IDEC SmartRelay Series

Manual

May 2002

www.idec.com/usa

idec

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Welcome to IDEC SmartRelay

Dear Customer,

Thank you for your purchase of an IDEC SmartRelay. With the IDEC SmartRelay you have acquired a logic module that meets the stringent quality requirements of ISO 9001.

The IDEC SmartRelay can be used in many applications. Due to its flexibility and ease of operation the IDEC SmartRelay offers you a highly economical product for almost any application.

IDEC SmartRelay Documentation

This IDEC SmartRelay Manual contains information relating to the installation, programming and the use of IDEC SmartRelay FL1B Basic devices.

You can also find information on wiring the IDEC SmartRelay in this manual as well as in the product information included with every device.

WindLGC is the programming software for PCs. It runs under Windows® and helps you to become comfortable with your IDEC SmartRelay in a familiar environment. You can write, test, print out and archive your programs, independent of the IDEC SmartRelay. Find additional information on programming the IDEC SmartRelay with the PC, in the online help for WindLGC at *smart.idec.com*.

We have divided this manual into 8 chapters and an appendix.

1. Working with IDEC SmartRelay
2. Installing and Wiring the IDEC SmartRelay
3. Programming IDEC SmartRelay
4. IDEC SmartRelay Functions
5. Configuring IDEC SmartRelay
6. IDEC SmartRelay Program Modules
7. IDEC SmartRelay Software
8. Applications
Appendix

Safety Guidelines

The notes in this manual are for your own personal safety and for pre-venting damage to property. You should read them carefully and follow the directions. These instructions are highlighted by a warning triangle and are marked as follows according to the hazard level:

> ⚠ Warning
> *Warns that death, serious harm to health or damage to property can result if the respective precautionary 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.

Major Changes to Previous Basic Device (FL1A)

- The design of IDEC SmartRelay Basic models has improved: all models are now equipped with 8 inputs and 4 outputs.
- IDEC SmartRelay Basic is modular: all models are equipped with an expansion interface.
- IDEC SmartRelay is very versatile: there is a series of expansion modules available to you, including, for example, digital modules and an analog module.

New Features of the Current Basic Device (FL1B)

- Password protection for the user program.
- Program can be named.
- Special "Softkey" function.
- New menu item "S/W Time" for automatic daylight savings time (summertime/wintertime conversion).
- Acknowledgment of the message text in RUN mode.
- Wall mounting is possible.

Additional Support

For additional information, please go to our web site at *www.idec.com/usa* or *smart.idec.com*.

⚠ Warning

Only skilled personnel should be allowed to start and operate this device. Qualified personnel are persons who are authorized to handle, ground and tag circuits, equipment and systems in accordance with approved safety regulations and standards.

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

This product must be properly transported, stored, handled and installed as well as meticulously operated and maintained in order to ensure it functions safely and correctly.

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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 cannot be ruled out. Any liability and warranty for the accuracy of this information is excluded. The data in this manual is reviewed at regular intervals. Any corrections required are included in the subsequent editions. Suggestions for improvement are welcomed.

1 Working with IDEC SmartRelay

What is IDEC SmartRelay?

IDEC SmartRelay represents the universal IDEC logic module. IDEC SmartRelay integrates

- controls
- an operating and display unit
- power supply
- interface for expansion modules
- an interface for program modules and a PC cable
- ready-to-use basic functions that are often required in day-to-day operation, e.g. functions for on/off delays, current impulse relays and Softkey
- time switch
- binary markers
- inputs and outputs according to the device type

What can IDEC SmartRelay do?

IDEC SmartRelay offers solutions for domestic and installation engineering (e.g. for stairway lighting, external lighting, sun blinds, shutters, shop window lighting etc.), switch cabinet engineering and mechanical and apparatus engineering (e.g. for gate control systems, ventilation 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. ASi) for distributed local controlling of machines and processes.

Special models without operator and display units are available for series production applications in small machine, apparatus, switch control and installation engineering.

New types of Equipment Now Available

IDEC SmartRelay Basic has two voltage classes:

- Class 1 < 24 V (12 V DC, 24 V DC, 24 V AC)
- Class 2 > 24 V (100...240 V AC/DC)

Inputs/Outputs:

- With display: 8 inputs and 4 outputs.
- Without display: 8 inputs and 4 outputs.

Each model is integrated in 4 units and is equipped with an expansion interface and offers you 30 ready-to-use basic and special functions for creating your program.

New Expansion Modules are Now Available?

- The IDEC SmartRelay digital module is available for 12 V DC, 24 V DC and 100 - 240 V AC/DC, with 8 I/Os.
- The IDEC SmartRelay analog module is available for 12 V DC and 24 V DC, with 2 inputs.
- The IDEC SmartRelay Communication module, e.g. the function module ASi (AS Interface bus system). This module is described in separate documentation.

The digital/analog modules are integrated in 2 units. Each one has two expansion interfaces for connecting additional modules.

It's Your Choice

The different basic models and expansion modules offer options and can be adapted by you specific for specific applications.

IDEC SmartRelay provides solutions ranging from the small domestic installation through small automation tasks to complex tasks integrating a bus system (e.g. the AS interface).

> Note
> *Every basic IDEC SmartRelay unit can be expanded with expansion modules of the same voltage class. Pin configuration prevents interconnection of devices of different voltage classes.*

Exception:The left interface of the analog module or communication module can be connected to devices of a different voltage class. See also "2.1 Configuration of the Modular IDEC SmartRelay" on page 2-2.

Regardless of the number of modules connected to the IDEC SmartRelay, the following I/O and memory bits are available: I1 to I24, AI1 to AI8, Q1 to Q16 And M1 to M8.

1.1 IDEC SmartRelay Structure

IDEC SmartRelay Basic (eg. FL1B-H12RCC)
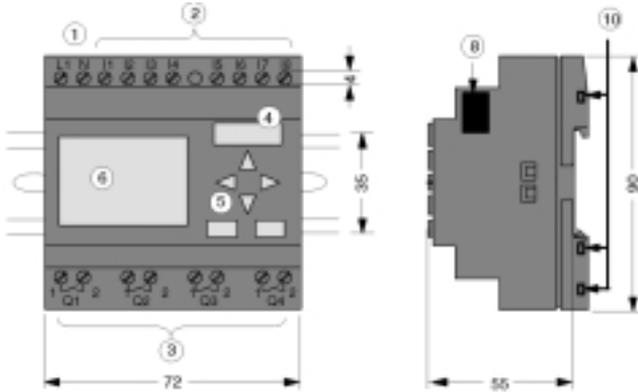
IDEC SmartRelay Expansion Module (eg. FL1B-M08C2R2)
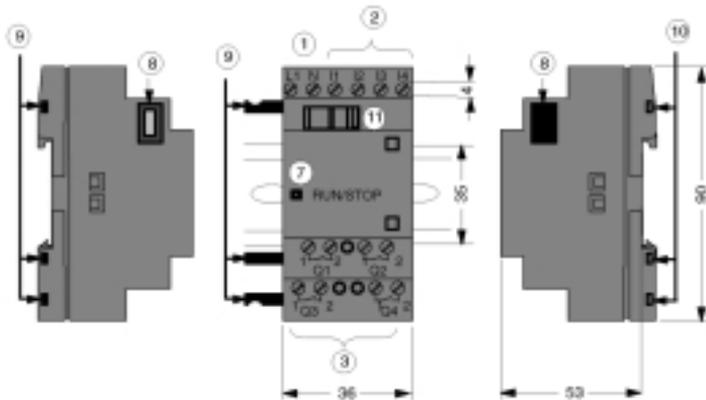
① Power supply

② Inputs

③ Outputs

④ Module slot with cover

⑤ Control panel (not with FL1B-B12***)

⑥ LCD (not with FL1B-B12***)

⑦ Status display RUN/STOP

⑧ Expansion interface

⑨ Mechanical coding – Pins

⑩ Mechanical coding sockets

⑪ Slide

IDEC SmartRelay Basic (eg. FL1B-H12RCE)
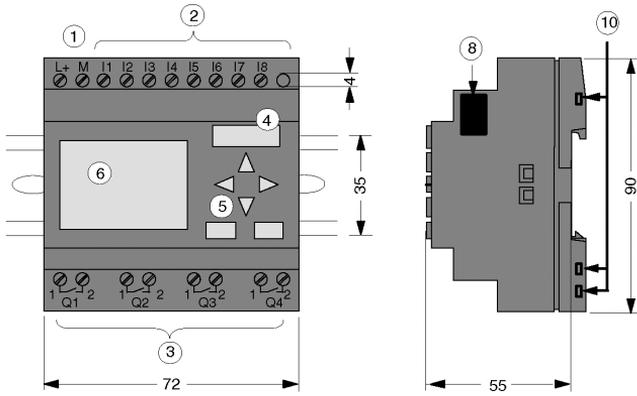
IDEC SmartRelay Expansion Module (eg. FL1B-M08B2R2)

① Power supply

② Inputs

③ Outputs

④ Module slot with cover

⑤ Control panel (not with FL1B-B12***)

⑥ LCD (not with FL1B-B12***)

⑦ Status display RUN/STOP

⑧ Expansion interface

⑨ Mechanical coding pins

⑩ Mechanical coding sockets

⑪ Slide

FL1B-J2B2
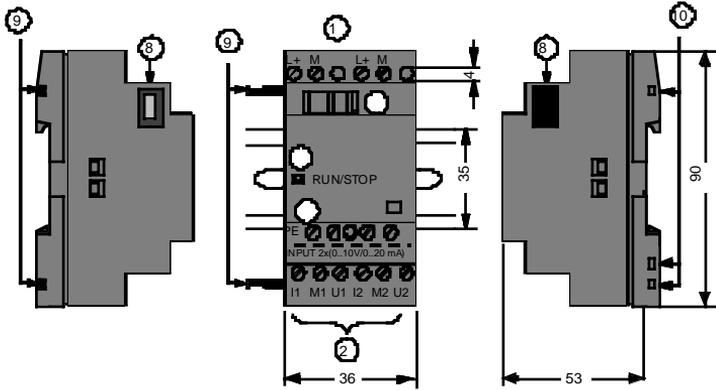
① Power supply	⑨ Mechanical coding pins	⑫ Grounding terminal for connecting ground and shielding of the analog measuring line.
② Inputs	⑩ Mechanical coding sockets	
⑦ Status display RUN/ STOP	⑪ Slide	
⑧ Expansion interface		

IDEC SmartRelay Part Numbers

The IDEC SmartRelay part number indicates the following properties:

- 12: Total I/Os
- 08: Total I/Os
- R: Relay outputs
- S: Transistor output
- C: Integrated seven -day time switch
- H: Model with display
- B: Model without display
- M: Digital module
- J: Analog module

1.2 Models

Models with display are equipped with 8 inputs and 4 outputs

Models without display are 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

Models

IDEC SmartRelay is available in the following models:

Model	Part Number	Supply voltage	Inputs	Outputs	Properties
	FL1B-H12RCE	12/24 V DC	8 Digital*	4 Relays 240 V x 10 A	
	FL1B-H12SND	24 V DC	8 Digital*	4 Transistor 24 V x 0.3 A	no clock
	FL1B-H12RCA	24 V AC	8 Digital	4 Relays 240 Vx10 A	
	FL1B-H12RCC #	100...240 V AC/DC	8 Digital	4 Relays 240 Vx10 A	
	FL1B-B12RCC	12/24 V DC	8 Digital*	4 Relays 240 Vx10 A	no display no keyboard
	FL1B-B12RCA	24 V AC	8 Digital	4 Relays 240 Vx10 A	no display no keyboard
	FL1B-B12RCC #	100...240 V AC/DC	8 Digital	4 Relays 240 Vx10 A	no display no keyboard

*: alternatively, 2 analog inputs (0...10V) and 2 fast inputs can be used.

#: 240 V AC models: Inputs in two groups of 4. Within a group only the same phase, between groups different phases are possible.

Expansion Module

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

Symbol	Designation	Supply Voltage	Inputs	Outputs
	FL1B-M08B2R2	12/24 V DC	4 Digital	4 Relays [3]
	FL1B-M08B1S2	24 V DC	4 Digital	4 Transistors
	FL1B-M08C2R2	100...240 V AC/DC	4 Digital [1]	4 Relays[3]
	FL1B-J2B2	12/24 V DC	2 Analog 0-10 V or 0-20 mA[2]	none

1. no different phases allowed within the inputs.

2. 0-10 V, 0-20 mA connection is optional.

3. The maximum sum switching power across all four relays is 20 A.

1.3 Certification, Recognition and Approval

UL, CSA and FM

IDEC SmartRelay is certified according to UL, CSA and FM.

- UL listing mark
  Underwriters Laboratories (UL) to
  UL 508 standard, file no. 116536

- CSA-Certification-Mark
  Canadian Standard Association (CSA) to
  Standard C22.2 No. 142, File No. LR 48323

- FM certification
  Factory Mutual (FM) Approval to
  Standard Class Number 3611,
  - Class I, Division 2, Group A, B, C, D
  - Class I, Zone 2, Group IIC

> Warning
>
> *Personal injury and property damage may occur.*
>
> *In potentially explosive areas, personal injury or property damage can result if you disconnect any connectors while the system is in operation. Always switch off the power supply for the IDEC SmartRelay and its components before disconnecting any connectors.*

CE, VDE, IEC and EN

IDEC SmartRelay carries CE marking, complies with VDE 0631 and IEC 61131-2 standard and has interference suppression to EN 55011 (limit class B, class A for ASi bus operation).

Shipbuilding Certification

- ABS - American Bureau of Shipping

- BV - Bureau Veritas

- DNV - Det Norske Veritas

- GL - Germanischer Lloyd

- LRS - Lloyds Register of Shipping

- PRS - Polski Rejestr Statków

 IDEC SmartRelay can therefore be used both in industrial and domestic applications.

C Tick Mark (Australia)

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

2 Installing & Wiring the IDEC SmartRelay

General Guidelines

When mounting and wiring your IDEC SmartRelay you should observe the following guidelines:

- When wiring the IDEC SmartRelay ensure you are conforming with current rules and standards. You should also follow any national and regional regulations when installing and operating the devices. Contact the relevant authorities to find out the standards and regulations that apply in your specific case.

- Use wires with the appropriate cross-section for the amount of current involved. IDEC SmartRelay can be wired using cables with a conductor cross-section of 1.5 mm^2 and 2.5 mm^2, refer to "2.3 Wiring the IDEC SmartRelay" on page 2-11.

- Don't over-tighten the connectors. Maximum torque: 0.5 N/m, refer to "2.3 Wiring the IDEC SmartRelay" on page 2-11.

- Keep wiring distances as short as possible. If longer wires are necessary, a shielded cable should be used. Arrange the wires in pairs: one neutral conductor with one phase conductor or one signal line.

- Keep the following separate:
  -AC circuits
  -High-voltage DC circuits with fast switching cycles
  -Low voltage signal wiring.

- Ensure that the wires have the required strain relief.

- Provide suitable overvoltage protection for wires that could be susceptible to lightning.

- Do not connect an external power supply to an output load parallel to a DC output. This can result in reverse current at the output unless you have a diode or a similar block in your configuration.

Note
IDEC SmartRelay must always be mounted and wired by skilled personnel who are familiar and follow current rules and standards.

2.1 Configuration of the Modular IDEC SmartRelay

2.1.1 Maximum Configuration

Maximum Configuration of IDEC SmartRelay With Analog Inputs

(FL1B-H12RCE/B12RCE and FL1B-H12SND)

IDEC SmartRelay Basic 4 Digital Modules and 3 Analog Modules						
I1......I6 AI1, AI2	I9...I12	I13...I16	I17...I20	I21...I24		
IDEC SmartRelay Basic	FL1B-M08****				FL1B-J2B2	
					AI3 , AI4	AI5 , AI6	AI7 , AI8

Tip
When using inputs I7 / AI1 and I8 / AI2 as analog inputs (AI1 and AI2), you should also avoid using them as digital inputs I7/I8.

Maximum Configuration of IDEC SmartRelay Without Analog Inputs

(FL1B-H12RCA/B12RCA and FL1B-H12RCC/B12RCC)

IDEC SmartRelay Basic 4 digital modules and 4 analog modules						
I1...........I8	I9...I12	I13...I16	I17...I20	I21...I24		
IDEC SmartRelay Basic	FL1B-M08****				FL1B-J2B2	
					AI1 , AI2	AI3 , AI4	AI5 , AI6	AI7 , AI8

Fast/Optimal Communication

In order to achieve optimal communication speed between IDEC Smart-Relay Basic and the various modules, we recommend configuring the digital modules first, then the analog modules as in the example above.

2.1.2 Configuration with Different Voltage Classes

Since the potential of the left analog module interface (FL1B-J2B2, 12/24 V DC) is separated from the right one, you can connect it to all IDEC SmartRelay Basic models.

The potential of expansion modules arranged to the right of the analog module is separated from IDEC SmartRelay Basic.

It is therefore possible to connect an expansion module of a different voltage class as IDEC SmartRelay Basic to the right side of an analog module.

Example:							
FL1B-*12RCC	FL1B-M08C2R2	FL1B-J2B2	FL1B-M08B1S2	**FL1B-J2B2**	FL1B-M08B2R2	FL1B-J2B2	FL1B-M08B1S2

The potential of an analog module is separated
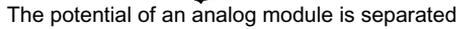
2.2 Installing/Uninstalling IDEC SmartRelay

Dimensions

IDEC SmartRelay's installation dimensions are compliant with DIN 43880.

IDEC SmartRelay can be snap-mounted on a 35 mm DIN EN 50022 profile rail or mounted on the wall.

Width of IDEC SmartRelay:

- IDEC SmartRelay Basic has a width of 72 mm, corresponding to 4 unit segments.

- The width of IDEC SmartRelay expansion modules is 36 mm, corresponding to 2 unit segments.

Note

We shall illustrate mounting and removal in a graphic overview for a FL1B-H12RCC and a digital module.The shown methods also apply for all other IDEC SmartRelay basic models and expansion modules.

⚠ Warning

Expansion modules must only be "connected" or "disconnected" after power is switched off.

2.2.1 Profile Rail Mounting

Installing

Follow the following guidelines to install the IDEC SmartRelay basic and a digital module on a profile rail:

IDEC SmartRelay Basic:

1. Place the IDEC SmartRelay basic on the rail.

2. Then rotate the unit around the rail. (The mounting slide at the rear must be engaged.)
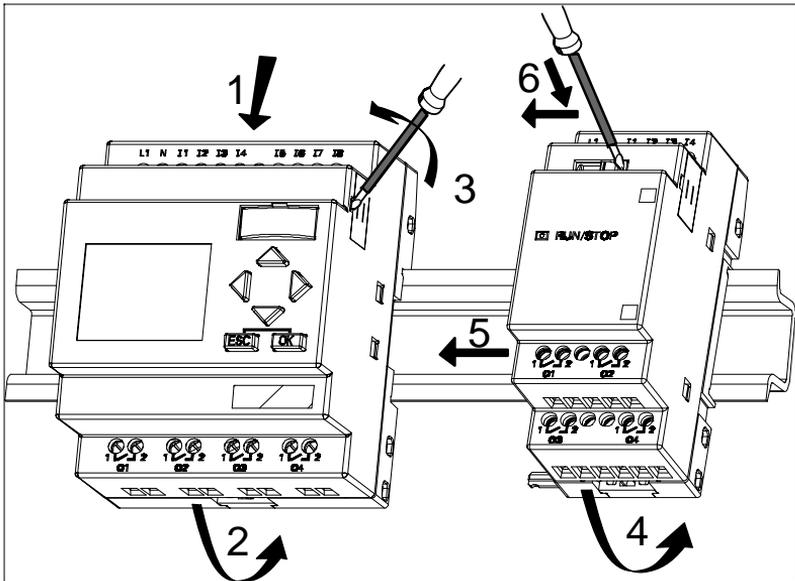
IDEC SmartRelay Digital Module:

3. At the right side of the IDEC SmartRelay Basic/IDEC SmartRelay expansion module, remove the cover of the connector.

4. Place the digital module to the right of the IDEC SmartRelay basic.

5. Slide the digital module towards the left up to the IDEC SmartRelay Basic.

Repeat steps 3 to 6 is you want to install additional expansion modules.
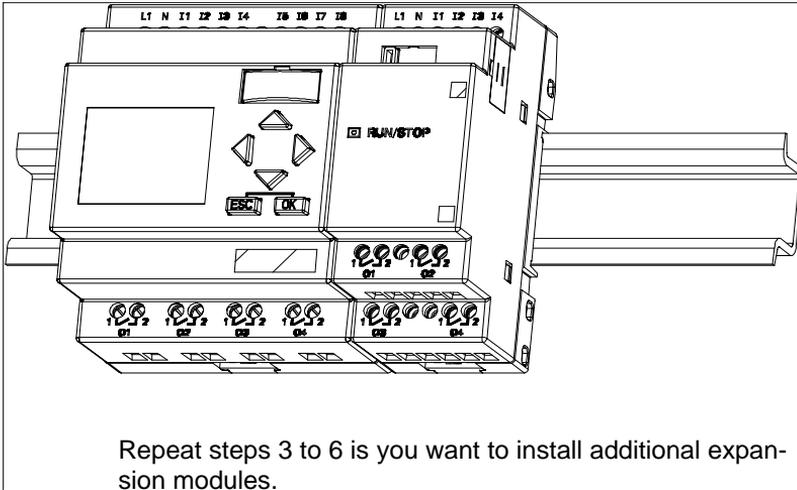
6. Using a screwdriver, slide the integrated to the left. When the slide engages in the IDEC SmartRelay basic it is in the correct position.

Note

The expansion interface of the last expansion module must be covered.

Uninstalling

To uninstall IDEC SmartRelay, proceed as follows:

A. One IDEC SmartRelay Basic is Installed:

1. Insert a screwdriver into the hole shown at the lower end of the mounting slide and push it downward.

2. Rotate the IDEC SmartRelay basic off the profile rail.
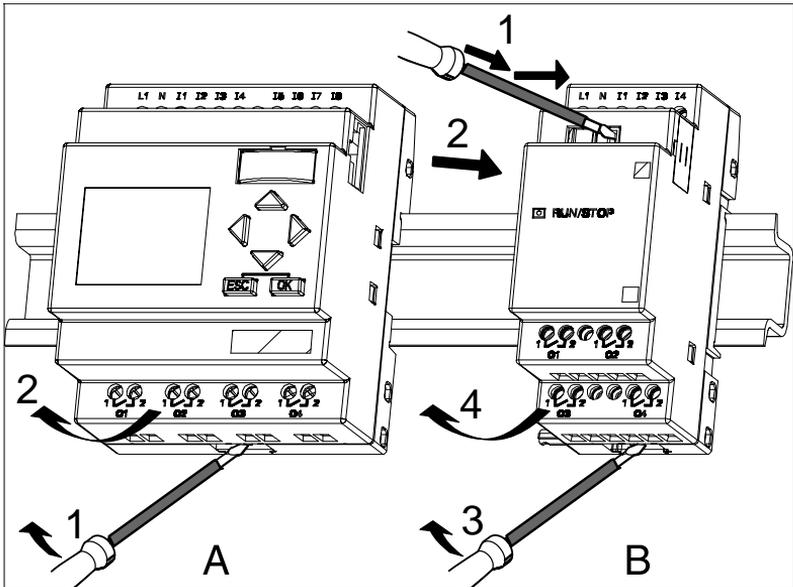
B. One Expansion Module Connected to the IDEC SmartRelay Basic:

1. Using a screwdriver, push down the slide and move it to the right.

2. Slide the expansion module towards the right.

3. Insert a screwdriver into the hole shown at the lower end of the mounting slide and push it downward.

4. Swing the expansion module off the profile rail.

Repeat steps 1 to 4 for all other expansion modules.

> Note
>
> *If more than one expansion module is connected, start with the last module on the right.*
>
> *Make sure that the slide of the module to be installed/removed is not connected to the next module.*

2.2.2 Wall-Mounting

Before you wall-mount the device, the mounting slides at the rear of the device must be pushed towards the outside or the inside. Insert the upper mounting slide (included with the modules) and push the lower one to the outside. You can the fasten the IDEC SmartRelay with two O 4-mm screws (tightening torque 0.8 to 1.2 N/m) to the bracket to mount it on the wall.

Mounting slides
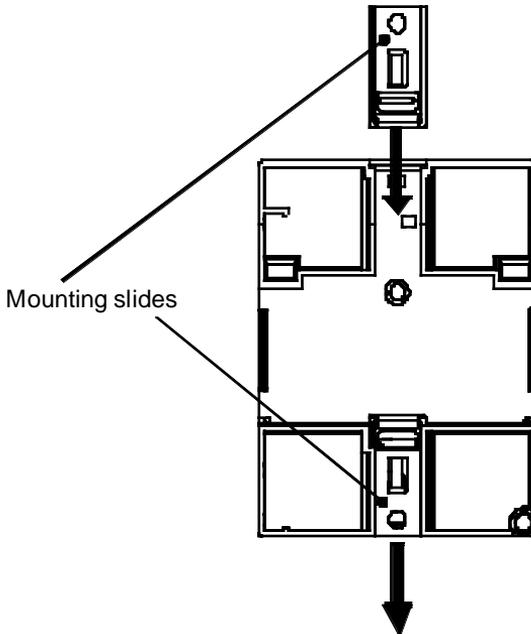
Drilling Template for Wall-Mounting

Before you mount the IDEC SmartRelay to the wall you should use the following template for location of the mounting screws.

All dimensions in mm
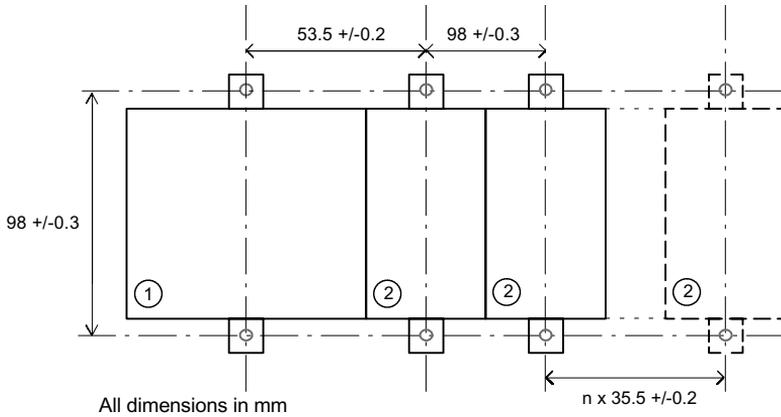
○ Screw bore 4 mm
  Tightening torque 0.8 to 1.2 N/m
① IDEC SmartRelay Basic
② IDEC SmartRelay Expansion module

2.3 Wiring the IDEC SmartRelay

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

You don't need wire ferrules for the connectors. You can use wires up to the following sizes:

- 1 x 2.5 mm^2
- 2 x 1.5 mm^2 for each second connector compartment
- Connecting torque: 0.4 - 0.5 N/m or 3 - 4 LBin

Note
Ensure that the connectors are covered.To protect the IDEC SmartRelay adequately against contact with any voltage carrying parts please conform to any national and regional standards that apply in your area.

2.3.1 Connecting the Power Supply

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

Please read the information on connecting in the product information documents shipped with your device and the technical specifications in Appendix A relating to permissible voltage tolerances, line frequency and current consumption.

Note
Power failure might result in an additional edge after power restoration with edge-triggered special functions.

Data from the last uninterrupted cycle is stored in IDEC SmartRelay.

Connecting

This is how you connect your IDEC SmartRelay to the power supply:

IDEC SmartRelay .....
with DC supply voltage

IDEC SmartRelay .....
with AC supply voltage
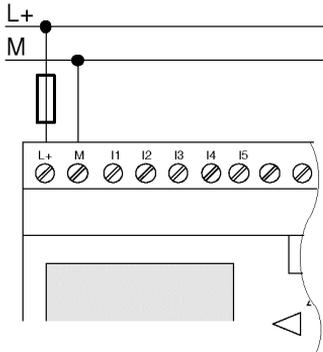
Protection by fuse
if required (recommended) for:
FL1B-*12RCE: 0.8A
FL1B-H12SND   2.0A
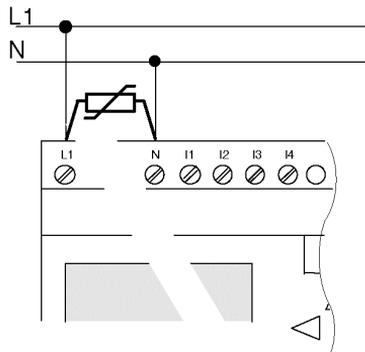
With voltage peaks, use a varistor
(MOV) with at least 20% higher op-
erating voltage than nominal voltage.

Note

*IDEC SmartRelay has protective insulation. A ground terminal is not neces-
sary.*

Protective Circuit with AC Voltage

You can eliminate line voltage peaks with a metal oxide varistor (MOV).
Make sure the operating voltage of the varistor exceeds the rated voltage
by at least 20%.

2.3.2 Connecting IDEC SmartRelay Inputs

Prerequisites

Connect sensors to the inputs. Sensors may be: pushbuttons, switches, photoelectric barriers, daylight control switches etc.

Sensor Attributes for IDEC SmartRelay

	FL1B-H12RCE/B12RCE FL1B-M08B2R2		FL1B-H12SND FL1B-M08B1S2	
	I1 ... I6	I7, I8	I1 ... I6	I7, I8
Circuit state 0 Input current	< 5 V DC < 1.0 mA	< 5 V DC < 0.05 mA	< 5 V DC < 1.0 mA	< 5 V DC < 0.05 mA
Circuit state 1 Input current	> 8 V DC > 1.5 mA	> 8 V DC > 0.1 mA	> 8 V DC > 1.5 mA	> 8 V DC > 0.1 mA

	FL1B-H12RCA/ B12RCA (AC)	FL1B-H12RCC/ B12RCC (AC) FL1B-M08C2R2 (AC)	FL1B-H12RCC/ B12RCC (DC) FL1B-M08C2R2 (AC)
Circuit state 0	< 5 V AC	< 40 V AC	< 30 V DC
Input current	< 1.0 mA	< 0.03 mA	< 0.03 mA
Circuit state 1	> 12 V AC	> 79 V AC	> 79 V DC
Input current	> 2.5 mA	> 0.08 mA	> 0.08 mA

Note

The digital inputs of the FL1B-H12RCC/B12RCC are divided into two groups equipped with 4 inputs each. Within a 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.

Within the input circuit of the FL1B-M08C2R2 you must not connect different phases.

Sensor Connections

Connecting glow lamps, 2-wire Bero to the FL1B-H12RCC/B12RCC or FL1B-M08C2R2 (AC)
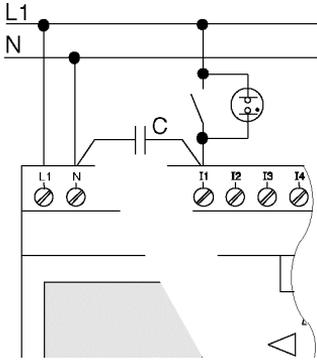
Restrictions

- Circuit status transition 0➔1 / 1➔0
  When the circuit state changes from 0 to 1, circuit state 1 and, in the case of a change from 1 to 0, circuit state 0 must be in place for at least one program cycle for IDEC SmartRelay to recognize the new circuit status.
  The cycle time of the program processing depends on the size of the program. In "3.7 Memory Space and Circuit Size" on page 3-42 you can find a description of a short test program that will help you to work out the current cycle time.

Special features of FL1B-H12RCE/B12RCE and FL1B-H12SND

- Fast inputs: I5 and I6
  These models are also equipped with inputs for frequency functions. The same restrictions do not apply to these fast inputs.

Note

There are no changes in the standard model compared to previous Basic devices (FL1A): I5 and I6 are still the fast inputs, that is, no changes are necessary to transfer the program written in these models to the new FL1B devices.

- Analog inputs: I7 and I8
  With the FL1B-H12RCE/B12RCE and FL1B-H12SND models the inputs I7 and I8 can be used as normal digital inputs or as analog inputs. How the input is used depends on its purpose in the IDEC SmartRelay control program.
  You can use the digital capability of the input with I7/I8 and its analog capability with the identifiers AI1 and AI2.
  See also Section 4.1.

Note

The expansion module FL1B-J2B2 is available for additional inputs.
For the analog signals you must always use twisted and shielded cables as short as possible.

Sensor Connections

This is how to connect sensors to the IDEC SmartRelay:
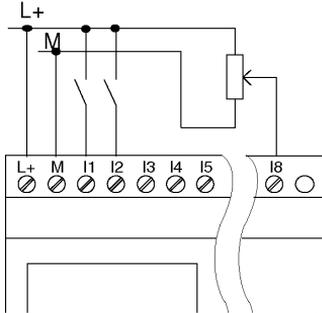
FL1B-H12RCE/-B12RCE

The inputs of these devices are non-isolated and therefore require the same reference potential (ground) as the power supply. With the FL1B-H12RCE/-B12RCE and FL1B-H12SND you can tap the analog signal between the supply voltage and ground

FL1B-H12RCC/-B12RCC
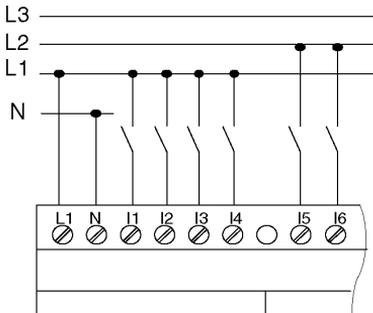
The inputs of these devices are arranged in 2 groups with 4 inputs each. Different phases are only possible between, but not within the blocks.

