

FL9Y-B966



IDEC SmartRelay

FL1D_{series}

IDEC SmartRelay

User's Manual



IDEC CORPORATION

Preface

Dear customer

We thank you for purchasing IDEC SmartRelay and congratulate you on your decision.

IDEC SmartRelay can be used in many fields of applications. Due to its high functionality and yet easy operation the IDEC SmartRelay offers you utmost efficiency for almost any application.

Purpose of this manual

This IDEC SmartRelay manual provides you with information about the creation of circuit programs, about the installation and use of IDEC SmartRelay FL1D devices and expansion modules, and about their compatibility to the previous FL1A to FL1C versions (FL1x are the last four characters of the type number and differentiate the device series).

IDEC SmartRelay's place in information technology

The wiring information in your IDEC SmartRelay manual is also found in the IDEC SmartRelay Product Info included with all devices. For further information on programming the IDEC SmartRelay on your PC, refer to the Online Help for WindLGC.

WindLGC is the programming software for PCs. It runs under Windows® and helps you to get started with IDEC SmartRelay and to write, test, print out and archive your programs, independent of the IDEC SmartRelay.

Guide

We have divided this manual into 9 chapters:

- Getting started with IDEC SmartRelay
- IDEC SmartRelay installation and wiring
- Programming IDEC SmartRelay
- IDEC SmartRelay functions
- Configuring IDEC SmartRelay
- IDEC SmartRelay memory cartridge (card)
- IDEC SmartRelay software
- Applications
- Appendix

Valid range of this manual

The manual applies to devices of the series FL1D.

Changes compared to previous releases of the manual

- The analog module IDEC SmartRelay FL1D-K2B2 was added.
- The communication module FL1B-CAS2 was added.
- Description of changes and new features of the series FL1D devices.

Main differences compared to previous devices (FL1A to FL1C)

- Display contrast may be changed.
- Default setting for the start screen may be changed.
- Analog output values for RUN/STOP transition may be selected.
- Analog inputs and analog outputs have been added to the RUN mode display.

New features of the current devices (FL1D)

- The “Analog Ramp Control” special function enables you to use a two-step speed control.
- The “Analog multiplexer” special function enables you to select 1 of 4 analog values to be output.
- The “PI controller” special function enables you to use a PI controller function.

Additional support

At our Internet address

<http://smart.idec.com/>

you can quickly and easily find answers to your queries about IDEC SmartRelay.

Safety guidelines

The notes in this user manual are for your own personal safety and for preventing damage to assets. You should read them carefully and follow the instructions they give you. These notes are highlighted with a warning triangle and are shown according to the degree of hazard as follows:



Danger

Warns that death, serious harm to health or damage to assets will result if the respective precautionary measures are not taken.



Warning

Warns that death, serious harm to health or damage can result if the respective precautionary measures are not taken.



Caution

Warns that harm to health or damage to assets can result if the respective precautionary measures are not taken.

Caution

Means that material damage may occur if corresponding safety measures are not taken.

Note

Draws your attention to particularly important information relating to the product and its handling, or to a part of the documentation requiring your special attention.

Qualified personnel

Only **skilled personnel** should be allowed to start and operate this device. Qualified personnel in the sense of the information on safety technology in this manual are persons who are authorized to commission, to ground and to tag circuits, equipment and systems in accordance with safety regulations and standards.

Use as intended

Please note:



Warning

This device must always be used as intended for the applications described in the catalog and in the technical specifications, and only in combination with third-party devices or components approved or recommended by IDEC.

Prerequisite for the safe and proper operation of the product is its proper transportation, storage, installation and mounting, and careful operator control and maintenance.

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Disclaimer of liability

We have examined the contents of this publication for agreement with the hardware and software described. Nevertheless, discrepancies can not be ruled out. Any liability and warranty for the accuracy of this information is excluded. The data in this manual are reviewed at regular intervals. Any corrections required are included in the subsequent editions. Suggestions for improvement are welcomed.

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1 Getting started with IDEC SmartRelay

Here's IDEC SmartRelay

IDEC SmartRelay is a universal logic module made by IDEC.

IDEC SmartRelay integrates

- Controls
- Operator and display panel with background lighting
- Power supply
- Interface for expansion modules
- Interface for the memory cartridge (card) and a PC cable
- Pre-configured standard functions, e.g. on- and off-delays, current impulse relay and softkey.
- Timers
- Inputs, Outputs, Memory Markers

What IDEC SmartRelay can do for you

IDEC SmartRelay offers solutions for installation engineering (e.g. for stairway lighting, external lighting, sun blinds, shutters, shop window lighting etc.), switch cabinet engineering, as well as for mechanical and apparatus engineering (e.g. for gate control systems, air-conditioning systems, or rainwater pumps etc.).

IDEC SmartRelay can also be implemented for special control systems in conservatories or greenhouses, for control signal processing and, by connecting a communication module (e.g. AS-Interface) for distributed local controlling of machines and processes.

Special versions without operator panel and display unit are available for series production applications in small machine, apparatus, switching cabinet and installation engineering.

Which devices are available?

IDEC SmartRelay Base is available in two voltage classes:

- Class 1 ≤ 24 V, i.e. 12V DC, 24V DC, 24V AC
- Class 2 > 24 V, i.e. 100...240V AC/DC,

in the versions:

- **With display:** 8 inputs and 4 outputs.
- **Without display** ("IDEC SmartRelay Pure"): 8 inputs and 4 outputs.

Each version is integrated into 4 subunits (SU), is equipped with an expansion interface and provides 36 pre-configured standard and special function blocks for the creation of your circuit program.

Which expansion modules are available?

- IDEC SmartRelay digital modules are available for operation with 12V DC, 24V AC/DC and 100...240V AC/DC, and are equipped with four inputs and four outputs.
- IDEC SmartRelay analog modules are available for operation with 24 V DC and with 12 V DC, and are equipped with two analog inputs or two analog outputs.

The digital/analog modules are integrated in two subunits. Each one is equipped with two expansion interfaces for connecting additional modules.

Which communication modules are available?

- IDEC SmartRelay communication module FL1B-CAS2, which is described in more detail in a separate documentation.

The communication module has four virtual inputs and outputs, and acts as an interface between an AS-Interface system and an IDEC SmartRelay system. The module enables four data bits to be transferred from the IDEC SmartRelay Base to the AS-Interface system and vice versa.

It's your choice

The various IDEC SmartRelay Base versions and expansion modules and communication modules offer you a highly flexible and adaptive system to suit your specific tasks.

The IDEC SmartRelay system offers you many solutions such as for simple automation tasks and even complex engineering tasks involving its integration into a bus system (e.g. communications module AS-interface.)

Note

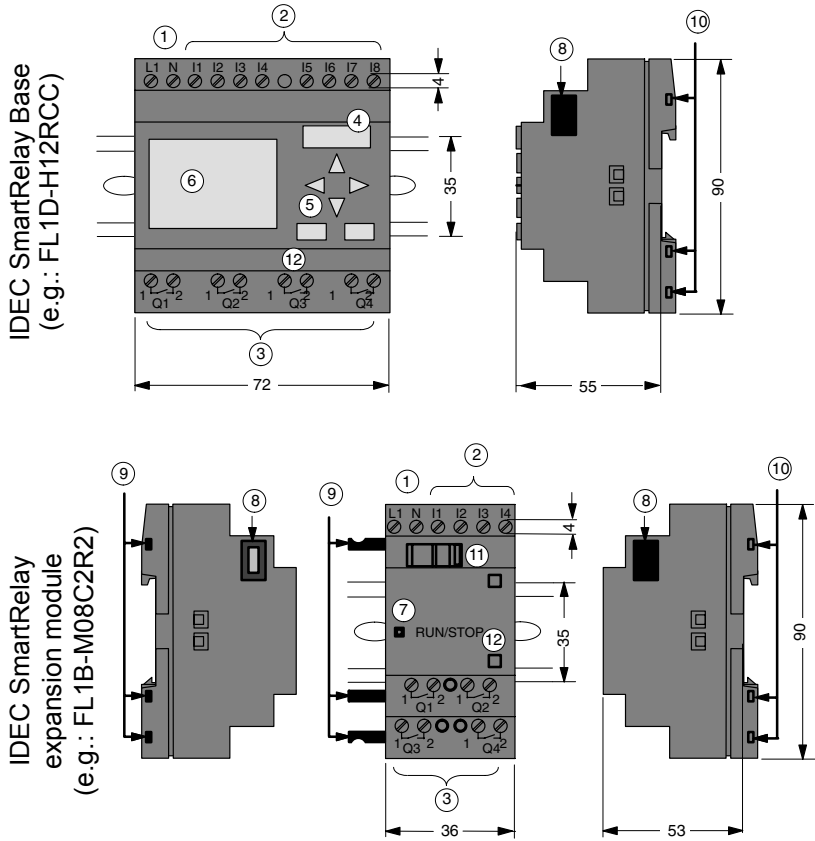
IDEC SmartRelay Base may only be equipped with expansion modules of the same voltage class. Mechanical encoding pins in the housing prevent you from connecting devices of a different voltage class.

Exception: The left-hand interface of an analog module or communication module is galvanically isolated. This type of expansion module can therefore be connected to devices of a different voltage class. See also Chapter 2.1.

Each IDEC SmartRelay Base provides the following connections for the creation of the circuit program, regardless of the number of connected modules:

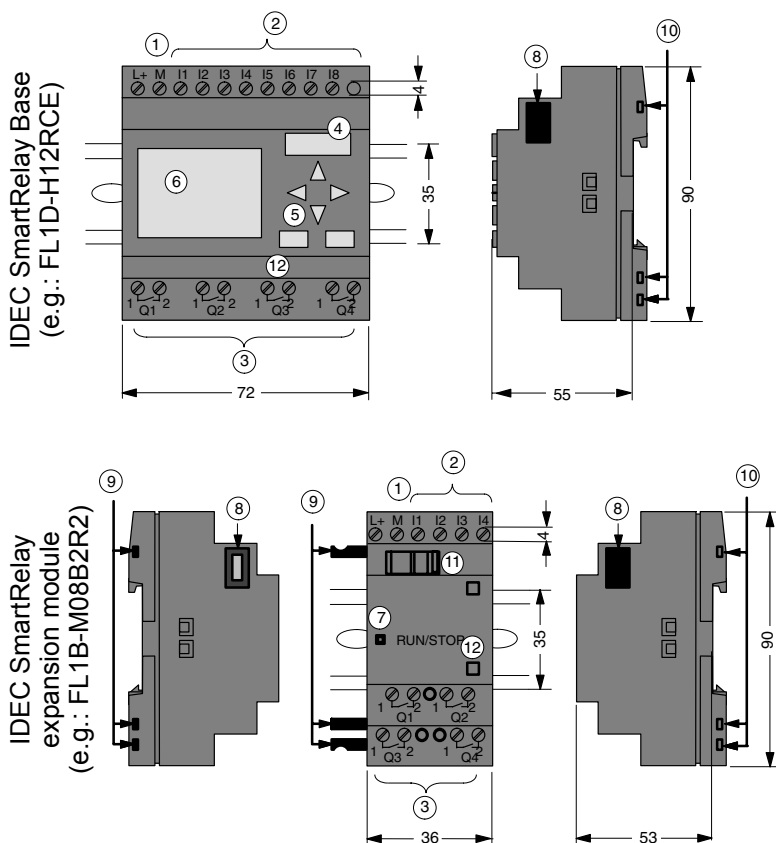
- Inputs I1 to I24
 - Analog inputs AI1 to AI8
 - Outputs Q1 to Q16
 - Analog outputs AQ1 and AQ2
 - Memory Markers M1 to M24, M8: Startup Markers
 - Analog Memory Markers AM1 to AM6
 - Shift register bits S1 to S8
 - 4 Cursor keys
 - 16 Blank outputs X1 to X16.
-

The IDEC SmartRelay structure



- | | | |
|-------------------------|--|-------------------------------|
| 1. Power supply | 5. Control panel
(not with FL1D-B12...) | 9. Mechanical coding pins |
| 2. Inputs | 6. LCD
(not with FL1D-B12...) | 10. Mechanical coding sockets |
| 3. Outputs | 7. RUN/STOP indicator | 11. Slide |
| 4. Module slot with cap | 8. Expansion interface | 12. Version number |

(example: $\frac{X}{3} \frac{2}{4}$
represents Version 1.)



1. Power supply

2. Inputs

3. Outputs

4. Module slot with cap

5. Control panel
(not with FL1D-B12...)

6. LCD
(not with FL1D-B12...)

7. RUN/STOP indicator

8. Expansion interface

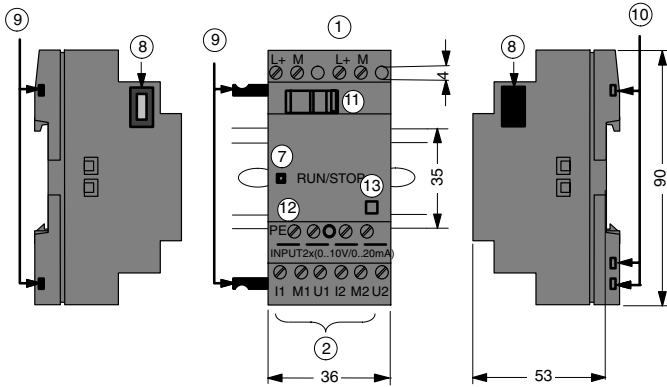
9. Mechanical coding pins

10. Mechanical coding sockets

11. Slide

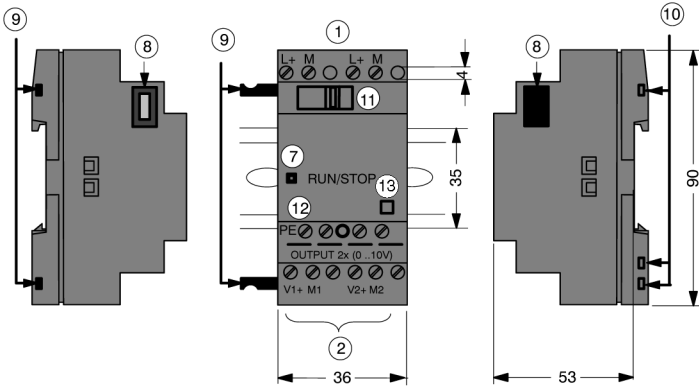
12. Version number

FL1B-J2B2



- | | | |
|------------------------|-------------------------------|---|
| 1. Power supply | 9. Mechanical coding pins | 12. PE terminal, for connecting earth and the shielding of analog measuring cables. |
| 2. Inputs | 10. Mechanical coding sockets | 13. Version number |
| 7. RUN/STOP indicator | 11. Slide | |
| 8. Expansion interface | | |

FL1D-K2B2



- | | | |
|------------------------|-------------------------------|---------------------------------------|
| 1. Power supply | 9. Mechanical coding pins | 12. PE terminal, for connecting earth |
| 2. Outputs | 10. Mechanical coding sockets | 13. Version number |
| 7. RUN/STOP indicator | 11. Slide | |
| 8. Expansion interface | | |

How to identify the IDEC SmartRelay

The IDEC SmartRelay identifier informs you of various properties.

Base module

FL1D-①②③④⑤

- ① B: Base module without display H: Base module with display
- ② Number of Inputs and Outputs
- ③ R: Relay output S: Tr. (source) output
- ④ C: With clock N: Without clock
- ⑤ D: 24V DC E: 12/24V DC A: 24V AC/DC
B: 100...240V AC C: 100...240V AC/DC

Expansion module

Digital module

FL1B-M①②③④

- ① Number of Inputs and Outputs
- ② B1: 24V DC B2: 12/24V DC
C2: 100...240V AC/DC D2: 24V AC/DC
- ③ S: Tr. (source) output R: Relay output
- ④ Terminal type 2: non-removable terminal

Analog input module

FL1B-J①②③

- ① Number of Inputs
- ② Resolution B: 10bit
- ③ Terminal type 2: non-removable terminal

Analog output module

FL1D-K①②③

- ① Number of Outputs
- ② Resolution B: 10bit
- ③ Terminal type 2: non-removable terminal

Communication module

FL1B-①②③④

- ① C: Communication module
- ② L1: LONWORKS AS: AS-Interface
- ③ blank: AS-Interface rated voltage (30V DC) C1: 24V AC/DC
- ④ Terminal type 2: non-removable terminal

Symbols



Version with display unit is equipped with 8 inputs and 4 outputs



Version without display unit is equipped with 8 inputs and 4 outputs



The digital module is equipped with 4 digital inputs and 4 digital outputs





The analog module is equipped with 2 analog inputs or two analog outputs



The communications module (CM); e.g. AS-Interface is equipped with 4 virtual inputs and 4 virtual outputs

Versions

The following IDEC SmartRelay versions are available:

Symbol	Description	Supply Voltage	Inputs	Outputs	Properties
	FL1D-H12RCE	12/24 V DC	8 digital ⁽¹⁾	4 relays (10 A)	
	FL1D-H12SND	24 V DC	8 digital ⁽¹⁾	4 Transistor 24V / 0.3A	no clock
	FL1D-H12RCA ⁽²⁾	24 V AC / 24 V DC	8 digital	4 relays (10A)	
	FL1D-H12RCC ⁽³⁾	100...240 V AC/DC	8 digital	4 relays (10A)	
	FL1D-B12RCE	12/24 V DC	8 digital ⁽¹⁾	4 relays (10A)	no display unit no keyboard
	FL1D-B12RCA ⁽²⁾	24 V AC / 24 V DC	8 digital	4 relays (10A)	no display unit no keyboard
	FL1D-B12RCC ⁽³⁾	100...240 V AC/DC	8 digital	4 relays (10A)	no display unit no keyboard



(1): Of those can be used alternatively: 2 analog inputs (0 ... 10V) and 2 fast inputs.

(2): The digital inputs can be operated with P or N action.

(3): Two groups consisting of 4 inputs each. Each input within a group must be connected to the same phase. It is possible to interconnect groups with a different phase.

Expansion modules

The following expansion modules can be connected to the IDEC SmartRelay:

Symbol	Description	Supply Voltage	Inputs	Outputs
	FL1B-M08B2R2	12/24 V DC	4 digital	4 relays (5A)
	FL1B-M08B1S2	24 V DC	4 digital	4 Transistor 24 V / 0.3 A
	FL1B-M08D2R2 ⁽¹⁾	24 V AC/DC	4 digital	4 relays (5A)
	FL1B-M08C2R2	100...240 V AC/DC	4 digital ⁽²⁾	4 relays (5A)
	FL1B-J2B2	12/24 V DC	2 analog 0 ... 10 V or 0 ... 20 mA ⁽³⁾	none
	FL1D-K2B2	24 V DC	none	2 analog 0 ... 10 V DC

(1): Digital inputs can be operated either with P or with N action.

(2): Different phases are not allowed within the inputs.

(3): 0 ... 10 V, 0 ... 20 mA can be connected optionally.

Certification and approvals

IDEC SmartRelay is certified to cULus and FM.

- cULus Haz. Loc.
Underwriters Laboratories Inc. (UL) to
 - UL 508 (Industrial Control Equipment)
 - CSA C22.2 No. 142 (Process Control Equipment)
 - UL 1604 (Hazardous Location)
 - CSA-213 (Hazardous Location)

APPROVED for use in

Class I, Division 2, Group A, B, C, D Tx

Class I, Zone 2, Group IIC Tx

- FM Approval
Factory Mutual Research (FM) to
Approval Standard Class Number 3611, 3600, 3810
APPROVED for use in
Class I, Division 2, Group A, B, C, D Tx
Class I, Zone 2, Group IIC Tx

Note

You will find current approvals on the rating plate of the relevant module.



Warning

Risk of personal injury and material damage.

In potentially explosive atmospheres, there is a risk of personal injury or damage to material if you disconnect connectors when the system is in RUN.

In potentially explosive atmospheres, always switch off the power supply to IDEC SmartRelay and its components before you disconnect any connectors.

IDEC SmartRelay is issued with the CE Certificate of Conformity. It is compliant with VDE 0631 and IEC 61131-2 and interference-proof to EN 55011, Limit Class B.

Marine certification has been requested.

- ABS (American Bureau of Shipping)
- BV (Bureau Veritas)
- DNV (Det Norske Veritas)
- GL (Germanischer Lloyd)
- LRS (Lloyds Register of Shipping)
- Class NK (Nippon Kaiji Kyokai)

ID for Australia



Our products carrying the label shown at the side are compliant with AS/NZS 2064:1997 (Class A) standard.

Recycling and Disposal

IDEC SmartRelay units can be fully recycled, due to their low-pollutant equipment. Contact a certified electronic waste disposal center for environmentally acceptable recycling and disposal of your old devices.

2 IDEC SmartRelay installation and wiring

General guidelines

Please note the following guidelines for the installation and wiring of your IDEC SmartRelay :

- Always ensure that the wiring of your IDEC SmartRelay is compliant with current rules and standards. Also, conform with all national and regional regulations when you install and operate the devices. For information on standards and regulations that apply to your specific case, contact your local authorities.
- Always switch off power before you wire or install/remove a module.
- Always use cables with an appropriate conductor cross-sections for the relevant current. You can wire the IDEC SmartRelay with cable conductor cross-sections from 1.5 mm² to 2.5 mm²; see Chapter 2.3.
- Do not exceed the screw torque of the terminals. The maximum torque is: 0.5Nm, see Chapter 2.3.
- Keep the cabling as short as possible. If longer cables are necessary, you should use shielded versions. You should always route your cables in pairs: i.e. one neutral conductor plus one phase conductor or signal line.
- Always keep separate:
 - The AC wiring
 - High-voltage DC circuits with high-frequency switching cycles
 - Low-voltage signal wiring.
 - The EIB bus cable may also be laid in parallel to other signal lines.
- Ensure that the wires are installed with an appropriate strain relief.
- Provide a suitable lightning surge arrester for cables installed in hazardous areas.

- Do not connect an external power supply in parallel to the output load of a DC output. This could develop a reverse current at the output if you have not installed a diode or similar barrier device.
 - Reliable functioning of the equipment is only ensured with certified components!
-

Note

IDEC SmartRelay units may only be installed and wired by skilled personnel who know and follow the general engineering rules and the relevant regulations and standards.

What you must note when installing

IDEC SmartRelay is designed for fixed and enclosed installation in the housing or the control cabinet.



Warning

Open facilities

Death, serious bodily injury or considerable damage to property can occur.

Modules of an IDEC SmartRelay are open facilities. This means you must install IDEC SmartRelay only in a housing or cabinet.

Access to the housings or cabinets must only be possible by using a key or a tool and only authorized or approved personnel may be allowed access.

It is permissible to operate IDEC SmartRelay from its front at any time.

Safety of electronic control equipment

Introduction

The notes below apply regardless of the type or manufacturer of the electronic control.

Reliability

Maximum reliability of IDEC SmartRelay devices and components is achieved by implementing extensive and cost-effective measures during development and manufacture.

This includes the following:

- Use of high-quality components;
- Worst-case design of all circuits;
- Systematic and computer-aided testing of all components;
- Burn-in of all large-scale integrated circuits (e.g. processors, memory, etc.);
- Measures preventing static charge when handling MOS ICs;
- Visual checks at different stages of manufacture;
- Continuous heat-run test at elevated ambient temperature over a period of several days;
- Careful computer-controlled final testing;
- Statistical evaluation of all returned systems and components to enable the immediate initiation of suitable corrective measures;
- Monitoring of major control components, using online tests (cyclic interrupt for the CPU, etc.).

These measures are referred to as basic measures.

Carrying out tests

You must, however, ensure safety in your plant.

Before finally commissioning a system you should carry out complete functional testing as well as all the necessary safety testing.

In testing, also include any predictable faults that can occur. This means that you will avoid any danger to the plant or to people during operation.

Risks

In all cases where the occurrence of failures can result in material damage or injury to persons, special measures must be taken to enhance the safety of the installation - and therefore also of the situation. System-specific and special regulations exist for such applications. They must be observed on installing the control system (e.g. VDE 0116 for burner control systems).

For electronic control equipment with a safety function, the measures that have to be taken to prevent or rectify faults are based on the risks involved in the installation. As of a certain degree of hazard the basic measures mentioned above are no longer sufficient. Additional measures must be implemented and approved for the controller.

Important information

The instructions in the operating manual must be followed exactly. Incorrect handling can render measures intended to prevent dangerous faults ineffective, or generate additional sources of danger.

2.1 Modular IDEC SmartRelay setup

2.1.1 Maximum setup

Maximum setup of a IDEC SmartRelay *with* analog inputs (FL1D-H12RCE/FL1D-B12RCE and FL1D-H12SND)

IDEC SmartRelay Base, 4 digital modules and 3 analog modules (example)

I1.....I6, I7, I8 AI1, AI2	I9...I12	I13...I16	I17...I20	I21...I24	AI3, AI4	AI5, AI6	AI7, AI8
IDEC SmartRelay Base	FL1B- M08	FL1B- M08	FL1B- M08	FL1B- M08	FL1B- J2B2	FL1B- J2B2	FL1B- J2B2
Q1...Q4	Q5...Q8	Q9...Q12	Q13...Q16				

In addition, you can plug in an analog output module.

The base module with analog inputs can connect a maximum of three analog input modules and one analog output module.

Note

When using inputs I7 / AI1 and I8 / AI2 as analog inputs, AI1 and AI2, do not use them as digital inputs I7/I8.

Maximum setup of a IDEC SmartRelay *without* analog inputs (FL1D-H12RCA/FL1D-B12RCA and FL1D-H12RCC/FL1D-B12RCC)

IDEC SmartRelay Base, 4 digital modules and 4 analog modules (example)

I1.....I8	I9...I12	I13...I16	I17...I20	I21...I24	AI1, AI2	AI3, AI4	AI5, AI6	AI7, AI8
IDEC SmartRelay Base	FL1B- M08	FL1B- M08	FL1B- M08	FL1B- M08	FL1B- J2B2	FL1B- J2B2	FL1B- J2B2	FL1B- J2B2
Q1...Q4	Q5...Q8	Q9...Q12	Q13...Q16					

In addition, you can plug in an analog output module.

The base module without analog inputs can connect a maximum of four analog input modules and one analog output module.

High-speed/optimal communication performance

For optimal and high-speed communication performance between IDEC SmartRelay Base and the various modules, we recommend you install the “digital modules first, then the analog modules” (example above). (The special function PI

controller is an exception: the AI used for the value PV should be on the IDEC SmartRelay Base or an analog input module adjacent to the IDEC SmartRelay Base).

We **recommend** that you position the FL1B-CAS2 on the far right-hand side. (If the AS Interface voltage fails, communication between the IDEC SmartRelay system and the expansion modules, which are arranged to the right of the IDEC SmartRelay AS Interface expansion module, is interrupted).

2.1.2 Setup with different voltage classes

When setting up expansion modules of different power voltages, take the following restrictions into consideration.

Note

- To power the CPU module and expansion I/O modules, use one power supply to supply the same power voltage. When using different power supplies, the fast transient/burst immunity (IEC61000-4-4) will be 1 kV (power supply).
 - A 100 to 240V AC/DC module cannot be connected to the right side of a 12/24V DC, 24V DC, or 24V AC/DC module.
 - For analog input module and AS-Interface communication module, a module of any voltage can be connected to the left side. To the right side, however, a 100 to 240V AC/DC module cannot be connected.
-

2.2 Installing/removing IDEC SmartRelay

Dimensions

The IDEC SmartRelay installation dimensions are compliant with DIN 43880.

IDEC SmartRelay can be snap-mounted to 35 mm DIN rails to EN 50022 or on the wall.

IDEC SmartRelay width:

- IDEC SmartRelay Base has a width of 72 mm, which corresponds with 4 subunits.
- IDEC SmartRelay expansion modules have a width of 36 mm, which corresponds with 2 subunits.

Note

The figure below shows you an example of the installation and removal of a FL1D-H12RCC and a digital module. The measures shown apply to all other IDEC SmartRelay Base versions and expansion modules.



Warning

Always switch off power before you “remove” and “insert” a module (base module, expansion module, communication module).

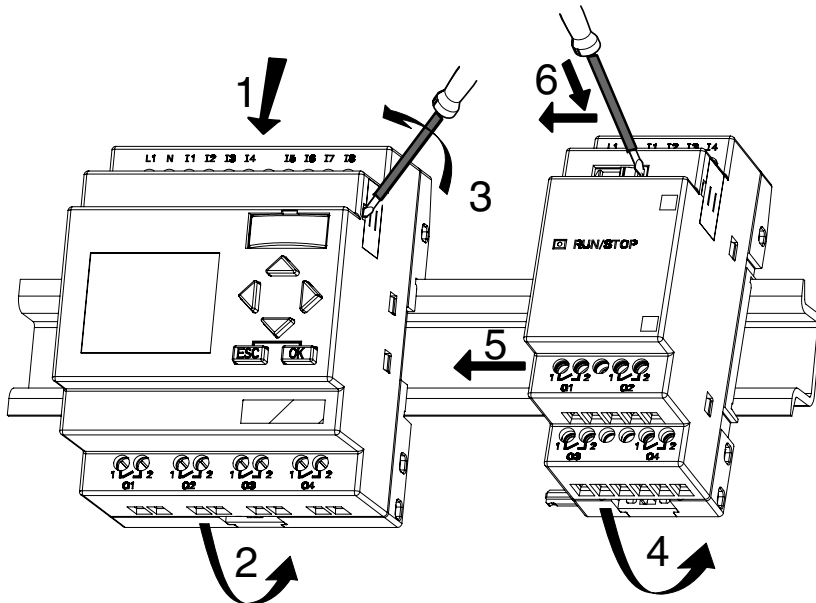
2.2.1 DIN rail mounting

Mounting

How to **mount** an IDEC SmartRelay Base **and** a digital module onto a DIN rail:

IDEC SmartRelay Base:

1. Hook the IDEC SmartRelay Base module onto the rail and
2. then push down the lower end to snap it on. The mounting interlock at the rear must engage.



IDEC SmartRelay digital module:

3. On the right side of the IDEC SmartRelay Base/IDEC SmartRelay expansion module, remove the connector cap.
4. Place the digital module onto the DIN rail on the right-hand side of the IDEC SmartRelay Base.
5. Slide the digital module towards the left until it contacts the IDEC SmartRelay Base.

-

Note

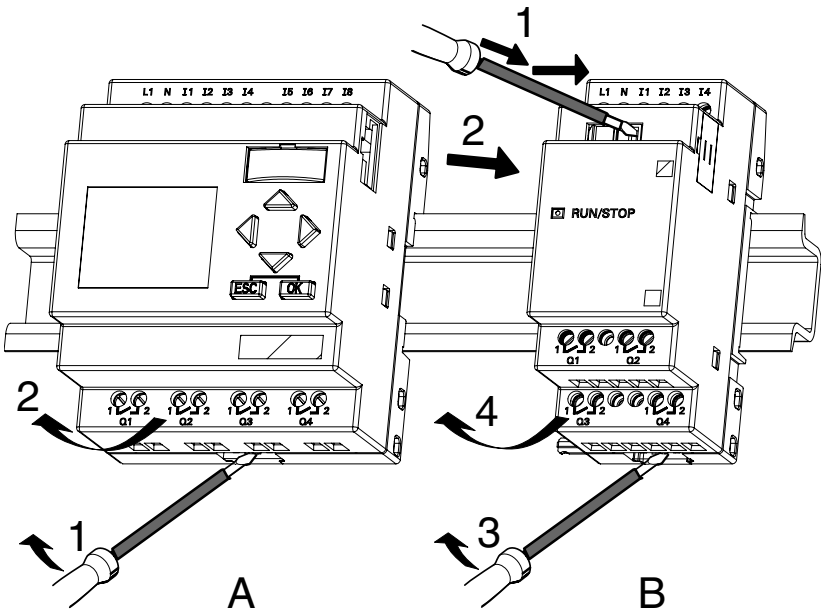
Removal

To **remove** the IDEC SmartRelay:

..... if you have installed **only one IDEC SmartRelay Base**:

Part A

1. Insert a screwdriver into the eyelet at the bottom of the slide interlock and move the latch downward.
2. Swing the IDEC SmartRelay Base off the DIN rail.



..... if you have connected **at least one expansion module** to the IDEC SmartRelay Base:

Part B

1. Using a screwdriver, push the integrate slide interlock to the right.
2. Slide the expansion module off towards the right.
3. Insert a screwdriver into the eyelet at the bottom of the slide interlock and lever it downward.
4. Swing the expansion module off the profile rail.

Repeat steps 1 to 4 for all other expansion modules.

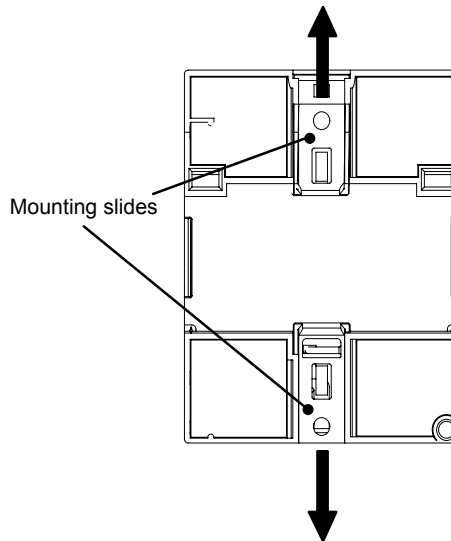
Note

If you have connected more than one expansion module, it is advisable to start removal with the last module at the right-hand side.

Make sure that the slide interlock of the module to be installed/removed is not engaged in the next module.

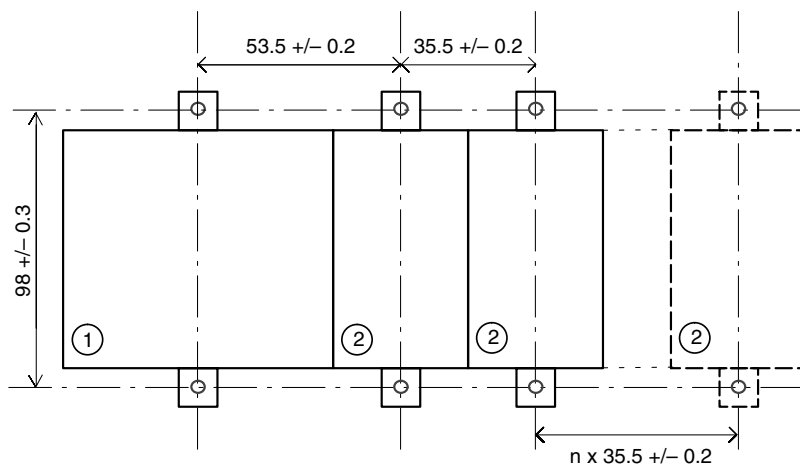
2.2.2 Wall-mounting

For wall-mounting, first slide the mounting slides on the rear side of the devices towards the **outside**. You can now wall-mount the IDEC SmartRelay by means of two mounting slides and two ϕ M4 screws (tightening torque 0.8 to 1.2Nm).



Drilling template for wall-mounting

Before you can wall-mount the IDEC SmartRelay, you need to drill holes using the template shown below.



- Tightening torque 0.8 to 1.2 Nm
- 1 IDEC SmartRelay Base
- 2 IDEC SmartRelay expansion module

2.3 Wiring IDEC SmartRelay

Wire IDEC SmartRelay using a screwdriver with a 3-mm blade.

You do not need wire ferrules for the terminals. Permitted conductor cross-sections:

- 1 x 2.5 mm²
- 2 x 1.5 mm² for each second terminal chamber

Tightening torque: 0.4...0.5 Nm or 3...4 lbs in

Recommended ferrules

Ferrules order No.

For 1-cable connection

Cross-section [mm ²]	AWG	Phoenix Contact Ferrule type No.	NIC HIFU Blade Terminals type No.	NIC HIFU Insulated Pin Terminals type No.
0.3	22	AI0,5-10WH	BT1.25-10-1	—
0.5	20	AI0,5-10WH		TGN-TC-1.25-11T
0.75	18	AI0,75-8GY		
1.25	18	AI1,5-8BK	BT1.25-10-1 BT2-9-1	
2.0	16	AI2,5-8BU	BT2-9-1	—
Recommended crimping tool		CRIMPFOX ZA 3	NH1 NH61	NH11 NH32 NH65

For 2-cable connection

Cross-section [mm ²]	AWG	Phoenix Contact Ferrule type No.
0.3	22	AI-TWIN2X0,5-8WH
0.5	20	AI-TWIN2X0,5-8WH
0.75	18	AI-TWIN2X0,75-8GY
1.25	18	AI-TWIN2X1,5-8BK
Recommended crimping tool		CRIMPFOX ZA 3

Note

Always cover the terminals after you have completed the installation. To protect IDEC SmartRelay adequately from impermissible contact to live parts, local standards must be complied with.

2.3.1 Connecting the power supply

IDEC SmartRelays (FL1D-*12RCC, FL1B-M08C2R2) are suitable for nominal line voltages of 100 V AC/DC and 240 V AC/DC. IDEC SmartRelays (FL1D-*12RCA, FL1B-M08D2R2) are suitable for a supply voltage of 24 V AC/DC. IDEC SmartRelays (FL1D-H12SND, FL1B-M08B1S2) are suitable for a supply voltage of 24 V DC. IDEC SmartRelays (FL1D-*12RCE, FL1B-M08B2R2) are suitable for a supply voltage of 12 V AC/DC or 24 V AC/DC.

Note the information on connection in the product information document shipped with your device and the technical specifications in Appendix A relating to permissible voltage tolerances, line frequency and current consumption.

Note

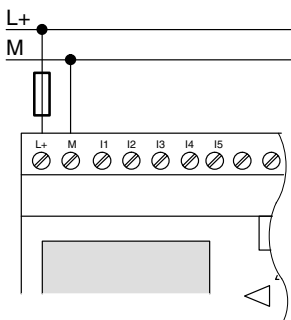
A power failure may cause an additional edge triggering signal at the special functions, for example.

Data of the last uninterrupted cycle are stored in IDEC SmartRelay.

Connecting IDEC SmartRelay

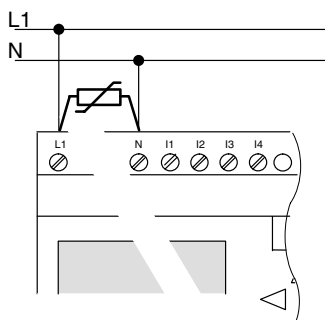
To connect IDEC SmartRelay to the power supply:

IDEC SmartRelay
with DC power supply



Protection with safety fuse
if required (recommended) for:
FL1D-H12RCE: 0.8 A
FL1D-H12SND: 2.0 A

IDEC SmartRelay
with AC power supply



To suppress surge voltages, install
varistors (MOV) with an operating
voltage at least 20 % above the rated
voltage.

Note

IDEC SmartRelay is a double-insulated switchgear. You do not need to connect an equipment grounding conductor.

Circuit protection with AC voltage

To suppress voltage peaks on the power supply lines, you can install a metal oxide varistor (MOV). Make sure that the operating voltage of the varistor (MOV) used lies at least 20 % above the rated voltage.

2.3.2 Connecting IDEC SmartRelay inputs

Requirements

At the inputs you connect sensor elements such as: momentary switches, switches, light barriers, daylight control switches etc.

Sensor characteristics for IDEC SmartRelay

	FL1D-H12RCE FL1D-B12RCE FL1B-M08B2R2^{(1),(2)}		FL1D-H12SND FL1B-M08B1S2^{(3),(4),(5)}	
	I1 ... I6	I7, I8	I1 ... I6	I7, I8
Signal status 0	< 5 VDC	< 5 VDC	< 5 VDC	< 5 VDC
Input current	< 0.85 mA ⁽¹⁾	< 0.05 mA	< 0.85 mA ⁽³⁾	< 0.05 mA
Signal status 1	> 8.5 V DC ⁽²⁾	> 8.5 V DC	> 12 V DC ⁽⁴⁾	> 12 V DC
Input current	> 1.5 mA	> 0.1 mA	> 2 mA ⁽⁵⁾	> 0.15 mA
	FL1D-H12RCA/ FL1D-B12RCA (AC) FL1B-M08D2R2 (AC)	FL1D-H12RCA/ FL1D-B12RCA (DC) FL1B-M08D2R2 (DC)	FL1D-H12RCC/ FL1D-B12RCC (AC) FL1B-M08C2R2 (AC)	FL1D-H12RCC/ FL1D-B12RCC (DC) FL1B-M08C2R2 (DC)
Signal status 0	< 5 V AC	< 5 V DC	< 40 V AC	< 30 V DC
Input current	< 1.0 mA	< 1.0 mA	< 0.03 mA	< 0.03 mA
Signal status 1	> 12 V AC	> 12 V DC	> 79 V AC	> 79 V DC
Input current	> 2.5 mA	> 2.5 mA	> 0.08 mA	> 0.08 mA

(1) : 1.0 mA (Version 1 to 5 specifications)

(2) : 8 V DC (Version 1 to 5 specifications)

(3) : 1.0 mA (Version 1 to 4 specifications)

(4) : 8 V DC (Version 1 to 4 specifications)

(5) : 1.5 mA (Version 1 to 4 specifications)

For identifying the version, see page 4.

Note

The digital inputs of FL1D-H12RCC/FL1D-B12RCC are divided into two groups, each consisting of four inputs. **Within** the same group, all inputs must be operated on the **same** phase. **Different** phases are only possible **between** the groups.

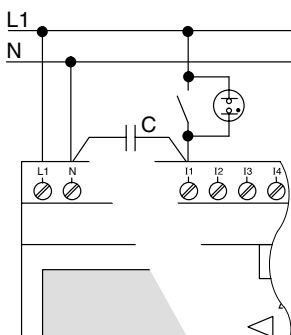
Example: I1 to I4 on phase **L1**, I5 to I8 on phase **L2**.

Inputs within the FL1B-M08C2R2 may **not** be connected to different phases.

Sensor connections

Connecting glow lamps and 2-wire proximity switches (Bero) to FL1D-H12RCC/FL1D-B12RCC or FL1B-M08C2R2 (AC)

The figure below shows how you connect a switch with a glow lamp to IDEC SmartRelay. The current that flows through the glow lamp allows IDEC SmartRelay to detect a "1" signal even though the switch contact is not closed. If, however, you use a switch the glow lamp of which is fitted with a power supply, this response does not occur.



Take into account the quiescent current of any 2-wire proximity switches used into account. The level of the quiescent current of some 2-wire proximity switches is high enough to trigger a logical "1" signal at the IDEC SmartRelay input. You should therefore compare the quiescent current of the proximity switches with the technical data of inputs Appendix A.

Remedy

To suppress this response, use an X capacitor rated at 100 nF and 2.5 kV. In a destructive situation, this type of capacitor safely disconnects. You must choose the voltage level for which the capacitor is rated such that it is not destroyed in the case of overvoltage!

At 230 V AC, the voltage between N and an input I(n) must not be greater than 40 V to guarantee a “0” signal. You can connect approximately ten glow lamps to the capacitor.

Restrictions

- Signal status transitions $0 \rightarrow 1$ / $1 \rightarrow 0$

After a 0 to 1 or 1 to 0 transition, the signal must remain constant at the input at least for the duration of one program cycle, so that IDEC SmartRelay can detect the new signal status.

The program execution time is determined by the size of the circuit program. Appendix B contains a benchmark test routine that you can use to determine the current scan cycle time.

Special features of FL1D-H12RCE/FL1D-B12RCE and FL1D-H12SND

- High-speed inputs: I5 and I6

These versions are also equipped with high-speed counting inputs (up/down counters, frequency triggers). The restrictions mentioned earlier do not apply to these high-speed inputs.

Note

The high-speed inputs I5 and I6 are the same as in the previous versions FL1A to FL1C, i.e. a circuit program that is written in these versions can be transferred to the new FL1D units by means of the programming software WindLGC, without any changes to these features.

Expansion modules do not have high-speed inputs.

- *Analog inputs: I7 and I8*

The inputs I7 and I8 of IDEC SmartRelay versions FL1D-H12RCE/FL1D-B12RCE and FL1D-H12SND can be used both as standard digital inputs and as analog inputs. The input mode is defined in the IDEC SmartRelay circuit program. The inputs I7 / I8 provide digital functions, and the inputs AI1 and AI2 provide analog functions.

See also Chapter 4.1.

When using inputs I7 and I8 as analog ones, only the range from 0 to 10 V DC is available.

Connecting a potentiometer to inputs I7 / I8

To allow you to achieve 10 V as the maximum value when you completely turn the potentiometer once, you must connect a series resistor on the potentiometer's input side regardless of the input voltage (see figure below).

We suggest the following sizes of potentiometers and associated series resistors:

Voltage	Potentiometer	Series Resistor
12 V	5 k Ω	—
24 V	5 k Ω	6.6 k Ω

When using a potentiometer and 10 V input voltage as the maximum value, you must ensure that with a connected input voltage of 24 V, 14 V must release via the series resistor so that a maximum of 10 V are supplied when you turn the potentiometer one full rotation. With a voltage of 12 V, this can be neglected.

Note

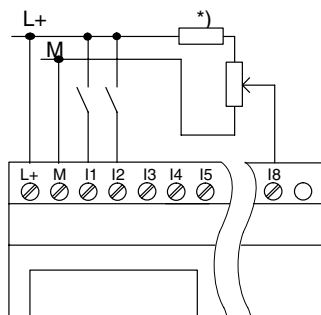
The FL1B-J2B2 expansion module provides additional analog inputs.

Always use twisted and shielded cables for analog signals, and keep these as short as possible.

Sensor connections

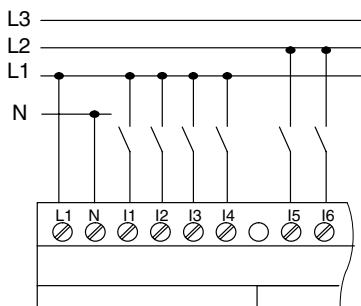
To connect sensors to the IDEC SmartRelay :

FL1D-H12RCA / FL1D-B12RCA / FL1D-H12RCE / FL1D-B12RCE / FL1D-H12SND



The inputs of these devices are not isolated and therefore require a common reference potential (chassis ground).
With FL1D-H12RCE/FL1D-B12RCE and FL1D-H12SND modules, you can tap analog signals between the supply voltage and chassis ground
(* = series resistor with 24 V DC).

FL1D-H12RCC / FL1D-B12RCC



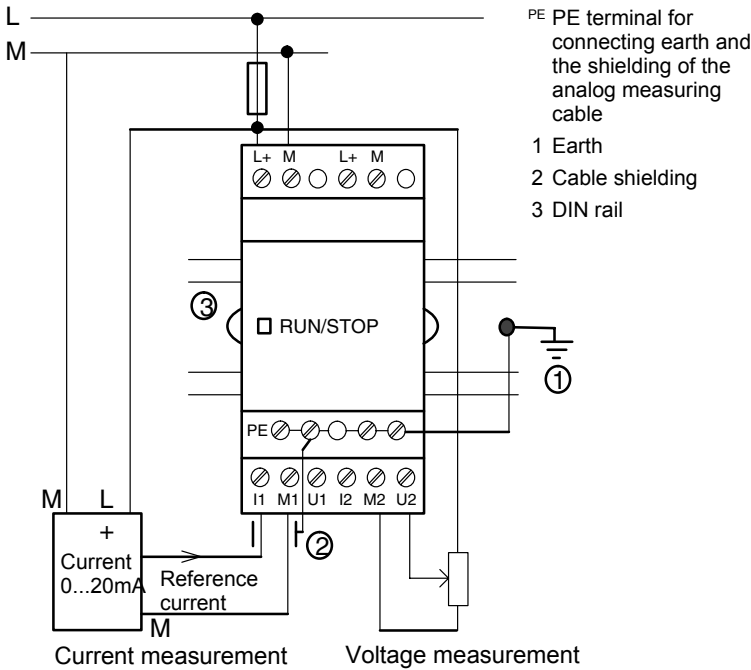
The inputs of these devices are arranged in 2 groups, each consisting of 4 inputs. Different phases are only possible between blocks, but not within the blocks.



