Motors | Automation | Energy | Transmission & Distribution | Coatings

Safe Brake Control

EBC500

Safety User Manual

Language: English

Information about this manual

General information

NOTE!

In industry, the terms “Inverter”, “Regulator” and “Drive” are sometimes interchanged. In this document, the terms “Drive” and "Inverter" will be used.

WARNING!

A copy of this manual shall be near the device, or in any case easily available to the operator.

Before using the product, read the safety instruction section carefully. Keep the manual in a safe place and available to engineering and installation personnel during the product functioning period.

WEG Automation Europe S.r.l. has the right to modify products, data and dimensions without notice. The data can only be used for the product description and they can not be understood as legally stated properties.

Thank you for choosing this WEG product.

We will be glad to receive any possible information which could help us improving this manual. The e-mail address is the following: techdoc@weg.net

Table of Contents

1 - Introduction

EBC is an electronic device purposely developed to manage lift brake system. EBC replaces a series of components normally used to actuate the motor brakes:

- Brake contactors
- Rectifier circuit
- Transformer

As such it sports many features as described in EBC500 User Manual. Some EBC features are:

- Brake current measurement
- Power economizer
- Brake self-test
- Brake feedback inputs

One of the EBC feature is the implementation of functional safety Safe Brake Control (SBC).

The whole safety related parts must be designed, connected and assembled to work properly in normal and misused cases. Usage must be trouble-free and reach of safe state shall be the default condition.

SBC was develop consistently with these requirements: the whole safety related part was analyzed by means of FMEDA, Reliability Block Diagram (RBD) and other state of the art techniques.

The purpose of the document is to inform and instruct users about the purpose of safe applications including following topics:

- Functional specification (description, fault reaction, application conditions, etc.)
- Safety Integrity Level (SIL) and PFH
- Definition of the environmental and operating conditions
- Indication of any constraints (mission profile, any testing, limits, etc.)
- The act of installing and commissioning guidance (settings and parameterization included)
- Operation and maintenance procedures, configuration, special tools to be used (if any)
- Any actions necessary to prevent an unsafe state and/or reduce the consequences of a hazard (hazardous event).

2 - Definitions

Diagnostic Test	Test intended to detect faults and/or failures and produce specific output information or activity when they are detected.
Fault tolerance	Ability of a functional unit to continue to perform a required function in the presence of faults or errors. A hardware fault tolerance of N means that N+1 is the minimum number of faults that could cause *a loss of the safety function*.
Integrator	A person or a company (final User) that puts together pieces/devices of equipment to form a complete system.
Hazard	Potential source of harm (physical injury or damage to the health of people or damage to property or the environment).
Mission Profile	Definition of the loads and stresses acting on the product in actual use (changes in temperature, temperature profile, vibration and working of electrical and mechanical fields, other environmental factors, etc.)
Recommendation	A suggestion or proposal as to the best course of action.

2.1 Symbols used in the manual

WARNING!

Indicates a procedure, condition, or statement that, if not strictly observed, could result in personal injury or death.

CAUTION!

Indicates a procedure, condition, or statement that, if not strictly observed, could result in damage to or destruction of equipment.

ATTENTION!

Indicates a procedure, condition, or statement that should be strictly followed in order to optimize these applications.

NOTE!

Indicates an essential or important procedure, condition, or statement.

3 - Reference documents

This safety user manual, the standards and rules are applicable for EBC500 used with ADL550 products belonging to ADL500 family.

3.1 Safety standards

EN 81-20

Safety rules for the construction and installation of lifts – Lifts for the transport of persons and good – Passenger and goods passenger lifts

EN 81-50

Safety rules for the construction and installation of lifts – Examinations and tests – Design rules, calculations, examinations and tests of lift components

IEC 61508

Functional safety of electrical/electronic/programmable electronic safety-related systems

EN 50178

Electronic equipment for use in power installations

NOTE!

Main safety standards are EN 81-20 and EN 81-50.
IEC 61508 is used as basic rules as for as is called into EN 81-20 and EN 81-50.

3.2 Related products and documents

- **ADL500, Quick start up guide,** Specification and installation
- **ADL500 User Manual,** Functions description and parameters list
- **EBC500 User Manual,** Safe Brake Control

4 - Acronyms

Acronym	Definition
BRK	Brake
CAN	Controller Area Network
CMD	Command
CPU	Central Processing Unit
EBC	Electronic Brake Control
ECU	Elevator control Unit
EMC	Electro-Magnetic Compability
EN	Enable
FBK	Feedback
FMEDA	Failure Mode Effect and Diagnostic Analysis
HFT	Hardware Fault Tolerance
HW	Hardware
kPa	kiloPascal
LBR	Local Brake
LED	Light Emitting Diode
MooN	M out of N
MOS	Metal Oxide Semiconductor
PFH	Average frequency of a dangerous failure per hour
PWR	Power
SBC	Safe Bake Control
SCR	Silicon Controlled rectifier
SFTY	Safety
SIL	Safety Integrity Level
STO	Safe Torque Off
TB	Terminal Block

5 - Safety Function

EBC500 implements a Safe Brake Control (SBC) with direct electrical control and connection of a safety brake for lift system. SBC function actuates brakes in a safety manner when safe inputs SBC1 and SBC2 and open.

There are no other safety functions implemented onto EBC500 device.

EBC - SBC function is a Safety function according to Lifts Directive Annex III point 6 being used to control directly the safety brakes. Device provides same safety as double contactor solution as currently used in lift application.

EBC - SBC function is a safety related function certified according to applicable standards EN 81-20 and EN 81-50.

