Safely Limited Speed on a JM-200 with STO (Option S1) and Safety Controller JSC-110-1-RS

Description of application

The safety function "Safely LimitedSpeed" is to be implemented on a JM-200 drive. It is to be activated when the machine guard door is opened.

When the guard door is opened, a signal is sent to the controller. Then, the JM-200 drive must reduce the motor speed. If the maximum speed is exceeded after the maximum permissible delay time has elapsed, the safety function STO on the JM-200 is triggered. Once the STO function has been triggered, a signal is sent to the controller.

For a motor/encoder connection with exclusion of faults, a motor with option Y (safely attached encoder/resolver) must be used. Faults are also excluded for lines protected to EN ISO 13849-2. This applies to lines within an electric cabinet which are protected by a cable duct.
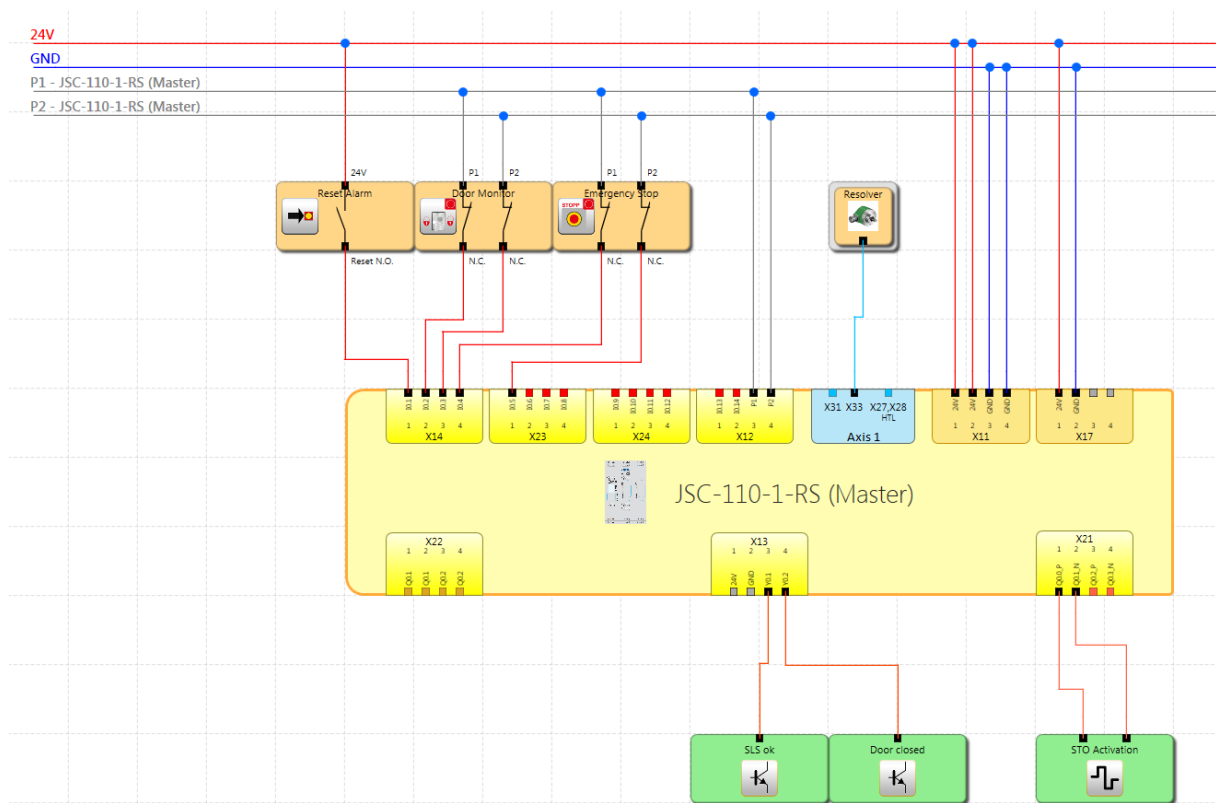

Fig. 1: Wiring diagram JSC-110-1-RS

The resolver signals are monitored by the JSC-110-1-RS as slave. To be able to do so, a splitter must be installed in the resolver cable between motor and JM-200. We recommend using the splitter JSC-Adapter-RS (item # 10001589).