Warning

Current safety regulations (VDE 0110, ... and IEC 61131-2, ... as well as cULus) do not permit the connection of different phases to an AC input group (I1 to I4 or I5 to I8) or to the inputs of a digital module.

FL1B-J2B2



The illustration above shows an example of four-wire current measurement and two-wire voltage measurement.

Connecting a two-wire sensor to the FL1B-J2B2

Wire up the two-wire sensor's connecting wires as follows:

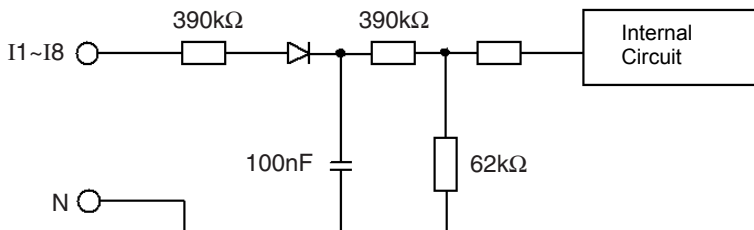
1. Connect the sensor's output to connection U (0 ... 10 V voltage measurement) or to connection I (0 ... 20 mA current measurement) of the FL1B-J2B2 module.
2. Connect the plus connector on the sensor to the 24 V supply voltage (L+).

Connect the ground connection on the sensor to the corresponding M input (M1 or M2) on the FL1B-J2B2 module.

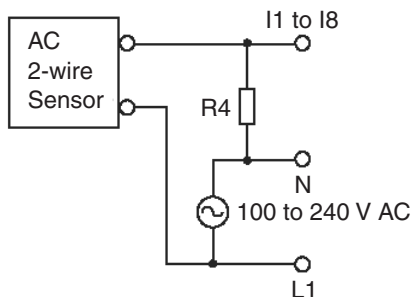
Input Internal Circuit

FL1D-H12RCC / FL1D-B12RCC / FL1B-M08C2R2

Digital AC/DC Input



When using the AC two-wire sensor



Note : Bleeder resistance (R4) calculation

R4 must satisfy the following three conditions.

$$\text{Condition 1: } R4 (\Omega) \leq \frac{\text{Maximum input OFF voltage (= 40V AC)}}{\text{Maximum sensor leakage current (A)}}$$

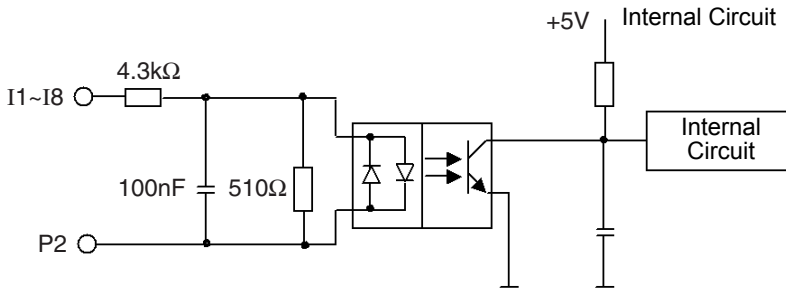
$$\text{Condition 2: } R4 (\Omega) \leq \frac{\text{Sensor power voltage (V)}}{\text{Minimum sensor load current (A)}}$$

The voltage drop across the load (R4) must be less than 40V while the sensor is turned off.

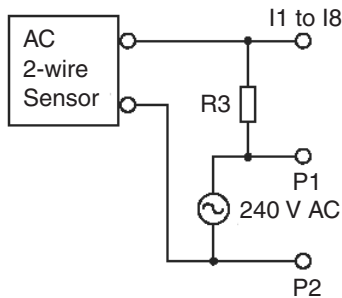
$$\text{Condition 3: } PR4 (W) \geq \frac{\{\text{Sensor power voltage (V)}\}^2}{R4 \text{ resistance } (\Omega)} \times 3 \text{ (3: recommended allowance)}$$

FL1D-H12RCA / FL1D-B12RCA / FL1B-M08D2R2

Digital AC/DC Input



When using the AC two-wire sensor



Note : Bleeder resistance (R3) calculation

R3 must satisfy the following three conditions.

$$\text{Condition 1: } R3 (\Omega) \leq \frac{\text{Maximum input OFF voltage } (= 5V \text{ AC})}{\text{Maximum sensor leakage current (A)}}$$

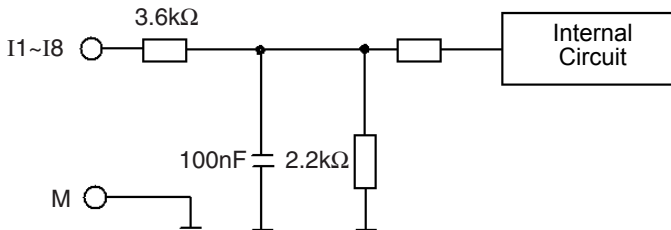
$$\text{Condition 2: } R3 (\Omega) \leq \frac{\text{Sensor power voltage (V)}}{\text{Minimum sensor load current (A)}}$$

The voltage drop across the load (R3) must be less than 5V while the sensor is turned off.

$$\text{Condition 3: } P_{R3} (W) \geq \frac{\{\text{Sensor power voltage (V)}\}^2}{R3 \text{ resistance } (\Omega)} \times 3 \text{ (3: recommended allowance)}$$

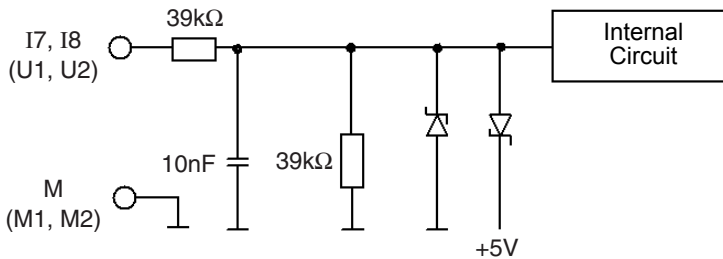
**FL1D-H12RCE / FL1D-B12RCE / FL1D-H12SND / FL1B-M08B2R2/
FL1B-M08B1S2**

Digital DC Input



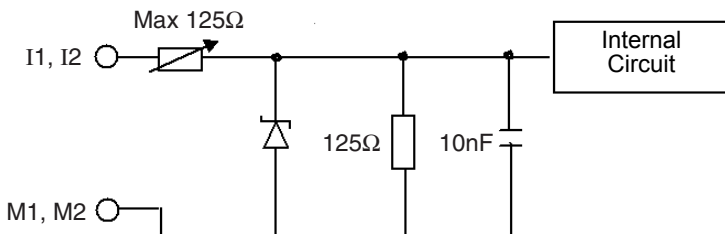
FL1D-H12RCE / FL1D-B12RCE / FL1D-H12SND / FL1B-J2B2

Analog Input (0-10V)



FL1B-J2B2

Analog Input (0-20mA)



Note

Fluctuating analog values are due to screening on the connecting wire from the analog valuator device to the analog FL1B-J2B2 IDEC SmartRelay expansion module (encoder wire) that has either been mounted incorrectly or not at all.

To avoid fluctuating analog values when using these expansion modules, proceed as follows:

- Use only shielded encoder wires.
 - Shorten the encoder wire as much as possible. The encoder wire must not be more than 10 meters long.
 - Clamp the encoder wire on one side only and clamp it only to the PE terminal on the FL1B-J2B2/FL1D-K2B2 expansion module.
 - Connect ground on the encoder supply to the PE terminal on the expansion module.
-

2.3.3 Connecting outputs

FL1D-H12RCA / FL1D-B12RCA / FL1D-H12RCC / FL1D-B12RCC / FL1D-H12RCE / FL1D-B12RCE

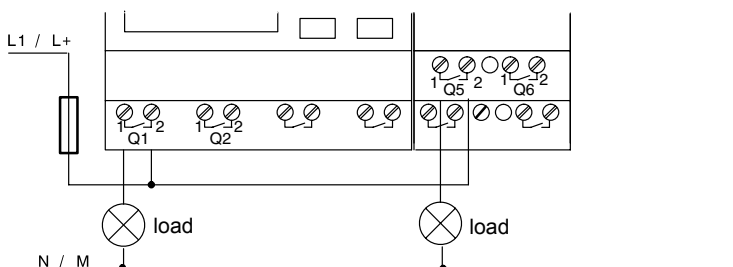
These units are equipped with relay outputs. The potential of the relay contacts is isolated from the power supply and the inputs.

Requirements for relay outputs

You can connect various loads to the outputs, e.g. lamps, fluorescent lamps, motors, contactor relays etc. For information on the properties required for the loads connected to the these units, refer to Appendix A.

Connecting

This is how you connect the load:



Protection with automatic circuit-breaker, max. 16 A, characteristics B16, e.g.: Power circuit-breaker 5SX2 116-6 (if required)

IDEC SmartRelay with transistor outputs

IDEC SmartRelay versions with transistor outputs can be identified by the fact that the letter **R** is missing from their type name. The outputs are short circuit-proof and over-load-proof. An auxiliary load voltage supply is not necessary, because IDEC SmartRelay supplies the load voltage.

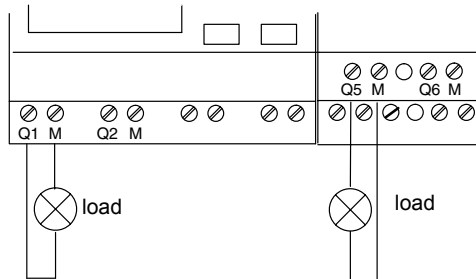
Requirements for transistor outputs

The load connected to IDEC SmartRelay must have the following characteristics:

- The maximum switched current is 0.3 A per output.

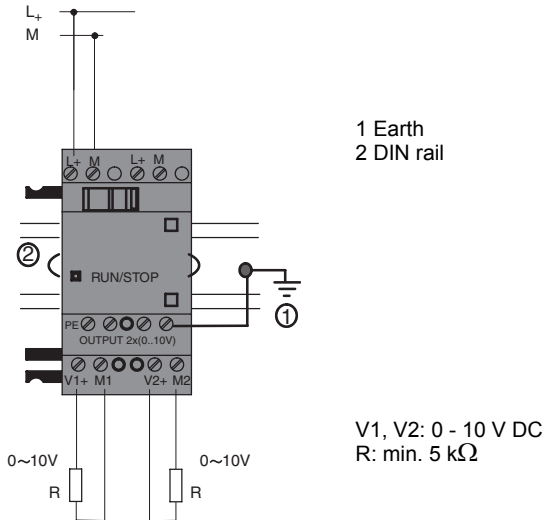
Connecting

This is how you connect the load to a IDEC SmartRelay with transistor outputs:



Load: 24 V DC, 0.3 A max.

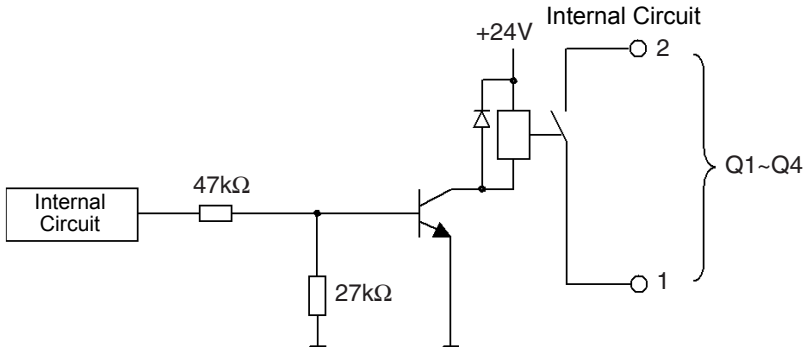
FL1D-K2B2



Output Internal Circuit

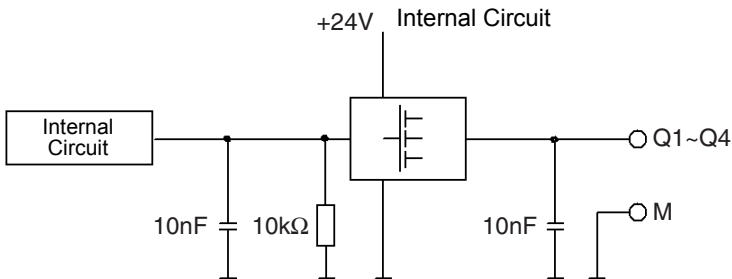
**FL1D-H12RCA / FL1D-B12RCA / FL1D-H12RCC / FL1D-B12RCC /
FL1D-H12RCE/ FL1D-B12RCE / FL1B-M08B2R2 / FL1B-M08C2R2/
FL1B-M08D2R2**

Relay Output



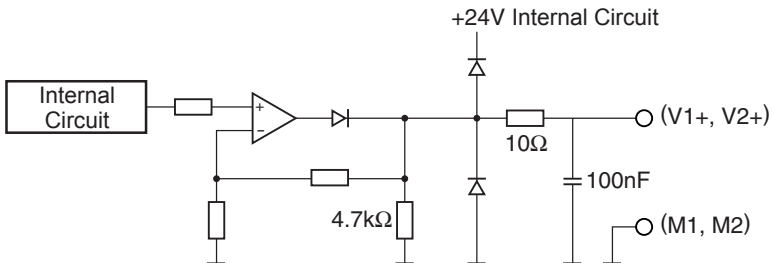
FL1D-H12SND / FL1B-M08B1S2

Transistor Output (Source)



FL1D-K2B2

Analog Output (0-10V)



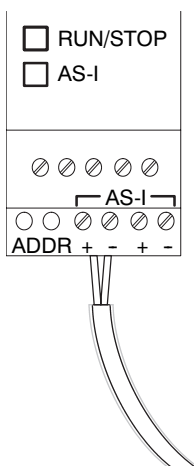
2.3.4 Connecting the AS interface bus

To set the address of the module on the AS interface bus, you need an addressing unit.

Valid addresses are in the range of 1 to 31. Use each address once only.

You can set the address on the AS interface bus before or after installation.

If the installed module is addressed via the address socket, the AS-Interface voltage must be disconnected beforehand. This is necessary for safety reasons.



Networking on the AS interface bus

To make the connection to the AS interface bus, you need a communications-capable IDEC SmartRelay variant:

- IDEC SmartRelay base module + FL1B-CAS2.
- an AS interface power supply and
- an AS interface master.

IDEC SmartRelay can only be accepted as a slave on the AS interface bus. This means that it is not possible to directly exchange data between two IDEC SmartRelay devices. Data is always exchanged across the AS interface master.



Warning

The AS-Interface and IDEC SmartRelay systems must **never** be connected together electrically!
 Use safe isolation acc. to IEC 61131-2, EN 50178, UL 508, CSA C22.2 No. 142.

Logic Assignments

IDEC SmartRelay system		AS Interface system
Inputs		Output data bits
I _n		D0
I _{n+1}		D1
I _{n+2}		D2
I _{n+3}		D3
Outputs		Output data bits
Q _n		D0
Q _{n+1}		D1
Q _{n+2}		D2
Q _{n+3}		D3

“n” depends on the plug-in position of the expansion module relative to the IDEC SmartRelay Base. It indicates the number of the input or output in IDEC SmartRelay program code.

Note

Ensure that there is enough space for the inputs/outputs of the AS interface in the IDEC SmartRelay’s address space. If you are already using more than 12 physical outputs or more than 20 physical inputs, it is no longer possible to operate the FL1B-CAS2!

2.4 Putting into operation

2.4.1 Switching on the IDEC SmartRelay/Power On

IDEC SmartRelay does not have a power switch. The reaction of IDEC SmartRelay during startup depends on

- Whether a circuit program is stored in IDEC SmartRelay
- Whether a memory cartridge (card) is inserted
- Whether this is an IDEC SmartRelay version without display unit (FL1D-B12...)
- The status of IDEC SmartRelay at the time of power failure.

All possible reaction of IDEC SmartRelay are described on the following page.

To ensure that the expansion module on IDEC SmartRelay changes to RUN mode, check the following:

- Has the sliding contact between IDEC SmartRelay and the expansion module snapped into place properly?
- Is the power supply connected to the expansion module?
- In addition, always ensure that you switch on the power supply to the expansion module first before activating the power supply to the IDEC SmartRelay base module (or activate both power supplies at the same time); if you do not do this, the system does not detect the expansion module when you start up the IDEC SmartRelay base module.

Note

After power-up, the FL1D performs initialization. After completing initialization, the FL1D is ready to start to run. During initialization, a sandglass is displayed on the CPU module with display, or the LED is lit red on the CPU module without display.

Initialization time (regardless of expansion module)

When a memory cartridge is installed: Max. 10 sec

When a memory cartridge is not installed: Max. 9 sec

* The initialization time depends on the program size.

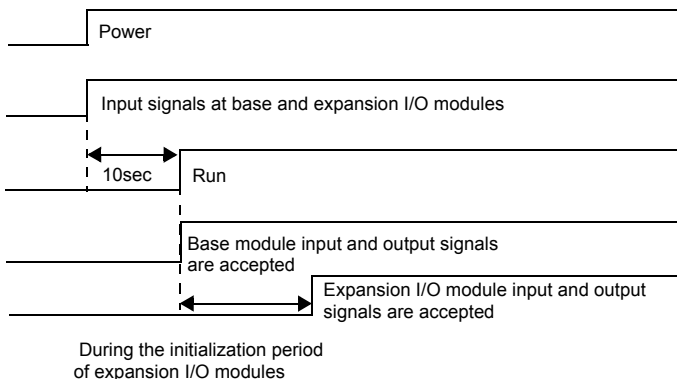
Notes for Using Expansion I/O Modules

When using 3 or more expansion I/O modules including those of the versions listed below, immediately after power-up, it takes a specific period of time for the base module to accept input signals from the expansion I/O modules. Until the output terminals on the expansion I/O module are actually turned on or off.

Expansion I/O Modules

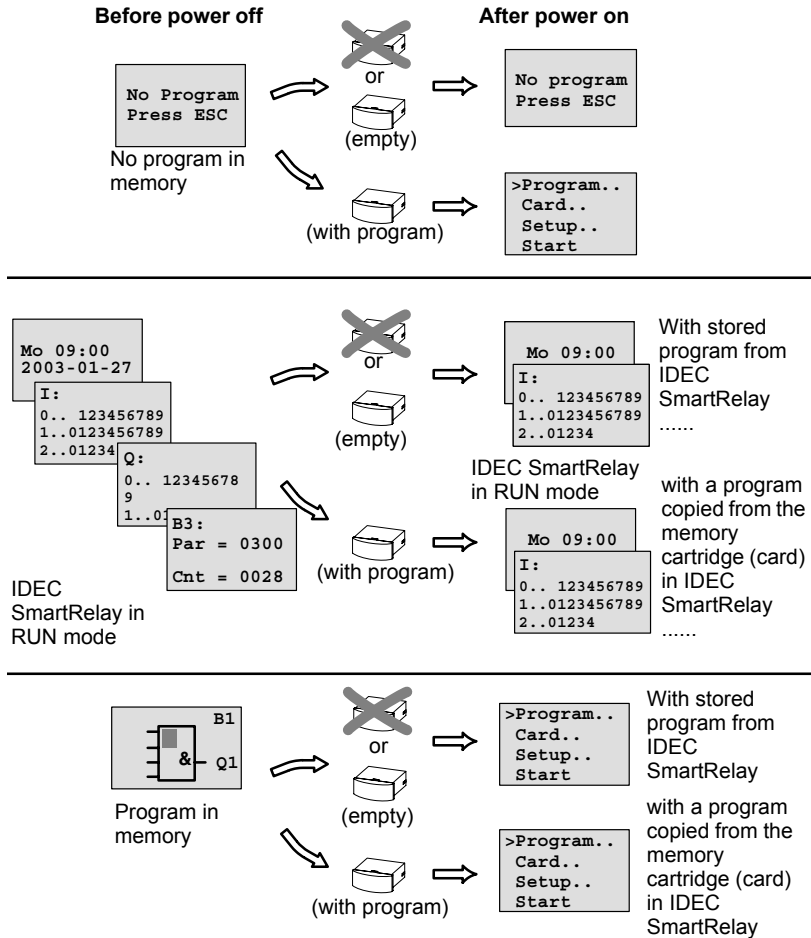
FL1B-M08C2R2(Version 1 to 3),
FL1B-M08B1S2(Version 1 to 5),
FL1B-M08B2R2(Version 1 to 6),
FL1B-M08D2R2(Version 1 to 3),
FL1B-J2B2(Version 1 to 4),
FL1D-K2B2(Version 1)

For identifying the version, see page 4.



* During the initialization period of expansion I/O modules, inputs and outputs are off. In addition, the length of initialization period varies with expansion I/O modules, and I/O response depends on the expansion I/O modules.

For further information, see our Internet address
(URL: <http://www.idec.com/faq/en/controller/>).



You can also memorize four simple rules for starting IDEC SmartRelay :

1. If neither IDEC SmartRelay nor the inserted memory cartridge (card) contains a circuit program, IDEC SmartRelay (with display unit) reports: 'No Program / Press ESC'.
2. A circuit program on the memory cartridge (card) is automatically copied to IDEC SmartRelay. The circuit program in IDEC SmartRelay is overwritten.
3. If there is a circuit program in IDEC SmartRelay or on the memory cartridge (card), IDEC SmartRelay adopts the operational state it had prior to POWER-OFF. Versions without display unit (FL1D-B12...) automatically change from STOP to RUN (LED changes from red to green).
4. If you have enabled retentivity at least for one function, or a function is permanently retentive, the current values are retained at POWER-OFF.

Note

When a power failure occurs while you are entering a circuit program, the program in IDEC SmartRelay will be deleted after power is returned.

Before you modify the circuit program, you should therefore save a backup copy of your original to a memory cartridge (card) or to a computer (WindLGC).

2.4.2 Operating states

IDEC SmartRelay Base operating states

IDEC SmartRelay Base/Pure knows two operating states: STOP and RUN

STOP	RUN
<ul style="list-style-type: none"> The display shows: 'No Program' (not FL1D-B12...) Switching IDEC SmartRelay to programming mode (not FL1D-B12...) LED is red (only FL1D-B12...) 	<ul style="list-style-type: none"> Display: Screen mask for monitoring I/Os and messages (after START in the main menu) (not FL1D-B12...) Switching IDEC SmartRelay to parameter assignment mode (not FL1D-B12...) LED is green (only FL1D-B12...)
<p>Action of IDEC SmartRelay:</p> <ul style="list-style-type: none"> The inputs data is not read. The circuit program is not executed The relay contacts are permanently open or the transistor outputs are switched off 	<p>Action of IDEC SmartRelay:</p> <ul style="list-style-type: none"> IDEC SmartRelay reads the status of the inputs IDEC SmartRelay uses the circuit program to calculate the status of the outputs IDEC SmartRelay switches the relay/transistor outputs on or off

Note

After switching the mains on, the system briefly switches through the outputs on the FL1D-H12SND. With an open circuit, a voltage of > 8 V can occur for up to approximately 100 ms; when loaded, this time reduces to a matter of microseconds.

IDEC SmartRelay expansion modules, operating states

IDEC SmartRelay expansion modules know three operating states: The LED is lit green, red or orange.

LED is lit		
Green (RUN)	Red (STOP)	Orange
The expansion module communicates with the device to its left	The expansion module does not communicate with the device to its left	Initialization phase of the expansion module

FL1B-CAS2, communication states

The FL1B-CAS2 knows three communication states: The LED is lit green, red or flashes red/yellow.

LED AS-I is lit		
Green	Red	Red/Yellow
AS Interface communication OK	AS Interface communication failed	Slave has address "0"

FL1B-CAS2, behaviour on communication failure

- If the FL1B-CAS2 voltage fails, communication between the IDEC SmartRelay system and the expansion modules, which are arranged to the right of the FL1B-CAS2 expansion module, is interrupted. Recommendation: Position FL1B-CAS2 on the far right-hand side!
- If communication is interrupted, the switching outputs are reset after about 40 to 100 ms.

3 Programming IDEC SmartRelay

Getting started with IDEC SmartRelay

Programming in our context refers to the creation of a circuit program. A IDEC SmartRelay circuit program is actually nothing more than a circuit diagram presented in a slightly different form!

We have adapted this presentation to the IDEC SmartRelay display field. In this chapter we will show you how to use IDEC SmartRelay to create the IDEC SmartRelay circuit programs for your application.

At this point, we once again refer to WindLGC, which is the IDEC SmartRelay programming software you can use to quickly and easily create, test, modify save and print the circuit programs. The topics in this manual relate only to the creation of circuit programs on the actual IDEC SmartRelay, because the programming software WindLGC already contains an extensive Online Help. See also Chapter 7.

Note

IDEC SmartRelay versions without display unit, i.e. the FL1D-B12RCE, FL1D-B12RCA and FL1D-B12RCC units, do not have an operator panel and display unit. They are primarily designed for use in small machine and process equipment engineering systems for series production.

FL1D-B12... versions are not programmed directly at the unit. Instead, the circuit program is downloaded to this device by means of WindLGC or memory cartridges (cards) of other IDEC SmartRelay FL1D units.

IDEC SmartRelay versions without display can not write data to memory cartridges (cards).

See Chapter 6, 7 and Appendix C.

A small example in the first part of this chapter introduces the operating principle of IDEC SmartRelay.

- We shall first show you the meaning of two basic terms, namely the **connector** and the **block**.
- As the next step, we shall create a circuit program based on a simple conventional circuit, which you ...
- can enter directly in IDEC SmartRelay in the third step.

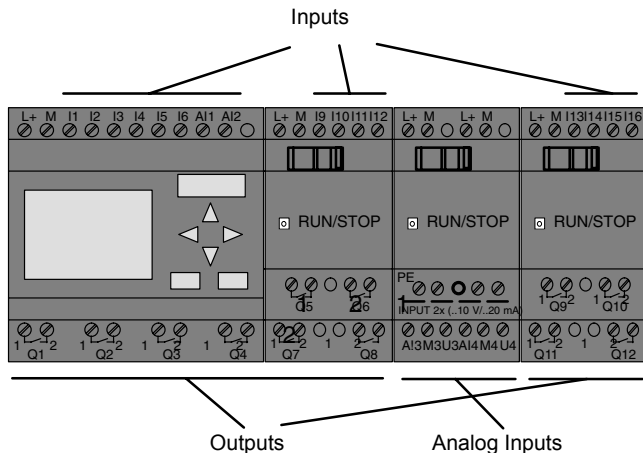
It will take you only a few pages of this manual store your first executable circuit program in the IDEC SmartRelay unit.

With a suitable hardware (switches etc.), you will then be able to carry out first tests.

3.1 Connectors

IDEC SmartRelay is equipped with inputs and outputs

Example of a configuration with several modules:



Each input is identified by the letter I plus a number. When you look at IDEC SmartRelay from the front, you can see the input terminals at the top. Only the analog modules FL1B-J2B2 has the inputs at the bottom.

Each output is identified by the letter Q plus a number (FL1D-K2B2: AQ plus number). In the figure, you can see the output terminals at the bottom.

Note

IDEC SmartRelay can recognize, read and switch the I/O of all expansion modules, regardless of their type. The I/Os are presented in the installation order of the modules.

The following I/Os and marker blocks are available for creating your circuit program: I1 to I24, AI1 to AI8, Q1 to Q16, AQ1, AQ2, M1 to M24 and AM1 to AM6. Also available are the shift register bits S1 to S8, 4 cursor keys C▲, C▶, C▼ and C◀, as well as 16 blank outputs X1 to X16. See Chapter 4.1 for more details.

The following applies to the inputs I7 and I8 of FL1D-H12RCE/FL1D-B12RCE and FL1D-H12SND versions: If I7 or I8 is used in the circuit program, this input signal is digital; signals at AI1 or AI2 are analog.

IDEC SmartRelay's connectors

The term connector refers to all connections and states in IDEC SmartRelay.

The digital I/O status can be '0' or '1'. Status '0' means that the input does not carry a voltage. Status '1' means that the input carries voltage.

The 'hi', 'lo' and 'x' connectors have been introduced to make it easier for you to create the circuit program:






'hi' (high) is assigned the status '1',

'lo' (low) is assigned the status '0'.

You do not have to use all the of connectors of a block. The circuit program automatically assigns the unused connectors a status that ensures proper functioning of the relevant block. If you prefer to do so, you can identify unused connectors with an 'x'.

For information on the meaning of the term “block”, refer to Chapter 3.2.

IDEC SmartRelay knows the following connectors:

Con- nectors	IDEC SmartRelay Base / Pure		DM	AM	FL1D- K2B2
	 				
Inputs	FL1D-H12RCC FL1D-B12RCC FL1D-H12RCA FL1D-B12RCA	Two groups: I1... I4 and I5 ... I8	I9 ... I24	AI1...AI8	none
	FL1D-H12RCE FL1D-B12RCE FL1D-H12SND	I1... I6, I7, I8 AI1, AI2	I9 ... I24	AI3...AI8	
Outputs	Q1...Q4		Q5 ... Q16	none	AQ1, AQ2
lo	Logical '0' signals (off)				
hi	Logical '1' signals (on)				
x	An existing connection that is not used				

DM: Digital module.

AM: Analog module.

3.2 Blocks and block numbers

This chapter shows you how to use IDEC SmartRelay elements to create complex circuits and how blocks and I/O are interconnected.

In Chapter 3.3 we are going to show you how to transform a conventional circuit to obtain a IDEC SmartRelay circuit program.

Blocks

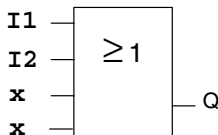
A block in IDEC SmartRelay represents a function that is used to convert input information into output information. Previously you had to wire the individual elements in a control cabinet or terminal box.

When you create the circuit program, you interconnect the blocks. To do so, simply select the connection you require from the **Co** menu. The menu name Co is an abbreviation of the term “Connector”.

Logic operations

The most elementary blocks are the logic operations:

- AND
- OR
- ...



Inputs I1 and I2 are here connected to the OR block. The last two inputs of the block remain unused and are identified by the creator of the circuit program with an 'x'.

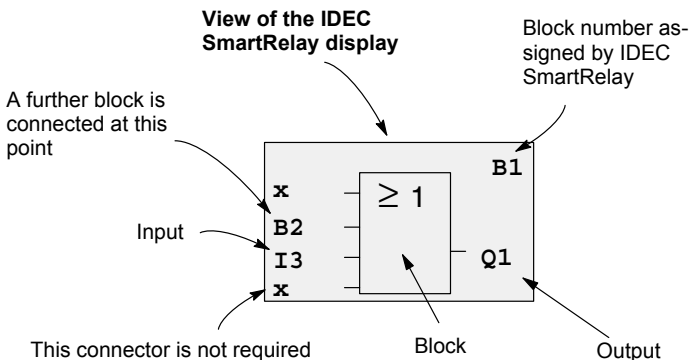
These special functions offer you a significantly greater performance:

- Current impulse relay
- Up/down counter
- On-delay
- Softkey
-

Chapter 4 gives a full list of the IDEC SmartRelay functions.

Block representation on the IDEC SmartRelay display

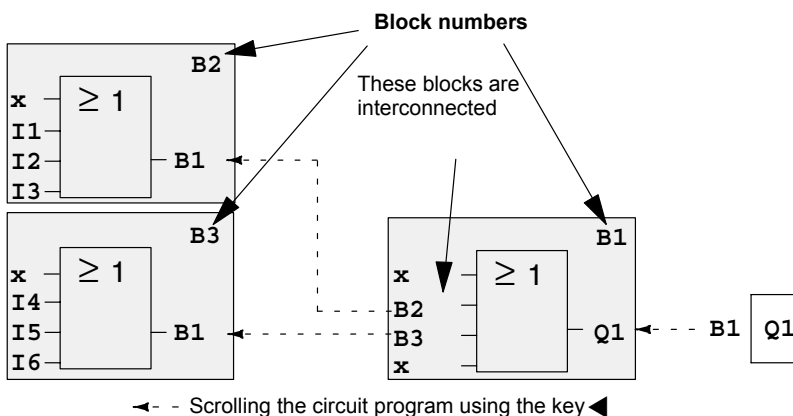
The figure below shows a typical view of the IDEC SmartRelay display. As you can see, it can show only one block at a time. We have therefore introduced block numbers to help you check the circuit structure.



Assigning a block number

IDEC SmartRelay assigns each new block a circuit program a block number.

IDEC SmartRelay uses these block numbers to indicate the block interconnections. This means that these numbers are mainly an aid to your orientation in the circuit program.



The figure above shows you three views of the IDEC SmartRelay display, which represent the circuit program. As you can see, IDEC SmartRelay interconnects the blocks using their numbers.

Advantages of block numbers

You can connect almost any block to an input of the current block by means of its block number. In this way, you can re-use the interim results of logical or other operations, reduce programming effort, save memory space and clean up your circuit layout. To do so, however, you need to know how IDEC SmartRelay has named the blocks.

Note

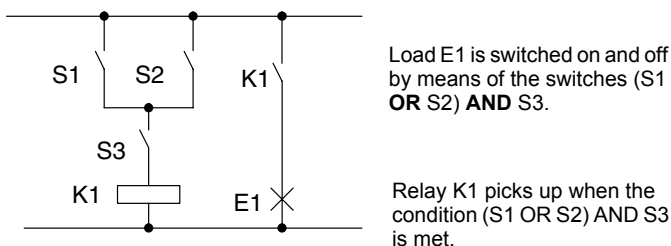
We advise you to create an organizational program chart. You will find this a valuable aid when you create the circuit program, because you can enter in this chart all block numbers that IDEC SmartRelay assigns.

By using the WindLGC software to program IDEC SmartRelay, you can directly create a function chart of your circuit program. WindLGC also allows you to assign eight-character names to up to 64 blocks, and to view these on the IDEC SmartRelay display in parameter assignment mode (see Chapter 3.4).

3.3 The way to IDEC SmartRelay, starting with the circuit diagram

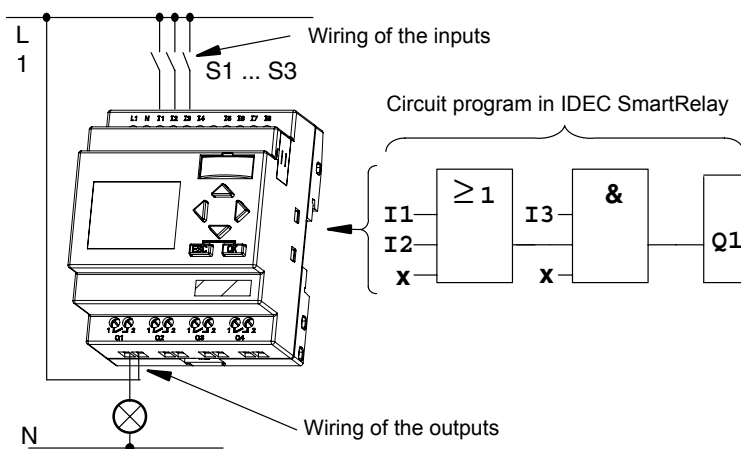
View of a circuit diagram

You know, of course, how a circuit logic is represented in a circuit diagram. Nevertheless, here is an example:



Creating this circuit with IDEC SmartRelay

In IDEC SmartRelay you create a circuit logic by interconnecting blocks and connectors:



Note

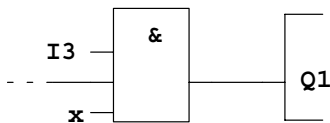
Although you have four inputs available for logic operations (Basic functions, see Chapter 4.2), most of the views will only show three inputs for reasons of clarity. You program this fourth input and assign parameters just like you do with the other three inputs.

To create a circuit logic in IDEC SmartRelay, start at the circuit output.

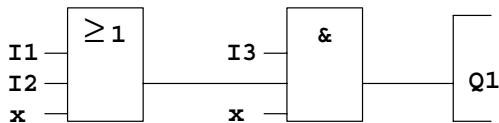
The output is the load or relay that is to be switched.

Convert the circuit logic into blocks by working through the circuit, starting at the output and ending at the input:

Step 1: The normally open contact S3 is interconnected in series to output Q1 and to a further circuit element. A series connection corresponds with the AND block:



Step 2: S1 and S2 are connected in parallel. A parallel circuit corresponds with the OR block:



Unused inputs

The circuit program automatically assigns the unused connectors a status that ensures proper functioning of the relevant block. If you like, you can label unused connectors with an 'x' identifier.

In our example we shall use only two inputs of the OR block and two inputs of the AND block; the relevant unused third and fourth inputs are identified at the connector with an 'x'.

Now connect the I/Os to IDEC SmartRelay.

Wiring

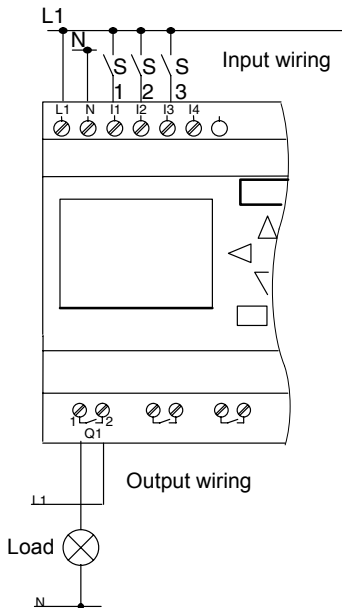
Connect the switches S1 to S3 to the screw terminals of your IDEC SmartRelay :

- S1 to connector I1 of IDEC SmartRelay
- S2 to connector I2 of IDEC SmartRelay
- S3 to connector I3 of IDEC SmartRelay

The output of the AND block controls the relay at output Q1.
The load E1 is connected to output Q1.

Wiring example

The following figure shows you the wiring, based on the FL1D-H12RCC/-B12RCC.



3.4 The four golden rules for operating IDEC SmartRelay

Rule 1

Changing the operating mode

- You create the circuit program in **programming mode**. After power is on, and when the display shows “No Program / Press ESC”, press the **ESC** key to select programming mode.
- Timer and parameter values of an existing circuit program can be edited both in **parameter assignment mode** and in **programming mode**. During **parameter assignment** IDEC SmartRelay is in **RUN mode**, i.e. it continues executing the circuit program (see Chapter 5). To work in **programming mode**, you need to terminate the circuit program by calling the “**Stop**” command.
- Select the 'Start' command on the main menu to set **RUN mode**.
- When the system is in **RUN**, you can return to **parameter assignment mode** by pressing the **ESC** key.
- When **parameter assignment mode** is open and you want to return to **programming mode**, select the “**Stop**” command from the parameter assignment menu, and confirm “**Stop Prg**” prompt with “**Yes**”. To do so, move the cursor to “**Yes**” and confirm with OK.

For more details on operating modes, refer to Appendix D.

Rule 2

Outputs and inputs

- Always create your circuit program by working from the output to the input.
- You can connect an output to several inputs, but not the same input to several outputs.
- Within the same program path you may not connect an output to an upstream input. For such internal recursions you should interconnect memory markers or outputs.

Rule 3

Cursor and cursor movement

The following applies when you edit a circuit program:

- You can **move the cursor** when it appears in the form of an underscore:
 - Press ◀, ▶, ▼ or ▲ to move the cursor in the circuit program.
 - Press **OK** to change to "Select connector/block"
 - Press **ESC** to exit programming mode.
- You **select a connector/block**
- when the cursor appears as solid square
 - Press ▼ or ▲ to select a connector or a block.
 - Confirm with OK.
 - Press **ESC** to return to the previous step.

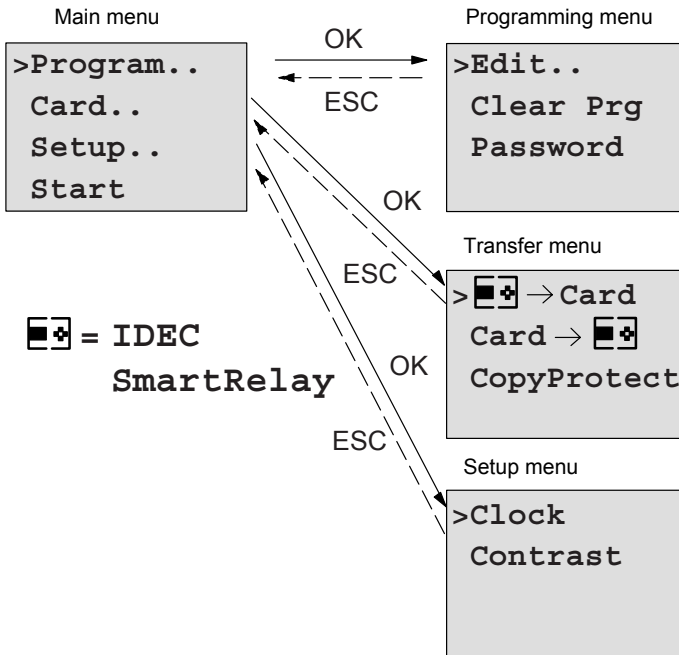
Rule 4

Planning

- Before you start to create a circuit program, you should either first create design on paper or program IDEC SmartRelay directly using WindLGC.
- IDEC SmartRelay can only save complete and faultless circuit programs.

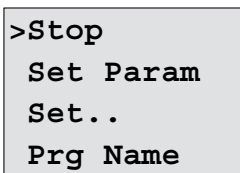
3.5 Overview of IDEC SmartRelay menus

Programming mode



Parameter assignment mode

Parameter assignment menu



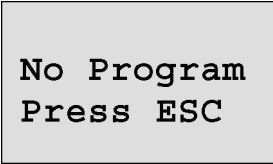
For more details on these menus, refer to Appendix D.

3.6 Writing and starting the circuit program

After you have designed a circuit, you want to write it to your IDEC SmartRelay. The small example below shows how to do this.

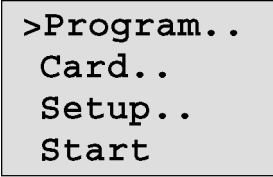
3.6.1 Select programming mode

You have connected IDEC SmartRelay to the power supply and switched it on. The display now shows you the message:



```
No Program  
Press ESC
```

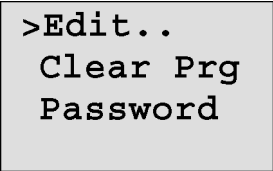
Switch IDEC SmartRelay to programming mode by pressing **ESC**. This will take you to the main menu of IDEC SmartRelay:



```
>Program..  
Card..  
Setup..  
Start
```

IDEC SmartRelay's main menu

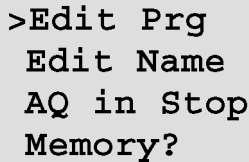
The first character in the first line is the ">" cursor. Press ▲ and ▼ to move the ">" cursor up and down. Move it to "Program.." and confirm with **OK**. IDEC SmartRelay opens the programming menu.



```
>Edit..  
Clear Prg  
Password
```

IDEC SmartRelay's programming menu

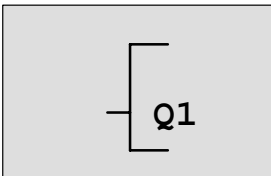
Here you can also move the ">" cursor by pressing ▲ and ▼. Move the ">" cursor to "**Edit..**" (for editing, i.e. input) and confirm with **OK**.

A screenshot of the IDEC SmartRelay Edit menu. The menu is displayed in a monospaced font and contains the following text: ">Edit Prg", "Edit Name", "AQ in Stop", and "Memory?". The ">" cursor is positioned at the beginning of the first line.

```
>Edit Prg
Edit Name
AQ in Stop
Memory?
```

The Edit menu of IDEC SmartRelay

Move the ">" cursor to "**Edit Prg**" (for editing the circuit program) and confirm with **OK**. IDEC SmartRelay now shows you the first output:



The first output of IDEC SmartRelay

You are now in programming mode. Press ▲ and ▼ to select the other outputs. Now start to edit your circuit program.

Note

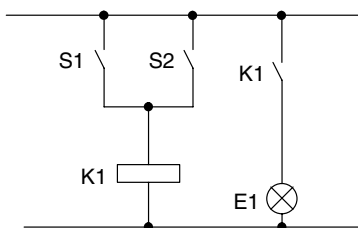
Because we have not yet saved a **password** for the circuit program in IDEC SmartRelay, you can directly enter editing mode. When you select "Edit" after you have saved a password-protected circuit program, you are prompted to enter a password and to confirm it with **OK**. You can only edit the program after you have entered the correct password (see Chapter 3.6.5.).

3.6.2 The first circuit program

Let us now take a look at the following parallel circuit consisting of two switches.

Circuit diagram

The corresponding circuit diagram:



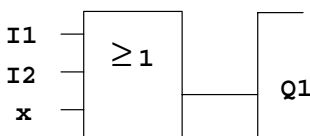
The load is switched on with S1 OR S2. IDEC SmartRelay interprets this parallel circuit as an 'OR' logic, because S1 **OR** S2 switches on the output.

Translated into a IDEC SmartRelay circuit program this means: Relay K1 is (at output Q1) is controlled by means of an OR block.

Circuit program

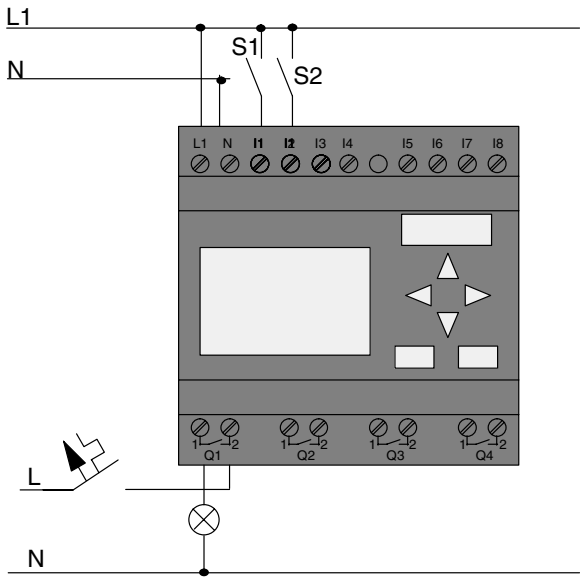
S1 is connected to the I1 and S2 to the I2 input connector of the OR block.

The corresponding layout of the circuit program in IDEC SmartRelay:



Wiring

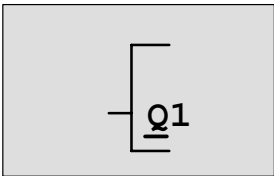
The corresponding wiring:



S1 switches input I1, while S2 switches input I2. The load is connected to the relay Q1.

