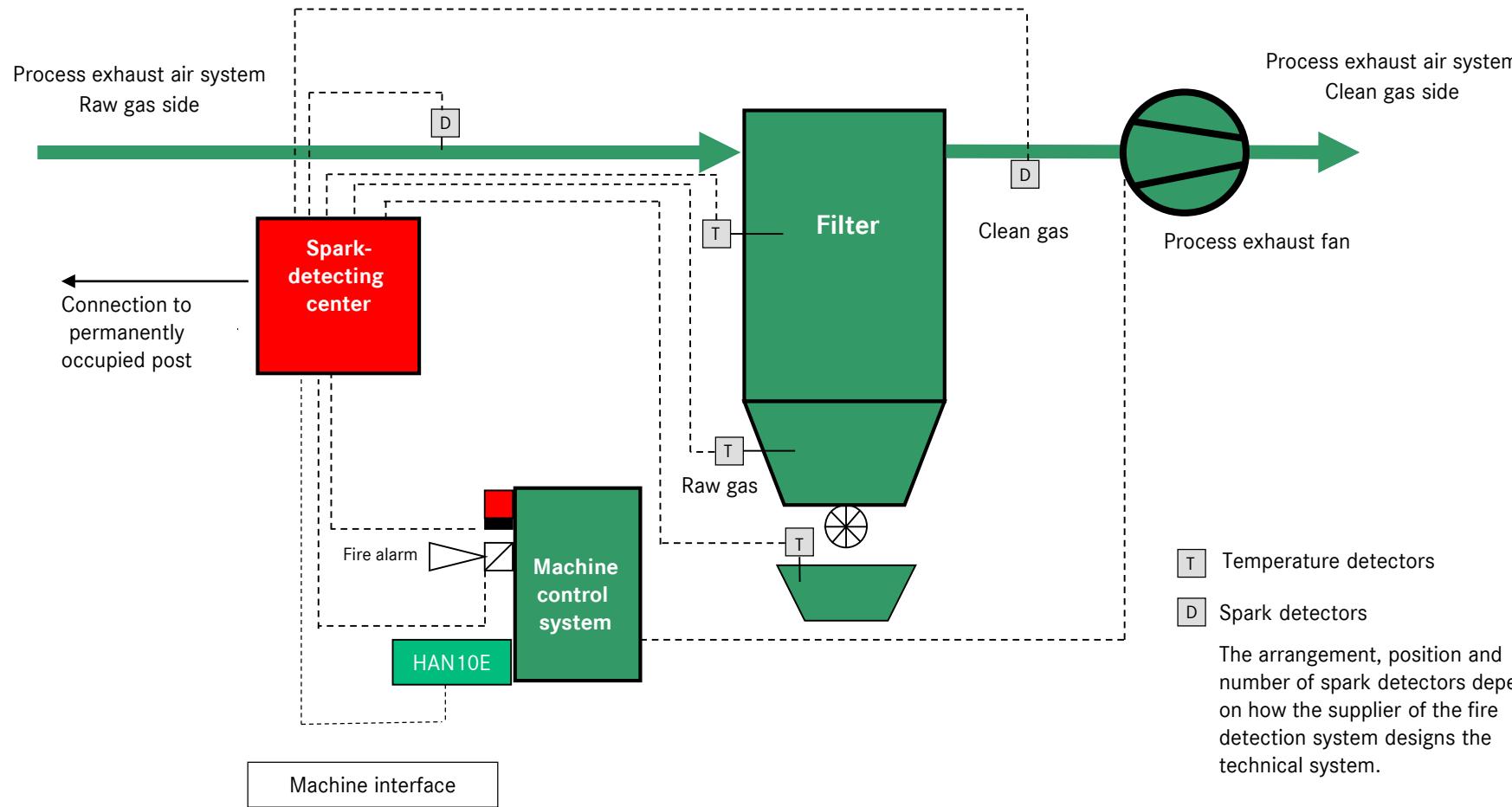
3.4 Overview of Machines with Compact Extinguisher Systems



3.5 Overview of the Machine with Fire Monitoring only



3.6 Overview of the Machine and Spark Monitoring



3.7 Inspection Opening for Mechanical Installation of Spark Detectors

Inspection openings

Description

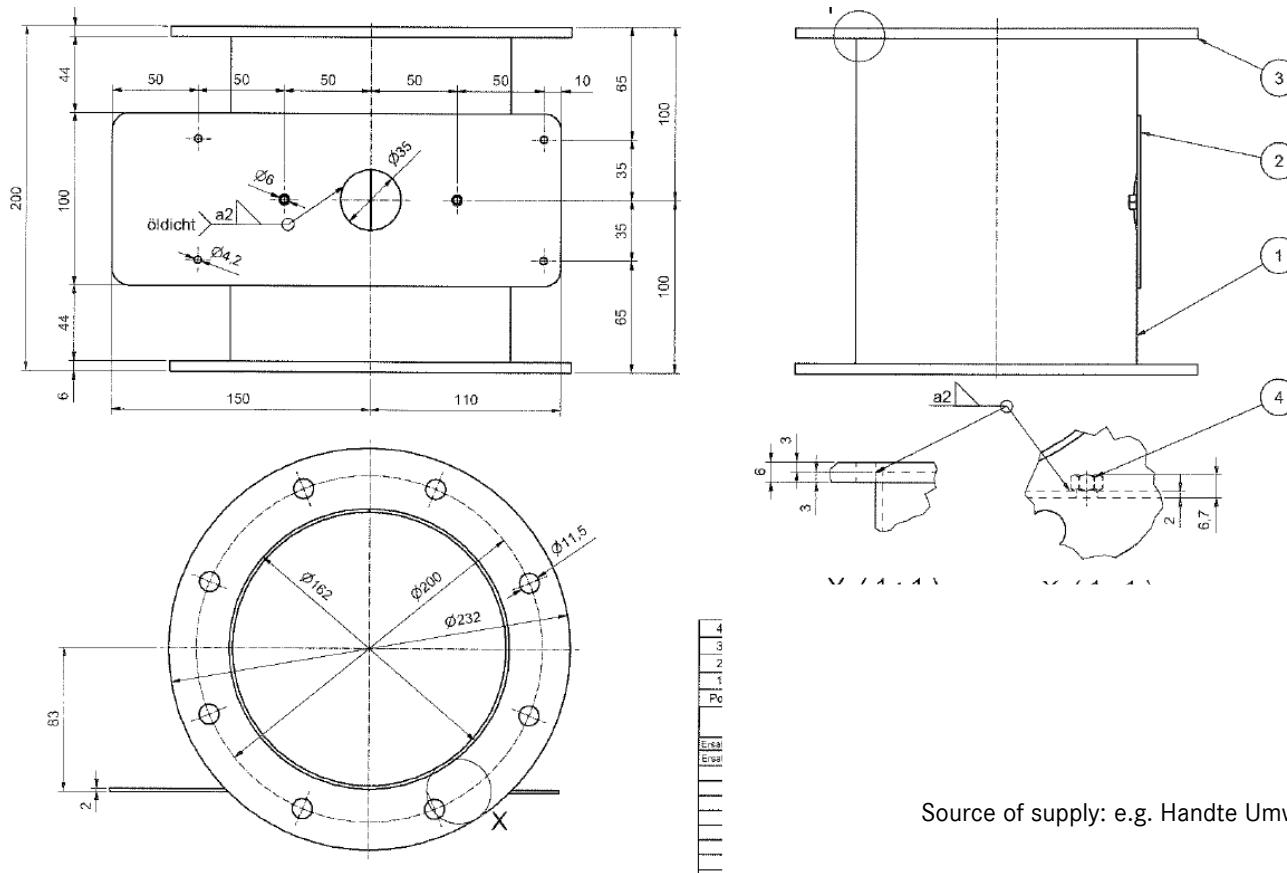
- From a nominal width of DN 180 and higher
- For nominal sizes smaller than DN 180 -> consult the client
- Tightly closing hinged lid with espagnolette lock
- Espagnolette lock secured with a knotted chain
- Height min. 80% of DN, length = 2 x height
- Inside as smooth as possible (low pipe friction coefficient, avoids deposits)
- Frame joined tightly with extraction duct
- Accessibility must be guaranteed.
- Installation above the center axis



3.8 Adapter for Installing Fire Detectors

Adapter for the installation of fire detectors in the exhaust air duct of machines. The height of the adapter is 200 mm for all nominal widths.

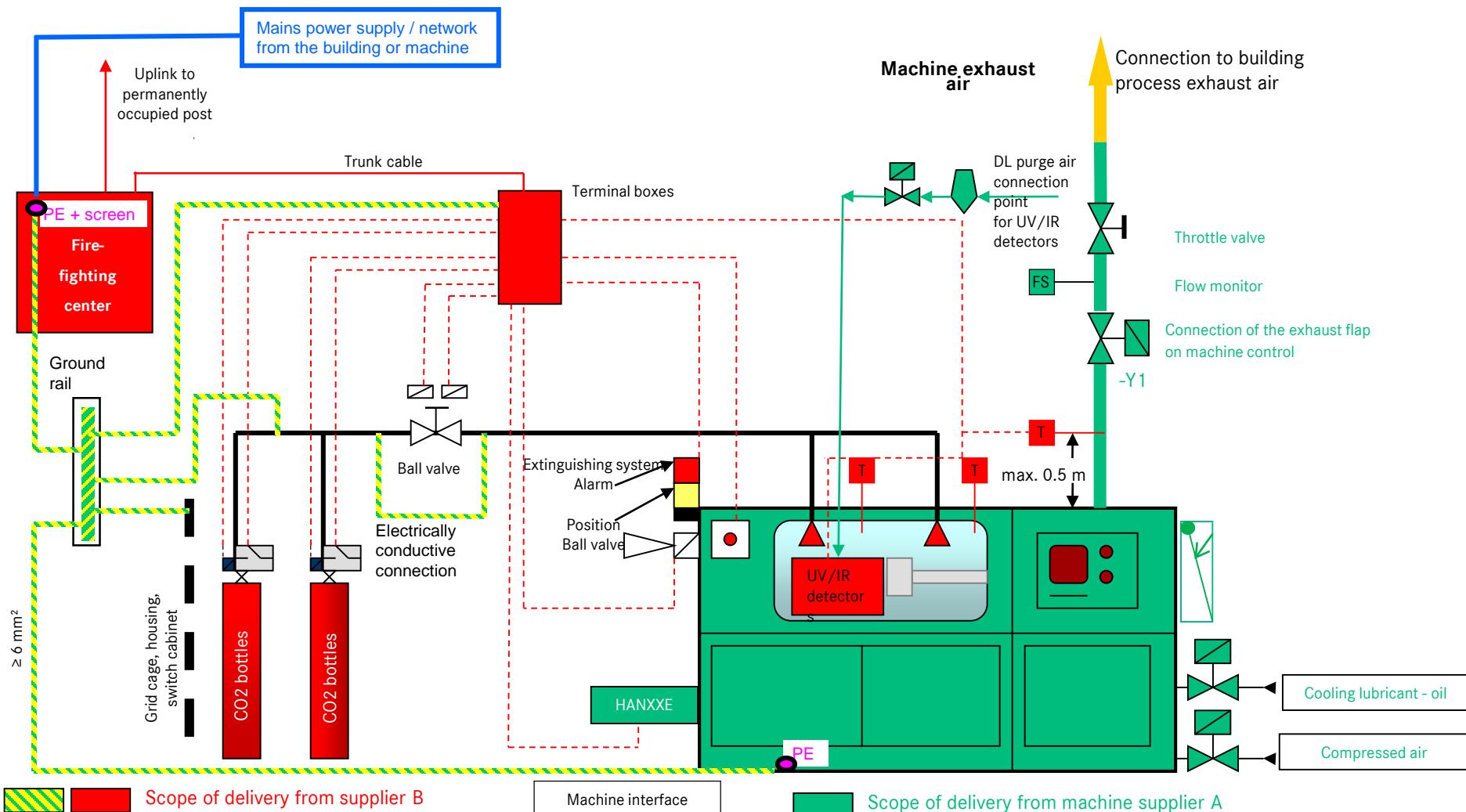
Nominal width shown, DN 160



Source of supply: e.g. Handte Umwelttechnik GmbH, Tuttlingen

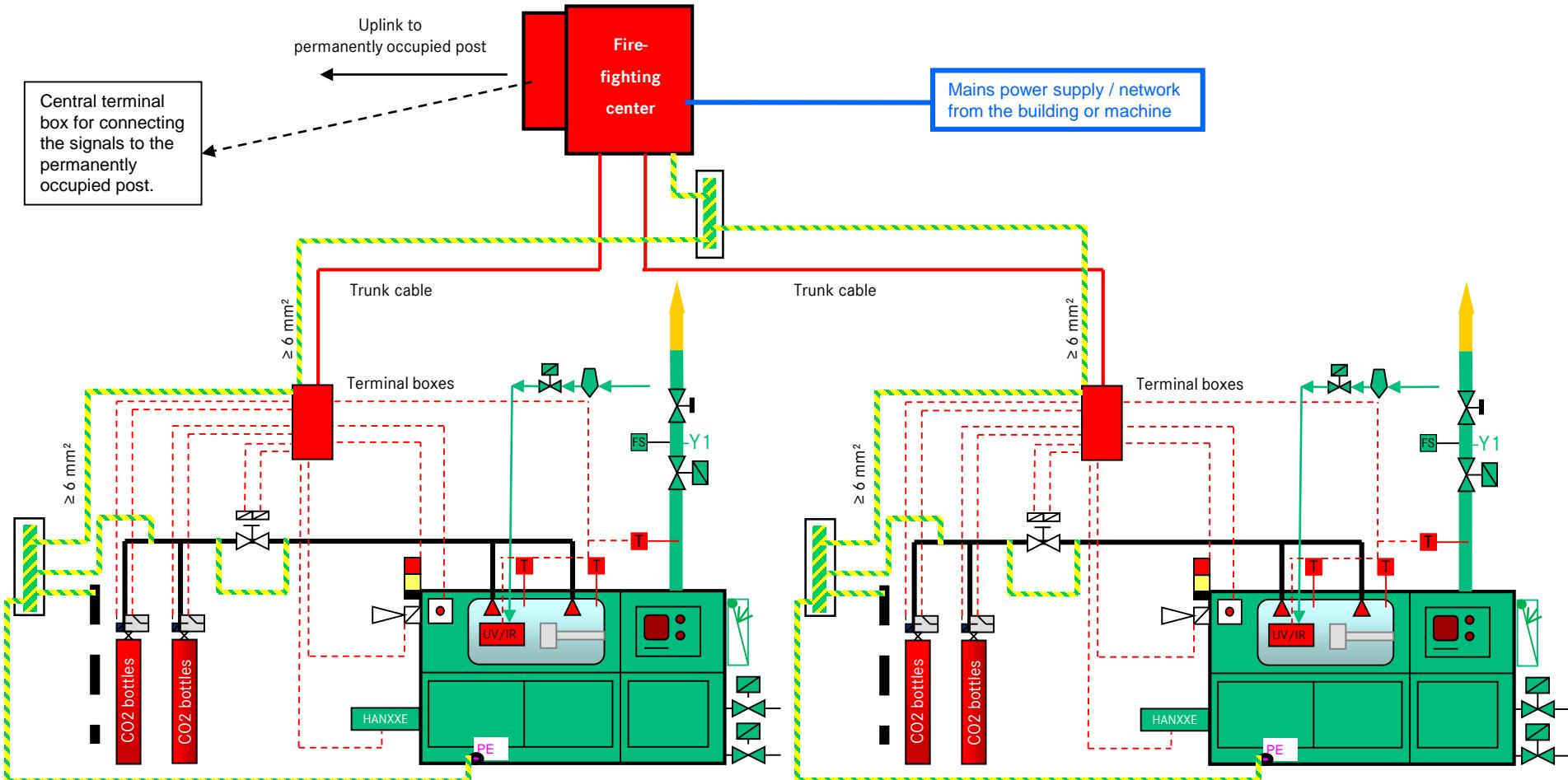
3.9.1 Equipotential Bonding

C1. Machine with extinguisher system



3.9.2 Equipotential Bonding

C2. Overview of machines with extinguishing systems, with central LSZ and protective grid housing



3.9.3 Checklist of Earthing and Equipotential Bonding for Gas Extinguishing Systems for Machines 1/2

Installation location	Date
Machine number	Auditor (in block letters)

Inspection points

No.	Content	Yes	No
1	Is the PE of the mains supply line connected to the central fire alarm system?		
2	Are all the installations of the fire detection system (central fire alarm system, detectors, tripping and switching elements) connected to the shielding of the fire alarm wiring?)		
3	Is there an earthing rail installed in the extinguishing system?		
4	Is the main extinguishing gas pipe of the extinguishing gas supply connected to the earthing machine with a copper cross-section of $\geq 6 \text{ mm}^2$?		
5	Is the PE protective ground conductor of the machine which the extinguishing gas piping leads to connected to the earthing machine with a copper cross-section of $\geq 6 \text{ mm}^2$?		
6	Is the housing / chassis of the central fire alarm system connected to the earthing rail with a copper cross-section of $\geq 6 \text{ mm}^2$?		
7	Is the terminal box of the firefighting center connected to the earthing machine with a copper cross-section of $\geq 6 \text{ mm}^2$?		
8	Is the shield of the fire alarm wiring connected to the earthing rail with a copper cross-section of $\geq 6 \text{ mm}^2$?		
9	Is the housing of the switch cabinet connected to the earthing rail with a copper cross-section of $\geq 6 \text{ mm}^2$?		
10	Is the grid cage of the gas extinguishing system connected to the earthing rail with a copper cross-section of $\geq 6 \text{ mm}^2$?		
11	Is the terminal box connected to the earthing rail with a copper cross-section of $\geq 6 \text{ mm}^2$?		

3.9.3 Checklist of Earthing and Equipotential Bonding for Gas Extinguishing Systems for Machines 2/2

No.	Content	Yes	No
12	Can all the connection lines be clearly inspected throughout the entire extent of the installation?		
13	If 12 is answered as "no", the reliability of the connections shall be demonstrated by measurement: a. Measurement of the connection from the earthing rail to the firefighting center. $R_{measured} \approx R_{calculated} \approx L \times R_I \approx$ Act. $R_{measured} \approx R_{calculated}$		
b.	Measurement of the connection from the earthing rail to the extinguishing gas piping (longest runner) $R_{measured} \approx R_{calculated} \approx L \times R_I \approx$ Act. $R_{measured} \approx R_{calculated}$		
c.	Measurement of the connection from the earthing rail to the housing, switch cabinet, grid cage $R_{measured} \approx R_{calculated} \approx L \times R_I \approx$ Act. $R_{measured} \approx R_{calculated}$		
d.	Measurement of the connection from the earthing rail to the PE protective ground conductor of the machine (to which the extinguishing system is assigned). $R_{measured} \approx R_{calculated} \approx L \times R_I \approx$ Act. $R_{measured} \approx R_{calculated}$		
e.	Measurement of the connection from the earthing rail to the terminal box $R_{measured} \approx R_{calculated} \approx L \times R_I \approx$ Act. $R_{measured} \approx R_{calculated}$		
f.	Measurement of the connection from to $R_{measured} \approx R_{calculated} \approx L \times R_I \approx$ Act. $R_{measured} \approx R_{calculated}$		
14	Grounding and equipotential bonding OK Date	Signature of installer / Auditor	

Fire Protection in Powertrain III Requirement Specifications

Appendix 17/2: Documentation



Mercedes-Benz

Table of Contents for Appendix 17/2

- 1. Documentation of an individual extinguishing system or fire monitoring system**
- 2. Documentation of firefighting center**
- 3. Documentation of fire detection system**

Documentation of an individual extinguishing system / one extinguishing section

Block: e.g. 2/39 1st floor, axis X-Y / 10-11

Object:

EQ No.

Tab	Content		Form of delivery			Responsibility		
			Paper	PDF file	MS file	Machine installer	Planner	Operator
1	Function description		X	X		X		
2	Installation certificate		X	X		X		
3	Layout plan		X	X		X		
4	RI scheme, isometrics, and calculation		X	X		X		
5	Product/ component certificates		X			X		
6	Electrical documentation (according to Powertrain requirement specifications)		X			X		
7	Expert first acceptance protocol		X	X		X		
8	Acceptance report		X				X	
9	Confirmation that installation is defect-free		X				X	
10	Certification of the connection to the permanently occupied post		X				X	
11	Declaration of conformity by manufacturer		X	X		X		
12	Operating instructions for machine planner (EN 13478 No.. 6.5) (additionally 1 x in documentation for the machine)		X	X		X		
	Delivery note (handover to machine planner)		X				X	
13	Line charts		X		X		X	
14	Directive	BA 380-n	X				X	
15	- Risk assessment for extinguisher system	Betr.SichV Sec. 3	X				X	
	- Assessment of the risks and hazards resulting from EN 292, where necessary for the risk assessment.		X	X		X		
16	Explosion protection document for extinguishing system	Betr.SichV Sec. 5	X				X	
17	Recurring tests for the extinguisher system	Betr.SichV Sec. 15	X					X
18	Repair of extinguishing system	Betr.SichV Sec. 15	X	X	-	X	-	-
19	Preventative maintenance, maintenance and scheduled inspection plans		-	-	-	-	-	-
20	1 x data carrier with documentation 1 x write-protected data storage medium with system software					X		

One copy each of the complete documentation and electronic data storage medium shall be submitted.

Abbreviations:

PDF file
MS file

File readable with Acrobat Reader
File created with CAD Microstation, according to Daimler CAD user manual

Object:

EQ No.

Tab	Content		Form of delivery			Responsibility		
			Paper	PDF file	MS file	Machine installer	Planner	Operator
1	Function description		X	X	-	X	-	-
2	Reserve		-	-	-	-	-	-
3	Reserve		-	-	-	-	-	-
4	Reserve		-	-	-	-	-	-
5	Product/ component certificates		X			X		
6	Electrical documentation (according to Powertrain requirement specifications)		X			X		
7	Expert first acceptance protocol		X	X		X		
8	Acceptance report		X				X	
9	Confirmation that installation is defect-free		X				X	
10	Certification of the connection to the permanently occupied post		X					X
11	Declaration of conformity by manufacturer		X	X		X		
12	Reserve		-	-	-	-	-	-
13	Line charts		X		X		X	
14	Reserve		-	-	-	-	-	-
15	- Risk assessment	Betr.SichV Sec. 3	X				X	
	- Assessment of the risks and hazards resulting from EN 292, where necessary for the risk assessment.		X	X		X		
16	Explosion protection document	Betr.SichV Sec. 5	X					X
17	Recurring tests	Betr.SichV Sec. 15	X					X
18	Repairs		X	-	-	-	-	X
19	Preventative maintenance, repairs and scheduled inspection plans		-	-	-	-	-	-
20	1 x data carrier with documentation 1 x write-protected data storage medium with system software					X		

One copy each of the complete documentation and electronic data storage medium shall be submitted.

Abbreviations:

PDF file
MS file

File readable with Acrobat Reader

File created with CAD Microstation, according to Daimler CAD user manual

Documentation of the fire detection system

Block: e.g. 2/39 1st floor, axis X-Y / 10-11

Object:

Installation No.:

EQ No.

Tab	Content		Form of delivery			Responsibility		
			Paper	PDF file	MS file	Machine installer	Planner	Operator
1	SigmaNet overview		X			X		
2	Supply		X			X		
3	Overview of alarm groups		X			X		
4	FM relay module		X			X		
5	SigmaNet separator element		X			X		
6	Operating instructions		X			X		
7	Installation instructions		X			X		
8	Start-up test report		X			X		
9	Reserve							
10	VdS acceptance report		X	X		X		
11	Acceptance report		X				X	
12	Confirmation that installation is defect-free		X				X	
13	Certification of the connection to the permanently occupied post		X				X	
14	Declaration of conformity by manufacturer		X	X		X		
15	Line charts		X		X		X	
16	- Risk assessment	Betr.SichV Sec. 3	X					X
	- Assessment of the risks and hazards resulting from EN 292, where necessary for the risk assessment.		X	X		X		
17	Explosion protection document	Betr.SichV Sec. 5	X				X	
18	Recurring tests	Betr.SichV Sec. 15	X					X
19	Preventative maintenance, repairs and scheduled inspection plans		X					X
20	1 x data carrier with documentation 1 x write-protected data storage medium with system software					X		

One copy each of the complete documentation and electronic data storage medium shall be submitted.

Abbreviations:

PDF file
MS file

File readable with Acrobat Reader
File created with CAD Microstation, according to Daimler CAD user manual

Fire Protection in Powertrain III Requirement Specifications

Appendix 17/3: Designations and Signage



Mercedes-Benz

Table of Contents for Appendix 17/3

- 1. Color Coding of Fire Protection Systems**
- 2. Labeling of Ball Valve Protective Box**
- 3. Color Coding of Fire Protection Systems**
- 4. Color Coding of Fire Protection Systems**
- 5. Color Coding of Fire Protection Systems**
- 6. Production Equipment Labeling for Fire Detector and Extinguisher Systems**
 - 6.1 Extinguishing Section Labeling on the Machine - Mannheim Plant Only -**
 - 6.2 Production Equipment Labeling for Monitoring Devices**
 - 6.3 Labeling of Optical Detectors**

1. Color Coding of Fire Protection Systems

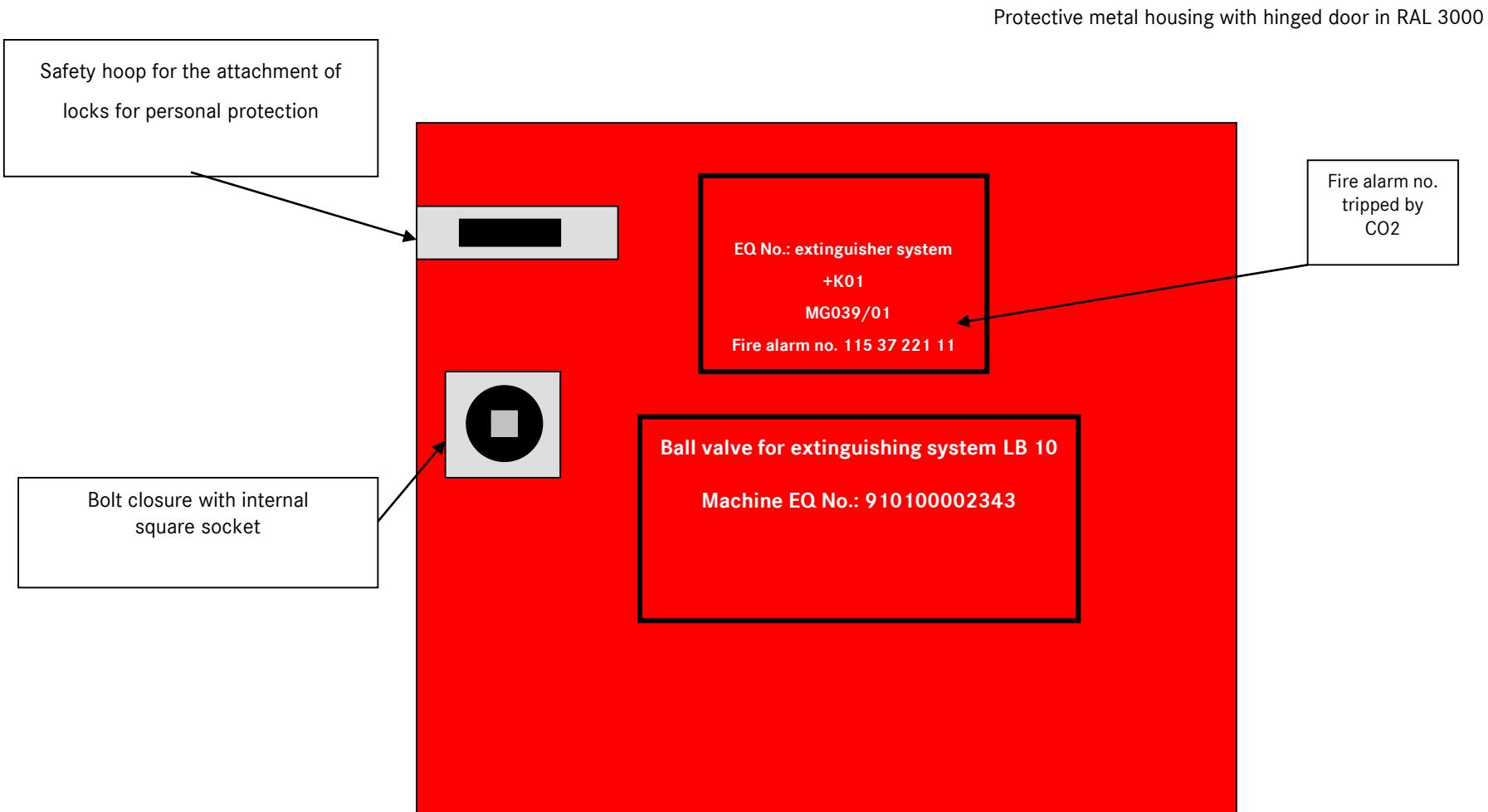
The following guidelines apply to the color coding of fire protection systems:

Part/component	Color	Notes
Central fire alarm systems, firefighting centers, spark detector centers and compact extinguisher cabinets	RAL 3000	
Wire guards/access barriers	RAL 3000	
Terminal boxes	RAL 3000	
Exhaust flap	RAL 3000	Mark flap red, color ring RAL 3000, additional sign
Extinguishing agent lines	Marking tape in RAL 3000	with overprint showing the extinguishing gas
Pneumatic control lines	Sign in RAL 3000	Label with overprint "Extinguishing system control line" and additional reference to the extinguishing section.
Fire detectors, e.g. heat detectors	Sign in RAL 3000	Label with overprint "Extinguishing system and equipment identification".
Extinguishing agent reservoir	Manufacturer's standard	

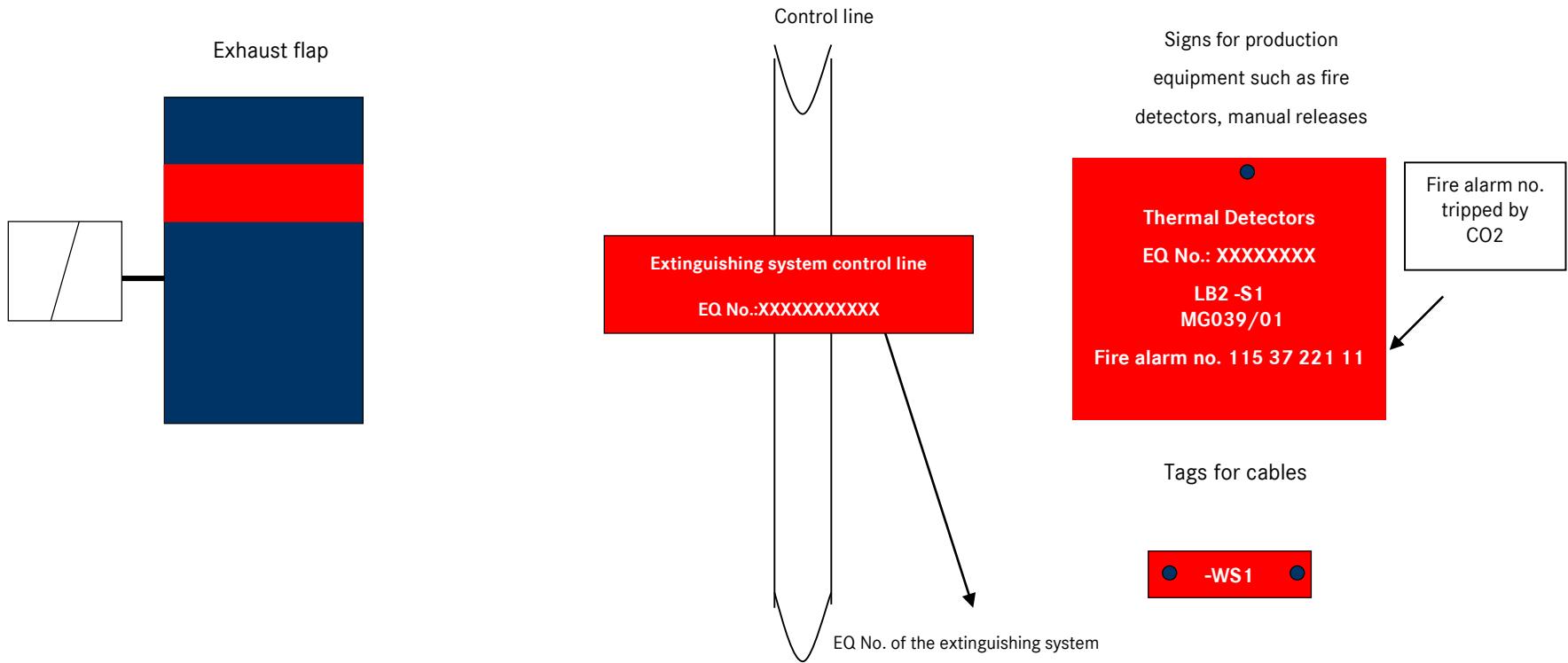
RAL 3000



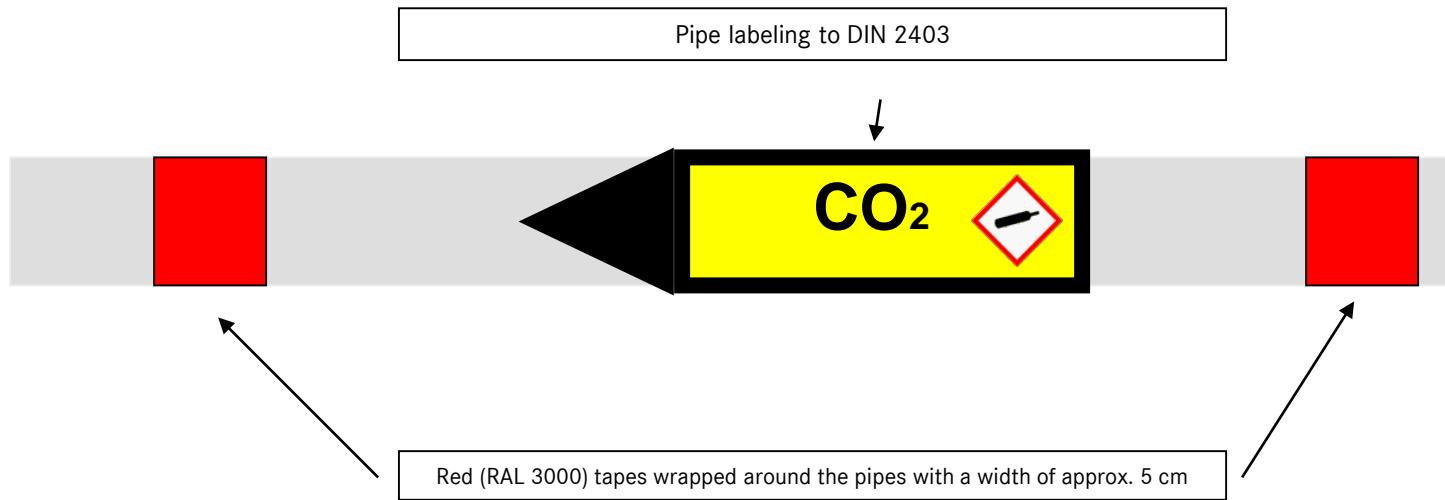
2. Labeling of Ball Valve Protective Box



3. Color Coding of Fire Protection Systems



4. Color Coding of Fire Protection Systems



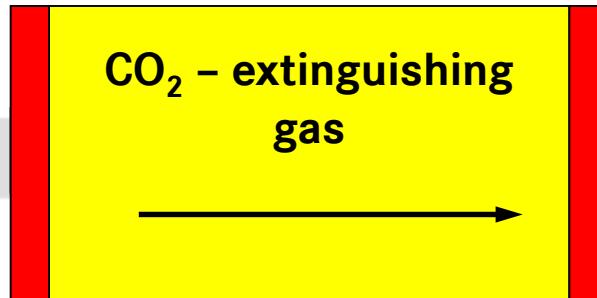
Fitting:

On both sides of wall feed-throughs.

At least every 5 m and after every change of direction. Pipe routing must be simple and clearly traceable.

5. Color Coding of Fire Protection Systems

Pipe labeling for small pipe diameters



Resopal sign, engraved lettering, sign size

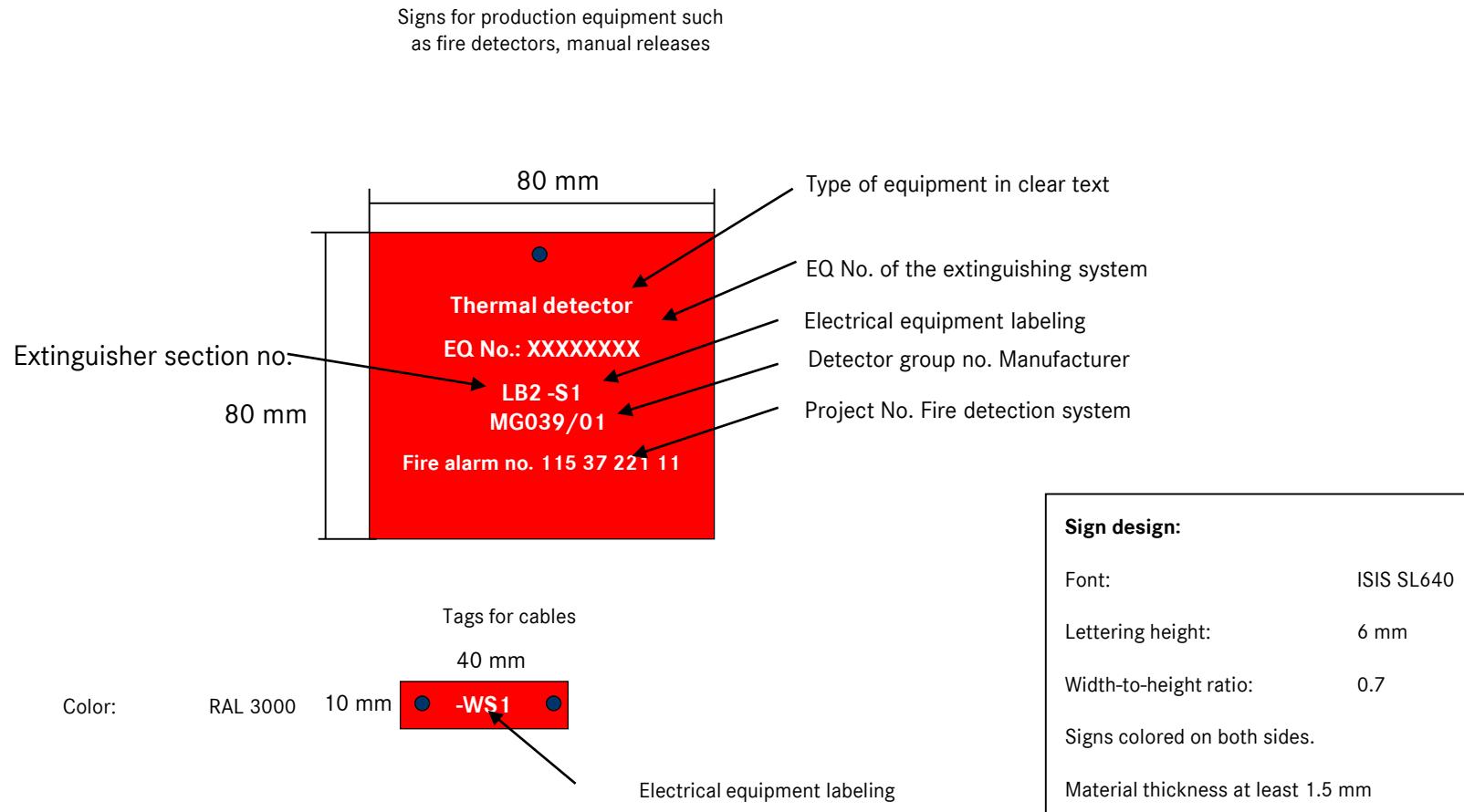
50 x 100 mm or 35 x 70 mm, riveted or screwed to sign holder

Fitting:

On both sides of wall feed-throughs.

