

SEMESTERPROJECT

IM STUDIENGANG BMR (BACHELOR)

SEMPR

CONVEYOR BELT

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Wien 28.05.2023

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1 Change history

24.04.23	0.1	Created	FM
17.05.23	0.2	Added contents	FM
28.05.2023	0.3	included Documentation	FM

2 Abbreviations

- FH - FH Technikum Wien
- RA - Risk Analysis
- CAD - Design Department
- PLC - Automation Department
- Eplan - Electrical Engineering and Electrical Planning
- Department
- PM - Project Management

3 Team

Role	Name	Department
Programming and Automation	Mayra Diaz Romero	SPS
Design and Calculations	Jannis Steinbacher, Raphael Zehner	CAD
Electrical Engineering and Eplan	Kerim Pasic	EPlan
Project Management	Fabian Mühlberger	PM

4 Project Scope

4.1 Purpose of this document

This document contains the description and documentation of the BMR4 semester project, including the areas of design and CAD, control programming (SPS), electronics and Eplan (Eplan), as well as project management (PM). It describes the individual functions of the conveyor belt, explains operating and safety instructions, and documents the work performed.

4.2 Project objective

Development of a conveyor belt for transporting a cardboard box (150x30x30). This conveyor belt is intended for educational purposes for students at the FH starting from the 4th semester.

4.3 Project non-objectives

The construction of the conveyor belt is not planned, which is why testing and ordering processes are considered, but purchasing and construction of the conveyor belt will not be carried out. Therefore, a final test of the conveyor belt is also not possible.

4.4 Requirements

The following requirements have been provided to the project team by the customer:

1. Horizontal transport of a box (110x65x20) weighing 150g along the length of the conveyor belt.
2. Minimum speed of 30mm/s, maximum speed of 250mm/s.
3. Ensuring the correct positioning of the conveyed goods on the belt.
4. Sensors at both ends of the conveyor belt.
5. Control using an SPS (Programmable Logic Controller)
6. Start/Stop functionality and selection of operating modes.

4.5 Hardware

- SPS - Siemens S7-1200 PLC
- HMI - Simatic HMI KTP 700 Basic
- Power supply ensured by 230VAC/24VDC power supplies
- Sensor technology to be selected from SICK.
- Safety components to be selected from PILZ.
- The conveyor belt will have the following specifications:
 - GREEN 1.3MM transport belt
 - Length: 1132mm, Width: 80mm (endless)
 - Carrying side: PU, green, matte embossing
 - Running side: Fabric, light gray
 - Total thickness: approximately 1.3mm, Minimum Ø: 8mm

4.6 Enviroment

- Protection class: IP-20
- Ambient temperature: 0-40 degrees Celsius

5 Intended use

The mini conveyor belt is intended for the training and education of mechatronic systems for students in the 4th semester of Mechatronics/Robotics at FH Technikum Wien.

The machine is intended to be operated in the premises of FH Technikum Wien and should be placed on a raised flat surface (table). It is designed for suitable environmental conditions and should not be operated in harsh environments.

The operating time has been set in consultation with the FH at 8 hours per week for a duration of 4 years.

6 Risk analysis

For the risk analysis, scenarios were developed considering the operation while adhering to the intended use.

	Eintrittswarscheinlichkeit			
Ausmaß	A	B	C	D
4				
3				
2				
1				

Abbildung 1: risk analysis matrix

Nr	Szenario	Schaden	Grund	Risiko	Maßnahe
1	Finger können zwischen Band und Rolle geraten	Quetschen, Schnitte	Nicht abgedeckte bewegliche Teile	B2	Konstruktiv, Abdeckung
2	Kippen des Förderbandes	Schaden am Förderband, Prellungen	Unsachgemäße Handhabung	A2	Konstruktiv, Verschraubung, Warnhinweis
3	Verschütten von Flüssigkeiten	Kurzschluss, Brand	Unsachgemäße Handhabung	B4	Warnhinweis, FI/LS
4	Reißen des Förderbands	Schaden am Förderband	Überlast	D1	Bedienhinweis
	Brand Motortreiber oder Motor	Brand	Überlast/Gurtspannung	D4	LS, Serviceintervalle
5	Herabfallende Teile	Quetschungen, Prellungen	Unsachgemäße Handhabung	C2	Bedienhinweis
6	Haare oder Kleidung in beweglichen Teilen	Verlust von Haaren, Stoßen des Kopfes	Lange Haare, unpassende Kleidung	C3	Haare zusammenbinden, Kleidung
7	Schräglauf Gurt	Reißen des Gurtes	Achsen nicht Parallel	C2	Stufenlose Spanner
8	Schlupf Gurt	Teil wird nicht korrekt befördert	Gurtspannung unzureichend	A1	Betriebsanleitung, Spanner
9	beförderungsgeschwindigkeit langsam	Überlast Motor	hohe Gurtspannung	A4	Betriebsanleitung, Spanner
10	Ausfall des Sensors	Teil wird nicht gestoppt	Verschmutzung	D2	Serviceintervalle
11	Ausfall SPS	Undefinierter Zustand		D1	SPS Safety

Abbildung 2: risk analysis

7 Documentation

7.1 Functional model

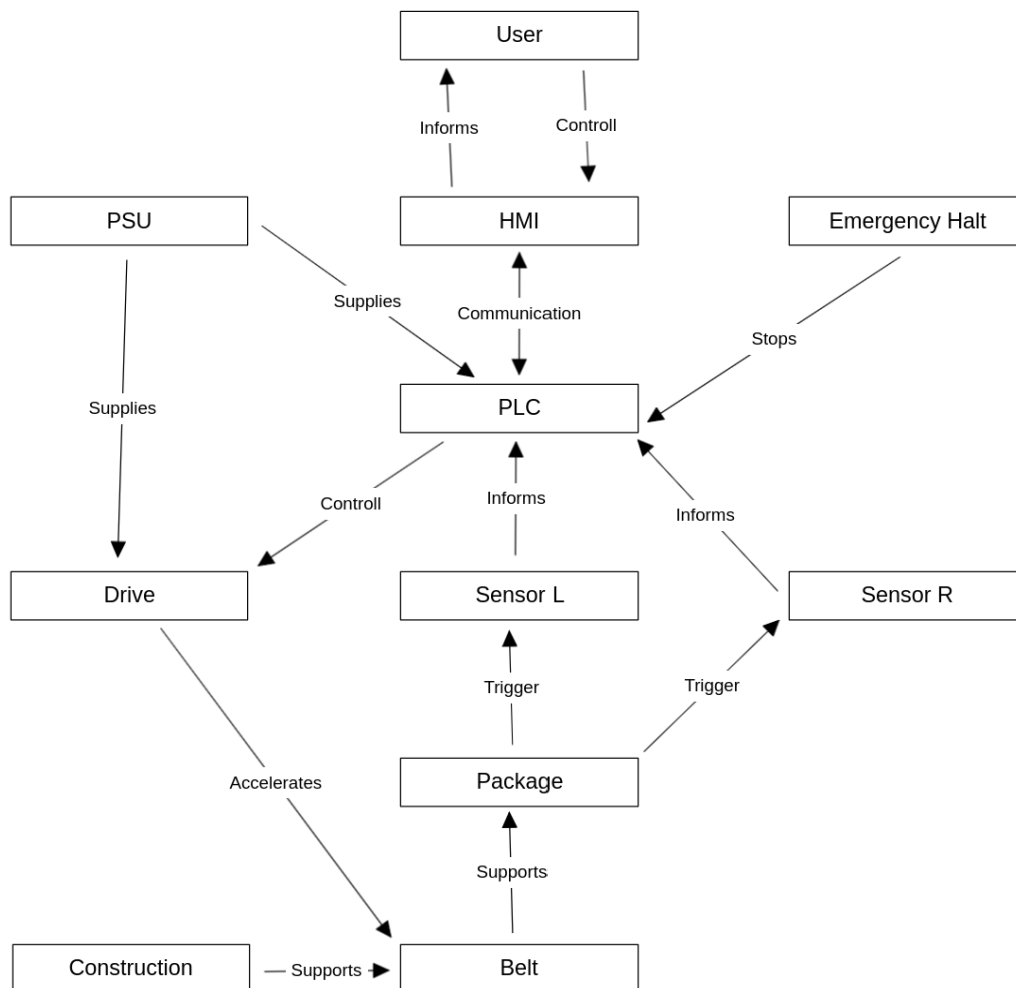


Abbildung 3: functional model

7.2 Flowchart

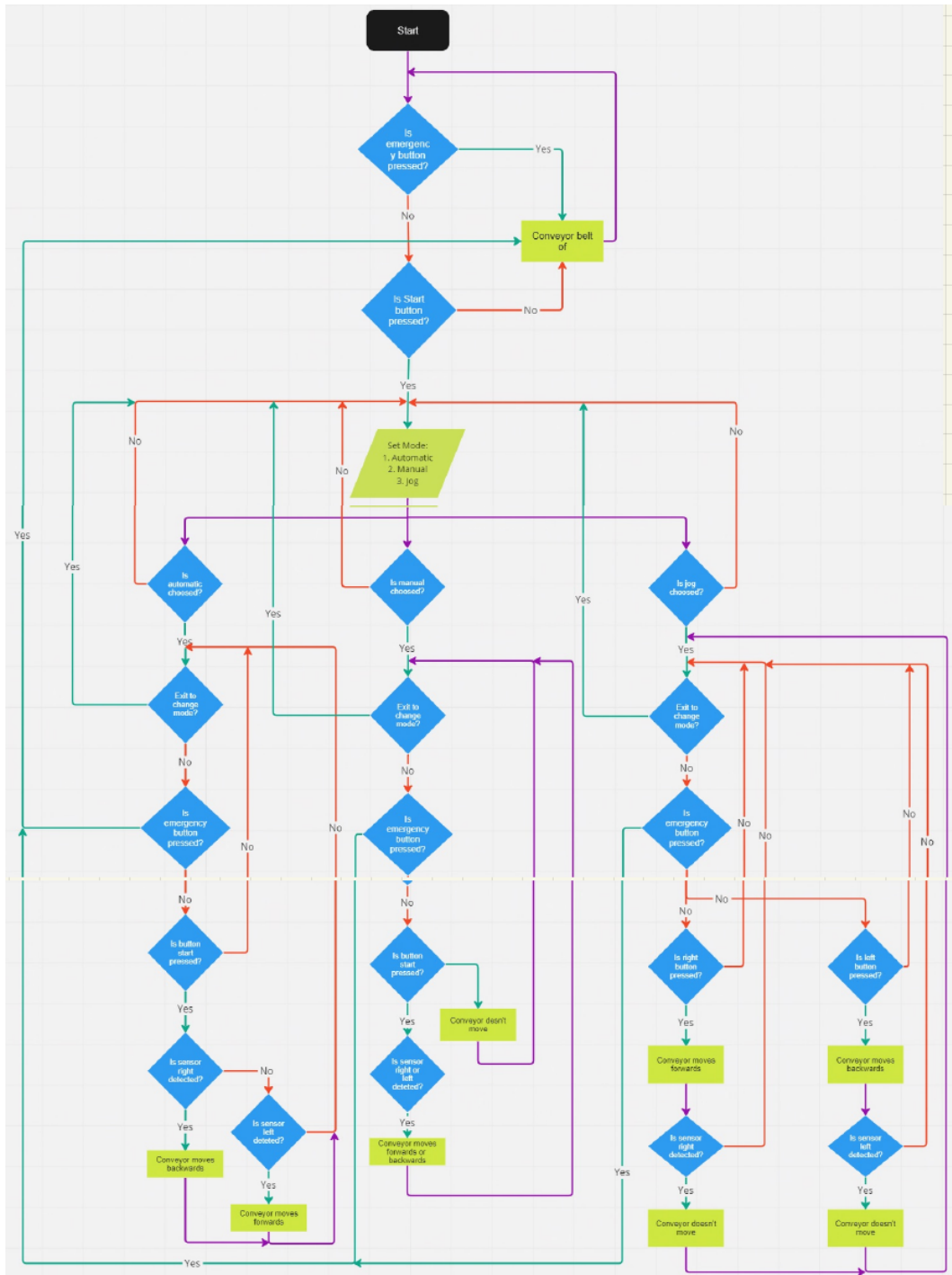


Abbildung 4: flowchart

8 Assembly

The assemblies were split up as follows:

1. Frame
2. Band assembly
3. Electronics
4. Tentioning system
5. Interface
6. Sensor System

8.1 Frame

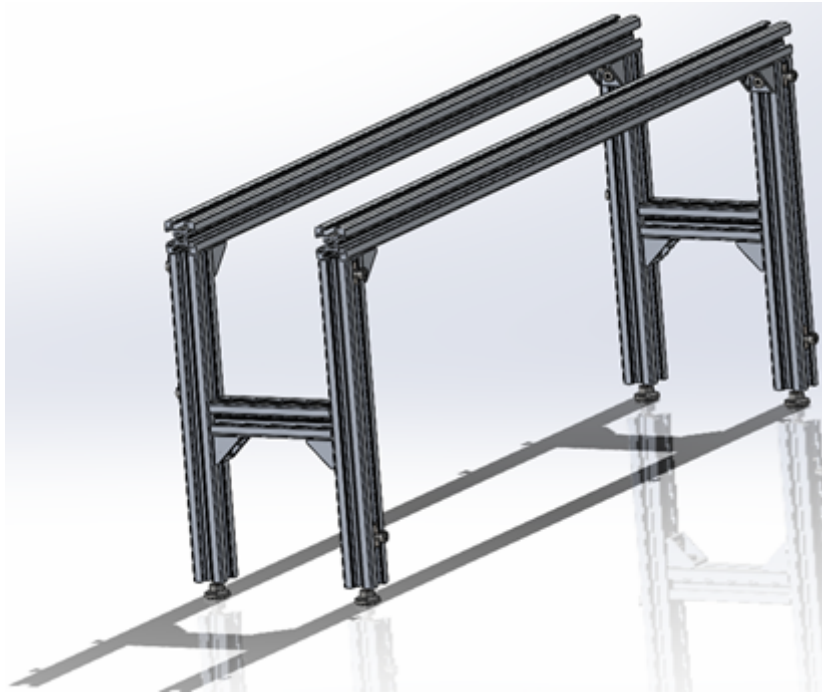


Abbildung 5: Frame Assembly

The frame assembly takes into consideration the dimensions of the belt. The frame has to house a belt that is 1132 mm long and 80 mm wide, as well as its system. The height from the ground to top of the belt has to be at most 300 mm high. The dresses, top part, and package orienter are to be ordered and cut with a water cutter from the same sheet of 3 mm thick Plexiglas. The dresses can house and fit various parts that are necessary for the system. The dresses also add to the stability and safety of the conveyor belt, since they are connected to the aluminum profiles. The rubber on the bottom parts of the feet makes sure that the whole frame will not slide around on the ground, further adding to the safety and stability of the whole design. The top part can be fit in between the front and back dresses by sticking it into the holes.



Abbildung 6: Package Orienter

The package orienter is necessary as it keeps the package in the right direction and orientation and it can be fit into the top part by also sticking it into the given holes.