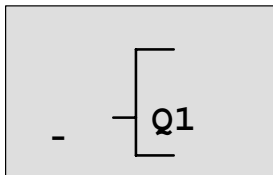
3.6.3 Circuit program input

Let us now write the circuit program, starting at the output and working towards the input. IDEC SmartRelay initially shows the output:



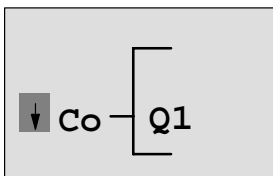
The first IDEC SmartRelay output

You will see an underscore below the Q in Q1, which is the **cursor**. The cursor indicates your current position in the circuit program. You can move the cursor by pressing the ▲, ▼, ◀ and ▶ keys. Now press the ◀ key. The cursor moves to the left.



The cursor indicates your current position in the circuit program.

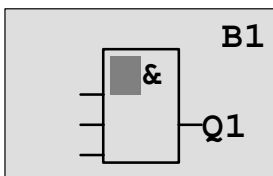
At this point you enter only the first (OR) block. Press **OK** to select editing mode.



The cursor is displayed as a solid square: You can now select a connector or a block

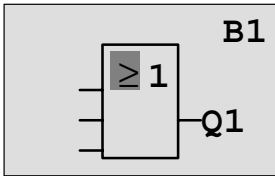
The cursor no longer appears in the form of an underscore; but instead as a flashing solid square. IDEC SmartRelay offers you various options here.

Select GF (basic functions) by pressing the ▼ key until GF appears, and confirm with **OK**. IDEC SmartRelay now shows the first block from the list of basic functions:



The AND is the first block of the basic functions list.
The solid square cursor prompts you to select a block.

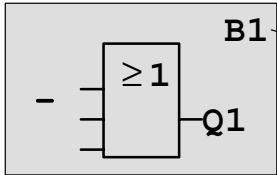
Now press ▼ or ▲ until the OR block appears on the display:



The solid square cursor is still positioned on the block.

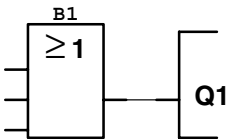
Press **OK** to confirm your entries and exit the dialog.

The display now shows:



Block number

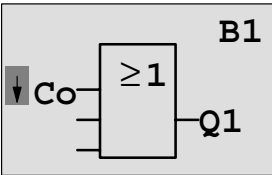
Your complete circuit program layout



You have now entered the first block. Each new block is automatically assigned a block number. The only thing left to do is interconnect the block inputs. This is how it is done:

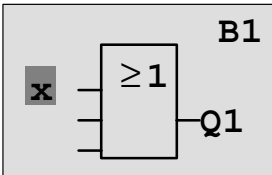
Press **OK**.

The display now shows:



Select the **Co** list: Press **OK**

The display now shows:

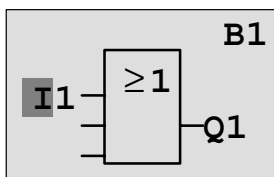


The first element of the **Co** list is the “Input 1” character, namely ‘**I1**’.

Note

Press ▼ to go the start of the Co list: I1, I2 to I0.

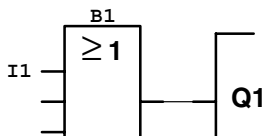
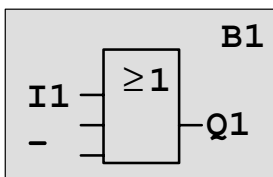
Press ▲ to go to the end of the Co list: I0, I1, to I1.



Press **OK**. I1 is now connected to the input of the OR block. The cursor jumps to the next input of the OR block.

The display now shows:

Your complete circuit program in IDEC SmartRelay up to now:

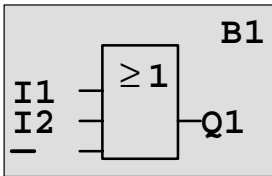


Now you connect input I2 to the input of the OR block. You already know how to do this:

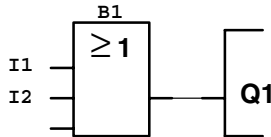
- | | |
|----------------------------------|-----------------|
| 1. Switch to editing mode: | Press OK |
| 2. To select the Co list: | Press ▼ or ▲ |
| 3. To confirm the Co list with: | Press OK |
| 4. To select I2 : | Press ▼ or ▲ |
| 5. To apply I2: | Press OK |

I2 is now connected to the input of the OR block:

The display now shows:



Your circuit program layout in IDEC SmartRelay up to now



We do not need the last two inputs of the OR block for this circuit program. You can mark the unused inputs with an 'x'. Enter the 'x' character twice:

1. Switch to editing mode:
2. To select the **Co** list:
3. To accept the Co list:
4. To select 'x':
5. To apply x:

Press **OK**

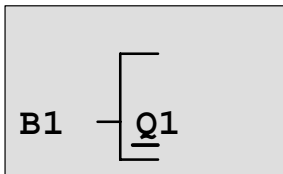
Press **▼** or **▲**

Press **OK**

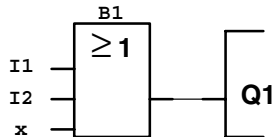
Press **▼** or **▲**

Press **OK**

The display now shows:



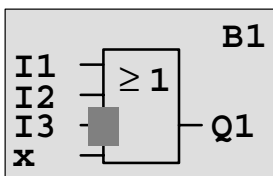
This is the layout of your circuit program



Note

You can invert individual inputs of the basic and special functions, i.e. if an input carries a logical “1” signal, the circuit program will output a logical “0”. On the other hand, a logical “0” is inverted into a logical “1” signal.

To invert an input, move the cursor to the relevant position, e.g.:

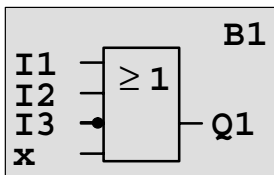


Confirm with **OK**.

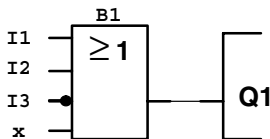
Now press ▼ or ▲ to invert this input: —●

Next, press **ESC**.

The display now shows:



Your circuit program layout



You can review your first circuit program by pressing ◀ or ▶ to move the cursor through the circuit program.

We shall now exit circuit programming mode. This is how it is done:

Return to the programming menu: Press **ESC**

Note

IDEC SmartRelay has now saved your circuit program to nonvolatile memory. The circuit program remains in the IDEC SmartRelay memory until you explicitly delete it.

You can save the actual values of special functions in the case of a power outage assuming that these functions support the “Retentive” parameter and that the necessary program memory is available. The Retentive parameter is deactivated in the basic status (i.e. when inserting the function). To use it, you must enable this option.

3.6.4 Assigning a circuit program name

You can assign your circuit program a name that consists of up to 16 uppercase/lowercase letters, numbers and special characters.

In the programming menu:

- 1. To move the “>” cursor to **'Edit..'**: Press ▼ or ▲
- 2. To accept 'Edit': Press **OK**
- 3. Move the “>” cursor to **'Edit Name'**: Press ▼ or ▲
- 4. To accept 'Edit Name': Press **OK**

Press ▲ and ▼ to list the alphabet from A (a) to Z (z), numbers and special characters, either in ascending or descending order. You can select any letter, number or character.

To enter a space character, simply movie the cursor with ► to the next position. This character is the first one in the list.

Examples:

Press ▼ once to select an “**A**”
▲ four times to select “**{**”, etc.

The following character set is available:

	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	0	1	2	3	4	5	6	7	8	9	!
"	#	\$	%	&	'	()	*	+	,	-	.	/	:	;
<	=	>	?	@	[\]	^	_	`	{		}	~	

Let us assume you want to name your circuit program
“**ABC**”:

5. Select “**A**”: Press ▼
6. Move to the next letter: Press ►
7. Select “**B**”: Press ▼
8. Move to the next letter: Press ►
9. Select “**C**”: Press ▼
10. To confirm the complete name: Press **OK**

Your circuit program is now named “**ABC**”, and you are returned to the programming menu.

To **change** the name of your circuit program, proceed in the same way.

Note

You can change the name of the circuit program only in programming mode. You can read the name both in programming **and** in parameter assignment mode

3.6.5 Password

You can protect a circuit program from unauthorized access by assigning it a password.

To assign a password

A password may have a maximum length of 10 characters, and consists only of uppercase letters (A to Z). On IDEC SmartRelay, the password can be assigned, edited or deactivated only in the “Password” menu.

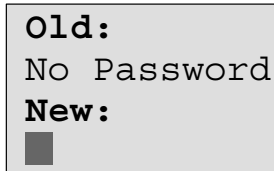
In the programming menu:

1. Move the “>” cursor to '**Password**': Press ▼ or ▲
2. To confirm the 'Password': Press **OK**

Press ▼ or ▲ to move up and down the alphabet to select your letters. Because IDEC SmartRelay only provides uppercase letters for the password, you can quickly access letters “at the end” of the alphabet by using the ▲ button:

Press ▲ once to select “Z”
Press ▲ twice to select “Y”, etc.

Let us assign the password “AA” to our first circuit program.
The display now shows:

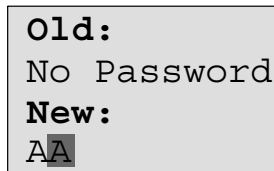


Old:
No Password
New:
■

This procedure is the same as for entering the name of the circuit program. Select “New” and enter:

3. Select “A”: Press ▼
4. To move to the next letter: Press ►
5. Select “A”: Press ▼

The display now shows:



Old:
No Password
New:
AA

6. To confirm the password: Press **OK**

Your circuit program is now protected with the password “AA”, and you are returned to the programming menu.

Note

You can cancel the input of a new password with **ESC**. In this case, IDEC SmartRelay returns to the programming menu without saving the password.

You can also set your password using WindLGC. You can not edit a password-protected circuit program on IDEC SmartRelay or upload it to WindLGC unless you enter the correct password.

To allow you to create and edit a circuit program for a protected memory cartridge (card), you first need to assign a password to this new program (see Chapter 6.1).

Changing the Password

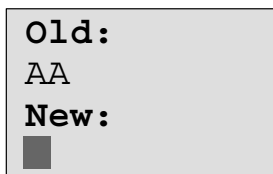
You need to know the current password in order to change it.

In the programming menu:

1. Move the '>' cursor to '**Password**': Press ▼ or ▲
2. To confirm the 'Password': Press **OK**

Select “Old” and enter your old password (in our case: '**AA**') by repeating steps 3 through 6 as described earlier.

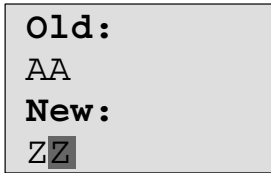
The display now shows:



Now you can select “New” to enter the new password, e.g. “**ZZ**”:

3. Select “**Z**”: Press ▲
4. To move to the next letter: Press ►
5. Select “**Z**”: Press ▲

The display now shows:



Old:
AA
New:
ZZ

6. To confirm your new password: Press **OK**

Your new password “**ZZ**” is now set, and you are returned to the programming menu.

Deactivating the Password

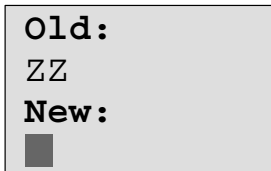
Let us assume you want to deactivate the password for whichever reason. For example, you want to allow another user to edit your circuit program. You must know your current password (in our example “**ZZ**”), same as if you were changing it.

In the programming menu:

1. Move the '>' cursor to '**Password**': Press ▼ or ▲
2. To confirm the 'Password': Press **OK**

Select “Old” and enter your current password as described in steps 3 to 5. Confirm your entries with **OK**.

The display shows:



Old:
ZZ
New:
■

Clear the password by leaving the input box **blank**:

3. To confirm the “blank” password: Press **OK**

The password is “cleared”, and you are returned to the programming menu.

Note

This action disables the password prompt, and thus permits access without password.

Let the password prompt be **deactivated** for the time being, in order to accelerate progress in our further exercises and examples.

Password: Wrong Password!

When the user inputs the **wrong** password and confirms the input with **OK**, IDEC SmartRelay does not open editing mode, but returns to the programming menu. This repeats itself over and over again until you input the correct password.

3.6.6 Switching IDEC SmartRelay to RUN mode

In the main menu, select RUN to start IDEC SmartRelay.

1. To return to the main menu: Press **ESC**
2. Move the '>' cursor to '**Start**': Press **▲** or **▼**
3. To confirm 'Start': Press **OK**

IDEC SmartRelay runs the circuit program and shows the following display:

Display field of the IDEC SmartRelay in RUN mode

```
Mo 09:00
2005-01-27
```

Start screen: Date and current time-of-day (only for versions with realtime clock). This element flashes if the date and time are not set.

◀ Press ▶

```
I:
0.. 123456789
1..0123456789
2..01234
```

Inputs I1 to I9
Inputs I10 to I19
Inputs I20 to I24

◀ Press ▶

```
Q:
0.. 123456789
1..0123456
```

Outputs Q1 to Q9
Outputs Q10 to Q16

◀ Press ▶

```
AI:
1: 00000
2: 01000
3: 00253
```

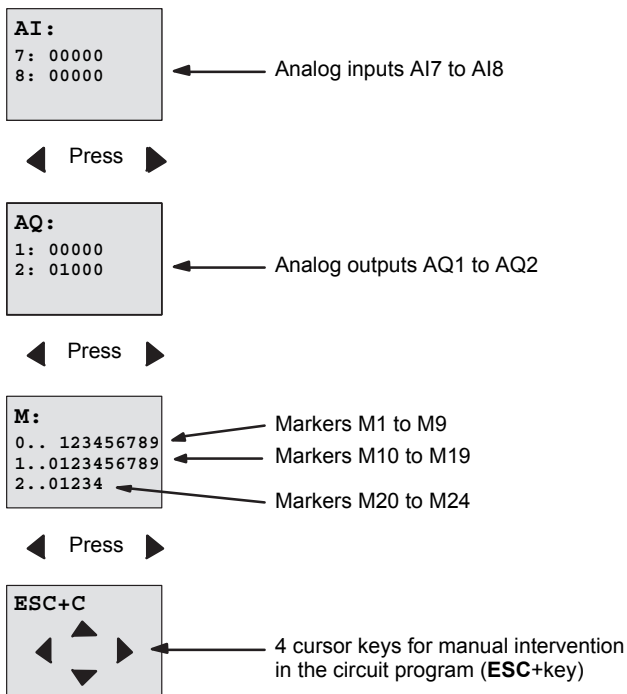
Analog inputs AI1 to AI3

◀ Press ▶

```
AI:
4: 00010
5: 00000
6: 00005
```

Analog inputs AI4 to AI6

◀ Press ▶



What is meant by: "IDEC SmartRelay is in RUN"?

In RUN mode, IDEC SmartRelay executes the circuit program. To do so, IDEC SmartRelay first reads the status at the inputs, determines the status of the outputs by means of the user program, and switches these on or off according to your settings.

This is how IDEC SmartRelay indicates the I/O status:

I :

0 ..	1	2	3	4	5	6	7	8	9
1 ..	0	1	2	3	4	5	6	7	8
2 ..	0	1	2	3	4				

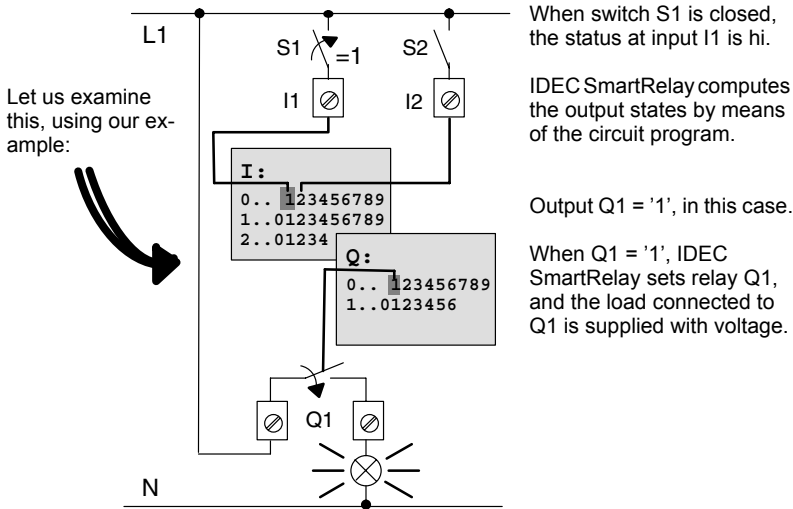
Input/output status is '1':
inverted ☒
Input/output status is '0':
not inverted

Q :

0 ..	1	2	3	4	5	6	7	8	9
1 ..	0	1	2	3	4	5	6		

In this example, only the inputs I1, I15, Q8 and Q12 are set 'high'.

Status indication on the display



3.6.7 Second circuit program

Up to this point, you have successfully created your first circuit and assigned it a name and, if desired, a password. In this section we will show you how to modify existing circuit programs and how to use the special functions.

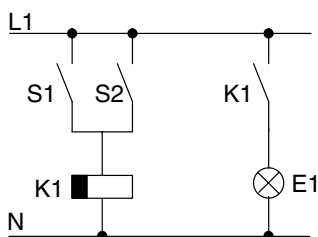
Using this second circuit program, we will show you how to:

- Add a block to an existing circuit program.
- Select a block for a special function.
- Assign parameters.

Modifying circuits

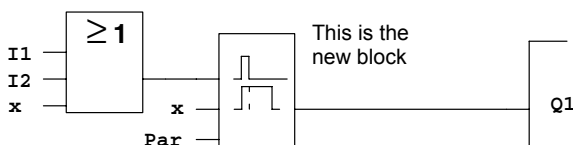
We shall use the first circuit program as a basis for the second, with some slight modifications.

First of all take a look at the circuit diagram for the second circuit program:



You already know the first part of the circuit. S1 and S2 switch a relay, which is to be used to switch on the load E1, and to switch off the load with a delay of 12 minutes.

This is the circuit program layout in IDEC SmartRelay:



You can see the OR block and the output relay Q1 we have already used in the first circuit program. The only difference is the new off-delay block.

Editing the circuit program

Switch IDEC SmartRelay to programming mode.

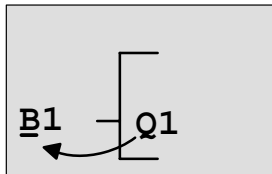
As a reminder:

1. Switch the IDEC SmartRelay to programming mode (in RUN: Press **ESC** to enter the parameter assignment mode. Select the '**Stop**' command, confirm with **OK**, then move the '>' cursor to '**Yes**', and once again confirm with **OK**). See page 63.
2. On the main menu, select "**Program**"
3. On the Programming menu, select "**Edit**", confirm with **OK**. Next, select "**Edit Prg**" and confirm with **OK**.
If required, enter your password at the prompt and confirm with **OK**.

You can now modify the current circuit program.

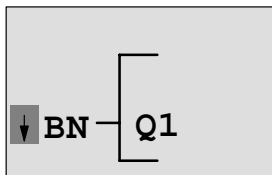
Adding a block to a circuit program

Move the cursor to the B in B1 (B1 is the number of the OR block):



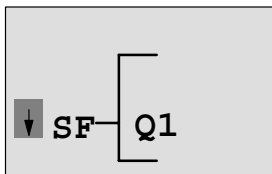
To move the cursor:
Press ◀

We now insert the new block at this position.
Confirm with **OK**.



IDEC SmartRelay shows
you the BN list

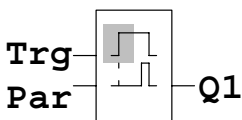
Press ▼ to select the SF list:



The SF list contains the special function blocks.

Press OK.

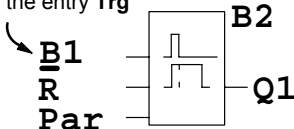
The block of the first special function is shown:



When you select a special or basic function block, IDEC SmartRelay shows you the relevant function block. The solid square cursor is positioned on the block. Press ▼ or ▲ to select the required block.

Select your block (off-delay, see the next figure), and then press **OK**:

Before you press 'OK', this shows the entry **Trg**

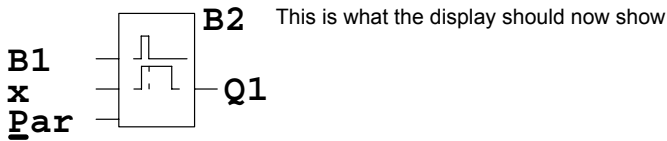


The added block is assigned the block number B2. The cursor is positioned at the top input of the added block.

The B1 block previously connected to Q1 is automatically connected to the uppermost input of the new block. Note that you can only interconnect digital inputs with digital outputs or analog inputs with analog outputs. The 'old' block will otherwise be lost.

The off-delay block has three inputs. At the top is the trigger input (Trg) you use to start the off-delay time. In our example, the OR block B1 triggers the off-delay. You reset the time and the output with a signal at the reset input. Set the off-delay time at parameter T of the input Par.

In our example we do not use the reset input of the off-delay function, and we identify it with an 'x' connector.

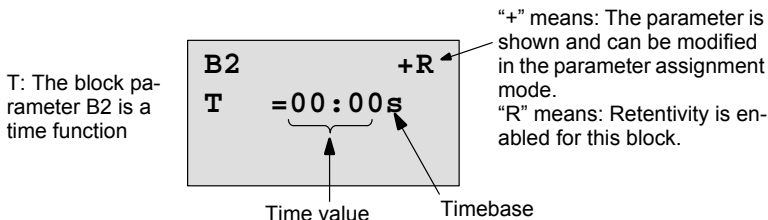


Assigning block parameters

Now you set the off-delay time T:

1. Move the cursor to **Par**, if it not already at this position:
Press **▲** or **▼**
2. Switch to editing mode: Press **OK**

IDEC SmartRelay shows the parameters in the parameter assignment window:



To change the time value:

- Press **◀** and **▶** to position the cursor.
- Press **▲** and **▼** to modify the value at the relevant position.
- Confirm your entries with **OK**.

Setting the time

Set the time T = 12:00 minutes:

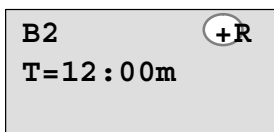
1. Move the cursor to the first digit: Press ◀ or ▶
2. Select the digit '1': Press ▲ or ▼
3. Shift the cursor to the second digit: Press ◀ or ▶
4. Select digit '2': Press ▲ or ▼
5. Move the cursor to the unit: Press ◀ or ▶
6. Select the timebase 'm' (for minutes): Press ▲ or ▼

Showing/hiding parameters - the parameter protection mode

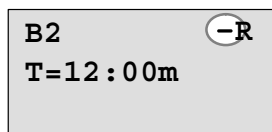
If you want to show/hide the parameter and allow/prevent its modification in parameter assignment mode:

1. Move the cursor to the protection mode: Press ◀ or ▶
2. Select the protection mode: Press ▲ or ▼

The display should now show:



or



Protection mode +:

The value of the time T can be modified in parameter assignment mode.

Protection mode --:

The value of the time T is hidden in parameter assignment mode

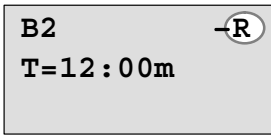
3. Confirm your entries with: **OK**

Enabling/disabling retentivity

To decide whether you want to retain your current data after a power failure or not:

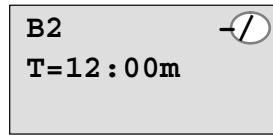
1. Move the cursor to the retentivity setting: Press ◀ or ▶
2. Select the retentivity setting: Press ▲ or ▼

The display now shows:



Retentivity R: Current data are retained

or



Retentivity /: Current data are not retained

3. Confirm your entries with **OK**

Note

For further information on the protection mode, refer to Chapter 4.3.5.

For further information on retentivity, refer to Chapter 4.3.4.

You can modify the protection mode and retentivity setting only in programming mode, i.e. this is **not** possible in parameter assignment mode.

In this manual, the protection mode ("+" or "-") and retentivity ("R" or "/") settings are only shown in the displays where these can actually be changed.

Verification of the circuit program

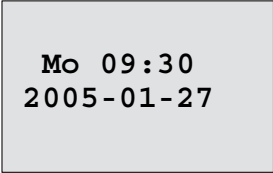
This program branch for Q1 is now completed. IDEC SmartRelay shows you the output Q1. You can once again view the circuit program on the display. Use the keys to browse the circuit program, i.e. press ◀ or ▶ to move from block to block, ▲ and ▼ to move between the inputs at a block.

Closing the programming mode

Although you were shown how to exit the programming mode when you created your first circuit program, here is a reminder:

1. To return to the programming menu: Press **ESC**
2. To return to the main menu: Press **ESC**
3. To move the '>' cursor to '**Start**': Press **▲** or **▼**
4. To confirm 'Start': Press **OK**

IDEC SmartRelay is back in RUN mode:

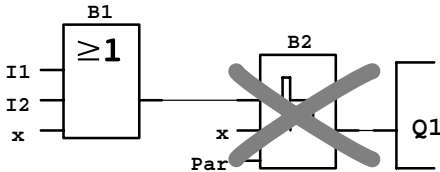


Mo 09:30
2005-01-27

You can press **◀** or **▶** to scroll the pages and to monitor the I/O states.

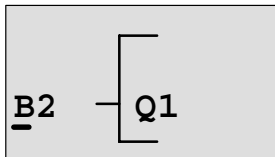
3.6.8 Deleting a block

Let us assume you want to delete the block B2 from your circuit program and connect B1 directly to Q1.



Proceed as follows:

1. Switch the IDEC SmartRelay to programming mode (as a reminder, refer to page 63).
2. Select '**Edit**': Press ▲ or ▼
3. Confirm 'Edit': Press **OK**
(If required, enter your password and confirm with **OK**).
4. Select '**Edit Prg**': Press ▲ or ▼
5. Confirm 'Edit Prg': Press **OK**
6. To move the cursor to the input of Q1, i.e. to B2, press ◀:

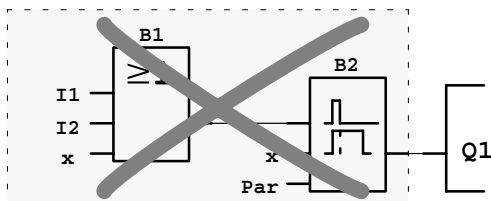


7. Confirm with **OK**.
8. Now replace block B2 with block B1 at output Q1. The procedure:
 - Select the **BN** list: Press ▲ or ▼
 - Accept the BN list: Press **OK**
 - Select '**B1**': Press ▲ or ▼
 - Apply 'B1': Press **OK**

Result: Block B2 is deleted, because it is no longer used in the circuit. Block B1 has replaced B2 directly at the output.

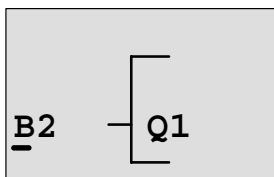
3.6.9 Deleting block groups

Let us assume you want to delete the blocks B1 **and** B2 from the following circuit program (corresponds with the circuit program in Chapter 3.6.7).



Proceed as follows:

1. Switch IDEC SmartRelay to programming mode
(as a reminder, refer to page 63).
2. To select '**Edit**': Press ▲ or ▼
3. To confirm 'Edit': Press **OK**
(if required, enter your password and confirm with **OK**).
4. To select '**Edit Prg**': Press ▲ or ▼
5. To confirm 'Edit Prg': Press **OK**
6. To move the cursor to the input of Q1, i.e. to B2, press ◀:



7. Confirm with **OK**.
8. Now set the connector 'x' at output Q1 instead of block B2. To do so:
 - Select the **Co** list: Press ▲ or ▼
 - Accept the Co list: Press **OK**
 - Select '**x**': Press ▲ or ▼
 - Apply '**x**': Press **OK**

Result: Block B2 is deleted, because it is no longer used in the circuit. This includes all blocks connected to B2. In this example, block B1 also.

3.6.10 Correcting programming errors

Programming errors can be corrected easily in IDEC SmartRelay :

- Provided editing mode is not yet closed, you can revert by one step by pressing **ESC**.
- If you have already configured all inputs, simply reconfigure the faulty input:
 1. Move the cursor to the faulty position
 2. Change to editing mode. Press **OK**
 3. Enter the correct input circuit.

You can only replace a block with a block that has exactly the same number of inputs. However, you can delete the old block and then insert a new one. You can choose any new block.

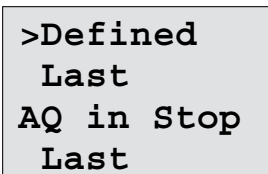
3.6.11 Selecting analog output values for RUN/STOP transition

You can select the analog values that are output at the two analog outputs when IDEC SmartRelay changes from RUN mode to STOP mode.

In the programming menu:

1. Move the ">" cursor to '**Edit..**': Press ▼ or ▲
2. To accept 'Edit..': Press **OK**
3. Move the ">" cursor to '**AQ in Stop**': Press ▼ or ▲
4. To accept 'AQ in Stop': Press **OK**

IDEC SmartRelay shows the following display:



```
>Defined
  Last
AQ in Stop
  Last
```

The current setting for the analog output channels is shown on the bottom row. The default setting is 'Last'.

You can select either 'Last' value (i.e. analog output values are held at their last value) or 'Defined' value (i.e. analog output values are set to specific values). When IDEC SmartRelay changes from RUN mode to STOP mode, the

values of the analog outputs change as well, depending on the setting.

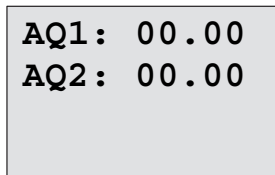
5. Select the desired output setting: Press ▲ or ▼.
6. To confirm your entry: Press **OK**

Defining a specific analog output value

You want to output a specific analog value at the two analog outputs.

1. Move the '>' cursor to '**Defined**': Press ▲ or ▼
2. Confirm 'Defined': Press **OK**

The display shows:



AQ1: 00.00
AQ2: 00.00

3. Enter a specific output value for each of the two analog outputs.
4. To confirm your entry: Press **OK**

3.6.12 Deleting the circuit program

To delete a circuit program:

1. Switch the IDEC SmartRelay to programming mode

```
>Program..  
Card..  
Setup..  
Start
```

IDEC SmartRelay opens the main menu

2. On the main menu, press ▲ or ▼ to move the '>' cursor to '**Program**'. Press **OK**.

```
>Edit..  
Clear Prg  
Password
```

IDEC SmartRelay changes to the programming menu

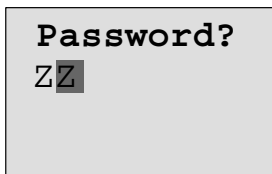
3. Move the '>' cursor to '**Clear Prg**': Press ▲ or ▼
4. Confirm 'Clear Prg': Press **OK**

```
Clear Prg  
>No  
Yes
```

To cancel deletion of the circuit program, leave the '>' cursor at '**No**' and press **OK**.

If you are sure that you want to delete the circuit program from memory:

5. Move the '>' cursor to **'Yes'**: Press ▲ or ▼
6. Press **OK**.



To prevent unintentional deletion of your circuit program, you are prompted to enter your password (provided you have assigned one).

7. Enter your password.
8. Press **OK**. The circuit program is deleted.

Note

Although you may have forgotten your password, you can still delete the circuit program by entering the wrong password three times.

3.6.13 Summertime/wintertime conversion

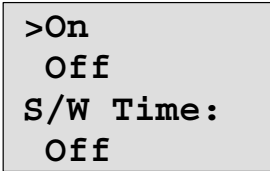
You can enable or disable automatic summertime/wintertime conversion

- in parameter assignment mode by calling the "Set.." menu command
- in programming mode by calling the "Setup" menu command.

To enable/disable automatic S/W Time conversion in programming mode:

1. Switch IDEC SmartRelay to programming mode.
2. You are now in the main menu and want to select the **'Setup'** menu command: Press ▲ or ▼
3. Confirm 'Setup': Press **OK**
4. Move the '>' cursor to **'Clock'**: Press ▲ or ▼
5. Confirm 'Clock': Press **OK**
6. Move the '>' cursor to **'S/W Time'**: Press ▲ or ▼
7. Confirm 'S/W Time': Press **OK**

IDEC SmartRelay shows the following display:



The image shows a rectangular display with a light gray background. It contains four lines of text in a monospaced font: the first line is '>On', the second is 'Off', the third is 'S/W Time:', and the fourth is 'Off'.

```
>On
Off
S/W Time:
Off
```

The current setting of automatic S/W Time conversion is shown in the bottom row. The default setting is 'Off': disabled.

To enable/disable automatic S/W Time conversion in parameter assignment mode:

If you want to enable/disable automatic S/W Time conversion in parameter assignment mode, select in the parameter assignment menu '**Set..**', then menus '**Clock**' and '**S/W Time**'. You can now enable/disable automatic S/W Time conversion.

Enabling summertime/wintertime conversion

You now want to enable this conversion and define or set its parameters:

1. Move the '>' cursor to 'On': Press **▲** or **▼**
2. Confirm 'On': Press **OK**

The display shows:



The image shows a rectangular display with a light gray background. It contains two lines of text in a monospaced font: the first line is '>EU' and the second line is blank.

```
>EU
```

3. Select the desired conversion: Press **▲** or **▼**

What is shown on the display?:

- '**EU**' represents the start and end of European summertime.
- '**UK**' represents the start and end of summertime in the United Kingdom.
- '**US**' represents the start and end of summertime in the United States.

- **'AUS'** represents the start and end of Australian summertime.
- **'AUS-TAS'** represents the start and end of Australian/ Tasmanian summertime.
- **'NZ'** represents the start and end of New Zealand summertime.
- **..** : Here you can enter any month, day and time zone difference.

The preset conversion data for EU, UK and US is found in the table below:

	Start of summertime	End of summertime	Time zone difference Δ
EU	Last Sunday in March: 02:00-->03:00	Last Sunday in October: 03:00-->02:00	60 Min.
UK	Last Sunday in March: 01:00-->02:00	Last Sunday in October: 02:00-->01:00	60 Min.
US	First Sunday in April: 02:00-->03:00	Last Sunday in October: 02:00-->01:00	60 Min.
AUS	Last Sunday in October: 02:00-->03:00	Last Sunday in March: 03:00-->02:00	60 Min.
AUS-TAS	First Sunday in October: 02:00-->03:00	Last Sunday in March: 03:00-->02:00	60 Min.
NZ	First Sunday in October: 02:00-->03:00	Third Sunday in March: 03:00-->02:00	60 Min.
..	Customizing the month and the day: 02:00--> 02:00 + Time zone difference	Customizing the month and the day: 03:00--> 03:00 - Time zone difference	User-defined (resolution in minutes)

Note

You can specify a time zone difference Δ between 0 and 180 minutes.

Let us assume you want to enable European summertime/ wintertime conversion:

4. Move the '>' cursor to **'EU'**: Press **▲** or **▼**
5. Confirm 'EU': Press **OK**

IDEC SmartRelay shows the following display:

```
>On
Off
S/W Time:
On→EU
```

IDEC SmartRelay indicates that European S/W Time conversion is enabled.

User-defined parameters

If none of the parameters/conversions apply to your country, you can customize these under menu item '.'. To do so:

1. Confirm 'On' once again: Press **OK**
2. Move the '>' cursor to ' . ': Press **▲** or **▼**
3. Confirm the menu item ' . ': Press **OK**

The display shows:

Cursor / solid square

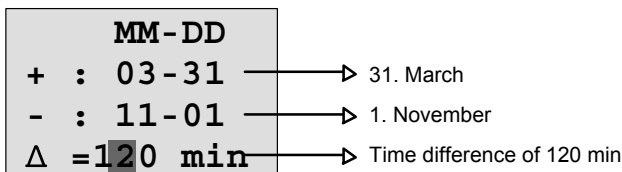
MM-DD	→	Month (MM) and Day (DD)
+ : 01-01	→	Start of summertime
- : 01-01	→	End of summertime
Δ =000min	→	The desired time zone difference in [min]

Let us assume you want to configure the following parameters: Start of summertime = 31st of March, end of summertime = 1st of November, time difference of 120 minutes.

This is how you can enter your data:

- Press **◀** or **▶** to move the solid square/cursor.
- Press **▲** or **▼** to change the value at the cursor position.

The display shows:



- Confirm all your entries with **OK**.

You have now customized the summertime/wintertime conversion. The IDEC SmartRelay display now shows:

```

>On
  Off
S/W Time:
  On→..
  
```

IDEC SmartRelay indicates that summertime/wintertime conversion is enabled, and that user-defined parameters ('..') have been set.

Note

To disable summertime/wintertime conversion in this menu, you merely confirm 'Off' with **OK**.

Note

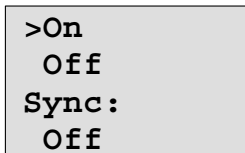
Summertime/wintertime conversion only functions when IDEC SmartRelay is operating (in RUN or STOP status). It does not function when IDEC SmartRelay is in buffered operation (see Chapter 4.3.3).

3.6.14 Synchronization

Time synchronization between IDEC SmartRelay and the connected expansion modules can be enabled/disabled in programming mode by means of the real-time clock menu ("Clock" menu item).

1. Switch the IDEC SmartRelay to programming mode.
2. You are now in the main menu, and want to select **'Clock'**: Press **▲** or **▼**
3. Confirm **'Clock'**: Press **OK**
4. Move the **'>'** cursor to **'Sync'**: Press **▲** or **▼**
5. Apply **'Sync'**: Press **OK**

IDEC SmartRelay shows the following display:



```
>On
Off
Sync :
Off
```

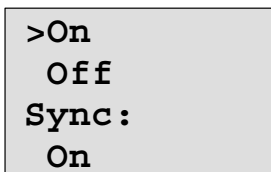
The current setting of the automatic synchronization function is displayed in the bottom row. The default setting is 'Off': disabled.

Enabling synchronization

You want to enable synchronization:

1. Move the **'>'** cursor to **'On'**: Press **▲** or **▼**
2. Confirm **'On'**: Press **OK**

IDEC SmartRelay shows the following display:



```
>On
Off
Sync :
On
```

When synchronization is enabled, IDEC SmartRelay transmits the time-of-day to the expansion modules once daily, after each transition to RUN mode and when the TOD is changed after a 'Set Clock' is executed or after a summer-time/wintertime conversion.

Note

The expansion module with this function does not have already been released.(As of Feb. 2006)

3.7 Memory space and circuit dimensions

The size of a circuit program in IDEC SmartRelay is limited by the memory space (memory used by the blocks).

Memory areas

- **Program memory:**
IDEC SmartRelay allows only a limited number of blocks in your circuit program.
The second limitation is based on the maximum number of bytes a circuit program may contain. The total number of bytes used can be determined by adding up the number of bytes used for the relevant function blocks.
- **Retentive memory (Rem):**
In this area, IDEC SmartRelay stores process variables which need to be retentive, e.g. the Operating hours counter value. Blocks with optional retentivity use this memory area only if this function is actually enabled.



Caution

At a power failure, the logical input level may drop to zero before IDEC SmartRelay can save the functions to the retentive memory. In this case, the IDEC SmartRelay saves the function values determined by the zero state at its inputs of the inputs.

Example: On-delay

With an input (I1) connected to a Trg connector of an On-delay FB as shown in Fig.1, if I1 is ON and the IDEC SmartRelay power is turned off and on, the timer current value of the On-delay FB is sometimes reset as shown in Fig.2.

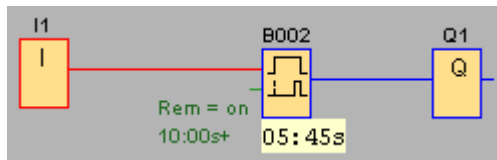


Fig. 1

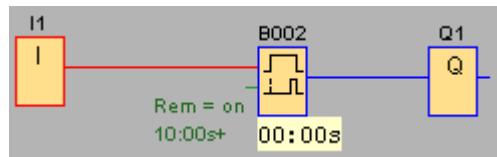


Fig. 2

Other FBs are shown below.

- Function blocks whose timer current value is sometimes reset. Off-delay, On-delay, On-/Off-delay, Retentive on-delay, Interval time-delay relay/Pulse output, Edge-triggered interval time-delay relay, Operating hours counter, Asynchronous pulse generator, Stairwell Light Switch, Dual-function switch
- Function blocks whose output is sometimes set or reset when input (I*) is connected to a S(R) connector with NOT. Latching relay, Current impulse relay

Resources available in IDEC SmartRelay

A circuit program in IDEC SmartRelay can occupy the following maximum resources:

Bytes	Blocks	REM
2000	130	60

IDEC SmartRelay monitors memory utilization, and offers only those functions from the lists for which it can actually provide sufficient memory space.

Memory requirements

The table below shows an overview of the memory requirements for the basic and special function blocks:

Function	Program memory	Rem memory ⁽¹⁾
Basic functions		
AND	12	-
AND with Edge Detection	12	-
NAND (not AND)	12	-
NAND with Edge Detection	12	-
OR	12	-
NOR (not OR)	12	-
XOR (exclusive OR)	8	-
NOT (Negation)	4	-
Special functions		
Times		
On-delay	8	3
Off-delay	12	3
On-/Off-delay	12	3
Retentive on-delay	12	3
Interval time-delay relay / Pulse output	8	3
Edge-triggered interval time-delay relay	16	4
Asynchronous pulse generator	12	3
Random generator	12	-
Stairwell Light Switch	12	3
Dual-function switch	16	3
Seven-day time switch	20	-
Twelve-month time switch	8	-

Function	Program memory	Rem memory ⁽¹⁾
Counter		
Up/down counter	24	5
Operating hours counter	24	9
Frequency trigger	16	-
Analog		
Analog trigger	16	-
Analog differential trigger	16	-
Analog comparator	24	-
Analog value monitoring	20	-
Analog amplifier	12	-
Analog multiplexer	20	-
Analog Ramp Control	36	-
PI controller	40	2
Others		
Latching relay	8	1
Current impulse relay	12	1
Message texts	8	-
Softkey	8	2
Shift register	12	1

(1): Bytes in the Rem memory area, if retentivity is enabled.

Utilization of memory areas

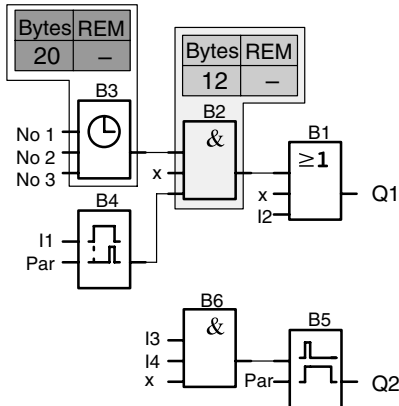
The system indicates that there is insufficient memory space by not allowing you to add a further block to your circuit program. IDEC SmartRelay offers you only the blocks for which it can provide sufficient memory space. If IDEC SmartRelay memory space is insufficient to hold any further blocks you select from a block list, the system will deny access to this list.

If memory space is fully occupied, optimize your circuit program, or install a second IDEC SmartRelay.

Calculating memory requirements

When calculating the memory requirements of a circuit, you must always take into account all individual areas of memory.

Example:



The sample circuit program contains:

Block no.	Function	Memory area		
		Bytes	Blocks	REM
B1	OR	12	1	-
B2	AND	12	1	-
B3	Seven-day time switch	20	1	-
B4	On-delay ⁽¹⁾	8	1	3
B5	Stairwell Light Switch	12	1	0
B6	AND	12	1	-
	Resources used by the circuit program	76	6	3
	Memory space limits in IDEC SmartRelay	2000	130	60
	Still available in IDEC SmartRelay	1924	124	57

(1): Configured with retentivity.

This means that this circuit program fits in IDEC SmartRelay.

Indication of available memory space

IDEC SmartRelay shows you the amount of free memory space.

Proceed as follows:

1. Switch the IDEC SmartRelay to programming mode
(as a reminder, refer to page 63).
2. Select '**Edit**': Press ▲ or ▼
3. Accept 'Edit': Press **OK**
4. Select '**Memory?**': Press ▲ or ▼
5. Accept 'Memory?': Press **OK**

The display now shows:

```
Free Memory:
Byte =1924
Block= 124
Rem  =  57
```

4 IDEC SmartRelay functions

Organization

IDEC SmartRelay provides you with various elements in programming mode. In order to maintain the overview, we have organized the elements in 'Lists'. These lists are:

- ↓**Co**: Connector list (**C**onnectors)
(see Chapter 4.1)
- ↓**GF**: List of the basic functions AND, OR, ...
(refer to Chapter 4.2)
- ↓**SF**: List of the special functions
(refer to Chapter 4.4)
- ↓**BN**: List of reusable blocks configured in the circuit program

List contents

All lists show the elements available in IDEC SmartRelay. Usually, this includes all connectors, basic functions and special functions the IDEC SmartRelay knows. This includes all the blocks you have created in IDEC SmartRelay by the time you call the ↓**BN** list.

If not all is shown

IDEC SmartRelay does not show all elements if:

- No further blocks may be added.
This is either an indication of insufficient memory space or that the maximum number of blocks has been reached.
- A specific block's memory space requirement would exceed the space available in IDEC SmartRelay.

See Chapter 3.7.

4.1 Constants and connectors - Co

Constants and connectors (= Co) represent inputs, outputs, markers and constant voltage levels (constants).

Inputs:

1) Digital inputs

Digital inputs are identified with an I. The number of the digital inputs (I1, I2, ...) corresponds to the number of the input connectors of the IDEC SmartRelay Base and of the connected digital modules, in the order of their installation. See the following figure below.

2) Analog inputs

The IDEC SmartRelay versions FL1D-H12SND, FL1D-H12RCE and FL1D-B12RCE are equipped with the inputs I7 and I8, which can also be programmed for use as **AI1** and **AI2** inputs. Signals at the I7 and I8 inputs are interpreted as digital values, and those at the AI1 and AI2 inputs are interpreted as analog values. The inputs of a connected analog module are numbered according to the already existing analog inputs. Special functions the inputs of which should only be connected to analog inputs are offered in programming mode when you select the input signal, i.e. the analog inputs AI1...AI8, Analog Memory Markers AM1...AM6, the block numbers of a function with analog output.

Outputs:

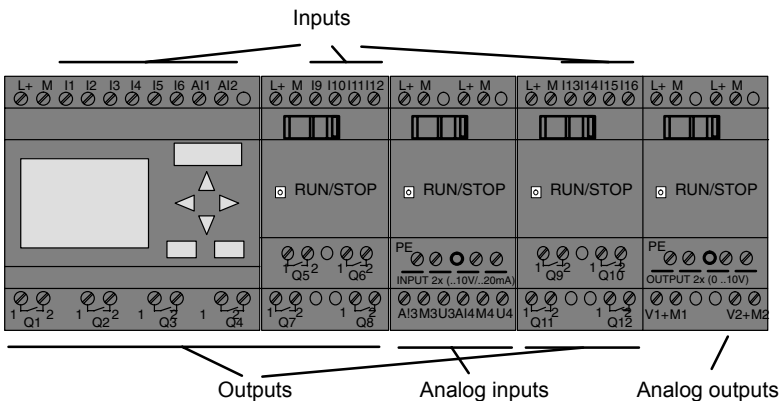
1) Digital outputs

Digital outputs are identified by the character **Q**. The output numbers (Q1, Q2, ... Q16) correspond with the numbers of the output connectors at the IDEC SmartRelay Base and with those of the expansion modules, in their order of installation. See the following figure.

There are also 16 blank outputs available. These are identified with an **X** and can not be reused in a circuit program (in contrast to markers, for example). The list shows all programmed blank outputs, and one blank output which is not yet configured. A blank output, for example, is useful for the special function "Message texts" (see Chapter 4.4.23), if only the message text is of significance to a circuit program.

