# Differences with ISaGRAF 3

**Software release 5.1**

**March 2008**

**Differences with ISaGRAF 3**

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# Differences with ISaGRAF 3

The latest **ISaGRAF** version enables developing **ISaGRAF 3** configurations for use on **ISaGRAF 3** targets. Moreover, an **ISaGRAF 5** project can hold **ISaGRAF 5** and **ISaGRAF 3** configurations. In such a case, only the features relating to the individual configuration versions are available to each; many **ISaGRAF 4** and **5** features are not available to **ISaGRAF 3** configurations while many **ISaGRAF 3** features are not available to the later **ISaGRAF** versions.

In the **ISaGRAF 5** Workbench, **ISaGRAF 3** configurations are compiled using the **ISaGRAF 3** compiler. Incompatibility errors are indicated when compiling.

The following list shows the significant differences between developing **ISaGRAF 3** configurations in the different versions of the Workbench:

| ISaGRAF 3 Workbench | ISaGRAF 5 Workbench |
|---|---|
| **Managing Projects** | |
| **ISaGRAF 3** projects are equivalent to one configuration having one resource. | For **ISaGRAF 3** configurations, these can only contain one resource. Furthermore, a Workbench project can only contain one **ISaGRAF 3** configuration. |
| | For **ISaGRAF 5** configurations, these can contain multiple resources. A Workbench project can contain multiple **ISaGRAF 5** configurations but only one **ISaGRAF 3** configuration. |
| A resource definition file can be merged with the generated code and downloaded to the target PLC. | In the **ISaGRAF 5** Workbench, to retain the resource definition information created with the Make>Resource command in the **ISaGRAF 3** environment, you need to create a text file called definitions.res in which you can copy the contents of the window resulting from the command. You need to place this file at the root of the resource directory. |
| Open multiple projects simultaneously | Open one project at a time |

| ISaGRAF 3 Workbench | ISaGRAF 5 Workbench |
|---|---|
| Password-protection is available for projects and libraries with up to 16 access levels. Elementary commands and data can be protected separately. Programs can have multiple passwords with multiple levels (0 to 15) | For **ISaGRAF 3** configurations, password protection and access control is not available. For **ISaGRAF 5** configurations, access control (Password-protection) is available for projects, libraries, resources, POUs, and targets. The Workbench does not support multiple passwords with multiple levels. |
| Project names have a maximum of eight characters | Projects containing **ISaGRAF 3** configurations can have names with a maximum of eight characters. Projects not containing **ISaGRAF 3** configurations can have names with a maximum of 128 characters. |
| A project can contain a maximum of 127 conversion tables | For **ISaGRAF 3** configurations, the maximum number of conversion tables is 127. Furthermore, these tables are also limited to a maximum of two points defined by the Y=aX+b linear function. For **ISaGRAF 5** configurations, conversion tables are replaced by associating I/Os with the Y=aX+b linear function. |
| A project can have a maximum of 128 "C" conversion functions | For **ISaGRAF 3** configurations, the maximum number of "C" conversion functions is128 For **ISaGRAF 5** configurations, these can hold any number of "C" conversion functions |
| Project groups are a list of project directories grouped together under the same root directory. These groups are identified using a name. Default project groups are "Default" and "Samples". Inserting separators enables grouping projects attached to the same application. Projects in the list having separators between them can be moved together. | For all configurations, projects can be grouped within directories. |
| History of modifications (one file per project). Each modification has a title, date and time. | In the Workbench, project descriptions can hold a history of modifications. |

| ISaGRAF 3 Workbench | ISaGRAF 5 Workbench |
|---|---|
| **Managing POUs (Programs, Functions, and Function Blocks)** | |
| Programs are placed in three sections, Begin, Sequential, and End, where FC and SFC programs are located in the Sequential section uninterrupted by any other program type. | For **ISaGRAF 3** configurations, within the program hierarchy, FC and SFC programs must be adjacent within the hierarchy where their execution is not interrupted by non-sequential programs (IL, ST, FBD, and LD); Non-sequential programs can be placed before or after but not between sequential programs. |
| | For **ISaGRAF 5** configurations, within the program hierarchy, programs are placed following the order of execution while all SFC and FC programs must be adjacent. Furthermore, SFC Child or FC Sub-programs must use the same language as their parent. |
| Programs (functions, function blocks, and sub-programs) have a maximum of 32 parameters (inputs and outputs). Parameter names have a maximum of 32 characters. | **ISaGRAF 3** POUs (programs, functions, function blocks, and sub-programs) names have a maximum of 32 parameters. Parameter names have a maximum of 32 characters. |
| | **ISaGRAF 5** POUs (functions, function blocks) have a maximum of 128 parameters (inputs and outputs). Parameter names have a maximum of 256 characters. |
| Program diary containing syntax checking output messages from compilations | In the Workbench, the POU description enables entering a description for each program. |
| Program names have a maximum of eight characters | **ISaGRAF 3** POU names have a maximum of eight characters. |
| | **ISaGRAF 5** POU names have a maximum of 128 characters |

