Allen-Bradley

Logix5000™ Controllers Import/Export

1756 ControlLogix
1769 CompactLogix
1789 SoftLogix5800
1794 FlexLogix
PowerFlex 700s with DriveLogix

Reference Manual

Rockwell Automation

Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Allen-Bradley does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Allen-Bradley publication SGI-1.1, *Safety Guidelines for the Application, Installation and Maintenance of Solid-State Control* (available from your local Allen-Bradley office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

Throughout this manual we use notes to make you aware of safety considerations:

ATTENTION Or **ATTENTION** 	Identifies information about practices or circumstances that can lead to personal injury or death, property damage or economic loss

Attention and warning statements help you to:

- identify a hazard
- avoid a hazard
- recognize the consequences

IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

Summary of Changes

This document describes how to use version 2.4 (major revision 2, minor revision 4) of the import/export utility that is included with RSLogix 5000 programming software, version 13. Changes made to this version of the manual include:

- Corrections to the Producer, RemoteTag, RemoteFile, and RPI attributes for a TAG (see page 3-13).
- Clarification on how CSV rung comments attach to rungs on import (see page 1-6 and see page 8-4).

Changes made to the import/export utility for version 13 include:

- Support for new controllers (see page 2-5).
- ExtendedProp section to MODULE data (see page 3-5).
- Support for new TAG attributes (see chapter 3).

  Attributes can be in any order in an import/export file. The order shown in this document is the order the attributes export.
- Support for a TREND object in the import/export .L5K file (see chapter 3).
- New MCSV instruction in ladder logic (chapter 4) and structured text (chapter 6).
- Online editing support for structured text (chapter 6) and sequential function chart (chapter 7) logic.
- Updated CSV format now includes rung comments (chapter 8).
- New .L5X format for partial import/export of ladder rungs, tags, and trends (chapter 9).

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Importing and Exporting Files

Introduction

This document describes how to use version 2.4 (major revision 2, minor revision 4) of the import/export utility that is included with RSLogix 5000 programming software, version 13.

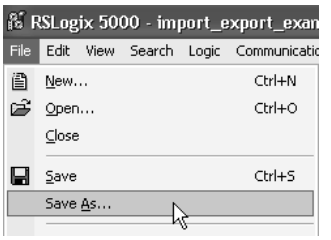
With a Logix controller, you can do a complete import/export of an entire project or you can do a partial import/export of parts of a project. The structure of the import/export file depends on whether you perform a complete or partial import/export operation. There are also different considerations for complete and partial import/export operations. This chapter shows how to perform the import/export operations and describes any considerations.

Exporting a Project to a Text File

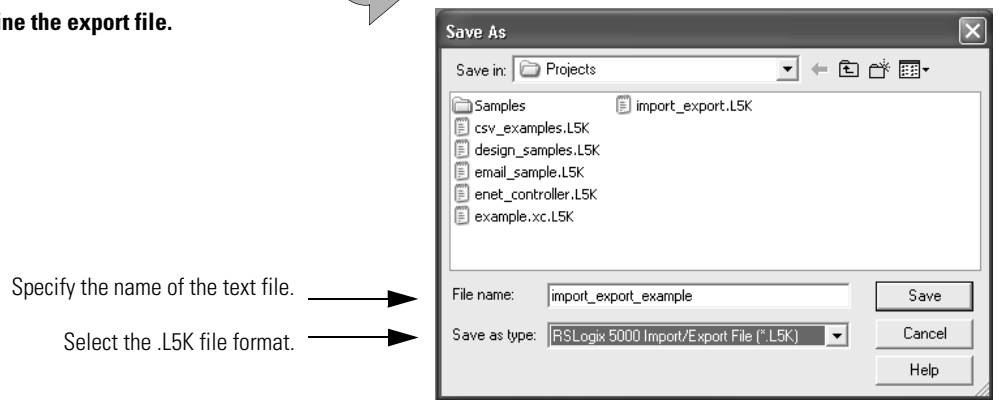
You can export a project to a text file. You can then use any text editor to modify the project.

Make sure the project you want to export is already open.

1. **Select File → Save As.**



2. **Define the export file.**



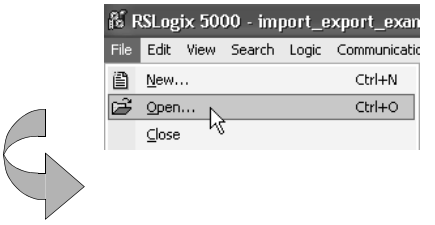
Click Save.

IMPORTANT Any unsaved edits are automatically saved when you OK the export operation.

Importing a Text File into a Project

You can import controller information from a saved text file (that has a .L5K extension). This lets you use any text editor to create a project.

1. **Select File → Open.**



2. **Select the text file.**

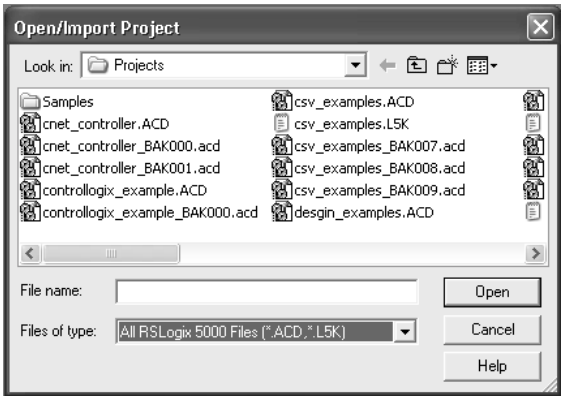
The text file must have a .L5K extension.

Select the file to import.

By default, the software points to the \RSLogix5000\Project folder. You can change the default via Tools → Options.

Specify the name for the file to import.

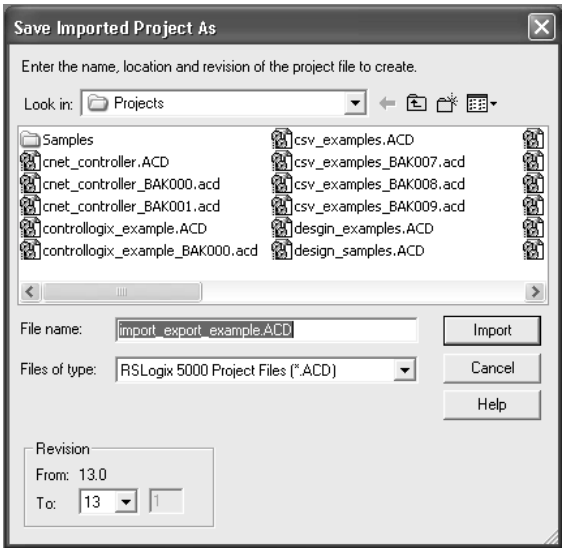
Click Open.



3. **Specify the name and location of the project**

Specify the project location.

Specify the project name.



Click Import.

If you import a project that has forces, the project defaults to Forces Disabled, even if the project was exported with Forces Enabled.

For more information about the structure of the complete import/export file, see:

For information on:	See chapter:
structuring a complete import/export file	2
creating a complete import/export file	3
entering relay ladder logic	4
entering function block diagram logic	5
entering structured text logic	6
entering sequential function chart logic	7

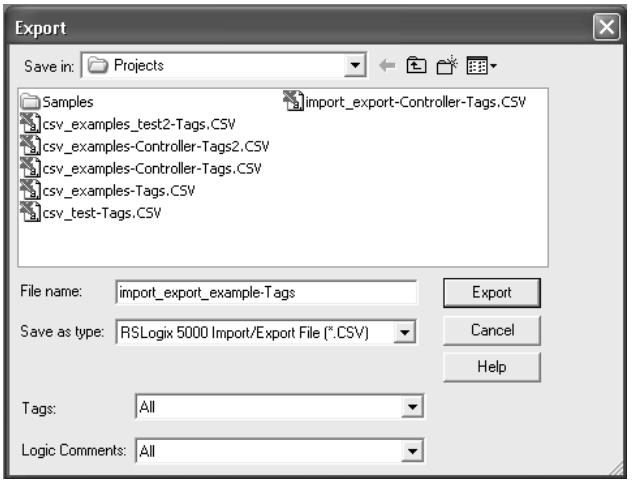
Exporting to a .CSV File

When you have a project open, you can export tags and rung comments to a .CSV file. You can then use a database program (like Microsoft® Excel®) to edit the tags and comments.

Make sure the project you want to export tags and comments from is already open.

1. **Select Tools → Export.**

2. **Define the export file and select which tags and/or rung comments to export.**



Specify the name of the export file.

Select the .CSV file format.

Select the scope to export.

Click Export.

Selecting the scope to export

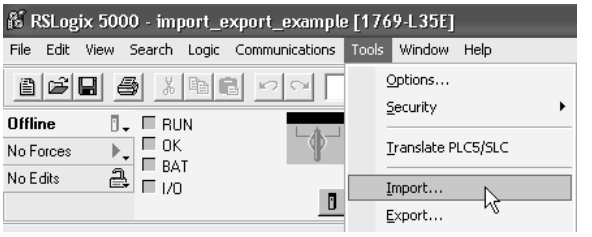
For tags and rung comments, you have these choices as to which content to export.

Scope:	This option exports:
None	no tags or rung comments
All	all the tags (controller-scope and program-scope)or rung comments in the project
Controller	(tags only) the controller-scoped tags of the project
individual program names	the program-scoped tags or rung comments of the program you select

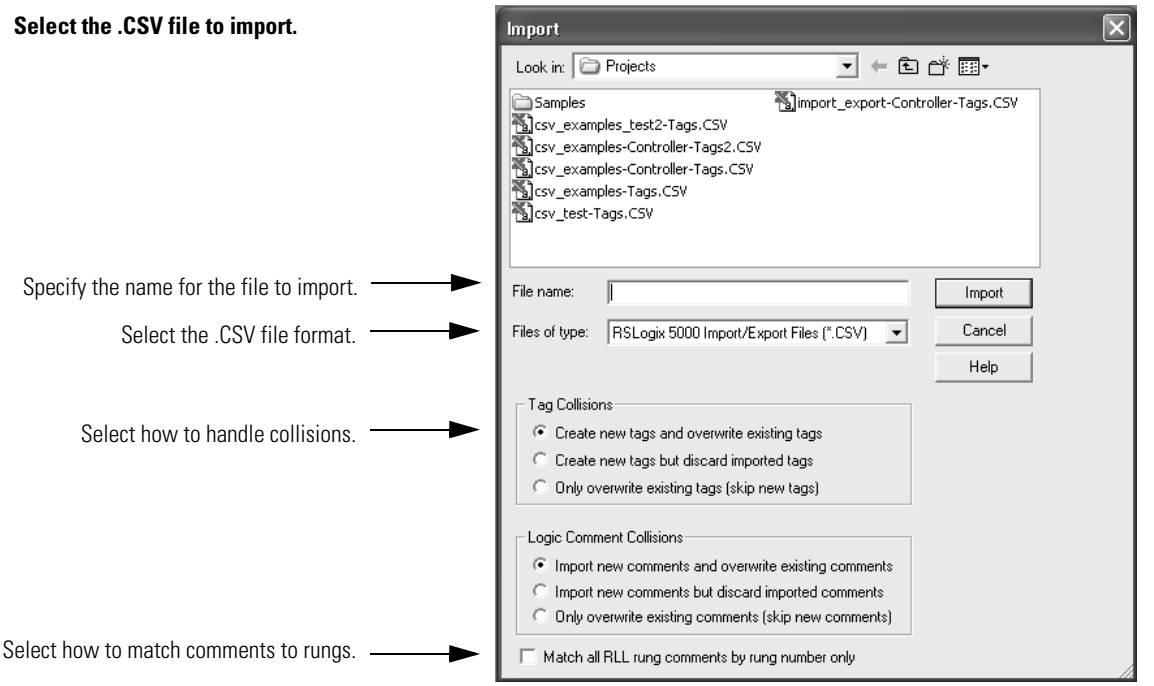
Importing a .CSV File

When you are offline and have a project open, you can import tags and rung comments from a saved .CSV file. This lets you use a database program (like Microsoft Excel) to create and edit tags.

1. **Select Tools → Import.**



2. **Select the .CSV file to import.**



Click Import.

When you import tags, the possibility exists for tags in the import file to have the same name as tags already in the open project. This condition is a collision. You specify how to handle a collision when you select the file to import:

If you want to:	Select:
replace tags in the project with tags from the import file, in addition to adding any new tags from the import file	Create new tags and overwrite existing tags (this is the default selection)
keep tags that are in the project and discard tags in the import file, in addition to adding any new tags from the import file	Create new tags but discard imported tags
replace tags in the project with tags from the import file, but do not add any new tags from the import file	Only overwrite existing tags (skip new tags)

If you delete tags from an import/export file and then import the file, tags are not deleted from the controller project. You have to use the programming software to delete tags from the tag list.

When you import rung comments, the possibility exists for comments in the import file to differ from comments in the open project when both are matched to the same rung. You specify how to handle a collision when you select the file to import:

If you want to:	Select:
replace comments in the project with comments from the import file, in addition to adding any new comments from the import file	Import new comments and overwrite existing comments (this is the default selection)
keep comments that are in the project and discard comments in the import file, in addition to adding any new comments from the import file	Import new comments but discard imported comments
replace comments in the project with comments from the import file, but do not add any new comments from the import file	Only overwrite existing comments (skip new comments)

You also select whether to match comments to rungs based on rung numbers or on owning element information:

If you want rung comments applied to:	Then in the "Match all RLL comments to rung number only" box:
the next rung that has the instruction, as specified in the Owning Element, as its last instruction on the rung this is the default and recommended option the Location element is ignored	leave the box unchecked
the rung number specified in the Location element this overrides the default and recommended option the Owning Element is ignored	check the box

For more information about the structure of the partial import/export file for tags and rung comments, see:

For information on:	See chapter:
structuring a partial import/export .CSV file	8

Exporting to an .L5X File

If you want to re-use ladder logic from another project, export only that portion of logic to a .L5X file and import it into the required project. You can export these .L5X files:

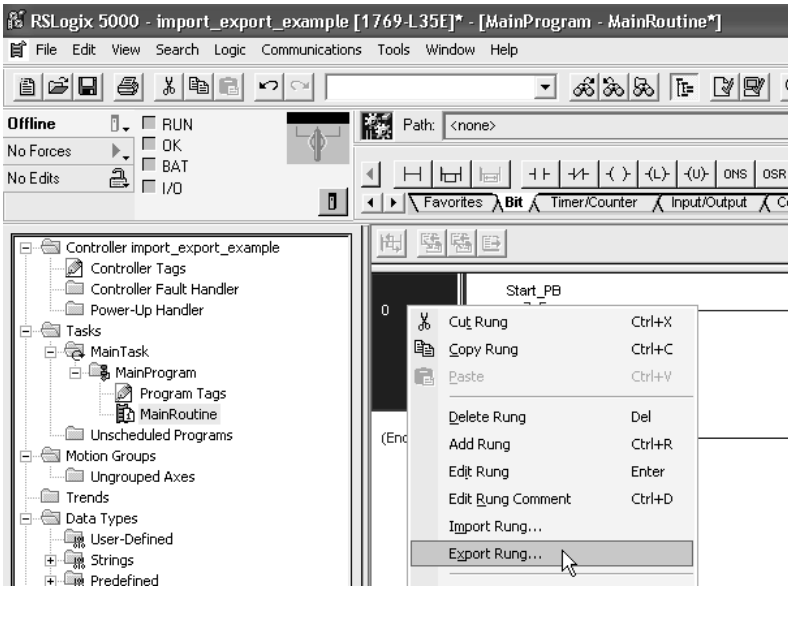
- ladder rungs, including the referenced tags and data types
- trends

Make sure the project you want to export from is already open.

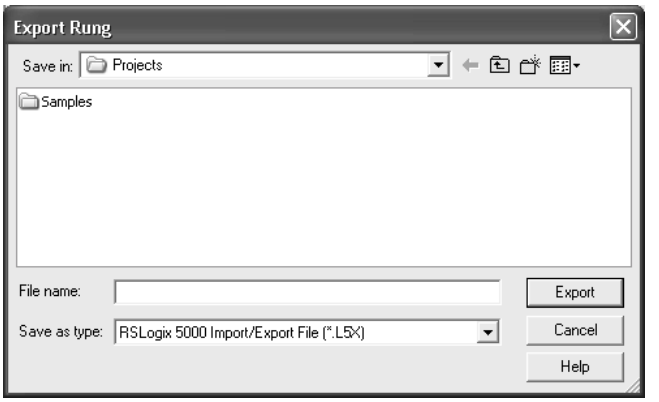
1. Select the content to export.

To export a rung, right-click on the rung and select Export Rung. You can select multiple rungs.

To export trends, right-click on the Trends folder in the Controller Organizer and select Export Trend.



2. Define the export file.



Specify the name of the export file.

Select the .L5X file format.

Click Export.

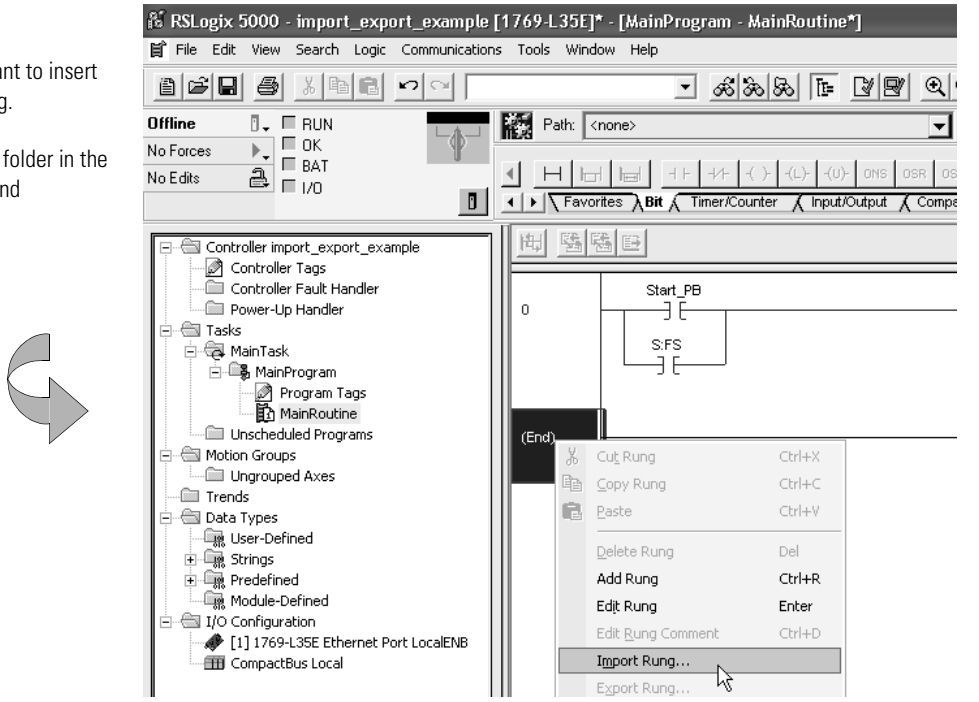
Importing an .L5X File

When you are offline and have a project open, you can import rungs or tags from a saved .L5X file.

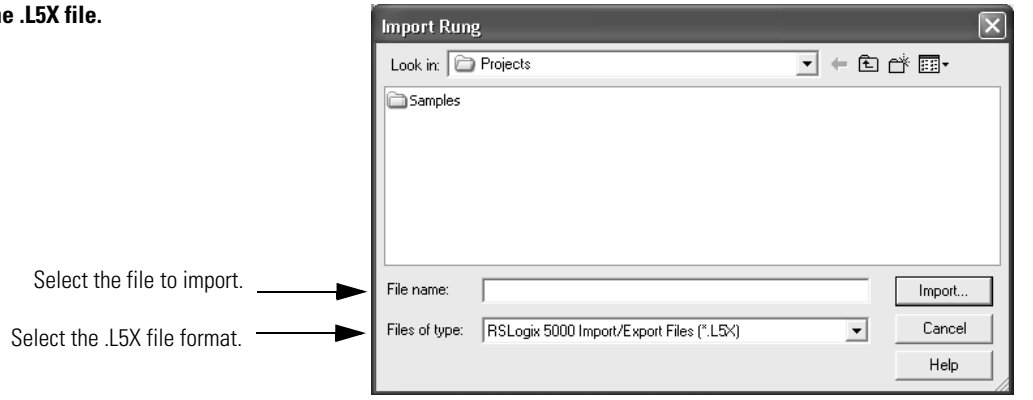
1. Select the content to import.

