Table of Contents

Table of Contents

WindLGC V6.0

Welcome to WindLGC V6.0!

Elements of the programming interface

Tutorials

Sample applications

Tips and Tricks

Look it up:
- Constants and terminal blocks
- Basic functions (FBD Editor)
- SFBs
- Circuit programs

What's new in WindLGC V6.0
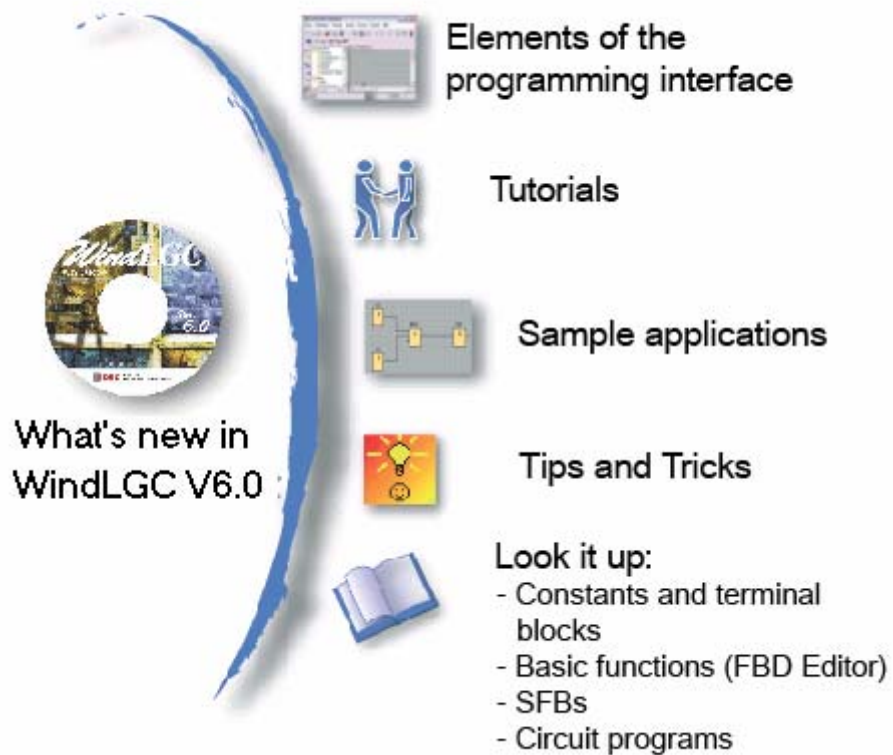
Help -> Content

Help -> Context-sensitive help

CD contents

The CD ROM

The CD-ROM included with your installation software for WindLGC V6.0 contains additional useful information.

Start.html

This file guides you through the contents of the CD-ROM. It helps you to perform these tasks:

- Install WindLGC
- Start WindLGC

The file also provides you with access to many more items, including the following items:

- CAD drawings
- Manuals
- Drivers

Folders on the CD-ROM:

The list below describes some of the folder contents of the CD_ROM:

- The ..\CAD folder contains CAD drawings of the IDEC SmartRelay devices.
- The..\Manuals folder contains the current IDEC SmartRelay manual as a PDF file that you can read with AcrobatReader.
- The \Onlinehelp folder contains the current WindLGC online help as a PDF file that you can read with AcrobatReader.
- The \Readme folder contains an HTML readme file that includes information that you need to know prior to installation.
- The ..\Sample folder contains a few sample applications, which give you example solutions for a few of the many fields of applications of the versatile IDEC SmartRelay.
- The ..\Windows\Tools\Acrobat folders contain the Adobe AcrobatReader, which you need to view and print the PDF files of the manual and online help.
- The ..\Windows\Tools\ Application folder on the full version CD-ROM contain installation versions of WindLGC. As an alternative to installing WindLGC, simply copy the ..\Tools\Application folder to your hard disk drive and start WindLGC by calling ..\Application\WindLGC.

What's new in WindLGC V6.0?

New SFBs

- Pulse Width Modulator (PWM)

- Analog math

- Analog math error detection

Updated SFBs

The following SFBs support new features:

- Message text

- Operating operating hours counter

- Seven-day time switch

- Twelve-month time switch

- Analog watchdog

- Up/down counter

Additionally, WindLGC supports new reference parameters for many blocks.

New Text Display module

IDEC SmartRelay supports a new text display module. This Text Display module extends the display and user interface capabilities of IDEC SmartRelay Basic. WindLGC provides configuration of the following Text Display features:

- Power-on screen

- Function keys

- Message texts

- Backlight function

For further information about the Text Display module, refer to your product information and the IDEC SmartRelay manual.

New features

WindLGC V6.0 together with the IDEC SmartRelay FL1E hardware series provides the following new features:

- Method to delete user program and password from IDEC SmartRelay FL1E

- Additional languages, resolution, and backlight function for the IDEC SmartRelay FL1E display

- Ability to perform online tests of LAD circuit programs

- Display of PI controller analog output value in a trend view during simulation or online test

- USB cable communication between a PC and IDEC SmartRelay Base module

- New memory cartridge, battery cartridge and combined memory/battery cartridge for IDEC SmartRelay FL1E devices.

Changed functionality

WindLGC V6.0 provides changes in the following areas:

WindLGC V6.0

- Number of user program blocks increased to 200 blocks
- Additional retentive memory for a total of 250 bytes
- Configuration support for all I/O changes to IDEC SmartRelay basic and expansion modules

Ladder Diagram (LAD) and Function Block Diagram (FBD)

WindLGC provides you with two options of creating circuit programs:

- Ladder diagram (LAD)

- Function block diagram (FBD)

Who will use the ladder diagram (LAD)?

Users who are used to working with circuit diagrams.

Who will use the function block diagram (FBD)?

Users who are familiar with the logic boxes of Boolean algebra.

Differences between LAD and FBD in the online help

The online help primarily describes the FBD Editor, because its functionality is closely related to that of the LAD Editor. Where LAD differs, the online help will describe the differences. The following symbol in the online help indicates a difference in LAD and FBD functionality:

Converting circuit programs

Information on the conversion of circuit programs from LAD to FDB is found here.

Information on the conversion of circuit programs from FBD to LAD is found here.

Switching between LAD and FDB

Information on this topic is found here.

IDEC SmartRelay and WindLGC on the Internet

http://smart.idec.com/

From the Support selection at this Internet URL you will find abundant information about IDEC SmartRelay and WindLGC:

- Updates and upgrades for WindLGC

- FAQs (frequently asked questions)

- Downloads of current manuals

- News and other information

You are welcome to visit this site!

Compatibility

Compatibility with previous IDEC SmartRelay Hardware series

WindLGC V6.0 is optimized for IDEC SmartRelay devices of the FL1E series (indicated by the order number).

You can also use the current WindLGC version to create circuit programs for the previous IDEC SmartRelay hardware series. You cannot, however, download programs that use the new SFBs or new SFB parameters to IDEC SmartRelay devices prior to the FL1E series. WindLGC provides a list of hardware that is compatible with your circuit program from the Tools -> Select Hardware menu command. You can download your circuit program to any device in the list.

WindLGC V6.0 adds reference functionality to many existing SFBs. You cannot download programs that use the new reference parameters to IDEC SmartRelay devices prior to the FL1E series.

You can continue to use the input connectors of some of the IDEC SmartRelay FL1E devices as they were prior to FL1E, that is as inputs. However with the FL1E series, these inputs can also be used for analog inputs or high-speed counters. Existing WindLGC programs that use these connectors as inputs will function in the same way as they did with the FL1D and earlier series. New programs can make use of the new analog inputs and high-speed counters. Refer to your product information and the IDEC SmartRelay manual for detailed information about these modules: FL1E-H12RCE, FL1E-B12RCE, and FL1E-H12SND.

Any differences concerning the operation of WindLGC that are based on differences between the previous series and the current IDEC SmartRelay series FL1E are described separately. If programming differences exist based on the IDEC SmartRelay series, this help system uses this graphic to alert you to those differences:

Compatibility with previous versions of WindLGC

You can edit and expand circuit programs written with older versions of WindLGC using your current WindLGC version.

Compatibility with previous IDEC SmartRelay memory cartridges

Refer to the IDEC SmartRelay manual for compatibility information regarding IDEC SmartRelay memory cartridges. WindLGC does not access programs stored on memory cartridges).

See also

IDEC SmartRelay Hardware

Here you'll find information about the individual hardware series. This also includes a table from which you can see which basic and special functions are available as of which hardware series.

User interface

User interface - Overview

User interface and programming interface

WindLGC V6.0 starts with the empty user interface of WindLGC. Click on this icon: ▯

Result: WindLGC creates a new, empty circuit program.

You now see the complete user interface of WindLGC. The programming interface for creating your circuit programs occupies the greater part of the screen. The icons and logical links of the circuit program are arranged on this programming interface.

To help you to maintain an overview of large circuit programs, the right side and the bottom of the programming interface contain scroll bars, which you can use for vertical and horizontal scrolling of the circuit program.
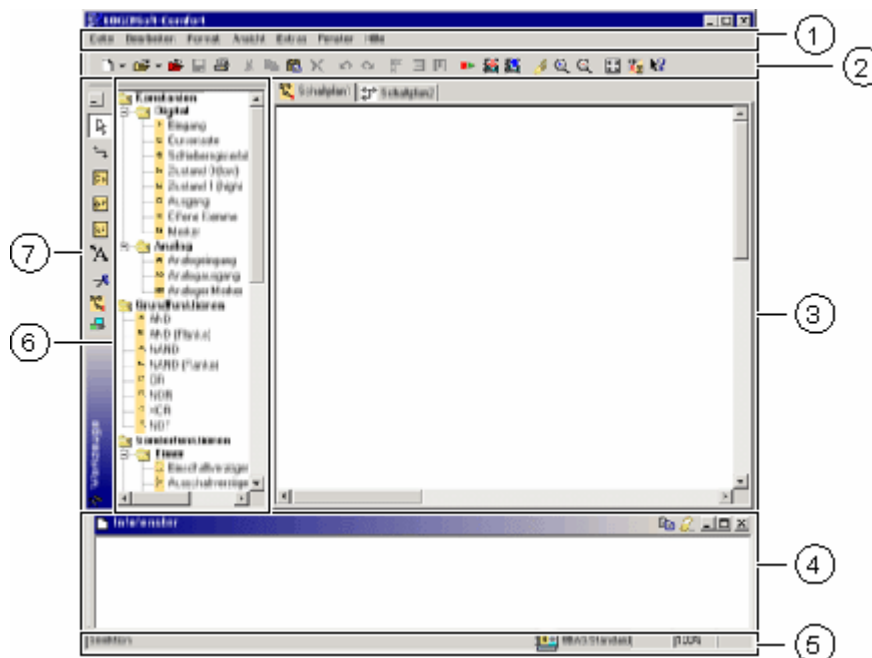
①   Menu bar

②   Standard toolbar

③   Programming interface

④   Info box

⑤   Status bar

⑥   •   Constants and connectors

      •   Basic functions (only FBD Editor)

      •   Special functions

⑦   Programming toolbar

Menu bar

The menu bar is located at the top of the WindLGC window. Here, you can find various commands for editing and managing your circuit programs, as well as functions for defining your default settings and for transferring of the circuit program to and from IDEC SmartRelay.

Toolbars

WindLGC provides the following three toolbars:

- Standard toolbar
- Programming toolbar
- Simulation toolbar

Standard toolbar

The standard toolbar is located above the programming interface. After its start, WindLGC shows you a reduced standard toolbar that provides only the essential functions.

The standard toolbar provides direct access to the essential functions of WindLGC.

After you have opened a circuit program for editing on the programming interface, you can see the complete standard toolbar.

You can use the icons to create a new circuit program or to download, save and print out an existing program, cut/copy and paste objects, or initiate data transfer to and from IDEC SmartRelay devices.

You can use the mouse to select and move the standard toolbar. The toolbar is always snapped onto the top of the menu bar when you close it.

Programming toolbar

The programming toolbar is located at the left of the screen. Its icons can be used to change to other editing modes, or for quick and easy creation or editing of a circuit program.

or

You can drag and drop the programming toolbar to another location with the mouse. The toolbar is always snapped onto the top of the menu bar when you close it.

The LAD Editor no longer contains the Basic function (SF) icon, because you create logical "AND" and "OR" links by interconnecting individual blocks.

Simulation toolbar

This toolbar is only relevant for the simulation of circuit programs. Further information is found here.

Info box

The Info Window, located at the bottom of the programming interface, displays information and notes, as well as the IDEC SmartRelay devices recommended by the Tools -> Determine IDEC SmartRelay function for use in your circuit program.

Status bar

The status bar is located at the bottom of the program window. It shows the currently active tool, the program status, the zoom factor, the page number of the circuit diagram and the selected IDEC SmartRelay device.

Description of the Info Window

Content

The Info Window shows:

- Error messages generated at the start of simulation
- IDEC SmartRelay devices determined by the Tools -> Determine IDEC SmartRelay menu command or the function key [F2]
- The date and time of the message
- The name of the circuit program for which the message was generated

If you have opened more than one circuit program, you can determine to which program the message belongs.

At the start of simulation mode, the function analyzes the circuit program with regard to its resources and the IDEC SmartRelay to be used. The resources used and the errors that occurred are displayed in the Info Window.

The Info Window displays all information in successive order. Use the scroll bar to browse all the information pages. All information is deleted from the Info Window when you close WindLGC.

Operation

You can open and close the Info Window with the View -> Info window menu command or the [F4] function key. The Info window is usually positioned at the bottom of the programming interface. You can move it with the mouse and snap it onto the top of the programming interface, in the same way as you move the toolbars. You can move the window by drag and drop, or move it out of WindLGC to open it as a separate window.

A quick way of increasing/reducing the size of the Info Window

Editing the texts in the Info window

You can delete selected messages from the Info window or copy them to other applications. You can also write personal comments in the Info Window.

Use the mouse to select a text from the Info Window and use this icon to copy it to the clipboard of your operating system.

This icon can be used to delete the content of the Info Window.

How to use the Info Window texts for your documentation

Description of the status bar

The status bar is split into five sections and contains useful information about your circuit program.

(1)   Information field. Displays the currently used tool, for example.

(2)   Displays your selected IDEC SmartRelay by means of a WindLGC tooltip. If you have not yet selected a IDEC SmartRelay, or want to change the selection, you can double-click on the IDEC SmartRelay icon to call the Tools -> Select Hardware dialog.

(3)   Shows you the currently set zoom factor.

(4)   This last field displays the current circuit program page.

Function keys and shortcuts

We have implemented a number of function keys and shortcuts for frequently called functions, in order to support your work with WindLGC.

Function keys in WindLGC:

[F1]	→	Calls the context sensitive Online Help
[F2]	→	Tools -> Determine IDEC SmartRelay
[F3]	→	Simulation start/exit
[F4]	→	View -> Info Window open/close
[F5]	→	Connector tool
[F6]	→	Constants and terminals tool
[F7]	→	Basic functions tool
[F8]	→	Special functions tool
[F9]	→	Text tool
[F10]	→	Opens the menu bar
[F11]	→	Cut/Join tool

Shortcuts in WindLGC:

In the File menu:

[Ctrl+N]	→	File -> New (opens the default editor specified under Tools/Options/Editor)
[Ctrl+O]	→	File -> Open
[Ctrl+S]	→	File -> Save
[Ctrl+F1]	→	File -> Print preview
[Ctrl+P]	→	File -> Print
[Ctrl+-]	→	File -> Compare
[Alt+F4]	→	File -> Exit

In the Edit menu:

[Ctrl+Z]	→	Edit -> Undo
[Ctrl+Y]	→	Edit -> Redo
[Ctrl+X]	→	Edit -> Cut
[Ctrl+C]	→	Edit -> Copy
[Ctrl+V]	→	Edit -> Paste
[Ctrl+A]	→	Edit -> Select all
[Ctrl+G]	→	Edit -> Go to block

In the View Menu

[Ctrl+M]   Select Connections

| [Ctrl+mouse wheel] | → View -> Zoom in |
| | → View -> Zoom out |

In the Tools menu:

[Ctrl+D]	→ Tools -> Transfer: PC -> IDEC SmartRelay
[Ctrl+U]	→ Tools -> Transfer: IDEC SmartRelay -> PC
[Ctrl+H]	→ Tools -> Select Hardware

How to access functions via the shortcut menu

Toolbars

Standard toolbar - overview

The icons of the standard toolbar provide quick access to commands that are also available on the menu.

The following commands are found in the standard toolbar:

	File:	New
		Open
		Close
		Save
		Print
	Edit:	Cut
		Copy
		Paste
		Delete
		Undo
		Redo
	Format	Automatic

Ǝ		Vertical
Ш		Horizontal
■▶	**Tools**:	Switch IDEC SmartRelay Mode
		PC -> IDEC SmartRelay (Download)
		IDEC SmartRelay -> PC (Upload)
	View:	Select Lines
		Zoom in
		Zoom out
	File:	Properties, Page Layout tab
		Convert (LAD > FBD)
		Convert (FBD > LAD)
	Help:	Context-sensitive help

Simulation toolbar and status window

The toolbar

A toolbar pops up when you open the simulation mode. It contains the following icons:

- Icons (for example, switches) for operator control of the inputs
- An icon for the simulation of a power failure, for testing the switching response with reference to retentivity characteristics after power failure
- Icons (for example, bulbs) for monitoring outputs
- Simulation control icons
- Time control icons
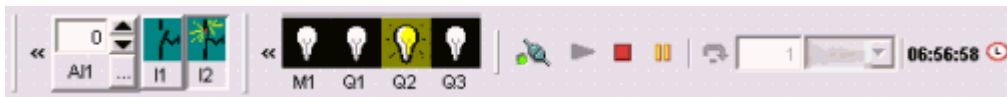
Click << to hide a partial area of the toolbar. To show this area again, click >>.

Arranging the toolbar

You can move this I/O toolbar to the left, right, top or bottom of the programming interface by drag and drop, same as the other toolbars. If your program is exceptionally large and contains many I/Os, you can also drag and drop the I/O icons out of WindLGC individually to open them in a separate window. This ensures a clear layout for your simulation.

Simulation control icons

▶	Start simulation
■	Stop simulation
‖	Hold simulation (pause)

Time control

If you have programmed a time-sensitive circuit, you can use the time control to monitor the reaction of your circuit program.

↻	Start simulation for a specific time or number of cycles. Set the period and the number of cycles using the following icons.
01:00 s ▼	Set the period and the time base for a time-limited simulation or set a specific number of cycles
8:40:56 AM	Display the current time in WindLGC

	Modify the current time in WindLGC
⊙	

Status display

Prerequisite: The display of signal states and process variables is enabled under **Tools** ➔ **Options: Simulation**.

The colored indication lets you identify the "1" or "0" status of a connecting line. Default color of connecting lines carrying a "1" signal is red. Default color of connecting lines carrying a "0" signal is blue.

Example for the FBD Editor:
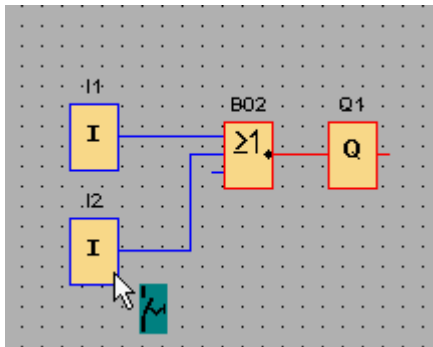
PI controller trend view

If your circuit program includes one or more PI controller function blocks, the simulation displays a trend view window of the analog output that shows the change in the value over time. The trend view is continually updated while the simulation is in progress. You can also display the process variable PV from the trend view window.
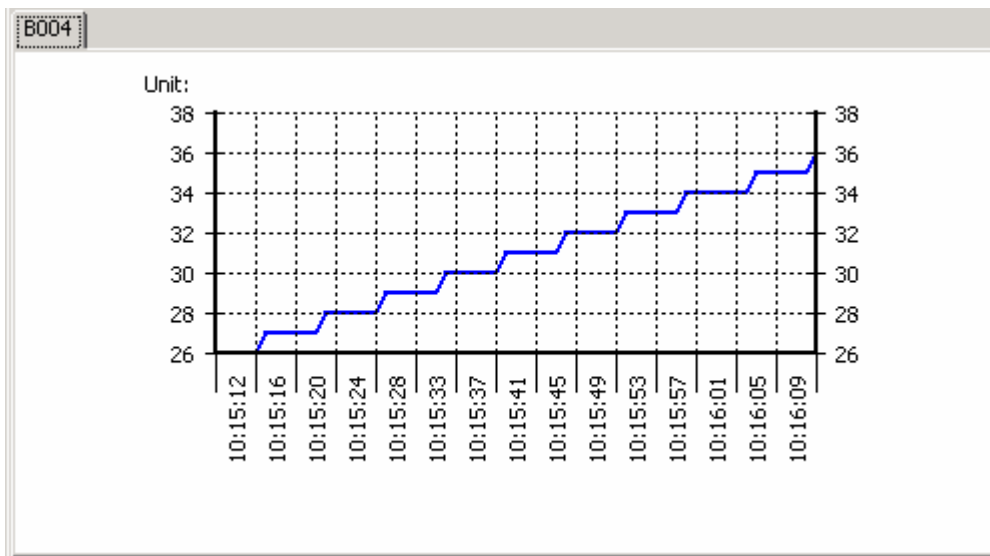
If your circuit program has more than one PI controller function block, the trend view has a separate tab for each PI controller analog output.

Programming toolbox

The programming toolbar - Overview

The programming toolbar contains integral icons for creating, editing and testing programs. Each one of these tools represents a programming mode, in which mouse operations have different effects.

The editing tools are not available as menu commands.

⊡ or ⊟	Catalog of the elements of a circuit program open / close
↳	Selection tool
ᴬ	Text tool
✂	Cut / Join
↳	Connector tool
Co	Constants and Terminals
GF	FBD Editor only: Basic functions Special functions
SF	
🖳	Simulation
🖥	Online test

Catalog of circuit program elements

This catalog provides a hierarchical listing of all elements you can use to create your circuit program.

You can open and close this catalog via the icons ⊡ or ⊟ of the programming toolbar.

The handling of the catalog is self-explanatory.

A quick and easy way of selecting blocks and placing these into your circuit program

Selection tool

You can use the selection tool to select and move blocks, text and connecting lines. You can select objects individually with a left-click; you can select multiple objects with [Ctrl]+Click, or you can use the mouse as a "lasso" to surround objects with a rectangle and capture them as a selection.

You can call the selection tool in any other tool by pressing the [ESC] key or by clicking on the icon in the programming toolbar.

Selecting objects

Text tool

A

This tool is used to insert or edit user-defined text objects in the programming interface. Instead of user-specific or block-independent text objects, you can also create labels which are assigned directly to specific blocks and are moved or deleted along with the relevant block. To create an associated label, click directly on the required block when the text tool is selected.

There can only be one associated label for each block. You can specify the font type, font size and font color for each individual label.

The width of the text box is the size of the longest line of text in the text box. To resize a text object or label, insert or delete carriage returns in the text string to make the text box the width and height that you require.

Documentation of the circuit program

Cut/Join

This tool is used to cut and join connections between blocks. To cut a connection, left-click to select the relevant line while the Cut/Join tool is active. The connection is replaced at the blocks by a reference to the partner block. The reference is labeled with the page number, block number and the I/O of the partner block.

Cut connections

Connector tool

This tool is used to connect blocks. To do so, move the mouse pointer to a block input or output and press the left mouse button. Keep the mouse button pressed, drag the mouse pointer from your selected source terminal to the target terminal. Now release the mouse button to anchor the connecting line to both terminals. While the connecting line is being drawn, it is shown as a straight line between the first terminal and the mouse pointer. Once it is anchored, it appears as a combination of horizontal and vertical lines, which can be manipulated using the selection tool.

Connecting blocks

Menu bar

Menu bar - Overview

The menu bar commands contain administrative and editing functions for the circuit program of your IDEC SmartRelay and context-sensitive help.

- File menu
- Edit menu
- Format menu
- View menu
- Tools menu
- Window menu
- Help menu

File menu

File menu - Overview

The **File** menu command contains commands for file management. Included are also commands for downloading, saving or creating circuit programs, for setting general file properties and for printing.

- New
- Open
- Close
- Close All
- Save
- Save As
- Page Setup
- Print Preview
- Print
- Properties
- Compare

- Exit

Available in the LAD Editor only:

Convert (LAD > FBD)

Available in the FBD Editor only:

Convert (FBD > LAD)

File -> New

 → Menu command **New**

The command opens a new window with an empty programming interface for programming in LAD or FBD, depending on your set mode. Depending on your default setting, a window opens with a number of tabs in which you can specify the properties of the circuit program you are going to create. This window can also be called later to either enter or modify the properties with the File -> Properties menu.

Program sections that have previously been placed on the clipboard by means of the cut or copy functions remain on the clipboard and can be pasted into the new circuit program.

An icon for this menu command is also found in the standard toolbar.

Switching between LAD and FBD

You select the editor for creating a new circuit program from the Tools -> Options: Standard Editor menu command.

Select either "FBD Diagram Editor" or "LAD Editor" from the Standard Editor drop-down list. New circuit programs will be created in either LAD or FBD according to your selection.

File -> Open

 → File **Open**

The command opens a dialog box from which you can select and open a previously created circuit program for further editing on the programming interface. Circuit programs created in WindLGC have the file extension *.lsc. The loaded circuit program is opened in a new window.

An icon for this menu command is also available in the standard toolbar.

Alternatives

You can also open a circuit program by one of the following means:

- In Windows you can also drag and drop a WindLGC circuit program file to the programming interface. When you "release" this file on the programming interface, WindLGC opens it in a new window.

- If you double-click a file with the extension *.lsc or *.lld in the file manager, WindLGC automatically opens the file.

What happens with the clipboard content?

Program objects previously copied to the clipboard with the cut or copy functions are stored in the clipboard and can be pasted into the new circuit program.

Recently-opened files

At end of the **File** menu you see a list of files that were recently opened in WindLGC.

File -> Close

→ File **Close**

Click on the **Close** menu command to close the active window. If you have not yet saved the current circuit program, you are prompted to do so.

The standard toolbar also contains an icon for this menu command.

As an alternative, you can right-click on the tab of a circuit program and select the **Close** menu command from the shortcut menu.

File -> Close all

A click on the **Close all** menu command closes all open windows. If you have not yet saved one or more of the current circuit programs, you are prompted in a dialog to select the program to be saved. All selected programs will be saved.
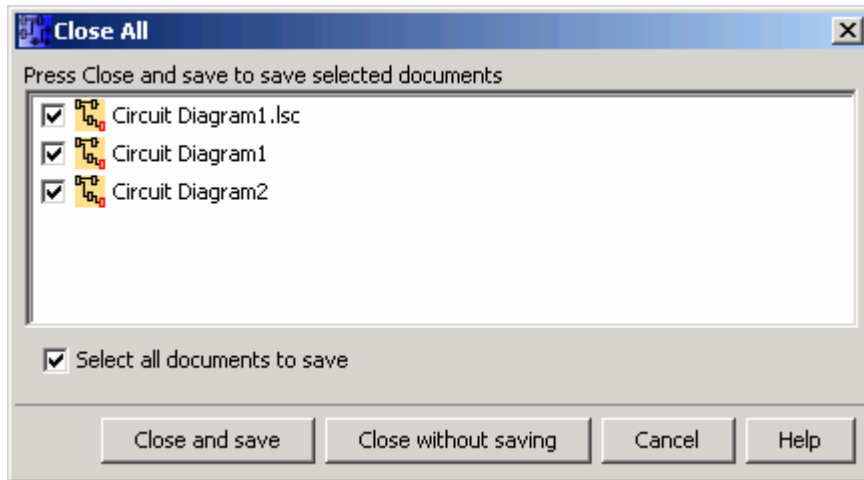
File -> Save

 ➔ File **Save**

When you initially save a newly created program, a window opens in which you can specify the path and file name under which you want to save your circuit program. Details are found under File -> Save as.

If you are saving a modified version of an existing program, a Quick Save is performed. The old version of the circuit program is overwritten by the revised version: the new program is saved to the same path and name as the source file.

The standard toolbar also contains an icon for this menu command.

As an alternative, you can right-click on the tab of a circuit program and select the **Save** menu command from the shortcut menu.

File -> Save As

A dialog box opens for you to specify the path and file name under which the current circuit program is to be saved. This allows you to save modified programs under a different name or folder, and thus keep previous versions for retrieval.

The types of files that you can save are listed below:

- WindLGC file FBD(*.lsc)

- WindLGC file LAD (*.lld)

- Portable Document Format (*.pdf)

- JPG file (*.jpg)

- Bitmap file (*.bmp)

The default WindLGC file name extension for FBD programs is *.lsc or *.lld for LAD programs.

You can also save the circuit program in a graphical format, e.g. *.jpg, *.bmp or *.pdf, the AcrobatReader document format for program documentation and presentation. However, note that such files do not contain logic elements; you cannot reopen these in WindLGC.

The AcrobatReader format offers a special feature. Saving your circuit program in *.pdf format gives you an AcrobatReader document that is absolutely identical to the hardcopy of your program. For example, you could distribute this document to users who do not have WindLGC, and thus enable them to view your project in AcrobatReader and make hardcopies.

As an alternative, you can right-click on the tab of a circuit program and select the **Save as** menu command from the shortcut menu.

File -> Page Setup

This command opens a dialog box in which you can specify the page settings for creating circuit programs. Here you can specify the paper format, page margins or whether to print in portrait or landscape format.

WindLGC offers multi-page printout feature, with the position of page breaks indicated on-screen. The print area is user-definable.

You can paginate your circuit program via the File -> Properties menu.

The settings made at this point have no effect on the printer settings. Select the printer setup command via the File -> Print menu. Finally, you can specify the scope of your hardcopies with Tools -> Options: Print.

File -> Page Setup

File -> Print preview

The print preview option shows what a hardcopy of your circuit program is going to look like. Choose the relevant icons to scroll the pages, zoom the window or to start printing directly.

File -> Print

🖨 → Menu command **Print**

This command opens a dialog from which you can select the scope of information to print. You can also open this dialog from the Tools -> Options: Print menu.
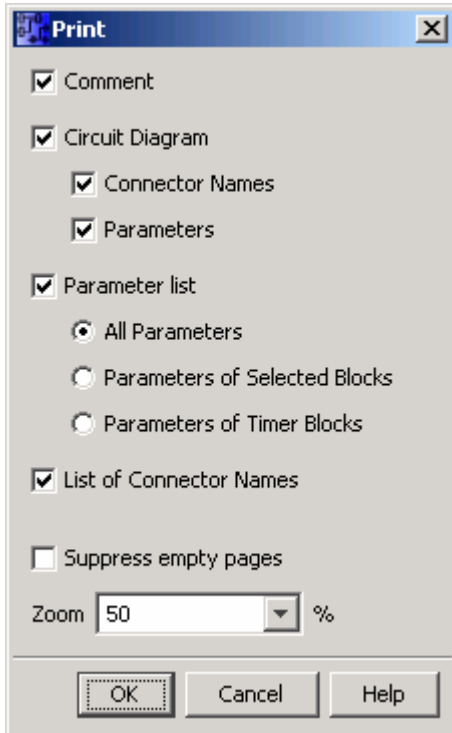
You can choose whether to print **comments** you entered under File -> Properties comment or not.

You can also choose to include or omit **connection names** and parameters.

If you require a **parameter list**, you can also choose whether to include the parameters of all blocks, all selected blocks or only the special timer block.

Finally, you can print out a **list of connection names**.

The **Suppress empty pages** option allows you to exclude pages that do not contain any graphical objects.

Because blank pages are included in the page numbering, gaps will appear if these are not printed.

In the printer dialog, you can specify your default printer and the print properties. In the control panel of your computer you can specify advanced printer settings.

The AcrobatReader *.pdf format provides a further print option. You can save your program in AcrobatReader document format and distribute it to users who do not have WindLGC and can then use AcrobatReader to view and print out your circuit program.

The standard toolbar also contains an icon for this menu command.

Set the page format under File -> Page Setup.

File -> Properties

The properties dialog contains the following tabs:

- General
- Comment
- Statistics
- Page Layout
- Parameter

File -> Properties: General

In the **General** tab of the Properties dialog, you can enter details of the current circuit program. There are input boxes for project-related and internal company data. You can quickly and easily specify the version of your circuit programs with the help of this dialog.

As an alternative to a text string for your company name, you can specify a *.bmp or *.jpg file with your company logo for the Company field. This feature lets you create a customized layout of your program files.

By setting the **Show at new file** check box, you are shown a flag that indicates where to input the specifications described above each time you create a new circuit program.

How to identify your circuit program version

File -> Properties: Comment

In the **Comment** tab, you can enter a description of the circuit program or notes relating to it. When you print your circuit program using the File -> Print menu command, you can choose to print this comment on a separate printed page.

File -> Properties: Statistics

The **Statistics** tab shows the creation date of the circuit program and the last author.

File -> Properties: Page Layout

 → Menu command **Page format**

In the **Page Layout** tab, you can specify how and on how many pages to print your circuit program. You can preview the pagination in this tab. If you choose more than one program page, the page breaks are indicated by white lines on the programming interface. Your circuit program is later printed out according to this pagination. Please note that connections extending to other pages are simply cut off when you print the hardcopy. We recommend you create cross-references by splitting the file at this position with the help of the Cut/Join tool. In the File -> Page Setup menu you can specify the paper size, page alignment and margins.

The standard toolbar also contains an icon for this menu command.

File -> Properties: Parameter

When the circuit program is transferred, all **Parameter** tab specifications are also transferred to IDEC SmartRelay and then saved there.

In the **Program name** field, a program name with up to 16 characters can be entered for the circuit program. After transfer, the circuit program will then be shown on the IDEC SmartRelay display under this name.

You can assign a password to your circuit program or change or delete an already assigned password. In order to assign a new password, you must enter the password in the two text boxes for **New password** and then confirm with OK. The password can have a maximum of 10 characters. To change the password, you must first enter the existing password in the **Old password** text box and the new password in the two boxes for **New password** and then confirm with OK. You can delete your assigned password at any time. To do this, enter the existing password in the box **Old password** and leave the two **New password** boxes empty. Then confirm with OK.

The password protects your circuit program on IDEC SmartRelay. You can open or edit circuit programs from WindLGC at any time regardless of whether the program is password-protected or not. For password-protected circuit programs, you must enter the password to view or change the program on IDEC SmartRelay, or to load the circuit program from IDEC SmartRelay to the computer.

With **Display content on IDEC SmartRelay after power on** you can set what is shown on the IDEC SmartRelay display when you switch IDEC SmartRelay on. Your choices are as follows:

* Display the date and time.

* Display inputs and outputs.

With **Behavior of analog outputs in STOP mode** you can set what the analog outputs of IDEC SmartRelay should issue when IDEC SmartRelay is in STOP mode. Your choices are as follows:

* AQ1 and AQ2 retain their last values.

* AQ1 and AQ2 are set to values that you define.

With **Set analog outputs value range type** you can set the range for analog outputs. Your choices are as follows:

* 0-20 mA / 0-10V

* 4-20 mA
Note
The analog output module that supports 0/4..20mA outputs has not yet been released. (As of Oct. 2008).

With **Set AI3 and AI4 position** you can choose to enable the optional AI3 and AI4 on the IDEC SmartRelay FL1E devices that have an option of four analog inputs. For IDEC SmartRelay FL1E devices that support four analog inputs, you can choose how many to use. Your choices are as follows:

* 2 AIs: Only AI1 and AI2 corresponding to input terminals I7 and I8 are available for use in your circuit program.

* 4 AIs: AI1 and AI2 corresponding to input terminals I7 and I8 are available for use in your circuit program. Additionally, AI3 and AI4 corresponding to input terminals I1 and I2 are available for use.

FL1A - FL1D   The presence of tabs and fields on the Properties dialog depend on the IDEC SmartRelay module that you select from the Tools->Select Hardware menu command.

File -> Compare circuit programs

This function can be used to compare two circuit programs.

WindLGC does not recognize differences in the graphical block layout and in comments.

Prerequisite

- The circuit programs must be open in WindLGC. As an alternative, you can also compare a program opened in WindLGC with a program on the IDEC SmartRelay device.

- You can compare only circuit programs of the same type, e.g.: *.lsc with *.lsc.
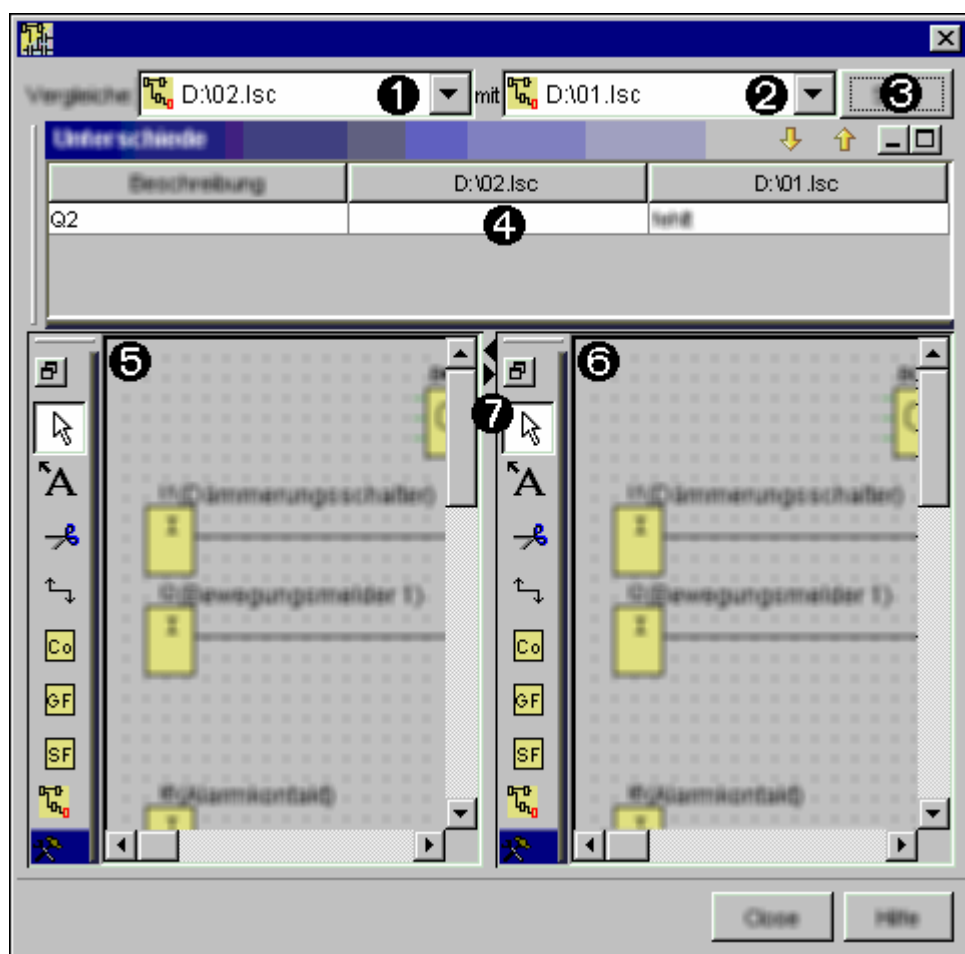
Comparison

Procedure:

Step	Legend	Action
1	①	Select the first circuit program.
	⑤	Display of the first circuit program
2	②	Select the second circuit program you want to compare with the first one.
	⑥	Display of the second circuit program

	⑦	The two arrow icons can be used to increase the display area of one circuit program. However, the display area for the other circuit program is thus reduced.
3	③	Click on the **Start** button
4	④	The table indicates the following differences if found in the two circuit programs: • Number of blocks • Block parameters • Additional/missing blocks • Connections • Different hardware

Editing

All options are available to you for separate editing of the two circuit programs.

Different hardware

A considerable number of messages may be output if you have configured different IDEC SmartRelay devices in the circuit programs you want to compare.

In this case, match the IDEC SmartRelay devices in your programs.

Note

When you compare circuit programs with internal markers, in some circumstances WindLGC reports more differences than there really are.

A quick and easy way of zooming your circuit program window

How to access functions via the shortcut menu

File -> Convert (LAD > FBD)

Use this function to convert your circuit diagram from LAD to FBD.

The following rules apply to the conversion from LAD to FBD:

- A series circuit of contacts is converted into an AND block.

- A parallel circuit of contacts is converted into an OR block.

- User-defined comments are not included, as their position in the circuit diagram can not be defined based on blocks.

- Crosslinks (connections where a block output is connected to multiple block inputs and at least one of the inputs is connected to multiple block outputs) are converted into an OR block.
  Inputs for the OR block are all block outputs of the crosslink.
  The output of the OR block is connected to all block inputs of the crosslink.

- Internal Memory Markers are resolved, and the current paths are linked.

Overview: File -> Convert (FBD > LAD)

File -> Convert (FBD > LAD)

Use this function to convert your circuit diagram from FBD to LAD.

The following rules apply to the FBD to LAD conversion:

- An AND block is converted into a series contact circuit

- An OR block is converted into a parallel contact circuit

- Comments for basic functions are not applied in LAD, as a basic function is converted into multiple contacts. Thus, the comment cannot be assigned definitely.

- In LAD, input comments are assigned to all contacts of this input.

- User-defined comments are not included, as their position in the circuit diagram can not be defined based on blocks.

- XOR blocks must be converted into corresponding LAD logic consisting of positive and negative contacts.

Note

When converting, the total number of blocks in your circuit program can sometimes increase. This could cause the permitted number of blocks for your IDEC SmartRelay to be exceeded.

It is therefore not always possible to convert from FBD to LAD.

Remedy: Under **Tools > Select Hardware**, select the hardware series **FL1E**. Start converting to LAD. Then under **Tools > Determine IDEC SmartRelay**, see which hardware series is compatible with the circuit program.

Overview: File -> Convert (LAD > FBD)

File -> Message Text Settings

Use this command to configure message text settings that apply to all message texts. The global message text settings are defined as follows:

- **Use new feature:** WindLGC V6.0 provides many new features for message texts. If you want to use these new features, select this check box. If you want to use message texts with the functionality prior to V6.0, do not select this check box. Note that once you select new features, you cannot revert back to the previous functionality without loss of your message text data.

- **Character Set 1:** This specifies the primary character set for message texts. Message texts can be composed from characters from either Character Set 1 or Character Set 2. Either character set can be the default for configuring message texts.

- **Character Set 2:** This specifies the secondary character set for message texts. Message texts can be composed from characters from either Character Set 1 or Character Set 2. Either character set can be the default for configuring message texts.

- **Analog input filter timer:** This time determines the frequency at which IDEC SmartRelay refreshes the analog values in a message text. The value is in milliseconds.

