MOELLER

User Manual

easy800
Control Relays

05/02 AWB2528-1423G

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Warning!
Dangerous electrical voltage!

Before commencing the installation

- Disconnect the power supply of the device.
- Ensure that devices cannot be accidentally restarted.
- Verify isolation from the supply.
- Earth and short circuit.
- Cover or enclose neighbouring units that are live.
- Follow the engineering instructions (AWA) of the device concerned.
- Only suitably qualified personnel in accordance with EN 50110-1/-2 (VDE 0105 Part 100) may work on this device/system.
- Before installation and before touching the device ensure that you are free of electrostatic charge.
- The functional earth (FE) must be connected to the protective earth (PE) or to the potential equalisation. The system installer is responsible for implementing this connection.
- Connecting cables and signal lines should be installed so that inductive or capacitive interference do not impair the automation functions.
- Install automation devices and related operating elements in such a way that they are well protected against unintentional operation.
- Suitable safety hardware and software measures should be implemented for the I/O interface so that a line or wire breakage on the signal side does not result in undefined states in the automation devices.
- Ensure a reliable electrical isolation of the low voltage for the 24 volt supply. Only use power supply units complying with IEC 60364-4-41 (VDE 0100 Part 410) or HD 384.4.41 S2.
- Deviations of the mains voltage from the rated value must not exceed the tolerance limits given in the specifications, otherwise this may cause malfunction and dangerous operation.
- Emergency stop devices complying with IEC/EN 60204-1 must be effective in all operating modes of the automation devices. Unlatching the emergency-stop devices must not cause restart.
- Devices that are designed for mounting in housings or control cabinets must only be operated and controlled after they have been installed with the housing closed. Desktop or portable units must only be operated and controlled in enclosed housings.

- Measures should be taken to ensure the proper restart of programs interrupted after a voltage dip or failure. This should not cause dangerous operating states even for a short time. If necessary, emergency-stop devices should be implemented.
- Wherever faults in the automation system may cause damage to persons or property, external measures must be implemented to ensure a safe operating state in the event of a fault or malfunction (for example, by means of separate limit switches, mechanical interlocks etc.).

Contents

About this manual

This manual describes the installation, commissioning and programming (circuit-diagram generation) of the easy800 control relay.

Specialist electrical training is needed for commissioning and creating circuit diagrams. Parts of the system can be damaged and persons put at risk if easy is connected or programmed incorrectly, causing active components such as motors or pressure cylinders to start up.

Device designation

This manual uses the following abbreviated designations for different easy models:

- easy800 for
  - EASY819-..,
  - EASY820-..,
  - EASY821-..,
  - EASY822-..
- easy412 for
  - EASY412-AC-...,
  - EASY412-D.-...
- easy600 for
  - EASY6..-AC-RC(X)
  - EASY6..-DC-.C(X)

- easy-AC for
  - EASY8..-AC-...
  - EASY412-AC-..
  - EASY6..-AC-RC(X)
- easy-DC for
  - EASY8..-.DC-...
  - EASY412-DC-..
  - EASY620/621-DC-.C(X)
- easy-DA for
  EASY412-DA-RC

Writing conventions

Symbols used in this manual have the following meanings:

▶ indicates actions to be taken.

Note
Warns of a hazardous situation that could result in damage to the product or components.

Caution!
Warns of the possibility of a hazardous situation that could result in major damage and minor injury.

Warning
Warns of the possibility of a hazardous situation that could result in major damage and serious or fatal injury or even death.

Indicates interesting tips and additional information

For greater clarity, the name of the current chapter is shown in the header of the left-hand page and the name of the current section in the header of the right-hand page. Pages at the start of a chapter and empty pages at the end of a chapter are exceptions.

1 easy800

Overview

easy800 is an electronic control relay with built-in logic, timer, counter, time switch and arithmetic functions. easy800 is a further development of the easy600. easy800 is a control and input device rolled into one. The easy800 can perform many tasks in the building and machinery engineering areas.

The integral NET network enables connection of up to eight easy800 control relays to form a single control system. Each NET station can contain an individual circuit diagram. This allows the design of systems with fast controllers incorporating decentralized intelligence.

Circuit diagrams are connected up using ladder diagrams, and each element is entered directly via the easy display. For example, you can:

- connect make and break contacts in series and in parallel
- switch output relays and auxiliary contacts,
- define outputs as coils, impulse relays, rising or falling edge-triggered relays or as latching relays,
- select timing relays with different functions:
  - on-delayed,
  - on-delayed with random switching,
  - off-delayed,
  - off-delayed with random switching,
  - on and off delayed,
  - on and off delayed with random switching,
  - pulse shaping,
  - synchronous flashing,
  - asynchronous flashing.
- use up and down counters,

- count high-speed signals,
  - up and down counters with upper and lower threshold values,
  - preset,
  - frequency counter,
  - fast counter,
  - count incremental value encoder values.
- compare values,
- display texts with variables,
- process analog input and output values (DC units),
- use 7-day and 12-month timers,
- count operating time/hours (operating time counter),
- communicate via the integrated NET network,
- implement arithmetic functions,
  - add,
  - subtract,
  - multiply,
  - divide.
- track the flow of current in the circuit diagram
- load, save and password-protect circuit diagrams

If you prefer to wire up easy800 from a PC, then use EASY-SOFT. EASY-SOFT allows you to create and test your circuit diagram on the PC. EASY-SOFT enables you to print out your circuit diagram in DIN, ANSI or easy format.

Device overview — easy basic units at a glance

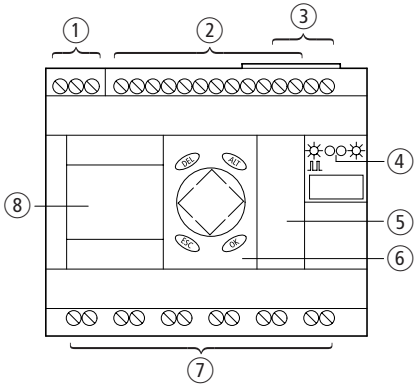
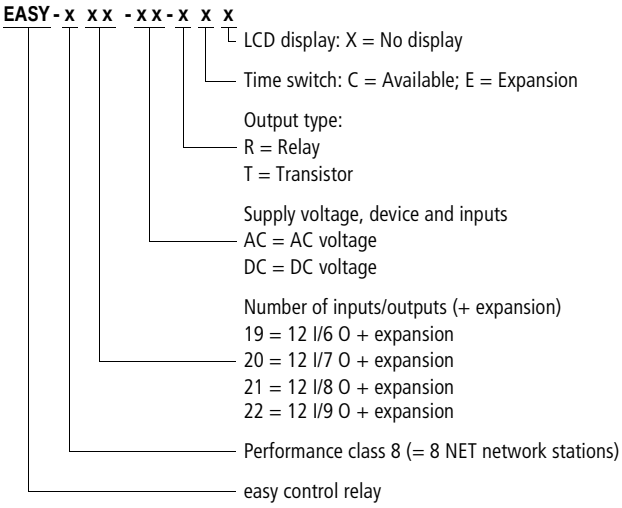


Figure 1: Device overview

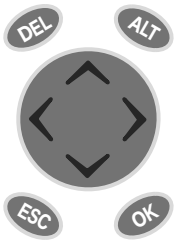
① Power supply
② Inputs
③ EASY-NET connections
④ Operating status LEDs
⑤ Interface socket for memory card or PC connection
⑥ Buttons
⑦ Outputs
⑧ LCD display

Key to type references



easy operating principles

Operating buttons



DEL: Delete object in circuit diagram

ALT: Special functions in circuit-diagram, status display

Cursor buttons ⟨⟩ ∧∨:
Move cursor
Select menu items
Set contact numbers, contacts and values

OK: Next menu level, Save your entry

ESC: Previous menu level, Cancel

Moving through menus and choosing values

DEL and ALT — Show System menu

OK — Go to next menu level
Select menu item
Store your entry

ESC — Return to last menu level
Cancel your entry since the last **OK**

∧∨ Change menu item
Change value

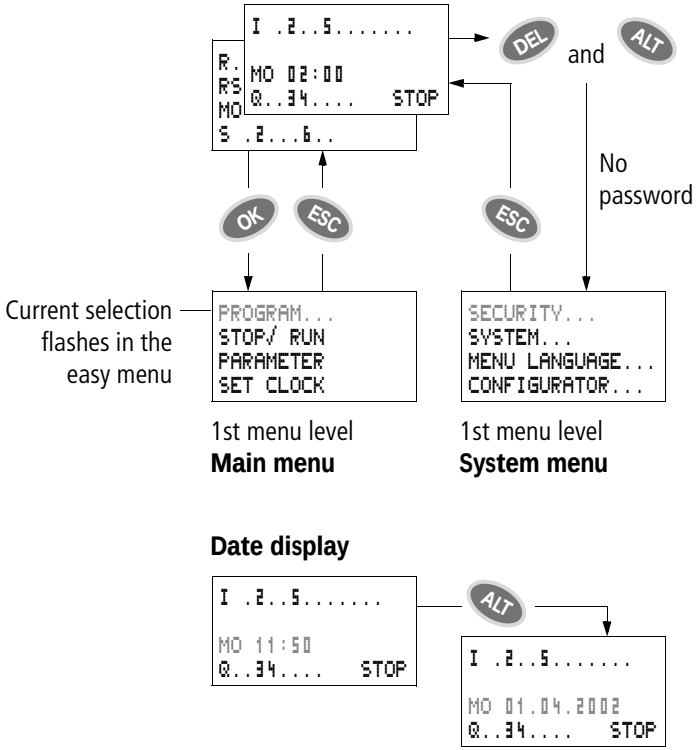
⟨⟩ Change position

P button function:

⟨ Input P1, ∧ Input P2
⟩ Input P3, ∨ Input P4

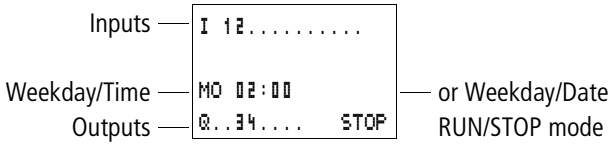
Select main and special menu

Status display



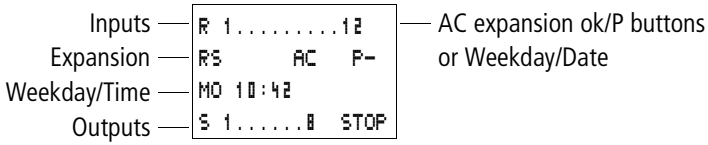
Date display

Status display easy800



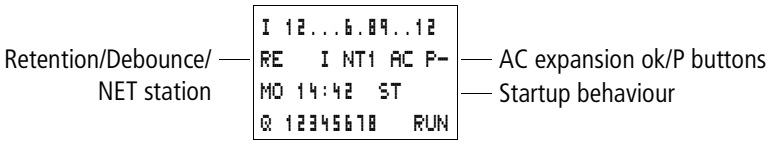
On: 1, 2, 3, 4/Off:...

Status display for local expansion



On: 1, 2, 3, 4/Off:...
RS = Expansion functioning correctly

easy800 advanced status display



RE : Retention switched on
I : Debounce switched on
NT1 : NET station with station address
AC : AC expansion functioning correctly
DC : DC expansion functioning correctly
GW : Bus coupling module recognised
GW flashes: Only EASY200-EASY recognised. E/A-expansion will not be recognised.
ST : When the power supply is switched on, easy switches to Stop mode

easy800-LED display

easy800 has two LEDs located on the front side which indicate the state of the power supply voltage (POW) as well as the Run or Stop modes (→ Fig. 1, Page 11).

Table 1: LED power supply/Run-Stop mode

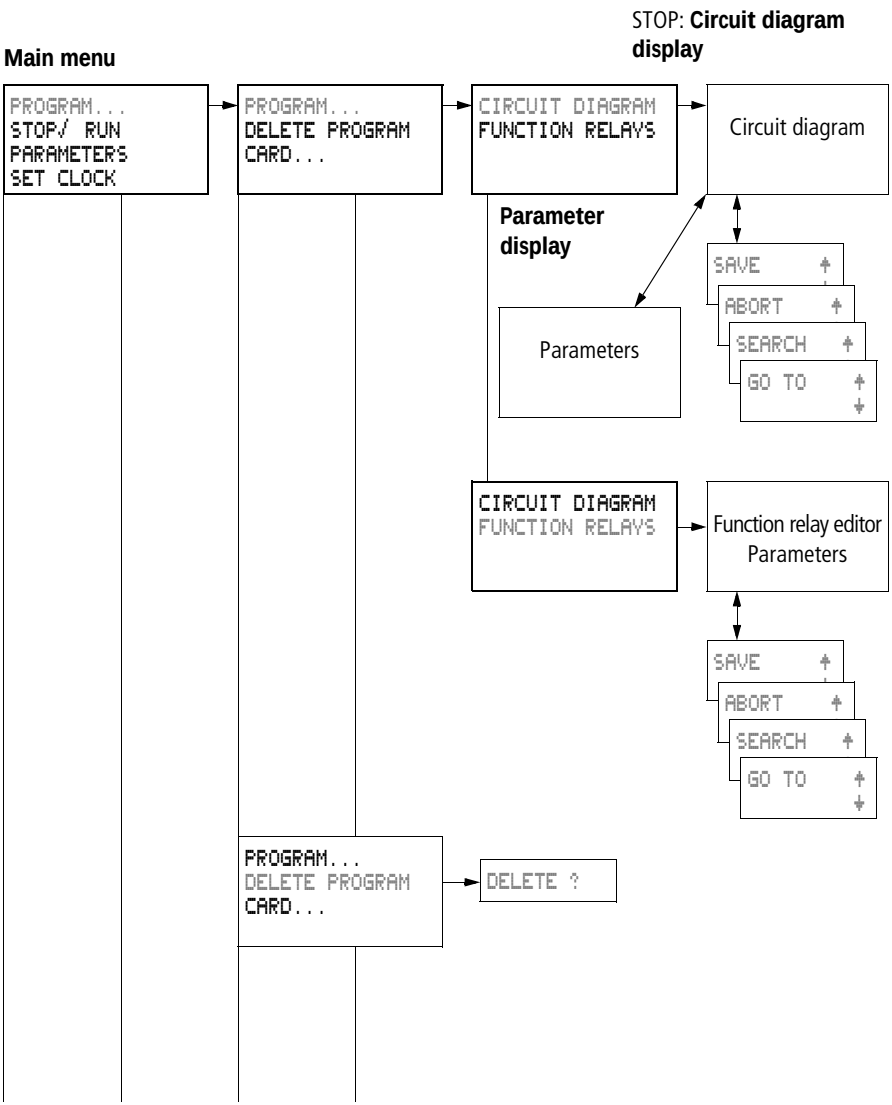
LED OFF	No power supply
LED continuously lit	Power supply present, Stop mode
LED flashing	Power supply present, Run mode

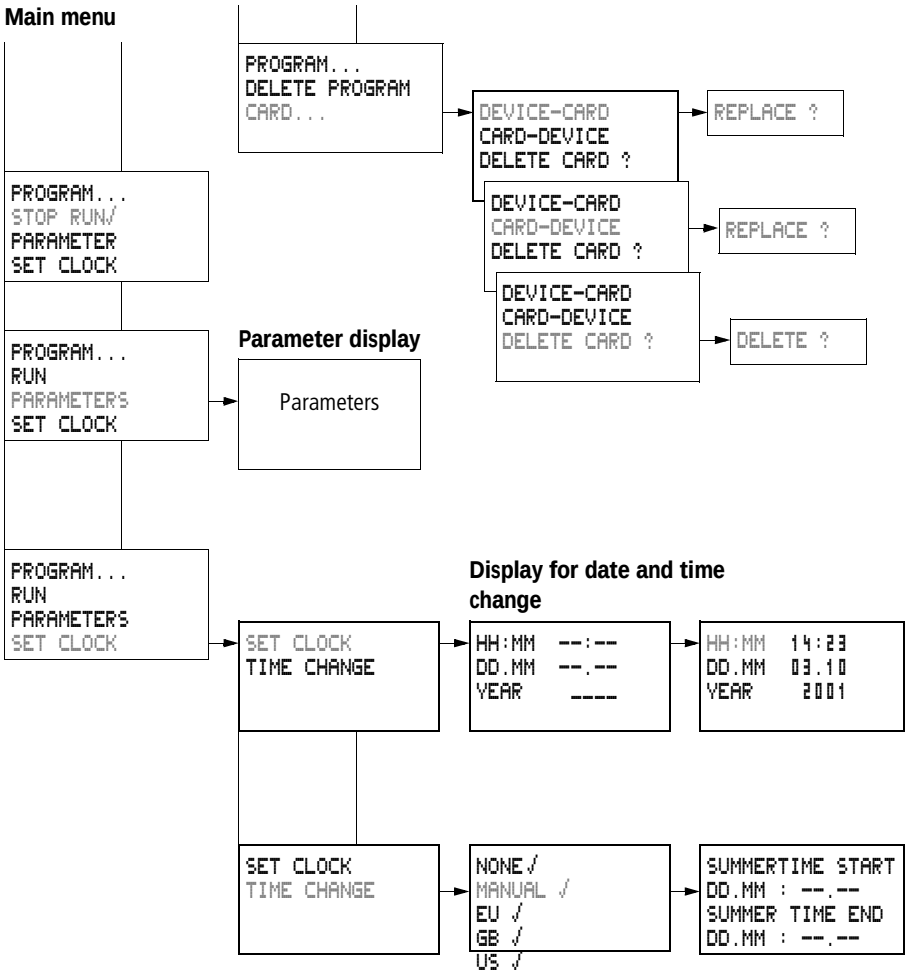
Table 2: LED NET (NET)

LED OFF	NET not operational, fault in configuration
LED continuously lit	NET is initialized and no station has been recognised.
LED flashing	NET operating without fault

Menu structure

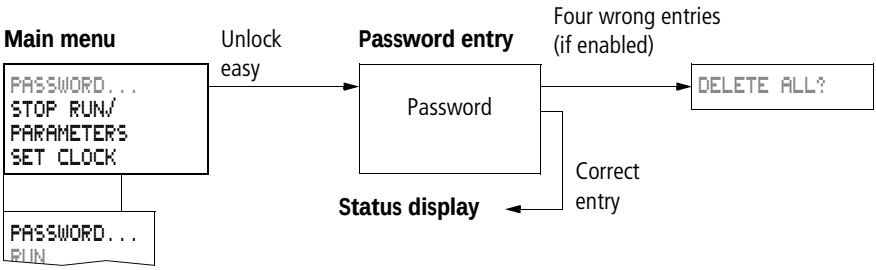
Main menu without password protection



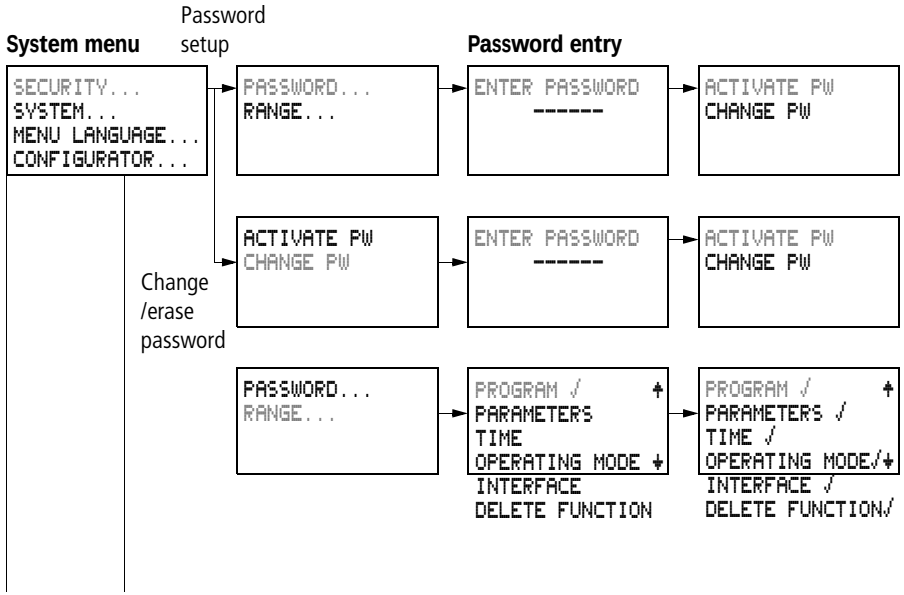


Only one selection is possible.

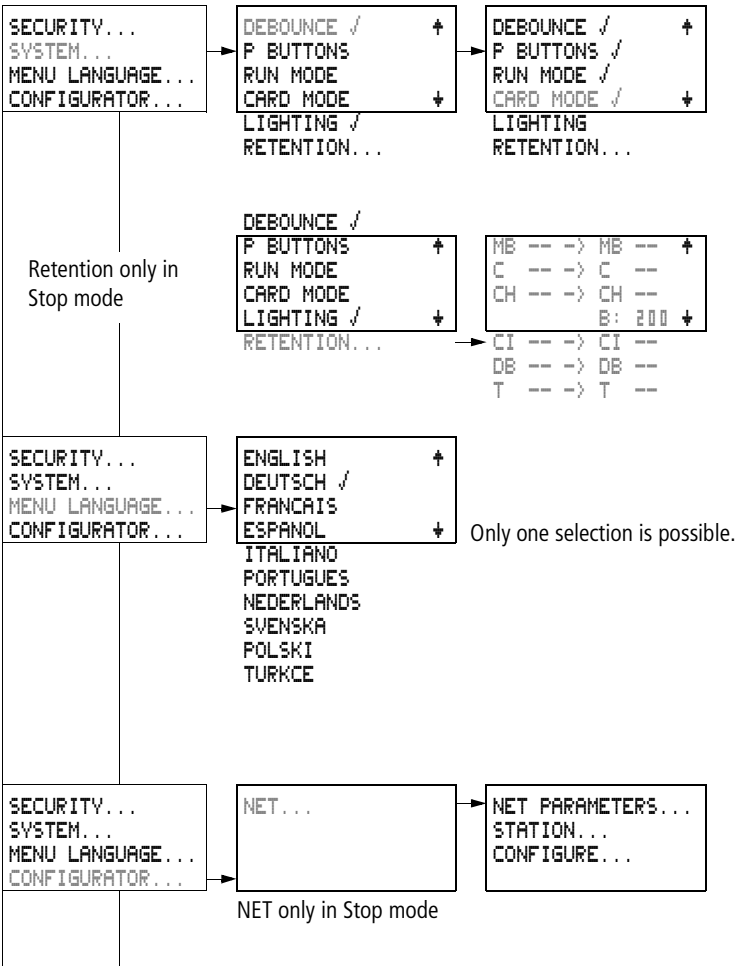
Main menu with password protection



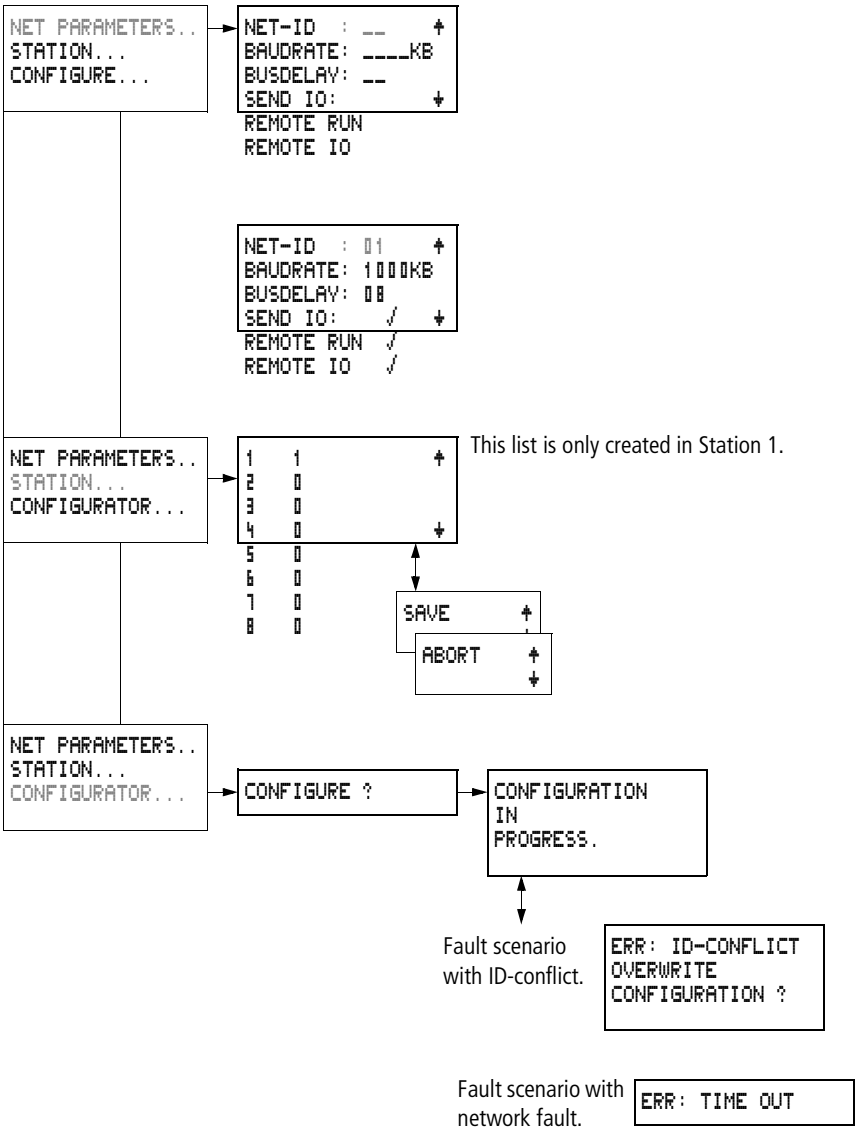
easy800 system menu



System menu


SECURITY...
SYSTEM...
MENU LANGUAGE...
CONFIGURATOR...
DEBOUNCE √
P BUTTONS
RUN MODE
CARD MODE
LIGHTING √
RETENTION...
DEBOUNCE √
P BUTTONS √
RUN MODE √
CARD MODE √
LIGHTING
RETENTION...
Retention only in Stop mode
DEBOUNCE √
P BUTTONS
RUN MODE
CARD MODE
LIGHTING √
RETENTION...
MB -- -> MB --
C -- -> C --
CH -- -> CH --
B: 200
CI -- -> CI --
DB -- -> DB --
T -- -> T --
SECURITY...
SYSTEM...
MENU LANGUAGE...
CONFIGURATOR...
ENGLISH
DEUTSCH √
FRANCAIS
ESPANOL
ITALIANO
PORTUGUES
NEDERLANDS
SVENSKA
POLSKI
TURKCE
Only one selection is possible.
SECURITY...
SYSTEM...
MENU LANGUAGE...
CONFIGURATOR...
NET...
NET PARAMETERS...
STATION...
CONFIGURE...
NET only in Stop mode

System menu

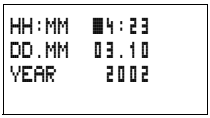

NET PARAMETER'S..
STATION...
CONFIGURE...
NET-ID : __
BAUDRATE: ____KB
BUSDELAY: __
SEND IO:
REMOTE RUN
REMOTE IO
NET-ID : 01
BAUDRATE: 1000KB
BUSDELAY: 08
SEND IO: √
REMOTE RUN √
REMOTE IO √
NET PARAMETER'S..
STATION...
CONFIGURATOR...
1 1
2 0
3 0
4 0
5 0
6 0
7 0
8 0
SAVE
ABORT
This list is only created in Station 1.
NET PARAMETER'S..
STATION...
CONFIGURATOR...
CONFIGURE ?
CONFIGURATION
IN
PROGRESS.
Fault scenario
with ID-conflict.
ERR: ID-CONFLICT
OVERWRITE
CONFIGURATION ?
Fault scenario with
network fault.
ERR: TIME OUT

Selecting or toggling between menu items

Cursor ∧∨

Select or toggle

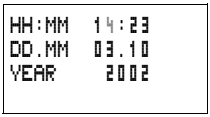
Cursor display



The cursor blinks:

Full cursor ▮/:

- Move cursor with < >,
- in circuit-diagram also with ∧∨

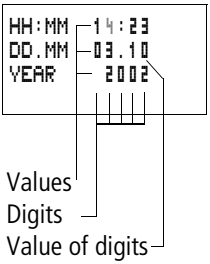


Value M/M

- Change position with < >
- Change values with ∧∨

Flashing values/menus are shown grey in this manual.

Setting values



Change value ∧∨

Move cursor up and down < >

Change position ∧∨

Store entries

Retain previous value

2 Installation

easy must only be installed and wired up by trained electricians or other persons familiar with the installation of electrical equipment.

Danger of electric shock
Never carry out electrical work on the device while the power supply is switched on.

Always follow the safety rules:

- Switch off and isolate
- Ensure that the device is no longer live
- Secure against reclosing
- Short-circuit and earth
- Cover adjacent live parts

easy is installed in the following order:

- Mounting
- Wiring up the inputs
- Wiring up the outputs
- Wiring up the NET network (if required)
- Connecting the power supply

Mounting

Install easy in an enclosure, switch cabinet or distribution board so that the power feed and terminal connections cannot be touched accidentally during operation.

Snap easy onto a DIN EN 50022 conform top-hat rail or fix easy in place using fixing brackets. easy can be mounted vertically or horizontally.

When using easy with expansion units, connect the expansion concerned before mounting (see → page 26).

For ease of wiring, leave a gap of at least 3 cm between easy terminals and the wall or adjacent devices.

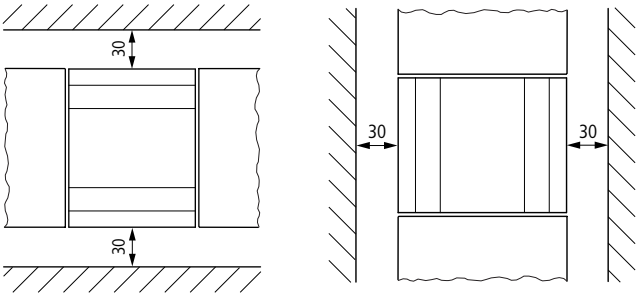
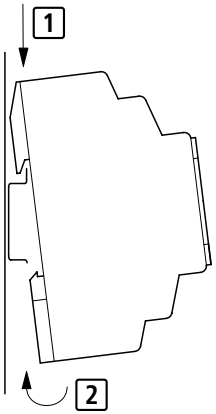


Figure 2: Clearances to easy



Mounting on mounting rail

▶ Hook easy to the top edge of the top-hat rail and hinge into place while pressing down slightly as shown by the arrows. Press down lightly on both the device and the top-hat rail until easy snaps over the lower edge of the top-hat rail.

easy will clip into place and will be secured by the built-in spring mechanism without needing screws.

▶ Check that easy is seated firmly.

easy is mounted vertically on a top-hat rail in the same way.

Mounting on a mounting plate

For screw fixing, fixing brackets which are fixed to the back of easy must be used. The fixing bracket can be ordered as an accessory.

EASY2..-..: easy600, easy800:

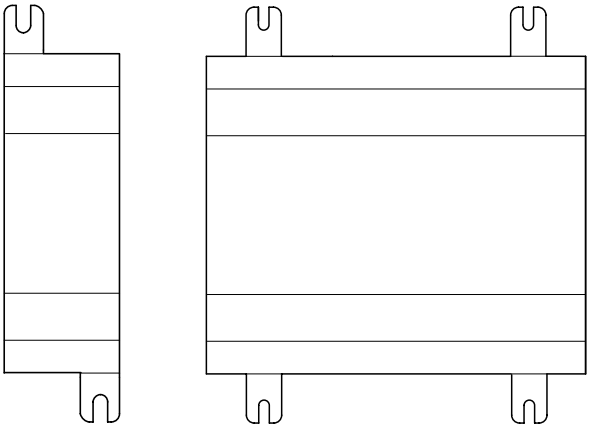


Figure 3: Mounting on a mounting plate

Connecting the expansion device

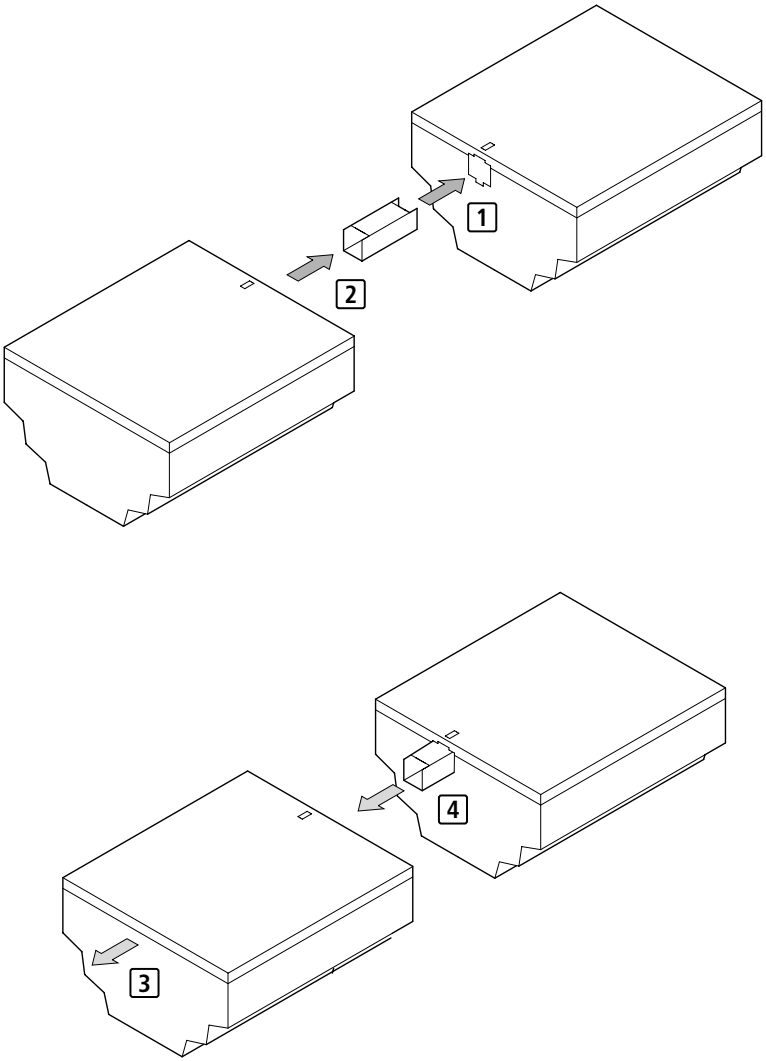


Figure 4: Expansion connection

Terminals

Tools

Slot-head screwdriver, width 3.5 mm, tightening torque 0.6 Nm.

Cable cross-sections

- Solid: 0.2 to 4 mm^2
- Flexible with ferrule: 0.2 to 2.5 mm^2

Network cables and jack

Use the prefabricated EASY-NT-"Long" cables when possible.

Other cable lengths can be manufactured using the EASY-NT-CAB cable, the EASY-NT-RJ45 jack as well as the EASY-RJ45-TOOL crimping tool.

AWG 24, 0.2 mm^2 are the largest cross-sections which can be crimped.

The first and last stations in the network must each be terminated with the EASY-NT-R bus termination resistor.

Connecting the power supply

For the technical data of both versions, **easy-DC** with 24 V DC and **easy-AC** with standard voltages of 100 V to 240 V AC, refer to Chapter "Technical Data" from page 239.

The easy800 models run a system test for one second after the power supply has been switched on. Either Run or Stop mode will be activated after this time depending on the default setting.

AC basic units

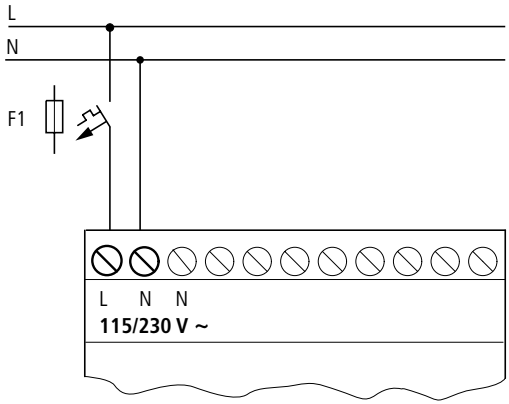


Figure 5: Power supply on the AC-basic units

EASY...-AC-.E AC expansion units

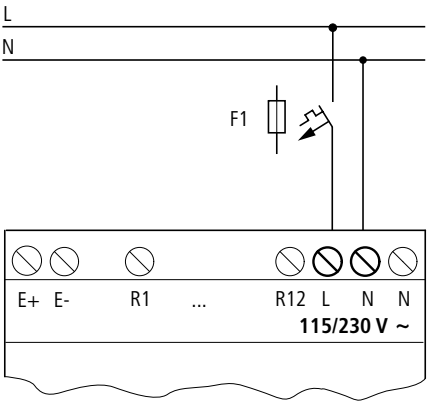


Figure 6: Power supply on the AC-expansion units

Note!
A short current surge will be produced when switching on for the first time. Do not switch on easy via Reed contacts since these may burn or melt.

