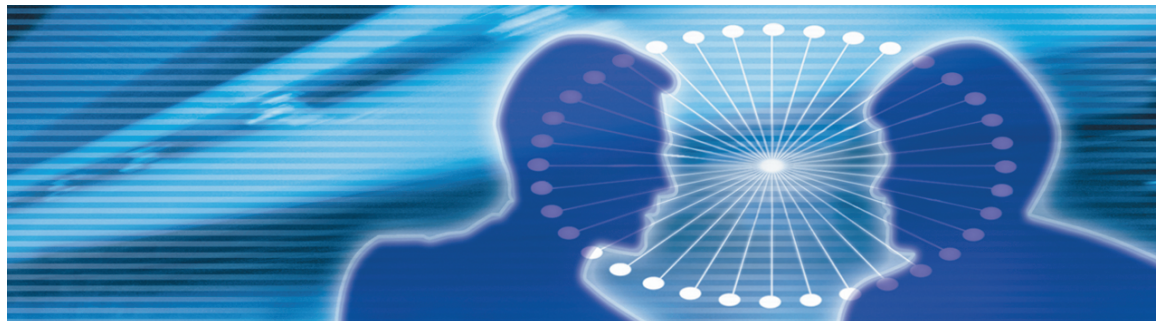


# Protection System Simulator SIM600

Operator's Manual



**ABB**



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## **1. About this manual**

### **1.1. Copyrights**

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### **1.2. Trademarks**

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### **1.3. Guarantee**

Please inquire about the terms of guarantee from your nearest ABB representative. Factory warranty period of SIM600 is 1 year from product delivery.

### **1.4. General**

This manual provides thorough information on SIM600 and the central concepts related to it. For more information on installation and configuration, refer to 1.9, Related documents.

Information in this user's guide is intended for trainers, product demonstrators, marketers, and sales personnel.

SIM600 Editor and its logical symbols are in some parts in compliance with the IEC 61131–3 standard. Knowledge of the standard is an advantage when you work with the editor and design the logic.

## 1.5. Document conventions

The following conventions are used for the presentation of material:

- The words in names of screen elements (for example, the title in the title bar of a window, the label for a field of a dialog box) are initially capitalized.
- Capital letters are used for the name of a keyboard key if it is labeled on the keyboard. For example, press the ENTER key.
- Lowercase letters are used for the name of a keyboard key that is not labeled on the keyboard. For example, the space bar, comma key, and so on.
- Press CTRL+C indicates that you must hold down the CTRL key while pressing the C key (to copy a selected object in this case).
- Press ESC E C indicates that you press and release each key in sequence (to copy a selected object in this case).
- The names of push and toggle buttons are boldfaced. For example, click **OK**.
- The names of menus and menu items are boldfaced. For example, the **File** menu.
  - The following convention is used for menu operations: **MenuName > MenuItem**. For example: select **File > New**.
  - The **Start** menu name always refers to the **Start** menu on the Windows taskbar.

## 1.6. Use of symbols

This publication includes warning, caution, and information icons that point out safety related conditions or other important information. It also includes tip icons to point out useful information to the reader. The corresponding icons should be interpreted as follows.



The electrical warning icon indicates the presence of a hazard which could result in electrical shock.



The warning icon indicates the presence of a hazard which could result in personal injury.



The caution icon indicates important information or warning related to the concept discussed in the text. It might indicate the presence of a hazard which could result in corruption of software or damage to equipment or property.



The information icon alerts the reader to relevant facts and conditions.



The tip icon indicates advice on, for example, how to design your project or how to use a certain function.

## 1.7. Terminology

The following is a list of terms associated with SIM600 that you should be familiar with. The list contains terms that are unique to ABB or have a usage or definition that is different from standard industry usage. See also 1.8, Abbreviations

Term	Description
amplitude	Peak value of a sinusoidal quantity.
analogue output	A connector whose output signal is analogue.
binary output	Informs the IED of on/off states, such as disconnect and circuit breaker states, alarm signals or control functions.
connector	Device providing connection and disconnection to a suitable mating component.
digital output	See "binary output".
Input/Output	Connection points to a system. I/O can be digital (the signal is TRUE or FALSE, for example 0 or 10 V) or analogue (where the signal can vary from for example 0 to 10 V).
Intelligent Electronic Device	A physical IEC 61850 device that behaves as its own communication node in the IEC 61850 protocol.
Light Emitting Diode	Semiconductor that emits light.
protection relay	Measuring relay which, either solely or in combination with other relays, is a constituent of protection equipment.