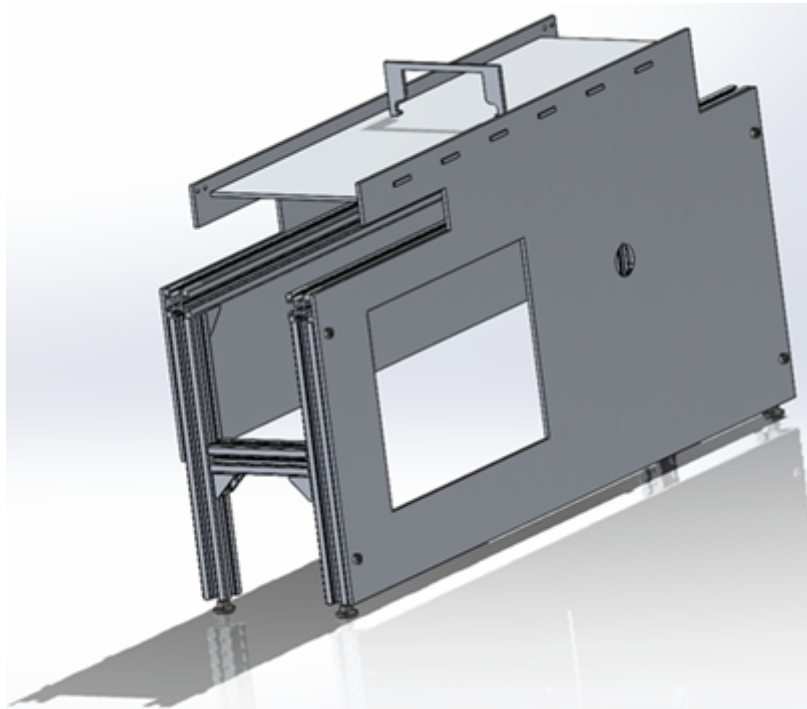


Abbildung 7: Complete Frame assembly

8.2 Band assembly

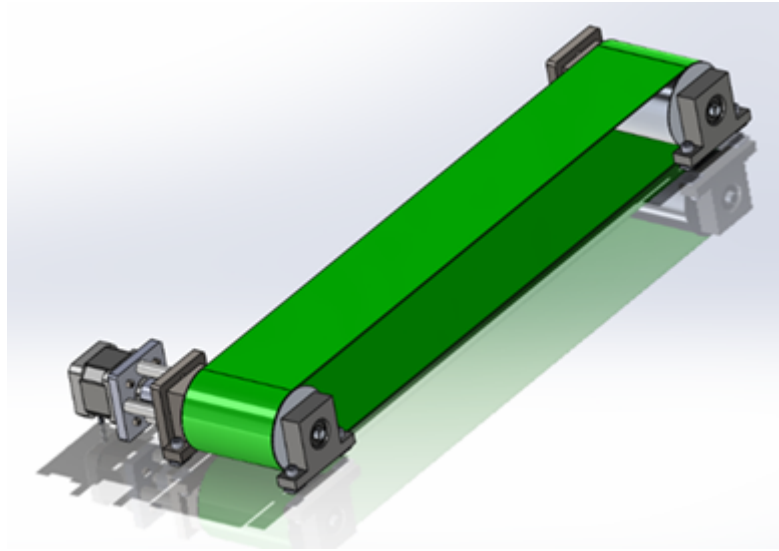


Abbildung 8: Band Assembly

The band assembly must power and keep in place the belt for the system. The dimensions, the motor and thickness of the drive rollers are based on the calculations in . The system uses a DC motor, which is attached laterally to the drive roller in the back of the conveyor system using an engine mount. The two drive rollers are 62 mm thick in the middle sections, and 8 mm on the outer sections, where they rest on the bearing units. The drive rollers are to be built from round steel. The band assembly is to be fixated on the frame by screws and threaded nuts.

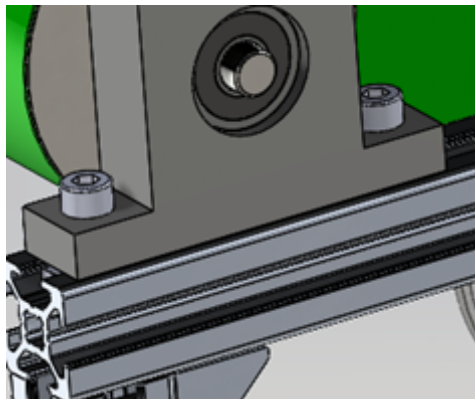


Abbildung 9: Caption

8.3 Electronics



Abbildung 10: Electronics

This assembly consists of the SPS, Siemens SPS S7-1200 control system, and a rail. To mount the SPS, it is fitted onto the rail which itself is screwed to the back dress, facing inwards.

8.4 Tentioning system

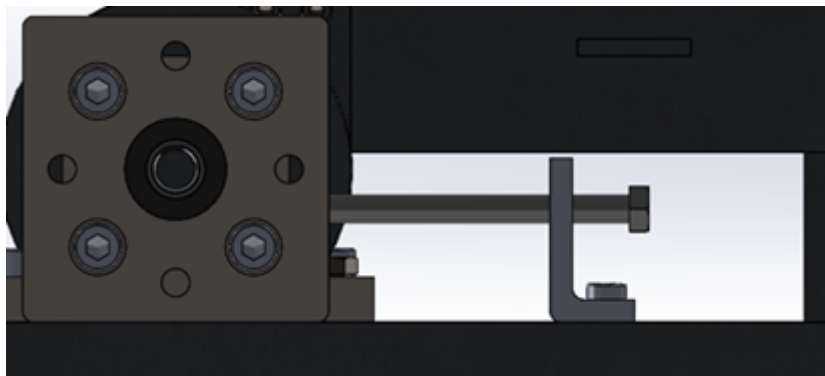


Abbildung 11: Tentioning System

The tensioning system allows for the relaxation or tensening of the belt whenever necessary, which helps in the mounting or dismounting of the belt. The assembly uses a cheap and simple approach, the Jack-Screw Tension. In the Jack-Screw Tension System, the tension on the belt is accomplished by turning the screw at the end of the angle bracket, which is fixed on the frame.

8.5 Interface



Abbildung 12: Interface

The Interface consists of the HMI, Human-Machine Interface, and the emergency switch. These two parts are fitted to the front dress, facing outwards.

8.6 Sensor System

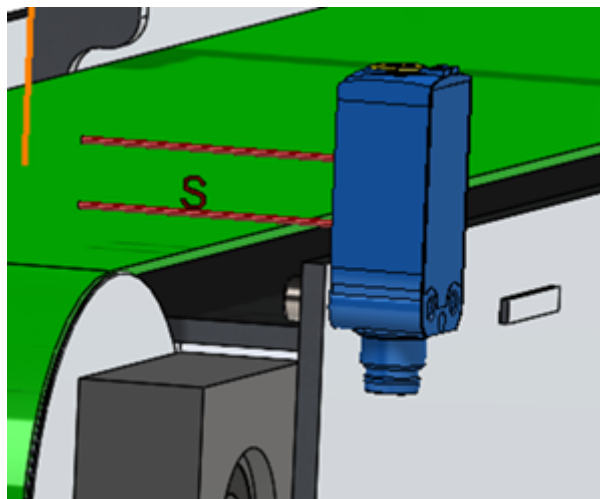


Abbildung 13: Sensors

The sensor system consists of two light barrier sensors, attached to the front and back end of the conveyor belt via screws, as is required from the given requirements, which state that the sensors are to be fixed at the front and back end of the conveyor belt.

8.7 Electric

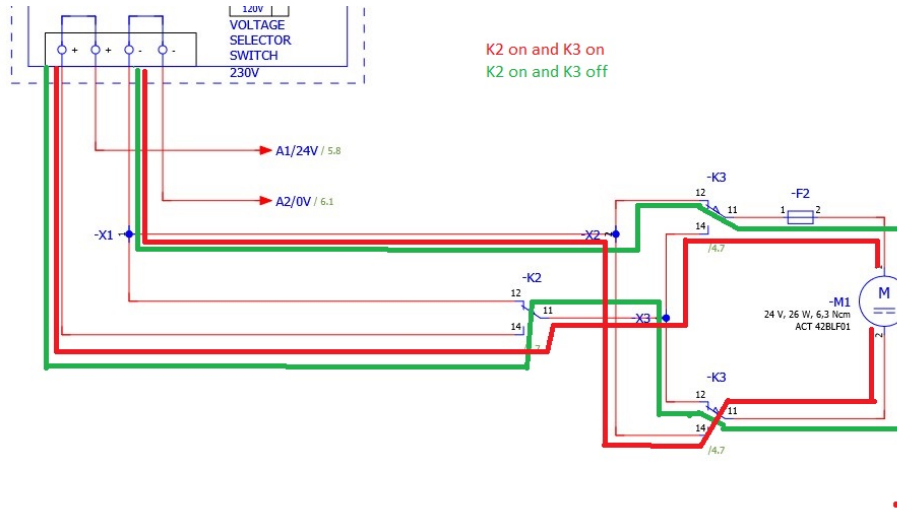
In this chapter, the electrical part of the project will be presented. It will be explained in words how it works and the completed circuit diagrams will be shown in pictures so that the diagrams explained in words become clearer. Circuit diagrams were made in the EPLAN.

8.7.1 Concept

The power supply unit is connected to a wall outlet that supplies alternating current (AC) at a voltage of 230 V. The power supply unit is responsible for converting this high voltage

AC input to a lower voltage of direct current (DC), specifically 24V DC. The 24 V DC output from the power supply unit is then distributed to various devices and components within the system. This includes the motor, relays, sensors and emergency stop. By using a 24 V DC power supply, these components can be efficiently powered and operated within their specified voltage range.

8.7.2 equipment box circuit



Our conveyor belt will be controlled by two relays. The first relay is actually a start stop relay, while the second relay is a direction relay. If both relays are on, then the motor will be controlled from one side, and if we turn off the direction relay, then the motor will be controlled from the other side. A fuse holder is placed before the motor to protect motors from excessive current, but also provides protection for the overall electrical circuit.

8.7.3 PLC Circuit Control

IEC Module with fuse insert at the beginning of our PLC circuit control serves as a power connector with an integrated fuse holder, providing both power connection and fuse protection for electrical devices. It adds an extra level of safety and protects the connected equipment from potential damage due to electrical faults. The sensors are connected to the inputs of the PLC as well as the emergency stop. The relays mentioned earlier are connected as PLC outputs.

8.7.4 Component Selection

Sensors

These specific SICK sensors were chosen for several reasons. Firstly, they offer reliable and precise detection capabilities, ensuring accurate recognition of the packet's position. The sensors are designed to detect changes in light intensity, making them well-suited for applications where objects passing by can cause variations in reflected or transmitted light. They are rated for a switching distance between 4 and 100mm and work on a wide range of materials without the need of a reflector, making them perfectly suited for the application. They are also smaller than most other SICK sensors, which makes their mounting easier.

Relais The Phoenix Contact type 2903370 relay module is used to control the motor. Acting as a break contact, it enables the motor to be started and stopped via PLC. Connected to the direction relay, it allows the motor to change direction during operation. Relay module specifications include 24V DC input, one normally open (NO) contact relay and 6A current carrying capacity.

The Phoenix Contact type 2903342 direction relay plays a crucial role in this project. It can change the polarity of the engine output, allowing for direction control. Connected

to the start/stop relay on the input side and the engine on the output side, it facilitates immediate direction changes .

8.8 Structural Analysis

8.8.1 Motor torque

The calculation of the torque required is essential for choosing components as the motor as well as designing the driveshaft. The required torque is mainly induced by the friction between the conveyor belt and the plate below, which is supporting the weight of any product, that is transported on top. Other sources of friction are the rolling friction inside the bearing or the friction between the belt and the outer part of the assembly. Following equation is used to calculate the torque

$$F_R = F_u = \mu q(m_G + m_F) = 0.3114N$$

The maximum velocity allowed for the conveyor belt is $0.25 \frac{m}{s}$, which results in following power requirement:

$$P_{AN} = \frac{F_U v}{\eta} = 0.0865W$$

There are minor losses in the friction in the bearings, therefore an efficiency of 0.9 is approximated. The torque can then be calculated with respect to the angular velocity, which is dependent on the design of the shaft. In this case it equals:

$$T_{AN} = \frac{P_{AN}}{\omega} = 1.038Ncm$$

8.8.2 Bearing life

The calculation of the bearing life is essential for ensuring lifelong operation of the bearings, as these are essential components for structural support as well as safety of the system. In this design an angular contact ball bearing is chosen (30/8-2RS).

The equation for nominal bearing life (1.000.000 revolutions) is:

$$L_{10} = \left(\frac{C}{P}\right)^p$$

P is in this case the dynamic equivalent bearing load and is dependent on the types of loads on the bearings and their respective forces:

$$P = X * F_R + Y * F_A = 0.003kN$$

There is no axial force expected in the design, therefore it is approximated with $0kN$. The factors X and Y can be found in TB14.3. For ball bearings p (exponent) equals 3.

For the nominal bearing life in hours the formula is:

$$L_{10h} = \frac{10^6 * L_{10}}{60 * n} = 1.02 * 10^{12}$$

It is evident that the expected lifetime of the bearing under the expected loads far exceeds the planned lifetime of the conveyor belt, which is $5y = 2085,7h$. A failure of the bearings is therefore not to be expected in its lifetime.

8.8.3 Shaft design

The shaft combines the function of forwarding torque and providing a drum to guide the belt. To reduce the revolutions per minute the motor must spin, the diameter of the drum is set to 60mm. Nevertheless, the design must be proven to these forces. To evaluate the forces, diagrams of the forces along the shaft are created.

Firstly, the resisting moment for bending and the polar resisting moment for torque must be calculated. The bending resisting moment is:

$$W = \frac{\pi * d^3}{32} = 21206mm^3$$

The polar resisting moment is:

$$Wt = \frac{2 * \pi * d^3}{32} = 101mm^3$$

The maximum bending moment can be calculated from the maximum shear force and the distance to bearing:

$$M_{max} = F_V * l = 153Nmm$$

The maximum torque is the calculated torque $T_{an} = 10,38Nmm$ (see torque calculation).

The resulting maximum bending stress is:

$$\sigma_{bmax} = \frac{M_{max}}{W} = 0.0072 \frac{N}{mm^2}$$

The resulting maximum torque stress is:

$$\tau_{tmax} = \frac{T_{max}}{Wt} = 0.0072 \frac{N}{mm^2}$$

The material selected for use in the shaft is S235JR, which is rather cheap and sufficiently strong material. It's maximum Yield strength $R_{p0.2}$ is $235MPa$.

The allowed bending stress is:

$$\sigma_{bf} = 1.2 * R_{p0.2} * K_t = 270MPa$$

The allowed torsion stress is:

$$\tau_{bf} = 1.2 * R_{p0.2} * \frac{K_t}{\sqrt{3}} = 270MPa = 155.88Pa$$

The resulting safety factor can be calculated: $S_F = 56.656.559,98$ It is evident that the shaft could handle much higher stresses, but as being said before the design was mainly driven by functionality.

8.8.4 Belt tensioning

There is one major force, which is inducing tension in the belt, and it is dependent on the circumferential force (see drive torque calculation). The calculation of the belt tension proves that the design of the conveyor will not stress the belt over its maximum tensile stress. The preload force in the drum will be:

$$F_s = 2 * F_U * \frac{e^{\alpha\mu}}{2(e^{\alpha\mu} - 1)} = 6.012N$$

in this case describes the static friction coefficient between the steel of the shaft and polyester fabric (U0).

The preload force in the belt (F_V) will therefore be exactly half of F_s : $F_v = \frac{F_U}{2} = 3.006N$, assuming the preload force F_s attacks in the middle between the two bearings. Due to the spinning direction and only one drum being powered by the motor, as well as all the friction being generated on the top half of the conveyor belt, the top of the belt (F_Z) will experience a higher stress than the bottom half (FL). F_Z is the combination of F_U and

$$F_V : F_Z = F_V + F_U = 3.16N$$

The maximum stress allowed in the belt is $90 \frac{N}{mm}$ (see datasheet).

$$a = F_Z * b = 3,16N * 80mm = 0,0395N/mm$$

8.9 Project management

For the team's work, weekly meetings were held to discuss current and upcoming tasks. The tool used was open-project, which was self-managed and included all essential aspects of project management, including: - Work packages/Gantt chart - Weekly meetings (Jour-Fixe) - Document management

In addition, a messaging service was used for quick exchange of important information.

The individual team members worked largely independently and took personal responsibility to minimize organizational efforts.

