

Uwe Graune, Mike Thielert, Ludwig Wenzl

# LOGO!

Practical Training

**SIEMENS**



Graune/Thielert/Wenzl  
LOGO! Practical Training



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by Uwe Graune,  
Mike Thielert and  
Ludwig Wenzl

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# Preface

The LOGO! control relay is being used to an increasing extent in installation technology, and also for simple industrial applications. This is because this mini PLC permits simple implementation of control tasks along with flexible use.

This handbook has a practice-based structure, and is appropriate for trainees, pupils and students as well as technical employees and trainers. In addition to basic "operating instructions", an holistic approach is used to indicate the fundamental procedures when tackling control problems.

At the beginning, programming of the LOGO! control relay is explained by means of a "quick start" using both manual inputs and the LOGO!Soft Comfort software.

Standard situations encountered in control technology are subsequently presented in numerous projects (e.g. interlocks, sequential circuits, safety regulations etc.). Selection of the hardware is considered along with development of the program. The enclosed CD includes a LOGO! demo version. Readers can thus understand the explanations in the book in parallel on a PC, and check using a simulation. The scope of explanations is extremely detailed in the first examples, but is then continuously reduced to the necessary amount.

In the more complex tasks, both the processing of analog values and the connection of LOGO! over the AS-i and EIB bus systems are treated. The comprehensive possibilities offered by the LOGO! control relay are presented here in abbreviated form such that the interest of LOGO! beginners is also aroused.

The following functions of LOGO! are only available with the LOGO! devices starting with release version 0BA6 and with LOGO!Soft Comfort starting with version 6:

- Analog arithmetic operations (Chapter 7.5 Mathematical functions)
- External text display LOGO! TD (Chapter 7.6 and Chapter 8)
- Pulse width modulation (Chapter 7.7 PWM)

All other contents of the book can also be programmed for LOGO! devices of earlier release versions.

The last two chapters of the book are provided for information purposes for the previous project tasks. Detailed reference is made there to control elements, sensors and LOGO! hardware. This part is rounded off by a list of all program commands for LOGO!

The enclosed CD contains the following contents:

- LOGO!Soft Comfort configuring software (demo version)
- LOGO! control programs for the application examples presented in this book
- The LOGO! Manual in eight languages: Chinese, Dutch, English, French, German, Italian, Russian, Spanish, Turkish
- A PDF of a brochure on micro automation and LOGO!

The contents of the book form a training arrangement which directs you toward planned actions in that the steps "Planning" (including documentation), "Implementation" (= programming) and "Checking" (e.g. by means of program simulation) are executed in each project task.

The authors hope you will be able to work successfully with this handbook, and are always grateful to hear your responses or suggestions for improvement.

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# LOGO! Practical Training

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# 1 Quick start

## 1.1 Solving of control tasks with LOGO!

The principle of operation for the control of technical systems with LOGO! control relays can be described in abbreviated form as follows:

Input signals supply the control relay with information on the current state of the process and any operator commands. The control relay reacts to these input signals in accordance with a defined program. It then generates output signals which influence the process in the intended manner via actuators (final control elements).

Small control tasks can be solved using programmable control relays with a minimum of hardware. It is possible to learn and apply the required programming knowledge extremely easily. The following example is a direct introduction to the programming of LOGO!

The control sequence is defined by a corresponding **program** in the memory of the LOGO! device. There are **two different ways** to enter the program. These two programming methods are described in brief below.

