



The safe choice – Selection of operation mode with EKS up to PL e

EUCHNER
More than safety.

Tampering with safety guards is prohibited

Without suitable operation mode, safety guards (e.g. safety doors) on many machines and installations still must be tampered with by bypassing for maintenance and servicing work.

Providing selection of operation mode allows the operator to select the required operation mode (e.g. setup mode) and activate the suitable safety guard (e.g. enabling switch).

The Electronic-Key-System EKS is ideal for convenient selection of operation mode in full compliance with laws.



Requirements of laws and standards in machine building

In order to use selection of operation mode in compliance with laws and standards, the following requirements must be met:

► Access to use an operation mode selector switch must be restricted to certain categories of people

The Machinery Directive requires the use of dangerous machine functions to be restricted to certain categories of people. The operation mode selector switch must be lockable for this reason. A password or a key-operated rotary switch is only marginally suitable. Passwords could be disclosed to others or keys could be left inserted.

► Selection of operation mode must fulfill a Performance Level

Many standards now require selection of operation mode to fulfill at least PL c according to EN ISO 13849-1.

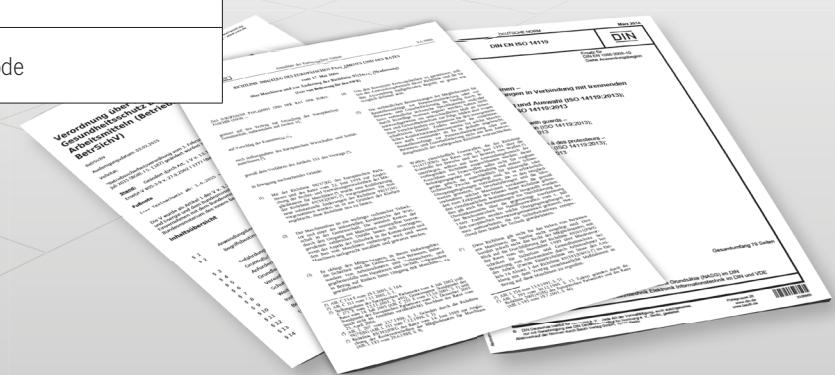
There are certainly better solutions than fulfilling a PL only with a password.

► Suitable safety guards must be in place for all work required on a machine

In accordance with the risk assessment, an appropriate safety guard must be used for all work required on a machine. Special servicing work also requires the best possible protection for the personnel. Even in this case, bypassing safety guards is impermissible. Not just the Machinery Directive but also the Occupational Health and Safety requirements must be fulfilled by both the machine manufacturer and the user in this case.

Mode of safe operation (MSO)	Symbol	Meaning
MSO 0		Manual mode
MSO 1		Automatic mode
MSO 2		Setup mode
MSO 3		Automatic with manual intervention
MSO SE		Service mode

Example for operating modes from EN ISO 16090
(Safety of milling machines)

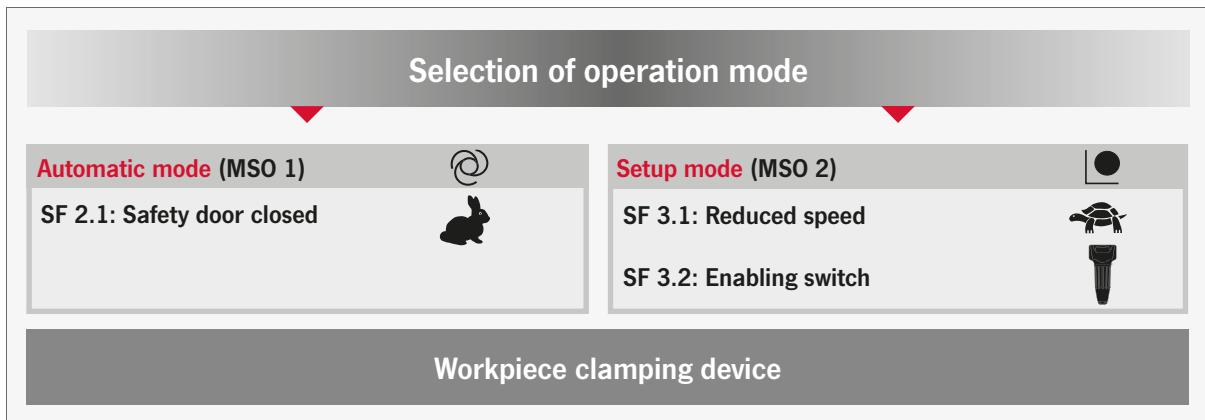


How safe does selection of operation mode have to be?

