

# Protection System Simulator SIM600

Installation Manual



**ABB**



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## 1. About this manual

### 1.1. Copyrights

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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 installing SIM600 and the central concepts related to it. For more information on configuring and using SIM600, 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 Operator's Manual	1MRS756103
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.



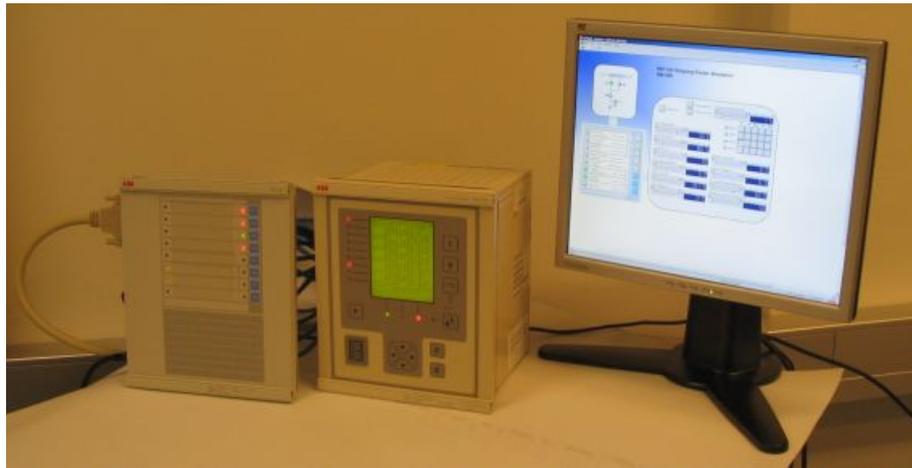
SIM600\_front\_coi300.jpg

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

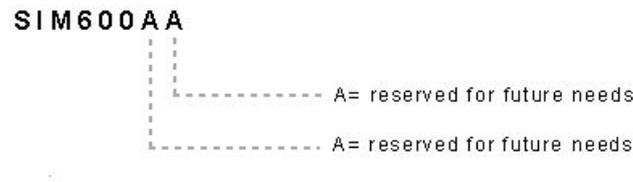
External power supply:

- 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 4.3, Configuring the connectors.

## 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

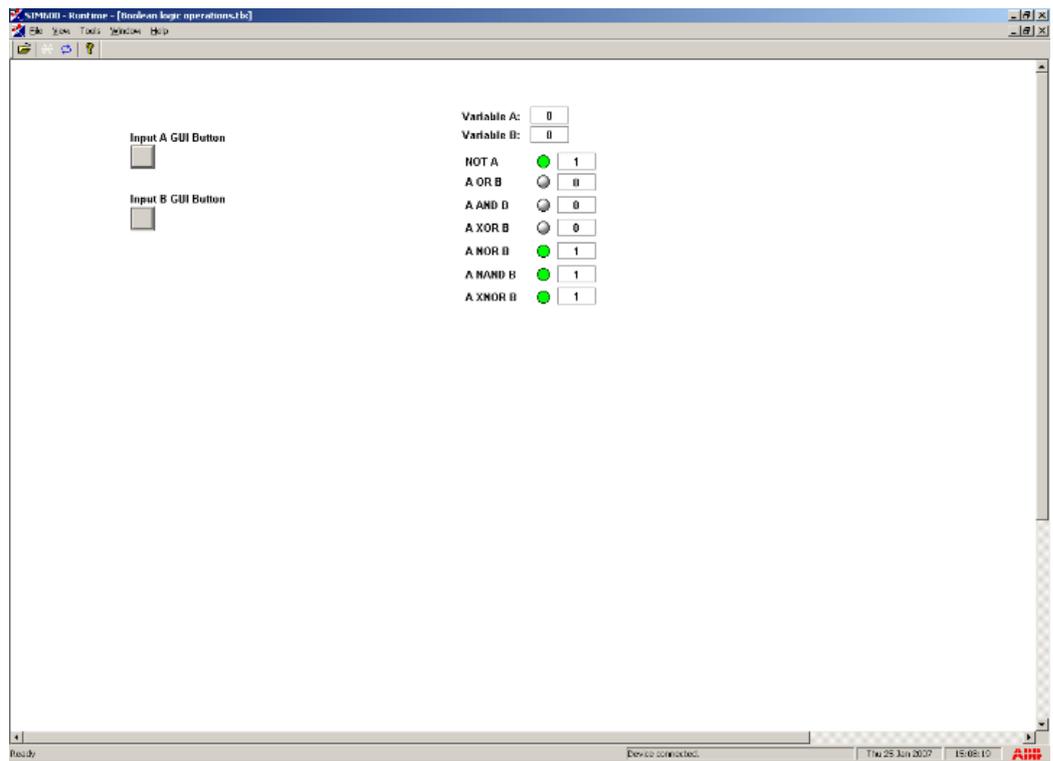
IO Editor is used to connect the objects displayed in the user interface and to specify the necessary operation for SIM600. The workspace of IO Editor contains a list of input and output signals of SIM600. The IO Tools window on the right of IO Editor view contains logic symbols. Logic symbols are used 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 3.2, Installing SIM600 Editor and SIM600 Runtime