2) Analog outputs

Analog outputs are identified by the letters **AQ**. Two analog outputs are available, namely AQ1 and AQ2. An analog output can only be connected with the analog input of a function, an analog memory marker AM or an analog output connector.



Memory Markers

Memory Markers are identified by the letters **M** or **AM**. These are virtual outputs, which output the value of their inputs. IDEC SmartRelay provides 24 Memory Markers M1 ... M24 and 6 Analog Memory Markers AM1 ... AM6.

Startup Marker

Marker M8 is set in the first cycle of the user program and can thus be used in your circuit program as a startup marker. This signal is automatically reset after the circuit program has completed its first cycle.

The M8 marker can be used in all further cycles for setting, deletion and evaluation procedures in the same way as other markers.

Note

The output of the marker always carries the signal of the previous program cycle. This value does not change within the same program cycle.

Shift register bits

IDEC SmartRelay provides the shift register bits S1 to S8, which are assigned the read-only attribute in the circuit program. The content of shift register bits can only be modified by means of the “Shift register” special function (see Chapter 4.4.25).

Cursor keys

Up to four cursor keys are available to you, namely C▲, C►, C▼ and C◄ (“C” = “Cursor”). Cursor keys are programmed for the circuit program in the same ways as other inputs. You can set the cursor keys in the corresponding display while the system is in RUN (see Chapter 3.6.6), and in an active message text (ESC + Key). Cursor keys can save switches and inputs, and allow operator control of the circuit program.

Levels

Voltage levels are designated **hi** and **lo**. A constant “1” = hi or “0” = lo status at the block can be set by means of a permanent voltage level or constant value hi or lo.

Open connectors

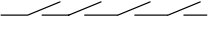
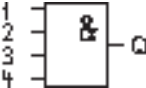
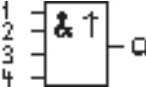
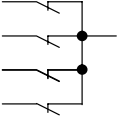


Unused block connectors can be identified with an **x**.

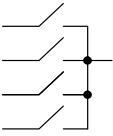
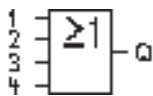
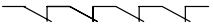
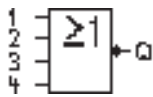
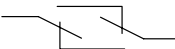
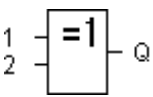
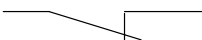
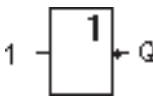
4.2 Basic functions list - GF

Basic functions represent simple logical elements of Boolean algebra.

You can invert the inputs of individual basic functions, i.e. the circuit program inverts a logical “1” at a relevant input to a logical “0”; if “0” is set at the input, the program sets a logical “1”. A programming example is found in Chapter 3.6.3.

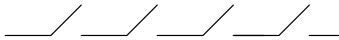
The GF list contains the basic function blocks you can use for your circuit program. The following basic functions are available:

View in the circuit diagram	View in IDEC SmartRelay	Name of the basic function
 <p>Series circuit with normally open contact</p>		<p>AND (see page 114)</p>
		<p>AND with Edge Detection (see page 115)</p>
 <p>Parallel circuit with normally closed contact</p>		<p>NAND (not AND) (see page 116)</p>
		<p>NAND with Edge Detection (see page 117)</p>

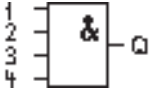
View in the circuit diagram	View in IDEC SmartRelay	Name of the basic function
 <p>Parallel circuit with normally open contact</p>		OR (see page 118)
 <p>Series circuit with normally closed contact</p>		NOR (not OR) (see page 119)
 <p>Double changeover contact</p>		XOR (exclusive OR) (see page 120)
 <p>Normally closed contact</p>		NOT (negation, inverter) (see page 120)

4.2.1 AND

Circuit diagram of a series circuit with several normally open contacts:



Symbol in IDEC SmartRelay:



The output of the AND is only 1 if **all** inputs are 1, i.e. all contacts are closed.

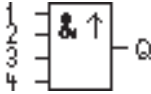
At an unused block input (x): $x = 1$.

Table of the AND logic

1	2	3	4	Q
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	1

4.2.2 AND with Edge Detection

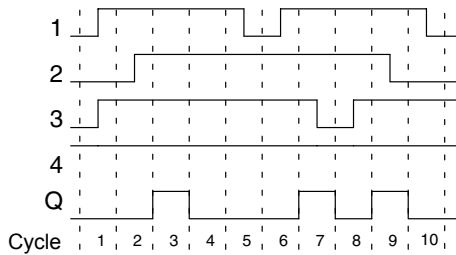
Symbol in IDEC SmartRelay:



The output of an edge triggered AND is only 1 if **all** inputs are 1 and if **at least one** input was low in the previous cycle.

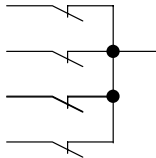
At an unused block input (x): $x = 1$.

Timing diagram for the AND with Edge Detection

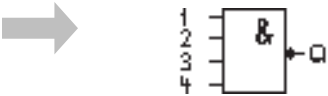


4.2.3 NAND (not AND)

Parallel circuit with multiple normally closed contacts in the circuit diagram:



Symbol in IDEC SmartRelay:



The output of the NAND is only 0 if the status at **all** inputs is 1, i.e. the contacts are closed.

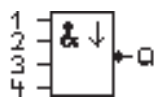
At an unused block input (x): $x = 1$.

Table of the NAND logic

1	2	3	4	Q
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

4.2.4 **NAND with Edge Detection**

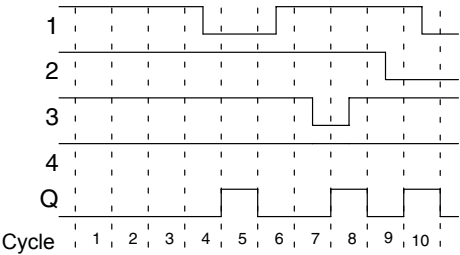
Symbol in IDEC SmartRelay:



The output status of the NAND with Edge Detection is only 1 if **at least one** input is 0 and if **all** inputs were 1 in the previous cycle.

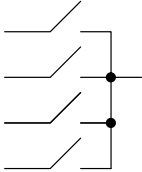
At an unused block input (x): x = 1.

Timing diagram for the NAND with Edge Detection

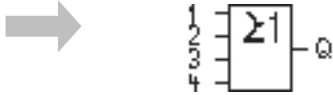


4.2.5 OR

Circuit diagram of a parallel circuit
with several normally open contacts:



Symbol in IDEC SmartRelay:



The output status of the OR element is only 1 if **at least one** input is 1, i.e. at least one of the contacts is closed.

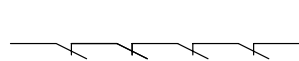
At an unused block input (x): x = 0.

Table of the OR logic

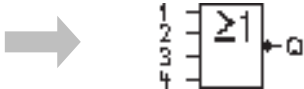
1	2	3	4	Q
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

4.2.6 NOR (not OR)

Circuit diagram of a series circuit with several normally closed contacts:



Symbol in IDEC SmartRelay:



The output status of the NOR is only 1 if **all** inputs are 0, i.e. if switched off. The NOR output is set to 0 when one of the inputs is switched on (logical 1 status).

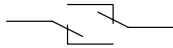
At an unused block input (x): x = 0.

Table of the NOR logic

1	2	3	4	Q
0	0	0	0	1
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	0

4.2.7 XOR (exclusive OR)

The XOR in a circuit diagram, shown as series circuit with 2 changeover contacts:



Symbol in IDEC SmartRelay:



The output status of the XOR is 1 if the inputs are **not equivalent**.

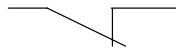
At an unused block input (x): x = 0.

Table of the XOR logic

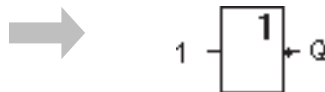
1	2	Q
0	0	0
0	1	1
1	0	1
1	1	0

4.2.8 NOT (Negation, Inverter)

A normally closed contact in the circuit diagram:



Symbol in IDEC SmartRelay:



The output status is 1 if the input is 0. The NOT block inverts the input status.

Advantage of the NOT block, for example: The IDEC SmartRelay does not require normally closed contacts. You simply use a normally open contact and the NOT block to convert these into a normally closed contact.

Table of the NOT logic

1	Q
0	1
1	0

4.3 Basics on special functions

Because of their different input designation, you can see right away that there is a difference between the special functions and basic functions. SFs contain timer functions, retentive functions and various parameter assignment options, which allow you to adapt the circuit program to suit your own requirements.

This section provides you with a brief overview of input designations and with some particular background information on SFs. The SFs in particular are described in Chapter 4.4.

4.3.1 Designation of the inputs

Logical inputs

Here, you will find the description of the connectors you can use to create a logical link to other blocks or to the inputs of the IDEC SmartRelay unit.

- **S (Set):**
A signal at input S sets the output to logical “1”.
- **R (Reset):**
The reset input R takes priority over all other inputs and resets the outputs.
- **Trg (Trigger):**
This input is used to trigger the start of a function.
- **Cnt (Count):**
This input is used for counting pulses.
- **Fre (Frequency):**
Frequency signals to be evaluated are applied to this input.
- **Dir (Direction):**
This input determines the direction of count, for example.
- **En (Enable):**
This input enables a block function. When this input is “0”, other signal to the block will be ignored.
- **Inv (Invert):**
A signal at this input inverts the output signal of the block.
- **Ral (Reset all):**
All internal values are reset.

Connector X at SF inputs

SF inputs connected to connector x are set low. That is, the inputs carry a ‘lo’ signal.

Parameter inputs

At some of the inputs you do not apply any signals. You configure the relevant block values instead. Examples:

- **Par (Parameter):**
This input will not be connected. Here, you set the relevant block parameters (times, on/off thresholds etc.).
- **No (Cam):**
This input will not be connected. Here, you configure the time patterns.
- **P (Priority):**
This is an open input. Here, you define priorities and specify whether a message is to be acknowledged in RUN.

4.3.2 Time response

Parameter T

At some of the SFs it is possible to configure a time value T. When you preset this time, note that your input values are based on the timebase set:

Timebase	— — : — —
s (seconds)	seconds : ¹ / ₁₀₀ seconds
m (minutes)	minutes : seconds
h (hours)	hours : minutes

B1

T

=

04

:

10

h

+

Setting a time T of 250 minutes:
 Unit in hours h:
 04:00 hours 240 minutes
 00:10 hours +10 minutes
 = 250 minutes

Note

Always specify a time T in ≥ 0.02 s. The time T is not defined for T < 0.02 s.

Accuracy of T

Because of slight tolerances in the characteristics of electronic components, the set time T may deviate. IDEC SmartRelay has a maximum tolerance of ± 0.02%. When 0.02% of the time T is smaller than 0.02 seconds, the maximum deviation is 0.02 seconds.

Example:

The maximum tolerance per hour (3600 seconds) is ±0.02%, which is proportional to ± 0.72 seconds.
 The maximum tolerance per minute (60 seconds) is ± 0.02 seconds.

Accuracy of the timer (Seven-day/Twelve-month time switch)

To prevent timing inaccuracy of the real-time clock in C versions caused by this deviation, the timer value is continuously compared with a high-precision timebase and corrected. The resultant maximum timing inaccuracy is ± 5 s/day.

4.3.3 Backup of the real-time clock

Because the internal real-time clock of an IDEC SmartRelay is backed up, it continues operation after a power failure.

The ambient temperature influences the backup time. At an ambient temperature of 25°C, the typical backup time is 80 hours.

If there is a power outage of an IDEC SmartRelay for more than 80 hours, the internal clock responds, as shown below:

On restarting, the clock is set to "Sunday 00:00 1 January". The time is stopped and flashes. IDEC SmartRelay is back in the status that it was in before the power outage. In the RUN status, the system processes the counters that were parameterized with the time above. The clock is, however, still stopped.

4.3.4 Retentivity

The switching states and counter values of SFs can be set retentive. This means that current data are retained after a power failure, and that the block resumes operation at the break point. The timer is not reset, but resumes operation until the time-to-go has expired, for example.

To enable this response, however, the relevant functions must be set retentive. Two options are available:

R: The data is retained.

/: Current data is not retained (default). See the example on page 88.

SFs Operating hours counter, Seven-day time switch, Twelve-month time switch and PI controller are always retentive.

4.3.5 Parameter protection

In the parameter protection settings, you can determine whether or not the parameters can be displayed and edited in IDEC SmartRelay parameter assignment mode. Two options are available:

+: The parameter attribute permits read/write access in parameter assignment mode (default).

–: The parameter settings are read/write protected in parameter assignment mode, and can be edited only in programming mode. See the example on page 88.

4.3.6 Calculating the gain and offset of analog values

A sensor is connected to the analog input and converts a process variable into an electrical signal. This value of signal lies within the typical range of this sensor.

IDEC SmartRelay always converts the electrical signals at the analog input into digital values from 0 to 1000.

A voltage of 0 to 10V at input AI is transformed internally into range of values from 0 to 1000. An input voltage exceeding 10V is shown as internal value 1000.

Because you can not always process the range of values from 0 to 1000 as predetermined by IDEC SmartRelay, you can multiply the digital values by a gain factor and then shift the zero of the range of values (offset). This allows you to output an analog value to the IDEC SmartRelay display, which is proportional to the actual process variable.

Parameter	Minimum	Maximum
Input voltage (in V)	0	≥ 10
Internal value	0	1000
Gain	-10.00	10.00
Offset	-10000	+10000

Mathematical rule

Actual value **Ax** =
(internal value at input Ax • gain) + offset

Gain and offset calculation

The gain and offset is calculated based on the relevant high and low values of the function.

Example 1:

The available thermocouples have the following technical data: -30 to +70°C, 0 to 10 V DC (i.e. 0 to 1000 in IDEC SmartRelay).

Actual value = (internal value • gain) + offset, thus
 -30 = (0 • A) + B, i.e. offset B = -30
 +70 = (1000 • A) -30, i.e. gain A = 0.1

Example 2:

A pressure sensor converts a pressure of 1000 mbar into a voltage of 0 V, and a pressure of 5000 mbar into a voltage of 10 V.

Actual value = (internal value • gain) + offset, thus
 1000 = (0 • A) + B, i.e. offset B = 1000
 5000 = (1000 • A) +1000, i.e. gain A = 4

Example of analog values

Process variable	Voltage (V)	Internal value	Gain	Offset	Value shown (Ax)
-30° C	0	0	0.1	-30	-30
0° C	3	300	0.1	-30	0
+70° C	10	1000	0.1	-30	70
1000 mbar	0	0	4	1000	1000
3700 mbar	6.75	675	4	1000	3700
5000 mbar	10	1000	4	1000	5000
	0	0	0.01	0	0
	5	500	0.01	0	5
	10	1000	0.01	0	10
	0	0	1	0	0
	5	500	1	0	500
	10	1000	1	0	1000
	0	0	10	0	0
	5	500	10	0	5000
	10	1000	10	0	10000
	0	0	0.01	5	5
	5	500	0.01	5	10
	10	1000	0.01	5	15
	0	0	1	500	500
	5	500	1	500	1000
	10	1000	1	500	1500
	0	0	1	-200	-200
	5	500	1	-200	300
	10	1000	1	-200	800
	0	0	10	-10000	-10000
	10	1000	10	-10000	0
	0.02	2	0.01	0	0
	0.02	2	0.1	0	0
	0.02	2	1	0	2
	0.02	2	10	0	20

A sample application is found in the description of the “Analog comparator” SF on page 184.

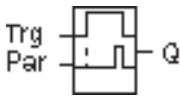
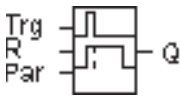
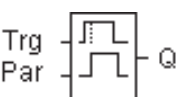
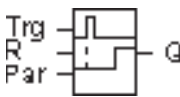
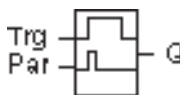
For further information on analog inputs, refer to Chapter 4.1.

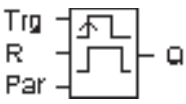
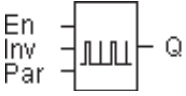
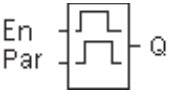
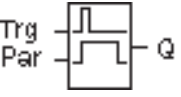
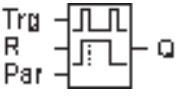
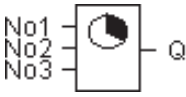

4.4 Special functions list - SF

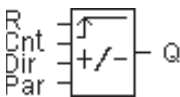
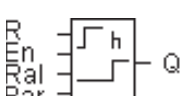


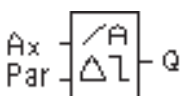


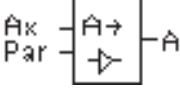
When you create your circuit program in IDEC SmartRelay, you find the special function blocks in the SF list.

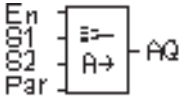
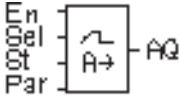
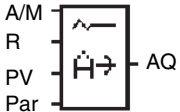

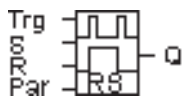
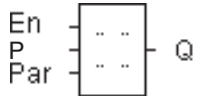
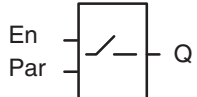
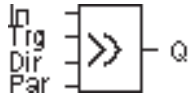
You can invert the inputs of SFs individually, i.e. the circuit program converts a logical “1” at the input into a logical “0”; a logical “0” it converts into a logical “1”. An example of the program code found in Chapter 3.6.3.

The table also specifies whether the relevant function can be set retentivity (Rem). The following SFs are available:

View in IDEC SmartRelay	Name of the special function	Rem
Times		
	On-delay (see page 132)	REM
	Off-delay (see page 136)	REM
	On-/Off-delay (see page 138)	REM
	Retentive on-delay (see page 140)	REM
	Interval time-delay relay / Pulse output (see page 142)	REM

View in IDEC SmartRelay	Name of the special function	Rem
	Edge-triggered interval time-delay relay (see page 144)	REM
	Asynchronous pulse generator (see page 147)	REM
	Random generator (see page 149)	
	Stairwell Light Switch (see page 151)	REM
	Dual-function switch (see page 154)	REM
	Seven-day time switch (see page 157)	
	Twelve-month time switch (see page 162)	


View in IDEC SmartRelay	Name of the special function	Rem
Counter		
	Up/down counter (see page 165)	REM
	Operating hours counter (see page 169)	REM
	Frequency trigger (see page 174)	
Analog		
	Analog trigger (see page 177)	
	Analog differential trigger (see page 180)	
	Analog comparator (see page 184)	
	Analog value monitoring (see page 189)	
	Analog amplifier (see page 192)	

View in IDEC SmartRelay	Name of the special function	Rem
	Analog multiplexer (see page 213)	
	Analog Ramp Control (see page 217)	
	PI controller (see page 222)	REM
Miscellaneous		
	Latching relay (see page 195)	REM
	Current impulse relay (see page 196)	REM
	Message texts (see page 199)	
	Softkey (see page 206)	REM
	Shift register (see page 210)	REM

4.4.1 On-delay

Short description

The output is only set after a configurable on-delay time has expired.

Symbol in IDEC SmartRelay	Wiring	Description
	Input Trg	You start the on-delay with a negative edge (1 to 0 transition) at input Trg (Trigger).
	Parameter	T represents the time after which the output is switched on (0 to 1 transition of the output signal). Retentivity: / = no retentivity R = the status is retentive.
	Output Q	Q is switched on when the set time T has expired, provided Trg is still set.

Parameter T

Please note the defaults for parameter T in Chapter 4.3.2.

The time for parameter T can also be preset based on the actual value of another, already configured function. You can use the actual values of the following functions:

- Analog comparator (actual value Ax - Ay, see Chapter 4.4.18)
- Analog trigger (actual value Ax, see Chapter 4.4.16)
- Analog amplifier (actual value Ax, see Chapter 4.4.20)
- Analog multiplexer (actual value AQ, see Chapter 4.4.26)
- Analog Ramp Control (actual value AQ, see Chapter 4.4.27)
- PI controller (actual value AQ, see Chapter 4.4.28)
and
- Counter (actual value Cnt, see Chapter 4.4.13).

Select the required function by means of the block number.
The timebase is adjustable. Please note the following listing:

Valid ranges of the timebase, if T = parameter

Timebase	max. value	min. resolution	Accuracy
s (seconds)	99:99	10 ms	± 10 ms
m (minutes)	99:59	1s	± 1 s
h (hours)	99:59	1 min	± 1 min

The display in programming mode (example):

```

B12      +R
T    =04:10h
    
```

Valid ranges of the timebase, if T = Actual value of an already programmed function

Timebase	max. value	min. resolution	Accuracy
ms	99990	Number of ms	± 10 ms
s	5999	Number of s	± 1 s
m	5999	Number of min	± 1 min

The display in programming mode (example):

```

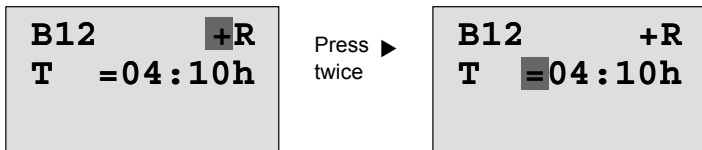
B12      +R
T    →B006s
    
```

If the referenced block (B6, in the example) returns a value that lies out of the valid range, the value is rounded up or down to the next valid value.

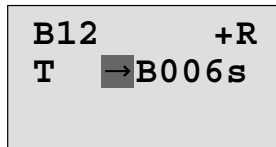
Parameter preset = Actual value of an already programmed function

How to include the actual value of an already programmed function:

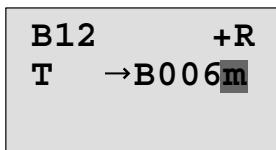
1. Press ► to move the cursor to the equal sign of parameter T.



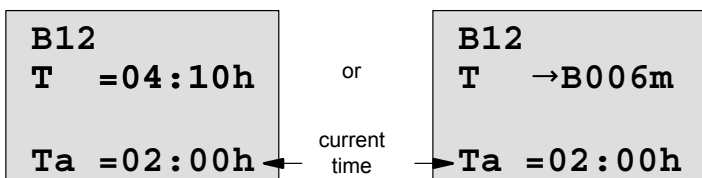
2. Press ▼ to change the equal sign into an arrow. If it exists, the last referenced block and its timebase is shown.



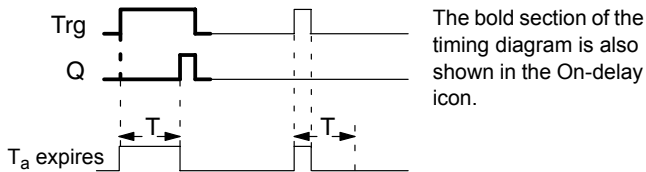
3. Press ► to move the cursor to the “B” of the shown block, and then press ▼ to select the required block number.
4. Press ► to move the cursor to the block’s timebase and press ▼ to select the required timebase.



The view in parameter assignment mode (example):



Timing diagram



Functional description

The time T_a is triggered with a 0 to 1 transition at input Trg (T_a is the current IDEC SmartRelay time).

If the status of input Trg is 1 at least for the duration of the configured time T , the output is set to 1 on expiration of this time (the output follows the input with on-delay).

The time is reset when the status at input Trg returns to 0 before the time T has expired.

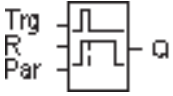
The output is reset to 0 when the signal at input Trg is 0.

If retentivity is not set, output Q and the expired time are re-set after a power failure.

4.4.2 Off-delay

Short description

When an on-delay is set, the output is reset when the configured time has expired.

Symbol in IDEC SmartRelay	Wiring	Description
	Input Trg	You start the off-delay time with a negative edge (1 to 0 transition) at input Trg (Trigger).
	Input R	A signal at input R resets the on-delay time and the output.
	Parameter	T is the time that expires after which the output is switched off (1 to 0 transition of the output signal). Retentivity: / = No retentivity R = The status is retentive.
	Output Q	Q is set with a signal at input Trg. It holds this state until T has expired.

Parameter T

Please note the parameter T defaults specified in Chapter 4.3.2.

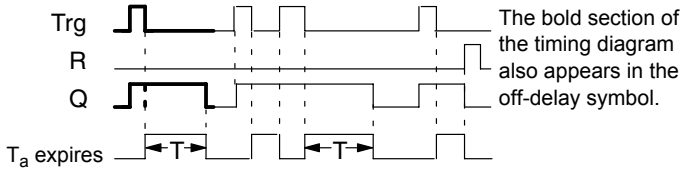
The time for parameter T can be based on the actual value of another, already configured function. You can use the process variables of the following functions:

- Analog comparator (actual value Ax - Ay, see Chapter 4.4.18)
 - Analog trigger (actual value Ax, see Chapter 4.4.16)
 - Analog amplifier (actual value Ax, see Chapter 4.4.20)
 - Analog multiplexer (actual value AQ, see Chapter 4.4.26)
 - Analog Ramp Control (actual value AQ, see Chapter 4.4.27)
 - PI controller (actual value AQ, see Chapter 4.4.28)
- and

- Counter (actual value Cnt, see Chapter 4.4.13).

Select the required function by means of the block number.
The timebase is configurable. For information on valid timebase ranges and parameter preset, refer to Chapter 4.4.1.

Timing diagram



Functional description

Output Q is set to hi immediately when the input Trg changes to hi.

The actual time T_a in IDEC SmartRelay is retrigged at the 1 to 0 transition of Trg. The output remains set. Output Q is reset to 0 with off-delay when T_a reaches the value configured at T ($T_a=T$).

The time T_a is retrigged with a one-shot at input Trg.

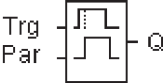
You can set input R (Reset) to reset the time T_a and the output before T_a has expired.

If retentivity is not set, output Q and the expired time are re-set after a power failure.

4.4.3 On-/Off-delay

Short description

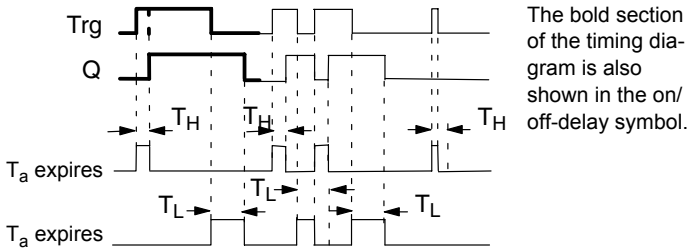
The on-/off-delay function sets the output after the set on-delay time has expired, and resets it upon expiration of the off-delay time.

Symbol in IDEC SmartRelay	Wiring	Description
	Input Trg	<p>A positive edge (0 to 1 transition) at input Trg (Trigger) triggers the on-delay time T_H.</p> <p>A negative edge (1 to 0 transition) at input Trg (Trigger) triggers the off-delay time T_L.</p>
	Parameter	<p>T_H is the time after which the output is set hi (output signal transition 0 to 1).</p> <p>T_L is the time after which the output is reset (output signal transition 1 to 0).</p> <p>Retentivity: / = No retentivity R = The status is retentive.</p>
	Output Q	<p>Q is set when the configured time T_H has expired and Trg is still set. It is reset on expiration of the time T_L, if the trigger Trg has not been set again.</p>

Parameters T_H and T_L

Note the preset values for the parameters T_H and T_L in Chapter 4.3.2.

Timing diagram



Functional description

The time T_H is triggered with a 0 to 1 transition at input Trg.

If the status at input Trg is 1 at least for the duration of the time T_H , the output is set to 1 on expiration of the time T_H (the output follows the input with on-delay).

The time is reset when the signal at input Trg is reset to 0 before the time T_H has expired.

A 1 to 0 transition at input Trg triggers the time T_L .

If the status at input Trg is 0 at least for the duration of the signal T_L , the output is set to 0 on expiration of the time T_L (the output follows the input with off-delay).

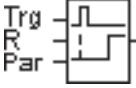
The time is reset when the signal at input Trg changes to 1 again before the time T_L has expired.

If retentivity is not set, output Q and the expired time are re-set after a power failure.

4.4.4 Retentive on-delay

Short description

A one-shot at the input triggers a configurable on-delay time. The output is set when this time has expired.

Symbol in IDEC Smart Relay	Wiring	Description
	Input Trg	A signal at input Trg (Trigger) triggers the on-delay time.
	Input R	A signal at input R resets the on-delay time and the output.
	Parameter	T represents the on-delay time for the output (output status transition 0 to 1). Retentivity: / = no retentivity R = The status is retentive.
	Output Q	Q is set after the time T has expired.

Parameter T

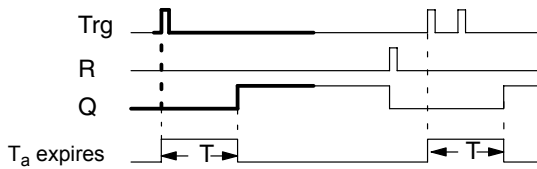
Note the defaults specified in Chapter 4.3.2.

The time for parameter T can be based on the process variable of another, already programmed function. You can use the process variables of the following functions:

- Analog comparator (actual value Ax - Ay, see Chapter 4.4.18)
- Analog trigger (actual value Ax, see Chapter 4.4.16)
- Analog amplifier (actual value Ax, see Chapter 4.4.20)
- Analog multiplexer (actual value AQ, see Chapter 4.4.26)
- Analog Ramp Control (actual value AQ, see Chapter 4.4.27)
- PI controller (actual value AQ, see Chapter 4.4.28)
and
- Counter (actual value Cnt, see Chapter 4.4.13).

Select the required function by means of the block number. The timebase is configurable. For information on valid ranges and parameter defaults, refer to Chapter 4.4.1.

Timing diagram



The bold section of the timing diagram is also shown in the symbol of the retentive on-delay.

Functional description

The 0 to 1 signal transition at input Trg triggers the current time T_a . Output Q is set when $T_a = T$. A further signal at input Trg does not influence the time T_a .

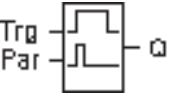
The output and the time T_a are reset with the next 1 signal at input R.

If retentivity is not set, output Q and the expired time are re-set after a power failure.

4.4.5 Interval time-delay relay / Pulse output

Short description

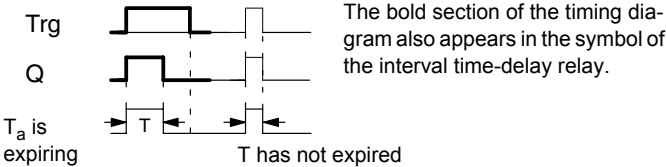
An input pulse generates a signal with a configurable period at the output.

Symbol in IDEC SmartRelay	Wiring	Description
	Input Trg	A signal at input Trg (Trigger) triggers the time for the Interval time-delay relay function.
	Parameter	The output is switched off after the time T has expired (output signal transition 1 to 0). Retentivity: / = No retentivity R = The status is retentive.
	Output Q	A signal at input Trg sets Q. If the input signal = 1, output Q remains set for the time Ta.

Parameter T

Please note the information on parameter T in Chapter 4.3.2.

Timing diagram



Functional description

A 0 to 1 transition at input Trg sets the output, and triggers a time T_a during which the output remains set.

Output Q is reset to lo (pulse output) when T_a reaches the value preset at T ($T_a = T$).

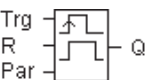
The output is immediately reset if there is a 1 to 0 transition at input Trg before the specified time has expired.

If retentivity is not set, output Q and the expired time are reset after a power failure.

4.4.6 Edge-triggered interval time-delay relay

Short description

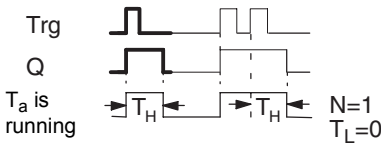
An input pulse generates a preset number of output pulses with a defined pulse/pause ratio (retriggerable), after a configured delay time has expired.

Symbol in IDEC SmartRelay	Wiring	Description
	Input Trg	A signal at input Trg (Trigger) triggers the times for the edge-triggered interval time-delay relay.
	Input R	A signal at input R resets the current time (T_a) and the output.
	Parameter	<p>The interpulse width T_L and the pulse width T_H are configurable.</p> <p>N determines the number of pulse/pause cycles TL/TH: Range of values: 1...9</p> <p>Retentivity: / = No retentivity R = The status is retentive.</p>
	Output Q	Q is set after T_L has expired, and reset after T_H has expired.

Parameter T

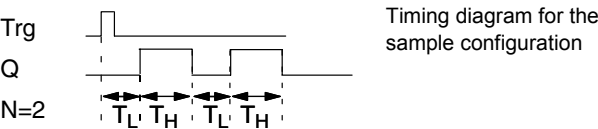
Please note the information on parameter T in Chapter 4.3.2.

Timing diagram A



The bold section of the timing diagram also appears in the symbol of the edge-triggered interval time-delay relay.

Timing diagram B



Functional description

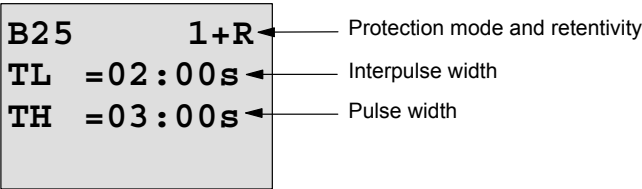
A 0 to 1 transition at input Trg triggers the time T_L (Time Low). After the time T_L has expired, output Q is set for the duration of T_H (Time High).

If there is a further 0 to 1 transition (retriggering pulse) at input Trg before the preset time ($T_L + T_H$) has expired, T_a is reset and the pulse/pause cycle is restarted.

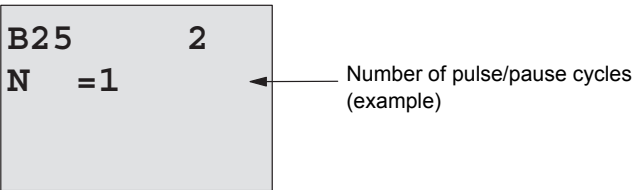
If retentivity is not set, output Q and the time are reset after a power failure.

Preset of the Par parameter

View in programming mode (example):



Press ►



View in parameter assignment mode (example):

B25

TL =02:00s

TH =03:00s


Ta =01:15s

← Current pulse width T_L or T_H

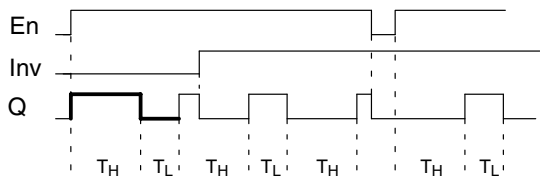
4.4.7 Asynchronous pulse generator

Short description

The output pulse shape can be modified by reconfiguring the pulse/pause ratio.

Symbol in IDEC SmartRelay	Wiring	Description
	Input En	You can use input EN to set and reset the asynchronous pulse generator.
	Input INV	Input INV can be used to invert the output signal of the active asynchronous pulse generator.
	Parameter	You can configure the pulse width T_H and the interpulse width T_L . Retentivity: / = No retentivity R = The status is retentive.
	Output Q	Q is set and reset cyclically according to the pulse/pause ratio T_H and T_L .

Timing diagram



Functional description

You can configure the pulse/interpulse width at the T_H (Time High) and T_L (Time Low) parameters.


Input Inv can be used to invert the output signal, provided the block is enabled with a signal at input EN.

If retentivity is not set, output Q and the expired time are re-set after a power failure.

4.4.8 Random generator

Short description

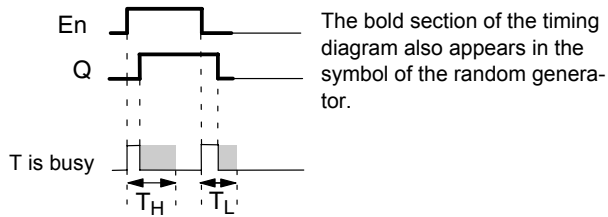
The output of the random generator is set or reset within a configured time.

Symbol in IDEC SmartRelay	Wiring	Description
<div> En  </div>	Input En	<p>A positive edge (0 to 1 transition) at input En (Enable) triggers the on-delay time of the random generator.</p> <p>A negative edge (1 to 0 transition) at input En (Enable) triggers the off-delay time of the random generator.</p>
	Parameter	<p>The on-delay is set at random to a value between 0s and T_H.</p> <p>The off-delay is set at random to a value between 0s and T_L.</p>
	Output Q	<p>Output Q is set when the on-delay has expired and if En is still set. It is reset when the off-delay has expired, provided En was not set again meanwhile.</p>

Parameter T_H and T_L

Note the defaults of the T_H and T_L parameters listed in Chapter 4.3.2.

Timing diagram



Functional description

The 0 to 1 transition at input En triggers a random on-delay time between 0 s and T_H . The output is set when the on-delay time has expired and if the signal at input En remains hi at least for the duration of this time.

The time is reset if input En is reset before the on-delay time has expired.

A 1 to 0 transition at input EN triggers a random on-delay time between 0s and T_L .

The output is reset after the off-delay time has expired, provided input En remains lo at least for the duration of this time.


The time is reset if the signal at input En changes to 1 again before the off-delay time has expired.

The time expired is reset after a power failure.

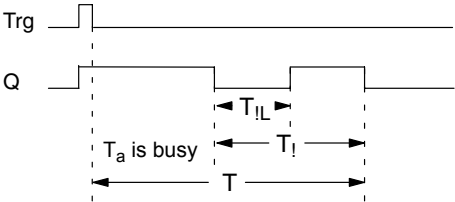
4.4.9 Stairwell Light Switch

Short description

An input edge triggers a configurable and retriggerable time. The output is reset after this time has expired. A warning signal can be output before this time has expired to warn of the impending shutdown.

Symbol in IDEC SmartRelay	Wiring	Description
	Input Trg	A signal at input Trg (Trigger) triggers the off-delay time for the Stairwell Light Switch.
	Parameter	T represents the off-delay time of the output (output signal transition 1 to 0). T _I determines the triggering time for the pre-warning. T _{IL} determines the length of the pre-warning signal. Retentivity: / = No retentivity R = The status is retentive.
	Output Q	Q is reset after the time T has expired. A warning signal can be output before this time has expired.

Timing diagram



Functional description

A 0 to 1 signal transition at input Trg sets output Q. The next 1 to 0 transition at Trg retriggers the current time T_a , and output Q remains set.

Output Q is reset when $T_a = T$. You can output a warning signal before the off-delay time has expired to reset Q for the time of the pre-warning period $T_{!L}$.

A further one-shot at input Trg during T_a retriggers the time T_a .

If retentivity is not set, output Q and the expired time are reset after a power failure.

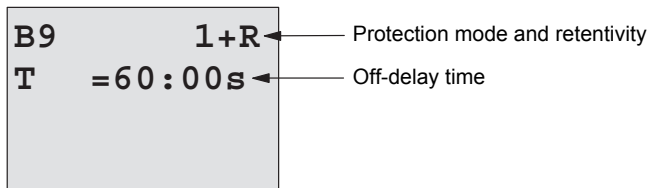
Preset of the Par parameter

Note the defaults specified in Chapter 4.3.2.

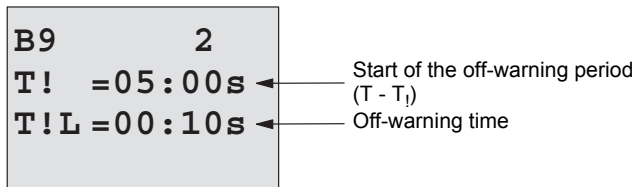
Note

All times must have the same timebase.

View in programming mode (example):



Press ►



View in parameter assignment mode (example):

B9	1
T	=60:00s
Ta	=06:00s


← Current value of T

4.4.10 Dual-function switch

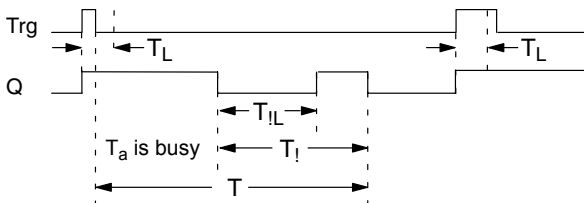
Short description

Switch with two different functions:

- Pulse switch with off-delay
- Switch (permanent lighting)

Symbol in IDEC SmartRelay	Wiring	Description
	Input Trg	A signal at input Trg (Trigger) sets output Q (permanent light) or resets it with off-delay. When active, output Q can be reset with a signal at input Trg.
	Input R	A signal at input R resets the current time T_a and the output.
	Parameter	<p>T represents the time after which the output is reset (output signal transition 1 to 0).</p> <p>T_L represents the time during which the output must be set to enable the permanent lighting function.</p> <p>T_I represents the preset time for the start of the off-warning signal.</p> <p>T_{IL} represents the length of the off-warning period.</p> <p>Retentivity: / = No retentivity R = The status is retentive.</p>
	Output Q	A signal at Trg switches on output Q. Depending on the length of the input at Trg, the output is switched off again or switched on permanently, or it is reset with a further signal at Trg.

Timing diagram



Functional description

A 0 to 1 transition at input Trg sets output Q.

If output Q = 0, and input Trg is set hi at least for the duration of T_L , the permanent lighting function is enabled and output Q is set accordingly.

The off-delay T is triggered when input Trg returns to 0 before T_L has expired.

Output Q is reset when $T_a = T$.

You can output an off-warning signal prior to the expiration of the off-delay time, to reset Q for the duration of the off-warning signal T_{IL} . A further signal at Trg always resets T and the output Q.

If retentivity is not set, output Q and the expired time are reset after a power failure.

Preset of the Par parameter

Note the defaults specified in Chapter 4.3.2.

Note

T, T_I and T_{IL} must all have the same timebase.

View in programming mode (example):

B5	1+R	← Protection mode and retentivity
T	=60:00s	← Off-delay
TL	=10:00s	← Permanent light on-time

Press ►

B5	2	
T!	=30:00s	← Start of the off-warning period ($T - T_l$)
T!L	=20:00s	← Off-warning time

View in parameter assignment mode (example):

B5	1	
T	=60:00s	
TL	=10:00s	
Ta	=06:00s	← Current value of the time T_L or T

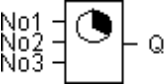
4.4.11 Seven-day time switch

Short description

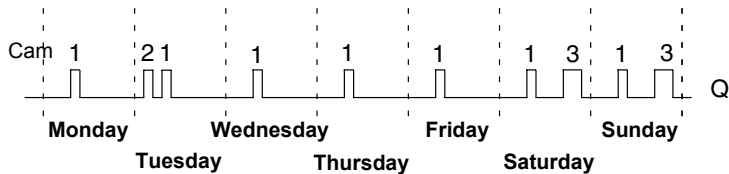
The output is controlled by means of a configurable on/off date. The function supports any combination of weekdays. You select the active weekdays by hiding the inactive days.

Note

Because the FL1D-H12SND does not have a real-time clock, the Seven-day time switch function is not available for this version.

Symbol in IDEC SmartRelay	Wiring	Description
	Cam parameters No1, No2, No3	At the Cam parameters, you set the on- and off-times of the Seven-day time switch for each Cam switch. Here you also configure the days and the time-of-day.
	Output Q	Q is set when the configured cam is actuated.

Timing diagram (three examples)



Cam No1: Daily: 06:30 h to 08:00h
 Cam No2: Tuesday: 03:10 h to 04:15h
 Cam No3: Saturday and Sunday: 16:30 h to 23:10h

Functional description

Each Seven-day time switch has three cams you can use to configure a time hysteresis. You specify the on- and off-times at the Cam parameters. The Seven-day time switch sets the output at a certain on-time, if this is not already set.

The Seven-day time switch resets the output at a certain off-time, if it is not switched off already. You will cause a conflict if the on- and off-times you set for the Seven-day time switch are identical, though set on different cams. In this case, cam3 takes priority over cam2, whereas cam2 takes priority over cam1.

The switching state of the Seven-day time switch is determined by the status of all three cams.

Parameter assignment screen form

View of the parameter assignment screen form, for example for Cam1:

Block B1

Cam No1

See Showing/hiding parameters-Parameter protection mode on page 88.

Weekdays (daily)

On-time (06:30 h)

Off-time (08:00 h)

B1 1+

D=MTWTFSS

On =06:30

Off=08:00

Weekday

The suffix of "D=" (Day) has the following meaning:

- M : Monday
- T : Tuesday
- W : Wednesday
- T : Thursday
- F : Friday
- S : Saturday
- S : Sunday

The uppercase letter indicates: A weekday is selected. A "-" means: A weekday has not been selected.

On-/Off-times

Any time between 00:00 h and 23:59 h is possible.

– : – means: No on-/off-times set.

Setting the Seven-day time switch

To set the on-/off-times:

1. Move the cursor to one of the Cam parameters of the timer (e.g. No1).
2. Press **OK**. IDEC SmartRelay opens the Cam parameter assignment screen form. The cursor is positioned on the weekday.
3. Press **▲** and **▼** to select one or several weekdays.
4. Press **▶** to move the cursor to the first position of the on-time.
5. Set the on-time.
Modify the value at the respective position, using the keys **▲** and **▼**. Move to the cursor to the various positions, using the keys **◀** and **▶**. At the first position, you can only select the value – : –
(– : – means: No on-/off-times set).
6. Press **▶** to move the cursor to the first position of the off-time.
7. Set the off-time (in same way as in step 5).
8. Confirm your entries with **OK**.
The cursor is now positioned on the No2 parameter (Cam2) and you can configure a further cam.

Note

For information on timer accuracy, refer to the technical data and to Chapter 4.3.2.

Seven-day time switch: Example

The output of the Seven-day time switch is to be set daily from 05:30h to 07:40h. The output should also be set every Tuesday from 03:10 h to 04:15h, and at the weekends from 16:30 h to 23:10h.

This requires three cams.

Here are the parameter assignment screen forms of the cams No 1, 2 and 3, based on the timing diagram shown earlier.

Cam1

Cam No1 must set the output of the Seven-day time switch daily from 05:30 h to 07:40 h.

B1	1+
D=MTWTFSS	
On =05:30	
Off=07:40	

Cam2

Cam No2 must set the output of the Seven-day time switch every Tuesday from 03:10 h to 04:15 h.

B1	2
D=-T-----	
On =03:10	
Off=04:15	

Cam3

Cam No3 must set the output of the Seven-day time switch switch every Saturday and Sunday from 16:30 h to 23:10 h.

B1

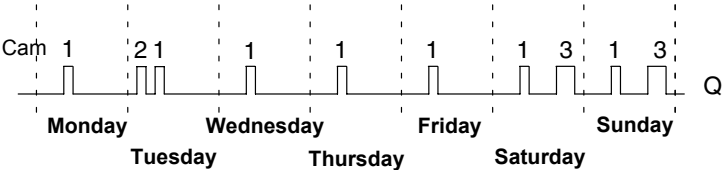
3

D=----SS

On =16:30

Off=23:10

Result



4.4.12 Twelve-month time switch

Short description

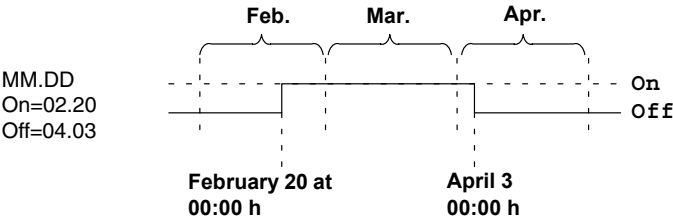
The output is controlled by means of a configurable on/off date.

