Application support
Material handling systems

Control relays for quick and easy automation of conveyor systems.

The new easyE4 can even handle tasks of medium complexity. Up to 11 extensions can be connected, for 188 I/Os per basic device.

The new easyE4 is the perfect choice for small to medium-sized automation tasks.

Conveyor systems of small to medium complexity pose a variety of challenges for the user. To address these, the easyE4 offers programmers the choice between function block diagram (FBD), ladder diagram (LD) and structured text (ST). In addition, the easyE4 also comes with a comprehensive range of functions:

- Modbus communications for connecting a touch display
- Interrupt processing for accurate identification and tracking of packages
- Fast counters and frequency measurement for detecting the actual belt or package speed
- Controllable cycle times: users can program pre-defined ramps for belt acceleration and deceleration
- Constant input scan times, as well as special modules for controlling cycle times and interrupt processing allow for the detection and readjustment of the distances between packages via the belt speed. Product-specific accelerations and decelerations are also possible. These processes can be stored and optimized via a microSD card.

Powering Business Worldwide

1. Application description: Modularization using the example of a logistics application with a conveyor belt

An essential advantage of the easyE4 is the possibility of supplementing FBD and LD programs with function modules in structured text (ST). These function modules can be fine-tuned to the respective application and can easily be stored for re-use in the same or similar applications.

The following application example will demonstrate how easy it is to implement a modular concept using the easyE4 control relay.

2. Modularization

The creation of a program or function block begins with the definition of the functionality, the scope of performance, the performance data/features (reaction rates, mathematics, retention...), the error monitoring and the corresponding messages, as well as the design of the module or the module interface.

In the following, the procedure will be illustrated using the example of a "conveyor belt application in the packaging industry".

The function block should have the following inputs and outputs:

I1: Manual mode - ON/OFF
I2: Automatic start
I3: Stop - lock
I4: Light curtain at the entry point
I5: Safety system OK

IA1: Run time 1 in manual mode
IA2: Run time 2 in automatic mode

Q1: Controlling the belt drive
Q2: Indication that the drive is active – released – warning light
QA1: Run time
QA2: Current drive run time
QA3: Switching frequency of the light curtain at the entry point

In the present example, the engineers in charge use "structured text" for setting up the application, while its implementation and commissioning will be carried out by trained electricians using the ladder diagram.

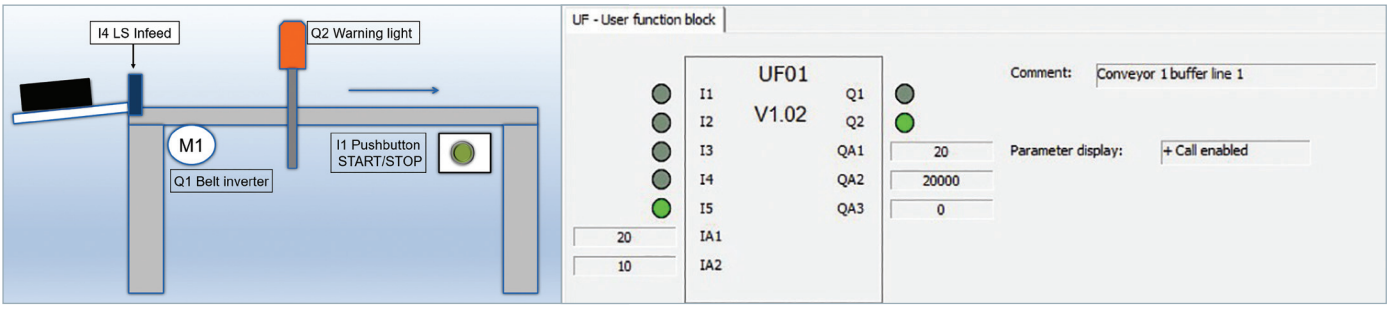

Fig. 1: A UF (user function block) depicting a system module

2.1 Description of the example application

The conveyor function module "Belt_Type1" is created in "ST" and will then be adapted in the ladder diagram.