## 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. Installing software

#### 3.1. Software requirements

SIM600 Editor and SIM600 Runtime are compatible with MS Windows 2000 or newer.

#### 3.2. Installing SIM600 Editor and SIM600 Runtime

To install SIM600 Editor and SIM600 Runtime:

1. Insert the installation CD to your PC.
2. Copy the **PRS.exe** and **PRSEditor.exe** files from the CD to the hard disk of your PC. If you want to install only SIM600 Editor or SIM600 Runtime, copy the appropriate file to your PC.



You can run SIM600 Editor and SIM600 Runtime also directly from the CD.

3. Connect your PC to Protection System Simulator SIM600 with the USB cable.
4. The **Found New Hardware Wizard** opens. Select **No, not this time** to browse for the correct software on your PC.
5. Click **Next**.



driver\_installation1.jpg

Figure 3.2-1 Searching for new software

6. Select **Install from a list or specific location (Advanced)** and click **Next** to browse for the drivers from the correct location.



driver\_installation2.jpg

*Figure 3.2-2 Selecting installation options*

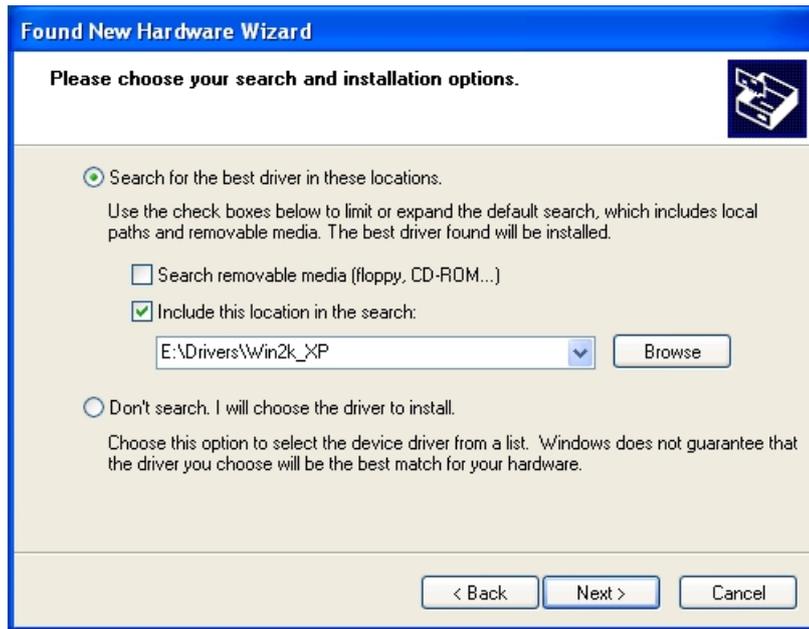
7. Select **Search for the best driver in these locations** and **Include this location in the search** and browse for one of the three folders on the installation CD:
  - Drivers\Win2k\_XP for Windows 2000 and Windows XP
  - Drivers\Win98 for Windows 98
  - Drivers\AMD\_64 for 64 bit Windows XP on 64 bit AMD processor.



