Application Guide

Easy Control Relay

Dieter Bauerfeind, Volker Jakobi

MOELLER

Think future. Switch to green.

Warning!
Dangerous electrical voltage!

Before commencing the installation

- Disconnect the power supply of the device.

- Ensure that devices cannot be accidentally restarted.

- Verify isolation from the supply.

- Earth and short circuit.

- Cover or enclose neighbouring units that are live.

- Follow the engineering instructions (AWA) of the device concerned.

- Only suitably qualified personnel in accordance with EN 50110-1/-2 (VDE 0105 Part 100) may work on this device/system.

- Before installation and before touching the device ensure that you are free of electrostatic charge.

- The functional earth (FE) must be connected to the protective earth (PE) or to the potential equalisation. The system installer is responsible for implementing this connection.

- Connecting cables and signal lines should be installed so that inductive or capacitive interference does not impair the automation functions.

- Install automation devices and related operating elements in such a way that they are well protected against unintentional operation.

- Suitable safety hardware and software measures should be implemented for the I/O interface so that a line or wire breakage on the signal side does not result in undefined states in the automation devices.

- Ensure a reliable electrical isolation of the low voltage for the 24 volt supply. Only use power supply units complying with IEC 60364-4-41 (VDE 0100 Part 410) or HD 384.4.41 S2.

- Deviations of the mains voltage from the rated value must not exceed the tolerance limits given in the specifications, otherwise this may cause malfunction and dangerous operation.

- Emergency stop devices complying with IEC/EN 60204-1 must be effective in all operating modes of the automation devices. Unlatching the emergency-stop devices must not cause restart.

- Devices that are designed for mounting in housings or control cabinets must only be operated and controlled after they have been installed with the housing closed. Desktop or portable units must only be operated and controlled in enclosed housings.

- Measures should be taken to ensure the proper restart of programs interrupted after a voltage dip or failure. This should not cause dangerous operating states even for a short time. If necessary, emergency-stop devices should be implemented.

- Wherever faults in the automation system may cause damage to persons or property, external measures must be implemented to ensure a safe operating state in the event of a fault or malfunction (for example, by means of separate limit switches, mechanical interlocks etc.).

Contents

Contents

TB 2528-025 GB

Contents

Contents

TB 2528-025 GB

To the best of our knowledge all program
examples have been written correctly and have
been carefully tested. They are executable
programs for training purposes only.
Klöckner-Moeller GmbH cannot accept any
liability in the event of a fault.

6

1 Showroom And Shop Window Lighting

Task

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

Overview drawing

Functional description

External advertising display

Mon – Sun 06:00 – 23:00   Time switch 1

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

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

☞ The P buttons are activated in the Special system menu. Press ALT and DEL simultaneously to switch to the Special menu. See also the User Manual AWB 2528-1304 GB or Training Guide AWB 2528-1316 GB.

Shop window lighting

Mon – Fri 08:00 – 22:00   Time switch 2
Sat   08:00 – 23:00
Sun   10:00 – 22:00

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

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

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

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

TB 2528-025 GB

Showroom lighting
Mon – Fri 08:55 – 13:05 Time switch 3
　　　　 13:55 – 18:35
Sat　　　 08:55 – 14:05

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

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

Circuit diagram
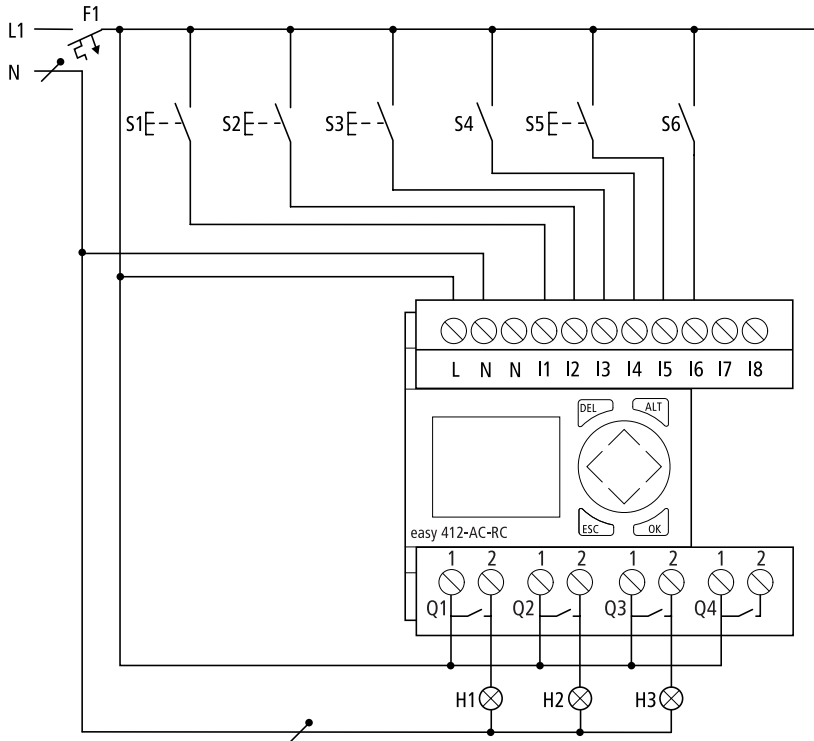
S1 – S3	Light switches for showroom lighting
S4	Switching contact for daylight control switch
S5	Light switch for shop window lighting
S6	Switching contact for alarm system
H1	External advertising display
H2	Shop window lighting
H3	Showroom lighting
F1	16 A char. B miniature circuit-breaker

⚠

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, "easy" will not detect the switching level and can be damaged by overvoltages.

Parts list

The order numbers and specified pages are taken from the 1999 Moeller Main Catalogue.

Qty.	Device	Article No.	Page of Main Catalogue
1	"easy" control relay	EASY412-AC-RC	05/006
1	Daylight control switch		
4	1-pole flush-mounted switch		
1	16 A miniature circuit-breaker	FAZN B16	12/004

☞

The Appendix contains a guide for determining the maximum possible lamp loads.
Contactors should be used if the required lamp load exceeds the switching capacity of the "easy" relay outputs.

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, switching contact, daylight control switch
I5	Input, light switch, shop window lighting
I6	Input, switching contact, alarm system
M1	Marker relay, buffer memory, external advertising display ON/OFF
M2	Marker relay, buffer memory, shop 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, shop window lighting
Q3	Output relay, showroom lighting
🕐1	Switching contact, time 1 = time switching, external advertising display
🕐2	Switching contact, time 2 = time switching, shop window lighting
🕐3	Switching contact, time 3 = time switching, showroom lighting

Benefits

Implemented functions

$3 \times$ single-channel time switches with weekly and daily programs
List price approx. DM 300
$3 \times$ impulse changeover relays
List price approx. DM 60

Less wiring required

Takes up less space than conventional systems

Password function protects against unauthorised access

"easy" Control Relay Circuit Diagram FO 98

Customer: art deco

Date: 13.8.98

Program: Lighting, example 1

Page: 1

Comment:

I 1 — ⌠ M 3	Flush-mounted switch S1,S2,S3
I 2	for showroom lighting
I 3	
P 2 — S M 1	Set external advertising display switch
P 4 — R M 1	Reset external advertising display switch
I 5 — ⌠ M 2	Switch for shop window lighting
⊕ 1 — I 4 — ⌈ Q 1	External advertising display which is dependent
M 1	on daylight control switch I4
⊕ 2 — I 4 — ⌈ Q 2	Shop window lighting which is dependent
M 2	on daylight control switch I4, switch
I 6	and alarms
⊕ 3 — ⌈ Q 3	Showroom lighting which is dependent on
M 3	flush-mounted switch
I 6	and alarms

TB 2528-025 GB

13

"easy" Control Relay Parameters

Customer: _art deco_   Program: _Lighting, example 1_

Date: _13.8.98_   Page: _2_

Time switches

M	O - S	O			⏲	1
ON	0 6 : 0 0	A				
OFF	2 3 : 0 0	_				

	-		⏲
ON	:		
OFF	:		

	-		⏲
ON	:		
OFF	:		

Time switches

M	O - F R		⏲	2
ON	0 8 : 0 0	A		
OFF	2 2 : 0 0	+		

S	A -		⏲	2
ON	0 8 : 0 0	B		
OFF	2 3 : 0 0	+		

S	O -		⏲	2
ON	1 0 : 0 0	C		
OFF	2 2 : 0 0	+		

Time switches

M	O - F R		⏲	3
ON	0 8 : 5 5	A		
OFF	1 3 : 0 5	_		

M	O - F R		⏲	3
ON	1 3 : 5 5	B		
OFF	1 8 : 3 5	_		

S	A -		⏲	3
ON	0 8 : 5 5	C		
OFF	1 4 : 0 5	_		
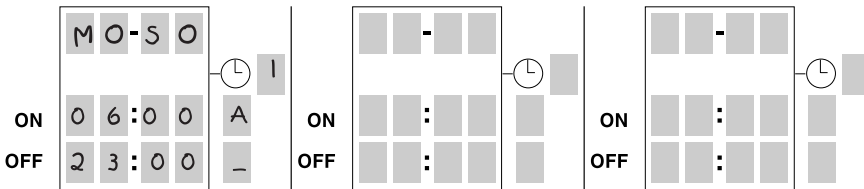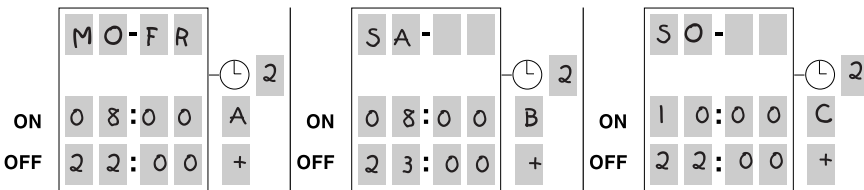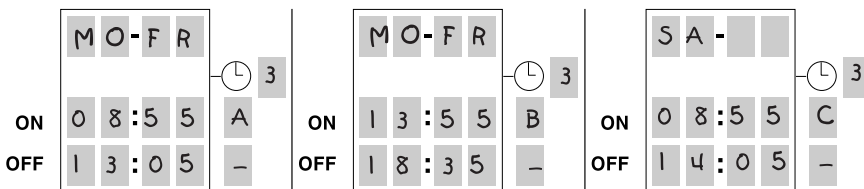
2 Floor Lighting

Task

To enable the corridor lights on each floor of a multi-storey 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 switched on and off. In the event of a fire, it must be possible to switch on all the corridor lights. To save energy, the corridor lights should be switched off altogether at certain times.

Overview drawing
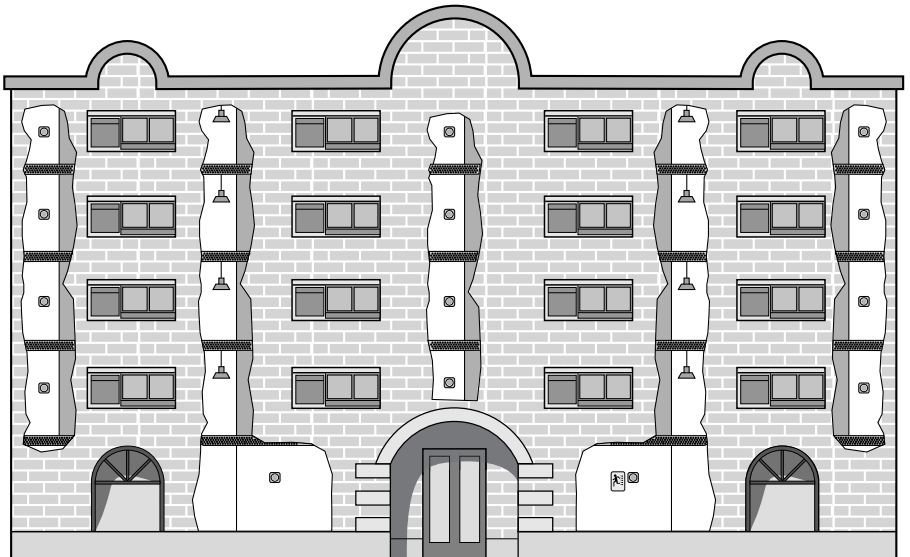
Functional description   On each of the four floors, the corridor lights can be switched on and off (three-wire control) at three flush-mounted switches (S1 to S12).

If necessary, e.g. for cleaning, the corridor lights on every floor can be turned on at switch S13 and turned off at switch S14 in the central porter's lodge or caretaker's room.

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

To save energy, the corridor lights are all switched off at 18.30 on Monday to Friday and at 14.30 on Saturday.

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, "easy" will not detect the switching level and can be damaged by overvoltages.

TB 2528-025 GB

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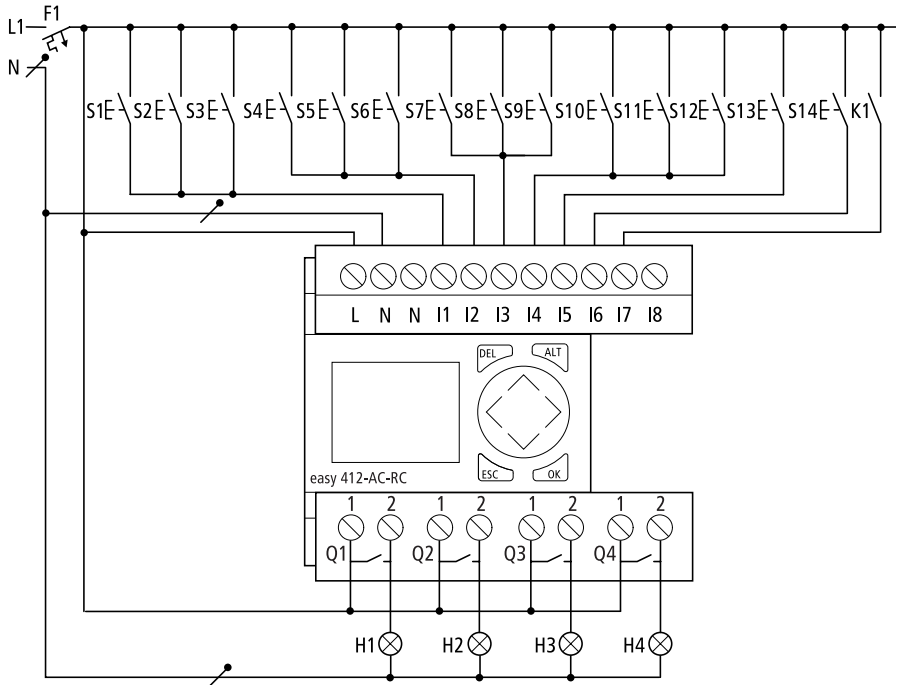
F1	16 A, char. B miniature circuit-breaker
H1 – H4	Lights on 1st – 4th floors
S1 – S3	Light switches, 1st floor
S4 – S6	Light switches, 2nd floor
S7 – S9	Light switches, 3rd floor
S10 – S12	Light switches, 4th floor
S13	Central ON switch
S14	Central OFF switch
K1	Contact, fire alarm system

Parts list

The order numbers and specified pages are taken from the 1999 Moeller Main Catalogue.

Qty.	Device	Article No.	Page of Main Catalogue
1	"easy" control relay	EASY412-AC-RC	05/006
1	16 A miniature circuit-breaker	FAZN B16	12/004
12	1-pole flush-mounted switch		
xx	Contactors	See Appendix	06/002

☞ See the Appendix for determining the maximum lamp load that can be switched via the "easy" output relay. If this is not sufficient, then contactors should be used for switching the lights.

