easyRelay applications

Contents

EATON
Powering Business Worldwide

Showroom and store window lighting

Task

To automatically switch the showroom lights, store window lighting, and external advertising display for a retail store on or off. The on/off function must take into account the day of the week, the time, and a daylight control switch. The connection times for the store window lighting can be set as required. It must also be possible to switch all the lights on and off manually. The showroom and store window lighting must turn on in the event of an alarm.

Overview drawing

Figure 1. Overview

Operating description

External advertising display

Mon–Sun	6:00 a.m. to 11:00 p.m. Time switch 1

The daylight control switch causes the advertising display to turn off as the light level rises and to turn on at dusk.

It must also be possible to manually turn the advertising display on and off at any time. The P2 (Up arrow) and P4 (Down arrow) function buttons on the easyRelay are used for this purpose.

Note: The P buttons are activated in the Special system menu. Press ALT and DEL simultaneously to change to the Special menu. See also the User Manual MN05013003E.

Store window lighting

Mon–Fri	8:00 a.m. to 10:00 p.m. Time switch 2
Sat	8:00 a.m. to 11:00 p.m.
Sun	10:00 a.m. to 10:00 p.m.

The store window lighting is also controlled by the daylight control switch. It is turned off as the light level rises and is turned on when it starts to get dark.

The S5 button is used to turn the store window lighting on and off manually outside the programmed times.

In the event of an alarm, potential-free contact S6 in the alarm system turns the store window lighting on.

Once time switch 2 has been enabled, it can be used to change the on/off times, even if a password was activated up in the Special menu. The time switch is enabled by programming the "+" symbol.

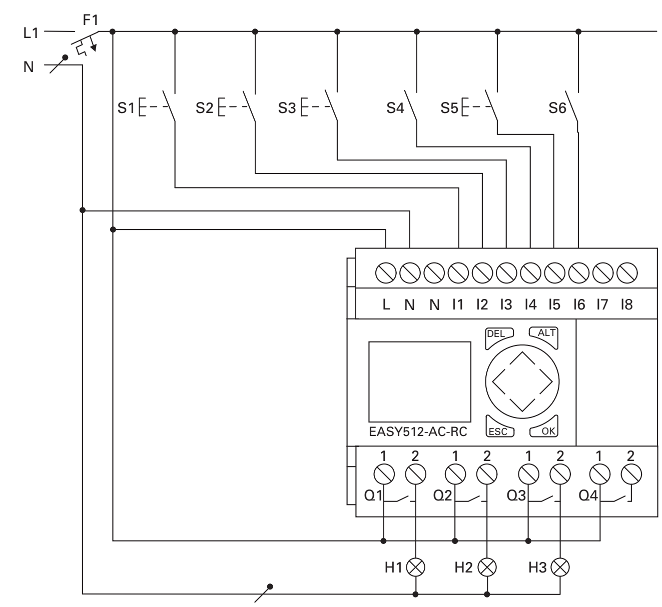
Showroom lighting

Mon–Fri	8:55 a.m. to 1:05 p.m. Time switch 3 1:55 a.m. to 6:35 p.m.
Sat	8:55 a.m. to 2:05 p.m.

The flush-mounted switches S1, S2, and S3 can be used to activate the showroom lighting outside the programmed times.

In the event of an alarm, the showroom and store window lights are turned on by contact S6.

Control circuit



S1–S3	Light switches for showroom lighting
S4	Connection contact for daylight control switch
S5	Light switch for store window lighting
S6	Connection contact for alarm system
H1	External advertising display
H2	Store window lighting
H3	Showroom lighting
F1	16A char. B miniature circuit breaker

Figure 2. Control Wiring Diagram

⚠ CAUTION

THE SAFETY REQUIREMENTS OF THE APPLICABLE VDE, IEC, UL® AND CSA® STANDARDS REQUIRE THE PHASE THAT IS USED FOR THE POWER SUPPLY TO BE USED FOR THE INPUTS AS WELL. IF THIS IS NOT THE CASE, THE easyRELAYS WILL NOT DETECT THE CONNECTION LEVEL AND CAN BE DAMAGED BY OVERVOLTAGES.

List of operands

I1 Input, light switch 1, showroom lighting
I2 Input, light switch 2, showroom lighting
I3 Input, light switch 3, showroom lighting
I4 Input, connection contact, daytime control switch
I5 Input, light switch, store window lighting
I6 Input, connection contact, alarm system
M1 Marker relay, buffer memory, external advertising display ON/OFF
M2 Marker relay, buffer memory, store window lighting ON/OFF
M3 Marker relay, buffer memory, showroom lighting ON/OFF
P2 Up arrow cursor key = external advertising display ON
P4 Down arrow cursor key = external advertising display OFF
Q1 Output relay, external advertising display
Q2 Output relay, store window lighting
Q3 Output relay, showroom lighting
◷ 1 Connection contact, time 1 = time switching, external advertising display
◷ 2 Connection contact, time 2 = time switching, store window lighting
◷ 3 Connection contact, time 3 = time switching, showroom lighting

Benefits

- Implemented functions:
  - 3 x single-channel time switches with weekly and daily programs
  - 3 x impulse changeover relays
- Less wiring required
- Takes up less space than conventional systems
- Password function protects against unauthorized access

Examples

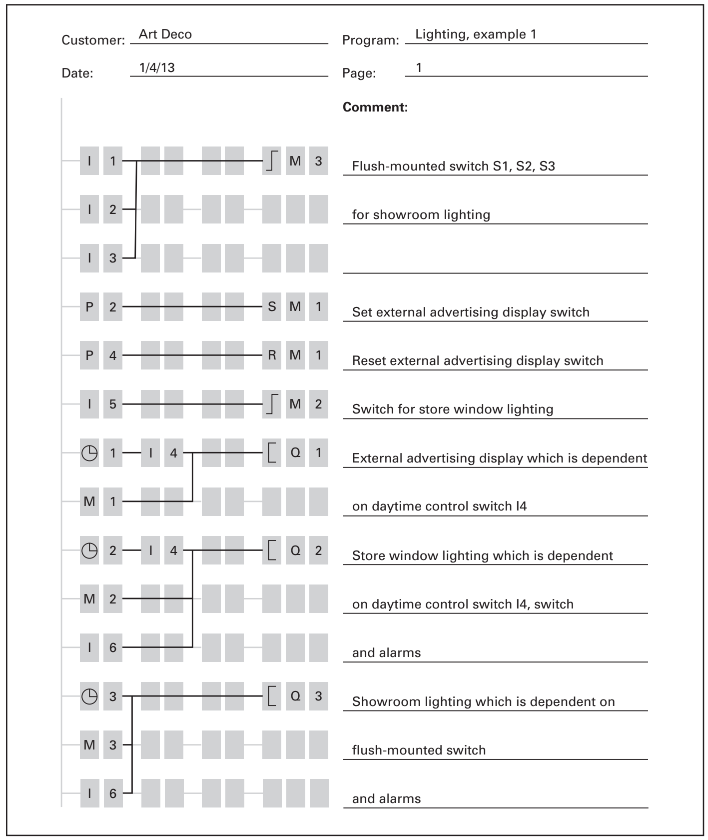


Figure 3. easyRelay Display Diagram

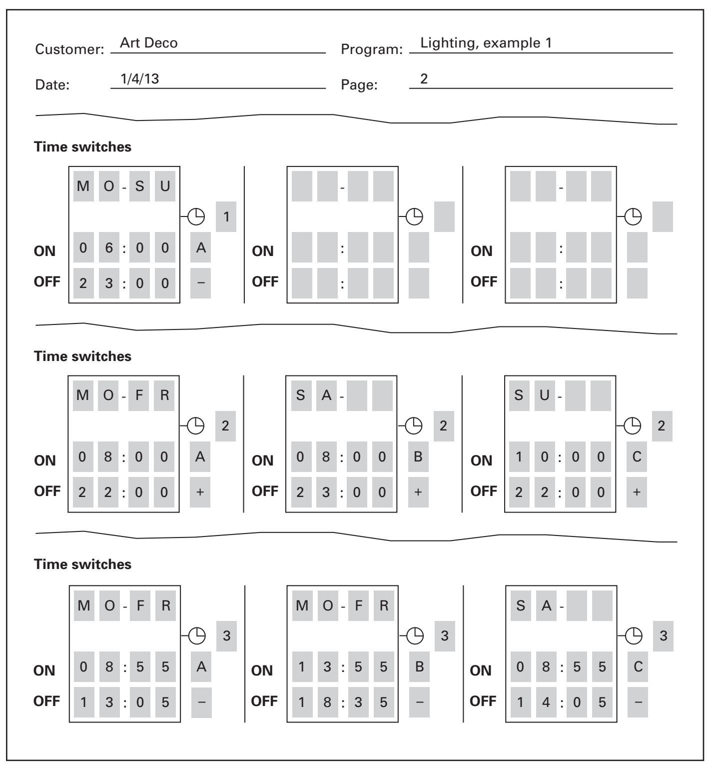


Figure 4. easyRelay Display Parameters

Floor lighting

Task

To enable the corridor lights on each floor of a multi-story building to be switched on and off at various flush-mounted switches. In parallel, there should also be a central switch from which all the lights can be turned on and off. In the event of a fire, it must be possible to turn on all the corridor lights. To save energy, the corridor lights should be turned off altogether at certain times.

Overview drawing

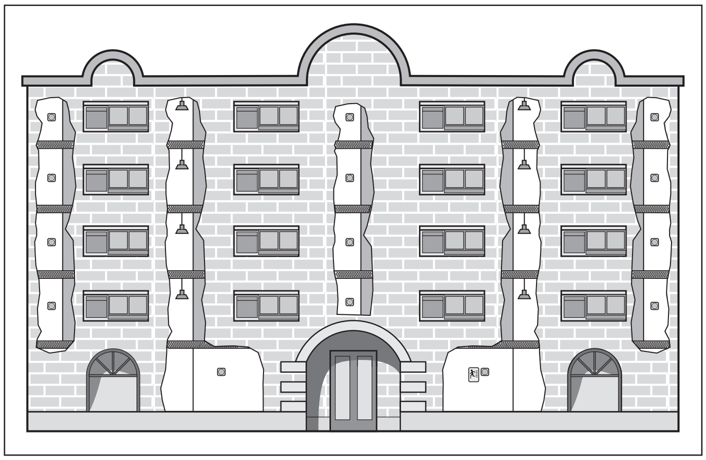


Figure 5. Overview

Operating description

On each of the four floors, the corridor lights can be turned on and off (three-wire control) at three flush-mounted switches (S1 through S12).

If necessary, for example, for cleaning, the corridor lights on every floor can be turned on at switch S13 and turned off at switch S14 in the maintenance personnel's quarters or the building superintendent's room.

In the event of a fire, contact K1 in the fire alarm system turns on all the corridor lights.

To save energy, all corridor lights are turned off at 6:30 p.m. Monday through Friday and at 2:30 p.m. Saturday.

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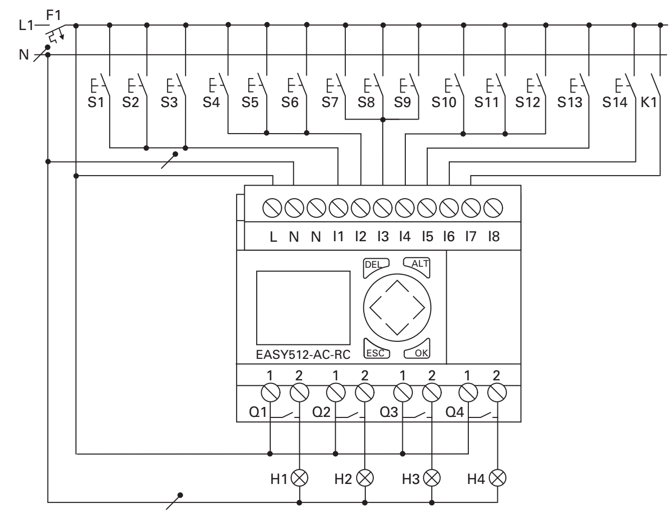
Control circuit



F1	16 A, char. B miniature circuit breaker
H1–H4	Lights on 1st–4th floors
S1–S3	Light switches, 1st floor
S4–S6	Light switches, 2nd floor
S7–S9	Light switches, 3rd floor
S10–S12	Light switches, 4th floor
S13	Central ON switch
S14	Central OFF switch
K1	Contact, fire alarm system

Figure 6. Control Wiring Diagram

List of operands

I1	Input, light switches on 1st floor
I2	Input, light switches on 2nd floor
I3	Input, light switches on 3rd floor
I4	Input, light switches on 4th floor
I5	Input, central ON switch
I6	Input, central OFF switch
I7	Input, contact in fire alarm system
M1	Marker relay, buffer memory light on 1st floor ON/OFF
M2	Marker relay, buffer memory light on 2nd floor ON/OFF
M3	Marker relay, buffer memory light on 3rd floor ON/OFF
M4	Marker relay, buffer memory light on 4th floor ON/OFF
M5	Marker relay, buffer memory light ON/OFF at central switch
M6	Marker relay, buffer memory light ON/OFF at central switch or via fire alarm system
Q1	Output relay, lights on 1st floor
Q2	Output relay, lights on 2nd floor
Q3	Output relay, lights on 3rd floor
Q4	Output relay, lights on 4th floor
T1	Timing relay, control pulse, central light OFF switch
⌚1	Contact switch, Time 1 Current switch, Mon–Fri 6:30 p.m./Sat 2:30 p.m.

Benefits

- Implemented functions:
  - 1 x single-channel time switch with weekly and daily programs
  - 4 x impulse changeover relays with central circuit
- Less wiring required
- Takes up less space than conventional systems
- Increased flexibility facilitates modification and extension
- Password function protects against unauthorized access

Examples

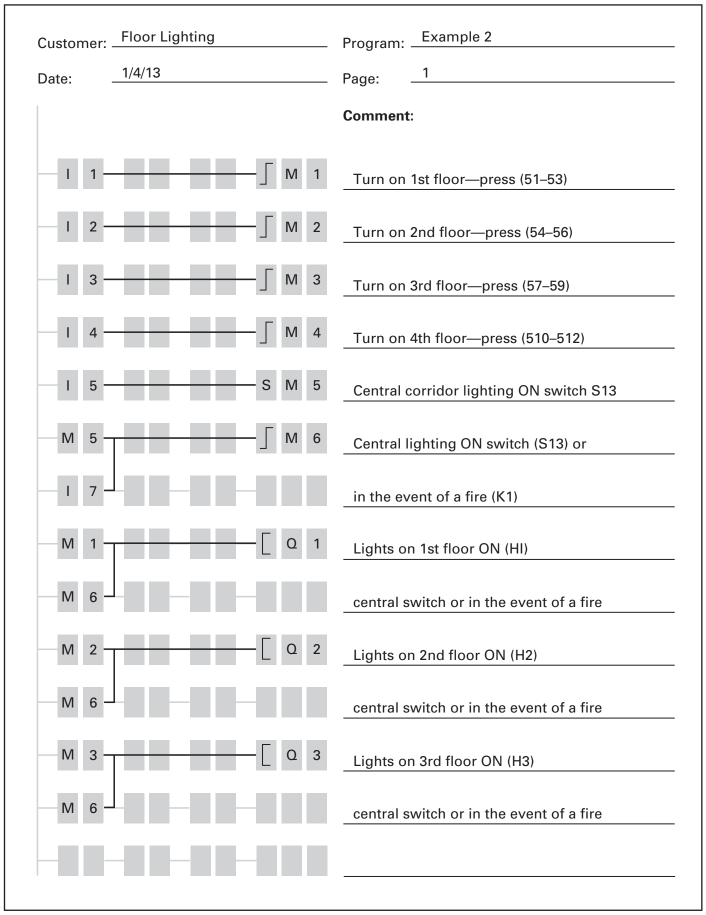


Figure 7. easyRelay Display Diagram

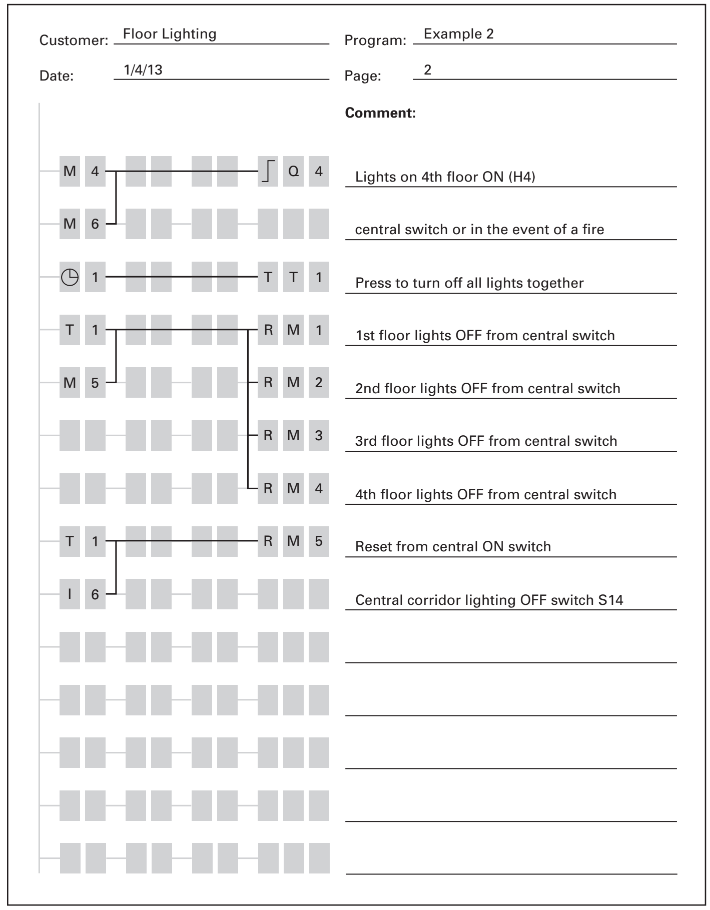


Figure 8. easyRelay Display Diagram

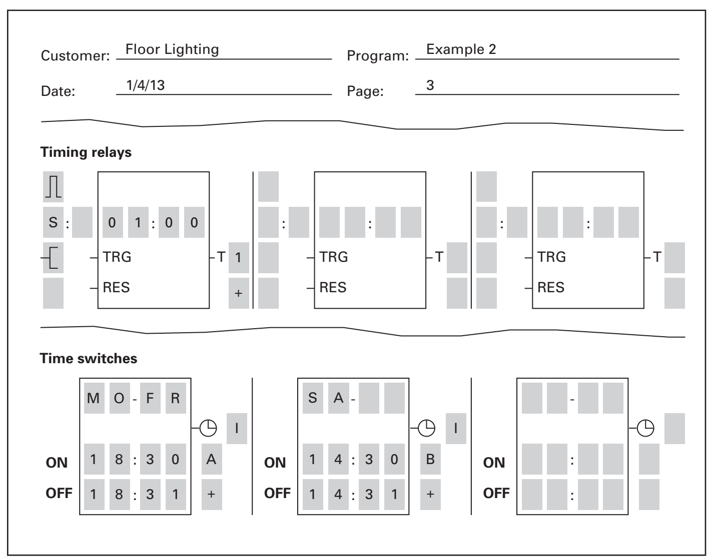


Figure 9. easyRelay Display Parameters

Belt sequence control for three conveyor belts with motor monitoring

Task

To start up and shut down three conveyor belts at different times. There are to be three operating modes "Staggered start-up", "Staggered shut-down", and "Fast stop". The motor-protective circuit breakers in the belt drives should be monitored; if a circuit breaker trips, the conveyor system should stop in a controlled manner. The fault should also be signaled by a flashing light.