The aim is to create a universal function block (UF) for conveyor control, given the large number of similar conveyors in the project and the fact that similar conveyors are also envisaged as the standard solution in future projects.

Note: The software development process is based on machine building considerations. Just as complete conveyor lines are composed of various separate modules, it is now also possible to assemble entire control systems from individual modules.

The application requires that each conveyor belt can be switched on and off via a pushbutton (manual mode). At the same time, the belt features a higher-level on and off contact (automatic). Once the belt has started, it should stop again after a pre-defined time if no package or workpiece is detected by the light curtain at the entry point. A yellow warning light indicates that the motor is ready to start as soon as a package is detected (standby).

2.2 Settings – parameter configurations

After the functional specifications have been drawn up – which also define the input/output interface of the user function block (UF) – the parameters of the user function block can be configured.

Configuring the function blocks:

- Up to 12 inputs and 12 outputs are available. The mixing of analog (byte, WORD, double WORD) and digital inputs/outputs is possible.
- Once the UF is saved under a unique name as a "user function block", it can be used for the present as well as any other projects.
- It is important to maintain the consistency of the version numbers. The system comes with integrated version management.
- The password protection prevents any unauthorized changes or theft of know-how.
- Individual retentive variables and blocks can be defined for the user function block.

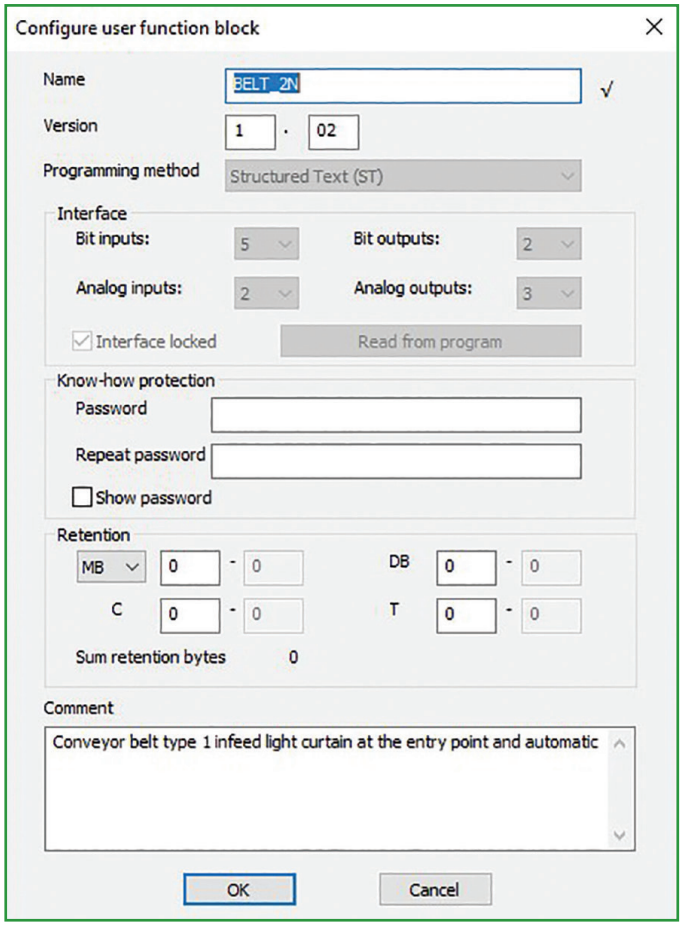

Fig. 2: Configuring the user function block

As soon as the user function block (UF) has been saved and a name and version number have been assigned to it, it can be accessed via the "user function block" tab and is ready for use. After post-processing it can also be exported to a library.

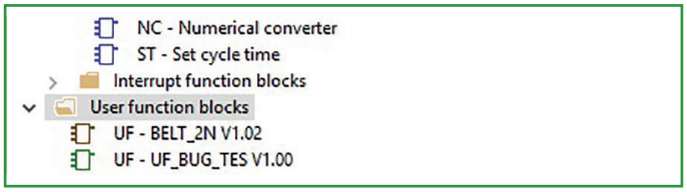

Fig. 3: As soon as the UF "Belt_Type1" has been saved, it is ready for use.

