Claims

1. Safety arrangement of an elevator, comprising:

sensors configured to indicate functions that are critical from the viewpoint of the safety of the elevator;

an electronic supervision unit, which comprises an input for the data formed by the aforementioned sensors indicating the safety of the elevator;

c h a r a c t e r i z e d in that the safety arrangement comprises a drive device for driving the hoisting machine of the elevator;

which drive device comprises:

a DC bus;

a motor bridge connected to the DC bus for the electricity supply of the elevator motor;

which motor bridge comprises high-side and low-side switches for supplying electric power from the DC bus to the elevator motor when driving with the elevator motor, and also from the elevator motor to the DC bus when braking with the elevator motor;

a control circuit of the motor bridge, with which control circuit the operation of the motor bridge is controlled by producing control pulses in control poles of the high-side and low-side switches of the motor bridge;

an input circuit for a safety signal, which safety signal can be disconnected/connected from outside the drive device;

a drive prevention logic, which is connected to the input circuit and is configured to prevent the passage of control pulses to the control poles of the high-side and/or low-side switches of the motor bridge when the safety signal is disconnected;

a brake controller, which comprises a switch for supplying electric power to the control coil of an electromagnetic brake;

a brake control circuit, with which the operation of the brake controller is controlled by producing control pulses in the control pole of the switch of the brake controller;

a brake drop-out logic, which is connected to the input circuit and is configured to prevent passage of the control pulses to the control pole of the switch of the brake controller when the safety signal is disconnected; and

an indicator logic for forming a signal permitting startup of a run;

and in that a signal conductor of the safety signal is wired from the electronic supervision unit to the drive device;

and in that the electronic supervision unit comprises means for disconnecting/connecting the safety signal;

and in that the electronic supervision unit is arranged to bring the elevator into a state preventing a run by disconnecting the safety signal;

and in that the electronic supervision unit is arranged to remove the state preventing a run by connecting the safety signal;

and in that the indicator logic is configured to activate the signal permitting startup of a run when both the drive prevention logic and the brake drop-out logic are in a state preventing the passage of control pulses;

and in that the indicator logic is configured to disconnect the signal permitting startup of a run if at least either one of the drive prevention logic and the brake drop-out logic is in a state permitting the passage of control pulses;

and in that the drive device comprises an output for indicating the signal permitting startup of a run to the electronic supervision unit external to the drive device;

and in that the signal permitting startup of a run is conducted from the drive device to the electronic supervision unit;

and in that the electronic supervision unit is configured to read the status of the signal permitting startup of a run when the safety signal is disconnected;

and in that the electronic supervision unit is arranged to prevent a run with the elevator, if the signal permitting startup of a run does not activate when the safety signal is disconnected.

2. Safety arrangement according to claim 1, characterized in that a data transfer bus is formed between the electronic supervision unit and the drive device;

and in that one of the sensors is a pulse encoder which measures a state of motion of the elevator;

and in that the drive device comprises an input for measuring data of the pulse encoder which measures the state of motion of the elevator;

and in that the electronic supervision unit is arranged to receive measuring data from the pulse encoder via the data transfer bus between the electronic supervision unit and the drive device.

3. Safety arrangement of an elevator, comprising:

a safety circuit, which comprises mechanical safety switches fitted in series with each other, the safety switches configured to indicate functions that are critical from the viewpoint of the safety of the elevator;

characterized in that the safety arrangement comprises a drive device for driving the hoisting machine of the elevator;

which drive device comprises:

a DC bus;

a motor bridge connected to the DC bus for the electricity supply of the elevator motor;

which motor bridge comprises high-side and low-side switches for supplying electric power from the DC bus to the elevator motor when driving with the elevator motor, and also from the elevator motor to the DC bus when braking with the elevator motor;

a control circuit of the motor bridge, with which control circuit the operation of the motor bridge is controlled by producing control pulses in the control poles of the high-side and low-side switches of the motor bridge;

an input circuit for a safety signal, which safety signal can be disconnected/connected from outside the drive device;

a drive prevention logic, which is connected to the input circuit and is configured to prevent the passage of control pulses to the control poles of the high-side and/or low-side switches of the motor bridge when the safety signal is disconnected;

a brake controller, which comprises a switch for supplying electric power to the control coil of an electromagnetic brake;

a brake control circuit, with which the operation of the brake controller is controlled by producing control pulses in the control pole of the switch of the brake controller;

a brake drop-out logic, which is connected to the input circuit and is configured to prevent passage of the control pulses to the control pole of the switch of the brake controller when the safety signal is disconnected; and