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   Switching contact, Time 1
      Switch-off pulses, Mon-Fri 18:30/Sat 14:30
```

Benefits

Implemented functions
> 1 × single-channel time switch with weekly and daily programs
> List price approx. DM 100
> 4 × impulse changeover relays with central circuit
> List price approx. DM 300

Less wiring required

Takes up less space than conventional systems
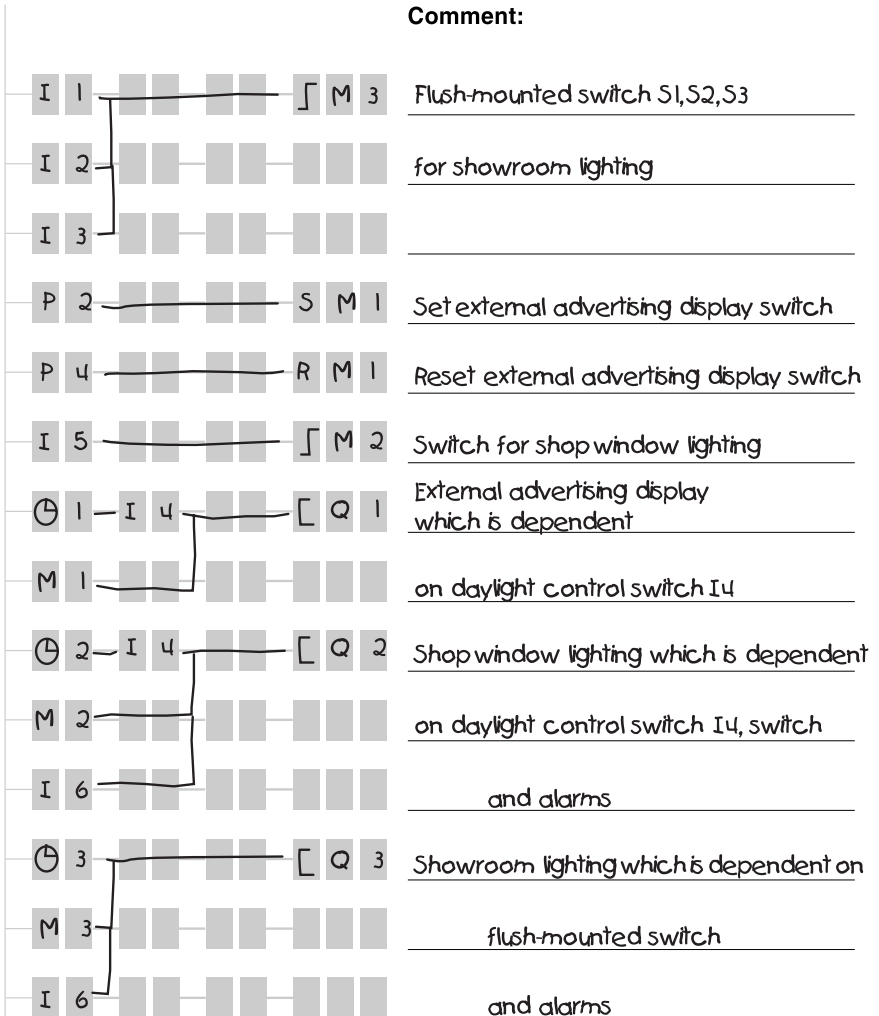
Increased flexibility facilitates modification and extension

Password function protects against unauthorised access

"easy" Control Relay Circuit Diagram FO 98

Customer: Floor lighting

Date: 13.8.98

Program: Example 2

Page: 1

Comment:

I 1	⌐ M 1	Switch on 1st floor pressed (S1–S3)
I 2	⌐ M 2	Switch on 2nd floor pressed (S4–S6)
I 3	⌐ M 3	Switch on 3rd floor pressed (S7–S9)
I 4	⌐ M 4	Switch on 4th floor pressed (S10–S12)
I 5	S M 5	Central corridor lighting ON switch S13
M 5	[M 6	Central lighting ON switch (S13) or
I 7		in the event of a fire (K1)
M 1	[Q 1	Lights on 1st floor ON (H1)
M 6		central switch or in the event of a fire
M 2	[Q 2	Lights on 2nd floor ON (H2)
M 6		central switch or in the event of a fire
M 3	[Q 3	Lights on 3rd floor ON (H3)
M 6		central switch or in the event of a fire

"easy" Control Relay Circuit Diagram   FO 98

Customer: Floor lighting   Program: Example 2

Date: 13.8.98   Page: 2

Comment:

M 4		[Q 4	Lights on 4th floor ON (H4)
M 6			central switch or in the event of a fire
⊕ 1		T T 1	Pulse to switch all lights off together
T 1		R M 1	1st floor lights OFF from central switch
M 5		R M 2	2nd floor lights OFF from central switch
		R M 3	3rd floor lights OFF from central switch
		R M 4	4th floor lights OFF from central switch
T 1		R M 5	Reset from central ON switch
I 6			Central corridor lighting OFF switch S14

"easy" Control Relay Parameters

FO 98

Timing relays

	S :	0 1 : 0 0		:	:		:	:	
TRG			T	TRG		T	TRG		T
RES				RES			RES		

Time switches

M O - F R			
ON	1 8 : 3 0	A
OFF	1 8 : 3 1	+

S A -			
ON	1 4 : 3 0	B
OFF	1 4 : 3 1	+

-			
ON	:	
OFF	:	

3 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 signalled by a flashing light.

Overview drawing

Belt Sequence Control For
Three Conveyor Belts With
Motor Monitoring
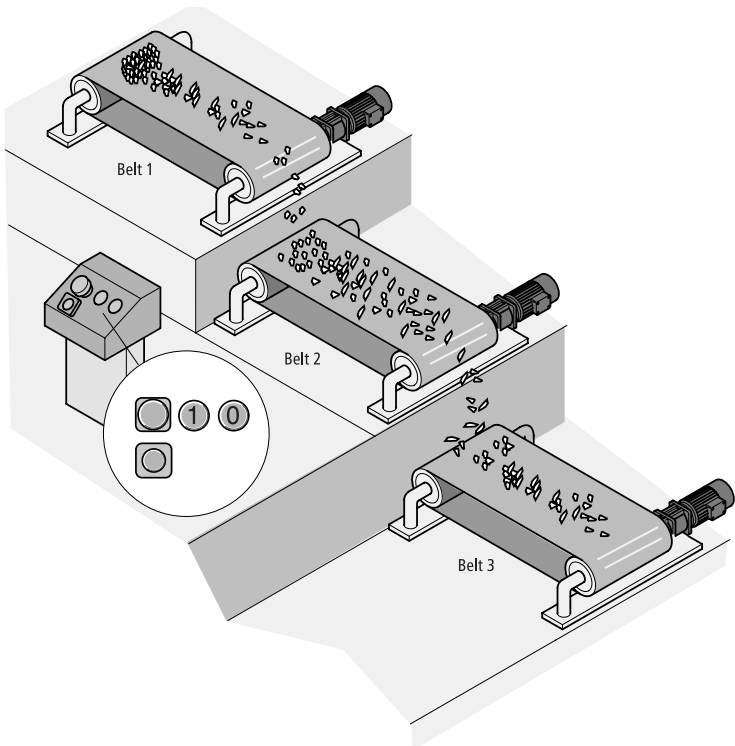
Functional description

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.

Start-up
When the 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.

Shut-down
When the 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 then switch off, again after a 5-second delay.
It must be possible to change the time via the "easy" control relay. To do this, the "+" must be set when the function block is programmed.

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

Failure of a motor
If a drive motor fails, the trip-indicating auxiliary contact (PKZ) opens. The fault is signalled 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 switched off. Any belts upstream of the defective drive are switched off immediately.

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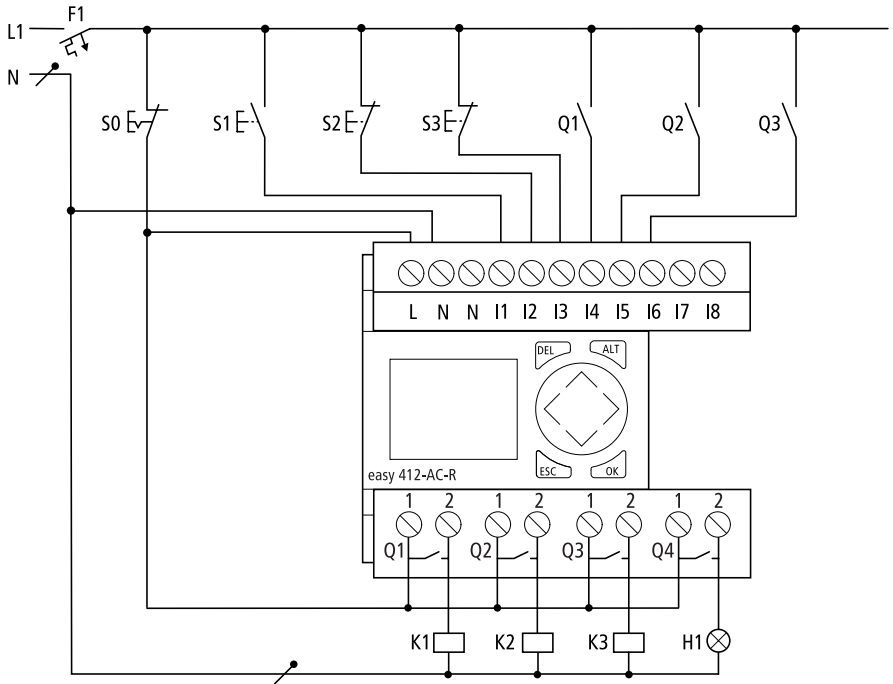
S0	Emergency stop
S1	START button
S2	STOP button
S3	Fast stop button
Q1 – Q3	Trip-indicating auxiliary contact for motor 1 – 3
K1 – K3	Motor, belt 1 – 3
H1	Indicator light
F1	16 A, char B miniature circuit-breaker

⚠ 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, "easy" will not detect the switching level and can be damaged by overvoltages.

Belt Sequence Control For
Three Conveyor Belts With
Motor Monitoring

Load circuit
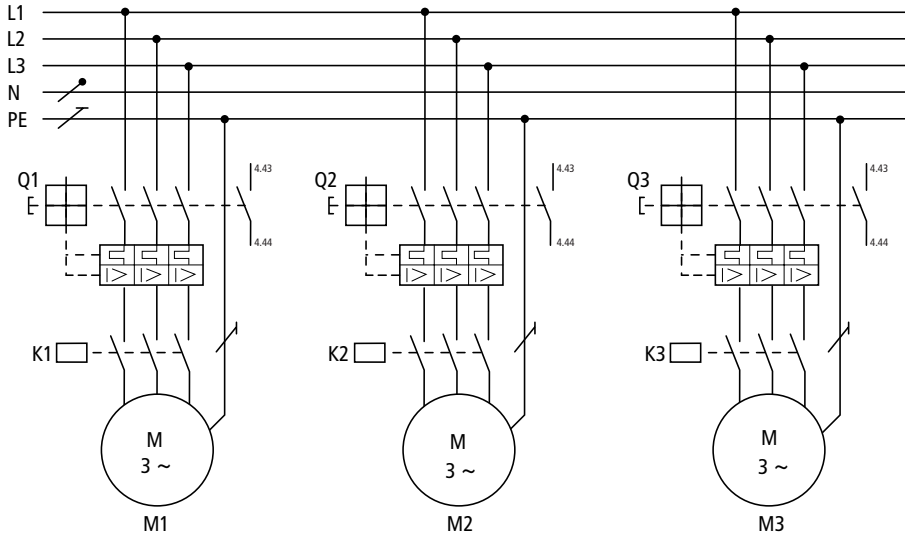
Parts list

The order numbers and specified pages are taken from the 1999 Moeller Main Catalogue.

Qty.	Device	Article No.	Page of Main Catalogue
1	"easy" control relay	EASY412-AC-R	05/006
1	Push-button actuator break contact	RD-11/K10	03/006
1	Push-button actuator make contact	RD-10/K01	03/006
1	Mushroom actuator break contact	RP-RT10/K01	03/006
1	Emergency stop	RPV/K01	03/012
1	Indicator light, red	RL-RT/FR	03/007
3	Circuit-breaker	PKZM0-xx	08/008 (xx = switched current)
3	Trip-indicating auxiliary contact	AGM2-10-PKZ 0	08/017
3	Contactors	See selection guide on page 06/002 of Main Catalogue	
1	16 A miniature circuit-breaker	FAZN B16	12/004

List of operands

I1	Input, START button
I2	Input, STOP button
I3	Input, Fast stop button
I4	Input, trip-indicating aux. contact for motor 1
I5	Input, trip-indicating aux. contact for motor 2
I6	Input, trip-indicating aux. contact for motor 3
M1	Marker relay, buffer memory, trip-indicating aux. 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 sec. ON delay $\Rightarrow$ Start belt 2
T2	Timing relay with 5 sec. ON delay $\Rightarrow$ Start belt 1
T3	Timing relay with 5 sec. OFF delay $\Rightarrow$ Stop belt 1
T4	Timing relay with 5 sec. OFF delay $\Rightarrow$ Stop belt 2
T5	Timing relay with 5 sec. OFF delay $\Rightarrow$ Stop belt 3
T6	Timing relay flashing for 1 second to indicate fault

Benefits

Implemented functions

$2 \times$ ON-delayed timing relays

List price approx. DM 140

$2 \times$ OFF-delayed timing relays

List price approx. DM 240

$1 \times$ flash/blink relay

List price approx. DM 120

$2 \times$ auxiliary contactors

List price approx. DM 80

Less wiring required

Takes up less space than conventional systems

Password function protects against unauthorised access

Belt Sequence Control For
Three Conveyor Belts With
Motor Monitoring

"easy" Control Relay Circuit Diagram   FO 98

Customer: _Belt control_   Program: _Example 3_

Date: _13.8.98_   Page: _1_

Comment:

I 4 – I 5 – I 6 ~ [M 1					Motor-protective circuit-breaker 1, 2, 3 not tripped
I 1 ⌐ M 1 ————— S Q 3					START button -> motor for belt 3 on
└———————— S M 3					START button pressed
Q 3 ———————— T T 1					ON-delay for belt 2
T 1 – M 1 ———— S Q 2					Motor for belt 2 on
Q 2 ———————— T T 2					ON-delay for belt 1
T 2 – M 1 ———— S Q 1					Motor for belt 1 on
$\bar{I}$ 2 ———————— S M 2					STOP button pressed
M 2 ———————— T T 3					OFF-delay for belt 1
T 3 – $\bar{M}$ 3 ———— R Q 1					Motor for belt 1 off
$\bar{M}$ 1 ————					
$\bar{I}$ 3 ————					
$\bar{Q}$ 1 ———————— T T 4					OFF-delay for belt 2

28
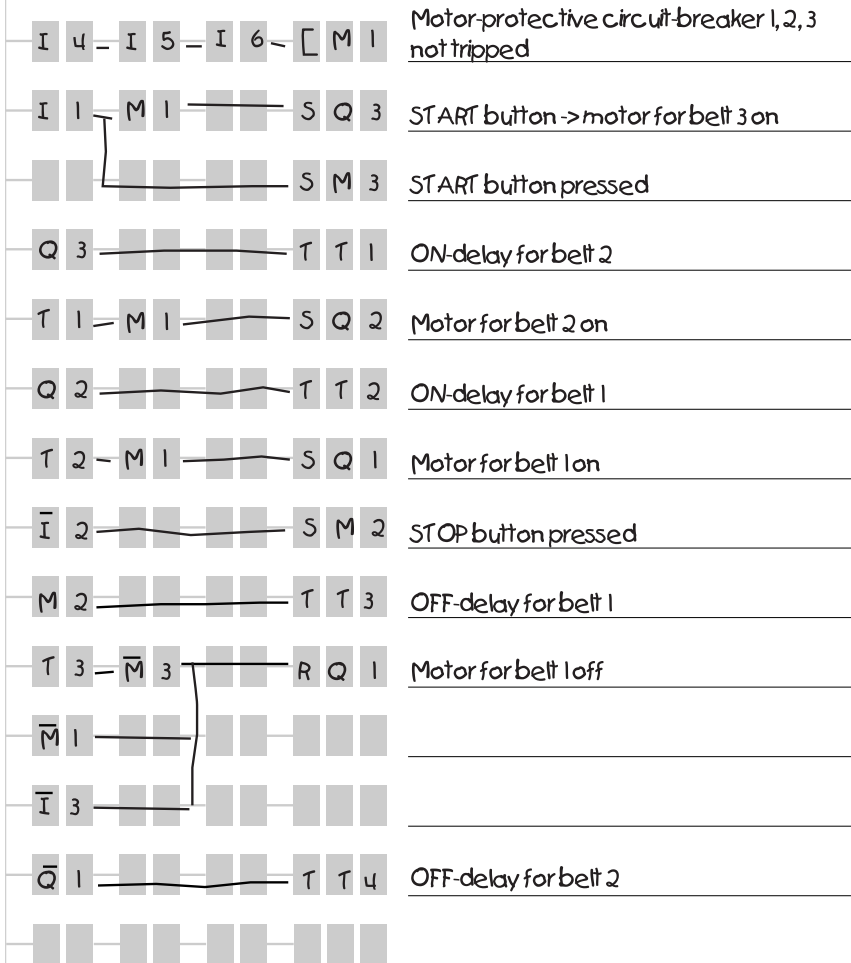
"easy" Control Relay Circuit Diagram

FO 98

Customer: _Belt control_ Program: _Example 3_

Date: _13.8.98_ Page: _2_

Comment:
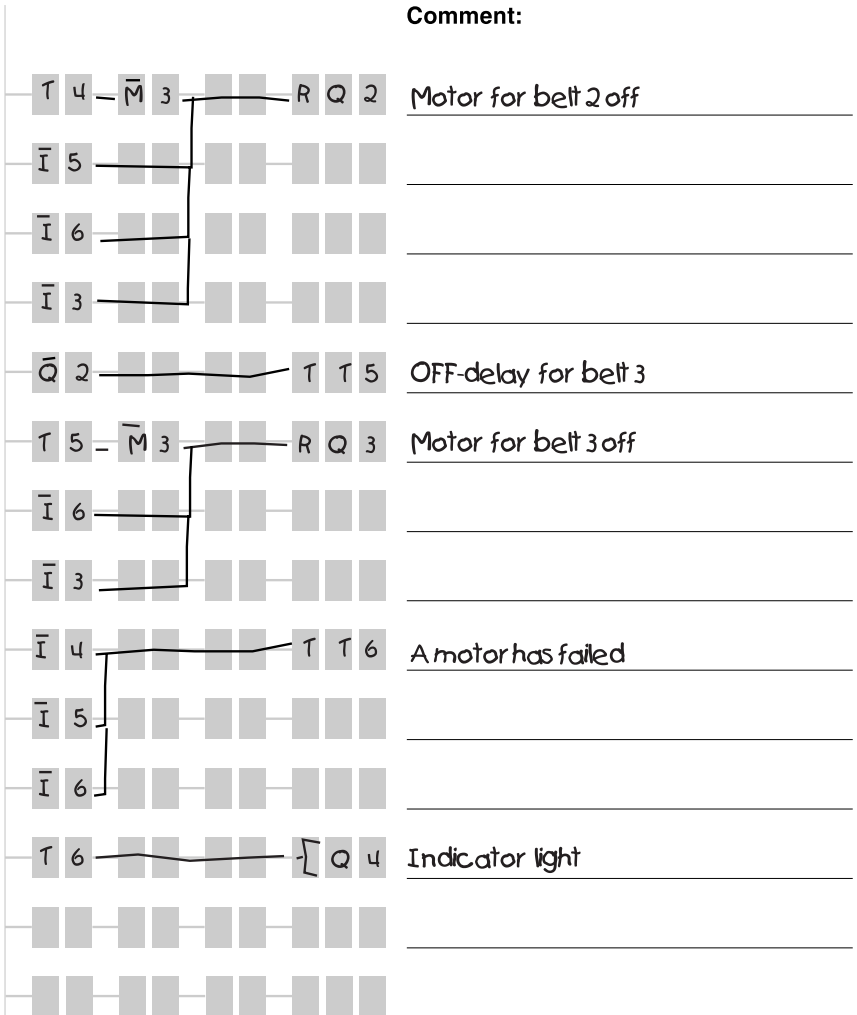
T 4 — M̄ 3	R Q 2	Motor for belt 2 off
I̅ 5		
I̅ 6		
I̅ 3		
Q̄ 2	T T 5	OFF-delay for belt 3
T 5 — M̄ 3	R Q 3	Motor for belt 3 off
I̅ 6		
I̅ 3		
I̅ 4	T T 6	A motor has failed
I̅ 5		
I̅ 6		
T 6	-[Q 4	Indicator light

"easy" Control Relay Circuit Diagram

FO 98

Customer: **Belt control** Program: **Example 3**

Date: **13.8.98** Page: **3**

Comment:
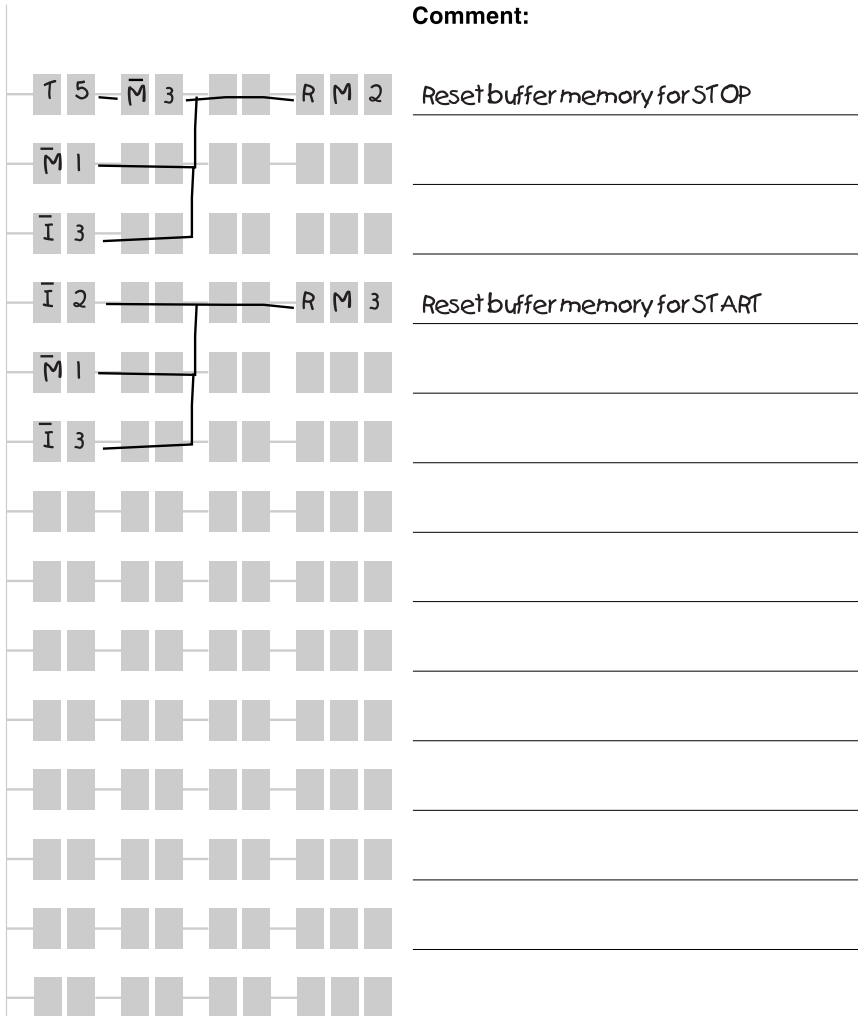
T 5 — M̄ 3 — R M 2   Reset buffer memory for STOP

M̄ 1

Ī 3

Ī 2 — R M 3   Reset buffer memory for START

M̄ 1

Ī 3

30

"easy" Control Relay Parameters

FO 98

Customer: _Belt control_   Program: _Example 3_

Date: _13.8.98_   Page: _4_

Timing relays

X		X		X	
S: 0 5:0 0		S: 0 5:0 0		S: 0 5:0 0	
TRG	T 1	TRG	T 2	TRG	T 3
RES	+	RES	+	RES	+

Timing relays

X		X		工	
S: 0 5:0 0		S: 0 5:0 0		S: 0 1:0 0	
TRG	T 4	TRG	T 5	TRG	T 6
RES	+	RES	+	RES	+

31
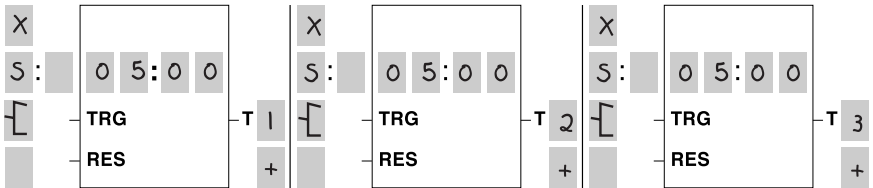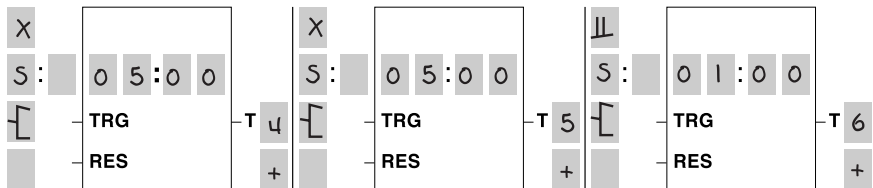
4 Greenhouse Temperature and Ventilation Control

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 roof lights must be monitored for faults, which should also be signalled by a flashing light.

Overview drawing
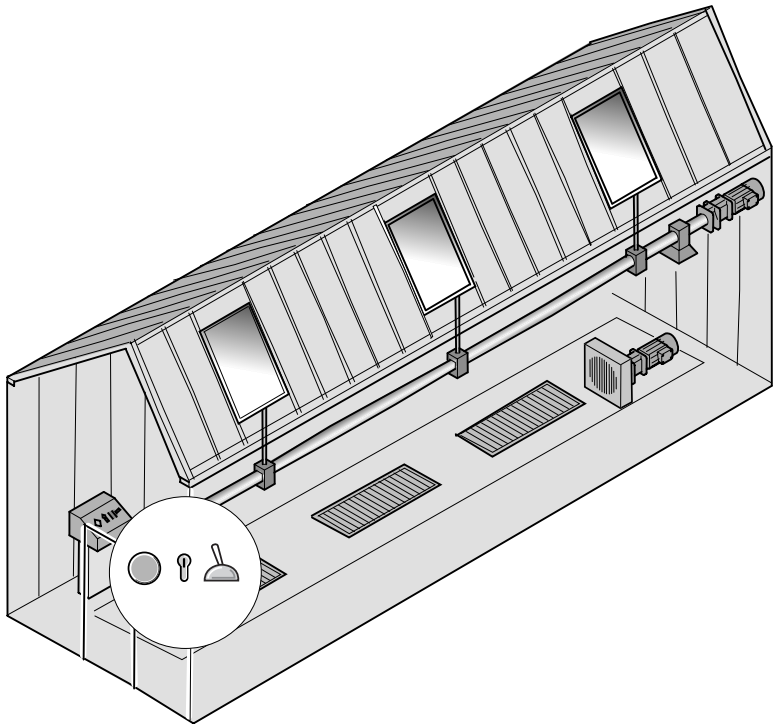
Functional description

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 "easy" control relay. 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 actuated 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.

Failure of a motor

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

Continuous ventilation

Key switch S1 is used switch 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 "easy" control relay.

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 P4 (Down arrow).

☞ The P buttons are activated in the Special menu. Press ALT and DEL simultaneously to switch to the Special menu. See also the User Manual AWB 2528-1304 GB or Training Guide AWB 2528-1316 GB.

Greenhouse Temperature
and Ventilation Control

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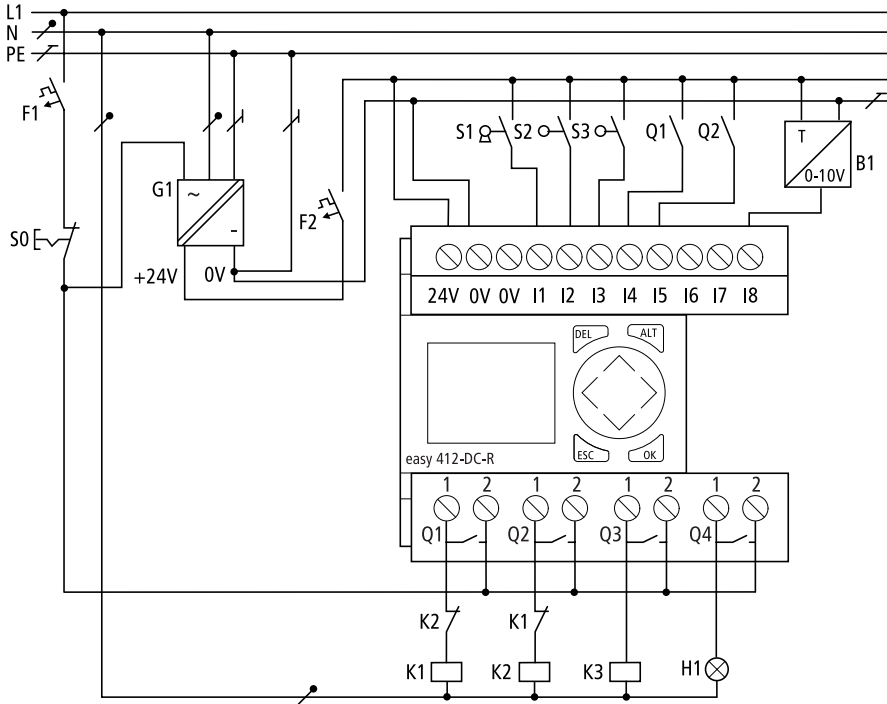
B1	Temperature sensor
F1	16 A char. B miniature circuit-breaker
F2	Miniature circuit-breaker (optional)
G1	Power supply unit 230 V AC/24 V DC
H1	Motor fault indicator light
K1	Contactor for Open window drive motor
K2	Contactor for Close window drive motor
K3	Contactor for fan motor
Q1	Window drive motor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

☞ The electrical interlock may be omitted when using a reversing contactor combination with a mechanical mechanical interlock (see Parts list).

Load circuit

Parts list   The order numbers and specified pages are taken
from the 1999 Moeller Main Catalogue.

Qty.	Device	Article No.	Page of Main Catalogue
1	"easy" control relay	EASY412-DC-R	05/006
1	Temperature sensor		
1	Power supply unit 230 V AC/24 V DC $I_N = 200$ mA	SN4-025-Bl7	01/049
1	Key switch for front panel	RS/K10	03/007
1	Indicator light, red	RL-RT/FR	03/007
2	Motor-protective circuit-breaker	PKZM0-xx (xx = motor current)	08/008
2	Trip-indicating aux. contactor	AGM2-10-PKZ 0	08/017
1	Power contactor up to 4 kW up to 5.5 kW up to 7.5 kW	DIL 00M (230 V 50 Hz) DIL 00AM (230 V 50 Hz) DIL 00BM (230 V 50 Hz)	06/008
1	Reversing contactor up to 4 kW up to 5.5 kW up to 7.5 kW	DIUL EM/21/MV (230 V 50 Hz) DIUL 00AM/11 (230 V 50 Hz) DIUL 0M/11 (230 V 50 Hz)	06/028
2	Limit switch	See page 04/002 of Main Catalogue	
1	Miniature circuit-breaker	FAZN B16	12/004
1	Emergency stop	RPV/K01	03/012

Specimen switching points

Temperature sensor measuring range: –35 to +55 °C

Output signal from
temperature sensor: 0 to 10 V DC

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

Setpoint value for Open comparator

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

Setpoint value for Close comparator

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

Setpoint value for Heat comparator

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

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

This gives the following switching points in the comparator blocks:

Open window	ON = 6.8 V	OFF = 6.6 V
Close window	ON = 6.3 V	OFF = 6.5 V
Heat	ON = 6.0 V	OFF = 6.2 V

Greenhouse Temperature and Ventilation Control

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 aux. contact
	Input, fan motor trip-indicating aux. 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

$1 \times$ ON-delayed timing relay
List price approx. DM 70
$1 \times$ flash/blink relay
List price approx. DM 120

Temperature values can be processed (analog values)

Less wiring required

More flexible if modifications are required

"easy" Control Relay Circuit Diagram

FO 98

Customer: **Greenhouse**

Program: **Example 4**

Date: **13.8.98**

Page: **1**

Comment:

A 1	S M 3	Open window ON
A 2	R M 3	Open window OFF
A 3	S M 4	Close window ON
A 4	R M 4	Close window OFF
A 5	S M 5	Heat ON
A 6	R M 5	Heat OFF
M 3 — $\overline{I}$ 2 — I 4 ─ [M 1		$\geq 25°C$, do not open window, motor 1
M 1 — $\overline{I}$ 1 — $\overline{Q}$ 2 ─ [Q 1		Motor 1 opens
P 2 — $\overline{I}$ 2 ─┘		
T 2 — $\overline{I}$ 2 ─		
M 4 — $\overline{I}$ 3 — I 4 ─ [M 2		$\leq 23°C$, do not close window, motor 1
M 2 — $\overline{I}$ 1 — $\overline{Q}$ 1 ─ [Q 2		Motor 1 closes
P 4 — $\overline{I}$ 3 ─┘		
I 1 — $\overline{I}$ 3 — $\overline{M}$ 6 ─		

"easy" Control Relay Circuit Diagram FO 98

Customer: __Greenhouse__ Program: __Example 4__

Date: __13.8.98__ Page: __2__

Comment:

M 5 — I 5 ————[Q 3   ≤ 20°C, motor 2, -> warm air

I 1 — I 3 ——— T T 2   degree of opening via T2

S M 6   Marker Open via T2

Ī 4 ———— T T 1   Motor 1 or 2 defective

Ī 5

T 1 ————[Q 4   Indicator light H1 flashes

Ī 1 ———— R M 6   Reset Marker Open via T2

TB 2528-025 GB

"easy" Control Relay Parameters

FO 98

Customer: _Greenhouse_   Program: _Example 4_

Date: _13.8.98_   Page: _3_

Timing relays

S :	0 1 : 0 0		S :	0 4 : 0 0		:	:
TRG		T 1	TRG		T 2	TRG	T
RES	+		RES	+		RES	

Analog comparators

ANALOG			ANALOG			ANALOG		
I 8	≥	A 1	I 8	≤	A 2	I 8	≤	A 3
6. 8		+	6. 6		+	6. 3		+

Analog comparators
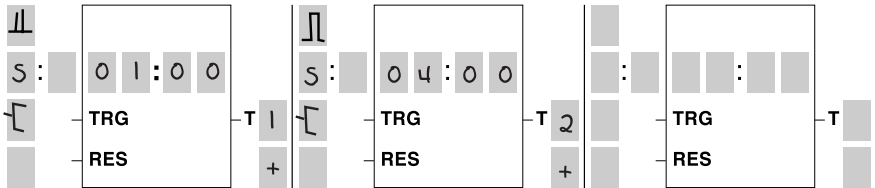
ANALOG			ANALOG			ANALOG		
I 8	≥	A 4	I 8	≤	A 5	I 8	≥	A 6
6. 5		+	6. 0		+	6. 2		+
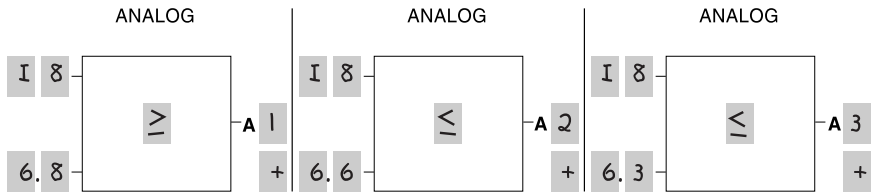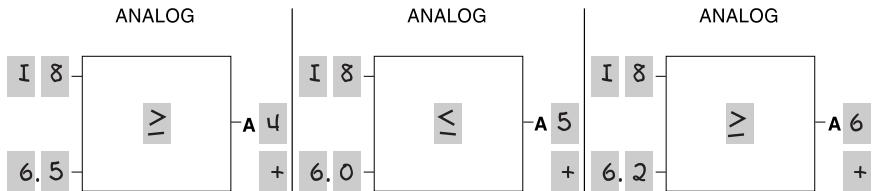
5   Lighting Control In A Production Hall

Task

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

Overview drawing

Functional description

Three lighting strips, each with 12 fluorescent lamps, are suspended from a busbar system.
The lighting is active from 6.00 to 17.30 on Monday to 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 lamp
Activated via contactor K1
Enabled via daylight control switch B1

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

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

Lighting stages

Stage 0:
All the lamps are off.

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

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

Stage 3:
All the lamps 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 to S3.

Use of the manual function is signalled by indicator lights H1 to H3.

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

☞ | 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 one second).
Alternatively, the ON-delayed timers T1 to T6 programmed in the "easy" control relay (default value: 60 seconds) can be changed to obtain the required overall delay.

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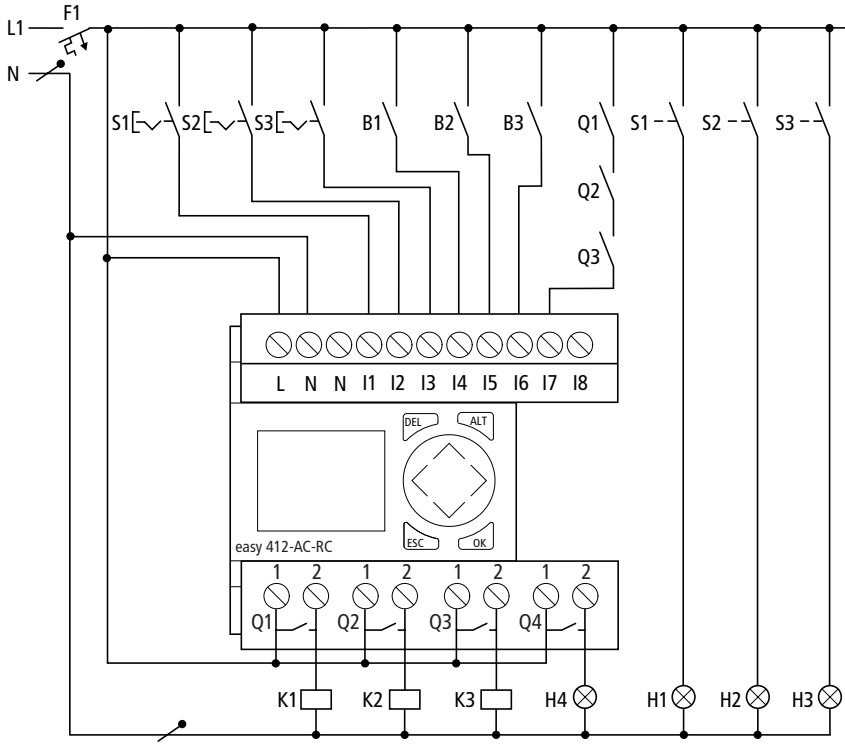
B1 – B3	Contact, daylight control switch 1 – 3
F1	16 A, char B miniature circuit-breaker
H1 – H3	Indicator light, stage 1 – 3
H4	Fault indicator light
K1 – K3	Contactor, lighting stage 1 – 3
Q1 – Q3	Miniature circuit-breaker 1 – 3
S1 – S3	Light switch, stage 1 – 3

Load circuit

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, "easy" will not detect the switching level and can be damaged by overvoltages.

Load circuit

