FL9Y-B1789(2)

IDEC SmartRelay

User's Manual

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ DANGER
indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING
indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION
indicates that minor personal injury can result if proper precautions are not taken.

NOTICE
indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of IDEC products

Note the following:

⚠ WARNING
IDEC products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by IDEC. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Preface

With IDEC SmartRelay you have acquired a logic module that meets the stringent quality requirements of ISO 9001.

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

Purpose of this manual

This IDEC SmartRelay manual provides you with information about the creation of circuit programs, about the installation and use of Base Modules with more enhanced features, the FL1F-RD1 (Text Display with Ethernet interfaces), and IDEC SmartRelay expansion modules.

For FL1F series, WindLGC uses device type to distinguish different IDEC SmartRelay device. For more information, you can refer to the following table.

Device	Device type in WindLGC	WindLGC Version
SmartRelay Base Module (FL1F-H12RC*, FL1F-B12RC*, FL1F-H12SCD)	SmartRelay FL1F	WindLGC V8.0 and later version
	SmartRelay FL1F FS5	WindLGC V8.2 and later version
	SmartRelay FL1F FS6	WindLGC V8.4 and later version
Text Display (FL1F-RD1)	SmartRelay TDE	WindLGC V8.0
	SmartRelay TDE FS4	WindLGC V8.2 and later version

IDEC SmartRelay's place in information technology

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

WindLGC is IDEC SmartRelay programming software for PCs. It runs under Windows® (Windows 7®, Windows 8®, Windows 10® and Windows 11®). It helps you to get started with IDEC SmartRelay and to write, test, print out and archive your programs, independent of IDEC SmartRelay.

Valid range of this manual

The manual applies to devices of IDEC SmartRelay FL1F FS6.

New features of IDEC SmartRelay FL1F FS6 device series

The following features are new for IDEC SmartRelay FL1F FS6 devices:

- Cloud IoT connection
  - IDEC SmartRelay BM supports AWS, Azure and Alibaba IoT Cloud connections and general MQTT broker connection through MQTT protocol on Ethernet TCP/IP network.
  - You can use IoT connectivity to synchronize data between IDEC SmartRelay BM and Cloud services. When this function is enabled, IDEC SmartRelay BM can publish data to Cloud services, and you can change IDEC SmartRelay BM data remotely through Cloud services.
  - You can use WindLGC V8.4 to set the Cloud data transmission.
  - The IDEC SmartRelay BM menu includes "Cloud" in the "Diagnostics" page.
  - You can configure and use cloud data format which is displayed as Decimal or which is displayed as Binary
- Variable Memory extension
  - VX: the extended area of V area, and it has the same memory function as V area;
  - VR: the extended area to store retentive data, and the behavior is the same with retentivity of function block. When you save the circuit diagram to the SD card, VR area values in the circuit diagram will be sychronized to the inserted SD card.
- BM sending emails
  - IDEC SmartRelay BM supports to send customized emails to corresponding receipients at trigger events after configuration in WindLGC.
  - IDEC SmartRelay BM menu includes "Email" in the "Diagnostics" page.
- Data log improvement

  You can check and upload the connected BM's data log on BM Web server.
- BM soft keyboard

  IDEC SmartRelay BM provides soft keyboard (Page 63) to use when you change block name, circuit program name, program password, or switch from operator to administrator.
- Micro SD card support

  Other than micro SD cards that support FAT32 file system format, IDEC SmartRelay BM also support micro SD cards that support exFAT file system format.
- Security enhancement

  – Enhanced the Network security (Page 295).

New features of IDEC SmartRelay FL1F FS5 device series

The following features are new for IDEC SmartRelay FL1F FS5 devices:

- **Support the function that TDE can be scanned**

  IDEC SmartRelay TDE FS4 can be scanned by WindLGC V8.2 and later versions.

- **Support FL1F Web Editor tool**

  FL1F Web Editor is a new tool used together with IDEC SmartRelay Base Module (BM) and WindLGC. This tool helps you create user-defined web pages in the Editor pane, and visit the whole project through Web Server of IDEC SmartRelay Base Module. With FL1F Web Editor, you can also integrate different components including some variables conveniently. For detailed information, refer to *FL1F Web Editor Tool Online Help*.

- **Support function block parameters automatic storage**

  The modification for function block parameters can be saved to SD card automatically.

- **Support Modbus protocol on Ethernet TCP/IP networks**

  IDEC SmartRelay supports both Modbus Server functions and Modbus Client functions. Modbus modules share connections with FL1F modules. IDEC SmartRelay has separated connection pools for server and client. Each connection in server pool can be used for FL1F Server or Modbus Server. There is no limitation and reservation for any server. It means FL1F server cannot access if all server connections are occupied by Modbus Server. It is also the same case for client connection pool. Refer to FL1F sections for detailed information about server/client connection.

- **Support wider ambient temperature range**

  IDEC SmartRelay BM and EM modules can support wider ambient temperature range, and the ambient temperature is widened to -20 °C to +55 °C.

- **Support Network Time Protocol (NTP) function for time and data synchronization**

  An NTP client can synchronize time from an NTP server. FL1F FS5 BM can serve as both an NTP server and an NTP client at the same time. The NTP function of IDEC SmartRelay BM is disabled by default. You can enable it on the BM/TDE menu or WindLGC.

- **Support FL1F Access Tool**

  IDEC provides a new tool, FL1F Access Tool, to view and trace the variables in IDEC SmartRelay Base module. You can also save the log files of the traced variables with this tool. For detailed information, refer to *FL1F Access Tool Help*.

New features of the IDEC SmartRelay FL1F

The following features are new for the IDEC SmartRelay FL1F devices:

- Ethernet communication support by all Base Modules

  Each Base Module is equipped with an RJ45 interface and a two-color status LED for Ethernet communication.

- New text display (FL1F-RD1) with enhanced features
  - The Text Display module is available with two Ethernet interfaces. These two Ethernet interfaces can also function as a two-port switcher. You can connect the Text Display with a Base Module, a PC, or another Text Display through the Ethernet interfaces. Text Display can connect with different Base Modules through IP address selection.
  - Text Display provides a three-pin (P1, P2, and FE) terminal for power connection.
  - Text Display has three main menu commands available, respectively for the IP address selection of a Base Module, the remote settings of the connected Base Module, and the independent configuration of the Text Display.

- Support of 6-line display and three backlight colors

  Both the IDEC SmartRelay onboard display and Text Display support a 6-line character display and three backlight colors (white/amber/red). The IDEC SmartRelay onboard display can display a maximum of 16 Western European characters or 8 Asian characters per line. Text Display can display a maximum of 20 Western European characters or 10 Asian characters per line.

- Increased maximum I/O connections

  IDEC SmartRelay supports a maximum of 24 digital inputs, 20 digital outputs, 8 analog inputs and 8 analog outputs.

- Built-in Web server in Base Modules

  IDEC SmartRelay provides you with easy access through Internet browsers. With the Web server function, you can access the Base Module using a connected device (PC, tablet or smart phone) by entering the IP address of the IDEC SmartRelay module in the Web browser of the connected device.

- Enhanced functions added to special function blocks
  - Message texts: The IDEC SmartRelay support a 6-line message text display and ticking messages, as well as message text display on the Web server. You can enable the tick setting for each display line by setting the block parameters.

- More memory markers for the creation of the circuit program

  The IDEC SmartRelay supports 64 digital memory markers and 64 analog memory markers. Some new special markers are described as follows:
  - M28: Enables the Display amber backlight
  - M29: Enables the Display red backlight
  - M30: Enables the Text Display amber backlight
  - M31: Enables the Text Display red backlight

- Extended menu commands for diagnostics

  With the extended menu commands for diagnostics, the IDEC SmartRelay provides a facility for diagnosing software and hardware errors and viewing the error logs. You can use these menu commands to troubleshoot and debug the IDEC SmartRelay system.

- **Curve representation of analog value changes**

  IDEC SmartRelay supports the graphical display of analog value changes in the form of a trend curve on the onboard display. You can easily monitor each analog I/O in use by means of the trend curves when IDEC SmartRelay is in RUN mode.

- **Micro SD card support**

  IDEC SmartRelay supports micro SD (Secure Digital) cards that support FAT32 file system format. You can store and copy-protect a circuit program, with or without the data log of process data, from IDEC SmartRelay to an SD card, or copy a circuit program from the card to IDEC SmartRelay. The maximum capacity of micro SD card is 32 GB.

- **Enhanced Data Log function**

  IDEC SmartRelay supports a maximum of 20000 lines for each data log file stored on the micro SD card. IDEC SmartRelay automatically creates a new data log file with a new name on the micro SD card when the number of lines in the current file exceeds the maximum number of lines.

Compatibility with previous IDEC SmartRelay series

IDEC SmartRelay device series are incompatible with any previous device series such as FL1E series.

WindLGC version 8.0 or later is required to use IDEC SmartRelay FL1F. IDEC SmartRelay FL1F cannot be programmed with WindLGC prior than version 8.0.

The circuit programs used with prior versions of IDEC SmartRelay, such as IDEC SmartRelay FL1E, can be transferred to IDEC SmartRleay FL1F using WindLGC.

Security information

IDEC provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

IDEC's products and solutions undergo continuous development to make them more secure. IDEC strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customers' exposure to cyber threats.

Data protection

This product does not process / save any personal information, but only technical functional data (e.g. time stamps). If the user links this data to other data (e.g. shift plans) or if the user save personal information on the same medium (e.g. hard disk) and therefore creates a personal reference in the process, the user has to ensure meeting the guidelines regarding data protection in their region of use.

Note

Notes on protecting administrator accounts

A user with administrator rights has extensive access and manipulation options available to the system.

Therefore, ensure there are adequate safeguards for protecting the administrator accounts to prevent unauthorized changes. To do this, use secure passwords and a standard user account for normal operation. Other measures, such as the use of security policies, should be applied as needed.

Note

To protect WindLGC and FL1F Web Editor from any undesired manipulation when your PC suffers malicious attacks from the Internet, we recommend that you install whitelist-based security software on the PC. Then use the whitelist-based security software to manage the software installed on your PC.

Table of contents

Getting started with IDEC SmartRelay 1

Here's IDEC SmartRelay

IDEC SmartRelay is a universal logic module made by IDEC that integrates:

- Controls
- Operator and display panel with background lighting
- Power supply
- Interface for expansion modules
- Interface for a micro SD card
- Interface for an optional text display (TDE) module
- Pre-configured standard functions, for example, on- and off-delays, current impulse relay and softkey
- Timers
- Digital and analog memory markers
- Inputs and outputs, according to the device type

IDEC SmartRelay additionally integrates the following components:

- Interfaces for Ethernet communication
- FE (Functional Earth) terminal for connecting to earth ground
- One LED for indicating Ethernet communication status

What IDEC SmartRelay can do for you

IDEC SmartRelay offers solutions for domestic and installation engineering applications such as stairwell lighting, external lighting, sun blinds, shutters, shop window lighting and more. It can also offer solutions for switch cabinet engineering, as well as for mechanical and apparatus engineering such as gate control systems, air-conditioning systems, and rainwater pumps.

You can also use IDEC SmartRelay to implement special control systems in conservatories or greenhouses, for control signal processing and for distributed local controlling of machines and processes.

Special versions without operator panel and display unit are available for series production applications in installation engineering.

Which devices are available?

Base Modules are available in two voltage classes:

- Class 1 ≤ 24 V, i.e. 12 VDC, 24 VDC, 24 VAC
- Class 2 > 24 V, i.e. 100 VAC/VDC to 240 VAC/VDC

Base Modules are available in two versions:

- Base Modules (version with display): 8 inputs and 4 outputs
- Base Modules (version without display): 8 inputs and 4 outputs

Each module has an expansion interface and an Ethernet interface and provides 44 pre-configured standard and special function blocks for the creation of your circuit program.

Which expansion modules are available?

- FL1F-M08... digital modules are available for operation with 12 VDC, 24 VAC/VDC and 100 VAC/VDC to 240 VAC/VDC, and are equipped with four inputs and four outputs.
- IDEC SmartRelay analog modules are available for operation with 24 VDC and some with 12 VDC, depending on the specific module. Each is equipped with two analog inputs or two analog outputs.

Each digital/analog module has two expansion interfaces for connecting additional modules.

Which display modules are available?

- Base Modules (integrated in base module)
- Text Display

Features of the Text Display

The Text Display is available for the Base Modules. It provides an additional display that is wider than the Base Module. It has four function keys that you can program in your circuit program as inputs. Like the IDEC Base Module, it has four cursor keys, an ESC key and an Enter key that you can also program in your circuit program and use for navigation on the Text Display.

You can create and download a power-up screen for the Text Display from WindLGC. This screen displays briefly when you initially power on the Text Display. You can also upload the power-up screen from the Text Display to WindLGC.

The Text Display provides three main menu commands, respectively for the IP address selection of a Base Module, the remote settings of the connected Base Module, and the independent configuration of the Text Display. The menus for the Text Display are shown in Appendix "Text Display (Page 342)".

IDEC SmartRelay TDE FS4 can be scanned by WindLGC V8.2 and later versions.

It's your choice

The various Base Modules, expansion modules, and Text Display offer you a highly flexible and adaptive system to suit your specific tasks.

The IDEC SmartRelay system offers you many solutions for small domestic installations, simple automation tasks, and even complex engineering tasks involving its integration into a bus system.

Note

You can only use expansion modules of the same voltage as the Base Module. Mechanical encoding pins in the housing prevent you from connecting devices of a different voltage class.

Exception: The interface on the left side of an analog module is galvanically isolated. These types of expansion modules can therefore be connected to devices of a Setup with different voltage classes (Page 19).

A Text Display has two Ethernet interfaces. You can connect each interface to a Base Module, a PC, or another Text Display.

Each Base Module supports the following connections for the creation of the circuit program, regardless of the number of connected modules:

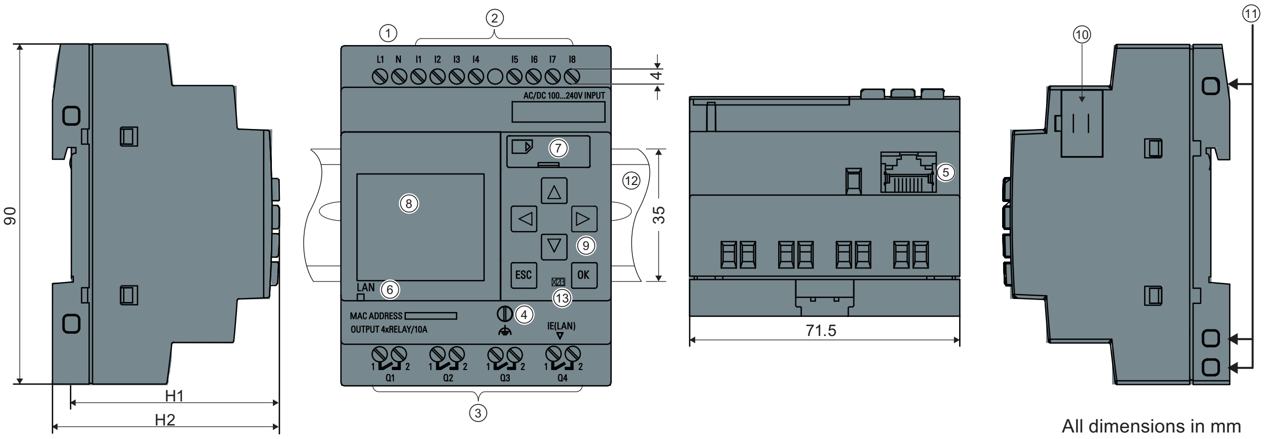
- Digital inputs I1 to I24
- Analog inputs AI1 to AI8
- Digital outputs Q1 to Q20
- Analog outputs AQ1 to AQ8
- Digital flag blocks M1 to M64:
  - M8: Initialization Flag (Displays blue in WindLGC V8.2 and later versions)
  - M25: Backlight flag: onboard display white
  - M26: Backlight flag: Text Display white
  - M27: Message Character Set Flag (Displays green in WindLGC V8.2 and later versions)
  - M28: Backlight flag: onboard display amber
  - M29: Backlight flag: onboard display red
  - M30: Backlight flag: Text Display amber
  - M31: Backlight flag: Text Display red
- Analog flag blocks: AM1 to AM64
- Shift register bits: S1.1 to S4.8 (32 shift register bits)
- 4 cursor keys
- Blank outputs: X1 to X64

The devices of FL1F series additionally supports the display of the following network digital/ analog inputs and outputs if you have previously configured them in the circuit program in WindLGC V8.2 (and later versions) and downloaded the program to the device:

- 64 network digital inputs: NI1 to NI64
- 32 network analog inputs: NAI1 to NAI32
- 64 network digital outputs: NQ1 to NQ64
- 16 network analog outputs: NAQ1 to NAQ16

The IDEC SmartRelay structure

IDEC SmartRelay FL1F
(FL1F-H12RCC)



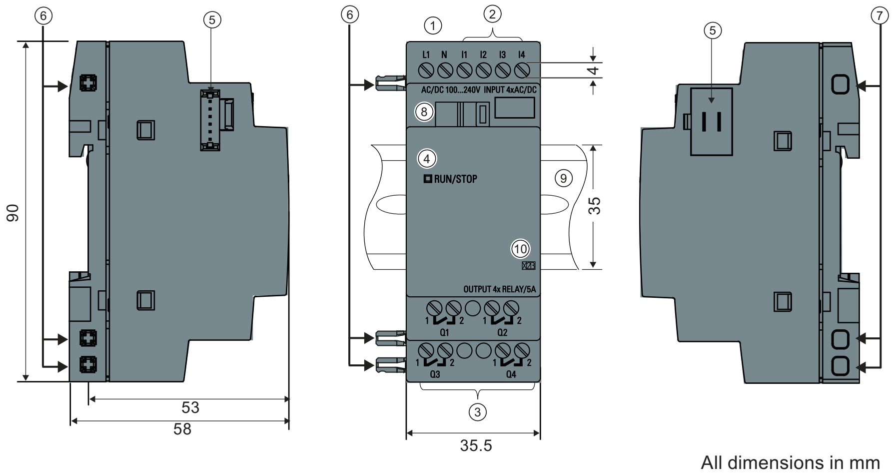
① Power supply
② Inputs
③ Outputs
④ FE terminal
⑤ RJ45 interface, for connection to Ethernet (10/100 Mbit/s)
⑥ Ethernet communication status LED
⑦ Micro SD card slot
⑧ LCD (only for version with display) (Note 1)
⑨ Control panel (only for version with display)
⑩ Expansion interface
⑪ Mechanical coding sockets
⑫ Standard DIN rail
⑬ Version number
(Example: X 2 3 represents Version 1.)

H1: Version with display: 55 mm
Version without display: 53 mm

H2: Version with display: 60 mm
Version without display: 58 mm

Note 1: For version without display, LCD is replaced by RUN/STOP LED.

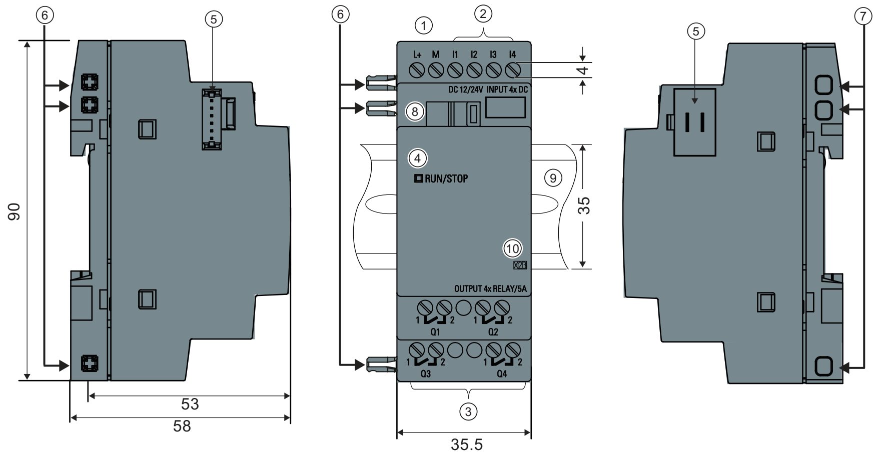
FL1F-M08C2R2



All dimensions in mm

①	Power supply	②	Inputs
③	Outputs	④	RUN/STOP LED
⑤	Expansion interface	⑥	Mechanical coding pins
⑦	Mechanical coding sockets	⑧	Slide
⑨	Standard DIN rail	⑩	Version number

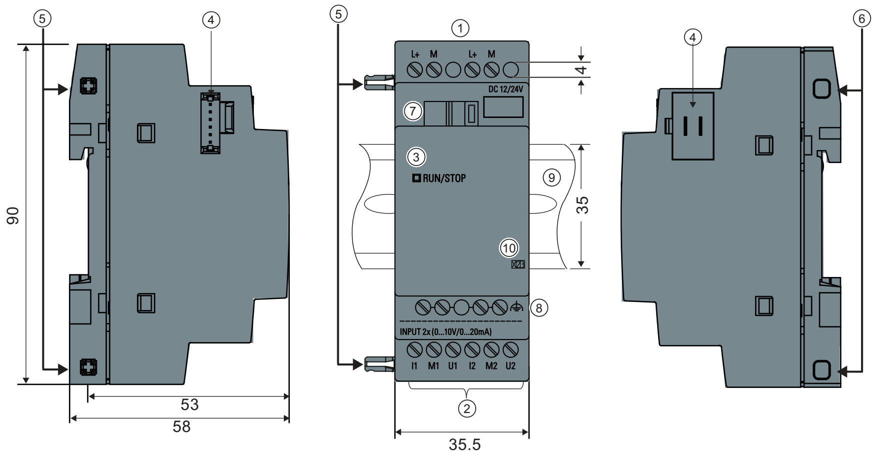
FL1F-M08B2R2



All dimensions in mm

①	Power supply	②	Inputs
③	Outputs	④	RUN/STOP LED
⑤	Expansion interface	⑥	Mechanical coding pins
⑦	Mechanical coding sockets	⑧	Slide
⑨	Standard DIN rail	⑩	Version number

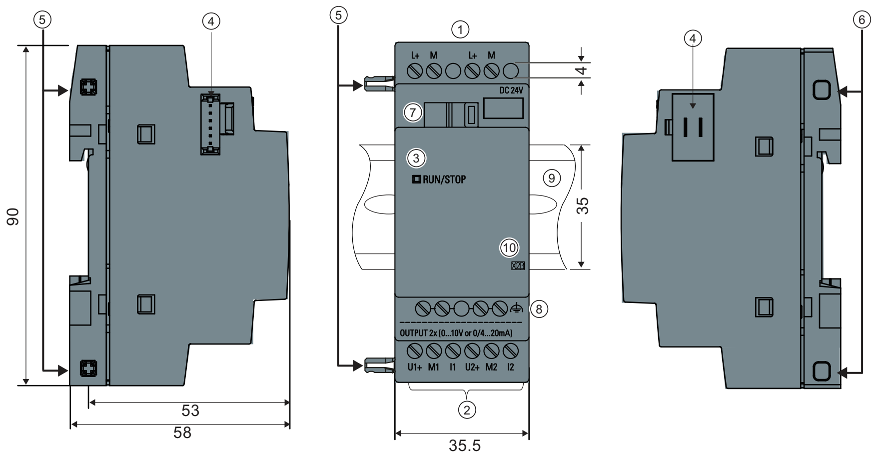
FL1F-J2B2



All dimensions in mm

①	Power supply	②	Inputs
③	RUN/STOP LED	④	Expansion interface
⑤	Mechanical coding pins	⑥	Mechanical coding sockets
⑦	Slide	⑧	FE terminal
⑨	Standard DIN rail	⑩	Version number

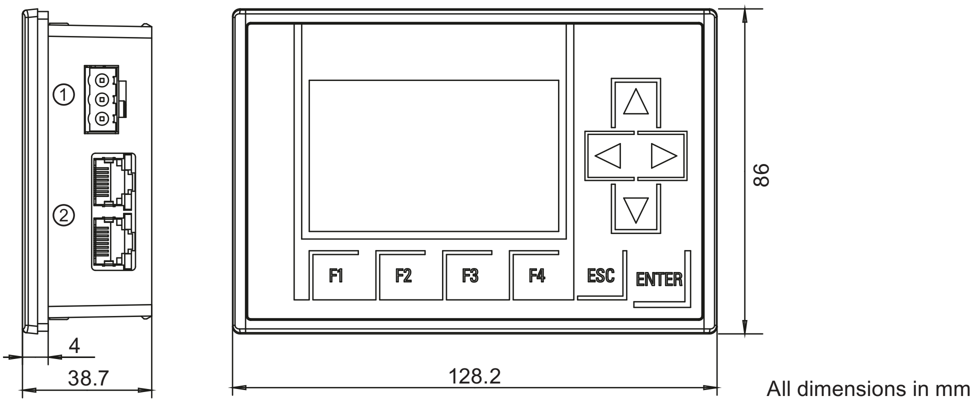
FL1F-K2BM2 (0 ... 10 VDC or 0/4 ... 20 mA)



All dimensions in mm

①	Power supply	②	Outputs
③	RUN/STOP LED	④	Expansion interface
⑤	Mechanical coding pins	⑥	Mechanical coding sockets
⑦	Slide	⑧	FE terminal
⑨	Standard DIN rail	⑩	Version number

FL1F-RD1



① Power supply

② Ethernet interfaces

The Text Display includes a wider display area than onboard display. It includes four programmable cursor keys, four programmable function keys, an ESC key, and an ENTER key. You use the Ethernet cable to connect from the Ethernet interface on the right side of the Text Display to the Ethernet interface on the Base Module.

How to identify the IDEC SmartRelay

The IDEC SmartRelay identifier informs you of various properties.

Base module

FL1F- ① ② ③ ④ ⑤

① B: Base module without display

H: Base module with display

② Number of Inputs and Outputs

③ R: Relay output

S: Tr. (source) output

④ C: With clock

⑤ D: 24V DC

E: 12/24V DC

A: 24V AC/DC

C: 100...240V AC/DC

Expansion module

Digital module

FL1F-M ① ② ③ ④

① Number of Inputs and Outputs

② B1: 24V DC B2: 12/24V DC

C2: 100...240V AC/DC D2: 24V AC/DC

③ S: Tr. (source) output R: Relay output

④ Terminal type 2: non-removable terminal

Analog input module

FL1F-J ① ② ③

① Number of Inputs

② Resolution B: 10bit

③ Terminal type 2: non-removable terminal

Analog output module

FL1F-K ① ② ③ ④

① Number of Outputs

② Resolution B: 10bit

③ M: 0 ... 10V, 0/4 ... 20 mA

④ Terminal type 2: non-removable terminal

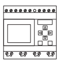
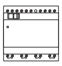
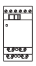
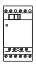
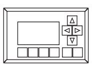
Text Display

FL1F- ① ②

① RD: Remote Display

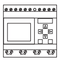
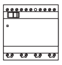
② Version type

Symbols

	Version with display unit is equipped with 8 inputs, 4 outputs and 1 Ethernet interface.
	Version without display unit is equipped with 8 inputs, 4 outputs and 1 Ethernet interface.
	The digital module is equipped with 4 digital inputs and 4 digital outputs.
	The analog module is equipped with 2 analog inputs or 2 analog outputs, according to the device type.
	The Text Display module is equipped with 2 Ethernet interfaces.

Versions

The following IDEC SmartRelay versions are available:

Symbol	Designation	Supply voltage	Inputs	Outputs	Properties
	FL1F-H12RCE	12/24VDC	8 digital [1]	4 relays (10 A)	
	FL1F-H12RCC	100 VAC/VDC to 240 VAC/VDC	8 digital	4 relays (10 A)	
	FL1F-H12SCD	24 VDC	8 digital [1]	4 solid state 24 V/0.3 A	
	FL1F-H12RCA [3]	24 VAC/VDC	8 digital	4 relays (10 A)	
	FL1F-B12RCE	12/24 VDC	8 digital [1]	4 relays (10 A)	no display unit no keyboard
	FL1F-B12RCA [3]	24 VAC/VDC	8 digital	4 relays (10 A)	no display unit no keyboard
	FL1F-B12RCC [2]	100 VAC/VDC to 240 VAC/VDC	8 digital	4 relays (10 A)	no display unit no keyboard

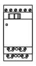
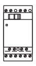
1) Of those can be used alternatively: 4 analog inputs (0 V to 10 V) and 4 fast digital inputs.

2) 100-240 VAC/VDC versions: AC input group has two groups consisting of 4 inputs each. Each input within a group must be connected to the same phase. It is possible to interconnect groups with a different phase.

3) The digital inputs can be operated with P or N action.

Expansion modules

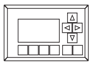
The following expansion modules can be connected to IDEC SmartRelay:

Symbol	Name	Power supply	Inputs	Outputs
	FL1F-M08B2R2	12/24 VDC	4 digital	4 relays (5 A)
	FL1F-M08B1S2	24 VDC	4 digital	4 solid state 24 V/0.3 A
	FL1F-M08D2R2 [3]	24 VAC/VDC	4 digital	4 relays (5 A)
	FL1F-M08C2R2	100 VAC/VDC to 240 VAC/VDC	4 digital [1]	4 relays (5 A)
	FL1F-J2B2	12/24 VDC	2 analog 0 V to 10 V or 0/4 mA to 20 mA [2]	None
	FL1F-K2BM2	24 VDC	None	2 analog 0 VDC to 10 VDC or 0/4 mA to 20 mA [4]

1) Different phases are not allowed within the inputs.
2) 0 V to 10 V, 0/4 mA to 20 mA can be connected optionally.
3) Digital inputs can be operated either with P or with N action.
4) 0 V to 10 V, 0/4 mA to 20 mA can be connected optionally.

Text display module

The following FL1F-RD1 module is available:

Symbol	Name	Supply voltage	Display
	FL1F-RD1	24 VAC/VDC 12 VDC	LCD (160 x 96) 6-row display

1.1 Approvals and certification

Approvals and certification

North America laws and standards

This product has received the following UL certifications.

– UL 508
– CSA C22.2 No. 142
– UL 121201
– CSA C22.2 No.213

Explosion-proof performance

Class I, Division 2, Group A, B, C, D T4

Class I, Zone 2, Group IIC T4

This product has received the following FM certifications.

– FM Class 3611, 3600, 3810
– ANSI/UL 61010-1
– ANSI/UL 121201
– ANSI/IEC60529
– ANSI/NEMA 250
– CSN/CSA-C22.2 No. 213
– CAN/CSA-C22.2 No. 61010-1
– CAN/CSA-C22.2 No.94

Explosion-proof performance

– Class I, Division 2, Group A, B, C, D T4
– Class I, Zone 2, Group IIC T4

⚠ WARNING
Substitution of components can impair the suitability for Class I, Division 2 and Zone 2.

Note

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

CE marking

This product complies with the following EU directives.

- Low Voltage Directive
- EMC Directive
- RoHS Directive

To comply with these directives, this product was designed and evaluated per the following international and European standards.

- EN 61131-2
- EN 61000-6-1, EN 61000-6-2, EN 61000-6-3, EN61000-6-4
- EN IEC 63000

Marine standards

- BV (BV Classification Society)
- DNV (Det Norske Veritas)
- LR (Lloyd's Register)
- Class NK (Nippon Kaiji Kyokai)

Marine certification is certified with the following conditions:

- All 12/24VDC modules are only to be used with 24VDC power supply.
- 24V power supply line are to be protected by surge protective device ((order No. 918 402/ 918 422 manufactured by DEHN+SÖHNE GmbH CO.) or equivalent).
- When using IDEC SmartRelay FL1F in bridge and deck zones with filter ((B84113-C-B-30 manufactured by EPCOS AG) or equivalent).

Please contact us if there are any questions such as about the environment in which IDEC SmartRelay is used.

ID for Australia

Our products carrying the label shown at the side are compliant with AS/NZS 61000.6.4, AS/NZS 61000.6.3 standard.

Waste Electrical and Electronic Equipment Directive

For disposal, observe local regulations and the following Recycling and Disposal information.

Recycling and disposal

The low-pollution SmartRelay device is fully recyclable. For environmentally friendly recycling and disposal of your old equipment, contact a qualified electrical/electronic waste disposal contractor and dispose of the equipment according to the applicable regulations in your country.

UKCA marking

UK
CA

The device complies with the designated British standards (BS) for programmable logic controllers published in the official consolidated list of the British Government. The device meets the requirements and protection targets of the following regulations and related amendments:

- Electrical Equipment (Safety) Regulations 2016 (Low-Voltage)
- Electromagnetic Compatibility Regulations 2016 (EMC)
- Regulations on the restriction of the use of certain hazardous substances in electrical and electronic equipment 2012 (RoHS).

1.2 Secure decommissioning

In this section, you will find information on how to properly decommission individual components of your automation system. Decommissioning is necessary when the component has reached the end of its service life.

Decommissioning includes environmentally sound disposal and secure removal of all digital data of electronic components with storage medium.

1.2.1 Securely removing data

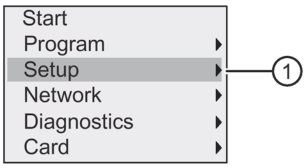
Before disposing of components of your automation system, you should securely delete all data from the storage media of these components. How to securely delete data from the devices so that it cannot be recovered is described below.

NOTICE
Data misuse resulting from non-secure deletion of data Incomplete or non-secure deletion of data from data memories can result in data misuse by third parties. For this reason, ensure secure deletion of data from all storage media used before disposing of the product.

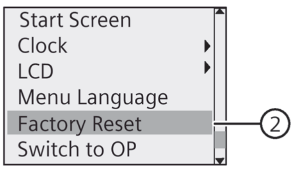
To delete all data from the data memories of IDEC SmartRelay device, reset the device to factory setting. The function deletes all information that was saved internally on the module. You can take the following three methods to reset your IDEC SmartRelay device to factory setting.

Factory reset by IDEC SmartRelay BM/TDE menu command

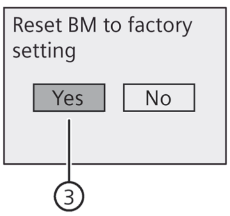
1. Switch the IDEC SmartRelay to programming mode. IDEC SmartRelay opens the main menu:
2. Press ▲ or ▼ to move the cursor to ① , then press **OK**. IDEC SmartRelay open the programming menu.



3. Move the cursor to ② , then press **OK**.



4. Move the cursor to ③ , then press **OK** to confirm factory reset operation.



Factory reset by WindLGC

Use menu command in WindLGC: *Tools -> Transfer -> Factory Reset SmartRelay*. For detailed operation, refer to the section: *Tools -> Transfer -> Factory Reset SmartRelay (SmartRelay FL1F FS5 and later versions only)* in *WindLGC Online Help*.

Factory reset by reset file

1. Copy _reset.bm file in the DVD-ROM into the root directory of an SD card.
2. Insert the SD card into the IDEC SmartRelay BM.
3. Power on the IDEC SmartRelay BM to execute factory reset. After the BM is reset to factory setting, _reset.bm file in the SD card is deleted automatically.

Note

The _reset.bm file can only be used to reset factory setting for IDEC SmartRelay BM FS6 and later versions.

1.2.2 Recycling and disposal

You can fully recycle IDEC SmartRelay devices due to their low-pollutant equipment. For environmentally friendly recycling and disposal of your old equipment, contact a certified electronic waste disposal company and dispose of the equipment according to the applicable regulations in your country.

IDEC SmartRelay installation and wiring 2

General guidelines

Note the following guidelines for installing and wiring your IDEC SmartRelay:

- Always ensure you comply with current rules and standards when wiring your IDEC SmartRelay. Also, conform with all national and regional regulations when you install and operate the devices. For information on standards and regulations that apply to your specific case, contact your local authorities.
- Always switch off power before you wire or install/remove a module.
- Always use cables with appropriate conductor cross-sections for the relevant current. You can wire IDEC SmartRelay with cable conductor cross-sections (Page 28) from 1.5 mm^2 to 2.5 mm^2.
- Keep the cabling as short as possible. If longer cables are necessary, use shielded cables. Always route your cables in pairs; that it, one neutral conductor plus one phase conductor or signal line.
- Always keep separate:
  - The AC wiring
  - High-voltage DC circuits with high-frequency switching cycles
  - Low-voltage signal wiring
- Install wires with appropriate strain relief.
- Provide a suitable lightning surge arrester, such as DCO RK E 24, for cables installed in hazardous areas.
- Do not connect an external power supply in parallel to the output load of a DC output. This could develop a reverse current at the output if you have not installed a diode or similar barrier device.
- Be sure to use only certified components to ensure reliable functioning of equipment.

Note

Only qualified personnel who are familiar with and follow general engineering rules, relevant regulations and standards must install IDEC SmartRelay devices.

⚠WARNING
Explosion hazard
Do not disconnect equipment while the circuit is live or unless the area is known to be free of ignitable concentrations.

What you must note when installing

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

⚠WARNING
IDEC SmartRelay is designed for installation in a cabinet. Do not install IDEC SmartRelay outside a cabinet. If IDEC SmartRelay is installed outside a cabinet, severe personal injury or death or damage to equipment may be caused due to unexpected operations. You can operate IDEC SmartRelay from the front panel at any time.

2.1 Modular IDEC SmartRelay setup

2.1.1 Maximum IDEC SmartRelay network setup

Maximum IDEC SmartRelay network setup

IDEC SmartRelay supports FL1F/Modbus Communication over a 10/100 Mbit/s TCP/IP Ethernet network.

An IDEC SmartRelay can support the following network connections:

- A maximum of 16 TCP/IP-based FL1F/Modbus Communication connections with the following devices:
  - Additional IDEC SmartRelay
  - Modbus over TCP/IP compatible device

  There are two types of connections available for FL1F/Modbus Communication, static connection and dynamic connection. For the static connection, the server reserves the required resources for the connected client to ensure stable data transfer. For the dynamic connection, the server responds to a communication request only when free resources are available. You can configure the static/dynamic connections as required, for example, n static connections and 16-n dynamic connections. IDEC SmartRelay supports a maximum of eight static connections.
- A maximum of one TCP/IP Ethernet connection with the Text Display. A Text Display module can connect with different Base Modules through IP address selection, but can not communicate with more than one Base Module at the same time.
- A maximum of one TCP/IP Ethernet connection between a Base Module and a PC with WindLGC V8.2 or later version.

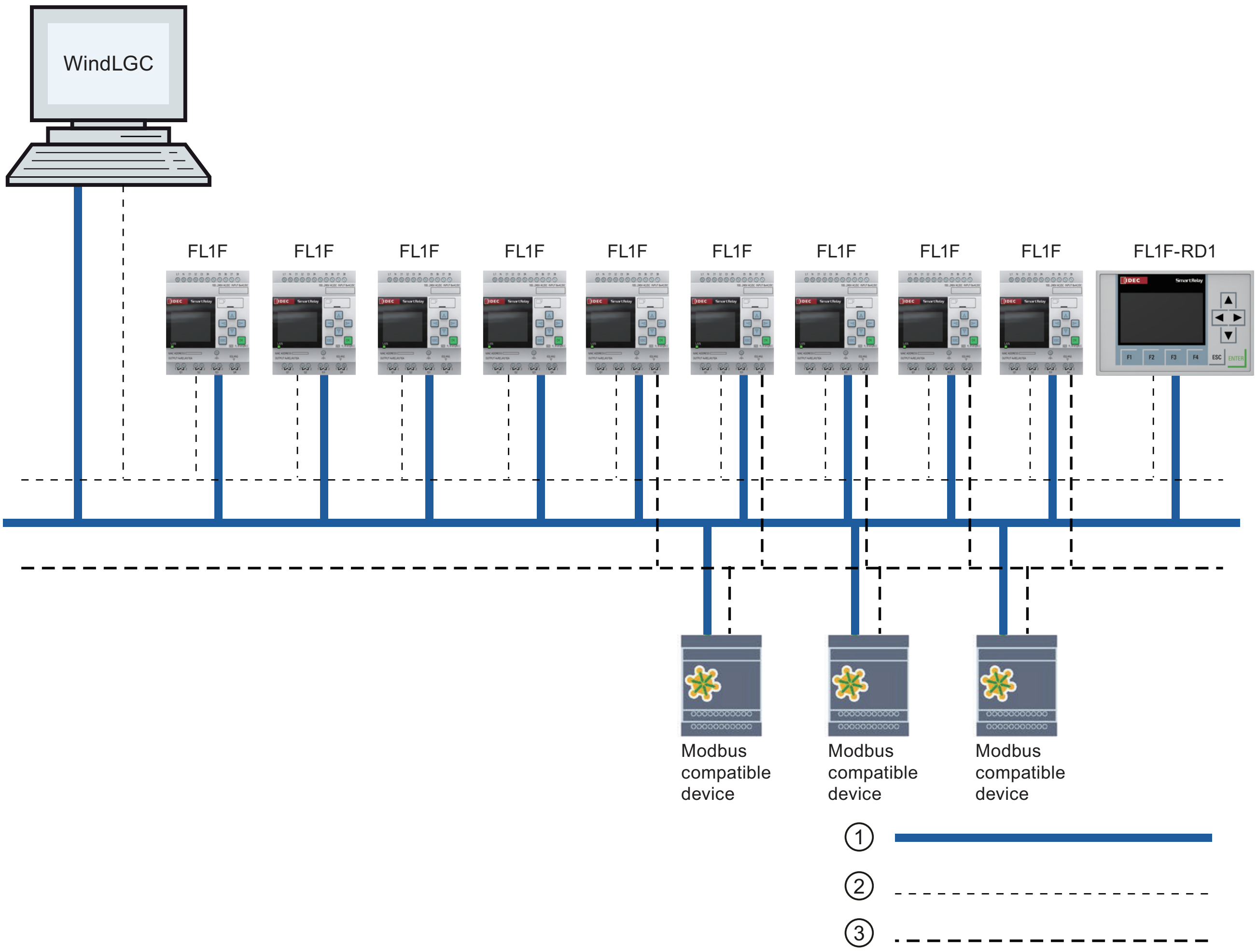
Note

For detailed information about security functions on IDEC SmartRelay, see Chapter Security (Page 294).

Note

You can only construct an IDEC SmartRelay network using WindLGC V8.0 and later versions.

A **typical** IDEC SmartRelay network setup shows as below:



① Physical Ethernet connections

② Logical connection for communication between IDEC SmartRelay and PC (by TCP/IP-based Ethernet)

③ Logical connections for Modbus communication between Modbus compatible devices (with Modbus protocol over TCP/IP)

2.1.2 Maximum setup with expansion modules

IDEC SmartRelay supports a maximum of Getting started with IDEC SmartRelay (Page 1). You can achieve the maximum setup in different ways as shown below:

Maximum setup of an IDEC SmartRelay *with* analog inputs onboard - four in use

Base Module, 4 digital modules and 6 analog modules (example)

I1, I2, I3 .. I6, I7, I8 AI3, AI4, AI1, AI2	I9..I12	I13..I16	I17..I20	I21..I24	AI5, AI6	AI7, AI8				
IDEC Smart-Relay Base Module	FL1F-M08	FL1F-M08	FL1F-M08	FL1F-M08	FL1F-J2B2	FL1F-J2B2	FL1F-K2BM2	FL1F-K2BM2	FL1F-K2BM2	FL1F-K2BM2
Q1..Q4	Q5..Q8	Q9..Q12	Q13..Q16	Q17..Q20			AQ1, AQ2	AQ3, AQ4	AQ5, AQ6	AQ7, AQ8

Maximum setup of an IDEC SmartRelay *with* analog inputs onboard - two in use

Base Module, 4 digital modules and 7 analog modules (example)

I1, I2, I3 .. I6, I7, I8 AI1, AI2	I9..I12	I13..I16	I17..I20	I21..I24	AI3, AI4	AI5, AI6	AI7, AI8				
IDEC Smart-Relay Base Module	FL1F-M08	FL1F-M08	FL1F-M08	FL1F-M08	FL1F-J2B2	FL1F-J2B2	FL1F-J2B2	FL1F-K2BM2	FL1F-K2BM2	FL1F-K2BM2	FL1F-K2BM2
Q1..Q4	Q5..Q8	Q9..Q12	Q13..Q16	Q17..Q20				AQ1, AQ2	AQ3, AQ4	AQ5, AQ6	AQ7, AQ8

Maximum setup of an IDEC SmartRelay *without* analog inputs onboard (FL1F-H12RCA/B12RCA and FL1F-H12RCC/B12RCC)

Base Module, 4 digital modules and 8 analog modules (example)

I1 . . . . . . I8	I9..I12	I13..I16	I17..I20	I21..I24	AI1, AI2	AI3, AI4	AI5, AI6	AI7, AI8				
IDEC Smart-Relay Base Module	FL1F-M08	FL1F-M08	FL1F-M08	FL1F-M08	FL1F-J2B2	FL1F-J2B2	FL1F-J2B2	FL1F-J2B2	FL1F-K2BM2	FL1F-K2BM2	FL1F-K2BM2	FL1F-K2BM2
Q1..Q4	Q5..Q8	Q9..Q12	Q13..Q16	Q17..Q20					AQ1, AQ2	AQ3, AQ4	AQ5, AQ6	AQ7, AQ8

For FL1F-H12RCE/B12RCE and FL1F-H12SCD modules, you can configure whether the module uses zero, two or four of the four possible analog inputs. AI inputs are numbered consecutively depending on how many you configure the IDEC SmartRelay Base Module to use. If you configure two inputs, they are numbered AI1 and AI2, and correspond to the I7 and I8 input terminals. Subsequent AI expansions modules would begin numbering at AI3. If you configure four inputs, they are numbered AI1, AI2, AI3, and AI4, and correspond to I7, I8, I1, and I2 in that order. Subsequent AI expansions modules would begin numbering at AI5. See topics "Constants and connectors (Page 116)" and "Setting the number of AIs in IDEC SmartRelay (Page 285)".

High-speed/optimal communication performance

For optimal and high-speed communication performance between the Base Module and the various modules, install the digital modules first, then the analog modules (as the examples above show). (The special function PI controller is an exception: the AI used for the value PV should be on the Base Module or an analog input module adjacent to the Base Module).

You install the Text Display module separately and connect it to the Base Module with the Ethernet interface.

2.1.3 Setup with different voltage classes

Rules

You can only connect digital modules to devices of the same voltage class.

You can connect analog modules to devices of any voltage class.

Overview: Connecting an expansion module to the IDEC SmartRelay Base Module

In the following tables, "X" means that the connection is possible; "-" means that the connection is not possible.

IDEC SmartRelay Base Module	Expansion modules				
	FL1F-M08B2R2	FL1F-M08B1S2	FL1F-M08D2R2	FL1F-M08C2R2	FL1F-J2B2/K2BM2
FL1F-H12RCE	x	x	x	-	x
FL1F-H12RCC	-	-	-	x	x
FL1F-H12SCD	x	x	x	-	x
FL1F-H12RCA	x	x	x	-	x
FL1F-B12RCE	x	x	x	-	x
FL1F-B12RCA	x	x	x	-	x
FL1F-B12RCC	-	-	-	x	x

Overview: Connecting an additional expansion module to an expansion module

Expansion module	Additional expansion modules				
	FL1F-M08B2R2	FL1F-M08B1S2	FL1F-M08D2R2	FL1F-M08C2R2	FL1F-J2B2/K2BM2
FL1F-M08B2R2	x	x	x	-	x
FL1F-M08B1S2	x	x	x	-	x
FL1F-M08D2R2	x	x	x	-	x
FL1F-M08C2R2	-	-	-	x	x
FL1F-J2B2/K2BM2	x	x	x	-	x

2.1.4 Compatibility

The compatibility of modules

All of IDEC SmartRelay FL1F modules are compatible with FL1F series only.

You cannot connect IDEC SmartRelay FL1F Base Modules to old expansion modules such as FL1E series.

You cannot connect IDEC SmartRelay FL1F expansion modules to old Base Modules such as FL1E series.

You cannot connect IDEC SmartRelay FL1F text display to old Base Modules such as FL1E series.

You can only use the Text Display module with equipment series FL1F.

The Text Display provides two Ethernet ports for network connection and six-line text display specifically for the IDEC SmartRelay FL1F device.

All FL1F expansion modules are completely compatible with the Base Modules of FL1F series and you can only use them with equipment of FL1F series.

IDEC SmartRelay supports micro SD cards.

The compatibility of message texts

You cannot edit message texts from the Base Module that contain any of the following parameters:

- Par
- Time
- Date
- EnTime
- EnDate
- Analog input
- Digital I/O status
- Special characters (for example: ±, €)

You can only edit such message texts from WindLGC.

The compatibility of circuit diagram

The table below shows the detailed compatibility information for different device modules and circuit diagrams.

Device Module	Circuit Diagram hardware type		
	FL1F	FL1F FS5	FL1F FS6
FL1F module	Yes	No	No
FL1F FS5 module	Yes	Yes	No
FL1F FS6 module	Yes	Yes	Yes

2.2 Installing/removing IDEC SmartRelay

Dimensions

The IDEC SmartRelay installation dimensions are compliant with DIN 43880.

IDEC SmartRelay can be snap-mounted to 35 mm DIN rails according to EN 60715 or mounted on the wall with two M4 screws.

IDEC SmartRelay width:

- Text Display has a width of 128.2 mm.
- Base Modules have a width of 71.5 mm.
- Expansion Modules have a width of 35.5 mm (FL1F-M08...)

Note

The figures above show you an example of the installation and removal of an FL1F-H12RCE and a digital module. The measures shown apply to all other Base Module versions and expansion modules.

WARNING

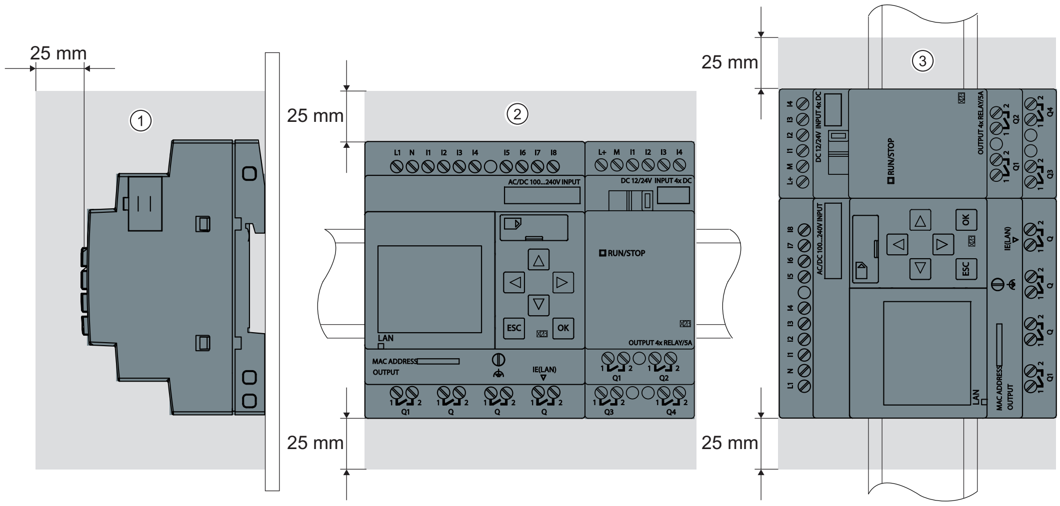
Hazardous Voltage

Hazardous electrical voltage can cause electric shock, burns and property damage.

Disconnect your system and devices from the power supply before starting any assembly tasks.

Mounting positions

IDEC SmartRelay modules support vertical and horizontal mounting position. When planning your layout for IDEC SmartRelay modules, allow enough clearance for the wiring and communication cable connections.



① Side view ② Horizontal mounting ③ Vertical mounting

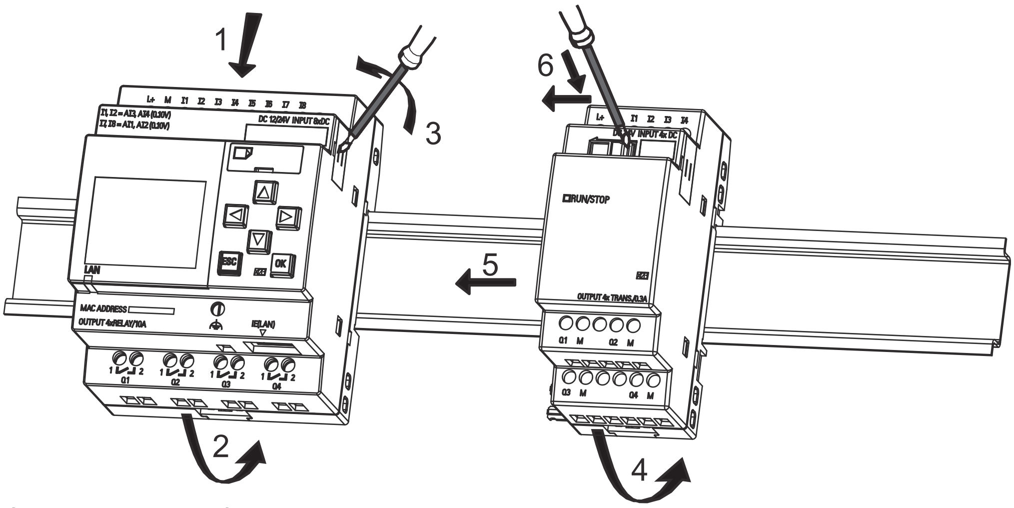
For proper cooling, you must provide a clearance of at least 25 mm above and below the mounting devices. Also, allow at least 25 mm of space between the front of modules and the inside of the enclosure.

2.2.1 DIN rail mounting

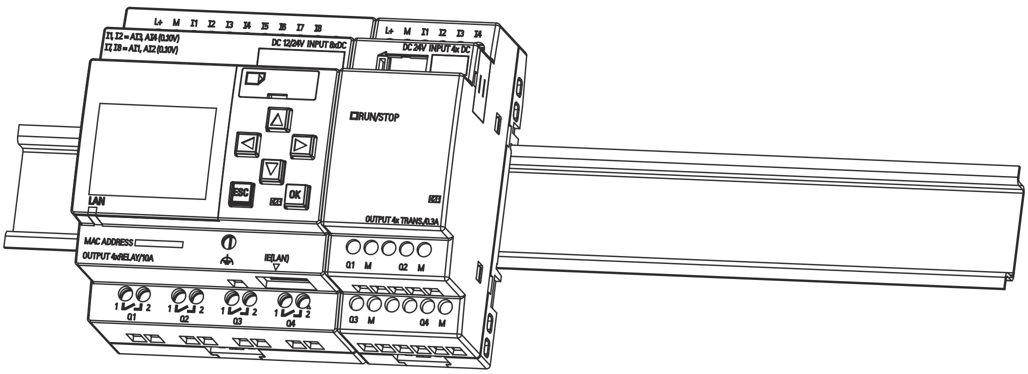
Mounting

To **mount** a Base Module **and** a digital module onto a DIN rail, follow these steps:

1. Hook the Base Module onto the rail.
2. Push down the lower end to snap it on. The mounting interlock at the rear must engage.



3. On the right side of the Base Module/Expansion Module, remove the connector cap.
4. Place the digital module onto the DIN rail on the right-hand side of the Base Module.
5. Slide the digital module towards the left until it contacts the Base Module.
6. Using a screwdriver, push the interlock to the left. In its end position the slide interlock engages in the Base Module.



Repeat the digital module steps to mount further expansion modules.

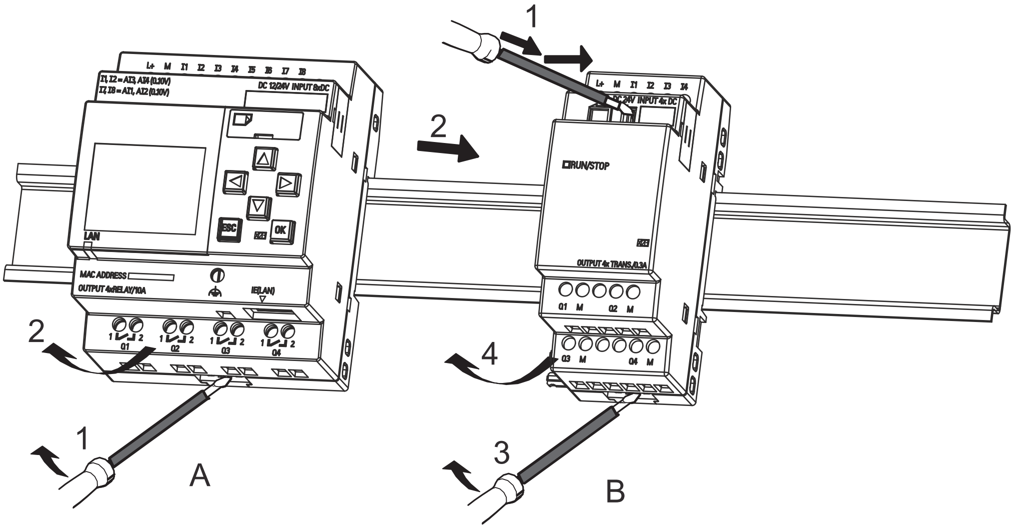
Note

Be sure to cover the expansion interface on the last expansion module.

Removal

To **remove** IDEC SmartRelay if you have installed **only one Base Module**, follow these steps:

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



To **remove** IDEC SmartRelay if you have connected **at least one expansion module** to the Base Module, follow these steps:

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

Repeat steps 1 to 4 for all other expansion modules.

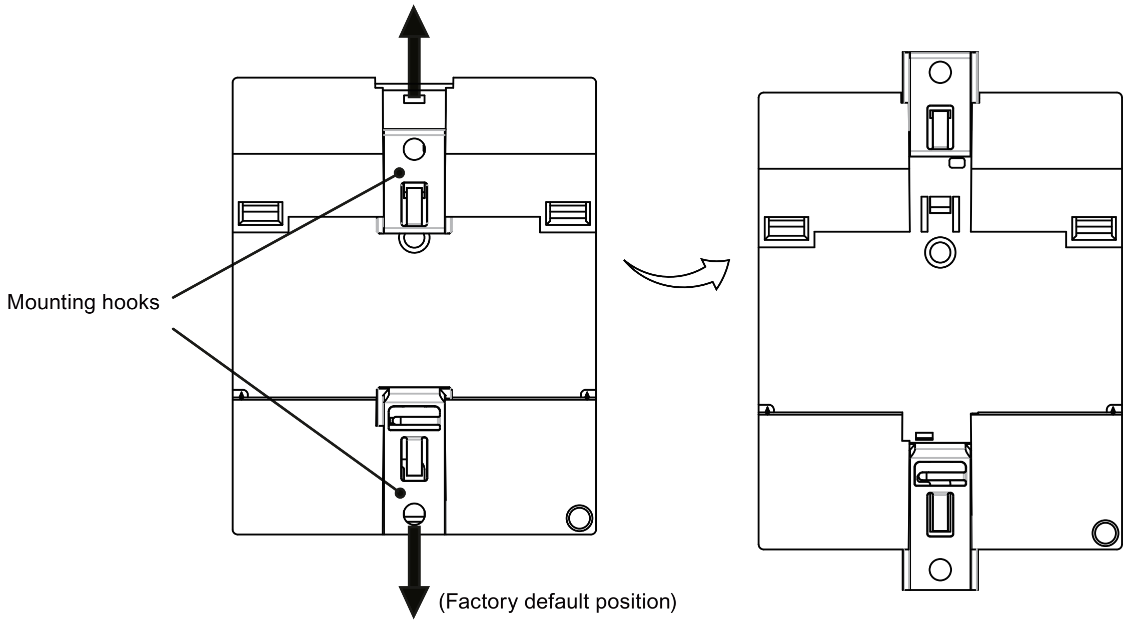
5. After removing all expansion modules, remove the base module.

Note

When removing modules, be sure to disengage the slide interlock of the module that connects it to the next module. When removing multiple modules, it is easier to start with the last module on the right side.

2.2.2 Wall-mounting

Follow the instructions below to wall-mount IDEC SmartRelay by means of two mounting slides and two M4 screws (tightening torque 0.8 Nm to 1.2 Nm).

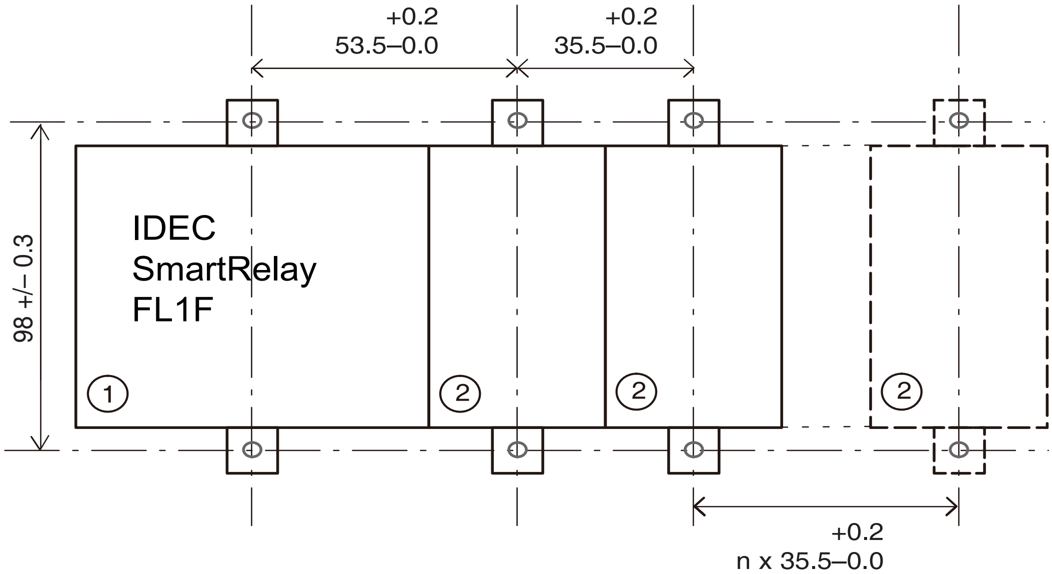


Note

When you do not wall-mount IDEC SmartRelay, always keep the mounting hooks in the factory default positions, that is, within the data area given in the illustration above; otherwise, the mounting hooks may deform if they are exposed to hot and humid surroundings for a long term.

Drilling template for wall-mounting

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



All dimensions in mm

Bore hole for M4 screw, tightening torque 0.8 Nm to 1.2 Nm

① Base Module

② Expansion Modules

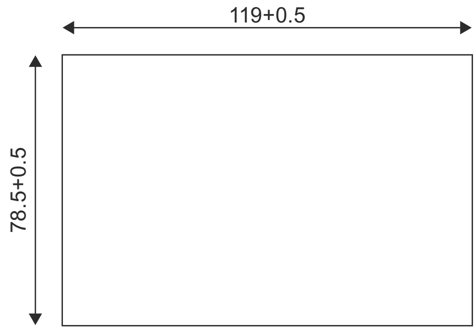
2.2.3 Mounting the Text Display

Note

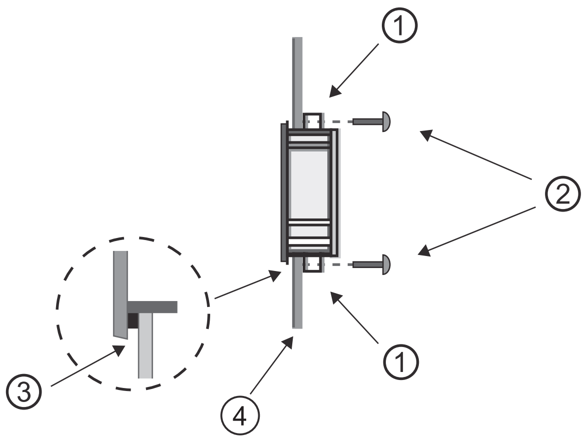
Make sure you mount the Text Display vertically on a flat surface of an IP 65 or Type 4X/12 enclosure.

To prepare the mounting surface for the optional Text Display and mount it, follow these steps:

1. Cut a 119 mm × 78.5 mm (tolerance: +0.5 mm) hole in the mounting surface.



2. Place the included gasket on the frontplate of the Text Display.
3. Fit the Text Display into the cutout you made in the mounting surface.
4. Attach the mounting brackets (included) to the Text Display
5. Tighten the mounting screws on the mounting brackets to 0.2 Nm torque to secure the Text Display.

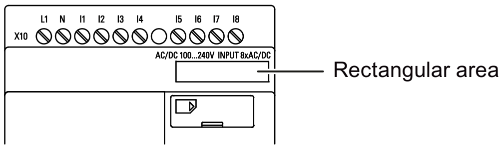


① Mounting brackets
② Mounting screws
③ Gasket
④ Cabinet door or control panel (Thickness: 1.5 mm to 4 mm)

You can then connect the Text Display to the Base Module through the Ethernet interface.

2.2.4 Labeling IDEC SmartRelay

The rectangular areas on the IDEC SmartRelay modules are intended for labeling.



In the case of expansion modules, you can use the rectangular areas for labeling the inputs and outputs, for example. In this connection, you can enter a delta factor of +8 for the inputs or +4 for the outputs if the Base Module already has 8 inputs or 4 outputs.

2.3 Wiring IDEC SmartRelay

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

You do not need to wire ferrules for the terminals. You can use conductors fulfilled the following requirements:

- Cross-sections of up to the following thicknesses:
  - 1 × 2.5 mm^2
  - 2 × 1.5 mm^2 for each second terminal chamber
- Conductor material: Cu

  Insulation temperature rating: 75 °C
- Tightening torque:

  <Base module: FS05 or less / Expansion module: FS01>

  0.5 Nm to 0.6 Nm or 4.5 in.lbf to 5.3 in.lbf

  <Base module: FS06 or over / Expansion module: FS02 or over>

  0.8 Nm or 7 in.lbf

Recommended ferrules

Ferrules order No.
For 1-cable connection

Cross-section [mm^2]	AWG	Phoenix Contact Ferrule type No.	NIC HIFU Blade Terminals type No.	NIC HIFU Insulated Pin Terminals type No.
0.3	22	AI0,5-10WH	BT1.25-10-1	TGN-TC-1.25-11T
0.5	20	AI0,5-10WH		
0.75	18	AI0,75-8GY		
1.25	16	AI1,5-8BK	BT1.25-10-1 BT2-9-1	
2.0	14	AI2,5-8BU	BT2-9-1	-
Recommended crimping tool		CRIMPFOX ZA 3	NH1 NH61	NH11 NH32 NH65

For 2-cable connection

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

Note

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

CAUTION

Use copper cables at connectors with terminal connections

Use copper (Cu) cables for all supply lines that are connected to the device with terminals, e.g. 24/240 VDC power supply cables to the 24/240 VDC power supply connectors.

Utiliser des câbles en cuivre sur les connexions à bornes

Utilisez des câbles en cuivre (Cu) pour tous les câbles d'alimentation qui sont raccordés à l'appareil par des bornes, par exemple les câbles d'alimentation 24/240 VCC sur le connecteur d'alimentation 24/240 VCC.

2.3.1 Connecting the power supply

The 100-240 VAC/VDC versions of IDEC SmartRelay are suitable for operation with rated voltages of 100 VAC/VDC and 240 VAC/VDC. The IDEC SmartRelay 24 V and 12 V versions can be operated with a 24 VDC, 24 VAC or 12 VDC power supply. For information on permissible voltage tolerances, line frequencies and power consumption, refer to the installation instructions in the Product Information supplied with your device and to the technical data in Appendix A.

The Text Display must be supplied with a voltage of 12 VDC or 24 VAC/VDC.

CAUTION

Expansion modules FL1F-M08C2R2 must be operated with the same type of power supply (DC or AC) as for the connected 100-240 VAC/VDC version of the Base Module. The same supply output "+/- "on DC power supplies or "N/L" on AC power supplies must connect to the same phase on both the expansion module FL1F-M08C2R2 and the connected FL1F-H12RCC/B12RCC. Failure to follow the instructions could result in personal injury.

Note

A power failure might cause an additional edge triggering signal at the special functions. The stored data will be from the last uninterrupted cycle.

When using different power supplies, supply power to the base module and expansion modules at the same time, or supply power to expansion modules before the base module. When supplying power to expansion modules after the base module, expansion modules may not be recognized by the base module.

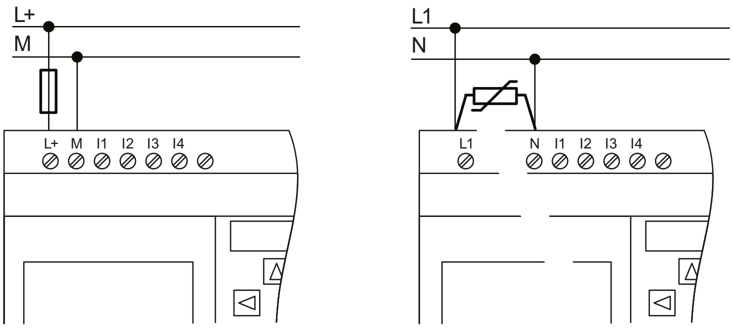
When using different power supplies, the fast transient/burst immunity (IEC61000-4-4) will be 1kV (power supply).

Connecting IDEC SmartRelay

Connect IDEC SmartRelay to the power supply as shown below, depending on whether your power supply is DC or AC:

IDEC SmartRelay with DC power supply

IDEC SmartRelay with AC power supply



Protection with safety fuse if required (recommended) for:
FL1F-H12RCE: 0.8 A
FL1F-H12SCD: 2.0 A

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

Note

IDEC SmartRelay is a double-insulated switchgear. You must connect its FE terminal to earth ground.

Circuit protection with AC voltage

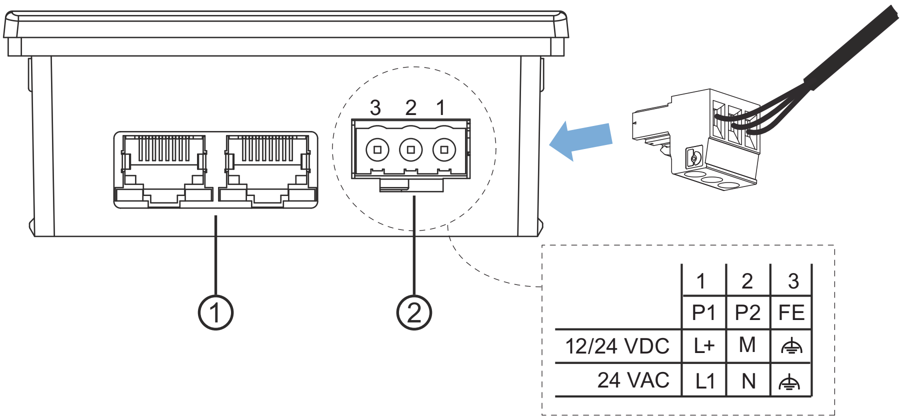
To suppress voltage peaks on the power supply lines, you can install a metal oxide varistor (MOV). Make sure the operating voltage of the varistor (MOV) used lies at least 20% above the rated voltage.

Circuit protection with DC voltage

To suppress voltage peaks on the power supply lines, install a protection device.

2.3.2 Connecting the Text Display power supply

You must connect the FL1F-RD1 to an external power supply that supplies a voltage of 12 VDC or 24 VAC/VDC. Text Display includes a power connector. Connect the power supply to the power connector then plug the power connector to the power supply interface on Text Display.



① Ethernet interfaces

② Power supply

- The power connection is non-polar. If you connect a DC power supply to the Text Display, you can connect the positive supply wire or negative supply wire to either pin 1 or pin 2.
- Pin 3 must be connected to the ground.

Note

IDEC recommends that you protect the Text Display with a 0.5 A safety fuse on the power supply.

2.3.3 Connecting IDEC SmartRelay inputs

Requirements

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

Sensor characteristics for IDEC SmartRelay

	FL1F-H12RCE FL1F-B12RCE		FL1F-H12SCD		FL1F-H12RCA FL1F-B12RCA		FL1F-H12RCC FL1F-B12RCC	
	I3 ~ I6	I1,I2,I7,I8	I3 ~ I6	I1,I2,I7,I8	AC	DC	AC	DC
Input voltage (Signal 0)	< 5 V DC	< 5 V DC	< 5 V DC	< 5 V DC	< 5 V AC	< 5 V DC	< 40 V AC	< 30 V DC
Input current (Signal 0)	< 0.88mA	< 0.07mA	< 0.9mA	< 0.07mA	< 1.2mA	< 1.2mA	< 0.05mA	< 0.06mA
Input voltage (Signal 1)	> 8.5 V DC	> 8.5 V DC	> 12 V DC	> 12 V DC	> 12 V AC	> 12 V DC	> 79 V AC	> 79 V DC
Input current (Signal 1)	> 1.5mA	> 0.12mA	> 2.1mA	> 0.18m	> 2.6mA	> 2.6mA	> 0.08 mA	> 0.13mA

	FL1F-M08B2R2	FL1F-M08B1S2	FL1F-M08D2R2		FL1F-M08C2R2	
			AC	DC	AC	DC
Input voltage (Signal 0)	< 5 V DC	< 5 V DC	< 5 V AC	< 5 V DC	< 40 V AC	< 30 V DC
Input current (Signal 0)	< 0.88mA	<0.88mA	< 1.1mA	< 1.1mA	< 0.05mA	< 0.06mA
Input voltage (Signal 1)	> 8.5 V DC	> 12 V DC	> 12 V AC	> 12 V DC	> 79 V AC	> 79 V DC
Input current (Signal 1)	> 1.5mA	> 2.1mA	> 2.63mA	> 2.63mA	> 0.08 mA	> 0.13mA

Note

FL1F-H12RCC/B12RCC contains two groups of four inputs, for a total of eight. Within each group, you must operate all inputs on the same phase. Different phases are only possible between the groups.

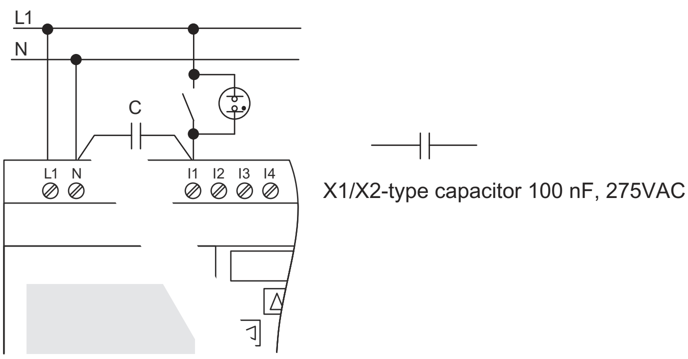
Example: I1 to I4 on phase L1, I5 to I8 on phase L2.

You must not connect the inputs of the FL1F-M08C2R2 to different phases.

Sensor connections

Connecting glow lamps and two-wire proximity switches (Bero) to FL1F-H12RCC/B12RCC or FL1F-M08C2R2 (AC)

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



Take into account the quiescent current of any two-wire proximity switches that you use. The level of the quiescent current of some two-wire proximity switches is high enough to trigger a logical "1" signal at the IDEC SmartRelay input. You should therefore compare the quiescent current of the proximity switches with the Technical data (Page 312).

Remedy

To suppress this response, use an X1/X2-type capacitor rated at 100 nF and 275 VAC. In a destructive situation, this type of capacitor safely disconnects. You must choose the voltage level for which the capacitor is rated such that it is not destroyed in the case of overvoltage!

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

Restrictions

Signal status transitions 0 → 1/1 → 0

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

The size of the circuit program determines the program execution time. The appendix "Determining the cycle time (Page 332)" contains a benchmark test routine that you can use to determine the current scan cycle time.

Special features of FL1F-H12RCE/B12RCE and FL1F-H12SCD

Fast digital inputs: I3, I4, I5 and I6

These modules include fast digital inputs (up/down counters, frequency triggers). The restrictions mentioned earlier do not apply to these fast digital inputs.

Note

Expansion modules do not have fast digital inputs.

Analog inputs: I1 and I2, I7 and I8

You can use the inputs I1, I2, I7 and I8 of IDEC SmartRelay versions FL1F-H12RCE/B12RCE and FL1F-H12SCD as either digital inputs or analog inputs. The IDEC SmartRelay circuit program defines the input mode (digital or analog).

The inputs I1, I2, I7 and I8 provide digital inputs, and the inputs AI3, AI4, AI1 and AI2 provide analog inputs, as described in the topic "Constants and connectors (Page 116)". AI3 corresponds to the input terminal I1; AI4 corresponds to I2; AI1 corresponds to I7; AI2 corresponds to I8. The use of AI3 and AI4 is optional. You configure your IDEC SmartRelay to use either two or four analog inputs as the topic "Setting the number of AIs in IDEC SmartRelay (Page 285)" describes.

When using inputs I1, I2, I7 and I8 as analog inputs, only the range from 0 to 10 VDC is available.

Connecting a potentiometer to inputs I1, I2, I7 and I8

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

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

Voltage	Potentiometer	Series Resistor
12 V	5 kΩ	-
24 V	5 kΩ	6.6 kΩ

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

Note

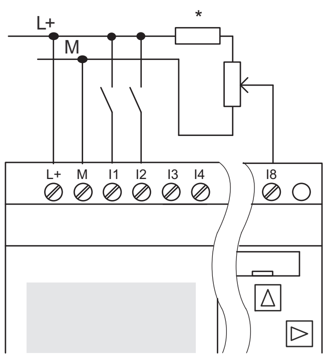
The FL1F-J2B2 expansion module provides additional analog inputs.

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

Sensor connections

Connect sensors to IDEC SmartRelay as shown below.

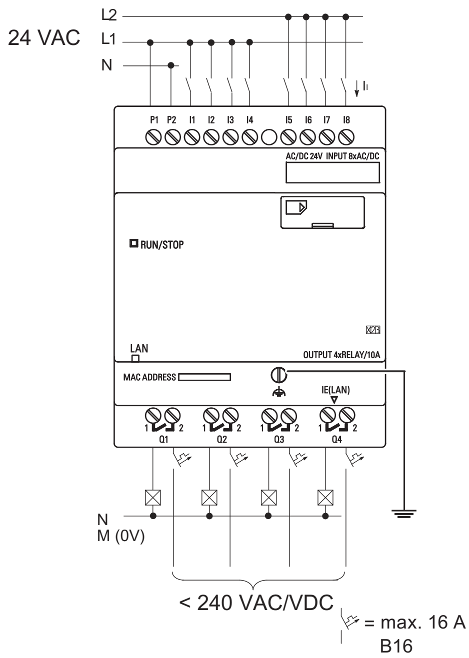
FL1F-B12RCE/H12RCE and FL1F-B12RCA/H12RCA/H12SCD



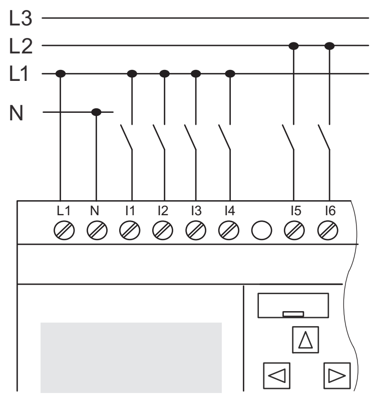
The inputs of these devices are not isolated and therefore require a common reference potential (chassis ground).

With FL1F-H12RCE/B12RCE and FL1F-H12SCD modules, you can tap analog signals between the supply voltage and chassis ground (* = series resistor (6.6 kΩ) at 24 VDC).