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9 appendix

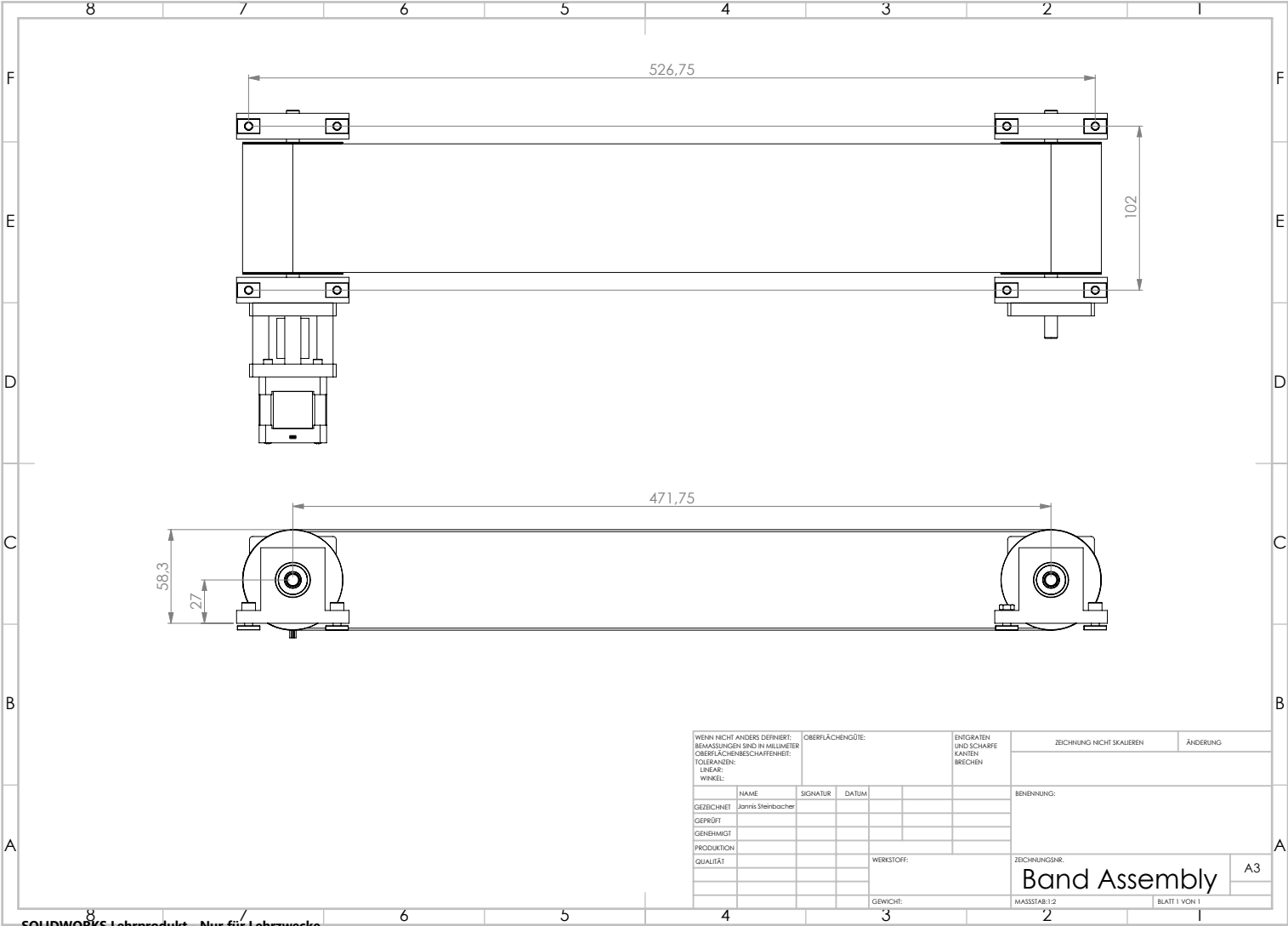
The following additional files and documents are part of this document and provided.

- Visual components project file
- Solid works project file
- Eplan project file
- TIA Portal project file
- Bill of Materials
- cost calculation

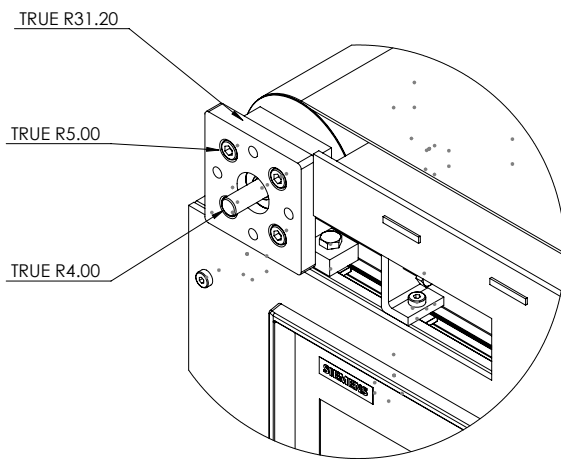
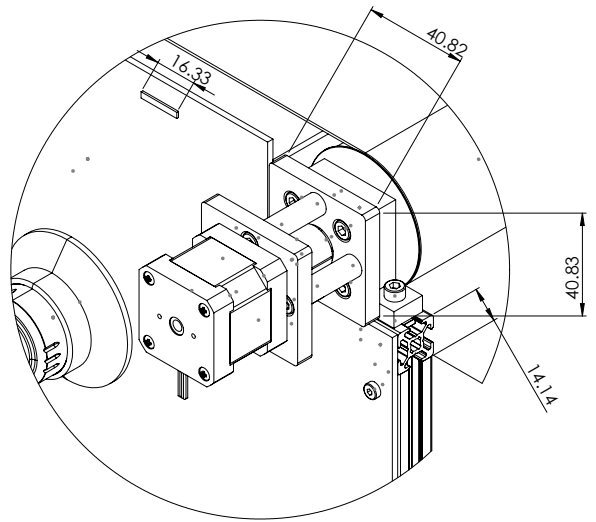
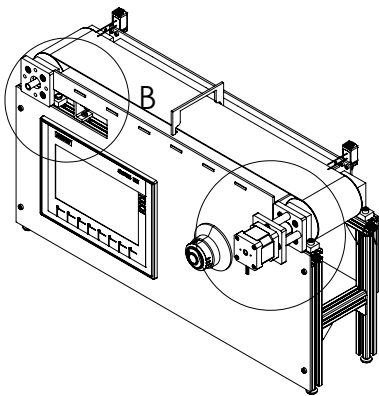
The following additional files are attached to this documents:

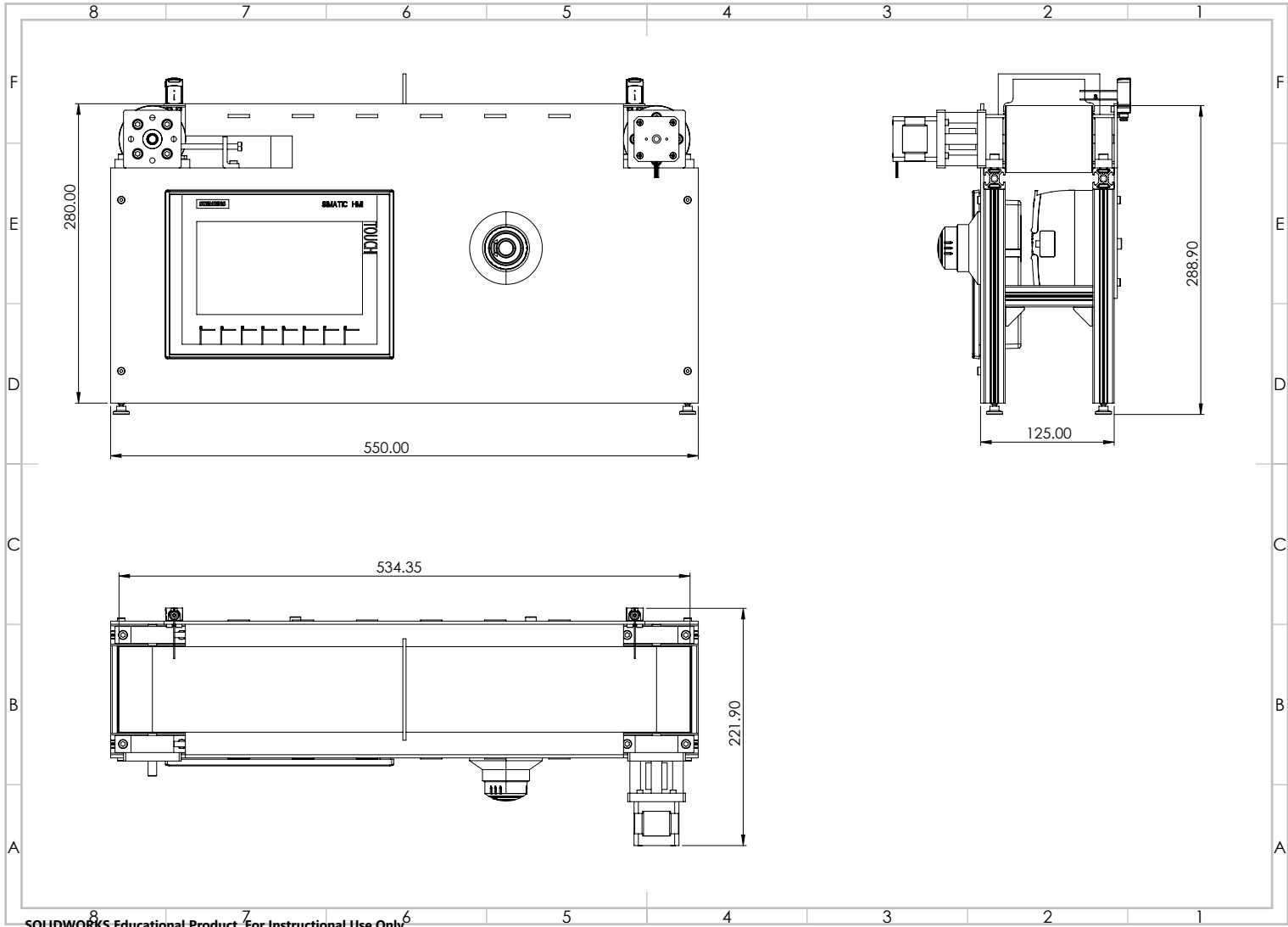
1. CAD drawings
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3. PLC function blocks
4. HMI pages

9.1 CAD drawings

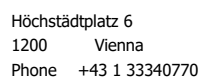



WENN NICHT ANDERS DEINIERT: BEWASSUNGEN SIND IN MILLIMETER OBERFLÄCHENBESCHAFFENHEIT: TOLERANZEN: LINEAR: WINKEL:		OBERFLÄCHENGÜTE:		ENTGRATEN UND SCHARFE KANTEN BRECHEN		ZEICHNUNG NICHT SKALIEREN	ÄNDERUNG
						BENENNUNG:	
GEZEICHNET	NAME	SIGNATUR	DATUM			ZEICHNUNGSNR. Band Assembly	A3
GEPRÜFT	Jannis Steinbacher						
GENÜHMIGT							
PRODUKTION							
QUALITÄT							
					WERKSTOFF:	MASSSTAB: 1:2	BLATT 1 VON 1
					GEWICHT:		





9.2 Eplan

2

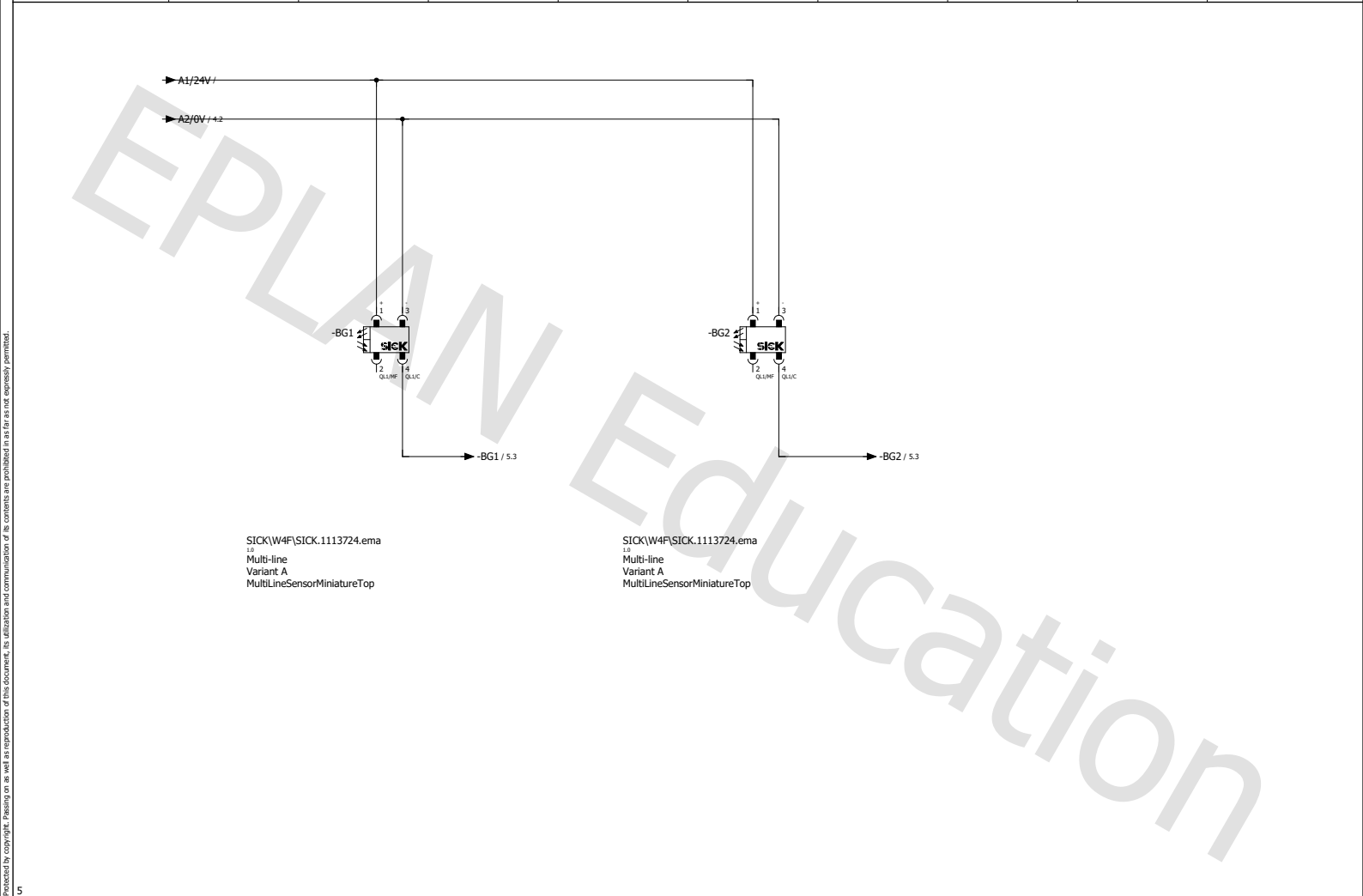
	18.05.2023	MR20B028	Project name Semesterprojekt	Job number 1	Fachhochschule Technikum Wien		Title Page	=	a	2
			Conveyor belt	Drawing number						
Modification	Date	Name	Creator Korisnik	Approved by				+	Page	1
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6



			Project name	SemesterProjekt	Job number	1	Fachhochschule Technikum Wien		Sensors		=		&	
			Conveyor belt		Drawing number						+		Page	6
Modification	Date	Name	Creator	Korisnik	Approved by				Date	24.5.2023,	Ed.	Korisnik	Page	6 from 6

9.3 PLC program

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Programmbausteine / Main

Automatic Mode [DB2]

Automatic Mode Eigenschaften

Allgemein

Name	Automatic Mode	Nummer	2	Typ	DB	Sprache	DB
Nummerierung	Automatisch						

Information

Titel		Autor		Kommentar		Familie	
Version	0.1	Anwenderdefinierte ID					

Name	Datentyp	Startwert	Remanenz
▼ Input			
StartButton	Bool	false	False
LeftSensor	Bool	false	False
RightSensor	Bool	false	False
IsSafe	Bool	false	False
StopMode	Bool	false	False
▼ Output			
Forwards	Bool	false	False
Backwards	Bool	false	False
InOut			
▼ Static			
LeftSensorActiv	Bool	false	False
RightSensorActiv	Bool	false	False

Programmbausteine / Main

Control Mode [DB3]

Control Mode Eigenschaften							
Allgemein							
Name	Control Mode	Nummer	3	Typ	DB	Sprache	DB
Nummerierung	Automatisch						
Information							
Titel		Autor		Kommentar		Familie	
Version	0.1	Anwenderdefinierte ID					

Name	Datentyp	Startwert	Remanenz
▼ Input			
Backwards	Bool	false	False
Forwards	Bool	false	False
IsSafe	Bool	false	False
▼ Output			
MotorMovesBackwards	Bool	false	False
MotorMovesForwards	Bool	false	False
InOut			
Static			

Programmbausteine / Main

Jog Mode [DB7]

Jog Mode Eigenschaften							
Allgemein							
Name	Jog Mode	Nummer	7	Typ	DB	Sprache	DB
Nummerierung	Automatisch						
Information							
Titel		Autor		Kommentar		Familie	
Version	0.1	Anwenderdefinierte ID					

Name	Datentyp	Startwert	Remanenz
▼ Input			
RightButton	Bool	false	False
LeftButton	Bool	false	False
RightSensor	Bool	false	False
LeftSensor	Bool	false	False
IsSafe	Bool	false	False
▼ Output			
Forwards	Bool	false	False
Backwards	Bool	false	False
InOut			
Static			

Programmbausteine / Main

Manual Mode [DB5]

Manual Mode Eigenschaften							
Allgemein							
Name	Manual Mode	Nummer	5	Typ	DB	Sprache	DB
Nummerierung	Automatisch						
Information							
Titel		Autor		Kommentar		Familie	
Version	0.1	Anwenderdefinierte ID					