- **Ticker timer:** For messages that tick, the ticker timer determines how fast or slow a message text ticks or scrolls on the IDEC SmartRelay Display or Text Display. The value is in milliseconds, and you can use the adjacent button to access a scroll bar to set the ticker timer.

Supported Character Sets

WindLGC, the IDEC SmartRelay Display, and the Text Display support the following character sets:

Character Set in IDEC SmartRelay	Common Name	Supports Languages
ISO-8859-1	Latin-1	English German Italian Spanish (partly) Dutch (partly)
ISO-8859-5	Cyrillic	Russian
ISO-8859-9	Latin-5	Turkish
ISO-8859-16	Latin-10	French
GB-2312 / GBK	Chinese	Chinese
SJIS	Shift-JIS	Japanese

See the message text function description for details on how these settings apply.

File -> Exit

WindLGC will be closed.

If you are actually editing a circuit program or haven't yet saved it, a window opens upon exit.

In this window you can state which circuit programs are to be saved. Alternatively, you can exit WindLGC without saving circuit programs. To do this, click **Close without saving**.

A quick way of closing WindLGC without saving the data

Edit menu
Edit menu - Overview

In the Edit menu you will find commands for editing your circuit program. Basic commands for the creation and editing of a circuit program are included in the icons of the programming toolbar.

- Undo
- Redo
- Delete
- Cut
- Copy
- Paste
- Select All
- Goto block
- Bring to front
- Send to back
- Input/Output names
- Block properties
- Block properties (all blocks)
- Cut connections

Edit -> Undo

 → Edit **Undo**

This command allows you to undo actions carried out on the programming interface. Position your mouse pointer on the undo menu command and hold it there briefly. The tooltip opens and shows you the actions you can undo by clicking on the menu item. Currently you can undo up to 30 actions.

The standard toolbar also contains an icon for this menu command.

Edit -> Redo

 → Edit **Redo**

The redo reverts the last undo action. Click on the menu command to view the tooltip for the action to be redone.

The standard toolbar also contains an icon for this menu command.

Edit -> Delete

 → Edit **Delete**

The command deletes selected objects, without copying them to the clipboard. You can retrieve deleted objects with the **Undo** function.

Edit -> Cut

✄ ➔ Edit **Cut**

The command deletes one or more selected objects, for example, blocks and/or connecting lines, from the programming interface and copies them to the clipboard.

The standard toolbar also contains an icon for this menu command.

Edit -> Copy

 → Edit **Copy**

The command is used to copy one or more selected objects, for example, blocks, text, or connecting lines, to the clipboard.

The standard toolbar also contains an icon for this menu command.

Edit -> Paste

The command copies the clipboard content to the programming interface. The insert position is either below the previously selected object or a position determined with a mouse click.

The standard toolbar also contains an icon for this menu command.

 → Edit Paste

You can only paste the clipboard content if sufficient resources are available. Blocks require a certain amount of resources, depending on the block type. An error message is generated if your system does not provide sufficient resources.

Connecting lines with open ends can not be pasted. They can only be pasted if they connect two blocks and were copied to the clipboard together with those blocks.

Edit -> Select all

The command is used to select all objects (blocks, connecting lines and labels) on the programming interface.

Edit -> Select all

Edit -> Go to block

You can use this command to view a list of all blocks used, including information about the block numer, block name and block type. You can enter a short description in the **Block number** line (for example, I1, I2, B004, etc.) If the block number that you entered is in the circuit program, WindLGC hightlights the specified block in the list and on the programming interface.

You can also select a block from the list directly to highlight it on the programming interface.

Edit -> Bring to front

You can use this command to bring one of a number of overlapping objects to the foreground.

Edit -> Send to back

You can use this command to bring one of a number of overlapping objects to the background.

Edit -> Input/Output Names

This command enables you to enter names for the input and output terminals (connector names). Call the Tools -> Options -> Screen menu to specify whether to display the connector names on the programming interface. Call the Tools -> Options -> Print command to open a dialog to specify whether to include the connector names and connection list in the printed copy of your circuit program.

Edit -> Block properties

This command displays the block properties of a block that is selected on the programming interface.
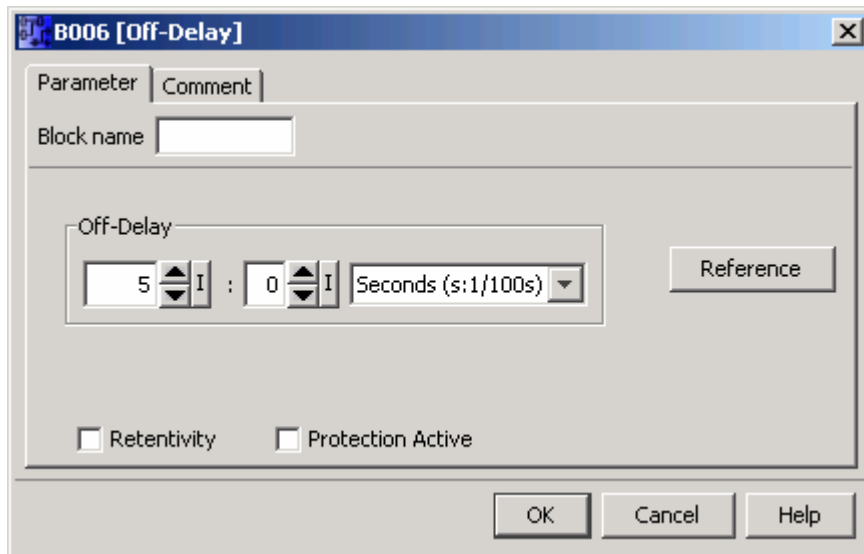
The block properties dialog box consists of several tabs. Every block has a Comment tab, where you can enter relevant block comments. For some blocks a Parameter tab is available where you can describe specific block parameters. Input simulation parameters are configured from the Simulation tab.

You can also call the block properties by right-clicking on the required block, and selecting the block properties menu command from the shortcut menu.

Edit -> Block properties (all blocks)

This command opens a window with two sections. In the left section, you can see all the blocks that are used in your program. Click on a block to view its corresponding parameters in the right column. You can now edit these parameters and set the changes by clicking the **Apply** button.

The modified block is displayed in blue in the selection list, if you do not accept the parameter changes made and select another block. All changes are discarded by clicking on the **Cancel** button. You confirm your entries and exit the dialog with **OK**.

If you select the "Select block from drawing" check box, then when you select subsequent blocks from the list they are highlighted in the circuit diagram.

Special functions

Basic functions

Constants and Terminals

Edit -> Cut connections

You can choose to cut connections via the Cut / Join tool either manually or automatically.

In this dialog you can specify one or both of the following types of connections to be cut:

- Connections routed across a block

- Connections exceeding a configurable length

Confirm these settings with **OK,** and WindLGC will cut connections accordingly.

If you select the **Cut connections during import/upload** check box, the settings described above will also be applied in the following cases:

- When you upload (transfer) a circuit program from IDEC SmartRelay to WindLGC

- When you import (open) a circuit program created with WindLGC Standard or WindLGC

Format menu

Format menu - Overview

This menu provides formatting options for labels and function groups. You can define the font, the font size and style as well as the alignment of selected objects.

- Font

- Align

- Format Grid

- Snap to Grid

Format -> Font

Here you can specify the font type, size, style, and the text color. To redefine the format of existing text objects, you first have to select them. You can then specify the font attributes to suit requirements and click on OK to apply the new formats.

You can choose to set particular default formats. New text objects are then displayed with these default settings. To return to the standard settings, click the **Standard** button.

Format -> Align

This command offers various options of aligning labels and function blocks:

Vertical

Horizontal

Automatic

Format -> Align -> Align Vertical

→ Format **Align vertical**

Selected objects are aligned vertically to the objects with the highest block number or to the last selected object you have placed into the circuit program.

The standard toolbar also contains an icon for this menu command.

Format -> Align -> Align Horizontal

 → Format **Align horizontal**

Selected objects are aligned horizontally to objects with the highest block number or to the last object placed into the circuit program.

The standard toolbar also contains an icon for this menu command.

Format -> Align -> Align Automatically

[icon] ⟶ Menu Format **Align automatically**

Selected objects are automatically aligned in vertical and horizontal direction. Slightly offset or adjoining blocks are aligned along a common line. Reference for vertical alignment is the relevant upper block of a column. Reference for horizontal alignment is the block at the extreme left of a line.
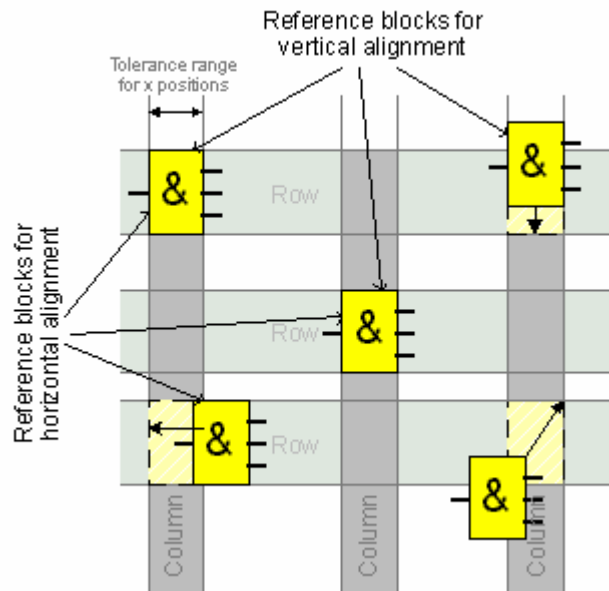
The standard toolbar also contains an icon for this menu command.

Format -> Format grid

This tool helps you to organize the various objects of your circuit program on the programming interface. The grid is switched on by default.

You can adjust the grid pattern (spacing) in increments of 5 points.

If you have enabled the "Snap Block to Grid" function, WindLGC aligns the objects with the relevant grid intersections. This helps you to avoid a vertical or horizontal offset of the objects. To finely position objects on your programming interface, disable the "Snap Block to Grid" function.

If you have enabled the "Snap Connection to Grid" function, WindLGC aligns the connection lines between objects with the relevant grid intersections. To allow connection lines to not align with grid lines on the programming interface, disable the "Snap Connection to Grid" function.

You can hide the grid with the Visibility check box.

You can select the "Use as Default" check box to keep your settings as the default for WindLGC circuit programs.

Format -> Snap to grid

If you have made changes to the grid pattern, or inserted objects while the grid was disabled, the position of objects may be offset when they are aligned to the grid points. Call this command to correct the offset of selected objects and to realign them.

View menu

View menu - Overview

From the View menu, you can set the zoom factor for the display of your circuit, and decide to show or hide various display windows.

- Zoom
- Zoom In
- Zoom Out
- Toolbars
- Select Lines
- Info Window
- Status bar
- Tooltips

View -> Zoom

WindLGC offers a variety of options for enlarging or reducing the size of the circuit program display. By selecting Zoom, you open a dialog box in which you can set the zoom factor from a default list or in the relevant box.

If you choose an unfavorable zoom factor, the objects may appear out of focus on your screen. You should therefore use the default zoom factors wherever possible. This effect has no influence on the layout of the printed circuit program.

A quick and easy way of zooming your circuit program window

View -> Zoom In

 → View **Zoom In**

The zoom factor is increased by defined increments:

25 (min) → 50 → 75 → **100** (default) → 150 → 200 → 250 → 300 → 400 (max)

The standard toolbar also contains an icon for this menu command.

A quick and easy way of zooming your circuit program window

View -> Zoom Out

▢ ➔ View **Zoom Out**

The zoom factor is reduced in defined increments:

400 (Max) ➔ 300 ➔ 250 ➔ 200 ➔ 150 ➔ **100** (default) ➔ 75 ➔ 50 ➔ 25 (Min)

The standard toolbar also contains an icon for this menu command.

A quick and easy way of zooming your circuit program window

View -> Toolbars

This command lets you hide or show selected toolbars.

- Standard: Hide/show the standard toolbar
- Tools: Hide/show the programming toolbar

View - > Select Lines

View **Select Lines**

With this setting all connections (lines) that lead to or away from a selected block are shown in color.

If you select a single connection with this setting, then the selected connection is highlighted in color.

Under **Tools > Options > Screen** you can set whether the connections should also be labeled. Under **Tools > Options > Colors** you can set the colors to use to display the connections.

Tools -> Options: Screen

Tools -> Options: Colors

View -> Info Window

This menu command can be used to show or hide the Info Window. You can also use the function key [F4].

View -> Status bar

This menu command can be used to hide or show the status bar.

View -> Tooltips

In WindLGC, you can use the mouse-over-button function to display the icon name, which represents the tooltip.

This helps you to quickly recall the function of the icon, without having to call the menu or the help.

Tools menu
Tools menu - Overview

The options menu provides the following menu commands:

- Transfer
- Determine IDEC SmartRelay
- Select Hardware
- Simulation
- Simulation parameters
- Online test
- Connect modem
- Disconnect modem
- Options

Tools -> Transfer

Prerequisite for data transfer

The interface used to link IDEC SmartRelay to the PC must be configured via the Tools -> Options: Interface menu.

- Otherwise WindLGC will return an appropriate error message. Click on the **Select New interface** button from any of the Transfer menu command dialogs to open the options dialog for the configuration of the communication interface. If the wrong interface or no interface is set, you can determine the PC interface to which IDEC SmartRelay is connected or you can start a search for the interface.

- For further information on how to connect the IDEC SmartRelay to your PC with a USB interface, refer to the IDEC SmartRelay manual.

- The IDEC SmartRelay must be connected to the PC with the PC cable or be accessible by modem.

- IDEC SmartRelay may neither be in RUN nor in editing mode.

FL1A-FL1B:
The IDEC SmartRelay must be prepared for data transfer with the PC/Card -> PC <-> IDEC SmartRelay setting. For further information, refer to the IDEC SmartRelay manual.

Menu commands

The **Tools** ➔ **Transfer** menu contains the following menu commands:

Tools -> Transfer: PC -> IDEC SmartRelay

Tools -> Transfer: IDEC SmartRelay -> PC

Tools -> Transfer: Switch IDEC SmartRelay Mode

Tools -> Transfer: Set clock

Tools -> Transfer: Summer/Winter time

Tools -> Transfer: Operating hours counter

Tools -> Transfer: Clear User Program and Password

Tools -> Transfer: Set Text Display Power-on Screen

Tools -> Transfer: PC -> IDEC SmartRelay

[icon] → Tools -> Transfer: **PC -> IDEC SmartRelay**

This command is used to download a circuit program created on the PC in WindLGC to the IDEC SmartRelay module. The name of the program transferred to IDEC SmartRelay is specified in the File -> Properties menu. WindLGC uses the interface you specified in Tools -> Options: Interface to transfer the circuit program.

The standard toolbar also contains an icon for this menu command.

Preparations

Prior to the download, the system determines the minimum IDEC SmartRelay version required for your circuit program. The modular IDEC SmartRelay always provides all available I/O resources for your circuit program. It is up to the user to install an appropriate number of expansion modules in the base device.

Error messages

If the circuit program cannot be downloaded to the available IDEC SmartRelay, the transfer is aborted and an error message is displayed. The user is informed of unknown IDEC SmartRelay versions and then has the choice of continuing or canceling the download. A message in the status bar reports the successful download.

Transfer messages are displayed in the status bar and in the Info Window.

Detailed error messages are displayed in the Info Window.

Password

If you have assigned a password to your circuit program, then you will be asked to enter this password before you transfer to IDEC SmartRelay. The circuit program will then only be transferred to IDEC SmartRelay if you have entered the correct password.

Tools -> Transfer: IDEC SmartRelay -> PC

![icon] ➡ Tools -> Transfer: **IDEC SmartRelay -> PC**

The circuit program is imported from IDEC SmartRelay to WindLGC. WindLGC uses the interface you specified in Tools -> Options: Interface to transfer the circuit program. Transfer messages are displayed in the status bar and in the Info Window.

The standard toolbar also contains an icon for this menu command.

Missing graphical information

A program imported from IDEC SmartRelay to WindLGC does not contain any graphical information for the block layout on the programming interface. A suitable layout for the circuit program is therefore generated automatically. The generated circuit diagram corresponds with the layout in the WindLGC block diagram, except that multiple instances of the same block are not displayed, but are instead identified by means of the block connectors.

The blocks are always arranged at the top left corner of the programming interface. If necessary, you can use the scroll bars to bring the circuit program into view.

Cutting connections

If you have set the "Cut connections during import/upload" check box under Tools -> Options: Cut connections, the relevant connections are cut during the upload from IDEC SmartRelay to the PC, according to the rules set in this dialog.

Password

At the start of the upload of a password protected circuit program from the IDEC SmartRelay to the PC, the user is prompted to enter the password. If an invalid password or no password is entered, the transfer is aborted with an error message.

Tools -> Transfer: Switch IDEC SmartRelay Mode

■▶ ⟶ Tools -> Transfer -> **Switch IDEC SmartRelay Mode**

This special function is only available with devices of the FL1C hardware series or later.

When you click on this symbol you change the mode of a connected IDEC SmartRelay from STOP mode to RUN mode or from RUN mode to STOP mode.

Tools -> Transfer -> Set Clock

This menu option can be used to view and set the date and time of the connected IDEC SmartRelay.

Click on **current time** to apply the system time of the PC in WindLGC.

Manual input of values

You can enter the values directly from the keyboard by clicking on the number input box instead of clicking on the arrow icons of the date and time setting function. WindLGC automatically corrects any invalid date values.

Tools -> Transfer -> Summer time/Winter time

This menu command lets you set an automatic conversion of the summer and winter time for the IDEC SmartRelay clock.

When you enable summer/winter time conversion, you can specify a country-specific time conversion:

- EU: European Union

- UK: United Kingdom of Great Britain and Northern Ireland

- US1 / US2: United States of America

- Australia

- Tasmania

- New Zealand

- Freely adjustable: customized switchover dates and times

For the "Freely adjustable" selection, you specify the month and day of the switchover. The start time of summer time is 02:00 + the entered time difference; the end time is 03:00 - the entered time difference.

The United States of America redefined the Daylight Saving Time / Standard Time calendar in 2007. US1 is the convention in effect prior to 2007 and US2 is the convention defined in 2007 where Daylight Saving Time is in effect from 2:00 a.m. on the second Sunday in March until 2:00 a.m. on the first Sunday in November according to the local time zone.

Note that this function is only supported in IDEC SmartRelay devices as of the series FL1B.

The US2 selection is only supported in IDEC SmartRelay devices as of the series FL1E.

Tools -> Transfer -> Operating hours counter

Use this menu command to read the operating hours counter of IDEC SmartRelay.

You can also fetch the operating hours counter from IDEC SmartRelay devices with a password protected program without having to enter a password.

FL1A
:
FL1D

Only the IDEC SmartRelay devices >= version FL1B support this function. Also, you can only transfer the operating hours counter of a IDEC SmartRelay that is not equipped with a red module, because you delete the IDEC SmartRelay program if you remove this module.

Tools -> Transfer -> Clear User Program and Password

Use this command to clear the circuit program in the IDEC SmartRelay device and the program password if a password exists.

You must respond to a confirmation dialog to ensure that you do intend to clear both the circuit program and the password (if configured) from the IDEC SmartRelay device. After you confirm the command, WindLGC performs the clear operation. If you do not confirm the command, WindLGC performs no action. The circuit program and password (if configured) remain in the IDEC SmartRelay device.

FL1A : FL1D   IDEC SmartRelay devices prior to version FL1E do not support this function. If you attempt this command on an earlier device, WindLGC displays a message that states that the device does not support this function.

Tools -> Transfer: Set Text Display Power-on Screen

Use this command to configure a power-up screen for the Text Display. From the dialog, you can also use the Read button to read a previously-configured power-up screen that is stored in the memory of the IDEC SmartRelay Base module, or you can use the Write button to write the currently-configured screen to the IDEC SmartRelay Base module memory. The IDEC SmartRelay Base module updates the Text Display with the power-up screen that is stored in memory.

Use the keyboard to type characters into the display window. The power-up screen can only contain simple text strings.

FL1A : FL1D IDEC SmartRelay devices prior to version FL1E do not support this function. If you attempt this command on an earlier device, WindLGC displays a message that states that the device does not support this function.

Tools -> Determine IDEC SmartRelay

When you click on this menu command, WindLGC calculates the minimum IDEC SmartRelay version requirements for the IDEC SmartRelay circuit program. The result is shown in the status bar. The Info window displays all versions to which you can download the program. You can also use the function key [F2] to execute this menu command.

Tools -> Select Hardware

You have two options of selecting the device when you create your program in WindLGC:

- You can first create your program and then determine the required IDEC SmartRelay by using the Tools -> Determine IDEC SmartRelay dialog.

- You can first determine the IDEC SmartRelay version for which you want to create your circuit program by calling the **Tools** ➞ **Select Hardware** dialog. You can also call the device selection dialog by double-clicking on the IDEC SmartRelay icon in the status bar.

The device selection dialog shows you which blocks and memory resources are available to you.

If you have already created a circuit program or are using some blocks, the hardware selection dialog offers you only the IDEC SmartRelay devices you can operate with the currently used blocks.

Tools -> Simulation

Introduction

Program simulation allows you to test a program and modify its parameters. This ensures the download of a fully functioning and optimized program to your IDEC SmartRelay.

Simulation mode

Click on the **Simulation** icon in the programming toolbar to start the simulation. This changes the program to simulation mode.

 → **Simulation**

The active icon is highlighted in simulation mode. By clicking once again on the **Simulation** icon, or on any other icon of the programming toolbar, you exit simulation mode and open another tool mode (for example, for selecting or inserting blocks).

At the start of simulation mode, the program is verified and the results are output to the Info Window.

Simulation Parameters: Input functions

Select the **Tools** → **Simulation Parameters** command to configure the response of an input. The dialog shows only the inputs actually used in your circuit diagram.
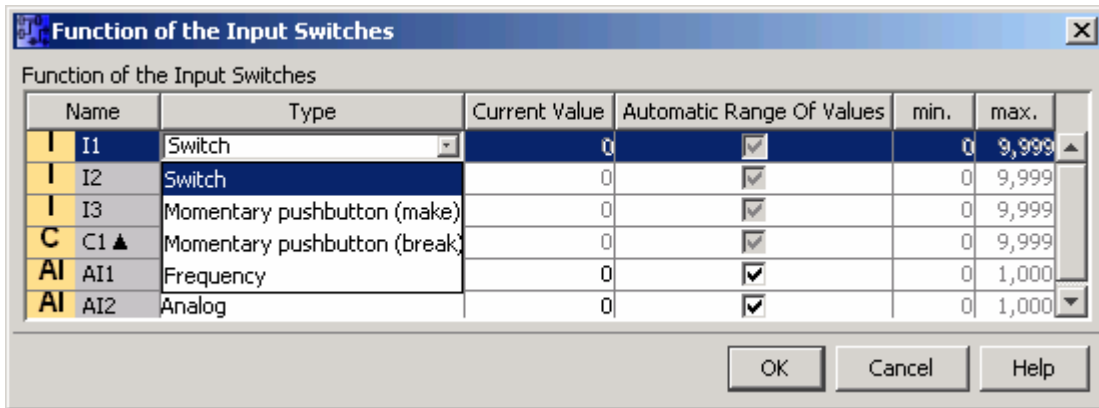
You have four options:

- Switch
- Momentary pushbutton
- Frequency (not for analog inputs)
- Analog (analog inputs only)

Switch

A switch latches when actuated and is released by actuating it once again.

Momentary pushbutton

A momentary pushbutton is only active while it is held down. The contact opens as soon as you release the button.

You can determine a make or break action for the pushbuttons.

Frequency (not for analog inputs)

The frequency of the frequency input can be preset or changed while simulation is running. The device frequency is expressed in Hz. A frequency input is a special case in this context, because it is only useful in conjunction with the frequency trigger SFB.

Analog (analog inputs only)

You can preset the value for the analog input or modify it while running in simulation mode. The unit of the analog value to be set corresponds with the default process variable. The range corresponds with the specified measurement range, provided the option "Auto range" is selected. The value range corresponds in this case with the measurement range of the function connected to the input. The analog input represents a special case, because it should only be used for analog SFBs.

Refer to the information in the "Analog value processing" section for help on analog block parameters.

Name column

Inputs are designated I.

Analog inputs are designated AI.

Settings

When you save your circuit program, the settings for circuit simulation are included. Thus, you do not need to enter the simulation parameters once again when you exit and reopen your circuit program.

While simulation mode is active, you can click on a input in the list of input switches to change its settings. From the drop-down list select Switch, Momentary pushbutton (make), Momentary pushbutton (break) or Frequency. Use the OK button to enter your settings.

While simulation mode is active, you can also right-click on a input in the circuit program and edit its block properties. In the Simulation tab of the block properties dialog, you can select the type of the input as described above. Use the OK or Apply button to enter your settings.

Tools -> Online Test

The online test and simulation modes allow you to monitor the execution of your circuit program and how it reacts to the various input states.

Difference from simulation mode

In simulation mode you execute your circuit program on the PC. To do so, you do not require a IDEC SmartRelay. The status of inputs can be preset on the PC.

During an online test, the circuit program is executed on a IDEC SmartRelay. The user monitors this "work" of the IDEC SmartRelay. The status of the inputs corresponds with the actual states at the IDEC SmartRelay inputs.

Prerequisite for an online test

Your PC must be linked to a IDEC SmartRelay.

The circuit program to be tested can be in either FBD or LAD format and must be transferred to IDEC SmartRelay.

The circuit programs in WindLGC and on the IDEC SmartRelay must be identical. Upload the program from the IDEC SmartRelay to your PC, or download the program from your PC to the IDEC SmartRelay if necessary.

You can monitor the parameters of up to 30 blocks. The number of blocks you can monitor simultaneously decreases when you monitor blocks that contain a high number of parameters (for example, analog SFBs).

To start the online test

Select the Tools ➔ Online Test menu command

If the IDEC SmartRelay is in STOP, start it with the Start ▷ button
Result: The IDEC SmartRelay executes your circuit program.

Now start the monitoring mode. 👁️

Select the blocks whose parameters you want to monitor.
Result: You are shown "live" how the parameters of the selected blocks change.

Switching the IDEC SmartRelay to STOP

If you want to stop the IDEC SmartRelay via WindLGC, click on the Stop icon ■.

| FL1A - FL1D | Devices of the FL1C series and later support Online tests. |

Possible errors

The following types of errors can occur:

- Your IDEC SmartRelay does not support the online test.
  Remedy: Install a IDEC SmartRelay device of the latest series.

- The programs on your PC and on the IDEC SmartRelay are different.
  Remedy: Upload the circuit program from the IDEC SmartRelay to your PC, or download the program from your PC to IDEC SmartRelay.

- You are attempting to monitor too many parameters/blocks simultaneously.
  Remedy: Reduce the number of simultaneously monitored parameters/blocks.

- The communication between your PC and IDEC SmartRelay goes down.
  Remedy: Re-establish the connection.

Tools -> Connect Modem

Note: Modem communication is not available yet (October 2008)

You can use modems to download and upload circuit programs between WindLGC and IDEC SmartRelay devices. WindLGC supports 11-bit modems that use standard AT commands.

Select the **Tools -> Connect Modem** menu command to start the process of configuring modems to use between your PC with WindLGC and a IDEC SmartRelay Base module. WindLGC displays a Modem Information dialog that provides an overview of the configuration process.

You must complete a series of dialogs to configure your modems. After you configure the modems and make the connections, you can download and upload circuit programs between WindLGC and IDEC SmartRelay across a telephone connection between the modems.

The steps for connecting and configuring modems are listed below:

- Select Modem
- Select Remote Configuration
- Configure Remote Modem Command
- Configure Remote Modem
- Select Local Configuration
- Configure Local Modem Command
- Configure Telephone Number

From the modem configuration dialogs, you can use the Next button to proceed through the dialogs, or the Previous button to return to an earlier step.

Tools -> Connect Modem - Select Modem

Note: Modem communication is not available yet (October 2008)

From the Select modem dialog, you can select check boxes to configure the remote modem or the local modem. The remote modem is the one connected to the IDEC SmartRelay Base module and the local modem is the one connected to the computer with WindLGC.

If you have previously configured the remote modem or local modem from WindLGC, the dialog displays the names of the modem as configured from WindLGC. You can click the Detail button to display specific information about the WindLGC configuration of a modem.

If you have configured the remote modem by some means other than WindLGC, you can disregard the displayed settings. WindLGC will use the configuration in the actual modem. If you have not yet configured the remote modem, or choose to change the existing configuration, then select the Remote modem check box.

For the local modem, WindLGC will use the settings as displayed by the Detail button, or you can select the Local modem checkbox to edit the configuration.

If you need to configure or change the configuration of both modems, then select both check boxes.

If you have already configured both modems but need to set the telephone number, do not select the check boxes. When you click the Next button you will advance to the telephone number configuration dialog. Otherwise, when you click the Next button you will proceed to configuration of the modems that you selected.

Tools -> Connect Modem - Select Remote Configuration

Note: Modem communication is not available yet (October 2008)

From the Select remote configuration dialog, you select whether to edit or delete an existing configuration, if one exists, or to create a new configuration.

Click the Next button to continue with modem configuration.

Tools -> Connect Modem - Configure Remote Modem Command

Note: Modem communication is not available yet (October 2008)

From the Configure remote modem command dialog, you provide the name of the remote modem. You can select the check box to accept the default settings for the modem commands, or you can choose not to use the defaults and to edit the individual commands. The "Additional" field provides the opportunity to enter other modem commands. Separate each one with a blank if you add additional commands.

The commands are all standard commands. Refer to the documentation provided with your modem for specific command syntax.

Click the Save Configuration button to save this configuration for the remote modem.

Tools -> Connect Modem - Configure Remote Modem

Note: Modem communication is not available yet (October 2008)

The Configure remote modem dialog is the last dialog for you to complete remote modem configuration. After you ensure that the remote modem is connected to the IDEC SmartRelay Base module, follow these steps:

1. Select the Done check box.

2. Select the communications port to use.

3. Click the Configure remote modem button.

WindLGC will complete the modem configuration and display a status message.

Tools -> Connect Modem - Select Local Configuration

Note: Modem communication is not available yet (October 2008)

From the Select local configuration dialog, you select whether to edit or delete an existing configuration, if one exists, or to create a new configuration.

Click the Next button to continue with modem configuration.

Tools -> Connect Modem - Configure Local Modem Command

Note: Modem communication is not available yet (October 2008)

From the Configure local modem command dialog, you provide the name of the local modem. You can select the check box to accept the default settings for the modem commands, or you can choose not to use the defaults and to edit the individual commands. The "Additional" field provides the opportunity to enter other modem commands. Separate each one with a blank if you add additional commands.

The commands are all standard commands. Refer to the documentation provided with your modem for specific command syntax.

Click the Save Configuration button to save this configuration for the local modem.

Tools -> Connect Modem - Configure Telephone number

Note: Modem communication is not available yet (October 2008)

From this dialog you can add and delete telephone numbers for the modem connection.

Click the Add New button to provide a name, telephone number, and description for a telephone connection. To add multiple telephone numbers, click Add New and enter additional telephone numbers as needed. To remove a telephone number from the list, select it and click Remove.

From this dialog, you can dial one of the telephone numbers. To establish modem communication across one of the telephone connections, follow these steps:

1. Verify that the local modem is connected to your computer and that the remote modem is connected to IDEC SmartRelay, and click the Done check box.

2. Select a telephone number from the list.

3. Click the Dial button.

WindLGC will establish the modem connection and display a status message. If any error occurs, WindLGC will display an error message. Check your connections and your configuration if you receive an error. Refer to the documentation provided with your modem for additional information.

Tools -> Disconnect Modem

Note: Modem communication is not available yet (October 2008)

Use this command to disconnect an existing modem connection.

To configure modems, or to connect across configured modems, select the Tools -> Connect Modem menu command.

Tools -> Options: General

Here you can select various options for WindLGC:

- Standard Editor
- Language
- Document view
- Screen
- Print
- Cut connections
- Interface
- Simulation
- Colors
- Look & Feel

Tools -> Options - Standard Editor

Here you define the default editor; that is, the FBD or LAD editor.

Tools -> Options: Language

Here you set the dialog language for WindLGC.

To set and apply a new language, you must close and restart WindLGC.

Tools -> Options: Document view

Here you determine whether to display the circuit programs in WindLGC from a dialog tab or in windows.

The advantage of the window view is that you can arrange several circuit programs next to each other for easy comparison.

In the tab view, you can right-click on the tab to open a shortcut menu with the following menu items:

- Close
- Save
- Save as

Tools -> Options: Screen

This is where you perform all the settings to do with screen display.

Here you determine what you see in your circuit program:

* Comments
* Connector Names
* Block Parameters

Other possible settings:

* Antialiasing. With Antialiasing corners and edges appear softened.
* If you have **View > Select lines** switched on, with **Label marked lines** you establish that marked lines are to be labeled as shown in the following example:
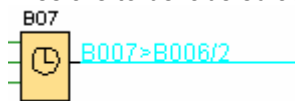
B007 > B006/2 means: the connection runs from block 7 to block 6 at pin 2. Connections are not labeled if the target block to which the connection is running is located in the immediate vicinity.

* You determine whether WindLGC should note the size and position of dialogs that have been opened once.
* You also determine whether WindLGC should note the entire working environment (position of windows, opened circuit programs etc.).

Tools -> Options: Print

Here you determine what is to be the printed from the following choices:

- The comment you have entered under File -> Properties: Comment

- Connector names and parameters

- A list of the parameters of all blocks, of all selected blocks, or only of the special timer functions

- List of connector names

Here you can also set whether empty pages should be suppressed and if the circuit program should be printed out enlarged or reduced.

This dialog is always displayed before you start printing.

Edit -> Cut connections

You can choose to cut connections via the Cut / Join tool either manually or automatically.

In this dialog you can specify one or both of the following types of connections to be cut:

- Connections routed across a block

- Connections exceeding a configurable length

Confirm these settings with **OK,** and WindLGC will cut connections accordingly.

If you select the **Cut connections during import/upload** check box, the settings described above will also be applied in the following cases:

- When you upload (transfer) a circuit program from IDEC SmartRelay to WindLGC

- When you import (open) a circuit program created with WindLGC Standard or WindLGC

Tools -> Options: Interface

Specify an interface from the list, if you know exactly which one links the IDEC SmartRelay.

If you are using a PC cable interface, but you do not know exactly to which interface the IDEC SmartRelay is connected, you can let WindLGC automatically detect the relevant interface.

Tools -> Options: Simulation

In simulation mode you can switch the display of signal states and process variables on or off. Switching it off improves the performance of your simulation because when you disable the display of signal states and process variables, there is no need for WindLGC to calculate these values continuously.

Tools -> Options: Colors

Here you can define the color settings:

- Desktop color

- Colors of signal lines carrying a logical "1" or "0" signal in simulation mode

- Color of a selected line: You can set the color of a selected connection for each of the 4 maximum possible inputs and for the output of a block separately.

To restore the original settings, click the **Standard** button.

Tools -> Options: Look and Feel

Here you can personalize the layout of the WindLGC user interface. Try it out!

How to display a corresponding tooltip for a function key

Window menu

Window menu - Overview

From the Window menu, you can arrange your circuit program windows on the desktop You can duplicate existing circuit programs and split the windows in order to obtain a clearer overview of large programs. The following window options are available:

- Arrange Vertical

- Arrange Horizontal

- Cascade

- Split Vertical

- Split Horizontal

- Undo Split

Window -> Arrange Vertical

You can tile several windows containing circuit program vertically on the programming interface.

This menu command is only available if you have set the window view instead of the dialog tab view via the Tools -> Options: Document view dialog.

Window -> Arrange Horizontal

You can tile several windows containing circuit programs horizontally on the programming interface.

This menu command is only available if you have set the window view instead of the dialog tab view via the Tools -> Options: Document view dialog.

Window -> Cascade

You can cascade several open windows containing circuit programs on your programming interface, starting on the upper left corner.

This menu command is only available if you have set the window view instead of the dialog tab view via the Tools -> Options: Document view dialog.

Window -> Split Vertical

If you have a large circuit program and want to view and compare widely distributed circuit objects, you can split the window vertically. The split, of course, affects only the window, but not your circuit program. You can use the scroll bars in the split windows to view or modify the various elements of your circuit diagram.

You can also split the window into several partitions if you consider it necessary. You can split each window several times, both in the horizontal and vertical direction; the partition in which the last mouse operation has taken place is the partition that is affected.

You can modify your circuit program in any area of the split window. These changes are, of course, executed throughout the circuit program, because only the window was split, and not the circuit program.

Window -> Split Horizontal

If you have a large circuit program and want to view and compare widely distributed circuit objects, you can split the window horizontally. The split, of course, affects only the window, but not your circuit program. You can use the scroll bars in the split windows to view or modify the various elements of your circuit diagram.

You can also split the window into several partitions, if you consider it necessary. You can split each window several times, both in the horizontal and vertical direction; the partition in which the last mouse operation has taken place is the partition that is affected.

You can modify your circuit program in any area of the split window. These changes are, of course, executed throughout the circuit program, because only the window was split, and not the circuit program.

Window -> Undo Split

You can use this menu command to undo all splits of a circuit program window.

Window -> Selection list

The selection list at the end of the Window menu shows you all the windows you have opened on the programming interface. You can use this selection list to quickly change between windows.

Help menu
Help menu - Overview

This menu provides you with help and information on WindLGC.

- Content
- Context-sensitive help
- Update Center
- About

Help -> Contents

The Online Help

The Online Help quickly and reliably provides you with information about program configuration, tools and the creation of circuit programs with WindLGC.

Topics of the Online Help

The user interface section describes the user interface with its toolbars and the WindLGC menus in detail.

Refer to the tutorial for a quick and easy introduction to the basics of operating WindLGC and its circuit programming features.

Towards the end of this section you will find an extensive practical example that takes you through all the steps of circuit program creation.

The sample applications section introduces a few applications for IDEC SmartRelay.

The reference chapter contains the following subsections:

- The constants and terminals, basic functions (only FBD editor) and special functions subsections provide you with information about the various elements of a circuit program.

- The circuit programs subsection provides information on memory requirements, circuit program limits for IDEC SmartRelay, and additional information about blocks.

In the Tips and Tricks section we have gathered information that supports your daily tasks with WindLGC.

The Online Help naturally includes an **index** as well as a **full text search** feature for keyword and terminology based searches.

Help for blocks

If you double click on a block in the circuit diagram, you receive a window with parameters and settings for the block. If you then click on the Help button in this window you receive the Help for this

block in its own window. This Help window is missing the following symbols:

Remedy: Right-click on the block in the circuit diagram and select the **Help** menu command.

Help -> Context-sensitive help

→ Help **Context-sensitive help**

To call a help file on an object, first click on the context-sensitive help icon (see above) and then on the object.

Result: A window opens with information on this object.

You can also right-click on objects on the programming interface to call a corresponding help topic. The help entry in the shortcut menu called provides you with the required support.

The standard toolbar also contains an icon for this menu command.

Help -> Update Center

Update Center

The Update Center helps you to install additional languages, program add-ons, service packs and new versions for your WindLGC.

Update and upgrade

If you update the software within the same main version, then this is an update. For example, WindLGC Version 4.0 can be updated to Version 4.1. It is only possible to update via the Internet.

If you update the software to a higher main version, then this is an upgrade. For example, WindLGC Version 5.0 can be upgraded to Version 6.0. You can upgrade from either the Update Center or a CD-ROM.

How to use the Update Center

Follow these steps to perform an update or upgrade:

1. Select whether you want to update WindLGC via the Internet or using your local file system (CD-ROM, floppy or hard disk drive).

2. If you choose to update WindLGC from your local file system, then you are prompted to enter the folder path in which the updates / upgrades are saved.
If you update WindLGC from the Internet, then the correct Internet address is already preset in the Settings Internet Update. If you are not connected directly to the Internet, then you must specify a proxy server. Consult your network administrator in this regard. An Internet connection is then created.

3. You are then shown all the updates / upgrades available for your software version. Select the desired updates / upgrades. If you are updating WindLGC from the Internet, then your selected updates / upgrades will be downloaded and installed.

4. If you are updating WindLGC via the Internet, you are prompted to manually close the Internet connection when you have completed these actions.

WindLGC is closed automatically when the update / upgrade is completed. The functionality of the installed update / upgrade is available to you after you restart WindLGC.

Possible errors

If, when installing an upgrade / update, you receive the error message **Does not agree with magic number**, this means the upgrade / update file **Setup.exe** has not been executed in full.

In this case, download the upgrade / update file from the Internet again and ensure the file is transferred in full.

Help -> About

The **General** tab displays the version number and the release version of your WindLGC software.

The **System** tab provides you with information on the version of the Java Runtime environment used, the program paths, the installed operating system and on the memory used.

Tutorial

Prerequisites for working with the tutorial

We assume you are familiar with PC operation and that you know how to create a function block diagram. To download your circuit programs, you also need the PC cable for connecting the serial PC interface to your IDEC SmartRelay device.

Getting started with program creation

Introducing the creation of circuit programs

You are going to learn the basics of working with WindLGC, by creating a simple circuit program and simulating it on your PC. Towards the end of this chapter, you will find a few sample applications for WindLGC, and information on how to prepare, transfer and archive your application.

If necessary, review the elements of the user interface before beginning the tutorial.

Factory door

Air-conditioning system

Heating control

Fill station

Creating a circuit program

Creating a circuit program

Creating programs with the help of the toolbars

In this intro section you require only the standard toolbar and programming toolbar.

To select a tool, drag the mouse pointer onto the icon and left click to select it. This selection is indicated.
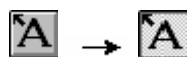
Developing a circuit program

Follow these steps to develop a circuit program:

Create a new circuit program.

Select blocks

Place the blocks

Configure and comment the blocks

Connect the blocks

Optimize the circuit program

Save the circuit program

Please note that not all blocks are available under all circumstances.

Creating a new circuit program

You can start to create a new circuit program immediately after you have started WindLGC.

To do so, click on the **File new** icon in the standard toolbar.

⬚ ➔ File new

WindLGC then opens the FBD Editor (or the default editor specified under Tools/Options/Editor), and you can create the new circuit program in a new window on the programming interface.

Click on the small arrow on the right side of the **File new** icon to open the LAD or FBD Editor.

Selecting blocks

Your first step in programming a circuit diagram is to select the blocks for your circuit. Determine the order in which you want to insert the I/Os and the standard/SFB blocks.

Under Co in the programming toolbar, you will find the constants and terminals (only in the LAD editor), that is, a selection of I/Os and constant signals. Under BF, you will find the basic logic functions of Boolean algebra: standard digital logic blocks. Under SF you can find the special functions. You can also call the respective function groups via the function keys.