Connection example



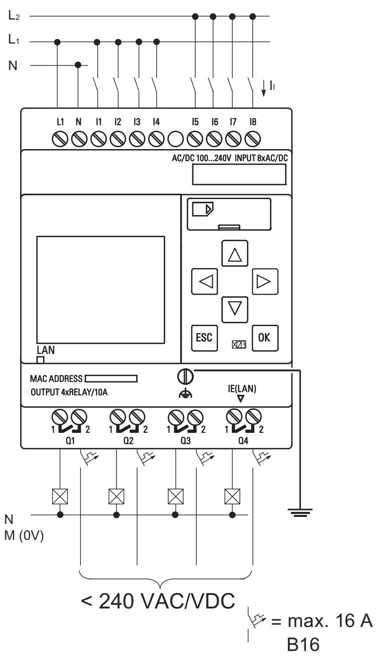
FL1F-B12RCC/H12RCC



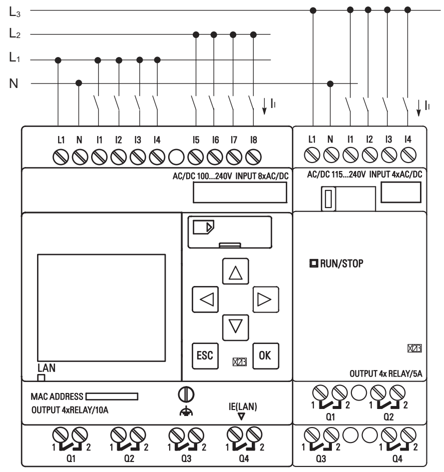
The inputs of these devices are in two groups, each consisting of four inputs. Different phases are only possible between groups, but not within the groups.

Connection example

Two-phase connection of the Base Module



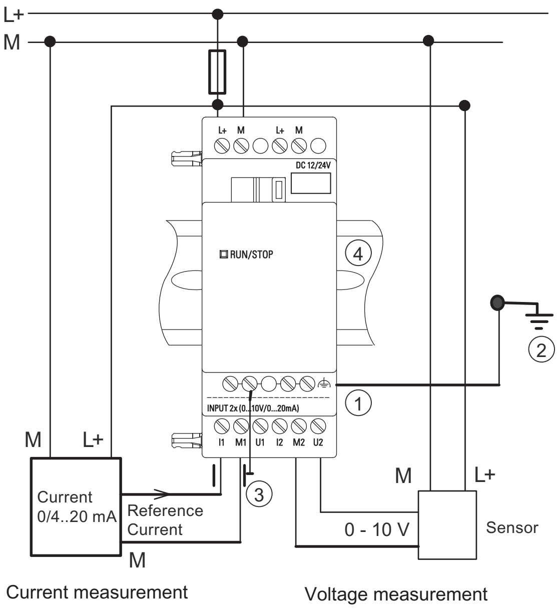
Three-phase connection of the Base Module with an expansion module



⚠ WARNING

Current safety regulations (VDE 0110, ... and IEC 61131-2, ... as well as UL 508) do not permit the connection of different phases to an AC input group (I1 to I4 or I5 to I8) or to the inputs of a digital module.

FL1F-J2B2



①	FE terminal for connecting earth and shielding the cable	③	Shielded cable
②	Earth	④	Standard DIN rail

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

Connecting a two-wire sensor to the FL1F-J2B2

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

1. Connect the sensor's output to connection U (0 V to 10 V voltage measurement) or to connection I (0/4 mA to 20 mA current measurement) of the FL1F-J2B2 module.
2. Connect the plus connector on the sensor to the 24 V supply voltage (L+).
3. Connect the ground connection of the current output M (on the right side of the sensor, as shown in the figure above) to the corresponding M input (M1 or M2) on the FL1F-J2B2 module.

Note

Fluctuating analog values can occur if you do not mount/correctly mount the screening on the connecting wire from the analog valuator device to the analog FL1F-J2B2 expansion module (encoder wire).

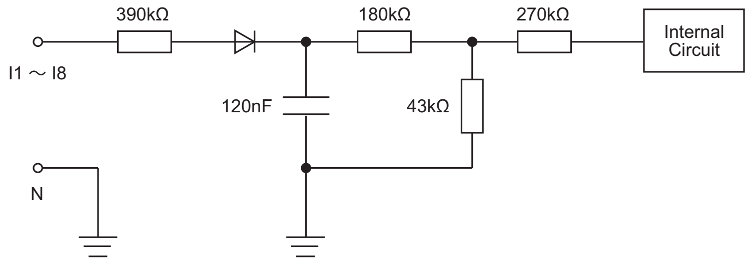
To avoid fluctuating analog values when using these expansion modules, take the following measures:

- Use only shielded cable.
- Shorten the cable as much as possible. The cable must not be more than 10 meters long.
- Clamp the cable on one side only and clamp it only to the FE terminal on the FL1F-J2B2/K2BM2 expansion module.
- Connect the earth to the FE terminal on the expansion module.

Input Internal Circuit

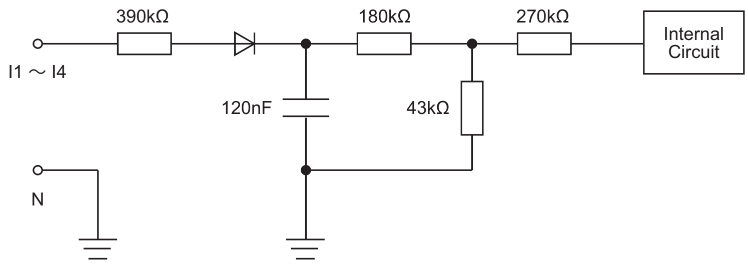
FL1F-H12RCC / FL1F-B12RCC

Digital AC/DC Input

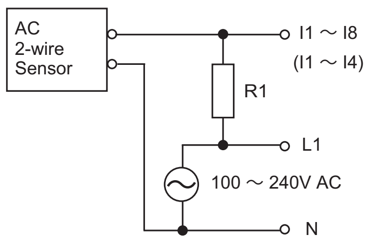


FL1F-M08C2R2

Digital AC/DC Input



When using the AC two-wire sensor



Note : Bleeder resistance (R1) calcuation

R1 must satisfy the following three conditions.

Condition 1: $\text{R1}\ (\Omega) \leq \dfrac{\text{Maximum input OFF voltage (= 40V AC)}}{\text{Maximum sensor leakage current (A)}}$

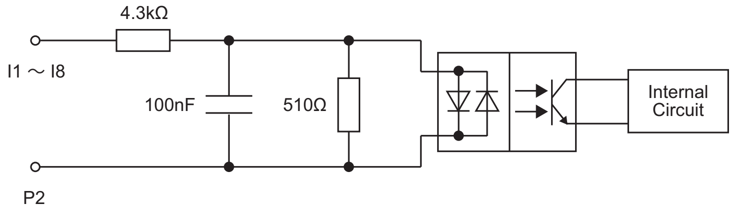
Condition 2: $\text{R1}\ (\Omega) \leq \dfrac{\text{Sensor power voltage (V)}}{\text{Minimum sensor load current (A)}}$

The voltage drop across the load (R1) must be less than 40V while the sensor is turned off.

Condition 3: $P_{R1}\ (\text{W}) \geq \dfrac{\{\text{Sensor power voltage (V)}\}^2}{\text{R1 resistance }(\Omega)} \times 3$ (3: recommended allowance)

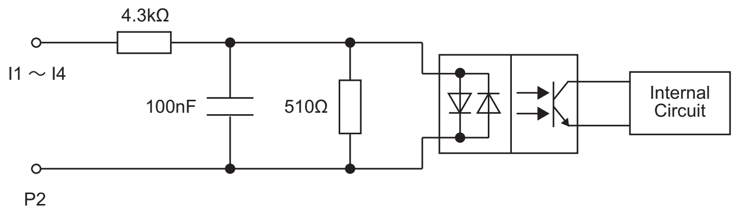
FL1F-H12RCA / FL1F-B12RCA

Digital AC/DC Input

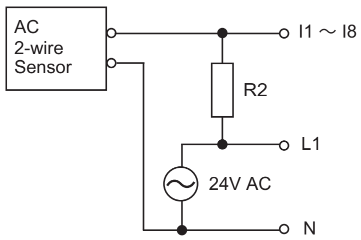


FL1F-M08D2R2

Digital AC/DC Input



When using the AC two-wire sensor



Note : Bleeder resistance (R2) calcuation

R3 must satisfy the following three conditions.

Condition 1: $R2\ (\Omega) \leq \dfrac{\text{Maximum input OFF voltage (= 5V AC)}}{\text{Maximum sensor leakage current (A)}}$

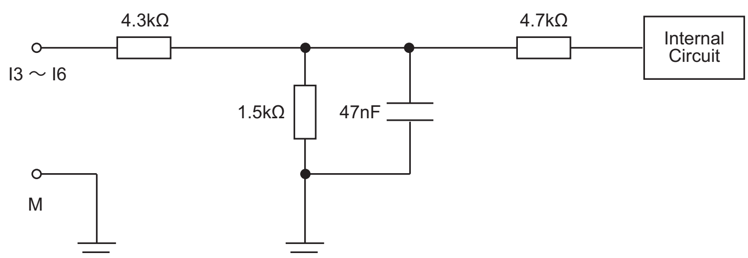
Condition 2: $R2\ (\Omega) \leq \dfrac{\text{Sensor power voltage (V)}}{\text{Minimum sensor load current (A)}}$

The voltage drop across the load (R2) must be less than 5V while the sensor is turned off.

Condition 3: $P_{R2}\ (W) \geq \dfrac{\{\text{Sensor power voltage (V)}\}^2}{\text{R2 resistance }(\Omega)} \times 3$ (3: recommended allowance)

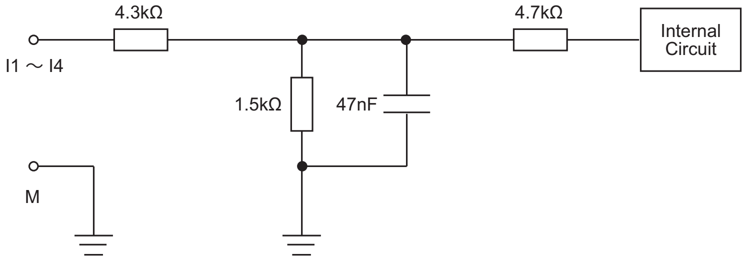
FL1F-H12RCE / FL1F-B12RCE / FL1F-H12SCD

Digital DC Input



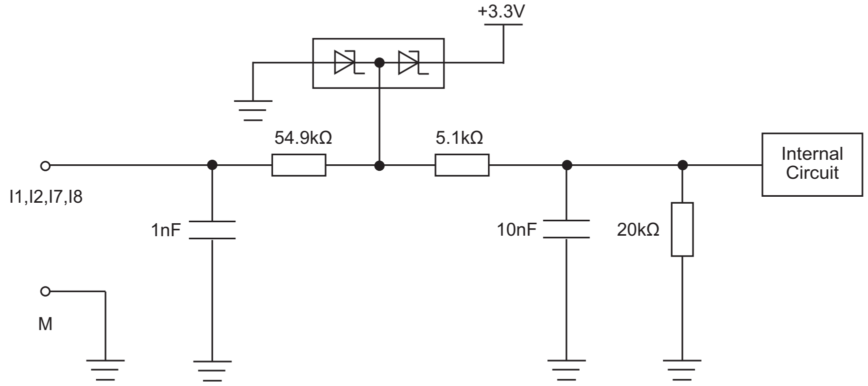
FL1F-M08B2R2/FL1F-M08B1S2

Digital DC Input



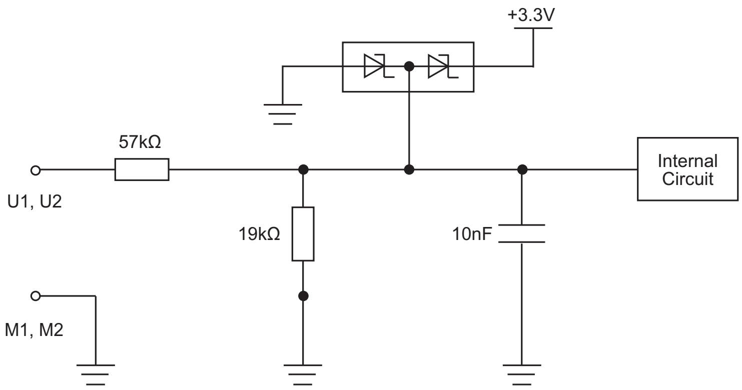
FL1F-H12RCE / FL1F-B12RCE / FL1F-H12SCD

Analog Input (0-10V)



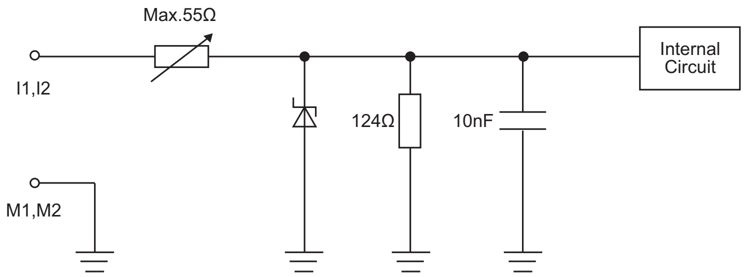
FL1F-J2B2

Analog Input (0-10V)



FL1F-J2B2

Analog Input (0-20mA)



2.3.4 Connecting outputs

FL1F-H12RCA/B12RCA/H12RCC/B12RCC/H12RCE/B12RCE

The FL1F-H12RCA/B12RCA/H12RCC/B12RCC/H12RCE/B12RCE version includes relay outputs. The potential of the relay contacts is isolated from the power supply and the inputs.

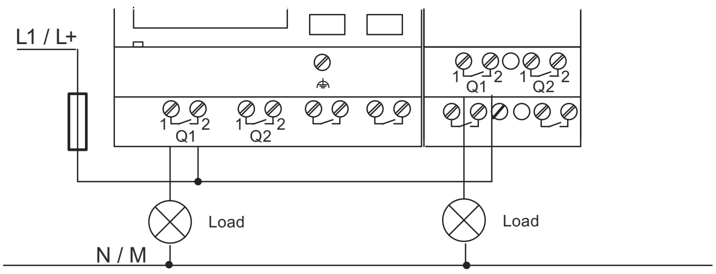
Requirements for relay outputs

You can connect various loads to the outputs; for example lamps, fluorescent lamps, motors, contactor relays, and so on. For information on the properties required for the loads connected to FL1F-H12RCA/B12RCA/H12RCC/B12RCC/H12RCE/B12RCE, refer to the General technical data (Page 312).

NOTICE
IDEC SmartRelay Relay contacts may be damaged by a high inrush current.
When low energy lamps or LED Lamps are controlled by IDEC SmartRelay relay outputs, the energy lamps and/or LED lamps may have a very high inrush current. If the inrush current is not limited, the IDEC SmartRelay relay contacts may be damaged after some switch cycles.
Use an inrush current limiter to protect the relay contacts.

Connecting

Connect the load to FL1F-H12RCA/B12RCA/H12RCC/B12RCC/H12RCE/B12RCE as shown below:



Protection with automatic circuit-breaker, max. 16 A, characteristics B16

IDEC SmartRelay with transistor outputs

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

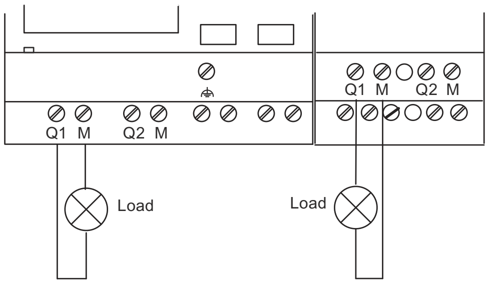
Requirements for transistor outputs

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

- The maximum switched current is 0.3 A per output.

Connecting

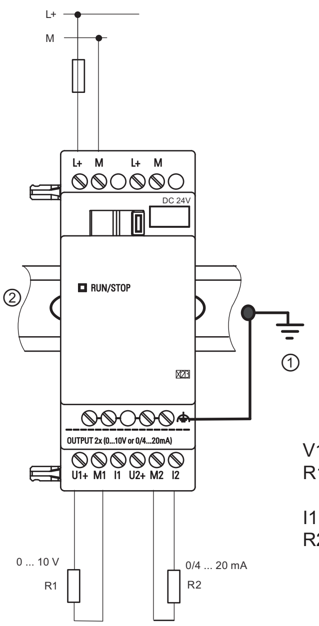
Connect the load to an IDEC SmartRelay with transistor outputs as shown below:



Load: 24 VDC, 0.3 A max.

FL1F-K2BM2

The illustration below shows an example of how to connect the voltage or current load.



V1, V2: 0 ... 10 VDC
R1: >= 5 kΩ

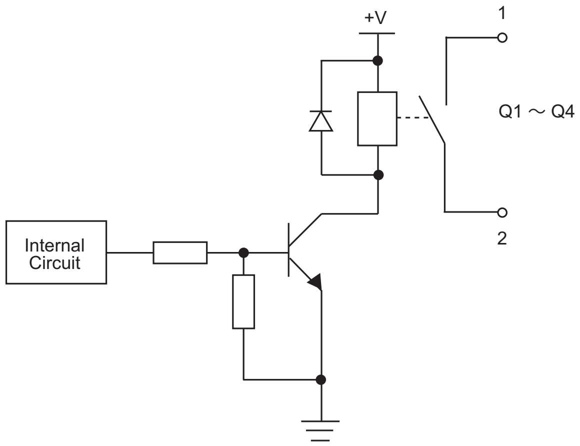
I1, I2: 0/4 ... 20 mA
R2: <= 250 Ω

① Earth
② Standard DIN rail

Output Internal Circuit

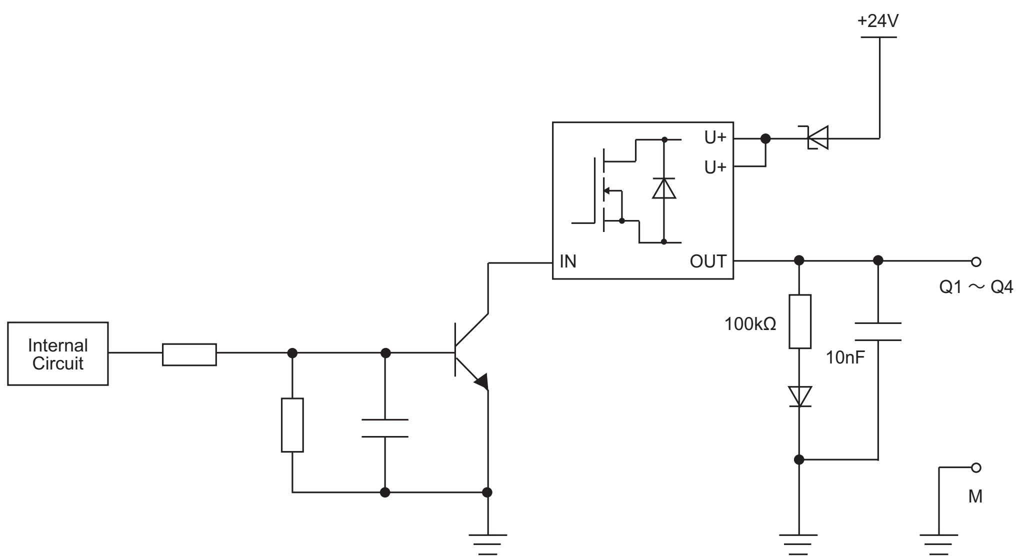
FL1F-H12RCA / FL1F-B12RCA / FL1F-H12RCC / FL1F-B12RCC / FL1F-H12RCE / FL1F-B12RCE / FL1F-M08B2R2 / FL1F-M08C2R2 / FL1F-M08D2R2

Relay Output



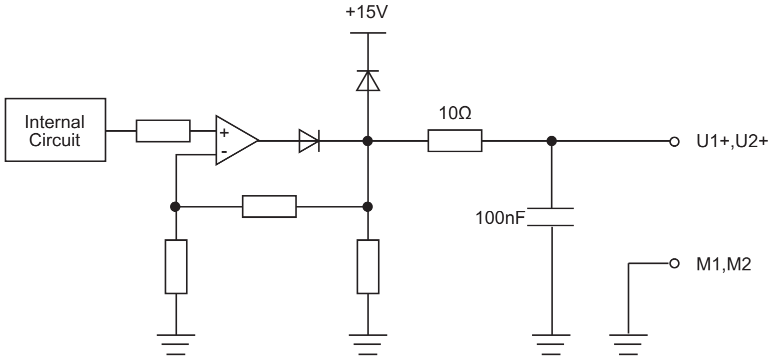
FL1F-H12SCD / FL1F-M08B1S2

Transister Output (Source)



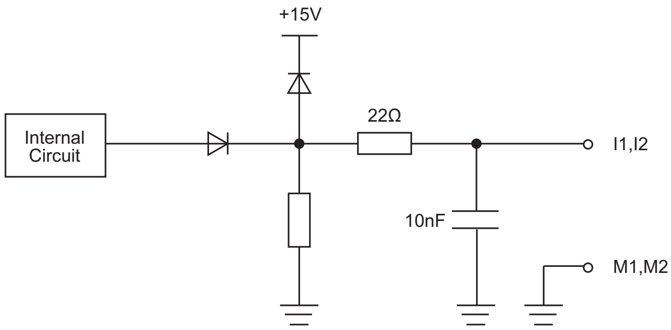
FL1F-K2BM2

Analog Output (0-10V)



FL1F-K2BM2

Analog Output (0/4 ... 20mA)



2.3.5 Connecting the Ethernet interface

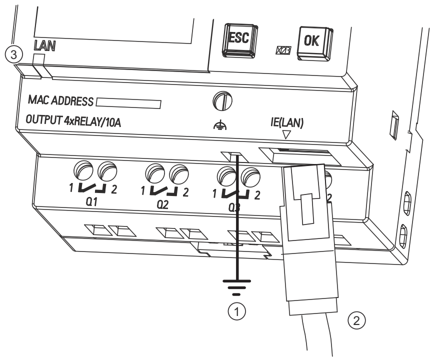
Base modules and text display are equipped with a 10/100 Mbit/s Ethernet RJ45 interface.

Requirements for the network cable

Use a shielded Ethernet cable to connect to the Ethernet interface. To minimize electromagnetic interference, make sure you use a standard Category 5 shielded twisted-pair Ethernet cable with a shielded RJ45 connector on each end.

Connecting

You connect the FE terminal to earth ground, and connect a network cable to the Ethernet interface.



① Earth ground

② Ethernet cable, for connecting to the Ethernet interface

③ Ethernet status LED

Ethernet status LED

LED type	Color	Description
Status LED	Flashing orange	IDEC SmartRelay is receiving/sending data across Ethernet.
	Steady green	IDEC SmartRelay is already connected to Ethernet.

2.4 Putting into operation

2.4.1 Powering on IDEC SmartRelay

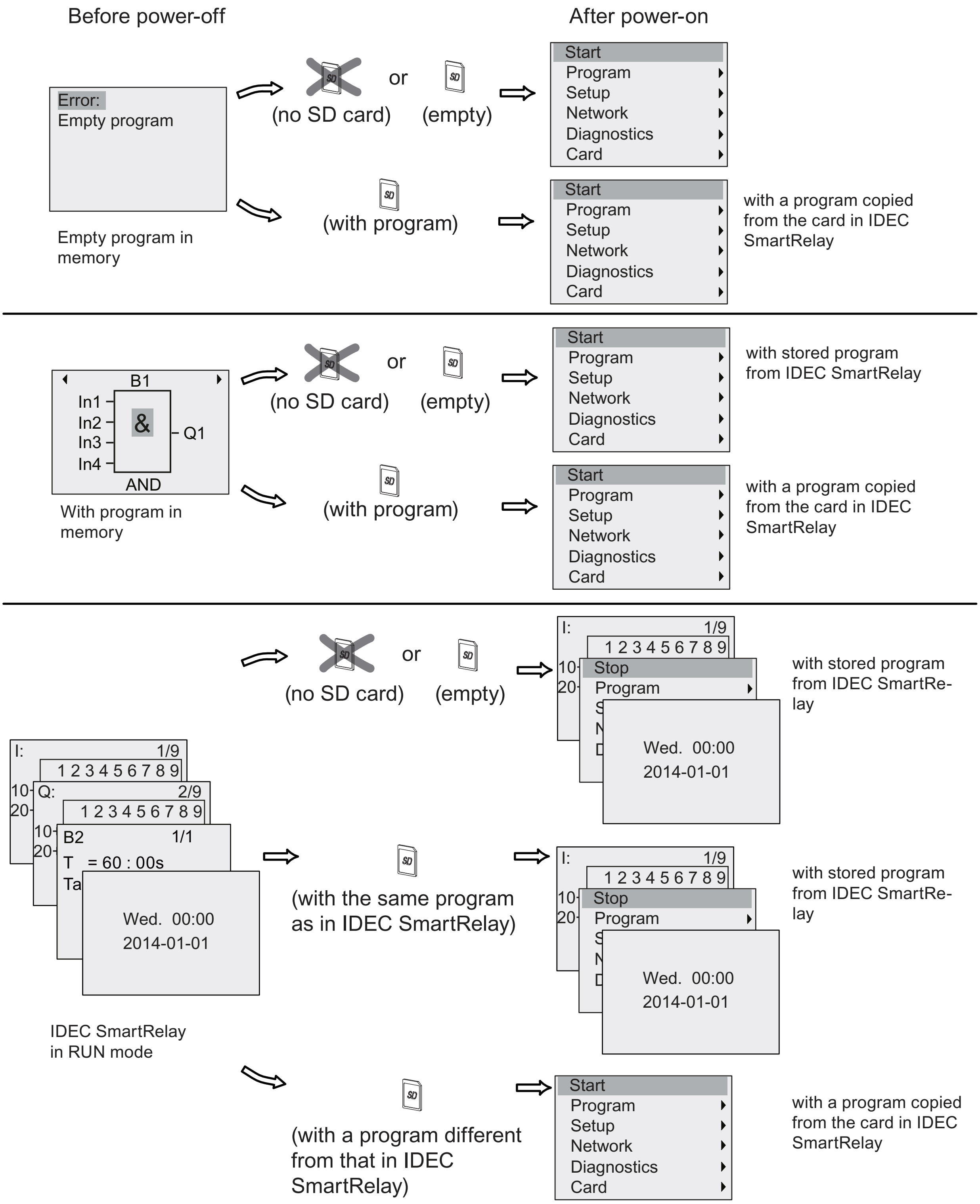
IDEC SmartRelay does not have a power switch. The reaction of IDEC SmartRelay during startup depends on the following:

- Whether a circuit program is stored in IDEC SmartRelay
- Whether a micro SD card is inserted
- Whether this is an IDEC SmartRelay version without display unit (FL1F-B12RCE/ B12RCA/B12RCC)
- Whether IDEC SmartRelay is in RUN mode or STOP mode at the time of power failure

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

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

The following illustration shows all possible reactions of IDEC SmartRelay:



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

1. If neither IDEC SmartRelay nor the inserted card contains a circuit program, the Base Module displays the following:

   ```
   Error:
   Empty program
   ```

2. IDEC SmartRelay automatically copies the circuit program on the card to memory and overwrites the existing circuit program.
3. If there is a circuit program in IDEC SmartRelay or on the card, IDEC SmartRelay adopts the operational state it had prior to power-off. Versions without a display unit (FL1F-B12RCE/B12RCA/B12RCC) automatically change from STOP to RUN (LED changes from red to green).
4. If you have enabled retentivity for at least one function, or a function is permanently retentive, IDEC SmartRelay retains the current values at power-off.

Note

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

Before you modify the circuit program, save a backup copy of your original to a card or to a computer using WindLGC.

2.4.2 Operating states

Base Module operating states

Base Modules (Version with and without LCD Display) have two operating states: STOP and RUN.

STOP	RUN
• The display shows that the program is empty when you start the program (except for FL1F-B12RCE/B12RCA/ B12RCC devices) • Switching IDEC SmartRelay to programming mode (except for FL1F-B12RCE/B12RCA/ B12RCC devices) • LED is red (only for FL1F-B12RCE/B12RCA/ B12RCC devices)	• Display: Screen mask for monitoring I/O and messages (after START in the main menu) or for the parameter assignment menu (except for FL1F-B12RCE/B12RCA/B12RCC devices) • Switching IDEC SmartRelay to parameter assignment mode (except for FL1F-B12RCE/B12RCA/B12RCC devices) • LED is green (only for FL1F-B12RCE/B12RCA/B12RCC devices)
Action of IDEC SmartRelay: • The input data is not read. • The circuit program is not executed. • The relay contacts are permanently open or the transistor outputs are switched off.	Action of IDEC SmartRelay: • IDEC SmartRelay reads the status of the inputs. • IDEC SmartRelay uses the circuit program to calculate the status of the outputs. • IDEC SmartRelay switches the relay/transistor outputs on or off.

Note

After switching the power on, the system briefly switches through the outputs on the FL1F-H12SCD. With an open circuit, a voltage of > 8 V can occur for up to approximately 100 ms; when the circuit is loaded, this time reduces to a matter of microseconds.

IDEC SmartRelay expansion modules, operating states

Expansion modules have three operating states. The color of the LED (RUN/STOP) indicates one of three operating states for expansion modules.

Green (RUN)	Red (STOP)	Orange/Yellow
The expansion module communicates with the device to the left.	The expansion module does **not** communicate with the device to its left.	Initialization phase of the expansion module

Programming IDEC SmartRelay 3

Getting started with IDEC SmartRelay

Programming refers to creating a circuit program from the Base Module.

In this chapter you will learn how to use IDEC SmartRelay to create the IDEC SmartRelay circuit programs for your application.

WindLGC is the IDEC SmartRelay programming software that you can use on your PC to quickly and easily create, test, modify, save and print the circuit programs. The topics in this manual, however, relate only to the creation of circuit programs on the actual IDEC SmartRelay Base Module. The programming software WindLGC contains extensive online help.

Note

IDEC SmartRelay versions without a display unit, that is, the FL1F-B12RCE, FL1F-B12RCA and FL1F-B12RCC versions, do not have an operator panel and display unit. These devices are ideal for use in small machine and process equipment engineering systems for series production.

You do not program FL1F-B12RCE/B12RCA/B12RCC versions directly on the device. Instead, you download a program to the device from WindLGC or from memory cards with the program you created on another IDEC SmartRelay device.

IDEC SmartRelay versions without a display cannot write data to memory cards.

See Chapters "Using memory cards (Page 287)", "IDEC SmartRelay software (Page 306)" and the Appendix "IDEC SmartRelay without display ("IDEC SmartRelay Pure") (Page 334)" for more information.

A small example in the first part of this chapter introduces the operating principles of IDEC SmartRelay:

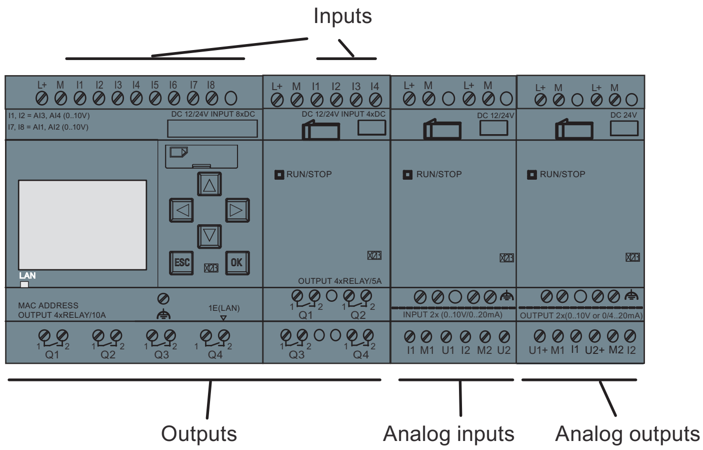
- You will learn the meaning of two basic terms, namely the **connector** and the **block**.
- As the next step, you will create a circuit program based on a simple conventional circuit.
- Lastly, you will enter this program directly in IDEC SmartRelay.

It will take you only a few pages of this manual to store your first executable circuit program in the IDEC SmartRelay device. With suitable hardware (switches etc.), you will then be able to carry out initial tests.

3.1 Connectors

IDEC SmartRelay is equipped with inputs and outputs

Example of a configuration with several modules:



The illustration shows the conceptual usage of the inputs, not the actual physical markings on the module.

The letters I followed by numerals identify the inputs. When you look at IDEC SmartRelay from the front, you can see the input terminals at the top. Only analog input modules FL1F-J2B2 has the inputs at the bottom.

The letters Q followed by numerals (on FL1F-K2BM2) identify the outputs. In the figure, you can see the output terminals at the bottom.

Note

IDEC SmartRelay can recognize, read and switch the I/O of all expansion modules regardless of their type. The I/O numbers follow the installation order of the modules.

For IDEC SmartRelay FL1F series, the following I/O and memory markers blocks are available for creating your circuit program from IDEC SmartRelay:

- I1 to I24, AI1 to AI8, Q1 to Q20, AQ1 to AQ8, M1 to M64, and AM1 to AM64
- 32 shift register bits S1.1 to S4.8
- 4 cursor keys C ▲, C ▶, C ▼ and C ◀
- four function keys on the FL1F-RD1: F1, F2, F3, and F4
- 64 blank outputs X1 to X64

If you have previously configured any of the network digital or analog inputs/outputs NI1 to NI64, NAI1 to NAI32, NQ1 to NQ64, and NAQ1 to NAQ16 in your circuit program from WindLGC, after downloading the circuit program to IDEC SmartRelay, these network digital or analog inputs/outputs are available in the IDEC SmartRelay; however, you can not edit the rest of the program from the IDEC SmartRelay, except for the Par parameter.

See the "Constants and connectors (Page 116)" topic for more details.

The following applies to inputs I1, I2, I7 and I8 of FL1F-B12RCE/H12RCE and FL1F-H12SCD versions: If you use I1, I2, I7 or I8 in the circuit program, this input signal is digital. If you use AI3, AI4, AI1, or AI2, the input signal is analog. The numbering of the analog inputs is significant: AI1 and AI2 corresponded to I7 and I8. With the addition of two new analog inputs, these modules optionally use I1 for AI3 and I2 for AI4. See the graphical representation in the topic on "Maximum setup with expansion modules (Page 18)". Also note that you can also use I3, I4, I5, and I6 as fast digital inputs.

IDEC SmartRelay's connectors

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

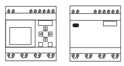
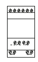
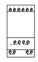
The digital I/O status can be '0' or '1'. Status '0' means that the input does not carry a specific voltage. Status '1' means that the input does carry a specific voltage.

The 'hi' and 'lo' connectors make it easier for you to create the circuit program. 'hi' (high) is assigned the status '1', and 'lo' (low) is assigned the status '0'.

You do not have to use all of the connectors of a block. The circuit program automatically assigns the unused connectors a status that ensures proper functioning of the relevant block.

For information on the meaning of the term "block", refer to the topic on "Blocks and block numbers (Page 53)".

IDEC SmartRelay has the following connectors :

Connectors	 IDEC SmartRelay FL1F		FL1F-M08... 	FL1F-J2B2 	FL1F-K2BM2 
Inputs	FL1F-H12RCC FL1F-B12RCC FL1F-H12RCA FL1F-B12RCA	Two groups: I1 to I4 and I5 to I8	I9 to I24	AI1 to AI8	none
	FL1F-H12RCE FL1F-B12RCE FL1F-H12SCD	I1, I2, I3-I6, I7, I8 AI3, AI4 ... AI1, AI2	I9 to I24	AI5 to AI8	
Outputs	Q1 to Q4		Q5 to Q20	none	AQ1 to AQ8
lo	Logical '0' signals (off)				
hi	Logical '1' signals (on)				
Memory markers	Digital memory markers: M1 to M64 Analog memory markers: AM1 to AM64				
Shift register bits	S1.1 to S4.8				
Network inputs 1)	NI1 to NI64				
Network analog inputs 1)	NAI1 to NAI32				
Network outputs 1)	NQ1 to NQ64				
Network analog outputs 1)	NAQ1 to NAQ16				

DM: Digital Module

AM: Analog Module

1) To make these four connectors available in an IDEC SmartRelay module, you must configure them in the circuit program with WindLGC V8.0 or later version and download the circuit program to the IDEC SmartRelay.

3.2 Blocks and block numbers

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

In the topic "From circuit diagram to IDEC SmartRelay program (Page 56)" you will learn how to transform a conventional circuit into an IDEC SmartRelay circuit program.

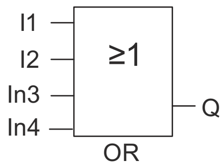
Blocks

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

Logic operations

The most elementary blocks are the logic operations:

- AND
- OR
- ...



Inputs I1 and I2 connect to the OR block. The last two inputs of the block remain unused.

These special functions offer you significantly greater performance:

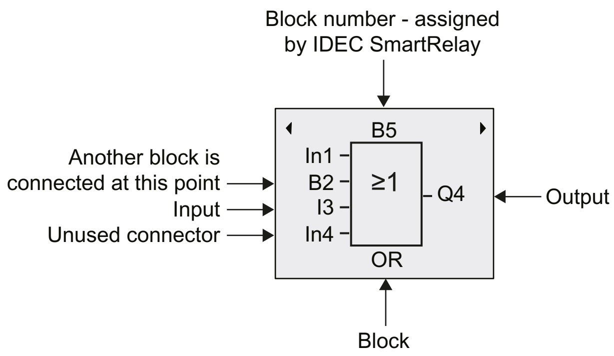
- Current impulse relay
- Up/down counter
- On-delay
- Softkey
- ....

The chapter entitled "IDEC SmartRelay functions (Page 115)" gives a full list of the IDEC SmartRelay functions.

Block representation on the IDEC SmartRelay onboard display

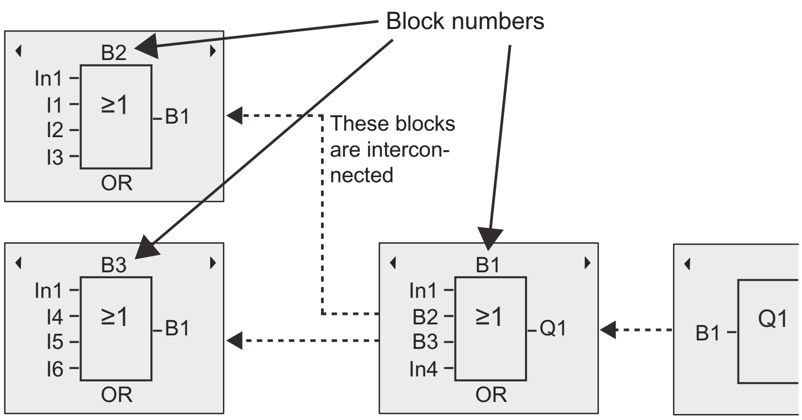
The figure below shows a typical view of the IDEC SmartRelay onboard display. As you can see, it can show only one block at a time. IDEC SmartRelay shows the block number on the top of the display by default if you assign no name to this block. The block numbers help you check the circuit structure. Alternatively, you can also choose to display a customized block name instead of the block number. For more information about assigning a block name, refer to Section "Circuit program input (Page 67)".

View of the IDEC SmartRelay display



Assigning a block number

IDEC SmartRelay automatically assigns each new block in a circuit program a block number. IDEC SmartRelay uses these block numbers to indicate the block interconnections. This means that these numbers are mainly an aid to your orientation in the circuit program.



The figure above shows you three views of the IDEC SmartRelay onboard display, which represent the circuit program. As you can see, IDEC SmartRelay interconnects the blocks using their numbers. To scroll the circuit program, use the keys ◀ or ▶.

Advantages of block numbers

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

Note

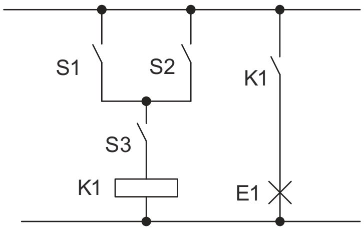
An organizational program chart can be a valuable aid when you create the circuit program because you can enter in this chart all the block numbers that IDEC SmartRelay assigns.

By using the WindLGC software to program IDEC SmartRelay, you can directly create a function chart of your circuit program. WindLGC also allows you to assign 12-character names to up to 100 blocks, and to view these on the IDEC SmartRelay onboard display in parameter assignment mode. See the topic "The four golden rules for operating IDEC SmartRelay (Page 58)".

3.3 From circuit diagram to IDEC SmartRelay program

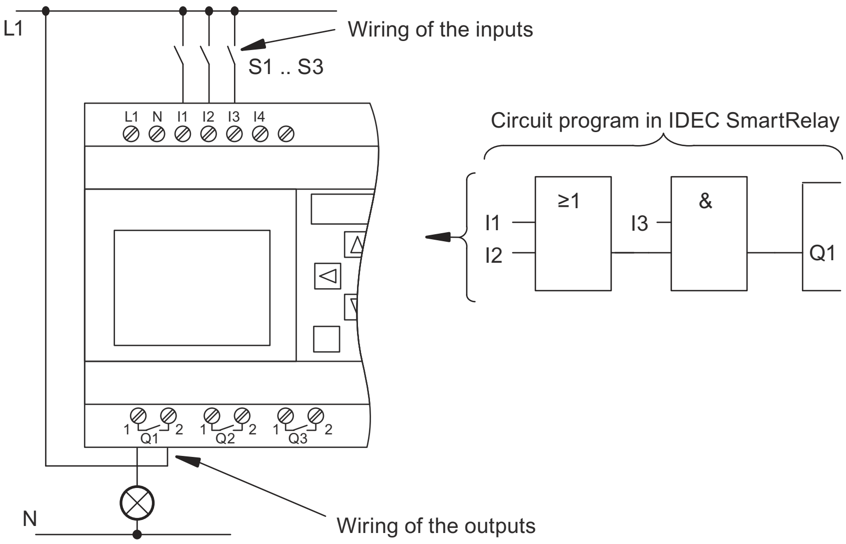
View of a circuit diagram

The following illustration shows a typical circuit diagram that represents the circuit logic:



Creating this circuit with IDEC SmartRelay

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



Note

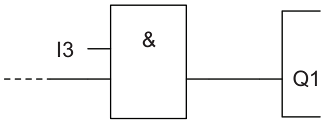
Although you have four inputs available for Basic functions list - GF (Page 120), most of the views only show three inputs for reasons of clarity. You program this fourth input and assign parameters just like you do with the other three inputs.

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

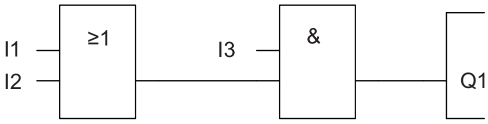
The output is the load or relay that is to be switched.

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

Step 1: Connect the normally open contact S3 in series with another circuit element to output Q1. A series connection corresponds to the AND block:



Step 2: Use an OR block to connect S1 and S2 in parallel. A parallel circuit corresponds to the OR block:



Unused inputs

The circuit program automatically assigns the unused connectors a status that ensures proper functioning of the relevant block.

In our example we shall use only two inputs of the OR block and two inputs of the AND block; the third and fourth inputs are unused.

Now connect the I/O to IDEC SmartRelay.

Wiring

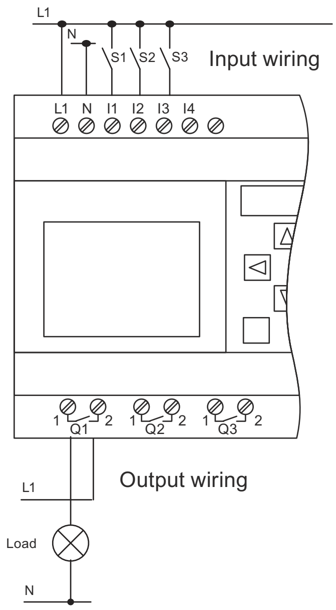
Connect the switches S1 to S3 to the screw terminals of your IDEC SmartRelay :

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

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

Wiring example

The following figure shows you the wiring, based on a 100-240 VAC/VDC version of IDEC SmartRelay.



3.4 The four golden rules for operating IDEC SmartRelay

Rule 1: Changing the operating mode

- You create the circuit program in programming mode. After power is on, and when the program is empty in IDEC SmartRelay, IDEC SmartRelay selects the programming mode by default.
- You can edit timer and parameter values of an existing circuit program in both **parameter assignment mode** and **programming mode.** During **parameter assignment** IDEC SmartRelay is in **RUN mode**; that is, it continues executing the circuit program (see the topic "Configuring IDEC SmartRelay (Page 274)"). To work in **programming mode,** you need to terminate the circuit program.
- Select the menu command Start on the main menu to set **RUN mode.**
- When the system is in **RUN** mode, you can return to **parameter assignment mode** by pressing the **ESC** key.
- When **parameter assignment mode** is open and you want to return to **programming mode**, select the menu command Stop from the parameter assignment menu to set **STOP mode.**

For more details on operating modes, refer to the Appendix topic "IDEC SmartRelay menu structure (Page 336)".

Rule 2: Outputs and inputs

- Always create your circuit program by working from the output to the input.
- You can connect one output to several inputs, but you cannot connect several outputs to one input.
- Within the same program path you cannot connect an output to an upstream input. You can use markers or outputs for such internal recursions.

Rule 3: Cursor and cursor movement

The following applies when you edit a circuit program:

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

Rule 4: Planning

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

3.5 Configuring menu access protection for IDEC SmartRelay

IDEC SmartRelay provides two access levels, administrator and operator, to limit access to specific menus in programming mode. As an administrator, you can access all menu commands; while as an operator, some specific menu commands are not visible (see section "Overview of IDEC SmartRelay menus (Page 62)"). IDEC SmartRelay's default setting is administrator at delivery, and you can switch to operator at any time. When switching from operator to administrator, you need to enter a valid password. To learn how to change the password, refer to section *"Tools -> Transfer -> Access Control"* in *WindLGC Online Help*. IDEC SmartRelay always saves its access level before power-off.

Note

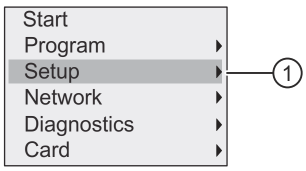
The access level of the Text Display is operator by default, and you can switch it to administrator with the password.

The Text Display saves its access level before power-off if it connects to the same Base Module after power-on. If you connect a different Base Module to it, however, the Text Display restores its access level to operator after power-on.

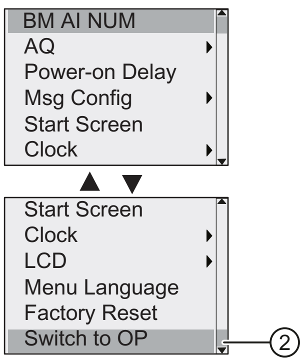
Switching IDEC SmartRelay from administrator to operator

To switch IDEC SmartRelay's access level from administrator to operator, follow these steps:

1. Move the cursor to " ① " on the main menu of programming mode: Press ▲ or ▼.



2. Confirm " ① ": Press **OK**.
3. Move the cursor to " ② ": Press ▲ or ▼.



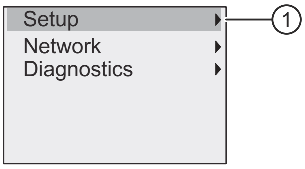
4. Confirm " ② ": Press **OK**.

   IDEC SmartRelay now switches to the access level of operator and returns to the main menu.

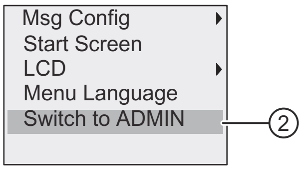
Switching IDEC SmartRelay from operator to administrator

To switch IDEC SmartRelay's access level from operator to administrator, follow these steps:

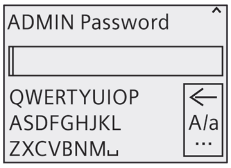
1. Move the cursor to " ① " on the main menu of programming mode: Press ▲ or ▼



2. Confirm " ① ": Press **OK**.
3. Move the cursor to " ② ": Press ▲ or ▼.

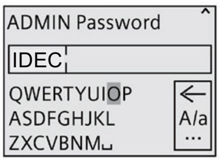


4. Confirm " ② ": Press **OK**. The display appears as follows:



5. To select a character, press ◀, ▶, ▼ or ▲ to move the flashing selection cursor to the character in the soft keyboard and press **OK**, then the selected character appears in the input box.

   Refer to section "Using soft keyboard (Page 63)" to learn how to use the soft keyboard.

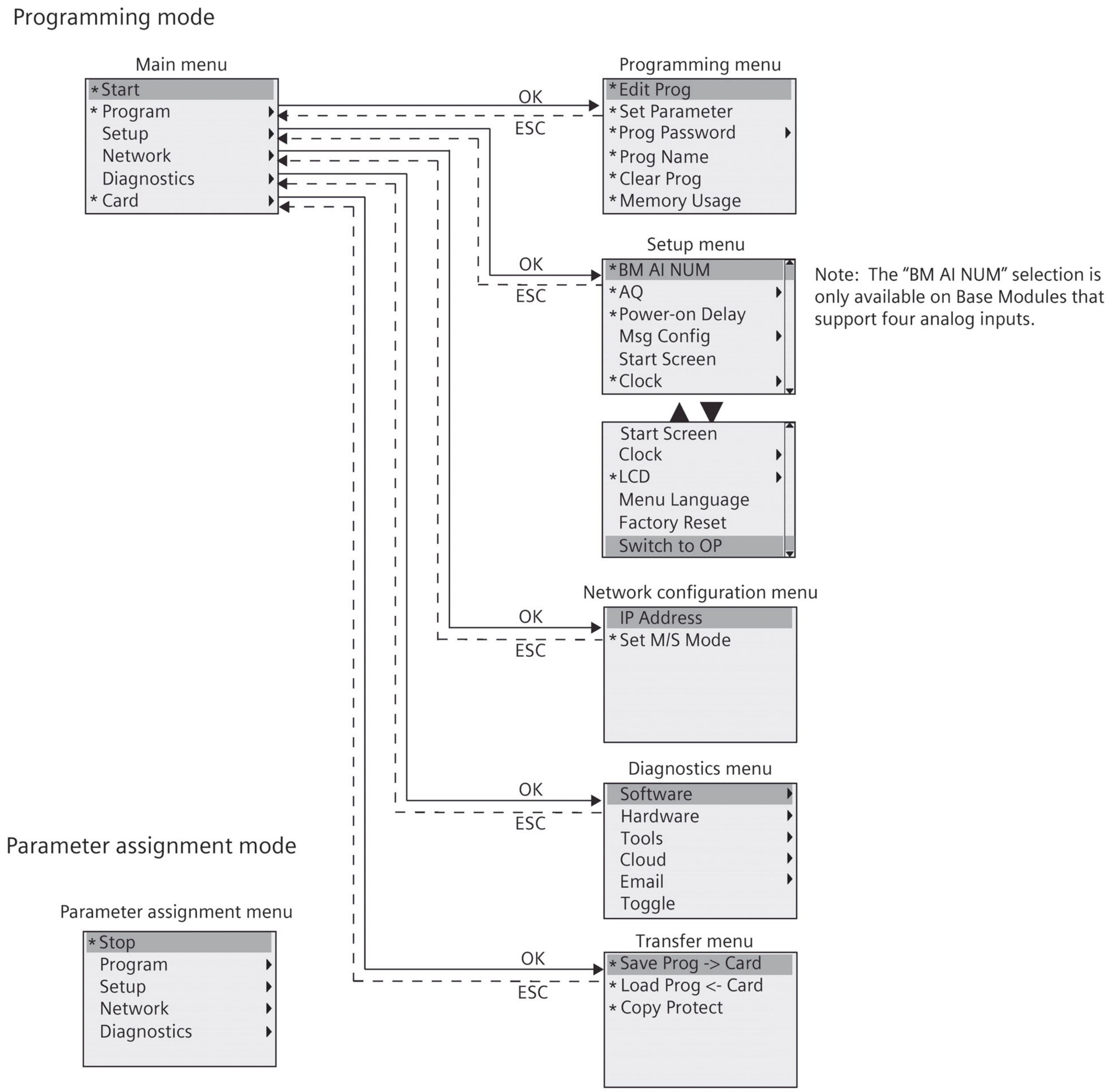


6. To confirm the password, press **ESC** to exit character selection, or move the flashing selection cursor back to the input box, then the dashed cursor in the input box becomes solid cursor. Press **OK**.

   IDEC SmartRelay now switches to the access level of administrator and returns to the main menu.

3.6 Overview of IDEC SmartRelay menus

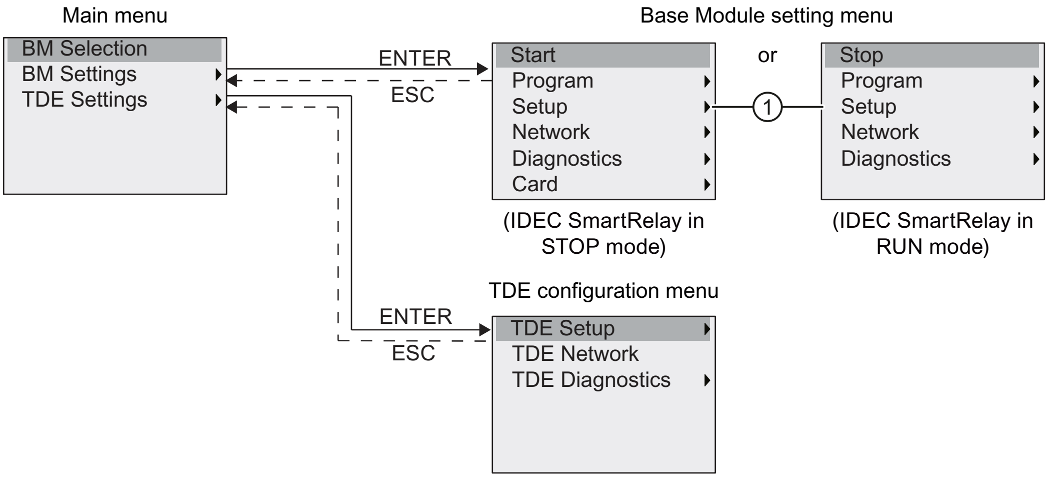
The following illustration shows an overview of IDEC SmartRelay menus:



* These menu commands are visible only with the access level of administrator.

For more details on the menus, refer to the Appendix "Base Module (Page 336)".

The following illustration shows an overview of Text Display menus:



The Text Display provides three menus as follows:

- The Base Module selection menu

  You can use this menu to select a connected Base Module by entering a specific IP address.

- The Base Module setting menu

  You can use this menu to perform the remote setting of the connected Base Module. This menu has almost the same menu commands as those on the Base Modules, except for the menu commands under " ① ". The menu commands for setting the start screen, message text, contrast and backlight, and menu language for the Base Module are not available on the Text Display.

- The TDE configuration menu

  You can use this menu to perform the independent configuration of the Text Display.

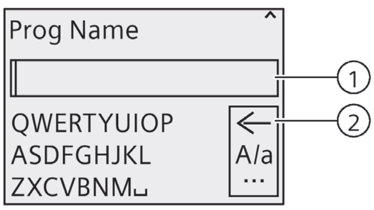
For more details on the menus, refer to the Appendix "Text Display (Page 342)".

3.7 Using soft keyboard

You can use the soft keyboard in IDEC SmartRelay BM to enter block name, program name or password.

Soft keyboard introduction

Here we take entering program name as an example. The input page is as follows:

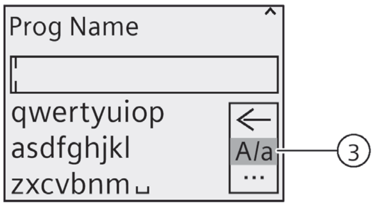


There is a solid cursor in " ① " the text input box. You can use ◀ or ▶ key to move the solid cursor between characters in the box. When the flashing selection cursor appears in the soft keyboard, the solid cursor in the input box becomes a dashed cursor.

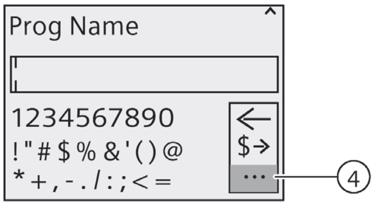
To enter any characters, move the flashing selection cursor to the character in the keyboard and press **OK**, then the character will be selected and appear in the input box.

To use " ② ", move the flashing selection cursor to it and press **OK**, the character before the dashed cursor in the input box will be deleted.

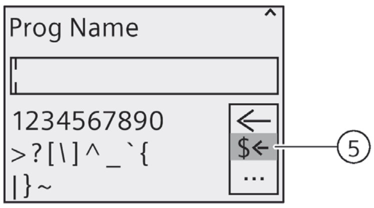
To use " ③ ", move the flashing selection cursor to it and press **OK**, the keyboard will be switched from upper case letters to lower case letters or the other way round.



To use " ④ ", move the flashing selection cursor to it and press **OK**, the keyboard will be switched into numbers and special characters.



To use " ⑤ ", move the flashing selection cursor to it and press **OK**, the keyboard will be switched to the next page of special characters.



To confirm the input content in the input box, press **ESC** to exit character selection, or move the flashing selection cursor back to the input box, then the dashed cursor in the input box becomes solid cursor. Press **OK**.

Available character set

The following character set is available in the soft keyboard:

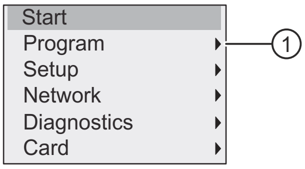
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
P	Q	R	S	T	U	V	W	X	Y	Z	0	1	2	3	4
5	6	7	8	9	!	"	#	$	%	&	'	(	)	*	+
,	-	.	/	:	;	<	=	>	?	@	[	\	]	^	_
`	{	|	}	~	a	b	c	d	e	f	g	h	i	j	k
l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	

3.8 Writing and starting the circuit program

The example below shows how to create a program for your circuit design in IDEC SmartRelay.

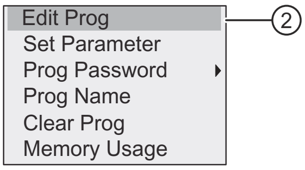
3.8.1 Selecting programming mode

When you connect IDEC SmartRelay to the power supply and switch it on, the display shows you the main menu of the programming mode:



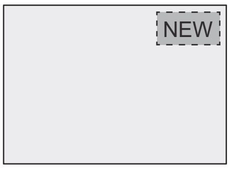
The first line is highlighted. Press ▲ and ▼ to move the highlight bar up and down. Move it to " ① " and confirm with **OK**. IDEC SmartRelay opens the programming menu.

The **IDEC SmartRelay's programming menu** is as shown below:

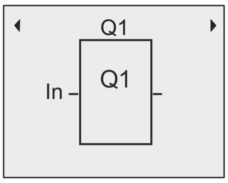


Here you can also move the highlight bar by pressing ▲ and ▼. Move the highlight bar to " ② " and confirm with **OK**.

You are now in the circuit program window. Press **OK** to enter the program editing mode, and the cursor appears as a solid square at the "**NEW**" block. The display now shows as follows:



Confirm with **OK** and IDEC SmartRelay now shows you the first output:



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

Note

Because you have not yet saved a **password** for the circuit program in IDEC SmartRelay, you can directly enter editing mode. When you select to edit the program after you have saved a password-protected circuit program, IDEC SmartRelay prompts you to enter a password and to confirm it with **OK**. You can only edit the program after you have entered the correct Password for circuit program protection (Page 71).

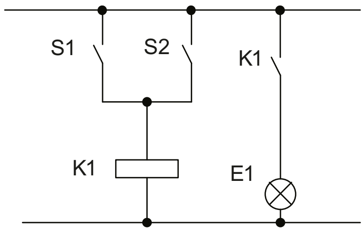
If you have created your circuit program in IDEC SmartRelay, you can view it in the circuit program window by moving cursor on the blocks. IDEC SmartRelay can display a maximum of 31*31 blocks in the circuit program window.

3.8.2 The first circuit program

The following parallel circuit consists of two switches.

Circuit diagram

The corresponding circuit diagram shows as follows:



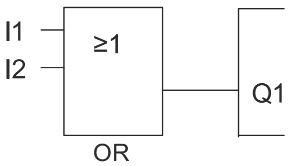
The switch S1 OR S2 turns on the load. IDEC SmartRelay interprets this parallel circuit as an 'OR' logic, because S1 OR S2 switches on the output.

Translated into an IDEC SmartRelay circuit program, you use an OR block to control relay K1 at output Q1.

Circuit program

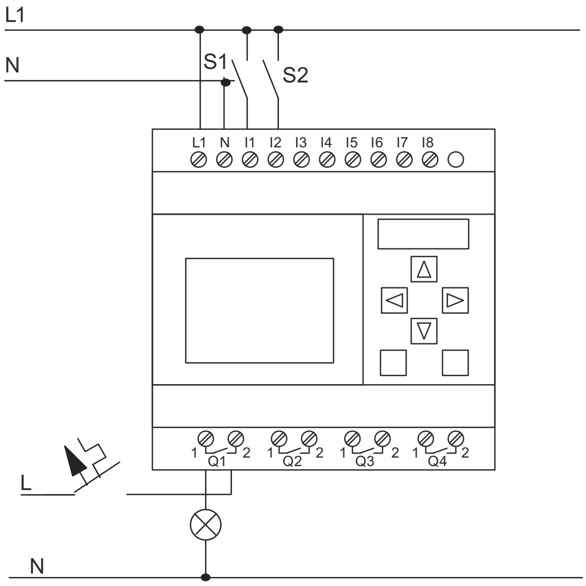
Switch S1 connects to input I1 and switch S2 connects to input I2. Inputs I1 and I2 connect to the OR block connectors.

The corresponding layout of the circuit program in IDEC SmartRelay shows as follows:



Wiring

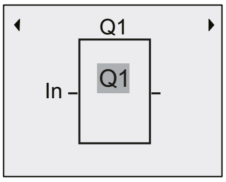
The corresponding wiring shows as follows:



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

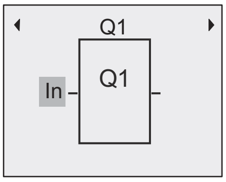
3.8.3 Circuit program input

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



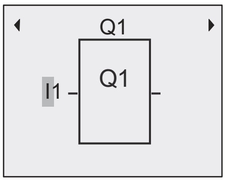
The first IDEC SmartRelay output

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



The cursor indicates your current position in the circuit program.

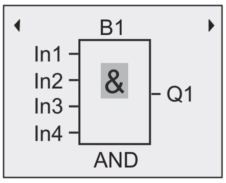
At this point you enter only the first (OR) block. Press **OK** to select editing mode.



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

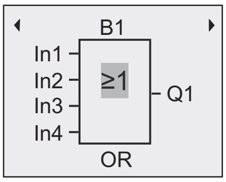
The cursor now appears as a flashing solid square. IDEC SmartRelay offers you various options here.

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



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

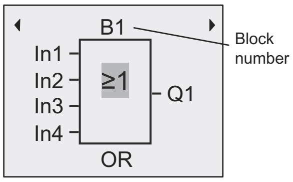
Press **OK** to select editing mode, which causes IDEC SmartRelay to display the cursor as a flashing solid square. Now press ▼ or ▲ until the OR block appears on the display:

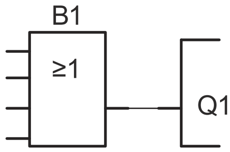


The flashing solid square cursor still appears on the block.

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

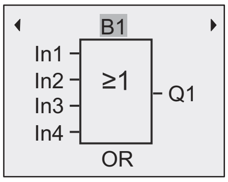
The display now shows: Your complete circuit program layout



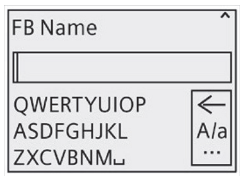


You have now entered the first block. IDEC SmartRelay automatically assigns a block number to each new block. If you assign a name to the block, IDEC SmartRelay shows the block name instead of the block number. You can assign a block name as required:

Press ▲ to move the cursor to "B1".



Press **OK**. The name edit page is displayed as follows:



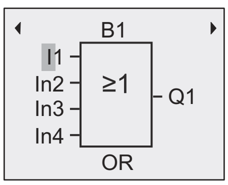
Now you can enter the block name using the soft keyboard (Page 63). After you complete the change, press **OK** to confirm.

You then connect the block inputs as follows:

Press ◀ to position the cursor on In1 and press **OK** to select editing mode.

Press ▼ or ▲ to select the digital input list. The first element of the digital input list is the "Input 1", namely "I1". You can press ▶ to move the cursor to the input number, and then use ▼ or▲ to select the desired input (I1 to I24).

The display now shows:



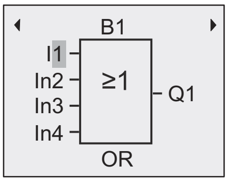
Note

Inputs F1, F2, F3, and F4 correspond to the four function keys on the optional Text Display.

More shift register bits (S1.1 to S4.8), blank connectors (X1 to X64) and analog memory markers (AM1 to AM64) are available in the FL1F device series.

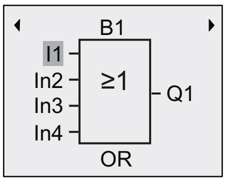
Network digital inputs (NI1 to NI64), network analog inputs (NAI1 to NAI32), network digital outputs (NQ1 to NQ64), and network analog outputs (NAQ1 to NAQ16) are available for the FL1F device series. IDEC SmartRelay does not include these inputs and outputs until you configure them in a circuit program in WindLGC V8.0 or later and download the program to your IDEC SmartRelay.

After selecting I1, the display now shows as follows:

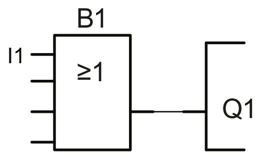


Press **OK** to confirm. You have now connected I1 to the input of the OR block.

The display now shows:



Your complete circuit program in IDEC SmartRelay up to now:

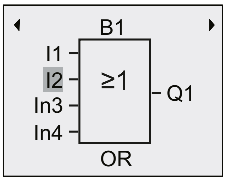


Now you connect input I2 to the input of the OR block:

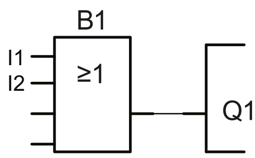
1. Move the cursor to In2: Press ▼ or ▲.
2. Switch to editing mode: Press **OK**.
3. Select the digital input list: Press ▼ or ▲.
4. Move the cursor to the input number: Press ▶.
5. Select I2: Press ▼ or ▲.
6. Apply I2: Press **OK**.

You have now connected I2 to the second input of the OR block:

The display now shows:



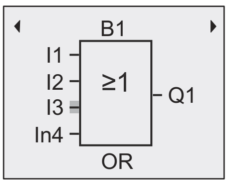
Your complete circuit program in IDEC SmartRelay up to now:



Note

You can invert individual inputs of the basic and special functions; that is, if an input carries a logical "1" signal, you can cause the circuit program to output a logical "0". You can also cause IDEC SmartRelay to invert a logical "0" signal to a logical "1".

To invert an input, move the cursor to the relevant position, for example:

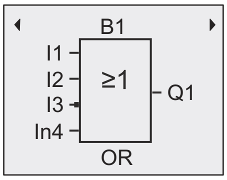


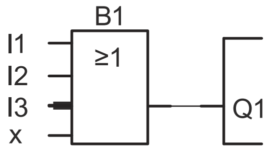
Confirm with **OK**.

Now press ▲ or ▼ to invert this input:

Next, press **ESC**.

Your circuit program layout:





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

To exit circuit programming mode and return to the programming menu, press **ESC**

Note

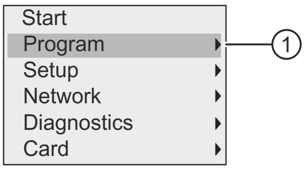
IDEC SmartRelay has now saved your circuit program to nonvolatile memory. The circuit program remains in the IDEC SmartRelay memory until you explicitly delete it.

You can save the actual values of special functions in the case of a power outage assuming that these functions support the "Retentive" parameter and that the necessary program memory is available. By default, IDEC SmartRelay deactivates the "Retentive" parameter when you insert a function; to use it, you must enable this option.

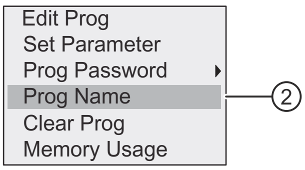
3.8.4 Assigning a circuit program name

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

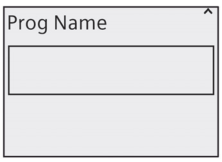
1. In the main menu in programming mode, press ▼ or ▲ to move the cursor to " ① ".



2. To confirm " ① ", press **OK**.
3. Press ▼ or ▲ to move the cursor to " ② ".

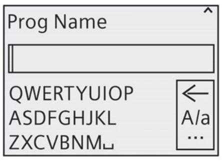


4. To confirm " ② ", press **OK**.



5. Press **OK** to enter the editing page with soft keyboard.

   Now you can use the soft keyboard to enter program name. Refer to section "Using soft keyboard (Page 63)" to learn how to use the soft keyboard.

6. To confirm the program name, press **ESC** to exit character selection, or move the flashing selection cursor back to the input box, then the dashed cursor in the input box becomes solid cursor. Press **OK**.

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

Note

Circuit program name input limit

The length of circuit program name cannot exceed 16 bytes. All characters in the soft keyboard are supported for the circuit program name. Refer to section "Using soft keyboard (Page 63)" to learn about the supported character set.

Note

You can change the name of the circuit program in programming mode only. If you have saved a password-protected circuit program, you can change the name of the circuit program only after you have entered the correct password (refer to section "Password for circuit program protection (Page 71)"). You can **read** the name in both programming mode **and** parameter assignment mode.

3.8.5 Password for circuit program protection

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

You can assign, change, or deactivate a program password from a Base Module, WindLGC or a Text Display.

Note

There is only one circuit program protection password that you can assign for IDEC SmartRelay.

Note

IDEC recommends you transfer password with secure communication (Page 295).

Note

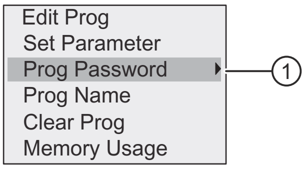
You can assign a password with the maximum length of 10 bytes and only consisting of upper case letters.

You can assign, edit or deactivate the password only in the programming mode on Base Module.

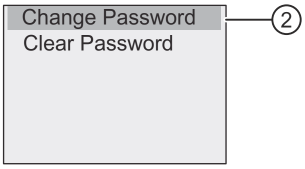
Assigning a program password from Base Module

To enter a password, follow these steps in the programming menu:

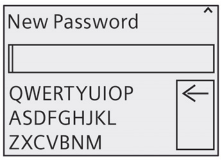
1. Move the cursor to " ① ": Press ▼ or ▲.



2. Confirm " ① ": Press OK.
3. Move the cursor to " ② ": Press ▼ or ▲.



4. Confirm " ② ": Press OK. The input page is as follows:



   As you can assign password only consisting of upper case letters for the program, only upper case letters are available in the soft keyboard.

5. To select a character, move the flashing selection cursor to the letter in the soft keyboard, then press OK. The selected letter appears in the input box.
   Refer to section Using soft keyboard (Page 63) to learn how to use the soft keyboard.
6. To confirm the password, press ESC to exit character selection, or move the flashing selection cursor back to the input box, then the dashed cursor in the input box becomes solid cursor. Press OK.

You have now protected your circuit program with the password and IDEC SmartRelay returns to the programming menu.

Note

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

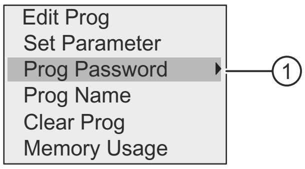
You can also set your password using WindLGC or Text Display. You cannot edit a password-protected circuit program in a Base Module or upload it to WindLGC unless you enter the correct password.

To allow you to create and edit a circuit program for a protected module (Card), you first need to Program copy protection (Page 298).

Changing the password from Base Module

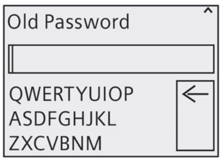
You must know the current password in order to change it. From the programming menu, follow these steps to change the password:

1. Move the cursor to " ① ": Press ▼ or ▲.



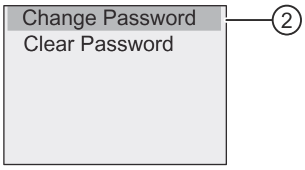
2. Confirm " ① ": Press **OK**.

   The display now shows:

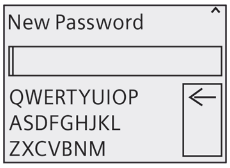


   Enter your old password using the soft keyboard (Page 63). Confirm your password with **OK**.

3. Move the cursor to " ② ": Press ▼ or ▲.



4. Confirm " ② ": Press **OK**. Now you can enter your new password.



5. To confirm the password, press **ESC** exit character selection, or move the flashing selection cursor back to the input box, then the dashed cursor in the input box becomes solid cursor.
   Press **OK**.

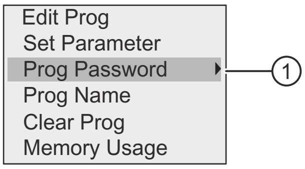
You have now set a new password and IDEC SmartRelay returns to the programming menu.

Deactivating the password from Base Module

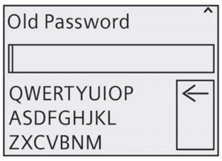
To deactivate the password to allow, for example, another user to edit your circuit program, you must know your current password.

To deactivate the password, follow these steps in the programming menu:

1. Move the cursor to " ① ": Press ▼ or ▲.

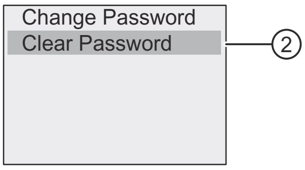


2. Confirm " ① ": Press **OK**.



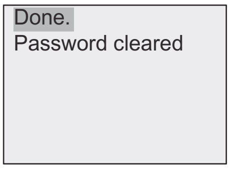
   Enter your current password using the soft keyboard (Page 63). Confirm your password with **OK**.

3. Move the cursor to " ② ": Press ▼ or ▲.

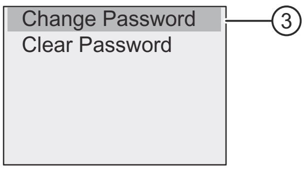


4. Confirm " ② ": Press **OK**.

   The display now shows:



   Alternatively, you can also select " ③ " to clear the password by leaving the input box blank.



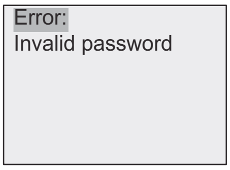
5. Press any key and IDEC SmartRelay returns to the programming menu. You have now cleared the password.

Note

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

Password: Wrong Password!

If you enter the **wrong** password and confirm the input with **OK**, Base Module does not open editing mode, and the display shows as follows:

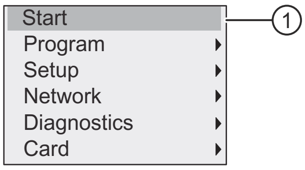


In this case, press any key and IDEC SmartRelay returns to the programming menu. This repeats itself over and over again until you enter the correct password.

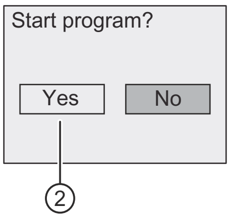
3.8.6 Switching IDEC SmartRelay to RUN mode

To switch IDEC SmartRelay to RUN mode, follow these steps:

1. Return to the main menu: Press **ESC**.
2. Move the cursor to " ① ": Press ▲ or ▼.



3. Confirm " ① ": Press **OK**. The display now shows:



4. Press ◀ to move the cursor to " ② " and press **OK**.

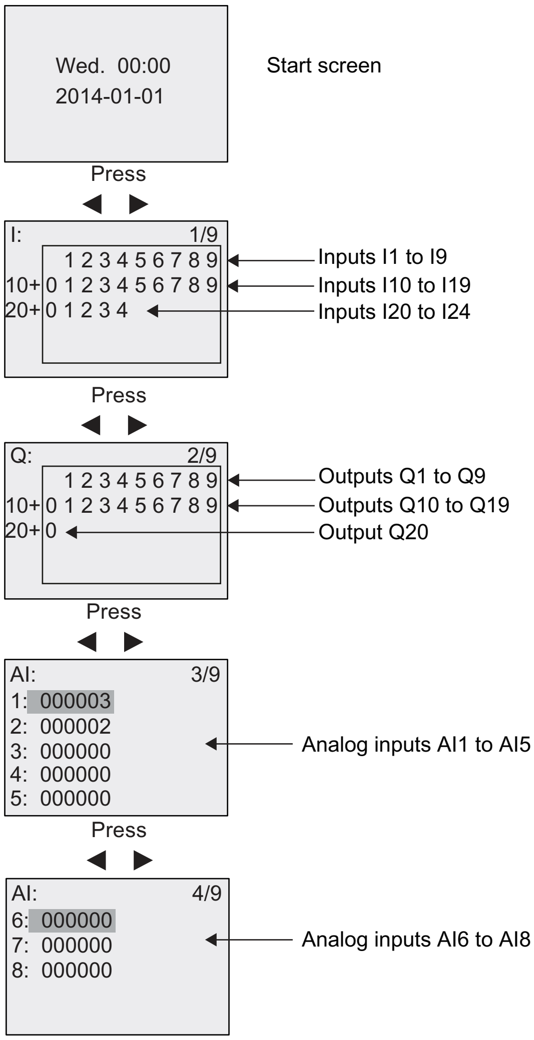
IDEC SmartRelay runs the circuit program and shows the following display:

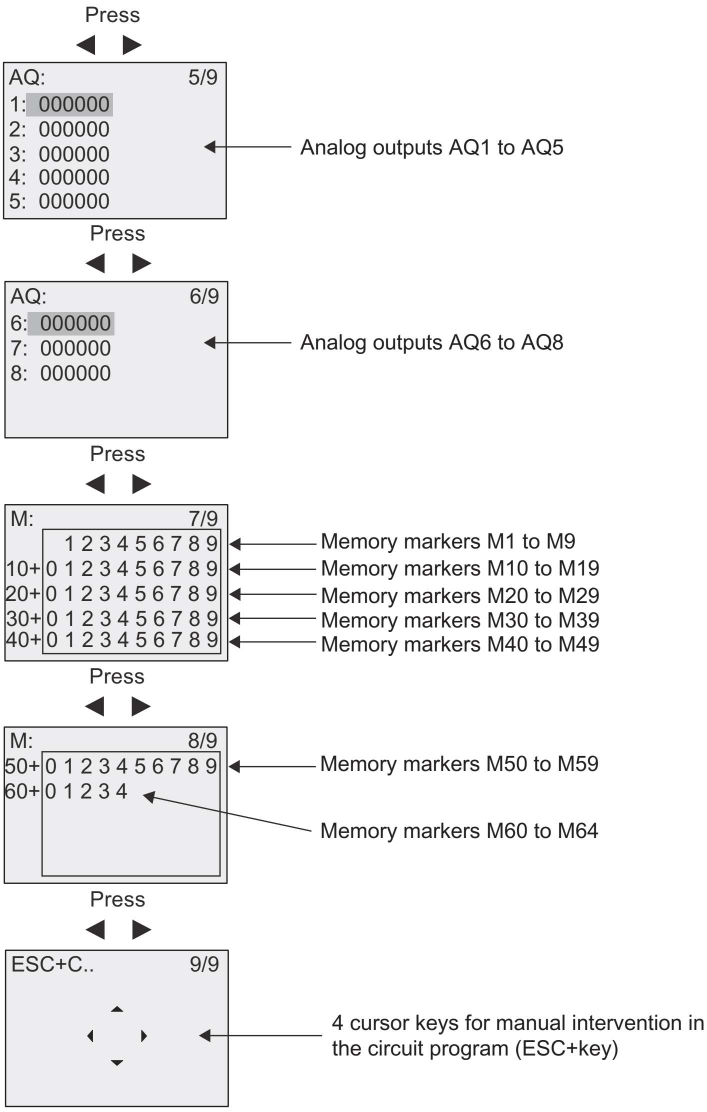
The start screen of IDEC SmartRelay displays one of the following:

- Date and current time-of-day (only for versions with real-time clock). This element flashes if you have not set the date and time.
- Digital inputs
- Parameter assignment menu

You can select the default setting for the start screen that IDEC SmartRelay displays in RUN mode. For more information, see Section "Setting the start screen (Page 286)".