| ISaGRAF 3 Workbench | ISaGRAF 5 Workbench |
|---|---|
| **IEC 61499 Programming** | |
| The IEC 61499 distribution method is not available in the **ISaGRAF 3** Workbench | Not available for **ISaGRAF 3** configurations.<br><br>For other configurations, the distribution method enables the distribution of individual IEC 61499 function blocks belonging to an IEC 61499 program across multiple resources. The IEC 61499 standard function blocks are available with the IEC 61499 library. Basic and composite IEC 61499 function blocks can also be programmed. |
| | |
| **Code Generation** | |
| The **ISaGRAF** 3 compiler performs compilations (makes) and syntax verifications | For **ISaGRAF 3** configurations, the **ISaGRAF 3** compiler performs compilations (makes) and syntax verifications.<br><br>For **ISaGRAF 5** configurations, the **ISaGRAF 5** compiler performs syntax verifications and compilations (builds). |
| | |
| **I/O Wiring (I/O Connections)** | |
| Simple and complex devices have a maximum of 128 channels | For **ISaGRAF 3** configurations, simple and complex devices have a maximum of 128 channels.<br><br>For **ISaGRAF 5** configurations, simple and complex devices have a maximum of 65536 channels. |
| Simple and complex devices have a maximum of 16 parameters, excluding OemKey | For **ISaGRAF 3** configurations, simple and complex devices have a maximum of 16 parameters, excluding OemKey.<br><br>For **ISaGRAF 5** configurations, simple and complex devices have an unlimited number of parameters. |

| ISaGRAF 3 Workbench | ISaGRAF 5 Workbench |
|---|---|
| Simple device members across different complex devices may have the same name but different parameters | Simple device members used across complex devices have unique names. Therefore, when importing **ISaGRAF 3** projects having simple device members of complex devices, the Workbench renames member instances with unique names by adding the _n extension to each, where n indicates an incrementing number. For example, two simple device members belonging to different complex devices become *member*_1 and *member*_2. Also, since **ISaGRAF 3** configurations support device names having a maximum of 8 characters, the names of the renamed members may be truncated to allow the addition of the _n extension. |
| Board slots can be numbered starting from 0 to 15. Grouping of boards can be created by moving individual board slots up or down in the list an by placing empty slots between them. <br> Note: Boards correspond to devices in **ISaGRAF 5**. | For all configurations, numbering of devices (device index) and creating grouping by moving individual devices to reorganize list of devices. |
| The numbering starting index for I/O channels ranges from 0 to 15. The default value is 1. | For all configurations, enables specifying number of channels, however, these channels are automatically numbered from 0. |
| Password-protection for individual I/O channels | For all configurations, password protection is only available for projects, libraries, resources, POUs, and targets. |
| For I/O connections with boards or equipment, technical notes provide information for I/O board management. These notes are written by the board or equipment supplier. | For all configurations, for I/O wiring devices, help in a Comment window is available for a device. This help is defined for the device using the Target Definition Builder. |
| You can only wire global variables. | For **ISaGRAF 3** configurations, you can only wire global variables. <br> For **ISaGRAF 5** configurations, you can wire local and global variables. |
| Comments are available for free channels | Not available in the **ISaGRAF 5** Workbench |
| In debug mode, the values of free channels can be modified. | In debug mode, the values of free channels cannot be modified. |

| ISaGRAF 3 Workbench | ISaGRAF 5 Workbench |
|---|---|
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| **Variable Bindings** | |
| Internal Bindings are not available in the **ISaGRAF 3** Workbench | Not available for **ISaGRAF 3** configurations<br>For other configurations, Internal Bindings bind variables from resources belonging to the same project |
| External Bindings are not available in the **ISaGRAF 3** Workbench | Not available for **ISaGRAF 3** configurations<br>For other configurations, External Bindings bind variables from resources belonging to different projects |
| | |
| **Version Source Control** | |
| Version source control management is not available in the **ISaGRAF 3** Workbench | In the **ISaGRAF 5** Workbench, Version source control management of changing versions of Workbench elements including projects, configurations, resources, and POUs by saving them to a control database where older versions of the elements can be retrieved at a later time. Other operations include comparing current and previous versions, accessing details for a previous version, and creating a history report. |
| | |
| **Cross References** | |
| Dictionary errors are displayed in a dialog | Dictionary errors are displayed in the output window when compiling |
| Statistics show the number of objects and variables declared in a project | Not available in the **ISaGRAF 5** Workbench |
| | |

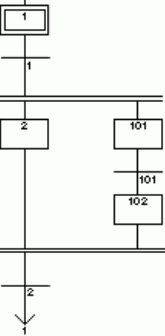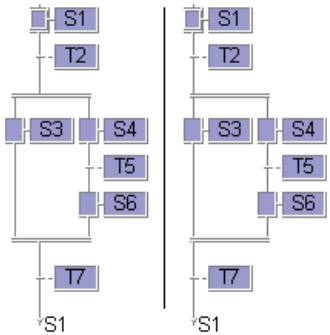| ISaGRAF 3 Workbench | ISaGRAF 5 Workbench |
|---|---|
| **Downloads and Debugging** | |
| Downloads are performed while in debug mode | In the **ISaGRAF 5** Workbench, downloads are performed prior to launching the debug mode. You can start the target upon completion of the download. While in debug mode, on-line changes are available. |
| The "Show cycle timing" display option displays the allowed, current, maximum, and overflow cycle times | For **ISaGRAF 3** configurations, the Timing tab of the Diagnosis window displays the programmed (allowed), current, maximum, and overflow cycle times. <br><br> For **ISaGRAF 5** configurations, the Timing tab of the Diagnosis window displays the programmed, current, maximum, and overflow cycle times as well as the resource state and the indication of whether the code has been saved on the target system |
| The "Show errors" display option displays the detected run-time errors in the bottom area of the debugger window | For **ISaGRAF 3** configurations, run-time errors are not displayed. <br><br> For **ISaGRAF 5** configurations, run-time errors are displayed in the events viewer. |
| Graphical monitoring of FC tokens moving through an FC chart. Graphical monitoring of blocks (operator, function, or function block) output values is not available. | For **ISaGRAF 3** configurations, graphical monitoring of any type is not available. <br><br> For **ISaGRAF 5** configurations, graphical monitoring of blocks (operator, function, or function block) output values where boolean types are displayed using color while SINT, USINT, BYTE, INT, UINT, WORD, DINT, UDINT, DWORD, LINT, ULINT, LWORD, REAL, LREAL, TIME, DATE, and STRING types are displayed as a numeric or textual value in a label directly above the output. When the output is a structure type, the displayed value is the selected member. |