[Co] or [F6] → Constants / Terminals

[SF] or [F8] → SFBs

Only in the FBD editor:

[SF] or [F7] → Basic functions

A quick and easy way of selecting blocks and placing them into your circuit program

Placing blocks

Click on the icon group that contains the required block or, as an alternative, press the function key. All blocks belonging to the selected function group are now shown below the programming interface.

Example for the FBD Editor:
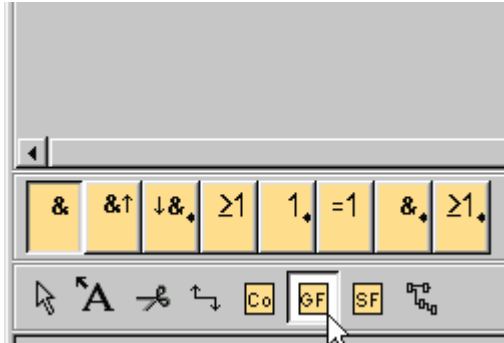
You can insert the selected function on your programming interface with a simple mouse click. The first group function is set by default, and you can select other functions with the mouse before you place them.

Example for the FBD Editor:
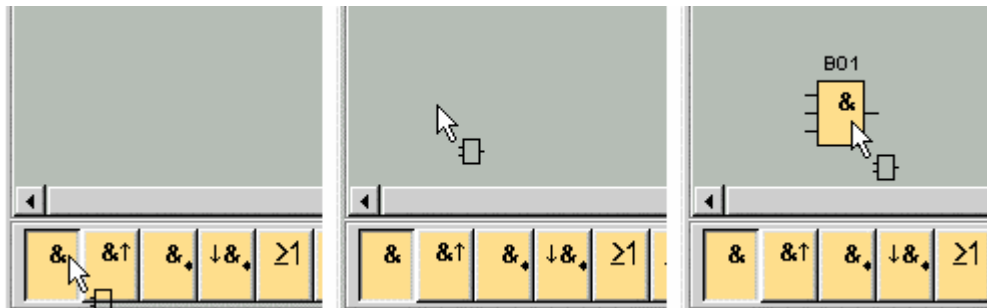
There is no need to align the blocks right away. A precise alignment of the blocks at this time does not make sense, unless you have interconnected them and entered the comments in your circuit program.

Information on block numbering is found here.

    How to quickly and easily select blocks and place them into your circuit program

Editing blocks

Shortcut menus
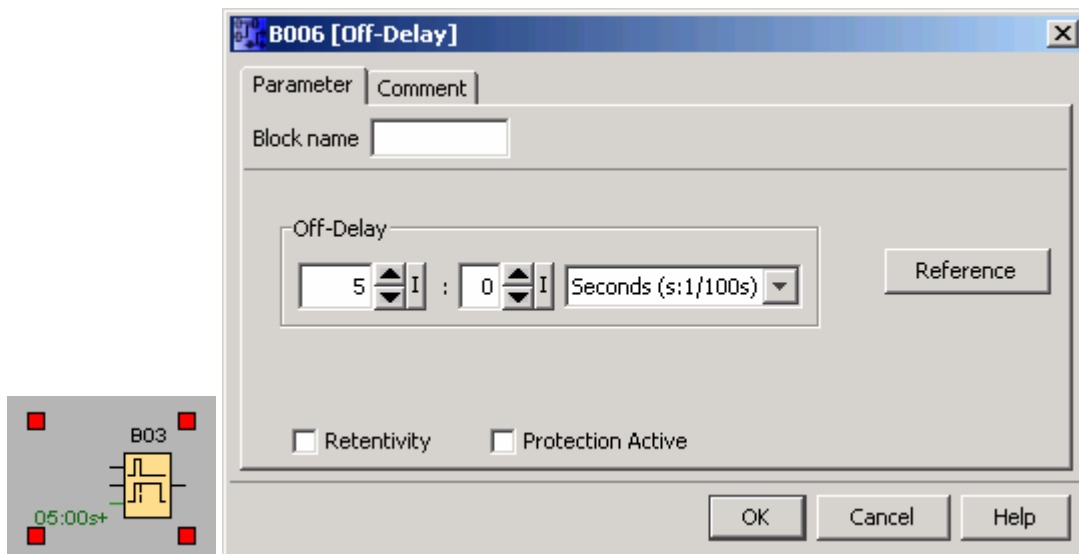
A right-click on an object opens a shortcut menu that offers you various object editing options. The editing options depend on the selected object. Objects consist of not only blocks and connecting lines, but also the programming interface and toolbars.

You can also call help on the selected object in the shortcut menu.

Configuring blocks

Double-click with the left mouse button to configure block properties. The properties dialog includes a Comment tab as well as various parameter tabs for the SFBs, and for some of the basic functions and constants and connectors. You specify here the values and settings for your blocks. **Help** on the parameters of the relevant block can be called by clicking the help button.

Special functions can be recognized by the green lettering to the left of the block on the programming interface.

Connecting blocks

To complete the circuit diagram, you must interconnect the blocks. In the programming toolbar, select the block connection icon.

Example for FBD:

 → Connector

Position the mouse pointer on the block connector. Press the left mouse button and hold it. Move the pointer from the source connector to the target connector. Release the mouse button. WindLGC connects the two terminals.

Example for LAD:
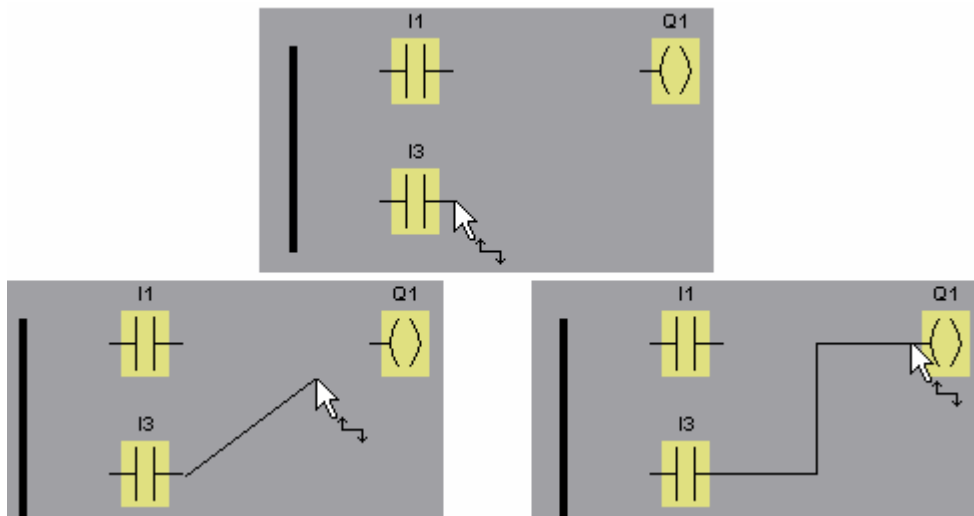
WindLGC offers you a further option of connecting blocks when you right-click on the input or output of a block. In the shortcut menu, click the **Connect to block** menu command. This calls a selection list that contains all blocks available for your connection. Click on the relevant target block. WindLGC then draws the connecting line. This method is especially useful for connecting a source to a target block over a greater distance on the programming interface.
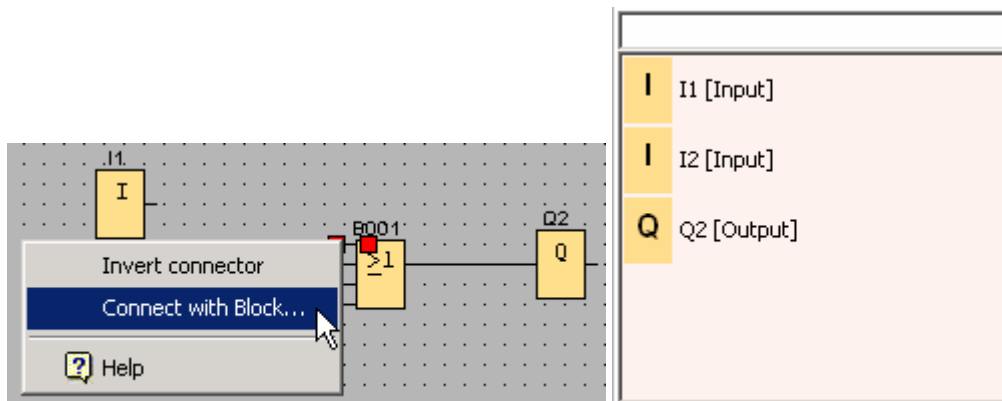
 Note on the LAD Editor:

Do not forget to connect the I/Os to the bus bar on the left edge of the editor window.

Tips on connecting blocks

After the line is connected from an output to an input, or vice versa, a pop-up tool tip opens to show the connection. Release the mouse button to snap the line onto the indicated input.

You can refer to the short information (tool tips) in WindLGC for additional help on circuit programming. Move the mouse pointer over a block and briefly hold it in this position. The name of the block is shown. The name of the block input appears when you move the mouse pointer onto the input.
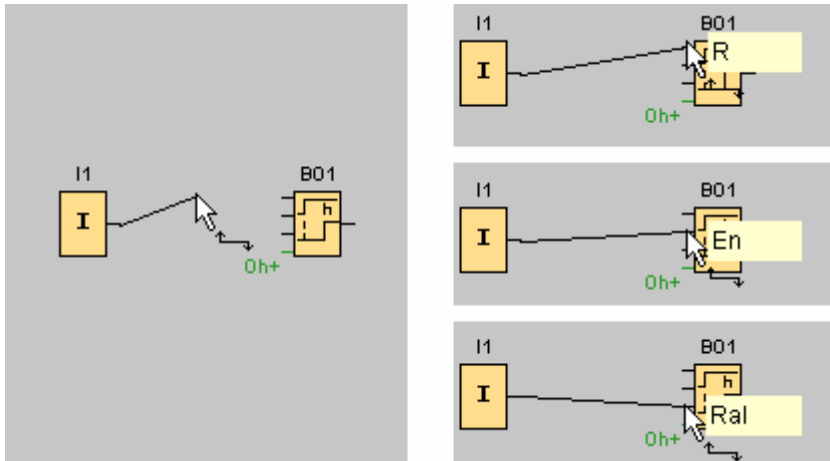
To make it easier for you to interconnect blocks, a blue frame around the mouse pointer pops when it is "captured" by a pin.

Rules for connecting blocks

The following rules apply to the connection of blocks:

- You can connect a single input to multiple outputs.

- You cannot connect multiple inputs to a single output.

- You cannot interconnect I/O in the same path of a circuit program.Recursion is not permitted. Interconnect a Memory Marker or output if necessary.

- SFBs also have green "connectors". These do not represent connecting pins, but are used instead for assigning the parameter settings.

- Analog I/O cannot be connected to digital I/O.

Multiple connections

You can connect I/O to existing connections.

 A quick and easy way of connecting blocks in large circuit programs

Availability of blocks

Hardware defaults

The memory space and the device series of your IDEC SmartRelay determines:

- How many blocks you can use in the circuit program

- Which blocks you have available to create your circuit program

A IDEC SmartRelay of the latest device generation is selected by default.

After you have created a circuit program, you can call the Tools -> Determine IDEC SmartRelay menu command or press the function key [F2] to display an Info Window that shows you which IDEC SmartRelay devices are available for executing your circuit program.

The blocks which are not available for your selected IDEC SmartRelay are grayed out.

Optimizing the circuit program

Should you determine in the course of creating your circuit program that a IDEC SmartRelay device is unable to handle your circuit program, you should first fall back on all the functional resources offered to you by the IDEC SmartRelay device. You could, for instance, replace memory intensive blocks with a structure consisting of several blocks, which altogether require less memory space.

If the various optimization attempts are unsuccessful, then you can use an additional IDEC SmartRelay, or optimize / simplify the functionality of your application.

Editing the layout

Editing and optimizing the layout

The circuit program is ready for use after you have inserted and connected the blocks. However, a slight touchup of your circuit is required in order to optimize your layout. You can reposition the inserted blocks and lines accordingly.

Selecting objects

Before you can move or align objects you must first select them. Click on the Selection Tool in the programming toolbar. You can also press the [ESC] key to activate the Selection.

![Selection Tool icon] or **[ESC]** → Selection

Single blocks or connecting lines are selected simply by mouse click. Groups of blocks or connecting lines are selected by "capturing" them with the mouse pointer. To "capture" objects, keep the left mouse button pressed and draw a frame around them and then release the mouse button. The "captured" objects are highlighted by small red squares at the corners of the selected fields.

Sample for the FBD Editor:
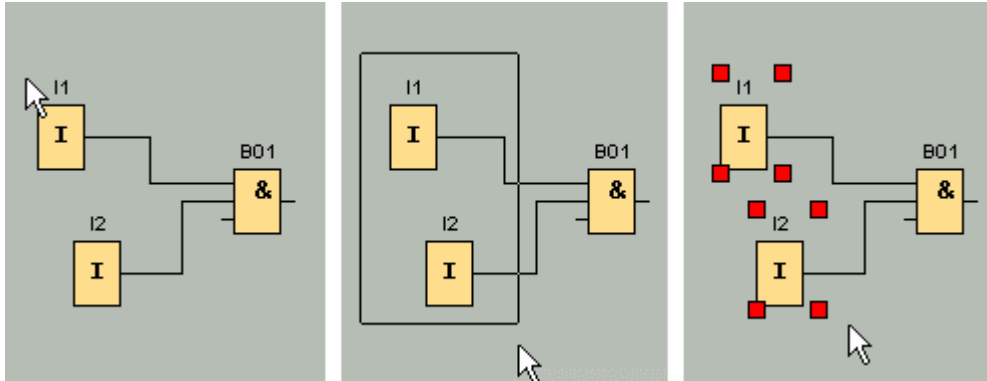
In addition to the selection of single objects by a simple mouse click or highlighting object groups by "capturing", there is a further selection option: Under "optional selection", mark the objects one after the other by holding down the [Ctrl] key while you select the objects. To remove an object from the selection, hold down the [Ctrl] key and click on a selected object once again.

Editing selected objects

You can delete single or grouped objects with the [Del] key, or move them with drag and drop or use the keyboard. The cursor keys allow fine positioning in very small steps. However, the snap function must not be set in the Format -> Grid menu when doing so. You can also cut, copy and paste selected objects by means of the relevant toolbar icons.

✂ ➔ **Cut a Selected Object**

📋 ➔ **Copy a Selected Object**

📋 ➔ **Paste a Selected Object**

Editing selected connecting lines

A special option is offered for editing connecting lines. Selected connecting lines are indicated by round and square blue handles. The round handles can be used to move the lines at a right angle into the direction in which they extend. The square handles can be used to reassign the beginning or end of a line. The lines are moved by dragging the round handles.

Example for the FBD Editor:
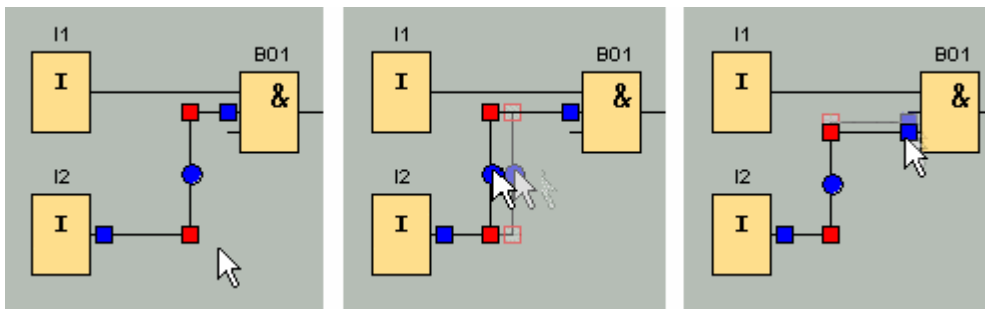
If the end of a connecting line is not assigned to a suitable target connector, it is automatically reconnected to its initial position after you "release" the mouse button.

Replacing blocks

How to replace a block in your circuit diagram with another function:

1.   Insert the new block above or below the block you want to replace.

Rewire the connecting lines of the old block to the new one as described under Editing selected connecting linesedit_marked_objects.

After having rewired all the connecting lines, you can delete the old block and move the new block into this position.

Example for the FBD Editor:
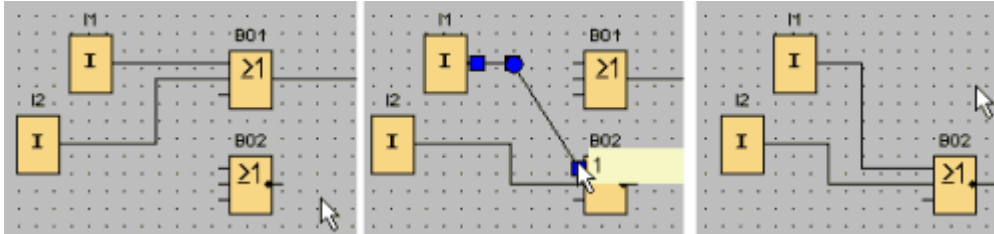
By keeping to this block replacement order, you can maintain your connecting lines. If you first delete the old block, you also delete its connections, which means you have to recreate all connections.

Cutting connections

It may turn out to be difficult to interpret the layout of a large circuit, especially if it contains many line crossings. You can clean up your connection layout, using the "Cut/Join" tool of the programming toolbar.

 → **Cut/Join**

Click on a connection after you have called this tool. The selected connecting line is graphically split. However, the link between the blocks remains active.

The open ends of the cut connection are now shown with arrowhead icons, which indicate the direction of the signal flow. Above the icons, you can now see the cross-references, including the page number of the circuit diagram, the block name and the number of the block terminal that is connected to the open link.

Right-click on the line connecting the two blocks you want to cut, then select the cut command.

You can also cut a group of connections, using the Edit -> Cut Connections menu command. Before you cut any connections, you can also set the cutting criteria, for example, cut all connections routed through blocks.

Example for the FBD Editor:
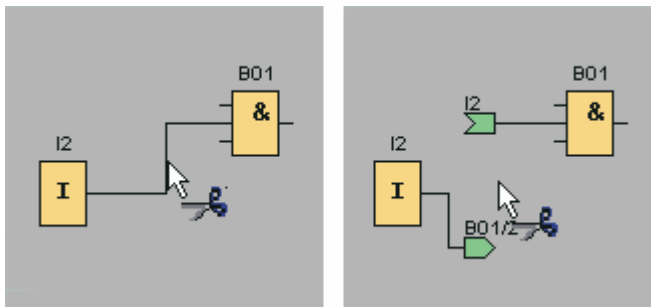
The connection is closed again by clicking on its open end while the Cut/Join tool is active. Optionally, you can close the connection by right-clicking on an open end and calling the **Link** menu command.

Example for the FBD Editor:
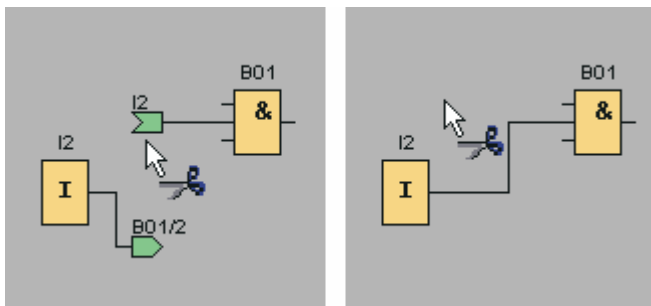
You should not use this tool to edit smaller circuit diagrams. In most cases you can optimize the layout by repositioning the icons.

Applications and advantages

Large and complex circuit layouts may contain numerous line crossings, thus making it more or less difficult to interpret the circuit. In such cases, the Cut/Join button is a highly effective means of clearing up the circuit layout.

You can quickly jump to the partner connector by right-clicking the open end of a cut connection. This opens a shortcut menu, in which you can select the **GoTo Partner** menu command to jump to the partner end of the cut connection.

Another advantage of the Cut/Join tool is its utilization for circuits extending across more than one printable page, that is, across a page break. The connecting lines of two circuit blocks which are shown on different pages are cut without cross-reference. However, if you cut such connections using the Cut/Join tool you generate a cross-reference pointing to the source or the connection target.

Example for the FBD Editor:
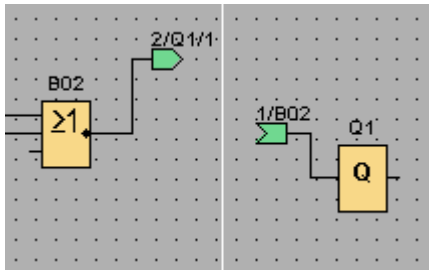
Documentation and saving
Documentation of the circuit program

Labels

You can create block-independent and associated labels using the text tool of the programming toolbar. To do so, click on the text tool.

 → **Text tool**

When this icon is active, open a text input box by clicking on a free area of the programming interface or on a block. After you have entered the label text, simply click anywhere outside the label window or press the [ESC] key. The window is closed and the label text is displayed in the diagram. That label can now be selected, moved or aligned.

Example for the FBD Editor:
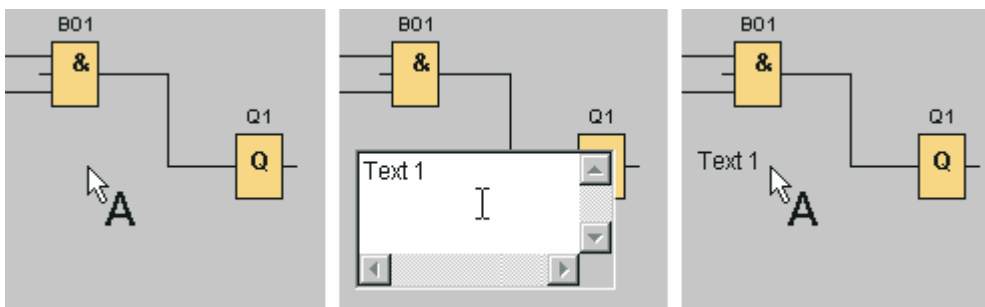
Block independent and associated text

Click on a free area of the programming interface to create a block independent label. A label can be edited by calling the text tool and then clicking on the relevant label.

By clicking on a block with the text tool, you create an associated label, namely the block comment. You can also input and edit this comment in the comments tab of the block properties dialog. The block comment can be used, for example, to assign a name to a block or to insert comments describing the task of the block within your circuit.
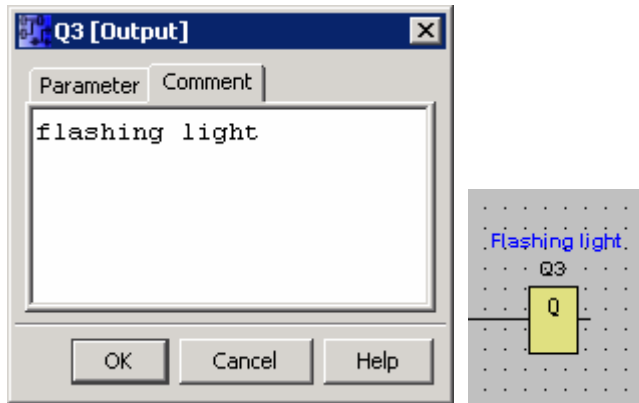
If you select a block with an associated label, the text is not marked. However, when you move the block, you also move the label. When you copy or cut the block, only the block itself is copied to the clipboard. A cut operation deletes the associated label. However, the associated label can be selected and moved, copied, cut or pasted individually. An associated label that is pasted from the clipboard is no longer associated with the block.

In Edit -> Input/Output Names you can assign block numbers and connector names to the I/Os.

Opening and saving the circuit program

Saving the circuit program

Click on the save icon in the standard toolbar to save the circuit program.

![save icon] ⟶ **File Save**

The circuit program is saved under the name it was opened with, while older versions are overwritten. When you initially save it, you are prompted to specify a program path and name.

Opening a circuit program

You can always clicking on the **File open** icon to open a circuit program for further editing. You open a list of recently opened programs by clicking on the arrow icon on the right side of the button.

![file open icon] ⟶ **File Open**

Simulation of a circuit program

Starting the simulation

Use the Tools -> Simulation menu command or the simulation icon ![simulation icon] in the programming toolbar to place your circuit program in simulation mode.

At the start of simulation, WindLGC verifies the circuit program and shows any existing errors in the Info Window, which you can view by calling the View -> Info Window menu command or by pressing the function key [F4]. You can also use function key [F2] in the Info Window to display the IDEC SmartRelay modules capable of running your program.

In simulation mode, you have the simulation toolbar and status window available for performing the simulation and for observing and controlling the behavior of your circuit program.

Layout of inputs

The inputs are displayed in the form of key or switch icons. The name of the input is displayed below the icon. An open input represents an inactive switch. When you click on the icon, it is indicated active and the switch is shown in closed state.

 → Icon for pushbutton I1, not actuated → open input

 → Icon for pushbutton I1, actuated → closed input

 → Icon for pushbutton I2, not actuated → open input

 → Icon for pushbutton I2, actuated → closed input

Layout of analog and frequency inputs

You can set the analog voltage or frequency values for analog and frequency inputs by means of a slide resistor. Click on the relevant block to pop up and operate this slide controller directly in the diagram. If you want to specify a more precise value, enter it directly or set it directly via the up/down keys at the side of the input window.

 → Display for input block I1 → Frequency input

 → Display for input block I1 → Frequency input

Input Functions

You set the response of your inputs for simulation purposes with the Tools -> Simulation Parameters menu command.

Layout of the outputs

In simulation mode, the outputs Q and the Memory Marker M. are displayed as outputs.

The status of an output or Memory Marker is indicated by a light or dark bulb icon. The name of the output in your circuit program is displayed below this icon.

 → Status display of output Q1 → Output switched off

 → Status display of output Q1 → Output switched on

The output status only indicates the status as such. Here, you cannot switch an output by clicking on an icon. When your circuit program switches an output, the indicator lamp is active; when the output is switched off, the indicator lamp is also switched off.

Set output

In simulation mode, you can select the command Set output by right clicking the mouse on the output of a block.

This command allows you to set an output, irrespective of the current status of a block. The output remains set until you enable it again or you end the simulation.

This way you can use a simulation to check how a circuit program will react to certain states.

Power failure

The user can simulate a power failure by clicking on the **Power** icon to interrupt the power supply to all inputs.

 → Power icon, not actuated

 → Power icon, actuated → Simulated power failure

This function can be used to test the reaction of the circuit to power failure and restart, as well as its retentivity. In contrast to the start of simulation, retentivity is relevant for the "Power failure" function. The start of a simulation is equivalent to the "Load Program" function in IDEC SmartRelay. All values are reset, including the retentive values.

Layout of message texts

If you right-click on the entry in the message text, you can see from which block the entry in the message text originates. You can also select this block in the circuit program (**Go to Block**) and call up the properties of this block (**Block Properties**).

Standard View
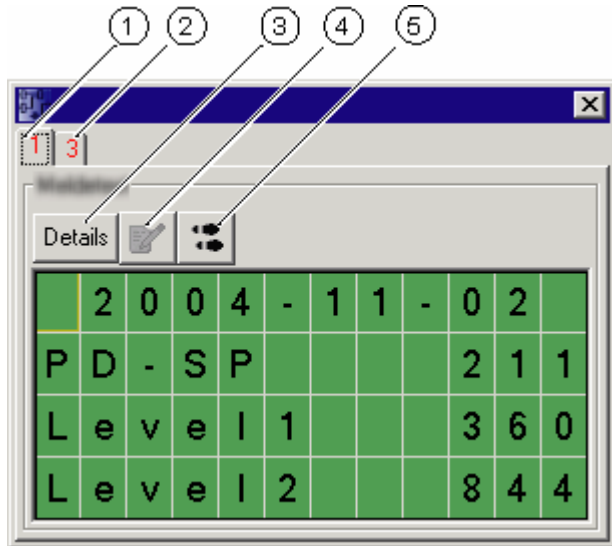
①	Tab of the displayed message text stating the priority.
②	Tab of another message text. Here you can see that another message text of priority 3 exists.
③	**Details** button If you click on this button, the view changes and you receive more detailed information in the Detail View (see below).
④	**Enter value manually** symbol Before you can use this function you must first click on a changeable entry in the message text. If you then click on this button, you can manually change the current value. Alternatively you can also double-click on an entry in order to manually change it.
⑤	**Go to Block** symbol If you click on this button, the special function belonging to the message text is selected in the circuit program.

Detail View
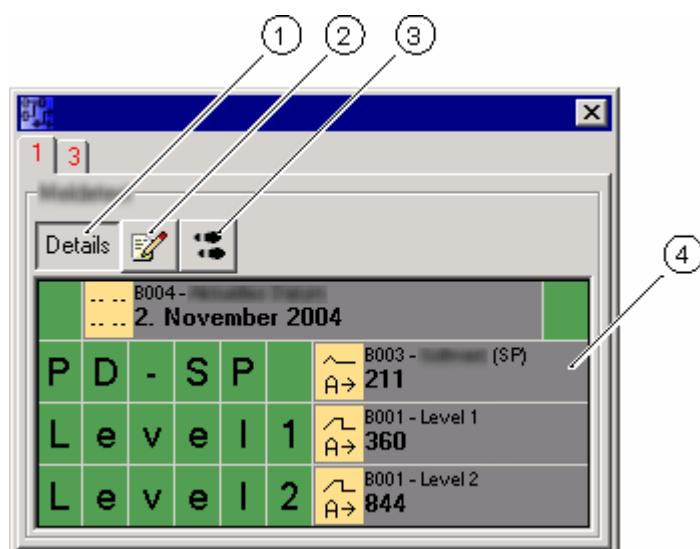
① **Details** button

If you click on this button, you return to the standard view (see above).

② **Enter value manually** symbol

Before you can use this function you must first click on a changeable entry in the message text.

If you then click on this button, you can manually change the current value.

Alternatively you can also double-click on an entry in order to manually change it.

③ **Go to Block** symbol

If you click on this button, the special function belonging to the message text is selected in the circuit program.

④ Entry in message text with information regarding the block from which the entry originated.

Parameter assignment in simulation mode

You can double-click on a block while a simulation is performed to open the block properties dialog. Here, as in programming mode, you can modify comments or parameters.
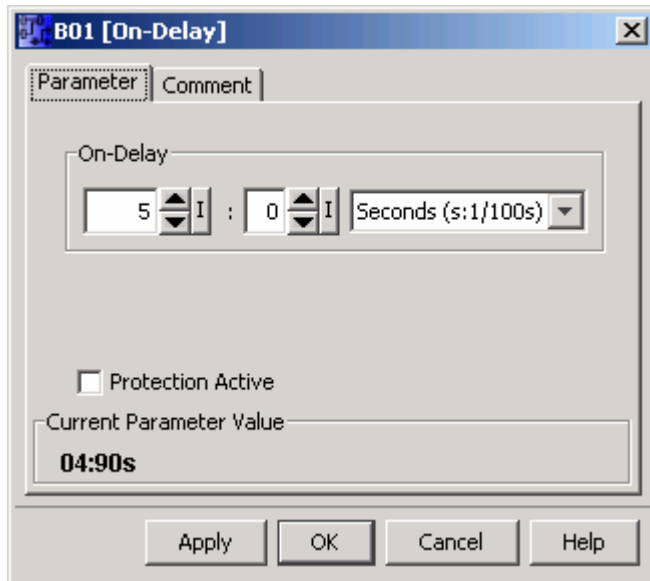
In simulation mode you are shown the actual parameter values. This analysis option allows you to test the reaction of your circuit program. You can open several parameter assignment windows concurrently in simulation mode.

Alternative operation

You can click directly on the inputs to switch them on or off..
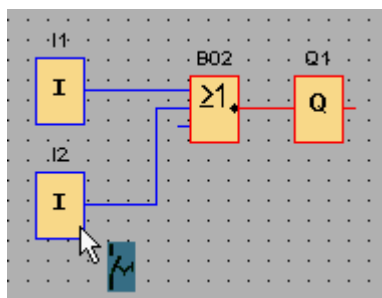
You can select the status window with the mouse, or drag and drop it out of WindLGC to form a separate window. This is a particularly helpful feature for handling a large amount of I/Os in your circuit program, and for arranging the I/O layout to suit your requirements.

Example for the FBD Editor:
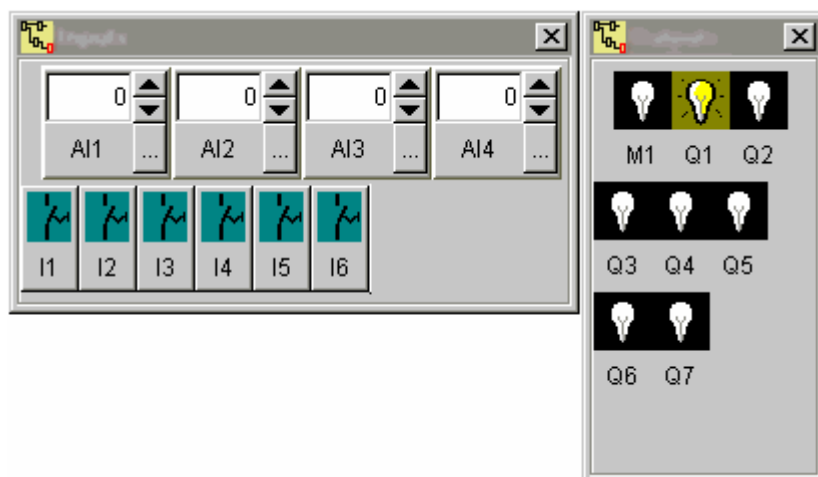
Controlling the simulation time

The simulation mode of WindLGC allows you to test your circuit program on a timed basis, or over a specific number of cycles. You can even modify the time of day to test timer operations in your circuit program. See the time control section in the simulation toolbar topic for more information on the capabilities you have in simulation mode.

Practical example

Practical example: Introduction

This practical sample application for a service water pump offers newcomers a step-by-step introduction. In contrast to the previous tutorial, you learn here how to apply the functions that you have learned, based on a practical example.

Further samples of circuit programs are found in the sample applications section.

The task

Application

In addition to the drinking water supply, rainwater takes an increasing part in domestic water supply systems, thus saving money and helping to protect the environment. For example, rainwater can be used for the following needs:

- Washing clothes

- Watering the garden

- Watering indoor plants

- Washing the car

- Flushing the toilet

Rainwater can be collected in a suitable system to be used instead of drinking water.

Description of the system

The rainwater is collected in a reservoir. From the reservoir, it is pumped into a respective water supply system. From there it can be tapped in the same way as drinking water. The system functions can be upheld by supplying drinking water if the reservoir runs out of service water.

A control circuit is to be created that suits the requirements for such an installation.

The sketch below illustrates how such a service water system works:
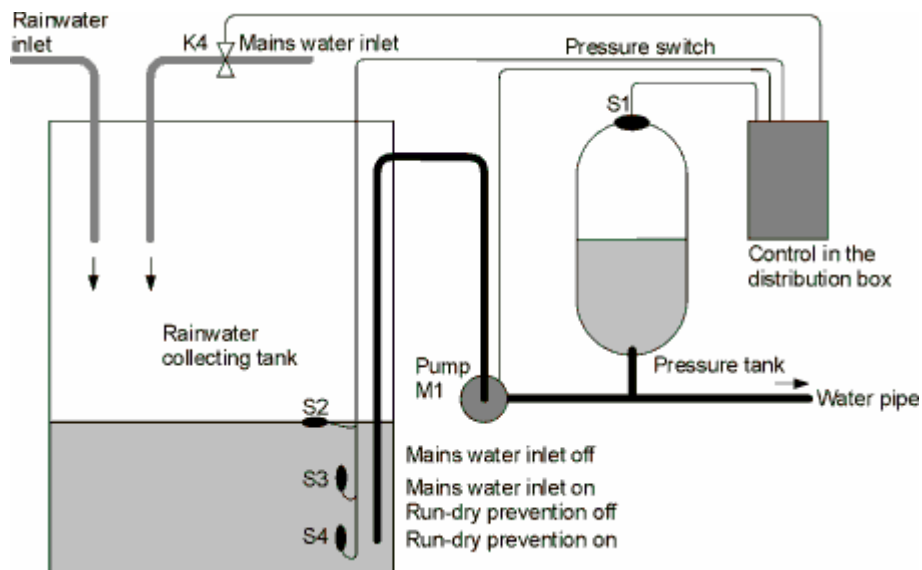
Requirements on the control system

- Service water must be available at all times. An emergency control system must change over to drinking water supply, for example, if service water runs low.

- The ingress of service water into the drinking water network must be prevented when switching over to drinking water supply.

- The pump must be disabled if the service water reservoir runs low of water (dry-run protection).

Layout of the solution

The pump and a solenoid valve are controlled by a pressure switch and three float switches, which are installed in the service water reservoir. The pump must be switched on if the pressure in the reservoir drops below minimum. When the operating pressure is reached, the pump is switched off again after a tracking time of a few seconds. The tracking time prevents pump oscillation if water is tapped over an extended period.
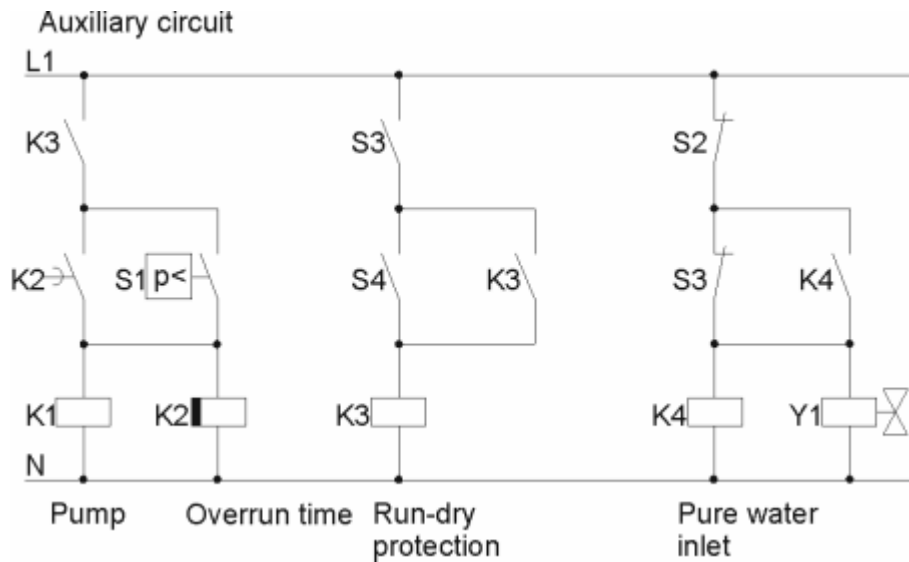
Solution with IDEC SmartRelay

Connecting field devices

In addition to the IDEC SmartRelay device, all you need is the pressure switch and the float switches to control the pump. If you are using a 3-phase AC motor, a contactor relay is required for switching the pump. In systems with single-phase AC pumps, you must install a contactor relay if the current of the AC pump exceeds the switching capacity of the output relay Q1. A solenoid valve can usually be controlled directly, due to its low power consumption.

Connection diagram
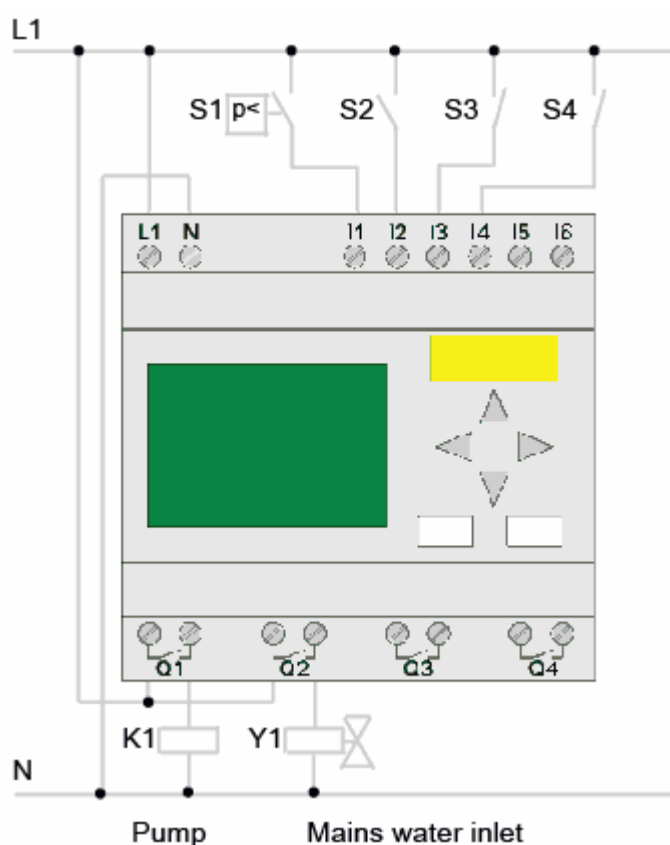
Block diagram

The block diagram shows you how to interconnect the pump controls and the solenoid valve. Its layout corresponds with the structure of the circuit diagram.
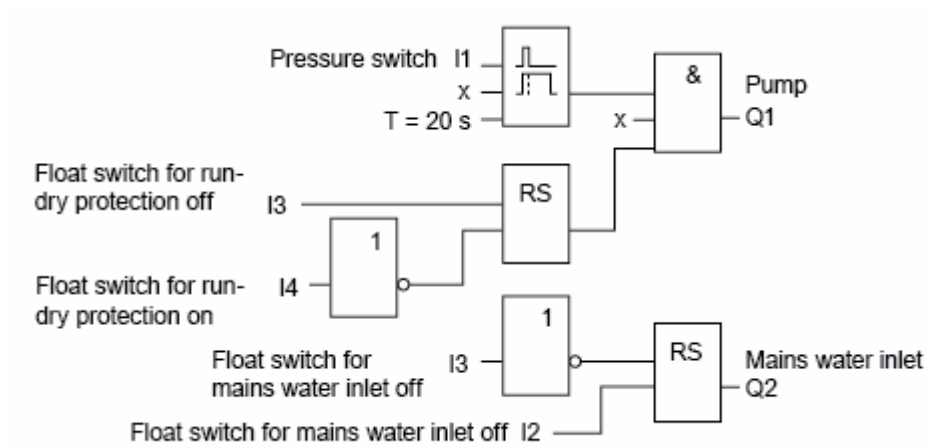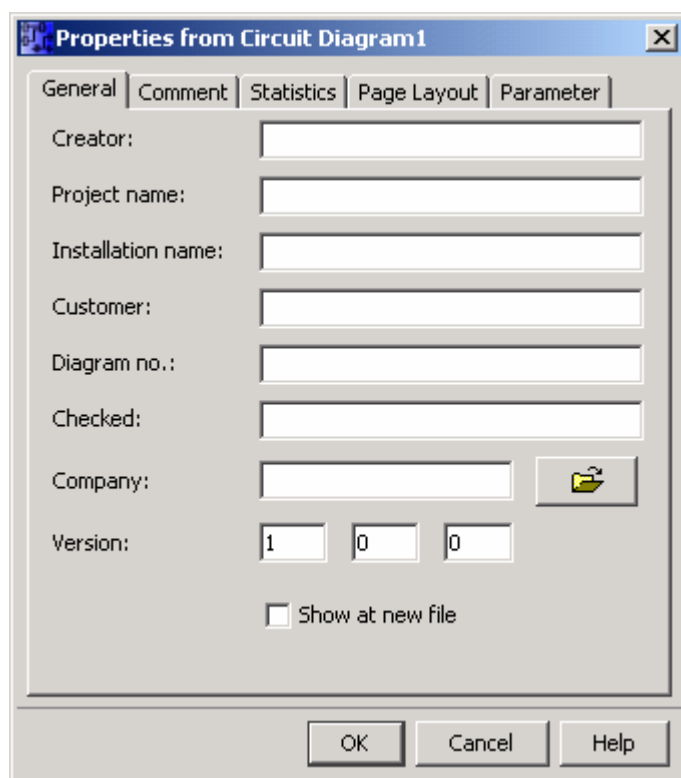
Options

For specific applications, you also have the choice of integrating additional functions which could otherwise only be realized with additional switchgear:

- Enabling the pump at specific times, for example, only during the summer months or at a specific time-of-day

- Indication of imminent or existing shortage of water

- System error messages

Input of project data

After you have planned your project, you can start to create it in WindLGC. If you do not want to start programming right away, you can first input your project data in the properties menu dialog.