SBC safety features:

- SIL is equal to 3 when both safety inputs are disabled.
- SBC safety function is implemented by two independent safety channels to ensure the safety intervention even in case of single channel fault and a diagnostic check to detect and signal a fault on the safety functions intervention. Hardware Fault tolerance, HFT=1. Architecture of the safety functions is 1oo2.
- PFH value is lower than 1,5E-08 [1/h] (15% of the maximum allowed value for SIL3).
- EBC mission time is 20 years.

5.1 Responsibility

The **User/Operator** is responsible for safety concerning application and use.

5.2 Safety Standard adherence

SBC integrated safety function meets the following standard requirements:
Safety integrity level SIL3 according to **EN 81-20 / EN 81-50** and **IEC 61508**.

6 - Safe Brake Control description

“Safe Brake Control” (SBC) is a safety function used to break off power and current output onto the motor brakes to prevent cabin undue movements.

Safety brake in lift systems are safety means installed onto electrical motors featuring double redundant brake units (calipers). When brake is depowered both brake units are closed. Even when one of the brakes is closed (depowered) brake performs its action and is capable of blocking the motor and preventing dangerous conditions.

Safe Brake Control (SBC) function assures that in case of disabling input signals SBC1 and SBC2 the device outputs BRK1 and BRK2 are disabled and no current/power is supplied to the Brakes (safe state).

SBC functionality is normally implemented by means of contactors actuating motor brakes: when SBC is operated a safe break off of power on brakes is activated and a safe cabin stop is obtained. EBC500 works in conjunction with ADL550 family and supports SBC function being capable of directly actuating motor brakes. EBC, thanks to SBC function replaces brake contactors and provides more features:

- Avoids electrical stress and electromagnetic problems
- Longer lifetime
- Smart management of brakes

It shall be underlined that SBC is a safety function implemented in EBC500 whereas safety capability is implemented at system level, in the lift system.

6.1 SBC Design

Safety functionalities are better identified and described in Figure 1 which highlights the safety internal blocks (yellow) and other relevant blocks and signals:

- **S_MOS1/2: SBC** function is implemented in two separated safety channels called S_MOS1/S_MOS2 which deliver power on the BRK1/BRK2 power outputs and consequently actuates the brakes
- **OK:** A safe feedback system called OK provides a safe consistency information which reflects the status of safety channels.
- **BRIDGE:** A non-safety relevant block BRIDGE which controls the output power and voltage on the brakes.
- **CONTROL:** A non-safety control block which contains the microcontroller and the logic that controls the brakes (when SBC disabled), IOs, communication and all the other EBC functionalities.

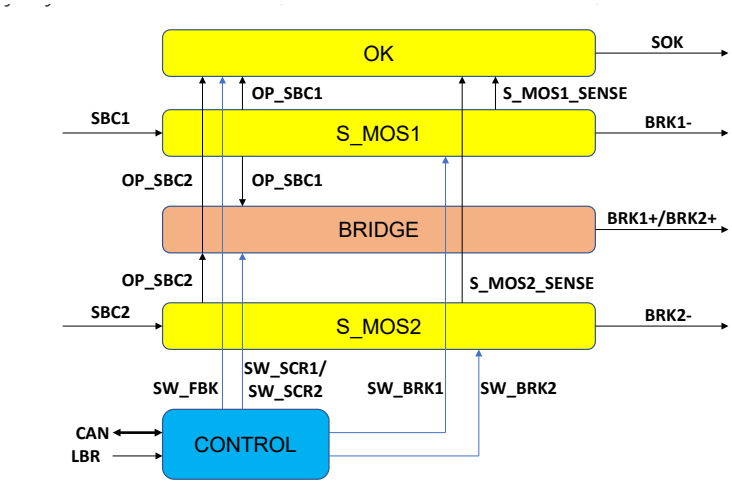


Figure 1 - SBC Architecture

SBC function is implemented in S_MOS1/2 channels as well as in OK feedback block in a purely hardware-based solution.

6.1.1 Detailed description

SBC function is internally implemented in the EBC by two independent safety channels called S_MOS1 and S_MOS2 which act on interruption of the supply to the external brake connected on BRK1/2 terminals.

Action modes of each safety channel are as follows:

- S_MOS1 interrupts the current flowing to the BRK1 output terminals turning off a dedicated solid-state switch. Action is controlled only by the SBC1 signal.
- S_MOS2 interrupts the current flowing to the BRK2 output terminal turning off a dedicated solid-state switch. Action controlled by the SBC2 signal.

The architecture of SBC function is 1oo2 (1 out of 2) because the loss of the SBC function occurs when all two channels are faulty.

OK block is used to detect a failure on SBC function. OK block monitors SBC status for failures:

- Compares input signals SBC1/2 for inconsistencies and or stuck conditions
- Verifies that S_MOS channels are disabled (no power) in case of no inputs on SBC1/2
- Monitors internal power supply

If any failure is detected SOK status will be different from the expected one.

Electro-mechanical braking (safe state condition) is executed by means of any single SBC signal: If a single SBC signal is taken low, then a single S_MOS channel is activated and SBC function is actuated. In order to have a full safe state on both channels and to be compliant with normative and safety requirements both SBC1/2 signals must be operated together and OK must be externally monitored.

6.2 SBC specification & usage

6.2.1 SBC Enablig/Disabling

SBC function is enabled (go into safe state) by means of input signals SBC1/2.

SBC signals are digital on/off signals with 24Vdc as high logic value:

- SBC is enabled by setting the SBC signals to low logic level or leaving them open.
- SBC is disabled (brakes can be open) when SBC signals are powered to 24 Vdc.