```
L1
L2
L3
N
PE

Q1  E        4.43        Q2  E        4.43        Q3  E        4.43
             4.44                     4.44                     4.44
K1                       K2                       K3

                                                              1L1
                                                              1L2
                                                              1L3
                                                              N
                                                              PE

                                                              2L1
                                                              2L2
                                                              2L3
                                                              N
                                                              PE

                                                              3L1
                                                              3L2
                                                              3L3
                                                              N
                                                              PE
```
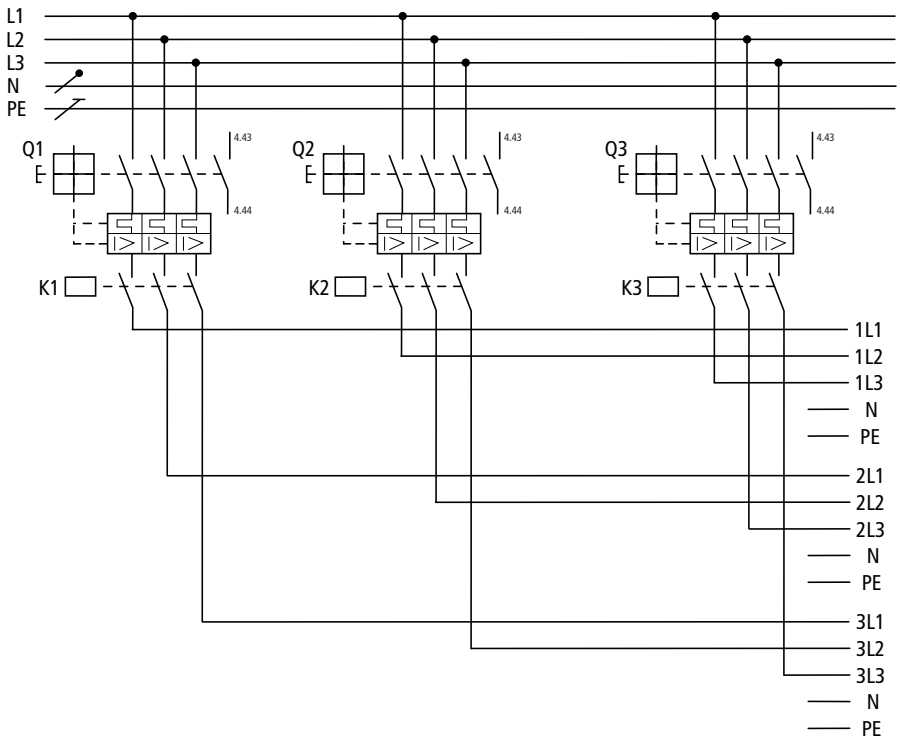
Switching points of the daylight control switch

```
                              On < - B2-> Off
Dark                                                        Light
  <---------|-----------------|-----------------|----------->
       On < - B3-> Off                    On < - B1-> Off
```

Parts list

The order numbers and specified pages are taken from the 1999 Moeller Main Catalogue.

Qty.	Device	Article No.	Page of Main Catalogue
1	"easy" control relay	EASY412-AC-RC	05/006
1	Daylight control switch		
3	Light switch for mounting in front panel and consisting of:		
	Illuminated push-button actuator, latching, green	RLTR-GN	03/028
	Fixing adapter	BE3	03/036
	Make contact element	EK10	03/036
	Lamp socket element	EF	03/038
	Neon bulb 230 V AC	GIL 220K	03/059
1	Indicator light, red	RL-RT/FR	03/007
3	Circuit-breaker	PKZM0-xx	08/008 (xx = switching current)
1	Tripping indicator	AGM2-10-PKZ0	08/017
3	Power contactors	see Appendix A	06/002
1	16 A miniature circuit-breaker	FAZN B16	12/004

Notes on the busbar system:

	CD busbar trunking system	CD-xxxx	16/006

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 sec. ON delay. ⇒ Stage 1 ON
T2   Timing relay with 60 sec. ON delay. ⇒ Stage 1 OFF
T3   Timing relay with 60 sec. ON delay. ⇒ Stage 2 ON
T4   Timing relay with 60 sec. ON delay. ⇒ Stage 2 OFF
T5   Timing relay with 60 sec. ON delay. ⇒ Stage 3 ON
T6   Timing relay with 60 sec. ON delay. ⇒ Stage 3 OFF
T7   Timing relay, flashing for 1 second to indicate fault
```

Benefits

Implemented functions
  $1 \times$ flash/blink relay
  List price approx. DM 120
  $1 \times$ single-channel time switch with weekly
  and daily programs
  List price approx. DM 100

Functional overall solution

Less wiring required

Takes up less space than conventional systems

"easy" Control Relay Circuit Diagram FO 98

Customer: _Lighting strips_ Program: _Example 5_

Date: _13.8.98_ Page: _1_

Comment:

Contact	Coil	Comment
I 4	T T 1	Daylight control switch 1 ON, B1
T 1	S M 1	Stage 1 ON
Ī 4	T T 2	Daylight control switch 1 OFF, B1
T 2	R M 1	Stage 1 OFF
I 5	T T 3	Daylight control switch 2 ON, B2
T 3	S M 2	Stage 2 ON
Ī 5	T T 4	Daylight control switch 2 OFF, B2
T 4	R M 2	Stage 2 OFF
I 6	T T 5	Daylight control switch 3 ON, B3
T 5	S M 3	Stage 3 ON
Ī 6	T T 6	Daylight control switch 3 OFF, B3
T 6	R M 3	Stage 3 OFF
Ī 7	T T 7	Fault in busbar 1, 2 or 3
T 7	[Q 4	Fault indicator light, b, ⊥

"easy" Control Relay Circuit Diagram

Customer: _Lighting strips_   Program: _Example 5_

Date: _13.8.98_   Page: _2_

Comment:

I 1 ─┐─── Q 1   _Stage 1 ON (B1)_

M 1 ─┘

I 2 ─┐─── Q 2   _Stage 2 ON (B1 + B2)_

M 2 ─┘

I 3 ─┐─── Q 3   _Stage 3 ON (B1 + B2 + B3)_

M 3 ─┘

"easy" Control Relay Parameters

| Customer: | Lighting strips | Program: | Example 5 |
| Date: | 13.8.98 | Page: | 3 |