Display field of IDEC SmartRelay in RUN mode

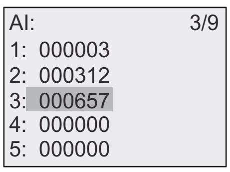




Viewing the analog value changes

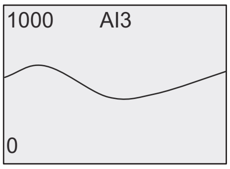
You can view the value changes of each analog I/O in the form of a trend curve when IDEC SmartRelay is in RUN mode. For example, to view the value changes of AI3, follow these steps:

1. Switch IDEC SmartRelay to RUN mode.
2. Scroll the display to the AI screen form (3/9): Press ◀ or ▶.



3. Move the cursor to AI3: Press ▲ or ▼.

4. Press **OK** to confirm your selection. The display now shows the AI3 value changes in the form of a curve, for example:

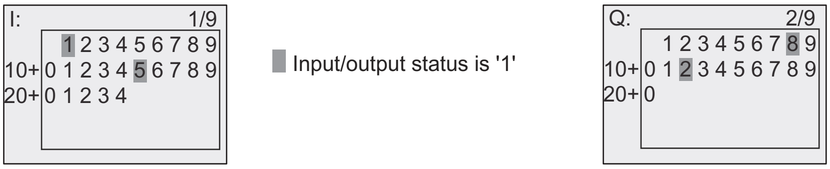


The display refreshes continuously and the curve shifts to the left of the display bit by bit. You can press ◀ or ▶ to move the screen form to the left/right in order to view the earlier/later value changes.

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

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

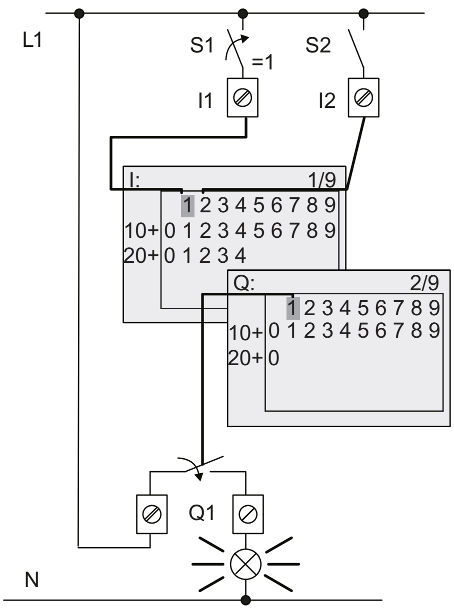
This is how IDEC SmartRelay indicates the I/O status:



In this example, only the inputs I1and I15 and the outputs Q8 and Q12 are set "high".

Status indication on the display

Using the example, you can see how IDEC SmartRelay displays the input and output states:



When switch S1 is closed, the status at input I1 is high.

IDEC SmartRelay computes the output states by means of the circuit program.

Output Q1 = “1”, in this case.

When Q1 = “1”, IDEC SmartRelay sets relay Q1, and the load connected to Q1 is supplied with voltage.

3.8.7 Second circuit program

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

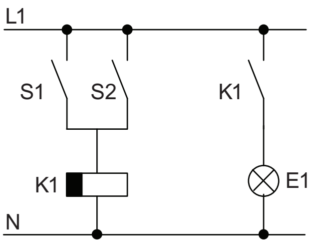
Using this second circuit program, you will learn how to perform the following tasks:

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

Modifying circuits

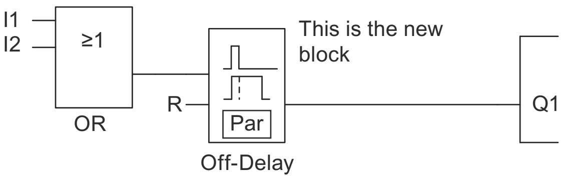
You will use the first circuit program as a basis for the second, with some slight modifications.

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



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

This is the circuit program layout in IDEC SmartRelay:

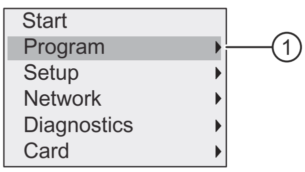


You can see the OR block and the output relay Q1 that you used in the first circuit program. The only difference is the new off-delay block.

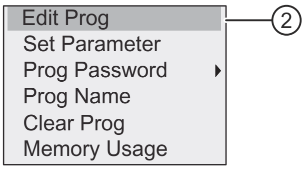
Editing the circuit program

Follow these steps to edit the circuit program:

1. Switch IDEC SmartRelay to programming mode. For additional details, see the topic "The four golden rules for operating IDEC SmartRelay (Page 58)".
2. On the main menu, move the cursor to " ① ": Press ▲ or ▼.



3. Confirm " ① ": Press **OK**. The display now shows:

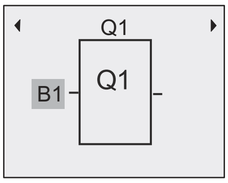


4. On the programming menu, move the cursor to " ② ": Press ▲ or ▼.
5. Confirm " ② ": Press **OK**. If required, enter your password at the prompt and confirm with **OK**.
6. In the circuit program window, press **OK** to activate the cursor as a solid square.

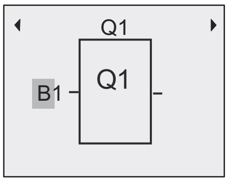
You can now modify the current circuit program.

Adding a block to a circuit program

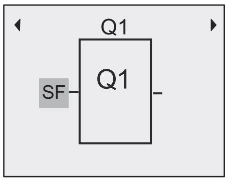
Press ◀ to move the cursor to B1 (B1 is the number of the OR block):



Insert the new block at this position.
Confirm with **OK**, and the cursor appears as a flashing solid square.

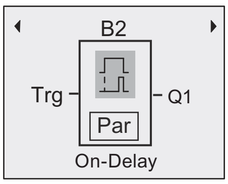


Press ▼ twice to select the SF list. The SF list contains the special function blocks.



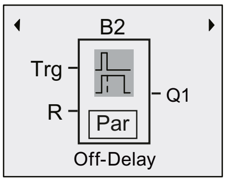
Press **OK**.

IDEC SmartRelay displays the block of the first special function:



When you select a special or basic function block, IDEC SmartRelay shows you the relevant function block and positions the solid square cursor on the block. Press **OK** to enter the editing mode, and the cursor appears as a flashing solid square. Press ▲ or ▼ to select the required block.

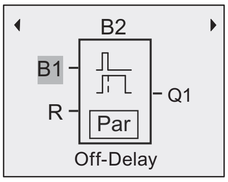
Select your block (off-delay, see the next figure), and then press **OK**:



IDEC SmartRelay assigns the block number B2 to the block that you added.

Press ◀ to move the cursor to Trg, and then press **OK**.

Press ▲ or ▼ to select B1 and confirm with **OK**.



IDEC SmartRelay automatically connects the uppermost input of the new block to B1, which you had previously connected to Q1. Note that you can only interconnect digital inputs with digital outputs or analog inputs with analog outputs. IDEC SmartRelay otherwise removes the 'old' block.

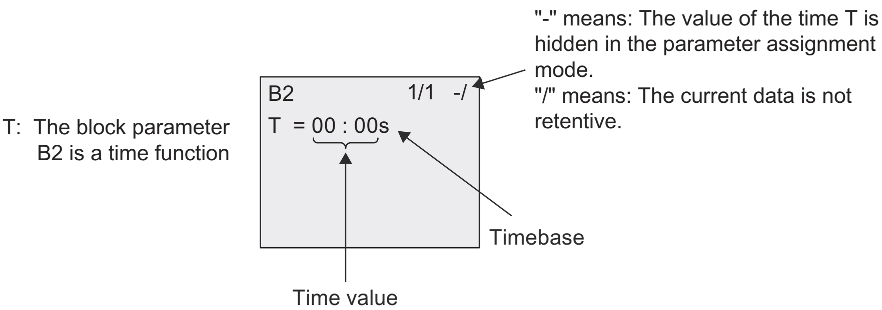
The off-delay block has two inputs and a parameter. At the top is the trigger input (Trg) you use to start the off-delay time. In our example, the OR block B1 triggers the off-delay. You reset the time and the output with a signal at the reset input (R). You set the off-delay time at parameter T of the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

Assigning block parameters

Now you set the off-delay time T:

1. Move the cursor to **Par**: Press ▶
2. Switch to editing mode: Press **OK**

IDEC SmartRelay shows the parameters in the parameter assignment window:



To change the time value, follow these steps:

1. Move the cursor to the time value: Press ▼.
2. Switch to editing mode: Press **OK.**
3. Press ◀ and ▶ to position the cursor.
4. Press ▲ and ▼ to modify the value at the relevant position.
5. Confirm your entries with **OK.**

Setting the time

Set the time T = 12:00 minutes:

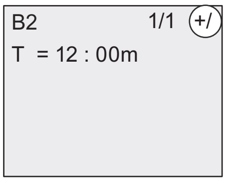
1. Move the cursor to the first digit: Press ◀ or ▶.
2. Select the digit "1": Press ▲ or ▼.
3. Shift the cursor to the second digit: Press ◀ or ▶.
4. Select digit "2": Press ▲ or ▼.
5. Move the cursor to the unit: Press ◀ or ▶.
6. Select the timebase "m" (for minutes): Press ▲ or ▼.
7. Confirm your entries with **OK**.

Showing/hiding parameters - the parameter protection mode

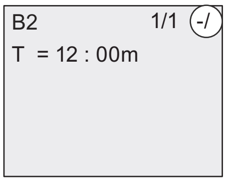
If you want to show/hide the parameter and allow/prevent its modification in parameter assignment mode, follow these steps:

1. Move the cursor to "-/": Press ▲ or ▼.
2. Switch to editing mode: Press **OK**.
3. Select the protection mode: Press ▲ or ▼.

   The display should now show:



or



When the protection mode shows "+", you can modify the time T in parameter assignment mode.

When the protection mode shows "-", you cannot modify the time T in parameter assignment mode.

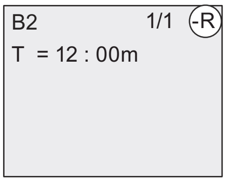
4. Confirm your entries with **OK**.

Enabling/disabling retentivity

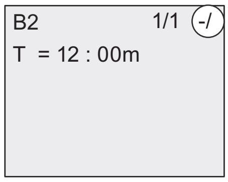
To decide whether you want to retain your current data after a power failure or not, follow these steps:

1. Move the cursor to "-/": Press ▲ or ▼.
2. Switch to editing mode: Press **OK**.
3. Move the cursor to the retentivity setting: Press ◀ or ▶.
4. Select the retentivity setting: Press ▲ or ▼.

The display now shows:



or



Retentivity R: Current data is retentive.

Retentivity /: Current data is not retentive.

5. Confirm your entries with **OK**.

Note

For further information on the protection mode, refer to the topic "Parameter protection (Page 129)".

For further information on retentivity, refer to the topic "Retentivity (Page 129)".

You can modify the protection mode and retentivity setting only in programming mode. This is **not** possible in parameter assignment mode.

IDEC SmartRelay displays protection mode ("+" or "-") and retentivity ("R" or "/") settings only where you can actually change these settings.

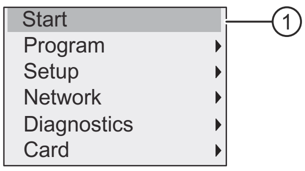
Verification of the circuit program

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

Closing the programming mode

When you finish programming, you can exit the programming mode by following these steps:

1. Return to the programming menu: Press **ESC**.
2. Return to the main menu: Press **ESC**.
3. Move the cursor to " ① ": Press ▲ or ▼.



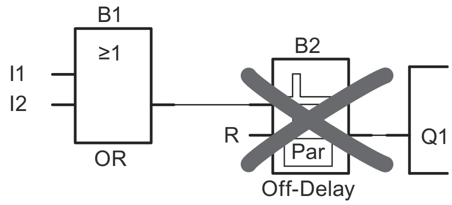
4. Confirm " ① ": Press **OK**.

IDEC SmartRelay is back in RUN mode:

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

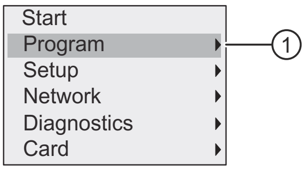
3.8.8 Deleting a block

Consider the case where you want to delete the block B2 from your circuit program and connect B1 directly to Q1.

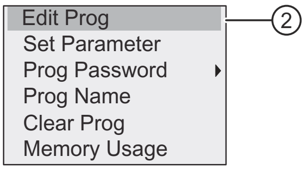


To delete this block, follow these steps:

1. Switch IDEC SmartRelay to programming mode.
   (As a reminder, refer to the topic "The four golden rules for operating IDEC SmartRelay (Page 58)").
2. Select " ① ": Press ▲ or ▼.

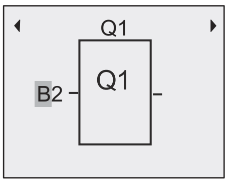


3. Confirm" ① ": Press **OK**.
4. Select " ② ": Press ▲ or ▼.



5. Confirm " ② ": Press **OK**.

   (If required, enter your password and confirm with **OK**.)
6. Press **OK** in the circuit program window, and the cursor now appears as a solid square.
7. Move the cursor to the Q1 block and then press **OK**.
8. Move the cursor to B2, the input of Q1, and confirm with **OK**.

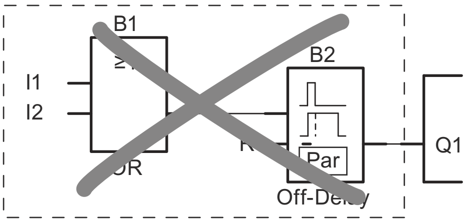


9. Now replace block B2 with block B1 at output Q1.
   – Move the cursor to the 2 in B2: Press ▶.
   – Select 'B1': Press ▼.
   – Apply 'B1': Press **OK**.

Result: IDEC SmartRelay deletes block B2 from the circuit and connects the output of B1 directly to output Q1.

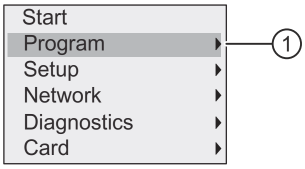
3.8.9 Deleting block groups

Consider the case where you want to delete blocks B1 and B2 from the second circuit program example (refer to the "Second circuit program (Page 79)" topic).

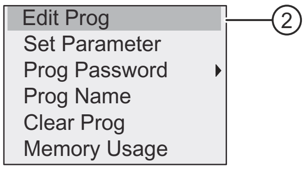


To delete these two blocks from that program, follow these steps:

1. Switch IDEC SmartRelay to programming mode.
   (As a reminder, refer to the topic "The four golden rules for operating IDEC SmartRelay (Page 58)").
2. To select " ① ": Press ▲ or ▼.

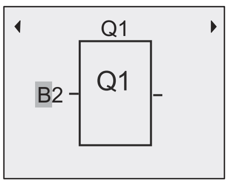


3. To confirm " ① ": Press **OK**.
4. To select " ② ": Press ▲ or ▼.



5. To confirm " ② ": Press **OK**.

   (If required, enter your password and confirm with **OK**.)
6. Press **OK** in the circuit program window, and the cursor now appears as a solid square.
7. Move the cursor to the Q1 block and then press **OK**.
8. Move the cursor to B2, the input of Q1, and confirm with **OK**.



9. Now set the blank connector at output Q1 instead of block B2:
   – Select the blank connector: Press ▲ or ▼.
   – Apply the blank connector: Press **OK**.

Result: IDEC SmartRelay deletes block B2 and all blocks that connect to B2 (in this case, block B1) from the circuit.

3.8.10 Correcting programming errors

You can easily correct programming errors in IDEC SmartRelay. Providing that you are still in editing mode, you can revert one step by pressing **ESC**. If you have already configured all inputs, simply reconfigure the faulty input:

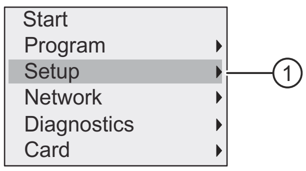
1. Move the cursor to the faulty position.
2. Change to editing mode: Press **OK**.
3. Enter the correct input circuit.

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

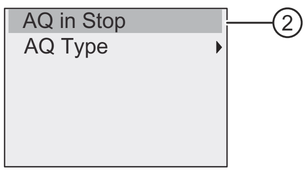
3.8.11 Selecting analog output values for RUN/STOP transition

You can set the behavior of up to eight analog outputs when IDEC SmartRelay changes from RUN mode to STOP mode. To set the behavior for analog outputs for a RUN-to-STOP transition, follow these steps:

1. In the programming menu, move the cursor to " ① ": Press ▼ or ▲.



2. Select " ① ": Press **OK.**
3. Move the cursor to "'**AQ**": Press ▼ or ▲.
4. Select "**AQ**": Press **OK.**
5. Move the cursor to " ② ": Press ▼ or ▲.



6. Select " ② ": Press **OK**.

   IDEC SmartRelay shows the following display:

   The circle with a dot before " ④ " above indicates the current setting for the analog output channels.

   You can select either " ③ " or " ④ ". The default setting is " ④ " which means that IDEC SmartRelay holds the values of the analog outputs at their last values. A setting of " ③ " means that IDEC SmartRelay sets the analog output values to specific values, which you can configure. When IDEC SmartRelay changes from RUN mode to STOP mode, the values of the analog outputs change as well, depending on the setting.

7. Select the desired output setting: Press ▲ or ▼.
8. Confirm your entry: Press **OK**.

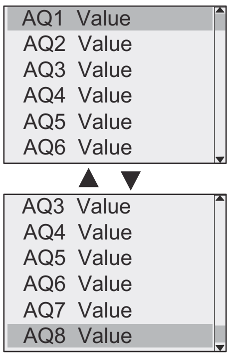
Defining a specific analog output value

To output a specific analog value at the analog outputs, follow these steps:

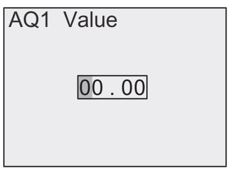
1. Move the cursor to " ③ ": Press ▲ or ▼.

2. Confirm " ③ ": Press **OK**.

   The display shows:



3. Select a desired analog output and press **OK**.
4. Enter a specific output value for the analog output.



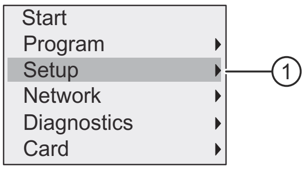
5. To confirm your entry, press **OK**.

3.8.12 Defining the type of analog outputs

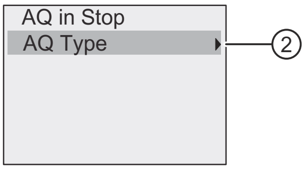
Analog outputs can be either 0..10V/0..20mA, which is the default, or 4..20mA.

To define the type of analog outputs, follow these steps starting from the programming menu:

1. Move the cursor to " ① ": Press ▼ or ▲.

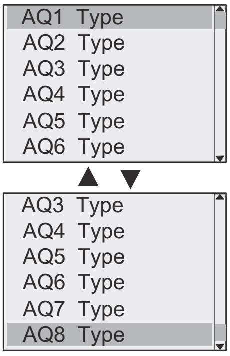


2. Select " ① ": Press OK.
3. Move the cursor to "AQ": Press ▼ or ▲.
4. Select "AQ": Press OK.
5. Move the cursor to " ② ": Press ▼ or ▲.



6. Select " ② ": Press OK.

   IDEC SmartRelay shows the following display:



7. Move the cursor to the desired AQ, and press OK.

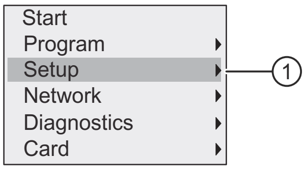
   IDEC SmartRelay indicates the defined type for the analog channel by a circle with a dot.
8. Select either 0..10V/0..20mA (default) or 4..20mA: Press ▼ or ▲.
9. Confirm your selection: Press OK.

3.8.13 Setting the power-on delay of IDEC SmartRelay

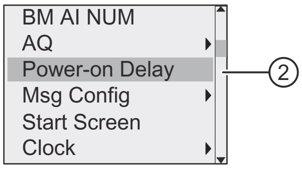
You can set a power-on delay for IDEC SmartRelay in order to make sure all the connected expansion modules are powered on and ready to use before IDEC SmartRelay runs the circuit programs.

To set the power-on delay, follow these steps:

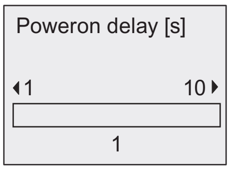
1. In the programming menu, move the cursor to " ① ": Press ▲ or ▼.



2. Confirm " ① ": Press **OK**.
3. Move the cursor to " ② ": Press ▲ or ▼.



4. Confirm " ② ": Press **OK**. IDEC SmartRelay shows the following display:

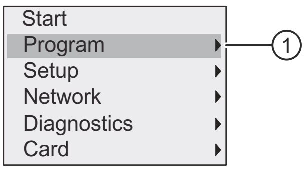


5. Press ▶ or ◀ to increase or decrease the delay time by 0.2 s. You can also press and hold down ▶ or ◀ to quickly increase or decrease the time.
6. Confirm your setting: Press **OK**.

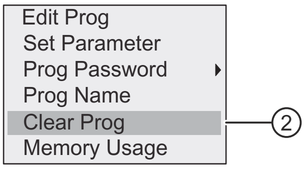
3.8.14 Clearing the circuit program and password

To clear a circuit program and the password if one is defined, follow these steps:

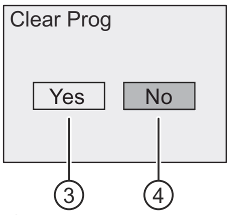
1. Switch the IDEC SmartRelay to programming mode. IDEC SmartRelay opens the main menu:



2. On the main menu, press ▲ or ▼ to move the cursor to " ① ". Press **OK**. IDEC SmartRelay opens the programming menu.
3. On the programming menu, move the cursor to " ② ": Press ▲ or ▼.



4. Confirm " ② ": Press **OK**.



5. If you are sure that you want to clear the circuit program in the memory, move the cursor to " ③ " and confirm with **OK**. IDEC SmartRelay clears the circuit program and password.

   To cancel clearing of the circuit program, leave the cursor at " ④ " and press **OK**.

3.8.15 Summertime/wintertime conversion

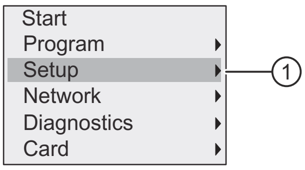
You can enable or disable automatic summertime/wintertime conversion.

Note

Summertime refers to "daylight saving time" and wintertime refers to "standard time" in the United States.

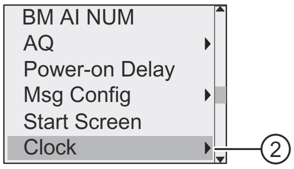
To enable/disable automatic S/W Time conversion in programming mode:

1. Switch IDEC SmartRelay to programming mode. IDEC SmartRelay displays the main menu.
2. Select " ① ": Press ▲ or ▼.

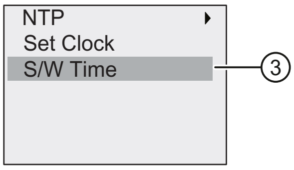


3. Confirm " ① ": Press **OK**.

4. Move the cursor to " ② ": Press ▲ or ▼.

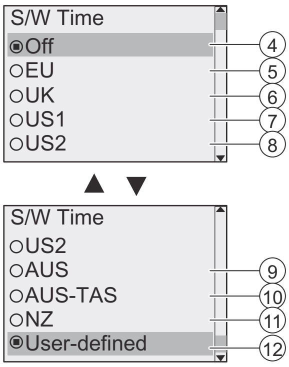


5. Confirm " ② ": Press **OK.**
6. Move the cursor to " ③ ": Press ▲ or ▼.



7. Confirm " ③ ": Press **OK.**

   IDEC SmartRelay shows the following display:



The current setting of automatic S/W Time conversion is indicated by a circle with a dot. The default setting is " ④ ": disabled.

What is shown on the display?:

– " ④ ": IDEC SmartRelay disables automatic S/W time conversion.
– " ⑤ " represents the start and end of European summertime.
– " ⑥ " represents the start and end of summertime in the United Kingdom.
– " ⑦ " represents the start and end of daylight saving time (summertime) in the United States prior to 2007.
– " ⑧ " represents the start and end of daylight saving time (summertime) in the United States in 2007 and later years.
– " ⑨ " represents the start and end of Australian summertime.
– " ⑩ " represents the start and end of Australian/Tasmanian summertime.
– " ⑪ " represents the start and end of New Zealand summertime.
– " ⑫ ": Here you can enter any month, day and time zone difference.

The table below lists the preset conversions:

Menu command	Start of summertime	End of summertime	Time zone difference Δ
⑤	Last Sunday in March: 02:00 → 03:00	Last Sunday in October: 03:00 → 02:00	60 minutes
⑥	Last Sunday in March: 01:00 → 02:00	Last Sunday in October: 02:00 → 01:00	60 minutes
⑦	First Sunday in April: 02:00 → 03:00	Last Sunday in October: 02:00 → 01:00	60 minutes
⑧	Second Sunday in March: 02:00 → 03:00	First Sunday in November: 02:00 → 01:00	60 minutes
⑨	Last Sunday in October: 02:00 → 03:00	First Sunday in April: 03:00 → 02:00	60 minutes
⑩	First Sunday in October: 02:00 → 03:00	First Sunday in April: 03:00 → 02:00	60 minutes
⑪	Last Sunday in September: 02:00 → 03:00	First Sunday in April: 03:00 → 02:00	60 minutes
⑫	Customized month and day; 02:00 → 02:00 + Time zone difference	Customized month and day; Time zone difference: 03:00 → 03:00 - Time zone difference	User-defined (resolution in minutes)

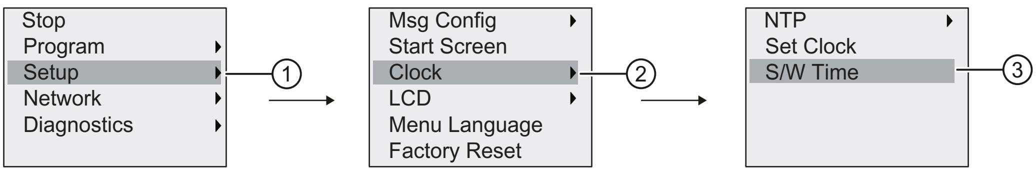
8. To enable the summertime/winter time conversion and set parameters, press ▲ or ▼ to select the desired conversion and then press OK to confirm.

Note

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

Enabling/disabling automatic S/W Time conversion in parameter assignment mode

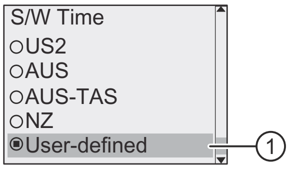
If you want to enable/disable automatic S/W Time conversion in parameter assignment mode, select " ① " in the parameter assignment menu, then menus " ② " and " ③ ". You can now enable/disable automatic S/W Time conversion.



User-defined parameters

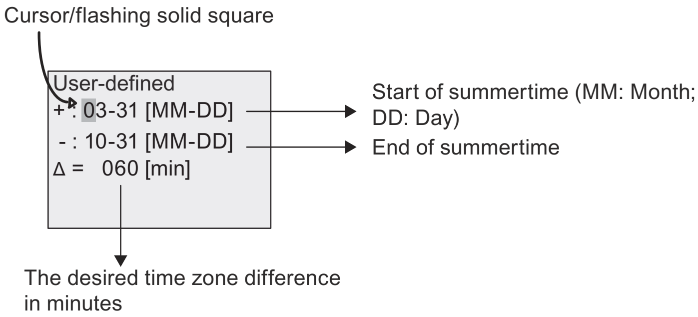
If none of the parameters/conversions apply to your country, follow these steps to customize the settings:

1. Move the cursor to the menu item " ① ": Press ▲ or ▼.



2. Confirm with **OK**.

The display shows:



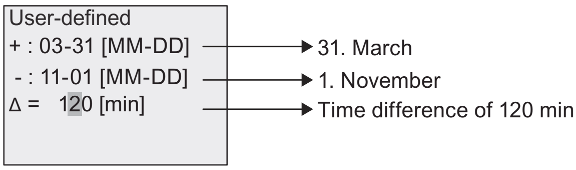
For example, consider an example where you want to configure the following parameters:

- Start of summertime = 31st March
- End of summertime = 1st November
- Time difference of 120 minutes

To configure these settings, follow these steps:

1. Press ◀ or ▶ to move the flashing solid square/cursor.
2. Press ▲ and ▼ to change the value at the cursor position.

   The display shows:



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

You have now customized the summertime/wintertime conversion.

Note

Summertime/wintertime conversion only functions when IDEC SmartRelay is operating in RUN or STOP mode. It does not function when the internal real–time clock of IDEC SmartRelay continues operation after a power failure (refer to Section "Backup of the real-time clock (Page 129)").

3.8.16 Network Time Protocol (FL1F FS5 and later versions only)

Network Time Protocol(NTP) function is a new feature and supported in FL1F FS5 and later versions BM. It is used for network time synchronization.

The NTP contains three function settings:

- NTP Client

  NTP Client is used for configuring the NTP function, FL1F FS5 BM can both serve as an NTP Server and an NTP Client at the same time. To make IDEC SmartRelay BM synchronize time from the NTP Server, you need to set BM as NTP Client and configure its NTP Server IP first.

- NTP Server

  NTP Server is only a reactor server. It can only provide the time passively while the broadcast function is disabled. FL1F FS5 can act as an NTP Server. When you enable it, FL1F FS5 works as a time provider for all standard NTP client, includes Windows/Linux NTP client, FL1F FS5 and so on.

- NTP Time Zone

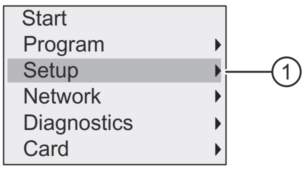
  NTP Client/Server can synchronize the time in different time zone, so we need to set NTP Time Zone in IDEC SmartRelay for reference. NTP Time Zone is used for setting the local time zone in BM/TDE and WindLGC. The default setting is GMT time zone.

The NTP function of IDEC SmartRelay BM is disabled by default. You can enable it in the BM/TDE menu or WindLGC.

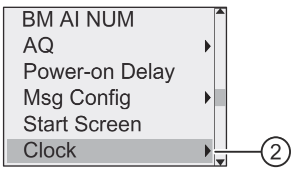
Configuring NTP in programming mode

To configure NTP function, follow these steps:

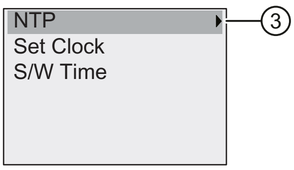
1. Switch IDEC SmartRelay to programming mode. IDEC SmartRelay displays the main menu.



2. Select " ① ": Press ▲ or ▼.
3. Confirm " ① ": Press **OK**.
4. Move the cursor to " ② ": Press ▲ or ▼.



5. Confirm " ② ": Press **OK**.
6. Move the cursor to " ③ ": Press ▲ or ▼.



7. Apply " ③ ": Press **OK**.

8. Then there are three options for selecting:

- **NTP Time Zone**

  NTP Client/Server can synchronize the time in different time zone, you can provide a time zone in FL1F FS5 for NTP functions.

  The default setting is GMT time zone, and you can change it to the real local time zone in BM/TDE and WindLGC.

- **NTP Client**

  To make IDEC SmartRelay BM synchronize time from the NTP server, you need to set BM as NTP client and configure its NTP server IP first. Any standard NTP server can be used for FL1F FS5, such as the Windows/Linux NTP Server, standard time provider and FL1F FS5 itself.

  Note

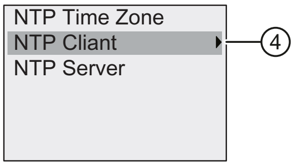
  IDEC strongly recommends that you use NTP function at firewalls within Secure Network.

  For detailed information about security functions on IDEC SmartRelay, see Chapter Security (Page 294).

  The NTP client is disabled by default, you can enable it in BM/TDE and WindLGC.

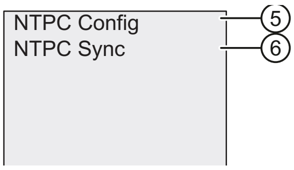
  To enable NTP Client function, follow these steps:

  – Move the cursor to " ④ ": Press ▲ or ▼.



  – Apply " ④ ": Press **OK**.

  – IDEC SmartRelay shows the following display:



  To enable NTP Client function, press ▲ or ▼ to select " ⑤ ";

  To identify whether the synchronization request success or failure, press ▲ or ▼ to select " ⑥ ", and then confirm with **OK**. If the last synchronization is successful, the result panel in this menu item shows the last synchronize timestamp with a real time mode, otherwise a "not synchronized" is shown.

To enable NTP Client function, follow these steps:

Note

The NTP client can synchronize time from NTP server every 4096 seconds, but it can synchronize the time immediately in the following scenarios:

- Base Module Power on
- Base Module from Stop to Run
- Server IP is changed
- Select " ⑥ "

- **NTP Server**

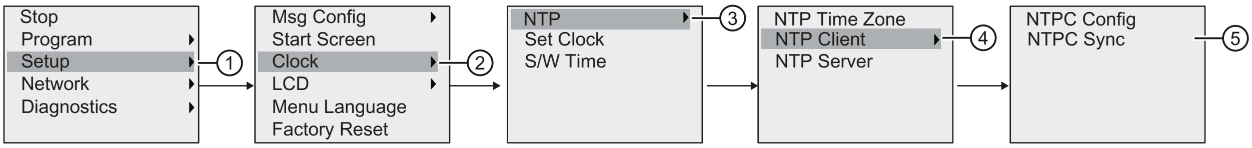
  NTP server is only a reactor server. It can only provide the time passively while the broadcast function is disabled.

  NTP server is disabled by default. You can enable it in BM/TDE or WindLGC.

  FL1F FS5 can act as an NTP server. When you enable it, FL1F FS5 works as a time provider for all standard NTP client, includes Windows/Linux NTP client, FL1F FS5 and so on.

Configuring NTP in parameter assignment mode

If you want to configure NTP function in parameter assignment mode, select " ① " in the parameter assignment menu , then menus " ② " , " ③ " and " ④ ". You can now enable NTP Client synchronization by selecting " ⑤ ".



3.9 Configuring additional functions for IDEC SmartRelay

After you have successfully created the second circuit program, you can configure additional functions by means of the following menu commands:

- Network
- Diagnostics

UDF and Data Log

You can configure the UDF and Data Log functions only from WindLGC. After you have configured them in WindLGC and downloaded them to the IDEC SmartRelay, you can then edit elements connected to these functions from the device:

- UDFs (User-Defined Functions)
- Data Log

Network digital and analog I/O

You can configure the following connectors representing network digital or analog inputs/outputs only from WindLGC:

- Network digital inputs
- Network analog inputs
- Network digital outputs
- Network analog outputs

Note

If your circuit program in an IDEC SmartRelay contains any network digital or analog inputs/outputs, you can only edit the "Par" parameter of function blocks from IDEC SmartRelay. You can not edit any of the rest of the circuit program from the device.

3.9.1 Configuring network settings

An IDEC SmartRelay can establish network communication with other IDEC SmartRelay or a PC with WindLGC V8.0 or later version (For more detailed information, refer to the Maximum IDEC SmartRelay network setup (Page 16) topic). You can configure the IDEC SmartRelay network only from WindLGC V8.0 or later version. From IDEC SmartRelay, you can configure your IDEC SmartRelay's network settings including IP address, subnet mask and gateway.

Note

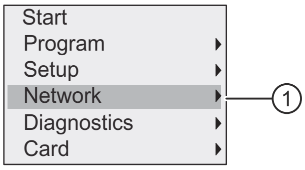
You can configure IDEC SmartRelay's network settings including IP address, subnet mask and gateway with the access level of administrator only. With the access level of operator, you can only view but cannot change the network settings.

For detailed information about Network security on IDEC SmartRelay, see Chapter Security (Page 294).

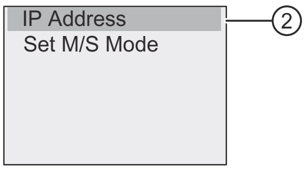
Configuring the network settings

IDEC SmartRelay provides a menu command for configuring network settings.

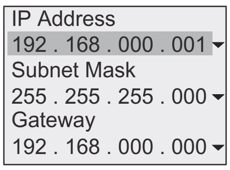
1. Switch IDEC SmartRelay to programming mode.
2. Press ▲ or ▼ to move the cursor to " ① ".



3. Press **OK** to confirm " ① ".
4. Press ▲ or ▼ to move the cursor to " ② ".



5. Press **OK** to confirm " ② ". IDEC SmartRelay displays the following view:



6. The display now shows the default IP address of your IDEC SmartRelay. To change the setting, press **OK**. When the cursor appears in a flashing solid square, press ◀ or ▶ to move the cursor to a position where you want to modify the number, then press ▲ or ▼ to increase or decrease the number. To confirm your change, press **OK**.

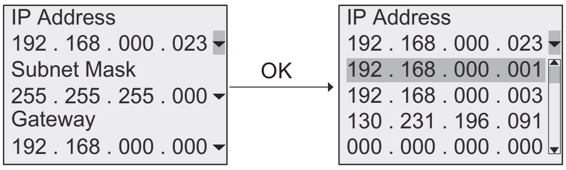
Note

The default IP address for FL1F: 192.168.000.001

The default IP address for Text Display: 192.168.000.002

The default IP address for FL1F FS5 and later version: 192.168.000.003

IDEC SmartRelay stores up to four addresses that you set previously. To view your last settings, press ▶ to move the cursor to the "▼" symbol, and then press **OK** to open a drop-down list, for example:



You can press ▲ or ▼ to select a previously configured address in the list, and then press **OK** to confirm.

7. Press ▲ or ▼ to move to the subnet mask setting. The default subnet mask is as shown above. To change the setting, press **OK**. When the cursor appears in a flashing solid square, press ◀ or ▶ to move the cursor to a position where you want to modify the number, then press ▲ or ▼ to increase or decrease the number. To confirm your change, press **OK**.
8. Press ▼ to move to the gateway address setting. The default gateway is as shown above. To change the setting, press **OK**. When the cursor appears in a flashing solid square, press ◀ or ▶ to move the cursor to a position where you want to modify the number, then press ▲ or ▼ to increase or decrease the number. To confirm your change, press **OK**.

Transferring the circuit program to WindLGC

After you have finished the network settings, you can transfer the circuit program from IDEC SmartRelay to WindLGC using the transfer command IDEC SmartRelay → PC in WindLGC. For further information on uploading the circuit program to WindLGC with this transfer menu command, refer to WindLGC Online Help.

3.9.2 Configuring a UDF (User-Defined Function)

You can configure UDF (User-Defined Function) blocks only from WindLGC.

A UDF block is a preconfigured circuit program that you create in WindLGC. You can add it to an existing circuit program as you do with a function block. For a detailed description of the UDF configuration in WindLGC, refer to the Online Help for WindLGC.

If your circuit program in IDEC SmartRelay contains a UDF block, you can configure elements connected to the block. For more information of configuration of UDF elements from IDEC SmartRelay, refer to the topic UDF (User-Defined Function) (Page 268).

3.9.3 Configuring the Data Log

You can configure the Data Log block only from WindLGC.

You can configure a maximum of one Data Log for your circuit program using WindLGC. The Data Log is used to record process measurement variables of the selected function blocks. For a detailed description of configuration of the Data Log function in WindLGC, refer to the Online Help for WindLGC.

If your circuit program in IDEC SmartRelay contains the Data Log block, you can configure elements connected to the block. For more information of configuration of Data Log elements from IDEC SmartRelay, refer to the topic Data log (Page 272).

3.9.4 Viewing network inputs/outputs

WindLGC provides you with the following connectors representing network input/output blocks:

- Network digital inputs (identified with an **NI** in IDEC SmartRelay)
- Network analog inputs (identified with an **NAI** in IDEC SmartRelay)
- Network digital outputs (identified with an **NQ** in IDEC SmartRelay)
- Network analog outputs (identified with an **NAQ** in IDEC SmartRelay)

Network digital or analog inputs can connect with the inputs of function blocks. Network digital or analog outputs can connect with the outputs of function blocks.

If your circuit program contains a network digital/analog input, IDEC SmartRelay can read a digital/analog value from another circuit program in a networked device. If your circuit program contains a network digital/analog output, IDEC SmartRelay can write its digital/ analog output value to another networked IDEC SmartRelay in slave mode.

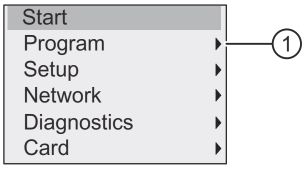
Note

You can only configure these network connectors for your circuit program from WindLGC. If your circuit program in IDEC SmartRelay contains a network connector, you can not make any edits to the circuit program from the IDEC SmartRelay onboard display.

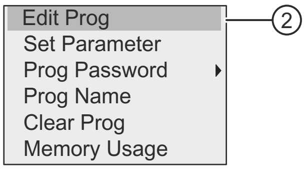
Viewing network connectors in IDEC SmartRelay

Consider a circuit program where a network digital input NI1 connects to the function block B5. B5 is connected to Q4. To view this network input, follow these steps:

1. Switch IDEC SmartRelay to programming mode.
2. Select " ① ": Press ▲ or ▼.

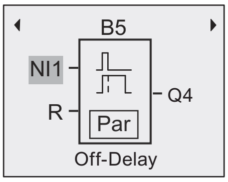


3. Confirm" ① ": Press **OK**.
4. Select " ② ": Press ▲ or ▼.



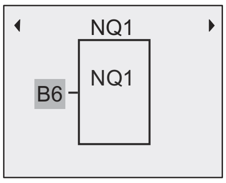
5. Confirm " ② ": Press **OK**.

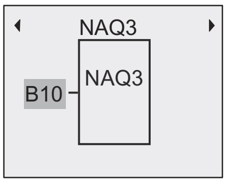
   (If required, enter your password and confirm with **OK**.)
6. Press **OK** in the circuit program window, and the cursor now appears as a solid square.
7. Move the cursor to the B5 block and then press **OK**. IDEC SmartRelay shows the following display:



You can see that there is a network digital input NI1 connected at the first input of B5.

The following views are examples of network digital and analog outputs in IDEC SmartRelay:





Available network input/output blocks in WindLGC

The following network I/O blocks are available for you to create your circuit program in WindLGC:

- Network digital inputs: NI1 to NI64
- Network analog inputs: NAI1 to NAI32
- Network digital outputs: NQ1 to NQ64
- Network analog outputs: NAQ1 to NAQ16

3.9.5 Changing IDEC SmartRelay to master/slave mode

IDEC SmartRelay provides a menu command for network communication settings. This section shows you how to change IDEC SmartRelay's network communication mode.

An IDEC SmartRelay works in either master or slave communication mode.

Master mode versus slave mode

An IDEC SmartRelay in master mode supports client-server communication with other FL1F devices across Ethernet. This IDEC SmartRelay can additionally act as a master to communicate with one or more FL1F devices in slave mode.

An IDEC SmartRelay in slave mode functions as an expansion module. IDEC SmartRelay slave devices do not require a circuit program. A master IDEC SmartRelay can read one or more slave IDEC SmartRelay's digital/analog input/output values and write its own digital/ analog output values to these slaves. This helps IDEC SmartRelay achieve network I/O expansion.

Note

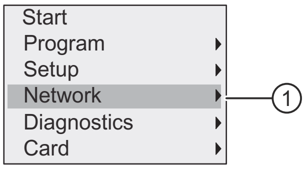
An IDEC SmartRelay in slave mode can also have its own expansion modules. It also supports a maximum of 24 digital inputs, 8 analog inputs, 20 digital outputs and 8 analog outputs.

Note

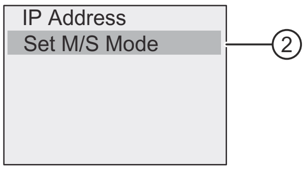
Change IDEC SmartRelay to slave mode will enable the unsecure port 102 and 502-510.

Changing IDEC SmartRelay from master mode to slave mode

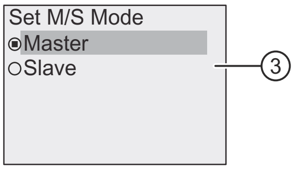
1. In the main menu in programming mode, move the cursor to " ① ": Press ▲ or ▼.



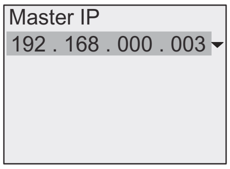
2. Confirm " ① ": Press **OK**.
3. Move the cursor to " ② ": Press ▲ or ▼.



4. Confirm " ② ": Press **OK**.
5. Move the cursor to ③ ": Press ▲ or ▼.

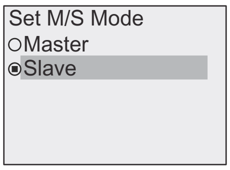


6. Confirm " ③ ": Press **OK**.



7. In this view, you enter the IP address of the IDEC SmartRelay that you want to configure to be the master of your slave IDEC SmartRelay. To change the setting, press **OK**. When the cursor appears in a flashing solid square, press ◀ or ▶ to move the cursor through the numbers. Press ▲ or ▼ to change the number.
8. Confirm the setting: Press **OK**

   You have now successfully changed IDEC SmartRelay from master mode to slave mode. IDEC SmartRelay restarts automatically and then displays the main menu. Stepping into the following view, you can see that your IDEC SmartRelay is now in slave mode:



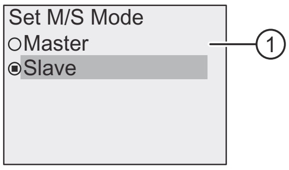
Note

When IDEC SmartRelay is in slave mode, you can not edit the circuit program from the slave IDEC SmartRelay.

You cannot change IDEC SmartRelay to master/slave mode in parameter assignment mode.

Changing IDEC SmartRelay from slave mode to master mode

IDEC SmartRelay is now in slave mode:



1. Move the cursor to " ① ": Press ▲ or ▼.
2. Confirm " ① ": Press OK.

   You have now successfully changed IDEC SmartRelay from slave mode to master mode. IDEC SmartRelay restarts automatically and then displays the main menu.

Alternatively, you can change IDEC SmartRelay from slave mode to master mode from WindLGC. If you download a circuit program to an IDEC SmartRelay in slave mode from WindLGC, you are prompted to switch IDEC SmartRelay to master mode to complete the downloading. For more information, refer to the Online Help for WindLGC.

3.9.6 Diagnosing errors from IDEC SmartRelay

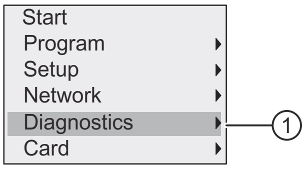
IDEC SmartRelay supports error event diagnostics. You can perform the following actions from IDEC SmartRelay's diagnostics menu:

- View software status and errors:
  - Data connection error
  - Firmware version of IDEC SmartRelay
- View hardware status and errors:
  - Ethernet connection error
  - Micro SD card error (for example, card read/write error, card is not inserted, or card is full)
  - EM (expansion module) status and error (for example, bus error and configuration update)
  - MAC address of IDEC SmartRelay
- View and clear the event log, and check the availability of a specific IP address
- View Cloud connection status, errors and the log for Cloud synchronization
- View the configured SMTP information and logs of mail sending failure
- Toggle an error event alert

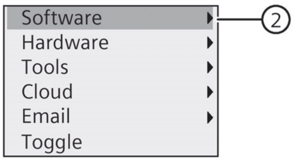
Viewing the software status and errors of IDEC SmartRelay

To view the software status and errors, follow these steps:

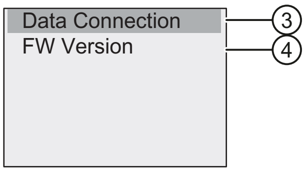
1. In the main menu, move the cursor to " ① ": Press ▲ or ▼.



2. Confirm " ① ": Press **OK.**
3. IDEC SmartRelay shows you the diagnostics menu. Move the cursor to " ② ": Press ▲ or ▼.



4. Confirm " ② ": Press **OK.** IDEC SmartRelay shows you the following display:



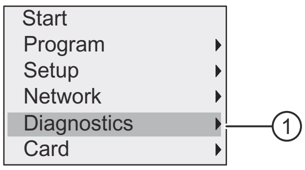
5. You can select " ③ " to view the real-time status of the FL1F connection or Modbus connection. Select " ④ " to view the firmware version of IDEC SmartRelay.

   After you select " ③ ", you can press ◀ or ▶ to view the status of each Data connection.

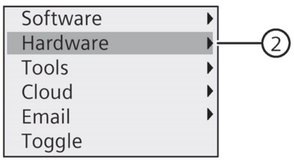
Viewing the hardware status and errors of IDEC SmartRelay

To view the hardware status and errors, follow these steps:

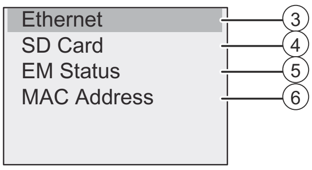
1. In the main menu, move the cursor to " ① ": Press ▲ or ▼.



2. Confirm " ① ": Press **OK.**
3. IDEC SmartRelay shows you the diagnostics menu. Move the cursor to " ② ": Press ▲ or ▼.



4. Confirm " ② ": Press **OK**. IDEC SmartRelay shows you the following display:

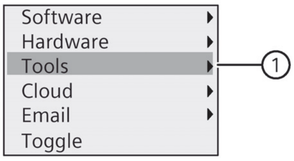


5. You can select the following menu commands to view the corresponding hardware status and errors:
   – ③ : To view the status of the Ethernet interface of IDEC SmartRelay. If the Ethernet cable is not connected, an error appears.
   – ④ : To view the status of the micro SD card. You may find an error event under this menu command when no card is inserted, the card is full, or a read/write error occurs.
   – ⑤ : To view the real-time status of the connected expansion module(s). You can find the number of the expansion modules and the total I/O number under this menu command.
   – ⑥ : To view the MAC address of IDEC SmartRelay

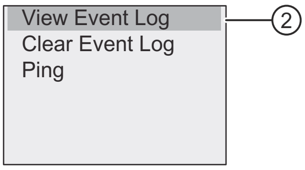
Viewing error information

To view the errors detected, follow these steps:

1. In the diagnostics menu shown below, move the cursor to " ① ": Press ▲ or ▼.



2. Confirm " ① ": Press **OK**.
3. Move the cursor to " ② ": Press ▲ or ▼.



4. Confirm " ② ": Press **OK**. IDEC SmartRelay displays all errors detected. You can press ◀ or ▶ to view each error record. Press **ESC** or **OK** to return to the previous menus.

Note

BM crash caused by a damaged circuit diagram

If BM crashes by a damaged circuit diagram, BM will try to restart for four times at most. If BM still cannot work after these restarts, BM will:

- delete the error diagram in BM. If the diagram is loaded to BM by SD card, BM will also save the bin file in SD card as dmg file to avoid this error diagram being loaded to BM again.
- record this error in the event log

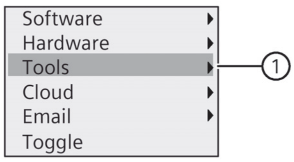
After BM deleted the error diagram, the screen of IDEC SmartRelay Basic or the RUN/STOP LED for IDEC SmartRelay Pure will flashes once every second in amber in next BM restarts. The flash stops when you do either of the following:

- Download a new diagram to BM.
- Switch off the power and then restart BM.

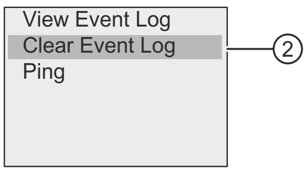
Clearing error information

To clear all errors, follow these steps:

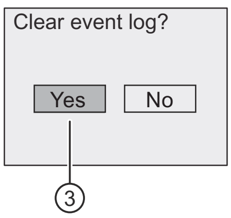
1. In the diagnostics menu shown below, move the cursor to " ① ": Press ▲ or ▼.



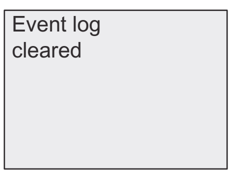
2. Confirm " ① ": Press **OK**.
3. Move the cursor to " ② ": Press ▲ or ▼.



4. Confirm " ② ": Press **OK**.
5. Move the cursor to " ③ ": Press ▲ or ▼.



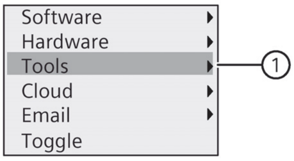
6. Confirm " ③ ": Press **OK**. IDEC SmartRelay clears all error messages and displays as follows:



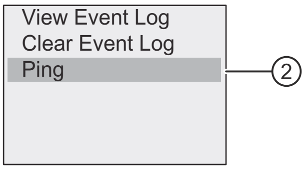
Diagnosing a specific IP address

You can check the availability of a specific IP address by following these steps:

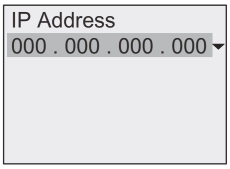
1. In the diagnostics menu shown below, move the cursor to " ① ": Press ▲ or ▼.



2. Confirm " ① ": Press **OK**.
3. Move the cursor to " ② ": Press ▲ or ▼.



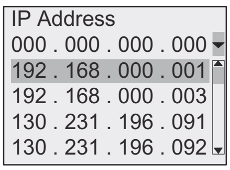
4. Confirm " ② ": Press **OK**. IDEC SmartRelay displays the following view:



5. To enter an IP address, Press **OK**. When the cursor appears in a flashing solid square, press ◀ or ▶ to move the cursor to a position where you want to modify the number, then press ▲ or ▼ to increase or decrease the number.
6. Press **OK** to confirm your input.

   When pinging the IP address is successful and the IP address is available, OK message is displayed. If timeout occurs and the IP address is unavailable, an error message is displayed.

   IDEC SmartRelay stores up to four addresses that you entered previously. To view your last inputs, press ▶ to move the cursor to the "▼" symbol, and then press **OK** to open a drop-down list, for example:

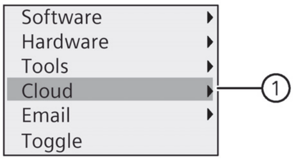


   You can press ▲ or ▼ to select a previously configured address in the list, and then press **OK** to confirm.

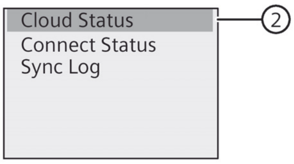
Viewing Cloud status

To view the Cloud status, follow these steps:

1. In the diagnostics menu shown below, move the cursor to " ① ": Press ▲ or ▼.



2. Confirm " ① ": Press **OK**.
3. Move the cursor to " ② ": Press ▲ or ▼.

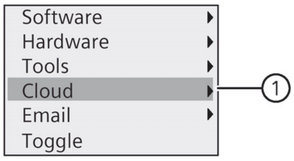


4. Confirm " ② ": Press **OK**. IDEC SmartRelay displays the real-time Cloud status and Cloud configuration. Press **ESC** or **OK** to return to the previous menus.

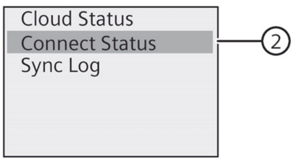
Viewing Cloud connection status

To view Cloud connection state, follow these steps:

1. In the diagnostics menu shown below, move the cursor to " ① ": Press ▲ or ▼.



2. Confirm " ① ": Press **OK**.
3. Move the cursor to " ② ": Press ▲ or ▼.



4. Confirm " ② ": Press **OK**.

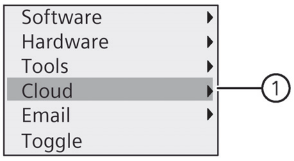
   If the connection state is **Error**, IDEC SmartRelay displays specific error information. You can refer to Troubleshooting (Page 349) to try to fix connection error.

   Press **ESC** or **OK** to return to the previous menus.

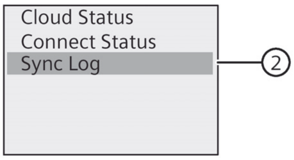
Viewing the synchronization log

To view the synchronization log, follow these steps:

1. In the diagnostics menu shown below, move the cursor to " ① ": Press ▲ or ▼.



2. Confirm " ① ": Press **OK**.
3. Move the cursor to " ② ": Press ▲ or ▼.

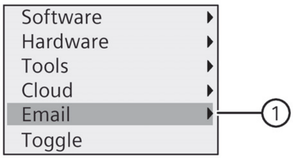


4. Confirm " ② ": Press **OK**.

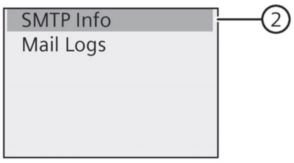
Viewing Email SMTP information

To view the configured Email SMTP information, follow these steps:

1. In the diagnostics menu shown below, move the cursor to " ① ": Press ▲ or ▼.



2. Confirm " ① ": Press **OK**.
3. Move the cursor to " ② ": Press ▲ or ▼.

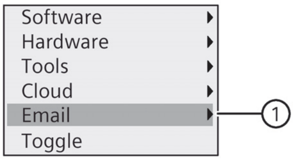


4. Confirm " ② ": Press **OK**.

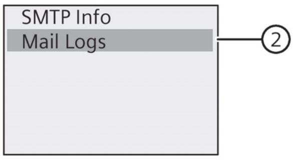
Viewing logs of email sending failure

To view logs of email sending failure, follow these steps:

1. In the diagnostics menu shown below, move the cursor to " ① ": Press ▲ or ▼.



2. Confirm " ① ": Press **OK**.
3. Move the cursor to " ② ": Press ▲ or ▼.



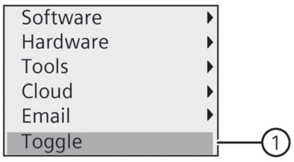
4. Confirm " ② ": Press **OK**.

IDEC SmartRelay Base Module records the latest 16 logs. According to the fail cause displayed in the log, you can refer to Troubleshooting (Page 349) to try to fix email sending errors.

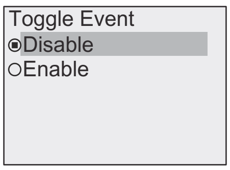
Toggling an error alert

You can enable/disable an error alert by following these steps:

1. In the diagnostic menu shown below, move the cursor to " ① ": Press ▲ or ▼.



2. Confirm " ① ": Press **OK**.
3. The circle with a dot indicates the current setting. To change the setting: Press ▲ or ▼.



4. Confirm your selection: Press **OK**. IDEC SmartRelay returns to the previous view.

If you enable the error alert, when an error occurs, the IDEC SmartRelay display turns to red backlight, reminding you that IDEC SmartRelay detects an error. You can go to the diagnostics menu to view and clear the error.

3.10 Memory space and circuit program size

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

Memory areas

- **Program memory**:
  IDEC SmartRelay allows only a limited number of blocks in your circuit program.
  The second limitation is based on the maximum number of bytes a circuit program can contain. You can determine the total number of bytes used by adding up the number of bytes used for the relevant function blocks.
- **Retentive memory (Rem)**:
  In this area, IDEC SmartRelay stores values that are retentive; for example, the operating hours counter value. Blocks with optional retentivity use this memory area only if you have enabled the retentivity function.

CAUTION

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

Example: On-delay

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

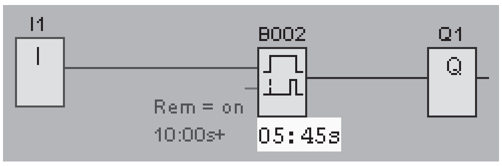


Fig. 1

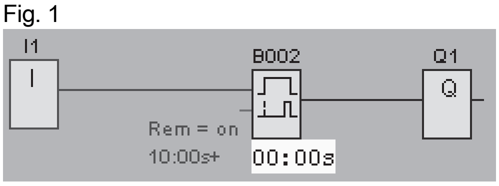


Fig. 2

Other FBs are shown below.

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

Resources available in IDEC SmartRelay

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

IDEC SmartRelay device series	Bytes	Blocks	REM
IDEC SmartRelay	8500	400	250

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

Memory requirements

The table below shows an overview of the memory requirements for the basic and special function blocks in IDEC SmartRelay FL1F:

Function	Program memory	REM memory*
Basic functions		
AND	12	-
AND with edge detection	12	-
NAND (not AND)	12	-
NAND with edge detection	12	-
OR	12	-
NOR (not OR)	12	-
XOR (exclusive OR)	8	-
NOT (Negation)	8	-
Special functions		
Timers		
On-delay	12	3
Off-delay	16	3
On-/Off-delay	16	3
Retentive on-delay	16	3
Interval time-delay relay/Pulse output	12	3
Edge-triggered interval time-delay relay	20	4
Asynchronous pulse generator	16	3
Random generator	16	-
Stairwell light switch	16	3
Dual-function switch	20	3
Seven-day time switch	24	-
Twelve-month time switch	12	-
Astronomical clock	40	-
Stopwatch	28	19
Counters		
Up/down counter	32	5
Operating hours counter	36	13
Frequency trigger	20	-
Analog		
Analog trigger	20	-

Function	Program memory	REM memory*
Analog differential trigger	20	-
Analog comparator	24	-
Analog watchdog	24	-
Analog amplifier	12	-
Pulse Width Modulator (PWM)	32	-
Analog math	24	-
Analog math error detection	16	1
Analog multiplexer	20	-
Analog ramp control	40	-
PI controller	44	2
Analog filter	20	-
Max/Min	20	7
Average value	32	20
Others		
Latching relay	12	1
Current impulse relay	12	1
Message texts	12	-
Softkey	12	2
Shift register	16	1
Float/Integer Converter	20	-
Integer/Float Converter	24	-

*: Bytes in the REM memory area if you have enabled retentivity

Note

Since a UDF block is a preconfigured circuit program that you create from WindLGC for your IDEC SmartRelay device, the memory size (program memory and REM memory) of a UDF block depends upon the size of the function blocks contained in the UDF.

Utilization of memory areas

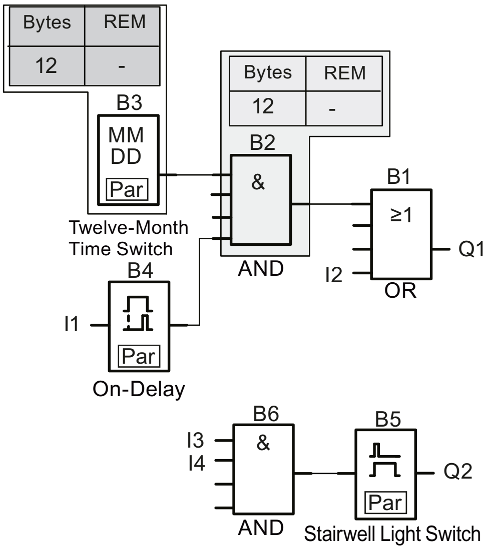
IDEC SmartRelay indicates that there is insufficient memory space by not allowing you to add a block to your circuit program. IDEC SmartRelay offers you only the blocks for which it can provide sufficient memory space. If IDEC SmartRelay memory space is insufficient to hold any additional blocks, the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

If memory space is full, optimize your circuit program or install another IDEC SmartRelay.

Calculating memory requirements

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

Example:



The sample circuit program contains:

Block no.	Function	Memory area		
		Bytes	Blocks	REM
B1	OR	12	1	-
B2	AND	12	1	-
B3	Twelve-month time switch	12	1	-
B4	On-delay*	12	1	3
B5	Stairwell light switch	16	1	3
B6	AND	12	1	-
	Resources used by the circuit program	76	6	6
	Memory space limits in IDEC SmartRelay	8500	400	250
	Still available in IDEC SmartRelay	**8424**	**394**	**244**

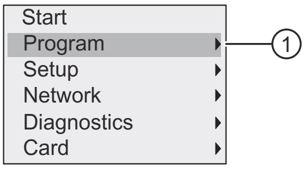
*: Configured with retentivity.

This means that this circuit program fits in IDEC SmartRelay.

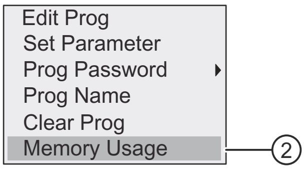
Indication of available memory space

To view the amount of free memory space in IDEC SmartRelay, follow these steps:

1. Switch IDEC SmartRelay to programming mode.
   (As a reminder, refer to the topic "The four golden rules for operating IDEC SmartRelay (Page 58)".
2. Move the cursor to " ① ": Press ▲ or ▼.

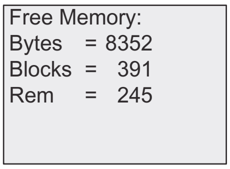


3. Confirm " ① ": Press OK.
4. Move the cursor to " ② ": Press ▲ or ▼.



5. Confirm " ② ": Press OK.

   The display now shows:



IDEC SmartRelay functions 4

IDEC SmartRelay provides you with various elements in programming mode, and organizes them in the following lists:

- Constants and connectors (Page 116)
- Basic functions list - GF (Page 120)
- Special functions list - SF (Page 132)
- List of reusable blocks configured in the circuit program

IDEC SmartRelay FL1F can additionally provide you with the following elements in programming mode, if you have previously configured them in your circuit program using WindLGC:

- UDF: List of user-defined function blocks configured in the circuit program
- L: A Data Log function block configured in the circuit program

List contents

All lists show the elements available in IDEC SmartRelay. Usually, this includes all connectors, basic functions, and special functions.

IDEC SmartRelay does not show all elements if:

- You cannot add additional blocks.

  This occurs when the memory space is insufficient or when you have reached the maximum number of blocks.
- A specific block's Memory space and circuit program size (Page 110) would exceed the space available in IDEC SmartRelay.
- You have created program elements in WindLGC but have not downloaded the program to IDEC SmartRelay.

4.1 Constants and connectors

Constants and connectors represent inputs, outputs, markers, constants, and network digital and analog inputs/outputs.

Inputs

- **Digital inputs**

  Digital inputs begin with the letter **I**. The number of the digital inputs (I1, I2, ...) corresponds to the number of the input connectors of the IDEC SmartRelay Base Module and of the connected digital modules, in the order of their installation. You can use the fast digital inputs I3, I4, I5, and I6 of the IDEC SmartRelay versions FL1F-H12RCE, FL1F-B12RCE, and FL1F-H12SCD as fast counters.

  Note

  To avoid that the IDEC SmartRelay Base Module fails to read input signals because its built-in MCU (Microcontroller Unit) is too sensitive and runs much faster than those in previous IDEC SmartRelay devices, an on-/off-delay function is designed for IDEC SmartRelay:

  - For FL1F-H12RCC and FL1F-B12RCC, a 25 ms on-delay time and a 20 ms off-delay time are defined for digital inputs I1 to I8.
  - For all the other IDEC SmartRelay versions, a 5 ms on-delay time and a 5 ms off-delay time are defined for all the digital inputs.

  Besides, when the Base Module is in slave mode, a 5 ms on-delay time and a 100 ms signal-retentive-time are defined for all the digital inputs.

- **Analog inputs**

  The IDEC SmartRelay versions FL1F-H12SCD, FL1F-H12RCE and FL1F-B12RCE have the inputs I1, I2, I7 and I8, which you can also program for use as **AI3, AI4, AI1** and **AI2** inputs. As described in topic "Setting the number of AIs in IDEC SmartRelay (Page 285)", you can configure these modules to use either two analog inputs (AI1 and AI2), or all four. IDEC SmartRelay interprets signals at the I1, I2, I7 and I8 inputs as digital values, and those at the AI3, AI4, AI1 and AI2 inputs as analog values. Note that AI3 corresponds to I1 and AI4 corresponds to I2. This numbering preserves the previous correspondence of AI1 to I7 and AI2 to I8 that was available with the FL1D series. IDEC SmartRelay numbers the inputs of a connected analog module according to the already existing analog inputs. See topic "Maximum setup with expansion modules (Page 18)" for example setups. In programming mode, when you select the input signal of a special function that takes an analog input, IDEC SmartRelay offers the analog inputs AI1 to AI8, analog memory markers AM1 to AM64, analog outputs AQ1 to AQ8, and the block numbers of functions with analog outputs.

Outputs

- **Digital outputs**

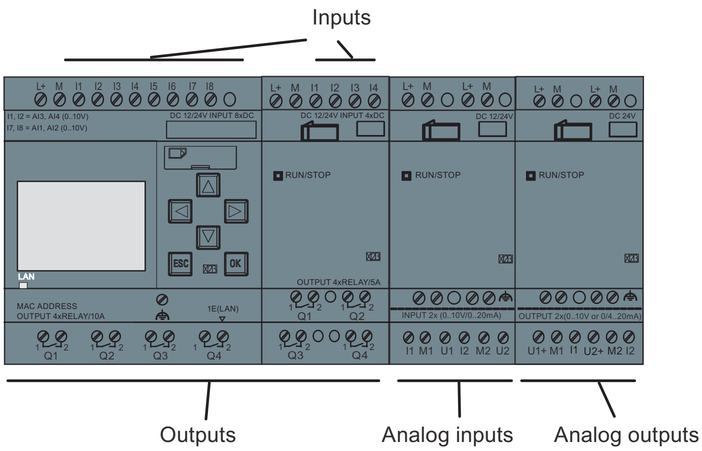
  Digital outputs begin with the letter **Q**. The output numbers (Q1, Q2, ... Q20) correspond with the numbers of the output connectors at the IDEC SmartRelay Base Module and with those of the expansion modules, in their order of installation.

  IDEC SmartRelay FL1F also provides 64 blank outputs and identifies them with the letter **x**. You cannot reuse the blank outputs in a circuit program. The blank outputs differ from memory markers, for example, which you can reuse. A blank output, for example, is useful for the special function Message texts (Page 200), if only the message text is of significance to a circuit program.

- **Analog outputs**

  Analog outputs begin with the letters **AQ**. Eight analog outputs are available, namely AQ1, AQ2,... AQ8. You can only connect an analog output with the analog input of a function, an analog memory marker AM or an analog output connector.

  The following figure shows an example IDEC SmartRelay configuration and the numbering of the inputs and outputs for the circuit program.



Note

IDEC SmartRelay supports the graphical display of the analog value changes in the form of a trend curve on the onboard display. You can easily monitor each analog I/O in use by means of the trend curves when IDEC SmartRelay is in RUN mode. For more information on how to view the trend curve, refer to "Switching IDEC SmartRelay to RUN mode (Page 75)".

Memory markers

The letters **M** or **AM** identify memory markers blocks. These are virtual outputs, which output the value of their inputs. IDEC SmartRelay provides 64 digital memory markers M1 to M64 and 64 analog memory markers AM1 to AM64.

Startup marker M8

IDEC SmartRelay sets marker M8 in the first cycle of the circuit program. You can thus use it as a startup marker in your circuit program. IDEC SmartRelay resets M8 at the end of the first cycle.

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

Backlight markers M25, M26, M28 to M31

The following markers control the backlight colors of the IDEC SmartRelay onboard display or the FL1F-RD1:

Backlight display	Marker	Remarks
White	M25	The color white means IDEC SmartRelay is in RUN mode.
	M26	The color white means FL1F-RD1 is in RUN mode.
Amber	M28	The color amber means IDEC SmartRelay is in programming mode or parameter assignment mode.
	M30	The color amber means Text Display is in programming mode, parameter assignment mode or TDE setting mode.
Red	M29	The color red means IDEC SmartRelay has a diagnosis error.
	M31	The color red means Text Display has a diagnostics error.

Note: The backlight lifetime of the Text Display is 20,000 hours.

Message text character set marker M27

The M27 marker selects between the two character sets that IDEC SmartRelay uses to display message texts. State 0 corresponds to Character Set 1, and state 1 corresponds to Character Set 2. If M27=0 (low), IDEC SmartRelay only displays message texts configured for Character Set 1; If M27=1 (high), IDEC SmartRelay only displays message texts configured for Character Set 2. If you do not include M27 in the circuit program, message texts display in the character set that you selected from either WindLGC or an IDEC SmartRelay device.

Note

- The output of the marker always carries the signal of the previous program cycle. This value does not change within the same program cycle.
- You can read or write markers from the network. If you have not added any special markers in the diagram, but written them from the network, they can still work except M27. So if you want to control character sets by M27, you must add it in the diagram first, and you can connect M27 to NI blocks to control it from the network.

Shift register bits

IDEC SmartRelay provides read-only shift register bits S1.1 to S4.8. Only the Shift register (Page 211) special function can modify shift register bit values.

Cursor keys

Up to four cursor keys are available to you, namely C ▲, C ▶, C ▼ and C ◀ ("C" = "Cursor"). Cursor keys are programmed for the circuit program in the same way as other inputs. You can program cursor keys in the corresponding display Switching IDEC SmartRelay to RUN mode (Page 75) , and in an active message text (ESC + Key). Cursor keys can save switches and inputs, and allow operator control of the circuit program. Cursor key inputs from the FL1F-RD1 are identical to cursor key inputs from the Base Module.

FL1F-RD1 function keys

The FL1F-RD1 has four function keys, F1, F2, F3, and F4, which you can use in your circuit program. You program these keys in the same way as other inputs. Like the cursor keys, you can press these keys when IDEC SmartRelay is in RUN mode to affect the behavior of the circuit program, and to save switches and inputs.

Levels

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

Open connectors

IDEC SmartRelay uses the letter **x** to indicate unused block connectors.

Network inputs/outputs (available only if configured from WindLGC)

You can configure the following network inputs/outputs only from WindLGC. If the circuit program in IDEC SmartRelay contains a network digital/analog I/O, you can not edit any of the rest of the circuit program except for the Par parameter. To edit the rest of the program, you must upload the program to WindLGC and then edit from WindLGC.

1) Network digital inputs

The letters **NI** identify a network digital input. There are 64 digital network digital inputs NI1 to NI64 available for configuration in the circuit program from WindLGC.

2) Network analog inputs

The letters **NAI** identify a network analog input. There are 32 network analog inputs NAI1 to NAI32 available for configuration in the circuit program from WindLGC.

3) Network digital outputs

The letters **NQ** identify a network digital output . There are 64 network digital outputs NQ1 to NQ64 available for configuration in the circuit program from WindLGC.

4) Network analog outputs

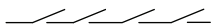
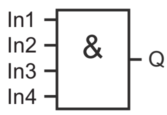
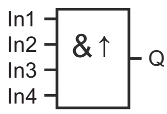
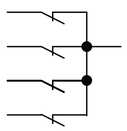
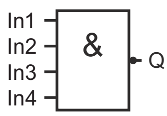
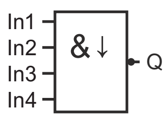
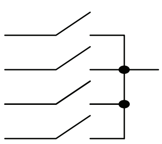
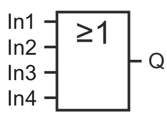
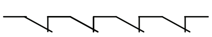
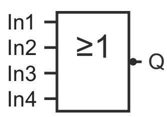
The letters **NAQ** identify a network analog output. There are 16 network analog outputs NAQ1 to NAQ16 available for configuration in the circuit program from WindLGC.

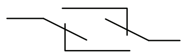
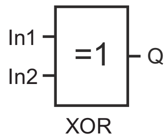
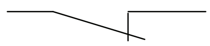
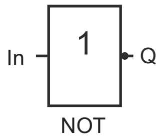
4.2 Basic functions list - GF

Basic functions represent simple logical elements of Boolean algebra.

You can invert the inputs of individual basic functions, that is, the circuit program inverts a logical "1" at a relevant input to a logical "0"; if "0" is the value at the input, the program sets a logical "1". See the programming example at Circuit program input (Page 67).

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

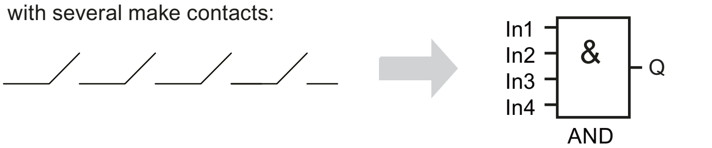
View in the circuit diagram	View in IDEC SmartRelay	Name of the basic function
 Series circuit make contact	 AND	AND (Page 121)
	 AND (Edge)	AND with edge detection (Page 122)
 Parallel circuit with break contacts	 NAND	NAND (not AND) (Page 122) (not AND)
	 NAND (Edge)	NAND with edge detection (Page 123)
 Parallel circuit with make contacts	 OR	OR (Page 124)
 Series circuit with break contacts	 NOR	NOR (not OR) (Page 125) (not OR)

View in the circuit diagram	View in IDEC SmartRelay	Name of the basic function
 Double changeover contact		XOR (exclusive OR) (Page 126) (exclusive OR)
 Break contact		NOT (Negation, Inverter) (Page 126) (negation, inverter)

4.2.1 AND

Circuit diagram of a series circuit with several make contacts:

Symbol in IDEC SmartRelay:



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

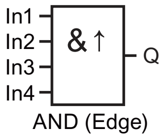
At an unused block input (x): x = 1.

AND function logic table

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

4.2.2 AND with edge detection

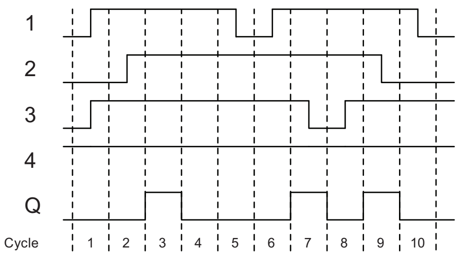
Symbol in IDEC SmartRelay:



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

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

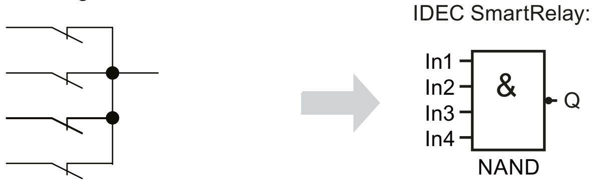
Timing diagram for the AND with edge detection



4.2.3 NAND (not AND)

Parallel circuit with multiple break contacts in the circuit diagram:

Symbol in IDEC SmartRelay:



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

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

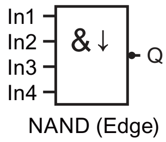
NAND function logic table

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

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

4.2.4 NAND with edge detection

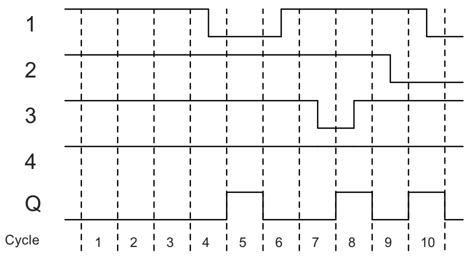
Symbol in IDEC SmartRelay:



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

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

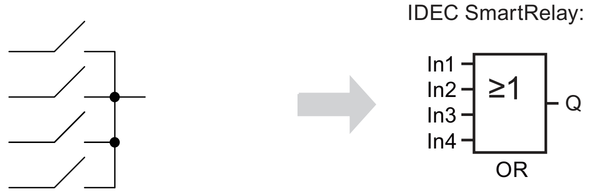
Timing diagram for the NAND with edge detection



4.2.5 OR

Circuit diagram of a parallel circuit
with several make contacts:

Symbol in
IDEC SmartRelay:



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

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

OR function logic table

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

4.2.6 NOR (not OR)

Circuit diagram of a series circuit with several break contacts:

Symbol in IDEC SmartRelay:

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

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

NOR function logic table

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

4.2.7 XOR (exclusive OR)

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

Symbol in IDEC SmartRelay:

The output status of the XOR is 1 if the inputs are **not equivalent**.
At an unused block input (x): x = 0.

XOR function 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 inverts the input status.

An advantage of the NOT block, for example, is that you do not have to use normally closed contacts. You simply use a normally open contact and the NOT block to convert these into a normally closed contact.

NOT function logic table

1	Q
0	1
1	0

4.3 Special functions

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

This section provides you with a brief overview of input designations and with some particular background information on Special functions list - SF (Page 132).