Overview drawing

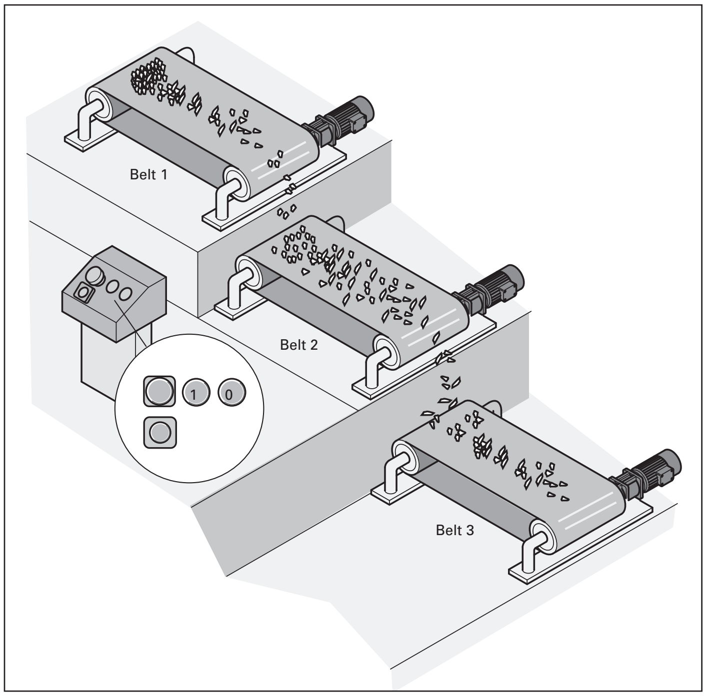


Figure 10. Overview

Operating description

The three conveyor belts in a bulk material handling installation have to be started up and shut down at different times in order to ensure that the materials are transported safely and without interruption.

Startup

When START button S1 is pressed, the belts start up at 5-second intervals (this interval is permanently programmed and cannot be changed). Belt 3 starts up first.

Shutdown

When STOP button S2 is pressed, the belts stop in reverse order, i.e., starting from belt 1. This guarantees that the belts are running at no-load when they are restarted, thus avoiding heavy starting with a loaded belt.

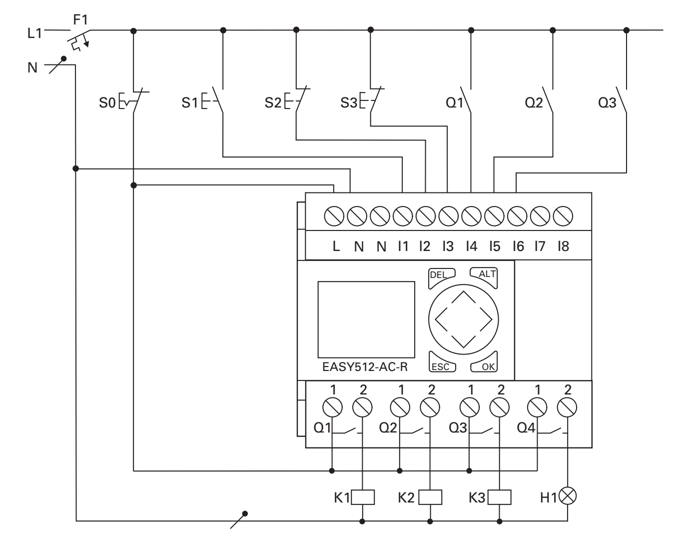
When the button is pressed, 5 seconds elapse before belt 1 is shut down. The subsequent belts turn off again after a 5-second delay. It must be possible to change the time via the easyRelay. To do this, the "+" must be set when the function block is programmed.

"Fast stop" button S3 turns off all three belts without a time delay.

Motor failure

If a drive motor fails, the trip-indicating auxiliary contact (PKZ) opens. The fault is signaled via the flashing light and automatically triggers the STOP function. This means that in the event of a fault, any belts downstream of the defective drive run at no-load for 5 seconds before they are turned off. Any belts upstream of the defective drive are turned off immediately.

Control circuit



S0	Emergency stop
S1	START button
S2	STOP button
S3	Fast stop button
Q1–Q3	Trip-indicating auxiliary contact for motor 1–3
K1–K3	Motor, belt 1–3
H1	Indicator light
F1	16 A, char B miniature circuit breaker

Figure 11. Control Wiring Diagram

⚠ CAUTION

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Load circuit

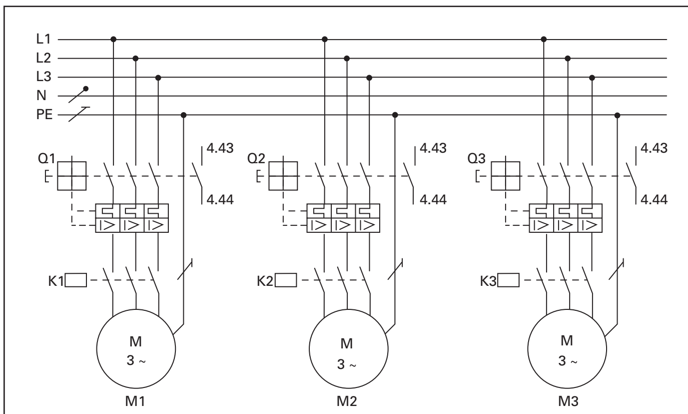


Figure 12. Load Circuit Diagram

List of operands

I1 Input, START button
I2 Input, STOP button
I3 Input, Fast stop button
I4 Input, trip-indicating auxiliary contact for motor 1
I5 Input, trip-indicating auxiliary contact for motor 2
I6 Input, trip-indicating auxiliary contact for motor 3
M1 Marker relay, buffer memory, trip-indicating auxiliary contact, motor 1, 2, 3
M2 Marker relay, buffer memory, STOP
M3 Marker relay, buffer memory, START
Q1 Output, contactor in motor for belt 1
Q2 Output, contactor in motor for belt 2
Q3 Output, contactor in motor for belt 3
Q4 Output, indicator light
T1 Timing relay with 5-second ON delay —> Start belt 2
T2 Timing relay with 5-second ON delay —> Start belt 1
T3 Timing relay with 5-second OFF delay —> Stop belt 1
T4 Timing relay with 5-second OFF delay —> Stop belt 2
T5 Timing relay with 5-second OFF delay —> Stop belt 3
T6 Timing relay flashing for 1 second to indicate fault

Benefits

- Implemented functions:
  - 2 x ON-delayed timing relays
  - 2 x OFF-delayed timing relays
  - 1 x flash/blink relay
  - 2 x auxiliary contactors
- Less wiring required
- Takes up less space than conventional systems
- Password function protects against unauthorized access

Examples

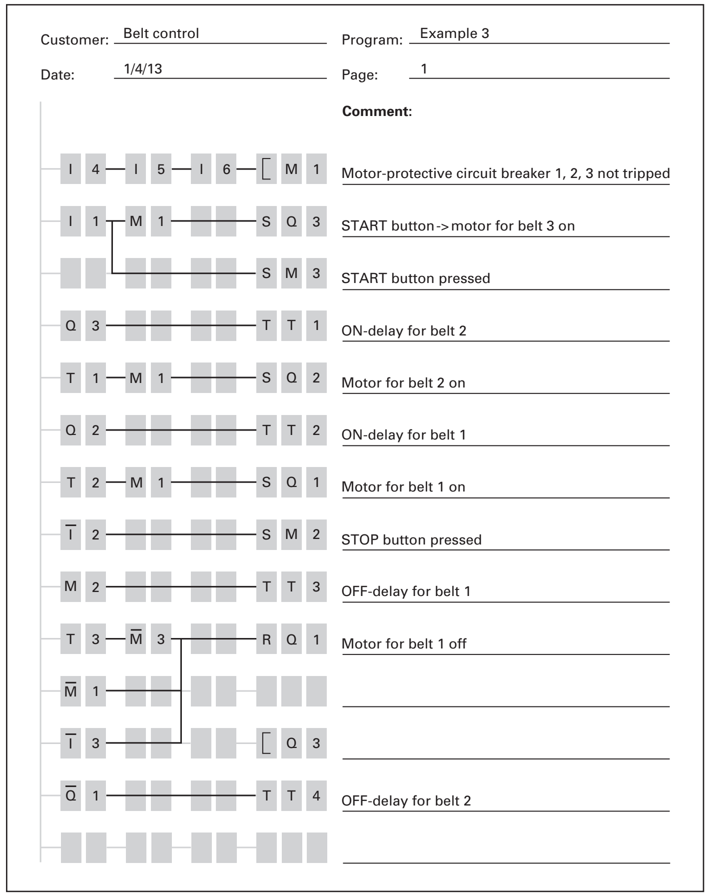


Figure 13. easyRelay Display Diagram

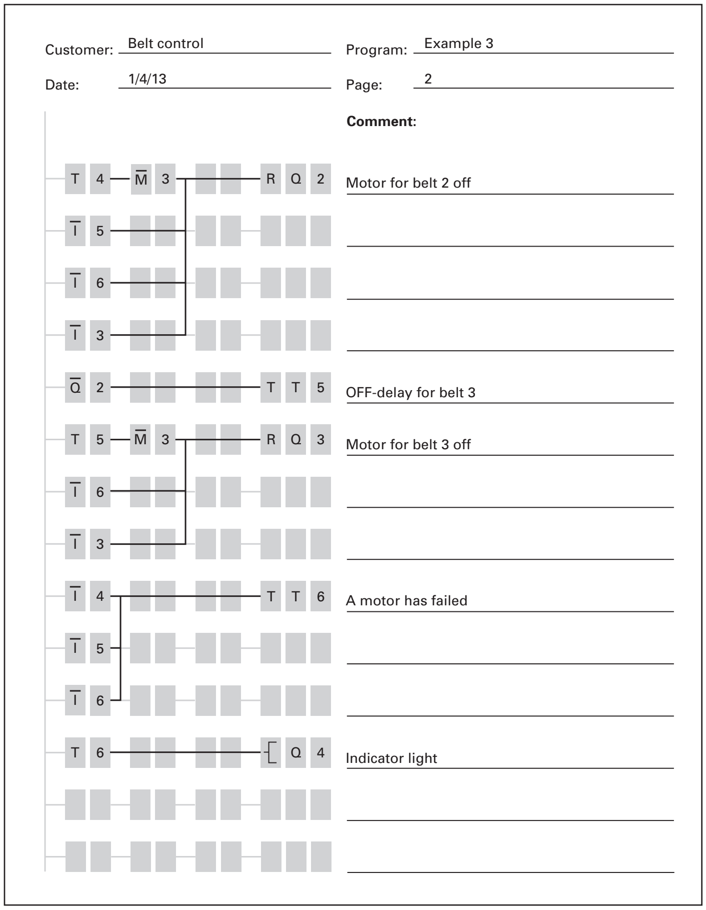


Figure 14. easyRelay Display Diagram

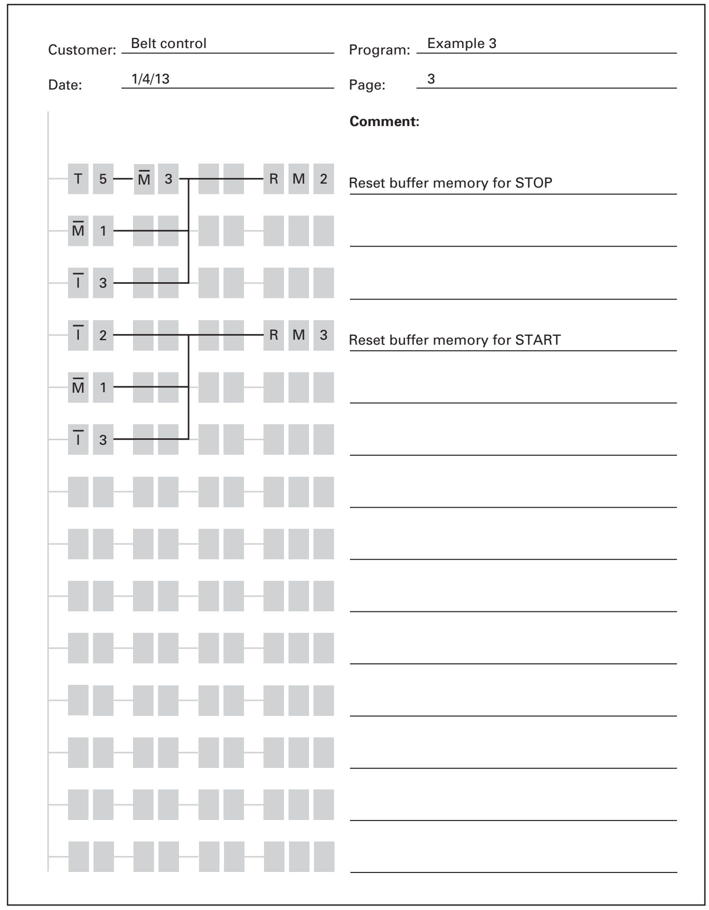


Figure 15. easyRelay Display Diagram

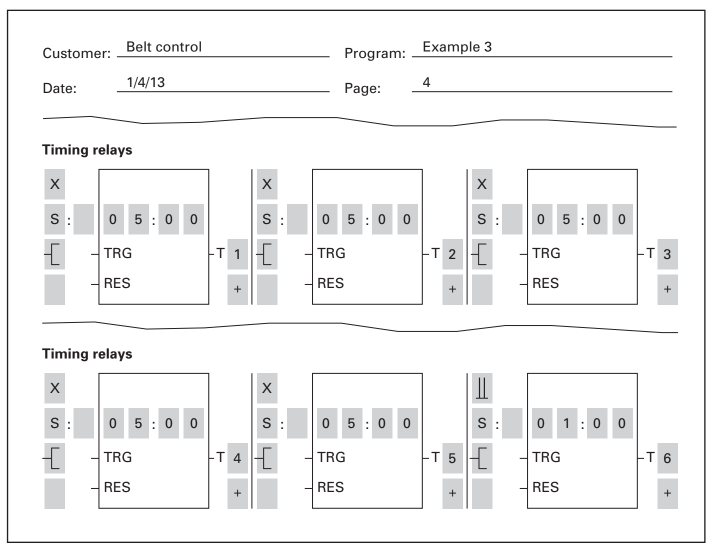


Figure 16. easyRelay Display Parameters

Greenhouse temperature and ventilation control

Task

To automatically open and close the roof lights of a greenhouse in order to adjust the ventilation and temperature. Warm air should be blown in via the heating system when the temperature drops below a certain level. The drive motors for the fans and the roof lights must be monitored for faults, which should also be signaled by a flashing light.

Overview drawing

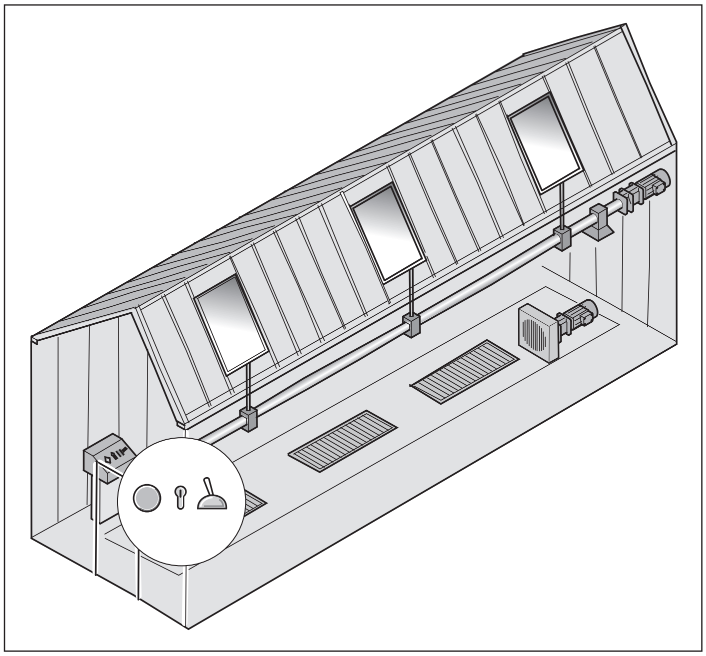


Figure 17. Overview

Operating description

The greenhouse is also used as a display and sales area. The roof lights are opened for ventilation and are closed again depending on the temperature. The "Open window" and "Close window" switching points are programmed via the easyRelay. The voltage output of temperature sensor B1 supplies the necessary comparison value. The following example demonstrates how the switching points are determined or calculated.

Ventilation control

All the roof lights are activated by a three-phase AC motor M1 with a reversing contactor circuit. The end positions are detected by limit switch S2 (open) and S3 (closed). The motor switches off when the limit switch is reached.

Warm air supply

When the temperature in the greenhouse falls below a certain level, the fan motor M2 is automatically activated to blow in warm air. The motor is switched off again when the temperature returns to the desired level.

Motor failure

If M1 or M2 fails, the contact of the corresponding trip-indicating auxiliary contact Q1 or Q2 opens. The fault is signaled via the flashing light H1 for both motors.

Continuous ventilation

Key switch S1 is used to turn off the automatic temperature control and select "Continuous ventilation". It may be necessary to first close the roof lights and then open them again in order to use this function.

It should be possible to enter the motor run time T2, which determines how far the roof light is opened, directly on the easyRelay.

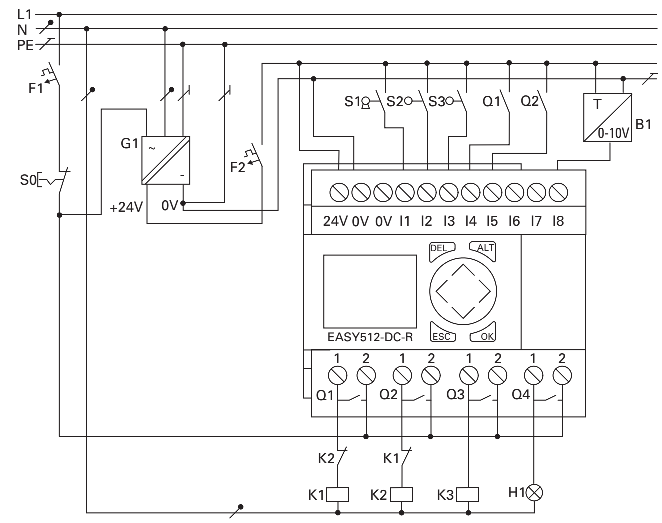
The roof lights can be opened as far as the end position. The default for T2 is 4 seconds.

Manual operation

For maintenance and repairs, the windows can be opened via the P2 button (Up arrow) and closed via the P4 button (Down arrow).

Note: The P buttons are activated in the Special menu. Press ALT and DEL simultaneously to change to the Special menu. See also the User Manual MN05013003E.

Control circuit



B1	Temperature sensor
F1	16 A char. B miniature circuit breaker
F2	Miniature circuit breaker (optional)
G1	Power supply unit 230 Vac/24 Vdc
H1	Motor fault indicator light
K1	Contactor for Open window drive motor
K2	Contactor for Close window drive motor
K3	Contactor for fan motor
Q1	Window drive motor tripping indicator
Q2	Fan motor tripping indicator
S0	Emergency stop
S1	Key switch
S2	Open limit switch
S3	Closed limit switch

Figure 18. Control Wiring Diagram

Note: The electrical interlock may be omitted when using a reversing contactor combination with a mechanical interlock.