Note

Because FL1D-H12SND does not have a real-time clock, the Twelve-month time switch is not available for this version.

Symbol in IDEC SmartRelay	Wiring	Description
<div> <div>No</div> <div> <div>MM</div> <div>DD</div> </div> <div>Q</div> </div>	Cam parameter	At the Cam parameter, you configure the on-/off-times for the cam of the Twelve-month time switch.
	Output Q	Q is set when the configured cam is actuated.

Timing diagram



Functional description

The Twelve-month time switch sets the output at a specific on-time, and resets it at a specific off-time. The off-date identifies the day on which the output is reset again. The first value identifies the month, the second the day. For “MM” you can select a placeholder (**), so that the on- and off-time is set for a specific day each month.

Sample configuration

The output of a IDEC SmartRelay is to be set annually on March 1, reset on April 4, set again on July 7, and reset again on November 19. You need to configure two Twelve-month time switches with corresponding on-times. The outputs are then logically linked by means of an OR block

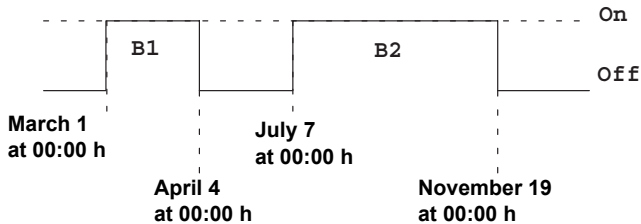
B1	+
MM-DD	
On =03-01	
Off=04-04	

On-time March 1
Off-time April 4

B2	+
MM-DD	
On =07-07	
Off=11-19	

In addition:
On-time July 7
Off-time November 19

Result



Further examples

```

B11      +
      ** -DD
On  =** -01
Off=** -02
    
```

On-time is the first,
and off-time the second day each month.

```

B12      +
      ** -DD
On  =** -10
Off=** -20
    
```

Each month, from the 10th through to the
20th

```

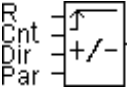
B13      +
      ** -DD
On  =** -25
Off=** -05
    
```

In the next month,
from the 25th through the 5th

4.4.13 Up/down counter

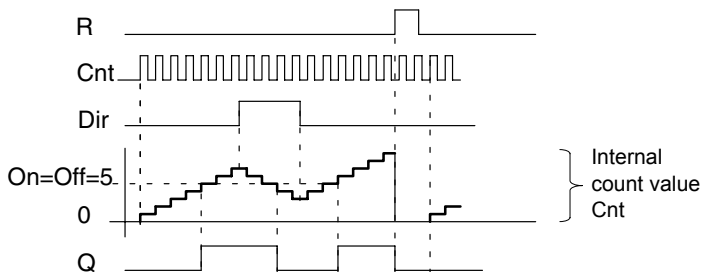
Short description

An input pulse increments or decrements an internal value, depending on the parameter setting. The output is set or re-set when a configured threshold is reached. The direction of count can be changed with a signal at input Dir.

Symbol in IDEC SmartRelay	Wiring	Description
	Input R	A signal at input R resets the internal count value to zero.
	Input Cnt	<p>The function counts the 0 to 1 transitions at input Cnt. 1 to 0 transitions are not counted.</p> <p>Use</p> <ul style="list-style-type: none">• inputs I5/I6 for high-speed counting (only FL1D-H12RCE/FL1D-B12RCE and FL1D-H12SND): max. 2 kHz.• any other input or circuit component for counting low frequency signals (typ. 4 Hz).
	Input Dir	<p>You set the direction of count at input Dir:</p> <p>Dir = 0: Up count</p> <p>Dir = 1: Down count</p>

Symbol in IDEC SmartRelay	Wiring	Description
	Parameter	<p>On: On threshold Range of values: 0...999999</p> <p>Off: Off threshold Range of values: 0...999999</p> <p>Retentivity for internal counter value Cnt: / = No retentivity R = The status is retentive.</p>
	Output Q	Q is set or reset, depending on the current value at Cnt and the set thresholds.

Timing diagram



Functional description

The internal counter increments (Dir = 0) or decrements (Dir = 1) by one count with every positive edge at input Cnt.

You can use input R to reset the internal count value to '000000'. As long as R = 1, the output is also lo and the pulses at input Cnt are not counted.

If retentivity is not set, output Q and the expired time are reset after a power failure.

Q is set or reset depending on the current value at Cnt and the set thresholds. See the calculation rule below.

Calculation rule

- If the On threshold \geq Off threshold, then:
Q = 1, if Cnt \geq On
Q = 0, if Cnt < Off.
- If the On threshold < Off threshold, then Q = 1, if On \leq Cnt < Off.

Default on/off parameters

The default limits for the on and/or off parameters can be derived from another, already programmed function. You can use the actual values of the following functions:

- Analog comparator (actual value Ax - Ay, see Chapter 4.4.18)
- Analog trigger (actual value Ax, see Chapter 4.4.16)
- Analog amplifier (actual value Ax, see Chapter 4.4.20)
- Analog multiplexer (actual value AQ, see Chapter 4.4.26)
- Analog Ramp Control (actual value AQ, see Chapter 4.4.27)
- PI controller (actual value AQ, see Chapter 4.4.28)
and
- Counter (actual value Cnt, see Chapter 4.4.13).

Select the required function by means of the block number. For information on parameter defaults, refer to Chapter 4.4.1.

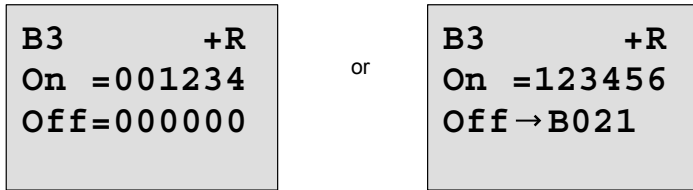
Note

The system scans the counter limit value cyclically.

Thus, if the pulse frequency at the fast inputs I5/I6 is faster than the cycle time, the special function might not switch until after the specified limit value is exceeded.

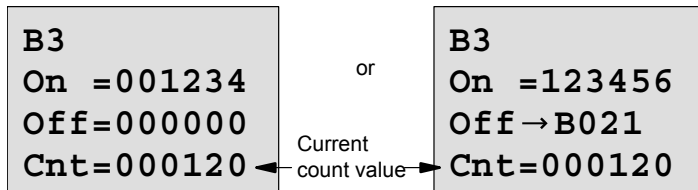
Example: Up to 100 pulses per cycle can be counted; 900 pulses have been counted so far. On = 950; Off = 10000. The output is set in the next cycle, after the value has reached 1000. (The output would not be set at all if the value Off = 980.)

View in programming mode (example):



If the referenced block (B6, in the example) returns a value that lies out of the valid range, the value is rounded to the next valid value.

The view in parameter assignment mode (example):



4.4.14 Operating hours counter

Short description

A configured time is triggered with a signal at the monitoring input. The output is set when this time has expired.

Symbol in IDEC SmartRelay	Wiring	Description
	Input R	A positive edge (0 to 1 transition) at input R resets output Q and sets a configured value MI at the counter for the duration of the time-to-go (MN).
	Input En	En is the monitoring input. IDEC SmartRelay scans the on-time of this input.
	Input Ral	<p>A positive edge at input Ral (Reset all) resets both the Operating hours counter (OT) and the output, and sets the configured value MI at the counter to for the duration of the time-to-go (MN). That is,</p> <ul style="list-style-type: none"> • output Q = 0, • measured operating time OT = 0 and • the time-to-go of the maintenance interval MN = MI.

Symbol in IDEC SmartRelay	Wiring	Description
	Parameter	<p>MI: Maintenance interval to be preset in hour units Range of values: 0000...9999 h</p> <p>OT: The accumulated total operating time; you can specify an offset Range of values: 00000...99999 h</p> <p>Q → 0:</p> <ul style="list-style-type: none"> • When “R” is selected: Q = 1, if MN = 0; Q = 0, if R = 1 or Ral = 1 • When “R+En” is selected: Q = 1, if MN = 0; Q = 0, if R = 1 or Ral = 1 or En = 0.
	Output Q	<p>The output is set when the time-to-go MN = 0 (see timing diagram).</p> <p>The output is reset:</p> <ul style="list-style-type: none"> • When “Q → 0:R+En”, if R = 1 or Ral = 1 or En = 0 • When “Q → 0:R”, if R = 1 or Ral = 1.

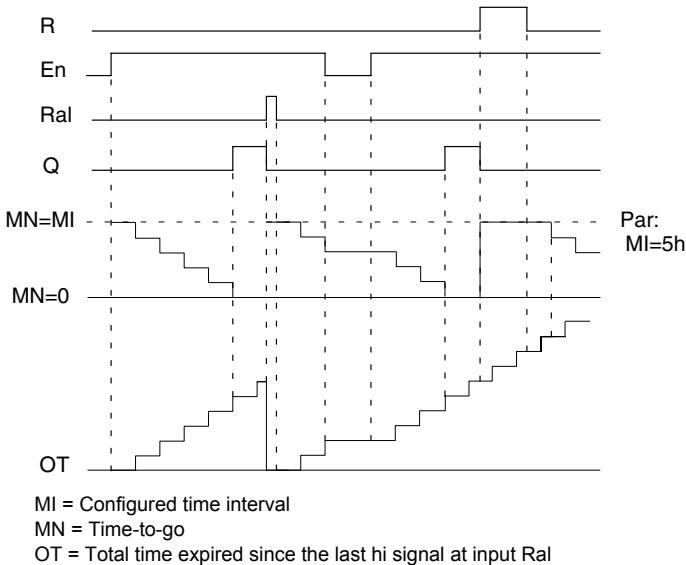
MI = Configured time interval

MN = Time-to-go

OT = Total time expired since the last hi signal at input Ral

These values are always retentive!

Timing diagram



Functional description

The Operating hours counter monitors input En. When En = 1, IDEC SmartRelay computes the time expired and the time-to-go MN. IDEC SmartRelay shows these times in parameter assignment mode. Output Q is set when the time-to-go MN = 0.

A signal at reset input R resets output Q and sets the preset value of MI at the counter for the duration of MN. The Operating hours counter OT continues the count.

With a signal at the reset input Ral, you reset output Q and set the preset value of MI at the counter for the duration of MN. The Operating hours counter OT is reset to zero.

Depending on your configuration of parameter Q, the output is either reset with a signal at input R or Ral ("Q → 0:R"), or when a reset signal is set hi, or the En signal is set lo ("Q → 0:R+En").

Viewing the MI, MN and OT values

- IDEC SmartRelay Base with display unit: You can open the parameter assignment mode when the system is in RUN to view the actual values of MI, MN and OT.
- IDEC SmartRelay Base without display unit: In WindLGC, you can use the Online Test to read these values (for further information, see Chapter 7).

Limit value of OT

The value of the operating hours in OT are retained when you reset the Operating hours counter with a signal at input R. The Operating hours counter OT continues the count as long as En = 1, irrespective of the status at the reset input R.

The counter limit of OT is 99999 h.

The Operating hours counter stops when it reaches this value.

In programming mode, you can set the initial value of OT.

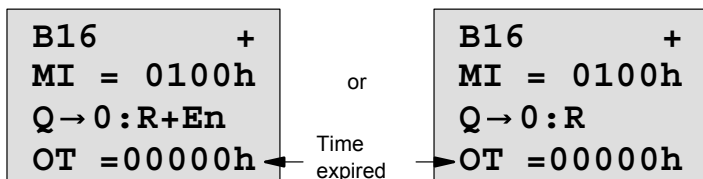
The counter starts operation at any value other than zero.

MN is automatically calculated at the START, based on the MI and OT values

(Example: MI = 100, OT = 130, the result is MN = 70).

Preset of the Par parameter

View in programming mode:



MI is the configurable time interval. Its permissible range of values lies between 0 and 9999 hours.

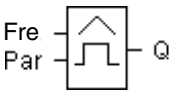
View in parameter assignment mode:

B16	
MI = 0100h	← Time interval
MN = 0017h	← Time-to-go
OT = 00083h	← Total operating hours

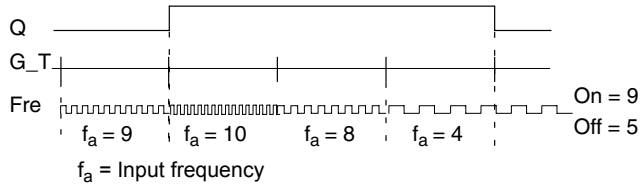
4.4.15 Frequency trigger

Short description

The output is set and reset with two configurable frequency triggers.

Symbol in IDEC SmartRelay	Wiring	Description
	Input Fre	<p>The function counts the 0 to 1 transitions at input Fre. 1 to 0 transitions are not counted.</p> <p>Use</p> <ul style="list-style-type: none"> inputs I5/I6 for high-speed counting (only FL1D-H12RCE/FL1D-B12RCE and FL1D-H12SND): max. 2 kHz. any other input or circuit component for counting low frequency signals (typ. 4 Hz).
	Parameter	<p>On: On threshold Range of values: 0000...9999</p> <p>Off: Off threshold Range of values: 0000...9999</p> <p>G_T: Time interval or gate time during which the input pulses are measured. Range of values: 00:05 s...99:99 s</p>
	Output Q	Q is set and reset at the thresholds.

Timing diagram



Functional description

The Frequency trigger measures the signals at input Fre. The pulses are recorded across a configurable time G_T. Output Q is set and reset in accordance with the set thresholds. See the calculation rule below.

Calculation rule

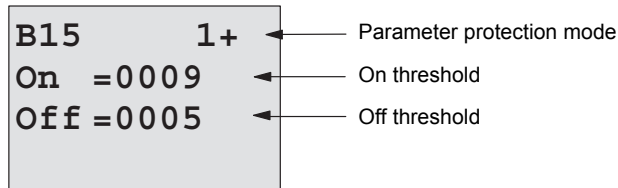
- If the On threshold \geq Off threshold, then:
 $Q = 1$, if $f_a > \text{On}$
 $Q = 0$, if $f_a \leq \text{Off}$.
- If the On threshold $<$ Off threshold, then $Q = 1$ if
 $\text{On} \leq f_a < \text{Off}$.

Preset of the Par parameter

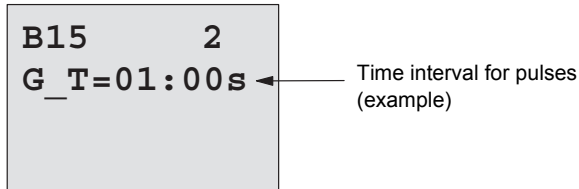
Note

The system scans the counter limit value once per interval G_T.

View in programming mode (example):



Press ►

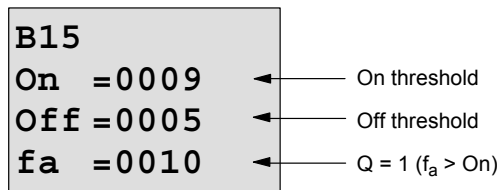


Note

The “seconds” timebase is here set as permanent default.

When you preset a time G_T of 1 s, the IDEC SmartRelay returns the current frequency in parameter f_a in Hz.

View in parameter assignment mode (example):



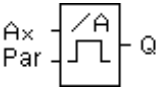
Note

f_a always represents the total pulses measured per time unit G_T.

4.4.16 Analog trigger

Short description

The output is set and reset at two configurable thresholds.

Symbol in IDEC SmartRelay	Wiring	Description
	Input Ax	<p>You apply the analog signal to be analyzed at input Ax.</p> <p>Use the analog inputs AI1...AI8 (*), the Analog Memory Markers AM1...AM6, the block number of a function with analog output.</p>
	Parameter	<p>A: Gain Range of values: ± 10.00</p> <p>B: Offset Range of values: $\pm 10,000$</p> <p>On: On threshold Range of values: $\pm 20,000$</p> <p>Off: Off threshold Range of values: $\pm 20,000$</p> <p>p: Number of decimals Range of values: 0, 1, 2, 3</p>
	Output Q	Q is set or reset by the threshold triggers.

* AI1...AI8:0...10 V corresponds with 0...1000 (internal value).

Gain and offset parameters

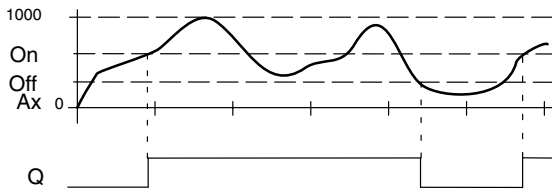
Please note the information on gain and offset parameters in Chapter 4.3.6.

Parameter p (number of decimals)

Does not apply to the display of On, Off and Ax values in a message text.

Does not apply to the comparison of On and Off values! (The compare function ignores the decimal point.)

Timing diagram



Functional description

The function fetches the analog signal at input Ax.

Ax is multiplied by the value of the A (gain) parameter, and the value at parameter B (offset) is added to product, i.e. $(Ax \cdot \text{gain}) + \text{offset} = \text{actual value of Ax}$.

Output Q is set or reset, depending on the set thresholds. See the calculation rule below.

Calculation rule

- If the On threshold \geq Off threshold, then:
 $Q = 1$, if the actual value $Ax > \text{On}$
 $Q = 0$, if the actual value $Ax \leq \text{Off}$.
- If the On threshold $<$ Off threshold, then $Q = 1$ if $\text{On} \leq \text{actual value Ax} < \text{Off}$.

Preset of the Par parameter

The gain and offset parameters are used to adapt the sensors to the relevant application.

View in programming mode (example):

B3
 1+
 On =+04000
 Off =+02000

Parameter protection mode
 On threshold
 Off threshold

Press ►

B3
 2
 A =01.00
 B =+00000
 p =2

Gain
 Offset
 Decimals in the message text

View in parameter assignment mode (example):

B3
 On =+04000
 Off =+02000
 Ax =+05000

On threshold
 Off threshold
 Q = 1 (A_X > On)

View in the message text (example):


+050.00

Ax, when p = 2
 Q = 1 (A_X > On)

4.4.17 Analog differential trigger

Short description

The output is set and reset depending on a configurable threshold and a differential value.

Symbol in IDEC SmartRelay	Wiring	Description
	Input Ax	<p>You apply the analog signal to be analyzed at input Ax.</p> <p>Use the analog inputs AI1...AI8^(*), the Analog Memory Markers AM1...AM6, the block number of a function with analog output.</p>
	Parameter	<p>A: Gain Range of values: ± 10.00</p> <p>B: Offset Range of values: $\pm 10,000$</p> <p>On: On/Off threshold Range of values: $\pm 20,000$</p> <p>Δ: Differential value for calculating the off parameter Range of values: $\pm 20,000$</p> <p>p: Number of decimals Range of values: 0, 1, 2, 3</p>
	Output Q	Q is set or reset, depending on the threshold and difference values.

*AI1...AI8:0...10V corresponds with 0...1000 (internal value).

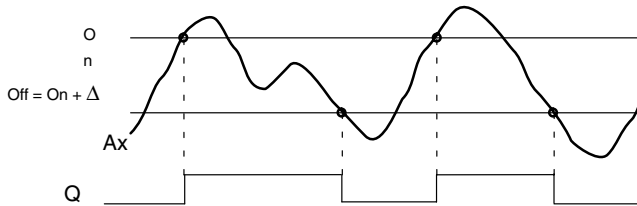
Gain and offset parameters

Please note the information on gain and offset parameters in Chapter 4.3.6.

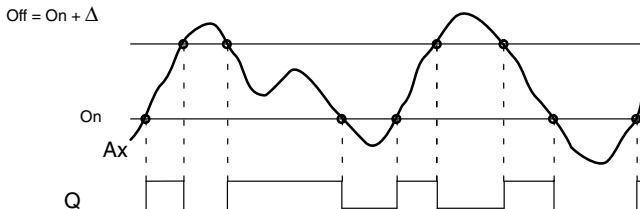
Parameter p (number of decimals)

Does not apply to the display of On, Off and Ax values in a message text.

Timing diagram A: Function with negative difference Δ



Timing diagram B: Function with positive difference Δ



Functional description

The function fetches the analog signal at input Ax.

Ax is multiplied by the value of the A (gain) parameter, and the value at parameter B (offset) is added to product, i.e. $(Ax \cdot \text{gain}) + \text{offset} = \text{actual value of Ax}$.

Output Q is set or reset, depending on the set (On) threshold and difference value (Δ). The function automatically calculates the Off parameter: $\text{Off} = \text{On} + \Delta$, whereby Δ may be positive or negative. See the calculation rule below.

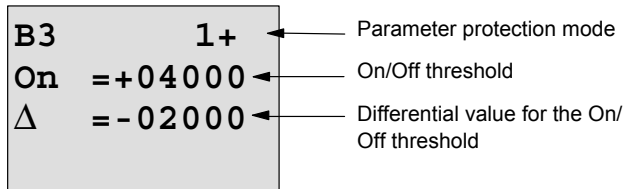
Calculation rule

- When you set a negative differential value Δ , the On threshold \geq Off threshold, and:
 $Q = 1$, if the actual value $A_x > \text{On}$
 $Q = 0$, if the actual value $A_x \leq \text{Off}$.
 See the timing diagram A.
- When you set a positive differential value Δ , the On threshold $<$ the Off threshold, and $Q = 1$, if:
 $\text{On} \leq \text{actual value } A_x < \text{Off}$.
 See the timing diagram B.

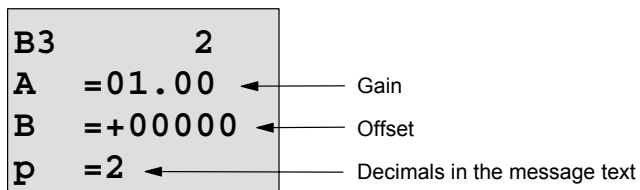
Preset of the Par parameter

The gain and offset parameters are used to adapt the sensors to the relevant application.

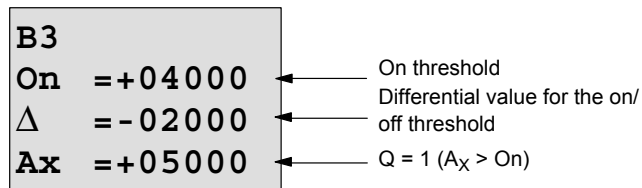
View in programming mode (example):



Press ►



View in parameter assignment mode (example):




B3
Off = +02000 ←

4.4.18 Analog comparator

Short description

The output is set and reset, depending on the difference $A_x - A_y$ and on two configurable thresholds.

Symbol in IDEC SmartRelay	Wiring	Description
	Inputs A_x and A_y	<p>You apply the analog signals whose difference you want to analyze at the inputs A_x and A_y.</p> <p>Use the analog inputs $AI1...AI8$ (*), the Analog Memory Markers $AM1...AM6$, the block number of a function with analog output.</p>
	Parameter	<p>A: Gain Range of values: ± 10.00</p> <p>B: Offset Range of values: $\pm 10,000$</p> <p>On: On threshold Range of values: $\pm 20,000$</p> <p>Off: Off threshold Range of values: $\pm 20,000$</p> <p>p: Number of decimals Range of values: 0, 1, 2, 3</p>
	Output Q	Q is set or reset, depending on the difference $A_x - A_y$ and the set thresholds.

* $AI1...AI8$: 0...10 V corresponds with 0...1000 (internal value).

Gain and offset parameters

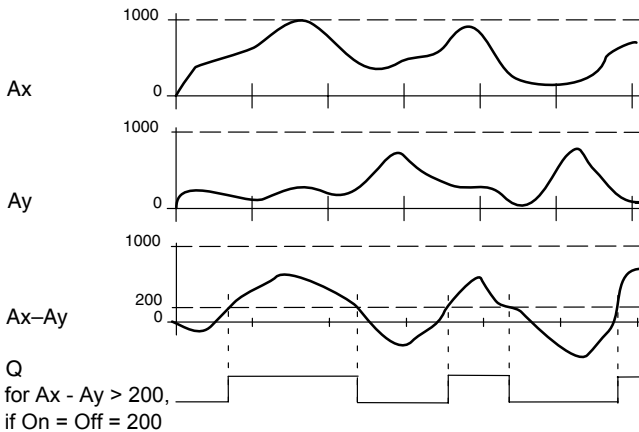
For more information on the gain and offset parameters, refer to Chapter 4.3.6.

Parameter p (number of decimals)

Does not apply to Ax, Ay, On, Off and Δ values displayed in a message text.

Does not apply to the comparison of on and off values! (The compare function ignores the decimal point.)

Timing diagram



Functional description

The function fetches the analog values from the inputs Ax and Ay.

Ax and Ay are each multiplied by the value of the A (gain) parameter, and the value at parameter B (offset) is then added to the relevant product, i.e.

$(Ax \cdot \text{gain}) + \text{offset} = \text{actual value Ax or}$

$(Ay \cdot \text{gain}) + \text{offset} = \text{actual value Ay.}$

The function forms the difference (" Δ ") between the actual values Ax - Ay.

Output Q is set or reset, depending on difference of the actual values Ax - Ay and the set thresholds. See the calculation rule below.

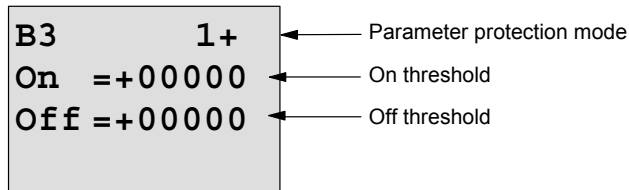
Calculation rule

- If the On threshold \geq Off threshold, then:
 $Q = 1$, if:
 (actual value A_x - actual value A_y) $>$ On
 $Q = 0$, if:
 (actual value A_x - actual value A_y) \leq Off.
- If the On threshold $<$ Off threshold, then $Q = 1$, if:
 $On \leq$ (actual value A_x - actual value A_y) $<$ Off.

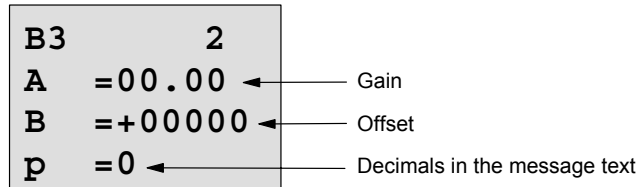
Preset of the Par parameter

The gain and offset parameters are used to adapt the sensors to the relevant application.

View in programming mode:



Press ►



Example

In a heating control system, the supply T_v and return line temperatures T_r are to be compared, for example with a sensor at AI2.

A control signal is to be triggered (for example "heater On"), when the difference between the supply and return line temperatures is greater than 15°C. The control signal is reset when the difference is less than 5°C.

The process variable of the temperature is to be shown in parameter assignment mode.

The thermocouples available have the following technical data: -30 to +70°C, 0 to 10 VDC.

Application	Internal mapping
-30 to +70°C=0 to 10 V DC	0 to 1000
0°C	300 → Offset = -30
Range of values: -30 to +70°C=100	1000 → Gain = 100/1000 = 0.1
On threshold = 15°C	Threshold = 15
Off threshold = 5°C	Threshold = 5

See also Chapter 4.3.6.

Configuration (example):

B3

1+

On =+00015

Off =+00005

Protection mode

On threshold

Off threshold

Press ►

B3

2

A =00.10

B =-00030

p =0

Gain

Offset

Decimals in the message text
(if used)

View in parameter assignment mode (example):

B3

1

On =+00015

Off =+00005

On threshold

Off threshold

Press ▼

B3	2	
Ax	=+00010	Temperature values
Ay	=-00020	
Δ	=+00030	Q = 1 (differential value > On)

View in the message text (example):

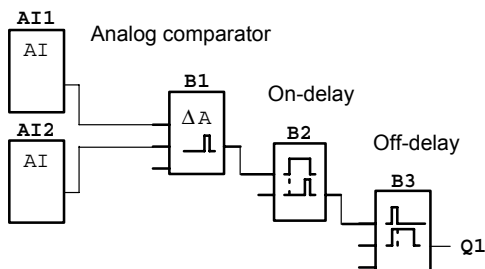
Ax	=+00010
Ay	=-00020

Reducing the input response of the analog comparator

You can selectively delay the output of an analog comparator by means of the “On-delay” and “Off-delay” special functions. With on-delay, output Q is only set if the pulse width of the triggering signal at input Trg (=analog comparator output) is longer than the on-delay time.

Using this method, you will obtain a virtual hysteresis and reduce the input response to short signals.

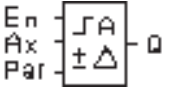
Function block diagram



4.4.19 Analog value monitoring

Short description

This special function saves the process variable of an analog input to memory, and sets the output when the output variable exceeds or drops below this stored value plus a configurable offset.

Symbol in IDEC SmartRelay	Wiring	Description
	Input En	A positive edge (0 to 1 transition) at input En saves the analog value at input Ax ("Aen") to memory and starts monitoring of the analog range Aen $\pm\Delta$.
	Input Ax	You apply the analog signal to be monitored at input Ax. Use the analog inputs AI1...AI8 (*), the Analog Memory Markers AM1...AM6, the block number of a function with analog output.
	Parameter	A: Gain Range of values: ± 10.00 B: Offset Range of values: $\pm 10,000$ Δ : Difference value for the Aen on/off threshold Range of values: $\pm 20,000$ p: Number of decimals Range of values: 0, 1, 2, 3
	Output Q	Q is set/reset, depending on the stored analog value and the offset.

* AI1...AI8: 0...10 V corresponds with 0...1000 (internal value).

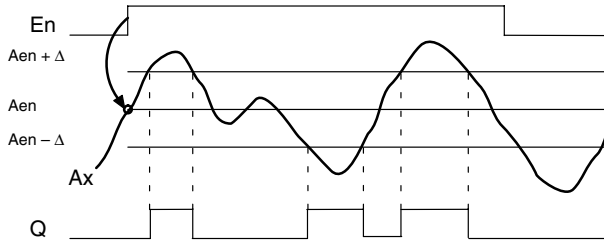
Gain and offset parameters

For more information on gain and offset parameters, refer to Chapter 4.3.6.

Parameter p (number of decimals)

Applies only to the Aen, Ax and Δ values displayed in a message text.

Timing diagram



Functional description

A 0 to 1 transition at input En saves the value of the signal at the analog input Ax. This saved process variable is referred to as "Aen".

Both the analog actual values Ax and Aen are multiplied by the value at parameter A (gain), and parameter B (offset) is then added to the product, i.e.

$(Ax \cdot \text{gain}) + \text{offset} = \text{Actual value Aen}$, when input En changes from 0 to 1, or

$(Ax \cdot \text{gain}) + \text{offset} = \text{Actual value Ax}$.

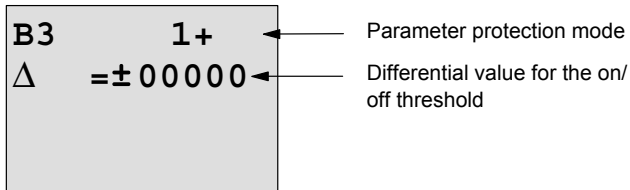
Output Q is set when the signal at input En = 1 and if the actual value at input Ax is out of range of $Aen \pm \Delta$.

Output Q is reset, when the actual value at input Ax lies within the range of $Aen \pm \Delta$, or when the signal at input En changes to 0.

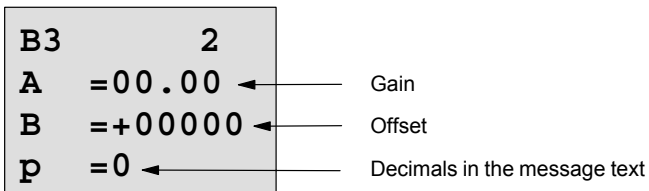
Preset of the Par parameter

The gain and offset parameters are used to adapt the used sensors to the respective application.

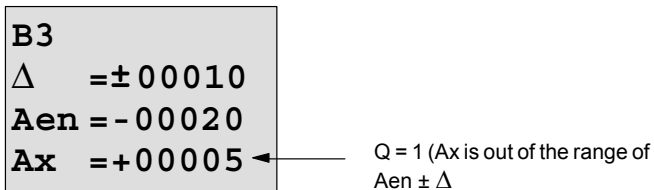
View in programming mode:



Press ►



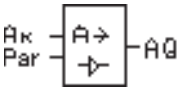
View in parameter assignment mode (example):



4.4.20 Analog amplifier

Short description

This special function amplifies the value of an analog input and outputs the result at an analog output.

Symbol in IDEC SmartRelay	Wiring	Description
	Input Ax	<p>You apply the analog signal to be amplified at input Ax.</p> <p>Use the analog inputs AI1...AI8 (*), the Analog Memory Markers AM1...AM6, the block number of a function with analog output.</p>
	Parameter	<p>A: Gain Range of values: ± 10.00</p> <p>B: Offset Range of values: $\pm 10,000$</p> <p>p: Number of decimals Range of values: 0, 1, 2, 3</p>
	Output AQ	<p>This special function has an analog output! This output can only be connected with the analog input of a function or with an Analog Memory Marker.</p> <p>Range of values for AQ: -32768...+32767</p>

*AI1...AI8: 0...10V corresponds with 0...1000 (internal value).

Gain and offset parameters

Please note the information on gain and offset parameters in Chapter 4.3.6.

Parameter p (number of decimals)

Applies only to the AQ value in a message text.

Functional description

The function fetches the analog signal of input Ax.

This value is multiplied by the value of the A (gain) parameter, and parameter B (offset) is then added to the product, i.e. $(A_x \cdot \text{gain}) + \text{offset} = \text{actual value } A_x$.

The actual value Ax is output at AQ.

Analog output

If you interconnect this special function with a real analog output, note that the analog output can only process values between 0 and 1000. To do this, you may need to connect an additional amplifier between the analog output of the special function and the real analog output. Using this amplifier, you standardize the output range of the special function to a value range of 0 to 1000.

Scaling an analog input value

You can influence the analog input value of a potentiometer by interconnecting an analog input with an analog amplifier and an analog memory marker.

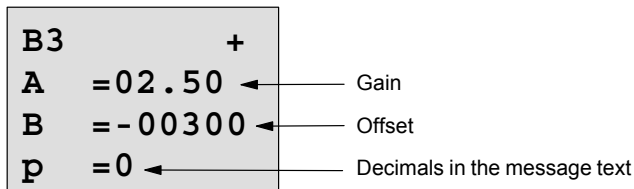
- Scale the analog value at the analog amplifier for further use.
- Connect, for example, the time base for parameter T of a time function (e.g. On-/Off-delay, Chapter 4.4.3) or the on and/or off limit specification of an up/down counter (Chapter 4.4.13) to the scaled analog value.

For more information with programming examples refer to the online help for WindLGC.

Preset of the Par parameter

The gain and offset parameters are used to adapt the sensors to the relevant application.

View in programming mode (example):



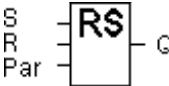
View in parameter assignment mode (example):

B3	
A	=02.50
B	=-00300
AQ	=-00250

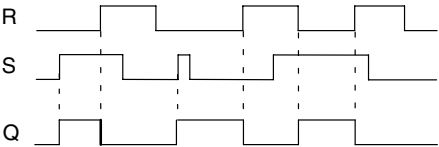
4.4.21 Latching relay

Short description

Input S sets output Q, input R resets output Q again.

Symbol in IDEC SmartRelay	Wiring	Description
	Input S	You set output Q with a signal at input S.
	Input R	You reset output Q with a signal at input R. If S and R = 1, the output is reset.
	Parameter	Retentivity: / = No retentivity R = The status is retentive.
	Output Q	Q is set with a signal at input S, and reset with a signal at input R.

Timing diagram



Switching response

A latching relay represents a simple binary element. The output value depends on the status at the inputs and on the previous output status. The following table shows the logic once again:

S	R	Q	Comment
0	0	x	The status is retentive
0	1	0	Reset
1	0	1	Set
1	1	0	Reset (takes priority over Set)

When retentivity is enabled, the current status of the output signal is retained after a power failure.

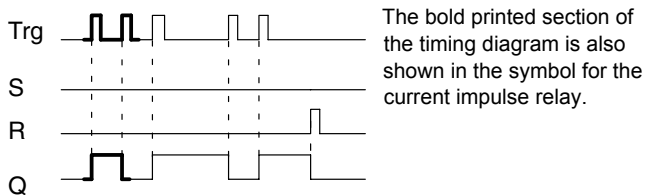
4.4.22 Current impulse relay

Short description

A short pulse at the input sets and resets the output.

Symbol in IDEC SmartRelay	Wiring	Description
	Input Trg	You set and reset output Q with a signal at input Trg (Trigger).
	Input S	You set output Q with a signal at input S.
	Input R	You reset output Q with a signal at input R.
	Parameter	Selection: RS (R input priority) or SR (S input priority) Retentivity: / = No retentivity R = The status is retentive.
	Output Q	Q is set with a signal at Trg, and reset with the next signal at Trg, if S and R = 0.

Timing diagram



Functional description

Output Q changes its status, i.e. the output is set or reset, with each 0 to 1 transition at input Trg and if the inputs S and R = 0.

The signal at input Trg does not influence the special function when S or R = 1.

You set the current impulse relay with a signal at input S, i.e. the output is set hi.

You reset the current impulse relay with a signal at input R, i.e. the output is set lo.

Status diagram

Par	Q _{n-1}	S	R	Trg	Q _n
*	0	0	0	0	0
*	0	0	0	0 ->1	1**
*	0	0	1	0	0
*	0	0	1	0 ->1	0
*	0	1	0	0	1
*	0	1	0	0 ->1	1
RS	0	1	1	0	0
RS	0	1	1	0 ->1	0
SR	0	1	1	0	1
SR	0	1	1	0 ->1	1
*	1	0	0	0	1
*	1	0	0	0 ->1	0**
*	1	0	1	0	0
*	1	0	1	0 ->1	0
*	1	1	0	0	1
*	1	1	0	0 ->1	1
RS	1	1	1	0	0
RS	1	1	1	0 ->1	0
SR	1	1	1	0	1
SR	1	1	1	0 ->1	1

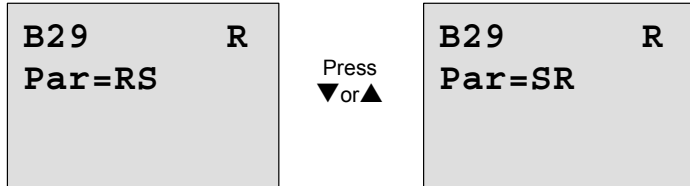
*: RS or SR

** : Triggering signal is effective, because S and R = 0.

Depending on your configuration, either input R takes priority over input S (i.e. input S is not effective when R = 1), or vice versa (i.e. input R is not effective when S = 1).

After a power failure, the current impulse relay and output Q are reset if you have not enabled retentivity.

View in programming mode:



This special function is not available in parameter assignment mode.

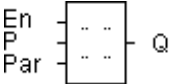
Note

If Trg = 0 and Par = RS, the special function “Current impulse relay” corresponds with the special function “Latching relay” (see Chapter 4.4.21).

4.4.23 Message texts

Short description

View of a configured message text in RUN mode.

Symbol in IDEC SmartRelay	Wiring	Description
	Input En	A 0 to 1 transition at input En (Enable) starts the output of the message text.
	Input P	P: Priority of the message text Range of values: 0...30 Quit: Acknowledgment of the message text.
	Parameter	Text: Input of the message text Par: Parameter or actual value of another, already programmed function (see "Visible parameters or process variables") Time: Display of the continuously updated time-of-day Date: Display of the continuously updated date EnTime: Display of the time of the 0 to 1 transition of the signal at input En EnDate: Display of the date of the 0 to 1 transition of the signal at input En
	Output Q	Q remains set as long as the message text is set.

Restriction

A maximum of 10 message text functions are available.

Functional description

With the 0 to 1 transition of the signal at input En and when the system is in RUN, the message text you have configured (process variable, text, time-of-day, date) is output to the display.

Acknowledgment disabled (Quit = Off):

The message text is hidden when the status of the signal at input En changes from 1 to 0.

Acknowledgment enabled (Quit = On):

When the status of the signal at input En changes from 1 to 0, the message text is output until it is acknowledged with **OK**. When En = 1, you can not acknowledge the message text.

When multiple message text functions are triggered with En=1, the message text that has the highest priority is shown (0 = lowest, 30 = highest). This also means, that a newly activated message text is shown only if its priority is higher than that of previously activated message texts.

After a message text is disabled or acknowledged, the function automatically shows the previously active message text that takes the highest priority.

You can change the view and the message texts by pressing the keys ▲ and ▼.

Example

This is how two message texts could be shown:

Display field of the IDEC SmartRelay in RUN mode

```
Motor 5
STOP AT
10:12
!!Action!!
```

← Example: Message text with priority 30

▼ Press ▲

```
Motor 2
3000
hours
MAINTENANCE
```

← Example: Message text with priority 10

▼ Press ▲

```
Mo 09:00
2003-01-27
```

Date and current time-of-day (only for versions with real-time clock).

Input P configuration

To configure the priority and the acknowledgment (programming mode):

```
B33      +
Priority
00
Quit=Off
```

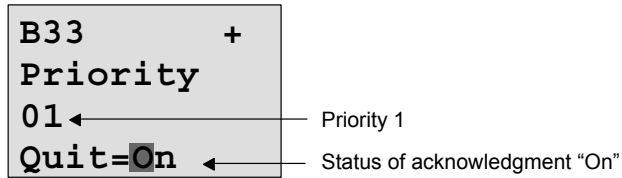
“+” means: The parameters and actual values in an active message text can be edited

← Priority

← Status of the acknowledgment

1. Increase the priority to 1: Cursor on ‘0’ + ▲
2. Change to ‘Quit’: Press ►
3. Enable ‘Quit’: Press ▲ or ▼

IDEC SmartRelay shows:



4. Confirm the entries with **OK**

Visible parameters or process variables

The following parameter or process variables can be displayed in a message text:

Special function	Parameter or process variable visible in a message text
Times	
On-delay	T, T_a
Off-delay	T, T_a
On-/Off-delay	T_a, T_H, T_L
Retentive on-delay	T, T_a
Interval time-delay relay / Pulse output	T, T_a
Edge-triggered interval time-delay relay	T_a, T_H, T_L
Asynchronous pulse generator	T_a, T_H, T_L
Random generator	T_H, T_L
Stairwell Light Switch	T_a, T, T_I, T_{IL}
Dual-function switch	T_a, T, T_L, T_I, T_{IL}
Seven-day time switch	3*on/off/day
Twelve-month time switch	On, Off
Counter	
Up/down counter	Cnt, On, Off
Operating hours counter	MI, Q, OT
Frequency trigger	$f_a, \text{On, Off, } G_T$
Analog	
Analog trigger	On, Off, A, B, Ax
Analog differential trigger	On, Δ , A, B, Ax, Off
Analog comparator	On, Off, A, B, Ax, Ay, ΔA

Special function	Parameter or process variable visible in a message text
Analog value monitoring	Δ , A, B, Ax, Aen
Analog amplifier	A, B, Ax
Analog multiplexer	V1, V2, V3, V4, AQ
Analog Ramp Control	L1, L2, MaxL, StSp, Rate, A, B, AQ
PI controller	SP, Mq, KC, TI, Min, Max, A, B, PV, AQ
Miscellaneous	
Latching relay	-
Current impulse relay	-
Message texts	-
Softkey	On/Off
Shift register	-

Changing parameters in the active message text

You can allow editing of parameter and process variables in an active message text by entering a “+” in the first line. To prevent changes, enter a “-” sign.

When the message text is active, press **ESC** to select the editing mode.

Note

You must keep the **ESC** key pressed at least for one second.

Press ◀ and ▶ to select the relevant line (you can only select lines that contain parameters). Press **OK** to change the parameter. Use the keys ◀, ▶, ▲ and ▼.

Confirm your changes with **OK**. You can now edit further parameters in the message text (if any exist). Press **ESC** to exit editing mode.

Key input simulation in the active message text

You can enable the four cursor keys C▲, C▶, C▼ and C◀ in an active message text by pressing **ESC** plus the relevant cursor key.

Preset of the Par parameter

To configure the message text (programming mode):



A rectangular screen form with a light gray background. On the left side, there are four rows of two dots (• •) each, representing a list of options for parameter assignment.

Parameter assignment
screen form for Par

Press ► to select a line for the message text.

Press ▲ or ▼ to select the relevant type of message text (Text, Par, Time...). Confirm with **OK**.

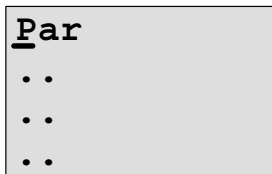
Further entries are required when “Text” or “Par” are selected:

Press ▲ or ▼ to select the letter to be displayed in the text.
To move the cursor from one position to the other, press ◀ or ▶.

The list of available characters is here the same as for the circuit program name. The character set is found in Chapter 3.6.4.

Press **OK** to confirm your changes, and press **ESC** to exit the editing mode.

To output a parameter (e.g. a process variable or function value) as message text, select the relevant line with ► and then press ▼:



A rectangular screen form with a light gray background. At the top, the word "Par" is displayed with a horizontal line underneath it. Below this, there are three rows of two dots (• •) each, representing a list of options for parameter assignment.

Press **OK** to open the editing mode:



B01>T

Press ◀ or ▶ to select the blocks to be displayed and the corresponding parameters.

Press ▲ or ▼ to select the block or parameter you want to view.

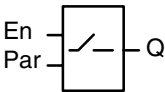
Select the parameter by pressing **OK**.

Press **ESC** to exit the parameter assignment mode and to apply your changes.

4.4.24 Softkey

Short description

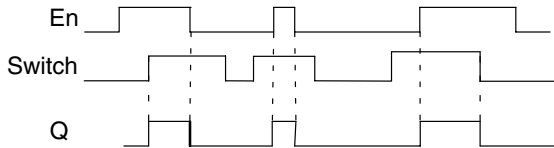
This special function has the effect of a mechanical pushbutton or switch.

Symbol in IDEC SmartRelay	Wiring	Description
	Input En	Output Q is set with a 0 to 1 transition of the signal at input En (Enable), and if 'Switch=On' was confirmed in parameter assignment mode.
	Parameter	<p><u>Programming mode:</u> Selecting the function for pushbutton action for the duration of one cycle, or for switching action.</p> <p>Start: On or off state, initialized at the first start of the program if retentivity is disabled.</p> <p>Retentivity: / = No retentivity R = The status is retentive.</p> <p><u>Parameter assignment mode (RUN mode):</u> Switch: Switches the momentary pushbutton or switch on or off.</p>
	Output Q	Switches on if En=1 and Switch=On was confirmed with OK .

Factory setting

The default setting at 'Par' is 'Momentary pushbutton' action.

Timing diagram



Functional description

In parameter assignment mode, the output is set with a signal at input En, if the 'Switch' parameter is set to 'On' and confirmed with **OK**. Whether the function was configured for pushbutton or switching action is here of no concern here.

The output is reset to '0' in the following three cases:

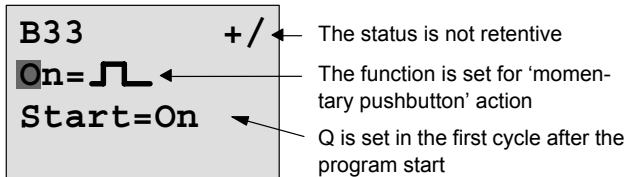
- After a 0 to 1 transition at input En.
- When the function was configured for momentary pushbutton action, and one cycle has expired since it was switched on.
- When the position 'Off' was selected at the 'Switch' parameter and confirmed with **OK** in parameter assignment mode.