DC-basic units

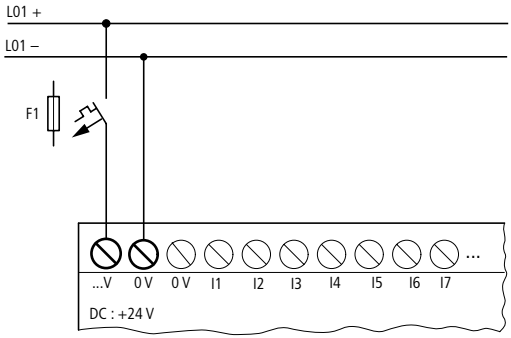


Figure 7: Power supply on the DC-basic units

EASY...-DC-.E DC expansion units

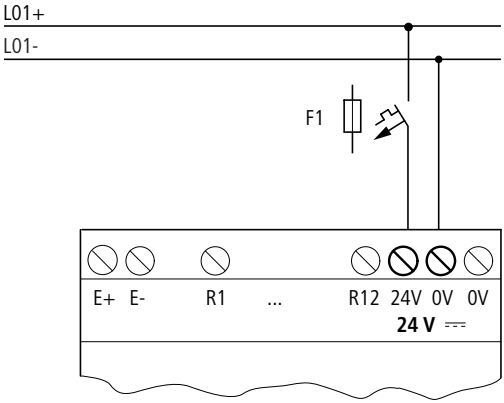


Figure 8: Power supply on the DC-basic units

→ easy DC is protected against polarity reversal. To ensure that easy works correctly, ensure that the polarity of each terminal is correct.

Cable protection

Both easy AC and DC versions require cable protection (F1) rated for at least 1 A (slow).

→ When easy is switched on for the first time, its power supply circuit behaves like a capacitor. Use an appropriate device for switching on the power supply and do not use any reed relay contacts or proximity switches.

Connecting the inputs

easy inputs switch electronically. Once you have connected a contact via an input terminal, you can reuse it as a contact in your easy circuit diagram as often as you like.

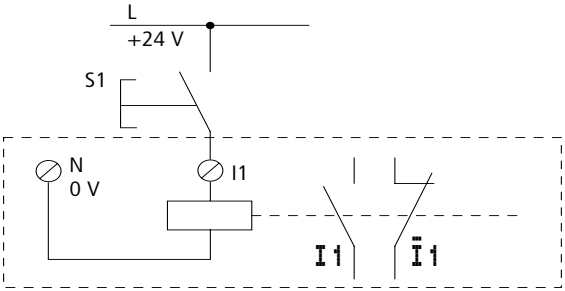


Figure 9: Connecting the inputs

Connect contacts such as push-button actuators or switches to easy input terminals.

Connecting easy-AC inputs

Caution!
For easy-AC, connect the inputs to the same line as the power feed in accordance with the VDE, IEC, UL and CSA safety regulations. Otherwise easy will not detect the switching level and may be damaged or destroyed by overvoltage.

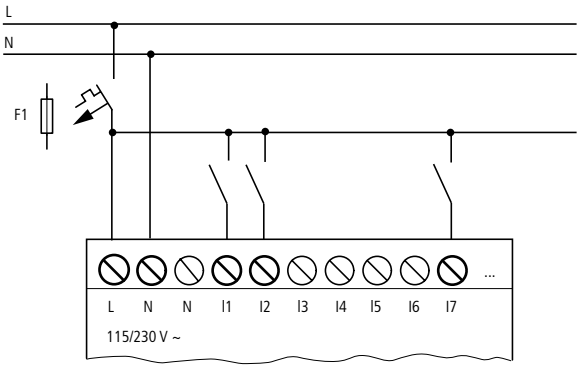


Figure 10: easy-AC basic unit

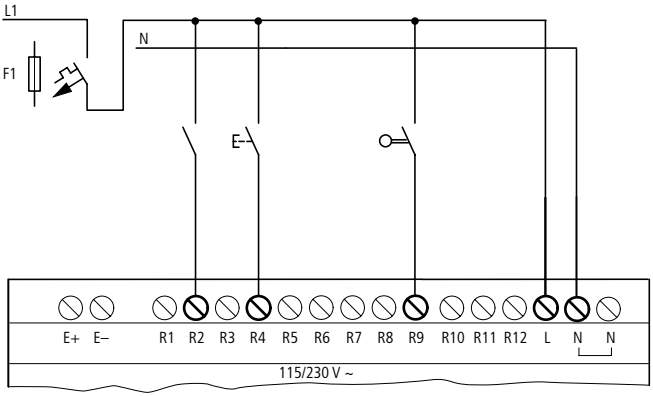


Figure 11: EASY...-AC-.E expansion unit

Connect the inputs, for example, to push-button actuators, switches or relay/contactor contacts.

Input signal voltage range

- OFF signal: 0 V to 40 V
- ON signal: 79 V to 264 V

Input current

- R1 to R12, I1 to I6, I9 to I12: 0.5 mA/0.25 mA at 230 V/115 V
- I7, I8: 6 mA/4 mA at 230 V/115 V

Cable lengths

Severe interference can cause input of a signal condition "1" without a proper signal being applied. Observe therefore the following maximum cable lengths:

- R1 to R12: 40 m without additional circuit
- I1 to I6, I9 to I12: 100 m with input debounce switched on, 60 m without additional circuit with input debounce switched off.
- I7, I8: 100 m without additional circuit

The following applies for expansion units:
With longer cables, connect a diode (e.g. 1N4007) for 1 A, minimum 1 000 V reverse voltage, in series to the easy input. Ensure that the diode is pointing towards the input as shown in the circuit diagram, otherwise easy will not detect the 1 state.

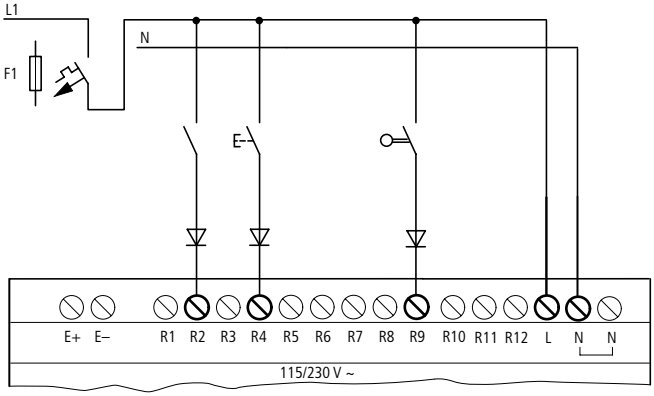


Figure 12: easy-AC with a diode on the inputs

Neon bulbs with a maximum residual current of 2 mA/1 mA at 230 V/115 V can be connected to I7 and I8.

→ Always use neon bulbs that are operated with a separate N connection.

Caution!
Do not use reed relay contacts on inputs I7 and I8. These may burn or melt due to the high inrush current of I7, I8.

Two-wire proximity switches have a residual current with the "0" state. If this residual current is too high, the easy input may detect a "1" signal.

Therefore, use inputs I7 and I8. An additional input circuit is required if more inputs are used.

Increasing the input current

The following input circuit can be used in order to prevent interference and also when using two-wire proximity switches:

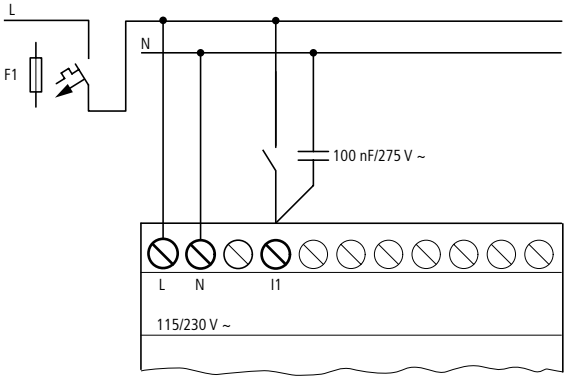


Figure 13: Increasing the input current

When using a 100 nF capacitor the drop-off time of the input increases by 80 (66.6) ms at 50 (60) Hz.

A resistor can be connected in series with the circuit shown in order to restrict the inrush current.

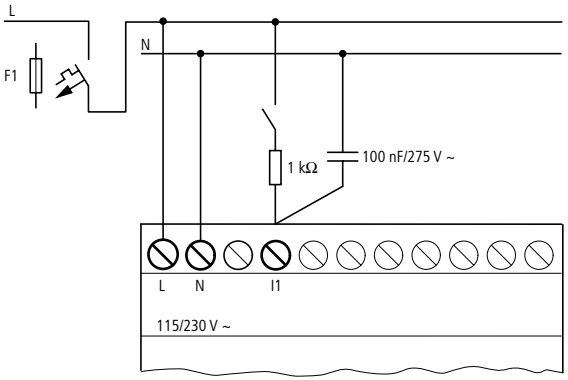


Figure 14: Limitation of the inrush current with a resistor

Complete devices for increasing the input current are available under the type reference EASY256-HCI..

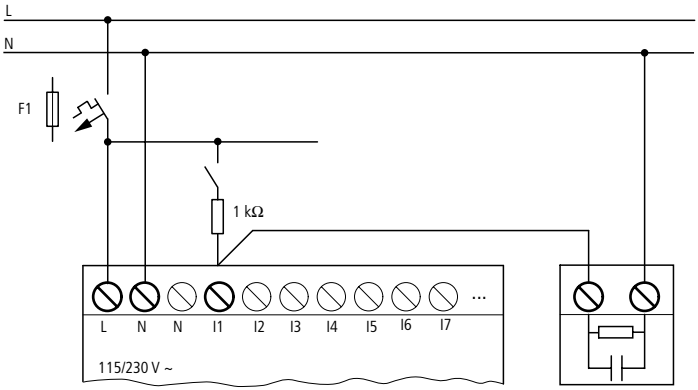


Figure 15: easy800 with EASY256-HCI

→ The increased capacitance increases the drop-out time by approx. 40 ms.

Connecting the easy-DC

Use input terminals I1 to I12 to connect push-button actuators, switches or 3 or 4-wire proximity switches. Given the high residual current, do not use 2-wire proximity switches.

Input signal voltage range

- I1 to I6, I9, I10
  - OFF signal: 0 V to 5 V
  - ON signal: 15 V to 28.8 V
- I7, I8, I11, I12
  - OFF signal: < 8 V
  - ON signal: > 8 V

Input current

- I1 to I6, I9, I10, R1 to R12: 3.3 mA at 24 V
- I7, I8, I11, I12: 2.2 mA at 24 V

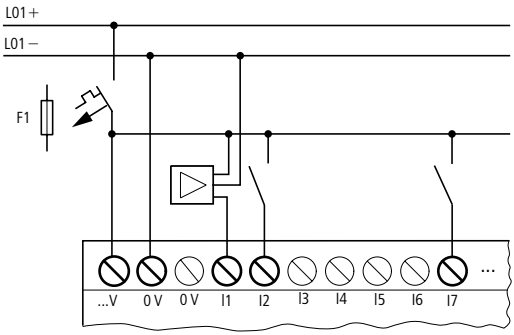


Figure 16: easy-DC

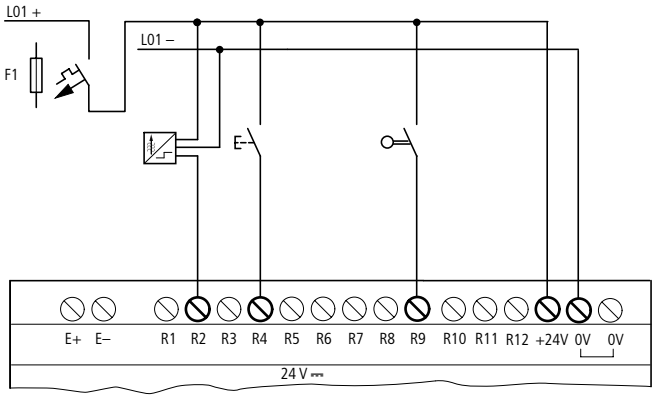


Figure 17: EASY...-DC-.E

Connecting analog inputs

Inputs I7, I8, I11 and I12 can also be used to connect analog voltages ranging from 0 V to 10 V.

The following applies:

- I7 = IA01
- I8 = IA02
- I11 = IA03
- I12 = IA04

The resolution is 10 Bit = 0 to 1023.

Caution!
Analog signals are more sensitive to interference than digital signals. Consequently, more care must be taken when laying and connecting the signal lines. Incorrect switching states may occur if they are not connected correctly.

- ▶ Use screened twisted pair cables to prevent interference with the analog signals.
- ▶ For short cable lengths, ground the screen at both ends using a large contact area. If the cable length exceeds 30 m or so, 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 easy outputs to a separate power supply, or use a suppressor circuit for motors and valves. If loads such as motors, solenoid valves or contactors are operated with easy via the same power feed, switching may result in interference on the analog input signals.

The following four circuits contain examples of applications for analog value processing.

→ Ensure that the reference potential is connected. Connect the 0 V of the power supply unit for the different setpoint potentiometers and sensors shown in the examples to the 0 V of the easy power feed.

Setpoint potentiometer

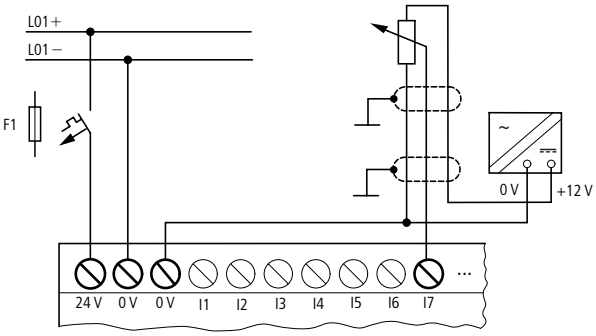


Figure 18: Setpoint potentiometer

Use a potentiometer with a resistance of ≦ 1 kΩ, e.g. 1 kΩ, 0.25 W.

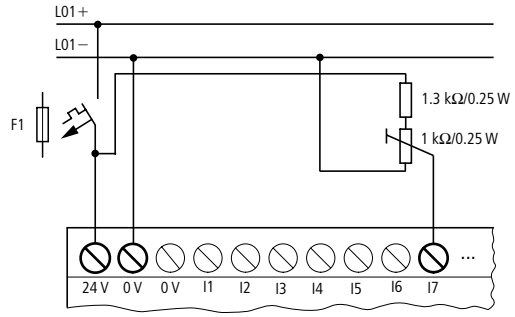


Figure 19: Setpoint potentiometer with upstream resistor

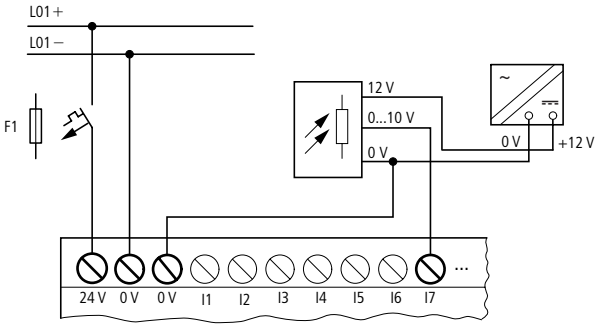


Figure 20: Brightness sensor

Temperature sensor

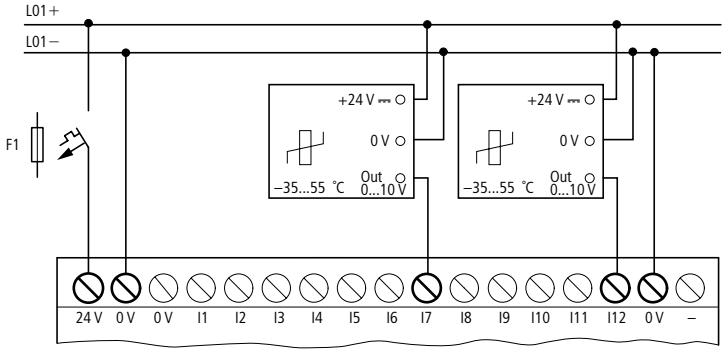


Figure 21: Temperature sensor

20-mA sensor

4 to 20 mA (0 to 20 mA) sensors can be connected easily without any problem using an external 500 Ω resistor.

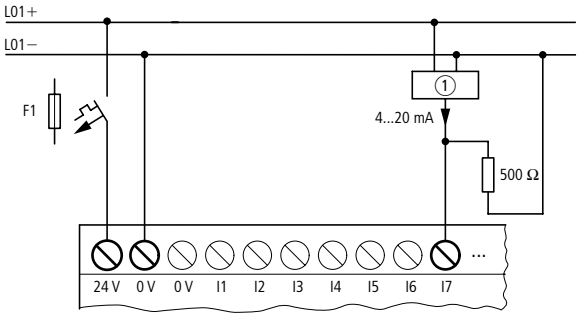


Figure 22: 20-mA sensor

① Analog sensor

The following values apply:

- 4 mA = 0.2 V
- 10 mA = 4.8 V
- 20 mA = 9.5 V

(according to $U = R \times I$ = 478 Ω × 10 mA ~ 4.8 V)

Connecting fast counters and frequency generators

It is possible on the easy800 to correctly count fast counter signals on inputs I1 to I4 by bypassing the cycle time.

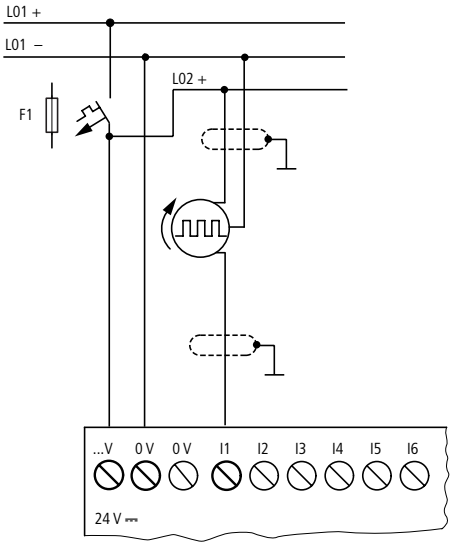


Figure 23: Fast counters

Connecting incremental value encoders

It is possible on the easy800 to correctly count incremental value encoder signals by connecting them to inputs I1, I2 and I3, I4 when bypassing the cycle time. The incremental value encoder must generate two 24 V DC square wave signals with a 90° phase shift between them.

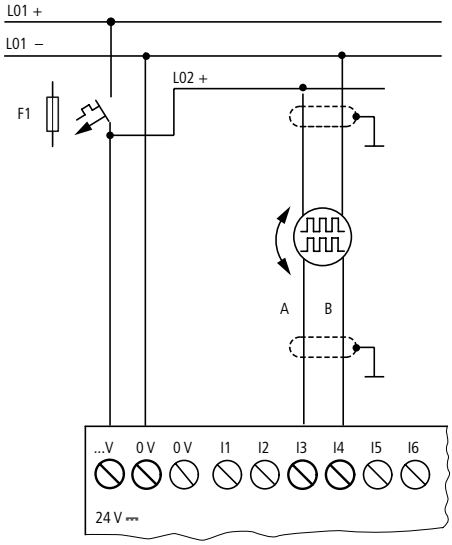


Figure 24: Connecting incremental value encoders

Connecting the outputs

The Q output terminals function inside easy as isolated contacts.

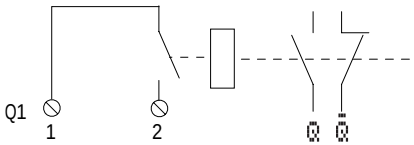


Figure 25: Output "Q"

The respective relay coils are actuated in the easy circuit diagram via the output relay Q 01 to Q 06 or Q 01 to Q 08. You can use the signal states of the output relays as make or break contacts in the easy circuit diagram to provide additional switching conditions.

The relay or transistor outputs are used to switch loads such as fluorescent tubes, filament bulbs, contactors, relays or motors. Check the technical thresholds and output data before installing such devices (see → chapter "Technical Data", from page 245).

Connecting relay outputs EASY8..-..-RC..

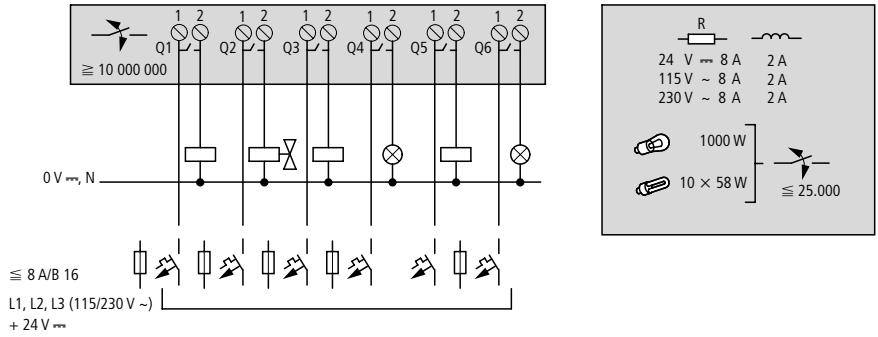


Figure 26: EASY8..-..RC.. relay outputs

EASY6..-..-RE..

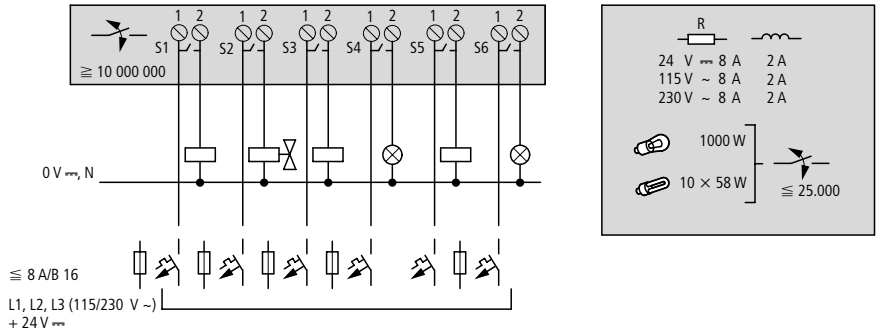


Figure 27: EASY6..-..-RE.. relay outputs

Unlike the inputs, the relay outputs can be connected to different lines.

Do not exceed the maximum voltage of 250 V AC on a relay contact. If the voltage exceeds this threshold, flashover may occur at the contact, resulting in damage to the device or a connected load.

Connecting transistor outputs

EASY8..-DC-TC, EASY6..-DC-TE

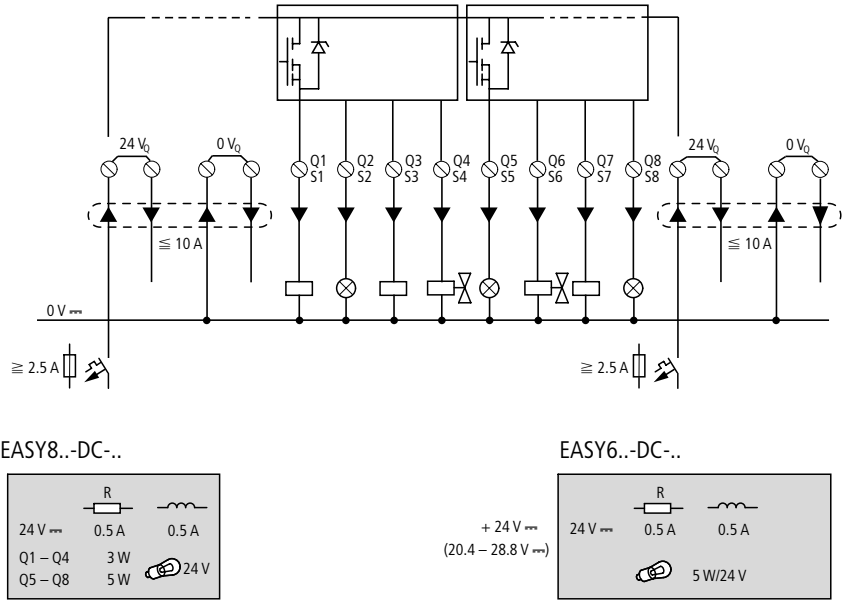


Figure 28: Transistor outputs EASY8..-DC-TC, EASY6..-DC-TE

Parallel connection:
Up to four outputs can be connected in parallel in order to increase the power. The output current will increase in this case to a maximum of 2 A.

Caution!
Outputs may only be connected in parallel within a group (Q1 to Q4 or Q5 to Q8, S1 to S4 or S5 to S8), such as Q1 and Q3 or Q5, Q7 and Q8. Outputs connected in parallel must be switched at the same time.

Caution!
Please note the following when switching off inductive loads:
Suppressed inductive loads cause less interference in the entire electrical system. For optimum suppression the suppressor circuits are best connected directly in the proximity of the inductive load.

If inductive loads are not suppressed, the following applies: Multiple inductive loads may 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, then you must provide suppressor circuits for these loads (→ following diagrams).

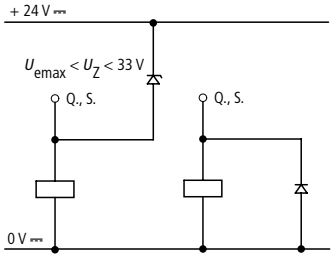


Figure 29: Inductivity with suppressor circuit

Behaviour with short-circuit/overload
Should a short circuit or overload occur on a transistor output, this output will switch off. The output will switch on up to maximum temperature after the cooling time has elapsed. This time depends on the ambient temperature and the current involved. If the fault condition persists, the output will keep switching off and on until the fault is corrected or until the power supply is switched off (→ section "Monitoring of short-circuit/overload with EASY..-D.-T..", page 230).

Connecting analog outputs

EASY820-DC-RC and EASY822-DC-TC each have an analog output QA 01, 0 V to 10 V DC, 10 Bit resolution (0 to 1023). The analog output allows you to control servo-valves and other final controlling elements.

Caution!
Analog signals are more sensitive to interference than digital signals. Consequently, more care must be taken when laying and connecting the signal lines. Incorrect switching states may occur if they are not connected correctly.

Connecting servo-valves

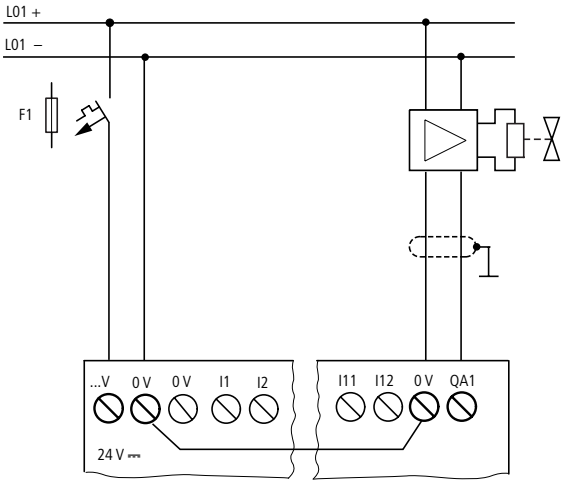


Figure 30: Connecting servo-valves

Setpoint definition for the drive

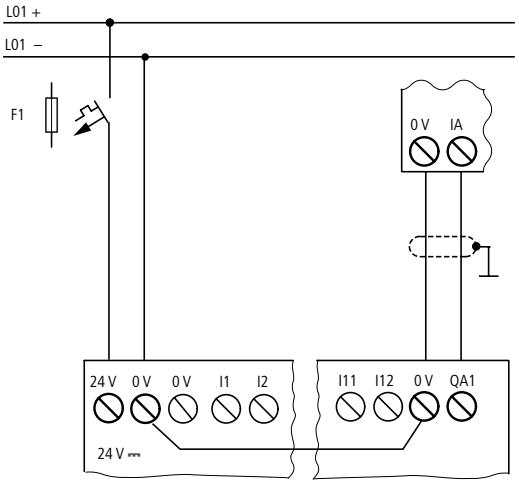


Figure 31: Setpoint definition for the drive

Connecting the NET network

easy800 enables the installation and configuration of the NET network. A maximum of eight easy800 devices can be connected to this network. Further information can be found in the Chapter "NET Network", page 183.

Accessories

Connection jack:
8-pole RJ45, EASY-NT-RJ45

Connection cable:
4-pair twisted cable; → chapter "Technical Data", page 251

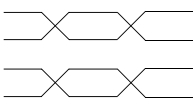


Figure 32: Connection assignment

ECAN_H data cable, pin 1, cable pair A
ECAN_L data cable, pin 2, cable pair A
Ground cable GND, pin 3, cable pair B
Select cable SEL_IN, pin 4, cable pair B

Table 3: Prefabricated cables, RJ45 jack on both ends

Cable lengths cm	Type designation
30	EASY-NT-30
80	EASY-NT-80
150	EASY-NT-150

Material for self-manufactured cables

100 m 4 × 0.18 mm^2: EASY-NT-CAB

Required crimping tool for RJ45 jack: EASY-RJ45-TOOL

Bus termination resistor

The first and last stations in the network must be provided with a bus termination resistor.

- Value: 124 Ohms
- Termination connector: EASY-NT-R

Cable lengths and cross-sections

For correct operation of the network it is necessary that the cable lengths, cross-sections and cable resistances correspond to the following table.

Cable lengths	Cable resistance	Cross-section	
m	mΩ/m	mm^2	AWG
up to 40	< 140	0,13	26
up to 175	< 70	0.25 to 0.34	23, 22
up to 250	< 60	0.34 to 0.6	22, 20, 19
up to 400	< 40	0.5 to 0.6	20, 19
up to 600	< 26	0.75 to 0.8	18
up to 1000	< 16	1.5	16

Calculate cross-section with known cable lengths
The minimum cross-section is determined for the known maximum extent of the network.

l = cable length in m
S_{min} = minimum cable cross-section in mm^2
ρ_{cu} = resistivity of copper, if not otherwise stated 0.018 $\Omega mm^2/m$

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

→ If the result of the calculation does not yield a standard cross-section, the next larger cross-section is used.

Calculate cross-section with known cable lengths
The maximum cable lengths are calculated for a know conductor cross-section

l = cable length in m
S_{min} = minimum cable cross-section in mm^2
ρ_{cu} = resistivity of copper, if not otherwise stated 0.018 $\Omega mm^2/m$

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

Pluging-in and pluging-out network cables

easy800 is equipped with two RJ45 network sockets.

Socket 1 which is the lefthand socket is for the bus termination resistor on the first physical station. For other stations, socket 1 is used for insertion of the incoming cable. Socket 2 which is the righthand socket is used for the outgoing cable or for the bus termination resistor on the last physical station in the network.

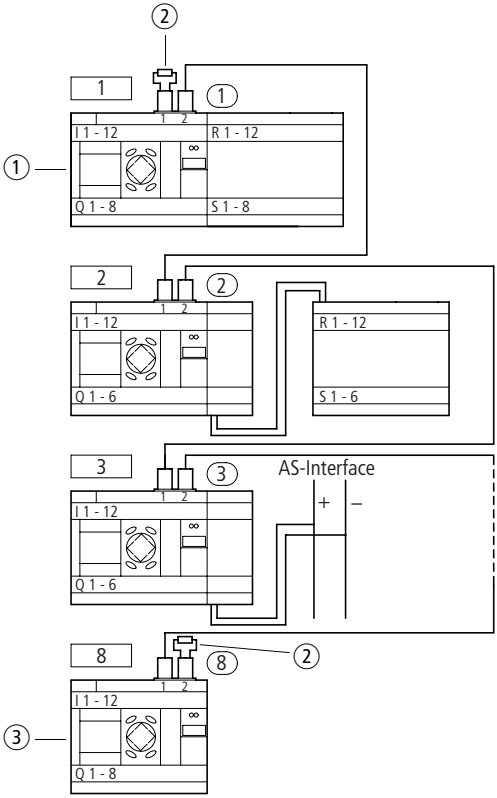


Figure 33: Bus termination resistors

① First easy800 in the NET

② Bus termination resistor

③ Last easy800 in the NET

Physical location, place

Station address

Both RJ45 interfaces are visible after the cover plate has been removed.

When a cable is inserted, the mechanical connection must be audible (click) and visible 1.

Before a jack or cable is removed, the mechanical locking feature must be undone 2, 3.

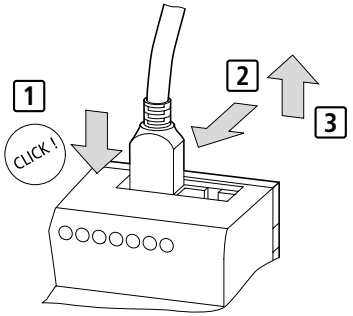


Figure 34: Cable insertion and removal

Expanding inputs/outputs

You can add expansion units to all easy800 models in order to increase the number of inputs and outputs:

Expandable easy basic units	Expansion units	
EASY8..-..-R.. EASY8..-..-T..	EASY618-..-RE	• 12 AC inputs, • 6 relay outputs
	EASY620-..-TE	• 12 DC inputs, • 8 transistor outputs
	EASY202-RE	2 relay outputs, common[1)]
	Special expansion units → current catalogue	

1) common supply for multiple outputs

Local expansion

Local expansion units are connected directly next to the basic unit.

▶ Connect the easy expansion unit via the EASY-LINK-DS plug connector.

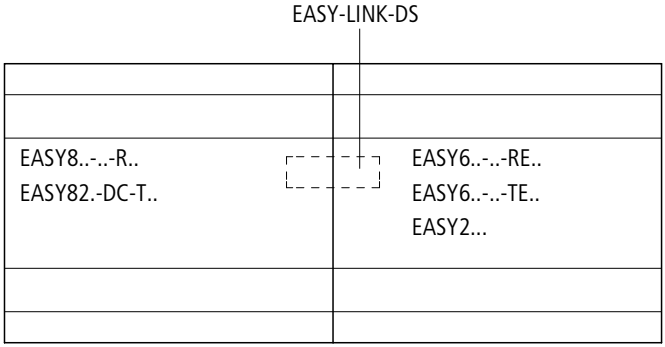


Figure 35: Conecting local expansions with easy800

The following electrical separation is implemented between the EASY8..-..-.C. basic unit and the expansion device (separation always in local connection of expansion unit)

- Simple isolation 400 V AC (+10 %)
- Safe isolation 240 V AC (+10 %)

Units may be destroyed if the value 400 V AC +10 % is exceeded, and may cause the malfunction of the entire system or machine!

Basic unit and expansion unit can be provided with different DC power supplies.

Decentralized (distributed) expansion

Decentralized expansion units can be installed and run up to 30 m away from the basic unit.

Warning
The two-wire or multiple-wire cable between the devices must adhere to the insulation voltage requirement which is stipulated for the installation environment. Otherwise, a fault scenario (earth fault, short-circuit) may lead to destruction of the units or injury to personnel.

A cable such as NYM-0 with a rated operational voltage of U_e = 300/500 V AC is normally sufficient.

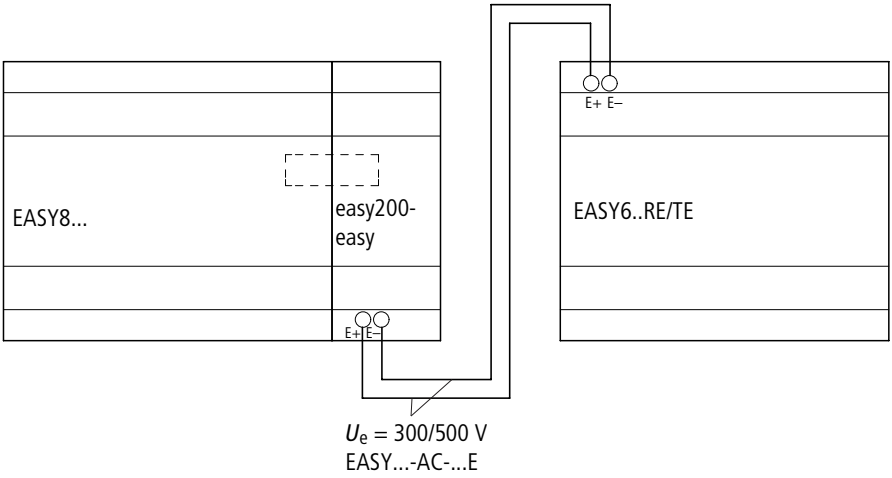


Figure 36: Connecting decentral expansions to the easy800

→ Terminals E+ and E– of the EASY200-EASY are protected against short-circuits and polarity reversal.
Functionality is only ensured if E+ is connected with E+ and E– with E–.

3 Commissioning

Switching on

Before switching on easy, check that you have connected the power supply terminals, inputs, outputs and network connection correctly:

- 24 V DC version:
  - Terminal +24 V: +24 V voltage:
  - Terminal 0 V: 0 V voltage:
  - Terminals I1 to I12, R1 to R12:
  - Actuation via +24 V
- 230 V AC version:
  - Terminal L: Phase conductor
  - Terminal N: Neutral conductor N
  - Terminals I1 to I12, R1 to R12:
  - Actuation via phase conductor L

If you have already integrated easy into a system, secure any parts of the system connected to the working area to prevent access and ensure that no-one can be injured if, for example, motors start up unexpectedly.

Setting the menu language

When you switch on easy for the first time, you will be asked to select the menu language.

▶ Use the cursor buttons ∧ or ∨ to select the language required.

- English
- German
- French
- Spanish
- Italian
- Portuguese
- Dutch
- Swedish
- Polish
- Turkish

▶ Press **OK** to confirm your choice and press **ESC** to exit the menu.

easy will then switch to the Status display.

You can change the language setting at a later date, if you wish, see → section "Changing the menu language", page 206.

If you do not set the language, easy will display this menu and wait for you to select a language every time you switch on.

easy operating modes

easy has two operating modes - Run and Stop.

In Run mode easy continuously processes a stored circuit diagram until you select Stop or disconnect the power. The circuit diagram, parameters and the easy settings are retained in the event of a power failure. All you will have to do is reset the real-time clock after the back-up time has elapsed. Circuit diagram entry is only possible in Stop mode.

Caution!
In Run mode easy will immediately run the saved circuit diagram in the unit when the power supply is switched on. This will happen unless Stop mode was set as startup mode. In Run mode outputs are activated according to the switch logic involved.

If a memory card with a valid easy800 circuit-diagram is inserted, the following should be observed when the voltage is applied. If easy800 does not have a circuit-diagram, the circuit diagram stored on the memory card is automatically loaded and the easy800 immediately operates with the circuit diagram in Run mode.