Load circuit

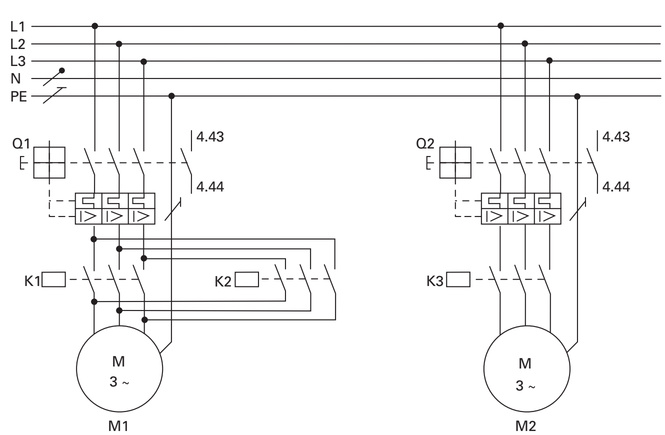


Figure 19. Load Circuit Diagram

Sample switching points

- Temperature sensor measuring range: –35°C to +55°C
- Output signal from temperature sensor: 0 to 10 Vdc
- Selected switching point—Open: 25°C
- Selected switching point—Close: 23°C
- Selected switching point—Heat: 20°C

General formula for the comparison value:

$$= \frac{10V}{UL + LL} \times (\text{Switchpoint} + LL)$$

UL = Upper limit of measured value
LL = Lower limit of measured value

Set point value for Open comparator:

$$\frac{10V}{55°C + 35°C} \times (25°C + 35°C) = 6,4V$$

Set point value for Close comparator:

$$\frac{10V}{55°C + 35°C} \times (23°C + 35°C) = 6,4V$$

Set point value for Heat comparator:

$$\frac{10V}{55°C + 35°C} \times (20°C + 35°C) = 6,1V$$

A switching range (± 0.1V) must be defined for each comparison value to avoid having to repeatedly turn ON and OFF when the comparison value is reached.

- This gives the following switching points in the comparator blocks:
  - Open window
    ON = 6.8V
    OFF = 6.6V
  - Close window
    ON = 6.3V
    OFF = 6.5V
  - Heat
    ON = 6.0V
    OFF = 6.2V

List of operands

A1	Comparator, Open window ON
A2	Comparator, Open window OFF
A3	Comparator, Close window ON
A4	Comparator, Close window OFF
A5	Comparator, Heat ON
A6	Comparator, Heat OFF
I1	Input, key switch for continuous ventilation
I2	Input, Open limit switch
I3	Input, Closed limit switch
I4	Input, window drive motor trip-indicating auxiliary contact. Input, fan motor trip-indicating auxiliary contact
I8	Input, comparative voltage of temperature sensor

M1 Marker relay, buffer memory, Open window
M2 Marker relay, buffer memory, Close window
M3 Marker relay, buffer memory, Open window comparator
M4 Marker relay, buffer memory, Close window comparator
M5 Marker relay, buffer memory, Heat comparator
M6 Open marker via T2
P2 Up arrow cursor button = Open window
P4 Down arrow cursor button = Close window
Q1 Output, contactor for Open window drive motor
Q2 Output, contactor for Close window drive motor
Q3 Output, contactor for fan motor
Q4 Output, motor fault indicator light
T1 Timing relay, flashing, for fault message
T2 Timing relay, single-pulse, 4 seconds = opening time for continuous ventilation

Benefits

- Implemented:
  - 1 x ON-delayed timing relay
  - 1 x flash/blink relay
- Temperature values can be processed (analog values)
- Less wiring required
- More flexible if modifications are required

Examples

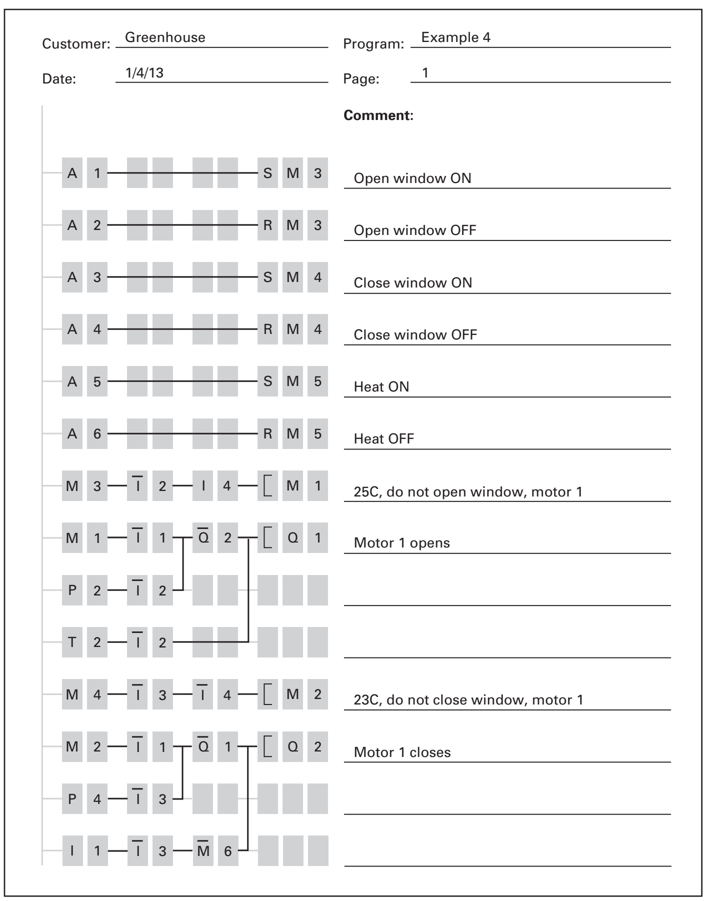


Figure 20. easyRelay Display Diagram

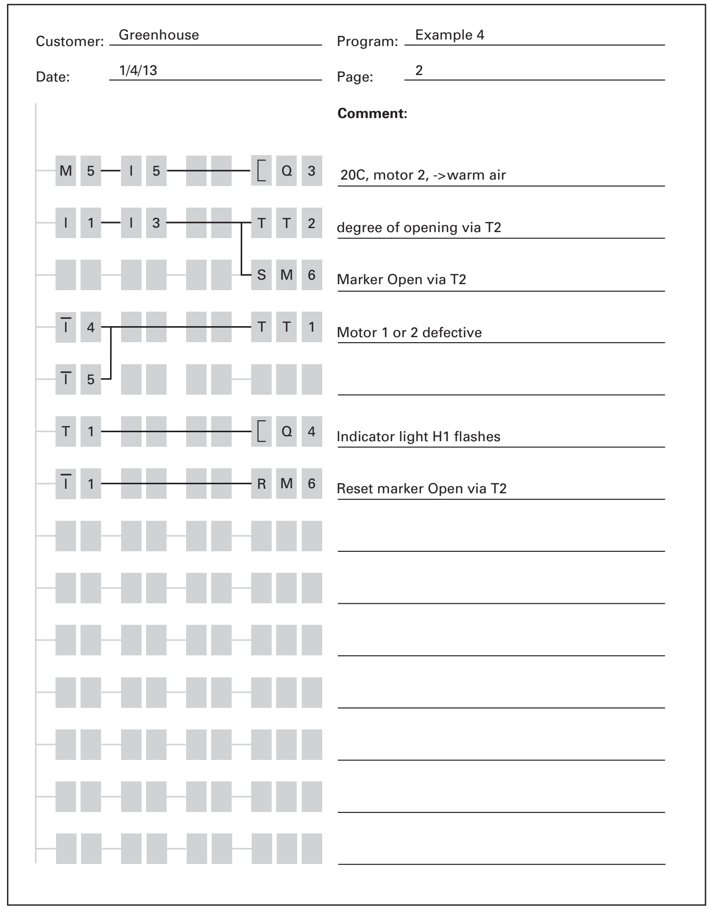


Figure 21. easyRelay Display Diagram

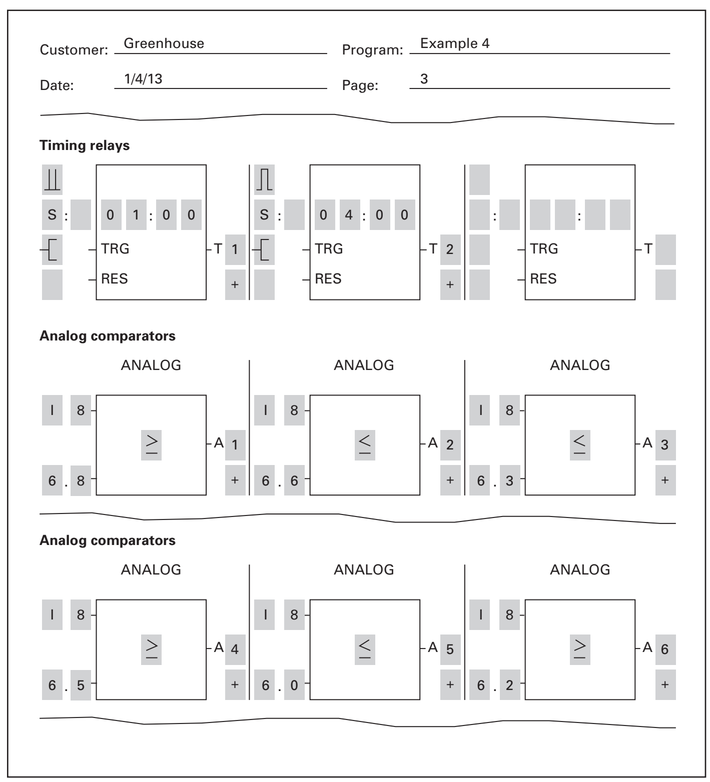


Figure 22. easyRelay Display Parameters

Lighting control in a production room

Task

To automatically turn on the lighting fixtures in a production room during production hours. The lights should turn on and off gradually in response to changes in the daylight level. It must be possible to turn the switch for the individual lighting stages on and off manually at any time. Faults in the lighting system should be signaled by a flashing light.

Overview drawing

Figure 23. Overview

Operating description

Three light fixtures, each with 12 fluorescent lights, are suspended from a busbar system. The lighting is on from 6:00 a.m. to 5:30 p.m. Monday through Friday and is varied according to the daylight level. The switch-on times and the ON duration must be variable to suit requirements.

Lighting stages

The use of three different switching stages guarantees the necessary brightness, saves energy, and places a uniform load on the mains supply.

Connection to the busbar system

Phase 1:
Every 1st, 4th, 7th, and 10th neon light.
Activated via contactor K1.
Enabled via daylight control switch B1.

Phase 2:
Every 2nd, 5th, 8th, and 11th neon light.
Activated via contactor K2.
Enabled via daylight control switch B2.

Phase 3:
Every 3rd, 6th, 9th, and 12th neon light.
Activated via contactor K3.
Enabled via daylight control switch B3.

Lighting stages

Stage 0:
All the lights are off.

Stage 1:
Every third light is on. Contact B1 is closed.

Stage 2:
Every third light is off. Contacts B1 and B2 are closed.

Stage 3:
All the lights are on. Contacts B1, B2, and B3 are closed.

Manual operation

It must be possible to switch the individual lighting stages at light switches S1 through S3.

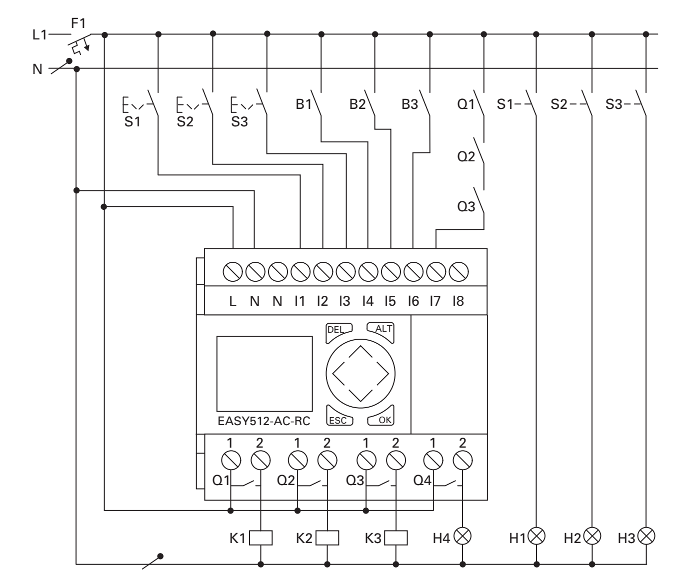
Use of the manual function is signaled by indicator lights H1 through H3.

Failure of a busbar

The busbars are protected via miniature circuit breakers Q1 through Q3 and are monitored by trip indicating auxiliary contacts. Faults are signaled in the form of a group alarm via flashing indicator light H4.

Note: If the daylight control switches already have an ON-delay or OFF-delay, these times should be set as low as possible (of the order of 1 second). Alternatively, the ON-delayed timers T1 through T6 programmed in the easyRelay (default value 60 seconds) can be changed to obtain the required overall delay.

Control circuit



B1–B3 Contact, daylight control switch 1–3
F1 16 A, char B miniature circuit breaker
H1–H3 Indicator light, stage 1–3
H4 Fault indicator light
K1–K3 Contactor, lighting stage 1–3
Q1–Q3 Miniature circuit breaker 1–3
S1–S3 Light switch, stage 1–3

Figure 24. Control Wiring Diagram

⚠ CAUTION

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Load circuit

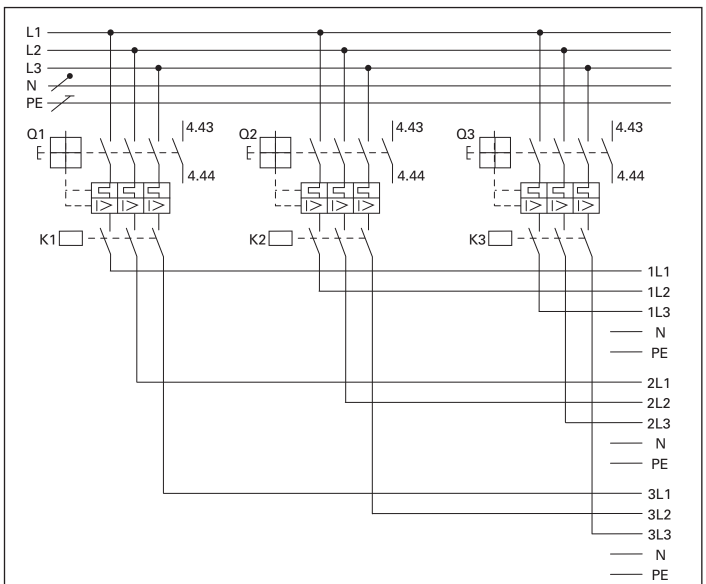


Figure 25. Load Circuit Diagram

Switching points of the daylight control switch

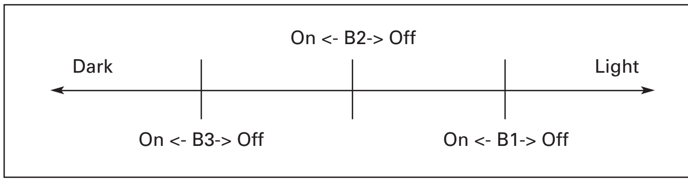


Figure 26. Switching Points of the Daylight Programmable Switch

List of operands

I1 Input, light switch, stage 1
I2 Input, light switch, stage 2
I3 Input, light switch, stage 3
I4 Input, contact of daylight control switch 1
I5 Input, contact of daylight control switch 2
I6 Input, contact of daylight control switch 3
I7 Input, circuit breaker messages
M1 Marker relay, buffer memory, stage 1
M2 Marker relay, buffer memory, stage 2
M3 Marker relay, buffer memory, stage 3
Q1 Output, contactor for stage 1
Q2 Output, contactor for stage 2
Q3 Output, contactor for stage 3
Q4 Output, fault indicator light
T1 Timing relay with 60-second ON delay —>Stage 1 ON
T2 Timing relay with 60-second ON delay —>Stage 1 OFF
T3 Timing relay with 60-second ON delay —>Stage 2 ON
T4 Timing relay with 60-second ON delay —>Stage 2 OFF
T5 Timing relay with 60-second ON delay —>Stage 3 ON
T6 Timing relay with 60-second ON delay —>Stage OFF
T7 Timing relay, flashing for 1 second to indicate fault

Benefits

- Implemented functions:
  - 1 x flash/blink relay
  - 1 x single-channel time switch with weekly and daily programs
- Functional overall solution
- Less wiring required
- Takes up less space than conventional systems