To import a rung, right-click where you want to insert the imported rungs and select Import Rung.

To import trends, right-click on the Trends folder in the Controller Organizer and select Import Trend



2. Select the .L5X file.



Click Import.

For more information about the structure of the .L5X format for the partial import/export of rungs or trends, see:

For information on:	See chapter:
structuring a partial import/export .L5X file	9

Notes:

Structuring a Complete (.L5K) Import/Export File Format

Introduction

This chapter explains the overall structure of a complete import/export file. The file extension for a complete import/export file is .L5K.

For information about the specifics of each component in an import/export file, see the chapter "Creating an Import/Export File". For information on entering logic, see the chapter "Entering Logic."

Conventions

The import/export utility is based on the formats specified by the IEC 1131-3 specification. The examples follow these conventions:

Convention:	Meaning:
`< >`	items shown in angle brackets are required
`[ ]`	items shown in square brackets are optional
`user_value`	items in italics indicate user-supplied information
`LITERAL`	items in all uppercase indicate a required keyword or symbol that must be entered as shown
`"["`	items in double quotes are required characters

White space characters include spaces, tabs, carriage return, newline, and form feed. These characters can occur anywhere in an import/export file, except in keywords or names. If white space characters occur outside of descriptions, they are ignored.

Internal file comments

You can enter comments to document your import files. The import process ignores these comments. You can place comments anywhere in an import/export file, except in keywords, names, component descriptions, and the value portion of attributes (before the delimiting comma or the end parenthesis).

You can enter comments using either of these methods:

- Start the comment with two percent (%%) characters and stop at the end of the line.
- Start the comment with a "(*" and end with a corresponding "*)". Comments can extend multiple lines.

Placing Information in an Import/Export File

The import/export file contains different components of information. These components are:

Component:	Identifies:
CONTROLLER	name of the controller
DATATYPE	user-defined and I/O data structures
MODULE	modules in the controller organizer
TAG	controller-scope tags
PROGRAM	program files
ROUTINE	ladder logic routines
FBD_ROUTINE	function block diagram routines
SFC_ROUTINE	sequential function chart routine
ST_ROUTINE	structured text routine
TASK	controller tasks
TREND	any trend configured for the controller project
CONFIG	configuration information

All components in an import/export file follow this structure:

```
Component_Type <component_name> [Attributes]
        [body]
END_Component_Type
```

Where:

Item:	Identifies:
Component_Type	the component (as defined in above table)
component_name	a specific instance of the component
Attributes	any attributes of the component can also contain a description of the component separate each attribute with a comma (,)
body	any sub-components (children) of this component
END_Component_Type	end of the component information

Display style

Tags and data types support a radix attribute that lets you specify how to display the associated numerical information. The options are:

Display Option:	Example (based on 15 decimal):
Binary (uses a 2# prefix)	2#0000_0000_0000_1111
Octal (uses a 8# prefix)	8#000_017
Decimal	15
Hex (uses a 16# prefix)	16#000F
Ascii	'$00$0F'
Exponential	1.5000000e+01
Float	15.0

Component descriptions

Descriptions of components are optional. Unlike internal comments, descriptions are imported. Place the description within double quotes. For example:

```
TASK Task1 (Description := "Hello World", Rate := 10000,
Priority := 10 )
END_TASK
```

To enter control characters in the description, precede the character with a dollar sign ($). The following table shows how to enter the supported control characters in a description:

For this character:	Enter:
$	$$
'	$'
"	$Q
10 (line feed)	$L or $l
13,10 (carriage return, line feed)	$N or $n
12 (form feed)	$P or $p
13 (carriage return)	$R or $r
9 (tab)	$T or $t
xxxx (4-digit character code that represents a hexadecimal value)	$xxxx

Defining a Controller

The CONTROLLER component is the overall structure of a project to be executed on one controller. It contains the configuration information and logic that you download to one controller. Preceding the CONTROLLER component, you have the header remarks (optional) and the version statement:

```
Import-Export
Version  := RSLogix 5000 13.00
Owner    := User Name, Rockwell Automation Inc.
Exported := Fri March 26 10:25:38 2004

IE_VER := 2.4;
```

Following the header and version statement, the CONTROLLER component follows this structure:

```
CONTROLLER <controller_name>  [Attributes]
       [<DATATYPE declaration>]
       [<MODULE declaration>]
       [<TAG declaration>]
       [<PROGRAM declaration>]
       [<TASK declaration>]
       [<CONFIG controller objects declaration>]
END_CONTROLLER
```

Where:

Item:	Identifies:
controller_name	the controller name for the project
Attributes	attributes of the controller can also contain a description of the controller separate each attribute with a comma (,)
DATATYPE	I/O and user-defined data structures See page 3-1.
MODULE	devices in the controller organizer See page 3-5.
TAG	controller-scope tags See page 3-11.
PROGRAM	organization of routines See page 3-28.
TASK	organization of programs See page 3-30.
CONFIG	characteristics of controller objects (status information) See page 3-41.

Specifying CONTROLLER attributes

You can specify these attributes for a CONTROLLER:

Attribute:	Description:
`Description`	Provide information about the controller. Specify: `Description := "text"`
`ProcessorType`	Specify the type of controller (1756-L1, 1756-L55, 1756-L60M03SE, 1756-L61, 1756-L62, 1756-L63, 1769-L20, 1769-L30, 1769-L31, 1769-L32E, 1769-L35E, 1769-L35C, 1769-L35CR, 1789-L60, 1794-L33, 1794-L34, PowerFlex 700S, PowerFlex 700 S2, Emulator) Specify: `ProcessorType := name`
`Major`	Specify the major revision number (1-127) of the controller. Specify: `Major := number`
`TimeSlice`	Percentage of available CPU time (10-90) that is assigned to communications. Specify: `TimeSlice := value`
`PowerLossProgram`	Name of the program to be executed on reboot after a power loss. Specify: `PowerLossProgram := name`
`MajorFaultProgram`	Name of the program to be executed when a major fault occurs. Specify: `MajorFaultProgram := name`
`CommPath`	Specify the devices in the communication path. The communication path ends with the controller (`\Backplane\1`). This is only exported if you select manual configuration of the communications path in RSLinx software. Specify: `CommPath := device\device\device...\Backplane\1`
`CommDriver`	Specify the type of communication driver. This is the name of the selected driver in RSLinx software. This is only exported if you select manual configuration of the communications driver in RSLinx software. Specify: `CommDriver := text`
`RedundancyEnabled`	Specify whether redundancy is used or not. Enter a 0 to disable redundancy; enter a 1 to enable redundancy. Specify: `RedundancyEnabled := number`
`KeepTestEditsOnSwitchOver`	Specify whether to keep test edits on when a switchover occurs (only in a redundant system). Enter a 0 not to keep test edits on; enter a 1 to keep test edits on. Specify: `KeepTestEditsOnSwitchOver := number`
`DataTablePadPercentage`	Specify the percentage (0-100) of the data table to reserve. If redundancy is not enabled, enter 0. If redundancy is enabled, enter 50. Specify: `DataTablePadPercentage := name`
`SecurityCode`	Specify whether the RSI Security Server is enabled for the controller. Enter 0 if the controller is unsecured; enter -1 the controller is secured. Specify: SecurityCode `:= text`

Attribute:	Description:
SFCExecutionControl	Specify whether the SFC executes the current active steps before returning control (CurrentActive) or whether the SFC executes all threads until reaching a false transition (UntilFalse). Specify: SFCExecutionControl := *name*
SFCRestartPosition	Specify whether the SFC restarts at the most recently executed step (MostRecent) or at the initial step (InitialStep). Specify: SFCRestartPosition := *name*
SFCLastScan	Specify how the SFC manages its state on last scan. Select AutomaticReset, ProgrammaticReset, or DontScan. Specify: SFCLastScan := *name*

CONTROLLER guidelines

Keep these guidelines in mind when defining a data type:

- All declarations must be explicitly ordered as shown in the syntax above.
- The maximum number of tasks depends on the controller type:

Controller:	Maximum Number of Tasks:
ControlLogix	32
SoftLogix5800	32
FlexLogix	8
CompactLogix (L20, L30)	4
DriveLogix	4

- There can only be one continuous task.
- Programs can only be scheduled under one task
- Scheduled programs must be defined - i.e. must exist

CONTROLLER example

```
CONTROLLER TestImportExport (Description := "Example",
TimeSlice := 11, MajorFaultProgram := Prg2)

END_CONTROLLER
```

Creating a Complete Import/Export File

Introduction

This chapter explains how to enter project and configuration information in a complete import/export file.

For information on entering logic, see the next chapter.

Defining a Data Type

A DATATYPE component follows this structure:

```
DATATYPE <DataType_name> [(Attributes)]
        [member_definition]
END_DATATYPE
```

Where:

Item:	Identifies:
`DataType_name`	the data structure
`Attributes`	attributes of the data structure can also contain a description of the component enclose in parenthesis separate each attribute with a comma (,)
`member_definition`	each member of the data structure

Specifying DATATYPE attributes

You can specify these attributes for a DATATYPE:

Attribute:	Description:
`Description`	Provide information about the data type. Specify: `Description := "text"`
`FamilyType`	Specify StringFamily for a string datatype. Specify NoFamily for all other datatypes. Specify: `FamilyType := text`

Specifying a DATATYPE member

There are two kinds of data type members. A bit member is a member in which only a single bit of information is to be accessed. A non-bit member is a member that is defined as another data type (such as SINT, INT, DINT, COUNTER, etc.).

A non-bit member definition follows this structure:

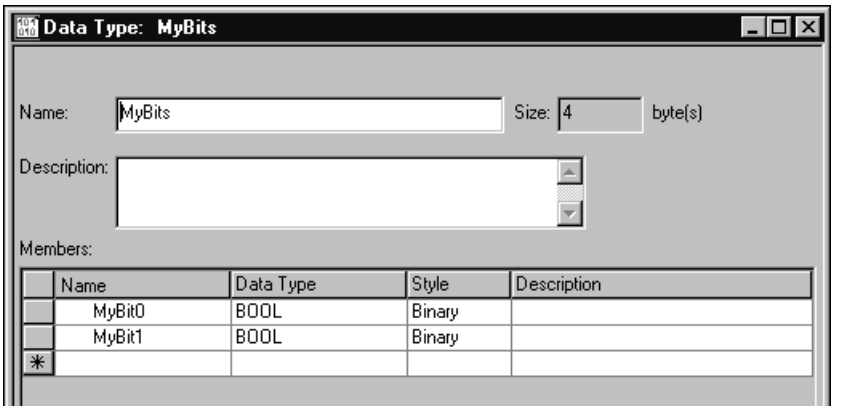
```
<TypeName> <MemberName> [(Attributes)];
```

All data types are allocated in 8-bit boundaries. A single bit of storage is not allowed, so a member cannot be a BOOL data type. To access a single bit, use the BIT declaration. BIT allows access to a single bit within a host member (a non-bit member).

```
A bit member uses the following syntax:
BIT <BitName> <HostMemberName> : <BitPosition> [(Attributes)];
```

For example, create a user-defined datatype called “MyBits” and a tag called “MyTag” of type “MyBits.”

User-defined datatype “MyBits”



Tag “MyTag” of type “MyBits”

MyTag	{...}	{...}		MyBits
MyTag.MyBit0	2#0		Binary	BOOL
MyTag.MyBit1	2#0		Binary	BOOL

`ZZZZZZZZZZMyBits0` is the host member of MyBit0 and MyBit1. The datatype syntax for this example is:

```
DATATYPE MyBits (FamilyType := NoFamily)
       SINT ZZZZZZZZZZMyBits0 (Hidden := 1);
       BIT MyBit0 ZZZZZZZZZZMyBits0 : 0 (Radix := Binary);
       BIT MyBit1 ZZZZZZZZZZMyBits0 : 1 (Radix := Binary;
END_DATATYPE
```

The host member is normally a hidden member because only the bit references are visible when you define a tag of the datatype.

IMPORTANT There **must** be a space between the host member name and the colon and the colon and the bit position because type names can contain a colon (for example, I/O structures) and without the space we could not tell where type name actually ends.

Bit members cannot be defined before their host members. Note that BitPosition zero is the least significant bit.

Specifying DATATYPE member attributes

You can specify these attributes for a member of a DATATYPE:

Attribute:	Description:
`Description`	Provide information about the data type member. Specify: `Description := "text"`
`Radix`	Specify decimal, hex, octal, binary, exponential, float, or ASCII. Specify: `Radix := value`
`Hidden`	Make the member a hidden member of the structure. Specify: `Hidden := 1`

DATATYPE guidelines

Keep these guidelines in mind when defining a data type:

- Data types must be defined first within the controller body.
- Data types can be defined out of order. For example, if Type1 depends on Type2, Type2 can be defined first.
- Data types can be unverified. For example if Type1 depends on Type2 and Type2 is never defined, then Type1 will be accessible as an unverified type. Type2 will be typeless type. Tags of Type1 may be created but not of Type2.
- Data type members can be arrays but only one dimension is allowed.
- The following data types cannot be used in a user-defined data type: AXIS types, MOTION_GROUP, and MESSAGE.

DATATYPE example

```
DATATYPE MyStructure (FamilyType := NoFamily)
       DINT x;
       TIMER y[3] (Radix := Decimal);
       SINT MyFlags (Hidden :=1);
       BIT aBit0 MyFlags : 0 (Radix := Binary);
       BIT aBit1 MyFlags : 1 (Radix := Binary);
END_DATATYPE
```

Defining a Module

A MODULE component follows this structure:

```
MODULE <device_name> [(Attributes)]
       [ConfigData := <initial_value>;]
       [ExtendedProp := <text>]
       [connection_list]
END_MODULE
```

Where:

Item:	Identifies:
`device_name`	the module
`Attributes`	attributes of the module can also contain a description of the module enclose in parenthesis separate each attribute with a comma (,)
`ConfigData`	operating characteristics of the module
`ExtendedProp`	additional profile data stored in the controller the format is XML currently used by the CompactBus MODULE
`Connection`	connection characteristics for the module see page 3-7

Specifying MODULE attributes

You can specify these attributes for a MODULE:

Attribute:	Description:
`Description`	Provide information about the module. Specify: `Description := "text"`
`Parent`	If this module is a child to another module, specify the name of the parent module. The parent module must be defined before any child module. Specify: `Parent := name`
`CatalogNumber`	Specify the catalog number of the module. Specify: `CatalogNumber := number`
`Vendor`	Specify the vendor of the module. A number 1 indicates Allen-Bradley. Specify: `Vendor := number`
`ProductType`	Specify the product type of the module. Specify: `ProductType := number`
`ProductCode`	Specify the product code of the module. Specify: `ProductCode := number`
`Major`	Specify the major revision number (1-127) of the module. Specify: `Major := number`

Attribute:	Description:
`Minor`	Specify the minor revision number (1-255) of the module. Specify: `Minor := number`
`PortLabel`	Specify the port used to reach this module. The port label is either `RxBACKPLANE` for modules in a chassis or a text string for modules on a network. Specify: `PortLabel := label`
`ChassisSize`	Specify the number of slots in the chassis (1-32). This only applies to the MODULE statement that defines the controller selected for the project. Specify: `ChassisSize := number`
`Slot`	Specify the slot number (0-31) where the module is in the chassis. Specify: `Slot := number`
`NodeAddress`	Specify the ControlNet node address (1-99) or the remote I/O rack address (0-63) of the module. Specify: `NodeAddress := number`
`Group`	If the module is a remote I/O module, specify the starting group (0-7). For a block-transfer module, this is the module group number under the remote I/O adapter. Specify: `Group := number`
`CommMethod`	Specify the method of connecting to the module. Specify: `CommMethod := number`
`ConfigMethod`	Specify the method of configuring the module. Specify: `ConfigMethod := number`
`Mode`	Select a specific mode by setting the appropriate bit. **Set:** **For:** 0 fault in the module causes major fault in controller 2 inhibit the module Specify: `Mode := number`
`CompatibleModule`	Specify whether to connect to a compatible module based on the minor revision (*value* = 1) or to an exact match of the module (*value* = 0). If you specify exact for KeyMask (below), set CompatibleModule to 2#0000_0000_0000_0000_0000_0000_0000_0000. If you specify compatible for KeyMask (below), set CompatibleModule to 2#0000_0000_0000_0000_0000_0000_1000_0000. Specify: `CompatibleModule := value`
`KeyMask`	Specify whether to connect to the exact module that matches the electronic keying information (vendor, product code, product type, major revision, minor revision). No keying will connect to any module. **Specify:** **To:** 2#0000_0000_0000_0000 disable keying 2#0000_0000_0001_1111 require a replacement module to be compatible 2#0000_0000_0001_1111 require a replacement module to be an exact match The values for compatible module and for exact match are the same because this attribute is used in conjunction with CompatibleModule (above) to distinguish between compatible module or exact match. Specify: `KeyMask := hex_string`
`PrimCxnInputSize`	Specify the size of the data associated with the primary input connection (0-500 bytes). Specify: `PrimCxnInputSize := number`

Attribute:	Description:
PrimCxnOutputSize	Specify the size of the data associated with the primary output connection (0-496 bytes). Specify: PrimCxnOutputSize := *number*
SecCxnInputSize	Specify the size of the data associated with the secondary input connection (0-500 bytes). Typically, there is one I/O connection on a module (primary connection). If there are two, the second connection is the secondary connection. Specify: SecCxnInputSize := *number*
SecCxnOutputSize	Specify the size of the data associated with the secondary input connection (0-496 bytes). Typically, there is one I/O connection on a module (primary connection). If there are two, the second connection is the secondary connection. Specify: SecCxnOutputSize := *number*
ChABaud	For a 1756-DHRIO module, specify the baud rate for channel A. Enter 57.6, 115.2, or 230.4. Specify: ChABaud := *baud*
ChBBaud	For a 1756-DHRIO module, specify the baud rate for channel B. Enter 57.6, 115.2, or 230.4. Specify: ChBBaud := *baud*
DtlsFileName	Specify the file name associated with a DriveExecutive project. DriveExecutive configures drives on ControlNet and EtherNet/IP networks. Specify: DtlsFileName := *text*
ConfigCode	Specify the value that represents the drive rating of the drive. You select this rating on the Power tab in a DriveExecutive project for drives on ControlNet and EtherNet/IP networks. Specify: ConfigCode := *text*
RSNetWorxFileName	Specify the file name of an associated RSNetWorx project file. Specify: RSNetWorxFileName := *filename*
ControlNetSignature	This value (hexadecimal) is exported only for the purpose of doing a file compare. This value is ignored on import. The export file contains: ControlNetSignature := *16#value*

Specifying a MODULE connection

You can specify these attributes for a connection:

```
CONNECTION <connection_name> [(Attributes)]
        [InputData := <value_list>;]
        [InputForceData := <value_list>;]
        [OutputData := <value_list>;]
        [OutputForceData := <value_list>;]
END_CONNECTION
```

Where:

Item:	Identifies:
connection_name	the connection
InputData	input channel data
InputForceData	forcing information for the input channel

Item:	Identifies:
`OutputData`	output channel data
`OutputForceData`	forcing information for the output channel
`Attributes`	attributes of the connection can also contain a description of the module enclose in parenthesis separate each attribute with a comma (,)

For details on the data in the connection list, see the user manual for the I/O module. The connection list data depends on the I/O module and the configuration for that module.

Forces appear as arrays of bytes under the InputForceData and OutputForceData attributes of the connection list. Do not modify forces in the import/export file. Use the programming software to enter and enable forces.

Specifying MODULE connection attributes

You can specify these attributes for a MODULE connection:

Attribute:	Description:
`Rate`	Specify the requested packet interval (RPI) rate in microseconds. Specify: `Rate := microseconds`
`InputCxnPoint`	Specify the input connection point for the primary connection (0-255). Specify: `InputCxnPoint := number`
`OutputCxnPoint`	Specify the output connection point for the primary connection (0-255). Specify: `OutputCxnPoint := number`
`EventID`	Specify the event ID if used in conjunction with an event task. Specify: `EventID := number`

MODULE guidelines

Keep these guidelines in mind when defining a module:

- Attributes can be in any order. They export in the order defined.
- A parent module must be defined before any definitions of its child modules.