## 1.8. Abbreviations

The following is a list of abbreviations associated with SIM600 that you should be familiar with. See also 1.7, Terminology.

Abbreviation	Description
AO	Analogue output

Abbreviation	Description
DO	Digital output
GUI	Graphical User Interface
HMI	Human Machine Interface
HSPO	High-Speed Power Output
IED	Intelligent Electronic Device
I/O	Input/Output
LED	Light Emitting Diode
PC	Personal Computer
PO	Power output
USB	Universal Serial Bus

## 1.9. Related documents

Name of the manual	MRS number
Protection System Simulator SIM600 Installation Manual	1MRS756102
Protection System Simulator SIM600 Configuration Manual	1MRS756239

## 1.10. Document history

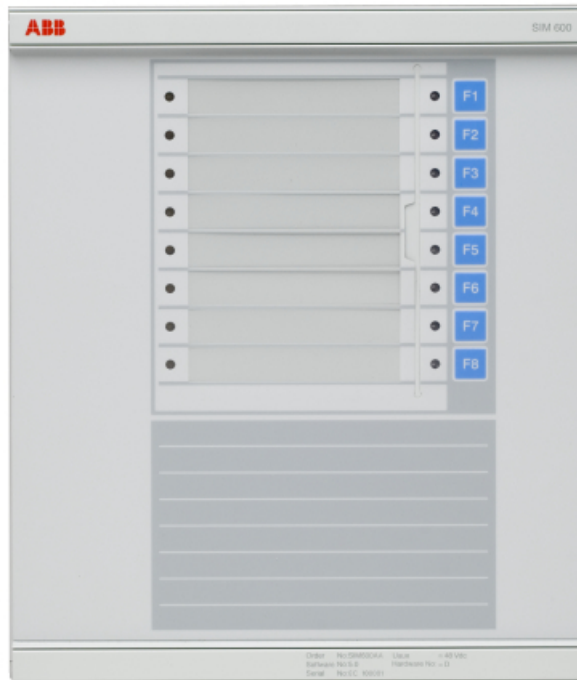
Document version/date	Product revision	History
A/28.9.2007	1.0	Document created
B/08.12.2008	1.0	Document updated



## 2. Product overview

### 2.1. Protection System Simulator SIM600 overview

Protection System Simulator SIM600 is used to simulate network operation for protection and control IEDs. It can be used for different applications, for example product demonstration purposes, education, training, product development, and functional testing of protection relays.



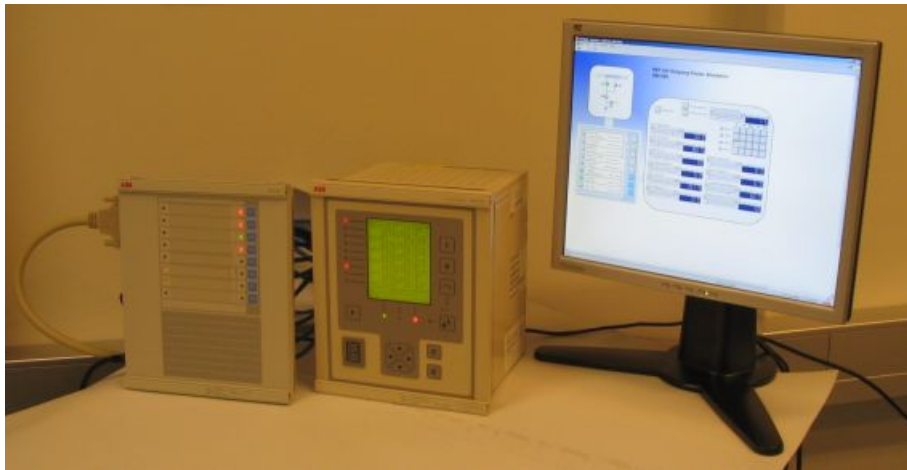
SIM600\_front\_coi300.jpg

Figure 2.1-1 Protection System Simulator SIM600

The SIM600 product consists of:

- Protection System Simulator SIM600
- SIM600 Editor software
- SIM600 Runtime software.