| ISaGRAF 3 Workbench | ISaGRAF 5 Workbench |
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| For online modifications, only modifications to code sequences are allowed. Variable definition, application parameters and I/O connections cannot be modified. | For **ISaGRAF 3** configurations, only on-line modifications to code sequences are allowed. Variable definition, application parameters and I/O connections cannot be modified. |
| | For **ISaGRAF 5** configurations, for online modifications, modifications to code sequences and add or remove variables with some limitations. Cannot change the descriptions of I/O devices. Other limitations exist for various items of a project: |
| | Types, cannot add, remove, or change types definitions. When required, you could define extra types. Such extra types could then be used for future changes. |
| | Bindings, for some changes made to bindings, no warning message appears during compilation and modifications are not taken into account by the target at online change. |
| | Resource properties, for some changes made to other options, no warning message appears and the modification is not taken into account by the target at on line change. |

| ISaGRAF 3 Workbench | ISaGRAF 5 Workbench |
|---|---|
| Updating the code of a running application consists of the following operations: | In the **ISaGRAF 5** Workbench, modifying a running resource consists of the following operations: |
| 1. Before making changes to a running application, making a copy of the current project under another name. | 1. Modifying the resource source code on the Workbench |
| 2. Before editing a program, setting the "update diary" option to ease future program maintenance. | 2. Generating the new resource code |
| 3. When one or more sequences have been modified (without modifying SFC structures and program hierarchy), generating the new application code on the workbench before downloading. | 3. Downloading the new resource code using "Online change: download" command on the Debug menu (instead of "download") |
| 4. Using the debugger, from within the old project, connecting the target PLC and performing any operation which can make the application update faster or more safely. | 4. Switching from the old resource code to the new one in between PLC execution cycles, using the "Online change: update" command on the Debug menu |
| 5. Using the debugger, from inside the new project, connecting the target PLC. When application name is changed, the target database cannot be accessed. Users must run the "File / Update" command. | |
| 6. Downloading the modified application by selecting the "Update later" option. This may slightly slow down the PLC during transfer. | |
| 7. When download is complete, running the "File / Realize update" command to enable the switch at the most adequate moment. The switch will last one or two cycles. | |
| When the switch has been correctly performed, the programs of the modified running application are displayed. If not, the existing running application remains as is. | |

| ISaGRAF 3 Workbench | ISaGRAF 5 Workbench |
|---|---|
| The step-by-step mode is not available in the **ISaGRAF 3** Workbench | Not available for **ISaGRAF 3** configurations<br><br>For **ISaGRAF 5** configurations, the step-by-step mode for ST, IL, and LD POUs enables setting breakpoints to specific lines of code. For LD POUs, you set breakpoints to rungs. When running an application in Debug mode, the application stops when it encounters a breakpoint where depending on the state of the resource, you choose to perform various operations:<br>- Step to the next line of code or rung<br>- Step into the next line of code or rung<br>- Execute one cycle<br>- Switch to cycle-to-cycle mode<br>- Switch to real-time mode<br>A call stack window shows stepping information between POUs and called functions |
| Diagnosis tool enables working on a predefined set of variables, in order to examine and control the process. This tool provides a safe way to control the target application for final running operations or maintenance. | For **ISaGRAF 3** configurations, diagnostic information provides access to cycle timing and version information (only the Compiled and Running versions are valid; the Stored version is not valid). System variables, locked variables, and breakpoints are not available.<br><br>For **ISaGRAF 5** configurations, diagnostic information provides access to cycle timing, system variables, and version information as well as a list of locked variables and a list of all breakpoints defined for ST, IL, and LD POUs of a resource |
| In the **ISaGRAF 3** Workbench, Spotlight enables basic debugging of an application. Provides a table displaying the values of variables contained in a project. | In the **ISaGRAF 5** Workbench, HiBeam enables debugging an application. All interfaces and variable definitions must be defined. |
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| ISaGRAF 3 Workbench | ISaGRAF 5 Workbench |
|---|---|
| **Simulator** | |
| The simulator enables saving and restoring input states of named input channels. The simulator also includes a tool to build and run simulation scripts. A script is described with an easy ST like textual language and is used to automate tests with the ISaGRAF simulator. | For **ISaGRAF 3** configurations, the **ISaGRAF 3** simulator is launched enabling saving and restoring input states of named input channels. The simulator also enables using the cycle profiler as well as building and running scripts. |
| | For **ISaGRAF 5** configurations, simulating a panel of I/Os, i.e., displaying the values of inputs and outputs defined for a project, in their I/O devices. When testing a project in simulation mode, the Simulator (I/O Panel Simulation) is automatically launched. The **ISaGRAF 5** Workbench does not include a tool to build and run simulation scripts. |
| | |
| **Libraries** | |
| Password protection is available for individual elements in a library | In the **ISaGRAF 5** Workbench, access control is available for POUs, resources, configurations (targets), and projects |
| Libraries are available for use from the Library tool when these are located in the LIB directory | In the **ISaGRAF 5** Workbench, for all configurations, dependencies on libraries enables accessing their defined components |
| | |
| **Run-time System Events** | |
| Logging of run-time system events is not available in the **ISaGRAF 3** Workbench | For **ISaGRAF 3** configurations, logging of run-time system events is not available. |
| | For **ISaGRAF 5** configurations, logging of run-time system events on the Windows platform using the Events Logger and where the viewing of events is performed in the Events Viewer |
| | |