⚠ **Warning**

Current safety regulations (VDE 0110, ... and IEC 61131-2, ... as well as UL and CSA) do not permit the connection of different phases to one input group (I1-4 or I5-8) of an AC model or on the inputs of one digital module.

FL1B-J2B2

PE Grounding terminal for connecting ground and shielding of the analog measuring line

① Ground

② Cable shielding

③ Profile rail

Current measurement

Voltage measurement
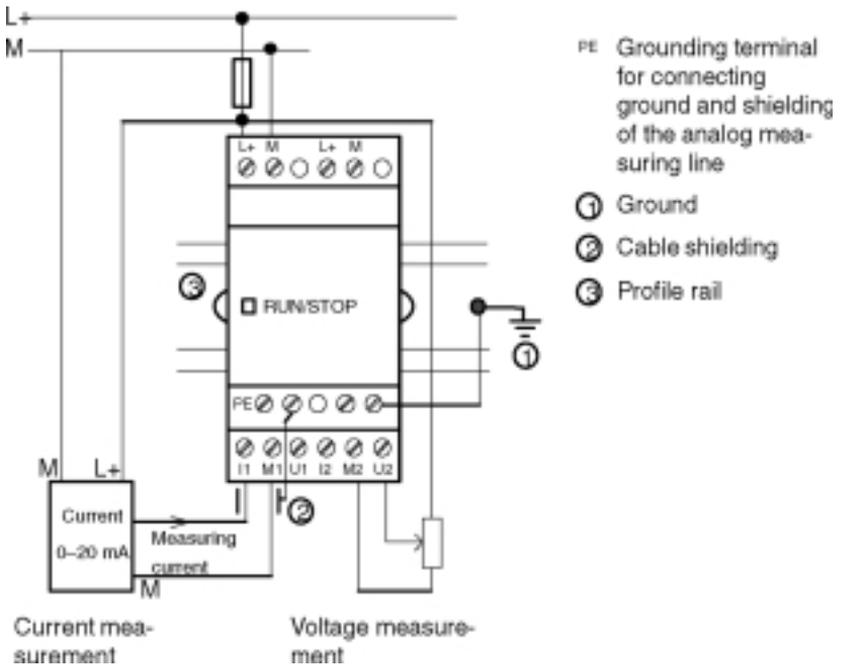
Input Internal Circuit

FL1B-H12RCC/FL1B-B12RCC/FL1B-M08C2R2

Digital AC/DC Input

390k ohm   390k ohm

Internal Circuit
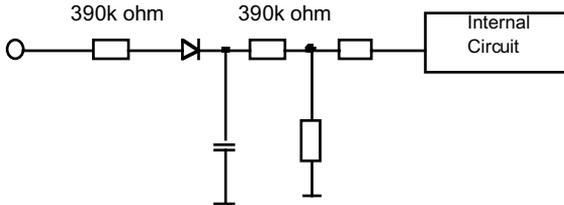
FL1B-H12RCA/FL1B-B12RCA

Digital AC Input

+5V internal

4,3k ohm

510 ohm

Internal Circuit

100n

N

100nF
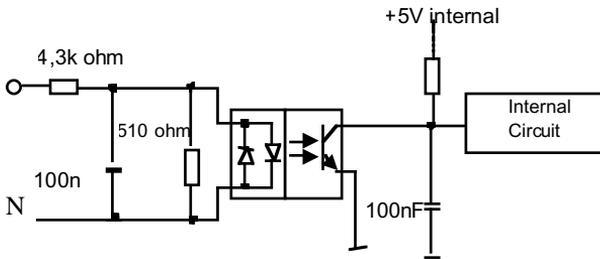
FL1B-H12RCE/FL1B-B12RCE/FL1B-H12SND

Digital DC Input

3,3k ohm

Internal Circuit
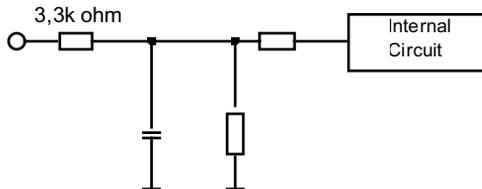
FL1B-H12RCE/FL1B-B12RCE/FL1B-J2B2

Analog Input
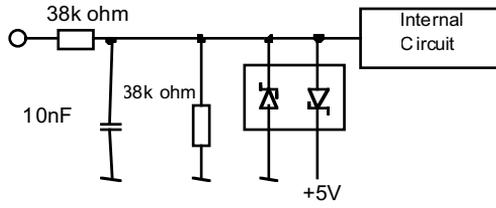
2.3.3 Connecting IDEC SmartRelay Outputs

FL1B-*12R*

The IDEC SmartRelay outputs ...R... are relays. The relay contacts are isolated from the power supply and from the inputs.

Prerequisites for Relay Outputs

You can connect different loads to the outputs such as lamps, fluorescent tubes, motors, contactors etc. The loads connected to FL1B-*12R** must have the following properties:

- The maximum switched current depends on the type of load and the number of switching cycles (For details refer to Chapter A "Technical Data").

- IDEC SmartRelay FL1B-*12R** in switched on state (Q = 1) and with ohmic load the maximum current is 10 A and for inductive loads the maximum is 3 A (2 A at 12/24 V AC/DC).

Connecting

This is how to connect the load to the FL1B-*12R**:
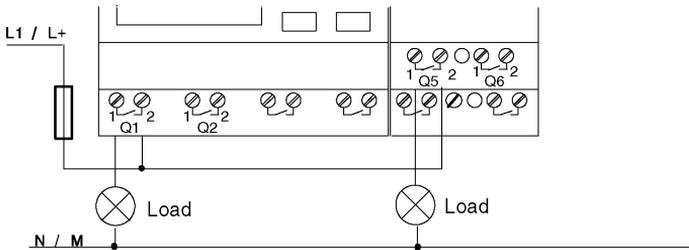
Protection with automatic circuit breaker (max. 16 A, B16, e.g. power circuit breaker 5SX2 116-6 (if desired)

IDEC SmartRelay with Transistor Outputs

IDEC SmartRelay models with transistor outputs can be identified by the fact that the letter R is missing from their type designation. The outputs are short circuit-proof and overload-proof. An auxiliary load voltage supply is not necessary since IDEC SmartRelay supplies the load voltage.

Prerequisites for Transistor Outputs

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

- The maximum switched current is 0.3 amperes per output.

Connecting

This is how to connect the load to a IDEC SmartRelay with transistor outputs:
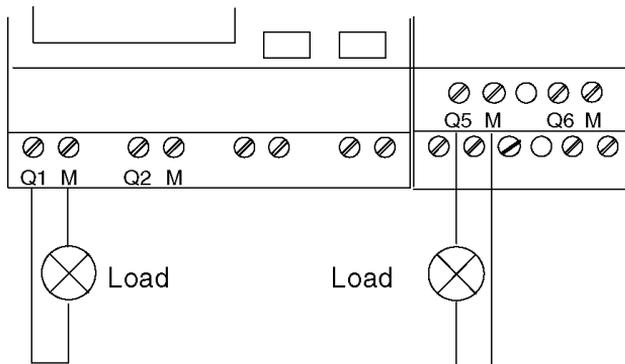
Load: 24 V DC, 0.3 A max.

Output Internal Circuit

FL1B-H12RCE/-B12RCE, FL1B-H12RCA/-B12RCA, FL1B-H12RCC/-B12RCC, FL1B-M08B2R2/ -M08C2R2
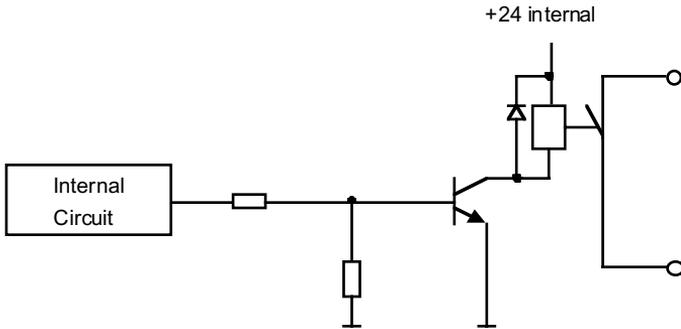
FL1B-H12SND, FL1B-M08B1S2

Digital AC Input
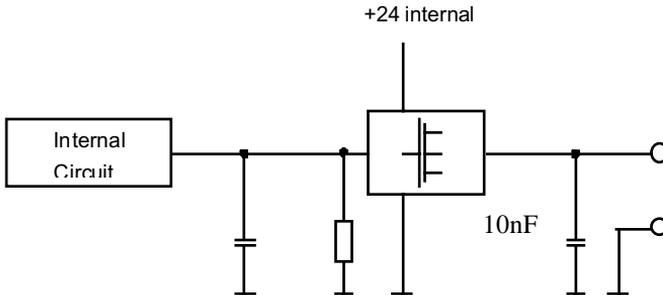
2.4 Switching on the IDEC SmartRelay/Power Return

IDEC SmartRelay does not have a power switch. The IDEC SmartRelay response when switched on depends upon the following:

- If a program is stored in IDEC SmartRelay.
- If a program module is connected.
- If it is a IDEC SmartRelay model without display (FL1B-B12RC*).
- The state IDEC SmartRelay was in prior to POWER-OFF and whether a PC cord was connected.

The IDEC SmartRelay reaction to all possible situations is shown on the following diagram.

Before power off

No Program
Press ESC

No program
in memory

or

(empty)

(with program)

After power on

No Program
Press ESC

>Program..
PC/Card..
Clock..
Start

Mo 09:00
06.21.01
I : 0. , 1. , 2.
123456789
0123456789
01234

Q : 0. , 1.
123456789
0123456

B03:Par
Par = 0300
Cnt = 0028

IDEC
SmartRelay
in Run state

or

(empty)

(with program)

Mo 09:00
I : 0. , 1. , 2.
123456789
0123456789
01234

With stored
program IDEC
SmartRelay

IDEC SmartRelay
in Run state

With program
copied from the
module to the
IDEC
SmartRelay

Mo 09:00
I : 0. , 1. , 2.
123456789
0123456789
01234

B01
&— Q1

Program in
memory

or

(empty)

(with program)

>Program..
PC/Card..
Clock..
Start

With stored
program IDEC
SmartRelay

>Program..
PC/Card..
Clock..
Start

With program
copied from the
module to the IDEC
SmartRelay

No Program
Press ESC

No program
in memory

or

B01
&— Q1

Program in
memory

and
PC cord

PC↔

Stop?
Press ESC

IDEC
SmartRelay

Guidelines for Starting IDEC SmartRelay

1. If there is no program in IDEC SmartRelay or in the connected program modules, IDEC SmartRelay (with display) reports: "No Program Press ESC".

2. If there is a program on the program module, it is automatically copied to IDEC SmartRelay. Any program in IDEC SmartRelay is overwritten.

3. If there is a program in IDEC SmartRelay or in the connected program module, IDEC SmartRelay takes over the operating state it had prior to POWER-OFF. The model without display (FL1B-B12RC*) is switched automatically from STOP to RUN mode (LED toggles from red to green).

4. If at least one function is switched retentive or if you have used a function that is permanently retentive the current values are also retentive at POWER-OFF.

    Note

    If a power loss occurs while you are entering a program, the program in IDEC SmartRelay is deleted after power is returned. You should therefore save your original program before modifying it on a program module (card) or on a computer (WindLGC).

IDEC SmartRelay Basic Operating States

IDEC SmartRelay Basic has two operating states: STOP and RUN

STOP	RUN
• Display: "No Program" (not FL1B-B12RC*) • IDEC SmartRelay to programming mode (not FL1B-B12RC*) • The LED lights up red (only FL1B-B12RC*)	• Display: screen form for monitoring I/O and messages (after START in the main menu) (not FL1B-B12RC*) • IDEC SmartRelay to programming mode (not FL1B-B12RC*) • The LED lights up green (FL1B-B12RC*)
Action by IDEC SmartRelay: • The inputs are not read. • The program is not executed. • The relay contacts are always open or the transistor outputs are switched off	Action by IDEC SmartRelay: • IDEC SmartRelay reads the state of the inputs • IDEC SmartRelay calculates the state of the outputs with the program. • IDEC SmartRelay switches the relays/ transistor outputs on or off

IDEC SmartRelay Expansion Modules Operating States

IDEC SmartRelay expansion modules have three operating states. This is shown by the color of the LED indicator; green, red or orange.

IDEC SmartRelay Expansion Modules Operating States		
Green LED (RUN)	**Red LED (STOP)**	**Orange LED**
The expansion module communicates with the left device	The expansion module does not communicate with the left device	Initialization phase of the expansion module

3 Programming IDEC SmartRelay

IDEC SmartRelay Programming Introduction

The term programming refers to the input of a circuit program. An IDEC SmartRelay program is actually no more than a circuit diagram presented in a slightly different form.

In this chapter we are going to show you how to transform your applications into a IDEC SmartRelay program.

> Note
> *The IDEC SmartRelay models FL1B-H12RCE, FL1B-B12RCA and FL1B-B12RCC do not have a keyboard or a display unit. They are mainly intended for production applications in small machine and plant engineering.*
>
> *FL1B-B12RC* models are not programmed locally. Rather, programs in WindLGC or in the memory modules of other IDEC SmartRelay units are transferred to this device.*

In the first section of this chapter we shall use an example to show you how to program the IDEC SmartRelay.

- We shall begin by introducing two basic terms, namely the connector and the block, and show you what they represent.
- Secondly, we shall work out a simple circuit program.
- Finally, you will enter the program directly in IDEC SmartRelay.

By the end of this chapter you will have your first running program stored in the IDEC SmartRelay. With suitable hardware (switches etc.) you will then be able to carry out your first test.

3.1 Connectors

IDEC SmartRelay I/Os

Example of a configuration with several modules:

Inputs

Outputs   Analog inputs
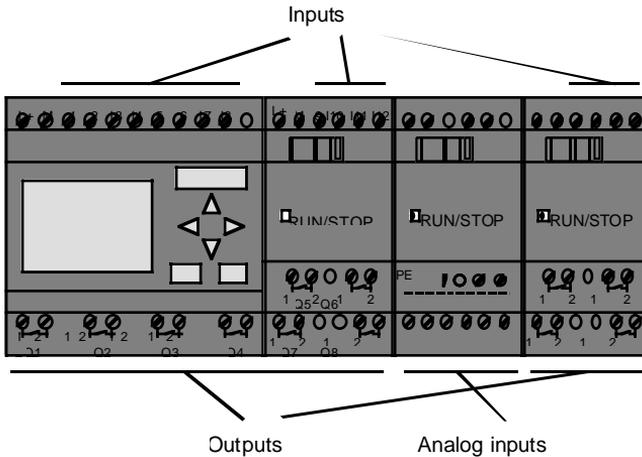
Each input is identified by the letter I and a number. When you look at the IDEC SmartRelay from the front, you can see the connectors for the inputs at the top. Only the analog module FL1B-J2B2 has its inputs at the bottom.

Each output is identified by the letter Q and a suffix. You can see that the connectors of the outputs are located at the bottom.

Note

IDEC SmartRelay can recognize, read and switch the I/O of all expansion slots, regardless of their type. The I/O is shown in the order of the module arrangement.

The following I/Os and memory bits are available for programming: I1 to I24, AI1 to AI8, Q1 to Q16 and M1 to M8. For the FL1B-*12RCE and FL1B-H12SND inputs I7 and I8 applies: if Ix is used in the program, the input signal is interpreted as digital signal; with AIx it is an analog signal.

IDEC SmartRelay's Connectors

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

The 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.

We have implemented the connectors hi, lo and x in order to facilitate programming for you. The default fixed status of "hi" (high) is "1" and of "lo" (low) is "0".

If you do not want to wire the input of a block, use the "x" connector. The meaning of the term block is explained on the next page.

IDEC SmartRelay knows the following connectors:
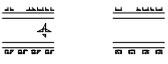
Connectors	FL1B-*12***		FL1B-M08****	FL1B-J2B2
Inputs	FL1B-H12RCC/B12RCC FL1B-H12RCA/B12RCA	Two groups: I1... I4 and I5 ... I8	I9 ... I24	AI1(AI3) ... AI8
	FL1B-H12RCE/ B12RCE FL1B-H12SND	I1... I8 along with I7(AI1), I8(AI2)		
Outputs	Q1...Q4		Q5 ... Q16	none
lo	Signal with "0" level (off)			
hi	Signal with "1" level (on)			
x	An existing connection that is not used			

3.2 Blocks and Block Numbers

This section shows you how to use the IDEC SmartRelay elements to create extensive circuits and how the blocks and the I/O are interconnected.

Then go to "3.3 From Circuit Diagram to IDEC SmartRelay" on page 3-7. There you will learn how to convert a simple circuit into a IDEC SmartRelay program.

Blocks

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

When you program IDEC SmartRelay, you connect connectors with blocks. To do this, simply select the connection you require from the Co menu. We have used the abbreviation Co for the term "Connector" to name the menu.

Logic Operations

The most elementary blocks are logical links:

- AND
- OR
- ...

```
I1 ──┐┌──────┐
I2 ──┤│  ≥1  │
x  ──┘│      │──Q
      └──────┘
```
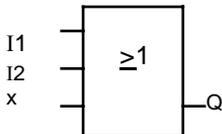
Inputs I1 and I2 are connected to the OR block. The last input of the block is not used and is therefore marked with an x.

The special functions are far more powerful:

- Pulse relay
- Counter
- On delay
- Softkey
- ....

See Chapter 4 "IDEC SmartRelay Functions" on page 4-1 for a complete list of IDEC SmartRelay's functions.

Displaying a Block in IDEC SmartRelay

The figure below shows a typical IDEC SmartRelay display. Only one block can be displayed at a time. We have therefore introduced block numbers to help you check the circuit structure.

Display view of IDEC SmartRelay

Here is another block connected

Block number - assigned by IDEC SmartRelay

B01

B02

Input

I2

x

>1

Q1

This connection is not required

Block

Output
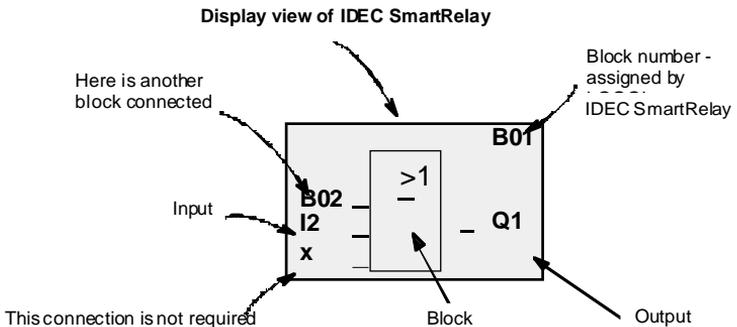
Assigning a Block Number

When you insert a block in a program, IDEC SmartRelay always assigns it a block number.

IDEC SmartRelay uses the block numbers to show you the block inter-connections. Primarily, the block numbers are meant to help you find your way around the program.
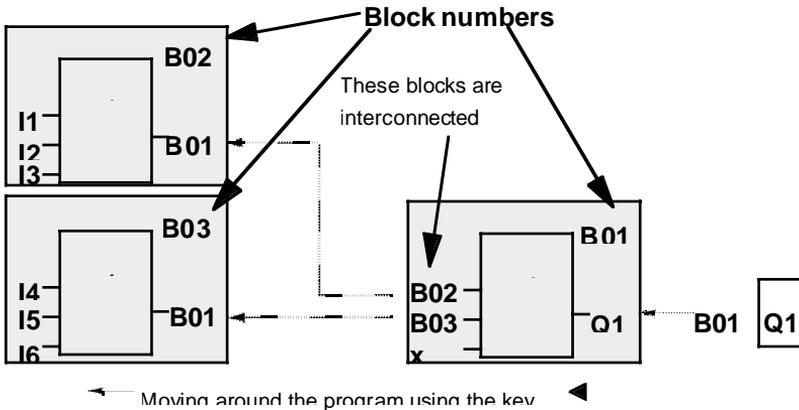
The sample diagram shows you three displays of IDEC SmartRelay, which together form the program. You can see how IDEC SmartRelay interconnects the blocks, using the block numbers.

Advantages of Block Numbers

You can append almost any block to an input of the current block using its block number. In this way you can reuse the interim results of logical links or other operations. This saves you input work and memory space, and ensures a clear arrangement of your circuit. In this case, you must know how IDEC SmartRelay has named the blocks.

> Note
>
> *We recommend that you create a block diagram of the program. This will make programming easier, because you can enter the block numbers assigned by IDEC SmartRelay.*
>
> *If you program the IDEC SmartRelay using WindLGC software, you can directly create a logic diagram of your program.*

3.3 From Circuit Diagram to IDEC SmartRelay

How a Circuit is Represented in a Circuit Diagram

Here is an example of how a circuit is represented in a circuit diagram:
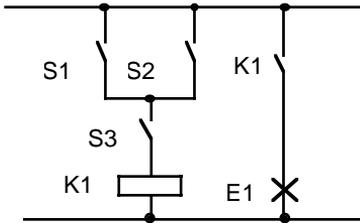
The load E1 is switched on and off by means of the switches (S1 **OR** S2) **AND** S3.
The relay K1 picks up if S1 OR S2 AND S3 are closed.

Configuring this Circuit in IDEC SmartRelay

In IDEC SmartRelay you construct a circuit by interconnecting blocks and connectors:
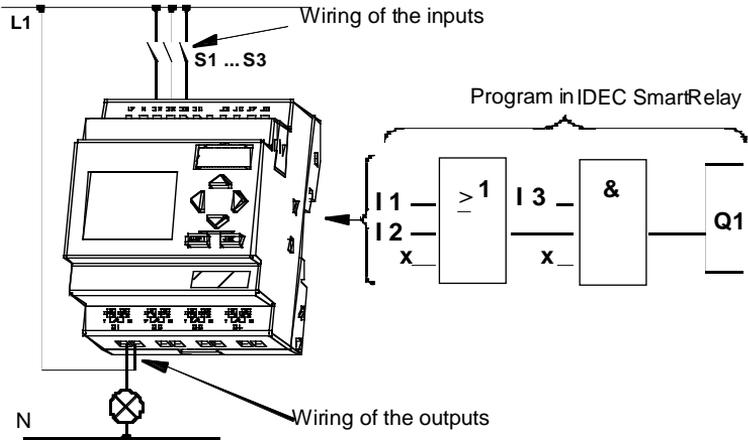
To convert a circuit in IDEC SmartRelay, start at the output of the circuit.

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

Convert the circuit to blocks. To do this, go through the circuit from the output to the input:

1. At output Q1 there is a series connection of the normally open contact S3 with another circuit component. The series connection corresponds to an AND block:
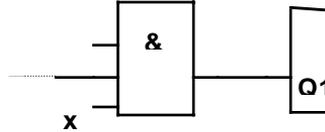
2. S1 and S2 are connected in parallel. The parallel circuit corresponds to an OR block:
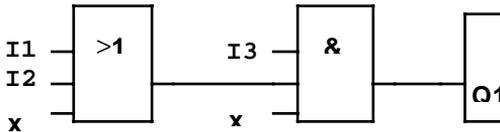
You have now completely described the circuit for the IDEC SmartRelay. Now connect the I/Os to the IDEC SmartRelay.

Wiring

Connect the switches S1 to S3 to the screw terminals of the IDEC Smart-Relay:

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

Since only two inputs of the OR blocks are being used, the third input of this block must be marked as "unused". This is indicated by the suffix x.

Likewise, only 2 inputs of the AND block are used. Thus, the third input is also marked as "unused" by the suffix x.

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

Wiring Example

The following table shows you the wiring based on a 240 V AC model of IDEC SmartRelay.
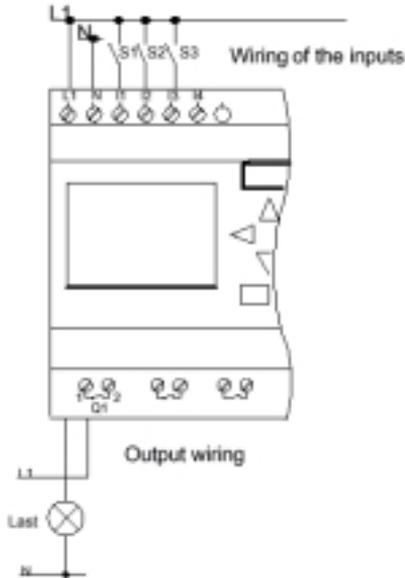
3.4 Four Rules for Working with IDEC SmartRelay

Rule 1 - Changing Operating Mode

- Edit the circuit in programming mode. After Power On and if "No Program, Press ESC" is displayed, you can open the programming mode by pressing the ESC key.

- You can edit the time and parameter values of an existing program in the parameter assignment mode and in programming mode.

- Start RUN mode by executing "Start" in the main menu.

- In RUN mode you can return to parameter assignment mode via ESC key.

- If you want to return from parameter assignment mode to programming mode, execute the "Stop" command in the parameter assignment menu. When prompted to confirm with "Yes" when "Stop Prg" appears, move the cursor to "Yes" and confirm with OK.

You can find more information on operating modes in the Appendix "D. IDEC SmartRelay Menu Structure" on page Appendix-14.

Rule 2 - Outputs and Inputs

- Always program a circuit working from the output towards the input.

- You can connect an output to several inputs, however, you cannot fan out one input to several outputs.

- You cannot connect an output to a preceding input in the same program path. For such internal recursions you should interconnect memory bits or outputs.

Rule 3 - Cursor and Cursor Movement

When programming a circuit, note:

- When the cursor appears with an underscore, the underscore is indicating that the cursor can be moved:
  -Use the ◂ , ▸ , ▴ or ▾ key to move the cursor in the circuit
  -Press OK to change to "Select terminal/block"
  -Press ESC to exit circuit programming.

- When the cursor appears as a solid square, you should select a connector/block.
  -Use the ▴ or ▾ key to select a connector/block.
  -Confirm your selection with OK.
  -Press ESC to go back one step.

Rule 4 - Planning

- Make a complete plan of your circuit on paper before you input the circuit or program IDEC SmartRelay directly using WindLGC.

- IDEC SmartRelay can only save complete programs. If the circuit program is incomplete IDEC SmartRelay will not exit the programming mode.

3.5 Overview of the IDEC SmartRelay Menus

Programming mode

Main menu

```
>Program..
 PC/Card..
 Clock..
 Start
```

Programming menu

```
>Edit Prg
 Prg Name
 Clear Prg
 Password
```

OK

ESC

◼➕ =IDEC
     SmartRelay

OK

ESC

Transfer menu

```
>PC_  ◼➕
◼➕ _ Card
 Card_ ◼➕
```

OK

ESC

Menu Clock

```
>Set Clock
 S/W Time
```

Parameter assignment mode

Parameter assignment menu

```
>Stop
 Set Param
 Set Clock
 Prg Name
```
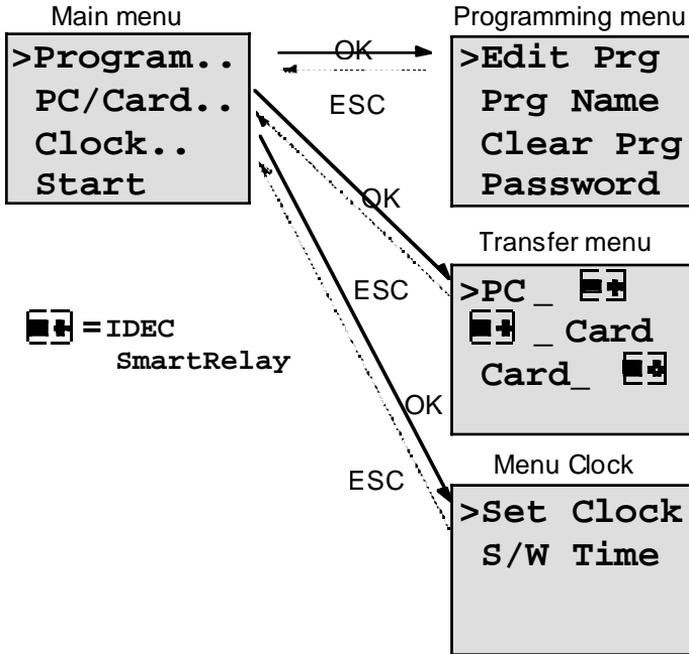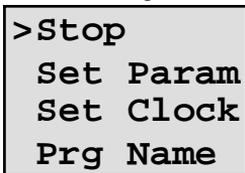
You can find more information on menus in the Appendix "D. IDEC Smar-tRelay Menu Structure" on page Appendix-14.

3.6 Program Input and Start

You have designed a circuit and now want to enter it in IDEC SmartRelay. The following example will show how to do this.

3.6.1 Change to Programming mode

You have connected the IDEC SmartRelay to the power supply and voltage is switched on. The display shows you the message:
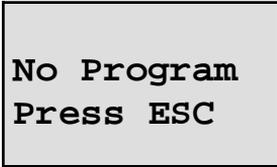
```
No Program
Press ESC
```

Switch the IDEC SmartRelay to programming mode by pressing the ESC key. This will take you to the main menu of the IDEC SmartRelay:
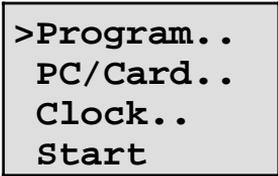
```
>Program..
 PC/Card..
 Clock..
 Start
```
IDEC SmartRelay's main menu

The first character in the first row is the cursor ">". Use the ▲ and ▼ key to move the cursor ">" up and down. Move the cursor ">" to "Program.." and confirm with OK. IDEC SmartRelay opens the programming menu.
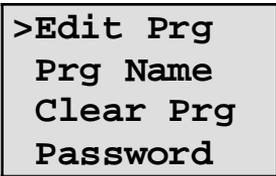
```
>Edit Prg
 Prg Name
 Clear Prg
 Password
```
IDEC SmartRelay's programming menu

Here too, you can move the cursor ">" by pressing the ▲ or ▼ key. Move the cursor ">" to "Edit Prg" (edit program or input) and confirm with OK. IDEC SmartRelay now shows you the first output:

Q1
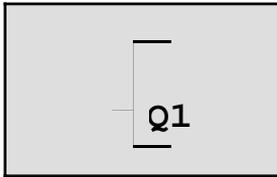
IDEC SmartRelay's first output

You are now in programming mode. Use the ▲ or ▼ key to select the other outputs. At this point you can begin programming your circuit.

> Note
> *Since our program has not yet been saved with a password in IDEC SmartRelay you can start editing your program right away. If you start a program already saved with password protection, "Edit Prg" and confirmation with OK would be followed by the prompt to enter a password. In this case you cannot start editing unless you enter the correct password (refer to "3.6.5 Password" on page 3-22 for more information).*

3.6.2 First Program Example

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

Circuit Diagram

How the circuit is represented in a circuit diagram:
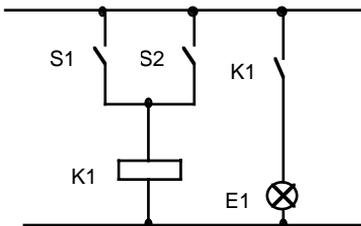
The load is switched on via switch S1 OR S2. IDEC SmartRelay interprets the circuit as 'OR', because either switch S1 **OR** S2 switches the output.

Translated in the IDEC SmartRelay program this means: relay K1 (in IDEC SmartRelay via output Q1) is controlled by an OR block.

Program

I1 and I2 are connected to the input of the OR block, whereby S1 is connected to I1 and S2 to I2.

This is what the IDEC SmartRelay program then looks like:
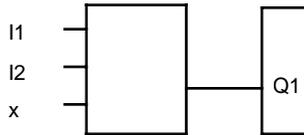
Wiring

The corresponding wiring:
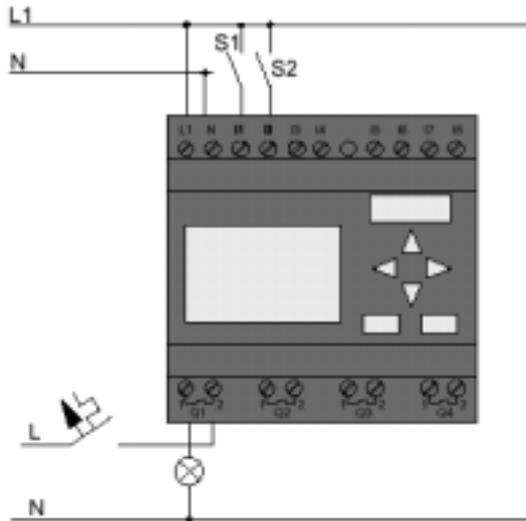
Switch S1 acts on input I1, switch S2 on input I2. The load is connected to relay Q1.