browse\_for\_folder.jpg

*Figure 3.2-3 Browsing for folder containing drivers*

8. Click **Next**.



driver\_installation3.jpg

Figure 3.2-4 Searching for drivers

9. Wait while the wizard searches and installs the drivers.



driver\_installation5.jpg

Figure 3.2-5 Installing drivers

10. Click **Finish** to close the wizard after the drivers have been installed.



driver\_installation6.jpg

Figure 3.2-6 Completing the installation of drivers



If the installation is interrupted, disconnect SIM600 from the PC and then connect it again. If you need to install the drivers again, you can uninstall the existing drivers, see 6.1, Uninstalling SIM600 , or connect SIM600 to a new USB port on the PC and then install the drivers.

For new versions of drivers, see [www.ftdichip.com](http://www.ftdichip.com).

## 4. Connecting SIM600 to IED

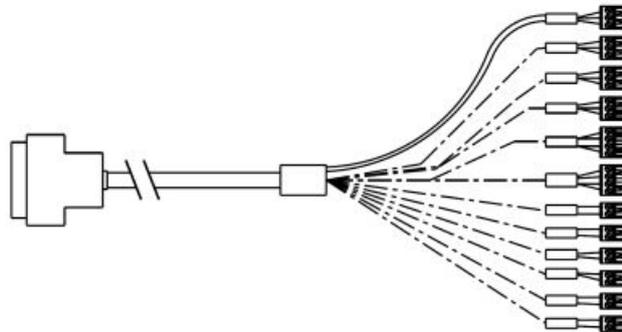
### 4.1. Connecting binary I/O cables

Two binary I/O cables are delivered with the SIM600. These cables transfer binary data to and from the protection and control IED.

Each cable has three sets of plugs:

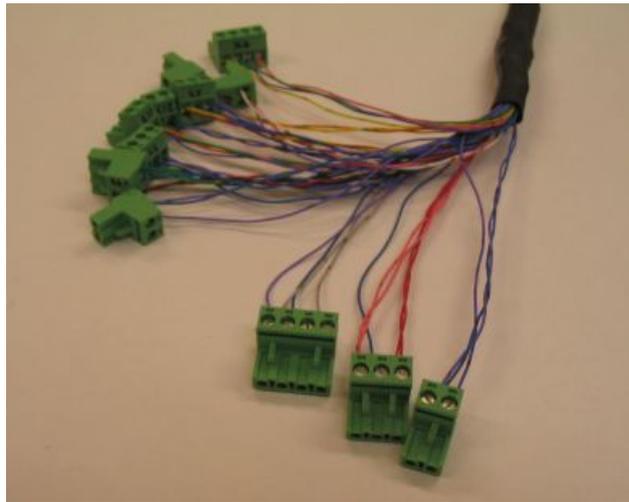
- four 3-pin plugs (X1 to X4) or digital outputs (DO) that transfer signals from SIM600 to the IED
- two 4-pin plugs (X5 and X6) or digital inputs (DI) that transfer signals from the IED to SIM600 and circuit breaker and disconnector trip signals (specifically designed for connection to the High-Speed Power Outputs (HSPO) or the power outputs (PO) of the IED)
- six 2-pin plugs (X7 to X12) or digital inputs (DI) that transfer signals from the IED to SIM600.

Connect the cables to the connectors labelled DIGITAL I/O 1 and DIGITAL I/O 2 on the side panel of SIM600 Protection System Simulator. Connect the 3-pin connectors to the IED binary inputs and the 4- and 2-pin connectors to the binary (signal) outputs of the IED.