Name	Datentyp	Startwert	Remanenz
▼ Input			
StartButton	Bool	false	False
LeftSensor	Bool	false	False
RightSensor	Bool	false	False
IsSafe	Bool	false	False
StopMode	Bool	false	False
▼ Output			
Forwards	Bool	false	False
Backwards	Bool	false	False
InOut			
▼ Static			
LeftSensorActiv	Bool	false	False
RightSensorActiv	Bool	false	False

Programmbausteine / Main

Safety System [DB4]

Safety System Eigenschaften							
Allgemein							
Name	Safety System	Nummer	4	Typ	DB	Sprache	DB
Nummerierung	Automatisch						
Information							
Titel		Autor		Kommentar		Familie	
Version	0.1	Anwenderdefinierte ID					

Name	Datentyp	Startwert	Remanenz
▼ Input			
EmergencyButton1	Bool	false	False
EmergencyButton2	Bool	false	False
RightSensor	Bool	false	False
LeftSensor	Bool	false	False
▼ Output			
IsSafe	Bool	false	False
InOut			
Static			

Programmbausteine / Main

Select a Mode [DB6]

Select a Mode Eigenschaften

Allgemein

Name	Select a Mode	Nummer	6	Typ	DB	Sprache	DB
Nummerierung	Automatisch						

Information

Titel		Autor		Kommentar		Familie	
Version	0.1	Anwenderdefinierte ID					

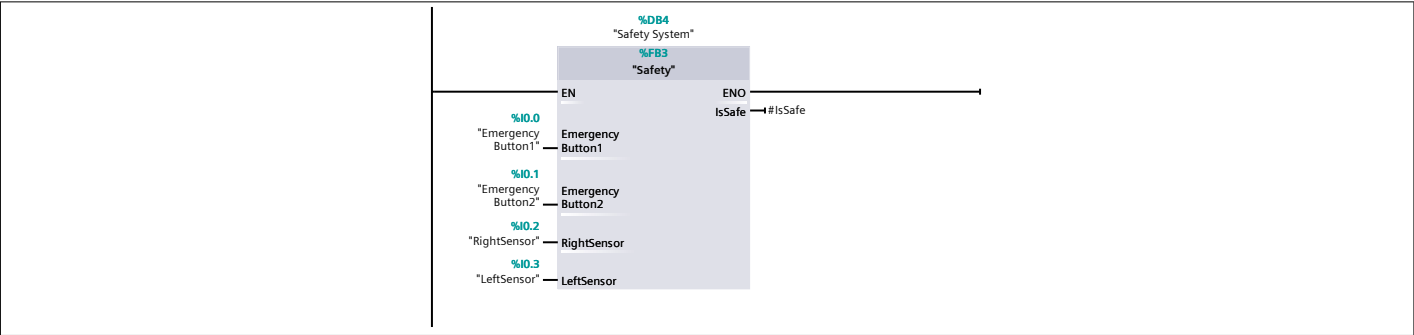
Name	Datentyp	Startwert	Remanenz
▼ Input			
Automatic	Bool	false	False
Manual	Bool	false	False
Jog	Bool	false	False
Stop	Bool	false	False
▼ Output			
AutomaticModeButton	Bool	false	False
ManualModeButton	Bool	false	False
JogModeButton	Bool	false	False
InOut			
Static			

Programmbausteine / Main

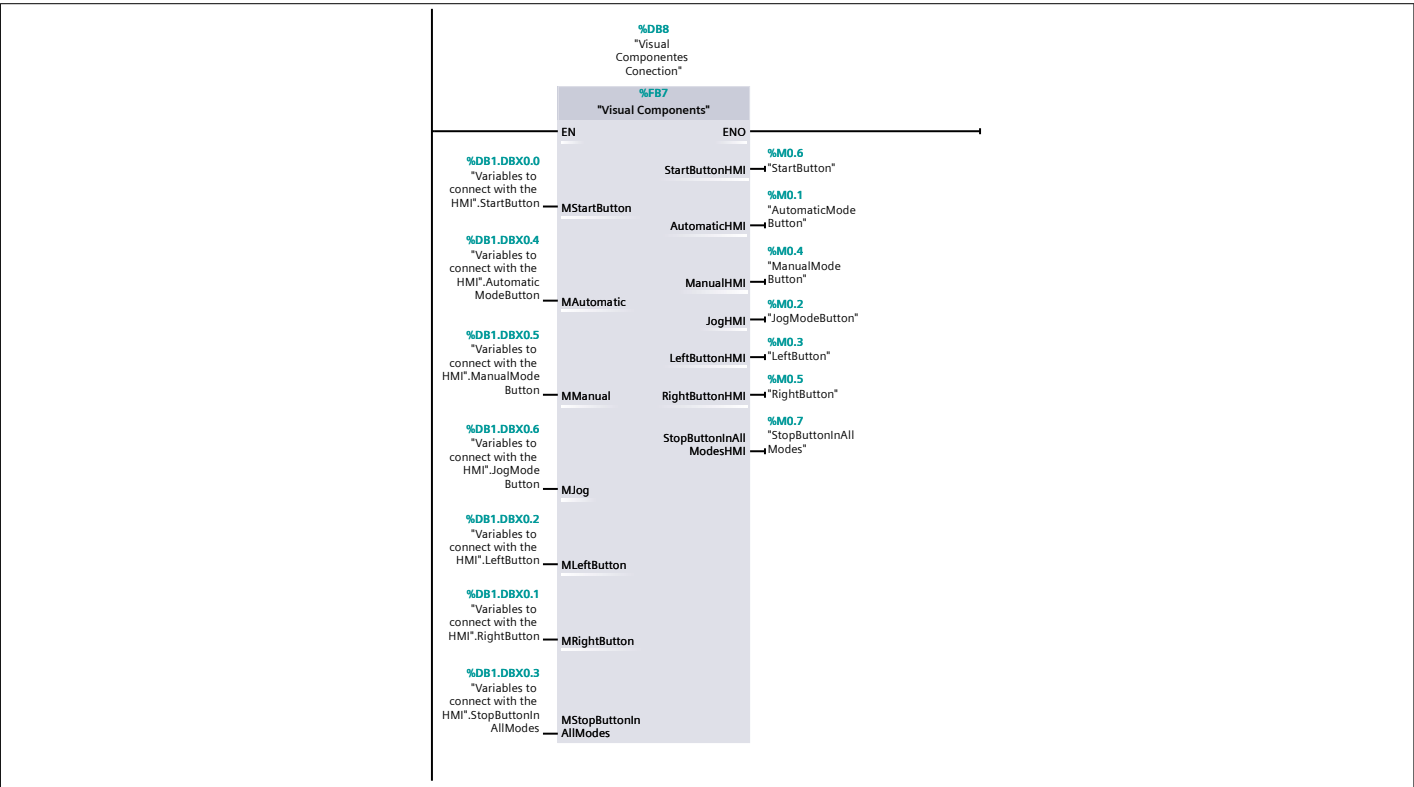
Main [OB1]

Main Eigenschaften							
Allgemein							
Name	Main	Nummer	1	Typ	OB	Sprache	KOP
Nummerierung	Automatisch						
Information							
Titel	"Main Program Sweep (Cycle)"	Autor		Kommentar		Familie	
Version	0.1	Anwenderdefinierte ID					
Name			Datentyp		Defaultwert		
▼ Input							
Initial_Call			Bool				
Remanence			Bool				
▼ Temp							
IsSafe			Bool				
Forwards			Bool				
Backwards			Bool				
AutomaticMode			Bool				
ManualMode			Bool				
JogMode			Bool				
Constant							

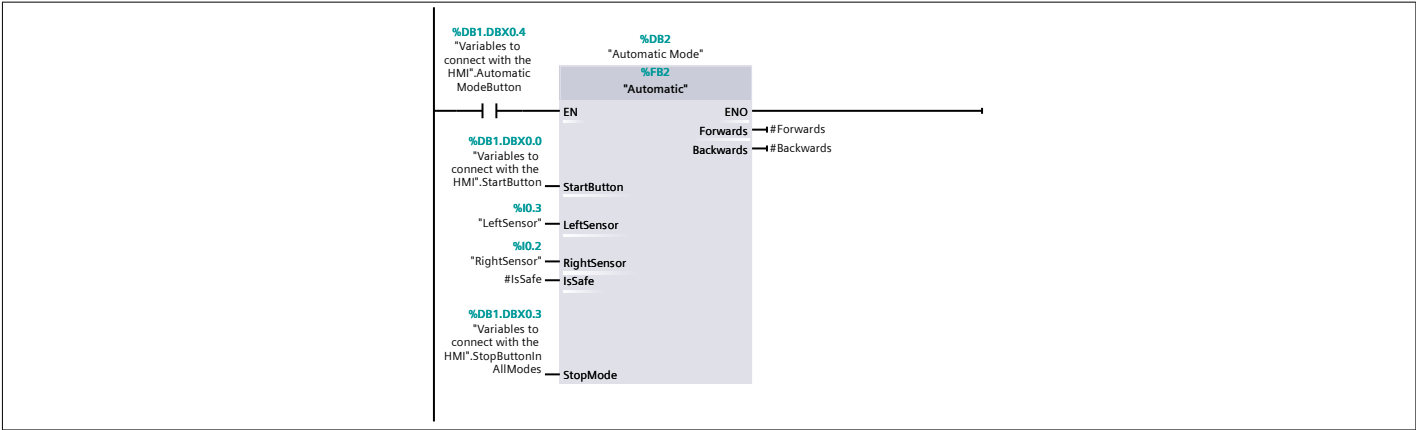
Netzwerk 1 : Safety system



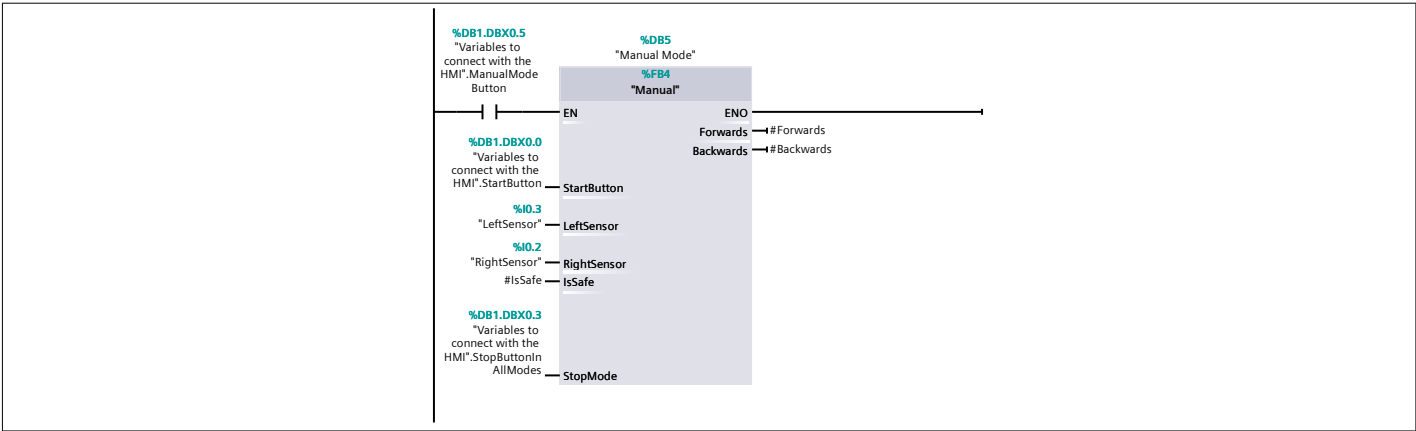
Netzwerk 2: Visual Components conection



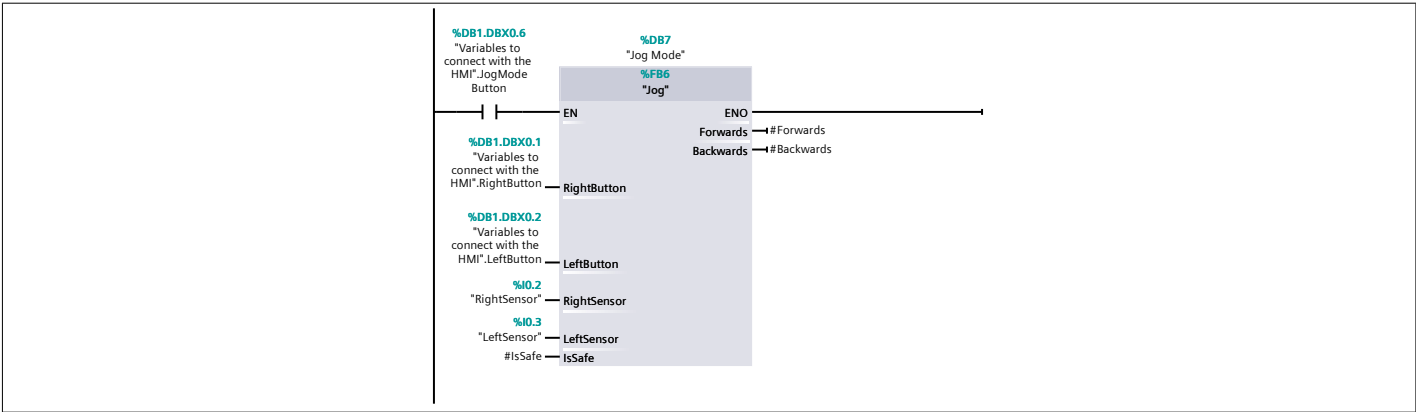
Netzwerk 3: Automatic mode



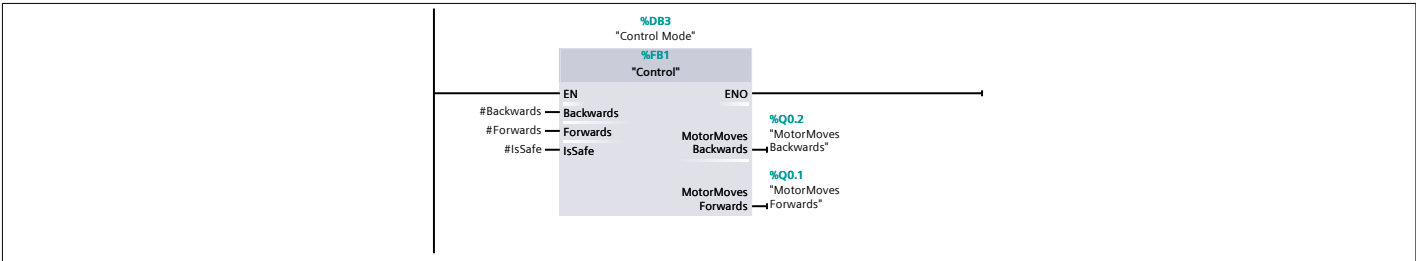
Netzwerk 4: Manual mode



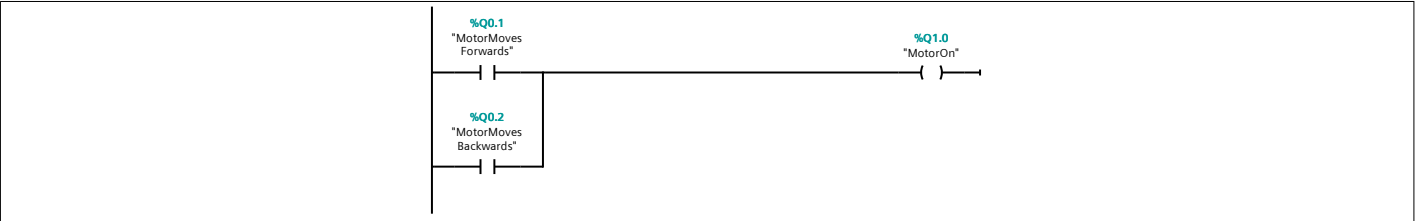
Netzwerk 5: Jog mode



Netzwerk 6: Motor control



Netzwerk 7: Visual Componets Motor Signal



Netzwerk 8: VC-Settings



Programmbausteine / Main

Visual Componentes Conection [DB8]