Protection System Simulator SIM600 can be used to generate analogue and digital signals needed to simulate the function of a substation configuration, switchgear system and protection scheme. It can be used as a stand-alone device or connected to a PC.



SIM600\_connected\_to\_PC.JPG

Figure 2.1-2 SIM600 connected to a PC and an IED

SIM600 Editor is used for creating the configuration for Protection System Simulator SIM600. The editor is not mandatory for the operation of the simulator, if the required configuration is already available.

SIM600 Runtime is used as the user interface of Protection System Simulator SIM600.

### Modules included in SIM600

Protection System Simulator unit:

- Device

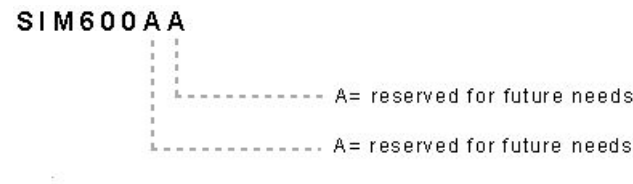
External power supply:

- Single output AC/DC
  - 90-130VAC or 180-260VAC (auto-ranging)
  - 48Vdc/80 W

Cables:

- Electric cable for an external power supply
- 48 Vdc power supply cable to a protection relay
- Binary input and output cables (2 cables)
- Analogue output cables (5 cables)
- Analogue mA output cable (1 cable)
- USB cable

## Ordering information



SIM600AA.jpg

Figure 2.1-3 Ordering code for SIM600

Option available:

- Package of cables: 5 Analogue + 1 mA cables
- Ordering code: 1MRS090070

Mounting:

- Ordering code: 1MRS050993

Commission order by ABB:

- Current amplifiers (Tillquist)
  - CXV30 Rogowski-Voltage to AC Current amplifier
- Voltage amplifiers (Tillquist)
  - Three-phase RHVD-voltage power-amplifier, type: PXV33-X-I/O V

## 2.2.

### Hardware

Protection System Simulator SIM600 is a microprocessor-based device that can be used as a stand-alone device or connected to a PC. It can be configured in any way required. Protection System Simulator SIM600 consists of a central unit, housed in a metallic case. The central unit contains a USB-connection to a PC, eight pushbuttons, and 16 LED indicators. For more information on connectors for SIM600, see Protection System Simulator SIM600 Installation Manual.

## 2.3.

### SIM600 Editor

SIM600 Editor is used for configuring Protection System Simulator SIM600 for the required task. SIM600 Editor is not mandatory for the operation of SIM600, if the required configuration is already available.

SIM600 Editor has two views, the GUI Editor and the IO Editor view.

#### GUI Editor

GUI Editor is used for drawing the user interface that includes all the functional objects required by the application. The objects available are shown in the GUI Tools window

on the right of the GUI Editor view. Objects can be added to the workspace and they can be freely moved within the area.