Timing relays

X
S :   6 0 : 0 0
⌐   TRG   T 1
     RES   +

X
S :   6 0 : 0 0
⌐   TRG   T 2
     RES   +

X
S :   6 0 : 0 0
⌐   TRG   T 3
     RES   +

Timing relays

X
S :   6 0 : 0 0
⌐   TRG   T 4
     RES   +

X
S :   6 0 : 0 0
⌐   TRG   T 5
     RES   +

X
S :   6 0 : 0 0
⌐   TRG   T 6
     RES   +

Timing relays

JL
S :   0 1 : 0 0
⌐   TRG   T 7
     RES   +

 :   :
     TRG   T
     RES
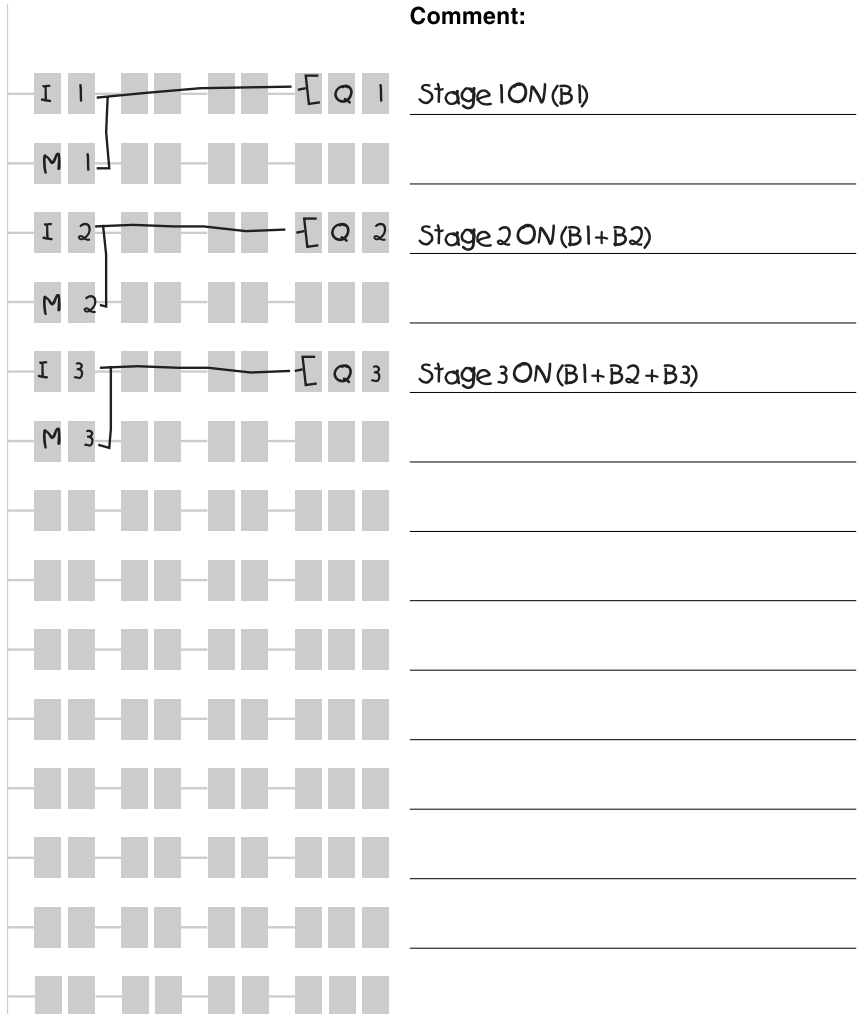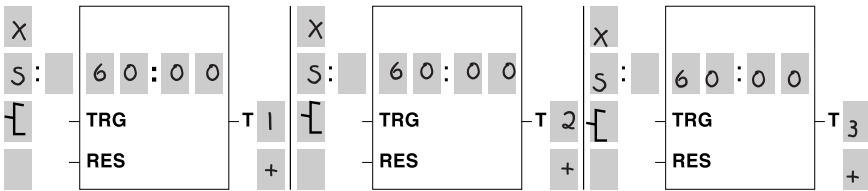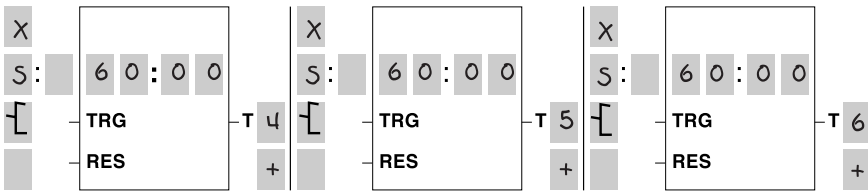
 :   :
     TRG   T
     RES
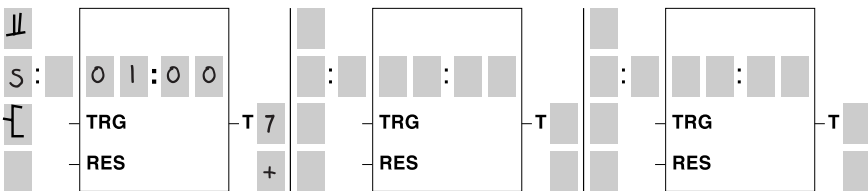
6 Booster Pumps

Task

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

Overview drawing

Functional 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 the pressure sensor B1.

To ensure that the two pumps are subject to equal use and wear, they are run alternately for 48-hour periods. The two indicator lights H1 and H2 signal which of the two pumps is in use.

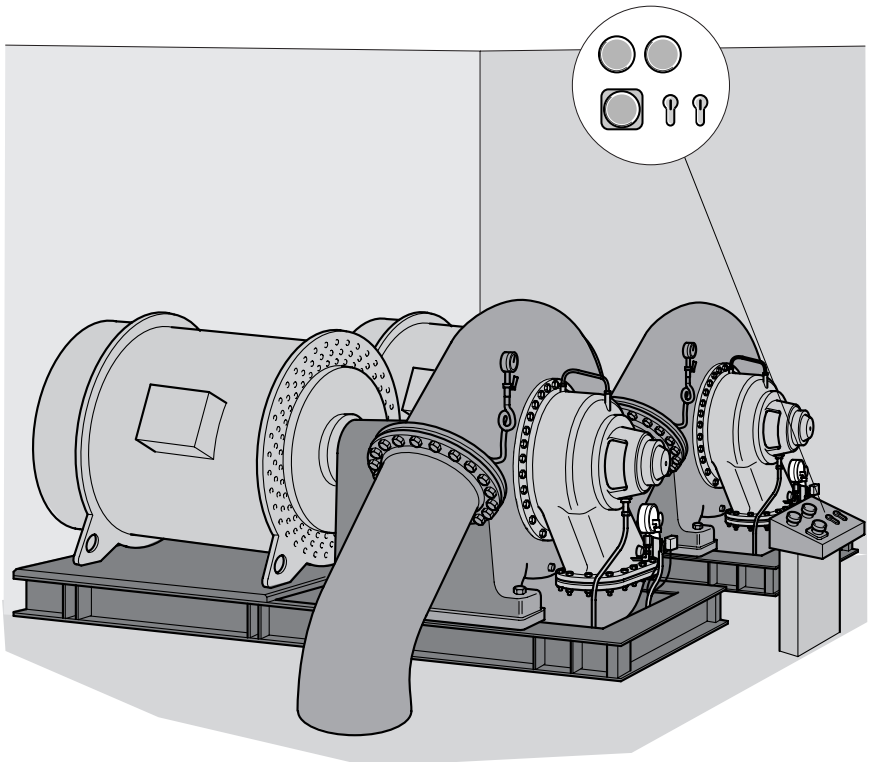If "easy" is disconnected from the power supply, counting of the operating hours will start again and pump 1 will be activated first.

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

Desired
changeover time in hours $\times$ 60 = comparison value

Default:
48 hours $\times$ 60 = 2880

Faults

Electrical failure of a pump motor is detected by the trip indicating auxiliary-contacts for 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 types of fault are signalled by the flashing indicator light H1 or H2.

When both pumps are electrically defective, the indicator lights H1 and H2 will flash simultaneously.

TB 2528-025 GB

Low pressure

The system is monitored for low pressure, which is signalled by indicator lights H1 and H2 which flash alternately after time T5 has elapsed.

It must be possible to set the low pressure limit on the "easy" control relay.

Acknowledgement

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

Maintenance

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

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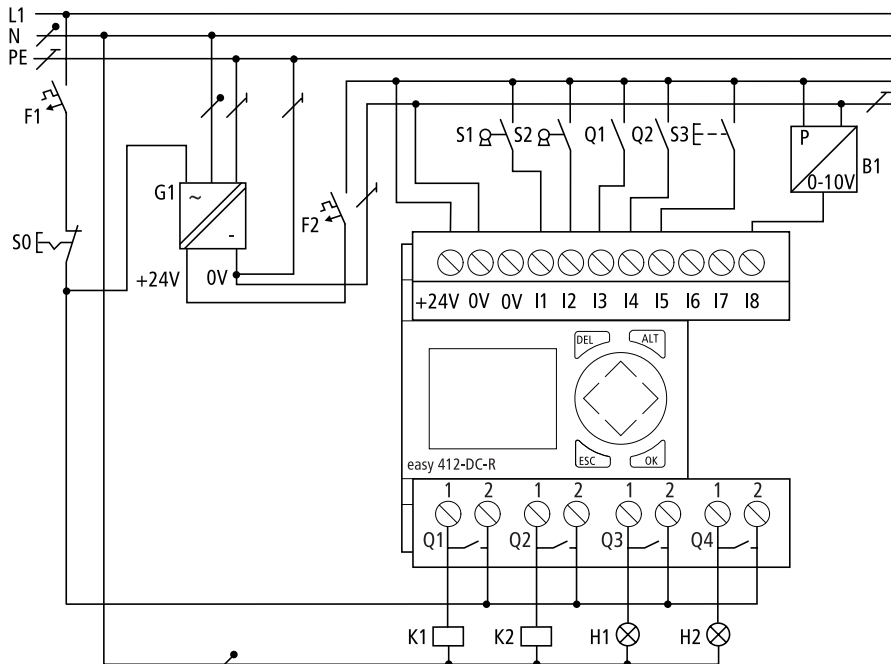
B1	Pressure sensor
F1	16 A char. B miniature circuit-breaker
F2	Miniature circuit-breaker (optional)
G1	Power supply unit 230 V AC/24 V DC
H1	Indicator light for pump 1
H2	Indicator light for pump 2
K1	Contactor for pump P1
K2	Contactor for pump P2
Q1	Tripping indicating auxiliary-contact for pump 1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

Load circuit
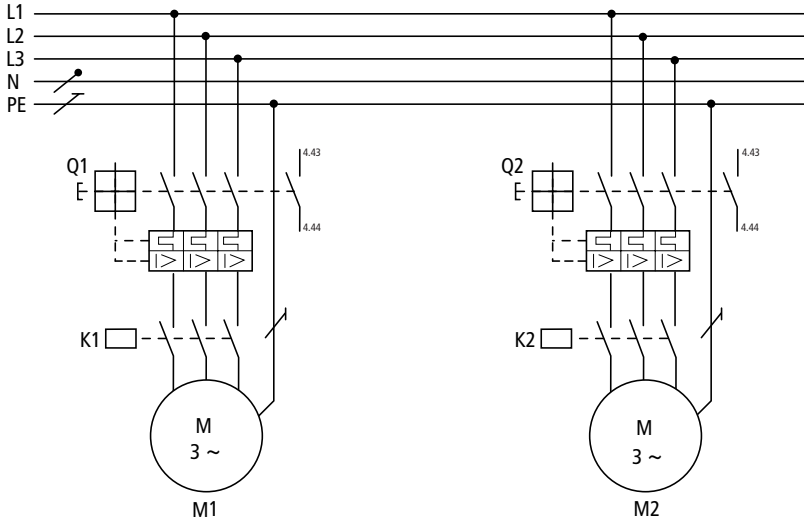
L1
L2
L3
N
PE

Q1
4.43
4.44
K1
M
3 ~
M1

Q2
4.43
4.44
K2
M
3 ~
M2

Parts list   The order numbers and specified pages are taken from the 1999 Moeller Main Catalogue.

Qty.	Device	Article No.	Page of Main Catalogue
1	"easy" control relay	EASY412-DC-R	05/006
1	Pressure sensor		
1	Power supply unit 230 V AC/24 V DC $I_N = 200$ mA	SN4-025-BI7	01/049
2	Key switch for mounting in front panel	RS/K10	03/007
1	Push-button actuator	RD20/K10	03/006
1	Reset button plate	286T	03/045
2	Indicator light, yellow	RL-GE/FR	03/007

Booster Pumps

Qty.	Device	Article No.	Page of Main Catalogue
2	Motor-protective circuit-breaker	PKZM0-xx	08/008 (xx = motor current)
2	Tripping indicating auxiliary-contact	AGM2-10-PKZ0	08/015
2	Power contactor	DIL-EM01 DIL-00BM-01	Motor output up to 4 kW Motor output up to 7.5 kW
1	16 A miniature circuit-breaker	FAZN B16	12/004

