

Switching, control, visualisation

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Switching, control, visualisation

Timing relays

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Electronic timing relays are used in contactor control systems which require short reset times, high repetition accuracy, high switching frequency, and a long component lifespan.

Times between 0.05 s and 100 h can be easily selected and set.

The switching capacity of electronic timing relays corresponds to the utilisation categories AC -15 and DC -13.

In terms of the actuating voltages there are with timing relays the following differences :

- **Version A** (DILET... and ETR4) Universal devices:
DC 24 to 240 V
AC 24 to 240 V, 50/60 Hz
- **Version W** (DILET... and ETR4) AC devices:
AC 346 to 440 V, 50/60 Hz
- **ETR2...** (as row mounting device to DIN 43880)
Universal device:
DC 24 to 48 V
AC 24 to 240 V, 50/60 Hz

The functions of each of the timing relays are as follows:

- DILET11, ETR4-11, ETR2-11 **Function 11** (on-delayed)
- ETR2-12 **Function 12** (off-delayed)
- ETR2-21 **Function 21** (fleeting contact on energisation)
- ETR2-42 **Function 42** (flashing, pulse initiating)

- ETR2-44 **Function 44** (flashing, two speeds; can be set to either pulse initiating or pause initiating)
- Multifunction relays DILET70, ETR 4-69/70 **Function 11** (on-delayed)
Function 12 (off-delayed)
Function 16 (on- and off-delayed)
Function 21 (fleeting contact on energisation)
Function 22 (fleeting contact on de-energisation)
Function 42 (flashing, pulse initiating)
- **Function 81** (pulse generating)
Function 82 (pulse shaping)
ON, OFF
- Multifunction relays ETR2-69 **Function 11** (on-delayed)
Function 12 (off-delayed)
Function 21 (fleeting contact on energisation)
Function 22 (fleeting contact on de-energisation)
Function 42 (flashing, pulse initiating)
Function 43 (flashing, pause initiating)
Function 82 (pulse shaping)
- Star-delta timing relays ETR4-51 **Function 51** (on-delayed)

With both DILET70 and ETR4-70 an external potentiometer can be connected. Upon connection, both timing relays automatically recognize that a potentiometer is fitted.

The ETR4-70 has a special feature. Equipped with two changeover contacts which can be converted to two timing contacts 15-18 and 25-28 (A2-X1 bridged) or one timing contact 15-18 and a non-delayed contact 21-24 (A2-X1 not bridged). If the link A2-X1 is removed, only the timed contact 15-18 carries out the functions described below.

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Timing relays

Function 11

On-delayed



The control voltage U_s is applied to terminals A1 and A2 through an actuating contact.

After the set delay time the changeover contact of the output relay goes to position 15-18 (25-28).

Function 12

Off-delayed

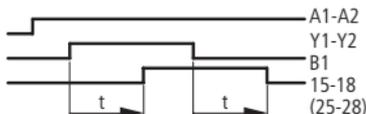


After the control voltage has been applied to terminals A1 and A2, the changeover contact of the output relay remains in the original position 15-16 (25-26). If terminals Y70 and Y1 in the DILET2 are linked with a floating NO contact or, in the case of the ETR4-69/70 or ETR2-69, a potential is applied to B1, the changeover contact changes to position 15-18 (15-28) immediately.

If the connection between terminals Y1-Y1 is now interrupted or B2 is isolated from voltage, the changeover contact returns to its original position 1-1 (15-25) once the set time has elapsed.

Function 16

On- and Off-delayed

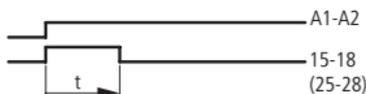


The control voltage U_s is applied directly to terminals A1 and A2. If terminals Y1 and Y2 in the DILET70 are linked by a floating contact, or in the case of the ETR4-69/70 a potential is applied to B1, the changeover contact goes to the position 15-18 (25-28) after a set time t .

If connection Y1-Y1 is now interrupted or B2 is separated from the potential, the changeover contact goes back to its original position 1-1 (15-25) after the same time t .

Function 21

Fleeting contact on energization



After the voltage U_s has been applied to A1 and A2, the changeover contact of the output relay goes to position 15-18 (25-28) and remains actuated for the set fleeting contact time.

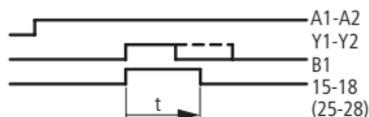
A fleeting pulse (terminals 1-2, 15-18) of defined duration is therefore produced from a two-wire control process (voltage on A25/A28) by this function.

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Timing relays

Function 82

Pulse forming

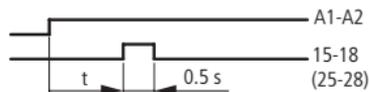


After the control voltage has been applied to A1 and A2, the changeover contact of the output relay remains in the rest position 15–16 (25–26). If terminals Y70 and Y1 in the DILET2 are linked through a floating contact, or in the case of the ETR4-69/70 or ETR2-69, a potential is applied to B1, the changeover contact changes to the position 15–18 (25–28) immediately.

If Y1–Y2 is now opened again or B1 is isolated from voltage, the changeover contact remains actuated until the set time has elapsed. If, instead, Y1–Y2 remain closed or B1 is separated from the potential for a longer period, the output relay likewise changes back to its rest position after the set time. An output pulse of precisely defined duration is thus produced in the pulse-forming function, irrespective of whether the input pulse via Y1–Y2 or B1 is shorter or longer than the set time.

Function 81

Pulse generating with fixed pulse

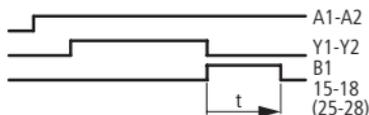


The actuating voltage is applied to terminals A1 and A2 via an actuating contact. After the set delay time has elapsed the changeover contact of the output relay goes to position 15-18 (25-28) and returns to its original position 0.5-15

(16-25) after 26 s. This function is therefore a fleeting pulse with a time delay.

Function 22

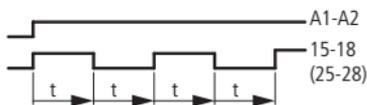
Fleeting contact on de-energization



The control voltage U_s is applied directly to A1 and A2. If terminals Y1 and Y2 on DILET70 that are shorted at any time beforehand (DILET-70: floating) and then reopened (or for ETR4-69/70 or ETR2-69 contact B1 is floating), contact 15-18 (25-28) closes for the duration of the set time.

Function 42

Flashing, pulse initiating



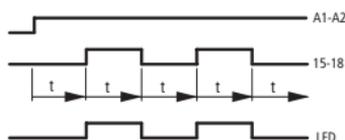
After the voltage U_s has been applied to A1 and A2, the changeover contact of the output relay changes to position 15–18 (25–28) and remains actuated for as long as the set flashing time. The subsequent pause duration corresponds to the flashing time.

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Timing relays

Function 43

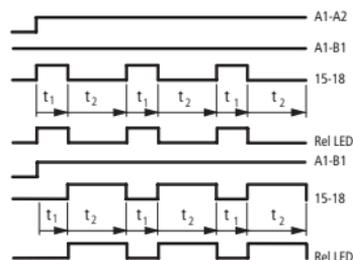
Flashing, pause initiated



After the voltage U_s has been applied to A1 and A2 the changeover contact of the output relay stays in position 15-16 for the set flashing time and, after this time, goes to position 15-18 (the cycle begins with a pause phase).

Function 44

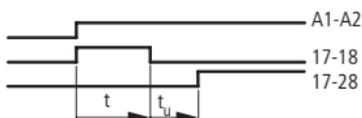
Flashing, two speeds



After the voltage U_s has been applied to A1 and A2 the changeover contact of the output relay goes to position 15-18 (pulse begin). By bridging the contacts A1 and Y1 the relay can be switched to pause begin. The times t_1 and t_2 can be set to different times.

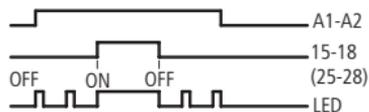
Function 51 Star-delta

On-delayed



If the control voltage U_s is applied to A1 and A2, the instantaneous contact switches to position 17-18. After the set time the instantaneous contact opens; the timing contact 17-28 closes after a changeover time t_u of 50 ms.

On-Off Function



The On-Off function allows the operation of a control system to be tested and is an aid, for example, for commissioning. The Off function allows the output relay to be de-energized so that it no longer reacts to the functional sequence. The On function energizes the output relay. This function is dependent on the supply voltage being applied to the terminals A1/A2. The LED indicates the operational status.

Further information sources

Installation instructions

- DILET...: AWA2527-1587
- ETR4...: AWA2527-1493, AWA2527-1485
- ETR2...: AWA2527-2372

Main catalogue for industrial switchgear,
Section 4 "Timing relays"

Switching, control, visualisation

EMR4 measuring and monitoring relays

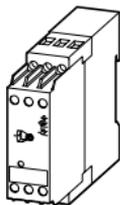
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General

For the various applications measurement and monitoring relays are necessary. With the new EMR4 range Moeller covers a large number of requirements:

- general use, current monitor EMR4-I
- space saving monitoring of the rotary field phase sequence relay EMR4-F
- protection against destruction or damage of single system parts, phase monitoring relay EMR4-W
- safe recognition of phase failure, phase imbalance monitoring relay EMR4-A
- increased safety by motor current principle, level relay EMR4-N
- increased operational safety, insulation monitoring relay EMR4-R

Current monitoring relay EMR4-I



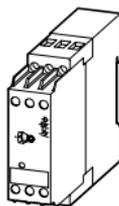
The current monitoring relay EMR4-I is suitable for monitoring AC as well as DC current. With the definable low and high current limits, pumps and drill machines can be monitored. That is due to the selectable under or over limit.

There are two versions, each with three measuring ranges (30/100/1000 mA, 1.5/5/15 A). The multi-voltage coil allows universal use of the relay. The two auxiliary changeover contacts allow a direct feedback.

Selected bridging of short current peaks

By using the selected time delay of between 0.05 and 30 s short current peaks can be bridged.

EMR4-W phase monitoring relay



The phase monitoring relay EMR4-W monitors the voltage height as well as the field rotation to provide protection against destruction or damage of single system parts. That means protection against destruction or damage of single system parts. Here the minimum low voltage and also the maximum overvoltage can be easily set to the required voltage within a defined range.

An ON- or Off delay can be set. In the On-delay position short voltage breaks can be bridged. The off-delay position allows a failure storage for the set time.

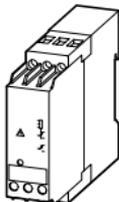
Switching, control, visualisation

EMR4 measuring and monitoring relays

The delay time can be set between 0.1 and 10 s.

The relay activates with the correct rotation and voltage. After drop-out the device reactivates when a the voltage exceeds a 5 % hysteresis.

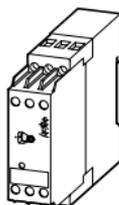
Phase sequence relay EMR4-F



The phase sequence relay with a width of only 22.5 mm monitors the rotating field of portable motors for which the rotation direction is important (such as pumps, saws, drilling machines). This protects the motor from damage. The narrow mounting width saves space in the control panel.

With a correctly rotating field the changeover contact switches the control voltage of the motor switching device. The EMR4-F500-2 covers the total voltage range from 200 to 500 V AC.

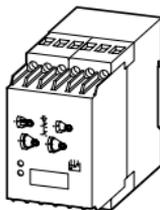
Phase imbalance relay EMR4-A



The 22.4 mm wide EMR4-A phase imbalance relay provides protection against phase to protect motors against destruction.

Because the phase failure is determined through the phase shift, it can also be reliably detected to prevent motor overload in the event of a high motor feedback. The relay protects motors with a rated voltage of $U_n = 380 \text{ V}$, 50 Hz.

Level monitoring relay EMR4-N



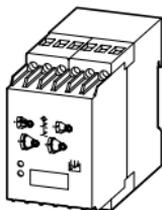
The level monitoring relay EMR4-N is used mostly as dry running protection for pumps or for level regulation of liquids. It operates with sensors that measure conductivity. A sensor is required for the maximum and also a sensor for the minimum level. A third sensor is used for earth potential.

The 22.5 mm wide device EMR4-N100 is suitable for conductive liquids. It can be switched from level regulation to dry running protection. The safety is increased as in both cases the motor current principle is used.

Switching, control, visualisation

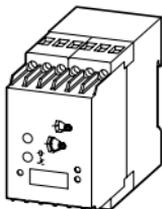
EMR4 measuring and monitoring relays

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The level monitoring relay EMR4-N500 has a higher sensitivity and is suitable for less conductive liquids. Due to an integrated rise and fall delay of between 0.1 and 10 s moving liquids can also be monitored.

EMR4-R insulation monitoring relay



EN 60204 "Safety of machines" provides increased operational safety by monitoring the control voltage circuit for earth-fault using an insulation monitor. This is the main application for the EMR4-R. There are similar requirements in medical applications.

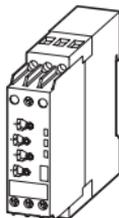
An earth-fault is signalled via a changeover contact so that a fault can be cleared without expensive down time.

The device has a selectable fault memory so that the fault must be acknowledged after its removal. A Test button allows the device to be checked for correct operation at any time.

AC or DC control voltage

Devices for AC and for DC are available, which cover the total control voltage range. The DC device has a multi-voltage source and can therefore also be used for AC.

Multifunctional EMR4-AW(N) three-phase monitors



The multifunctional three-phase monitors provide space saving monitoring of rotating fields. They feature a range of phase parameter measuring functions for phase sequence, phase failure, phase imbalance as well as undervoltage and overvoltage.

Depending on device type, the threshold value for phase imbalance can be set between 2 and 15 %. The threshold values for undervoltage and overvoltage are fixed or adjustable.

Switching, control, visualisation

EMR4 measuring and monitoring relays

The different options and setting values are explained in the applicable installation instructions. The function "with neutral conductor monitoring" is a new feature of the EMR4-AWN... models.

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Further information sources

Installation instructions

- Phase imbalance monitoring relay EMR4-A400-1 AWA2431-1867
- Insulation monitoring relay EMR4-RAC-1-A AWA2431-1866
- Insulation monitoring relay EMR4-RDC-1-A AWA2431-1865
- Level monitoring relay EMR4-N100-1-B AWA2431-1864
- Phase sequence relay EMR4-F500-2 AWA2431-1863
- Phase monitoring relay EMR4-W... AWA2431-1863
- Current monitoring relay EMR4-I... AWA2431-1862
- Measuring/monitoring relays: 3-phase monitors EMR4-A..., EMR4-AW..., EMR4-AWN..., EMR4-W... AWA2431-2271

Main catalogue Industrial Switchgear, Section 4 "monitoring relays".

Switching, control, visualisation

The way to the safe machine

1 Safety Technology

Control the unexpected

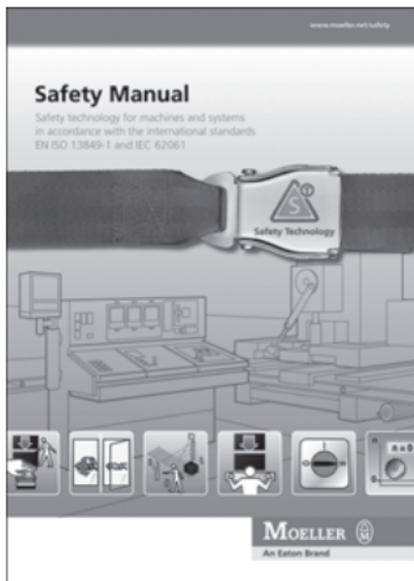
The international standard EN ISO 12100-1 "Safety of machinery - Basic concepts, general principles for design" provide the design engineer with detailed assistance in the identification of hazards and the resulting risks to be assessed.

This therefore lays down the technical measures for the reduction of hazards.

The parts of machine control systems that handle safety tasks are defined as the "safety-related parts of control systems" (SRP/CS). Safety-related control systems comprise the entire safety function consisting of the input level (sensor), the logic (safety signal processing) and the output level (actuator).

For reducing risks by means of SRP/CS, Moeller offers the right components with safety technology in accordance with the most stringent requirements stipulated in the safety standards EN 954-1, EN ISO 13849-1 and EN IEC 62061/61508. The appropriate safety functions are used according to the application field and the necessary hazard protection.

Further information on the previous and the new international safety standards as well as circuit examples for a wide range of applications are provided in the latest version of the Moeller Safety Applications Technical Guide TB0200-009.



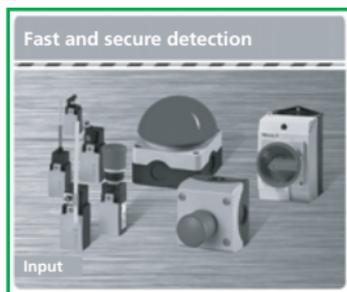
The safety manual helps you by means of practical safety circuit examples and the associated calculations to determine safety performance in accordance with EN ISO 13849-1 and EN IEC 62061.

Further technical information on the individual safety products is provided at

www.moeller.net/Safety.

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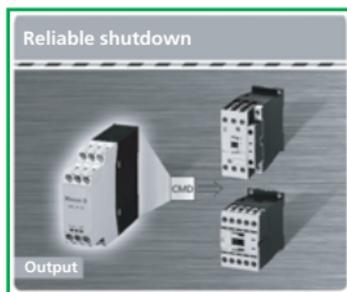
The way to the safe machine



Detecting hazards quickly with RMQ-Titan and FAK emergency-stop buttons.
Motion safety under control with LS-Titan® position switches.
Safe switching, disconnection and control with T rotary switches and P switch-disconnectors.