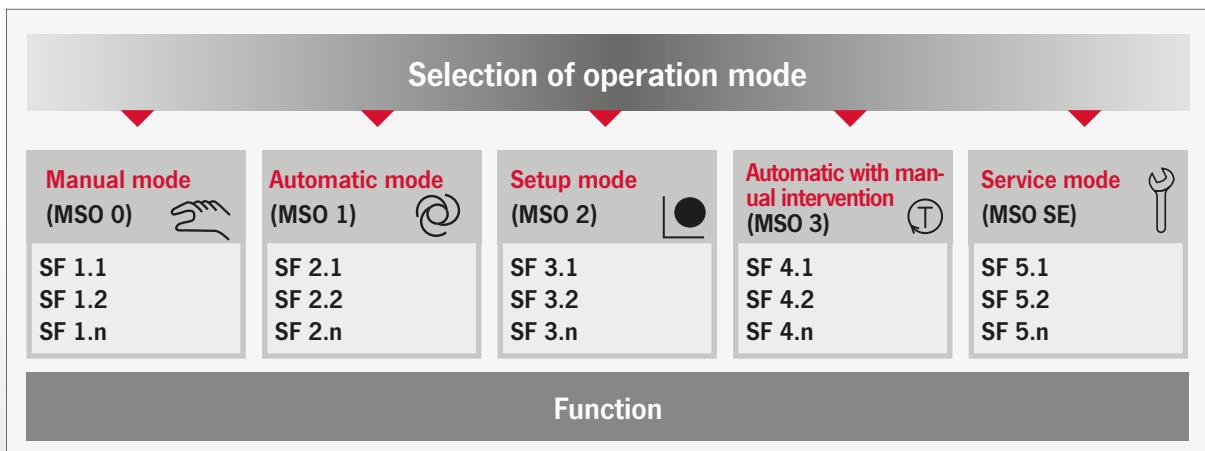
Each mode of safe operation (MSO) has one or more safety functions (SF) intended to protect the operator while working. In automatic mode, for example, a closed safety door prevents the operator from being endangered by the running machine. In "setup" mode, the operator works with the safety door open. The safety function is no longer "safety door closed" in this case, but instead the use of an enabling device in combination with reduced speed, for example.

Changing the operation mode selector switches from one safeguard to another one. Improper switchover can endanger the operator, so selection of operation mode must fulfill a Performance Level according to EN ISO 13849-1 corresponding to the risk assessment of the machine/installation.

Example of selection of operation mode



Overview of selection of operation mode



Selection of operation mode up to PL d with controls

Operating panels have proven their worth over many years of practical use on machines and installations. If an additional operation mode, such as Service mode, is to be added to such machines, it is usually expedient to realize selection of operation mode with controls.

Technical implementation is particularly easy in this case. The EKS with data interface or the EKS Light is used as the access system in order to restrict access to certain categories of people as required in the Machinery Directive. The controls are released with the authorization stored on the EKS Electronic-Key. For example, these controls flash depending on the content of the Electronic-Key. This can be realized with the standard PLC, because access to selection of operation mode does not have to fulfill any PL.

Controls are used to achieve a PL for selection and activation of an operation mode. Practical examples of how operating mode selection can be implemented with EKS Light can be found in the download area at <https://www.euchner.de/en-us/Service/Downloads/Applications/EKS>. Signals are read in the safe control system, and the selected operation mode is signaled by continuous illumination of the control, for example. The machine simultaneously switches to the new operation mode.