SBC1	SBC2	SBC STATUS
0V	0V	Full Safe State, BRK1 BRK2 powered off
+ 24V	0V	BRK1 is functionally off, BRK2 in safe OFF state
0V	+ 24V	BRK2 is functionally off, BRK1 in safe OFF state
+ 24V	+ 24V	SBC disabled, BRK1, BRK2 can be functionally activated

SBC signals shall be operated both at the same time, connected to safety chain so that when safety chain opens, SBC1/2 are open. When safety chain closes, SBC1/2 are power at +24Vdc.

SBC disable removes the safety means and allows EBC to fully control the brakes. EBC receives waits for specific commands from system CPU to actuate and open brakes in a functional context as shown in Figure 2, where BRK CMD stands for Brake Command from CPU.

6.2.2 SBC Feedback SOK

SOK output relay must be monitored for internal failure or SBC alarms. SOK must comply with following behavior:

- SOK is open if S_MOS1/2 channels are disabled (no power on BRK1/BRK2 outputs);
- SOK is closed if output power on both BRK1 and BRK2 outputs is activated;
- In any case SOK signal is not consistent with described conditions (ex. SBC1/2 low and SOK high) SBC is

issuing an alarm.

SBC1	SBC2	BRK1/2 Control	SOK
0V	0V	Disabled	Open
+ 24V	0V	Disabled	Locked open / open
0V	+ 24V	Disabled	Locked open / open
+ 24V	+ 24V	Disabled	Open
+ 24V	+ 24V	Enabled	Closed

Particularly it should be highlighted that following situations might occur as consequences of misuses or internal failures:

1. If one SBC gets stuck to 24V (either internally or externally) and other SBC is low for longer than 2 seconds SOK enters in a state called “locked open”: it will stay open as long as both SBC are reset to 0V at same time (see the first table below).
2. If SBC is activated and EBC identifies an internal dangerous failure on output section SOK gets closed (see the second table below)..

Following figures are describing SBC expected behavior is normal conditions as well as in case of internal failures (BRK CMD is the CPU command which shall actuate brakes open).

In case of failure in SBC input section, SOK behavior is:

SBC1	SBC2	BRK1/2 Control	SOK
0V	0V	Disabled	Open
+ 24V	0V	Disabled	Open
0V	+ 24V	Disabled	Open
+ 24V	+ 24V	Disabled	Open
+ 24V	+ 24V	Enabled	Open

In case of failure in SBC output section, SOK behavior is:

SBC1	SBC2	BRK1/2 Control	SOK
0V	0V	Disabled	Closed
+ 24V	0V	Disabled	Locked open / open
0V	+ 24V	Disabled	Locked open / open
+ 24V	+ 24V	Disabled	Open
+ 24V	+ 24V	Enabled	Closed

Normal operation:

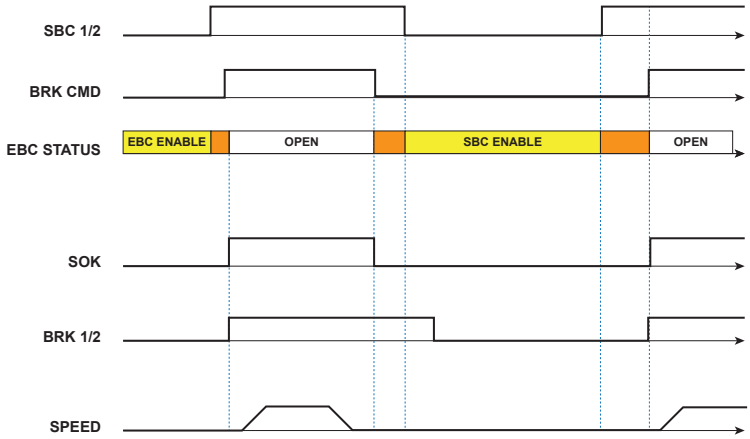


Figure 2 - SBC signals in case of normal lift sequence.

Output fail:

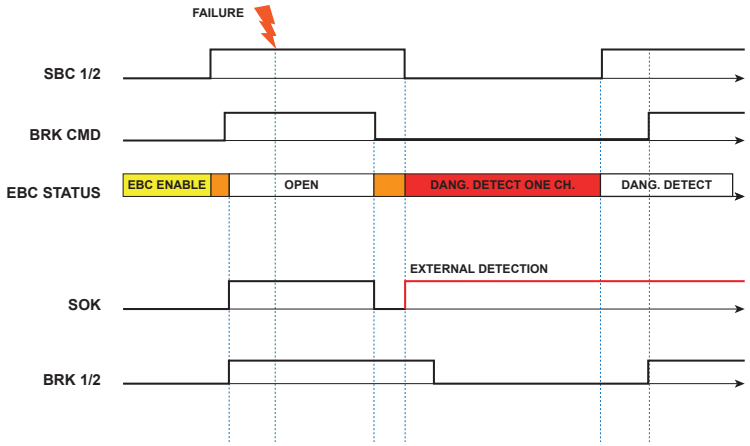


Figure 3 - SBC signals in case of output failure during lift sequence.

Input fail:

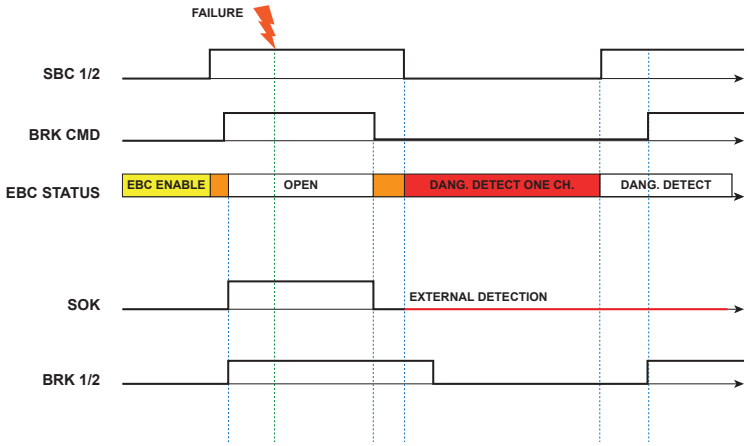


Figure 4 - SBC signals in case of input failure during lift sequence.