## IO Editor

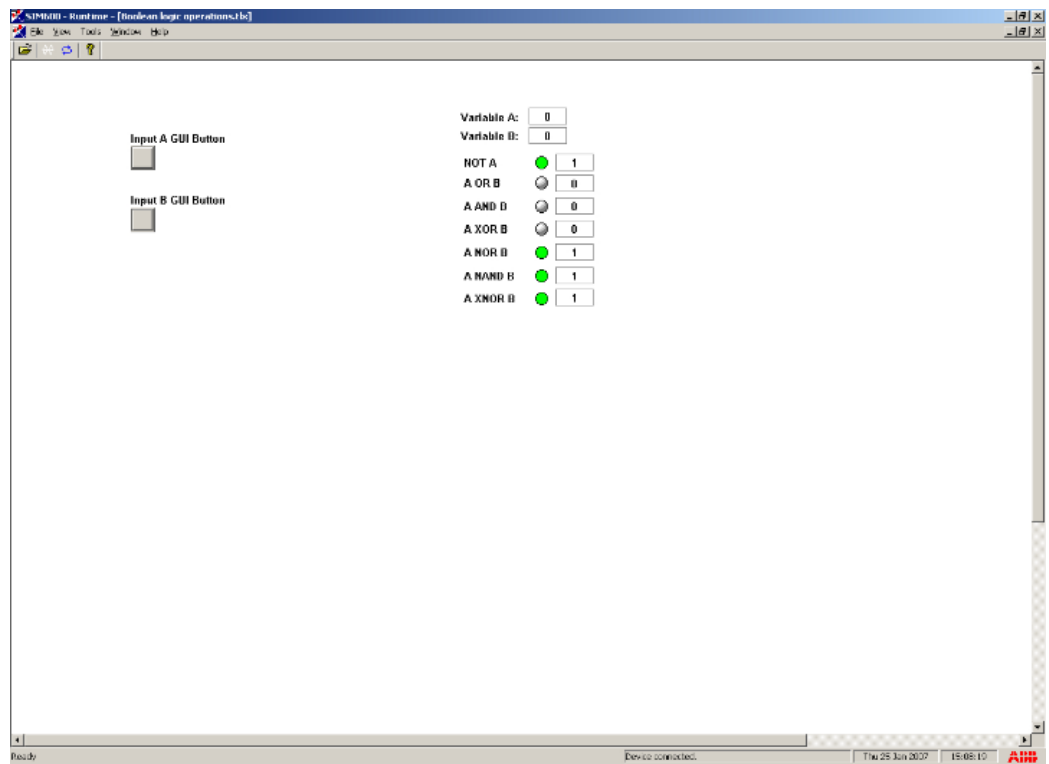
IO Editor is used to connect the objects displayed in the user interface and to specify the necessary operation for SIM600. The workspace of IO Editor contains a list of input and output signals of SIM600. The IO Tools window on the right of IO Editor view contains logic symbols. Logic symbols are used in the same way as the objects in GUI Editor, that is, they can be added to the workspace as required.

For information on installing SIM600 Editor, see Protection System Simulator SIM600 Installation Manual.

## 2.4.

### SIM600 Runtime

SIM600 Runtime is used as the user interface of Protection System Simulator SIM600, especially if the eight pushbuttons and the 16 LEDs are not sufficient for the required functions. The configuration created with SIM600 Editor is loaded into Protection System Simulator SIM600 via SIM600 Runtime.



Runtime\_example.jpg

Figure 2.4-1 An example view of SIM600 Runtime

## 3. Using SIM600

### 3.1. Modifying configuration

You can modify a configuration in SIM600 Editor, if necessary. The modifications are made to the .TLX file, which is compiled and loaded to Protection System Simulator SIM600.

Use the GUI Editor to modify the appearance of the user interface. The user interface includes LEDs, buttons, disconnectors, breakers, sliders, text, graphs and values. The objects specified in GUI Editor are connected in IO Editor. IO Editor is also used to specify the operation of the objects in SIM600.

Add new objects by drag and dropping them from the IO Tools and GUI Tools windows. Save changes by selecting **File > Save**. Update the changes by selecting **IO Editor > Compile**.

For more detailed information on creating and modifying configurations, refer to Protection System Simulator SIM600 Configuration Manual.

### 3.2. Loading configuration

You can load a configuration to Protection System Simulator SIM600 from your hard disk or from a CD with SIM600 Runtime. The configuration is stored in a .TLX file, which can be further modified in SIM600 Editor, see 3.1, Modifying configuration. You have to compile the configuration, before you can load it to SIM600 Runtime.

To load a configuration:

1. Connect the PC to SIM600 with USB cable.
2. Open SIM600 Runtime by double-clicking **PRS.exe** on the installation CD or on your hard disk.
3. Select **File > Open** and browse for the configuration file.
4. Click **Open**. The configuration has now been loaded to SIM600 and you can use SIM600 Runtime as a user interface.