MODULE example

```
MODULE Local (Parent := Local,
       CatalogNumber := 1756-L1,
       Major := 1,
       PortLabel := RxBACKPLANE,
       ChassisSize := 10,
       Slot := 3,
       Mode := 2#0000_0000_0000_0000,
       CompatibleModule :=
2#0000_0000_0000_0000_0000_0000_1000_0000,
       KeyMask := 2#0000_0000_0001_1111)

END_MODULE

MODULE DHRIO_Module (Parent := Local,
       CatalogNumber := 1756-DHRIO,
       Major := 2,
       PortLabel := RxBACKPLANE,
       Slot := 8,
       CommMethod := Standard,
       ConfigMethod := ChannelA RIO ChannelB DH,
       Mode := 2#0000_0000_0000_0000,
       CompatibleModule :=
2#0000_0000_0000_0000_0000_0000_1000_0000,
       KeyMask := 2#0000_0000_0001_1111,
       ChABaud := 115.2,
       ChBBaud := 57.6)

       CONNECTION Standard (Rate := 500000,
              EventID := 0
       END_CONNECTION
END_MODULE
```

```
MODULE Diagnostic_Module_1 (Parent := Local,
       CatalogNumber := 1756-OB16D,
       Major := 1,
       PortLabel := RxBACKPLANE,
       Slot := 5,
       CommMethod := Full Diagnostics - Output Data,
       ConfigMethod := Diagnostic,
       Mode := 2#0000_0000_0000_0000,
       CompatibleModule :=
2#0000_0000_0000_0000_0000_0000_1000_0000,
       KeyMask := 2#0000_0000_0001_1111)
       ConfigData :=
[44,19,1,0,0,0,0,0,0,0,65535,65535,65535,0];

       CONNECTION Diagnostic (Rate := 5000,
              EventID := <NA>)
       END_CONNECTION

END_MODULE
MODULE input_1 (Parent := Local,
                     CatalogNumber := 1756-IA16,
                     Major := 2,
                     Minor := 1,
                     PortLabel := RxBACKPLANE,
                     Slot := 1,
                     CommMethod := 536870913,
                     ConfigMethod := 8388610,
                     Mode := 2#0000_0000_0000_0000,
                     CompatibleModule :=
2#0000_0000_0000_0000_0000_0000_1000_0000,
                     KeyMask := 2#0000_0000_0001_1111)
              ConfigData  :=
[28,16,1,0,0,0,1,9,1,9,0,0,0,0,65535,65535];
              CONNECTION StandardInput (Rate := 5000,
                                        EventID := 0)
              InputData  := [0,0];
              InputForceData :=
[0,0,0,0,0,0,0,0,0,0,0,0,0,0,16,0,0,0,0,0,0,0,16,0];
              END_CONNECTION

       END_MODULE
```

Defining a Tag

You can define controller-scope tags and program-scope tags. Controller-scope tags are defined in one TAG component within the CONTROLLER component; program-scope tags are defined in a TAG component within a PROGRAM component within a CONTROLLER component. For example, all the tags for one program are defined in one TAG component within that PROGRAM component. A TAG component follows this structure:

```
TAG
        [tag_declarations]
END_TAG
```

Within a tag list, message and motion tags must follow all non-motion tags and axis tags must follow motion group tags.

IMPORTANT For detailed information about atomic and structure tags and their supported attributes and ranges, see the *Logix5000 Controllers Common Procedures Programming Manual*, publication 1756-PM001.

Defining a TAG declaration for a non-alias tag

A tag declaration for a non-alias tag follows this structure:

```
<tag_name> : <type[array_specification]> [(Attributes)][:= <initial_value>]
[, <tag_force_data>];
```

Where:

Item:	Identifies:
tag_name	name of the tag
type	type of tag atomic types: BOOL, SINT, INT, DINT, REAL string types: STRING predefined types: AXIS_CONSUMED, AXIS_SERVO, AXIS_SERVO_DRIVE, AXIS_VIRTUAL, CAM, CAM_PROFILE, CONTROL, COORDINATE_SYSTEM, COUNTER, MESSAGE, MOTION_GROUP, MOTION_INSTRUCTION, OUTPUT_CAM, OUTPUT_COMPENSATION, PID, SERIAL_PORT_CONTROL, TIMER function block types: unique type for each function block sequential function chart: SFC_ACTION, SFC_STEP, SFC_STOP
array	dimensional boundaries for array tags see page 3-13

Item:	Identifies:
`Attributes`	attributes of the tag can also contain a description of the tag enclose in parenthesis separate each attribute with a comma (,) see page 3-13
`initial_value`	initial value of the tag see page 3-26
`tag_forced_data`	list of forced tag data for an example, see page 3-27

There **cannot** be any whitespace between the type and array definition. There **must** be a space between the tag name and the colon and another space between that same colon and the type name. This is because type names can contain a colon and without the space it would be impossible to detect where the type name actually starts.

Defining a TAG declaration for an alias tag

A tag declaration for an alias tag follows this structure:

`<tag_name> OF <alias> [(Attributes)];`

Where:

Item:	Identifies:
`tag_name`	name of the alias tag
`alias`	name of the base tag the alias tag references Specify: `alias<specifier>` Where the *specifier* is: a bit (.*bitnumber*), array element ([*element*]), or structure member (.*membername*) of the tag.
`Attributes`	attributes of the tag can also contain a description of the tag enclose in parenthesis separate each attribute with a comma (,)

Defining an array specification within a TAG declaration

An array specification follows this structure:

```
"["<element> [,<element> [,<element>] ]"]"
```

Where:

Item:	Identifies:
`element`	the number of elements within the array dimension for example: [5, 10, 2]

Specifying TAG attributes

You can specify these attributes for a TAG:

Attribute:	Description:
`Description`	Provide information about the tag. Specify: `Description := "text"`
`Comment`	Provide information about a tag component. Specify: `Comment<specifier> := "text"` Where the *specifier* is: *.bitnumber* for a bit in the tag [*element*] for an array element of the tag *.membername* for a structure member of the tag
`Radix`	Specify the display style as decimal, hex, octal, binary, exponential, float, or ASCII. Specify: `Radix := value`
`ProduceCount`	Specify the number of consumers allowed (any positive number). Specify: `ProduceCount := value`
`PLCMappingFile`	If this tag is mapped to a PLC controller, specify the file number (any positive number). Specify: `PLCMappingFile := number`
`PLC2Mapping`	If this tag is mapped to a PLC-2 file, set this attribute to 1. If this tag is not mapped to a PLC-2 file, set this attribute to 0. Specify: `PLC2Mapping := value`
`ProgrammaticallySend EventTrigger`	If the project programmatically sends an event trigger, set this attribute to 1. Otherwise, set this attribute to 0. Specify: `ProgrammaticallySendEventTrigger := value`
`Producer`	If the controller consumes this tag, specify the name of the remote controller that produces this tag. You must also specify RemoteTag and RPI attributes. Specify: `Producer:= name`

Attribute:	Description:
RemoteTag	If the controller consumes this tag from a controller that supports tag names, specify the name of the tag on the remote controller. You must also specify Producer and RPI attributes. Specify: `RemoteTag := name`
RemoteFile	If the controller consumes this tag from a PLC-5 controller, specify the PLC-5 file number (any positive number) on the PLC-5 controller. You must also specify Producer and RPI attributes. Specify: `RemoteFile := number`
RPI	If the controller consumes this tag, specify the RPI value in milliseconds (any positive number). You must also specify Producer and RemoteTag attributes. Specify: `RPI := milliseconds`

IMPORTANT If consume information is provided on an alias tag, the alias tag is converted to a base tag before it can consume data.

Specifying attributes for a MOTION_GROUP tag

A MOTION_GROUP tag differs from a basic tag. A motion group tag has these attributes:

Attribute:	Description:
Description	Provide information about the tag. Specify: `Description := "text"`
Comment	Provide information about a tag component. Specify: `Comment<specifier> := "text"` Where the *specifier* is: *.bitnumber* for a bit in the tag [*element*] for an array element of the tag *.membername* for a structure member of the tag
GroupType	Specify the type of motion group. Enter Warning Enabled or Warning Disabled. Specify: `GroupType := text`
CourseUpdatePeriod	Specify the coarse update period in milliseconds (500-3200ms). Specify: `CourseUpdatePeriod := value`
PhaseShift	Specify the phase shift (0-65,535). Specify: `PhaseShift := value`
GeneralFaultType	Specify whether an error generates a major fault or a non-major fault. Enter Major Fault or Non Major Fault. Specify: `GeneralFaultType := text`
AutoTagUpdate	Enter Disabled or Enabled. Specify: `AutoTagUpdate := text`

Specifying attributes for a MESSAGE tag

A message tag differs from a basic tag. A MESSAGE tag has these attributes:

Attribute:	**Description:**
`Description`	Provide information about the tag. Specify: `Description := "text"`
`Comment`	Provide information about a tag component. Specify: `Comment<specifier> := "text"` Where the *specifier* is: *.bitnumber* for a bit in the tag [*element*] for an array element of the tag *.membername* for a structure member of the tag
`MessageType`	Enter Block Transfer Read, Block Transfer Write, CIP Data Table Read, CIP Data Table Write, CIP Generic, PLC2 Unprotected Read, PLC2 Unprotected Write, PLC3 Typed Read, PLC3 Typed Write, PLC3 Word Range Read, PLC3 Word Range Write, PLC5 Typed Read, PLC5 Typed Write, PLC5 Word Range Read, PLC5 Word Range Write, SLC Typed Read, SLC Typed Write, Unconfigured, or Module Reconfigure. Specify: `MessageType := text`
`RemoteElement`	Specify the address or tag name of the element in the remote device. This is the source element of a read instruction or the destination element of a write instruction. Specify: `RemoteElement := text`
`RequestedLength`	Specify the number of elements to be transferred (0-32,767). Specify: `RequestedLength := value`
`ConnectedFlag`	Specify whether the CIP generic message requires a connection or not. Enter 1 for connected; enter 0 for not connected. Specify: `ConnectedFlag := value`
`ConnectionPath`	Specify the connection path to the other device. Specify: `ConnectionPath := string`
`CommTypeCode`	Specify the type of communication method. **Enter** **For this communication method** 0 CIP (most messages use CIP communications) 1 DH+ 2 CIP with source ID 3 block transfer via universal remote I/O 4 block transfer via ControlNet Specify: `CommTypeCode := value`
`ServiceCode`	If the message type is CIP Generic, specify the service code (0-32,767 hexadecimal). Specify: `ServiceCode := 16#value`
`ObjectType`	If the message type is CIP Generic, specify the object type (0-32,767 hexadecimal). The ObjectType attribute is the same as the Class field on the MSG configuration dialog. Specify: `ObjectType := 16#value`
`TargetObject`	If the message type is CIP Generic, specify the target object (0-32,767 decimal). The TargetObject attribute is the same as the Instance field on the MSG configuration dialog. Specify: `TargetObject := value`
`AttributeNumber`	If the message type is CIP Generic, specify the attribute number (0-65,535 hexadecimal). Specify: `AttributeNumber := 16#value`
`Channel`	For a DH+ or block transfer message, specify the channel. Enter either A or B. Specify: `Channel := value`

Attribute:	Description:
SourceLink	If the communication method uses DH+, specify the source link (0-199). Specify: `DHPlusSourceLink := value`
DestinationLink	If the communication method uses DH+, specify the destination link (0-199). Specify: `DHPlusDestinationLink := value`
DestinationNode	If the communication method uses DH+, specify the destination node number (0-77 octal). Specify: `DHPlusDestinationNode := value`
Rack	For a DH+ or block transfer message, enter the rack number (0-77 octal) of the target device. Specify: `Rack := value`
Group	For a DH+ or block transfer message, enter the group number (0-7) of the target device. Specify: `Group := value`
Slot	For a DH+ or block transfer message, enter the slot number (0-15) of the target device. Specify: `Slot := value`
LocalIndex	Specify the index into the local element, typically 0. Specify: `LocalIndex := value`
RemoteIndex	Specify the index into the remote element, typically 0. Specify: `RemoteIndex := value`
LocalElement	Specify the tag name of the element in the local controller. This is the destination element of a read instruction or the source element of a write instruction. Specify: `LocalElement := text`
DestinationTag	Specify the tag name of the destination element. Specify: `DestinationTag := text`
CacheConnections	If the message is to cache connections, enter TRUE. If the message is not to cache connections, enter FALSE. Specify: `CacheConnections := text`

Specifying attributes for an AXIS_CONSUMED, AXIS_SERVO, AXIS_SERVO_DRIVE, and AXIS_VIRTUAL tag

The axis tags differ from the basic tag. The axis tags have these attributes:

Attribute:	Description:
Description	Provide information about the tag. Specify: `Description := "text"`
Comment	Provide information about a tag component. Specify: `Comment<specifier> := "text"` Where the *specifier* is: *.bitnumber* for a bit in the tag [*element*] for an array element of the tag *.membername* for a structure member of the tag
MotionGroup	Enter the name of the associated motion group, or enter <NA>. Specify: `MotionGroup := text`
MotionModule	Enter the name of the associated motion module, or enter <NA>. Specify: `MotionModule := text`
RotationalPosResolution	Specify the number of counts per motor revolution (1 to [2^{32}-1]). Specify: `RotationalPosResolution := text`

Attribute:	Description:
ConversionConstant	Specify the number of feedback counts per position unit. Enter a real number from 1.0 to $1.0e^9$. Specify: `ConversionConstant := value`
OutputCamExecutionTargets	Specify the number of output cam execution targets (any positive number). Specify: `OutputCamExecutionTargets := text`
AxisState	Enter Axis-Ready, Direct Drive Control, Servo Control, Axis Faulted, or Axis Shutdown. Specify: `AxisState := text`
PositionUnits	Specify user-defined engineering units (rather than feedback units). Specify: `PositionUnits := text`
AverageVelocityTimebase	Specify the time in seconds for calculating the average velocity of the axis (any positive number). Specify: `AverageVelocityTimebase := value`
RotaryAxis	Specify the positioning mode for an axis. Enter Rotary or Linear. Specify: `RotaryAxis := text`
PositionUnwind	For a rotary axis, specify the distance (in feedback counts) used to perform electronic unwind (any positive number). Specify: `PositionUnwind := value`
HomeMode	Specify the homing mode. Enter Passive, Active, or Absolute. Specify: `HomeMode := text`
HomeDirection	For active homing sequences, except for the immediate sequence type, specify the desired homing direction. Enter Uni-directional Forward, Bi-directional Forward, Uni-directional Reverse, or Bi-directional Reverse. Specify: `HomeDirection := text`
HomeSequence	Specify the event that will cause the home position to be set. Enter Immediate, Switch, Marker, or Switch-Marker. Specify: `HomeSequence := text`
HomeConfigurationBits	Specify the home configuration bits. Enter a hexadecimal number. Specify: `HomeConfigurationBits := 16#value`
HomePosition	Specify the desired absolute position, in positioning units, for the axis after the homing sequence is complete (any positive number). Specify: `HomePosition := value`
HomeOffset	Specify the desired offset (any positive number) in position units the axis is to move, upon completion of the homing sequence, to reach the home position. In most cases, this value will be zero. Specify: `HomeOffset := value`
HomeSpeed	Specify the speed of the jog profile used in the first leg of the homing sequence (any positive number). The homing speed should be less than the maximum speed and greater than zero. Specify: `HomeSpeed := value`
HomeReturnSpeed	Specify speed of the jog profile used in the return leg(s) of an active homing sequence (any positive number). The return speed should be less than the maximum speed and greater than zero. Specify: `HomeReturnSpeed := value`
MaximumSpeed	Specify the maximum speed (any positive number). Specify: `MaximumSpeed := value`

Attribute:	Description:
MaximumAcceleration	Specify the maximum acceleration rate of the axis in position units/second (any positive number). Specify: `MaximumAcceleration := value`
MaximumDeceleration	Specify the maximum deceleration rate of the axis in position units/second (any positive number). Specify: `MaximumDeceleration := value`
ProgrammedStopMode	Specify how a specific axis will stop when the controller changes mode or a motion group stop (MGS) instruction is executed. Enter Fast Disable, Fast Stop, Fast Shutdown, Hard Disable, or Hard Shutdown. Specify: `ProgrammedStopMode := text`
MasterInputConfigurationBits	Specify the master input configuration bits. Enter a hexadecimal number. Specify: `MasterInputConfiguration := 16#value`
MasterPositionFilter Bandwidth	Specify the bandwidth in Hertz of the master position filter. Specify: `MasterPositionFilterBandwidth := value`
AxisType	Specify the intended use of the axis. Enter Servo or Feedback Only. Specify: `AxisType := text`
ServoLoopConfiguration	Specify the configuration of the loop. Enter Custom, Position Servo, Aux Position Servo, Dual Position Servo, Aux Command Servo, Dual Command Servo, Velocity Servo, or Torque Servo. Specify: `ServoLoopConfiguration := text`
FaultConfigurationBits	Specify the fault configuration bits. Enter a hexadecimal number. Specify: `FaultConfigurationBits := 16#value`
AxisInfoSelect1	Specify an axis attribute to transmit, along with the actual position data, to the controller. Enter <none>, Position Command, Position Feedback, Aux Position Feedback, Position Error, Position Int. Error, Velocity Command, Velocity Feedback, Velocity Error, Velocity Int. Error, Accel. Command, Accel. Feedback, Servo Output Level, Marker Distance, Torque Command, Torque Feedback, Positive Dynamic Torque Limit, Negative Dynamic Torque Limit, Motor Capacity, Drive Capacity, Power Capacity, Bus Regulator Capacity, Motor Electrical Angle, Torque Limit Source, DC Bus Voltage, Absolute Offset. Specify: `AxisInfoSelect1 := text`
AxisInfoSelect2	Specify a second axis attribute to transmit, along with the actual position data, to the controller. Enter <none>, Position Command, Position Feedback, Aux Position Feedback, Position Error, Position Int. Error, Velocity Command, Velocity Feedback, Velocity Error, Velocity Int. Error, Accel. Command, Accel. Feedback, Servo Output Level, Marker Distance, Torque Command, Torque Feedback, Positive Dynamic Torque Limit, Negative Dynamic Torque Limit, Motor Capacity, Drive Capacity, Power Capacity, Bus Regulator Capacity, Motor Electrical Angle, Torque Limit Source, DC Bus Voltage, Absolute Offset. Specify: `AxisInfoSelect2 := text`
LDTTYpe	Specify the LDT device type. Enter PWM, Start/Stop Rising, or Start/Stop Falling. Specify: `LDTType := text`
LDTRecirculations	Only use this field if you specified PWM for LDTType. Specify the number of recirculations that the transducer is configured for so the 1756-HYD02 module knows how the LDT is configured. Specify: `LDTRecirculations := value`
LDTCalibrationConstant	Specify the calibration constant (also called gradient on some LDTs). This number is engraved on each LDT by the manufacturer. It specifies the characteristics of that individual transducer. Specify: `LDTCalibrationConstant := value`

Attribute:	Description:
LDTCalibrationConstantUnits	Specify the units of the calibration constant. Enter us/in or m/s. Specify: `LDTCalibrationConstantUnits := text`
LDTScaling	Define the relationship between the unit of measurement of the transducer and the system. This is necessary for calculating the conversion constant. The LDT length is used with the number of recirculations to calculate the minimum servo update period. Specify: `LDTScaling := value`
LDTScalingUnits	Specify the units of scaling. Enter us/in or m/s. Specify: `LDTScalingUnits := text`
LDTLength	Specify the length of the LDT. Specify: `LDTLength := value`
LDTLengthUnits	Specify the units of length. Enter us/in or m/s. Specify: `LDTLengthUnits := text`
SSICodeType	Specify the encoding on the data sent from an SSI transducer. Enter Binary or Grey. Specify: `SSICodeType := text`
SSIDataLength	Specify the data length (8-32 bits) of the SSI transducer. The default value is 13. Specify: `SSIDataLength := text`
SSIClockFrequency	Specify the SSI clock frequency (in kHz). Valid values are 208 (default) or 650. Specify: `SSIClockFrequency := value`
AbsoluteFeedbackEnable	Specify whether to enable absolute feedback. Enter 1 to enable absolute feedback. Otherwise, enter 0. Absolute feedback is always enabled for LDT. Specify: `AbsoluteFeedbackEnable := value`
AbsoluteFeedbackOffset	Specify the absolute offset that is used to place the machine zero point at the desired location relative to the zero point of the LDT. Specify: `AbsoluteFeedbackOffset := value`
ServoFeedbackType	Specify the type of feedback device. Enter LDT (linear displacement transducer), AQB (A quadrature B), or SSI (synchronous serial interface) Specify: `ServoFeedbackType := text`
ServoPolarityBits	Specify the servo polarity bits. Enter a hexadecimal number. Specify: `ServoPolarityBits := 16#value`
VelocityFeedforwardGain	Specify the velocity feedforward gain (any positive number). Specify: `VelocityFeedforwardGain := value`
AccelerationFeedforwardGain	Specify the acceleration feedforward gain (any positive number). Specify: `AccelerationFeedforwardGain := value`
PositionProportionalGain	Specify the position proportional gain (any positive number). Specify: `ProportionalPositionGain := value`
PositionIntegralGain	Specify the position integral gain (any positive number). Specify: `PositionIntegralGain := value`
VelocityProportionalGain	Specify the velocity proportional gain (any positive number). Specify: `VelocityProportionalGain := value`
VelocityIntegralGain	Specify the velocity integral gain (any positive number). Specify: `VelocityIntegralGain := value`
VelocityScaling	Specify the velocity scaling attribute that is used to convert the output of the servo loop into equivalent voltage to an external velocity servo drive. Specify: `VelocityScaling := value`