Selection of operation mode up to PL e via touch panel

Modern touch panels are increasingly being used in the HMI of machines and installations. Simple, intuitive operation facilitates and improves daily work for the operator. Touchscreens also permit the integration of many functions, which can be represented in a customer-specific manner. As a touchscreen offers many new options, the next logical step is to select a machine's operation mode exclusively via the touchscreen as well. This will eliminate the need for additional mechanical controls.

This was previously not possible due to the lack of suitable systems.

This has now changed. Using the EKS FSA, it was for the first time possible to develop a procedure permitting selection of operation mode on a touch panel without additional mechanical controls. With this method the touchscreen meets all requirements from the risk assessment for a Performance Level (PL_r).

The procedure was approved by the Institute for Occupational Safety and Health of the German Social Accident Insurance (Institut für Arbeitsschutz, IFA). This institute confirms that selection of operation mode with a touchscreen is possible up to PL e according to EN ISO 13849-1. This requires using the EKS FSA in combination with suitable software in the failsafe PLC. The procedure also allows so-called softkeys to be used instead of a touchscreen, also up to PL e.



The EKS System

The Electronic-Key-System EKS consists of a read station and at least one Electronic-Key. The Electronic-Key contains a writable memory. Two different EKS systems are available: the EKS with data interface and the EKS *Light*.

EKS with data interface

The EKS with data interface features an Electronic-Key with freely programmable memory. With this EKS, applications such as access to control systems/operating parameters and entry of an expiration date, etc., can be realized in addition to selection of operation mode. The Electronic-Key data are transmitted from the read station to the control system via the data interface (e.g. PROFINET, PROFIBUS, USB, Ethernet TCP/IP).



Compact (left) and modular (right) EKS systems are available

EKS *Light*

The EKS *Light* has five outputs, and the Electronic-Key is evaluated directly in the device. As the evaluation is integrated, the EKS *Light* can perform only a single function such as controlling access to selection of operation mode. The outputs are connected directly to the control system or, if necessary, also to the safety control.

EKS FSA / EKS *Light* FSA

The EKS systems are also differentiated by the *FSA* (*For Safety Applications*) option, which is available both for the EKS with data interface and for EKS *Light*. *FSA* devices have a second channel, which is generally available in the form of an additional output. This output is always evaluated for safety purposes.

Selecting the right EKS system for your application	EKS with data interface	EKS FSA with data interface	EKS <i>Light</i>	EKS <i>Light</i> FSA
Selection of operation mode with controls	●	○	●	○
Selection of operation mode with touch panel or softkeys	–	●	–	●
High copy protection level of the Electronic-Keys	●	●	●	●
Additional functions (access control to parameters, of persons, of other installations, etc.)	●	●	–	–

● = suitable, ○ = suitable, but not recommended, – = not possible

EKS makes selection of operation mode even safer

The EKS *FSA* offers additional options for improving selection of operation mode and making it safer.

► Personalization of each EKS Electronic-Key

EKS Electronic-Keys can be allocated individually to persons. Responsibility is thereby visibly transferred to the Electronic-Key holder, effectively preventing Electronic-Keys from being passed along or left inserted.

► Effective Electronic-Key management

Unlike passwords or conventional keys, EKS Electronic-Keys cannot be easily copied. With EKS, you always retain an overview of your group of users. If a key should be lost, it can be blocked. This keeps you in control of the Electronic-Keys.

► Access management through individual storage of authorizations

On many installations there are particularly dangerous tasks that can be performed only with open safety doors and, in some cases, only at full speed. Persons must be specially trained to perform these tasks. The EKS with data interface offers the option of storing verification of training on the Electronic-Key. The dangerous work can then be performed only with valid verification.

TIP!