When working through the following steps, you should remember to save your circuit program at regular intervals. You may want to open a revised version at a later time to test out other options.

Placing blocks

In the next step, place the required blocks into the programming interface. Note that in addition to the standard and special functions, you also require I/O blocks. At this stage of progress it is sufficient for you to place the blocks roughly into position that seems appropriate to you for connecting them later. Fine positioning is carried out after all connections are made.

FBD Editor:
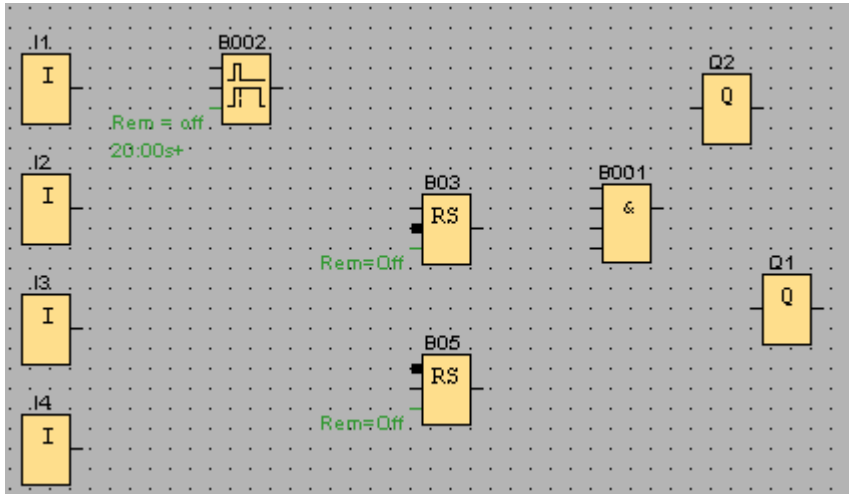
LAD Editor
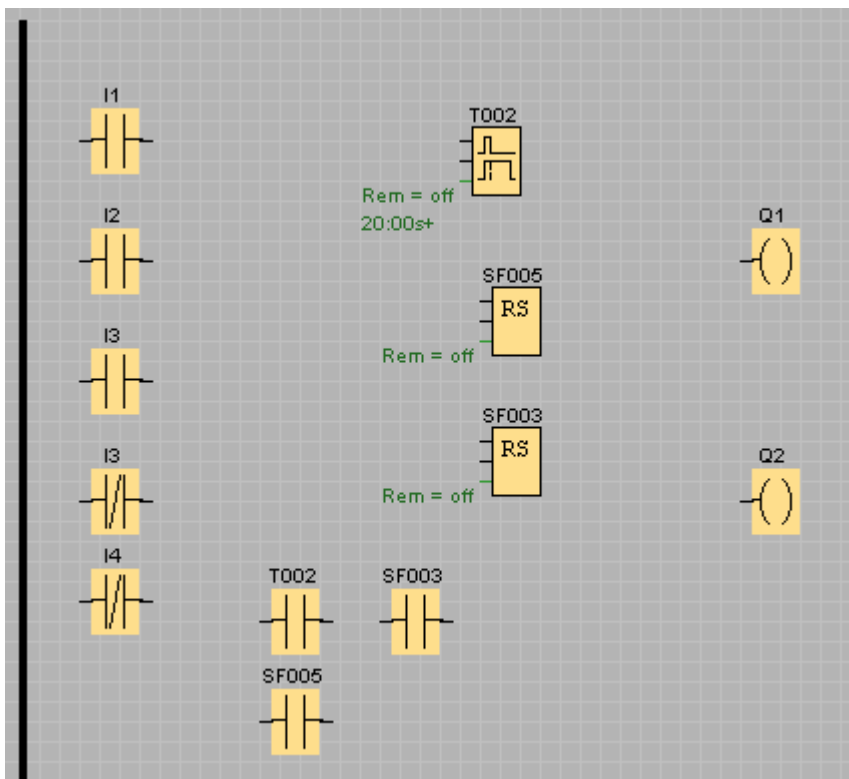
Connecting blocks

Connect the blocks as you have planned previously. Connect them by drawing the connecting line, starting at the output of a source block and ending at the input of the target block. This has the advantage that you are shown the name of the connector when you interconnect the input, which is particularly advantageous for the various connectors of SFBs.

FBD Editor:
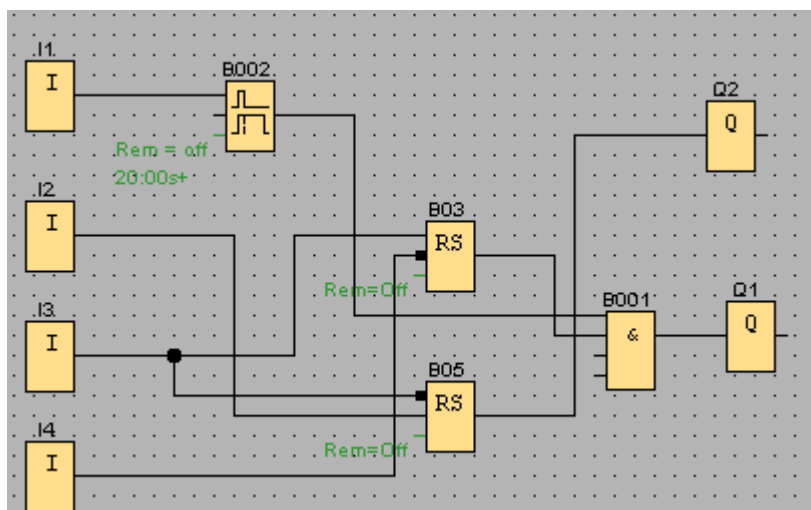
LAD Editor:
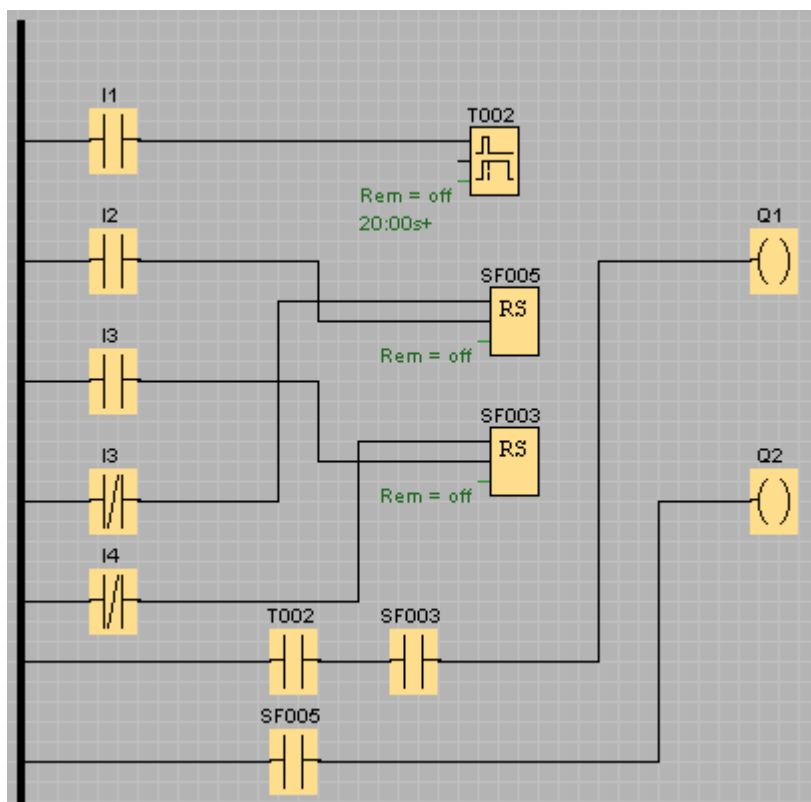
Cleaning up the programming interface

Some of the connecting lines may be routed across blocks. The layout of the circuit program is not particularly clear at the present. In order to "tidy up" the programming interface, select the connecting lines and blocks where required and move or align them until you have optimized the circuit program layout as far as possible.

FBD Editor:
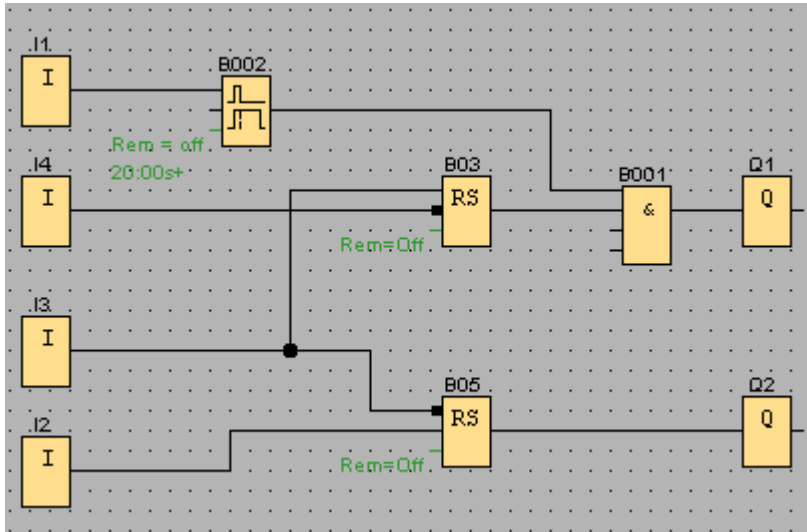
LAD Editor:
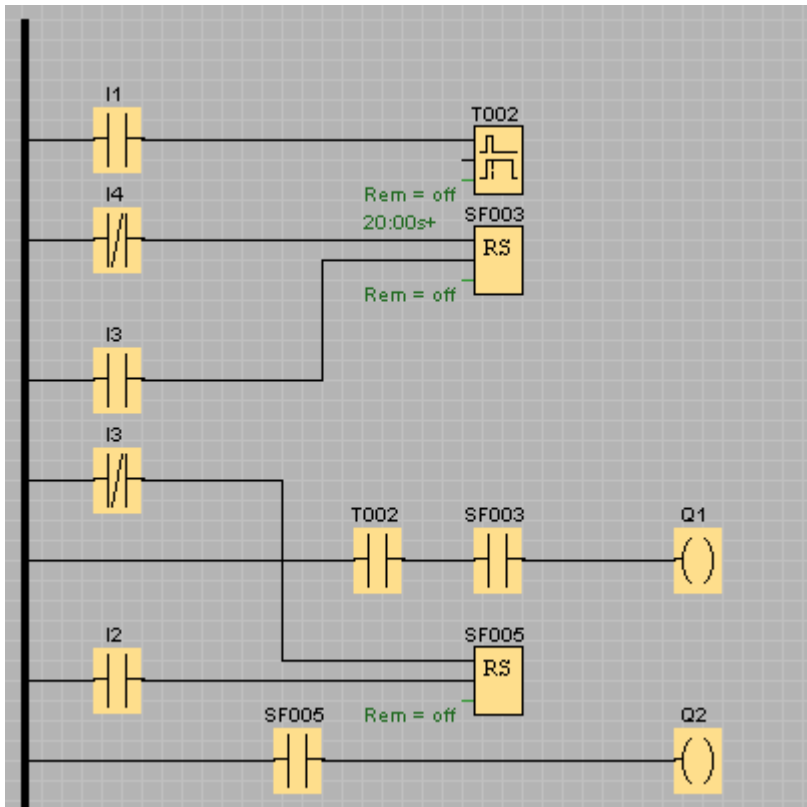
Optimizing the view

Unwanted though unavoidable line crossings can be cut using the Cut/Join tool. This improves the overview.

FBD Editor:
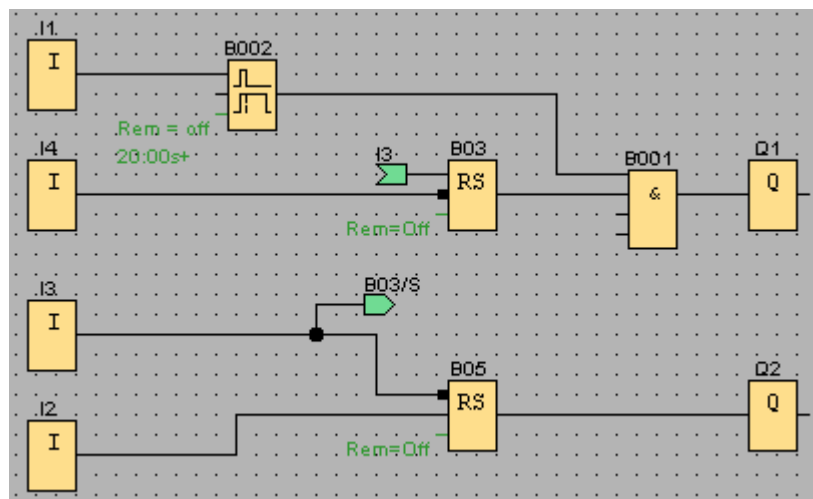
LAD Editor:
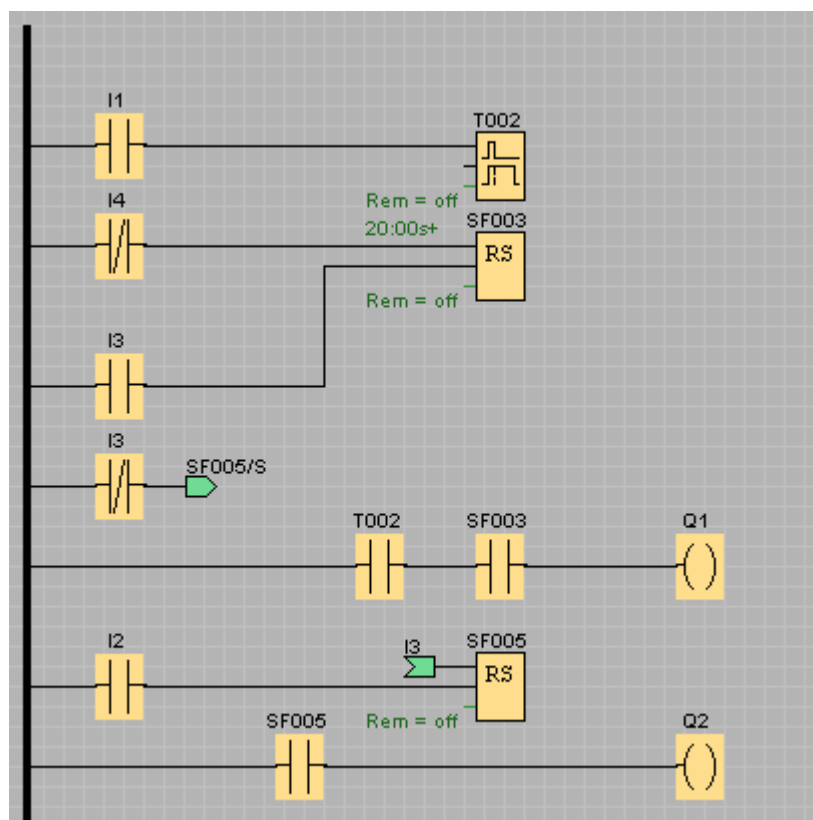
You have now completed your circuit program. Verify all connections once again and configure the block parameters to suit your requirements.

Testing the circuit program

Place your circuit program in simulation mode and verify that your program is error-free.

Although you now know that you can run your circuit program in IDEC SmartRelay, you still need to make sure your circuit program operates as planned. You may also want to modify certain parameters. You can try out different input values, test the reaction of the system to power failure and compare your calculations or expectations with the simulated reaction of the outputs. The simulation toolbar and status window provides the tools you need for these tasks.

The float and pressure switches have a momentary action. If, however, you wish to simulate your circuit for testing purposes, simply change the input function from momentary action to switching action.

Example for the FBD Editor:
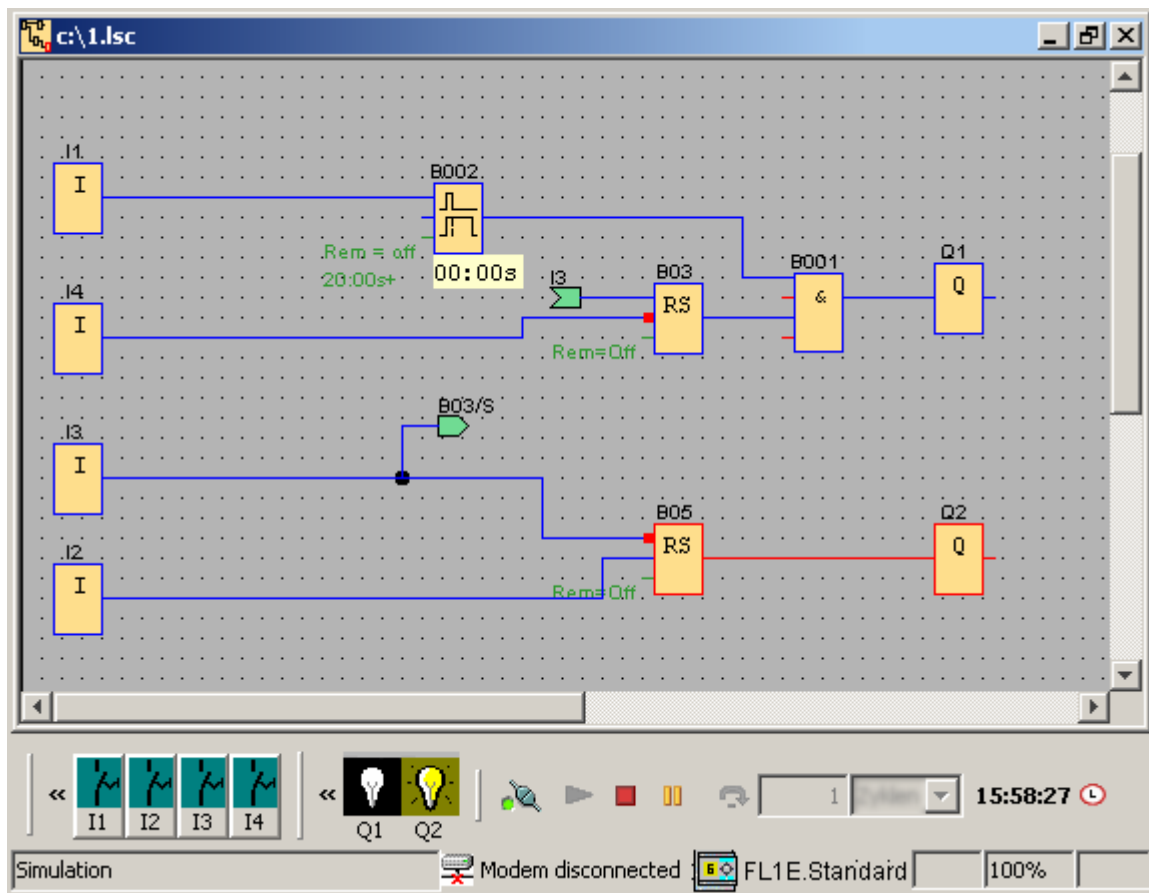
When you have made all corrections and everything runs as expected, you can start to document your circuit program.

Circuit program documentation

Program comments

You can now start to add comments to your program using the Text tool. Describe the I/Os to make your circuit program easy to understand. You do not have to display the connector names on-screen. You should nevertheless assign names to the connectors, because you may want to print out a connection list at a later time. From the comment tab of the File -> Properties dialog, you can add a comment to your circuit program, which you can include when you print the circuit program.

Example for the FBD Editor:
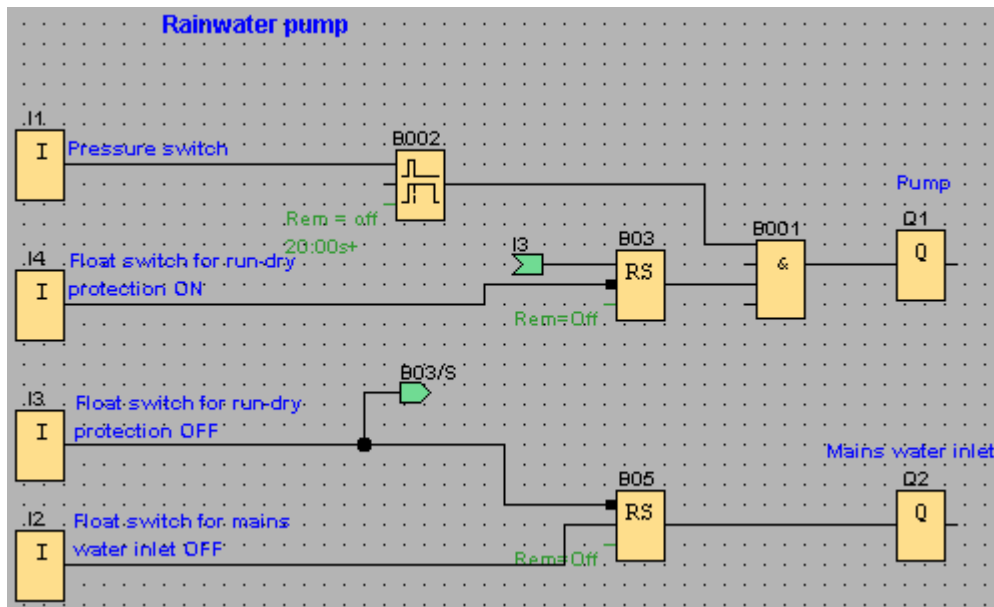
Saving the file to a storage medium

Before you transfer your circuit program, you should save it once again. Choose the relevant command from the menu and enter a program name and path.

Printing the circuit program

Use the FIle->Print command to print a copy of your circuit program. From this dialog you specify the print format and the details to be included or omitted.

Transferring the circuit program

Password protection

To protect your process solution and prevent unauthorized access to your circuit program, you can assign a password before you transfer it to IDEC SmartRelay.

To assign this password, use the Parameter tab of the File->Properties menu command dialog. Enter your password and confirm it with OK.

Password protection is used when you transfer the circuit program to IDEC SmartRelay and is activated when IDEC SmartRelay exits transfer mode.

The password protects your circuit program in IDEC SmartRelay. Editing values and parameters, or viewing the circuit program in IDEC SmartRelay, or uploading the circuit program from IDEC SmartRelay to the PC is now only possible after you have entered the password.

Transferring the circuit program

Finally, transfer your circuit program to a suitable IDEC SmartRelay version and then connect the module. Connect IDEC SmartRelay with the consumer devices in your project.

You have created the circuit program under WindLGC within a very short time and, compared with conventional methods, you have saved yourself a considerable amount of time and effort.

Performing an online test of the circuit program

After you are satisfied with your program simulation and have downloaded it to IDEC SmartRelay, you can also perform an online test of the circuit program. An online test is similar to simulation in that you can view inputs and outputs and block parameters. It differs, however, in that you are testing the program running in the IDEC SmartRelay device with "live" inputs rather than testing the program on the PC with simulated inputs.

The following example shows an online test of the practical example circuit program. In this example, input I1 was turned on and then turned off. The off-delay timer began counting when I1 was turned off:
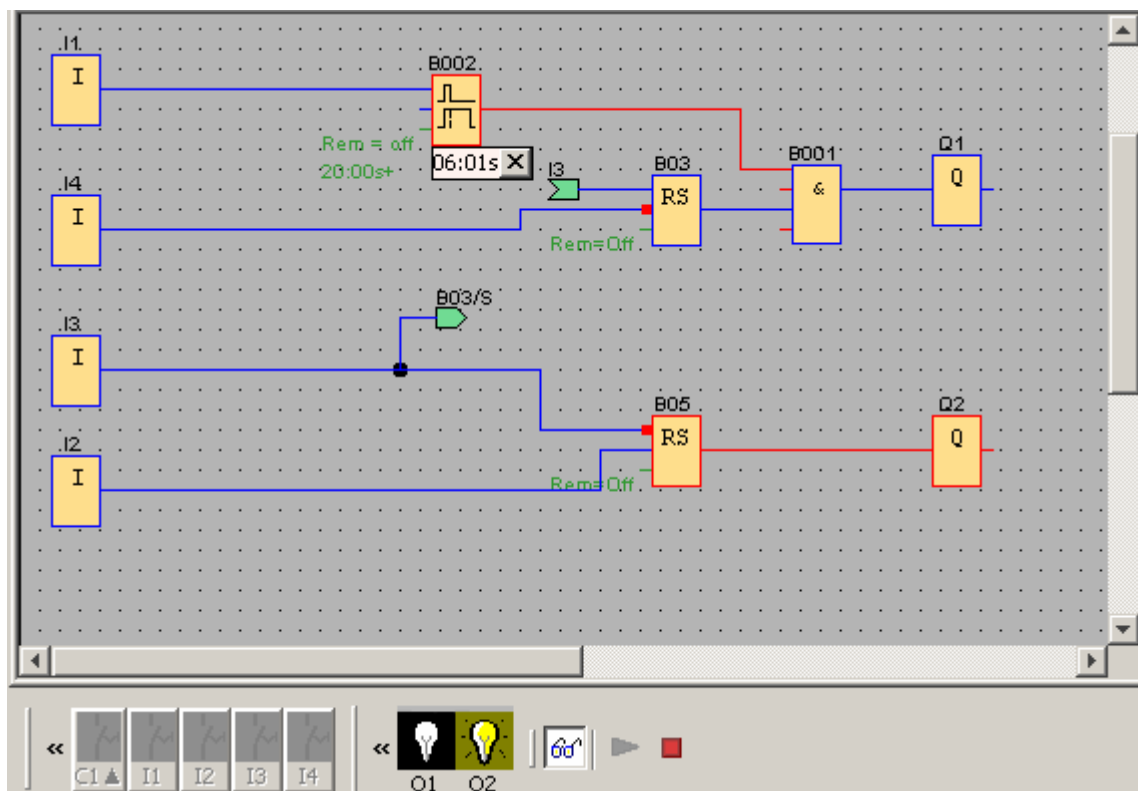
See the topic Tools->Online Test for prequisite conditions for an online test.

Sample applications

Sample applications - Overview

Introduction

To give you an impression of the versatility of IDEC SmartRelay, WindLGC includes a small collection of applications, in addition to the service water pump application shown in the tutorial.

This online help briefly describes the tasks and presents the relevant solution with WindLGC. These circuit programs, as well as many others, are found on your WindLGC CD-ROM in the ..\Samples folder. You will also find there documentation for the various samples.

Note

IDEC SmartRelay sample applications are available free of charge to our customers. These are provided without guarantee, and are intended for general information about the possible fields of application for IDEC SmartRelay modules and WindLGC software. Custom solutions may be different.

The user operates the system at his own responsibility. We also refer to local standards and system-related installation regulations.

This section presents the following sample applications:

- Air-conditioning system
- Factory door
- Heating control
- Fill station

Please also note the service water pump example.

Air-conditioning system

Requirements for an air-conditioning system

An air-conditioning system supplies fresh air into a room and exhausts the contaminated air. Let us look at the following sample system:

- A room contains an extractor fan and a fresh-air fan.

- Each fan is monitored by means of a flow sensor.

- The pressure in the room may rise above the atmospheric pressure.

- The fresh-air fan may only be switched on if the flow sensor signals the safe operational state of the extractor fan.

- A warning lamp indicates failure of one of the fans.

Standard solution

The fans are monitored by means of flow sensors. If no air flow is registered after a short delay time has expired, the system is switched off and an error message is generated, which can be acknowledged by pressing the off button.

Fan monitoring requires an analyzer circuit with several switching devices, in addition to the flow sensors. A single IDEC SmartRelay device can replace this analyzer circuit.

WindLGC solution

The use of IDEC SmartRelay reduces the amount of switchgear. Thus, you save installation time and space in the control cabinet. You may even be able to use as a smaller control cabinet.

With IDEC SmartRelay you can also switch off the fans sequentially after the system is switched off.

The circuit in WindLGC

The system is switched on and off at the inputs I1 and I2. The fans are connected to outputs Q1 and Q2, the flow sensors are connected to the inputs I3 and I4. Blocks B007 and B008 are used to set the watchdog times after which the flow sensors should send a signal to the fault output Q3.
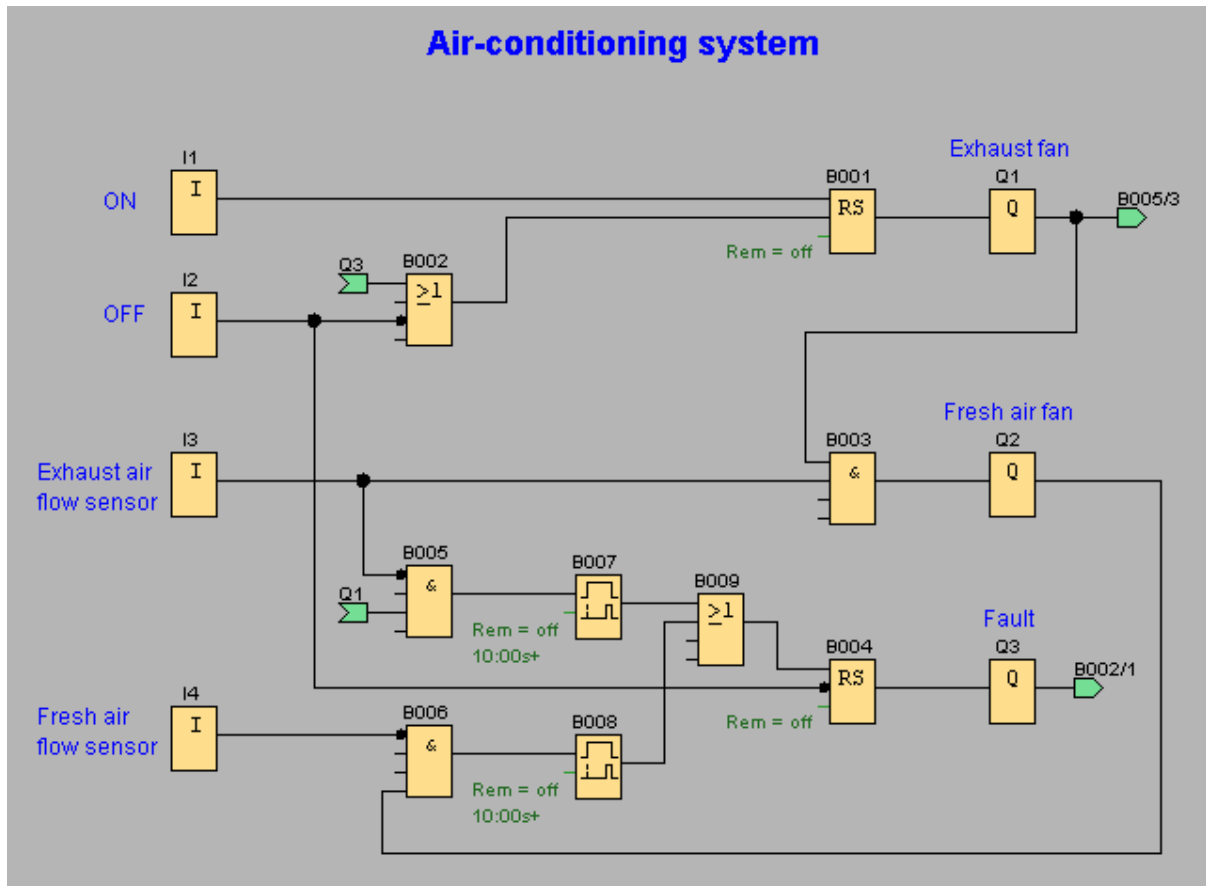
You can invert output Q3 to use output messages at Q4. Relay Q4 only drops out if main power is lost or if there is a fault in the system. The output can then be used for a remote message.

Factory door

Requirements for a gate control system

In many cases a factory entrance is closed with roll gates. Those gates are only opened when vehicles need to enter or leave the factory grounds. The gate is controlled by a gatekeeper.

- The sliding gate is opened and closed by means of a pushbutton control in the gatehouse. The gatekeeper can monitor the gate operation.

- The roll gate is normally fully opened or it is closed. However, gate movements can always be interrupted.

- A flashing light is activated five seconds before the gate moves and while the gate is in motion.

- A safety pressure strip ensures that people are not injured and that no objects are trapped and damaged when the gate is closing.

Standard solution

There are many different control systems for operating automatic gates. The OPEN and CLOSE buttons initiate gate movements in the relevant direction, provided it is not already moving in the opposite direction. Movement of the gate is terminated either by means of the STOP button or the relevant limit switch.

WindLGC solution

A IDEC SmartRelay circuit provides a further feature compared to standard controls: The actuation of a safety bar interrupts the closing motion of the gate. Five seconds before the gate opens or closes, a flashing light is activated and signals the start of the movement. It continues flashing until the gate has stopped.

In contrast to standard solutions, IDEC SmartRelay offers an easy and economic means of modifying the control system.

Industrial gate
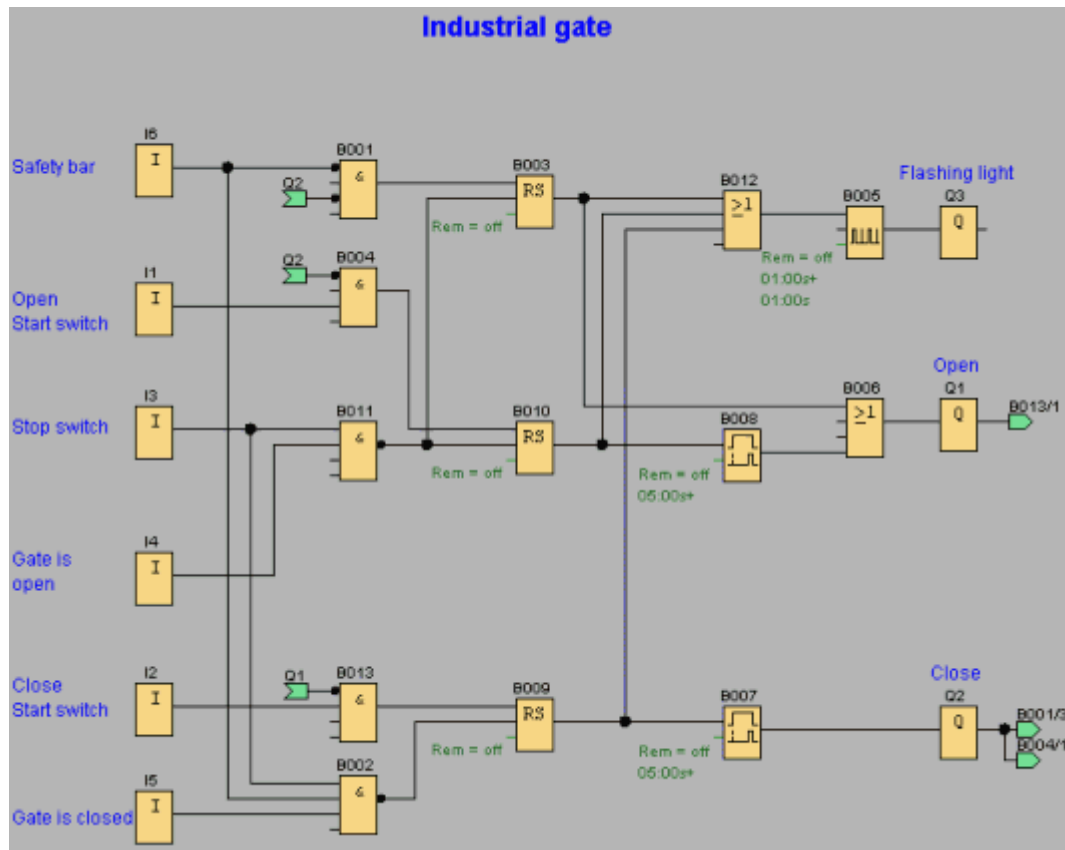
Heating control

Demands on the heating control

The example illustrates the counter rotational nature of lead temperature and outdoor temperature with a heating control.

The lead temperature of the heating should be controlled inversely proportional to the outdoor temperature. This means: The lower the outdoor temperature, the greater the lead temperature.

Outdoor and lead temperatures are measured using PT100 sensors.

With an outdoor temperature of 0 °C, the lead temperature (**x**) should be 50 °C.

If the outdoor temperature drops by more than 4 °C, the heating should switch on.

WindLGC solution
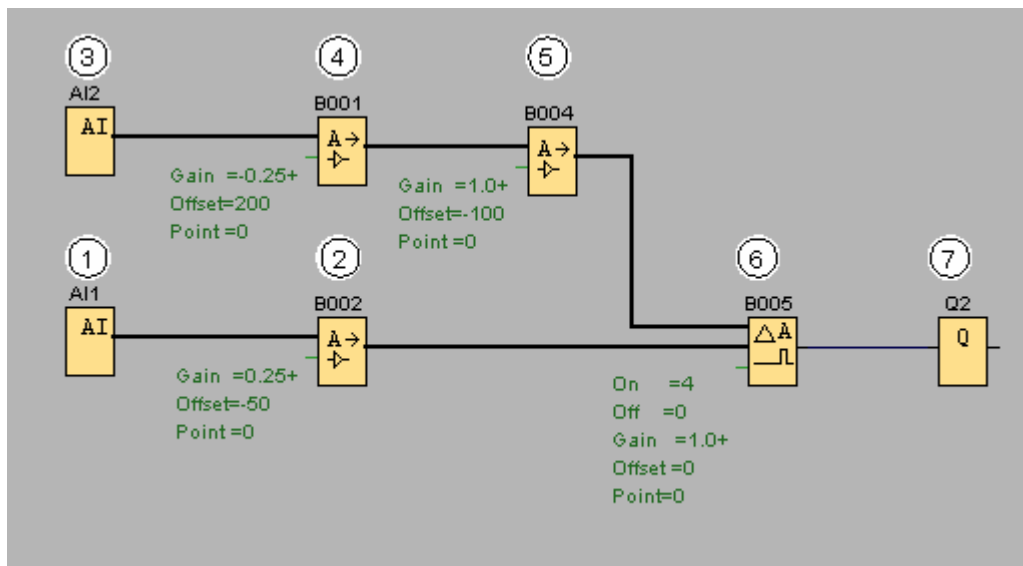
(1)   A PT100 sensor is connected to an AI1, and this measures the lead temperature.

(2)   The analog amplifier is parameterized as follows:
- Sensor: PT100 (proportional)
- Measuring range and parameters are stipulated by the PT100 sensors.
- Unit: Celsius
- Resolution: x 1

The amplifier causes the actual temperature that has been measured by the sensor to be issued on its output.

(3)   A PT100 sensor is connected to an AI2, and this measures the outside temperature.

(4)   The analog amplifier is parameterized as follows:
- Sensor: PT100 (**inversely** proportional)
- Measuring range and parameters are stipulated by the PT100 sensors.
- Unit: Celsius
- Resolution: x 1

The amplifier causes a value that is inversely proportional to the temperature measured by the sensor to be issued on its output.

Hence: The greater the outside temperature, the lower the issued value.

⑤   The analog amplifier is parameterized as follows:

- Sensor: No sensor

- Gain: 1

- Offset: -100 (**y**)

The value issued by ④ is edited (standardized) by this analog amplifier in such a way that it can be compared with the lead temperature.

⑥   The analog comparator is parameterized as follows:

- Sensor: No sensor

- Gain: 1

- Offset: 0

- Threshold value in: 4

- Threshold value out: 0

The analog comparator switches on the output Q2 ⑦ if the difference between the lead temperature and the standardized outdoor temperature exceeds 4 °C.

If the difference falls short of 0 °C, the analog comparator switches the output Q2 back off again.

⑦   Output Q2 switches the heating on and off.

Mode of operation

The outside temperature drops; this causes the value issued on the analog amplifier ⑥ to increase to the same extent. The difference on the analog comparator between the lead and the outside temperature increases.

If the difference exceeds 4 °C the heating is switched on.

By switching on the heating the lead temperature increases. Because of this, the difference on the analog comparator between the lead and the outside temperature lowers (provided the outside temperature drops more slowly than the lead temperature increases).

If the difference falls short of 0 °C, the heating is switched off.

Changing parameters

The Offset (y) parameter with the analog amplifier ⑤ depends on your desired lead temperature (x) with 0 °C outside temperature. The parameter is calculated as follows:

$y = x - 150$

Furthermore, the switch-on threshold and the switch-off threshold of the heating can change by means of the threshold value of the analog comparator ⑥.

Note

You can save block ⑤ if you adapt the threshold value in the analog comparator accordingly.

Try it out!

The example can be found as a circuit program on the WindLGC CD-ROM. Load the circuit program in WindLGC and try out the instructions above in simulation mode.

Fill station

Requirements for a fill station

A box shall be filled with two different items, up to a specified total for each item. When all items are in the box, it will be transported to the packaging station. A conveyor belt transports the items of both types to the box. (This example does not show the filling conveyor belt.) This circuit program for this example uses two up/down counters to count the items of each type, an analog math instruction to sum the total number of items, and message texts to be displayed on the IDEC SmartRelay Display and Text Display (Text Display) that show the number of items of each type and the total number counted so far.

This process is described below:

- To fill the box, each item is transported by a conveyor belt to the box (not part of this example).

- The sequence in which the items fall into the box is random.

- Each item that falls into the box is counted by a sensor.

- The connected Text Display as well as the IDEC SmartRelay Display must display how many items of each kind have been counted, how many total items are in the box.