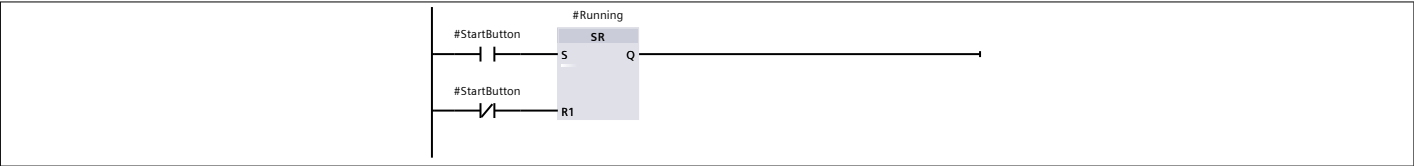
Visual Componentes Conection Eigenschaften							
Allgemein							
Name	Visual Componentes Conec-tion	Nummer	8	Typ	DB	Sprache	DB
Nummerierung	Automatisch						
Information							
Titel		Autor		Kommentar		Familie	
Version	0.1	Anwenderdefi-nierte ID					
Name		Datentyp		Startwert		Remanenz	
▼ Input							
MStartButton		Bool		false		False	
MAutomatic		Bool		false		False	
MManual		Bool		false		False	
MJog		Bool		false		False	
MLeftButton		Bool		false		False	
MRightButton		Bool		false		False	
MStopButtonInAllModes		Bool		false		False	
▼ Output							
StartButtonHMI		Bool		false		False	
AutomaticHMI		Bool		false		False	
ManualHMI		Bool		false		False	
JogHMI		Bool		false		False	
LeftButtonHMI		Bool		false		False	
RightButtonHMI		Bool		false		False	
StopButtonInAllModesHMI		Bool		false		False	
InOut							
Static							

Programmbausteine / Functions

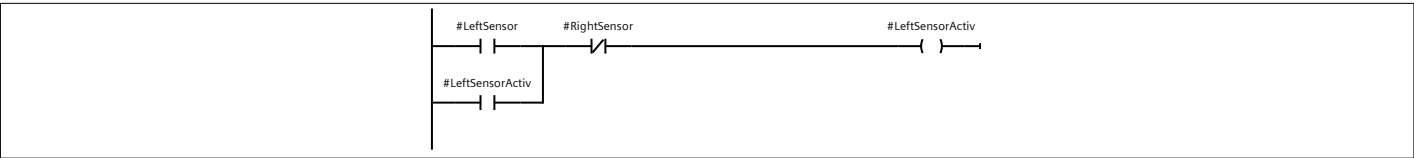
Automatic [FB2]

Automatic Eigenschaften							
Allgemein							
Name	Automatic	Nummer	2	Typ	FB	Sprache	KOP
Nummerierung	Automatisch						
Information							
Titel		Autor		Kommentar		Familie	
Version	0.1	Anwenderdefinierte ID					
Name			Datentyp	Defaultwert		Remanenz	
▼ Input							
StartButton			Bool	false		Nicht remanent	
LeftSensor			Bool	false		Nicht remanent	
RightSensor			Bool	false		Nicht remanent	
IsSafe			Bool	false		Nicht remanent	
StopMode			Bool	false		Nicht remanent	
▼ Output							
Forwards			Bool	false		Nicht remanent	
Backwards			Bool	false		Nicht remanent	
InOut							
▼ Static							
LeftSensorActiv			Bool	false		Nicht remanent	
RightSensorActiv			Bool	false		Nicht remanent	
▼ Temp							
Running			Bool				
Constant							

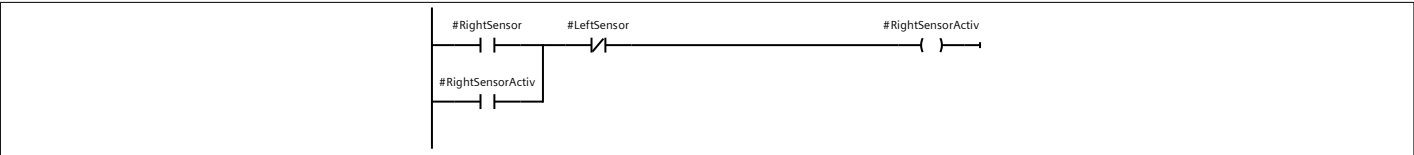
Netzwerk 1: Star and Stop button in HMI



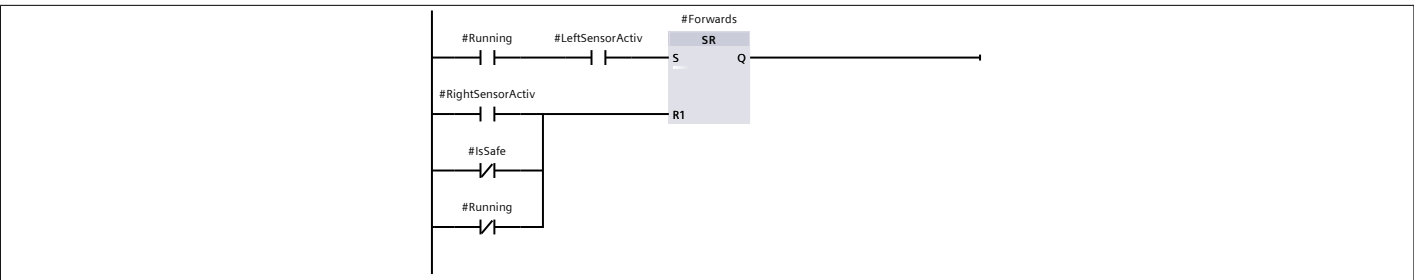
Netzwerk 2: Left sensor is activ



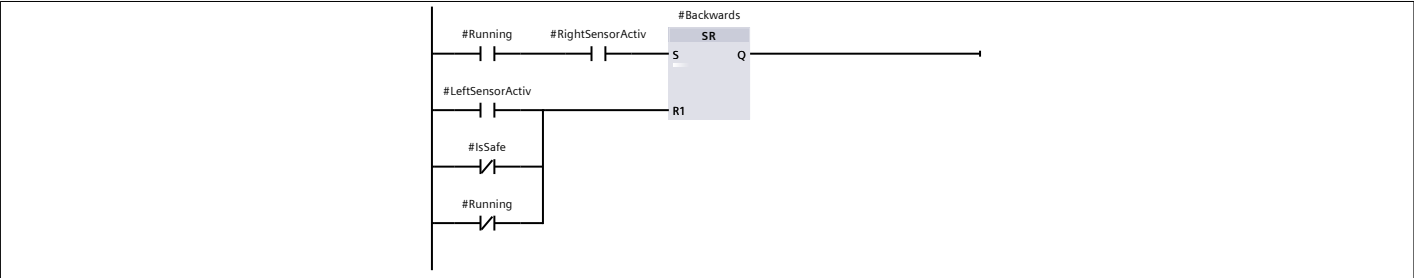
Netzwerk 3: Right sensor is activ



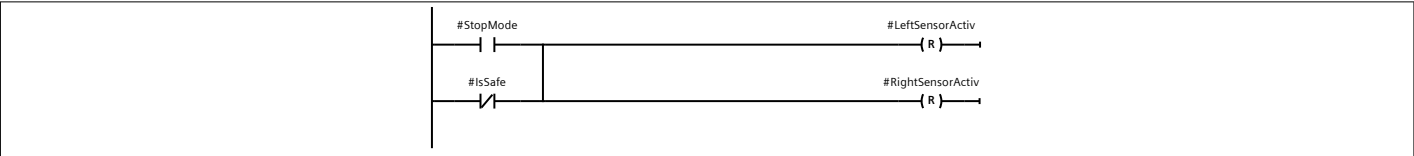
Netzwerk 4: Moves forwards



Netzwerk 5: Moves backwards



Netzwerk 6: Stop Mode



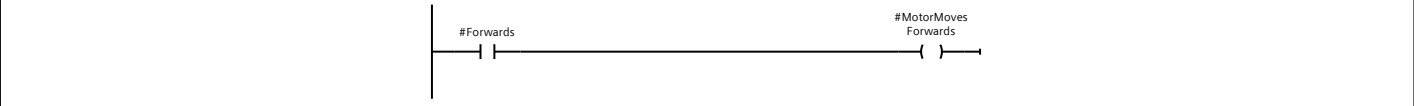
Programmbausteine / Functions

Control [FB1]

Control Eigenschaften							
Allgemein							
Name	Control	Nummer	1	Typ	FB	Sprache	KOP
Nummerierung	Automatisch						
Information							
Titel		Autor		Kommentar		Familie	
Version	0.1	Anwenderdefinierte ID					

Name	Datentyp	Defaultwert	Remanenz
▼ Input			
Backwards	Bool	false	Nicht remanent
Forwards	Bool	false	Nicht remanent
IsSafe	Bool	false	Nicht remanent
▼ Output			
MotorMovesBackwards	Bool	false	Nicht remanent
MotorMovesForwards	Bool	false	Nicht remanent
InOut			
Static			
Temp			
Constant			

Netzwerk 1: Motor moves forwards



Netzwerk 2: Motor moves backwards



Programmbausteine / Functions

Jog [FB6]

Jog Eigenschaften							
Allgemein							
Name	Jog	Nummer	6	Typ	FB	Sprache	KOP
Nummerierung	Automatisch						
Information							
Titel		Autor		Kommentar		Familie	
Version	0.1	Anwenderdefinierte ID					

Name	Datentyp	Defaultwert	Remanenz
▼ Input			
RightButton	Bool	false	Nicht remanent
LeftButton	Bool	false	Nicht remanent
RightSensor	Bool	false	Nicht remanent
LeftSensor	Bool	false	Nicht remanent
IsSafe	Bool	false	Nicht remanent
▼ Output			
Forwards	Bool	false	Nicht remanent
Backwards	Bool	false	Nicht remanent
InOut			
Static			
Temp			
Constant			

Netzwerk 1: Conveyor moves forwards



Netzwerk 2: Motor moves backwards



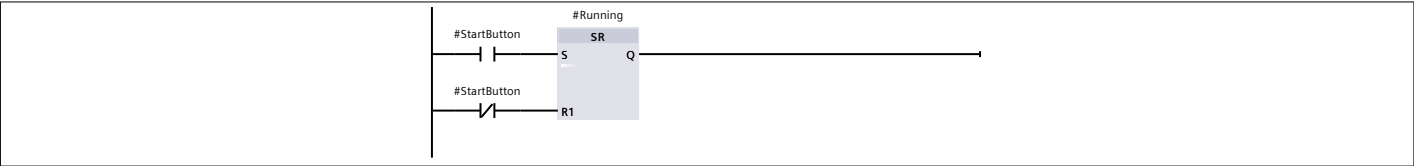
Programmbausteine / Functions

Manual [FB4]

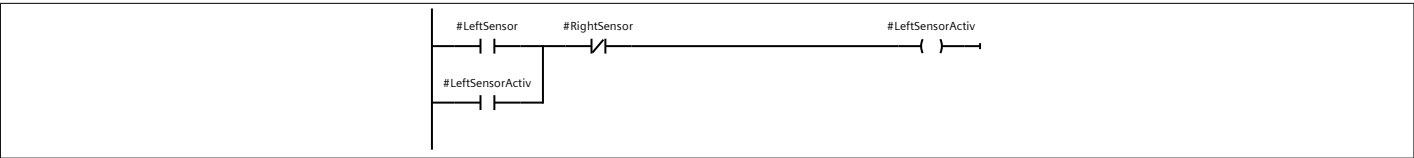
Manual Eigenschaften							
Allgemein							
Name	Manual	Nummer	4	Typ	FB	Sprache	KOP
Nummerierung	Automatisch						
Information							
Titel		Autor		Kommentar		Familie	
Version	0.1	Anwenderdefinierte ID					

Name	Datentyp	Defaultwert	Remanenz
▼ Input			
StartButton	Bool	false	Nicht remanent
LeftSensor	Bool	false	Nicht remanent
RightSensor	Bool	false	Nicht remanent
IsSafe	Bool	false	Nicht remanent
StopMode	Bool	false	Nicht remanent
▼ Output			
Forwards	Bool	false	Nicht remanent
Backwards	Bool	false	Nicht remanent
InOut			
▼ Static			
LeftSensorActiv	Bool	false	Nicht remanent
RightSensorActiv	Bool	false	Nicht remanent
▼ Temp			
Running	Bool		
Constant			

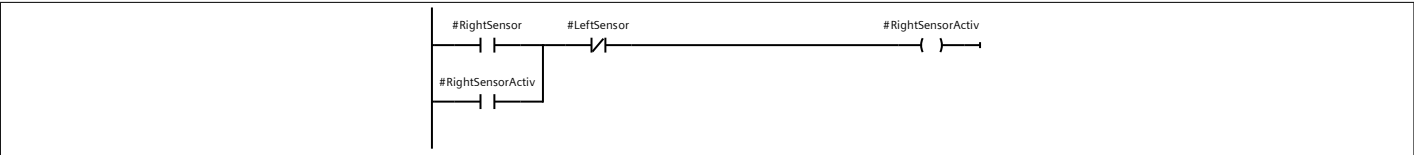
Netzwerk 1: Star and Stop button in HMI



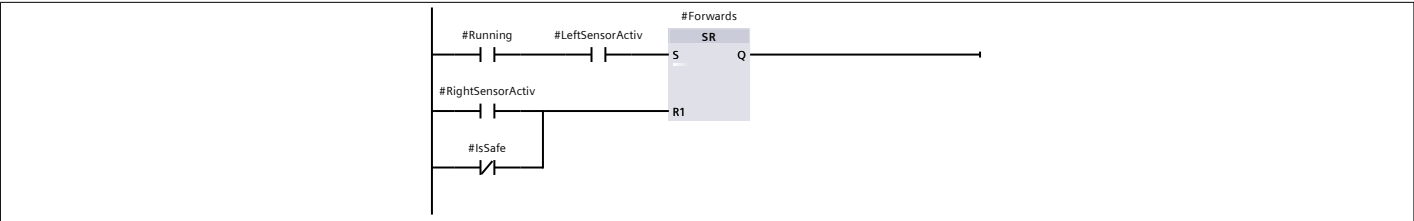
Netzwerk 2: Left sensor is activ



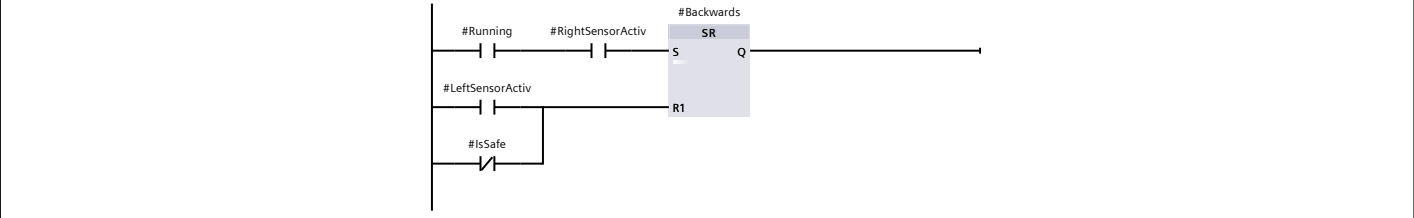
Netzwerk 3: Right sensor is activ



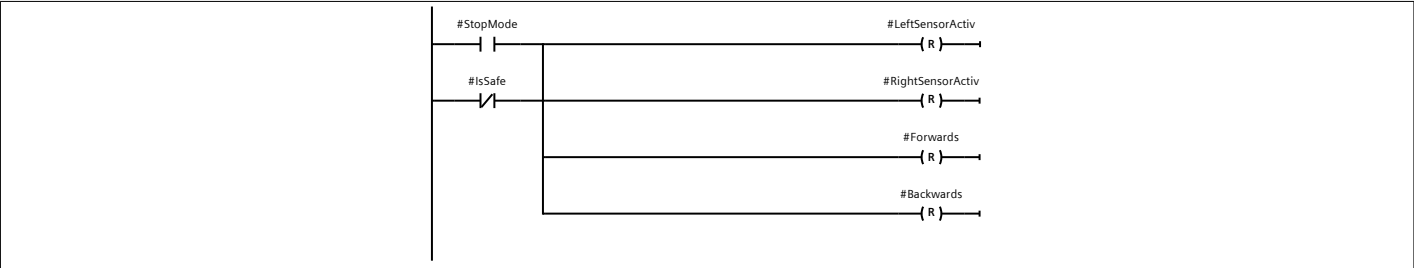
Netzwerk 4: Moves forwards



Netzwerk 5: Moves backwards



Netzwerk 6: Stop Mode



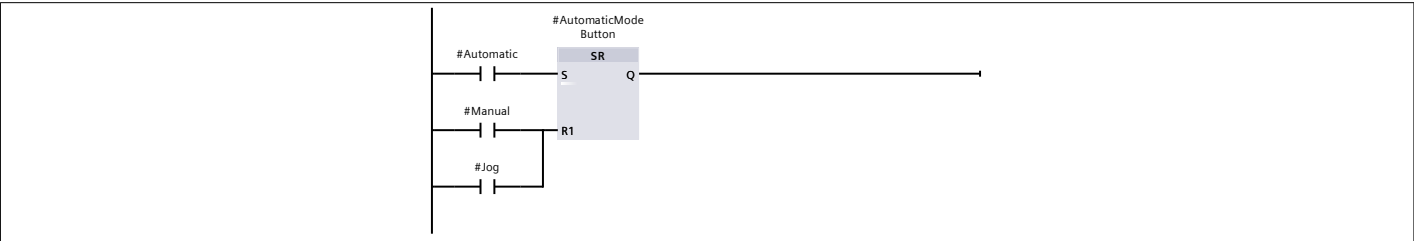
Programmbausteine / Functions

Mode Selection [FB5]