| ISaGRAF 3 Workbench | ISaGRAF 5 Workbench |
|---|---|
| **Language Editors** | |
| Macro steps representing a unique group of steps and transitions in the SFC editor | For **ISaGRAF 3** configurations, macro steps are not available.<br><br>For **ISaGRAF 5** configurations, in some designs, SFC function blocks could be used as macro steps. |
| The SFC editor manages an SFC gallery, i.e, a collection of SFC structures to insert in SFC charts | SFC galleries are not available in the **ISaGRAF 5** Workbench |
| SFC steps can only be programmed in ST. | For **ISaGRAF 3** configurations, SFC steps can only be programmed in ST. These steps can only have one action block.<br><br>**Note:** When using an SFC child, make sure to add the GS prefix to the step calling the SFC child. To start an SFC child, use the <child_program> (S) syntax and to stop the child, use the child_program> (R) syntax.<br><br>For **ISaGRAF 5** configurations, SFC steps can be programmed in ST, LD, or IL. |
| SFC transitions can only be programmed in ST or LD. | For **ISaGRAF 3** configurations, SFC transitions can only be programmed in ST or LD.<br><br>For **ISaGRAF 5** configurations, SFC transitions can be programmed in ST or LD. |
| SFC diagrams can have a maximum size of 20 by 20 cells | For **ISaGRAF 3** configurations, SFC diagrams can have a maximum size of 20 by 20 cells.<br><br>For **ISaGRAF 5** configurations, SFC diagrams are not limited to 20 by 20 cells. |
| SFC steps can include negated Boolean actions. | SFC steps can include Boolean actions having the N, S, or R qualifier. Therefore, when importing projects having SFC steps with negated Boolean actions, these are not converted in the ISaGRAF 5 Workbench. Before importing such a project, replace the negated Boolean action using either R and S qualifier or using an ST statement where you assign a Boolean variable to a negated Boolean variable (e.g., `bool_var:=NOT(bool_var)`). |

| ISaGRAF 3 Workbench | ISaGRAF 5 Workbench |
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| SFC diagrams are aligned from the left:<br> | For **ISaGRAF 3** configurations, SFC diagrams must be aligned from the left to enable reading by the **ISaGRAF 3** compiler. Therefore, since the **ISaGRAF 5** default aligns them by the center, these diagrams must be realigned once drawn:<br><br>For **ISaGRAF 5** configurations, SFC diagrams are aligned by the center. |
| Steps names must be GS*x* and transitions names must be GT*x* | For **ISaGRAF 3** configurations, steps names must be GS*x* and transitions names must be GT*x*.<br>For **ISaGRAF 5** configurations, step names and transition names can have any name other than variable names or reserved keywords. |
| The Quick LD editor enables in-line function blocks | In-line function blocks are not available in the **ISaGRAF 5** Workbench |
| In FBD diagrams, adding or removing horizontal space | In the Workbench, moving elements adds or removes space in FBD diagrams |
| Styles (predefined) and modification tracking | Styles (predefined) and modification tracking is not available in the **ISaGRAF 5** Workbench |
| Tooltips are available in the Quick LD and FBD/LD editors | In the **ISaGRAF 5** Workbench, variable comments display various information for variables in the FBD editor |
| In the ST and IL text editor, inserting files having Ascii content | In the **ISaGRAF 5** Workbench, the contents of Ascii files can be copied then pasted into the ST and IL text editor. |

| ISaGRAF 3 Workbench | ISaGRAF 5 Workbench |
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| **Basic Types** | |
| BOOLEAN: logic (true or false) value<br>ANALOG: integer or real (floating) continuous value<br>TIMER: time value<br>MESSAGE: character string | For **ISaGRAF 3** configurations, only the following corresponding data types are available:<br>BOOL (replaces BOOLEAN): logic (true or false) value<br>DINT (replaces ANALOG): double integer continuous value (32 bit)<br>REAL (replaces ANALOG): real (floating) continuous value (32 bit)<br>TIME (replaces TIMER): time values less than one day; these value types cannot store dates (32 bit)<br>STRING (replaces MESSAGE): character string having a defined size, representing the maximum number of characters the string can contain. For example, to define MyString as a string containing 10 characters, enter MyString(10). |