DIO cable.jpg

Figure 4.1-1 Digital I/O cable set



IO\_connectors.JPG

Figure 4.1-2 I/O connectors

The digital I/O requires an IED with a low-voltage power supply (48 Vdc) to ensure proper function. The digital outputs of SIM600 output a maximum of 48 Vdc when in a logical 1 (TRUE) state. The digital inputs of SIM600 are optically isolated and accept a maximum of 60 Vdc. A voltage between 0...8 Vdc is interpreted as a logical 0 (FALSE) state, while a voltage in the range of 24...60 Vdc is interpreted as a logical 1 (TRUE) state.

Table 4.1-1 I/O connections of the simulator

I/O	Name	Construction
2 analogue current outputs	DCO1, DCO2	0...25 mA, current source type, $U_{\text{supply}} \geq 8,75$ Vdc
10 analogue voltage outputs	AO1...AO10	$\pm 10$ V voltage, programmable waveform, sinusoidal 45...65 Hz
16 digital inputs	DI1...DI16, TCS1, TCS2, TCS9, TCS10	12 opto-isolated 24...60 Vdc inputs and 4 optoisolated 48 Vdc inputs and control for the trip circuit supervision circuit (TCS)
16 digital outputs	REL1...REL16	Relay output, 1 A n.o. contact

The same I/O connection names as those in the table appear in the editor used for creating the configuration that controls the operation of SIM600.

I/O and other connections are located on the rear plate of the SIM600.

## 4.2. Connecting analogue output cables

Ten analogue output (AO) cables are delivered with SIM600.

Connect the cables to the connectors labelled AO1 to AO10 on the side panel of Protection System Simulator SIM600 and to the current or voltage sensors of the IED. If there are no current or voltage sensors in the IED, the AO cables have to be connected to the measurement transformers of the IED via a suitable voltage and/or current amplifiers.



AO cable.jpg

Figure 4.2-1 Analogue output cable



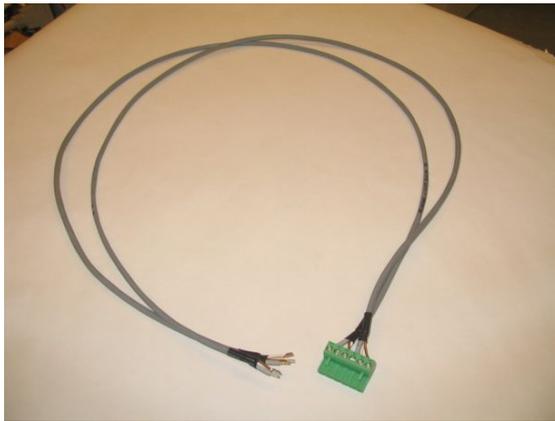
AO\_connectors.JPG

Figure 4.2-2 Analogue output connectors

### Analog mA outputs

SIM600 is equipped with two constant current outputs, that can be set in the range of 0-25 mA. The outputs are labeled “DCO1” and “DCO2” in SIM600 Editor. The constant current outputs can be used for simulation of thermal measurements.

The outputs are located in a 6-pin connector next to the power supply connector of SIM600, and are labeled “AO11” and “AO12”. The DCO1 configuration component corresponds to AO11, while DCO2 corresponds to AO12. The brown wire of the connector is the current output (positive terminal), while the white wire is the return path of the current (negative terminal).



mA\_cable2.JPG

Figure 4.2-3 mA cable

## 4.3. Configuring the connectors

### Binary I/O connectors

The binary I/O connectors are represented in the IO Editor by components labelled REL and DI.

The 16 REL components correspond to the digital output connectors that transfer data to the IED, see Table 4.3-1.

**Table 4.3-1 Binary I/O connectors**

REL component	I/O cable	I/O connector
REL 1 - 2	DIGITAL I/O 1	X1
REL 3 - 4	DIGITAL I/O 1	X2
REL 5 - 6	DIGITAL I/O 1	X3
REL 7 - 8	DIGITAL I/O 1	X4
REL 9 - 10	DIGITAL I/O 2	X1
REL 11 - 12	DIGITAL I/O 2	X2
REL 13 - 14	DIGITAL I/O 2	X3
REL 15 - 16	DIGITAL I/O 2	X4

To activate a REL component, apply a logical 1 (TRUE) signal to the input. To deactivate the component, return the input signal to a logical 0 (FALSE level).