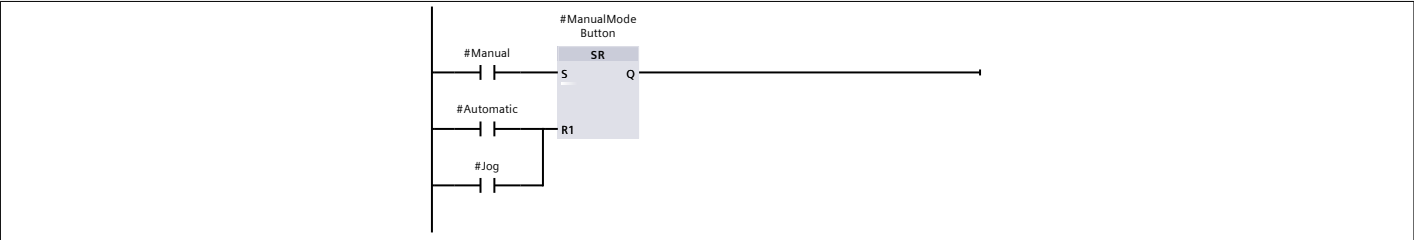
Mode Selection Eigenschaften							
Allgemein							
Name	Mode Selection	Nummer	5	Typ	FB	Sprache	KOP
Nummerierung	Automatisch						
Information							
Titel		Autor		Kommentar		Familie	
Version	0.1	Anwenderdefinierte ID					

Name	Datentyp	Defaultwert	Remanenz
▼ Input			
Automatic	Bool	false	Nicht remanent
Manual	Bool	false	Nicht remanent
Jog	Bool	false	Nicht remanent
Stop	Bool	false	Nicht remanent
▼ Output			
AutomaticModeButton	Bool	false	Nicht remanent
ManualModeButton	Bool	false	Nicht remanent
JogModeButton	Bool	false	Nicht remanent
InOut			
Static			
Temp			
Constant			

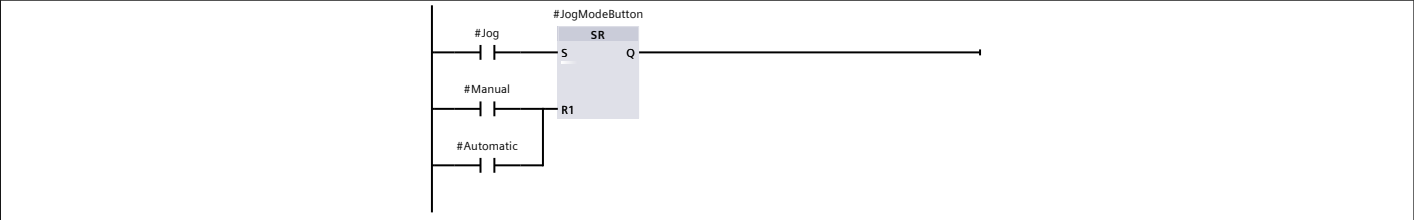
Netzwerk 1: Automatic



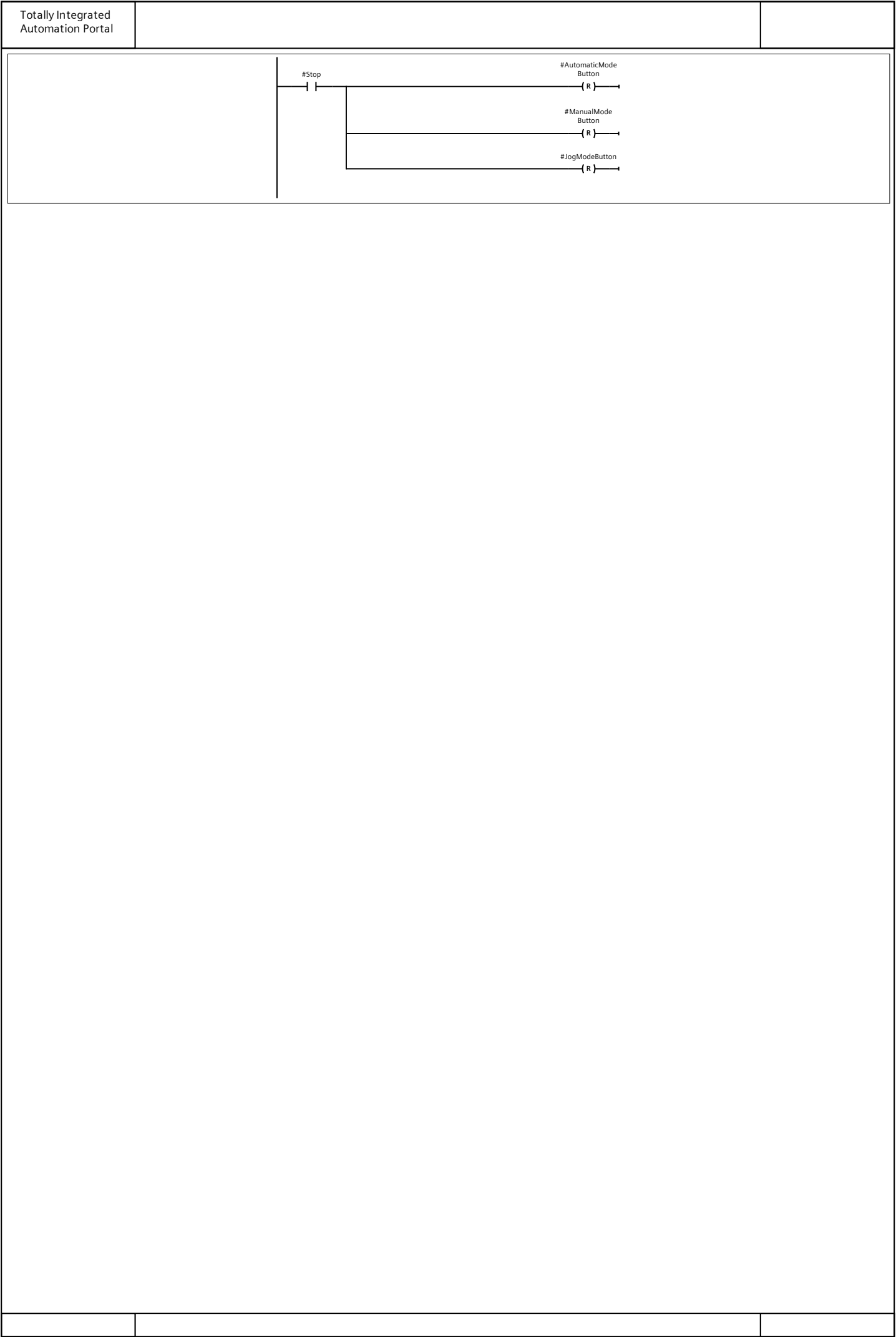
Netzwerk 2: Manual



Netzwerk 3: Jog



Netzwerk 4: Back to home



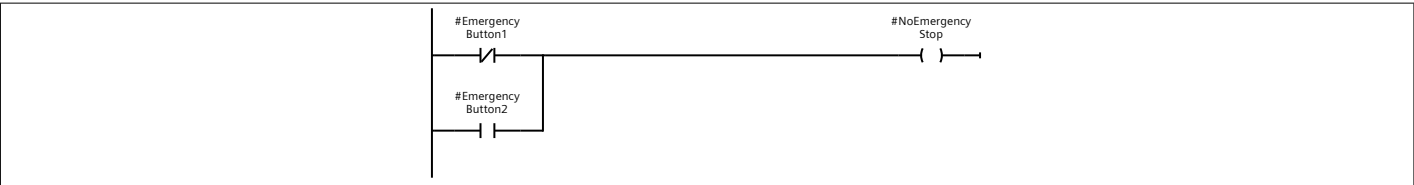
Programmbausteine / Functions

Safety [FB3]

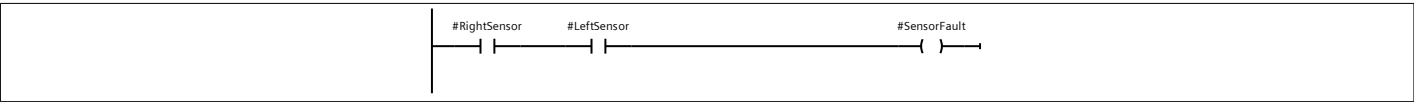
Safety Eigenschaften							
Allgemein							
Name	Safety	Nummer	3	Typ	FB	Sprache	KOP
Nummerierung	Automatisch						
Information							
Titel		Autor		Kommentar		Familie	
Version	0.1	Anwenderdefinierte ID					

Name	Datentyp	Defaultwert	Remanenz
▼ Input			
EmergencyButton1	Bool	false	Nicht remanent
EmergencyButton2	Bool	false	Nicht remanent
RightSensor	Bool	false	Nicht remanent
LeftSensor	Bool	false	Nicht remanent
▼ Output			
IsSafe	Bool	false	Nicht remanent
InOut			
Static			
▼ Temp			
SensorFault	Bool		
NoEmergencyStop	Bool		
Constant			

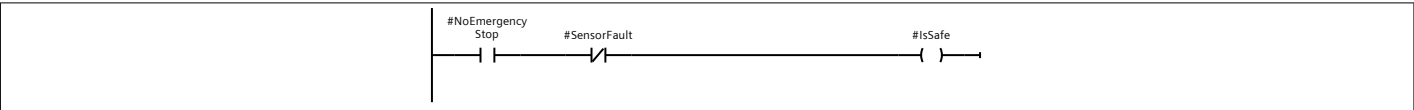
Netzwerk 1: Emergency button



Netzwerk 2: Sensors fault



Netzwerk 3: Safe state



Programmbausteine / Functions

Visual Components [FB7]

Visual Components Eigenschaften							
Allgemein							
Name	Visual Components	Nummer	7	Typ	FB	Sprache	KOP
Nummerierung	Automatisch						
Information							
Titel		Autor		Kommentar		Familie	
Version	0.1	Anwenderdefinierte ID					

Name	Datentyp	Defaultwert	Remanenz
▼ Input			
MStartButton	Bool	false	Nicht remanent
MAutomatic	Bool	false	Nicht remanent
MManual	Bool	false	Nicht remanent
MJog	Bool	false	Nicht remanent
MLeftButton	Bool	false	Nicht remanent
MRightButton	Bool	false	Nicht remanent
MStopButtonInAllModes	Bool	false	Nicht remanent
▼ Output			
StartButtonHMI	Bool	false	Nicht remanent
AutomaticHMI	Bool	false	Nicht remanent
ManualHMI	Bool	false	Nicht remanent
JogHMI	Bool	false	Nicht remanent
LeftButtonHMI	Bool	false	Nicht remanent
RightButtonHMI	Bool	false	Nicht remanent
StopButtonInAllModesHMI	Bool	false	Nicht remanent
InOut			
Static			
Temp			
Constant			

Netzwerk 1:



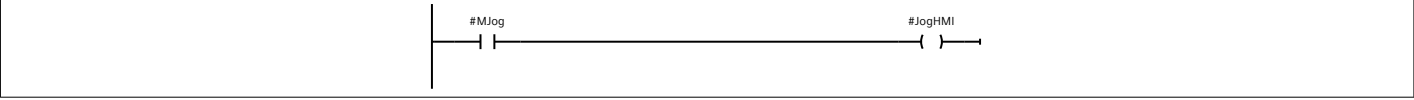
Netzwerk 2:



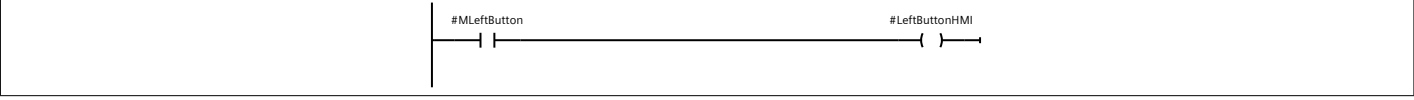
Netzwerk 3:



Netzwerk 4:



Netzwerk 5:



Netzwerk 6:

Totally Integrated Automation Portal		
<div><div></div><div>#MRightButton#RightButtonHMI</div></div>		
Netzwerk 7:		
<div><div></div><div>#MStopButtonInAllModes#StopButtonInAllModesHMI</div></div>		

Programmbausteine / Data base HMI

Variables to connect with the HMI [DB1]

Variables to connect with the HMI Eigenschaften

Allgemein

Name	Variables to connect with the HMI	Nummer	1	Typ	DB	Sprache	DB
Nummerierung	Automatisch						

Information

Titel		Autor		Kommentar		Familie	
Version	0.1	Anwenderdefinierte ID					

Name	Datentyp	Startwert	Remanenz
▼ Static			
StartButton	Bool	false	False
RightButton	Bool	false	False
LeftButton	Bool	false	False
StopButtonInAllModes	Bool	false	False
AutomaticModeButton	Bool	false	False
ManualModeButton	Bool	false	False
JogModeButton	Bool	false	False

9.4 HMI

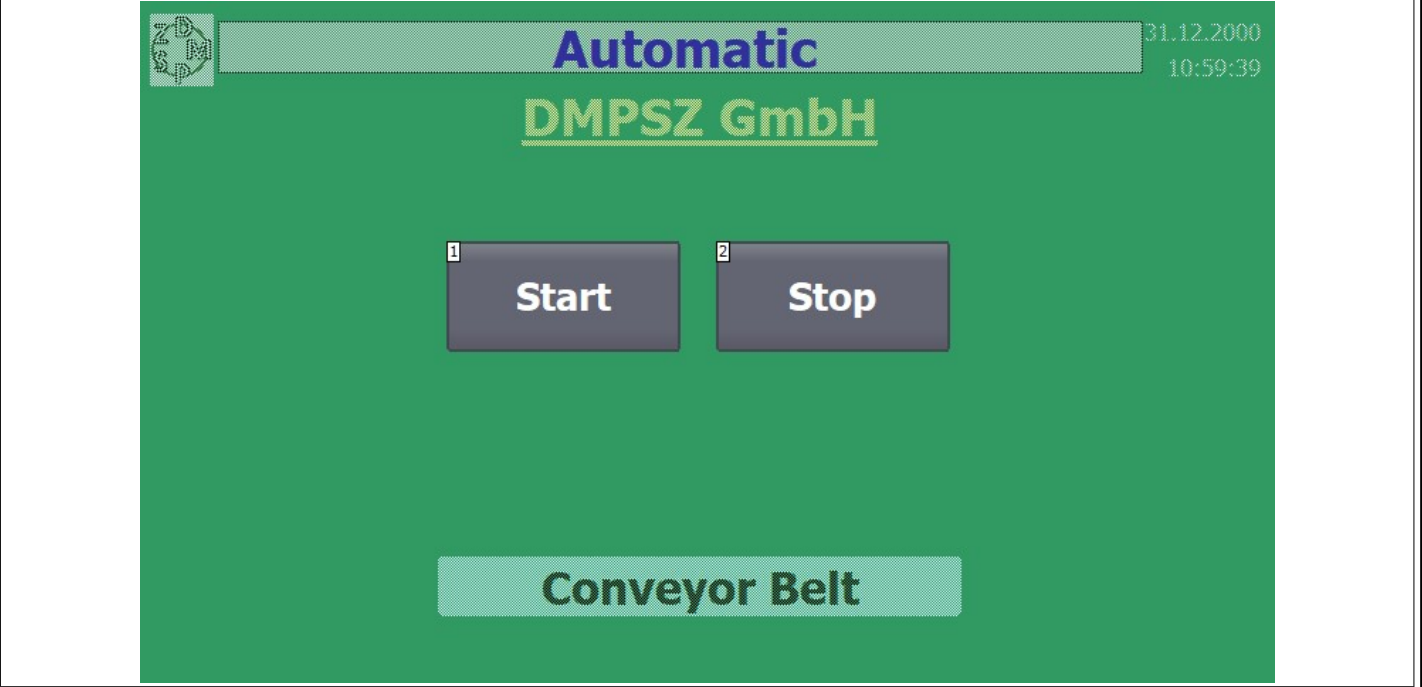
Inhaltsverzeichnis

Bilder	
Automatic	3 - 1
Back From Automatic	4 - 1
Back From Manual	5 - 1
Home	6 - 1
Jog	7 - 1
Manual	8 - 1
Menu	9 - 1