The circuit program in WindLGC

Light barriers are connected to the two inputs I1 and I2 sensors that detect when an item falls into the box. The two counters (B001 and B002) count each item for the two specific types of items as they fall into the box. The on-threshold of each counter specifies the maximum number possible for each item type. When the box is full, a conveyor belt activates for ten seconds to transport the filled box to the packaging station and to transport an empty box to the fill station.

The circuit program uses a message text function block to display on the Text Display and IDEC SmartRelay Display how many total items and how many of each type have been counted. The message text uses the "ticking" feature to alternate between displaying bar graphs of the counted items and displaying a text summary of the counts. In addition, the text part of the message text will be shown in either English or German, depending on the current character set configuration for message texts.
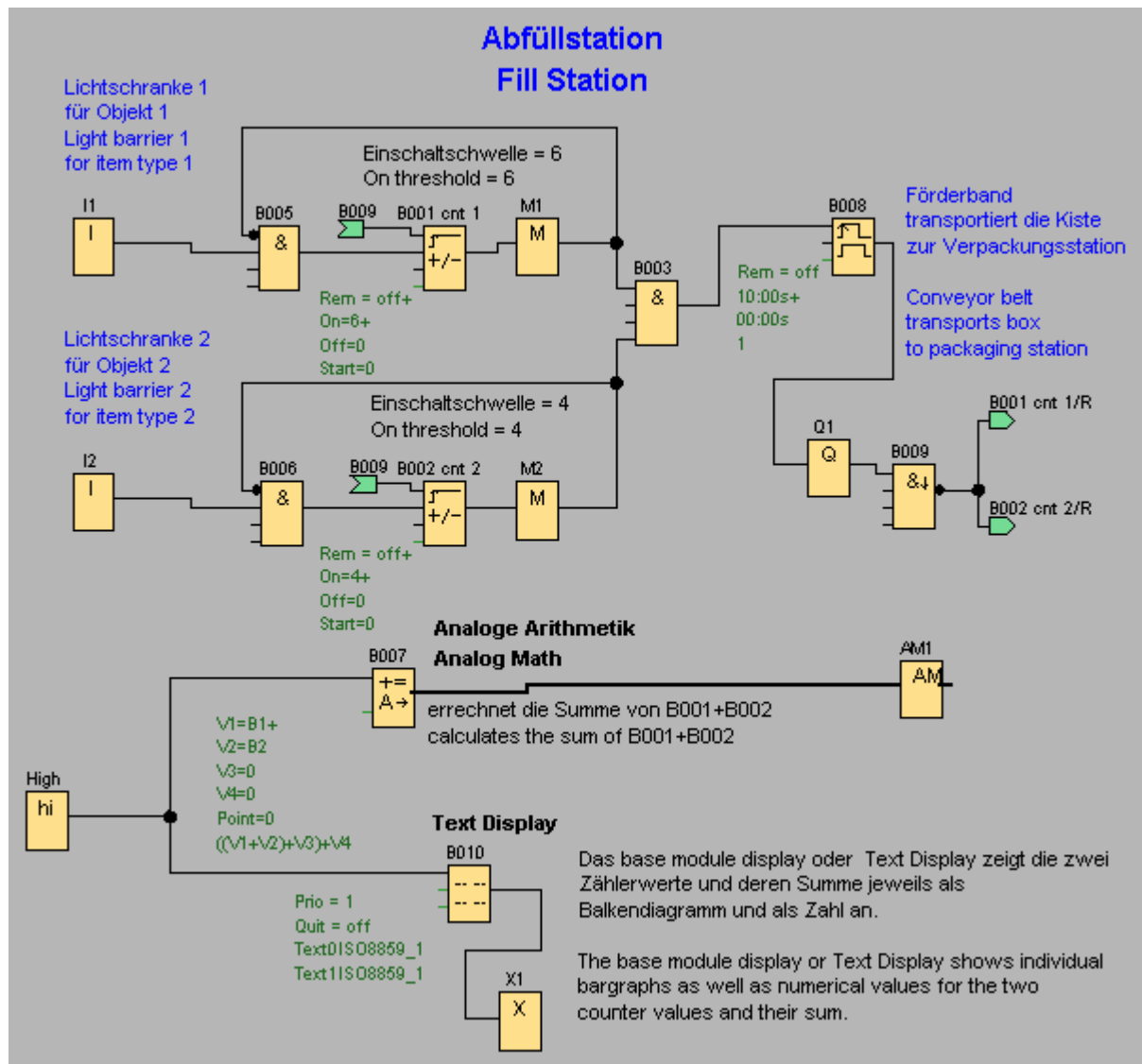
Parameters of the functions blocks

Note the following parameter usage:

- The on-thresholds of counters B001 and B002 define the maximum number of items of each item type to be put in the box.

- The pulse width (TH) of the Edge-triggered interval time-delay relay defines the duration of the movement of the conveyor belt.

- The Analog Math function block B007 that calculates the total is programmed as follows:

  Value 1 is a reference parameter to the current value of counter B001.

  Value 2 is a reference parameter to the current value of counter B002.

  Operator 1 is "+" to sum the two counters.

  Priority 1 is high. (This is the only operation in the function block, so the priority in this case is irrelevant).

  The remaining operands and operators are set to "+ 0" and do not affect the output of the equation.

Message texts

Message text block B010 displays a message text whose four lines all tick "line by line", such that two screen forms display in alternation. The first shows bar graph representations of the counted items (B001 and B002 current values) and a bar graph for the summed total items as calculated by B007. The second screen form shows the same values numerically and with text descriptions.

The message text function block is configured with two character sets enabled. The message text for character set 1 is configured with English text and the message text for character set 2 is configured with German text. You use the File -> Message Text Settings to select the two character sets. In this case you would select the same character set for both English and German characters. When IDEC SmartRelay is in run mode, the current character set selection for message texts determines which message will display.

Reference material

Constants and connectors

Constants and connectors - Overview

Co

This tool must be selected if you want to place input blocks, output blocks, Memory Markers or constants (high, low) on the programming interface. The specific type of block to be inserted is selected from an additional toolbar that pops up when you select the **Constants and Connectors** tool.

	Display in the FBD Editor	Display in the LAD Editor
	I Inputs	Normally Open Contact
	C Cursor keys	Analog Input
	F Text Display function keys	Normally Closed Contact
	S Shift register bits	Output
	lo **hi** Fixed Signal Levels	Output Not
	Q Outputs	
	X Open connectors	
	M Memory Markers	
	AI Analog inputs	
	AQ Analog outputs	
	AM Analog Memory Markers	

FL1A - FL1D

The number of available icons depends on the IDEC SmartRelay version you have selected.

FBD

Inputs

I – Q
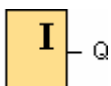
Input blocks represent the input terminals of IDEC SmartRelay. Up to 24 inputs are available to you.

173

In your block configuration, you can assign an input block a new input terminal, if this terminal is not already used in the circuit program.

Overview

Cursor keys
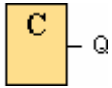
Up to four cursor keys are available to you. Cursor keys are programmed for the circuit program in the same ways as other inputs. Cursor keys can save switches and inputs, and allow operator control of the circuit program.

The four cursor keys on the Text Display are the same cursor key inputs on the IDEC SmartRelay Base module. Pressing ESC + C4B, for example, on either the Text Display or IDEC SmartRelay activates a single input for C4B.

Overview

Text Display Function Keys

The Text Display module has four function keys that you can use as inputs in your circuit program. You program the function keys in the same way as other inputs in your circuit program. Function keys can save switches and inputs, and allow operator control of the circuit program.
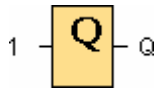
Outputs

Output blocks represent the output terminals of IDEC SmartRelay. You can use up to 16 outputs. In your block configuration, you can assign an output block a new terminal, provided this terminal is not already used in your circuit program.

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

Overview

Fixed Signal Levels
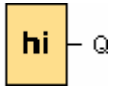
Set the block input to logical **hi** (hi = high) to set it permanently to logical '1' or 'H' state.
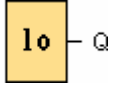
Set the block input to logical **lo** (lo = low) to set it permanently to logical '0' or 'L' state.

Overview

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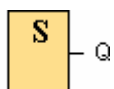
IDEC SmartRelay provides the shift register bits S1 to S8, which are assigned the read-only attribute in the circuit program. The content of shift register bits can only be modified by means of the Shift register special function.

Overview

Open connectors
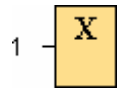
Interconnect the output of an unused block (for example, message texts) with the "open connector" block.

Overview

Memory Markers (digital and analog)
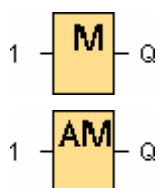
Memory Marker blocks output their input signal. IDEC SmartRelay provides 27 digital Memory Markers M1 ... M27 and 6 Analog Memory Markers AM1 ... AM6.

FL1C, FL1D: 24 Digital Memory Markers M1 ... M24; 6 Analog Memory Markers AM1..AM6

FL1B, FL1A: 8 Digital Memory Markers M1 ... M8

In your block configuration, you can assign a new number to the Memory Marker, provided this Memory Markersnumber does not already exist in your circuit program.

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

Startup Memory Marker: M8

The M8 Memory Marker is set in the first cycle of the user program and can thus be used in your circuit program as a **startup Memory Marker**. It is reset after the first program execution cycle.

In the subsequent cycles, the M8 Memory Marker reacts in the same way as the M1 to M7 Memory Markers.

Backlight Memory Markers: M25 and M26

The M25 Memory Marker controls the backlight of the IDEC SmartRelay Display. The M26 Memory Markers controls the backlight of the Text Display (Text Display).

You can use the outputs of timers, message texts, or other function blocks to activate the backlight Memory Markers. To enable multiple conditions to control the backlight of the devices, you can use multiple function blocks in parallel or in sequence.

Message text character set Memory Marker: M27

The M27 Memory Marker, if used, determines whether the message texts of the primary character set or the secondary character set will display. You select the two character sets from either the Msg Config menu of IDEC SmartRelay or the File -> Message Text Settings menu command of WindLGC. Then when you configure message texts, you select whether a particular message text consists of characters from the primary character set (Character Set 1) or the secondary character set (Character Set 2).

In the circuit program, M27 can be used to enable the message texts of either the primary or secondary character set and to disable the message texts of the other. When M27=0 (low), then IDEC SmartRelay only displays the message texts from the primary character set. When M27=1 (high), then IDEC SmartRelay only displays the message texts from the secondary character set.

Analog Memory Markers: AM1 to AM6

You can use the Analog Memory Markers serve as a markers for analog inputs or analog instruction blocks. The Analog Memory Marker merely accepts an analog value as input and outputs that value.

WindLGC V6.0

Overview

Analog inputs
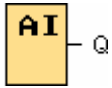
The IDEC SmartRelay versions FL1E-H12RCE, FL1E-B12RCE and FL1E-H12SND, as well as the expansion modules FL1B-J2B2 process analog signals. You can use up to eight analog inputs. In your block configuration, you can assign a new input terminal to an input block, provided this terminal is not already used in the circuit program.

Some of the input terminals of the IDEC SmartRelay FL1E-H12RCE, FL1E-B12RCE and FL1E-H12SND have a dual definition: they can be used as either inputs or analog inputs. See the IDEC SmartRelay manual or product information for specific information about specific modules. Circuit programs written for these modules for the FL1D release and earlier can run on FL1E modules without modification. New circuit programs can make use of the new input features, which provide additional fast-speed counters and analog capability.

For help on analog block parameters, refer to Information on analog value processing.

   The block input number is not determined by the hardware structure in systems operating with devices of the FL1A series.

Overview

Analog outputs
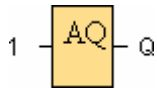
Two analog outputs are available, namely AQ1 and AQ2. You can only set an analog value at the analog output, that is, a function with an analog output or Analog Memory Marker AM.

If you connect a special function (that has an analog output) to a **real** analog output, then note that the analog output can only process values from 0 to 1000.

As of the FL1D device series, you can configure the behavior of analog outputs in STOPmode. Analog outputs can retain their last values when IDEC SmartRelay goes to STOP mode. Alternatively, you can configure specific values to be set for AQ1 and AQ2 when IDEC SmartRelay Goes to STOP mode.

You can also set the analog output value range. You have two choices:

- Normal (0 to 10 V or 0-20 mA)

- 4-20 mA

 FL1A to FL1D: You cannot configure the behavior of AQ1 and AQ2 on transition to STOP mode for IDEC SmartRelay modules prior to the FL1D device series.

Note:
The analog output module that supports 0/4..20mA outputs has not yet been released. (As of Oct. 2008).

Overview

LAD
Normally Closed Contact

Normally Closed Contacts, as well as normally open contacts and analog inputs represent the input terminals of a IDEC SmartRelay module.

A pop-up window opens when you insert the contact in your circuit diagram. In this dialog you can specify the type of input according to your IDEC SmartRelay. The cursor keys are also available as inputs as are the Text Display function keys if you have a Text Display module.You can also select a fixed logical level for the input.

To change an input in your LAD circuit diagram, double-click on the corresponding block to open a pop-up window in which you can make your changes.

Overview

Normally Open Contact

Normally Open Contacts, as well as normally closed contacts and analog inputs represent the input terminals of a IDEC SmartRelay module.

A pop-up window opens when you place the contact into your circuit diagram. In this dialog, you can specify the type of input according to the IDEC SmartRelay used. The cursor keys are also available as inputs as are the Text Display function keys if you have a Text Display module. You can also select a fixed logical level for the input.

To change an input in your LAD circuit diagram, double-click on the corresponding block to open the relevant pop-up dialog.

Overview

Analog Input

Analog Inputs, as well as normally closed contacts and normally open contacts represent the input terminals of a IDEC SmartRelay device.

A pop-up window opens when you insert the contact in your circuit diagram. In this dialog you can specify the type of input according to your IDEC SmartRelay device.

To change an input in your LAD circuit diagram, double-click on the corresponding block in your circuit diagram to open a pop-up window in which you can make your changes.

Overview

Output

{}

Outputs represent the output terminals like output not and analog outputs on a IDEC SmartRelay.

To change an output in your LAD circuit diagram, double-click on the corresponding block to open a pop-up window in which you can assign various functions to the output.

Overview

Output Not

Output Nots, as well as outputs and analog outputs represent the output terminals of a IDEC SmartRelay device.

To change an output in your LAD circuit diagram, double-click on the corresponding block to open a pop-up window in which you can assign various functions to the output.

Overview

Analog output

Analog outputs represent the output terminals like outputs and output not on a IDEC SmartRelay.

To change an output in your LAD circuit diagram, double-click on the corresponding block to open a pop-up window in which you can assign various functions to the output.

If you connect a special function that has an analog output to a **real** analog output, then note that the analog output can only process values from 0 to 1000.

Overview

Internal Memory Markers

You can use an internal Memory Marker to terminate a current path and continue it in a new path.

Contrary to the Memory Marker block, this does not use a Memory Marker resource of your IDEC SmartRelay device.

Overview

Basic functions (only FBD Editor)

Basic functions (FBD Editor only) - Overview

This tool has to be selected if you want to place standard Boolean logic blocks on the programming interface. The specific type of block is selected from this group from an additional toolbar that is opened when you select the **basic functions** tool.

	AND		OR
	AND with Edge Detection		NOR
	NAND		XOR
	NAND with Edge Detection		NOT

Inverting the inputs

You can invert individual inputs:

- A logical "1" at a specific input is inverted to logical "0" in the circuit program.
- A logical "0" is inverted to logical "1" in the circuit program.

To do so, right-click on the input and select the **invert** command from the shortcut menu.

You cannot invert the inputs of output blocks.

FL1A-FL1B:
To invert an input, use the basic function NOT.

Timing diagrams

Each timing diagram of the basic functions displays three inputs to make evaluation easier for you.

FL1A-FL1B:

The basic functions have three inputs.

AND
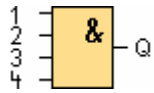
The output of an AND function is only 1 if **all** inputs are 1, that is, when they are closed.

A block input that is not used (x) is assigned: x = 1.

AND function logic table

Input 1	Input 2	Input 3	Input 4	Output
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

Overview

AND with Edge Detection
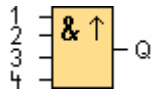
The output of an AND with Edge Detection is only 1 if **all** inputs are 1 and **at least one** input was 0 during the last cycle.

The output is set to 1 for the duration of one cycle and must be reset to 0 for the duration of the next cycle before it can be set to 1 again.

A block input that is not used (x) is assigned: x = 1.

Timing diagram of an AND with Edge Detection:
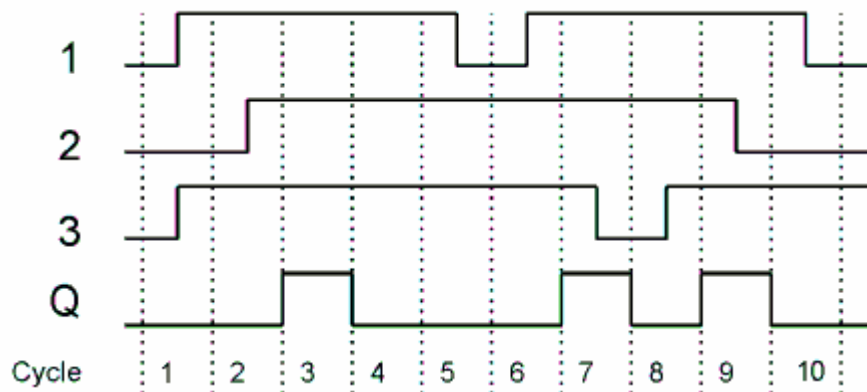
Overview

NAND
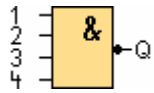
The output of an NAND function is only 0 if **all** inputs are 1, i.e. when they are closed.

A block input that is not used (x) is assigned: x = 1.

NAND function logic table

Input 1	Input 2	Input 3	Input 4	Output
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

Overview

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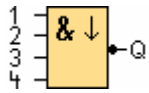
The output of a NAND with Edge Detection is only 1 if **at least one** input is 0 and **all** inputs were 1 during the last cycle.

The output is set to 1 for the duration of one cycle and must be reset to 0 at least for the duration of the next cycle before it can be set to 1 again.

A block input that is not used (x) is assigned: x = 1.

Timing diagram of a NAND with Edge Detection
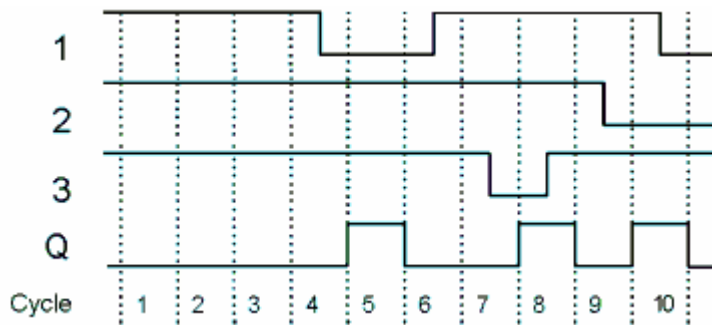
Overview

OR
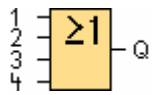
The output of an OR is 1 if **at least one** input is 1 (closed).

A block input that is not used (x) is assigned: x = 0.

OR function logic table

Input 1	Input 2	Input 3	Input 4	Output
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

Overview

NOR
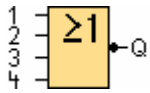
The output of a NOR (NOT OR) is only 1 if **all** inputs are 0 (open). When one of the inputs is switched on (logical 1 state), the output is switched off.

A block input that is not used (x) is assigned: x = 0.

NOR function logic table

Input 1	Input 2	Input 3	Input 4	Output
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

Overview

XOR
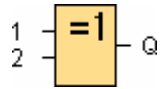
The XOR (exclusive OR) output is 1 if the signal status of the inputs is **different**.

A block input that is not used (x) is assigned: x = 0.

XOR function logic table

Input 1	Input 2	Output
0	0	0
0	1	1
1	0	1
1	1	0

Overview

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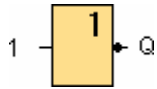
The output is 1 if the input is 0. The NOT block inverts the input status.

Advantage of the NOT, for example: IDEC SmartRelay no longer requires normally closed contacts. You simply use a normally open contact and convert it into a normally closed contact with the help of the NOT function.

NOT function logic table

Input 1	Output
0	1
1	0

Overview

Special functions

Special functions - Overview

This tool has to be selected if you want to place additional retentive or time-related function blocks on the programming interface. The specific type of block is selected from an additional toolbar that opens when you select the **SFB** tool.

This topic also describes the following tasks or characteristics of the special functions:

- Inverting inputs
- Block configuration
- Reference parameters
- Protection
- Retentivity

The special functions are organized by group and are listed below:

Timers	Analog
On-delay	Analog trigger
Off-delay	Differential analog trigger
On-/Off-delay	Analog comparator
Retentive on-delay	Analog value monitoring
Interval time-delay relay/Pulse output	Analog amplifier
Edge-triggered interval time-delay relay	Analog multiplexer

Symmetrical clock pulse generator

Pulse width modulator (PWM)

Asynchronous pulse generator

Analog math

Random generator

Control and Regulate

Stairwell Light switch

PI controller

Dual-function switch

Analog ramp control

Seven-day time switch

Others

Twelve-month time switch

Latching relay

Counters

Current impulse relay

Up/down counter

Message text

Operating hours counter

Softkey

Frequency trigger

Shift register

Analog math error detection

The **LAD Editor** offers you the following additional functions:

AND with Edge Detection

NAND with Edge Detection

FBD editor: description of the blocks of special functions

The description of the blocks of special functions in the circuit diagram begins with timer blocks ("T"), with counter blocks ("C") and with the remaining blocks ("SF").

The IDEC SmartRelay version you have selected determines these characteristics of your circuit program:

- Available blocks
- Parameters that you can set

Inverting inputs

You can invert individual inputs:

- A logical "1" at a specific input is inverted to logical "0" in the circuit program.

- A logical "0" is inverted to logical "1" in the circuit program.

To do so, right-click on the input and select the **invert** command from the shortcut menu.

You cannot invert the inputs of output blocks.

Note: Unused logical inputs default to logical "0".

FL1A-FL1B:
To invert an input, use the basic function NOT.

Block configuration

The block properties dialog provides you with an easy means of setting the various block parameters.

Reference functionality

You can also assign parameters to blocks by means of other blocks. Such parameters are called reference parameters.

If you click on the Reference button next to a parameter in the block properties window, you can select which other block provides the actual value for that parameter. For example, if you click the Reference button for the Off-Delay parameter of an Off-Delay timer, you can then choose a specific block to use to provide the time value of the timer. WindLGC displays the set of available blocks in your circuit program that you can use to provide the reference parameter.

This way it is possible, for example, to assign the time of an off-delay timer from an analog output value from another block.

A quick way of changing block parameters

Protection

If a **Protection Active** check box exists for the protection of a block parameter, you can enable or lock the display and editing of this parameter in IDEC SmartRelay configuration mode.

Retentivity

The switching state and counter values of SFBs can be retentive. This means that the current data values are retained, for example after a power failure, so that the function is resumed at the break position after power on. Hence, a timer is not reset, but instead the time-to-go expires.

However, to enable this feature for the relevant function, retentivity needs to be set. There are two possible settings:

- on: Current data values are retained

- off: Current data values are not retained (default).

The operating hours counter is an exception, because it is generally retentive.

Timers
On-delay

Short description

The output is not switched on until a configured delay time has expired.

Connection	Description
Trg input	The on-delay time is triggered via the Trg (Trigger) input.
Parameter	**T** represents the on-delay time after which the output is switched on (output signal transition 0 to 1). **Retentivity** on = the status is retentive in memory.
Output **Q**	Q switches on after a specified time T has expired, provided Trg is still set.

Parameter T

The time in parameter T can be provided by the value of another already-programmed function:

- Analog comparator: Ax - Ay

- Analog trigger: Ax

- Analog amplifier: Ax

- Analog multiplexer: AQ

- Analog ramp: AQ

- Analog math: AQ

- PI controller: AQ

- Up/down counter: Cnt

You select the required function by the block number.

For information on the validity and accuracy of the time base, refer to the IDEC SmartRelay manual.

Timing diagram
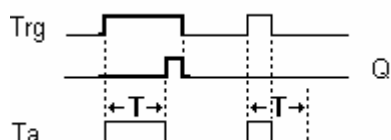
Description of the function

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

If the status at input Trg stays 1 at least for the duration of the configured time T, the output is set to 1 when this time has expired (the on signal of the output follows the on signal of the input with delay).

The time is reset if the status at input Trg changes to 0 again before the time T has expired.

The output is reset to 0 when input Trg is 0.

Overview: Special Functions

Off-delay

Short description

The output with off delay is not reset until a defined time has expired.

Connection	Description
Input **Trg**	Start the off-delay time with a negative edge (1 to 0 transition) at input Trg (Trigger).
Input **R**	Reset the off-delay time and set the output to 0 via the R (Reset) input. Reset has priority over Trg.
Parameter	**T:** The output is switched off on expiration of the delay time T (output signal transition 1 to 0). **Retentivity** on = the status is retentive in memory.
Output **Q**	Q is switched on for the duration of the time T after a trigger at input Trg.

Parameter T

The time set in parameter T can be supplied by the value of another already-programmed function:

- Analog comparator: Ax - Ay

- Analog trigger: Ax

- Analog amplifier: Ax

- Analog multiplexer: AQ

- Analog ramp: AQ

- Analog math: AQ

- PI controller: AQ

- Up/down counter: Cnt

You select the required function by the block number.

For information on the validity and accuracy of the time base, refer to the IDEC SmartRelay manual.

Timing diagram
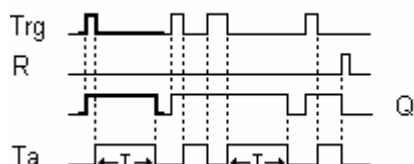
Description of the function

Output Q is set to 1 instantaneously with a 0 to 1 transition at input Trg.

At the 1 to 0 transition at input Trg, IDEC SmartRelay retriggers the current time T, and the output remains set. The output Q is reset to 0 when T_a reaches the value specified in T (T_a=T) (off delay).

A one-shot at input Trg retriggers the time Ta.

You can reset the time Ta and the output via the input R (Reset) before the time Ta has expired.

Overview: Special Functions

On-/Off-delay

Short description

The on/off delay function block is used to set an output after a configured on-delay time and then reset it again upon expiration of a second configured time.

Connection	Description
input **Trg**	You trigger the on-delay with a positive edge (0 to 1 transition) at input Trg (Trigger). You trigger the off-delay with a negative edge (1 to 0 transition).
Parameter	T_H is the on-delay time for the output (output signal transition 0 to 1). T_L is the off-delay time for the output (output signal transition 1 to 0). **Retentivity** on = the status is retentive in memory.
Output **Q**	Q is switched on upon expiration of a configured time T_H if Trg is still set. It is switched off again upon expiration of the time T_L and if Trg has not been set again.

Parameters T_H and T_L

The on-delay time and off-delay time set in parameter T_H and T_L can be provided by the actual value of another already-programmed function:

- Analog comparator: Ax - Ay

- Analog trigger: Ax

- Analog amplifier: Ax

- Analog multiplexer: AQ

- Analog ramp: AQ

- Analog math: AQ

- PI controller: AQ

- Up/down counter: Cnt

You select the required function by the block number.

For information on the validity and accuracy of the time base, refer to the IDEC SmartRelay manual.

Timing diagram
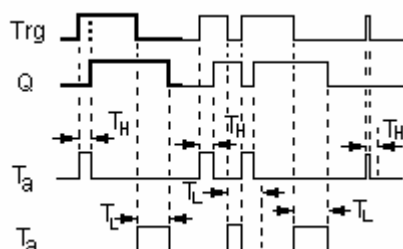
Description of the function

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

If the status at input Trg is 1 for at least the duration of the configured time T_H, the output is set to logical 1 upon expiration of this time (output is on-delayed to the input signal).

The time T_H is reset if the status at input Trg is reset to 0 before this time has expired.

The time T_L is triggered with the 1 to 0 transition at the output.

If the status at input Trg remains 0 at least for the duration of a configured time T_L, the output is reset to 0 upon expiration of this time (output is off delayed to the input signal).

The time T_L is reset if the status at input Trg returns to 1 before this time has expired.

Overview: Special Functions

Retentive on-delay
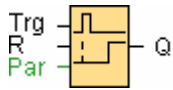
Short description

A one-shot at the input triggers a configurable time. The output is set upon expiration of this time.

Connection	Description
Input **Trg**	Trigger the on-delay time via the Trg (Trigger) input.
Input **R**	Reset the on-delay time and reset the output to 0 via input R (Reset). Reset takes priority over Trg.
Parameter	**T** is the on-delay time for the output (output signal transition 0 to 1). **Retentivity** on = the status is retentive in memory.
Output **Q**	Q is switched on upon expiration of the time T.

Parameter T

The time in parameter T can be provided by the value of another already-programmed function:

- Analog comparator: Ax - Ay
- Analog trigger: Ax
- Analog amplifier: Ax
- Analog multiplexer: AQ
- Analog ramp: AQ
- Analog math: AQ
- PI controller: AQ
- Up/down counter: Cnt

You select the required function by the block number.

Timing diagram
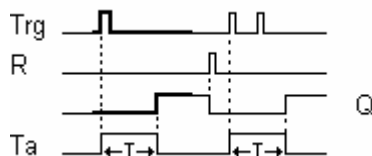
Description of the function

The current time Ta is triggered with a 0 to 1 signal transition at input Trg. Output Q is set to 1 when Ta reaches the time T. A further pulse at input Trg does not affect Ta.

The output and the time Ta are only reset to 0 with a 1 signal at input R.

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

Overview: Special Functions

WindLGC V6.0

Interval time-delay relay/Pulse output
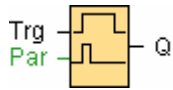
Short description

An input signal generates an output signal of a configurable length.

| Connection	Description
Input **Trg**	You trigger the time for the interval time-delay relay with a signal at input Trg (Trigger).
Parameter	**T** represents the time after which the output is reset (output signal transition 1 to 0). **Retentivity** set (on) = the status is retentive in memory.
Output **Q**	A pulse at Trg sets Q. The output stays set until the time T has expired and if Trg = 1 for the duration of this time. A 1 to 0 transition at Trg prior to the expiration of T also resets the output to 0.

Parameter T

The off time T can be provided by the actual value of another already-programmed function:

- Analog comparator: Ax - Ay

- Analog trigger: Ax

- Analog amplifier: Ax

- Analog multiplexer: AQ

- Analog ramp: AQ

- Analog math: AQ

- PI controller: AQ

- Up/down counter: Cnt

You select the required function by the block number.

Timing diagram
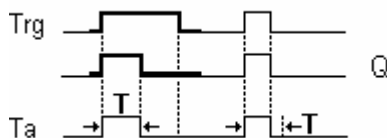
Description of the function

With the input signal Trg = 1, output Q is set to 1. The signal also triggers the time Ta, while the output remains set.

When Ta reaches the value defined at T (Ta=T), the output Q is reset to 0 state (pulse output).

If the signal at input Trg changes from 1 to 0 before this time has expired, the output is immediately reset from 1 to 0.

Overview: Special Functions

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.

Connection	Description
Input **Trg**	You trigger the times for the Edge-triggered interval time-delay relay with a signal at input Trg (Trigger).
Input **R**	The output and the current time Ta are reset to 0 with a signal at input R.
Parameter	**TH, TL:** The pulse width TH and the interpulse width TL are adjustable. **N** determines the number of pulse/pause cycles TL / TH: Value range: 1...9. **Retentivity** set (on) = the status is retentive in memory.
Output **Q**	Output Q is set when the time T_L has expired and is reset when T_H has expired.

FL1A, FL1B:

Only the parameter T_H exists. T_H represents the off-delay time for the output.

Input R is not available

Parameters TH and TL

The pulse width TH and the interpulse width TL can be provided by the actual value of another already-programmed function:

- Analog comparator: Ax - Ay
- Analog trigger: Ax
- Analog amplifier: Ax
- Analog multiplexer: AQ
- Analog ramp: AQ
- Analog math: AQ
- PI controller: AQ
- Up/down counter: Cnt

You select the required function by the block number.

Timing diagram
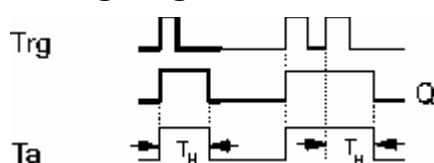
$T_L = 0$; N = 1

Description of the function

With the change at input Trg to 1, the time T_L (time low) is triggered. After the time T_L has expired, output Q is set to 1 for the duration of the time T_H (time high).

If input Trg is retriggered prior to the expiration of the preset time ($T_L + T_H$), the time Ta is reset and the pulse/pause period is restarted.

Overview: Special Functions

Symmetrical clock pulse generator

FL1A ⋮ **FL1D**

The Symmetrical clock pulse generator is only available for devices of the series FL1B.

IDEC SmartRelay devices of the current series use an asynchronous pulse generator instead of the Symmetrical clock pulse generator.

En —
T

Q
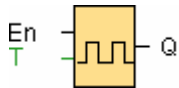
Short description

The function outputs a pulse signal with a configurable period.

Connection	Description
Input **En**	You enable (En=1) or disable (En=0) the pulse generator with the signal at input En (Enable).
Parameter	**T** is the on or off time of the output.
Output **Q**	Q is toggled periodically on and off with the pulse time T.

Timing diagram

En

Q
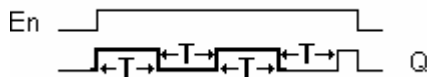
Description of function

You define the length of the on and off times at the parameter T. The **En** input enables the pulse generator. The pulse generator sets the output to 1 for the duration of the time T, then to 0 for the duration of the time T and so forth, until input En = 0.

Always specify a time T of 0.1 s. A time T is not defined for T = 0.05 s and T = 0.00 s.

Overview: Special Functions

Asynchronous pulse generator
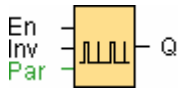
Description of function

The pulse shape at the output can be modified by a configurable pulse/pause ratio.

Connection	Description
Input **En**	You enable/disable the asynchronous pulse generator with the signal at input En.
Input **Inv**	The Inv input can be used to invert the output signal of the active asynchronous pulse generator.
Parameter	**TH,TL:** You can customize the pulse width (TH) and the interpulse width (TL). **Retentivity** set (on) = the status is retentive in memory.
Output **Q**	Q is toggled on and off cyclically with the pulse/pause times T_H and T_L .

Parameters TH and TL

The pulse width TH and the interpulse width TL can be provided by the actual value of another already-programmed function:

- Analog comparator: Ax - Ay
- Analog trigger: Ax
- Analog amplifier: Ax
- Analog multiplexer: AQ
- Analog ramp: AQ
- Analog math: AQ
- PI controller: AQ
- Up/down counter: Cnt

You select the required function by the block number.

Timing diagram

Description of the function

You can set the pulse/pause ratio at the TH (Time High) and TL (Time Low) parameters.

The INV input can be used to invert the output signal. The input block INV only inverts the output signal if the block is enabled with EN.

Overview: Special Functions

Random generator

En —⊓ — Q
Par —

Short description

The output of a random generator is toggled within a configurable time.

| Connection	Description
Input **En**	The positive edge (0 to 1 transition) at the enable input En (Enable) triggers the on-delay for the random generator. The negative edge (1 to 0 transition) triggers the off-delay for the random generator.
Parameter	**TH:** The on-delay is determined at random and lies between 0 s and T_H. **TL:** The off-delay is determined at random and lies between 0 s and T_L.
Output **Q**	Q is set on expiration of the on-delay if En is still set. It is reset when the off-delay time has expired and if En has not been set again.

Parameters TH and TL

The on-delay time TH and the off-delay time TL can be provided by the actual value of another already-programmed function:

- Analog comparator: Ax - Ay

- Analog trigger: Ax

- Analog amplifier: Ax

- Analog multiplexer: AQ

- Analog ramp: AQ

- Analog math: AQ

- PI controller: AQ

- Up/down counter: Cnt

You select the required function by the block number.

Timing diagram

Description of the function

216
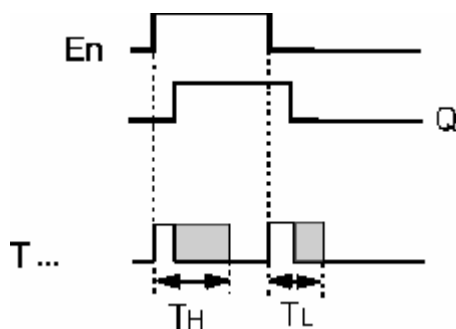
With the 0 to 1 transition at input En, a random time (on-delay time) between 0 s and T_H is set and triggered. If the status at input En is 1 for at least the duration of the on-delay, the output is set to 1 when this on-delay time has expired.

The time is reset if the status at input En is reset to 0 before the on-delay time has expired.

When input En is reset 0, a random time (off-delay time) between 0 s and T_L is set and triggered.

If the status at input En is 0 at least for the duration of the off-delay time, the output Q is reset to 0 when the off-delay time has expired.

The time is reset if the status at input En returns to 1 before the on-delay time has expired.

Overview: Special Functions

Stairwell Light switch

Trg ⌐ Par ⌐ Q
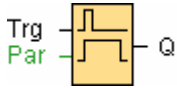
Short description

The edge of an input pulse triggers a configurable time. The output is reset when this time has expired. An off warning can be output prior to the expiration of this time.

Connection	Description
Input **Trg**	You trigger the time (off-delay) for the stairway switch with a signal at input Trg (Trigger).
Parameter	**T:** The output is reset (1 to 0 transition) when the off-delay time T has expired. **T$_!$** determines the triggering time for the prewarning. **T$_{!L}$** determines the length of the prewarning time. **Retentivity** set (on) = the status is retentive in memory.
Output **Q**	Q is reset after the time T has expired. A warning signal can be output before this time has expired.

Parameters T, T$_!$ and T$_{!L}$

The off-delay time T, the prewarning time T$_!$ and the prewarning period T$_{!L}$ can be provided by the actual value of another already-programmed function:

- Analog comparator: Ax - Ay

- Analog trigger: Ax

- Analog amplifier: Ax

- Analog multiplexer: AQ

- Analog ramp: AQ

- Analog math: AQ

- PI controller: AQ

- Up/down counter: Cnt

You select the required function by the block number.

Timing diagram
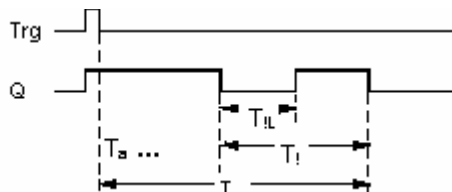
FL1A, FL1B:
The prewarning time is set to 15 s. The T$_!$ and T$_{!L}$ parameters thus become obsolete.
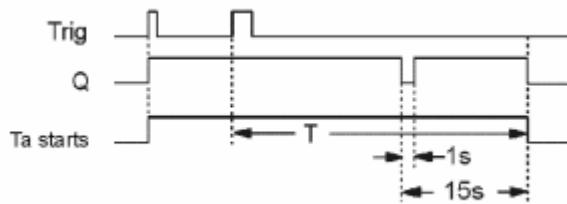
Changing the time base

You can change the prewarning time base and the period.

Time base T	Prewarning time	Prewarning period
Seconds*	750 ms	50 ms
Minutes	15 s	1 s
Hours	15 min	1 min

* makes sense only for programs with a cycle time of < 25 ms

Description of the function

Output Q is set to 1 with a 0 to 1 signal transition at input Trg. The 1 to 0 transition at input Trg triggers the current time and output Q remains set.

Output Q is reset to 0 when Ta reaches the time T. Before the off delay time $(T - T_!)$ has expired, you can output a prewarning that resets Q for the duration of the off prewarning time $T_{!L}$.

Ta is retriggered (optional) at the next high/low transition at input Trg and if Ta is expiring.

Scan cycle time

For information on how to determine the scan cycle time of a IDEC SmartRelay, refer to the appendix of the IDEC SmartRelay manual.

Overview: Special Functions

Dual-function switch
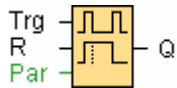
Short description

Switch with two different functions:

- Pulse switch with off delay

- Switch (continuous light)

Connection	Description
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 Ta and resets the output.
Parameter	**T:** determines the off-delay time. The output is reset (1 to 0 transition) when the time T expires. **T$_L$** determines the period during which the input must be set in order to enable the permanent light function. **T$_!$** determines the on delay for the prewarning time. **T$_{!L}$** determines the length of the prewarning time period. **Retentivity** set (on) = the status is retentive in memory.
Output **Q**	Output Q is set with a signal at input Trg, and it is reset again after a configured time has expired and depending on the pulse width at input Trg, or it is reset with another signal at input Trg.

Parameters T, T$_L$, T$_!$ and T$_{!L}$

The off-delay time T, the permanent light time T$_L$, the on-delay prewarning time T$_!$, and the prewarning time period T$_{!L}$ can be provided by the actual value of another already-programmed function:

- Analog comparator: Ax - Ay

- Analog trigger: Ax

- Analog amplifier: Ax

- Analog multiplexer: AQ

- Analog ramp: AQ

- Analog math: AQ

- PI controller: AQ

- Up/down counter: Cnt

You select the required function by the block number.

Timing diagram
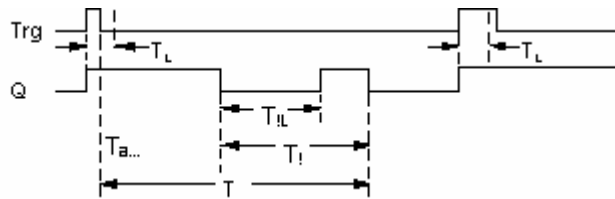
FL1A, FL1B:

Only the T_L and T parameters exist.

The output is reset when T has expired.

T_L determines the period during which the input must be set in order to enable the permanent light function.

Input R is not available to the user.
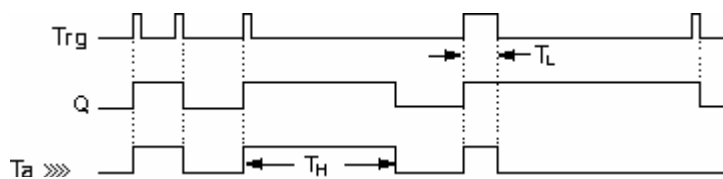
Description of the function

Output Q is set to 1 with a 0 to 1 signal transition at Trg.

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

The off-delay time T is triggered when the status at input Trg changes to 0 before the time T_L has expired.

Output Q is reset when the Ta = 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 off prewarning time $T_{!L}$. A subsequent signal at input Trg always resets T and output Q.

Caution

The time base for T, $T_!$ and $T_{!L}$ must be identical.