Attribute:	Description:
TorqueScaling	Specify the torque scaling attribute that is used to convert the acceleration of the servo loop into equivalent % rated torque to the motor. Specify: `TorqueScaling := value`
OutputLPFilterBandwidth	Specify the bandwidth in Hertz of the servo's low-pass digital output filter. Specify: `OutputLPFilterBandwidth := value`
IntegratorHoldEnable	Enter Disabled or Enabled. Specify: `IntegratorHoldEnable := value`
PositionDifferentialGain	Specify a position differential gain (PosD) to help predict a large overshoot ahead of time and make an attempt to correct before the overshoot actually occurs. Specify: `PositionDifferentialGain := value`
DirectionalScalingRatio	Specify the ratio between the extend direction gain and the retract direction gain. Specify: `DirectionalScalingRatio := value`
MaximumPositiveTravel	Specify the maximum positive position (any positive number) to be used for software overtravel checking, in position units. Specify: `MaximumPositiveTravel := value`
MaximumNegativeTravel	Specify the maximum negative position (any positive number) to be used for software overtravel checking, in position units. Specify: `MaximumNegativeTravel := value`
PositionErrorTolerance	Specify the how position error the servo module will tolerate (any positive number) before issuing a position error fault. Specify: `PositionErrorTolerance := value`
PositionLockTolerance	Specify the maximum position error the servo module will accept (any positive number) in order to indicate that the position lock status bit is set. Specify: `PositionLockTolerance := value`
OutputLimit	Specify the maximum servo output voltage of a physical axis (any positive number). Specify: `OutputLimit := value`
DirectDriveRampRate	Specify the rate at which the analog output changes from the current value to the requested value when an MDO command is given (if ramp control is enabled). The ramp rate is specified in Volts per second. Specify: `DirectDriveRampRate := value`
OutputOffset	Specify a fixed voltage value (-10 to 10V) to add to the servo output value to correct axis drift. Specify: `OutputOffset := value`
VelocityOffset	Specify a dynamic velocity correction to the output of the position servo loop, in position units/second (any positive number). Specify: `VelocityOffset := value`
TorqueOffset	Specify a dynamic torque command correction to the output of the velocity servo loop as a percentage of the velocity servo loop output (-100 to 100). Specify: `TorqueOffset := value`
FrictionCompensation	Specify the percentage (0-100) of output level added to a positive current servo output value, or subtracted from a negative current servo output value, for the purpose of moving an axis that is stuck in place due to static friction. Specify: `FrictionCompensation := value`

Attribute:	Description:
FrictionCompensationWindow	This window is defined as: command position - window attribute to command position + window attribute While the command velocity is zero and the actual position is within this window, the friction compensation (or deadband compensation, for hydraulics) is applied proportionally to the position error. While the command velocity is non-zero, the full friction compensation is applied. Specify: `FrictionCompensationWindow := value`
BacklashStabilizationWindow	The window controls the backlash stabilization feature in the servo control loop. Mechanical backlash is a common problem in applications that utilize mechanical gearboxes. Specify: `BacklashStabilizationWindow := value`
BacklashReversalOffset	Specify the backlash reversal error to compensate for positional inaccuracy introduced by mechanical backlash. Specify: `BacklashReversalOffset := value`
HardOvertravelFaultAction	Specify the fault action taken when a hardware overtravel error occurs. Enter Shutdown, Disable Drive, Stop Motion, or Status Only. Specify: `HardOvertravelFaultAction := text`
SoftOvertravelFaultAction	Specify the fault action taken when a software overtravel error occurs. Enter Shutdown, Disable Drive, Stop Motion, or Status Only. Specify: `SoftOvertravelFaultAction := text`
PositionErrorFaultAction	Enter Shutdown, Disable Drive, Stop Motion, or Status Only. Specify: `PositionErrorFaultAction := text`
FeedbackFaultAction	Specify the fault action to be taken when a feedback loss condition is detected. Enter Shutdown, Disable Drive, Stop Motion, or Status Only. Specify: `FeedbackFaultAction := text`
FeedbackNoiseFaultAction	Specify the fault action to be taken when excessive feedback noise is detected. Enter Shutdown, Disable Drive, Stop Motion, or Status Only. Specify: `FeedbackNoiseFaultAction := text`
DriveFaultAction	Specify the fault action to be taken when a drive fault condition is detected. Enter Shutdown, Disable Drive, Stop Motion, or Status Only. Specify: `DriveFaultAction := text`
TestIncrement	Specify the amount of distance traversed by the axis when executing the output and feedback test (any positive number). Specify: `TestIncrement := value`
TuningTravelLimit	Specify the tuning travel limit in revolutions (any positive number). Specify: `TuningTravelLimit := value`
TuningSpeed	Specify the tuning speed in revolutions per second (any positive number). Specify: `TuningSpeed := value`
TuningTorque	Specify the tuning torque % rated (0-300). Specify: `TuningTorque := value`
DampingFactor	Specify the damping factor (0.5 to 2). Specify: `DampingFactor := value`
DriveModelTimeConstant	Specify the drive model time constant ($1.0e^{-6f}$ to 1). Specify: `DriveModelTimeConstant := value`
PositionServoBandwidth	Specify the maximum allowable value for position bandwidth (0.001F to 1000), given the damping factor. This parameter is disabled if the loop configuration is set to velocity. Specify: `PositionServoBandwidth := value`

Attribute:	Description:
VelocityServoBandwidth	Specify the unity gain bandwidth that is to be used to calculate the subsequent gains for a motion apply axis tuning (MAAT) instruction (0.001F to 1000). Specify: `VelocityServoBandwidth := value`
TuningConfigurationBits	Specify the tuning configuration bits. Enter a hexadecimal number. Specify: `TuningConfigurationBits := 16#value`
TorqueLimitSource	Enter Not Limited, Negative Limit, Positive Limit, Bridge Limit, I(t) Limit, or Motor Limit. Specify: `TorqueLimitSource := text`
DriveUnit	Specify the units of the drive. Enter us/in or m/s. Specify: `DriveUnit := text`
PositionDataScaling	Specify the scaling method used on position values (0-255). Specify: `PositionDataScaling := value`
PositionDataScalingFactor	Specify the scaling factor for all position data in a drive (1-65535). Specify: `PositionDataScalingFactor := value`
PositionDataScalingExp	Specify the scaling exponent for all position data in a drive (-32768 to 32767). Specify: `PositionDataScalingExp := value`
VelocityDataScaling	Specify the scaling method to use for all velocity values (0-127). Specify: `VelocityDataScaling := value`
VelocityDataScalingFactor	Specify the scaling factor for all velocity data (1-65535). Specify: `VelocityDataScalingFactor := value`
VelocityDataScalingExp	Specify the scaling exponent for all velocity data (-32768 to 32767). Specify: `VelocityDataScalingExp := value`
AccelerationDataScaling	Specify the scaling method for all acceleration values (0-127). Specify: `AccelerationDataScaling := value`
AccelerationData ScalingFactor	Specify the scaling factor for all acceleration data (1-65535). Specify: `AccelerationDataScalingFactor := value`
AccelerationDataScalingExp	Specify the scaling exponent for all acceleration data (-32768 to 32767). Specify: `AccelerationDataScalingExp := value`
TorqueDataScaling	Specify the scaling method for all torque values (0-127). Specify: `TorqueDataScaling := value`
TorqueDataScalingFactor	Specify the scaling factor for all torque values (1-65535). Specify: `TorqueDataScalingFactor := value`
TorqueDataScalingExp	Specify the scaling exponent for all torque values (-32768 to 32767). Specify: `TorqueDataScalingExp := value`
DrivePolarity	Specify the polarity of the servo loop of the drive. Enter Custom, Positive, or Negative. Specify: `DrivePolarity := text`
MotorFeedbackType	Specify the type of motor associated with the selected motor (MotorCatalogNumber). If you specify <NONE> for the motor, you must specify a feedback type. Specify: `MotorFeedbackType := value`
MotorFeedbackResolution	Specify the resolution of the motor (1-2147483647). Specify: `MotorFeedbackResolution := value`
AuxFeedbackType	Specify the type of auxiliary feedback device. Specify: `AuxFeedbackType := value`
AuxFeedbackResolution	Specify the resolution of the auxiliary feedback device (1-2147483647). Specify: `AuxFeedbackResolution := value`

Attribute:	Description:
AuxFeedbackRatio	Specify the auxiliary feedback ratio (any positive number). Specify: `AuxFeedbackRatio := value`
MotorFeedbackUnit	Specify the units for motor feedback. Enter Rev, Inch, or Millimeter. Specify: `MotorFeedbackUnit := text`
AuxFeedbackUnit	Specify the units for auxiliary feedback. Enter Rev, Inch, or Millimeter. Specify: `AuxFeedbackUnit := text`
OutputNotchFilterFrequency	Specify the frequency of the drive's digital notch filer (0 -10,000.0). Specify: `OutputNotchFilterFrequency := value`
VelocityDroop	Specify the velocity droop (any positive number). Specify: `VelocityDroop := value`
VelocityLimitBipolar	Specify the velocity limit symmetrically in both directions (any positive number). Specify: `VelocityLimitBipolar := value`
AccelerationLimitBipolar	Specify the acceleration and deceleration limits for the drive (any positive number). Specify: `AccelerationLimitBipolar := value`
TorqueLimitBipolar	Specify the torque limit symmetrically in both directions (0 - 1000.0). Specify: `TorqueLimitBipolar := value`
VelocityLimitPositive	Specify the maximum allowable velocity in the positive direction (any positive number). Specify: `VelocityLimitPositive := value`
VelocityLimitNegative	Specify the maximum allowable velocity in the negative direction (any positive number). Specify: `VelocityLimitNegative := value`
VelocityThreshold	Specify the velocity threshold limit (any positive number). Specify: `VelocityThreshold := value`
VelocityWindow	Specify the limits of the velocity window (any positive number). Specify: `VelocityWindow := value`
VelocityStandstillWindow	Specify the velocity limit for the standstill window (any positive number). Specify: `VelocityStandstillWindow := value`
AccelerationLimitPositive	Specify the maximum acceleration ability of the drive (any positive number). Specify: `AccelerationLimitPositive := value`
AccelerationLimitNegative	Specify the maximum acceleration ability of the drive (any negative number). Specify: `AccelerationLimitNegative := value`
TorqueLimitPositive	Specify the maximum torque in the positive direction (0-1000.0). Specify: `TorqueLimitPositive := value`
TorqueLimitNegative	Specify the maximum torque in the negative direction (-1000.0 - 0). Specify: `TorqueLimitNegative := value`
TorqueThreshold	Specify the torque threshold (0-1000.0). Specify: `TorqueThreshold := value`
DriveThermalFaultAction	Specify the fault action to be taken when a drive thermal fault is detected. Enter Shutdown, Disable Drive, Stop Motion, or Status Only. Specify: `DriveThermalFaultAction := text`
MotorThermalFaultAction	Specify the fault action to be taken when a motor thermal fault is detected. Enter Shutdown, Disable Drive, Stop Motion, or Status Only. Specify: `MotorThermalFaultAction := text`
DriveEnableInputFaultAction	Specify the fault action to be taken when a drive enable input fault is detected. Enter Shutdown, Disable Drive, Stop Motion, or Status Only. Specify: `MotorThermalFaultAction := text`

Attribute:	Description:
StoppingTorque	Specify the amount of torque available to stop the motor (0-1000). Specify: `StoppingTorque := value`
StoppingTimeLimit	Specify the maximum amount of time that the drive amplifier will remain enabled while trying to stop (0-6553.5). Specify: `StoppingTimeLimit := value`
BrakeEngageDelayTime	Specify the amount of time that the drive maintains torque when the servo axis is disabled and the drive decelerates to a minimum speed (0-6.5535). Specify: `BrakeEngageDelayTime := value`
BrakeReleaseDelayTime	Specify amount of time that the drive ignores command values from the controller when the servo axis is enabled and the drive activates the torque (0-6.5535). Specify: `BrakeReleaseDelayTime := value`
PowerSupplyID	Specify the power supply ID (any positive number). Specify: `PowerSupplyID := value`
BusRegulatorID	Specify the bus regulator ID (any positive number). Specify: `BusRegulatorID := value`
PWMFrequencySelect	Specify Enter High Frequency or Low Frequency. Specify: `PWMFrequencySelect := text`
AmplifierCatalogNumber	Specify the catalog number of the amplifier to which this axis is connected. Specify: `AmplifierCatalogNumber := text`
MotorCatalogNumber	Specify the catalog number of the motor to which this axis is connected or enter <NONE>. Specify: `MotorCatalogNumber := text`
AuxFeedbackRatio	Specify the auxiliary feedback ratio (any positive number). Specify: `AuxFeedbackRatio := value`
LoadInertiaRatio	Specify the load inertia ratio (any positive number). Specify: `LoadInertiaRatio := value`
ContinuousTorqueLimit	Specify the maximum torque limit (0-200). Specify: `ContinuousTorqueLimit := value`
ResistiveBrakeContactDelay	Specify amount of time to delay resistive brake contact. Specify: `ResistiveBrakeContactDelay := value`

Specifying attributes for an COORDINATE_SYSTEM tag

The axis tags differ from the basic tag. The COORDINATE_SYSTEM tag has these attributes:

Attribute:	Description:
Description	Provide information about the tag. Specify: `Description := "text"`
Comment	Provide information about a tag component. Specify: `Comment<specifier> := "text"` Where the *specifier* is: *.bitnumber* for a bit in the tag [*element*] for an array element of the tag *.membername* for a structure member of the tag
MotionGroupInstance	Enter the name of the associated motion group, or enter <NA>. Specify: `MotionGroupInstance := text`

Attribute:	Description:
SystemType	Specify the coordinate system type. Currently, only Cartesian is available. Specify: `SystemType := Cartesian`
Dimension	Specify the number of axes that this coordinated system supports. Enter 1, 2, or 3. Specify: `Dimension := value`
Axes	Specify the name of the axes in this coordinated system. Specify: `Axes := value`
CoordinationMode	Specify coordination mode. Currently, only Primary is available. Specify: `CoordinationMode := Primary`
CoordinationUnits	Specify units to be used for measuring and calculating motion related values such as position, velocity, etc. Enter units that are relevant to your application. Specify: `CoordinationUnits := text`
ConversionRatioNumerator	The conversion ratio defines the relationship of axis position units to coordination units for each axis. Enter the numerator as a float or an integer. Specify: `ConversionRatioNumerator := value`
ConversionRatioDenominator	The conversion ratio defines the relationship of axis position units to coordination units for each axis. Enter the denominator as an integer. Specify: `ConversionRatioDenominator := value`
CoordinateSystemAutoTag Update	Specify whether or not the actual position values of the current coordinated system are automatically updated during operation. To enable auto tag update, enter 1. Otherwise, enter 0. Specify: `CoordinateSystemAutoTagUpdate := text`
MaximumSpeed	Specify the maximum speed to be used by the coordinated motion instructions in calculating vector speed when speed is expressed as a percent of maximum. Specify: `MaximumSpeed := value`
MaximumAcceleration	Specify the value for maximum acceleration to be used by the coordinated motion instructions to determine the acceleration rate to apply to the coordinate system vector when acceleration is expressed as a percent of maximum. Specify: `MaximumAccelaertion := value`
MaximumDeceleration	Specify the value for maximum deceleration to be used by the coordinated motion instructions to determine the deceleration rate to apply to the coordinate system vector when deceleration is expressed as a percent of maximum. Specify: `MaximumAccelaertion := value`
ActualPositionTolerance	Specify the value in coordination units, for actual position to be used by coordinated motion instructions when they have a termination type of actual tolerance. Specify: `ActualPositionTolerance := value`
CommandPositionTolerance	Specify the value in coordination units, for command position to be used by coordinated motion instructions when they have a termination type of command tolerance. Specify: `CommandPositionTolerance := value`

Defining TAG initial values

The `initial_value` format follows the C-language initialization syntax, except that you use square brackets instead of curly brackets. The following table shows some examples of entering initial values.

If the tag is:	Enter:
single, atomic value	[*Value*]
structure with three members	[*Value1*, *Value2*, *Value3*]
structure with a nested structure	[*Value1*, [*Value2*, *Value3*], *Value4*]
structure with a nested array	[*Value1*, [*ArrayValue1*, *ArrayValue2*], *Value3*]

The initial value for a string value identifies the number of characters in the string and the text string. The format for a string TAG is:

```
<tag_name> : STRING := [<number>, ‘string_text$00 ... $00’];
```

Where:

Item:	Identifies:
`tag_name`	name of the string tag
`STRING`	the STRING data type
`number`	number of characters in the string
`string_text`	text of the string
`$00`	the string is padded with $00 to fill its maximum of 82 characters Each $00 equals one character not used in the string. The entire text string, including the $00 characters, is enclosed in single quotation marks.

For example:

```
TAG
       sourcea_string : STRING  :=
[5,'hello$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00
$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00
$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00'
       ];
       sourceb_string : STRING  := [11,'how are
you$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00
$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00$00
$00$00$00$00$00$00$00$00$00$00'
       ];
END_TAG
```

Defining a comment for a TAG component

The comment attribute of a tag declaration lets you provide information about a component of the tag, such as a specific bit, array element, or structure member. For example:

To add a comment to this operand:	Enter:
bit 3 of a tag	COMMENT.3 := "*description*"
element 8 of an array tag	COMMENT[8] := "*description*"
preset value of a tag	COMMENT.PRE := "*description*"

TAG guidelines

Keep these guidelines in mind when defining a tag:

- Tags must be defined after devices (if there are no devices, then after the data types) within the controller body.
- Base tags and aliases can be defined out of order within a tag block.
- You cannot define a 2nd dimension without a 1st dimension or a 3rd dimension without a 2nd dimension.
- The initial values must comply with the tag type and dimensions.
- Whitespace can not occur within the initial values or within the type/dimension specifier.

TAG examples

```
TAG
       bits : MySint := [0];
       dest : INT (RADIX := Decimal) := 0;
       overflow OF bits.MyBit0 (RADIX := Binary);
       source : REAL (RADIX := Exponential) := 0.0;
       timer : TIMER[3] := [[0,0,100],[0,10,100],[0,0,50]];
END_TAG
```

This example shows forced tag data:

```
TAG
       dint_a : DINT (RADIX := Decimal) := 0;
       int_a : INT (RADIX := Decimal) := 0;
       tag_a : UDT_A (ProduceCount := 2) := [0,0],
       TagForceData := [0,0,0,0,1,0,-1,-1,1,0,-72,34];
END_TAG
```

Defining a Program

A PROGRAM component follows this structure:

```
PROGRAM <program_name> [(Attributes)]
       [TAG declaration]
       [ROUTINE declaration]
       [FBD_ROUTINE declaration]
       [ST_ROUTINE declaration]
       [SFC_ROUTINE declaration]
END_PROGRAM
```

Where:

Item:	Identifies:
program_name	the program
Attributes	attributes of the program (such as MAIN or FAULT) can also contain a description of the program enclose in parenthesis separate each attribute with a comma (,)
TAG	program-scoped tags follows same format as controller-scoped tags see page 3-11
ROUTINE	ladder logic routine for this program see chapter 4
FBD_ROUTINE	function block diagram routine for this program see chapter 5
ST_ROUTINE	structured text routine for this program see chapter 6
SFC_ROUTINE	sequential function chart routine for this program see chapter 7

You can intermix ROUTINE, FBD_ROUTINE, ST_ROUTINE, and SFC_ROUTINE declarations.