3.6.3 Editing a Program

We will now edit the program (working from the output to the input). Initially, IDEC SmartRelay displays the output:
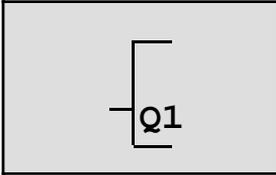
IDEC SmartRelay's first output

The Q of Q1 is underscored. This underscore is called the cursor. The cursor indicates your current position in the program. You can move the cursor by pressing the ▲ , ▼ , ◀ or ▶ key. Now press the ◀ key. The cursor moves to the left.
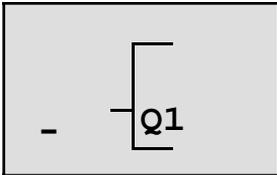
The cursor indicates your position in the program.

At this point, enter only the first block (the OR block). Press OK to switch to editing mode.
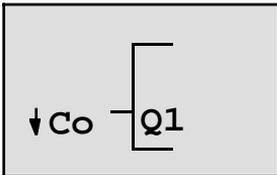
The cursor is displayed as a solid square: You can now select a terminal or a block

The cursor no longer appears in the form of an underscore; but rather as a flashing solid square. At the same time IDEC SmartRelay gives you various options.

Select the BF (basic functions) by pressing the ▾ key until BF appears. Confirm with OK. IDEC SmartRelay then displays the first block in the list of basic functions:
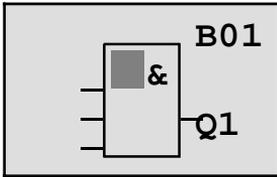
An AND is the first block in the list of basic functions. The cursor is displayed as solid square, thus prompting you to select a block.

Now press the ▴ OR ▾ key until the OR block is displayed:
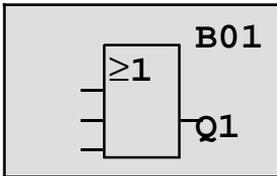
The cursor square is still positioned in the block.

Press OK to confirm your selection.

This is what you see in the display

Your entire program looks like this
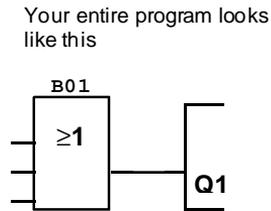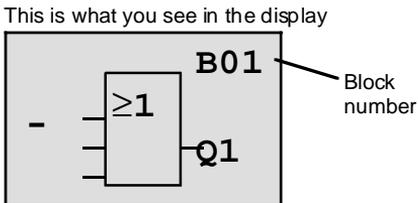
Block number

You have now entered the first block. Each block you enter is assigned a block number. What is now left to do is to wire the inputs of the block. This is how it is done:

Press OK.

This is what you see in the display

```
                            B01
         ┌─────┐
    ▌Co ─┤ ≥1  │
         │     ├─ Q1
         │     │
         └─────┘
```
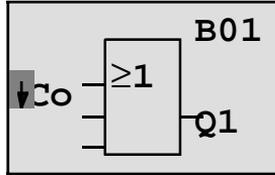
Select the Co list: Confirm with OK

This is what you see in the display

```
                            B01
         ┌─────┐
    █x   ┤ ≥1  │
       ──┤     │
         │     ├─ Q1
       ──┤     │
         └─────┘
```
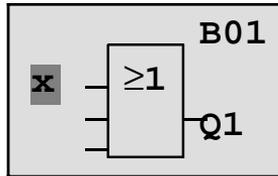
The first element in the Co list is the "Input not used" character, an "x". Use the ▲ or ▼ key to select input I1.

> **Note**
> *Use the ▼ key to go to the start of the Co list: I1, I2 .... to lo, and again "x".*
> *Use the ▲ key to start at the end of the Co list: lo, hi, Q ..... to I1, and once again "x".*

This is what you see in the display

```
                            B01
         ┌─────┐
    █x   ┤ ≥1  │
       ──┤     │
         │     ├─ Q1
       ──┤     │
         └─────┘
```
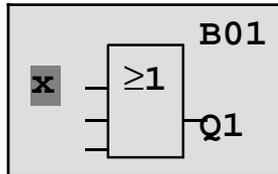
Press OK. I1 is now connected to the input of the OR block. The cursor jumps to the next input of the OR block.

This is what you see in the display
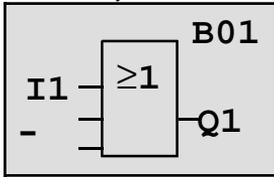
Up to this point, your program in IDEC SmartRelay looks like this
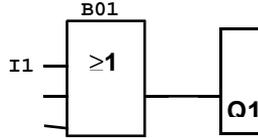
Now connect input I2 to the input of the OR block. You already know how to do this:

1. Switch to editing mode: OK

2. Select the Co list: use ▼ or ▲

3. Accept the Co list: OK

4. Select I2:   use ▼ or ▲

5. Accept I2:   OK

I2 is now connected to the input of the OR block:
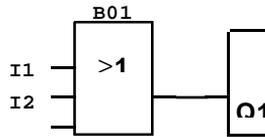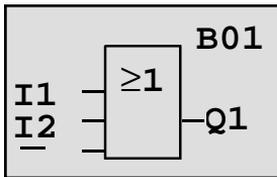
We do not need the last input of the OR block for this program. In a IDEC SmartRelay program the unused inputs are identified with an "x". Now enter the "x":

1. Switch to editing mode: OK

2. Select the Co list: use ▼ or ▲

3. Accept the Co list: OK

4. Select x: use ▼ or ▲

5. Accept x: OK

Now all the inputs of the block are wired. IDEC SmartRelay considers the program as being complete and jumps back to output Q1.

This is what you see in the display
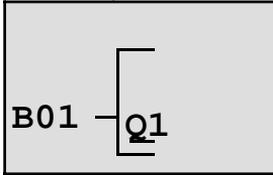
Your program looks like this

B01
| B01 | Q1 |

I1
I2
x
≥1
Q1
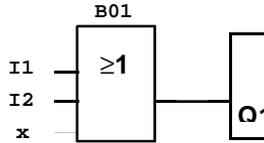
If you want to review your first program, you can use the ◀ or ▶ key to move the cursor through the program.

Exit Program Input

Return to the programming menu: ESC

If this does not return you to the programming menu, you have not wired a block completely. IDEC SmartRelay indicates positions at which you have missed something (For safety reasons, IDEC SmartRelay accepts only complete programs).

> Note
> *IDEC SmartRelay has now saved your program which will be retained on power failure.The program is only stored in the IDEC SmartRelay until you delete it per instruction.*

3.6.4 Assigning a Program Name

You can assign a name to your program. This name consists of upper and/or lower case letters, numbers and special characters. The maximum length is 16 characters.

1. move ">" to "Prg Name": use ▾ or ▴

2. Accept "Prg Name":   OK

Using the ▴ or ▾ key you can list the alphabet from A(a) to Z(z), numbers and special characters. You can list them forward and backwards. You can select any letter, number or character. Input a blank space by moving the cursor using the ▸ key to the next position. The blank space is the first character of the list.
Examples:

-   Press ▾ once: the result is an " A "

-   Press ▴ four times: the result is a left bracket " { "

Available Characters															
	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	!
	"#	$	%	&	"	(	)	*	+	,	-	.	/	:	;
<	=	>	?	@	[	\	]	^	_	'	{	|	}	~	

To name your program "ABC":

3. Select " A":   Press ▾

4. To the next letter: Press ▸

5. Select " B":   Press ▾

6. To the next letter: Press ▸

7. Select "C":   Press ▾

8. Confirm the name: OK

Your program is now named "ABC" and you have been returned to the programming menu.

The program name can be changed in the same way as above.

Note

The program name can only be changed in programming mode.You can read the program name in programming mode and in parameter assignment mode.

3.6.5 Password

You can assign a password to protect the program from being edited by unauthorized access.

How to Assign a Password

The maximum password length is 10 characters. It consists of uppercase letters only (A to Z). On the device you can only assign, edit and deactivate the password in the "Password" menu.

In the programing menu:

1. move ">" to "Password": use ▲ or ▼

2. Accept the "Password": OK

Use the ▼ or ▲ key to move up and down the alphabet to select your letters. Since IDEC SmartRelay allows only uppercase letters for passwords, you can quickly access the letters "at the end" of the alphabet faster by using the key ▲ :

- Press ▲ once gives you a "Z"
- Pressing ▲ twice gives you a "Y" etc.

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

```
Old:
No Password
New:
■
```
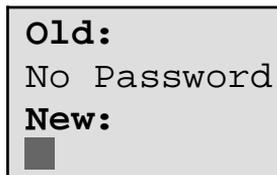
The procedure is the same as for entering the program name. Under "New", enter:

3. Select " A":   Press ▼

4. To the next letter: Press ▶

5. Select " A":   Press ▼

The display now shows:

```
Old:
No Password
New:
  ▮
```

6. Confirm the password: OK

Your program is now password protected with "AA" and you have been returned to the programming menu.

> Note
>
> *If the input of the new password is interrupted with ESC IDEC SmartRelay returns to the programming menu without saving the password.*
>
> *You can also input your password in WindLGC. You can only upload a password protected program in WindLGC or edit your program on the device after you have entered the correct password.*

Changing the Password

In order to change the password you must know the current one.

In the programming menu:

1. move ">" to "Password": use ▼ or ▲

2. Accept the "Password": OK

Under "Old", enter your old password (in our case "AA") by repeating steps 3 to 6 as described above.

The display now shows:

```
Old:
AA
New:
█
```

Now you can enter a new password under "New", e.g. "ZZ":

3. Select "Z":   Press ▲
4. To the next letter: Press ▶
5. Select "Z":   Press ▲

The display now shows:

```
Old:
AA
New:
ZZ
```
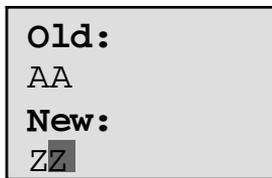
6. Confirm your new password: OK

"ZZ" is now your new password and you are back in the programming menu.

Deactivating the Password

Let us assume you want to deactivate the password. For example, you want to grant another user read/write access to your program. Just as when changing it, you must know your current password (in our example "ZZ").

In the programming menu:

1. move ">" to "Password": use ▼ or ▲
2. Accept the "Password": OK

Under "Old" you must now enter your current password as described in steps 3 to 5. Confirm your entry with OK.

The display shows:

```
Old:
ZZ
New:
█
```

 Now deactivate the password without making another entry

3.   Confirm the "empty" password: OK

The password does not exist anymore. You have been returned to the programming menu.

> Note
>
> *This deactivation switches off the password prompt. Editing is possible without entering a password.*
>
> *For the moment, leave the password prompt deactivated in order to speed up our progress with the remaining examples.*

Password: Wrong input!

When you enter the wrong password and confirm your entry with OK, IDEC SmartRelay does not open editing mode, but rather returns to the programming menu. This repeats itself until you have entered the correct password.

3.6.6 IDEC SmartRelay to RUN Mode

IDEC SmartRelay to RUN mode in the main menu.

1. Return to the main menu: ESC

2. move ">" to "Start":   use ▲ or ▼

3. Confirm "Start":   OK

IDEC SmartRelay starts the program and displays:

Display field of the IDEC SmartRelay in RUN mode

| Mo 09:00 06.21.01 | Press ▶ / Press ◀ | I:0.,1.,2. 123456789 0123456789 01234 | Press ▶ / Press ◀ | Q:0..1. 123456789 0123456 |

Status of the inputs   Status of the outputs
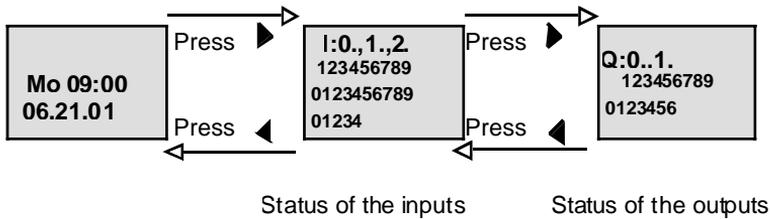
Date and TOD on the Display

This display flashes as long as date and TOD are not set.

Presentation of the Inputs on the Display

| I:0.,1.,2. 123456789 0123456789 01234 | → Inputs I1 to I9 → Inputs I10 to I19 → Inputs I20 to I24 |
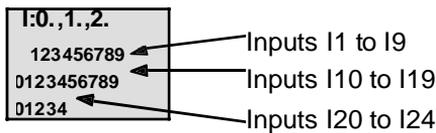
Presentation of the Outputs on the Display

Q:0.,1.
123456789
0123456

Outputs Q1 to Q9
Outputs Q10 to Q16
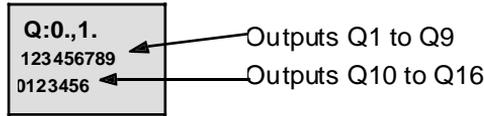
What does "IDEC SmartRelay is in RUN" Mean?

In RUN mode IDEC SmartRelay processes the program. To do this, IDEC SmartRelay initially reads the status of the inputs, determines the status of the outputs using your specified program and switches the outputs on or off.

The IDEC SmartRelay presents the I/O status in this way:

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

Input/output has the state '1':
inverse
Input/output has the state
'0': not inverse

```
Q:0.,1.
123456789
0123456
```
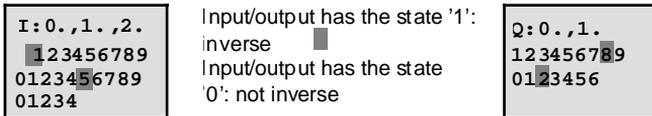
In this example, only the inputs I1, I15, Q8 and Q12 are "high".

Status Display

L1
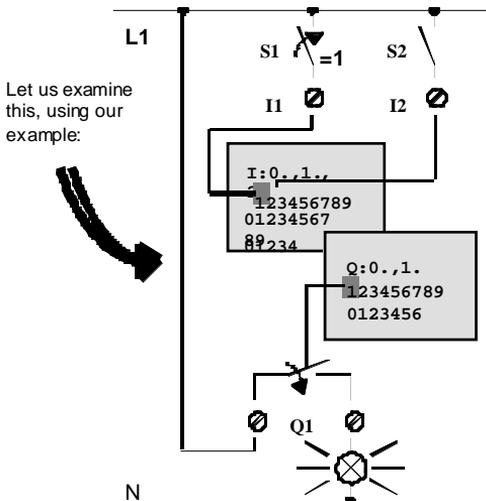
Let us examine this, using our example:

S1 =1   **S2**

I1   **I2**

```
I:0.,1.,
 123456789
01234567
89234
```

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

Q1

N

When switch S1 is closed, voltage applied to input I1, which has the state '1'.

IDEC SmartRelay uses the program to calculate the output states.

Output Q1 has the state '1' here.

If the status of Q1 is '1' IDEC SmartRelay switches the relay Q1, the load on Q1 is supplied with voltage.

3.6.7 Second Program Example

Now that you have successfully programmed your first circuit, a program name and assigned a password, we shall show in this section how you can modify existing programs and use the special functions.

In this second program you will be shown how to:

- Insert a block in an existing program.
- Select a block for a special function.
- Assign parameters.

Modification of Circuits

In order to produce the second program, we are now going to modify the first one slightly.

First, let us examine the circuit diagram for the second program:
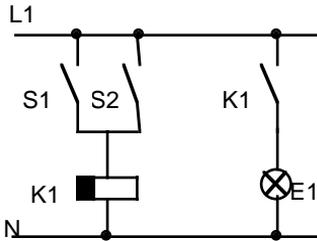
You already know the first part of the circuit. Switches S1 and S2 operate a relay. This relay switches on the load E1. It should switch off the load again on expiration of a 12-minute off delay.

In IDEC SmartRelay:
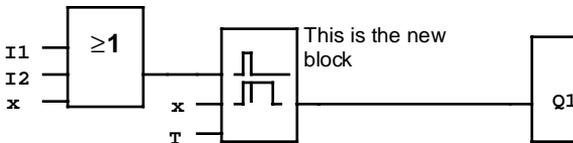
You will recognize the OR block and the output relay Q1 from the first program. Only the off delay is new.

How to Edit the Program

Switch the IDEC SmartRelay to programming mode:

1. In RUN mode: press ESC. This opens the parameter assignment menu
    Select "Stop": confirm with OK, move ">" to "Yes" and confirm once again with OK

2. In the main menu, select "Program.."

3. In the programming menu, select "Edit Prg"
    (If required, enter the password and confirm with OK)

You can now modify the existing program.

How to Insert a New Block in a Program

Move the cursor underneath the B in B01 (B01 is the block number of the OR):
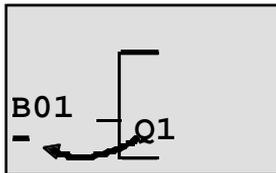
Move the cursor:
press the ◀ key

We now insert the new block at this position. Press OK.
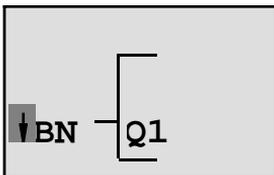
IDEC SmartRelay shows you the BN list.

Select the SF list (▼ key):
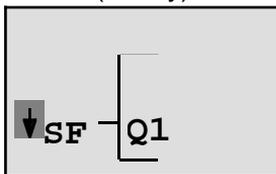
The SF list contains the blocks for the special functions.

Confirm with OK.

The block of the first special function is displayed:
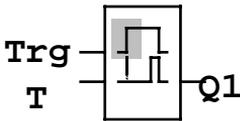
When you select a special or basic function block, IDEC SmartRelay displays the respective function block. The full square cursor is positioned in the block. Use the keys ▼ or ▲ to select the required block.

Select the block (off delay, see next diagram) and confirm with OK:

'OK' is preceded with **Trg**
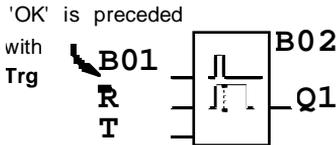
The inserted block is assigned the block number B02. Block B01, up to now connected to Q1, is automatically connected to the upper input of the new block. The cursor is positioned at the upper input of the new block.

The off-delay block has three inputs. The upper input is the trigger input (Trg). Use this input to start the off delay. In our example, the off delay is started via the OR block B01. Reset the time and outputs, using the reset input. In the T parameter, set off delay time.

In our example, we do not use the reset input of the off delay. We wire it with "x". In the first program you have seen how this is done. As a reminder:

1. Position the cursor under the R: use ▲ or ▼

2. change over to editing mode: OK

3. Select the Co list: use ▲ or ▼

4. Accept the Co list: OK

5. Select x: use ▲ or ▼

6. Accept x: OK
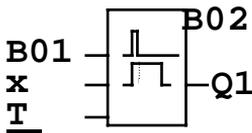
The display should now look like this:

How to Assign Block Parameters

Now, specify the off delay time T:

1. If the cursor is not yet positioned underneath the T,
   move it there: use ▲ or ◄

2. change over to editing mode: OK

For the parameters IDEC SmartRelay displays the parameter assignment screen form:

```
B02:T  ◄─────────── B02: The T parameter of
                     block B02: is a time

T=00.00s+  ◄──────── + means: the parameter is
                      displayed and can be edited
                      in parameter assignment
                      mode

     Time value        Time unit
```
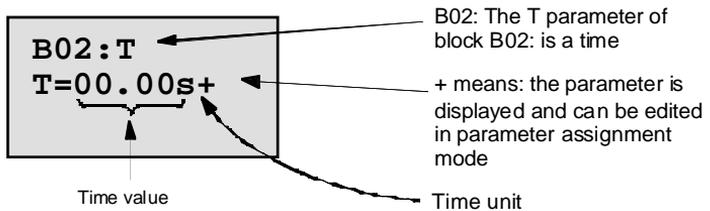
The cursor is positioned on the first digit of the time value.

This is how you change the time value:

- Use the ◄ or ► key to move the cursor back and forth.
- Use the ▲ or ▼ key to change the value.
- Confirm the time value you have entered with OK.

Setting the Time

Set the time T = 12:00 minutes:

1. Move the cursor to the first digit: use ◄ or ►

2. Select the digit "1": use ▲ or ▼

3. Shift the cursor to the second digit: use ◄ or ►

4. Select the digit "2": use ▲ or ▼

5. Move the cursor onto the unit: use ◄ or ►

6. Select the m unit for minutes: use ▲ or ▼

Displaying/Hiding Parameters -Type of Protection

If you do not want to have the parameter displayed in parameter assignment mode:

1. Move the cursor onto the type of protection:
   use ◀ or ▶

2. Select the type of protection "-": use ▲ or ▼

On the display you should now see:

```
B02:T
T=12:00m+
```

or

```
B02:T
T = 12:00m
```

Type of protection : +
The time T can be
changed in parameter
assignment mode
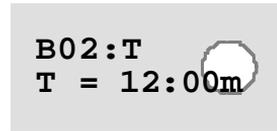
Type of protection : -
The time T cannot be
changed in parameter
assignment mode

3. Close and confirm your entries withOK

   Note
   *You can only change the type of protection and the time unit in programming
   mode, you cannot do this in parameter assignment mode.*

Checking the Program

The program path for Q1 is now complete. IDEC SmartRelay shows you the output Q1. You can review the program on the display. Use the keys to browse through the program, e.g. ◂ or ▸ to move from block to block ▴ or ▾ to move between the inputs on a block.

Exiting Programming Mode

You already know how to exit a program from our first program. As a reminder:

1. Return to the programming menu: ESC

2. Return to the main menu:ESC

3. Move ">" to "Start":   use ▴ or ▾

4. Confirm "Start":   OK

IDEC SmartRelay has now returned to RUN mode

```
Th 09:30
 06.21.01
```
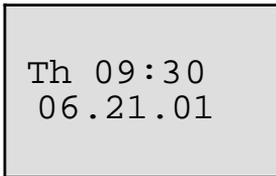
You can use ◂ or ▸ for viewing and monitoring the status of I/Os.

3.6.8 Deleting a Block

Let us assume, in your program you want to delete block B02 and connect B01 directly to Q.
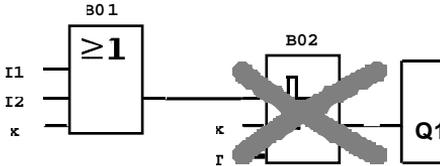
Proceed as follows:

1. Switch the IDEC SmartRelay to programming mode.

2. Select "Edit Prg":   use ▲ or ▼

3. Confirm "Edit Prg":   OK
    (If required, enter the password and confirm with OK)

4. Position the cursor on the input of Q1, that is, underneath B02. Use
    the ◄ key:
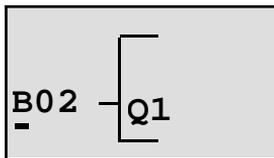
5. Confirm with OK.

6. Now, replace the block B02 with block B01 directly on output Q1. How
    to do this:
    -Select the BN list: use ▲ or ▼
    -Accept the BN list: OK
    -Select "B01":   use ▲ or ▼
    -Accept "B01":   OK

Result: Block B02 is deleted because it is not used in the circuit. Block
B01 is now connected directly to the output instead of B02.

3.6.9 Deleting Multiple Interconnected Blocks

In the following program, (created in "3.6.7 Second Program Example" on page 3-28) delete the blocks B01 and B02.
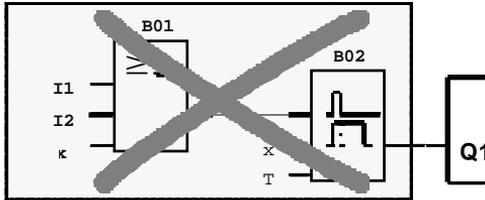
Proceed as follows:

1. Switch the IDEC SmartRelay to programming mode.

2. Select "Edit Prg":   use ▲ or ▼

3. Confirm "Edit Prg":   with OK
    (if required, enter the password and confirm with OK)

4. Position the cursor on the input of Q1, underneath B02. Use the ◄ key:
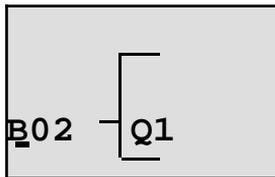
5. Confirm with OK.

6. Now, replace block B02 with the connector x on output Q1. How to do this:
    -Select the Co list: use ▲ or ▼
    -Accept the Co list: OK
    -Select x: use ▲ or ▼
    -Accept x: OK

Result: Block B02 is deleted because it is not used in the circuit. All blocks connected to B02 are deleted (in our example block B01).

3.6.10 Correcting Typing Errors

Programming errors can be corrected easily in IDEC SmartRelay:

- Provided you have not exited editing mode, you can go back one step using ESC.

- If you have configured all inputs, just enter the wrong input once again:
  1. Move the cursor to the location of the error.
  2. Change to editing mode. Confirm with OK
  3. Enter the correct input circuit.

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

3.6.11 "?" on the Display

If you have entered a program and want to exit "Edit Prg" with ESC, IDEC SmartRelay checks whether you have connected the inputs of all blocks. If you have missed an input or parameter IDEC SmartRelay takes you to the incorrect position. It indicates the first incorrect position and marks all inputs which are not connected and the parameters with a question mark.

In this position you have
connected the input

You have not yet declared a
parameter value

B02
B01
R ?   Q1
T ?
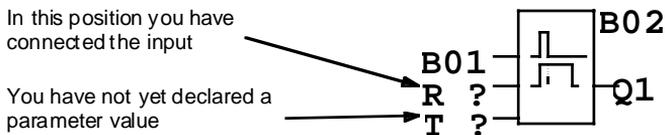
Connect the input and enter a value for the parameter. You can then close the editor using the ESC key.

3.6.12 Deleting a Program

To delete a program:

1. Switch the IDEC SmartRelay to programming mode

```
>Program..
 PC/Card..
 Clock..
 Start
```
IDEC SmartRelay displays the main menu

2. In the main menu, use ▲ or ▼ to move ">" to "Program.."- Confirm with OK

```
>Edit Prg
 Prg Name
 Clear Prg
 Password
```
IDEC SmartRelay opens the programming menu.

3. Move ">" to "Clear Prg": use ▲ or ▼

4. Confirm "Clear Prg":   OK

```
 Clear Prg
>No
 Yes
```
To prevent you from unintentionally deleting your program, we have implemented an additional prompt.

If you do not want to delete the program, leave the ">" on "No" and confirm with OK.

If you are sure that you want to delete the program saved in the IDEC SmartRelay:

5. move the ">" to "Yes":   use ▲ or ▼

6. Confirm with OK. IDEC SmartRelay deletes the program.

3.6.13 Daylight Savings Time (Summertime/Winter-
time Conversion)

You can enable or disable automatic Daylight Savings Time (Summer-
time/Wintertime Conversion) in programming mode under the menu item
"Clock".

1. Switch the IDEC SmartRelay to programming mode

2. You are now in the main menu and want to select the menu item
    "Clock":   use ▲ or ▼

3. Confirm "Clock":   OK

4. Move the ">" to "S/W Time": use ▲ or ▼

5. Confirm "S/W Time":   OK

IDEC SmartRelay displays:

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

The current setting of automatic Daylight Savings Time (Summertime/
Wintertime Conversion) is shown in the bottom row. Factory default is Off
("Off" = disabled).

Enabling Daylight Savings Time (Summertime/Wintertime Conversion)

To enable this function and specify its parameter:

1. Move ">" to "On":   use ▲ or ▼

2. Confirm "On":   OK

The display shows:

```
>EU
 UK
 US
 ..
```

Description of what is displayed:

- "EU" represents the start and end of daylight savings time in Europe.
- "UK" represents the start and end of daylight savings time in the United Kingdom.
- "US" represents the start and end of daylight savings time in the United States.
- . . : here you can specify any month, day and time difference.

The default program for EU, UK and US daylight savings time are found in the table below:

	Start of Daylight Savings Time	End of Daylight Savings Time	Time difference D
EU	Last Sunday in March: 02:00-->03:00	Fourth Sunday in October: 03:00-->02:00	60 Min
UK	Last Sunday in March: 02:00-->03:00	Last Sunday in October: 03:00-->02:00	60 Min
US	First Sunday in April: 02:00-->03:00	Last Sunday in October: 03:00-->02:00	60 Min
..	Customizing the month and the day: 02:00--> 02:00 + Time difference	Customizing the month and the day: 03:00--> 03:00 + Time difference	Specified by the user (minute accuracy)

Note

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

Let us assume you want to enable European daylight savings time:

3. Move ">" to "EU":   use ▲ or ▼

4. Confirm "EU":   OK

IDEC SmartRelay displays:

```
>On
 Off
S/W Time
 On→EU
```
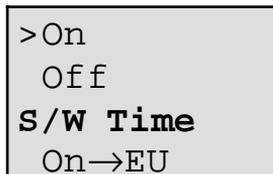
IDEC SmartRelay indicates that European daylight savings time is enabled.

How to Customize Parameters

If all parameters/conversions do not apply to your country, you can customize them in the menu item ". .".

1. Confirm "> On" once again:OK

2. Move ">" to ". .":   use ▲ or ▼

3. Confirm menu item ". ." : OK

The display shows:

Cursor / full square

```
    MM.DD          ──────►  Month (MM) and Day (DD)
 + : 01.01         ──────►  Start of summertime
 – : 01.01         ──────►  End of summertime
 Δ =000 min        ──────►  the desired time difference in
                            minutes
```
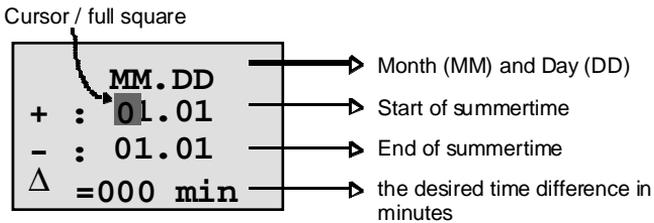
Let us assume you want to configure the following parameters: start of daylight savings time, March 31, end of daylight savings time, November 1, time difference of 120 minutes.

To enter the data:

- Use the ◀ or ▶ key to move the cursor/full square to and fro.
- Use the ◀ or ▶ key to change the values at the cursor position.

The display shows:

```
      MM.DD
+  :  03.31  ──────────→ 31. March
−  :  11.01  ──────────→ 1. November
Δ  =120 min  ──────────→ Time difference of 120 Min
```
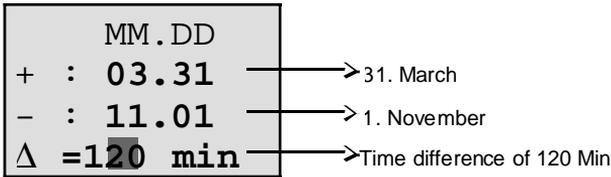
- Confirm your entries with OK.

You have now customized your daylight savings time. IDEC SmartRelay displays:

```
>On
 Off
S/W Time
 On→..
```

 IDEC SmartRelay indicates that daylight savings time is enabled and that the parameters were manually entered ("..").

Note

To disable daylight savings time (summertime/wintertime conversion), all you have to do is to confirm "Off" with OK in this menu

3.7 Memory Space and Circuit Size

The size of a program (Circuit program in IDEC SmartRelay, circuit dia-
gram) is limited by the available memory space (memory requirement for
the blocks).

Memory Area

In IDEC SmartRelay you can only utilize a specific number of blocks in
your program. Some blocks require extra memory for their special func-
tions.

The memory required for special functions can be split into four memory
areas.

- Par: The area in which the IDEC SmartRelay stores setpoint val-
  ues, e.g. the limit values of a counter.

- RAM: The area in which the IDEC SmartRelay stores actual val-
  ues, e.g. a counter value.

- Timer: The area IDEC SmartRelay utilizes for timer functions, e.g.
  for on delays.

- REM: The area in which the IDEC SmartRelay stores retentive
  actual values, e.g. the hours counter value. In blocks with selective
  use of the retentivity function, this memory area is only used if
  retentivity is switched on.

Resources Available in IDEC SmartRelay

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

Blocks	Par	RAM	Timer	REM	Bit
56	48	27	16	15	8

IDEC SmartRelay monitors memory utilization. It restricts the functions
offered in the function lists to those for which sufficient memory space is
physically available.

Memory Utilization

This table gives you an overview of the specific memory requirements of the special functions:

Function block	Par	RAM	Timer	REM
Latching relay*	0	(1)	0	(1)
Current impulse relay	0	(1)	0	(1)
Interval time-delay relay / Pulse output	1	1	1	0
Edge-triggered interval				
time-delay relay	1	1	1	0
On delay	1	1	1	0
Off delay	2	1	1	0
On/off delay	2	1	1	0
Retentive				
on delay	2	1	1	0
Seven-day time switch	6	2	0	0
Twelve-month time switch	2	0	0	0
Up/down counter*	2	(2)	0	(2)
Operating hours counter	2	0	0	4
Symmetrical clock pulse generator	1	1	1	0
Asynchronous pulse generator	3	1	1	0
Random generator	2	1	1	0
Frequency trigger	3	3	1	0
Analog trigger	4	2	0	0
Analog comparator	3	4	0	0
Stairwell light switch	1	1	1	0
Dual-function switch	2	1	1	0
Message texts	1	0	0	0
Softkey	1	(1)	0	(1)

*Depending whether or not the function is configured retentive, it occupies the following memory space:
   • Retentivity switched off: RAM area
   • Retentivity switched on: REM area

Utilization of Memory Space

If you are unable to add another block when editing a program, this is a clear indication that no more memory space is available. IDEC SmartRelay offers only the blocks for which it can provide sufficient memory space. If a block from the list cannot be added into the IDEC SmartRelay program you cannot access this list anymore.

If the memory space is fully utilized you must optimize your circuit program or use a second IDEC SmartRelay.

