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1 ISaGRAF 3 Quick Start Guide

Documentation

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All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed. Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

1 Technical Support

Support related to any part of this documentation can be directed to one of the following support centers.
Technical Support: The Americas
Available Monday to Friday 8:00am – 6:30pm Eastern Time
Toll free within North America 1-888-226-6876
Direct Worldwide +1-613-591-1943
Email TechnicalSupport@controlmicrosystems.com

Technical Support: Europe
Available Monday to Friday 8:30am – 5:30pm Central European Time
Direct Worldwide +31 (71) 597-1655
Email euro-support@controlmicrosystems.com

Technical Support: Asia
Available Monday to Friday 8:00am – 6:30pm Eastern Time (North America)
Direct Worldwide +1-613-591-1943
Email TechnicalSupport@controlmicrosystems.com

Technical Support: Australia
Inside Australia 1300 369 233
Email au.help@schneider-electric.com

2 Safety Information
Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a Danger or Warning safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.
**DANGER**

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

**WARNING**

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

**CAUTION**

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

CAUTION used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result in** equipment damage.

**PLEASE NOTE**

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and the installation, and has received safety training to recognize and avoid the hazards involved.

**BEFORE YOU BEGIN**

Do not use this product on machinery lacking effective point-of-operation guarding. Lack of effective point-of-operation guarding on a machine can result in serious injury to the operator of that machine.

**CAUTION**

EQUIPMENT OPERATION HAZARD

- Verify that all installation and set up procedures have been completed.
- Before operational tests are performed, remove all blocks or other temporary holding means used for shipment from all component devices.
Failure to follow these instructions can result in injury or equipment damage.

Follow all start-up tests recommended in the equipment documentation. Store all equipment documentation for future references.

Software testing must be done in both simulated and real environments.

Verify that the completed system is free from all short circuits and grounds, except those grounds installed according to local regulations (according to the National Electrical Code in the U.S.A, for instance). If high-potential voltage testing is necessary, follow recommendations in equipment documentation to prevent accidental equipment damage.

Before energizing equipment:

- Remove tools, meters, and debris from equipment.
- Close the equipment enclosure door.
- Remove ground from incoming power lines.
- Perform all start-up tests recommended by the manufacturer.

OPERATION AND ADJUSTMENTS

The following precautions are from the NEMA Standards Publication ICS 7.1-1995 (English version prevails):

- Regardless of the care exercised in the design and manufacture of equipment or in the selection and ratings of components, there are hazards that can be encountered if such equipment is improperly operated.

- It is sometimes possible to misadjust the equipment and thus produce unsatisfactory or unsafe operation. Always use the manufacturer’s instructions as a guide for functional adjustments. Personnel who have access to these adjustments should be familiar with the equipment manufacturer’s instructions and the machinery used with the electrical equipment.

- Only those operational adjustments actually required by the operator should be accessible to the operator. Access to other controls should be restricted to prevent unauthorized changes in operating characteristics.

3 Preface

Scope

This document is intended as a quick start guide to help new users create an ISaGRAF application, connect and download the application to a SCADAPack E controller in a timely fashion.

The simple tasks presented in this guide therefore do not include important user information necessary
for the control of real life applications. As such, this introductory document should be used in conjunction with the *ISaGRAF Workbench User Guide* and the *SCADAPack E ISaGRAF Technical Reference Manual*.

**Purpose**
The purpose of this document is to provide a quick guide for creating an ISaGRAF application, connecting and downloading the application onto a SCADAPack E controller.

**Assumed Knowledge**
Exposure to the ISaGRAF Workbench is recommended.

**Target Audience**
- Systems Engineers
- Commissioning Engineers
- Maintenance Technicians

**References**
- SCADAPack E Configuration Reference Manual
- ICS Triplex ISaGRAF 3 Manuals
4  Overview

This document is to be used as a guide to help new users configure, program and operate SCADAPack E controllers in a timely fashion.

This is not a substitute for the ISaGRAF IEC 61131-3 and SCADAPack E Controller manuals, but rather as a companion to these manuals.

For a thorough treatment of IEC 61131-11 ISaGRAF fundamentals, it is recommended that the user consult the SCADAPack E ISaGRAF Technical Reference Manuals and/or the ICS Triplex ISaGRAF 3 User Guide.