## Digital input connectors

The 16 DI components correspond to the digital input connectors, see Table 4.3-1

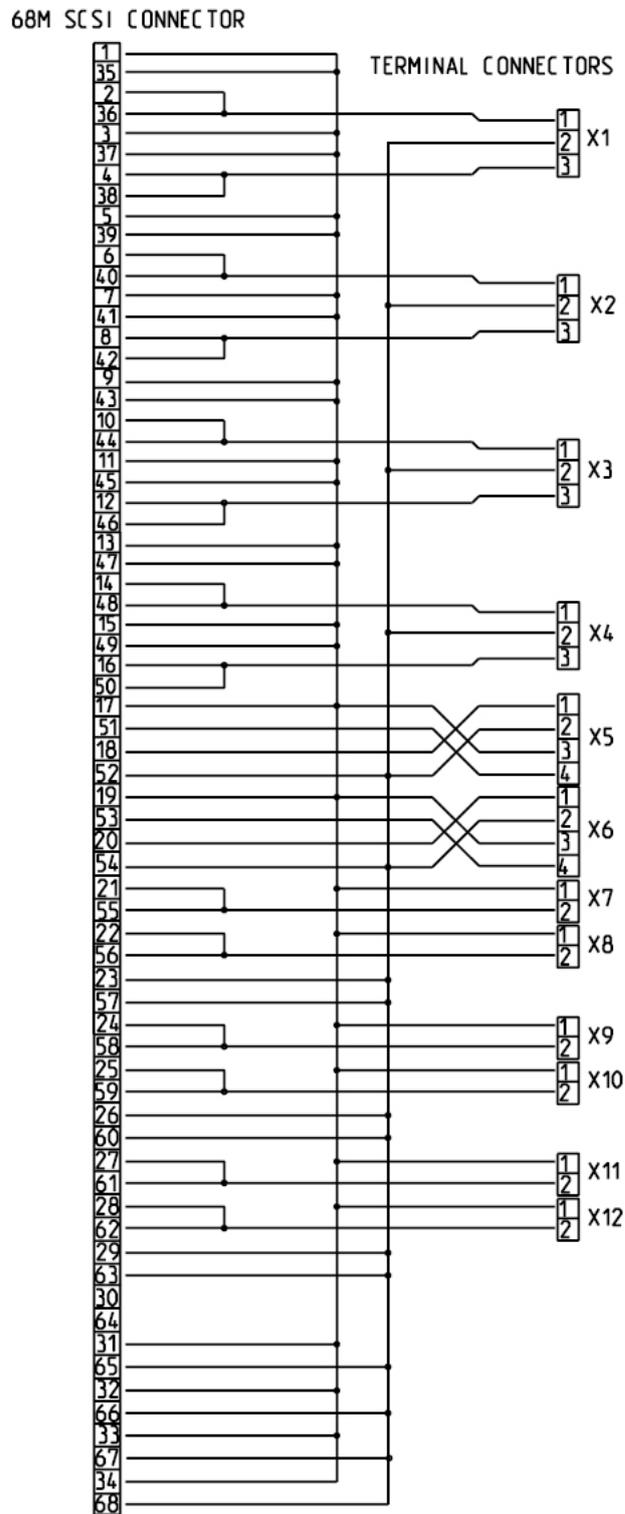
**Table 4.3-1 Digital output connectors**

DI component	I/O cable	Plug	I/O connector
DI1	DIGITAL I/O 1	4-pin	X5
DI2	DIGITAL I/O 1	4-pin	X6
DI3	DIGITAL I/O 1	2-pin	X7
DI4	DIGITAL I/O 1	2-pin	X8
DI5	DIGITAL I/O 1	2-pin	X9
DI6	DIGITAL I/O 1	2-pin	X10
DI7	DIGITAL I/O 1	2-pin	X11
DI8	DIGITAL I/O 1	2-pin	X12
DI9	DIGITAL I/O 2	4-pin	X5
DI10	DIGITAL I/O 2	4-pin	X6
DI11	DIGITAL I/O 2	2-pin	X7
DI12	DIGITAL I/O 2	2-pin	X8
DI13	DIGITAL I/O 2	2-pin	X9
DI14	DIGITAL I/O 2	2-pin	X10
DI15	DIGITAL I/O 2	2-pin	X11
DI16	DIGITAL I/O 2	2-pin	X12