4.3.1 Designation of the inputs

Logical inputs

The following connectors enable you to create a logical link to other blocks or to the inputs of the IDEC SmartRelay unit:

- S (Set):
  A signal at input S sets the output to logical "1".
- R (Reset):
  The reset input R takes priority over all other inputs and resets the outputs.
- Trg (Trigger):
  This input triggers the start of a function.
- Cnt (Count):
  This input counts pulses.
- Fre (Frequency):
  IDEC SmartRelay applies frequency signals to be evaluated to this input.
- Dir (Direction):
  This input determines the direction, + or -.
- En (Enable):
  This input enables a block function. When this input is "0", the block ignores all other signals.
- Inv (Invert):
  A signal at this input inverts the output signal of the block.
- Ral (Reset all):
  A signal at this input resets all internal values.
- Lap (for the stopwatch function)

  A signal at this input pauses the stopwatch.

Note

Unused logical inputs of special functions default to logical "0".

Connector X at SF inputs

The connector "x" input for any SF input is low. That is, the input carries a "lo" signal.

Parameter inputs

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

- **Par (Parameter):**
  You do no connect the Par parameter. Instead, you set the relevant block parameters (times, on/off thresholds etc.).
- **Priority:**
  This is an open input. Here, you define priorities and specify whether a message is to be acknowledged in RUN.

4.3.2 Time response

Parameter T

You can configure a time value T for some of the SF blocks. When you preset this time, note that your input values are based on the timebase set:

Timebase	_ _ : _ _
s (seconds)	seconds : $^{1}/_{100}$ seconds
m (minutes)	minutes : seconds
h (hours)	hours : minutes

```
B6        1/1  +/
T =04:10h
```

Setting a time T of 250 minutes:
Unit in hours h:

04:00 hours	240 minutes
00:10 hours	+10 minutes
=	250 minutes

The IDEC SmartRelay FL1F-specific Stopwatch (Page 170) function provides an additional timebase - 10 ms.

Accuracy of T

Because of slight tolerances in the characteristics of electronic components, the set time T can deviate. You can find a detailed description of such deviations in the On-delay (Page 136).

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

To prevent timing inaccuracy of the real-time clock in C versions (IDEC SmartRelay devices with an integrated real-time clock) caused by this deviation, IDEC SmartRelay continuously compares the timer value to a high-precision timebase and makes continual corrections. The resultant maximum timing inaccuracy is ±2 s/day.

4.3.3 Backup of the real-time clock

The supercapacitor in IDEC SmartRelay backs up the internal real-time clock, making the real-time clock continue operation after a power failure. The surrounding temperature influences the backup time. At a surrounding temperature of 25°C, the typical backup time of a IDEC SmartRelay FL1F is 20 days. It takes 30 minutes to get the supercapacitor fully charged after the IDEC SmartRelay is powered up, and the fully charged supercapacitor can support typical 20-day backup time.

If there is a power outage of an IDEC SmartRelay for more than 20 days, on restarting, the internal clock is back in the status that it was in before the power outage.

4.3.4 Retentivity

You can set the switching states, counter and time values of many Special functions list - SF (Page 132) to be retentive. This means that IDEC SmartRelay retains current data values after a power failure, and that the block resumes operation at the break point. The timer is not reset, but resumes operation until the time-to-go has expired.

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

R: The data is retentive.
/: Current data is not retentive (default). See the section in topic "Second circuit program (Page 79)" on enabling and disabling retentivity.

The operating hours counter, seven-day time switch, twelve-month time switch and PI controller are always retentive.

4.3.5 Parameter protection

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

+: The parameter attribute permits read/write access in parameter assignment mode (default).
-: The parameter settings are read–/write–protected in parameter assignment mode, and you can only edit them in programming mode. See the parameter protection mode example in the Second circuit program (Page 79).

Note

Parameter protection covers only the "Set Parameter" window. If you embed variables of protected special functions in a message text, the variables are still editable from the message text. To protect these variables, you must also activate the protection of the message text.

4.3.6 Calculating the gain and offset of analog values

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

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

IDEC SmartRelay internally transforms a voltage of 0 V to 10 V at input AI to a range of values from 0 to 1000. IDEC SmartRelay interprets an input voltage exceeding 10 V as internal value 1000.

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

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

Mathematical rule

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

Gain and offset calculation

IDEC SmartRelay calculates the gain and offset based on the relevant high and low values of the function.

Example 1:

The available thermocouples have the following technical data: -30 °C to +70 °C, 0 to 10 VDC (that is, 0 to 1000 in IDEC SmartRelay).

Actual value = (internal value • gain) + offset, thus

-30 = (0 • A) + B, that is, offset B = -30

+70 = (1000 • A) -30, that is, gain A = 0.1

Example 2:

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

Actual value = (internal value • gain) + offset, thus

1000 = (0 • A) + B, that is, offset B = 1000

5000 = (1000 • A) +1000, that is, gain A = 4

Example of analog values

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

For further information on a sample application, refer to the "Analog comparator (Page 187)" topic.

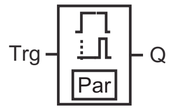
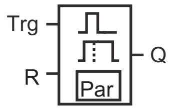
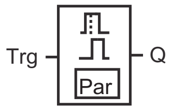
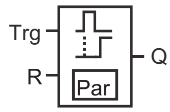
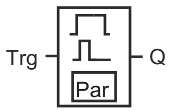
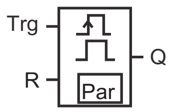
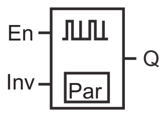
For further information on analog inputs, refer to the Constants and connectors (Page 116) topic.

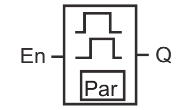
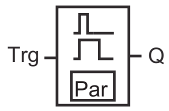
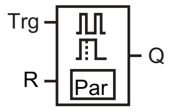
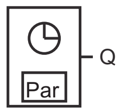
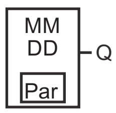
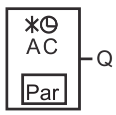
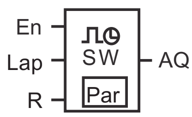
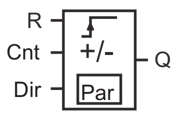
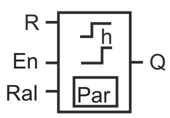
4.4 Special functions list - SF

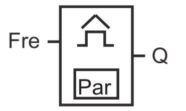
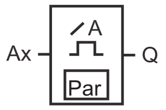
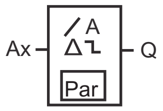
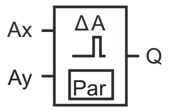
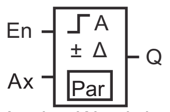
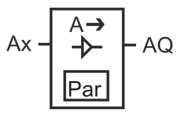
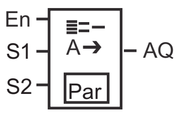
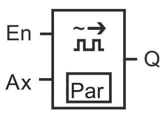
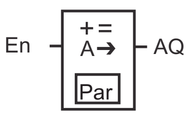
When you create your circuit program in IDEC SmartRelay, you find the special function blocks in the SF list.

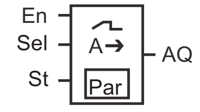
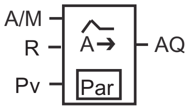
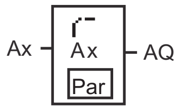
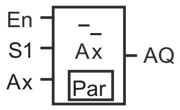
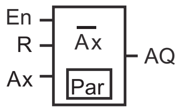
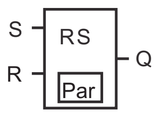
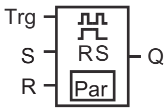
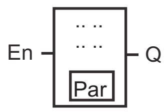
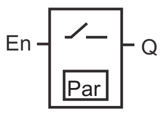
You can invert the inputs of SFs individually, that is, the circuit program converts a logical "1" at the input into a logical "0"; a logical "0" it converts into a logical "1". See the programming example in topic "Circuit program input (Page 67)".

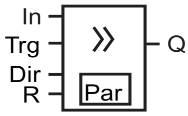
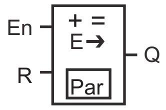
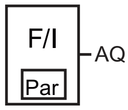
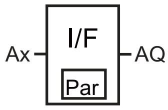
The table also specifies whether the relevant function can be set retentive (REM). The following SFs are available:

View in IDEC SmartRelay	Name of the special function	REM
Timers		
 On-Delay	On-delay (Page 136)	REM
 Off-Delay	Off-delay (Page 140)	REM
 On-/Off-Delay	On-/off-delay (Page 142)	REM
 RetentiveOnDelay	Retentive on-delay (Page 144)	REM
 INT TimeDelay	Interval time-delay relay/Pulse output (Page 146)	REM
 ET INT TimeDelay	Edge-triggered interval time-delay relay (Page 148)	REM
 Async. Pulse	Asynchronous pulse generator (Page 150)	REM

View in IDEC SmartRelay	Name of the special function	REM
 Random Generator	Random generator (Page 152)	
 StairLightSwitch	Stairwell light switch (Page 154)	REM
 DualFunc. Switch	Dual-function switch (Page 156)	REM
 Seven-Day Switch	Seven-day time switch (Page 159)	
 12-Month Switch	Twelve-month time switch (Page 162)	
 Astron. Clock	Astronomical clock (Page 167)	
 Stopwatch	Stopwatch (Page 170)	
Counter		
 Up/Down Counter	Up/down counter (Page 172)	REM
 Hours Counter	Operating hours counter (Page 175)	REM

View in IDEC SmartRelay	Name of the special function	REM
 FrequencyTrigger	Frequency trigger (Page 179)	
Analog		
 Analog Trigger	Analog trigger (Page 182)	
 AnalogDiff.Trig	Analog differential trigger (Page 185)	
 AnalogComparator	Analog comparator (Page 187)	
 Analog Watchdog	Analog watchdog (Page 192)	
 Analog Amplifier	Analog amplifier (Page 195)	
 Analog MUX	Analog multiplexer (Page 213)	
 PWM	Pulse width modulator (PWM) (Page 225)	
 Analog Math	Analog Math (Page 228)	

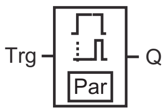
View in IDEC SmartRelay	Name of the special function	REM
 Analog Ramp	Analog ramp control (Page 216)	
 PI Controller	PI controller (Page 220)	REM
 Analog Filter	Analog filter (Page 233)	
 Max/Min	Max/Min (Page 235)	REM
 Average Value	Average value (Page 239)	REM
Miscellaneous		
 Latching Relay	Latching relay (Page 197)	REM
 ImpulseRelay (A)	Current impulse relay (Page 198)	REM
 Message Text	Message texts (Page 200)	
 Softkey	Softkey (Page 209)	REM

View in IDEC SmartRelay	Name of the special function	REM
 Shift Register	Shift register (Page 211)	REM
 AnalogMath Error	Analog Math error detection (Page 231)	
 FIConverter	Float/Integer Converter (Page 241)	
 IFConverter	Integer/Float Converter (Page 243)	

4.4.1 On-delay

Short description

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

Symbol in IDEC SmartRelay	Wiring	Description
 On-Delay	Input Trg	A signal at input Trg (Trigger) triggers the on-delay timer.
	Parameter	T represents the time after which the output is on (0 to 1 transition of the output signal). Retentivity: / = no retentivity R = the status is retentive.
	Output Q	Q is on when the set time T expires, provided Trg is still set.

Parameter T

Note the defaults for parameter T in topic Time response (Page 128).

The actual value of another already-configured functions can provide the time for parameter T. You can use the actual values of the following functions for the value of T:

- Analog comparator (Page 187)(actual value Ax - Ay)
- Analog trigger (Page 182)(actual value Ax)
- Analog amplifier (Page 195)(actual value Ax)
- Analog multiplexer (Page 213)(actual value AQ)
- Analog ramp control (Page 216)(actual value AQ)

- Analog Math (Page 228) (actual value AQ)
- PI controller (Page 220)(actual value AQ)
- Up/down counter (Page 172)(actual value Cnt)
- Analog filter (Page 233) (actual value AQ)
- Average value (Page 239) (actual value AQ)
- Max/Min (Page 235) (actual value AQ)
- On-delay (current time Ta)
- Off-delay (Page 140)(current time Ta)
- On-/off-delay (Page 142)(current time Ta)
- Retentive on-delay (Page 144)(current time Ta)
- Interval time-delay relay/Pulse output (Page 146)(current time Ta)
- Edge-triggered interval time-delay relay (Page 148)(current time Ta)
- Asynchronous pulse generator (Page 150)(current time Ta)
- Stairwell light switch (Page 154)(current time Ta)
- Dual-function switch (Page 156)(current time Ta)
- Stopwatch (Page 170)(actual value AQ)
- Frequency trigger (Page 179) (actual value Fre)

Select the required function by the block number. The timebase is configurable.

Valid ranges of the timebase, if T = parameter

Note the following characteristics of timebase values.

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

The parameter T initially appears as follows in programming mode, for example:

```
B12        1/1  +R
T  =04:10h
```

Valid ranges of the timebase

If an already-programmed function provides the value of T, the valid ranges of the timebase are as follows:

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

The IDEC SmartRelay display appears as follows in programming mode, if you have, for example, set the actual value of B6 in seconds to parameter T of B12:

```
B12        1/1  +R
T  →B006s
```

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

Parameter preset = Actual value of an already-programmed function

To include the actual value of an already-programmed function for parameter T, follow these steps:

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

```
B12        1/1 +R
T  =04:10h
```

Press ▶ twice

```
B12        1/1 +R
T  =04:10h
```

2. Press ▼ to change the equal sign into an arrow. IDEC SmartRelay displays the last referenced block if it exists.

```
B12        1/1  +R
T  →B006s
```

3. Press ▶ to move the cursor to the "B" of the shown block, and then press ▼ to select the required block number.
4. Press ▶ to move the cursor to the block's timebase and press ▼ to select the required timebase.

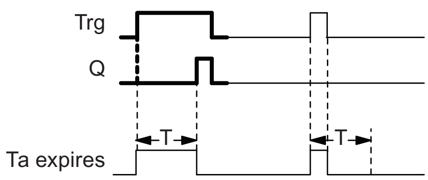
```
B12         1/1  +R
T  →B006m
```

The view in parameter assignment mode appears as follows, for example:

```
B12         1/1                    B12         1/1
T  =04:10h            or           T  →B006m


Ta =02:00h   ←  current time  →   Ta =02:00h
```

Timing diagram



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

Functional description

A 0 to 1 transition triggers the time T_a at input Trg (T_a is the current IDEC SmartRelay time).

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

IDEC SmartRelay resets the time when the status at input Trg returns to 0 before the time T expires.

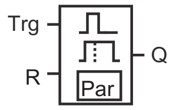
IDEC SmartRelay resets the output to 0 when the signal at input Trg is 0.

If the block is retentive, IDEC SmartRelay resets output Q and the expired time to the values before a power failure; if the block is not retentive, IDEC SmartRelay resets output Q and the expired time to defaults after a power failure.

4.4.2 Off-delay

Short description

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

Symbol in IDEC SmartRelay	Wiring	Description
 Off-Delay	Input Trg	The off-delay timer starts with a negative edge (1 to 0 transition) at input Trg (Trigger)
	Input R	A signal at input R resets the on-delay time and the output.
	Parameter	The output switches off (transitions from1 to 0) when the delay time T expires. Retentivity: / = No retentivity R = The status is retentive.
	Output Q	A signal at input Trg sets Q. Q holds this state until T expires.

Parameter T

Note the parameter T defaults specified in topic Time response (Page 128).

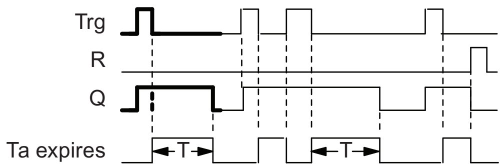
The actual value of another already-configured functions can provide the time for parameter T. You can use the actual value of the following functions:

- Analog comparator (Page 187) (actual value Ax - Ay)
- Analog trigger (Page 182) (actual value Ax)
- Analog amplifier (Page 195) (actual value Ax)
- Analog multiplexer (Page 213) (actual value AQ)
- Analog ramp control (Page 216) (actual value AQ)
- Analog Math (Page 228) (actual value AQ)
- PI controller (Page 220) (actual value AQ)
- Up/down counter (Page 172) (actual value Cnt)
- Analog filter (Page 233) (actual value AQ)
- Average value (Page 239) (actual value AQ)
- Max/Min (Page 235) (actual value AQ)
- On-delay (Page 136) (current time Ta)
- Off-delay (current time Ta)
- On-/off-delay (Page 142) (current time Ta)
- Retentive on-delay (Page 144) (current time Ta)
- Interval time-delay relay/Pulse output (Page 146) (current time Ta)
- Edge-triggered interval time-delay relay (Page 148) (current time Ta)
- Asynchronous pulse generator (Page 150) (current time Ta)
- Stairwell light switch (Page 154) (current time Ta)

- Dual-function switch (Page 156) (current time Ta)
- Stopwatch (Page 170) (actual value AQ)
- Frequency trigger (Page 179) (actual value Fre)

Select the required function by the block number. The timebase is configurable. For information on valid timebase ranges and parameter preset, refer to Section "On-delay (Page 136)".

Timing diagram



The bold section of the timing diagram also appears in the off-delay symbol.

Functional description

IDEC SmartRelay sets Output Q to hi immediately when the input Trg changes to hi.

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

IDEC SmartRelay retriggers he time T_a with a one-shot at input Trg.

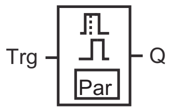
You can set input R (Reset) to reset the time T_a and the output before T_a expires.

If the block is retentive, IDEC SmartRelay resets output Q and the expired time to the values before a power failure; if the block is not retentive, IDEC SmartRelay resets output Q and the expired time to defaults after a power failure.

4.4.3 On-/off-delay

Short description

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

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

Parameters T_H and T_L

Note the preset values for the parameters T_H and T_L in topic Time response (Page 128).

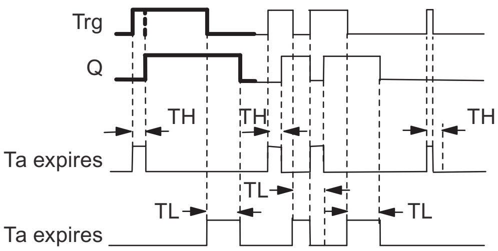
The actual value of another, already-configured function can provide the on-delay and off-delay times for parameters T_H and T_L . You can use the actual values of the following functions:

- Analog comparator (Page 187)(actual value Ax - Ay)
- Analog trigger (Page 182)(actual value Ax)
- Analog amplifier (Page 195)(actual value Ax)
- Analog multiplexer (Page 213)(actual value AQ)
- Analog ramp control (Page 216)(actual value AQ)
- Analog Math (Page 228) (actual value AQ)
- PI controller (Page 220)(actual value AQ)
- Up/down counter (Page 172)(actual value Cnt)
- Analog filter (Page 233) (actual value AQ)
- Average value (Page 239) (actual value AQ)
- Max/Min (Page 235) (actual value AQ)
- On-delay (Page 136)(current time Ta)
- Off-delay (Page 140)(current time Ta)
- On-/off-delay (current time Ta)
- Retentive on-delay (Page 144)(current time Ta)

- Interval time-delay relay/Pulse output (Page 146)(current time Ta)
- Edge-triggered interval time-delay relay (Page 148)(current time Ta)
- Asynchronous pulse generator (Page 150)(current time Ta)
- Stairwell light switch (Page 154)(current time Ta)
- Dual-function switch (Page 156)(current time Ta)
- Stopwatch (Page 170)(actual value AQ)
- Frequency trigger (Page 179) (actual value Fre)

Select the required function by the block number. The timebase is configurable. For information on valid timebase ranges and parameter preset, refer to Section "On-delay (Page 136)".

Timing diagram



The bold section of the timing diagram also appears in the on/off-delay symbol.

Functional description

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

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

IDEC SmartRelay resets the time when IDEC SmartRelay resets the signal at input Trg to 0 before the time T_H expires.

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

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

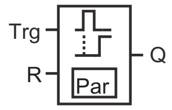
IDEC SmartRelay resets the time when the signal at input Trg changes to 1 again before the time T_L expires.

If the block is retentive, IDEC SmartRelay resets output Q and the expired time to the values before a power failure; if the block is not retentive, IDEC SmartRelay resets output Q and the expired time to defaults after a power failure.

4.4.4 Retentive on-delay

Short description

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

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

Parameter T

Note the defaults specified in topic Time response (Page 128).

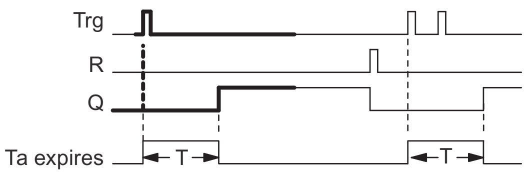
The actual value of another already-programmed function can provide the time for parameter T. You can use the actual values of the following functions:

- Analog comparator (Page 187)(actual value Ax – Ay)
- Analog trigger (Page 182)(actual value Ax)
- Analog amplifier (Page 195)(actual value Ax)
- Analog multiplexer (Page 213)(actual value AQ)
- Analog ramp control (Page 216)(actual value AQ)
- Analog Math (Page 228) (actual value AQ)
- PI controller (Page 220)(actual value AQ)
- Up/down counter (Page 172)(actual value Cnt)
- Analog filter (Page 233) (actual value AQ)
- Average value (Page 239) (actual value AQ)
- Max/Min (Page 235) (actual value AQ)
- On-delay (Page 136)(current time Ta)
- Off-delay (Page 140)(current time Ta)
- On-/off-delay (Page 142)(current time Ta)
- Retentive on-delay (current time Ta)

- Interval time-delay relay/Pulse output (Page 146)(current time Ta)
- Edge-triggered interval time-delay relay (Page 148)(current time Ta)
- Asynchronous pulse generator (Page 150)(current time Ta)
- Stairwell light switch (Page 154)(current time Ta)
- Dual-function switch (Page 156)(current time Ta)
- Stopwatch (Page 170)(actual value AQ)
- Frequency trigger (Page 179) (actual value Fre)

Select the required function by the block number. The timebase is configurable. For information on valid ranges and parameter defaults, refer to Section "On-delay (Page 136)".

Timing diagram



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

Functional description

The 0 to 1 signal transition at input Trg triggers the current time T_a. IDEC SmartRelay sets output Q when T_a = T. A further signal at input Trg does not influence the time T_a.

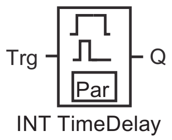
IDEC SmartRelay resets the output and the time T_a with the next 1 signal at input R.

If the block is retentive, IDEC SmartRelay resets output Q and the expired time to the values before a power failure; if the block is not retentive, IDEC SmartRelay resets output Q and the expired time to defaults after a power failure.

4.4.5 Interval time-delay relay/Pulse output

Short description

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

<table>
<tr><th>Symbol in IDEC SmartRelay</th><th>Wiring</th><th>Description</th></tr>
<tr><td rowspan="3"></td><td>Input Trg</td><td>A signal at input Trg (Trigger) triggers the time for the interval time-delay relay function.</td></tr>
<tr><td>Parameter</td><td>The output is switched off after the time T has expired (output signal transition 1 to 0).
Retentivity:
/ = No retentivity
R = The status is retentive.</td></tr>
<tr><td>Output Q</td><td>A signal at input Trg sets Q. If the input signal = 1, output Q remains set for the time Ta.</td></tr>
</table>

Parameter T

Note the information on parameter T in topic Time response (Page 128).

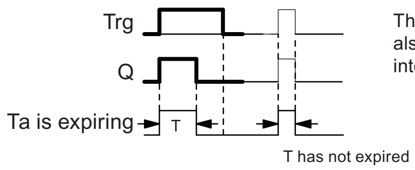
The actual value of another already-programmed function can provide the time for parameter T. You can use the actual values of the following functions:

- Analog comparator (Page 187)(actual value Ax – Ay)
- Analog trigger (Page 182)(actual value Ax)
- Analog amplifier (Page 195)(actual value Ax)
- Analog multiplexer (Page 213)(actual value AQ)
- Analog ramp control (Page 216)(actual value AQ)
- Analog Math (Page 228) (actual value AQ)
- PI controller (Page 220)(actual value AQ)
- Up/down counter (Page 172)(actual value Cnt)
- Analog filter (Page 233) (actual value AQ)
- Average value (Page 239) (actual value AQ)
- Max/Min (Page 235) (actual value AQ)
- On-delay (Page 136)(current time Ta)
- Off-delay (Page 140)(current time Ta)
- On-/off-delay (Page 142)(current time Ta)
- Retentive on-delay (Page 144)(current time Ta)
- Interval time-delay relay/Pulse output (Page 146) (current time Ta)
- Edge-triggered interval time-delay relay (Page 148)(current time Ta)
- Asynchronous pulse generator (Page 150)(current time Ta)
- Stairwell light switch (Page 154)(current time Ta)
- Dual-function switch (Page 156)(current time Ta)

- Stopwatch (Page 170)(actual value AQ)
- Frequency trigger (Page 179) (actual value Fre)

Select the required function by the block number. The timebase is configurable. For information on valid ranges and parameter defaults, refer to Section "On-delay (Page 136)".

Timing diagram



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

Functional description

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

IDEC SmartRelay resets output Q to lo (pulse output) when T_a reaches the value preset at T (T_a = T).

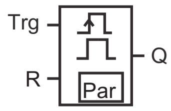
IDEC SmartRelay sets the output immediately if there is a 1 to 0 transition at input Trg before the specified time expires.

If the block is retentive, IDEC SmartRelay resets output Q and the expired time to the values before a power failure; if the block is not retentive, IDEC SmartRelay resets output Q and the expired time to defaults after a power failure.

4.4.6 Edge-triggered interval time-delay relay

Short description

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

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

Parameters TH and TL

Note the information on parameter T in topic Time response (Page 128).

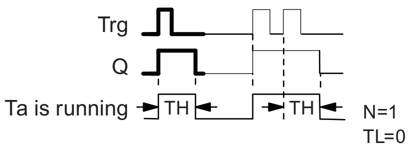
The actual value of another already-programmed function can provide the pulse width TH and the interpulse width TL. You can use the actual values of the following functions:

- Analog comparator (Page 187) (actual value Ax – Ay)
- Analog trigger (Page 182) (actual value Ax)
- Analog amplifier (Page 195) (actual value Ax)
- Analog multiplexer (Page 213) (actual value AQ)
- Analog ramp control (Page 216) (actual value AQ)
- Analog Math (Page 228) (actual value AQ)
- PI controller (Page 220) (actual value AQ)
- Up/down counter (Page 172) (actual value Cnt)
- Analog filter (Page 233) (actual value AQ)
- Average value (Page 239) (actual value AQ)
- Max/Min (Page 235) (actual value AQ)
- On-delay (Page 136) (current time Ta)
- Off-delay (Page 140) (current time Ta)
- On-/off-delay (Page 142) (current time Ta)
- Retentive on-delay (Page 144) (current time Ta)
- Interval time-delay relay/Pulse output (Page 146) (current time Ta)
- Edge-triggered interval time-delay relay (Page 148) (current time Ta)

- Asynchronous pulse generator (Page 150) (current time Ta)
- Stairwell light switch (Page 154) (current time Ta)
- Dual-function switch (Page 156) (current time Ta)
- Stopwatch (Page 170) (actual value AQ)
- Frequency trigger (Page 179) (actual value Fre)

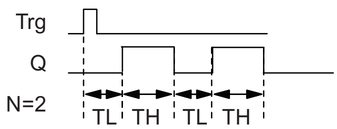
Select the required function by the block number. The timebase is configurable. For information on valid ranges and parameter defaults, refer to the On-delay (Page 136) topic.

Timing diagram A



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

Timing diagram B



Timing diagram for the sample configuration

Functional description

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

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

If the block is retentive, IDEC SmartRelay resets output Q and the expired time to the values before a power failure; if the block is not retentive, IDEC SmartRelay resets output Q and the expired time to defaults after a power failure.

Setting the Par parameter

View in programming mode (example):

B25 1/1 +R	← Protection mode and retentivity
TH =03:00s	← Interpulse width
TL =02:00s	← Pulse width
No =1	← Number of pulse/pause cycles (example)

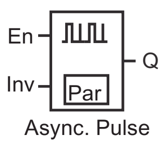
View in parameter assignment mode (example):

B25 1/1	
TH =03:00s	
TL =02:00s	
Ta =01:15s	← Current pulse width T_L or T_H

4.4.7 Asynchronous pulse generator

Short description

You can asynchronously output pulses with this function.

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

Parameters TH and TL

Note the information on parameter T in topic Time response (Page 128)

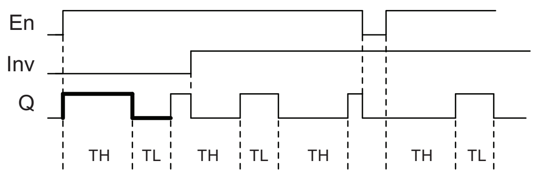
The actual value of another already-programmed function can provide the pulse width TH and the interpulse width TL. You can use the actual values of the following functions:

- Analog comparator (Page 187) (actual value Ax – Ay)
- Analog trigger (Page 182) (actual value Ax)
- Analog amplifier (Page 195) (actual value Ax)
- Analog multiplexer (Page 213) (actual value AQ)

- Analog ramp control (Page 216) (actual value AQ)
- Analog Math (Page 228) (actual value AQ)
- PI controller (Page 220) (actual value AQ)
- Up/down counter (Page 172) (actual value Cnt)
- Analog filter (Page 233) (actual value AQ)
- Average value (Page 239) (actual value AQ)
- Max/Min (Page 235) (actual value AQ)
- On-delay (Page 136) (current time Ta)
- Off-delay (Page 140) (current time Ta)
- On-/off-delay (Page 142) (current time Ta)
- Retentive on-delay (Page 144) (current time Ta)
- Interval time-delay relay/Pulse output (Page 146) (current time Ta)
- Edge-triggered interval time-delay relay (Page 148) (current time Ta)
- Aysnchronous pulse generator (current time Ta)
- Stairwell light switch (Page 154) (current time Ta)
- Dual-function switch (Page 156) (current time Ta)
- Stopwatch (Page 170) (actual value AQ)
- Frequency trigger (Page 179) (actual value Fre)

Select the required function by the block number. The timebase is configurable. For information on valid ranges and parameter defaults, refer to the On-delay (Page 136) topic.

Timing diagram



Functional description

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

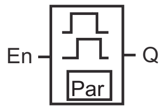
Input Inv can be used to invert the output signal, provided the block is enabled with a signal at input EN.

If the block is retentive, IDEC SmartRelay resets output Q and the expired time to the values before a power failure; if the block is not retentive, IDEC SmartRelay resets output Q and the expired time to defaults after a power failure.

4.4.8 Random generator

Short description

The random generator function sets an output randomly within a configured time.

Symbol in IDEC SmartRelay	Wiring	Description
 Random Generator	Input En	A positive edge (0 to 1 transition) at input En (Enable) triggers the on-delay time of the random generator. A negative edge (1 to 0 transition) at input En (Enable) triggers the off-delay time of the random generator.
	Parameter	IDEC SmartRelay sets the on-delay at random to a value between 0 s and T_H. The off-delay is set at random to a value between 0 s and T_L.
	Output Q	IDEC SmartRelay sets output Q when the on-delay expires and if En is still set. IDEC SmartRelay resets Q when the off-delay expires, provided IDEC SmartRelay has not set En again meanwhile.

Parameter T_H and T_L

Note the defaults of the T_H and T_L parameters listed in topic Time response (Page 128).

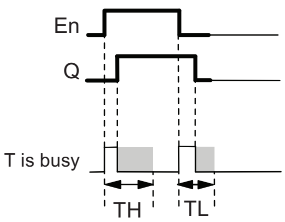
The actual value of another already-programmed function can provide the on-delay time TH and the off-delay time TL. You can use the actual values of the following functions:

- Analog comparator (Page 187) (actual value Ax – Ay)
- Analog trigger (Page 182) (actual value Ax)
- Analog amplifier (Page 195) (actual value Ax)
- Analog multiplexer (Page 213) (actual value AQ)
- Analog ramp control (Page 216) (actual value AQ)
- Analog Math (Page 228) (actual value AQ)
- PI controller (Page 220) (actual value AQ)
- Up/down counter (Page 172) (actual value Cnt)
- Analog filter (Page 233) (actual value AQ)
- Average value (Page 239) (actual value AQ)
- Max/Min (Page 235) (actual value AQ)
- On-delay (Page 136) (current time Ta)
- Off-delay (Page 140) (current time Ta)
- On-/off-delay (Page 142) (current time Ta)
- Retentive on-delay (Page 144) (current time Ta)

- Interval time-delay relay/Pulse output (Page 146) (current time Ta)
- Edge-triggered interval time-delay relay (Page 148) (current time Ta)
- Asynchronous pulse generator (Page 150) (current time Ta)
- Stairwell light switch (Page 154) (current time Ta)
- Dual-function switch (Page 156) (current time Ta)
- Stopwatch (Page 170) (actual value AQ)
- Frequency trigger (Page 179) (actual value Fre)

Select the required function by the block number. The timebase is configurable. For information on valid ranges and parameter defaults, refer to the On-delay (Page 136) topic.

Timing diagram



The bold section of the timing diagram also appears in the symbol of the random generator.

Functional description

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

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

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

IDEC SmartRelay resets the output after the off-delay time expires, provided input En remains lo at least for the duration of this time.

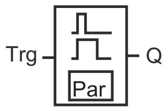
IDEC SmartRelay resets the time if the signal at input En changes to 1 again before the off-delay time expires.

If the block is retentive, IDEC SmartRelay resets output Q and the expired time to the values before a power failure; if the block is not retentive, IDEC SmartRelay resets output Q and the expired time to defaults after a power failure.

4.4.9 Stairwell light switch

Short description

An input edge triggers a configurable and retriggerable time. IDEC SmartRelay resets the output after this time expires. IDEC SmartRelay can optionally output a warning signal to warn of the impending time expiration.

Symbol in IDEC SmartRelay	Wiring	Description
 StairLightSwitch	Input Trg	A signal at input Trg (Trigger) triggers the off-delay time for the stairwell light switch.
	Parameter	T represents the off-delay time of the output (output signal transition 1 to 0). $T_!$ determines the triggering time for the pre-warning. $T_{!L}$ determines the length of the pre-warning signal. Retentivity: / = No retentivity R = The status is retentive.
	Output Q	IDEC SmartRelay resets Q after the time T expires. IDEC SmartRelay outputs a warning signal before this time expires.

Parameter T, $T_!$ and $T_{!L}$

Note the defaults of the T parameters listed in topic Time response (Page 128).

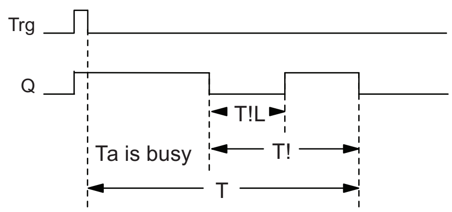
The actual value of another already-programmed function can provide the off-delay time T, the pre-warning time $T_!$ and the pre-warning period $T_{!L}$. You can use the actual values of the following functions:

- Analog comparator (Page 187) (actual value Ax – Ay)
- Analog trigger (Page 182) (actual value Ax)
- Analog amplifier (Page 195) (actual value Ax)
- Analog multiplexer (Page 213) (actual value AQ)
- Analog ramp control (Page 216) (actual value AQ)
- Analog Math (Page 228) (actual value AQ)
- PI controller (Page 220) (actual value AQ)
- Up/down counter (Page 172) (actual value Cnt)
- Analog filter (Page 233) (actual value AQ)
- Average value (Page 239) (actual value AQ)
- Max/Min (Page 235) (actual value AQ)
- On-delay (Page 136) (current time Ta)
- Off-delay (Page 140) (current time Ta)
- On-/off-delay (Page 142) (current time Ta)
- Retentive on-delay (Page 144) (current time Ta)
- Interval time-delay relay/Pulse output (Page 146) (current time Ta)

- Edge-triggered interval time-delay relay (Page 148) (current time Ta)
- Asynchronous pulse generator (Page 150) (current time Ta)
- Stairwell light switch (Page 154) (current time Ta)
- Dual-function switch (Page 156) (current time Ta)
- Stopwatch (Page 170) (actual value AQ)
- Frequency trigger (Page 179) (actual value Fre)

Select the required function by the block number. The timebase is configurable. For information on valid ranges and parameter defaults, refer to the On-delay (Page 136) topic.

Timing diagram



Functional description

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

IDEC SmartRelay resets output Q when T_a = T. You can output a warning signal before the off-delay time (T - $T_!$) expires to reset Q for the time of the pre-warning period $T_{!L}$.

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

If the block is retentive, IDEC SmartRelay resets output Q and the expired time to the values before a power failure; if the block is not retentive, IDEC SmartRelay resets output Q and the expired time to defaults after a power failure.

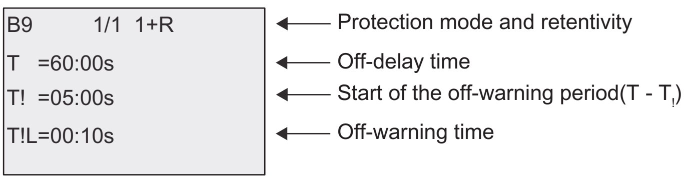
Setting the Par parameter

Note the defaults specified in topic Time response (Page 128).

Note

All times must have the same timebase.

View in programming mode (example):



View in parameter assignment mode (example):

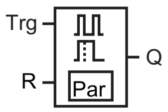
```
B9       1/1
T   =60:00s
T!  =05:00s
T!L =00:10s
Ta  =06:00s     ← Current value of T
```

4.4.10 Dual-function switch

Short description

The dual-function switch provides two different functions:

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

Symbol in IDEC SmartRelay	Wiring	Description
 DualFunc. Switch	Input Trg	A signal at input Trg (Trigger) sets output Q (permanent light) or resets Q with an off-delay. When active, output Q can be reset with a signal at input Trg.
	Input R	A signal at input R resets the current time T_a and resets the output.
	Parameter	T represents the off-delay time. IDEC SmartRelay resets the output (1 to 0 transition) when time T expires. T_L represents the time during which the output must be set to enable the permanent light function. $T_!$ represents the on-delay for the prewarning time. $T_{!L}$ represents the length of the prewarning time period. Retentivity: / = No retentivity R = The status is retentive.
	Output Q	A signal at Trg switches on output Q. Depending on the length of the input at Trg, the output is off again or on permanently, or it is reset with a further signal at Trg.

Parameters T, T_L,$T_!$ and $T_{!L}$

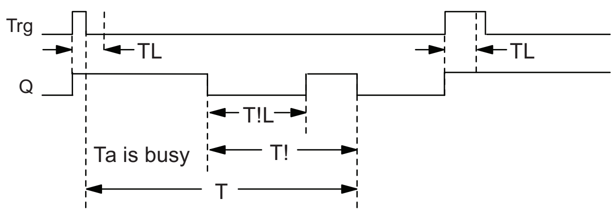
Note the defaults of the T parameters listed in topic Time response (Page 128).

The actual value of another already-programmed function can provide the off-delay time T, the permanent light time T_L, the on-delay prewarning time $T_!$ and the prewarning time period $T_{!L}$. You can use the actual values of the following functions:

- Analog comparator (Page 187) (actual value Ax – Ay)
- Analog trigger (Page 182) (actual value Ax)
- Analog amplifier (Page 195) (actual value Ax)
- Analog multiplexer (Page 213) (actual value AQ)
- Analog ramp control (Page 216) (actual value AQ)
- Analog Math (Page 228) (actual value AQ)
- PI controller (Page 220) (actual value AQ)
- Up/down counter (Page 172) (actual value Cnt)
- Analog filter (Page 233) (actual value AQ)
- Average value (Page 239) (actual value AQ)
- Max/Min (Page 235) (actual value AQ)
- On-delay (Page 136) (current time Ta)
- Off-delay (Page 140) (current time Ta)
- On-/off-delay (Page 142) (current time Ta)
- Retentive on-delay (Page 144) (current time Ta)
- Interval time-delay relay/Pulse output (Page 146) (current time Ta)
- Edge-triggered interval time-delay relay (Page 148) (current time Ta)
- Asynchronous pulse generator (Page 150) (current time Ta)
- Stairwell light switch (Page 154) (current time Ta)
- Dual-function switch (Page 156) (current time Ta)
- Stopwatch (Page 170) (actual value AQ)
- Frequency trigger (Page 179) (actual value Fre)

Select the required function by the block number. The timebase is configurable. For information on valid ranges and parameter defaults, refer to the On-delay (Page 136) topic.

Timing diagram



Functional description

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

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

IDEC SmartRelay triggers the off-delay T when input Trg returns to 0 before T_L has expired.

Output Q is reset when $T_a = T$.

You can output an off-warning signal prior to the expiration of the off-delay time ($T - T_!$) that resets Q for the duration of the prewarning time period $T_{!L}$. A subsequent signal at Trg always resets T and the output Q.

If the block is retentive, IDEC SmartRelay resets output Q and the expired time to the values before a power failure; if the block is not retentive, IDEC SmartRelay resets output Q and the expired time to defaults after a power failure.

Setting the Par parameter

Note the defaults specified in the topic "Time response (Page 128)".

Note

T, $T_!$ and $T_{!L}$ must all have the same timebase.

View in programming mode (example):

Display	
B5 1/1 +R	Protection mode and retentivity
T =60:00s	Off-delay
TL =10:00s	Permanent light on-time
T! =30:00s	Start of the off-warning period($T - T_!$)
T!L=20:00s	Off-warning time

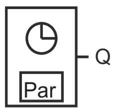
View in parameter assignment mode (example):

Display	
B5 1/1	
T =60:00s	
TL =10:00s	
T! =30:00s	
T!L =20:00s	
Ta =06:00s	Current value of the time T_L or T

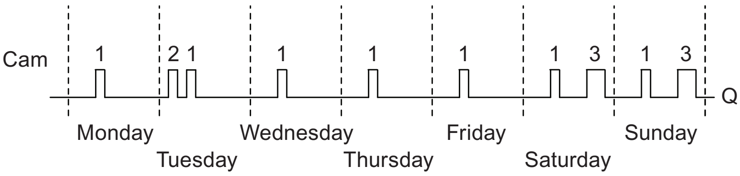
4.4.11 Seven-day time switch

Short description

The seven-day time switch controls an output by means of a configurable on/off date. The function supports any combination of weekdays. You select the active weekdays by hiding the inactive days.

Symbol in IDEC SmartRelay	Wiring	Description
 Seven-Day Switch	Cam parameters 1, 2 and 3	At the Cam parameters, you set the on- and off-times of the seven-day time switch for each **Cam** switch. Here you also configure the days and the time-of-day. You can also specify whether the timer pulses on for one cycle when activated and then reset. The pulse setting applies to all three cams.
	Output Q	IDEC SmartRelay sets Q when actuating the configured cam.

Timing diagram (three examples)



Cam 1:	Daily:	06:30 h to 8:00 h
Cam 2:	Tuesday:	03:10 h to 04:15 h
Cam 3:	Saturday and Sunday:	16:30 h to 23:10 h

Functional description

Each seven-day time switch has three cams for you to configure a time hysteresis. You specify the on- and off-times at the Cam parameters. The seven-day time switch sets the output at a certain on-time; if you have not set it, the seven-day time switch resets the output at a certain off-time if you configure an off-time, or at the end of the cycle if you specify a pulse output.

You will cause a conflict if you set overlapping on- and off-times; the earliest on- and off-times take priority. Here is an example:

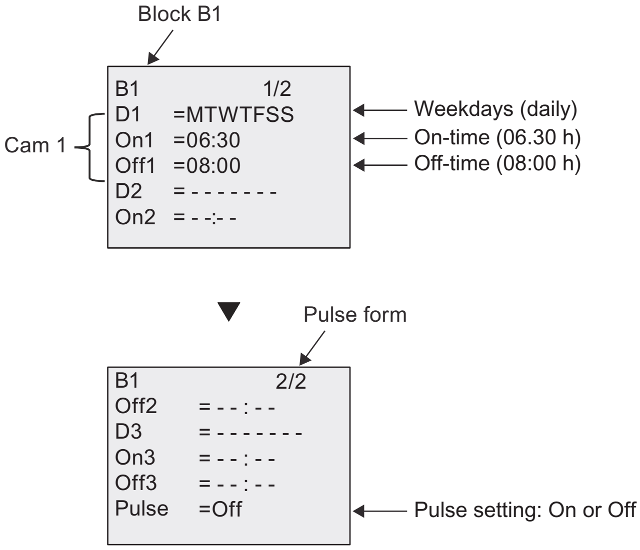
Cam	On-time	Off-time
1	1:00h	2:00h
2	1:10h	1:50h
3	1:20h	1:40h

In this example, the work time is 1:00h to 1:40h.

The status of all three cams determines the switching state of the seven-day time switch.

Parameter assignment screen form

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



Days of the week

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

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

Uppercase letters indicate a specific day of the week. A "-" indicates no selection for the day of the week. Each character is displayed in the order of the days of the week. Saturday and Sunday are distinguished by its position.

On-/Off-times

Any time between 00:00 h and 23:59 h is possible. You can also configure the on time to be a pulse signal. The timer block will be activated at the specified time for one cycle and then the output is reset.
- -:- - means: No on-/off-times set.

Setting the seven-day time switch

To set the on-/off-times:

1. Move the cursor to one of the Cam parameters of the timer (for example, No1).
2. Press **OK**. The cursor is positioned on the day of the week.
3. Press ▲ and ▼ to select one or several days of the week.
4. Press ▶ to move the cursor to the first position of the on-time.

5. Set the on-time.
   Modify the value at the respective position, using the keys ▲ and ▼. Move to the cursor to the various positions, using the keys ◀ and ▶. At the first position, you can only select the value - -:- -
   (- -:- - means: No on-/off-times set).
6. Press ▶ to move the cursor to the first position of the off-time.
7. Set the off-time (in same way as in Step 5).
8. Confirm your entries with **OK**.

   To configure Cam2, press ▶. The cursor is now positioned on the No2 parameter (Cam2) and you can continue with Steps 1 to 8.

Note

For information on timer accuracy, refer to the technical data and to the topic "Time response (Page 128)".

Seven-day time switch: Example

The output of the seven-day time switch is to be set daily from 06:30 h to 08:00 h. The output should also be set 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 the cams No 1, 2 and 3, based on the timing diagram shown earlier.

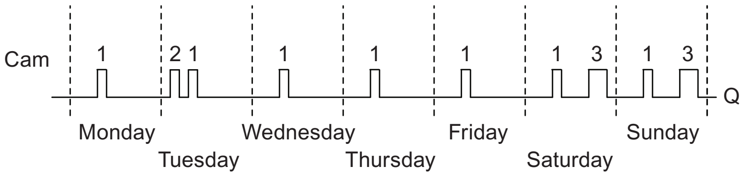
- Cam No1 must set the output of the seven-day time switch daily from 06:30 h to 08:00 h.
- Cam No2 must set the output of the seven-day time switch every Tuesday from 03:10 h to 04:15 h.
- Cam No3 must set the output of the seven-day time switch every Saturday and Sunday from 16:30 h to 23:10 h.

Views in IDEC SmartRelay:

```
B1            1/2
D1    =MTWTFSS
On1   =06:30
Off1  =08:00
D2    = -T- - - - -
On2   = 03:10
```

```
B1            2/2
Off2  =04:15
D3    =- - - - -SS
On3   =16:30
Off3  =23:10
Pulse =Off
```

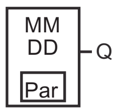
Result



4.4.12 Twelve-month time switch

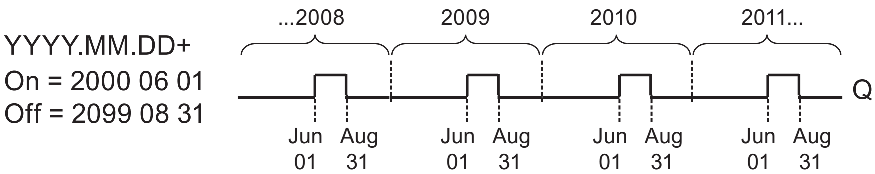
Short description

The output is controlled by means of a configurable on/off date. You can configure the timer to activate on a yearly, monthly, or user-defined time basis. With any mode, you can also configure the timer to pulse the output during the defined time period. The time period is configurable within the date range of January 1, 2000 to December 31, 2099.

Symbol in IDEC SmartRelay	Wiring	Description
 12-Month Switch	Cam parameter	At the Cam parameter, you configure the timer mode, the on-/off-times for the timer, and whether the output is a pulse output.
	Output Q	IDEC SmartRelay sets Q when the configured cam is on.

Timing diagrams

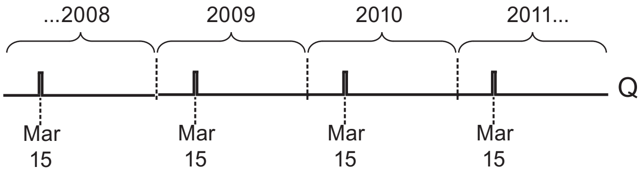
Example 1: Yearly mode on, Monthly mode off, Pulse Off, On Time = 2000-06-01, Off Time = 2099-08-31: every year on June 1 the timer output switches on and remains on until August 31.



B6 1/3	B6 2/3	B6 3/3
Yearly =On	On Date	Off Date
Monthly =Off	YYYY-MM-DD	YYYY-MM-DD
Pulse =Off	2000-06-01	2099-08-31

Example 2: Yearly mode on, Monthly mode off, Pulse on, On Time = 2000-03-15, Off Time = 2099-**-**: every year on March 15, the timer switches on for one cycle.

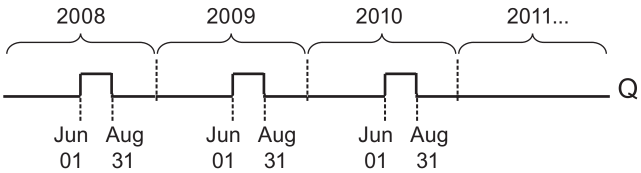
YYYY.MM.DD+
On = 2000 03 15
Off = 2099 ** **



B6 1/3	B6 2/3	B6 3/3
Yearly =On	On Date	Off Date
Monthly =Off	YYYY-MM-DD	YYYY-MM-DD
Pulse =On	2000-03-15	2099-**-**

Example 3: Yearly mode on, Monthly mode off, Pulse off, On Time = 2008-06-01, Off Time = 2010-08-31: on June 1 of 2008, 2009, and 2010 the timer output switches on and remains on until August 31.

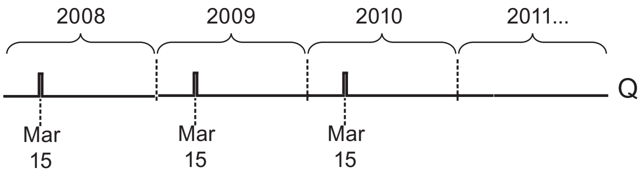
YYYY.MM.DD+
On = 2008 06 01
Off = 2010 08 31



B6 1/3	B6 2/3	B6 3/3
Yearly =On	On Date	Off Date
Monthly =Off	YYYY-MM-DD	YYYY-MM-DD
Pulse =Off	2008-06-01	2010-08-31

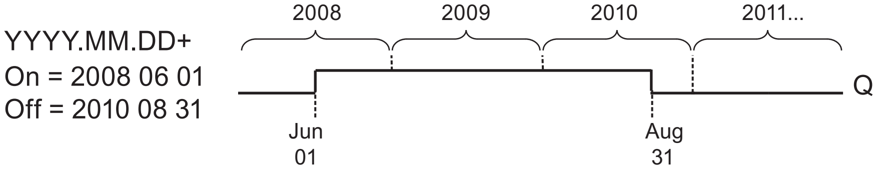
Example 4: Yearly mode on, Monthly mode off, Pulse on, On Time = 2008-03-15, Off Time = 2010-**-**: on March 15 of 2008, 2009, and 2010, the timer output switches on for one cycle.

YYYY.MM.DD+
On = 2008 03 15
Off = 2010 ** **



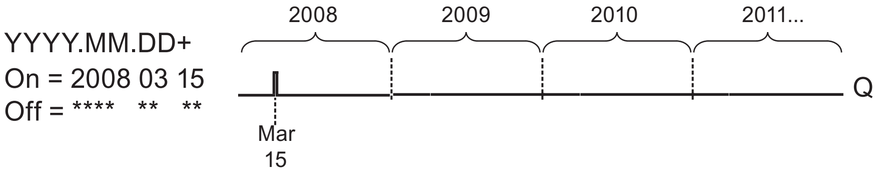
B6 1/3	B6 2/3	B6 3/3
Yearly =On	On Date	Off Date
Monthly =Off	YYYY-MM-DD	YYYY-MM-DD
Pulse =On	2008-03-15	2010-**-**

Example 5: Yearly mode off, Monthly mode off, Pulse off, On Time = 2008-06-01, Off Time = 2010-08-31: on June 1, 2008 the timer output switches on and remains on until August 31, 2010.



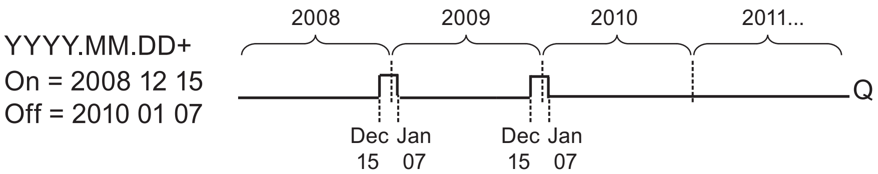
B6 1/3	B6 2/3	B6 3/3
Yearly =Off	On Date	Off Date
Monthly =Off	YYYY-MM-DD	YYYY-MM-DD
Pulse =Off	2008-06-01	2010-08-31

Example 6: Yearly mode off, Monthly mode off, Pulse selected, On Time = 2008-03-15, Off Time = ****-**-**: on March 15, 2008 the timer output switches on for one cycle. Because the timer does not have a monthly action or yearly action, the timer output pulses only one time at the specified On Time.



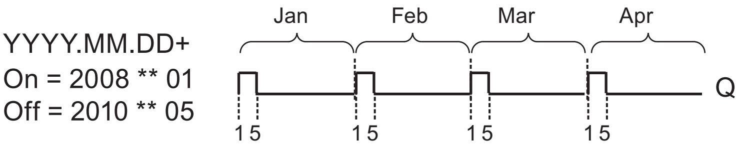
B6 1/3	B6 2/3	B6 3/3
Yearly =Off	On Date	Off Date
Monthly =Off	YYYY-MM-DD	YYYY-MM-DD
Pulse =On	2008-03-15	****-**-**

Example 7: Yearly mode on, Monthly mode off, Pulse off, On Time = 2008-12-15, Off Time = 2010-01-07: on December 15 of 2008 and 2009, the timer output switches on and remains on until January 7 of the following year. When the timer output turns off on January 7, 2010 it does NOT turn on again the following December 15.



B6 1/3	B6 2/3	B6 3/3
Yearly =On	On Date	Off Date
Monthly =Off	YYYY-MM-DD	YYYY-MM-DD
Pulse =Off	2008-12-15	2010-01-07

Example 8: Yearly mode on, Monthly mode on, On Time = 2008-**-01, Off Time = 2010-**-05: starting in 2008, on the first day of each month the timer output switches on and switches off on the fifth day of the month. The timer continues in this pattern through the last month of 2010.



B6 1/3
Yearly =On
Monthly =On
Pulse =Off

B6 2/3
On Date
YYYY-MM-DD
2008-**-01

B6 3/3
Off Date
YYYY-MM-DD
2010-**-05

Functional description

The twelve-month time switch sets and resets the output at specific on and off dates. Sets and resets are executed at 00:00. If your application requires a different time, use a seven-day time switch together with a twelve-month time switch in your circuit program.

The on time specifies when the timer is activated. The off time specifies when the output is reset again. For the on and off times, note the order of the fields: The first field defines the year, the second the month and the third the day.

If you set the Monthly mode on, the timer output switches on each month at the specified day of the on time and remains on until the specified day of the off time. The on time specifies the initial year in which the timer is activated. The off time defines the last year in which the timer turns off. The maximum year is 2099.

If you set the Yearly mode on, the timer output switches on each year at the specified month and day of the on time and remains on until the specified month and day of the off time. The on time specifies the initial year in which the timer is activated. The off time defines the last year in which the timer turns off. The maximum year is 2099.

If you set Pulse output, the timer output switches on at the specified on time for one cycle and then the timer output is reset. You can choose to pulse a timer on a monthly or yearly basis, or just a single time.

If you set none of the Monthly, Yearly, or Pulse modes on, you can define a specific time period with the on time and off time. It can span any time period that you choose.

For a process action that is to be switched on and off at multiple but irregular times during the year, you can define multiple twelve-month time switch with the outputs connected by an OR function block.

Backup of the real-time clock

The internal real-time clock of IDEC SmartRelay is buffered against power failure. The buffering time is influenced by the surrounding temperature, and is typically 20 days at a surrounding temperature of 25°C.

Sample configuration

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

```
B1        1/3
Yearly   =On
Monthly  =Off
Pulse    =Off
```

Yearly Timer 1
On-time Mar 1
Off-time Apr 4

```
B1        2/3
On Date
YYYY-MM-DD
2000-03-01
```

```
B1        3/3
Off Date
YYYY-MM-DD
2099-04-04
```

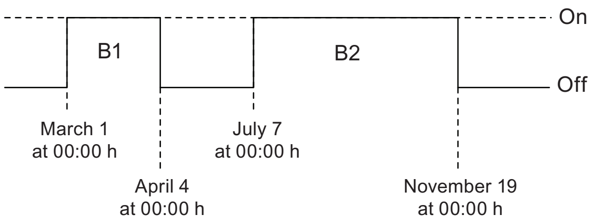
```
B2        1/3
Yearly   =On
Monthly  =Off
Pulse    =Off
```

Yearly Timer 2
On-time Jul 7
Off-time Nov 19

```
B2        2/3
On Date
YYYY-MM-DD
2000-07-07
```

```
B2        3/3
Off Date
YYYY-MM-DD
2099-11-19
```

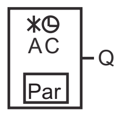
Result



4.4.13 Astronomical clock

Short description

The astronomical clock function is used to set an output high when the current time of your IDEC SmartRelay Base Module is between the time of sunrise (TR) and the time of sunset (TS). IDEC SmartRelay automatically calculates these times based on the geographical location, the settings for automatic summertime/wintertime conversion, and the current time of the module.

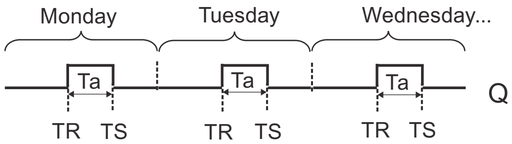
Symbol in IDEC SmartRelay	Wiring	Description
 Astron. Clock	Parameter	You specify the longitude, latitude, time zone, sunrise time offset and sunset time offset: **Longitude:** Direction settings: EAST or WEST Range of values: 0 ° to 180 ° (degrees) 0 ' to 59 ' (minutes) 0 " to 59 " (seconds) **Latitude**: Direction settings: NORTH or SOUTH Range of values: 0 ° to 90 ° (degrees) 0 ' to 59 ' (minutes) 0 " to 59 "(seconds) **Zone**: Range of values: -11 to 12 **TR Offset** (sunrise time offset): Range of values: -59 minutes to 59 minutes **TS Offset** (sunset time offset): Range of values: -59 minutes to 59 minutes
	Output Q	IDEC SmartRelay sets Q to "1" when the current time of your IDEC SmartRelay Base Module is between the sunrise time (TR) and the sunset time (TS).

Note

From WindLGC V8.0, you can choose from several pre-defined time zone locations. If you select one of these locations, WindLGC uses the latitude, longitude, and the time zone of your selection. This location pre-configuration capability is only possible from WindLGC.

Timing diagram

The following illustration is an example of the timing diagram where Ta refers to the current time of the IDEC SmartRelay Base Module:



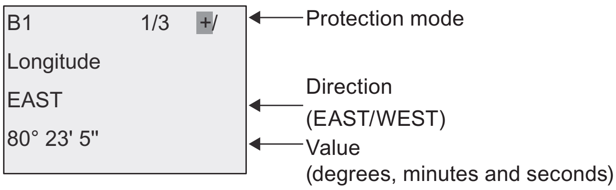
Functional description

The function calculates the TR and TS values at the input and sets Q when Ta (Ta is the current IDEC SmartRelay Time) is between TR and TS; otherwise, the function resets Q.

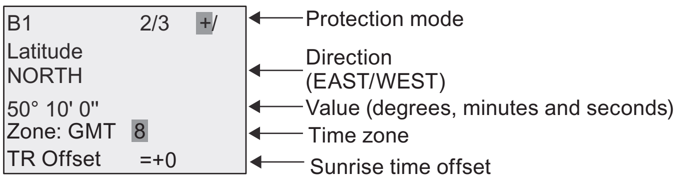
If automatic summertime/wintertime conversion (see the topic Summertime/wintertime conversion (Page 90) for details) is enabled, the function takes the configured time difference into consideration when calculating the TR and TS values.

Setting the Par parameter

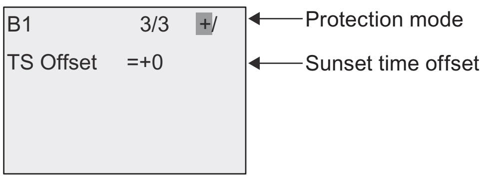
View in programming mode (example):



Press ▶



Press ▶



View in parameter assignment mode (example):

```
B1          1/3
Longitude
EAST
80° 23' 5''
```

Press ▼

```
B1          2/3
Latitude
NORTH
50° 10' 0''
Zone: GMT   8
TR Offset   =+0
```

If automatic summertime/wintertime conversion is disabled, press ▼ and IDEC SmartRelay shows the following view in parameter assignment mode (example):

```
B1          3/3
TR Offset   =+0
TR          =10:38    Sunrise time
TS          =18:46    Sunset time
```

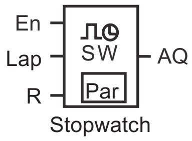
If automatic summertime/wintertime conversion is enabled and set to "EU" (for example), press ▼ and IDEC SmartRelay shows the following view in parameter assignment mode (example):

```
B1          3/3
TR Offset   =+0
TR          =11:38
TS          =19:46
```

4.4.14 Stopwatch

Short description

The stopwatch function counts the elapsed time between a start stopwatch signal and a stop stopwatch signal.

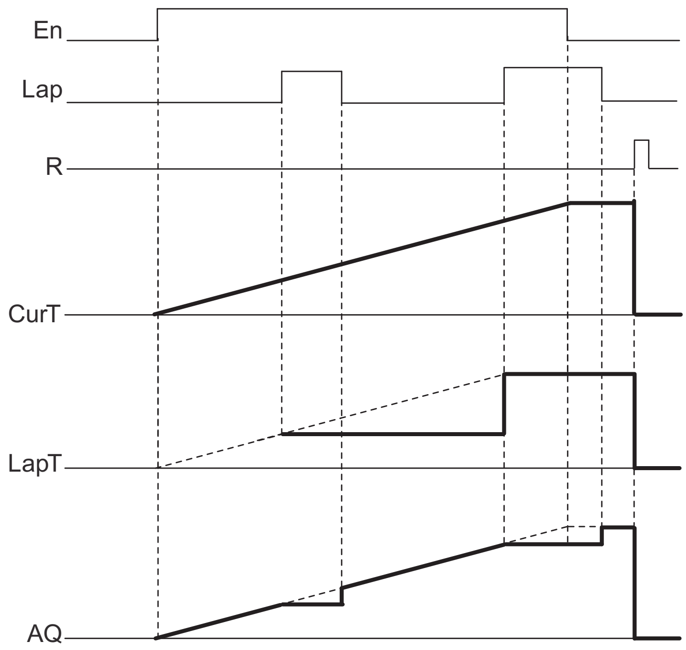
<table>
<tr><th>Symbol in IDEC SmartRelay</th><th>Wiring</th><th>Description</th></tr>
<tr><td rowspan="5">
</td><td>En</td><td>A signal at input En begins counting elapsed time at analog output AQ.</td></tr>
<tr><td>Lap</td><td>A positive edge (0 to 1 transition) at input Lap pauses the stopwatch.
A negative edge (1 to 0 transition) at input Lap resumes the stopwatch.</td></tr>
<tr><td>R</td><td>A signal at input R resets the elapsed time.</td></tr>
<tr><td>Parameter</td><td>You can set a timebase TB for the stopwatch.
Possible timebase settings:
10 ms, s, m, and h
Retentivity:
/ = No retentivity
R = The status is retentive</td></tr>
<tr><td>Output AQ</td><td>A signal at input Lap holds the value of AQ until Lap is reset to 0. A signal at input R resets the value of AQ to 0.</td></tr>
</table>

Parameters TB

You can set a timebase from the following timebase set:

- 10 ms (10 milliseconds)
- s (seconds)
- m (minutes)
- h (hours)

Timing diagram



Functional description

En = 1 and Lap = 0: Using the selected timebase, the stopwatch outputs the current time (CurT) to AQ.

En = 1 and Lap = 1: The stopwatch leaves AQ at its last value when Lap = 0. This value is recorded as LapT for stopwatch pause time.

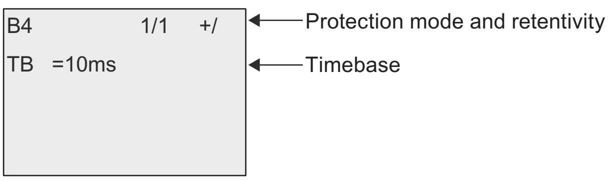
En = 0 and Lap = 1: The stopwatch pauses counting time. It outputs LapT to AQ.

En = 0 and Lap = 0: The stopwatch outputs the current time (CurT) to AQ.

A signal at R sets the AQ value to 0.

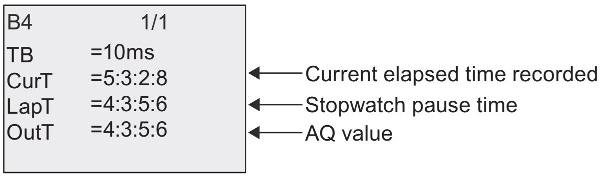
Setting the Par parameter

View in programming mode (example):



To change the timebase, press ▶ to move the cursor to "10ms". Press OK and now the timebase can be selected. Press▲ or ▼ to select another timebase. To confirm your selection, press OK.

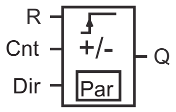
View in parameter assignment mode (example):



4.4.15 Up/down counter

Short description

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

Symbol in IDEC SmartRelay	Wiring	Description
 Up/Down Counter	Input R	A signal at input R resets the internal count value to zero.
	Input Cnt	The function counts the 0 to 1 transitions at input Cnt. 1 to 0 transitions are not counted. You can use the following as the input: • inputs I3, I4, I5, and I6 for fast counting (only FL1F-H12RCE/B12RCE and FL1F-H12SCD): max. 5 kHz, if the fast input is directly connected to the up/down counter function block • any other input or circuit component for counting low frequency signals (typically 4 Hz)
	Input Dir	You set the direction of count at input Dir: Dir = 0: Count up Dir = 1: Count down
	Parameter	On: on threshold Range of values: 0...999999 Off: off threshold Range of values: 0...999999 StartVal: initial value from which to begin counting either down or up. Retentivity for internal counter value Cnt: / = No retentivity R = The status is retentive.
	Output Q	Q is set or reset, depending on the current value at Cnt and the set thresholds.

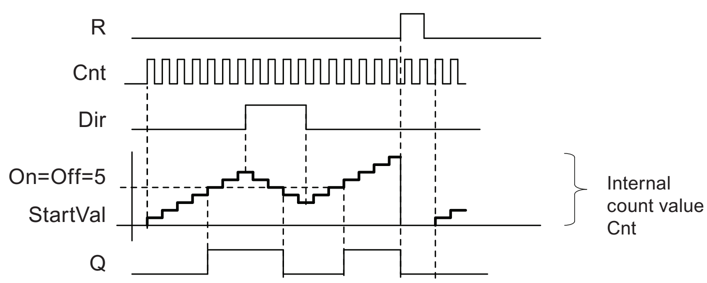
Parameters On and Off

The actual value of another already-programmed function can provide the on threshold On and the off threshold Off. You can use the actual values of the following functions:

- Analog comparator (Page 187) (actual value Ax – Ay)
- Analog trigger (Page 182) (actual value Ax)
- Analog amplifier (Page 195) (actual value Ax)
- Analog multiplexer (Page 213) (actual value AQ)
- Analog ramp control (Page 216) (actual value AQ)
- Analog Math (Page 228) (actual value AQ)
- PI controller (Page 220) (actual value AQ)
- Up/down counter (actual value Cnt)
- Analog filter (Page 233) (actual value AQ)
- Average value (Page 239) (actual value AQ)
- Max/Min (Page 235) (actual value AQ)
- On-delay (Page 136) (current time Ta)
- Off-delay (Page 140) (current time Ta)
- On-/off-delay (Page 142) (current time Ta)
- Retentive on-delay (Page 144) (current time Ta)
- Interval time-delay relay/Pulse output (Page 146) (current time Ta)
- Edge-triggered interval time-delay relay (Page 148) (current time Ta)
- Asynchronous pulse generator (Page 150) (current time Ta)
- Stairwell light switch (Page 154) (current time Ta)
- Dual-function switch (Page 156) (current time Ta)
- Stopwatch (Page 170) (actual value AQ)
- Frequency trigger (Page 179) (actual value Fre)

Select the required function by the block number.

Timing diagram



Functional description

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

You can use input R to reset the internal count value to the start value. As long as R = 1, the output is also 0 and the pulses at input Cnt are not counted.

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

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

Calculation rule

- If the On threshold ≥ Off threshold, then:
  Q = 1, if Cnt ≥ On
  Q = 0, if Cnt < Off
- If the On threshold < Off threshold, then Q = 1, if On ≤ Cnt < Off.

Note

The system scans the counter limit value cyclically.

Thus, if the pulse frequency at the fast digital inputs I3, I4, I5 or I6 is faster than the cycle time, the special function might not switch until after the specified limit value is exceeded.

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

View in programming mode (example):

```
B3            1/1  +R
On   =+1234
Off  =+0
STV  =+100
```

or

```
B3            1/1  +R
On   =+1234
Off  →B021
STV  =+100
```

If the referenced block (B021, in the example) returns a value that lies out of the valid range, the value is rounded to the next valid value.

The view in parameter assignment mode (example):

```
B3            1/1
On     =+1234
Off    =+0
Cnt    =+120
STV    =+100
```

or

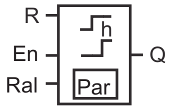
```
B3            1/1
On     =+123456
Off    =→B021
Cnt    =+120
STV    =+100
```

Current count value

4.4.16 Operating hours counter

Short description

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

Symbol in IDEC SmartRelay	Wiring	Description
 Hours Counter	Input R	A positive edge (0 to 1 transition) at input R resets output Q and sets a configured value MI at the counter for the duration of the time-to-go (MN).
	Input En	En is the monitoring input. IDEC SmartRelay scans the on-time of this input.
	Input Ral	A positive edge at input Ral (Reset all) resets the operating hours counter (OT) and the output, and sets the time-to-go value (MN) to the maintenance interval MI: • Output Q = 0 • Measured operating time OT = 0 • Time-to-go of the maintenance interval MN = MI.
	Parameter	MI: Maintenance interval to be preset in units of hours and minutes Range of values: 0000 h to 9999 h, 0 m to 59 m OT: the accumulated total operating time (you can specify an offset in hours and minute) Range of values: 00000 h to 99999 h, 0 m to 59 m Q → 0 occurs depending on the following conditions: • When "R" is selected: Q = 1, if MN = 0; Q = 0, if R = 1 or Ral = 1 • When "R+En" is selected: Q = 1, if MN = 0; Q = 0, if R = 1 or Ral = 1 or En = 0.
	Output Q	The output is set when the time-to-go MN = 0 (see timing diagram). The output is reset under the following conditions: • When "Q → 0:R+En", if R = 1 or Ral = 1 or En = 0 • When "Q → 0:R", if R = 1 or Ral = 1.

Note

MI, MN and OT are always retentive.

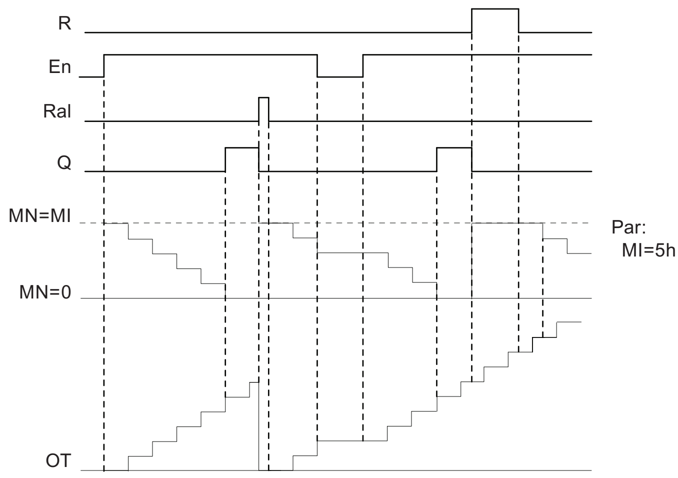
Parameter MI

The maintenance interval MI can be provided by the actual value of another already-programmed function. The timebase of the referenced value is "h" (for hours) only. You can use the actual values of the following functions:

- Analog comparator (Page 187) (actual value Ax – Ay)
- Analog trigger (Page 182) (actual value Ax)
- Analog amplifier (Page 195) (actual value Ax)
- Analog multiplexer (Page 213) (actual value AQ)
- Analog ramp control (Page 216) (actual value AQ)
- Analog Math (Page 228) (actual value AQ)
- PI controller (Page 220) (actual value AQ)
- Up/down counter (Page 172) (actual value Cnt)
- Analog filter (Page 233) (actual value AQ)
- Average value (Page 239) (actual value AQ)
- Max/Min (Page 235) (actual value AQ)
- On-delay (Page 136) (current time Ta)
- Off-delay (Page 140) (current time Ta)
- On-/off-delay (Page 142) (current time Ta)
- Retentive on-delay (Page 144) (current time Ta)
- Interval time-delay relay/Pulse output (Page 146) (current time Ta)
- Edge-triggered interval time-delay relay (Page 148) (current time Ta)
- Asynchronous pulse generator (Page 150) (current time Ta)
- Stairwell light switch (Page 154) (current time Ta)
- Dual-function switch (Page 156) (current time Ta)
- Stopwatch (Page 170) (current time Ta)

Select the required function by the block number.

Timing diagram



MI = Configured time interval
MN = Time-to-go
OT = Total time expired since the last hi signal at input Ral

Functional description

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

A signal at reset input R resets output Q and sets the preset value of MI at the counter for the duration of MN. The operating hours counter OT is not affected.

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

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

Viewing the MI, MN and OT values

- IDEC SmartRelay Basic: You can open the parameter assignment mode when the system is in RUN to view the actual values of MI, MN and OT.
- IDEC SmartRelay Pure: In WindLGC, you can use the Online Test to read these values. For further information, see chapter "IDEC SmartRelay software (Page 306)".
- In WindLGC you can get the operating hours counter via the *"Tools -> Transfer: Hours counter"* menu command.

Limit value of OT

The value of the operating hours in OT is retained when you reset the operating hours counter with a signal at input R. The operating hours counter OT will be reset to zero with a transition from 0 to 1 at Ral. It continues the count as long as En = 1, irrespective of the status at the reset input R. The counter limit of OT is 99999 h. The operating hours counter stops when it reaches this value.

In programming mode, you can set the initial value of OT. MN is calculated according to the following formula when reset input R is never enabled: MN = MI - (OT % MI). The % operator provides an integer division remainder.

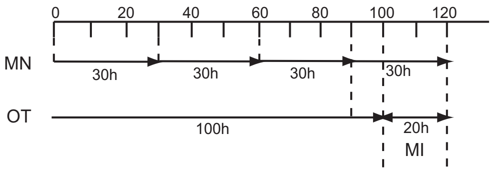
Example:

MI = 30h, OT = 100h

MN = 30 - (100 % 30)

MN = 30 -10

MN = 20h



In runtime mode, the value OT can not be preset. If the value for MI is changed, there would be no calculation for the MN. MN would take on the value of MI.

Setting the Par parameter

View in programming mode:

```
B16          1/1  +/
MI      =100h:0m
OT      =30h:0m
Q→0:    =R+En
```

```
B16          1/1  +/
MI      →B001   h
OT      =30h:0m
Q→0:    =R+En
```

MI is the configurable time interval. The permissible range of values is 0 to 9999 hours.

For information on how to assign the actual value of another already-programmed function to a parameter, see the On-delay (Page 136) topic.

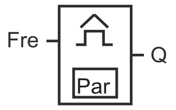
View in parameter assignment mode:

```
B16            1/1
MI   =100h:0m      ← Time interval
OT   =83h:15m      ← Total operating hours
MN   =16h:45m      ← Time-to-go
```

4.4.17 Frequency trigger

Short description

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

Symbol in IDEC SmartRelay	Wiring	Description
 FrequencyTrigger	Input Fre	The function counts the 0 to 1 transitions at input Fre. 1 to 0 transitions are not counted. Use the following as the input: • inputs I3, I4, I5, I6 for fast counting (only FL1F-H12RCE/B12RCE and FL1F-H12SCD): max. 5 kHz, if the fast input is directly connected to the frequency trigger function block • any other input or circuit component for counting low frequency signals (typically 4 Hz)
	Parameter	On: on threshold Range of values: 0000...9999 Off: off threshold Range of values: 0000...9999 G_T: time interval or gate time during which the input pulses are measured Range of values: 00:00 s...99:99 s
	Output Q	Q is set and reset at the thresholds.

Parameter G_T

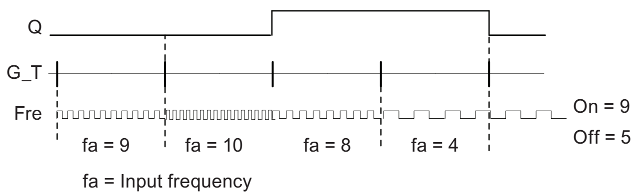
The gate time G_T can be provided by the actual value of another already-programmed function. You can use the actual values of the following functions:

- Analog comparator (Page 187) (actual value Ax – Ay)
- Analog trigger (Page 182) (actual value Ax)
- Analog amplifier (Page 195) (actual value Ax)
- Analog multiplexer (Page 213) (actual value AQ)
- Analog ramp control (Page 216) (actual value AQ)
- Analog Math (Page 228) (actual value AQ)
- PI controller (Page 220) (actual value AQ)
- Up/down counter (Page 172) (actual value Cnt)
- Analog filter (Page 233) (actual value AQ)
- Average value (Page 239) (actual value AQ)
- Max/Min (Page 235) (actual value AQ)
- On-delay (Page 136) (current time Ta)
- Off-delay (Page 140) (current time Ta)
- On-/off-delay (Page 142) (current time Ta)

- Retentive on-delay (Page 144) (current time Ta)
- Interval time-delay relay/Pulse output (Page 146) (current time Ta)
- Edge-triggered interval time-delay relay (Page 148) (current time Ta)
- Asynchronous pulse generator (Page 150) (current time Ta)
- Stairwell light switch (Page 154) (current time Ta)
- Dual-function switch (Page 156) (current time Ta)
- Stopwatch (Page 170) (actual value AQ)
- Frequency trigger (Page 179) (actual value Fre)

Select the required function by the block number.

Timing diagram



Functional description

The frequency trigger measures the signals at input Fre. The pulses are recorded across a configurable time G_T.

Output Q is set and reset in accordance with the set thresholds. See the calculation rule below.