Specifying PROGRAM attributes

You can specify these attributes for a PROGRAM:

Attribute:	Description:
`Description`	Provide information about the program. Specify: `Description := "text"`
`Main`	Name of the main routine of the program. Specify: `Main := name`
`Fault`	Name of the program fault routine, if any. Specify: `Fault := name`
`Mode`	Enter 0 for not testing edits; enter 1 for testing edits. Specify: `Mode := value`
`DisableFlag`	Enter 1 to disable the program; enter 0 to enable the program. Specify: `DisableFlag := value`

PROGRAM guidelines

Keep in mind these guidelines when defining a program:

- The MAIN and FAULT attributes can be defined in any order.
- The TAG declaration block must occur before the routine block.
- All tag collection declaration blocks that occur in a program definition block are imported as tags of a given program and can only be seen by routines under that program. Controller tags, on the other hand can be seen by routines in any program.

PROGRAM example

```
PROGRAM Prg1 (Main := RoutineB, Description := "I $'am$'" "
$0034 a $"program$"")
       TAG
       st11 : DINT (RADIX := Decimal, ProduceCount := 0) := 2;
       st12 : BOOL (RADIX := Binary, ProduceCount := 0) :=
2#00000000;
       END_TAG

       ROUTINE RoutineA
       JSR(_2_LADDER, 0);
       END_ROUTINE

       ROUTINE RoutineB
              RC: "$L ** ;MORE $";STUFF" do not include "more";
              xic(st11) ote(st12);
       END_ROUTINE
END_PROGRAM
```

Defining a Task

The maximum number of tasks depends on the of controller:

Controller:	Maximum Number of Tasks:
ControlLogix	32
SoftLogix5800	32
FlexLogix	8
CompactLogix (L35E)	8
CompactLogix (L20, L30)	4
DriveLogix	4

A TASK component follows this structure:

```
TASK <task_name> [(Attributes)]
       <program_name>;
END_TASK
```

Where:

Item:	Identifies:
`task_name`	the task
`Attributes`	attributes of the task can also contain a description of the task enclose in parenthesis separate each attribute with a comma (,)
`program_name`	each program within the task all program names are followed by a semi colon (;)

Specifying TASK attributes

You can specify these attributes for a TASK:

Attribute:	Description:
`Description`	Provide information about the task. Specify: `Description := "`*`text`*`"`
`Type`	Specify the type of task (CONTINUOUS, PERIODIC, or EVENT). There can be only one continuous task. Specify: `Type :=` *`type`*
`Watchdog`	Enter the watchdog timeout for the task (1.000-2,000,000.000 us). Specify: `Watchdog :=` *`number`*
`Priority`	Specify the priority of a periodic task (1-15) Specify: `Priority :=` *`number`*
`Rate`	If the task is a periodic task, specify how often to run the task (1.000-2,000,000.000 us). Specify: `Rate :=` *`number`*
`EventTrigger`	Only used for event tasks. Specify the trigger for the event task. Enter Axis Home, Axis Watch, Axis Registration 1, Axis Registration 2, Motion Group Execution, EVENT Instruction Only, Module Input Data State Change, Consumed Tag, or Windows Event. Specify: `EventTrigger :=` *`text`*
`EventTag`	Only used for event tasks with a Consumed Tag trigger or a Module Input Data State Change trigger. Specify the tag to consume. Specify: `EventTag :=` *`tag_name`*
`EnableTimeout`	If the you want to enable timeouts for the task, enter Yes. Otherwise enter No. Specify: `EnableTimeout :=` *`text`*
`DisableUpdateOutputs`	If the you want to disable updates to outputs while the task executes, enter Yes. Otherwise enter No. The default for a periodic or continuous task is No. The default for an event task is yes. Specify: `DisableUpdateOutputs :=` *`text`*
`InihibitTask`	If the you want to inhibit the task, enter Yes. Otherwise enter No. Specify: `InhibitTask :=` *`text`*

TASK guidelines

Keep these guidelines in mind when defining a task:

- Tasks must be defined after programs and before controller objects.
- There can be at most 32 tasks.
- There can only be one continuous task.
- A program can be scheduled under only one task.
- Scheduled programs must be defined - i.e. must exist.

TASK example

```
TASK joe (TYPE := PERIODIC,  PRIORITY := 8, RATE := 10000)
       sue;
       betty;
END_TASK
```

The task attributes (Type, Priority, Rate, and Watchdog) can be defined in any order. The list of programs scheduled for a task are listed in the task declarations block, as shown above. The programs are executed in the order they are specified.

Defining a Trend

A TREND component defines controller trend object and follows this structure:

```
TREND <trend_name> [(Attributes)]
        [Template]
        [PEN declaration]
END_TREND
```

Where:

Item:	Identifies:
`trend_name`	the trend
`Attributes`	attributes of the trend can also contain a description of the trend enclose in parenthesis separate each attribute with a comma (,)
`Template`	the Trend template in a byte value list
`PEN declaration`	individual pens within the trend each trend can support as many as 8 pens

Trend objects are optional. You can have as many as 32 trends per import/export file.

Specifying TREND attributes

You can specify these attributes for a TREND:

Attribute:	Description:
`Description`	Provide information about the trend. Specify: `Description := "text"`
`SamplePeriod`	Specify how often trending tags are collected in msec (1 msec to 30 minutes). Specify: `SamplePeriod := number`
`NumberOfCaptures`	Specifies the maximum number of captures allowed (1-100). Specify: `NumberOfCaptures := number`
`CaptureSizeType`	Define how the capture size is specified. Enter Samples, TimePeriod, or NoLimit. Specify: `CaptureSizeType := text`
`CaptureSize`	Specify the number of samples for each capture. The maximum number of samples is 2-hours worth of data samples or 1000 samples, whichever is greater. If the CaptureSizeType is Samples, the range is 1 to (2 hours/SamplePeriod) or 1000 samples, whichever is greater. If the CaptureSizeType is TimePeriod, the range is SamplePeriod to 2 hours or (SamplePeriod * 1000), whichever is greater. Specify: `CaptureSize := number`
`StartTriggerType`	Specify the type of the start trigger. Enter NoTrigger or EventTrigger. Specify: `StartTriggerType := text`

Attribute:	Description:
`StartTriggerTag1`	Specify the tag name of the first start trigger. The name must be one of the pen names. Specify: `StartTriggerTag1 := text`
`StartTrigger Operation1`	Specify the operation that is applied on StartTriggerTag1, and StartTriggerTargetValue1 or StartTriggerTargetTag1. **Enter: For:** 0 Exact Equal (Tag EQU Target) 1 Trigger Level Equal (Tag = Target) 2 Not Equal (Tag != Target) 3 Less Than (Tag < Target) 4 Greater Than (Tag > Target) 5 Less Than or Equal To (Tag <= Target) 6 Greater Than or Equal To (Tag >= Target) 7 Positive Slope (slope of Tag is positive) 8 Negative Slope (slope of Tag is negtive) 9 Bitwise OR ((Tag OR Target) = 0) 10 Bitwise OR ((Tag OR Target) != 0) 11 Bitwise AND ((Tag AND Target) = 0) 12 Bitwise AND ((Tag AND Target) != 0) 13 Bitwise XOR ((Tag XOR Target) = 0) 14 Bitwise XOR ((Tag XOR Target) != 0) Specify: `StartTriggerOperation1 := number`
`StartTriggerTarget Type1`	Specify the type of the first start trigger target. Enter TargetValue or TargetTag. If you enter TargetValue, StartTriggerTargetValue1 is expected. Otherwise, StartTriggerTargetTag1 is expected. Specify: `StartTriggerTargetType1 := text`
`StartTriggerTarget Value1`	Specify a target value if the StartTriggerTargetType1 is TargetValue. Enter a binary, octal, decimal, or hexadecimal integer number or enter a floating point number. Specify: `StartTriggerTargetValue1 := text`
`StartTriggerTarget Tag1`	Specify a target tag if the StartTriggerTargetType is TargetTag. The tag must be one of the pen names. Specify: `StartTriggerTargetTag1 := text`
`StartTriggerLogical Operation`	Specify a logical operation (AND or OR) that is performed on StartTriggerxxx1 and StartTriggerxxx2. StartTriggerxxx1 consists of StartTriggerTag1, StartTriggerOperation1, StartTriggerTargetType1, and StartTriggerTargetValue1 or StartTriggerTargetTag1. StartTriggerxxx2 consists of StartTriggerTag2, StartTriggerOperation2, StartTriggerTargetType2, and StartTriggerTargetValue2 or StartTriggerTargetTag2. Specify: `StartTriggerLogicalOperation := text`
`StartTriggerTag2`	Specify the tag name of the second start trigger. The name must be one of the pen names. Specify: `StartTriggerTag2 := text`

Attribute:	Description:
`StartTrigger Operation2`	Specify the operation that is applied on StartTriggerTag2, and StartTriggerTargetValue2 or StartTriggerTargetTag2. **Enter:** **For:** 0 Exact Equal (Tag EQU Target) 1 Trigger Level Equal (Tag = Target) 2 Not Equal (Tag != Target) 3 Less Than (Tag < Target) 4 Greater Than (Tag > Target) 5 Less Than or Equal To (Tag <= Target) 6 Greater Than or Equal To (Tag >= Target) 7 Positive Slope (slope of Tag is positive) 8 Negative Slope (slope of Tag is negtive) 9 Bitwise OR ((Tag OR Target) = 0) 10 Bitwise OR ((Tag OR Target) != 0) 11 Bitwise AND ((Tag AND Target) = 0) 12 Bitwise AND ((Tag AND Target) != 0) 13 Bitwise XOR ((Tag XOR Target) = 0) 14 Bitwise XOR ((Tag XOR Target) != 0) Specify: `StartTriggerOperation2 := number`
`StartTriggerTarget Type2`	Specify the type of the second start trigger target. Enter TargetValue or TargetTag. If you enter TargetValue, StartTriggerTargetValue2 is expected. Otherwise, StartTriggerTargetTag2 is expected. Specify: `StartTriggerTargetType2 := text`
`StartTriggerTarget Value2`	Specify a target value if the StartTriggerTargetType2 is TragetValue. Enter a binary, octal, decimal, or hexadecimal integer number or enter a floating point number. Specify: `StartTriggerTargetValue2 := text`
`StartTriggerTarget Tag2`	Specify a target tag if the StartTriggerTargetType is TargetTag. The tag must be one of the pen names. Specify: `StartTriggerTargetTag2 := text`
`PreSampleType`	Define how pre-samples are specified. Enter Samples or TimePeriod. Specify: `PreSampleType := text`
`PreSamples`	Specify the number of pre-samples (0-1000) if the PreSampleType is Samples. Specify a time period (0 to (SamplePeriod * 1000)) that covers pre-samples if the PreSampleType is TimePeriod. Specify: `PreSamples := number`
`StopTriggerType`	Specify the type of the stop trigger. Enter NoTrigger or Event Trigger. Specify: `StopTriggerType := text`
`StopTriggerTag1`	Specify the tag name of the first trigger. The name must be one of the pen names. Specify: `StopTriggerTag1 := text`

Attribute:	Description:
`StopTrigger Operation1`	Specify the operation that is applied on StopTriggerTag1 and StopTriggerTargetValue1 or StopTriggerTargetTag1. **Enter:** **For:** 0 Exact Equal (Tag EQU Target) 1 Trigger Level Equal (Tag = Target) 2 Not Equal (Tag != Target) 3 Less Than (Tag < Target) 4 Greater Than (Tag > Target) 5 Less Than or Equal To (Tag <= Target) 6 Greater Than or Equal To (Tag >= Target) 7 Positive Slope (slope of Tag is positive) 8 Negative Slope (slope of Tag is negtive) 9 Bitwise OR ((Tag OR Target) = 0) 10 Bitwise OR ((Tag OR Target) != 0) 11 Bitwise AND ((Tag AND Target) = 0) 12 Bitwise AND ((Tag AND Target) != 0) 13 Bitwise XOR ((Tag XOR Target) = 0) 14 Bitwise XOR ((Tag XOR Target) != 0) Specify: `StopTriggerOperation1 := number`
`StopTriggerTarget Type1`	Specify the type of the first stop trigger target. Enter TargetValue or TargetTag. If you specify TargetValue, StopTriggerTargetValue1 is expected. Otherwise, StopTriggerTargetTag1 is expected. Specify: `StopTriggerTargetType1 := text`
`StopTriggerTarget Value1`	Specify a target value if the StopTriggerTargetType1 is TargetValue. Enter a binary, octal, decimal, or hexadecimal integer number or enter a floating point number. Specify: `StopTriggerTargetValue1 := number`
`StopTriggerTarget Tag1`	Specify a target tag if the StopTriggerTargetType is TargetTag. The name must be one of the pen names. Specify: `StopTriggerTargetTag1 := text`
`StopTriggerLogical Operation`	Specify a logical operation (AND or OR) that is performed on StopTriggerxxx1 and StopTriggerxxx2. StopTriggerxxx1 consists of StopTriggerTag1, StopTriggerOperation1, StopTriggerTargetType1, and StopTriggerTargetValue1 or StopTriggerTargetTag1. StopTriggerxxx2 consists of StopTriggerTag2, StopTriggerOperation2, StopTriggerTargetType2, and StopTriggerTargetValue2 or StopTriggerTargetTag2. Specify: `StopTriggerLogicalOperation := text`
`StopTriggerTag2`	Specify the tag name of the second trigger. The name must be one of the pen names. Specify: `StopTriggerTag2 := text`

Attribute:	Description:
`StopTrigger Operation2`	Specify the operation that is applied on StopTriggerTag2 and StopTriggerTargetValue2 or StopTriggerTargetTag2. **Enter:** **For:** 0 Exact Equal (Tag EQU Target) 1 Trigger Level Equal (Tag = Target) 2 Not Equal (Tag != Target) 3 Less Than (Tag < Target) 4 Greater Than (Tag > Target) 5 Less Than or Equal To (Tag <= Target) 6 Greater Than or Equal To (Tag >= Target) 7 Positive Slope (slope of Tag is positive) 8 Negative Slope (slope of Tag is negtive) 9 Bitwise OR ((Tag OR Target) = 0) 10 Bitwise OR ((Tag OR Target) != 0) 11 Bitwise AND ((Tag AND Target) = 0) 12 Bitwise AND ((Tag AND Target) != 0) 13 Bitwise XOR ((Tag XOR Target) = 0) 14 Bitwise XOR ((Tag XOR Target) != 0) Specify: `StopTriggerOperation2 := number`
`StopTriggerTarget Type2`	Specify the type of the second stop trigger target. Enter TargetValue or TargetTag. If you specify TargetValue, StopTriggerTargetValue2 is expected. Otherwise, StopTriggerTargetTag2 is expected. Specify: `StopTriggerTargetType2 := text`
`StopTriggerTarget Value2`	Specify a target value if the StopTriggerTargetType2 is TargetValue. Enter a binary, octal, decimal, or hexadecimal integer number or enter a floating point number. Specify: `StopTriggerTargetValue2 := number`
`StopTriggerTarget Tag2`	Specify a target tag if the StopTriggerTargetType is TargetTag. The name must be one of the pen names. Specify: `StopTriggerTargetTag2 := text`
`PostSampleType`	Define how post-samples are specified. Enter Samples or TimePeriod. Specify: `PostSampleType := text`
`PostSamples`	Specify the number of post-samples (0-1000) if the PostSampleType is Samples. Specify a time period (0 to (SamplePeriod * 1000)) that covers post-samples if the PostSampleType is TimePeriod. Specify: `PostSamples := number`
`TrendxVersion`	Specify the version of the Trend utility. Specify: `TrendxVersion := number`

Specifying a PEN declaration

A TREND object can have as many as 8 PEN declarations. A PEN declaration follows this structure:

```
PEN <pen_name> [(Attributes)];
END_PEN
```

Where:

Item:	Identifies:
`pen_name`	the pen
`Attributes`	attributes of the pen can also contain a description of the pen enclose in parenthesis separate each attribute with a comma (,)

Speciyfing attributes for a PEN declaration

You can specify these attributes for a PEN declaration:

Attribute:	Description:
`Description`	Provide information about the pen. Specify: `Description := "text"`
`Color`	Specify the color of the line in RGB format. Enter the hex number for the color (16#0000_0000 – 16#00FF_FFFF). Specify: `Color := hex_number`
`Visible`	Specify whether or not the line should be visible. Enter TRUE or FALSE. Specify: `Visible := text`
`Width`	Specify the width of the line in pixels (1-10). Specify: `Width := number`
`Type`	Specify the line type. Enter Analog, Digital, or Full-Width. Specify: `Type := text`
`Style`	Specify the style of line. **Enter** **For** 0 ..... 1 ... ... 2 ..... 3 ... ... 4 ... . Specify: `Style := number`
`Marker`	Specify the line marker (0-83) Specify: `Marker := number`

Attribute:	Description:
`Min`	Specify the minimum value for the pen. The minimum cannot be greater than or equal to the maximum. Specify: `Min := number`
`Max`	Specify the maximum value for the pen. The maximum cannot be less than or equal to the minimum. Specify: `Max := number`
`EngUnits`	Specify engineering units. For example, rpm, gallon, fps, degrees, etc.. Specify: `EngUnits := text`

TREND guidelines

Keep these guidelines in mind when defining a trend:

- A trend can support as many as 8 PEN declarations.
- You can export just the trend of a controller project by right-clicking on the trend in the Controller Organizer and selecting Export. This saves the trend as a .L5X file (XML format), which follows the same format as described above for the complete project .L5K file. For more information, see chapter 9.
- To import a trend .L5X file into a controller project, right-click on the Trends in the Controll Organizer and select Import.

TREND example

```
TREND trend1 (SamplePeriod := 10,
              NumberOfCaptures := 1,
              CaptureSizeType := Samples,
              CaptureSize := 60000,
              StartTriggerType := No Trigger,
              StopTriggerType := No Trigger,
              TrendxVersion := 5.2)
Template :=
[208,207,17,224,161,177,26,225,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,62,0,3,0,254,255,9,0,6,0,0,0,0
,0,0,0,0,0,0,0,1,0,0,0,1,0,0,0,0,0,0,0,0,16,0,0,2,0,0,0,1,0,0,0,254,255,255,255,0,0,0,0,0,0,0
,0,255,255,255,255,255,255,,etc....
PEN Local:1:I.CHA_Status (Color := 16#00ff_0000,
                                Visible := 1,
                                Width := 1,
                                Type := Analog,
                                Style := 0,
                                Marker := 0,
                                Min := 0.0,
                                Max := 100.0)
END_PEN
PEN Local:1:I.CHB_Status (Color := 16#0000_ff00,
                                Visible := 1,
                                Width := 1,
                                Type := Analog,
                                Style := 0,
                                Marker := 0,
                                Min := 0.0,
                                Max := 100.0)
END_PEN
END_TREND
```

Defining a Controller

A CONFIG component defines controller objects and follows this structure:

```
CONFIG <object_name> [(Attributes)]
       [body]
END_CONFIG
```

Where:

Item:	Identifies:
`object_name`	the controller object see the list of attributes below for a list of valid controller objects
`Attributes`	attributes of the controller object can also contain a description of the controller object enclose in parenthesis separate each attribute with a comma (,)

Controller objects are optional. There can be only one of each controller object you choose to define. Controller objects appear at the end of the import/export file.