6.2.3 Intervention time

Switching power off on BRK1/2 outputs from the moment SBC inputs being disabled takes no longer than 50ms.

Brake closing takes usually much longer time than 50ms due to mechanical movements. Brake closing time shall be considered in the larger view of the elevator system. Tests and requirements on braking system are specified in EN81-20/50.

Figure 5 shows time diagram of brake closing. A number of delay times need to be considered for proper installation and cabin safety:

- **Td** is intervention time < 50ms
- **Tbrkd:** time for brake to get closed after current decrease
- **Tspdd:** time for cabin to stop after brake closing

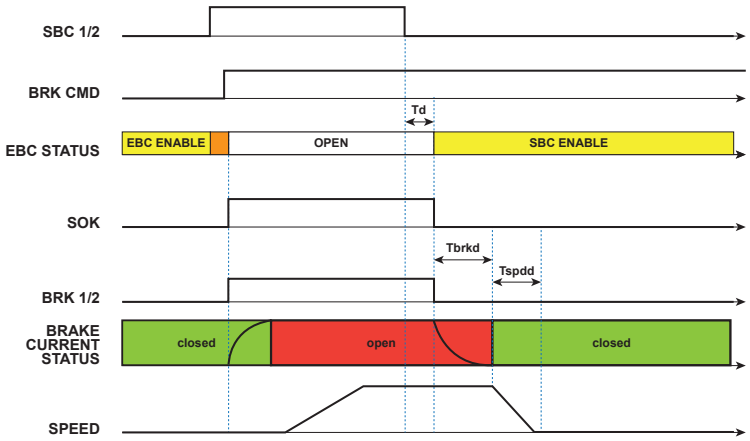


Figure 5 - Time diagram of brake closing.

6.3 EBC Operative Specification

Requirement Description
Climatic Conditions
• Operating humidity admitted: from 5% to 95% (from 1 g/m^3 to 25 g/m^3 without condensation and ice formation) • Operating temperature: from -10°C to 55°C (without current derating) • Operating atmospheric pressure admitted: from 86 kPa to 106 kPa
Installation Conditions
• Maximum installation altitude: 4000 m • Pollution level equal to 2 or less (free by direct sun ray, vibration, dust, fog, vaporous oils and water droplets; Avoid environment with high level of saltness)
EMC
• Compliance with EN12015, EN12016
IP Level
• EBC product supports IP20 protection level
Other compliance
• EN 50178:1999 Electronic equipment for use in power installations
Safety Integrity Level (SIL)
• SIL is equal to 3 for SBC only when both safety inputs are disabled
Architecture
• SBC safety function is implemented by two independent safety channels to ensure the safety intervention even in case of single channel fault and a diagnostic check to detect and signal a fault on the safety functions intervention • HFT=1 • Architecture of the safety functions is 1oo2
Demand mode
• High demand mode according to [B02]
PFH
• The PFH value is equal to 3,09 E-11 [1/h]

7 - Installation and Commissioning Guidance

Installation and commissioning shall be performed only by qualified personnel fully aware of the risks generally and specifically involved in the operations.

NOTE!

Generally speaking, installation sustaining highest integrity levels requires some basic principles:

- Both enable signals must be used with full wiring redundancy in order to sustain fault tolerance equal to 1 (this function is HFT = 1).
- All devices used to assist/monitor/actuate safety related signals shall claim a compliant safety integrity level.

WARNING!

The operator or electrical installer is responsible for correct earthing and compliance with all relevant national and local safety regulations.

WARNING!

It must be understood and accepted by the users that safety function cannot be accessed, modified or maintained outside of the condition herein described. Only authorized production facilities can access the integrated safety function in order to assure safe integrity.

7.1 SBC Input / Output

EBC is capable of replacing contactors assuring highest functional safety level.

EBC electrical symbol is shown in Figure 6.

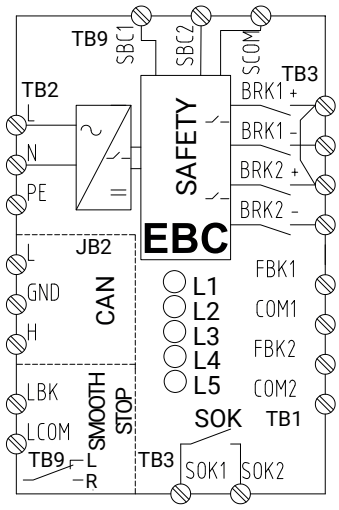


Figure 6: EBC signals and electrical diagram

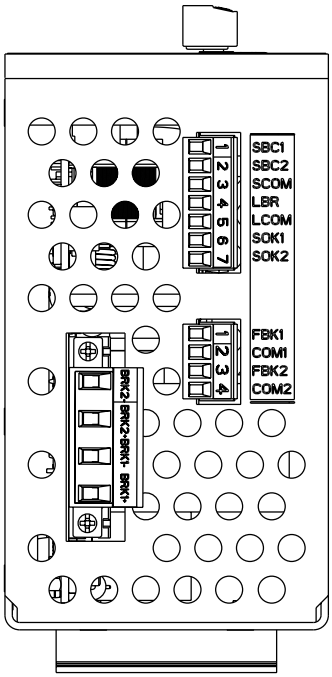
At device level EBC is a safety relevant component which actuates BRK1 and BRK2 outputs and provides a feedback signal SOK to be monitored to make sure SBC function works correctly.