Determining the Amount of Memory Required

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

Example:
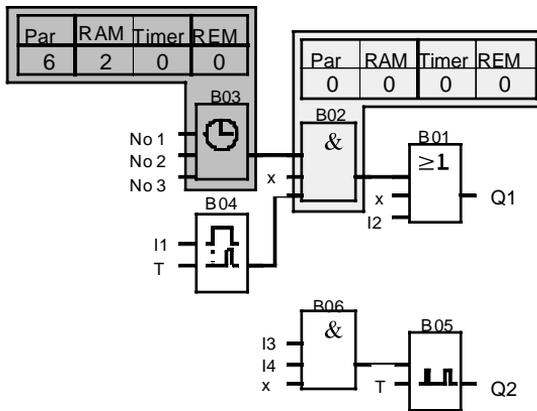
The sample program contains:

Block No.	Function	Memory Area				
		Par	RAM	Timer	REM	Blocks
B01	OR	0	0	0	0	1
B02	AND	0	0	0	0	1
B03	Timer switch	6	2	0	0	1
B04	On delay	1	1	1	0	1
B05	Clock generator	1	1	1	0	1
B06	AND	0	0	0	0	1
	Resources occupied by the program	8	4	2	0	6
	IDEC SmartRelay memory limitations	48	27	16	15	56
	still available in IDEC SmartRelay	40	23	14	15	50

The program therefore fits into IDEC SmartRelay.

4 IDEC SmartRelay Functions

IDEC SmartRelay provides various elements for the programming mode. The elements have been separated in to "Lists". These lists are:

- ↓Co: Connector list (Connector) (see "4.1 Constants and Connectors - Co" on page 4-2)

- ↓BF: List of basic functions AND, OR, ... (see "4.2 List of Basic Functions BF" on page 4-5)

- ↓SF: List of special functions (refer to "4.4 List of Special Functions - SF" on page 4-22)

- ↓BN: List of reusable blocks configured in the circuit program

List Contents

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

If Not All Choices are Shown

IDEC SmartRelay does not show all elements if:

- No more blocks can be added
  in this case, there is either no more memory space available or the maximum possible number of blocks was reached (56).

- A specific block's memory space requirement would exceed the space available in IDEC SmartRelay.

4.1 Constants and Connectors - Co

Constants and Connectors (= Co) are inputs, outputs, memory bits and fixed voltage levels (constants).

Inputs

1. Digital Inputs
   Digital inputs are designated with an I. The numbers of the digital inputs (I1, I2, ...) correspond with the numbers of the input connectors of the IDEC SmartRelay Basic and of the connected digital modules in the order they were installed. See the figure on the next page.

2. Analog Inputs
   The IDEC SmartRelay models FL1B-H12SND, FL1B-H12RCE and FL1B-B12RCE are equipped with the inputs I7 and I8 which can also be used as AI1 and AI2, depending on the program. If these inputs are used as I7 and I8 the input signal is interpreted as digital value. When using AI1 and AI2 the signals are interpreted as analog value. When you connect an analog module, the inputs are numbered in the order of the existing analog inputs. When selecting the input signal in programming mode, only the analog inputs AI1 to AI8 are offered for special functions which can be connected to analog inputs. See the figure on the next page.

Outputs

Outputs are designated with a Q. The output numbers (Q1, Q2, ...) correspond to the output connectors of the IDEC SmartRelay Basic and of the connected expansion modules in the order they were installed. See the figure on the following page.
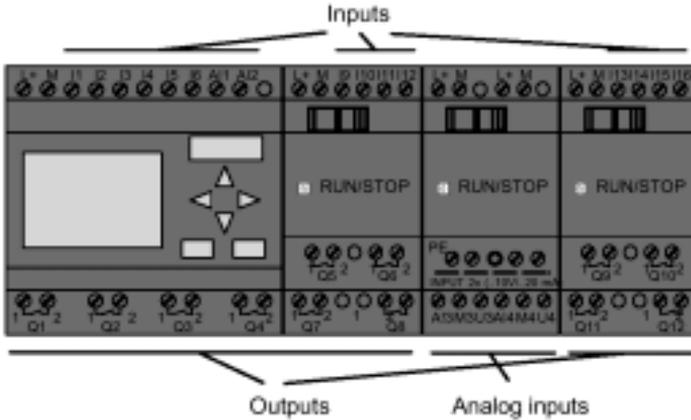
Memory Markers

Memory markers are identified with an M. Memory markers are virtual outputs, with a value at their output analog to that at the input. The IDEC SmartRelay provides 8 memory markers, namely M1 ... M8.

Previous Devices

With previous IDEC SmartRelay models the maximum number of blocks connected in a series can be extended by adding memory markers to the program.

Initialization Memory Marker

Memory marker M8 is set during the first cycle of the user program. You can therefore use it in the program as an initialization memory marker. After the first program cycle it is automatically reset.

In all subsequent cycles you can use memory marker 8 in the same way as memory markers M1 to M7 for setting, deleting and evaluation operations.

> Note
> *The output signal of the memory marker is always that of the previous program cycle. The value does not change within the same program cycle.*

Levels

Voltage levels are designated hi and lo. A constant block status of "1" = hi or "0" = lo is achieved via input of a fixed level or constant hi or lo value.

Open Connectors

Block pins not connected are identified with an x.

4.2 List of Basic Functions BF

Basic functions represent a simple Boolean algebra logic.

When programming a circuit, you can find the basic function blocks in the BF list. In the last column you can locate the position of every basic function by scrolling through the BF list using the ▼ key from top to bottom. Here are the available basic functions:

View in the Circuit Diagram	View in IDEC SmartRelay	Designation of the Basic Function	Position in the BF
Series circuit n.o. contact		AND	1
		AND with RLO Edge Detection	7
Parallel circuit n.c. contact		NAND (AND not)	4
		AND with RLO Edge Detection	8
Parallel circuit n.o. contact		OR	2
Series circuit n.c. Contact		NOR (OR not)	5
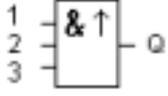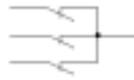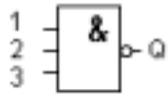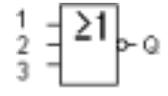
View in the Circuit Diagram	View in IDEC SmartRelay	Designation of the Basic Function	Position in the BF
Double change-Over contact	1 2 =1 Q	XOR (exclusive OR)	6
n.c. contact	1 1 Q	NOT (negation, inverter	3
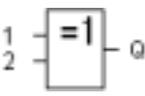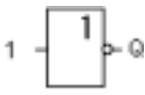
4.2.1 AND (AND)

Series connection of multiple make
contacts in the circuit diagram   Symbol in IDEC SmartRelay:
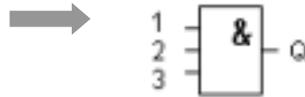
The status of the AND output is 1 when all inputs are 1, if they are closed.

The status of a block input pin which is not connected (x) is: x = 1.

AND Logic Table

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

4.2.2 AND with RLO Edge Detection

Symbol in IDEC SmartRelay:
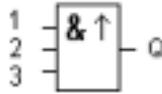
The output status of an edge-triggered AND is only 1 if all inputs are 1, and if at least one input was 0 in the previous cycle.

The status of a block input pin which is not connected (x) is: x = 1.

Timing Profile for the AND with RLO Edge Detection
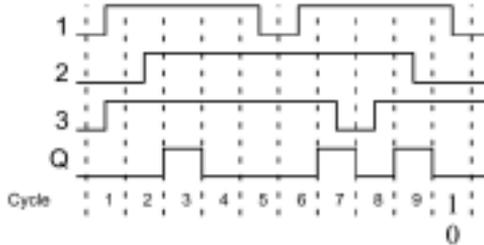
4.2.3 NAND (AND not)

Parallel connection of multiple break
contacts in the circuit diagram:
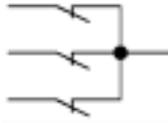
Symbol in IDEC
SmartRelay:
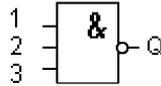
The output status of the NAND is only 0 if all inputs are 1, that is, if the
contacts are closed.

The status of a block input pin which is not connected (x) is: x = 1.

NAND Logic Table

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

4.2.4 NAND with RLO Edge Detection

Symbol in IDEC SmartRelay:
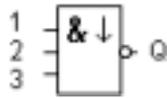
The output status of the NAND with edge evaluation is only 1 if at least one input is 0 and if all inputs were 1 in the previous cycle.

The status of a block input pin which is not connected (x) is: x = 1.

Timing Profile for the NAND with RLO Edge Detection
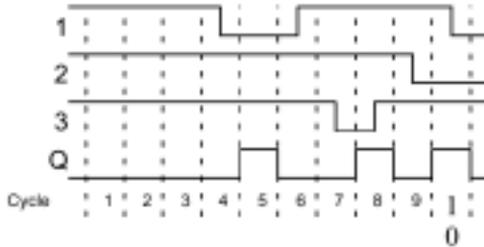
4.2.5 OR (OR)

The parallel connection of multiple make
contacts in a circuit diagram:

Symbol in IDEC SmartRelay:
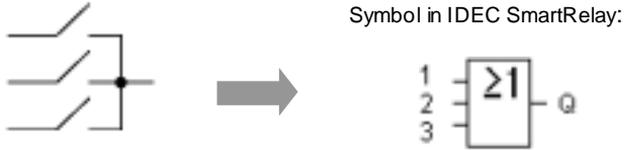
The output status of the OR is only 1 if at least one input is 1, that is, if
one of the contacts is closed.

The status of a block input pin which is not connected (x) is: x = 0.

OR Logic Table

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

4.2.6 NOR (OR not)

The series connection of multiple break contacts in the circuit diagram:

Symbol in IDEC SmartRelay:

The output status of the NOR is only 1 if all inputs are 0, if switched off. The NOR output is set to 0 at the 0 to 1 transition at one of the inputs.

The status of a block input pin which is not connected (x) is: x = 0.

NOR Logic Table

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

4.2.7 XOR (exclusive OR)

The XOR in the circuit diagram as two
changeover contacts connected in series:

Symbol in IDEC
SmartRelay:

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

The status of a block input pin which is not connected (x) is: x = 0.

XOR Logic Table

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

4.2.8 NOT (Negation, Inverter)

A break contact in the circuit diagram

Symbol in IDEC
SmartRelay:
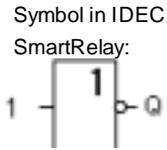
The output status is 1 if the input is 0. The NOT block is an input status inverter.

For the IDEC SmartRelay, the advantage of the NOT is that you do not need break contacts anymore. You simply use a make contact and convert it with the NOT into a break contact.

NOT logic Table

1	Q
0	1
1	0

4.3 Special Functions

Special functions differ from the basic functions because of their different input designation. Special functions include timer functions, retentivity and diverse parameter assignment options for customizing the program.

In this section we should like to give you an overview of the input designations and of special items relating to special functions. The special functions are described in "4.4 List of Special Functions - SF" on page 4-22.

4.3.1 Input Designation

Logical Inputs

Here you find the description of the connections which can be linked to other modules or inputs of the IDEC SmartRelay device.

- S (set):
  Input S can be used to set the output to "1".

- R (reset):
  The reset input R has priority over all other inputs; it switches the outputs to "0".

- Trg (trigger):
  This input is used to trigger the start of a function cycle.

- Cnt (count):
  This input is used to capture count pulses.

- Fre (frequency):
  Frequency signals to be evaluated are input with this designation.

- Dir (direction):
  This input, for example, determines the direction of count.

- En (enable):
  This input enables the block functions. When this input is "0", the block ignores all other signals.

- Inv (invert):
  The output signal of the block is inverted when this input is set.

- Ral (reset all):
  All internal values are reset.

Connection X at the Inputs of the Special Functions

The inputs of the special functions are 0 when connected to the connection "x". That is, the inputs are "lo".

Parameter Inputs

To some of the inputs you do not apply signals, but rather assign specific values to the function block.

- Par (parameter):
  This input is not wired. Here, you configure the block parameters.

- T (time):
  This input is not wired. Here you configure the times for a block.

- No (cam):
  This input is not wired. Here, you configure the time patterns.

- P (priority):
  This input is not wired. Here, you specify priorities and determine whether or not a message must be acknowledged in RUN mode.

4.3.2 Time Response

Parameter T

With some of the special functions it is possible to configure a time value T. When specifying the time, please note that the values to be entered depend on the set timebase:

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

B01:T
T=04.10h+

Setting the time T to 250 minutes:

Unit in hours h:

04.00 hours	240 minutes
00.10 hours	+10 minutes
=	250 minutes

Note
Always specify a time T ≥ 0.10 s. The time T is not de-fined for T = 0.05 s and T= 0.00 s.

Accuracy of T

All electronic components have slightly different parameters. This can cause deviations in the configured time T. With the IDEC SmartRelay the maximum deviation is ± 0.02%. If 0.02% of time T is smaller than 0.1 seconds the maximum deviation is 0.1 seconds.

Example:
The maximum deviation for 1 hour (3600 seconds) is ± 0.02%, that is, ± 0.72 seconds. The maximum deviation for 1 minute (60 seconds) is ± 0.1 seconds.

Timer Switch Accuracy

In order to prevent inaccuracies of clock timing in the C-models as a result of this deviation, the timer switch is continuously compared with a highly accurate timebase and readjusted. This results in a maximum timing deviation of ±5 s/day.

4.3.3 Buffering the Clock

The internal clock of a IDEC SmartRelay continues operation even with a power failure because the clock is buffered. The duration of this buffering is influenced by the ambient temperature. At an ambient temperature of 25°C the buffering time is normally 80 hours.

4.3.4 Retentivity

For special functions there is a possibility to keep circuit states and counter values retentive. This, however, requires that retentivity is enabled for the respective functions. An exception is the principally retentive operating hours meter. See also "6.1 Overview of the Modules" on page 6-2.

4.3.5 Parameter Protection

In the parameter protection configuration you can specify whether the parameters can be displayed and edited in IDEC SmartRelay parameter assignment mode. There are two optional configurations:

+: The parameter configuration can be displayed and edited in parameter assignment mode.

-: The parameter configuration cannot be displayed in parameter assignment mode. Editing is only possible in programming mode.

4.3.6 Gain and Offset Calculation With Analog Values

The gain and offset parameters can be used to adjust the internal image of an analog value to the actual measurement value.

Characteristic Quantity	Minimum	Maximum
Terminal voltage (in V)	0	≥ 10
Internal value	0	1000
Gain (in %)	0	1000
Offset	-999	+999

The terminal voltage (at input AI) of 0 to 10 V is mapped internally to values from 0 to 1000. A terminal voltage higher than 10 V is mapped internally by the value 1000.

With the gain parameter, for example, you can achieve an amplification of 1:10 at a setting of 1000%.

The offset parameter can be used to shift the decimal point of measurement values.

Formula

Displayed value Ax = (Internal value + Offset) • Gain / 100

The gain value displayed is the amplification as percentage.

Hence, the division by 100 in the formula.

Example of Analog Values

Measurement Value	Voltage (V)	Internal Value	Offset	Gain	Displayed Value (Ax)
	0 5 100	0 500 1000	0 0 0	1 1 1	0 5 10
	0 5 10	0 500 1000	0 0 0	100 100 100	0 500 1000
	0 5 10	0 500 1000	0 0 0	1 1 1	0 5000 10000
	0 5 10	0 500 1000	500 500 500	100 100 100	5 10 15
	0 5 10	0 500 1000	500 500 500	100 100 100	500 1000 1500
	0 5 10	0 500 1000	-200 -200 -200		-200 300 800
	0 10	0 1000	-999 999	1000 1000	-9990 19990
	0.02 0.02 0.02 0.02	2 2 2 2	0 0 0 0	1 10 100 1000	0 0 2 20
-30° C 0° C +70° C	0 3 10	0 300 1000	-300 -300 -300	10 10 10	-30 0 70

You can find an a sample application in the description of the special function "4.4.18 Analog Comparator" on page 4-55.

For information on analog inputs also refer to "4.1 Constants and Connectors - Co" on page 4-2.

4.4 List of Special Functions - SF

When programming in IDEC SmartRelay, you can find the blocks for the special functions in the SF list. In the table below you can also find comparable views of circuit diagrams as well as the information whether or not retentivity can be configured for the respective function. In the last column you can locate the position of all special functions by scrolling through the list using the ▾ key.

Display in the Circuit Diagram	Display in IDEC SmartRelay	Designation of the Special Function	Re	Position in SF
	Trg T	On delay		1
	Trg R T	Off delay		2
	Trg Par	On/off delay		14
R K Trg K Q K 1	Trg R T	Retentive on delay		7
R S K1 K1	S R Par RS	Latching relay	Re	5
	Trg R Par	Current impulse relay	Re	3
	Trg T	Interval time-delay relay / Pulse output		9
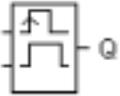
Display in the Circuit Diagram	Display in IDEC SmartRelay	Designation of the Special Function	Re	Position in SF
	Trg T — Q	Edge triggered interval time-delay relay		18
⊙	No1 No2 No3 — Q	Seven-day time switch		4
	No — MM DD — Q	Twelve-month time switch		13
	R Cnt Dir Par — +/− — Q	Up/down counter	Re	10
	R En Ral Par — h — Q	Operating hours counter		8
⊓	En T — Q	Symmetrical clock pulse generator		6
	En Inv Par — Q	Asynchronous pulse generator		12
	En Par — Q	Random generator		15
	Fre Par — Q	Frequency trigger		11
	Ax Par — /A — Q	Analog trigger		20
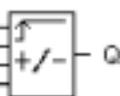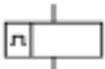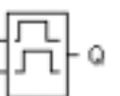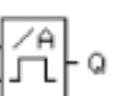
Display in the Circuit Diagram	Display in IDEC SmartRelay	Designation of the Special Function	Re	Position in SF
	A_x A_y Par	Analog comparator		21
	Trg T	Stairwell light switch		16
	Trg Par	Dual function switch		17
	En P Par	Message texts		19
	En Par	Softkey	Re	22
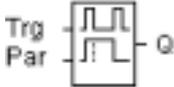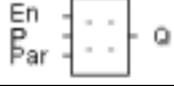
4.4.1 On Delay

Description

An output with on delay is not switched on until the specified time has elapsed.
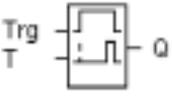
Symbol in IDEC SmartRelay	Wiring	Description
Trg ⊓ ─ Q T	Input Trg	Use input Trg (Trigger) to start the on delay time
	Parameter T	T is the time after which the output is switched (0 to 1 transition of the output signal).
	Output Q	Q is switched on when a specified time T has elapsed, provided Trg is still set.

Parameter T

Please note the specifications for parameter T in "4.3.2 Time Response" on page 4-18.
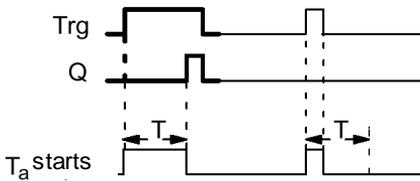
Timing Diagram

The section of the timing diagram displayed in bold print is found again in the symbol for the on delay.

Function Description

- On 0 to 1 transition of input Trg the time T_a starts (T_a is the current time in IDEC SmartRelay.
- If the status of input Trg is 1, at least for the duration of the configured time T, the output is set to 1 when this time expires (the output follows the input with on delay).
- The time is reset if the status of input Trg changes to 0 before the time T has elapsed.
- The output is set to 0 when the status at input Trg is 0.
- The elapsed time is reset after a power failure.

4.4.2 Off Delay

Description

The output is not reset until the set time has elapsed.

Symbol in IDEC SmartRelay	Wiring	Description
Trg R T ... Q	Input Trg	You start the off delay at the negative edge (1 to 0 transition) at input Trg (Trigger)
	Input R	Input R resets the on delay time. It also resets the output to 0.
	Parameter T	T is the time after which the output is switched off (1 to 0 transition of the output signal).
	Output Q	Q is switched on with Trg. It holds this state until T has elapsed.

Parameter T

Please note the value specification for parameter T in "4.3.2 Time Response" on page 4-18.

Timing Diagram

The bold printed section of the timing diagram is found again in the symbol for the off delay.
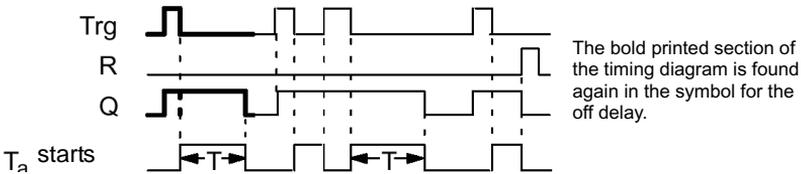
Function Description

• When the status of Trg has changed to 1, the output Q is instantly switched to 1.
• The actual time T_a in IDEC SmartRelay restarts on a 1 to 0 transition at Trg. The output remains set. When T_a reaches the configured value T ($T_a = T$), output Q is reset to 0 (off delay).
• The time T_a restarts when input Trg is switched on and off again.
• Input R (Reset) is used to reset the time T_a and the output before T_a has elapsed.
• The elapsed time is reset after a power failure.

4.4.3 On/Off Delay

Description

An output with on/off delay is set and reset on expiration of specified times.
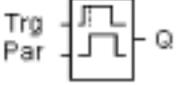
Symbol in IDEC SmartRelay	Wiring	Description
	Input Trg	The positive edge (0 to 1 transition) at input Trg (Trigger) starts the time T_H for the on delay. The negative edge (1 to 0 transition) at input Trg (Trigger) starts the time T_L for the off delay.
	Parameter Par	T_H is the time after which the output is switched on (0 to 1 transition of the output signal). T_L is the time after which the output is switched off (1 to 0 transition of the output signal).
	Output Q	On expiration of the configured time T_H, output Q is switched on provided Trg is still set. On expiration of the time T_L it is switched off, provided Trg was not set again.

Parameter T_H and T_L

Note the value specifications for the parameters T_H and T_L in "4.3.2 Time Response" on page 4-18.

Timing Diagram

Function Description

• The time T_H starts after 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 on delayed).
• The time is reset if input Trg changes to 0 before the time T_H has elapsed.
• Time T_L starts when the status at input Trg returns to 0.
• If the status at input Trg is 0 at least for the duration of T_L, the output is set to 0 on expiration of the time T_L (the output follows the input off delayed).
• The time is reset if the status at input Trg returns to 1 before the time T_L has elapsed.
• The time elapsed is reset after a power failure.

4.4.4 Retentive On Delay

Description

The specified time starts after an input pulse. The output is set on expiration of this time.
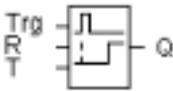
Symbol in IDEC SmartRelay	Wiring	Description
	Input Trg	You start the on delay at the negative edge (1 to 0 transition) at input Trg (Trigger).
	Input R	Use the input R to reset the on delay time and the output.
	Parameter T	T is the time after which the output is switched on (output transition 0 to 1).
	Output Q	On expiration of the time T output Q is switched on.

Parameter T

Note the value specifications in "4.3.2 Time Response" on page 4-18.
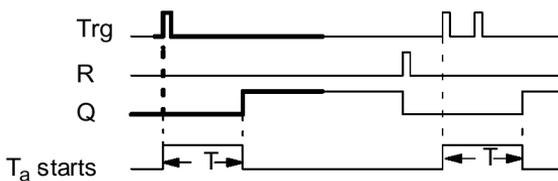
Timing Diagram

The bold printed section of the timing diagram is found again in the symbol for the retentive on delay.

Function Description

- The current time T_a starts at the 0 to 1 transition at input Trg. Output Q is set to 1 when $T_a = T$. Further switching actions at input Trg have no influence on T_a.
- The output and the time T_a are only reset to 0 when the status at input R is 1.
- The elapsed time is reset after a power failure.

4.4.5 Latching Relay

Description

Input S sets output Q. Input R resets output Q.

Symbol in IDEC SmartRelay	Wiring	Description
S R Par **RS** Q	Input S	Use input S to set output Q to 1.
	Input R	Use input R to reset output Q to 0 again. If both S and R are 1, the output is reset.
	Parameter Par	This parameter can be used to switch retentivity on and off. **Ret:** **off = no retentivity** **on = the status is retentive**
	Output Q	Q is switched on with a signal at input S. This state is maintained until input R is set.

Timing Diagram
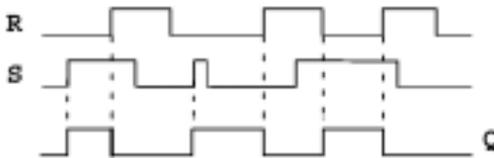
Switching Behavior

A latching relay is a simple logic memory. The output value depends on the input states and on the previous output status. The following table shows the logic once again:

S_n	R_n	Q	Comment
0	0	x	The status is retentive
0	1	0	Reset
1	0	1	Set
1	1	0	Reset (has priority over Set)

With enabled retentivity the status of the output signal does not change when power is returned after power failure.

4.4.6 Current Impulse Relay

Description

A short one-shot at the input is used to set and reset the output.
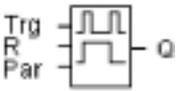
Symbol in IDEC SmartRelay	Wiring	Description
Trg R Par — Q	Input Trg	You use input Trg (Trigger) to switch the output Q on and off.
	Input R	The input R is used to reset the output and the relay.
	Parameter Par	This parameter can be used to switch retentivity on and off. **Ret:** **off = no retentivity** **on = the status is retentive**
	Output Q	Q is switched on with Trg and off again with the next Trg.

Timing Diagram

The bold printed section of the timing diagram is found again in the symbol for the pulse relay.
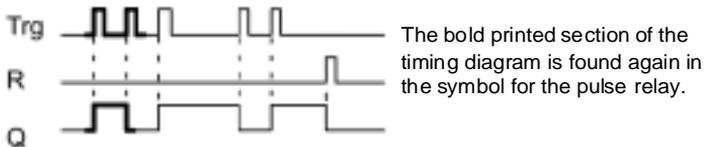
Function Description

• Output Q status is toggled at every 0 to 1 transition of the status at input Trg, that is, the output is switched on or off.
• Use input R to reset the pulse relay to initial state, that is, the output is set to 0.
• After a power failure the pulse relay is reset and the output Q is set to 0 if you have not enabled retentivity.

4.4.7 Interval Time-Delay Relay / Pulse Output

Description

An input signal generates a signal of specified length at the output.

Symbol in IDEC SmartRelay	Wiring	Description
Trg T ⊓⌐⊔ Q	Input Trg	You use input Trg (Trigger) to start the time for the wiping relay.
	Parameter T	T is the time after which the output is switched off (1 to 0 transition of the output signal).
	Output Q	Q is switched on with Trg as long as the time T_a expires and the input is set to 1.

Parameter T

For information on the parameter T refer to "4.3.2 Time Response" on page 4-18.
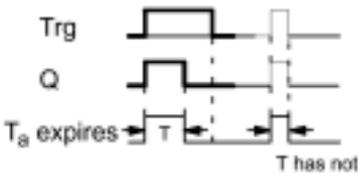
Timing Diagram

The bold printed section of the timing diagram is found again in the symbol for the wiping relay.

Function Description

- The output status is switched to 1 after the input Trg is set to 1. The time T_a is started at the same time and the output remains set.
- When T_a reaches the value specified in T (T_a = T), the status of output Q is reset to 0 (pulse output).
- On input Trg transition from 1 to 0 before the specified time has elapsed, the output follows immediately with a 1 to 0 transition.

4.4.8 Edge-Triggered Interval Time-Delay Relay

Description

An input signal generates an output signal of specified length (retriggering).

Symbol in IDEC SmartRelay	Wiring	Description
Trg T Q	Input Trg	Use the input Trg (Trigger) to start the time for the edge-triggered wiping relay.
	Parameter T	T is the time after which the output is switched off (1 to 0 transition of the output signal).
	Output Q	Q is switched on with Trg. It holds this state until T has elapsed.

Parameter T

For information on the parameter T refer to "4.3.2 Time Response" on page 4-18.

Timing Diagram

The bold printed section of the timing diagram is found again in the symbol for the edge-triggered wiping relay.
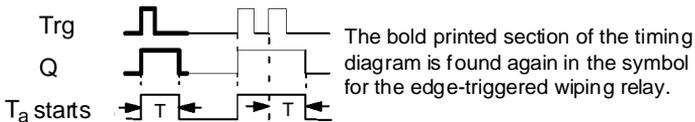
Function Description

- The output status is switched to 1 after the input Trg is set to 1. Time T_a is started at the same time. After T_a has reached the value specified in T ($T_a = T$) the output Q status is reset to 0 (pulse output).
- The time T_a is reset if input Trg changes again from 0 to 1 (retriggering) before the specified time has elapsed. The output remains switched on.

4.4.9 Seven-Day Time Switch

Description

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

Note
The FL1B-H12SND model does not have an internal clock.Therefore, the weekly timer switch cannot be used for this model.

Symbol in IDEC SmartRelay	Wiring	Description
No1 No2 No3 — Q	The parameters Cam 1, **Cam 2** **Cam 3**	In the Cam parameter you set the on-/off-time respectively for one Cam of the weekly timer switch. Here you configure the days and the time-of-day.
	Output Q	Q is switched on when the configured cam is switched on.

Timing Diagram (three examples)
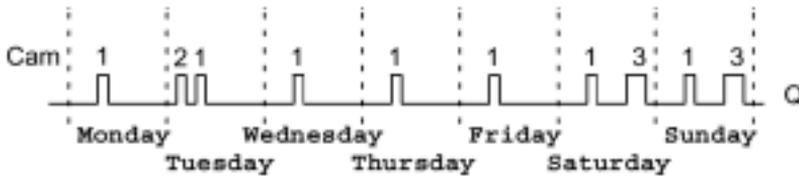
Cam1:	Daily:	06:30 h to 08:00 h
Cam 2:	Tuesday:	03:10 h to 04:15 h
Cam 3:	Saturday and Sunday:	16:30 h to 23:10 h

Function Description

• Every Seven-day time switch has three cams. In the cam setting you
  specify the on-/off-times. At the on-time, the Seven-day time switch
  switches on the output, if the output is not already switched on.
• At the off-time, the Seven-day time switch switches off the output, if the
  output is not already switched off. The on- and off-times are in conflict if
  their specified switching time is the same for the Seven-day time switch,
  but on different cams. In this case cam 3 has priority over cam 2,
  whereas cam 2 has priority over cam 1.

Parameter Assignment Screen Form

Parameter assignment screen form for cam no.1:

```
Block B01      Cam 1                    Weekdays (daily)

                                        See display/hide parameter -
                                        Type of protection.
 B01: No1
 D=MTWTFSS+
 On =06:30                              On-time (06.30 h)
 Off=08:00                              Off-time (08.00 h)
```
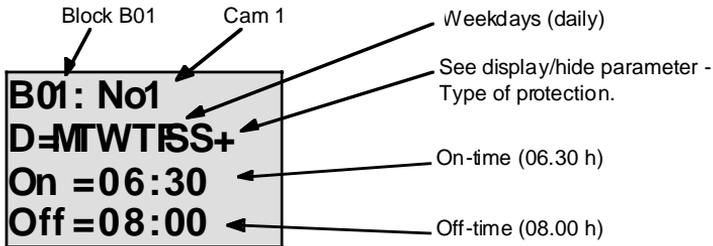
Weekday

The letters behind the "D=" have the following meaning:

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

An upper case letter means that the weekday is selected. The character
"-" means that the weekday is not selected.

Switching Times

Switching times are possible between 00:00 h and 23:59 h.

—:— means there are no on- and off-times.

Setting the Weekly Timer Switch

This is how you specify the switching times:

1. Position the cursor on one of the Cam parameters of the timer switch (e.g. Cam 1).

2. Confirm with OK. IDEC SmartRelay opens the parameter assignment screen form for the cam. The cursor is positioned on the weekday.

3. Use ▲ and ▼ to select one or several weekdays.

4. Use ▶ 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 ▲ or ▼ key. Move the cursor around to the various positions, using the ◀ or ▶ key. You can only select the value —:—at the first position (—:— means: no switching operation).

6. Using the ▶ key, 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 positioned on the Cam 2 parameters. You can now configure another cam.

> Note
> *You can find information on timer switch accuracy in the "A. Technical Specifications" on page 9-1 and in "4.3.2 Time Response" on page 4-18.*

Seven-Day Time Switch:

Example:

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

This requires three cams.

Here are the parameter assignment screen forms of cams 1, 2 and 3, based on the timing diagram above.

Cam 1

Cam 1 must switch on the output of the weekly timer switch daily from 05:30 h to 07:40 h.

```
B01: No 1
D=MTWTFSS+
On  =05:30
Off =07:40
```

Cam 2

Cam 2 must switch on the output of the weekly timer switch every Tuesday from 03:10 h to 04:15 h.

```
B01: No 2
D= T--- --+
On  =03:10
Off =04:15
```

Cam 3

Cam 3 must switch on the output of the weekly timer switch every Saturday and Sunday from 16:30 h to 23:10 h.

```
B01: No 3
D= ----   SS+
On =16:30
Off =23:10
```

Result
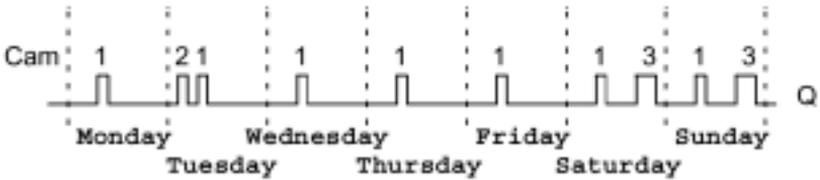
4.4.10 Twelve-Month Time Switch

Description

The output is controlled by a specified on-/off-date.