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 sec. pulse for operating hours of pump 1
C2    Counter with 30 sec. 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 sec. cycle for recording operating time, pump 1
T2    30 sec. cycle for recording operating time, pump 2
T3    1 sec. 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
```

Pressure diagram

| 0 bar | A2 | A1 | A3 | Pressure |
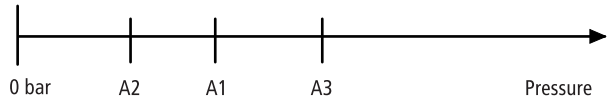
Switching points

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 signalled 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.

Benefits

Implemented functions
    1 × flash/blink relay
    List price approx. DM 120
    2 × ON-delayed timing relays
    List price approx. DM 140
    1 × 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

"easy" Control Relay Parameters   FO 98

Customer: Pumping station   Program: Example 6

Date: 13.8.98   Page: 1

Kommentar:

A 1		S	M 7	Lower threshold for minimum pressure
A 3		R	M 7	Upper threshold for minimum pressure
I 1		[	M 8	Pump 1 ON indicator light
M 7 — M̄ 1 — I 3		[	Q 1	Pump 1 active
M 1 — I 4		[	Q 2	Pump 2 active
I 2		[	M 9	Pump 2 ON indicator light
Q 1		T	T 1	Pump 1 run time clock
		R	C 2	Reset counter 2
T 1		C	C 1	Pulse counter 1 – 48 hours
C 1		S	M 1	Change over to pump 2
Q 2		T	T 2	Pump 2 run time clock
		R	C 1	Reset counter 1
T 2		C	C 2	Pulse counter 2 – 48 hours
C 2		R	M 1	Change over to pump 1

"easy" Control Relay Circuit Diagram

FO 98

Customer: __Pumping station__   Program: __Example 6__

Date: __13.8.98__   Page: __2__

Comment:

					T T 3	Clock for flashing signal from indicator light
$\overline{I}$ 3					S M 1	Electrical fault in pump 1
					S M 4	Activate pump 2
$\overline{I}$ 4					R M 1	Electrical fault in pump 2
					S M 5	Activate pump 1
A 2	$\overline{I}$ 5				T T 4	Low pressure monitoring
					T T 5	
T 5					S M 6	Low pressure signal, total failure
T 4	Q 1	$\overline{M}$ 3	S M 2			Mechanical fault in pump 1
M 2	I 4				S M 1	Activate pump 2
M 2	T 3	$\overline{M}$ 6	[Q 3			Fault in pump 1 -> Indicator light
M 4						H1 flashes
M 8						Pump 1 in use
M 6	T 3					Total failure -> Lights flash alternately

63

"easy" Control Relay Circuit Diagram   FO 98

Customer: _Pumping station_   Program: _Example 6_

Date: _13.8.98_   Page: _3_

Comment:

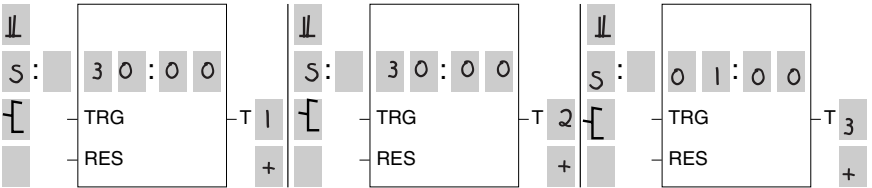| Circuit	Comment
T 4 – Q 2 – M̄ 2 – S M 3	Mechanical fault in pump 2
M 3 – I 3 ——— R M 1	Activate pump 1
M 3 – T 3 – M̄ 6 – [Q 4	Fault in pump 2 -> Indicator light
M 5	H2 flashes
M 9	Pump 2 in use
M 6 – T̄ 3	Total failure -> Lights flash alternately
I 5 ——— R M 2	Acknowledge fault messages
R M 3	
R M 4	
R M 5	
R M 6	

TB 2528-025 GB

"easy" Control Relay Parameters

FO 98

Customer: Pumping station   Program: Example 6

Date: 13.8.98   Page: 4

Timing relays

⫫			
S:	3 0 : 0 0		
⊣[— TRG		—T 1	
— RES		+	

⫫			
S:	3 0 : 0 0		
⊣[— TRG		—T 2	
— RES		+	

⫫			
S:	0 1 : 0 0		
⊣[— TRG		—T 3	
— RES		+	

Timing relays

X			
S:	1 0 : 0 0		
⊣[— TRG		—T 4	
— RES		+	

X			
S:	2 5 : 0 0		
⊣[— TRG		—T 5	
— RES		+	

:	:		
— TRG		—T	
— RES			

Analog comparators

ANALOG		ANALOG		ANALOG	
I 8 —		I 8 —		I 8 —	
$\leq$	—A 1	$\leq$	—A 2	$\geq$	—A 3
2.9 —	+	2.0 —	+	3.1 —	+

Up and down counters

2 8 8 0			
— DIR			
⊣[— CNT		—C 1	
⊣[— RES		+	

2 8 8 0			
— DIR			
⊣[— CNT		—C 2	
⊣[— RES		+	

— DIR			
— CNT		—C	
— RES			

7 Level Indication In A Tank Installation

Task

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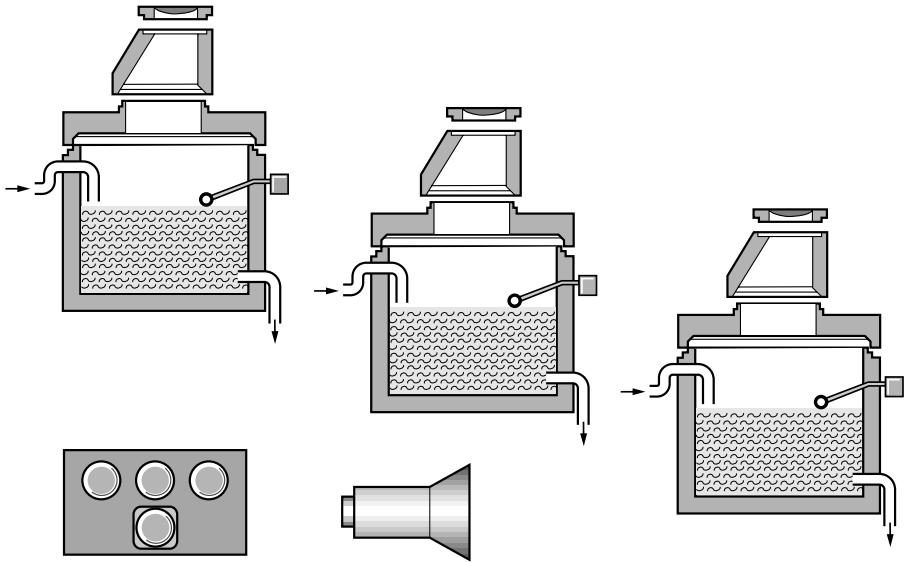
Overview drawing

Functional 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) a hooter starts as well.
The acknowledgement button S4 can be used for all
three tanks; this acknowledges the audible signal
from the hooter and changes the flashing light to a
continuous light.

Control circuit

TB 2528-025 GB
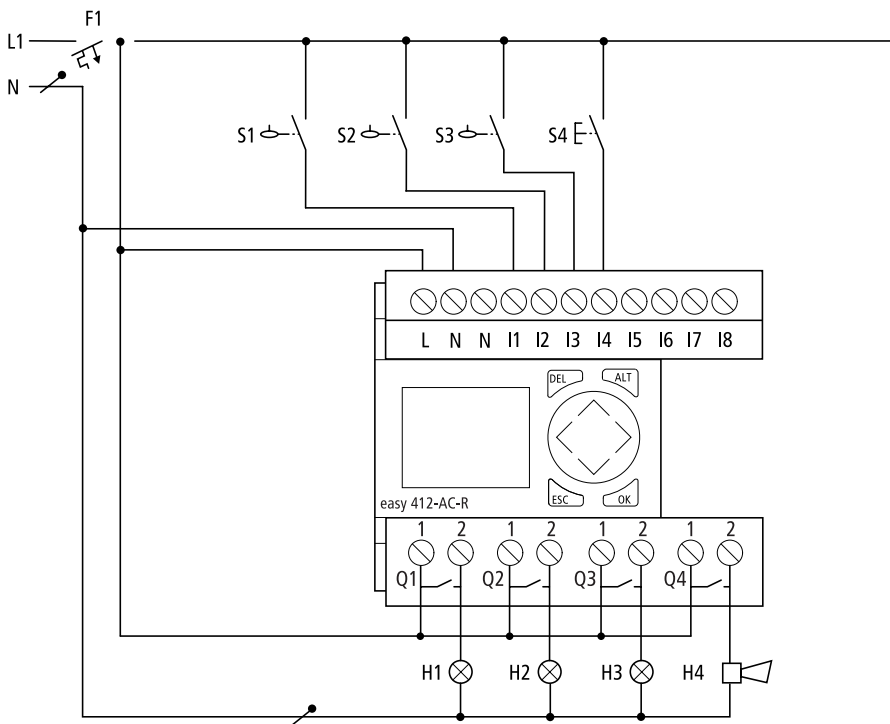
F1	16 A, char. B miniature circuit-breaker
H1	Indicator light for tank 1
H2	Indicator light for tank 2
H3	Indicator light for tank 3
H4	Hooter
S1	Level indicator for tank 1
S2	Level indicator for tank 2
S3	Level indicator for tank 3
S4	Acknowledgement button

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, "easy" will not detect the switching level and can be damaged by overvoltages.

Parts list

The order numbers and specified pages are taken from the 1999 Moeller Main Catalogue.

Qty.	Device	Article No.	Page of Main Catalogue
1	"easy" control relay	EASY412-AC-R	05/006
3	Float switch	SW	04/038
1	Push-button actuator for mounting in front panel	RD-11/K10	03/006
1	Reset button plate	286T	03/045
3	Indicator light, yellow	RL-GE/FR	03/007
1	16 A miniature circuit-breaker	FAZN B16	12/004
1	Hooter		

Level Indication In A Tank
Installation

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, Hooter
T1	Timing relay with 3 sec. ON delay → delay after tank 1 full message
T2	Timing relay with 3 sec. ON delay → delay after tank 2 full message
T3	Timing relay with 3 sec. ON delay → delay after tank 3 full message
T4	Single-pulse timing relay → Hooter ON set pulse
T5	Single-pulse timing relay → Hooter ON set pulse
T6	Single-pulse timing relay → Hooter ON set pulse
T7	Timing relay flashing for 0.5 sec. → New value signal

Benefits

Implemented functions

$3 \times$ ON-delayed timing relays

List price approx. DM 210

$1 \times$ flash/blink relay

List price approx. DM 120

$3 \times$ auxiliary contactors

List price approx. DM 120

Less wiring required

Takes up less space than conventional systems

"easy" Control Relay Circuit Diagram

FO 98

Customer: Tank installation

Program: Example 7

Date: 13.8.98

Page: 1

Comment:

I 1 — M̄ 1 — T 7 — [Q 1	Tank 1 full (S1), H1 flashes
M 1	
M 1 — [M 1	H1 maintained light
I 4	by acknowledgement button
T T 1	Timing relay for hooter
I 2 — M̄ 2 — T 7 — [Q 2	Tank 2 full (S2), H2 flashes
M 2	
M 2 — [M 2	H2 maintained light
I 4	by acknowledgement button
T T 2	Timing relay for hooter

"easy" Control Relay Circuit Diagram

FO 98

Customer: _Tank installation_   Program: _Example 7_

Date: _13.8.98_   Page: _2_

Comment:
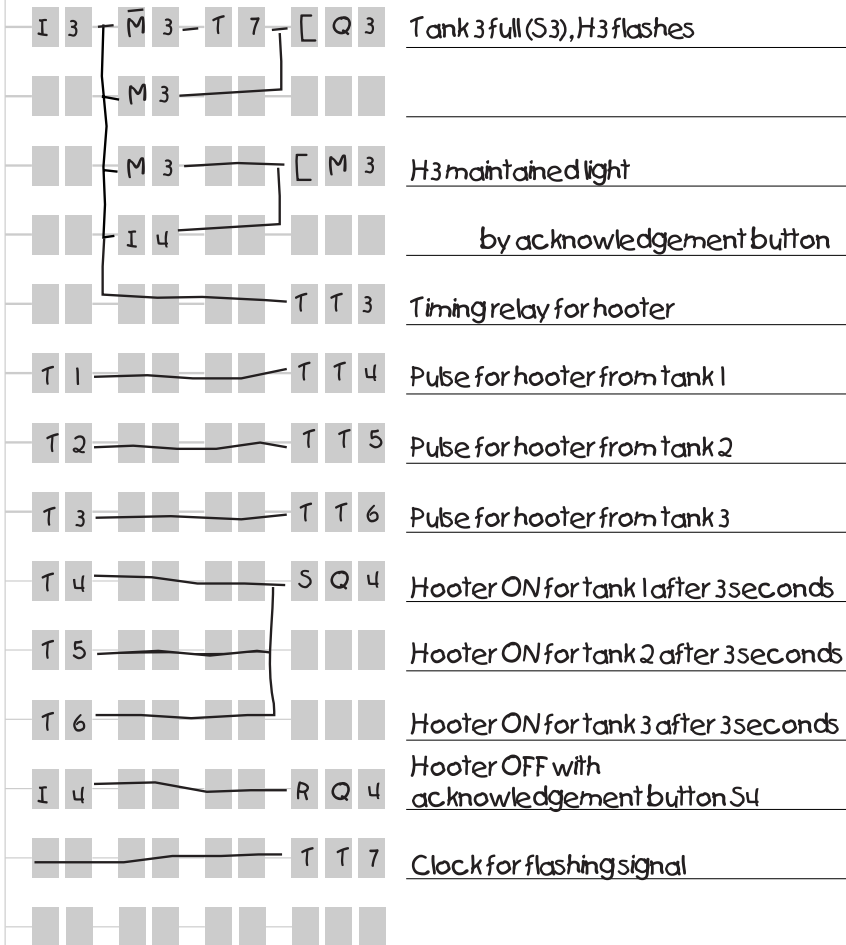
I 3	M̄ 3 — T 7 — [Q 3			_Tank 3 full (S3), H3 flashes_
	M 3			
	M 3 — [M 3			_H3 maintained light_
	I 4			_by acknowledgement button_
	T T 3			_Timing relay for hooter_
T 1 — T T 4				_Pulse for hooter from tank 1_
T 2 — T T 5				_Pulse for hooter from tank 2_
T 3 — T T 6				_Pulse for hooter from tank 3_
T 4 — S Q 4				_Hooter ON for tank 1 after 3 seconds_
T 5				_Hooter ON for tank 2 after 3 seconds_
T 6				_Hooter ON for tank 3 after 3 seconds_
I 4 — R Q 4				_Hooter OFF with acknowledgement button S4_
T T 7				_Clock for flashing signal_

TB 2528-025 GB
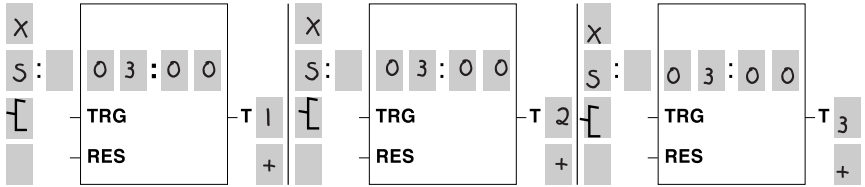
"easy" Control Relay Parameters

FO 98

Customer: _Tank installation_   Program: _Example 7_

Date: _13.8.98_   Page: _3_

Timing relays

X	S :	0 3 : 0 0	TRG	RES	T	1 +
X	S :	0 3 : 0 0	TRG	RES	T	2 +
X	S :	0 3 : 0 0	TRG	RES	T	3 +

Timing relays

S :	0 0 : 0 0	TRG	RES	T	4 +
S :	0 0 : 0 0	TRG	RES	T	5 +
S :	0 0 : 0 0	TRG	RES	T	6 +

Timing relays
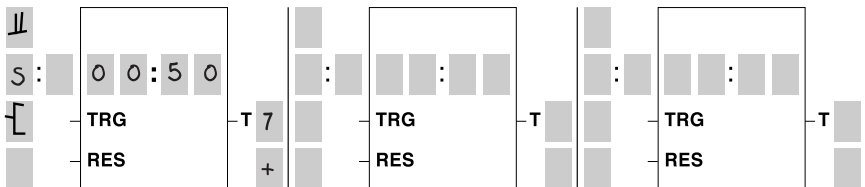
| S : | 0 0 : 5 0 | TRG | RES | T | 7 + |
| : | : | TRG | RES | T |
| : | : | TRG | RES | T |

☞ The specified time of 0 seconds in the timing relay produces a pulse of the same length as one "easy" cycle time.

74

8   Access Monitoring For A Car Park

Task

To monitor the occupancy of a company car park. Cars can enter the car park provided that there are still some spaces free. Access is controlled by a barrier system. The occupancy of the car park is signalled by a "Full/Empty" display.

Overview drawing
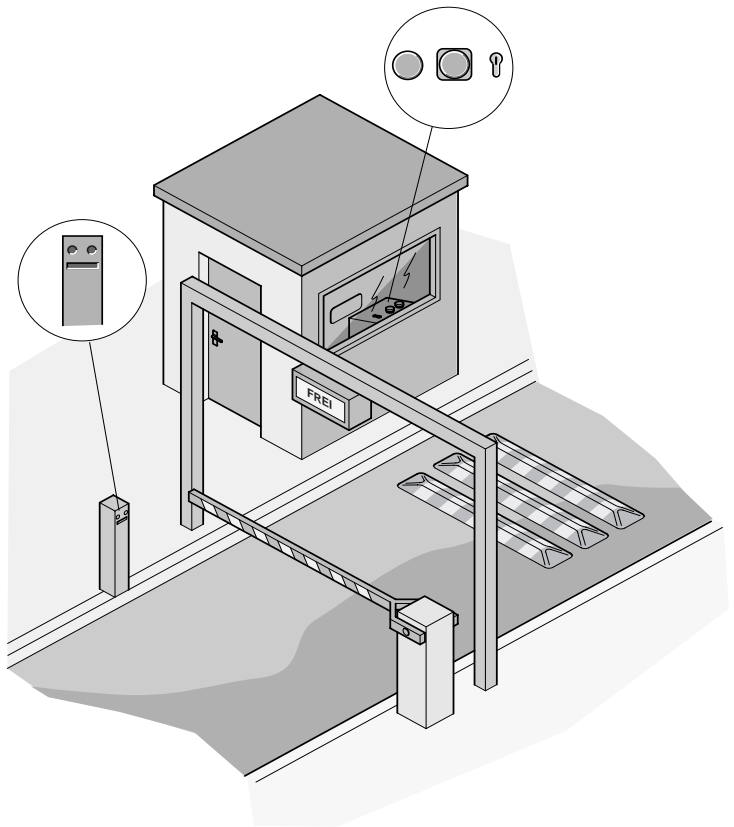
Functional description   **Entry and exit**

Access to the car park is monitored by a swipe card reader. If the card is valid, contact S3 is closed briefly. When a vehicle leaves the car park, 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 "easy" control relay. The maximum number of vehicles that can be parked can be set on the "easy". 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 an initial status.

Manual operation

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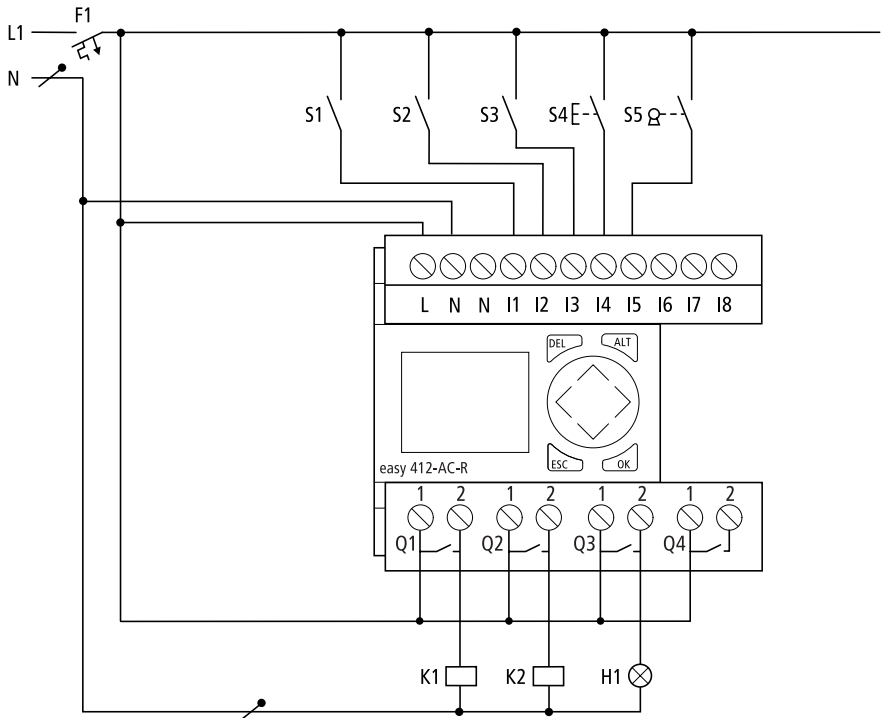
Faults

A fault in the barrier system, which is signalled via make contact S1, is displayed by flashing indicator light H1 in the car park attendant's cabin.

Maintenance

The barrier can be opened by pressing function button P2 (Up arrow) on the "easy" control relay.

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

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, "easy" will not detect the switching level and can be damaged by overvoltages.

Parts list

The order numbers and specified pages are taken
from the 1999 Moeller Main Catalogue.)

Qty.	Device	Article No.	Page of Main Catalogue
1	"easy" control relay	EASY412-AC-R	05/006
2	Key switch for mounting in front panel	RS/K10	03/007
1	Push-button actuator for mounting in front panel	RD-20/K10	032/006
2	Indicator light, red	RL-RT/FR	03/007
1	16 A miniature circuit-breaker	FAZN B16	12/004
Optional:			
1	Anodised aluminium flush mounting plate or	E3M	03/055
1	Plastic surface mounting enclosure	IM3	03/056

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
  $1 \times$ flash/blink relay
  List price approx. DM 120
  $1 \times$ up/down counter with reset function
  $1 \times$ ON-delayed timing relay
  List price approx. DM 70
Compact system
Easy program duplication with program transfer

TB 2528-025 GB

"easy" Control Relay Circuit Diagram

FO 98

Customer: _Car park_   Program: _Example 8_

Date: _13.8.98_   Page: _1_

Comment:
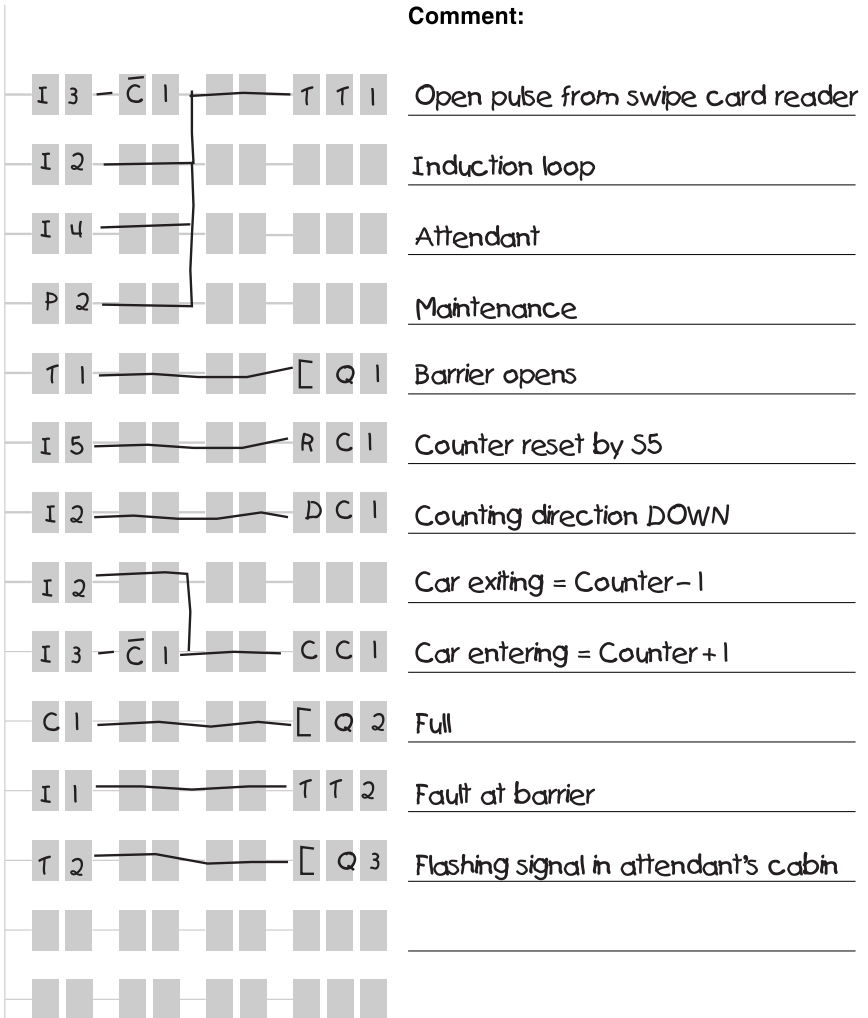
I 3 — C̄ 1	T T 1	Open pulse from swipe card reader
I 2		Induction loop
I 4		Attendant
P 2		Maintenance
T 1	[Q 1	Barrier opens
I 5	R C 1	Counter reset by S5
I 2	D C 1	Counting direction DOWN
I 2		Car exiting = Counter – 1
I 3 — C̄ 1	C C 1	Car entering = Counter + 1
C 1	[Q 2	Full
I 1	T T 2	Fault at barrier
T 2	[Q 3	Flashing signal in attendant's cabin

"easy" Control Relay Parameters

FO 98

Customer: _Car park_   Program: _Example 8_

Date: _13.8.98_   Page: _2_

Timing relays

S :	0 2 : 0 0	T 1	S :	0 1 : 0 0	T 2	:	:	T
TRG		+	TRG		+	TRG		
RES			RES			RES		

Up and down counters

0 0 3 0				
DIR		DIR		DIR	
CNT	C 1	CNT	C	CNT	C
RES	+	RES		RES	

TB 2528-025 GB

80
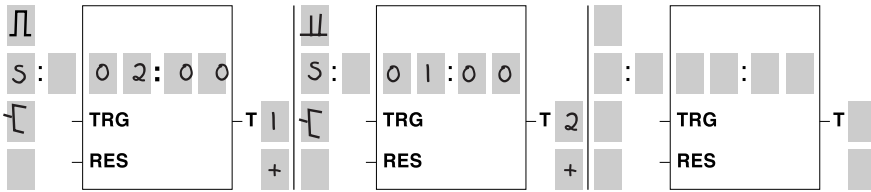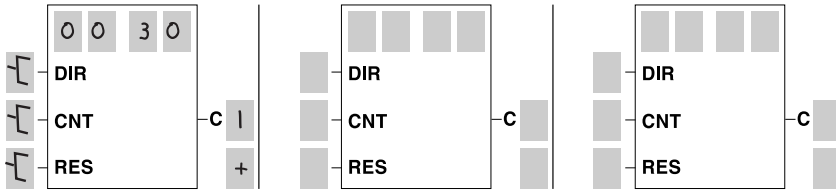
9 Time-controlled Lighting System

Task

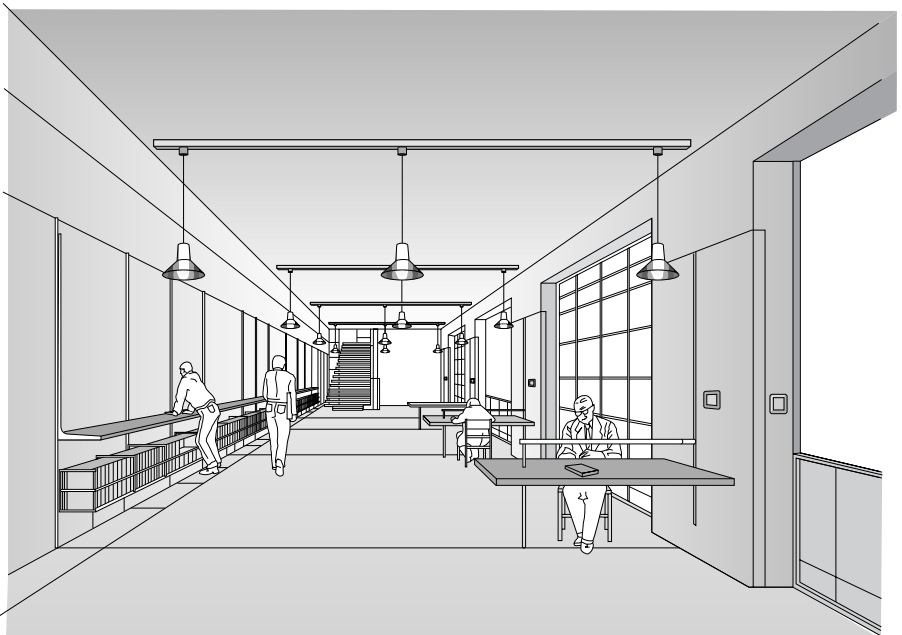To activate the lighting in rarely-visited departments of a library only when switched on by the user in order to save energy. The user may select how long he wants the lights to remain on. It should also be possible switch the lights on and off permanently at a central switch.

Overview drawing