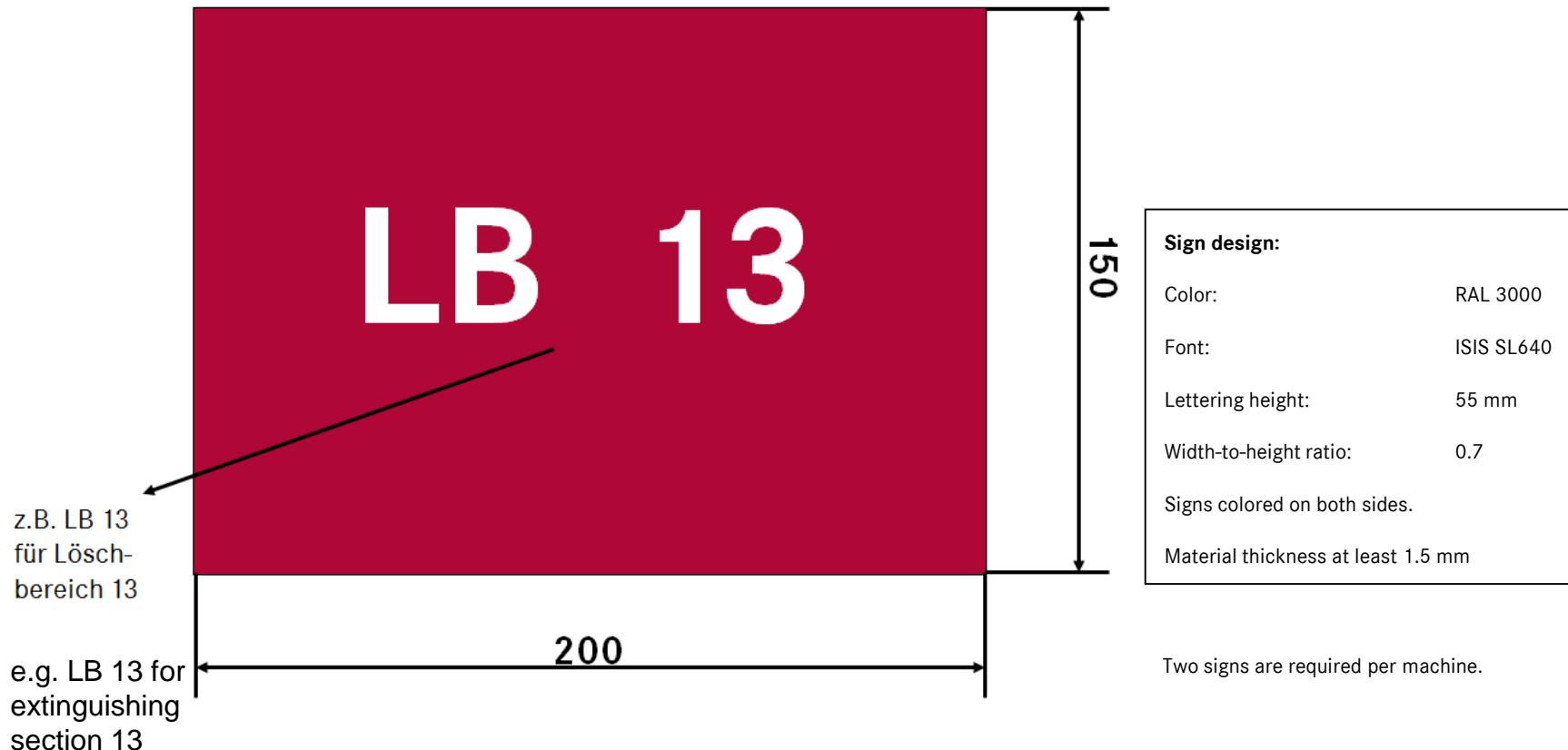
At least every 5 m and after every change of direction. Pipe routing must be simple and clearly traceable.

6. Production Equipment Labeling



6.1 Extinguishing Section Labeling on the Machine

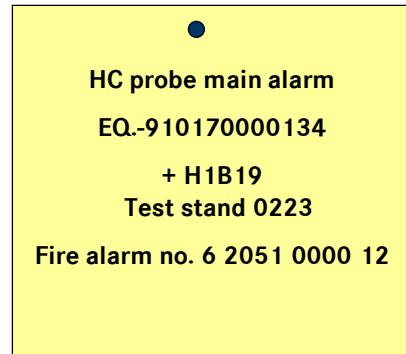
- Mannheim Plant Only -



6.2 Production Equipment Labeling

Signs for monitoring devices

Signs for gas alarms



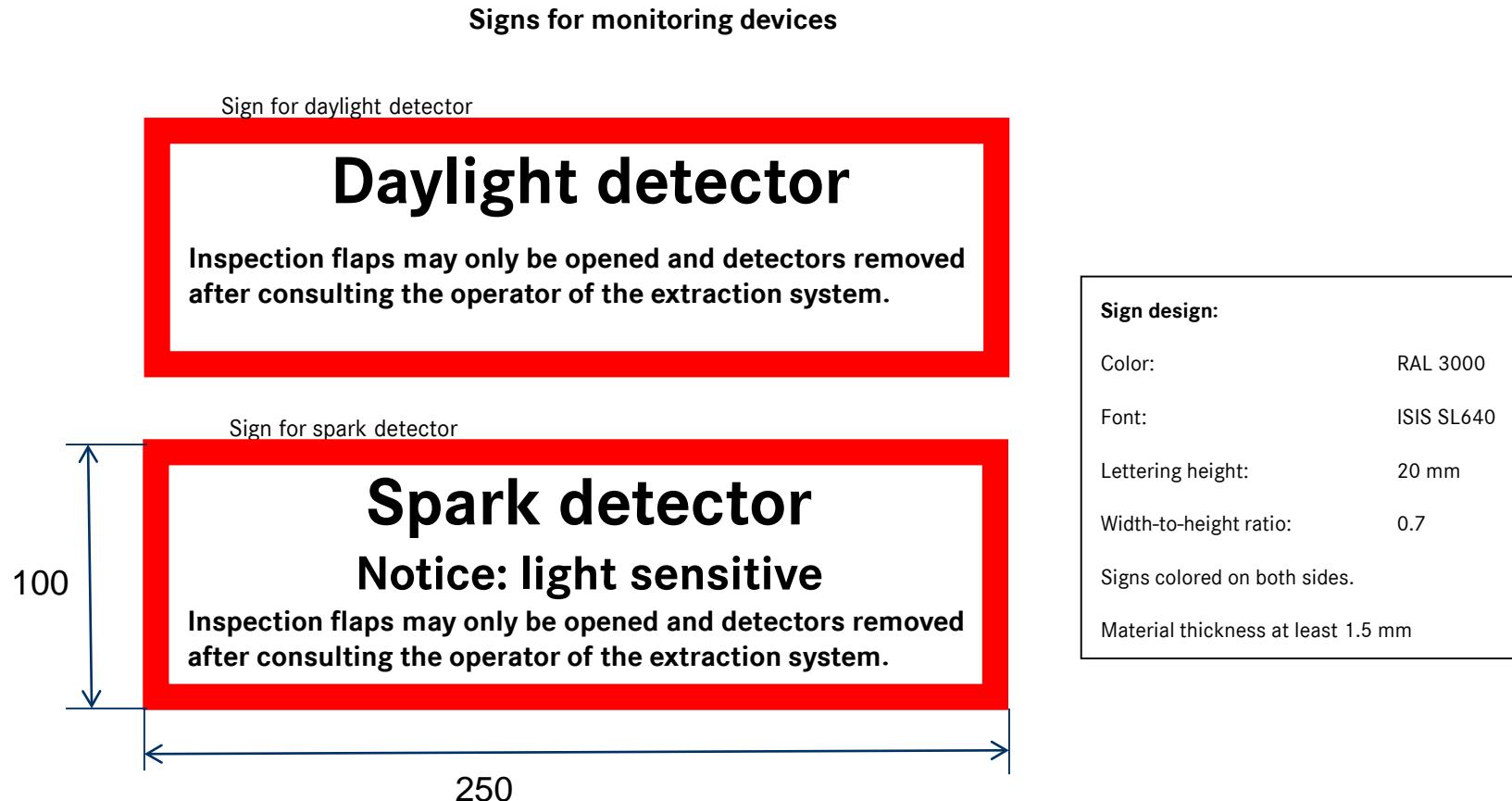
Color: RAL 1023

Signs for liquid monitoring

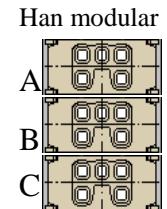


Color: RAL 5012

6.3 Labeling of Optical Detectors



Machine Extraction Monitoring Unit (ÜEMA) / Machine Interface



General:

The interface shall be designed in HAN modular format.

Contacts shall be designed as normally open contacts. All signals are present statically.

The 16-pin connecting cable is contained in the machine's scope of delivery.

Volumetric flow monitoring:

Attached housing with plastic cap (09300100301) or base housing (19300101230)

Articulated frame for 3 module pressurization A...C (09140100303) ;

Grommet housing with 2 brackets on the housing lower part - lateral cable outlet on sideways installation (09300101521)

Grommet housing with 2 brackets on the housing lower part - straight cable outlet with installation location from below (09300101421)/preferential use

Metal threaded cable connection M25 (19000005092)

Modules:

HAN ES module socket insert with cage clamp (09140052716) / socket insert with cage clamp (09140052616)

The modules shall be arranged in the sequence A..C from top to bottom (sideways installation) ; A...C from left to right (installation from beneath).

Machine:

The attached housing shall be installed in the installation space planned for this.

Volumetric flow monitoring is a compact interface consisting of:

- Throttle valve for regulating the volumetric flow
- Quick-closing valve in the event of a fire

Monitoring on machine extraction facilities:

- The min. vacuum is monitored with S1; if no extraction takes place, S1 outputs a signal to the machine.
- The max. vacuum is monitored with S2; if the vacuum is too high (e.g. due to a blockage between the machine and volumetric flow monitoring), S2 outputs a signal.

ÜEMA / Machine Interface

Volumetric flow monitoring and display:

- The vacuum is monitored by means of an evaluation unit. The volumetric flow is displayed digitally.
- Vacuum in the extraction facility is monitored. If the specifications are overshot or undershot, a signal is output to the machine.

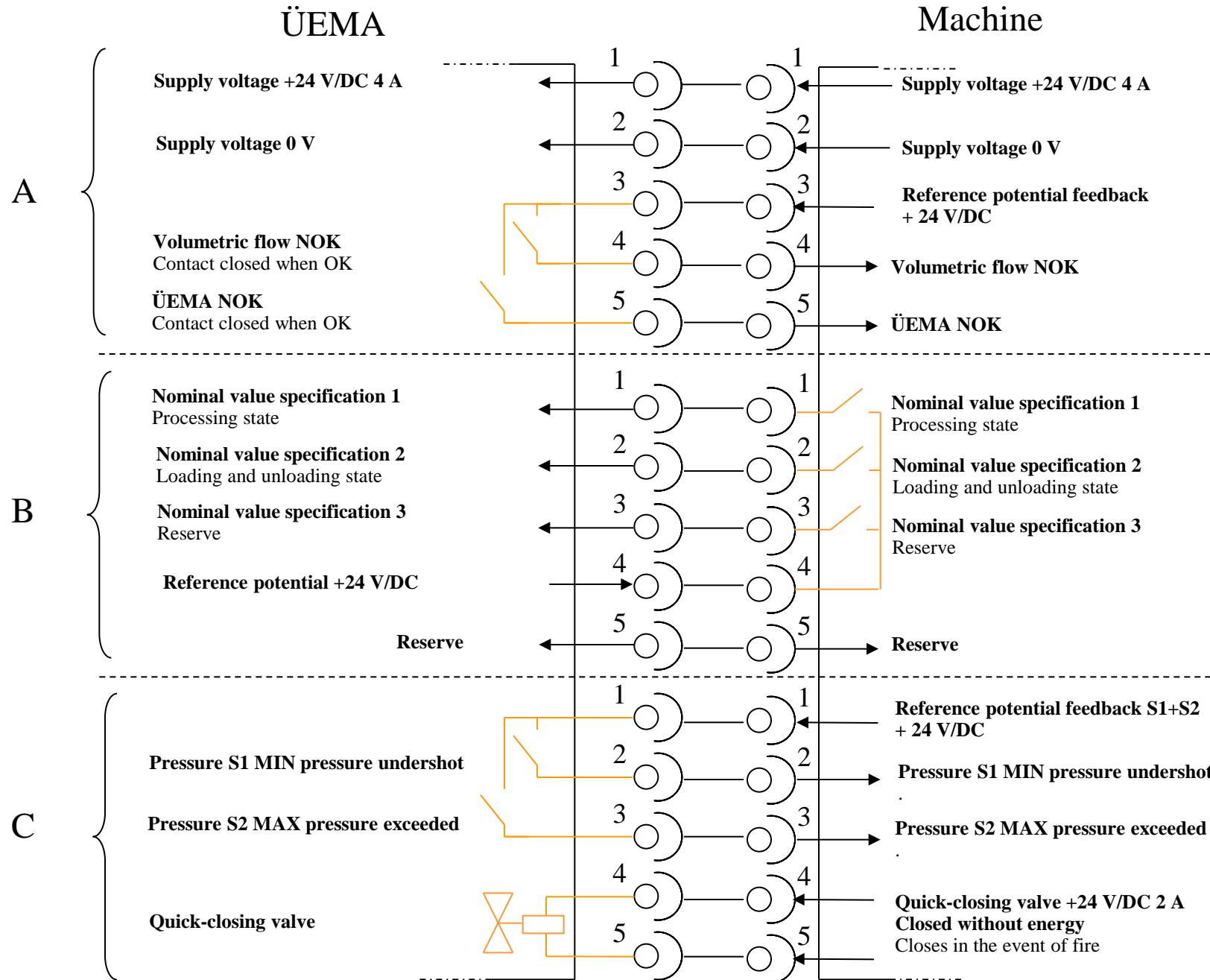
Volumetric flow monitoring and regulation:

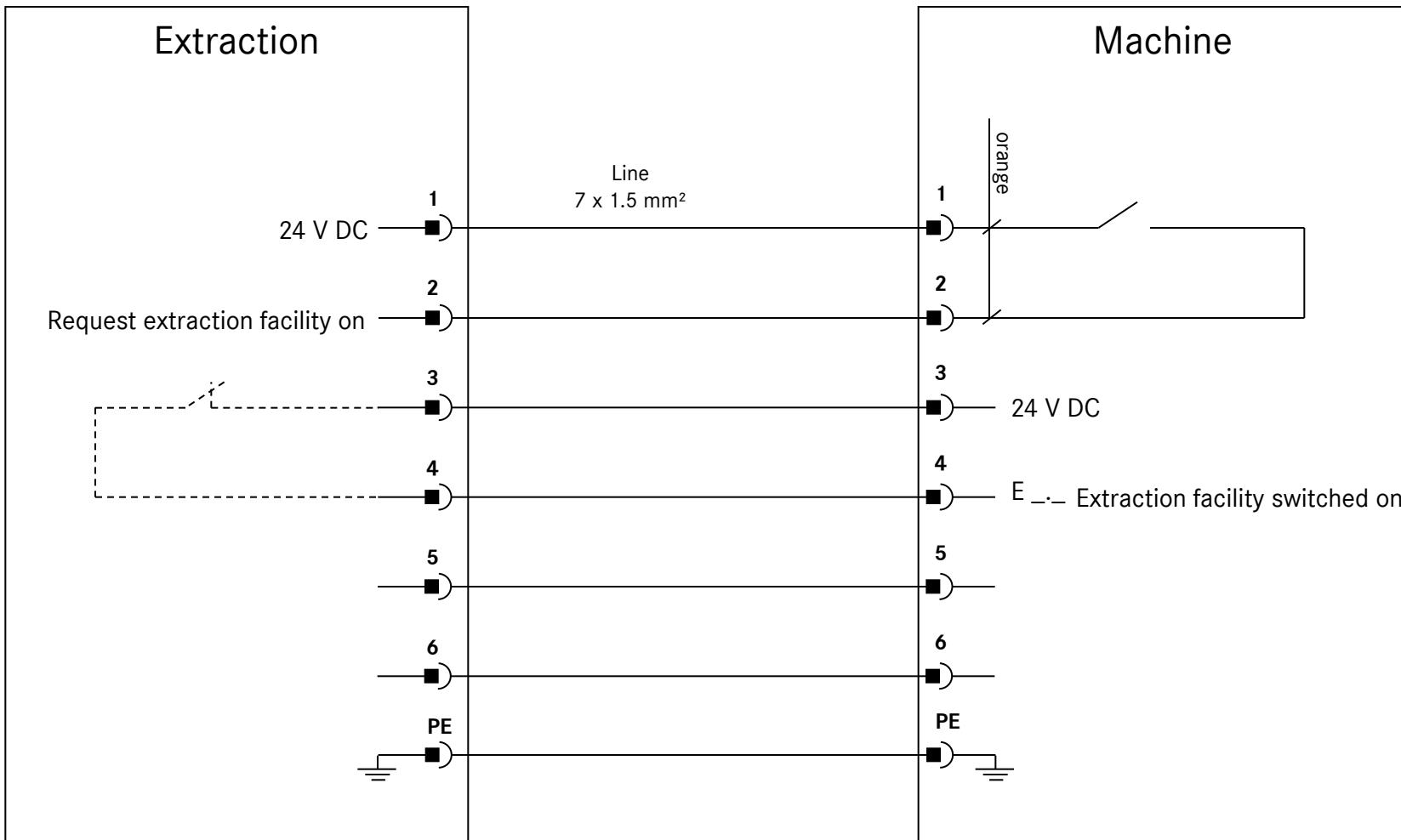
Volumetric flow is constantly monitored, controlled and adjusted using nominal value specifications 1-3.

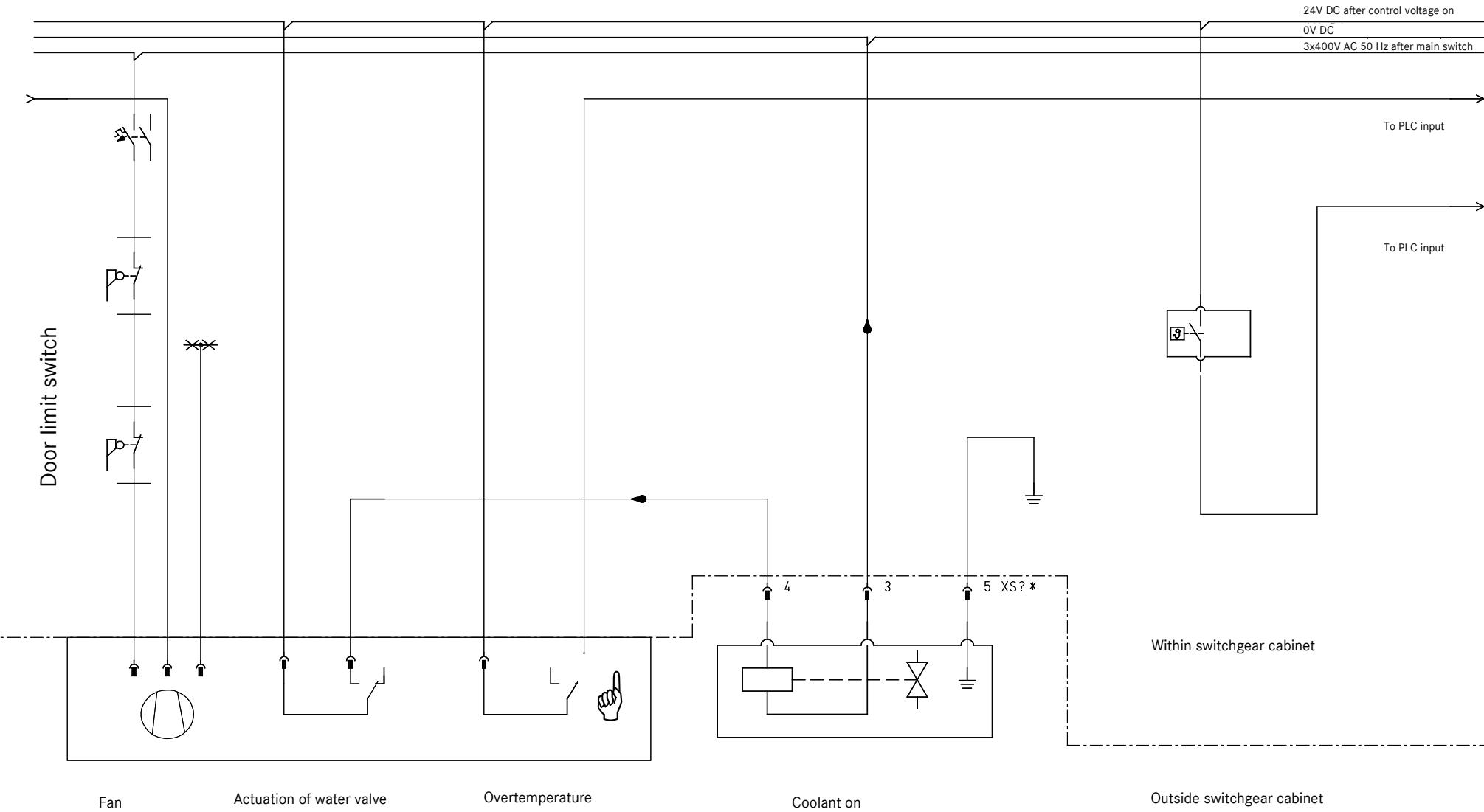
Dynamic system; nominal values 1-3 can be individually adapted to the machine's required extraction power (depending on the size of the volumetric flow display). Nominal value specifications are actuated via the machine's PLC.

Quick-closing valve 24 V/2 A:

All design variants of machines with fire monitoring are equipped with a quick-closing valve. In the event of a fire, the valve shall be actuated according to Chapter 4.9.





Anlage 19

*= M12x1 connector



Important: Contacts and assignments are manufacturer-specific!

CAPABILITY AND TYPE APPROVAL OF HAND-GUIDED ELECTRIC SCREWDRIVERS AND MOUNTED SCREWDRIVER SPINDLE UNITS FOR INSTALLING ELEMENTS WITH THREADS

1 GENERAL

This specification applies to the determination of the capability and type approval of electric screwdrivers and the mounted screwdriver spindle units for assembling elements with threads.

Technical queries as well as the selection of the screwdriver systems to be tested shall be clarified with the responsible representative of the orderer.

The particular supplier must comply with the following procedures for the approval of screwdriver systems:

- a) Inspection and type approval of the torque/torque angle pickup for screwdriver spindle units
- b) Inspection and type approval of the mounted screwdriver spindle units
- c) Inspection and type approval of the electric screwdriver with torque/angle sensor units

2 TYPE APPROVAL OF THE TORQUE/TIGHTENING ANGLE PICKUP

The type approval for the pickup types employed at Daimler AG Mercedes-Benz Cars/P-Powertrain must occur once only and must be issued in the form of a document. For newly used pickups without type approval this approval must be subsequently supplied.

2.1 Torque Pickup

The capability of the torque pickups must be tested on the test facility provided by the screwdriver supplier for this purpose. Based on the applicable standard DIN 51309 and VDI Directive 2646, the measuring pickup is preferably tested at 20%, 60% and 100% of the rated value and so documented. The hysteresis characteristics must also be tested with suitable methods and documented (see "Annex" in VDI 2646). The measurement setup and performance of the test must be described by the screwdriver supplier.

The proof of capability must be documented by the supplier in a test record.

2.2 Tightening Angle Pickup

The capability of the tightening angle pickups shall be tested on the test facility planned at the screwdriver suppliers. The pulse number must be checked over a rotational angle of 360° and documented. The permissible deviation is </= +/- 1°. The measurement setup and the performance of the test must be described by the screwdriver supplier.

The proof of capability must be documented by the supplier in a test record.

2.3 Torque/Tightening Angle Pickup

For each of the pickups installed at Daimler AG the test records must be archived at the screwdriver supplier's end. The basis for the test record is a measuring system based on VDI 2646.

3 TYPE APPROVAL OF THE INSTALLED SCREWDRIVING SPINDLES

For the type approval of the screwdriver spindle units employed at Daimler AG (Mercedes-Benz plants in Berlin, Hamburg and Untertürkheim) machine-capable studies must be conducted according to the currently applicable ISO 5393 or VDI Directive 2647.

The type approval must absolutely be preceded by a table of contents including the clear-cut specification on the output (gear ratio, typical efficiency) of the screwdriver spindle units and electric screwdrivers certified for Daimler AG. The table of contents shall be continued accordingly.

The type approval must separately occur for each output variant (e.g. straight output, angle head, offset output). Wrench attachments that have longer spline shafts or extensions than the certified wrench attachment need not be certified separately. Angle heads and offset outputs having different gearing in front of the pickup must be certified for each type.

For newly used screwdriver spindle units without type approval this approval must be subsequently supplied. The table of contents must be adapted accordingly.

Powertrain Requirement Specifications, Part III Electrical System: APPENDIX 20

In departure from or supplemental to ISO 5393 or VDI 2647, the following points must be kept in mind

- 3.1** The proof of machine capability must be checked in reference to the specified torque range using the steps and settings specified in VDI guideline 2647.
- 3.2** The basis for these proofs of machine capability is a tolerance of +/- 10% (corresponding to MBN10130-3, class 2) and a cmk factor of > 1.67.
The proofs of capability shall be performed on the basis of VDI 2647 Annex A3.
- 3.3** For obtaining reproducible test results, the testing is conducted for both the hard and soft standard screwdriving cases according to ISO 5393 or VDI 2647. 100 measurements must be performed per torque setting. At least two diagrams must be recorded from each series of measurements.

Hard connection = < 30 degrees according to ISO 5393 or
 15 degrees as of 50% from the test torque based on VDI 2647

Soft connection = > 720 degrees according to ISO 5393 or
 360 degrees as of 50% from the test torque based on VDI 2647

- 3.4** To cancel operator effects, the screwdriver spindle unit must be fastened in the test stand. The screwdriving procedure must occur dynamically and the screwdriver freely rotate at least two revolutions in front of the head stop.
- 3.5.1** For obtaining statistically validated results, 100 measurement values must be obtained per series of measurements. At least three screwdrivers per type shall be tested in the case of standard components.
- 3.5.2** Special components are not subject to type approval and shall be validated through a single machine capability study/component.

EMC – Electromagnetic Compatibility

In order to ensure conformity (§3 of the law on electromagnetic compatibility), the contractor is obliged to take the physical ambient and operating conditions encountered at the site of installation or operation into account in its EMC design and layout guiding principles (DIN EN 61204-1, Section 4.4, Subsection 4.4.2 - EMC).

The contractor is obliged to comply with the EMC in accordance with the EMC guidelines specifications, “**PRODUCTION ENVIRONMENT**” classification for the following applicable physical ambient and operating conditions in the Bremen, Gaggenau, Hamburg, Kassel, Kölleda, Mannheim and Untertürkheim plants.

Rated voltage on IPC	$U_c = 400 \text{ V} \pm 10\%$	Bremen, Gaggenau, Hamburg, Kassel, Kölleda, Mannheim, Untertürkheim
Rated frequency on IPC	$f_n = 50 \text{ Hz}$	
Frequency of the signal voltage on IPC (ripple control frequency)	$f_{s,R} = 211 \text{ Hz}$	Untertürkheim
	$f_{s,R} = \text{none effective}$	Bremen, Gaggenau, Hamburg, Kassel, Kölleda, Mannheim
Nominal line short circuit output/network conditions at IPC with n-1 operation and network station connection point	$S_k = 44.5 \text{ MVA}$ with $R/X = 0.24$	Untertürkheim
	$S_k = 30.8 \text{ MVA}$ with $R/X = 0.25$	Bremen, Gaggenau, Hamburg, Kassel, Kölleda, Mannheim
Maximum line short circuit output/network condition at IPC (maximum development stage)	$S_k'' \text{ max.} = 57.2 \text{ MVA}$ with $R/X = 0.24$	Bremen, Gaggenau, Hamburg, Kassel, Kölleda, Mannheim, Untertürkheim

The EMC guidelines are available under:

www.emv-ila.de

Interface description

KSS return pump station (RPS) with cutting unit machine tool interface to electrical equipment

Display of messages and contacts from and to the machine when connected to a central supply system or return pump station (RPS) with a cutting unit

Necessary 24-pin Harting coupling with the following potential free contacts on the switch cabinet:

Contacts:	Message:	Remark:
1./2.	Enabled by machine tool	Enabled by machine tool (machine ON) Not enabled by machine tool (machine OFF)
3./4.		
5./6.	Ready for operation	From the RPS to the machine tool by "Stop at end of block or cycle".
7./8.	Max./max. message	<ul style="list-style-type: none"> • Max./max. message from the RPS to the machine tool by "immediate controlled program abort with back-off". • If overlift pumps are used in the machine tool, these must not be allowed to start up if the Max.max message is sent. • The main valve in the coolant flow line must be closed by the machine tool. <p>(The coolant main valve is controlled by the machine)</p>

Signal state 1 = OK /

If the inspection door on the cutter unit is opened (protected by the Euchner switch), the cutter unit stops immediately and the "ready for operation" signal to the machine tool goes out.

If the machine tool does not receive the "Ready for operation" signal from the RPS, the machining operation in the machine tool is terminated by "Stop at end of block or cycle".

If this is not technically possible or if the Max.max message appears, processing by the machine tool is aborted by "immediate controlled program abort with clearing" and the coolant main valve is closed.

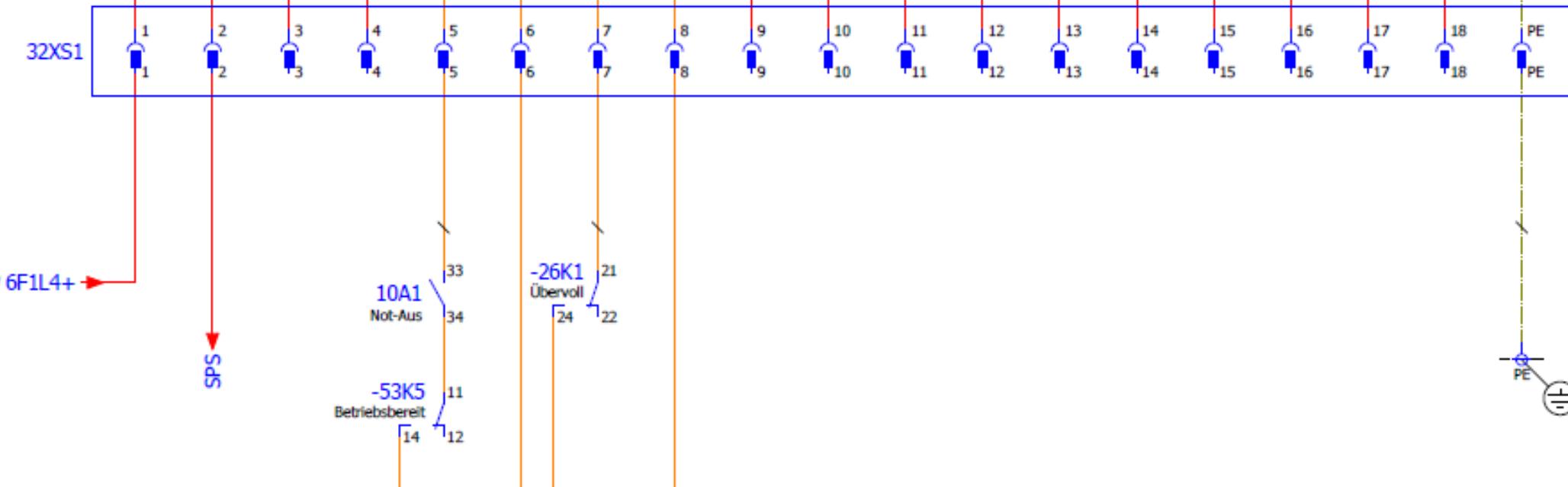
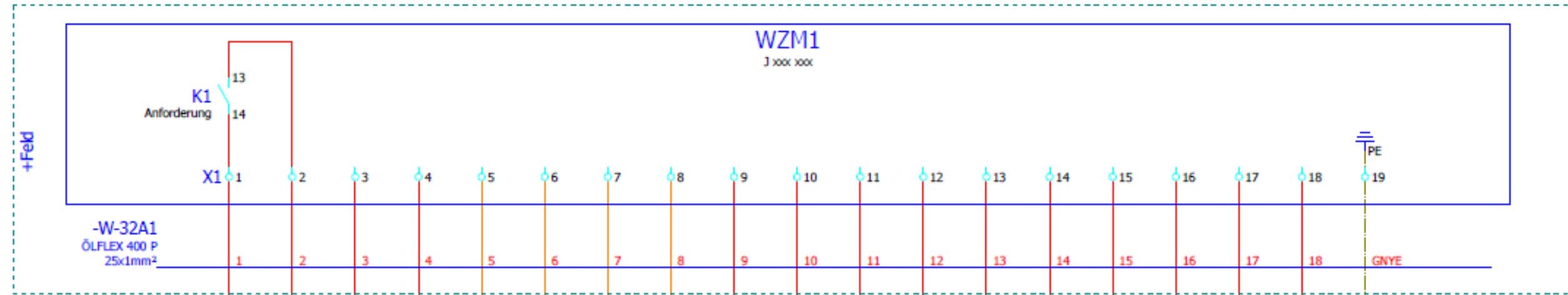
A main solenoid valve must be provided upstream of the machine tool and controlled by the machine tool. In addition, a pressure monitor or a flow monitor must be installed upstream of the machine tool to ensure safety in case the cooling lubricant system fails.

Please note: The RPS must have its own power supply with a main switch. DAG generally expects the chip conveyors to clear.

0	1	2	3	4	5	6	7	8	9
---	---	---	---	---	---	---	---	---	---

Signalaustausch WZM	Signal exchange with machine tool (WZM)
Signalaustausch RPS <-> Maschine	Signal exchange RPS <-> machine
K1 Anforderung	K1 request
+Feld	+field
Freigabe von Bearbeitungsmaschine	Enable signal from processing machine
ÖLFLEX	Oil flex
Not-Aus	Emergency OFF
Betriebsbereit	Ready for operation
Übervoll	Over-full
Anlage betriebsbereit	Installation ready for operation
Max-max Alarm Vorlage-Behälter OK	Max-max alarm – tanks OK

Signalaustausch WZM



Freigabe von
Bearbeitungs-
maschine

Anlage
betriebsbereit

Max-Max Alarm
Vorlage-
behälter O.K.

/6F1L4+
SPS



Signalaustausch
RPS <=> Maschine



Daimler AG

ZLT Name
Ohne ZLT Anschluss

Projekt- / Zeichnungsnr.
B08-RPS-01

= RPS
+ B08
Blatt 32
Bl 1

0	1	2	3	4	5	6	7	8	9
		Datum	01.08.2016						
		Bearb	hweicht						
		Gepr							
Aenderung	Datum	Name	Urspr						

Suction sluice / machine tool interface electrical engineering

Display of messages and contacts from and to the machine when connected to a central chip removal system; vacuum chip extraction system

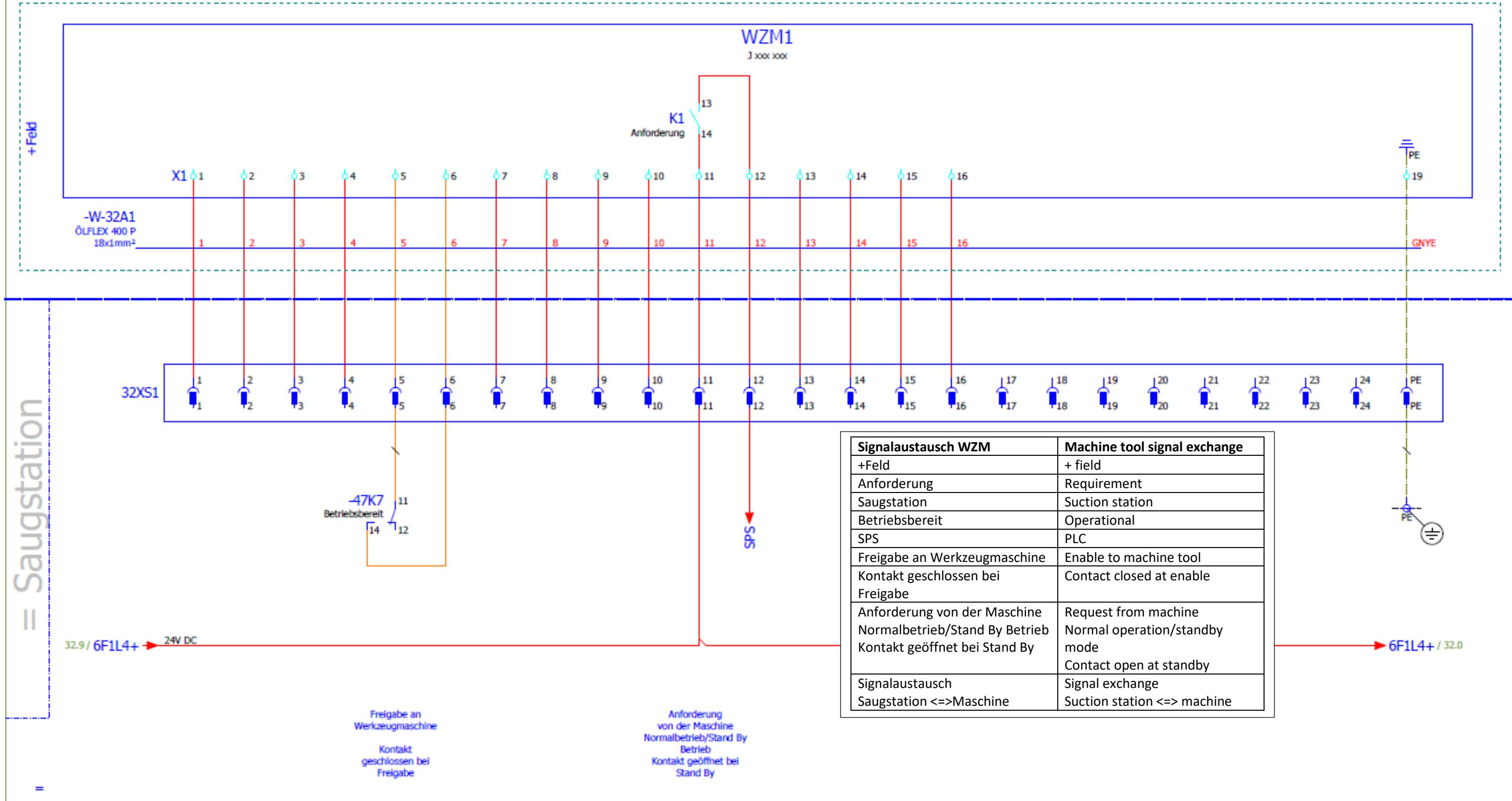
Necessary 24-pin Harting coupling with the following potential free contacts on the switch cabinet:

Contacts:	Message:	Remark:
1./2.	Emergency off = signal 0	Potential-free contact on the emergency stop relay of the machine. From the machine to the suction sluice, i.e. standstill of dangerous motions (screw, cutting unit)
5./6.	Ready for operation	Enable from the RPS to the machine tool by "Stop at end of block or cycle". <ul style="list-style-type: none">• Signal state 1 = enable• Signal state 0 = end of cycle
11./12.	Switching on the suction sluice/cutter from the machine	<ul style="list-style-type: none">• Signal state 1 = suction sluice "ON"• Signal state 0 = suction sluice "OFF"

The suction sluice can be switched on via the chip conveyor if it is not running in interval mode or stops when the machine door is opened.