Safe monitoring and processing with ESR safety relays and easySafety control relay.



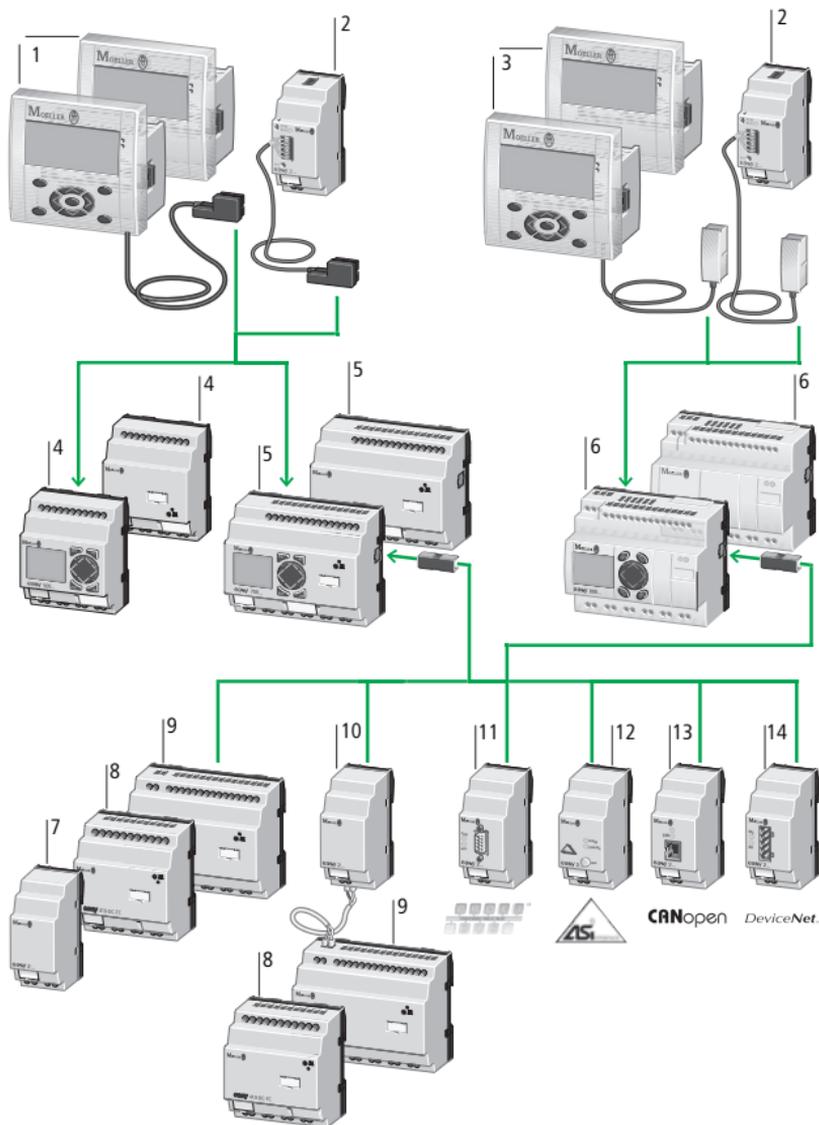
Reliable disconnection with DILM contactors and CMD contactor monitoring relay.

Switching, control, visualisation

System overview easy

easyRelay

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Switching, control, visualisation

System overview easy

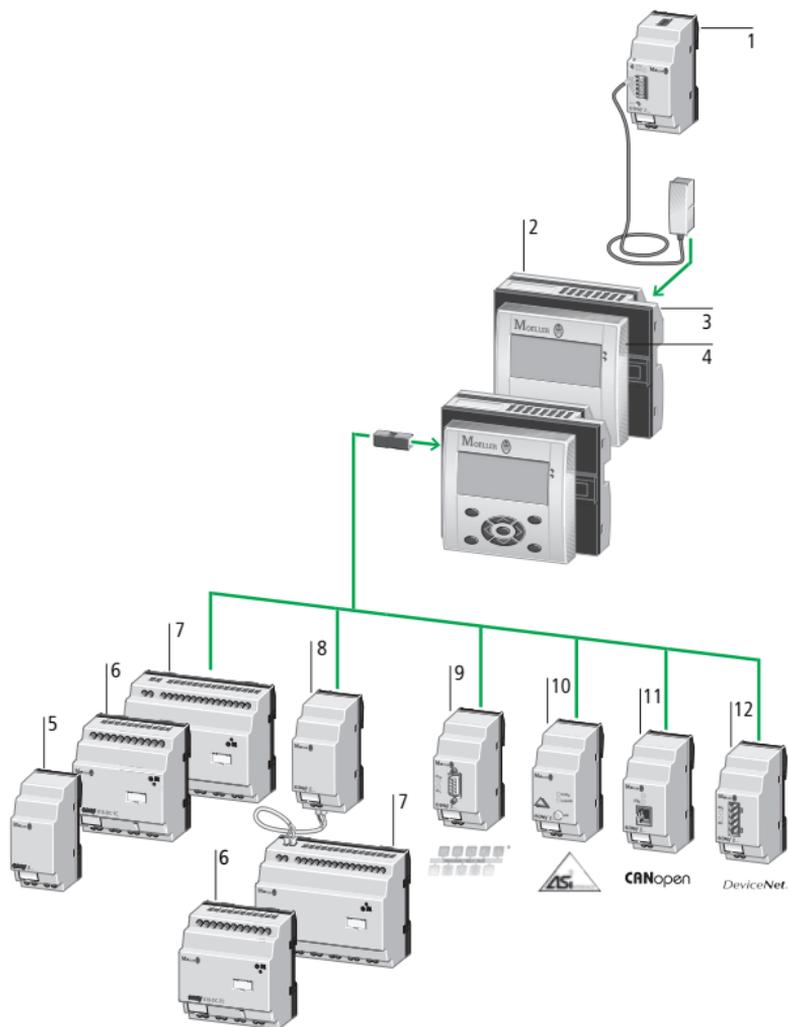
- 1) Detachable display MFD-80... and MFD(-AC)-CP4-500
- 2) Ethernet-Gateway EASY209-SE
- 3) Detachable display MFD-80... and MFD(-AC)-CP4-800
- 4) Basic device easy500
- 5) Basic device easy700, expandable
- 6) Basic unit easy800, expandable, networkable via easyNet
- 7) EASY202-RE output expansion
- 8) easy410 I/O expansion
- 9) easy6... I/O expansion
- 10) Coupling unit EASY200-EASY for remote expansion of easy700, easy800
- 11) Expansion unit for networking PROFIBUS-DP EASY204-DP
- 12) Expansion unit for networking AS-Interface EASY205-ASI
- 13) Expansion unit for networking CANopen EASY221-CO
- 14) Expansion unit for networking DeviceNet EASY222-DN

Switching, control, visualisation

System overview easy

easyHMI

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Switching, control, visualisation

System overview easy

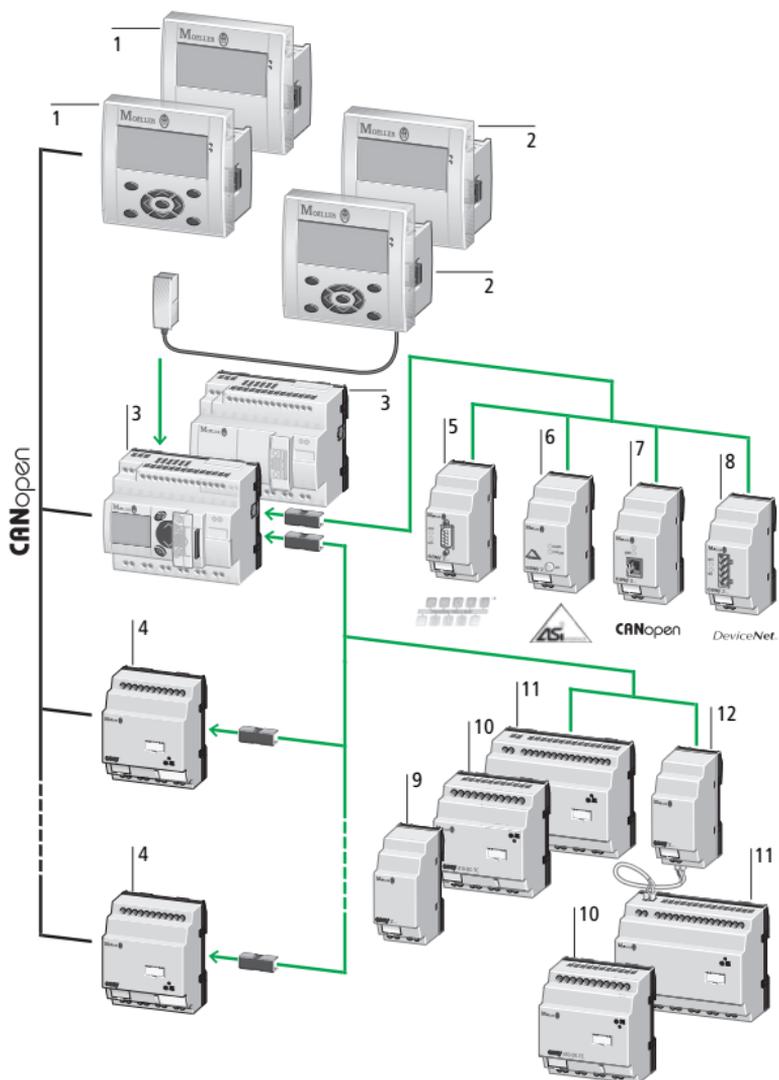
- 1) Ethernet gateway EASY209-SE
- 2) I/O module with or without temperature measuring for MFD-Titan
- 3) Power supply unit/CPU MFD(-AC)-CP8...
- 4) Display/operating unit MFD-80...
- 5) EASY202-RE output expansion
- 6) easy410 I/O expansion
- 7) easy6... I/O expansion
- 8) Coupling unit EASY200-EASY for remote expansion of MFD(-AC)-CP8...
- 9) Expansion unit for networking PROFIBUS-DP EASY204-DP
- 10) Expansion unit for networking AS-Interface EASY205-ASI
- 11) Expansion unit for networking CANopen EASY221-CO
- 12) Expansion unit for networking DeviceNet EASY222-DN

Switching, control, visualisation

System overview easy

easyControl

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Switching, control, visualisation

System overview easy

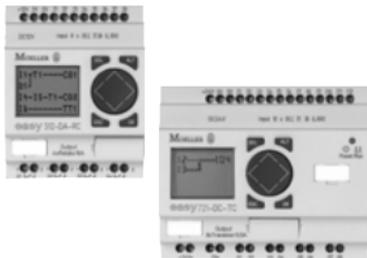
- 1) CANopen connection for MFD-80... and MFD-CP4-CO
- 2) Detachable display MFD-80... and MFD(-AC)-CP4-800
- 3) Basic device EC4P-200
- 4) CANopen I/O expansion EC4E...
- 5) Expansion unit for networking PROFIBUS-DP EASY204-DP
- 6) Expansion unit for networking AS-Interface EASY205-ASI
- 7) Expansion unit for networking CANopen EASY221-CO
- 8) Expansion unit for networking DeviceNet EASY222-DN
- 9) EASY202-RE output expansion
- 10) easy410 I/O expansion
- 11) easy6... I/O expansion
- 12) Coupling unit EASY200-EASY for remote expansion of EC4P-200

Switching, control, visualisation

System overview easy

Functions easy

easy500 and easy700



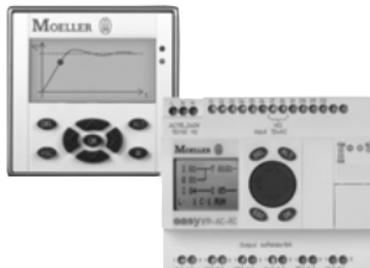
easy500 and easy700 have the same functions. easy700 offers more inputs and outputs, is expandable and can be connected to a standard bus system. The series and parallel linking of four contacts and coils takes place in up to 128 current paths. The units have three contacts and a coil in series. The display of 16 operating and report texts is via an internal or external display.

The main functions are:

- Multi-function timing relay,
- current impulse relay,
- counters
 - forwards and backwards,
 - fast counter,
 - frequency counters,
 - operational time counter,
- analog value comparator,
- week and year time switch,
- automatic summertime changeover,
- retentive actual values of markers, numbers and timing relays.

easy500 and easy700 can be custom-labelled.

MFD(-AC)-CP8... and easy800



MFD...CP8... and easy800 have the same functions. With its degree of protection MFD-80...with IP65 can also be used in harsh environments. In addition for expansion and connection to standard bus systems eight easy800 or MFD-Titan units can be networked via easyNet. The series and parallel linking of four contacts and coils takes place in up to 256 current paths. The units have four contacts and a coil in series. The display of 32 operating and report texts is via an internal or external display.

In addition to the functions offered by easy700 the easy800 and the MFD-Titan feature:

- PID controller,
- arithmetic modules,
- value scaling,
- and much more.

MDF-80 and easy800 can be custom-labelled.

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System overview easy

easyControl: EC4P-200



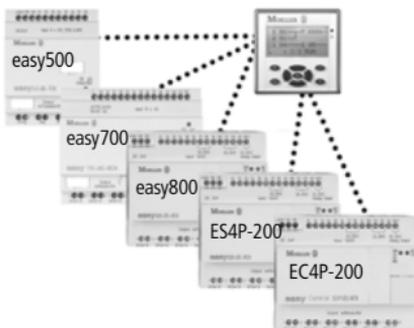
easyControl is the obvious successor to the easyRelay. The easyControl EC4P-200 can be used for implementing both small and medium-sized automation solutions. The easyControl can be combined with the standard easyRelaysystem as well as with virtually all automation devices via the integrated CANopen interface.

With Ethernet on board, additional requirements such as OPC server and network programming are provided for.

The easyControl EC4P-200 comes with a powerful CPU and an internal 256 KByte program memory.

The EC4P-200 is programmed with easySoft-CoDeSys (ECP-SOFT) based on IEC 61131-3.

“Detachable” display – text display for easyRelay, easySafety and easyControl with IP65 protection



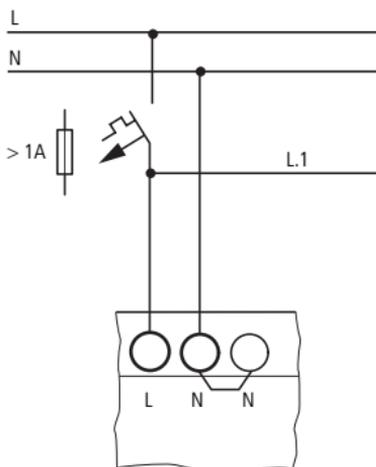
The plug & play functionality allows you to connect the MFD-80.. display to the easyRelay, easySafety or easyControl via MFD-CP4.. power supply and communication module. The MFD-CP4.. has an integrated 5 m connection cable which can be shortened as required. This has the advantage that no software or drivers are required for connection. The MFD-CP4.. offers genuine plug & play capabilities. The inputs and outputs are wired on the easyRelay, easySafety and easyControl. The MFD-80.. is mounted using 22.5 mm fixing holes. The IP65 display is backlit and offers a easy to read display. The display can be labelled to individual requirements.