| ISaGRAF 3 Workbench | ISaGRAF 5 Workbench |
|---|---|
| (continued) | For **ISaGRAF 5** projects, the following corresponding data types are available:<br><br>BOOL: logic (true or false) value<br><br>SINT: short integer continuous value (8 bit)<br><br>USINT: unsigned short integer continuous value (8 bit)<br><br>BYTE: byte value (8 bit)<br><br>INT: single integer continuous value (16 bit)<br><br>UINT: unsigned single integer continuous value (16 bit)<br><br>WORD: word value (16 bit)<br><br>DINT: double integer continuous value (32 bit)<br><br>UDINT: unsigned double integer continuous value (32 bit)<br><br>DWORD: double word value (32 bit)<br><br>LINT: long integer continuous value (64 bit)<br><br>ULINT: unsigned long integer continuous value (64 bit)<br><br>LWORD: long word value (64 bit)<br><br>REAL: real (floating) continuous value (32 bit)<br><br>LREAL: long real (floating) continuous value (64 bit)<br><br>TIME: time values less than one day; these value types cannot store dates (32 bit)<br><br>DATE: date values (32 bit)<br><br>STRING: character string having a defined size, representing the maximum number of characters the string can contain. For example, to define MyString as a string containing 10 characters, enter MyString(10). |

| ISaGRAF 3 Workbench | ISaGRAF 5 Workbench |
|---|---|
| **User-defined Types** | |
| Arrays are an informal feature having one dimension supporting analog, real and timer (not supporting messages) | For **ISaGRAF 3** configurations, arrays of BOOL, DINT, REAL, and TIME type can have one dimension. STRING type arrays are not supported. |
| | For **ISaGRAF 5** configurations, arrays can be multi-dimensional supporting arrays, structures, and all standard IEC 61131 data types |
| Structures are not available in the **ISaGRAF 3** Workbench | For **ISaGRAF 3** configurations, structures are not available |
| | For **ISaGRAF 5** configurations, structures using structures, arrays, and standard IEC 61131 data types. These are composed of sub-entries called Fields. When structures are defined, variables can be created with this type. |
| | |
| **Constant Expressions** | |
| Boolean constant expressions<br>Integer analog constant expressions<br>Real analog constant expressions<br>Timer constant expressions<br>Message string constant expressions | For **ISaGRAF 3** configurations, the following constant expressions are available:<br>Boolean Constant Expressions<br>Double Integer Constant Expressions<br>Real Constant Expressions<br>Timer Constant Expressions<br>String Constant Expressions |

| ISaGRAF 3 Workbench | ISaGRAF 5 Workbench |
|---|---|
| (continued) | For **ISaGRAF 5** configurations, the following constant expressions are available: |
| | Boolean Constant Expressions |
| | Short Integer Constant Expressions |
| | Unsigned Short Integer and BYTE Constant Expressions |
| | Integer Constant Expressions |
| | Unsigned Integer and WORD Constant Expressions |
| | Double Integer Constant Expressions |
| | Unsigned Double Integer and Double Word Constant Expressions |
| | Long Integer Constant Expressions |
| | Unsigned Long Integer and Long Word Constant Expressions |
| | Real Constant Expressions |
| | Long Real Constant Expressions |
| | Timer Constant Expressions |
| | Date Constant Expressions |
| | String Constant Expressions |
| **Reserved Keywords** | |
| In the **ISaGRAF 3** Workbench, reserved keywords include FEDGE, OPERATE, REDGE, TSTART, TSTOP | In the **ISaGRAF 5** Workbench, reserved keywords include SUB_DATE_DATE |

| ISaGRAF 3 Workbench | ISaGRAF 5 Workbench |
|---|---|
| **Directly Represented Variables** | |
| %IXs.c free channel of a Boolean input board<br>%IDs.c free channel of an integer input board<br>%ISs.c free channel of a message input board<br>%QXs.c free channel of a Boolean output board<br>%QDs.c free channel of an integer output board<br>%QSs.c free channel of a message output board | For **ISaGRAF** 3 configurations, the following directly represented variables are available:<br>%IXs.c  free Channel of a Boolean input I/O device<br>%IDs.c  free Channel of a Double integer input I/O device<br>%ISs.c  free Channel of a String input I/O device<br>%QXs.c  free Channel of a Boolean output I/O device<br>%QDs.c  free Channel of a Double integer output I/O device<br>%QSs.c  free Channel of a String output I/O device<br><br>For **ISaGRAF 5** configurations, the following directly represented variables are available:<br>%IXs.c  free Channel of a Boolean input I/O device<br>%IBs.c  free Channel of a Short integer, Unsigned short integer, or BYTE input I/O device<br>%IWs.c  free Channel of an Integer, Unsigned integer, or WORD input I/O device<br>%IDs.c  free Channel of a Double integer, Unsigned double integer, Double word, or DATE input I/O device<br>%ILs.c  free Channel of a Long integer, Unsigned long integer, Long word, or Long real input I/O device<br>%IRs.c  free Channel of a Real input I/O device<br>%ITs.c  free Channel of a Time input I/O device<br>%ISs.c  free Channel of a String input I/O device |