Examples

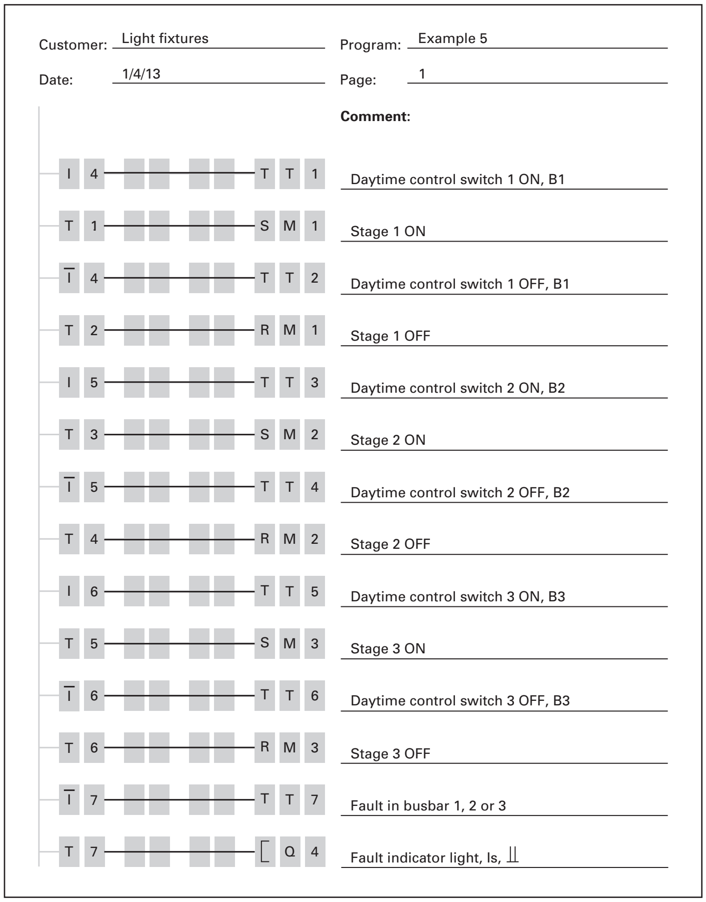


Figure 27. easyRelay Display Diagram

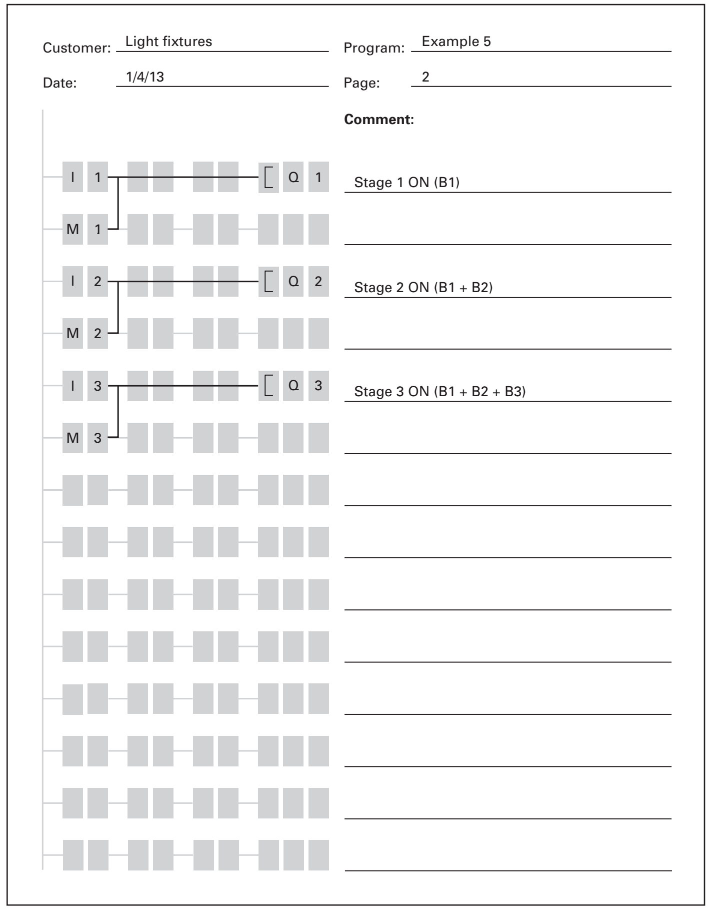


Figure 28. easyRelay Display Diagram

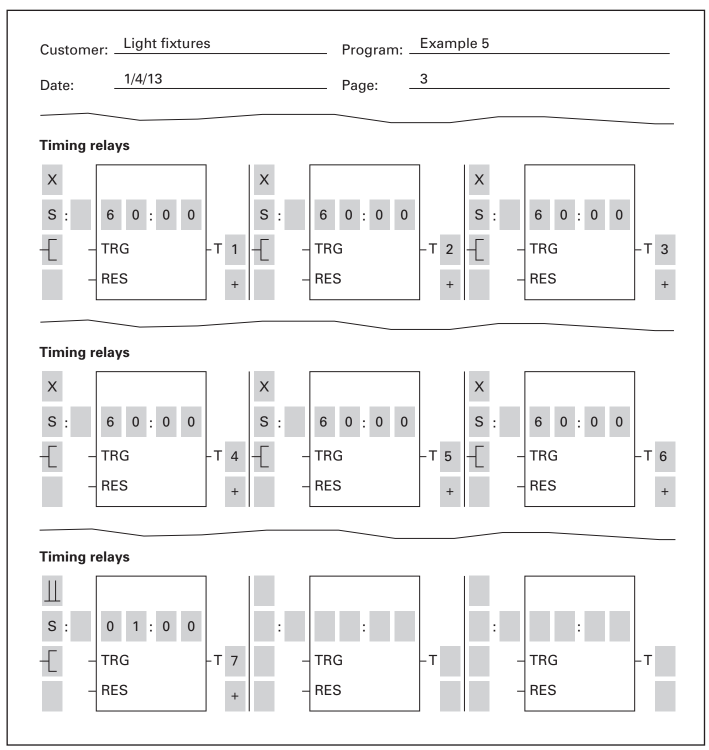


Figure 29. easyRelay Display Parameters

Booster pumps

Task

Two pumps provide the water supply for an installation. Their operation is to be monitored. The two pumps are to be operated alternately to prevent excessive wear. The operating status and the faults within the installation are to be signaled by two indicator lights. It must be possible to select the pressure-related switching points for activating the pumps as required.

Overview drawing

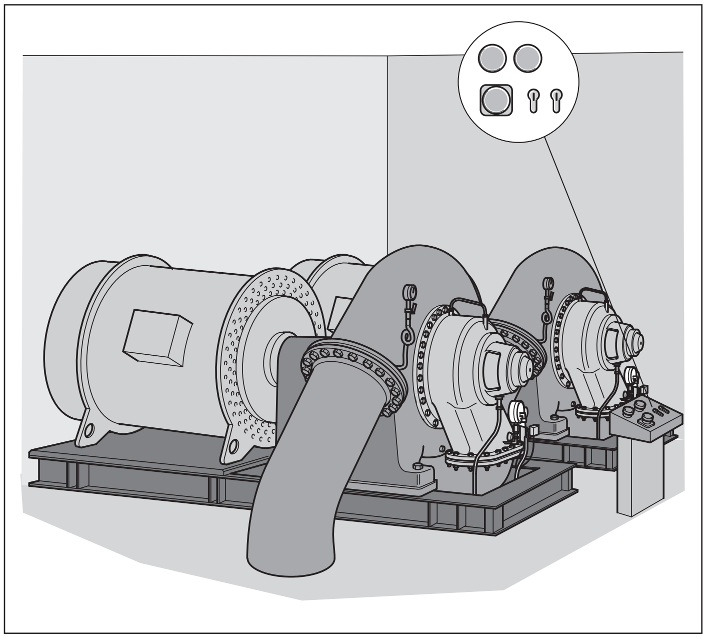


Figure 30. Overview

Operating description

Pumping operation

The pumping station provides the water supply for an installation. It must also ensure that the pressure does not fall below a specified minimum level. There are two booster pumps—P1 and P2. If the pressure is too low, one of the pumps is activated via pressure sensor B1. To ensure that the two pumps are subject to equal use and wear, they are run alternately for 48-hour periods. Two indicator lights, H1 and H2, signal which of the two pumps is in use. If the easyRelay is disconnected from the power supply, the operating hours count will start again, and pump 1 will be activated first.

To enable the pumps to change over after a shorter or longer operating period, counters C1 and C2 should be set to new comparison values using the following formula:

Desired changeover time in hours x 60 = comparison value.

Default: 48 hours x 60 = 2880.

Faults

Electrical failure of a pump motor is detected by the trip-indicating auxiliary contacts for the motor-protective circuit breaker Q1 and Q2. The pump that is still in working order will be activated. If one of the pumps is mechanically defective, the resulting drop in pressure will be detected, and the other pump will be activated after time T4 has elapsed. Both fault types are signaled by the flashing indicator light H1 or H2. When both pumps are electrically defective, indicator lights H1 and H2 will flash simultaneously.

Low pressure

The system is monitored for low pressure, which is signaled by indicator lights H1 and H2 that flash alternately after time T5 has elapsed. It must be possible to set the low pressure limit on the easyRelay.

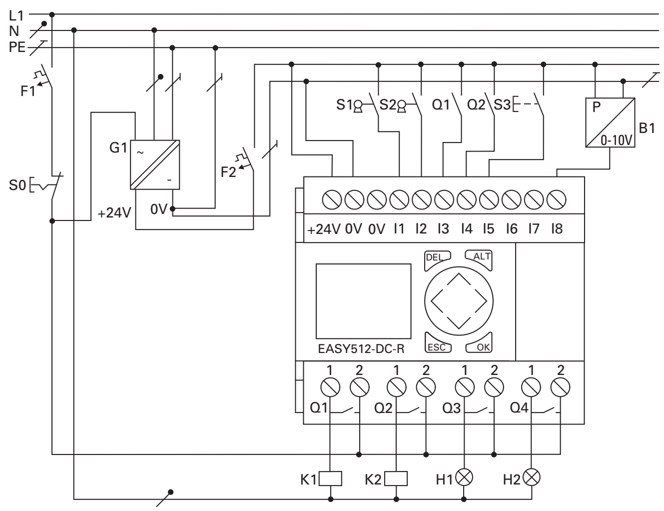
Acknowledgement

All fault messages are retained until they have been acknowledged by pressing the S3 button.

Maintenance

It must be possible to directly switch pump P1 using key switch S1 and pump P2 using key switch S2.

Control circuit



B1	Pressure sensor
F1	16 A char. B miniature circuit breaker
F2	Miniature circuit breaker (optional)
G1	Power supply unit 230 Vac/24 Vdc
H1	Indicator light for pump 1
H2	Indicator light for pump 2
K1	Contactor for pump P1
K2	Contactor for pump P2
Q1	Trip-indicating auxiliary contact for pump 1
Q2	Trip-indicating auxiliary contact for pump 2
S0	Emergency stop
S1	Key switch for pump 1
S2	Key switch for pump 2
S3	Acknowledgement button

Figure 31. Control Wiring Diagram

Load circuit

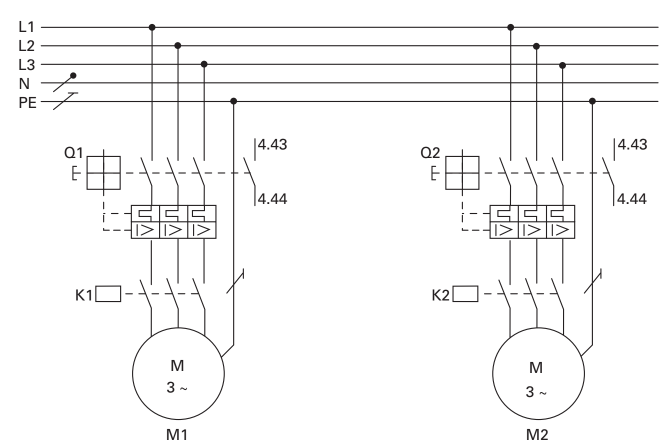


Figure 32. Load Circuit Diagram

Pressure diagram

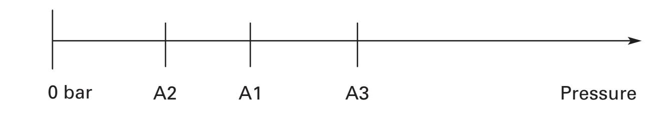


Figure 33. Pressure Diagram

Switching points

A1 Pump 1 or pump 2 is activated; H1 or H2 lights up

A2 Low pressure After time T4 (10 sec), changeover to the inactive pump, the fault is indicated by flashing signal at H1 or H2. After time T5, a total failure is signaled by H1 and H2 flashing alternately

A3 Pump 1 or pump 2 is switched off; H1 or H2 goes out

See example 4 for determining the pressure switching points.

List of operands

A1	Comparator for minimum pressure monitoring, lower threshold
A2	Comparator for low pressure monitoring due to electrical or mechanical fault
A3	Comparator for minimum pressure monitoring, upper threshold
C1	Counter with 30-second pulse for operating hours of pump 1
C2	Counter with 30-second pulse for operating hours of pump 2
I1	Input, key switch for directly activating pump 1
I2	Input, key switch for directly activating pump 2
I3	Input, motor-protective circuit breaker for pump 1
I4	Input, motor-protective circuit breaker for pump 2
I5	Input, fault message acknowledgement button
M1	Pump changeover marker relay M1 = Off: pump 1; M1 = On: pump 2
M2	Marker relay for low pressure/mechanical fault, pump 1
M3	Marker relay for low pressure/mechanical fault, pump 2
M4	Marker relay for electrical fault, pump 1
M5	Marker relay for electrical fault, pump 2
M6	Marker relay for total failure of pumping system
M7	Marker relay for minimum pressure switching point, switch pump on/off
M8	Marker relay, buffer memory, indicator light for pump 1
M9	Marker relay, buffer memory, indicator light for pump 2
Q1	Output, contactor for pump 1
Q2	Output, contactor for pump 2
Q3	Output, indicator light for pump 1
Q4	Output, indicator light for pump 2
T1	30-second cycle for recording operating time, pump 1
T2	30-second cycle for recording operating time, pump 2
T3	1-second cycle for flashing signal from indicator light
T4	Time delay for low pressure message/mechanical fault, pump 1, 2
T5	Time delay for low pressure message, total failure

Benefits

- Implemented functions:
  - 1 x flash/blink relay
  - 2 x ON-delayed timing relays
  - 1 x operating hour counters
- Processing of pressure values (analog values)
- Variable switching points and operating hour changeover
- Less wiring required
- Takes up less space than conventional systems

Examples

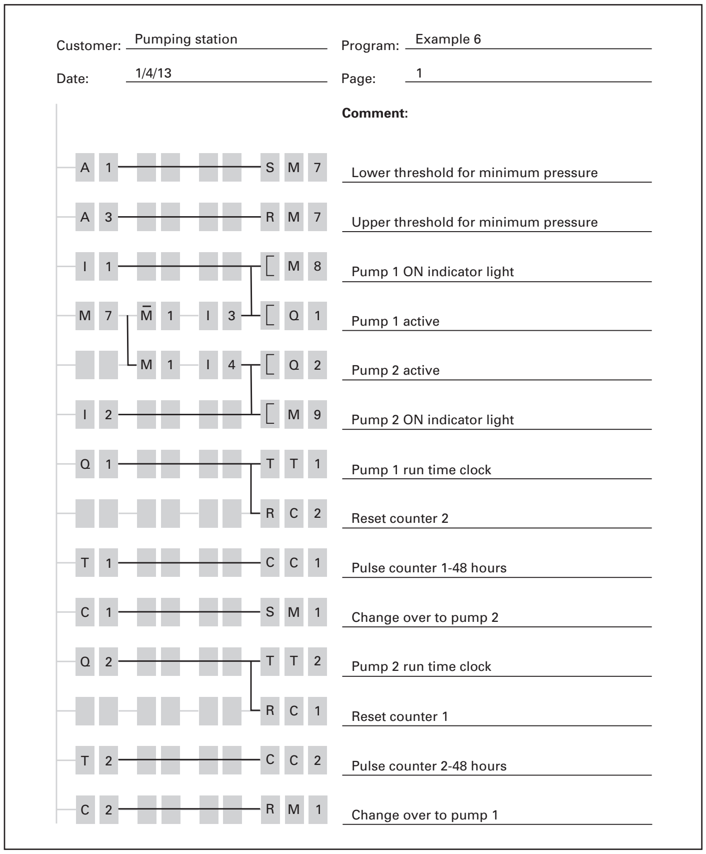


Figure 34. easyRelay Display Diagram

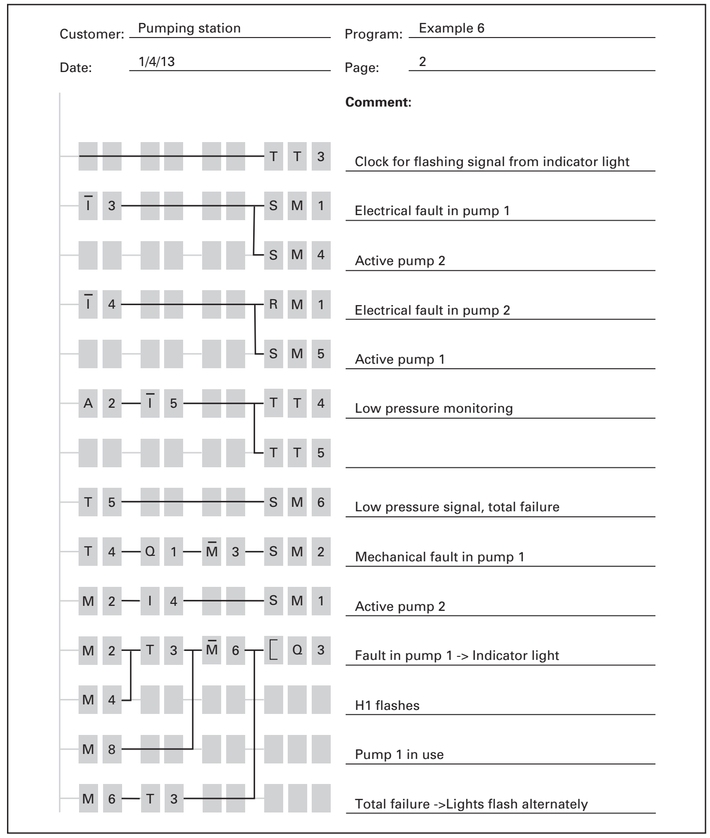


Figure 35. easyRelay Display Diagram

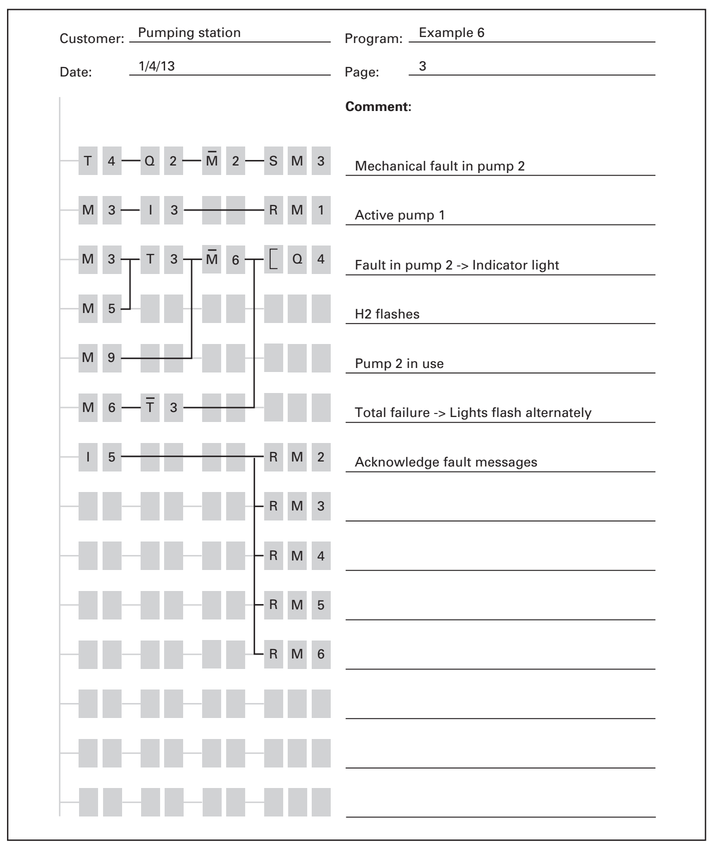


Figure 36. easyRelay Display Diagram

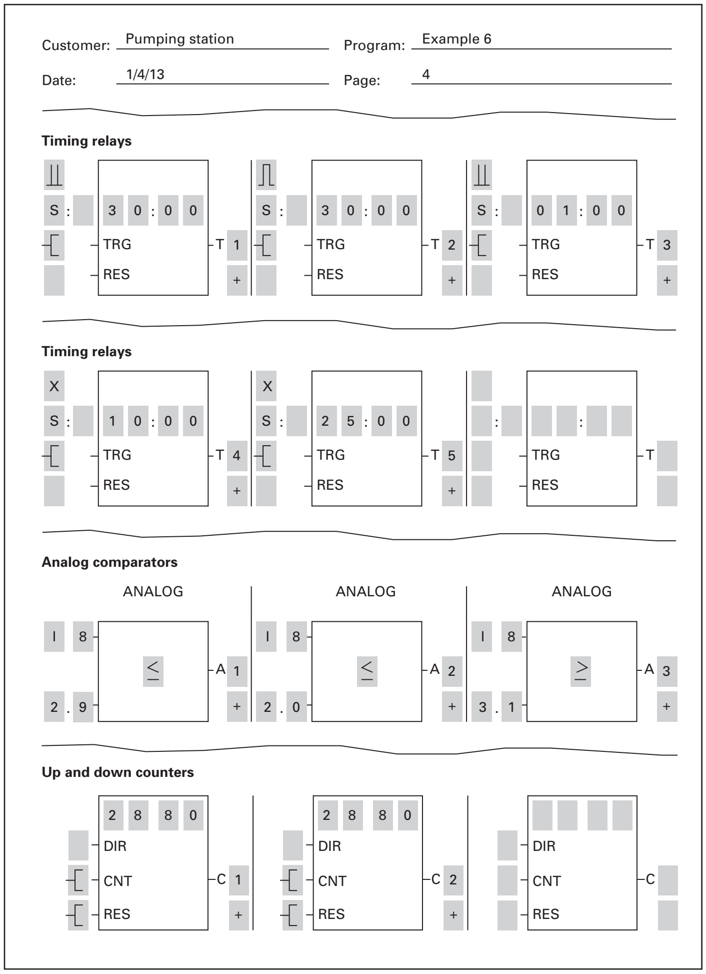


Figure 37. easyRelay Display Parameters

Tank installation level indicator

Task

To monitor the fill level of three tanks. When the maximum level is reached, this should be indicated by a visual and audible signal.