Bilder

Automatic

Hardcopy von Automatic

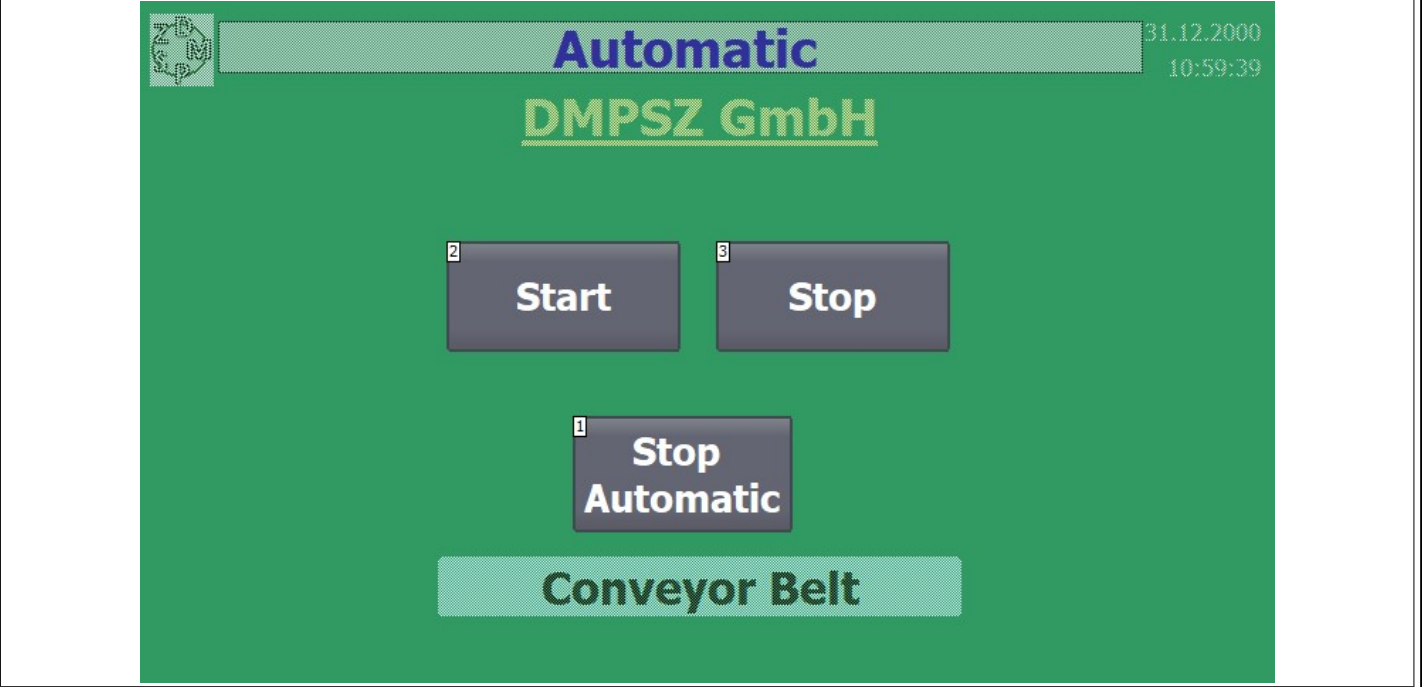


Name	Automatic	Farbe Hintergrund	49; 154; 99	Farbe Raster	0; 0; 0
Nummer	3	Vorlage	Vorlage_1	Tooltip	
Dynamisierungen\Ereignis					
Ereignisname		Aufgebaut			
Funktionsliste\SetzeVariable					
Variable	Variable_Bildnummer		Wert	1	
Textfeld_3					
Typ	Textfeld	Name	Textfeld_3	Position X	288
Position Y	9	Breite	191	Höhe	47
Ebene	0 - Ebene_0	Schriftart	Tahoma, 36px, style=Bold	Text	Automatic
Schaltfläche_1					
Typ	Schaltfläche	Name	Schaltfläche_1	Position X	216
Position Y	169	Breite	165	Höhe	78
Modus	Text	Text AUS	Start	Text EIN	Text
Dynamisierungen\Ereignis					
Ereignisname		Drücken			
Funktionsliste\SetzeBit					
Variable		StartButton			
Funktionsliste\RücksetzeBit					
Variable		StopButtonInAllModes			
Dynamisierungen\Gestaltung					
Variable - Zyklus	StartButton -	Datentyp	Bereich	Bereich	1..1
Farbe Vordergrund	255; 255; 255	Hintergrundfarbe	0; 255; 0	Blinken	Nein
Schaltfläche_2					
Typ	Schaltfläche	Name	Schaltfläche_2	Position X	406
Position Y	169	Breite	165	Höhe	78
Modus	Text	Text AUS	Stop	Text EIN	Text
Dynamisierungen\Ereignis					
Ereignisname		Drücken			
Funktionsliste\AktiviereBild					
Bildname	Back From Automatic		Objektnummer	0	
Funktionsliste\RücksetzeBit					
Variable		StartButton			

Bilder

Back From Automatic

Hardcopy von Back From Automatic

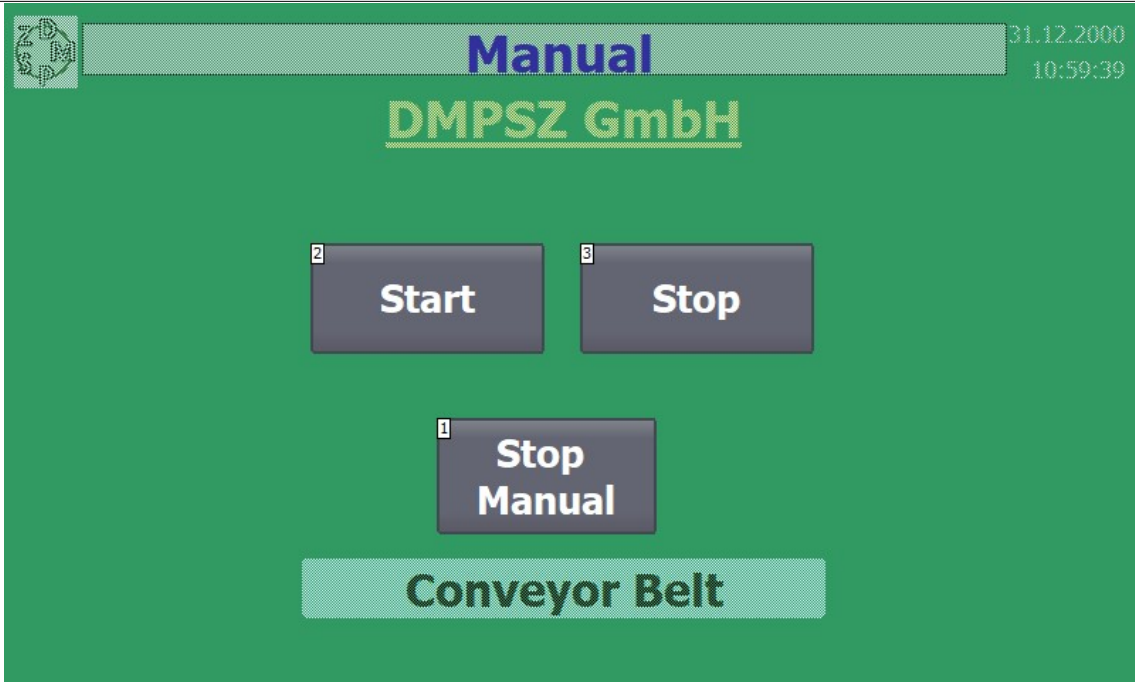


Name	Back From Automatic	Farbe Hintergrund	49; 154; 99	Farbe Raster	0; 0; 0
Nummer	2	Vorlage	Vorlage_1	Tooltip	
Dynamisierungen\Ereignis					
Ereignisname		Aufgebaut			
Funktionsliste\SetzeVariable					
Variable		Variable_Bildnummer	Wert	1	
Schaltfläche_3					
Typ	Schaltfläche	Name	Schaltfläche_3	Position X	305
Position Y	292	Breite	155	Höhe	82
Modus	Text	Text AUS	Stop Automatic	Text EIN	Text
Dynamisierungen\Ereignis					
Ereignisname		Drücken			
Funktionsliste\AktiviereBild					
Bildname		Menu	Objektnummer	0	
Funktionsliste\SetzeBit					
Variable		StopButtonInAllModes			
Textfeld_3					
Typ	Textfeld	Name	Textfeld_3	Position X	288
Position Y	9	Breite	191	Höhe	47
Ebene	0 - Ebene_0	Schriftart	Tahoma, 36px, style=Bold	Text	Automatic
Schaltfläche_1					
Typ	Schaltfläche	Name	Schaltfläche_1	Position X	216
Position Y	169	Breite	165	Höhe	78
Modus	Text	Text AUS	Start	Text EIN	Text
Dynamisierungen\Ereignis					
Ereignisname		Drücken			
Funktionsliste\AktiviereBild					
Bildname		Automatic	Objektnummer	0	
Funktionsliste\SetzeBit					
Variable		StartButton			
Dynamisierungen\Gestaltung					
Variable - Zyklus	StartButton -	Datentyp	Bereich	Bereich	0..0
Farbe Vordergrund	255; 255; 255	Hintergrundfarbe	99; 101; 113	Blinken	Nein

Bilder

Back From Manual

Hardcopy von Back From Manual



Name	Back From Manual	Farbe Hintergrund	49; 154; 99	Farbe Raster	0; 0; 0
Nummer	6	Vorlage	Vorlage_1	Tooltip	

Dynamisierungen\Ereignis

Ereignisname	Aufgebaut
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Funktionsliste\SetzeVariable

Variable	Variable_Bildnummer	Wert	1
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Schaltfläche_3

Typ	Schaltfläche	Name	Schaltfläche_3	Position X	305
Position Y	292	Breite	155	Höhe	82
Modus	Text	Text AUS	Stop Manual	Text EIN	Text

Dynamisierungen\Ereignis

Ereignisname	Drücken
--------------	---------

Funktionsliste\AktiviereBild

Bildname	Menu	Objektnummer	0
----------	------	--------------	---

Funktionsliste\SetzeBit

Variable	StopButtonInAllModes
----------	----------------------

Textfeld_3

Typ	Textfeld	Name	Textfeld_3	Position X	322
Position Y	11	Breite	138	Höhe	47
Ebene	0 - Ebene_0	Schriftart	Tahoma, 36px, style=Bold	Text	Manual

Schaltfläche_1

Typ	Schaltfläche	Name	Schaltfläche_1	Position X	216
Position Y	169	Breite	165	Höhe	78
Modus	Text	Text AUS	Start	Text EIN	Text

Dynamisierungen\Ereignis

Ereignisname	Drücken
--------------	---------

Funktionsliste\SetzeBitWährendTasteGedrückt

Variable	StartButton	Bit	0
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Funktionsliste\AktiviereBild

Bildname	Manual	Objektnummer	0
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Dynamisierungen\Gestaltung

Variable - Zyklus	StartButton -	Datentyp	Bereich	Bereich	1..1
Farbe Vordergrund	255; 255; 255	Hintergrundfarbe	0; 255; 0	Blinken	Nein

Schaltfläche_2

Type	Schaltfläche	Name	Schaltfläche_2	Position X	406
Position Y	169	Breite	165	Höhe	78
Modus	Text	Text AUS	Stop	Text EIN	Text

Dynamisierungen\Ereignis

Ereignisname	Drücken
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Funktionsliste\RücksetzeBit

Variable	StartButton
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Funktionsliste\AktiviereBild

Bildname	Back From Manual	Objektnummer	0
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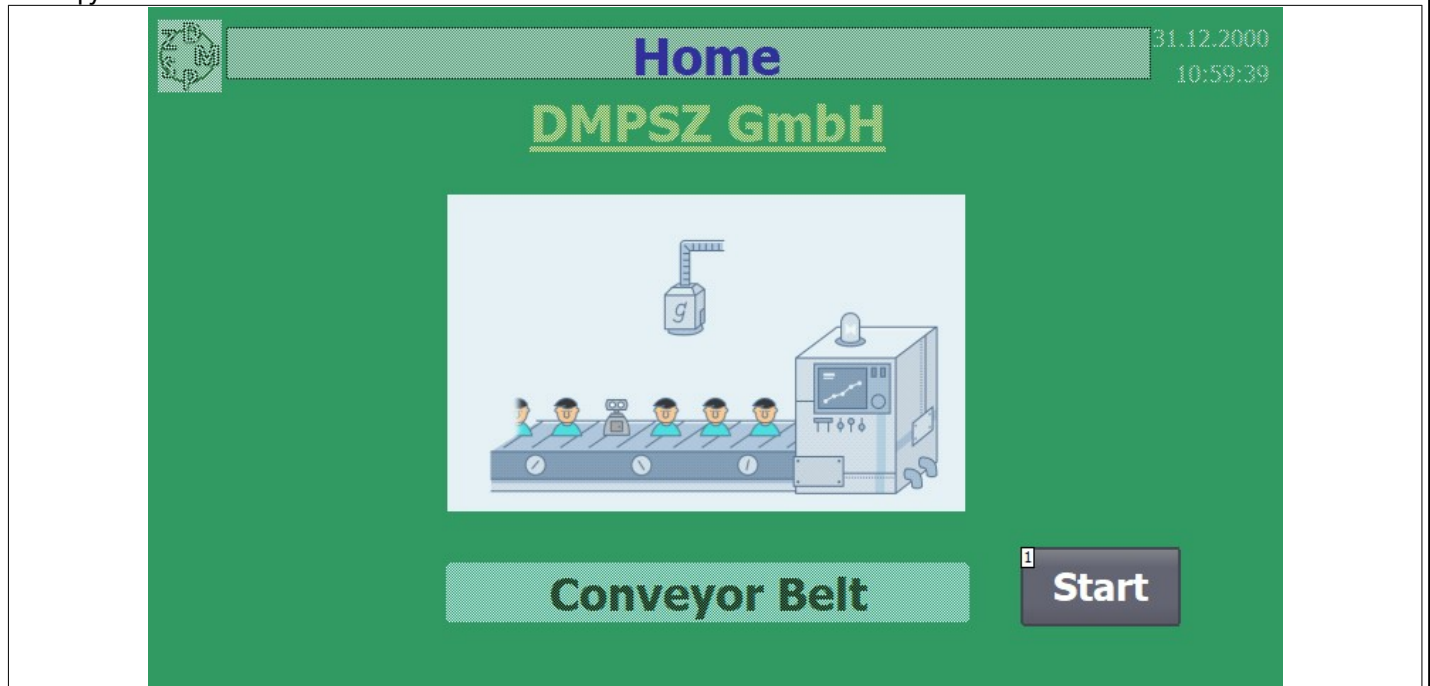
Dynamisierungen\Gestaltung

Variable - Zyklus	StartButton -	Datentyp	Bereich	Bereich	0..0
Farbe Vordergrund	255; 255; 255	Hintergrundfarbe	255; 0; 0	Blinken	Nein

Bilder

Home

Hardcopy von Home



Name	Home	Farbe Hintergrund	49; 154; 99	Farbe Raster	0; 0; 0
Nummer	1	Vorlage	Vorlage_1	Tooltip	

Dynamisierungen\Ereignis

Ereignisname	Aufgebaut
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Funktionsliste\SetzeVariable

Variable	Variable_Bildnummer	Wert	1
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Grafikanzeige_1

Typ	Grafikanzeige	Name	Grafikanzeige_1	Position X	211
Position Y	132	Breite	365	Höhe	223
Ebene	0 - Ebene_0	Grafik	Conveyor Belt_Bilt	Grafik an Objektgröße anpassen	Bild strecken

Schaltfläche_1

Typ	Schaltfläche	Name	Schaltfläche_1	Position X	615
Position Y	380	Breite	113	Höhe	56
Modus	Text	Text AUS	Start	Text EIN	Text

Dynamisierungen\Ereignis

Ereignisname	Drücken
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Funktionsliste\AktiviereBild