Calculation rule

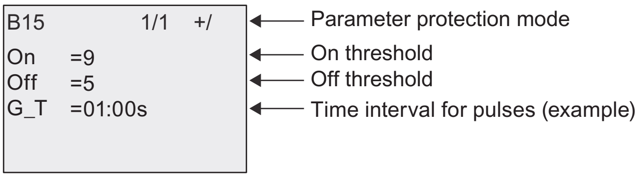
- If the On threshold ≥ Off threshold, then Q = 1, if f_a > On or Q = 0, if f_a ≤ Off.
- If the On threshold < Off threshold, then Q = 1 if On ≤ f_a < Off.

Setting the Par parameter

Note

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

View in programming mode (example):

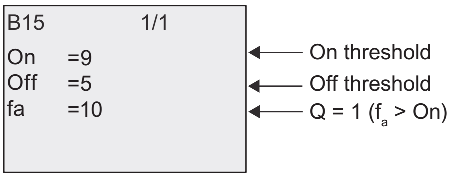


Note

The "seconds" timebase is here set as permanent default.

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

View in parameter assignment mode (example):



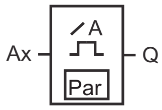
Note

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

4.4.18 Analog trigger

Short description

The output is set and reset at two configurable thresholds.

Symbol in IDEC SmartRelay	Wiring	Description
 Analog Trigger	Input Ax	Input Ax is one of the following analog signals: • AI1 to AI8 (*) • AM1 to AM64 • NAI1 to NAI32 • AQ1 to AQ8 • NAQ1 to NAQ16 • Block number of a function with analog output
	Parameter	A: gain Range of values: -10.00 to 10.00 B: zero offset Range of values: -10,000 to 10,000 On: on threshold Range of values: -20,000 to 20,000 Off: off threshold Range of values: -20,000 to 20,000 p: number of decimals Range of values: 0, 1, 2, 3
	Output Q	Q is set or reset by the thresholds.
* AI1...AI8: 0...10 V corresponds with 0...1000 (internal value).		

Gain and offset parameters

Please note the information on gain and offset parameters in topic "Calculating the gain and offset of analog values (Page 130)".

Parameters On and Off

The actual value of another already-programmed function can provide the On and Off parameters. You can use the actual values of the following functions:

- Analog comparator (Page 187) (actual value Ax – Ay)
- Analog amplifier (Page 195) (actual value Ax)
- Analog multiplexer (Page 213) (actual value AQ)
- Analog ramp control (Page 216) (actual value AQ)
- Analog Math (Page 228) (actual value AQ)
- PI controller (Page 220) (actual value AQ)
- Up/down counter (Page 172) (actual value Cnt)
- Analog filter (Page 233) (actual value AQ)
- Average value (Page 239) (actual value AQ)
- Max/Min (Page 235) (actual value AQ)

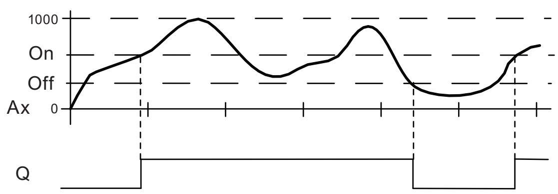
- On-delay (Page 136) (current time Ta)
- Off-delay (Page 140) (current time Ta)
- On-/off-delay (Page 142) (current time Ta)
- Retentive on-delay (Page 144) (current time Ta)
- Interval time-delay relay/Pulse output (Page 146) (current time Ta)
- Edge-triggered interval time-delay relay (Page 148) (current time Ta)
- Asynchronous pulse generator (Page 150) (current time Ta)
- Stairwell light switch (Page 154) (current time Ta)
- Dual-function switch (Page 156) (current time Ta)
- Stopwatch (Page 170) (actual value AQ)
- Analog trigger (Page 182) (actual value Ax)
- Frequency trigger (Page 179) (actual value Fre)

Select the required function by the block number.

Parameter p (number of decimals)

Applies only to the display of On, Off and Ax values in a message text.
Does not apply to the comparison of On and Off values. (The compare function ignores the decimal point.)

Timing diagram



Functional description

The function fetches the analog signal at input Ax.

Ax is multiplied by the value of the A (gain) parameter, and the value at parameter B (offset) is added to product, i.e. (Ax • gain) + offset = actual value of Ax.

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

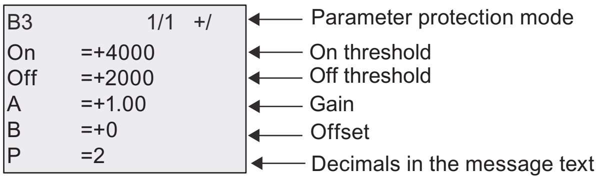
Calculation rule

- If the On threshold ≥ Off threshold, then Q = 1, if the actual value Ax > On or Q = 0, if the actual value Ax ≤ Off.
- If the On threshold < Off threshold, then Q = 1 if On ≤ actual value Ax < Off.

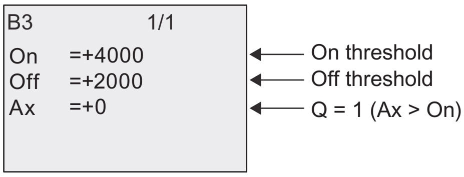
Setting the Par parameter

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

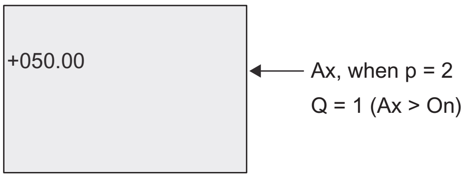
View in programming mode (example):



View in parameter assignment mode (example):



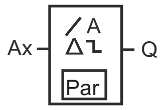
View in the message text (example):



4.4.19 Analog differential trigger

Short description

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

Symbol in IDEC SmartRelay	Wiring	Description
 AnalogDiff.Trig	Input Ax	Input Ax is one of the following analog signals: • AI1 to AI8 (*) • AM1 to AM64 • NAI1 to NAI32 • AQ1 to AQ8 • NAQ1 to NAQ16 • Block number of a function with analog output
	Parameter	A: gain Range of values: -10.00 to 10.00 B: zero offset Range of values: -10,000 to 10,000 On: On/Off threshold Range of values: -20,000 to 20,000 Δ: differential value for calculating the off parameter Range of values: -20,000 to 20,000 p: Number of decimals Range of values: 0, 1, 2, 3
	Output Q	Q is set or reset, depending on the threshold and difference values.
* AI1...AI8: 0...10 V corresponds with 0...1000 (internal value).		

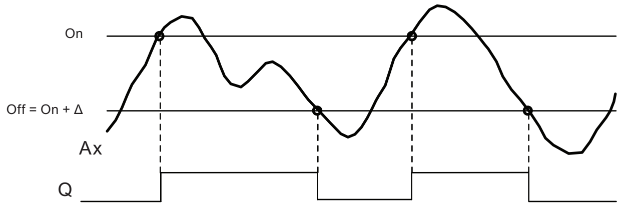
Gain and offset parameters

Please note the information on gain and offset parameters in topic "Calculating the gain and offset of analog values (Page 130)".

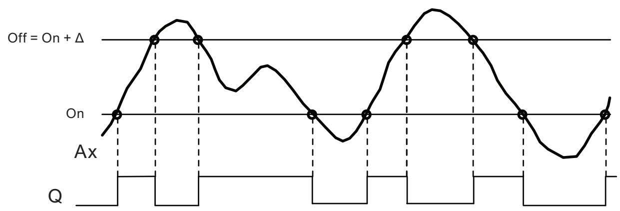
Parameter p (number of decimals)

Applies only to the display of On, Off and Ax values in a message text.

Timing diagram A: Function with negative difference Δ



Timing diagram B: Function with positive difference Δ



Functional description

The function fetches the analog signal at input Ax.

Ax is multiplied by the value of the A (gain) parameter, and the value at parameter B (offset) is added to product, i.e. (Ax • gain) + offset = actual value of Ax.

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

Calculation rule

- When you set a negative differential value Δ, the On threshold ≥ Off threshold, and Q = 1if the actual value Ax > On or Q = 0 if the actual value Ax ≤ Off.
  See the timing diagram A.
- When you set a positive differential value Δ, the On threshold < the Off threshold, and Q = 1, if On ≤ actual value Ax < Off.
  See the timing diagram B.

Setting the Par parameter

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

View in programming mode (example):

B3	1/1 +/	Parameter protection mode
On	=+4000	On/off threshold
Δ	=-2000	Differential value for the on/off threshold
A	=+1.00	Gain
B	=+0	Offset
P	=2	Decimals in the message text

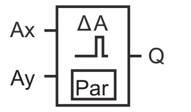
View in parameter assignment mode (example):

B3	1/1	
On	=+4000	On threshold
Δ	=-2000	Differential value for the off threshold
Off	=+2000	Off threshold
Ax	=+5000	Q = 1 (A_x > On)

4.4.20 Analog comparator

Short description

The output is set and reset depending on the difference Ax - Ay and on two configurable thresholds.

Symbol in IDEC SmartRelay	Wiring	Description
	Inputs Ax and Ay	Inputs Ax and Ay are one of the following analog signals: • AI1 to AI8 (*) • AM1 to AM64 • NAI1 to NAI32 • AQ1 to AQ8 • NAQ1 to NAQ16 • Block number of a function with analog output
	Parameter	A: gain Range of values: -10.00 to 10.00 B: ero offset Range of values: -10,000 to 10,000 On: on threshold Range of values: -20,000 to 20,000 Off: off threshold Range of values: -20,000 to 20,000 p: number of decimals Range of values: 0, 1, 2, 3
	Output Q	Q is set or reset, depending on the difference Ax - Ay and the set thresholds.
* AI1...AI8: 0...10 V corresponds with 0...1000 (internal value).		

Gain and offset parameters

For more information on the gain and offset parameters, refer to topic "Calculating the gain and offset of analog values (Page 130)".

Parameters On and Off

The actual value of another already-programmed function the on threshold On and the off threshold Off. You can use the actual values of the following functions:

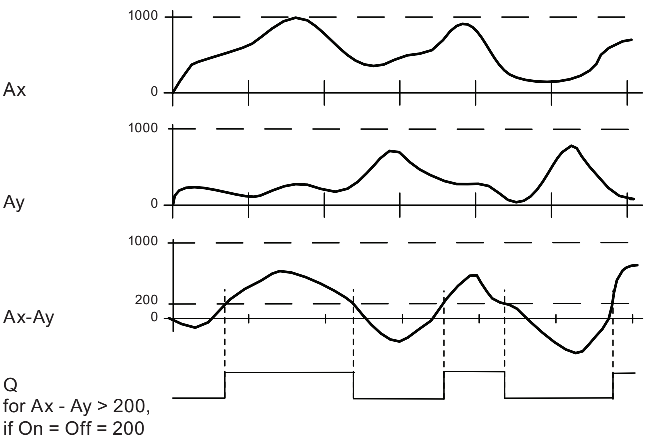
- Analog trigger (Page 182) (actual value Ax)
- Analog amplifier (Page 195) (actual value Ax)
- Analog multiplexer (Page 213) (actual value AQ)
- Analog ramp control (Page 216) (actual value AQ)
- Analog Math (Page 228) (actual value AQ)
- PI controller (Page 220) (actual value AQ)
- Up/down counter (Page 172) (actual value Cnt)
- Analog filter (Page 233) (actual value AQ)
- Average value (Page 239) (actual value AQ)
- Max/Min (Page 235) (actual value AQ)
- On-delay (Page 136) (current time Ta)
- Off-delay (Page 140) (current time Ta)
- On-/off-delay (Page 142) (current time Ta)
- Retentive on-delay (Page 144) (current time Ta)
- Interval time-delay relay/Pulse output (Page 146) (current time Ta)
- Edge-triggered interval time-delay relay (Page 148) (current time Ta)
- Asynchronous pulse generator (Page 150) (current time Ta)
- Stairwell light switch (Page 154) (current time Ta)
- Dual-function switch (Page 156) (current time Ta)
- Stopwatch (Page 170) (actual value AQ)
- Analog comparator (actual value Ax - Ay)
- Frequency trigger (Page 179) (actual value Fre)

Select the required function by the block number.

Parameter p (number of decimals)

Applies only to Ax, Ay, On, Off and Δ values displayed in a message text.
Does not apply to the comparison of on and off values! (The compare function ignores the decimal point.)

Timing diagram



Functional description

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

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

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

Output Q is set or reset, depending on difference of the actual values Ax - Ay and the set thresholds. See the calculation rule below.

Calculation rule

- If the On threshold ≥ Off threshold, then Q = if (actual value Ax - actual value Ay) > On or Q = 0 if (actual value Ax - actual value Ay) ≤ Off.
- If the On threshold < Off threshold, then Q = 1, if On ≤ (actual value Ax - actual value Ay) < Off.

Setting the Par parameter

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

View in programming mode:

B3	1/1 +/	← Parameter protection mode
On	=+0	← On threshold
Off	=+0	← Off threshold
A	=+0.00	← Gain
B	=+0	← Offset
P	=0	← Decimals in the message text

Example

In a heating control system, the supply T_v and return line temperatures T_r are to be compared, for example with a sensor at AI2.

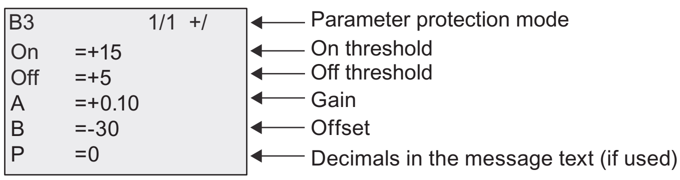
A control signal is to be triggered (for example "heater On") when the difference between the supply and return line temperatures is greater than 15 °C. The control signal is reset when the difference is less than 5 °C.

The process variable of the temperature is to be shown in parameter assignment mode.

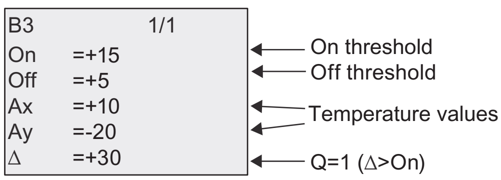
The thermocouples available have the following technical data: -30 °C to +70 °C, 0 VDC to 10 VDC.

Application	Internal mapping
-30 °C to 70 °C = 0 VDC to 10 VDC	0 to 1000
0 °C	300 → Offset = -30
Range of values: -30 °C to 70 °C = 100	1000 → Gain = 100/1000 = 0.1
On threshold = 15 °C	Threshold = 15
Off threshold = 5 °C	Threshold = 5
See also topic "Calculating the gain and offset of analog values (Page 130) ".	

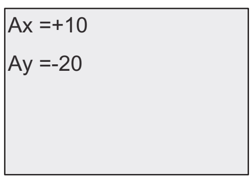
Configuration (example):



View in parameter assignment mode (example):



View in the message text (example):

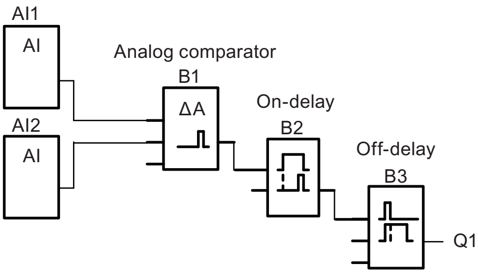


Reducing the input response of the analog comparator

You can selectively delay the output of an analog comparator by means of the "On-delay" and "Off-delay" special functions. With on-delay, output Q is only set if the pulse width of the triggering signal at input Trg (=analog comparator output) is longer than the on-delay time.

Using this method, you will obtain a virtual hysteresis and reduce the input response to short signals.

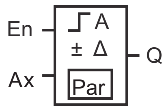
Function block diagram



4.4.21 Analog watchdog

Short description

This special function saves the process variable of an analog input to memory, and sets the output when the output variable exceeds or drops below this stored value plus a configurable offset.

Symbol in IDEC SmartRelay	Wiring	Description
 Analog Watchdog	Input En	A positive edge (0 to 1 transition) at input En saves the analog value at input Ax ("Aen") to memory and starts monitoring of the analog range Aen - Δ_2 to Aen+ Δ_1
	Input Ax	Input Ax is one of the following analog signals: • AI1 to AI8 (*) • AM1 to AM64 • NAI1 to NAI32 • AQ1 to AQ8 • NAQ1 to NAQ16 • Block number of a function with analog output
	Parameter	A: gain Range of values: -10.00 to 10.00 B: zero offset Range of values: -10,000 to 10,000 Δ_1: difference value above Aen: on/off threshold Range of values: 0 to 20,000 Δ_2: difference value below Aen: on/off threshold Range of values: 0 to 20,000 p: number of decimals Range of values: 0, 1, 2, 3 Retentivity: / = no retentivity R = the status is retentive in memory
	Output Q	Q is set/reset, depending on the stored analog value and the offset.
* AI1...AI8: 0...10 V corresponds with 0...1000 (internal value).		

Gain and offset parameters

For more information on gain and offset parameters, refer to topic "Calculating the gain and offset of analog values (Page 130)".

Parameters Delta1 and Delta2

The actual value of another already-programmed function the Delta1 and Delta2 parameters. You can use the actual value of the following functions:

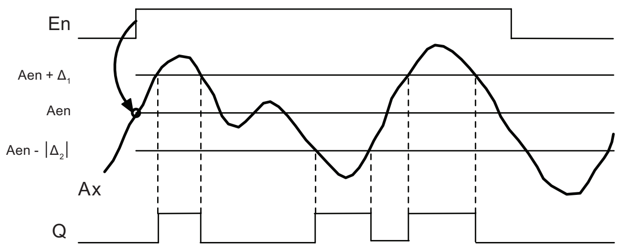
- Analog comparator (Page 187) (actual value Ax – Ay)
- Analog trigger (Page 182) (actual value Ax)
- Analog amplifier (Page 195) (actual value Ax)
- Analog multiplexer (Page 213) (actual value AQ)
- Analog ramp control (Page 216) (actual value AQ)
- Analog Math (Page 228) (actual value AQ)
- PI controller (Page 220) (actual value AQ)
- Up/down counter (Page 172) (actual value Cnt)
- Analog filter (Page 233) (actual value AQ)
- Average value (Page 239) (actual value AQ)
- Max/Min (Page 235) (actual value AQ)
- On-delay (Page 136) (current time Ta)
- Off-delay (Page 140) (current time Ta)
- On-/off-delay (Page 142) (current time Ta)
- Retentive on-delay (Page 144) (current time Ta)
- Interval time-delay relay/Pulse output (Page 146) (current time Ta)
- Edge-triggered interval time-delay relay (Page 148) (current time Ta)
- Asynchronous pulse generator (Page 150) (current time Ta)
- Stairwell light switch (Page 154) (current time Ta)
- Dual-function switch (Page 156) (current time Ta)
- Stopwatch (Page 170) (actual value AQ)
- Frequency trigger (Page 179) (actual value Fre)

Select the required function by the block number.

Parameter p (number of decimals)

Applies only to the Aen, Ax, Δ_1 and Δ_2 values displayed in a message text.

Timing diagram



Functional description

A 0 to 1 transition at input En saves the value of the signal at the analog input Ax. This saved process variable is referred to as "Aen".

Both the analog actual values Ax and Aen are multiplied by the value at parameter A (gain), and parameter B (offset) is then added to the product:
(Ax • gain) + offset = Actual value Aen, when input En changes from 0 to 1, or
(Ax • gain) + offset = Actual value Ax.

Output Q is set when the signal at input En = 1 and if the actual value at input Ax is out of range of Aen - Δ_2 to Aen + Δ_1 .

Output Q is reset, when the actual value at input Ax lies within the range of Aen - Δ_2 to Aen+ Δ_1, or when the signal at input En changes to lo.

Setting the Par parameter

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

View in programming mode:

Display	
B3 1/1 +/	← Parameter protection mode
△1 =0	← Differential value for the on/off threshold
△2 =0	
A =+0.00	← Gain
B =+0	← Offset
P =0	← Decimals in the message text

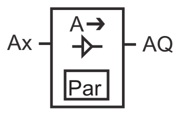
View in parameter assignment mode (example):

Display	
B3 1/1	
Ax =+5	← Q = 1 (Ax is out of the range of Aen - △2 to Aen + △1)
Aen =-20	
△1 =10	
△2 =10	

4.4.22 Analog amplifier

Short description

This special function amplifies the value of an analog input and outputs the result at an analog output.

Symbol in IDEC SmartRelay	Wiring	Description
Analog Amplifier	Input Ax	Input Ax is one of the following analog signals: • AI1 to AI8 (*) • AM1 to AM64 • NAI1 to NAI32 • AQ1 to AQ8 • NAQ1 to NAQ16 • Block number of a function with analog output
	Parameter	A: gain Range of values: -10.00 to 10.00 B: zero offset Range of values: -10,000 to 10,000 p: number of decimals Range of values: 0, 1, 2, 3
	Output AQ	This special function has an analog output. This output can only be connected with analog inputs, analog memory markers, analog outputs or network analog outputs. Range of values for AQ: -32767 to 32767
* AI1...AI8: 0 V to 10 V corresponds with 0 to 1000 (internal value).		

Gain and offset parameters

Please note the information on gain and offset parameters in topic Calculating the gain and offset of analog values (Page 130).

Parameter p (number of decimals)

Applies only to the AQ value in a message text.

Functional description

The function fetches the analog signal of input Ax.

This value is multiplied by the value of the A (gain) parameter, and parameter B (offset) is then added to the product: (Ax • gain) + offset = actual value Ax.

The actual value Ax is output at AQ.

Analog output

If you interconnect this special function with a real analog output, note that the analog output can only process values between 0 and 1000. To do this, you may need to connect an additional amplifier between the analog output of the special function and the real analog output. Using this amplifier, you standardize the output range of the special function to a value range of 0 to 1000.

Scaling an analog input value

You can influence the analog input value of a potentiometer by interconnecting an analog input with an analog amplifier and an analog memory marker.

- Scale the analog value at the analog amplifier for further use.
- Connect, for example, the time base for parameter T of a time function (e.g. On-/off-delay (Page 142)) or the on and/or off limit specification of an Up/down counter (Page 172) to the scaled analog value.

For more information with programming examples refer to the Online Help for WindLGC.

Setting the Par parameter

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

View in programming mode (example):

```
B3          1/1  +/
A   =+2.5            ← Gain
B   =-300            ← Offset
P   =0               ← Decimals in the message text
```

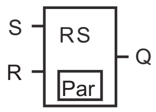
View in parameter assignment mode (example):

```
B3          1/1
A   =+2.5
B   =-300
AQ  =-250
```

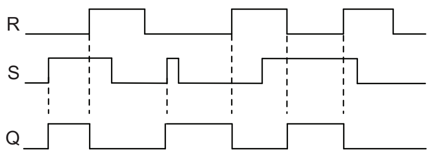
4.4.23 Latching relay

Short description

Input S sets output Q, input R resets output Q again.

Symbol in IDEC SmartRelay	Wiring	Description
 Latching Relay	Input S	You set output Q with a signal at input S.
	Input R	You reset output Q with a signal at input R. If S and R = 1, the output is reset.
	Parameter	Retentivity: / = no retentivity R = the status is retentive.
	Output Q	Q is set with a signal at input S, and reset with a signal at input R.

Timing diagram



Switching response

A latching relay represents a simple binary element. The output value depends on the status at the inputs and on the previous output status. The following table shows the logic once again:

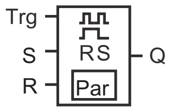
S_n	R_n	Q	Comment
0	0	x	The status is retentive
0	1	0	Reset
1	0	1	Set
1	1	0	Reset (takes priority over Set)

When retentivity is enabled, the current status of the output signal is retained after a power failure.

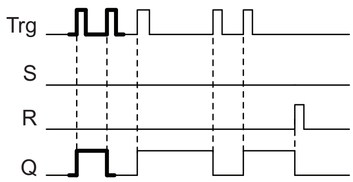
4.4.24 Current impulse relay

Short description

A short pulse at the input sets and resets the output.

Symbol in IDEC SmartRelay	Wiring	Description
 ImpulseRelay (A)	Input Trg	You set and reset output Q with a signal at input Trg (Trigger).
	Input S	You set output Q with a signal at input S.
	Input R	You reset output Q with a signal at input R.
	Parameter	Selection: RS (R input priority) or SR (S input priority) Retentivity: / = no retentivity R = the status is retentive.
	Output Q	Q is set with a signal at Trg, and reset with the next signal at Trg, if S and R = 0.

Timing diagram



The bold printed section of the timing diagram is also shown in the symbol for the current impulse relay.

Functional description

Output Q changes its status; that is, the output is set or reset with each 0 to 1 transition at input Trg and if the inputs S and R = 0.

The signal at input Trg does not influence the special function when S or R = 1.

You set the current impulse relay with a signal at input S. The output is set hi.

You reset the current impulse relay with a signal at input R. The output is set lo.

Status diagram

Par	Q_{n-1}	S	R	Trg	Q_n
*	0	0	0	0	0
*	0	0	0	0 ->1	1**
*	0	0	1	0	0
*	0	0	1	0 ->1	0
*	0	1	0	0	1
*	0	1	0	0 ->1	1
RS	0	1	1	0	0
RS	0	1	1	0 ->1	0
SR	0	1	1	0	1
SR	0	1	1	0 ->1	1
*	1	0	0	0	1
*	1	0	0	0 ->1	0**
*	1	0	1	0	0
*	1	0	1	0 ->1	0
*	1	1	0	0	1
*	1	1	0	0 ->1	1
RS	1	1	1	0	0
RS	1	1	1	0 ->1	0
SR	1	1	1	0	1
SR	1	1	1	0 ->1	1

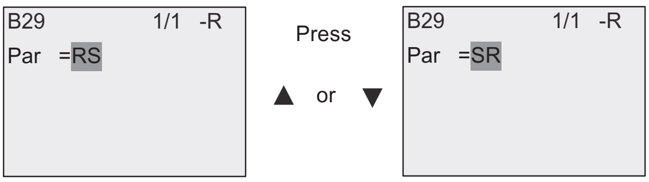
*: RS or SR

**: Triggering signal is effective, because S and R = 0.

Depending on your configuration, either input R takes priority over input S (input S is not effective when R = 1), or vice versa (input R is not effective when S = 1).

After a power failure, the current impulse relay and output Q are reset if you have not enabled retentivity.

View in programming mode:



This special function is not available in parameter assignment mode.

Note

If Trg = 0 and Par = RS, the special function "Current impulse relay" corresponds with the special function "Latching relay (Page 197)".

4.4.25 Message texts

Short description

With the message text function block, you can configure a message that includes text and other parameters for IDEC SmartRelay to display in RUN mode.

You can configure simple message texts from the IDEC SmartRelay onboard display. WindLGC provides an extended set of features for message texts: bar graph representation of data, names for digital I/O states and more. Refer to the WindLGC documentation for information on these features.

Global message text settings

You configure global parameters that apply to all message texts on the programming menu:

- Analog time: refresh rate in milliseconds that specifies how frequently analog inputs in message texts are updated
- Tick time: frequency at which message texts scroll on and off the display
  There are two ways that a message text can tick on and off the screen: line by line, or character by character, which are described in more detail below. A line of a text message, or each character of a text message in turn will tick on and off the IDEC SmartRelay onboard display based on the tick time. For a message that ticks line by line, the actual tick time is ten times the configured tick time. For messages that tick character by character, the actual tick time is the configured tick time.
- Current character set: which character set is selected for the display of message texts. Options Set1 and Set2 can be any of the supported character sets for IDEC SmartRelay:

Character set in IDEC SmartRelay	Common name	Supported languages	Internet reference
ISO8859-1	Latin-1	English, German, Italian, Spanish (partly), Dutch (partly)	http://en.wikipedia.org/wiki/ISO/IEC_8859-1
ISO8859-5	Cyrillic	Russian	http://en.wikipedia.org/wiki/ISO/IEC_8859-5
ISO8859-9	Latin-5	Turkish	http://en.wikipedia.org/wiki/ISO/IEC_8859-9
ISO8859-16	Latin-10	French	http://en.wikipedia.org/wiki/ISO/IEC_8859-16
GB-2312	Chinese	Chinese	http://en.wikipedia.org/wiki/GB2312
Shift-JIS	Japanese	Japanese	http://en.wikipedia.org/wiki/Shift-jis

Of the 50 possible message texts that you can configure, you can select any number of them to be from the first language and any number from the second language. For example, you could configure 50 message text function blocks that have a single message text for Character Set 1. Alternatively, you could configure twenty-five message text function blocks, each of which has two message texts: one for Character Set 1 and one for Character Set 2. Any combination is valid such that the total does not exceed 50.

Within a single message text, the text must be from one character set. You can edit message texts in any of the supported character sets from WindLGC. From IDEC SmartRelay Basic, you can only edit text using characters from the ISO8859-1 character set.

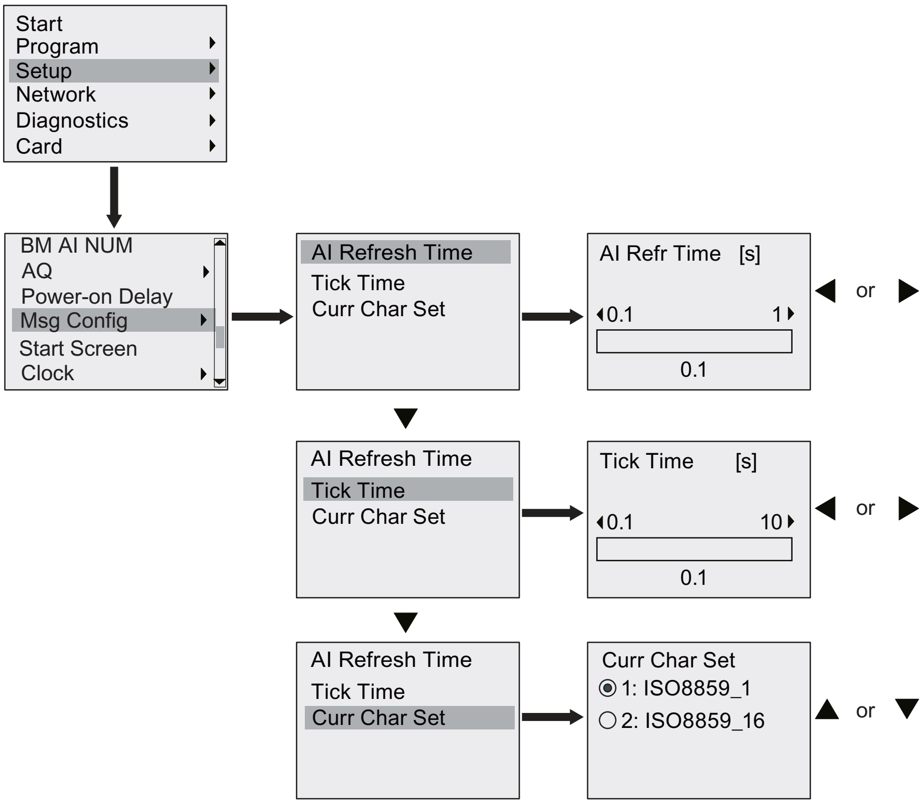
The language and therefore character set of a message text is independent of the language setting for menus on the IDEC SmartRelay onboard display. They can be different.

Chinese character set

IDEC SmartRelay Basic and the FL1F-RD1 support the Chinese character set (GB-2312) for the People's Republic of China. The devices use Microsoft Windows encoding for this character set. The Windows encoding allows the devices to display the same characters as shown in the WindLGC message text editor when you are using a Chinese emulator or a Chinese version of Microsoft Windows.

The Chinese character set requires a Chinese version of Windows or a Chinese emulator to properly display Chinese characters in the WindLGC message text editor. You must start the Chinese emulator before you open the message text function block in WindLGC.

Programming global message text parameters

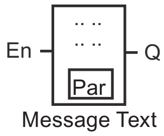


Step through values of 0.1, 0.2, 0.4, 0.8 or 1 s to increase or decrease the analog input refresh time. IDEC SmartRelay updates the value and cursor position between 0.1 s and 1 s to show your the current selection.

Increase or decrease the tick time by 0.1 s. Minimum tick time is 0.1 s. Maximum tick time is 10 s.

Select the desired current character set for the display of message texts.

Message text function block

Symbol in IDEC SmartRelay	Wiring	Description
	Input En	A 0 to 1 transition at input En (Enable) starts the output of the message text.
	Parameter	Ack: acknowledgment of the message text Msg Text: input of the message text Priority: priority of the message text Range of values: 0 to 127 Tick Type: • C-C: tick message character by character • L-L: tick message line by line Msg. Dst: message destination (BM, TDE or Both) Web Show: show IDEC SmartRelay Basic on Web server Line tick settings (to define whether a line ticks): • Line1 Tick • Line2 Tick • Line3 Tick • Line4 Tick • Line5 Tick • Line6 Tick **Note:** You can only edit the Text parameter of the message from IDEC SmartRelay Basic. ISO8859-1 is the only available character set for editing text. You can edit all other parameters, and other languages for the Text parameter from WindLGC. For configuration details, refer to the Online Help for WindLGC.
	Output Q	Q remains set as long as the message text is set.

Restriction

A maximum of 50 message text blocks are available.

Functional description

When IDEC SmartRelay is in RUN mode, IDEC SmartRelay displays the message text that you have configured along with its parameter values upon a 0 to 1 transition of the signal at input En.

Based on your setting for the message destination, the message text displays on the IDEC SmartRelay onboard display, the FL1F-RD1, or both.

If you use marker M27 in your circuit program, then if M27=0 (low) then IDEC SmartRelay displays the message text only if it is from the primary character set (Character Set 1). If M27=1 (high), then IDEC SmartRelay displays the message text only if it is from the secondary character set (Character Set 2). (See the M27 marker description in topic Constants and connectors (Page 116)).

If you have configured message ticking, the message will tick on and off the display according to your specifications, either a character at a time, or a line at a time.

If acknowledgment is disabled (Ack = No), the message text is hidden when the status of the signal at input En changes from 1 to 0.

If acknowledgment is enabled (Ack = Yes) and the status of the signal at input En changes from 1 to 0, the message text is output until it is acknowledged with **OK**. When En = 1, you cannot acknowledge the message text.

When multiple message text functions are triggered with En=1, IDEC SmartRelay displays the message text with the highest priority (0 = lowest, 127 = highest). This also means that IDEC SmartRelay displays a newly activated message text only if its priority is higher than that of previously activated message texts.

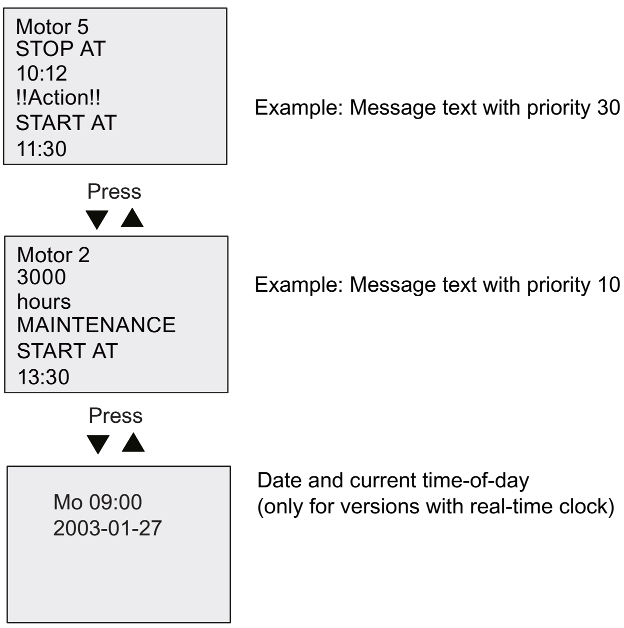
After a message text is disabled or acknowledged, the function automatically shows the previously active message text that takes the highest priority.

You can press the ▲ and ▼ keys to step through multiple active message texts.

Example

This is how two message texts could be shown:

Display field of IDEC SmartRelay in RUN mode



Message ticking

You can configure message text lines to tick or not tick. Two types of message ticking exist:

- Character by character
- Line by line

Messages that tick character by character scroll off the characters of the message line one character at a time to the left with the additional characters scrolling in one at a time from the right. The time interval for the tick is specified by the TickTime message text setting.

Messages that tick line by line scroll one half of the message off the display to the left with the second half of the message scrolling in from the right. The time interval for the tick is ten times the TickTime parameter. The two halves of the message simply alternate on the IDEC SmartRelay onboard display or FL1F-RD1.

Example: tick message character by character

The following illustration shows a one-line, 24-character message text:

X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}	X_{16}	X_{17}	X_{18}	X_{19}	X_{20}	X_{21}	X_{22}	X_{23}	X_{24}

If you set this message to tick "character by character" with a tick interval of 0.1 seconds, then the initial appearance of this message line on the IDEC SmartRelay onboard display or FL1F-RD1 is as shown in this illustration:

X_1 X_2 X_3 X_4 X_5 X_6 X_7 X_8 X_9 X_{10} X_{11} X_{12} | X_{13} X_{14} X_{15} X_{16} X_{17} X_{18} X_{19} X_{20} X_{21} X_{22} X_{23} X_{24}

After 0.1 second, one character of the message line ticks. The message appears as follows on the IDEC SmartRelay onboard display or FL1F-RD1:

X_2 X_3 X_4 X_5 X_6 X_7 X_8 X_9 X_{10} X_{11} X_{12} X_{13} | X_{14} X_{15} X_{16} X_{17} X_{18} X_{19} X_{20} X_{21} X_{22} X_{23} X_{24} X_1

Example: tick message line by line

The following example uses the same message configuration as the previous example:

X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}	X_{16}	X_{17}	X_{18}	X_{19}	X_{20}	X_{21}	X_{22}	X_{23}	X_{24}

If you set this message to tick "line by line" with a tick interval of 0.1 seconds, then the initial appearance of this message on the IDEC SmartRelay onboard display or FL1F-RD1 is the left half of the message as shown in this illustration:

X_1 X_2 X_3 X_4 X_5 X_6 X_7 X_8 X_9 X_{10} X_{11} X_{12} | X_{13} X_{14} X_{15} X_{16} X_{17} X_{18} X_{19} X_{20} X_{21} X_{22} X_{23} X_{24}

After 1 second (10 x 0.1 second), the message ticks to show the right half of the message as shown in this illustration:

X13 X14 X15 X16 X17 X18 X19 X20 X21 X22 X23 X24 X1 X2 X3 X4 X5 X6 X7 X8 X9 X10 X11 X12

The screen display alternates between the two message halves every second.

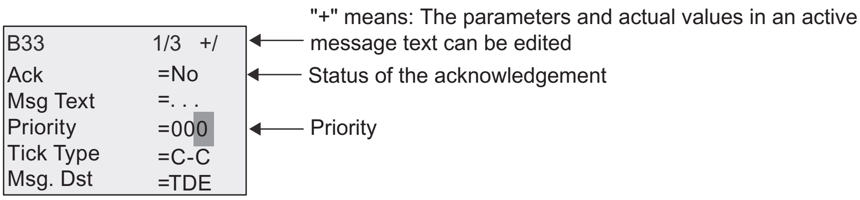
You can configure each individual line of a message text to tick or not tick. The "character by character" or "line by line" setting applies to all lines that you configure to tick.

Setting the Par parameter

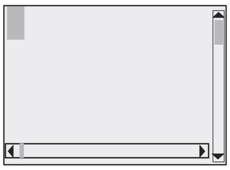
From the input P, you configure the following characteristics of the message text:

- Priority
- Acknowledgement
- Message destination
- Tick type, and tick setting for each line

View in programming mode:



1. Press ▶ to position the cursor on the "ACK" line.
2. Press **OK**. Enable "Ack": Press ▲ or ▼.
3. Position the cursor on the "Msg Text" line by pressing ▶. Press **OK** twice. To select a line for the message text, press ▲ and ▼. IDEC SmartRelay shows as follows:



4. Press ▲ and ▼ to select the letter to be displayed in the text. To move the cursor from one position to another, press ◀ and ▶.

> **Note**
>
> The list of available characters is the same as for the circuit program name. The character set is found in topic Circuit program input (Page 67). When you enter message text from IDEC SmartRelay Basic, you can only enter characters from the ISO8859-1 character set. To enter text from another language, you must enter the text in WindLGC.
>
> Note that the number of characters per line of message text can be greater than the number of character positions on the IDEC SmartRelay onboard display.

5. Confirm your entries with **OK**.
6. Press ▶ to position the cursor on the "Priority" line.
7. Increase the priority by pressing ▲.

8. Press ▶ to position the cursor on the "Msg. Dst" line.

```
B33          1/3  +/
Ack          =No
Msg Text     =. . .
Priority     =001
Tick Type    =C-C
Msg. Dst     =TDE
```

Message destination: IDEC SmartRelay Basic Module, FL1F-RD1, or both

9. Press ▲ or ▼ to toggle through the three choices for message destination: BM, TDE, or Both.

10. Press ◀ to position the cursor on the "Tick Type" line.

```
B33          1/3  +/
Ack          =No
Msg Text     =. . .
Priority     =001
Tick Type    =C-C
Msg. Dst     =TDE
```

Tick Type: character by character (C-C) or line by line (L-L)

11. Press ▲ or ▼ to select either "C-C" or "L-L" for the "Tick Type".

12. Enable or disable ticking for each line of the message text by pressing ▶ . IDEC SmartRelay displays as follows:

```
B33          2/3  +/
Web Show     =No
Line1 Tick   =No
Line2 Tick   =No
Line3 Tick   =No
Line4 Tick   =No
```

No: Disable message text display on the Web server
Yes: Enable message text display on the Web server

No: Line does not tick
Yes: Line ticks

13. To choose between "No" and "Yes" to define whether Line 1 ticks, press ▲ or ▼.

14. Press ▶ to move the cursor to the second line, and press ▲ or ▼ to choose between "No" and "Yes" for Line 2. Configure line ticking for lines 3, 4, 5 and 6 in the same way as for lines 1 and 2.

15. Position the cursor on the "Web Show" line by pressing ▶. Press ▲ or ▼ to select between "No" and "Yes" for "Web Show".

16. Press **OK** to confirm the complete message text configuration.

Visible parameters or process variables

The following parameters or process variables can be displayed in a message text, as either numerical values or bar-graph representations of values:

Special function	Parameter or process variable visible in a message text
Timers	
On-delay	T, T_a
Off-delay	T, T_a
On-/Off-delay	T_a, TH, TL
Retentive on-delay	T, T_a
Interval time-delay relay (pulse output)	T, T_a
Edge-triggered interval time-delay relay	T_a, TH, TL
Asynchronous pulse generator	T_a, TH, TL
Random generator	T_H, TL
Stairwell light switch	T_a, T, T!, T!L
Dual-function switch	T_a, T, TL, T!, T!L
Seven-day time switch	3*on/off/day
Twelve-month time switch	On, Off
Astronomical clock	Longitude, latitude, zone, TS, TR
Stopwatch	TB, Ta, Lap, AQ
Counter	
Up/down counter	Cnt, On, Off
Operating hours counter	MI, Q, OT
Frequency trigger	f_a, On, Off, G_T
Analog	
Analog trigger	On, Off, A, B, Ax
Analog differential trigger	On, n, A, B, Ax, Off
Analog comparator	On, Off, A, B, Ax, Ay, nA
Analog watchdog	n, A, B, Ax, Aen
Analog amplifier	A, B, Ax
Analog multiplexer	V1, V2, V3, V4, AQ
Analog ramp control	L1, L2, MaxL, StSp, Rate, A, B, AQ
PI controller	SP, Mq, KC, TI, Min, Max, A, B, PV, AQ
Analog math	V1, V2, V3, V4, AQ
PWM (Pulse Width Modulator)	A, B, T, Ax amplified
Miscellaneous	
Latching relay	-
Current impulse relay	-
Message texts	-
Softkey	On/Off
Shift register	-
Analog filter	Sn, Ax, AQ

Special function	Parameter or process variable visible in a message text
Max/Min	Mode, Min, Max, Ax, AQ
Average value	Ax, St, Sn, AQ
Float /Integer Converter	Typ, VM, Res, eAx, Aq,
Integer/Float Converter	Typ, VM, Res, eAx, eAq, Aq,

For timers, a message text can also display the remaining time. "Remaining time" refers to how much time of the parameter setting remains.

Bar graphs can be either horizontal or vertical representations of the current or actual value scaled between the minimum and maximum value. For more information on configuring and displaying bar graphs in message texts, refer to the Online Help for WindLGC.

Editing message texts

You can only edit simple message texts from IDEC SmartRelay Basic. You cannot edit message texts that contain features such as bar graphs, I/O status names, and others from IDEC SmartRelay Basic. You can only edit these types of message texts from WindLGC.

Also, you **cannot** edit message texts from IDEC SmartRelay Basic that contain any of the following parameters:

- Par
- Time
- Date
- EnTime
- EnDate
- Analog input
- Digital I/O status
- Special characters (for example: ±, €)

You can only edit such message texts from WindLGC.

Changing parameters in the active message text

When the message text is active, press **ESC** to select the editing mode.

Note

You must keep the **ESC** key pressed for at least one second.

Press ◀ and ▶ to select the relevant parameter. Press **OK** to change the parameter. Use the ▲ and ▼ keys to edit a parameter.

Confirm your changes with **OK**. You can now edit further parameters in the message text (if any exist). Press **ESC** to exit editing mode.

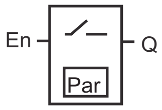
Key input simulation in the active message text

You can enable the four cursor keys C ▲, C ▼, C ◀ and C ▶ in an active message text by pressing **ESC** plus the relevant cursor key.

4.4.26 Softkey

Short description

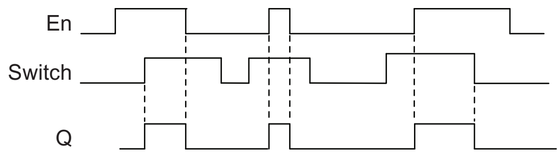
This special function has the effect of a mechanical pushbutton or switch.

Symbol in IDEC SmartRelay	Wiring	Description
 Softkey	Input En	Output Q is set with a 0 to 1 transition of the signal at input En (Enable), and if "Switch=On" was confirmed in parameter assignment mode.
	Parameter	Programming mode: Selecting the function for pushbutton action for the duration of one cycle, or for switching action. Start: on or off state, initialized at the first start of the program. Retentivity: / = no retentivity R = the status is retentive. Parameter assignment mode (RUN mode): Switch: switches the momentary pushbutton (switch) on or off.
	Output Q	Switches on if En=1 and Switch=On was confirmed with **OK**.

Factory setting

The default parameter setting is switching action.

Timing diagram



Functional description

In parameter assignment mode, the output is set with a signal at input En, if the "Switch" parameter is set to "On" and confirmed with **OK**. Whether the function was configured for pushbutton or switching action is of no concern here.

The output is reset to "0" in the following three cases:

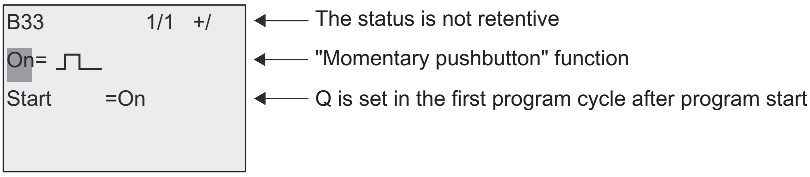
- After a 1 to 0 transition at input En
- When the function was configured for momentary pushbutton action, and one cycle has expired since it was switched on
- When the position "Off" was selected at the "Switch" parameter and confirmed with **OK** in parameter assignment mode

If retentivity is not set, output Q is initialized after a power failure according to your configuration at the "Start" parameter.

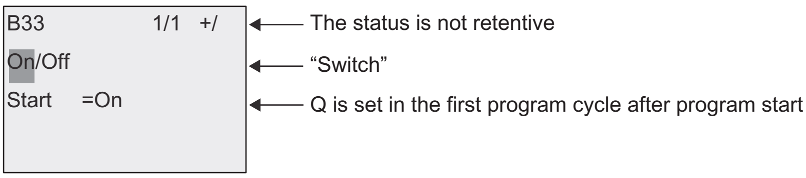
Setting the Par parameter

View in programming mode (example):

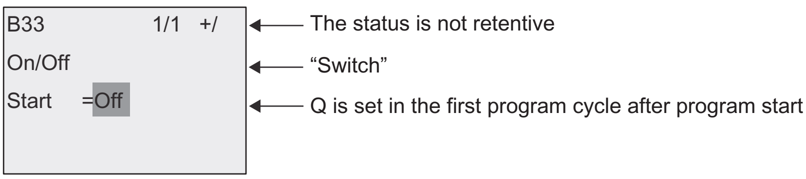
1. Position the cursor on "Par". Press **OK**.
2. Press ▶ to position the cursor on the "On" line.



3. Press **OK**. Select "Momentary pushbutton" or "Switch": Press ▲ or ▼.



4. Press ▶ to move the cursor to "Start" line.
5. To change the "Start" state: Press ▲ or ▼.



6. Confirm your entries with **OK**.

View in parameter assignment mode (example):

Here, you can set or reset the "Switch" parameter (On/Off). When in RUN, IDEC SmartRelay shows the following display:

```
B33          1/1
Switch   =Off
```

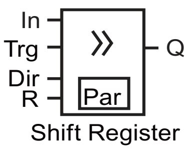
Let us assume you want to set "Switch" (On).

1. Press **OK** (the cursor is now positioned on "Off").
2. To change from "Off" to "On": Press ▲ or ▼.
3. Confirm your entries with **OK.**

4.4.27 Shift register

Short description

You can use the shift register function to read the value of an input and to shift its bits left or right. The output value corresponds with the configured shift register bit. The shifting direction can be changed at a special input.

Symbol in IDEC SmartRelay	Wiring	Description
	Input In	Input read at the start of the function.
	Input Trg	A positive edge (0 to 1 transition) at input Trg (Trigger) starts the special function. 1 to 0 transitions are irrelevant.
	Input Dir	The signal at input Dir determines the shifting direction for the shift register bits Sx.1 to Sx.8. "x" refers to the configured shift register byte index 1, 2, 3, or 4. Dir = 0: shift up (Sx.1>>Sx.8) Dir = 1: shift down (Sx.8>>Sx.1)
	Input R	The SFB is reset with a positive edge (0 to 1 transition) at input R (Reset). All the shift register bit (Sx.1 to Sx.8) are set to 0 when the SFB is reset.
	Parameter	Shift register bit that determines the value at output Q. Possible settings: Byte index: 1 to 4 Q: S1 to S8 IDEC SmartRelay provides a maximum of 32 shift register bits, with eight bits per shift register. Retentivity: / = no retentivity R = the status is retentive.
	Output Q	The output value corresponds with the configured shift register bit.

Functional description

The function reads the value at input In with a positive edge (0 to 1 transition) at input Trg (Trigger).

This value is applied to shift register bit Sx.1 or Sx.8 depending on the shifting direction, where "x" refers to the index number of the shift register and the number after the decimal point refers to the bit number:

- Shift up: the value at input In is set at Sx.1; the previous value at Sx.1 is shifted to Sx.2; the previous value at Sx.2 is shifted to Sx.3 etc.
- Shift down: the value at input In is set at Sx.8; the previous value at Sx.8 is shifted to Sx.7; the previous value at Sx.7 is shifted to Sx.6 etc.

Output Q returns the value of the configured shift register bit.

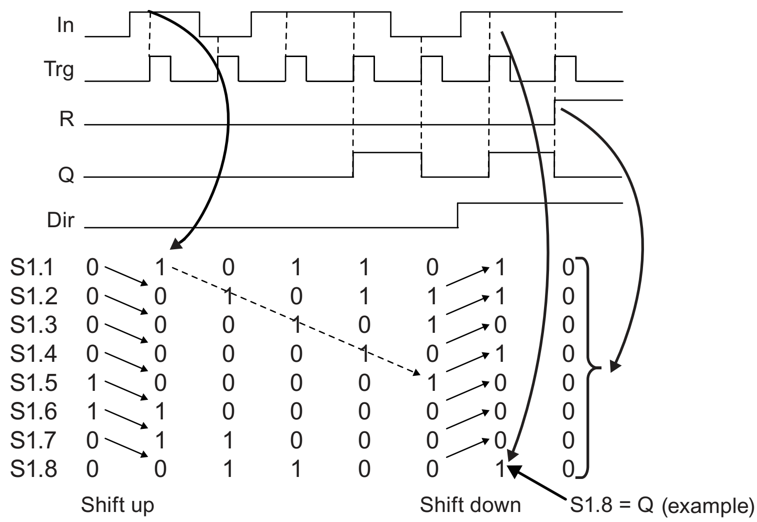
If retentivity is disabled, the shift function restarts at Sx.1 or Sx.8 after a power failure. When enabled, retentivity always applies to all shift register bits.

Note

There are a maximum of four shift register function blocks available for use in the circuit program in IDEC SmartRelay.

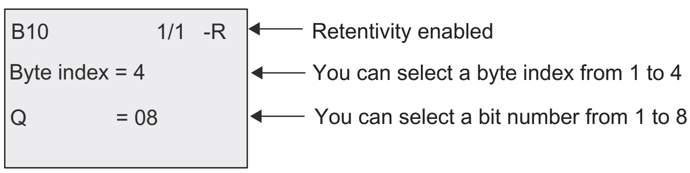
Timing diagram

The timing diagram example for the shift register in IDEC SmartRelay is shown as follows:



Setting the Par parameter

View in programming mode (example):



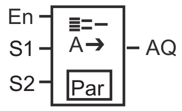
The view above indicates that the configured shift register bit is S4.8.

This special function is not available in parameter assignment mode.

4.4.28 Analog multiplexer

Short description

This special function outputs one of four predefined analog values or 0 at the analog output.

Symbol in IDEC SmartRelay	Wiring	Description
 Analog MUX	Input En	A change in status from 0 to 1 at input En (Enable) switches a parameterized analog value to the output AQ, depending on the value of S1 and S2.
	Inputs S1 and S2	S1 and S2 (selectors) for selecting the analog value to be issued. • S1 = 0 and S2 = 0: value 1 is issued. • S1 = 0 and S2 = 1: value 2 is issued. • S1 = 1 and S2 = 0: value 3 is issued. • S1 = 1 and S2 = 1: value 4 is issued.
	Parameter	V1 to V4: analog values that will be issued. Range of values: -32768 to 32767 p: number of decimals Range of values: 0, 1, 2, 3
	Output AQ	This special function has an analog output. This output can only be connected with analog inputs, analog memory markers, analog outputs or network analog outputs. Range of values for AQ: -32768 to 32767

Parameters V1...V4

The analog values for the parameters V1to V4 can be derived from another already-programmed function. You can use the actual values of the following functions:

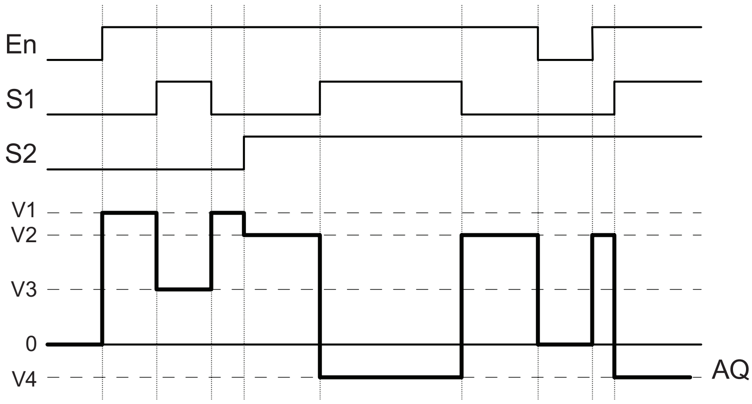
- Analog comparator (Page 187) (actual value Ax – Ay)
- Analog trigger (Page 182) (actual value Ax)
- Analog amplifier (Page 195) (actual value Ax)
- Analog ramp control (Page 216) (actual value AQ)
- Analog Math (Page 228) (actual value AQ)
- PI controller (Page 220) (actual value AQ)
- Up/down counter (Page 172) (actual value Cnt)
- Analog multiplexer (actual value AQ)
- Analog filter (Page 233) (actual value AQ)
- Average value (Page 239) (actual value AQ)
- Max/Min (Page 235) (actual value AQ)
- On-delay (Page 136) (current time Ta)
- Off-delay (Page 140) (current time Ta)
- On-/off-delay (Page 142) (current time Ta)
- Retentive on-delay (Page 144) (current time Ta)
- Interval time-delay relay/Pulse output (Page 146) (current time Ta)
- Edge-triggered interval time-delay relay (Page 148) (current time Ta)
- Asynchronous pulse generator (Page 150) (current time Ta)
- Stairwell light switch (Page 154) (current time Ta)
- Dual-function switch (Page 156) (current time Ta)
- Stopwatch (Page 170) (actual value AQ)
- Frequency trigger (Page 179) (actual value Fre)

Select the required function by the block number. For information on parameter defaults, refer to the On-delay (Page 136) topic.

Parameter p (number of decimals)

Applies only to the values displayed in a message text.

Timing diagram



Functional description

If input En is set, then the function issues one of four possible analog values V1 to V4 at the output AQ, depending on the value of S1 and S2.

If the input En is not set, then the function issues the analog value 0 at output AQ.

Analog output

If you interconnect this special function with a real analog output, note that the analog output can only process values between 0 and 1000. To do this, you may need to connect an additional amplifier between the analog output of the special function and the real analog output. Using this amplifier, you standardize the output range of the special function to a value range of 0 to 1000.

Setting the Par parameter

View in programming mode (example):

```
B3          1/1  +/
V1   =+4000
V2   =-2000
V3   =+0
V4   =+0
p    =0
```

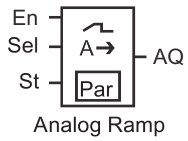
View in parameter assignment mode:

```
B3          1/1
V1   =+4000
V2   =-2000
V3   =+0
V4   =+0
AQ   =+0
```

4.4.29 Analog ramp control

Short description

This function allows the output to be changed from the current level to the selected level at a specified rate.

Symbol in IDEC SmartRelay	Wiring	Description
	Input En	A change in the status from 0 to 1 at input En (Enable) applies the start/stop level (Offset "B" + StSp) to the output for 100 ms and starts the ramp operation to the selected level. A change in the status from 1 to 0 immediately sets the current level to Offset "B", which makes output AQ equal to 0.
	Input Sel	Sel = 0: level 1 is selected. Sel = 1: level 2 is selected. A change in status of Sel causes the current level to start changing to the selected level at the specified rate.
	Input St	A change in the status from 0 to 1 at input St (Decelerated Stop) causes the current level to decrease at a constant rate until the start/stop level (Offset "B" + StSp) is reached. The start/stop level is maintained for 100 ms and then the current level is set to Offset "B", which makes output AQ equal to 0.

Symbol in IDEC SmartRelay	Wiring	Description
	Parameter	Level 1 and Level 2: levels to be reached Range of values for each level: -10000 to 20000 MaxL: maximum value that must not be exceeded under any circumstances. Range of values: -10000 to 20000 StSp: Start/Stop offset: value that is added to Offset "B" to create the start/stop level. If the Start/Stop offset is 0, then the start/stop level is Offset "B". Range of values: 0 to 20000 Rate: acceleration with which level 1, level 2 or Offset is reached. Steps/seconds are issued. Range of values: 1 to 10000 A: gain Range of values: 0 to 10.00 B: offset Range of values: -10000 to 10000 p: number of decimals Range of values: 0, 1, 2, 3
	Output AQ	Range of values for AQ: 0 to 32767 (Current Level - Offset "B") / Gain "A" Range of values: 0 to 32767 **Note**: When AQ is displayed in parameter mode or message mode, it is displayed as a scaled value, both on the IDEC SmartRelay Base Module and WindLGC (engineering units: current level).

Parameters L1, L2

The analog values for the parameters L1 and L2 can be derived from another already-programmed function. You can use the actual values of the following functions:

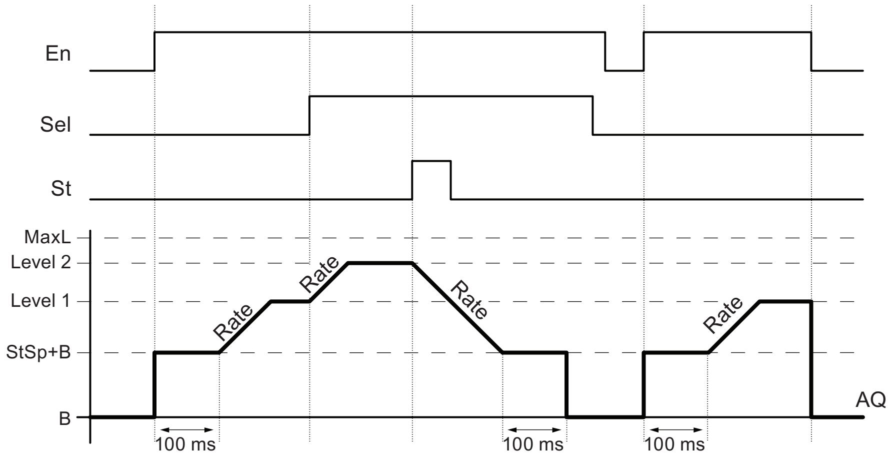
- Analog comparator (Page 187) (actual value Ax – Ay)
- Analog trigger (Page 182) (actual value Ax)
- Analog amplifier (Page 195) (actual value Ax)
- Analog multiplexer (Page 213) (actual value AQ)
- Analog Math (Page 228) (actual value AQ)
- PI controller (Page 220) (actual value AQ)
- Up/down counter (Page 172) (actual value Cnt)
- Analog filter (Page 233) (actual value AQ)
- Average value (Page 239) (actual value AQ)
- Max/Min (Page 235) (actual value AQ)
- On-delay (Page 136) (current time Ta)
- Off-delay (Page 140) (current time Ta)
- On-/off-delay (Page 142) (current time Ta)
- Retentive on-delay (Page 144) (current time Ta)
- Interval time-delay relay/Pulse output (Page 146) (current time Ta)
- Edge-triggered interval time-delay relay (Page 148) (current time Ta)
- Asynchronous pulse generator (Page 150) (current time Ta)
- Stairwell light switch (Page 154) (current time Ta)
- Dual-function switch (Page 156) (current time Ta)
- Stopwatch (Page 170) (actual value AQ)
- Analog ramp control (actual value AQ)
- Frequency trigger (Page 179) (actual value Fre)

Select the required function by the block number. For information on parameter defaults, refer to the On-delay (Page 136) topic.

Parameter p (number of decimals)

Applies only to the AQ, L1, L2, MaxL, StSp and Rate values displayed in a message text.

Timing diagram for AQ



Functional description

If the input En is set, then the function sets the current level to StSp + Offset "B" for 100 ms.

Then, depending on the connection of Sel, the function runs from the level StSp + Offset "B" to either level 1 or level 2 at the acceleration set in Rate.

If the input St is set, the function runs to a level of StSp + Offset "B" at the acceleration set in Rate. Then the function holds the level at StSp + Offset "B" for 100 ms. After 100 ms, the level is set to Offset "B". The scaled value (output AQ) is 0.

If the input St is set, the function can only be restarted after the inputs St and En have been reset.

If input Sel has been changed, depending on the connection of Sel, the function runs from the current target level to the new target level at the rate that is specified.

If the input En is reset, the function immediately sets the current level to Offset "B".

The current level is updated every 100 ms. Note the following relationship between output AQ and the current level:

Output AQ = (current level - Offset "B") / Gain "A"

Note

For further information on analog value processing, please refer to the Online Help for WindLGC.

Setting the Par parameter

View in programming mode (example):

```
B3           1/2   +/
L1     =+4000
L2     =+2000
StSp   =222
Rate   =500
MaxL   =+7000
```

Press ▶

```
B3           2/2   +/
A    =2.50          ← Gain
B    =-300          ← Offset
P    =0             ← Decimals in the message text
```

View in parameter assignment mode:

```
B3           1/2
L1     =+4000
L2     =+2000
AQ     =+0
StSp   =222
Rate   =500
```

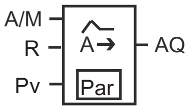
Press ▶

```
B3           2/2
A    =2.50          ← Gain
B    =-300          ← Offset
```

4.4.30 PI controller

Short description

Proportional-action and integral-action controllers. You can use both types of controller individually or combined.

Symbol in IDEC SmartRelay	Wiring	Description
 PI Controller	Input A/M	Set the mode of the controller: 1: automatic mode 0: manual mode
	Input R	Use the input R to reset the output AQ. As long as this input is set, the input A/M is disabled. Output AQ is set to 0.
	Input PV	Analog value: process variable, influences the output
	Parameter	SP: set-value assignment Range of values: -10,000 to 20,000 KC: gain Range of values: 00.00 to 99.99 TI: integral time Range of values: 00:01m to 99:59 m Dir: action direction of the controller Range of values: + or - Mq: value from AQ with manual mode Range of values: 0 to 1,000 Min: minimum value for PV Range of values: -10,000 to 20,000 Max: maximum value for PV Range of values: -10,000 to 20,000 A: gain Range of values: -10.00 to 10.00 B: offset Range of values: -10,000 to 10,000 p: number of decimals Range of values: 0, 1, 2, 3
	Output AQ	This special function has an analog output (= manipulated variable). This output can only be connected with analog inputs, analog memory markers, analog outputs or network analog outputs. Range of values for AQ: 0 to 1,000

Parameters SP and Mq

The set-value SP and the value for Mq can be provided by another already-programmed function. You can use the actual values of the following functions:

- Analog comparator (Page 187) (actual value Ax – Ay)
- Analog trigger (Page 182) (actual value Ax)
- Analog amplifier (Page 195) (actual value Ax)
- Analog multiplexer (Page 213) (actual value AQ)
- Analog ramp control (Page 216) (actual value AQ)
- Analog Math (Page 228) (actual value AQ)
- Up/down counter (Page 172) (actual value Cnt)
- Analog filter (Page 233) (actual value AQ)
- Average value (Page 239) (actual value AQ)
- Max/Min (Page 235) (actual value AQ)
- On-delay (Page 136) (current time Ta)
- Off-delay (Page 140) (current time Ta)
- On-/off-delay (Page 142) (current time Ta)
- Retentive on-delay (Page 144) (current time Ta)
- Interval time-delay relay/Pulse output (Page 146) (current time Ta)
- Edge-triggered interval time-delay relay (Page 148) (current time Ta)
- Asynchronous pulse generator (Page 150) (current time Ta)
- Stairwell light switch (Page 154) (current time Ta)
- Dual-function switch (Page 156) (current time Ta)
- Stopwatch (Page 170) (actual value AQ)
- PI controller (actual value AQ)
- Frequency trigger (Page 179) (actual value Fre)

Select the required function by the block number. For information on parameter defaults, refer to the On-delay (Page 136) topic.

Parameters KC, TI

Please note the following circumstances:

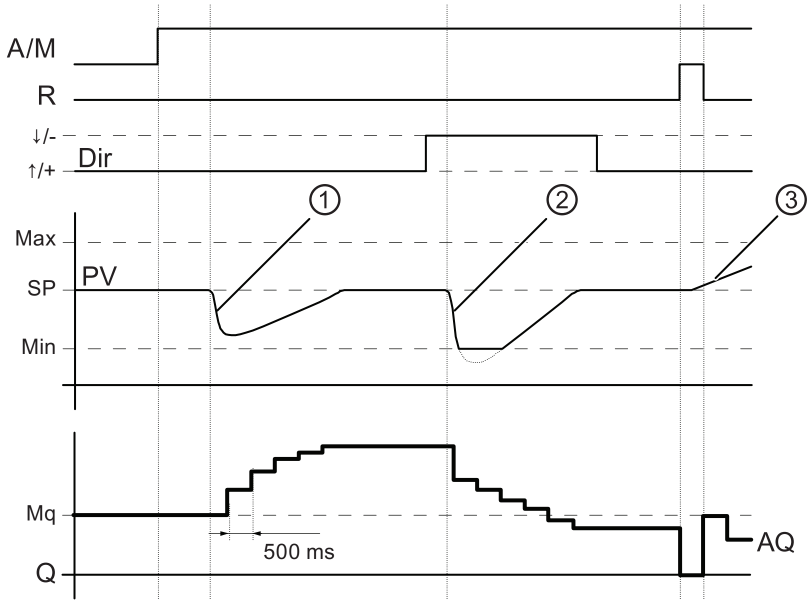
- If parameter KC has value 0, the "P" function (proportional control) will not be executed.
- If parameter TI has value 99:59 m, the "I" function (integral-action control) will not be executed.

Parameter p (number of decimals)

Applies only to the PV, SP, Min and Max values displayed in a message text.

Timing diagram

The nature, manner and speed with which the AQ changes depend on the parameters KC and TI. Thus, the course of AQ in the diagram is merely an example. A control action is continuous; therefore the diagram portrays just an extract.



1. A disturbance causes the PV to drop, as Dir is positioned upwards, AQ increases until PV corresponds again to SP.
2. A disturbance causes the PV to drop, as Dir is positioned downwards, AQ decreases until PV corresponds again to SP.
   It is not possible to change the direction (Dir) at runtime of the function. The change is shown here for illustrative purposes only.
3. As AQ is set to 0 by means of the input R, PV changes. This is based on the fact that PV increases, which on account of Dir = upwards causes AQ to drop.

Functional description

If the input A/M is set to 0, then the special function issues output AQ with the value that you set with parameter Mq.

If the input A/M is set to 1, then automatic mode commences. As an integral sum the value Mq is adopted, the controller function begins the calculations.

Note

For further information on the controller basics, please refer to the Online Help for WindLGC.

The updated value PV is used to calculate in the formulas:

Updated value PV = (PV • gain) + offset

- If the updated value PV = SP, then the special function does not change the value of AQ.
- Dir = upwards (+) (timing diagram numbers 1. and 3.)
  - If the updated value PV > SP, then the special function reduces the value of AQ.
  - If the updated value PV < SP, then the special function increases the value of AQ.

- Dir = downwards (-) (timing diagram number 2.)
  - If the updated value PV > SP, then the special function increases the value of AQ.
  - If the updated value PV < SP, then the special function reduces the value of AQ.

With a disturbance, AQ continues to increase / decrease until the updated value PV again corresponds to SP. The speed with which AQ changes depends on the parameters KC and TI.

If the input PV exceeds the parameter Max, then the updated value PV is set to the value of Max. If the PV falls short of the parameter Min, then the updated value PV is set to the value of Min.

If the input R is set to 1, then the AQ output is reset. As long as R is set, the input A/M is disabled.

Sampling time

The sampling time is fixed at 500 ms.

Parameter sets

For more information and application examples with application-related parameter sets for KC, TI and Dir, refer to the Online Help for WindLGC.

Setting the Par parameter

View in programming mode (example):

```
B3          1/2  +/
SP   =+4000
KC   =10.00
TI   =01:00m
Dir  =+
Mq   =200
```

Press ▶

```
B3          2/2  +/
Min    =-5000
Max    =+5000
A      =+2.50
B      =-300
P      =0
```

View in parameter assignment mode:

```
B3          1/3
SP   =+4000
PV   =-292
AQ   =+0
KC   =10.00
TI   =01:00m
```

Press ▶

```
B3          2/3
Dir    =+
Mq     =200
Min    =-5000
Max    =+5000
A      =+2.50
```

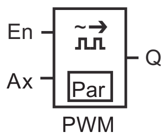
Press ▶

```
B3          3/3
B      =-300
```

4.4.31 Pulse width modulator (PWM)

Short description

The Pulse Width Modulator (PWM) instruction modulates the analog input value Ax to a pulsed digital output signal. The pulse width is proportional to the analog value Ax.

Symbol in IDEC SmartRelay	Wiring	Description
	Input En	A positive edge (0 to 1 transition) at input En enables the PWM function block.
	Input Ax	Analog signal to be modulated to a pulsed digital output signal.
	Parameter	A: gain Range of values: -10.00 to 10.00 B: zero offset Range of values: 10,000 to 10,000 T: periodic time over which the digital output is modulated p: number of decimals Range of values: 0, 1, 2, 3 Min: Range of values: -20,000 to 20,000 Max: Range of values: -20,000 to 20,000
	Output Q	Q is set or reset for the proportion of each time period according to the proportion of the standardized value Ax to the analog value range.

Parameter T

Note the defaults of the T parameters listed in topic Time response (Page 128).

The periodic time T can be provided by the actual value of another already-programmed function. You can use the actual value of the following functions:

- Analog comparator (Page 187) (actual value Ax – Ay)
- Analog trigger (Page 182) (actual value Ax)
- Analog amplifier (Page 195) (actual value Ax)
- Analog multiplexer (Page 213) (actual value AQ)
- Analog ramp control (Page 216) (actual value AQ)
- Analog Math (Page 228) (actual value AQ)
- PI controller (Page 220) (actual value AQ)
- Up/down counter (Page 172) (actual value Cnt)
- Analog filter (Page 233) (actual value AQ)
- Average value (Page 239) (actual value AQ)
- Max/Min (Page 235) (actual value AQ)
- On-delay (Page 136) (current time Ta)
- Off-delay (Page 140) (current time Ta)
- On-/off-delay (Page 142) (current time Ta)
- Retentive on-delay (Page 144) (current time Ta)
- Interval time-delay relay/Pulse output (Page 146) (current time Ta)
- Edge-triggered interval time-delay relay (Page 148) (current time Ta)
- Asynchronous pulse generator (Page 150) (current time Ta)
- Stairwell light switch (Page 154) (current time Ta)
- Dual-function switch (Page 156) (current time Ta)
- Stopwatch (Page 170) (actual value AQ)
- Frequency trigger (Page 179) (actual value Fre)

Select the required function by the block number. The timebase is configurable. For information on valid ranges and parameter defaults, refer to the On-delay (Page 136) topic.

Parameters p (number of decimals)

Parameter p applies only to the display of the Ax value in a message text.

Functional description

The function reads the value of the signal at the analog input Ax.
This value is multiplied by the value of parameter A (gain). Parameter B (offset) is added to the product, as follows:

(Ax • Gain) + Offset = Actual value Ax

The function block calculates the proportion of the actual value Ax to the range. The block sets the digital output Q high for the same proportion of the T (periodic time) parameter, and sets Q low for the remainder of the time period.

Examples with timing diagrams

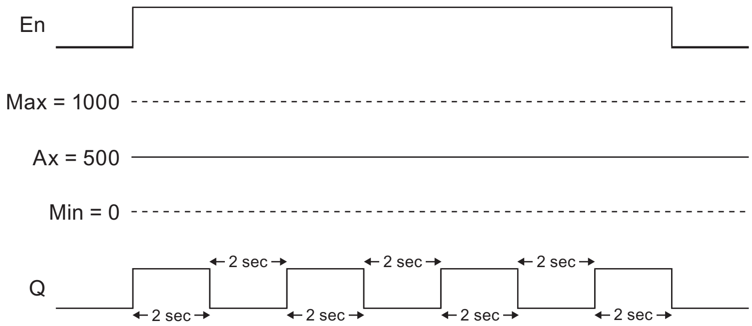
The following examples show how the PWM instruction modulates a digital output signal from the analog input value:

Example 1

Analog input value: 500 (range 0 to 1,000)

Periodic time T: four seconds

The digital output of the PWM function is 2 seconds high, 2 seconds low, 2 seconds high, 2 seconds low and continues in that pattern as long as parameter "En" = high.

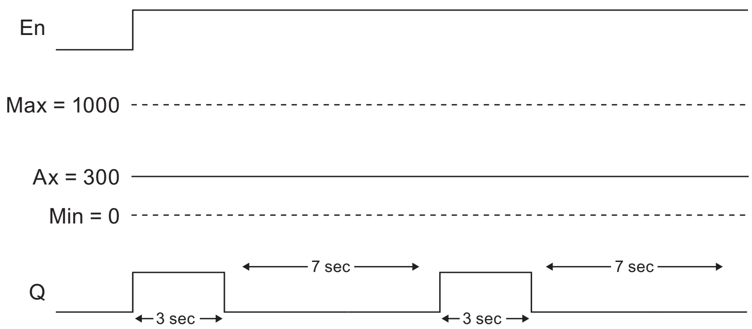


Example 2

Analog input value: 300 (range 0 to 1,000)

Periodic time T: 10 seconds

The digital output of the PWM function is three seconds high, seven seconds low, three seconds high, seven seconds low and continues in that pattern as long as parameter "En" = high.



Calculation rule

Q = 1, for (Ax - Min)/ (Max - Min) of time period T, when Min < Ax < Max.
Q = 0, for PT - [(Ax - Min) / (Max - Min)] of periodic time T.

Note: Ax in this calculation refers to the actual value Ax as calculated using the Gain and Offset.

Setting the Par Parameter

The following illustration shows the view in programming mode that corresponds to the first example:

```
B1          1/2  +/
Min  =+0
Max  =+1000
A    =+1.00
B    =+0
T    =00:04s
```

Press ▶

```
B1          2/2  +/
P   =2
```

View in parameter assignment mode:

```
B1          1/2
Min  =+0
Max  =+1000
A    =+1.00
Ax   =+0
B    =+0
```

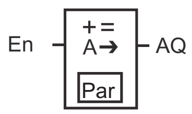
Press ▶

```
B1          2/2
T   =00:04s
```

4.4.32 Analog Math

Short description

The analog math block calculates the value AQ of an equation formed from the user-defined operands and operators.

Symbol in IDEC SmartRelay	Wiring	Description
 Analog Math	Input En	A change in the status from 0 to 1 at input En (Enable) enables the analog math function block.
	Parameter	**V1:** first operand value **V2:** second operand value **V3:** third operand value **V4:** fourth operand value **Op1:** first operator **Op2:** second operator **Op3:** third operator **Operator Prio:** priority of the operands **Qen → 0:** 0: reset value of AQ to 0 when En=0 1: retain last value of AQ when En=0 **p:** number of decimals Range of values: 0, 1, 2, 3
	Output AQ	The output AQ is the result of the equation formed from the operand values and operators. AQ will be set to 32767 if a divide by 0 or overflow occurs, and -32768 if a negative overflow (underflow) occurs.

Parameters V1 to V4

Another already-programmed function can provide the analog values for the parameters V1 to V4. You can use the actual values of the following functions:

- Analog comparator (Page 187) (actual value Ax – Ay)
- Analog trigger (Page 182) (actual value Ax)
- Analog amplifier (Page 195) (actual value Ax)
- Analog multiplexer (Page 213) (actual value AQ)
- Analog ramp control (Page 216) (actual value AQ)
- PI controller (Page 220) (actual value AQ)
- Up/down counter (Page 172) (actual value Cnt)
- Analog filter (Page 233) (actual value AQ)
- Average value (Page 239) (actual value AQ)
- Max/Min (Page 235) (actual value AQ)
- On-delay (Page 136) (current time Ta)
- Off-delay (Page 140) (current time Ta)
- On-/off-delay (Page 142) (current time Ta)
- Retentive on-delay (Page 144) (current time Ta)
- Interval time-delay relay/Pulse output (Page 146) (current time Ta)
- Edge-triggered interval time-delay relay (Page 148) (current time Ta)
- Asynchronous pulse generator (Page 150) (current time Ta)
- Stairwell light switch (Page 154) (current time Ta)
- Dual-function switch (Page 156) (current time Ta)
- Stopwatch (Page 170) (actual value AQ)
- Analog math (actual value AQ)
- Frequency trigger (Page 179) (actual value Fre)

Select the required function by the block number. For information on parameter defaults, refer to the On-delay (Page 136) topic.

Note

If the analog value for parameter V1, V2, V3 or V4 is derived from another already-programmed function whose actual value exceeds the value range for V1 to V4, IDEC SmartRelay will display the limit value -32768 if the value is less than the lower range or 32767 if the value is greater than the upper range.

Parameters p (number of decimals)

Parameter p applies only to the display of Value1, Value2, Value3, Value4 and AQ in a message text.

Functional description

The analog math function combines the four operations and three operators to form an equation. The operator can be any one of the four standard operators: +, -, *, or /. The priority of operators is determined by "( )" and "[ ]", in which "( )" has a higher priority. The operand values can reference another previously-defined function to provide the value. The analog math function rounds the result to the nearest integer value.