Overview drawing

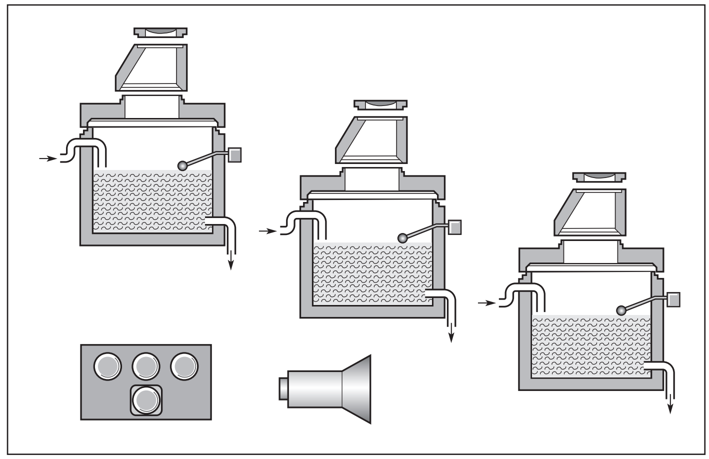
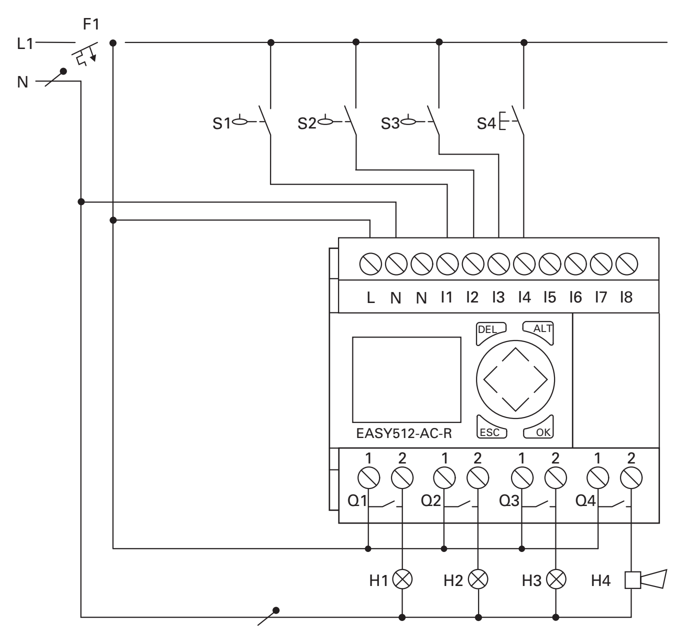


Figure 38. Overview

Operating description

The fill level of three fat tanks in an animal feed plant is monitored. If one tank is full, the corresponding indicator light H1, H2, or H3 flashes in the control room to signal that a “new value” is being formed. After a set time has elapsed (default 3 seconds), an alarm starts as well. Acknowledgement button S4 can be used for all three tanks; it acknowledges the audible signal from the alarm and changes the flashing light to a continuous light.

Control circuit



F1	16 A, char. B miniature circuit breaker
H1	Indicator light for tank 1
H2	Indicator light for tank 2
H3	Indicator light for tank 3
H4	Alarm
S1	Level indicator for tank 1
S2	Level indicator for tank 2
S3	Level indicator for tank 3
S4	Acknowledgement button

Figure 39. Control Wiring Diagram

⚠ CAUTION

THE SAFETY REQUIREMENTS OF THE APPLICABLE VDE, IEC, UL, AND CSA STANDARDS REQUIRE THE PHASE THAT IS USED FOR THE POWER SUPPLY TO BE USED FOR THE INPUTS AS WELL. IF THIS IS NOT THE CASE, THE easyRELAYS WILL NOT DETECT THE CONNECTION LEVEL AND CAN BE DAMAGED BY OVERVOLTAGES.

List of operands

I1	Input, float switch for tank 1
I2	Input, float switch for tank 2
I3	Input, float switch for tank 3
I4	Input, acknowledgement button
M1	Marker relay, acknowledged full message from tank 1
M2	Marker relay, acknowledged full message from tank 2
M3	Marker relay, acknowledged full message from tank 3
Q1	Output, indicator light for tank 1
Q2	Output, indicator light for tank 2
Q3	Output, indicator light for tank 3
Q4	Output, Alarm
T1	Timing relay with 3-second ON delay —> delay after tank 1 full message
T2	Timing relay with 3-second ON delay —> delay after tank 2 full message
T3	Timing relay with 3-second ON delay —> delay after tank 3 full message
T4	Single-pulse timing relay —> Alarm ON set pulse
T5	Single-pulse timing relay —> Alarm ON set pulse
T6	Single-pulse timing relay —> Alarm ON set pulse
T7	Timing relay flashing for 0.5 second —> New value signal

Benefits

- Implemented functions:
  - 3 x ON-delayed timing relays
  - 1 x flash/blink relay
  - 3 x auxiliary contactors
- Less wiring required
- Takes up less space than conventional systems

Examples

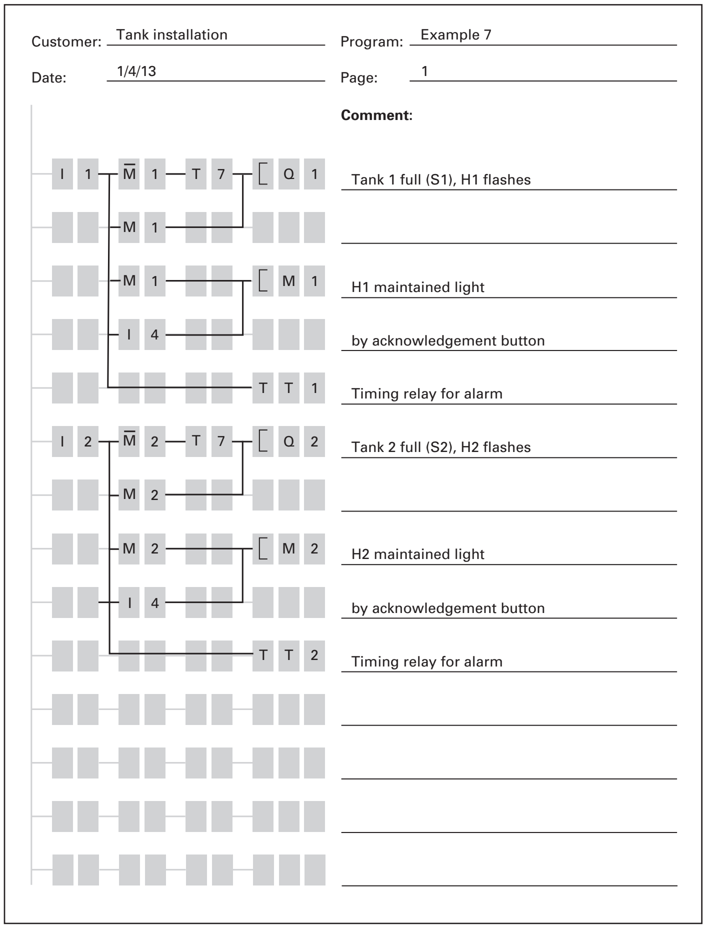


Figure 40. easyRelay Display Diagram

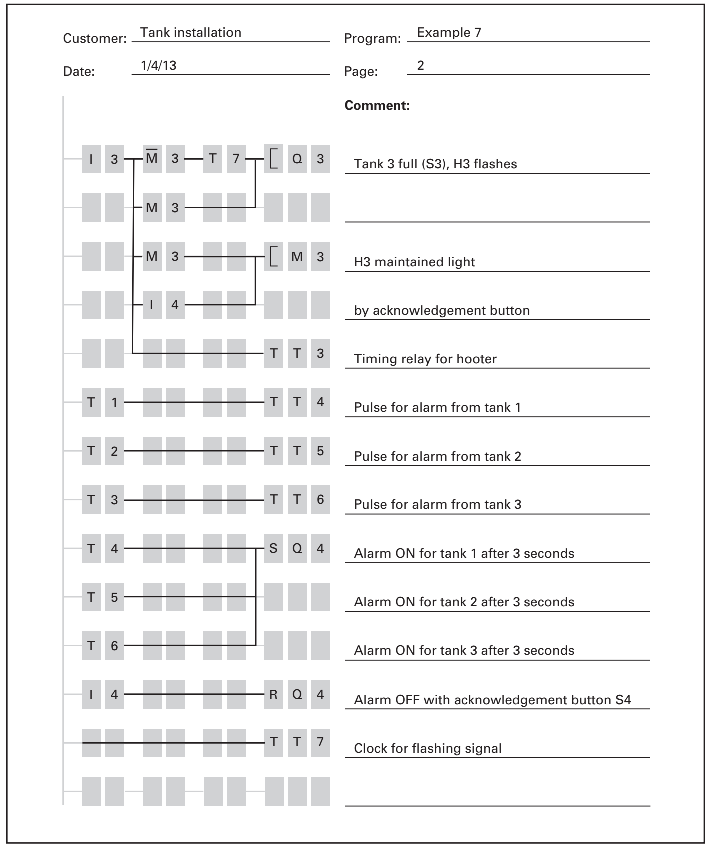


Figure 41. easyRelay Display Diagram

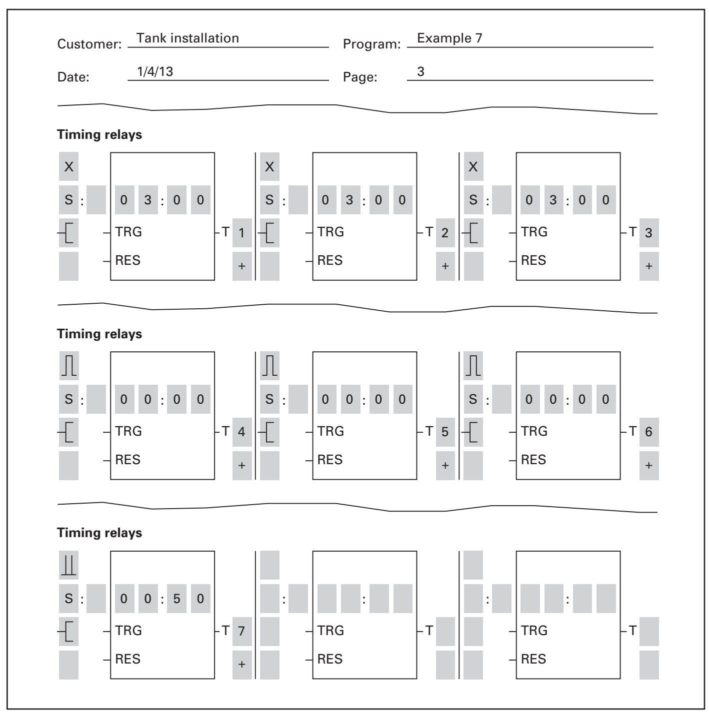


Figure 42. easyRelay Display Parameters

Note: The specified time of 0 seconds in the timing relay produces a pulsing signal of the same length as one easyRelay cycle time.

Access monitoring for a parking garage

Task

To monitor the occupancy of a company parking garage. Cars can enter the garage provided that there are still some spaces available. Access is controlled by a barrier system. The occupancy of the garage is signaled by a "Full/Empty" display.

Overview drawing

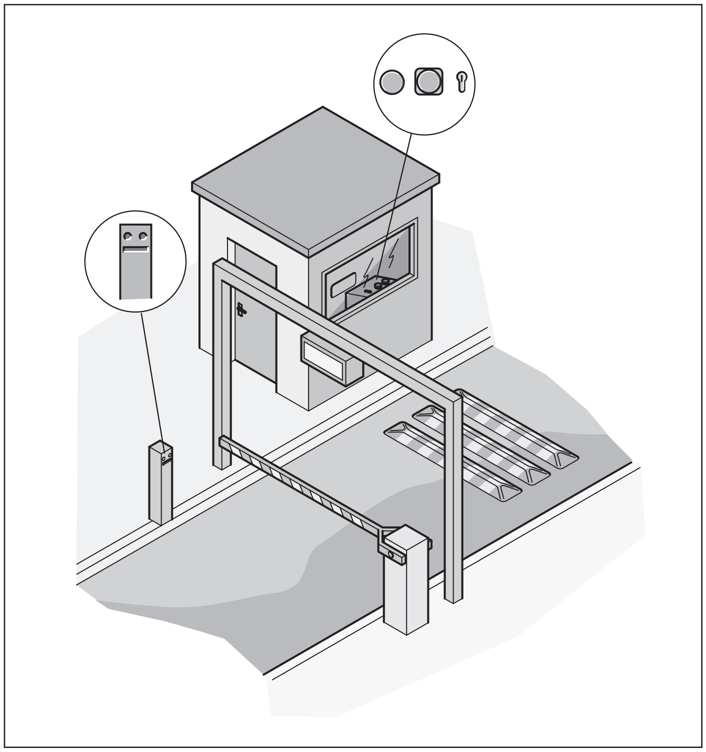


Figure 43. Overview

Operating description

Entry and exit

Access to the garage is monitored by a swipe card reader. If the card is valid, contact S3 is closed briefly. When a vehicle leaves the garage, contact S2 is closed via an induction loop embedded in the ground. A display panel with the message "Full" or "Spaces free" at the point of entry should indicate whether there are still parking spaces available. If voltage is present at signal input K2, the display panel should read "Full", otherwise it should read "Spaces free". The barrier opens when a voltage pulse is applied to K1 for 2 seconds, and it closes automatically when a vehicle has passed through or after a set time has elapsed.

Counting the vehicles

Incoming and outgoing vehicles should be counted by the easyRelay. The maximum number of vehicles that can be parked can be set on the easyRelay. Vehicles may enter if there are parking spaces available. The counter can be reset to zero via the key switch S5 in order to establish a baseline.

Manual operation

The garage attendant should be able to open the barrier at any time using button S4, regardless of whether the garage is full or not.

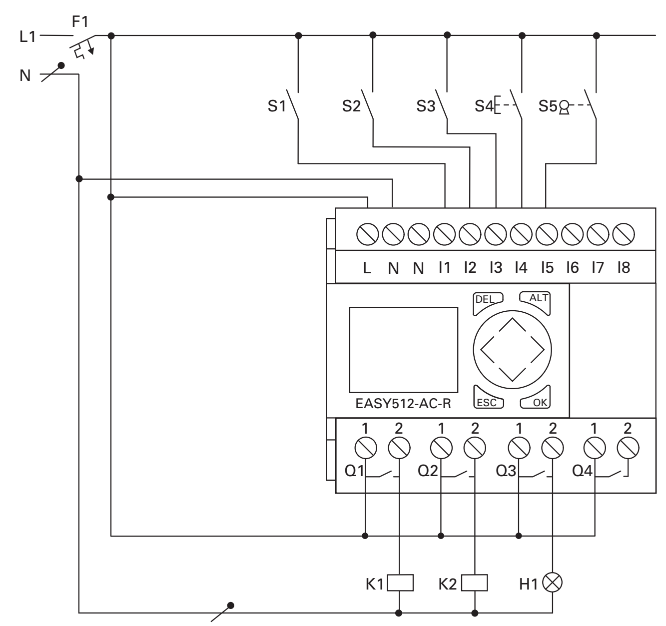
Faults

A fault in the barrier system, which is signaled via make contact S1, is displayed by flashing indicator light H1 in the garage attendant's booth.

Maintenance

The barrier can be opened by pressing the P2 function button (Up arrow) on the easyRelay.

Control circuit



F1	16 A, char. B miniature circuit breaker
H1	Fault flashing indicator light
K1	Barrier driving circuit
K2	Display panel driving circuit
S1	Barrier fault indicator
S2	Contact for induction loop
S3	Contact for swipe card reader
S4	Open barrier button
S5	Reset counter key switch

Figure 44. Control Wiring Diagram

⚠ CAUTION

THE SAFETY REQUIREMENTS OF THE APPLICABLE VDE, IEC, UL, AND CSA STANDARDS REQUIRE THE PHASE THAT IS USED FOR THE POWER SUPPLY TO BE USED FOR THE INPUTS AS WELL. IF THIS IS NOT THE CASE, THE easyRELAYS WILL NOT DETECT THE CONNECTION LEVEL AND CAN BE DAMAGED BY OVERVOLTAGES.