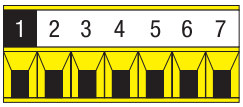
As shown in Figure 7, EBC provides many functionalities but those related to functional safety SBC are separated and independent (block labelled as Safety): at the device perimeter safety relevant signals are only the following:

- SBC1, SBC2: input for activation of SBC function
- BRK1+/-, BRK2+/-: power output for brakes
- SOK1/2: activation feedback of SBC

SBC signals (1 and 2 of TB9) are electrically opto-isolated. They have a common reference 0V on connector TB9 named SCOM.

SOK1/SOK2 outputs are electrically opto-isolated from any other signals.



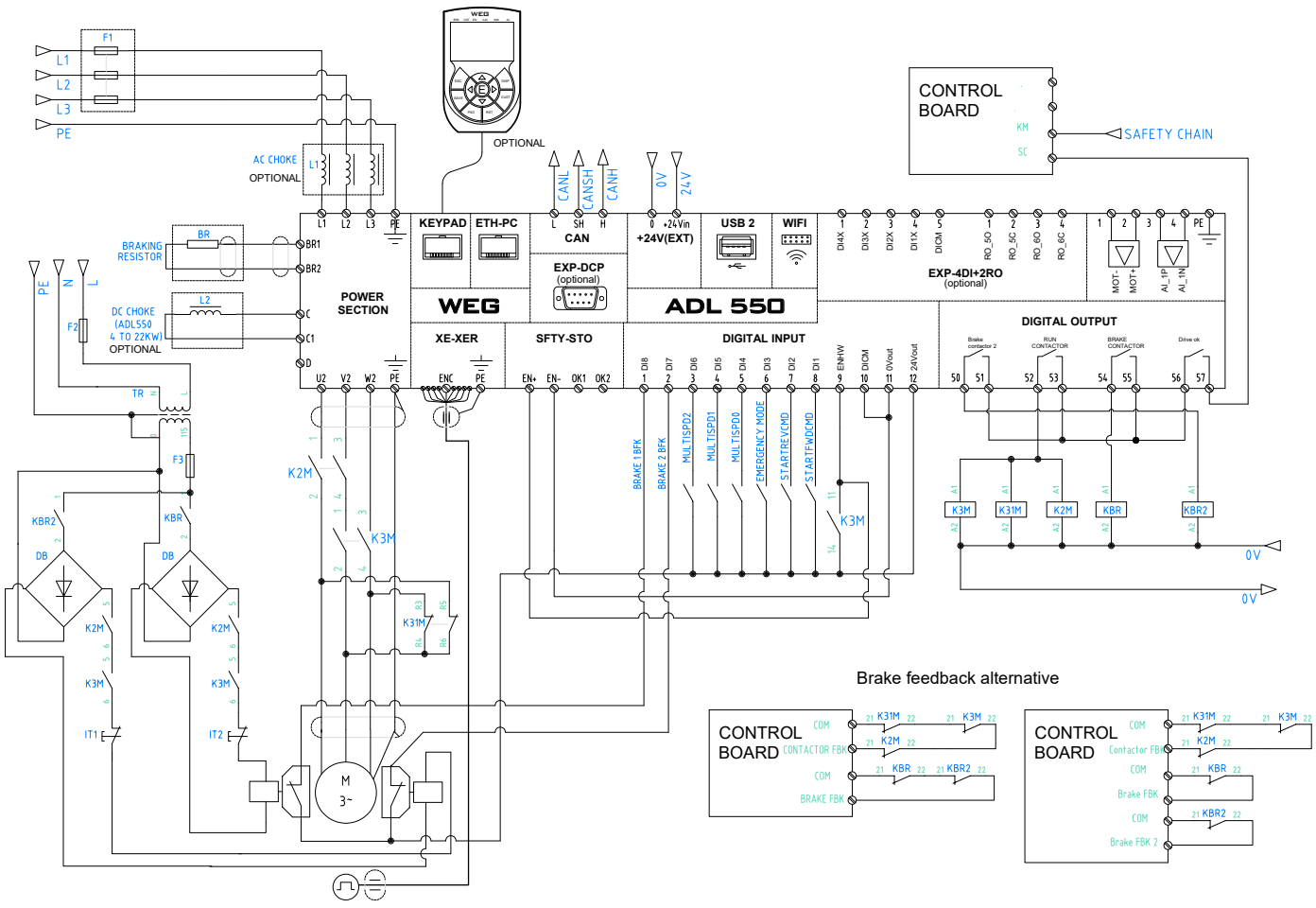


PIN	ACRONYM	DESCRIPTION
1	**SBC1**	Safety channel 1 input (+24VDC)
2	**SBC2**	Safety channel 2 input (+24VDC)
3	**SCOM**	Safety common input (+0VDC)
4	**LBR**	Input brake activation in LOCAL mode
5	**LCOM**	Input common brake activation in LOCAL mode
6	**SOK1**	SOK status output
7	**SOK2**	

7.2 SBC Connections in lift system

At system level the actuation of brake is managed according to existing standards EN 81-20/50.

At elevator system level, command brake SBC is activated under a series of conditions (ex. Opening of car doors, floor positioning, etc). All these conditions are serially connected in an electrical circuit called safety chain.