The number of operand values is fixed at four and the number of operators is fixed at 3. If you need to use fewer operands, use constructions such as + 0 or * 1 to fill the remaining parameters.

You can also configure the behavior of the function when the Enable parameter En=0. The function block can either retain its last value, or be set to 0. If the parameter Qen → 0 = 0, then the function sets AQ to 0 when En=0. If the parameter Qen → 0 = 1, then the function leaves AQ at its last value when En=0.

Possible errors: zero division and overflow

If the analog math function block execution results in zero division or overflow, it sets internal bits that indicate the type of error that occurred. You can program an analog math error detection function block in your circuit program to detect these errors, and to control the program behavior as needed. You program one analog math error detection function block to reference one specific analog math function block.

Examples

The following tables show some simple example analog math block parameters, and the resulting equations and output values:

V1	Op1 (Priority)	V2	Op2 (Priority)	V3	Op3 (Priority)	V4
12	[+]	6	(/)	3	-	1

Equation: [12 + (6 / 3)] - 1

Result: 13

V1	Op1 (Priority)	V2	Op2 (Priority)	V3	Op3 (Priority)	V4
2	+	3	[*]	1	(+)	4

Equation: 2 + [3 * (1 + 4)]

Result: 17

V1	Op1 (Priority)	V2	Op2 (Priority)	V3	Op3 (Priority)	V4
100	(-)	25	/	2	[+]	1

Equation: (100 - 25) / [2 + 1]

Result: 25

Setting the Par parameter

The following illustration shows the view in programming mode that corresponds to the first example [12 + (6 / 3)] - 1:

```
B1          1/3  +/
V1    =+12
OP1   =+
V2    =+6
OP2   =/
V3    =+3
```

Press ▶

```
B1          2/3  +/
OP3   =-
V4    =+1
Operator Prio:
[V1+(V2/V3)]-V4
Qen-> 0: 0
```

Press ▶

```
B1          3/3  +/
p   =0
```

View in parameter assignment mode:

```
B1          1/2
V1    =+12
OP1   =+
V2    =+6
OP2   =/
V3    =+3
```

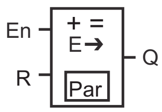
Press ▶

```
B1          2/2
OP3   =-
V4    =+1
Operator Prio:
[V1+(V2/V3)]-V4
Qen-> 0: 0
```

4.4.33 Analog Math error detection

Short description

The analog math error detection block sets an output if an error has occurred in the referenced Analog Math (Page 228) function block.

Symbol in IDEC SmartRelay	Wiring	Description
 AnalogMath Error	Input En	A change in the status from 0 to 1 at input En (Enable) enables the analog math error detection block.
	Input R	A signal at input R resets the output.
	Parameter	MathBN: block number of an analog math Err: ZD: divide by 0 error OF: overflow error ZD/OF: (divide by 0 error) OR (overflow error) AutoRst: reset the output before the next execution of the analog math error function block. Y = yes; N = no
	Output Q	Q is set high if the error to detect occurred in the last execution referenced analog math function block.

Parameter MathBN

The value for the MathBN parameter references the block number of an already-programmed analog math function block.

Functional description

The analog math error detection block sets the output when the referenced analog math function block has an error. You can program the function to set the output on a zero division error, an overflow error, or when either type of error occurs.

If AutoRst is set, the output is reset prior to the next execution of the function block. If AutoRst is not set, then whenever the output is set it remains set until the analog math error detection block is reset with the R parameter. In this way, even if the error subsequently clears, the circuit program still has knowledge that an error did occur at some point.

In any scan cycle, if the referenced analog math function block executes before the analog math error detection function block, the error is detected in the same scan cycle. If the referenced analog math function block executes after the analog math error detection function block, the error is detected in the next scan cycle.

Analog math error detection logic table

In the table below, Err represents the parameter of the analog math error detection instruction that selects which type of error to detect. ZD represents the zero division bit set by the analog math at the end of its execution: 1 if the error occurred, 0 if not. OF represents the overflow bit set by the analog math: 1 if the error occurred, 0 if not. The ZD/OF Err parameter represents the logical OR of the zero division bit and overflow bit of the referenced analog math instruction. Q represents the output of the analog math error detection function. An "x" indicates that the bit can be either 0 or 1 with no influence on the output.

Err	ZD	OF	Q
ZD	1	x	1
ZD	0	x	0
OF	x	1	1
OF	x	0	0
ZD/OF	1	0	1
ZD/OF	0	1	1
ZD/OF	1	1	1
ZD/OF	0	0	0

If the MathBN parameter is null, then the output Q is always 0.

Setting the Par parameter

The parameters MathBN, AutoRst, and Err can be set in programming mode or parameter assignment mode.

View in programming mode (example):

Display		
B3	1/1 +/	
MathBN	=B001	Block number of an already-programmed analog math instruction
AutoRst	=No	Auto Reset (Y or N)
Err	=ZD/OF	ZD, OF, or ZD/OF

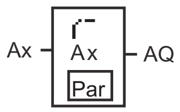
View in parameter assignment mode (example):

Display		
B3	1/1	
MathBN	=B001	Block number of an already-programmed analog math instruction
AutoRst	=No	Auto Reset (Y or N)
Err	=ZD/OF	ZD, OF, or ZD/OF

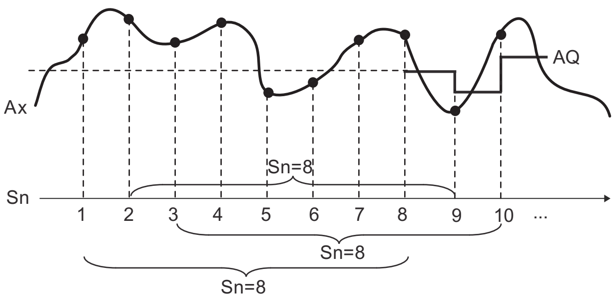
4.4.34 Analog filter

Short description

The analog filter function smooths the analog input signal.

Symbol in IDEC SmartRelay	Wiring	Description
 Analog Filter	Ax	Input Ax is the analog input signal to be smoothed. Input Ax is one of the following analog signals: • AI1 to AI8 (*) • AM1 to AM64 • NAI1 to NAI32 • AQ1 to AQ8 • NAQ1 to NAQ16 • Block number of a function with analog output
	Parameter	Sn (Number of samples) determines how many analog values are sampled within the program cycles that are determined by the set number of samples. IDEC SmartRelay samples an analog value within every program cycle. The number of program cycles is equal to the set number of samples. Possible settings: 8, 16, 32, 64, 128, 256
	Output AQ	AQ is the average value of input Ax over the current number of samples.
* AI1 to AI8: 0 V to 10 V corresponds with 0 to 1000 (internal value).		

Timing diagram (example)



Functional description

The function fetches the analog signal at input Ax based on the set number of samples (Sn) and outputs the average value.

Note

There are a maximum of eight analog filter function blocks available for use in the circuit program in IDEC SmartRelay.

Setting the Par parameter

View in programming mode (example):

```
B20           1/1  +/     <-- Protection mode
Sn  =128                  <-- Number of samples
```

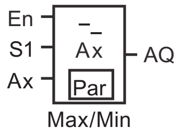
View in parameter assignment mode (example):

```
B20           1/1
Sn     =128
AQ     =+0
```

4.4.35 Max/Min

Short description

The Max/Min function records the maximum or minimum value of Ax.

Symbol in IDEC SmartRelay	Wiring	Description
	En	A signal at input En (Enable) outputs an analog value to AQ, depending on the settings of parameters ERst and Mode.
	S1	S1 functions only when the parameter Mode is set to 2. If Mode is set to 2, a change in status from 0 to 1 at input S1 (selector) outputs the maximum value to AQ. If Mode is set to 2, a change in status from 1 to 0 at S1 outputs the minimum value to AQ.
	Ax	Input Ax is one of the following analog signals: • AI1 to AI8 (*) • AM1 to AM64 • NAI1 to NAI32 • AQ1 to AQ8 • NAQ1 to NAQ16 • Block number of a function with analog output
	Parameter	Mode: Possible settings: 0, 1, 2, 3 Mode = 0: AQ = Min Mode = 1: AQ = Max Mode = 2 and S1= 0 (low): AQ = Min Mode = 2 and S1= 1 (high): AQ = Max Mode = 3: AQ = Actual value of Ax ERst (Enable Reset): Possible settings: ERst = 0: disable reset ERst = 1: enable reset Retentivity: / = no retentivity R = the status is retentive
	Output AQ	The function issues a minimum, maximum, or current value at AQ, depending on your configuration.
* AI1 to AI8: 0 V to 10 V corresponds with 0 to 1000 (internal value).		

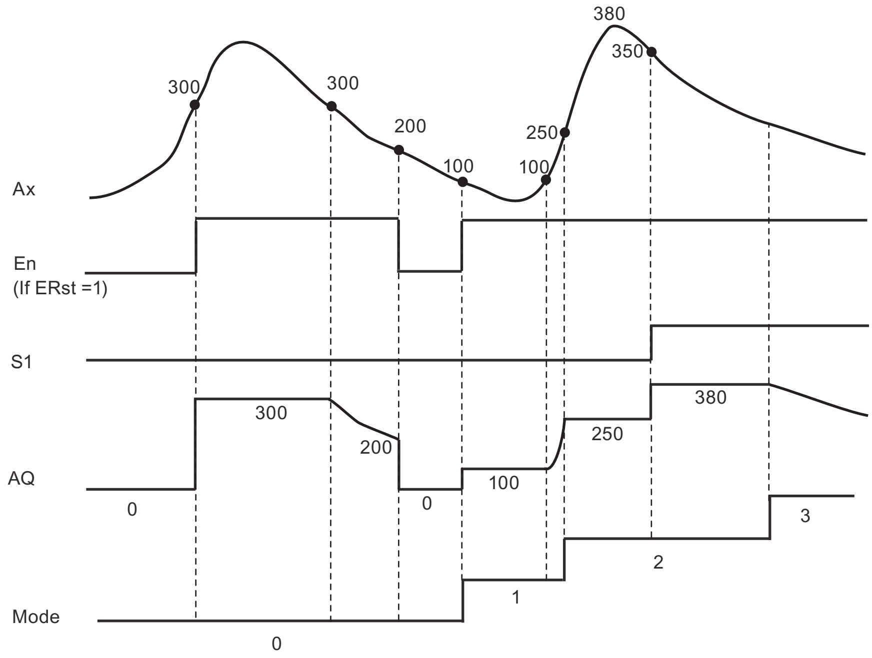
Parameter Mode

The actual value of another already-programmed function can provide the value for parameter Mode. You can use the actual values of the following functions:

- Analog comparator (Page 187) (actual value Ax – Ay)
- Analog trigger (Page 182) (actual value Ax)
- Analog amplifier (Page 195) (actual value Ax)
- Analog multiplexer (Page 213) (actual value AQ)
- Analog ramp control (Page 216) (actual value AQ)
- Analog Math (Page 228) (actual value AQ)
- PI controller (Page 220) (actual value AQ)
- Up/down counter (Page 172) (actual value Cnt)
- Analog filter (Page 233) (actual value AQ)
- Average value (Page 239) (actual value AQ)
- On-delay (Page 136) (current time Ta)
- Off-delay (Page 140) (current time Ta)
- On-/off-delay (Page 142) (current time Ta)
- Retentive on-delay (Page 144) (current time Ta)
- Interval time-delay relay/Pulse output (Page 146) (current time Ta)
- Edge-triggered interval time-delay relay (Page 148) (current time Ta)
- Asynchronous pulse generator (Page 150) (current time Ta)
- Stairwell light switch (Page 154) (current time Ta)
- Dual-function switch (Page 156) (current time Ta)
- Stopwatch (Page 170) (actual value AQ)
- Max/Min (actual value AQ)
- Frequency trigger (Page 179) (actual value Fre)

Select the required function by the block number.

Timing diagram (example)



Functional description

ERst = 1 and En = 0: the function sets the AQ value to 0.

ERst = 1 and En = 1: the function outputs a value at AQ, depending on the settings of Mode and S1.

ERst = 0 and En = 0: the function holds the value of AQ at the current value.

ERst = 0 and En = 1: the function outputs a value at AQ, depending on the settings of Mode and S1.

Mode = 0: the function sets AQ to the minimum value

Mode = 1: the function sets AQ to the maximum value

Mode = 2 and S1 = 0: the function sets AQ to the minimum value

Mode = 2 and S1 = 1: the function sets AQ to the maximum value

Mode = 3: the function outputs current analog input value.

Setting the Par parameter

View in programming mode (example)

```
B37           1/1   +/     ← Protection mode and retentivity
Mode    =2                 ← Number of samples
Erst    =1                 ← Enable reset
```

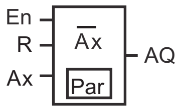
View in parameter assignment mode (example)

```
B37           1/1
Mode    =2
Min     =+0
Max     =+0
Erst    =1
AQ      =+0
```

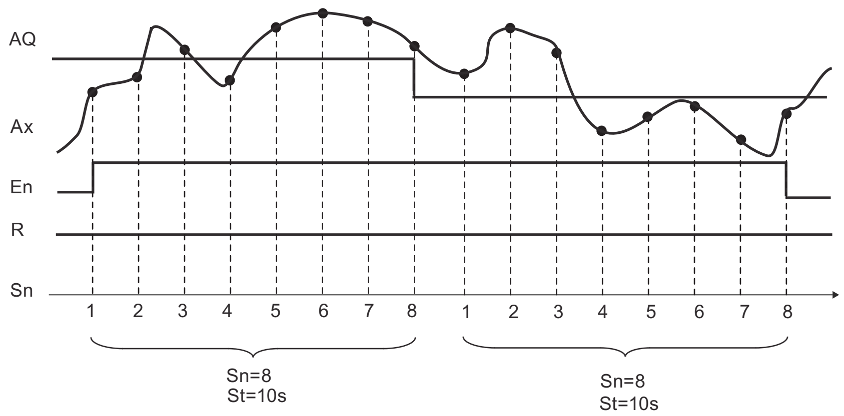
4.4.36 Average value

Short description

The average value function calculates the average value of an analog input over a configured time period.

Symbol in IDEC SmartRelay	Wiring	Description
Average Value	En	A change in status from 0 to 1 transition at input En starts the average value function. A change in status from 1 to 0 at input En holds the analog output value.
	R	A signal at input R clears the analog output value.
	Ax	Input Ax is one of the following analog signals: • AI1 to AI8 (*) • AM1 to AM64 • NAI1 to NAI32 • AQ1 to AQ8 • NAQ1 to NAQ16 • Block number of a function with analog output
	Parameter	**St** (Sampling time): you can set the timebase to s (seconds), d (days), h (hours), or m (minutes). Range of values: St = s: 1 to 59 St = d: 1 to 365 St = h: 1 to 23 St = m: 1 to 59 **Sn** (Number of samples): Range of values: St = s: 1 to St*100 St = d: 1 to 32767 St = h: 1 to 32767 St = m and St ≤ 5 minutes: 1 to St*6000 St = m and St ≥ 6 minutes: 1 to 32767 Retentivity: / = no retentivity R = retentivity
	Output AQ	Outputs the average value of input Ax over configured time sampling period.
* AI1 to AI8: 0 V to 10 V corresponds with 0 to 1000 (internal value).		

Timing diagram (example)

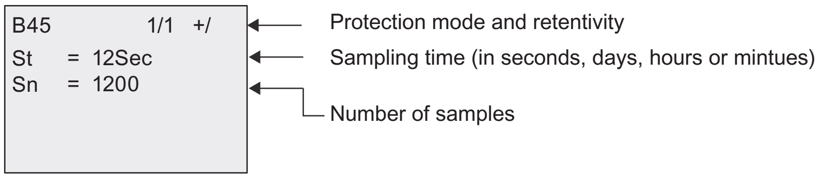


Functional description

This function fetches the analog input signal according to both the set sampling time St and the number of samples Sn and outputs the average value. A signal at R sets AQ to 0.

Setting the Par parameter

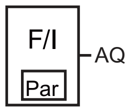
View in programming mode (example):



4.4.37 Float/Integer Converter

Short description

IDEC SmartRelay only can deal with integer. If you transfer some float from outer system by network with FL1F/Modbus protocol, IDEC SmartRelay cannot deal with it directly. With this Float /Integer Converter function block, you can convert a float to integer by dividing a resolution in the range of values, and then the IDEC SmartRelay can process the logic with this integer. If required, use Integer/Float Converter to convert the result into float and store it in the VM; and transfer the float to outer system with FL1F/Modbus protocol. You need to set a suitable resolution for the input float in the parameter setting.

Symbol in IDEC SmartRelay	Wiring	Description
 FIConverter	Parameter	• Typ. : It specifies the type of input data. – Float: it is a 32 bits single-precision float number; – Double:it is a 64 bits double-precision float number. • VM. : Variable Memory Address, starting address of float or double stored in VM. Range of values: – For Float: 0-847 – For Double: 0-843 • Res. : Resolution, it’s a divider for output value. Range of values: 0.001 to 1000
	Extended analog output **eAQ**	Extended analog output for programming via parameter reference. • Used as a reference parameter of the other function block. • Signed 32 bits value. • Range of values: -999,999,999 to 999,999,999.
	Output **AQ**	AQ is the analog output value. It has the following features. • Used as input value of the other function block. • Signed 16 bit value. • Range of values: -32768 to 32767.

Functional description

You usually need both the blocks Float/Integer converter and Integer/Float converter to complete a task. A typical way to use these function blocks is:

1. Transfer the floats from outer system by network (with FL1F/Modbus protocol) and store them in VM.
2. Convert the floats stored in VM to integer by Float/Integer converter.
3. Process the integer with IDEC SmartRelay BM.
4. Convert the result to floats by Integer/Float and store them in the VM.
5. Transfer the floats to outer system (with FL1F/Modbus protocol).

Calculation rule

Define Q =Data Input/Resolution

Analog output (AQ)

- if -32768 ≤ Q ≤ 32767, the Analog output = Q.
- if the Q ≥ 32767, then Analog output = 32767.
- if the Q ≤ -32768, then Analog output = -32768.

Extended analog output (eAq)

- if -999,999,999 ≤ Q ≤ 999,999,999, the Extended analog output = Q.
- if the Q ≥ 999,999,999, then Extended analog output = 999,999,999.
- if the Q ≤ -999,999,999, then Extended analog output = -999,999,999.

Setting the Par parameter

View in programming mode (example):

B1 1/1	
Typ. =Float	The type for the input
VM. =0	Variable Memory Address
Res. =0.100	Resolution

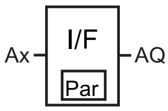
View in parameter assignment mode (example)

B1 1/1	
Typ. =Float	The type for the input
VM. =0	Variable Memory Address
Res. =0.100	Resolution
eAq =0	Extended analog output
Aq =0	Analog output

4.4.38 Integer/Float Converter

Short description

IDEC SmartRelay only can deal with integer. If you transfer some float from outer system by network with FL1F/Modbus protocol, IDEC SmartRelay cannot deal with it directly. With this Integer/Float Converter function block, you can convert an integer to float by multiplying a resolution in the range of values, and stored it in VM, then you can transfer this result to the outer system through network. You need to set a suitable resolution for the output float in the parameter setting.

Symbol in IDEC SmartRelay	Wiring	Description
 IFConverter	Input **Ax**	Input Ax is one of the following analog signals: • AI1 to AI8 (*) • AM1 to AM16, or AM1 to AM64 (if FL1F) • NAI1 to NAI32 • AQ1 to AQ2, or AQ1 to AQ8 (if FL1F) • NAQ1 to NAQ16 • Block number of a function with analog output
	Parameter	• Typ. : It specifies the type of output data. – Float: it is a 32 bits single-precision float number; – Double:it is a 64 bits double-precision float number. • VM. : Variable Memory Address, starting address of float or double stored in VM: – For Float: 0-847 – For Double: 0-843 • Res. : Resolution, it's a multiplier for output value. Range of values: 0.001 to 1000
	Extended analog input **eAx**	If the analog input (Ax) is not available, you can assign a value to Extended analog input (eAQ) by inputting a value to the eAx field or referring to other FB's parameter. Range of values: -999,999,999 to 999,999,999
	Extended analog output **eAQ**	Extended analog output for programming through parameter reference. • Used as a reference parameter of the other function block. • Signed 32 bits value. • Range of values: -999,999,999 to 999,999,999.
	Output **AQ**	AQ is the analog output value. It has the following features. • Used as input value of the other function block. • Signed 16 bit value. • Range of values: -32768 to 32767.
* AI1 to AI8: 0 V to 10 V corresponds with 0 to 1000 (internal value).		

Functional description

You usually need both the blocks Float/Integer converter and Integer/Float converter to complete a task. A typical way to use these function blocks is:

1. Transfer the floats from outer system by network (with FL1F/Modbus protocol) and store them in VM.
2. Convert the floats stored in VM to integer by Float/Integer converter.
3. Process the integer with IDEC SmartRelay BM.
4. Convert the result to floats by Integer/Float and store them in the VM.
5. Transfer the floats to outer system (with FL1F/Modbus protocol).

Calculation rule

Float Value in VM address

Float Value in VM address = Analog input x Resolution

Analog output (AQ)

- Analog input connector is connected: Analog output = Analog input
- Analog input connector isn't connected:
  - if -32768 ≤ Extended analog input ≤ 32767, the Analog output = Extended analog input.
  - if the Analog input ≥ 32767, then Analog output = 32767.
  - if the Analog input ≤ -32768, then Analog output = -32768.

Extended analog output (eAq)

- If the analog input connector is connected: Extended analog input = analog input.
- Extended analog input connector isn't connected:
  - if -999,999,999 ≤ Extended analog input ≤ 999,999,999, the Extended Analog Output = Extended analog input.
  - if the Extended analog input ≥ 999,999,999, then Extended analog output = 999,999,999.
  - if the Extended analog input ≤ -999,999,999, then Extended analog output = - 999,999,999.

Setting the Par parameter

View in programming mode (example):

B1	1/2	
Typ.	=Float	The type for the input
VM.	=0	Variable Memory Address
Res.	=0.100	Resolution
eAx	=0	Extended analog input

View in parameter assignment mode (example)

B1	1/2	
Typ.	=Float	The type for the input
VM.	=0	Variable Memory Address
Res.	=0.100	Resolution
eAx	=0	Extended analog input
eAq	=0	Extended analog output

B1	2/2	
Aq	=0	Analog output

5 Web server

IDEC SmartRelay has a built-in Web server which enables you to operate the Base Module or the Text Display from a traditional PC or a mobile device.

In this approach, you can access the Base Module or the Text Display using a connected device (conventional PC, tablet or smart phone with Web browsing capabilities) through its IP address.

The Web server allows you to use the mouse pointer or the touch screen, depending on the device you are using, to perform fast and easy operations on the virtualized Base Module and Text Display.

IDEC SmartRelay supports the following protocols for Web server communication:

- HTTP
- HTTPS (recommended)

Note

When you use the HTTPS protocol to access the Web server through port mapping on the router, the browser would remind you of privacy error.

For detailed information about security functions on IDEC SmartRelay, see Chapter Security (Page 294).

5.1 Enabling the Web server

Make sure you have connected your PC or mobile device to the desired Base Module or Text Display, and guarantee you have enabled the Web user access in WindLGC according to instructions in the user profile settings of the Online Help for WindLGC.

Install the SmartRelay Root certificate (Page 300) if you enabled HTTPS access for web server.

Supported network explorers

The IDEC SmartRelay Web server supports the following Web browsers:

- Windows
  - Edge 90.0 to 126.0
  - Firefox 67.0 to 115.13
  - Google Chrome 63.0 to 126.0
  - Opera 84.0 to 125.0

Note

Make sure you do not disable cookies on your browser.

Supported devices

The IDEC SmartRelay Web server supports the following communications devices when you use one of the above explorers:

- Conventional PC
- Apple iPhone series
- Apple iPad series
- Smart phones and tablets with Android system with minimum version Android 2.0

Supported Web page language

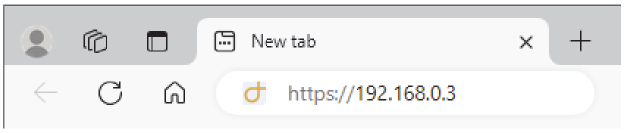
The IDEC SmartRelay Web server supports the following Web page languages:

- German
- English
- Italian
- French
- Spanish
- Chinese Simplified
- Japanese

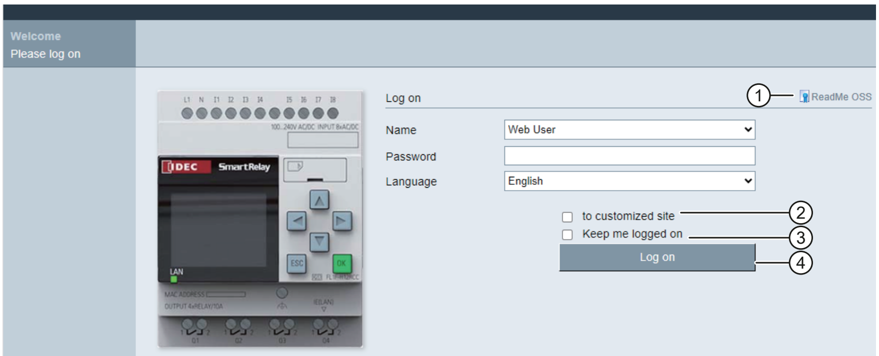
5.2 Logging on to the Web server

Follow the steps below to log on to the desired Base Module.

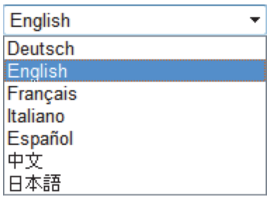
1. Open your Web browser.
2. Enter the IP address of your Base Module in the IP address bar.



3. Press **Enter** key on your keyboard. The IDEC SmartRelay Web server redirects you to the welcome page.
4. Select the account and enter the password. You can log on as Web user or Web guest user.



5. Select an appropriate language from the drop-down menu if needed.



6. Click or tap " ① " to view the OSS Readme.

Note

You can view the OSS Readme without enabling the Web server.

---

7. If you want to view the FWE project deployed on BM after logon, select the " ② " check box.
8. Enter the password.

Note

- You can only enable the Web server access or change the logon password using WindLGC For more information about setting the user password, refer to the Online Help for WindLGC.
- If you do not desire to enter the user name and password again at the next logon, you can select the " ③ " check box. Make sure you do not set your browser to private mode, since your browser does not record any browsing history or passwords in this mode.
- You can access one IDEC SmartRelay Base Module from multiple IDEC SmartRelay Web server clients, but due to memory usage, this might also impact the performance of the connected Base Module.

---

9. Click or tap " ④ " to log on to the Web server.

Note

- For remote access, the logon may take several seconds.
- If your logon fails, press or tap the refresh button on your browser (or press the keyboard shortcut "F5" on the conventional PC) to try it again.

5.3 Viewing IDEC SmartRelay system information

Once logged in, the IDEC SmartRelay Web server displays all the system information of the IDEC SmartRelay Base Module including module generation, module type, firmware (FW) version, IP address, and module status.

Note

The firmware version in the above screen is listed for an example, your IDEC SmartRelay device may be of a later version.

5.4 Operating the virtual module on the Web server

The IDEC SmartRelay Web server enables you to do the following operations on the virtual Base Module through **SmartRelay BM** menu and the virtual Text Display through **SmartRelay TD** menu.

Operating the keys on the virtual module

If you have previously programmed the cursor keys and function keys in your circuit program, you can perform the following basic operations with these keys on the virtual Base Module or Text Display:

To enable the functionality of the programmed cursor, click or tap the **ESC** key. Function keys are always enabled.

You can then proceed as follows:

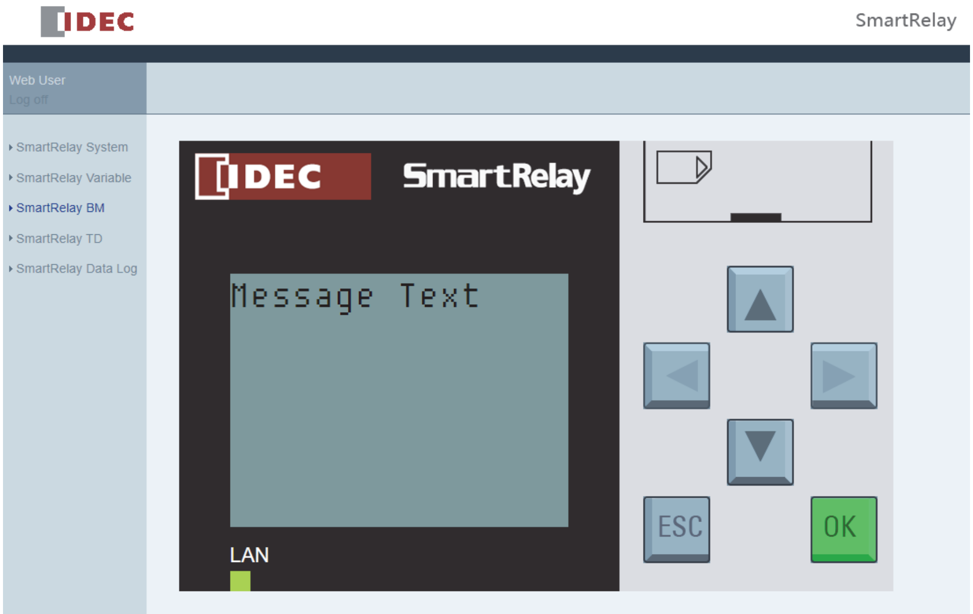
- To enable pulse inputs, click or tap the cursor key or function key concerned.
- To enable continuous high-level signal input, continue to click the cursor keys or function key, if you release the button, the high-level signal will be lost.
- To disable the programmed cursor key or function key, click or tap the **ESC** key again.
- To disable the display of an active message as long as this message has been previously configured in WindLGC as acknowledgeable, click or tap the **OK** key.

Viewing message text

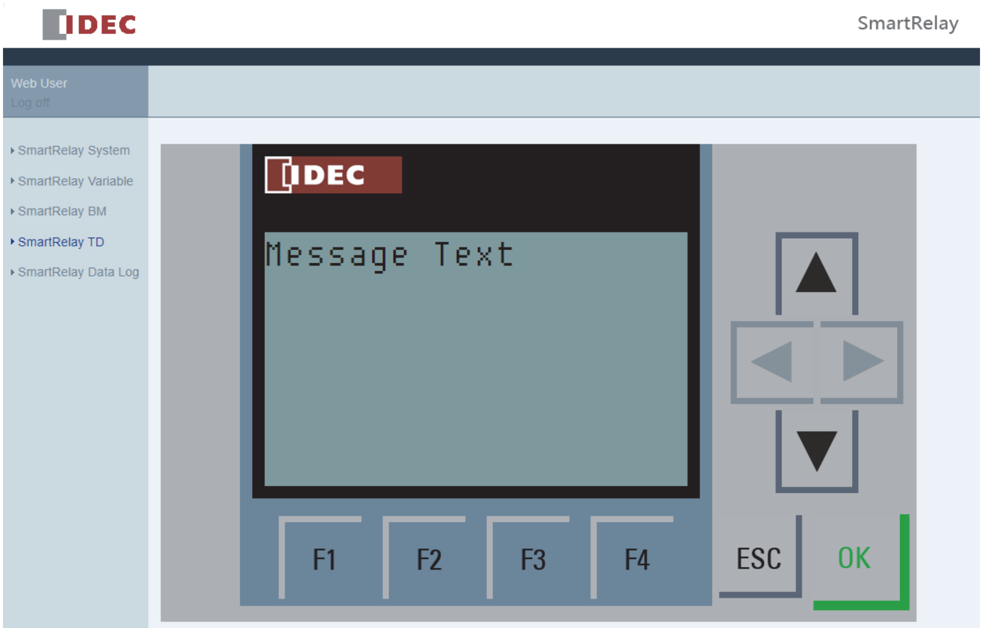
If you have configured your message text on WindLGC according to the instructions in the Online Help for WindLGC, you are then able to see them on the virtual screen of the module. You can view the eastern characters in Web server in WindLGC V8.4 and later versions.

Click or tap **SmartRelay BM** or **SmartRelay TD** on the left navigation bar and you can view active messages on the virtual device.

- On the Base Module:



- On the Text Display:



You can click or tap ▲ or ▼ to tick manually for available messages.

Note

The ◀ and ▶ are gray, indicating they are not applicable in viewing message texts.

Viewing message text ticking

If you have configured message ticking settings on WindLGC according to the instructions in the Online Help for WindLGC, you can see the message text ticking by lines or characters on the virtual Base Module or Text Display.

Checking backlight color status

If you have configured backlight color settings on WindLGC according to the instructions in the Online Help for WindLGC, you can see the same backlight effect displayed on the virtual Base Module or Text Display.

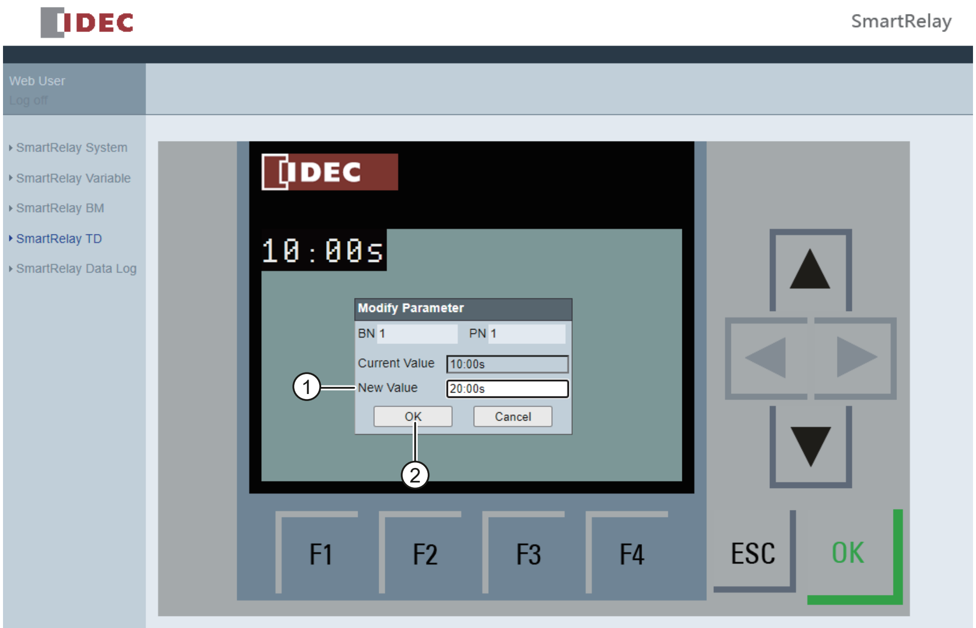
Setting the configurable parameters

If you have configured to show certain parameters on Base Module or Text Display according to the instructions in the Online Help for WindLGC, you can see them displayed on the screen.

Double-click or double-tap on the displayed parameter to activate the parameter modification dialog. A parameter is grayed out when it is not editable.

- On the Base Module:

- On the Text Display:

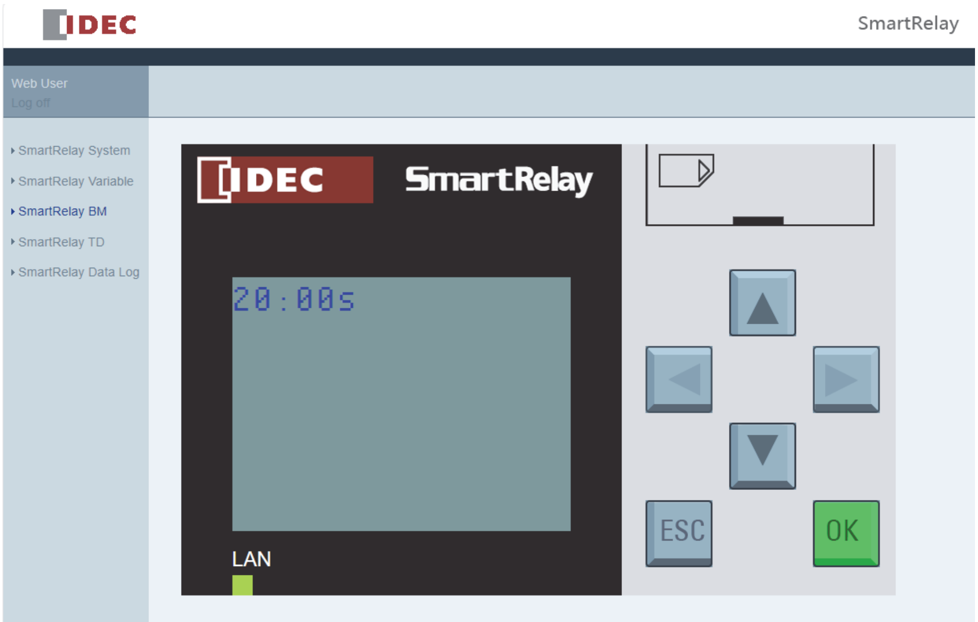


Enter the desired parameter value in line " ① " on the above screens. In this example, enter "20:00s".

Make sure you have strictly followed the example of your current value. Any inconsistency may cause errors on the module.

Click or tap " ② ". The updated parameter is displayed.

- On the Base Module:



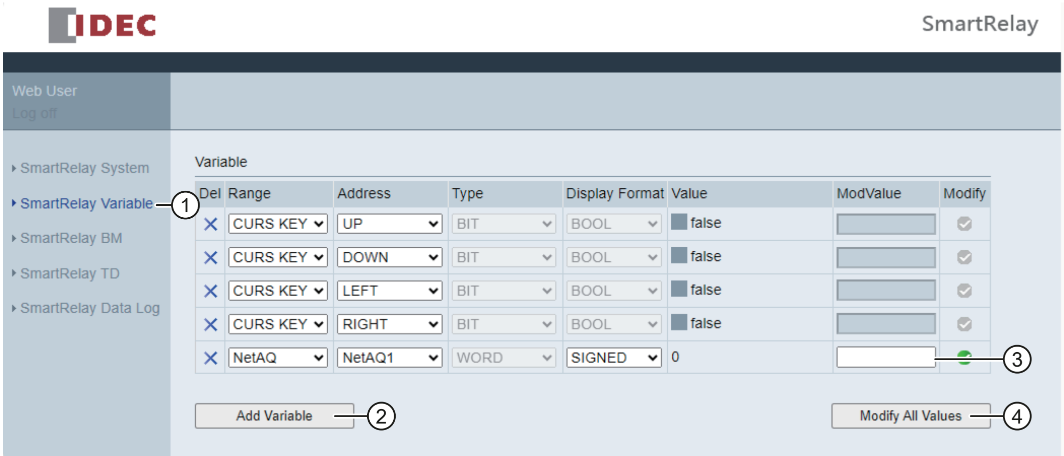
- On the Text Display:

5.5 Viewing and editing variable memory tables

The IDEC SmartRelay Web server allows you to check and modify variable memory tables on the Web browser.

For complete description on the IDEC SmartRelay variables, refer to the "Parameter VM mapping" section of the Online Help for WindLGC.

Click or tap " ① " on the left navigation bar to show the variable table.



Click or tap " ② " to add a new variable. Follow the steps below to set the variable.

1. Choose a desired range. Web server displays the mapping address, variable type, display format of the range.
2. Enter the new mapping address in the added empty column " ③ ".

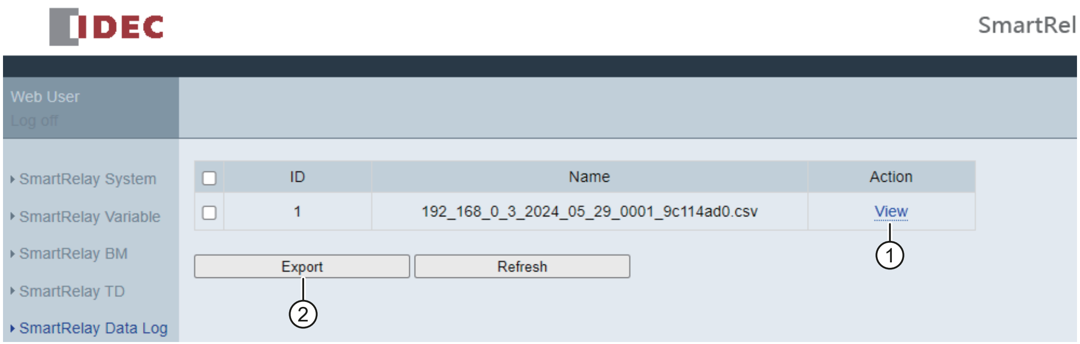
The indicates the variable is to be modified.

The indicates it is not editable.

Click or tap " ④ " to apply the new mapping addresses.

5.6 Viewing and uploading data log

The IDEC SmartRelay Web server allows you to view data log (Page 272) of IDEC SmartRelay Base Module, and upload data log files into the connected PC.



Click " ① " to view the detailed information of the data log file.

To Upload certain data log files into the connected local PC, follow these steps:

1. Check the box of the displayed data log file you want to upload. You can select all files by checking the box in the header of the table.
2. Click " ② " to start the upload process. The uploaded data log files are saved in the default directory set by the web browser, and they are in .CSV format. You can open these files by Microsoft Excel or a text editor.

5.7 Logging off from the Web server

To log off from the Web server, click or tap the button on top of the left navigation bar .

Cloud IoT connection 6

Functions of IDEC SmartRelay Cloud connection

With the FL1F FS6 (and later versions) product portfolio, you can access and work with IDEC SmartRelay BM and its extension modules connected through public Cloud. With this new function, you can

- publish IDEC SmartRelay BM data to the supported public IoT Cloud and MQTT brokers (for example, HiveMQ, EMQX, Mosquitto, ioBroker) as configured
- change IDEC SmartRelay BM data remotely through the supported public IoT Cloud and MQTT brokers

Below public IoT Cloud are supported:

- FL1F FS6 supports AWS, Azure, Alibaba Cloud

Note

For FL1F FS6 and later version BMs, Cloud connection is available when Cloud connection is configured and regardless of whether circuit diagram is in run or stop mode. Cloud data is transferred when Cloud connection is configured and circuit diagram is in run mode.

Protocols for the Cloud connection

FL1F FS6 and later versions support the following protocols for communication with a Cloud server:

- MQTT over Transport layer security (TLS), according to OASIS standard version 3.1 / 3.1.1

For general MQTT broker connection, FL1F FS6 also supports MQTT over TCP (Transmission Control Protocol) after configured.

6.1 IDEC SmartRelay Cloud configuration

IDEC SmartRelay Cloud connection includes:

- Connection between the supported IoT Cloud and IDEC SmartRelay BM (registered and configured by WindLGC V8.4 or later version)
- Connection between deployed FWE project on AWS Elastic Beanstalk and IDEC SmartRelay BM (deployed and configured by FL1F Web Editor V1.2.0 or later version)

Note

Only AWS Cloud is supported to deploy FWE projects as WebApp.

All deployed FWE projects are under your account and you can access these projects by URL which are provided by AWS.

Note

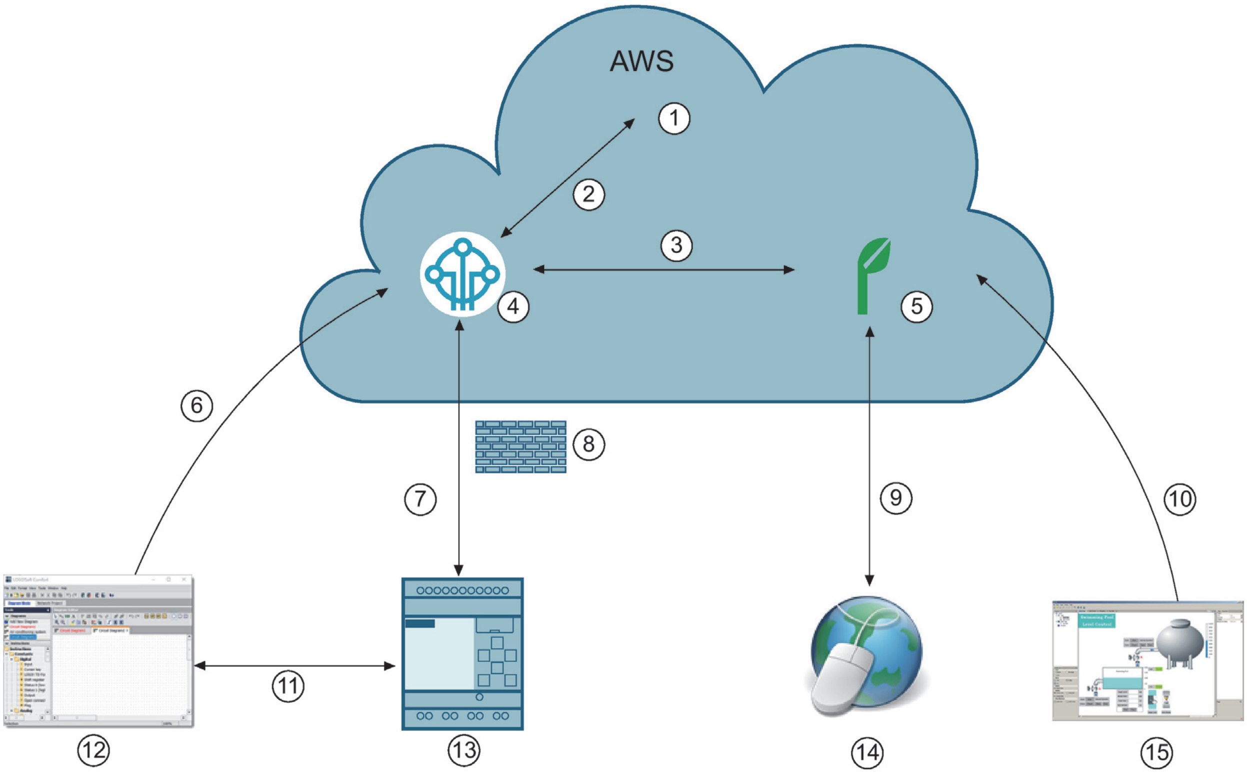
The data collected by AWS IoT can be used by other services only with your own AWS account. And other AWS services or applications are also created by yourself. So all the data and applications are under your instance and belong to you. According to AWS rules, you can use correct "AWSAccessKeyId" and "AWSSecretKey" to fetch data from IoT shadow by yourself too.

For FL1F FS6 and later version BM, you can also use AWS Temporary Credential Account (TVM) to establish AWS IoT Cloud connection. You can use correct "AWSAccessKeyId", "AWSSecretKey" and "SessionToken"to fetch data from IoT shadow by yourself.

On how to establish a Cloud connection to IDEC SmartRelay, refer to section *Tools -> Transfer -> Cloud Connecion Settings* in *WindLGC Online Help*.

AWS Cloud configuration

The following picture shows the relationship and roles each part plays in AWS Cloud configuration.



①	Other AWS services	⑨	Http/Https
②	AWS rules (https://docs.aws.amazon.com/iot/latest/developerguide/iot-rules-tutorial.html)	⑩	Deploy
③	MQTT	⑪	Configure connection and transfer
④	AWS IoT	⑫	WindLGC
⑤	AWS Elastic Beanstalk (Web server)	⑬	IDEC SmartRelay Base Module
⑥	Register	⑭	Browser
⑦	Transfer Data through MQTT	⑮	FL1F Web Editor
⑧	Firewall		

Note

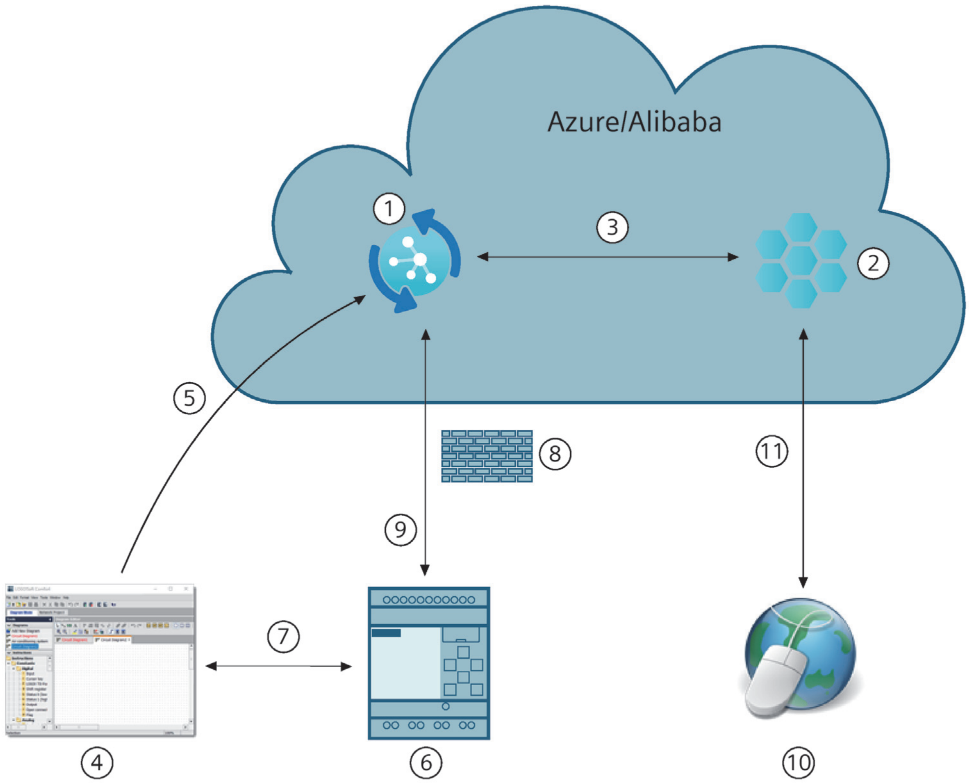
All data in Other AWS services, AWS IoT and AWS Elastic Beanstalk belong to the login account.

Note

IDEC recommends you use standalone firewall to protect you IDEC SmartRelay BM device.

Azure/Alibaba Cloud configuration

The following picture shows the relationship and roles each part plays in Azure/Ali Cloud configuration.



①	Azure/Alibaba IoT Hub	⑦	Configure connection and transfer
②	Other services	⑧	Firewall
③	Azure/Alibaba rules	⑨	Transfer Data through MQTT
④	WindLGC	⑩	Browser
⑤	Register	⑪	Http/Https
⑥	IDEC SmartRelay Base Module		

Note

IDEC recommends you use standalone firewall to protect you IDEC SmartRelay BM device.

MQTT configuration

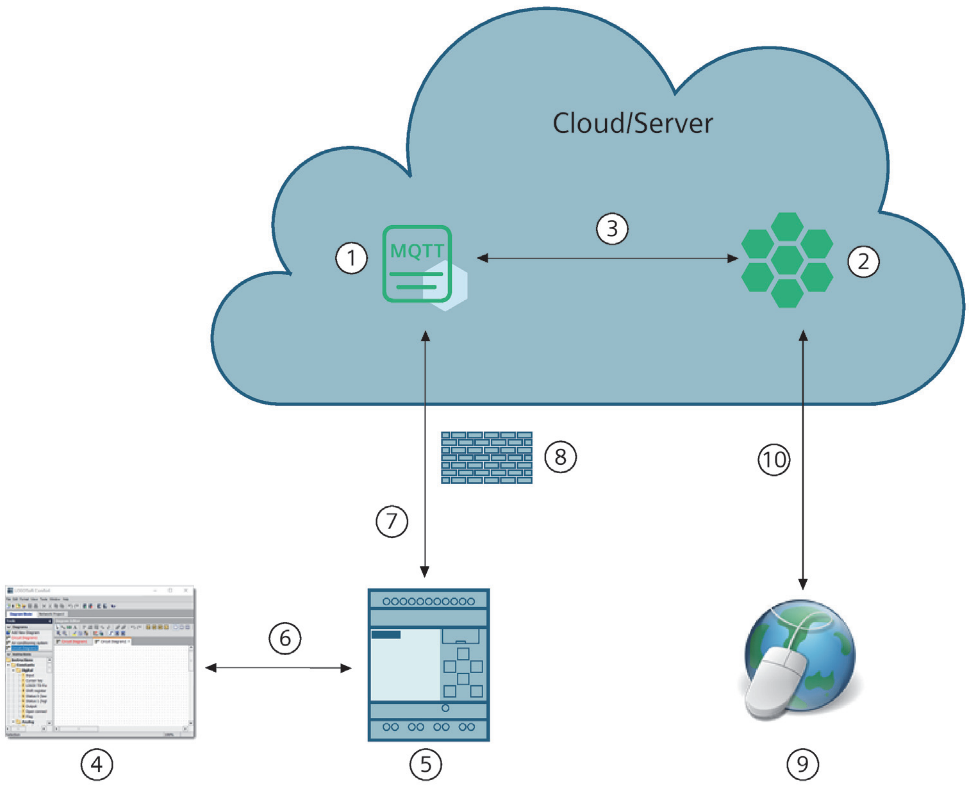
General MQTT can be used to connect IDEC SmartRelay BM to other Clouds/Servers that support MQTT.

You cannot register IoT things/devices for these Clouds/Servers on WindLGC, but you can configure general MQTT on WindLGC.

Note

IDEC SmartRelay BM only supports JSON format, therefore, only general MQTT which support JSON format can establish IoT connection with IDEC SmartRelay BM and transfer data.

The following picture shows the relationship and roles each part plays in MQTT configuration.



①	MQTT broker	⑥	Configure connection and transfer
②	Other services	⑦	Transfer Data through MQTT
③	Cloud/Server specific rules	⑧	Firewall
④	WindLGC	⑨	Browser
⑤	IDEC SmartRelay Base Module	⑩	Http/Https

Note

IDEC recommends you use standalone firewall to protect you IDEC SmartRelay BM device.

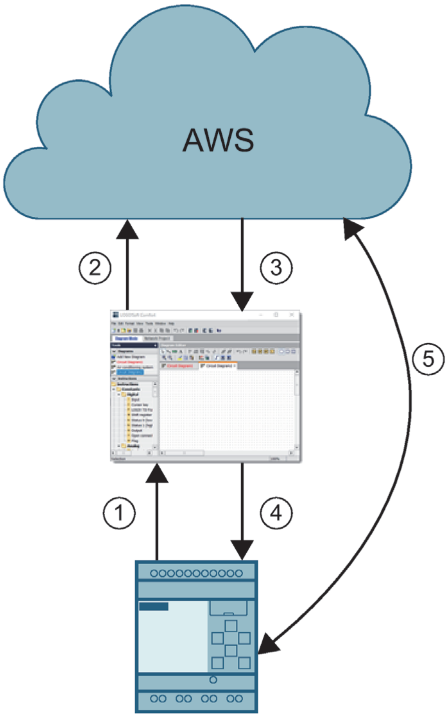
6.2 Secure Cloud connection

Secure Cloud connection to AWS

With WindLGC V8.4 or later version, you can register IDEC SmartRelay BM and download the Amazon Root CA Certificate to IDEC SmartRelay BM. IDEC SmartRelay BM saves the certificates for Cloud and devices in it. IDEC SmartRelay BM establishes connection to AWS through TLS (Transport Layer Security).

On how to register IDEC SmartRelay BM and download the Amazon Root CA certification, refer to Chapter *Tool -> Transfer --> Cloud Connection Settings* in *WindLGC Online Help*.

WindLGC V8.4 (or later version) creates the AWS Cloud certificate as follows:



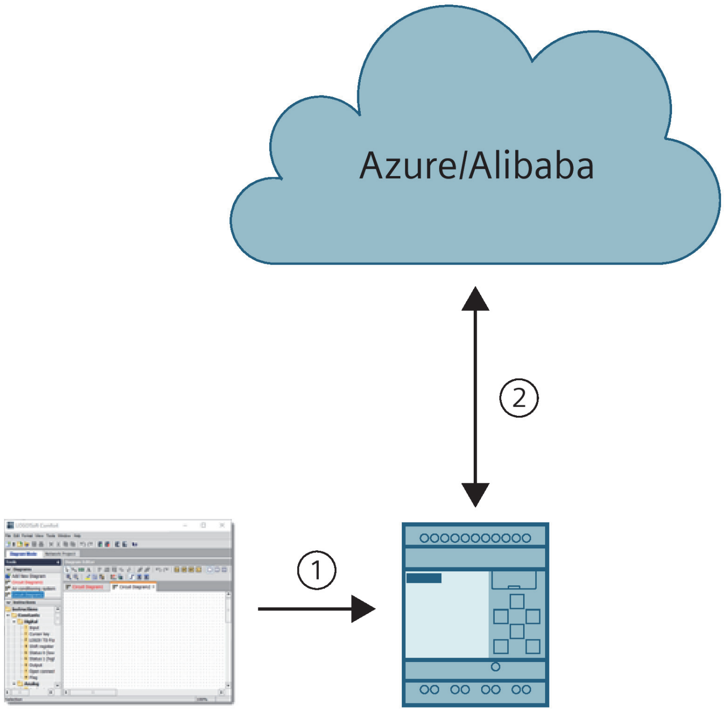
① WindLGC connects to IDEC SmartRelay BM and gets the certificate signing request (CSR).
② WindLGC connects to AWS through HTTPS and send the CSR to AWS.
③ AWS returns the signed certificate to WindLGC.
④ WindLGC downloads certificate to IDEC SmartRelay BM.
⑤ IDEC SmartRelay BM connects to AWS through encrypted channel.

Note

If the Cloud security configuration is out of date or invalid, you should reconfigure it through WindLGC.

Secure Cloud connection to Azure/Alibaba

FL1F FS6 supports Azure/Alibaba IoT Cloud connection. IDEC SmartRelay BM builds the secure connection with Azure/Alibaba as follows:



① WindLGC downloads Azure/Alibaba CA certificate to IDEC SmartRelay Base Module.

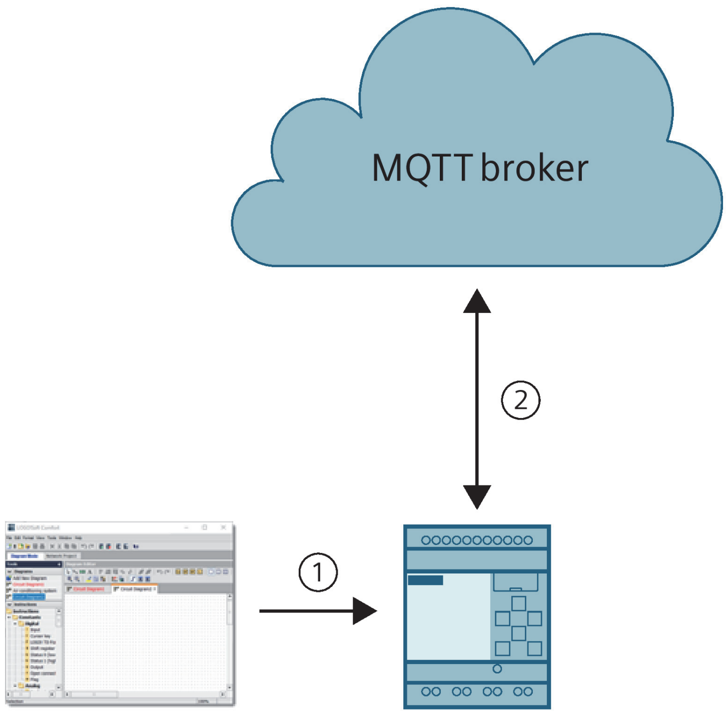
② IDEC SmartRelay Base Module connects to Azure/Alibaba through encrypted channel.

Secure Cloud connection to general MQTT

FL1F FS6 supports general MQTT connection modes as follows:

Connection mode	Description
TCP	Data transfer channel is not encrypted.
TLS without authentication	Data transfer channel is encrypted, but both server and client are not authenticated. IDEC doesn't recommend you use this connection mode as connection is not secure enough.
TLS one-way	Data transfer channel is encrypted, and only the client authenticates the server.
TLS two-way	Data transfer channel is encrypted, and both server and client are authenticated

When you use TCP or TLS without authentication connection mode, IDEC SmartRelay Base Module connects to the Cloud directly. When you use TLS one-way or two-way mode, the secure connection is as follows:



① TLS one-way: WindLGC downloads server's CA certificate to IDEC SmartRelay Base Module.

TLS two-way: WindLGC downloads server's CA certificate as well as registered device's key and certificate to IDEC SmartRelay Base Module.

② TLS one-way/two-way: IDEC SmartRelay Base Module connects to server through encrypted channel.

6.3 AWS Cloud data format

Customized format for IDEC SmartRelay JSON document

IDEC SmartRelay Base Module publishes data to the supported IoT Cloud with its device shadow. A device's shadow is a JSON document that is used to store and retrieve current state information for a device in the Cloud. Each device's shadow is uniquely identified by the name of the corresponding thing. You can use the shadow to get and set the state of IDEC SmartRelay BM over MQTT, regardless of whether the IDEC SmartRelay BM is connected to the Internet. If BM is not connected to internet, when Cloud sends data to the BM, the data is saved in buffer and will be send to the BM when it is connected to internet.

IDEC customized the format of JSON document for IDEC SmartRelay BM. When you change the values in the shadow of IDEC SmartRelay BM, follow the customized format. Otherwise, IDEC SmartRelay BM ignores the changes.

IDEC SmartRelay JSON documents have the following format:

`"range.sub_range.data_type:start_addr-number":"value"`

Variables	Mandatory or not?	Description			
range	Yes	Range of a block type. Support I, Q, M, AI, AQ, AM, NI, NQ, NAI, NAQ, V, VB, VX, VR, VW, VD Cursors key (CK), function key (FK), shift register (SR). All range should be capitalized.			
sub_range	No	Reserved			
data_type	No	1	2	4	6
		bit	byte	word	double word
start_addr	Yes	The start address of data.			
number	Yes	The length of data value. The unit depends on data_type.			
value	Yes	The value of data. It is hex string.			

Variables	Bit range	Word range	V range	Range shift register
range	I, Q, M, NI, NQ, Cursors key (CK), Function key (FK)	AI, AM, AQ, NAI, NAQ	V	Shift register (SR)
sub_range	Reserved			
data_type	1	4	1, 2, 4, 6 default value is 2.	1
start_addr	1 to n	1 to n	0 to n If the data type is 1 (bit), the starts address starts from 0.0. Otherwise, the start address starts from 0.	1.1 to n.8
number	1 to n	1 to n	1 to n+1	1 to 8n

Example

- **Bit range**: Q1~Q2:11. Start_addr = Q1, number = 2. Format: "Q..:1-2":"03" or "Q..1:1-2":"03"
- **Word range**: AI1~AI4: 0x1111222233334444 Start_addr = AI2, number = 2. Format: "AI..4:2-2":"22223333" or "AI..:2-2":"22223333"

- **V range**: V0~V8: 001122334455667788 Start_addr = V1.1, number = 3. Format: "V..1:1.1-3":"01" Start_addr = VB0, number = 2. Format: "V..2:0-2":"0011" or "V..:0-2":"0011" Start_addr = VW2, number = 2. Format: "V..4:2-2":"22334455" Start_addr = VD3,number = 1. Format: "V..6:3-1":"33445566"
- **SR1.1~S2.8**: 1134 Start_addr = SR1.1, number = 3. Format: "SR..1:1.1-3":"01" or "SR..:1.1-3":"01"

Cloud variable parsing strategy

- If the value field is not byte-aligned (odd characters), add '0' before the first character to align its bytes.

  Example: "Q..1:1-2":"3" → "Q..1:1-2":"03"
- In a left-aligned manner, BM parses each element specified by key (WORD,DWROD)

  Example: "AI..:2-2":"22223333" → AI2: 0x2222; AI3: 0x3333
- If the length of value is smaller than that specified by key, the values of the remaining elements are '0' by default.

  Example: "V..2:0-2":"11" → VB0: 0x11; VB1: 0x00
- If the length of the last element of value does not meet the length of a single element, fill '0' in the MSB (Most Significant Bit).

  Example: 'V..6:3-1":"334455" → VD3: 0x00334455

  "V..6:3-2":"334455667788" → VD3: 0x33445566; VD4: 0x00007788
- If the length of value is larger than the length specified by key, the data of extra length is discarded.

  Example: "V..6:3-2":"33445566778899AA001122" → VD3: 0x33445566; VD4: 0x778899AA

General integer array format

FL1F FS6 and later versions BM also support integer array format for Cloud data transfer.

Integer array follows below format:

```
"{name}":{
"desc":"{range}-{type}-{start address}-{count}",
"value":[signed decimal, signed decimal ......]
}
```

Variables	Mandatory or not	Description
`{name}`	Yes	You can configured it through "Cloud Data Transfer Settings" in *WindLGC*.
`{range}`	Yes	Range of a block type. Support I, Q, M, AI, AQ, AM, NI, NQ, NAI, NAQ, V, VB, VX, VR, VW, VD Cursors key (CK), function key (FK), shift register (SR). All range should be capitalized.
`{start address}`	Yes	The start address of data.
`{count}`	Yes	The length of data value.
`{type}`	Yes	It can be bit, byte, word or dword.

`"value"` is represented as an array of signed decimal integers, and the number of integers is the same with `{count}` in `"desc"`.

Example:

- Bit range: Q1-Q2:11. Start address = Q1, number = 2. Format: "desc": "Q-bit-1-2", "value": [1, 1]
- Word range: AI1-AI4: 0x1111222233334444. Start address = AI2, number = 2. Format: "desc": "AI-word-2-2", "value": [8738, 13107]
- V range: V0-V8: 0x001122334455667788. Start address = V1.1, number = 3. Format: "desc": "V-bit-1.1-3", "value": [1, 0, 0]. Start address = VB0, number = 2, Format: "desc": "V-byte-0-2", "value": [0, 17]. Start address = VW2, number = 2, Format: "desc": "V-word-2-2", "value": [8755, 17493]. Start address = VD3, number = 1, Format: "desc": "V-dword-3-1", "value": [860116326]
- SR1.1-S2.8: 0x1134. Start address = SR1.1, number = 3. Format: "desc": "SR-bit-1.1-3", "value": [1, 0, 0]

Cloud variable parsing strategy

- If the length of value array is smaller than that specified by count in `"desc"`, the values of the remaining elements are unchanged.

  Example: "desc": "V-byte-0-2", "value": [3] → VB0: 0x11; VB1: 0x00
- If the length of value array is larger than that specified by count in `"desc"`, the data of extra length is discarded.

  Example: "desc": "V-dword-3-2", "value": [860116326, 2005440938, 4386] → VD3: 0x33445566; VD4: 0x778899AA
- If some values in array are out of range specified by type, these values are ignored.

  Example: "desc": "V-word-100-3", "value": [100,40000,60] (40000 is out of range: -32768 to 32767) → VW100: 0x64; VW101: unchanged; VW102: 0x3C

Send data to broker

According to the configuration in Cloud Data Transfer Settings in WindLGC, IDEC SmartRelay BM sends data to broker only when it's in RUN mode. To learn more about cloud data transfer configuration, refer to section *Tools -> Transfer -> Cloud Data Transfer Settings* in *WindLGC Online Help*.

When IDEC SmartRelay BM is set from STOP to RUN mode, BM publishes below messages to the public topic:

- Clean broker shadow caches:

```
{
 "state": {
 "reported": null
 }
}
```

- Send data format version information to parse data:

```
{
 "state": {
 "reported": {
 "$style": 1
 }
 }
}
```

When IDEC SmartRelay BM is in RUN mode, BM publishes IDEC SmartRelay time data value every 10 seconds. The IDEC SmartRelay time data value can be concluded in a message that contains other data values. The following are examples of messages containing IDEC SmartRelay time data value:

- IDEC SmartRelay time data value in hex string format (Compatible to 8.4 cloud data format):


```
{
 "state": {
 "reported": {
 "I..1:1-1": "00",
 "V..2:990-6": "282303060313"
 }
 }
}
```


- IDEC SmartRelay time data value in integer array format:


```
{
 "state": {
 "reported": {
 "I": {
 "desc": "I-bit-1-1",
 "value": [
 0
 ]
 },
 "$logotime": 1678072448
 }
 }
}
```

UDF (User-Defined Function) 7

User-Defined Function (UDF)

WindLGC provides you with a UDF (User-Defined Function) editor for creating circuit programs. You can save circuit programs created in the UDF editor as individual UDF blocks for use in a circuit program in the UDF or FBD editor.

A UDF block is a preconfigured circuit program that you create. You can add it to an existing circuit program as you do with a function block. If the circuit program in WindLGC already contains a UDF, after transferring the program from WindLGC to an IDEC SmartRelay, you can edit the elements connected to this UDF from the module.

For a detailed description of the UDF configuration in WindLGC, refer to the Online Help for WindLGC.

Editing elements connected to a UDF block

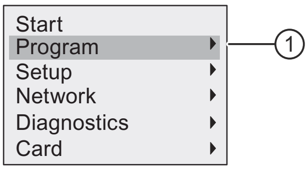
You can neither create a UDF block from IDEC SmartRelay, nor edit the members of the block. You can only edit elements connected to the inputs or outputs of a UDF block or edit its parameter settings.

Note

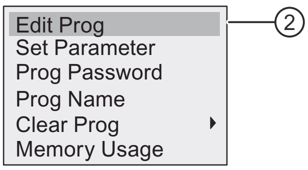
Each UDF block has a maximum of eight inputs and four outputs, dependent upon your configuration in WindLGC.

Editing elements to the inputs of a UDF block

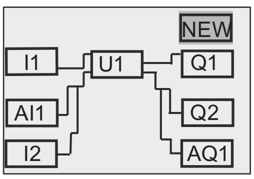
1. Switch IDEC SmartRelay to programming mode.



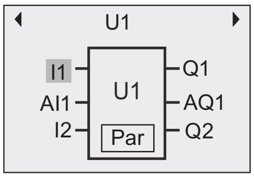
2. Select " ① " on the main menu: Press ▲ or ▼.
3. Confirm " ① ": Press **OK**.



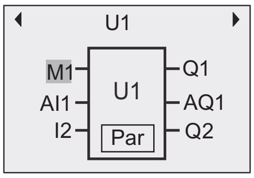
4. Select " ① ": Press ▲ or ▼.
5. Press **OK** twice to enter circuit program edit mode. A "U" identifies a UDF block. "U1" refers to the first UDF block. The following display shows you an example of the circuit program that contains a UDF block configured from WindLGC.



6. Move the cursor to "U1": Press ▲, ▼,◀ or ▶.
7. Press **OK** to enter the screen form for the first UDF block "U1". To select another element, press the cursor keys.

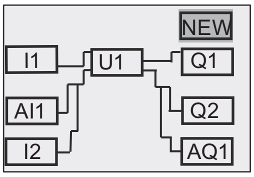


8. Position the cursor on the selected input ("I1" in this example) and press **OK**. The cursor appears in a flashing solid square. If you want to change the first input to another element, press ▲ or ▼.
9. Confirm your selection by pressing **OK**. The first input of "U1" is now changed.

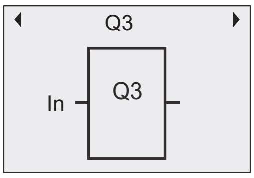


Editing elements to the outputs of a UDF block

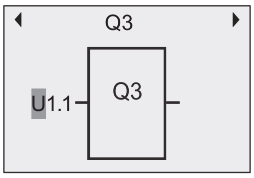
If IDEC SmartRelay shows the following screen form as shown in the above Step 5 and you want to change "Q1" to another element, follow the steps below:



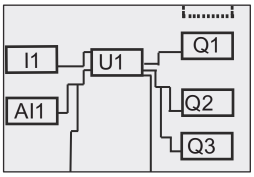
1. Press **OK** and IDEC SmartRelay shows the following display:



2. Move the cursor to "In" by pressing ◀. Press **OK** and the cursor appears in a flashing solid square. You can change the input to "U1.1" (".1" refers to the first output of the UDF block that is connected to "Q1") by pressing ▲ or ▼ and IDEC SmartRelay shows the following display:

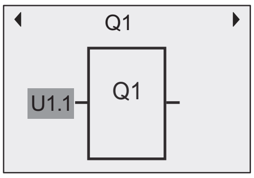


3. Confirm your selection by pressing **OK**. Press **ESC** and IDEC SmartRelay shows the following display:

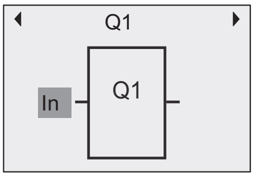
   

   Now "U1" is connected to "Q3".

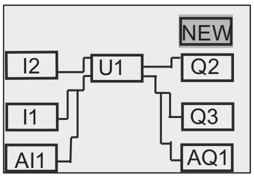
4. Press **OK** and move the cursor to "Q1" by pressing ▲, ▼, ◄ or ►. Press **OK** and IDEC SmartRelay shows the following display:

5. Press **OK** and the cursor appears in a flashing solid square. Select an empty input by pressing ▲ or ▼. Press **OK** and IDEC SmartRelay shows the following display:

6. Press **ESC** and IDEC SmartRelay shows the following display:

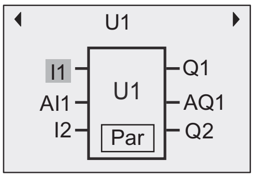
   Now the connection between "U1" and "Q1" is removed.

You have changed the element connected to the first output of "U1" from "Q1" to "Q3".

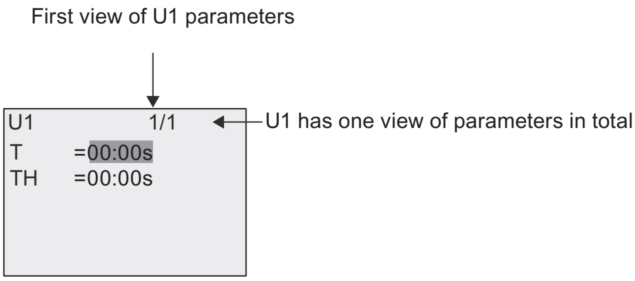
Setting the Par parameter

You can edit the **Par** parameter for your UDF block if you have configured parameters for this UDF using WindLGC; otherwise, you cannot edit parameters for UDF blocks. If your UDF block contains the **Par** parameter, you can edit the parameters as described below:

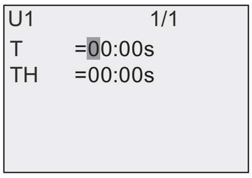
View in programming mode (example):



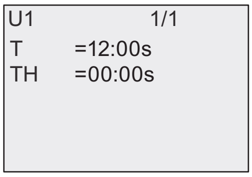
1. Press ▼ to move the cursor to "Par" and press **OK**. IDEC SmartRelay shows you the following display (T and TH are the identifiers you specified for the relevant UDF parameters in WindLGC. You can configure a maximum of eight parameters for each UDF block using WindLGC. IDEC SmartRelay can show a maximum of three parameters on a single display.):



2. Press **OK** and the cursor moves to the first number of "T":



3. Press ▲ or ▼ to change the value. Press ◀ or ▶ to select another number and then press ▲ or ▼ to change its value. Press **OK** to confirm your modifications. Then IDEC SmartRelay shows the following display:



You can also edit UDF parameter settings in parameter assignment mode in the same way as you do in programming mode.

Data log

8

You can configure a maximum of one data log for your circuit program using WindLGC. The data log records process measurement variables for function blocks that you configure for data logging. You can add the data log instruction to your circuit program as you do with a function block.

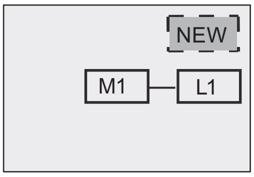
If you configured the data log for your circuit program, after transferring the program from WindLGC to IDEC SmartRelay, you can edit the elements connected to the data log block.

For a detailed description of configuration of the data log function in WindLGC, refer to the Online Help for WindLGC. From the Base Module, you can only configure elements connected to the data log block.

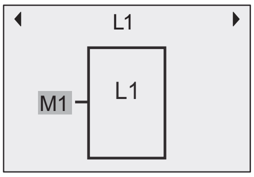
Editing elements connected to the data log block

If your circuit program in IDEC SmartRelay contains a data log block configured from WindLGC, you can edit elements connected to this data log as follows:

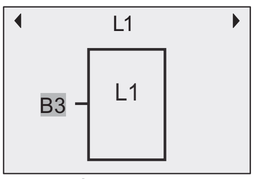
1. Switch to programming mode. Press **OK** twice to step into the following display of your circuit program:



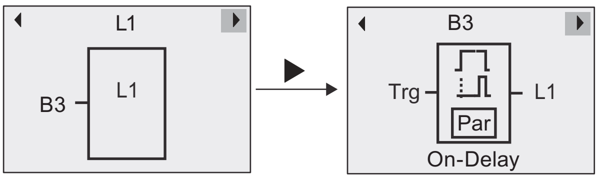
2. Move the cursor to "L1" by pressing ▼ (The data log is identified with a "L1"). Press **OK**. IDEC SmartRelay shows the following display:



3. Press **OK** on the selected input ("M1" in this example) and the cursor appears in a flashing solid square. To select a different element from the available list (for example, B3), press ▼. Press **OK**. IDEC SmartRelay shows the following display:



4. In the following example, you can see that this "L1" is now connected to the B3 block:



Note

For FL1F FS6 devices, it provides a 4096-byte buffer for data logging. If no micro SD card is inserted in the IDEC SmartRelay BM card slot before running a circuit diagram, IDEC SmartRelay BM writes data to buffer temporarily. Buffer keeps the latest 4096-byte data while the old data gets lost. If a micro SD card is inserted in the IDEC SmartRelay BM card slot before running a circuit diagram, IDEC SmartRelay writes data in the buffer to SD card firstly, and IDEC SmartRelay writes data generated later into SD card as well. If the SD card is removed out of IDEC SmartRelay in the process of a circuit running, the generated data gets lost. If the speed of data generation in IDEC SmartRelay FL1F is faster than that of data writing to the micro SD card, data loss can occur. To avoid the occurrence of data loss, apply an enable signal to the data log function block at a minimum time interval of 500 ms.

A micro SD card can store a maximum of 50 latest data log files for each circuit diagram running in each IDEC SmartRelay Base Module. If the inserted SD card already stores 50 data log files for a circuit diagram, the SD card stores newly created data log files and deletes the oldest ones to keep the maximum number of 50 data log files. The micro SD card stores another 50 data log files of another circuit program running in the same IDEC SmartRelay Base Module, but the maximum number of lines that a card can store is limited to its memory size. A data log file on the micro SD card can contain a maximum of 20000 lines. If the memory of the micro SD card is full and you want to create a new data file, then an error message will be generated automatically.

IDEC SmartRelay automatically creates file names with the format of "<IP>_<date>_<number>_<checksum>.csv". <IP> stands for the IP address of the connected IDEC SmartRelay Base Module. <date> stands for the date when creating this data log file. <number> indicates the sequential number of the created data file and ranges from 1 to 9999. <checksum> identifies the circuit diagram. Do not change the file name because the IDEC SmartRelay Base Module cannot recognize user-defined names.

You can upload the data log files in buffer or micro SD card from IDEC SmartRelay to the connected PC through WindLGC or web server (Page 255).

Under the following circumstances, IDEC SmartRelay creates a new data log file:

- When the circuit program in IDEC SmartRelay is changed
- When the IP address of the connected IDEC SmartRelay Base Module is changed
- When the number of lines in the data log file exceeds 20000

The created file will have a name with an increased number index, for example, if the name for the current data file is "192_168_0_3_2023_06_30_0001_ad4b810.csv", the new file will be named "192_168_0_3_2023_06_30_0002_ad4b810.csv".

9 Configuring IDEC SmartRelay

Parameter assignment refers to the configuration of the block parameters. You can set delay times for time functions, the switching times of timers, counter threshold values, the monitoring interval of an operating hours counter, the on and off thresholds of the trigger, and more.