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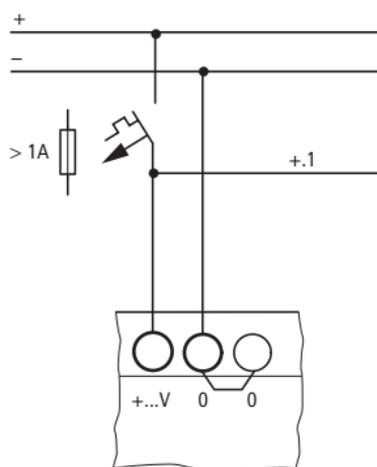
Engineering easy

Power supply connection

for AC devices



for DC devices



Basic devices

EASY512-AB-...	24 V AC
EASY719-AB-...	24 V AC
EASY512-AC-...	115/230 V AC
EASY719-AC-...	115/230 V AC
EASY819-AC-...	115/230 V AC

MFD-AC-CP8-...	115/230 V AC
----------------	--------------

Expansion devices

EASY618-AC...	115/230 V AC
---------------	--------------

Basic devices

EASY512-DA-...	12 V DC
EASY719-DA-...	12 V DC
EASY512-DC-...	24 V DC
EASY7...-DC-...	24 V DC
EASY819-DC-...	24 V DC
EASY82...-DC-...	24 V DC

ES4P-...	24 V DC
----------	---------

EC4P-200	24 V DC
----------	---------

MFD-CP8-...	24 V DC
-------------	---------

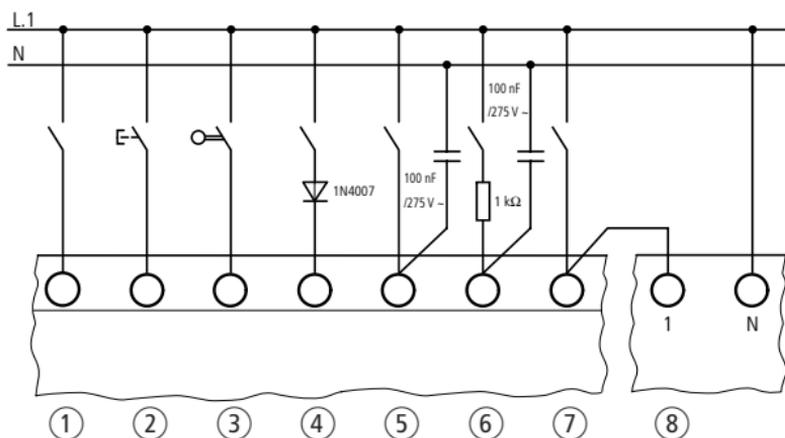
Expansion devices

EASY410-DC...	24 V DC
EASY618-DC...	24 V DC
EASY620-DC...	24 V DC

Switching, control, visualisation

Engineering easy

Digital input connection of the AC devices



- ① Input signal via relay contact e.g. DILER
- ② Input signal via pushbutton RMQ Titan
- ③ Input signal via position switch e.g. LS-Titan
- ④ Conductor length 40 to 100 m for input without additional switching (e.g. easy700 I7, I8 already has addition switching, possible conductor length 100 m)
- ⑤ Increased input current
- ⑥ Limiting the input current
- ⑦ Increasing the input current with EASY256-HCI
- ⑧ EASY256-HCI ballast device

Note

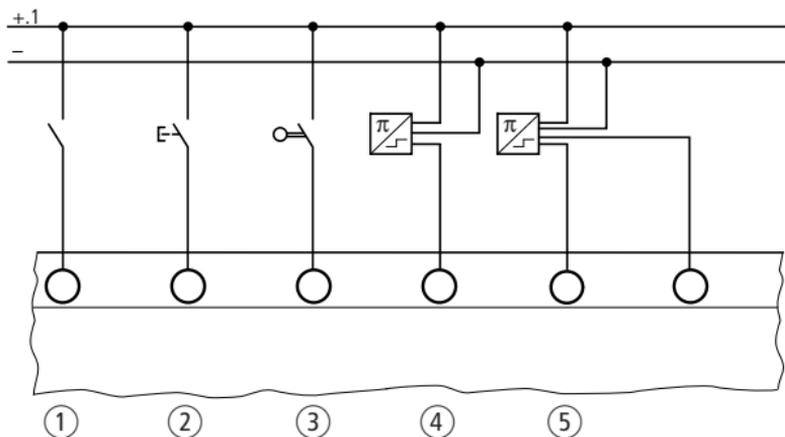
- Due to the input circuitry the drop-out time of the input is increased.
- Length of input conductor without additional circuit ≤ 40 m, with additional circuit ≤ 100 m.

Switching, control, visualisation

Engineering easy

Digital input connection of the DC devices

1



- ① Input signal via relay contact e.g. DILER
- ② Input signal via pushbutton RMQ Titan
- ③ Input signal via position switch e.g. LS-Titan
- ④ Proximity switch, three-wire
- ⑤ Proximity switch, four-wire

Note

- Consider the voltage drop across the used conductor length.
- Because of the high residual currents, two-wire proximity switches should not be used.

Switching, control, visualisation

Engineering easy

Analog inputs

Depending upon the device two or four 0 to 10 V inputs are available.

The resolution is 10-bit = 0 to 1023.

The following applies:

I7 = IA01	}	EASY512-AB/DA/DC...
I8 = IA02		
	}	EASY719-AB/DA/DC... EASY721-DC...
I11 = IA03		
	}	EASY819/820/821/822-DC... MFD-R16, MFD-R17, MFD-T16, MFD-TA17 EC4P-200
I12 = IA04		

Caution!

Analog signals are more sensitive to interference than digital signals so that more care must be taken when laying and connecting the signal cables. Incorrect switching states may occur if they are not connected correctly.

- Use shielded twisted pair cables to prevent interference with the analog signals.

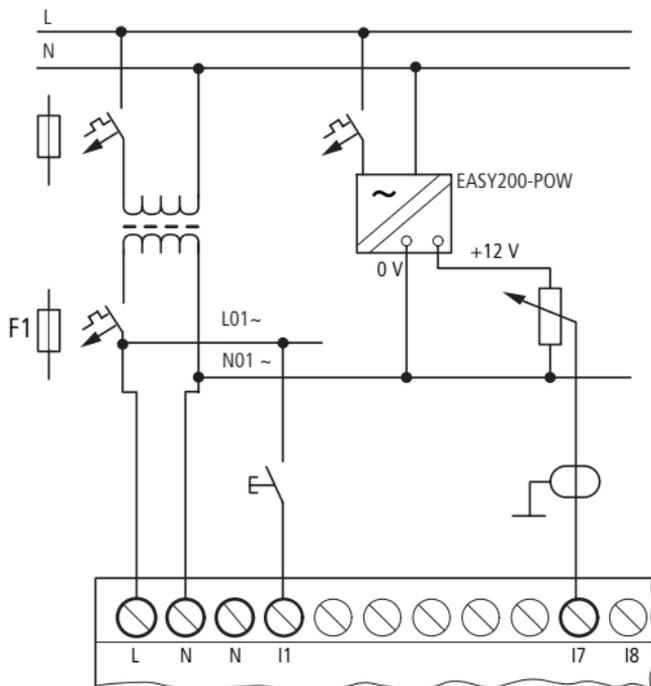
- With short cable lengths, ground the shield at both ends using a large contact area. If the cable length is more than around 30 m, grounding at both ends can result in equalisation currents between the two grounding points and thus in the interference of analog signals. In this case, only ground the cable at one end.
- Do not lay signal lines parallel to power cables.
- Connect inductive loads to be switched via the easy outputs to a separate power feed, or use a suppressor circuit for motors and valves. Supplying loads such as motors, solenoid valves or contactors and easy from the same power supply may cause interference of the analog input signal when switching.

Switching, control, visualisation

Engineering easy

Connecting power supply and analog inputs for easy...AB device

1



Note

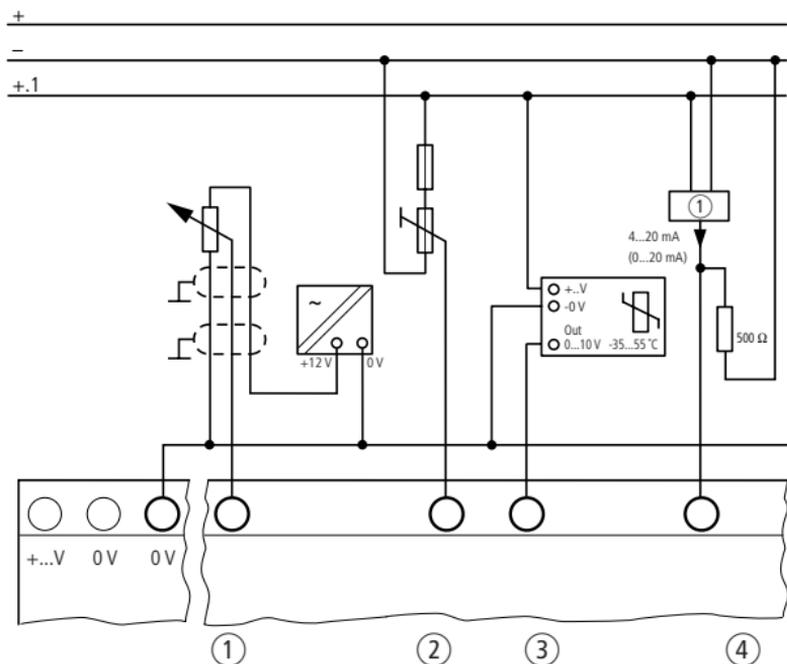
With easy.... AB devices that process analog signals, the device power must be supplied through a transformer so that the device is isolated from the mains supply. The neutral conductor and the reference potential of DC-supplied analog sensors must be electrically connected.

Ensure that the common reference potential is earthed or monitored by an earth fault monitoring device. Observe the applicable regulations.

Switching, control, visualisation

Engineering easy

Connecting analog inputs of easy...DA/DC-... or MFD-R.../T... or EC4P-200



- ① Setpoint potentiometer via separate power supply and potentiometer $\leq 1 \text{ k}\Omega$, e.g. $1 \text{ k}\Omega$, 0.25 W
 - ② Setpoint potentiometer with upstream resistor $1.3 \text{ k}\Omega$, 0.25 W, potentiometer $1 \text{ k}\Omega$, 0.25 W (values for 24 V DC)
 - ③ Temperature monitoring via temperature sensor and transducer
 - ④ Sensor 4 to 20 mA with resistor 500Ω
- Connect the 0 V of the or the MFD-Titan with the 0 V of the power supply of the analogue encoder.
 - Sensor of 4(0) to 20 mA and a resistance of 500Ω give the following approx. values:
 - 4 mA $\approx 1.9 \text{ V}$,
 - 10 mA $\approx 4.8 \text{ V}$,
 - 20 mA $\approx 9.5 \text{ V}$.
 - Analogue input 0 to 10 V, resolution 10-bit, 0 to 1023.

Note

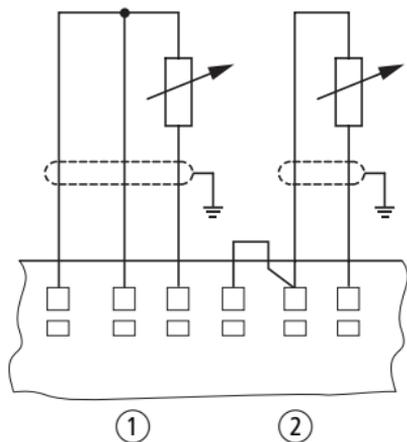
- Pay attention to the differing number and designation of the analogue inputs of each device type.

Switching, control, visualisation

Engineering easy

Connecting Pt100/Ni1000 with MFD-T(A)P...

1



- ① Three wire connection ② Two wire connection

MFD-TAP13-PT-A	-40 °C ... +90 °C
MFD-TP12-PT-A	0 °C ... +250 °C
	0 °C ... +400 °C
MFD-TAP13-NI-A	0 °C ... +250 °C
MFD-TP12-NI-A	-40 °C ... +90 °C
MFD-TAP13-PT-B	0 °C ... +850 °C
MFD-TP12-PT-B	-200 °C ... +200 °C

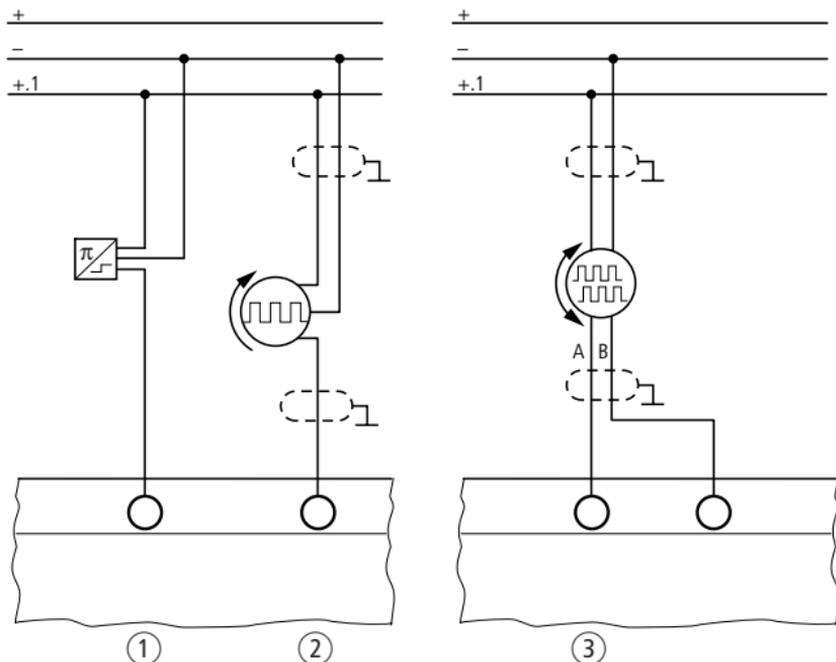
Note

Cable length, shielded < 10 m.

Switching, control, visualisation

Engineering easy

Connecting "high-speed counters", "frequency generators" and "incremental encoders" on easy...DA/DC devices or MFD-R.../T... or EC4P-200



- ① High-speed counters, square wave signal via proximity switch, mark to space ratio should be 1:1
 easy500/700 max. 1 kHz
 easy800 max. 5 kHz
 MFD-R/T... max. 3 kHz
 EC4P-200 max. 50 kHz
- ② Square wave signal via frequency generator, mark to space ratio 1:1
 easy500/700 max. 1 kHz
 easy800 max. 5 kHz
 MFD-R/T... max. 3 kHz
 EC4P-200 max. 50 kHz
- ③ Square wave signals via 24 V DC incremental encoder
 easy800-DC... and MFD-R/T... max. 3 kHz
 EC4P-200 max. 40 kHz

Note

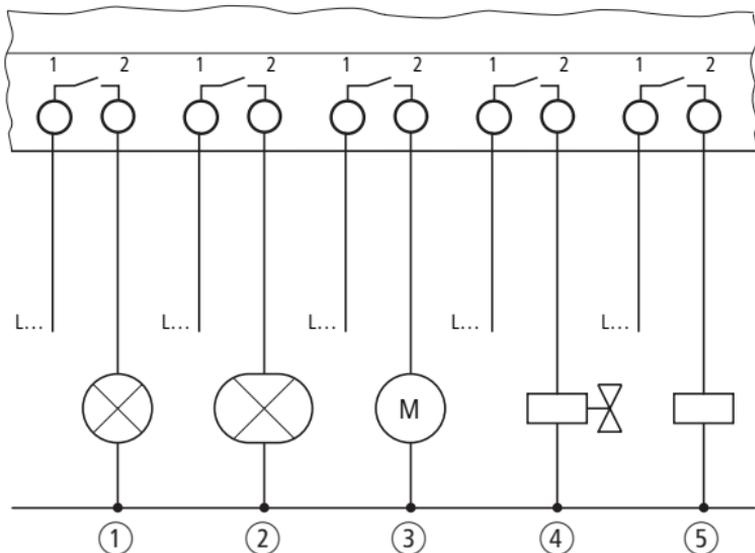
Observe the different number and designation of the inputs of the "fast counter", "frequency generator" and "incremental encoder" for each device type.

Switching, control, visualisation

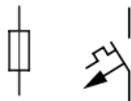
Engineering easy

Connecting relay outputs on EASY...R, MFD...R and EC4P...MR, ES4P...

1



Fuse protection switch potential L..



≤ 8 A/B16

Possible AC voltage range:

24 to 250 V, 50/60 Hz

e.g. L1, L2, L3 phase to zero conductor

Possible DC voltage range:

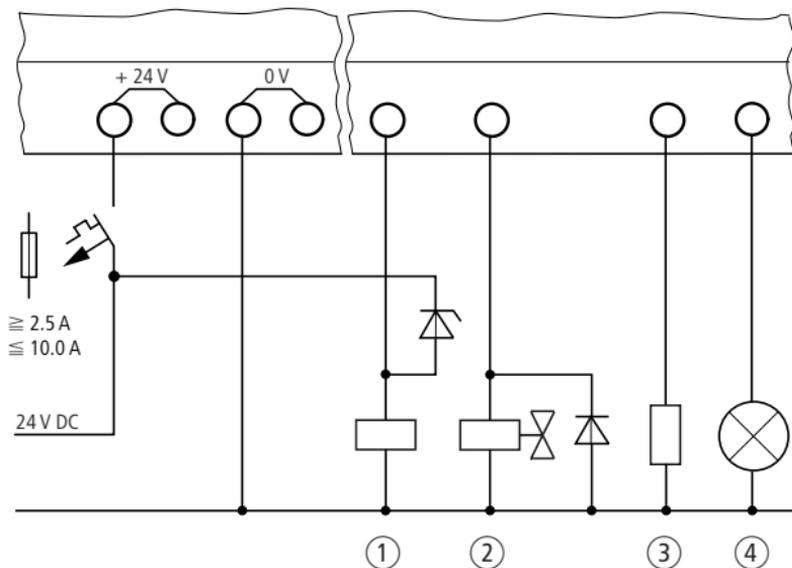
12 to 300 V DC

- ① Lamp, max. 1 000 W at 230/240 V AC
- ② Fluorescent tube, max. 10 × 28 W with electronic starter, 1 × 58 W with conventional starter at 230/240 V AC
- ③ AC motor
- ④ Valve
- ⑤ Coil

Switching, control, visualisation

Engineering easy

Connecting transistor outputs on EASY...T, MFD-T... and EC4P...MT, ES4P...



- ①  Contactor coil with zener diode as suppressor, 0.5 A at 24 V DC
- ②  Valve with diode as protective element, 0.5 A at 24 V DC
- ③  Resistor, 0.5 A at 24 V DC
- ④  Indicator lamp 3 or 5 W at 24 V DC, Output dependant upon device types and outputs

If inductive loads are not suppressed, the following applies:

Several inductive loads should not be switched off simultaneously to avoid overheating the driver blocks in the worst possible case. If in the event of an emergency stop the +24 V DC power supply is to be switched off by means of a contact, and if this would mean switching off more than one controlled output with an inductive load, these inductive loads must be provided with a suppressor circuit.