> Note
> *The FL1B-H12SND model does not have a clock. Therefore, the yearly timer switch cannot be used for this model.*
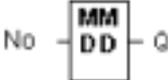
Symbol in IDEC SmartRelay	Wiring	Description
No — **MM** **DD** — Q	Input Cam	In the Cam parameters, you configure the on-/off-times for the cams of the yearly timer switch.
	Output Q	Q is switched on when the configured cam is switched on.

Timing Diagram
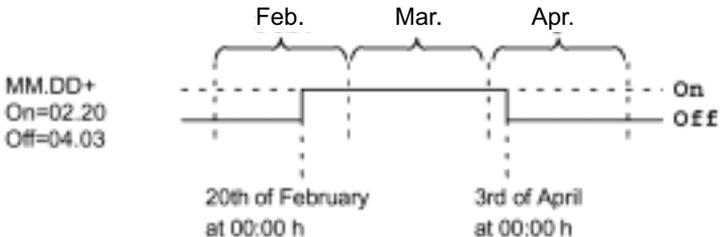
Function Description

At the specified on-time the Twelve-month time switch switches on the output. At the specified off-time the yearly timer switch switches off the output. The off-date specifies the day on which the output is reset to 0 again. The first value identifies the months, the second value the day.

Sample Configuration

On March 1st the output of a IDEC SmartRelay is to be switched on until the April 4th. On July 7th it is switched on once again until the November 19th. This requires two yearly timer switches for which the respective on times must be configured. The outputs are then linked by an OR block.

```
B01: No
      MM DD
On =03.01        on-time 1st of march
Off=04.04        off-time 4th of April
```

```
B02: No
      MM DD        in addition:
On =07.07         on-time 7th of July
Off=11.19         off-time on 19th of November
```

Result
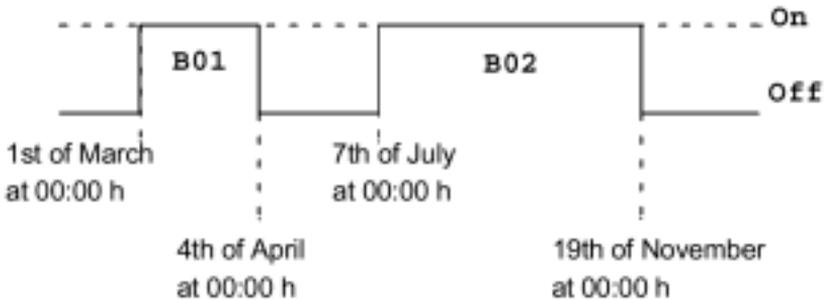
4.4.11 Up/Down Counter

Description

Depending on the configuration, an internal value is counted up or down at every input pulse. The output is set when the configured count value is reached. A special input can be used to change the counting direction.
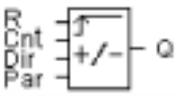
Symbol in IDEC SmartRelay	Wiring	Description
	Input R	Input R resets the internal count value and the output to zero.
	Input Cnt	The counter counts the 0 to 1 transitions at input Cnt. 1 to 0 transitions are not counted. Maximum counting frequency at the input terminals: 5 Hz
	Input Dir	You specify the counting direction using the input Dir: **Dir = 0: Up-count** **Dir = 1: Down-count**
	Parameter Par	Lim: Counter value limit at which the output is reset by the internal count value. **Ret: Enabling retentivity**
	Output Q	Q is switched on when the count value is reached.

Timing Diagram
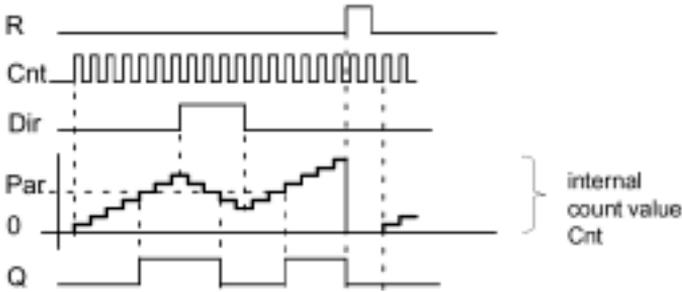
Function Description

- With every positive edge at input Cnt the internal counter increments (Dir = 0) or decrements (Dir = 1) by one count.
- Output Q is set to 1 when the internal value is greater than or equal to the value specified in Par.
- You can use reset input R to reset the output and the internal count value to "000000". When R=1, the output is 0 and the pulses at input Cnt are not counted.

Count value

See display/hide parameter - Type of protection on page 67

Retentivity
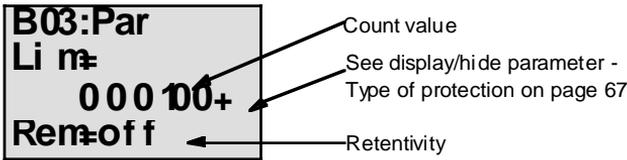
Configuration of the Par Parameter

The output is set when the internal value is greater than or equal to the value specified in Par. The counter stops on over/underflow.

Lim can lie between 0 and 999999.

Ret: This parameter is used to switch retentivity on and off for the internal count value Cnt.

off = no retentivity

on = the count value Cnt is retentive

When retentivity is switched on, the counter value is maintained in the event of power failure. The count is resumed at the same value after power is restored.

4.4.12 Operating Hours Counter

Description

A specified time starts when the input is set. The output is set on once this time has elapsed of this time.

Symbol in IDEC SmartRelay	Wiring	Description
R ─ En ─ [Symbol] ─ Q Ral ─ Par ─	Input R	R = 0: Counting is enabled if Ral is not 1 **R = 1: Counter has stopped** **Use input R to reset the output. The time-to-go for the maintenance interval MN is set to the value MN = MI. The time elapsed is maintained.**
	Input En	En is the monitoring input. IDEC SmartRelay measures the time when this input is set.
	Input Ral	Ral = 0:Counting is enabled if Ral is not 1 **Ral = 1: The counter has stopped** **Use input Ral (Reset all) to reset the counter and the output. That is,** • output Q = 0, • measured operating time OT = 0 and **• the time-to-go of the maintenance interval MN = MI.**
	Parameter Par: MI	MI: maintenance interval to be specified, in hour units. MI can lie between 0 and 9999 hours.
	Output Q	The output is set when the time-to-go MN = 0 (see the timing diagram).

Timing Diagram

R

En

Ral

Q

MN=MI — Par: MI=5h

MN=0

1h   x   x–R=1h

OT

R

The counter holds when R or Ral is set

MI = configured time interval
MN = time–to–go
OT = total time elapsed since the last 1 signal at the Ral–input
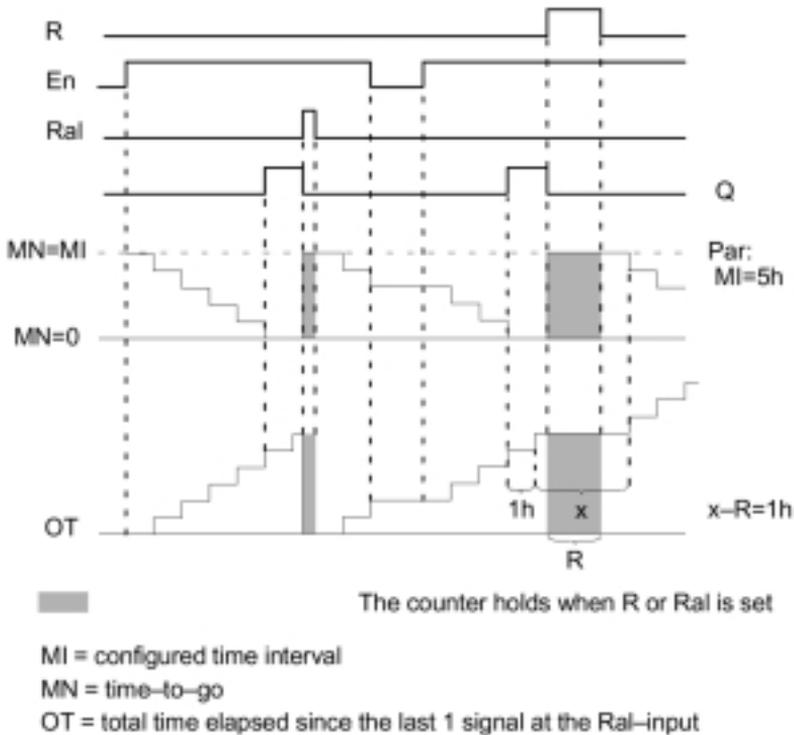
Function Description

The hour counter monitors the input En. As long as the status of this input is 1, IDEC SmartRelay determines the time elapsed and the time-to-go MN. The IDEC SmartRelay displays the times in parameter assignment mode. Output Q is set to 1 when the time-to-go MN = 0.
• Use input R to reset output Q and time-to-go counter to the specified value MI. The internal counter OT continues the count.
• Use input Ral to reset output Q and the time-to-go counter to the specified value MI. The internal counter OT is reset to 0.

Viewing MN and OT Values

- IDEC SmartRelay Basic with display: In parameter assignment mode you can view the actual values of MN and OT while the program is running.
- IDEC SmartRelay Basic without display: with WindLGC (refer to "IDEC SmartRelay Software" on page 7-1 for additional information) you can read the values as follows:

Note
The PC link must be connected to the IDEC SmartRelay before you switch on the power supply.

1. In the "Extras transfer" menu, select the menu item "Hours counter". A connection is automatically established to the IDEC SmartRelay and the current program is retrieved.
2. An Info box pops up showing the data.

Note
The hours counter can be accessed without entering a password.

If your IDEC SmartRelay without display is equipped with a red module you cannot access the hours counter, because the program of the IDEC SmartRelay will be deleted when you remove the module (to connect the PC cable).

Limit Value for OT

Elapsed operating hours are saved in OT when using the input R signal to reset the hours counter. The limit value for the OT counter is 99999 h.

When the hours counter reaches this value, no more hours are counted.

The OT value ensures retentivity of the hours counter.

Configuration of the Par parameter

```
B03:Par
MI = 0000h+
```
→ Monitoring interval in hours
→ Parameter protection
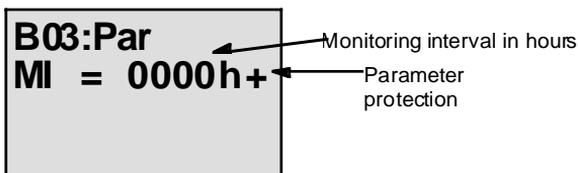
MI is the specified time interval. It can be between 0 and 9999.

4.4.13 Symmetrical Clock Pulse Generator

Description

The period of the output clock signal can be configured.

Symbol in IDEC SmartRelay	Wiring	Description
En T —[⊓⊔⊓]— Q	Input En	Use the input En to switch the clock generator on and off.
	Parameter T	T is the time during which the output is switched on or off.
	Output Q	Q is toggled periodically depending on the clock cycle time T.

Parameter T

Note the value specifications in "4.3.2 Time Response" on page 4-18.
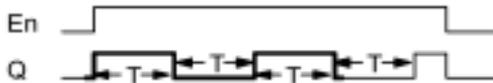
Timing Diagram

The bold printed section of the timing diagram is found again in the symbol for the symmetric clock generator.

Function Description

• In parameter T you specify the length of the on and off times. Using input En (Enable) you can switch on the clock generator, that is, the generator toggles the output between 1 and 0, respectively for the duration of the time T, until the input status is 0 again.

> Note relating to relay outputs:
> *The output contacts of a relay wear slightly when switched under load. You can find information on the number of switching cycles an output of a IDEC SmartRelay can safely process in the appendix "A. Technical Specifications" on page Appendix-1.*

4.4.14 Asynchronous Pulse Generator

Description

The pulse profile of the output can be customized using pulse/pause ratio.

Symbol in IDEC SmartRelay	Wiring	Description
	Input En	You can use input EN to switch the asynchronous pulse generator on and off.
	Input INV	You can use input INV to invert the output signal of the active asynchronous pulse generator.
	Parameter Par	You can customize the period TH and the pulse pause width TL.
	Output Q	Q is toggled periodically, depending on the clock cycles TH and TL.

Timing Diagram
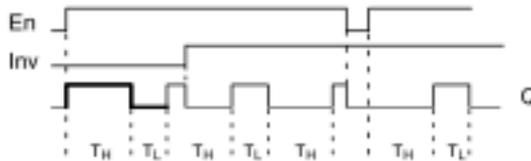
Function Description

• In the parameters T_H (Time High) and T_L (Time Low) you can adjust the period and the pause width.
• With input INV you can also invert the output. The input block INV only negates the output if it is enabled by EN.

4.4.15 Random Generator

Description

With a random generator the output is switched on and off again within a specified time.

Symbol in IDEC SmartRelay	Wiring	Description
En Par — Q	Input En	You can start the on delay time of the random generator at the positive edge (0 to 1 transition) at the enable input En. **You can start the off delay time of the random generator at the negative edge (1 to 0 transition).**
	Parameter Par	The random on delay time is 0 s to TH. The random on delay time is 0 s to TL.
	Output Q	On expiration of the on delay time output Q is switched on, provided En is still set. On expiration of the off delay time it is switched off, provided En was not set again meanwhile.

Parameter T_H and T_L

Note the value specifications for the parameters T_H and T_L in "4.3.2 Time Response" on page 4-18.
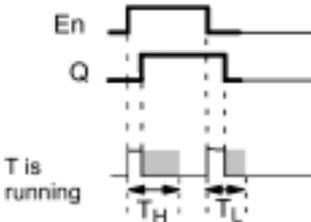
Timing Diagram

The bold printed section of the timing diagram is found again in the symbol for the off delay.

Function Description

- A random time (on delay) between 0 s and T_H is determined and started at the 0 to 1 transition of the status at input EN. The output is set to 1 on expiration of the on delay time, if the status at input En is 1 at least for the duration of the on delay time.
- The time is reset if the status at input En returns to 0 before the on delay time has elapsed.
- When the status at input En returns to 0, a random time (off delay) between 0s and T_L is determined and started.
- The output is reset to 0 on expiration of the off delay time, if the status at input En is 0 at least for the duration of the off delay time.
- The time is reset if the status at input En returns to 1 before the on delay time has elapsed.
- The time elapsed is reset after a power failure.

4.4.16 Frequency Trigger

Description

The output is switched on and off, depending on two specified frequencies.

Symbol in IDEC SmartRelay	Wiring	Description
Fre ─[⌂]─ Q Par ─	input Fre	At input Fre you connect the input that supplies the pulses to be counted. Use • **inputs I5/I6 for fast counting operations (only FL1B-H12RCE/ B12RCE and FL1B-H12SND): max. 1 kHz.** • any other input or circuit component for counting low frequencies.
	Parameter Par: **sw↓ , sw ↑** **G_T**	SW↑: on threshold SW↓: off threshold **G_T: Time interval or gate time during which the pulses are measured.**
	Output Q	Q is switched on and off depending on SW↑ and SW↓.

Timing Diagram
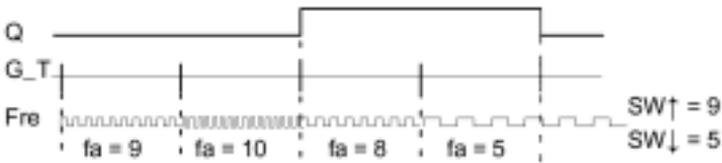
Function Description

• The threshold switch measures the signals at input Fre. The pulses are captured across a specified period G_T. Output Q is switched on if the value measured within the time G_T is higher then the on and off threshold.
• Q is switched off again when the measured pulse rate is equal to/lower than the off threshold value.

Configuration of the Par Parameter

```
B03:Par        ──── on threshold
SW↑=0050+◄     ──── Parameter protection
SW↓=0048 ◄     ──── off threshold
G_T:01:00s◄    ──── Time interval for pulses
```
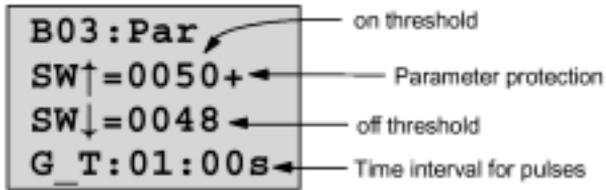
SW↑ is the on threshold. The range is 0000 to 9999.

SW↓ is the off threshold. The range is 0000 to 9999.

G_T is the time interval during which the pulses at the Fre input are measured. The range for G_T is 00.05 s to 99.95 s.

Note

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

f_a *is always the sum of the measured pulses per time unit G_T.*

4.4.17 Analog Switch

Description

The output is switched on when the analog value exceeds a specified on threshold. The output is switched on when the analog value drops below a specified off threshold.

Symbol in IDEC SmartRelay	Wiring	Description
Ax Par — Q	Input Ax	At input Ax you apply the analog signal you want to evaluate. Only use terminals I7 (AI1) or I8 (AI2), on FL1B-H12RCE/B12RCE and FL1B-H12SND or those of an analog module. 0-10 V is equivalent to 0-1000 (internal value).
	Parameter Par: $\updownarrow$, $\uparrow$, SW$\uparrow$, SW$\downarrow$	$\updownarrow$: Gain in % range of values 0..1000% $\uparrow$: Offset range of values ±999 SW$\uparrow$: on threshold range of values ±19990 SW$\downarrow$: off threshold range of values ±19990
	Output Q	Q is set and reset depending on the thresholds.

Gain and Offset Parameters

Note the information relating to the gain and offset parameters in "4.3.6 Gain and Offset Calculation With Analog Values" on page 4-20.

Timing Diagram
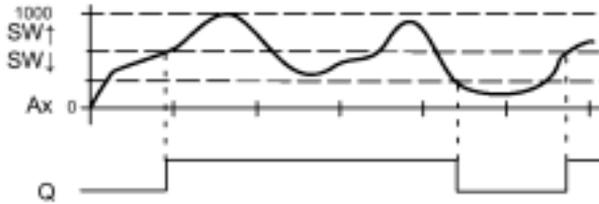
Function Description

This function retrieves the analog value of a signal at the analog input (AI1, AI2...AI8).

The offset parameter is then added to the analog value. The result is multiplied by the gain parameter.

Since this is given as a percentage, the value 1000% for instance is equivalent to a multiplication by 10. See "4.3.6 Gain and Offset Calculation With Analog Values" on page 4-20.

Output Q is set to 1 if this value exceeds the on threshold (SW ↑).

Q is reset to 0 again after the value reaches or drops below the off threshold (SW ↓).

Configuration of the Par Parameter

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

Parameter assignment:

```
B03:Par
SW↑ =+00000◄──────── on threshold
SW↓ =+00000◄──────── off threshold
                      Gain in %
↕     =0050+◄──────── Parameter protection
```

Press the ▶ key

```
SW↑ =+00000
SW↓ =+00000
↕     =0050+
↑     =+200◄──────── Offset
```

Display in parameter assignment mode (example):

```
B02:Par
SW↑ =+400
SW↓ =+200
Ax  =+20
```
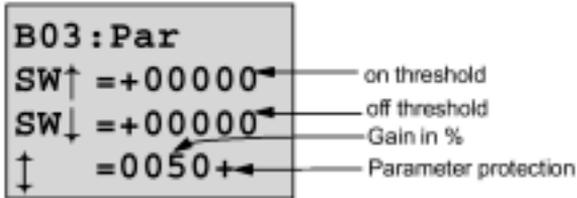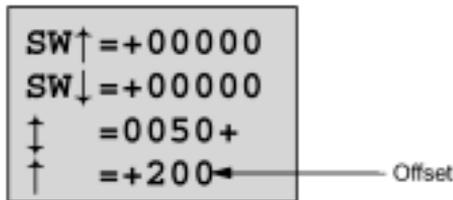
4.4.18 Analog Comparator

Description

The output is switched on if the difference Ax - Ay exceeds the set threshold.

Symbol in IDEC SmartRelay	Wiring	Description
Ax Ay Par ⊿A Q	Inputs Ax and Ay	At the inputs Ax and Ay, apply the analog signals for which you want to evaluate the difference. **Use the terminals I7 (AI1) and I8 (AI2), only the FL1B-H12RCE/B12RCE and FL1B-H12SND or those of an analog module.**
	Parameter Par: $\updownarrow$, $\uparrow$, $\triangle$	$\updownarrow$: Gain in % range of values 0..1000% $\uparrow$: Offset **range of values ±999** $\triangle$ **: threshold**
	Output Q	Q is set to 1 if the difference Ax-Ay exceeds the threshold.

Gain and Offset Parameters

Note the information relating to the gain and offset parameters in "4.3.6 Gain and Offset Calculation With Analog Values" on page 4-20.

Timing Diagram
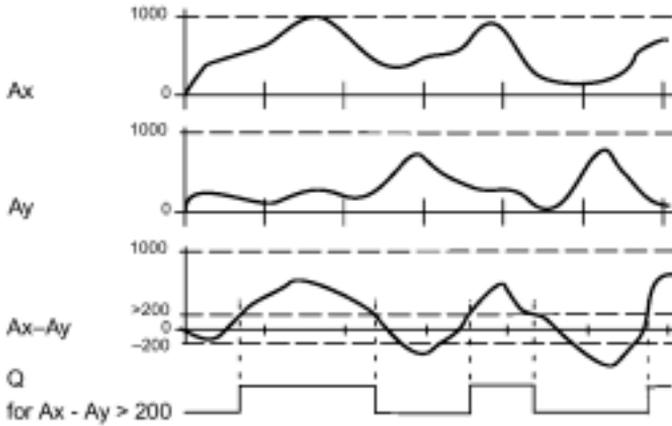
Function Description

The analog comparator function carries out the following calculations:

1. The value configured in the offset parameter is added to Ax and Ay.

2. Ax and Ay are multiplied by the gain parameter. Since this is given as a percentage, the value 1000% for instance is equivalent to a multiplication by 10.

3. The function forms the difference of the analog values Ax-Ay

Output Q to 1 if this differential value exceeds the threshold you have configured under r. Otherwise Q is reset to 0.

Calculation Guidelines

Q = 1, if:

$[(Ax + offset) \cdot gain] - [(Ay + offset) \cdot gain] > threshold$

Configuration of the Par Parameter

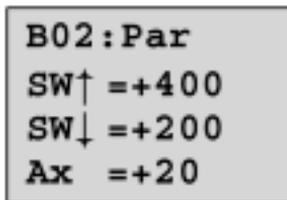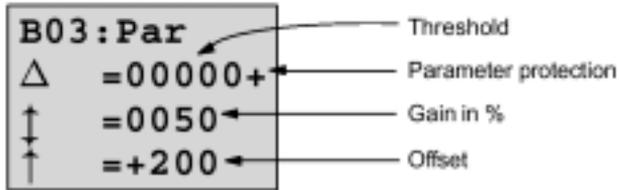The gain and offset parameters are used to adapt the used sensors to the respective application.

```
B03:Par            ─────── Threshold
△    =00000+  ◄──── Parameter protection
↕    =0050  ◄─────── Gain in %
↑    =+200  ◄─────── Offset
```

Example

• For the controls of a heater, the supply and return line temperatures T_v (e.g. with a sensor at AI1) and T_r (e.g. with a sensor at AI2) are to be compared.
• A switching operation is to be triggered (e.g. burner on) if the return line temperature deviates by more than 15 °C from the supply line temperature.
• The physical temperature is to be displayed in parameter assignment mode.
• Available are thermal elements with the following technical data: -30 to +70°C, 0 to 10 V DC.

Application	Internal Mapping
-30 to +70° C = 0 to 10V DC	0 to 1000
0° C	300 → Offset = -300
Range of values: -30 to +70∞C = 100	1000 → Gain = 100/1000 = 0,1 = 10%
Switching threshold = 15°C	Threshold = 15

See also "4.3.6 Gain and Offset Calculation With Analog Values" on page 4-20.

Parameter assignment:

```
B03:Par
△    =00015
↕    =0010+
↑    =-300
```

Display in parameter assignment mode (example):

```
B03:Par          B03:Par
△   = 20         △   = 30
Ax  = 10         Ax  = 10
Ay  = 30         Ay  =- 20
```

4.4.19 Stairwell Light Switch

Description

The input pulse (edge control) starts a specified time. The output is reset on expiration of this time. 15 s prior to the expiration of this time an off warning is generated.

Symbol in IDEC SmartRelay	Wiring	Description
	Input Trg	Use the input Trg (Trigger) to start the timer for the stairway lighting switch (off delay).
Trg T Q	Parameter T	T is the time after which the output is switched off (1 to 0 transition of the output status). **Default timebase is the minute.**
	Output Q	On expiration of the time T Q is switched off. 15 s prior to the expiration of this time the output is switched to 0 fro the duration of 1 s.

Parameter T

Note the value specifications in "4.3.2 Time Response" on page 4-18.

Timing Diagram
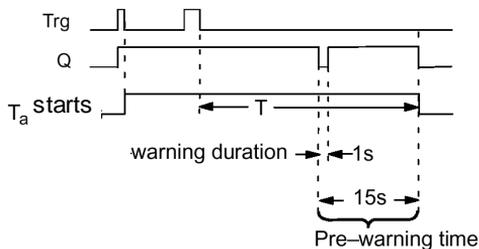
Function Description

- The output Q is set to 1 on a 0 to 1 transition at input Trg. At the 1 to 0 transition of the status at input Trg the current time T_a starts. The output Q remains set.
- 15 s before T_a reaches the time T the output Q is reset to 0 for a time of 1 s.
- When T_a = T, the output Q is reset to 0.
- When input Trg is switched on and off again while T_a expires, T_a is reset (retriggering option).
- The time elapsed is reset after a power failure.

How to Change the Timebase

You can also set other values for the warning time and warning period.

Timebase T	Pre-warning time	Pre-warning duration
Seconds*	750 ms	50 ms
minutes	15 s	1 s
hours	15 min	1 min

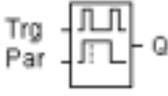*Only feasible for programs with a cycle time < 25 ms

For more information see the Appendix "B. Determining the Cycle Time" on page Appendix-9.

4.4.20 Dual-Function Switch
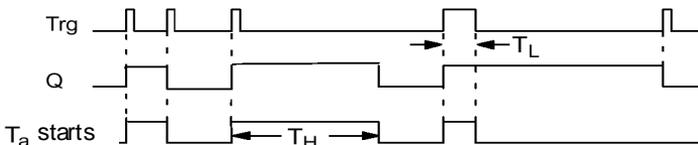
Description

Switch with two different functions:

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

Symbol in IDEC SmartRelay	Wiring	Description
Trg — ⎍⎍⎍ — Q Par —	Input Trg	Use input Trg (Trigger) to switch on the output Q (off delay or continuous lighting). The active output Q can be reset with Trg.
	Parameter Par	T_H is the time after which the output is switched off (1 to 0 transition of the output status). **T_L is the period during which the input must be set in order to enable the continuous lighting function.**
	Output Q	The output Q is switched on with Trg. Depending on the pulse width at the input Trg, it is switched off again on expiration of a specified time, or reset by setting Trg once again.

Parameter T_H and T_L

Note the value specifications in "4.3.1 Input Designation" on page 4-16 (as a reminder: "Always specify a time $T \geq 0.10$ s. The time T is not defined for T = 0.05 s and T= 0.00 s")

Timing Diagram

Function Description

The current time T_a starts and the output Q is set to 1 at the 0 to 1 transition of the status at input Trg.

When T_a reaches the time T_H, the output Q is reset to 0.

The elapsed time is reset after a power failure.

At the 0 to 1 transition of the status at input Trg and if the status "1" is set at least for the duration of the time T_L, the continuous lighting function is enabled and output Q is switched on continuously.

If the input is switched once again, Trg resets T_H nevertheless and the output Q is switched off.

4.4.21 Message Texts

Description

Displaying a specified message text in RUN mode.
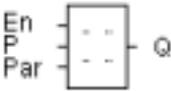
Symbol in IDEC SmartRelay	Wiring	Description
	Input En	The 0 to 1 transition of the status at input En (Enable) starts the output of the message text.
En P Par — Q	Parameter P	P represents the priority of the message text. **Quit: Acknowledgment of the message text.**
	Parameter Par	Par is the text for the message output.
	Output Q	Q is set as long as the message text is displayed.

Restriction

A maximum of five message text functions are possible.

Function Description

• On 0 to 1 transition of the status at input En the display shows in RUN mode your specified message text.
• Acknowledgment disabled (Quit = Off):
• On 1 to 0 transition of the status at input En the message text is hidden.
• Acknowledgment enabled (Quit = On):
• On a 1 to 0 transition of the status at input En, the message text is held until acknowledged with OK. When En is 1, you cannot acknowledge the message text.
• When multiple message text functions are triggered with En=1, the message text with the highest priority is shown (0=lowest, 9=highest).
• You can toggle between the standard display and the message text display using the ▲ or ▼ keys.
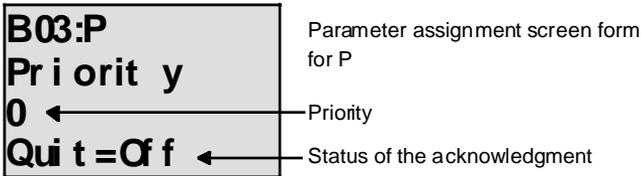
Example

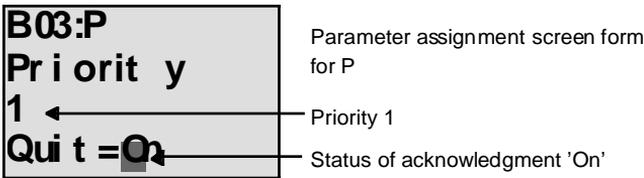This is how the message text might be displayed:

En=1

```
Motor 2
3000
hours
MAINTENANCE!
```

▲
▼

```
Th 09:30
06.21.01
```

Parameter Assignment Screen Form

This is how to configure the priority and the acknowledgment:

```
B03:P
Priority
0
Quit=Off
```

Parameter assignment screen form for P

Priority

Status of the acknowledgment

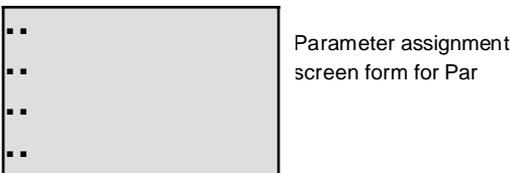1. Increase priority to 1:   Cursor on "0" + ▲

2. Change to "Quit":   Press the ▶ key

3. Enable "Quit":   use ▲ or ▼

IDEC SmartRelay displays:

```
B03:P
Priority
1
Quit=On
```

Parameter assignment screen form for P

Priority 1

Status of acknowledgment 'On'

4. Confirm messages with OK

This is how to configure the message text

```
..
..
..
..
```

Parameter assignment screen form for Par

Using the ▸ key, select the row for the message text.
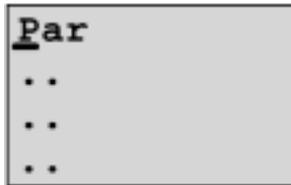
Confirm with OK to open the editing mode for this line.

Use the ▲ or ▼ keys to select the letter to be displayed. Move the cursor from one position to the other, using the ◂ or ▸ keys.

The list of available characters is the same as for the program name. You can find a list of the available characters in "3.6.4 Assigning a Program Name" on page 3-21.

Confirm the changes with OK. Exit the editing mode with ESC.

In order to output a parameter (e.g.: the display of a measurement or function value) as message text in a line, select this line with the ▸ key and then press the ▼ key:

```
Par
 . .
 . .
 . .
```

Confirm with OK to open editing mode:

```
B01>T
```

Use the ◂ or ▸ keys to select the blocks to be displayed and their corresponding parameters.

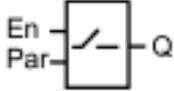Use the ▲ or ▼ keys to select the block or the parameter you want to view.

Select the parameter with OK.

Exit parameter assignment mode with ESC. Your changes are applied.

4.4.22 Softkey

Description

This logical function has the effect of a mechanical momentary switch or of a switch.

Symbol in IDEC SmartRelay	Wiring	Description
En —⌐/—Q Par—	Input En	On a 0 to 1 transition of the status at input En (Enable) the output Q is switched on, provided "Switch=On" was confirmed in parameter assignment mode.
	Parameter Par	Par gives you the option to use the function as momentary pushbutton in one cycle or to use it as switch. Ret: off = no retentivity on = the status can be saved retentive In RUN mode: Switch: switches the pushbutton or switch on or off.
	Output Q	Switches on if En=1 and if Switch=On was confirmed with OK.

Factory Default

The factory default setting of "Par" is "Pushbutton".

Timing Diagram
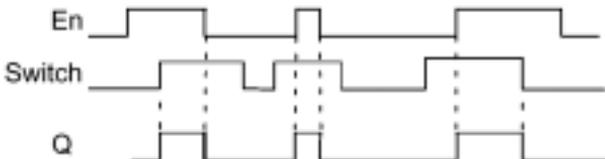
Function Description

• The output is switched on after input En is set and, in parameter assignment mode, if "On" is selected in the parameter "Switch" "On" and confirmed with OK. The function can be configured as either a pushbutton or a switch.