List of operands

C1 Vehicle counter
I1 Input, fault barrier
I2 Input, contact for induction loop
I3 Input, contact for swipe card reader
I4 Input, open barrier button
I5 Input, reset counter key switch
P2 Up arrow cursor button = open barrier
Q1 Output, open barrier
Q2 Output, display panel
Q3 Output, fault indicator light
T1 Single 2-second single-pulse timing relay = open barrier pulse
T2 Timing relay with 1-second flashing cycle = barrier fault flashing message

Benefits

- Implemented functions:
  - 1 x flash/blink relay
  - 1 x up/down counter with reset function
  - 1 x ON-delayed timing relay
- Compact system
- Easy program duplication with program transfer

Examples

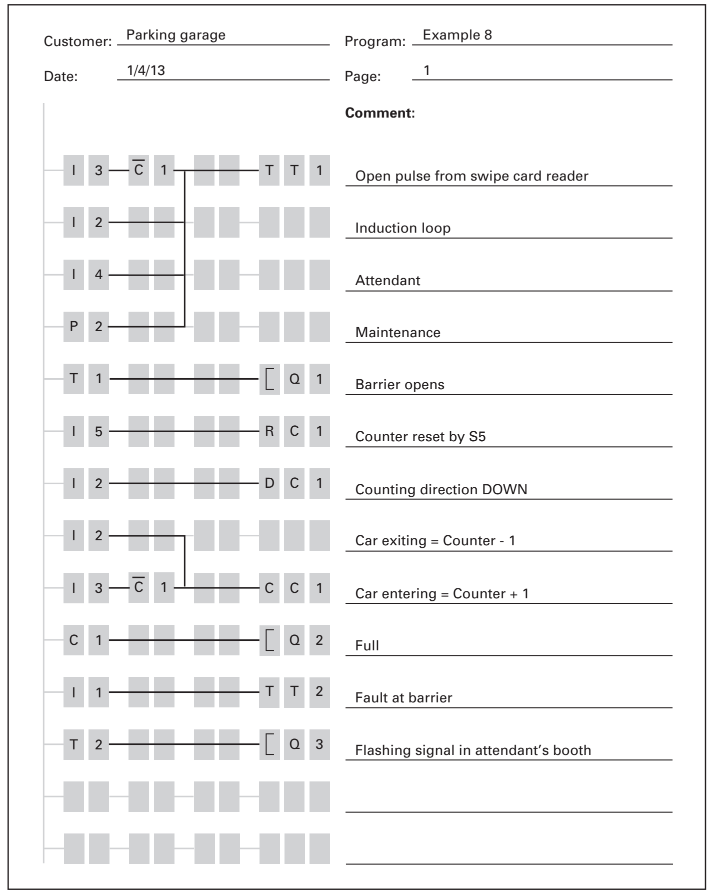


Figure 45. easyRelay Display Diagram

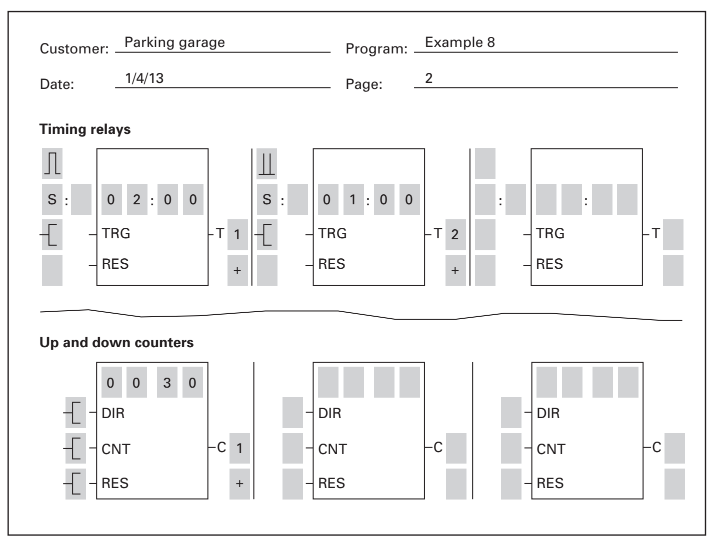


Figure 46. easyRelay Display Parameters

Time-controlled lighting system

Task

To activate the lighting in rarely visited rooms in a library only when turned on by the user in order to save energy. The user may select how long he/she wants the lights to remain on. It should also be possible to switch the lights on and off permanently at a central switch.

Overview drawing

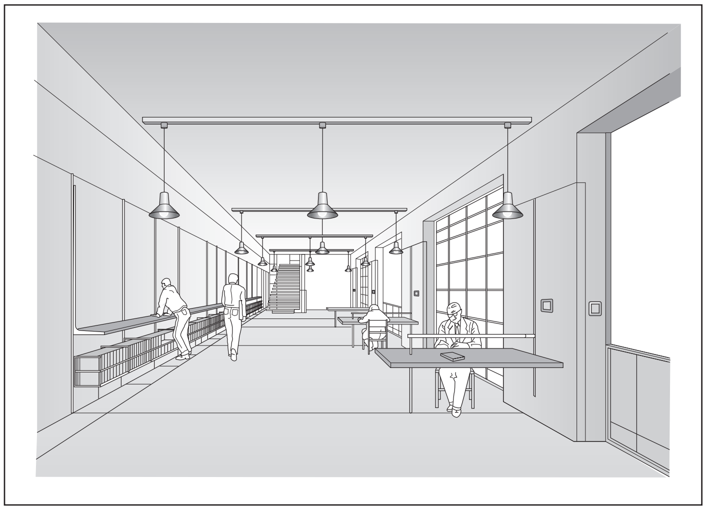
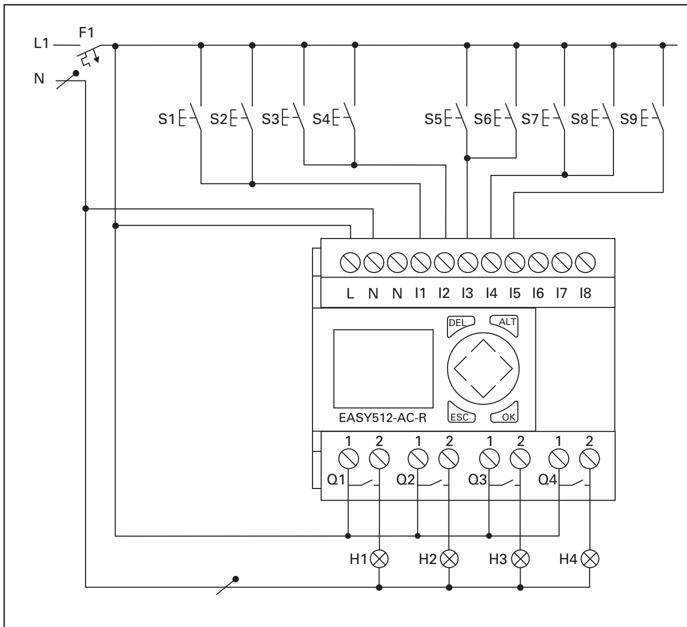


Figure 47. Overview

Operating description

The four groups of lights (H1 through H4) in a library should only be switched on at a reader's request. Two flush-mounted buttons (S1 through S8) are provided for this purpose at the end of a shelving area. If the reader presses the button briefly, the light will come on for just 5 minutes. More pressure on the button will light the area for a half-hour period. All the lights can be turned on and off for cleaning via the central flush-mounted S9 button.

Control circuit



F1	16 A, char. B miniature circuit breaker
H1	Lights in area A
H2	Lights in area B
H3	Lights in area C
H4	Lights in area D
S1–S2	Light switch in area A
S3–S4	Light switch in area B
S5–S6	Light switch in area C
S7–S8	Light switch in area D
S9	Central ON/OFF light switch

Figure 48. Control Wiring Diagram

⚠ CAUTION

THE SAFETY REQUIREMENTS OF THE APPLICABLE VDE, IEC, UL, AND CSA STANDARDS REQUIRE THE PHASE THAT IS USED FOR THE POWER SUPPLY TO BE USED FOR THE INPUTS AS WELL. IF THIS IS NOT THE CASE, THE easyRELAYS WILL NOT DETECT THE CONNECTION LEVEL AND CAN BE DAMAGED BY OVERVOLTAGES.

List of operands

C1 Counter, ON duration 5 min., area A
C2 Counter, ON duration 30 min., area A
C3 Counter, ON duration 5 min., area B
C4 Counter, ON duration 30 min., area B
C5 Counter, ON duration 5 min., area C
C6 Counter, ON duration 30 min., area C
C7 Counter, ON duration 5 min., area D
C8 Counter, ON duration 30 min., area D
I1 Input, light switch S1/S2, area A
I2 Input, light switch S3/S4, area B
I3 Input, light switch S5/S6, area C
I4 Input, light switch S7/S8, area D
I5 Input, central ON/OFF light switch
M1 Marker relay, buffer memory, light in area A ON for 5 min.
M2 Marker relay, buffer memory, light in area A ON for 30 min.
M3 Marker relay, buffer memory, light in area B ON for 5 min.
M4 Marker relay, buffer memory, light in area B ON for 30 min.
M5 Marker relay, buffer memory, light in area C ON for 5 min.
M6 Marker relay, buffer memory, light in area C ON for 30 min.
M7 Marker relay, buffer memory, light in area D ON for 5 min.
M8 Marker relay, buffer memory, light in area D ON for 30 min.
M9 Marker relay, buffer memory, light ON/OFF at central switch
Q1 Output relay, light area A
Q2 Output relay, light area B
Q3 Output relay, light area C
Q4 Output relay, light area D
T1 Timing relay with 2-second ON delay = short/long ON duration, area A
T2 Timing relay with 2-second ON delay = short/long ON duration, area B
T3 Timing relay with 2-second ON delay = short/long ON duration, area C
T4 Timing relay with 2-second ON delay = short/long ON duration, area D
T8 Flashing 20-second cycle for short/long ON duration

Benefits

- Implemented functions:
  - 12 x ON-delayed timing relays
  - 1 x impulse changeover relay
- Less wiring required
- Takes up less space than conventional systems

Examples

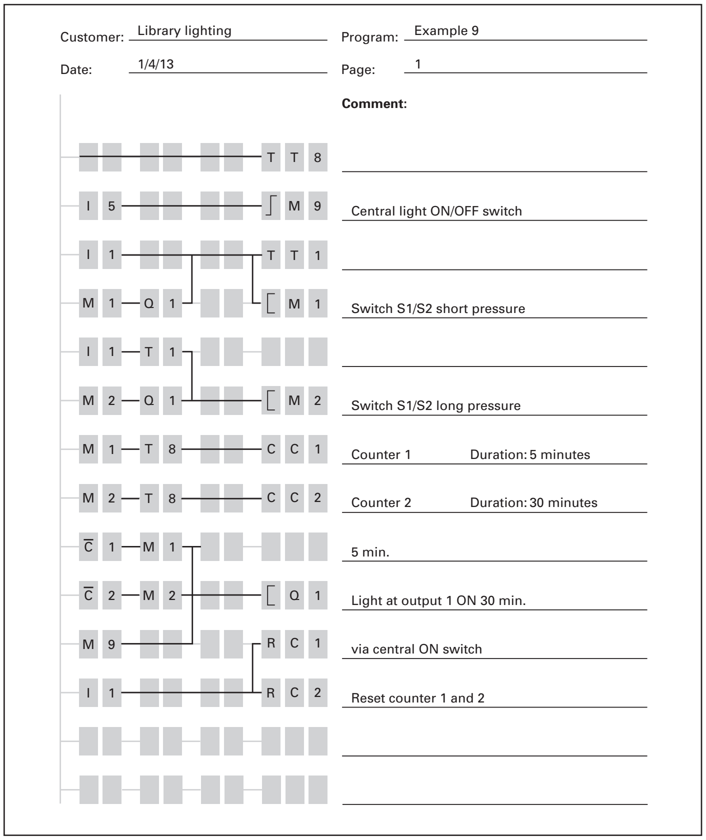


Figure 49. easyRelay Display Diagram

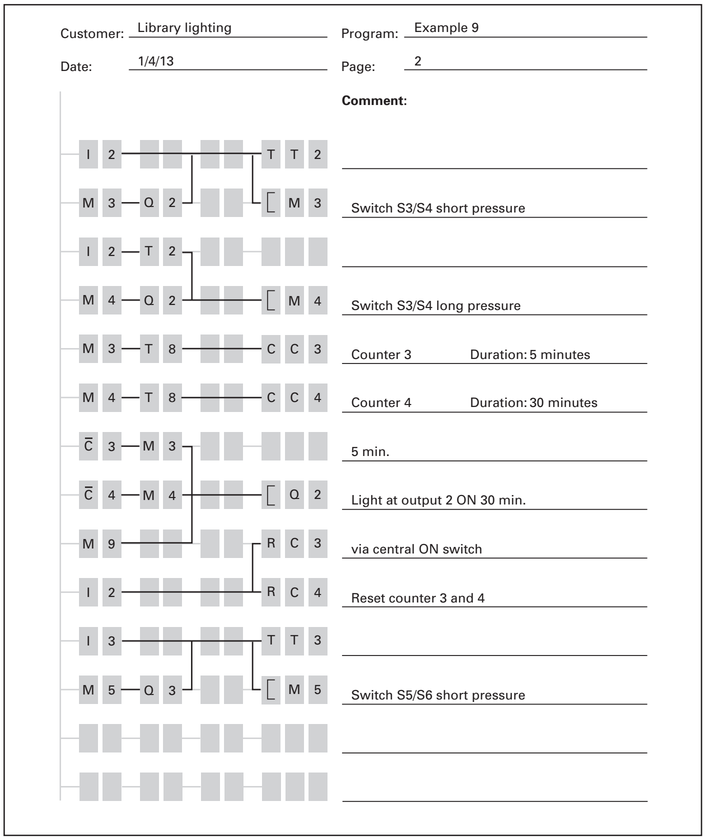


Figure 50. easyRelay Display Diagram

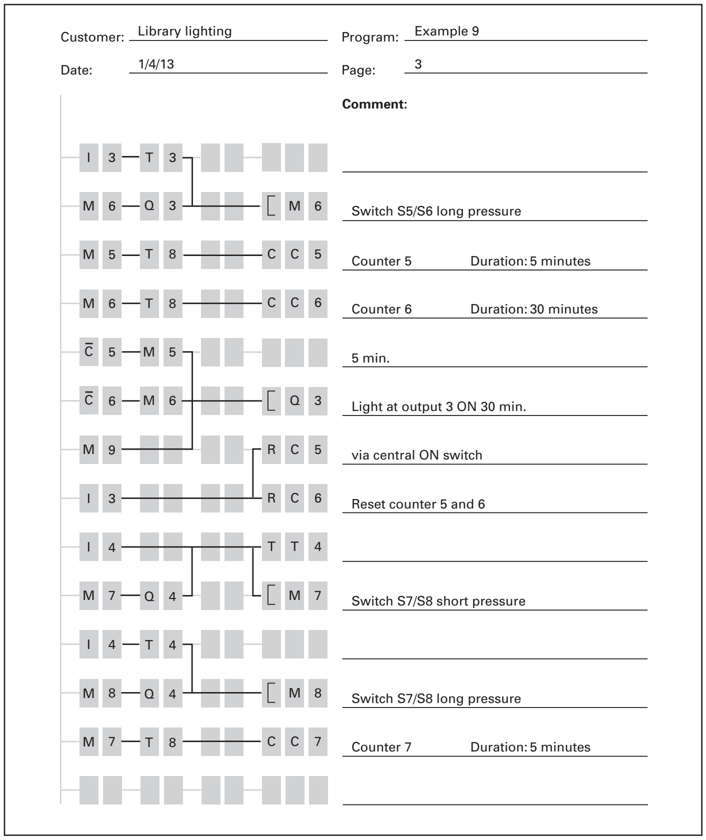


Figure 51. easyRelay Display Diagram

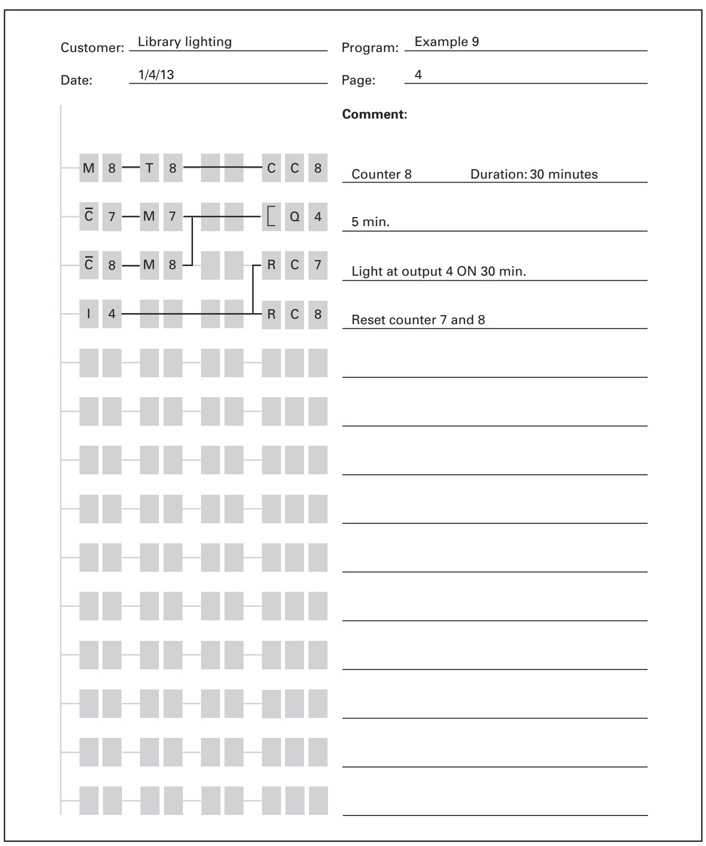


Figure 52. easyRelay Display Diagram

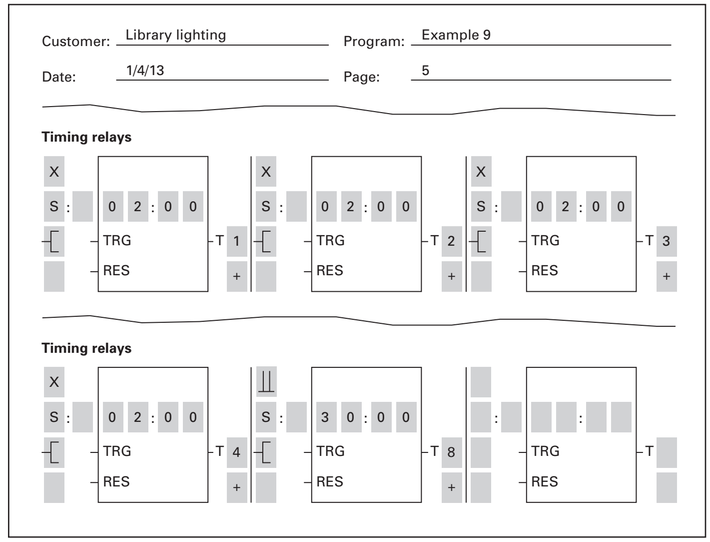


Figure 53. easyRelay Display Parameters

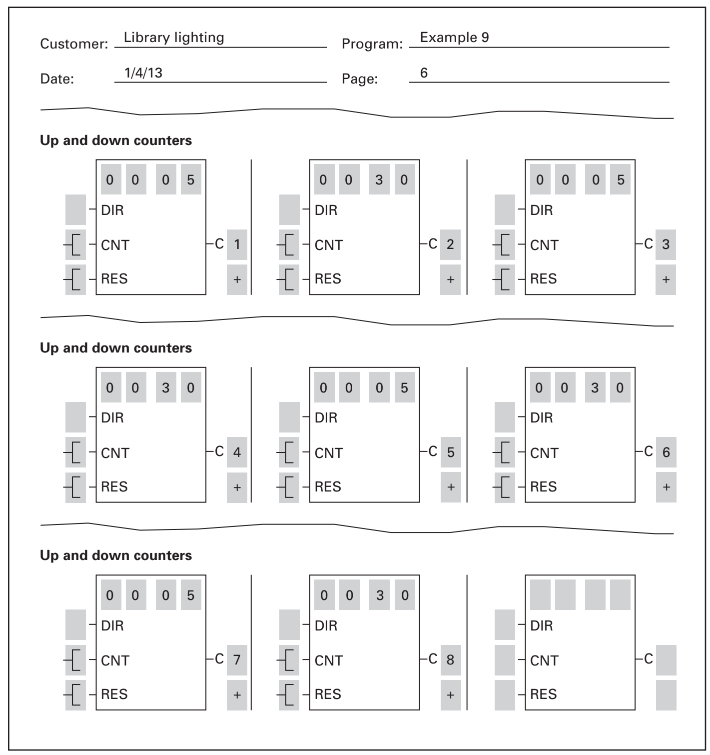


Figure 54. easyRelay Display Parameters

Refrigeration control system

Task

To turn the compressors of the refrigeration system in a hotel on and off in response to the system pressure. The system pressure is supplied by the easyRelay via analog input I8. The value at I8 is compared with set point values and the switching points are derived from the comparison value.