Creating your first circuit diagram

The following small circuit diagram takes you step by step through wiring up your first easy circuit diagram. In this way you will learn all the rules, quickly enabling you to use easy for your own projects.

As with conventional wiring, you use contacts and relays in the easy circuit diagram. With easy, however, you no longer have to connect up components individually. At the push of a few buttons, the easy circuit diagram produces all the wiring. All you have to do is then connect any switches, sensors, lamps or contactors you wish to use.

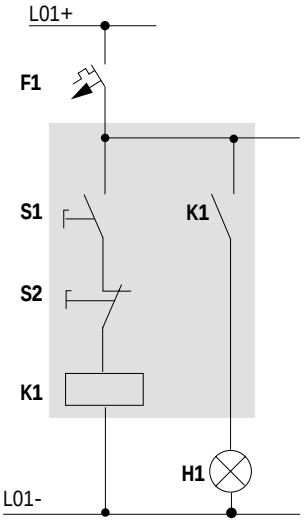


Figure 37: Lamp controller with relays

In the following example, easy carries out all the wiring and performs the tasks of the circuit diagram highlighted previously.

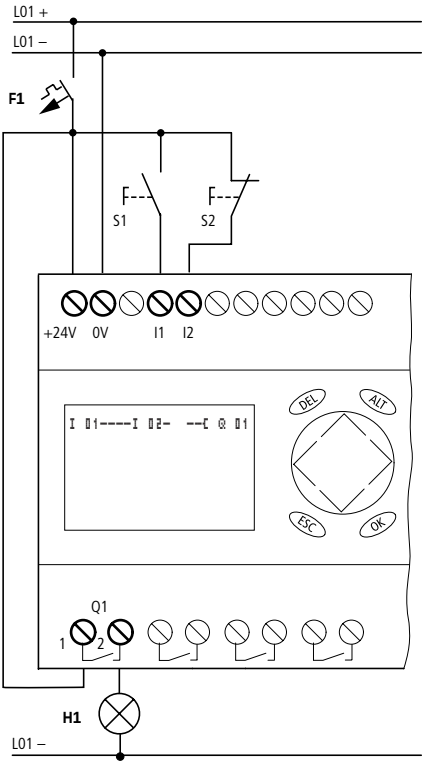
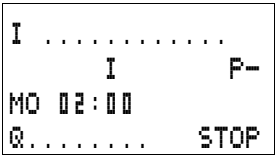


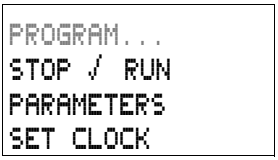
Figure 38: Lamp controler with easy

Starting point: the Status display



When you switch on easy, it opens the Status display immediately to show the switching state of the inputs and outputs. It also indicates whether easy is already running a circuit diagram.

→ The examples were written without the use of expansion units. If an expansion unit is connected, the Status display will first show the status of the basic unit and then the status of the expansion unit before showing the first selection menu.



▶ Press **OK** to switch to the main menu.

Press **OK** to switch to the next menu level, and press **ESC** to move one level back.

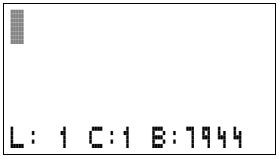
→ **OK** has two other functions:

- Press **OK** to save modified settings.
- In the circuit diagram, you can also press **OK** to insert and modify contacts and relay coils.

In this case easy must be in Stop mode

▶ Press 2 × **OK** to enter the circuit diagram display via menu points PROGRAM... → PROGRAM. This is where you will create the circuit diagram.

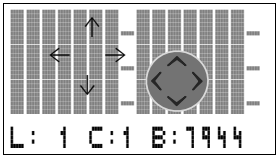
Circuit diagram display



The circuit diagram display is currently empty. The cursor is flashing at the top left, which is where you will start to create your diagram.

The position of the cursor is displayed in the status line.
L: = current path (line), C: = contact or coil (contact),
B: = number of free memory slots in bytes. Start value 7944, where the first three current paths are already generated.

The easy800 circuit diagram supports 4 contacts and a coil in series. The easy800 display can display 6 circuit diagram contact fields.



The cursor is moved with the ∧∨ 〈 〉 cursor keys over the invisible circuit-diagram grid.

The first four columns are contact fields, the fifth column is a coil field. Each line is a current path. easy automatically connects the first contact to voltage.

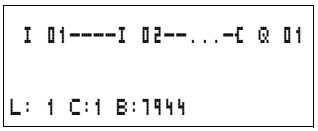


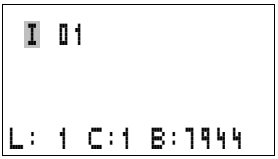
Figure 39: Circuit diagram with inputs "I1", "I2" and output "Q1"

▶ Now try to wire up the following easy circuit diagram.

Switches S1 and S2 are at the input. I 01 and I 02 are the contacts for the input terminals. Relay K1 is represented by the relay coil (Q 01. The symbol (identifies the coil's function, in this case a relay coil acting as a contactor. Q 01 is one of the easy output relays.

From the first contact to the output coil

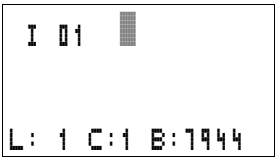
With easy, you work from the input to the output. The first input contact is "I1".



▶ Press **OK**.

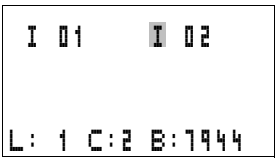
easy inserts the first contact I 01 at the cursor position.

I flashes and can be changed, for example, to a P for a button input using the cursor buttons ∧ or ∨. However, nothing needs to be changed at this point



▶ Press 2 × **OK**, to move the cursor across the 01 to the next contact field.

You could also move the cursor to the next contact field using the cursor button >.

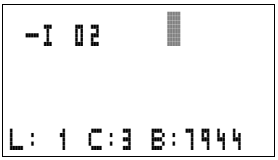


▶ Press **OK**.

Again, easy creates a contact I 01 at the cursor position. Change the contact number to I 02, so that break contact S2 can be connected to input terminal I2.

▶ Press **OK** so that the cursor jumps to the next position and press cursor button ∧ or ∨ to change the number to 02.

→ Press **DEL** to delete a contact at the cursor position.



▶ Press **OK** to move the cursor to the third contact field.

You do not need a third relay contact, so you can now wire the contacts directly to the coil field.

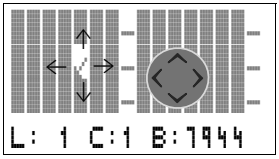
Wiring

easy displays a small arrow when creating the circuit diagram ↙.

Press **ALT** to activate the arrow and press the cursor buttons ∧∨ 〈 〉 to move it.

→ **ALT** has two other functions depending on the cursor position:

- In the left contact field, press **ALT** to insert a new empty circuit connection.
- The contact under the cursor changes with **ALT** between a make and break contact.



The wiring arrow works between contacts and relays. When you move the arrow onto a contact or relay coil, it changes back to the cursor and can be reactivated with ALT if required.

→ easy automatically wires adjacent contacts in a circuit connection up to the coil.

▶ Press **ALT** to wire the cursor from **I 02** throught to the coil field.

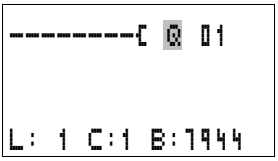
The cursor changes into a flashing wiring arrow and automatically jumps to the next possible wiring position.

▶ Press the cursor button 〉. Contact **I 02** will be connected up to the coil field.

→ Press **DEL** to erase a connection at the cursor or arrow position. Where connections intersect, the vertical connections are deleted first, then, if you press **DEL** again, the horizontal connections are deleted.

▶ Press the cursor button > again.

The cursor will move to the coil field.



▶ Press **OK**.

easy inserts the relay coil Q 01. The specified coil function [and the output relay Q 01 are correct and do not have to be changed.

Your first working easy circuit diagram now looks like this:

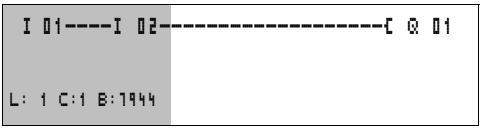


Figure 40: Your first circuit diagram

= visible area

▶ Press **ESC** to leave the circuit diagram display.

The SAVE menu appears.

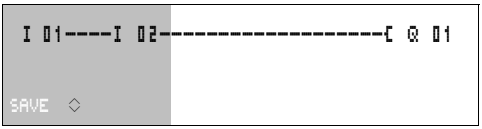


Figure 41: SAVE menu

= visible area

▶ Press the **OK** button.

The circuit diagram is stored.

Once you have connected buttons S1 and S2, you can test your circuit diagram straight away.

Testing the circuit diagram

▶ Switch to the main menu and select the Stop Run menu option.

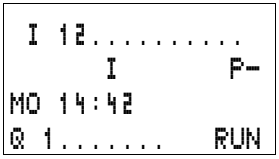
With a tick at Run or Stop you switch to the Run or Stop operating modes.

easy runs in the mode where the tick is located.

▶ Press the **OK** button. easy changes over to the Run mode.

→ The mode assigned with the tick is always active.

The Status display shows the current mode and the switching states of the inputs and outputs.



▶ Change to the Status display and press push-button actuator S1.

The contacts for inputs I1 and I2 are activated and relay Q 01 picks up. It is recognisable on the figures which are displayed

Power flow display

easy allows you to check circuit connections in Run mode. This means that you can check your circuit diagram via the built-in power flow display while it is being processed by easy.

▶ Change to the Circuit diagram display and press push-button actuator S1.

The relay picks up and easy displays the current flow.

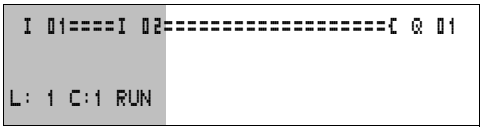


Figure 42: Power flow display: Inputs "I1" and "I2" are closed, relay "Q 01" has picked up

= visible area

▶ Press push-button actuator S2, that has been connected as a break contact.

The circuit connection is interrupted and relay Q 01 drops out.

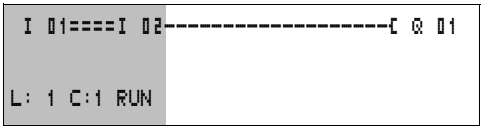


Figure 43: Power flow display: Input "I1" is closed, input "I2" is open, relay "Q 01" has picked up

= visible area

▶ Press **ESC** to return to the Status display.

→ A circuit diagram does not have to be completed before you can test parts of it with easy.

easy simply ignores any incomplete wiring that is not yet working and only uses the finished wiring.

Deleting the circuit diagram

▶ Switch easy to Stop mode.

→ easy must be in Stop mode in order to extend, delete or modify the circuit diagram.

▶ Use PROGRAM... to switch from the main menu to the next menu level.

▶ Select DELETE PROGRAM

easy will display the prompt DELETE?" .

▶ Press **OK** to delete the program or **ESC** to cancel.

▶ Press **ESC** to return to the Status display.

Fast circuit diagram entry

You can create a circuit-diagram in several ways: The first option is to enter the elements in the circuit and then to wire all the elements together. The other option is to use the enhanced operator guidance of easy and create the circuit diagram in one go, from the first contact through to the last coil.

If you use the first option, you will have to select some of the elements in order to create and connect up your circuit diagram.

The second, faster option is what you learned in the example. In this case you create the entire circuit connection from left to right.

Configuration of the NET network

If you want to work with the NET network and communicate with multiple stations, the network must be configured first.

Proceed as follows:

- ▶ Connect all the network stations to one another. On the right is NET socket 2↑ on the left is NET socket 1↓.
- ▶ The first station 1 (socket 1↓) and the last station (socket 2↑) must be provided with a network termination resistor ①.
- ▶ Connect all stations to the power supply.

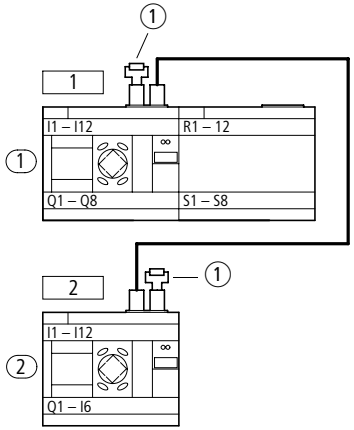


Figure 44: Example topology with two NET stations

① Network termination resistor

Physical location

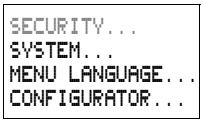
Station address

- ▶ Switch on the power supply on all stations.
- ▶ Ensure that all stations have a voltage supply. The POW LED must light up or flash. It is only possible to configure the stations which are supplied with voltage.
- ▶ Proceed to the first physical station (Location 1). This station has the termination resistor inserted in socket 1.

→ The following tasks are only possible in Stop mode.

Enter the network station address

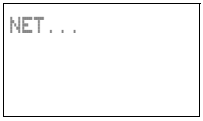
▶ Simultaneously press the **DEL** and **ALT** buttons while easy displays the Status display.



The system menu appears

Select the CONFIGURATIOR menu option.

▶ Press the **OK** button.

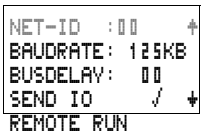


The NET menu appears.

▶ Press the **OK** button.

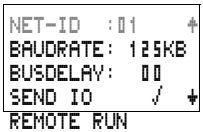
The NET PARAMETERS.. menu appears.

▶ Press the **OK** button.



▶ Press the **OK** button and select the address with ∧ and ∨. In this case the address (NET-ID) "01".

▶ Press the OK button.



▶ Exit the NET PARAMETERS menu with **ESC**.

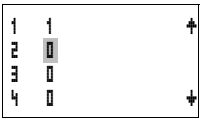
→ The station with address 1 is the master. For this reason the REMOTE RUN and REMOTE IO functions are not available.

Enter network station

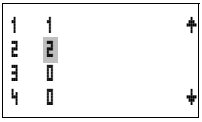
Only the network station at physical location 1 with station address 1 has a station list.

The left hand column is the physical location. You can only assign a physical location to non-used station addresses. Physical location 1 is reserved to station address 1.

- ▶ Use the ∧ and ∨ cursor buttons to select the STATION menu and press the **OK** button.
- ▶ Proceed to the station with physical address 2.



- ▶ Select the required physical location with the ∧ and ∨ cursor buttons. Press the **OK** button.
- ▶ Select station address number 2 with the ∧ and ∨ cursor buttons.



- ▶ Press the **OK** button.

At physical location 2, the station has been assigned with address 2.

- ▶ Press **ESC** to return to the STATION menu point.

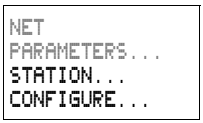
Configuration of the NET network

The NET network can only be configured by station 1.

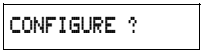
Prerequisite:
All stations are correctly connected to the network and the termination resistors have been connected.

All stations have a voltage supply and are in the Stop mode. POW LED lights continuously. NET LED lights continuously.

If the connected stations are being configured, all stations automatically switch to the Stop mode.

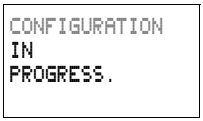


▶ Proceed to the CONFIGURE menu point and press the **OK** button.



You will be asked to acknowledge that you want to configure the system.

▶ Press the **OK** button.

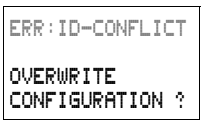


The message on the left appears:

All NET LEDs on the stations which are assigned with station addresses higher than 1 (2 to 8) switch to the Off state.

As soon as the configuration has been successfully completed the NET LED´s on all stations flash. The NET network is ready for operation.

An error message will appear if a station is assigned with a station address which does not correspond to the physical location in the station list.



If you want to overwrite the station address press the **OK** button. The configuration can be aborted by pressing the **ESC** button.

Changing the NET network configuration

The configuration of the NET network can be modified at any time at station 1, physical location 1.

▶ The NET PARAMETERs are modified as described when inputting parameters for the first time.

Station addresses in the STATION menu are changed as follows:

▶ Goto the physical location (easy800 station) which is to be modified.

▶ Press the **OK** button.

→ Existing station addresses can only be modified to free, non-assigned station addresses. If all eight addresses are assigned, all station addresses which are to be modified must be set to address zero. Thereafter, all station addresses can be reassigned. (easy800 sets all station addresses to zero which are assigned with a physical location behind the leading zero.)

▶ Select the required station address with the ∧ and ∨ cursor keys and confirm your input with the **OK** button.

▶ Configure all NET stations again using the CONFIGURATION menu.

→ Further information concerning the NET network topic can be found in Chapter "NET Network", page 183.

4 Wiring a circuit diagram with easy800

This chapter provides you with information concerning the entire functional range of easy800.

easy800 operation	Buttons for drawing circuit diagrams and function block usage
	Delete circuit connection, contact, relay or empty line in the circuit diagram
	Toggle between break and make contact Connect contacts and relays Add circuit connections
	∧∨ Change value Move cursor up and down 〈 〉 Change position Move cursor to left and right Cursor buttons set as P buttons: 〈 Input P1, ∧ Input P2 〉 Input P3, ∨ Input P4
	Undo settings from previous **OK** Exit current display or menu
	Change, add contact/relay Save setting

Operation

The cursor buttons in the easy800 circuit diagram preform three functions. The current mode is indicated by the appearance of the flashing cursor.

- Move
- Enter
- Connect

In Move mode you can use ∧∨ < > to move the cursor around the circuit diagram in order to select a circuit connection, contact or relay coil.

Use **OK** to switch to Enter mode so that you can enter or change a value at the current cursor position. If you press **ESC** in Enter mode, easy800 will undo the most recent changes.

Press **ALT** to switch to Connect mode for wiring contacts and relays. Press **ALT** again to return to Move.

Press **ESC** to leave the circuit diagram and parameter display.

easy800 performs many of these cursor movements automatically. For example, easy800 switches the cursor to Move mode if no further entries or connections are possible at the selected cursor position.

Opening the parameter display for function blocks with contacts or relays

If you specify the contact or coil of a relay type in Enter mode, easy800 automatically switches from the contact number to the parameter display of the function block when you press **OK**.

Press > to switch to the next contact or coil field without entering any parameters.

Program

A program is a sequence of commands which the easy800 performs in a cycle in the Run mode. An easy800 program consists of a circuit diagram at the very least. When you use function blocks, the program contains the function block and the circuit diagram.

Circuit diagram

The circuit diagram is a constituent of the program where the contacts are connected to one another. In Run mode the coil functions of a coil are switched on and off in accordance with the current flow.

Function modules

Function modules are elements with special functions. Example: timing relays, timeswitches, arithmetic functions. Function modules are elements with and without contacts and coils. In Run mode the function modules are processed according to the circuit diagram and the results are updated accordingly.

Examples:
Timing relay = function module with contacts and coil
Timeswitches = function module with contacts

Relays

Relays are switching devices which are electronically simulated in easy800. They actuate their contacts depending on their function. A relay consists of a coil and at least one contact.

Contacts

You modify the current flow in the easy800 with the contacts. Contacts such as make contacts carry a 1 signal when closed and 0 when open. Every contact in the easy800 circuit diagram can be defined as either a make contact or a break contact.

Coils

Coils are the drives for relays. Coils are issued with the results of the wiring in the Run mode and switch on or off accordingly. Coils can have seven different coil functions.

Table 4: Usable contacts

Contact		easy800 representation
	Make contact, open in idle state	I, Q, M, A, ... further contacts → table
	Break contact, closed in idle state	Ī, Q̄, M̄, Ā, . . . further contacts → table

easy800 works with different contacts, which can be used in any order in the contact fields of the circuit diagram.

Contact	Make contact	Break contact	Number	Page
Inputs				
Inputs of a network station * = station address 1 to 8	*I	*Ī	01...12	186
easy800 input terminal	I	Ī	01...12	–
Cursor button	P	P̄	01...04	–
Network station expansion input terminal * = station address 1 to 8	*R	*R̄	01...12	186
Expansion input terminal	R	R̄	01...12	–
Bit inputs via the network * = station address 1 to 8	*RN	*R̄N	01...32	186
Diagnostics inputs				
Network station expansion status * = station address 1 to 8	*I	*Ī	14	232
Expansion network station short-circuit/overload * = station address 1 to 8	*I	*Ī	15...16	186

Contact	Make contact	Break contact	Number	Page
Expansion status	I	Ī	14	232
Short-circuit/overload	I	Ī	15...16	230
Short-circuit/overload in expansion network station * = station address 1 to 8	*R	*R̄	15...16	186
Short circuit/overload with expansion	R	R̄	15...16	230
Outputs				
easy800 output EASY network station * = station address 1 to 8	*Q	*Q̄	01...08	186
easy800 output	Q	Q̄	01...08	–
easy800 output expansion with network station * = station address 1 to 8	*S	*S̄	01...08	186
easy800 output expansion	S	S̄	01...08	–
Bit outputs via the network * = station address 1 to 8	*SN	*S̄N	01...32	186
Other general contacts				
Marker relay contact	M	M̄	01...96	82
Jump label	:		01...32	156
Diagnostics messages	ID	ĪD	01...16	196
Function blocks				
Function block analog value comparator	A X Q1	Ā X Q1	X=01...32	109
Function block - arithmetic value overflow (carry)	AR X CY	ĀR X CY	X=01...32	112
Function block - arithmetic value zero	AR X ZE	ĀR X ZE	X=01...32	112
Function block - boolean operation, value zero	BV X ZE	B̄V X ZE	X=01...32	115
Function block counters, upper setpoint value exceeded (Overflow)	C X OF	C̄ X OF	X=01...32	118

Contact	Make contact	Break contact	Number	Page
Function block counters, lower setpoint value undershot (Fall below)	C X FB	C̄ X FB	X=01...32	118
Function block counters, actual value equal to zero	C X ZE	C̄ X ZE	X=01...32	118
Function block counters, actual value has exceeded counter range (carry)	C X CV	C̄ X CV	X=01...32	118
Function block frequency counters, upper setpoint value exceeded (Overflow)	CF X OF	C̄F X OF	X=01...04	124
Function block frequency counters, lower setpoint value undershot (Fall below)	CF X FB	C̄F X FB	X=01...04	124
Function block frequency counters, actual value equal to zero	CF X ZE	C̄F X ZE	X=01...04	124
Function block fast counters, upper setpoint value exceeded (Overflow)	CH X OF	C̄H X OF	X=01...04	128
Function block fast counters, lower setpoint value undershot (Fall below)	CH X FB	C̄H X FB	X=01...04	128
Function block fast counters, actual value equal to zero	CH X ZE	C̄H X ZE	X=01...04	128
Function block fast counters, actual value has exceeded counter range (carry)	CH X CV	C̄H X CV	X=01...04	128
Function block incremental value counters, upper setpoint value exceeded (Overflow)	CI X OF	C̄I X OF	X=01...02	134
Function block incremental value counters, lower setpoint value undershot (Fall below)	CI X FB	C̄I X FB	X=01...02	134
Function block incremental value counters, actual value equal to zero	CI X ZE	C̄I X ZE	X=01...02	134

Contact	Make contact	Break contact	Number	Page
Function block incremental value counters, actual value has exceeded counter range (carry)	CI X CV	$\bar{C}$I X CV	X=01...02	134
Function block comparator, less than	CP X LT	$\overline{CP}$ X LT	X=01...32	139
Function block comparator, equal to	CP X EQ	$\overline{CP}$ X EQ	X=01...32	139
Function block comparator, greater than	CP X GT	$\overline{CP}$ X GT	X=01...32	139
Function block - text output module	D X Q1	$\bar{D}$ X Q1	X=01...32	141
Data element	DB X Q1	$\overline{DB}$ X Q1	X=01...32	144
Receive a variable from a station (Get)	GT X Q1	$\overline{GT}$ X Q1	X=01...32	146
Function block - seven day time switch	HW X Q1	$\overline{HW}$ X Q1	X=01...32	147
Function block twelve month time switch	HY X Q1	$\overline{HY}$ X Q1	X=01...32	152
Master reset, sets all outputs and markers to zero state	MR X Q1	$\overline{MR}$ X Q1	X=01...32	159
Function block operation time counter, set time reached	OT X Q1	$\overline{OT}$ X Q1	X=01...04	160
Operation time counter, value overflow (carry)	OT X CV	$\overline{OT}$ X CV	X=01...04	160
Sends a variable on the network, enable active Put	PT X Q1	$\overline{PT}$ X Q1	X=01...32	162
Function block sends date and time via the network (NET)	SC X Q1	$\overline{SC}$ X Q1	X=01	163
Function block timing relay	T X Q1	$\bar{T}$ X Q1	X=01...32	164

Usable relays and function blocks

easy800 provides various relay types as well as function blocks and their coils for wiring purposes in a circuit diagram.

Relays/Function blocks	easy800 display	Number	Coil	Parameter
Outputs				
easy800 output relays, network stations (only network master) * = station address 2 to 8	*Q	01...08	✓	–
easy800 output relay	Q	01...08	✓	–
easy800 output relay expansion, network stations (only network master) * = station address 2 to 8	*S	01...08	✓	–
easy800 output relay expansion	S	01...08	✓	–
Bit outputs * = station address 1 to 8	*SN	01...32	✓	–
General coils				
Marker, auxiliary relay	M	01...96	✓	–
Jump label	:	01...32	✓	–
Function blocks				
Function block analog value comparator	A	01...32	–	✓
Function block - arithmetic	AR	01...32	–	✓
Boolean operation	BV	01...32	–	✓
Function block counters, counter input	C X C_	X=01...32	✓	✓
Function block counters, direction	C X D_	X=01...32	✓	✓
Function block counters, set counter value (Preset)	C X SE	X=01...32	✓	✓
Function block counters, reset counter value	C X RE	X=01...32	✓	✓

Relays/Function blocks	easy800 display	Number	Coil	Parameter
Function block frequency counters, activate counters (enable)	CF X EN	X=01...04	✓	✓
Function block fast counters, direction	CH X D_	X=01...04	✓	✓
Function block fast counters, activate counters (enable)	CH X EN	X=01...04	✓	✓
Function block fast counters, set counter value (Preset)	CH X SE	X=01...04	✓	✓
Function block fast counters, reset counter value	CH X RE	X=01...04	✓	✓
Function block incremental value counters, set counter value (Preset)	CI X SE	X=01...02	✓	✓
Function block incremental value counters, activate counters (enable)	CI X EN	X=01...02	✓	✓
Function block incremental value counters, reset counter value	CI X RE	X=01...02	✓	✓
Function block comparator	CP	X=01...32	–	✓
Function block - activate text output (enable)	D X EN	X=01...32	✓	✓
Data element, trigger coil	DB X T_	X=01...32	✓	✓
Function block - receive from network station	GT	X=01...32	–	✓
Function block - seven day time switch	HW	X=01...32	–	✓
Function block twelve month time switch	HY	X=01...32	–	✓
Function block master reset	MR X T_	X=01...32	✓	✓
Function block operation time counter, enable	OT X EN	X=01...04	✓	✓
Function block operation time counter, reset	OT X RE	X=01...04	✓	✓

Relays/Function blocks	easy800 display	Number	Coil	Parameter
Function block send to the network (NET), trigger	PT X T_	X=01...32	✓	✓
Function block send time to the network (NET), trigger	SC X T_	X=01	✓	–
Function block timing relay, trigger control coil (enable)	T X EN	X=01...32	✓	✓
Function block timing relay, stop	T X ST	X=01...32	✓	✓
Function block timing relay, reset	T X RE	X=01...32	✓	✓

The switching behaviour of these relays is set by the coil functions and parameters selected.

The options for setting output and marker relays are listed with the description of each coil function.

The coil functions and parameters are listed with the description of each function relay type.

Markers, analog operands

In order to actively address values or inputs/outputs, certain defined markers are available.

Markers	easy800 display	Number	Valuerange
Marker 32 bit	MD	01...96	32 Bit
Marker 16 bit	MW	01...96	16 bit
Marker 8 bit	MB	01...96	8 bit
Marker 1 bit	M	0...96	1 bit
Analog inputs basic unit	IA X	X=01...04	10 bit
Analog output	QA X	X=01	10 bit

The following applies if you want to use the binary operands (contacts) from the markers MD, MW, MB:

Applies for MD, MW, MB, M	Left = Most significant bit, byte, word			Right = least significant bit, byte, word
32 bit	MD1			
16 bit	MW2		MW1	
8 bit	MB4	MB3	MB2	MB1
1 bit	M32 to M25	M24 to M17	M16 to M9	M8 to M1
32 bit	MD2			
16 bit	MW4		MW3	
8 bit	MB8	MB7	MB6	MB5
1 bit	M64 to M57	M56 to M49	M48 to M41	M40 to M33
32 bit	MD3			
16 bit	MW6		MW5	
8 bit	MB12	MB11	MB10	MB9
1 bit	M96 to M89	M88 to M81	M80 to M73	M72 to M65
32 bit	MD4			
16 bit	MW8		MW7	
8 bit	MB16	MB15	MB14	MB13
32 bit	MD5			
16 bit	MW10		MW9	
8 bit	MB20	MB19	MB18	MB17
...				
...				
...				

Applies for MD, MW, MB, M	Left = Most significant bit, byte, word			Right = least significant bit, byte, word
32 bit	MD23			
16 bit	MW46		MW45	
8 bit	MB92	MB91	MB90	MB89
32 bit	MD24			
16 bit	MW48		MW47	
8 bit	MB96	MB95	MB94	MB93
32 bit	MD25			
16 bit	MW50		MW49	
32 bit	MD26			
16 bit	MW52		MW51	
...				
...				
32 bit	MD48			
16 bit	MW96		MW95	
32 bit	MD49			
32 bit	MD50			
...				
32 bit	MD95			
32 bit	MD96			

Number formats

easy makes computations with a signed 31 bit value.

The value range is:
–2147483648 bis +2147483647

The 32nd bit is the sign bit with a 31 bit value.

Bit 32 = state "0" means a positive number.

Example:
$0000000000000000000010000010010_{bin}$ =
$412_{hex} = 1042_{dec}$

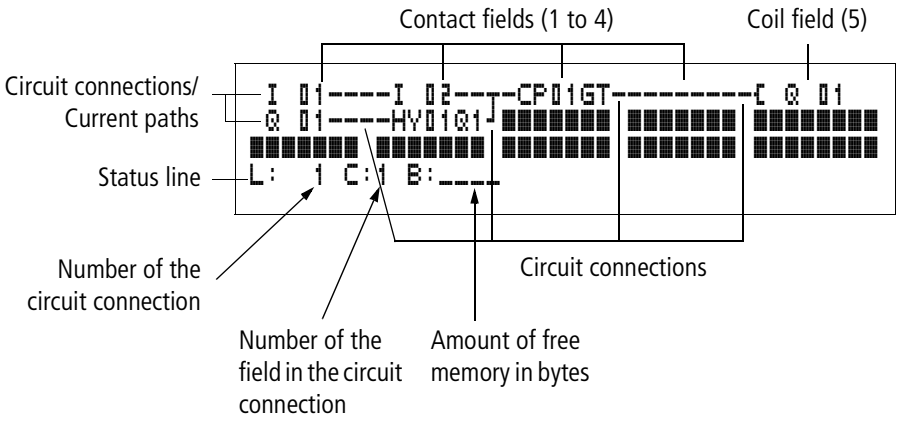
Bit 32 = state "1" means a negative number.

Example:
$11111111111111111101110010101110_{bin}$ =
$FFFFDCAE_{hex} = -9042_{dec}$

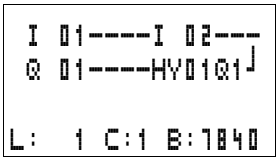
Circuit diagram display

In the easy800 circuit diagram, contacts and coils of relays are connected up from left to right - from the contact to the coil. The circuit diagram is created on a hidden wiring grid containing contact fields, coil fields and circuit connections (current paths). It is then wired up with connections.

- Insert contacts in the four **contact fields**. The first contact field on the left is automatically connected to the voltage.
- Insert the relay coil to be controlled together with its function and designation in the **coil field**. The coil designation consists of the coil name, coil number and function block from the function designation. The coil function defines the method of operation of the coil.
- Every line in the circuit diagram forms a **circuit connection**. With the easy800, up to 256 circuit connections can be wired in a circuit diagram



- **Circuit connections** are used to produce the electrical contact between relay contacts and the coils. They can be created across several circuit connections. Each point of intersection is a connection.
- The number of free bytes is displayed so that you can recognise how much **memory** is available for the circuit diagram and function blocks.



easy800 circuit diagram display

In order to improve the readability, you will see two contacts per circuit connection or one contact plus a series coil in the circuit diagram display on the easy800. A total of 16 characters per circuit connection and three circuit connections (current paths) and a status line can be displayed simultaneously.

You can change the contact fields with the < > cursor buttons. The number of the circuit connection (current path) and the contact are displayed in the lower status line.

→ The circuit diagram display performs two functions:

- In Stop mode it is used to edit the circuit diagram
- In Run mode it is used to check the circuit diagram using the Power flow display

Save and load program

There are two ways of saving circuit diagrams in easy800 externally:

- By saving to a memory card
- By saving to a PC running EASY-SOFT.

Once they have been saved, programs can be reloaded into easy800, edited and run.

All program files are saved in easy800. In the event of a power failure the data will be retained until the next time it is overwritten or deleted.

Memory card

Each memory card contains a circuit diagram which is inserted into the easy800 interface.

The easy800 behaves in the following manner in accordance with the type and setting.

Prerequisite:
A valid circuit diagram is stored on the card.

Variant with display:

▶ Go to the CARD menu and load the circuit diagram into the unit in the Stop mode with CARD → DEVICE.

CARD MODE setting → page 215.

Variant without display:
If the circuit diagram on the card is different to the circuit diagram in the device, the program from the card is loaded as soon as the power supply is turned on.

EASY-SOFT

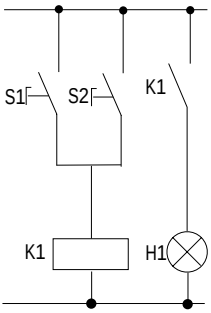
EASY-SOFT is a PC program for creating, testing and managing easy800 programs and circuit diagrams.

Completed programs are exchanged between the PC and easy800 via connection cable. Once you have transferred a circuit diagram, simply run easy straight from your PC.

Working with contacts and relays

In easy800 circuit diagrams, the switches, buttons and relays of conventional circuit diagrams are connected up using input contacts and relay coils.

Conventional circuit



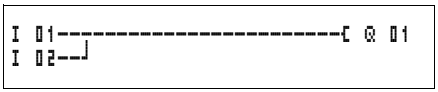
Wired with easy800

easy800 connection

Connect make contact S1 to input terminal I1
Connect make contact S2 to input terminal I2
Connect load H1 to output Q1

S1 or S2 switches on H1.

easy800 circuit diagram:

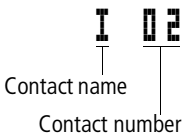


First specify which input and output terminals you wish to use in your circuit.

The signal states on the input terminals are detected in the circuit diagram with the input contacts "I", "R*" or "RN". The outputs are switched in the circuit diagram with the output relays "Q", "S" or "SN".

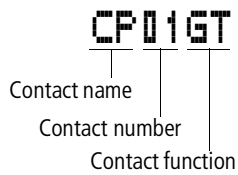
Entering and changing contacts and relay function coils

Contacts



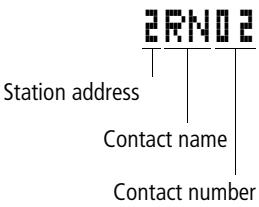
An input contact is selected in the easy800 via the contact name and contact number.

Example: input contact



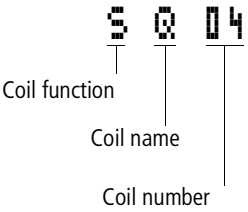
A contact of a function relay is assigned with the name of the element, the number and the contact function.

Example: contact - comparator function block



If the contact on a network station is used, the address of the station is placed before the contact name.

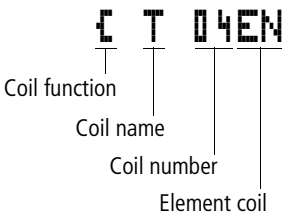
Example: contact of a Net station



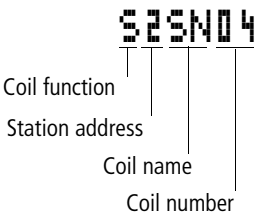
Coils

With a relay coil or function block select the coil function, coils or function block names, coils function block number as well as coils of the function block. The coils of an EASY-NET network station should be selected before the coil names of the network address.

Example: relay coil output



Relay coil function block - timing relay with control coil



Relay coil of an EASY-NET station

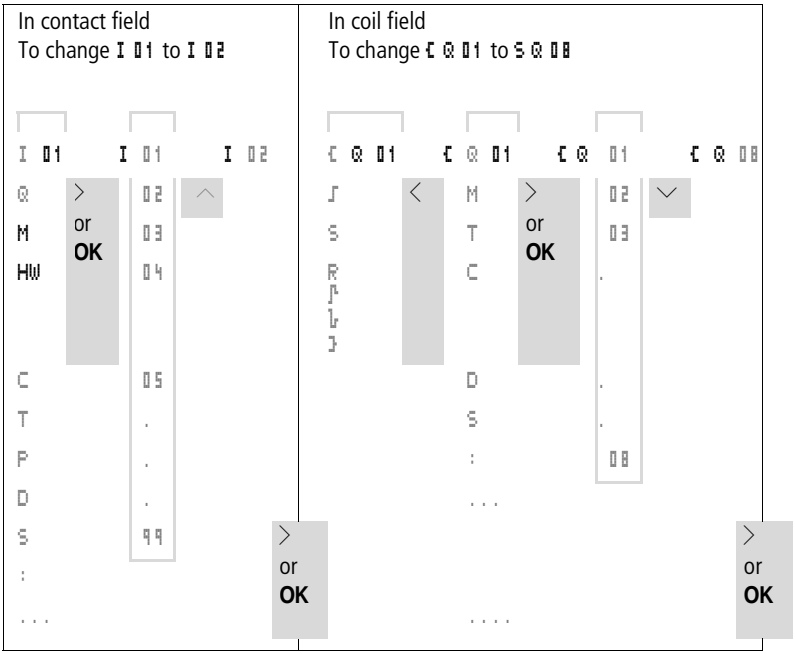
→ A full list of all the contacts and relays is given in the overview starting on page 75.