Note

Please note the following when switching off inductive loads:

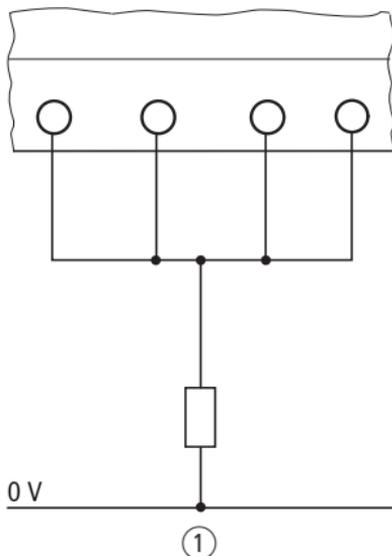
Suppressed inductive loads cause less interference in the entire electrical system. It is generally recommended that the suppressor is connected as close as possible to the inductive load.

Switching, control, visualisation

Engineering easy

Parallel connection

1



① Resistor

Note

The outputs must be connected only in parallel within a group (Q1 to Q4 or Q5 to Q8, S1 to S4 or S5 to S8); Q1 and Q3 or Q5, Q7 and Q8. Parallel outputs must be activated simultaneously.



if 4 outputs in parallel,
max. 2 A at 24 V DC



if 4 outputs in parallel,
max. 2 A at 24 V DC
Inductance without suppression
max. 16 mH



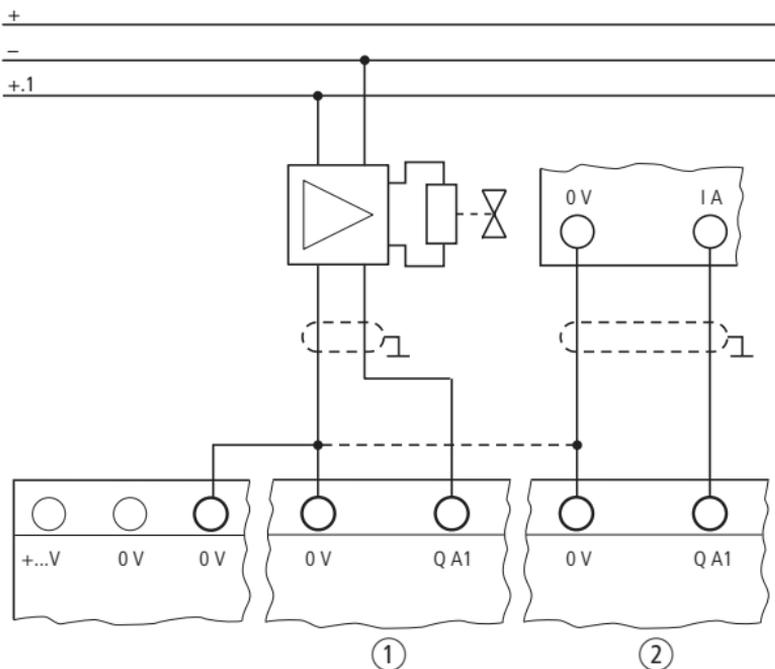
12 or 20 W at 24 V DC
Output dependant upon device types and
outputs

Switching, control, visualisation

Engineering easy

Connecting analog output on EASY820-DC-RC..., EASY822-DC-TC..., MFD-RA..., MFD-TA..., EC4P...MTA, EC4P...MRA...

1



- ① Servo valve control
- ② Set value selection for drive control

Note

- Analog signals are more sensitive to interference than digital signals, greater care must be therefore taken when routing signal cables. Incorrect switching states may occur if they are not connected correctly.
- Analogue output 0 to 10 V, Resolution 10-bit, 0-1023.

Switching, control, visualisation

Engineering easy

Input/output expansion easy

1

Central expansion, up to 40 I/O

easy700, easy800, MFD(-AC)-CP8... as well as EC4P-200 can be expanded with easy202, easy410, easy618 or easy620. This provides you with up to 24 inputs and 16 outputs. One expansion device per basic unit is possible, → section "Central and remote expansion **easy**", page 1-33.

Remote expansion, up to 40 I/O

easy700, easy800, EC4P-200 and MFD-Titan are expanded with easy410, easy618 or easy620 using the EASY200-EASY coupling module. The expansion device can be operated up to 30 m from the basic device. There are a maximum of 24 inputs and 16 outputs available. One expansion device per basic unit is possible, → section "Central and remote expansion **easy**", page 1-33.

Networking via **easyNet**, up to 320 I/O

Up to eight stations can be interconnected by expanding the inputs and outputs via **easyNet**. An expansion device can be added to each easy800, MFD(-AC)-CP8... or EC4P-200. A network length of up to 1 000 m is possible. There are two types of operation:

- A master (position 1, station address 1) and up to 7 other stations. The program is contained in the master.
- A master (space 1, station address 1) and up to 7 other "intelligent" or "dumb" stations. Each "intelligent" station has a program.

→ section "**easyNet**, "loop through the device" network connection", page 1-34

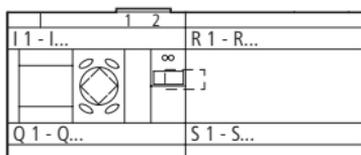
Networking via **CANopen** (**easyControl**)

easyControl makes it possible to create networks via **CANopen**. For this the digital or analog I/O expansion modules EC4E... can be used. Another **easy** expansion module can be then connected to this (e.g. **easy410**, **easy618**, **easy620**). Observe the **CANopen** specification! → section "Network connection, **CANopen**", page 1-39

Switching, control, visualisation

Engineering easy

Central and remote expansion easy

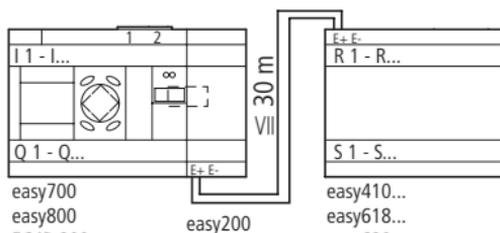


easy700
easy800
EC4P-200
ES4P

easy202...
easy410...
easy618...
easy620...

Central expansion

1



easy700
easy800
EC4P-200
ES4P

easy200

easy410...
easy618...
easy620...

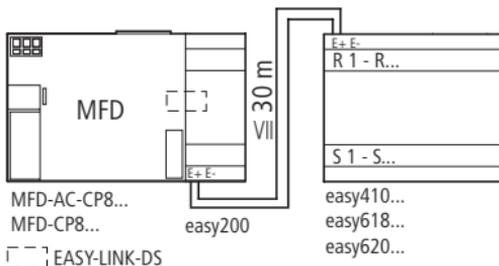
Remote expansion



MFD-AC-CP8...
MFD-CP8...

easy202...
easy410...
easy618...
easy620...

Central expansion



MFD-AC-CP8...
MFD-CP8...

easy200

easy410...
easy618...
easy620...

□ □] EASY-LINK-DS

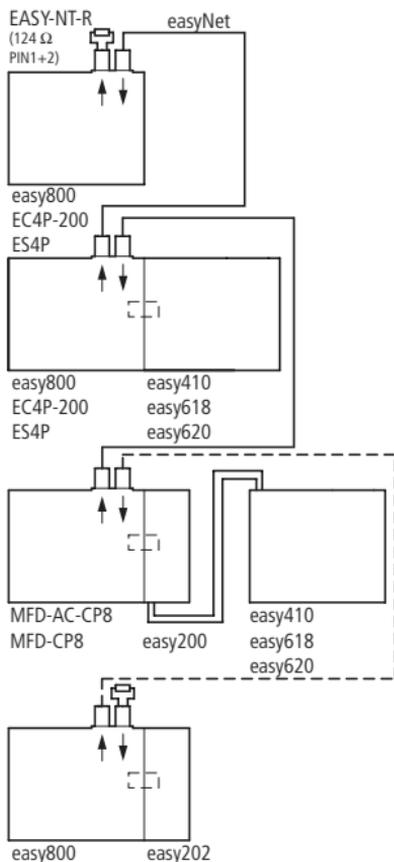
Remote expansion

Switching, control, visualisation

Engineering easy

easyNet, "loop through the device" network connection

1



□ □ □ EASY-LINK-DS

- Addressing the stations:
 - Automatic addressing of from station 1 or via easySoft... from the PC, **physical location = station**,
 - Single addressing on the corresponding device or via easySoft... on each station, **geographic location and station can be different**.

Geographic location, position ¹⁾	Station Example 1	Example 2
1	1	1
2	2	3
3	3	8
8	8	2

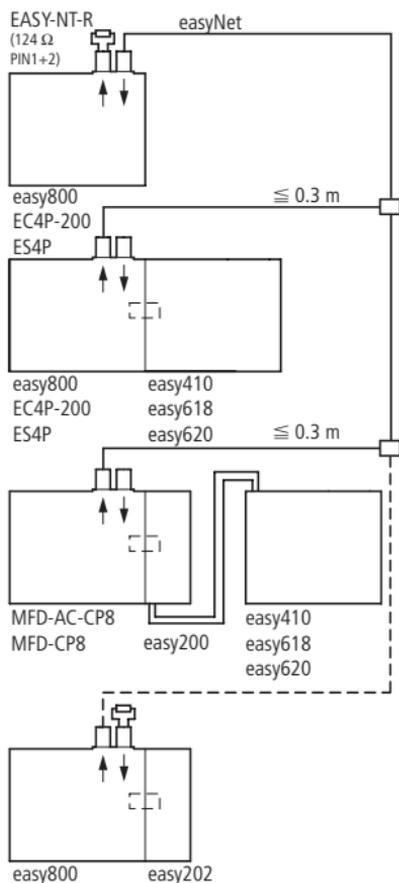
1) 1)The geographic location/place 1 **always** has the device address 1.

- The maximum length easyNet is 1000 m.
- Should easyNet be interrupted or a device is not operational, the network is no longer active from the interrupted point.
- Unscreened 4-core cable, each two cores twisted. Characteristic impedance of the cable must be 120 Ω.

Switching, control, visualisation

Engineering easy

easyNet, network connection "T piece with spur cable"



□ □ EASY-LINK-DS

- Addressing the stations:
 - Single addressing on corresponding device or via easySoft... on every device.
- The max. total length, including spur cables, with easyNet is 1 000 m.
- The max. length of T pieces for easy800 or for MFD-Titan is 0,30 m.

Geographic location, position ¹⁾	Station Example 1	Example 2
1	1	1
2	2	3
3	3	8
8	8	2

1) The geographic location/place 1 **always** has the station address 1.

- If easyNet is interrupted between the T piece and the device, or a device is not operational, the network is still active for the remaining devices.
- Unscreened 4-core cable, each two cores twisted. Three cores are required. Characteristic impedance of the cable must be 120 Ω.

Switching, control, visualisation

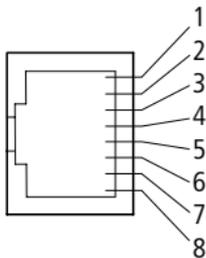
Engineering easy

Network connection easyNet

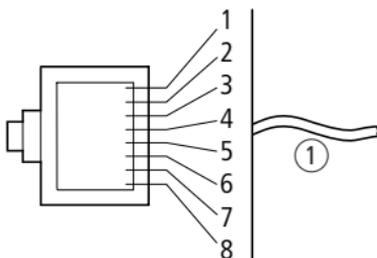
1

RJ 45 sockets and plugs

Connection layout of RJ45 socket on easy and MFD-Titan.



Connection layout of the RJ45 plug on the easy, MFD(-AC)-CP8..., EC4P-200 and ES4P.



① Cable entry side
8-pole RJ45, EASY-NT-RJ45

Pin assignment for easyNet

PIN 1; ECAN_H; Data conductor; conductor pair A

PIN 2; ECAN_L; Data conductor; conductor pair A

PIN 3; GND; ground conductor; conductor pair B

PIN 4; SEL_IN; Select conductor; conductor pair B

Assembly of the network cable for easyNet

The characteristic impedance of the cable must be **120 Ω**.

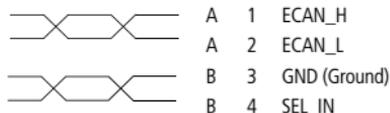
The network cable does not require a screen braid.

If a network cable with shield braid is used, the braid does not have to be connected to PE. If a PE connection is required nevertheless, the screen braid must be connected to PE at **only one end**.

Note

Cable lengths and cross-sections → table, page 1-38.

The minimum operation with easyNet functions with cables ECAN_H, ECAN_L, GND. The SEL_IN cable is used only for automatic addressing.



Bus terminating resistor

A bus terminal resistor must be connected to the physically first and last device in the network:

- Rating of the bus terminal resistor 124 Ω,
- connect to PIN 1 and PIN 2 of the RJ-45 plug,
- connection plug : EASY-NT-R.

Switching, control, visualisation

Engineering easy

Prefabricated cables, RJ45 plug at both ends

Cable length [cm]	Type designation
30	EASY-NT-30
80	EASY-NT-80
150	EASY-NT-150

User prepared cables

100 m 4 × 0.14 mm²; twisted pair:
EASY-NT-CAB

RJ45 plug:
EASY-NT-RJ45

Crimping tool for RJ45 plug: EASY-RJ45-TOOL.

Calculating cross-section with known cable lengths

The minimum cross-section is determined for the known maximum expansion of the network.

l = Length of conductor in m

S_{\min} = minimum cross-section in mm²

ρ_{Cu} = specific resistance of copper, unless otherwise stated 0.018 Ωmm²/m

$$S_{\min} = \frac{l \times \rho_{\text{Cu}}}{12.4}$$

Note

If the result of the calculation is not a standard cross-section, use the next highest standard cross-section.

Calculating length with known cable cross-section

For a known conductor cross section the maximum conductor length is calculated.

l_{\max} = Length of conductor in m

S = Conductor cross-section in mm²

ρ_{Cu} = specific resistance of copper, when nothing else state 0.018 Ωmm²/m

$$l_{\max} = \frac{S \times 12.4}{\rho_{\text{Cu}}}$$

Switching, control, visualisation

Engineering easy

1

Permissible network lengths with easyNet

Total cable length of easyNet m	Transmission speed Kbaud	Conductor cross-section, standardised		Bus conductor, minimum conductor cross-section mm ²
		EN mm ²	AWG	
≤ 6	≤ 1000	0.14	26	0.10
≤ 25	≤ 500	0.14	26	0.10
≤ 40	≤ 250	0.14	26	0.10
≤ 125	≤ 125 ¹⁾	0.25	24	0.18
≤ 175	≤ 50	0.25	23	0.25
≤ 250	≤ 50	0.38	21	0.36
≤ 300	≤ 50	0.50	20	0.44
≤ 400	≤ 20	0.75	19	0.58
≤ 600	≤ 20	1.0	17	0.87
≤ 700	≤ 20	1.5	17	1.02
≤ 1 000	=10	1.5	15	1.45

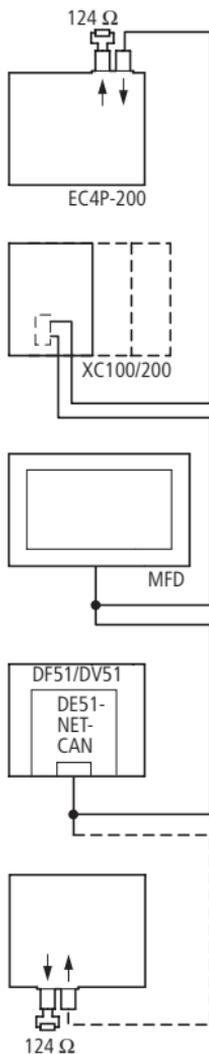
1) Factory setting

Switching, control, visualisation

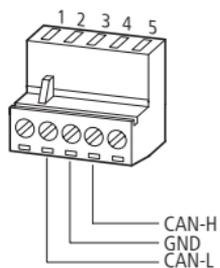
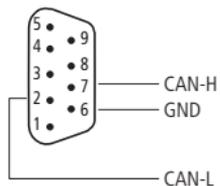
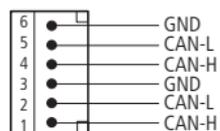
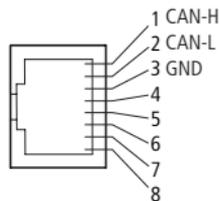
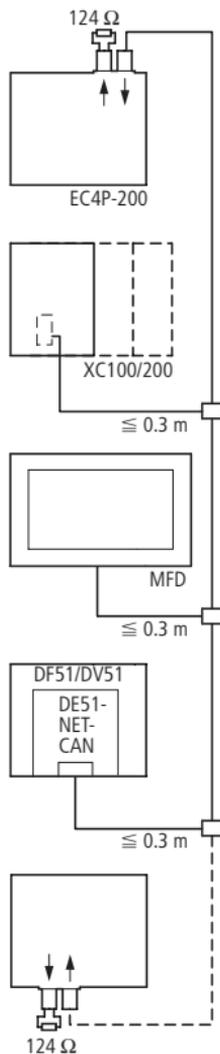
Engineering easy

Network connection, CANopen

Loop through the device



T piece with spur line



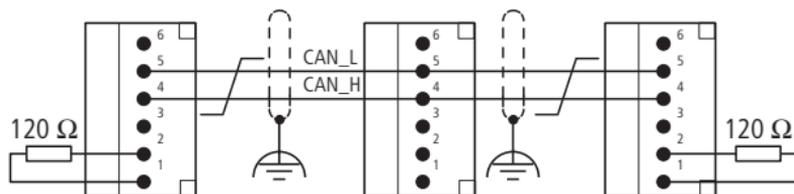
Switching, control, visualisation

Engineering easy

1

Bus terminating resistors

The ends of the network link must be terminated with $120\ \Omega$ bus termination resistors.