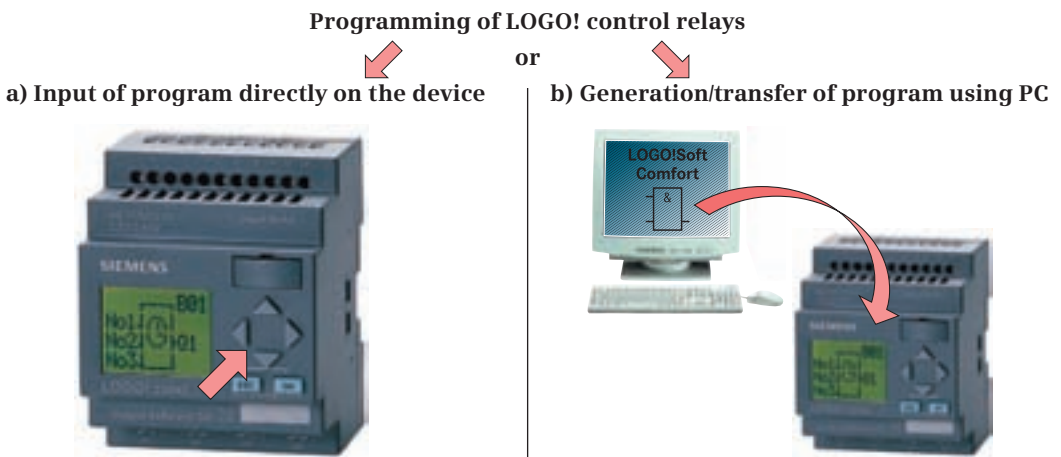


Fig. 1.1 Programming using manual inputs

Fig. 1.2 Programming using PC

The LOGO! basic module can be programmed **directly** on the device without particular effort. The six existing keys and the LCD are used.

When pressing a key, users are provided with menu prompting which allows the input or deletion of a program, parameterization of characteristic values, etc. A **PC is not required!** The program is output on the display in the **Function Block Diagram (FBD)**.

This diagram corresponds to the FBD language used for PLC programming. Logic operations, timers, counters etc. are displayed as rectangular blocks. Only one block can be output on the display at a time, and jumping to other blocks is possible using arrow keys. This programming technique is described in Chapter 1.5.

The LOGO!Soft Comfort software allows a clear display of the complete program on the screen. Following generation and the simulation test, the finished program can be transferred via cable to the LOGO! basic module. An online test permits monitoring of control signals during operation of the device. The LOGO!Soft Comfort software can display programs in the following two ways:

- a) **Function Block Diagram (FBD)**.
- b) **Ladder (LAD)**

The LAD display is referred to in PLC programming as the ladder diagram. It is very similar to a circuit diagram, and therefore represents control programs in an extremely clear manner. This programming method is described in Chapter 1.6.

## 1.2 Description of control task

Customer orders are assembled on pallets in the warehouse of a wholesale company for sanitary requirements. In the area in front of the warehouse, orders ready for dispatch are transported on a pallet conveyor system (chain conveyor) to the truck ramp (Fig. 1.3).

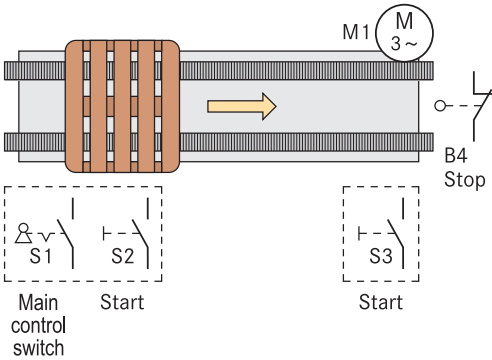


Fig. 1.3 Process schematic of the conveyor system

### Control sequence:

The two keys S2 and S3 permit transportation of the pallets in so-called jogging mode. The pallets are only transported further if at least one of the start keys is kept depressed.

The pallets are transported into the end position where they activate the limit contact B4 ("end switch"). B4 prevents a pallet from being unintentionally transported beyond the end position and thus falling off. Switching-off of the master switch S1 suppresses all movements of the chain conveyor drive.

The control task which has just been described was previously executed as a hardwired control system. The circuit diagram of the control circuit is shown in Fig. 1.4.

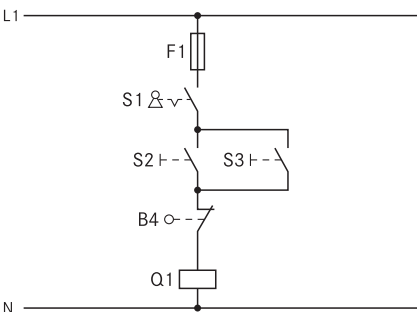


Fig. 1.4 Previous control circuit as hardwired control system

## 1.3 Implementation of control task with LOGO!

Since the warehouse of the wholesale company for sanitary requirements is to be modernized, this is an appropriate time to replace the previous conventional contactor controls. For the pallet conveyor system, the decision is made by the commissioned electrical company to use the LOGO! programmable control relay.

Application of the control relay provides the user with numerous expansion options for special functions which are already integrated in the device, meaning that no additional hardware costs arise.

Examples can be mentioned here:

- Recording of quantities
- Operating hours counter
- Time functions
- Bus communication (only special modules)

Further chapters in the book provide comprehensive information on the numerous special functions of the LOGO! devices.

In addition to the special functions, such types of control relays can be reprogrammed rapidly and simply. Therefore changes in functions can usually be carried out without modification of the hardware (rewiring).