I 01 Values for contacts and coil fields are changed in the Enter mode. The value to be changed flashes.

→ easy800 assumes the contact I 01 or the coil Q 01 with the entry in an empty field.

- ▶ Move the cursor using the buttons < > ∧∨ to a contact or coil field.
- ▶ Press **OK** to switch to Enter mode.
- ▶ Use < > to select the position you wish to change, or press **OK** to jump to the next position.
- ▶ Use ∧∨ to modify the value of the position.

easy800 will leave Enter mode when you press < > or **OK** to leave a contact field or coil field.



Deleting contacts and coils

▶ Move the cursor using the buttons < > ∧∨ to a contact or coil field.

▶ Press **DEL**.

The contact or the coil will be deleted, together with any connections.

Changing make contacts to break contacts

Every relay contact in the easy800 circuit diagram can be defined as either a make contact or a break contact.

▶ Switch to Enter mode and move the cursor over the contact name.

▶ Press **ALT.** The make contact will change to a break contact.

▶ Press 2 ×**OK** to confirm the change.

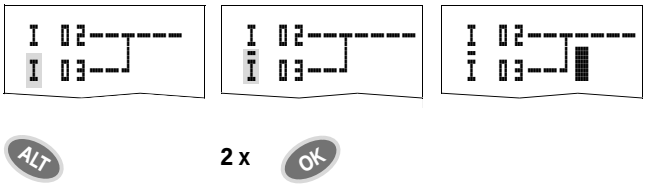


Figure 45: Change contact I 03 from make to breake

Creating and modifying connections

Contacts and relay coils are connected with the arrow in the Connect mode. easy800 displays the cursor in this mode as an arrow.

▶ Use < > ∧∨ to move the cursor onto the contact field or coil field from which you wish to create a connection.

→ Do not position the cursor on the first contact field. At this position the **ALT** button has a different function (Insert circuit connection).

▶ Press **ALT** to switch to Connect mode.

▶ Use < > to move the diagonal arrow between the contact fields and coil fields and ∧∨ to move between circuit connections.

▶ Press **ALT** to leave Connect mode.

easy800 will leave Connect mode automatically when you move the diagonal arrow onto a contact field or coil field which has already been assigned.

→ In a circuit connection, easy800 automatically connects contacts and the terminal to the relay coil if there are no empty fields in-between.

Never work backwards. You will learn why wiring backwards does not work in Section "Effects on the creation of the circuit diagram" on page 224.

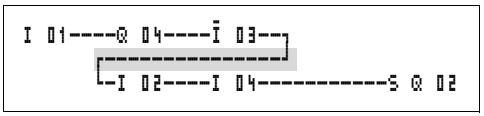


Figure 46: Circuit diagram with five contacts, invalid

When wiring more than four contacts in series, use one of 96 M marker relays.

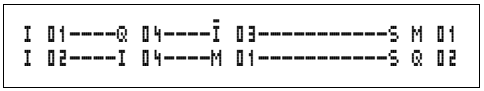


Figure 47: Circuit breaker with M marker relay

Delecting connections

▶ Move the cursor onto the contact field or coil field to the right of the connection that you want to delete. Press **ALT** to switch to Connect mode.

▶ Press **DEL**.

easy800 will delete a connection. Closed adjacent connections will be retained.

If several circuit connections are connected to one another, easy800 first deletes the vertical connection. If you press **DEL** again, it will delete the horizontal connection as well.

You cannot delete connections that easy800 has created automatically.

Close the delete operation with **ALT** or by moving the cursor to a contact or coil field.

Inserting and deleting a circuit connection

The easy800 circuit diagram shows three of the 250 circuit connections on the display at the same time. easy800 automatically scrolls up or down the display to show hidden circuit connections – even empty ones – if you move the cursor past the top or bottom of the display.

A new circuit connection is added below the last connection or inserted above the cursor position:

- ▶ Position the cursor on the **first** contact field of the empty circuit connection.
- ▶ Press **ALT**.

The existing circuit connection with all its additional connections is "shifted" downwards. The cursor is then positioned directly in the new circuit connection.

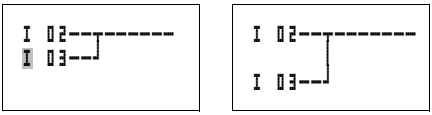
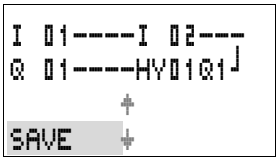


Figure 48: Insert new circuit connection

Saving circuit diagrams

▶ Press the **ESC** button to save a circuit diagram.

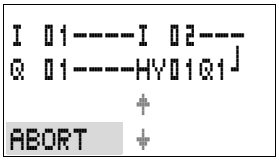


The menu on the left appears in the status line.

▶ Press **OK** and the entire program, circuit diagram and function blocks are saved.

After saving you will be in the CIRCUIT DIAGRAM menu point.

Aborting circuit diagram entry



▶ If you want to exit without saving the circuit diagram, press **ESC**.

▶ Use the cursor buttons ∧∨ to select the ABORT menu.

▶ Press **OK**.

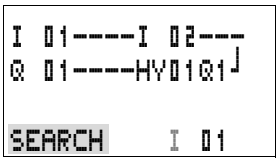
The circuit diagram is not saved.

Searching for contacts and coils

You search for contacts and coils in the following manner:

▶ Press **ESC**. Use the cursor buttons ∧∨ to select the SEARCH menu.

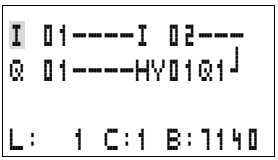
▶ Press **OK**.



▶ Select the desired contact, coil and number with the ∨ and 〈 〉 cursor buttons.

With function relays, select the function block, the number and the coil.

▶ Confirm the search with the **OK** button.

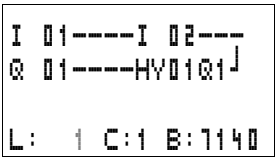


The first contact or coil from the call position to the end of the circuit diagram is sought. If no contact or coil is found, the easy800 circuit diagram editor will continue the search from the start of the circuit diagram. If a contact or coil is found, the easy800 editor automatically jumps to the respective field in the circuit diagram.

"Go to" a circuit connection (current path)

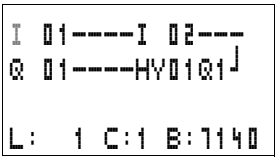
The easy800 circuit diagram editor provides a Go To function in order to enable fast access to a circuit connection.

- ▶ Press **ESC** and use the ∧∨ cursor buttons to select the GO TO menu.
- ▶ Press **OK**.
- ▶ Select the required circuit connection (L...) (current path) with the ∧∨ cursor buttons.



The first contact on the current path is always indicated.

- ▶ Press **OK**.



The cursor remains stationary at the required (circuit connection) current path contact L 1.

Deleting the circuit connection (current path)

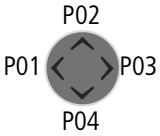
easy800 only removes empty current paths (without contacts or coils).

- ▶ Delete all the contacts and coils from the circuit connection.
- ▶ Position the cursor on the first contact field of the empty circuit connection.
- ▶ Press **DEL**.

The subsequent circuit connection(s) will be "pulled up" and any existing links between circuit connections will be retained.

Switching via the cursor buttons

With easy800, you can also use the four cursor buttons as hard-wired inputs in the circuit diagram.



The buttons are wired in the circuit diagram as contacts P 01 to P 04. The P buttons can be activated and deactivated → in the System menu.

The P buttons can also be used for testing circuits or manual operation. These button functions are also useful for servicing and commissioning purposes.

Example 1
A lamp at output Q1 is switched on and off via inputs I1 and I2 or using cursor buttons ∧∨.

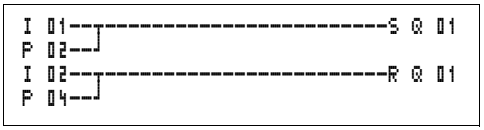


Figure 49: Switch "Q1" via "I1", "I2", ∧, or ∨

Example 2
Output Q1 is actuated via input I1. "I5" switches over to cursor operation and decouples the circuit connection I 01 via M 01.

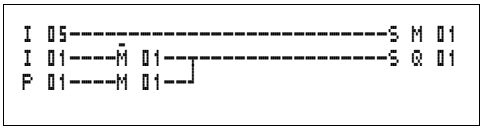
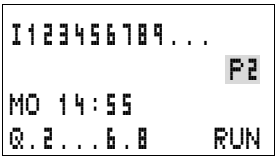


Figure 50: "I5" switches over the cursor keys.

→ The P buttons are only recognised as contacts in the Status menu, and not in the Power flow display.

The Status menu display shows whether the P buttons are used in the circuit diagram.



Displayed on the status display:

- P: button function wired and active
- P2: button function wired, active and P2 button ⌃ pressed
- P: button function wired and not active
- empty field: P buttons not used

Checking the circuit diagram

easy800 contains a built-in measuring device enabling you to monitor the switching states of contacts, relays and function block coils during operation.

▶ Create a parallel circuit and save it.

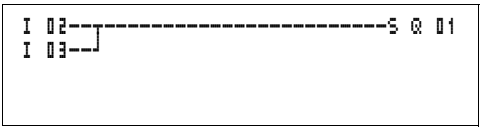


Figure 51: Parallel circuit

▶ Switch easy800 to the Run mode via the main menu.

▶ Return to the circuit diagram display.

You are now unable to edit the circuit diagram.

→ If you switch to the circuit diagram display and are unable to modify a circuit diagram, first check whether easy800 is in Stop mode.

The circuit diagram display performs two functions depending on the mode:

- STOP: Creation of the circuit diagram
- RUN: Power flow display

▶ Switch I 03 on.

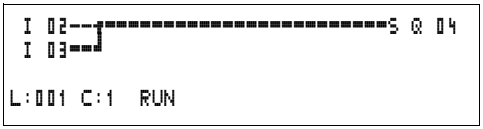


Figure 52: Power flow display

In the power flow display, energized connections are thicker than non-energized connections.

You can follow a current-carrying connection across all circuit connections by scrolling the display up and down.

On the bottom right of the power flow display you can recognize that the controller is in the Run mode.

→ The power flow display will not show signal fluctuations in the millisecond range. This is due to the inherent delay factor of LCD displays.

Function block editor

The easy800 has the FUNCTION RELAYS menu point in order to edit the function blocks without circuit diagrams. The function blocks are an inherent component of the program.

Calling the function blocks via the FUNCTION RELAYS menu

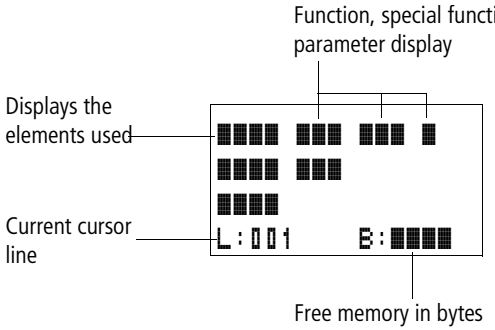


Figure 53: Explanation of the element display

Display of the function blocks for editing

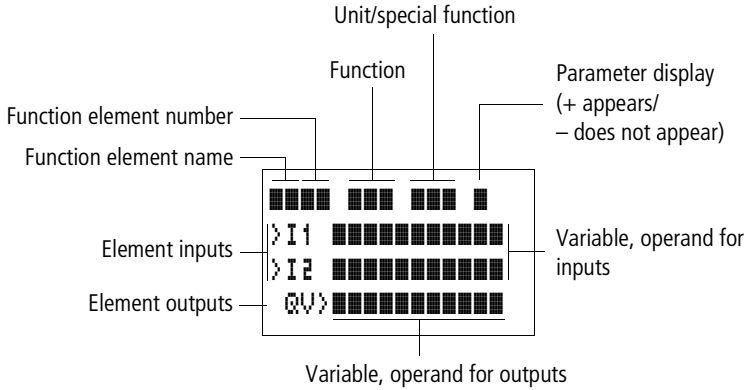
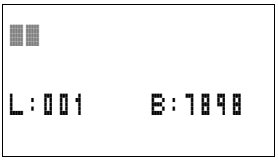


Figure 54: Function block display during editing

Editing elements

▶ Go to the FUNCTION RELAYS menu.

▶ Press the **OK** button.

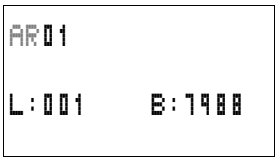


The following display appears if no elements are available.

The cursor flashes.

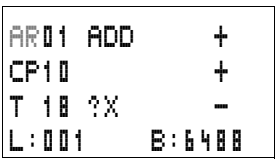
▶ Press the **OK** button.

The editor for input of a function block is displayed.



Select the desired function block and number with the ∧∨< > cursor buttons.

The functions of the individual function blocks should be taken from the description of the individual blocks on the following pages.

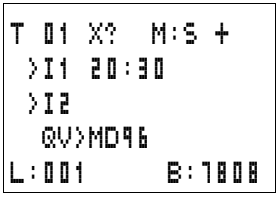


The following display appears if elements are available.

The function blocks are created in the sequence in which they have been edited.

Calling up function blocks from the circuit diagram

If you transfer a function block parameter from the circuit diagram, you jump from the circuit diagram editor to the function block editor. If you have assigned the parameter, return to the position where you left the circuit diagram with Save or Abort. The operation is the same with circuit diagram operation.



Example: timing relay function block

Function block:	Timing relays
Switch function	On-delayed with random switching
Time range:	M:S (Minute:Seconds)
Setpoint time I1:	20 min 30 s
Actual time QV:	Will be copied to MD96

Assignment of operands on the input >... of a function block

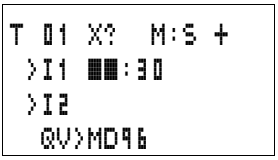
→ Only the following variables can be assigned to the input of a function block:

- constants, e.g.: 42,
- markers such as MD, MW, MB,
- the analog output QA ,
- analog inputs IA,
- all output variables of the function blocks ...QV

Assigning operands on an output QV> of a function block

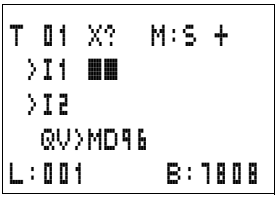
→ Only markers such as MD, MW, MB or the analog output QA can be assigned to a variable output of a function block.

Deleting operands on the inputs/outputs function block



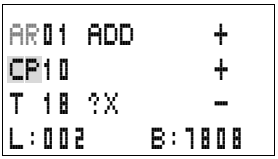
Position the cursor on the required operands.

▶ Press the **DEL** button.



The operand is erased.

Erasing an entire function block

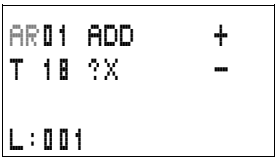


Ensure that all contacts and coils of the function block are erased.

▶ Select the required element from the list.

In this case CP10.

▶ Press the **DEL** button.

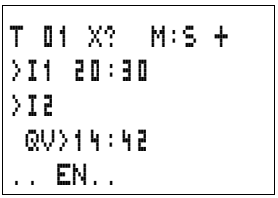


The element is erased.

Checking the function block

You can check the function block like the circuit diagram. The device is in Run mode

Checking from the circuit diagram:
Position the cursor on a contact or a coil of the required element. Press **OK**.



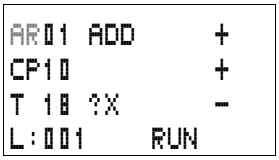
The function block will be displayed, in this case a timing relay.

- I1= set time of the timing relay,
- QV = the actual value is 14 minutes 42 seconds,
- The enable coil is actuated, EN is visible.

If a coil of a function block is actuated in Run mode, the coil name with the coil designation appear on the display.

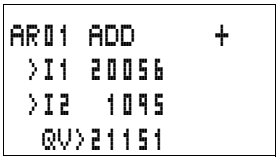
Checking the function block via the function block editor:
You access the element list via the FUNCTION RELAYS menu.

Select the required element:



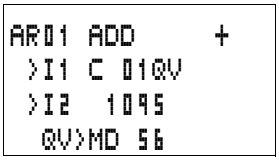
In this case the arithmetic element AR01 in the Adder mode.

▶ Press the **OK** button.



The element is presented with the actual values and the result.

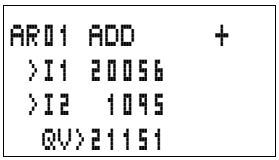
Displaying the elements when checking the operands:
If you want to know which operands are used on the inputs and outputs of the element when checking the element, press the **ALT** button on the displayed value.



The operand is displayed.

- I1= actual value of counter C 01
- I2= constants 1095
- QV = marker double word MD56

▶ Press the **ALT** button again.



The display displays the values.

Coil functions

You can set the coil function to determine the switching behaviour of relay coils. The folowing coil functions apply for all coils:

easy800 display	Coil function	Example
C	Contactor function	C Q01, C D02, C S04, C :01, C M07, ..
J	Impulse relay function	J Q03, J M04, J D08, J S07, J :01, ..
S	Set	S Q08, S M02, S D03, S S04 ..
R	Reset	R Q04, R M05, R D07, R S03 ..
N	Contactor function with inverted result	N Q06, N M96 ..
P	Cycle impulse with positive edge	P M01 ..
N	Cycle impulse with negative edge	N M42 ..

The usable coil functions of function blocks are described with the elements.

Rules for wiring relay coils

Relay with contactor function

A coil should only be used once in order to retain an overview of the statii of the relays. However, retentative coil functions such as S, R, J can be used several times.

The following applies for non-retentative coil functions such as C (contactor), N (inverted contactor), P, N (positive and negative edge triggering): Each coil can only be used once. The last coil in the circuit diagram determines the status of the relay.

Exception: Double usage of the same coil is possible when using jumps.

Coil with contactor function

The output signal follows immediately after the input signal and the relay acts as a contactor.

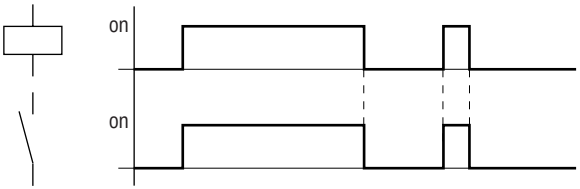


Figure 55: Contactor function signal diagram

Impulse relay

The relay coil switches whenever the input signal changes from 0 to 1. The relay behaves like a flipflop.

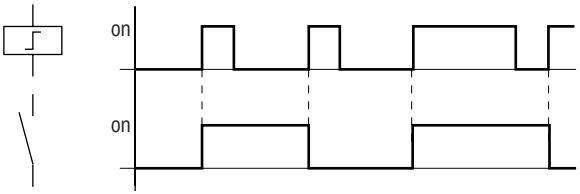


Figure 56: Impulse relay signal diagram

A coil is automatically switched off if the power fails and if easy is in Stop mode. Exception: Retentive coils retain signal 1 (see → section "Retention", page 217).

"Set" and "Reset" coil function

The "Set" and "Reset" coil functions are normally used in pairs.

The relay picks up when the coil is set (A) and remains in this state until it is reset (B) by the coil function.

The supply voltage is switched off (C), the coil does not have a retentive effect.

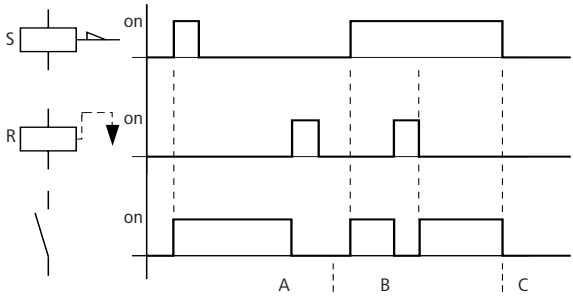


Figure 57: "Set" and "reset" signal diagram

If both coils are triggered at the same time, priority is given to the coil in the circuit diagram with the higher circuit connection number. This is shown in the above signal diagram in section B.

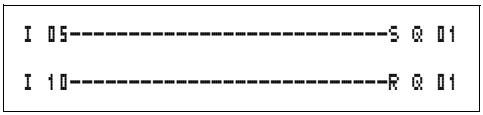


Figure 58: Simultaneous triggering of Q 01

In the example above, the reset coil has priority with simultaneous triggering of the set and reset coils.

Coil negation (inverse contactor function)]

The output signal is simply an inversion of the input signal; the relay operates like a contactor whose contacts have been negated. If the coil is triggered with the 1 state, the coil switches its make contacts to the 0 state.

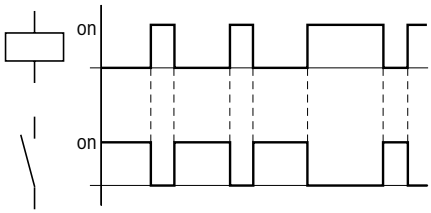


Figure 59: Inverse contactor function signal diagram

Positive edge triggering (Cycle impulse)
If the coil is only to switch on a positive edge, this function will be applied. With a rise in the coil state from 0 to 1, the coil switches to the 1 state for a cycle time of its make contacts.

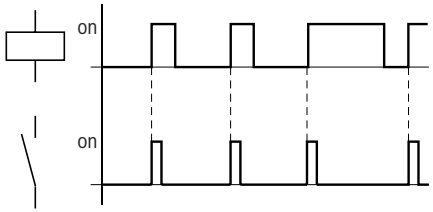


Figure 60: Cycle impulse with positive edge signal diagram

Negative edge triggering (Cycle impulse)
If the coil is only to switch on a negative edge, this function will be applied. With a fall in the coil state from 1 to 0, the coil switches to the 1 state for a cycle time of its make contacts.

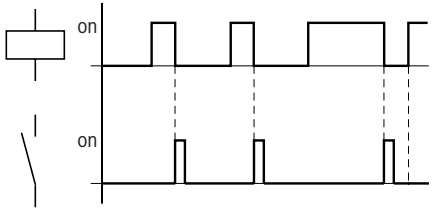


Figure 61: Cycle impulse with negative edge signal diagram

→ A set coil is automatically switched off if the power fails and if easy is in Stop mode. Exception: Retentive coils retain signal 1 (see → section "Retention", page 217).

Function blocks

Using function blocks, you can implement the functions of common devices in the field of control engineering in your circuit diagram. easy800 provides you with the following function blocks:

- Analog value comparator/trigger (only with easy800 24 V DC variants)
- Arithmetic,
  - addition, subtraction, multiplication, division
- Boolean operation
- Counters,
  - up and down counters with upper and lower threshold values, preset
  - frequency counters,
  - fast counters,
  - incremental value counters
- Comparators
- Text, issue freely editable text
- Data element
- Getting data from the NET
- Time switches,
  - weekday/time
  - year, month, day (date),
- Master reset
- Operating hours counter
- Putting data onto the NET
- Synchronization of data and time via the NET
- Timing relays
  - on-delayed,
  - on-delayed with random switching,
  - off-delayed,
  - off-delayed with random switching,
  - on and off delayed,

– on and off delayed with random switching,
– pulse shaping,
– synchronous flashing,
– asynchronous flashing,

The following applies for function blocks:

Current actual values are cleared if the power supply is switched off or if easy800 is switched to Stop mode. Exception: Retentive data keeps its state (→ section "Retention", page 217).

The current actual values are transferred to the operands every cycle. The data element is an exception.

Useful coil functions of the coil elements:

- Enable and stop coils: **xxEN, **xxST:
  – contactor
  – negated contactor
- Trigger and reset coils: **xxT_, **xxRE:
  – contactor
  – negated contactor

Special coils for counters:

- Set default value **xxSE:
  – contactor
  – negated contactor
- Counting coil **xxC_:
  – contactor
  – negated contactor
- Count direction **xxD_:
  – contactor
  – negated contactor

Note!
The following applies for Run mode: easy800 processes the function block after a pass through the circuit diagram. The last state of the coils is considered in doing so.

If you want to prevent other people from modifying the parameters, change the access enable symbol from "+" to "–" when creating the circuit diagram and setting parameters and protect the circuit diagram with a password.

Analog value comparator/trigger

easy800 provides 32 analog value comparators from A 01 to A 32.

With an analog value comparator or trigger you can, for example, compare analog input values with a setpoint value.

All easy800 DC variants have analog inputs.

The following comparisons are possible:

- Element input >I1 **greater than or equal to, equal to, less than or equal to** element input >I2
- Using the factors >F1 and >F2 as inputs you are able to amplify and match the values of the element inputs.
- The >OS input element can be used as an offset for the >I1 input.
- The >HY input element is used for positive and negative switching hysteresis of the input >I2. The contact switches in accordance with the comparison mode of the function block.

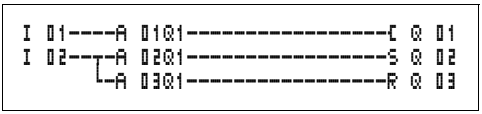
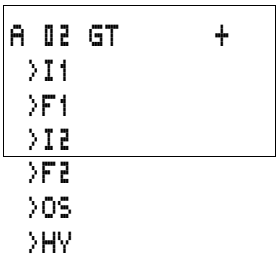


Figure 62: easy800 circuit diagram with analog value comparators



Parameter display and parameter set for analog value comparators:

A 02	Analog value comparator number 02 function block
GT	Greater than mode
+	Appears in the parameter display
>I1	Comparison value 1
>F1	Amplification factor for >I1 (>I1 = >F1 × value)
>I2	Comparison value 2
>F2	Amplification factor for >I2 (>I2 = >F2 × value)
>OS	Offset for the value of >I1
>HY	Switching hysteresis for value >I2 (Value HY applies for positive and negative hysterysis.)

Inputs

The >I1, >F1, >I2, >F2, >OS element inputs and >HY can have the following operands:

- Constants
- Marker MD, MW, MB
- Analog inputs IA01 to 04
  - IA01: terminal I7
  - IA02: terminal I8
  - IA03: terminal I11
  - IA04: terminal I12
- Analog output QA01
- Actual value ...QV of another function block

Analog value comparator operating modes

Parameter	Function
GT	>I1 greater than >I2
EQ	>I1 equal to >I2
LT	>I1 less than >I2

Contacts

A 01Q1 to A 32Q1

Memory requirement of the analog value comparator

The analog value comparator function block requires 68 bytes of memory plus 4 bytes per constant on the element inputs.

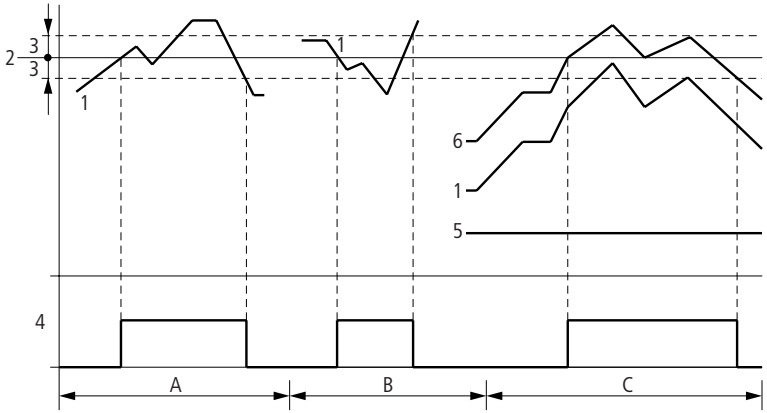


Figure 63: Analog value comparator signal diagram

1: actual value on ›I1

2: setpoint value on ›I2

3: hysterysis on ›HY

4: switching contact (make contact)

5: offset for value ›I1

6: actual value plus offset

- Range A: Compare ›I1 > ›I2
  - The actual value ›I1 increases.
  - The contact switches when the actual reaches the setpoint value.
  - The actual value changes and falls below the value of the setpoint value minus the hysterysis.
  - The contact goes to the normal position.
- Range B: Compare ›I1 < ›I2
  - The actual value drops.
  - The contact switches if the actual reaches the setpoint value.
  - The actual value changes and rises above the value of the setpoint value plus hysterysis.
  - The contact goes to the normal position.

- Range C: Compare >I1 > >I2 with offset
  - This example behaves in the same manner as described under "Range A". The offset value is added to the actual value.
- Compare >I1 = >I2
  - The contact switches on when the actual value and the setpoint value are equal.
  - If the upper or lower hysterysis thresholds are reached, the contact goes to its normal position.

Arithmetic element

easy800 provides 32 arithmetic elements AR01 to AR32.

The arithmetic element is used for computation. All four fundamental operations of arithmetic are supported:

- addition,
- subtraction,
- multiplication,
- division.

Inputs

The input elements >I1 and >I2 can have the following operands:

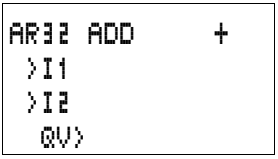
- Constants
- Marker MD, MW, MB
- Analog inputs IA01 to 04
  - IA01: terminal I7
  - IA02: terminal I8
  - IA03: terminal I11
  - IA04: terminal I12
- Analog output QA01
- Actual value ...QV of another function block

Actual value ...QV

The actual value ...QV can be assigned with the following operands:

- Marker MD, MW, MB
- Analog output QA01

An arithmetic element is not wired in the circuit diagram.



Parameter display and parameter sets for arithmetic elements:

AR32	Function block – arithmetic number 32
ADD	Addition mode
+	Appears in the parameter display
>I1	First value
>I2	Second value
QV>	Result of the addition

Only constants can be modified in the parameter display of the arithmetic element.

Arithmentic element modes

Parameter	Function
ADD	Addition of summand value >I1 plus summand >I2
SUB	Subtraction of minuend >I1 minus subtrahend >I2
MUL	Multiplication of factor >I1 by factor >I2
DIV	Division of dividend >I1 by divisor >I2

Value range

The element operates in the interger range from –2147483648 to +2147483647.

Behaviour when value range is exceeded

- The element sets the switching contact AR..CY to status 1.
- The element retains the value of the last valid operation. The value is zero when it is first called.

Display the parameter set in the PARAMETERS menu

- + Access enabled
- – Access inhibited

Contacts

AR01CY to AR32CY: CARRY overflow bit, value on element output greater than or less than the value range

AR01ZE to AR32ZE: ZERO zero bit, value on output element is equal to zero

Coils

The arithmetic element does not have any coils

Memory space requirement of the artihmetic element

The arithmetic function block requires 40 bytes of memory plus 4 bytes per constant on the element inputs.

Addition

42 + 1000 = 1042

2147483647 + 1 = last valid value of this mathematical operation, due to overflow (CARRY)
AR..CY = Status 1

–2048 +1000 = –1048

Subtraction

1134 – 42 =1092

–2147483648 – 3 = last valid value of this mathematical operation, due to overflow (CARRY)
AR..CY = Status 1

–4096 – 1000 = –5096

–4096 – (–1000) = –3096

Multiplication

12 × 12 = 144

1000042 × 2401 = last valid value of this mathematical operation, due to overflow (CARRY)
correct value = 2401100842
AR..CY = Status 1

–1000 × 10 = –10000

Division

1 024 : 256 = 4

1024 : 35 = 29 (The positions behind the comma are omitted.)

1 024 : 0 = last valid value of this mathematical operation, due to overflow (CARRY)
(mathematically correct: "Infinite")
AR..CY = Status 1

–1 000 : 10 = –100

1 000 : –10 = –100

–1 000 : (–10) = 100

10 : 100 = 0

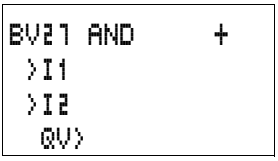
Boolean operation

easy800 provides 32 elements from BV01 to BV32 for boolean operations with values.

The following possibilities are provided by the "Boolean operation" element:

- Masking out of special bits from values,
- Bit pattern recognition,
- Bit pattern modification.

A "Boolean operation" element is not wired in the circuit diagram.



Parameter display and parameter set for "boolean operation" element":

BV27	Function block - boolean operation number 27
AND	AND operation mode
+	Appears in the parameter display
>I1	First value
>I2	Second value
QV>	Result of the operation

Only constants can be modified in the parameter display of an element.

Operating modes of the “Boolean operation” element

Parameter	Function
AND	AND operation
OR	OR operation
XOR	Exclusive OR operation
NOT	Negation of the boolean value of >I1

Value range

32 bit signed value

Inputs

The input elements >I1 and >I2 can have the following operands:

- Constants
- Marker MD, MW, MB
- Analog inputs IA01 to 04
  - IA01: terminal I7
  - IA02: terminal I8
  - IA03: terminal I11
  - IA04: terminal I12
- Analog output QA01
- Actual value ...QV of another function block

Actual value ...QV

The actual value ...QV can be assigned with the following operands:

- Marker MD, MW, MB
- Analog output QA01

If you link a negative value, e.g.: -10_{dec} the CPU will form the two's complement of the amount.

Example:
$-10_{dec} = 10000000000000000000000000001010_{bin}$

Two's complement =
$11111111111111111111111111110110_{bin} =$
$FFFFFFF6_{hex}$

Bit 32 is the signed bit and remains as 1.

Display the parameter set in the PARAMETERS menu

- + Access enabled
- – Access inhibited

Contacts

BV01ZE to BV32ZE: ZERO zero bit, value on output element is equal to zero

Coils

The "boolean operation" element does not have coils.

Memory space requirement of the "Boolean operation" element

The Boolean operation comparator function block requires 40 bytes of memory plus 4 bytes per constant on the element inputs.

AND boolean operation

Value >I1: $13219_{dec} = 0011001110100011_{bin}$

Value >I2: $57193_{dec} = 1101111101101001_{bin}$

Result QV>: $4897_{dec} = 0001001100100001_{bin}$

OR boolean operation

Value >I1: $13219_{dec} = 0011001110100011_{bin}$

Value >I2: $57193_{dec} = 1101111101101001_{bin}$

Result QV>: $65515_{dec} = 1111111111101011_{bin}$

XOR boolean operation

Value >I1: $13219_{dec} = 0011001110100011_{bin}$

Value >I2: $57193_{dec} = 1101111101101001_{bin}$

Result QV>: $60618_{dec} = 1110110011001010_{bin}$

NOT boolean operation

Value >I1: $13219_{dec} = 0011001110100011_{bin}$

Value >I2: Omitted

Result QV>: $52316_{dec} = 1100110001011100_{bin}$

Counters

easy800 provides 32 up-down counters from C 01 to C 32. The counter relays allow you to count events. You can enter upper and lower threshold values as comparison values. The contacts switch in accordance with the actual value. If you want to define a start value, for example, starting from the value "1200", this is possible with a "C.." counter.

The "C.." counters are cycle time dependent.

Wiring of a counter

You integrate a counter into your circuit in the form of a contact and coil. The counter relay has different coils and contacts.

→ To prevent unpredictable switching states, use each coil of a relay once only in the circuit diagram.

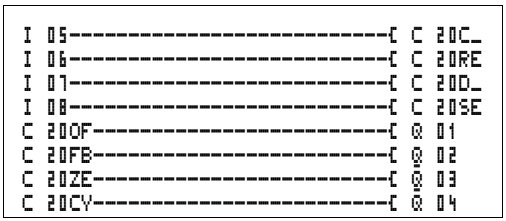
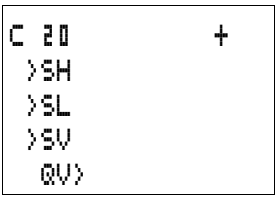


Figure 64: easy800 circuit diagram with counter relay



Parameter display and parameter set for counter relay:

C 20	Function block – counter relay number 20
+	Appears in the parameter display
>SH	Upper setpoint value, comparison value for comparison of greater than or equal to the actual value
>SL	Lower setpoint value, comparison value for comparison of less than or equal to the actual value
>SV	Defined actual value (Preset)
QV>	Actual value in Run mode

In the parameter display of a counter relay you change setpoint values and/or the preset value and enabling of the parameter display.

Value range
The element operates in the interger range from –2147483648 to 2147483647.

Behaviour when value range is exceeded
The element sets the switching contact C .. CY to the status 1 and retains the value of the last valid operation.

→ Counter C counts every rising edge on the counter input. If the value range is exceeded, the switching contact switches to status 1 for one cycle per rising edge detected.

Inputs
The element inputs >SH, >SL and >SV can have the following operands:

- Constants
- Marker MD, MW, MB
- Analog inputs IA01 to 04
  - IA01: terminal I7
  - IA02: terminal I8
  - IA03: terminal I11
  - IA04: terminal I12
- Analog output QA01
- Actual value ...QV of another function block

Actual value ...QV
The actual value ...QV can be assigned with the following operands:

- Marker MD, MW, MB
- Analog output QA01

Display the parameter set in the PARAMETERS menu
- + Access enabled
- – Access inhibited

Contacts
- C 01OF to C 32OF: upper setpoint value ≧ actual value
- C 01FB to C 32FB: lower setpoint value ≦ actual value
- C 01ZE to C 32ZE: actual value = zero
- C 01CY to C 32CY: value range exceeded

Coils
- C 01C_ to C 32C_: counter coils, count with rising edges
- C 01D_ to C 32D_: count direction definition, state "0" = count upwards, state "1" = count downwards
- C 01RE to C 32RE: reset actual value to zero
- C 01SE to C 32SE: accept defined actual value with rising edge.