an indicator logic for forming a signal permitting startup of a run;

and in that a signal conductor of the safety signal is wired from the safety circuit to the drive device;

and in that the safety circuit comprises means for disconnecting/connecting the safety signal;

and in that the safety signal is configured to be disconnected by opening the safety switch in the safety circuit;

and in that the indicator logic is configured to activate the signal permitting startup of a run when both the drive prevention logic and the brake drop-out logic are in a state preventing the passage of control pulses;

and in that the indicator logic is configured to disconnect the signal permitting startup of a run if at least either one of the drive prevention logic and the brake drop-out logic is in a state permitting the passage of control pulses;

and in that the drive device comprises an output for indicating the signal permitting startup of a run to the electronic supervision unit external to the drive device;

and in that the signal permitting startup of a run is conducted from the drive device to the electronic supervision unit;

and in that the electronic supervision unit is configured to read the status of the signal permitting startup of a run when the safety signal is disconnected;

and in that the electronic supervision unit is arranged to prevent a run with the elevator, if the signal permitting startup of a run does not activate when the safety signal is disconnected.

4. Safety arrangement according to any one of the preceding claims, characterized in that the aforementioned brake controller is connected to the DC bus;

and in that the aforementioned switch of the brake controller is configured to supply electric power from the DC bus to the control coil of an electromagnetic brake.

5. Safety arrangement according to any one of the preceding claims, characterized in that the drive prevention logic is configured to allow passage of the control pulses to the control poles of the switches of the motor bridge when the safety signal is connected.

6. Safety arrangement according to any one of the preceding claims, characterized in that the brake drop-out logic is configured to allow passage of the control pulses to the control pole of the switch of the brake controller when the safety signal is connected.

7. Safety arrangement according to any one of the preceding claims, characterized in that the signal path of the control pulses to the control poles

of the high-side and/or low-side switches of the motor bridge travels via the drive prevention logic;

and in that the electricity supply to the drive prevention logic is arranged via the signal path of the safety signal.

8. Safety arrangement according to any of the preceding claims, characterized in that the signal path of the control pulses from the control circuit of the motor bridge to the drive prevention logic is arranged via an isolator.

9. Safety arrangement according to any one of the preceding claims, characterized in that the signal path of the control pulses travels to the control pole of the switch of the brake controller travels via the brake drop-out logic;

and in that the electricity supply to the brake drop-out logic is arranged via the signal path of the safety signal.

10. Safety arrangement according to any one of the preceding claims, characterized in that the signal path of the control pulses from the brake control circuit to the brake drop-out logic is arranged via an isolator.

11. Safety arrangement according to any one of claims 8 – 10, characterized in that the aforementioned isolator is a digital isolator.

12. Safety arrangement according to any one of the preceding claims, characterized in that the drive prevention logic comprises a bipolar or multipolar signal switch, via which the control pulses travel to the control pole of a switch of the motor bridge;

and in that at least one pole of the signal switch is connected to the input circuit in such a way that the signal path of the control pulses through the signal switch breaks when the safety signal is disconnected.

13. Safety arrangement according to claim 12, characterized in that the signal switch is fitted in connection with the control pole of each high-side switch of the motor bridge and/or in connection with the control pole of each low-side switch of the motor bridge.

14. Safety arrangement according to any one of the preceding claims, characterized in that the brake drop-out logic comprises a bipolar or multipolar signal switch, via which the control pulses travel to the control pole of the switch of the brake controller;

and in that at least one pole of the signal switch is connected to the input circuit in such a way that the signal path of the control pulses through the signal switch breaks when the safety signal is disconnected.

15. Safety arrangement according to any one of claims 7 - 14, characterized in that the electricity supply occurring via the signal path of the safety signal is configured to be disconnected by disconnecting the safety signal.

16. Safety arrangement according to any one of the preceding claims, characterized in that the drive device comprises a rectifier connected between the AC electricity source and the DC bus.

17. Safety arrangement according to any one of the preceding claims, characterized in that the drive device is implemented without a single mechanical contactor.

18. Safety arrangement according to any one of the preceding claims, characterized in that the safety arrangement further comprises an emergency drive device, which is connected to the DC bus of the drive device;

and in that the emergency drive device comprises a secondary power source, via which electric power can be supplied to the DC bus during a malfunction of the primary power source of the elevator system;

and in that both the emergency drive device and the drive device are implemented without any mechanical contactors.