#### Reloading a configuration

If you have modified the configuration in SIM600 Editor, you have to update the changes by compiling the configuration, before you can load it to SIM600 Runtime.

After you have successfully compiled the new configuration, you can load it to SIM600 by selecting **Tools > Reload Configuration** in SIM600 Runtime.

For more detailed information on compiling a configuration, refer to Protection System Simulator SIM600 Configuration Manual.

### **3.3. Simulation with SIM600**

#### **3.3.1. General about running a simulation**

Protection System Simulator SIM600 simulates configurations according to an event-driven principle. This means that the input and output states of logic function blocks are re-evaluated only when an event occurs. An event is a change of state in an output of a component, for example a button press or an alarm signal. Events are often intended to alter the operation of SIM600, and as a result, the configuration logic must be re-evaluated to determine whether any SIM600 output signals are affected by the event.

SIM600 simulates digital and analogue signals. Digital output signals are used to inform the IED of on/off states, such as disconnecter and circuit breaker states, alarm signals or control functions. This information is transferred using two binary I/O cables. SIM600 can also receive digital input from the IED. This information relates to, for example, protection trip signals or state indication.

Analogue signals can be used to simulate both voltage and current levels. These signals are transferred to the IED using ten AO cables, which are connected either directly to the measurement sensors of the IED or, if none are available, via separate voltage or current amplifiers that connect to the measurement transformers of the IED. The configuration determines the properties of the signals that are transmitted. It also affects the voltage and current values that the IED measures. The AO signals can be adjusted in several ways, but are often configured using SIM600 Runtime. It is also possible to create a configuration that generates analogue output signals independent of user input, based on predefined signal values.

Faults are simulated by altering signal properties. If the signal properties are altered so that the values measured by the IED exceed the limit configured in its settings, the IED will react accordingly and most often try to trip the circuit breaker of the configuration. If the trip signal of the IED is monitored in the configuration, the current signal transmission can be interrupted programmatically and thus the circuit breaker trip can be simulated completely.

Throughout the simulation, the state of the IED can be monitored using the IED's HMI. All measurement values, events and alarms can be viewed, analysed and cleared without affecting the operation of SIM600. External monitoring systems connected to the IED react to the information received from the IED, meaning that the simulation process can be made part of a bigger system.

#### **3.3.2. Running a simulation**

Protection System Simulator SIM600 can be run either as stand-alone or with a PC connected to its USB port. In order to load the configuration to SIM600 you need to have your PC connected to it. When the configuration has been loaded, SIM600 can be disconnected from the configuration PC. If the downloaded configuration is used with

IEDs, SIM600 must be connected to these devices using the supplied I/O cables. SIM600 can also be used as such, without being connected to IEDs.

For more information on connecting the SIM600 to IEDs, refer to Protection System Simulator SIM600 Installation Manual.

### **Stand-alone simulation**

To run a simulation in stand-alone mode:

1. Connect the PC to SIM600 with USB cable.
2. Start SIM600 Runtime.
3. Load the configuration to SIM600, see 3.2, Loading configuration.
4. Save the configuration by selecting **File > Save**. If the configuration is not saved in the memory of SIM600, the configuration will be lost if SIM600 is disconnected from the power supply.
5. Disconnect the USB cable.
6. Use the buttons and the LED indicators on the central unit as your user interface.

or

1. Connect the PC to SIM600 with USB cable.
2. Start SIM600 Runtime.
3. Load the configuration to SIM600, see 3.2, Loading configuration.
4. Shut down SIM600.
5. Move SIM600 to a correct location. The saved configuration commences automatically once SIM600 is started again.
6. Use the buttons and the LED-indicators on the central unit as your user interface.

### **Simulation with a PC connected**

To run a simulation with a PC connected:

1. Connect the PC to SIM600 with USB cable.
2. Open SIM600 Runtime by clicking **PRS.exe**.
3. Load the configuration to SIM600, see 3.2, Loading configuration.
4. Operate the user interface by clicking on the buttons, dragging the sliders and so on. You can also use the buttons on the central unit.





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