DAG generally expects the chip conveyors to clear. Signal state 1 = OK

Signalaustausch WZM



WHG - Meldung - Standard über den Einbau WHG Melder

WHG-Melder und Füllstandsgrenzschalter (Überfüllsicherungen):

Gemäß den geltenden Vorschriften nach WHG (Wasserhaushaltsgesetz) und VAWs (Anlagenverordnung) müssen eventuelle Leckagemengen in Bereichen, welche mit **Wasser gefährdenden Stoffen** (z.B. Öle, Emulsionen, Lösungen, Laugen, Elektrolytflüssigkeiten etc.) beaufschlagt sind, u.a. sofort und zuverlässig erkennbar sein. Da diese Voraussetzung im Werk Gaggenau und im Werkteil Rastatt nicht überall gegeben ist, wird ersatzweise der Einbau von Flüssigkeitssensoren (sogenannten WHG-Meldern bzw.

Füllstandsgrenzschaltern-Überfüll-sicherungen) notwendig. Vor dem Hintergrund der bestehenden Altlasten im Werk Gaggenau sind diese Gewässerschutzmaßnahmen unumgänglich. Ersatzweise können diese Bereiche selbstverständlich auch jederzeit einsehbar und begehbar ausgestaltet werden. Hier muß aber auch sichergestellt werden, daß auftretende Leckagen (z.B. über Wochenenden oder an schichtfreien Tagen) zuverlässig erkannt und ordnungsgemäß beseitigt werden.

==> Dieser Standard gilt nicht für unterirdische Tanks!!!

Generell gilt:

Priorität 1-Alarm:

Die Meldung wird von WSF ohne zeitliche Verzögerung abgearbeitet; die WSF rückt aus und informiert den Betreiber und die Anlagenwärter; die detaillierten Maßnahmen müssen vor Ort geklärt werden.

Priorität 2-Störung:

WSF rückt nicht sofort aus; WSF informiert die Anlagenwärter bzw. am Wochenende den Betreiber; Anlagenwärter oder Betreiber entscheidet mit WSF über die notwendigen Maßnahmen; es muß eine Rückmeldung zu WSF erfolgen.

Folgende Bereiche sind mit WHG-Meldern bzw. Überfüllsicherungen auszustatten:

	Unzugängliche bzw. uneinsehbare Bereiche:	Einzel versorgte Maschinen und Behälter mit einem Volumen > 1.000 Liter:	Zentral versorgte Maschinen ohne eigenes Behältervolumen:
Priorität 1 - Alarm	Maschinengruben; Gruben in Kanälen, welche Rohrleitungen mit Wasser gefährdenden Stoffen führen; Pumpensümpfe (Ausführung generell doppelwandig und lecküberwacht);	Tropf-Auffangwannen unter diesen Maschinen bzw. Behältern;	
Priorität 2 - Störung		z.B. auch Waschmaschinen, Räummaschinen, KSS-Anlagen etc.; doppelwandige, (leck-) überwachte Behälter;	z.B. Rückpumpstationen etc.;



Dieser Standard ist anzuwenden und über das von TS herausgegebene Formblatt zur Darstellung von WHG-Meldungen zu realisieren.

Informationen über die technische Ausführung der WHG-Melder und Füllstandsgrenzschalter (Überfüllsicherungen) sind dem TDS-Lastenheft (über Intranet) zu entnehmen.

Was ist nun zu tun?

1. Anlagen definieren anhand des vorliegenden Standards
2. Bedarfs-Meldung über das o.g. Formular an TS-BAE, H. Maier

Formular kann auch extra über die Peripherieauswahl ausgedruckt werden!!!

BearbeitungsInformation :

Erstellt von:

[Dusko Remus/034/INT/EEC]
[08.07.2004 15:21:00]

Zuletzt bearbeitet von :

[Dusko Remus/034/INT/EEC]
[12.03.2009 14:07:34]

Gebäudeleittechnik - Steuerung

Ansteuerungen über die GLT finden generell nur mit Hilfe von Koppelrelais statt.

Koppelrelais statisch:

Weidmüller RSLT-A / Best-Nr.: 115456 o. WAGO 21,8 mA Typ: 288-312

Koppelrelais dynamisch:

murr-electronic Artikel-Nr.: 67148 MKS-RA 21/24 o. WAGO 21,8 mA Typ: 288-758

BearbeitungsInformation :

Erstellt von:

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[08.07.2004 15:21:00]

Zuletzt bearbeitet von :

[Dusko Remus/034/INT/EEC]
[12.03.2009 14:16:13]

Gebäudeleittechnik - Meldungen

Für die Aufschaltung und Überwachung sind innerhalb der Steuerung potentialfreie Kontakte vorzusehen.

Zur Parametrierung der Meldungen sind Meldetyp mit Prioritäten nach folgendem Muster anzugeben:

Fachgruppe:	MSR	Messen, Steuern, Regeln
	E	Elektrofachkraft
	I	Installateur
	B	Blechner
	S	Schreiner
	F	Werkfeuerwehr

Priorität:	1	Rund um die Uhr
	2	innerhalb Schichtbetrieb (falls besetzt)
	3	zur normalen Arbeitszeit

Entsprechend der Parameter werden durch TS oder WSF die Rufbereitschaften informiert.

Beispiel:

Bei einer Meldung I3 handelt es sich um eine Störung, die von einem Installateur zur normalen Arbeitszeit behoben wird.

BearbeitungsInformation :

Erstellt von:

[Dusko Remus/034/INT/EEC]
[08.07.2004 15:21:00]

Zuletzt bearbeitet von :

[Dusko Remus/034/INT/EEC]
[12.03.2009 14:17:28]

Powertrain Requirement Specifications Part III

Appendix 30: PROFINET Specifications Version 4.3

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1 Overview of Important Standards and Directives

All of the following specifications, measurements and continuous monitoring tasks are based on the following standards, directives and guidelines:

- EN50173 / ISO IEC 11801 "Structured Cabling"
- PROFINET Guideline, Planning and Installation of PROFINET Cabling Systems
- PROFINET Guideline, Planning, Installation and Commissioning
- PROFINET PROFIsafe System Description
- PROFINET IO Conformance Classes Version 1.1
- PROFIsafe – Profile for Safety Technology
- EN 50310 "Application of Equipotential Bonding and Earthing in Buildings with Information Technology Equipment."
- ~~- VDI/VDE Guideline 2184 "Reliable Operation and Maintenance of Field Bus Systems"~~
- VDI/VDE 2183 for Ethernet-based systems
- Functional Earthing and Shielding of PROFIBUS and PROFINET, PI Guideline Version 1.0, March 2018

2 Network Installation

Component parts/components shall be selected from the material release list (MFL) in the Material Data Manager (MDM). If additional components are required, the following technical specifications shall be complied with.

2.1 Device

Only PROFINET components that are subject to at least Conformance Class B (CC-B) and support the protocols (LLDP, SNMP) for neighborhood detection (determination of the topology plan) shall be used.

All network nodes shall communicate with a data transfer rate of 100 Mbit/s (Fast Ethernet) in full duplex (FDX).

2.2 Switches

Only SCALANCE type managed switches from Siemens may be used in the PROFINET network (see MDM). If settings in the switch are carried out via the WEB server, the C-PLUG removable medium shall be used for rapid device exchange. The web servers shall be integrated in the system's user interface.

The project engineering specifications in the project books from Siemens shall be complied with.

Several switches shall not be used in the same installation location, e.g. in the switchgear cabinet, to increase the number of ports (unless more than 24 ports are required).

2.3 Cables

Only the following CAT5e PROFINET lines with a star quad line design (AWG22) shall be used:

- Line type B: Only permitted for firmly routed line
→ max. length approx. 80 m*
- Line type C: Generally permitted; mandatory for flexibly routed lines
→ max. length approx. 60 m*

*The maximum line length (channel) specified in the manufacturer's data sheet shall be taken into consideration for the lines that are used.

Mixing line types B and C over the section between two PROFINET(PN) nodes is not permissible.

For cable installation, the following shall be observed:

- The minimum bending radius for permanently installed cables is 10x dia.
- The minimum bending radius for movable cables is 20x dia.
- No cable reserves may be installed in the cable ducts.
- Pre-assembled lines shall be used for the PROFINET installation outside of the control cabinet.
The use of manually assembled lines shall be coordinated via the representative.

2.4 Plug Connectors

Only the following PROFINET connectors shall be used:

- In the control cabinet:
RJ45 plug with robust metal housing
and FastConnect connection technology.
The cable outlets 180° (straight), 145° (angled)
and 90° (angled) shall be taken into account
in accordance with the installation situation
of the RJ45 connector.
- Outside control cabinet:
M12 connector, 4-pin,
D-coded according to IEC61076-2-10
M12 plugs with FastConnect connection technology
shall be used for manually assembled lines;
these lines are subject to official approval.

Max. six connectors are permissible over the entire line length between two PROFINET(PN) nodes (end-to-end link). → ([See Table 1](#))

It shall generally be ensured that the fewest possible connectors are present in an end-to-end link. The use of plug-in bushings, e.g. with an M12 or RJ45 connection, is not permitted on the control cabinet.

2.5 Network Design

2.5.1 Topology

The topology always begins with a star-shaped design. Each controller shall always be followed by a managed switch (root switch) as the next PROFINET node, see [example of a network design](#).

For reasons of availability and diagnosability, while taking the cable situation into account, it shall be ensured that the line depths tend to be planned minimally and uniformly.

Devices that do not correspond to Netload Class 3 shall be connected in-line to a separate switch port depending on type subject to consultation with the Daimler specialized department (representative).

Mixing PROFINET with TCP/IP communication in the line depth is not permissible. TCP/IP devices and PROFINET nodes shall be connected separately to the root switch.

The topology shall be submitted to the representative for approval.

2.5.2 Line Depth

The line depth specifies the number of route-through communication nodes between the PLC (controller) and the terminal.

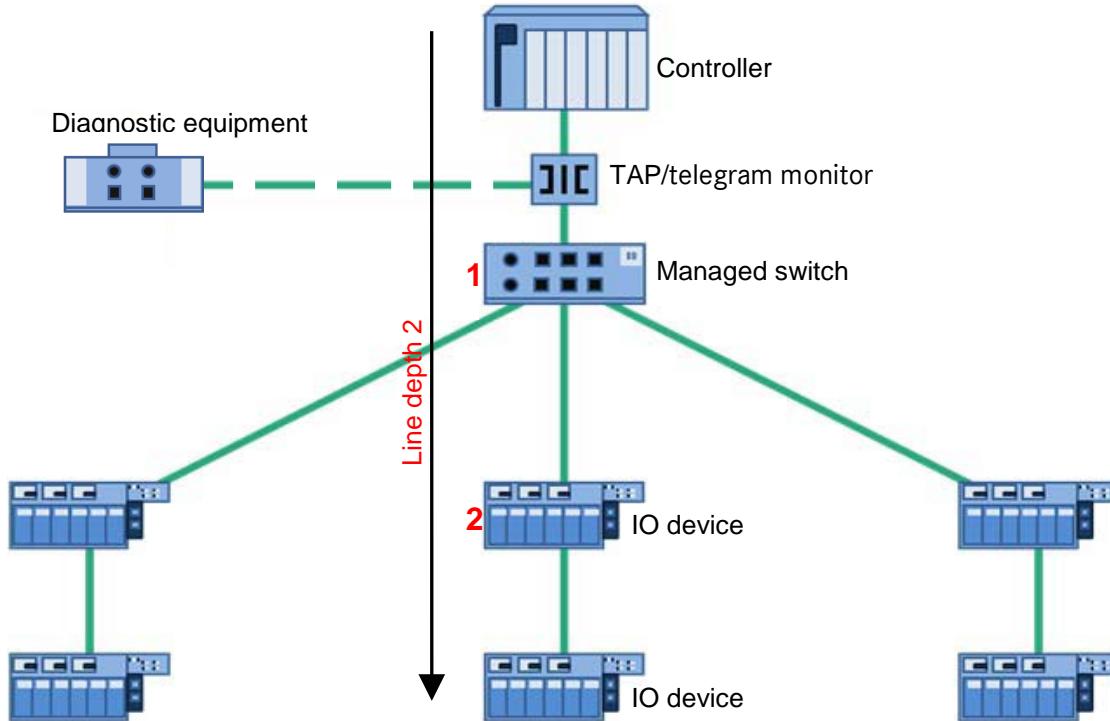
The line depth shall always be coordinated with the representative for the specific system. Irrespective of the possible line depth in [Table 4](#), a maximum line depth of 12 shall be adhered to.

2.5.3 Access Points for Network Diagnosis

An access point to the PROFINET network shall always be available between the controller and the switch to be able to connect diagnostic devices during ongoing operation without interrupting system operation.

A TAP (Test Access Point) shall be inserted directly into a communication section as shown in the Figure to determine the precise data traffic.

Example of a Network Design



(Figure: Source: PI Planning Guideline; the line depth has been added)

Note:

The TAP can be omitted if an intelligent TAP (passive telegram monitor, e.g. PROFINET-INspektor® NT) has already been installed in the machine/system by the supplier. The component part shall be coordinated with the representative.

Space shall be reserved in the switchgear cabinet for a passive telegram monitor.

With special approval by the representative, line certification can be forgone due to permanent use of a passive telegram monitor. Communication errors caused by line problems are detected by the telegram monitor.

3. Parametrization

When replacing a device, automatic configuration is carried out via the PN controller.

The following settings shall be taken into account:

- The PN devices shall be interconnected via the topology editor.
- If possible, the communication share shall be set to 75% on the PROFINET controller.
- A fixed updating rate shall be set for each device.
- The setting "Support device replacement without removable media" shall be activated.
- Device name/PN name*
- IP address**
- Subnet mask**
- Device number or user ID matches the last place of the IP address
(e.g. 172.1.10.XYZ or 192.168.214.XYZ)

The specifications shall be taken from the following documents:

* Requirement Specifications Part III, Appendix 1 => "Network Subscriber Nomenclature..."

** On the Siemens Daimler extranet => "Manufacturing_Network Concept..." or "Assembly Networking Concept..."

Setting updating time:

The updating times to be set shall be selected depending on the line depth so that data exchange between the controller and device is twice as fast as the control system cycle time.

→ ([See Table 4](#))

The updating time for each individual device shall be set manually in the hardware configuration.

Basic principle: Never as fast as possible, but always as fast as necessary.

4. Display and Labeling

Display:

The following information shall be shown in the circuit diagram:

- Network topology
- Device name/PN name
- IP address
- Port designation
- Production equipment ID code

Labeling:

ProfiNet/network components shall be marked on the machine/system as follows:

- Device name/PN name
- IP address
- Production equipment ID code

5. Equipotential Bonding

5.1 Equipotential Bonding Quality

The supplier shall furnish evidence of quality for the system on installation in compliance with standards and interference-free functioning of the equipotential bonding system by taking measurements. The associated test records (acceptance measurement report) then form a part of the electrical documentation.

A tightly-meshed, low-impedance equipotential bonding system according to "DIN EN 50310" shall be provided.

The quality of equipotential bonding shall be metrologically verified with the determination of the impedance. The following values shall be complied with:

	Impedance measurement	Current measurement*
Protective equipotential bonding conductor (BN)	Max. 0.3 ohm at 2.1 kHz	Max. 300 mA (German Statutory Accident Insurance Association V3)
Functional equipotential bonding conductor	Max. 0.3 ohm at 2.1 kHz	Max. 300 mA
Screen for data cables	Max. 0.6 ohm at 2.1 kHz	Max. 40 mA (approx. 1 mW)

* The current measurements shall be carried out separately in the grid frequency range (50/60 Hz) and into the frequency range of the potential influencing sources (e.g. up to 2.5 kHz in the case of Siemens drive electronics).

Measuring instrument: Indusol

MWMZ II (mesh resistance measuring clamp),
LSMZ I (screen current clamp), ISMZ I
(intelligent current clamp)
or equivalent

Note: The screens of the data cables and the functional equipotential bonding shall be evaluated separately. The impedance of the protective equipotential bonding conductor and the impedance of the screen for data cables shall always be jointly considered. It shall be ensured that the impedance of the protective equipotential bonding conductor is lower than the impedance of the screen. These measurements do not relieve the supplier of its duty of accountability according to German Statutory Accident Insurance Association Region 3.

5.2 Screen Support

If PROFINET lines are routed into the switchgear cabinet from the outside, a generously sized screen support shall always be provided. This can be carried out at the switchgear cabinet entrance or directly upstream of the device. Pressure and pinching loads (deformation of the cable structure) shall be avoided in the design.

6. PROFIsafe

If the PROFIsafe safety profile is used in conjunction with PROFINET, the addressing of the source/target address (F address) of the safety peripherals shall be unique throughout the Ethernet subnet. This shall be comprehensively documented for networked controllers (systems) located in the same plant network. A reference to the respective system circuit diagram is not sufficient.

7. General Information on Network Checking

The acceptance check is an important metrological quality verification for the verification of the long-term safe and reliable function of the PROFINET network.

In the following considerations, in addition to the offline measurement (cable test), the online measurement is divided into "**System-describing and Quality**" analyses.

8. PROFINET "Acceptance"

8.1 Offline Analysis - "Line Test"

Each cable connection shall be measured and logged after installation or after commissioning of the system at the installation location while taking the following limits into account.

The determined measurement values shall be checked and confirmed as specified by Daimler AG. This effort can be reduced in individual cases subject to consultation with the representative.

Limits:

- Max. attenuation (loss over the length of the line)
→ ([See Table 2](#) "Length-dependent values for attenuation...")
- Min. next (cross-talk between the individual wire pairs)
→ ([See Table 3](#) "Length-dependent values for cross-talk/NEXT ...")

Measuring instruments:

Acceptance tester

ETHERtest V5 (manufacturer Fluke), WireXpert 500 or equivalent

8.2 Online Analysis - "Telegram Analysis"

8.2.1 System-describing Analyses

The network topology including all following network and device information shall be checked for conformance with the planning and requirement specifications using a suitable measurement and diagnostic tool and shall be documented.

- Network topology
- Current port assignments
- Port operating mode (full duplex)
- Port speed (100 Mbit/s)
- Device names/PN names
- Device types
- IP addresses
- MAC addresses
- Hardware versions
- Firmware versions

Note on firmware versions:

With new systems, it must be ensured that the **same firmware version** is also installed for each controller of all devices of the same type. This requirement shall also be complied with when an upward and/or downward compatibility of the firmware versions is referred to in the specifications of the device manufacturer.

8.2.2 PROFINET Quality Analysis

The quality of the telegram traffic between the controller and the first device shall be evaluated for the parameters listed in the following under near-production conditions with a suitable measuring and diagnostic tool.

All of the following Q values are guideline values in the sense of a long-term system operation while taking the possibility of a network expansion into account. Deviations shall be analyzed and explained in the report.

The "quality analysis" shall be performed under production-near conditions over a period of 24 hours after commissioning the system at the installation location.

8.2.3 PROFINET IO (RT)/(IRT) Quality Analysis

- **Jitter**
is a measure of the deviation of the updating time including the number of failed telegrams.
 - RT quality value: Max. 50%
 - IRT quality value: 0%
- **Network load**
is the sum of the generated network load of all communication protocols with reference to the maximum possible load of a line of 100 Mbit/s
 - Quality value: Max. 20%
- **Load ratio**
is the ratio of the number of PROFINET protocols to other protocols transferred in the same network (e.g. TCP/IP, Modbus TCP, etc.)
 - Quality value: $\geq 100:1$ (*Regarded as an acceptance criterion for network loads over 10%*)
- **Rejected packets/telegram gaps**
Describes the absence of a package in an anticipated updating time due e.g. to discard or error telegrams
 - Quality value: 0
- **Error telegrams**
The discrepancies in the telegram checksums (e.g. due to EMC coupling).
 - Quality value: 0
- **Telegram overtaking**
can occur when new telegrams are transmitted before old ones due to load peaks in the switch or I/O device.
 - Quality value: 0

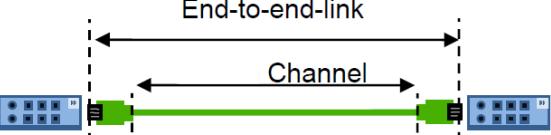
8.3 Measurement and Logging

All measuring results and quality values (Q values) described in this document shall be documented in a measuring report. Deviations from the specifications are subject to approval.

The original measurement files shall be enclosed with the documentation for subsequent comparative measurements.

Appendix:

Table 1: Permissible Plug Connections

Cabling example of two network Components	Number of plug connections	Max. length dependent on cable type
	2	60 - 80 m
	4	60 - 80 m
	6	60 - 80 m
		

(Figure: Source: PI Planning Guideline; the values were changed and the M12 connectors were added)

Table 2:
Length-Dependent Values for Attenuation (End-to-End Link)

Installed cable length		Max. attenuation as per standard Cat. 5e for 100 MHz	Length-dependent max. attenuation	DAIMLER specification Length-dependent max. attenuation
100	M	24 dB	24 dB	21 dB
50	M	24 dB	21 dB	18 dB
25	M	24 dB	18 dB	15 dB
12	M	24 dB	15 dB	12 dB
6	M	24 dB	12 dB	9 dB
3	M	24 dB	9 dB	6 dB
1.5	M	24 dB	6 dB	3 dB

Note: The cable certification measurement results (e.g. FLUKE) are usually specified as a reserve versus the limit value (24 dB).

Table 3: Length-dependent values for cross-talk/NEXT (end-to-end link)

Installed cable length		Min. attenuation according to ISO IEC 11801 Class D for 100 MHz	Length-dependent min. attenuation	DAIMLER specification Length-dependent min. attenuation
100	M	30 dB	30 dB	33 dB
50	M	30 dB	33 dB	36 dB
25	M	30 dB	36 dB	39 dB
12	M	30 dB	39 dB	42 dB
6	M	30 dB	42 dB	45 dB
3	M	30 dB	45 dB	48 dB
1.5	M	30 dB	48 dB	51 dB

Note: The cable certification measurement results (e.g. FLUKE) are usually specified as a reserve versus the limit value (30 dB).

Table 4:

Updating Times for Store and Forward depending on Line Depth

PLC Cycle time e.g.	Updating interval of device	Max. no. of PN devices per controller			
		70	130	200	250
Line depth					
2 ms	1 ms	7			
4 ms	2 ms	14	14		
8 ms	4 ms	28	28	28	
16 ms	8 ms	58	58	58	58
32 ms*	16 ms*		112	112	112

Also dependent on the type of switch (Store and Forward or Cut Through), see PNO recommendation.

Maximum permissible line depth, see [2.5.2 Line Depth](#).

* These values are not generally permissible!

1. NC Program Designations

The NC program name (program designation) consists of numbers and letters (incl. "_"). Special characters and umlauts are not permitted in the NC program name!

If designations of operation number, unit and tool type are shorter than provided for, these should be filled up with leading zeros.

Name of the NC program: OP<Operation number>_<Unit>_<Workpiece type>_<Info text> _<Channel number>

Operation number	Mandatory	Numbers	3 digits
Unit	Mandatory for units	Numbers and letters	3 digits
Workpiece type	Mandatory	Numbers	2 digits
Info text	Optional	Numbers and letters	Max. 8 digits
Channel number	Mandatory with several channels	Numbers	2 digits

Examples: "OP020_03A_02_02" or "OP120_01_01" or "OP010_01_NPV_02" or "OP160_12"

Workpiece types shall be numbered following the order of the parameters in the "Set-up" display.

2. NC Programming Rules

The following rules shall be observed during program creation:

Rule	Structure and syntax rules
001	Before starting programming, coordination with the responsible Daimler department** is required.
101	NC programs shall be straightforward and understandably created.
102	Uniform NC commands and subprograms shall be used, i.e. the same operations shall be programmed with the same commands within a project.
106*	If possible, program jumps with GOTO shall be avoided and shall be replaced with GOTOB or GOTOF; control structures (e.g.: IF, WHILE, LOOP, ...) shall preferably be used.
107*	Deviations subject to coordination with the responsible Daimler department** are permissible: If a value (e.g. operating speed, rotational speed, drilling depth) is programmed more than once in the same operations, this shall be programmed using the variables _CLS, _RTP, _DP1, _DP2, _DP* so that only one value has to be altered in the event of a change. The corresponding value shall be assigned to the variable at the start of the program section.
108*	Calculation variables (Siemens = R) shall be avoided and replaced by symbolic variables.
109*	Interface signals (\$A_DBB), direct inputs (\$A_IN) and direct outputs (\$A_OUT) shall be replaced by symbolic names using "DEFINE", and shall be visualized in a variable view (e.g. Interface signals.com).
110*	The NC programs shall be written so that they can be executed in an individual statement (with the exception of functions that are not technically feasible, e.g. thread cutting).
111*	Deviations subject to coordination with the responsible Daimler department** are permissible: In the case of metal-cutting processes, the operating speed shall be defined using the variable "_FED1" ("_FED2" ... etc.) and the rotational speed using the variable "_SPD1" ("_SPD2" ... etc.) after the tool change (see sample program). The variables shall be created globally (REAL). All data shall always be programmed in a CNC line (with the machining point number)! The feed and rotational speed shall always be uniquely correlated with the machining point number!
112	If the operating speed is not programmed in "mm/min" (e.g. mm/rev.), the corresponding G-command shall always be programmed in the declaration line.
113	If the rotational speed is not programmed in "rpm" (constant cutting speed), the corresponding G-command shall always be programmed in the declaration line.
114*	Deviations subject to coordination with the responsible Daimler department** are permissible: The machining point number shall be specified with the parameter "_BST=" each time before machining (see example). If several surfaces are produced simultaneously with one cut, all numbers shall be specified separated by commas. All numbers shall be specified completely with hyphen; abbreviation or summarization is not permissible. The variable shall be created globally (STRING[100]).
115	Tool numbers shall always be programmed directly as numbers; the tool number shall be coordinated with the Daimler department**.
116	Each tool shall be created in tool administration and shall be called in the NC program. In the case of

Rule	Structure and syntax rules
	multi-blade tools, the blades shall also be created and programmed.
117	NC machining programs shall be stored with a unique name (see "Program designations") in the workpiece directory. A separate NC start program shall be created for each workpiece type, even if the machining of the individual types does not differ or the type to be transferred to Prisma changes.
118	Machining cycles used shall be saved in the CUS directory (user cycles).
119	Machine functions (loading, unloading, tool changes, organization, etc.) shall be each saved individually in the CMA directory (manufacturer cycles).
120	Deviations subject to coordination with the responsible Daimler department** are permissible: For workpiece zero points a subprogram shall be created and saved in the same directory as the machining program. A separate program shall be planned for zero point corrections (dimension corrections).
121	Between each instruction (word) a blank character shall occur. No blanks shall occur within an instruction (e.g. not: R1 = 10).
122	Program structures shall be clearly depicted by indentations (blank characters, no tabs).
123*	Each NC record shall receive a four-place number, to be assigned in steps of 10.
124*	The workpiece geometry (center tolerance) shall be programmed in the NC program. reserving any necessary tool corrections for the tool correction switches.
126	All identical machines within a project shall have the same program version (structure, definitions, cycles, ...). Apart from corrections (zero point shifts, ...) parallel machines (which replace each other) shall have exactly the same programs and settings.
127	Tool geometry data shall be checked as regards plausibility. This can be carried out before, during or after the tool change. The tolerance can be overwritten in the main program depending on process.
129	Withdrawal programs for moving clear after program cancellation shall be created (required to enable even less qualified personnel to automatically move clear and back again and to avoid crashes).
130	After cancellation, the machining program starts with the not yet completed machining step, or with the accompanying program section subject to coordination (required to enable even less qualified personnel to automatically move clear and back again and to avoid crashes).

Rule	Comments
201*	Unclear program points shall be provided with a comment.
203*	It shall be ensured that comments are shown uniformly at the right edge of the control panel without line break.
204	New program sections shall be clearly indicated by a double continuous line and a comment.
205	If there are several sections in one program (e.g. several tools), these shall be provided with a clear comment.
206	If several operations are programmed within one program section, these shall be separated from each other by a continuous line.
207	Help functions, macros, subprogram calls, variables, control commands, etc. shall be provided with a comment if they are not standard commands (e.g. G0, G1, M3, ...).
208*	Deviations subject to coordination with the responsible Daimler department** are permissible: Each machining program (main program, subprogram, etc.) shall be provided with a program header. The template shall be used.
210	All comments shall be implemented in German.
211	All "MSG" messages shall be implemented in German.

Rule	Performance and energy
301	As far as possible, operations shall be programmed in parallel, for example tool changing and indexing.
302	Positioning movements shall be described over the quickest route (e.g. several axes simultaneously).
303	Safety clearances shall not be greater than is technologically necessary.
304*	Dwell times that are not technologically required shall be avoided.
305*	Commands that interrupt the statement sequence of the NC shall be avoided (e.g. "STOPRE").
308	The cooling lubricant/HMI shall be shut off on final machining of a tool (tool change).
309	In the case of longer interruptions in machining, the HMI shall be switched off and switched on again before machining is next carried out.
310	The spindle rpm shall be shut off at the hole base during final machining of a tool (tool change), but at

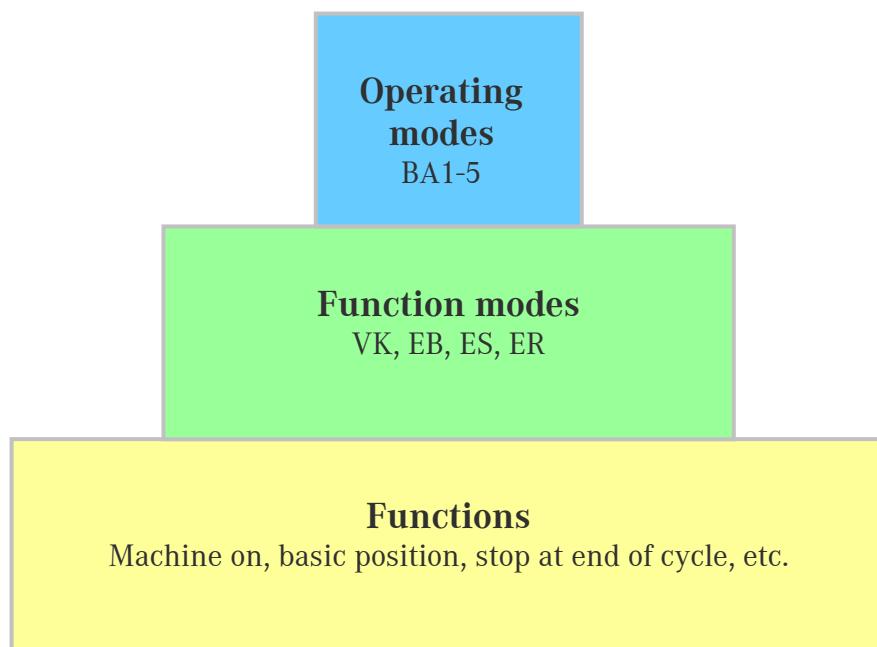
Rule	Performance and energy
	the latest on exiting the hole (BAZ). The spindle rpm shall be adapted to the subsequent tool (tool change). Only acceleration or brake application shall take place. Braking and accelerating is not permissible (lathing).
311	Cooling lubricant/HMI shall be switched off in the case of machine or logistical faults.
312	The spindle rpm shall be switched off in the case of machine or logistical faults.
313	If possible, the cooling lubricant pressure shall be adapted to the respective machining operation/tool case by case.
314	On spindles on which no machining is taking place, the spindle rpm, cooling lubricant/HMI and other consumers shall be shut off.
315	Cooling lubricant showers, flushing facilities, sealing air, presence-of-workpiece sensors, blowing facilities and conveyors shall be used specifically (e.g. only during final machining).
316*	Subprogram end should always take place with "RET".
317	Positioning traverses shall be programmed without an accurate stop, as this would cause the track to wear. Only axial movements that require a precise stop due to technical or qualitative reasons shall be planned with a precise stop. The precise stop shall then be selected as small as necessary (machine data, program commands). Careful use of the machine should be ensured.
320*	Successive fast speed movements shall always be forward shifted (e.g. G60 G603).
321*	If forward shifting is undertaken with G641, "ADIS" or "ADISPOS" shall be >1 mm.
322*	Straight axis movements over several records shall always be forward shifted (e.g. G64).
323*	If possible, feed blocks shall be forward shifted (e.g. G64).
330*	Each position specification shall result in an axis movement.
340	When programming, optimize cycling times (refer to the documentation of the control system manufacturer).
341	Fast speed movements shall be programmed over the fastest route (e.g. the shortest possible withdrawal level).
351*	Unnecessary and repeated commands, functions and calls shall be avoided.

* A semiautomated rule check can be performed using the NCPA tool (contained in requirement specifications CD).

** In plant 034: Daimler NC programmer on site in the commissioning plant

Appendix 32

Technical Description of Operating Modes



Version 2.0

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1 General

1.1 Preface

This document serves to establish the cross-company standardization of operating modes and function modes. The aim of the document is to ensure that terminology and content are uniformly defined and put into practice.

The standards (Machinery Directive, etc.) and company-specific specifications (Powertrain Requirement Specifications, Siemens Software Guide, etc.) form the basis for standardization.

This document has been created by Daimler AG (PT/TPM & PP/PTM) in consultation with the involved companies, so that the result is uniform and recognized specifications for all parties concerned.

1.2 Record of Revisions

Version	Last revised	Change	Changed by:
1.0	18.11.10	New draft	A. Müller (PMF)
2.0	07.08.15	Revision	P. Baur/B. Swoboda

1.3 Contacts

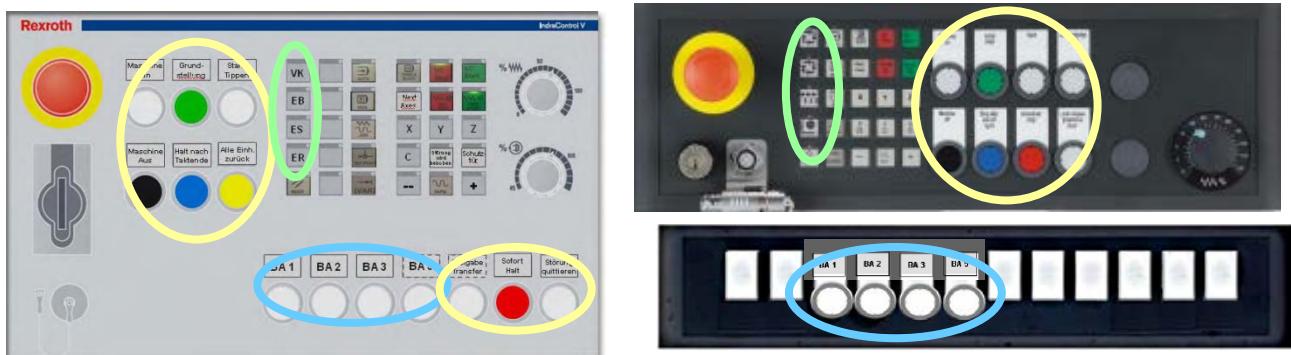
For general, content-related questions regarding understanding of the requirement specifications, send an e-mail to the address below:

mbox-lh3-elektrik@daimler.com

Please contact - in accordance with the further processing/data processing-compliant procedure - the representative specified on the client's side in the case of order-specific questions.

2 Definitions

The following generic terms have been defined for the key pad on the machine control panel:



Use of BA1 – BA5	Use of ER, VK, EB, ES	Use of machine settings and default settings etc.
Operating Mode (BA)	Function Mode (FA)	Function (F)

The following terms apply when using this document:

2.1 Basic Position

The default setting is the machine mode in which components (actuators) are in the mode defined by the manufacturer - a mode in which the machine can always be restarted.

2.2 "Flashing" Illuminated Display:

This is a transitional state; the triggered action has not yet been completed.

2.3 "Steady" Illuminated Display:

Action active or status achieved.

2.4 Single Movement

Single movements are actuator actions that occur once e.g.:

- an NC-axle moves, while in jog mode, into a specific direction
- a pneumatic cylinder performs a movement (tightening a tensioning cylinder)
- turning a spindle on/off

2.5 Single Operation

Single operation is the combination of successive individual movements. Either a complete working process or a one-time, partial process is executed.

2.6 Ramp-up

Machines shall, as a basic principle, feature an "automatic start up function". All required/product-relevant substances shall be used.

In ES, EB, VK: switching on control voltage, load voltage, substances
In ER: switching on the control voltage

If the "Machine On" button is pressed in interlinked operation (VK), automatic start up shall be activated.

2.7 Machine

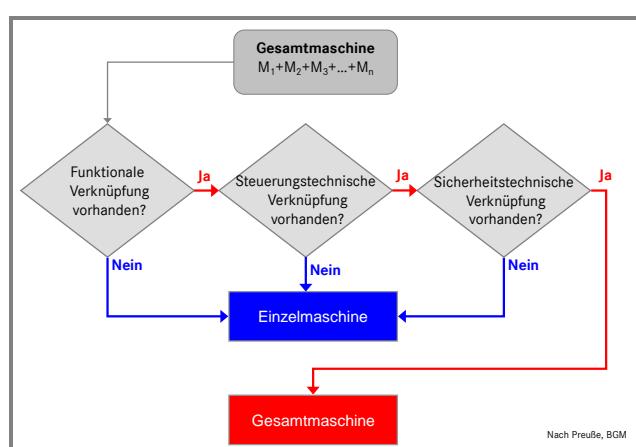
The term **machine** stands for a processing or assembly machine with its own control system, e.g. processing center, unit of a transfer line, assembly station, measurement or inspection station, test stand, loading system.

2.8 Cooperating Machines

Cooperating machines are components of the entire machine that always or occasionally operate in conjunction with one another, e.g. a process center with a loading system.

2.9 Entire Machine

The term **entire machine** denotes machines that are connected by means of safety technology, e.g. transfer lines or flexible processing lines.



Gesamtmaschine	Overall machine
Funktional Verknüpfung vorhanden?	Functional connection available?
Steuerungstechnische Verknüpfung vorhanden?	Technical control connection available?
Sicherheitstechnische Verknüpfung vorhanden?	Technical security connection available?
Ja	Yes
Nein	No
Einzelmaschine	Single machine
Gesamtmaschine	Overall machine

3 Overview of Operating Modes, Function Modes and Functions

A short and concise description is required for operating mode terminology for the purposes of differentiation between different operating modes but such descriptions do not have a bearing on established safety regulations.