| ISaGRAF 3 Workbench | ISaGRAF 5 Workbench |
|---|---|
| (continued) | %QXs.c  free Channel of a Boolean output I/O device |
| | %QBs.c  free Channel of a Short Integer, Unsigned short integer, or BYTE output I/O device |
| | %QWs.c  free Channel of an Integer, Unsigned integer, or WORD output I/O device |
| | %QDs.c  free Channel of a Double integer, Unsigned double integer, Double word, or DATE output I/O device |
| | %QLs.c  free Channel of a Long integer, Unsigned long integer, Long word, or Long real output I/O device |
| | %QRs.c  free Channel of a Real output I/O device |
| | %QTs.c  free Channel of a Time output I/O device |
| | %QSs.c  free Channel of a String output I/O device |
| %IXs.b.c free channel of a Boolean input board %IDs.b.c free channel of an integer input board %ISs.b.c free channel of a message input board %QXs.b.c free channel of a Boolean output board %QDs.b.c free channel of an integer output board %QSs.b.c free channel of a message output board | For **ISaGRAF 3** configurations, the following directly represented variables are available: %IXs.b.c  free Channel of a Boolean input I/O device %IDs.b.c  free Channel of a Double integer input I/O device %ISs.b.c  free Channel of a String input I/O device %QXs.b.c  free Channel of a Boolean output I/O device %QDs.b.c  free Channel of a Double integer output I/O device %QSs.b.c  free Channel of a String output I/O device |

| ISaGRAF 3 Workbench | ISaGRAF 5 Workbench |
|---|---|
| (continued) | For **ISaGRAF 5** configurations, the following directly represented variables are available: |
| | %IXs.b.c  free Channel of a Boolean input I/O device |
| | %IBs.b.c  free Channel of a Short Integer, Unsigned short integer, or BYTE input I/O device |
| | %IWs.b.c  free Channel of an Integer, Unsigned integer, or WORD input I/O device |
| | %IDs.b.c  free Channel of a Double integer, Unsigned double integer, Double word, or DATE input I/O device |
| | %ILs.b.c  free Channel of a Long integer, Unsigned long integer, Long word, or Long real input I/O device |
| | %IRs.b.c  free Channel of an Real input I/O device |
| | %ITs.b.c  free Channel of a Time input I/O device |
| | %ISs.b.c  free Channel of a String input I/O device |
| | %QXs.b.c  free Channel of a Boolean output I/O device |
| | %QBs.b.c  free Channel of a Short Integer, Unsigned short integer, or BYTE output I/O device |
| | %QWs.b.c  free Channel of an Integer, Unsigned integer, or WORD output I/O device |
| | %QDs.b.c  free Channel of a Double integer, Unsigned double integer, Double word, or DATE output I/O device |
| | %QLs.b.c  free Channel of a Long integer, Unsigned long integer, Long word, or Long real output I/O device |
| | %QRs.b.c  free Channel of a Real output I/O device |
| | %QTs.b.c  free Channel of a Time output I/O device |
| | %QSs.b.c  free Channel of a String output I/O device |

| ISaGRAF 3 Workbench | ISaGRAF 5 Workbench |
|---|---|
| **Variables** | |
| Variable grouping is not available in the **ISaGRAF 3** Workbench | For **ISaGRAF 3** configurations, variable grouping is not available<br><br>For **ISaGRAF 5** configurations, variable groups provide a method of managing variables and logically sorting them within a resource |
| Variable names have a maximum of 32 characters | For **ISaGRAF 3** configurations, variable names have a maximum of 32 characters<br><br>For **ISaGRAF 5** configurations, variable names have a maximum of 128 characters |
| Quick declaration of variables in dictionary | In the **ISaGRAF 5** Workbench, duplication of variables enables a similar declaration where a sample variable is created having the required attributes then duplicated |
| Importing/Exporting variables data using tab, comma (CSV), semicolon, or comma and quote separators | In the **ISaGRAF 5** Workbench, importing / exporting variables data using comma-separated (CSV) or XLS format. The CSV format lines must end with a carriage return. Also, importing / exporting Workbench elements (projects, configurations, resources, and POUs) from one project to another. |

| ISaGRAF 3 Workbench | ISaGRAF 5 Workbench |
|---|---|
| Boolean variables<br>Analog variables<br>Timer variables<br>Message String variables | For **ISaGRAF 3** configurations, the following variable types are available:<br>Boolean Variables (BOOL)<br>Double Integer Variables (DINT)<br>Real Variables (REAL)<br>Timer Variables (TIME)<br>String Variables (STRING)<br>For **ISaGRAF 5** configurations, the following variable types are available:<br>Boolean Variables (BOOL)<br>Short Integer Variables (SINT)<br>Unsigned Short Integer (USINT) or BYTE Variables<br>Integer Variables (INT)<br>Unsigned Integer (UINT) or WORD Variables<br>Double Integer Variables (DINT)<br>Unsigned Double Integer (UDINT) or Double Word (DWORD) Variables<br>Long Integer Variables (LINT)<br>Unsigned Long Integer (ULINT) or Long Word (LWORD) Variables<br>Real Variables (REAL)<br>Long Real Variables (LREAL)<br>Timer Variables (TIME)<br>Date Variables (DATE)<br>String Variables (STRING) |

| Defined Words | |
|---|---|
| Defined words have a maximum of 32 characters. These can have a common, global, or local scope. | For **ISaGRAF 3** configurations, defined words have a maximum of 32 characters. These can only have a global scope.<br>For **ISaGRAF 5** configurations, defined words have a maximum of 128 characters. These can only have a global scope. |