Time-controlled Lighting
System

Functional description

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

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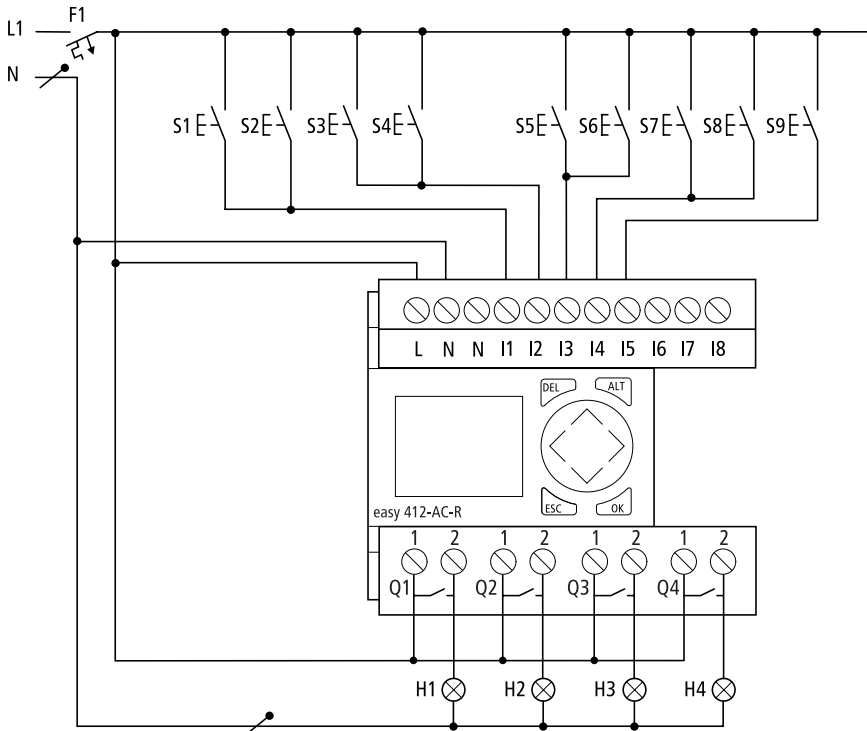
F1	16 A, char. B miniature circuit-breaker
H1	Lights in area A
H2	Lights in area B
H3	Lights in area C
H4	Lights in area D
S1 – S2	Light switch in area A
S3 – S4	Light switch in area B
S5 – S6	Light switch in area C
S7 – S8	Light switch in area D
S9	Central ON/OFF light switch

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, "easy" will not detect the switching level and can be damaged by overvoltages.

Parts list

The order numbers and specified pages are taken from the 1999 Moeller Main Catalogue.

Qty.	Device	Article No.	Page of Main Catalogue
1	"easy" control relay	EASY412-AC-R	05/006
1	16 A miniature circuit-breaker	FAZN B16	12/004
9	1-pole flush-mounted switch		

☞ The Appendix contains a guide for determining the maximum possible lamp loads.
Contactors should be used if the required lamp load exceeds the switching capacity of the "easy" relay outputs.

Time-controlled Lighting System

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-sec. ON delay = short/long ON duration, area A
T2	Timing relay with 2-sec. ON delay = short/long ON duration, area B
T3	Timing relay with 2-sec. ON delay = short/long ON duration, area C
T4	Timing relay with 2-sec. ON delay = short/long ON duration, area D
T8	Flashing 20-sec. cycle. for short/long ON duration

Benefits

Implemented functions

12 × ON-delayed timing relays
List price approx. DM 70 each
1 × impulse changeover relay
List price approx. DM 30

Less wiring required

Takes up less space than conventional systems

"easy" Control Relay Circuit Diagram

FO 98

Customer: _Lighting for library_

Program: _Example 9_

Date: _13.8.98_

Page: _1_

Comment:

				T T 8	
I 5				⌐ M 9	Central light ON/OFF switch
I 1				T T 1	
M 1 — Q 1				[M 1	Switch S1 / S2 short press
I 1 — T 1					
M 2 — Q 1				[M 2	Switch S1 / S2 long press
M 1 — T 8			C C 1		Counter 1 Duration: 5 minutes
M 2 — T 8			C C 2		Counter 2 Duration: 30 minutes
C̄ 1 — M 1					5 min.
C̄ 2 — M 2			[Q 1		Lamps at output 1 ON 30 min.
M 9			R C 1		via central ON switch
I 1			R C 2		Reset counter 1 and 2

TB 2528-025 GB

"easy" Control Relay Circuit Diagram

Customer: __Lighting for library__   Program: __Example 9__

Date: __13.8.98__   Page: __2__

Comment:

I 2		T T 2
M 3 — Q 2		[M 3	Switch S3/S4 short press
I 2 — T 2			
M 4 — Q 2		[M 4	Switch S3/S4 long press
M 3 — T 8		C C 3	Counter 3 Duration: 5 minutes
M 4 — T 8		C C 4	Counter 4 Duration: 30 minutes
C̄ 3 — M 3			5 min.
C̄ 4 — M 4		[Q 2	Lamps at output 2 ON 30 min.
M 9		R C 3	via central ON switch
I 2		R C 4	Reset counter 3 and 4
I 3		T T 3	
M 5 — Q 3		[M 5	Switch S5/S6 short press

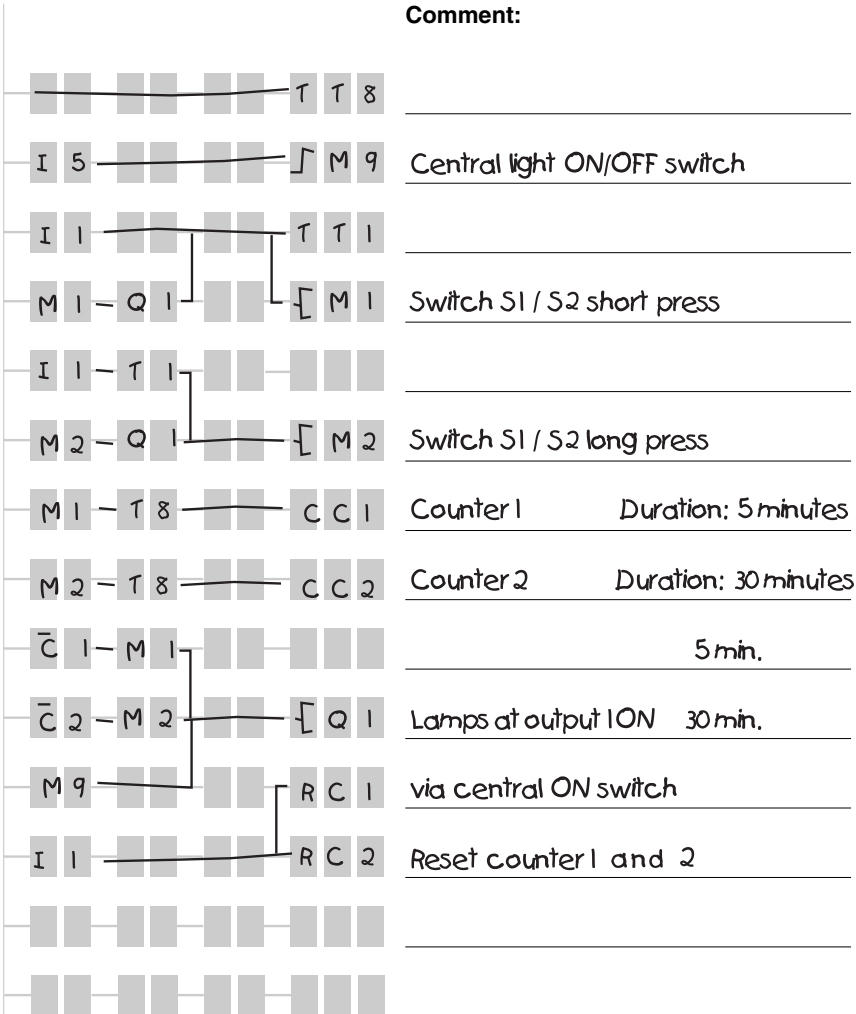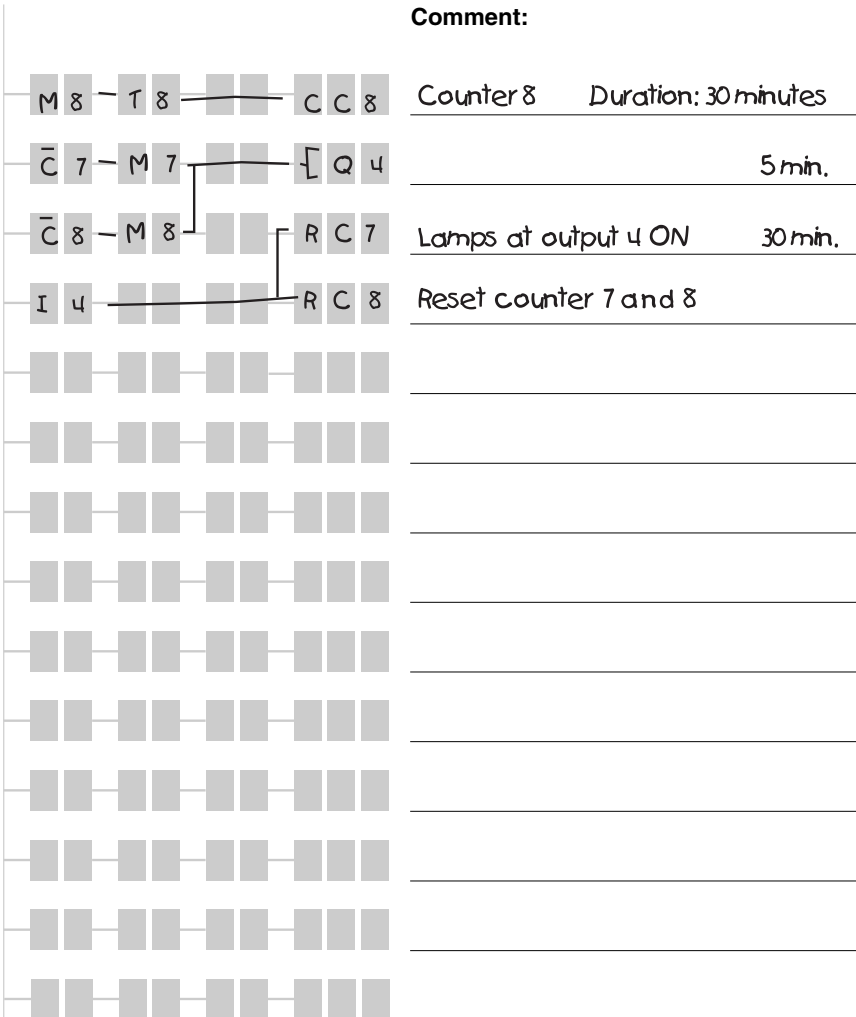# "easy" Control Relay Circuit Diagram

FO 98

Customer: Lighting for library

Program: Example 9

Date: 13.8.98

Page: 3

Comment:

I 3	T 3					
M 6	Q 3		[M 6	Switch S5/S6 long press		
M 5	T 8		C C 5	Counter 5 Duration: 5 minutes		
M 6	T 8		C C 6	Counter 6 Duration: 30 minutes		
C̄ 5	M 5			5 min.		
C̄ 6	M 6		[Q 3	Lamps at output 3 ON 30 min.		
M 9			R C 5	via central ON switch		
I 3			R C 6	Reset counter 5 and 6		
I 4			T T 4			
M 7	Q 4		[M 7	Switch S7/S8 short press		
I 4	T 4					
M 8	Q 4		[M 8	Switch S7/S8 long press		
M 7	T 8		C C 7	Counter 7 Duration: 5 minutes		

TB 2528-025 GB

87

"easy" Control Relay Circuit Diagram   FO 98

Customer: __Lighting for library__   Program: __Example 9__
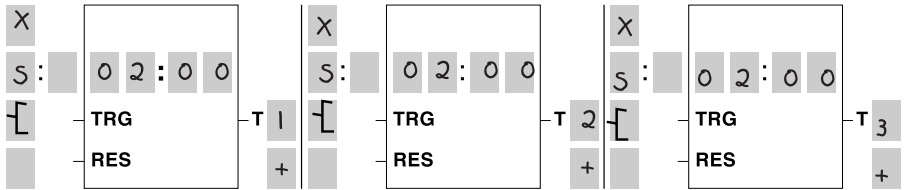
Date: __13.8.98__   Page: __4__

Comment:

M 8	T 8			C C 8	Counter 8 Duration: 30 minutes
C̄ 7	M 7		[Q 4		5 min.
C̄ 8	M 8		R C 7		Lamps at output 4 ON 30 min.
I 4			R C 8		Reset counter 7 and 8

"easy" Control Relay Parameters

FO 98

Customer: _Lighting for library_   Program: _Example 9_

Date: _13.8.98_   Page: _5_

Timing relays
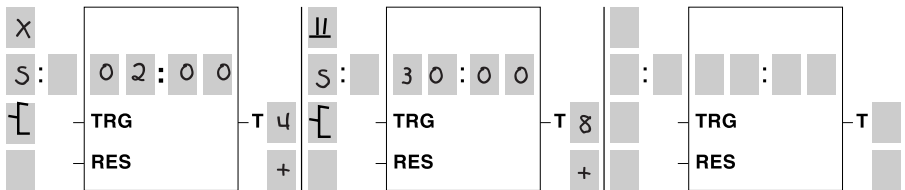
X
S : 0 2 : 0 0
⌐ TRG   T 1
  RES   +

X
S : 0 2 : 0 0
⌐ TRG   T 2
  RES   +

X
S : 0 2 : 0 0
⌐ TRG   T 3
  RES   +

Timing relays

X
S : 0 2 : 0 0
⌐ TRG   T 4
  RES   +

Ⅱ
S : 3 0 : 0 0
⌐ TRG   T 8
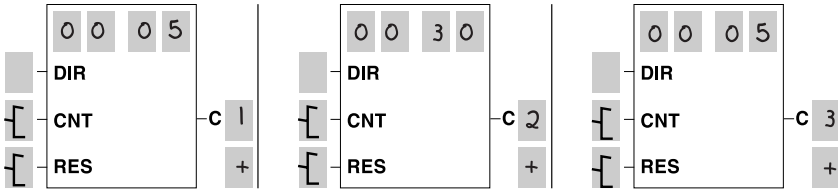 RES   +

:
:
 TRG   T
 RES

"easy" Control Relay Parameters FO 98

Customer: <u>Lighting for library</u>   Program: <u>Example 9</u>
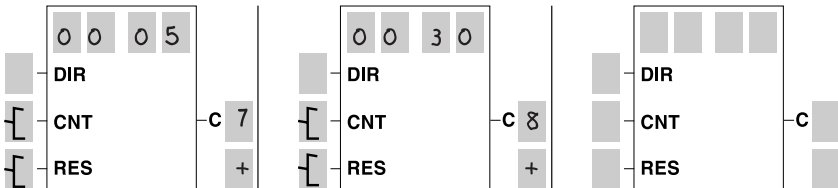
Date: <u>13.8.98</u>   Page: <u>6</u>

Up and down counters

0	0		0	5
DIR
CNT   C 1
RES   +

0	0		3	0
DIR
CNT   C 2
RES   +

0	0		0	5
DIR
CNT   C 3
RES   +

Up and down counters

0	0		3	0
DIR
CNT   C 4
RES   +

0	0		0	5
DIR
CNT   C 5
RES   +

0	0		3	0
DIR
CNT   C 6
RES   +

Up and down counters

0	0		0	5
DIR
CNT   C 7
RES   +

| 0	0		3	0
DIR
CNT   C 8
RES   +
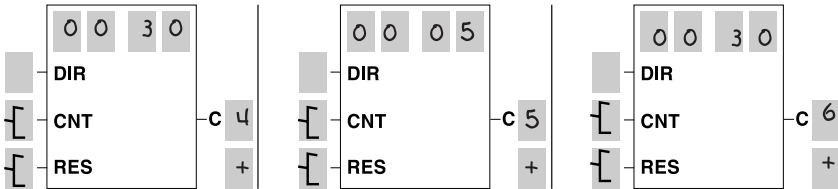
DIR
CNT   C
RES

10 Control of a Refrigeration System

Task

To switch 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 "easy" control relay via analog input I8. The value at I8 is compared with setpoint values and the switching points are derived from the comparison value.

Overview drawing
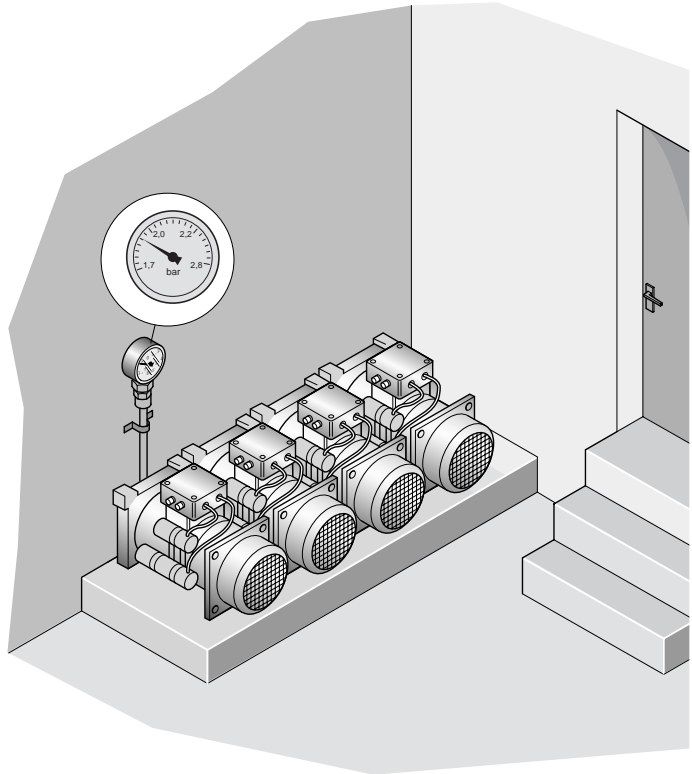
Functional description   The pressure of the refrigeration system is compared
with setpoint values. Timers are connected upstream
of the outputs so that pressure fluctuations in the
system do not cause the compressors to switch on
immediately.

Setpoint 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
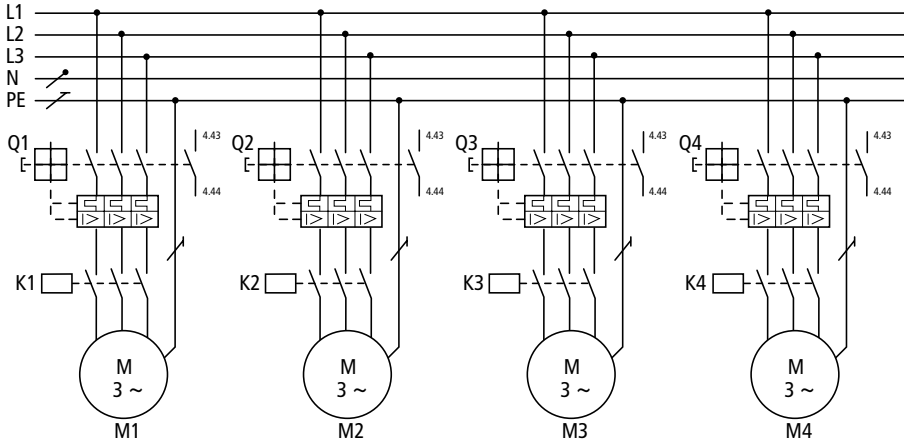Reset: A8 ≤ 2.3 bar

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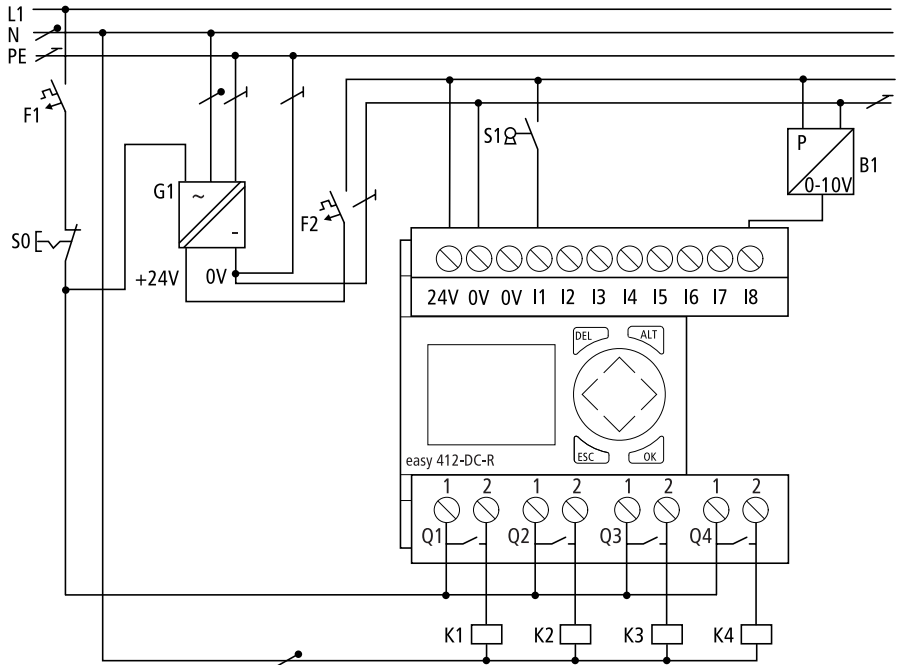
B1	Pressure sensor
F1	16 A, char. B miniature circuit-breaker
F2	Miniature circuit-breaker (optional)
G1	Power supply unit 230 V AC/24 V DC
K1 – K4	Compressor 1 – 4
S0	Emergency stop
S1	ON/OFF key switch

Control of a Refrigeration
System

Load circuit

Parts list

The order numbers and specified pages are taken from the 1999 Moeller Main Catalogue.

Qty.	Device	Article No.	Page of Main Catalogue
1	"easy" control relay	EASY412-DC-R	05/006
1	Pressure sensor		a
1	Power supply unit 230 V AC/24 V DC $I_N = 200$ mA	SN4-025-BI7	01/049
1	Emergency stop	RPV/K01	03/012
1	Miniature circuit-breaker	FAZN B16	12/004
1	Key switch	RS/K11	03/007
4	Power contactor	See selection guide on page 06/002 of Main Catalogue	
4	Motor-protective circuit-breaker	PKZM-xx	08/008 (xx = motor current)

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 OFF
I1	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
  $4 \times$ ON-delayed timing relays
  List price approx. DM 280

Processing of pressure values (analog values)

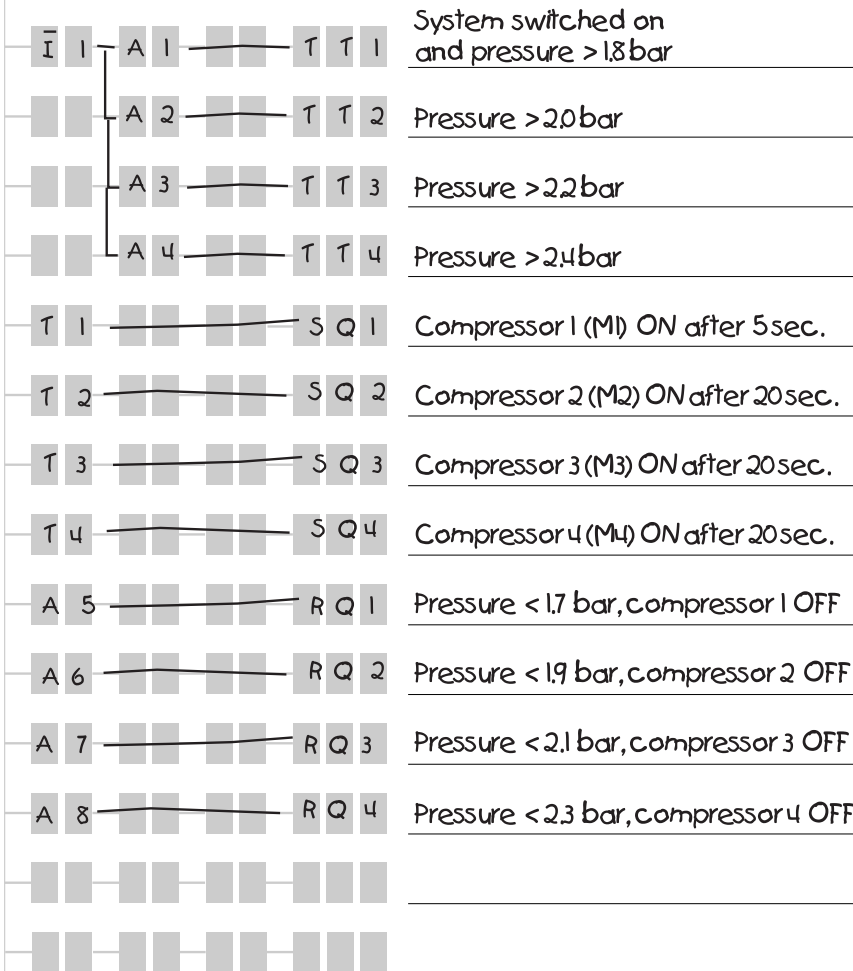Password function protects against unauthorised access

"easy" Control Relay Circuit Diagram   FO 98

Customer: _Refridgeration system_   Program: _Example 10_
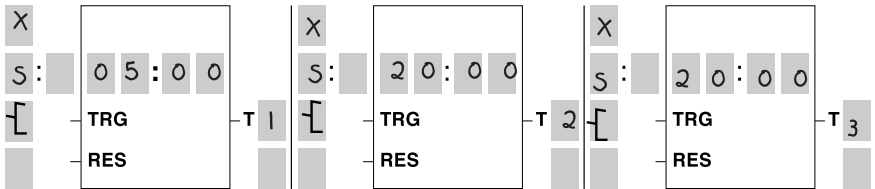
Date: _13.8.98_   Page: _1_

Comment:

I 1 — A 1 ———— T T 1   _System switched on_
and pressure > 1.8 bar

A 2 ———— T T 2   _Pressure > 2.0 bar_

A 3 ———— T T 3   _Pressure > 2.2 bar_

A 4 ———— T T 4   _Pressure > 2.4 bar_

T 1 ———— S Q 1   _Compressor 1 (M1) ON after 5 sec._

T 2 ———— S Q 2   _Compressor 2 (M2) ON after 20 sec._

T 3 ———— S Q 3   _Compressor 3 (M3) ON after 20 sec._

T 4 ———— S Q 4   _Compressor 4 (M4) ON after 20 sec._

A 5 ———— R Q 1   _Pressure < 1.7 bar, compressor 1 OFF_

A 6 ———— R Q 2   _Pressure < 1.9 bar, compressor 2 OFF_

A 7 ———— R Q 3   _Pressure < 2.1 bar, compressor 3 OFF_

A 8 ———— R Q 4   _Pressure < 2.3 bar, compressor 4 OFF_

"easy" Control Relay Parameters FO 98

Customer: _Refridgeration system_   Program: _Example 10_

Date: _13.8.98_   Page: _2_

Timing relays

X

S : 0 5 : 0 0
— TRG   — T 1
— RES

X

S : 2 0 : 0 0
— TRG   — T 2
— RES

X

S : 2 0 : 0 0
— TRG   — T 3
— RES

Timing relays

X

S : 2 0 : 0 0
— TRG   — T 4
— RES

:   :
— TRG   — T
— RES

:   :
— TRG   — T
— RES
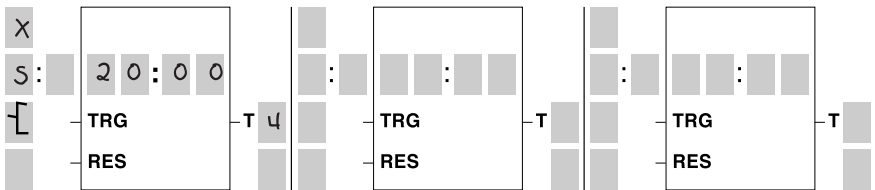
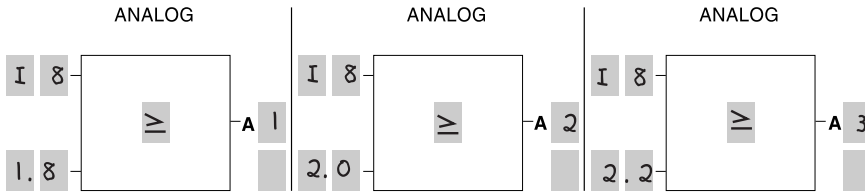# "easy" Control Relay Parameters   FO 98

Customer: _Refridgeration system_   Program: _Example 10_
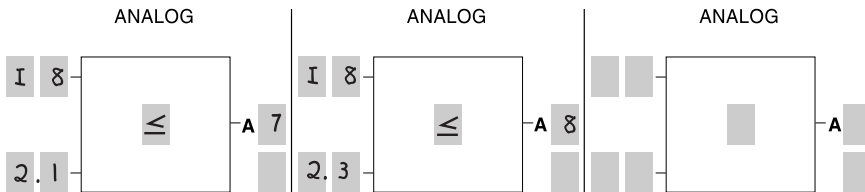
Date: _13.8.98_   Page: _3_

Analog comparators

ANALOG	ANALOG	ANALOG
I 8	I 8	I 8
≥ A 1	≥ A 2	≥ A 3
1.8	2.0	2.2

Analog comparators

ANALOG	ANALOG	ANALOG
I 8	I 8	I 8
≥ A 4	≤ A 5	≤ A 6
2.4	1.7	1.9

Analog comparators
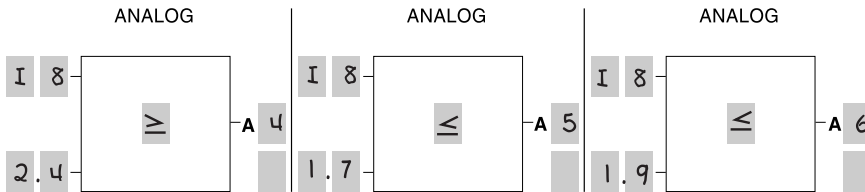
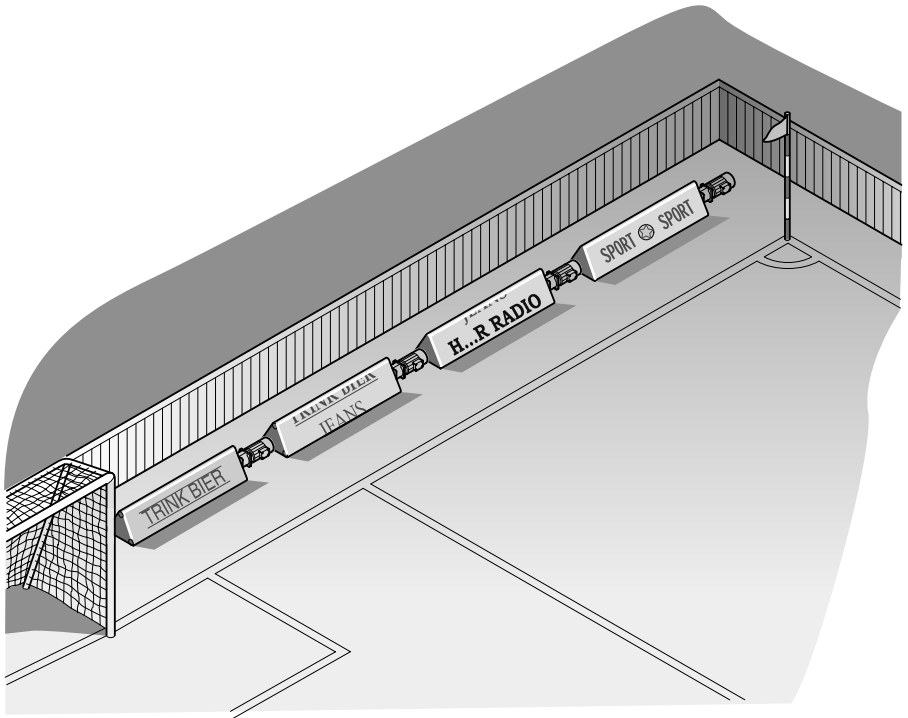| ANALOG	ANALOG	ANALOG
I 8	I 8	
≤ A 7	≤ A 8	A
2.1	2.3	

11 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

Perimeter Advertising in a
Stadium

Functional description   **Start**

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

Turning

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

Testing and maintenance

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

☞ | The P buttons are activated in the Special menu.
Press ALT and DEL simultaneously to switch to
the Special menu.

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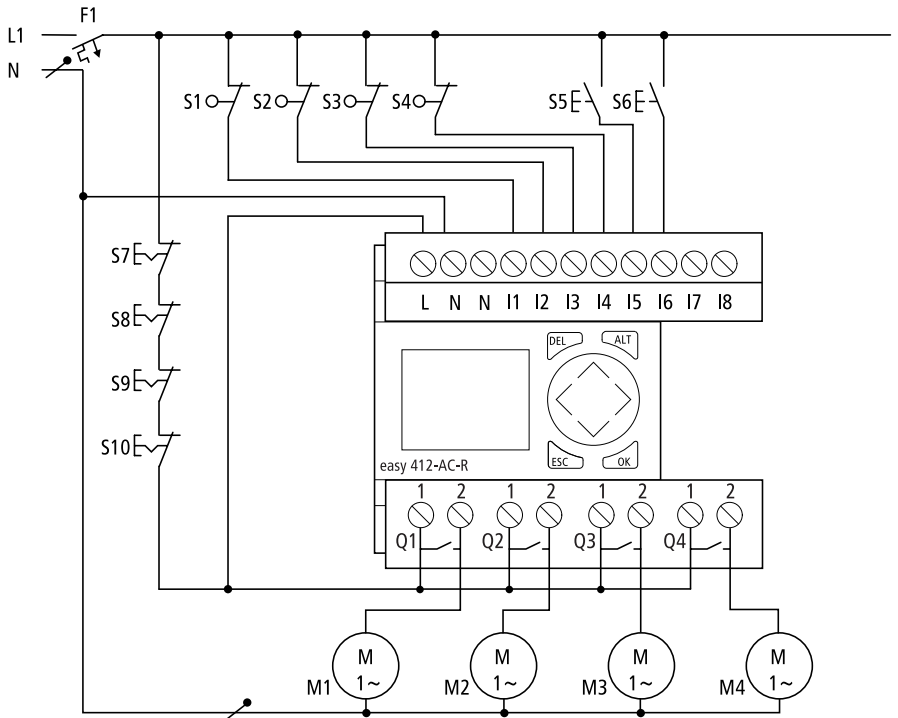
F1	16 A, char.B miniature circuit-breaker		S1	Limit switch for strip 1
M1	Motor for strip 1		S2	Limit switch for strip 2
M2	Motor for strip 2		S3	Limit switch for strip 3
M3	Motor for strip 3		S4	Limit switch for strip 4
M4	Motor for strip 4		S5	Start/Stop button
			S6	Turn button
			S7 – S10	Emergency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

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, "easy" will not detect the switching level and can be damaged by overvoltages.

Parts list

The order numbers and specified pages are taken from the 1999 Klöckner-Moeller Main Catalogue.

Qty.	Device	Article No.	Page of Main Catalogue
1	"easy" control relay	EASY412-AC-R	05/006
2	Push-button actuator make contact	RD-10/K01	03/006
4	Limit switch break contact	AT0-11-S-I/RS	04/005
4	Emergency stop	RPV/K01	03/012
1	16 A miniature circuit-breaker	FAZN B16	12/004

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× Turn strip 1
P2   Cursor button 1× Turn strip 2
P3   Cursor button 1× Turn strip 3
P4   Cursor button 1× 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-sec. ON delay
     => Advert viewing time, strip 1
T2   Timing relay with 30-sec. ON delay
     => Advert viewing time, strip 2
T3   Timing relay with 30-sec. ON delay
     => Advert viewing time, strip 3
T4   Timing relay with 30-sec. ON delay
     => Advert viewing time, strip 4
T5   Single 1-sec. pulse timing relay
     => Block limit switch for starting strip 1
T6   Single 1-sec. pulse timing relay
     => Block limit switch for starting strip 2
T7   Single 1-sec. pulse timing relay
     => Block limit switch for starting strip 3
T8   Single 1-sec. pulse timing relay
     => Block limit switch for starting strip 4
```