3.1 Operating Modes, BA (BA1-BA5)

Mode	Description	Applicable Function Modes	EKS
1	Operation with active safety systems	ER , EB , ES , VK	No (wh, gy)
2	Setup mode	ER	Yes (gy)
3	Single step or single operation	ES , EB	Yes (bk)
5	Process monitoring	VK , EB	Yes (rd, bu)

3.2 Function Modes, FA (ER, ES, EB, VK)

	Description
ER	Setup mode
Single step	Single step
Single-cycle	Single operation
VK	Linked operation (automatic)

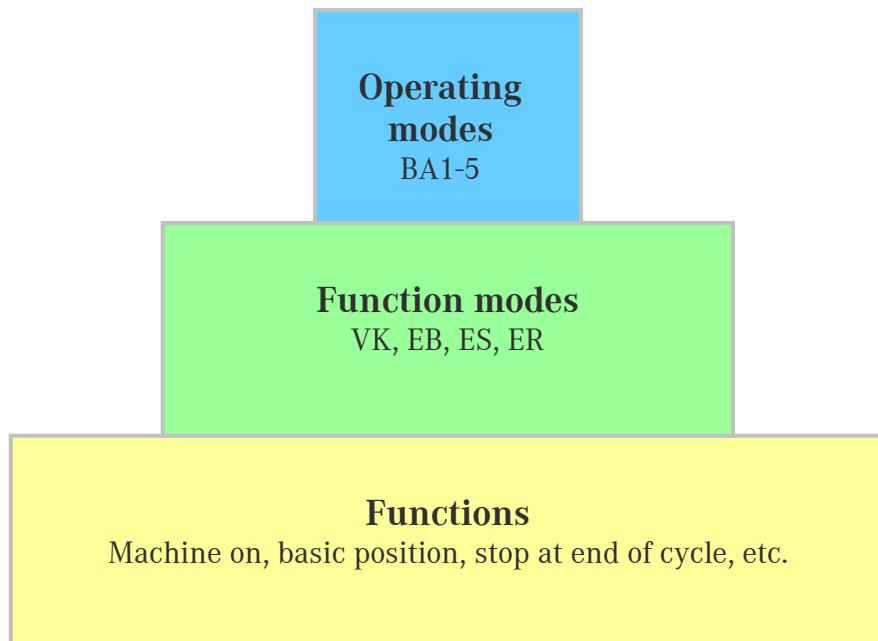
Information on the connection between NC function mode and TRANSLINE function mode, see Appendix 02, Chapter 2.2, Table 1

3.3 Function, F

	Function	Abbreviation
1	Machine on/unit on	ME
2	Machine off /unit off	MA
3	Basic position	GS
4	Start/Jog	ST
5	Acknowledge Fault	SQ
6	Stop at end of cycle	HAT
7	Immediate Stop	SH
8	Override manual control unit	ÜH
9	Lock / unlock safety doors	ST
10	Fault being cleared	SB

3.4 Hierarchical Structure

The following pyramid diagram sets out the structure of the operating ranges. The operating modes (BA1-5) are placed at the top of the pyramid and denote which function modes can be selected. After the function mode has been selected the function can be carried out.



3.5 Robotic Operating Modes

The following operating modes are defined for robots according to *DIN EN ISO 10218-1:2009-08*:

1. Automatic
2. Manually reduced speed (formerly T1)
3. Manual speed level (formerly T2)

4 Operating Modes (BA1-5)

4.1 General

The selection of operating modes (BA1-5) shall be completely **independent** of:

- the status of safety doors
- function modes (ER, EB, ES, VK)
- whether hand control units are connected or not/ selected or not

The selection of the operating modes (BA1-5) is **dependent** on:

- whether the EKS is connected or not
- the authorization of the connected EKS

Basic definition

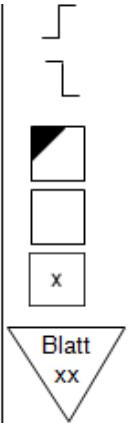
- The default setting is always BA1
- There shall always be an active BA - the absence of a BA is not permitted
- BA1 can be selected in any situation
- BA2-5 can be selected independent of EKS
- If certain selection requirements are not fulfilled, this is to be displayed in an error message
- If the EKS is disconnected, BA1 shall be the active mode
- There shall only be one EKS connected at a given control point

Lamp definitions

- Steady light: BA is active
- Dark: BA is not active
- Flashing light: State transition; selection of control system detected

Authorization not recognized: the button is pressed but either does not flash or is not steadily lit.

Legend for operating mode diagrams:

Legende:	Z Zurück EB: Einzelbetrieb ER: Einrichten ES: Einzelschritt GRND: Grundstellung HNTE: Halt nach Taktende SH: sofort Halt ST: Schutztür STRT: Start VK: verketteter Betrieb *: mögliche Funktion wenn gewünscht Softkey am OP bzw. Touchfeld		drücken/ stecken loslassen/ ziehen vorgewählte NC Betriebsart NC Funktionstaste NC-Achsanwahl (z.B. X, Y, Z-Achse) Blatt
	 Bedienelement  Zustimmungstaste (mobiles Panel)		Zustand / Prozess - Maschine Zustand / Prozess – Gesamtmaschine (bei verketteten Anlagen)
Z	Back		
EB:	Single operation		Press/insert
ER:	Setup		Release/pull
ES:	Single step		Preselected NC operating mode
GRND:	Basic position		NC button
HNTE:	Stop at end of cycle		NC axis selection (e.g. X, Y, Z axis)
SH:	Immediate stop	Sheet xx	Page
ST:	Safety door		
VK:	Automatic linked operation		Machine state/process
*:	Possible function if desired		Overall machine state/process (with interlinked systems)
	Softkey at OP or touch field		
	Control element of the machine control panel (softkey or illuminated pushbutton)		
	Enable button (portable panel)		

4.2 Boundary Conditions for Hand Control Units

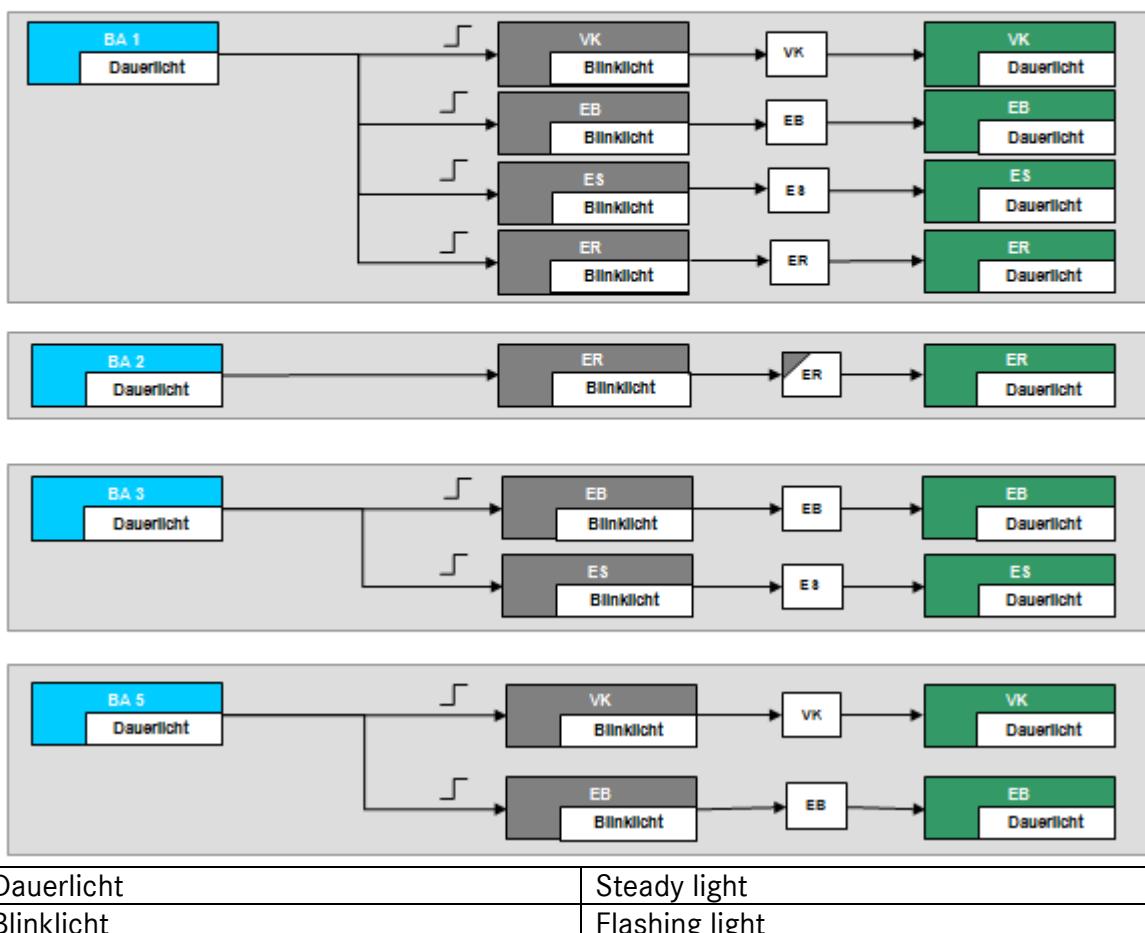
- The functionality is (with the exception of enabling switches) completely independent of BAs and shall always be in a functioning condition
- The enabling function of the hand control unit shall only be accessible when a safety door is open. In the case of several safety doors there shall be a message displayed stating: "Enabling mode not possible with more than one open safety door". If all safety doors are closed then the enabling function shall not be used.
- When using BA2-5 with a hand control unit, the functions on the machine control panel shall only be displayed - selection is only possible on the hand control unit itself (with one exception: Machine On/Off)
- "Hand control unit" and "mobile control unit" are equivalent terms

Detailed specifications are contained in the project records of the companies Siemens or Bosch Rexroth or in project-specific documents (e.g. MAG: HT8 Changing/Selection Transfer; OM651)

4.3 Operating Mode Changing and Function Modes (ER, EB, ES, VK)

Hinweis:

- Die BA3 beinhaltet nicht die Funktionalität von BA2
- Die Berechtigung (EKS) von BA3 berechtigt auch zum Anwählen der BA2
- Die BA5 beinhaltet nicht die Funktionalität von BA2 und BA3
- Die Berechtigung (EKS) von BA5 berechtigt auch zum Anwählen der BA2 und BA3
- Eine Umschaltung zur BA1 aus einer höheren Betriebsart bringt die dort vorgewählte Funktionsart mit
- Default Einstellung bei Betriebsartenanwahl
- Blinklicht: siehe Kap. 2.2 und Kap. 2.3



Note:

- Operating mode 3 does not include the functionality of operating mode 2
- The authorization (EKS) of operating mode 3 also authorizes selection of operating mode 2
- Operating mode 5 does not include the functionality of operating modes 2 and 3
- The authorization (EKS) of operating mode 5 also authorizes selection of operating modes 2 and 3
- Change-over to operating mode 1 from a higher operating mode carries along the function type pre-selected there
- ... Default setting at operating mode selection

Flashing light: see Chap. 2.2 and Chap. 2.3

4.4 BA1 - (Operation with Active Safety Systems)

The machine only runs with guards active or closed, e.g. monitored safety doors are closed or in the protection position.

The specific operating requirements for MB Powertrain are to be taken from the latest Appendix 2 of the Powertrain Requirement Specifications.

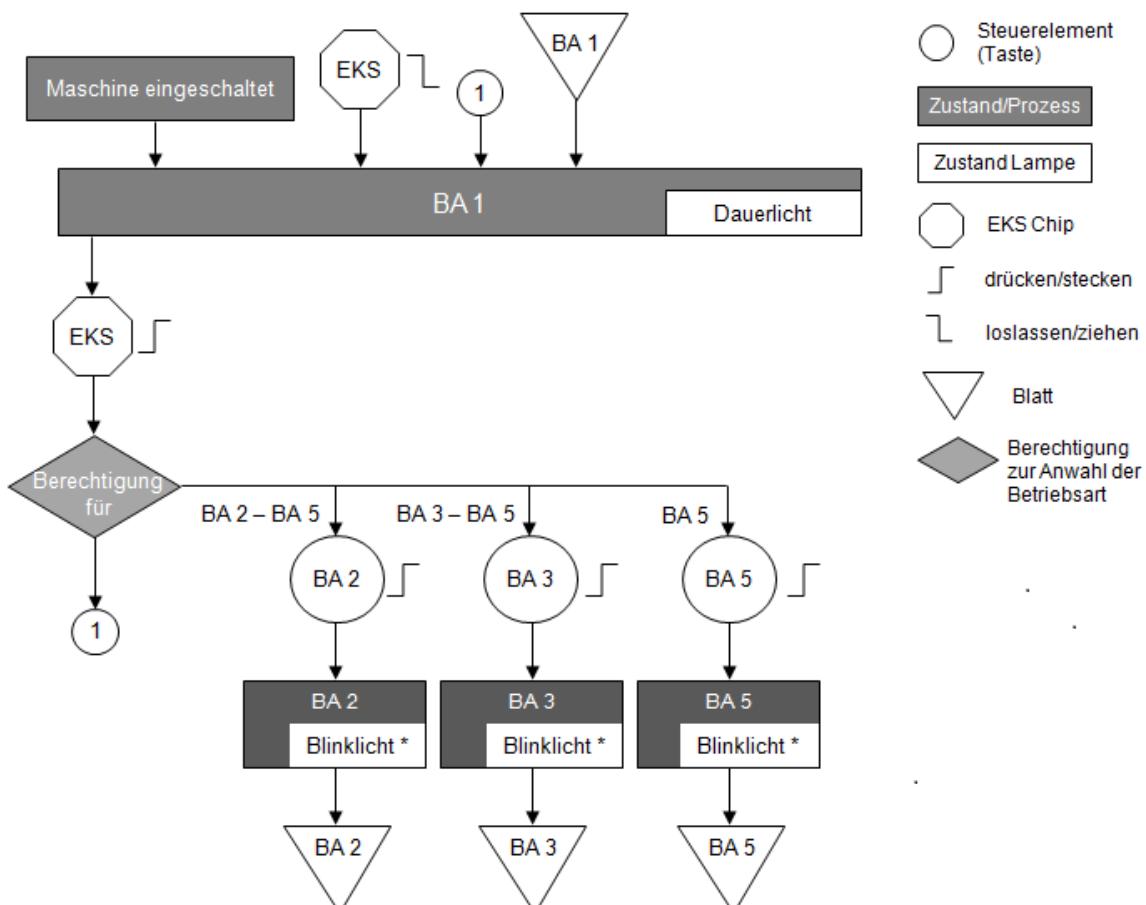
- BA1 is the default setting of the machine
 - BA1 can be selected in any situation

The following function modes can be selected in BA1:

- Setup mode ER: see Chap. 4.4.1
 - Single step ES, see Chap. 4.4.2
 - Single operation EB, see Chap. 4.4.3
 - Interlinked operation VK (automatic), see Chap. 4.4.4

Operating mode diagram BA1

Betriebsart BA 1 (Grundzustand)



* Ansteuerung Blinklicht: siehe Kap. 2.2 und Kap. 2.3

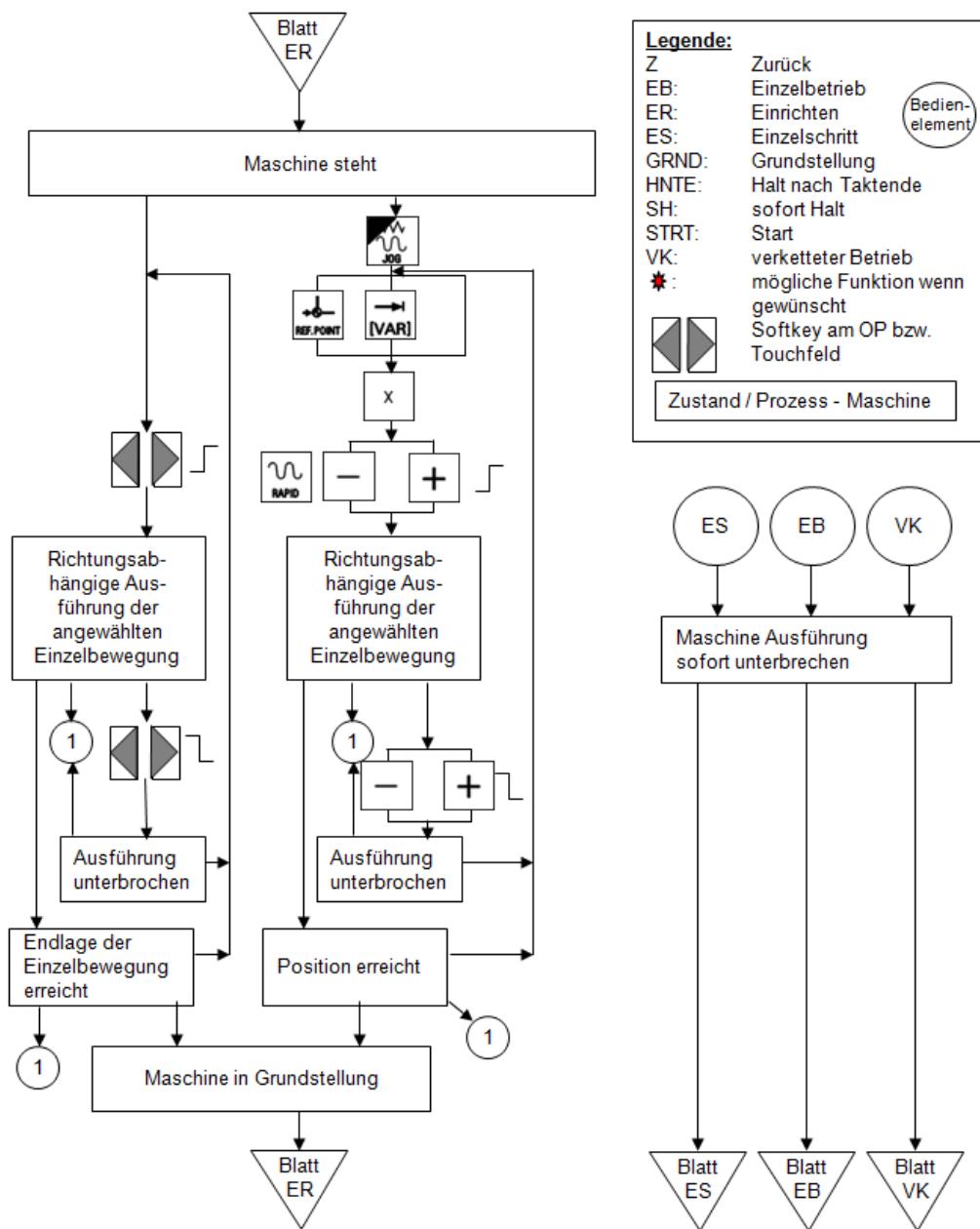
Legend

Betriebsart BA1 (Grundzustand)	
Maschine eingeschaltet	Steuerelement (Taste)
Dauerlicht	Zustand/Prozess
	Zustand/Lampe
	EKS Chip
	drücken/stecken
	loslassen/ziehen
	Berechtigung zur Anwahl der Betriebsart
Berechtigung für	
Blinklicht	
*Ansteuerung Blinklist: siehe Kap. 2.2 und Kap. 2.3	

Operating mode 1 (basic state)	
Machine on	Control element (button)
Steady light	State/process
	State/lamp
	EKS chip
	Press/insert
	Release/pull
	Authorization for selecting the operating mode
Authorization for	
Flashing light	
*Flashing light actuation: see Chap. 2.2 and Chap. 2.3	

4.4.1 BA1 and ER

Operating mode diagram BA1/ER



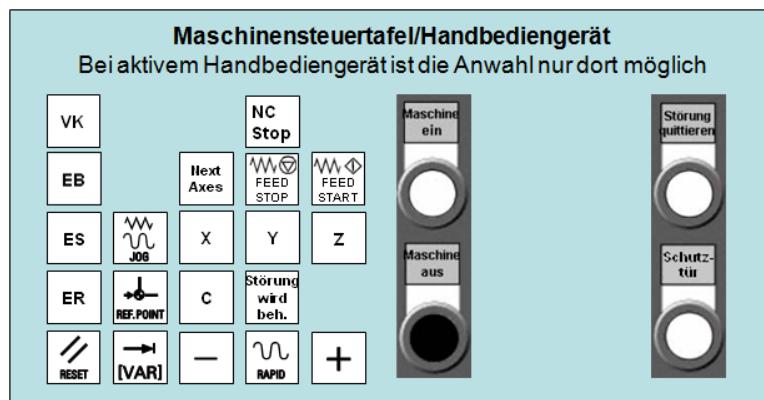
Legend

Z:	Back	
EB:	Single operation	
ER:	Setup	
ES:	Single step	Operating element
GRND:	Basic position	
HNTET:	Stop at end of cycle	
SH:	Immediate stop	
ST:	Safety door	
VK:	Automatic linked operation	
*:	Possible function if desired	
	Softkey at OP or touch field	
Machine state/process		

Blatt ER		
Maschine steht		
Richtungsabhängige Ausführung der ausgewählten Einzelbewegung	Richtungsabhängige Ausführung der ausgewählten Einzelbewegung	Maschine Ausführung sofort unterbrechen
Ausführung unterbrochen	Ausführung unterbrochen	
Endlage der Einzelbewegung erreicht	Position erreicht	
Maschine in Grundstellung		
Blatt ER		
Blatt ES		
Blatt EB		
Blatt VK		

ER sheet		
Machine at standstill		
Direction-dependent execution of the selected single motion	Direction-dependent execution of the selected single motion	Immediately interrupt machine execution
Execution interrupted	Execution interrupted	
Limit position of single motion reached	Position reached	
Machine on default setting		
ER sheet		
ES sheet		
EB sheet		
VK sheet		

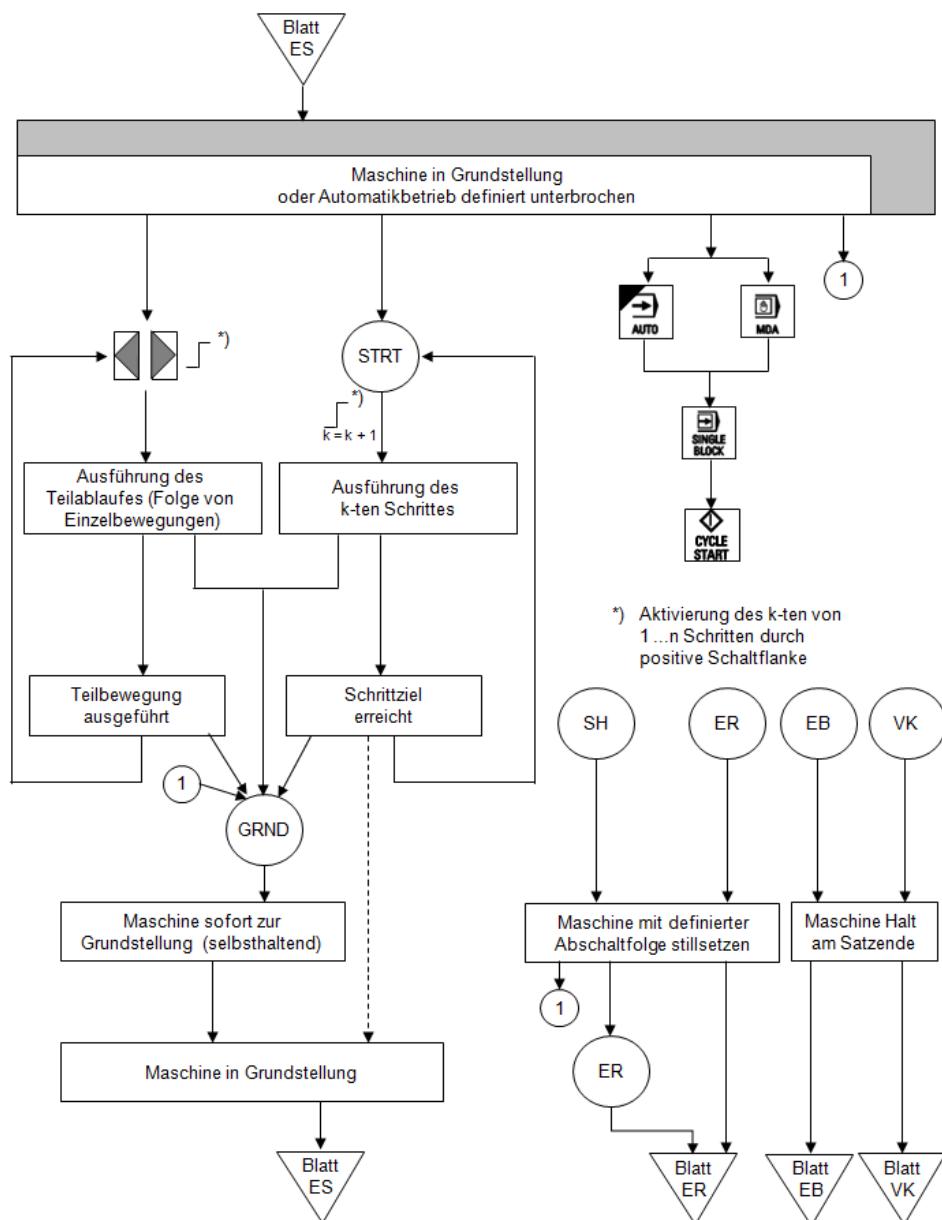
Effective button functions:



Maschinensteuertafel/Handbediengerät Bei aktivem Handbediengerät ist die Anwahl nur dort möglich	Machine control panel/hand control unit If hand control unit is active, selection is possible there only
Maschine ein	Machine ON
Maschine aus	Machine Off
Störung quittieren	Acknowledge fault
Schutztür	Safety door

4.4.2 BA1 and ES

Operating mode diagram BA1/ES



Legend

Blatt ES		
Maschine in Grundstellung oder Automatikbetrieb definiert unterbrochen		
Ausführung des Teilablaufes (Folge von Einzelbewegungen)	Ausführung des k-ten Schrittes	
Teilbewegung ausgeführt	Schrittziel erreicht	*Aktivierung des k-ten von 1 ... n Schritten durch positive Schaltflanke
Maschine sofort zur Grundstellung (selbsthaltend)	Maschine mit definierter Abschaltfolge stillsetzen	Maschine hält am Satzende
Maschine in Grundstellung		
Blatt ES		
Blatt ER		
Blatt EB		
Blatt VK		

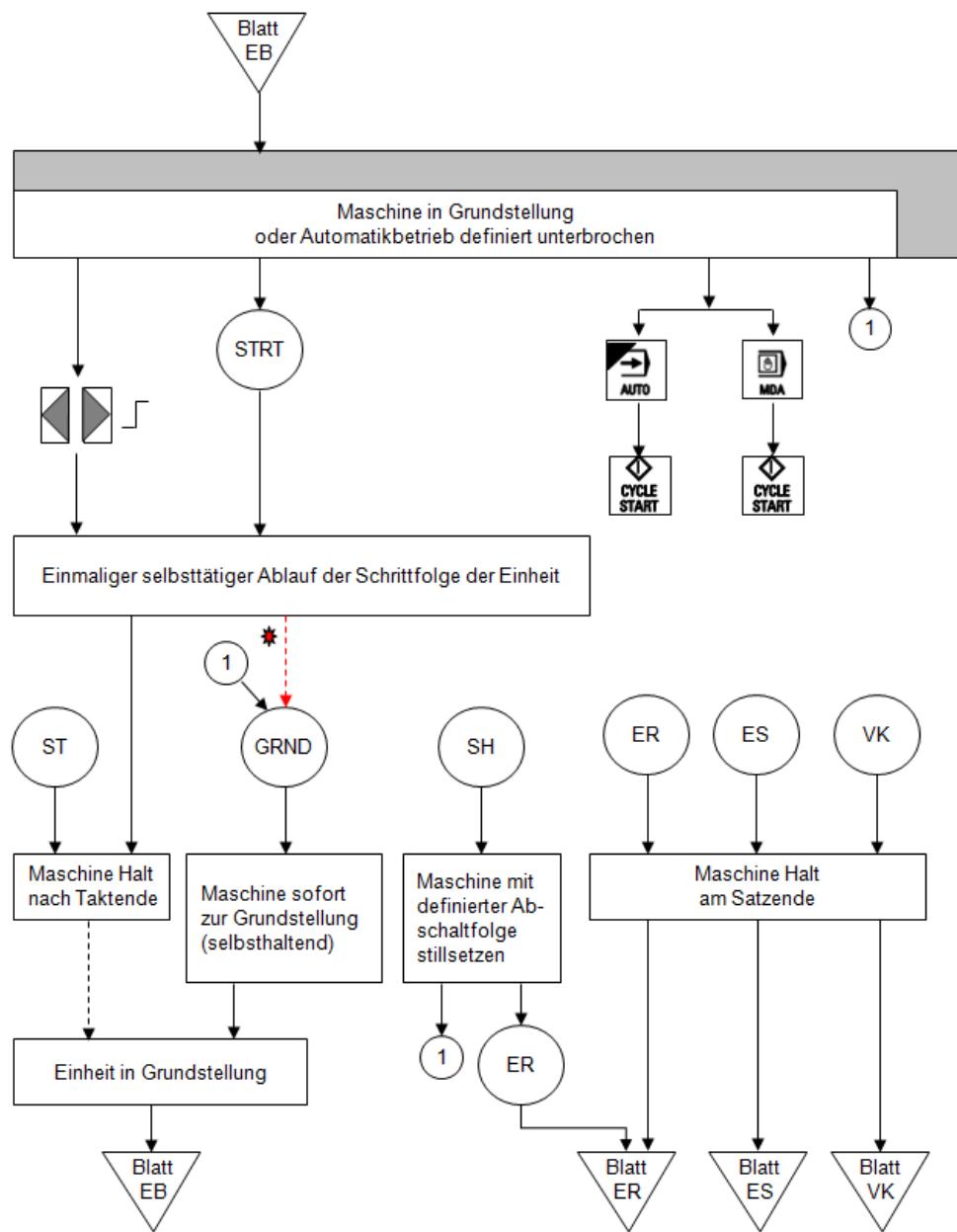
ES sheet		
Machine in basic position or automatic mode interrupted in defined way		
Execution of the partial sequence (sequence of single motions)	Execution of the kth step	
Partial motion executed	Step target reached	*Activation of the kth of 1 ... n steps by positive switching edge
Machine immediately to basic position (self-maintaining)	Stop machine with defined shutdown sequence	Machine stops at end of record
Machine on default setting		
ES sheet		
ER sheet		
EB sheet		
VK sheet		

Effective button functions:



Maschinensteuertafel/Handbediengerät Bei aktivem Handbediengerät ist die Anwahl nur dort möglich	Machine control panel/hand control unit If hand control unit is active, selection is possible there only
Maschine ein	Machine ON
Maschine aus	Machine OFF
Grundstellung	Basic position
Start/Tippen	Start/jog
Störung quittieren	Acknowledge fault
Sofort Halt	Immediate stop
Schutztür	Safety door
Störung wird behoben	Fault being cleared

4.4.3 BA1 and EB

Operating mode diagram BA1 /EB

Legend

Blatt EB			
Maschine in Grundstellung oder Automatikbetrieb definiert unterbrochen			
Einmaliger selbsttägiger Ablauf der Schrittfolge der Einheit			
Maschine Halt nach Taktende	Maschine sofort zur Grundstellung (selbsthaltend)	Maschine mit definierter Abschaltfolge stillsetzen	Maschine Halt am Satzende
Einheit in Grundstellung			
Blatt EB			
Blatt ER			
Blatt ES			
Blatt VK			

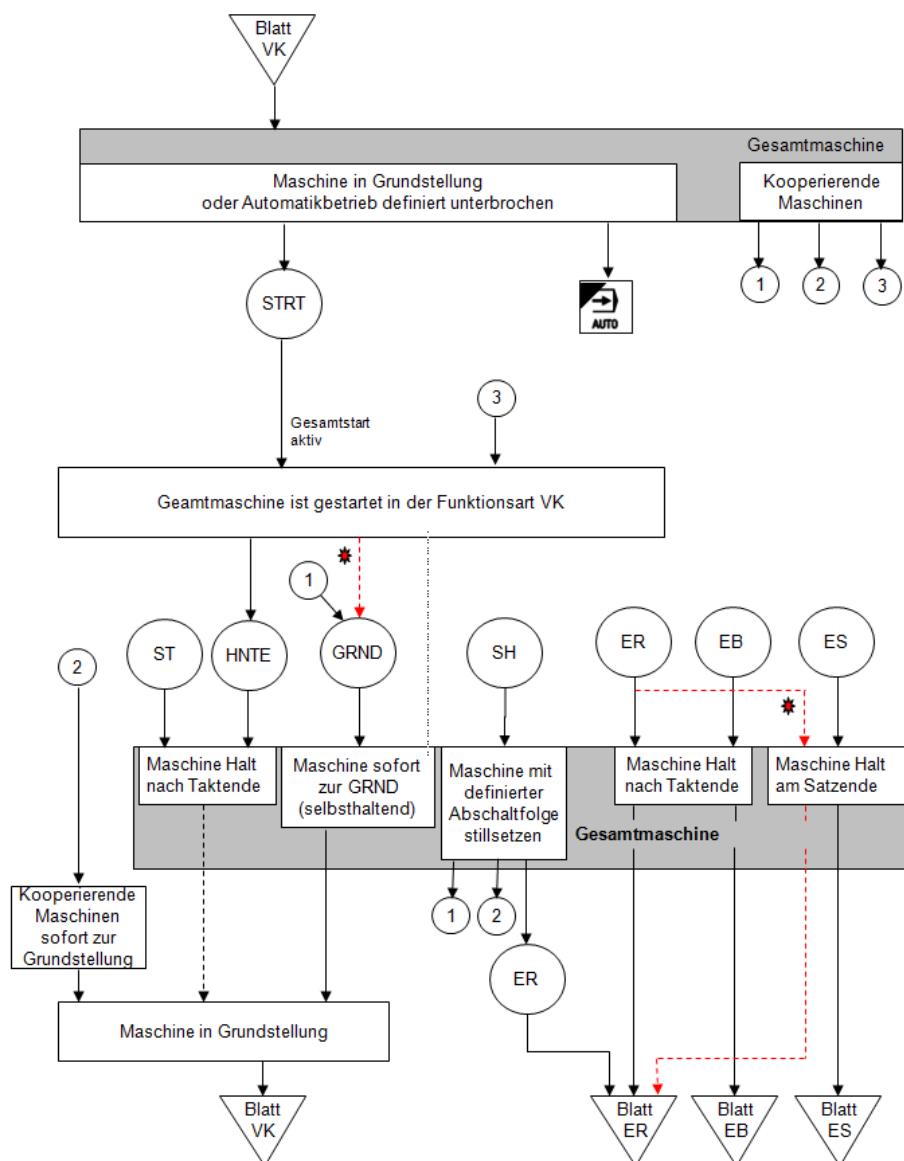
EB sheet			
Machine in basic position or automatic mode interrupted in defined way			
Single automatic run of the step sequence of the unit			
Machine stops at end of cycle	Machine immediately to basic position (self-maintaining)	Stop machine with defined shutdown sequence	Machine stops at end of record
Unit in basic position			
EB sheet			
ER sheet			
ES sheet			
VK sheet			

Effective button functions:



Maschinensteuertafel/Handbediengerät Bei aktivem Handbediengerät ist die Anwahl nur dort möglich	Machine control panel/hand control unit If hand control unit is active, selection is possible there only
Maschine ein	Machine ON
Maschine aus	Machine OFF
Grundstellung	Basic position
Start/Tippen	Start/jog
Störung quittieren	Acknowledge fault
Sofort Halt	Immediate stop
Schutztür	Safety door
Störung wird behoben	Fault being cleared

4.4.4 BA1 and VK

Operating mode diagram BA1 /VK

Legend

Blatt VK					
Maschine in Grundstellung oder Automatikbetriebs definiert unterbrochen					Gesamtmaschine Kooperierende Maschine
	Gesamtstart aktiv				
Gesamtmaschine ist gestartet in der Funktionsart VK					
	Maschine Halt nach Taktende	Maschine sofort zur GRND (selbsthaltend)	Maschine mit definierter Abschaltfolge stillsetzen	Maschine Halt nach Taktende	Maschine Halt am Satzende
			Gesamtmaschine		
Kooperierende Maschinen sofort zur Grundstellung					
	Maschine in Grundstellung				
	Blatt VK		Blatt ER	Blatt EB	Blatt ES

VK sheet					
					Overall machine
Machine in basic position or automatic mode interrupted in defined way					Cooperating machine
	Overall start active				
Overall machine started in VK function mode					
	Machine stops at end of cycle	Machine immediately to GRND (self-maintaining)	Stop machine with defined shutdown sequence	Machine stops at end of cycle	Machine stops at end of record
			Overall machine		
Cooperating machines immediately to basic position					
	Machine on default setting				
	VK sheet		ER sheet	EB sheet	ES sheet

Effective button functions:



Spindle override: 100%

Feed override: 0% and. 100%

Maschinensteuertafel/Handbediengerät Bei aktivem Handbediengerät ist die Anwahl nur dort möglich	Machine control panel/hand control unit If hand control unit is active, selection is possible there only
Maschine ein	Machine ON
Maschine aus	Machine Off
Grundstellung	Basic position
Halt nach Taktende	Stop at end of cycle
Start/Tippen	Start/jog
Sofort Halt	Immediate stop
Störung quittieren	Acknowledge fault
Schutztür	Safety door
Störung wird behoben	Fault being cleared

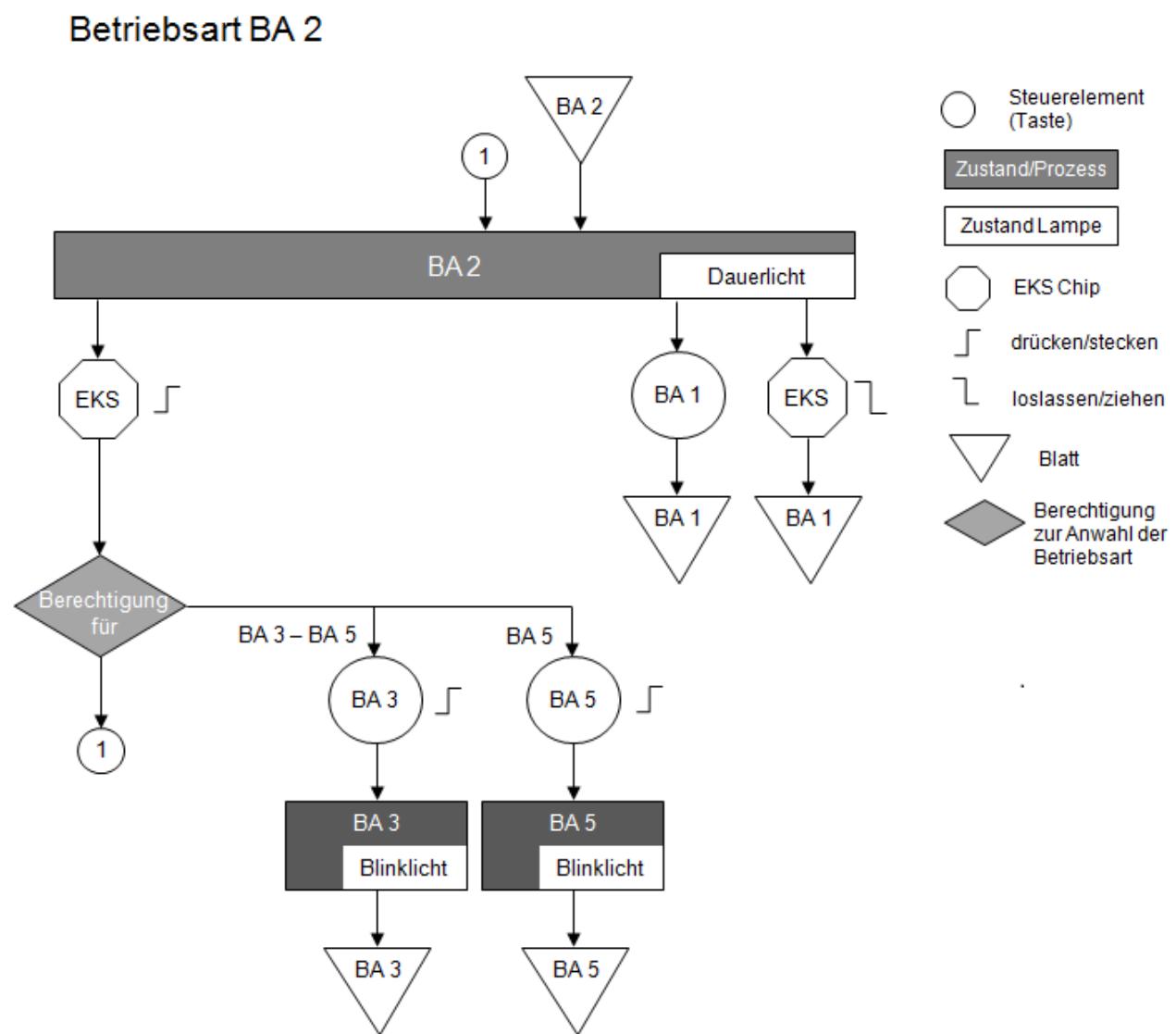
4.5 BA2 – (Setup Mode)

The specific operating requirements for MB Powertrain are to be taken from the latest Appendix 2 of the Powertrain Requirement Specifications.