In this manual, the user is guided through the task of creating a sample ISaGRAF Function Block Diagram program, compilation of the program, connecting to the SCADAPack E RTU and downloading the compiled program onto the target kernel.
5 Programming with ISaGRAF

In this section, the user will be guided through creating a simple ISaGRAF application and downloading the compiled program to the RTU target kernel.

The process of creating an ISaGRAF application comprises the following steps:

- Creating an ISaGRAF application.
- Defining dictionary variables.
- Connecting to external I/O
- Compiling and making the source code available for download to the target controller.
- Connecting and downloading the ISaGRAF application onto the target controller.
- Monitoring the ISaGRAF program variables online.

Each of the above tasks will be covered in the remaining section of this manual.
5.1 Hardware Requirements

The following hardware items are recommended to perform the tasks in this manual:

- CD containing SCADAPack E Configurator Software.
- SCADAPack E controller – Check the nominal operational voltage.
- A 12Vdc/1.1A or 24 VDC/0.55A power supply depending on controller requirement.
- RJ to DB-9 crossed cable (e.g., CMI part # 297324).
- Windows PC or laptop with the following minimum hardware requirements:
  - Intel (or equivalent) Pentium III CPU, 1.0GHz recommended
  - 256MB RAM (512MB recommended)
  - 100MB free disk space
  - Microsoft Windows® 2000 / XP / Vista 32-bit or 64-bit Operating System
  - 1024x768 VGA recommended
  - Mouse (or other pointing device)
  - CD-ROM drive
  - One (1) RS-232 serial communication port
  - Ethernet port (optional)

A USB-to-RS-232 adapter will be required if PC or laptop is only equipped with a USB port.
5.2 Creating an ISaGRAF Application

In this section, a sample ISaGRAF application which cycles through the first four digital output channels on the SCADAPack E Smart RTU at a controlled frequency will be created and downloaded to the controller. The frequency at which the output LEDs are cycled is controlled by a potentiometer attached to one of the analog input ports of the SCADAPack E controller.

1. From the main menu, click ISaGRAF | Launch Workbench to open the ISaGRAF Workbench application.
2. Click on File | New from the Project Management menu bar to create a new application.
3. Enter a project name e.g. Proj1 and click on OK to close the dialog.
4. Double click on the project name e.g. Proj1 to open the project’s program window.
5. Select File | New from the program menu bar to create a new program.
6. Specify a program name e.g. prog1 and select FBD: Function Block Diagram from the Language drop down menu in the New Program dialog. Leave the style parameter at the default Begin: Main Program.
7. Click on OK to and double click on the newly created program name e.g prog1 to open the FBD/QL editor.

Subsequent references to this sample program will be done using 'prog1'.

8. Create the sample FBD program exactly as captured in the screen shot below.
ResetCir:
Reset the counter to 1 when the program comes here

1 counter

Seg LED:
Turn on each LED in turn for 'counter' values 1, 2, 3, and 4 when the program comes here

counter
1
2
3
4

LED1 LED2 LED3 LED4

TheEnd:
End of program
5.3 Defining Dictionary Variables

Variables defined within an ISaGRAF program need to exist in the dictionary for the program to compile successfully. The following variables have been used in the above FBD program.

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Type</th>
<th>Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>speed_control</td>
<td>Integer (Analog)</td>
<td>Input</td>
</tr>
<tr>
<td>counter</td>
<td>Integer</td>
<td>Internal</td>
</tr>
<tr>
<td>SW1</td>
<td>Boolean</td>
<td>Input</td>
</tr>
<tr>
<td>LED1</td>
<td>Boolean</td>
<td>Output</td>
</tr>
<tr>
<td>LED2</td>
<td>Boolean</td>
<td>Output</td>
</tr>
<tr>
<td>LED3</td>
<td>Boolean</td>
<td>Output</td>
</tr>
<tr>
<td>LED4</td>
<td>Boolean</td>
<td>Output</td>
</tr>
<tr>
<td>led_frequency</td>
<td>Timer</td>
<td>Internal</td>
</tr>
</tbody>
</table>

The variable’s attribute defines its direction and relationship to physical I/O. A variable with an input attribute is attached to a physical input. A variable with an output attribute is attached to a physical output and a variable with an internal attribute is not attached to physical I/O.

DNP3 points (input, output or derived) defined within the point database of the SCADAPack E RTU is considered as physical I/O external to the ISaGRAF Workbench. As a result, variables that need to be attached to the RTU point database need to be assigned an input or output type attribute within the dictionary.