Memory requirement of the counter relays
The counter relay function block requires 52 bytes of memory plus 4 bytes per constant on the element inputs.

Retention
Counter relays can be operated with retentive actual values. The number of retentive counter relays can be selected in the SYSTEM → RETENTION menu.

The retentive actual value requires 4 bytes of memory.

If a counter relay is retentive, the actual value is retained when the operating mode changes from Run to Stop as well as when the power supply is switched off.

If easy is started in Run mode, the counter relay operates with a zero-voltage safe saved actual value.

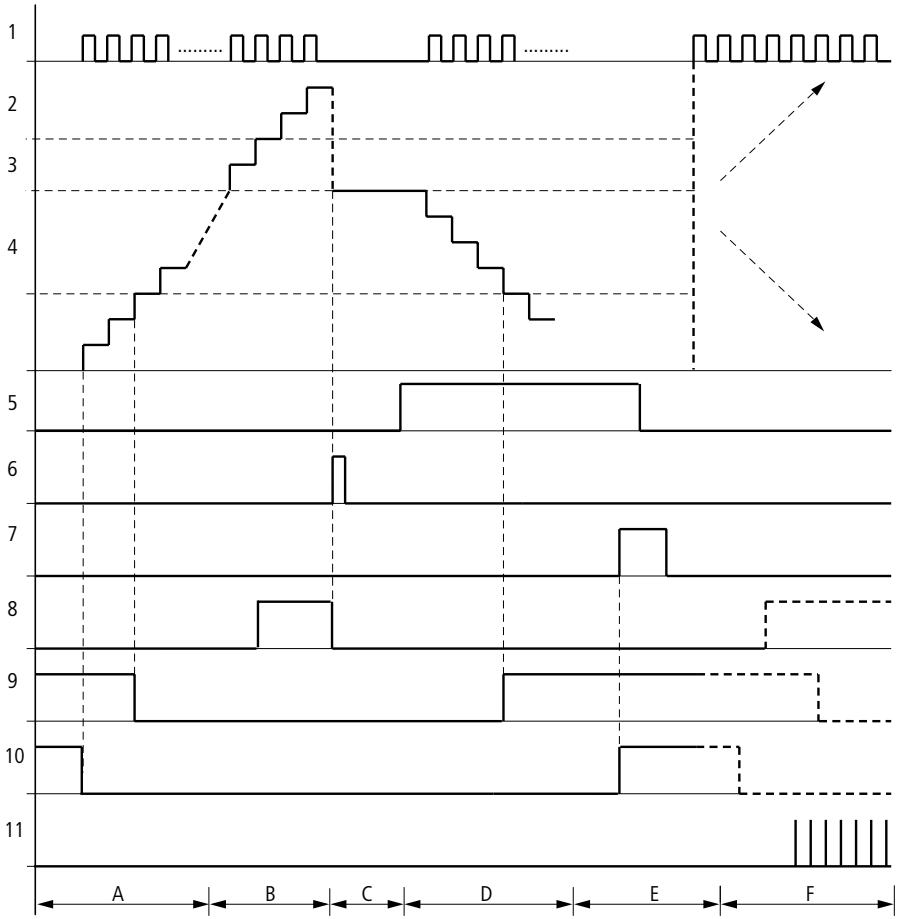


Figure 65: Counters signal diagram

Legends → next page

Legends for Figure 65:

1: counter coil C..C_

2: upper setpoint value >SH

3: preset actual value >SV

4: lower setpoint value >SL

5: counting direction, coil C..D_

6: accept preset actual value, coil C..SE

7: reset coil C..RE

8: contact (make contact) C..OF upper setpoint value reached, exceeded

9: contact (make contact) C..FB lower setpoint value reached, undershot

10: actual value equal to zero

11: out of value range

- Range A:
  - The counter has the value zero.
  - The contacts C..ZE (actual value equal to zero) and C..FB (lower setpoint value undershot) are active.
  - The counter receives counter values and increases the actual value.
  - C..ZE drops out as well as C..FB and also when the lower setpoint value is reached.
- Range B:
  - The counter counts upwards and achieves the upper setpoint value. The contact "upper setpoint value" C..OF becomes active.
- Range C:
  - The coil C..SE is briefly actuated and the actual value is set to the preset actual value. The contacts go to the respective position.
- Range D:
  - The counting direction coil C..D_ is actuated. If counting impulses are present, downward count is initiated.
  - If the lower setpoint value is undershot, the contact C..FB becomes active.
- Range E:
  - The reset coil C..RE is activated. The actual value is set to zero.
  - The contact C..ZE is active.
- Range F:
  - The actual value goes outside the value range of the counter.
  - The contacts become active according to the direction of the values (positive or negative).

Fast counters

easy800 provides various fast counter functions. These counter elements are coupled directly to the digital inputs. The fast counter functions are only available with EASY8..-DC.. .

The following functions are possible:

- Frequency counters, measure frequencies **CF..**
- Fast counters, count fast signals **CH..**
- Incremental value counters, count two-channel incremental value encoder signals **CI..**

The fast inputs are I1 to I4.

The following wiring rules apply:

- I1: CF01 or CH01 or CI01
- I2: CF02 or CH02 or CI01
- I3: CF03 or CH03 or CI02
- I4: CF04 or CH04 or CI02

Each input I .. may only use the CF, CH, CI elements once.

The incremental value encoder occupies an input pair.

Example:

- I1: fast counter CH01
- I2: frequency counter CF02
- I3: incremental value encoder channel A CI02
- I4: incremental value encoder channel B CI02

Note!
If an input is used for multiple purposes, the counter which is at the bottom of the element list is run:

Example: element list in the FUNCTION RELAYS menu:

```
CI01
CF01
CH01
```

All elements access I1.

Only CH01 supplies the correct value.

Frequency counters

easy800 provides four frequency counters which are CF01 to CF04. The frequency counters enable the measurement of frequencies. You can enter upper and lower threshold values as comparison values. The fast frequency counters are hardwired to the digital inpus I1 to I4.

The "CF.." frequency counters are independent of the cycle.

Counter frequency and pulse shape

The maximum counter frequency is 5 kHz.

The minimum counter frequency is 4 Hz.

The signals must be square waves. The mark-to-space ratio is 1:1.

Measurement method

The pulses on the input are counted for one second regardless of the cycle time and the frequency is determined. The result of the measurement is made available as a value to the element output CF..QV.

Wiring of a counter

The following assignment of the digital inputs apply.

- I1 counter input for the counter CF01
- I2 counter input for the counter CF02
- I3 counter input for the counter CF03
- I4 counter input for the counter CF04

→ To prevent unpredictable switching states, use each coil of a relay once only in the circuit diagram. Use a counter input for the CF, CH, CI counters only once.

Wiring of a frequency counter

You integrate a frequency counter into your circuit in the form of a contact and coil. The counter relay has different coils and contacts available.

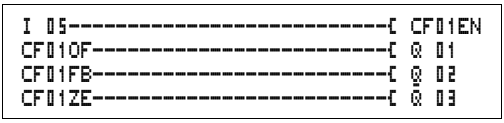
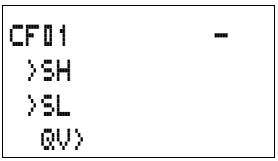


Figure 66: easy800 circuit diagram with frequency counter



Parameter display and parameter set for frequency counter:

CF01	Function block – frequency counter number 01
-	Does not appear in the parameter display
>SH	Upper setpoint value, comparison value for comparison of greater than or equal to the actual value
>SL	Lower setpoint value, comparison value for comparison of less than or equal to the actual value
QV>	Actual value in Run mode

In the parameter display of a counter relay you change setpoint values and/or the preset value and enable of the parameter display.

Value range

The element operates in the interger range from
0 to 5000
1 kHz = 1000

Behaviour when value range is exceeded

The value range cannot be exceeded as the maximum measured value is less than the value range.

Inputs
The input elements >SH and >SL can have the following operands:

- Constants
- Marker MD, MW, MB
- Analog inputs IA01 to 04
  - IA01: terminal I7
  - IA02: terminal I8
  - IA03: terminal I11
  - IA04: terminal I12
- Analog output QA01
- Actual value ...QV of another function block

Actual value ...QV
The actual value ...QV can be assigned with the following operands:

- Marker MD, MW, MB
- Analog output QA01

Display the parameter set in the PARAMETERS menu
- + Access enabled
- – Access inhibited

Contacts
- CF01OF to CF04OF, upper setpoint value ≧ actual value
- CF01FB to CF04FB, lower setpoint value ≦ actual value
- CF01ZE to CF04ZE, actual value = zero

Coils
CF01EN to CF04EN: enable of the counter with coil status = 1.

Memory requirement of the counter relays
The counter relay function block requires 40 bytes of memory plus 4 bytes per constant on the element inputs.

Retention

The frequency counter does not retain actual values, as the frequency is remeasured continuously.

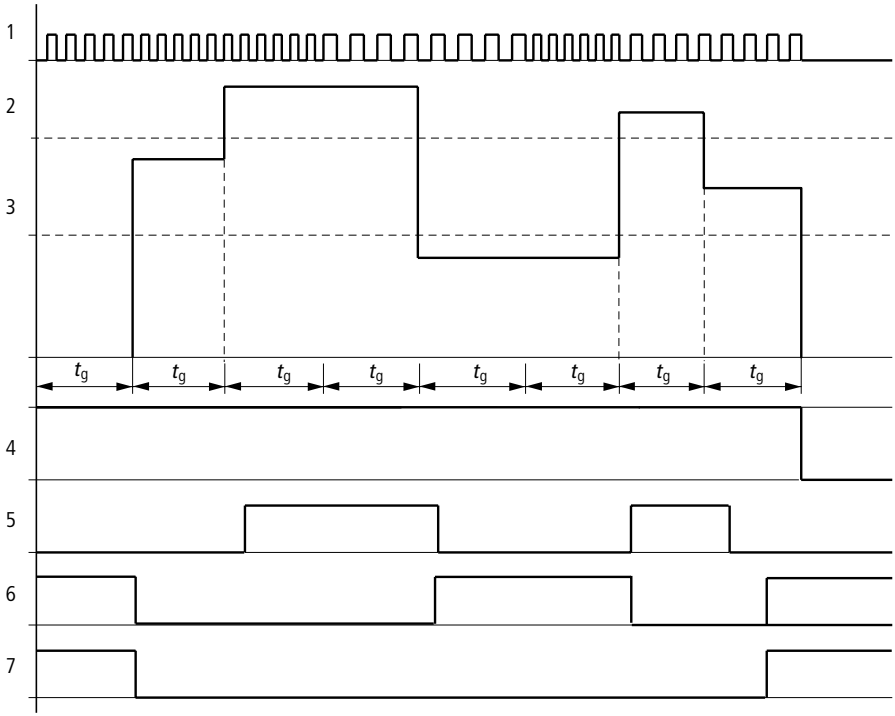


Figure 67: Frequency counter signal diagram

1: counter input I 01 to I 04

2: upper setpoint value >SH

3: lower setpoint value >SL

4: enable CF..EN

5: contact (make contact) CF..OF upper setpoint value exceeded

6: contact (make contact) CF..FB lower setpoint value undershot

7: actual value equal to zero CF..ZE

t_g: peak time for the frequency measurement

- The first measurements are made after the CF..EN enable signal occurred. The value is output after the peak time has timed out.
- The contacts are set in accordance with the measured frequency.
- If the CF..EN enable signal is removed, the output value is set to zero.

Fast counter

easy800 provides four fast up/down counters CH01 to CH04 for usage. The fast counter inputs are hardwired to the digital inpus I1 to I4. These counter relays allow you to count events without having to consider the cycle time. You can enter upper and lower threshold values as comparison values. The contacts switch in accordance with the actual value. If you want to define a start value, for example, starting from the value "1989", this is possible with a "CH.." counter.

The "CH.." counters are independant of the cycle time.

Counter frequency and pulse shape

The maximum counter frequency is 5 kHz.

The signals must be square waves. The mark-to-space ratio is 1:1.

Wiring of a counter

The following assignment of the digital inputs apply.

- I1 counter input for the counter CH01
- I2 counter input for the counter CH02
- I3 counter input for the counter CH03
- I4 counter input for the counter CH04

To prevent unpredictable switching states, use each coil of a relay once only in the circuit diagram. Use a counter input for the CF, CH, CI counters only once.

You integrate a counter into your circuit in the form of a contact and coil. The counter relay has different coils and contacts available.

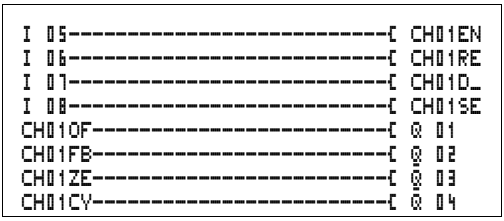
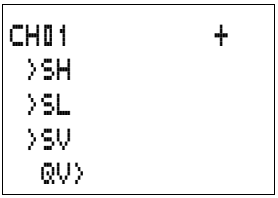


Figure 68: easy800 circuit diagram with fast counters



Parameter display and parameter set for fast counters:

CH01	Function block – fast counter number 01
+	Appears in the parameter display
>SH	Upper setpoint value, comparison value for comparison of greater than or equal to the actual value
>SL	Lower setpoint value, comparison value for comparison of less than or equal to the actual value
>SV	Defined actual value (Preset)
QV>	Actual value in Run mode

In the parameter display of a counter relay you change setpoint values and/or the preset value and enable of the parameter display.

Value range

The element operates in the interger range from –2147483648 to 2147483647.

Behaviour when value range is exceeded

- The element sets the switching contact CH..CY to status 1.
- The element retains the value of the last valid operation.

Inputs
The element inputs >SH, >SL and >SV can have the following operands:

- Constants
- Marker MD, MW, MB
- Analog inputs IA01 to 04
  - IA01: terminal I7
  - IA02: terminal I8
  - IA03: terminal I11
  - IA04: terminal I12
- Analog output QA01
- Actual value ...QV of another function block

Actual value ...QV
The actual value ...QV can be assigned with the following operands:

- Marker MD, MW, MB
- Analog output QA01

→ The actual value is only erased in Run mode with a selective reset signal.

Display the parameter set in the PARAMETERS menu
- + Access enabled
- – Access inhibited

Contacts
- CH01OF to CH04OF, upper setpoint value ≧ actual value
- CH01FB to CH04FB, lower setpoint value ≦ actual value
- CH01ZE to CH04ZE, actual value = zero
- CH01CY to CH04CY, value range exceeded

Coils

- CH01EN to CH04EN: enable of the counter
- CH01D to CH04D: count direction declaration, state "0" = count upwards, state "1" = count downwards
- CH01RE to CH04RE: reset actual value to zero
- CH01SE to CH04SE: accept preset actual value with rising edge.

Memory requirement of the counter relays

The fast counter function block requires 52 bytes of memory plus 4 bytes per constant on the element inputs.

Retention

Fast counter relays can be operated with retentive actual values. The number of retentive counter relays can be selected in the SYSTEM → RETENTION menu.

If a counter relay is retentive, the actual value is retained when the operating mode changes from Run to Stop as well as when the power supply is switched off.

If easy is started in Run mode, the counter relay operates with a zero-voltage safe saved actual value.

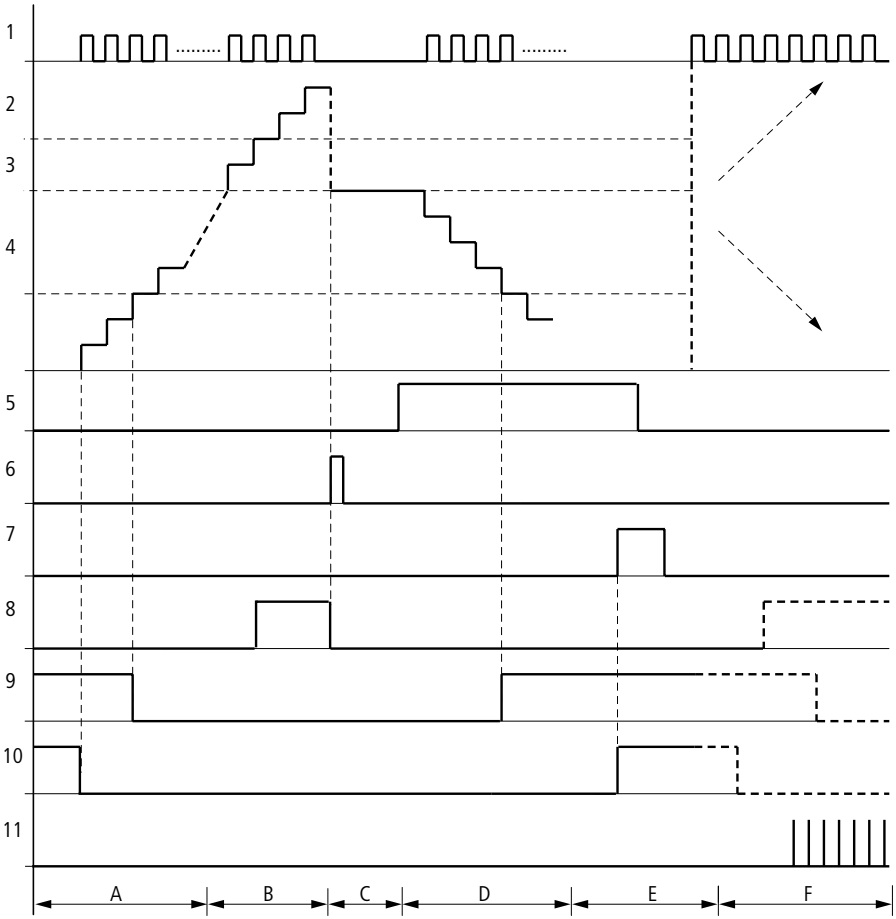


Figure 69: "Fast counter" signal diagram

1: counter input I01 to I04
2: upper setpoint value >SH
3: preset actual value >SV
4: lower setpoint value >SL
5: enable of the counter CH..EN
6: counting direction, coil CH..D
7: accept preset actual value, coil CH..SE
8: reset coil CH..RE

9: contact (make contact) CH..OF upper setpoint value reached, exceeded

10: contact (make contact) CH..FB lower setpoint value reached, undershot

11: contact (make contact) CH..ZE actual value equal to zero

- Range A:
  - The counter has the value zero.
  - The contacts CH..ZE (actual value equal to zero) and CH..FB (lower setpoint value undershot) are active.
  - The counter receives counter values and increases the actual value.
  - CH..ZE drops out as well as CH..FB after the lower setpoint value is reached.
- Range B:
  - The counter counts upwards and achieves the upper setpoint value. The contact "upper setpoint value" CH..OF becomes active.
- Range C:
  - The coil CH..SE is briefly actuated and the actual value is set to the preset actual value. The contacts go to the respective position.
- Range D:
  - The counting direction coil CH..D is actuated. If counting impulses are present, downward count is initiated.
  - If the lower setpoint value is undershot, the contact CH..FB becomes active.
- Range E:
  - The reset coil CH..RE is activated. The actual value is set to zero.
  - The contact CH..ZE is active.
- Range F:
  - The actual value goes outside the value range of the counter.
  - The contacts become active according to the direction of the values (positive or negative).

Faster incremental value encoder counters

easy800 provides two fast incremental value encoders CI01 and CI02. The fast counter inputs are hardwired to the digital inputs I1, I2, I3 and I4. These counter relays allow you to count events without having to consider the cycle time. You can enter upper and lower threshold values as comparison values. The contacts switch in accordance with the actual value. If you want to predefine a start value you can do this with a counter "CI..".

The "CI.." counter is independant of the cycle time.

Counter frequency and pulse shape

The maximum counter frequency is 3 kHz.

The signals must be square waves. The mark-to-space ratio is 1:1. The signals on channels A and B must lead or lag by 90°. Otherwise the counting direction cannot be determined.

Double the number of pulses are counted as a result of the internal method of operation of the incremental value encoder. The incremental value encoder evaluates the rising and falling edges. This ensures that the pulse count is not affected by oscillation of a signal edge. If the number of pulses are required, divide the value by two.

Wiring of a counter

The following assignment of the digital inputs apply.

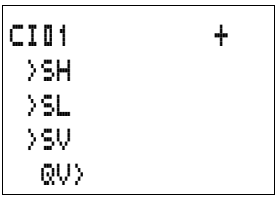
- I1 counter input for the counter CI01 channel A
- I2 counter input for the counter CI01 channel B
- I3 counter input for the counter CI02 channel A
- I4 counter input for the counter CI02 channel B

To prevent unpredictable switching states, use each coil of a relay once only in the circuit diagram.

Use a counter input for the CF, CH, CI counters only once.

You integrate a counter into your circuit in the form of a contact and coil. The counter relay has different coils and contacts.

Figure 70: easy800 circuit diagram with fast incremental value encoder counters



Parameter display and parameter set for fast incremental value encoder counters:

CI01	Function block – fast incremental value encoder counter number 01
+	Appears in the parameter display
>SH	Upper setpoint value, comparison value for comparison of greater than or equal to the actual value
>SL	Lower setpoint value, comparison value for comparison of less than or equal to the actual value
>SV	Defined actual value (Preset)
QV>	Actual value in Run mode

In the parameter display of a counter relay you change setpoint values and/or the preset value and enable of the parameter display.

Value range

The element operates in the interger range from –2147483648 to 2147483647.

Each pulse is counted twice.

Example: value of CI..QV = 42000

The counter has counted 21000 pulses.

Behaviour when value range is exceeded

- The element sets the switching contact CI..CY to status 1.
- The element retains the value of the last valid operation.

Inputs

The element inputs >SH, >SL and >SV can have the following operands:

- Constants
- Marker MD, MW, MB
- Analog inputs IA01 to 04
  - IA01: terminal I7
  - IA02: terminal I8
  - IA03: terminal I11
  - IA04: terminal I12
- Analog output QA01
- Actual value ...QV of another function block

Actual value ...QV

The actual value ...QV can be assigned with the following operands:

- Marker MD, MW, MB
- Analog output QA01

→ The actual value is only erased in Run mode with a selective reset signal.

Display the parameter set in the PARAMETERS menu

- + Access enabled
- – Access inhibited

Contacts

- CI01OF to CI02OF, upper setpoint value ≧ actual value
- CI01FB to CI02FB, lower setpoint value ≦ actual value
- CI01ZE to CI 02ZE: actual value = zero
- CI01CY to CI02CY: value range exceeded

Coils

- CI01EN to CI02EN: enable of the counter
- CI01RE to CI02RE: reset actual value to zero
- CI01SE to CI02SE: accept preset actual value with rising edge.

Memory requirement of the counter relays

The fast counter function block requires 52 bytes of memory plus 4 bytes per constant on the element inputs.

Retention

Fast counter relays can be operated with retentive actual values. The number of retentive counter relays can be selected in the SYSTEM → RETENTION menu.

If a counter relay is retentive, the actual value is retained when the operating mode changes from Run to Stop as well as when the power supply is switched off.

If easy is started in Run mode, the counter relay operates with a zero-voltage safe saved actual value.

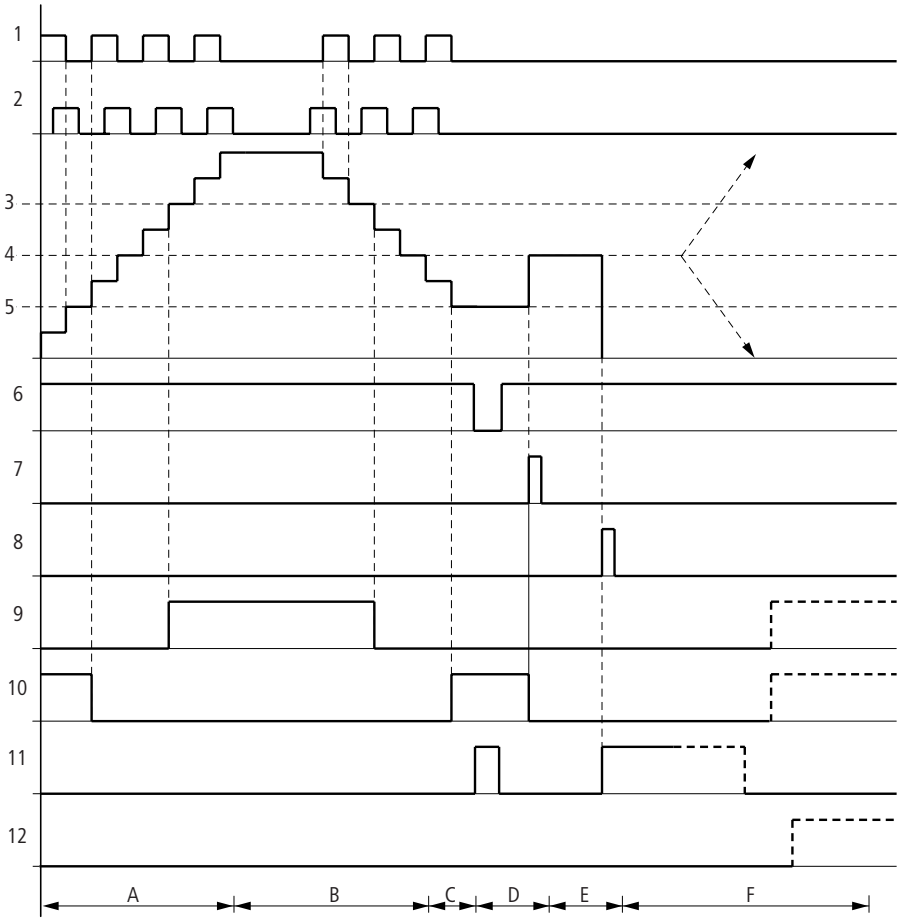


Figure 71: "Fast incremental value encoder counter" signal diagram

1: counter input channel A

2: counter input channel B

3: upper setpoint value ›SH

4: preset actual value ›SV

5: lower setpoint value ›SL

6: counter enable

7: accept preset actual value, coil CI..EN

8: reset coil CI..RE

9: contact (make contact) CI..OF upper setpoint value reached, exceeded

10: contact (make contact) CI..FB lower setpoint value reached, undershot

11: contact (make contact) CI..ZE actual value equal to zero

12: contact (make contact) CI..CY value range exceeded or undershot

- Range A:
  – The counter counts upwards.
  – The value leaves the lower threshold value and achieves the upper value.
- Range B:
  – The count direction changes to a downward count.
  – The contacts switch in accordance with the actual value.
- Range C:
  – The enable signal is set to 0. The actual value becomes 0.
- Range D:
  – The rising edge on the accept preset value coil sets the actual value to the preset value.
- Range E:
  – The reset pulse sets the actual value to zero.
- Range F:
  – The actual value goes outside the value range of the counter.
  – The contacts become active according to the direction of the values (positive or negative).

Comparators

You can compare constants and variables with one another with a comparator.

The following comparisons are possible:

Element input		Element input
>I1	greater than or equal to	>I2
	equal to	
	less than or equal to	

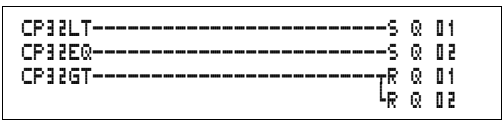
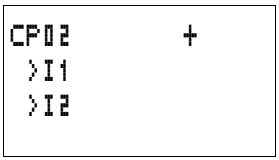


Figure 72: easy800 circuit diagram with comparator



Parameter display and parameter set for the comparator element:

CP02	Function block – analog value comparator number 02
+	Appears in the parameter display
>I1	Comparison value 1
>I2	Comparison value 2

Inputs

The input elements >I1 and >I2 can have the following operands:

- Constants
- Marker MD, MW, MB
- Analog inputs IA01 to 04
  - IA01: terminal I7
  - IA02: terminal I8
  - IA03: terminal I11
  - IA04: terminal I12
- Analog output QA01
- Actual value ...QV of another function block

Contacts

- CP01LT to CP32LT, (less than)

contact (make contact) switches to status 1, if the value on >I1 is less than the value on >I2; >I1 < >I2.

- CP01EQ to CP32EQ, (equal to)

contact (make contact) switches to status 1, if the value on >I1 is equal to the value on >I2; >I1 = I2.

- CP01GT to CP32GT, (greater than)

contact (make contact) switches to status 1, if the value on >I1 is greater than the value on >I2; >I1 < >I2.

Memory requirement of the counter relays

The comparator function block requires 32 bytes of memory plus 4 bytes per constant on the element inputs.

Text output element

easy800 allows you to display 32 user-defined texts. The texts can be edited with EASY-SOFT. The texts are saved in the EASY-SOFT file *.e40 or on the EASY-M-256K memory card for easy800.

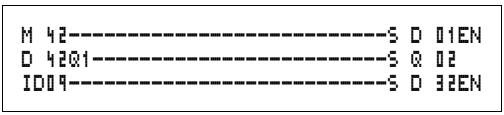


Figure 73: easy800 circuit diagram with a text output element

Contacts

The text output module has one contact.
D01Q1 to D32Q1, text module is active.

Coils

D01EN to D32EN, enable of the text element

Memory space requirement of the text output element

The text output element function block requires 156 bytes of memory. This is independant of the text size.

Display

Up to 16 characters per line and up to 4 lines can be displayed.

Variables

Actual values from the function block, timing relays and C upward counter as well as the analog inputs (scaled) can be displayed. The display of date and time is also possible.

The variables can be inserted at any desired position in the text. The variables can be 4, 7 and 11 positions in length.

Pay attention to the maximum character length of the variables. Otherwise, characters will be overwritten or not displayed.

Scaling

The values of the analog inputs and analog output can be scaled.

Range	Selectable display range	Example
0 to 10 V	0 to 9999	0000 to 0100
0 to 10 V	± 999	–025 to 050
0 to 10 V	± 9.9	–5.0 to 5.0

Function

The text output elements D = "Display", "Text display" function in the circuit diagram as normal M markers. If a text is assigned to a marker, it will be displayed in the easy LCD if the coil is set to 1. For this to happen easy must be in Run mode and the Status display must be showing before the text is activated.

The following applies for **D 02** to **D 32**:
When activating several texts, they will be displayed automatically in succession every 4 seconds. This process will be repeated until

- none of the text output elements are set to 1.
- Stop mode is selected.
- the easy power supply is switched off.
- the **OK** or **DEL** + **ALT** buttons are used to switch to a menu.
- the text for D01 is displayed.

The following applies to **D 01**:
D1 is assigned as an alarm text. If D01 is activated, the text assigned to it will be displayed until

- the coil D 01EN is reset to 0.
- Stop mode is selected.
- the easy power supply is switched off.
- the **OK** or **DEL** + **ALT** buttons are used to switch to a menu.

Text entry

Text entry is only possible using EASY–SOFT, from version V 4.0 upwards

Character set

All ASCII characters in upper and lower case are permissible.

- A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
- a b c d e f g h i j k l m n o p q r s t u v w x y z

The following special characters are permissible:
! „ " # $ % & ' ( ) * + , – . / 0 1 2 3 4 5 6 7 8 9

Counter with actual value

```
QUANTITY
QTY:       0042
  !COUNTING!
```

Analog values scaled as temperature values

```
TEMPERATURE
OUT   -010 DEG
IN    +018 DEG
  HEATING
```

D1 as error message on fuse failure

```
FUSE FAULT

   HOUSE 1
   FAILED!
```

Figure 74: Text output example

Data element

The data element allows you to selectively save a value. Setpoint values for the function block can be saved in this manner.

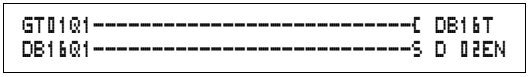
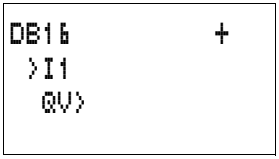


Figure 75: easy800 circuit diagram with data element



Parameter display and parameter set for the data element:

DB16	Function block – data element number 16
+	Appears in the parameter display
>I1	Input value
QV>	Actual value

Inputs

The element input >I1 can be assigned with the following operands:

- Constants
- Marker MD, MW, MB
- Analog inputs IA01 to 04
  - IA01: terminal I7
  - IA02: terminal I8
  - IA03: terminal I11
  - IA04: terminal I12
- Analog output QA01
- Actual value ...QV of another function block

Output

The element output QV> can be assigned with the following operands:

- Marker MD, MW, MB
- Analog output QA01

Contacts
DB01Q1 to DB32Q1

Contact (make contact) DB..Q1 switches to state 1 if the trigger signal has the status 1.

Coils
DB01T_ to DB32T_, acceptance of the value at >I1 with a rising edge.

Memory requirement of the data element
The data element function block requires 36 bytes of memory plus 4 bytes per constant on the element input.

Retention
Data elements can be operated with retentive actual values. The quantity can be selected in the SYSTEM → RETENTION menu

Signal diagram

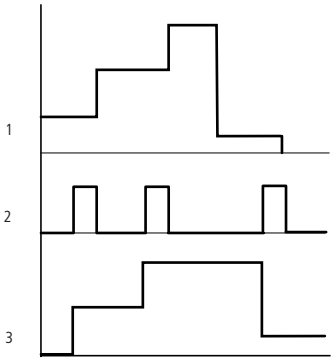


Figure 76: Data element signal diagram

1: value on input >I1

2: trigger coil DB..T_

3: value on DB..QV

→ The value on input >I1 is only transferred with a rising trigger edge to an operand on output QV.

GET, take a value from the network

The element allows you to selectively read (get) a 32 bit value from the network. The GET element gets data which another station has made available on the NET network with a PUT function block.

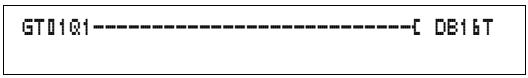
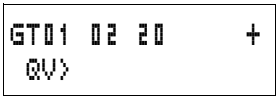


Figure 77: easy800 circuit diagram with GET element



Parameter display and parameter set for the GET element:

GT01	GET function block (gets a value from the network), number 01
02	Station number from which the value is sent. Possible station number: 01 to 08
20	Send element (PT 20) of the station who sends. Possible element number: 01 to 32
+	Appears in the parameter display
QV>	Actual value from the network

Output
The element output QV> can be assigned with the following operands:

- Marker MD, MW, MB
- Analog output QA01

Contacts
GT01Q1 to GT32Q1

contact (make contact) GT..Q1 switches to state 1, if a new value transfered on the NET network is present.

Memory space requirement of the GET element
The GET function block requires 28 bytes of memory.

GET diagnostics

The GET element only functions when the NET network is functioning correctly (→ section "Vital signs" of the individual stations and diagnostics", page 195).

Signal diagram

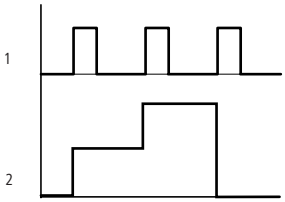


Figure 78: GET element signal diagram

1: GT..Q1

2: value on GT..QV

Seven day timer

easy800 is equipped with a real time clock which you can use in the circuit diagram as a seven day timer and twelve month timer.

→ The procedure for setting the time is described under Section "Setting date, time and seasonal time changes" on page 209.

easy provides 32 seven day timers "HW01" to "HW32" for a total of 128 switching times.

Each time switch has four channels which you can use to set four on and off times. The channels are set via the parameter display.

The timer has a back-up battery. This means that it will continue to run in the event of a power failure, although the time switch relays will not switch. When the timer is disconnected from the power supply, the contacts remain open. Information on the battery back-up time are provided in Chapter "Technical Data", page 238.

Wiring of a seven day timer

A seven day timer is integrated into the circuit diagram as a contact.

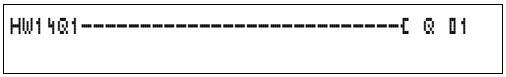
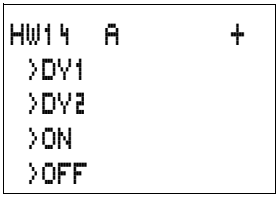


Figure 79: easy800 circuit diagram with seven day timer



Parameter display and parameter set for the seven day timer HW::

HW14	Function block – seven day timer number 14
A	Timer channel A
+	Appears in the parameter display
>DY1	Day 1
>DY2	Day 2
>ON	On time
>OFF	Off time

Channels

4 channels are available per timer, channels A, B, C and D. These channels all act on the contact of the seven day timer.

Day 1 and day 2

Either the time period acts from day 1 to day 2, e.g. Monday to Friday, or for one day only.

Monday = MO, Tuesday = TU, Wednesday = WE,
Thursday = TH, Friday = FR, Saturday = SA, Sunday = SU,

Time

00:00 to 23:59

Display the parameter set in the PARAMETERS menu

- + Access enabled
- – Access inhibited

Contacts

HW01Q1 to HW32Q1

Memory requirement of the seven day timer

The seven day timer function block requires 48 bytes of memory.

Signal diagrams

The switching points are determined to reflect the parameter requirements.

MO to FR: on the weekdays Mo, Tu, We, Th, Fr

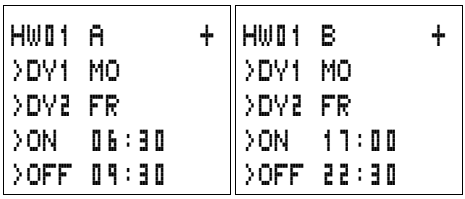
ON 10:00, OFF 18:00: on and off switching times for the individual days of the week.