Claims

1. Safety arrangement of an elevator, comprising:

sensors (27, 28) configured to indicate functions that are critical from the viewpoint of the safety of the elevator;

an electronic supervision unit (20), which comprises an input for the data formed by the aforementioned sensors (27, 28) indicating the safety of the elevator;

characterized in that the safety arrangement comprises a drive device (1) for driving the hoisting machine of the elevator;

which drive device (1) comprises:

a DC bus (2A, 2B);

a motor bridge (3) connected to the DC bus for the electricity supply of the elevator motor (6);

which motor bridge (3) comprises high-side (4A) and low-side (4B) switches for supplying electric power from the DC bus (2A, 2B) to the elevator motor (6) when driving with the elevator motor (6), and also from the elevator motor (6) to the DC bus (2A, 2B) when braking with the elevator motor (6);

a control circuit (5) of the motor bridge, with which control circuit the operation of the motor bridge (3) is controlled by producing control pulses in the control poles of the high-side (4A) and low-side (4B) switches of the motor bridge;

an input circuit (12) for a safety signal (13), which safety signal (13) can be disconnected/connected from outside the drive device (1);

drive prevention logic (15), which is connected to the input circuit (12) and is configured to prevent the passage of control pulses to the control poles of the high-side (4A) and/or low-side (4B) switches of the motor bridge when the safety signal (13) is disconnected;

and in that the signal conductor of the safety signal (13) is wired from the electronic supervision unit (20) to the drive device (1);

and in that the electronic supervision unit (20) comprises means (14) for disconnecting/connecting the safety signal (13);

and in that the electronic supervision unit (20) is arranged to bring the elevator into a state preventing a run by disconnecting the safety signal (13);

and in that the electronic supervision unit (20) is arranged to remove the state preventing a run by connecting the safety signal (13).

2. Safety arrangement according to claim 1, characterized in that a data transfer bus (30) is formed between the electronic supervision unit (20) and the drive device (1);

and in that the drive device (1) comprises an input for the measuring data of a sensor (27) measuring the state of motion of the elevator;

and in that the electronic supervision unit (20) is arranged to receive measuring data from the sensor (27) measuring the state of motion of the elevator via the data transfer bus (30) between the electronic supervision unit (20) and the drive device (1).

3. Safety arrangement of an elevator, comprising:

a safety circuit (34), which comprises mechanical safety switches (28) fitted in series with each other, which safety switches (28) are configured to indicate functions that are critical from the viewpoint of the safety of the elevator;

characterized in that the safety arrangement comprises a drive device (1) for driving the hoisting machine of the elevator;

which drive device (1) comprises:

a DC bus (2A, 2B);

a motor bridge (3) connected to the DC bus for the electricity supply of the elevator motor (6);

which motor bridge (3) comprises high-side (4A) and low-side (4B) switches for supplying electric power from the DC bus (2A, 2B) to the elevator motor (6) when driving with the elevator motor (6), and also from the elevator motor (6) to the DC bus (2A, 2B) when braking with the elevator motor (6);

a control circuit (5) of the motor bridge, with which control circuit the operation of the motor bridge (3) is controlled by producing control pulses in the control poles of the high-side (4A) and low-side (4B) switches of the motor bridge;

an input circuit (12) for a safety signal (13), which safety signal (13) can be disconnected/connected from outside the drive device (1);

drive prevention logic (15), which is connected to the input circuit (12) and is configured to prevent the passage of control pulses to the control poles of the high-side (4A) and/or low-side (4B) switches of the motor bridge when the safety signal (13) is disconnected;

and in that the signal conductor of the safety signal (13) is wired from the safety circuit (34) to the drive device (1);

and in that the safety circuit (34) comprises means (14) for disconnecting/connecting the safety signal (13);

and in that the safety signal (13) is configured to be disconnected by opening a safety switch (28) in the safety circuit (34).

4. Safety arrangement according to any of the preceding claims, characterized in that the drive device comprises:

a brake controller (7), which comprises a switch (8A, 8B) for supplying electric power to the control coil (10) of an electromagnetic brake (9);

a brake control circuit (11), with which the operation of the brake controller (7) is controlled by producing control pulses in the control pole of the switch (8A, 8B) of the brake controller; and also

brake drop-out logic (16), which is connected to the input circuit (12) and is configured to prevent passage of the control pulses to the control pole of the switch (8A, 8B) of the brake controller when the safety signal (13) is disconnected.

5. Safety arrangement according to claim 4, characterized in that the aforementioned brake controller (7) is connected to the DC bus (2A, 2B);

and in that the aforementioned switch (8A, 8B) is configured to supply electric power from the DC bus (2A, 2B) to the control coil (10) of an electromagnetic brake (9).