Overview drawing

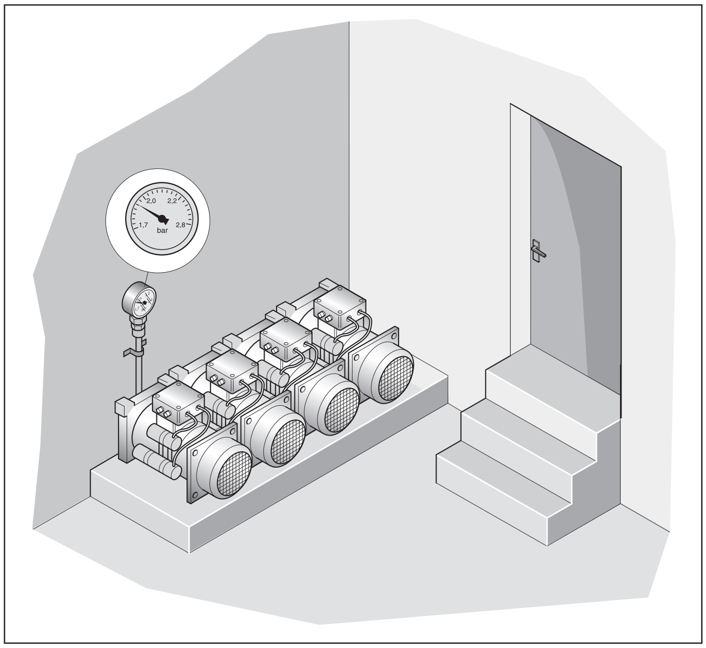


Figure 55. Overview

Operating description

The pressure of the refrigeration system is compared with set point values. Timers are connected upstream of the outputs so that pressure fluctuations in the system do not cause the compressors to turn on immediately.

Set point values

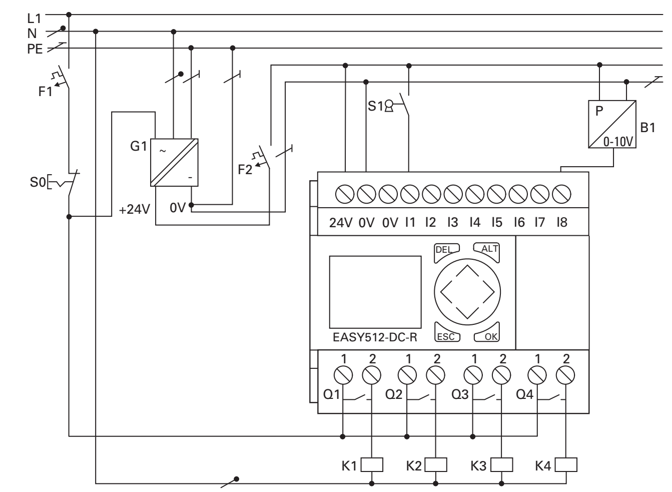
Output Q1:
Set: A1 ≥ 1.8 bar
Time T1 = 5 sec
Reset: A5 ≤ 1.7 bar

Output Q2:
Set: A2 ≥ 2.0 bar
Time T2 = 20 sec
Reset: A6 ≤ 1.9 bar

Output Q3:
Set: A3 ≥ 2.2 bar
Time T3 = 20 sec
Reset: A7 ≤ 2.1 bar

Output Q4:
Set: A4 ≥ 2.4 bar
Time T4 = 20 sec
Reset: A8 ≤ 2.3 bar

Control circuit



B1	Pressure sensor
F1	16 A, char. B miniature circuit breaker
F2	Miniature circuit breaker (optional)
G1	Power supply unit 230 Vac/24 Vdc
K1–K4	Compressor 1–4
S0	Emergency stop
S1	ON/OFF key switch

Figure 56. Control Wiring Diagram

Load circuit

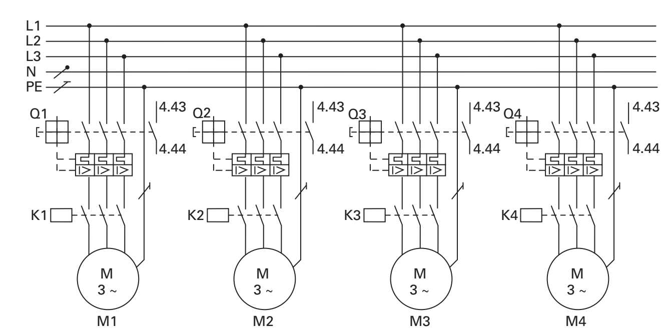


Figure 57. Load Circuit Diagram

List of operands

A1	Comparator, motor 1 ON after T1 has elapsed
A2	Comparator, motor 2 ON after T2 has elapsed
A3	Comparator, motor 3 ON after T3 has elapsed
A4	Comparator, motor 4 ON after T4 has elapsed
A5	Comparator, motor 1 OFF
A6	Comparator, motor 2 OFF
A7	Comparator, motor 3 OFF
A8	Comparator, motor 4 OFFI1 Input, system ON/OFF
I8	Input, comparison voltage from pressure sensor

Q1 Output, motor 1
Q2 Output, motor 2
Q3 Output, motor 3
Q4 Output, motor 4
T1 Timing relay, ON delay, motor 1
T2 Timing relay, ON delay, motor 2
T3 Timing relay, ON delay, motor 3
T4 Timing relay, ON delay, motor 4

Benefits

- Implemented functions:
  - 4 x ON-delayed timing relays
- Processing of pressure values (analog values)
- Password function protects against unauthorized access

Examples

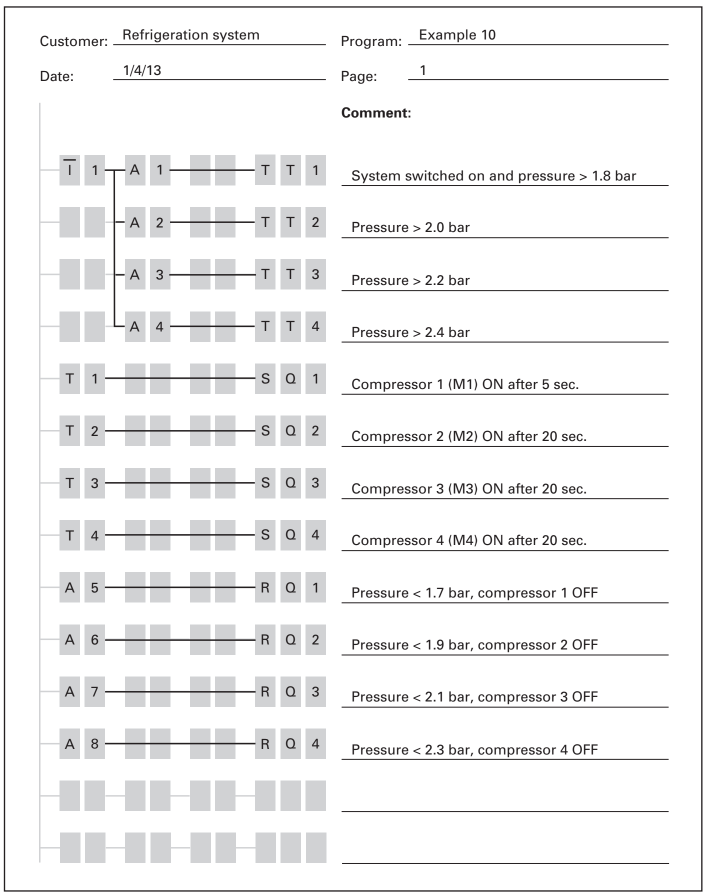


Figure 58. easyRelay Display Diagram

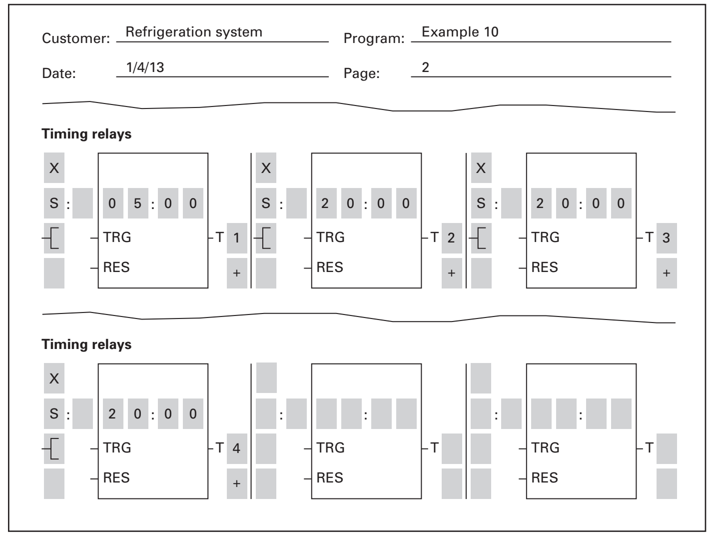


Figure 59. easyRelay Display Parameters

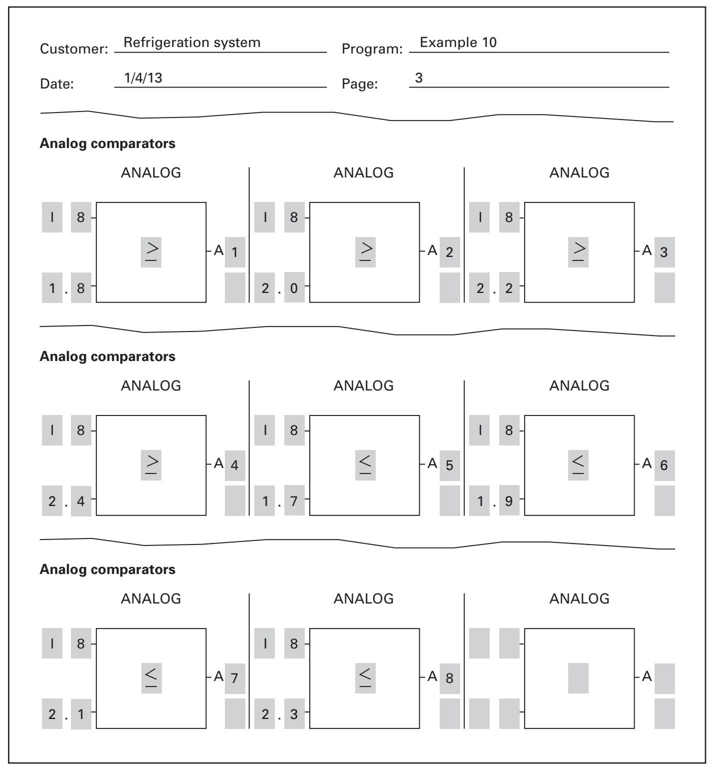


Figure 60. easyRelay Display Parameters

Perimeter advertising in a stadium

Task

The time-dependent control of four advertising panels, each with three sides. Each side is to be visible for 30 seconds, after which the next side is to be turned to the front.

Overview drawing

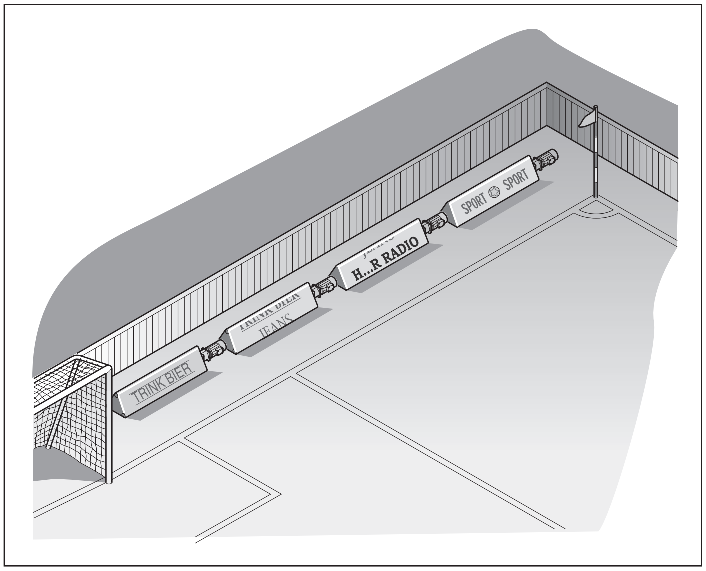


Figure 61. Overview

Operating description

Start

Start/Stop button S5 is used to start the procedure for all four panel fixture electrical strips. The visible advertising panel is on view for a variable time (controlled via T1 through T4). It should be possible to stop the entire procedure by pressing the S5 button again.

Rotation

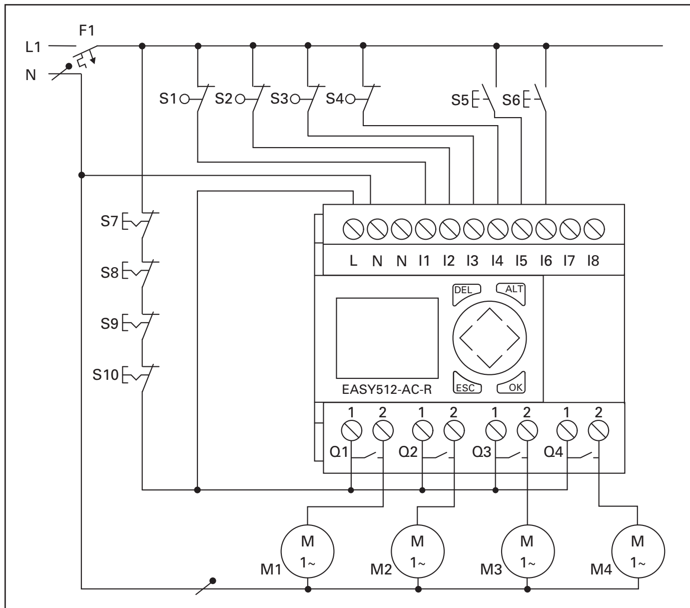
Once the set time has elapsed, the motor (M1 through M4) associated with the strip must start automatically. The strip rotates to display the next advertising panel. Once the advertising panel is in the correct position, this is signaled via the corresponding limit switch (S1 through S4) and the motor is turned off. To enable the strip to leave the limit switch position, disconnection must be bypassed, again for a variable time (controlled via T5 through T8), when the rotation procedure starts.

Testing and maintenance

It must be possible to activate the rotation procedure manually in order to be able to test the individual strips during installation and assembly and to replace the advertising panels. The cursor buttons P1 through P4 on the easyRelay are used to activate a single turn for each individual strip, and button S6 activates a single turn of all the strips together.

Note: The P buttons are activated in the Special menu. Press ALT and DEL simultaneously to change to the Special menu.

Circuit diagram



F1 16 A, char.B miniature circuit breaker
M1 Motor for strip 1
M2 Motor for strip 2
M3 Motor for strip 3
M4 Motor for strip 4
S1 Limit switch for strip 1
S2 Limit switch for strip 2
S3 Limit switch for strip 3
S4 Limit switch for strip 4
S5 Start/Stop button
S6 Turn button
S7–S10 Emergency stop

Figure 62. Control Wiring Diagram

⚠ CAUTION

THE SAFETY REQUIREMENTS OF THE APPLICABLE VDE, IEC, UL, AND CSA STANDARDS REQUIRE THE PHASE THAT IS USED FOR THE POWER SUPPLY TO BE USED FOR THE INPUTS AS WELL. IF THIS IS NOT THE CASE, THE easyRELAYS WILL NOT DETECT THE CONNECTION LEVEL AND CAN BE DAMAGED BY OVERVOLTAGES.

List of operands

I1 Input, limit switch for strip 1
I2 Input, limit switch for strip 2
I3 Input, limit switch for strip 3
I4 Input, limit switch for strip 4
I5 Input, Start/Stop button
I6 Input, Turn button
M1 Marker relay, buffer memory, Start/Stop
P1 Cursor button 1 x Turn strip 1
P2 Cursor button 1 x Turn strip 2
P3 Cursor button 1 x Turn strip 3
P4 Cursor button 1 x Turn strip 4
Q1 Output, motor for strip 1
Q2 Output, motor for strip 2

Q3 Output, motor for strip 3

Q4 Output, motor for strip 4

T1 Timing relay with 30-second ON delay => Advert viewing time, strip 1

T2 Timing relay with 30-second ON delay => Advert viewing time, strip 2

T3 Timing relay with 30-second ON delay => Advert viewing time, strip 3

T4 Timing relay with 30-second ON delay => Advert viewing time, strip 4

T5 Single 1-second pulse timing relay => Block limit switch for starting strip 1

T6 Single 1-second pulse timing relay => Block limit switch for starting strip 2

T7 Single 1-second pulse timing relay => Block limit switch for starting strip 3

T8 Single 1-second pulse timing relay => Block limit switch for starting strip 4

Benefits

- Implemented functions:
  - 8 x ON-delayed timing relays
  - 1 x impulse changeover relay
- Less wiring required
- Takes up less space than conventional systems
- Dwell-time of each strip can be individually selected