MO: every Monday
ON 10:00: switch on time

SA: every Saturday
OFF 18:00: switch off time

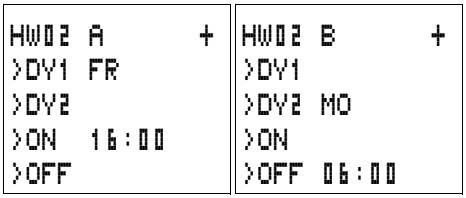
Switching example 1

Time switch "HW01" switches on Monday to Friday between 6:30 and 9:30 and between 17:00 and 22:30.



Switching example 2

Time switch HW02 switches on at 16:00 on Friday and switches off at 6:00 on Monday.



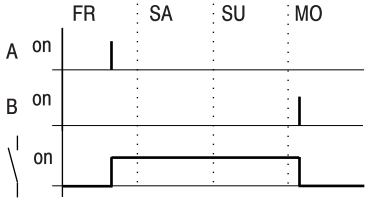
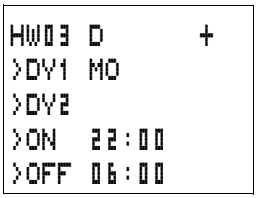


Figure 80: Weekend signal diagram

Switching example 3

Time switch HW03 switches on overnight at 22:00 on Monday and switches off at 6:00 on Tuesday.



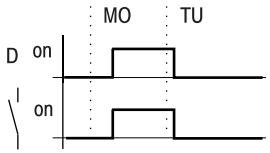


Figure 81: Night switch signal diagram

→ If the Off time is before the On time, easy will switch off on the following day.

Switching example 4

The time settings of a time switch overlap. The clock switches on at 16:00 on Monday, whereas on Tuesday and Wednesday it switches on at 10:00. On Monday to Wednesday the switching-off time is 22:00.

HW04 A +	HW04 B +
>DY1 MO	>DY1 TU
>DY2 WE	>DY2 WE
>ON 16:00	>ON 10:00
>OFF 22:00	>OFF 00:00

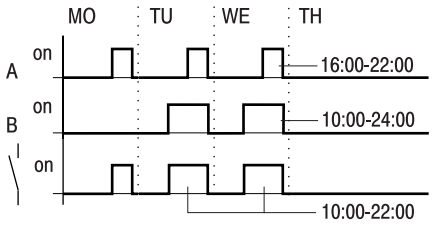


Figure 82: Overlap signal diagram

→ Switch-on and switch-off times always follow the channel which switches first.

Switching example 5

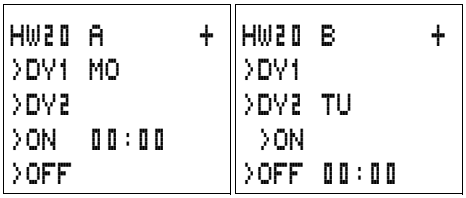
The power is removed between 15:00 and 17:00. The relay drops out and remains off, even after the power returns, since the first switching-off time was at 16:00.

HW05 A +	HW05 B +
>DY1 MO	>DY1 MO
>DY2 SU	>DY2 SU
>OFF 16:00	>ON 12:00
	>OFF 18:00

→ When switched on, easy always updates the switching state on the basis of all the available switching time settings.

Switching example 6

The time switch is to switch for 24 hours. Switch-on time at 0:00 on Monday and switch-off time at 0:00 on Tuesday.



Twelve month timer

easy800 is equipped with a real time clock which you can use in the circuit diagram as a seven day timer and twelve month timer.

→ The procedure for setting the time is described under Section "Setting date, time and seasonal time changes" on page 209.

easy provides 32 twelve month timers HY01 to HY32 for a total of 128 switching times.

Each time switch has four channels which you can use to set four on and off times. The channels are set via the parameter display.

The time and date are backed up by a battery and continue to run if the voltage fails. This means that it will continue to run in the event of a power failure, although the time switch relays will not switch. When the timer is disconnected from the power supply, the contacts remain open. Information on the battery back-up time are provided in Chapter "Technical Data", page 238.

Wiring of a twelve month timer

A twelve month timer is integrated into the circuit diagram as a contact.

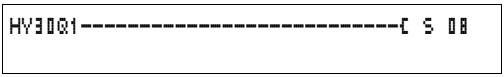
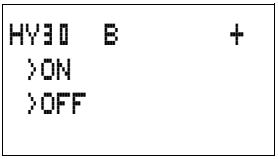


Figure 83: easy800 circuit diagram with twelve month timer



Parameter display and parameter set for the twelve month timer HY:

HY30	Function block – twelve month timer number 30
B	Timer channel B
+	Appears in the parameter display
>ON	Switch on time
>OFF	Switch off time

Channels

4 channels are available per timer, channels A, B, C and D. These channels all act on the contact of the twelve month timer.

Date

Day.Month.Year: DD.MM.YY

Example 11.11.02

Switch on and off times

ON: switch on time
OFF: switch off time

→ The switch on year may not be later than the switch off year. Otherwise the twelve month timer will not function.

Display the parameter set in the PARAMETERS menu

- + Access enabled
- – Access inhibited

Contacts
HY01Q1 to HY32Q1

Memory space requirement for the twelve month timer
The twelve month timer function block requires 52 bytes of memory.

Function
The twelve month timer can operate with ranges, individual days, months, years or combinations.

Years
ON: 2002 to OFF: 2010 means:
Switch on at 01.01.2002 00:00 and switch off at 01.01.2010 00:00.

Months
ON: 04 to OFF: 10 means:
Switch on at 01. April 00:00 and switch off on 01. October 00:00

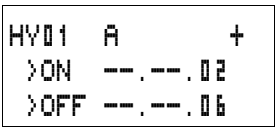
Days
ON: 02 to OFF: 25 means:
Switch on the 2nd at 00:00 and switch off on the 25th at 00:00

Rules for the twelve month timer
The contact switches on in the defined years (ON to OFF), the defined months (ON to OFF) and in the days entered (ON to OFF).

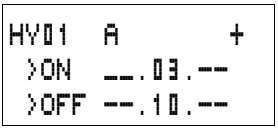
Time ranges must be input with two channels, one for ON and one for OFF.

Overlapping channels:
The first ON date switches on and the first OFF date switches off.

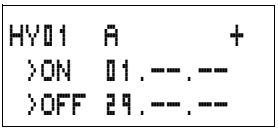
Avoid incomplete entries. It hinders transparency and leads to unwanted functions.



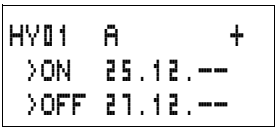
Example 1
Year range selection
The twelve month timer HY01 should switch on at 01 January 2002 at 00:00 and remain on until 31 December 2005 at 23:59.



Example 2
Month range selection
The twelve month timer HY01 should switch on at 01 March at 00:00 and remain on until 30 September at 23:59.

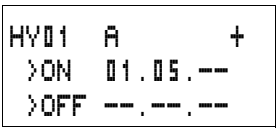


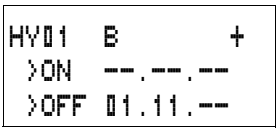
Example 3
Day range selection
The twelve month timer HY01 should switch on at the 1st of each month at 00:00 and remain on until the 28th of each month at 23:59.



Example 4
Holiday selection
The twelve month timer HY01 should switch on at the 25.12 each year at 00:00 and remain on until the 26.12 at 23:59.
"Christmas program"

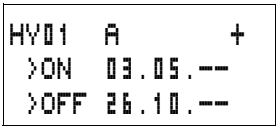
Example 5
Time range selection
The twelve month timer HY01 should switch on at 01.05 each year at 00:00 and remain on until the 01.11. at 23:59.
"Open air season"



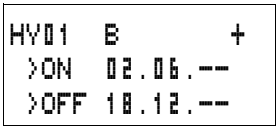


Example 6
Overlapping ranges

The twelve month timer HY01 channel A switches on at the 3rd at 00:00 in the months 5, 6, 7, 8, 9, 10 and remains on until the 25th of these months at 23:59.



The twelve month timer HY01 channel B switches on at the 2nd at 00:00 in the months 6, 7, 8, 9, 10, 11, 12 and remains on until the 17th of these months at 23:59.



Sum of the channels and behaviour of the HY01Q1 contact:
In the month of May, the timer switches on at the 3rd of the month at 00:00 and remains on until the 25th of the month at 23:59.
In the months of June, July, August, September and October the timer switches on from the 2nd at 00:00 until the 17th at 23:59
In the months November and December the timer switches on from the 2nd at 00:00 until the 17th at 23:59.

Jumps

Jumps can be used to optimize the structure of a circuit diagram or to implement the function of a selector switch. Jumps can be used for example to select whether manual/ automatic operation or other machine programs are to be set.

Jumps consist of a jump location and a jump destination (label).

Circuit diagram symbols for jumps

Contact	
Make contact[1)]	:
Numbers	01 to 32
Coils	C
Numbers	01 to 32
Coil function	C, J, J, P, L

1) can only be used as first leftmost contact

Function

If the jump coil is triggered, the circuit connections coming directly after it will not be processed. The states of the coils before the jump will be retained, unless they are overwritten in circuit connections that were not missed by the jump. Jumps are always made forwards, i.e. the jump ends on the first contact with the same number as that of the coil.

- Coil = jump when 1
- Contact only at the first leftmost contact = Jump destination

The Jump contact point will **always be set to 1**

Backward jumps are not possible with easy due to the way it operates. If the jump label does not come after the jump coil, the jump will be made to the end of the circuit diagram. The last circuit connection will also be skipped.

If a jump destination is not specified, the jump will be made to the end of the circuit diagram.

Multiple use of the same jump coil and jump contact is possible as long as this is implemented in pairs, i.e.
Coil C:1/jumped range/Contact :1,
Coil C:1/jumped range/Contact :1
etc.

Note!
The states of jumped circuit connections are retained. The time value of timing relays that have been started will continue to run.

Power flow display

Jumped ranges are indicated by the coils in the power flow display.

All coils after the jump coil are shown with the symbol of the jump coil.

Example

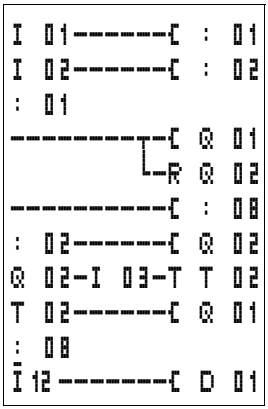
A selector switch allows two different sequences to be set.

- Sequence 1: Switch on Motor 1 immediately.
- Sequence 2: Switch on Guard 2, Wait time, then switch on Motor 1.

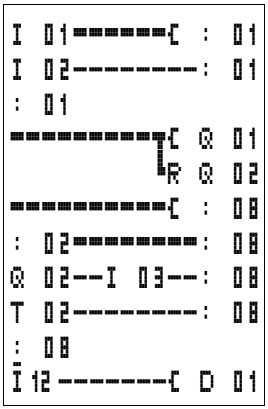
Contacts and relays used:

- I 01 sequence 1
- I 02 sequence 2
- I 03 guard 2 moved out
- I 12 motor-protective circuit-breaker switched on
- Q 01 motor 1
- Q 02 guard 2
- T 01 wait time 30.00 s, on-delayed
- D 01 text "motor-protective circuit-breaker tripped"

Circuit diagram:



Power flow display: I 01 selected:



Range from jump label 1 processed.

Jump to label 8.
Range to jump label 8 skipped.

Jump label 8, circuit diagram processed from this point on.

Master reset

The master reset element allows you to reset the state of the markers and all outputs to the 0 state with a single command. Depending on the operating mode of this element, it is possible to reset the outputs only, or the markers only, or both. 32 elements are available.

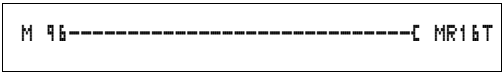
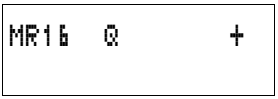


Figure 84: easy800 circuit diagram with master reset element



Parameter display and parameter set for the master reset element:

MR16	Master reset element number 16
Q	Reset outputs mode
+	Appears in the parameter display

Operating modes

- Q: Acts on the outputs Q.., *Q.., S.., *S.., *SN.., QA01; *: network station address
- M: acts on the marker range MD01 to MD48.
- ALL: acts on Q and M.

Contacts

MR01Q1 to MR32Q1

The contact switches on the marker if the trigger coil MR..T has the 1 state.

Coils

MR01T to MR32T: trigger coils

Memory requirement of the data element

The master reset function block requires 20 bytes of memory.

Function

The outputs or the marker are set to the 0 state in accordance with the operating mode when a rising edge is detected on the trigger coil.

The contacts MR01Q1 to MR32Q1 assumes the state of their own trigger coil.

Operating hours counter

easy800 provides 4 independent operation time counters. The counter states are retained even in a no-voltage state.

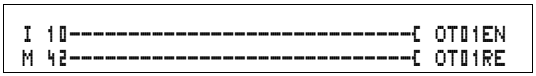
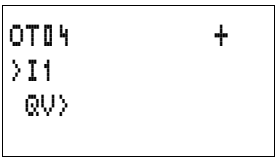


Figure 85: easy800 circuit diagram with operation time counter



Parameter display and parameter set for the operation time counter element:

OT04	Operation time counter number 04
+	Appears in the parameter display
>I1	Upper threshold value
QV>	Actual value of the operation time counter

Contacts
OT01Q1 to OT04Q1

The contact switches when the upper threshold value has been reached (greater than or equal to).

Coils
- OT01EN to OT04EN: enable coil
- OT01RE to OT04RE: reset coil

Memory space requirement of the operation time counter
The operation time counter function block requires 36 bytes of memory plus 4 bytes per constant on the element input.

Function
If the enable coil OT..EN is triggered to the 1 state, the counter adds the value 1 to its actual value every minute (basic clock rate: 1 minute).

If the actual value on QV> achieves the setpoint value of >I1, the contact OT..Q1 switches until the actual value is greater than or equal to the setpoint value.

The actual value is retained in the unit until the Reset coil OT..RE is actuated. The actual value is then set to zero.

→ Operating mode change Run, Stop, Voltage On, Off, Delete program, Change program, Load new program. All these actions do not delete the actual value of the operation time counter.

Accuracy

The operation time counter operates exactly to the minute. If the enable coil signal is terminated wthin a minute, the value for seconds is lost.

PUT, place a value onto the network

The element allows you to selectively put a 32 bit value onto the network. The PUT element places data which another station indicates that it requires with the GET function block, on the NET network.

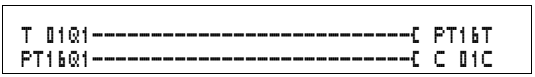
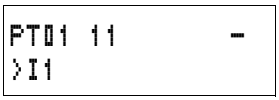


Figure 86: easy800 circuit diagram with PUT element



Parameter display and parameter set for the PUT element:

PT01	PUT function block (places a value onto the network), number 11
-	Does not appear in the parameter display
>I1	Setpoint value which is placed onto the NET network

Input

The element input >I1 can be assigned with the following operands:

- Constants
- Marker MD, MW, MB
- Analog inputs IA01 to 04
  - IA01: terminal I7
  - IA02: terminal I8
  - IA03: terminal I11
  - IA04: terminal I12
- Analog output QA01
- Actual value ...QV of another function block

Contacts

PT01Q1 to PT32Q1: state of the trigger coil

Coils

PT02T to PT32T: trigger coils

Memory space requirement of the PUT element

The PUT function block requires 36 bytes of memory plus 4 bytes per constant on the element input.

PUT diagnostics

The PUT element only functions when the NET network is functioning correctly (→ section ""Vital signs" of the individual stations and diagnostics", page 195).

Signal diagram

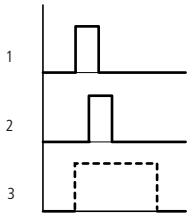


Figure 87: PUT element signal diagram

1: trigger coil

2: trigger coil contact feedback

3: send

Setting date/time

This element allows you to selectively place the date and time onto the network. All other stations accept the date and time of the sending station. The element name is SC01 (send clock).

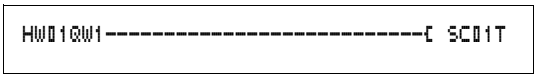


Figure 88: easy800 circuit diagram with SC element

Parameter display and parameter set for the SC element:
The SC01 element has no parameters as it is a triggered system service.

Coil
SC01T: trigger coil

Memory space requirement of the SC element
The SC function block requires 20 bytes of memory.

SC diagnostics
The SC element only functions when the NET network is functioning correctly (→ section "Vital signs" of the individual stations and diagnostics", page 195).

Function
If the trigger coil of the element is triggered, the current date, the day of the week and time from the sending station is automatically put onto the NET network. All other network stations must accept these values.

This process can be repeated as often as desired. The trigger coil must be triggered again from the 0 to the 1 state.

Timing relays

easy800 provides 32 timing relays from T 01 to T 32.

A timing relay is used to change the switching duration and the make and break times of a relay contact. The adjustable delay times are in the range between 5 ms and 99 h 59 min. If you use variable values, delay times from 5 ms to 596 h are possible.

Wiring a timing relay

You integrate a timing relay into your circuit in the form of a contact and coil. The function of the relay is defined via the function relay display. The relay is started via the trigger coil T..EN and can be selectively reset via the reset coil T..RE. The actual time sequence can be stopped via the third coil T..ST.

→ To prevent unpredictable switching states, use each coil of a relay once only in the circuit diagram.

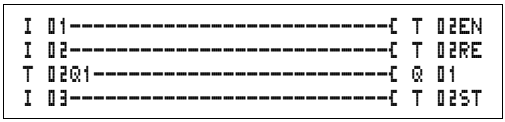
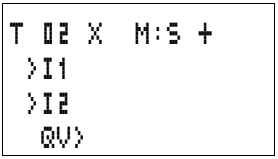


Figure 89: easy800 circuit diagram with timing relay



Parameter display and parameter set for timing relay:

T 02	Function block – timing relay number 02
X	On-delayed mode
M:S	Time range Minute: Seconds
+	Appears in the parameter display
>I1	Time nominal value 1
>I2	Time nominal value I2 (on a timing relay with 2 setpoint values)
QV>	Timed-out actual time in Run mode

The parameter display for a timing relay is used to modify the switching function, time base or setpoint times and enable of the parameter display.

Timing relay modes

Parameter	Switch function
X	Switch with on-delay
?X	Switch with on-delay and random time range
▮	Switch with off-delay
?▮	Switch with off-delay and random time range
X▮	On and off delayed
?X▮	On and off delayed with random time range switching, 2 time nominal values
⎍	Switch with single-pulse
⎍⎍	Switch with flashing, synchronous, 2 time setpoint values
⎍⎍	Switch with flashing, asynchronous, 2 time setpoint values

Time range

Parameter	Time range and setpoint time	Resolution
S 000.000	Seconds, 0.005 to 2 147 483,645 s (596 h) for constants and variable values	5 ms
M:S 00:00	Minutes: Seconds 00:00 to 99:59 only for constants and variable values	1 s
H:M 00:00	Hours: Minutes, 00:00 to 99:59 only for constants and variable values	1 min.

→ Minimum time setting:

- 0.005 s (5 ms)

If a time value is less than the easy cycle time, the time sequence will only be recognised in the next cycle.

Inputs

The input elements >I1 and >I2 can have the following operands:

- Constants
- Marker MD, MW, MB

- Analog inputs IA01 to 04
  - IA01: terminal I7
  - IA02: terminal I8
  - IA03: terminal I11
  - IA04: terminal I12
- Analog output QA01
- Actual value ...QV of another function block

Actual value ...QV
The actual value ...QV can be assigned with the following operands:

- Marker MD, MW, MB
- Analog output QA01

Variable setpoint values
Behaviour of the setpoint value when variable values are used.

- Variable values can be used.
- Variable values must be transferred using operands.
- With the time base "s" the value is accepted as a "value in ms".
- The last position is rounded up to a zero or five.
- With the time base "M:S" the value is accepted as a "value in ms".
- With the time base "H:M:" the value is accepted as a "value in M (minutes)".

Example:

Time base "s"
The operand has the value 9504.
The time value is 9,500 s.
Operand value 45507
The time value is 45,510 s.

Display the parameter set in the PARAMETERS menu
- + Access enabled
- – Access inhibited

Contacts
T 01Q1 to T 32Q1

Coils
- T 01EN to T 32EN: trigger coil;
- T 01RE to T 32RE: reset coil;
- T 01ST to T 32ST: stop coil.

Memory space requirement of the timing relay
The timing relay function block requires 52 bytes of memory.

Retention
Timing relays can be operated with retentive actual values. The number of retentive timing relays can be selected in the SYSTEM → RETENTION menu.

If a timing relay is retentive, the actual value is retained when the operating mode changes from Run to Stop as well as when the power supply is switched off.

If easy is started in Run mode, the timing relay operates with a zero-voltage safe saved actual value. The state of the trigger impulse must correspond to the function of the timing relay.

State 1 with

- on-delayed,
- pulse shaping,
- flashing.

State 0 with

- off-delayed.

Timing relay, on-delayed with and without random switching

Random switching
The contact of the timing relay switches randomly within the setpoint value range.

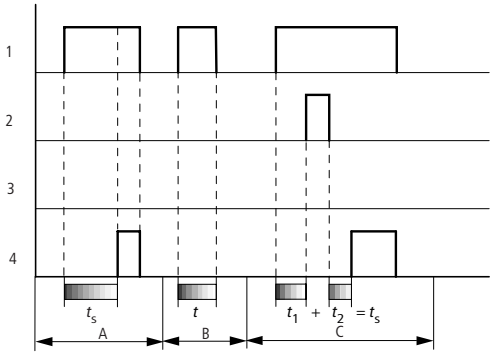


Figure 90: Timing relay, on-delayed signal diagram (with and without random switching)

1: trigger coil T..EN

2: stop coil T..ST

3: reset coil T..RE

4: switching contact (make contact) T..Q1

t_S: setpoint time

- Range A:
  - The trigger coil T..EN of the timing relay is actuated.
  - The set setpoint time times out and contact T..Q1 of the relay switches.
  - The trigger coil T..EN is actuated.
  - The contact T..Q1 goes to the normal position.
- Range B:
  - The trigger coil T..EN of the timing relay is actuated and the trigger signal drops out before the setpoint time has elapsed.
  - Contact T..Q1 does not switch.
- Range C:
  - The trigger coil T..EN of the timing relay is actuated.
  - The stop coil T..ST is actuated before the setpoint time has elapsed.
  - The actual value remains constant as long as the T..ST stop coil is actuated.
  - If the T..ST stop coil drops out, the actual value is counted further and the setpoint time t_S is reached.
  - The contact T..Q1 switches after the setpoint time t_S has elapsed, until the trigger coil T..EN is no longer actuated.

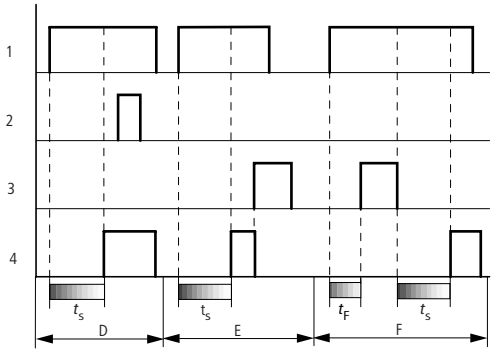


Figure 91: Timing relay, on-delayed signal diagram (with and without random switching)

- Range D:
  - The setpoint time t_s is achieved.
  - The contact T..Q1 has switched.
  - The actuated stop coil T..ST does not influence the contact in this state.
- Range E:
  - The setpoint time t_s is achieved.
  - The contact T..Q1 has switched.
  - The actuated reset coil T..RE switches off the contact T..Q1. The trigger coil T..EN no longer has an effect.
- Range F:
  - The trigger coil T..EN is actuated.
  - The actual time runs.
  - The actuated reset coil T..RE interrupts the trigger pulse and sets the actual time to zero.
  - After the reset coil T..RE drops out,
    - The trigger coil T..EN remains actuated.
    - The actual time continues to run until the setpoint time t_s has been reached,
    - The contact T..Q1 switches until the trigger coil T..EN is no longer actuated.

Timing relay, off-delayed with and without random switching

Random switching

The contact of the timing relay switches randomly within the setpoint value range.

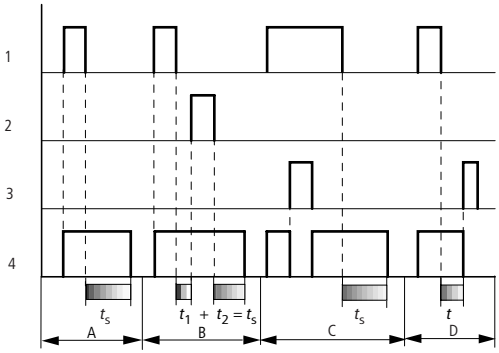


Figure 92: Timing relay, on-delayed signal diagram (with and without random switching)

1: trigger coil T..EN

2: stop coil T..ST

3: reset coil T..RE

4: switching contact (make contact) T..Q1

t_S: setpoint time

- Range A:
  - The trigger coil T..EN is actuated and the contact T..Q1 switches to the working position.
  - The trigger coil T..EN is actuated.
  - The time continues to run until the setpoint time $t_S$has timed out.
  - The contact T..Q1 goes back to the normal position.
- Range B:
  - The trigger coil T..EN is actuated and the contact T..Q1 switches to the working position.
  - The trigger coil T..EN is actuated.
  - The time t_1 runs.
  - The stop coil T..ST is actuated.
  - The actual value remains constant as long as long as the T..ST stop coil is actuated.
  - The stop coil T..ST is no longer actuated, the actual value continues to run until the setpoint time t_S.
  - The contact T..Q1 goes to the normal position.

- Range C:
  - The trigger coil T..EN is actuated and the contact T..Q1 is in the working position.
  - The reset coil T..RE is actuated.
  - The contact T..Q1 goes to the normal position as long as the reset coil T..RE is actuated.
  - The reset coil T..RE is deactivated and the trigger coil T..EN remains actuated.
  - The contact T..Q1 goes to the working position.
  - The trigger coil T..EN is deactivated, the actual time continues to run until the setpoint time t_s is reached.
  - The contact T..Q1 goes to the normal position.
- Range D:
  - The contact T..Q1 is in the working position and the actual time runs.
  - The reset coil T..RE is actuated and sets the actual time to zero. The contact T..Q1 goes to the normal position.

Timing relay, on-delayed and off-delayed with and without random switching

Time value >I1: pick-up delay time

Time value >I2: drop-out delay time

Random switching

The contact of the timing relay switches randomly within the setpoint value range.

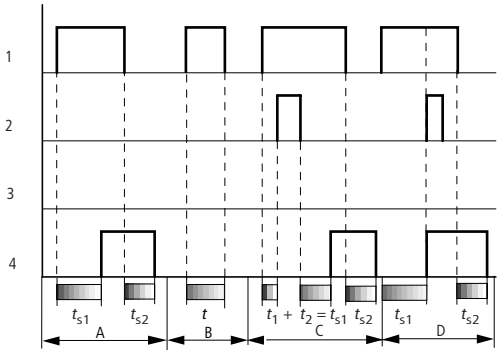


Figure 93: Signal diagram for timing relays, delayed pick-up and drop-out 1

Legends for Figure 93:

1: trigger coil T..EN

2: stop coil T..ST

3: reset coil T..RE

4: switching contact (make contact) T..Q1

t_{s1}: pick-up time

t_{s2}: drop-out time

- Range A:
  - The trigger coil T..EN is actuated.
  - The pick-up time t_{s1} times out.
  - Contact T..Q1 switches.
  - The trigger coil T..EN is actuated.
  - The drop-out time t_{s2} times out.
  - The contact T..Q1 drops out.
- Range B:
  - The trigger coil T..EN is actuated.
  - The pick-up time t runs.
  - The trigger coil T..EN is deactivated before the pick-up time is reached.
  - The contact T..Q1 stays in its normal position.
- Range C:
  - The trigger coil T..EN is actuated.
  - The pick-up time t_1 runs.
  - The stop coil T..ST is actuated.
  - The actual value t_1 of the pick-up time remains constant.
  - The stop coil T..ST is deactivated.
  - The pick-up time $t_s = t_1 \times t_2$ times out.
  - Contact T..Q1 switches.
  - The trigger coil T..EN is actuated.
  - The drop-out time t_{s2} times out.
  - The contact T..Q1 drops out.
- Range D:
  - Behaviour as described under Range A
  - The brief actuation of stop coil T..ST has no effect as it does not occur within a timing sequence.

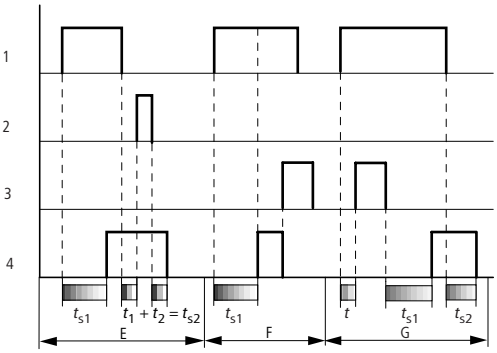


Figure 94: Signal diagram for timing relays, delayed pick-up and drop-out 2

- Range E:
  - Sequence as described under Range C.
  - The stop coil T..ST is actuated.
  - The drop-out time t_1 remains constant.
  - The stop coil T..ST is deactivated, the drop-out time $t_{s2} = t_1 + t_2$ times out and the contact T..Q1 goes to the normal position.
- Range F:
  - The pick-up time t_{s1} times out.
  - Contact T..Q1 switches.
  - The reset coil T..RE is actuated.
  - All time actual values are deleted.
  - The contact T..Q1 goes to the normal position.
  - The trigger coil T..EN is deactivated by the reset coil T..RE. The pick-up time is no longer started.
- Range G:
  - The reset coil T..RE is actuated during the pick-up time t.
  - The trigger coil T..EN remains actuated.
  - The reset coil T..RE is deactivated.
  - The pick-up time t_{s1} times out.
  - Contact T..Q1 switches.
  - The trigger coil T..EN is deactivated and the drop-out time t_{s2} times out.
  - The contact T..Q1 goes to the normal position.

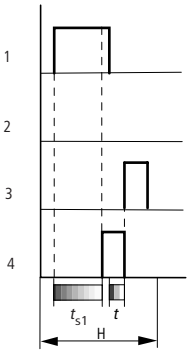


Figure 95: Signal diagram for timing relays, delayed pick-up and drop-out 3

- Range H:
  - The pick-up time t_{s1} times out and the contact T..Q1 switches.
  - The trigger coil T..EN is deactivated and the drop-out time t runs.
  - The reset coil T..RE is actuated and sets all actual values to zero.
  - The contact T..Q1 drops out.

Timing relay, single pulse

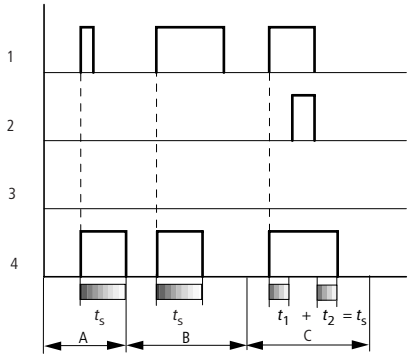


Figure 96: Timing relay, single pulse signal diagram 1

1: trigger coil T..EN

2: stop coil T..ST

3: reset coil T..RE

4: switching contact (make contact) T..Q1

- Range A:
  - The trigger coil T..EN is actuated with a short pulse.
  - Contact T..Q1 switches.
  - After the pulse time t_s has timed out, the contact T..Q1 switches to its normal position.
- Range B:
  - The trigger coil T..EN is actuated.
  - Contact T..Q1 switches.
  - After the pulse time t_s has timed out, the contact T..Q1 switches to its normal position.
  - The trigger pulse is actuated.
- Range C:
  - The trigger coil T..EN is actuated.
  - Contact T..Q1 switches.
  - The stop coil T..ST is actuated.
  - The actual value t_1 of the pulse time remains constant.
  - The trigger coil T..EN and the stop coil T..ST are deactivated.
  - The pulse time $t_s = t_1 + t_2$ runs until the setpoint value.
  - The contact T..Q1 goes to the normal position.

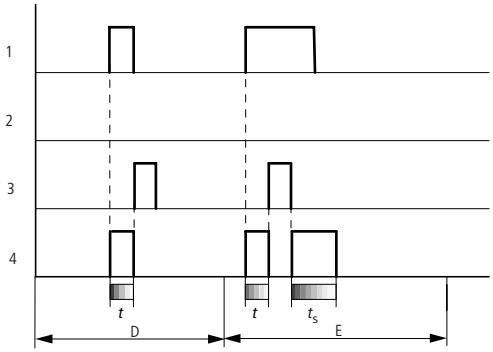


Figure 97: Timing relay, single pulse signal diagram 2

- Range D:
  - The trigger coil T..EN is actuated.
  - Contact T..Q1 switches.
  - The pulse time *t* runs.
  - The trigger coil T..EN drops-out.
  - The reset coil T..RE is actuated.
  - The contact T..Q1 goes to the normal position.
  - The reset coil T..RE is deactivated.
- Range E:
  - The trigger coil T..EN is actuated.
  - Contact T..Q1 switches.
  - The pulse time *t* runs.
  - The reset coil T..RE is actuated and the contact T...Q1 goes to the normal position.
  - The actual value of the pulse time is set to zero.
  - The reset coil T..RE is deactivated.
  - Contact T..Q1 switches.
  - The trigger coil T..EN is actuated.
  - The pulse time t_s times out.
  - The contact T..Q1 goes to the normal position.

Timing relay, synchronous and asynchronous flashing

Synchronous flashing:
Time value >I1: pulse and pause time

Asynchronous flashing:
Time value >I1: pause time
Time value >I2: pulse time

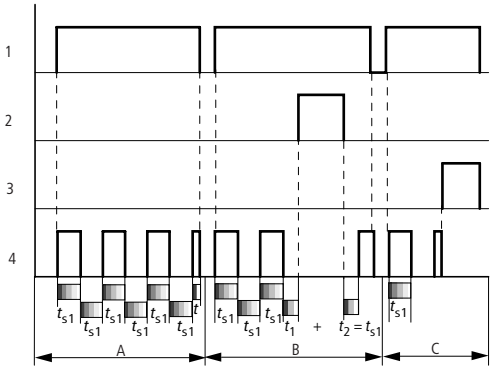


Figure 98: Timing relay, synchronous and asynchronous flashing signal diagram

1: trigger coil T..EN

2: stop coil T..ST

3: reset coil T..RE

4: switching contact (make contact) T..Q1

- Range A:
  - The trigger coil T..EN is actuated.
  - Contact T..Q1 switches.
  - The pulse time times out.
  - The contact T..Q1 goes to the normal position.
  - The relay flashes as long as the trigger signal is present.
- Range B:
  - The trigger coil T..EN is actuated and the relay (T..Q1) flashes.
  - The stop coil T..ST is actuated.
  - The pause time remains constant.
  - The stop coil T..ST is deactivated.
  - The pause time times out and the relay (T..Q1) continues to flash.
- Range C:
  - The trigger coil T..EN is actuated and the relay (T..Q1) flashes.
  - The reset coil T..RE is actuated.
  - The actual value of the pulse time is set to zero.
  - The trigger coil T..EN and the reset coil T..RE are deactivated.

Example with timing relays and counter elements
A warning light flashes when the counter reaches 10. In the example, both function blocks C 01 and T 01 are wired.

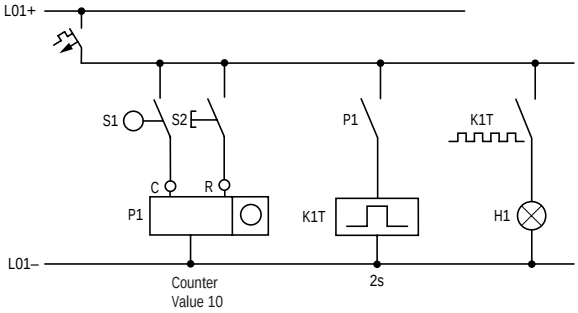


Figure 99: Hard-wiring with relays

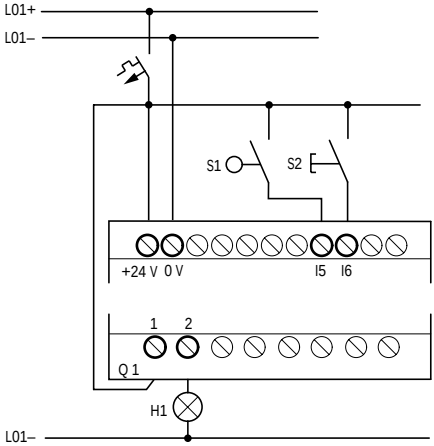


Figure 100: Wiring with easy

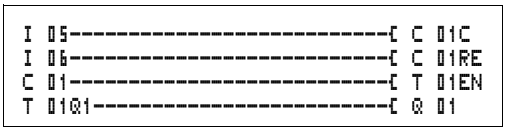


Figure 101: easy800 wiring and circuit diagram

Entering parameters from the function blocks into the circuit diagram.

You can access the parameter input from the contact as well as from a coil.

▶ Enter the circuit diagram up to C 01 as a coil.

C 01C is the counter coil of the function block counter 01.

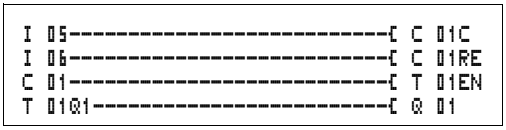
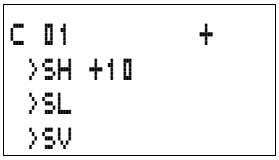


Figure 102: easy800 wiring and circuit diagram

▶ Remain stationary on the number.