If retentivity is not set, output Q is initialized after a power failure according to your configuration at the "Start" parameter.

Preset of the Par parameter

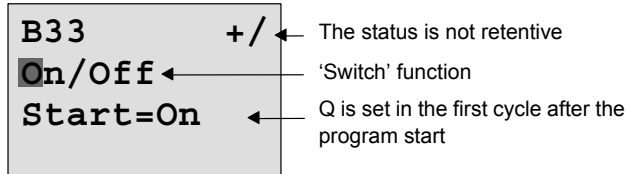
View in programming mode (example):

1. Select the 'SoftkeyE' function.
2. Select input En and confirm with **OK**. The cursor is now positioned below 'Par'.
3. Change to the input mode of 'Par': Confirm with **OK** (the cursor is now positioned to 'On')

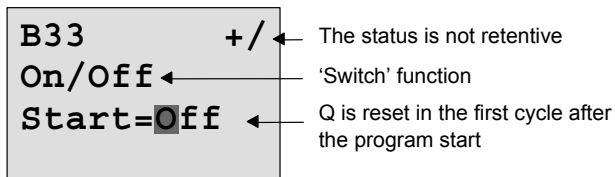


To change 'Par' to 'Switch' action and the initialization status after the program start:

4. To select 'Momentary pushbutton' or 'Switch' action:
Press ▲ or ▼



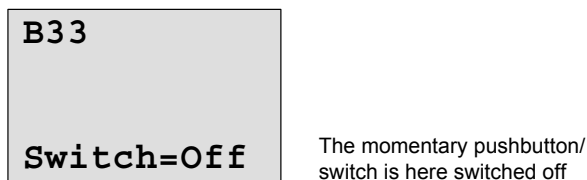
5. To change to the start state: Press ◀ or ▶
6. To change the start state: Press ▲ or ▼



7. Confirm your entries with **OK**

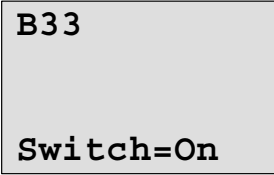
View in parameter assignment mode (example):

Here, you can set or reset the 'Switch' parameter (On/Off).
When in RUN, the IDEC SmartRelay shows the following display:



Let us assume you want to set 'Switch' (On).

1. Change to the editing mode: Confirm with **OK**
(the cursor is now positioned on 'Off')
2. To change from 'Off' to 'On': Press ▲ or ▼
3. Confirm your entries with Press **OK**




The momentary pushbutton/
switch is here switched on

4.4.25 Shift register

Short description

You can use the shift register function to read the value of an input and to shift its bits left or right. The output value corresponds with the configured shift register bit. The shifting direction can be changed at a special input.

Symbol in IDEC SmartRelay	Wiring	Description
	Input In	Input read at the start of the function.
	Input Trg	A positive edge (0 to 1 transition) at input Trg (Trigger) starts the special function. 1 to 0 transitions are irrelevant.
	Input Dir	The signal at input Dir determines the shifting direction for the shift register bits S1...S8 an: Dir = 0: Shift up (S1 >> S8) Dir = 1: Shift down (S8 >> S1)
	Parameter	Shift register bit that determines the value at output Q. Possible settings: S1 ... S8 Retentivity: / = No retentivity R = The status is retentive.
	Output Q	The output value corresponds with the configured shift register bit.

Functional description

The function reads the value at input In with a positive edge (0 to 1 transition) at input Trg (Trigger).

This value is applied to shift register bit S1 or S8, depending on the shifting direction:

- Shift up: The value at input In is set at S1; the previous value at S1 is shifted to S2; the previous value at S2 is shifted to S3 etc.
- Shift down: The value at input In is set at S8; the previous value at S8 is shifted to S7; the previous value at S7 is shifted to S6 etc.

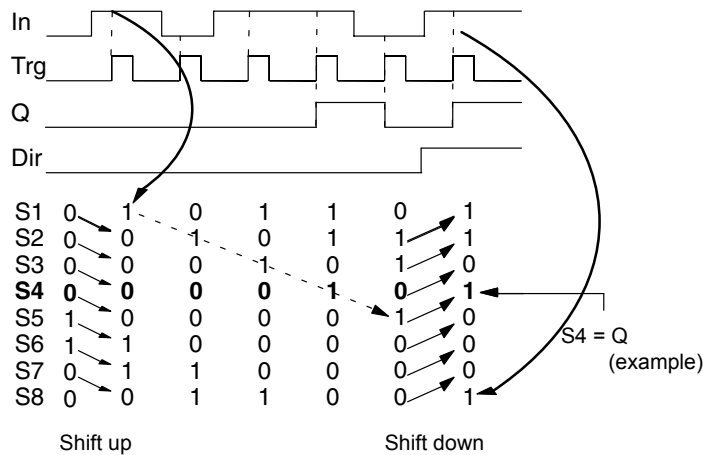
Output Q returns the value of the configured shift register bit.

If retentivity is disabled, the shift function restarts at S1 or S8 after a power failure. When enabled, retentivity always applies to all shift register bits.

Note

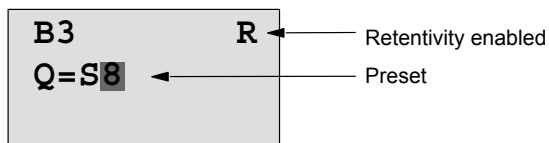
The special function shift register can be used only once in the circuit program.

Timing diagram

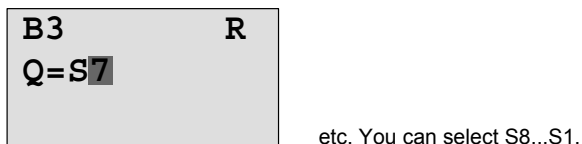


Preset of the Par parameter

View in programming mode:



Press ▼

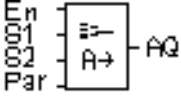


This special function is not available in parameter assignment mode.

4.4.26 Analog multiplexer

Short description

This special function outputs one of four predefined analog values or 0 at the analog output.

Symbol in IDEC SmartRelay	Wiring	Description
	Input En	A change in status from 0 to 1 at input En (Enable) switches a parameterized analog value to the output AQ, depending on the value of S1 and S2.
	Inputs S1 and S2	S1 and S2 (selectors) for selecting the analog value to be issued. <ul style="list-style-type: none"> S1 = 0 and S2 = 0: Value 1 is issued S1 = 0 and S2 = 1: Value 2 is issued S1 = 1 and S2 = 0: Value 3 is issued S1 = 1 and S2 = 1: Value 4 is issued

Symbol in IDEC SmartRelay	Wiring	Description
	Parameter	V1...V4: Analog values that will be issued. Range of values: -32768...+32767 p: Number of decimals Range of values: 0, 1, 2, 3
	Output AQ	This special function has an analog output. This output can only be connected with the analog input of a function, an analog memory marker or an analog output connector (AQ1, AQ2). Range of values for AQ: -32768...+32767

Parameters V1...V4

The analog values for the parameters V1...V4 can be derived from another, already programmed function. You can use the actual values of the following functions:

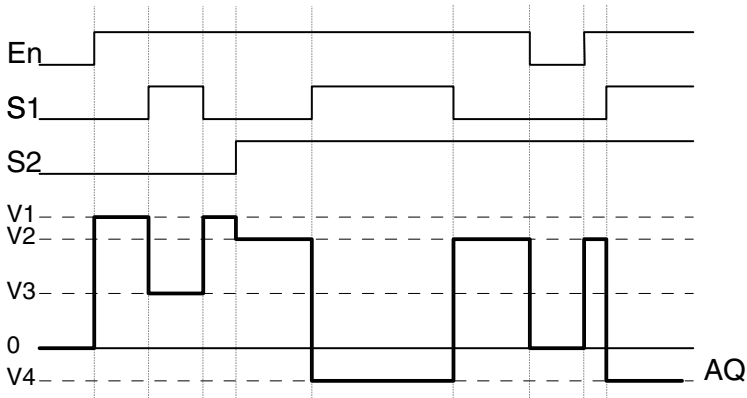
- Analog comparator (actual value Ax - Ay, see Chapter 4.4.18)
- Analog trigger (actual value Ax, see Chapter 4.4.16)
- Analog amplifier (actual value Ax, see Chapter 4.4.20)
- Analog multiplexer (actual value AQ, see Chapter 4.4.26)
- Analog Ramp Control (actual value AQ, see Chapter 4.4.27)
- PI controller (actual value AQ, see Chapter 4.4.28)
- and
- Counter (actual value Cnt, see Chapter 4.4.13).

Select the required function by means of the block number. For information on parameter defaults, refer to Chapter 4.4.1.

Parameter p (number of decimals)

Applies only to the values displayed in a message text.

Timing diagram



Functional description

If input En is set, then the function issues one of 4 possible analog values V1 to V4 at the output AQ, depending on the value of S1 and S2.

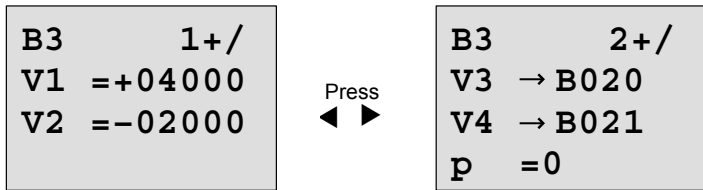
If the input En is not set, then the function issues the analog value 0 at output AQ.

Analog output

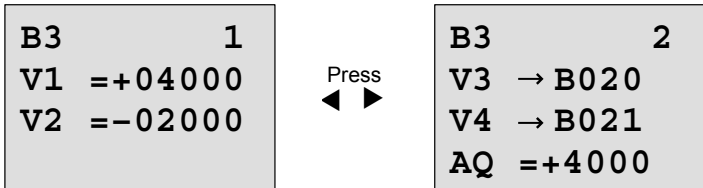
If you interconnect this special function with a real analog output, note that the analog output can only process values between 0 and 1000. To do this, you may need to connect an additional amplifier between the analog output of the special function and the real analog output. Using this amplifier, you standardize the output range of the special function to a value range of 0 to 1000.

Preset of the Par parameter

View in programming mode (example):



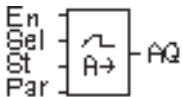
View in parameter assignment mode:



4.4.27 Analog Ramp Control

Short description

The AnalogRampinstructionallowstheoutputtobe changed fromthecurrentleveltotheselectedlevelata specified rate.

Symbol in IDEC SmartRelay	Wiring	Description
	Input En	<p>A changeinthestatus from 0 to1at input En(Enable) applies the start/stop level (Offset (B)+StSp) to the output for 100ms and starts the ramp operation to the selected level.</p> <p>A change in the status from 1 to 0 immediately sets the output AQ to 0.</p>
	Input Sel	<ul style="list-style-type: none"> Sel =0: Level1 is selected Sel =1: Level2 is selected <p>A change instatus of Sel causes the output AQ to start changing to the selected level at the specified rate.</p>
	Input St	<p>A change in the status from 0 to 1 at input St (Decelerated Stop) causes AQ to decrease at a constant rate until the start/stop level (Offset (B)+StSp) is reached.</p> <p>The start/stop level is maintained for 100ms and then the output AQ is set to 0.</p>

	Parameter	<p>L1 (Level 1) and L2 (Level 2): Levels to be reached Range of values for each level: –10,000 to +20,000</p> <p>MaxL: Maximum value that must not be exceeded under any circumstances. Range of values: –10,000 to +20,000</p> <p>StSp: Start/Stop offset: value that is added to Offset(B) to create the start/stop level. If the Start/Stop offset is 0, then the start/stop level is Offset(B). Range of values: –10,000 to +20,000</p> <p>Rate: Acceleration with which level 1, level 2 or Offset is reached. Steps/seconds are issued. Range of values: 1 to 10,000</p> <p>A: Gain Range of values: 0 to 10.00</p> <p>B: Offset Range of values: ±10,000</p> <p>p: Number of decimals Range of values: 0, 1, 2, 3</p>
--	-----------	--

Symbol in IDEC SmartRelay	Wiring	Description
	Output AQ	<p>The output AQ is scaled using the formula: $(\text{Current Level} - \text{Offset (B)}) / \text{Gain (A)}$ Range of values: 0 to +32767</p> <p>Note: When AQ is displayed in parameter mode or message mode, it is displayed as an unscaled value (engineering units).</p>

Parameters L1, L2

The analog values for the parameters L1 and L2 can be derived from another, already programmed function. You can use the actual values of the following functions:

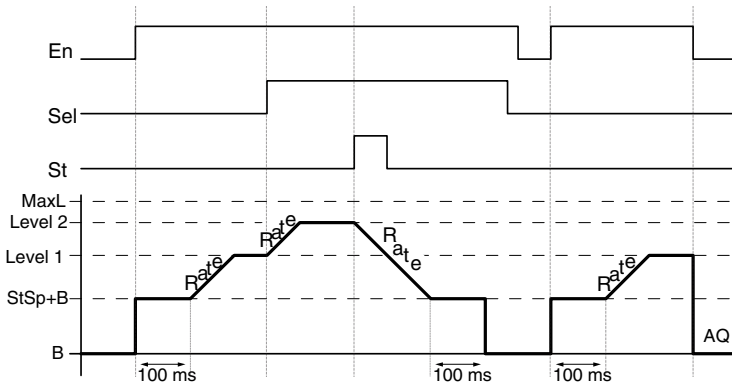
- Analog comparator (actual value Ax - Ay, see Chapter 4.4.18)
- Analog trigger (actual value Ax, see Chapter 4.4.16)
- Analog amplifier (actual value Ax, see Chapter 4.4.20)
- Analog multiplexer (actual value AQ, see Chapter 4.4.26)
- Analog Ramp Control (actual value AQ, see Chapter 4.4.27)
- PI controller (actual value AQ, see Chapter 4.4.28)
and
- Counter (actual value Cnt, see Chapter 4.4.13).

Select the required function by means of the block number.
 For information on parameter defaults, refer to Chapter 4.4.1.

Parameter p (number of decimals)

Applies only to the AQ, L1, L2, MaxL, StSp and Rate values displayed in a message text.

Timing diagram for AQ



Functional description

If the input En is set, then the function issues the value $\text{StSp} + \text{Offset (B)}$ at output AQ for the first 100ms.

Then, depending on the connection of Sel, the function runs from value $\text{StSp} + \text{Offset (B)}$ to either level1 or level2 at the acceleration set in Rate.

If the input St is set, the function runs to the value $\text{StSp} + \text{B}$ at the acceleration set in Rate. Then the function issues the value $\text{StSp} + \text{Offset (B)}$ at output AQ for 100ms. Finally Offset (B) is issued at output AQ. The scaled value is 0.

If the input St is set, the function can only be restarted once the inputs St and En have been reset.

If input Sel has been changed, depending on the connection of Sel, the function runs from the current target level to the new target level at the rate that is specified.

If the input En is reset, the function immediately sets the output AQ to 0.

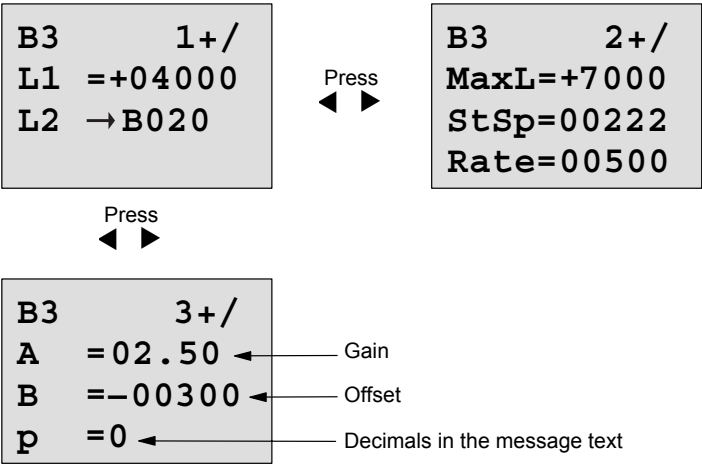
The output AQ is updated every 100ms.

Note

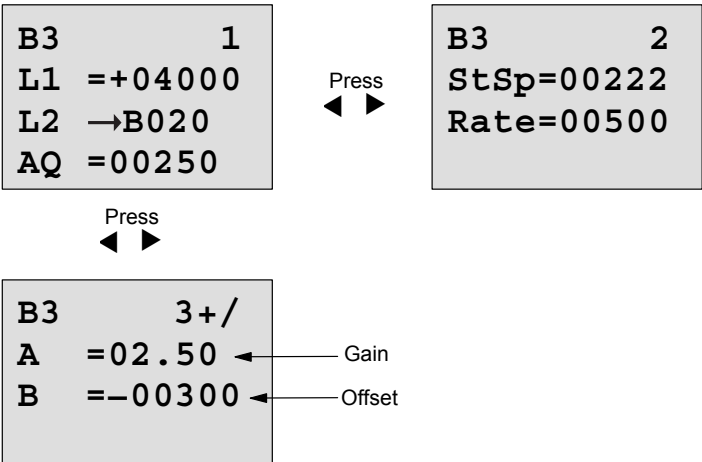
For further information on analog value processing please refer to the Online Help for WindLGC.

Preset of the Par parameter

View in programming mode (example):



View in parameter assignment mode:



4.4.28 PI controller

Short description

Proportional-action and integral-action controllers. You can use both types of controller individually or combined.

Symbol in IDEC SmartRelay	Wiring	Description
<div> <div> <div>A/M</div> <div>R</div> <div>PV</div> <div>Par</div> </div> <div> </div> </div>	Input A/M	Set the mode of the controller: 1: automatic mode 0: manual mode
	Input R	Use the input R to reset the output AQ. As long as this input is set, the input A/M is disabled. Output AQ is set to 0.
	Input PV	Analog value: process value, influences the output

Symbol in IDEC SmartRelay	Wiring	Description
	Parameter	<p>SP: Set-value assignment Range of values: –10,000 to +20,000</p> <p>KC: Gain Range of values: 00.00 to 99.99</p> <p>TI: Integral time Range of values: 00:01 to 99:59 m</p> <p>Dir: Action direction of the controller Range of values:+ or –</p> <p>Mq: Value from AQ with manual mode Range of values: 0 to 1000</p> <p>Min: Minimum value for PV Range of values: –10,000 to +20,000</p> <p>Max: Maximum value for PV Range of values: –10,000 to +20,000</p> <p>A: Gain Range of values: ±10.00</p> <p>B: Offset Range of values: ±10,000</p> <p>p: Number of decimals Range of values: 0, 1, 2, 3</p>

Symbol in IDEC SmartRelay	Wiring	Description
	Output AQ	This special function has an analog output (= manipulated variable). This output can only be connected with the analog input of a function, an analog memory marker or an analog output connector (AQ1, AQ2). Range of values for AQ: 0...1000

Parameters SP, Mq

The analog values for the parameters SP and Mq can be derived from another, already programmed function. You can use the actual values of the following functions:

- Analog comparator (actual value Ax - Ay, see Chapter 4.4.18)
- Analog trigger (actual value Ax, see Chapter 4.4.16)
- Analog amplifier (actual value Ax, see Chapter 4.4.20)
- Analog multiplexer (actual value AQ, see Chapter 4.4.26)
- Analog Ramp Control (actual value AQ, see Chapter 4.4.27)
- PI controller (actual value AQ, see Chapter 4.4.28)
and
- Counter (actual value Cnt, see Chapter 4.4.13).

Select the required function by means of the block number.
For information on parameter defaults, refer to Chapter 4.4.1.

Parameters KC, TI

Please note:

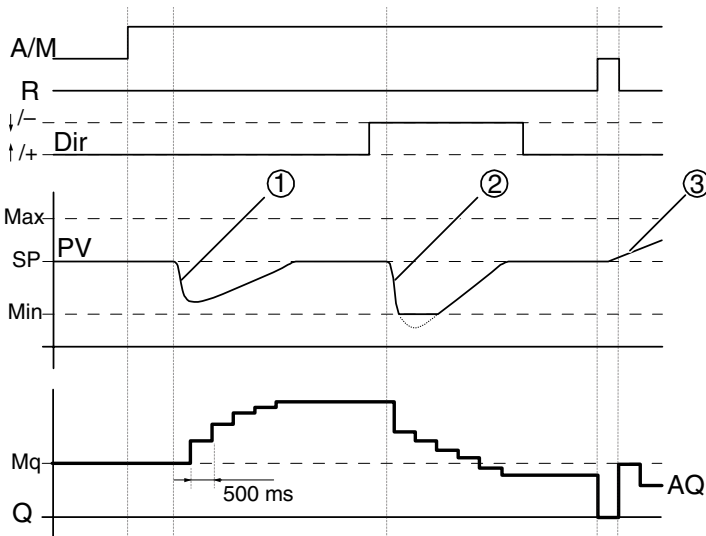
- If parameter KC has value 0, the “P” function (proportional control) will not be executed.
- If parameter TI has value 99:59 m, the “I” function (integral-action control) will not be executed.

Parameter p (number of decimals)

Applies only to the PV, SP, Min and Max values displayed in a message text.

Timing diagram

The nature, manner and speed with which the AQ changes depend on the parameters KC and TI. Thus, the course of AQ in the diagram is merely an example. A control action is continuous; therefore the diagram portrays just an extract.



1. A disturbance causes the PV to drop, as Dir is positioned upwards, AQ increases until PV corresponds again to SP.
2. A disturbance causes the PV to drop, as Dir is positioned downwards, AQ decreases until PV corresponds again to SP.

It is not possible to change the direction (Dir) at runtime of the function. The change is shown here for illustrative purposes only.

3. As AQ is set to 0 by means of the input R, PV changes. This is based on the fact that PV increases, which on account of Dir = upwards causes AQ to drop.

Functional description

If the input A/M is set to 0, then the special function issues output AQ with the value that you set with parameter Mq.

If the input A/M is set to 1, then automatic mode commences. As an integral sum the value Mq is adopted, the controller function begins the calculations.

Note

For further information on the controller basics please refer to the Online Help for WindLGC.

The updated value PV is used to calculate in the formulas:

$$\text{Updated value PV} = (\text{PV} \bullet \text{gain}) + \text{offset}$$

- If the updated value PV = SP, then the special function does not change the value of AQ.
- Dir = upwards (+) (timing diagram numbers 1. and 3.)
 - If the updated value PV > SP, then the special function reduces the value of AQ.
 - If the updated value PV < SP, then the special function increases the value of AQ.
- Dir = downwards (–) (timing diagram number 2.)
 - If the updated value PV > SP, then the special function increases the value of AQ.
 - If the updated value PV < SP, then the special function reduces the value of AQ.

With a disturbance, AQ continues to increase / decrease until the updated value PV again corresponds to SP. The speed with which AQ changes depends on the parameters KC and TI.

If the input PV exceeds the parameter Max, then the updated value PV is set to the value of Max. If the PV falls short of the parameter Min, then the updated value PV is set to the value of Min.

If the input R is set to 1, then the AQ output is reset. As long as R is set, the input A/M is disabled.

Sampling time

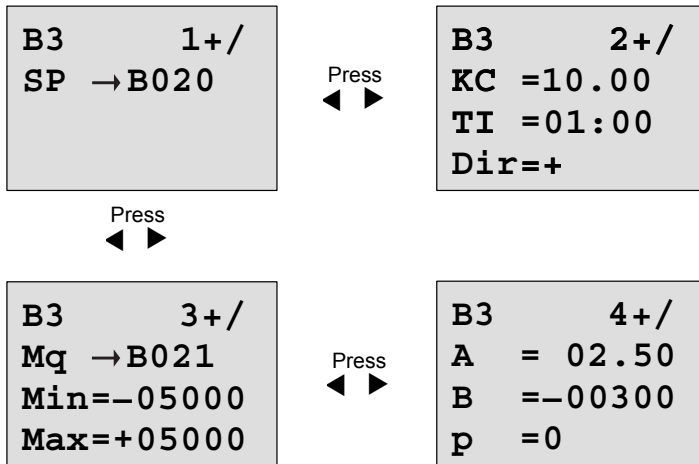
The sampling time is fixed at 500 ms.

Parameter sets

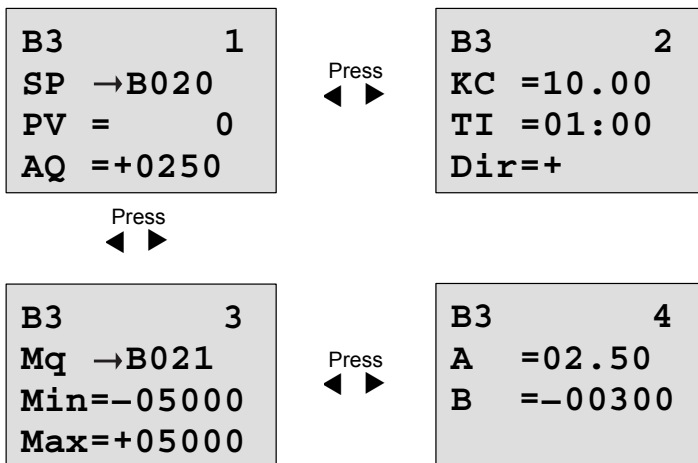
For more information and application examples with application-related parameter sets for KC, TI and Dir refer to the online help for WindLGC.

Preset of the Par parameter

View in programming mode (example):



View in parameter assignment mode:



5 Configuring IDEC SmartRelay

When speaking of 'parameter assignment', we refer to the configuration of the block parameters. You can set delay times for time functions, the switching times of the timers, the counter threshold value, the monitoring interval of an Operating hours counter and the on and off thresholds of the trigger.

You can configure the parameters

- In programming mode
- In parameter assignment mode

In programming mode, the author of the circuit program also sets the parameters.

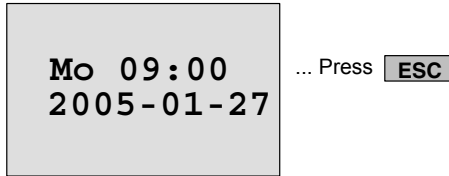
We have added the parameter assignment mode to allow the editing of parameters without having to modify the circuit program. This feature is available for the user to edit parameters, without having to change to programming mode, for example. The advantage: The circuit program remains protected, but can be adapted by the user to meet specific requirements.

Note

In parameter assignment mode, IDEC SmartRelay continues execution of the circuit program.

5.1 Selecting parameter assignment mode

Press **ESC** to change from RUN to parameter assignment mode:

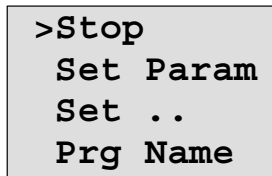


Note

The following applies to earlier device versions up to 0BA2:

- You open parameter assignment mode by pressing **ESC+OK**.

IDEC SmartRelay changes to parameter assignment mode and opens the parameter assignment menu:

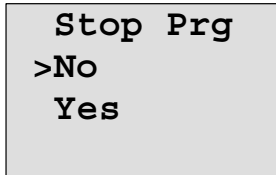


Description of the four menu items of the parameter assignment menu

- **Stop**

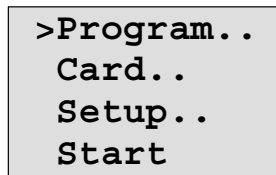
You select this command to stop your circuit program and thus change to the main menu of programming mode. To do so:

1. To move the '>' cursor to **'Stop'**: Press ▲ or ▼
2. To confirm 'Stop': Press **OK**



3. To move the '>' cursor to **'Yes'**: Press ▲ or ▼
4. To confirm 'Yes': Press **OK**

IDEC SmartRelay shows the main menu of the programming mode:



- **Set Param**

For information on the various parameters, refer to the Chapters 5.1.1 to 5.1.3.

- **Set..**

For information on the various settings, refer to Chapter 5.2.

- **Prg Name**

This menu command only allows you to **read** the name of your circuit program. It is not possible to modify this name in parameter assignment mode. (see Chapter 3.6.4.)

5.1.1 Parameters

Note

In the following discourse on parameters, we presume that the respective default parameter protection mode (“+”) has been maintained. This is prerequisite for viewing and editing parameter in the parameter assignment mode! See Chapter 4.3.5 and the example on page 88.

Parameters are, for example:

- The delay times of a time relay.
- The switching times (cams) of time switch.
- Counter thresholds
- The monitoring time for hour counters
- The trigger thresholds.

Each one of the parameters is identified by its block number (Bx) and the shortname of the parameter. Examples:

- T:...is a configurable time.
 - MI:...is a configurable time interval.
-

Note

WindLGC also allows you to assign names to blocks (for more information, refer to Chapter 7).

5.1.2 Selecting the parameters

To select a parameter:

1. On the parameter assignment menu, select 'Set Param': Press ▼ or ▲

```
Stop
>Set Param
Set ..
Prg Name
```

2. Confirm with **OK**.
IDEC SmartRelay shows the first parameter. If no parameter can be set, you can press **ESC** to return to the parameter assignment menu.

<pre>B9 1 T =60:00s Ta =06:00s</pre>	<p>Block number</p> <p>Display number for functions with several displays</p> <p>The value set at parameter T (Time)</p> <p>The current time in the IDEC SmartRelay</p>
--	---

```
No Param
Press ESC
```

No parameters for editing:
Press **ESC** to return to the parameter assignment menu

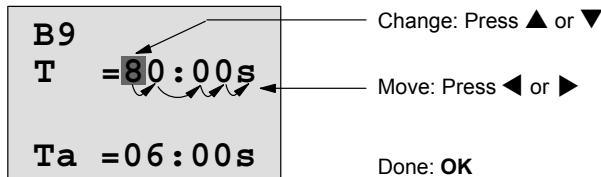
3. Now, select the desired parameter: Press ▲ or ▼.
4. Select the parameter you want to edit, and press **OK**.

5.1.3 Modifying parameters

You first select the parameter you want to edit (see Chapter 5.1.2).

You change the value of the parameter in the same way as you did in programming mode:

1. Move the cursor to the point at which you want to make the change: Press ◀ or ▶
2. To change this value: Press ▲ or ▼
3. To apply the value: **OK**

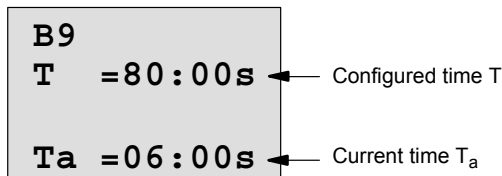


Note

When changing the time parameters when the system is in RUN, you can also change the timebase (s = seconds, m = minutes, h = hours). This does not apply if the time parameter represents the result of another function (for an example, see Chapter 4.4.1). In this case you can neither change the value nor the timebase. The current time is reset to zero when you change the timebase.

Current value of a time T

View of a time T in parameter assignment mode:



You can change the configured time T.

Current timer value

View of a timer cam in parameter assignment mode:

```
B1      1
D=M-W-F--
On  =09:00
Off=10:00
```

You can change the on/off times and the day.

Current value of a counter

View of a counter parameter in parameter assignment mode:

<pre>B3 On =001234 Off=000000 Cnt=000120</pre>	or	<pre>B3 On =123456 Off→B021 Cnt=000120</pre>
<p>← Current count value →</p>		

You can change the On/Off threshold. This does not apply if the on or off threshold represents the result of another function (in the example, this is B21, see Chapter 4.4.13).

Current value of an hour counter

View of an hour counter parameter in parameter assignment mode:

<pre>B16 MI = 0100h MN = 0017h OT = 00083h</pre>	<p>← Time interval</p> <p>← Time-to-go</p> <p>← Total operating hours</p>
--	---

You can edit the configured time interval MI.

Current value of a frequency trigger

View of the parameter of a frequency trigger in parameter assignment mode:

B15	
On =0009	← On threshold
Off =0005	← Off threshold
fa =0010	← Process variable

You can change the On/Off threshold.

5.2 Setting the default values for IDEC SmartRelay

You can set the following default values for IDEC SmartRelay:

Clock settings

You can set the default values for time-of-day and date, summertime/wintertime conversion and synchronization

- in parameter assignment mode by means of the set menu ("Clock" menu item)
- in programming mode by means of the setup menu ("Clock" menu item).

Time-of-day and date see Chapter 5.2.1.

Summertime/wintertime conversion see Chapter 3.6.13.

Synchronization see Chapter 3.6.14.

Contrast settings

You can set the default value for the display contrast

- in parameter assignment mode by means of the set menu ("Contrast" menu item)
- in programming mode by means of the setup menu ("Contrast" menu item).

See Chapter 5.2.2.

Start screen settings

You can select the default setting for the start screen

- in parameter assignment mode by means of the set menu ("StartScreen" menu item).

See Chapter 5.2.3.

5.2.1 Setting the time-of-day and date (FL1D-H12RC...)

You can set the TOD and the date

- in parameter assignment mode by means of the set menu ("Clock" menu item).
- in programming mode by means of the setup menu ("Clock" menu item).

To set the TOD and the date in parameter assignment mode:

1. Select parameter assignment mode. (see Chapter 5.1.)
2. On the parameter assignment menu, select '**Set..**':
Press ▼ or ▲

```

Stop
Set Param
>Set..
Prg Name
    
```

3. Confirm '**Set..**': Press **OK**
4. Move the '>' cursor to '**Clock**': Press ▲ or ▼
5. Confirm '**Clock**': Press **OK**
6. Move the '>' cursor to '**Set Clock**': Press ▲ or ▼
7. Apply '**Set Clock**': Press **OK**

Note

The 'Set Clock' command is only executed if your IDEC SmartRelay is equipped with a real-time clock. You set the real-time clock of IDEC SmartRelay by means of the 'Set Clock' command.

IDEC SmartRelay shows the following display.

```

Set Clock
Mo 15:30
YYYY-MM-DD
2005-01-27
    
```

The cursor is positioned on the weekday.

8. Select the day of the week: Press ▲ or ▼
9. Move the cursor to the next position: Press ◀ or ▶
10. To change the value: Press ▲ or ▼
11. To set the correct TOD, repeat steps 9 and 10.
12. To set the correct date, repeat steps 9 and 10.
13. To confirm your entries: Press **OK**

To set the TOD and the date in programming mode:

If you want to set the TOD and the date in programming mode, select '**Setup**' in the main menu, then menus '**Clock**' and '**Set Clock**'. You can now set the weekday and the time as described earlier (as of step 8.).

5.2.2 Setting the display contrast

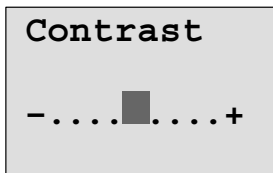
You can set the default value for the display contrast

- in parameter assignment mode by means of the set menu ("Contrast" menu item)
- in programming mode by means of the setup menu ("Contrast" menu item).

To set the display contrast in parameter assignment mode:

1. Select parameter assignment mode (see Chapter 5.1.)
2. On the parameter assignment menu, select '**Set..**':
Press ▼ or ▲
3. Confirm 'Set..':
Press **OK**
4. Move the '>' cursor to '**Contrast**':
Press ▲ or ▼
5. Confirm 'Contrast':
Press **OK**

IDEC SmartRelay shows the following display:



6. To change the display contrast:
Press ◀ or ▶
7. To confirm your entry:
Press **OK**

To set the display contrast in programming mode:

If you want to set the display contrast in programming mode, select '**Setup**' in the main menu, then menu '**Contrast**'. You can now set the display contrast as described earlier (as of step 6.).

5.2.3 Setting the start screen

You can select the default setting for the start screen of IDEC SmartRelay in RUN mode:

- in parameter assignment mode by means of the set menu ("StartScreen" menu item).

To select the start screen:

1. Select parameter assignment mode (see Chapter 5.1.)
2. On the parameter assignment menu, select '**Set..**':
Press ▼ or ▲
3. Confirm 'Set..':
Press **OK**
4. Move the '>' cursor to '**StartScreen**':
Press ▲ or ▼
5. Confirm 'StartScreen':
Press **OK**

IDEC SmartRelay shows the following display:

```

>Clock
  Input DI
  StartScreen
  Clock
  
```

The current setting of the start screen is shown in the bottom row. The default setting is 'Clock'.

You can choose between the display of the current time-of-day and date, or the values of the digital inputs:

6. Select the desired default setting:
Press ▲ or ▼.
7. To confirm your entry:
Press **OK**

6 IDEC SmartRelay memory cartridge (card)

IDEC SmartRelay allows you to store only one circuit program in its memory. If you want to modify the circuit program or create a further one without deleting the first, you must archive it somewhere. One of the options is to use a memory cartridge/card.

The circuit program stored in IDEC SmartRelay can be copied to a memory cartridge (card). You can then insert the memory cartridge/card in another IDEC SmartRelay in order to copy the circuit program. using the memory cartridge (card), you can:

- Archiving circuit programs
- Reproducing circuit programs
- Write and test your circuit program at the office, and then transfer it to a IDEC SmartRelay in the switching cabinet.

IDEC SmartRelay is supplied with a hood. The memory cartridge (card) is supplied separately.

Note

You do **not** need a module to backup the circuit program in your IDEC SmartRelay.

The IDEC SmartRelay circuit program is automatically stored in nonvolatile memory when you exit the programming mode.

We shall now introduce the memory cartridge (card) you can order for IDEC SmartRelay. The card can backup all data in the IDEC SmartRelay circuit program memory.

The type number is found in the appendix.

Compatibility

... to current versions (FL1C and FL1D devices):

Data written to the memory cartridge (card) in an FL1C version can be read in all FL1C and FL1D versions.

Data written to the memory cartridge (card) in an FL1D version can be read in all FL1D versions.

... to earlier versions (FL1A or FL1B devices):

A memory cartridge (card) that contains data written in earlier versions (FL1A or FL1B devices) can not be used in IDEC SmartRelay devices of the FL1C or FL1D generation. When the IDEC SmartRelay system detects such an 'old' memory cartridge (card), the message "Unknown Card / Press ESC" is output to the display.

Vice versa, an FL1C or FL1D memory cartridge (card) can not be used in IDEC SmartRelay devices of the FL1A or FL1B family.

Upward compatibility of circuit programs

Circuit programs written for the previous versions FL1A or FL1B can only be applied in FL1C or FL1D units by means of WindLGC.

6.1 Security function (CopyProtect)

We principally distinguish between memory cartridges (card) with and without circuit program/copy protection.

Unprotected memory cartridge (card)

You can edit circuit programs without restrictions, and exchange data between the memory cartridge (card) and the IDEC SmartRelay.

Protected memory cartridge (card)

A circuit program is **protected** when it is transferred from a protected memory cartridge (card) to the IDEC SmartRelay. To execute this circuit program in IDEC SmartRelay, the protected memory cartridge (card) must remain inserted during RUN, i.e. the circuit program stored on the memory cartridge (card) can not be copied to other IDEC SmartRelay devices. Over and above that, a protected circuit program is write-protected.

A circuit program with **password** protection is no longer protected after the correct password has been entered, i.e. you can then edit the program and remove the module.

Note

You need to assign a password when you create the circuit program for a protected module (card) to be able to edit it at a later time (see Chapter 3.6.5).

Correlation between the password and copy protection

Password	Protection	Editing	Copying	Deleting
-	-	Yes	Yes	Yes
Yes	-	Yes, with password	Yes	Yes, with password
-	Yes	No	No	Yes
Yes	Yes	Yes, with password	Yes, with password	Yes, with password

Note

To delete a circuit program in a memory cartridge (card), download a blank program to it.

Assigning a security function

To assign a circuit program and copy protection function to the memory cartridge (card), open the programming mode and select "Card".

1. Switch the IDEC SmartRelay to programming mode (ESC / >Stop).
2. The main menu opens. To select the '**Card**' command:
Press ▲ or ▼
3. To apply 'Card':
Press **OK**
4. Move the '>' cursor to '**CopyProtect**':
Press ▲ or ▼
5. To apply 'CopyProtect':
Press **OK**

IDEC SmartRelay shows the following display:

```
>No
  Yes
CopyProtect:
  No
```

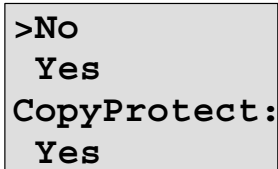
The current protection setting is shown in the bottom line. This function is disabled by default ("No": disabled).

Enabling copy protection

To enable copy protection:

1. Move the '>' cursor to **'Yes'**: Press **▲** or **▼**
2. Confirm **'Yes'**: Press **OK**

IDEC SmartRelay shows the following display:



The screenshot shows a monochrome display with the following text:
>No
Yes
CopyProtect:
Yes

Note

This only generates a circuit program and copy protection for the memory cartridge (card); the circuit program itself must be copied separately from the IDEC SmartRelay to the memory cartridge (card) (can also be done initially).

You can always change the “No” status (security function disabled) to “Yes” (security function enabled).

A status change from “Yes” (security function enabled) to “No” (security function disabled) is only possible if the memory cartridge (card) does not contain a circuit program.

6.2 Inserting and removing the memory cartridge (card)

When you remove a memory cartridge (card) with circuit program and copy protection attribute, note the following: The circuit program stored on the memory cartridge (card) can only be executed if the card remains inserted during system runtime.

After you have removed the memory cartridge (card), IDEC SmartRelay outputs the message 'No Program'. A removal of the memory cartridge (card) during RUN will lead to impermissible operating states.

Always heed the following warning:



Warning

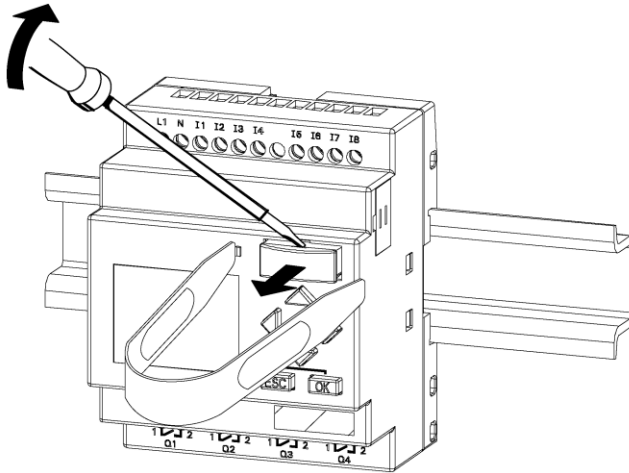
Do not touch the open slot of the memory cartridge (card) neither with your fingers, nor with a metallic or conductive object.

The memory cartridge (card) socket may be under voltage if the polarity is accidentally reversed at L1 and N.

The memory cartridge (card) may only be removed by qualified personnel.

Removing the memory cartridge (card)

To remove the memory cartridge (card):



1. Carefully insert a screwdriver into the slot at the upper end of the memory cartridge, and ease it out of the slot a little.
2. Hold the memory cartridge at both sides using the memory cartridge removal tool (MT-101), and pull the memory cartridge straight out.

Inserting a memory cartridge (card)

The entry of the memory cartridge (card) slot is chamfered on its bottom right. The edge of the memory cartridge (card) is chamfered accordingly. This encoding prevents you from inserting the memory cartridge (card) the wrong way round. Insert the memory cartridge (card) into the slot and push it in until it engages.

6.3 Copying data from the IDEC SmartRelay to the memory cartridge (card)

To copy the circuit program to the memory cartridge (card):

1. Insert the memory cartridge (card) into the slot.
2. Switch the IDEC SmartRelay to programming mode (ESC / >Stop).

```
>Program..
  Card..
  Setup..
  Start
```

IDEC SmartRelay main menu

3. The main menu opens. To select the '**Card**' command:
Press ▲ or ▼
4. Press **OK**. The transfer menu opens.

```
>[ESC]→Card
  Card→[ESC]
  CopyProtect
```

[ESC] = IDEC
SmartRelay

5. Move the '>' cursor to '**IDEC SmartRelay → Card**' (if required)
Press ▲ or ▼
6. Press **OK**.

IDEC SmartRelay now copies the circuit program to the memory cartridge (card).

When IDEC SmartRelay has finished copying, it automatically returns you to the main menu:

```
>Program..
  Card..
  Setup..
  Start
```

The circuit program backup is now stored on your memory cartridge (card) and you can remove the card. **Do not forget** to replace the cap.

If power fails while IDEC SmartRelay is copying the circuit program, repeat the process after Power On.

Note

The password X of a protected circuit program in IDEC SmartRelay also applies to the copied program version on your memory cartridge (card).

6.4 Copying data from the memory cartridge (card) to IDEC SmartRelay

You have a memory cartridge (card) that contains your circuit program. There are two ways to copy it to IDEC SmartRelay:

- Automatically during the startup of IDEC SmartRelay (POWER ON) or
- by means of the “Card” menu of IDEC SmartRelay.

Note

If the program on the module/card is protected with the password X, the copied program in the IDEC SmartRelay is also protected with the same password.

Automatic copying during the startup of IDEC SmartRelay

Proceed as follows:

1. Switch off the power supply to IDEC SmartRelay (POWER OFF)
2. Remove the slot cover.
3. Insert the memory cartridge/card into the relevant slot.
4. Switch on the power supply to the IDEC SmartRelay

IDEC SmartRelay copies the program from the memory cartridge/card to IDEC SmartRelay. When IDEC SmartRelay has finished copying, it opens the main menu:

```
>Program..
Card..
Setup..
Start
```

Note

Before you switch the IDEC SmartRelay to RUN, you must ensure that the system you are controlling with IDEC SmartRelay does not represent a source of hazard.

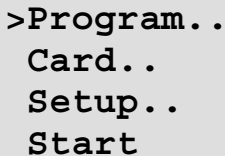
1. Move the '>' cursor to '**Start**': Press ▲ or ▼
2. Press **OK**.

Copying by means of the “Card” menu

For information on the replacement of a memory cartridge (card), also note Chapter 6.2.

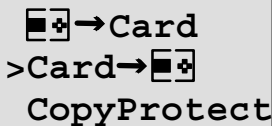
To copy a program from the memory cartridge (card) to IDEC SmartRelay:

1. Insert the memory cartridge (card)
2. Switch IDEC SmartRelay to programming mode (ESC / >Stop).



```
>Program..  
Card..  
Setup..  
Start
```

3. Move the '>' cursor to '**Card**': Press ▲ or ▼
4. Press **OK**. The transfer menu opens.
5. Move the '>' cursor to '**Card → IDEC SmartRelay**': Press ▲ or ▼



```
[Icon]→Card  
>Card→[Icon]  
CopyProtect
```

[Icon] = IDEC
SmartRelay

6. Press **OK**.

IDEC SmartRelay copies the circuit program from the memory cartridge (card) to IDEC SmartRelay. When IDEC SmartRelay has finished copying, it automatically returns to the main menu.

7 IDEC SmartRelay software

WindLGC is available as a programming package for the PC. This software provides many features, for example:

- A graphic interface for offline creation of your circuit program by means of Function Block Diagram (function chart)
- Simulation of your circuit program on the PC
- Generating and printing of an overview chart for the circuit program
- Saving a backup of the circuit program on the hard drive or other media
- Comparing circuit programs
- Easy configuration of blocks
- Transferring the circuit program
 - from IDEC SmartRelay to the PC and
 - from the PC to IDEC SmartRelay
- Reading the values of the hour counter
- Setting the TOD
- Summertime/wintertime conversion
- Online test: Display of status changes and process variables of IDEC SmartRelay in RUN mode:
 - Status of a digital I/O, markers, shift register bits and cursor keys
 - The values of all analog inputs and markers
 - The results of all blocks
 - The current values (including the times) of selected blocks
- Stopping circuit program execution via the PC (RUN, STOP).