6. Safety arrangement according to any of the preceding claims, characterized in that the drive prevention logic (15) is configured to allow passage of the control pulses to the control poles of the switches (4A, 4B) of the motor bridge when the safety signal (13) is connected.

7. Safety arrangement according to any of claims 4 – 6, characterized in that the brake drop-out logic (16) is configured to allow passage of the control pulses to the control pole of the switch (8A, 8B) of the brake controller when the safety signal (13) is connected.

8. Safety arrangement according to any of claims 4 - 7, characterized in that the drive device (1) comprises indicator logic (17) for forming a signal (18) permitting startup of a run,

and in that the indicator logic (17) is configured to activate the signal (18) permitting startup of a run when both the drive prevention logic (15) and the brake drop-out logic (16) are in a state preventing the passage of control pulses;

and in that the indicator logic (17) is configured to disconnect the signal (18) permitting startup of a run if at least either one of the drive prevention logic (15) and the brake drop-out logic (16) is in a state permitting the passage of control pulses;

and in that the drive device (1) comprises an output (19) for indicating the signal (18) permitting startup of a run to a supervision logic (20) external to the drive device.

9. Safety arrangement according to claim 8, characterized in that the signal (18) permitting startup of a run is conducted from the drive device (1) to the electronic supervision unit (20);

and in that the electronic supervision unit (20) is configured to read the status of the signal (18) permitting startup of a run when the safety signal (13) is disconnected;

and in that the electronic supervision unit (20) is arranged to prevent a run with the elevator, if the signal (18) permitting startup of a run does not activate when the safety signal (13) is disconnected.

10. Safety arrangement according to any of the preceding claims, characterized in that the signal path of the control pulses to the control poles of the high-side (4A) and/or low-side (4B) switches of the motor bridge travels via the drive prevention logic (15);

and in that the electricity supply to the drive prevention logic (15) is arranged via the signal path of the safety signal (13).

11. Safety arrangement according to any of the preceding claims, characterized in that the signal path of the control pulses from the control circuit (5) of the motor bridge to the drive prevention logic (15) is arranged via an isolator (21).

12. Safety arrangement according to any of claims 4 - 11, characterized in that the signal path of the control pulses travels to the control pole of the switch (8A, 8B) of the brake controller travels via the brake drop-out logic (16);

and in that the electricity supply to the brake drop-out logic (16) is arranged via the signal path of the safety signal (13).

13. Safety arrangement according to any of claims 4 - 12, characterized in that the signal path of the control pulses from the brake control circuit (11) to the brake drop-out logic (16) is arranged via an isolator (22).

14. Safety arrangement according to any of claims 11 – 13, characterized in that the aforementioned isolator (21, 22) is a digital isolator.

15. Safety arrangement according to any of the preceding claims, characterized in that the drive prevention logic (15) comprises a bipolar or multipolar signal switch (23), via which the control pulses travel to the control pole of a switch (4A, 4B) of the motor bridge;

and in that at least one pole of the signal switch (23) is connected to the input circuit (12) in such a way that the signal path of the control pulses through the signal switch (23) breaks when the safety signal (13) is disconnected.

16. Safety arrangement according to claim 15, characterized in that the signal switch (23) is fitted in connection with the control pole of each high-side switch (4A) of the motor bridge and/or in connection with the control pole of each low-side switch (4B) of the motor bridge.

17. Safety arrangement according to any of claims 4 - 16, characterized in that the brake drop-out logic (16) comprises a bipolar or multipolar signal switch (24), via which the control pulses travel to the control pole of the switch (8A, 8B) of the brake controller;

and in that at least one pole of the signal switch (24) is connected to the input circuit (12) in such a way that the signal path of the control pulses through the signal switch (24) breaks when the safety signal (13) is disconnected.

18. Safety arrangement according to any of claims 10 - 17, characterized in that the electricity supply occurring via the signal path of the safety signal (13) is configured to be disconnected by disconnecting the safety signal (13).

19. Safety arrangement according to any of the preceding claims, characterized in that the drive device (1) comprises a rectifier (26) connected between the AC electricity source (25) and the DC bus (2A, 2B).

20. Safety arrangement according to any of the preceding claims, characterized in that the drive device (1) is implemented without a single mechanical contactor.

21. Safety arrangement according to any of the preceding claims, characterized in that the safety comprises an emergency drive device (32), which is connected to the DC bus (2A, 2B) of the drive device;

and in that the emergency drive device (32) comprises a secondary power source (33), via which electric power can be supplied to the DC bus (2A, 2B) during a malfunction of the primary power source (25) of the elevator system;

and in that both the emergency drive device (32) and the drive device (1) are implemented without any mechanical contactors.