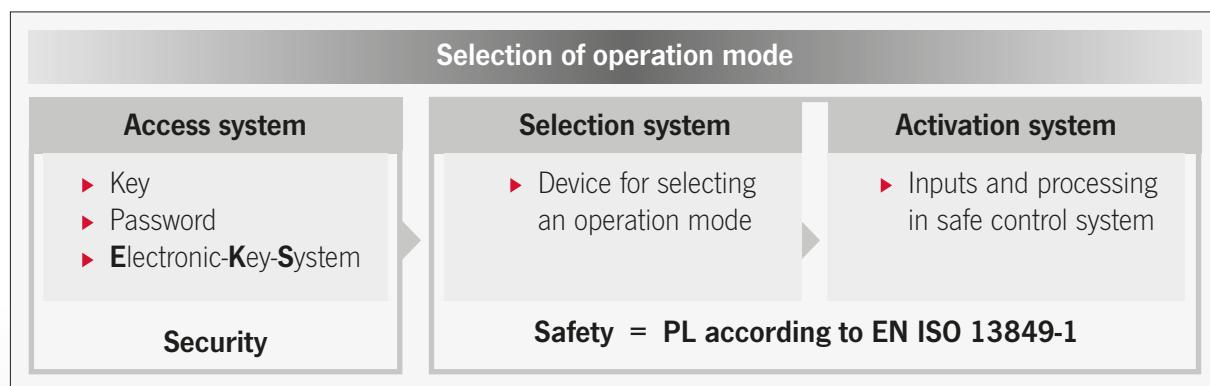
More safety through training

Train your customers about how to perform dangerous work on the machine. Thereby give them the opportunity to operate the machine safely. If required, the training date or only general verification of training can be noted on the Electronic-Key using the EKS with data interface. With this training, you and your customers can be confident of doing everything right and meeting all legal requirements. Simply holding the Electronic-Key constitutes verification of training.

Evaluation of the Performance Level (PL) of selection of operation mode

Assessment of the safety engineering of an operation mode selector switch according to EN ISO 13849-1 was defined in various standardization committees, and the procedure was defined. Selection of operation mode was subdivided into three systems:

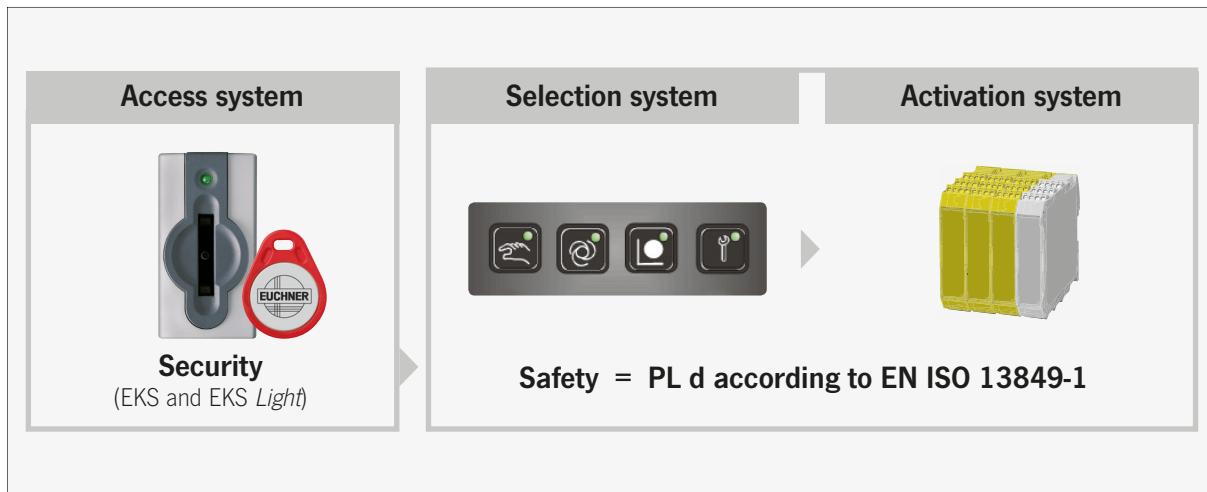
- ▶ **Access system**
- ▶ **Selection system**
- ▶ **Activation system**



The access system does not have to be implemented according to EN ISO 13849-1. It is not possible to determine a PL for the monitoring of an authorization. By contrast, the selection system and the safe control system of a machine must fulfill the required PL. This is very simple for mechanical controls or key-operated rotary switches.