The IDEC SmartRelay alternatives

As you can see, WindLGC represents an alternative to conventional engineering methods:

1. You start by developing the circuit program on your desktop.
2. You simulate the circuit program on your computer and verify its functions before you actually implement it in your system.
3. You can add comments to the circuit program and create hardcopies.
4. You save a copy of your circuit program to the file system on your PC, to make it directly available for any modifications.
5. It takes only a few key actions to download the circuit program to IDEC SmartRelay.

WindLGC

WindLGC runs under Windows 95/98, Windows NT 4.0, Windows Me[®], Windows 2000[®] and Windows XP[®].

WindLGC is capable of client/server operation and offers you a high degree of freedom and comfort for creating your circuit program.

WindLGC V5.0

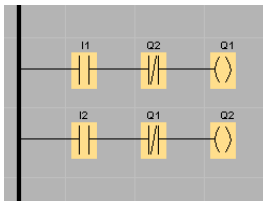
This is the current version of WindLGC. You will find all the functions and the functionality of the devices described in this manual in the version 5.0 and later.

Note

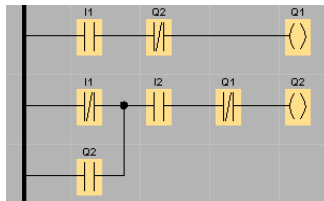
Please note that the SmartRelay ladder programming is slightly different from PLC programming. In the case of a PLC, the output result on each line is reflected on the inputs within the same scan time. However, in the case of the IDEC SmartRelay, all the inputs are processed first and then the outputs. Thus the output results are not reflected on the inputs within the same scan time, but rather they are reflected at the following scan.

ex) Interlock is not activated in the sample program (1) below in which input terminals I1 and I2 are simultaneously turned on. The interlock is activated in the sample program (2) below in which input terminals I1 and I2 are simultaneously turned on.

(1)



(2)



7.1 Connecting IDEC SmartRelay to a PC

Connecting the PC cable

To connect IDEC SmartRelay to a PC, you need the IDEC SmartRelay PC cable (Type Number is found in Appendix E).

Remove the cap or memory cartridge (card) from your IDEC SmartRelay and connect the cable to this socket. Connect the other end of the cable to the serial port of your PC.

Connecting the PC cable to the USB port

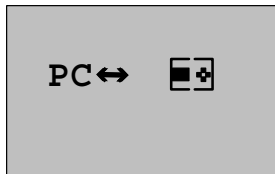
If your PC is only equipped with a USB interface (Universal Serial Bus), you will need a converter and a device driver to connect the IDEC SmartRelay cable to this port. Follow the instructions on the screen when you install the driver for the converter. Make sure you specify the correct Windows OS version when you select the driver.


Switching IDEC SmartRelay to PC↔IDEC SmartRelay mode

1. Switch the IDEC SmartRelay with/without display to STOP from your PC (refer to the WindLGC Online Help), or select the ESC / >Stop command on a device with display and confirm the entry with 'Yes'.

When IDEC SmartRelay is in STOP and online with the PC, the following PC commands are accepted:

- Switch IDEC SmartRelay to RUN
 - Read/write the circuit program
 - Read/write the summertime/wintertime
2. When you start the upload/download in STOP, the following display appears automatically:



 = IDEC SmartRelay

Closing the PC↔IDEC SmartRelay mode

When the data transfer is completed, the connection to the PC is shut down automatically.

Note

If the circuit program created with WindLGC is password protected, both the circuit program and the password are downloaded to IDEC SmartRelay. The password prompt is enabled at the end of the data transfer.

The upload of a password protected program created in IDEC SmartRelay is only possible after the correct password is entered in WindLGC.

8 Applications

We have provided a small collection of applications in this manual to give you an impression of the versatility of IDEC SmartRelay. For these examples we have recorded once again the original solution of the circuit diagram, and compared it with the IDEC SmartRelay solutions.

You can find solutions for the following tasks:	Page
Stairway or corridor lighting system	page 259
Automatic door	page 263
Ventilation system	page 270
Factory gate	page 275
Central controlling and monitoring of several factory gates	page 279
Luminous rows	page 283
Service water pump	page 287

Note

IDEC SmartRelay applications are available to all our customers free of charge. The examples provided are noncommittal, serve as general information about the fields of application for IDEC SmartRelay, and may be different to user-specific solutions.

The user operates the system at his own responsibility. We refer to the relevant national standards and system-related installation regulations.

Although you have four inputs available for logic operations (basic functions, see Chapter 4.2), the following figures will only show a maximum of three inputs for reasons of clarity. You program this fourth input and assign parameters just like the other three inputs.

Errors can not be ruled out, and the right to make changes is reserved.

8.1 Stairway or corridor lighting

8.1.1 Requirements for a stairway lighting system

The basic requirements for a stairway lighting system are as follows:

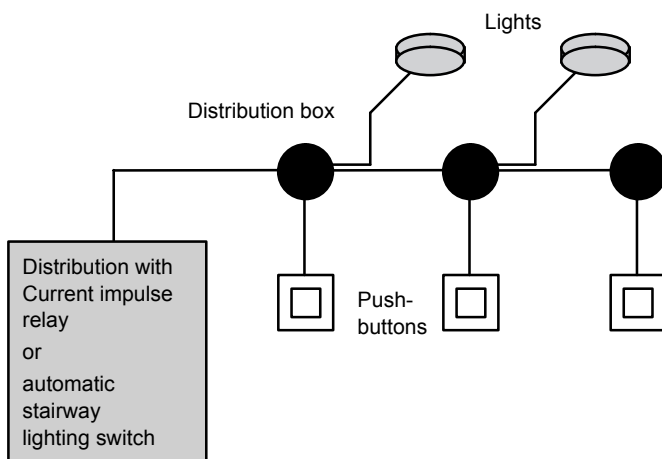
- When someone is using the stairway, the lighting should be switched on.
- If no-one is in the stairway, the lights should be switched off in order to save energy.

8.1.2 Previous solution

The two conventional options for switching the lights:

- With a pulse relay
- With an automatic stairway lighting switch

The wiring of both these lighting systems is identical.



Components used

- Momentary switches
- Automatic stairway lighting switch or pulse relay

Lighting system with pulse relay

Function of a lighting system with pulse relay:

- Press any pushbutton: The lighting is switched on
- Press any of the pushbuttons once again: The lighting is switched off.

Disadvantage: People often forget to switch off the lights.

Lighting system with an automatic stairway lighting switch

Function of a lighting system with automatic stairway lighting switch:

- Press any pushbutton: The lighting is switched on
- The lights are switched off automatically when the preset time has expired.

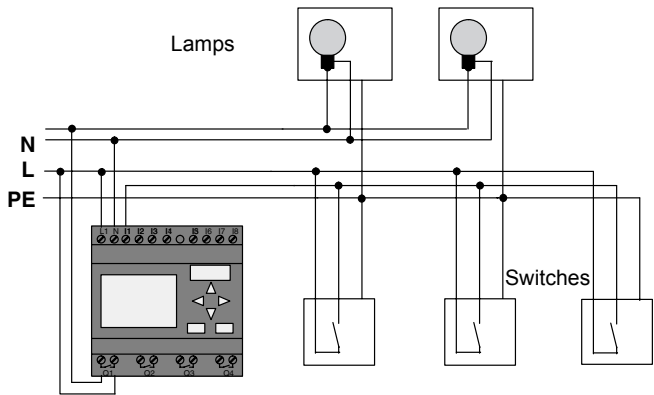
Disadvantage: The lights can not be switched on for a longer period of time (e.g. when cleaning the stairway). The switch for permanent lighting is usually located on the automatic stairway lighting switch and may be difficult or impossible to access.

8.1.3 Lighting system with IDEC SmartRelay

A IDEC SmartRelay system allows you to replace the automatic stairway lighting switch or the Current impulse relay. You can also implement both functions (timed off-delay and Current impulse relay) in a single unit. What is more, you can incorporate extra functions without making any alterations to the wiring. Here are some examples:

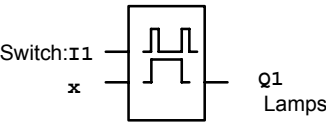
- Current impulse relay with IDEC SmartRelay
- Automatic stairway lighting switch with IDEC SmartRelay
- Dual-function switch with IDEC SmartRelay
 - Switch light on
 - Switch on permanent lighting
 - Switch light off

Wiring of a lighting system with FL1D-H12RCC



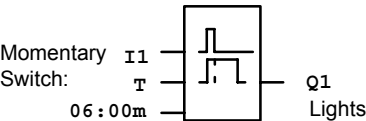
The external wiring of a lighting system with a IDEC Smart-Relay is no different than it is for a conventional stairway and corridor lighting system. Only the automatic stairway lighting switch/Current impulse relay is replaced. Supplementary functions are entered directly in IDEC SmartRelay.

Current impulse relay with IDEC SmartRelay



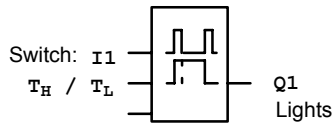
Output Q1 is toggled with a pulse signal at input I1.

Automatic stairway lighting switch with IDEC SmartRelay



Output Q1 is set for the duration of 6 minutes with a pulse signal at input I1.

Dual-function switch with IDEC SmartRelay



Output Q1 is set for the duration of a preset time T_H with a pulse signal at input I1.

The permanent lighting function is enabled by keeping the momentary switch pressed for a specified time T_L .

8.1.4 Special features and expansion options

Other options for increasing comfort or saving energy are, for example:

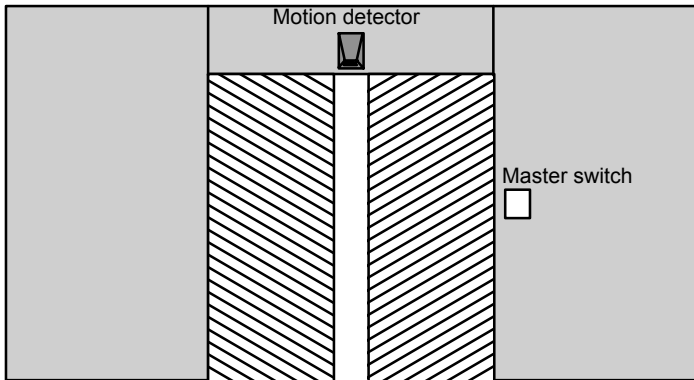
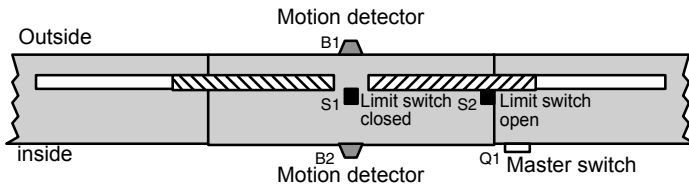
- A flashing function that indicates that the light is about to be switched off automatically.
- You can integrate various central functions:
 - Central off
 - Central on (panic button)
 - Control of all lamps or individual circuits by means of a daylight control switch
 - Controlling by means of an integrated timer (e.g. permanent lighting only until 24.00 h; disabled at specific times)
 - Automatically switching off the permanent lighting on expiration of a preset time (e.g. after 3 hours)

8.2 Automatic door

You often find automatic door control systems at the entrance to supermarkets, public buildings, banks, hospitals etc.

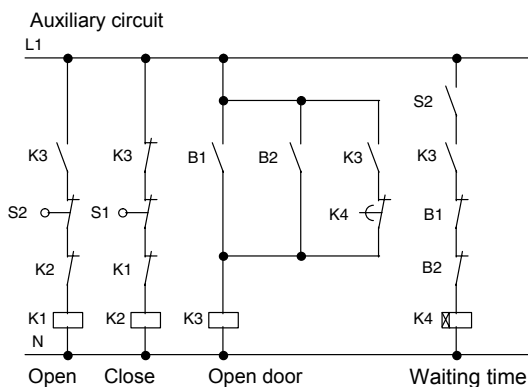
8.2.1 Requirements of an automatic door

- When a person approaches the door, it must open automatically.
- The door must remain open until the doorway is cleared.
- When the doorway is cleared, the door must close automatically with a short delay.



The door is usually driven by a motor that is equipped with a slip coupling. This prevents people from being squeezed in and injured. The control system is connected to the mains via a master switch.

8.2.2 Conventional solution



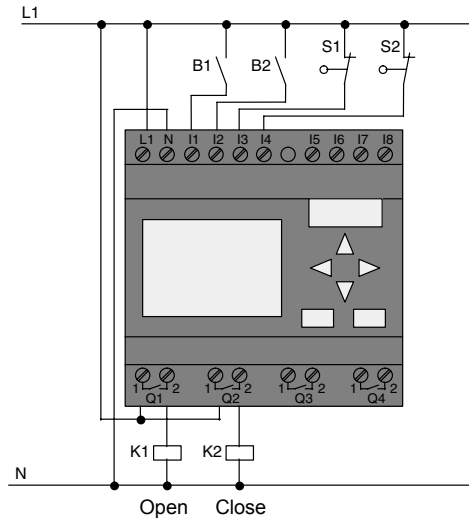
When someone enters the detection range of one of the motion sensors B1 or B2, the door opening motion is initiated by setting K3.

After the detection range of the two motion sensors has been cleared at least for a minimum time, K4 enables the closing motion.

8.2.3 Door control system with IDEC SmartRelay

IDEC SmartRelay can simplify this circuit considerably. You only need to connect the motion sensors, limit switches and the contactor relays to the IDEC SmartRelay.

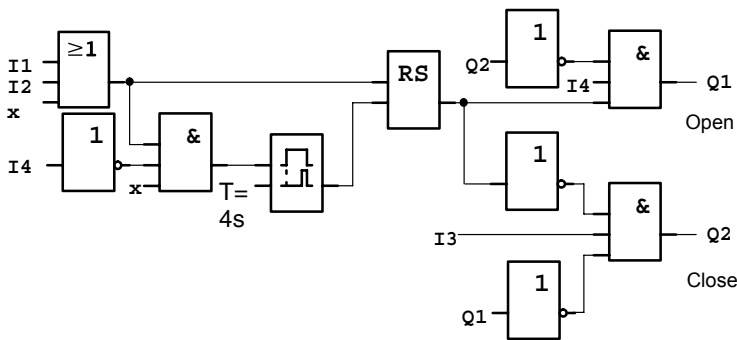
Wiring of a door control system with FL1D-H12RCC



Components used

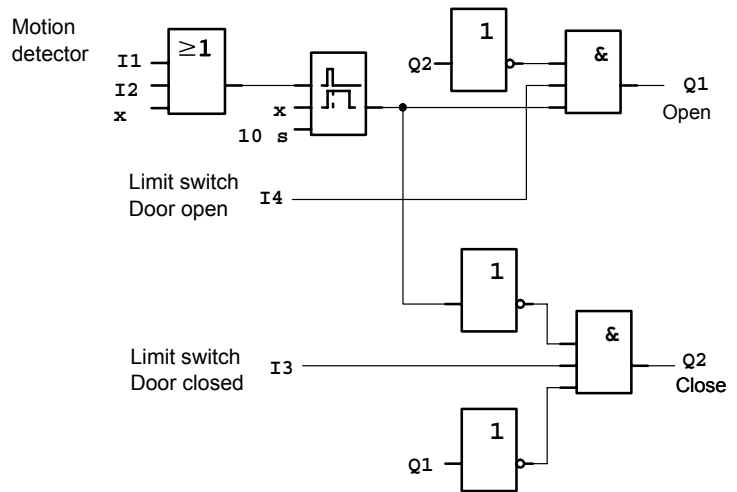
- K1 contactor relay (*open*)
- K2 contactor relay (*close*)
- S1 (*normally closed contact*) limit switch (*close*)
- S2 (*normally closed contact*) limit switch (*open*)
- B1 (*normally open contact*) infrared motion sensor *outside*
- B2 (*normally open contact*) infrared motion sensor *inside*

Door control system with IDEC SmartRelaycircuit diagram



This is what the circuit diagram of the conventional solution looks like.

You can simplify this circuit if you make use of the IDEC SmartRelay functions. You can use the off-delay function to replace the latching relay and the on-delay. The block diagram below illustrates this simplification:



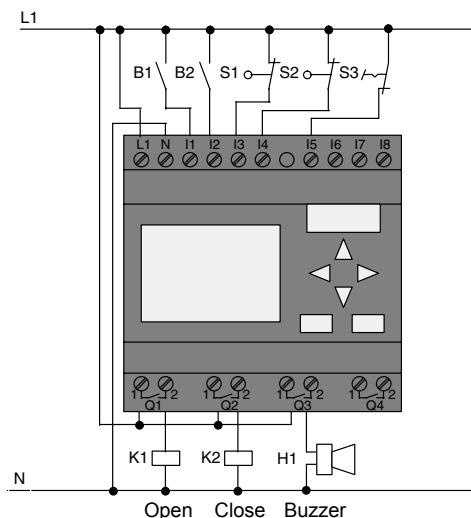
8.2.4 Special features and expansion options

Options for increasing comfort and user friendliness are, for example:

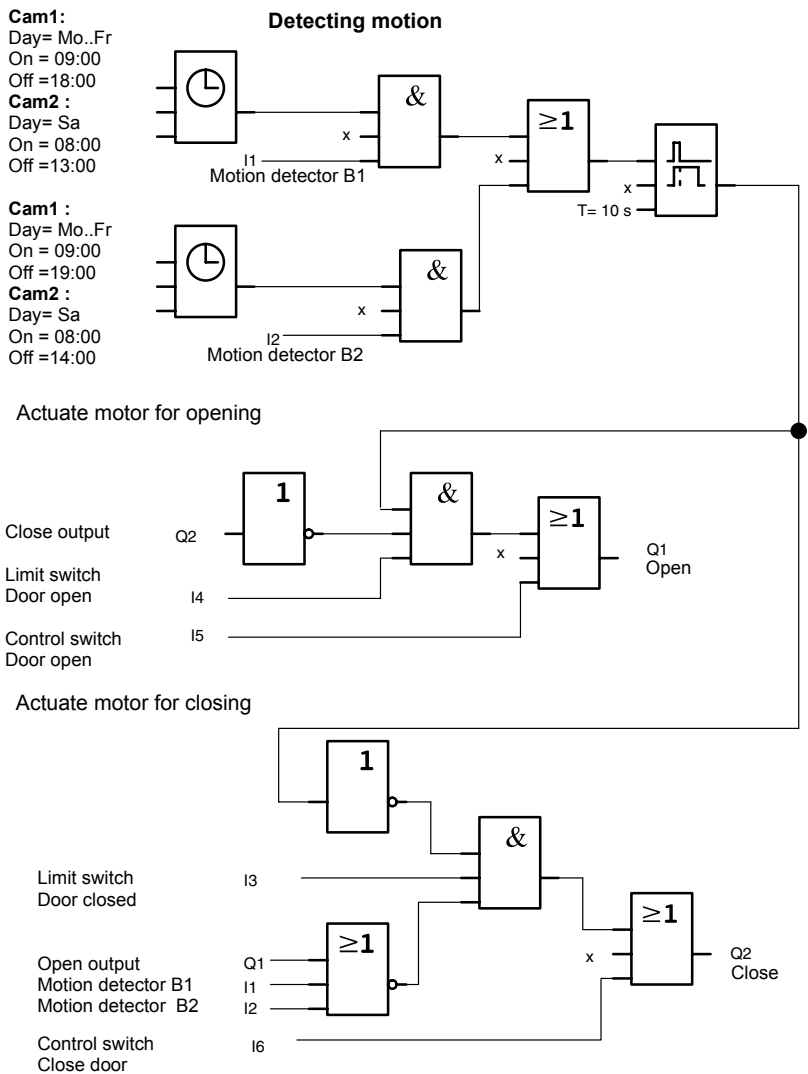
- You can connect an additional control switch with the positions: Open - Automatic - Closed (O-A-C)
- You can connect a buzzer to an output of the IDEC SmartRelay to warn of the closing of the door.
- You can enable opening of the door time and direction-dependent, i.e. opening only during business hours, and opening only from the inside after closing time.

8.2.5 Extended solution with FL1D-H12RCC

Wiring the IDEC SmartRelay extended solution



Block diagram of the extended IDEC SmartRelay solution



Detecting motion

During business hours, the motion detector B1 initiates the opening of the door when somebody wants to enter the shop. Motion detector B2 initiates the opening of the door when somebody wants to leave the shop.

After closing time, the motion detector B2 continues to be used to open the door for 1 hour to allow the customers to leave the shop.

Actuating the motor for opening

Output Q1 is set and opens the door when:

- The control switch at I5 is actuated (the door is permanently open), or
- The motion detectors indicate that somebody is approaching the door, and
- The door has not yet fully opened (limit switch at I4).

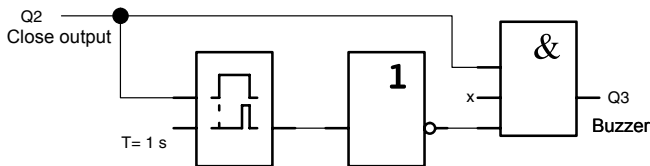
Actuating the motor for closing

Output Q2 is set to close the door when:

- The control switch at I6 is actuated (the door is permanently closed) or
- The motion detectors indicate that there is nobody near the door, and
- The door has not yet fully closed (limit switch at I3).

Buzzer

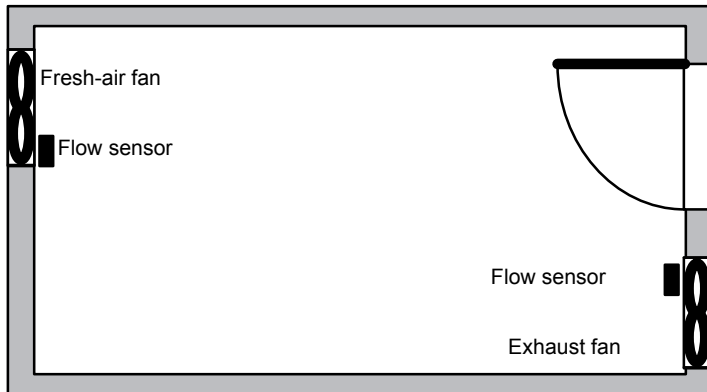
Connect the buzzer to output Q3. The buzzer gives a brief warning (in this case 1 second) when the door is closing. Enter the following circuit at Q3 in the circuit program:



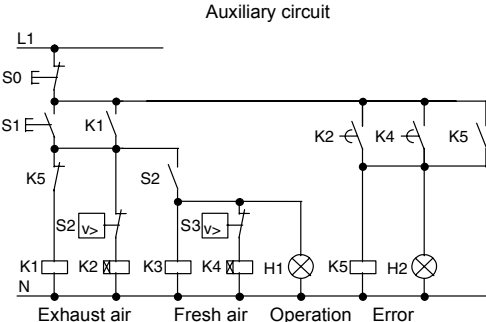
8.3 Air-conditioning system

8.3.1 Requirements for an air-conditioning system

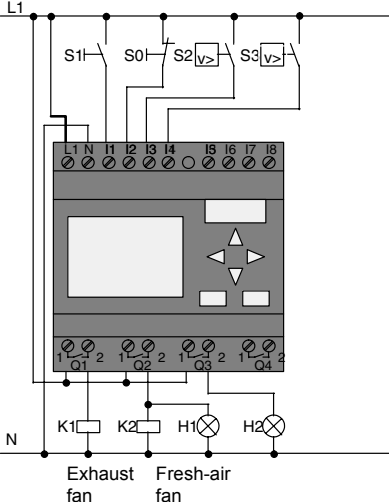
The air-conditioning system supplies fresh air to a room or exhausts the contaminated air from a room. Let us examine following example:



- The room is equipped with an exhaust fan and a fresh-air fan.
- Both fans are monitored by means of a flow sensor.
- An excess atmospheric pressure may never develop in the room.
- The fresh-air fan must only be switched on if safe functioning of the exhaust fan is signaled by the flow sensor.
- A warning lamp indicates failure of a fan.



In addition to the flow sensors, the fan monitoring system also requires an evaluating circuit with several switching devices. This evaluating circuit can be replaced by a single IDEC SmartRelay unit.

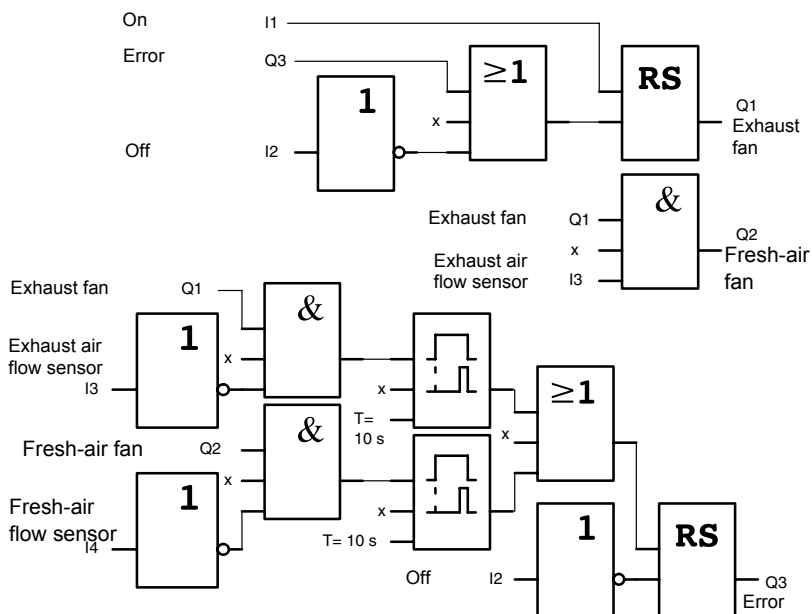


Components used

- K1 contactor relay
- K2 contactor relay
- S0 (*normally closed contact*) STOP pushbutton
- S1 (*normally open contact*) START pushbutton
- S2 (*normally open contact*) flow sensor
- S3 (*normally open contact*) flow sensor
- H1 signal lamp
- H2 signal lamp

Block diagram of the IDEC SmartRelay solution

The block diagram of the air-conditioning system with IDEC SmartRelay :



8.3.2 Advantages of using IDEC SmartRelay

The IDEC SmartRelay solution requires less switchgear. That saves you installation time and space in the control cabinet. You might even be able to use a smaller switching cabinet.

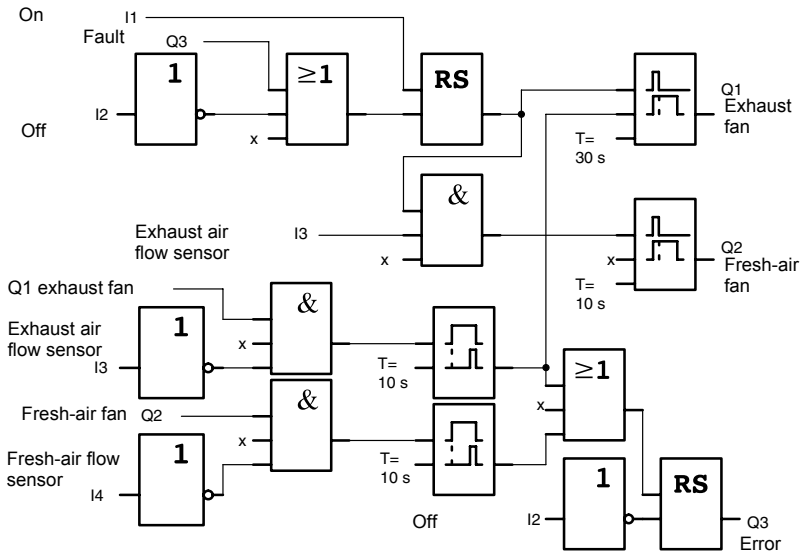
Additional IDEC SmartRelay options

- The free output (Q4) can be used as isolated signal contact for reporting faults or power failure.
- It is possible to switch off of the fans by means of a sequential circuit.

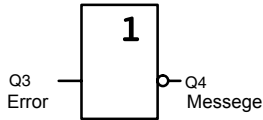
These functions can be implemented without additional switchgear.

Block diagram of the extended IDEC SmartRelay solution

The fans at Q1 and Q2 are switched on and off by means of the following circuit:

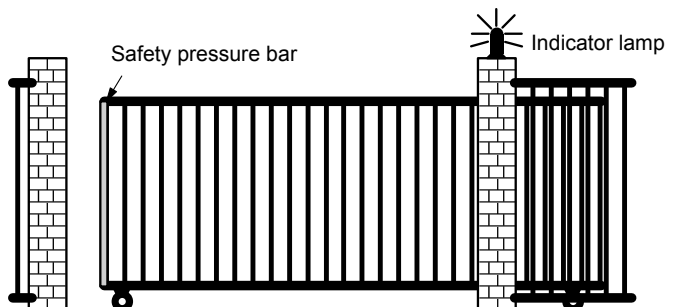


You can also generate a message at output Q4:



The relay contacts of output Q4 are always closed when the system is in operation. Relay Q4 does not drop off unless there is a power failure or a fault in the system. This contact can be used for remote monitoring, for example.

8.4 Factory door



The entrance to a company's premises is often closed with a gate. The gate is only opened to let vehicles in and out.

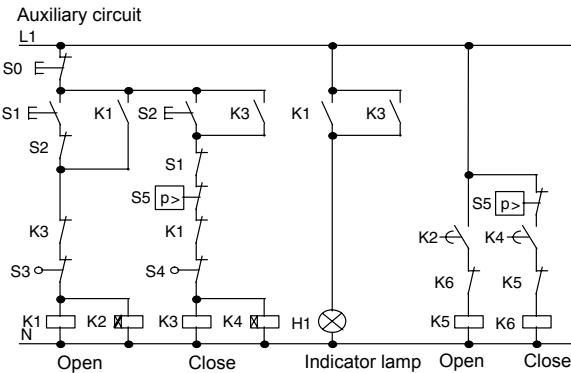
The gate is controlled by the porter.

8.4.1 Requirements for a gate control system

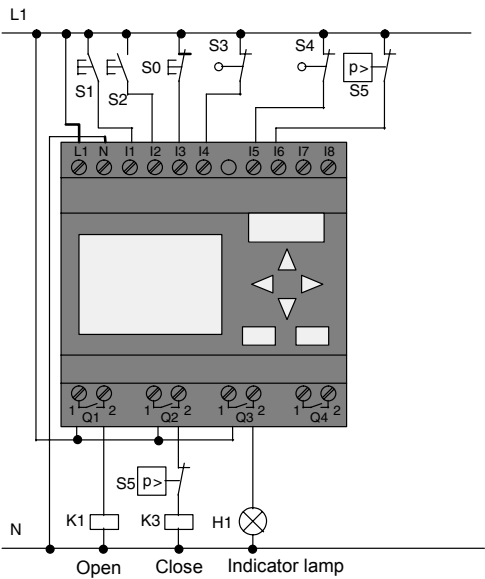
- The gate is opened and closed by means of pushbuttons in the gatehouse. The porter can monitor the operation of the gate at the same time.
- The gate is normally fully opened or fully closed. The gate motion can be interrupted at any time.
- An indicator lamp is switched on five seconds before the gate starts moving and when the gate is in motion.
- A safety pressure bar prevents harm to persons and objects from getting trapped or damaged when the gate is closing.

8.4.2 Previous solution

Various control systems are used to operate automatic gates. The circuit diagram below shows one of these options.



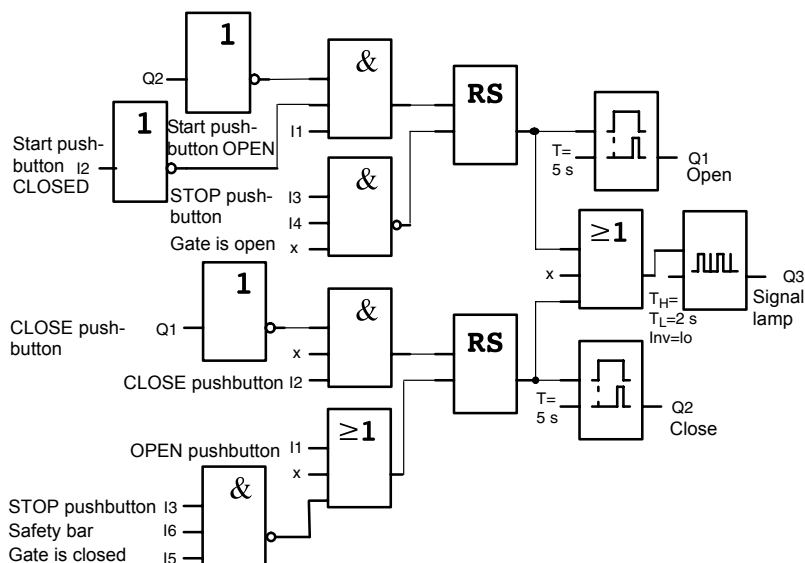
Wiring of a gate control system with FL1D-H12RCC



Components used

- K1 contactor relay
- K2 contactor relay
- S0 (normally closed contact) STOP pushbutton
- S1 (normally open contact) OPEN pushbutton
- S2 (normally open contact) CLOSE pushbutton
- S3 (normally closed contact) Position sensor OPEN
- S4 (normally closed contact) Position sensor CLOSED
- S5 (normally closed contact) Safety bar

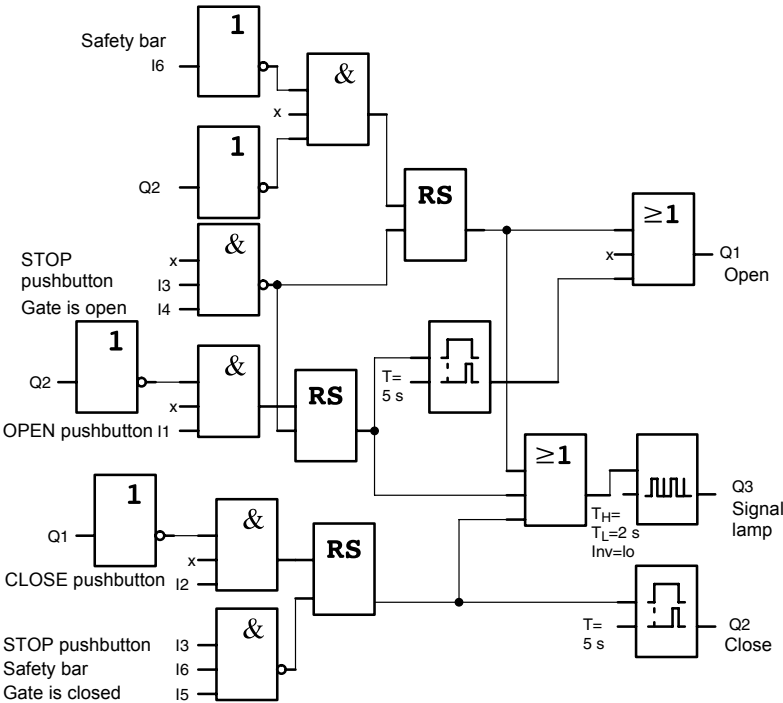
Block diagram of the IDEC SmartRelay solution



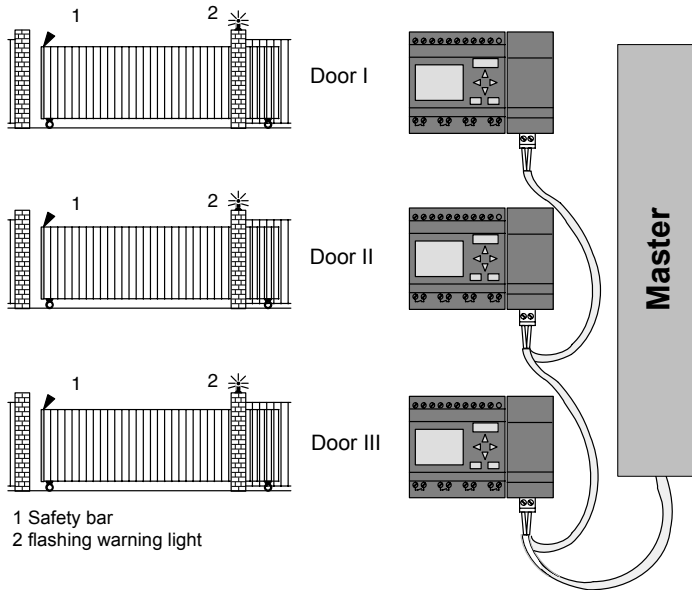
The OPEN or CLOSE pushbuttons initiate the gate motion, provided it is not already moving in the other direction. The gate is stopped by means of the STOP pushbutton or the relevant limit switch. A safety bar furthermore interrupts the closing motion of the gate.

8.4.3 Extended IDEC SmartRelay solution

Our extended control circuit is to open the gate automatically when the safety bar is actuated.



8.5 Centralized control and monitoring of several factory doors



Often, a company's premises can be entered at several locations. Not all of the gates can always be monitored locally by personnel. They must therefore be able to be monitored and operated by the porter who sits in a central gatehouse. It must also be possible for a member of staff to open and close the gate locally.

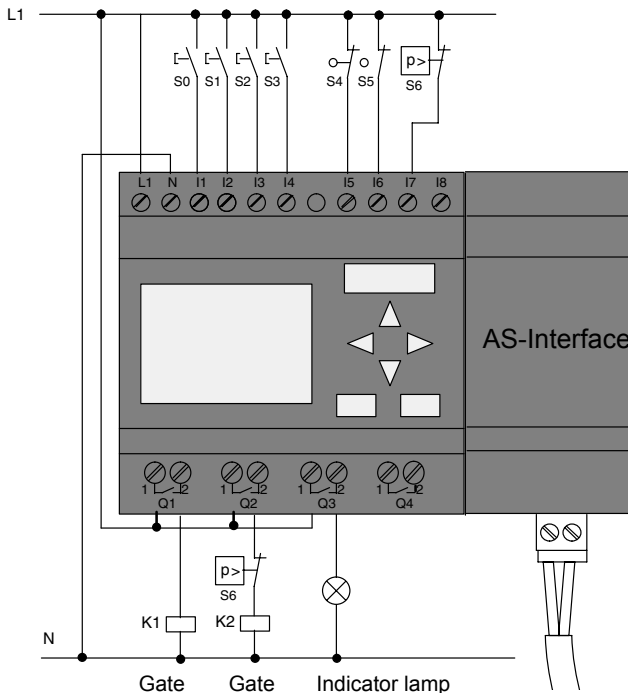
For **each** gate we are going to use one FL1D-H12RCC and one communication module. The modules and the master are interconnected by means of a bus system.

This chapter describes a gate control system. The structures of the other gate control systems are identical.

8.5.1 Requirements for a gate control system

- Every gate is opened and closed by means of a cord-operated switch. The gate is will be fully opened or fully closed.
- All gate can be opened and closed locally by means of pushbuttons.
- The gate can be opened and closed at the gatehouse by means of the bus system. The GATE OPEN or GATE CLOSED status is indicated.
- An indicator lamp is switched on five seconds before the gate starts moving and when the gate is in motion.
- A safety pressure bar prevents harm to persons and objects from getting trapped or damaged when the gate closes.

Wiring of the gate control system with FL1D-H12RCC and CM AS-Interface



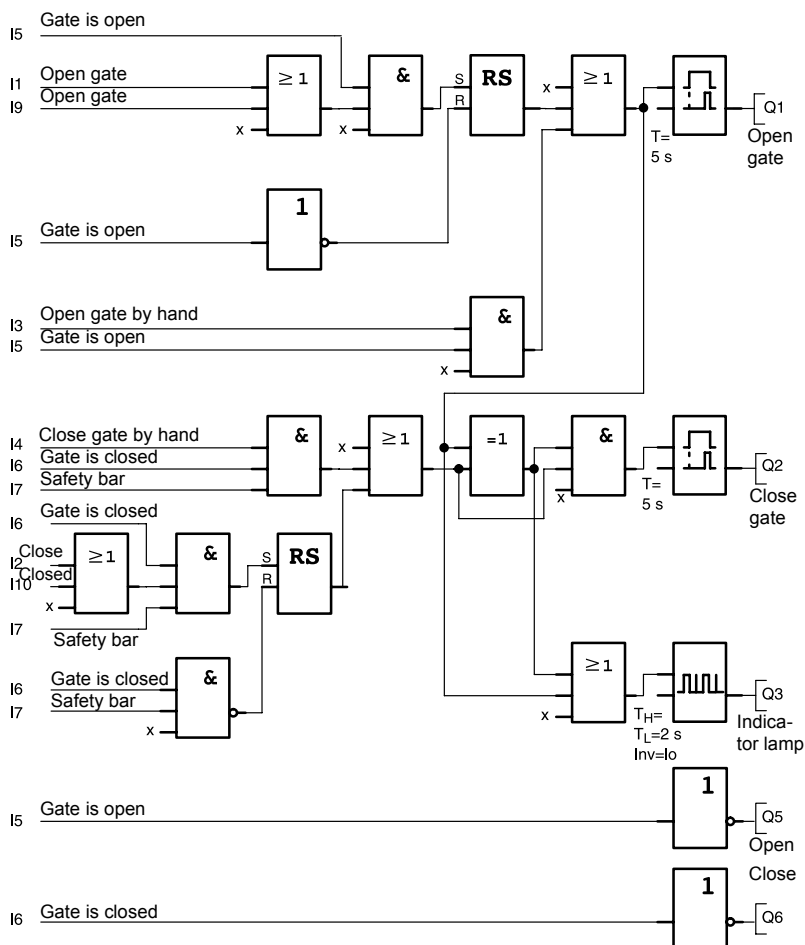
Components used

- K1 contactor relay open
- K2 contactor relay close
- S0 (*normally open contact*) cord operated switch open
- S1 (*normally open contact*) cord operated switch close
- S2 (*normally open contact*) OPEN pushbutton
- S3 (*normally open contact*) CLOSE pushbutton
- S4 (*normally closed contact*) position sensor
GATE IS OPEN
- S5 (*normally closed contact*) position sensor
GATE IS CLOSED
- S6 (*normally closed contact*) Safety bar

Master control system

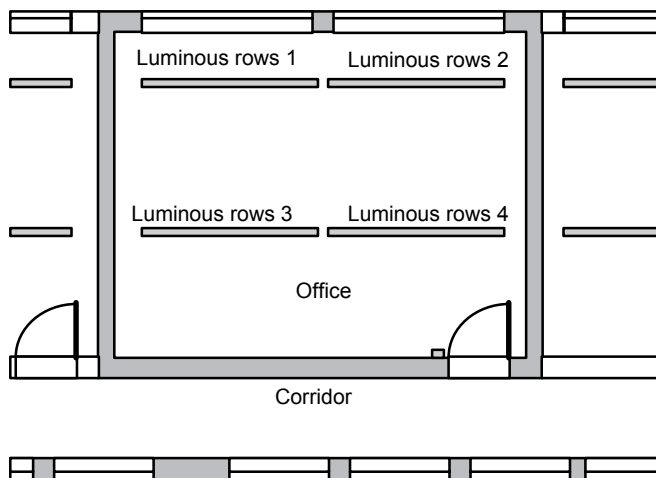
- Q5 position sensor
GATE IS OPEN
- Q6 position sensor
GATE IS CLOSED
- I9 external pushbutton
OPEN GATE
- I10 external pushbutton
CLOSE GATE

Block diagram of the IDEC SmartRelay solution



The OPEN GATE and CLOSE GATE pushbuttons initiate the gate motion, provided it is not already moving in the other direction. The gate motion ends at the respective limit switch. Closing of the gate is also interrupted by the safety bar.

8.6 Luminous rows

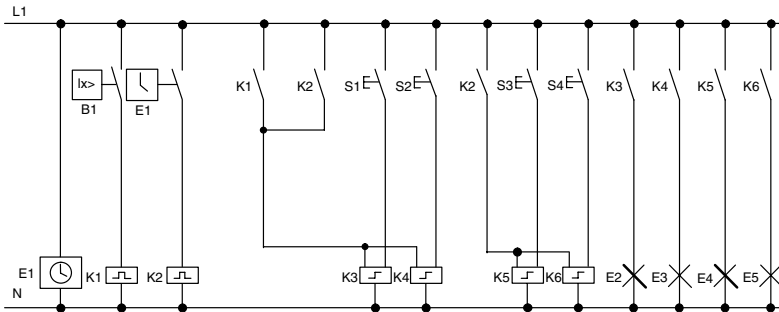


When planning lighting systems for commercial locations, the type and number of lamps used is determined by the luminance required. For reasons of cost efficiency, the installation often consists of fluorescent tubes arranged in luminous rows, and are divided into separate switching circuits, according to the way the room is used.

8.6.1 Requirements for a lighting system

- The various luminous rows are switched on and off locally.
- If there is sufficient daylight, the rows on the window side of the room are automatically switched off by means of a daylight control switch.
- The lights are switched off automatically at 20.00 h.
- Local manual operation of the lighting must be possible at all times.

8.6.2 Previous solution



The lamps are switched on and off with pulse relays, by means of pushbutton control at the door. Regardless of this, they are reset with a timer or daylight control switch signal at the *central off* input. The pulse width of the off commands must be reduced by means of interval time-delay relays to allow operation of the lights after they are switched off.

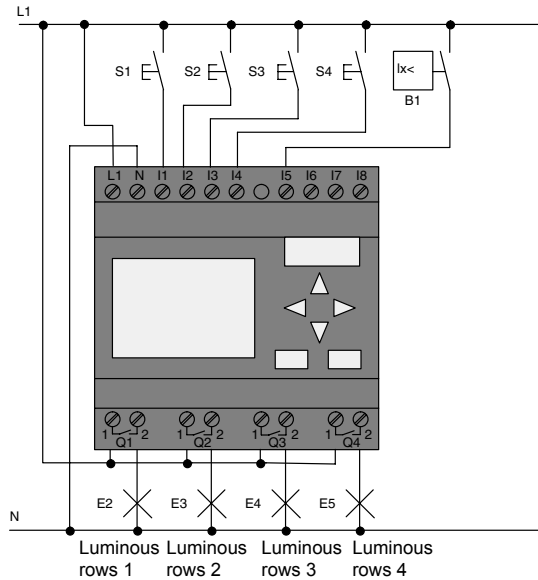
Components required:

- Pushbuttons S1 to S4
- Daylight control switch B1
- Timer E1
- Interval time-delay relays K1 and K2
- Pulse switches K3 to K6 with central OFF function

Disadvantages of the previous solution

- A substantial amount of switchgear needs to be installed to implement the necessary functions.
- Due to the large number of mechanical components, high wear and tear and maintenance expenditure is to be expected.
- The modification of functions involves considerable effort.