Overview: Special Functions

Seven-day time switch

No1 ──┐
No2 ──┤ 🕐 ├── Q
No3 ──┘
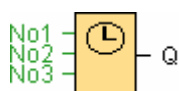
Caution

Your IDEC SmartRelay must be equipped with an internal real-time clock if you are going to use this SFB.

Short description

The output is controlled by means of a configurable on/off date. The function supports any combination of weekdays.

Connection	Description
Parameters No1, No2, No3	At the **No1, No2, No3** (Cam) parameters you set the on- and off-time triggers for each cam of the seven-day time switch. For each Cam you specify the day of the week and the time of day for the on- and off-times.
Par	You specify whether the timer pulses on for one cycle when activated and is then reset. The pulse parameter applies to all three cams.
Output Q	Q is set when the configured cam is actuated.

Timing diagram (three practical examples)
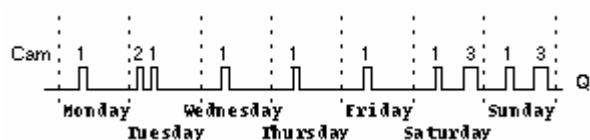
No1:   Daily: 06:30 h to 8:00 h

No2:   Tuesday: 03:10 h to 04:15 h

No3:   Saturday and Sunday: 16:30 h to 23:10 h

Description of the function

Each seven-day time switch is equipped with three cams. You can configure a time hysteresis for each individual cam. At the cams you set the on- and off-hysteresis. The seven-day time switch sets the output at a certain time, provided it is not already set.

The seven-day time switch resets the output at the off-time if you configured an off-time, or at the end of the cycle if you specified a pulse output. A conflict is generated in the seven-day time switch when the on-time and the off-time at another cam are identical. In this case, cam 3 takes priority over cam 2, while cam 2 takes priority over cam 1.

The switching status of the seven-day time switch is determined by the status at the No1, No2 and No3 cams.

On-times

The on-time is any time between 00:00 h and 23:59 h. 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. The off-time is disabled in this case as it is not applicable.

Special characteristics to note when configuring

The block properties window offers a tab for each one of the three cams. Here you can set the day of the week for each cam. Each tab offers you in addition an option of defining the on- and off-times for each cam in hour and minute units. Hence, the shortest switching cycle is one minute. Also on each tab you have the option of specifying a pulse output for the cam.

You can disable the on- and off-times individually. You can achieve switching cycles extending across more than one day, for example, by setting the on-time for cam 1 to Monday 7:00 h and the off-time of cam 2 to Wednesday 13:07 h, while disabling the on time for cam 2.
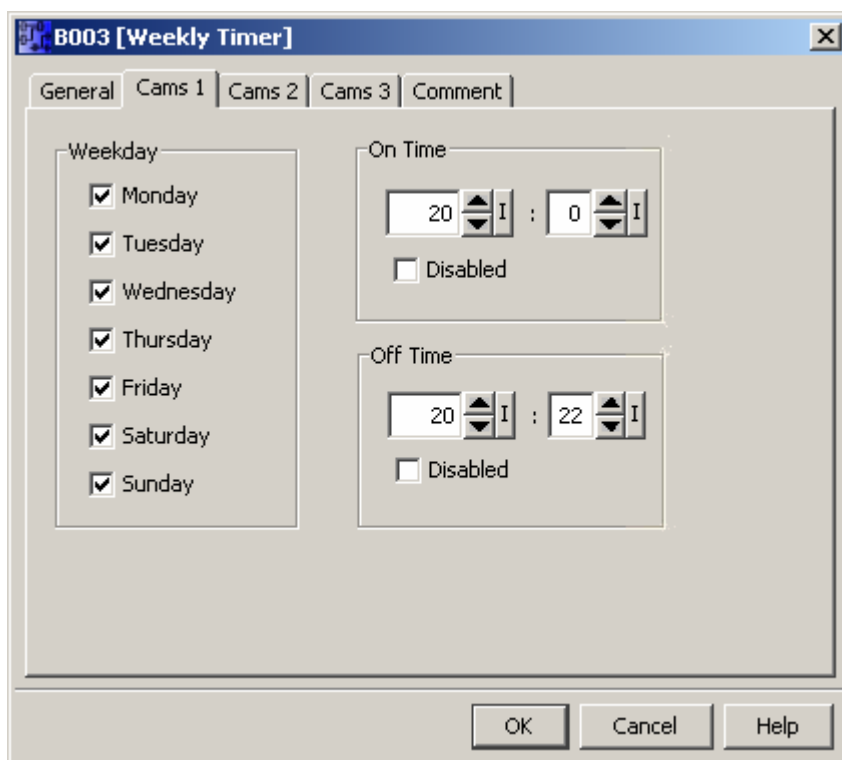
The **Pulse** setting is available only as of the FL1E device series.

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 ambient temperature, and is typically 80 hours at an ambient temperature of 25°C.

The IDEC SmartRelay FL1E devices and later support the option of a battery cartridge or a combined program module (memory) and battery cartridge. The real-time clock is buffered for several years with either of these cards.

Overview: Special Functions

Twelve-month time switch
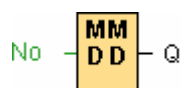
Short description

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.

Note: To use this function block, you must use a IDEC SmartRelay with an internal real-time clock.

Connection	Description
Parameter	At the **No** (cam) parameter, you configure the timer mode, the on-/off-times for the timer, and whether the output is a pulse output.
Output **Q**	Q is set on when the configured cam is switched on.

Timing diagrams

Example 1: Yearly selected, 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.
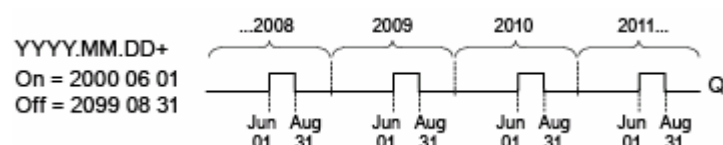
Example 2: Yearly selected, **Pulse** selected, On Time = 2000.03.15, Off Time = 2099.**.**. Every year on March 15, the timer switches on for one cycle.
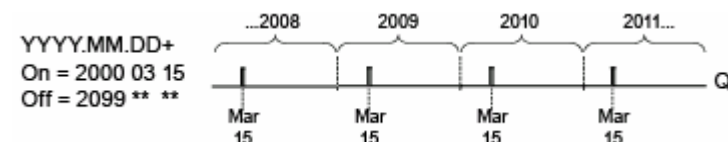
Example 3: Yearly selected, On Time = 2008.06.01, Off Time = 2010.08.31. On June 1 of 2008, 2009, and 2010, the timer output switches on and remains on until August 31.
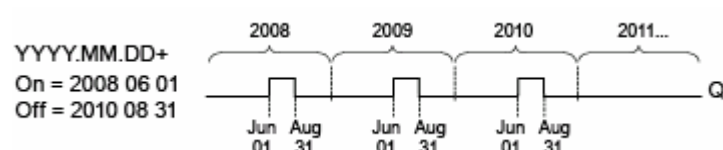
Example 4: Yearly selected, **Pulse** selected, On Time = 2008.03.15, Off Time = 2010.**.**. On March 15 of 2008, 2009, and 2010, the timer output switches on for one cycle.
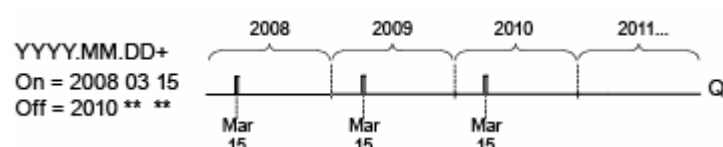
Example 5: Monthly not selected, **Yearly** not selected, On Time = 2008.06.01, Off Time = 2010.08.31. On June 1, 2008 the timer output switches on and remains on until August 31, 2010.
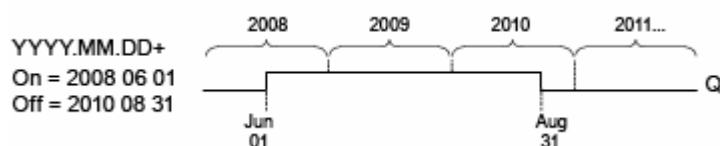
Example 6: **Monthly** not selected, **Yearly** not selected, **Pulse** selected, On Time = 2008.03.15, Off Time = ****.**.**. On March 15, 2008 the timer switches on for one cycle. Because the timer does not have a monthly action or yearly action, the timer output pulses only one time at the specified On Time.
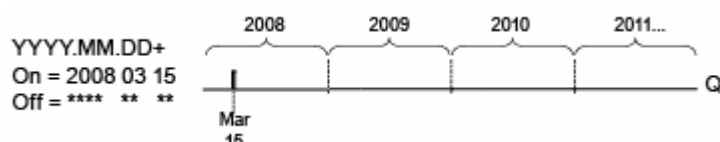
Example 7: Yearly selected, On Time = 2000.12.15, Off Time =2010. 01.07. On December 15 of 2008 and 2009, the timer output switches on and remains on until January 7 of the following year. When the timer output turns off on January 7, 2010 it does NOT turn on again the following December 15.
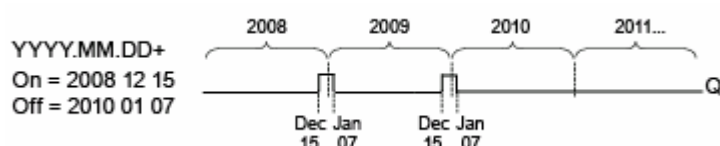
Example 8: Monthly selected, On Time = 2008.**.01, Off Time = 2010.**.05. Starting in 2008, on the first day of each month the timer output switches on and switches off on the fifth day of the month. The timer continues in this pattern through the last month of 2010.
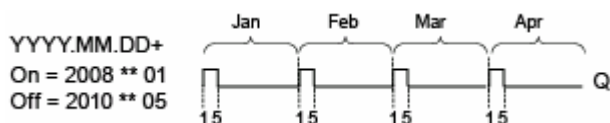
Description of the function

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 the month and day when the timer is set. The Off Time identifies the month and day on which 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.

When you select the **Monthly** check box, the timer output switches on each month at the specified day of the start time and remains on until the specified day of the Off Time. The On Year specifies the initial year in which the timer is activated. The Off Year defines the last year in which the timer turns off. The maximum year is 2099.

If you select the **Yearly** check box, the timer output switches on each year at the specified month and day of the start time and remains on until the specified month and day of the Off Time. The On Year specifies the initial year in which the timer is activated. The Off Year defines the last year in which the timer turns off. The maximum year is 2099.

If you select the **Pulse** check box, 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 select none of the Monthly, Yearly, or Pulse check boxes, 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 switchs with the outputs connected by an **OR** function block.

FL1A : FL1D The **Yearly** and **Pulse** settings are available only as of the FL1E device series

The **Monthly** setting is available only as of the FL1C device series.

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 ambient temperature, and is typically 80 hours at an ambient temperature of 25°C. If you are using the optional IDEC SmartRelay Battery cartridge, or combined IDEC SmartRelay Memory/Battery cartridge, IDEC SmartRelay can retain the clock time for up to two years.

Special characteristics to note when configuring

You can numerically enter values for the month and day fields. Enter values within the logical range of month values and day values; otherwise WindLGC returns an error message.

The **calendar** icon offers you an easy way of setting the date. It opens a window where you can set the days and months by clicking the relevant buttons on a calendar page.

Sample configuration

The output of a IDEC SmartRelay is to be switched on annually, from the 1st of March to the 4th of April and from the 7th of July to the 19th of November. This requires two blocks for configuring the specific On Times. The outputs are then linked via an OR block.

Place two twelve-month time switch switch SFBs on your programming interface. Configure the On Time for the first twelve-month time switch to 03.01 and the Off Time to 04.04. Configure the On Time for the second twelve-month time switch to 07.07 and the Off Time to 11.19.

Create a logical link of the blocks with a standard OR block. The OR output is 1 if at least one of the twelve-month time switch switches is set.
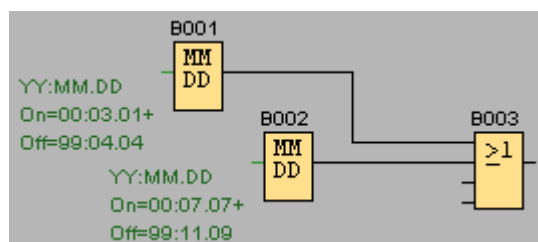
Overview: Special Functions

Counters

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.

Connection	Description
Input **R**	You reset the output and the internal counter value to the start value (StartVal) with a signal at input R (Reset).
Input **Cnt**	This function counts the 0 to 1 transitions at input Cnt. It does not count 1 to 0 transitions. • Use the inputs I3, I4, I5, and I6 for high-frequency counts (IDEC SmartRelay FL1E-H12RCE, FL1E-B12RCE and FL1E-H12SND): max. 5 kHz. • Use any other input or circuit element for low-frequency counts (typically 4 Hz).
Input **Dir**	Input Dir (Direction) determines the direction of count: Dir = 0: Up Dir = 1: Down
Parameter	**On:** On threshold Value range: 0...999999 **Off:** Off threshold Value range: 0...999999 **StartVal:** Initial value from which to begin counting either down or up. **Retentivity** set (on) = the status is retentive in memory.
Output **Q**	Q is set and reset according to the actual value at Cnt and the set thresholds.

Parameters On and Off

The on threshold On and the off threshold Off can be provided by the value of another already-programmed function:

• Analog comparator: Ax - Ay

• Analog trigger: Ax

• Analog amplifier: Ax

• Analog multiplexer: AQ

• Analog ramp: AQ

• Analog math: AQ

• PI controller: AQ

• Up/down counter: Cnt

You select the required function by the block number.

Timing diagram

Description of the function

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

You can reset the internal counter value to the start value with a signal at the reset input R. As long as R=1, the output Q is 0 and the pulses at input Cnt are not counted.

Output Q is set and reset according to the actual value at Cnt and the set thresholds. See the following rules for calculation.

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.

FL1A-FL1D:

The Start Value parameter does not exist. The counter always counts up or down from 0.

FL1A-FL1B:

The off parameter does not exist. The calculation rule is therefore void.

Caution

The function polls the limit value of the counter once in each cycle.

Thus, if the pulses at the fast inputs I3, I4, I5, or I6 are faster than the scan cycle time, the SFB might not switch until the specified limit has been 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

Scan cycle time

For information on how to determine the scan cycle time of a IDEC SmartRelay, refer to the appendix in the IDEC SmartRelay manual.

Overview: Special Functions

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.

Connection	Description
Input **R**	A positive edge (0 to 1 transition) at input R resets output Q and sets a configured value MI at the counter for the duration of the time-to-go (MN).
Input **En**	En is the monitoring input. IDEC SmartRelay scans the On Time of this input.
Input **Ral**	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 configured maintenance interval (MI): • Output Q = 0 • The measured operating hours OT = 0 • The time-to-go of the maintenance interval MN = MI.
Parameter	**MI**: Maintenance interval to be specified in units of hours and minutes Range of values: 0000...9999 h, 0…59 m **OT:** Accumulated total operating time. An offset start time can be specified in hours and minutes. Range of values: 00000...99999 h, 0...59 m **Q** ➞ 0: • 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. The output is reset: • When "Q ➞ 0:R+En", if R = 1 or Ral = 1 or En = 0 • When "Q ➞ 0:R", if R = 1 or Ral = 1.

Parameter MI

The maintenance interval MI can be provided by the actual value of another already-programmed function:

• Analog comparator: Ax - Ay

• Analog trigger: Ax

• Analog amplifier: Ax

• Analog multiplexer: AQ

• Analog ramp: AQ

- Analog math: AQ

- PI controller: AQ

- Up/down counter: Cnt

You select the required function by the block number.

Timing diagram
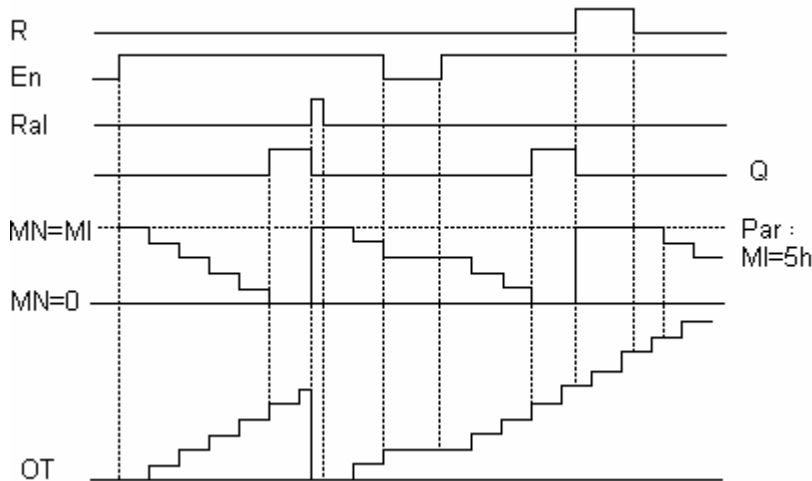
MI = Configured time interval

MN = Time-to-go

OT = Total time expired since the last 1 signal at the Ral input

These values are always retentive.

Description of the function

The operating hours counter monitors input En. As long as the status at this input is 1, IDEC SmartRelay calculates the expired time and the time-to-go MN. IDEC SmartRelay displays these times when set to configuration mode. The output is set to 1 when the time-to-go is equal to zero.

You reset output Q and the time-to-go counter to the specified value MI with a signal at input R. The operation hour counter OT remains unaffected.

You reset output Q and the time-to-go counter to the specified value MI with a signal at input Ral. The operation hour counter OT is reset to 0.

Depending on your configuration of the Q parameter, the output is either reset with a reset signal at input R or Ral ("Q ➔ R"), or when the reset signal is 1 or the En signal is 0 ("Q ➔ R+En").

Viewing the MI, MN and OT values

In WindLGC you can fetch the operating hours counter via the Tools -> Transfer: Operating hours counter menu command.

Limit value of OT

The value of the operating hours in OT are retained when you reset the operating hours counter with a signal at input R. The operating hours counter OT continues the count as long as En = 1, irrespective of the status at the reset input R. The counter limit of OT is 99999 h. The operating hours counter stops when it reaches this value.

In programming mode, you can set the initial value of OT. The counter starts operation at any value other than zero. MN is automatically calculated at the START, based on the MI and OT values.

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

Parameter preset

In WindLGC, you can define MI and an OT start value.

You determine that Q does not depend on En by selecting the corresponding check box.

Retentivity with the operating hours counter

The operating hours counter in the IDEC SmartRelay is generally retentive.

However, if the values of the operating hours counter are lost after a power failure, then select the respective block in your circuit program. Right-click on the operating hours counter and select **Block Properties > Parameters**. The option **Retentivity** must be activated and unchangeable (grayed out).

If the **Retentivity** option is not available, then delete the block and insert a new special function **operating hours counter** at the same position.

FL1A-FL1D:
The maintenance interval (MI) and the start time for the operating time (OT) were in units of hours. These values could not be provided by another function prior to the FL1E device series.

Overview: Special Functions

Frequency trigger

Fre —
Par —
Q

Short description

The output is switched on and off depending on two configurable frequencies.

Connection	Description
Input Fre	The function counts 0 to 1 transitions at input Fre. Transitions from 1 to 0 are not counted. • Use the inputs I3, I4, I5, and I6 for high-frequency counts (IDEC SmartRelay FL1E-H12RCE, FL1E-B12RCE and FL1E-H12SND): max. 5 kHz: • Use any other input or circuit element for low frequencies (typical 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: 00:05 s...99:99 s

Output **Q**	Q is set or reset according to the threshold values.

Parameter G_T

The gate time G_T can be provided by the actual value of another already-programmed function:

• Analog comparator: Ax - Ay

• Analog trigger: Ax

• Analog amplifier: Ax

• Analog multiplexer: AQ

• Analog ramp: AQ

• PI controller: AQ

• Up/down counter: Cnt

• Analog Math AQ

You select the required function by the block number.

Timing diagram
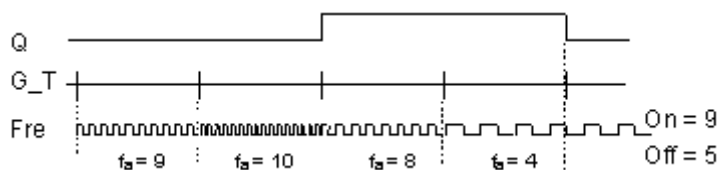
fa = Input frequency

Description of the function

The trigger measures the signals at input Fre. The pulses are captured during a configurable period G_T.

Q is set or reset according to the set thresholds. See the following calculation rule.

Calculation rule

- If the threshold (On) >= threshold (Off), then:
  Q = 1, if fa > On
  Q = 0, if fa <= Off.

- If the threshold (On) < threshold (Off), then Q = 1, if
  On <= fa < Off.

FL1A-FL1B:
The following calculation rules apply
- If Fre > threshold (On), then:
  Q = 1
- If Fre <= threshold (Off), then:
  Q = 0

Overview: Special Functions

Analog

Analog trigger

Short description

The output is set or reset depending on two configurable thresholds (hysteresis).

Connection	Description
Input **Ax**	Input the analog signal to be evaluated at input Ax. Use the analog inputs AI1...AI8, the Analog Memory Markers AM1...AM6, the block number of a function with analog output, or the analog outputs AQ1 and AQ2. 0 - 10 V is proportional to 0 - 1000 (internal value).

Parameter	**A:** Gain
	    Range of values: +- 10.00
	B: Zero offset
	    Range of values: +- 10,000
	On: On threshold
	    Range of values: +- 20,000
	Off: Off threshold
	    Range of values: +- 20,000
	p: Number of decimals
	    Range of values: 0, 1, 2, 3

Output **Q**	Q is set or reset depending on the set thresholds.

Parameters On and Off

The On and Off parameters can be provided by the actual value of another already-programmed function:

- Analog comparator: Ax - Ay

- Analog trigger: Ax

- Analog amplifier: Ax

- Analog multiplexer: AQ

- Analog ramp: AQ

- Analog math: AQ

- PI controller: AQ

- Up/down counter: Cnt

You select the required function by the block number.

<table>
<tr><td>FL1A
:
FL1D</td><td>FL1C:
A: Gain
                Range of values 0.00...10.00
FL1A, FL1B:
These parameters apply:
G: Gain in [%]
                Range of values 0..1,000 %
O: Offset
                Range of values ±999
On: On threshold
                Range of values 0..9,999
Off: Off threshold
                Range of values 0..9,999</td></tr>
</table>

Parameter p (number of decimals)

Parameter p applies only to the display of On, Off and Ax values in a message text.

Parameter p does not apply to the comparison of On and Off values. (The compare function ignores the decimal point.)

Timing diagram
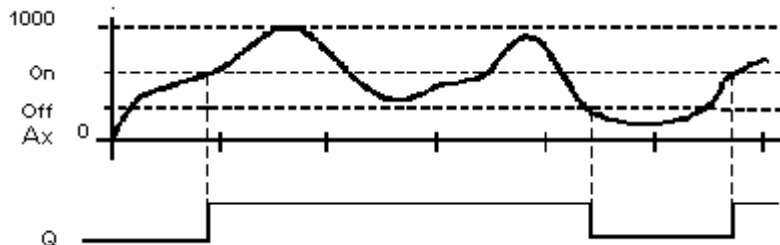
Description of the function

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, hence

(Ax * Gain) + Offset = Actual value Ax.

Output Q is set or reset depending on the set threshold values. See the following calculation rule.

FL1A, FL1B:
The **function** is as follows:
The offset parameter is added to the read analog value. The sum is multiplied by the value of the gain parameter.
Value = (AI+offset)*gain
Output Q is set to 1 if the calculated value exceeds the on threshold (TH high).
Q is reset to 0 when the value reaches or drops below the off threshold (TH low).

Calculation rule

- If threshold (On) >= threshold (Off), then:
  Q = 1, if the actual value Ax > On
  Q = 0, if the actual value Ax <= Off.

- If threshold (On) < threshold (Off), then Q = 1, if
  On <= the actual value Ax < Off.

Particular characteristics to be noted when configuring

Refer to the help on analog block parameters in the Analog value processing section.

Note

The decimal point setting must be identical in the minimum and maximum range.

Overview: Special Functions

Analog differential trigger

Ax
Par ┤/A Δ1├ Q

Short description

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

Connection	Description
Input **Ax**	You apply the analog signal to be analyzed at input Ax. Use the analog inputs AI1...AI8, the Analog Memory Markers AM1...AM6, the block number of a function with analog output, or the analog outputs AQ1 and AQ2. 0 - 10 V is proportional to 0 - 1000 (internal value).

Parameter	**A:** Gain
	      Range of values: +- 10.00
	B: Zero offset
	      Range of values: +- 10,000
	On: On threshold
	      Range of values: +- 20,000
	Delta: Differential value for calculating the off parameter
	      Range of values: +- 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.

FL1A
:
FL1D

FL1C:
A: Gain
              Range of values 0.00...10.00

Parameter p (number of decimals)

Parameter p applies only to the display of On, Off and Ax values in a message text.

Parameter p does not apply to the comparison of On and Off values. (The compare function ignores the decimal point.)

Timing diagram A: Function with negative difference Delta
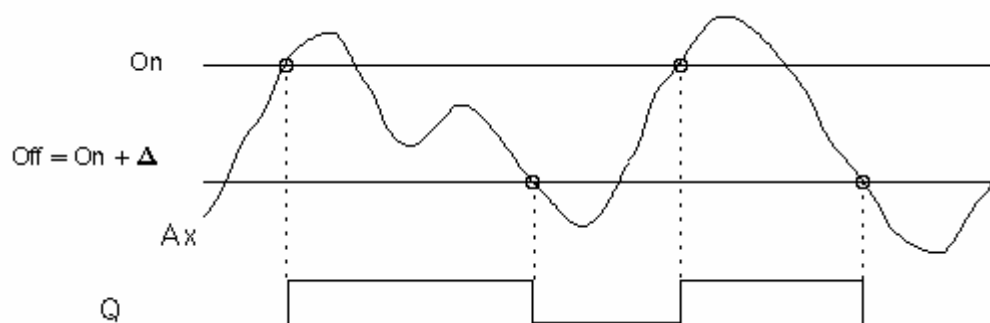
Timing diagram B: Function with positive difference Delta
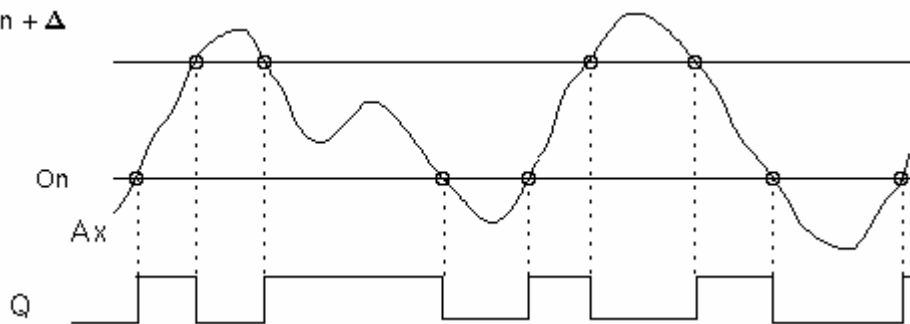
Description of the function

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 (Delta). The function automatically calculates the Off parameter: Off = On + Delta, whereby Delta may be positive or negative. See the calculation rule below.

Calculation rule

- When you set a negative differential value Delta, the On threshold >= Off threshold, and:
  Q = 1, if the actual value Ax > On
  Q = 0, if the actual value Ax <= Off.
  See the timing diagram A.

- When you set a positive differential value Delta, the On threshold < the Off threshold, and Q = 1, if:
  On <= the actual value Ax < Off.
  See the timing diagram B.

Particular characteristics to be noted when configuring

Refer to the help on analog block parameters in the Information on analog value processing section.

Overview: Special Functions

Analog comparator
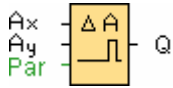
Short description

The output is set and reset depending on the difference Ax - Ay and on two configurable thresholds.

Connection	Description
Inputs **Ax, Ay**	Input the analog signals of which you want to determine the delta at the inputs Ax and Ay. Use the analog inputs AI1...AI8, the Analog Memory Markers AM1...AM6, the block number of a function with analog output, or the analog outputs AQ1 and AQ2. AI1..AI8: 0 - 10 V corresponds with 0 - 1000 (internal value).
Parameter	**A:** Gain Range of values: +- 10.00 **B:** Zero offset Range of values: +- 10,000 **On**: On threshold Range of values: +- 20,000 **Off:** Off threshold Range of values: +- 20,000 **p:** Number of decimals Range of values: 0, 1, 2, 3
Output **Q**	Q is set or reset depending on the set thresholds.

FL1C:
A: Gain
Range of values 0.00...10.00
FL1A-FL1B:
The following parameters apply:
G : Gain in [%]
Range of values: 0..1000 %
O : Offset
Range of values: ±999
delta : Threshold

Q is set to 1 when the difference Ax-Ay exceeds the threshold.

Parameters On and Off

The on threshold On and the off threshold Off can be provided by the actual value of another already-programmed function:

- Analog comparator: Ax - Ay

- Analog trigger: Ax

- Analog amplifier: Ax

- Analog multiplexer: AQ

- Analog ramp: AQ

- Analog math: AQ

- PI controller: AQ

- Up/down counter: Cnt

You select the required function by the block number.

Parameter p (number of decimals)

Parameter p applies only to Ax, Ay, Delta, On and Off values displayed in a message text.

Parameter p does not apply to the comparison of on and off values. (The compare function ignores the decimal point.)

Timing diagram
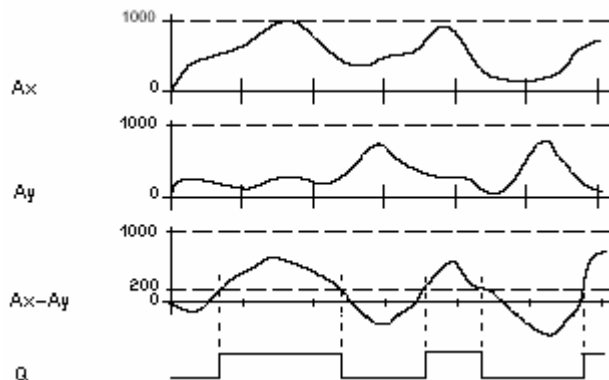
Q for Ax - Ay > 200, On = Off = 200

Description of the function

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, hence

(Ax * gain) + offset = Actual value Ax.

(Ay * gain) + offset = Actual value Ay.

Output Q is set or reset depending on the difference of the actual values Ax - Ay and the set thresholds. See the following calculation rule.

Calculation rule

- If threshold On >= threshold Off, then:
  Q = 1, if (actual value Ax - actual value Ay) > On
  Q = 0, if (actual value Ax - actual value Ay) <= Off.

- If threshold On < threshold Off, then Q = 1, then:
  On <= (actual value Ax - actual value Ay) < Off.

FL1A : FL1D	**FL1A, FL1B:** The following **functions/calculation rules** apply The function adds the relevant specified offset to the analog values Ax and Ay. The sum is multiplied with the value of the gain parameter. The difference is formed from both calculated values. Output Q is set if this difference between these values exceeds the threshold you have configured under delta. Calculation rule: Q = 1, if:

((Ax + offset) * gain) - ((Ay + offset)*gain)>threshold delta
Q is reset to 0 when the threshold reaches or drops below delta.

Reducing the input sensitivity of the analog comparator

You can delay the output of the analog comparator selectively by means of the "on delay" and "off delay" SFBs. By doing so, you determine that output Q is only set if the input trigger length Trg (= output of the analog comparator) exceeds the defined on delay time.

This way you can set a virtual hysteresis, which renders the input less sensitive to short changes.

Particular characteristics to be noted when configuring

For help on analog block parameters, refer to the Analog value processing section.

Overview: Special Functions

Analog watchdog
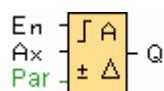
Short description

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.

Connection	Description
Input **En**	A positive edge (0 to 1 transition) at input En saves the analog value at input Ax ("Aen") to memory and starts monitoring of the analog range Aen +- Delta.
Input **Ax**	You apply the analog signal to be monitored at input Ax. Use the analog inputs AI1...AI8, the Analog Memory Markers AM1...AM6, the block number of a function with analog output, or the analog outputs AQ1 and AQ2. 0 - 10 V is proportional to 0 - 1000 (internal value).
Parameter	**A:** Gain Range of values: +- 10.00 **B:** Zero offset Range of values: +- 10,000 **Threshold 1:** Difference value above Aen: on/off threshold Range of values: 0 - 20,000 **Threshold 2:** Difference value below Aen: on/off threshold Range of values: 0 - 20,000 **p:** Number of decimals Range of values: 0, 1, 2, 3 **Retentivity** set (on) = the status is retentive in memory.
Output **Q**	Q is set/reset, depending on the stored analog value and the offset.

Parameters Threshold 1 and Threshold 2

The two threshold parameters Threshold 1 and Threshold 2 can be provided by the actual value of another already-programmed function:

- Analog comparator: Ax - Ay

- Analog trigger: Ax

- Analog amplifier: Ax

- Analog multiplexer: AQ

- Analog ramp: AQ

- Analog math: AQ

- PI controller: AQ

- Up/down counter: Cnt

You select the required function by the block number.

242

The thresholds are represented by the symbol Δ on the IDEC SmartRelay Base module and in the timing diagram below.

FL1C:
    A: Gain
                     Range of values 0.00...10.00

Parameter p (number of decimals)

Parameter p applies only to the display of Aen, Ax, Threshold 1 and Threshold 2 values in a message text.

Timing diagram
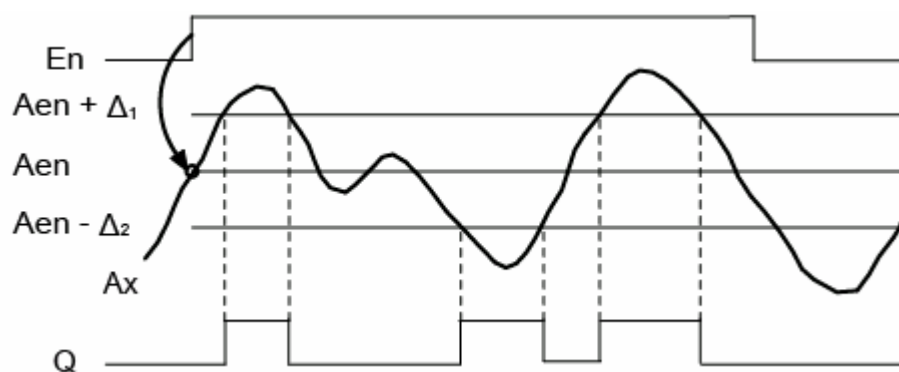
Description of the function

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, as follows:

(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 + Threshold 1 / Aen - Threshold 2.

Output Q is reset, when the actual value at input Ax lies within the range of Aen + Threshold 1 / Aen - Threshold 2, or when the signal at input En changes to lo.

Particular characteristics to be noted when configuring

Refer to the help on analog block parameters in the Analog value processing section.

Overview: Special Functions

Analog amplifier

Ax
Par ─ [A→ / ▷] ─ AQ
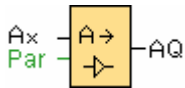
Short description

This SFB amplifies an analog input value and returns it at the analog output.

Connection	Description
Input **Ax**	Input the analog signal to be amplified at input Ax. Use the analog inputs AI1...AI8, the Analog Memory Markers AM1...AM6, the block number of a function with analog output, or the analog outputs AQ1 and AQ2. AI1..AI8: 0 - 10 V corresponds with 0 - 1000 (internal value).
Parameter	**A:** Gain Range of values: +- 10.00 **B:** Zero offset Range of values: +- 10000 **p:** Number of decimals Range of values: 0, 1, 2, 3
Output A**Q**	Analog output Value range for AQ: -32768...+32767

FL1A : FL1D   **FL1C:**
A: Gain
                     Range of values 0.00...10.00

Parameter p (number of decimals)

Parameter p applies only to the display of Ax and Ay values in a message text.

Parameter p does not apply to the comparison of On and Off values. (The compare function ignores the decimal point.)

Description of the function

The function reads the value of an analog signal at the analog input Ax.

This value is multiplied by the gain parameter A. Parameter B (offset) is added to the product, as follows:

(Ax * gain) + offset = Actual value Ax.

The actual value Ax is output at AQ.

Particular characteristics to be noted when configuring

For help on analog block parameters, refer to the Analog value processing section.

Analog output

If you connect this special function to a real analog output, then note that the analog output can only process values from 0 to 1000. To do this, connect an additional amplifier between the analog output

of the special function and the real analog output. With this amplifier you standardize the output range of the special function to a value range of 0 to 1000.

Example: additional amplifier behind an analog multiplexer.
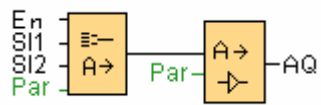
Overview: Special Functions

Analog multiplexer

En
S1
S2
Par ─ ┤ ═─ A→ ├─ AQ
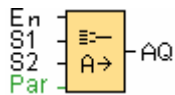
Short description

This special function displays 0 or one of 4 saved analog values on the analog output.

Connection	Description
Input **En**	1 on input En (Enable) switches, dependent on S1 and S2, a parameterized analog value to the output AQ. 0 on input EN switches 0 to the output AQ.
Inputs **S1** and **S2**	S1 and S2 (selectors) for selecting the analog value to be issued. S1 = 0 and S2 = 0: The value 1 is issued S1 = 0 and S2 = 1: The value 2 is issued S1 = 1 and S2 = 0: The value 3 is issued S1 = 1 and S2 = 1: The value 4 is issued
Parameter	**V1...V4**: Analog values (Value) that will be issued. Value range: -32768...+32767 **p**: Number of decimal places value range: 0, 1, 2, 3
Output **AQ**	Analog output Value range for AQ: -32768...+32767

Parameters V1…V4

The values for V1…V4 can be provided by the value of another already-programmed function:

- Analog comparator: Ax - Ay

- Analog trigger: Ax

- Analog amplifier: Ax

- Analog multiplexer: AQ

- Analog ramp: AQ

- Analog math: AQ

- PI controller: AQ

- Up/down counter: Cnt

You select the required function by the block number.

Parameter p (number of decimal places)

Parameter p applies only to the display of AQ, V1, V2, V3 and V4 values in a message text.

Timing diagram
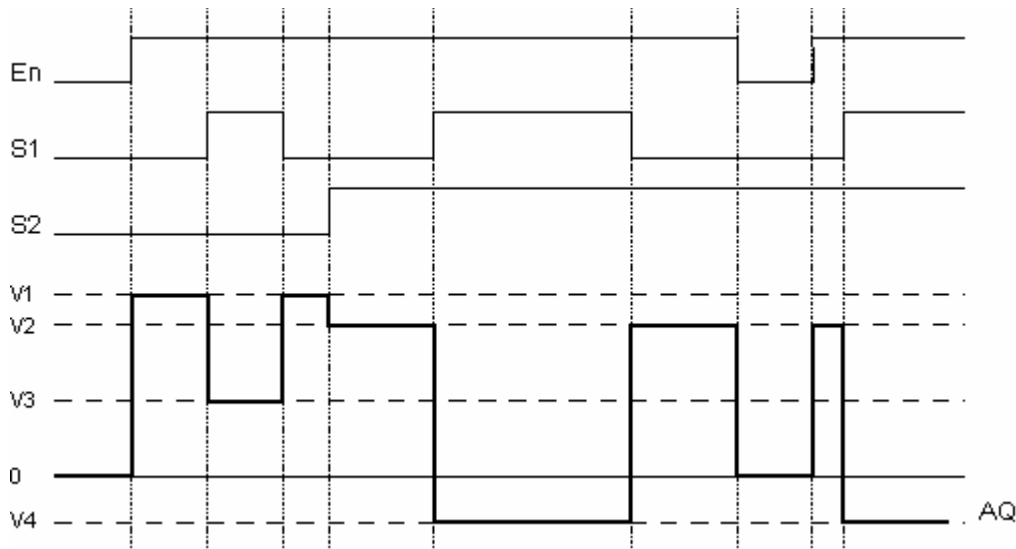
Description of function

If input En is set, then the function issues one of 4 possible analog values V1 to V4 at the output AQ, depending on the parameters S1 and S2.

If the input En is not set, then the function issues the analog value 0 at output AQ.

Particular characteristics to be noted when configuring

For help on analog block parameters, refer to the Analog value processing section.

Analog output

If you connect this special function to a real analog output, then note that the analog output can only process values from 0 to 1000. To do this, connect an additional amplifier between the analog output of the special function and the real analog output. With this amplifier you standardize the output range of the special function to a value range of 0 to 1000.

Example: additional amplifier behind an analog multiplexer.
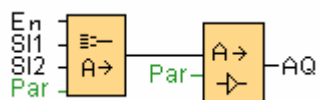
Overview: Special Functions

Pulse Width Modulator (PWM)

Short description

The Pulse Width Modulator (PWM) instruction modulates the analog input value Ax to a pulsed output signal. The pulse width is proportional to the analog value Ax.

Connection	Description
Input **Ax**	Analog signal to be modulated to a pulsed output signal.

Parameter	**Min:**
	      Range of values: -20,000 to +20,000
	 Max:
	      Range of values: -20,000 to +20,000
	 A: Gain
	      Range of values: +- 10.00
	 B: Zero offset
	      Range of values: +- 10,000
	 PT: Periodic time over which the output is
	      modulated
	 p: Number of decimals
	      Range of values: 0, 1, 2, 3

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.

 FL1A-FL1D: The PWM function block did not exist prior to FL1E.

Parameter PT

The periodic time PT can be provided by the actual value of another already-programmed function:

- Analog comparator: Ax - Ay
- Analog trigger: Ax
- Analog amplifier: Ax
- Analog multiplexer: AQ
- Analog ramp: AQ
- Analog math: AQ
- PI controller: AQ
- Up/down counter: Cnt

Parameter p (number of decimals)

Parameter p applies only to the display of the Ax value in a message text.

Description of the function

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 value Ax to the range. The block sets the output Q high for the same proportion of the PT (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 output signal from the analog input value:

Example 1

Analog input value: 500 (range 0...1000)
Periodic time T: 4 seconds

The 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.
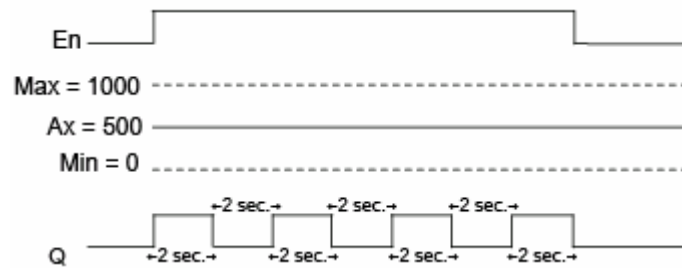
Example 2

Analog input value: 300 (range 0...1000)
Periodic time T: 10 seconds

The output of the PWM function is 3 seconds high, 7 seconds low, 3 seconds high, 7 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 PT
Q = 0, for PT - [(Ax - Min) / (Max - Min)] of time period PT.