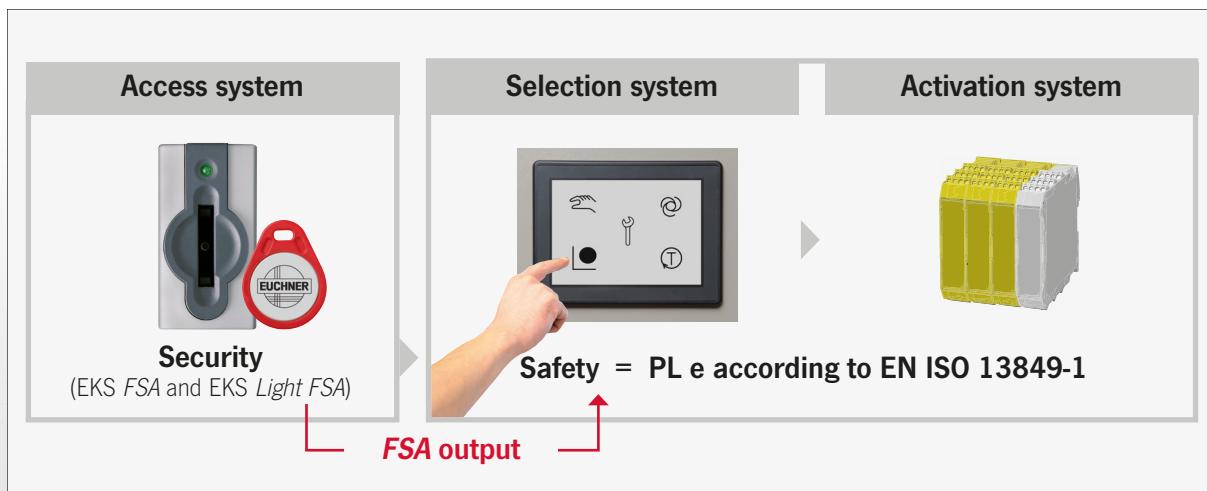
Selection of operation mode with controls

If controls are used for selection of operation mode, the question arises as to whether the B_{10d} value required for determining a PL is provided by the manufacturer. This is rarely the case. However, Table D.2 in BGIA Report 2/2008, which is available through the German Social Accident Insurance (DGUV), indicates that 1,000,000 cycles can be assumed as the B_{10d} value for position switches and controls if the electrical load is < 10% of the maximum load. This will provide all of the required values, and a PL can be determined.