Terminals 1 and 4, 2 and 5, 3 and 6 are internally connected.

Properties of the CANopen cable

Use only a cable that is approved for CANopen with the following characteristics:

- Surge impedance $120\ \Omega$
- Capacitance per unit length $< 60\ \text{pF/m}$

The specifications for cable, connector and bus termination resistor are defined in ISO 11898.

Some requirements and specifications for the CANopen network are listed below.

The length of the CANopen bus cable depends on the conductor cross-section and the number of bus stations connected. The following table includes values for the bus length in relation to the cross-section and the connected bus stations, which guarantee a secure bus connection (table corresponds with the requirements of the ISO 11898).

Cable cross-section [mm]	Maximum length [m]		
	n = 32	n = 64	n = 100
0.25	200	170	150
0.5	360	310	270
0.75	550	470	410

n = number of connected bus users

If the bus length is greater than 250 m and/or are more than 64 stations connected, the ISO 11898 demands a residual ripple of the supply voltage of $\leq 5\ \%$.

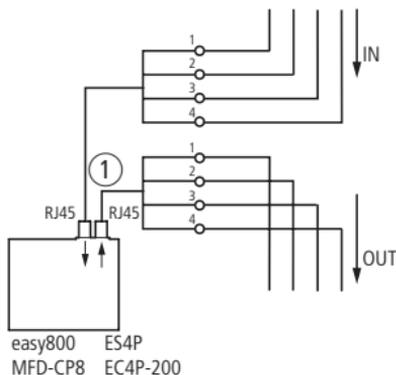
Switching, control, visualisation

Engineering easy

Network connection with cable cross-sections > 0.14 mm², AWG26

Network connect "through the device".

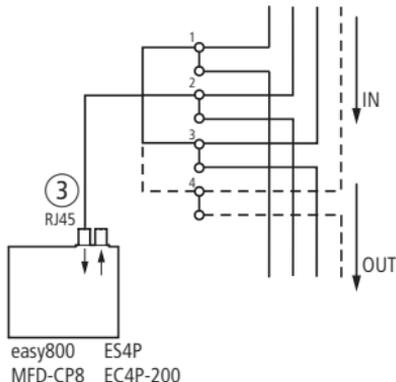
Example A, with terminals



① Recommendation ≤ 0.3 m

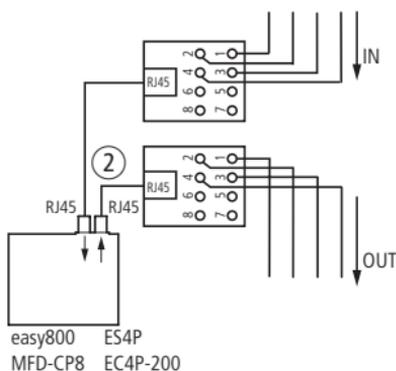
Network connection "T piece with spur cable"

Example A, with terminals



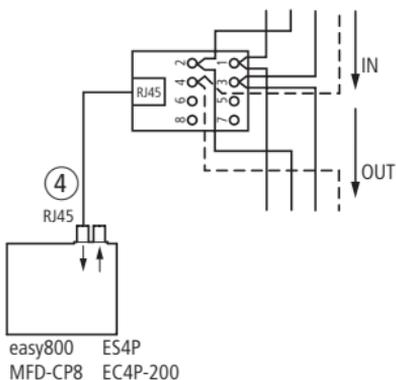
③ ≤ 0.3 m (3-core)

Example B, with interface element



② Recommendation ≤ 0.3 m (EASY-NT-30)

Example B, with interface element



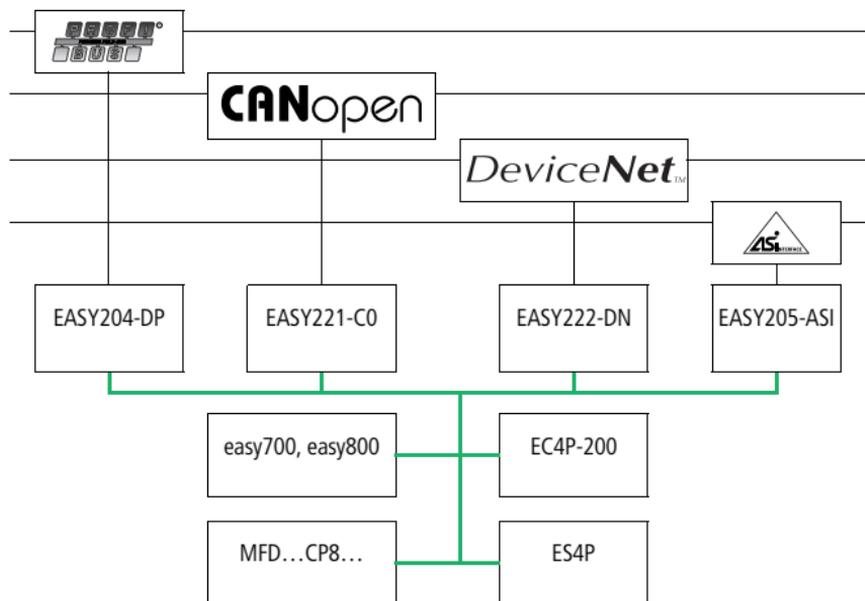
④ ≤ 0.3 m (EASY-NT-30)

Note Shielding is required for CANopen.

Switching, control, visualisation

Engineering easy

Expansion units for networking



A network module can be connected with easy700, easy800, MFD(-AC)-CP8... and EC4P-200. The network module must be included as a slave in the configuration.

The inputs and output points can be expanded via easyNet

(→ section "easyNet, network connection "T piece with spur cable"", page 1-35 and

→ section "easyNet, network connection "T piece with spur cable"", page 1-35).

Further information can be found in the following manuals:

- AWB2528-1508GB
easy500, easy700 control relay,
- AWB 2528-1423GB
easy800, control relay,
- GBAWB2528-1480GB
MFD-Titan, multi-function display,
- AWB2724-1584GB
EC4-200,
- AWB 2528-1401GB
EASY204-DP,
- AWB2528-1479GB
EASY221-CO,
- AWB2528-1427GB
EASY222-DN.

Switching, control, visualisation

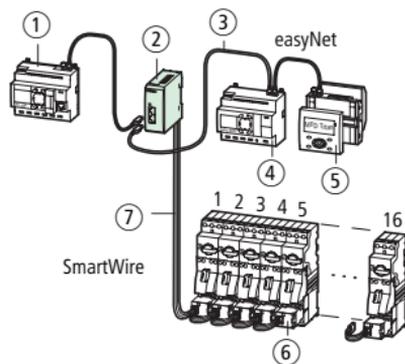
Engineering easy

SmartWire Gateway

The gateway allows the communication between 16 SmartWire modules and easy-NET compatible or CANopen compatible PLCs. It has a selector switch to select either easy-NET or CANopen operating mode. The gateway delivers the supply voltage for the electronic supply of the SmartWire modules and for the power element of the switchgear, e.g. the contactor coil actuation. The voltage is supplied to the modules via the SmartWire connection cable.

Operating mode easyNet

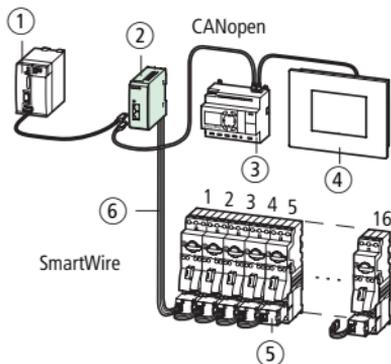
In easyNET mode the gateway acts as a station on easyNET and the SmartWire master at the same time. Up to 8 stations on the easyNET can be intelligently connected with each other.



- ① Head-end controller (easy800, MFD-CP8-NT, EC4P-200, ES4P, XC201)
- ② SmartWire Gateway
- ③ easyNet
- ④ easyNet station, e.g. easy800, ES4P
- ⑤ easyNet station, e.g. MFD-CP8-NT
- ⑥ SmartWire module, e.g.: for xStart
- ⑦ SmartWire connection cable

CANopen operating mode

CANopen mode allows communication between SmartWire modules and controllers with CANopen interface such as EC4--200 or XC100/200. In addition to standard fieldbus modules such as remote I/O systems or visualisation devices, this allows a number of switchgear devices can be networked directly with the PLC. Up to 126 stations can be connected to a CANopen network, depending on the performance level of the CANopen fieldbus master.



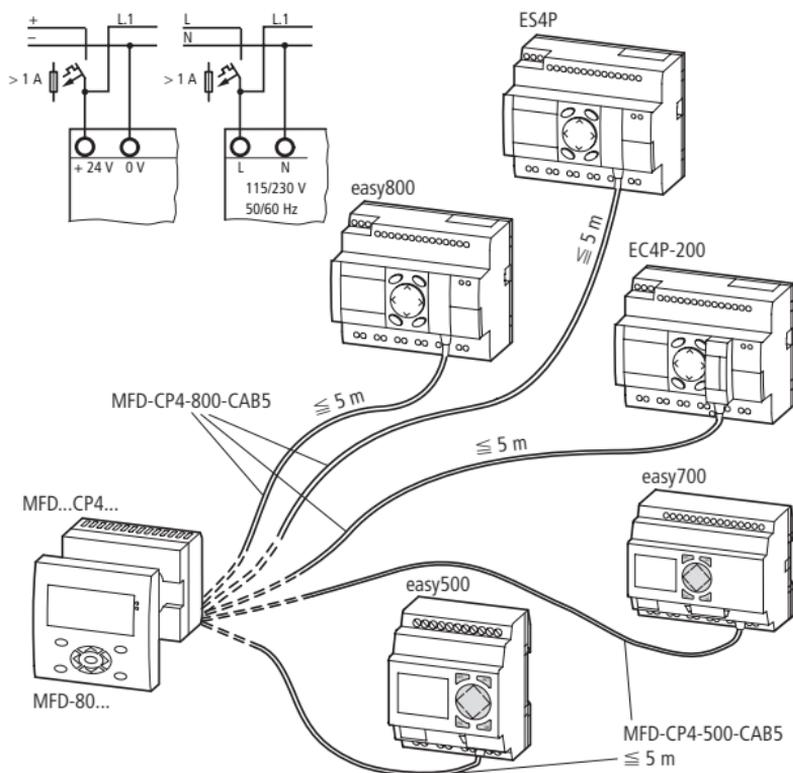
- ① CANopen PLC e.g. EC4P-200, XC100/XC200
- ② SmartWire Gateway
- ③ CANopen PLC, e.g. EC4P-200
- ④ CANopen station, e.g. MI4/MFD4
- ⑤ SmartWire module, e.g.: for xStart
- ⑥ SmartWire connection cable

Switching, control, visualisation

Engineering easy

Detachable display with protection type IP65

1



The display screen of the easyRelay or easyControl is shown on the MFD-80... "detachable display".

MFD-80-B can also be used to operate easyRelay and easyControl.

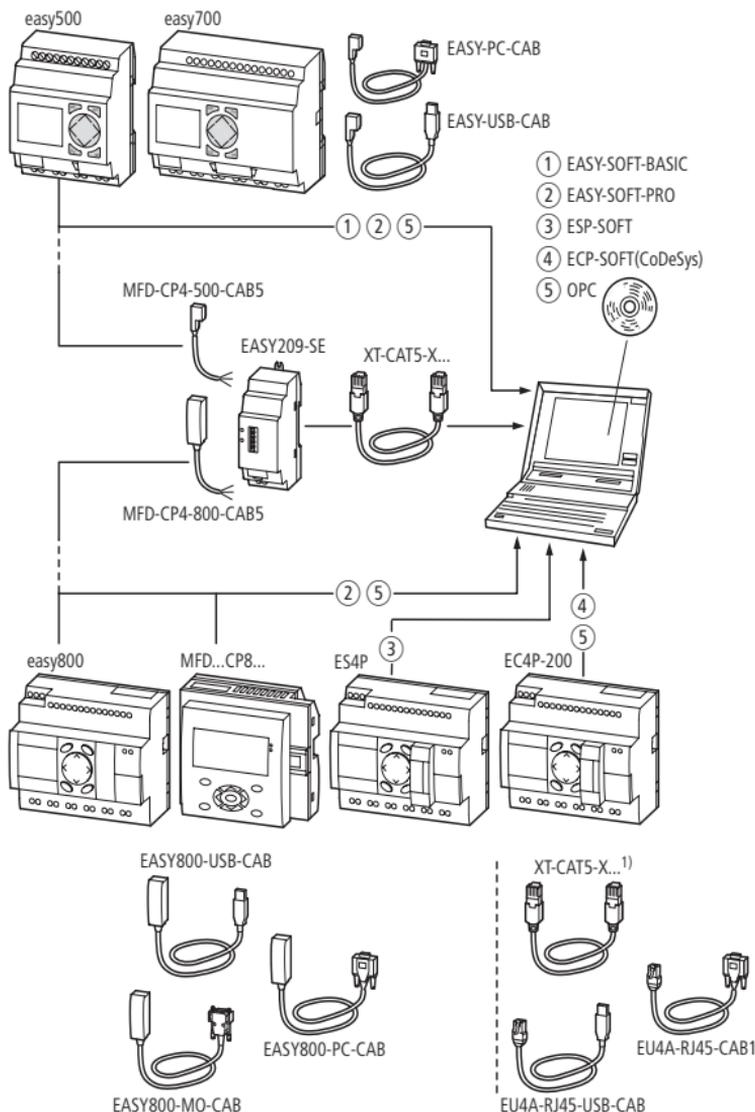
No extra software or programming is necessary to operate the "remote display".

The connection cable MFD-CP4...-CAB5 can be shortened.

Switching, control, visualisation

Engineering easy

Communication connections easy

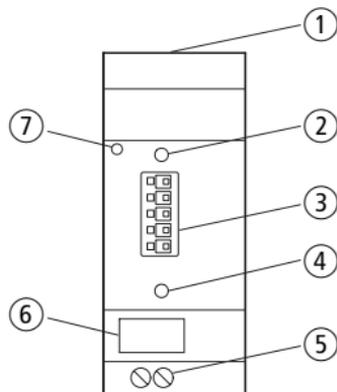


1) only EC4P-222... and XC200

Switching, control, visualisation

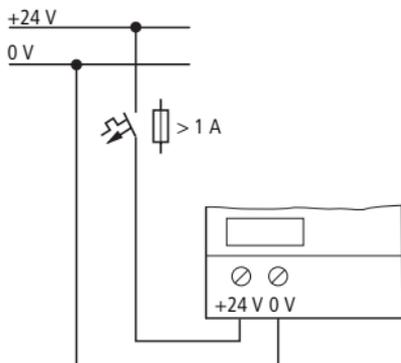
Engineering easy

EASY209-SE standard connection

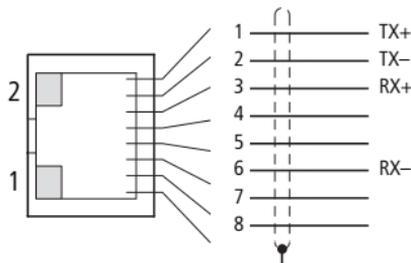


- ① Ethernet connection (RJ45 socket)
- ② Status LED (POW/RUN)
- ③ COM terminal, cage clamp terminal 5-pole
- ④ RESET button
- ⑤ Device power supply 24 V DC V
- ⑥ Device label
- ⑦ Strain relief

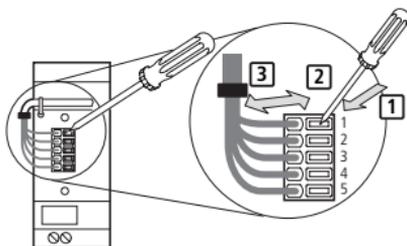
24 V connection



Ethernet connection



COM connection

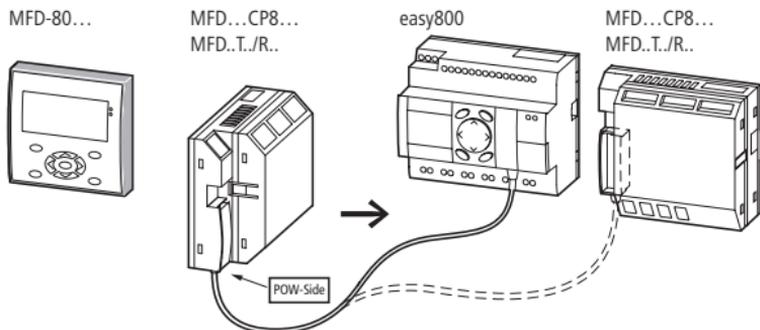


- ① press – ② insert – ③ remove
- 1 = grey, 2 = brown, 3 = yellow, 4 = white,
- 5 = green

Switching, control, visualisation

Engineering easy

COM-LINK connection



The COM-LINK is a point-to-point connection that uses the serial interface. Via this interface the status of the inputs and outputs are read, and marker areas read and written. Twenty marker double words read or written are possible. Reading and writing are freely selectable. This data can be used for reference value input or for display functions.