When connected properly, the DI1-2 and DI9-10 components output a logical 1 (TRUE) signal when inactive, whereas the other DI components output a logical 0 (FALSE) signal when inactive. When the IED outputs a signal, the states of these components switch.

Trip Circuit Supervision simulation is achieved with the TCS objects in SIM600 Editor. The fault simulation is activated by applying a logical 1 (TRUE) signal to the TCS object input. This causes the TCS of the corresponding 4-pin DI-component to be activated.

TCS component	Connector
TCS1	DI1
TCS2	DI2
TCS9	DI9
TCS10	DI10



DIO cable connections.jpg

Figure 4.3-1 Digital output connections

## AO Connectors

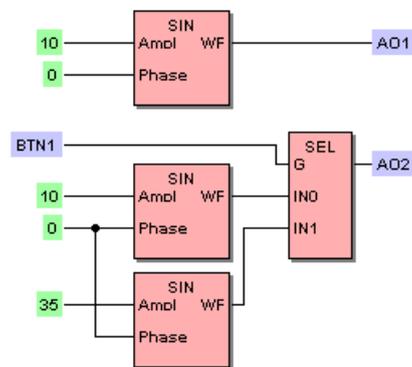
The AO connectors are represented in the IO Editor by the components labelled AO1 through AO10. Each of these corresponds to the physical connector with the same label.

To logically output a signal, the chosen AO component is connected to the WF-output of a SIN function block, either directly or through a MUX. The connected SIN block is supplied with an amplitude value and a phase value, upon which a sine wave is generated and output using the frequency value assigned to the Freq component in the logic.

The value of the amplitude signal determines the value that is perceived by the IED. The electrical sine wave output has an amplitude maximum of 10 V. This amplitude is achieved by applying a value of 100 or higher to the amplitude input pin of the SIN function block connected to the analogue output. The output amplitude can be calculated by multiplying the value input to the amplitude pin of the SIN block by 100 mV. The wave generation process responds to changes in the amplitude input value as small as 0.01, corresponding to a 1 mV change in the actual output. The reading displayed by the IED does not solely depend on the transmitted analogue signal, but also on the settings of the IED itself.



Depending on the load connected, the output of the analogue connector may differ from the expected value. This can be corrected by altering either the IED settings, or the amplitude input value in the simulation configuration logic.



AO connection.bmp

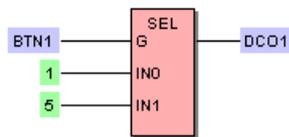
Figure 4.3-2 AO connectors in IO Editor

## Amplifier enable

The UIAMP\_ENA object controls the AO amplifiers. When a logical 1 (TRUE) signal is applied to UIAMP\_ENA, the AO amplifiers are powered up and able to output simulation signals. When a logical 0 (FALSE) signal is applied, the AO amplifiers are disabled.

## Analog mA outputs

The simulation value for the analog mA outputs is applied directly to the DCOX I/O component. A value of 0 corresponds to 0 mA, while a value of 25 corresponds to 25 mA. The 25 mA output is factory calibrated for an accuracy of 0.5%. However, the output current need not be linear over the 0-25 mA range and can thus differ considerably. If needed, the nonlinearity can be manually compensated in the simulation logic.



Analog mA output.bmp

Figure 4.3-3 Analog mA output logic

## Auxiliary power supply

The UAUX\_ENA object controls the IED auxiliary power supply output labeled “POWER OUT”, located next to the power supply connector of SIM600. When a logical 1 (TRUE) signal is applied to UAUX\_ENA, the output powers up and is able to supply power at 48 Vdc. When a logical 0 (FALSE) signal is applied, the output is disabled.