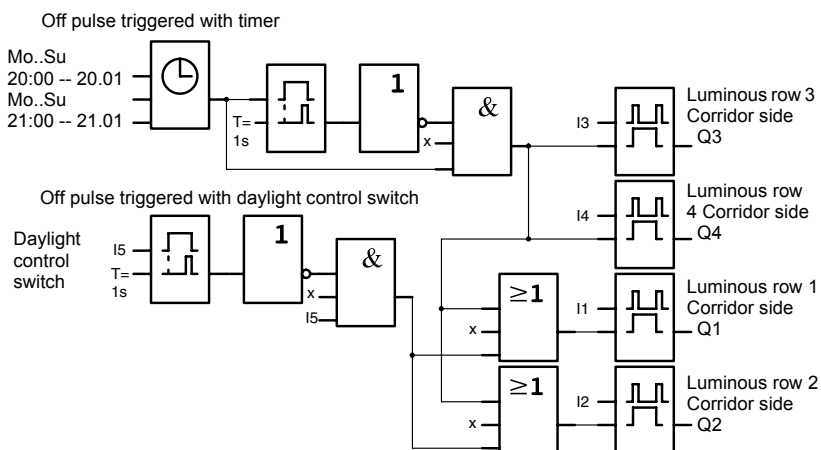
8.6.3 Luminous row control system with FL1D-H12RCC



Components used

- S1 to S4 (*normally open contact*)
momentary pushbutton
- B1 (*normally open contact*)
daylight control switch

Block diagram of the IDEC SmartRelay solution



Advantages of the IDEC SmartRelay solution

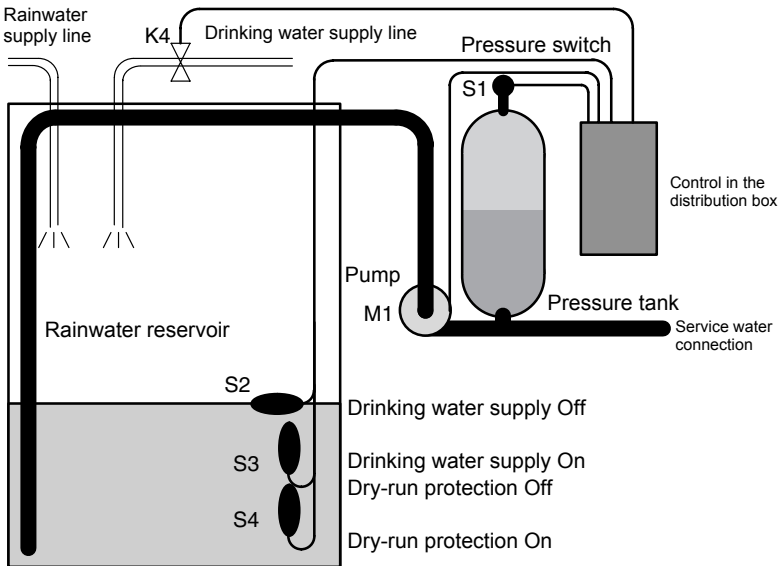
- You can connect the lamps directly to the IDEC SmartRelay, provided the power consumption does not exceed the switching capacity of the various outputs. Higher loads should be switched with a contactor relay.
- Connect the daylight control switch directly to an input of the IDEC SmartRelay.
- You do not need an external timer, because this function is integrated in the IDEC SmartRelay.
- Due to the reduced amount of switchgear, you can install a smaller and space-saving distribution cabinet.
- Fewer devices are required
- The lighting system can be easily modified.
- Additional switching times can be set as required (sequential circuit for the off pulses at the end of the day).
- The function of the daylight control switch can be easily applied to all lamps or to a modified group of lamps.

8.7 Service water pump

The use of rainwater as an addition to the drinking water supply is gaining importance. This saves cost and helps to protect the environment. For example, rainwater can be used for:

- Washing clothes
- Irrigation system for gardens
- Watering indoor plants
- Car wash
- Toilet flushing installations

The sketch below illustrates how such a rainwater utilization system is operated:

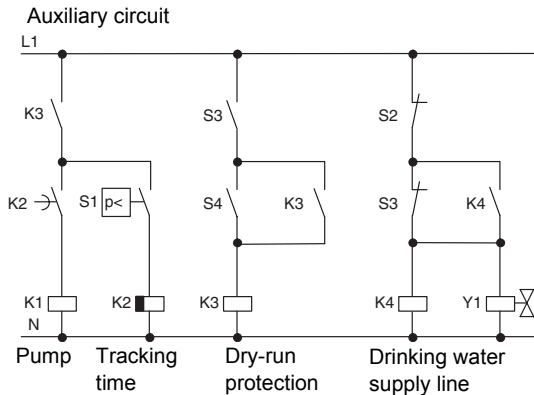


The rainwater is collected in a reservoir. From the reservoir, a pumping station supplies a respective line system. From there it can be tapped in the same way as normal drinking water. If the reservoir should run dry it can be topped up with drinking water.

8.7.1 Requirements for a control system of a service water pump

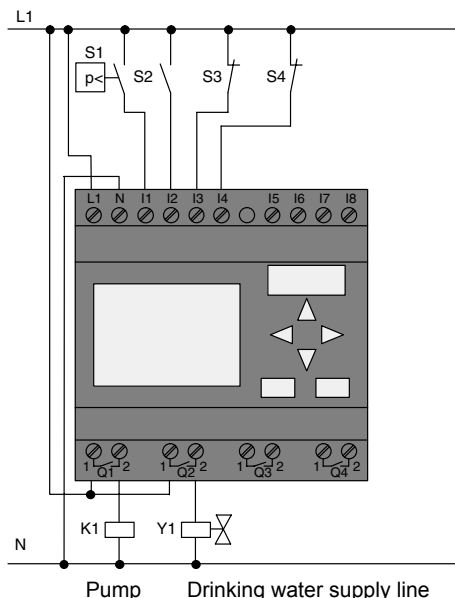
- Service water must be available at all times. In case of emergency, the control system must automatically switch over to drinking water supply.
- When switching over to the drinking water supply, the ingress of rainwater into the drinking water system must be prevented.
- The service water pump may not be switched on if the reservoir has run low of rainwater (dry-run protection).

8.7.2 Previous solution



The pump and a solenoid valve are controlled by means of a pressure switch and 3 float switches, which are installed in the rainwater reservoir. The pump must be switched on when the pressure level in the boiler drops below minimum. After the operating pressure is reached, the pump is switched off again after a tracking time of a few seconds has expired. The tracking time prevents oscillation of the water pump if water is drawn off over a longer period of time.

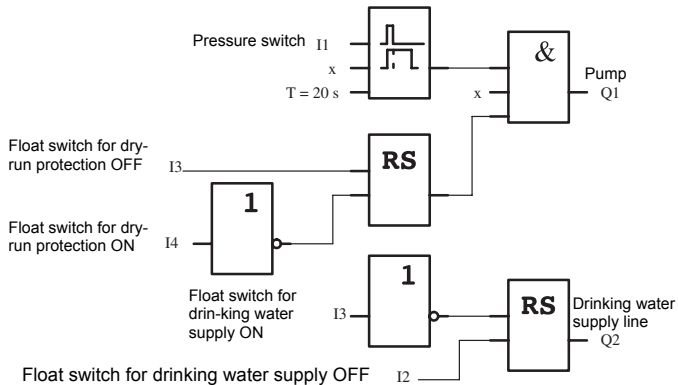
8.7.3 Service water pump system with FL1D-H12RCC



Apart from the IDEC SmartRelay, all you need is a pressure switch and the float switches to control the pump. If you are using a 3-phase AC motor, you must use a contactor relay to switch the pump. For single-phase AC pump systems you must provide a contactor relay if the power consumption of the AC motor exceeds the capacity of the output relay Q1. The power consumption of a solenoid valve is usually low enough to allow direct controlling.

- K1 contactor relay
- Y1 solenoid valve
- S1 (normally open contact) pressure switch
- S2 (normally open contact) float switch
- S3 (normally closed contact) float switch
- S4 (normally closed contact) float switch

Block diagram of the IDEC SmartRelay solution



8.7.4 Special features and expansions

The block diagram shows how you can interconnect the pump controls and the solenoid valve. The layout corresponds with the circuit diagram. You also have the option to integrate further functions for specific applications, which can only be implemented in a conventional circuitry by adding further switchgear, e.g.:

- Enabling the pump at specific times
- Indication of imminent or existing water shortage
- Reporting of system faults

8.8 Benefits of IDEC SmartRelay

IDEC SmartRelay is a particularly useful feature

- For replacing auxiliary switchgear with the integrated IDEC SmartRelay functions
- For saving wiring and installation work - because IDEC SmartRelay keeps the wiring "in its head".
- For reducing space requirements for components in the control cabinet/distribution box. A smaller control cabinet/distribution box may provide sufficient space.
- For adding or changing functions, without having to install additional switchgear or change the wiring.
- For offering your customers new, additional functions.

Examples:

- Security systems: IDEC SmartRelay switches on a lamp at regular intervals or opens and closes the shutters while you are on holiday.
- Central heating: IDEC SmartRelay runs the circulation pump only when water or heating is actually required.
- Refrigerating systems: IDEC SmartRelay can defrost refrigerating systems at regular intervals to save energy costs.
- You can illuminate aquaria and terraria on a time-dependent basis.

Last not least you can:

- Use commonly available switches and pushbuttons, which makes it easy to install the control system.
- Connect IDEC SmartRelay directly to the control system; the integrated power supply makes it possible.

There are definitely many more useful applications for the IDEC SmartRelay. For additional information, see "Sample" folder in WindLGC V.5 (Please find "Sample Applications" in start.html).

Do you want more Info?

For more information about IDEC SmartRelay, see our web page (see the preface for the URL).

A Technical data

A.1 General technical data

Criterion	Tested in accordance with	Values
IDEC SmartRelay Base: Dimensions (WxHxD) Weight Installation		72 x 90 x 55 mm Approx. 190 g on a 35 mm profile rail 4 module widths or wall mounting
IDEC SmartRelay expansion module: Dimensions (WxHxD) Weight Installation		36 x 90 x 53 mm Approx. 90 g on a 35 mm profile rail 2 module widths or wall mounting
Climatic conditions		
Ambient temperature Horizontal installation Vertical installation	Low temperature to IEC 60068-2-1 High temperature to IEC 60068-2-2	0 ... 55 °C 0 ... 55 °C
Storage/shipping		-40 °C... +70 °C
Relative humidity	IEC 60068-2-30	From 10 to 95 % no condensation
Air pressure		795 ... 1080 hPa
Pollutants	IEC 60068-2-42 IEC 60068-2-43	SO ₂ 10 cm ³ /m ³ , 4 days H ₂ S 1 cm ³ /m ³ , 4 days
Ambient mechanical conditions		
Protection mode		IP20
Vibrations:	IEC 60068-2-6	5 ... 9 Hz (constant amplitude 3.5 mm) 9 ... 150 Hz (constant acceleration 9.8m/s ²)
Shock	IEC 60068-2-27	18 shocks (half-sine wave 147m/ s ² /11 ms)
Drop	IEC 60068-2-31	Drop height 50 mm

Criterion	Tested in accordance with	Values
Free fall (packaged)	IEC 60068-2-32	1 m
Electromagnetic compatibility (EMC)		
Noise emission	EN 55011/A EN 55022/B EN 50081-1 (domestic area)	Limit class B group 1
Electrostatic discharge	IEC 61000-4-2 Severity 3	8 kV air discharge 6 kV contact discharge
Electromagnetic fields	IEC 61000-4-3	Field strength 10 V/m
HF currents on cables and cable shielding	IEC 61000-4-6	10 V
Burst pulses	IEC 61000-4-4 Severity 3	2 kV (supply) 1 kV (signal lines)
High-energy surge pulse (applies only to FL1D-H12RCC/FL1D-B12RCC)	IEC 61000-4-5 Severity 3	1 kV (power lines) symmetrical 2 kV (power lines) asymmetrical
Safety to IEC / VDE		
Clearance and creepage distance rating	IEC 60664, IEC 61131-2, EN 50178 cULus to UL 508, CSA C22.2 No. 142 With FL1D-B12RCC/ FL1D-H12RCC, also VDE 0631	Fulfilled
Insulation strength	IEC 61131-2	Fulfilled
Cycle time		
Cycle time per function		< 0.1 ms
Startup		
Startup time at power-up		typ. 8 s

Note: Use a surge absorber, noise cut transformer, or noise filter to protect DC power type modules (FL1D-H12RCE/B12RCE, FL1D-H12SND, FL1D-H12RCA/B12RCA) against surge.

A.2 Technical data: FL1D-H12RCC/FL1D-B12RCC and FL1B-M08C2R2

	FL1D-H12RCC FL1D-B12RCC	FL1B-M08C2R2
Power supply		
Input voltage	100...240 V AC/DC	100...240 V AC/DC
Permissible range	85 ... 265 V AC 100 ... 253 V DC	85 ... 265 V AC 100 ... 253 V DC
Permissible mains frequency	47 ... 63 Hz	47 ... 63 Hz
Power consumption		
100 V AC	10 ... 40 mA	10 ... 30 mA
240 V AC	10 ... 25 mA	10 ... 20 mA
100 V DC	5 ... 25 mA	5 ... 15 mA
240 V DC	5 ... 15 mA	5 ... 10 mA
Voltage failure buffering		
100 V AC	typ. 10 ms	typ. 10 ms
240 V AC	typ. 20ms	typ. 20ms
Power loss at		
100 V AC	1.1 ... 4.6W	1.1 ... 3.5W
240 V AC	2.4 ... 6 W	2.4 ... 4.8 W
100 V DC	0.5 ... 2.9 W	0.5 ... 1.8 W
240 V DC	1.2 ... 3.6 W	1.2 ... 2.4 W
Backup of the real-time clock at 25 °C	typ. 80 h	
Accuracy of the real-time clock	typ. ± 2 s/day	
Digital inputs		
Number	8	4
Electrical isolation	No	No
Input voltage L1		
Signal 0	< 40 V AC	< 40 V AC
Signal 1	> 79 V AC	> 79 V AC
Signal 0	< 30 V DC	< 30 V DC
Signal 1	> 79 V DC	> 79 V DC

	FL1D-H12RCC FL1D-B12RCC	FL1B-M08C2R2
Input current at Signal 0 Signal 1	< 0.03 mA > 0.08 mA	< 0.03 mA > 0.08 mA
Delay time at 0 to 1: 100 V AC : 240 V AC : 100 V DC : 240 V DC 1 to 0: 100 V AC : 240 V AC : 100 V DC : 240 V DC	typ. 50 ms typ. 30 ms typ. 25 ms typ. 15 ms typ. 65 ms typ. 105 ms typ. 95 ms typ. 125 ms	typ. 50 ms typ. 30 ms typ. 25 ms typ. 15 ms typ. 65 ms typ. 105 ms typ. 95 ms typ. 125 ms
Line length (unshielded)	100 m	100 m
Digital outputs		
Number	4	4
Output type	Relay outputs	Relay outputs
Electrical isolation	Yes	Yes
Dielectric Strength (between power/input terminals and output terminals)	2,500 V AC, 1minute 500 V DC, 1 minute	2,500 V AC, 1minute 500 V DC, 1 minute
In groups of	1	1
Control of a digital input	Yes	Yes
Continuous current I_{th}	max. 10 A per relay	max. 5 A per relay
Surge current	max. 30 A	max. 30 A
Incandescent lamp load (25000 switching cycles) at 230/240 V AC 100/120 V AC	1000 W 500 W	1000 W 500 W
Fluorescent tubes with ballast (25000 switching cycles)	10 x 58 W (at 230/240 V AC)	10 x 58 W (at 230/240 V AC)

	FL1D-H12RCC FL1D-B12RCC	FL1B-M08C2R2
Fluorescent tubes, conventionally compensated (25000 switching cycles)	1 x 58 W (at 230/240 V AC)	1 x 58 W (at 230/240 V AC)
Fluorescent tubes, uncompensated (25000 switching cycles)	10 x 58 W (at 230/240 V AC)	10 x 58 W (at 230/240 V AC)
Short circuit-proof cos 1	Power protection B16 600A	Power protection B16 600A
Short-circuit proof cos 0.5 to 0.7	Power protection B16 900A	Power protection B16 900A
Derating	none; across the entire temperature range	none; across the entire temperature range
Parallel output circuits for power increase	Not permitted	Not permitted
Protection of output relay (if desired)	max. 16 A, characteristic B16	max. 16 A, characteristic B16
Minimum Switching Load	10 mA, 12 V DC	10 mA, 12 V DC
Initial Contact Resistance	100 mΩ maximum (at 1A, 24V DC)	100 mΩ maximum (at 1A, 24V DC)
Mechanical Life	10,000,000 operations minimum (no load, 10 Hz)	10,000,000 operations minimum (no load, 10 Hz)
Electrical Life	100,000 operations minimum (rated resistive load, 1800 operations / hour)	100,000 operations minimum (rated resistive load, 1800 operations / hour)
Switching rate		
Mechanical	10 Hz	10 Hz
Ohmic load/lamp load	2 Hz	2 Hz
Inductive load	0.5 Hz	0.5 Hz

Note: When connecting a fluorescent lamp to the output, take the inrush current into consideration. When the inrush current exceeds the rated value, connect an appropriate relay between the output and the fluorescent lamp.

A.3 Technical data: FL1D-H12SND and FL1B-M08B1S2

	FL1D-H12SND	FL1B-M08B1S2
Power supply		
Input voltage	24 V DC	24 V DC
Permissible range	20.4 ... 28.8 V DC	20.4 ... 28.8 V DC
Reverse polarity protection	Yes	Yes
Permissible mains frequency		
Power consumption from 24 V DC	30 ... 55 mA 0.3 A per output	30 ... 45 mA 0.3 A per output
Voltage failure buffering		
Power loss at 24 V	0.7 ... 1.3 W	0.8 ... 1.1 W
Backup of the real-time clock at 25°C		
Accuracy of the real-time clock		
Digital inputs		
Number	8	4
Electrical isolation	No	No
Input voltage	L+	L+
• Signal 0	< 5 V DC	< 5 V DC
• Signal 1	> 12 V DC	> 12 V DC ⁽¹⁾
Input current at		
• Signal 0	< 0.85mA (I1...I6) < 0.05 mA (I7, I8)	< 0.85mA ⁽²⁾
• Signal 1	> 2 mA (I1...I6) > 0.15 mA (I7, I8)	> 2 mA ⁽³⁾
Delay time at		
• 0 to 1	typ. 1.5 ms (I1...I4) <1.0 ms (I5, I6)	typ. 1.5 ms
• 1 to 0	typ. 1.5 ms (I1...I4) <1.0 ms (I5, I6)	typ. 1.5 ms
Line length (unshielded)	100 m	100 m

	FL1D-H12SND	FL1B-M08B1S2
Analog inputs		
Number	2 (I7 = AI1, I8 = AI2)	
Range	0 ... 10 V DC input impedance 78 k Ω	
Resolution	10 bit, normalized to 0 ... 1000	
Cycle time for analog value generation	300 ms	
max. input voltage	28.8 V DC	
Line length (shielded and twist- ed)	10 m	
Error limit	± 1.5 % of full scale	
Digital outputs		
Number	4	4
Output type	Transistor, current-sourcing ⁽⁴⁾	Transistor, current-sourcing ⁽⁴⁾
Electrical isolation	No	No
In groups of		
Control of a digital input	Yes	Yes
Output voltage	Supply voltage	Supply voltage
Output current	max. 0.3 A	max. 0.3 A
Continuous current I_{th}		
Incandescent lamp load (25000 switching cycles) at		
Fluorescent tubes with ballast (25000 switching cycles)		
Fluorescent tubes, conventionally compensated (25000 switching cycles)		
Fluorescent tubes, uncompen- sated (25000 switching cycles)		
Short circuit-proof and over- load-proof	Yes	Yes
Short-circuit current limitation	Approx. 1 A	Approx. 1 A

	FL1D-H12SND	FL1B-M08B1S2
Derating	none; across the entire temperature range	none; across the entire temperature range
Short circuit-proof cos 1		
Short-circuit proof cos 0.5 to 0.7		
Parallel output circuit for power increase	Not permitted	Not permitted
Protection of output relay (if desired)		
Switching rate⁽⁵⁾		
Mechanical		
Electrical	10 Hz	10 Hz
Ohmic load/lamp load	10 Hz	10 Hz
Inductive load	0.5 Hz	0.5 Hz

(1): 8 V DC (Version 1 to 4 specifications)

(2): 1.0 mA (Version 1 to 4 specifications)

(3): 1.5 mA (Version 1 to 4 specifications)

For identifying the version, see page 4.

(4): When FL1D-H12SND or FL1B-M08B1S2 are switched on, signal 1 is sent to the digital outputs for about 50 microseconds. Take this into account, especially when using devices that react to short pulses.

(5): The maximum switching rate of the FL1D-H12SND is only dependent on the switching program's cycle time.

Note: When connecting a fluorescent lamp to the output, take the inrush current into consideration. When the inrush current exceeds the rated value, connect an appropriate relay between the output and the fluorescent lamp.

A.4 Technical data: FL1D-H12RCA/FL1D-B12RCA and FL1B-M08D2R2

	FL1D-H12RCA FL1D-B12RCA	FL1B-M08D2R2
Power supply		
Input voltage	24 V AC/DC	24 V AC/DC
Permissible range	20.4 ... 26.4 V AC 20.4 ... 28.8 V DC	20.4 ... 26.4 V AC 20.4 ... 28.8 V DC
Reverse polarity protection		
Permissible mains frequency	47 ... 63 Hz	47 ... 63 Hz
Power consumption • 24 V AC • 24 V DC	40 ... 100 mA 20 ... 75 mA	40 ... 100 mA 20 ... 75 mA
Voltage failure buffering	typ. 5 ms	typ. 5 ms
Power loss • 24 V AC • 24 V DC	0.9 ... 2.7 W 0.4 ... 1.8 W	0.9 ... 2.7 W 0.4 ... 1.8 W
Backup of the real-time clock at 25°C	typ. 80 h	
Accuracy of the real-time clock	typ. ± 2 s / day	
Digital inputs		
Number	8, optional P action or N action	4, optional P action or N action
Electrical isolation	No	No
Input voltage • Signal 0 • Signal 1	L < 5 V AC/DC > 12 V AC/DC	L < 5 V AC/DC > 12 V AC/DC
Input current at Signal 0	< 1.0 mA	< 1.0 mA
Signal 1	> 2.5 mA	> 2.5 mA

	FL1D-H12RCA FL1D-B12RCA	FL1B-M08D2R2
Delay time at •0 to 1	typ. 1.5 ms	typ. 1.5 ms
•1 to 0	typ. 15 ms	typ. 15 ms
Line length (unshielded)	100 m	100 m
Analog inputs		
Number		
Range		
max. Input voltage		
Digital outputs		
Number	4	4
Output type	Relay outputs	Relay outputs
Electrical isolation	Yes	Yes
Dielectric Strength (between power/input terminals and output terminals)	2,500 V AC, 1minute 500 V DC, 1 minute	2,500 V AC, 1minute 500 V DC, 1 minute
In groups of	1	1
Control of a digital input	Yes	Yes
Output voltage		
Output current		
Continuous current I_{th}	max. 10 A per relay	max. 5 A per relay
Surge current	max.30A	max.30A
Incandescent lamp load (25000 switching cycles) at	1000 W	1000 W
Fluorescent tubes with ballast (25000 switching cycles)	10 x 58 W	10 x 58 W
Fluorescent tubes, convention- ally compensated (25000 switching cycles)	1 x 58 W	1 x 58 W
Fluorescent tubes, uncompen- sated (25000 switching cycles)	10 x 58 W	10 x 58 W
Short circuit–proof and overload–proof		

	FL1D-H12RCA FL1D-B12RCA	FL1B-M08D2R2
Short-circuit current limitation		
Derating	none; across the entire temperature range	none; across the entire temperature range
Short circuit-proof cos 1	Power protection B16, 600A	Power protection B16, 600A
Short-circuit proof cos 0.5 to 0.7	Power protection B16, 900A	Power protection B16, 900A
Parallel output circuits for power increase	Not permitted	Not permitted
Protection of output relay (if desired)	max. 16 A, characteristic B16	max. 16 A, characteristic B16
Minimum Switching Load	10 mA, 12 V DC	10 mA, 12 V DC
Initial Contact Resistance	100 mΩ maximum (at 1A, 24V DC)	100 mΩ maximum (at 1A, 24V DC)
Mechanical Life	10,000,000 operations minimum (no load, 10 Hz)	10,000,000 operations minimum (no load, 10 Hz)
Electrical Life	100,000 operations minimum (rated resistive load, 1800 operations / hour)	100,000 operations minimum (rated resistive load, 1800 operations / hour)
Switching rate		
Mechanical	10 Hz	10 Hz
Electrical		
Ohmic load/lamp load	2 Hz	2 Hz
Inductive load	0.5 Hz	0.5 Hz

Note: When connecting a fluorescent lamp to the output, take the inrush current into consideration. When the inrush current exceeds the rated value, connect an appropriate relay between the output and the fluorescent lamp.

A.5 Technical data: FL1D-H12RCE/FL1D-B12RCE and FL1B-M08B2R2

	FL1D-H12RCE FL1D-B12RCE	FL1B-M08B2R2
Power supply		
Input voltage	12/24 V DC	12/24 V DC
Permissible range	10.8 ... 28.8 V DC	10.8 ... 28.8 V DC
Reverse polarity protection	Yes	Yes
Power consumption		
• 12 V DC	30 ... 140 mA	30 ... 140 mA
• 24 V DC	20 ... 75 mA	20 ... 75 mA
Voltage failure buffering		
• 12 V DC	typ. 2 ms	typ. 2 ms
• 24 V DC	typ. 5 ms	typ. 5 ms
Power loss		
• 12 V DC	0.3 ... 1.7 W	0.3 ... 1.7 W
• 24 V DC	0.4 ... 1.8 W	0.4 ... 1.8 W
Backup of the real-time clock at 25 °C	typ. 80 h	
Accuracy of the real-time clock	typ. ± 2 s / day	
Electrical isolation	No	No
Digital inputs		
Number	8	4
Electrical isolation	No	No
Input voltage L+		
• Signal 0	< 5 V DC	< 5 V DC
• Signal 1	> 8.5 V DC	> 8.5 V DC ⁽¹⁾
Input current at		
• Signal 0	< 0.85 mA (I1...I6) < 0.05 mA (I7, I8)	< 0.85 mA ⁽²⁾
• Signal 1	> 1.5 mA (I1... I6) > 0.1 mA (I7, I8)	> 1.5 mA

	FL1D-H12RCE FL1D-B12RCE	FL1B-M08B2R2
Delay time at <ul style="list-style-type: none"> • 0 to 1 • 1 to 0 	typ. 1.5 ms <1.0 ms (I5, I6) typ. 1.5 ms <1.0 ms (I5, I6)	typ. 1.5 ms typ. 1.5 ms
Line length (unshielded)	100 m	100 m
Analog inputs		
Number	2 (I7=AI1, I8=AI2)	
Range	0 ... 10 V DC input impedance 76 kΩ	
Resolution	10 bit, normalized to 0 ... 1000	
Cycle time for analog value generation	300 ms	
max. Input voltage	28.8 V DC	
Line length (shielded and twisted)	10 m	
Error limit	±1.5 % of full scale	
Digital outputs		
Number	4	4
Output type	Relay outputs	Relay outputs
Electrical isolation	Yes	Yes
Dielectric Strength (between power/input terminals and output terminals)	2,500 V AC, 1minute 500 V DC, 1 minute	2,500 V AC, 1minute 500 V DC, 1 minute
In groups of	1	1
Control of a digital input	Yes	Yes
Output voltage		
Output current		
Continuous current I_{th} (per ter- minal)	max. 10 A per relay	max. 5 A per relay
Surge current	max. 30 A	max. 30 A

	FL1D-H12RCE FL1D-B12RCE	FL1B-M08B2R2
Incandescent lamp load (25000 switching cycles) at	1000 W	1000 W
Fluorescent tubes with ballast (25000 switching cycles)	10 x 58 W	10 x 58 W
Fluorescent tubes, conventionally compensated (25000 switching cycles)	1 x 58 W	1 x 58 W
Fluorescent tubes, uncom- pensated (25000 switching cycles)	10 x 58 W	10 x 58 W
Short circuit–proof and overload–proof		
Short–circuit current limitation		
Derating	none; across the en- tire temperature range	none; across the en- tire temperature range
Short circuit–proof cos 1	Power protection B16 600A	Power protection B16 600A
Short–circuit proof cos 0.5 to 0.7	Power protection B16 900A	Power protection B16 900A
Parallel output circuits for power increase	Not permitted	Not permitted
Protection of output relay (if desired)	max. 16 A, characteristic B16	max. 16 A, characteristic B16
Minimum Switching Load	10 mA, 12 V DC	10 mA, 12 V DC
Initial Contact Resistance	100 mΩ maximum (at 1A, 24V DC)	100 mΩ maximum (at 1A, 24V DC)
Mechanical Life	10,000,000 operations minimum (no load, 10 Hz)	10,000,000 operations minimum (no load, 10 Hz)
Electrical Life	100,000 operations minimum (rated re- sistive load, 1800 operations / hour)	100,000 operations minimum (rated re- sistive load, 1800 operations / hour)

	FL1D-H12RCE FL1D-B12RCE	FL1B-M08B2R2
Switching rate		
Mechanical	10 Hz	10 Hz
Electrical		
Ohmic load/lamp load	2 Hz	2 Hz
Inductive load	0.5 Hz	0.5 Hz

(1): 8 V DC (Version 1 to 5 specifications)

(2): 1.0 mA (Version 1 to 5 specifications)

For identifying the version, see page 4.

Note: When connecting a fluorescent lamp to the output, take the inrush current into consideration. When the inrush current exceeds the rated value, connect an appropriate relay between the output and the fluorescent lamp.

A.6 Switching capacity and service life of the relay outputs

Ohmic load

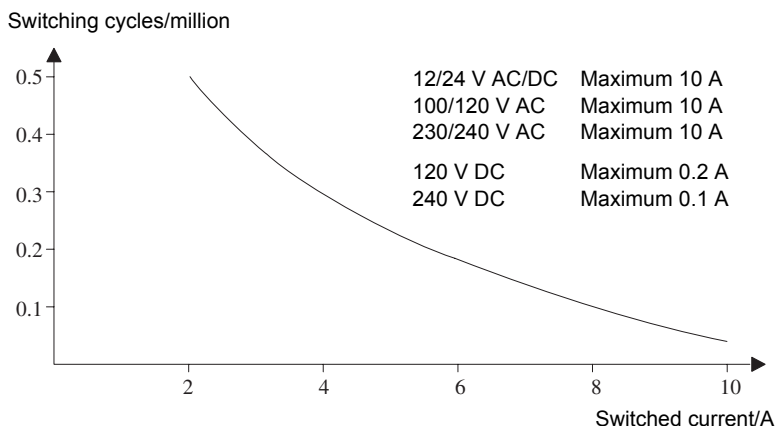


Figure A Switching capacity and service life of the contacts with ohmic load (heating)

Inductive load

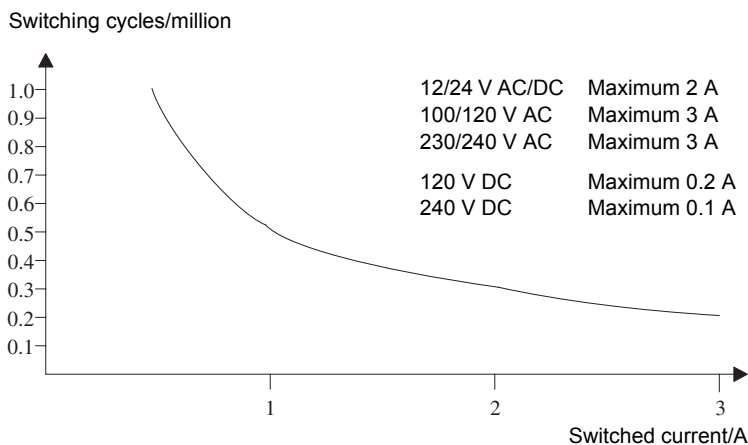


Figure B Switching capacity and service life of the contacts with high inductive load to IEC 947-5-1 DC 13/AC 15 (contactors, solenoid coils, motors)

A.7 Technical data: FL1B-J2B2

	FL1B-J2B2
Power supply	
Input voltage	12/24 V DC
Permissible range	10.8 ... 28.8 V DC
Power consumption	25 ... 50 mA
Voltage failure buffering	typ. 5 ms
Power loss at	
• 12 V	0.3 ... 0.6 W
• 24 V	0.6 ... 1.2 W
Electrical isolation	No
Reverse polarity protection	Yes
Ground terminal	for connecting ground and shielding of the analog measuring line.
Analog inputs	
Number	2
Type	Unipolar
Input range	0 ... 10 V DC (input impedance 76 k Ω) or 0 ... 20 mA (input impedance <250 Ω)
Resolution	10 bit, normalized to 0 ... 1000
Cycle time for analog value generation	50 ms
Electrical isolation	No
Line length (shielded and twisted)	10 m
Encoder supply voltage	none
Error limit	± 1.5 % of full scale
Interference frequency suppression	55 Hz

A.8 Technical data: FL1D-K2B2

	FL1D-K2B2
Power supply	
Input voltage	24 V DC
Permissible range	20.4 ... 28.8 V DC
Power consumption	25 ... 50 mA
Voltage failure buffering	typ. 5 ms
Power loss at 24 V	0.6 ... 1.2 W
Electrical isolation	No
Reverse polarity protection	Yes
Ground terminal	for connecting ground and shielding of the analog measuring line.
Analog outputs	
Number	2
Input range	0 ... 10 V DC
Load resistor	5 k Ω
Resolution	10 bit, normalized to 0 ... 1000
Cycle time for analog value output	depending on installation (typ. 50 ms)
Electrical isolation	No
Line length (shielded and twisted)	10 m
Error limit	± 2.5 % of full scale
Short circuit protection	Yes
Response at short-circuit	affected output = 0 V neighboring output reverts
Overload protection	Yes
Response at overload	affected output = 0 V neighboring output reverts

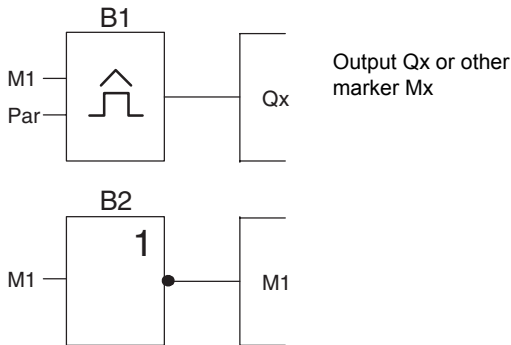
B Determining the cycle time

The program cycle is the complete execution of the circuit program, that is, primarily the reading in of the inputs, the processing of the circuit program and the subsequent reading out of the outputs. The cycle time is the time required to execute a circuit program once in full.

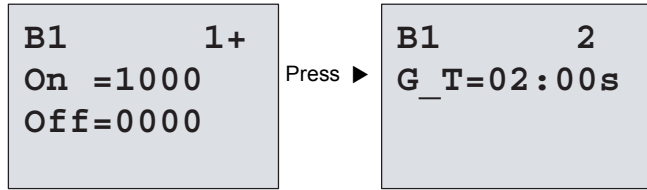
The time required for a program cycle can be determined using a short test program. This test program is created in IDEC SmartRelay and returns a value during its execution in parameter assignment mode from which the current cycle time is derived.

Test program

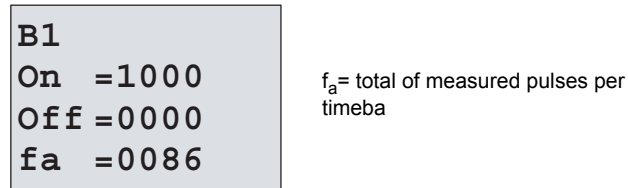
1. Create the test program by linking an output to a frequency trigger and connecting the trigger input with an inverted marker.



2. Configure the frequency trigger as shown below. A pulse is generated in each program cycle due to the inverted marker. The trigger interval is set to 2 seconds.



3. Now start the circuit program and switch IDEC SmartRelay to parameter assignment mode. In this mode, view the trigger parameters.

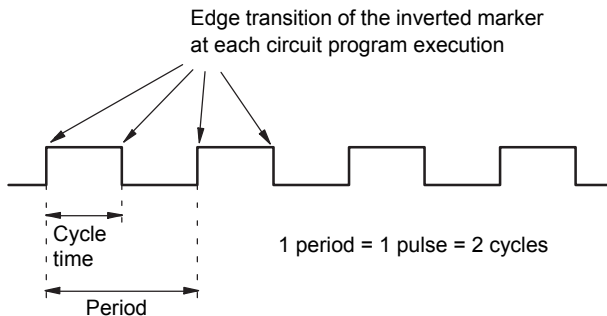


4. The reciprocal value of f_a is equivalent to the IDEC SmartRelay execution time of the current circuit program in its memory.
 $1/f_a$ = cycle time in s

Explanation

The inverted marker block changes its output signal at each program execution. Thus, one logic level (high or low) width is exactly equivalent to the length of one cycle. Hence, a period lasts 2 cycles.

The frequency trigger indicates the ratio of periods per 2 seconds, which results in the ratio of cycles per second.

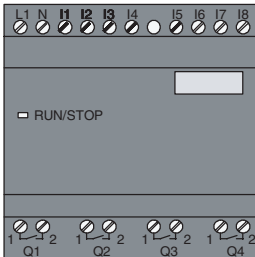


C IDEC SmartRelay without display



Because some specific applications do not require operator control and monitoring units such as buttons or a display, we provide the FL1D-B12RCE, FL1D-B12RCA and FL1D-B12RCC versions without display.

View of a FL1D-B12RCC, for example:



Less is definitely more!

The versions without display offer you the following benefits:

- Even more cost-effective without the operating element.
- Requires less switch cabinet space than conventional hardware.
- Substantial benefits with regard to flexibility and prime costs compared to stand-alone electronic switchgear.
- Of advantage even for applications in which merely two or three conventional switching devices can be replaced.
- Very easy to use.
- Access protected.
- Compatible to IDEC SmartRelay versions with display.
- Offers the option to read data by means of WindLGC.

Creating a circuit program without operator panel

There are two ways to create a circuit program for a IDEC SmartRelay without display:

- You create the circuit program with WindLGC on your PC and then download it to the IDEC SmartRelay (see Chapter 7).
- You download the circuit program from a IDEC SmartRelay memory cartridge (card) to your IDEC SmartRelay without display (see Chapter 6).

Operating characteristics

IDEC SmartRelay is ready for operation when power is switched on. Switching off a IDEC SmartRelay without display is equivalent to disconnecting the power supply, e.g. as if you were removing the plug.

The circuit program of FL1D-B12... versions can not be started or stopped by means of buttons. This is why the FL1D-B12... versions have other startup characteristics:

Startup characteristics

If there is no circuit program in the IDEC SmartRelay or on the inserted memory cartridge (card), IDEC SmartRelay remains in STOP.

If there is a valid circuit program in IDEC SmartRelay memory, the IDEC SmartRelay automatically switches from STOP to RUN when power is switched on.

The circuit program on an inserted memory cartridge (card) is automatically copied to the IDEC SmartRelay, immediately after power is switched on. The existing circuit program in IDEC SmartRelay memory is overwritten. The system automatically changes from STOP to RUN.

Provided the PC cable is connected to the IDEC SmartRelay, you can download the circuit program to IDEC SmartRelay and start it by means of the WindLGC PC software (see Chapter 7.1).

Operating status indication

Operating states, e.g. Power On, RUN and STOP are indicated by an LED on the front hood.

- Red LED: Power On/STOP
- Green LED: Power On/RUN

The red LED is lit after Power On and in all IDEC SmartRelay states other than RUN. The green LED is lit when IDEC SmartRelay is in RUN mode.

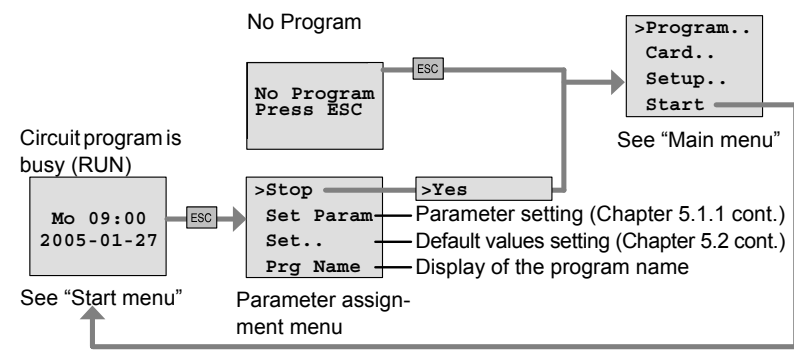
Reading current data

WindLGC (see Chapter 7) provides an online test for reading the current data of all functions while the system is in RUN.

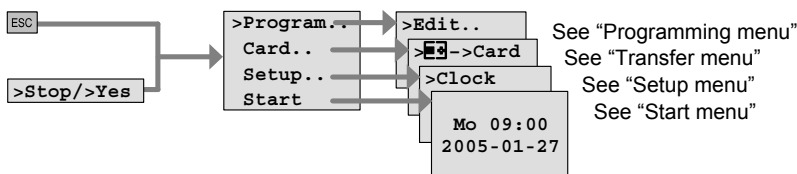
If your IDEC SmartRelay without display holds a protected memory cartridge (card), you can not read the current data unless you enter the correct password for your the circuit program. The circuit program is otherwise deleted from IDEC SmartRelay memory when you remove the memory cartridge (card) to connect the PC cable, for example (see Chapter 6.1).

D IDEC SmartRelay menu structure

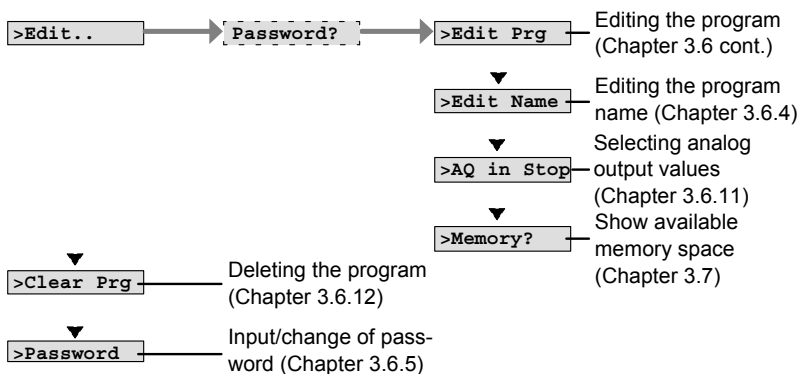
Menu overview



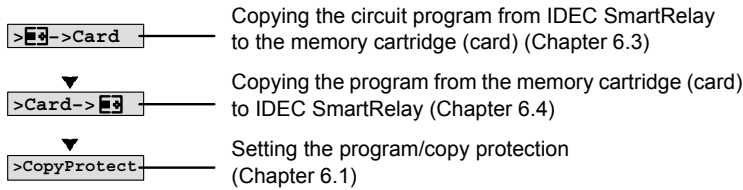
Main menu (ESC / >Stop)



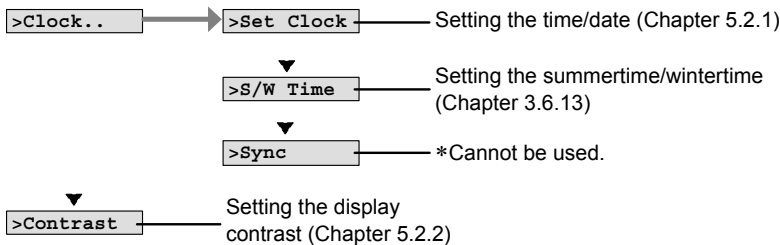
Programming menu (ESC / >Stop → >Program)



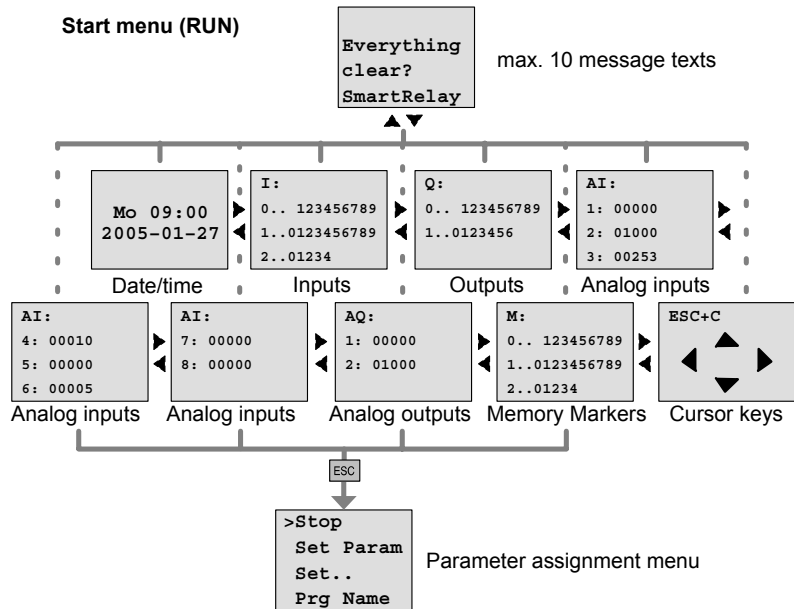
Transfer menu (ESC / >Stop → >Card)



Setup menu (ESC / >Stop → >Setup)



Start menu (RUN)



E Type Numbers

Table A IDEC SmartRelay Modules

Name	Type Number	Rated Power Voltage	Input Type (Digital)	Input Type (Analog)	Output Type (Relay)	Output Type (Analog)	Display and Keypad	Real Time Clock
Base Module (IDEC SmartRelay Base or Pure)	FL1D-H12RCC	100-240V AC/DC	8	-	4	-	Yes	Yes
	FL1D-B12RCC						-	
	FL1D-H12RCA	24V AC/DC	8	-	4	-	Yes	Yes
	FL1D-B12RCA						-	
	FL1D-H12RCE	12/24V DC	8 (I1-I8)	2 (I7, I8)	4	-	Yes	Yes
	FL1D-B12RCE						-	
	FL1D-H12SND	24V DC	8 (I1-I8)	2 (I7, I8)	4 (Tr)	-	Yes	-
Expansion Module	FL1B-M08B2R2	12/24V DC	4	-	4	-	-	-
	FL1B-M08B1S2	24V DC	4	-	4 (Tr)	-	-	-
	FL1B-M08C2R2	100-240V AC/DC	4	-	4	-	-	-
	FL1B-M08D2R2	24V AC/DC	4	-	4	-	-	-
	FL1B-J2B2	12/24V DC	-	2	-	-	-	-
	FL1D-K2B2	24V DC	-	-	-	2	-	-
AS-Interface Module	FL1B-CAS2	AS-Interface Voltage	-	-	-	-	-	-
LONWORKS® Module	FL1B-CL1C12	24V AC/DC	-	-	-	-	-	-

LONWORKS® is a registered trademark of Echelon company of United States.

Cable and Accessories Table B

Name	Function	Type Number
WindLGC	Exclusive Programming Software for IDEC SmartRelay (incl. Hardware/Software Manual)	FL9Y-LP1CDW
PC Cable	Down-load/Up-load Cable	FL1A-PC1
Memory cartridge (Brown)		FL1C-PM3
User's Manual	FL1D User's Manual (English)	FL9Y-B966
Mounting Clip	5 pieces	FL1B-PSP1PN05
Removal Tool	Memory Cartridge Removal Tool	MT-101

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