The stations of the COM-LINK have different functions. The active device is always a MFD...CP8... and controls the complete interface.

Remote stations can be easy800 or an MFD...CP8... The remote station responds to the requests of the active station. It does not recognise the difference whether COM-LINK is active or a PC with EASY-SOFT-PRO is using the interface.

The devices of the COM-LINK can be centralised or decentralised extended with easy expansion devices.

The remote device can also be a device in the easyNet.

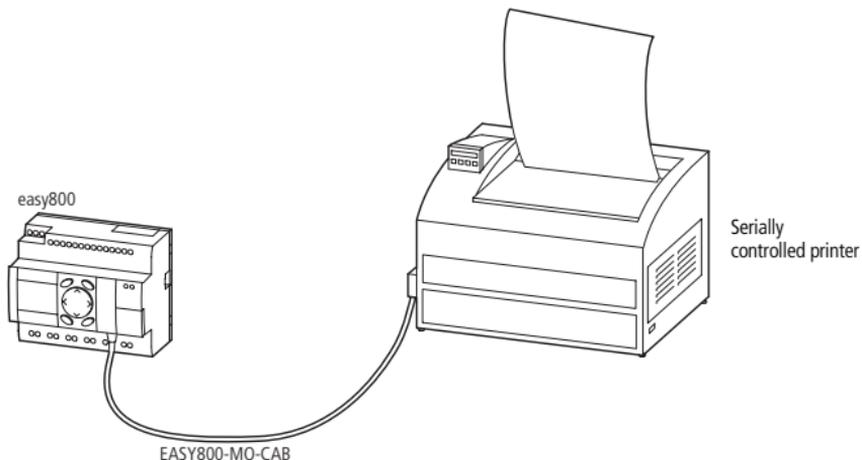
Switching, control, visualisation

Engineering easy

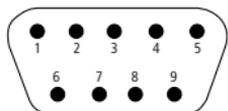
Connecting and operating the easy800 on the serial log printer

1

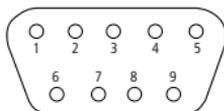
An SP (SP = serial protocol) function block can be used to send data directly via the serial PC interface on the front of the device. More information is provided in the EASY-SOFT-PRO help.



Pin assignment of EASY800-MO-CAB:



2 white T × D
3 brown R × D
5 green GND

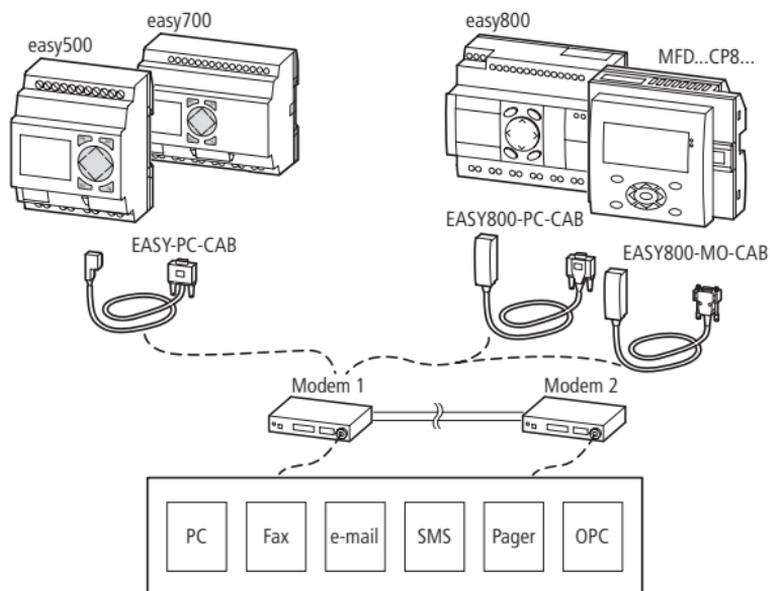


For information about EASY800-MO-CAB, see also AWA2528-2345.

Switching, control, visualisation

Engineering easy

Connection and modem operation with easy or MFD



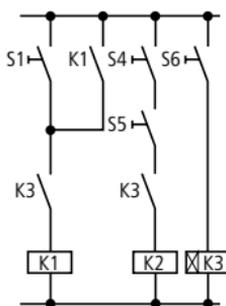
For information about EASY800-MO-CAB, see also AWA2528-2345.

Switching, control, visualisation

Programming easy

1

Circuit diagrams are the basis of all electrotechnical applications. In practice electrical devices are wired to each other. With control relay easy this can be done simply. Simple menu operation in many languages simplify the input. That saves time and therefore costs. easy and MFD-Titan are the professional devices for the world market.



Contacts, coils, function modules, operands

Operand	Description	easy500, easy700	easy800	MFD(-AC)-CP8...
I	Bit input, basic unit	×	×	×
nI	Bit input, basic unit via easyNET	-	×	×
IA	Analogue input	×	×	×
R	Bit input, expansion device ¹⁾	×	×	×
nR	Bit input, expansion device via easyNET	-	×	×
Q	Bit output, basic unit	×	×	×
nQ	Bit output, basic unit via easyNET	-	×	×
QA	Analogue output	-	×	×
S	Bit output, expansion device	×	×	×
nS	Bit output, expansion device via easyNET	-	×	×
ID	Diagnostic alarm	-	×	×
1ID	COM-Link diagnostic alarm	-	-	×
LE	Bit output display backlight + Front LEDs	-	-	×
M	Marker	×	×	×
1M	Marker COM-Link	-	-	×
MB	Marker Byte	-	×	×
MD	Marker double word	-	×	×
MW	Marker word	-	×	×
1ME/1MW	Marker operand COM-Link	-	-	×
/1MD				
N	Marker	×	-	-
P		×	×	×

Switching, control, visualisation

Programming easy

Operand	Description	easy500, easy700	easy800	MFD(-AC)-CP8...
:	Jump	×	×	×
nRN	Bit input via easyNET	–	×	×
nSN	Bit output via easyNET easyNET	–	×	×
A	Analog value comparator	×	×	×
AR	Arithmetic	–	×	×
BC	Block comparison	–	×	×
BT	Block transfer	–	×	×
BV	Boolean sequence	–	×	×
C	Counter relays	×	×	×
CF	Frequency counters	× ²⁾	×	×
CH	High-speed counters	× ²⁾	×	×
CI	Incremental counters	–	×	×
CP	Comparators	–	×	×
D	(reverse order)	×	×	–
DB	Data function block	–	×	×
DC	PID controllers	–	×	×
FT	PT1 signal smoothing filter	–	×	×
GT	Get value from easyNet	–	×	×
Ø H/HW	(clock)/Week time clock	×	×	×
Y/HY	Year time switch	×	×	×
JC	Conditional jump	–	×	×
LB	Jump label	–	×	×
LS	Value scaling	–	×	×
Z/MR	Master reset	×	×	×
MX	Data multiplexer	–	×	–
NC	Numerical converters	–	×	×
O/OT	Operating hours counters	×	×	×
PO	Pulse output	–	×	–
PW	Pulse width modulation	–	×	×
SC	Synchronise clock via network	–	×	×
ST	Set cycle time	–	×	×
SP	Serial protocol	–	×	–
SR	Shift register	–	×	×
T	Timing relays	×	×	×
TB	Table function	–	×	×
UC	Value limitation	–	×	×

1) With easy700, easy800 and MFD...CP8...

n = NET station 1...8

2) With easy500 and easy700 programmable as operation type.

Switching, control, visualisation

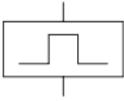
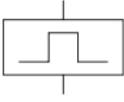
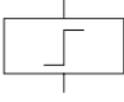
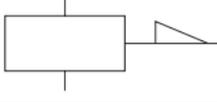
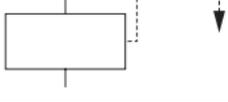
Programming easy

1

Coil functions

The switching behaviour of the relay coil is determined by the selected coil function. In the wiring diagram, the specified function should be used only once for each relay coil.

Unused outputs Q and S can also be used as markers like M and N.

Circuit diagram symbol	easy Display	Coil function	Example
	[Contactor function	$\text{[Q1, [D2, [S4, [I:1, [M7}$
	[Contactor function with negated result	$\text{[}Q1, \text{[}D2, \text{[}S4$
	[Cycle pulse on falling edge	$\text{[}Q3, \text{[}M4, \text{[}D8, \text{[}S7$
	[Cycle pulse on rising edge	$\text{[}Q4, \text{[}M5, \text{[}D7, \text{[}S3$
	[Surge function	$\text{[}Q3, \text{[}M4, \text{[}D8, \text{[}S7$
	S	Latch (set)	SQ8, SM2, SD3, SS4
	R	Reset (unlatching)	RQ4, RM5, RD7, RS3

Switching, control, visualisation

Programming easy

Parameter sets for times

Example based on EASY512

Depending up on the programme the following parameters can be set:

- Switching function,
- Time range,
- Parameter display,
- Time 1 and
- Time 2.

T1	∩	S	+
I1		30.000	
I2	I7		
□	T:00		

- T1 Relay no.
- I1 Time setpoint 1
- I2 Time setpoint 2
- Output switch status:
 - N/O contact open,
 - N/C contact closed
- ∩ Switching function
- S Time range
- + Parameter display
- 30.000 constant as value, e. g. 30 s
- I7 Variable, e. g. Analoge value I7
- T:00 clock time

Possible coil functions:

- Trigger = TT..
- Reset = RT..
- Halt = HT..

Parameters	Switch function
∩	Switch with on-delay
?∩	Switch with on-delay and random time range
■	Switch with off-delay
?■	Switch with off-delay and random time range
∩■	Switching with On-delay and Off-delay
?∩■	Switching with On-delay and Off-delay with random time
∩	Single-pulse switching
∩∩	Switching with flashing

Switching, control, visualisation

Programming easy

1

Parameters	Time range and setpoint time	Resolution
S 00.000	Seconds: 0.000 to 99.999 s	easy500, easy700 10 ms easy800, MFD...CP8... 5 ms
M:S 00:00	Minutes: Seconds 00:00 to 99:59	1 s
H:M 00:00	Hours: Minutes, 00:00 to 99:59	1 min.

Parameters	Displaying the parameter set via menu item "Parameter"
+	Call enabled
-	Access disabled

Basic circuits

The easy circuit configuration is input in ladder diagram. This section includes a few circuit examples which are intended to demonstrate the possibilities for your own circuit diagrams.

The values in the logic table have the following meanings for switching contacts:

0 = N/O contact open, N/C contact closed

1 = N/O contact closed, N/C contact open

For relay coils Qx"

0 = Coil not energized

1 = Coil energized

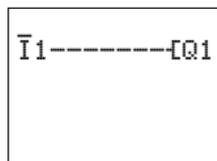
Note

The examples shown are based on easy500 and easy700. easy800 and MFD...CP8... provide four contacts and one coil per rung.

Negation

Negation means that the contact opens rather than closes when it is actuated (NOT circuit).

In the easy circuit diagram, press the **ALT** button to toggle contact I1 between N/C and N/O contact.



Logic table

I1	Q1
1	0
0	1

Switching, control, visualisation

Programming easy

Series connection

Q1 is controlled by a series circuit consisting of three make contacts (AND circuit).

$$I1-I2-I3-Q1$$

$$\bar{I1}-\bar{I2}-\bar{I3}-Q2$$

Q2 is actuated via three normally closed contacts connected in series (NAND circuit).

In the easy circuit diagram, you can connect up to three make or break contacts in series within a rung. Use M marker relays if you need to connect more than three make contacts in series.

Logic table

I1	I2	I3	Q1	Q2
0	0	0	0	1
1	0	0	0	0
0	1	0	0	0
1	1	0	0	0
0	0	1	0	0
1	0	1	0	0
0	1	1	0	0
1	1	1	1	0

Parallel switching

Q1 is controlled via a parallel circuit of several normally open contacts (OR circuit).

$$I1 \quad \text{-----} \quad Q1$$

$$I2 \quad \text{-----} \quad |$$

$$I3 \quad \text{-----} \quad |$$

A parallel circuit of normally closed contacts controls Q2 (NOR circuit).

$$\bar{I1} \quad \text{-----} \quad Q2$$

$$\bar{I2} \quad \text{-----} \quad |$$

$$\bar{I3} \quad \text{-----} \quad |$$

Logic table

I1	I2	I3	Q1	Q2
0	0	0	0	1
1	0	0	1	1
0	1	0	1	1
1	1	0	1	1
0	0	1	1	1
1	0	1	1	1
0	1	1	1	1
1	1	1	1	0

Switching, control, visualisation

Programming easy

1

Changeover circuit

A two-way circuit is made in easy using two series connections that are combined to form a parallel circuit (XOR).

```

I1- $\bar{I}2$ -----[Q1]
 $\bar{I}1$ -I2-----
  
```

An XOR circuit stands for an "Exclusive Or" circuit. Only when a contact is closed, is the coil energized.

Logic table

I1	I2	Q1
0	0	0
1	0	1
0	1	1
1	1	0

Self-latching

A combination of a series and parallel connection is used to wire a latching circuit.

Latching is established by contact Q1 which is connected in parallel to I1. When I1 is actuated and reopened, the current flows via contact Q1 until I2 is actuated.

S1 normally open contact on I1 S2 normally closed contact on I2

```

I1 I2-----[Q1]
Q1-----
  
```

Logic table

I1	I2	Contact Q1	Coil Q1
0	0	0	0
1	0	0	0
0	1	0	0
1	1	0	1
1	0	1	0
0	1	1	1
1	1	1	1

The hold-on (self-maintaining) circuit is used to switch machines on and off. The machine is switched on at the input terminals via normally open contact S1 and is switched off via normally closed contact S2.

S2 breaks the connection to the control voltage in order to switch off the machine. This ensures that the machine can be switched off, even in the event of a wire break. I2 is always closed when not actuated.

A self-latching circuit with wire break monitoring can alternatively be wired using the Set and Reset coil functions.

S1 normally open contact on I1 S2 normally closed contact on I2

```

I1-----SQ1
 $\bar{I}2$ -----RQ1
  
```

Switching, control, visualisation

Programming easy

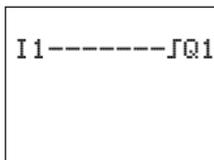
Coil Q1 latches if I1 is activated. I2 inverts the break contact signal of S2 and only switches if S2 is activated in order to disconnect the machine or in the event of a wire break.

Keep to the order that each coil is wired in the easy circuit diagram: first wire the "S"-coil, and then the "R"-coil. This will ensure that the machine will be switched off when I2 is actuated, even if I1 is switched on.

Impulse relays

An impulse relay is often used for controlling lighting such as for stairwell lighting.

S1 normally open contact on I1



Logic table

I1	Status of Q1	Q1
0	0	0
1	0	1
0	1	1
1	1	0

On-delayed timing relays

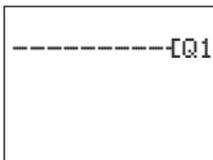
The on-delay can be used to override a short impulse or with a machine, to start a further operation after a time delay.

S1 normally open contact on I1



Permanent contact

To energize a relay coil continuously, make a connection of all contact fields from the coil to the leftmost position.



Logic table

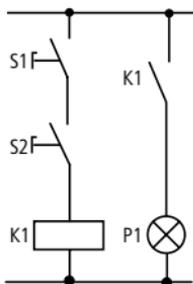
---	Q1
1	1

Switching, control, visualisation

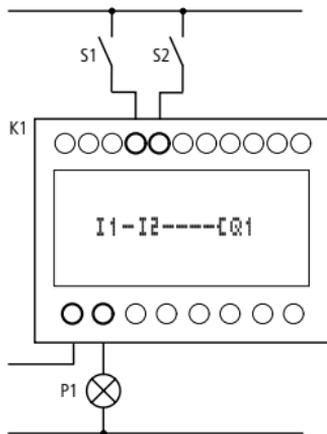
Programming easy

Wiring of contacts and relays

Hardwired



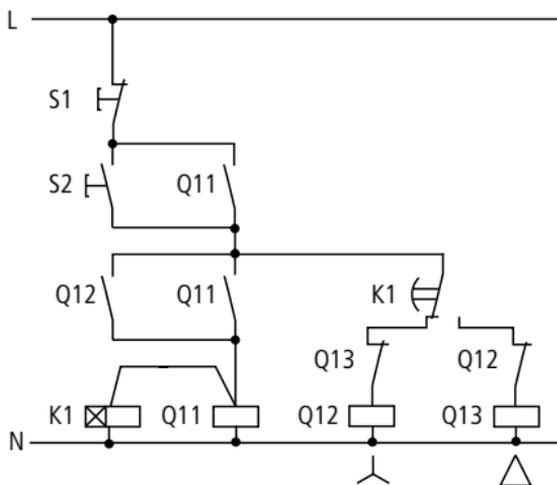
Wiring with easy



Star-delta starting

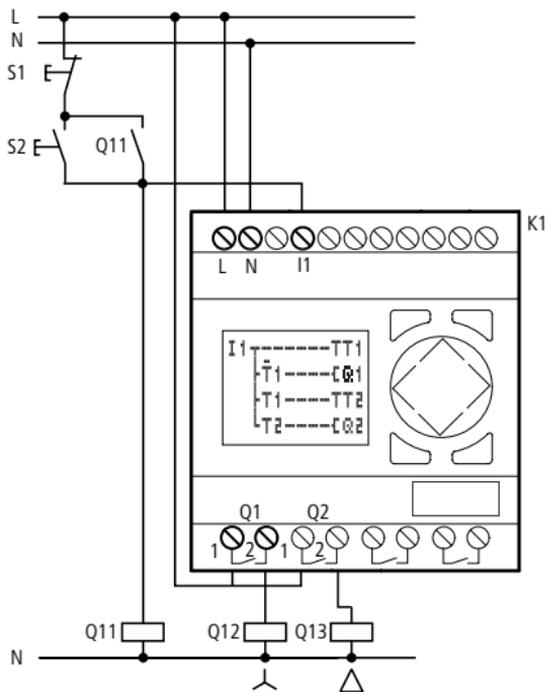
You can implement two star-delta circuits with easy. The advantage of easy is that it is possible to select the changeover time between star and

delta contactors, and also the time delay between switching off the star contactor and switching on the delta contactor.