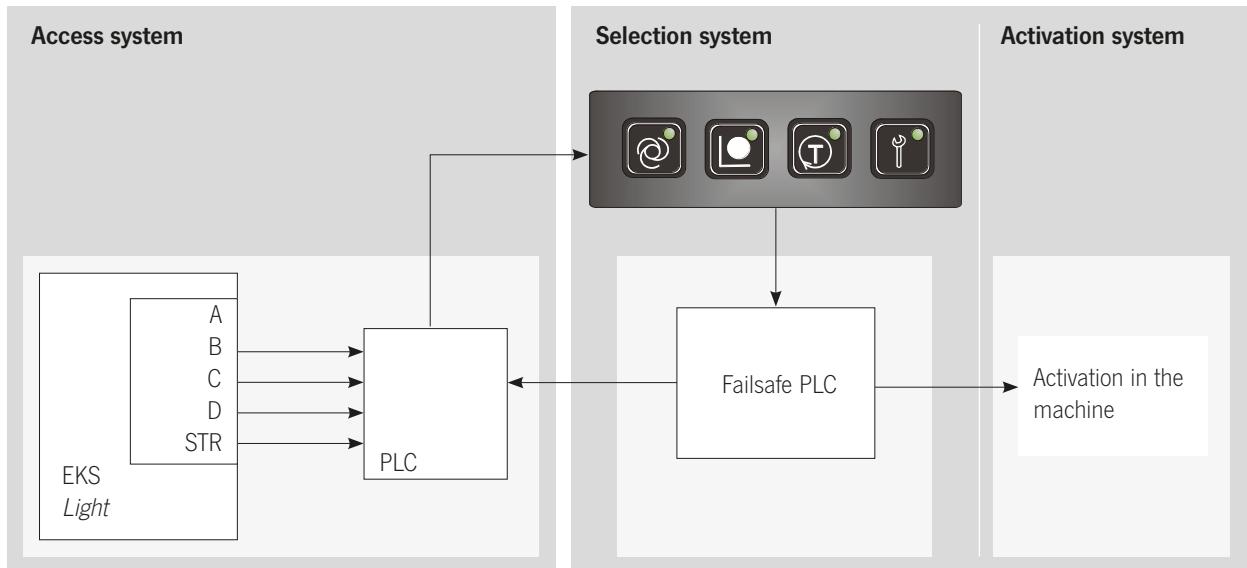


Selection of operation mode with touch panel

PL calculation is more difficult if a touchscreen is to be used as the selection system, because a touchscreen does not represent a safe selection system and there are no available values for the PL calculation. An entirely new procedure from EUCHNER now permits selection of operation mode to be realized up to PL e via a touchscreen.



Selection of safe operation mode with controls and EKS *Light*

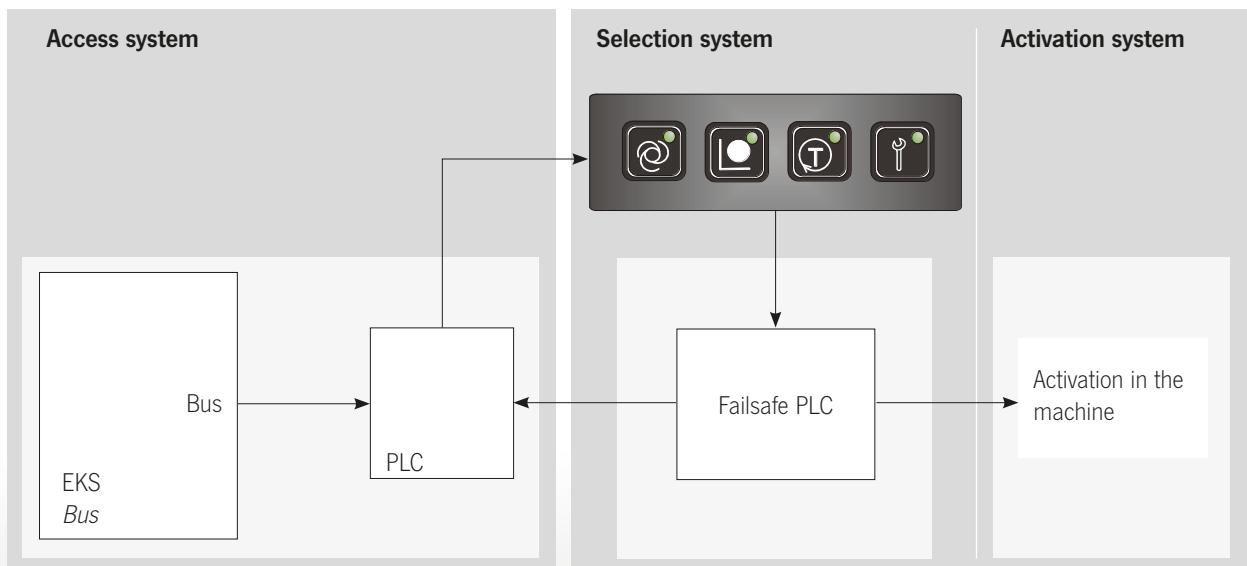


Implementation requires:

- ▶ EKS *Light*
- ▶ Safe control system
- ▶ Standard PLC or NC control system
- ▶ Illuminated controls
- ▶ EUCHNER application AP000225