• The output is reset to "0" at three events:

1.   At the 0 to 1 transition of the status at input En.

2.   When the function was configured as a pushbutton and one cycle has elapsed since it was switched on.

3.   When the position "Off" was selected in the parameter "Switch" and confirmed with OK in parameter assignment mode.

Configuration of the Par Parameter

In programming mode:

1.   Select the "Softkey" 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")

The function is configured as 'pushbutton'

The status is not retentive
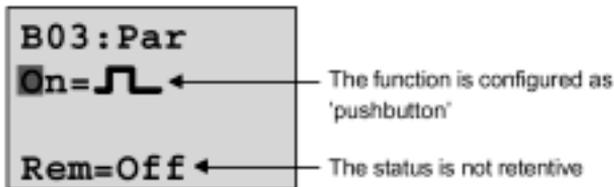
This is how to change "Par" to "Switch" and activate retentivity (Ret=On):

4.   Toggling between the "Pushbutton" and "Switch" function:
     use ▲ or ▼

Function as 'Switch'

The status is not retentive
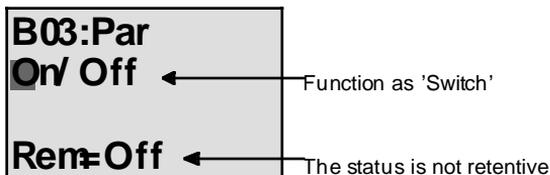
5. Change to retentivity: use ▲ or ▼

6. Enable retentivity: use ▲ or ▼

```
B03:Par
On/ Off          ◄────────── Function as 'Switch'


Rem=On           ◄────────── The status is retentive
```

7. Confirm your entries with OK

In Parameter Assignment Mode (RUN mode):

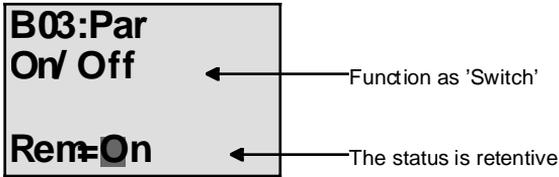Here, you can switch the parameter "Switch" on and off (On/Off). In RUN mode IDEC SmartRelay displays:

```
B03:Par
Switch=Off
```
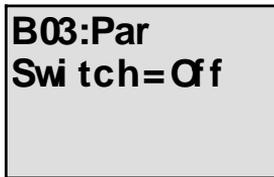
Let us assume you want to activate "Switch" (On).

1. Change into editing mode: Confirm with OK
    (the cursor is now positioned to "Off")

2. Change from "Off" to "On": use ▲ or ▼

3. Confirm your entries with OK

```
B03:Par
Switch=On
```
The switch is On
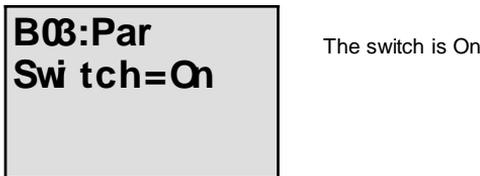
5 Configuring IDEC SmartRelay

"Parameter assignment" is the configuration of block parameters. You can set delay times for time functions, switching times for the timer switches, the threshold value of a counter, the monitoring interval of an operating hours counter and the on and off thresholds of the triggers.

You can configure the parameters:

- In programming mode
- In parameter assignment mode

In parameter assignment mode, the programmer configures the parameters.

Parameter assignment mode allows editing of the parameters without having to change the program. As a result, a user can edit parameters without having to switch to programming mode. The advantage: The program (and thus the circuit) is protected but can still be modified to suit requirements.

Note
In parameter assignment mode, the IDEC SmartRelay continues processing of the program.

5.1 Switching To Parameter Assignment Mode

In RUN mode, you can switch to parameter assignment mode by pressing the ESC key:

```
Mo 09:30        ...and press ESC
06.21.01
```
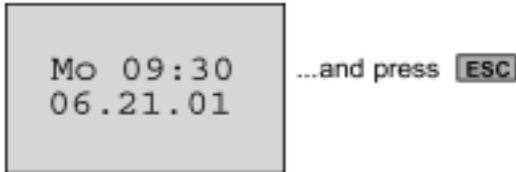
The IDEC SmartRelay switches to parameter assignment mode and displays Parameter assignment menu:

```
>Stop
 Set Param
 Set Clock
 Prg Name
```

5.1.1 Menu Options in Parameter Assignment Mode

Stop

You are going to use this menu item to stop your program and, as a result, open the main menu in programming mode. Proceed as follows:
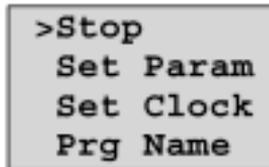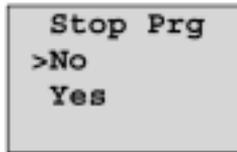
1. Move the ">" character to "Stop": use ▲ or ▼

2. Confirm the "Stop":　　　OK

```
 Stop Prg
>No
 Yes
```

3. Move the ">" character to "Yes": use ▲ or ▼

4. Confirm "Yes":　　　　OK

IDEC SmartRelay returns to the main menu:

```
>Program..
 PC/Card..
 Clock..
 Start
```
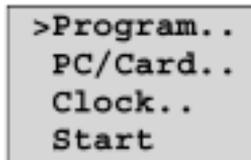
Set Param

The diverse parameters are described in the following Chapters "5.1.1 Menu Options in Parameter Assignment Mode" on page 5-3. to "5.1.3 Selecting the Parameters" on page 5-5.

Set Clock

The menu item "Set Clock" is only executed in a IDEC SmartRelay equipped with a clock (FL1B-*12RC*). In "Set Clock" you can set the internal clock of the IDEC SmartRelay. For more information, see "5.2 Setting the Time-of-Day and the Date (FL1B-*12RC*)" on page 5-9.

Prg Name

Under this menu item you can only read your program name. In parameter assignment mode it is not possible to change the program name.

5.1.2 Parameter

Parameters are:

- The delay times of a timer relay.
- The switching times (cams) of a timer switch.
- The threshold value of a counter.
- The monitoring time for an operating hours counter.
- The switching thresholds of a threshold switch.

Each one of the parameters is identified by its block number and mnemonics. Examples:

B01:T

Block number ↗   ↖ Mnemonic

- T: ...is a configurable time.
- No 1: ...is the first cam of a timer switch.
- Par: ...denotes multiple counter parameters that can be monitored.

5.1.3 Selecting the Parameters

Select a parameter:

1. In the parameter assignment menu using "Set Param" option
   Use ▲ or ▼ key

```
   STOP
  >Set Param
   Set Clock
   Prg Name
```

2. Press OK
   IDEC SmartRelay displays the first parameter. If the parameters can-
   not be set, you can use ESC to return to the parameter assignment
   menu.

```
B01:T
T = 12:00m        ← Value set for the parameter
Ta = 00:00m       ← the current time in the IDEC SmartRelay
```

Parameter

```
No Para m
Pr ess E SC
```

Parameters cannot be changed:
ESC returns you to the parameter
assignment menu

3. Now, Select the desired parameter:
   Use ▲ or ▼ key
   IDEC SmartRelay displays the parameter in separate windows.

4. If you want to edit a parameter, select it and press OK.

5.1.4 Changing the Parameters

To change a parameter, you first have to select it (see "5.1.3 Selecting the Parameters" on page 5-5).

You change the value of the parameter in the same way as you entered it in programming mode:

1. Move the cursor to the point at which you want to make the change: use ▲ or ▼

2. Change the value: use ▲ or ▼

3. Confirm the value: OK
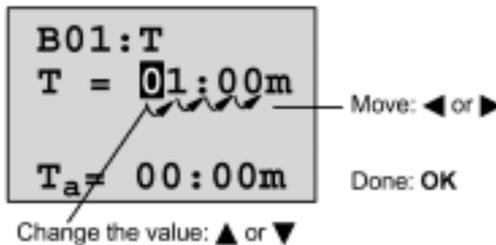
Note

In parameter assignment mode, you cannot change the unit of the delay time or the parameter protection for the parameter T. This is only possible in programming mode.

Current Value of Time T

If you view a time T in parameter assignment mode, it will look like this:

```
B01:T
T = 12:00m ——— Set time T

Ta = 00:00m ——— Current time Ta
```

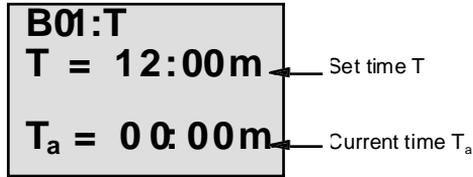You can change the set time T (see "5.1.4 Changing the Parameters" on page 5-6).

Current Value of the Seven-Day Timer Switch

If you view a timer switch cam in parameter assignment mode, it looks like this:

```
B02:No    1
Day = Su
On =09:00
Off=10:00
```

The circuit state of the timer switch is displayed:

0 The timer switch is off (status '0' at the output)

1 The timer switch is on (status '1' at the output)
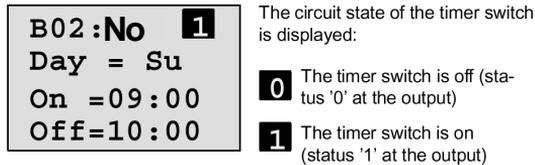
IDEC SmartRelay displays the circuit state of the timer switch rather than the circuit state of a cam. The circuit state of the timer switch depends on all three cams (Cam 1, Cam 2 and Cam 3).

Current Value of a Counter

If you view the parameter of a counter in parameter assignment mode, it looks like this:

```
B03:Par
Lim=00300 ——— Switching threshold

Cnt=00028 ——— Current count value
```
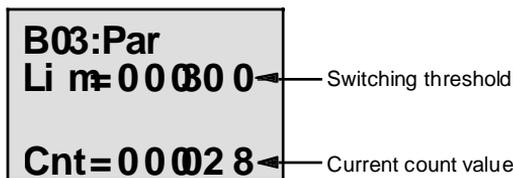
Current value of an Operating Hours Counter

If you view the parameter of an operating hours counter in parameter assignment mode, it looks like this:

```
B05:Par
MI  =  0100h  ◄────── Monitoring time
MN =  0017h  ◄────── time-to-go
OT = 0 0 8 3 h ◄───── Operating hours elapsed
```
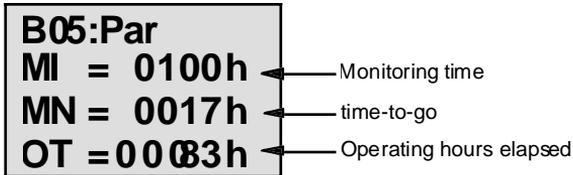
Current value of a Analog Trigger

If you view the parameter of a threshold switch in parameter assignment mode, it looks like this:

```
B06:Par
SW _          ◄────── On threshold
SW _          ◄────── Off threshold
fa   = 0 0 1 2 ◄────── Measured value
```
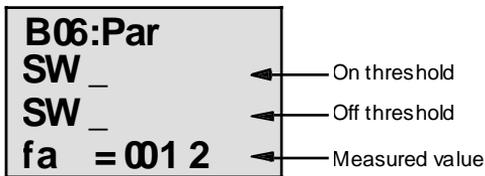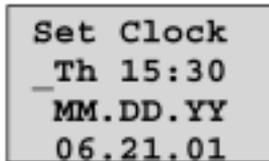
5.2 Setting the Time-of-Day and the Date (FL1B-*12RC*)

You can set the TOD and the date

- In parameter assignment mode
- In programming mode.

Set the TOD and Date in Parameter Assignment Mode

1. Open the parameter assignment mode (refer to Chapter 5.1 "Configuring IDEC SmartRelay" on page 5-1)

2. Select "Set Clock" (▲ or ▼ key) and press OK.

```
Set Clock
_Th 15:30
 MM.DD.YY
 06.21.01
```

The cursor position precedes the day of the week.

3. Select the day of the week: use ▲ or ▼

4. Move the cursor to the next position:

                        use ▲ or ▼

5. Change the value: use ▲ or ▼

6. Set the correct TOD. Repeat steps 4 and 5.

7. Set the correct date. Repeat steps 4 and 5

8. Confirm your entries: OK

Set the TOD and Date in Programming Mode:

1. Switch to programming mode: In RUN, execute the menu item "Stop".

2. Select "Clock.." (▲ or ▼) and press OK.

3. Select "Set Clock" (▲ or ▼) and press OK

Now you can set the day of the week and the time, as described in step 3 above.

6 IDEC SmartRelay Program Modules

In IDEC SmartRelay you can only have one program stored in memory at a time. If you want to modify the program or write another program without deleting the first one, you must archive it. You can use program modules/cards to do this.

You can copy the program stored in the IDEC SmartRelay to a program module/card. You can then insert the program module/card in another IDEC SmartRelay and transfer the program to this IDEC SmartRelay. You can use the program module/card to do the following:

- archive programs
- duplicate programs
- transport programs
- write and test programs out of the office and then transfer it to a IDEC SmartRelay in a switching cabinet

IDEC SmartRelay is supplied with a cover. You can order the program module/card separately.

> Note
> *It is not necessary to have a module to store your IDEC SmartRelay program.*
>
> *The IDEC SmartRelay program is automatically stored when programming mode is closed.*

Below we shall introduce the two modules that you can purchase for your IDEC SmartRelay. Both of them can accommodate the entire program memory of a IDEC SmartRelay.

Module	Type No.
Yellow module: for copying	FL1A-PM1
Red module: with know-how/copy protection	FL1A-PM2

6.1 Overview of the Modules

Yellow Program Module

- Programs can be transferred from the yellow module to the device and vice versa.

Red Program Module

- A program is protected if it is transferred from a red module to the IDEC SmartRelay.

- Such a protected program can only run if the red module remains inserted in IDEC SmartRelay during runtime.

- A protected program cannot be edited.

- A program is not protected anymore when the correct password is entered.

- If you create a program for the red module and want to edit it at a later time you must assign it a password.

Compatibility

- FL1B devices:
  A module written in one of the basic models (FL1B devices) can be read in all other basic models.

- FL1B devices --> FL1A devices:
  A module written in one of the basic models (FL1B devices) can only be read in FL1B devices.

Upward Compatibility

- The new FL1B devices support upward compatibility.

- A module written in one of the standard models (FL1A devices) can be read in all basic models (FL1B devices).

Note

Upward compatibility: An adaptation of the program or an upgrade of the IDEC SmartRelay Basic is required in some cases in order to achieve appropriate results. For more information see "Fast inputs" in "2.3.2 Connecting IDEC SmartRelay Inputs" on page 2-13.

6.2 Removing and Inserting Modules

When removing a red module (know-how/copy protection), note that: The program stored on this module can only run if the module remains inserted during runtime.

If the module is removed the IDEC SmartRelay reports a "No program" error. Removal of the red module during runtime leads to impermissible operate states.

Always heed the following warning:

⚠ Warning

Do not put your finger or objects made of metal or any other conductive material in the open slot of the memory cartridge.

The socket for the memory cartridge may be live if L1 and N have been incorrectly wired.

The memory cartridge must always be replaced by a skilled technician.

Removing the Module

To remove the memory cartridge:
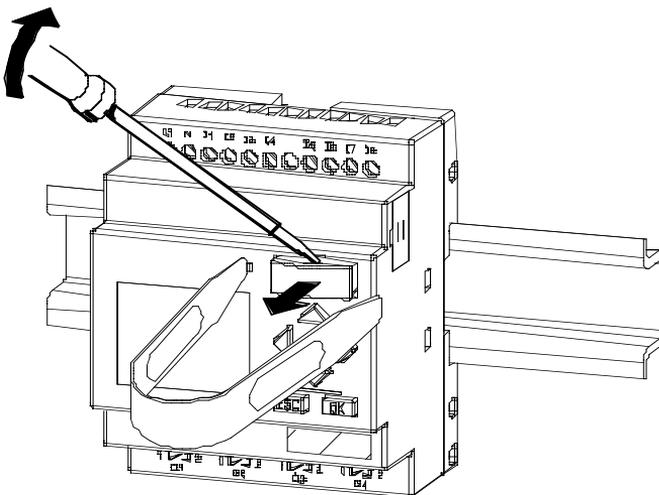
1. Carefully insert a screwdriver into the slot at the upper end of the memory cartridge, and ease it out of the slot a little.

2. Hold the memory cartridge at both sides using the memory cartridge removal tool (MT-101), and pull the memory cartridge straight out.

Note
When removing the memory cartridge, use the memory cartridge removal tool (MT-101), otherwise the connector may be damaged.

Inserting the Memory Cartridge

The slot for the memory cartridge is chamfered at the lower right edge. The memory cartridge also has a chamfered edge. This prevents you from inserting the memory cartridge the wrong way around. Insert the memory cartridge into the slot until it engages.

# 6.3 Copying from the IDEC SmartRelay to the Module

To copy a program to the program module/card:

1. Insert the program module/card into the slot.

2. Switch the IDEC SmartRelay to programming mode. In RUN

mode: Press ESC and execute the menu item "Stop".

> **>Program..**
> **PC/Card..**
> **Clock..**
> **Start**
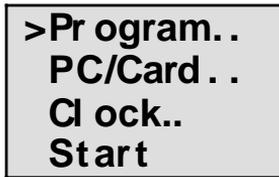
IDEC SmartRelay main menu

3. Move the ">" to "PC/Card": Press the ▼ key

4. Press OK. The transfer menu opens.

> **>PC↔■♦**
> **■♦→Card**
> **Card→■♦**
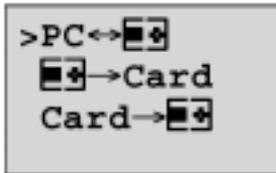
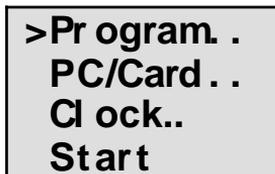**■♦** ‚**IDEC SmartRelay**

5. Move the ">" to " IDEC SmartRelay → Card": Press the ▼ key

6. Press OK.

IDEC SmartRelay copies the program to the program module/card.

When IDEC SmartRelay has finished copying, it automatically returns to the main menu:

> **>Program..**
> **PC/Card..**
> **Clock..**
> **Start**

The program is now also stored on the program module/ card. You can now remove the program module/card: Do not forget to replace the cover.

If power is lost while IDEC SmartRelay is copying the program you must copy it again when power is restored.

Note
If the program in the IDEC SmartRelay is protected with a password, the copied program in the module/card is also protected with the same password.

6.4 Copying from the Module to IDEC SmartRelay

You have a program module/card containing your program. You can copy the program to IDEC SmartRelay in two ways:

- Automatic copying when IDEC SmartRelay starts up (POWER ON) or
- via the PC/Card menu in IDEC SmartRelay.

Note

If the program in the module/Card is protected with the password X, the copied program in the IDEC SmartRelay is also protected with the same password.

Before you copy a module written in another device type, refer once again to the information on "Compatibility of IDEC SmartRelay models or devices" in "6.1 Overview of the Modules" on page 6-2.

Automatic Copying when IDEC SmartRelay Starts Up:

1. Switch off the power supply to the IDEC SmartRelay (POWER OFF)
2. Remove the slot cover.
3. Insert the program module/card into the appropriate slot.
4. Switch off the power supply to the IDEC SmartRelay.

IDEC SmartRelay copies the program from the program module/card to IDEC SmartRelay. When IDEC SmartRelay has finished copying, it displays the main menu:

```
>Program..
 PC/Card..
 Clock..
 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 possible hazard.
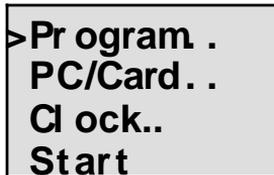
1. Move the ">" character to Start: use ▲ or ▼

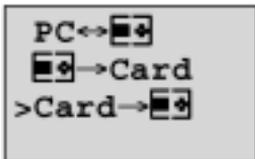2. Press OK.

Using the PC/Card Menu to Copy

Read the note about changing the program module/card.

This is how you copy a program from the program module/card to IDEC SmartRelay:

1. Insert the program module/card

2. Switch the IDEC SmartRelay to programming mode. In RUN mode: Press ESC execute the menu item "Stop".

```
>Program..
 PC/Card..
 Clock..
 Start
```

3. Move the ">" to "PC/Card": Press the ▼ key

4. Press OK. The transfer menu opens.

5. Move the ">" to "Card → IDEC SmartRelay": ▲ or ▼