Specifying CONFIG attributes

The attributes depend on the type on CONFIG object you specify. Some objects do not have any attributes. The following table lists those objects that have attributes and descriptions of each:

Object:	Attribute:	Description:
`ASCII`	`XONXOFFEnable`	Specify whether to regulate the flow of incoming data. Enter 0 to disable XON/XOFF; enter 1 to enable XON/XOFF. Specify: `XONXOFFEnable := value`
	`DeleteMode`	Specify the delete mode. Enter 0 for Ignore; enter 1 for CRT; or enter 2 for Printer. Specify: `DeleteMode := value`
	`EchoMode`	Specify whether to echo data back to the device from which it was sent. Enter 0 to disable; enter 1 to enable. Specify: `EchoMode := value`
	`TerminationChars`	Specify the characters that designate the end of a line. Specify: `TerminationChars := value`
	`AppendChars`	Specify the characters to append to the end of a line. Specify: `AppendChars := value`
	`BufferSize`	Specify the maximum size of the data array (1-65535 bytes) that you plan to send and receive. Specify: `BufferSize := value`
`ControllerDevice`	none	none
`CST`	`SystemTimeMasterID`	Specify whether the controller is the coordinated system time master. Enter 16#0000 is the controller is not the CST master; enter 16#0001 if the controller is the CST master. Specify: `CST := 16#value`

Object:	Attribute:	Description:
DF1	DuplicateDetection	Specify whether to enable duplicate message detection, which ignores duplicate messages. Enter 0 to disable; enter 1 to enable. Specify: `DuplicateDetection := value`
	ErrorDetection	Specify the error detection method. Enter BCC Error or CRC Error. Specify: `ErrorDetection := text`
	EnbeddedResponseEnable	Specify the response method. Enter 0 to autodetect; enter 1 to enable. Specify: `EnbeddedResponseEnable := value`
	DF1Mode	Specify the DF1 mode. Enter Pt to Pt, Master, or Slave. Specify: `DF1Mode := value`
	ACKTimeout	Specify the time to wait for an acknowledgment to a message transmission. Enter an increment of 20ms (0-32767). Specify: `ACKTimeout := value`
	NAKReceiveLimit	Specify the number of NAKS (0-127) the controller can receive in response to a message before stopping transmission. Specify: `NAKReceiveLimit := value`
	ENQTransmit	Specify the number of inquiries (0-127) you want the controller to send after an ACK timeout. Specify: `ENQTransmit := value`
	TransmitRetries	Specify the number of attempted retires (0-127) without getting an acknowledgement before the message is deemed undeliverable. Specify: `TransmitRetries := value`
	StationAddress	Specify the current station link address (0-254). Specify: `StationAddress := value`
	ReplyMessageWait	Specify the time the master waits after receiving an acknowledgment to a master-initiated message before polling the slave for a response. Enter an increment of 20ms (0-65535). Specify: `ReplyMessageWait := value`
	PollingMode	Specify the polling mode. Enter on of these: • 1 for Message Based (slave can initiate messages) • 2 for Message Based (slave cannot initiate messages) • 3 for Standard (multiple message transfer for node scan) • 4 for Standard (single message transfer per node scan) Specify: `PollingMode := value`
	MasterMessageTransmit	Specify when the master transmits. Enter 0 to transmit between station polls; enter 1 to transmit in poll sequence. Specify: `MasterMessageTransmit := value`
	NormalPollNodeFile	Specify the tag name of the structure that contains the normal poll node list. Or enter <NA>. Specify: `NormalPollNodeFile := value`
	NormalPollGroupSize	Specify the total number (0-255) of active stations polled from the poll list. Specify: `NormalPollGroupSize := value`
	PriorityPollNodeFile	Specify the tag name of the structure that contains the priority poll node list. Or enter <NA>. Specify: `PriorityPollNodeFile := value`

Object:	Attribute:	Description:
DF1 (continued)	ActiveStationFile	Specify the tag name of the structure that contains the status (active or non-active) of each node. Or enter <NA>. Specify: `ActiveStationFile := value`
	SlavePollTimeout	Specify the amount of time the master waits for an acknowledgement to a message sent to a slave. Enter an increment of 20ms (0-65535). Specify: `SlavePollTimeout := value`
	EOTSuppression	Specify whether to enable EOT suppression. Enter 0 to disable; enter 1 to enable. Specify: `EOTSuppression := value`
	MaxStationAddress	Specify the maximum station address (0-31). Specify: `MaxStationAddress := value`
	TokenHoldFactor	Specify the token hold factor (1-4). Specify: `TokenHoldFactor := value`
ExtendedDevice	none	none
FaultLog	none	none
ICP	none	none
PCCC	none	none
Redundancy	none	none

Object:	Attribute:	Description:
SerialPort	BaudRate	Specify the communication rate for the serial port. Enter 110, 300 600, 1200, 2400, 4800, 9600, 19200, or 38400 Specify: `BaudRate := value`
	Parity	Specify the parity setting for the serial port. Parity provides additional message-packet error detection. Enter None Parity, Even Parity, or Odd Parity. Specify: `Parity := text`
	DataBits	Specify the number of bits per message packet. Enter 0 7 Data Bits or 8 Data Bits. Specify: `DataBits := text`
	StopBits	Specify the number of stop bits to the device with which the controller is communicating. Enter 1 Stop Bit or 2 Stop Bit. Specify: `StopBits := text`
	ComDriverId	Specify the type of serial driver. Enter DF1. Specify: `ComDriverId := text`
	PendingComDriverId	Specify type of serial driver. Enter DF1. Specify: `PendingComDriverId := text`
	RTSOffDelay	Specify a time delay to make sure the modem successfully transmits the entire message. Enter an increment of 20ms (0-32767). Normally leave at zero. Specify: `RTSOffDelay := value`
	RTSSendDelay	Specify a time delay to let the modem prepare to transmit a message. Enter an increment of 20ms (0-32767). Specify: `RTSSendDelay := value`
	ControlLine	Specify the mode in which the serial driver operates. Enter No Handshake, Full Duplex, Half Duplex without Continuous Carrier, or Half Duplex with Continuous Carrier. Specify: `ControlLine := text`
	PendingControlLine	Specify the mode in which the serial driver operates. Enter No Handshake, Full Duplex, Half Duplex without Continuous Carrier, or Half Duplex with Continuous Carrier. Specify: `PendingControlLine := text`
	RemoteModeChangeFlag	Specify whether there is a remote change. Enter 0 or 1. Specify: `RemoteModeChangeFlag := value`
	PendingRemoteModeChange Flag	Specify whether there is a remote change. Enter 0 or 1. Specify: `PendingRemoteModeChangeFlag := value`
	ModeChangeAttentionChar	Specify the mode change attention character. Specify: `ModeChangeAttentionChar := value`
	PendingModeChange AttentionChar	Specify the mode change attention character. Specify: `PendingModeChangeAttentionChar := value`

Object:	Attribute:	Description:
SerialPort (continued)	SystemModeCharacter	Specify the system mode character. Specify: `SystemModeCharacter := value`
	PendingSystemMode Character	Specify the system mode character. Specify: `PendingSystemModeCharacter := value`
	UserModeCharacter	Specify the user mode character. Specify: `SystemModeCharacter := value`
	PendingSystemMode Character	Specify the user mode character. Specify: `PendingSystemModeCharacter := value`
UserMemory	none	none
WallClockTime	LocalTimeAdjustment	Specify any local time adjustment. Specify: `LocalTimeAdjustment := value`
	TimeZone	Specify the time zone. Specify: `TimeZone := value`

CONFIG examples

The following two examples show a DF1 controller object and a SerialPort controller object.

```
CONFIG DF1
       DuplicateDetection := -1,
       ErrorDetection := BCC Error,
       EmbeddedResponseEnable := -1,
       DF1Mode := Pt to Pt,
       ACKTimeout := 50,
       NAKReceiveValue := 3,
       DF1ENQs := 3,
       DF1Retries := 3,
       StationAddress := 0,
       ReplyMessageWait := 50,
       PollingMode := 0,
       MasterMessageTransmit := 0,
       NormalPollNodeFile := NA,
       NormalPollGroupSize := 0,
       PriorityPollNodeFile := NA,
       ActiveStationFile := NA)
END_CONFIG


CONFIG SerialPort
       (BaudRate := 19200,
       Parity := No Parity,
       DataBits := 8 Bits of Data,
       StopBits := 1 Stop Bit,
       ComDriverId := DF1,
       RTSOffDelay := 0,
       RTSSendDelay := 0,
       ControlLine := No Handshake,
       RemoteModeChangeFlag := 0,
       ModeChangeAttentionChar := 27,
       SystemModeCharacter := 83,
       UserModeCharacter := 85)
END_CONFIG
```

Entering Ladder Diagram Logic

Introduction

This chapter explains the how to enter ladder diagram logic in a complete import/export file.

For information about:	See page:
Entering a ladder logic routine	4-1
Entering rung logic	4-2
Entering comments	4-4
Entering instructions in neutral text language	4-4

Entering a Ladder Logic Routine

A ladder logic ROUTINE follows this structure:

```
ROUTINE <routine_name> [Attributes]
       <ladder rungs>
END_ROUTINE
```

Where:

Item:	Identifies:
`routine_name`	the routine
`Attributes`	attributes of the routine can also contain a description of the routine separate each attribute with a comma (,)
`ladder rungs`	ladder logic

Specifying ROUTINE attributes

You can specify these attributes for a ROUTINE:

Attribute:	Description:
`Description`	Provide information about the routine. Specify: `Description := "text"`

Entering Rung Logic

You enter rung logic within a ROUTINE component in an import/export file. Each rung follows this structure:

```
<RungType> : <RungNeutralText>;
```

Where:

Item:	Identifies:
`RungType`	the rung
`RungNeutralText`	the logic

The following rung types are available:

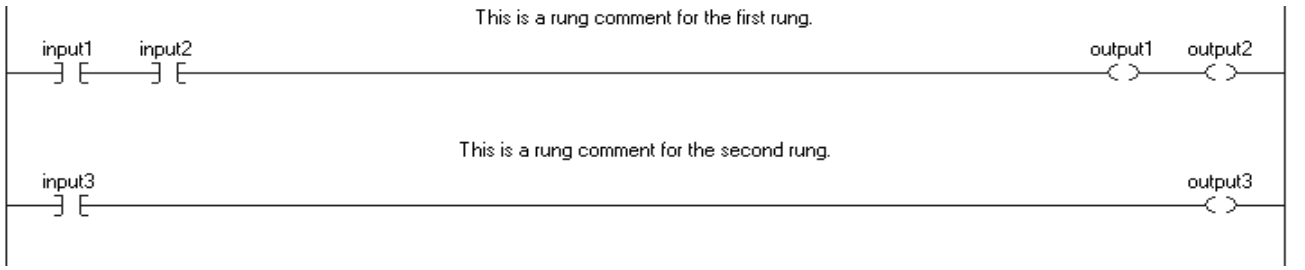
Rung type:	Description:
N	normal
I	insert
D	delete
IR	insert with a replace
rR	pending replace IR
R	replace
rI	pending replace I
rN	pending replace N
e	pending insert rung
er	pending replace rung

Rung guidelines

- Rungs are specified using neutral language. See the rest of this chapter for the neutral text language format for the supported instructions.
- Each rung ends with a semicolon (;).

Ladder ROUTINE example

This ladder routine exports as shown below.




```
ROUTINE Ladder_example
       RC: "This is a rung comment for the first rung.";
       N: XIC(input1)XIC(input2)OTE(output1)OTE(output2);
       RC: "This is a rung comment for the second rung.";
       N: XIC(input3)OTE(output3);
END_ROUTINE
```

Entering Branches

You can enter a single branch or simultaneous branches on a rung. A branch follows this structure:

```
[,BranchNeutralText]
```

Where:

Item:	Identifies:
[ ]	the branch
,	the beginning of each branch within the branch, to account for simultaneous branches
space	the end of each branch within the branch, to account for simultaneous branches
BranchNeutralText	the logic

Example with a single branch

```
N: XIC(conveyor_a)[,XIC(input_1) XIO(input_2) ]OTE(light_1);
```

Example with two simultaneous branches

```
N: XIC(conveyor_b)[,XIC(input_1) XIO(input_2) ,XIC(input_a) XIO(input_b)  ]OTE(light_2);
```

Entering Rung Comments

The comments for rungs are similar to those for components except that the syntax is a bit different. The rung comment syntax is:

```
RC: "comment" "more" "etc";
```

A rung comment must be followed by a rung.

Entering Neutral Text for Ladder Instructions

The following tables lists each ladder instruction and its neutral text format. For details about a specific instruction, see one of these manuals:

Instruction Type:	Documents:
Basic, sequential instruction	*Logix5000 Controllers General Instructions Set Reference Manual*, publication 1756-RM003
Process control or drives instruction	*Logix5000 Controllers Process Control and Drives Instruction sSet Reference Manual*, publication 1756-RM006
Motion instruction	*Logix5000 Controllers Motion Instructions Set Reference Manual,* publication 1756-RM007

Instruction:	Neutral text format:
ABL	`ABL(channel,serial_port_control,character_count);`
ABS	`ABS(source,destination);`
ACB	`ACB(channel,serial_port_control,character_count);`
ACL	`ACL(channel,clear_serial_port_read,clear_serial_port_write);`
ACS	`ACS(source,destination);`
ADD	`ADD(source_A,source_B,destination);`
AFI	`AFI();`
AHL	`AHL(channel,ANDMask,ORMask,serial_port_control,channel_status);`
AND	`AND(source_A,source_B,destination);`
ARD	`ARD(channel,destination,serial_port_control,string_length, characters_read);`

Instruction:	Neutral text format:
ARL	ARL(*channel,destination,serial_port_control,string_length, characters_read*);
ASN	ASN(*source,destination*);
ATN	ATN(*source,destination*);
AVE	AVE(*array,dim_to_vary,destination,control,length,position*);
AWA	AWA(*channel,source,serial_port_control,string_length,characters_sent*);
AWT	AWT(*channel,source,serial_port_control,string_length,characters_sent*);
BRK	BRK();
BSL	BSL(*array,control,source_bit,length*);
BSR	BSR(*array,control,source_bit,length*);
BTD	BTD(*source,source_bit,destination,destination_bit,length*);
CLR	CLR(*destination*);
CMP	CMP(*expression*);
CONCAT	CONCAT(*sourceA,sourceB,destination*)
COP	COP(*source,destination,length*);
COS	COS(*source,destination*);
CPS	CPS(*source,destination,length*)
CPT	CPT(*destination,expression*);
CTD	CTD(*counter,preset,accum*);
CTU	CTU(*counter,preset,accum*);
DDT	DDT(*source,reference,result,cmp_control,length,position,result_control, length,position*);
DEG	DEG(*source,destination*);
DELETE	DELETE(*source,quantity,start,destination*);
DIV	DIV(*source_A,source_B,destination*);
DTOS	DTOS(*source,destination*);
DTR	DTR(*source,mask,reference*);
EOT	EOT(*data_bit*);
EQU	EQU(*source_A,source_B*);
EVENT	EVENT(*task*);
FAL	FAL(*control,length,position,mode,destination,expression*);
FBC	FBC(*source,reference,result,cmp_control,length,position,result_control, length,position*);
FFL	FFL(*source,FIFO,control,length,position*);
FFU	FFU(*FIFO,destination,control,length,position*);
FIND	FIND(*source,search,start,result*);
FLL	FLL(*source,destination,length*);
FOR	FOR(*routine_name,index,initial_value,terminal_value,step_size*);

Instruction:	Neutral text format:
FRD	`FRD(source,destination);`
FSC	`FSC(control,length,position,mode,expression);`
GEQ	`GEQ(source_A,source_B);`
GRT	`GRT(source_A,source_B);`
GSV	`GSV(class_name,instance_name,attribute_name,destination);`
INSERT	`INSERT(sourceA,sourceB,start,destination);`
IOT	`IOT(output_tag);`
JMP	`JMP(label_name);`
JSR	`JSR(routine_name,input_1,...input_n,return_1,..return_n);`
JXR	`JXR(external_routine_name,external_routine_control,parameter, return_parameter);`
LBL	`LBL(label_name);`
LEQ	`LEQ(source_A,source_B);`
LES	`LES(source_A,source_B);`
LFL	`LFL(source,LIFO,control,length,position);`
LFU	`LFU(LIFO,destination,control,length,position);`
LIM	`LIM(low_limit,test,high_limit);`
LN	`LN(source,destination);`
LOG	`LOG(source,destination);`
LOWER	`LOWER(source,destination);`
MAAT	`MAAT(axis,motion_control);`
MAFR	`MAFR(axis,motion_control);`
MAG	`MAG(slave_axis,master_axis,motion_control,direction,ratio,slave_counts,master_counts,master_reference,ratio_format,clutch,accel_rate,accel_units);`
MAH	`MAH(axis,motion_control);`
MAHD	`MAHD(axis,motion_control,diagnostic_test,observed_direction);`
MAJ	`MAJ(axis,motion_control,direction,speed,speed_units,accel_rate, accel_units,decel_rate,decel_units,profile,merge,merge_speed);`
MAM	`MAM(axis,motion_control,move_type,position,speed,speed_units,accel_rate, accel_units,decel_rate,decel_units,profile,merge,merge_speed);`
MAOC	`MAOC(axis,execution_target,motion_control,output,input,output_cam, cam_start_position,cam_end_position,output_compensation,execution_mode, execution_schedule,axis_arm_position,cam_arm_position,reference);`
MAPC	`MAPC(slave_axis,master_axis,motion_control,direction,cam_profile, slave_scaling,master_scaling,execution_mode,execution_schedule, master_lock_position,cam_lock_position,master_reference, master_direction);`
MAR	`MAR(axis,motion_control,trigger_condition,windowed_registration, minimum_position,maximum_position);`
MAS	`MAS(axis,motion_control,stop_type,change_decel,decel_rate,decel_units);`
MASD	`MASD(axis,motion_control);`

Instruction:	Neutral text format:
MASR	`MASR(axis,motion_control);`
MATC	`MATC(axis,motion_control,direction,cam_profile,distance_scaling, time_scaling,execution_mode,execution_schedule);`
MAW	`MAW(axis,motion_control,trigger_condition,position);`
MCCD	`MCCD(coordinate_system,motion_control,motion_type,change_speed,speed, speed_units,change_accel,accel_rate,accel_units,change_decel,decel_rate, decel_units,scope);`
MCCM	`MCCM(coordinate_system,motion_control,move_type,position,circle_type, via/center/radius,direction,speed,speed_units,accel_rate,accel_units, decel_rate,decel_units,profile,termination_type,merge,merge_speed);`
MCCP	`MCCP(motion_control,cam,length,start_slope,end_slope,cam_profile);`
MCLM	`MCLM(coordinate_system,motion_control,move_type,position,speed, speed_units,accel_rate,accel_units,decel_rate,decel_units,profile, termination_type,merge,merge_speed);`
MCD	`MCD(axis,motion_control,motion_type,change_speed,speed,change_accel, accel_rate,change_decel,decel_rate,speed_units,accel_units, decel_units);`
MCR	`MCR();`
MCS	`MCS(coordinate_system,motion_control,stop_type,change_decel,decel_rate, decel_units);`
MCSD	`MCSD(coordinate_system,motion_control);`
MCSR	`MCSR(coordinate_system,motion_control);`
MCSV	`MCSV(motion_control,cam_profile,master_value,slave_value,slope_value, slope_derivative);`
MDF	`MDF(axis,motion_control);`
MDO	`MDO(axis,motion_control,drive_output,drive_units);`
MDOC	`MDOC(axis,execution_target,motion_control,disarm_type);`
MDR	`MDR(axis,motion_control);`
MDW	`MDW(axis,motion_control);`
MEQ	`MEQ(source,mask,compare);`
MGS	`MGS(group,motion_control,stop_mode);`
MGSD	`MGSD(group,motion_control);`
MGSP	`MGSP(group,motion_control);`
MGSR	`MGSR(group,motion_control);`
MID	`MID(source,quantity,start,destination);`
MOD	`MOD(source_A,source_B,destination);`
MOV	`MOV(source,destination);`
MRAT	`MRAT(axis,motion_control);`
MRHD	`MRHD(axis,motion_control,diagnostic_test);`
MRP	`MRP(axis,motion_control,type,position_select,position);`
MSF	`MSF(axis,motion_control);`

Instruction:	Neutral text format:
MSG	`MSG(message_control);`
MSO	`MSO(axis,motion_control);`
MUL	`MUL(source_A,source_B,destination);`
MVM	`MVM(source,mask,destination);`
NEG	`NEG(source,destination);`
NEQ	`NEQ(source_A,source_B);`
NOP	`NOP();`
NOT	`NOT(source,destination);`
ONS	`ONS(storage_bit);`
OR	`OR(source_A,source_B,destination);`
OSF	`OSF(storage_bit,output_bit);`
OSR	`OSR(storage_bit,output_bit);`
OTE	`OTE(data_bit);`
OTL	`OTL(data_bit);`
OTU	`OTU(data_bit);`
PID	`PID(PID,process_variable,tieback,control_variable,pid_master_loop, inhold_bit,inhold_value);`
RAD	`RAD(source,destination);`
RES	`RES(structure);`
RET	`RET(return_1,...return_n);`
RTO	`RTO(timer,preset,accum);`
RTOS	`RTOS(source,destination)`
SBR	`SBR(routine_name,input_1,...input_n);`
SFP	`SFP(SFC_routine_name,target_state);`
SFR	`SFR(SFC_routine_name,step_name);`
SIN	`SIN(source,destination);`
SIZE	`SIZE(souce,dimension_to_vary,size);`
SQI	`SQI(array,mask,source,control,length,position);`
SQL	`SQL(array,source,control,length,position);`
SQO	`SQO(array,mask,destination,control,length,position);`
SQR	`SQR(source,destination);`
SRT	`SRT(array,dim_to_vary,control,length,position);`
SSV	`SSV(class_name,instance_name,attribute_name,source);`
STD	`STD(array,dim_to_vary,destination,control,length,position);`
STOD	`STOD(source,destination)`
STOR	`STOR(source,destination)`
SUB	`SUB(source_A,source_B,destination);`

Instruction:	Neutral text format:
SWPB	`SWPB(source,order_mode,destination);`
TAN	`TAN(source,destination);`
TND	`TND();`
TOD	`TOD(source,destination);`
TOF	`TOF(timer,preset,accum);`
TON	`TON(timer,preset,accum);`
TRN	`TRN(source,destination);`
UID	`UID();`
UIE	`UIE();`
UPPER	`UPPER(source,destination);`
XIC	`XIC(data_bit);`
XIO	`XIO(data_bit);`
XOR	`XOR(source_A,source_B,destination);`
XPY	`XPY(source_A,source_B,destination);`

Notes:

Entering Function Block Diagram Logic

Introduction

This chapter explains the how to enter function block diagram logic in a complete import/export file.