Note: Ax in this calculation refers to the actual value Ax as calculated using the Gain and Offset. Min and Max refer to the minimum and maximum values specifed for the range.

Particular characteristics to be noted when configuring

Refer to the help on analog block parameters in the Analog value processing section.

Overview: Special Functions

WindLGC V6.0

250
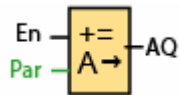
Analog math

Short description

The analog math block calculates the value AQ of an equation formed from the user-defined operands and operators.

Connection	Description
Input **En**	Enable the analog math function block.
Parameter	**V1:** Value 1: First operand **V2:** Value 2: Second operand **V3:** Value 3: Third operand **V4:** Value 4: Fourth operand **Operator1:** First operator **Operator2:** Second operator **Operator3:** Third operator **Priority1:** Priority of first operation **Priority2:** Priority of second operation **Priority3:** Priority of third operation **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.

FL1A-FL1D: The Analog Math function block did not exist prior to FL1E.

Parameters V1, V2, V3, and V4

The values V1, V2, V3, and V4 can be provided by the actual value of another already-programmed function:

- Analog comparator: Ax - Ay
- Analog trigger: Ax
- Analog amplifier: Ax
- Analog multiplexer: AQ
- Analog ramp: AQ
- Analog math: AQ
- PI controller: AQ
- Up/down counter: Cnt

Parameter p (number of decimals)

Parameter p applies to the display of V1, V2, V3, V4 and AQ in a message text.

Description of the function

The analog math function combines the four operands and three operators to form an equation. The operator can be any one of the four standard operators: +, -, *, or /. For each operator, you must set a unique priority of High ("H"), Medium ("M"), or Low ("L"). The high operation will be performed first, followed by the medium operation, and then by the low operation. You must have exactly one operation of each 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.

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	Operator1 (Priority 1)	V2	Operator2 (Priority 2)	V3	Operator3 (Priority 3)	V4
12	+ (M)	6	/ (H)	3	- (L)	1

Equation: (12 + (6 / 3)) - 1

Result: 13

V1	Operator1 (Priority 1)	V2	Operator2 (Priority 2)	V3	Operator3 (Priority 3)	V4
2	+ (L)	3	* (M)	1	+ (H)	4

Equation: 2 + (3 * (1 + 4))

Result: 17

V1	Operator1 (Priority 1)	V2	Operator2 (Priority 2)	V3	Operator3 (Priority 3)	V4
100	- (H)	25	/ (L)	2	+ (M)	1

Equation: (100 - 25) / (2 + 1)

Result: 25

Overview: Special Functions

Analog value processing
Basics

Analog and digital

An analog signal is a physical quantity, which, within a given range, can adopt any value - any continuous intermediate value. The opposite of analog is *digital.* A digital signal knows just two states: 0 and 1 or "off" and "on".

From electrical signal to analog value

Basic order of events

Several steps are required for IDEC SmartRelay to process physical quantities:

2. IDEC SmartRelay can read in electric voltages from 0 V to 10 V or electric currents from 0 mA to 20 mA to one analog input.
    The physical quantities (e.g. temperature, pressure, speed etc.) must therefore be converted into one electric quantity. This conversion is performed by an external sensor.

IDEC SmartRelay reads in the electric quantity and, with further processing, this is converted into a standardized value within the range 0 to 1000. This value is then applied in the circuit program on the input of an analog special function.

In order to adapt the standardized value to the application, IDEC SmartRelay uses an analog special function, while taking into consideration the gain and offset, to calculate the analog value. The analog value is then evaluated by the special function (e.g. analog amplifier). If an analog special function has an analog output, then the analog value is also applied to the output of the special function.

With the IDEC SmartRelay you can also convert analog values back into an electric voltage. In doing so, the voltage can adopt values between 0 and 10 V.

Using this voltage, IDEC SmartRelay can control an external actuator, which converts the voltage and also the analog value back into a physical quantity.

The following diagram illustrates this order of events.
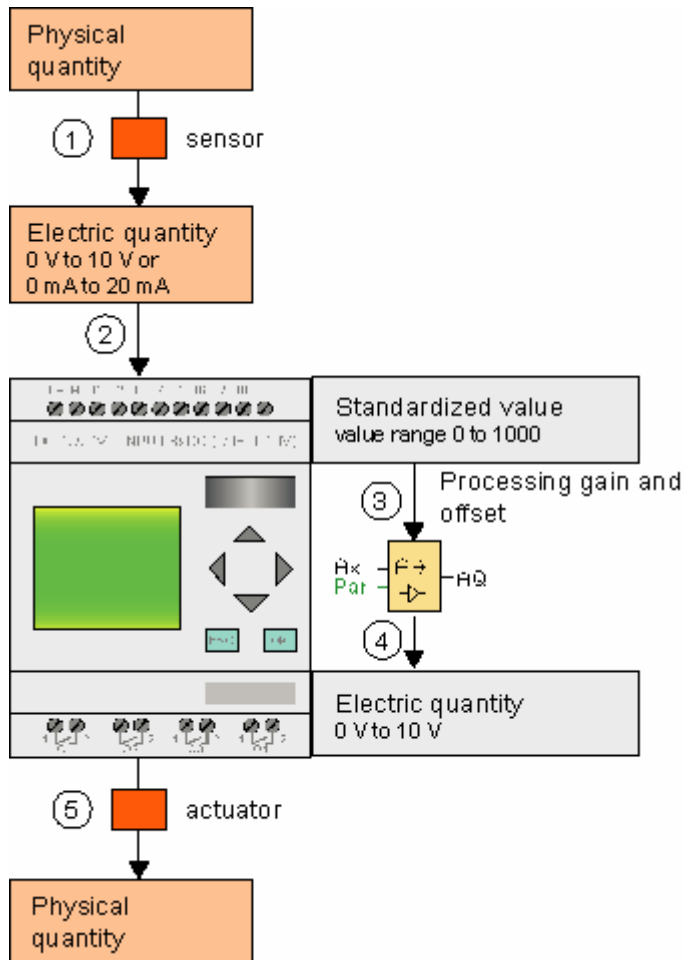
Gain

The standardized value is multiplied with a parameter. Using this parameter you can more or less boost the electric quantity. Hence, this parameter is called the "gain".

Zero point offset

You can add or subtract a parameter to or from the boosted standardized value.

Using this parameter you can more or loss move the zero point of the electric quantity. Hence, this parameter is called the "zero point offset".

Gain and offset

The analog value is therefore calculated as follows:

Analog value = (standardized value x gain) + offset

The following diagram illustrates this formula and the significance of gain and offset:
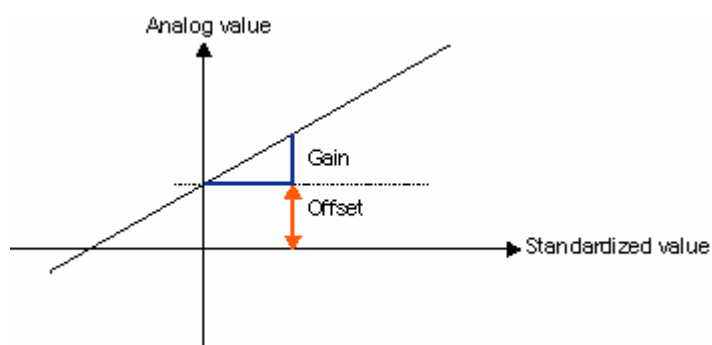
The straight line in the graphic describes which standardized value is being converted into which analog value. Gain corresponds to the slope of the straight line and offset to the movement of the zero passage of the straight line on the y-axis.

Analog output

If you connect a special function (that has an analog output) to a **real** analog output, then note that the analog output can only process values from 0 to 1000.

Possibile settings with WindLGC

Possible settings with IDEC SmartRelay

Example

Heating control

     FL1A to FL1C

Possible settings with WindLGC

Sensor

Set your sensor type. (0 to 10 V; 0 to 20 mA; 4 to 20 mA; no sensor)

With sensor type 4 to 20 mA the value range for the standardized value is 200 and 1000.

Measurement range

Stipulate the measurement range. The measurement range is the value range shown for the analog value.

Sensor	0 … 10 V			
Measurement Range			**Parameter**	
Minimum	0 ⬆⬇ I		Gain	1.00 ⬆⬇ I
Maximum	1000 ⬆⬇ I		Offset	0 ⬆⬇ I

WindLGC then automatically calculates the gain and offset from this.

Gain and offset

If you want to set the gain yourself, then you can enter values between -10.00 and 10.00. The value 0 makes no sense, as, irrespective of the applied analog value, you will always obtain the value 0 as a result.

If you wish to set the offset yourself, then enter values between -10,000 and +10,000.

Rounding error

WindLGC calculates the gain and zero point offset with utmost precision. However, IDEC SmartRelay calculates internally using whole numerical values. Therefore, not all parameter combinations are possible on IDEC SmartRelay. In this case, prior to transferring to IDEC SmartRelay you can make WindLGC aware of a rounding error and propose a possible replacement value range

Simulation in WindLGC

With simulation in WindLGC you can read the following values:
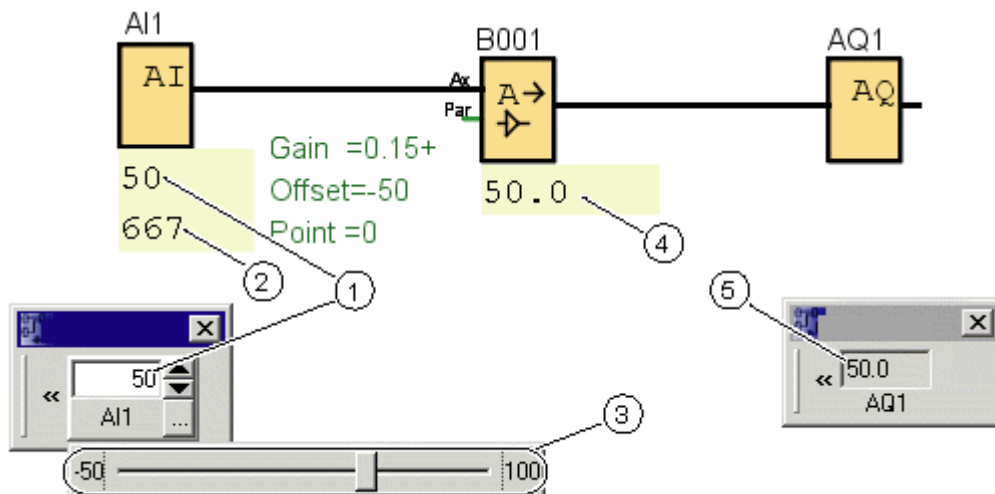
① Physical value; the ranges are stipulated by the measuring range (3)

② Standardized value

③ Measurement range

④ Analog value (after processing gain and offset)

⑤ Analog value on the analog output

Possible settings with IDEC SmartRelay

If you directly program your circuit program on the IDEC SmartRelay, then you can only enter the gain and offset parameters. You can calculate the gain and offset as follows:

External value range min_{Sensor} **-** max_{Sensor}

Range of a physical quantity that the sensor can measure.

Standardized value range min_{norm} **-** max_{norm}**:**

Value range of the standardized values.

With sensors that provide 0 to 10 V or 0 to 20 mA, the standardized value range is 0 - 1000.

With sensors that provide 4 to 20 mA, the standardized range is 200 - 1000.

So for gain and offset it follows:

Gain = $(max_{Sensor} - min_{Sensor}) / (max_{norm} - min_{norm})$

Offset = $[(min_{Sensor} \times max_{norm}) - (max_{Sensor} \times min_{norm})] / (max_{norm} - min_{norm})$

If you have calculated either the gain or the offset in accordance with the formulas above, you can then calculate the respective other value in accordance with the following formula:

Gain = $(min_{Sensor} - Offset) / min_{norm}$

Offset = $(min_{Sensor} - (Gain \times min_{norm}))$

Example

Prerequisites

Sensor: temperature sensor, measuring range -50 to 100°C

Temperature to be measured 25°C

Order of events with WindLGC

1. The sensor converts the temperature from 25°C to a voltage value of 5.0 V.

2. IDEC SmartRelay converts the 5.0 V to the standardized value 500.

3. Using the sensor and measurement range data, IDEC SmartRelay ascertains the value 0.15 for the gain and the value -50 for the offset.
According to the formula:
Analog value = (standardized value x gain) + offset
IDEC SmartRelay calculates as analog value:
Analog value = (500 x 0.15) - 50 = 25

Order of events with IDEC SmartRelay

1. The sensor converts the temperature from 25°C to a voltage value of 5.0 V.

2. IDEC SmartRelay converts the 5.0 V to the standardized value 500.

3. From the sensor and measuring range data you must establish the values for gain and offset.
According to the formulas:
Gain = (maxSensor - minSensor) / (maxnorm - minnorm)
and
Offset = minSensor - (Gain x minnorm)
it follows that
Gain = (100 - (-50)) / (1000 - 0) = 0.15
Offset = -50 - (0.15 x 0) = -50

4. According to the formula
Analog value = (standardized value x gain) + offset
IDEC SmartRelay calculates as analog value:
Analog value = (500 x 0.15) - 50 = 25

Additional examples

Physical quantity	Electric quantity of sensor	Standardized value	Gain	Offset	Analog value
	0 V 5 V 10 V	0 500 1000	0.01	0	0 5 10
	4 mA 12 mA 20 mA	0 500 1000	10	0	0 5000 10000
	0 mA 10 mA 20 mA	0 500 1000	1	50	50 550 1050
1000 mbar	0 V	0			1000

3700 mbar 5000 mbar	6.75 V 10 V	675 1000	4	1000	3700 5000
-30 °C 0 °C 70 °C	0 mA 6 mA 20 mA	0 300 1000	0.1	-30	-30 0 70

FL1A to FL1D

Restriction for device family FL1C

The Gain cannot be a negative value.

Calculation with the device families FL1A to FL1B

With IDEC SmartRelay devices from these device families the parameter offset is added or subtracted to or from the standardized value **before** the value is multiplied with the parameter gain.

Hence, the following formulas apply:

Analog value = (standardized value + offset) x (gain x 100)

Gain (in percent) = $(max_{Sensor} - min_{Sensor}) / [(max_{norm} - min_{norm}) \times 100]$

Offset = $[(min_{Sensor} \times max_{norm}) - (max_{Sensor} \times min_{norm})] / (max_{Sensor} - min_{Sensor})$

Gain (in percent) = $min_{Sensor} / [(min_{norm} + offset) \times 100]$

Offset = $[max_{Sensor} / (gain \times 100)] - max_{norm}$

Gain

This parameter is given in %.

The Gain cannot be a negative value.

Zero point offset

Here you can enter values between -999 and + 999.

Control and regulate
Control and regulate basics

Control and regulate

In engineering, quantities can be both controlled and regulated.

When controlling, a quantity is manipulated without being able to compensate for outside influences. When regulating, a quantity is maintained at a specific value in order to compensate for outside influences.

In the following example, controlling means that the person can set the heat output at a fixed value. The heater cannot compensate for the drop in room temperature when a window is opened.

In the example below, regulating means that the person can increase the heat output if the room temperature drops to below 20 °C. If the room temperature rises above 20 °C, the heat output is reduced.
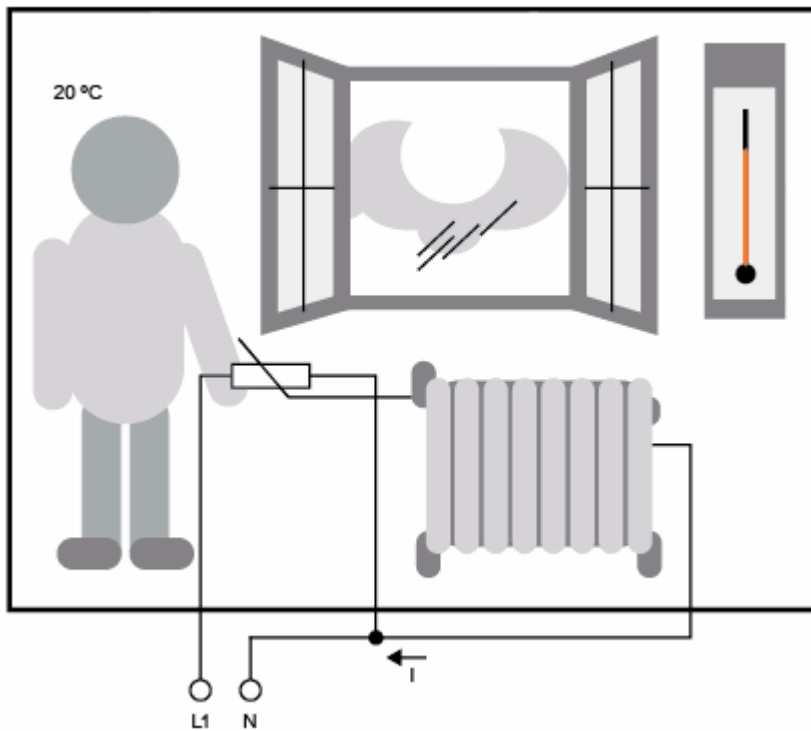
Basic concepts of regulating

In the example, the current for the electric heating is the **manipulated variable**. The changeable resistance is the **actuator**. The hand that operates the actuator is the **control**. The actual room temperature is the controlled variable or the **process value**. The desired room temperature is the **command variable** or the setpoint value. The electric heating is the **control process**. The thermometer is the **sensor**. The temperature loss from opening the window is the **disturbance variable**.

So this means that the person measures the process value (room temperature) with the sensor (thermometer), compares the process value (room temperature) with the command variable (desired room temperature) and uses the actuator (changeable resistance) to manually regulate the manipulated variable (heating current), in order to compensate for the disturbance variable (temperature drop from opening the window). The person is therefore the controller.
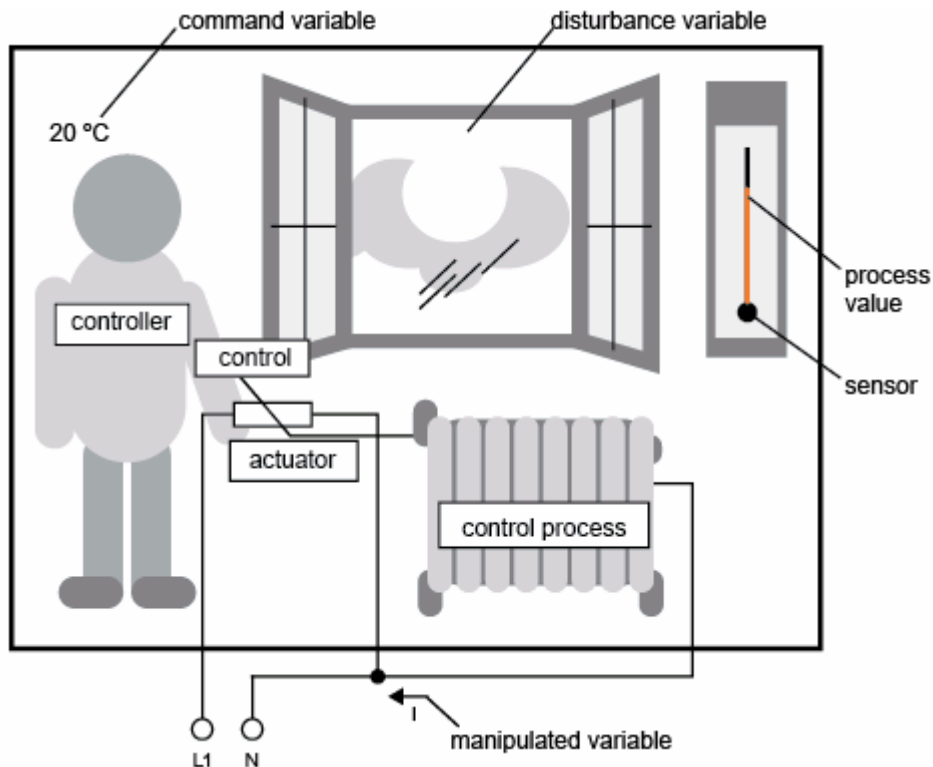
The **control device** is formed from the actuator and the control.

The control and controller together form the **regulating device**.

The following picture gives an abstract portrayal of the situation described above.

The comparing element uses the sensor to compare the command variable with the process value. If the command variables and process value deviate from one another, this results in a positive or negative loop error that in turn changes the process value.
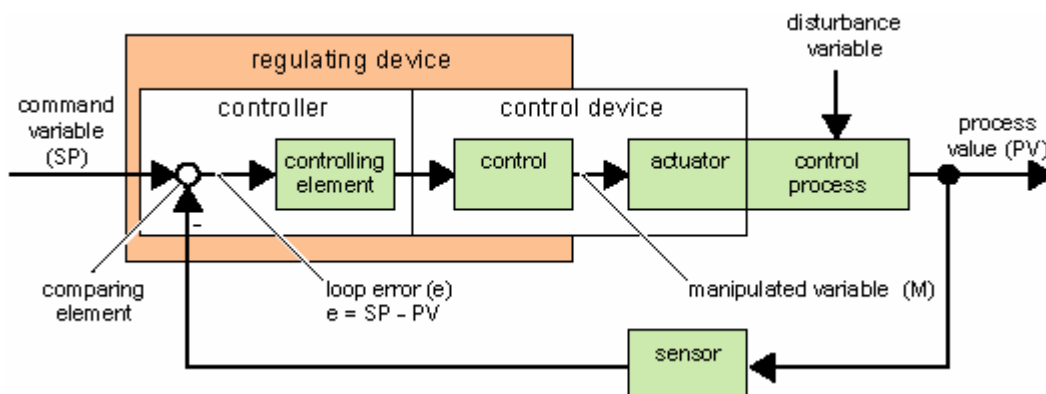
Control loop

The process value x influences the manipulated variable M by means of the regulating device. This creates a closed circuit that is also known as a **control loop**.

If, in the example above, the window is opened, the temperature in the room drops. The person must increase the heat output of the heater. If the heat output is increased too much, it will get too hot. The person must then reduce the heat output.

If the heat output is increased or reduced too quickly, then the control loop starts to sway. The room temperature fluctuates. It is either too hot or too cold. To prevent this, the person must carefully and slowly reduce or increase the heat output.

Loop error

The loop error is the difference between the command variable and the process value. In other words: the deviation of a process value from a set value.

e = SP - PV

The loop error e brings about a change to the manipulated variable M.

The example above illustrates this very well: if, with a desired temperature of 20 °C (= command value w), the room temperature is 22 °C (= process value PV), this results in the loop error:

e = SP - PV = 20 °C - 22 °C = -2 °C

In this case, the negative sign indicates a reversing action: the heat output is reduced.

In a control loop's state of equilibrium, the loop error is zero or very small. If the command variable changes or there is a disturbance, a loop error arises. The loop error is corrected by means of the manipulated variable M.

Controller basics

Description of the individual parameters

PI controller

Heating control

Analog ramp control

Controller basics

A controller can be simply portrayed as follows:
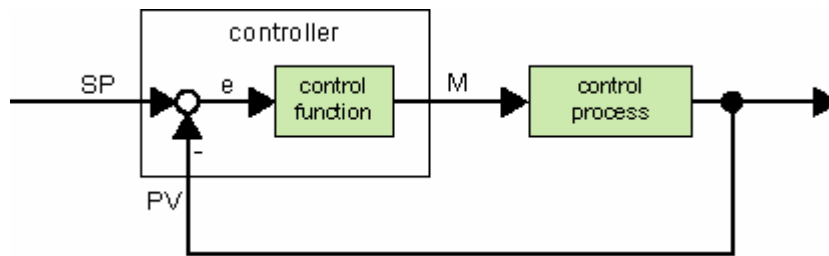
The comparing element and the controller function describe the conduct of the controller.

The following describes the most important types of controller. A controller's step response tells us a lot about its conduct. The step response describes how a controller reacts to the erratic change in the process value.

There are 3 important basic types of controller:

- Proportional-action controller (P controller)

- Integral-action controller (I controller)

- Differential-action controller (D controller - we're not touching on this here)

These are combined for a real controller. For instance, the PI controller:

P Controller

A proportional-action controller (P controller) changes the manipulated variable M proportional to the loop error. The P controller works immediately. By itself it cannot drive the loop error to zero.

$$M_{Pn} = k_P \times e_n$$

M_{Pn}:   Manipulated variable of the P controller at the time n

k_P: Gain of the P controller

e_n: Loop error at the time n

The following picture shows a jump in process value and step response of the controller:
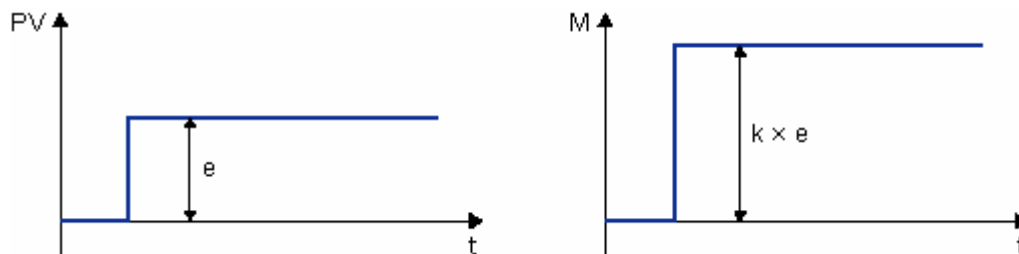
Summary

The P controller has the following characteristics:

- It cannot correct faults with the control process > lasting loop error.

- It reacts immediately to a change in the process value.

- It is stable.

I Controller

An integral-action controller (I controller) changes the manipulated variable M proportional to the loop error and to the time. The I controller works by delayed action. It completely remedies a loop error.

In order to calculate the value of the manipulated variable at a period of time **n**, the time up until this period of time must be divided into small time slices. The loop errors at the end of each time slice must be added up (integrated) and they are then entered in the calculation.

$$M_{In} = k_I \times (T_S / T_I) \times (e_n + e_{n-1} + e_{n-2} + e_{n-3} + \ldots + e_0) = k_I \times (T_S / T_I) \times e_n + M_{In-1}$$

M_{In}:   Manipulated variable of the I controller at the time n

M_{In-1}:   Manipulated variable of the I controller at the time n-1; also called integral sum

k_I: Gain of the I controller

T_S: Sampling time, duration of a time slice

T_I: Integral time: by means of this time, the influence of the integral part is controlled on the manipulated variable, also known as integral-action time

e_n: Loop error at the time n

e_{n-1}:   Loop error at the time n-1; etc.

e_0:   Loop error at the beginning of the calculations

The following picture shows a jump in process value and step response of the controller:
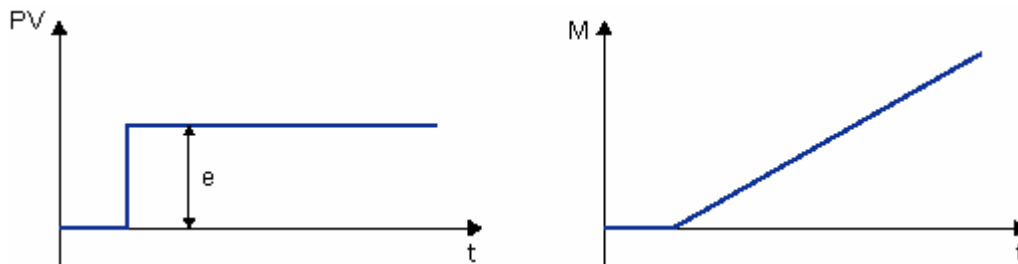
Summary

The I controller has the following characteristics:

- It sets the process value exactly to the command variable.

- By so doing, it tends to oscillate and is unstable.

- It requires more time to carry out the control action than the P controller .

PI controller

A PI controller reduces the loop error immediately and will eventually drive the loop error to zero.

$$M_n = M_{Pn} + M_{In} = k_P \times e_n + k_I \times (T_S / T_I) \times e_n + M_{In-1}$$

M_n: Manipulated variable at the time n

M_{Pn}:   Proportional part of the manipulated variable

M_{In}:   Integral part of the manipulated variable

M_{In-1}:   Manipulated variable of the I controller at the time n-1; also called integral sum

k_P: Gain of the P controller

k_I: Gain of the I controller

T_S: Sampling time, duration of a time slice

T_I: Integral time; by means of this time the influence of the integral part is controlled on the manipulated variable, also known as the integral-action time

e_n: Loop error at the time n

The following picture shows a jump in process value and step response of the controller:
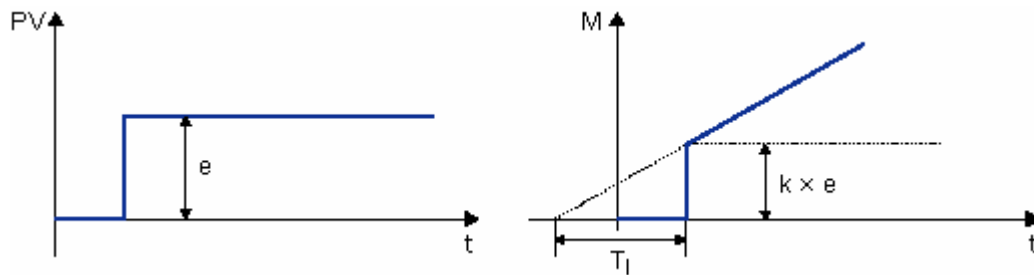
Summary

The PI controller has the following characteristics:

- The P controller components quickly intercept an occurring loop error.

- The I controller components can then remedy the remaining loop error.

- The controller components supplement each other so that the PI controller works quickly and precisely.

Description of the individual parameters

Controller parameters	Portrayed in IDEC SmartRelay	Possible value range in the IDEC SmartRelay
Mn Manipulated variable at the time n	Output of the PI controller block	0 to 1,000
kP Gain of the P part kI Gain of the I part	In the IDEC SmartRelay, the parameter KC applies as an increase for the I part and the P part of the controller equally. Should you enter KC=0, then the P part of the controller switches off. In this special case, k is automatically set to 1 for the I part. If KC = 0: kP = 0 and kI = 1 If KC <> 0: kP = kI = KC	0.00 to 99.99
T_S Sampling time, duration of a time slice	Fixed	500 ms
T_I Integral time	Parameter TI, if you set this parameter to 99:59 min, then you switch off the I part of the controller.	00:01 min to 99.59 min
e_n Loop error at the time n; generally applies: e = SP - PV	Refer to SP and PV	
SP	The parameter SP is the set-value assignment w. For this parameter you can use the analog output of a different special function.	-10,000 to +20,000
PV	PV is the process value x and is calculated as follows: PV = (analog value on input * gain) + offset. You can connect the input for example by means of an analog input with a PT100 sensor.	
	The gain parameter has an effect on PV	0.0 to 10.0
	The offset parameter has an effect on PV	-10,000 to +20,000
	PV is restricted by the parameters Min. and Max.	In each case: -10,000 to +20,000

	The Dir parameter gives the action direction of the controller.	- or +
	Positive means: If set value > process value then the process value is increased; if set value < process value then the process value is reduced.	
	Negative means: If set value > process value then the process value is reduced; if set value < process value then the process value is increased.	
	e.g. heat regulation: if the set value is greater than the process value (room is too cold), the manipulated variable increases the process value.	

Refer to the PI controllers - description of special function for more details (for example, switching from manual to automatic mode, parameter sets, etc.).

PI controller

Short description

A PI controller is a proportional-action and integral-action controller. You can use both proportional action and integral action individually or combined.

Connection	Description
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. The output AQ is set to 0.
Input **PV**	Analog value: process value, influences the output
Parameter	Sensor: Type of sensor being used **Min.:** Minimum value for PV value range: -10,000 to +20,000 **Max.:** Maximum value for PV value range: -10,000 to +20,000 **A:** Gain Value range: +- 10.00 **B:** Offset Value range: +- 10,000 **SP:** Set-value assignment value range: -10,000 to +20,000 **Mq:** Value from AQ with manual mode. Value range: 0 to 1,000 **Parameter sets:** application-related presets for KC, TI and Dir (see below) **KC:** Gain value range: 00.00 to 99.99 **TI:** Integral time value range 00:01 min to 99:59 min **Dir:** Action direction of the controller value range: + or - **p:** Number of decimal places value range: 0, 1, 2, 3
Output **AQ**	Analog output (manipulated variable) Value range for AQ: 0 to 1,000

Parameters SP and Mq

The set-value SP and the value for Mq can be provided by the actual value of another already-programmed function:

- Analog comparator: Ax - Ay
- Analog trigger: Ax
- Analog amplifier: Ax
- Analog multiplexer: AQ
- Analog ramp: AQ
- Analog math: AQ
- PI controller: AQ

- Up/down counter: Cnt

You select the required function by the block number.

Parameter P (number of decimal places)

Parameter p only applies for displaying the values from PV, SP, Min. and Max. in a message text.

Timing diagram

The nature, manner and speed with which the AQ changes depends 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.
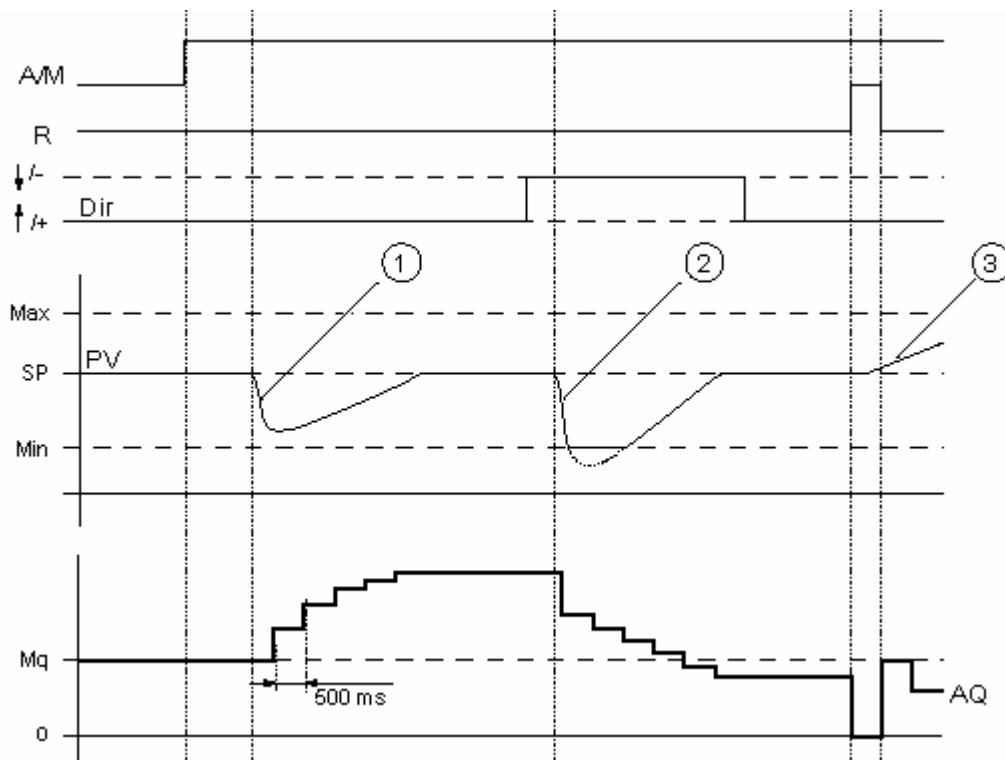
①   A disturbance causes the PV to drop, as Dir is positioned upwards, AQ increases until PV corresponds again to SP.

②   A disturbance causes the PV to drop, as Dir is positioned upwards, AQ decreases until PV corresponds again to SP.

         Dir is coordinated to the basic conduct of a control loop. The direction (dir) cannot be changed during the term of the function. The change in Dir here is shown for the purposes of clarification.

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.

When you view the circuit program in an online test or in a simulation, WindLGC displays a trend view of the analog output value of the PI controller. The trend view shows the change in the analog output value over time.

Description of Function

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 in accordance with the formulas given in Control and regulate basics. The updated value PV is used 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 increases or decreases 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

In order to simplify the use of the PI controller, the parameters for KC, TI and Dir are already given as sets for the following applications:

Parameter set	Application example	Parameter KC	Parameter TI (s)	Parameter Dir
Temperature fast	Temperature, cooling control of small spaces; small volumes	0.5	30	+
Temperature slow	Heating, ventilation, temperature, cooling control of large spaces; large volumes	1.0	120	+
Pressure 1	Quick pressure change, compressor control	3.0	5	+
Pressure 2	Slow pressure change, differential pressure control (flow controller)	1.2	12	+

Full level 1	Vat and/or reservoir filling without drain	1.0	99:59	+
Full level 2	Vat and/or reservoir filling with drain	0.7	20	+

Characteristics when configuring

Observe the Control and regulate basics.

Overview: Special Functions

Analog ramp control

En
Sel
St
Par
A→ — AQ
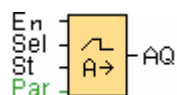
Short Description

The Analog Ramp Control instruction allows the output to be changed from the current level to the selected level at a specified rate.

Connection	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: The step 1 (level 1) is selected. Sel = 1: The step 2 (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.
Parameter	**Level1 and Level2:** Levels to be reached; value range for each level: -10,000 to +20,000 **MaxL:** Maximum value that must not be exceeded. Value range: -10,000 to +20,000 **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"). Value range: 0 to +20,000 **Rate:** Speed with which level 1, level 2 or 0ffset is reached. Steps/seconds are issued. Value range: 1 to 10,000 **A:** Gain Value range: 0 to 10,00 **B:** Offset Value range: +- 10.000 **p:** Number of decimal places Value range: 0, 1, 2, 3
Output **AQ**	The output AQ is scaled using the formula: (Current Level - Offset "B") / Gain "A" Note: When AQ is displayed in parameter mode or message mode, it is displayed as an unscaled value (engineering units: current level). Value range for AQ: 0...+32767

Parameters Level1 and Level2

The level parameters Level1 and Level2 can be provided by the value of another already-programmed function:

- Analog comparator: Ax - Ay

- Analog trigger: Ax

- Analog amplifier: Ax

- Analog multiplexer: AQ

- Analog ramp: AQ

- Analog math: AQ

- PI controller: AQ

- Up/down counter: Cnt

You select the required function by the block number.

Parameter p (number of decimal places)

Parameter p only applies for displaying the values of AQ, level 1, level 2, MaxL, StSp, and Rate in a message text.

Timing diagram for AQ
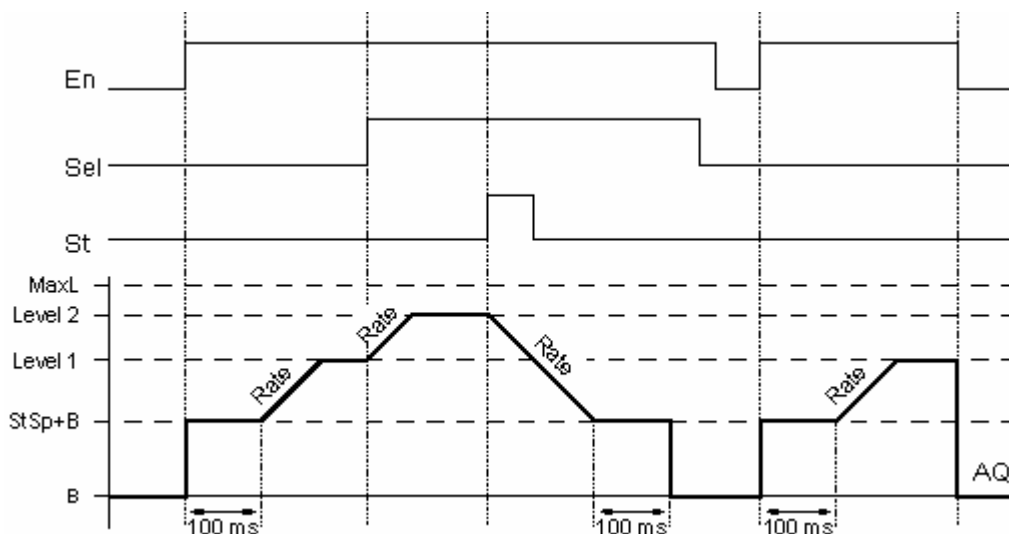
Description of function

If the input En is set, then the function sets the value 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 + 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". output AQ. The scaled value (output AQ) is 0.

If the input St is set, the function can only be restarted once the inputs St and En have been reset.

If input Sel has been changed, depending on the connection of Sel, the function runs from the current target level to the new target level at the rate that is specified.

If the input En is reset, the function immediately sets the current level to Offset "B".

The current level is updated every 100 ms. Note the relationship between output AQ and the current level:

Output AQ = (current level - Offset "B") / Gain "A"

Particular characteristics to be noted when configuring

For help on analog block parameters, refer to the Analog value processing section.

Overview: Special Functions

Miscellaneous
Latching relay

Short description

A signal at input S sets output Q. A signal at input R resets output Q.

Connection	Description
Input **S**	Set output Q with a signal at input S (Set).
Input **R**	Reset output Q with a signal at input R (Reset). Output Q is reset if S and R are both set (reset has priority over set).
Parameter	**Retentivity** set (on) = the status is retentive in memory.
Output **Q**	Q is set with a signal at input S and remains set until it is reset with signal at input R.

Timing diagram
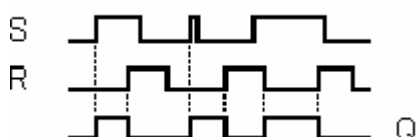
Description of the function

The latching relay represents a simple binary memory logic. The output value depends on the input states and the previous status at the output.

Logic table of the latching relay:

S	R	Q	Remark
0	0	x	Status unchanged
0	1	0	Reset
1	0	1	Set
1	1	0	Reset

When retentivity is enabled, the output signal corresponds with the signal status prior to the power failure.

276

Overview: Special Functions

Current impulse relay

Trg
S
R
Par — RS — Q
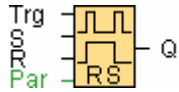
Short description

The output is set and reset with a short one-shot at the input.

Connection	Description
Input **Trg**	You switch output Q on or off with a signal at input Trg (Trigger) input.
Input **S**	A one-shot at input S (Set) sets the output to logical 1.
Input **R**	A one-shot at input R (Reset) resets the output to logical 0

Parameter	**Selection:**
	    RS (input R priority), or
	    SR (input S priority)
	Retentivity set (on) = the status is retentive in memory.

Output **Q**	Q is switched on with a signal at Trg and is reset again at the next Trg pulse, if both S and R = 0.