```
 PC↔■✦
 ■✦→Card
>Card→■✦
```

■✦ = **IDEC SmartRelay**

6. Press OK.

IDEC SmartRelay copies the program from the program module/card to IDEC SmartRelay. When IDEC SmartRelay has finished copying, it automatically returns to the main menu.

7 IDEC SmartRelay Software

The WindLGC software is available as a programming package for the PC. This software includes the following features:

- Offline program generation for your application

- Simulation of your circuit (or program) on the computer

- Generation and printing of a block diagram

- Saving the program to the hard disk or other storage media

- Program transfer
  -from the IDEC SmartRelay to the PC
  -From the PC to IDEC SmartRelay

- Reading the operating hours counter

- Setting the TOD

- Daylight Savings Time (summertime/wintertime conversion)

The IDEC SmartRelay Alternative

WindLGC software offers you an alternative to conventional means of programming:

1. First you develop your applications at your desktop.

2. You simulate the application in your computer and test whether or not it functions properly before the circuit is actually put to use.

3. You print out the entire circuit in one or several block diagrams, sorted according to outputs.

4. You archive your circuits in your PC file system. In this way you can retrieve a circuit directly for future changes.

5. You transfer the program to IDEC SmartRelay at a touch with just a few key operations. Your IDEC SmartRelay is quickly retooled.

WindLGC

In WindLGC you can create your circuit programs easily and efficiently ("wiring per keyboard"). Programs are created on the PC desktop using the "drag & drop" function. Once you have created your program, you can have the system evaluate the program in order to determine the required IDEC SmartRelay model, or you can determine this before you start programming.

One particularly user-friendly feature is the offline program simulation function. This allows the simultaneous status display of multiple special functions and permits extensive documentation of the programs created. This optional programming software also offers a comprehensive Online Help on CD ROM.

WindLGC runs under Windows 95/98, Windows NT 4.0, Windows Me, Windows 2000. It is capable of server operation.

WindLGC V3.0

This is the current version of WindLGC. In Version 3.0 you will find all the function and functionality included in the new devices, exactly the way they are described in this manual.

Upgrades & Info

At *smart.idec.com*, you can download software upgrades and demo versions free of cost.

7.1 Connecting the IDEC SmartRelay to a PC

Connecting a PC Cable

To connect the IDEC SmartRelay to a PC you require the IDEC SmartRelay-to-PC link (order part number FL1A-PC1).

Remove the cover or the program module/Card of your IDEC SmartRelay and connect the cable. Connect the other end of the cable to the serial port of your PC.
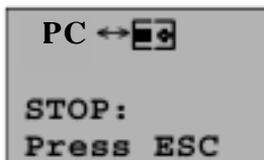
IDEC SmartRelay to PC - PC↔IDEC SmartRelay Mode

There are two ways of communication between the PC and the IDEC SmartRelay. IDEC SmartRelay to transfer mode in RUN state or automatically when the IDEC SmartRelay power supply is switched on, provided the link is plugged in.

To Switch the IDEC SmartRelay to the PC↔ IDEC SmartRelay mode:

1. Switch the IDEC SmartRelay to programming mode: In RUN mode, press ESC and execute the menu item "Stop".

2. Select "PC/Card":   use ▲ or ▼

3. Confirm with OK

4. Select "PC↔ IDEC SmartRelay": use ▲ or ▼

5. Confirm with OK

IDEC SmartRelay is now in PC↔ IDEC SmartRelay and displays:

■✛ = **IDEC SmartRelay**

To Automatically Switch IDEC SmartRelay to PC↔ IDEC SmartRelay Mode:

1. Switch off the power supply to IDEC SmartRelay

2. Remove the cover or the program module/card and connect the cable.

3. Switch on power.

IDEC SmartRelay switches automatically to PC↔ IDEC SmartRelay mode.

The PC can now communicate with the IDEC SmartRelay.

Use the ESC key on the IDEC SmartRelay if you want to interrupt the PC communication.

Note

If the program you have created in WindLGC is password protected, the "PC→IDEC SmartRelay" function transfers the program and the password to the IDEC SmartRelay. The password prompt is switched on when the device exits the transfer mode.

The upload of a password protected program created in IDEC SmartRelay is only possible after the correct password is entered in WindLGC.

When disconnecting the PC cable from IDEC SmartRelay, pull the cable straight out so the connector will not be damaged.

8 Applications

We have provided a small collection of applications in this manual to give you an idea of the versatility of the IDEC SmartRelay. For these examples we have shown the circuit diagram of both the original solution and the IDEC SmartRelay solution.

You will find solutions for the following tasks:

- Staircase or corridor lighting system
- Automatic door
- Ventilation system
- Industrial gate
- Central controlling and monitoring of several industrial gates
- Luminous rows
- Rainwater pump
- Other applications

Note
The following IDEC SmartRelay applications are available to all our customers.They are examples only and are not binding in any way.They are included to provide general information on the types of applications that a re possible with an IDEC SmartRelay. Customer specific solutions may be different.

The user must ensure proper operation of the system.We refer to the standards and system related installation regulations of your respective country.

We reserve the right to make changes to these examples.

8.1 Staircase or Corridor Lighting

8.1.1 Staircase Lighting System Requirements

- When someone is using the staircase, the lighting should be on.
- If no one is in the staircase the lights should be off in order to save energy.

8.1.2 Original Solution

The two conventional options for switching on the lights:

- Pulse relay
- Automatic staircase time switch

The wiring for these two lighting systems is identical.
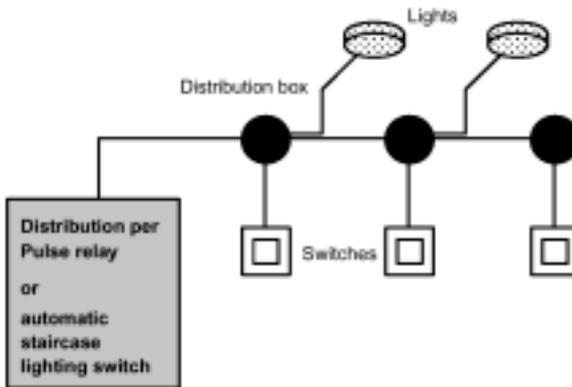
Components Used

- Switches
- Automatic staircase time switch or pulse relay

Lighting system with Current Impulse Relay

Function of a lighting system with current impulse relay:

- Activate any pushbutton: the lighting is switched on
- Activate any of the pushbuttons again: the lighting is switched off.

Disadvantage: Someone can forget to switch off the lights.

Lighting System with Automatic Staircase Time Switch

When an automatic staircase time switch is used, the lighting system behaves as follows:

- Actuate any pushbutton: The lighting is switched on
- On expiration of the preset time the lights switch off automatically.

Disadvantage: The light cannot be switched on for a longer period of time (e.g. when cleaning the staircase). The switch for continuous lighting is usually installed on the automatic staircase time switch that may be difficult or impossible to access.

8.1.3 Lighting System with IDEC SmartRelay

With the IDEC SmartRelay you can replace the automatic staircase time switch or the current impulse relay. You can also implement both functions (timed off delay and current impulse relay) in a single unit. In addition, you can incorporate extra functions without making any modifications to the wiring. Here are some examples:
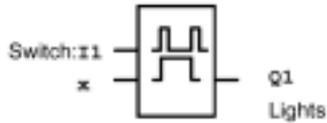
- Current impulse relay with IDEC SmartRelay

- Automatic staircase time switch with IDEC SmartRelay

- Dual-function switch with IDEC SmartRelay
  -Switch light on
  -Switch on continuous lighting
  -Switch light off

Wiring of the Lighting System with FL1B-H12RCC
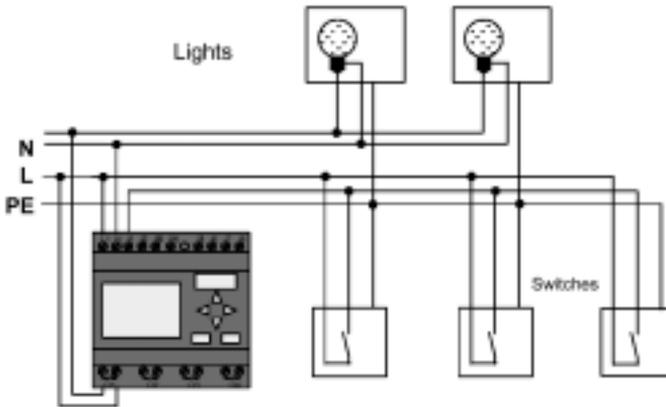
The external wiring of a lighting system with a IDEC SmartRelay is no different than it is for a conventional staircase and corridor lighting system. Only the automatic staircase time switch/ Current impulse relay is replaced. Supplementary functions are entered directly in IDEC SmartRelay.
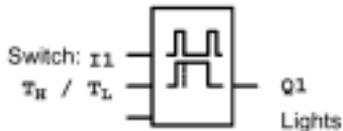
Current Impulse Relay with IDEC SmartRelay

Output Q1 is toggled with a gate pulse at input I1.

Automatic Staircase Time Switch with IDEC SmartRelay
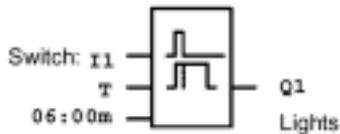
Output Q1 is switched on for the duration of 6 minutes with a gate pulse at input I1.

Dual-Function Switch with IDEC SmartRelay

Output Q1 is switched on for a specified time TH with a gate pulse at input I1.

The continuous lighting function is enabled by holding down the pushbutton for a specified time TL.

8.1.4 Special Features and Expansion Options

Other options for increasing comfort or saving energy are:

- 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 via a daylight control switch
  -Control via integrated timer switch
  (e.g. continuous lighting only until 24.00 h; disabling at specific times)
  -Automatic off for the continuous 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 super-markets, public buildings, banks, hospitals etc.

8.2.1 Automatic Door Requirements

- When somebody approaches the door, it must open automatically.
- The door must remain open until the doorway is clear.
- When the doorway is clear, the door must close automatically within a short time.
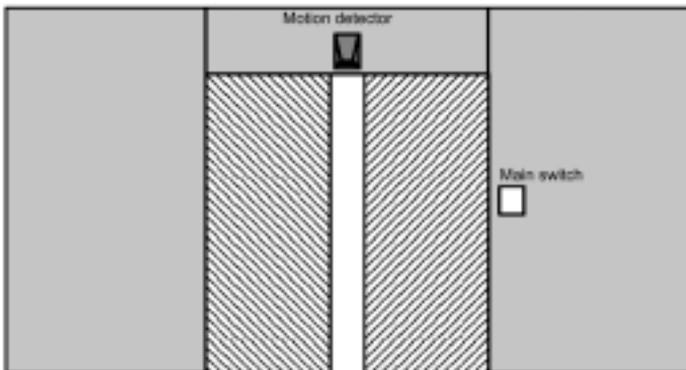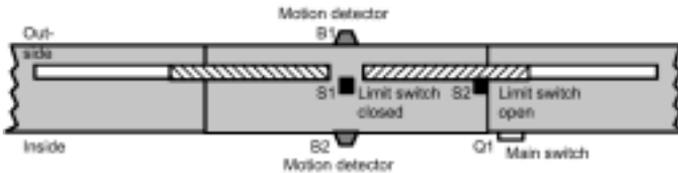
The door is usually motor-driven and equipped with a slip coupling. This prevents people from being trapped and injured. The control system is connected to the mains via a master switch.

8.2.2 Original Solution
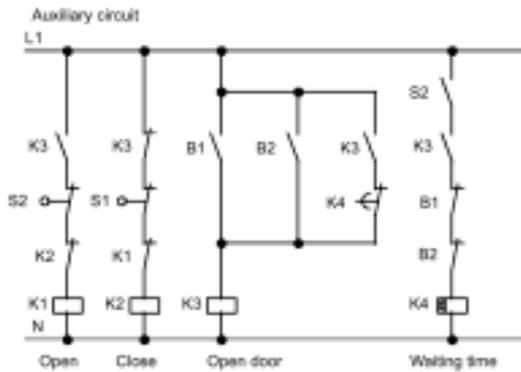
When someone enters the detection range of the motion sensors B1 or B2, the door is opened via K3.

After the detection range of the two motion sensors has been clear for a period, K4 enables the closing motion.

8.2.3 Door Control System with IDEC SmartRelay

With IDEC SmartRelay you can simplify this circuit considerably. Just connect the motion sensors, limit switches and power contactors to the IDEC SmartRelay.

Wiring the door control system with FL1B-H12RCC
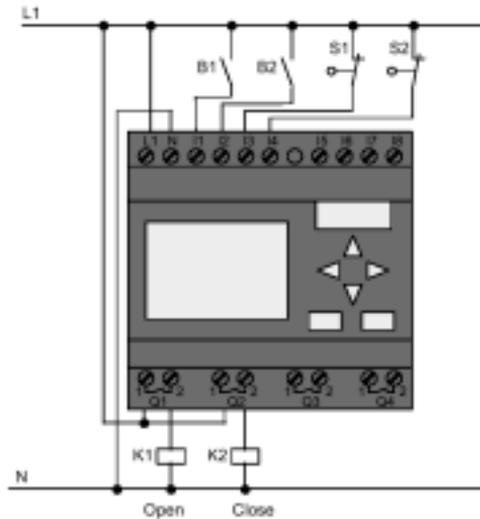
Components Used

- K1　　　　　　　　Main contactor Open
- K2　　　　　　　　Main contactor Close
- S1 (n.c. contact)　Limit switch Closed
- S2 (n.c. contact)　Limit switch Open
- B1 (n.o. contact)　Infrared motion detector outdoor
- B2 (n.o. contact)　Infrared motion detector indoor

Block Diagram of Door Control System with IDEC SmartRelay
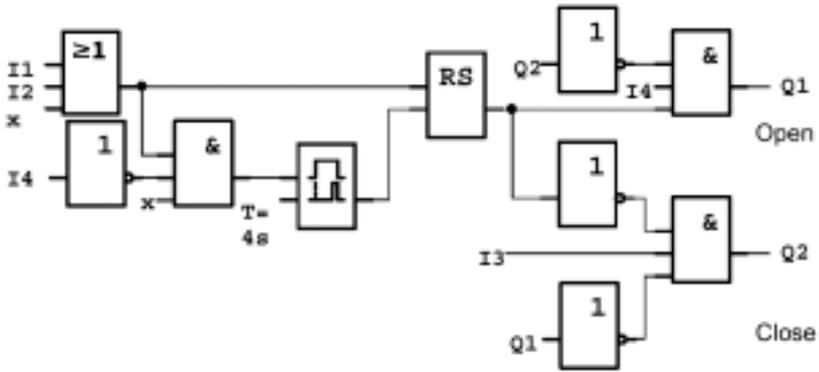
This is what the circuit diagram of the conventional solution looks like.

You can simplify this circuit if you make use of the IDEC SmartRelay functions. You can use the off delay to replace the latching relay and the on delay. The block diagram below illustrates this:
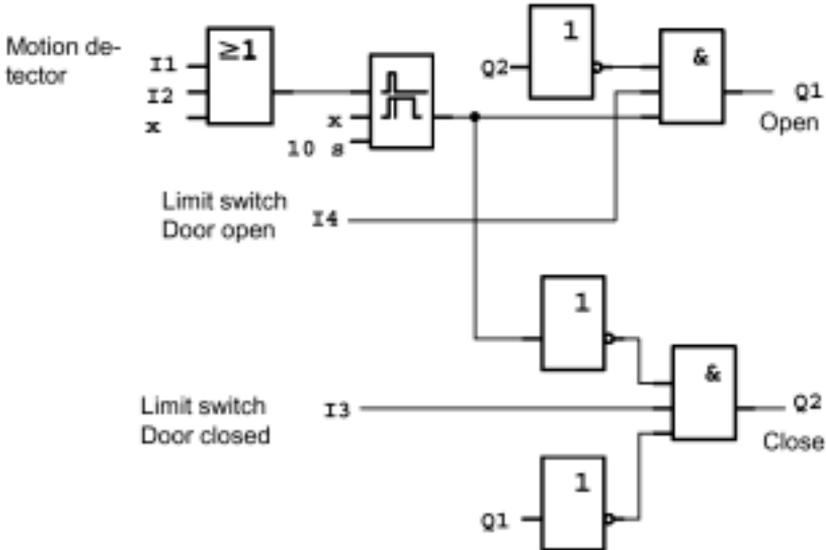
8.2.4 Special Features and Expansion Options

Options for increasing comfort and user friendliness are:

- • 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 door closing.

- • You can implement time and direction dependent enable functions for opening of the door (e.g. opening only during business hours; after business hours to be opened only from inside), etc.

8.2.5 Enhanced Solutions with FL1B-H12RCC

Wiring the IDEC SmartRelay Expansion
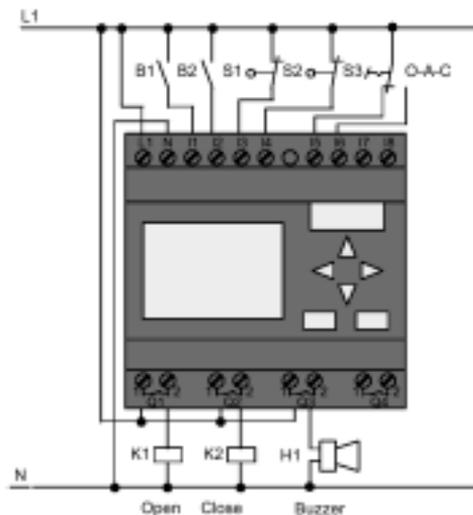
Block Diagram of the Enhanced IDEC SmartRelay Solution

Detecting motion

Cam1:
Day= Mo..Fr
On = 09:00
Off =18:00
Cam 2:
Day= Sa
On = 08:00
Off =13:00

I1
Motion detector B1

T= 10 s

Cam1:
Day= Mo..Fr
On = 09:00
Off =19:00
Cam 2:
Day= Sa
On = 08:00
Off =14:00

I2
Motion detector B2

Motor for opening

Close output   Q2

Limit switch
Door open   I4

Control switch
Door open   I5

Q1
Open

Motor for closing

Limit switch
Door closed   I3

Open output   Q1
Motion detector B1   I1
Motion detector B2   I2

Control switch
Close door   I6

Q2
Close

Detecting Motion

During business hours, the motion detector B1 initiates the opening of the door as soon as somebody wants to enter the shop from outside. Motion detector B2 initiates the opening of the door if 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.

Motor for Opening

Output Q1 is switched on to open the door when the following occurs:

- The control switch at I5 is operated (the door is to be constantly open) or
- The motion detectors indicate that somebody is approaching the door and
- The door is not yet fully open (limit switch at I4).

Motor for Closing

Output Q2 is switched on to close the door when the following occurs:

- The control switch at I6 is operated (the door is to be constantly closed) or
- The motion detectors indicate that there is nobody near the door and
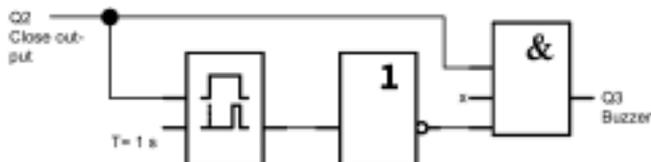- The door is not yet fully closed (limit switch at I3).

Buzzer

Connect the buzzer to output Q3. The buzzer sounds for a short time (in this case 1 second) when the door is closed. Enter the following circuit at Q3 in the block diagram:

8.3 Air Conditioning System

8.3.1 Air Conditioning System Requirements

The air-conditioning system is used to control the supply of fresh air to a room and to exhaust the contaminated air in the room. Let us examine the following example:

- The room is equipped with an exhaust fan and a fresh-air fan.
- Both fans are monitored by a flow sensor.
- The pressure in the room must not be allowed to rise above the atmospheric pressure.
- The fresh-air fan must only be switched on if reliable functioning of the exhaust fan is signaled by the flow sensor.
- A warning lamp indicates if one of the fans fails.

Circuit Diagram for Conventional Solution
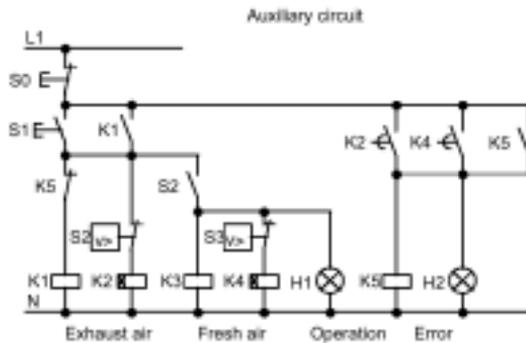

The fans are monitored by flow sensors. If, after a short delay, no air flow is detected, the system is switched off and an error is reported. Acknowledge this by pressing the off pushbutton.

Fan monitoring requires an evaluation circuit with several switching devices in addition to the flow sensors. The evaluation circuit can be replaced by a single IDEC SmartRelay unit.

Wiring the Air Conditioning System With FL1B-H12RCC
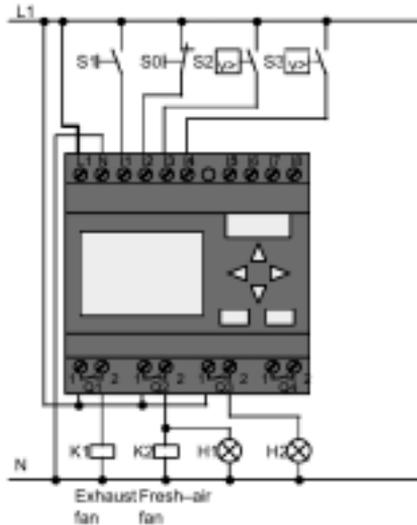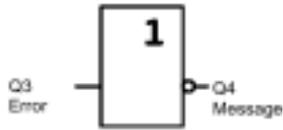

Components Used

- K1   Main contactor
- K2   Main contactor
- S0 (n.c. contact) STOP pushbutton
- S1 (n.o. contact) Start pushbutton
- S2 (n.o. contact) Flow sensor
- S3 (n.o. contact) Flow sensor
- H1   Indicator lamp
- H2   Indicator lamp

Circuit Diagram of the IDEC SmartRelay Solution

8.3.2 Advantages of Using IDEC SmartRelay

When using the IDEC SmartRelay, you require less switchgear. That saves you installation time and space in the control cabinet. You might even be able to use a smaller control cabinet.

Additional Options When Using IDEC SmartRelay

- The free output (Q4) can be used for signaling a fault or a power failure.
- It is possible to switch off of the fans via a sequential circuit.

These functions can be incorporated without additional switchgear.

Block Diagram of the Enhanced IDEC SmartRelay Solution

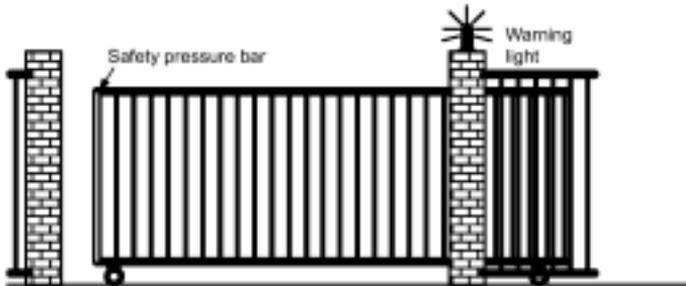The fans at Q1 and Q2 are switched on and off as shown in the following circuit:

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 unless there is a power failure or a fault in the system. This contact can also be used for remote messaging.

8.4 Industrial Gate

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 a gateman.

8.4.1 Gate Control System Requirements

- The gate is opened and closed by operating a pushbutton in the gatehouse. The gateman can monitor the operation of the gate at the same time.

- The gate is normally fully opened or closed. However, the gate motion can be interrupted at any time.

- A flashing light is activated 5 seconds before the gate begins to move and continues for as long as the gate is in motion.

- A safety pressure bar prevents harm to persons and objects from being trapped or injured when the gate closes.

8.4.2 Original Solution

Various kinds of control systems are used to operate automatic gates. The gate control circuit diagram shows one option.
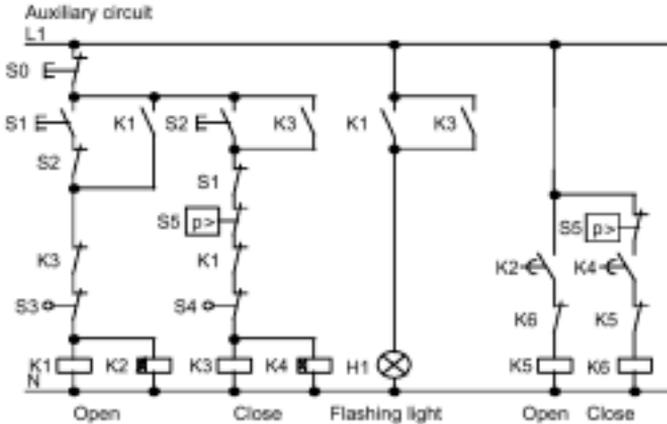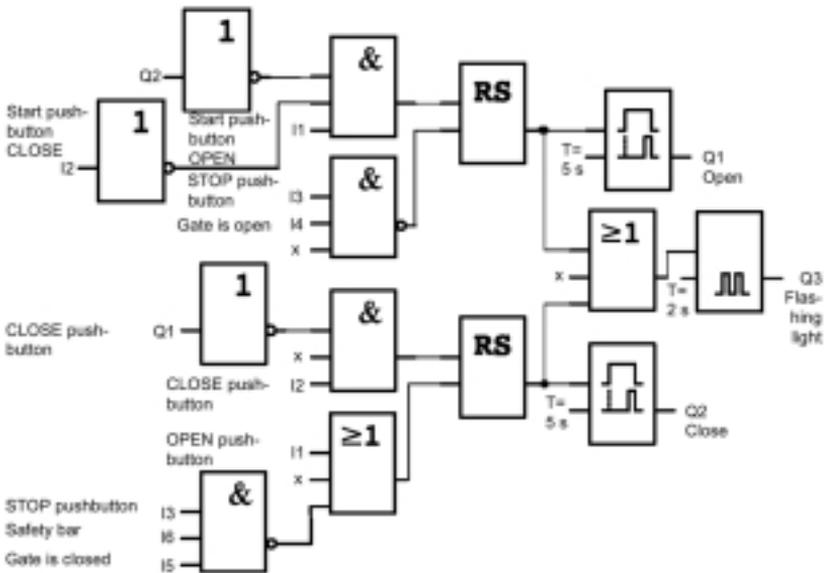

Wiring Gate Controls With FL1B-H12RCC
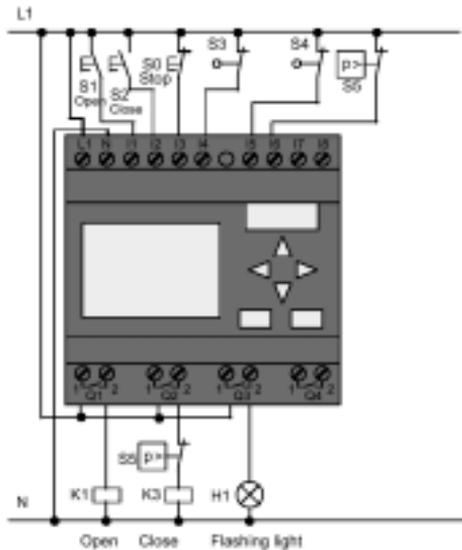
Components Used

- K1   Main contactor
- K2   Main contactor
- S0 (n.c. contact)   STOP pushbutton
- S1 (n.o. contact)   Open switch
- S2 (n.o. contact)   CLOSE pushbutton
- S3 (n.c. contact)   OPEN position switch
- S4 (n.c. contact)   CLOSED position switch
- S5 (n.c. contact)   Safety pressure bar

Block Diagram for the IDEC SmartRelay Solution

The OPEN or CLOSE start switches initiate the gate's motion in the appropriate direction provided it is not already moving in the other direction. The gate's motion is halted by the STOP pushbutton or the relevant limit switch. Closing of the gate is also interrupted by the safety bar.

8.4.3 Wiring the IDEC SmartRelay Solution

In this solution the gate will automatically open again when the safety bar is operated.
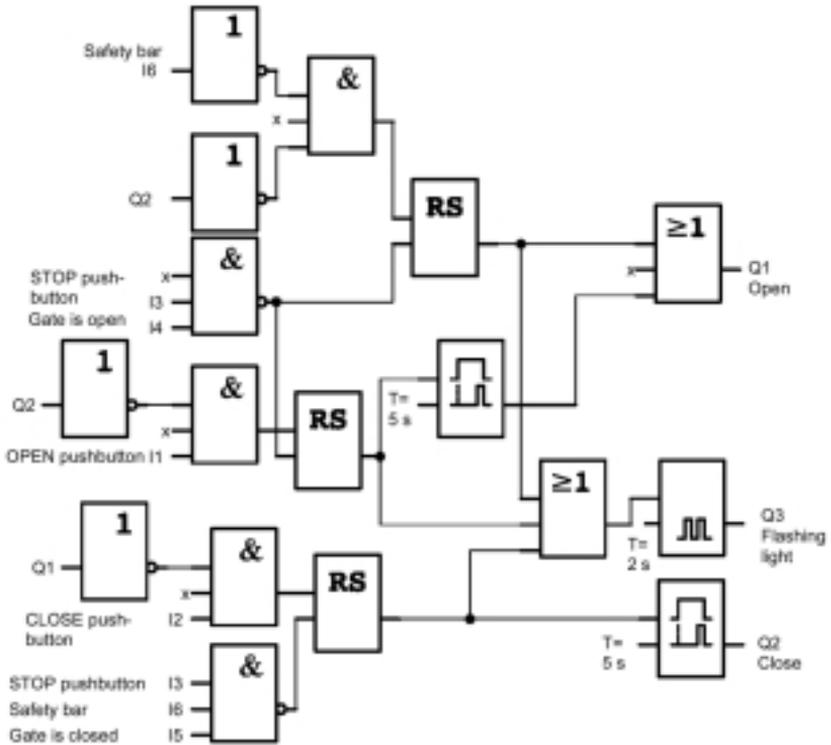
8.5 Centralized Control and Monitoring of Industrial Gates

1 Safety pressure bar 2 flashing warning light

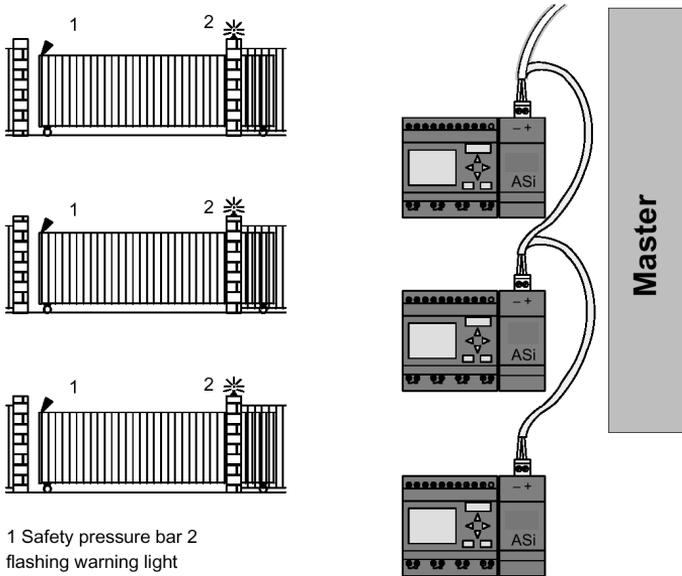Often, a company's premises can be entered at several locations. Not all of the gates can always be monitored by company personnel. They must therefore be able to be monitored and operated by the gateman who sits in a central gatehouse.

It must also be possible for an employee to open and close the gate locally.

For every gate we implement one FL1B-H12RCC and one AS interface function module. The bus interconnects the modules and the master.

In this section, we will describe a gate control system. The structure of the other gate control systems is identical.

8.5.1 Gate Control System Requirements

- Every gate is opened and closed by means of a cord-operated switch. The gate is fully opened or closed by this switch.

- Every gate can also be opened and closed per local pushbutton.

- The gate can be opened and closed via the bus link to the gate-house. The GATE OPEN or GATE CLOSED status is indicated.

- A flashing light is activated 5 seconds before the gate begins to move and continues for as long as the gate is in motion.

- A safety pressure bar prevents harm to persons and objects from being trapped or injured when the gate closes.

Wiring the Gate Controls With FL1B-H12RCC and FL1B-CASC12
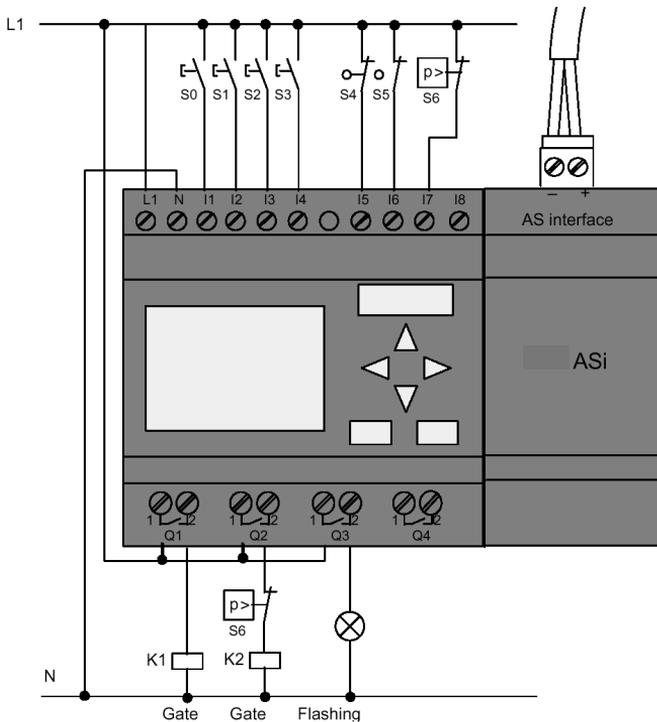
Components Used

- K1   Main contactor for opening
- K2   Main contactor for closing
- S0 (n.o. contact) Cord-operated switch OPEN
- S1 (n.o. contact) Cord-operated switch CLOSE
- S2 (n.o. contact) Open switch
- S3 (n.o. contact) CLOSE pushbutton
- S4 (n.c. contact) OPEN GATE position switch
- S5 (n.c. contact) CLOSE GATE position switch
- S6 (n.c. contact) Safety pressure bar

Higher Level Control System

- Q5 OPEN GATE position switch
- Q6 CLOSE GATE position switch
- I9External OPEN GATE pushbutton
- I10External CLOSE GATE pushbutton

Block Diagram of the IDEC SmartRelay Solution
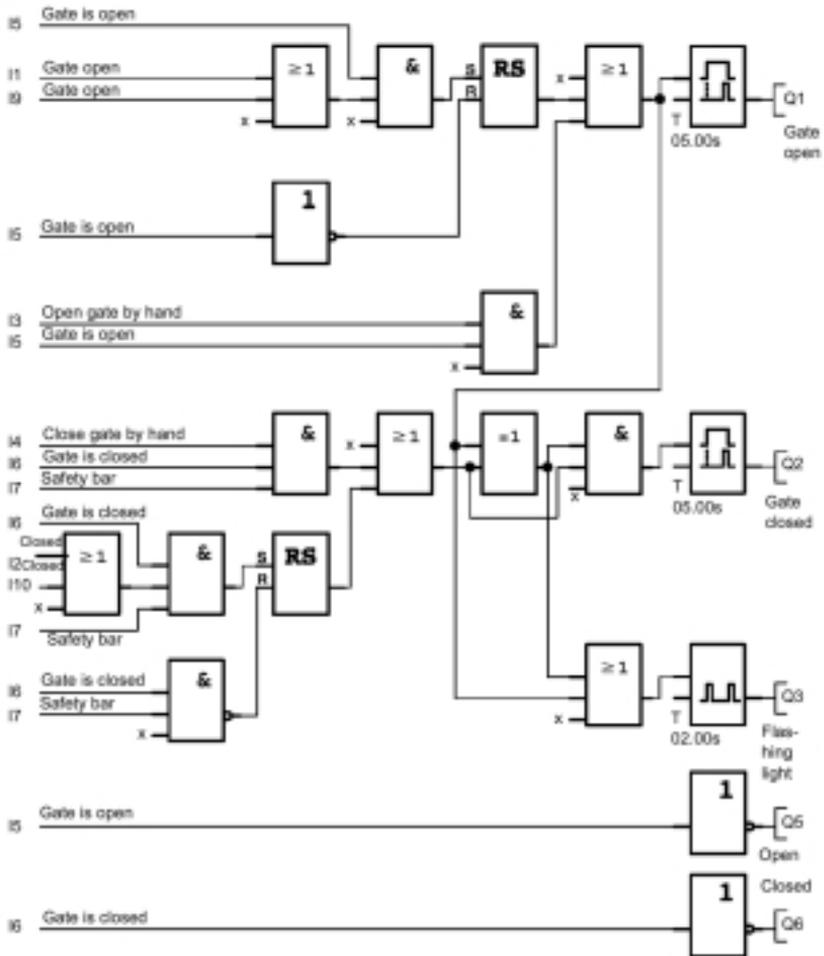
The OPEN GATE and CLOSE GATE start pushbuttons move the gate in the appropriate direction provided it is not already moving in the opposite direction. The gate motion ends at the respective limit switch. Closing of the gate is also interrupted by the safety bar.

8.6 Luminous Rows
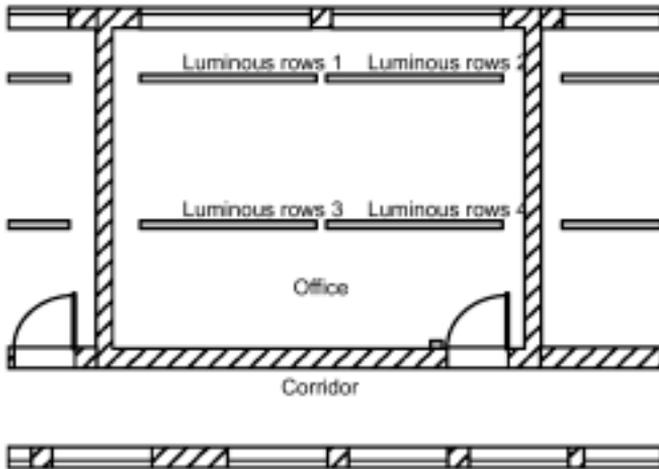
When planning lighting systems for commercial locations, the type and number of lamps used is determined by the lighting requirements. For reasons of cost, fluorescent tubes arranged in luminous rows are often used. They are divided into separate switching circuits, according to the way the room is used.

8.6.1 Lighting System Requirements

- These separate 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 a daylight control switch.
- The lights are switched off automatically at 20.00.
- It must be possible at all times to switch the lights on and off manually.

8.6.2 Original Solution
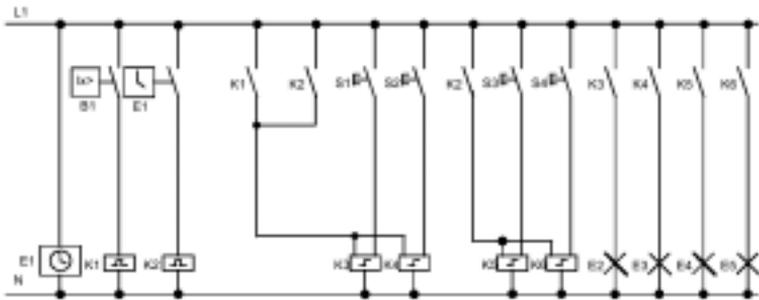
The lamps are switched on and off with a pulse relay that is controlled by pushbuttons at the door. Regardless of this, they are reset by the time switch or by the daylight control switch via the central off input. The length of the off commands must be reduced per wiping relays in order to make it possible to switch the lights on and off manually after they have been switched off.

Components Required:

- Switches S1 to S4
- Daylight control switch B1
- Timer switch E1
- Wiping relays K1 and K2
- Pulse switches with central off K3 to K6

Disadvantages of the Original Solution

- A substantial amount of switchgear is required in order to implement these functions.
- Due to the high number of mechanical components, wear and tear, and maintenance expenditures will be high.
- Changing the function requires considerable effort.

8.6.3 Luminous Row Control with FL1B-H12RCC
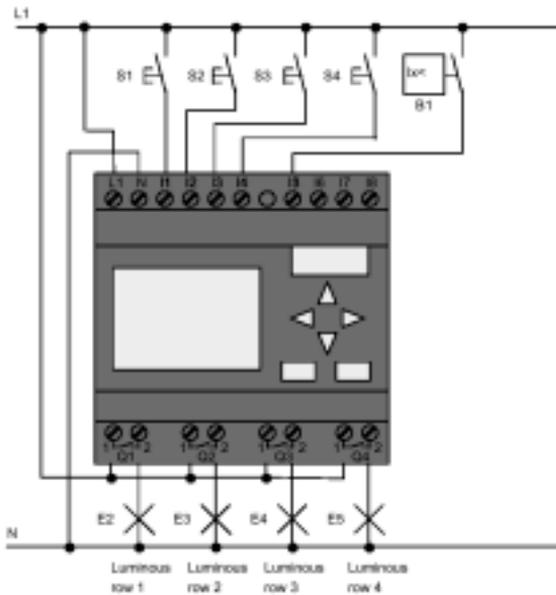
Components Used

- S1 to S4 (n.o. contact) Switches
- B1 (n.o. 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 of the individual outputs does not exceed its switching capacity. If higher loads must be switched you should use a power contactor.

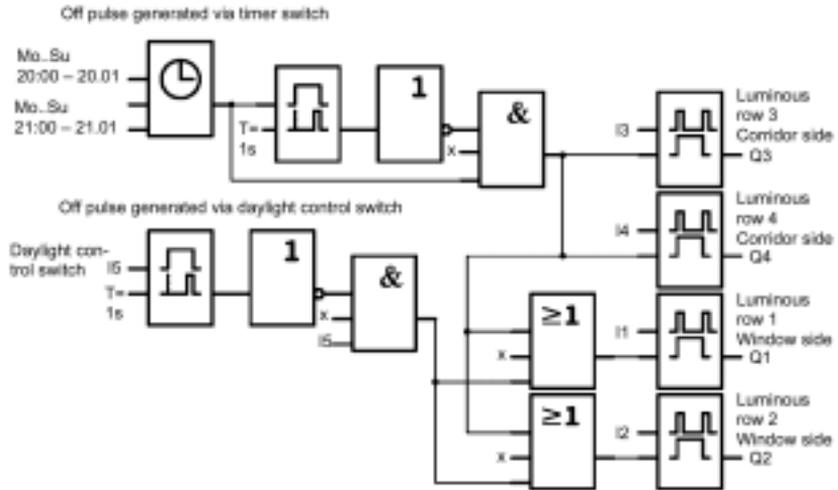- Connect the daylight control switch directly to an input of the IDEC SmartRelay.

- You do not need an external timer switch, because this function is integrated in the IDEC SmartRelay.

- Due to the reduced amount of switchgear, you can install a smaller and space-saving subsidiary distribution cabinet.

- Fewer devices are required.

- The lighting system can easily be 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 easily be applied to all lamps or a modified group of lamps.

8.7 Water Pump

The use of rainwater as an addition to the drinking water supply is gaining importance in the domestic housing market. This saves money and helps protect the environment. For example, rainwater can be used for:

- Washing clothes
- Irrigation for gardens
- Watering indoor plants
- Washing cars
- Flushing toilets

The sketch below illustrates how such a rainwater system is operated:
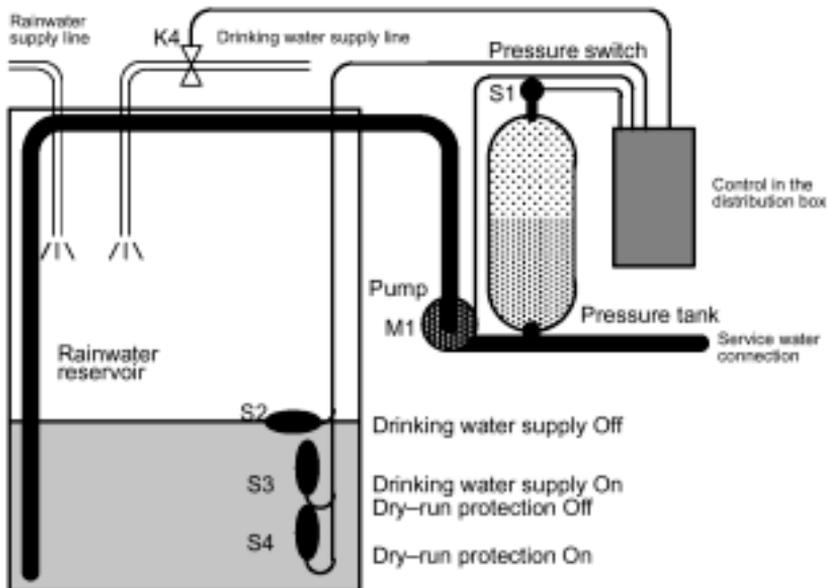
The rainwater is collected in a reservoir. From the reservoir a pumping station supplies a water line system. From there it can be tapped in the same way as normal drinking water. If the reservoir should run dry it can be backed up by the drinking water system.

8.7.1 Water Pump Control System Requirements

- The system must be capable of supplying water service at all times. In case of an emergency, the control system must automatically switch over to the drinking water supply.

- When switching over to the drinking water supply rainwater must not enter the main water system.

- The water service pump must not be switched on if rainwater is low in the reservoir.

8.7.2 Original Solution
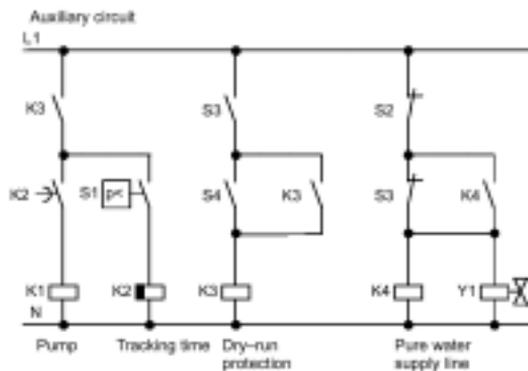
The pump and a solenoid valve are controlled by means of a pressure switch and three float switches installed in the rainwater reservoir. The pump must be switched on when the pressure level in the cylinder drops below a set minimum. Once the operating pressure has been reached, the pump is switched off again after a few seconds. The tracking time prevents oscillation of the water pump if water is drawn over any length of time.

8.7.3 Water Pump with FL1B-H12RCC

Pump   Drinking water supply line
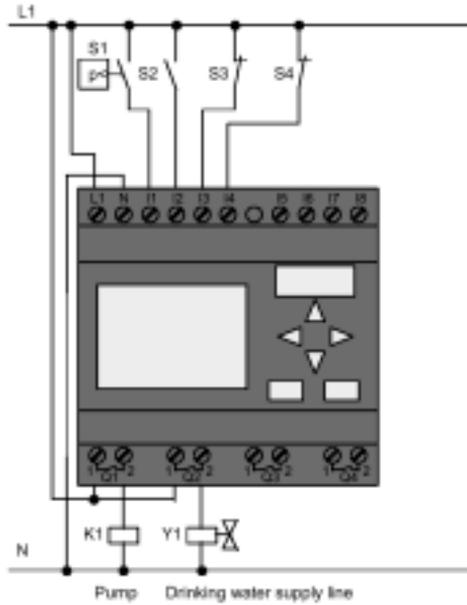
Besides the IDEC SmartRelay, all you need is a pressure switch and the float switches to control the pump. If you are using a 3-phase AC motor, you must use a power contactor for switching the pump. For single-phase AC pump systems you must provide a contactor if the current consumption of the AC motor exceeds the capacity of the output relay Q1. The power of a solenoid valve is low enough to allow direct controlling.

- K1   Main contactor
- Y1   Solenoid valve
- S1 (n.o. contact) Pressure switch
- S2 (n.o. contact) Float switch
- S3 (n.c. contact) Float switch
- S4 (n.c. contact) Float switch

Circuit Diagram of the IDEC SmartRelay Solution
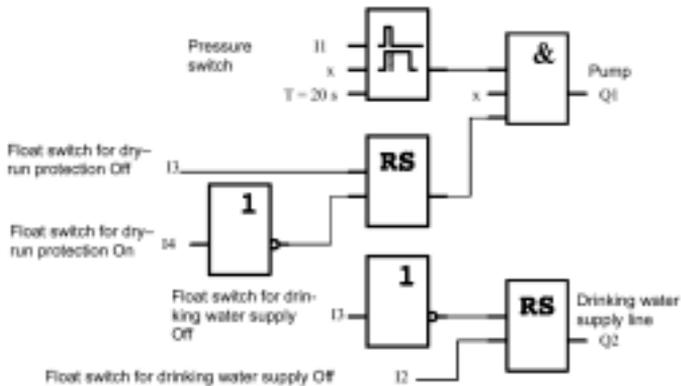
8.7.4 Special Features and Expansion Options

The circuit diagram shows how you can wire the pump controls and the solenoid valve. The layout corresponds to that of the circuit diagram. You also have the option to integrate further functions for specific applications that could otherwise only be accomplished with conventional technology and additional purchase of switchgear:

- Starting the pump at specific times
- Indication of possible water shortage
- Reporting of system faults

8.8 Additional Application Options

Possible applications:

- Irrigation system for greenhouse plants
- Controlling of conveyor systems
- Controlling of a bending machine
- Shop window lighting
- Bell system (e.g. in a school)
- Parking lot surveillance
- Outdoor lighting
- Control system for shutters
- Domestic outdoor and indoor lighting
- Control system for a cream mixer
- Sports hall lighting
- Constant load on 3 consumers
- Sequential control system for cable-welding machines for large cross-sections
- Step switch (e.g. for fans)
- Sequential control for a boiler
- Control system for several pump sets with centralized operation
- Cutting device (e.g. for detonating fuses)
- Monitoring periods of utilization, e.g. of a solar energy system
- Intelligent foot switches, e.g. for speed preselection)
- Controlling an elevated platform
- Textile printing; controlling the heating and conveyor belts
- Silo-filling system

On the Web you can also find descriptions and the corresponding circuit diagrams for the applications. You can view these PDF files using Adobe Acrobat Reader. If you have installed the WindLGC programming software on your PC, you can simply download the relevant circuit diagrams, adapt them to your requirements, and transfer them into IDEC SmartRelay using the PC cable.

Advantages of Using IDEC SmartRelay

The use of IDEC SmartRelay is highly beneficial, especially in the following situations:

- replace multiple auxiliary switchgear with integrated functions

- reduce wiring and installation labor and costs
  -IDEC SmartRelay does the wiring "internally"

- reduce component space in the control cabinet/distribution box
  - you might even be able to reduce the size of your control cabinet/distribution box

- modify functions after installation without having to install additional switchgear or change wiring

- offer customers additional functions for domestic and commercial housing installations. Examples:
  -domestic security systems: use IDEC SmartRelay to switch a lamp on regularly or open and close your shutters while you are on vacation.
  -central heating: use IDEC SmartRelay to run a circulation pump only when you actually require water or heating
  -refrigeration systems: use IDEC SmartRelay to defrost your refrigerator system at regular intervals; reducing energy costs.
  -you can illuminate aquariums (and terrariums) on a time-dependent basis.

In addition, you can:

- Use commonly available switches and pushbuttons, which makes it easy to install a domestic system.

- Wire IDEC SmartRelay directly to your house's electrical system; the integrated power supply makes it possible.

Appendix

A. Technical Specifications

A.1 General Technical Specifications

Item	Complies with	Specification
IDEC SmartRelay Basic:		
Dimensions (WxHxD)		72 x 90 x 55 mm
Weight		Approx. 190 g
Installation		on a 35 mm profile rail 4 module widths or wall mounting
IDEC SmartRelay Expansion module:		
Dimensions (WxHxD)		36 x 90 x 55 mm
Weight		Approx. 90 g
Installation		on a 35 mm profile rail 4 module widths or wall mounting
Climatic Environmental Conditions		
Ambient temperature		
Horizontal installation	Cold: IEC 60068-2-1 Heat: IEC 60068-2-2*	0 ... 55°C 0 ... 45°C (FL1B-M08B2R2, FL1B-M08C2R2)
Vertical installation		0 ... 55°C 0 ... 45°C (FL1B-M08B2R2, FL1B-M08C2R2)
Storage/transport		-40°C ... +70°C
Relative humidity	IEC 60068-2-30	From 10 to 85% no condensation
Air pressure		795 ... 1080 hPa
Pollutants	IEC 60068-2-42 IEC 60068-2-43	SO2 10 cm3 /m3, 4 days H2S 1 cm3 /m3, 4 days
Mechanical Environmental Conditions		
Type of protection		IP20
Vibrations:	IEC 60068-2-6	5 ... 9 Hz (constant amplitude 3.5 mm) 9 ... 150 Hz (constant acceleration 1 g)
Shock	IEC 60068-2-27	18 shocks (Half-sine wave 15g/11 ms)
Drop	IEC 60068-2-31	Drop height 50 mm
Free fall (packaged)	IEC 60068-2-32	1 m

Item	Complies with	Specification
Electromagnetic compatibility (EMC)		
Electrostatic discharge	IEC 1000-4-2 Severity 3	8 kV air discharge 6 kV contact discharge
Electromagnetic fields	IEC 1000-4-3	Field strength 10 V/m
Interference suppression	EN 55011	Limit class B group 1 Limit class for ASi operation
EMC interference emission	EN 50081-2	
Interference immunity	EN 50082-2	
Burst pulses	IEC 1000-4-4 Severity 3	2 kV (supply and signal lines)
Energy carriers Single pulse (surge) (applies only to FL1B-H12RCC, FL1B-B12RCC)	IEC 1000-4-5 Severity 3	1 kV (power lines) symmetrical 2 kV (power lines) asymmetrical
Information on IEC - / VDE - Safety		
Measurement of clearance and creepage distance	IEC 60664, IEC 61131-2, EN 50178 Draft. 11/94 UL 508, CSA C22.2 No. 142 With FL1B-H12RCC, FL1B-B12RCC also VDE 0631	Fulfilled
Insulation strength	IEC 61131-2	Fulfilled

*IEC 60068 includes VDE 0631

A.2 Technical Specifications: FL1B-H12RCC, FL1B-B12RCC & FL1B-M08C2R2

	FL1B-H12RCC FL1B-B12RCC	FL1B-M08C2R2
Power Supply		
Input voltage	100/240 V AC/DC	100/240 V AC/DC
Permissible range	85 ... 253 V AC 100 ... 253 V DC	85 ... 253 V AC 100 ... 253 V DC
Permissible mains frequency	47 ... 63 Hz	47 ... 63 Hz
Power Consumption		
100 V AC	10 ... 30 mA	10 ... 30 mA
240 V AC	10 ... 20 mA	10 ... 20 mA
100 VDC	5 ... 15 mA	5 ... 15 mA
240 V DC	5 ... 10 mA	5 ... 10 mA
Voltage Failure Buffering		
100 V AC/DC	typ. 10 ms	typ. 10 ms
240 V AC/DC	typ. 20 ms	typ. 20 ms
Power Loss at		
100 V AC	1.1 ... 3.5 W	1.1 ... 3.5 W
240 V AC	2.4 ... 4.8 W	2.4 ... 4.8 W
100V DC	0.5 ... 1.8 W	0.5 ... 1.8 W
240 V DC	1.2 ... 2.4 W	1.2 ... 2.4 W
Buffering the clock at 25 °C	typ. 80h	
Accuracy of the real-time clock	max. ±5 s / Tag	
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
Input current at		
Signal 0	< 0.03 mA	< 0.03 mA
Signal 1	> 0.08 mA	> 0.08 mA

	FL1B-H12RCC FL1B-B12RCC	FL1B-M08C2R2
Delay time at		
0 to 1	typ. 50 ms	typ. 50 ms
1 to 0	typ. 50 ms	typ. 50 ms
Line length (unshielded)	100 m	100 m
Digital Outputs		
Number	4	4
Output type	Relay outputs	Relay outputs
Electrical isolation	Yes	Yes
In groups of	1	1
Activation of digital input	Yes	Yes
Continuous current Ith	max. 10 A per relay	max. 5 A per relay
Incandescent lamp load (25,000 switching cycles) at		
230/240 V	1000 W	1000 W
115/120 V	500 W	500 W
Fluorescent tubes with choke (25,000 switching cycles)	10 x 58 W (at 230/240 V AC)	10 x 58 W (at 230/240 V AC)
Fluorescent tubes, conventionally compensated (25,000 switching cycles)	1 x 58 W (at 230/240 V AC)	1 x 58 W (at 230/240 V AC)
Fluorescent tubes, uncompensated (25,000 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 total temperature range	none; across the total temperature range
Parallel switching of outputs to increase power	Not permitted	Not permitted
Protection of output relay (if desired)	max. 16 A, characteristic B16	max. 16 A, characteristic B1
Switching Rate		
Mechanical	10 Hz	10 Hz
Ohmic load/lamp load	2 Hz	2 Hz
Inductive load	0.5 Hz	0.5 Hz

A.3 Technical Specifications:
FL1B-H12RCA, FL1B-B12RCA, FL1B-H12SND & FL1B-M08B1S2

	FL1B-M08B1S2 FL1B-H12SND	FL1B-H12RCA (AC) FL1B-B12RCA (AC)
Power Supply		
Input voltage	24 V DC	24 V AC
Permissible range	20.4 ... 28.8 V DC	20.4 ... 26.4 V AC
Reverse polarity protection	Yes	
Permissible mains frequency		47 ... 63 Hz
Power consumption from 24 V DC	FL1B-H12SND 10 ... 25 mA	120 ... 20 mA
	FL1B-M08B1S2 30 ... 45 mA	
	0.3 A per output	
Voltage failure buffering		typ. 5 ms
Power loss at 24 V	FL1B-H12SND 0,2 ... 0,6 W	0.5 ... 2.9 W (AC)
	FL1B-M08B1S2 0.8 ... 1.1 W	
Buffering the clock at 25°C		typ. 80h
Accuracy of the real-time clock		max. ±5 s / Tag
Digital Inputs		
Number	FL1B-H12SND: 8 FL1B-M08B1S2: 4	8
Electrical isolation	No	No
Input voltage	L+	L
Signal 0	< 5 V DC	< 5 V DC
Signal 1	> 8 V DC	> 12 V AC
Input current at		
Signal 0	< 1.0 mA (I1...I6) < 0.05 mA (I7, I8)	< 1.0 mA
Signal 1	> 1.5 mA (I1... I6) > 0.1 mA (I7, I8)	> 2.5 mA
Delay time at		
0 to 1	typ. 1.5 ms (I1...I4) <1.0 ms (I5, I6) typ. 300 ms (I7,I8)	typ. 15 ms
1 to 0	typ. 1.5 ms (I1...I4) <1.0 ms (I5, I6) typ. 300 ms (I7,I8)	typ. 1.5 ms
Line length (unshielded)	100 m	100 m

	FL1B-M08B1S2 FL1B-H12SND	FL1B-H12RCA (AC) FL1B-B12RCA (AC)
Analog Inputs		
Number	only FL1B-H12SND: 2 (I7 and I8)	
Range	0 ... 10 V DC	
max. Input voltage	28,8 V DC	
Digital Outputs		
Number	4	4
Output type	Transistor, current-sourcing	Relay outputs
Electrical isolation	No	Yes
In groups of		1
Activation of digital input	Yes	Yes
Output voltage	≙ Supply voltage	
Output current	max. 0.3 A	
Continuous current I_{th}		max. 10 A
Incandescent lamp load (25,000 switching cycles) at		1000 W
Fluorescent tubes with choke (25,000 switching cycles)		10 x 58 W
Fluorescent tubes, conventionally compensated (25,000 switching cycles)		1 x 58 W
Fluorescent tubes, uncompensated (25,000 switching cycles)		10 x 58 W
Short circuit-proof and overload-proof	Yes	
Short-circuit current limitation	Approx. 1 A	
Derating	none; across the total temperature range	none; across the total temperature range
Short circuit-proof cos 1		Power protection B16 600A
Short-circuit proof cos 0.5 to 0.7		Power protection B16 900A
Parallel switching of outputs to increase power	Not permitted	Not permitted
Protection of output relay (if desired)		max. 16 A, characteristic B16
Switching Rate		
Mechanical		10 Hz
Electrical	10 Hz	
Ohmic load/lamp load	10 Hz	2 Hz
Inductive load	0.5 Hz	0.5 Hz

A.5 Technical Specifications: FL1B-J2B2

	FL1B-J2B2
Power Supply	
Input voltage	12/24 V DC
Permissible range	10.8 ... 15.6 V DC 20.4 ... 28.8 V DC
Power consumption	25 ... 50 mA
Voltage failure buffering	typ. 5 ms
Power loss at	
0.3 ... 0.6 W	12 V
0.6 ... 1.2 W	24 V
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 or 0-20 mA
Resolution	10 bit, standardized to 0-1000
Cycle time for analog value generation	50 ms
Electrical isolation	No
Line length (shielded and twisted)	10m
Encoder supply voltage	none
Error limit	+/- 1.5 %
Interference frequency suppression	55 Hz

Switching Capacity and Service Life of the Relay Outputs

Ohmic load
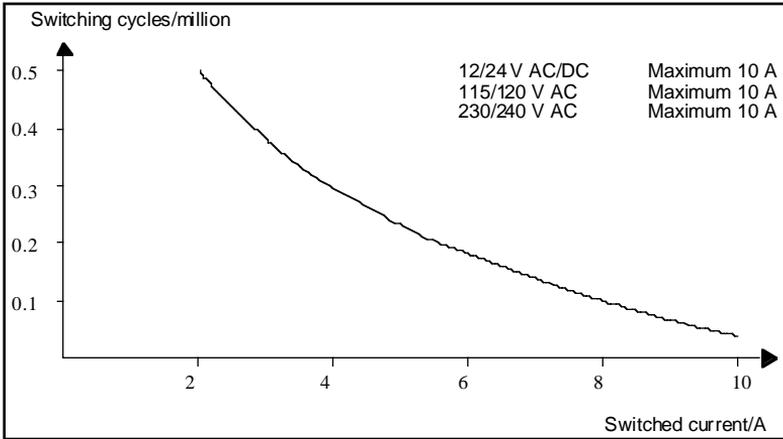
Figure A   Switching capacity and service life of the contacts at ohmic load (heating)

Inductive load
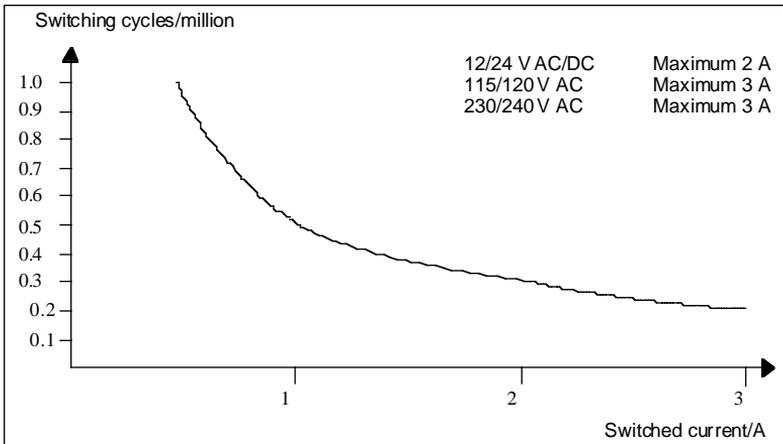
Figure B   Switching capacity and service life of the contacts at highly inductive load to IEC 947-5-1 DC 13/AC 15 (contactors, solenoid coils, motors)

B. Determining the Cycle Time

The program cycle is the complete execution of the program, that is, primarily the reading in of the inputs, the processing of the program and the subsequent reading out of the outputs. The cycle time is the time required to execute a complete program once.

The time required for a program cycle can be determined using a short test program. This test program is generated in IDEC SmartRelay. In parameter assignment mode it outputs a value used to calculate the actual cycle time.

Test Program

1. Start to create the test program by linking an output or memory bit to a threshold switch. At the input of the switch you can then connect a clock generator that is switched on with a hi signal.
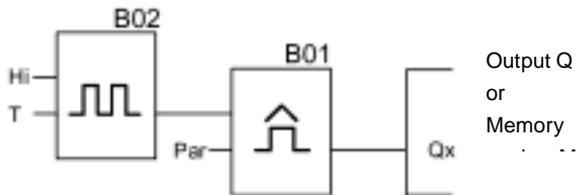
2. Configure the two blocks as shown below. Due to the pulse rate of 0 seconds a pulse is generated in every program cycle. The time interval of the threshold switch is set to 2 seconds.

3. Then start the program and switch the IDEC SmartRelay to parameter assignment mode. You can view the parameters of the threshold switch in this parameter assignment mode.