The positive output of the STO trigger must be connected to both STO enable terminals (E1 and E2) on the JM-200. The negative output of the STO trigger must be connected to the reference potential (COM).
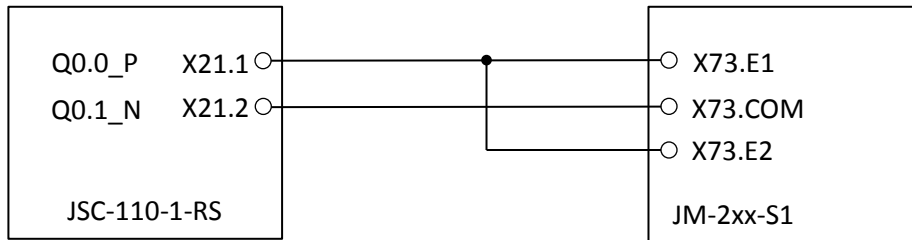

Fig. 2: Connecting the STO output of a JSC-110-1-RS with the STO input on a JM-200

Function block program in JSC-110-1-RS

The function block "Door Monitoring" evaluates the two signals coming from the door switch. To detect a short between contacts, pulses P1 and P2 from the controller JSC-110-1-RS are used. A controller is provided with the logic signal "Door" via output "Door closed". When the door is opened, the delay "Braking time" is triggered. Once the braking time has elapsed, the function "[SLS] Door open" is activated. This function monitors whether the speed is below the defined maximum speed. If the maximum speed is exceeded while this function is active, output "STO Enable" is triggered. Once the door has been closed, the function "[SLS] Door open" is deactivated.
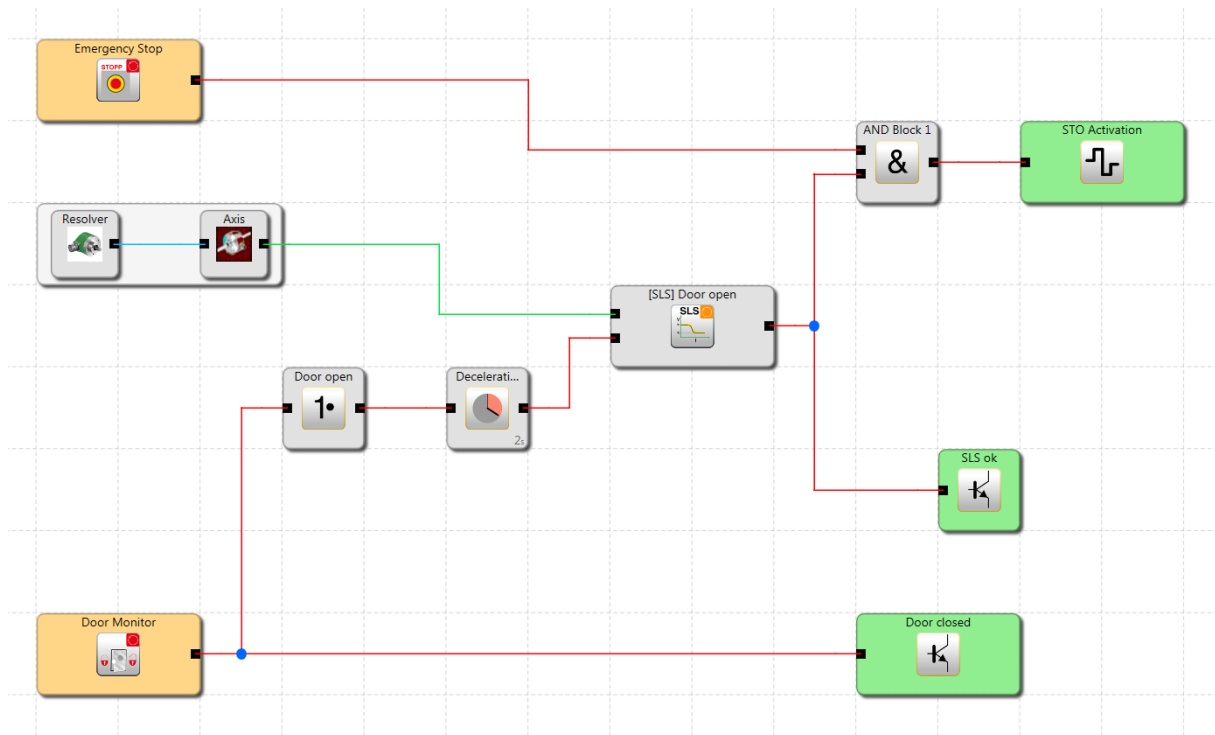
Fig. 3: Excerpt from the function block interconnection of JSC-110-1-RS

This tripping via STO corresponds to stop category 0 to DIN EN 60204-1.