2.3 Implementing the example application in "ST"

The implementation takes place in ST, using 4 IF statements and a pick-up delay (T01).

```
// Control of conveyor
// Control of manual operation
IF I1 AND NOT M1 THEN M6 := NOT M6 ;  MB5 := IA1 ;
END_IF;
// Automatic drive start
IF I02 AND NOT M3 THEN MB5 := IA2 ;  M6 := FALSE ;
END_IF ;
// STOP - OFF
IF I03  THEN M6 := FALSE ;
END_IF ;
// Drive runtime limit
T01 (
    EN := I2 OR M6, // Timer enable
    RE := I4 AND NOT M2, // Timer Reset
    I1 := MB5 *1000  // Handover time
);
// Inverter control
Q1 := ( M6 OR I2 ) AND NOT T01Q1 AND I5 AND NOT I3;
Q2 := ( M6 OR I2 ) AND I5 ;// Warning inverter enabled
// Handover Data
QA1 := MB5 ;    // Handover set time
QA2 := T01QV ;  // Handover current time
QA3 := MD10 ;   // Handover count amount
// Auxiliary marker  flank generation
M1 := I1 ; // flank generation I1
M2 := I4 ; // flank generation I4
M3 := I2 ; // flank generation I2
```

Fig. 4: UF – conveyor function block

2.4 Implementing the example application using the ladder diagram

The function block "Belt_Type1" can be implemented using either the function block diagram or structured text

Figure 5 below shows the program in simulation mode with status display.

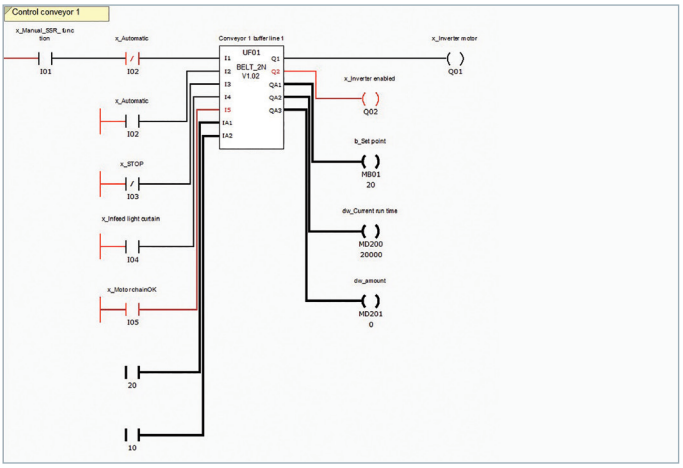

Fig. 5: Implementation of the conveyor "Belt_Type1" in the ladder diagram

2.5 Implementing the example application in "ST"

Implementing the UF "Belt_Type1" in simulation mode with status display.

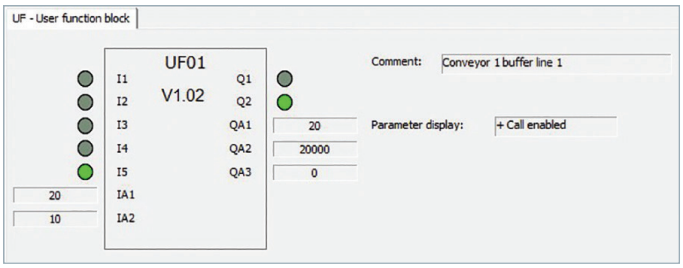

Fig. 6: The UF "Belt_Type1" in the example application - simulation mode

Conclusion: The individual function blocks can easily be reused. They can also be used to implement a modular application design. By integrating these tested function blocks in FBD or LD, they can be easily implemented and configured, even without any prior programming knowledge, thereby reducing the commissioning time of the project.

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