FL1A-FL1B:
The special function does not have an S input and priority preselection.
The following applies to output Q:
Q is switched on with a signal at Trg and is switched off again with the next signal at Trg or R.
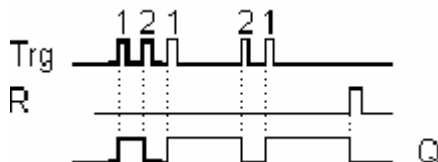
Timing diagram
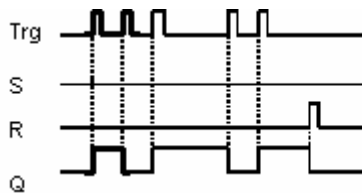
Description of the function

The status of output Q changes with each 0 to 1 transition at input Trg and if both S and R = 0, that is, the output is switched on or off.

Input Trg does not influence the SFB when S = 1 or R = 1.

A one-shot at input S sets the current impulse relay, that is, the output is set to logical 1.

A one-shot at input R resets the current impulse relay to its initial state, that is, the output is set to logical 0.

278

Either the input R takes priority over input S (the signal at input S has no effect as long as R = 1), or the input S takes priority over input R (the signal at input R has no effect as long as S = 1), depending on your configuration.

FL1A-FL1B:
The valid function is:
The status at output Q is toggled with each 0 to 1 transition at input Trg, that is, the output is switched on or off.
You reset the current impulse relay to its initial state with a one-shot at input, that is, the output is reset to 0.
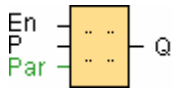The current impulse relay is reset and output Q = 0 after power on or by a reset signal.

Caution

If Trg = 0 and Par = RS, the "Current impulse relay " SFB corresponds with the "Latching relay" SFB function.

Overview: Special Functions

Message text (IDEC SmartRelay FL1E)

Short description

This function displays message texts and parameters of other blocks on the IDEC SmartRelay Display or Text Display when IDEC SmartRelay is in RUN mode.

The IDEC SmartRelay FL1E device series supports many new message text features that IDEC SmartRelay FL1D devices and earlier did not support. You can choose, however, whether to use IDEC SmartRelay FL1E message text functions blocks with the new features or IDEC SmartRelay FL1D message text function blocks in your circuit program. This selection is on the File -> Message Text Settings dialog, along with other global settings. You cannot mix and match IDEC SmartRelay FL1D message text function blocks and IDEC SmartRelay FL1E message text function blocks in your circuit program.

Connection	Description
Input **En**	A 0 to 1 transition at En (Enable) triggers the output of the message text.
Input **P**	P is the priority of the message text. 0 is the lowest, 127 the highest priority. Ack: Acknowledgement of the message text
Parameter	**Text:** Input of the message text **Par:** Parameter or actual value of another, already configured , which can be displayed numerically or as a bar graph (see "Visible parameters or actual values") **Time:** Shows the continuously updated time-of-day **Date:** Shows the continuously updated date **EnTime:** Display of the time of the 0 to 1 transition of the signal at input En **EnDate:** Display of the date of the 0 to 1 transition of the signal at input En **I/O Status Names:** Display of a input or output status name, for example "On" or "Off". **Analog Input:** Display of analog input value to the shown in message text and updated according to the analog time.
Output **Q**	Q remains set as long as the message text is queued.

Settings

In addition to the function block inputs and the parameters of the message text, the following settings provide additional control over the display of message texts:

- **Character set selection:** You can choose to compose a message text from characters from the primary character set or the secondary character set. You set the two character sets from either the "Msg Config" menu on the IDEC SmartRelay Base module, or by using the WindLGC File->Message Text Settings menu command.

- **Message destination:** You can choose to display the message text on the IDEC SmartRelay Display, the Text Display, or both.

- **Tick settings:** The message text can tick or not tick, meaning it can scroll on and off the display. The tick capabilites and your choices are described in more detail below.

Description of the function

With a 0 to 1 transition of the signal at input En, and with IDEC SmartRelay in run mode, the IDEC SmartRelay Display and/or Text Display displays your configured message text.

When the "Acknowledgement message" checkbox is not selected, the message text is hidden with a 1 to 0 signal transition at input En.

When the "Acknowledgement message" checkbox is selected, then after input En is reset to 0, the message text is displayed until acknowledged by pressing the OK button. The message text cannot be acknowledged as long as input En is high.

If several message text functions were triggered with En=1, the message with the highest priority (0 = lowest, 127 = highest) is displayed. This also implies that a new message text is only displayed if its priority is higher than that of previously enabled message texts.

If the circuit program uses Memory Marker M27, then whenever M27=0 (low) IDEC SmartRelay only displays message texts that are in the primary character set (Character Set 1). If M27=1 (high), then IDEC SmartRelay only displays message texts that are in the secondary character set (Character Set 2).

After a message text is disabled or acknowledged, the display automatically shows the previously active message text with the highest priority.

You can change between the display in RUN mode and the message texts by means of the and buttons.

Particular characteristics to be noted when configuring

①	**Block name area**
	Here you can provide a name for the block
②	**Settings area**
	Here you can configure the following settings:·
	• Priority of the message text
	• Acknowledge Message check box: if set requires a message to be acknowledged in order to be closed
	• Character set selection for the message text
③	**Tick area**
	Here you define the tick parameters for the message text:
	• Character by Character tick format
	• Line by Line tick format
	• Tick enabled checkbox for each display line
④	**Message destination area**
	Here you choose whether the target destination for the message is the IDEC SmartRelay Display, the Text Display, or both.
⑤	**Message area**
	Here you arrange the message text. The information that you enter in this area corresponds to what will be displayed on the IDEC SmartRelay Display or Text Display.
	Above this area are additional buttons:

Delete button: for deleting entries from the message area

°C Special characters button: for inserting special characters into the message area

Bar Graph button: for placing a horizontal or vertical bar graph into the message area

AI button: for placing an analog input value into the message area

ON/OFF button: for specifying a digital value to be represented by one of two strings corresponding to the 0 state and 1 state, for example "OFF" and "ON".

Edit manually button: for using the static editor to add, move, or delete message text elements without changing the position of any other elements

⑥ **Block area**

Here is where you select blocks from all of the blocks in the circuit program. You can subsequently choose parameters from these blocks to display in the message text.

⑦ **Block parameters area**

Here you can select the parameters to be displayed in the message text from the block that is selected in the Blocks area.

⑧ **Insert Parameter button**

This button is for inserting a selected block parameter into the message text.

To arrange the message text

The message area shows a grid of four lines and character positions. The message text configuration area is 24 characters wide for Western European character sets or 16 characters wide for Asian character sets. Either way, the character width of each line is double that of the IDEC SmartRelay Display or Text Display. Message lines that are longer than the width of the actual display can be set to "tick". In the message area, WindLGC indicates the region corresponding to the visible area of the IDEC SmartRelay Display or Text Display in one color, and the region that can only be shown by using the message ticking feature in another color.

To configure the content of a message text, follow these steps:

1. From the "Blocks" area, select the block whose parameters you want to output.

2. Drag and drop the parameters required from the "Block parameters" to the "Message Text" area. You can also use the "Insert " button to insert a parameter value.

3. In the "Message Text" area, you can add parameter data, time or date values from the block parameter area as required and enter text. To enter text, select the character set for the message text, and then type. You can also use the buttons above the message text area to add special characters, bar graphs, analog input values, and names for digital I/O states.

Message text character set

IDEC SmartRelay FL1E supports five character sets for messages. Of these, you can select two for the display of message texts with the File -> Message Text Settings menu command or from the "Msg Config" menu of IDEC SmartRelay. Of the fifty 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 fifty 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 fifty.

The Message text dialog displays the character sets that are currently available for your message text, as configured in the message text settings. To use a character set, select the "Enabled" check box, and the button for the character set. Characters that you subsequently type will be from the character set that you enabled and selected. If you deselect the "Enabled" check box for a character set,

WindLGC will prompt you for confirmation and then delete the message text, if it exists, that corresponds to that character set.

The character set of a message text is independent of the language setting for the IDEC SmartRelay Display menus. They can be different.

Chinese character set

The IDEC SmartRelay Base module and Text Display 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 the message text function block in WindLGC.

Message ticker

You can configure a message text to tick, or to 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 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 Display or Text Display.

The tick time is the interval of time by which a character or a line of text ticks off the screen. The tick time is a global message text parameter for all message texts.

Example: Tick Message Character by Character

The following illustration shows the configuration in WindLGC of a one-line, 24-character message text:

X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15	X16	X17	X18	X19	X20	X21	X22	X23	X24

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 Display or Text Display 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 Display or Text Display:

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

After the next 0.1 second, another character of the message line ticks. The message appears as follows on the IDEC SmartRelay Display or Text Display:

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 X_2

Example: Tick Message Line by Line

The following example uses the same message configuration as the previous example:

X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15	X16	X17	X18	X19	X20	X21	X22	X23	X24

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 Display or Text Display is the left half of the message as shown in this illustration:

X1 X2 X3 X4 X5 X6 X7 X8 X9 X10 X11 X12 | X13 X14 X15 X16 X17 X18 X19 X20 X21 X22 X23 X24

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 to tick at all. The "character by character" or "line by line" setting applies to all lines that you configure to tick. Select the check box beside a line number to enable ticking for that line.

Bar graphs

You can specify a bar graph representation for the actual value of any other function block in your circuit program. The bar graph can be horizontal or vertical on the IDEC SmartRelay Display or Text Display. You can configure up to four bar graphs per message text.

Use the bar graph button in the message text area to place a bar graph in the message text area. From the Bar Setting dialog you must provide the following information:

- Block from your circuit program that the bar graph represents

- Minimum and maximum value for the bar graph: IDEC SmartRelay will calculate the length or height of the bar graph by scaling the actual value between the minimum and maximum values.

- Orientation of the bar graph: horizontal or vertical

- Width or height of the bar graph, in character spaces

Example:

Consider a bar graph in a message text with the following characteristics:

- Configured bar graph length: 4 character spaces

- Orientation: Horizontal

- Configured minimum value: 1000

- Configured maximum value: 2000

- Actual value: 1750

The resulting bar graph will be 3 character spaces long.

Text representation of digital I/O states

You can assign names such as "On" or "Off" to the two states of a input or output. With the IDEC SmartRelay FL1E series, you can display this name of a digital I/O state in a message text. The maximum number of characters for a state name is eight for Western language character sets; for Asian language character sets the number of characters is four. Use the ON/OFF button in the

message text area to define names for the two states of a input or output to be used in the message text.

Within a single message text, you can configure up to four digital I/O state name displays.

Within one circuit program, a maximum of 20 I/O state names can be used in message text function blocks.

Display of remaining timer time

With the IDEC SmartRelay FL1E series, you can display the remaining time of a timer in a message text. Prior to this feature you could display the current elapsed time of a timer and the timer parameters.

When placed in a message text, the remaining time will show the time that remains before the timer expires. For timers with multiple timer values (for example on-delay time, off-delay time), you can display the remaining time of each one in a message text.

Display of analog inputs

You can also select analog inputs to be displayed in a message text. Use the AI button in the message text area to select a specific AI to place in the message text area.

If you have analog inputs in a message text, the global message text setting for the Analog input filter timer specified how often the message text is updated with current values. The refresh time choices are 100 ms, 200 ms, 400 ms, 800 ms, and 1000 ms. If you have more than one analog input in a message text, the refresh rate applies to them all.

Static editor (Edit manually)

WindLGC provides a static editor for message texts that can help when you need to reposition text elements. For example, it has a recycle bin area where you can temporarily move message text elements in order to rearrange the position of elements on the display area. You can move elements up, down, left, or right without changing the position of any other elements.

To use the static editor, click the "Edit manually" button above the message text area. You will also be prompted to edit manually if you try to place or move elements in the message area that have a position conflict with existing elements.

Simulation mode

Layout of message texts

Overview: Special Functions

FL1A-FL1B:
Maximum number of message texts: 5
Not supported: message ticker, bar graphs, analog inputs, I/O status names, and remaining timer time.
FL1C-FL1D:
Maximum number of message texts: 10
Not supported: message ticker, bar graphs, analog inputs, I/O status names, and remaining timer time.

Restrictions

The following restrictions apply to message text function blocks:

- Up to 50 message text functions are available.

- Up to 32 total bar graphs in message texts are available.

- WindLGC supports all of the defined features for message texts. When programming directly on the IDEC SmartRelay device, you can only program a limited number of the message text features. See the IDEC SmartRelay manual for a description of message text programming from the IDEC SmartRelay device.

- Each message line can contain 24 characters (Western language character sets) or 16 characters (Asian language character sets). Within a message text the following limitations apply:

  - Maximum number of parameters: 4
  - Maximum number of bar graphs: 4
  - Maximum number of I/O status names:4
  - Maximum number of time/date values: 4
  - Maximum number of analog inputs: 2

Particular characteristics to be noted when configuring

The message text can be configured in the block properties dialog. You can enter up to four lines for each message text (the text display of the IDEC SmartRelay Display and Text Display has four rows) and set the priority. You can move to the next line using the cursor keys or the mouse. Hit the [ENTER] key to confirm all your entries in the block properties dialog and to close the dialog.

You can also specify the actual values of other blocks in the text lines. To do so, select the relevant block from the **Block** dialog. A **Parameter** dialog opens to display a list of all parameters available for the selected block. The block parameter you select in this dialog is written to the selected text line. The actual parameter value is now included when you call the message text.

Set the "Acknowledge message" attribute to specify whether a message is be acknowledged before it is closed.

Simulation mode

Layout of message texts

Overview: Special Functions

Message text (IDEC SmartRelay FL1D)
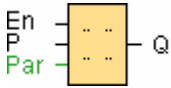
   The description of the device series FL1B and earlier is found below.

Short description

This function displays message texts and parameters of other blocks on the IDEC SmartRelay Display when IDEC SmartRelay is in RUN mode.

Note: The IDEC SmartRelay FL1E device series supports many new message text features that IDEC SmartRelay FL1D devices and earlier did not support. You can choose, however, whether to use IDEC SmartRelay FL1E message text functions blocks with the new features or IDEC SmartRelay FL1D message text function blocks in your circuit program. This selection is on the File -> Message Text Settings dialog, along with other global settings. You can also use the button at the bottom of the IDEC SmartRelay FL1D message dialog to change your message text functions to the IDEC SmartRelay FL1E style with the new features. You cannot mix and match IDEC SmartRelay FL1D message text function blocks and IDEC SmartRelay FL1E message text function blocks in your circuit program.

Connection	Description
Input **En**	A 0 to 1 transition at En (Enable) triggers the output of the message text.
Input **P**	P is the priority of the message text. 0 is the lowest, 30 the highest priority. Ack: Acknowledgement of the message text
Parameter	**Text:** Input of the message text **Par:** Parameter or actual value of another, already configured function (see "Visible parameters or actual values") **Time:** Shows the continuously updated time-of-day **Date:** Shows the continuously updated date **EnTime:** Shows the time of the 0 to 1 transition **EnDate:** Shows the 0 to 1 transition of the date
Output **Q**	Q remains set as long as the message text is queued.

Description of the function

With a 0 to 1 transition of the signal at input En, the display outputs your configured message text (actual value, text, TOD, date) in RUN mode.

Acknowledgement disabled (Ack = Off):

The message text is hidden with a 0 to 1 signal transition at input En.

Acknowledgement enabled (Ack = On):

After input En is reset to 0, the message text is displayed until acknowledged by pressing the OK button. The message text cannot be acknowledged as long as input En is high.

If several message text functions were triggered with En=1, the message with the highest priority (0 = lowest, 30 = highest) is displayed. This also implies that a new message text is only displayed if its priority is higher than that of previously enabled message texts.

After a message text is disabled or acknowledged, the function automatically shows the previously active message text that takes the highest priority.

You can change between the display in RUN mode and the message texts by means of the and buttons.

Restrictions

Up to 10 message text functions are available.

Particular characteristics to be noted when configuring
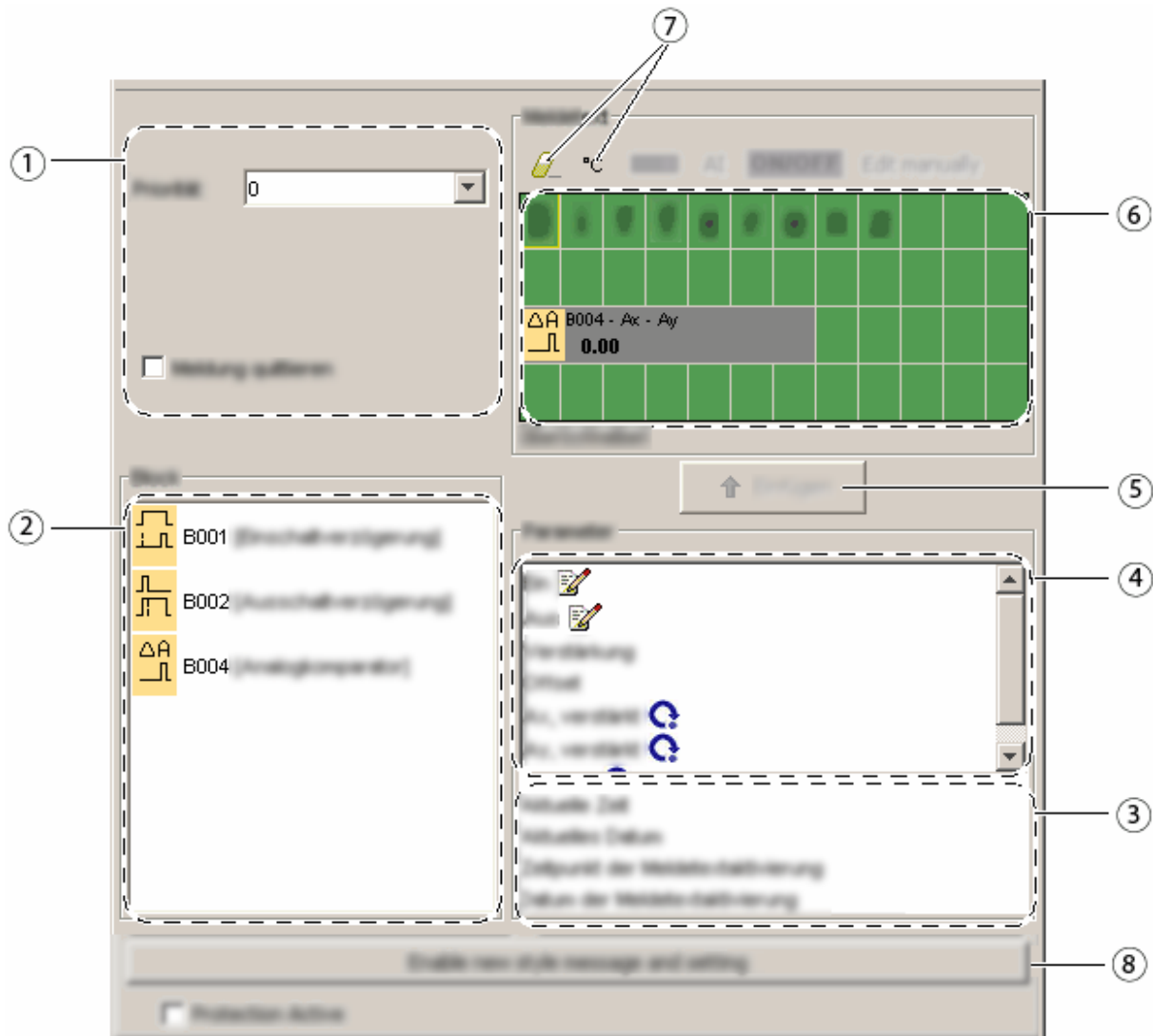
①   **"General" area**

Here you will find the following settings:·

- Priority of the message text
- Check box for message text acknowledgement

②   **"Blocks" area**

Shows a list of all the circuit program blocks and their parameters.

WindLGC V6.0

③ **"General parameters" area**

Shows general parameters such as the current date.

④ **"Block parameters" area**

Shows the parameters of a block selected from the "Blocks" area which you can output in the message text.

⑤ **"Insert" button**

Button for inserting a parameter selected from the **"Block parameters"** or **"General parameters"** area into the message text.

⑥ **"Messages" area**

You arrange the message text in this area. Information entered in this area corresponds with that on the IDEC SmartRelay display.

⑦ **"Delete" button**

Button for deleting entries from the **"Messages"** area

"Special characters" button

Button for inserting special characters in the **"Messages"** area

⑧ **"Enable new style message and setting"**

Button to switch to IDEC SmartRelay FL1E style message texts with new features. You must then complete the File -> Message Text Settings dialog to configure settings for IDEC SmartRelay FL1E style message texts. All message texts will be in the IDEC SmartRelay FL1E style after this selection.

To arrange the message text

From the **"Blocks"** area, select the block whose parameters you want to output.

Drag and drop the parameters required from the **"Block parameters"** to the **"Messages"** area. You may also use the **"Insert"** button to do so.

In the **"Messages"** area, you can add parameter data as required.

Simulation mode

Layout of message texts

Overview: Special Functions

FL1A : FL1D

FL1A-FL1B:
The following specifications apply:

Short description

Display of a configured message text in RUN mode

Connection	Description
Input En	The message text is output with a 0 to 1 transition at input En (Enable).
Parameter P	P is the priority of the message text. 0 is the lowest, 9 the highest priority.

Parameter	Par: Parameter or actual value of another, already programmed function (see "Displayable parameters or actual values")
Output Q	Q remains set as long as the message text is queued.

Description of the function

In RUN mode, a 0 to 1 transition of the signal at input En triggers the output of your configured message text on the display. The message text is closed after a 1 to 0 transition at input En and if the acknowledgment attribute is not set. If the acknowledgment attribute is set, the message text is not closed until input En=0 and the message is acknowledged at the IDEC SmartRelay with OK. The status at output Q remains 1 as long as the message text is displayed.

Of several message text functions triggered with En=1, the one with the highest priority is displayed. Low-priority messages can also by displayed by pressing the button on the IDEC SmartRelay.

You can switch between the standard display and the message text display by means of the IDEC SmartRelay buttons and .

Restrictions

Up to five message text functions are available.

Particular characteristics to be noted when configuring

The message text can be configured in the block properties dialog. You can enter up to four lines for each message text (the text display of the IDEC SmartRelay has four rows) and set the priority. You can move to the next line using the cursor keys or the mouse. Hit the [ENTER] key to confirm all your entries in the block properties dialog and to close the dialog.

You may also enter the actual values of other blocks in the text lines. To do so, select the relevant block from the **Block** dialog. A **Parameter** dialog opens to display a list of all parameters available for the selected block. The block parameter you select in this dialog is written to the selected text line. The actual parameter value is now included when you call the message text.

Set the "Acknowledge message" attribute to specify whether a message is be acknowledged before it is closed.

Simulation mode

Layout of message texts

Overview: Special Functions

Softkey
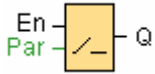
Short description

This SFB provides the action of a mechanical pushbutton or switch.

Connection	Description
Input **En**	Output Q is set with a 0 to 1 signal transition at input En (Enable) and if in addition, 'Status=On' has been confirmed in configuration mode.
Parameter	**Switch:** Sets either a momentary pushbutton action for one cycle (On) or a switching action of the function (Off). **Status**: On or Off state that is applied in the initial cycle after program startup, if retentivity is not set. **Retentivity** set (on) = the status is retentive in memory.
Output **Q**	Output Q remains set 1, as long as En=1 and the status at the parameter Type = Switch and Status = On. Output Q is set for the duration of one cycle if EN=1. Switch = On (momentary pushbutton) and Status = On.

Factory state

The default of the Switch parameter is switching action.

Timing diagram
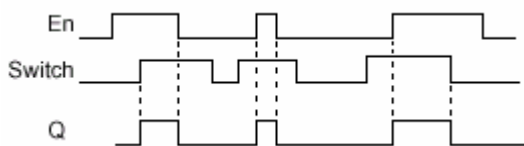
Description of the function

The output is set when input En is set and the 'Status' parameter is set to 'On' and confirmed with OK. This action is performed irrespective of a configured switch or pushbutton function.

The output is reset to '0' in the following three cases:

- With a 1 to 0 signal transition at input En

- When a pushbutton function is configured and one cycle has expired after its actuation

- When the 'Status' parameter sets the 'Off' status in configuration mode, and this has been confirmed with OK

Particular characteristics to be noted when configuring

The softkey can be used both with momentary pushbutton or switching action. At the status parameter you can define the on (actuated) or off state for the switch/pushbutton.

If the softkey is assigned a pushbutton action, the output is always set for the duration of one cycle with a 0 to 1 transition at input En when the pushbutton is in on state, or if the pushbutton state changes from Off to On when En=1.

Overview: Special Functions

Shift register

Short description

The shift register function can be used to read an input value and to shift the bits. The output value corresponds with the configured shift register bit. The shift direction can be changed at a special input.

Connection	Description
Input **In**	The function when started reads this input value.
Input **Trg**	The SFB is started with a positive edge (0 to 1 transition) at input Trg (Trigger). A 1 to 0 transition is irrelevant.
Input **Dir**	You define the shift direction of the shift register bits S1...S8 at the Dir input: Dir = 0: shift up (S1 >> S8) Dir = 1: shift down (S8 >> S1)
Parameter	**Shift register bit** that determines the value of output Q. Possible settings: S1 ... S8 **Retentivity** set (on) = the status is retentive in memory.
Output **Q**	The output value corresponds with the configured shift register bit.

Timing diagram
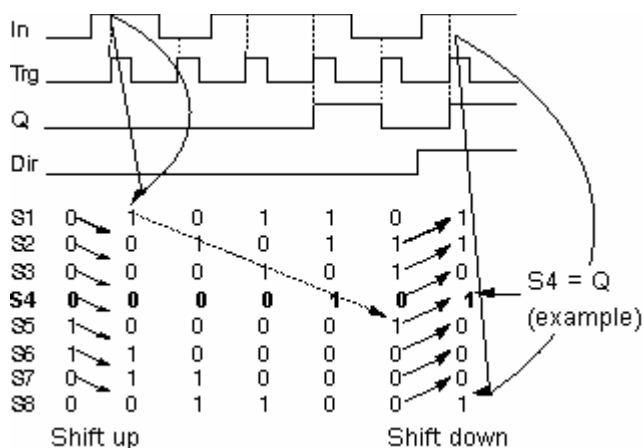
Description of the function

The function reads the value of input In with a positive edge (0 to 1 transition) at input Trg (Trigger).

This value is written to shift register bits S1 or S8, depending on the set shift direction:

- Shift up: S1 accepts the value of input In; the previous value of S1 is shifted to S2, S2 is shifted to S3, etc.

- Shift down: S8 accepts the value of input In; the previous value of S8 is shifted to S7, S7 is shifted to S6, etc.

Q outputs the value of the configured shift register bits.

If retentivity is not enabled, the shift function restarts at S1 or S8 after a power failure.

Note

The special function shift register can be used only once in the circuit program.

Overview: Special Functions

Analog math error detection
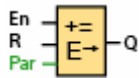
Short description

The analog math error detection block sets an output if an error has occurred in the referenced analog math function block.

Connection	Description
Input **En**	Enable the analog math error detection function block.
Input **R**	Reset the output.
Parameter	**Referenced FB:** block number of an analog math instruction **Error to detect:** Zero division, Overflow, or Zero division OR Overflow. **Auto Reset:** Reset the output when the failure condition clears.
Output **Q**	Q is set high if the error to detect occurred in the last execution of the referenced analog math function block.

 FL1A-FL1D: The analog math error detection function block did not exist prior to FL1E.

Parameter Referenced FB

The value for the Referenced FB parameter references the block number of an already-programmed analog math function block.

Description of the function

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 you select the Automatically reset checkbox, the output is reset prior to the next execution of the function block. If not, the output retains its state until the analog math error detection block is reset with the R parameter.

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, Error to Detect represents the parameter of the analog math error detection instruction that selects which type of error to detect. Zero represents the zero division bit set by the analog math instruction at the end of its execution: 1 if the error ocurred, 0 if not. OF represents the overflow bit set by the analog math instruction: 1 if the error occurred, 0 if not. Zero division OR Overflow represents the logical OR of the zero division bit and the overflow bit of the referenced

analog math instruction. Output (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.

Error to Detect	Zero	OF	Output (Q)
Zero division	1	x	1
Zero division	0	x	0
Overflow	x	1	1
Overflow	x	0	0
Zero division OR Overflow	1	0	1
Zero division OR Overflow	0	1	1
Zero division OR Overflow	1	1	1
Zero division OR Overflow	0	0	0

If the Referenced Analog Math FB is null, then the output is always 0.

Overview: Special Functions

Additional functions of the LAD Editor

In LAD circuit programs the AND with Edge Detection instruction and the NAND with Edge Detection instruction are available in the group of miscellaneous functions.

Circuit programs

Circuit programs - Introduction

With WindLGC you can start right away to design your own circuit programs. The tutorial section provides you with detailed information about the creation and simulation of circuit programs.

You first use the WindLGC software to write your programs, and secondly let WindLGC calculate the minimum IDEC SmartRelay version that you need to put your ideas into practice!

No particular program settings are required.

The type of IDEC SmartRelay device you can use to put your ideas into practice depends on a number of factors:

- The number of I/Os to be used

- Memory requirements of the circuit program

- The use of particular SFBs

IDEC SmartRelay Hardware

IDEC SmartRelay hardware series

WindLGC lets you create programs for IDEC SmartRelay devices of various series. Differences are found in the performance, memory space, number of program blocks (for example, Memory Marker blocks) and in the structure of the devices.

Because there are device-specific differences with regard to the functions, you are forced not only to distinguish between the IDEC SmartRelay versions, but also to take their version status into account. You can identify the version status by the suffix of the IDEC SmartRelay order number.

The current IDEC SmartRelay versions belong to the 5th generation. They can be identified by the last digits of their order number: FL1E.

Current devices

Version	Name
Standard	FL1E-H12RCE (DC)
Standard	FL1E-H12SND (DC)
Standard	FL1E-H12RCA (AC/DC)
Standard	FL1E-H12RCC (AC)
Standard	FL1E-B12RCE (DC)
Standard	FL1E-B12RCA (AC/DC)
Standard	FL1E-B12RCC (AC)

Memory space is identical for all these devices.

The following expansion modules are available for the standard devices

Version	Name
Digital	FL1B-M08C2R2
Digital	FL1B-M08B1S2
Digital	FL1B-M08B2R2
Digital	FL1B-M08D2R2 (AC/DC)
Analog	FL1B-J2B2 (DC)
Analog	FL1B-K2B2 (DC)
Text Display	FL1E-RD1

Current devices

The following memory cartridges and battery cartridges are available:

Description	Name
Memory cartridge	FL1E-PM4
Battery cartridge	FL1E-PB1
Combined memory and battery cartridge	FL1E-PG1

FL1A
FL1D

Special functions, depending on IDEC SmartRelay versions

Special function	FL1A all	FL1B all	FL1C all	FL1D all	FL1E all
On delay	X	X	Xr	Xr	Xr
Off delay	X	X	Xr	Xr	Xr
Retentive on delay	X	X	Xr	Xr	Xr
On/off delay	X	X	Xr	Xr	Xr
Latching relay	Xr	Xr	Xr	Xr	Xr
Current impulse relay	Xr	Xr	Xr	Xr	Xr
Interval time-delay relay	X	X	Xr	Xr	Xr
Edge-triggered interval time-delay relay	X	X	Xr	Xr	Xr
Seven-day time switch)*	X	X	X	X	X
Twelve-month time switch)*	X	X	X	X	X
Up/down counter	Xr	Xr	Xr	Xr	Xr
Operating hours counter	Xr	Xr	Xr	Xr	Xr
Symmetrical clock pulse generator	X	X	X	X	X
Asynchronous pulse generator	X	X	Xr	Xr	Xr
Random generator	X	X	X	X	X
Analog trigger	X	X	X	X	X
Analog trigger	X	X	X	X	X
Analog comparator	X	X	X	X	X
Stairwell Light Switch	X	X	Xr	Xr	Xr
Dual-function switch	X	X	Xr	Xr	Xr
Message text	X	X	X	X	X
Softkey	-	Xr	Xr	Xr	Xr
Shift register	-	-	Xr	Xr	Xr
Analog value monitoring	-	-	Xr	Xr	Xr
Analog amplifier	-	-	X	X	X
Analog Differential trigger SFBs	-	-	X	X	X
Analog multiplexer	-	-	-	X	X
Controller	-	-	-	Xr	Xr
Analog ramp control	-	-	-	-	X
Pulse width modulator (PWM)	-	-	-	-	X
Analog math	-	-	-	-	X
Analog math error detection	-	-	-	-	X

X = Yes; - = No

)* = Use of this function only makes sense for IDEC SmartRelay versions with integrated real-time clock.

r= retentive

Memory

Memory requirements

The blocks in your circuit program require a certain amount of memory space. The table shows you how much of the memory space each block occupies.

Memory space required for data backup after power failure is specified in the "Rem" column (retentivity enabled).

Block	RAM (Bytes)	Rem (Bytes)
AND (with/without Edge Detection)	12	-
NAND	12	-
OR (with/without Edge Detection)	12	-

NOR	12	-
XOR	8	-
NOT	4	-
On delay	8	3
Off delay	12	3
On/off delay	12	3
Retentive on delay	12	3
Interval time-delay relay	8	3
Edge-triggered interval time-delay relay	16	4
Asynchronous pulse generator	12	3
Random generator	12	-
Stairwell Light Switch	12	3
Dual-function switch	16	3
Seven-day time switch	20	-
Twelve-month time switch	12	-
Up/down counter	28	5
Operating hours counter	28	9
Analog trigger	16	-
Analog trigger	16	-
Analog differential trigger	16	-
Analog comparator	24	-
Analog value monitoring	20	-
Analog amplifier	12	-
Pulse width modulator (PWM)	24	-
Analog math	20	-
Analog math error detection	12	1
Latching relay	8	1
Current impulse relay	12	1
Message text	8	-
Softkey	8	2
Analog multiplexer	20	-
PI Controller	40	2
Analog ramp control	36	-
Shift register	12	1

FL1A-FL1B: The following specifications apply:

The blocks in your circuit program require a certain amount of memory space. The table below shows you how much memory space the blocks use in the various memory areas:

Block	Par	RAM	Timer	REM
Basic functions	0	0	0	0
On delay	1	1	1	0
Off delay	2	1	1	0
On/off delay	2	1	1	0
Retentive on delay	2	1	1	0
Interval time-delay relay	1	1	1	0
Edge-triggered interval time-delay relay	1	1	1	0
Symmetrical clock pulse generator	1	1	1	0
Asynchronous pulse generator	3	1	1	0
Random generator	2	1	1	0
Stairwell Light Switch	1	1	1	0
Dual-function switch	2	1	1	0
Seven-day time switch	6	2	0	0
Twelve-month time switch	2	0	0	0
Up/down counter*	2	(2)	0	(2)

Operating hours counter	2	0	0	4
Frequency trigger	3	3	1	0
Analog trigger	4	2	0	0
Analog comparator	3	4	0	0
Latching relay*	0	(1)	0	(1)
Current impulse relay *	0	(1)	0	(1)
Message texts	1	0	0	0
Softkey*	1	(1)	0	(1)

*: Depending on whether the function is configured with or without retentivity, it occupies the following memory space:

- Retentivity off: The function occupies RAM space

- Retentivity on: The function occupies REM space

Here you will find information on memory space provide by IDEC SmartRelay.

Memory space

You may use up to 200 blocks in your circuit program.

The maximum memory space used by a IDEC SmartRelay circuit program is:

- RAM: 3800 bytes

- Retentive data: 250 bytes

The Info Window displays the memory space used when you call the Tools -> Determine IDEC SmartRelay function, or when you press the function key [F2].

FL1A : FL1D

The following specifications apply

IDEC SmartRelay series	Blocks	Par	RAM	Timer	REM	Memory Markers
IDEC SmartRelay FL1C ... FL1D	130	Not restricted	Not restricted	Not restricted	60	24
IDEC SmartRelay FL1A ... FL1B	56	48	27	16	15	8

Blocks and block numbers
Blocks

Blocks represent terminals or functions. WindLGC distinguishes between various types of block and identifies these by means of an abbreviation.

Block type	Identifier	Block type	Identifier
Input	I	Memory Marker	M
Output	Q	High	Hi
Function	B	Low	Lo

Block numbers

Block number assignment

WindLGC assigns every block you insert in the circuit program a **block number**. IDEC SmartRelay displays the number of the current block at the top right of the display. WindLGC displays the block number directly above the inserted block.

Block numbers are used for orientation on the IDEC SmartRelay display and for the assignment of logical links. In WindLGC you can also track cut connections by means of their indicated block number.

The corresponding terminal name on the IDEC SmartRelay or a simple block name replaces the block number at constants and terminals. Each input, output and Memory Marker can be assigned further block identifiers via comments. The high and low signal blocks do not have a block number.

Determination of block numbers on a IDEC SmartRelay

IDEC SmartRelay has no default position for analog inputs or outputs. The respective block number is determined by the hardware structure.

On a IDEC SmartRelay without modular structure, the position of an analog or output is fixed, for example.

Tips and Tricks

Tips and tricks

How to maintain an overview during simulation

A quick and easy way of selecting blocks and placing these into your circuit program

A quick and easy way of connecting blocks in large circuit programs

How to use the Info Window texts for your documentation

A quick and easy way of increasing/reducing the size of the Info Window

How to display the corresponding tooltip for a function key

How to identify your circuit program version

How to access functions via the shortcut menu

A quick and easy way of zooming your circuit program window

A quick way of changing block parameters

A quick way of closing WindLGC without saving the data

How to establish the cycle time

How to maintain an overview during simulation

It may be difficult in simulation mode to maintain a clear overview of large circuit programs and/or when working on low resolution screens. We advise the following procedure:

1. Maximize the WindLGC application window to full screen size.

2. Close the Info Window and the catalog.

3. Position the mouse pointer onto the small strip, directly at the left side of the icons of the circuit program inputs. Keep the left mouse button pressed and drag and drop the input toolbar out of the WindLGC application window to the top edge of the screen.

4. Do the same with the toolbar of your circuit program outputs, as described under 2.

Advantage: The space for editing the circuit program has increased. You can still access the I/O toolbars without restriction, since they always remain in the foreground.

Note: You can restore the I/O toolbars to their original position by left-clicking the small cross icon in the upper right corner of the toolbar.

A quick and easy way of selecting blocks and placing these into your circuit program

You have two alternatives to the standard selection of blocks from the programming toolbar icons:

Alternative 1

1. Open the catalog from the programming toolbar.

2. Click on the required block in the catalog to select it.

3. In your circuit program, left-click the block insert position. The block appears at the correct position.

4. To insert further instances of this block, left-click on the relevant insert positions.

5. To insert a further block, select it from the catalog and proceed as described under item 3 and 4.

Advantage: When you change between constants/terminals, basic functions and SFBs, you save yourself having to click the relevant icons in the programming toolbar.

Alternative 2

1. Open the catalog of the programming toolbar.

2. Click on any block in the catalog to select it.

3. If you are creating a large program, you can close the catalog and also hide the programming toolbar.

4. Hold down the Ctrl key and left-click the block insert position in your circuit program. You are displayed a mask with block list, from which you can select the required block with a double-click.

5. Tip: In the mask header, you will also find an input field. You could, for example, enter the initial letter of the required SFB to restrict the display in the mask to a list of blocks with this initial. You thus do not have to browse the entire mask, and you can quickly find the relevant block.
The block is inserted at the correct position in your circuit program.

6. To insert further instances of this block, left-click on the relevant insert positions.

7. To insert a further block, select it from the catalog and proceed as described previously.

Advantage: You do not have to depend on the catalog and the programming toolbar to create large programs. You can thus close and hide these to provide more screen space for your circuit program.

A quick and easy way of connecting blocks in large circuit programs

In addition to the conventional method of creating connections with the programming toolbar icons, you have another alternative:

1. After you have placed the blocks into the circuit program, double-click on the input or output of a block.

2. A mask opens with a list of the target blocks. Double-click to select a block.
Tip: In the mask header you will find an input field. You could, for example, enter the initial letter of the required SFB to restrict the display in the mask to a list of blocks with this initial. You thus do not have to browse the entire mask, and you can quickly find the relevant block.
In addition, you can also use wildcards such as * or ?.

3. The connection is made.

Advantage: Particularly when you are handling large circuit programs, this method provides you with a quick and easy means of creating connections.

How to use the Info Window texts for your documentation

1. Use the mouse to mark the text you want to copy to your documentation.

2. Click the icon . The selected text is copied to the clipboard of your operating system.

3. Change to your documentation editor.

4. Call the Edit menu and select the Paste command to insert the text from the clipboard into your documentation.

A quick and easy way of increasing/reducing the size of the Info Window

Double-click the title bar of the Info Window to switch the window to full-screen mode in the WindLGC application window. Double-click the title bar of the Info Window to restore it to its original size.

How to display a corresponding tooltip for a function key

Prerequisite: The tooltips are enabled.

Under Tools -> Options: Look & Feel, select **Metal** or **Extended Windows Look and Feel.**

With the help of the mouse-over-icon function, WindLGC shows not only the tooltip for this icon, but also the corresponding function key (if available).

Here you will find an overview of the shortcuts.

How to identify your circuit program version

The first 16 characters you enter in the **Project name** field in the File -> Properties: General dialog are downloaded to the IDEC SmartRelay. The version identifier included with these 16 characters is maintained when you download and upload the circuit program between the PC <-> IDEC SmartRelay.

FL1A : FL1D   This special function is only available with devices as of hardware series FL1A.

How to access functions via the shortcut menu

Right-click on an object to open a context sensitive window that offers you all the major functions.

A quick and easy way of zooming your circuit program window

Press [CTRL] and turn the mouse wheel.

Result: The size of your circuit program window changes

A quick way of changing block parameters

Click the parameter field you want to change. Press [CTRL] and turn the mouse wheel.

Result: The parameter changes

A quick way of closing WindLGC without saving the data

Open the **File** menu, press [CTRL] and click the **Close** menu command.

Result: WindLGC is closed without prompt.

Caution: New or changed circuit programs will <u>not</u> be saved.

How to establish the cycle time

The cycle time is the pure program processing time (reading inputs, executing programs and writing outputs).

The cycle time of each function is less than 0.1 ms. The cycle time of the circuit program can be established using a test program. Refer to the IDEC SmartRelay manual, appendix B for more information.

FL1A
:
FL1D

With the IDEC SmartRelay hardware series FL1B or older no statements can be made regarding the cycle time of individual functions. The cycle times are different for each function. You can only establish the time for one program cycle. Refer to the IDEC SmartRelay manual, appendix B for more information. You can download this from the IDEC SmartRelay homepage on the Internet.

Index

A

B

C

D

E