For information about:	See page:
Entering a function block diagram routine	5-1
Entering function block diagram logic	5-2
Entering IREFs and OREFs	5-7
Entering ICONs and OCONs	5-9
Entering blocks	5-11
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Entering a Function Block Diagram Routine

A function block FBD_ROUTINE follows this structure:

```
FBD_ROUTINE <routine_name> [Attributes]
       <function block sheets>
END_FBD_ROUTINE
```

Where:

Item:	Identifies:
`routine_name`	the routine
`Attributes`	attributes of the function block routine (such as sheet size or sheet orientation) can also contain a description of the routine separate each attribute with a comma (,)
`function block sheets`	you enter function block logic in sheets

Specifying FBD_ROUTINE attributes

You can specify these attributes for a FBD_ROUTINE:

Attribute:	Description:
`Description`	Provide information about the routine. Specify: `Description := "text"`
`SheetSize`	Select one of these sizes: • Letter (8.5x11in) • Legal (8.5x14in) • Tabloid (11x17.in) • A4 (210x297mm) • A3 (297x420mm) Specify: `SheetSize := size`
`SheetOrientation`	Select the orientation of the sheet as Portrait or Landscape. Specify: `SheetOrientation := type`

Entering Function Block Diagram Logic

You enter function block diagram logic in sheets within a FBD_ROUTINE component in an import/export file. Each sheet follows this structure:

```
(* sheet <sheet_number> *)
SHEET (Name := <sheet_name>)
       <IREF_component>
       <ICON_component>
       <mnemonic_BLOCK_componment>
       <OREF_component>
       <OCON_component>
       <WIRE_component>
       <FEEDBACK_WIRE_component>
END_SHEET
```

Where:

Item:	Identifies:
`Name`	the name of the sheet. Specify: `Name := "text"`
`IREF`	input references see page 5-7
`ICON`	input wire connectors see page 5-9
`mnemonic_BLOCK`	function block instructions and their locations see page 5-11
`OREF`	output references see page 5-7
`OCON`	output wire connectors see page 5-9
`WIRE`	wires and what they are attached to see page 5-10
`FEEDBACK_WIRE`	feedback wires and what they are attached to see page 5-10

SHEET guidelines

- The sheets in the routine appear in order in the export file. Each sheet section contains all the drawing elements and wires for that sheet.
- The sheet number is stored in a comment at the beginning of the sheet for reference only. On import, sheet numbers are assigned based on order in the file, not on the number in the comment.
- The sheet name is stored as an attribute because it is optional.
- Input references, blocks, output references, special drawing elements, and wires are contained within the sheet. On export, the elements appear in the order shown. On import, elements can be interspersed in the file.
- WIRE and FEEDBACK_WIRE statements must appear after all the other components.
- Be careful when copying and pasting function block components within an import/export file. Each component within a sheet must have a unique ID number within that sheet.

FBD_ROUTINE example

```
FBD_ROUTINE My_FBD_Routine (SheetSize := "Tabloid (11x17in)", SheetOrientation := Landscape)
       SHEET  (Name := Input_Scaling)
              MUL_BLOCK  (ID := 0,
                          X := 440,
                          Y := 60,
                          Operand := MUL_01,
                          VisiblePins := "SourceA, SourceB, Dest")
              END_MUL_BLOCK

              SCL_BLOCK  (ID := 1,
                          X := 240,
                          Y := 60,
                          Operand := SCL_01,
                          VisiblePins := "In, InEUMax, Out, MaxAlarm")
              END_SCL_BLOCK

              PI_BLOCK  (ID := 2,
                         X := 260,
                         Y := 260,
                         Operand := PI_01,
                         VisiblePins := "In, Initialize, InitialValue, Out, HighAlarm,
LowAlarm")
              END_PI_BLOCK

              IREF  (ID := 3,
                     X := 120,
                     Y := 120,
                     Operand := Input_Tag)
              END_IREF

              ICON  (ID := 4,
                     X := 160,
                     Y := 320,
                     Name := ConnectorName)
              END_ICON
```

```
OREF  (ID := 5,
       X := 520,
       Y := 320,
       Operand := Output_Tag)
END_OREF

OCON  (ID := 6,
       X := 680,
       Y := 100,
       Name := ConnectorName)
END_OCON

FEEDBACK_WIRE  (FromElementID := 0,
                FromParameter := Dest,
                ToElementID := 0,
                ToParameter := SourceB)
END_FEEDBACK_WIRE

WIRE  (FromElementID := 3,
       FromParameter := "",
       ToElementID := 1,
       ToParameter := In)
END_WIRE

WIRE  (FromElementID := 4,
       FromParameter := "",
       ToElementID := 2,
       ToParameter := In)
END_WIRE

WIRE  (FromElementID := 0,
       FromParameter := Dest,
       ToElementID := 6,
       ToParameter := "")
END_WIRE
```

```
            WIRE  (FromElementID := 1,
                   FromParameter := Out,
                   ToElementID := 0,
                   ToParameter := SourceA)
            END_WIRE

            WIRE  (FromElementID := 2,
                   FromParameter := Out,
                   ToElementID := 5,
                   ToParameter := "")
            END_WIRE

      END_SHEET

END_FBD_ROUTINE
```

Exporting Function Block Logic While Editing Online

If you export function block logic that contains online edits, the export file exports LOGIC blocks to indicate the original, test edits, and pending edits states. If there are no online edits, you will not see these LOGIC blocks. The LOGIC blocks follow this format:

Example 1: Both Test edits and Pending edits exist

```
FBD_ROUTINE MyFbdRoutine (SheetSize := "Letter (8.5x11in)", SheetOrientation := Landscape)
      LOGIC (Online_Edit_Type := Orig)
            (* Sheets inserted here - see format described above *)
      END_LOGIC

      LOGIC (Online_Edit_Type := Test)
            (* Sheets inserted here - see format described above *)
      END_LOGIC

      LOGIC (Online_Edit_Type := Pend)
            (* Sheets inserted here - see format described above *)
      END_LOGIC
END_FBD_ROUTINE
```

Example 2: Only Pending edits exist

```
FBD_ROUTINE MyFbdRoutine (SheetSize := "Letter (8.5x11in)", SheetOrientation := Landscape)
       LOGIC (Online_Edit_Type := Orig)
              (* Sheets inserted here - see format described above *)
       END_LOGIC

       LOGIC (Online_Edit_Type := Pend)
              (* Sheets inserted here - see format described above *)
       END_LOGIC
END_FBD_ROUTINE
```

Where:

Item:	Identifies:
Online_Edit_Type	whether online edits exist when the logic is exported. If online edits exist, there will be a LOGIC block for Online_Edit_Type := Orig and then the appropriate LOGIC block for the existing edits. Online_Edit_Type : = Pend indicates pending edits. Online_Edit_Type := Test indicates test edits. If there are no online edits when the logic is exported, there are no LOGIC blocks and the main components in the routine are SHEET components.

Entering IREFs and OREFs

Input and output references have similar formats and identical attributes. They follow this format:

```
IREF (
       ID := <unique_identifier>
       X := <internal_grid_x_location>,
       Y := <internal_grid_y_location>,
       Operand := <tag_reference>)
END_IREF

OREF (
       ID := <unique_identifier>
       X := <internal_grid_x_location>,
       Y := <internal_grid_y_location>,
       Operand := <tag_reference>)
END_OREF
```

Where:

Item:	Identifies:
ID	the IREF or OREF identifier; uniqueness is important for wiring enter unsigned, 32-bit integer value Specify: ID := "*number*"
X	x-coordinates on internal grid enter unsigned, 32-bit integer value Specify: X := "*number*"
Y	y-coordinates on internal grid enter unsigned, 32-bit integer value Specify: Y := "*number*"
Operand	the reference (optional) enter tag or literal value for IREF; enter tag for OREF Specify: Operand := "*tag*"

IREF and OREF guidelines

- If the Operand is not a qualified tag or literal value, the IREF/OREF will not be verified.
- The X and Y grid locations are a relative position from the upper-left corner of the sheet. X is the horizontal position; Y is the vertical position.

IREF and OREF examples

```
IREF  (ID := 8,
       X := 200,
       Y := 380,
       Operand := PMUL_InitVal)
END_IREF


OREF  (ID := 9,
       X := 480,
       Y := 340,
       Operand := FB_PMUL)
END_OREF
```

Entering ICONs and OCONs

Input and output wire connectors have similar formats and identical attributes. They follow this format:

```
ICON (ID := <unique_identifier>
       X := <internal_grid_x_location>,
       Y := <internal_grid_y_location>,
       Name := <connector_name>)
END_ICON

OCON (ID := <unique_identifier>
       X := <internal_grid_x_location>,
       Y := <internal_grid_y_location>,
       Name := <connector_name>)
END_OCON
```

Where:

Item:	Identifies:
ID	the ICON or OCON identifier; uniqueness is important for wiring enter unsigned, 32-bit integer value Specify: `ID := "number"`
X	x-coordinates on internal grid enter unsigned, 32-bit integer value Specify: `X := "number"`
Y	y-coordinates on internal grid enter unsigned, 32-bit integer value Specify: `Y := "number"`
Name	the name of the wire connector (optional) Specify: `Name := "number"`

ICON and OCON guidelines

- OCON connector names must be unique within a function block routine.
- Multiple ICON connector names can reference the same OCON connector name.
- ICONs and OCONs with unmatched or blank connector names will not be verified.
- The X and Y grid locations are a relative position from the upper-left corner of the sheet. X is the horizontal position; Y is the vertical position.

ICON and OCON examples

```
ICON  (ID := 1,
       X := 140,
       Y := 300,
       Name := MyConnector)
END_ICON

OCON  (ID := 4,
       X := 460,
       Y := 140,
       Name := MyConnector)
END_OCON
```

Entering Wires and Feedback Wires

The wire and feedback wire formats describe a wire by specifying what it is attached to at each end, which is always a pin on another drawing element. Wires and feedback wires follow this format:

```
WIRE
       FromElementID := <indentifier_of_from_element>,
       FromParameter := <name_of_output_pin>,
       ToElementID := <indentifier_of_to_element>,
       ToParameter := <name_of_input_pin>
END_WIRE
```

Where:

Item:	Identifies:
`FromElementID`	the source drawing element enter unsigned, 32-bit integer Specify: `FromElementID := "number"`
`FromParameter`	the pin on the source drawing element **For:** **Enter:** blocks parameter name IREFs In ICONs In Specify: `FromParameter := "pin"`
`ToElementID`	the destination drawing element enter unsigned, 32-bit integer Specify: `ToElementID := "number"`
`ToParameter`	the pin on the destination drawing element **For:** **Enter:** blocks parameter name OREFs Out OCONs Out Specify: `ToParameter := "pin"`

WIRE guidelines

- Wires that are not correctly specified will not be imported.
- A feedback wire follows the same format as a wire. Just connect the source and destination elements to form a feedback.

WIRE example

```
WIRE  (FromElementID := 11,
       FromParameter := "",
       ToElementID := 1,
       ToParameter := Initialize)
END_WIRE
```

Entering Blocks

All function blocks follow this format:

```
mnemonic_BLOCK (
       ID := <unique_identifier>
       X := <internal_grid_x_location>,
       Y := <internal_grid_y_location>,
       Operand := <block_tag_reference>,
       <Array_Name>Operand := <array_tag_reference>,
       VisiblePins := "<parameter_name>, …")
END_mnemonic_BLOCK
```

Where:

Item:	Identifies:
`ID`	the block identifier; uniqueness is important for wiring enter unsigned, 32-bit integer value Specify: `ID := "number"`
`X`	x-coordinates on internal grid enter unsigned, 32-bit integer value Specify: `X := "number"`
`Y`	y-coordinates on internal grid enter unsigned, 32-bit integer value Specify: `Y := "number"`
`Operand`	tag name for the block (optional) Specify: `Operand := "tag_name"`
`ArrayName`	tag name for array (optional) Specify: `ArrayName := "array_name"`
`VisiblePins`	Comma-separated list of the names of all the parameters with pins visible for wiring. The names match the member names of the data type of the block tag. Specify: `VisiblePins := "parameter"`

BLOCK guidelines

- If the Operand is not a qualified tag of the correct data type, the block will not be verified.
- Some function block instructions require specific arrays. This table lists the valid Array Name for each of these instructions:

Instruction:	Array Name:
DEDT	Storage (required)
FGEN	X1 (required) Y1 (required) X2 (optional) Y2 (optional)
MAVE	Storage (required) Weight (optional)
RMPS	RampValue (required) SoakValue (required) SoakTime (required)

- The X and Y grid locations are a relative position from the upper-left corner of the sheet. X is the horizontal position; Y is the vertical position.

Entering Parameters for Function Block Instructions

The following tables lists each function block instruction and its format in the Block component of an import/export file. For details about a specific instruction, see one of these manuals:

Instruction Type:	Documents:
General, sequential instruction	*Logix5000 Controllers General Instructions Set Reference Manual*, publication 1756-RM003
Process control or drives instruction	*Logix5000 Controllers Process Control and Drives Instructions Set Reference Manual*, publication 1756-RM006
Motion instruction	*Logix5000 Controllers Motion Instructions Set Reference Manual,* publication 1756-RM007

Instruction:	Default Operand and VisiblePins formats (components within the Block structure):
ABS	`Operand := ABS_01,` `VisiblePins := "Source, Destination")`
ACS	`Operand := ACS_01,` `VisiblePins := "Source, Destination")`
ADD	`Operand := ADD_01,` `VisiblePins := "SourceA, SourceB, Destination")`
ALM	`Operand := ALM_01,` `VisiblePins := "In, HHAlarm, HAlarm, LAlarm, LLAlarm, ROCPosAlarm, ROCNegAlarm")`
AND	`Operand := AND_01,` `VisiblePins := "SourceA, SourceB, Destination")`
ASN	`Operand := ASN_01,` `VisiblePins := "Source, Destination")`
ATN	`Operand := ATN_01,` `VisiblePins := "Source, Destination")`
BAND	`Operand := BAND_01,` `VisiblePins := "In1, In2, In3, In4, Out")`
BNOT	`Operand := BNOT_01,` `VisiblePins := "In, Out")`
BOR	`Operand := BOR_01,` `VisiblePins := "In1, In2, In3, In4, Out")`
BTDT	`Operand := BTDT_01,` `VisiblePins := "Source, SourceBit, Length, DestBit, Target, Dest")`
BXOR	`Operand := BXOR_01,` `VisiblePins := "In1, In2, Out")`
COS	`Operand := COS_01,` `VisiblePins := "Source, Dest")`
CTUD	`Operand := CTUD_01,` `VisiblePins := "CUEnable, CDEnable, PRE, Reset, ACC, DN")`

Instruction:	Default Operand and VisiblePins formats (components within the Block structure):
D2SD	Operand := D2SD_01, VisiblePins := "*ProgCommand, State0Perm, State1Perm, FB0, FB1, HandFB, ProgProgReq, ProgOperReq, ProgOverrideReq, ProgHandReq, Out, Device0State, Device1State, CommandStatus, FaultAlarm, ModeAlarm, ProgOper, Override, Hand*")
D3SD	Operand := D3SD_01, VisiblePins := "*Prog0Command, Prog1Command, Prog2Command, State0Perm, State1Perm, State2Perm, FB0, FB1, FB2, FB3, HandFB0, HandFB1, HandFB2, ProgProgReq, ProgOperReq, ProgOverrideReq, ProgHandReq, Out0, Out1, Out2, Device0State, Device1State, Device2State, Command0Status, Command1Status, Command2Status, FaultAlarm, ModeAlarm, ProgOper, Override, Hand*")
DEDT	Operand := DEDT_01, VisiblePins := "*In, Out*", Storage := *array_name*)
DEG	Operand := DEG_01, VisiblePins := "*Source, Dest*")
DERV	Operand := DERV_01, VisiblePins := "*In, ByPass, Out*")
DFF	Operand := DFF_01, VisiblePins := "*D, Clear, Clock, Q, QNot*")
DIV	Operand := DIV_01, VisiblePins := "*SourceA, SourceB, Dest*")
ESEL	Operand := ESEL_01, VisiblePins := "*In1, In2, In3, In4, In5, In6, ProgSelector, ProgProgReq, ProgOperReq, ProgOverrideReq, Out, SelectedIn, ProgOper, Override*")
EQU	Operand := EQU_01, VisiblePins := "*SourceA, SourceB*")
FGEN	Operand := FGEN_01, VisiblePins := "*In, Out*", X1 := *array_name*, X2 := *array_name*, Y2 := *array_name*, Y2 := *array_name*)
FRD	Operand := FRD_01, VisiblePins := "*Source, Dest*")
GEQ	Operand := GEQ_01, VisiblePins := "*SourceA, SourceB*")
GRT	Operand := GRT_01, VisiblePins := "*SourceA, SourceB*")
HLL	Operand := HLL_01, VisiblePins := "*In, Out, HighAlarm, LowAlarm*")

Instruction:	Default Operand and VisiblePins formats (components within the Block structure):
HPF	Operand := HPF_01, VisiblePins := "*In, Out*")
INTG	Operand := INTG_01, VisiblePins := "*In, Out*")
JKFF	Operand := JKFF_01, VisiblePins := "*Clear, Clock, Q, QNot*")
LEQ	Operand := LEQ_01, VisiblePins := "*SourceA, SourceB*")
LES	Operand := LES_01, VisiblePins := "*SourceA, SourceB*")
LIM	Operand := LIM_01, VisiblePins := "*LowLlimit, Test, HighLimit*")
LN	Operand := LN_01, VisiblePins := "*Source, Dest*")
LOG	Operand := LOG_01, VisiblePins := "*Source, Dest*")
LPF	Operand := LPF_01, VisiblePins := "*In, Out*")
MAVE	Operand := MAVE_01, VisiblePins := "*In, Out*", Storage := *array_name*, Weight := *array_name*)
MAXC	Operand := MAXC_01, VisiblePins := "*In, Reset, ResetValue, Out*")
MEQ	Operand := MEQ_01, VisiblePins := "*Source, Mask, Compare*")
MINC	Operand := MINC_01, VisiblePins := "*In, Reset, ResetValue, Out*")
MOD	Operand := MOD_01, VisiblePins := "*SourceA, SourceB, Dest*")
MSTD	Operand := MSTD_01, VisiblePins := "*In, SampleEnable, Out*", Storage := *array_name*)
MUL	Operand := MUL_01, VisiblePins := "*SourceA, SourceB, Dest*")
MUX	Operand := MUX_01, VisiblePins := "*In1, In2, In3, In4, In5, In6, In7, In8, Selector, Out*")
MVMT	Operand := MVMT_01, VisiblePins := "*Source, Mask, Target, Dest*")