NOTICE! For reasons of clarity, in this example restart inhibit after an emergency stop (to DIN EN 60204-1) has not been implemented.

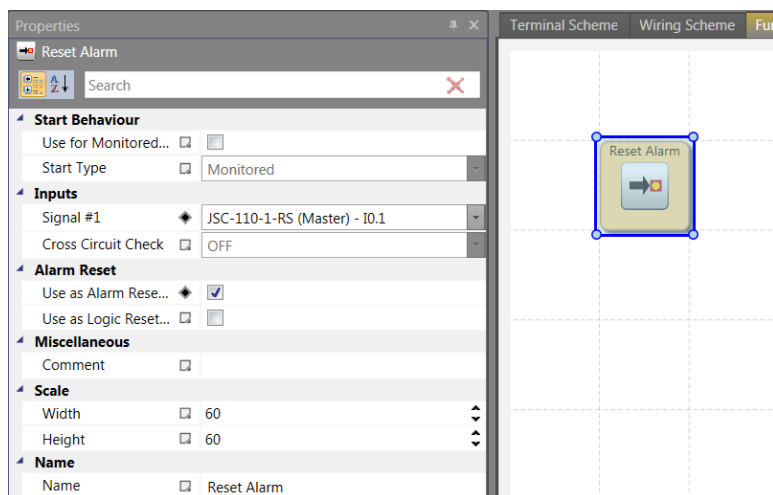Input I0.1 (terminal X14.1) is used as reset input for clearing the alarm of the SLS function.

Figure 4: Input configuration for alarm reset

7.3.2 Reset timing

The reset input for the internal reset is monitored in "RUN" mode. An internal reset is triggered with falling edge of the reset input under the condition T < 3 sec between rising/falling edge.
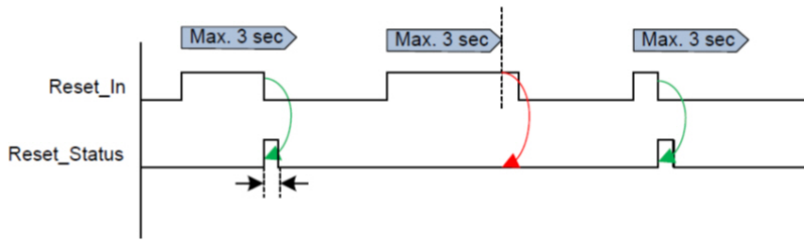
Figure 5: Excerpt from HB-DE JSC-110 Installationshandbuch

Notes on safety-related parameters

PFH of JSC-110-1-RS: 6.2×10^{-9}

PFH of JM-200-S1: 0 (all failures will result in a safe condition)

It is assumed that the door switch is a position switch, type 2, to EN ISO 13849-1, table C.1, with a $B10_d$ value of 2,000,000. If the switch is operated once an hour, 2 shifts on 250 days of operation per year (16 hours/day) result in a total of 4,000 switching cycles per year. Thus, the $MTTF_d$ is 5,000 years (2,000,000/4,000*10). For further calculations, this value is limited to 2,500. Using EN ISO 13849-1, table K.1, a PFH value of 9.06×10^{-10} is calculated.

The resulting PFH value of the total safety function is 7.11×10^{-9}.

Reference to other documents

EN ISO 13849-1: Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design

EN ISO 13849-2: Safety of machinery - Safety-related parts of control systems - Part 2: Validation

STO Safety Module for JM-2xx drives, Safety function STO, item # 60878628.

HB-DE JSC-110 Installationshandbuch

Required minimum hardware revisions of JM-2xx

To ensure safe evaluation of the resolver signal, the following hardware revisions are required:

Device variant	Minimum hardware revision
JM-203B	08.20
JM-D203	04.12
JM-204	02.20
JM-208	02.40
JM-215B	04.20
JM-225	04.20

Disclaimer

This application example does not release the user from its obligation to thoroughly plan the project. In engineering and commissioning the machine, follow the relevant EU directives, national legislation, and safety information in the technical documentation. Jetter AG assume no liability for potential damages or consequential damages.