▶ Press the **OK** button.

If the cursor is on the contact number, easy800 will call up the parameter display when you press **OK**.



The first part of the parameter set of a counter is displayed.

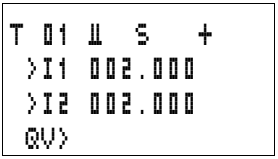
▶ Proceed with the cursor > over the + character to the value input behind >SH:
  – >SH means: entering of the element for the upper counter setpoint value
  – The + character means that the parameters of this timing relay can be modified using the PARAMETERS menu point.

▶ Change the upper counter setpoint to 10:
  – Use < > to move the cursor onto the tens digit.
  – Use ∧∨ to modify the value of the digit.

▶ Press **OK** to save the value and **ESC** to return to the circuit diagram.

easy800 has specific parameter displays for function elements. The meaning of these parameters are explained under each function block type.

▶ Enter the circuit diagram up to contact T 01 of the timing relay. Set the parameters for T 01.



The timing relay works like a flasher relay. The easy800 symbol for the flashing relay is Ш. The function is set on the top right beside the number in the parameter display.

The time base is set to the right of the "flashing" function. Leave the time base set to S for seconds.

▶ Proceed with the cursor to the right over the + character in order to input the time setpoint value >I1.

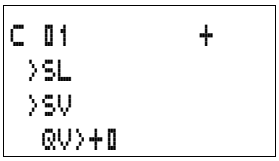
If the same setpoint value is input for >I1 and >I2, the timing relay functions as a synchronous flasher .

The + character means that the parameters of this timing relay can be modified using the PARAMETERS menu point.

▶ Confirm the value input with **OK**.
▶ Exit input of the element to the circuit diagram with **ESC**.
▶ Complete the circuit diagram.
▶ Test the circuit diagram using the power flow display.
▶ Switch easy800 to Run mode and return to the circuit diagram.

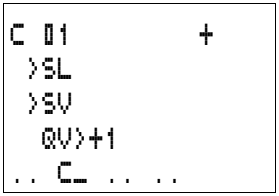
Each parameter set can be displayed using the power flow display for the circuit diagram.

▶ Move the cursor onto C 01 and press **OK**.



The parameter set for the counter is displayed with actual and setpoint values.

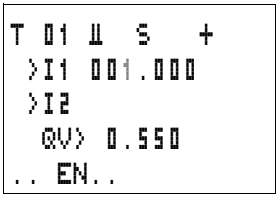
▶ Proceed with the cursor ∨ downwards until you see the value @V.



▶ Switch the input I5. The actual value changes.

On the display C_ you will recognise that the counting coil is actuated.

If the actual and upper setpoint values of the counter are the same, the timing relay switches the warning light on and off every 2 seconds.



Doubling the flashing frequency:

▶ Select the power flow display T 01 and change the constants of the setpoint time to 001.000.

When you press **OK**, the warning light will flash at twice the frequency.

On the display EN you will recognise that the enable coil is actuated.

Setpoint value settings with constants can be modified via the PARAMETERS menu point.

→ The actual time is only displayed in Run mode. To view the actual time, call up the parameter display via the power flow display or using the PARAMETERS option.

5 NET Network

Introduction to NET Network

All easy800 units have a NET network interface connection. This network is designed for eight stations.

Using the NET you can:

- Process additional inputs and outputs.
- Implement faster and improved control by distributed programs.
- Synchronize date and time
- Read and write inputs and outputs.
- Send values to other stations.
- Receive values from other stations.
- Load programs from or to other stations.

The NET network is based on the CAN network (Controller Area Network). CAN is specified according to the ISO 11898 standard. CAN is equipped as standard with the following features:

- Message oriented transmission protocol.
- Multimaster bus access capabilities with non-destructive bit-by-bit bus arbitration via priority messaging (Arbitration: An instance which defines which hardware can use the bus next).
- Multicast broadcast messaging with receiver side message filtering.
- High level of real-time capability (short reaction time for high priority messages, short fault message get times).
- Functionality under difficult noisy environments (short block lengths).
- High level of error security.

CAN has been used as the basis for the design of the NET network. The broadcast messaging has been adapted and optimised to suit the requirements of the easy800 environment.

NET network topologies, addressing and functions

The NET allows a line topology. There are two wiring methods which can be used for the required addressing possibilities.

- "Loop through the unit" wiring arrangement,
- Wiring arrangement using a T connector and a stub line.

Loop through the unit wiring method

With this wiring method it is possible to implement the addressing of the station with the aid of station 1 or the EASY-SOFT. If the line is interrupted, the network is no longer operational from this point in the network.

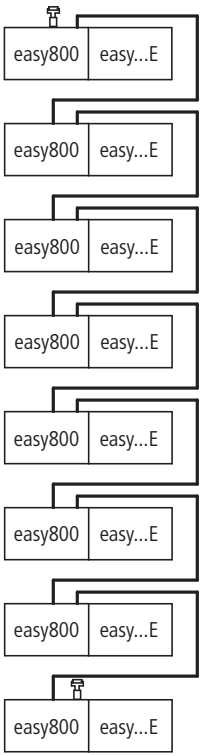
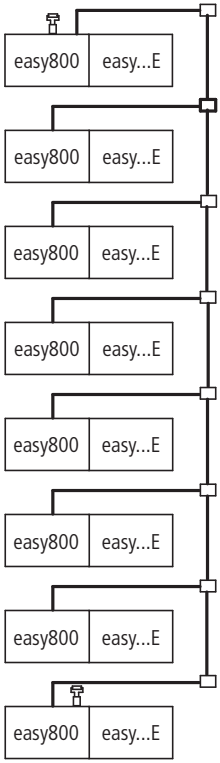
T connector and stub line

Each device must be addressed individually with this wiring method by:

- Downloading the program,
- Downloading the address with EASY-SOFT,
- Using the display or
- The device is already assigned with an address.

If a stub line is removed on a station, all other devices in the network remain functional.

Topology and addressing examples

Physical location, place	Station number Example 1	Station number Example 2	Loop through the unit	T connector and stub line
1	1	1		
2	2	3		
3	3	4		
4	4	8		
5	5	7		
6	6	2		
7	7	6		
8	8	5		

- Example 1: physical location is the same as the station number
- Example 2: physical location is not the same as the station number (with the exception that location 1 is the same as station 1).

→ Physical location 1 is always assigned as station 1. Station 1 is the only station which must be present.

Position and addressing of the operands via NET

Sta-tions	Basic unit		Local expansion		Network bit data		Network word data	
	Input I	Output Q	Input R	Output S	Input RN	Output SN	Receive	Send
1	1 I 1 to 16	1 Q 1 to 8	1 R 1 to 16	1 S 1 to 8	2 to 8 RN 1 to 32	2 to 8 SN 1 to 32	GT 1 to 32	PT 1 to 32
2	2 I 1 to 16	2 Q 1 to 8	2 R 1 to 16	2 S 1 to 8	1, 3 to 8 RN 1 to 32	1, 3 to 8 SN 1 to 32	GT 1 to 32	PT 1 to 32
3	3 I 1 to 16	3 Q 1 to 8	3 R 1 to 16	3 S 1 to 8	1, 2, 4 to 8 RN 1 to 32	1, 2, 4 to 8 SN 1 to 32	GT 1 to 32	PT 1 to 32
4	4 I 1 to 16	4 Q 1 to 8	4 R 1 to 16	4 S 1 to 8	1 to 3, 5 to 8 RN 1 to 32	1 to 3, 5 to 8 SN 1 to 32	GT 1 to 32	PT 1 to 32
5	5 I 1 to 16	5 Q 1 to 8	5 R 1 to 16	5 S 1 to 8	1 to 4, 6 to 8 RN 1 to 32	1 to 4, 6 to 8 SN 1 to 32	GT 1 to 32	PT 1 to 32
6	6 I 1 to 16	6 Q 1 to 8	6 R 1 to 16	6 S 1 to 8	1 to 5, 7, 8 RN 1 to 32	1 to 5, 7, 8 SN 1 to 32	GT 1 to 32	PT 1 to 32
7	7 I 1 to 16	7 Q 1 to 8	7 R 1 to 16	7 S 1 to 8	1 to 6, 8 RN 1 to 32	1 to 6, 8 SN 1 to 32	GT 1 to 32	PT 1 to 32
8	8 I 1 to 16	8 Q 1 to 8	8 R 1 to 16	8 S 1 to 8	1 to 7 RN 1 to 32	1 to 7 SN 1 to 32	GT 1 to 32	PT 1 to 32

→ With RN and SN the number of the contact must have the same number as the coil. Example: 2SN30 from station 8 is sent to 8RN30 of station 2.

→ Every station with a circuit diagram has read access to the physical station inputs and outputs of other statiaons and can process them locally.

Example 1

Station 1 should read the input I 01 of station 2 and write to output Q 01 of station 2. Station 2 does not have a circuit diagram.

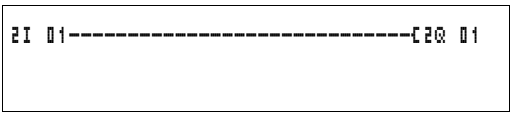


Figure 103: Circuit diagram in station 1

Example 2:

Marker M 01 of station 4 should switch the output Q1 of station 3 via the network. Both stations have a circuit diagram.

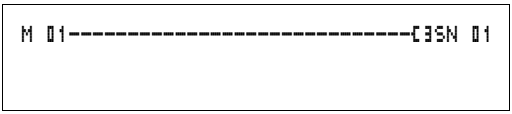


Figure 104: Circuit diagram in station 4: Set coil 01 in station 3

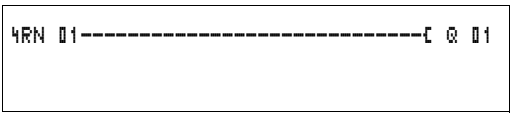


Figure 105: Circuit diagram in station 3: Get value from coil 01 in station 4

Functions of the stations in the network

The stations on the NET can have two different functions:

- Intelligent stations with their own programs (stations 1 to 8)
- Input/output devices (REMOTE IO) without their own program (stations 2 to 8)

→ Station 1 must always have a circuit diagram.

Possible write and read authorization in the network

The stations have differing read and write authorization in the NET network in accordance with their functions and configuration.

Station 1

Write authorization to all inputs and outputs of all stations regardless of the function. Observe the setting of SEND IO (→ section "Send each change on the inputs/outputs (SEND IO)", page 191).

Write authorization to the own local outputs.

Write authorization to the physical digital outputs of the stations which are functioning as input/output devices.

Write authorization to the network bit data 2 to 8 – SN 1 to 32.

Stations 2 to 8

Input/output device function

No read and write authorization.

Intelligent station function

Write authorization to all inputs and outputs of all stations regardless of the function. Observe the setting of SEND IO (→ section "Send each change on the inputs/outputs (SEND IO)", page 191).

Write authorization to the own local outputs.

Write authorization to the network bit data SN 1 to 32.

Configuration of the NET network

Net can be configured so that it can be optimised for your application.

Station number

The station number is identified as the NET-ID: in the device. The station number can be set on devices with a display using the keys on the easy800.

→ All the NET settings are undertaken on station 1 as it is the most practical solution. The entire network is configured from station 1. Local configurations should only be made when a device is exchanged.

Valid station numbers for operation are 01 to 08.

Station number 00 = factory default setting

With station number 00, double address assignment cannot occur when an existing device is being exchanged.

Transmission speed

The hardware of the easy800 devices allows you set transmissions speeds between 10 and 1000 kBaud in determined stages. In doing so, the length of all cables is linked to the maximum data transfer rate (→ chapter "Technical Data", page 251).

The data transfer rate is set under the BAUDRATE: menu point.

Possible baud rates are: 10, 20, 50, 125, 250, 500 and 1000 kB

500 kB = factory default setting

Changing the write repeat rate, time interval manually

Every NET network connection automatically determines the number of stations which are active on the network, the baud rate which is used and the total number of bytes which are transmitted. The minimum time interval which a device requires is automatically determined using this data, to ensure that all devices can send their messages. If a time interval is to be increased, the value of the BUSDELAY: must be set greater than zero.

Value "1" doubles the time interval, value "15" will increase it by a factor of 16.

$t_{pnew} = t_p \times (1 + n)$
t_{pnew} = new time interval
t_p = time interval determined by the network
n = value on BUSDELAY

An extension of the time interval means that fewer messages (inputs, outputs, bit data, word data) are transferred per time unit.

The reaction speed of the entire controller depends on the baud rate, the time interval and the quantity of transferred data.

The smaller the amount of data transferred, the faster the reaction times of the system.

An increase in the time interval is only useful during commissioning. To ensure that the data for the power flow direction is updated faster in the PC, a longer range for this data is created on the network within this time interval.

Send each change on the inputs/outputs (SEND IO)

If you require that all other network stations are immediately notified of a change to an input/output, the SEND IO function must be activated. If intelligent stations directly read inputs and outputs from other stations (2I 02, 8Q 01, etc.), the SEND IO should be activated

SEND IO √

This means that the quantity of messages on the network can increase significantly.

→ If fast counters are used, the SEND IO should be deactivated. Otherwise the input data is written very rapidly onto the network as they change continuously leading to unnecessary loading of the network.

If intelligent devices are required to exchange bit information, it should be implemented via RN and SN.

SEND IO √ = factory default setting

Automatic change of the Run and Stop mode

If stations 2 to 8 are to automatically follow the mode change of station 1 during operation REMOTE RUN should be activated.

→ Input and output devices must always have SEND IO activated, to ensure that station 1 always receives up-to-date input and output data.

→ Intelligent stations with display only follow the operating mode change when the display is displaying the Status display or a text.

The following is of utmost importance during commissioning!

Note!
If multiple spatially distributed stations are commissioned and operate machines or systems via the NET network, it is essential to ensure that the REMOTE RUN function is not activated.

Otherwise unwanted machine or system starts may occur during commissioning. The associated events depend on the machines or systems.

REMOTE RUN √ = factory default setting

Input/output device (REMOTE IO) configuration

All devices are configured in the factory as input and output devices. This has the advantage that devices with and without display can be used immediately as inputs and outputs. You only need to assign the station number. This can be implemented via EASY-SOFT or on a Station 1 with a display.

If you want to assign a device as an intelligent station on the network, the REMOTE IO should be deactivated.

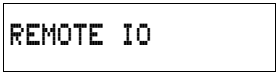


Figure 106: Remote IO deactivated

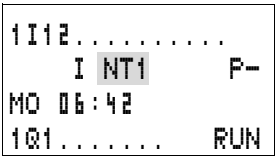
The standard settings for the input and output devices are:

```
SEND IO      √
REMOTE RUN   √
REMOTE IO    √
```

Station number (NET-ID) and baud rate can be determined via station 1.

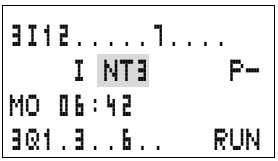
Displaying the station number from other stations

On every device with a display, you can display the states of the inputs and outputs of each network station.



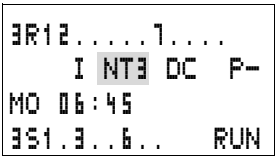
▶ Change to the status display and press the **ESC** button.

The cursor changes to the display of the network station NT.. and flashes. The station number is displayed in front of the inputs and outputs.



▶ Change the number of the required station with the ∧ and ∨ cursor buttons.

▶ Press the **OK** button.



▶ If you want to view the state of the inputs and outputs of a local expansion, press the **OK** button.

If you press the **ESC** button again or the **OK** button, the display of the input and output states of the station is terminated.

Station message types

The NET network recognises various message types. They are:

- Output data of station 1 (Q., S.) which is sent to stations without programs.
- Network outputs and inputs sent and received between stations with programs (*SN, *RN).
- Data sent and received via the network between stations with programs (PT and GT function blocks).
- Inputs, outputs, station status (I, R, Q, S) transfers.
- Loading programs to and from every station.

The NET network is based on a CAN (Controller Area Network) system. Each message type has its own identity. The message priority is determined via the identity. This is important in transmission borderline cases to ensure that all messages reach their destination.

Transfer behaviour

Network CPU data transfer to program image

The easy800 network connection is equipped with its own CPU. Network data is processed in parallel to execution of the program. After each program cycle, the status of the network data is written to the operand image of the program and the send data is read from the image. The program runs through the next cycle with this data.

Reading and sending the network data from the CPU

The network CPU of the station reads every message on the network. If the message is relevant for the station, it is accepted into a message memory.

If the content of the sent message changes, this is sent. Transmission only occurs when there is no message on the network.

NET is configured so that every station can send its message. This means that the station must wait for a time interval between sending messages. The time interval is extended with an increased number of stations and a reduced baud rate.

The number of stations is recognised by every station via a "vital sign".

The following applies for fast message transfer:

- Set the fastest possible baud rate to suit the network length and cable cross-section.
- Fewer messages means faster messages.
- Avoid program downloads during the Run mode.

"Vital signs" of the individual stations and diagnostics

The inputs and outputs message type applies as a "vital sign" recognition to ensure that the state of the station can be recognised by other stations. The states of the inputs and outputs are sent cyclically and baud rate dependant, and independantly of the SEND IO setting. If the inputs and outputs of a station are not recognised by other stations after a baud rate dependant time, the station is deemed to be disconnected until the next "vital sign" is recognised.

Evaluation occurs at the following intervals:

Baud rate [KB]	All stations must send a "vital sign" every ... [ms]	Stations recognize the absence of a "vital sign" after [ms]
1000	60	180
500	60	180
250	120	360
125	240	720
50	600	1800
20	1500	4500
10	3000	9000

If the absence of a "vital sign" is recognised, the respective diagnostics contact is set to the 1 state.

Diagnostics contact	Station number
ID 01	1
ID 02	2
ID 03	3
ID 04	4
ID 05	5
ID 06	6
ID 07	7
ID 08	8

→ If a station does not send a "vital sign" (station not available, NET interrupted), the respective diagnostics contact ID .. is activated.

▽ **Note!**
If the states of the inputs, outputs or data are urgently required by a station, the respective diagnostics contact should be evaluated and the information applied in accordance with its respective application.

If the respective diagnostics contacts are not evaluated, it may cause faults in your application.

→ The data to be read from a faulty station is set to the 0 state after recognition of the fault.

Network transmission security

The NET network is based on a CAN (Controller Area Network) system. CAN is used in cars and commercial vehicles in all areas. The same fault recognition capability with data transfer applies as with CAN. A BOSCH study relating to undiscovered and corrupt messages determined the following:

The probability of non-discovery of a corrupted message (residual error probability) is: $< 10^{-10}$ message error rate.

The message error rate is dependant on:

- Bus loading
- Telegram length
- Malfunction frequency
- Number of stations

Example:

Network with:

- 500 KBaud
- average bus load 25 %
- average operating time 2000 h/Jahr
- average error rate of 10^{-3},
  i.e.: every 1000th message is faulty
- transmission of 1.12×10^{10} messages per year of which 1.12×10^{7} messages are faulty
- residual error probability: $r < 10^{-10} \times 10^{-3} = 10^{-13}$

This means: One of 10^{13} messages is so corrupt that the message cannot be recognised as faulty. For a network, this corresponds to a working time of approx. 1000 years.

6 easy Settings

Settings can only be carried out on easy models provided with buttons and LCD display.

EASY-SOFT from V 4.0 upwards can be used to set all models with software.

Password protection

The easy can be protected against unauthorized access by a password.

In this case the password consists of a value between 000001 and 999999. The number combination 000000 is used to delete a password.

Password protection inhibits access to selected areas. The System menu is always protected by an activated password.

The password can protect the following inputs and areas:

- Starting or modification of the program
- Transfer of a circuit diagram to or from a memory card (Display variants).
- Change of the Run or Stop mode
- Calling and modification of function block parameters
- All settings of the real-time clock
- Modifications of all system parameters
- Communicaton with the individual devices. (Transmission to other devices is possible.)
- Switching off the password delete function.

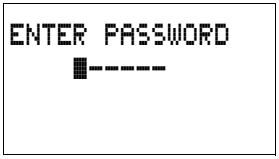
A password that has been entered in easy is transferred to the memory card together with the circuit diagram, irrespective of whether it was activated or not.

If this easy circuit diagram is loaded from the memory card, the password will also be transferred to easy and become activated immediately.

Password setup

A password can be set using the System menu regardless of the Run or Stop modes. If a password is already activated, you cannot changeover to the System menu.

- ▶ Press **DEL** and **ALT** to call up the System menu.
- ▶ Select the menu option SECURITY... to enter the password.
- ▶ Press the **OK** button and change over to the PASSWORD... menu.
- ▶ If you press the **OK** button again, you will access the password input.



If no password has been entered, easy changes directly to the password display and displays six dashes: No password available.

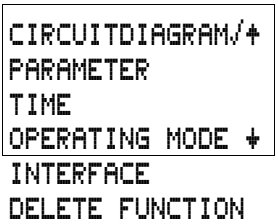
- ▶ Press **OK**, six zeros will appear
- ▶ Set the password using the cursor buttons:
  - – < > select position in password,
  - – ∧∨ set a value between 0 to 9.

▶ Save the new password by pressing **OK**.

Use **OK** to exit the password display and proceed with **ESC** and ∨ to the RANGE... menu.

The scope of the password has not yet been considered. The password is now valid but not yet activated.

Selecting the scope of the password



▶ Press the **OK** button.

▶ Select the function to be protected or the menu.

▶ Press the **OK** button in order to protect the function or menu (tick = protected).

→ Standard protection encompasses the programs and circuit diagram.

At least one function or menu must be protected.

- CIRCUIT DIAGRAM: Then password is effective on the program with circuit diagram and non-enabled function blocks.
- PARAMETERS: The PARAMETERS menu is protected.
- TIME: Date and time are protected with the password.
- OPERATING MODE: The conversion of the Run or Stop operating mode is protected.
- INTERFACE: The interface is inhibited for access to a connected device. Programs or commands to other devices connected via the NET network are routed further.
- DELETE FUNCTION: After four failed attempts to enter a password, the "DELETE FUNCTION?" query appears. This query is not displayed if selected. However, it is no longer possible to make changes in protected areas if you forget the password.

Activate the password

You can activate a valid password in three different ways:

- automatically when easy is switched on again
- automatically after a protected circuit diagram is loaded
- via the password menu

▶ Press **DEL** and **ALT** to call up the System menu.

▶ Open the password menu via the menu option SECURITY...

easy will only show this menu if a password is present.

```
CHANGE PW
ACTIVATE
```

Make a note of the password before you activate it. If the password is no longer known, easy can be connected (DELETE FUNCTION is not active), but the circuit diagram and data settings are lost.

Note!
If the password is unknown or lost, and the delete password function is deactivated: The unit can only be reset to the delivery state by the manufacturer. The program and all data are lost.

▶ Select ACTIVATE PW and confirm with **OK**.

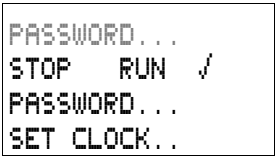
The password is now active. easy changes back automatically to the status display.

You must unlock easy with the password before you implement a protected function, enter a protected menu or the System menu.

Unlock easy

Unlocking easy will deactivate the password. You can re-activate password protection later via the password menu or by switching the power supply off and on again.

▶ Press **OK** to switch to the main menu.



The PASSWORD... entry will flash.

▶ Press **OK** to enter the password entry menu.

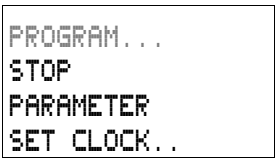
If easy shows PROGRAM... in the main menu instead of PASSWORD..., this means that there is no password protection active.

easy will display the password entry field.

▶ Set the password using the cursor buttons:

▶ Confirm with **OK**.

If the password is correct, easy will switch automatically to the Status display.



The PROGRAM... menu option is now accessible so that you can edit your circuit diagram.

The System menu is also accessible.

Changing or deleting the password range

▶ Unlock easy.
▶ Press **DEL** and **ALT** to call up the System menu.
▶ Open the password menu via the menu option SECURITY... and PASSWORD.

The CHANGE PW entry will flash.

easy will only show this menu if a password is present.

▶ Press **OK** to enter password entry menu.
▶ Use **OK** to move to the 6-digit entry field.
▶ The current password will be displayed.

▶ Modify the six password digits using the cursor buttons.
▶ Confirm with **OK**.

Use **ESC** to exit the security area.

Deleting

Use number combination 000000 to delete a password.

If a password has not been entered already, easy will show six dashes:

Password incorrect or no longer known

If you no longer know the exact password, you can try to re-enter the password several times.

→ The DELETE FUNCTION function has not been deactivated.

You have entered an incorrect password

▶ Re-enter the password.

After the fourth entry attempt easy will ask whether you wish to delete the circuit diagram and data.

▶ Press

– **ESC**: No input will be deleted.
– **OK**: Circuit diagram, data and password are erased.

easy will return to the Status display.

→ If you no longer know the exact password, you can press **OK** to unlock the protected easy. The saved circuit diagram and all function relay parameters will be lost.

Pressing **ESC** will retain the circuit diagram and data. You can then make another four attempts to enter the password.

Changing the menu language

easy800 provides ten menu languages which are set as required via the System menu.

Language	Display
English	ENGLISH
German	DEUTSCH
French	FRANCAIS
Spanish	ESPANOL
Italian	ITALIANO
Portuguese	PORTUGUES
Dutch	NEDERLANDS
Swedish	SVENSKA
Polish	POLSKI
Turkish	TURKCE

→ Language selection is only possible if easy is not password-protected.

▶ Press **DEL** and **ALT** to call up the System menu.

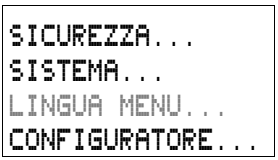
▶ Select MENU LANGUAGE... to change the menu language.

The language selection for the first entry ENGLISH is displayed.

▶ Use ∧ or ∨ to select the new menu language, e.g. Italian (ITALIANO).

▶ Confirm with **OK**. ITALIANO is assigned with a tick.

▶ Exit the menu with **ESC**.



easy will now show the new menu language.

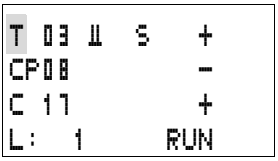
Press **ESC** to return to the Status display.

Changing parameters

easy allows you to change function relay parameters such as timing relay setpoint values and counter setpoints without having to call up the circuit diagram. This is possible regardless of whether easy is running a program or is in Stop mode.

▶ Press **OK** to switch to the main menu.

▶ Start the parameter display by selecting PARAMETERS.

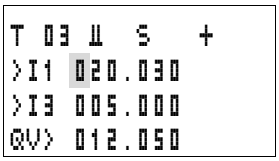


All function blocks are displayed as a list.

The following preconditions must be fulfilled in order for a parameter set to be displayed:

- A function relay must have been included in the circuit diagram.
- The PARAMETERS menu is available.
- The parameter set has been enabled for access, indicated by the + character at the bottom right of the display.

→ Parameter sets can only be enabled via the FUNCTION RELAYS menu or via the circuit diagram with the "+" enable and with "–" inhibit parameter set characters.



- ▶ Select the required element with ∧ or ∨ .
- ▶ Press the **OK** button.
- ▶ Page with the ∧ or ∨ cursor buttons through the constants of the element inputs.
- ▶ Change the values for a parameter set:
  - – with **OK** in the Enter mode.
  - – < > change decimal place
  - – ∧∨ change the value of a decimal place
  - – **OK** save constants or
  - – **ESC** retain previous setting.

Press **ESC** to leave the parameter display.

→ Only constants on the element inputs can be changed.

Adjustable parameters for function elements

You can modify the function blocks used in the circuit diagram in three different ways:

- All circuit diagram parameters can be adjusted in Stop mode via the element editor.
- Setpoints (constants) can be modified in Run mode via the element editor.
- Setpoints (constants) can be modified via the PARAMETERS menu.

Adjustable setpoint values are:

- The inputs with all function blocks if constants have been used.
- Switch on and off times with timeswitches.

In Run mode easy operates with a new setpoint as soon it has been modified the parameter display and saved with **OK**.

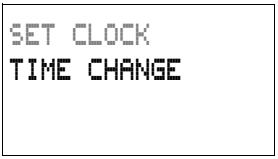
Setting date, time and seasonal time changes

The easy800 devices are equipped with a real-time clocks with date and time functions. With the "timeswitch" function block, timeswitch functions can be realized.

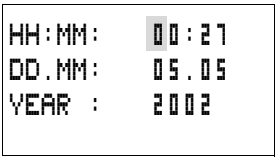
If the clock has not yet been set or if the device is switched on after the buffer time has elapsed, the clock starts with the setting "WE 1:00 01.05.2002". The easy clock operates with date and time and the hour, minute, day, month and year must be set.

→ The time e.g.: 1:00 indicates the version of the device operating system.

▶ Select SET CLOCK from the main menu.
This will open the menu for setting the time.



▶ Select SET CLOCK.



▶ Set the values for day, time, month and year.
▶ Press the **OK** button to access the Enter mode.
- – < > move between the parameters
- – ∧∨ change the value of a parameter
- – **OK** save day and time
- – **ESC** retain previous setting.

Press **ESC** to leave the time setting display.

Changing between winter/ summer time (DST)

easy800 models are fitted with a real-time clock. The clock has various possibilities to convert between summer and winter time. There are various laws covering this case in the EU, GB and USA.

- NONE: no conversion between summer and winter time
- MANUAL: a user defined date for the conversion
- EU: date defined by the European Union; Commences: last Sunday in March; Ends: last Sunday in October
- GB: date defined in Great Britain; Commences: last Sunday in March; Ends: fourth Sunday in October
- US: date defined in the United States of America: Commences: first Sunday in April; Ends: last Sunday in October

The following applies for all conversion variants:

Winter time → Summer time: On the day of conversion, the clock moves forward an hour at 2:00 to 3:00

Summer time → Winter time: On the day of conversion, the clock moves back an hour at 3:00 to 2:00.

Select SET CLOCK from the main menu.

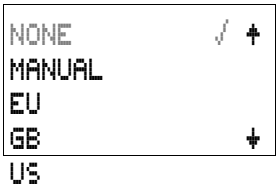
This will open the menu for setting the time.

▶ Select the TIME CHANGE menu option.

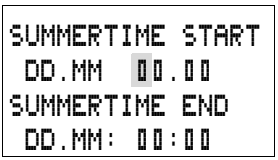
Selecting time conversion

easy shows you the options for time conversion.

The standard setting is NONE for automatic switchover for Summer and Winter time (Tick at NONE).



▶ Select the required variant and press the **OK.** button.



Manual selection

You want to enter your own date.

▶ Proceed to the MANUAL menu and press 2 × **OK**.
- – 〈 〉 move between the parameters
- – ∧∨ change the value of a parameter
- – **OK** save day and time
- – **ESC** retain previous setting.

▶ Press **ESC** to leave the display.

▶ Select the day and time at which Summer time is to commence.

▶ Select the day and time at which Summer time is to end.

→ The same time for conversion applies as for the legally determined variants (EU, GB, US).

Activating input delay (debounce)

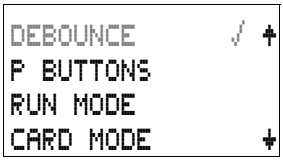
Input signals can be evaluated by easy with a debounce delay. This enables, for example, the trouble-free evaluation of switches and push-button actuators subject to contact bounce.

In many applications, however, very short input signals have to be monitored. In this case, the debounce function can be switched off.

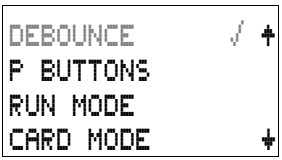
▶ Press **DEL** and **ALT** to call up the System menu.

▶ Select the SYSTEM menu.

→ If easy is password-protected you cannot open the System menu until you have "unlocked" it.



The input delay (debounce) is set with the DEBOUNCE menu point.



Activating debounce

If a tick √ is set beside DEBOUNCE, the input delay is set.

If this is not so, the following applies:

▶ Select DEBOUNCE and press **OK.**

If Debounce mode is activated the display will show DEBOUNCE OFF √.

Press **ESC** to return to the Status display.

Deactivating debounce (input delay)

If easy is showing DEBOUNCE in the display, this means that Debounce mode has already been deactivated.

▶ Otherwise select DEBOUNCE √ and press **OK.**

If Debounce mode is activated the display will show DEBOUNCE.

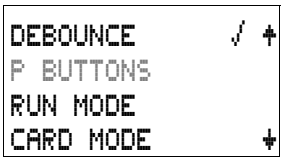
→ How easy input and output signals are processed internally is explained in Section "Delay times for inputs and outputs", from page 226.

Activating and deactivating the P buttons

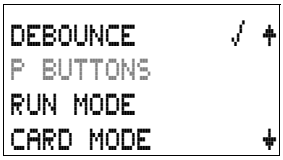
Even though the cursor buttons (P buttons) have been set as push-button actuator inputs in the circuit diagram, this function is not activated automatically. This prevents any unauthorised use of the cursor buttons. The P buttons can be activated in the System menu.

→ If easy is password-protected you cannot open the System menu until you have "unlocked" it.

The P buttons are activated and deactivated via the P BUTTONS menu point.



▶ Press **DEL** and **ALT** to call up the System menu.
▶ Select the SYSTEM menu.
▶ Move to the cursor to the P BUTTONS menu.

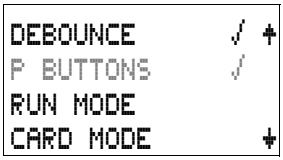


Activating the P buttons

If easy is displaying P BUTTONS √, the P buttons are active.

▶ Otherwise select P BUTTONS and press **OK.**
easy changes the display to P BUTTONS √ and the P buttons are activated.

▶ Press **ESC** to return to the Status display.



The P buttons are only active in the Status display. In this display you can use the P buttons to activate inputs in your circuit diagram.

Deactivating the P buttons

▶ Select P BUTTONS √ and press **OK**.
easy changes the display to P BUTTONS and the P buttons are activated.

→ The P buttons are automatically deactivated when loading a circuit diagram from the memory card or via EASY-SOFT to easy, or when deleting a circuit diagram in easy.

Startup behaviour

The startup behaviour is an important aid during the commissioning phase. The circuit diagram which easy contains is not as yet fully wired up or the system or machine is in a state which easy is not permitted to control. The outputs should not be controlled when easy is switched on.

Setting the startup behaviour

→ The EASY...-..-..X models can only be started in Run mode.

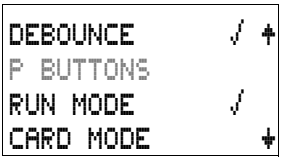
Precondition: easy must contain a valid circuit diagram.

▶ Switch to the System menu.

→ If easy is protected by a password, the System menu will not be available until easy is unlocked (see → section "Unlock easy" from page 203).

Specify the operating mode which easy must use when the supply voltage is applied.

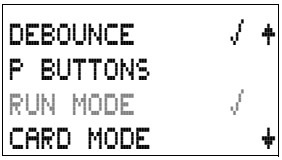
Activating Run mode
easy displays RUN MODE √,and easy starts in Run mode when the supply voltage is applied.



▶ Otherwise select RUN MODE and press **OK.**
Run mode is activated.

▶ Press **ESC** to return to the Status display.

Deactivating Run mode
▶ Select RUN MODE √ **OK**.
The Run mode function is deactivated.



The default setting for easy is for RUN MODE to be displayed. In other words, easy starts in RUN MODE √ when the power is switched on.

Startup behaviour	Menu display	Status of easy after startup
easy starts in Stop mode	RUN MODE	easy is in Stop mode
easy starts in Run mode	RUN MODE √	easy is in Run mode

Behaviour when the circuit diagram is deleted

The setting for the startup behaviour is an easy device function. When the circuit diagram is deleted this does not result in the loss of the selected setting.

Behaviour during upload/download to card or PC

When a valid circuit diagram is transferred from easy to a memory card or the PC or vice versa, the setting is still retained.

The EASY...-..-..X models can only be started in Run mode.

Possible faults

easy will not start in Run mode

- easy does not contain a circuit diagram.
- You have selected MODE: STOP in the MODE RUN/STOP menu (the menu displayed is thus MODE: RUN).

Card startup behaviour

The startup behaviour with memory card is for applications where unskilled personnel change the memory card under no-voltage conditions.

easy only starts in the Run mode if a memory card with a valid program is inserted.

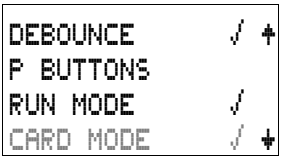
If the program on the memory card is different to the program in easy, the program from the card is loaded into easy and easy starts in Run mode.

▶ Switch to the System menu.

If easy is protected by a password, the System menu will not be available until easy is unlocked (see → section "Unlock easy" from page 203).

Activation of card mode

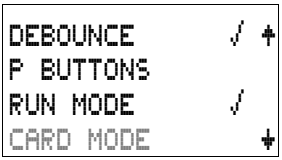
easy displays CARD MODE √, which means that when the voltage supply is applied, easy will only start in Run mode if a memory card with a valid program is inserted.



▶ Otherwise select CARD MODE and press **OK.**

easy will start up with the program on the card.

▶ Press **ESC** to return to the Status display.



Deactivation of card mode

▶ Select CARD MODE √ and press **OK**.

The Run mode function is deactivated.

The default setting for easy is for display of the CARD MODE menu, i.e. easy starts in Run mode without the memory card when the power is switched on.

LCD background illumination

The background illumination of the LCD display can be switched off. The display is not required during operation. The background illumination is only required for maintenance or to display text.