To define the above variables in the dictionary do the following:

1. From the programs window, select File | Dictionary or click on the dictionary icon from the toolbar.

2. Select the Boolean tab.
3. Select Edit | New and fill out the Boolean Variable dialog as follows:
   - Name: SW1
   - Attribute: Input

   Alternately, you can double click on a blank white space under the Boolean Variable ‘page’ to open the Boolean Variable dialog.

4. Click on Store to add this variable to the dictionary.
5. Re-open the Boolean Variable dialog and add the LED output variables using the following entries.
   - Name: LEDx (x = 1, 2, 3, 4)
   - Attribute: Output
6. After adding the Boolean variables, select File | Save to save the changes. The completed panel should look like this

![Boolean variables panel]

7. Select the Integers/Real tab within the dictionary.
8. Add the *speed_control* and *counter* variables, checking that the correct attribute is selected.
9. Save the changes. The completed panel should look like this

![Integers/Real variables panel]

10. Select the Timers tab within the dictionary.
11. Add the *led_frequency* variable also checking that the correct attribute is selected.
12. Save the changes.
13. After the variables have been entered, close the dictionary.
5.4 Connecting Variables to Physical I/O

Dictionary variables defined with an input or output attribute need to be tied to an input or output I/O board (for RTU database information or PLC Device information). In the RTU database case, the I/O boards provide a channel between the ISaGRAF workbench and the RTU point database.

Variables are connected to the point database within the SCADAPack E RTU using `rtu`... I/O boards. Variables are connected to a Modbus PLC device, for example, using `mbus`... I/O boards.

To couple the variables used in this exercise to physical RTU points, do the following:

1. Select Project | I/O Connection from the project’s program menu bar or click on the icon.

![Image of I/O Connection window]

2. Double click on the first empty slot 0 in the I/O connection window to view the list of available I/O drivers.

![Image of I/O connection window with board selection]

3. Select the board /Equipment board type labeled `rtu16di: RTU 16 Digital Input Board` from the list.
4. Click OK.

This board type provides and ISaGRAF application access to 16 physical digital inputs.

5. Double click on terminal connector 1 directly underneath first_point_num to open the Connect I/O Channel # dialog.
6. Select the variable SW1 from the Free list and click on the Connect button to attach this variable to the digital input channel 1 on the SCADAPack E controller.
7. Click on Close to return to the I/O connection window.
8. Double click on the second empty slot 1 in the I/O connection window and select the `rtu16do: RTU`
16 Digital Output Board.

9. Click on OK.
10. Double click on terminal connector 1 directly underneath first_point_num to open the Connect I/O Channel # dialog.
11. Select the variable LED1 from the Free list and click on the Connect button to attach this variable to the digital output channel 1 on the SCADAPack Econtroller.
12. Click on Next and Connect to add the remaining digital output variables.
13. Close the dialog.
14. Follow the same procedure above and connect the integer variable speed_control to an analog input channel 1 using the rtu1ai: RTU 1 Analog Input Board module.
15. Click on from the toolbar to save changes to the dictionary.

An alternative to connecting ISaGRAF to RTU data via ISaGRAF I/O Boards is the access of RTU data via function blocks. For more information see SCADAPack E ISaGRAF Technical manual and SCADAPack E ISaGRAF Function Block Reference manual.
5.5 **Compilation of the Source Code**

After completion of the source code (program, dictionary variables and I/O connection), the code is compiled for errors. If no errors are found, the ISaGRAF MAKE utility converts the source code into a form suitable for download onto the selected target controller.

1. Select **Make | Compiler** options from PROJ1’s program menu bar.
2. Highlight *ISA86M: TIC Code for Intel* and click on **Select**.
3. Click on **OK** to save the changes.
4. Click on **OK** on the next prompt indicating that every program will be verified during the next make command. Other parameters can be left at default settings.

5. Select **Make | Make application** from PROJ1’s program menu or click on  from the toolbar.
6. If no errors are detected, click on **Exit** from the Code Generator dialog. If errors are presented, it may be necessary to verify the source code.
5.6 Downloading the Compiled Program onto the Target RTU

Once the ISaGRAF program has been successfully compiled into a form suitable for download onto the target RTU using the ‘Make’ command, it then suffices to download the program onto the target RTU for execution. First, a communication link between the ISaGRAF Workbench and the RTU target kernel needs to be established.