CODE	REFERENCE
K2M, K3M	Motor contactors
K31M	Motor short windings contactor
R4, K4	STO circuit safety relay, STO circuit mini contactor
KBR	Brake contactor
DB	Conventional diode bridge or power saver
TR	Transformer
IT1, IT2	Switch for brake tests

Figura 7: Diagram showing a traditional brake drive circuit using an independent power supply circuit for each of the two brake coils

When Safety Chain is open elevator shall be safe, cabin stopped and SBC enabled. Whenever safety chain is closed to allow cabin to move, SBC is disabled and brake can be open.

It is mandatory for EBC- SBC to be part of safety chain as being a safe component.

When safety chain is closed system control unit (CPU) can manage the cabin movement properly: CPU will issue specific commands to ADL500-EBC500 system to open the brakes. EBC user manual specifies which commands are to be used for EBC to open brakes once SBC is disabled.

On the other side CPU monitors/controls a number of sensors and feedbacks to make sure that correct and safe sequences are taking place within the system. Sensors and feedbacks related to brakes are:

- brake feedback switches (one for each brake unit or caliper) which opens/closes according to the brake status (open/close);
- EBC feedback SOK which confirms opening/closing of brake power circuits.

The figures below are as Lift reference design to be implemented for a Lift System according to EN 81-20 using no contactors and a safety integrated function STO SIL3 instead of two contactors. EBC will use for safety inputs SBC1 and SBC2 same safety signals used for STO.

The function STO is enabled through parameter PAR 11088 (see also STO-ADL500 reference manual).
With respect to the below prescriptions we can notice that on STO function:

1. ECU uses both ENABLE and SAFETY ENABLE signals by means of two different relays (R2M, R4) that commands in parallel mode also SBC1 and SBC2 signals.
2. ECU monitors both feedback relays: STO FBK and CONTACTORLESS OK (which is contactor a configured as Digital Input Monitor ENHW; DRIVE OK in this case is not used) and so also SCB1 and SBC2 feedback are monitored.
3. Any time Motor comes to a stop STO FBK relay and CONTACTORLESS OK shall be monitored by ECU, switch from open status to closed status. In case of unexpected relay status (STO FBK, CONTACTORLESS OK) is found ECU will not issue a restart (R2M, K4 and K3M, Emergency Failure remain open) until condition is cleared.

NOTE!

Separate wirings are necessary for fault tolerance of 1 to be supported at system level, It should be noticed that any damage to wirings can take conductors either to:

- Short circuit
- Open circuit

Any of the above cases would prevent current from flowing in conductors making STO safety function active.

NOTE!

Same design philosophy should be used for feedback conductors: current flow in wirings is the normal condition, so that any damage would issue an alarm and be easily identified.

To summarize all these:

- When SBC function is needed safety chain opens and disables both safety inputs SBC1/2;
- In safe state EBC disables output power towards brakes and changes SOK status accordingly;
- When cabin movement is needed safety chain is enabled and specific commands are sent to EBC to open brakes;
- Lift Controller monitors the EBC SOK feedback as well as brake feedbacks to check their consistency with predefined sequences.