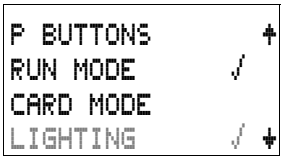
If the background illumination is switched off, the background illumination switches back on when a button is pressed. The background illumination switches off automatically 60 s after the last button is pressed.

▶ Switch to the System menu.

If easy is protected by a password, the System menu will not be available until easy is unlocked (see → section "Unlock easy" from page 203).

Activation of illumination

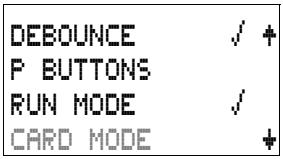
If easy displays LIGHTING √, the background lighting is permanently on.



▶ Otherwise select LIGHTING and press **OK**.
Permanent lighting is active.

▶ Press **ESC** to return to the Status display.

Deactivating illumination



▶ Otherwise select LIGHTING √ and press **OK**.
The permanent lighting function is deactivated.

The default setting on delivery of easy is the display of the LIGHTING √ menu, i.e. the background lighting is on permanently.

Retention

It is a requirement of system and machine controllers for operating states or actual values to have retentive settings. What this means is that the values will be retained safely even after the supply voltage to a machine or system has been switched off and are also retained until the next time the actual value is overwritten.

The following operands and elements can be set to operate retentatively:

- Markers
- Counter elements,
- Data elements and
- Timing relays

Operation time counter

easy800 provides four retentive operation time counters. They are always retentive and can only be selectively deleted with a reset command.

Retentive data quantity
200 bytes is the maximum memory range for retentive data (operation time counters are not included).

Markers
A user definable connected marker range can be declared as retentive.

Counters
All C.., CH.. and CI.. function blocks can be operated with retentive actual values.

Data elements
A user definable connected data element range can be operated with retentive actual values.

Timing relays
A user definable connected timing relay range can be operated with retentive actual values.

Preconditions

A precondition for retentive data is that the markers and elements have been declared as retentive.

Note!
The retentive data are saved each time the supply voltage is switched off and read during switch on. The data integrity of the memory is hereby assured for $\geqq 10^{10}$ read/write cycles.

Setting retentive behaviour

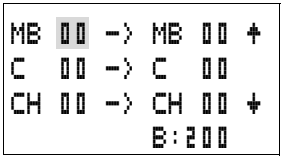
Precondition:
In this case easy must be in Stop mode.

▶ Switch to the System menu.

→ If easy is protected by a password, the System menu will not be available until easy is unlocked (see → section "Unlock easy" from page 203).

The default setting of easy is selected so that no retentive actual value data are selected.
When easy is in Stop mode or has been switched to a de-energized state, all actual values are cleared.

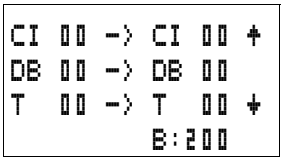
▶ Switch to Stop mode.
▶ Switch to the System menu.
▶ Proceed to the SYSTEM menu and continue to the RETENTION... menu.
▶ Press the **OK** button.



The first screen display is the selection of the marker range.

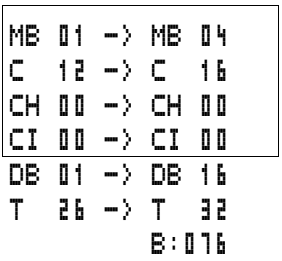
▶ ∧∨ select a range.
▶ Press **OK** to access the Enter modes.
  – < > select a position from/to,
  – ∧∨ set a value.
▶ Save the input from .. to .. with **OK**.

Press **ESC** to exit the input of the retentative ranges.



Up to six differing ranges can be selected.

→ The display on the lower right B:200 indicates the number of free bytes.



Example:
MB 01 to MB 04, C 12 to C 16, DB 01 to DB 16, T 26 to T 32 should be retentive.

124 bytes have been assigned to the retentive data range. 76 bytes are still available.

Deleting ranges

Set the ranges to be erased to the values from 00 to 00.

e.g.: MB 00 -> MB 00. The markers are no longer retentive.

Deleting retentive actual values of markers and function blocks

The retentive actual values are cleared if the following is fulfilled (applies only in Stop mode):

- When the circuit diagram is transferred from EASY-SOFT (PC) or from the memory card to easy, the retentive actual values are reset to 0. This also applies when there is no program on the memory card. In this case the old circuit diagram is retained in easy.
- When changing the respective retentive range.
- When the circuit diagram is deleted via the DELETE PROGRAM menu.

Transfer retentive behaviour

The setting for retentive behaviour is a circuit diagram setting. In other words, the setting of the retentive menu may also under certain circumstances be transferred to the memory card or by uploading or downloading from the PC.

Changing the operating mode or the circuit diagram
When the operating mode is changed or the easy circuit diagram is modified, the retentive data is normally saved together with their actual values. The actual values of relays no longer being used are also retained.

Changing the operating mode
If you change from Run to Stop and then back to Run, the actual values of the retentive data will be retained.

Modifying the easy circuit diagram
If a modification is made to the easy circuit diagram, the actual values will be retained.

Changing the startup behaviour in the SYSTEM menu
The retentive actual values are retained in easy regardless of the setting.

Modification of the retentive range
If the set retentive ranges are reduced, only the actual values saved in the range will remain.

If the retentive range is extended, the older data is retained. The new data is written with the current actual values in the Run mode.

7 Inside easy

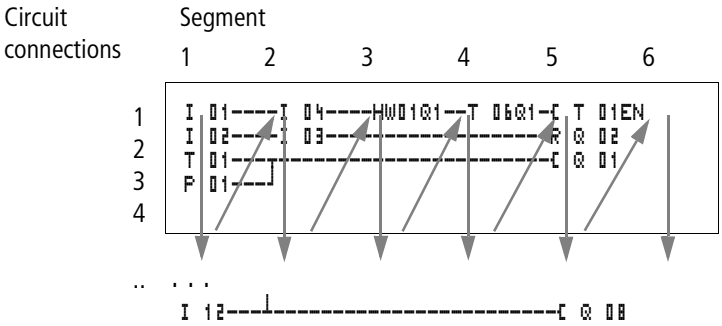
easy circuit diagram cycle

In conventional control systems, a relay or contactor control processes all the circuit connections in parallel. The speed with which a contactor switches is thus dependent on the components used, and ranges from 15 to 40 ms for relay pick-up and drop-out.

With easy the circuit diagram is processed with a microprocessor that simulates the contacts and relays of the circuit concerned and thus processes all switching operations considerably faster. Depending on its size, the easy circuit diagram is processed cyclically every 0.1 to 40 ms.

During this time, easy passes through six segments in succession.

How easy evaluates the circuit diagram:



In the first four segments easy evaluates the contact fields in succession. As it does so, easy also checks whether the contacts are connected in parallel or series and stores the switching states of all the contact fields.

In the fifth segment, easy assigns the new switching states to all the coils in one pass.

The sixth segment is outside the circuit diagram and easy uses it to:

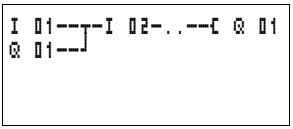
- update all function blocks.
- to establish contact to the "outside world": The output relays Q 01 to Q (S).. are switched and the inputs I1 to I (R).. are read once more.
- easy also copies all the new switching states to the status image register.
- exchange all data on the NET network (read and write).

easy only uses this status image for one cycle. This ensures that each circuit connection is evaluated with the same switching states for one cycle, even if the input signals I1 to I12 change their status several times within a cycle.

Effects on the creation of the circuit diagram

easy evaluates the circuit diagram in these five six segments in succession. You should therefore remember two points when you create your circuit diagrams:

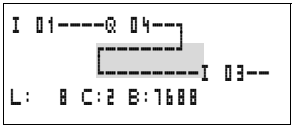
- The changeover of a relay coil does not change the switching state of an associated contact until the next cycle starts.
- Always wire forward or from top to bottom. Never work backwards.



Example: self-latching with own contact
Start condition:
Inputs I1 and I2 are switched on.
Q 01 is switched off.

This is the circuit diagram of a self-latching circuit. If I 01 and I 02 are closed, the switching state of relay coil Q 01 is "latched" via contact Q 01.

- **1st cycle:** Inputs I1 and I2 are switched on. The coil Q 01 picks up.
- Contact Q1 remains switched off since easy evaluates from left to right. When easy refreshes the 6th segment of the output image, the first coil field has already been passed through.
- **2nd cycle:** The self-latching function now becomes active. easy has transferred the coil states to contact Q 01 at the end of the first cycle.



Example: Do not wire backwards

This example is shown in Section "Creating and modifying connections"page 91. It was used here to illustrate how NOT to do it.

In the third circuit connection, easy finds a connection to the second circuit connection in which the first contact field is empty. The output relay is not switched.

When wiring more than four contacts in series, use one of the marker relays.

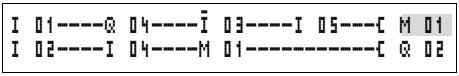


Figure 107: Circuit breaker with M 01 marker relay

How easy evaluates the fast counters CF, CH and CI

In order to evaluate the counter pulses at 5 kHz, the fast counter elements operate with an interrupt routine. The length of the circuit diagram and the associated cycle time has no effect on the counter result.

Delay times for inputs and outputs

The time from reading the inputs and outputs to switching contacts in the circuit diagram can be set in easy via the delay time.

This function is useful, for example, in order to ensure a clean switching signal despite contact bounce.

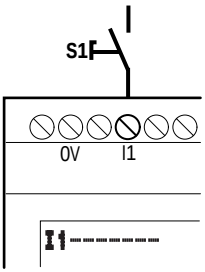


Figure 108: easy input assigned with a switch

easy-DC and easy-AC units function with different input voltages and therefore also have different evaluation methods and delay times.

Delay times with easy-DC basic units

The debounce for DC signals is 20 ms.

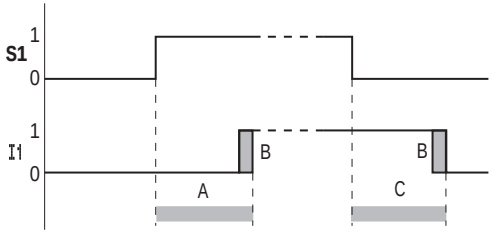


Figure 109: Debounce with easy-DC

An input signal S1 must therefore be 15 V or 8 V (DA) for at least 20 ms on the input terminal before the switch contact will change from 0 to 1 (A). If applicable, this time must also include the cycle time (B) since easy does not detect the signal until the start of a cycle.

The same debounce delay (C) applies when the signal drops out from 1 to 0.

If you use fast counter elements, the debounce time for the inputs is 0.025 ms. Otherwise it is not possible to count fast signals.

If the debounce is switched off, easy responds to an input signal after just 0.25 ms.

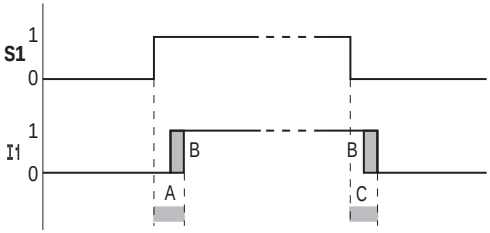


Figure 110: Switching behaviour with deactivated debounce

Typical delay times with the debounce delay switched off are:

- On-delay for
  - I1 to I4: 0.025 ms
  - I5 to I12: 0.25 ms (DC), 0.3 ms (DA)
- Off-delay for
  - I1 to I4: 0.025 ms
  - I5, I6 and I9 to I10: 0.4 ms (DC), 0.3 ms (DA)
  - I7, I8, I11 and I12: 0.2 ms (DC),

→ Ensure noise free input signals when the debounce is deactivated. easy reacts to very short signals.

Debounce time with easy-AC basic units

The input debounce with AC voltage signals depends on the frequency:

- On-delay
  - 80 ms at 50 Hz, 66 ms at 60 Hz
- Off-delay for
  - I1 to I6 and I9 to I12: 80 ms (66 ms)
  - I7 and I8: 160 ms (150 ms) with EASY412-AC
  - I7 and I8: 80 ms (66 ms) with EASY6..-AC

The corresponding values for 60 Hz are given in brackets.

Behaviour with and without debounce time

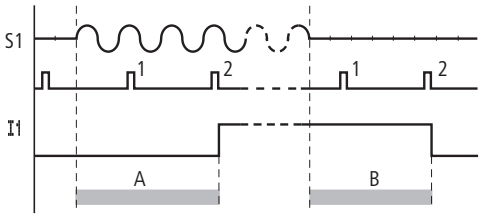


Figure 111: On-delay for easy-AC

If the debounce delay is switched on, easy checks at 40 ms (33 ms) intervals whether there is a half-wave present at an input terminal (1st and 2nd pulses in A). If easy detects two pulses in succession, the device switches on the corresponding input internally.

If this is not the case, the input is switched off again as soon as easy does not detect two successive half-waves (1st and 2nd pulses in B).

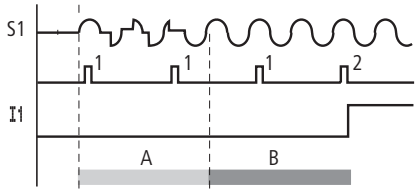


Figure 112: Push button with bounce

If a button or switch bounces (A), the delay time may be extended by 40 ms (33 ms) (A).

If the debounce delay is switched off, the delay time is reduced.

- Switch-on delay
  20 ms (16.6 ms)
- Off-delay for
  I1 to I6 and I9 to I12: 20 ms (16.6 ms)
- Off-delay
  – I7 and I8: 100 ms (100 ms) with EASY412-AC..
  – I7 and I8: 20 ms (16,6 ms) with EASY6..-AC-RC(X)

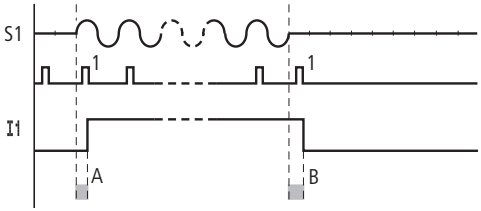


Figure 113: On and off delays

easy switches the contact as soon as it detects a pulse (A). If no pulse is detected, easy switches off the contact (B).

→ The procedure for changing the delay times is described in Section "Delay times for inputs and outputs" on page 226.

Monitoring of short-circuit/overload with EASY..-D.-T..

Depending on the type of easy in use, it is possible to use the internal inputs I15 and I16, R15, R16 to monitor for short-circuits or overloads on an output.

- EASY82 .-D.-T..:
  - I 16: Group fault signal for outputs Q1 to Q4.
  - I 15: Group fault signal for outputs Q5 to Q8.

- EASY620-D.-TE:
  - R 16: Group fault signal for outputs S1 to S4.
  - R 15: Group fault signal for outputs S5 to S8.

State Outputs	I 15 or I 16, R 15 or R 16
No fault found	0 = switched off (make contact)
At least one output has a fault	1 = switched on (make contact)

→ I 15 and I 16 can only be edited on easy variants with transistor outputs.

The following examples are for I16 = Q1 to Q4. I15 indicates in the same way short-circuits and overloads on Q5 to Q8.

Example 1: Output with fault indication

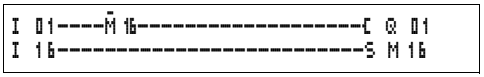


Figure 114: Circuit diagram for fault output via I 16

The above circuit diagram functions as follows:

If a transistor output reports a fault, M16 is set by I16. The break contact of M 16 switches off output Q1 (Q 01). M16 can be cleared by resetting the easy power supply.

Example 2: Output of operating state

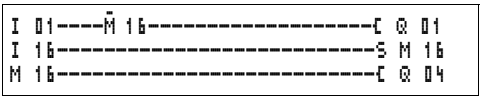


Figure 115: Output of operating state

The above circuit functions as described in Example 1. An additional feature is that when an overload is detected the indicator light at Q4 is actuated. If Q4 has an overload, it would "pulse".

Example 3: Automatic reset of error signal

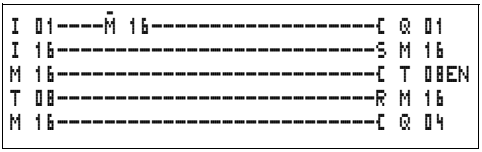


Figure 116: Automatic reset of error signal

The above circuit diagram functions in the same way as Example 2. In addition the marker M16 is reset every 60 seconds by timing relay T 08 (on-delayed, 60 s). If I 16 is still at the 1 state, M 16 remains set. Q 01 is set briefly to 1 until I 16 switches off again.

easy800 expansion

You can expand easy800 with easy models EASY618-..-RE , EASY620-D.-TE, EASY202-RE locally or the easy600 can be expanded decentrally using the EASY200-EASY coupling module.

Install the units and connect the inputs and outputs (see → section "Connecting the expansion device"page 26).

Incorporate the inputs of the expansion units as contacts in the easy circuit diagram like the inputs in the basic unit. The input contacts are called R 01 to R 12.

R 15 and R 16 are the group fault inputs of the transistor expansion unit (→ section "Monitoring of short-circuit/ overload with EASY..-D.-T..", page 230).

The outputs are processed as relay coils or contacts like the outputs in the basic unit. The output relays are S 01 to S 08.

→ EASY618-..-RE provides the outputs S1 to S6. The other outputs S7, S8 can be used internally.

How is an expansion unit recognised?

When at least one R contact or S contact/coil is used in the circuit diagram, the basic unit assumes that an expansion unit is connected.

Transfer behaviour

The input and output data of the expansion units is transferred serially in both directions. Take into account the modified reaction times of the inputs and outputs of the expansion units.

Input and output reaction times of expansion units

The debounce setting has no effect on the expansion unit.

Transfer times for input and output signals:

- Local expansion
  - Time for inputs R1 to R12: 30 ms + 1 cycle
  - Time for outputs S1 to S6 (S8): 15 ms + 1 cycle
- Remote expansion
  - Time for inputs R1 to R12: 80 ms + 1 cycle
  - Time for outputs S1 to S6 (S8): 40 ms + 1 cycle

Function monitoring of expansion units

If the power supply of the expansion unit is not present, no connection can be established between it and the basic unit. The expansion inputs R1 to R12, R15, R16 are incorrectly processed in the basic unit and show status 0. It cannot be assured that the outputs S1 to S8 are transferred to the expansion unit.

Warning
Ensure the continuous monitoring of the easy expansion in order to prevent switching faults in machines or systems.

The status of the internal input I14 of the basic unit indicates the status of the expansion unit:

- I14 = "0": expansion unit is functional
- I14 = "1": expansion unit is not functional

Example

Power can be applied to the expansion unit later than the basic unit. This means that the basic unit is switched to Run when the expansion unit is absent. The following easy circuit diagram detects if the expansion unit is functional or not functional.

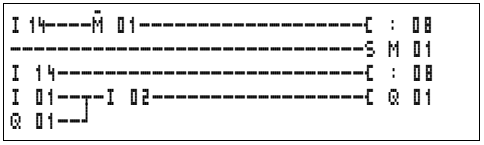


Figure 117: Circuit diagram for expansion testing

As long as I 14 is 1, the remaining circuit diagram is skipped. If I 14 is 0, the circuit diagram is processed. If the expansion unit drops out for any reason, the circuit diagram is skipped. M 01 detects whether the circuit diagram was processed for at least one cycle after the power supply is switched on. If the circuit diagram is skipped, all the outputs retain their previous state.

8 Technical Data

General

easy800

	easy800
Dimensions W × H × D	
[mm]	107.5 × 90 × 72
[inches]	4.23 × 3.54 × 2.84
Space units (SU) width	6
Weight	
[g]	320
[lb]	0,705
Mounting	Top-hat rail to DIN 50022, 35 mm or screw mounting with 3 ZB4-101-GF1 mounting feet

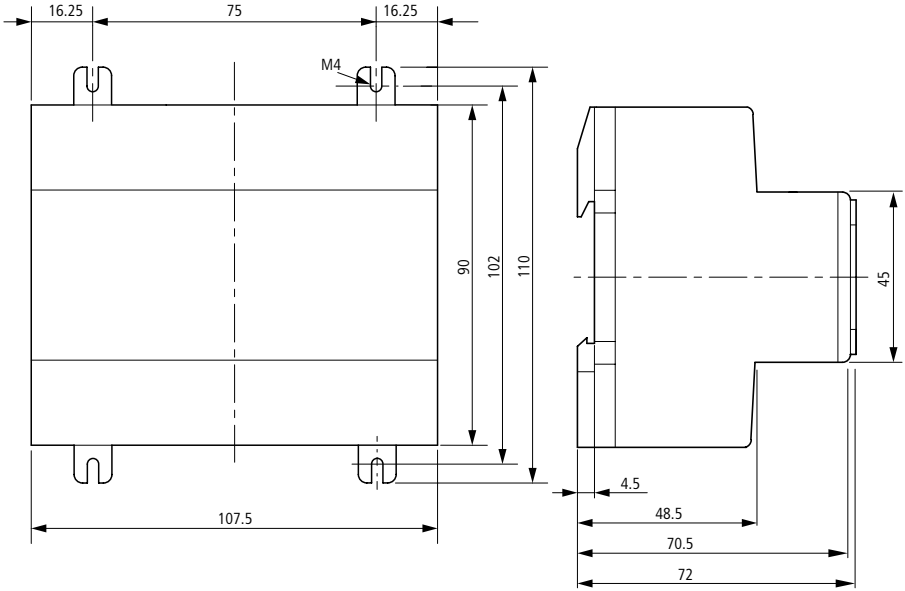


Figure 118: Dimensions easy800 in mm
(Stated in inches → table 5)

Table 5: Dimensions in inches

mm	inches	mm	inches
4,5	0,177	75	2,95
16,25	0,64	90	3,54
48,5	1,91	102	4,01
70,5	2,78	107,5	4,23
72	2,83	110	4,33

Climatic environmental conditions (Cold to IEC 60068-2-1, Heat to IEC 60068-2-2)		
Ambient temperature Installed horizontally/vertically	°C, (°F)	–25 to 55, (–13 to 131)
Condensation		Prevent condensation with suitable measures
LCD display (reliably legible)	°C, (°F)	0 to 55, (32 to 131)
Storage/transport temperature	°C, (°F)	–40 to 70, (–40 to 158)
Relative humidity (IEC 60068-2-30), no moisture condensation	%	5 to 95
Air pressure (operation)	hPa	795 to 1080
Ambient mechanical conditions		
Pollution degree		2
Degree of protection (EN 50178, IEC 60529, VBG4)		IP20
Oscillations (IEC 60068-2-6)		
constant amplitude 0.15 mm	Hz	10 to 57
constant acceleration 2 g	Hz	57 to 150
Shocks (IEC 60068-2-27) semi-sinusoidal 15 g/ 11 ms	Schocks	18
Drop (IEC 60068-2-31) Drop height	mm	50
Free fall, when packed (IEC 60068-2-32)	m	1
Electromagnetic compatibility (EMC)		
Electrostatic discharge (ESD), (IEC/EN 61000-4-2, severity level 3)		
Air discharge	kV	8
Contact discharge	kV	6
Electromagnetic fields (RFI), (IEC/EN 61000-4-3)	V/m	10
Radio interference suppression (EN 55011, EN 55022), class		B

Burst (IEC/EN 61000-4-4, severity level 3)		
Power cables	kV	2
Signal cables	kV	2
High energy pulses (Surge) easy-AC (IEC/EN 61000-4-5), power cable symmetrical	kV	2
High energy pulses (Surge) easy-DC (IEC/EN 61000-4-5, severity level 2), power cable symmetrical	kV	0,5
Line-conducted interference (IEC/EN 61000-4-6)	V	10
Dielectric strength		
Measurement of the air clearance and creepage distance		EN 50 178, UL 508, CSA C22.2, No 142
Dielectric strength		EN 50 178
Tools and cable cross-sections		
Solid, minimum to maximum	mm^2	0.2 to 4
	AWG	22 to 12
Flexible with ferrule, minimum to maximum	mm^2	0.2 to 2.5
	AWG	22 to 12
Factory wiring:	AWG	30
Slot-head screwdriver, width	mm	3.5 × 0.8
	inch	0.14 × 0.03
Tightening torque	Nm	0,6
Backup/accuracy of real-time clock (only with easy-C)		
Clock battery back-up		
at 25 °C/77 °F, typical	h	64
at 40 °C/104 °F, typical	h	24
Accuracy of the real-time clock		
Per day	s/day	± 5
Per year	h/year	± 0.5

Repetition accuracy of timing relays		
Accuracy of timing relay (from value)	%	± 0.02
Resolution		
Range "s"	ms	5
Range "M:S"	S	1
Range "H:M"	min.	1
Retentive memory		
Read/write cycles of retentive memory		≧ 10^{10}
Circuit connections (basic units)		
easy800		256

Power supply EASY819-AC-RC..

		EASY819-AC-RC..
Rated value (sinusoidal) U_e	V AC, (%)	100/110/115/120/230/240, (+10/–15)
Operating range	V AC	85 to 264
Frequency, rated value, tolerance	Hz, (%)	50/60, (± 5)
Input current consumption		
at 115/120 V AC 60 Hz, typical	mA	70
at 230/240 V AC 50 Hz, typical	mA	35
Voltage dips, IEC/EN 61131-2	ms	20
Power loss		
at 115/120 V AC, typical	VA	10
at 230/240 V AC, typical	VA	10

EASY8..-DC-...

		EASY8..-DC-...
Rated voltage		
Rated value	V DC, (%)	24, (+20, –15)
Permissible range	V DC	20.4 to 28.8
Residual ripple	%	≦ 5
Input current at 24 V DC, typical	mA	140
Voltage dips, IEC/EN 61131-2	ms	10
Power loss at 24 V DC, typical	W	3,4

Inputs EASY8..-AC-...

		EASY8..-AC-R..
Digital inputs 115/230 V AC		
Number		12
Status display		LCD (if provided)
Electrical isolation		
To supply voltage		No
Between each other		No
To the outputs		Yes
To PC interface, memory card, NET network, EASY-Link		Yes
Rated voltage L (sinusoidal)		
0 signal	V AC	0 to 40
1 signal	V AC	79 to 264
Rated frequency	Hz	50/60
Input current for state "1" I1 to I6, I9 to I12,		
at 230 V 50 Hz	mA	10 × 0.5
at 115 V, 60 Hz	mA	10 × 0.25

		EASY8..-AC-R..
Input current at state "1" I7, I8,		
at 230 V 50 Hz	mA	2 × 6
at 115 V, 60 Hz	mA	2 × 4
Delay time for 0 to 1 and 1 to 0 for I1 to I6, I9 to I12		
Debounce ON	ms, (Hz)	80, (50) 66⅔, (60)
Debounce OFF	ms, (Hz)	20, (50) 16⅔, (60)
Delay time I7, I8 for 1 to 0		
Debounce ON	ms, (Hz)	120, (50) 100, (60)
Debounce OFF	ms, (Hz)	40, (50) 33, (60)
Delay time I7, I8 for 0 to 1		
Debounce ON	ms, (Hz)	80, (50) 66⅔ , (60)
Debounce OFF	ms, (Hz)	20, (50) 16⅔, (60)
Max. permissible cable length (per input)		
I1 to I6, I9 to I12), typical, debounce on	m	100
I1 to I6, I9 to I12), typical, debounce off	m	60
I7, I8, typical	m	100

EASY8..-DC-...

		EASY8..-DC-...
Digital inputs		
Number		12
Inputs usable as analog inputs, (I7, I8, I11, I12)		4
Status display		LCD (if provided)
Electrical isolation		
To supply voltage		No
Between each other		No
To the outputs		Yes
To PC interface, memory card, NET network, EASY-Link		Yes
Rated voltage		
Rated value	V DC	24
0 signal		
I1 to I6 and I9 to I10	V DC	< 5
I7, I8, I11, I12	V DC	< 8
1 signal		
I1 to I6 and I9 to I10	V DC	> 15
I7, I8, I11, I12	V DC	> 8
Input current on 1 signal		
I1 to I6, I9 to I10 at 24 V DC	mA	3,3
I7, I8, I11, I12 at 24 V DC	mA	2,2
Delay time for 0 to 1		
Debounce ON	ms	20
Debounce off, typical		
I1 to I4	ms	0,025
I5, I6, I9, I10	ms	0,25
I7, I8, I11, I12	ms	0,15

		EASY8..-DC-...
Delay time for 1 to 0		
Debounce ON	ms	20
Debounce off, typical		
I1 to I4	ms	0,025
I5, I6, I9, I10	ms	0,25
I7, I8, I11, I12	ms	0,15
Cable length (unshielded)	m	100
Fast counter inputs, I1 to I4		
Number		4
Cable length (shielded)	m	20
Fast up and down counters		
Counting frequency	kHz	< 5
Pulse shape		Square wave
Mark-to-space ratio		1:1
Frequency counters		
Counting frequency	kHz	< 5
Pulse shape		Square wave
Mark-to-space ratio		1:1
Incremental value counters		
Counting frequency	kHz	< 3
Pulse shape		Square wave
Counter inputs I1 and I2, I3 and I4		2
Signal offset		90°
Mark-to-space ratio		1:1

		EASY8..-DC-...
Analog inputs		
Number		4
Electrical isolation		
To supply voltage		No
To the digital inputs		No
To the outputs		Yes
To the NET network		Yes
Input type		DC voltage
Signal range	V DC	0 to 10
Resolution analog	V	0,01
Resolution digital	Bit	10
	Value	0 to 1023
Input impedance	kΩ	11,2
Accuracy of		
Two easy-devices, from actual value	%	± 3
Within a unit, from actual value, (I7, I8, I11, I12)	%	± 2
Conversion time, analog/digital		
Debounce ON:	ms	20
Debounce OFF:		Each cycle time
Input current	mA	< 1
Cable length (shielded)	m	30

Relay outputs EASY8..-..-R..

		EASY8..-..-R..
Number		6
Type of outputs		Relay
In groups of		1
Connection of outputs in parallel to increase the output		Not permissible
Protection for an output relay		
Miniature circuit-breaker B16	A	16
or fuse (slow-blow)	A	8
Potential isolation to mains power supply, input, PC interface, memory card, NET network, EASY-Link		Yes
Safe isolation	V AC	300
Basic insulation	V AC	600
Mechanical lifespan	Switching operations	10×10^6
Contacts relays		
Conventional thermal current, (UL)	A	8, (10)
Recommended for load at 12 V AC/DC	mA	> 500
Potected against short-circuit cos φ = 1 16 A characteristic B (B16) at	A	600
Protected against short-circuit cos φ = 0.5 to 0.7 16 A characteristic B (B16) at	A	900
Rated impulse withstand voltage U_{imp} contact coil	kV	6
Rated insulation voltage U_i		
Rated operational voltage U_e	V AC	250
Safe isolation to EN 50178 between coil and contact	V AC	300
Safe isolation to EN 50178 between two contacts	V AC	300

		EASY8..-..-R..
Making capacity, IEC 60947		
AC-15 250 V AC, 3 A (600 Ops/h)	Switching operations	300000
DC-13 L/R ≦ 150 ms 24 V DC, 1 A (500 S/h)	Switching operations	200000
Breaking capacity, IEC 60947		
AC-15 250 V AC, 3 A (600 Ops/h)	Switching operations	300000
DC-13 L/R ≦ 150 ms 24 V DC, 1 A (500 S/h)	Switching operations	200000
Filament lamp load		
1000 W at 230/240 V AC	Switching operations	25000
500 W at 115/120 V AC	Switching operations	25000
Fluorescent tube with ballast, 10 × 58 W at 230/240 V AC	Switching operations	25000
Conventianal fluorescent tube, compensated, 1 × 58 W at 230/240 V AC	Switching operations	25000
Conventianal fluorescent tube, uncompensated, 10 × 58 W at 230/240 V AC	Switching operations	25000
Operating frequency, relays		
Mechanical switching operations	Switching operations	10 Million (10^7)
Mechanical switching frequency	Hz	10
Resistive lamp load	Hz	2
Inductive load	Hz	0,5

UL/CSA

Uninterrupted current at 240 V AC/24 V DC		A	10/8
AC	Control Circuit Rating Codes (utilization category)		B300 Light Pilot Duty
	Max. rated operational voltage	V AC	300
	Max. thermal uninterrupted current cos φ = 1 at B300	A	5
	Maximum make/break capacity cos φ ≠ 1 (Make/break) at B300	VA	3600/360
DC	Control Circuit Rating Codes (utilization category)		R300 Light Pilot Duty
	Max. rated operational voltage	V DC	300
	Max. thermal uninterrupted current at R300	A	1
	Maximum make/break capacity at R300	VA	28/28

Transistor outputs **EASY8..-D.-T..**

			EASY8..-DC-T..
Number of outputs			8
Contacts			Semiconductors
Rated voltage U_e		V DC	24
Permissible range		V DC	20.4 to 28.8
Residual ripple		%	≦ 5
Supply current			
at 0 state, typical/maximum		mA	18/32
at 1 state, typical/maximum		mA	24/44
Reverse polarity protection **Note** If voltage is applied to the outputs when the polarity of the power supply is reversed, this will result in a short circuit.			Yes
Potential isolation to the inputs, supply voltage, PC interface, memory card, NET network, EASY-Link			Yes
Rated current I_e at state 1, maximum		A	0,5

		EASY8..-DC-T..
Lamp load		
Q1 to Q4 without R_V	W	3
Q5 to Q8 without R_V	W	5
Residual current at state "0" per channel	mA	< 0.1
Max. output voltage		
at state 0 with external load, 10 MΩ	V	2.5
at state 1 , I_e = 0.5 A		$U = U_e - 1$ V
Short-circuit protection electronic (Q1 to Q4) thermal (Q5 to Q8) (Evaluation with diagnostics inputs I16, I15)		Yes
Short-circuit tripping current for $R_a \leqq 10$ mΩ (depending on number of active channels and their load)	A	$0.7 \leqq I_e \leqq 2$
Maximum total short-circuit current	A	16
Peak short-circuit current	A	32
Thermal cutout		Yes
Maximum switching frequency with constant resistive load R_L = 100 kΩ (depends on program and load)	Switching operations/h	40000
Parallel connection of outputs with resistive load; inductive load with external suppression circuit (→ section "Connecting transistor outputs", page 44); combination within a group		Yes
Group 1: Q1 to Q4		
Group 2: Q5 to Q8		
Maximum number of outputs		4
Total maximum current **Note** Outputs must be actuated simultaneously and for the same time duration.	A	2
Status display of the outputs		LCD display (if provided)

Inductive load **without external suppressor circuit**

General explanations:
$T_{0.95}$ = time in miliseconds until 95 % of the stationary current is reached

$$T_{0.95} \approx 3 \times T_{0.65} = 3 \times \frac{L}{R}$$

Utilization category in groups for

- Q1 to Q4, Q5 to Q8

$T_{0.95}$ = 1 ms R = 48 Ω L = 16 mH	Utilization factor per group g =		0,25
	Relative duty factor	%	100
	Max. switching frequency f = 0.5 Hz Max. duty factor DF = 50 %	Switching operations/h	1500
DC13 $T_{0.95}$ = 72 ms R = 48 Ω L = 1.15 H	Utilization factor g =		0,25
	Relative duty factor	%	100
	Max. switching frequency f = 0.5 Hz Max. duty factor DF = 50 %	Switching operations/h	1500

Other inductive loads:

$T_{0.95}$ = 15 ms R = 48 Ω L = 0.24 H	Utilization factor g =		0,25
	Relative duty factor	%	100
	Max. switching frequency f = 0.5 Hz Max. duty factor DF = 50 %	Switching operations/h	1500
Inductive loading with external supperssor circuit for each load (→ section "Connecting transistor outputs", page 44)			
	Utilization factor g =		1
	Relative duty factor	%	100
	Max. switching frequency Max. duty factor	Switching operations/h	Depends on the suppressor circuit

Analog output EASY8..-D.-T..

		EASY8..-DC-T..
Number		1
Electrical isolation		
To power supply		No
To the digital inputs		No
To the digital outputs		Yes
To the NET network		Yes
Output type:		DC voltage
Signal range	V DC	0 to 10
Output current max.	mA	10
Load resistor	kΩ	1
Short-circuit and overload proof		Yes

		EASY8..-DC-T..
Resolution analog	V DC	0,01
Resolution digital	Bit	10
	Value	0 to 1023
Transient recovery time	µs	100
Accuracy (–25 to 55 °C), related to the range	%	2
Accuracy (25 °C), related to the range	%	1
Conversion time		each CPU cycle

NET Network EASY8..-..-...

		EASY8..-..-...
Number of stations		8
Bus length/transmission speed[1)]	m/kBaud	6/1 000 25/500 40/250 125/125 300/50 700/20 1 000/10
Electrical isolation		Yes
To power supply, inputs, outputs, EASY-Link, PC interface, memory module		
Bus termination (→ accessories)		Yes
First and last station		
Plug connector (→ accessories)	poles	8
Type		RJ45

		EASY8..-..-...
Cable cross-sections, with cable lengths and cable resistances/m		
Cross-section up to 1000, < 16 mΩ/m	mm^2 (AWG)	1,5 (16)
Cross-section up to 600, < 26 mΩ/m	mm^2 (AWG)	0.75 to 0.8 (18)
Cross-section up to 400, < 40 mΩ/m	mm^2 (AWG)	0.5 to 0.6 (20, 19)
Cross-section up to 250, < 60 mΩ/m	mm^2 (AWG)	0.34 to 0.6 (22, 20, 19)
Cross-section up to 175, < 70 mΩ/m	mm^2 (AWG)	0.25 to 0.34 (23, 22)
Cross-section up to 40, < 140 mΩ/m	mm^2 (AWG)	0,13 (26)

1) Bus lengths above 40 m can only be achieved with cables with enhanced cross-section and connection adapter.

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