Examples

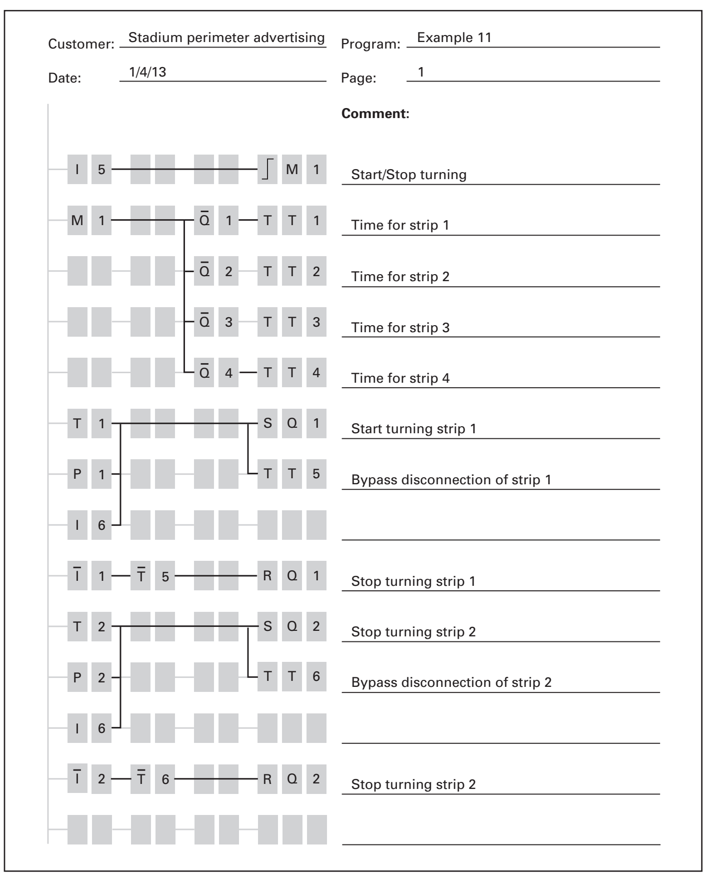


Figure 63. easyRelay Display Diagram

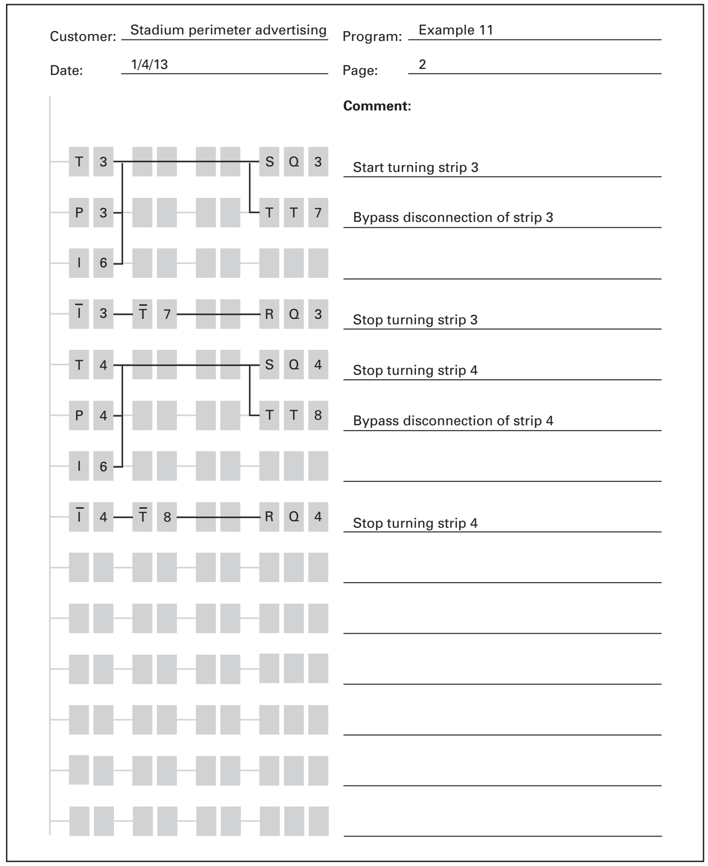


Figure 64. easyRelay Display Diagram

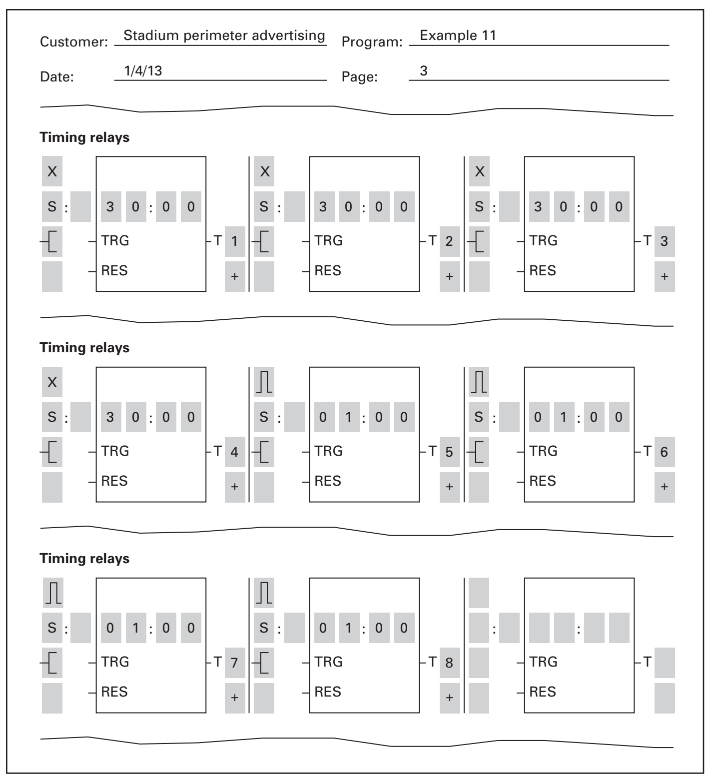


Figure 65. easyRelay Display Parameters

Rolling door control

Task

To automatically control the roll-up security door at the entrance to an underground garage. The door should open on request and then close automatically after a set time. It should also be possible to close the door upon request. The door is locked at certain times of the day and certain days of the week. The limit switches and mechanical operation of the door should be constantly monitored.

Overview drawing

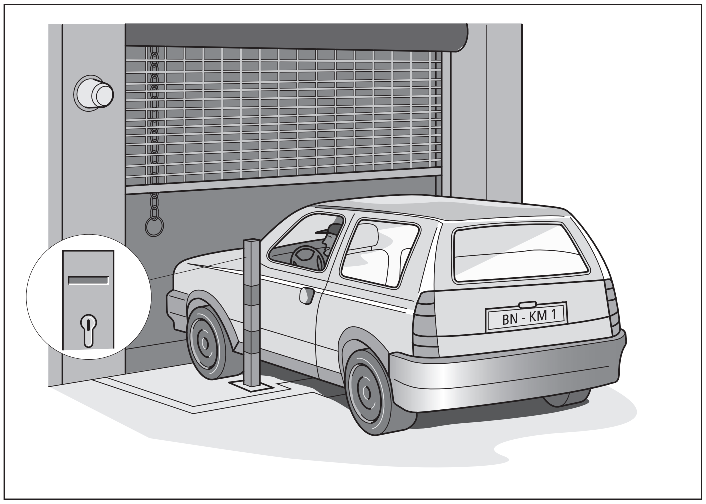


Figure 66. Overview

Operating description

Opening the rolling door

The rolling door can be opened from outside via a swipe card reader and/or key switch S6. Contact K1 closes briefly once the swipe card has been checked. It should be possible to lock the entrance at certain, variable times of the day and on certain days of the week (⏲1); although it should always be possible to open the door using key switch S5.

The door must be opened using pull switch S7 in order to leave the garage.

Closing the rolling door

Once a car has driven into the garage, the driver can close the door manually via pull switch S7. If the driver does not use the pull switch, the door will automatically close after a set time (T3). The door can be opened and closed manually using the S4 and S5 buttons in the control room.

Security

Door closing should be indicated by a brief audible signal (H3). At the same time, red warning lights H1 and H2 light up at the entrance and the exit. If there is a person, a vehicle, or another object under the door while it is closing, the procedure will be stopped or prevented via the contact in the safety bar (K2) and/or the light barrier (K3). The door will either immediately open fully or will remain open. If the safety bar is triggered, there is an audible signal, and warning lights H1 and H2 light up.

The "Open door" function is disabled by the safety bar when the door is closed (limit switches actuated) in order to prevent break-in and vandalism.

The contact bar can be tested by triggering the alarm while the door is open.

Pressing the emergency stop button stops all movement of the door. Warning lights H1 and H2 will start to flash, and the audible signal will start.

If the door is closed, the alarm cannot be triggered via the emergency stop button. The "Open door" command must be given to start the flashing lights and the audible signal in order to indicate that the emergency stop button has been pressed.

Break contacts should be used for the emergency stop, safety bar, and limit switch functions. The emergency stop button and the safety bar must be wired as shown in **Figure 67**. This will guarantee that the opening and closing procedure during an emergency stop, and the door closing procedure when the safety bar is tripped, work independently of the electronic circuit.

The following standards must be observed:

DIN EN 60 335-1 (VDE 0700 part 1)

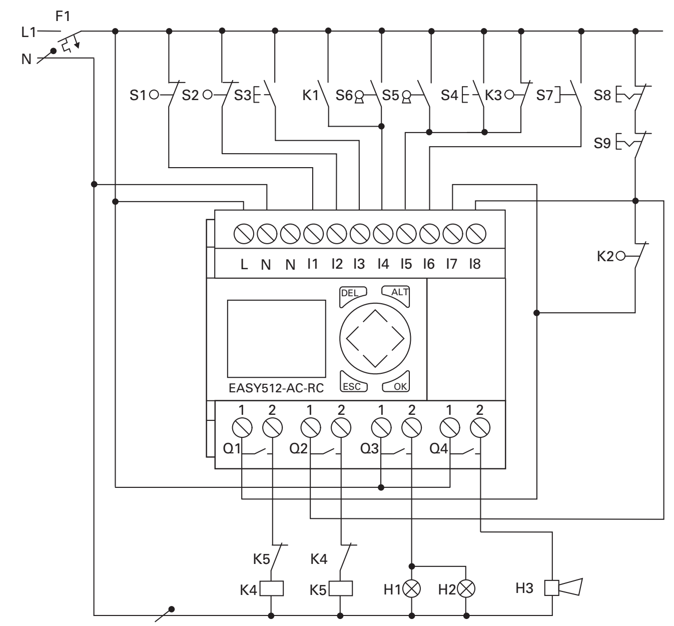
DIN 57 700-238 (VDE 0700 part 238)

German Workplace Directive ASR 11/1-5ZH1/494
and ZH1/580.1 Safety Rules

Faults

Defective limit switches S1 and S2 (door closed S1/door opened S2) and mechanical faults in the door must be detected. If a limit switch is not working correctly, the drive should be shut down after a variable time (T1 and T2) and warning lights H1 and H2 should start to flash. The message can be cleared by pressing and resetting emergency stop button S8. If emergency stop button S8 is pressed, the warning lights should light up and a continuous audible signal should start.

Control circuit



F1	16 A, char. B miniature circuit breaker
H1	Internal warning light
H2	External warning light
H3	Audible signal
K1	Contact for swipe card reader
K2	Contact for safety bar
K3	Contact for light barrier
K4	Close door contactor
K5	Open door contactor
S1	Door closed limit switch
S2	Door opened limit switch
S3	Close door button
S4	Open door button
S5	Open door key switch
S6	Open door key switch
S7	Pull switch
S8	Emergency stop button
S9	Emergency stop button

Figure 67. Control Wiring Diagram

⚠ CAUTION

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Load circuit

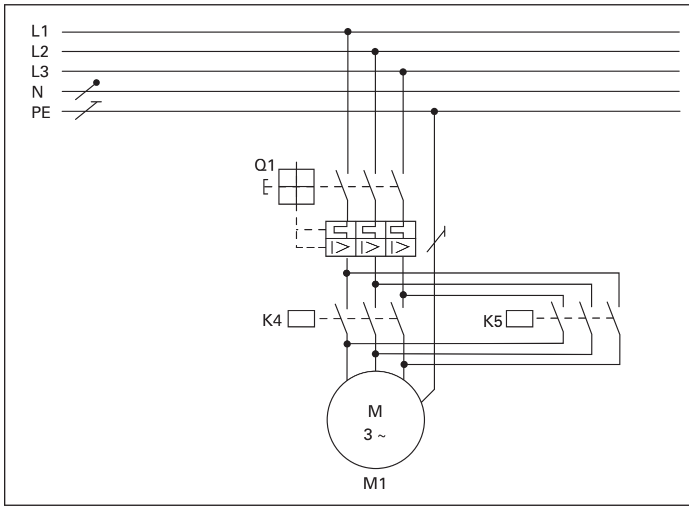

Figure 68. Load Circuit Diagram

Note: The electrical interlock may be omitted if a reversing contactor with a mechanical interlock is used.

List of operands

I1	Input, door closed limit switch
I2	Input, door opened limit switch
I3	Input, close door button
I4	Input, open door key switch/contact swipe card reader
I5	Input, open door button/open door key switch
I6	Input, pull switch
I7	Input, safety bar/light barrier triggered signal
I8	Input, emergency stop triggered signal
M1	Marker relay, buffer memory, close door
M2	Marker relay, buffer memory, open door
M3	Marker relay, buffer memory, close
M4	Marker relay, buffer memory, open
M5	Marker relay, buffer memory, pull switch
M6	Marker relay, buffer memory, time monitoring of limit switch
Q1	Output relay, close door
Q2	Output relay, open door
Q3	Output relay, warning lights
Q4	Output relay, audible signal
T1	ON-delayed timing relay, monitoring of door closed limit switch
T2	ON-delayed timing relay, monitoring of door opened limit switch
T3	Single-pulse timing relay, warning time before door closes
T4	ON-delayed timing relay, time until door closes automatically
T5	Single-pulse timing relay, open/close changeover delay
T6	Flashing timing relay for warning lights
⏲ 1	Switching contact time 1 = operating time

Examples

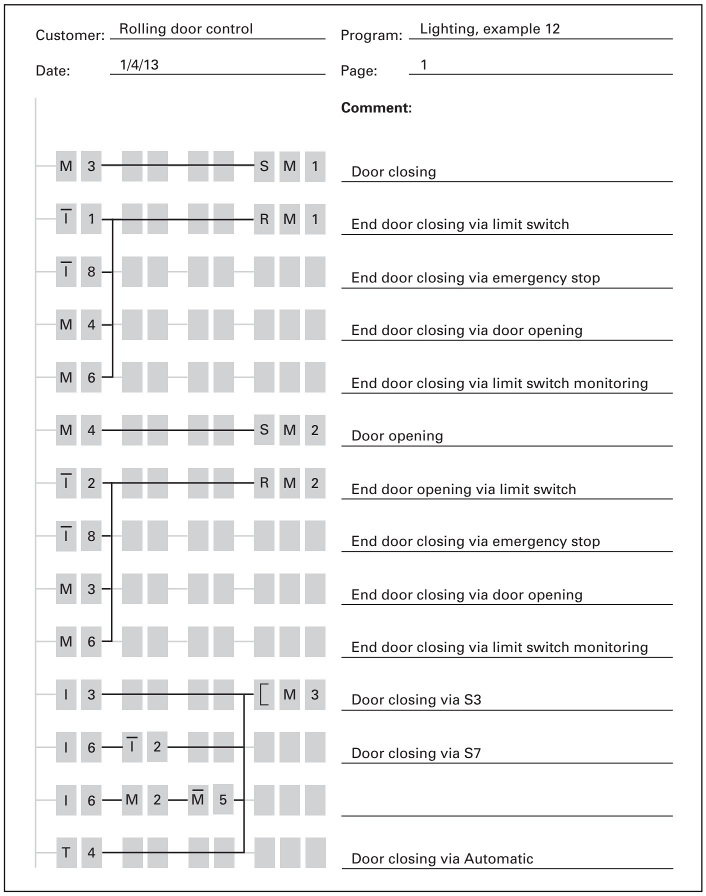

Figure 69. easyRelay Display Diagram

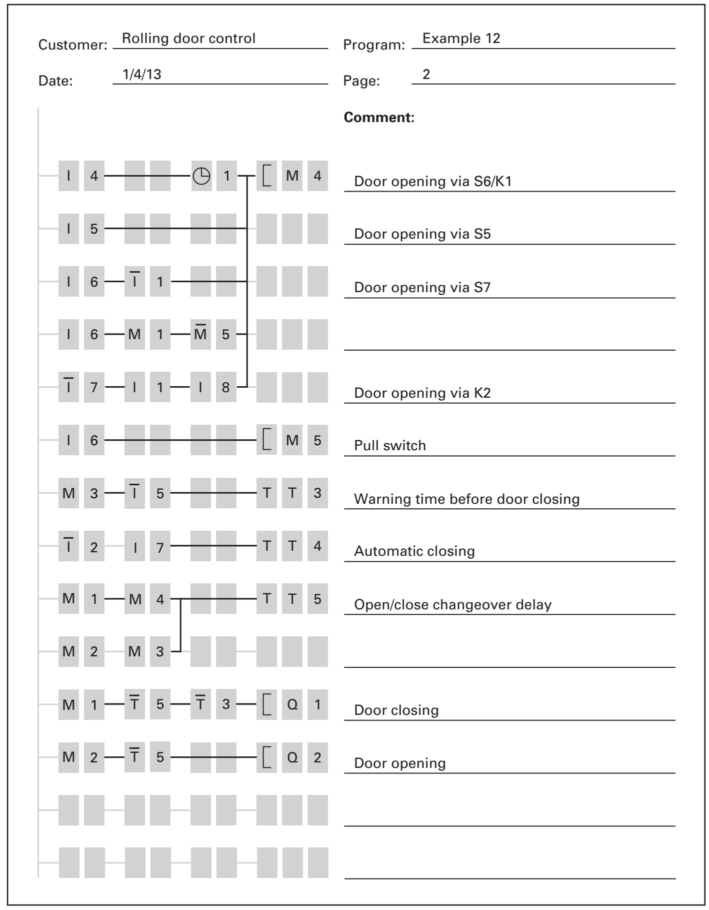

Figure 70. easyRelay Display Diagram

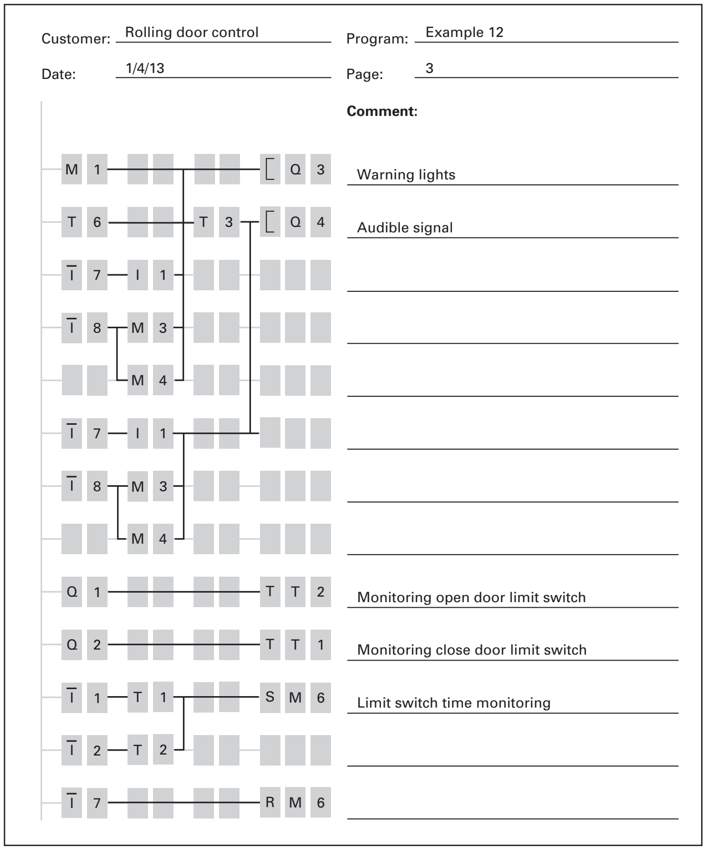

Figure 71. easyRelay Display Diagram

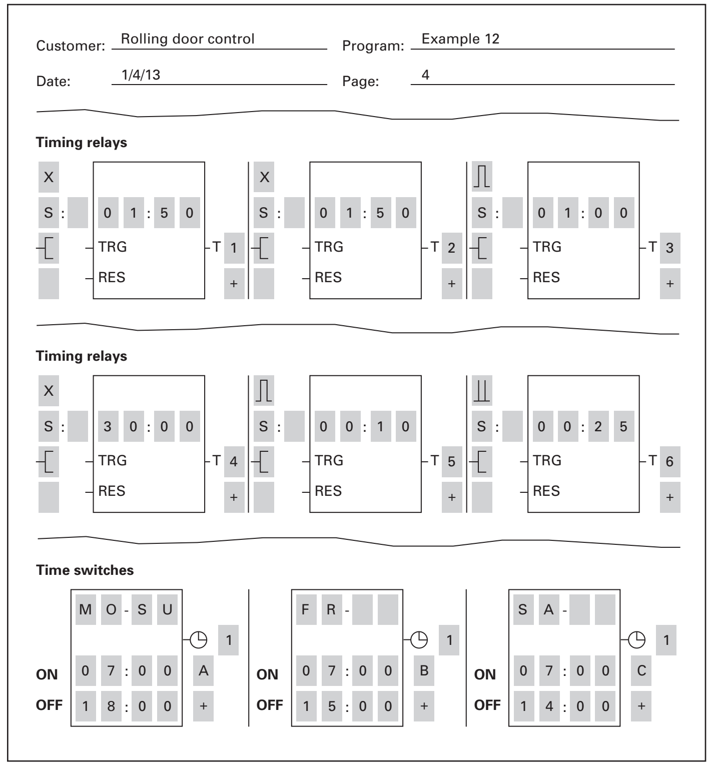

Figure 72. easyRelay Display Parameters

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