Bildname	Menu	Objektnummer	0
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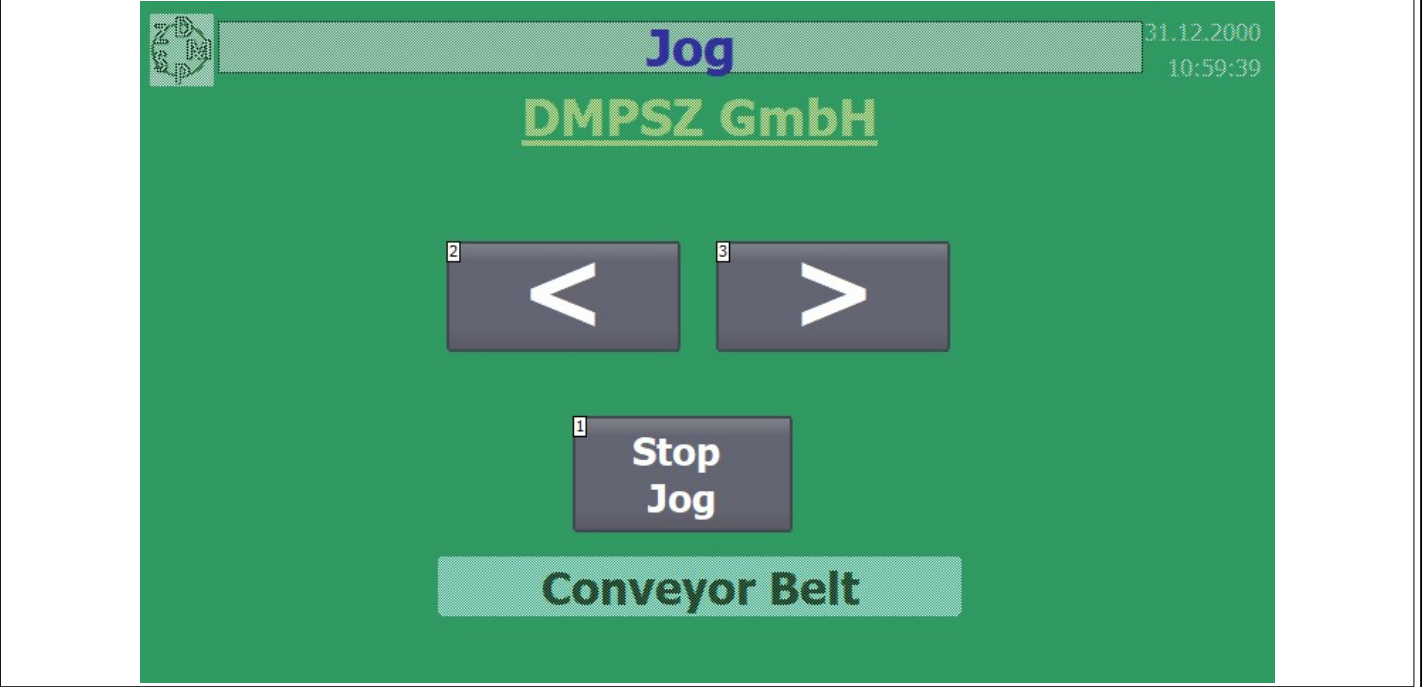
Textfeld_3

Typ	Textfeld	Name	Textfeld_3	Position X	338
Position Y	10	Breite	110	Höhe	47
Ebene	0 - Ebene_0	Schriftart	Tahoma, 36px, style=Bold	Text	Home

Bilder

Jog

Hardcopy von Jog



Name	Jog	Farbe Hintergrund	49; 154; 99	Farbe Raster	0; 0; 0
Nummer	7	Vorlage	Vorlage_1	Tooltip	

Dynamisierungen\Ereignis					
Ereignisname	Aufgebaut				

Funktionsliste\SetzeVariable

Variable	Variable_Bildnummer	Wert	1
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Textfeld_4

Typ	Textfeld	Name	Textfeld_4	Position X	354
Position Y	8	Breite	68	Höhe	47
Ebene	0 - Ebene_0	Schriftart	Tahoma, 36px, style=Bold	Text	Jog

Schaltfläche_3

Typ	Schaltfläche	Name	Schaltfläche_3	Position X	305
Position Y	292	Breite	155	Höhe	82
Modus	Text	Text AUS	Stop Jog	Text EIN	Text

Dynamisierungen\Ereignis					
Ereignisname	Drücken				

Funktionsliste\AktiviereBild

Bildname	Menu	Objektnummer	0
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Schaltfläche_1

Typ	Schaltfläche	Name	Schaltfläche_1	Position X	216
Position Y	169	Breite	165	Höhe	78
Modus	Text	Text AUS	<	Text EIN	Text

Dynamisierungen\Ereignis					
Ereignisname	Drücken				

Funktionsliste\SetzeBitWährendTasteGedrückt

Variable	LeftButton	Bit	0
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Dynamisierungen\Gestaltung

Variable - Zyklus	LeftButton -	Datentyp	Bereich	Bereich	0..0
Farbe Vordergrund	255; 255; 255	Hintergrundfarbe	99; 101; 113	Blinken	Nein
Bereich	1..1	Farbe Vordergrund	255; 255; 255	Hintergrundfarbe	0; 255; 0
Blinken	Nein				

Schaltfläche_2

Typ	Schaltfläche	Name	Schaltfläche_2	Position X	406
Position Y	169	Breite	165	Höhe	78
Modus	Text	Text AUS	>	Text EIN	Text

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Dynamisierungen\Ereignis

Ereignisname	Drücken
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Funktionsliste\SetzeBitWährendTasteGedrückt

Variable	RightButton	Bit	0
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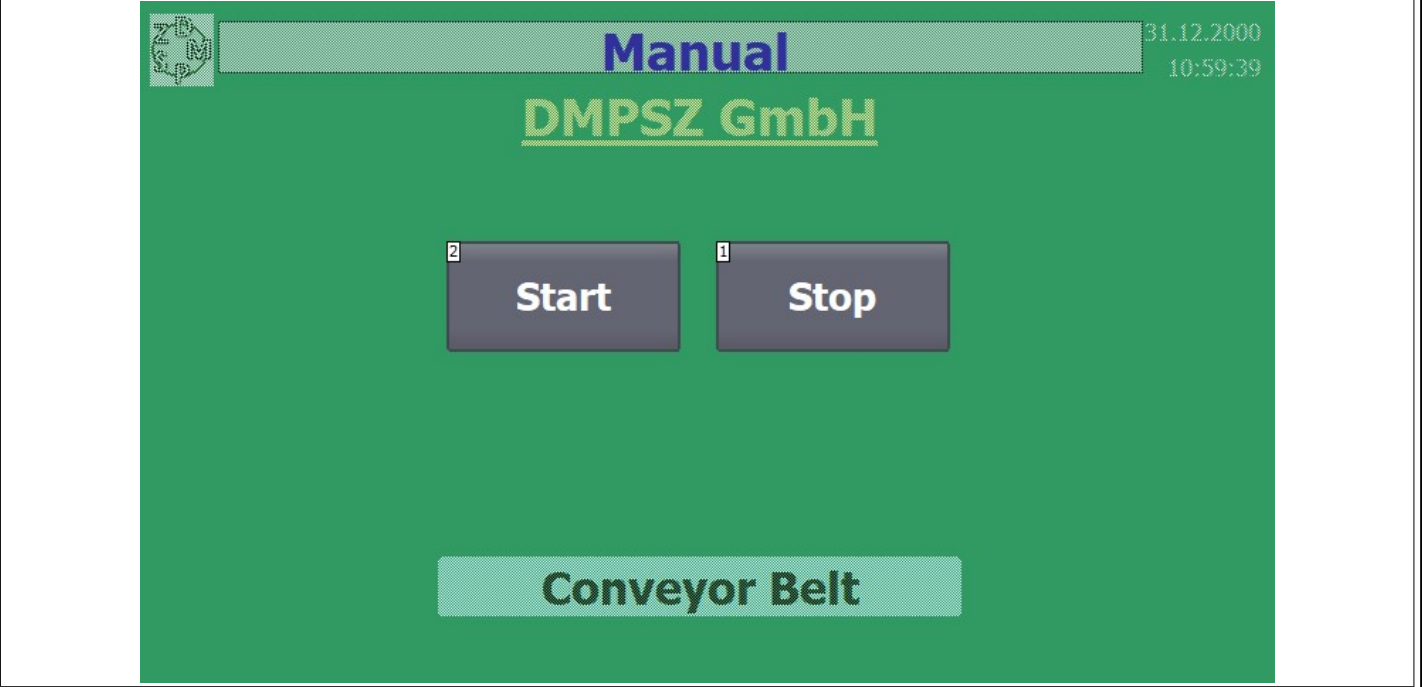
Dynamisierungen\Gestaltung

Variable - Zyklus	RightButton -	Datentyp	Bereich	Bereich	0..0
Farbe Vordergrund	255; 255; 255	Hintergrundfarbe	99; 101; 113	Blinken	Nein
Bereich	1..1	Farbe Vordergrund	255; 255; 255	Hintergrundfarbe	0; 255; 0
Blinken	Nein				

Bilder

Manual

Hardcopy von Manual

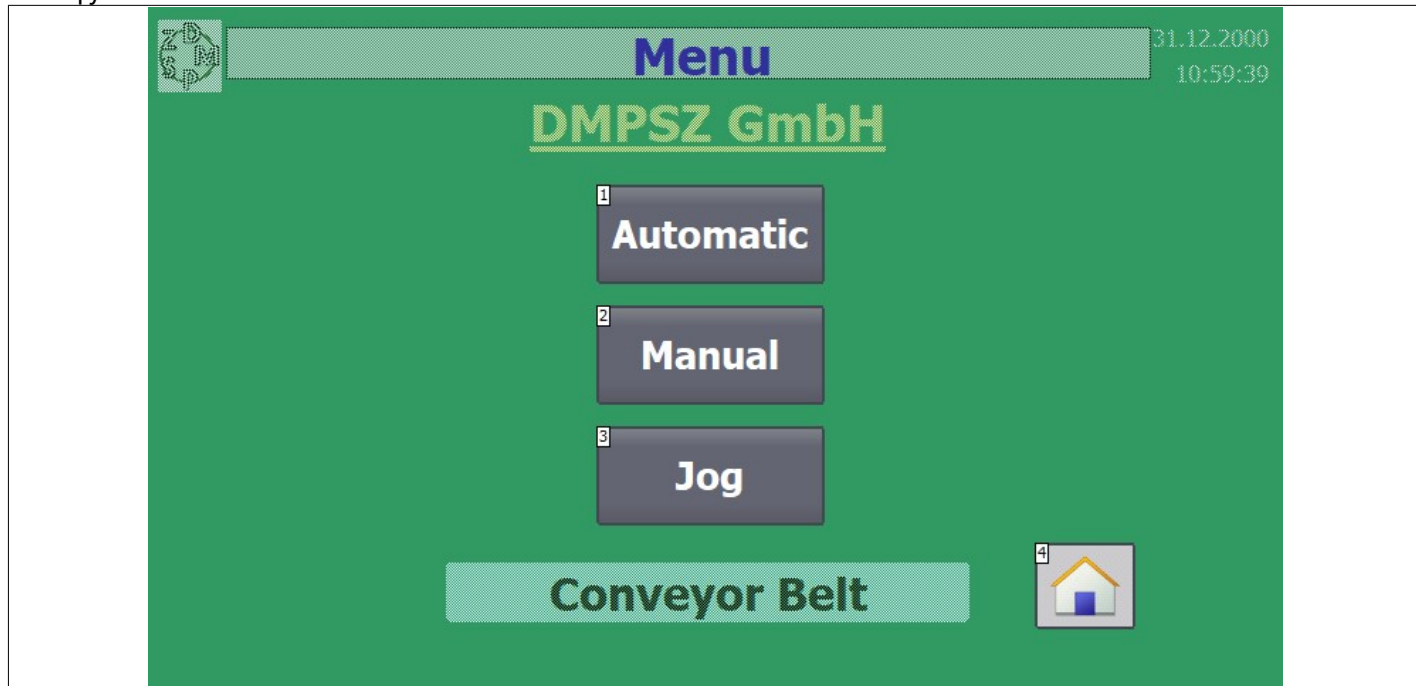


Name	Manual	Farbe Hintergrund	49; 154; 99	Farbe Raster	0; 0; 0
Nummer	5	Vorlage	Vorlage_1	Tooltip	
Dynamisierungen\Ereignis					
Ereignisname		Aufgebaut			
Funktionsliste\SetzeVariable					
Variable		Variable_Bildnummer	Wert	1	
Textfeld_4					
Typ	Textfeld	Name	Textfeld_4	Position X	322
Position Y	11	Breite	138	Höhe	47
Ebene	0 - Ebene_0	Schriftart	Tahoma, 36px, style=Bold	Text	Manual
Schaltfläche_2					
Typ	Schaltfläche	Name	Schaltfläche_2	Position X	406
Position Y	169	Breite	165	Höhe	78
Modus	Text	Text AUS	Stop	Text EIN	Text
Dynamisierungen\Ereignis					
Ereignisname		Drücken			
Funktionsliste\AktiviereBild					
Bildname		Back From Manual	Objektnummer	0	
Funktionsliste\RücksetzeBit					
Variable		StartButton			
Schaltfläche_1					
Typ	Schaltfläche	Name	Schaltfläche_1	Position X	216
Position Y	169	Breite	165	Höhe	78
Modus	Text	Text AUS	Start	Text EIN	Text
Dynamisierungen\Ereignis					
Ereignisname		Drücken			
Funktionsliste\SetzeBitWährendTasteGedrückt					
Variable		StartButton	Bit	0	
Funktionsliste\RücksetzeBit					
Variable		StopButtonInAllModes			
Dynamisierungen\Gestaltung					
Variable - Zyklus	StartButton -	Datentyp	Bereich	Bereich	1..1
Farbe Vordergrund	255; 255; 255	Hintergrundfarbe	0; 255; 0	Blinken	Nein

Bilder

Menu

Hardcopy von Menu



Name	Menu	Farbe Hintergrund	49; 154; 99	Farbe Raster	0; 0; 0
Nummer	4	Vorlage	Vorlage_1	Tooltip	

Dynamisierungen\Ereignis

Ereignisname	Aufgebaut
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Funktionsliste\SetzeVariable

Variable	Variable_Bildnummer	Wert	1
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Textfeld_3

Typ	Textfeld	Name	Textfeld_3	Position X	338
Position Y	10	Breite	104	Höhe	47
Ebene	0 - Ebene_0	Schriftart	Tahoma, 36px, style=Bold	Text	Menu

Schaltfläche_1

Typ	Schaltfläche	Name	Schaltfläche_1	Position X	316
Position Y	125	Breite	161	Höhe	70
Modus	Text	Text AUS	Automatic	Text EIN	Text

Dynamisierungen\Ereignis

Ereignisname	Drücken
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Funktionsliste\AktiviereBild

Bildname	Automatic	Objektnummer	0
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Funktionsliste\SetzeBit

Variable	AutomaticModeButton
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Funktionsliste\RücksetzeBit

Variable	ManualModeButton
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Funktionsliste\RücksetzeBit

Variable	JogModeButton
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Schaltfläche_2

Typ	Schaltfläche	Name	Schaltfläche_2	Position X	316
Position Y	210	Breite	161	Höhe	70
Modus	Text	Text AUS	Manual	Text EIN	Text

Dynamisierungen\Ereignis

Ereignisname	Drücken
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Funktionsliste\AktiviereBild

Bildname	Manual	Objektnummer	0
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Funktionsliste\SetzeBit

Variable	ManualModeButton
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Funktionsliste\RücksetzeBit

Variable	AutomaticModeButton
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Funktionsliste\RücksetzeBit

Variable	JogModeButton
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Schaltfläche_3

Typ	Schaltfläche	Name	Schaltfläche_3	Position X	316
Position Y	295	Breite	161	Höhe	70
Modus	Text	Text AUS	Jog	Text EIN	Text

Dynamisierungen\Ereignis

Ereignisname	Drücken
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Funktionsliste\AktiviereBild

Bildname	Jog	Objektnummer	0
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Funktionsliste\SetzeBit

Variable	JogModeButton
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Funktionsliste\RücksetzeBit

Variable	ManualModeButton
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Funktionsliste\RücksetzeBit

Variable	AutomaticModeButton
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Schaltfläche_4

Typ	Schaltfläche	Name	Schaltfläche_4	Position X	625
Position Y	377	Breite	71	Höhe	61
Modus	Grafik	Text AUS	Text	Text EIN	Text

Dynamisierungen\Ereignis

Ereignisname	Klicken
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Funktionsliste\AktiviereBild

Bildname	Home	Objektnummer	0
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Dynamisierungen\Ereignis

Ereignisname	Drücken
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Funktionsliste\RücksetzeBit

Variable	AutomaticModeButton
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Funktionsliste\RücksetzeBit

Variable	ManualModeButton
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Funktionsliste\RücksetzeBit

Variable	JoqModeButton
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