```
B01:Par
SW↑=1000+
SW↓=0000
fa =0086
```

fa= is the sum of the pulses measured per time unit G_T

4. The reciprocal value of Fe is equal to the cycle time of the IDEC SmartRelay with the program currently in its memory.
$1/Fe$ = cycle time in s

Explanation

The output signal of the clock pulse generator $(T = 0)$ is toggled at every program cycle. Thus, one logic level (high or low) width is exactly equivalent to the length of one cycle. Hence, a period lasts 2 cycles.

The threshold switch indicates the ratio of periods per 2 seconds which results in the ratio of cycles per second.

Edge change of the clock generator art every program cycle

Cycle time

Periods

1 period = 1 pulse = 2 cycles
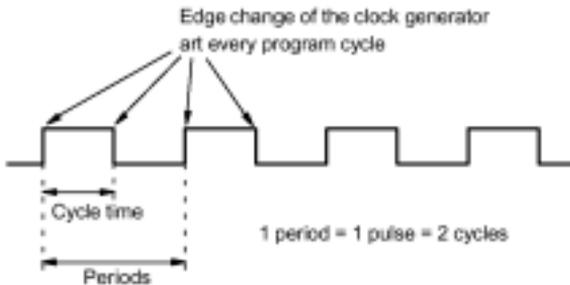
C. IDEC SmartRelay Without Display

The IDEC SmartRelay model without display is intended for use in specific applications not requiring operating elements such as a keyboard or a display FL1B-B12RCE, FL1B-B12RCA and FL1B-B12RCC.

For example, this is what a FL1B-B12RCC looks like:
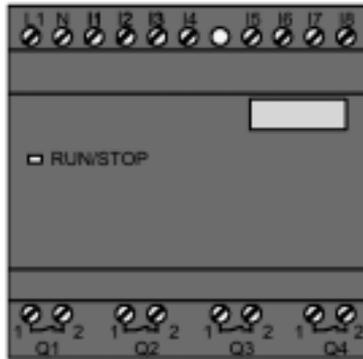
Less is Definitely More!

Benefits:

- Improved economies without the operating element.

- Requires less switch cabinet space than conventional hardware.

- Substantial benefits with regard to flexibility and 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.

- Cannot be used by unauthorized persons.

- Compatible with IDEC SmartRelay basic models.

- Offers the option to read data via WindLGC.

Programming Without an Operating Element

You can program the IDEC SmartRelay without display in two ways:

- On the PC, create a program with WindLGC and transfer it to the IDEC SmartRelay.

- Use a IDEC SmartRelay program module/card and transfer the program contained in this device to the IDEC SmartRelay without display.

Operating Characteristics

The 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.

FL1B-B12RC* models cannot be prepared for data transfer by the keyboard and the programs cannot be started or stopped by pushbutton. This is why the startup behavior of FL1B-B12RC* models has been slightly modified.

Startup Characteristics

The program in a module/card that is plugged into the IDEC SmartRelay is copied immediately to the IDEC SmartRelay after power is switched on. Any existing program is overwritten.

If a PC cable is connected, the IDEC SmartRelay switches automatically to PC ↔ IDEC SmartRelay mode at startup. The WindLGC software can be used to read the IDEC SmartRelay program or to save a program to the IDEC SmartRelay,

After power is switched on, the IDEC SmartRelay automatically switches from STOP to RUN if a valid program exists in memory.

Operating Status Indicator

Operating states, e.g. Power On, RUN and STOP are indicated by an LED on the front cover.

- 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.
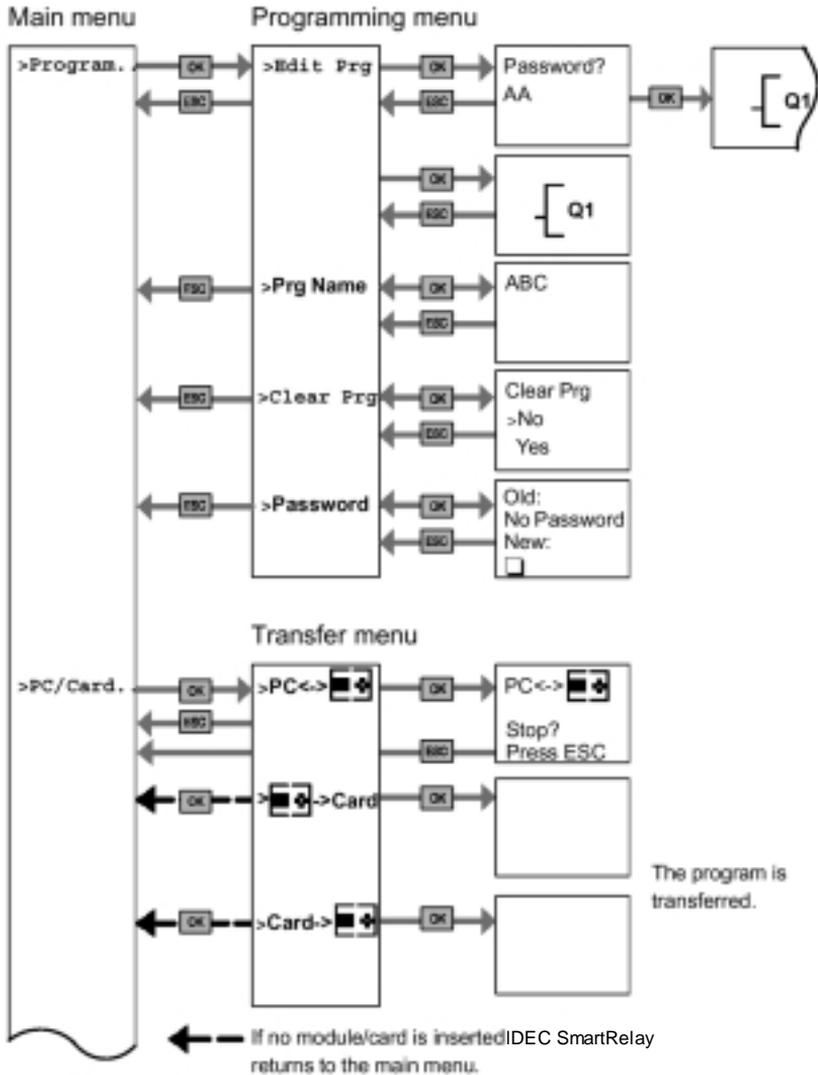
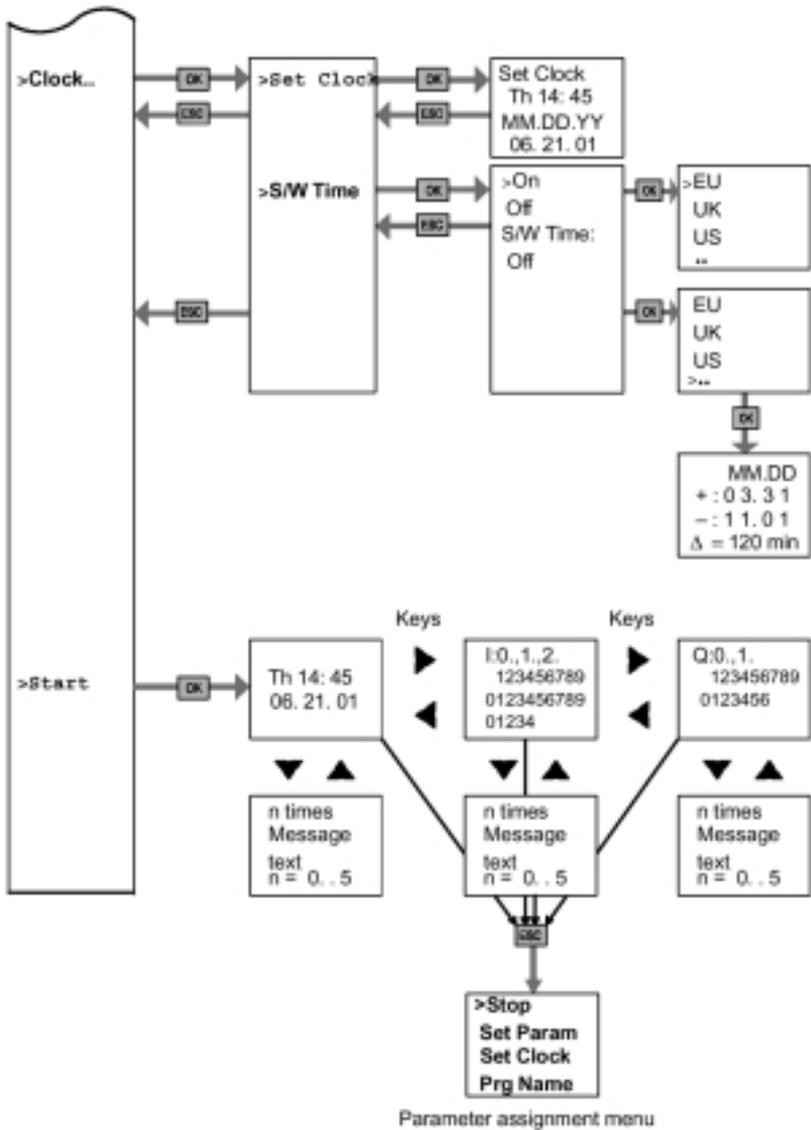**Reading the Operating Hours Counter in STOP Mode**

Prerequisites: The PC link must be plugged in prior to Power On.

In WindLGC V 3.0 (refer to Chapter 7 "IDEC SmartRelay Software" on page 7-1) you can read the MN and OT values of the hours counter. The hours counter values can be accessed without having to enter a password.

If your IDEC SmartRelay without display is equipped with a red module you cannot access the values of the hours counter, because when you remove the module (in order to connect the PC link) you delete the program in the IDEC SmartRelay.

D. IDEC SmartRelay Menu Structure

Main menu   Programming menu

>Program.   >Edit Prg   Password?
                          AA
                          Q1

                          Q1

             >Prg Name   ABC

             >Clear Prg   Clear Prg
                          >No
                          Yes

             >Password   Old:
                          No Password
                          New:

Transfer menu

>PC/Card.   >PC<->   PC<->
                          Stop?
                          Press ESC

             >->Card

             >Card->   The program is
                                      transferred.

             If no module/card is inserted IDEC SmartRelay
             returns to the main menu.

Parameter assignment menu

No program after Power on

```
                                    Main menu
                                  ┌──────────┐
   ┌──────────┐      ┌────┐       │ Program..│
   │ No  Program│    │ ESC│──────▶│ PC/Card..│
   │ Press ESC │     └────┘       │ Clock..  │
   └──────────┘                   │ Start    │
                                  └──────────┘
```

Parameter assignment menu

```
                ┌────┐        ┌──────────┐
  >Stop  ◀──────│ OK │───────▶│ Stop Prg │
         ◀──────│ ESC│        │ > No     │
                └────┘        │   Yes    │
                                              Main menu
                ┌────┐        ┌──────────┐   ┌──────────┐
         ──────▶│ OK │───────▶│ Stop Prg │   │ Program..│
         ◀──────│ ESC│        │   No     │──▶│ PC/Card..│
                └────┘        │ > Yes    │   │ Clock..  │
                              └──────────┘   │ Start    │
                                             └──────────┘

                ┌────┐        ┌──────────┐
  >Set Param ──▶│ OK │───────▶│ B05 : Par│
             ◀──│ ESC│        │ SW↑:0050 │
                └────┘        │ SW↓:0048 │
                              │ Fe = 0012│
                              └──────────┘

                ┌────┐        ┌──────────┐
  >Set Clock ──▶│ OK │───────▶│ Set Clock│
             ◀──│ ESC│        │  Th 14: 45│
                └────┘        │ MM.DD.YY │
                              │ 06. 21. 01│
                              └──────────┘

                ┌────┐        ┌──────────┐
  >Prg Name ◀──▶│ OK │───────▶│ ABC      │
            ◀───│ ESC│        │          │
                └────┘        │          │
                              └──────────┘

                ┌────┐    ┌──────────┐      ┌──────────┐      ┌──────────┐
            ───▶│ ESC│───▶│ Th 14: 45│ or   │I:0.,1.,2.│ or   │Q:0.,1.   │
                └────┘    │ 06. 21. 01│      │ 123456789│      │ 123456789│
                          └──────────┘      │0123456789│      │ 0123456  │
                                            │01234     │      └──────────┘
                                            └──────────┘
```

E. Models (Part Numbers)

Table A Model (Part Number) List

Model	Model Number	Rated Power Voltage	Input Type (Digital)	Input Type (Analog)	Output Type (Relay)	Display and Keypad	Real Time Clock
Base Modules	FL1B-H12RCC	100-240V **AC/DC**	8	-	4	Yes	Yes
	FL1B-B12RCC	100-240V **AC/DC**	8	-	4	-	Yes
	FL1B-H12RCA	24V **AC**	8	-	4	Yes	Yes
	FL1B-B12RCA	24V **AC**	8	-	4	-	Yes
	FL1B-H12RCE	12/24V **DC**	8 (I1-I8)	2 (I7, I8)	4	Yes	Yes
	FL1B-B12RCE	12/24V **DC**	8 (I1-I8)	2 (I7, I8)	4	-	Yes
	FL1B-H12SND	24V **DC**	8 (I1-I8)	2 (I7, I8)	4 (Tr)	Yes	
Expansion Modules	FL1B-M08B2R2	12/24V **DC**	4	-	4	-	-
	FL1B-M08B1S2	24V **DC**	4	-	4 (Tr)	-	-
	FL1B-M08C2R2	100-240V **AC/DC**	4	-	4	-	-
	FL1B-J2B2	12/24V **DC**	-	2	-	-	-

Table B Cable and Accessories

Model	Function	Model No.
Memory Cartridge (Yellow)	for copying	FL1A-PM1
Memory Cartridge (Red)	With know-how protection and copy protection	FL1A-PM2
PC Cable	Download/Upload Cable	FL1A-PC1
WindLGC	Exclusive programming software for IDEC SmartRelay	FL9Y-LP1CDW
Removal Tool	The memory cartridge removal tool	MT-101

F. Abbreviations

B01   Block number B01

BN   Block number

Cnt   Count = input for counter

Co   Connector

Dir   Direction (e.g. for counter)

En   Enable (e.g. for switching on the clock pulse generator)

BF   Basic functions

No   Cams (time switch parameters)

Par   Parameter

R   Reset

S   Set (e.g. setting the latching relay)

SF   Special functions

T   Time (parameter)

S   Segment

Trg   Trigger (parameter)

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