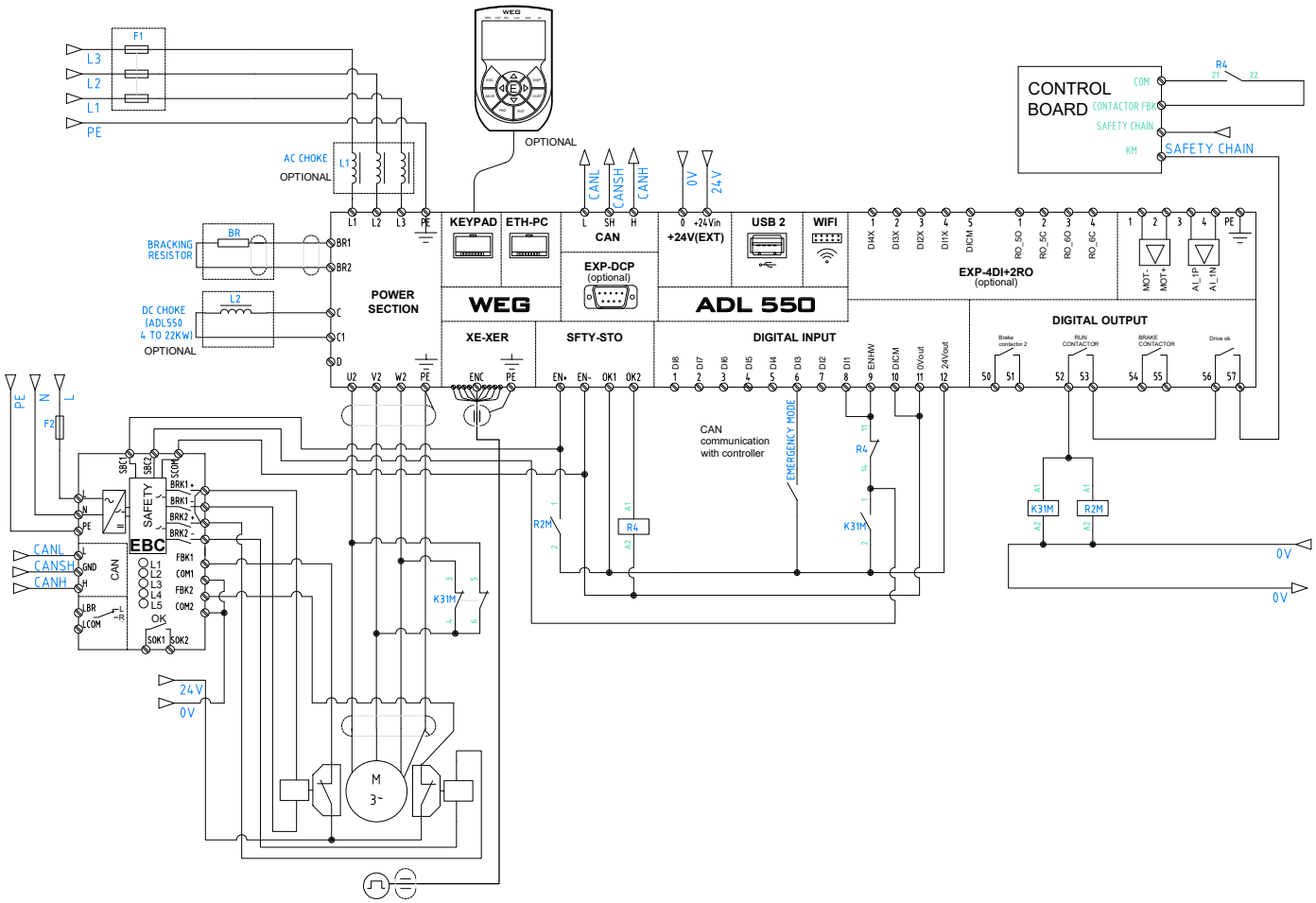


Figura 8: EBC within a lift system. Electrical diagram at system level.

7.3 SBC Management

As defined into § **"6.1 SBC Design"**, two signal inputs are provided to enable/disable SBC function into the EBC. Both inputs are controlled so that:

- SBC function is enabled (EBC output disabled) when either input SBC1 and SBC2 is not excited (voltage not applied on input)
- Both inputs will be properly excited (energized) in order to disable the SBC function and lead EBC to a normal operation.

System also provides two feedback signals, which must be used according to manual and installation guide in order to increase the safety integrity level of the system.

7.4 STO Electrical levels

SBC1 and SBC2 input signals comply with following electrical characteristics:

Nominal excitation voltage	24 Vdc
Min excitation voltage	18 Vdc
Max excitation voltage	36 Vdc
Max steady state current (25°C)	10 mA
Disabling condition	Open Circuit

Table 1 - SBC1/SBC2 Electrical levels

TERMINAL		**mm²**	**AWG**
SUPPLY	L1, N, PE	0,75 - 1,5mm²	19 - 15
SAFETY	7 ... 1	0,5 - 0,75mm²	20 - 18
UCM	4 ... 1	0,5 - 0,75mm²	20 - 18
BRK1/2	B1+, B1-, B2+, B2-	0,5 - 0,75mm²	20 - 18
CAN	H, L	0,2 ... 0,75mm²	26 ... 12
ETH	1 ... 8	Ethernet cable: category 5E shielded, maximum length 10mt.	

Table 2 - Cable cross-sections (Safety Connector)

7.5 Periodic SBC Testing

Periodic maintenance is necessary for EBC500 device to be safely operated during its lifetime period.

SBC shall be exercised by a specific test procedure at least once per year or whenever suspected failure conditions might appear.

Should test procedure fail even once, EBC device must be returned to factory for repair and analysis.

7.5.1 SBC Test Procedure

SBC function can be exercised by means of a specific working mode, “Local Mode”. Local mode operation can be selected by means of a front switch.

When Local mode is selected SBC is controlled only by signals on TB9 yellow connector:

- SBC1/2 are enabling disabling SBC function
- LBR switches on and off power on BRK1/2 outputs (when SBC is disable)

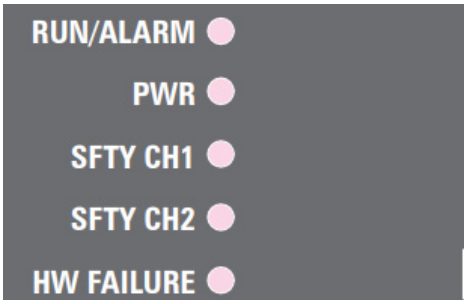
SBC function is tested by following a specific procedure.

Prior to implementing test procedure EBC500 shall be configured to open/close Brake system properly (all parameters Brake power, Brake Holding Voltage, Operation Mode, etc are configured).

1. Select local mode operation on EBC500 device.
2. Connect EBC properly: TB4 BRK1/BRK2 output to brake system. TB2 power input to mains. Allow for SBC1, SBC2, LBR to be manually powered by external 24Vdc. Allow for SOK1/2 to be electrically verified for opening and closing.
3. Power on EBC with SBC1, SBC2, LBR at 0v.
4. Verify all LEDs: RUN blinking green. PWR yellow on. SFTY CH1 SFTY CH2 yellow off. HW FAILURE off.
5. Verify SOK: open status.
6. Take SBC1 high powered at 24Vdc with respect to SCOM.
7. Verify SFTY CH1 yellow blinking slowly. Nothing else changes: BRK out off, Brakes are closed, other LEDs do not change.
8. Take LBR high powered at 24Vdc with respect to LBK.
9. Verify BRK1 powers, related brake 1 opens, related brake feedback 1 closes.
10. Verify SFTY CH1 yellow on, SFTY CH2 yellow off, SOK stays open.
11. Take SBC2 high, powered at 24Vdc with respect to SCOM.
12. Verify BRK2 powers, related brake 2 opens, related brake feedback 2 closes.
13. Verify SFTY CH1 yellow on, SFTY CH2 yellow on, SOK stays open.
14. Take SBC1 and SBC2 low, at 0v for few seconds.
15. Verify: Brakes are closed, Brake feedback are open, SFTY CH1 SFTY CH2 yellow off.
16. Take SBC1 and SBC2 high powered at 24Vdc with respect to SCOM.
17. Verify: SFTY CH1 yellow on, BRK1 powers, related brake 1 opens, related brake feedback 1 closes.
18. Verify: SFTY CH2 yellow on, BRK2 powers, related brake 2 opens, related brake feedback 2 closes.
19. Power EBC off, disconnect, test finished.