You can configure the parameters:

- In programming mode
- In parameter assignment mode

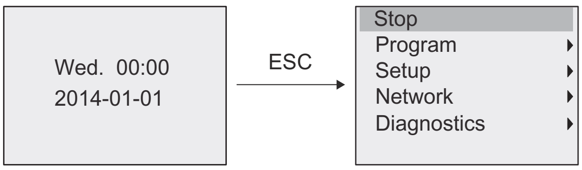
Parameter assignment mode allows the editing of parameters without having to modify the circuit program. This feature is available so that you can edit parameters without having to change to programming mode. The advantage is that you can edit program parameters, but the circuit program remains protected.

Note

In parameter assignment mode, IDEC SmartRelay continues execution of the circuit program.

9.1 Selecting parameter assignment mode

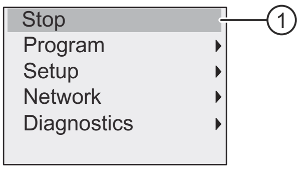
Press ESC to access the parameter assignment mode:



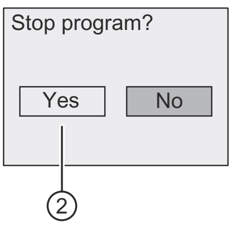
For more information about the menu commands in parameter assignment mode, refer to Section "Base Module (Page 336)".

Follow these steps to stop your circuit program and thus change to the main menu of programming mode:

1. Move the cursor to " ① ": Press ▲ or ▼.

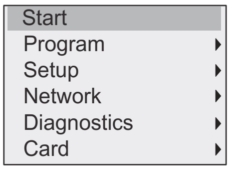


2. Confirm " ① ": Press OK.
3. Move the cursor to " ② ": Press ◀.



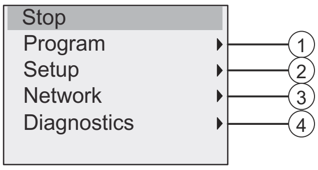
4. Confirm placing IDEC SmartRelay in STOP mode by pressing **OK** with the cursor on " ② ".

   IDEC SmartRelay shows the main menu of the programming mode:



For more information about switching IDEC SmartRelay to RUN mode, refer to Section "Switching IDEC SmartRelay to RUN mode (Page 75)".

Description of other menu commands of the parameter assignment menu



- Menu command ①

  For information on the various settings, refer to the following topics:

  – Parameters (Page 276)
  – Selecting the parameters (Page 276)
  – Modifying parameters (Page 277)
  – Assigning a circuit program name (Page 70)

- Menu command ②

  For information on the various settings, refer to the following topics:

  – Setting the time of day and date (Page 280)
  – Summertime/wintertime conversion (Page 90)
  – Network Time Protocol (FL1F FS5 and later versions only) (Page 94)
  – Setting the start screen (Page 286)
  – Setting the display contrast and backlight choice (Page 282)
  – Setting the default values for IDEC SmartRelay (Page 279)

- Menu command ③

  For information on the various settings, refer to the topic "Configuring network settings (Page 97)".

- Menu command ④

  For information on the various settings, refer to the topic "Diagnosing errors from IDEC SmartRelay (Page 102)".

9.1.1 Parameters

Note

You can only view and edit parameters in the parameter assignment mode when they have the read/write ("+") designation. See the "Parameter protection (Page 129)" topic.

Parameters are, for example:

- The delay times of a timer relay
- The switching times (cams) of a timer switch
- Counter thresholds
- The monitoring time for hour counters
- The trigger thresholds

A block number (Bx) and the short name of the parameter identifies each parameter. Examples:

- T: ...is a configurable time
- MI: ...is a configurable time interval

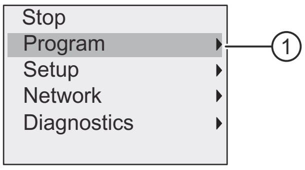
Note

WindLGC also allows you to assign names to blocks (for more information, refer to the chapter entitled "IDEC SmartRelay software (Page 306)".

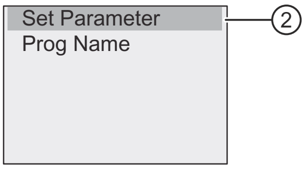
9.1.2 Selecting the parameters

To select a parameter:

1. On the parameter assignment menu, move the cursor to " ① ": Press ▼ or ▲.

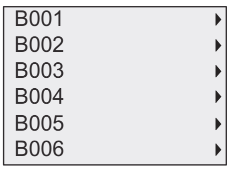


2. Confirm " ① " with **OK**.
3. Move the cursor to " ② ": Press ▼ or ▲.

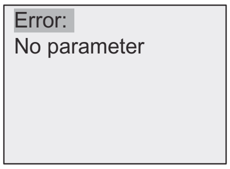


4. Confirm " ② " with **OK**.

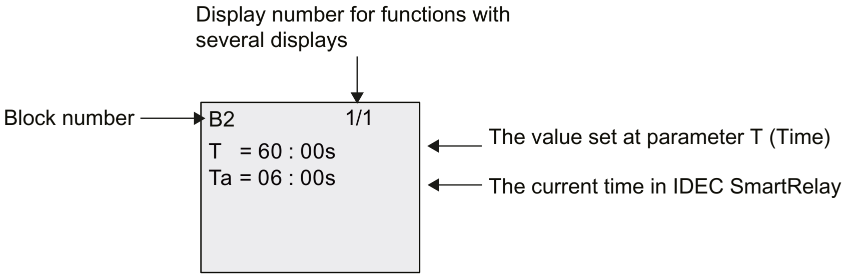
   IDEC SmartRelay shows the list of all available blocks, for example:



If no parameter can be set, the display shows as follows, and you can press **ESC** to return to the parameter assignment menu.



5. Press ▲ or ▼ to move the cursor to the block that you desire to change its parameter, and confirm with **OK**.



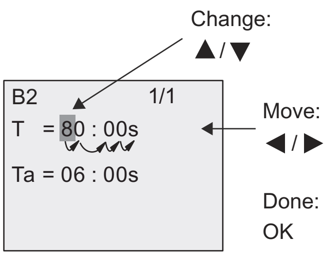
6. Now, select the desired parameter: Press ▲ or ▼.
7. Select the parameter you want to edit, and press **OK**.

9.1.3 Modifying parameters

You first Selecting the parameters (Page 276).

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

1. Move the cursor to the point at which you want to make the change: Press ◀ or ▶.
2. To change this value: Press ▲ or ▼.
3. To apply the value: **OK**.



Note

When changing the time parameter when the system is in RUN, you can also change the timebase (s=seconds, m=minutes, h=hours). This does not apply if the time parameter represents the result of another function (for an example, see the "On-delay (Page 136)" topic). In this case you can neither change the value nor the timebase. The current time is reset to zero when you change the timebase.

Current value of a time T

View of a time T in parameter assignment mode:

```
B2            1/1
T  = 60 : 00s      ← Configured time T
Ta = 06 : 00s      ← Current time Ta
```

You can change the configured time T.

Current timer value

View of a timer cam in parameter assignment mode:

```
B9            1/2
D1     = M-W-F- -
On1    = 09 : 00
Off1   = 10 : 00
D2     = -T- - - - -
On2    = 03 : 00
```

▲ ▼

```
B9            2/2
Off2   = 04:15
D3     = - - - - -SS
On3    = 16:30
Off3   = 23:10
Pulse  = Off
```

You can change the on/off times and the day.

Current value of a counter

View of a counter parameter in parameter assignment mode:

```
B3            1/1
On     =+1234
Off    =+0
Cnt    =+120
STV    =+100
```

or

```
B3            1/1
On     =+123456
Off    =→B021
Cnt    =+120
STV    =+100
```

Current count value

You can change the on/off threshold. This does not apply if the on or off threshold represents the result of another function (In the "Up/down counter (Page 172)" topic, this is B021).

Current value of an hour counter

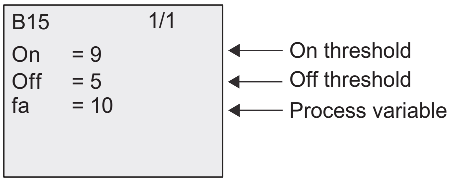
View of an hour counter parameter in parameter assignment mode:

```
B16           1/1
MI   =100h:0m      ← Time interval
OT   =83h:15m      ← Total operating hours
MN   =16h:45m      ← Time-to-go
```

You can edit the configured time interval MI.

Current value of a frequency trigger

View of the parameter of a frequency trigger in parameter assignment mode:



You can change the on/off threshold.

9.2 Setting the default values for IDEC SmartRelay

You can set the following default values for a Base Module:

Clock settings

You can set the default values for time-of-day and date (Page 280), and Summertime/wintertime conversion (Page 90) and Network Time Protocol (FL1F FS5 and later versions only) (Page 94) in programming mode or parameter assignment mode through the following menu commands:

Setup $\xrightarrow{\text{OK}}$ Clock

Contrast and backlight settings

You can set the default value for the backlight (Page 282) and the default value for the display contrast (Page 282) in programming mode or parameter assignment mode through the following menu commands:

Setup $\xrightarrow{\text{OK}}$ LCD

Menu language

You can Setting the menu language (Page 284) in which IDEC SmartRelay displays the menus in programming mode through the following menu commands:

Setup $\xrightarrow{\text{OK}}$ Menu Language

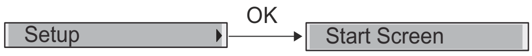
Number of Base Module analog inputs

The Base Modules FL1F-H12SCD, FL1F-H12RCE, and FL1F-B12RCE support four analog inputs. Formerly they supported two. You can choose whether to Setting the number of AIs in IDEC SmartRelay (Page 285) on these modules in programming mode through the following menu commands:

Setup $\xrightarrow{\text{OK}}$ BM AI NUM

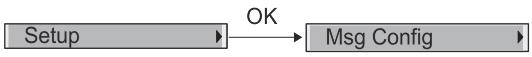
Start screen settings

You can select the Setting the start screen (Page 286) that displays on IDEC SmartRelay when IDEC SmartRelay transfers to RUN mode in programming mode or parameter assignment mode through the following menu commands:



Message text settings

You can select settings that apply to all Message text function blocks (Page 200) in programming mode or parameter assignment mode through the following menu commands:



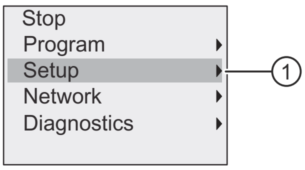
9.2.1 Setting the time of day and date

You can set the time of day and the date in programming mode or parameter assignment mode.

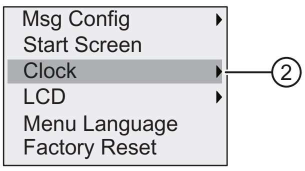
Setting the time of day and the date in parameter assignment mode

Follow these steps to set the time of day and the date:

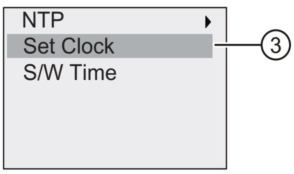
1. Selecting parameter assignment mode (Page 274).
2. On the parameter assignment menu, move the cursor to " ① ": Press ▼ or ▲.



3. Confirm " ① ": Press **OK**.
4. Move the cursor to " ② ": Press ▲ or ▼.



5. Confirm " ② ": Press **OK**.
6. Move the cursor to " ③ ": Press ▲ or ▼.



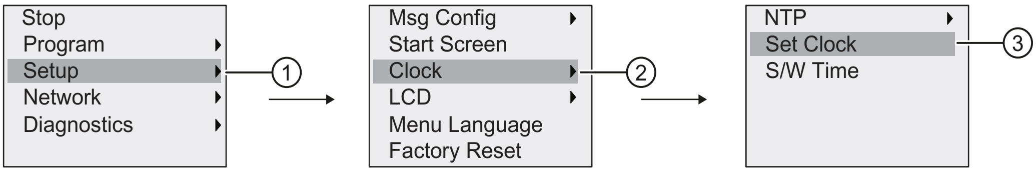
7. Confirm " ③ ": Press **OK**.

   IDEC SmartRelay shows the following display.

8. To set the correct time of day, press ◀ or ▶ to move the cursor to the desired position, and press ▲ or ▼ to change the value.
9. To set the correct date, press ◀ or ▶ to move the cursor to the desired position, and press ▲ or ▼ to change the value.
10. To confirm your entries: Press **OK**.

Setting the time of day and the date in programming mode

If you want to set the time of day and the date in programming mode, select " ① " in the main menu, then menus " ② " and " ③ ". You can now set the date and the time as described earlier.



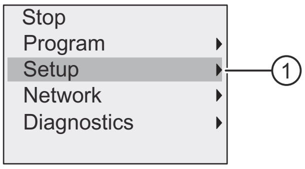
9.2.2 Setting the display contrast and backlight choice

You can set the default value for the display contrast and backlight in programming mode or parameter assignment mode.

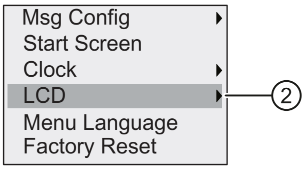
Setting the display contrast in parameter assignment mode

Follow these steps to set the display contrast:

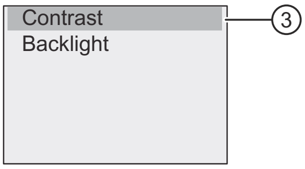
1. Selecting parameter assignment mode (Page 274).
2. On the parameter assignment menu, move the cursor to " ① ": Press ▼ or ▲.



3. Confirm " ① ": Press **OK**.
4. Move the cursor to " ② ": Press ▼ or ▲.

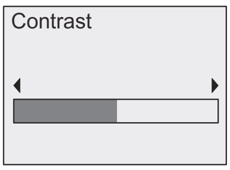


5. Confirm " ② ": Press **OK**.
6. Move the cursor to " ③ ": Press ▲ or ▼.



7. Confirm " ③ ": Press **OK**.

   IDEC SmartRelay shows the following display:



8. To change the display contrast: Press ◀ or ▶.
9. To confirm your entry: Press **OK**.

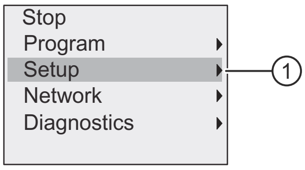
Setting the display contrast in programming mode

If you want to set the display contrast in programming mode, select menu command " ① " in the main menu, then menus " ② " and " ③ ". You can now set the display contrast as described earlier.

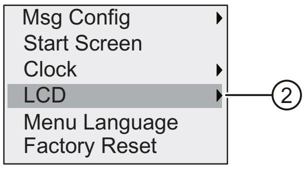
Setting the backlight choice in parameter assignment mode

Follow these steps to set the backlight choice:

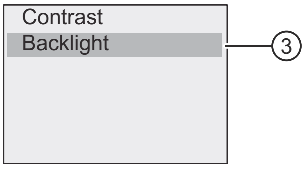
1. On the parameter assignment menu, move the cursor to " ① ": Press ▼ or ▲.



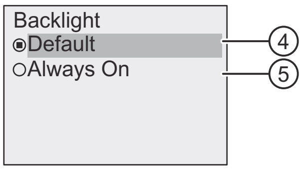
2. Confirm " ① ": Press **OK**.
3. Move the cursor to " ② ": Press ▼ or ▲.



4. Confirm " ② ": Press **OK**.
5. Move the cursor to " ③ ": Press ▲ or ▼.



6. Confirm " ③ ": Press **OK**.



7. Move the cursor to " ④ " or " ⑤ ": Press ▼ or ▲.
8. Confirm " ④ " or " ⑤ ": Press **OK**.

   The default setting is that the backlight is not on. To set the backlight to always be on, select " ⑤ ".

Setting the backlight choice in programming mode

If you want to set the backlight in programming mode, select menu command " ① " in the main menu, then menus " ② " and " ③ ". You can now set the backlight as described earlier.

Note

The backlight lifetime of the Text Display is 20000 hours.

You can change the backlight colors of the IDEC SmartRelay onboard display or the FL1F-RD1 by means of some special markers (M25, M26, M28 to M31). For more information, refer to section "Constants and connectors (Page 116)". If you use these special markers in your circuit programs, the backlight setting through the above menu commands takes no effect.

9.2.3 Setting the menu language

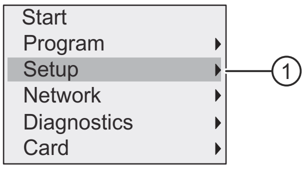
The language of the IDEC SmartRelay menus can be one of ten predefined languages:

German	English	French	Spanish	Italian
Chinese	Dutch	Turkish	Russian	Japanese

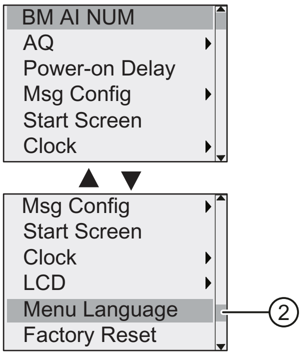
Setting the menu language in programming mode

You can set the menu language in programming mode only:

1. In the main menu of programming mode, move the cursor to " ① ": Press ▼ or ▲.



2. Confirm " ① ": Press **OK**.
3. Move the cursor to " ② ": Press ▼ or ▲.



4. Confirm " ② ": Press **OK**.
5. Move the cursor to the language of your choice: Press ▲ or ▼.
6. Confirm language selection: Press **OK**.

9.2.4 Setting the number of AIs in IDEC SmartRelay

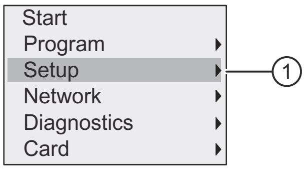
FL1F-H12RCE/B12RCE and FL1F-H12SCD support up to four onboard inputs that can be used as either digital or analog inputs (0 V to 10V). Inputs I7 (AI1) and I8 (AI2) are available as analog inputs by default, whether you use them or not. Inputs I1 (AI3) and I2 (AI4) are optional analog inputs. IDEC SmartRelay provides a menu where you can choose to use two analog inputs (the default, AI1 and AI2), or four, or even zero. Regardless of the settings, inputs I1 and I2 can be used as digital inputs. To use them as analog inputs AI3 and AI4, you must set the number of analog inputs to four. Note that the number of configured analog inputs on IDEC SmartRelay affects the subsequent numbering of analog inputs on attached expansion modules (see the "Maximum setup with expansion modules (Page 18)" topic).

You can set the number of AIs in programming mode only.

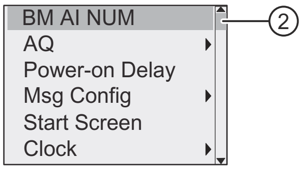
Setting the number of AIs in programming mode

Follow these steps to set the number of analog inputs:

1. In the main menu of programming mode, select " ① ": Press ▼ or ▲.



2. Confirm " ① ": Press **OK.**
3. Select " ② ": Press ▼ or ▲.



4. Confirm " ② ": Press **OK.**
5. Move to "0 AI", "2 AIs" or "4 AIs": Press ▲ or ▼.
6. Confirm your selection with **OK**, and the setting takes effect immediately.

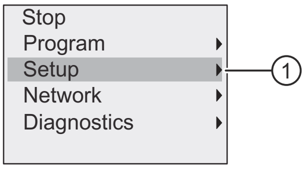
9.2.5 Setting the start screen

You can select the default setting for the start screen that IDEC SmartRelay displays in RUN mode. You make this selection from IDEC SmartRelay in either parameter assignment mode or programming mode.

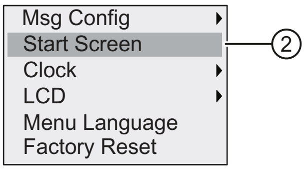
Selecting the start screen in parameter assignment mode

Follow these steps to select the start screen for IDEC SmartRelay:

1. Selecting parameter assignment mode (Page 274).
2. On the parameter assignment menu, move the cursor to " ① ": Press ▼ or ▲.

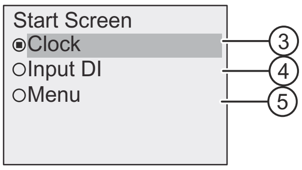


3. Confirm " ① ": Press **OK**.
4. Move the cursor to " ② ": Press ▲ or ▼.



5. Confirm " ② ": Press **OK**.

   The display now shows:



   The current setting of the start screen is indicated by the circle with a dot. The default setting is " ③ ".

   You can choose to display the current time-of-day and date (③), the values of the digital inputs (④), or the parameter assignment menu (⑤).
6. Select the desired default setting: Press ▲ or ▼.
7. To confirm your entry: Press **OK**.

Power IDEC SmartRelay off then on to make your changes take effect. When IDEC SmartRelay is in RUN mode, it displays the start screen that you selected.

Using memory cards 10

For program storage, IDEC SmartRelay supports micro SD cards that support below file system format:

- FL1F FS5 and earlier versions only support micro SD cards that support FAT32 file system format.
- FL1F FS6 and later versions support micro SD cards that support FAT32 and exFAT file system format.

You can store and copy-protect a circuit program, with or without the data log of process data, from an IDEC SmartRelay device to a micro SD card, or copy a circuit program from the card to an IDEC SmartRelay device.

IDEC SmartRelay allows you to store only one circuit program in its memory. If you want to modify the circuit program or create an additional one without deleting the first, you must archive it somewhere.

For detailed information about how to format micro SD cards, see Section "Formatting micro SD cards (Page 287)".

For detailed information about the copy protection function, see Section "Program copy protection (Page 298)".

For detailed information about the data log, see Chapter "Data log (Page 272)".

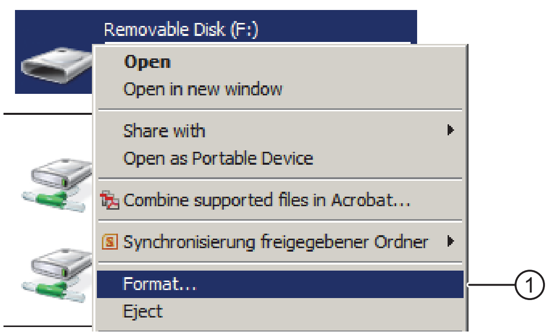
10.1 Formatting micro SD cards

As FL1F FS5 and earlier versions only supports micro SD cards that support FAT32 file system format, and FL1F FS6 and later versions support micro SD cards that support FAT32 and exFAT file system format for program storage, you must format the micro SD card first if it supports other file systems. The following examples describe how to format a micro SD card under operating system Windows 7.

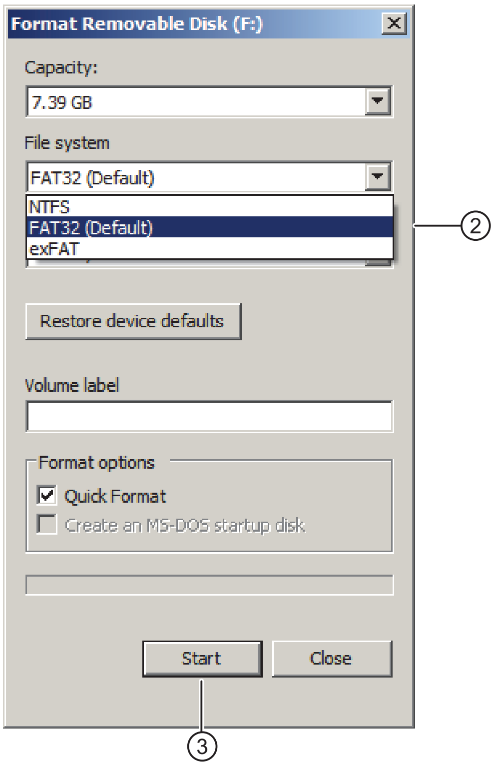
Formatting under Windows OS

Follow the steps below to format the micro SD card under Windows OS:

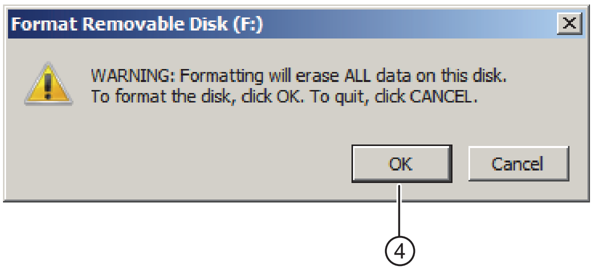
1.



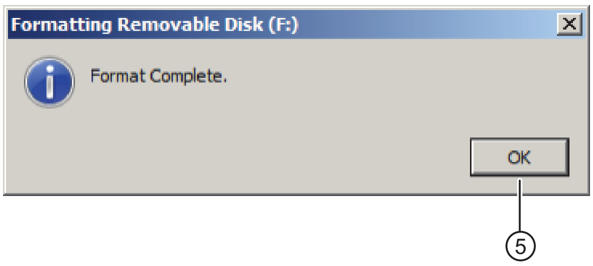
2.


Format Removable Disk (F:)
Capacity:
7.39 GB
File system
FAT32 (Default)
NTFS
FAT32 (Default)
exFAT
Restore device defaults
Volume label
Format options
Quick Format
Create an MS-DOS startup disk
Start
Close
2
3

3.


Format Removable Disk (F:)
WARNING: Formatting will erase ALL data on this disk.
To format the disk, click OK. To quit, click CANCEL.
OK
Cancel
4

4.


Formatting Removable Disk (F:)
Format Complete.
OK
5

10.2 Inserting and removing the card from IDEC SmartRelay

Do not remove a micro SD card while SmartRelay accesses the micro SD card.

When you remove a micro SD card that contains a circuit program with copy protection attributes, note the following: IDEC SmartRelay can only execute the circuit program stored on the card if the card remains inserted during system runtime.

A removal of the card during RUN mode can lead to impermissible operating states.

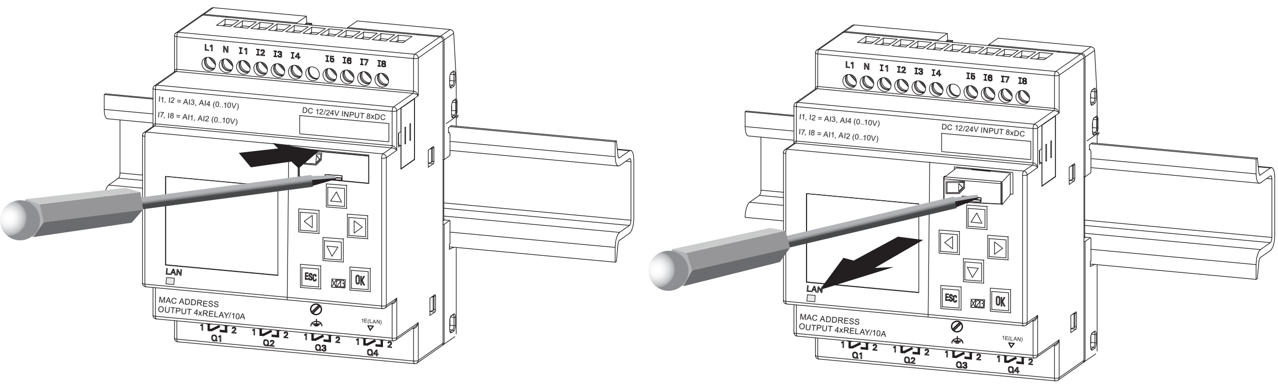
⚠WARNING
Fire hazard
Insert/remove under hazardous location may trigger a fire in the machine or plant.
Death or serious injury could occur.
Do not insert/remove the memory card in hazardous locations.

Removing the micro SD card

To remove the micro SD card, carefully insert a screwdriver with a 3-mm blade into the groove on the front of the socket, and lever the socket partially out of the slot. Pull the socket to the position as the following figure shows. You can now remove the micro SD card from the card slot on the left side of the socket.

Note

To avoid any possible damage to the SD card socket, do not pull the socket completely out from the module.



Inserting the micro SD card

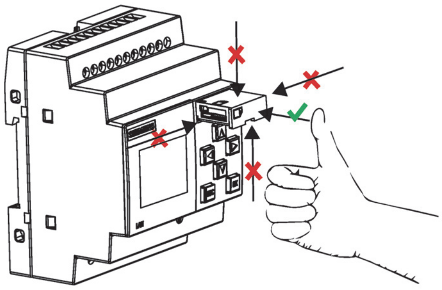
The entry of the card slot is chamfered on its bottom right. The edge of the cards is chamfered accordingly. This encoding prevents you from inserting cards in the wrong way. Insert the card into the holder and push it in until it engages.

Note

Make sure that you insert the card into the right position in the socket until you hear an audible sound of a click.

Note

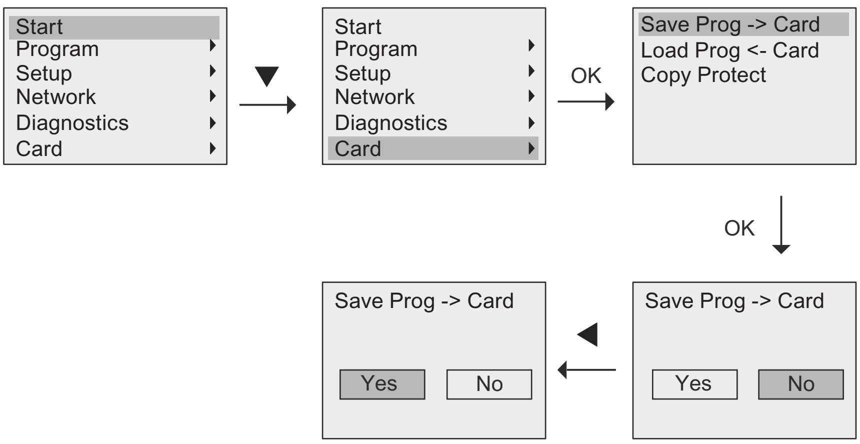
If the SD card socket cannot be pushed in smoothly, don't push hard. Pull the card, adjust the direction, and push it in again. Refer to the following figure for the right direction.



10.3 Copying data from IDEC SmartRelay to the card

Copying data from IDEC SmartRelay to the card manually

To manually copy the circuit program to the micro SD card, follow the steps shown in the illustration below:



Press OK. IDEC SmartRelay starts copying the circuit program to the card.

If power fails while IDEC SmartRelay is copying the circuit program, repeat the process after power-on.

Note

- If the program is empty, a message will display on the screen to remind you the program in IDEC SmartRelay is empty.
- The password of a protected circuit program in IDEC SmartRelay also applies to the copied program version on your card.

Copying data from IDEC SmartRelay to the card automatically

WindLGC provides an option for automatically copying the circuit program to the micro SD card when transferring the circuit program to IDEC SmartRelay. This option is available in the dialog for PC->IDEC SmartRelay transfer. If you select this option, WindLGC transfers the circuit program to IDEC SmartRelay and to the micro SD card.

Note

To successfully copy the circuit program from IDEC SmartRelay to the micro SD card, make sure that the free memory space available on the micro SD card is at least 1 M bytes.

Function block parameters can be saved automatically

In FL1F FS5 and later versions, if the parameters for function block have some modifications, they can be saved to SD card automatically.

Generating the data log on the micro SD card

If your circuit program in IDEC SmartRelay includes a Data Log function block configured from WindLGC, you can save the data log in your IDEC SmartRelay or on the micro SD card. If there is a micro SD card inserted into the slot of your IDEC SmartRelay, then when IDEC SmartRelay switches from STOP to RUN, it attempts to copy the data log to the micro SD card; otherwise, IDEC SmartRelay saves the data log in memory. At every STOP to RUN transition, IDEC SmartRelay determines the destination of the data log storage.

If IDEC SmartRelay copies the data log to the micro SD card, it saves the data log by default as .CSV file format, which you can then open from a PC. Each line in the .CSV file includes a time stamp, the function block number and the actual values recorded. For more information about the data log, refer to chapter "Data log (Page 272)".

Note

- For FL1F FS05 and earlier versions, when IDEC SmartRelay with an inserted micro SD card is in STOP mode, you can upload the most recent data log file on the micro SD card to WindLGC using a transfer menu command in WindLGC. For more information about the data log uploading command, refer to *WindLGC Online Help*.
- For FL1F FS06 and later versions, you can upload at most 50 recent log files on the micro SD card to WindLGC no matter when IDEC SmartRelay is in STOP or RUN mode.

10.4 Copying data from the card to IDEC SmartRelay

You can copy a circuit program from a micro SD card to IDEC SmartRelay in one of the following ways:

- Automatically during the startup of IDEC SmartRelay (POWER ON)
- By means of the card specific menu of IDEC SmartRelay

Note

If the program on the card is protected with a password, the copied program in IDEC SmartRelay is also protected with the same password. For more information about the Card menu, refer to Section "Overview of IDEC SmartRelay menus (Page 62)".

Automatic copying during the startup of IDEC SmartRelay

To automatically copy the circuit program to IDEC SmartRelay, follow these steps:

1. Switch off the power supply to IDEC SmartRelay.
2. Insert the card into the relevant slot.
3. Switch on the power supply to IDEC SmartRelay.

   IDEC SmartRelay copies the program from the program module/card to IDEC SmartRelay. For FL1F FS6 and later versions BM, when IDEC SmartRelay finishes copying, BM is in STOP mode. It opens the IDEC SmartRelay main menu as the following:

   ```
   Start
   Program      ▸
   Setup        ▸
   Network      ▸
   Diagnostics  ▸
   Card         ▸
   ```

   For FL1F FS5 and earlier versions BM, when IDEC SmartRelay finishes copying, BM is in the same status as the one before it's powered off. If BM is in RUN mode before it's powered off, after copying the circuit program, BM is also in RUN mode and you can ignore the following steps.

   Note

   Before you switch IDEC SmartRelay to RUN, you must ensure that the system you are controlling with IDEC SmartRelay does not represent a source of hazard.

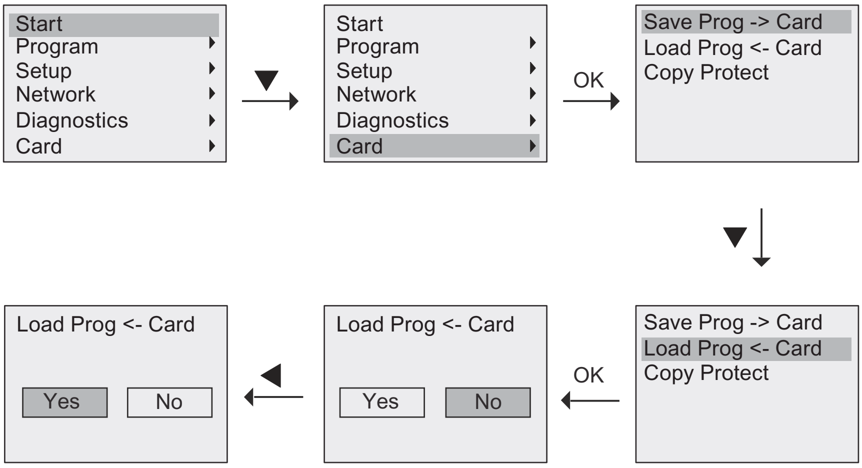
   ---

4. Move the cursor to the first menu command in Step 3: Press ▲ or ▼.
5. Press OK.

Copying by means of the card specific menu

For more information about the replacement of a micro SD card, refer to Section "Inserting and removing the card from IDEC SmartRelay (Page 289)".

To copy a program from the card to IDEC SmartRelay, insert the card and follow the steps shown in the illustration below:



Press OK. IDEC SmartRelay copies the circuit program from the card to IDEC SmartRelay. When IDEC SmartRelay has finished copying, it automatically returns to the IDEC SmartRelay main menu.

Security

11

Overview

This chapter describes the following security functions on IDEC SmartRelay:

Security function	Description
Network security	FL1F FS6 (and later version) Base Module can connect to Cloud (Page 256) through MQTT. To protect your network communication, FL1F FS6 (and later ver-sion) Base Module uses HTTPS for the following connections: • IDEC SmartRelay BM and WindLGC V8.4 (or later version)/FL1F Web Editor V1.2.0 (or later version) • FL1F Access Tool V2.1.1 (or later version)/standard web browser and FL1F FS6 (or later version) BM If authentication, encryption, or integrity protection is required in the Network, IDEC recommends that you protect network and physical access to the IDEC SmartRelay devices with appropriate measures. For more information about Network security, you can refer to Network security (Page 295).
Program access security	The following protection methods can help you protect your circuit programs from unauthorized access: • Password protection • Copy protection For detailed information, you can refer to Program access security (Page 298).
Menu access security	You can limit access to specific menus of IDEC SmartRelay by setting the access level. For detailed information, you can refer to Menu access security (Page 300).

⚠ WARNING

Protect the device against unauthorized access

An unauthorized user can operate the device incorrectly, read or write data and bypass logon by restarting the device.

Operation by unauthorized persons jeopardizes operational reliability.

You must protect these forms of communication by limiting physical access. IDEC recommend you lock the IDEC SmartRelay devices in a cabinet.

Note

The communication protocol for IDEC SmartRelay is designed for use in a trusted environment, and allows unauthenticated access to the devices. IDEC therefore strongly recommends you protect network access to the IDEC SmartRelay devices with appropriate mechanisms.

Note

Protect communication with IDEC SmartRelay devices through white list mechanism.

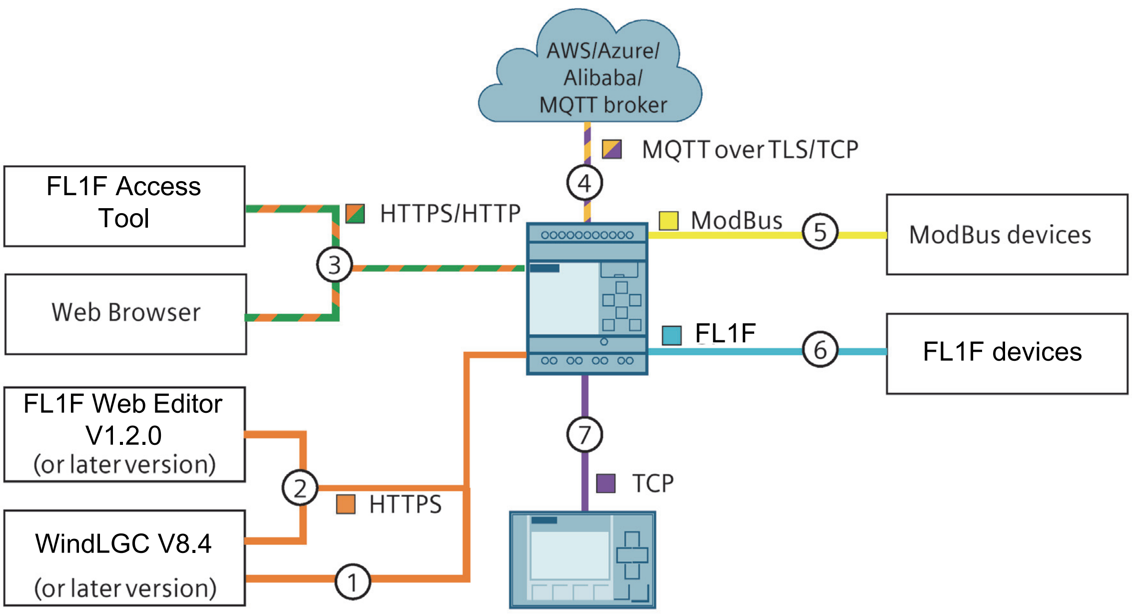
IDEC recommends that you use white list mechanism to protect the communication with IDEC SmartRelay devices. White list mechanism works when you don't use the default product root certificate as trust anchor, but use each independent unique issuing certificate. When one IDEC SmartRelay device is broken or out of use, you can remove the device issuing certificate out of trusted repository.

About how to download IDEC SmartRelay issuing certificate, refer to section *Tools -> Transfer -> Certificate Settings* in *WindLGC Online Help*.

11.1 Network security

With the enhanced network security of FL1F FS6 (and later version) devices, you can access the FL1F FS6 (and later version) Base Modules through a local area network, a remote area network or a Cloud.

Different devices/software connect to IDEC SmartRelay devices with different channels.



Connec-tions	Supported APP/Device	Port	Account	Protocols	Remarks
①	WindLGC V8.4 (or later version)	8443 (on TDE)	WindLGC user	HTTPS	Only one WindLGC V8.4 (or later version) can connect to a Text Display at a time.
②	WindLGC V8.4 (or later version) FWE V1.2.0 (or later version)	8443	WindLGC user	HTTPS	• Only one connection can be established between FL1F FS6 (or later version) BM and WindLGC V8.4 (or later version) or FL1F Web Editor V1.2.0 (or later version). • Only one WindLGC V8.4 (or later version) can connect to a FL1F FS6 (or later version) BM at a time.
③	FL1F Access Tool	80/443	Web User	HTTPS/ HTTP	You can select to use HTTPS or HTTP by WindLGC V8.4 (or later version). • For FL1F FS6 BM, Cloud access must be disabled if HTTPS is enabled. • Only two connections can be established between FL1F FS6 (or later version) BM and FL1F Access Tool/Web Browser.
	Web Browser	80/443	Web User/ Web Guest		
④	Cloud			MQTT over TLS/ TCP	• For AWS, Azure and Alibaba Cloud connection, the connection mode is MQTT over TLS. • For general MQTT broker connection, you can choose the connection mode as MQTT over TLS or TCP. Refer to Secure Cloud connection (Page 261) for details. • When the Cloud connection is enabled, FL1F FS6 BM cannot establish connection to FL1F Access Tool/Web Browser.
⑤	Modbus devices	502-510		Modbus	You can enable or disable the FL1F/Modbus connections through WindLGC V8.4 (or later version). • In the programs created by WindLGC V8.4 (or later version), the FL1F/Modubus connections are disabled by default. • In the programs converted from previous version WindLGC, the FL1F/Modbus connections are enabled after the conversion.
⑥	FL1F devices	102		FL1F Communi-cation	
⑦	Text Display	135	TDE Onboard User	TCP	Text Display connects to IDEC SmartRelay BM through unsecured channel. The connection is enabled by default. You can disable the connection through WindLGC V8.4 (or later version).

In order to maintain an adequate security level, IDEC strongly recommends that you open the ports only at firewalls within the Secure Network. The table above lists all the port information for the IDEC SmartRelay supported applications.

All static resources used in IDEC SmartRelay Web server or FWE project, for example, pictures or PDF files, is not protected by login password. You can access to these resources by entering corresponding static resource URL in the web browser without logging in IDEC SmartRelay Web server.

⚠ WARNING
Unauthorized access to the IDEC SmartRelay through the Web server Unauthorized access to the IDEC SmartRelay devices or changing IDEC SmartRelay variables to invalid values could disrupt process operation and could result in death, severe personal injury and/or property damage. Because enabling the Web server allows authorized users to perform operating mode changes, writes to IDEC SmartRelay data, and firmware updates, IDEC recommends that you observe the following security practices: • Enable access to the Web server only with the HTTPS protocol. • Password-protect Web server user IDs with a strong password. Strong passwords are ten characters in length, mix letters, numbers, and special characters, are not words that can be found in a dictionary, and are not names or identifiers that can be derived from personal information. Keep the password secret and change it frequently. • Perform error-checking and range-checking on your variables in your program logic because Web page users can change PLC variables to invalid values. • Use a secure Virtual Private Network (VPN) to connect to the IDEC SmartRelay Web server when you use HTTP protocol.

⚠ WARNING
Unauthorized access to the IDEC SmartRelay through unsecure port (502-510 for Modbus, 102 for FL1F, 135 for Text Display) Unauthorized access to the IDEC SmartRelay devices or changing IDEC SmartRelay variables to invalid values could disrupt process operation and could result in death, severe personal injury and/or property damage. Because enabling the unsecure port allows authorized users to perform operating mode changes, writes to IDEC SmartRelay data, and firmware updates, IDEC strongly recommends that you open the ports only at firewalls within the Secure Network.

11.2 Program access security

11.2.1 Program password protection

You can protect your circuit program from unauthorized access with a password. IDEC strongly recommends you use password protection to prevent unauthorized reading or editing of your circuit programs.

For more information about assigning and changing a program password, refer to Section "Password for circuit program protection (Page 71)".

Note

If a password protection program is stored in a IDEC SmartRelay Base Module and you want to download a new one, you must enter the password in order to unlock the current program.

Note

Circuit programs edited and saved in FL1F FS6 and later versions BM are encrypted.

11.2.2 Program copy protection

The copy protection function provides protection for circuit programs on micro SD cards. A circuit program is protected when you transfer it to a protected memory card.

This additional security feature allows you to bind the circuit program to a specific memory card. If you copy a protected circuit program to another memory card, IDEC SmartRelay cannot recognize the program and rejects loading it after you insert the card.

To execute this circuit program in IDEC SmartRelay, you must leave the card in the IDEC SmartRelay Base Module; that is, you cannot remove the card to copy the program to other IDEC SmartRelay devices.

A circuit program with password protection is no longer protected after the correct password has been entered; that is, you can then edit or copy the program and remove the card.

Operation status under the different functions

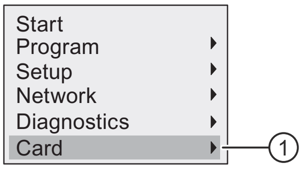
The following table describes which operations are possible:

Operations	Editing	Copying	Deleting
Without Program password protection and without Program copy protection	Yes	Yes	Yes
With Program password protection, without Program copy protection	Yes, with password	Yes	Yes
Without Program password protection, with Program copy protection	No	No	Yes
With Program password protection and with Program copy protection	Yes, with password	No	Yes

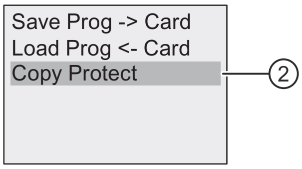
Enabling the protection function

To assign the copy protection function to the card, follow these steps:

1. Enter the programming mode and move the cursor to " ① ": Press ▼ or ▲.

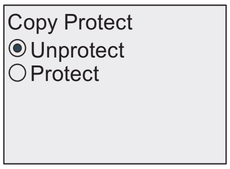


2. Confirm " ① " with **OK**.
3. Move the cursor to " ② ": Press ▼ or ▲.



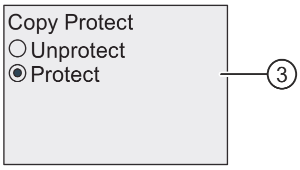
4. Confirm " ② " with **OK**.

   IDEC SmartRelay shows the following display:

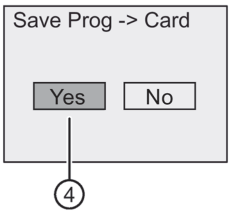


   By default, the card is unprotected.

5. Move the cursor to " ③ ": Press ▼ or ▲.



6. Move the cursor to " ④ ": Press ▼ or ▲.



7. Confirm " ④ " with **OK**.

   Then you can enable the protection function and save the program to card.

Note

The protection function applies only to the card; you must Copying data from IDEC SmartRelay to the card (Page 290) the circuit program to the card in a separate action at power-on.

You can always change the status of the protection function from "disabled" to "enabled".

You can always change the status of the card protection from "protection function disabled" to "protection function enabled".

11.3 Menu access security

IDEC SmartRelay provides two access levels, administrator and operator, to limit access to specific menus in programming mode. As an administrator, you can access all menu commands. As an operator, some specific menu commands are not visible. IDEC SmartRelays default setting is administrator, which you can change to operator at any time. When switching from operator to administrator, you must enter a valid password.

Note

For menu access security, IDEC recommend that you set a strong password. Strong passwords are at least eight characters in length; mix letters, numbers, and special character; are not words that can be found in a dictionary; and are not names or identifiers that can be derived from personal information. Keep the password secret and change it frequently. To learn how to change the password, refer to section *"Tools -> Transfer -> Access Control"* in *WindLGC Online Help*.

IDEC SmartRelay always saves its access level before power-off. For more information about switching between the access levels, refer to section "Configuring menu access protection for IDEC SmartRelay (Page 60)".

Note

The access level of the FL1F-RD1 is operator by default, and you can switch it to administrator with the password.

The FL1F-RD1 saves its access level before power-off if it connects to the same IDEC SmartRelay Base Module after power-on. If you connect a different IDEC SmartRelay Base module to it, however, the FL1F-RD1 restores its access level to operator after power-on.

11.4 Installing SmartRelay Root certificate

You need to import the SmartRelay Root certificate before using HTTPS to visit BM with browsers or FL1F Access Tool. You can import the SmartRelay Root certificate to the following OS and browsers:

- Windows
  - Edge 90.0 to 126.0
  - Firefox 67.0 to 115.13
  - Google Chrome 63.0 to 126.0
  - Opera 84.0 to 125.0

Note

SmartRelay Root Certificate cannot be installed in Android system.

Prerequisite

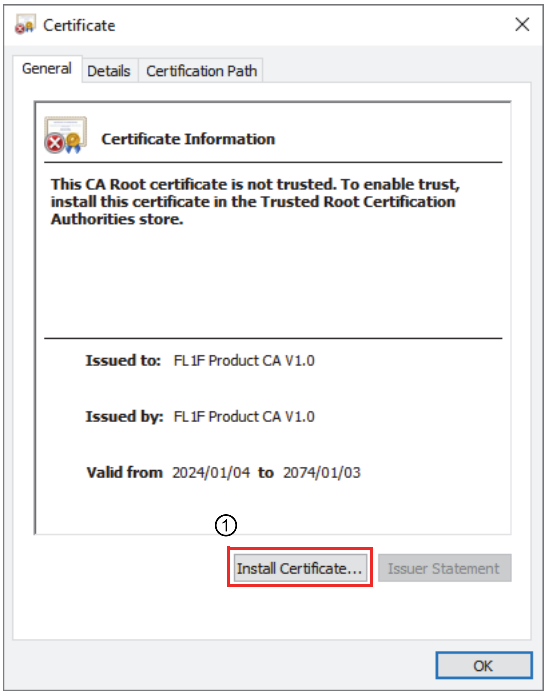
You can get the "SmartRelay Root certificate" in either of the following path:

- on DVD: **Windows** → **Application"_operating system version"** → **res**
  "_operating system version" is available only for Windows.
- in FL1F Web Editor installation path: The FL1F Web Editor installation drive (such as C:\) → **Program Files** → **IDEC** → **fwe** → **fwe** → **res**
- in WindLGC installation path: The WindLGC installation drive (such as C:\) → **Program Files** → **IDEC** → **WindLGC_V8.4** → **res**

11.4.1 Installing the certificate for Windows

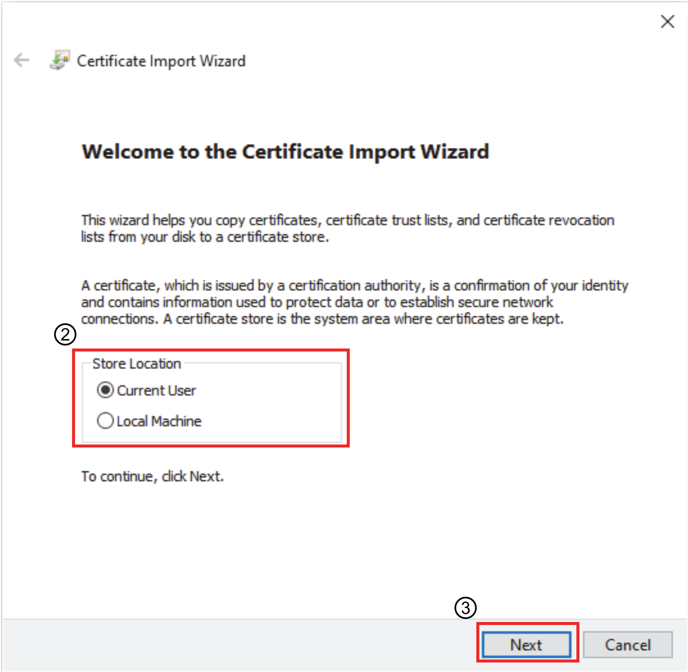
Install SmartRelay Root Certificate for Windows

1. Open the certificate by double-clicking the SmartRelayRootCert.cer and the click ① .



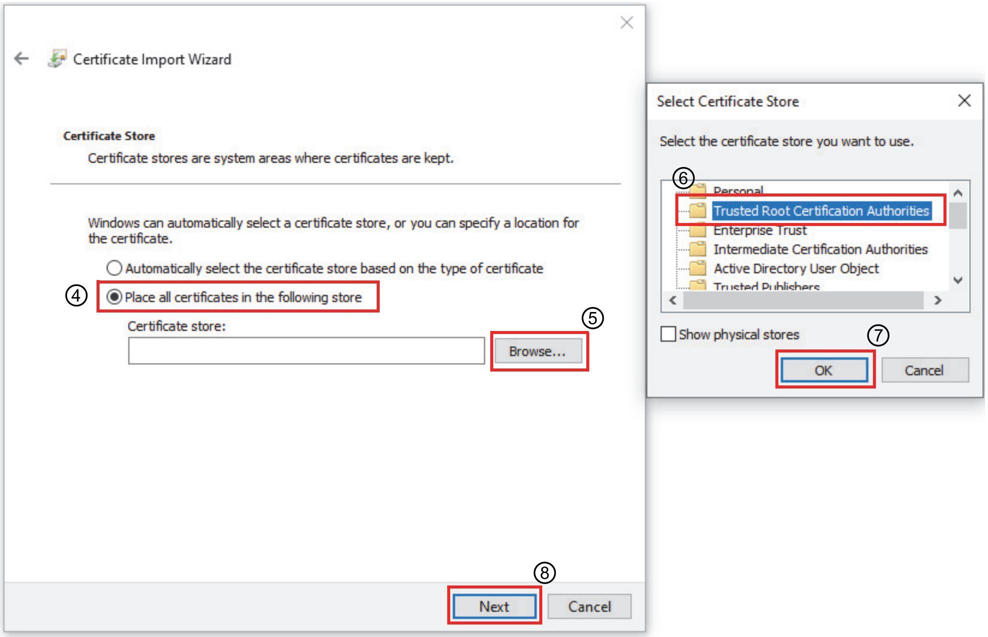
2. In the certificate import Wizard welcome page, select the store location ② .
   – If you select “Current User”, the certificate is only valid for the current user.
   – If you select "Local Machine", the certificate is valid for all the user on this PC. Only administrator can install the certificate as "Local Machine".

3. Click ③ to continue.

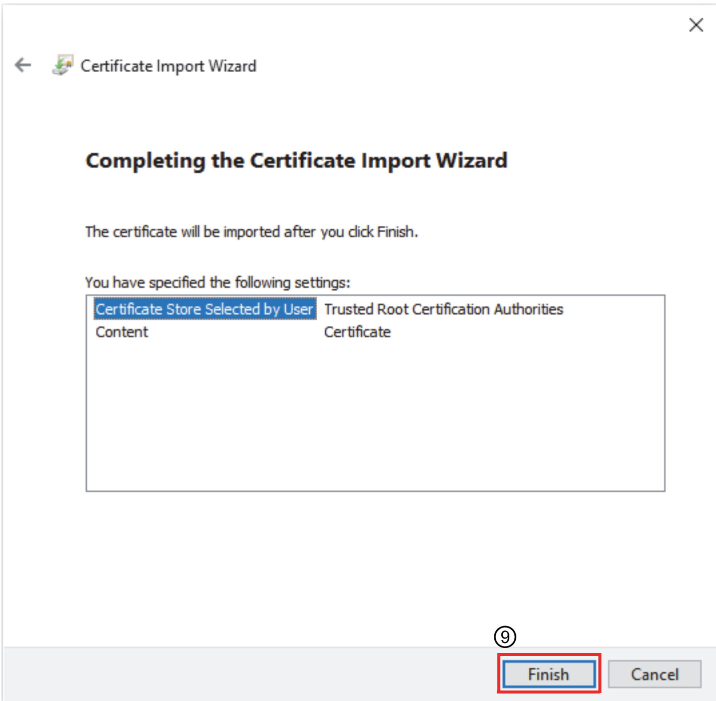


4. Select the check box of ④ and click ⑤ to store the certificate.
5. Trust the certificate by selecting ⑥ in the pop-up window and then clicking ⑦ .

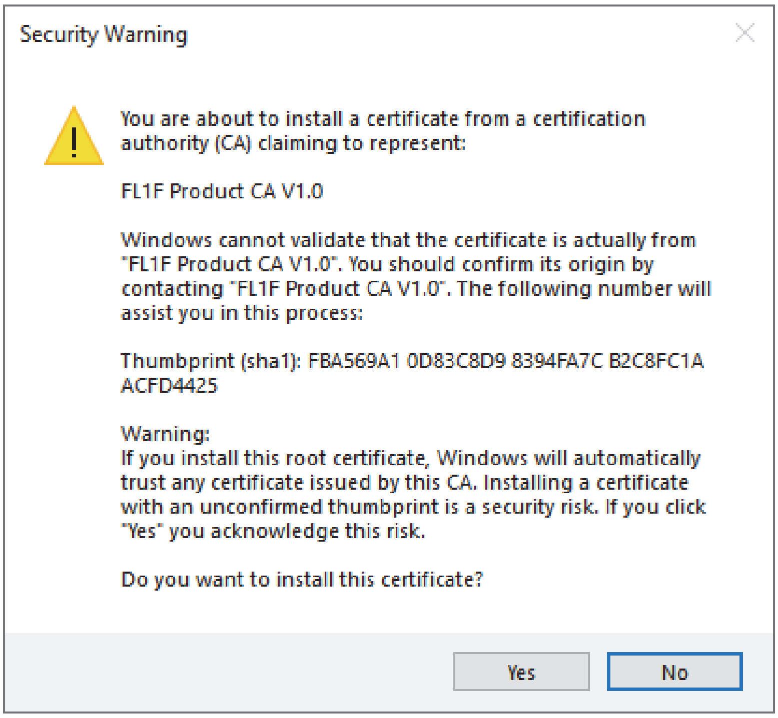
6. Click ⑧ to continue.



7. Click ⑨ to confirm your selection.



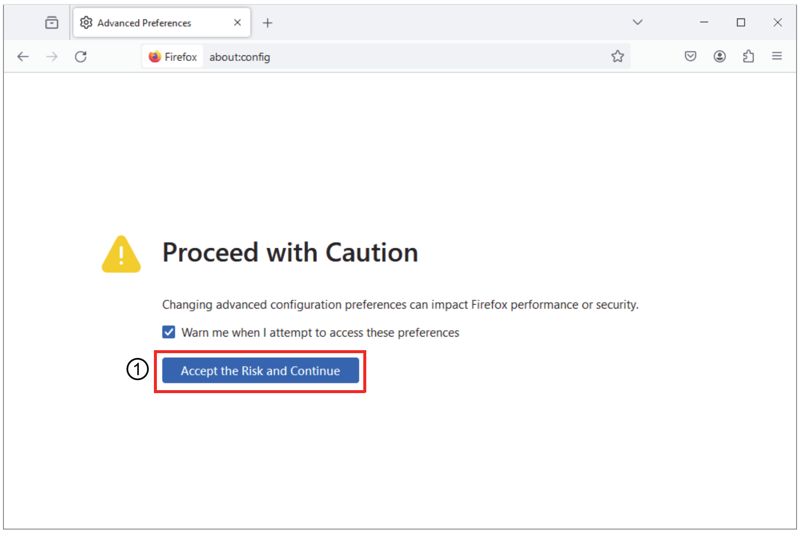
8. Click the "Yes" button to confirm the installation.



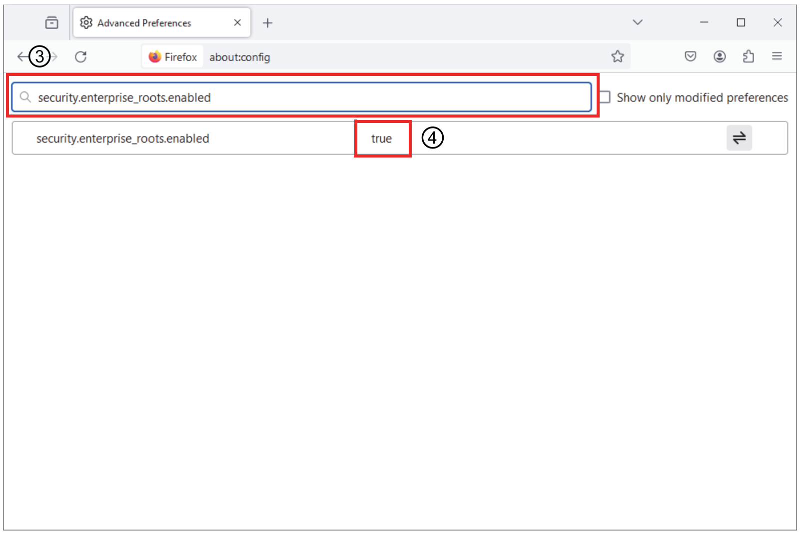
If Firefox still cannot trust the certificate after you installed the certificate, modify the setting as below steps:

1. Start Firefox.
2. Enter `about:config` in the address bar at the top of the browser.

3. Click ① .



4. Enter security.enterprise_roots.enabled in the search bar and set its value as “true”.



IDEC SmartRelay software 12

12.1 IDEC SmartRelay software

WindLGC is available as a programming package for the PC. This software provides many features, for example:

- A graphical user interface for offline creation of your circuit program by means of Ladder Diagram (contact chart / circuit diagram) or Function Block Diagram (function chart)
- A graphical user interface for offline creation of your Network project
- Simulation of your circuit program on the PC
- Generating and printing of an overview chart for the circuit program
- Saving a backup of the circuit program on the hard drive or other media
- Comparing circuit programs
- Easy configuration of blocks
- Transferring the circuit program in both directions:
  - from IDEC SmartRelay to the PC
  - from the PC to IDEC SmartRelay
- Reading the values of the hour counter
- Setting the time of day
- Summertime/wintertime conversion
- Online testing that provides a display of status changes and process variables of IDEC SmartRelay in RUN mode:
  - Status of digital I/O, markers, shift register bits and cursor keys
  - Values of all analog I/O and markers
  - Results of all blocks
  - Current values (including the times) of selected blocks
- Starting and stopping circuit program execution from the PC (switching between RUN and STOP modes)
- Network communication
- Creating UDF (User-Defined Function) (Page 268) for use in a circuit program
- Configuring the Data log (Page 272) function block for your circuit program to record process values of the configured function blocks

The current version is WindLGC V8.4. The Online Help for WindLGC describes all of the programming functionality and design features.

The IDEC SmartRelay advantages

As you can see, WindLGC offers many advantages:

- You can develop the circuit program on your PC.
- You simulate the circuit program on your computer and verify its functions before you actually implement it in your system.
- You can add comments to the circuit program and create hard copies.
- You can save a copy of your circuit program to the file system on your PC, to make it directly available for modifications.
- It takes only a few key actions to download the circuit program to IDEC SmartRelay.

Supported operating systems

You can execute WindLGC on any of the following operating systems:

- Windows: Windows 7 (64 bit), Windows 8 (64 bit), Windows 10 (32/64 bit) or Windows 11
- Recommended Java Runtime Environment version: Amazon Corretto 11.0.13.8.1

WindLGC V8.4

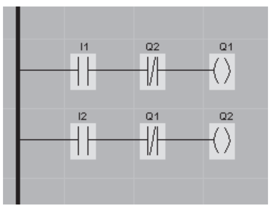
This is the current version of WindLGC. You will find all the functions and the functionality of the devices described in this manual in the version 8.4.

Note

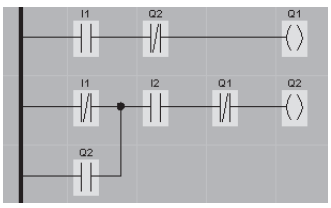
Please note that the SmartRelay ladder programming is slightly different from PLC programming.In the case of a PLC, the output result on each line is reflected on the inputs within the same scan time. However, in the case of the IDEC SmartRelay, all the inputs are processed first and then the outputs. Thus the output results are not reflected on the inputs within the same scan time, but rather they are reflected at the following scan.

ex) Interlock is not activated in the sample program (1) below in which input terminals I1 and I2 are simultaneously turned on. The interlock is activated in the sample program (2) below in which input terminals I1 and I2 are simultaneously turned on.

(1)



(2)



Installing/Starting WindLGC

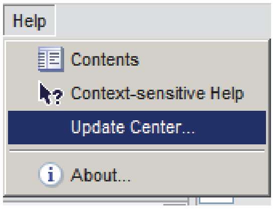
To install WindLGC, follow these steps:

1. Insert the DVD in the DVD-ROM driver.
2. View the DVD-ROM contents using your file-management program.
3. In the main directory of the DVD-ROM, open the folder with the name of the operating system (Windows)
4. Proceed in either of the following ways:
   - Select the **Setup** or **Start** file to install the program.

     In this way, you can select whether to install FL1F Web Editor after WindLGC is installed. Click **Yes** to install the FL1F Web Editor or Click **No** to quit.
   - Select the folder **Application<-operating system version>("<_operating system version>")** and copy it to your hard disk. Double-click WindLGC.exe in the folder to start the program.

Upgrading previous WindLGC versions

You can upgrade the WindLGC version from V2, V3, V4, V5, V6, V8.0 or V8.2 to V8.4. And you can download the upgrade packages manually from IDEC (www.idec.com).



You can find type numbers in Section "Type numbers (Page 348)".

To upgrade from an old version to a new version, follow these steps:

1. Start `setup.exe` of upgrade Web installer.
2. When the system prompts you for the previous version:
   - If you have an old version installed on your PC, point your browser to the "...\Application" directory of your WindLGC installation folder.
   - If you haven't an old version on your PC, place the old WindLGC DVD in the DVD drive and point your browser to the "...\Application" directory on the DVD.

Updates and information

You can download demo versions of the software free of charge from the Internet address specified in the Preface (Page ii).

For detailed information on updates, upgrades and the WindLGC Update Center, refer to the Online Help for WindLGC.

12.2 Connecting IDEC SmartRelay to a PC

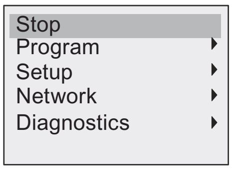
Connecting IDEC SmartRelay to a PC

You can connect a Base Module to a PC with an Ethernet cable.

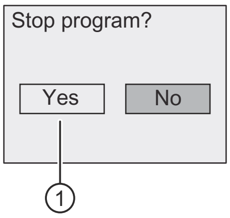
Switching IDEC SmartRelay to PC ↔ IDEC SmartRelay mode

Two methods are available to switch IDEC SmartRelay to STOP mode:

- Switch IDEC SmartRelay to STOP mode from your PC (refer to the Online Help for WindLGC).
- Select the following menu command on a device with display.



Confirm your selection with " ① ":



When IDEC SmartRelay is in STOP mode and online with the PC, the following PC commands are available:

- Switch IDEC SmartRelay to RUN
- Read/write the circuit program
- Read/write the summertime/wintertime

Note

For more information on IDEC SmartRelay versions without display, refer to the Appendix topic "IDEC SmartRelay without display ("IDEC SmartRelay Pure") (Page 334)".

Closing the PC ↔ IDEC SmartRelay mode

When IDEC SmartRelay completes the data transfer, it shuts down the connection to the PC.

Note

If you have password-protected the program that you created in WindLGC, IDEC SmartRelay receives both the circuit program and the password during the download.

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

Applications 13

Note

IDEC SmartRelay sample applications are available to all our customers free of charge on the WindLGC DVD.

IDEC does not guarantee that the provided examples are error-free; they serve as general information about the fields of application for IDEC SmartRelay, and can be different from user-specific solutions. IDEC reserves the right to make changes.

You are responsible for the operation of your system.. For safety concerns, refer to the relevant national standards and system-related installation regulations.

On the WindLGC DVD you can find the following sample applications, tips for further applications, and more:

- Irrigation system for greenhouse plants
- Shop window lighting
- Bell system (for example, in a school)
- Parking lot surveillance
- Outdoor lighting
- Shutter control system
- Domestic outdoor and indoor lighting system
- Control system of a cream stirrer
- Sports hall lighting
- Constant load on three consumers
- Sequential control for boilers
- Cutting device (for example, for detonating fuses)
- Monitoring periods of utilization, for example of a solar energy system
- Intelligent foot switches, for example, for speed preselection)
- Elevating platform controls
- Impregnation of textiles, heating and conveyor belt controls
- Silo-filling system
- Fill station with message text on the Text Display that displays the sum of counted objects

On the WindLGC DVD you can also find descriptions and the corresponding circuit diagrams of the applications. You can read these *.pdf files with the Adobe Acrobat Reader. If you have installed WindLGC on your computer, you can simply click the disk icon to download the relevant circuit programs, which you can then adapt to suit your application and download to IDEC SmartRelay directly via the PC cable.

Benefits of IDEC SmartRelay

IDEC SmartRelay is a particularly useful feature:

- For replacing auxiliary switchgear with the integrated IDEC SmartRelay functions
- For saving wiring and installation work - because IDEC SmartRelay keeps the wiring "in its head."
- For reducing space requirements for components in the control cabinet/distribution box. A smaller control cabinet/distribution box may provide sufficient space.
- For adding or changing functions, without having to install additional switchgear or change the wiring.
- For offering your customers new, additional functions for domestic and commercial housing installations. Examples:
  - Domestic security systems: IDEC SmartRelay switches on a lamp at regular intervals or opens and closes the shutters while you are on holiday.
  - Central heating: IDEC SmartRelay runs the circulation pump only when water or heating is actually required.
  - Refrigerating systems: IDEC SmartRelay can defrost refrigerating systems at regular intervals to save energy costs.
  - You can illuminate aquaria and terraria on a time-dependent basis.

Last but not least, you can:

- Use commonly available switches and pushbuttons, which makes it easy to install a domestic system.
- Connect IDEC SmartRelay directly to your domestic installation; the integrated power supply makes it possible.

Technical data A

A.1 General technical data

Criterion	Tested in accordance with	Values
Base Modules (FL1F) **(Version with display)** Dimensions (WxHxD) Weight • Modules with relay output • Modules with transistor output Installation **(Version without display)** Dimensions (WxHxD) Weight • Modules with relay output • Modules with transistor output Installation		 71.5 x 90 x 60 mm Approx. 240 g Approx. 195 g On a 35 mm profile rail four module widths or wall mounting 71.5 x 90 x 58 mm Approx. 200 g Approx. 160 g On a 35 mm profile rail four module widths or wall mounting
IDEC SmartRelay expansion modules FL1F-M08... Dimensions (WxHxD) Weight • Modules with relay output • Modules with transistor output Installation		 35.5 x 90 x 58 mm Approx. 130 g Approx. 95 g On a 35 mm profile rail two module widths or wall mounting
IDEC SmartRelay expansion modules FL1F-J2B2/K2BM2 Dimensions (WxHxD) Weight Installation		 35.5 x 90 x 58 mm Approx. 95 g On a 35 mm profile rail two module widths or wall mounting
FL1F-RD1 (Text Display with Ethernet interfaces) Dimensions (WxHxD) Weight Installation		 128.2 x 86 x 38.7 mm Approx. 220 g Bracket mounting
Climatic conditions		
Ambient temperature • Horizontal installation • Vertical installation	Low temperature to IEC 60068-2-1 High temperature to IEC 60068-2-2	-20 °C to +55 °C 1) -20 °C to +55 °C
Storage and Transport		- 40 °C to +70 °C
Relative humidity	IEC 60068-2-30	From 10% to 95% no condensation

Criterion	Tested in accordance with	Values
Atmospheric pressure, Altitude • Operation • Storage/transport		• 1080 to 795 hPa, corresponds to an elevation of -1000 m to 2000 m • 1080 to 660 hPa, corresponds to an elevation of -1000 m to 3500 m
Altitude during operation		Up to 2000 m
Pollutants	IEC 60068-2-42 IEC 60068-2-43	SO_2 10 cm^3/m^3, 21 days H_2S 1 cm^3/m^3, 21 days
Pollution degree		2
Ambient mechanical conditions		
Degree of protection		• IP20 for IDEC SmartRelay Base Modules, expansion modules, and the FL1F-RD1 excluding the TDE front panel • IP65 for FL1F-RD1 front panel
Enclosure type		• Type 1 for the front panel of IDEC SmartRelay Base Modules and expansion modules • Type 4X/12 for FL1F-RD1 front panel
Vibrations:	IEC 60068-2-6	5 Hz to 8.4 Hz (constant amplitude 3.5 mm) 8.4 Hz to 200 Hz (constant acceleration 1 g)
Shock	IEC 60068-2-27	half-sine wave 15 g/11 ms
Free fall (packaged)	IEC 60068-2-32	0.3 m
Electromagnetic compatibility (EMC)		
Radiated emission	EN 61000-6-3 EN 61000-6-4	Limit class B group 1 Limit class B
Electrostatic discharge	IEC 61000-4-2	±2 kV, ±4kV, ±8 kV air discharge ±6 kV contact discharge
Radiated electromagnetic field	IEC 61000-4-3	80 MHz-1000 MHz and 1.4 GHz-2.0 GHz 10V/m, 80% AM(1 kHz) 2.0 GHz-6.0 GHz 3V/m, 80% AM(1 kHz)
Conducted disturbance	IEC 61000-4-6	150 KHz-80 MHz 10 V, 80%AM(1 kHz)
Fast transient bursts	IEC 61000-4-4	• For power port: 2 kV • For signal port: - Signal Lines<30 m: 1 kV/ 5 kHz and 100 kHz - Signal Lines>30 m: 2 kV/ 5 kHz and 100 kHz

Criterion	Tested in accordance with	Values
Surge immunity (applies only to FL1F-B12RCC/H12RCC and FL1F-M08C2R2)	IEC 61000-4-5	1 kV line-to-line 2 kV line-to-earth
Surge immunity (applies to low-voltage (12 V or 24 V) IDEC SmartRelay modules)		With surge arrester (such as BVT AD 24): • 1 kV line-to-line • 2 kV line-to-earth Without surge arrester: • 0.5 kV line-to-line • 1 kV line-to-earth
Safety to IEC		
Clearance and creepage distance rating	IEC 60664, IEC61131-2, cULus to UL508, CSA C22.2 No.142, IEC 60730	Fulfilled
Insulation strength	IEC 61131-2	Fulfilled
Cycle time		
Cycle time per function		< 0.1 ms
Startup		
Startup time at power-up		Typ. 1.6 s
Overvoltage		
Overvoltage category		• Category II: FL1F-H12SCD, FL1F-M08B1S2, FL1F-J2B2, FL1F-K2BM2, FL1F-RD1 • Category III: FL1F-H12RCE, FL1F-H12RCA, FL1F-H12RCC, FL1F-M08B2R2, FL1F-M08D2R2, FL1F-M08C2R2

1) The updating rate of LCD can be reduced at operating temperature less than 0°C.

Note

The maximum length for directly connecting two IDEC SmartRelay Base Modules through CAT5e shielded network cable is 100 meters.

A.2 Technical data: FL1F-B12RCC/H12RCC

	FL1F-B12RCC	FL1F-H12RCC
Power supply		
Input voltage	100 VAC/VDC to 240 VAC/VDC	100 VAC/VDC to 240 VAC/VDC
Permissible range	85 VAC to 265 VAC 100 VDC to 253 VDC	85 VAC to 265 VAC 100 VDC to 253 VDC
Input frequency	50/60 Hz	50/60 Hz
Permissible mains frequency	47 Hz to 63 Hz	47 Hz to 63 Hz
Power consumption • 115 VAC • 240 VAC • 115 VDC • 240 VDC	 • 20 mA to 40 mA • 15 mA to 25 mA • 10 mA to 20 mA • 5 mA to 15 mA	 • 20 mA to 40 mA • 15 mA to 25 mA • 10 mA to 20 mA • 5 mA to 15 mA
Voltage failure buffering • 110 VAC/VDC • 240 VAC/VDC	 • Typ. 10 ms • Typ. 20 ms	 • Typ. 10 ms • Typ. 20 ms
Power loss at • 115 VAC • 240 VAC • 115 VDC • 240 VDC	 • 2.3 W to 4.6 W • 3.6 W to 6.0 W • 1.2 W to 2.3 W • 1.2 W to 3.6 W	 • 2.3 W to 4.6 W • 3.6 W to 6.0 W • 1.2 W to 2.3 W • 1.2 W to 3.6 W
Backup of the real-time clock at 25 °C	Typ. 20 days	Typ. 20 days
Accuracy of the real-time clock	Typ. ± 2 s/day	Typ. ± 2 s/day
Digital inputs		
Number	8	8
Electrical isolation	No	No
Number of high speed inputs	0	0
Input frequency • Normal input • High speed input	 • Max. 4 Hz • - -	 • Max. 4 Hz • - -
Digital input	115 to 240 VAC/DC, 50/60 Hz	115 to 240 VAC/DC, 50/60 Hz
Max. continuous permissible voltage	265 VAC 253 VDC	265 VAC 253 VDC
Input voltage L1 • Signal 0 • Signal 1 • Signal 0 • Signal 1	 • < 40 VAC • > 79 VAC • < 30 VDC • > 79 VDC	 • < 40 VAC • > 79 VAC • < 30 VDC • > 79 VDC
Input current at • Signal 0 • Signal 1 • Signal 0 • Signal 1	 • < 0.05 mA AC • > 0.08 mA AC • < 0.06 mA DC • > 0.13 mA DC	 • < 0.05 mA AC • > 0.08 mA AC • < 0.06 mA DC • > 0.13 mA DC

	FL1F-B12RCC	FL1F-H12RCC
Delay time at 0 to 1: • 120 VAC • 240 VAC • 120 VDC • 240 VDC Delay time at 1 to 0: • 120 VAC • 240 VAC • 120 VDC • 240 VDC	 • Typ. 40 ms • Typ. 30 ms • Typ. 25 ms • Typ. 20 ms • Typ. 45 ms • Typ. 70 ms • Typ. 60 ms • Typ. 75 ms	 • Typ. 40 ms • Typ. 30 ms • Typ. 25 ms • Typ. 20 ms • Typ. 45 ms • Typ. 70 ms • Typ. 60 ms • Typ. 75 ms
Line length (unshielded)	max. 100 m	max. 100 m
Digital outputs		
Number	4	4
Output type	Relay outputs	Relay outputs
Electrical isolation	Yes	Yes
Dielectric Strength (between power/input terminals and output terminals)	2,500 V AC, 1minute 500 V DC, 1 minute	2,500 V AC, 1minute 500 V DC, 1 minute
In groups of	1	1
Control of a digital input	Yes	Yes
Continuous current I_{th}	Recommended range of application ≥ 100 mA at 12 VAC/VDC Max. 10 A per relay	Recommended range of application ≥ 100 mA at 12 VAC/VDC Max. 10 A per relay
Relay rated voltage	240 VAC/VDC	240 VAC/VDC
Surge current Incandescent lamp load (25000 switching cycles) at • 230/240 VAC • 110/120 VAC	Max. 30 A • 1000 W • 500 W	Max. 30 A • 1000 W • 500 W
Fluorescent tubes with ballast (25000 switching cycles)	10 x 58 W (at 230/240 VAC)	10 x 58 W (at 230/240 VAC)
Fluorescent tubes, conventionally compensated (25000 switching cycles)	1 x 58 W (at 230/240 VAC)	1 x 58 W (at 230/240 VAC)
Fluorescent tubes, uncompensated (25000 switching cycles)	10 x 58 W (at 230/240 VAC)	10 x 58 W (at 230/240 VAC)
Short circuit-proof cos 1	Power protection B16, 600 A	Power protection B16, 600 A
Short circuit-proof cos 0.5 to 0.7	Power protection B16, 900 A	Power protection B16, 900 A
Derating	None; across the entire temperature range	None; across the entire temperature range
Parallel output circuits for power increase	Not permitted	Not permitted
Protection of output relay (if desired)	Max. 16 A, characteristic B16	Max. 16 A, characteristic B16
Initial Contact Resistance	100 mΩ maximum (at 1A, 24V DC)	100 mΩ maximum (at 1A, 24V DC)

	FL1F-B12RCC	FL1F-H12RCC
Mechanical Life	10,000,000 operations minimum (no load, 10 Hz)	10,000,000 operations minimum (no load, 10 Hz)
Electrical Life	100,000 operations minimum (rated resistive load, 1800 operations / hour)	100,000 operations minimum (rated resistive load, 1800 operations / hour)
Line length (unshielded)	Max. 100 m	Max. 100 m
Switching rate		
Mechanical	10 Hz	10 Hz
Ohmic load/lamp load	2 Hz	2 Hz
Inductive load	0.5 Hz	0.5 Hz

Notice: For volume load such as fluorescent lamps with capacitors, you must consider the technical data of fluorescent lamp ballasts. If the current exceeds the maximum allowed surge current, appropriate contactor relays must switch the fluorescent lamps.