This increases the flexibility and economy of transportation procedures and production processes. Conversion of the existing, conventional control system to LOGO! is carried out by connecting all previous sensors and control elements individually to the input side. In this case these are the master switch S1, the keys S2 and S3, and the limit contact B4. Assignment: S1→I1 ... B4→I4. The motor contactor (=actuator) is connected to the output side of the logic module (Fig. 1.5). The linking between the input and output sides is carried out by the con-

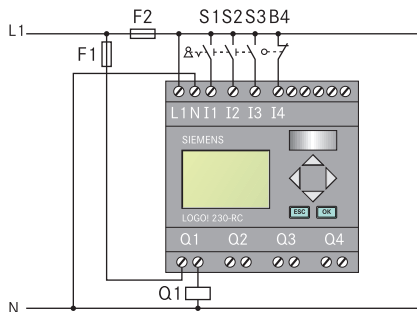


Fig. 1.5 Connection diagram of control system with switching relay

trol program. This is developed on the following pages (Chapter 1.4).

## 1.4 Generation of LOGO! program

The two start keys are connected in parallel in the circuit diagram. Since the activation of one of these two keys is sufficient for starting, this parallel connection represents **OR logic** (Fig. 1.6) which must also be integrated accordingly in the LOGO! program.

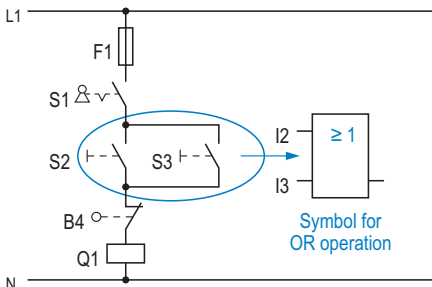


Fig. 1.6 OR logic of contacts

The master switch S1 and the limit contact B4 are connected in series to the start keys. In order to activate the motor contactor, S1 and B4 must also be closed in addition to a start key (Fig. 1.7).

Series connections are implemented in the logic diagram by **AND logic**. Therefore S1, B4 and the OR logic meet in a common AND logic.

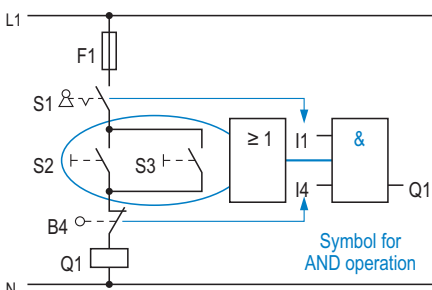


Fig. 1.7 AND logic of contacts

**Function analysis:** Q1 switches if S1 is activated **AND** (S2 **OR** S3 is activated) **AND** S4 is not activated.

It is recommendable to produce a sketch of the control program prior to direct input in the logic module. This provides you with a clear over-

view during the input, and facilitates documentation and troubleshooting.

Furthermore, an assignment list (cf. Chapter 2.2.2) is extremely helpful, especially with comprehensive control tasks.

This lists the input/output objects which have been used. This list defines the input/output of the control relay to which the objects are connected.

### 1.4.1 Function block diagram (FBD)

Manual input of the program into the logic module is carried out in the display mode "FBD" (Function Block Diagram).

The individual logic operations are implemented using so-called blocks. In our case, the program consists of two blocks (B1, B2) with simple logic operations.

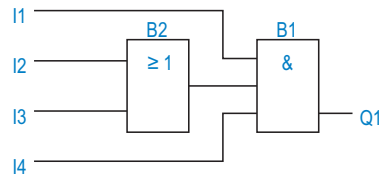


Fig. 1.8 LOGO! program in function block diagram

### 1.4.2 Ladder diagram (LAD)

Either the display mode FBD (see above) or LAD can be selected when generating the program with LOGO!Soft Comfort. The **Ladder diagram** is relatively similar to the circuit diagram. This display mode is also referred to in PLC programming as the ladder diagram. The parallel connection of contacts is implemented in LAD through parallel arrangement of the inputs (I2, I3). The series connection of contacts (I1, I4) is carried out analogous to the circuit diagram.

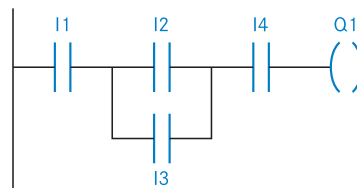


Fig. 1.9 LOGO! program in ladder diagram

**Note:** The conveyor must only move if NC contact B4 is not activated. A "1" state is then present at I4, thus permitting tripping of the AND logic. Input I4 must therefore be scanned for the idle state "1", i.e. non-inverted.