

Box Wrapper Project Requirements

[Motor Driving and Motor Cabling](#)

[Sensors, Actuators, and Cabling](#)

[PLC I/O](#)

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1 - Two Motors

- a) Up/Down for the wrapping stretch.
- b) Box Rotation

2 - Two Limit Switches

- a) High Limit
- b) Low Limit

3 - **Stretch Blade:** to stretch after wrapping.

4 - **Rotation Count Proximity Sensor**

5 - **Stretch Wrap empty Proximity sensor.**

Motor Driving and Motor Cabling

UP/DOWN Motor

- 0.37 kw | 380VAC | 3-Phases $I = W / (V * 0.7 * 1.73) = 0.8A$
- Speed Control Req: VFD 0.37kW
- Overload not req.
- Distance = 1m
- Cable 1*1.5mm

Rotation Motor

- 0.55 kW | 380VAC | 3-Phase $I = W / (V * 0.7 * 1.73) = 1.2A$
- Speed Control Req: VFD 0.55kW
- Overload not req.
- Distance = 1m
- Cable 1*1.5mm

Total Power Consumption: $0.37 + 0.55 = 0.92$ kw

Cable Extensions from motor to the electrical panel terminal blocks: 6m of 1*1.5mm.

Sensors, Actuators, and Cabling

Sensors:

1. **High Limit Switch** 24VDC NO | Distance = 2m | 2x0.75mm.
2. **Low Limit Switch** 24VDC NO | Distance = 1m | 2x0.75mm.
3. **Stretch Proximity Sensor** 24VDC | Distance = 2m | 3x0.75mm.
4. **Count Proximity Sensor** 24VDC | Distance = 1m | 3x0.75mm.

Current Consumption:

12mA per PLC input = 12mA x 4 = **48mA**.

Power = 48mA x 24VDC = 1.1W

Cabling from the sensor to the terminal blocks

3m of 2x0.75

3m of 3x0.75

Actuators

1. **VFD Rotation** 24VDC Relay | 1x0.75mm | 24VDC Relay.
2. **VFD UP_DOWN** 24VDC Relay | 1x0.75mm | 24VDC Relay.
3. **VFD UP_DOWN** 24VDC Relay | 1x0.75mm | 24VDC Relay.
4. **Spare** 24VDC Relay | 1x0.75mm | 24VDC Relay.

Total Current Consumption:

12mA per PLC output (AVG) + 9mA per Relay coil.

12mA x 4 + 9mA x 4 = 84 mA (For Power Supply current rating)

Power = 24VDC x 84mA = 2W

PLC I/O

Digital Outputs:

1. Rotation Motor.
2. Up_Down Motor.
3. Up_Down Motor.
4. Spare 2

Digital Input:

1. High Limit Switch
2. Low Limit Switch

3. Stretch Proximity
4. Count Proximity
5. Motor1 OVLD
6. Motor2 OVLD
7. EMGC Stop
8. Spare 1
9. Spare 2

Analog Output:

1. VFD1 Frequency
2. VFD2 Frequency

HMI Choice: PLC that supports Profinet or Modbus or control over remote PC (PLC with Ethernet port)

DC Power Consumption and Power Supply:

Digital Outputs: $12\text{mA} \times 4 = 48\text{mA}$

Digital Inputs: $12\text{mA} \times 9 = 108\text{mA}$

Analog Outputs: $12\text{mA} \times 2 = 24\text{mA}$

Relays: $9\text{mA} \times 4 = 36\text{mA}$

PLC Internal or Power Consumption: 20mA

VFD Internal or Power Consumption: $5\text{mA} \times 2 = 10\text{mA}$

Total: 246mA

1mA 24VDC with short circuit protection industrial Power Supply

Circuit Breakers

Total Motors Power Consumption = $0.92\text{kW} = 920\text{W}$

PLC I/O + PLC Power + Relays ~ 5W

Total Power $920\text{W} + 5\text{W} + 20\% = 1.1\text{kW}$

Total Current $1.1\text{kW} / (380 \times 0.7 \times 1.73) = 2.4\text{A}$

Note: Add 20% to the total power consumption for any further add-on.

VoltageDrop% = $1.73 \times \text{Current} \times \text{Cable_Impedence_per_Meter} \times \text{Cable Length} \times 100 / \text{Voltage_Source_Rate}$.

BoxWrapperProj = $1.73 \times 24 \times 0.0138 \times 10 \times 100 / 380 = 1.5\%$ (Less than 3%) a 25A is needed.
So, Main MCB rated at 25A Type C (to account for the InRush Current).

Note: Check table to voltage, cable, power

MCBs:

1. 24VDC Power Supply : MCB of 1A 1-Pole MCB - Switching.
2. PLC : 1A ControlCircuit MCB 1A 1-Pole MCB - Switching.
3. VFD 0.55kW : $0.55\text{kW} / (380 \times 1.73 \times 0.7) = 1.2\text{A}$ - Switching.
 - a. 2A 3-Pole MCB Type C (5-10 Times)
4. VFD 0.37kW : $0.37\text{kW} / (380 \times 1.73 \times 0.7) = 0.8\text{A}$ - Switching.
 - a. 1A 3-Pole MCB Type C (5-10 Times)

Note: MCBs are used for switching only. Any MCB rating higher than the device max rating is enough.

Internal Electrical Panel Cabling:

1. DC Control (Relays, PLC) : 0.75mm
2. VFDx2 : 1.5mm
3. Main Circuit Breaker Input 1.5mm

24VDC = brown

0VDC = blue

Phases = black

Analog Output = white

Digital Input = red

Digital Output Brown/yellow

Note: Check country code standards.

Fuses:

Total current consumption = 250mA, so a 500mA fuse is enough