Benefits

Implemented functions
    8 × ON-delayed timing relays
    List price approx. DM 560
    1 × impulse changeover relay
    List price approx. DM 30

Less wiring required

Takes up less space than conventional systems

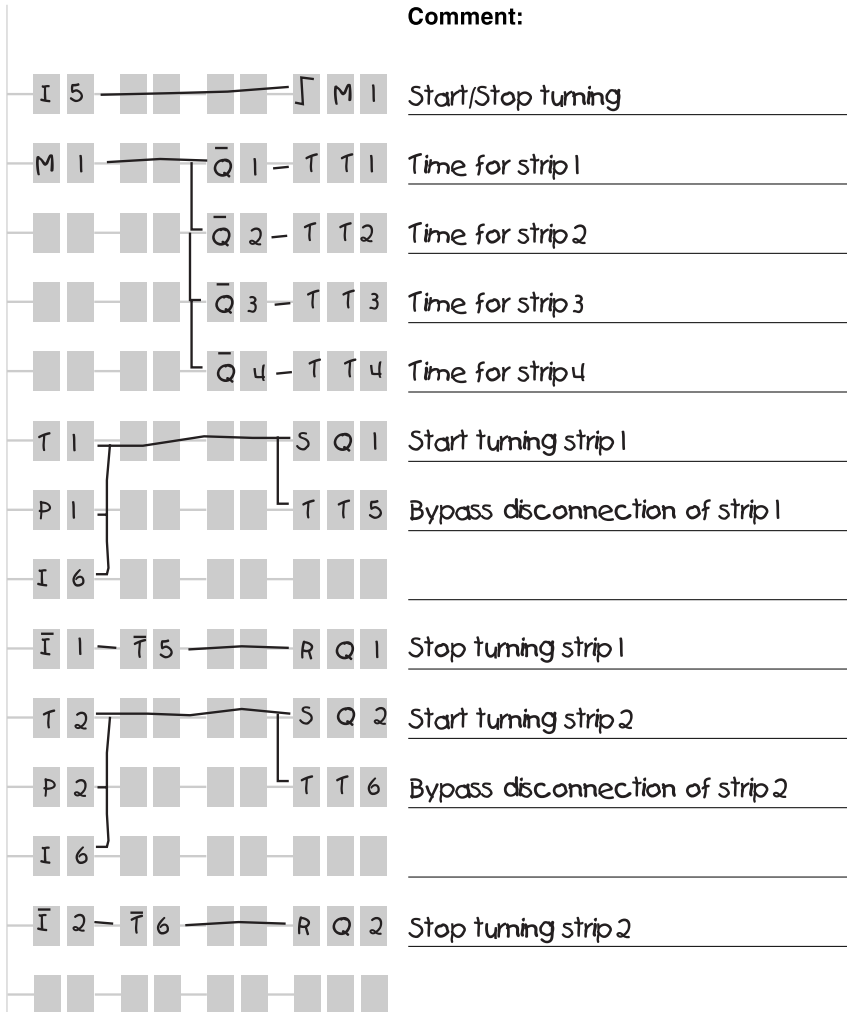Dwell time of each strip can be individually selected

"easy" Control Relay Circuit Diagram   FO 98

Customer: Stadium perimeter advertising   Program: Example II

Date: 13.8.98   Page: 1

Comment:

I 5 ──────┐ M 1   Start/Stop turning

M 1 ── Q̄ 1 ─ T T 1   Time for strip 1

── Q̄ 2 ─ T T 2   Time for strip 2

── Q̄ 3 ─ T T 3   Time for strip 3

── Q̄ 4 ─ T T 4   Time for strip 4

T 1 ── S Q 1   Start turning strip 1

P 1 ── T T 5   Bypass disconnection of strip 1

I 6

Ī 1 ─ T̄ 5 ── R Q 1   Stop turning strip 1

T 2 ── S Q 2   Start turning strip 2

P 2 ── T T 6   Bypass disconnection of strip 2

I 6

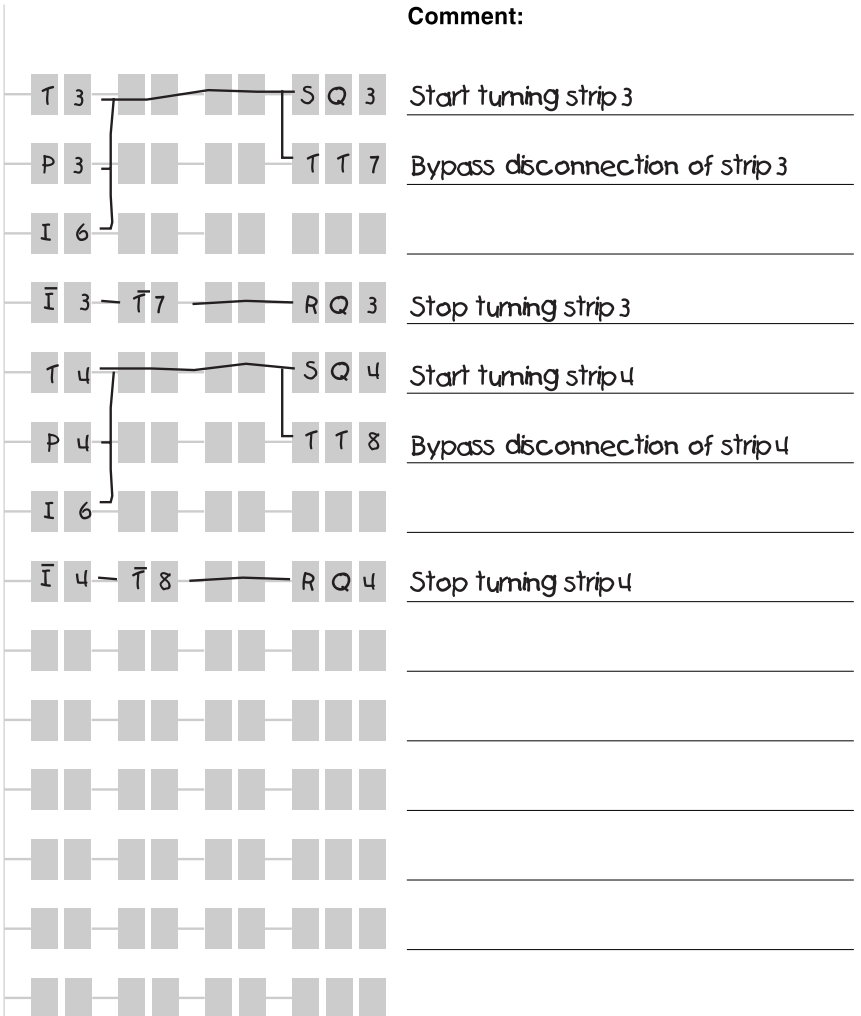Ī 2 ─ T̄ 6 ── R Q 2   Stop turning strip 2

TB 2528-025 GB

"easy" Control Relay Circuit Diagram FO 98

Customer: _Stadium perimeter advertising_ Program: _Example II_

Date: _13.8.98_   Page: _2_

Comment:

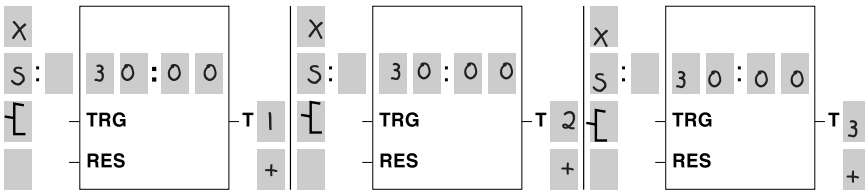|			
T 3		S Q 3	Start turning strip 3
P 3		T T 7	Bypass disconnection of strip 3
I 6			
Ī 3 — T̄ 7		R Q 3	Stop turning strip 3
T 4		S Q 4	Start turning strip 4
P 4		T T 8	Bypass disconnection of strip 4
I 6			
Ī 4 — T̄ 8		R Q 4	Stop turning strip 4

"easy" Control Relay Parameters

FO 98

Customer: Stadium perimeter advertising Program: Example II

Date: 13.8.98 Page: 3

Timing relays
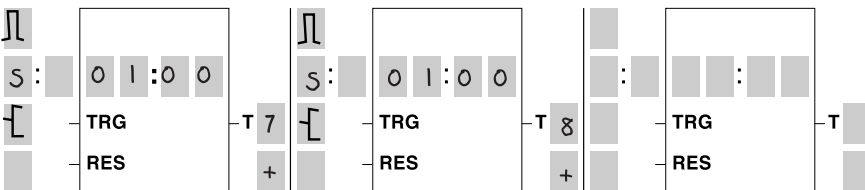

X				X				X			
S : 3 0 : 0 0				S : 3 0 : 0 0				S : 3 0 : 0 0			
TRG		T 1		TRG		T 2		TRG		T 3	
RES		+		RES		+		RES		+	

Timing relays

X				Л				Л			
S : 3 0 : 0 0				S : 0 1 : 0 0				S : 0 1 : 0 0			
TRG		T 4		TRG		T 5		TRG		T 6	
RES		+		RES		+		RES		+	

Timing relays

| Л				Л							
S : 0 1 : 0 0				S : 0 1 : 0 0				: :			
TRG		T 7		TRG		T 8		TRG		T	
RES		+		RES		+		RES			

12   Control of a Sliding Door

Task

To automatically control the sliding door at the entrance to an underground car park. The door should open upon 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 day and days of the week. The limit switches and mechanical operation of the door should be constantly monitored.