The following function modes can be selected in BA2:

- Setup mode ER: see Chap. 4.5.1

Operating mode diagram BA2



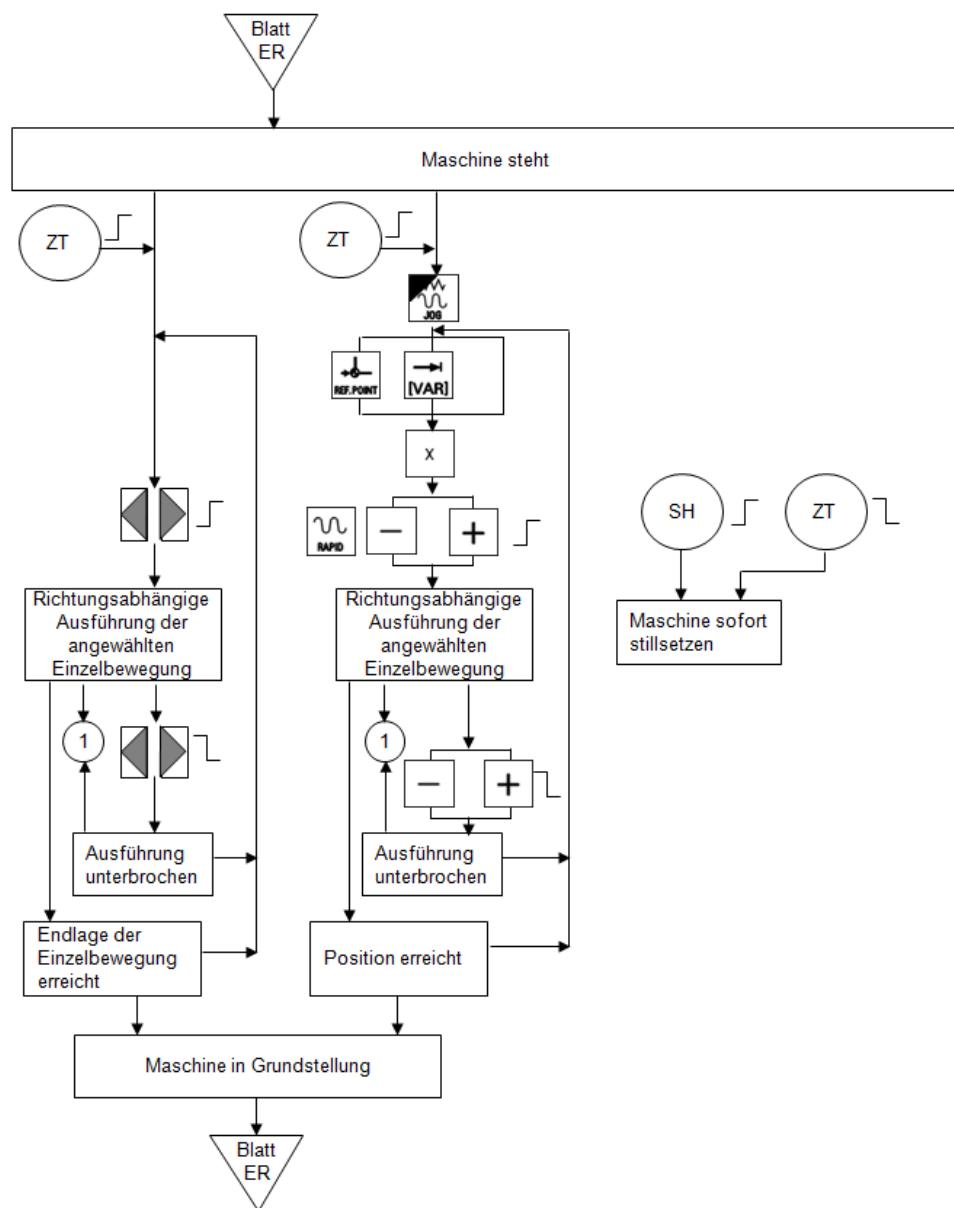
Legend

				Steuerelement (Taste)
				Zustand/Prozess
				Zustand Lampe
		Dauerlicht	EKS Chip	
			drücken/stecken	
			loslassen/ziehen	
			Blatt	
Berechtigung für				Berechtigung zur Anwahl der Be- triebsart
	Blinklicht	Blinklicht		

				Control element (button)
				State/process
				Lamp state
		Steady light	EKS chip	
			Press/insert	
			Release/pull	
			Page	
Authorization for				Authorization for selecting the operating mode
	Flashing light	Flashing light		

4.5.1 BA2 and ER

Operating mode diagram BA2/ER

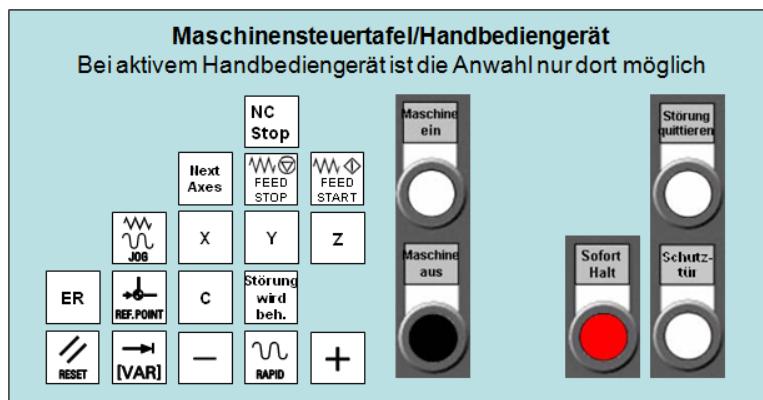


Legend

Blatt ER		
	Maschine steht	
Richtungsabhängige Ausführung der angewählten Einzelbewegung	Richtungsabhängige Ausführung der ausgeführten Einzelbewegung	Maschine sofort stillsetzen
Ausführung unterbrochen	Ausführung unterbrochen	
Endlage der Einzelbewegung erreicht	Position erreicht	
	Maschine in Grundstellung	

ER sheet		
	Machine at standstill	
Direction-dependent execution of the selected single motion	Direction-dependent execution of the executed single motion	Immediately stop machine
Execution interrupted	Execution interrupted	
Limit position of single motion reached	Position reached	
	Machine at default setting	

Effective button functions:



Maschinensteuertafel/Handbediengerät Bei aktivem Handbediengerät ist die Anwahl nur dort möglich	Machine control panel/hand control unit If hand control unit is active, selection is possible there only
Maschine ein	Machine ON
Maschine aus	Machine OFF
Sofort Halt	Immediate stop
Störung quittieren	Acknowledge fault
Schutztür	Safety door
Störung wird behoben	Fault being cleared

4.6 BA3 – (Single Step or Single Operation)

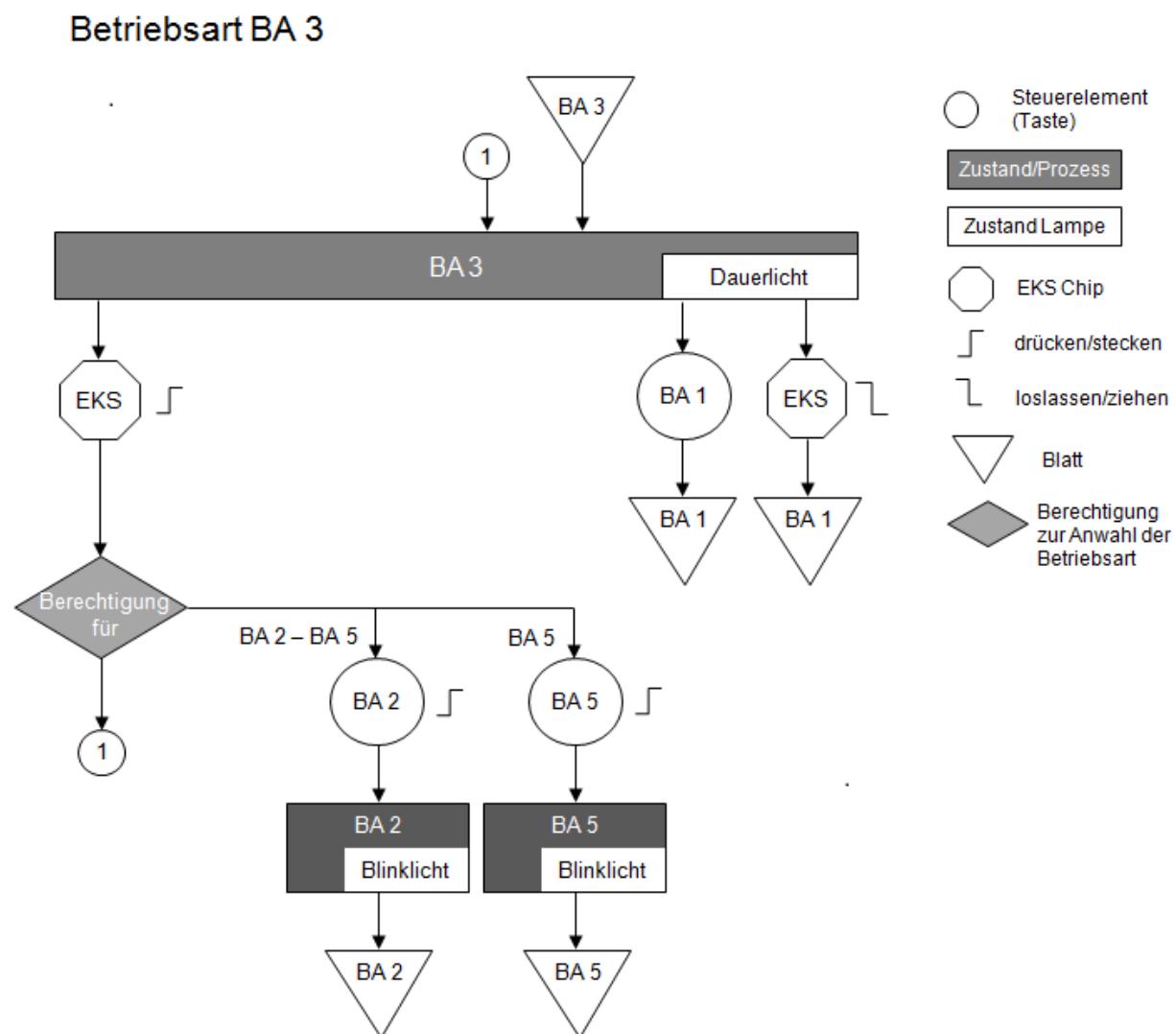
Operating Mode 3 is a manual or partially automated operating mode for process monitoring and process optimization with an open operating door.

The specific operating requirements for MB Powertrain are to be taken from the latest Appendix 2 of the Powertrain Requirement Specifications.

The following function modes can be selected in BA3:

- Single step ES, see Chap. 4.6.1
- Single operation EB, see Chap. 4.6.2

Operating mode diagram BA3



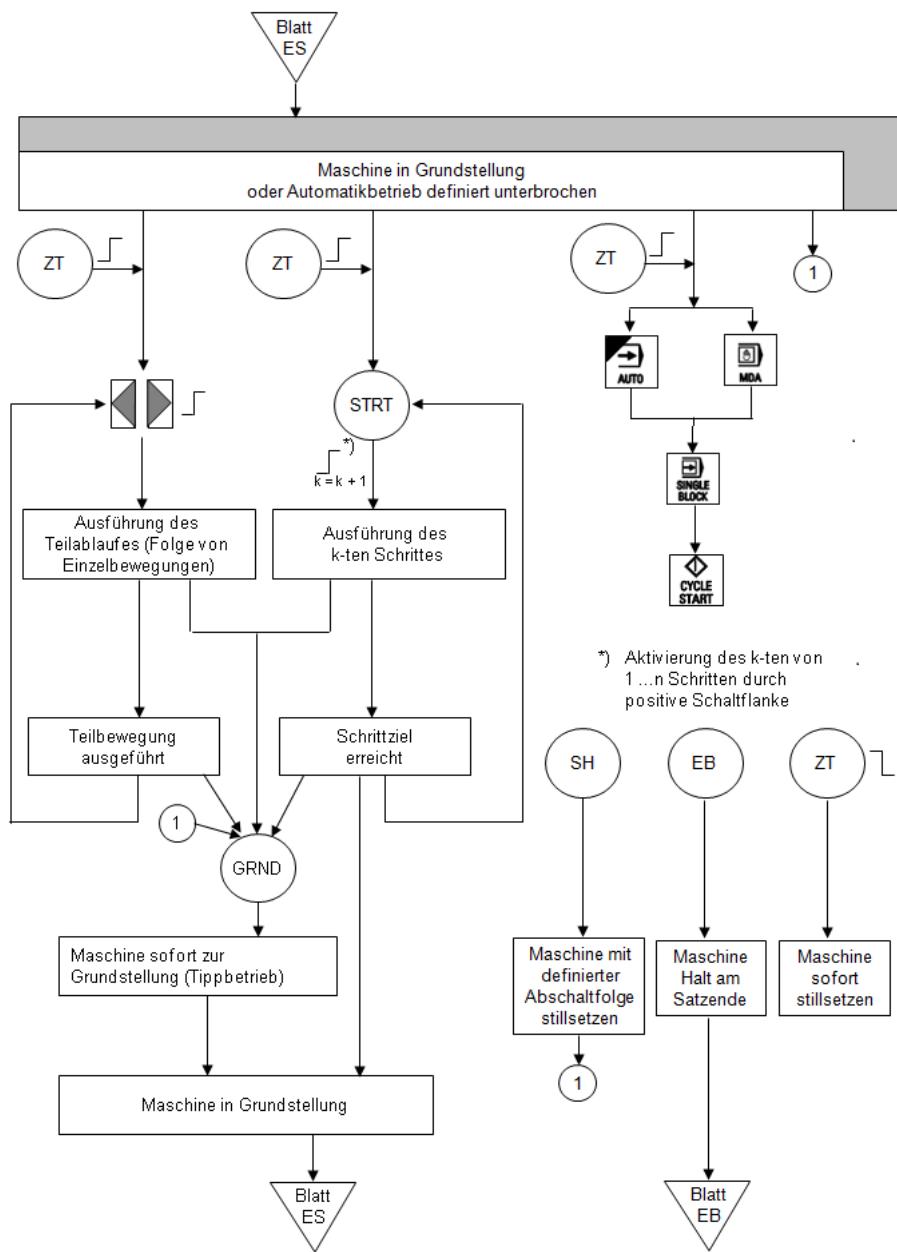
Legend

				Steuerelement (Taste)
				Zustand/Prozess
				Zustand Lampe
		Dauerlicht	EKS Chip	
			drücken/stecken	
			loslassen/ziehen	
			Blatt	
Berechtigung für				Berechtigung zur Anwahl der Be- triebsart
	Blinklicht	Blinklicht		

				Control element (button)
				State/process
				Lamp state
		Steady light	EKS chip	
			Press/insert	
			Release/pull	
			Page	
Authorization for				Authorization for selecting the operating mode
	Flashing light	Flashing light		

4.6.1 BA3 and ES

Operating mode diagram BA3/ES

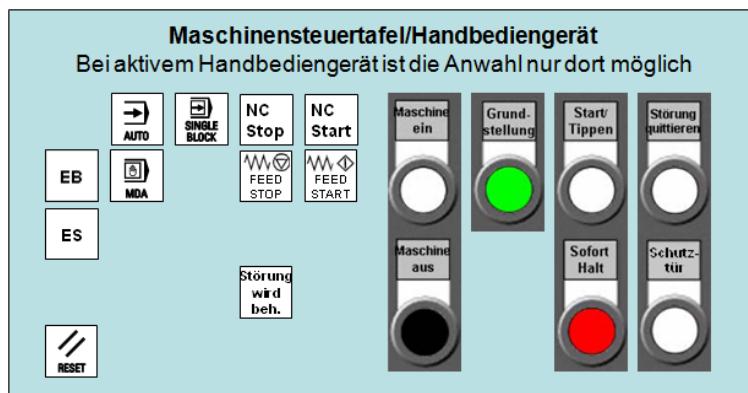


Legend

	Blatt ES			
	Maschine in Grundstellung oder Automatikbetrieb definiert unterbrochen			
Ausführung des Teilablaufes (Folge von Einzelbewegungen)	Ausführung des k-ten Schrittes			
			*) Aktivierung des k-ten von 1... Schritten durch positive Schaltflanke	
Teilbewegung ausgeführt	Schrittziel erreicht			
Maschine sofort zur Grundstellung (Tippbetrieb)		Maschine mit definierter Abschaltfolge stillsetzen	Maschine Halt am Satzende	Maschine sofort stillsetzen
Maschine in Grundstellung				
	Blatt ES		Blatt EB	

	ES sheet			
	Machine in basic position or automatic mode interrupted in defined way			
Execution of the partial sequence (sequence of single motions)	Execution of the kth step			
			*Activation of the kth of 1 ... steps by positive switching edge	
Partial motion executed	Step target reached			
Machine immediately to basic position (jogging mode)		Stop machine with defined shutdown sequence	Machine stops at end of record	Immediately stop machine
Machine on default setting				
	ES sheet		EB sheet	

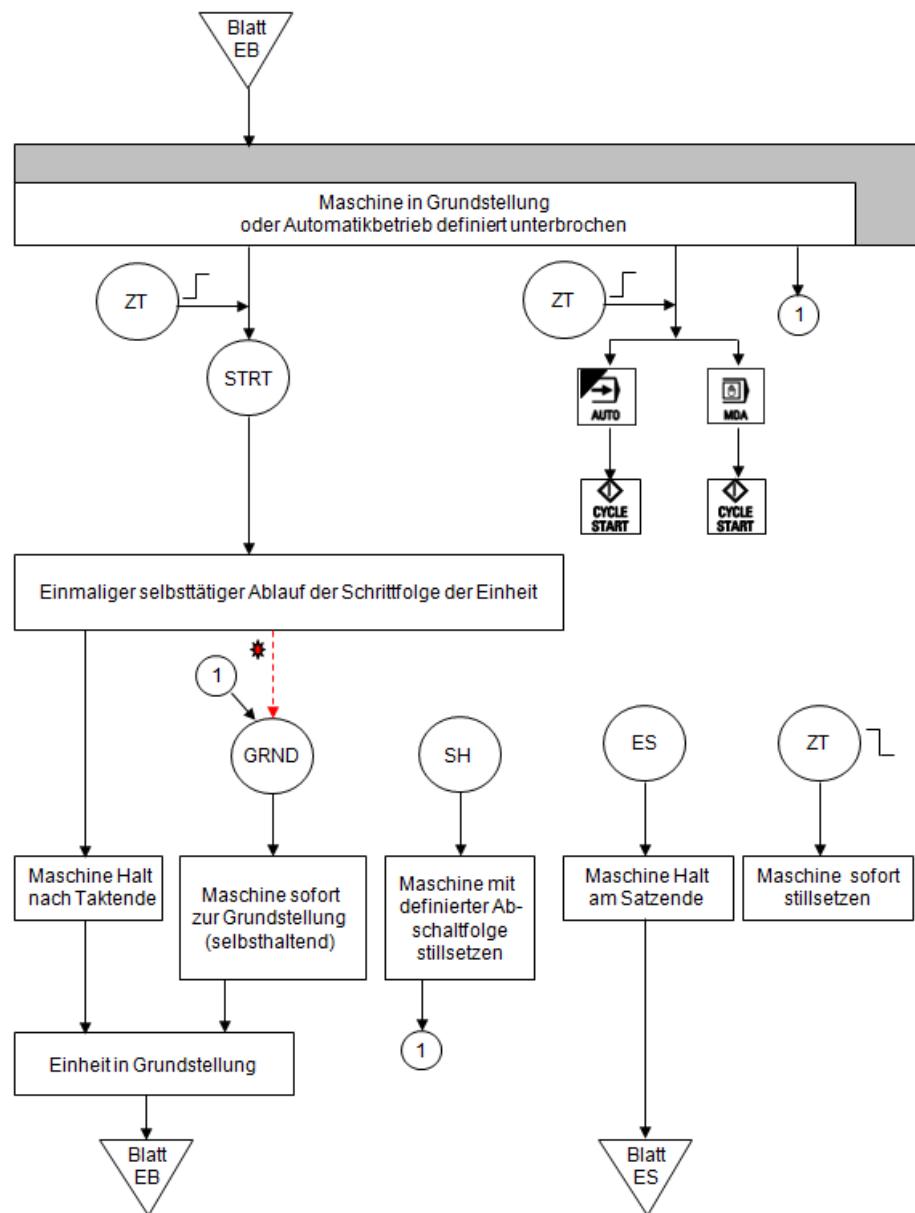
Effective button functions:



Maschinensteuertafel/Handbediengerät Bei aktivem Handbediengerät ist die Anwahl nur dort möglich	Machine control panel/hand control unit If hand control unit is active, selection is possible there only
Maschine ein	Machine ON
Maschine aus	Machine OFF
Grundstellung	Basic position
Start Tippen	Start jog
Sofort Halt	Immediate stop
Störung quittieren	Acknowledge fault
Schutztür	Safety door
Störung wird behoben	Fault being cleared

4.6.2 BA3 and EB

Operating mode diagram BA3/EB



Legend

	Blatt EB			
	Maschine in Grundstellung oder Automatikbetrieb definiert unterbrochen			
Einmaliger selbsttätiger Ablauf der Schrittfolge oder Einheit				
Maschine Halt nach Taktende	Maschine sofort zur Grundstellung (selbsthaltend)	Maschine mit definierter Abschaltfolge stillsetzen	Maschine Halt am Satzende	Maschine sofort stillsetzen
Einheit in Grundstellung				
	Blatt EB		Blatt ES	

	EB sheet			
	Machine in basic position or automatic mode interrupted in defined way			
Single automatic run of the step sequence or unit				
Machine stops at end of cycle	Machine immediately to basic position (self-maintaining)	Stop machine with defined shutdown sequence	Machine stops at end of record	Immediately stop machine
Unit in basic position				
	EB sheet		ES sheet	

Effective button functions:

Maschinensteuertafel/Handbediengerät Bei aktivem Handbediengerät ist die Anwahl nur dort möglich	Machine control panel/hand control unit If hand control unit is active, selection is possible there only
Maschine ein	Machine ON
Maschine aus	Machine OFF
Grundstellung	Basic position
Start Tippen	Start jog
Sofort Halt	Immediate stop
Störung quittieren	Acknowledge fault
Schutztür	Safety door
Störung wird behoben	Fault being cleared

4.7 BA4 – (Operation without Use of an Enabling Device)

Operating mode 4 enables a machine process without the continuous use of an enabling device. This mode is used in cases where, due to setting requirements or ergonomic reasons, a continuously operated enabling device cannot be used.

In series production, BA4 shall only be implemented in individual, separately agreed cases. The implementation must proceed according to the process steps of DIN EN 11161 (Appendix D: Intermittent observation of the automatic production process).

The following function modes can be selected in BA4:

- Single step ES
- Single operation EB

Further functions shall be created according to specific requirements.

Note: BA4 is not entered into Daimler AG's Powertrain standards.

4.8 BA5 – (Process Monitoring)

Operating Mode 5 is used for process monitoring in the case of an open operating door in connection with suitable protective measures.

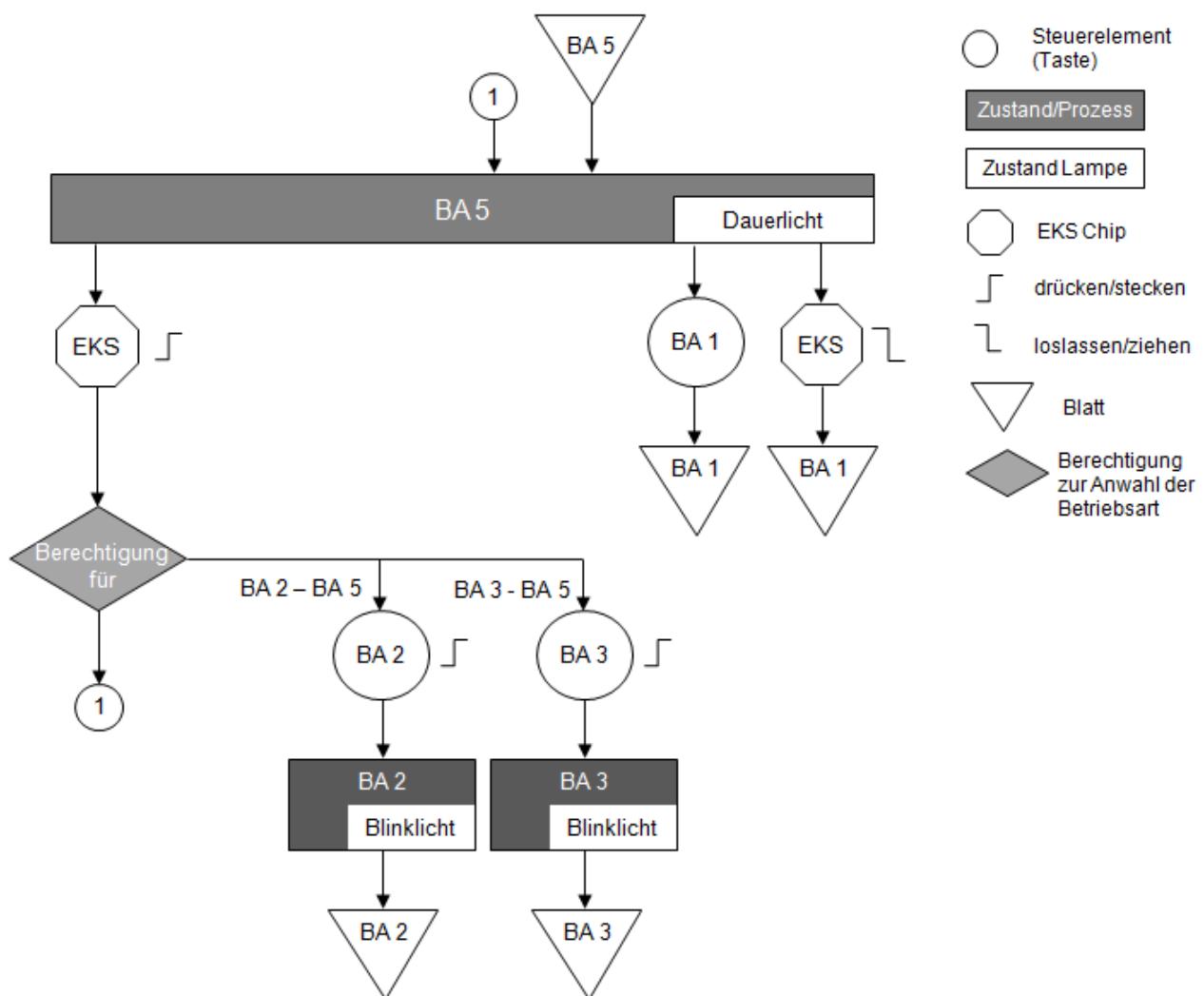
The specific operating requirements for MB Powertrain are to be taken from the latest Appendix 2 of the Powertrain Requirement Specifications.

The following function modes can be selected in BA5:

- Interlinked operation VK (automatic), see Chap. 4.8.1
- Single movement EB

Operating mode diagram BA5

Betriebsart BA 5

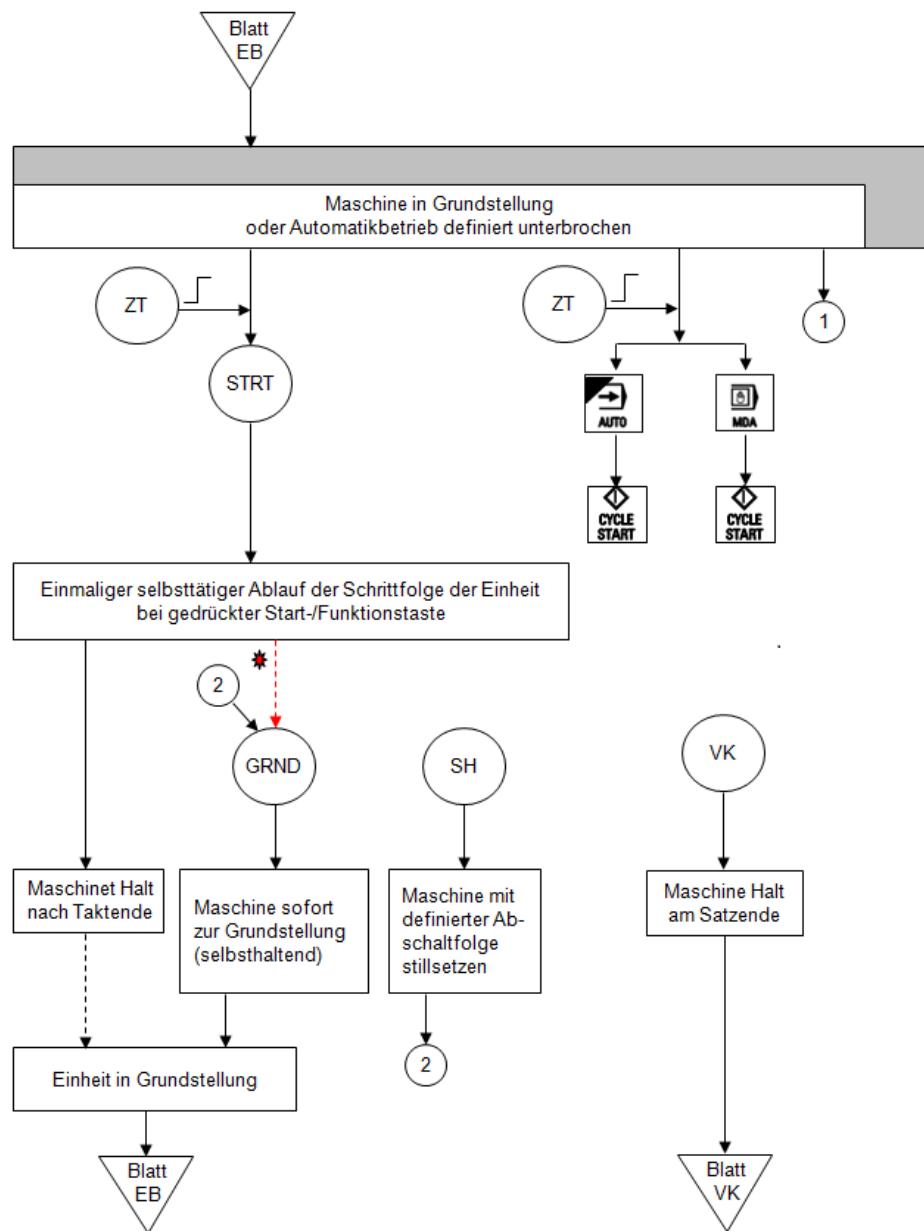


Legend

				Steuerelement (Taste)
				Zustand/Prozess
				Zustand Lampe
			Dauerlicht	EKS Chip
				drücken/stecken
				loslassen/ziehen
				Blatt
Berechtigung für				Berechtigung zur Anwahl der Be- triebsart
		Blinklicht	Blinklicht	

				Control element (button)
				State/process
				Lamp state
			Steady light	EKS chip
				Press/insert
				Release/pull
				Page
Authorization for				Authorization for selecting the operating mode
		Flashing light	Flashing light	

4.8.1 BA5 and EB

Operating mode diagram BA5/EB

Legend

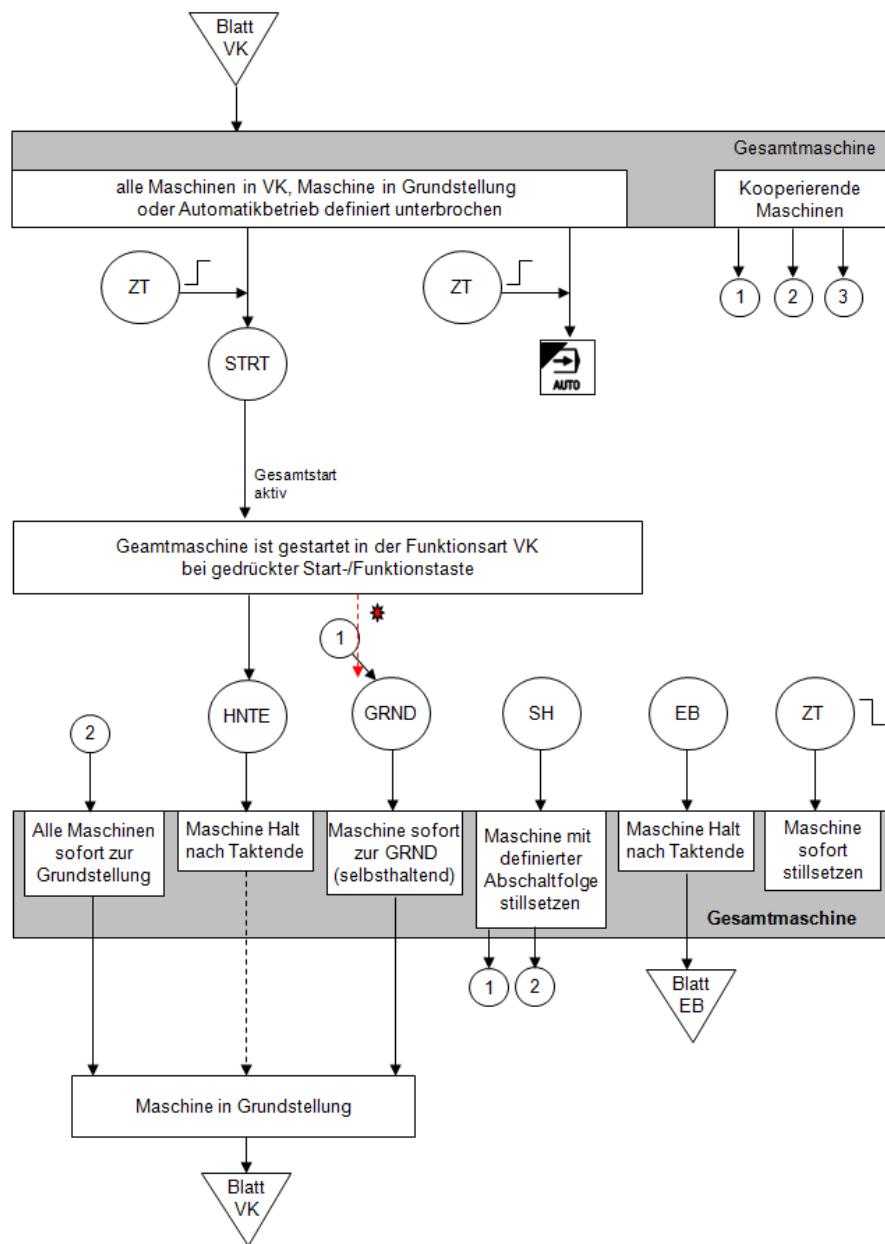
	Blatt EB		
	Maschine in Grundstellung oder Automatikbetrieb definiert unterbrochen		
Eimaliger selbsttäti-ger Ablauf der Schrittfolge der Einheit bei gedrückter Start-/Funktionstaste			
Maschine Halt nach Taktende	Maschine sofort zur Grundstellung (selbsthaltend)	Maschine mit definiert Abschaltfolge stillsetzen	Maschine Halt am Satzende
Einheit in Grundstel-lung			
	Blatt EB		Blatt VK

	EB sheet		
	Machine in basic position or automatic mode interrupted in defined way		
Single automatic run of the step sequence of the unit when start/function key pressed			
Machine stops at end of cycle	Machine immediate-ly to basic position (self-maintaining)	Stop machine with defined shutdown sequence	Machine stops at end of record
Unit in basic position			
	EB sheet		VK sheet

Effective button functions:

Maschinensteuertafel/Handbediengerät Bei aktivem Handbediengerät ist die Anwahl nur dort möglich	Machine control panel/hand control unit If hand control unit is active, selection is possible there only
Maschine ein	Machine ON
Maschine aus	Machine OFF
Grundstellung	Basic position
Start Tippen	Start jog
Sofort Halt	Immediate stop
Störung quittieren	Acknowledge fault
Schutztür	Safety door
Störung wird behoben	Fault being cleared

4.8.2 BA5 and VK

Operating mode diagram BA5/VK

Legend

	Blatt VK				
					Gesamtmaschine
Alle Maschinen in VK, Maschine in Grundstellung oder Automatikbetrieb definiert unterbrochen					Kooperierende Maschinen
	Gesamtstart aktiv				
Gesamtmaschine ist gestartet in der Funktionsart VK bei gedrückter Start-/Funktionstaste					
Alle Maschinen sofort zur Grundstellung	Maschine Halt nach Taktende	Maschine sofort zur GRND (selbsthaltend)	Maschine mit definiert Abschaltfolge stillsetzen	Maschine Halt nach Taktende	Maschine sofort stillsetzen
					Gesamtmaschine
				Blatt EB	
	Maschine in Grundstellung				
	Blatt VK				

	VK sheet				
					Overall machine
All machines in VK, machine in basic position or automatic mode interrupted in defined way					Cooperating machines
	Overall start active				
Overall machine started in VK function mode with start/function key pressed					
All machines immediately to basic position	Machine stops at end of cycle	Machine immediately to GRND (self-maintaining)	Stop machine with defined shutdown sequence	Machine stops at end of cycle	Immediately stop machine
					Overall machine
				EB sheet	
	Machine at default setting				
	VK sheet				

Effective button functions:

Maschinensteuertafel/Handbediengerät Bei aktivem Handbediengerät ist die Anwahl nur dort möglich	Machine control panel/hand control unit If hand control unit is active, selection is possible there only
Maschine ein	Machine ON
Maschine aus	Machine OFF
Grundstellung	Basic position
Halt nach Taktende	Stop at end of cycle
Start Tippen	Start jog
Sofort Halt	Immediate stop
Störung quittieren	Acknowledge fault
Schutztür	Safety door
Störung wird behoben	Fault being cleared

5 Function Modes (ER, ES, EB, VK)

The function modes are set out in line with the various operating modes (BA1-BA5).