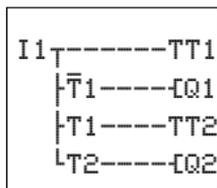
Switching, control, visualisation

Programming easy



Function of the easy circuit diagram

Start/Stop of circuit with the external actuators S1 and S2. The mains contactor starts the timing relay in the logic relay.



If your easy has an integral time switch, you can combine star-delta starting with the time switch function. In this case, use easy to also switch the mains contactor.

I1: Mains contactor switched on

Q1: Star contactor ON

Q2: Delta contactor ON

T1: Changeover time star/delta (10 to 30 s)

T2: Wait time between star off, delta on (30, 40, 50, 60 ms)

Switching, control, visualisation

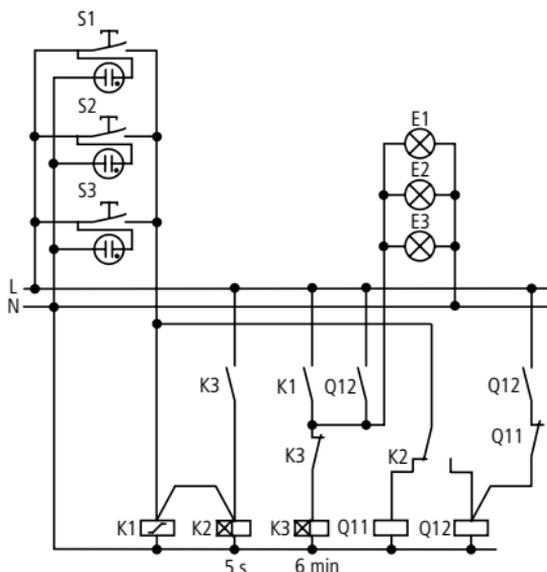
Programming easy

Stairway lighting

1

For a conventional circuit a minimum of five elements are required. An impulse relay, two timing relays, two auxiliary relays.

easy requires only four space units. With five connections and the easy circuit the stairway lighting is operational.

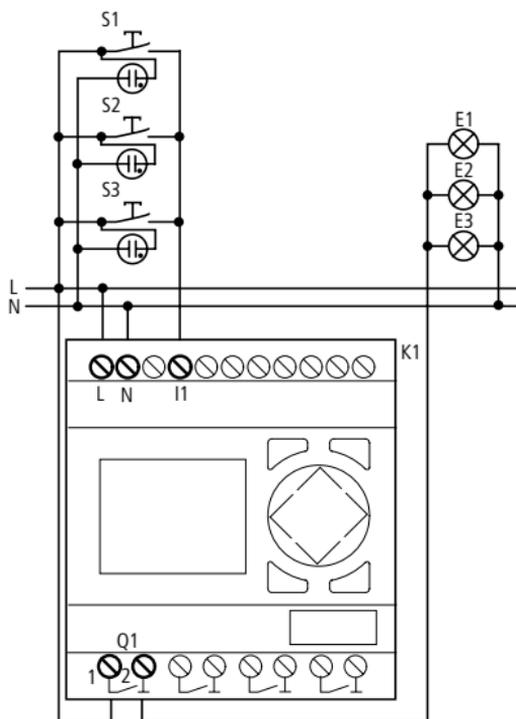


Important note

Four such stairway circuits can be implemented with one easy device.

Switching, control, visualisation

Programming easy



Button pressed briefly

Light On or Off, the impulse changeover relay function is able to switch off continuous lighting where required.

Light Off after 6 min.

Switched off automatically. With continuous lighting this function is not active.

Button pressed for more than 5 s

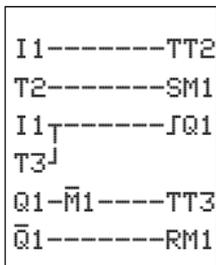
Continuous light

Switching, control, visualisation

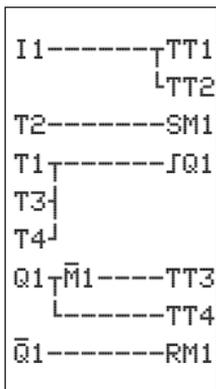
Programming easy

The easy circuit configuration for the function below looks like this:

1



The enhanced easy circuit diagram: after four hours, the continuous lighting is also switched off.



Meaning of the contacts and relays used:

I1: ON/OFF pushbutton

Q1: Output relay for light ON/OFF

M1: Marker relay. This is used to block the "switch off automatically after 6 minutes" function for continuous lighting.

T1: Cyclical impulse for switching Q1 ON/OFF, (I, impulse with value 00.00 s)

T2: Scan to determine how long the button was pressed. When pressed for longer than 5 s, it changes to continuous lighting. (X, on-delayed, value 5 s)

T3: Switch off after the light has been on for von 6 min. (X, on-delayed, value 6:00 min.)

T4: Switch off after 4 hours continuously on. (X, on-delayed, value 4:00 h)

Switching, control, visualisation

Programming easy

4-way shift register

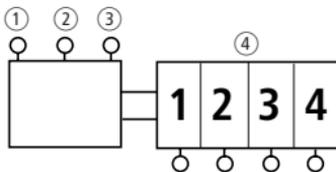
A shift register can be used for storing an item of information – e.g. sorting of items into “good” or “bad” – two, three or four transport steps further on.

A shift pulse and the value (0” or 1”) to be shifted are required for the shift register.

Values which are no longer required are deleted via the reset input of the shift register. The values in the shift register pass through the register in the following order:

1st, 2nd, 3rd, 4th storage position.

Block diagram of the 4-way shift register



- ① Pulse
- ② Value
- ③ Reset
- ④ Storage position

Function:

Pulse	Value	Storage position			
		1	2	3	4
1	1	1	0	0	0
2	0	0	1	0	0
3	0	0	0	1	0
4	1	1	0	0	1
5	0	0	1	0	0
Reset = 1		0	0	0	0

Allocate the value 0 with the information content bad. Should the shift register be accidentally deleted, no bad parts will be reused.

I1: Shift pulse (PULSE)

I2: Information (good/bad) to be shifted (VALUE)

I3: Clear content of the shift register (RESET)

M1: 1st storage location

M2: 2nd storage location

M3: 3rd storage location

M4: 4th storage location

M7: Marker relay for cycle pulse

M8: Cyclical pulse for shift pulse

Switching, control, visualisation

Programming easy

Display text and actual values , display and edit set values

easy500 and easy700 can display 16, easy800 can display 32 freely editable texts. These texts can be triggered by the actual values of function relays such as timing relays, counters, operating hours counters, analog value comparators, date, time or scaled analog values. The setpoints of timing relays, counters, operating hours counters, analog value comparators can be modified when the text is displayed.

```
SWITCHING;
CONTROL;
DISPLAY;
ALL EASY!
```

Example of a text display:

The text display can display the following:

RUNTIME M:S	— Line 1, 12 characters
T1 :012:46	— Line 2, 12 characters, a setpoint or actual value
C1 :0355 ST	— Line 3, 12 characters, a setpoint or actual value
PRODUCED	— Line 4, 12 characters

The text output unit D (D = Display) functions in the circuit diagram like a normal marker M. Should a text be attached to a marker this would be shown at condition 1 of the coil in the easy display. A precondition is that the easy is in RUN mode and before the texts are displayed the status display is shown.

D1 is defined as alarm text and has therefore priority over other displays.

D2 to D16/D32 are displayed when activated.

When several displays are activated they are shown one after the other every 4 seconds.

When a set value is edited the corresponding display remains shown until the value transfer.

Several values, such as actual and setpoint values from function relays, analog input values or time and date can be incorporated. The set values can be edited:

- easy500 and easy700, two values,
- easy800, four values.

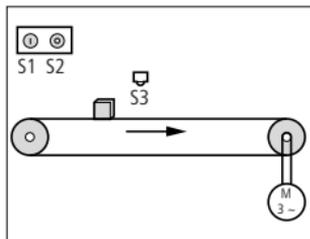
Switching, control, visualisation

Programming easy

Visualisation with easyHMI

The visualisation with easyHMI is by "screens", on which the display is shown.

Example of a "screen":



The following screen elements can be combined.

- Graphic elements
 - Bit display
 - Bitmap
 - Bargraph
 - Message bitmap
- Pushbutton elements
 - Latching button
 - Button field
- Text elements
 - Static text
 - Message text
 - Screen menu
 - Running text
 - Rolling text
- Value display elements
 - Date and time display
 - Numerical value
 - Timing relay value display
- Value entry elements
 - Value entry
 - Timing relay value entry
 - Date and time entry
 - 7-day time switch input
 - Year time switch entry

Switching, control, visualisation

Overview of automation products

The requirements placed on automation systems today range from the special manufacturing of single units up to the series production of millions of units. These call for flexible, open and modular automation products which meet these requirements.

Moeller can offer an optimum range of products and services that can be combined for your control and visualization tasks. This allows us to provide more efficient solutions and optimise the efficiency of your machines and electrical systems. Moeller offers worldwide economical solutions for the automation of production processes and machines.

Compact PLC, PS4 series



Compact PLCs are programmable logic controllers which offer outstanding basic features by means of the large number of hardware and software functions. They can be used for many applications for regulating, controlling and measuring. If the integrated functions are insufficient, the devices can be expanded locally or via networks.

Modular PLC, XC100/XC200



The outstanding feature of modular PLCs is their scalable design. This offers a high level of flexibility for designing individual automation systems.

Another benefit is their ability to be integrated in modern communication concepts. Access via Ethernet is indispensable for many applications. Firstly to enable efficient communication between controllers and secondly for data exchange with higher-level control systems using communication standards such as OPC.

HMI systems



Moeller offers a wide range of products for communication between human and machine, allowing you to implement optimum solutions quickly. The offer range includes graphical text operator panels (→ section "MFD4-5-XRC-30", page 1-72) and touch operator panels.

Switching, control, visualisation

Compact PLC, PS4

1

Compact PLCs are devices which offer outstanding basic features by means of the large number of hardware and software functions and can be used for many applications involving regulating, controlling and measuring tasks. If additional functions are required the devices can easily be expanded locally or via networks.

The PS4 compact PLCs have the following system characteristics:

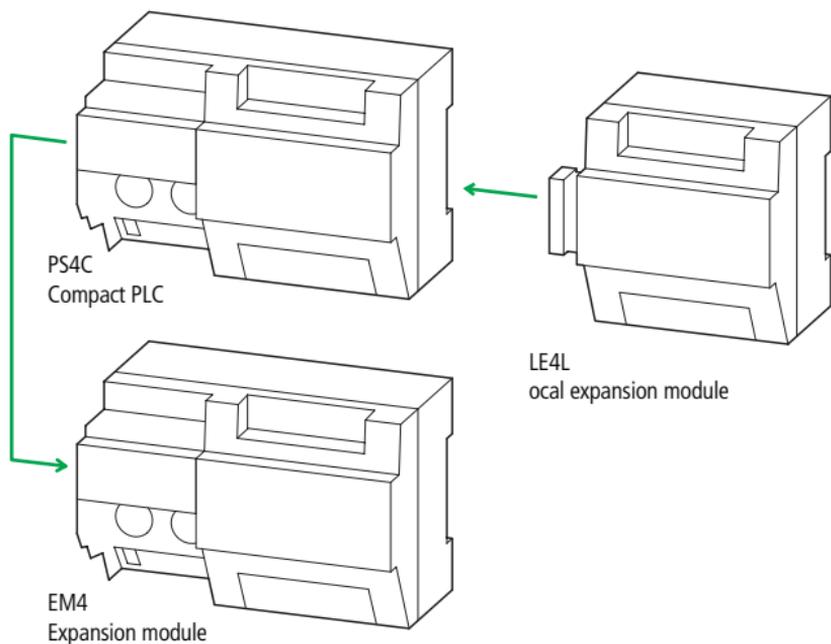
- Standard programming,
- Remote and local expansion options,
- Integrated fieldbus interface (Suconet),
- Plug-in screw terminals,
- Small, compact in size.

The controllers in this range are very versatile with a wide range of features, such as integrated setpoint potentiometers, analog inputs/outputs and memory expansion modules (from PS4-150).

The range consists of:

- Compact PLC PS4,
- LE4 local expansion modules,
- EM4 remote expansion modules.

All compact PLCs are networkable and can be networked and programmed via the integrated fieldbus. The common programming software is Sucusoft S40, a user-friendly programming package conforming to IEC 61131-3.



Switching, control, visualisation

Compact PLC, PS4

PS4-141/151 – the universal genius

Universal use, outstanding series features.

- Inputs/outputs
 - 16 digital inputs
 - 14 (PS4-151: 8) digital outputs
 - 2 analog inputs
 - 1 analog output
- Program memory
 - 24 kByte (+32 kByte optional)
 - Recipe memory (optional): 32 KByte
- Expandable by
 - Remote with EM4 modules
 - Networking:
 - Suconet, Ethernet

PS4-201 – the adaptable PLC

Flexible for standard solutions, locally and remotely expandable for a wide range of configuration options.

- Inputs/outputs
 - 8 digital inputs
 - 6 digital outputs
 - 2 analog inputs
 - 1 analog output
- Program memory
 - 24 kByte (+32 kByte optional)
 - Recipe memory (optional): 32 KByte
- Expandable by
 - Local with LE4 modules
 - Remote with EM4 modules
 - Networking:
 - Suconet, PROFIBUS-D, Ethernet

PS4-271 – The building services specialist

Locally and remotely expandable for AC applications.

- Inputs/outputs
 - 12 digital inputs
 - 8 digital outputs (12 A)
 - 8 analog inputs, of which 2 for PT1000/Ni1000)
 - 2 analog outputs
- Program memory
 - (+optional expansion)
 - 24 kByte (+32 kByte)
 - Recipe memory (optional): 32 KByte
- Expandable by
 - Local with LE4 modules
 - Remote with EM4 modules
 - Networking:
 - Suconet, PROFIBUS-DP, Ethernet

PS4-341 – the high-speed PLC

Even more speed and larger program and data memory.

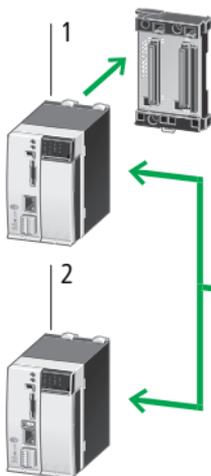
- Inputs/outputs
 - 16 digital inputs
 - 14 digital outputs
 - 2 analog inputs
 - 1 analog output
- Program memory
 - (+optional expansion)
 - 512 kByte
 - Recipe memory (optional): 512 KByte
- Expandable by
 - Local with LE4 modules
 - Remote with EM4 modules
 - Networking:
 - Suconet, PROFIBUS-DP, Ethernet

Switching, control, visualisation

Modular PLC, XC100/XC200

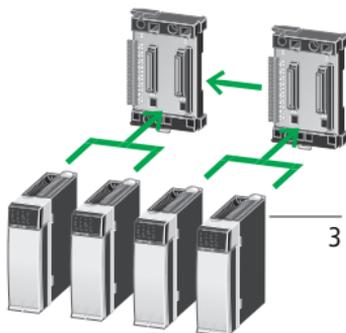
XC100

The modular PLC of the XC100 series is a powerful automation system for small and medium-sized applications. Locally expandable by up to 15 XI/OC modules. The integrated CANopen fieldbus interface provides the interface to the remote periphery. The OPC server also simplifies the connection with standard OPC client applications.



XC200

The modular PLCs of the XC200 series offer a high processing performance and outstanding communications capabilities. This includes the integrated Ethernet interface in addition to an RS 232 interface and a CANopen fieldbus interface. The OPC server also supplies the connection with standard OPC client applications. All XC201...-XV devices also feature an integrated WEB server as a technological highlight.



Switching, control, visualisation

Modular PLC, XC100/XC200

System components

- Modular PLCs
 - XC100 ①
 - 8 DI, 6 DO, CANopen, RS 232, 4 interrupt inputs
 - Slot for multimedia memory card, 64 – 256 KByte program/data memory, 4/8 KByte for retentive data, 0.5 ms/1000 instructions
 - XC200 ②
 - 8 DI, 6 DO, CANopen, RS 232, Ethernet, 2 counters, 2 interrupt inputs, WEB/OPC server, USB, locally expandable with XI/OC I/O modules, 256 – 512 KByte program/data memory, 0.05 ms/1000 instructions
- XI/OC input/output modules ③
 - Can be fitted to the XC100/200 (max. 15 modules)
 - Plug-in terminals with screw or springloaded terminal
- easySoft-CoDeSys
 - Programming, configuring, testing/commissioning in a single tool

For further information see the following product overview and manuals:

- XC100 hardware and engineering (AWB2724-1453)
- XC200 hardware and engineering (AWB2724-1491)
- XI/OC hardware and engineering (AWB2725-1452)
- XV100 hardware and engineering (AWB2726-1461)
- easySoft-CoDeSys PLC program development (AWB2700-1437)
- Function blocks for easySoft-CoDeSys (AWB2786-1456); including data handling function blocks for text display PLCs

The latest version can be found at:

www.moeller.net/support.