| ISaGRAF 3 Workbench | ISaGRAF 5 Workbench |
|---|---|
| | |
| **Various Differences** | |
| TSTART and TSTOP statements | For **ISaGRAF 5** configurations, the TSTART and TSTOP statements are replaced by the TON function block |
| Modbus SCADA addressing map | In the **ISaGRAF 5** Workbench, Modbus addressing is available using the Modbus driver |
| | |
| **Functions and Function Blocks** | |
| Maximum name length of "C" conversion functions, "C" functions, "C" function blocks, user functions, and user function blocks is eight characters. If the same function name is found in more than one library, it generates an error. | For **ISaGRAF 3** configurations, the maximum name length of "C" conversion functions, "C" functions, "C" function blocks, user functions, and user function blocks is eight characters. If the same function name is found in more than one library, it generates an error For **ISaGRAF 5** configurations, the maximum name length of "C" conversion functions, "C" functions, "C" function blocks, user functions, and user function blocks is 128 characters. |
| Functions and function blocks can be written in ST, IL, LD, or FBD languages. | For **ISaGRAF 3** configurations, functions can be written in ST, IL, LD, or FBD and function blocks can be written in ST, LD, or FBD languages. For **ISaGRAF 5** configurations, functions can be written in ST, LD, FBD or IL languages. Function blocks can be written in the SFC, ST, LD, or FBD languages. |
| Cannot assign an instance declared in the dictionary to a function or function block | For **ISaGRAF 3** configurations, in the FBD and LD editors, cannot assign an instance declared in the dictionary to a function or function block For **ISaGRAF 5** configurations, can have automatic or declared instances of functions and function blocks |
| | |

| ISaGRAF 3 Workbench | ISaGRAF 5 Workbench |
|---|---|
| **Operators** | |
| & | AND |
| =1 | XOR |
| >=1 | OR |
| 1 | 1 Gain |
| AND_MASK | In the **ISaGRAF 5** Workbench, is a standard function |
| OR_MASK | In the **ISaGRAF 5** Workbench, is a standard function |
| XOR_MASK | In the **ISaGRAF 5** Workbench, is a standard function |
| NOT_MASK | In the **ISaGRAF 5** Workbench, is a standard function |
| ANA | For **ISaGRAF 3** configurations, renamed to ISA3_ANA. Performs the same operation as ANY_TO_DINT.<br>Not available for **ISaGRAF 5** configurations. |
| BOO | Available for **ISaGRAF 3** configurations. Performs same operation as ANY_TO_BOOL. |
| REAL | For **ISaGRAF 3** configurations, renamed to ISA3_REAL. Performs same operation as ANY_TO_REAL. |
| TMR | Available for **ISaGRAF 3** configurations. Performs same operation as ANY_TO_TIME. |
| MSG | Available for **ISaGRAF 3** configurations. Performs same operation as ANY_TO_STRING. |
| CAT | Available only for **ISaGRAF 3** configurations |
| SYSTEM | For **ISaGRAF 3** configurations, renamed to ISA3_SYSTEM.<br>For **ISaGRAF 5** configurations, is a system variable accessed in the diagnostic information |
| OPERATE | Available only for **ISaGRAF 3** configurations |

| ISaGRAF 3 Workbench | ISaGRAF 5 Workbench |
|---|---|
| FEDGE | Not available in the **ISaGRAF 5** Workbench |
| REDGE | Not available in the **ISaGRAF 5** Workbench |
| Not available in the **ISaGRAF 3** Workbench | Available only for **ISaGRAF 5** configurations:<br>ANY_TO_SINT<br>ANY_TO_BOOL<br>ANY_TO_REAL<br>ANY_TO_TIME<br>ANY_TO_STRING<br>ANY_TO_USINT<br>ANY_TO_BYTE<br>ANY_TO_INT<br>ANY_TO_UINT<br>ANY_TO_WORD<br>ANY_TO_DINT<br>ANY_TO_UDINT<br>ANY_TO_DWORD<br>ANY_TO_LINT<br>ANY_TO_ULINT<br>ANY_TO_LWORD<br>ANY_TO_LREAL<br>ANY_TO_DATE<br>NOT |
| | |
| **Standard Functions** | |
| ARCREATE function<br>ARREAD function<br>ARWRITE function | Available only for **ISaGRAF 3** configurations.<br>For **ISaGRAF 5** configurations, arrays are declared in the Dictionary. |
| DAY_TIME function | Available only for **ISaGRAF 3** configurations.<br>For **ISaGRAF 5** configurations, available as the GET_TIME_STRING function and GET_TIME_STRUCT function block. |

| ISaGRAF 3 Workbench | ISaGRAF 5 Workbench |
|---|---|
| F_CLOSE function<br>F_EOF function<br>F_ROPEN function<br>F_WOPEN function<br>FA_READ function<br>FA_WRITE function<br>FM_READ function<br>FM_WRITE function | Available only for **ISaGRAF 3** configurations.<br>For **ISaGRAF 5** configurations, these functions can be developed as "C" functions using the Target Definition Builder. |
| Not available in the **ISaGRAF 3** Workbench | Available only for **ISaGRAF 5** configurations:<br>AS_SEND_EVENT<br>CURRENT_ISA_DATE<br>FAILOVER<br>GET_TIME_STRING<br>IOCTRL<br>LOG_MSG<br>SET_PRIORITY<br>SUB_DATE_DATE |
| | |
| **Optional Functions** | |
| **ODBC Functions** | |
| Not available in the **ISaGRAF 3** Workbench | Available only for **ISaGRAF 5** configurations:<br>SQLAllocHandle<br>SQLBindCol<br>SQLBindParameter<br>SQLBrowseConnect<br>SQLBulkOperation<br>SQLCancel<br>SQLCloseCursor<br>SQLColAttribute<br>SQLColumnPrivileges<br>SQLColumns<br>SQLConnect<br>SQLCopyDesc |