## 5. Mounting Protection System Simulator SIM600

### 5.1. Mounting of Protection System Simulator SIM600

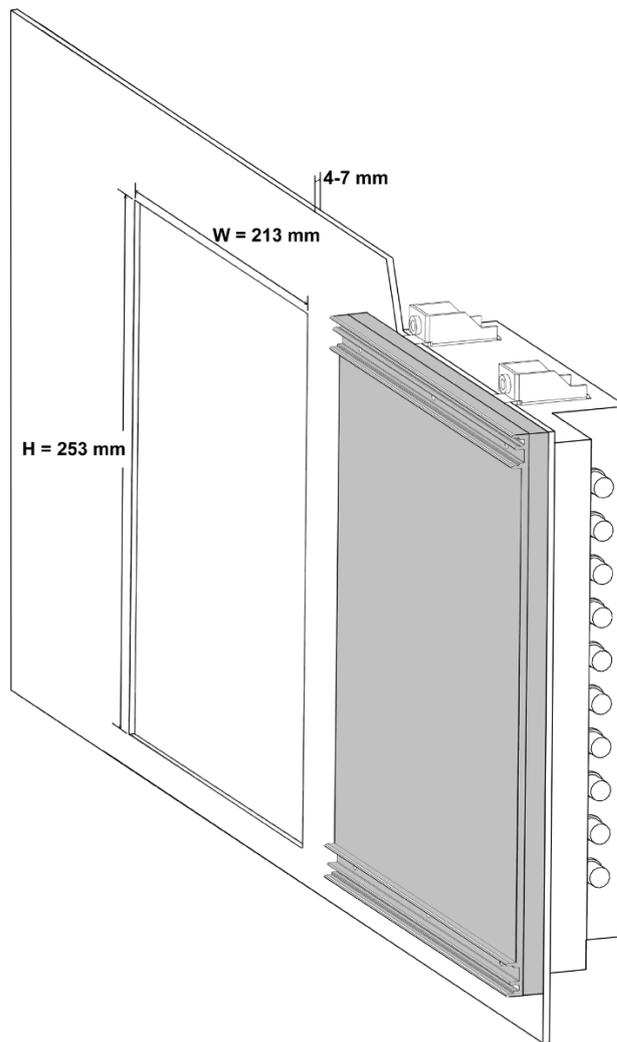
By using a suitable mounting kit, Protection System Simulator SIM600 can be flush-mounted into a wall or a panel for example for demonstration purposes. The kit contains four clamps and four screws.

The front panel of SIM600 is 224 mm wide and 266 mm high. The width of the cut-out should be 213 mm and the height of the cut-out should be 253 mm. These dimensions correspond to the dimensions of the SIM600 case. They do not include the data transmission cables that are connected to the side panels of SIM600. The size of these connectors must be taken into account when mounting. To connect the SIM600 simulation cables properly, leave an unobstructed space of 80-100 mm next to both side panels.



Do not use excessive force or bend the cables while mounting SIM600.

SIM600 must be positioned so, that its power supply can be connected to a mains outlet, and that the IEDs to which SIM600 is to be connected are within reach of the simulation cables.



Asennuskuva.png

*Figure 5.1-1 Mounting of SIM600*

## 6. Uninstalling SIM600 Editor and Runtime

### 6.1. Uninstalling SIM600



You must have administrator rights to be able to uninstall drivers.

To uninstall drivers:

1. Select **Start > Settings > Control Panel > System**.
2. In the System Properties window, select the **Hardware** tab.
3. Click **Device Manager**.
4. In the Device Manager window, open the **Universal Serial Bus controllers** structure.
5. Right-click on the **PRS USB Device** and select **Uninstall**.

To uninstall SIM600 Editor and Runtime

1. Disconnect Protection System Simulator SIM600 from your PC.
2. Delete the **PRS.exe** and **PRSEditor.exe** files from the hard disk of your PC.



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