PL d

Selection of safe operation mode with controls and EKS with data interface

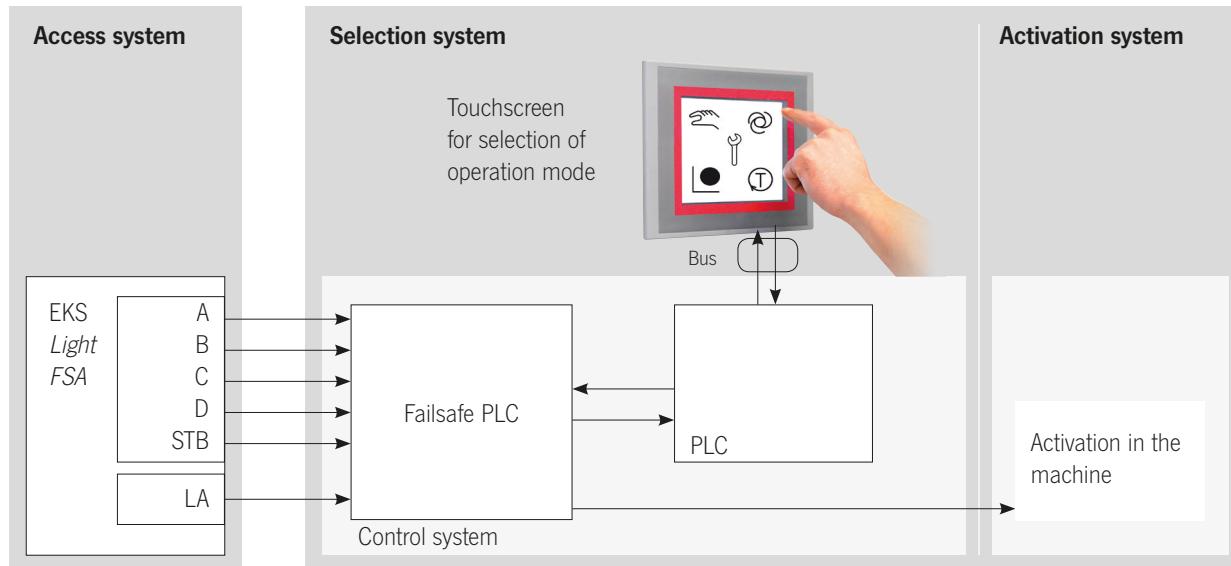


Implementation requires:

- ▶ EKS with PROFIBUS, PROFINET, USB or Ethernet TCP/IP
- ▶ Safe control system
- ▶ Standard PLC or NC control system
- ▶ Illuminated controls
- ▶ EUCHNER application AP000234

PL d

Selection of safe operation mode with touchscreen and EKS *Light FSA*

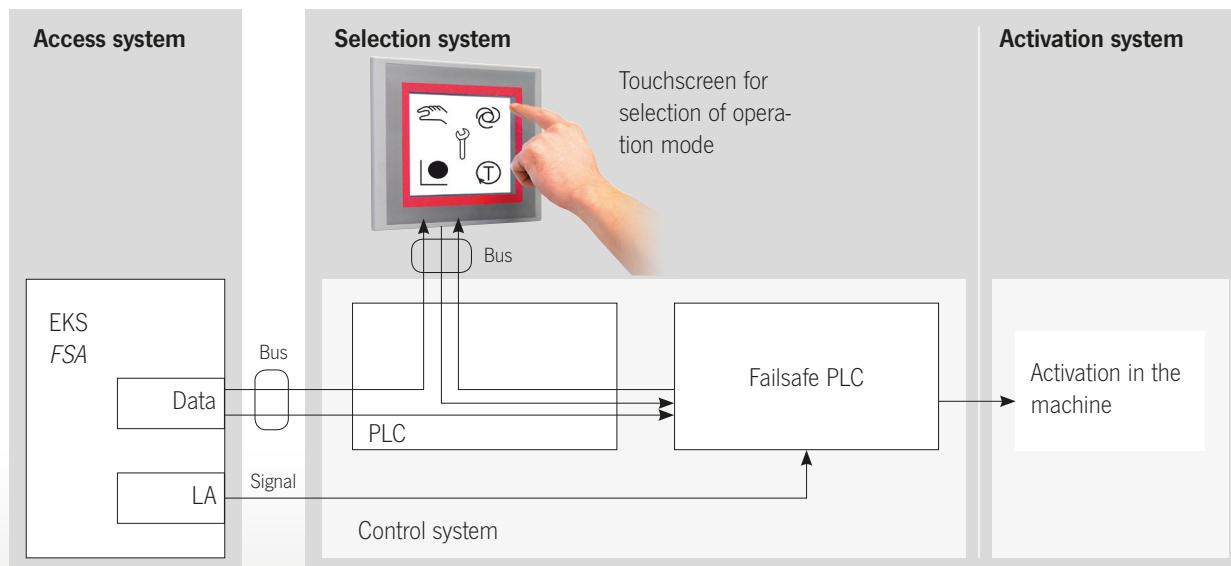


Implementation requires:

- ▶ EKS *Light FSA*
- ▶ Safe control system
- ▶ Standard PLC or NC control system
- ▶ Touchscreen
- ▶ EUCHNER application AP000200
- ▶ IFA research report

PL e

Selection of safe operation mode with touchscreen and EKS *FSA* with data interface



Implementation requires:

- ▶ EKS *FSA* with PROFIBUS, PROFINET, USB or Ethernet TCP/IP
- ▶ Safe control system
- ▶ Standard PLC or NC control system
- ▶ Touchscreen
- ▶ EUCHNER application AP000169
- ▶ IFA research report

PL e

Your checklist for selection of operation mode

	Yes	No
→ Is it possible to set up the machine without tampering with safeguard, thereby complying with all Occupational Health and Safety requirements?		
→ Can your customer perform all servicing work on the machine without bypassing safety guards?		
→ Is your customer sufficiently trained to perform all work on the machine without major hazard and can thereby complying with all Occupational Health and Safety requirements?		
→ Can organizational verification of the necessary training for hazardous work be maintained?		
→ Has the requirement in the Machinery Directive that foreseeable misuse of the machine must be prevented been met?		
→ Has the requirement in the Machinery Directive that only trained specialists are to be allowed access to selection of operation mode been met?		
→ Is access to selection of operation mode protected against copying and unauthorized passing along?		
→ Does selection of operation mode fulfill the PL _r from the risk assessment?		

If all questions can be answered with “YES”, the requirements of the Machinery Directive and the Occupational Health and Safety requirements have been met.

Notice: The checklist is for information purposes only and does not claim to be complete

Further information

For detailed information about the various EKS systems and the accessories, please refer to the product catalogs or visit our homepage at www.euchner.com.



Product information

Detailed product information about our EKS systems and the EKM and EKM *Light* software for convenient Electronic-Key administration can be found at

 <http://www.euchner.de/en-us/Products/Electronic-Key-System-EKS>



Applications

The complete AP000169, AP000200 and AP000225 applications, as well as the respective certificates from the Institute for Occupational Safety and Health of the German Social Accident Insurance (Institut für Arbeitsschutz, IFA), can be found in the download area at



Catalogs and flyers

EKS catalogs and flyers can be found at

 <http://www.euchner.de/en-us/Service/Downloads>



Your advantages when using EKS for selection of operation mode

- ▶ Consistent machine operating concept, including selection of operation mode
- ▶ Fulfils all specifications of the Machinery Directive
- ▶ Safe working according to the Occupational Health and Safety requirements can be realized

... with controls

- ▶ Can be incorporated into existing control panels
- ▶ Fulfils PL d according to EN ISO 13849-1
- ▶ IFA-tested procedure

... with touch panel

- ▶ No additional controls next to the touchscreen required
- ▶ Fulfils PL e according to EN ISO 13849-1
- ▶ IFA-tested procedure

Your advantages when using EKS systems

... with data interface

- ▶ Additional access controls can be programmed, e.g. access to control systems or operating parameters
- ▶ Simple integration into existing bus structures
- ▶ Training measures can be stored on the Electronic-Key
- ▶ A validity expiration date can be stored
- ▶ Lost Electronic-Keys can be blocked
- ▶ Various interfaces are available:
 - PROFINET
 - PROFIBUS
 - USB
 - Ethernet TCP/IP

... EKS *Light*

- ▶ No bus system required
- ▶ Simple wiring to the control system
- ▶ Electronic-Key evaluation takes place in the EKS *Light*

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