If test procedure is completed and verify steps are all successful SBC - EBC function is successfully tested.

7.6 Troubleshooting



Alarm	Cause / Solution	
EBC Fault	**Cause**	CAN communication problem with ADL550
	Solution	Following the displayed error subcode described in the QS_EBC500 manual, check the wiring, check the presence of the terminating resistors. The RUN/ALARM LED on the EBC will be flashing red
EBC Fault subcode 0x0011	**Cause**	The local/remote selector is set to Local
	Solution	This alarm occurs when the EBC's communication with the ADL is enabled but the local/ remote selector is set to local mode: move the selector to Remote mode
RUN/ALARM LED flashing red	**Cause**	Non-blocking hardware alarm internal to the EBC
	Solution	With CAN communication functioning and the EBC responding to commands, the flashing red LED indicates that there is a non-blocking hardware or software problem in the EBC
PER LED that does not light up	**Cause**	Lack of correct power supply to the EBC
	Solution	Check that power is arriving at the TB2 connector located on the top side of the EBC
SFTY CH1 slow flashing	**Cause**	The output that controls the coil of channel 1 is not powered
	Solution	This LED flashes slowly when the SBC1 and SBC2 inputs are powered and the local or remote command is not sent. If you are sure that the local or remote brake opening command has been sent then check the wiring that reaches the coil connected to output 1 to check if the circuit remains open or the coil itself has been interrupted
SFTY CH2 slow flashing	**Cause**	The output that controls the coil of channel 2 is not powered
	Solution	This LED flashes slowly when the SBC1 and SBC2 inputs are powered and the local or remote command is not sent. If you are sure that the local or remote brake opening command has been sent then check the wiring that reaches the coil connected to output 2 to check if the circuit remains open or the coil itself has been interrupted
SFTY CH1 and/or CH2 which remain off	**Cause**	One or both safety inputs SBC1 and SBC2 are not correctly powered
	Solution	Check the circuit that activates these two inputs to see why they are not being powered correctly
HW FAILURE LED lit red	**Cause**	There is a blocking hardware alarm
	Solution	The presence of a blocking hardware alarm

8 - Safety Advices

Specifications and instructions provided to support functional safety are essential part of function itself. Comprehension and knowledge are mandatory requirements for people getting involved in Installation and commissioning activities.

NOTE!

Only Qualified Personnel are allowed to execute any activities during installation and commisioning procedures.

WARNING!

All people working with or on the EBC and ADL500 device must have read the EBC and SBC safety manual and the warnings in this document. Before carrying out any work, they must be instructed in the correct handling of the device.

For the purposes of this Instruction Manual, a Qualified person is someone who is skilled to the installation, mounting, start-up and operation of the equipment and the hazards involved.

He / She should be:

- Trained in the proper care and use of protective equipment according to established safety procedures.
- Trained and authorized to energize, de-energize, clear, ground and tag circuits and equipment according to established safety procedures

Safety Manual complements and integrates instruction manuals for EBC and ADL500 drive family. It contains additional safety information complying with Lift Directive, for supporting use of safety-related functions.

Use of this function shall be possible only after this document has been carefully understood.

WARNING!

Improper installation and commissioning of safety related parts of the control system can cause an uncontrolled opening of the motor brake. This may cause death, serious injuries and significant material damage. Safety function control system shall only be installed and commissioned by qualified personnel.

Safety integrated system is not affected from operational status of the internal parts not related to safety.

Safety integrated system is not affected from operational status of the external parts not related to safety if the installation and commissioning activities are made correctly.

Procedures to check the safety function periodically according to the result of risk assessment and prescriptions in § "8.2 Maintenance" must be set-up.

SBC integrated safety function is single fault tolerant safe system. No single fault or component failure can cause the loss of safety state, causing the cabin free falling.

Wiring and connections of the system must be appropriately implemented and tested in order to support same fault tolerance at system level.

WARNING!

If some handheld radio transmitter is used closer than 20 cm, the PDS(SR) coud be disturbed.

WARNING!

For Lift applications, the ECU (Elevator Control Unit) shall use SBC safety integrated function as means to stop cabin. Two separated and independent wirings shall be used to activate/deactivate SBC1 and SBC2 signals.

WARNING!

The wiring used for SBC1 and SBC2 connections must be protected against external damage (armouring, cable ducting) and protected by means sleeve rated to 600V.

8.1 Overview SBC

European standards

Safety Rules for the construction and installation of lifts: Lifts for the transport of persons and goods	EN 81-20
Safety rules for the construction and installation of lifts: Examinations and tests	EN 81-50
Electromagnetic compatibility: Emission	EN 12015
Electromagnetic compatibility: Immunity	EN 12016

Safety Function Standards

Functional safety of electrical/electronic/programmable electronic safety-related systems	IEC 61508

Safety Performances

Safety Integrity Level (SIL)	3
Probability Dangerous Failure on Demand (High Demand)	3,08E-11 [1/h]
Hardware Fault Tolerance (HFT)	1 (1oo2)
Mission Time	20 Years

Reaction Time

Input to intervention response time	< 50 ms

9 - Description of the product code

For EBC product code composition refers to QS-EBC500 manual - code 1S9EBCEN (English language).

User Manual
Series: EBC500
Revision: 1.0
Date: 12/03/2025
Code: 1S9SBCEN

WEG Automation Europe S.r.l.
Via Giosuè Carducci, 24
21040 Gerenzano (VA) · Italy
info.motion@weg.net

Technical Assistance: technohelp@weg.net
Customer Service: salesmotion@weg.net