Enter the numbers shown in brackets as the search criterion e.g. "AWB2725-1453".

Switching, control, visualisation

HMI systems

Text operator panel MI4

The MI4 text operator panels are designed for simple and economical machine operation. The high contrast LCD displays come with a durable LED backlight. All displays have graphics capability. This enables the display of different character sets, graphics and bargraphs. All buttons can be configured by project. Insert labels can be provided for function buttons for individual labelling.



MFD4-5-XRC-30

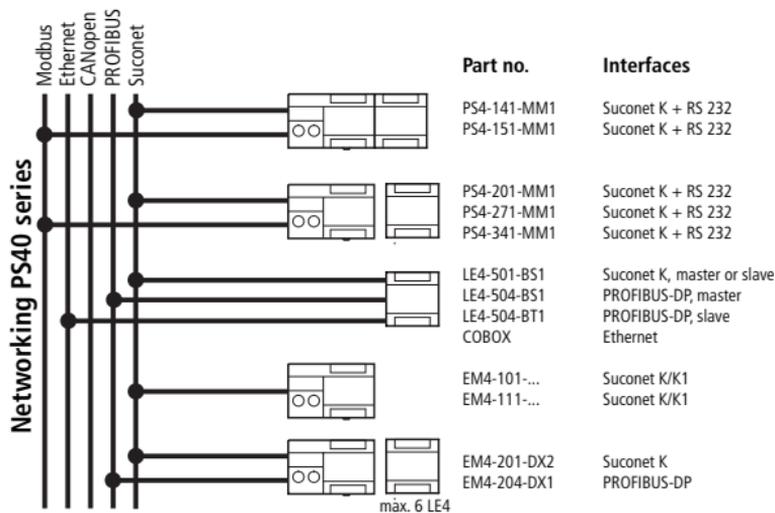
The 5.7" touch panel is a colour STN device based on resistive touch technology. It can be used solely as an HMI or also as an HMI with integrated PLC functionality and integrated web server. The display screens are created with the easySoft-CoDeSys programming software. A separate design tool is therefore unnecessary. The Ethernet, CANopen and RS232 interfaces are integrated on the touch panel.



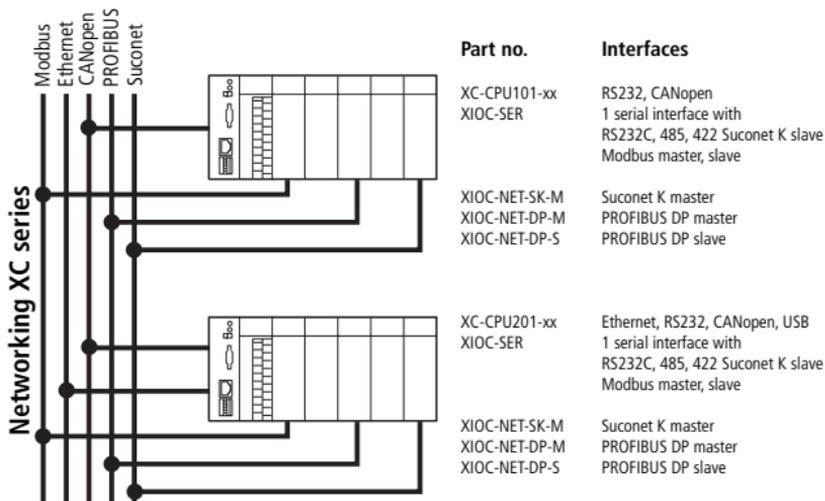
Switching, control, visualisation

Networking

PS40 Series



XC series



Switching, control, visualisation

Networking

Display and operator panels

1

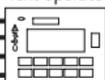
Display and operator units

CANopen
PROFIBUS
MPI
Suconet

Part no.

Resolution

Text operator panel MI4



MI4-110-KC1

120 × 32

MI4-110-KD1

120 × 32

MI4-110-KG1/2

120 × 32

MI4-117-KC1

120 × 32

MI4-117-KD1

120 × 32

Touch operator panel MI4



MI4-130-TA1

3,8"

320 × 240

STN mono

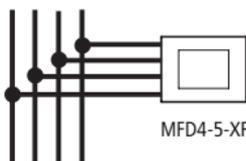
MI4-137-KD1

3,8"

320 × 240

STN mono

Ethernet
CANopen
easyNet
serial



MFD4-5-XRC-30

5,7"

320 × 240

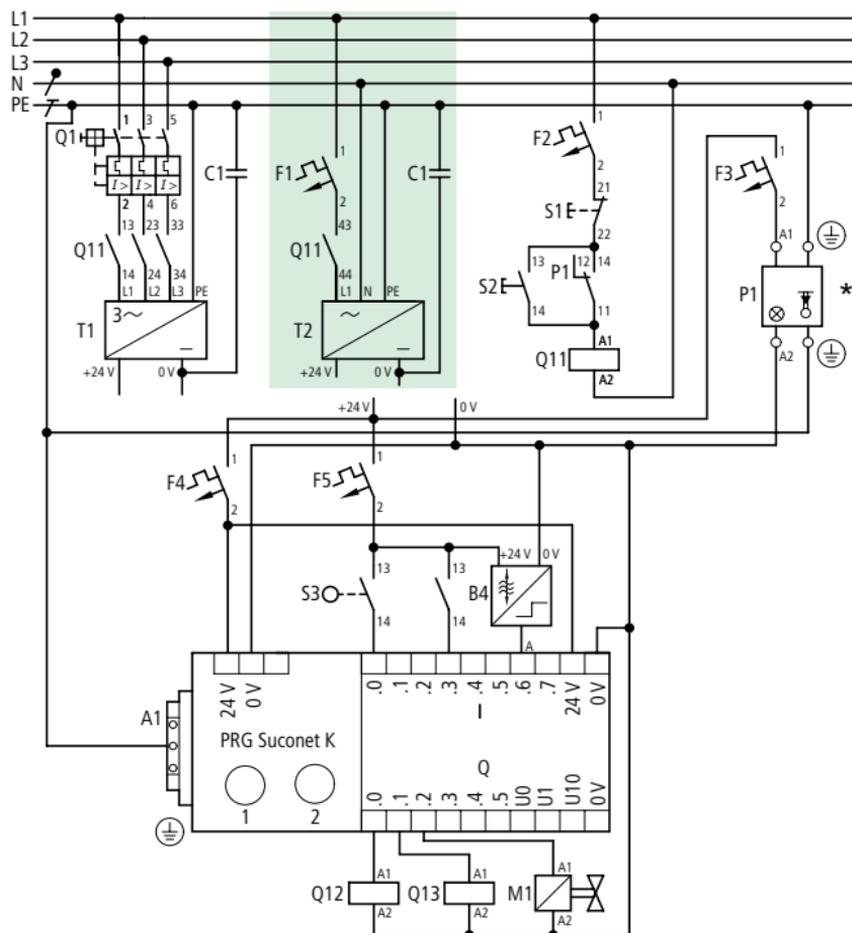
STN color

Switching, control, visualisation

Engineering PS4

PS4-201-MM1 compact PLC

- Shared power supply for PLC and inputs/outputs
- Non-earthed operation with insulation monitoring



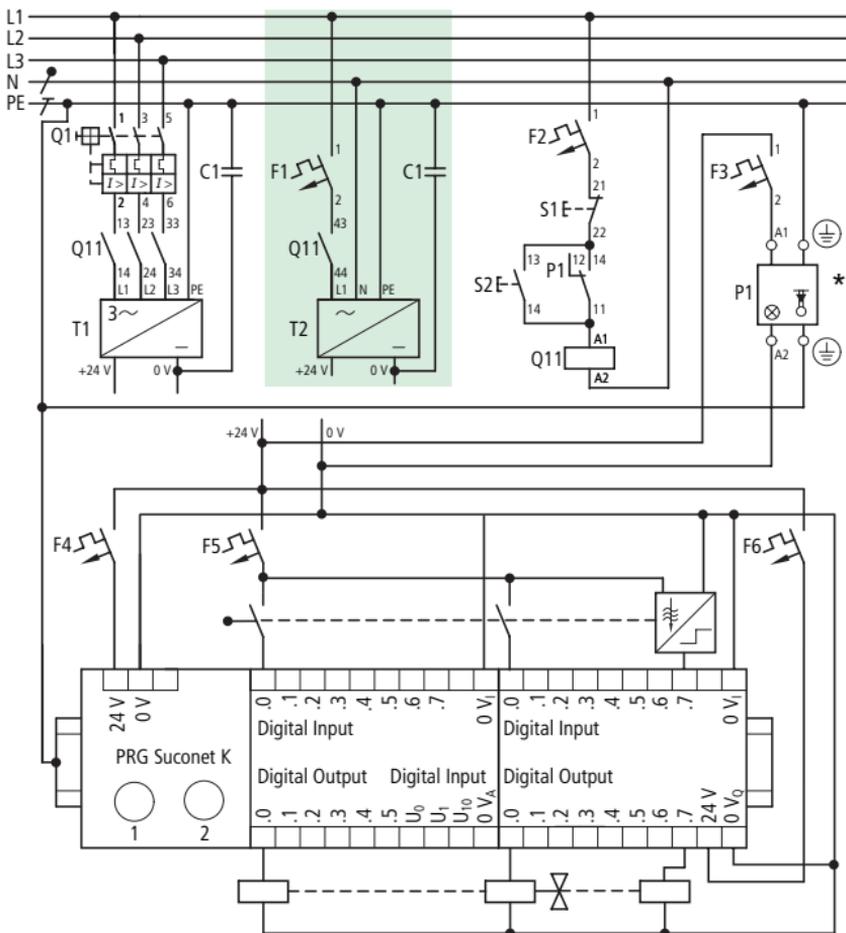
- * For operation without insulation monitoring, 0V must be linked with the PE potential in the control circuits.

Switching, control, visualisation

Engineering PS4

PS4-341-MM1 compact PLC

- Shared power supply for PLC and inputs/outputs
- Non-earthed operation with insulation monitoring



- * For operation without insulation monitoring, 0 V must be linked with the PE potential in the control circuits.

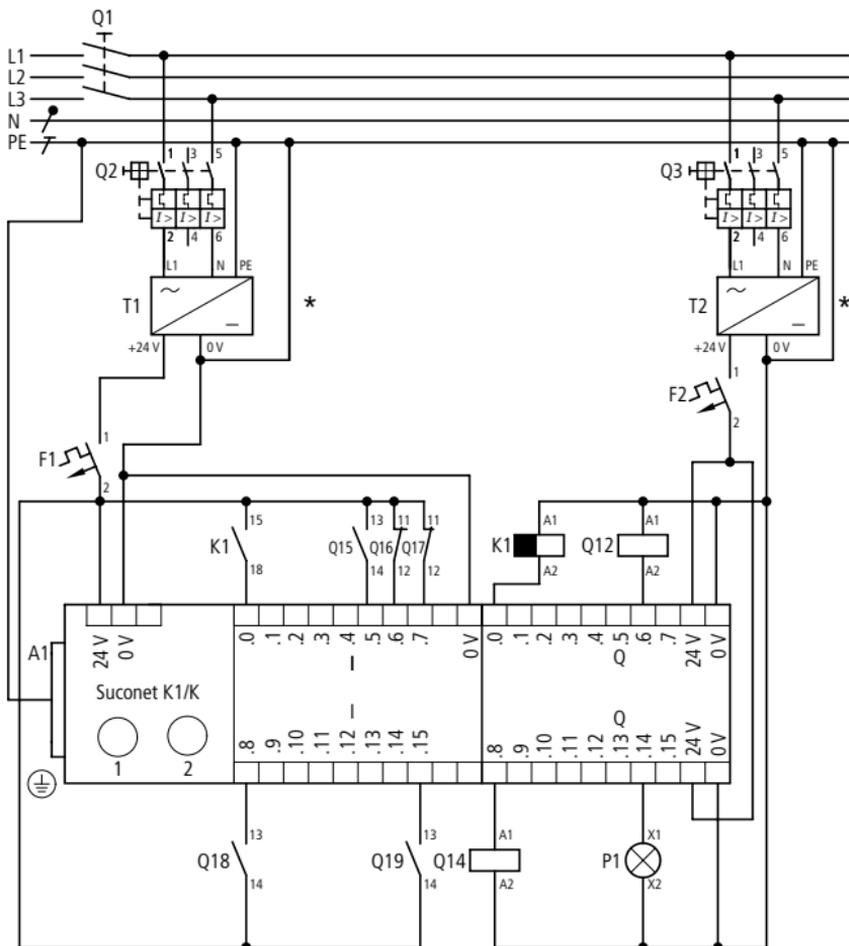
Switching, control, visualisation

Engineering EM4 and LE4

EM4-201-DX2 expansion module and LE4-116-XD1 local expansion module

- Inputs and outputs have a separate power supply
- Earthed operation

1



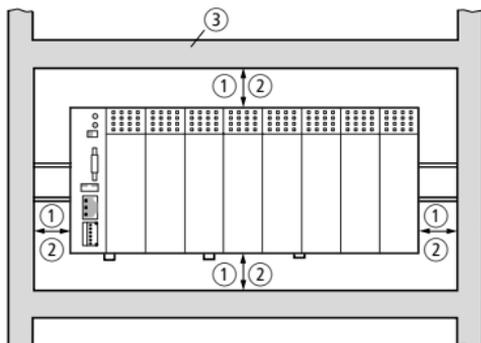
* Insulation monitoring must be provided where the control circuits are not earthed.

Switching, control, visualisation

Engineering XC100, XC200

Device arrangement

Install the rack and the PLC horizontally in the control cabinet as shown in the following figure.

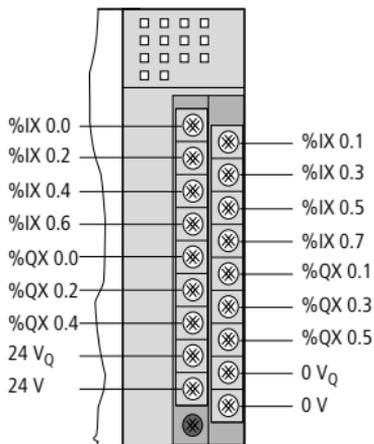


- ① Kerning > 50 mm
- ② Kerning > 75 mm to active elements
- ③ Cable duct

1

Terminal assignments

The terminals for the power supply and the local I/O have the following assignment:



Example of power supply wiring

The voltage terminal 0V_Q/24V_Q is only used for the power supply of the local 8 inputs and 6 outputs, and is potentially isolated from the bus.

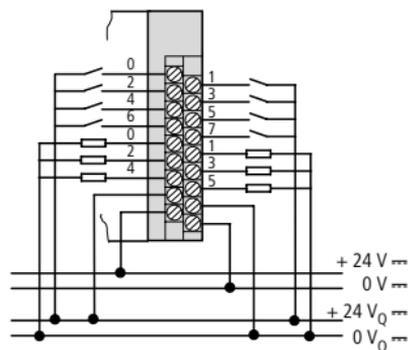
Outputs 0 to 3 can be loaded with 500 mA and outputs 4 and 5 with 1 A, each with a 100 % duty factor (DF) and a simultaneity factor of 1.

The wiring example shows the wiring with a separate power supply for the PLC and the IO terminals. If only one supply is used, then the following terminals must be connected together: 24 V to 24V_Q and 0 V to 0V_Q.

Switching, control, visualisation

Engineering XC100, XC200

1



Serial interface RS 232

This interface is used by the XC100/XC200 to communicate with the PC. The physical connection is implemented via an RJ-45 interface. The interface is not electrically isolated. The connector has the following assignment:

Pin	RS232 (XC-CPU101/ 201)	ETH (XC-CPU201)
8	RxD	-
7	GND	-
6	-	Rx-
5	TxD	-
4	GND	-
3	-	Rx+
2	-	Tx-
1	-	Tx+

You can use the COM1 or COM2 interface on the PC.

You use the XT-SUB-D/RJ45 programming cable for the physical connection.

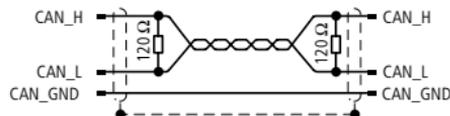
CANopen interface

Assignment of the 6-pole Combicon connector:

Terminal	Signal
6	GND
5	CAN_L
4	CAN_H
3	GND
2	CAN_L
1	CAN_H

Use only a cable that is permissible for CANopen with the following properties:

- Surge impedance 108 to 132 Ω
- Capacitance per unit length < 50 pF/m



Baud rate [Kbit/s]	Length [m]	Core cross-section [mm ²]	Loop resistance [Ω /km]
20	1000	0.75 – 0.80	16
125	500	0.50 – 0.60	40
250	250	0.50 – 0.60	40
500	100	0.34 – 0.60	60
1000	40	0.25 – 0.34	70

Notes

Notes

1