The SCADAPack E controller supports a serial or Ethernet communication link to the ISaGRAF Workbench. In this example, a serial communication link will be used to enable communication between the ISaGRAF Workbench and the SCADAPack E RTU.

To connect to the SCADAPack E via a serial connection, one of the RTU communication ports needs to be set for “ISaGRAF”.

To connect to the SCADAPack E via an Ethernet connection, the SCADAPack E ISaGRAF/TCP Service needs to be enabled using SCADAPack E Configurator. See TCP/IP page.
5.6.1 Configure the SCADAPack E ISaGRAF Port

1. Select Start > All Programs > Schneider Electric SCADAPack E > Configurator
2. Choose Create a new RTU configuration from the Wizard.
3. Select the appropriate RTU controller type.
4. Do one of the following:
   a. from the SCADAPack E Configurator menu bar, select Communication | Communication Type;
   or
   b. click on the icon on the SCADAPack E Configurator toolbar to select the communication type.
5. Check that the RS-232 (Serial) COM port is selected.
6. Click OK to close the dialog.
7. Select the Ports folder and Ports 0-3 or equivalent page.
8. Connect the PC to COM port 1 of the RTU.
9. Check that the Remote DNP3 Address in the Target DNP3 Address field on the menu bar is right.
10. Read the configuration from the controller by clicking on the icon.

If the yellow Comms status light on the bottom right-hand corner of the Ports page remains lit, indicating communications is not occurring, please refer to the SCADAPack E Configurator User Manual or the SCADAPack ES Quick Start Guide.

9. Check that a communication port on the controller is configured for ISaGRAF. If not, it is
recommended that at least one port (the serial port you are connected to, for example) remains set for DNP3 so the Configurator can be used at a later time.

10. Set **Port Function** on the chosen port to be *ISaGRAF* as shown in the screen capture above and check the Baud Rate and Data Mode parameters.

11. Write the configuration to the controller by clicking on the icon. Select controller to restart if prompted.

12. Select **Communication | Disconnect** from the SCADAPack E Configurator menu or click **Disconnect** on the toolbar to free the PC COM port.

This step is necessary to allow another application, ISaGRAF for example, to share the COM port.
5.6.2 Configure the ISaGRAF PC-PLC Link

1. On the RTU, remove the serial cable from the controller port and plug it into the port just configured for ISaGRAF.
2. Within ISaGRAF click on Debug | Link Setup from PROJ1’s Programs window to launch the PC-PLC link parameters dialog.
3. Alternatively, click on the icon from the program window toolbar to launch this dialog.
4. Within the PC-PLC link parameters dialog,
   1. Select the PC serial port connected to the Port 0 of the RTU from the Communication Port drop down menu.
   2. Click on the Setup button.
   3. Check that baud rate and other link properties match those noted in step 8 above. The baud rate may have to be changed from 19200 to 9600.
   4. In the figure below, the RTU is connected to COM 2 of the PC and the link properties have been set to match those in the figure above.

5. Click on OK on the Serial link parameters dialog to save the changes and close the dialog.
6. Click on OK on the PC-PLC link parameters dialog to save the changes and close the dialog.
7. From PROJ1’s program window click on Debug | Debug.

Alternatively, click on the icon from the program window toolbar to launch this dialog.
8. The ISaGRAF debugger window will open with the message No application as shown below. This indicates that there is currently no application running in the controller.

If presented with a different status message such as Disconnected or Logging… Cannot open COM2 communication port, double check the PC-PLC parameters.
9. From the Debugger menu bar, click on File | Download.

Alternatively, click on the icon from the program window toolbar to initiate the download process.
10. Check that ISA86M: TIC code for Intel is selected in the Download dialog and click on Download.
11. Observe the download progress on the status bar.
After the download is complete, toggle the switch attached to digital input channel 1 of the SCADAPack E and observe the LEDs on the controller digital output channels 1-4 cycle in a round-robin fashion. The Debugger status bar will display RUN while the program executes as shown below.

10. The application variables may now be viewed in real time by opening the dictionary and observing the real-time value of one of the variables.
11. Stop the running program by selecting **File** | **Stop Application** from the Debugger menu bar. Alternatively, click on the icon from the program window toolbar to stop the program from running.
12. The LEDs will stop turning on and off in a cyclic fashion.
This completes the exercise. This simple exercise does is only a very small sample of the capabilities of the SCADAPack E RTU. Please refer to the reference manuals that accompany your controller unit for details on the controller operation and capabilities.