Notice: Output: B300, R300; 8A, 24 VDC, G.P.; 10A, 240 VAC, G.P.; 3A, 120 VAC, Tungsten.

When you connect inductive load such as magnet or valve, it is recommended that you use diode for DC power supply and surge absorber for AC power supply to suppress the counter electromotive force.

A.3 Technical data: FL1F-M08C2R2

	FL1F-M08C2R2
Power supply	
Input voltage	100 VAC/VDC to 240 VAC/VDC
Permissible range	85 VAC to 265 VAC 100 VDC to 253 VDC
Input frequency	50/60 Hz
Permissible mains frequency	47Hz to 63 Hz
Power consumption • 115 VAC • 240 VAC • 115 VDC • 240 VDC	 • 20 mA to 40 mA • 15 mA to 30 mA • 10 mA to 25 mA • 5 mA to 15 mA
Voltage failure buffering • 100 VAC/VDC • 240 VAC/VDC	 • Typ. 10 ms • Typ. 20 ms
Power loss at • 115 VAC • 240 VAC • 115 VDC • 240 VDC	 • 2.3 W to 4.6 W • 3.6 W to 7.2 W • 1.2 W to 2.9 W • 1.2 W to 3.6 W
Digital inputs	
Number	4
Electrical isolation	No
Number of high speed inputs	0

	FL1F-M08C2R2
Input frequency • Normal input • High speed input	 • Max. 4 Hz • - -
Digital input	115 to 240 VAC/DC, 50/60 Hz
Max. continuous permissible voltage	265 VAC 253 VDC
Input voltage L1 • Signal 0 • Signal 1 • Signal 0 • Signal 1	 • < 40 VAC • > 79 VAC • < 30 VDC • > 79 VDC
Input current at • Signal 0 • Signal 1 • Signal 0 • Signal 1	 • < 0.05 mA AC • > 0.08 mA AC • < 0.06 mA DC • > 0.13 mA DC
Delay time at 0 to 1: • 120 VAC • 240 VAC • 120 VDC • 240 VDC Delay time at 1 to 0: • 120 VAC • 240 VAC • 120 VDC • 240 VDC	 • Typ. 40 ms • Typ. 30 ms • Typ. 25 ms • Typ. 20 ms • Typ. 45 ms • Typ. 70 ms • Typ. 60 ms • Typ. 75 ms
Line length (unshielded)	Max. 100 m
Digital outputs	
Number	4
Output type	Relay outputs
Electrical isolation	Yes
In groups of	1
Control of a digital input	Yes
Continuous current I_{th}	Recommended range of application ≥ 100 mA at 12 VAC/VDC Max. 5 A per relay
Relay rated voltage	240 VAC/VDC
Surge current	Max. 30 A
Incandescent lamp load (25000 switching cycles) at: 230/240 VAC 100/120 VAC	 1000 W 500 W
Fluorescent tubes with ballast (25000 switching cycles)	10 x 58 W (at 230/240 VAC)
Fluorescent tubes, conventionally compensated (25000 switching cycles)	1 x 58 W (at 230/240 VAC)

	FL1F-M08C2R2
Fluorescent tubes, uncompensated (25000 switching cycles)	10 x 58 W (at 230/240 VAC)
Short circuit-proof cos 1	Power protection B16, 600 A
Short circuit-proof cos 0.5 to 0.7	Power protection B16, 900 A
Derating	None; across the entire temperature range
Parallel output circuits for power increase	Not permitted
Protection of output relay (if desired)	Max. 16 A, characteristic B16
Line length (unshielded)	Max. 100 m
Switching rate	
Mechanical	10 Hz
Ohmic load/lamp load	2 Hz
Inductive load	0.5 Hz

Notice: For fluorescent lamps with capacitors, you must consider the technical data of fluorescent lamp ballasts. If the current exceeds the maximum allowed surge current, appropriate contactor relays must switch the fluorescent lamps.

Notice: Output: B300, R300; 5A, 24VDC, G,P.; 5A, 240 VAC, G.P.; 3A, 120VAC, Tungsten.

A.4 Technical data: FL1F-H12SCD

	FL1F-H12SCD
Power supply	
Input voltage	24 VDC
Permissible range	20.4 VDC to 28.8 VDC
Reverse polarity protection	Yes
Permissible mains frequency	- -
Power consumption from 24 VDC	25 mA to 50 mA (no load on digital output) 1.2 A (with max. load on digital output)
Voltage failure buffering	- -
Power loss at 24 VDC	0.6 W to 1.2 W
Backup of the real-time clock at 25 °C	Typ. 20 days
Accuracy of the real-time clock	Typ. ± 2 s/day
Digital inputs	
Number	8
Electrical isolation	No
Number of high speed inputs	4 (I3, I4, I5, I6)
Input frequency • Normal input • High speed input	 • Max. 4 Hz • Max. 5 kHz
Digital input	24 VDC
Max. continuous permissible voltage	28.8 VDC
Input voltage Signal 0 Signal 1	L+ < 5 VDC > 12 VDC

	FL1F-H12SCD
Input current at Signal 0 Signal 1	 < 0.9 mA (I3 to I6) < 0.07 mA (I1, I2, I7, I8) > 2.1 mA (I3 to I6) > 0.18 mA (I1, I2, I7, I8)
Delay time at 0 to 1 1 to 0	 • Typ. 1.5 ms <1.0 ms (I3 to I6) • Typ. 1.5 ms <1.0 ms (I3 to I6)
Line length (unshielded)	Max. 100 m
Analog inputs	
Number	4 (I1=AI3, I2=AI4, I7=AI1, I8=AI2)
Range	0 VDC to 10 VDC Input impedance 80 kΩ
Cycle time for analog value generation	300 ms
Line length (shielded and twisted)	Max. 10 m
Error limit	± 1.5% at FS
Digital outputs	
Number	4
Output type	Transistor, current-sourcing [1)]
Electrical isolation	No
In groups of	- -
Control of a digital input	Yes
Output voltage	≤ Supply voltage
Output current	Max. 0.3 A per channel
Short circuit-proof and overload-proof	Yes
Short circuit current limitation	Approx. 1 A per channel
Derating	None; across the entire temperature range
Short circuit-proof cos 1	- -
Short circuit-proof cos 0.5 to 0.7	- -
Parallel output circuit for power increase	Not permitted
Protection of output relay (if desired)	- -
Line length (unshielded)	Max. 100 m
Switching rate [2)]	
Mechanical	- -
Electrical	10 Hz
Ohmic load/lamp load	10 Hz
Inductive load	0.5 Hz

1) When you switch on FL1F-H12SCD or FL1F-M08B1S2, the CPU sends signal 1 to the digital outputs for about 50 µs. Take this into account, especially when using devices that react to short pulses.

2) The maximum switching rate is only dependent on the switching program's cycle time.

Notice: Output: 24 VDC, 0.3 A, RES./P.D.

A.5 Technical data: FL1F-M08B1S2

	FL1F-M08B1S2
Power supply	
Input voltage	24 VDC
Permissible range	20.4 VDC to 28.8 VDC
Reverse polarity protection	Yes
Permissible mains frequency	- -
Power consumption from 24 VDC	25 mA to 40 mA (no load on digital output) 1.2 A (with max. load on digital output)
Power loss at 24 V	0.6 W to 1.0 W
Digital inputs	
Number	4
Electrical isolation	No
Number of high speed inputs	0
Input frequency • Normal input • High speed input	 • Max. 4 Hz • - -
Digital input	24 VDC
Max. continuous permissible voltage	28.8 VDC
Input voltage • Signal 0 • Signal 1	L+ • < 5 VDC • > 12 VDC
Input current at • Signal 0 • Signal 1	 • < 0.88 mA • > 2.1 mA
Delay time at • 0 to 1 • 1 to 0	 • Typ. 1.5 ms • Typ. 1.5 ms
Line length (unshielded)	Max. 100 m
Digital outputs	
Number	4
Output type	Transistor, current-sourcing [1)]
Electrical isolation	No
In groups of	- -
Control of a digital input	Yes
Output voltage	≤ Supply voltage
Output current	Max. 0.3 A per channel
Short circuit-proof and overload-proof	Yes
Short circuit current limitation	Approx. 1 A per channel
Derating	None; across the entire temperature range
Short circuit-proof cos 1	- -
Short circuit-proof cos 0.5 to 0.7	- -
Parallel output circuit for power increase	Not permitted
Protection of output relay (if desired)	- -

	FL1F-M08B1S2
Line length (unshielded)	Max. 100 m
Switching rate	
Mechanical	- -
Electrical	10 Hz
Ohmic load/lamp load	10 Hz
Inductive load	0.5 Hz

1) When you switch on FL1F-H12SCD or FL1F-M08B1S2, the CPU sends signal 1 to the digital outputs for about 50 µs. Take this into account, especially when using devices that react to short pulses.

Notice:

- Output of FL1F-M08B1S2: 24 VDC, 0.3 A, RES./P.D.

A.6 Technical data: FL1F-H12RCA/B12RCA

	FL1F-H12RCA FL1F-B12RCA
Power supply	
Input voltage	24 VAC/VDC
Permissible range	20.4 VAC to 26.4 VAC 20.4 VDC to 28.8 VDC
Reverse polarity protection	- -
Input frequency	50/60 Hz
Permissible mains frequency	47 Hz to 63 Hz
Power consumption • 24 VAC • 24 VDC	 • 60 mA to 185 mA • 25 mA to 100 mA
Voltage failure buffering	Typ. 5 ms
Power loss • 24 VAC • 24 VDC	 • 1.4 W to 4.4 W • 0.6 W to 2.4 W
Backup of the real-time clock at 25 °C	Typ. 20 days
Accuracy of the real-time clock	Typ. ± 2 s/day
Digital inputs	
Number	8, optional positive voltage or negative voltage
Electrical isolation	No
Number of high speed inputs	0
Input frequency • Normal input • High speed input	 • Max. 4 Hz • - -
Digital input	24 VAC/DC, 50/60 Hz
Max. continuous permissible voltage	26.4 VAC 28.8 VDC
Input voltage • Signal 0 • Signal 1	L • < 5 VAC/VDC • > 12 VAC/VDC

	FL1F-H12RCA FL1F-B12RCA
Input current at • Signal 0 • Signal 1	 • < 1.2 mA • > 2.6 mA
Delay time at • 0 to 1 • 1 to 0	 • Typ. 1.5 ms • Typ. 15 ms
Line length (unshielded)	Max. 100 m
Analog inputs	
Number	- -
Range	- -
max. Input voltage	- -
Digital outputs	
Number	4
Output type	Relay outputs
Electrical isolation	Yes
In groups of	1
Control of a digital input	Yes
Continuous current I_{th}	Recommended range of application ≥ 100 mA at 12 VAC/VDC Max. 10 A per relay
Relay rated voltage	240 VAC/VDC
Surge current	Max. 30 A
Incandescent lamp load (25000 switching cycles) at	1000 W
Fluorescent tubes with ballast (25000 switching cycles)	10 x 58 W
Fluorescent tubes, conventionally compensated (25000 switching cycles)	1 x 58 W
Fluorescent tubes, uncompensated (25000 switching cycles)	10 x 58 W
Derating	None; across the entire temperature range
Short circuit-proof cos 1	Power protection B16, 600 A
Short circuit-proof cos 0.5 to 0.7	Power protection B16, 900 A
Parallel output circuits for power increase	Not permitted
Protection of output relay (if desired)	Max. 16 A, characteristic B16
Line length (unshielded)	Max. 100 m
Switching rate	
Mechanical	10 Hz
Ohmic load/lamp load	2 Hz
Inductive load	0.5 Hz

Notice: For fluorescent lamps with capacitors, you must consider the technical data of fluorescent lamp ballasts. If the current exceeds the maximum allowed surge current, appropriate contactor relays must switch the fluorescent lamps.

Notice: Output: B300, R300; 8A, 24 VDC, G.P.; 10A, 24 VAC, G,P.; 3A, 120 VAC, Tungsten.

A.7 Technical data: FL1F-M08D2R2

	FL1F-M08D2R2
Power supply	
Input voltage	24 VAC/VDC
Permissible range	20.4 VAC to 26.4 VAC 20.4 VDC to 28.8 VDC
Reverse polarity protection	- -
Input frequency	50/60 Hz
Permissible mains frequency	47 Hz to 63 Hz
Power consumption • 24 VAC • 24 VDC	 • 40 mA to 110 mA • 15 mA to 50 mA
Voltage failure buffering	Typ. 5 ms
Power loss • 24 VAC • 24 VDC	 • 1.0 W to 2.6 W • 0.4 W to 1.2 W
Digital inputs	
Number	4, optional positive voltage or negative voltage
Electrical isolation	No
Number of high speed inputs	0
Input frequency • Normal input • High speed input	 • Max. 4 Hz • - -
Digital input	24 VAC/DC, 50/60 Hz
Max. continuous permissible voltage	• 26.4 VAC • 28.8 VDC
Input voltage • Signal 0 • Signal 1	L • < 5 VAC/VDC • > 12 VAC/VDC
Input current at • Signal 0 • Signal 1	 • < 1.1 mA • > 2.63 mA
Delay time at • 0 to 1 • 1 to 0	 • Typ. 1.5 ms • Typ. 15 ms
Line length (unshielded)	Max. 100 m
Digital outputs	
Number	4
Output type	Relay outputs
Electrical isolation	Yes
In groups of	1
Control of a digital input	Yes
Continuous current I_{th}	Recommended range of application ≥ 100 mA at 12 VAC/VDC Max. 5 A per relay
Relay rated voltage	240 VAC/VDC

	FL1F-M08D2R2
Surge current	Max. 30 A
Incandescent lamp load (25000 switching cycles) at	1000 W
Fluorescent tubes with ballast (25000 switching cycles)	10 x 58 W
Fluorescent tubes, conventionally compensated (25000 switching cycles)	1 x 58 W
Fluorescent tubes, uncompensated (25000 switching cycles)	10 x 58 W
Derating	None; across the entire temperature range
Short circuit-proof cos 1	Power protection B16, 600 A
Short circuit-proof cos 0.5 to 0.7	Power protection B16, 900 A
Parallel output circuits for power increase	Not permitted
Protection of output relay (if desired)	Max. 16 A, characteristic B16
Line length (unshielded)	Max. 100 m
Switching rate	
Mechanical	10 Hz
Ohmic load/lamp load	2 Hz
Inductive load	0.5 Hz

Notice: For fluorescent lamps with capacitors, you must consider the technical data of fluorescent lamp ballasts. If the current exceeds the maximum allowed surge current, appropriate contactor relays must switch the fluorescent lamps.

Notice: Output: B300, R300; 5A, 24 VDC, G.P.; 5A, 240 VAC, G.P.; 3A, 120 VAC, Tungsten.

A.8 Technical data: FL1F-B12RCE/H12RCE, FL1F-M08B2R2

	FL1F-B12RCE FL1F-H12RCE	FL1F-M08B2R2
Power supply		
Input voltage	12/24 VDC	12/24 VDC
Permissible range	10.8 VDC to 28.8 VDC	10.8 VDC to 28.8 VDC
Reverse polarity protection	Yes	Yes
Power consumption • 12 VDC • 24 VDC	 • 50 mA to 165 mA • 25 mA to 90 mA	 • 20 mA to 90 mA • 15 mA to 50 mA
Voltage failure buffering • 12 VDC • 24 VDC	 • Typ. 2 ms • Typ. 5 ms	 • Typ. 2 ms • Typ. 5 ms
Power loss • 12 VDC • 24 VDC	 • 0.6 W to 2.0 W • 0.6 W to 2.2 W	 • 0.2 W to 1.1 W • 0.4 W to 1.2 W
Backup of the real-time clock at 25 °C	Typ. 20 days	- -
Accuracy of the real-time clock	Typ. ± 2 s/day	- -
Electrical isolation	No	No
Digital inputs		
Number	8	4
Electrical isolation	No	No
Number of high speed inputs	4 (I3, I4, I5, I6)	0
Input frequency • Normal input • High speed input	 • Max. 4 Hz • Max. 5 kHz	 • Max. 4 Hz • - -
Digital input	12/24 VDC	12/24 VDC
Max. continuous permissible voltage	28.8 VDC	28.8 VDC
Input voltage L+ • Signal 0 • Signal 1	 • < 5 VDC • > 8.5 VDC	 • < 5 VDC • > 8.5 VDC
Input current at • Signal 0 • Signal 1	 < 0.88 mA (I3 to I6) < 0.07 mA (I1, I2, I7, I8) > 1.5 mA (I3 to I6) > 0.12 mA (I1, I2, I7, I8)	 < 0.88 mA > 1.5 mA
Delay time at • 0 to 1 • 1 to 0	 • Typ. 1.5 ms <1.0 ms (I3 to I6) • Typ. 1.5 ms <1.0 ms (I3 to I6)	 • Typ. 1.5 ms • Typ. 1.5 ms
Line length (unshielded)	Max. 100 m	Max. 100 m
Analog inputs		
Number	4 (I1=AI3, I2=AI4, I7=AI1, I8=AI2)	- -
Range	0 VDC to 10 VDC Input impedance 80 kΩ	- -

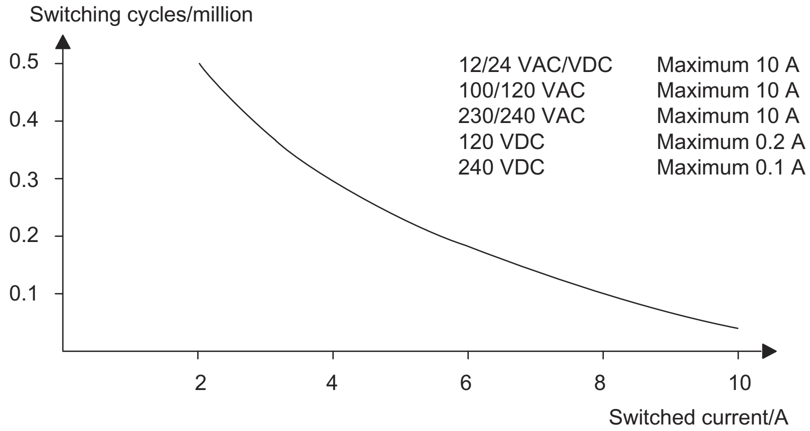
	FL1F-B12RCE FL1F-H12RCE	FL1F-M08B2R2
Cycle time for analog value generation	300 ms	- -
Line length (shielded and twisted)	Max. 10 m	- -
Error limit	± 1.5% at FS	- -
Digital outputs		
Number	4	4
Output type	Relay outputs	Relay outputs
Electrical isolation	Yes	Yes
In groups of	1	1
Control of a digital input	Yes	Yes
Continuous current I_{th} (per terminal)	Recommended range of application ≥ 100 mA at 12 VAC/ VDC Max. 10 A per relay	Recommended range of application ≥ 100 mA at 12 VAC/VDC Max. 5 A per relay
Relay rated voltage	240 VAC/VDC	240 VAC/VDC
Surge current	Max. 30 A	Max. 30 A
Incandescent lamp load (25000 switching cycles) at	1000 W	1000 W
Fluorescent tubes with ballast (25000 switching cycles)	10 x 58 W	10 x 58 W
Fluorescent tubes, conventionally compensated (25000 switching cycles)	1 x 58 W	1 x 58 W
Fluorescent tubes, uncompensated (25000 switching cycles)	10 x 58 W	10 x 58 W
Derating	None; across the entire temperature range	None; across the entire temperature range
Short circuit-proof cos 1	Power protection B16, 600 A	Power protection B16, 600 A
Short circuit-proof cos 0.5 to 0.7	Power protection B16, 900 A	Power protection B16, 900 A
Parallel output circuits for power increase	Not permitted	Not permitted
Protection of output relay (if desired)	Max. 16 A, characteristic B16	Max. 16 A, characteristic B16
Line length (unshielded)	Max. 100 m	Max. 100 m
Switching rate		
Mechanical	10 Hz	10 Hz
Ohmic load/lamp load	2 Hz	2 Hz
Inductive load	0.5 Hz	0.5 Hz

Notice: For fluorescent lamps with capacitors, you must consider the technical data of fluorescent lamp ballasts. If the current exceeds the maximum allowed surge current, appropriate contactor relays must switch the fluorescent lamps.

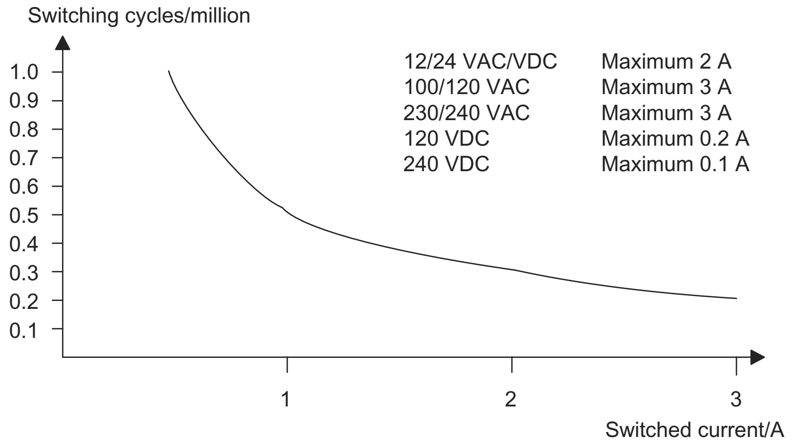
Notice:
- Output of FL1F-H12RCE/B12RCE: B300, R300; 8A, 24 VDC, G.P.; 10A, 240 VAC, G.P.; 3A, 120 VAC, Tungsten.
- Output of FL1F-M08B2R2: B300, R300; 5A, 24 VDC, G.P.; 5A, 240 VAC, G.P.; 3A, 120 VAC, Tungsten.

A.9 Switching capacity/service life of the relay outputs

Switching capacity and service life of the contacts with ohmic loading (heating):



Switching capacity and service life of the contacts with high inductive load to IEC 60947-5-1 DC 13/AC 15 (contactors, solenoid coils, motors):



Note

To ensure the switching capacity and service life, keep the minimum switching load of the relay outputs at 100 mA with the voltage of 12 VAC-/VDC.

A.10 Technical data: FL1F-J2B2

	FL1F-J2B2
Power supply	
Input voltage	12/24 VDC
Permissible range	10.8 VDC to 28.8 VDC
Power consumption	25 mA to 30 mA
Voltage failure buffering	Typ. 10 ms
Power loss at • 12 VDC • 24 VDC	 • 0.3 W to 0.4 W • 0.6 W to 0.7 W
Electrical isolation	No
Reverse polarity protection	Yes
Ground terminal	For connecting ground and shielding of the analog measuring line
Analog inputs	
Number	2
Type	Unipolar
Input range	0 VDC to 10 VDC (input impedance 76 kΩ) or 0/4 mA to 20 mA (input impedance <250 Ω)
Resolution	10 bit, normalized to 0 to 1000
Cycle time for analog value generation	50 ms
Electrical isolation	No
Line length (shielded and twisted)	Max. 10 m
Encoder supply voltage	None
Error limit	± 1.5%
Interference frequency suppression	55 Hz

A.11 Technical data: FL1F-K2BM2

	FL1F-K2BM2
Power supply	
Input voltage	24 VDC
Permissible range	20.4 VDC to 28.8 VDC
Power consumption	30 mA to 82 mA
Voltage failure buffering	Typ. 10 ms
Power loss at 24 VDC	0.7 W to 2.0 W
Electrical isolation	No
Reverse polarity protection	Yes
Ground terminal	For connecting ground and shielding of the analog output line.
Analog outputs	
Number	2
Voltage range	0 VDC to 10 VDC
Voltage load	≥ 5 kΩ
Current output	0/4 mA to 20 mA
Current load	≤ 250 Ω
Resolution	10 bit, normalized to 0 to 1000
Cycle time for analog output	Depending on installation (50 ms)
Electrical isolation	No
Line length (shielded and twisted)	Max. 10 m
Error limit	± 2.5% FS
Short circuit protection	Voltage output: Yes
Overload protection	Current output: Yes Voltage output: Yes

A.12 Technical data: IDEC SmartRelay Power 24 V

IDEC SmartRelay Power 24 V is a primary.

A.13 Technical data: FL1F-RD1 (Text Display with Ethernet interfaces)

	FL1F-RD1
Mechanical data	
Keyboard Display	Membrane keypad with 10 keys FSTN-Graphic Display with 160 x 96 (columns x rows), LED backlight (white/amber/red)
Power supply	
Input voltage	24 VAC/VDC 12 VDC
Permissible range	20.4 VAC to 26.4 VAC 10.2 VDC to 28.8 VDC
Input frequency	50/60 Hz
Permissible mains frequency	47Hz to 63 Hz
Power consumption (Ethernet and white backlight active) • 12 VDC • 24 VDC • 24 VAC	• Typ. 150 mA • Typ. 75 mA • Typ. 145 mA
Degree of protection	
	IP20 for FL1F-RD1 excluding front panel IP65 for FL1F-RD1 front panel
Enclosure type	Type 4X/12 for FL1F-RD1 front panel
Communication port	
Ethernet performance	Two Ethernet interfaces with 10/100 M full/half duplex data transmission rate
Connection distance	Max. 30 m
LCD Display and Backlight	
Backlight lifetime 1)	20,000 hours
Display lifetime 2)	50,000 hours
Mounting	
Mounting hole dimensions (WxH)	(119 + 0.5 mm) x (78.5 + 0.5 mm)
Mounting conditions	Mount the FL1F-RD1 vertically on a flat surface of an IP 65 or Type 4x/12 enclosure.

1) The backlight lifetime is when the final brightness is 50% of the original brightness.

2) The display lifetime is calculated under ordinary operating and storage conditions: room temperature (20 ± 8 °C), normal humidity below 65% relative humidity, and not in exposure to direct sunlight.

Determining the cycle time

B

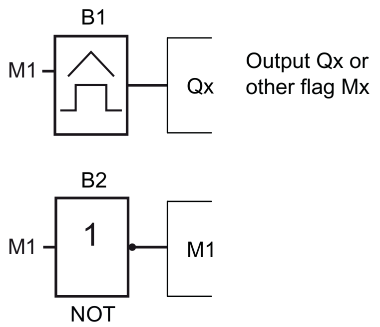
The program cycle is the complete execution of the circuit program, that is, primarily the reading in of the inputs, the processing of the circuit program and the subsequent writing the outputs. The cycle time is the time required to execute a circuit program once in full.

You can determine the time required for a program cycle using a short test program. Create this test program in IDEC SmartRelay to return a value from which you can calculate the cycle time.

Test program

To program this test program, follow these steps:

1. Create the test program by linking an output to a frequency trigger and connecting the trigger input with an inverted marker.



2. Configure the frequency trigger as shown below. IDEC SmartRelay generates a pulse in each program cycle due to the inverted marker. The trigger interval is 2 seconds.

```
B1            1/1   +/
On    =1000
Off   =0
G_T   =02:00s
```

3. Now start the circuit program and switch IDEC SmartRelay to parameter assignment mode. In this mode, view the trigger parameters.

```
B1            1/1
On    =1000
Off   =0
fa    =2130
```

f_a = total of measured pulses per timebase G_T

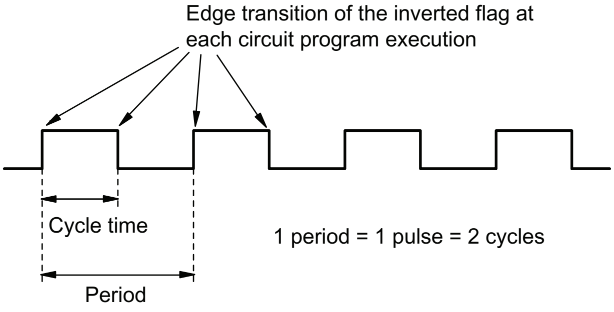
4. The reciprocal value of f_a is equivalent to the IDEC SmartRelay execution time of the current circuit program in its memory.

$1/f_a$ = cycle time in s

Explanation

The inverted marker block changes its output signal at each program execution. Thus, one logic level (high or low) width is exactly equivalent to the length of one cycle. Hence, a period lasts two cycles.

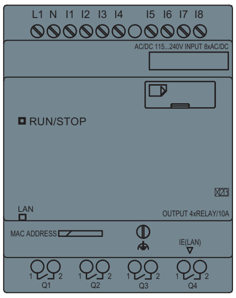
The frequency trigger indicates the ratio of periods per two seconds, which results in the ratio of cycles per second.



IDEC SmartRelay without display ("IDEC SmartRelay Pure")

C

Because some specific applications do not require operator control or interface elements, such as buttons or a display, IDEC provides the FL1F-B12RCE, FL1F-B12RCA and FL1FB12RCC versions without display.



Less is definitely more!

The versions without display offer you the following benefits:

- Even more cost-effective without the operating elements
- Requires less switch cabinet space than conventional hardware
- Substantial benefits with regard to flexibility and prime costs compared to stand–alone electronic switchgear
- Advantageous even for applications in which it replaces merely two or three conventional switching devices
- Very easy to use
- Access-protected
- Compatible to IDEC SmartRelay versions with display
- Offers the option to read data by means of WindLGC

Creating a circuit program without operator panel

You can use one of two ways to create a circuit program for an IDEC SmartRelay without display:

- You create the circuit program with WindLGC on your PC and then download it to IDEC SmartRelay.
- You download the circuit program from a Using memory cards (Page 287) to your IDEC SmartRelay without display.

Network communication indication

When you create a circuit program with WindLGC, you need to connect the module to your PC with an Ethernet cable. You can refer to the chapter Connecting the Ethernet interface (Page 45) to find the details about the wiring of the Ethernet interface and also about the status of the Ethernet LEDs.

Operating characteristics

IDEC SmartRelay is ready for operation when you switch on power. Switching off an IDEC SmartRelay without display is equivalent to disconnecting the power supply.

You can not start or stop the circuit program of FL1F-B12... versions by means of buttons, therefore, this is why the FL1F-B12... versions have other startup characteristics.

Startup characteristics

If there is no circuit program in IDEC SmartRelay or on the inserted micro SD card, IDEC SmartRelay remains in STOP mode.

If there is a valid circuit program in IDEC SmartRelay memory or on the micro SD card, IDEC SmartRelay automatically switches from STOP mode to RUN mode when you switch on power.

IDEC SmartRelay automatically copies the circuit program on an inserted micro SD card to memory, immediately after you switch on power. IDEC SmartRelay rewrites the existing circuit program in memory if one exists, and then changes from STOP mode to RUN mode.

By connecting an Ethernet cable to IDEC SmartRelay (Page 309), you can use WindLGC to download the circuit program and place IDEC SmartRelay in RUN mode.

Operating status indication

An LED on the front panel indicates the operating state:

- Lights red: Power On/STOP
- Lights green: Power On/RUN

The LED lights red after Power On and in all IDEC SmartRelay states other than RUN mode. The LED lights green when IDEC SmartRelay is in RUN mode.

Reading current data

WindLGC provides an online test for reading the current data of all functions while the system is in RUN.

If your IDEC SmartRelay without display holds a protected micro SD card, you cannot read the current data unless you Program copy protection (Page 298) for the circuit program. IDEC SmartRelay deletes the circuit program from memory when you remove the micro SD card.

Deleting the circuit program

Use WindLGC to delete the circuit program and password if a password exists.

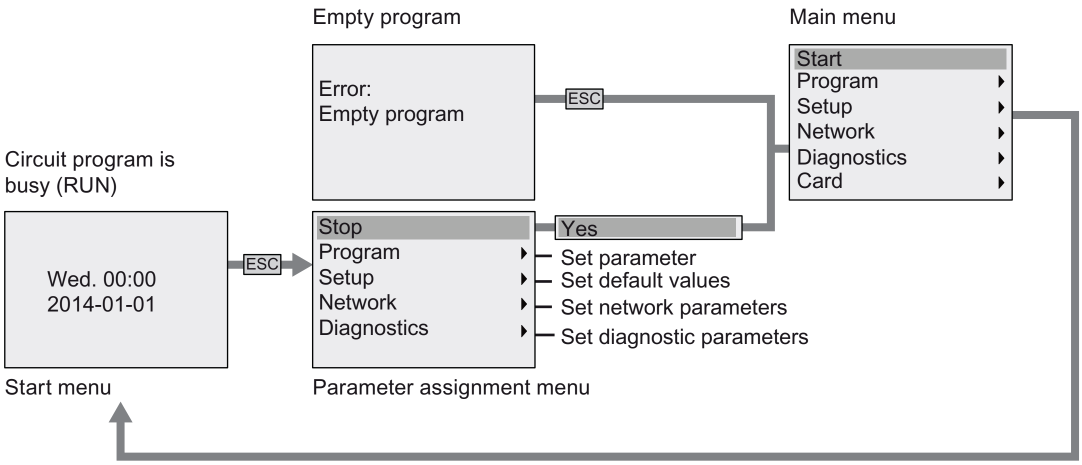
IDEC SmartRelay menu structure

D

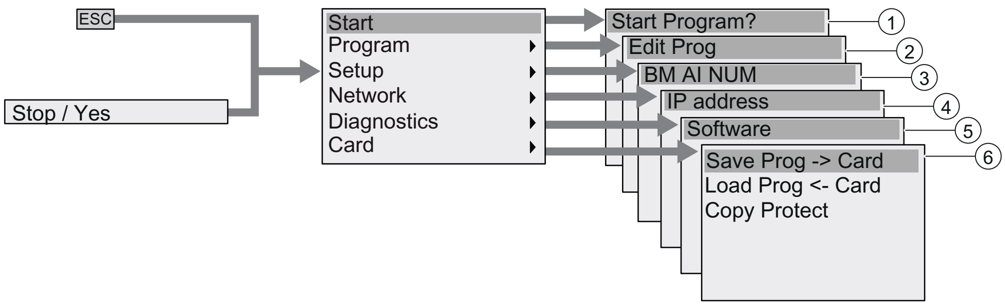
D.1 Base Module

D.1.1 Menu overview

All of the following menu commands are valid for Base Modules with the ADMIN access level. If you operate the IDEC SmartRelay with the OP access level, some menu commands are invisible. For more information see section Overview of IDEC SmartRelay menus (Page 62).



D.1.2 Main menu



① See "Start menu (Page 341)"

② See "Programming menu (Page 337)"

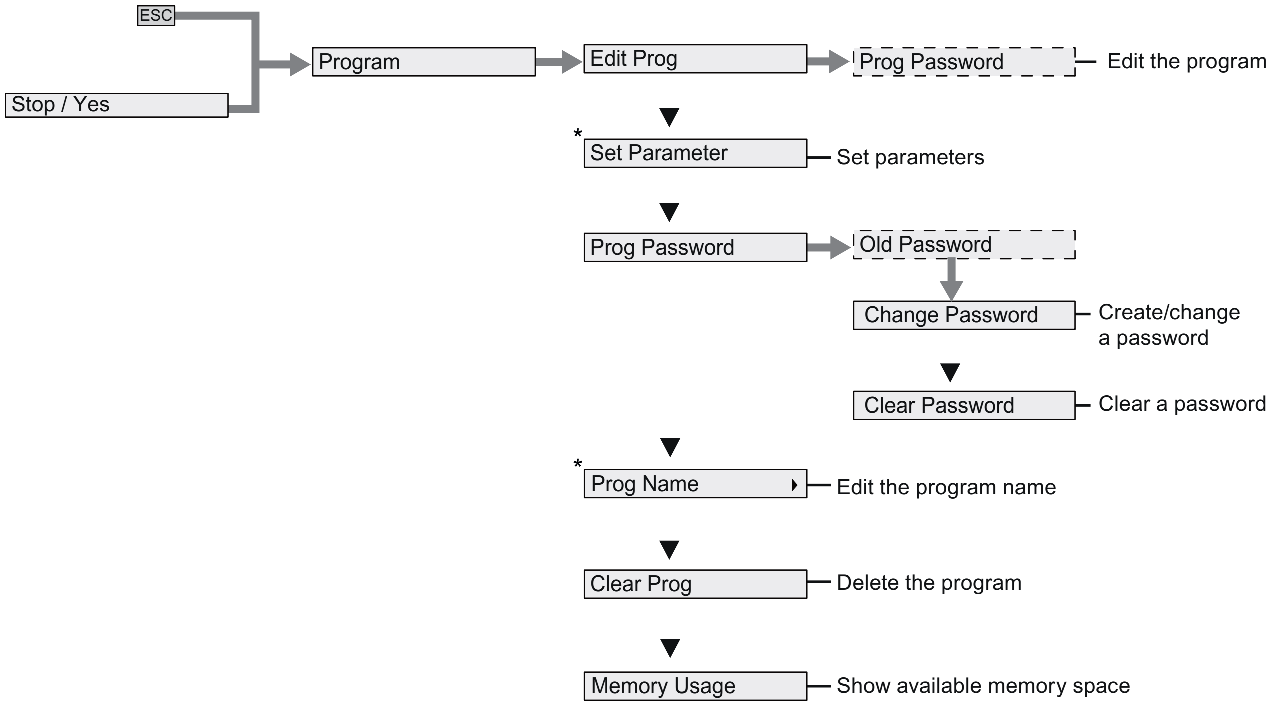
③ See "Setup menu (Page 338)"

④ See "Network menu (Page 339)"

⑤ See "Diagnostics menu (Page 340)"

⑥ See "Card menu (Page 337)"

D.1.3 Programming menu

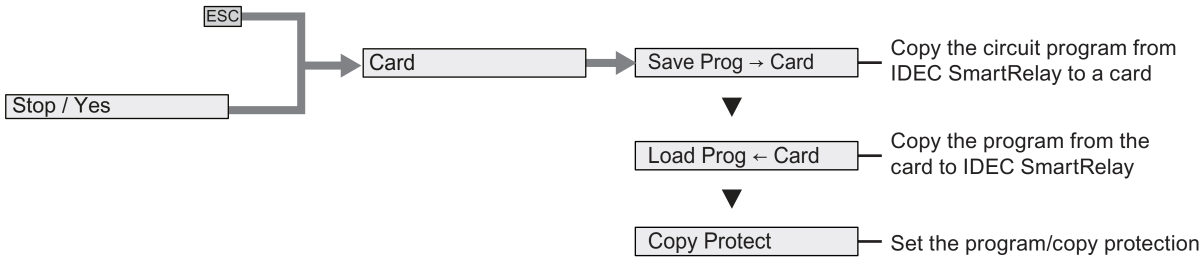


Note

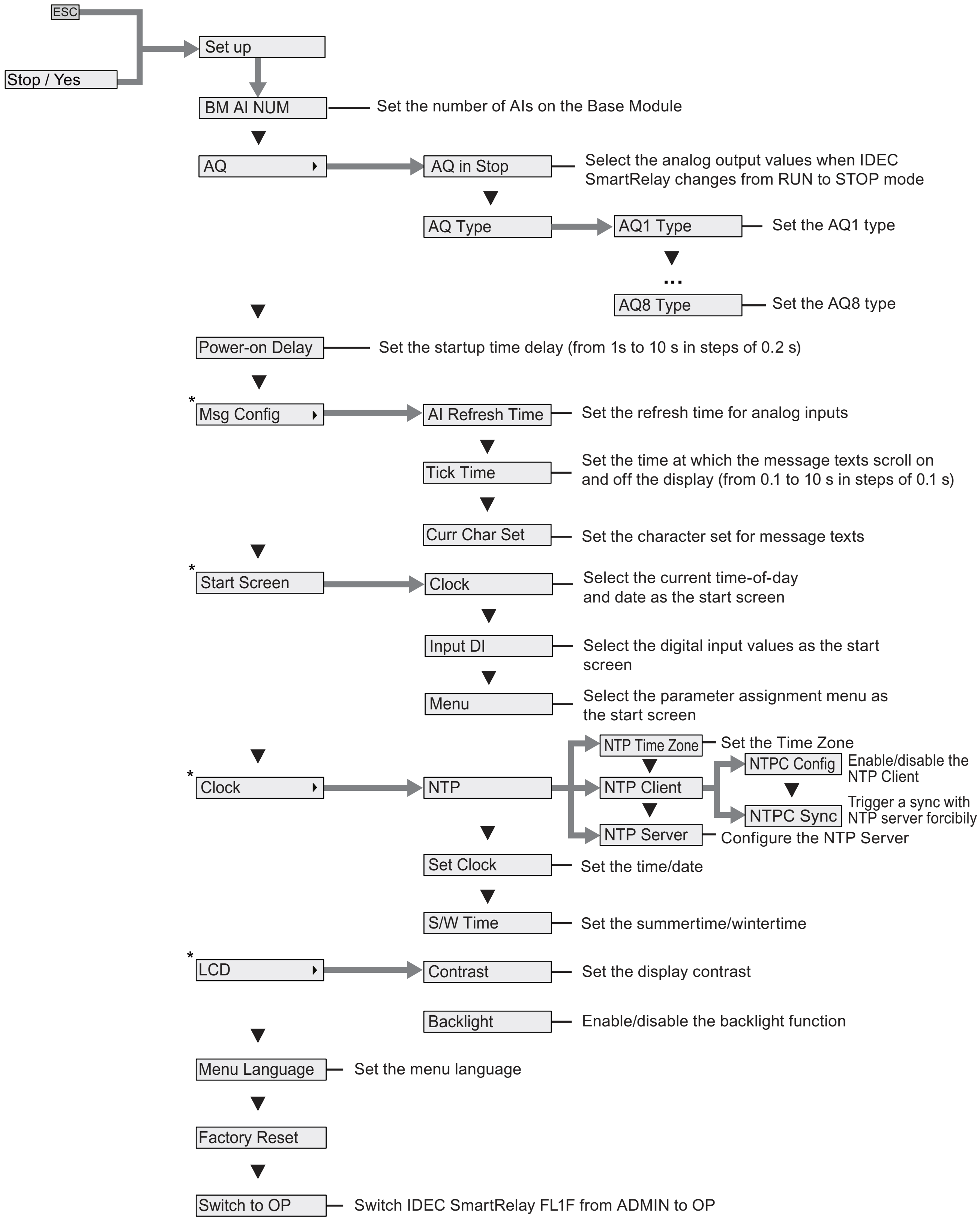
When IDEC SmartRelay is in RUN mode, only the menu commands with an asterisk (*) are available in the programming menu.

D.1.4 Card menu

This menu is available only when IDEC SmartRelay is in programming mode.



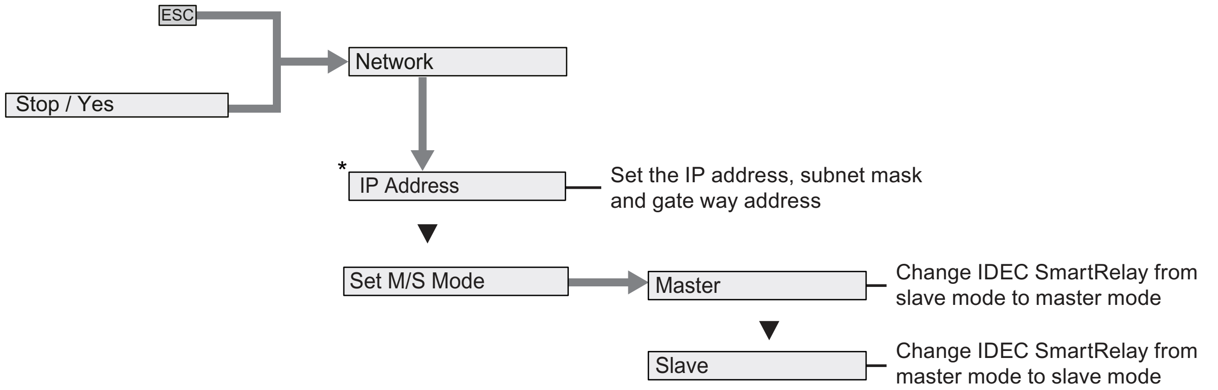
D.1.5 Setup menu



Note

When IDEC SmartRelay is in RUN mode, only the menu commands with an asterisk (*) are available in the setup menu.

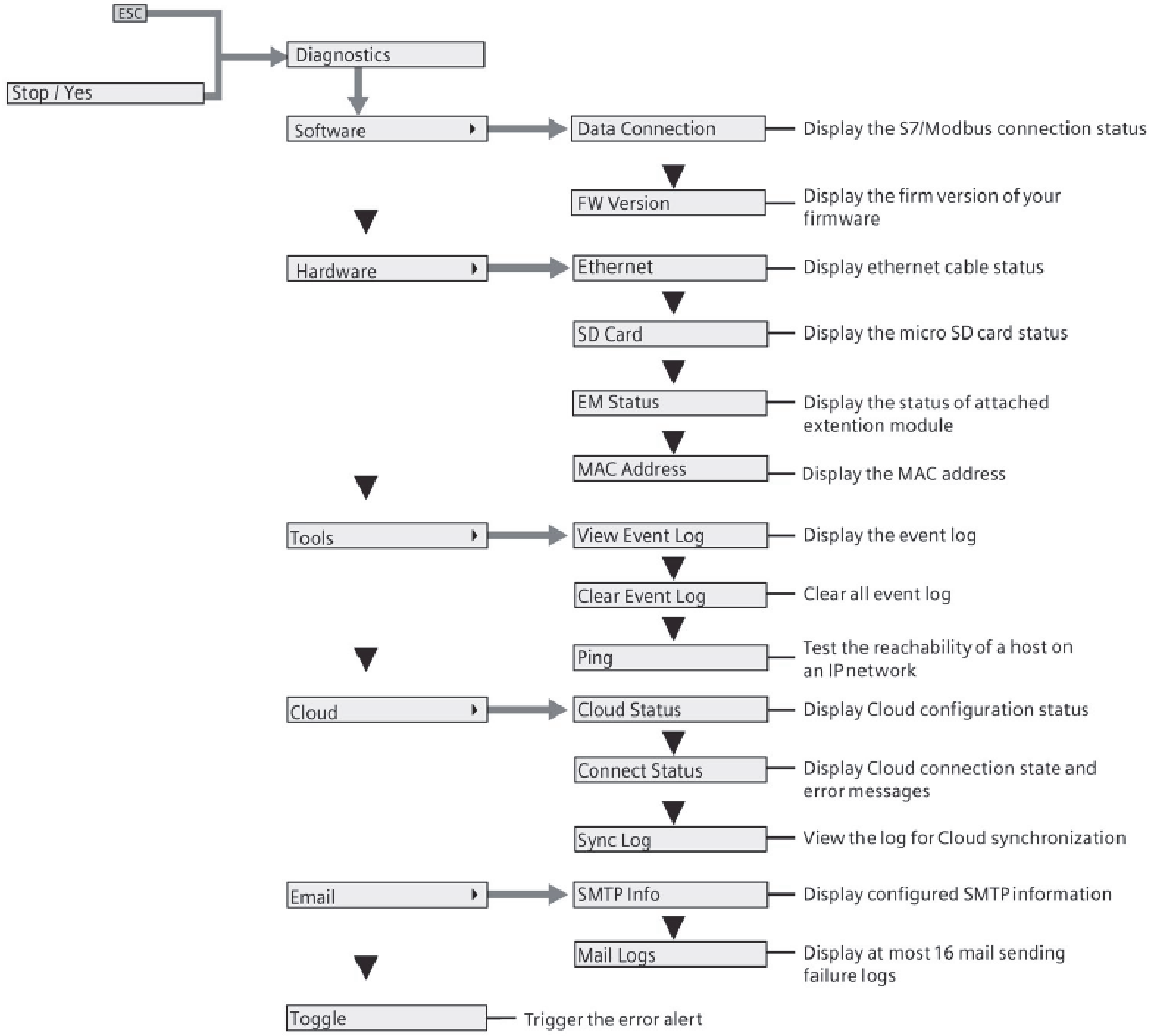
D.1.6 Network menu



Note

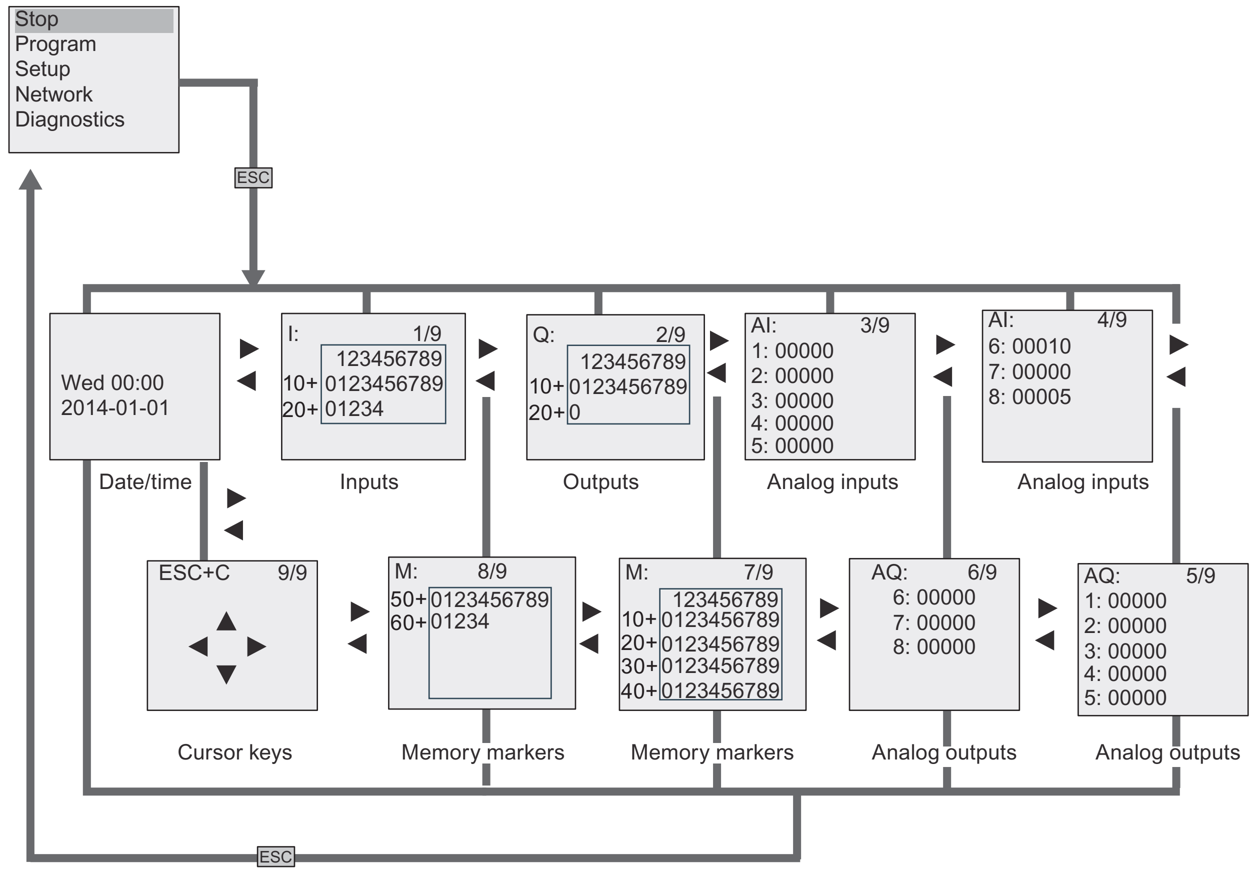
When IDEC SmartRelay is in RUN mode, only the menu commands with an asterisk (*) are available in the network menu.

D.1.7 Diagnostics menu



D.1.8 Start menu

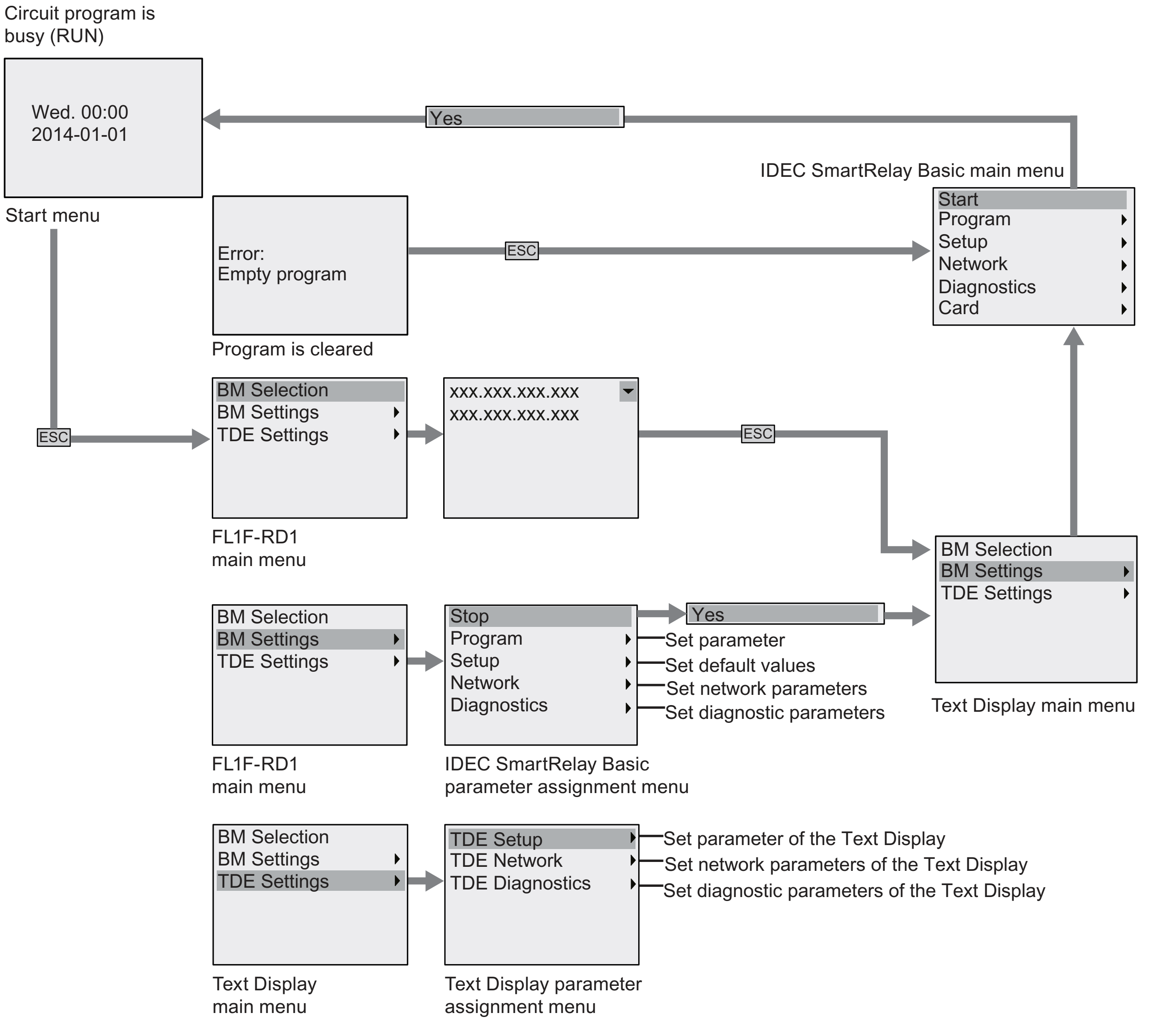
Parameter assignment menu



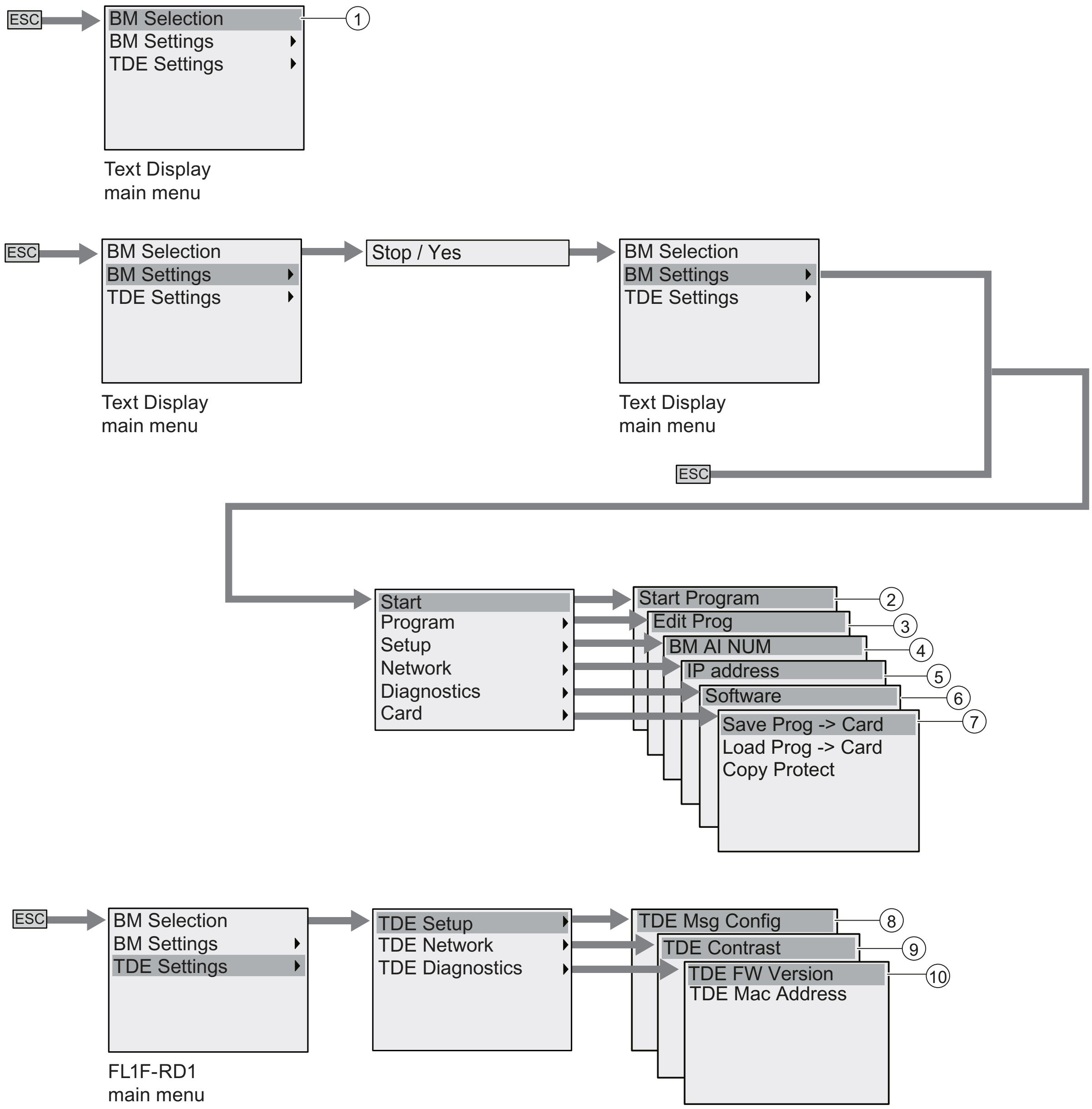
D.2 Text Display

D.2.1 Menu overview

All of the following menu commands are valid for the Text Display with the ADMIN access level. If you operate the Text Display with the OP access level, some menu commands are invisible. For more information, see section Overview of IDEC SmartRelay menus (Page 62).



D.2.2 Main menu



① See "BM selection menu (Page 344)".

② See "Setup menu (Page 338)".

③ See "Programming menu (Page 337)".

④ See "Setup menu (Page 338)".

⑤ See "Network menu (Page 339)".

⑥ See "Diagnostics menu (Page 340)".

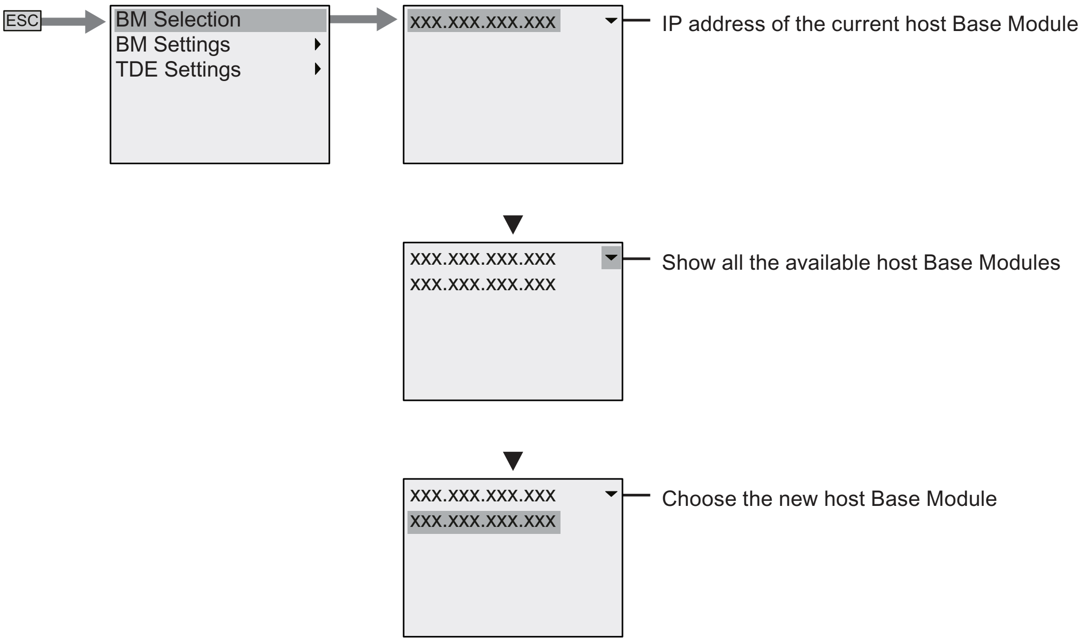
⑦ See "Card menu (Page 337)".

⑧ See "Text Display setup menu (Page 347)".

⑨ See "Text Display network menu (Page 347)".

⑩ See "Text Display diagnostics menu (Page 347)".

D.2.3 BM selection menu



D.2.4 BM settings menu

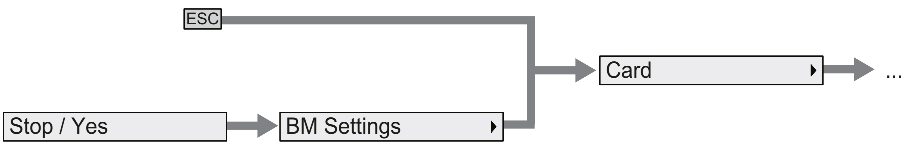
The Text Display allows you to view and configure settings of the connected Base Module in its BM settings menu.

Program menu

The program menu is the same as that on the Base Module. See "Programming menu (Page 337)" for more information.

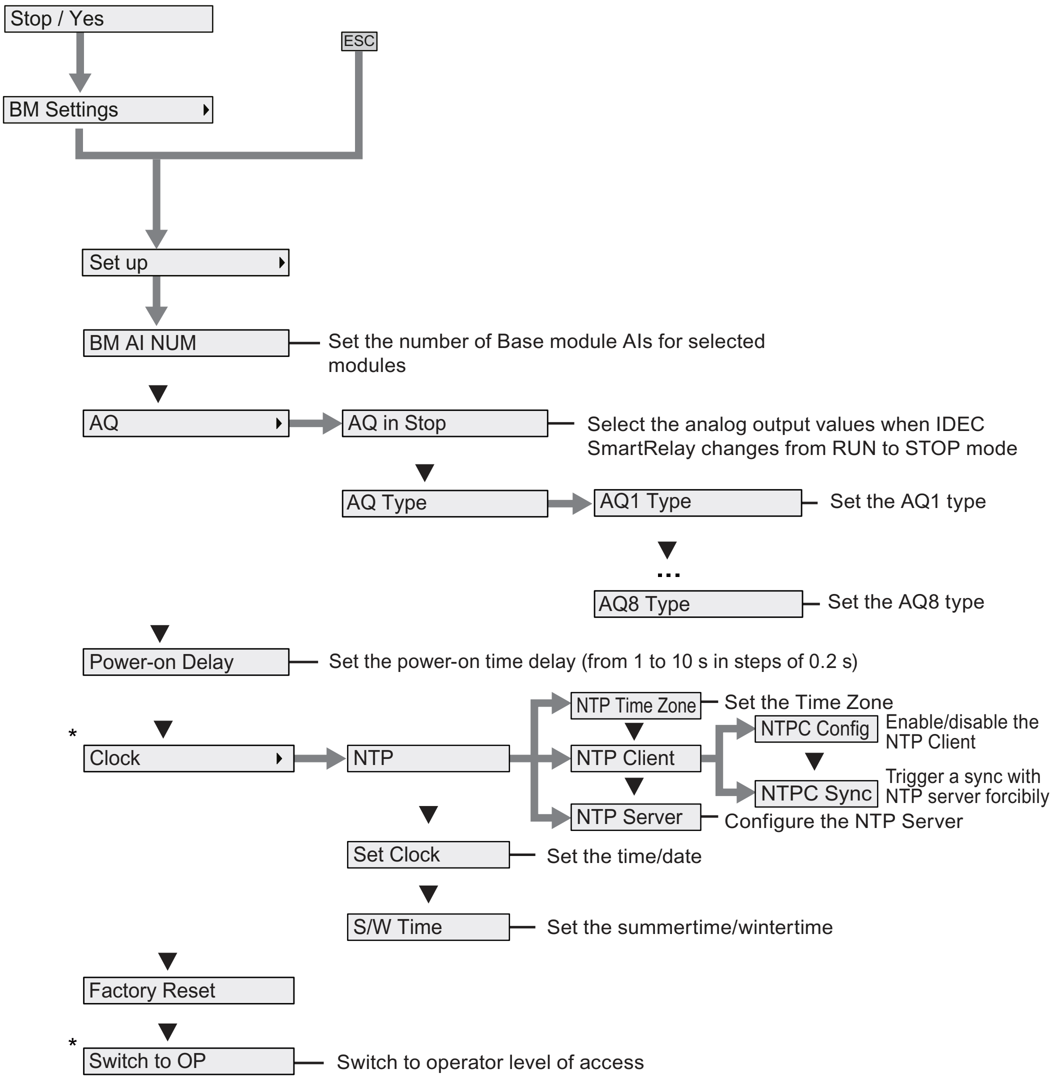
Card menu

The card menu is the same as that on the Base Module. See "Card menu (Page 337)" for more information.



Setup menu

The setup menu is different from that on the Base Module. See "Setup menu (Page 338)" for the complete setup menu for Base Module.

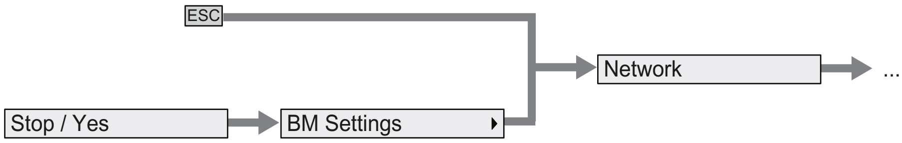


Note

When IDEC SmartRelay is in RUN mode, only the menu commands with an asterisk (*) are available in the above menu.

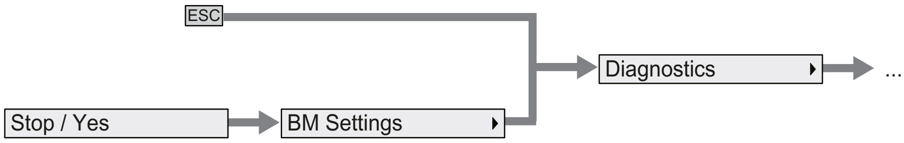
Network menu

The network menu is the same as that on the Base Module. See "Network menu (Page 339)" for more information.



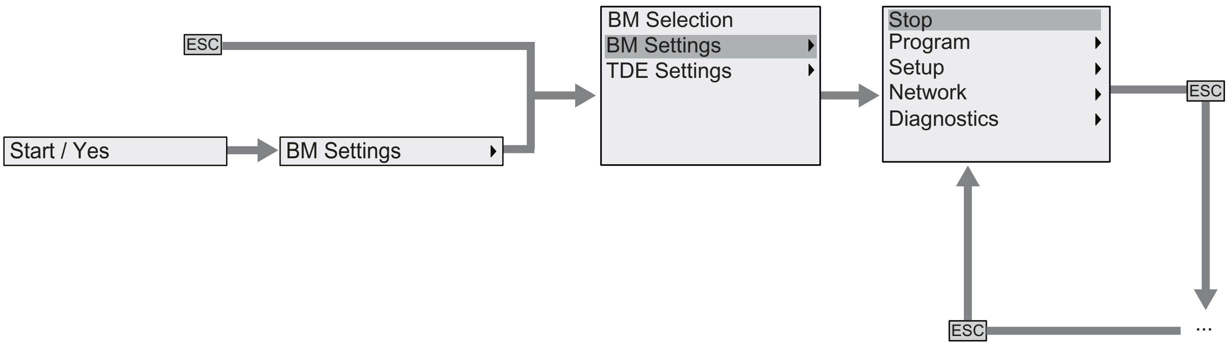
Diagnostics menu

The diagnostics menu is the same as that on the Base Module. See "Diagnostics menu (Page 340)" for more information.



Start menu

The start menu is the same as that on the Base Module. See "Start menu (Page 341)" for more information.



Note

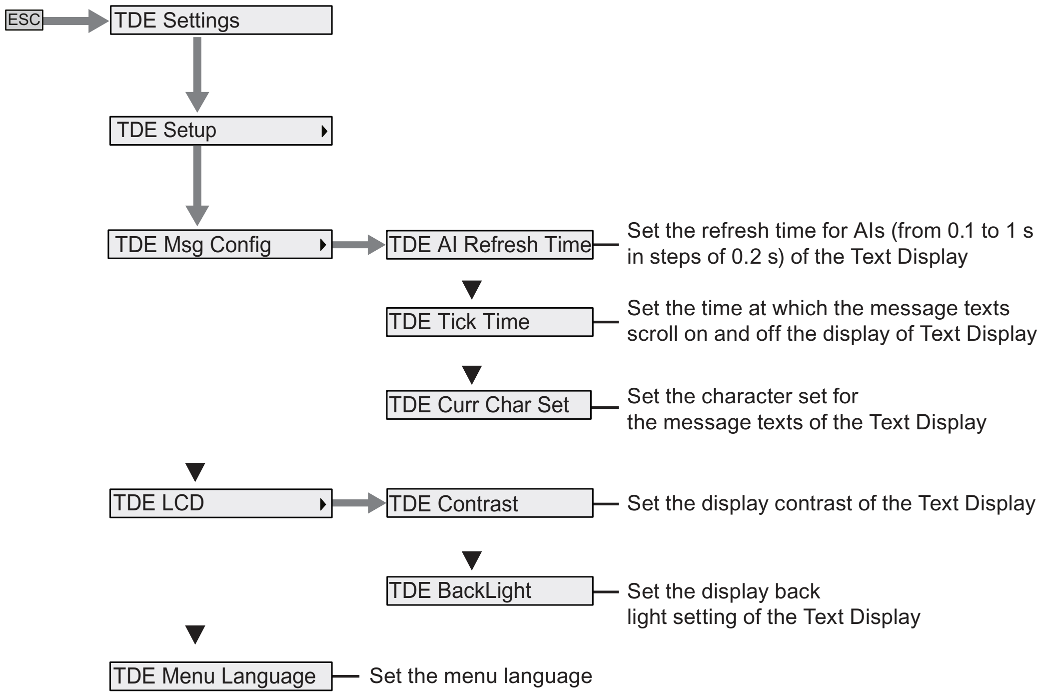
The start screen of the Text Display is always the clock display when Base Module is in RUN mode.

D.2.5 Text Display settings menu

The Text Display allows you to view and configure settings of the Text Display itself.

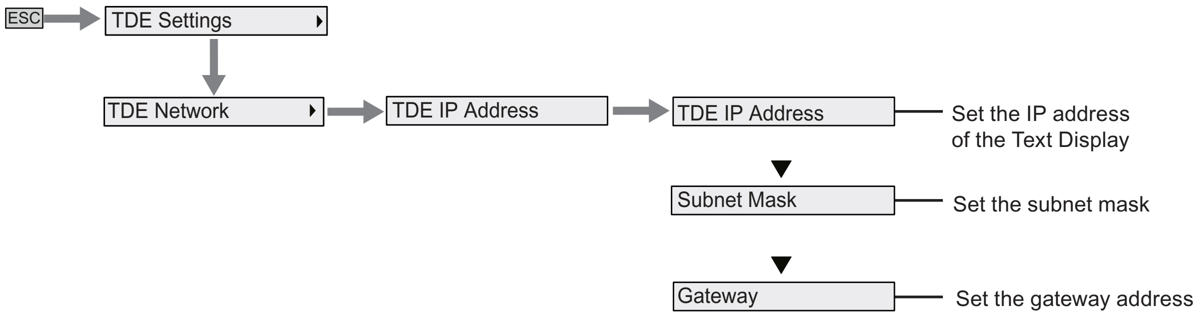
The following Text Display settings menu structure applies both when the connected Base Module is in RUN or STOP mode.

Text Display setup menu



Text Display network menu

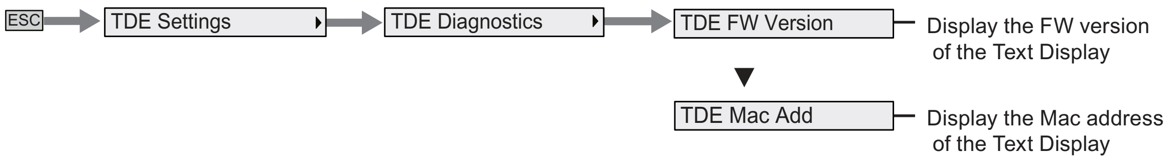
You can use the menu below to set the FL1F-RD1 network configurations.



Note

The IP address of the Text Display is read-only when it is in RUN mode.

Text Display diagnostics menu



Type numbers

E

Modules

Variant	Type number
Base Modules (Base Module with display)	FL1F-H12RCE * FL1F-H12SCD * FL1F-H12RCA FL1F-H12RCC
Base Modules (Base Module without display)	FL1F-B12RCE * FL1F-B12RCA FL1F-B12RCC
Digital modules	FL1F-M08B2R2 FL1F-M08B1S2 FL1F-M08D2R2 FL1F-M08C2R2
Analog modules	FL1F-J2B2 FL1F-K2BM2
Text Display module with Ethernet interfaces	FL1F-RD1

*: Also with analog inputs

Accessories

Accessories	Type number
WindLGC	FL9Y-LP1CDW
User's Manual	FL9Y-1789
Mounting Clip for Base module	FL1F-PSP1PN05
Mounting Clip and Waterproof Gasket for Text Display	FL1F-KW1

Troubleshooting

F

This chapter provides you with tips on how to locate and troubleshoot problems.

Sending emails

Diagnostics information is displayed on IDEC SmartRelay Base module through menu: *Diagnostics → Email → Mail Logs*. You can refer to the following table to troubleshoot the error cause and fix the error through corresponding solution.

Diagnostics	Possible cause	Possible remedy
Mail busy	Emails are sent too frequently. When the server is sending an email, another email is triggered to send.	As you cannot change the email sending frequency, modify the email sending trigger event.
Time out	• The network connection is unstable. • SMTP server response is time-out.	• Check if your network connection is interrupted. • Check if the communication with the SMTP server is normal.
Failed to parse DNS	• Network connection to DNS server is interrupted. • Some error occurs on the SMTP domain name.	• Check if the connection with the DNS server is normal. • Change DNS server. • Check if the SMTP server domain name is correct.
Failed to login	The login account or login password is incorrect in the SMTP settings.	Check the login account or password in SMTP settings. Additional application code is required for certain SMTP server login. Refer to the user manual of specified email server for detailed information.
Receiver error	• Email receiver is not configured. • Some error occurs on the configured email receiver.	• Check if the email receiving group is configured with email receivers. On how to configure email receiver, refer to *User interface -> Menu bar -> Tools menu -Transfer -> Email settings* in *WindLGConline help*. • Check if the receiver email address is correct. • Check if the receiver email address is within the receiving range of the SMTP server.
Net error	The network is disconnected when the server is sending the email.	Check your network connection.
No configuration	SMTP server is not configured in WindLGC.	Configure SMTP in WindLGC. Refer to *User interface -> Menu bar -> Tools menu -Transfer -> Email settings* in *WindLGC online help*.

Diagnostics	Possible cause	Possible remedy
Server error	• SMTP server rejects the email sending request. • SMTP server response doesn't meet with the SMTP specifications.	Check if error occurs on the SMTP server or the SMTP server login email account.
Failed to verify certificate	The SMTP server certificate is invalid.	• Upload valid certificate in SMTP configuration. • Check if the BM time is correct. Incorrect BM time makes it fail to verify certificate.

Cloud connection

Diagnostics information is displayed on IDEC SmartRelay Base module through menu: *Diagnostics → Cloud → Connection Status*. You can refer to the following table to troubleshoot the error cause and possible solution.

Diagnostics	Possible cause	Possible remedy
Failed to parse DNS	• DNS server is not available. • Error occurs when parsing IP address from DNS server.	• Check your network connection. • Check if the gateway configuration is correct. • Check if the broker URL is correct.
Server connection timeout	• No response from server when IDEC SmartRelay is establishing TCP/TLS connection with it. • Server is not accessible	• Check your network connection. • Check if the broker URL is correct. • Contact server technical support.
Server connection error	Error occurs when IDEC SmartRelay is establishing TCP/TLS connection with server.	Check connection parameters, for example, port, authentication mode, key, certificate.
No reply from MQTT broker	Server's MQTT service is unavailable.	Contact server technical support.
Failed to send data to MQTT broker	Cloud connection with MQTT broker is interrupted when IDEC SmartRelay is sending data.	Check your network connection.
Failed to receive data from MQTT broker	• Cloud connection with MQTT broker is interrupted when IDEC SmartRelay is receiving data. • Received data is invalid, for example, packet format error, unrecognizable packet type.	• Check your network connection. • Check server configuration.
Unacceptable protocol version	The server does not support the level of the MQTT protocol requested by the client.	Check if the server supports MQTT 3.1/3.1.1 protocol.
Identifier rejected	The client identifier is UTF-8 which is not supported by the server.	Contact server technical support.
Server unavailable	The network is connected but MQTT services is unavailable.	Contact server technical support.
Bad user name or password	The data in the user name or password is malformed.	• Check if user name and password are correct. • Contact server technical support.
Not authorized	The client is not authorized to connect.	Check if user name and password are provided.
Data from MQTT broker is too long	Data received from the server is malformed or too long.	• Check if data sent from the server is valid. • Contact server technical support.

Abbreviations

G

AM	Analog module
B1	Block number B1
BM	Base Module
C	IDEC SmartRelay device designation: integrated clock
Cnt	Count = Counter input
Dir	Direction (of count, for example)
DL	Data Log
DM	Digital Module
EM	Expansion Module
En	Enable = switching on (for example, clock generators)
FL1F device	The latest Base Module version, described in this manual
Fre	Input for frequency signals to be analyzed
GF	Basic Functions
Inv	Input for inverting the output signal
NAI	Network analog input
NAQ	Network analog output
NI	Network input
No	Cam (parameter of the timer)
NQ	Network output
Par	Parameter
R	Reset input
Ral	Reset all = Input for resetting all internal values
S	Set (latching relay, for example)
SF	Special functions
T	Time = parameter
TDE	Text Display with Ethernet interfaces
Trg	Trigger (parameter)
UDF	User-Defined Function

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Additional support

At our Internet address (https://us.idec.com/idec-us/en/USD/Programmable-Logic-Controller/c/Programmable_Logic_Controller) you can quickly and easily find answers to your queries about IDEC SmartRelay.