4 function modes shall be implemented:

1. Setup mode ER
2. Single step ES
3. Single operation EB
4. Interlinked operation VK

The allocation of function modes to operating modes is explained in Chapter 4.3.

Boundary conditions

- If the hand control unit is connected and authorization is granted, then movements cannot be triggered by means of the buttons on the stationary control panel.
- The selected function mode shall be displayed on the control panel.
- The restart of a process by pressing the start button, where there is a change of function mode from ES to EB or from VK or VK to EB or ES, shall always be possible.
- Tracking of parts and monitoring shall be active in every function mode (see Requirement Specifications 3 Appendix 16).

5.1 Setup Mode ER

The operating mode diagram for setup mode is shown in Chap. 4.4.1 and Chap. 4.5.1, and corresponds to the relevant operating mode.

In setup mode, only single movements can be performed.

In setup mode, the operator can select and run all desired single movements of the machine. For every movement, manual locking functions shall be programmed in as far as it is possible, to ensure the safety of the machine and prevent possible collisions. If a movement cannot be carried out on the basis of absent locking criteria, then those criteria shall be shown in a relevant diagnosis.

Hand operation movements shall be carried out using the direct buttons on the control unit, e.g. with the "+" and "-" buttons on the external control unit. Hand operation movements shall take the form of jog mode, e.g. releasing the movement buttons brings the machine to a halt.

Start up and shut down processes shall take place independently.

It shall be communicated to the operator, by means of the control panel with the small arrows (restart diagnosis), which movements can be performed. The movement that has been activated shall be shown by the large arrows.

A movement in the "+" direction (according to DIN 66217) should always lead in the direction of the basic position. On the control panel, the right side is the "+" direction.

In every line where an end position is displayed, movement description texts shall be entered. The setup image shall mirror the automated process, but without multiple listings of movements.

All movements shall be displayed in the setup images. Restart diagnosis shall only be displayed in function mode ER.

1. ER operation for single/ assembly machines

- Preselection on BF: ER

2. ER operation for interlinked machines**▪ Transfer lines****ER operation in units**

- Preselection on BF of head control system: Any/VK
- Preselection on BF of machining unit: ER

ER operation in the assembly head control

- Preselection on BF of head control system: ER
- Preselection on BF of machining unit: Any/VK

▪ Flexible processing line**ER operation in processing machines**

- Preselection on BF of linkage: Any/VK
- Preselection on BF of machining tool: ER

ER operation in the machine linkage

- Preselection on BF of linkage: ER
- Preselection on BF of machining tools: Any/VK

5.1.1 Activating Single Movements without Locking Mechanisms

In setup mode, all locking mechanisms that are programmed into actions as movement locks can be bypassed by selecting the function "setup without locks". This function mode is intended solely for maintenance purposes and may only be selected with the red EKS key.

The selection of this function shall be performed by pulling the red EKS key with a concurrent change of the function mode.

5.2 Single Step ES

The operating mode diagram for single step is shown in Chap. 4.4.2 and Chap. 4.6.1, and corresponds to the relevant operating mode (1-5).

In single step mode, the machine/ unit is run in stages. By pressing the "Start" button on the control panel, the respective subsequent movement is activated. A new movement is performed when the button is pressed another time.

If several single movements are combined into a series of movements, this partial machine process shall be selected via the setup image and started using the direct buttons on the control panel.

The locking of the movement processes is performed in the same way as in the function mode of the interlinked operating mode VK.

If jog mode operation cannot be used for partial functions, then several consecutive processing steps can be combined.

1. ES operation for single-/ assembly machines

- Preselection on BF: ES

2. ES operation with interlinked machines

▪ Transfer lines

ES operation in machine units

- Preselection on BF of head control system: Any/VK
- Preselection on BF of machining unit: ES

ES operation in the assembly head control

- Preselection on BF of head control system: ES
- Preselection on BF of machining unit: Any/VK

▪ Flexible processing line

ES operation in processing machines

- Preselection on BF of linkage: Any/VK
- Preselection on BF of machining tool: ES

ES operation in the machine linkage

- Preselection on BF of linkage: ES
- Preselection on BF of machining tools: Any/VK

5.3 Single Operation EB

The operating mode diagram for single operation is shown in Chap. 4.4.3 and Chap. 4.6.2, and corresponds to the relevant operating mode.

- A complete working cycle is triggered with the "Start" button.
- If several single movements are combined into a series of movements, this partial machine process shall be selected via the setup image and started using the direct buttons on the control panel.
- The transport of workpieces cannot take place.
- At the end of the working cycle the machine returns to the default setting.
- The monitoring of the movement processes is performed in the same way as in the function mode of the interlinked operating mode VK.

1. EB operation for single/ assembly machines

- Preselection on BF: EB

2. EB operation for interlinked machines

▪ Transfer lines

EB operation in units

- Preselection on BF of head control system: Any/VK
- Preselection on BF of machining unit: EB

EB operation in the assembly head control

- Preselection on BF of head control system: EB
- Preselection on BF of machining unit: Any/VK

▪ Flexible processing line

EB operation in the processing machines

- Preselection on BF of linkage: Any/VK
- Preselection on BF of machining tool: EB

EB operation in the machine linkage

- Preselection on BF of linkage: EB
- Preselection on BF of machining tools: Any/VK

5.4 Interlinked Operation (VK) (Automatic)

The operating mode diagram for interlinked operation is shown in Chap. 4.4.4 and Chap. 4.8.1, and corresponds to the relevant operating mode.

- Interlinked operation (automatic) is the function mode for series production
- Series production is initiated with the "Start" button

1. VK operation for single/ assembly machines

- Preselection on BF: VK

2. VK operation for cooperating machines

- All cooperating machines in VK

3. VK operation for cooperating machines

- Transfer lines

VK operation in machine units

- Preselection on BF of head control system: VK
- Preselection on BF of machining unit: VK

VK in the assembly head control

- Preselection on BF of head control system: VK
- Preselection on BF of machining unit: VK

- Flexible processing line

VK operation in processing machines

- Preselection on BF of linkage: VK
- Preselection on BF of machining tool: VK

VK operation in the machine linkage

- Preselection on BF of linkage: VK
- Preselection on BF of machining tool: VK

6 Function

6.1 Machine/Unit On

Generally applicable guidelines

This function contains all functions that are necessary for starting up the machine.

Touchshift function

Department	Effect
Machine	The relevant machine is switched on
Cooperating Machines	-
Entire machine: entire machine touchshift function	Activation of all machines (in VK) of the entire machine.
Entire machine: single machine touchshift function	Activation of the relevant machine.

Display function

Department	Steady light	Flashing display
Machine	Start up complete	Start up in progress
Cooperating Machines	-	-
Entire machine: entire machine touchshift function	Start up of all machines (in VK) completed	Start up of all machines (in VK) active
Entire machine: single machine touchshift function	Start up of single machine completed	Start up of single machine in progress

6.2 Machine/Unit Off

Generally applicable guidelines

The function automatically starts "Stop at end of cycle" in VK.

In a reverse process to machine start up, by pressing the "Machine off" button, the machine is switched off at the end of the cycle.

Touchshift function

Department	Effect
Machine	The relevant machine is switched off
Cooperating Machines	-
Entire machine: entire machine touchshift function	Deactivation of all machines (in VK) of the entire machine.
Entire machine: single machine touchshift function	Deactivation of the relevant machine.

Display function

Department	Steady light	Flashing display
Machine	Not available	Not available
Cooperating Machines	Not available	Not available
Entire machine: entire machine touchshift function	Not available	Not available
Entire machine: single machine touchshift function	Not available	Not available

6.3 Default Setting

Generally applicable guidelines

- The operation mode of the "default setting" function is shown in the operating mode diagrams (Chapter 5).
- It shall be possible to start up every device used for transport (portals, lifting systems, transfers etc.) in every defined position.
- It shall be possible to switch the machine to the default setting from every position. If, in exceptional circumstances, it is not possible to switch the machine to the default setting, then the necessary actions shall be displayed by means of operational prompts.

Touchshift function

Department	Effect
Machine	The relevant machine returns to the default setting
Cooperating Machines	The machines in VK return to the default setting
Entire machine: entire machine touchshift function	All machines in VK that are not in operation, return to the default setting.
Entire machine: single machine touchshift function	The relevant machine returns to the default setting

Display function

Department	Steady light	Flashing display
Machine	Machine is on default setting	Machine returns to default setting
Cooperating Machines	Machine is on default setting	Machine returns to default setting
Entire machine: entire machine touchshift function	Machines in VK are on default setting	Machines in VK return to default setting
Entire machine: single machine touchshift function	Machine is on default setting	Machine returns to default setting

If a tool change position is possible:

If an operating machine is on the default setting and the button "Default setting" is pressed, the machine returns to the tool change position (if available). This function can also be performed by means of a separate button.

In the tool change position the default setting lamp goes out.

6.4 Start/Jog

Start up can only be initiated once the start up requirements for the relevant function mode are fulfilled and the machine

- is on the default setting and/or
- in a defined position

Generally applicable guidelines

- The operating mode of the "Start/Jog" function is shown in the operating mode diagrams (Chapter 5).
- It is effective in function modes VK, EB, and ES, if all start up conditions are fulfilled.
- A restart of the entire facility shall be possible via the units of the transfer lines.

Touchshift function

Department	Effect
Machine	The relevant machine is started
Cooperating Machines	-
Entire machine: entire machine touchshift function	All machines in VK are started
Entire machine: single machine touchshift function	The relevant machine is started

Display function

Department	Steady light	Flashing display
Machine	Machine start in progress	Start up is initiated, but not yet active
Cooperating Machines	-	-
Entire machine: entire machine touchshift function	Machines in VK start up active	Start up is initiated, but not yet active
Entire machine: single machine touchshift function	Machine start in progress	Start up is initiated, but not yet active

6.5 Acknowledge Fault

Touchshift function

Department	Effect
Machine	All machine faults are acknowledged
Cooperating Machines	-
Entire machine: entire machine touchshift function	-
Entire machine: single machine touchshift function	All single machine faults are acknowledged

Display function

Department	Steady light	Flashing display
Machine	-	Machine defective
Cooperating Machines	-	-
Entire machine: entire machine touchshift function	-	-
Entire machine: single machine touchshift function	-	Single machine defective

Note

A central log and display of faults shall be established specifically for each project.

6.6 Stop at End of Cycle

Generally applicable guidelines

The machine finishes performing its processing procedures and remains on the Default Setting. When the "stop at end of cycle" stage is reached the "start initiated" message shall disappear.

Touchshift function

Department	Effect
Machine	"Stop at end of cycle" is initiated on the relevant machine.
Cooperating Machines	-
Entire machine: entire machine touchshift function	"Stop at end of cycle" is initiated on all machines in VK.
Entire machine: single machine touchshift function	"Stop at end of cycle" is initiated on the relevant machine.

Display function

Department	Steady light	Flashing display
Machine	by phone	initiated
Cooperating Machines	-	-
Entire machine: entire machine touchshift function	by phone	initiated
Entire machine: single machine touchshift function	by phone	initiated

6.7 Immediate Stop

Generally applicable guidelines

- The operation mode of the "immediate stop" function is shown in the operating mode diagrams (Chapter 5).
- "Immediate stop" brings the machine to the fastest possible halt with a predefined shut off sequence, without causing damage to the tool or work piece.
- The "immediate stop" shall involve a save and reset of the machine.

Touchshift function

Department	Effect
Machine	"Immediate stop" is initiated on the relevant machine.
Cooperating Machines	The "immediate stop" is initiated on cooperating machines in VK.
Entire machine: entire machine touchshift function	-
Entire machine: single machine touchshift function	"Immediate stop" is initiated on the relevant machine.

Display function

Department	Steady light	Flashing display
Machine	by phone	initiated
Cooperating Machines	by phone	initiated
Entire machine: entire machine touchshift function	-	-
Entire machine: single machine touchshift function	by phone	initiated

6.8 Override Hand Control Unit

Generally applicable guidelines

- By pressing the button (if available) the blind plug can be removed and the external control panel can be connected without disrupting the emergency stop circuit.
- The duration of button operation shall be monitored closely so as to prevent possible continuous operation.

6.9 Lock/Unlock the Safety Door

Generally applicable guidelines

- The button shall function in all operating/ function modes.
- The button shall only work in connection with the next accessible safety door.
- For every further safety door the locking/ unlocking mechanism shall be implemented directly on the safety doors.
- When all requirements for the safe opening of the safety door have been fulfilled, the door is then unlocked.
- In the case of a closed safety door, pressing the button a further time locks the door.
- The unlocking of several safety doors by means of other controllers is not permissible.
- Pressing the button activates a "stop at end of cycle" command.

Touchshift function

Department	Effect
Machine	"A lock/ unlock" request is activated on the relevant machine.
Cooperating Machines	-
Entire machine: entire machine touchshift function	-
Entire machine: single machine touchshift function	"A lock/ unlock" request is activated on the relevant machine.

Display function

Department	Steady light	Flashing display
Machine	unlocked	requested
Cooperating Machines	-	-
Entire machine: entire machine touchshift function	-	-
Entire machine: single machine touchshift function	unlocked	requested

6.10 Fault Being Cleared

See ITP Interface Catalog

7 Special Features

7.1 Further Use after an Interruption in Processes

- After an interruption in processes that does not involve the removal of parts or manual intervention, it shall be possible to recommence the process at the same termination point in a process-consistent manner.
- After manual intervention (resetting the system to setup mode) the system may only be restarted from the default setting.

7.2 Resetting the Active Start

A reset of the active start shall be initiated by:

- a change in operating mode
- immediate stop
- the "default setting" function
- a machine fault
- a break in the safety circuit (emergency stop, safety door open, ...)
- stop at end of cycle

7.3 Remote Operation and Sleep Mode

Remote operation and sleep mode are only permitted in operating mode BA1 and function mode VK. For details see Requirement Specifications Part 3.

8 Appendix

8.1 Control Panels

Relevant control panels and order numbers are pictured and described in the relevant project records (differential description) of the involved product partners.

8.2 EKS Protection Levels

Details of the corresponding current EKS protection levels are to be found in Appendix 2b of the Powertrain Requirement Specifications.



Mercedes-Benz

Lastenheft PPA, Teil III, Anlage 2
Spezifikation Electronic-Key-System EKS der Fa. Euchner
Stand: 28.06.2010

Betriebsart / Maschinenfunktion / EKS-Schlüssel(-farbe) / Schutzstufe

Achtung - hier ist die Standardzuordnung dargestellt!

Betriebsart	Benennung	Funktionsart	Schlüssel(-farbe)				Wer ?	Schutzstufe						
			ws	gr	sw	rt		1	2	3	4	5	6	7
1	Automatikbetrieb („alle Bewegungen ausschl. wenn Schutzeinrichtungen in Schutzstellung“)	VK, EB, ES, ER		gr	sw	rt	bl	Bediener (ws)						
2	Einrichtbetrieb („Maschine läuft bei aufgehobener Schutzwirkung...“)	ER		gr	sw	rt	bl	Bediener mit Befähigung zum Einrichten					6	7
3	Manueller oder teilautomatischer Betrieb bei offener Bedientür	EB, ES			sw	rt	bl	Systemführer			4	5	6	7
5	Automatikbetrieb bei offener Bedientür in Verbindung mit geeigneten Schutzmaßnahmen	VK, EB				rt	bl	Instandhaltung (rt) Fremdfirma (bl)	1	2	3	4	5	6

• Die Zuordnung Schlüsselfarbe zu Schutzstufe ist im LH vorgegeben
 • Die Zuordnung der zul. Betriebsarten zur Schlüsselfarbe erfolgt beim Beschreiben der Schlüssel (Standardzuordnung siehe oben)

Berger/Hofacker - Spezifikation Electronic Key System (EKS) Stand: 28.06.2010

Folie 11

PA Requirement Specifications, Part III, Appendix 2
Specification of Electronic Key System (EKS) from Eucher
Last revised: 28.06.2010

Operating mode / machine function / EKS key (color) / protection level

Attention – default assignment shown here!

Operating mode	Designation	Function mode	Key (color)	Who?	Protection Level
1	Automatic Mode ("shut off all motions when safety system is in safety position")	VK, EB, ES, ER	wht, grn, blk, red, blu	Operator (wht)	7
2	Setup mode ("machine operates when protective function is suspended...")	ER	grn, blk, red, blu	Operator with setup authorization	6, 7
3	Manual or partly automatic operation with an open operating door	EB, ES	blk, red, blu	System operators	4, 5, 6, 7
4	Automatic mode with open operating door in connection with suitable protective measures	VK, EB	red, blu	Maintenance (red) Contractor (blu)	1, 2, 3, 4, 5, 6, 7

* The assignment of key colors to protection levels is stated in the requirement specifications

* The permissible operating modes are assigned to the key color in the description of the keys (default assignment, see above)



Powertrain Requirements Specification, Appendix 33

IT Settings in Gaggenau on Production Systems

06.03.2019

Information required for a damage code VPN remote diagnosis request

Company:

Last name (service manager):

Street:

ZIP/city:

Email:

Contact person for remote diagnosis

Name:

Telephone number:

Office hours:

Software used + ports required:

Standard of Daimler Gaggenau: UltraVNC, port: 5900

Remote diagnosis settings for Siemens 840D control systems

HMI remote diagnosis screen (RCS)

Rights for remote access: **Permit remote control**, duration for confirmation dialog display: **3 s**; remote access is then automatically: **Permitted**

General network settings

IP address: **192.168.10.xx**

Subnet mask: **255.255.255.0**

Standard gateway: **192.168.10.1**

Preferred DNS server: **192.168.10.1**

DNS suffix: **degag.corpintra.net**

Windows system/system control

Computer name: J + Daimler inventory number e.g. **J817999**



Prisma settings for Siemens 840D control systems

Station designation: [M](#)
Control panel type: [HBF](#)
System number: Inventory number e.g. [817999](#)
Abbreviated designation: Inventory number e.g. [817999](#)
Machining type: Select, e.g. [milling](#)
Server IP address: prisma.degag.corpintra.net

Step7 installation for Siemens 840D control systems

Store current S7 project on the hard drive and carry out final settings in the Step7 software.

HMI Pro CS installation for Siemens 840D control systems

Store current HMI project on the hard drive.

IP addresses of the components within or behind the Daimler firewall

192.168.10.1	Gateway, DNS server, DHCP server, firewall
192.168.10.2	Up to 192.168.10.9/reserved for maintenance
192.168.10.10	PC 1, or main control console
192.168.10.11	Up to 192.168.10.19 / PC 2 to PC 10
192.168.10.20	Measuring computer
192.168.10.95	Prisma PLC interface 5
192.168.10.96	Prisma PLC interface 4
192.168.10.97	Prisma PLC interface 3
192.168.10.98	Prisma PLC interface 2
192.168.10.99	Prisma PLC interface 1
192.168.10.100	Up to 192.168.10.103 / DHCP automatic assignment, do not use
192.168.10.180	Up to 192.168.10.199/reserved for bus monitoring
192.168.10.210	Up to 192.168.10.219/reserved for CM
192.168.10.230	Up to 192.168.10.239 / switch
192.168.10.240	Up to 192.168.10.249 / energy measurement, do not use
192.168.10.250	Data logger / EDGE

Only subscribers of address range 192.168.10.xx shall generally be connected to the firewall.

- PCU50 / IPC427 / IPC 477 → Company network connection (Eth1)
- Service Ethernet socket
- NCU (optional) → Company network connection (X130)

Examples can be found in the project book chapter on "Siemens Differential Description for Gaggenau".

Firewall reference

VOQUZ Secure IT Systems AG
Reichenbachstrasse 2
D-85737 Ismaning bei München

Firewall model: CPAP-SG1200R-NGFW-KONF.

MDM-ID: 14891-V0.19

DAIMLER

WVS-Operate

Part III, Appendix 35

Version 1.2

Version	1.2	Number of Pages:	14
Last revised	09.02.2016		
File / template:	Appendix 35 - Tool Administration System (WVS) on Sinumerik Operate [en].docx / Normal.dotm		

DAIMLER

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1. WVS-Operate

Tool administration and service life monitoring on HMI Operate control panels.

Introduction

WVS-Operate (tool administration system) is the standard tool administration system for all manufacturing machines within MB Powertrain. The MTM-WVS manages the number of tool applications for each tool and generates tool change recommendations. Completed tool changes are documented and transferred to the superior PRISMA control system. Evaluations can be created directly in MTM-WVS or in the Prisma control system. The trigger for the WVS is the total machine counter. The tool counters in the WVS are incremented with each finished part message. On reaching a) the nominal number of tool applications (specified from the MTM), the WVS sets bit 0.2 in DB 555. If the alert limit is reached, bit 0.1 is set in DB 555 instead (also see Section "Machine Response").

1.1 General

1.1.1 HMI Version

The new WVS module from Siemens is available as of HMI version V4.5.2.3.

Version V4.5.2.1 can be upgraded to V4.5.3.x; the following effort shall be taken into consideration in this case:

- With a pure PLC control system, Operate and the HMI Pro sl (on PCU50) shall be upgraded. Approx. 4h are required for this (with data backup).
- With an NC, the Operate version of the NC shall additionally be upgraded, taking additional time depending on system (estimated effort approx. 1 day).

1.1.2 Prisma Connection

The WVS cannot be operated on machines without Prisma connection. The WVS uses the standard interfaces between the control panel and Prisma.

1.1.3 MTM Interface

Tool data administration for all machines is undertaken in the MTM system. The tool data are loaded onto the control panel via an XML interface. So that the WVS system functions trouble-free, the following central information shall be harmonized and documented in the MTM-WVS prior to commissioning:

- Workpiece numbers/program numbers (from the type preselection) or "Units per cycle" shall be entered in the "Workpiece configuration" screen.
- Units, spindles and tools shall be created in MTM-TPO.
- The responsibility matrix shall be taken from the Daimler AG Requirement Specifications IV Production Equipment Documentation.

1.1.4 DNS Server Configuration

The DNS server shall be configured on the control panel. Please contact the responsible Maintenance colleagues as part of machine installation. Request these via Planning if necessary.

1.1.5 Standard Tool Administration

External tool administration systems for service life controlling shall be deactivated. This applies to SIN-TDI but not the basic/standard administration system. Background: The WVS does not activate/block tools in standard administration (except in the case of sibling tools).

1.1.6 Machine Response

Starting point: On reaching the nominal number of tool applications, the WVS sets bit 0.2 and bit 0.1 on reaching the alert limit in DB 555. The following machine responses shall be programmed by the machine supplier:

- Case 1:

If bit 0.1 is set in DB 555, the yellow bulb (on the machine) should flash and the alarm text 7000XX "WVS: Alert limit reached" should be output.

- Case 2:

If bit 0.2 is set in DB 555, the machine shall switch to "Stop at cycle end" and the alarm text 7000XX "WVS: End of tool life" shall be output.

1.1.7 Subsequent Actions Depending on the Events "Tool Change" and "Number of Tool Applications Reached"

Depending on the events "Tool change" or "Number of tool applications reached", the control panel shall always offer the option of initiating subsequent actions. Pattern: On changing Tool 1, the next workpiece should be outfed for a quality check. Requirement: Either the control panel configuration/the machine control system always offers the option of configuring such events, e.g. outfeed on reaching the nominal number of tool applications or the following WVS options "PLC ID" shall exist as before: A PLC ID (a unique number for the tool) can be assigned to each tool in the WVS configuration in the MTM. On reaching the nominal number of tool applications or in the event of a tool change, this number can then be entered into a data word in data module 555 in WVS-Operate (see Section 1.3). A machine response to this entry can be programmed, e.g. the next component is outfed for quality control. Note: After reading (after the action), the tool numbers shall then be deleted from the DBW again by the PLC.

As many data words as there are tools shall be stored in DB 555: Example: 5 data words shall be created here: The first data word contains the number of tools which have a) expired / b) been changed. The 4 following data words contain the relevant numbers/PLC/IDs. The tools with the numbers 1, 2, 16 and 23 have been changed or their nominal number of tool applications reached.

WORD 1	WORD 2	WORD 3	WORD 4	WORD 5
Anzahl	Wkzg. Nr.	Wkzg. Nr.	Wkzg. Nr.	Wkzg. Nr.
4	1	2	16	23

Figure 1: PLC ID sample

1.2 Installation Instructions

1.2.1 Manual Control Panel Updating & Installation of WVS-Operate – if no Project DVD is Available

. As on 01/2016, there are no project DVDs for updating to a software release with WVS for any software releases using a project DVD [older than V8x.xx.xx. Manual updating of the control panel software shall be performed](#). A corresponding time slot shall be scheduled for this.

The software package necessary for this contains HMI-PRO-sl runtime V4.5.2.5 and the programming tool HMI-PRO-CS V07.03.00.30.

Procedure

- Preparations (on a programming computer, e.g. PG)
 - Install HMI-PRO-sl runtime V4.5.2.5 and the programming tool HMI-PRO-CS V07.03.00.30 on the programming computer
 - Update the machine's HMI text project to this HMI-PRO-sl runtime V4.5.2.5 (by means of HMI-PRO-CS tool using the function "...Update project")
 - Read the current Step7 hardware config into the updated HMI text project, then generate the diagnostic data anew – current S7 project shall be available
- On the machine to be updated
 - Create a hard disk image of the PCU50 as a backup before performing the update
 - Compare Step7 project online/offline

- Updating the HMI-PRO-sl runtime on the PCU: With the programming computer, use the HMI-PRO-CS tool to execute the function "Install system"; to do this, select the correct HMI-PRO-sl runtime V4.5.2.5 from the programming computer's installation directory and use the button "Update" to start transfer to the PCU50.
- Start HMI-Operate on the PCU50 (to start runtime installation)
- Then transfer the HMI text project updated on the programming computer to the PCU
- Start HMI-Operate on the PCU50 (to start text project installation)
- This status guarantees the prerequisites for being able to program the WVS on the PCU50.
- Programming (HMI-PRO text project and Step7) shall then be performed as per the following description.

1.2.2 Adding the HMI-Pro Additional Screen and then Configuring it.

Make the WVS screen known in the HMI PRO project:

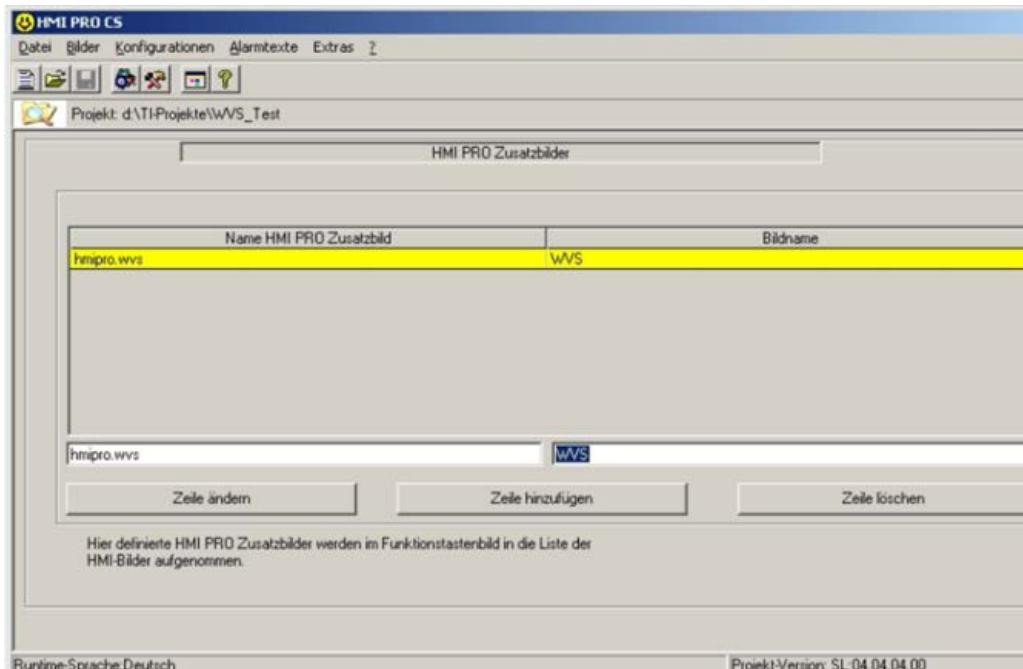


Figure 2: HMI PRO CS

Insert the WVS screen and protection level configuration:

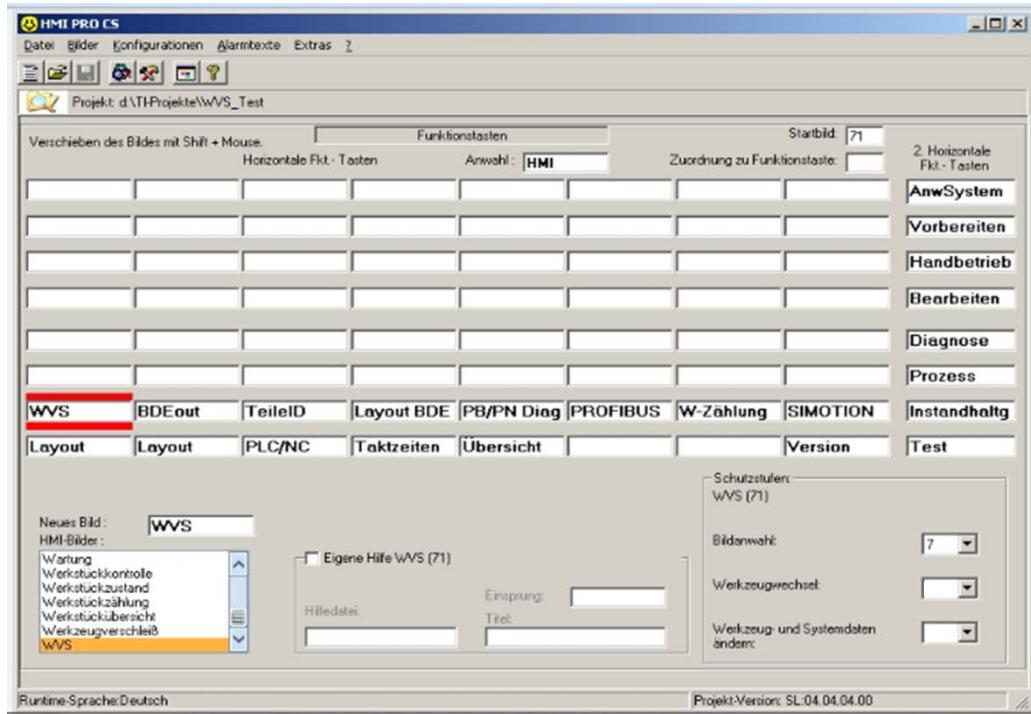


Figure 3: Insert WVS screen

- The protection level "Change settings" shall be set to 4.
- Level 7 shall be set for "Screen selection" and "Tool change".



Figure 4: Protection configuration 2

1.3 WVS-Operate Configuration

In the WVS configuration (HMI-Pro CS):

- The equipment number, 910100004711 in this case, shall be checked and entered in accordance with the standard if necessary
- The following options shall be set in the PLC interface configuration:
 - Collective bit alert limit reached, standard: DB 555 bit 0.1
 - Collective bit service life expired, standard: DB 555 bit 0.2
 - Service life monitoring using PLC ID, standard: DB 555 start byte 200
 - Change information using PLC ID, DB 555, start byte 10

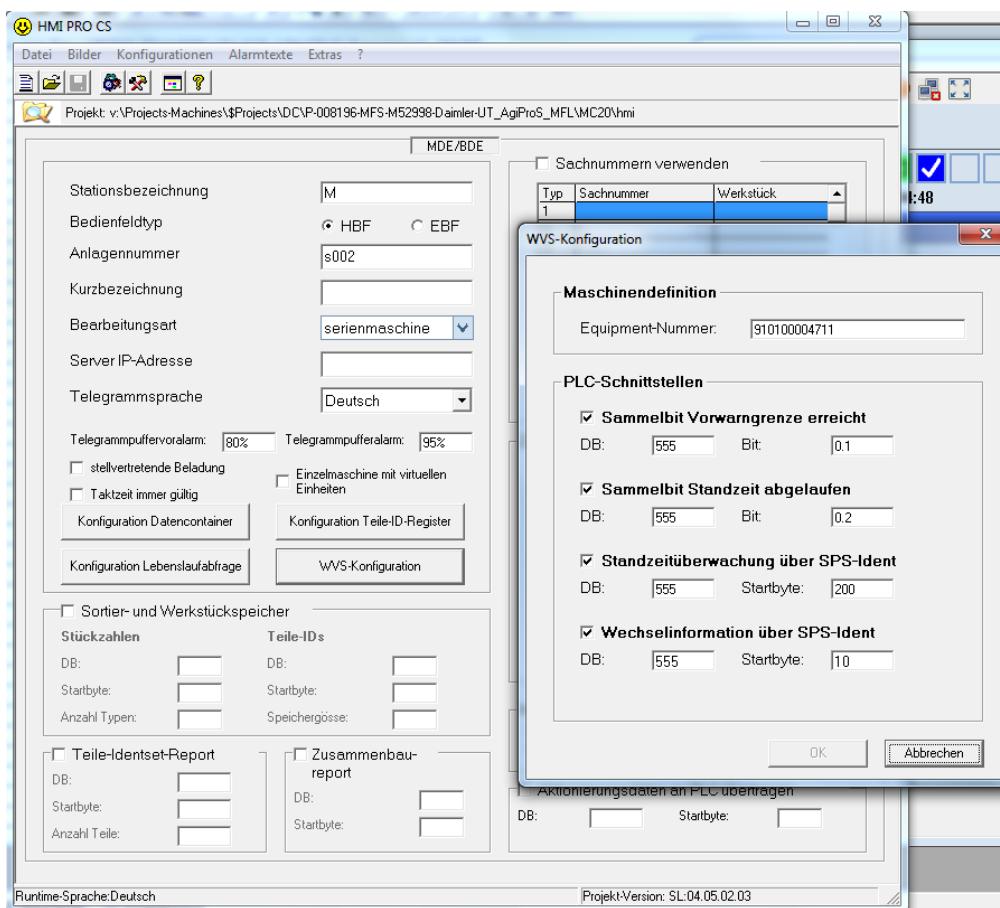


Figure 5: WVS configuration

Version 1.2

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Last revised 09.02.2016

1.4 WVS Test

WVS test can also be performed without a connection to the Daimler network. To do this, the test XML files shall be stored as follows:

- The XML file shall have the inventory number as its file name, e.g. 910100008446.xml

- After copying, HMI shall be restarted!

- Variant " PCU50 with Windows XP"

f:\hmisl\addon\sinumerik\hmi\cfg

- Variant PCU50 with Windows 7

C:\Program Files (x86)\Siemens\MotionControl\addon\sinumerik\hmi\cfg

- Embedded variant on NCU

/card/addon/sinumerik/hmi/cfg

1.5 Sibling Tools

Specific tool parameters shall be stored in MTM on use of sibling tools. These parameters can be taken from the following file:

- PCU50 with Windows XP

f:\hmisl\user\sinumerik\hmi\cfg\sltprovwstools.xml

- PCU50 with Windows 7

C:\Program Files (x86)\Siemens\MotionControl\user\sinumerik\hmi\cfg\sltlprowvstools.xml

- Embedded on NCU

/card/user/sinumerik/hmi/cfg/sltlprowvstools.xml

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3. History

Version:	Status:	Chapter:	Revised by:
1.0	24.02.14	<i>Initial processing</i>	Marco Miceli
1.1	09.12.15	<i>Update</i>	Christoph Willmann
1.2	09.02.16	<i>Update</i>	Christoph Willmann

Safety Switch

Powertrain Requirement Specifications Part III, Appendix 37

	Protective facility operated by cycle without interlock	Safety door <u>within a distance of 10 m from the control panel</u>	Safety door <u>more than a distance of 10 m from the control panel</u>	Emergency unlocking (<u>in the case of a risk of locking in</u>)	Safety doors which cannot be seen from the control panel
	Safety switch with interlock and selection button e.g. MGB	-	-	 MGB Zubehör Fluchtentriegelung	x
	Safety switch with interlock e.g. CET3	-	x	-	Necessary
	Safety switch without interlock e.g. CES-C01	x	Project-specific coordination	Project-specific coordination	Not required
	Safety switch without interlock, CES-C04, small design	x	Project-specific coordination	Project-specific coordination	Not required

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	Safety guard operated by cycle without interlock	Safety door <u>within</u> a distance of 3 m from the control panel	Safety door <u>more than</u> a distance of 10 m from the control panel	Emergency unlocking (in the case of a risk of locking in)	Safety doors which cannot be seen from the control panel
	Safety switch with interlock and selection button e.g. MGB	-	-	x	
	Safety switch with interlock e.g. CET3	-	x	-	Necessary
	Safety switch without interlock e.g. CES-C01	x	Project-specific coordination	Project-specific coordination	Not required
	Safety switch without interlock, CES-C04, small design	x	Project-specific coordination	Project-specific coordination	Not required

115150

Specifications for Suppliers

1	General
1.1	It shall always be ensured that the 24 V supply of the Kistler evaluation devices and the 24 V supply of the drive amplifiers are switched together. It shall be possible to switch off the power supply using a contactor from the OP/HMI with corresponding protection level EKS black and only in setup mode. The 24 V supply shall remain in place in emergency stop and machine off operating states.
1.2	The devices shall be designated according to the host names and connected to the Daimler network.
1.3	The network cable colors shall be implemented as per the Daimler requirement specifications. (Exception: The red Sercos MEM axis controller cable)
1.4	The program records/spaces shall be designated logically. (E.g. prog. 1 = 213 bearing/prog. 2 = 213 retaining ring, shorten if necessary)
1.5	A Kistler screen shall be created on the control console. In addition to +/- movements, pre-selection of the speed and brake test shall also be possible here. The error texts from the axis controller and the actual force and travel values shall be displayed.
1.6	The firmware for the devices (MEM and axis controller, etc.) shall be updated to the current version.
1.7	A display that is accessible at all times shall be installed per maXYmos (MEM module) used. If possible, the MEM should be installed in the control cabinet. In exceptional cases (locally and functionally sensible), a maximum of 4 MEM modules for one station may share a display (approval by Daimler specialized department required).
1.8	The Profinet interfaces of each Kistler MEM module should be individually connected to the Profinet switch. The Ethernet interfaces shall also be connected separately, per MEM module, to the corresponding switch.
2	Referencing
2.1	A reference position that is reproducible after disassembly shall be described for measuring systems with an external travel sensor. (Dimension reference and installed dimension)
2.2	The reference position of joining modules described by the manufacturer shall be used. This shall be shown using suitable measures on the machine bed, and shall be checkable at all times.
3	Calibration
3.1	The system manufacturer shall create a complete description for calibration, including: <ul style="list-style-type: none"> • The installation location • Assembly of special parts or disassembly of machine parts • Use of calibration devices • Operation of the system <ul style="list-style-type: none"> -Preselection of the operating mode -Movement of drives/specification of the speed -Evaluation technology operating instructions -Alternatively, a calibration program is available on the HMI screen.
3.2	A calibration device that can register a reference sensor shall be fabricated and its handling described for joining spindles or sensors that are calibrated when stationary. The calibration device shall have a workshop equipment ID. A fixed stowage position for the calibration device shall be reserved in the system.
3.3	To check linearity in the case of joining spindles and sensors, several operating points (20%, 40%, 60%, 80%, 100%) shall be checked. <i>Note:</i> To avoid damage to the reference sensors, the travel speed shall be very slow.
3.4	If several working ranges are specified by a sensor in various programs, these shall be calibrated individually.
3.5	A reference position that is reproducible after disassembly shall be described for sensors that have to be removed for calibration. A second sensor or an identical design shall be provided to avoid long production down times during calibration.
4	Data backup
4.1	A data backup for the components that are used (evaluation devices, axis controllers (<i>note: All parameters to be backed-up</i>) and load amplifiers) shall be transferred. The programs (software) required for this shall be designated.
5	Documentation
5.1	The location of the test setups (system composition) shall be stored clearly assigned to the stations.
5.2	All components (measuring equipment, cables with length specification, axis controllers, sensors, and specific accessories) shall be entered in the bill of materials on the basis of the original Kistler numbers.
5.3	The operating instructions shall be incorporated in the documentation.
5.4	Maintenance schedules and lubrication plans shall be supplied in the documentation scope; lubricating greases shall be designated. Lubrication points on joining systems shall be freely accessible.
5.5	Recovery concepts for joining spindles shall be created.