Overview drawing
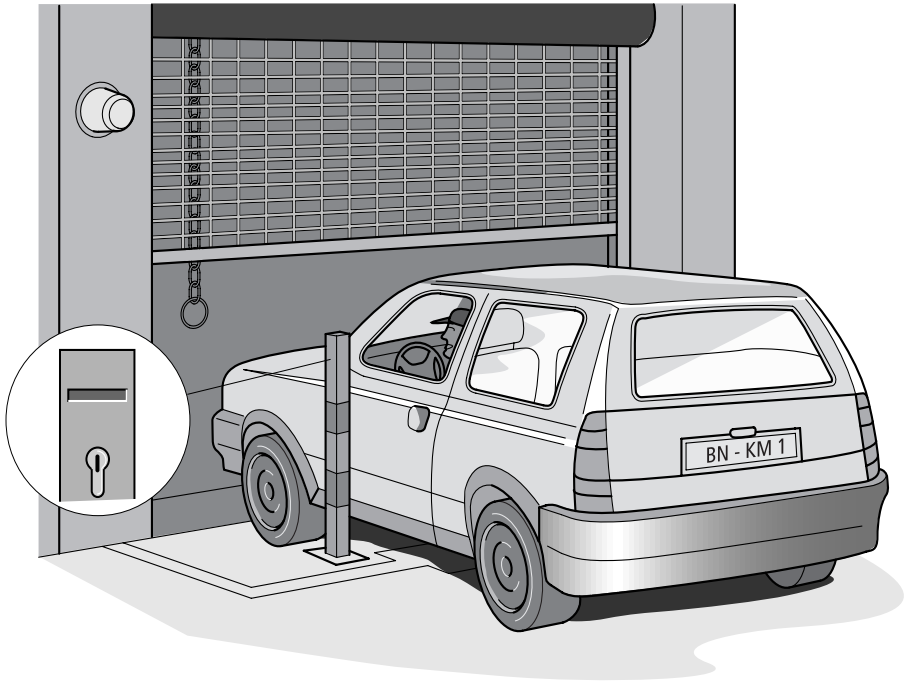
Functional description

Opening the sliding door

The sliding door can be opened from outside via a swipe card reader and/or the 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 the key switch S5.

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

Closing the sliding door

Once a car has driven into the car park, the driver can close the door manually via 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 buttons S4 and S3 in the control room.

Security

Door closing should be indicated by a brief audible signal (H3). At the same time, the red warning lights H1 and H2 light up at the entrance and exit.

If there is a person, vehicle or other 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 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 safety bar must be wired up as shown in the following circuit diagram. 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 11/1-5

ZH1/494 and ZH1/580.1 Safety Rules

Faults
Defective limit switches S1 and S2 (door opened S2/door closed S1) 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 the warning lights H1 and H2 should start to flash. The message can be cleared by pressing and resetting the emergency stop button S8. If the emergency stop button S8 is pressed, the warning lights should light up and a continuous audible signal should start.

Control of a Sliding Door

Control circuit
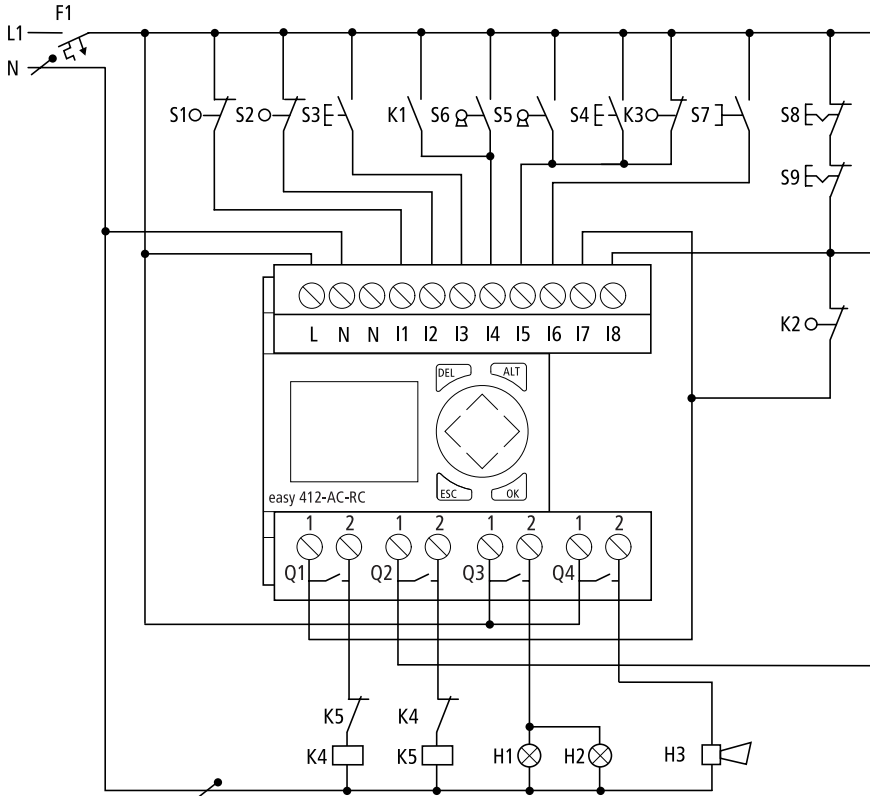
F1	16 A, char. B miniature circuit-breaker
H1	Internal warning light
H2	External warning light
H3	Audible signal
K1	Contact for swipe card reader
K2	Contact for safety bar
K3	Contact for light barrier
K4	Close door contactor
K5	Open door contactor
S1	Door closed limit switch
S2	Door opened limit switch

|	
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

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, "easy" will not detect the switching level and can be damaged by overvoltages.

Load circuit
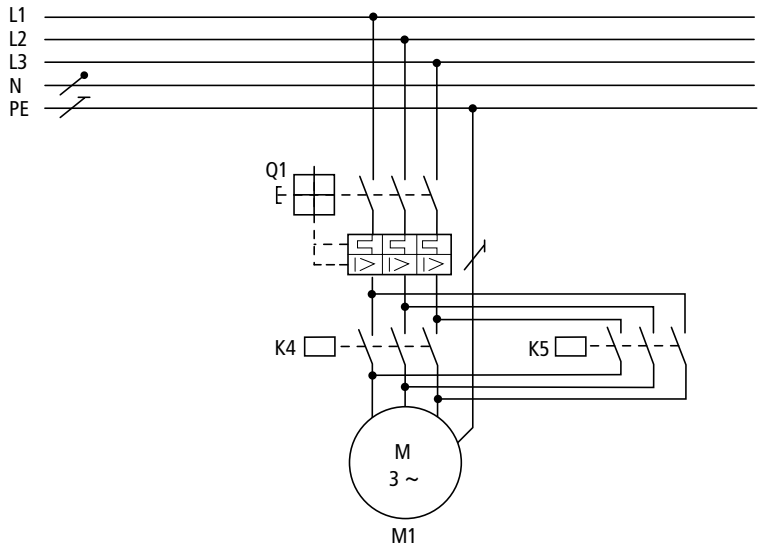
👉 | The electrical interlock may be omitted if a reversing contactor with a mechanical interlock is used (see Parts list).

Parts list

The order numbers and specified pages are taken from the 1999 Klöckner-Moeller Main Catalogue.

Off	Module	Order no.	Page of Main Catalogue
1	"easy" control relay	EASY412-AC-RC	05/006
2	Key switch for mounting in front panel	RS/K10	03/007
1	Motor-protective circuit-breaker	PKZM0-xx (xx = motor current)	08/008
1	Contactor-type reversing starter Up to 4 kW Up to 5.5 kW Up to 7.5 kW	 DIUL EM/21/MV (230 V 50 Hz) DIUL 00AM/11 (230 V 50 HZ) DIUL 0M/11 (230 V 50 HZ)	06/028
2	Limit switch	See page 04/002 of Main Catalogue	
1	Pull switch		
1	16 A miniature circuit-breaker	FAZN B16	12/004
2	Push-button actuators	RD-X	03/014
2	Fixing adapter	BE3	03/036
2	Contact element	EK10	03/036
2	Legend plates	32T	03/044
2	Emergency stop	RPV/K01	03/012

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

"easy" Control Relay Circuit Diagram

Customer: Control of a sliding door   Program: Example 12

Date: 13.8.98   Page: 1

Comment:

M 3				S	M 1	Door closing
Ī 1				R	M 1	End door closing via limit switch
Ī 8						emergency stop
M 4						door opening
M 6						limit switch monitoring
M 4				S	M 2	Door opening
Ī 2				R	M 2	End door opening via limit switch
Ī 8						emergency stop
M 3						door opening
M 6						limit switch monitoring
I 3				[	M 3	Door closing via S3
I 6	Ī 2					S7
I 6	M 2	M̄ 5				
T 4						Automatic

"easy" Control Relay Circuit Diagram

FO 98

Customer: __Control of a sliding door__   Program: __Example 12__

Date: __13.8.98__   Page: __2__

Comment:

Circuit	Comment
I 4 —— ⏱ 1 — [M 4	Door opening via S6/K1
I 5	S5
I 6 — Ī 1	S7
I 6 — M 1 — M̄ 5	
Ī 7 — I 1 — I 8	K2
I 6 —— [M 5	Pull switch
M 3 — Ī 5 —— TT 3	Warning time before door closing
Ī 2 — I 7 —— TT 4	Automatic closing
M 1 — M 4 —— TT 5	Open/close changeover delay
M 2 — M 3	
M 1 — T̄ 5 — T̄ 3 — [Q 1	Door closing
M 2 — T̄ 5 —— [Q 2	Door opening

"easy" Control Relay Circuit Diagram   FO 98

Customer: __Control of a sliding door__   Program: __Example 12__

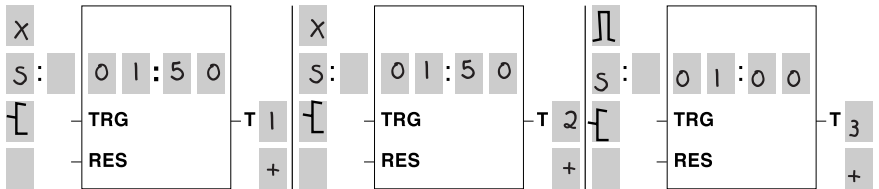Date: __13.8.98__   Page: __3__

Comment:

M 1 ——— [Q 3	Warning lights
T 6 —— T 3 — [Q 4	Audible signal
I̅ 7 — I 1	
I̅ 8 ┐ M 3	
└ M 4	
I̅ 7 — I 1	
I̅ 8 ┐ M 3	
└ M 4	
Q 1 ——— T T 2	Monitoring open door limit switch
Q 2 ——— T T 1	Monitoring close door limit switch
I̅ 1 — T 1 ——— S M 6	Limit switch time monitoring
I̅ 2 — T 2	
I̅ 7 ——— R M 6	
M 6 ——— T T 6	Flash warning lights

"easy" Control Relay Parameters

Customer: **Control of a sliding door**   Program: **Example 12**

Date: **13.8.98**   Page: **4**

Timing relays

X			
S :	0 1 : 5 0		
⊏	— TRG		— T 1
	— RES		+

X			
S :	0 1 : 5 0		
⊏	— TRG		— T 2
	— RES		+

⎍			
S :	0 1 : 0 0		
⊏	— TRG		— T 3
	— RES		+

Timing relays

X			
S :	3 0 : 0 0		
⊏	— TRG		— T 4
	— RES		+

⎍			
S :	0 0 : 1 0		
⊏	— TRG		— T 5
	— RES		+

Ⅱ			
S :	0 0 : 2 5		
⊏	— TRG		— T 6
	— RES		+

Time switches

M O - D O		🕐 1
ON 0 7 : 0 0	A	
OFF 1 8 : 0 0	+	

F R -		🕐 1
ON 0 7 : 0 0	B	
OFF 1 5 : 0 0	+	

S A -		🕐 1
ON 0 7 : 0 0	C	
OFF 1 4 : 0 0	+	

Appendix

**Output terminal data,
EASY AC / DC**

Relay outputs, EASY DC/AC	
Continuous current I_{th}	max. 8 A (UL: 10 A)
Short-circuit resistance $\cos \varphi = 1$	16 A characteristic B (B16) at 600 A
Short-circuit resistance $\cos \varphi = 0.5$ to 0.7	16 A characteristic B (B16) at 900 A
Connection of outputs in parallel to increase the output	Not admissible
Protection for an output relay	B16 circuit-breaker or 8 A (slow) fuse
Operation at AC 15 250 V, 3 A $\cos \varphi = 0.4$, 600 Ops/h	Switching on – 180,000 operations Switching off – 30,000 operations
Operation at DC 13	Switching on – 200,000 operations
24 V DC, 1 A	Switching off – 200,000 operations
L/R = 150 ms 500 Ops/h	
Filament lamp load	1000 W at 230/240 V AC/ 25,000 operations 500 W at 115/120V AC/ 25,000 operations
Fluorescent tube with ballast	10 × 58 W at 230/240 V AC/ 25.000 operations
Conventional fluorescent tube, compensated	1 × 58 W at 230/240 V AC/ 25.000 operations
Fluorescent tube, uncompensated	10 × 58 W at 230/240 V AC/ 25.000 operations

Mechanical switching cycles

Switching cycles (mechanical)	10 million (10^7)
Mechanical switching frequency	10 Hz
Resistive lamp load	2 Hz
Inductive load	0.5 Hz

Contactors and their switching capacity

Lamp				Maximum number of lamps switched on simultaneously per phase. The entire rated current can be used in a single circuit. **Contactors DIL...** Open: 100 % (Encapsulated: 80 % is recommended)			
Rated output without ballast W	Operating current A	Rated voltage 50 Hz V	Compensating capacitor µF	00AM	0AM	1AM	2AM
Fluorescent lamps							
Twin-lamp circuit				The number of lamps relates to the individual lamps, and not to the twin-lamp unit			
36/40	0.22	230	–	60	102	162	270
58/65	0.34	230	–	40	68	108	180
115	0.65	230	–	24	44	70	110
140	0.75	230	–	22	38	60	100
Single circuit, uncompensated				Also applies to lamps without starter			
36/40	0.43	230	–	40	60	95	165
58/65	0.67	230	–	25	40	61	90
115	1.5	230	–	9	15	35	45
140	1.5	230	–	9	15	35	45
215	1.5	400	–	9	13	20	41
Single circuit, compensated							
36/40	0.22	230	4.5	40	75	105	180
58/65	0.34	230	7.0	25	50	65	120
115	0.65	230	18.0	13	25	35	65
140	0.75	230	18.0	13	23	30	60
215	0.8	400	10.0	9	20	25	30

Lamp				Maximum number of lamps switched on simultaneously per phase. The entire rated current can be used in a single circuit. **Contactors DIL...** Open: 100 % (Encapsulated: 80 % is recommended)			
Rated output without ballast W	Operating current A	Rated voltage 50 Hz V	Compensating capacitor µF	00AM	0AM	1AM	2AM
High-pressure mercury vapour lamps, uncompensated							
250	2.2	230	–	6	11	18	30
400	3.3	230	–	4	7	12	18
700	5.5	230	–	2	4	7	12
1000	7.5	230	–	2	3	5	10
2000	8	400	–	1	3	4	6
High-pressure mercury vapour lamps, compensated							
125	0.7	230	10	13	25	35	60
250	1.3	230	18	7	14	25	35
400	2	230	25	5	10	18	24
700	3.5	230	40	2	5	8	15
1000	5	230	60	1	3	6	9
2000	5.5	400	37	1	2	4	6
Metal-halide lamps, uncompensated							
400	3.5	230	–	3	5	9	15
1000	9.5		–	1	2	3	6
2000	10.3	400	–	1	2	3	5
Metal-halide lamps, compensated							
400	2.2	230	35	3	5	6	13
1000	5.8	230	85	1	2	3	5
2000	6.6	400	60	–	1	2	4
3500	11.6	400	100	–	–	1	3

Lamp				Maximum number of lamps switched on simultaneously per phase. The entire rated current can be used in a single circuit. **Contactors DIL...** Open: 100 % (Encapsulated: 80 % is recommended)			
Rated output without ballast W	Operating current A	Rated voltage 50 Hz V	Compensating capacitor µF	00AM	0AM	1AM	2AM
Sodium lamps							
High-pressure lamps, uncompensated							
250	3.0	230	–	4	6	10	20
400	4.4	230	–	3	4	7	13
1000	10.3	230	–	1	2	3	5
High-pressure lamps, compensated							
250	1.5	230	36	5	8	10	20
400	2.4	230	45	3	6	8	15
1000	6.3	230	100	1	2	3	6
Low-pressure lamps, uncompensated							
35	1.4	230	–	9	16	23	40
55	1.4	230	–	9	16	23	40
90	2.1	230	–	5	10	14	26
135	3.1	230	–	4	7	10	18
180	3.1	230	–	4	7	10	18
Low-pressure lamps, compensated							
35	0.3	230	20	6	12	21	39
55	0.4	230	20	5	11	16	36
90	0.6	230	26	4	8	13	28
135	0.9	230	45	3	5	8	16
180	1.15	230	40	2	5	6	15

Lamp				Maximum number of lamps switched on simultaneously per phase. The entire rated current can be used in a single circuit. **Contactors DIL...** Open: 100 % (Encapsulated: 80 % is recommended)			
Rated output without ballast W	Operating current A	Rated voltage 50 Hz V	Compensating capacitor µF	00AM	0AM	1AM	2AM
Mixed-light lamps							
160	0.8	230	–	20	32	51	84
250	1.2	230	–	13	21	34	56
500	2.4	230	–	6	10	17	28
1000	4.7	230	–	3	5	8	14
Filament lamps							
100	0.45	230	–	28	40	73	110
200	0.91	230	–	14	20	36	55
300	1.36	230	–	9	13	24	37
500	2.27	230	–	5	8	14	22
1000	4.5	230	–	2	4	7	11
2000	9.1	230	–	1	2	3	5

Other documentation and guides

User Manual – "easy" control relay
Order no: AWB 2528-1304 D

Concise Instructions – "easy" control relay (free)
Order no: AWB 2528-1316 D

Demo CD-ROM (free)
Order no: VKF D 2528-313

Programming software for the "easy" control relay
Order no: easy-SOFT

Documentation pad for "easy" programs (free)
Order no: FO 98 D

"easy" information on the Internet
http://www.moeller.net/easy

For further information, please see page 05/006 of the 1999 Main Catalogue.
You can also access the Moeller Main Catalogue at our web site http://www.moeller.net.

Circuit diagram template
for easy 412-DC-R_

TB 2528-025 GB

129

TB 2528-025 GB

Index