| ISaGRAF 3 Workbench | ISaGRAF 5 Workbench |
|---|---|
| (continued) | SQLDataSources |
| | SQLDescribeCol |
| | SQLDescribeParam |
| | SQLDisconnect |
| | SQLDriverConnect |
| | SQLDrivers |
| | SQLEndTran |
| | SQLExecDirect |
| | SQLExecute |
| | SQLExtendedFetch |
| | SQLFetch |
| | SQLFetchScroll |
| | SQLForeignKeys |
| | SQLFreeHandle |
| | SQLFreeStmt |
| | SQLGetConnectAttr |
| | SQLGetCursorName |
| | SQLGetData |
| | SQLGetDescField |
| | SQLGetDescRec |
| | SQLGetDiagField |
| | SQLGetDiagRec |
| | SQLGetEnvAttr |
| | SQLGetFunctions |
| | SQLGetInfo |
| | SQLGetStmtAttr |
| | SQLGetTypeInfo |
| | SQLMoreResults |
| | SQLNativeSql |
| | SQLNumParams |
| | SQLNumResultCols |
| | SQLParamData |
| | SQLPrepare |
| | SQLPrimaryKeys |

| ISaGRAF 3 Workbench | ISaGRAF 5 Workbench |
|---|---|
| (continued) | SQLProcedureColumns |
| | SQLProcedures |
| | SQLPutData |
| | SQLRowCount |
| | SQLSetConnectAttr |
| | SQLSetCursorName |
| | SQLSetDescField |
| | SQLSetDescRec |
| | SQLSetEnvAttr |
| | SQLSetPos |
| | SQLSetStmtAttr |
| | SQLSpecialColumns |
| | SQLStatistics |
| | SQLTablePrivileges |
| | SQLTables |
| | SQLUpAndRunning |
| **Serial Communications Functions** | |
| Not available in the **ISaGRAF 3** Workbench | Available only for **ISaGRAF 5** configurations: |
| | SERIAL_CLOSE |
| | SERIAL_CONNECT |
| | SERIAL_DISCONNECT |
| | SERIAL_OPEN |
| | SERIAL_RECEIVE |
| | SERIAL_SEND |
| | SERIAL_SET |
| | SERIAL_STATUS |

| ISaGRAF 3 Workbench | ISaGRAF 5 Workbench |
|---|---|
| **Standard Function Blocks** | |
| SEMA | Available only for **ISaGRAF 3** configurations |
| **Basic Operations Function Blocks** | |
| Not available in the **ISaGRAF 3** Workbench | Available only for **ISaGRAF 5** configurations:<br>AS_AE<br>CONNECT<br>FC_GET_STAT<br>GET_TIME_STRUCT<br>NOW<br>URCV_S<br>USEND_S |

| ISaGRAF 3 Workbench | ISaGRAF 5 Workbench |
|---|---|
| **Advanced Control Function Blocks** | |
| Not available in the **ISaGRAF 3** Workbench | Available only for **ISaGRAF 5** configurations:<br>AnalogAlarm<br>BatchSwitch<br>BatchTotalizer<br>Bias<br>BiasCalibration<br>Characterizer<br>Comparator<br>DigitalAlarm<br>FlipFlop<br>IPIDController<br>LeadLagController<br>Limiter<br>PDController<br>RateLimiter<br>Ratio<br>RatioCalibration<br>RetentiveOnTimer<br>Scaler<br>Setpoint<br>SignalSelector<br>TrackAndHold<br>TransferSwitch |

| ISaGRAF 3 Workbench | ISaGRAF 5 Workbench |
|---|---|
| **Matrix Operations Function Blocks** | |
| Not available in the **ISaGRAF 3** Workbench | Available only for **ISaGRAF 5** configurations:<br>NEW_MATRIX<br>FREE_MATRIX<br>GET_I_MATRIX<br>PUT_I_MATRIX<br>GET_F_MATRIX<br>PUT_F_MATRIX<br>DUP_MATRIX<br>COPY_MATRIX<br>COPY_ROW_MATRIX<br>COPY_COL_MATRIX<br>TYPE_MATRIX<br>ROWS_MATRIX<br>COLS_MATRIX<br>TRANSPOSE_MATRIX<br>INVERT_MATRIX<br>ADD_MATRIX<br>SUBTRACT_MATRIX<br>MULTIPLY_MATRIX<br>SCALAR_I_MATRIX<br>SCALAR_F_MATRIX<br>PRINT_MATRIX |

| ISaGRAF 3 Workbench | ISaGRAF 5 Workbench |
|---|---|
| **Optional Function Blocks** | |
| Not available in the **ISaGRAF 3** Workbench | Smart PID Function Block available only for **ISaGRAF 5** configurations. |
| **IEC 61499 Function Blocks** | |
| Not available in the **ISaGRAF 3** Workbench | Available only for **ISaGRAF 5** configurations: E_CTU E_CYCLE E_D_FF E_DELAY E_DEMUX E_F_TRIG E_MERGE E_N_TABLE E_PERMIT E_R_TRIG E_REND E_RESTART E_RS E_SELECT E_SPLIT E_SR E_SWITCH E_TABLE E_TABLE_CTRL E_TRAIN |

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