Risk of Accident on Control Consoles

Poor example – sharp edges



PT/AGP company safety officers



Edge guard

- PT requirement specifications
- Machine acceptance
- Safety check

Good example - edge guard



Lastenheft Powertrain Teil III

Anlage 42:

Anmeldung Template-SharePoint

Version 1.3

Version	1.3	Anzahl Seiten	9
Stand	26.02.2021		
Datei	Anlage_42_-_Anmeldung_Template_SharePoint.docx		

Inhaltsverzeichnis

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1. Änderungsnachweis

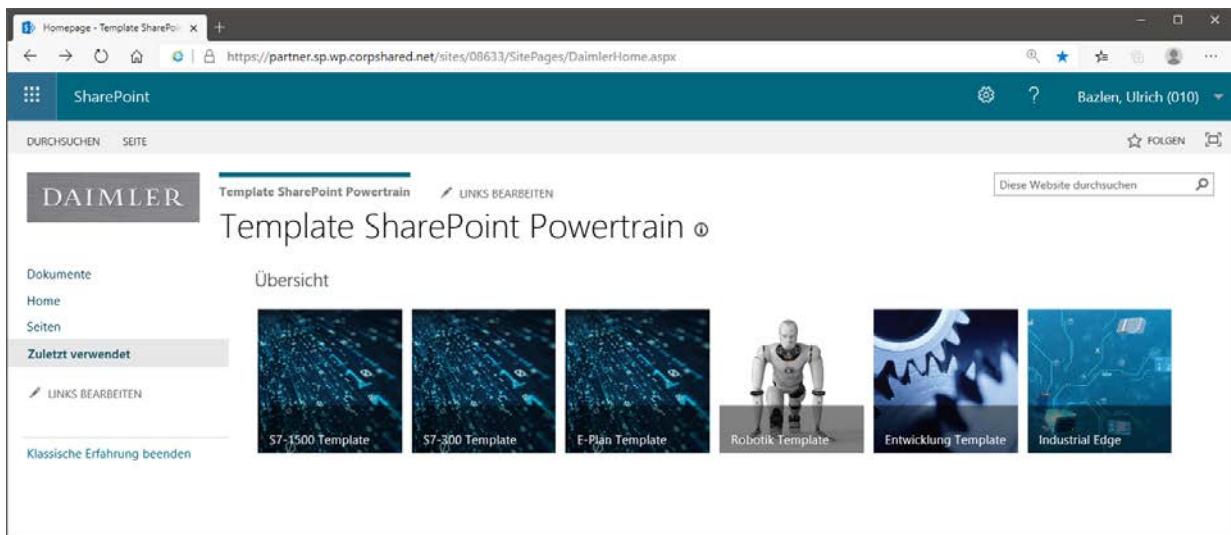
Version	Stand:	Kapitel:	Änderung durch:
1.0		Neuerstellung	AG
1.1	02.03.2020	Sharepoints hinzugefügt	UB
1.2	02.03.2020		JH
1.3	26.02.2021	Umgestaltung	UB

2. Template SharePoint Powertrain

2.1. Allgemein

Der Template SharePoint Powertrain enthält die im Lastenheft Powertrain geforderten Vorgaben in der jeweils aktuellen Ausführung. Jeder OEM hat zum Projektstart einer Anlagen- oder virtuellen Inbetriebnahme in Powertrain diese Vorgaben von dem SharePoint zu beziehen und einzusetzen.

Neben den Template-Bibliotheken und Robotik-Deployments werden auch Arbeitsdokumente zur Verfügung gestellt. Diese sind vom OEM für die Inbetriebnahme einzusetzen.



Der SharePoint ist unter folgenden Adressen zu erreichen:

Template SharePoint allgemein:

<https://partner.sp.wp.corphashed.net/sites/08633/SitePages/DaimlerHome.aspx>

SharePoint Robotik:

https://partner.sp.wp.corphashed.net/sites/08633/Robotik_Template/SitePages/DaimlerHome.aspx

SharePoint S7-1500:

<https://partner.sp.wp.corphashed.net/sites/08633/S7-1500/SitePages/DaimlerHome.aspx>

SharePoint S7-300:

<https://partner.sp.wp.corphashed.net/sites/08633/s7-300/SitePages/DaimlerHome.aspx>

SharePoint E-Plan:

<https://partner.sp.wp.corphashed.net/sites/08633/E-Plan-Template/SitePages/DaimlerHome.aspx>

Version 1.3
Stand 26.02.2021

Datei: Anlage_42_-_Anmeldung_Template_SharePoint.docx

2.2. Benutzer für SharePoint anlegen und freigeben

Das Anlegen der Externen Firmen sollte durch den zuständigen Fachplaner oder betreuenden Instandsetzungsbereich erfolgen. Der Antrag erfolgt per E-Mail an den Fachplaner mit folgendem Inhalt:

Betreff: Antrag zur Freischaltung SharePoint Template über EMT
Person: Anrede Vorname Nachname
Firmenname: Musterfirma
Email: Firmenemailderperson@firma.de

In dieser E-Mail an den Fachplaner bitte dieses Dokument anhängen.

2.2.1. Benutzer Anlegen

Schritt 1: EMT Management Tool im Social Intranet aufrufen und APP starten

Schritt 2: Anlegen „Partner“ Account anwählen

Schritt 3: Kontaktdaten ausfüllen

The screenshot shows the 'Anlegen - Partner' form. The left sidebar has links for 'Anlegen', 'Bearbeiten', and 'Exportieren'. The main form fields include: Geschlecht (männlich), Vorname (Max), Nachname (Mustermann), Firmenname (Fa. Mustermann GmbH), Kostenstelle (Übernahme von der Datenadministration (3274)), Datenadministration (Ulrich Bazlen), Externe E-Mail (max.mustermann@Mustermann), and gültig bis (26 Februar 2022). A note about Stellvertretende Datenadministration is shown. The 'Anlegen' button is at the bottom.

Hier bitte die Daten aus der E-Mail eingeben und die Gültigkeitsdauer des Zugangs. Zusätzlich muss ein Stellvertretender Datenadministrator für diesen Partner Account angegeben werden.

Der nun angelegte Benutzer bekommt bei erfolgreicher Aktivierung direkt im Anschluss eine E-Mail zur Aktivierungsbestätigung und muss im Anschluss dazu sein Passwort zurücksetzen und ein eigenes vergeben.

Nun ist der neue EMEA-User Partner Account angelegt und der Benutzer kann auf den SharePoint zugreifen. Jeder Partner Account hat einen lesenden Zugriff auf den SharePoint.

2.2.2. Bereits registrierte Benutzer

Ist ein Partner bereits registriert sind nachfolgende Schritte möglich.

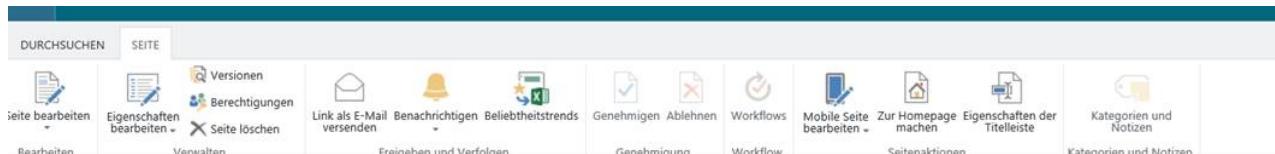
- Der Partner nutzt seinen Account und meldet sich durch eine Passwortrücksetzung selbstständig wieder an.
- Ist der Partner Account gesperrt, so kann diese Sperre im EMT durch den Administrator oder dessen Vertreter wieder aktiviert werden. Diese Aktivierung geht damit einher, dass es dann auch zu einer Passwortrücksetzung kommt.
- Ist bei einem Partner Account der Administrator oder dessen Vertreter nicht bekannt, so kann dies über den CUHD erfragt werden. Mit dieser Information kann dann Kontakt zum Administrator aufgenommen werden, der diese Schritte in die Wege leiten kann,
- Wird eine Übernahme der Administration des Partner Accounts gewünscht, so kann auch dies im EMT erfolgen. Den Anstoß zur Übertragung kann nur durch den eingetragenen Administrator vorgenommen werden, wird dies eingeleitet, so muss die Übernahme innerhalb von 4 Tagen durch den neuen Administrator erfolgen und der Partner Account gleichzeitig aktiviert werden.

Grundsätzlich unterstützt bei diesen Prozessen der CUHD, wenn gewünscht.

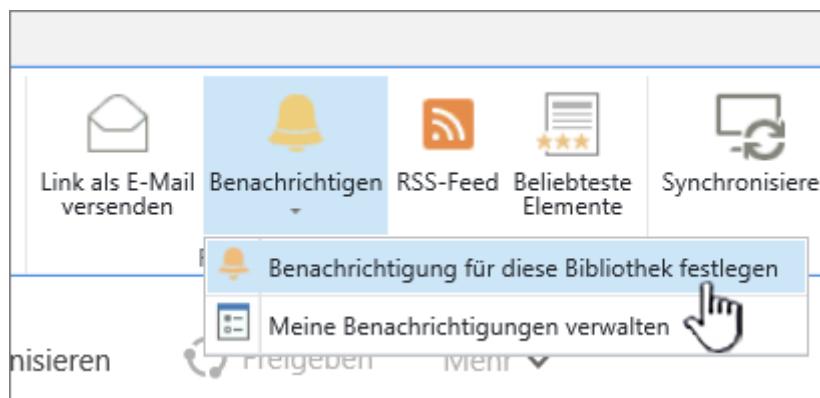
Zu beachten ist, dass ein Partner Account 1 Jahr nach Aktivierung gültig bleibt. Wenn einer Aufforderung zur Verlängerung nicht stattgegeben wird, so wird dieser aus dem System gelöscht. Eine Neubeantragung ist danach jederzeit möglich.

2.3. Einrichten einer Benachrichtigung in SharePoint Server 2019

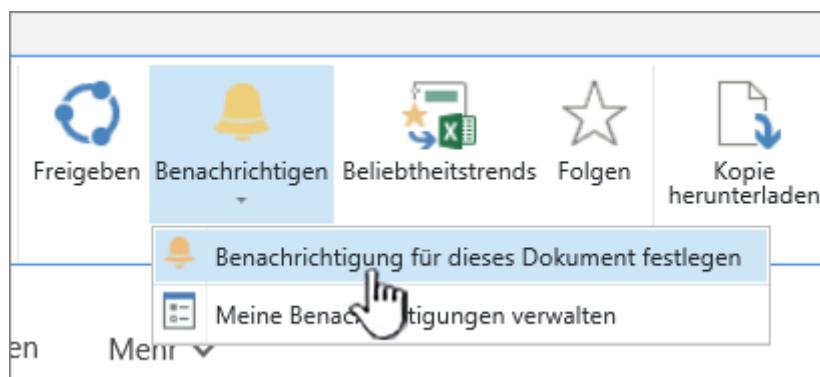
1. Wechseln Sie zur SharePoint Bibliothek oder Liste, in der Sie die Benachrichtigung einrichten möchten. Wenn Sie eine Ansicht der Liste oder Bibliothek auf einer anderen Seite suchen, müssen Sie möglicherweise zuerst den Titel der Liste oder Bibliothek auswählen. Um beispielsweise zur Dokument Bibliothek zu wechseln, müssen Sie möglicherweise zuerst Dokumente auswählen.
2. Führen Sie eine der folgenden Aktionen aus:



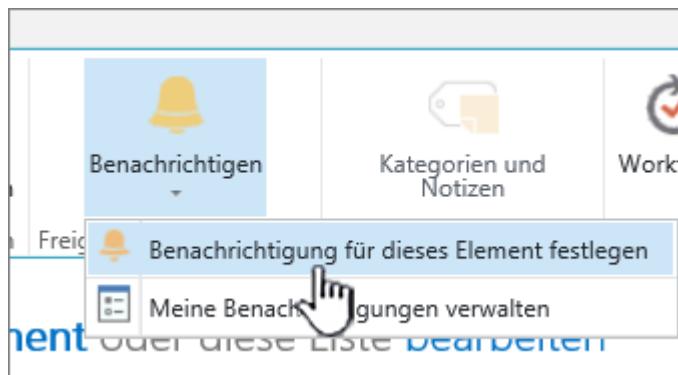
- Wenn Sie eine Benachrichtigung für die gesamte Bibliothek oder Liste festlegen möchten, wählen Sie Bibliothek oder Liste aus, wählen Sie dann Benachrichtigen aus, und wählen Sie dann Benachrichtigung für diese Bibliothek festlegen aus.



- Wenn Sie eine Benachrichtigung für ein Dokument festlegen möchten, wählen Sie das Dokument aus, wählen Sie Dateien oder Dokumente aus, wählen Sie Benachrichtigen aus, und wählen Sie dann Benachrichtigung für dieses Dokument festlegen aus.



- Wenn Sie eine Benachrichtigung für ein Listenelement festlegen möchten, wählen Sie das Element aus, wählen Sie die Registerkarte Elemente aus, wählen Sie Benachrichtigen aus, und wählen Sie dann Benachrichtigung für dieses Element festlegen aus.



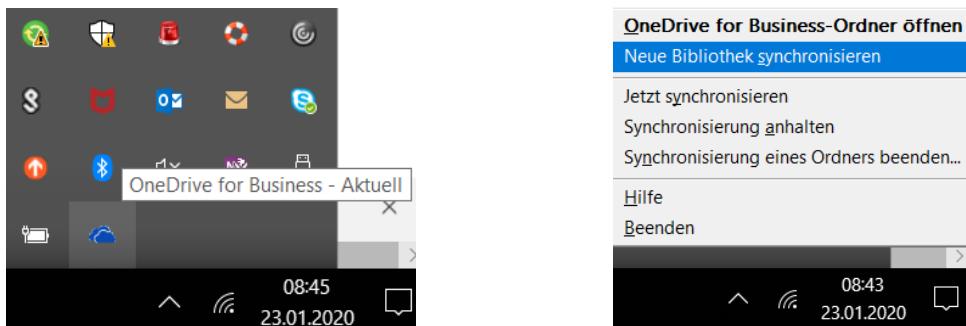
3. Wählen Sie gewünschten Optionen für die Benachrichtigung aus.

Hinweis: Die genauen Namen der Registerkarten und Schaltflächen in Schritt 1 und 2 lauten anders, wenn Sie sich in einer speziellen Bibliothek oder Liste befinden, z. B. in einer Bildbibliothek, Aufgabenliste oder Kalenderliste. Eine Kalenderliste beispielsweise weist die Registerkarten **Ereignisse** und **Kalender** auf, auf denen **Benachrichtigen** zu finden ist.

Je nachdem, wie Ihre Website und Ihre Server eingerichtet sind, erhält der Benutzer, für den Sie eine Benachrichtigung erstellt haben, möglicherweise eine E-Mail-Nachricht, die bestätigt, dass Sie eine Benachrichtigung erstellt haben. Die Benachrichtigungs- E-Mail enthält möglicherweise Links zu der Liste oder Bibliothek, zu Warnungseinstellungen, dem Namen des Benutzers, der die Benachrichtigung erstellt hat, einer mobilen Ansicht sowie anderen Informationen und Befehlen.

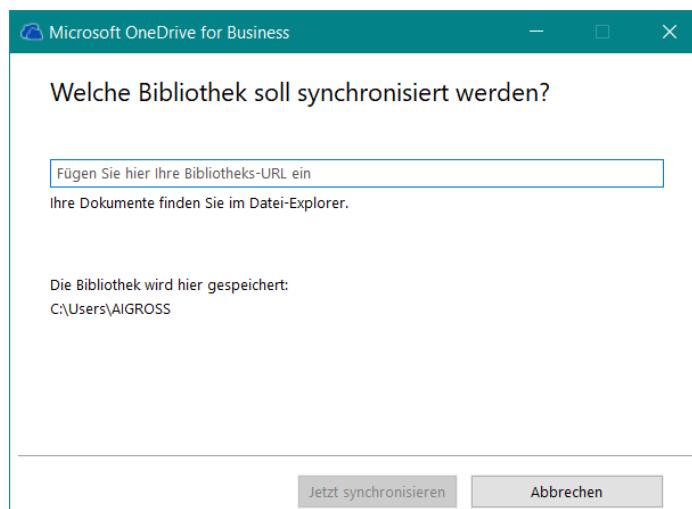
2.4. Synchronisierung einrichten

Über OneDrive for Business kann eine Synchronisierung mit dem SharePoint eingerichtet werden. Dazu „Neue Bibliothek synchronisieren“. In der Regel in der Startleiste zu finden (per Rechtsklick)

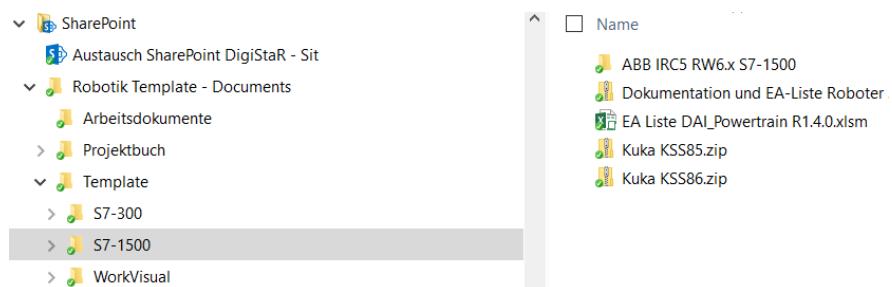


Dort Web-Pfad von SharePoint eintragen:

https://partner.sp.wp.corphashed.net/sites/08633/Robotik_Template/SitePages/DaimlerHome.aspx



Entsprechend der Rechte kann nun über den synchronisierten OneDrive-Pfad gelesen oder auch gepflegt werden. Die Synchronisierung erfolgt automatisch und wird angezeigt (grüner Haken steht hier für synchronisiert).



Damit werden auch Änderungen über die Website mit diesem OneDrive-Share synchronisiert.

DAIMLER

Powertrain Requirement Virtual Commissioning



Version 3

Version 3
Last revised 26.02.2021

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1. General Information

1.1 Preface

The present technical definition concerns the requirements and performance of all virtual commissioning in a Powertrain project. If the vendor feels that deviations are required with regard to individual points, these shall be indicated in the bid and require the written approval of Daimler AG.

The information makes no claim to completeness and the technical boundary conditions shall be coordinated with Daimler AG in the corresponding project phase in individual cases, if necessary.

The contractor shall ensure that all parties involved in the order adhere to the current Daimler AG regulations.

This tender document shall not be disclosed to third parties without the prior approval of Daimler AG!

Coordination with Electrical Planning several times is necessary during the bidding phase!

1.2 Record of Revisions

Version:	Last revised:	Chapter:	Revised by:
1.0	17.08.2017	<i>New draft</i>	Kai Klozenbücher
1.1	16.03.2018	<i>Supplement</i>	Kai Klozenbücher
2.0	11.12.2019	<i>Revision</i>	Andreas Deuschle, Daniel Hauptvogel
3.0	23.02.2021	<i>Revision</i>	Daniel Hauptvogel

2. Motivation and Potential

Increasingly complex system concepts and consequently increasing scope of the programming are accompanied by a constantly growing time requirement of the software commissioning. Studies by RWTH Aachen University show that the commissioning phase makes up 15 to 25% of the total duration of a project. 90% of this time goes to commissioning of the electrical components and control engineering. The greatest share is expended in correcting software errors at the client's construction site. Figure 1 clarifies the time distribution and the related potential.

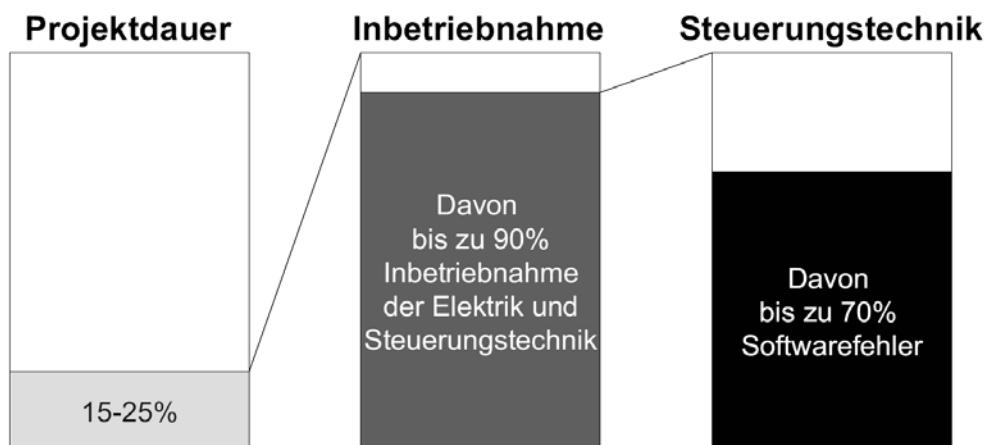


Figure 1: Time required for control engineering commissioning as a percentage of the project duration

An essential productivity lever in system planning and setup is the software-based support of the engineering processes through virtual models of machines, systems, robotic applications and material flows. These virtual models are used, for example, to carry out virtual commissioning (VIBN) in the software-in-the-loop (SiL) scenario or in the hardware-in-the-Loop (HiL) scenario.

In this way, too, system planning and automation concepts can be tested regarding functionality as well as their time-dependent behavior prior to the real-life commissioning, and process sequences thereby be optimized already prior to the real-life system setup. The commissioning at the virtual model can map all present and future operating sequences in real time and controlled with the original automation software. In this way, one can achieve a higher delivery quality of the software for automation and drive system solutions and identify design and process flaws at an early stage. The parallel arrangement of engineering development processes in planning, design and creation of the automation software, as well as the early usability of mechanical concepts, significantly minimizes the project duration.

Figure 2 below summarizes the motivation for virtual commissioning and clarifies the change from sequential to parallel engineering processes.



Figure 2: Requirement and benefit of virtual commissioning

The virtual system in Assembly and Production simulates process sequences, material flows and components and adapts the system software to the real-life system layout and the work procedures. This considerably facilitates commissioning as well as the testing of alternative possible solutions in bottle-neck situations. Virtual engineering can reduce the project throughput and commissioning times at the construction site, minimize the risk in the overall project, and safeguard deadlines. Another advantage of virtual models is their use in service or when operating a production system in order to reduce non-operational times. To this end the data must correspond to the current actual state of the system. Commissioning specialists, maintenance technicians, service technicians and system operators can then use virtual models for training purposes as well as for failure analysis.

Digitization affords the operator and in particular the machine and system builders many new ways to offer added value and improve the engineering processes.

2.1 Digital Engineering in Planning

A digital model in planning allows production to be prepared significantly more efficiently. Technology objects are recommended for re-using digital models as well as for implementing the direct transfer to a virtual real-time model.

In the planning phase, the use of technology modules allows production systems to be designed as digital models for the powertrain (engine, transmission, rear axle, front axle, etc.) fast and flexibly.

The development of the automation software already occurs in parallel with that of the digital model. Especially for special machines, the standardization of the software structure and basic software functions as templates is a crucial lever for arriving at the SOP (Start of Production) faster and with the less risk. Qualification or validation occurs at the digital model.

2.2 Costs and Benefits

Virtual commissioning shall be performed with zero cost impact by the suppliers, as the plant manufacturer itself benefits from the advantages of virtual commissioning. In 2020, the VDMA (German mechanical and plant engineering association) published a guideline for virtual commissioning. In summary, the following advantages can be derived for the plant manufacturer:

Significant time savings can be achieved by conducting engineering processes in parallel during software testing. The shortened commissioning phase and start-up phase at the operator lead to a shortened project duration and thus costs savings.

Errors can be detected and rectified earlier on in the engineering process. Faulty designs can be determined through the digital model before these components start to be manufactured. The earlier these engineering errors are detected, the more inexpensive function error adaptations and rectification are.

The crash risk can also be avoided by testing critical system states and NOK scenarios on the model. The system supplier's travel and accommodation costs can therefore also be reduced due to the reduced test effort at the construction site.

3. Timeline for Planning and Implementation with VIBN

The following timeline gives the most important milestones (see Figure 3), which shall be complied with by the machine supplier. For the implementation of relevant data (example: powertrain template), the machine supplier shall independently make request the data from Daimler.

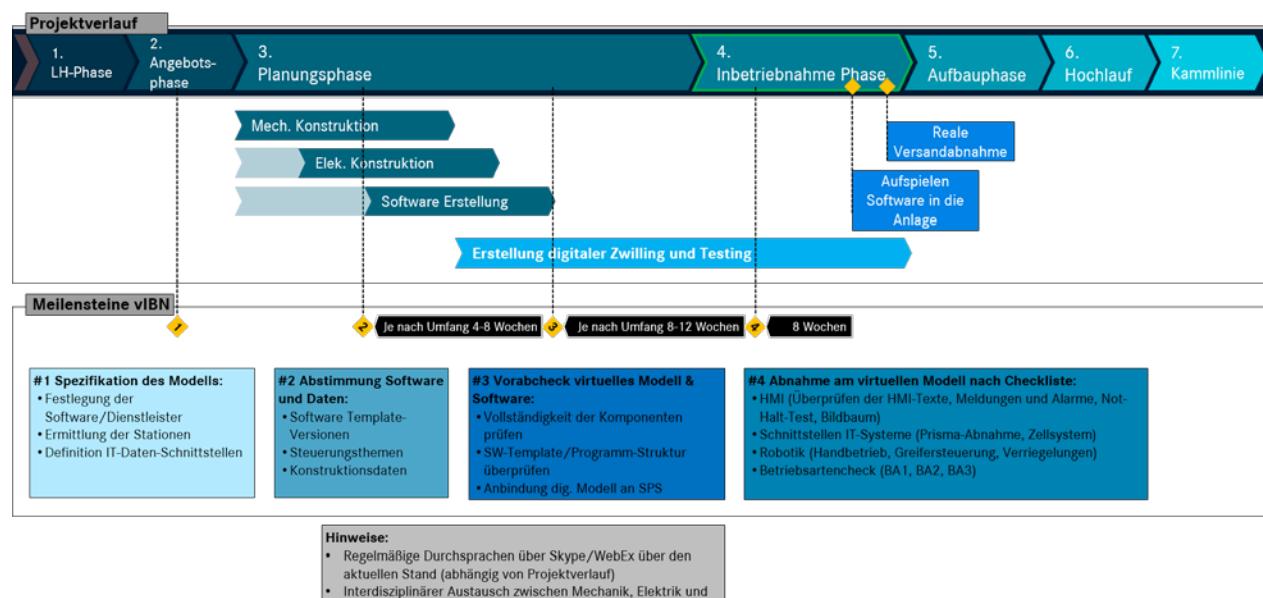


Figure 3: Timeline with milestones for implementing VIBN

Milestone #1: Create specifications for the digital model

Milestone #2: Coordination of the required data

Milestone #3: Preliminary check of the digital model

Milestone #4: Acceptance of virtual commissioning

4. Performance of Virtual Commissioning

Before the system / machine is put into operation in real life, virtual commissioning occurs at the digital model. The PLC program is simulated and tested in the simulation environment. All moving objects are kinematized in the CAx system; behavioral models shall be created for both the peripheral nodes and interfaces to subsystems.

With multiple smart systems, e.g. PLC and robots, the interplay of the functional sequences shall be implemented on the basis of the real-life project software. To achieve good performance with comprehensive systems or stations, several simulation computers may be required. To test the interplay of robotic programs and PLC programs, virtual robotic controllers are permitted.

The objective of commissioning on the virtual model is to test an overall procedure, starting with the required job data, the generation of station-specific operating data, all manual and automatic functions, and the NOK behavior with coordinated situations that were conceptually defined beforehand (checklist for virtual commissioning in Chapter 9).

Virtual acceptance of the station with all relevant procedures on the digital model is followed by approval for real-life commissioning at the contractor. The virtual commissioning shall be performed with an external service provider specified by Daimler. Special cases shall be resolved with the pertinent Daimler experts for the vComm.

4.1 Implementation Service Providers and Software Tools

For ensuring a standard process and for preserving quality in model creation, use is set by contractors. In addition, model creation via specialized companies has the advantage of saving license costs for the necessary software. This applies especially to system builders who have not yet acquired any experience in the field of virtual commissioning. Extensive qualification measures for the employees then become unnecessary.

The prescribed implementation contractors are:

- Siemens AG for **Siemens software** via vc.di.de@siemens.com
- EDAG PS GmbH for **Siemens software** via vertrieb-production-solutions@edag-ps.com
- Heitec AG for **ISG software or Siemens software** via digitalengineering@heitec.de

Besides modeling with ISG and Siemens software, project-related use of the fe.screen-sim tool from F.EE is also possible subject to consultation with the experts.

4.2 PLC and Robot Software Creation

PLC software creation is carried out based on the requirement specifications and the specifications for the Powertrain unit. In this regard, see Powertrain Requirement Specifications Part 3 Electrical Components, Chapter entitled "Software Specifications in General". Sample projects with the software structure, relevant templates and required interfaces are provided by the client or a tasked partner company. This scope will be determined at the start of the assignment. All station-specific processes, control codes, behavioral and kinematic models are included in the contractor's scope of delivery.

Prior robot offline programming with realistic path derivation is recommended for the maximum possible benefit of the digital model over the entire life of the system. Separate simulation tools are available for this. These derived robot programs serve as input data for virtual commissioning and can also be used for the real-life system. The robot commissioning time at the construction site can therefore also be reduced. Further information can be found in the requirement specifications "Robot Simulation Guideline V16".

The entire software project shall be tested and qualified at a virtual model prior to commissioning of the real-life system. At this model the software qualification occurs and following performance of the virtual commissioning and optimization of the software the initial inspection of the software package.

4.3 Input Data for Model Creation

The data shall be made available accordingly for efficient and fast model creation at the service provider. For instance, optimally generated CAD data for virtual commissioning can significantly shorten the modeling process. The following input data shall be made available to the service provider by the machine manufacturer at the start of model creation:

1. CAD Data:

These include all 3D system data required to create a digital model and the accompanying material flow geometries (workpieces, automatically guided vehicles, etc.). The following topics shall be noted on generation of the CAD data from the design engineering tool:

- a. If possible, the 3D data shall be supplied in native format for Siemens MCD as *.prt or in exchange formats such as JT or STEP with exact BREP geometries. STEP is recommended for the ISG tool
- b. The structure of the assemblies shall be contained; the objects shall not be present as a monolithic block
- c. Movable and fixed parts (e.g. stoppers, grippers, robots, clamping devices, doors) shall be represented individually (not amalgamated) in the model to be able to process/assign kinematics to them accordingly
- d. End positions shall be visible from the model
- e. The data on the stroke lengths shall be supplied
- f. In the case of moved objects, the coordinate system of the object shall be programmed at the pivot point
- g. For pickers, but also tools, a coordinate system shall be inserted as TCP in the model.
- h. The material flow parts/products shall be supplied as separate files. The level of detailing corresponds to the machining status of the product in the planned station
- i. The designations of the objects in the CAD structure are unique and identical to the sensor location plan
- j. Initial robot axis positions shall correspond to as-delivered state (all axes shall be programmed in the ZERO position)
- k. Product gripping positions or loading/unloading positions shall be represented with simplified geometries (gripper + product) in the model

2. Planning Data:

All data that describe the procedure as precisely as possible shall be transferred to the service provider. These include the storyboard and cycle time diagrams.

Electrical design engineering information is additionally required to simulate the digital system. This includes electrical circuit diagrams, pneumatic/hydraulic diagrams, and 3D sensor location plans (actuator/sensor plan).

3. PLC Project:

The PLC project includes the complete symbol table and the final hardware configuration. An interface description with time diagram shall be available for complex bus nodes (e.g. screwing controllers, presses) to ensure the most realistic possible integration in the model. An HMI project with the PLC status prepared for manual mode is required for verification of the digital model after the start of modeling.

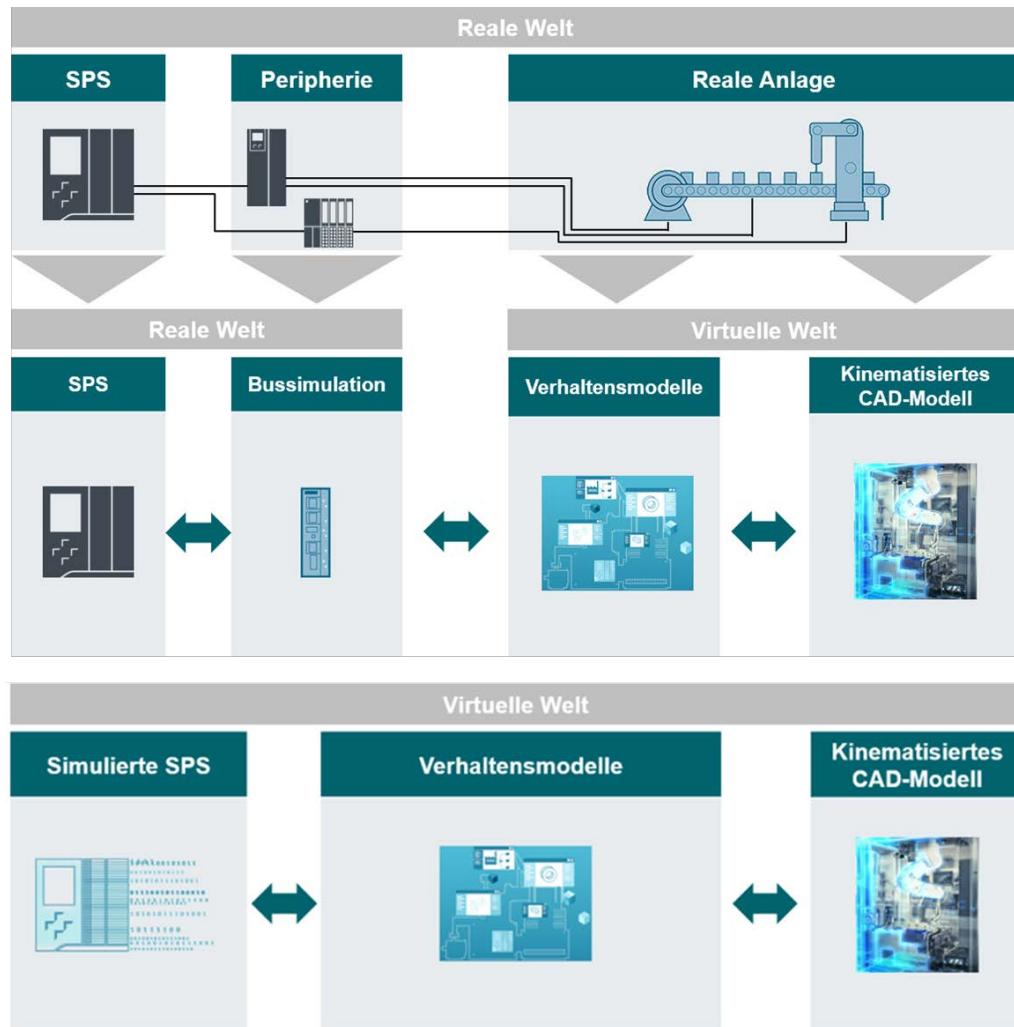
4. Robot Project:

In the case of robot cells, operable robot offline programs according to the Powertrain robotics template (incl. all main, sub-, and service programs) shall be created as a Work Visual project. The technology packages used are added to these. All programs relevant to the automatic sequence of the system are programmed incl. signal mapping (I/O) to the PLC and locking signals to robots and the system.

4.4 Schematic Layout of Real-Life and Virtual Machine/Station

The schematic layout of the virtual commissioning system is based on that of the real-life machine. If both the control system and the user interface are used as hardware, the HiL scenario obtains at the control system end. The solution with simulated software PLC as well as simulated user interfaces involve the SiL scenario. Sensor system and actuator control of the machine as well as the mechanics of the machine itself are generally modeled.

Figure 4:



Schematic layout of real-life and virtual station HiL (center) and SiL (bottom)

4.5 Necessary Hardware and Software

The test setup for the virtual commissioning is normalized and standardized; see schematic in Figure 4. The corresponding hardware and software are specified by Daimler and shall be applied by the machine supplier. The following chapters describe the mandatory hardware and software components.

Each station is considered as a unit and therefore has its own control system with control panel. The setup of the complete system, including all necessary software licenses (simulation, software, etc.), belongs to the system supplier's scope of delivery. The necessary control technology components (control panel, control system) for the virtual commissioning can be used for setting up the real-life stations following a successful virtual inspection. Components used to depict the simulation shall be documented such that all components are known when the simulation is restarted. The manufacturer, the designation of the component, and a specific manufacturer

product key shall be listed for this. All software components with version number, interface tools and robot technology packages that are used shall additionally be documented. The components are accordingly listed in a system description that is provided.

4.6 Transfer of System Data

The system supplier shall provide Daimler AG with two data packets with different time stamps:

- Complete virtual model, following successful virtual inspection
- Complete virtual model with all optimizations and changes for the final inspection of the real-life station

The system supplier shall additionally create a document clearly indicating which system changes have occurred between the acceptance of virtual commissioning and acceptance.

The data package contains the following data:

- CAD data
- PLC program
- Circuit diagram
- Sensor location plan
- Pneumatic / hydraulic system diagram
- HMI program
- Robot program (incl. WorkVisual project with the appropriate option packages)
- Process Description
- Project data for the vComm software (Siemens Simit+MCD/ISG Virtuous M+V/HeiVM)

5. Implementation with Siemens Software

The implementation of virtual commissioning with Siemens products is described in detail in the following chapter.

Daimler assumes no responsibility for the accuracy of the information; inquiries to Siemens as to correctness shall be made independently.

5.1 Schematic Layout of Real-Life and Virtual Machine/Station

The following discusses the Siemens components in the context of the schematic in Section 4.3. Only the IPC with HMI PRO, MPP, HT8, ET200, and EKS remain as hardware components in the virtual commissioning system. The sensors, actuators, and the assembly station are simulated in SIMIT and NX MCD. Any KUKA robot in the station shall also be integrated as an SiL component. To this end SIMIT is coupled with KUKA.OfficeLite. If a SINUMERIK is used, a SIMIT UNIT is necessary. In this case an HiL scenario obtains.

Figure 5 summarizes the transition from the real-life world to that of the virtual commissioning system.

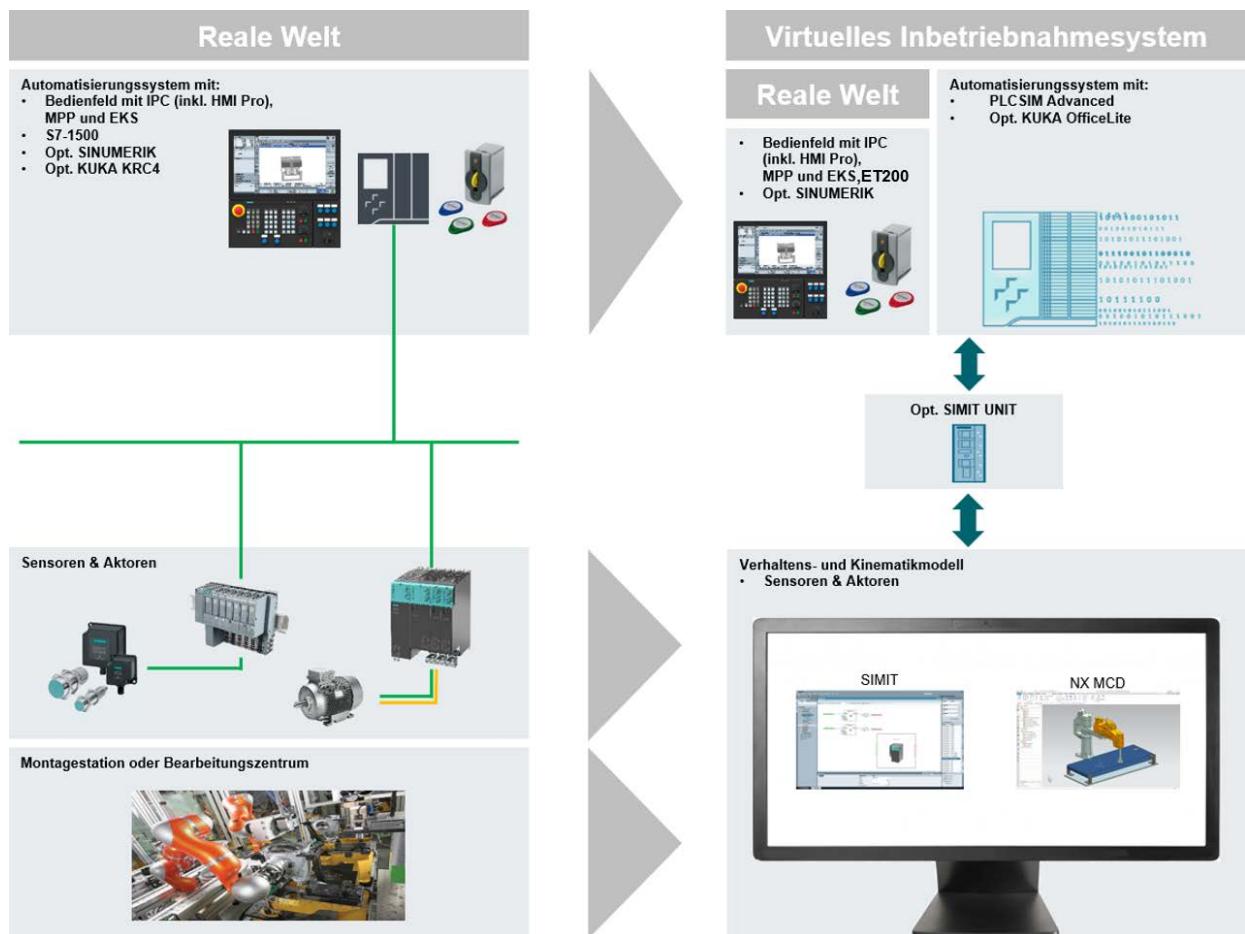


Figure 5: Overview of Siemens virtual commissioning

5.2 Necessary Components for Implementing the VComm

5.2.1 Hardware Components

The following hardware components shall be used for performing virtual commissioning. The exact types depend on the station to be virtually commissioned and the control panel package used there.

- 1x S7-1500
- 1x control panel with IPC (HMI Pro), MPP, HT8, and EKS
- ET200 for redundant signals (enable button and emergency stop on the HT8)
- Computer for software tools (number depending on qualities of the engine and performance of the PCs)
- Opt: simulation unit

Depending on the project, implementation as SiL variant is possible following consultation with the vComm experts.

5.2.2 Computer Infrastructure

To ensure smooth virtual commissioning at the digital model, a simulation computer with the following minimum requirements is required:

- Processor with 3.2 GHz base frequency (e.g. Intel i7/i9 11th gen or alternative manufacturer with equivalent performance)
- 32GB DDR4 SDRAM
- Graphics card with 4GB RAM (e.g. NVIDIA Quadro P2000 or performance-equivalent alternative manufacturer)
- 256GB SSD hard drive

Figure 6 shows a typical network topology of the employed hardware and software.

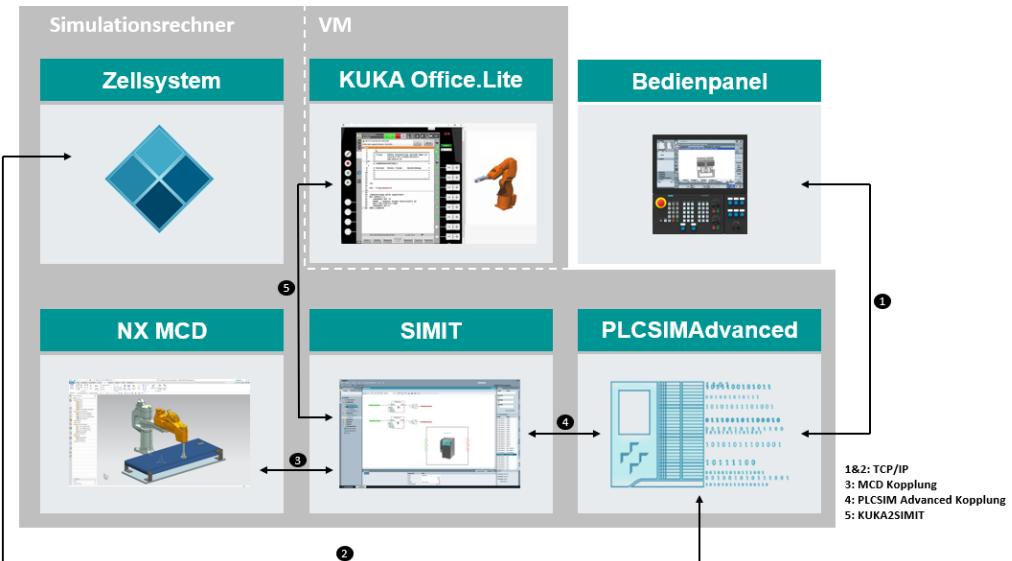


Figure 6: Network topology of Siemens virtual commissioning

5.2.3 Software Components

The following software tools are required for performing the virtual commissioning of a system:

- 1x Mechatronics Concept Designer (MCD) in the latest version
- 1x SIMIT in the latest version
- 1x TIA V15.1
- Opt.: 1x PLCSIM Advanced V3.0 as substitute for a S7-1500 control system
- Opt.: KUKA Office.Lite V8.6

6. Implementation with ISG Software

The following chapter describes implementation with the software from ISG Industrielle Steuerungstechnik GmbH in detail.

Daimler does not undertake to provide any guarantee for the data; inquiries to ISG (ISG-virtuos 3, TwinStore) and Heitec (HeiVM) with regard to correctness shall be carried out independently.

6.1 Schematic Layout of Real-Life and Virtual Machine/Station

The schematic layout of the virtual commissioning system is based on that of the real-life machine.

Real-life control systems such as PLC/NCU and HMI panel are coupled to the virtual commissioning system via hardware-in-the-loop.

Robotic systems are directly coupled as a software-in-the-loop solution to the virtual commissioning system via the software controller (e.g. Kuka OfficeLite) provided by the robot manufacturer.

Sensor system and actuator control systems like drive systems, RFID (including non-cyclical data communication), secure inputs and outputs as well as the mechanics of the machine itself are modeled.

Figure 7 summarizes the transition from the real-life world to that of the virtual commissioning system.

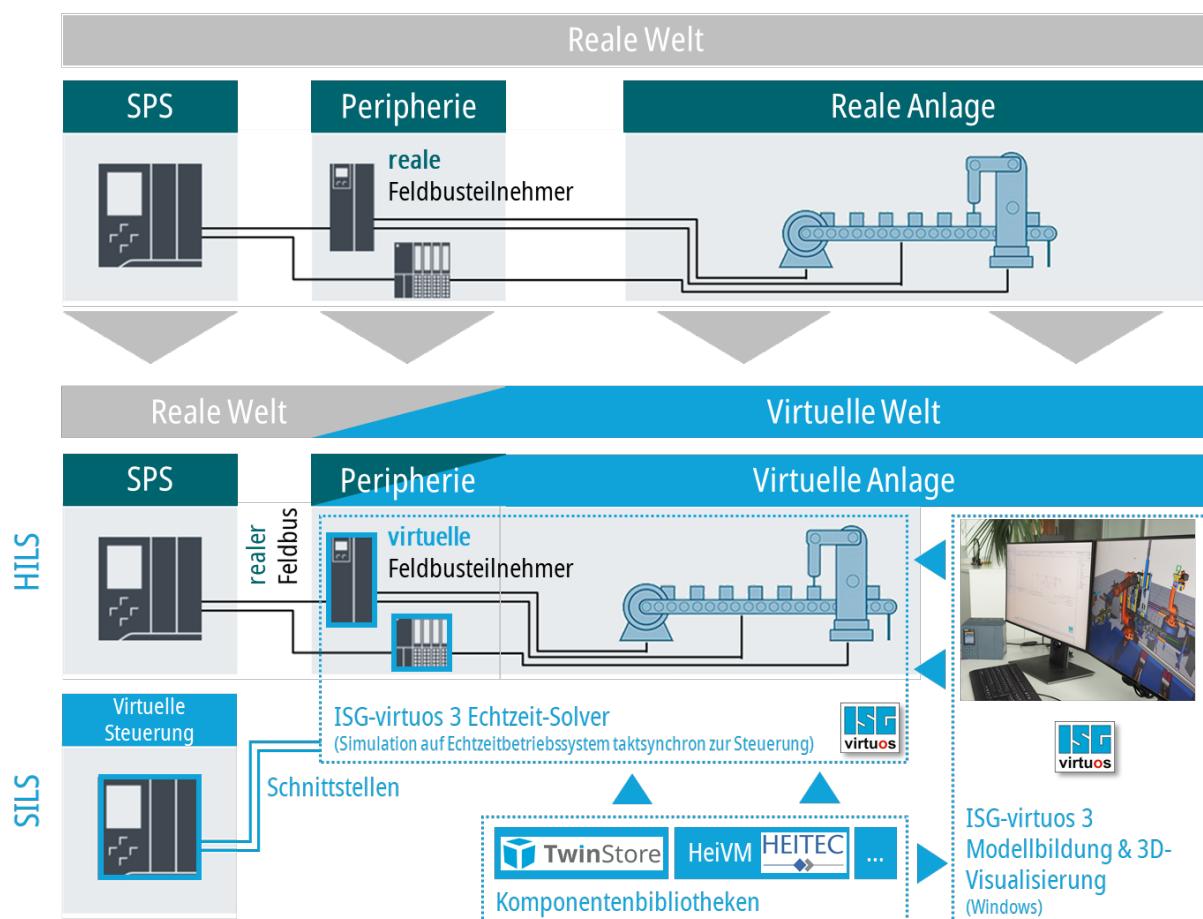


Figure 7: Overview of virtual commissioning

6.2 Necessary Components for Implementing the VComm

6.2.1 Hardware Components

The following hardware components shall be used for performing virtual commissioning. The exact types depend on the station to be virtually commissioned and the control panel package used there.

Depending on the project, implementation as SiL variant is possible following consultation with the vComm experts.

- 1x S7-1500
- 1x control panel with IPC (HMI Pro), MPP, HT8, and EKS
- ET200 for redundant signals (enable button and emergency stop on the HT8)
- Computer for software tools (number depending on qualities of the engine and performance of the PCs)

6.2.2 Computer Infrastructure

To ensure smooth virtual commissioning at the digital model, a computer with the following minimum requirements is required:

- Processor with 3.2 GHz base frequency (e.g. Intel i7/i9 11th gen)
- 32GB DDR4 SDRAM
- Graphics card with at least 4GB graphics memory (e.g. NVIDIA Quadro P2000)
- 256GB SSD hard drive
- Opt.: Real-time capable Ethernet adapter with Intel chipset for linking a real-life PLC or NC control system

Figure 8 shows a typical architecture of the employed hardware and software with HeiVM and ISG Virtuos.

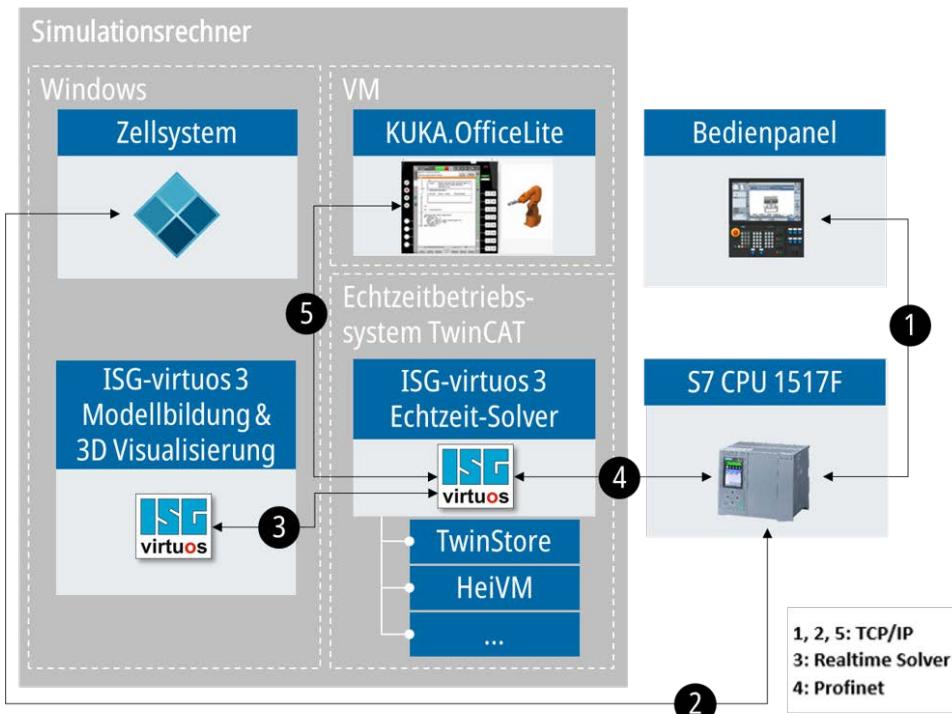


Figure 8: Virtual commissioning architecture with HeiVM and ISG Virtuos

6.2.3 Software Components

The following software tools are required for performing the virtual commissioning of a system:

- 1x ISG Virtuos in the latest version incl. TwinStore
- 1x HeiVM technology library usage license (from Heitec as service provider)
- 1x Beckhoff TwinCAT3
- Opt.: 1x PLCSIM Advanced V3.0 as substitute for a S7-1500 control system
- Opt.: KUKA Office.Lite V8.6

The HeiVM Technology Library from Heitec AG can be used either in connection with Siemens MCD or in connection with ISG Virtuos and contains a selection of objects for implementing the virtual commissioning.

The HeiVM Technology Library is being developed by Heitec with the goal of providing the user with components for drive technology, sensor systems, actuator control and communications and serves as an aid for smooth virtual commissioning. Another goal is to keep the labor in setting up required software and hardware to a minimum. For example, PROFINET communication without an additional hardware box is possible.

The ISG TwinStore offers a selection of free components and is supplied with ISG Virtuos. With TwinStore, prefabricated, certified digital twins can be integrated directly by the component manufacturer and simulation specialist and modeling times can be reduced. Libraries from TwinStore enable detailed simulation through the use of realistic models for illustrating e.g. irregular operating modes, dynamic parameterization, and the original real-time behavior.

Daimler does not undertake to provide any guarantee for the data; inquiries to Heitec and ISG with regard to correctness shall be carried out independently.

7. IT Interfaces

This section describes the IT interfaces as well as the link to the virtual model. More precise descriptions of PRISMA are contained in the requirement specifications under "Part 3 Electrical Components" in the ITP interface catalog. Further information on the cell system is contained in the requirement specifications in "Part 3 Electrical Components/IT Interfaces and Systems"

7.1.1 PRISMA

The purpose of PRISMA is to support production, maintenance and the ongoing optimization process through the acquisition, processing and analysis of machine and operating data (MDE/BDE) in Powertrain. The link to PRISMA as well as the data telegrams are tested via the "logfile viewer". This hardly requires any resources and can also be installed on low-powered notebooks. The current version can be requested via the specialist planner.

7.1.2 Cell System

The cell system is the higher-level system for job management in the Daimler AG Assembly departments. The process for testing the cell system connection and the data quality is identical to that of a real-life system. A double setup with interface test on the virtual and the real-life system shall be avoided. The objective is to bring the setup of the test system forward during the project and to connect it to the virtual model. The interface must be set up in time for the scheduled preliminary check. The contents of the telegrams are analyzed in detail for virtual acceptance.

There are two implementation options that shall be discussed project-specifically with the VIBN experts.

1. Via Autonomous Cell as Test System:

This method is sensible in the case of individual stations within a line. The supplier provides an efficient computer or notebook. A current cell system project status is loaded onto this as VMware by Daimler. Job data shall then be created manually.

2. Connection to the Live Cell System via Tunnel:

This method is sensible when simulating entire lines. The supplier accesses the already set-up cell system on the Daimler server via an encrypted connection. Access to these test systems renders local operation of the cell system unnecessary. In this case, jobs do not have to be created manually; real-life job data are available.

8. (Omitted)

9. Criteria for Selecting Stations for the Virtual Commissioning

The following decision-making aid (Table 1) is used to determine suitable stations that are commissioned virtually. These stations shall be identified project-specifically. This necessitates coordination with the representative and the machine supplier. The station with the highest number of fulfilled criteria is then to be recommended. The most complex stations possible with the maximum potential for delaying the overall project shall be selected.

Enter station here →					Station A	Station B			
Example: assembly									
Interfaces to Daimler IT									
Cell system					✓	✓			
PRISMA					✓	✓			
QDA					✓				
PLA					✓	✓			
Interfaces to other machine suppliers									
Interfaces to subsystems									
Robot					✓				
Technologies (screw-joining, pressing in, etc.)					✓	✓			
Technologically demanding functionality of a station									
Large technological scope					✓				
Handling					✓				
Stations with high type variance									
Large scope for product variants					✓	✓			
Large scope for add-on parts					✓	✓			
Bottlenecks for the overall line									
Technological scope adaptable to multiple stations					✓				

Suitable
station

Table 1: Determination of the stations to be virtually commissioned

10. Acceptance and Checklist

The virtual commissioning is inspected by the client in reference to the virtual model as well as to the technical implementation. The technical implementation comprises the same inspection items (software quality, processes, error simulation) as in the shipping acceptance at the real-life station. The following requirements (Table 2) are a part of this and shall be verifiably implemented by the supplier:

Qualification of PLC, HMI and robotic software at the virtual model
<p>Test and optimization of the different systems and interfaces:</p> <ul style="list-style-type: none"> • In particular: travel ranges, axis motions, collision tests • Robot handling (real-life robotic programs) in interplay with the material flow, controlled by the PLC • Data interfaces to parallel or higher-level systems, e.g. cell system, PRISMA • Data handling with RFID • Check of mechatronic implementability • Motions of driven components for checking trajectories for collisions and for cycle time determination • Interfaces to subsystems such as power screwdrivers, joining units, sealant application, machining centers, feed and removal units
<p>Performance of the real-life commissioning at the virtual (real-time) model (HIL):</p> <ul style="list-style-type: none"> • Check of the system access functions and access functions • Check of the safety functions (exception: robots) • Check of the operating modes • Single-step mode • Automatic mode • Test of the reports • Test of the error messages • Check of the diagnosis and fault message functions • Check of relevant control and operation functions

Table 2: Overview of some requirements

In the project history the individual test scenarios shall be coordinated in detail. See the following example according to "Data Handling with RFID":

- ➔ The virtual model shall be mapped in the material flow with the parts to be produced and their assigned unique data (job data, quality data, DMC code, etc.).

A detailed inspection checklist will be provided as a guideline during the project. These items are checked in the virtual inspection.

DAIMLER

Powertrain Requirement Specifications Part III

Appendix 44: Guideline for an MQTT Client

Version 2.0

Version	2.0	Number of Pages : 16
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1. General Information

1.1 Preface

This technical definition regulates the requirements and execution for production equipment with communication to a Manufacturing Service Bus (MSB) by means of MQTT client in the Powertrain unit. If the vendor feels that deviations are required with regard to individual points, these shall be indicated in the bid and require the written approval of Daimler AG.

The information makes no claim to completeness and the technical boundary conditions shall be coordinated with Daimler AG in the corresponding project phase in individual cases, if necessary.

The contractor shall make sure that all those involved in the contract comply with the current requirements of Daimler AG.

This tender document shall not be disclosed to third parties without the prior consent of Daimler AG!

1.2 Record of Revisions

Version:	Last revised:	Chapter:	Changed by:
1.0	17.08.2017	<i>New draft</i>	Tobias Neumann PT/TSD Kai Klozenbücher PP/PT4.0
2.0	28.02.2020	<i>Partitioning: IoT and MQTT specifications</i>	Tobias Neumann PT/TSD Andreas Deuschle PP/PT4.0

1.3 Contacts

Responsibility	Contacts	Plant/HPC	Depart- ment	Phone extension	E-mail:@daimler.com
Planning	Andreas Deuschle	010/E525	PP/PT4.0	+49 176 30967178	andreas.d.deuschle@daimler.com
TecFabric	Tobias Neumann	010/M442	PT/TSD	+49 176 30918638	tobias.neumann@daimler.com

2. Motivation and Potential

The extended analysis of machine data is a significant productivity lever in system optimization and preventative maintenance. Data that have not previously been used in any analysis should be transferred and analyzed in this process. Additional data should therefore be transmitted in addition to the existing data packets for the Daimler IT systems such as Prisma, the cell system, QDA, and PLA.

This additional information can be registered, for example, using existing data in the PLC or through new data sources and transmitted via MQTT to the Manufacturing Service Bus (MSB). The latter then relays the data to the target systems.

The digitization affords the operator, Maintenance as well as other shops new ways of generating added value through (e.g.) improved availability of the production equipment, optimization of production processes and cost reductions.

For transmission of the required data to the MSB and their restructured and recyclable use, the following sections contain specifications on the MQTT client and the MQTT messages.

3. Standard Specifications for an MQTT Client

3.1 Use of the MSB – Manufacturing Service Bus

The MQTT client should provide an interface for mass data and additional data traffic via the conventional IT interfaces. To do this, the MSB should be used as a data transport layer. The MSB shall be provided by Daimler. The requirements on such an MQTT client are described in the following.

3.2 MQTT Version

MQTT version 3.1.1 (OASIS standard) shall be supported. The official specifications shall be taken into consideration and all functions supported as standard unless described in further detail in this document.

3.3 Function Principle

The MQTT protocol is based on the publish/subscribe principle. In this, messages are published or subscribed to as regards a heading (topic). A broker is used between the sender (publisher) and recipient (subscriber) of topic messages. The broker shall be provided by Daimler in the form of the MSB. The following specifications are intended to ensure proper communication with the MSB and the provided broker.

The topic should clearly refer to actual data source, but does not necessarily have to originate from the actual sender. Concentrator solutions (i.e. a client transmits on behalf of various data sources) are therefore also legitimate.

The subscribe procedure shall be planned for each client, but shall only be programmed if necessary for the application and in coordination with Daimler.

3.4 Connection Establishment to the Broker and the MSB

After complete booting and when a network is available, a client should automatically establish a connection to the configured broker.

The broker connection data shall be provided by Daimler according to the project, and shall be stored in the client's configuration. Only one connection to a broker shall exist at any one time.

The broker shall be set using the network name and port. The standard target port is 1883 (unencrypted) or 8883 (encrypted).

After each successful connection establishment, an ONLINE message should first be transmitted. This is followed by an ASSET message. Both messages are described in Chapters 5.1 and 5.2.

3.5 Standard Specifications for the Connection

3.5.1 Client Identifier

The client identifier shall be assigned per client and shall be configurable. It shall be a maximum of 23 characters long, shall contain no special characters, and shall be unique throughout the plant.

The network device name (DNS name) shall always be used as the client identifier. Should this not be possible, the following ranking of the identifier shall be used:

1. The network device name assigned by Daimler.
2. Short form of the Profinet name according to the following convention:
 - Equipment no.: [12], OP/station no. [6], device class [2], device number [3]
 - Example: 910100022935op0010ir001
 - The precise description of the Profinet naming convention and the elements used here can be found in [Appendix 01, Powertrain Electrical Components Requirement Specifications](#).

3.

[4.3.](#) The MAC address of the device according to the following notation:

[AABBCCDDEEFF] (i.e. without hyphens)

3.5.2 Keep Alive

The keep alive shall be configurable and set to 60 seconds (default value) as default.

3.5.3 Clean Session

On connection establishment, the client sets the clean session flag. If this flag is true, all subscriptions are deleted as soon as the client has ended the connection.

At present, clean session shall always be true, and shall not be adjustable.

3.5.4 Last Will

The MQTT client should specify a LASTWILL message during connection establishment. This message specifies what the broker, as the representative of the MQTT client, should transmit to its subscribers in the event that the connection terminates unexpectedly.

The last will topic (Chapter 3.6), quality of service (Chapter 3.7.3), and retained message (Chapter 3.7.4) shall be configurable in this case.

The message content shall be substantiated with {"<Client identifier>": "Offline"}.

3.5.5 Encryption

Encryption is desired if technically possible and justifiable in terms of effort. The ranking of the method to be used is as follows:

1. Security with client certificate
2. Security with user/password
3. No security/encryption

At least the option for using the user and password shall be planned, even if it may not be applied depending on application.

3.6 Topic Structure

Topics shall be configurable per message type or data category.

All topics should be written in capitals to avoid problems during processing (topics are registered case-sensitively).

Topics adhere to the following convention:

\$root/\$format/\$compressed/\$standard/\$plant_id/\$unique_id/\$typ/\$typ_version/\$subtyp/\$version/#

Topic element	Value
\$root	Plant-specific (e.g. DAI/MBP/I/XZP) – fixed root is provided by the infrastructure provider (Daimler).
\$format	JSON XML CSV – defines the sent message format
\$compressed	"0" means uncompressed "GZIP" means GZIP-compressed

Topic element	Value
	"SNAPPY" means Snappy-compressed
\$standard	Daimler tooling standard that the sender uses, e.g. SPPA
\$plant_id	0100 – plant ID (4 numerals)
\$unique_id	<p>Unique ID of the client.</p> <p>Should be the Profinet device name (see Appendix 01, Powertrain Electrical Components Requirement Specifications).</p> <p>E.g. M010100110141324OP0170SP01SP001</p> <p>If it is not possible to use the Profinet device name, consultation with Daimler is required. In this case, the device name may be used or, if necessary, the MAC address.</p> <p>Important: Please do not confuse the unique_id with the client identifier!</p>
\$typ	<p>Type of technology (in consultation with Daimler)</p> <p>e.g. "IR", "SP", "NC", "MS", etc. (complete list of all types in Chapter 3.6, Appendix 01, Powertrain Electrical System Requirement Specifications)</p>
\$typ_version	<p>Version of the respective type</p> <p>E.g. "KRC4-82", "S7-317", "S7-1516", "840Dsl", ...</p> <p>Must be coordinated with Daimler</p>
\$subtyp	<p>Transaction of the respective type according to the message type</p> <p>E.g. "ASSET", "ONLINE", "MEASUREMENT VALUES", ...</p> <p>(in consultation with Daimler)</p>
\$version	<p>Unique versioning of the payload structure based on {\$standard, \$type, \$type_version, \$subtyp} to be able to determine the required parser on the recipient side.</p> <p>E.g. "V3"</p>
Any n-Times	For free use (in consultation with Daimler)

Topic examples:

~~DAI/MBP/I/XZP/JSON/0/SPPA/0100/M010100110141325OP0170SP01SP010/SPS/S7-317F/ONLINE~~

~~DAI/MBP/I/XZP/JSON/0/SPPA/0100/M010100110141324OP0171SP01SP010/PLC/S7-1515/ASSET/V2~~

~~DAI/MBP/I/XZP/JSON/0/SPPA/0100/M010910100022935OP0010SP01IR001/IR/KRC4-82/LASTWILL~~

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DAI/MBP/I/XZP/JSON/0/SPPA/0100/M010910100022935OP0010SP01IR001/IR/KRC4-82/AXVALUES/V3/AX3

Up to and including \$type_version, the topic is fixed for each data source, and can be stored once. The application-related part of the topic, which is therefore also variable on the client, starts as of \$subtype.

3.7 Standard Specifications for Messages

3.7.1 Message Size

The message size shall not exceed 100 kB. If it is necessary depending on application, Daimler shall be consulted beforehand.

In addition, with large quantities of data an aggregation of the data per message type is desirable. Multiple data points (time series elements, events, etc.) in the client should then be collected per topic and compiled in a message. This reduces the overhead of the message and the load on the MSB. For further information see 4.5.

3.7.2 Data Format

The data contents shall be transferred in a speaking message format. JSON based on UTF-8 should be used for this as standard.

Other hierarchical, speaking message formats, such as e.g. XML or CSV, may also be used depending on application. However, these shall be coordinated with Daimler in advance and approved separately.

3.7.3 Quality of Service

MQTT defines 3 different quality of service (QoS) levels. The QoS level shall be configurable for each message type.

Level 0 shall be maintained here by default. If necessary depending on application, the level can also be set to 1 or 2 following approval by Daimler.

3.7.4 Retained Message

The retained message flag can be used to activate saving the last message received for a topic on the topic. This is excluded in the standard, and should normally always be deactivated on the client. Otherwise high loads can result on the MSB and access can be denied to the client.

If it is necessary to set this flag depending on application, Daimler shall be consulted.

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4. MQTT Messages of an MQTT Client

4.1 ONLINE Message

An ONLINE message should be sent as the first message directly after connection establishment. The fixed topic is supplemented by the variable part "ONLINE" (see examples from Chapter 3.6).

The message content shall be substantiated with `{"<Client identifier>": "Online"}`, whereby `<Client identifier>` shall of course be replaced with the name/value of the client identifier (Chapter 3.5.1). A version specification in the topic is not necessary with this message.

4.2 OFFLINE Message

In the case of a planned and properly executable connection termination, an OFFLINE message should be transferred as the last message. The fixed topic is supplemented by the variable part "OFFLINE" (see examples from Chapter 3.6).

The message content shall be substantiated with `{"<Client identifier>": "Offline"}`, whereby `<Client identifier>` shall of course be replaced with the name/value of the client identifier (Chapter 3.5.1). A version specification in the topic is not necessary with this message.

4.3 LASTWILL Message

The MQTT client should specify a LASTWILL message during connection establishment. This determines which message the broker is to transmit as a stand-in for the MQTT client in the event of an unexpected loss of connection. This allows a life cycle consideration, even if the client unexpectedly goes offline (e.g. through "main switch OFF" at the system).

The message content shall be substantiated with `{"<Client identifier>": "Offline"}`. A version specification in the topic is not necessary with this message.

4.4 ASSET Message

The ASSET message shall be sent directly after the ONLINE message after connection establishment. With an existing connection, the ASSET messages should also be sent again at least once per calendar day. The device/component information to be transferred shall be entered as key value pairs.

In this case, the fixed topic is supplemented by the variable part "ASSET" and a version specification (e.g. V1") (see examples from Chapter 3.6).

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Should much ASSET information accumulate, sub-structuring is useful. The following structure is proposed:

.../ASSET/V1/EQUIPMENT

.../ASSET/V1/DEVICE

.../ASSET/V1/APPLICATION

- EQUIPMENT should contain system-specific information (e.g. manufacturer, machine type, "system name," OP no., technical place, included sub-systems, etc.).
- DEVICE should contain MQTT-client-specific information (e.g. device name, IP addresses, operating system / firmware, version information, employed software, etc.).
- APPLICATION should contain information (names, versions, conditions) for using the data, target application or target system (e.g. regarding IT system, cloud application, BigData project, etc.).

The minimum requirements on an ASSET message are listed in the following:

```
{  
    "PNDeviceName": "...",  
    "HostName": "...",  
    "IP": "...",  
    "SerialNumber": "...",  
    "OrderNumber": "...",  
    "Firmware": "...",  
    "HardwareRevision": "...",  
    "Manufacturer": "...",  
    "MachineType": "...",  
    "OP-Number": "...",  
  
    "TechnicalPlace": "..."  
}
```

4.5 Further Messages

The messages defined in this sub-chapter are the actual reason for using an MQTT client. They are used to transfer the desired useful data to the MSB and the downstream systems.

The data, topics, and structuring/hierarchy within the format of the message shall be defined for the specific application and shall be coordinated with Daimler.

In this case, the data can be sent in either a time-related (e.g. every 10 minutes), connection-oriented (e.g. after connection establishment) or event-related manner (e.g. in the case of a malfunction, a finished part message or an internal control system event). This shall also be defined for the specific application.

A few additions to the fixed topic shall be defined for these messages per transmission type and message content. Depending on necessity, levels below \$version can also be added here.

Topic examples with and without supplements according to \$version:

.../SCREWDATA/V1
.../AXIS/V1/MOVEMENT
.../PNEUMATICCYLINDER/V1/DIAGNOSIS
.../SPINDLE/V1/...
.../PLC_EVENTS/V1/...
.../TOOL_EVENTS/V1/...

The submission of a quantity scheme to Daimler, outlining the number of messages and the data volume (in kB, MB, ...) per unit of time to be anticipated is mandatory for these further messages.

As discussed in Section 3.7.1, message elements should be aggregated with larger data accumulations or denser data point cycling. Essential in each useful data message is the transmission of a time stamp. The ISO time stamp with following format should primarily be used:

YYYY-MM-ddTHH:mm:ss.SSSZ

Examples of the payload arrangement or useful data structuring occur in the following subsections.

4.5.1 Payload Structure with Event Data of a Time

In the following example structure, transmitted data contain multiple (event) information units regarding a time.

Example topic:

DAI/MBP/I/XZP/JSON/0/SPPA/0100/M010910100018999OP0040NC01CT010/NC/840DSL/
TOOL_EVENTS/V1/TOOL_CHANGE

Example payload:

```
{  
    "timestamp": "xxxx-yy-zzT11:11:11:123Z",  
    "event": "Toolchange",  
    "Tool-ID now": "104010",  
    "Tool-no now": 14,  
    "Tool-ID old": "104010",  
    "Tool-no old": 14,  
    "performed cuts": 1534,  
    "remaining cuts": 245  
}
```

4.5.14.5.2 Payload Structure with Aggregated Time Series Data

In the following example structure, the transmitted data contain multiple multivariate data points of a time series collected in a message and sent at a given time ("msg_timestamp"). Important is that the overall message must not exceed the limits in Section 3.7.1 (100kb). To this end a suitable logic shall be implemented in the MQTT client. In addition, if the message is "not to be full," transmission should be compelled by a time limit. This time value shall be specified specifically for the application.

4.5.2

Example topic:

DAI/MBP/I/XZP/JSON/0/SPPA/0100/M010910100018999OP0040NC01CT010/NC/840DSL/AXI
S/V1/MOVEMENT

Version

14

2.0

Page

Last revised 5.3.2020

File: Appendix 44 - Guideline MQTT Client v2.0.docx

Example payload:

{"msg_timestamp":"2020-01-21T14:39:12:321Z", content:

```
[{  
    "timestamp":"2020-01-21T14:38:52:765Z",  
    "x-pos":123.456,  
    "y-pos":123.123,  
    "z-pos":53.321,  
    "a-pos":0.000,  
    "b-pos":180.000,  
    "x-vel":123.456,  
    "y-vel":123.123,  
    "z-vel":...,  
    "a-vel":...,  
    "b-vel":...,  
    "x-cur":1.234,  
    "y-cur":4.321,  
    "z-cur":...,  
    "a-cur":...,  
    "b-cur":...,  
},  
{  
    "timestamp":"2020-01-21T14:38:52:841Z",  
    "x-pos":123.456,  
    "y-pos":123.123,  
    "z-pos":53.321,
```

```
...
},
{
    "timestamp": "...",
...
4.5.3        },
4.5.4  ...]
}
```



Topic:

Connecting Machines in the Context of IIoT

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Industry 4.0

Edge Device - Hardware Preparation

Two variants of an edge device connection prerequisite shall be analyzed for future extensions in the context of I4.0. Variant 1 refers to connection in the switchgear cabinet. Variant 2 refers to connection in a compact external installation space. Which variant is to be implemented shall be coordinated with the Daimler representative.

The variants are explained in the following sections.

Internal Switchgear Cabinet

In the specific plant, a reserved space shall be planned next to the machine firewall or the company network connection in the switchgear cabinet (shall be coordinated with the Daimler representative). The reserved space should have dimensions (W x H x D) of 200 x 180 x 150 mm (top view of the edge device) and the edge device should be mounted on a top hat rail. The following requirements shall additionally be ensured:

X Z

- 4 terminals each for the power supply (24 VDC & GND) upstream of the main switch incl. a 6 A prefuse
- The edge device's output of 28 W shall be included in the machine's thermal calculation
- Reserve 2 free ports in the company network connection or on the machine firewall (plant-specific - this shall be coordinated with the Daimler representative)
- Reserve 2 free ports in the internal machine network to the NCU (X120 with 840D Solution Line)

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External Compact Installation Space

The interior shall be designed in such a way that no EUP (person instructed in electrical engineering) qualification is necessary to open it. The installation space shall be easy to open.

Y Z

In the installation space, 24 V shall be applied to terminal strips. The fuses shall be dimensioned for an installed load of 50 W.

The dimensions of the edge component installed by Daimler are:

(W x H x D) 200 x 180 x 150 mm

A corresponding top hat rail for the installed components shall be available in the installation space.

The following requirements shall additionally be ensured:

- Cable gland for Daimler patch cable for the factory network connection
- A switch port for the internal Profinet (X120 switch with 840D Solution Line/switch with the PLC CPU port in the case of PLC machines) shall be routed out to an RJ 45 port on the top hat rail in the installation space
- The configuration of the port on the managed switch shall be coordinated with the client
- The number and configuration of the installation space shall be defined in the context of project handling. The price for 1 unit shall be shown in the bid.

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Edge Device - Software Extension

The following points shall be fulfilled to ensure uniform data connectivity:

Alarm Texts:

- Release (read authorization) of the HMI drive on which the alarm texts are stored. The release should be set up under the name "edgedrv" for the Siemens standard user "AUDUSER".
- A file called "Edge_Connect.txt" shall be created in the drive's master directory. The inventory number (e.g. inventory=J810815) of the machine shall be specified in the first line and the complete path of the alarm text directory shall be specified in the second line (e.g. path= D:\Siemens\OEM\Alarms).

X Y Z

Edge Connect Data Block:

- The appendix contains an edge connect data block (as a PDF & ZIP file). This should be cyclically filled with the necessary values by the machine manufacturer's PLC program.

X Y Z

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