Instruction:	Default Operand and VisiblePins formats (components within the Block structure):
NEG	Operand := NEG_01, VisiblePins := "*Source, Dest*")
NEQ	Operand := NEQ_01, VisiblePins := "*SourceA, SourceB*")
NOT	Operand := NOT_01, VisiblePins := "*Source, Dest*")
NTCH	Operand := NTCH_01, VisiblePins := "*In, Out*")
OR	Operand := OR_01, VisiblePins := "*SourceA, SourceB, Dest*")
OSFI	Operand := OSFI_01, VisiblePins := "*InputBit, OutputBit*")
OSRI	Operand := OSRI_01, VisiblePins := "*InputBit, OutputBit*")
PI	Operand := PI_01, VisiblePins := "*In, Out*")
PIDE	Operand := PIDE_01, VisiblePins := "*PV, SPProg, SPCascade, RatioProg, CVProg, FF, HandFB, ProgProgReq, ProgOperReq, ProgCasRatReq, ProgAutoReq, ProgManuaReq, ProgOverrideReq, ProgHandReq, CVEU, SP, PVHHAlarm, PVHAlarm, PVLAlarm, PVLLAlarm, PVROCPosAlarm, PVROCNegAlarm, DevHHAlarm, DevHAlarm, DevLAlarm, DevLLAlarm, ProgOper, CasRat, Auto, Manual, Override, Hand*")
PMUL	Operand := PMUL_01, VisiblePins := "*In, Multipler, Out*")
POSP	Operand := POSP_01, VisiblePins := "*SP, Position, OpenedFB, ClosedFB, OpenOut, CloseOut*")
RAD	Operand := RAD_01, VisiblePins := "*Source, Dest*")
RESD	Operand := RESD_01, VisiblePins := "*Set, Reset, Out, OutNot*")
RLIM	Operand := RLIM_01, VisiblePins := "*In, ByPass, Out*")
RMPS	Operand := RMPS_01, VisiblePins := "*PV, CurrentSegProg, OutProg, SoakTimeProg, ProgProgReq, ProgOperReq, ProgAutoReq, ProgManualReq, ProgHoldReq, Out, CurrentSeg, SoakTimeLeft, GuarRampOn, GuarSoakOn, ProgOper, Auto, Manual, Hold*", RampValue := *array_name*, SoakValue := *array_name*, SoakTime := *array_name*)
RTOR	Operand := RTOR_01, VisiblePins := *TimerEnable, PRE, Reset, ACC, DN*")

Instruction:	Default Operand and VisiblePins formats (components within the Block structure):
SCL	Operand := SCL_01, VisiblePins := "*In, Out*")
SCRV	Operand := SCRV_01, VisiblePins := "*In, Out*")
SEL	Operand := SEL_01, VisiblePins := "*In1, In2, SelectorIn, Out*")
SETD	Operand := SETD_01, VisiblePins := "*Set, Reset, Out, OutNot*")
SIN	Operand := SIN_01, VisiblePins := SIN(*source,destination*);
SNEG	Operand := SNEG_01, VisiblePins := "*In, NegateEnable, Out*")
SOC	Operand := SOC_01, VisiblePins := "*In, Out*")
SQR	Operand := SQR_01, VisiblePins := "*Source, Dest*")
SRTP	Operand := SRTP_01, VisiblePins := "*In, HeatOut, CoolOut, HeatTimePercent, CoolTimePercent*")
SSUM	Operand := SSUM_01, VisiblePins := "*In1, Select1, In2, Select2, In3, Select3, In4, Select4, Out*")
SUB	Operand := SUB_01, VisiblePins := "*SourceA, SourceB, Dest*")
TAN	Operand := TAN_01, VisiblePins := "*Source, Dest")*
TOD	Operand := TOD_01, VisiblePins := "*Source, Dest")*
TOFR	Operand := TOFR_01, VisiblePins := "*TimerEnable, PRE, Reset, ACC, DN*")
TONR	Operand := TONR_01, VisiblePins := "*TimerEnable, PRE, Reset, ACC, DN*")
TOT	Operand := TOT_01, VisiblePins := "*In, ProgProgReq, ProgOperReq, ProgStartReq, ProgStopReq, ProgResetReq, Total, OldTotal, ProgOper, RunStop, ProgResetDone, TargetFlag, TargetDev1Flag, TargetDev2Flag*")
TRN	Operand := TRN_01, VisiblePins := "*Source, Dest")*

Instruction:	Default Operand and VisiblePins formats (components within the Block structure):
UPDN	`Operand := UPDN_01,` `VisiblePins := "InPlus, InMinus, Out")`
XOR	`Operand := XOR_01,` `VisiblePins := "SourceA, SourceB, Dest")`
XPY	`Operand := XPY_01,` `VisiblePins := "SourceA, SourceB, Dest")`

Entering Structured Text Logic

Introduction

This chapter explains the how to enter structured text logic in a complete import/export file.

Entering a Structured Text Routine

A structured text ST_ROUTINE follows this structure:

```
ST_ROUTINE <routine_name> [Attributes]

       '<statements>;

END_ST_ROUTINE;
```

Where:

Item:	Identifies:
<routine_name>	the name of the structured text routine
Attributes	attributes of the structured text routine
<statements>	structured text logic every line must begin with a single quote (')

Specifying ST_ROUTINE attributes

You can specify these attributes for a ROUTINE:

Attribute:	Description:
Description	Provide information about the routine. Specify: `Description := "text"`

Entering Structured Text Logic

You enter structured text logic within an ST_ROUTINE component in an import/export file. Each line of structured text must begin with a single quote (').

Structured text is not case sensitive. Structured text can contain:

Term:	Definition:		Examples:
assignment	Use an assignment statement to assign values to tags. The := operator is the assignment operator. Terminate the assignment with a semi colon ";".		`tag := expression;`
expression	An expression is part of a complete assignment or construct statement. An expression evaluates to a number (numerical expression) or to a true or false state (BOOL expression). An expression contains:		
	tags	A named area of the memory where data is stored (BOOL, SINT,INT,DINT, REAL, string).	`value1`
	immediates	A constant value.	`4`
	operators	A symbol or mnemonic that specifies an operation within an expression.	`tag1 + tag2` `tag1 >= value1`
	functions	When executed, a function yields one value. Use parentheses to contain the operand of a function. Functions can only be used in expressions.	`function(tag1)`

instruction	An instruction is a standalone statement.
	An instruction uses parenthesis to contain its operands.
	Depending on the instruction, there can be zero, one, or multiple operands.
	When executed, an instruction yields one or more values that are part of a data structure.
	Terminate the instruction with a semi colon ";".
	
	Instructions cannot be used in expressions.
			`instruction();`
			
			`instruction(operand);`
			
			`instruction(operand1, operand2,operand3);`

construct	A conditional statement used to trigger structured text code (i.e, other statements).
	Terminate the construct with a semi colon ";".
			`IF...THEN`
			`CASE`
			`FOR...DO`
			`WHILE...DO`
			`REPEAT...UNTIL`
			`EXIT`

comment	Text that explains or clarifies what a section of structured text does.
	• Use comments to make it easier to interpret the structured text.
	• Comments do not affect the execution of the structured text.
	• Comments can appear anywhere in structured text.
			`//comment`
			
			`(*start of comment . . . end of comment*)`
			
			`/*start of comment . . . end of comment*/`

For details on these components, see the structured text appendix that is in both the *Logix5000 Controllers General Instructions Reference Manual*, publication 1756-RM003 and in the *Logix5000 Controllers Process Control and Drives Instructions Reference Manual*, publication 1756-RM006.

Structured text ST_ROUTINE example

This is an example of an exported structured text routine.

```
ST_ROUTINE <routine_name>
(*-------------------------------------------------------------------------------------------
----------- Sample of ST code ---------------------------------------------------------------
-------------------------------------------------------------------------------------------*)
              'IF (myInteger = 12) THEN
              '      myInteger := ((5 * myInputInteger1) + (7 * myInteger2)) - 71;
              '             WHILE (myTmpVar >= 0) DO
              '                    myInteger := myInteger + 3;
              '                    myTmpVar := myTmpVar - 1;
              '             END_WHILE;
              'END_IF;
END_ST_ROUTINE
```

Entering Comments

Enclose comments between (* and *) characters. Comments can include carriage returns. You can place comments anywhere in structured text logic. For example:

```
(*-------------------------------------------------------------------------------------------
----------- Example comment -----------------------------------------------------------------
-------------------------------------------------------------------------------------------*)
```

Exporting Structured Text Logic While Editing Online

If you export structured text logic that contains online edits, the export file exports LOGIC blocks to indicate the original, test edits, and pending edits states. If there are no online edits, you will not see these LOGIC blocks. The LOGIC blocks follow this format:

Example 1: Both Test edits and Pending edits exist

```
ST_ROUTINE MySTRoutine
       LOGIC (Online_Edit_Type := Orig)
              (* structured text logic here *)
       END_LOGIC

       LOGIC (Online_Edit_Type := Test)
              (* structured text logic here *)
       END_LOGIC

       LOGIC (Online_Edit_Type := Pend)
              (* structured text logix here *)
       END_LOGIC
END_ST_ROUTINE
```

Example 2: Only Pending edits exist

```
ST_ROUTINE MySTRoutine
       LOGIC (Online_Edit_Type := Orig)
              (* structured text logic here *)
       END_LOGIC

       LOGIC (Online_Edit_Type := Pend)
              (* structured text logic here *)
       END_LOGIC
END_ST_ROUTINE
```

Where:

Item:	Identifies:
`Online_Edit_Type`	whether online edits exist when the logic is exported. If online edits exist, there will be a LOGIC block for Online_Edit_Type := Orig and then the appropriate LOGIC block for the existing edits. Online_Edit_Type : = Pend indicates pending edits. Online_Edit_Type := Test indicates test edits. If there are no online edits when the logic is exported, there are no LOGIC blocks and the main components in the routine are structured text statements.

Entering Structured Text

The following tables lists each structured text instruction and function. For more details, see one of these manuals:

Instruction Type:	Documents:
General, sequential instruction	*Logix5000 Controllers General Instructions Set Reference Manual*, publication 1756-RM003
Process control or drives instruction	*Logix5000 Controllers Process Control and Drives Instructions Set Reference Manual*, publication 1756-RM006
Motion instruction	*Logix5000 Controllers Motion Instructions Set Reference Manual,* publication 1756-RM007

Instruction:	Neutral text format:
ABL	`ABL(Channel,SerialPortControl);`
ABS	`dest := ABS(source);`
ACB	`ACB(Channel,SerialPortControl);`
ACL	`ACL(Channel,ClearSerialPortRead,ClearSerialPortWrite);`
ACOS	`dest := ACOS(source);`
ADD	`dest := sourceA + sourceB;`
AHL	`AHL(Channel,ANDMask,ORMask,SerialPortControl);`
ALM	`ALM(ALM_tag);`
AND	`dest := sourceA & sourceB;` `dest := sourceA AND sourceB;`
ARD	`ARD(Channel,Destination,SerialPortControl);`
ARL	`ARL(Channel,Destination,SerialPortControl);`
ASIN	`dest := ASIN(source);`
ATAN	`dest := ATAN(source);`
AWA	`AWA(Channel,Source,SerialPortControl);`
AWT	`AWT(Channel,Source,SerialPortControl);`

BAND	`IF operandA AND operandB THEN`
	`  <statement>;`
	`ENDIF;`

BNOT	`IF NOT operand THEN`
	`  <statements>;`
	`ENDIF;`

BOR	`IF operandA OR operandB THEN`
	`  <statements>;`
	`ENDIF;`

BTDT	`BTD(BTDT_tag);`

BXOR	`IF operandA XOR operandB THEN`
	`  <statements>;`
	`ENDIF;`

Instruction:	Neutral text format:
CASE...OF	CASE *numeric_expression* OF *selector1*: *statement*; *selectorN*: *statement*; ELSE *statement*; END_CASE;
CLR	*dest* := 0;
CONCAT	CONCAT(*SourceA,SourceB,Dest*)
COP	COP(*Source,Dest,Length*);
COS	*dest* := COS(*source*);
CPS	CPS(*Source,Dest,Length*)
CTUD	CTUD(*CTUD_tag*);
D2SD	D2SD(*D2SD_tag*);
D3SD	D3SD(*D3SD_tag*);
DEDT	DEDT(*DEDT_tag,storage*);
DEG	*dest* := DEG(*source*);
DELETE	DELETE(*Source,Qty,Start,Dest*);
DERV	DERV(*DERV_tag*);
DFF	DFF(*DFF_tag*);
DIV	dest := *sourceA / sourceB*;
DTOS	DTOS(*Source,Dest*);
EOT	EOT(*DataBit*);

EQU	IF *sourceA* = source*B* THEN
	<*statements*>;
	ENDIF;

ESEL	ESEL(*ESEL_tag*);
EVENT	EVENT(*task*);
FGEN	FGEN(*FGEN_tag,X1,Y1,X2,Y2*);
FIND	FIND(*Source,Search,Start,Result*)
FOR...DO	FOR *count*:= *initial_value* TO *final_value* BY *increment* DO <*statement*>; END_FOR;

GEQ	IF *sourceA* >= source*B* THEN
	<*statements*>;
	ENDIF;

GRT	IF *sourceA* > source*B* THEN
	<*statements*>;
	ENDIF;

GSV	GSV(*ClassName,InstanceName,AttributeName,Dest*);

Instruction:	Neutral text format:
HLL	`HLL(HLL_tag);`
HPF	`HPF(HPF_tag);`

IF...THEN	`IF bool_expression THEN`
	`  <statement>;`
	`END_IF;`

INSERT	`INSERT(SourceA,SourceB,Start,Dest);`
INTG	`INTG(INTG_tag);`
IOT	`IOT(output_tag);`
JKFF	`JKFF(JKFF_tag);`
JSR	`JSR(RoutineName,InputCount,InputPar,ReturnPar);`
LDL2	`LDL2(LDL2_tag);`
LDLG	`LDLG(LDLG_tag);`

LEQ	`IF sourceA <= sourceB THEN`
	`  <statements>;`
	`ENDIF;`

LES	`IF sourceA < sourceB THEN`
	`  <statements>;`
	`ENDIF;`

LN	`dest := LN(source);`
LOG	`dest := LOG(source);`
LOWER	`LOWER(Source,Dest);`
LPF	`LPF(LPF_tag);`
MAAT	`MAAT(Axis,MotionControl);`
MAFR	`MAFR(Axis,MotionControl);`
MAG	`MAG(SlaveAxis,MasterAxis,MotionControl,Direction,Ratio,SlaveCounts,` `MasterCounts,MasterReference,RatioFormat,Clutch,AccelRate,AccelUnits);`
MAH	`MAH(Axis,MotionControl);`
MAHD	`MAHD(Axis,MotionControl,DiagnosticTest,ObservedDirection);`
MAJ	`MAJ(Axis,MotionControl,Direction,Speed,SpeedUnits,AccelRate,AccelUnits,` `DecelRate,DecelUnits,Profile,Merge,MergeSpeed);`
MAM	`MAM(Axis,MotionControl,MoveType,Position,Speed,SpeedUnits,AccelRate,` `AccelUnits,DecelRate,DecelUnits,Profile,Merge,MergeSpeed);`

MAOC	`MAOC(Axis,ExecutionTarget,MotionControl,Output,Input,OutputCam,`
	`CamStartPosition,CamEndPosition,OutputCompensation,ExecutionMode,`
	`ExecutionSchedule,AxisArmPosition,CamArmPosition,Reference);`

MAPC	`MAPC(SlaveAxis,MasterAxis,MotionControl,Direction,CamProfile,`
	`SlaveScaling,MasterScaling,ExecutionMode,ExecutionSchedule,`
	`MasterLockPosition,CamLockPosition,MasterReference,MasterDirection);`

MAR	`MAR(Axis,MotionControl,TriggerCondition,WindowedRegistration,` `MinimumPosition,MaximumPosition);`
MAS	`MAS(Axis,MotionControl,StopType,ChangeDecel,DecelRate,DecelUnits);`

Instruction:	Neutral text format:
MASD	`MASD(Axis,MotionControl);`
MASR	`MASR(Axis,MotionControl);`
MATC	`MATC(Axis,MotionControl,Direction,CamProfile,DistanceScaling, TimeScaling,ExecutionMode,ExecutionSchedule);`
MAVE	`MAVE(MAVE_tag,storage,weight);`
MAW	`MAW(Axis,MotionControl,TriggerCondition,Position);`
MAXC	`MAXC(MAXC_tag);`
MCCD	`MCCD(Coordinate_system,MotionControl,MotionType,ChangeSpeed,Speed, SpeedUnits,ChangeAccel,AccelRate,AccelUnits,ChangeDecel,DecelRate, DecelUnits,Scope);`
MCCM	`MCCM(CoordinateSystem,MotionControl,MoveType,Position,CircleType, Via/Center/Radius,Direction,Speed,SpeedUnits,AccelRate,AccelUnits, DecelRate,DecelUnits,Profile,TerminationType,Merge,MergeSpeed);`
MCCP	`MCCP(MotionControl,Cam,Length,StartSlope,EndSlope,CamProfile);`
MCD	`MCD(Axis,MotionControl,MotionType,ChangeSpeed,Speed,ChangeAccel, AccelRate,ChangeDecel,DecelRate,SpeedUnits,AccelUnits,DecelUnits);`
MCLM	`MCLM(CoordinateSystem,MotionControl,MoveType,Position,Speed,SpeedUnits, AccelRate,AccelUnits,DecelRate,DecelUnits,Profile,TerminationType,Merge, MergeSpeed);`
MCS	`MCS(CoordinateSystem,MotionControl,StopType,ChangeDecel,DecelRate, DecelUnits);`
MCSD	`MCSD(CoordinateSystem,MotionControl);`
MCSR	`MCSR(CoordinateSystem,MotionControl);`
MCSV	`MCSV(MotionControl,CamProfile,MasterValue,SlaveValue,SlopeValue, SlopeDerivative);`
MDF	`MDF(Axis,MotionControl);`
MDO	`MDO(Axis,MotionControl,DriveOutput,DriveUnits);`
MDOC	`MDOC(Axis,ExecutionTarget,MotionControl,DisarmType);`
MDR	`MDR(Axis,MotionControl);`
MDW	`MDW(Axis,MotionControl);`

MEQ	`IF (Source AND Mask) = (Compare AND Mask) THEN`
	`<statements>;`
	`END_IF;`

MGS	`MGS(Group,MotionControl,StopMode);`
MGSD	`MGSD(Group,MotionControl);`
MGSP	`MGSP(Group,MotionControl);`
MGSR	`MGSR(Group,MotionControl);`
MID	`MID(Source,Qty,Start,Dest);`
MINC	`MINC(MINC_tag);`
MOD	`dest := sourceA MOD sourceB;`
MRAT	`MRAT(Axis,MotionControl);`

Instruction:	Neutral text format:
MRHD	`MRHD(Axis,MotionControl,DiagnosticTest);`
MRP	`MRP(Axis,MotionControl,Type,PositionSelect,Position);`
MSF	`MSF(Axis,MotionControl);`
MSG	`MSG(MessageControl);`
MSO	`MSO(Axis,MotionControl);`
MUL	`dest := sourceA * sourceB;`
MVMT	`MVMT(MVMT_tag);`
NEG	`dest := -source;`

NEQ	`IF sourceA <> sourceB THEN`
	`  <statements>;`
	`END_IF;`

NOT	`IF NOT source THEN`
	`  <statements>;`
	`END_IF;`

OR	`dest := sourceA OR sourceB`
OSFI	`OSFI(OSFI_tag);`
OSRI	`OSRI(OSRI_tag);`
OTE	`data_bit [:=] BOOL_expression;`

OTL	`IF BOOL_expression THEN`
	`  data_bit := 1;`
	`END_IF;`

OTU	`IF BOOL_expression THEN`
	`  data_bit := 0;`
	`END_IF;`

PI	`PI(PI_tag);`
PID	`PID(PID,ProcessVariable,Tieback,ControlVariable,PIDMasterLoop,InholdBit,InholdValue);`
PIDE	`PIDE(PIDE_tag);`
PMUL	`PMUL(PMUL_tag);`
POSP	`POSP(POSP_tag);`
RAD	`dest := RAD(source);`

REPEAT...UNTIL	`REPEAT`
	`  <statement>;`
	`UNTIL bool_expression`
	`END_REPEAT;`

RESD	`RESD(RESD_tag);`
RET	`RET(ReturnPar);`
RLIM	`RLIM(RLIM_tag);`
RMPS	`RMPS(RMPS_tag,RampValue,SoakValue,SoakTime);`
RTOR	`RTOR(RTOR_tag);`

Instruction:	Neutral text format:
RTOS	`RTOS(Source,Dest)`
SBR	`SBR(InputPar);`
SCRV	`SCRV(SCRV_tag);`
SETD	`SETD(SETD_tag);`
SFP	`SFP(SFCRoutineName,TargetState);`
SFR	`SFR(SFCRoutineName,StepName);`
SIN	`dest := SIN(source);`
SIZE	`SIZE(Souce,Dimensiontovary,Size);`
SNEG	`SNEG(SNEG_tag);`
SOC	`SOC(SOC_tag);`
SQRT	`dest := SQRT(source);`
SRT	`SRT(Array,Dimtovary,Control);`
SRTP	`SRTP(SRTP_tag);`
SSUM	`SSUM(SSUM_tag);`
SSV	`SSV(ClassName,InstanceName,AttributeName,Source);`
STOD	`STOD(Source,Dest)`
STOR	`STOR(Source,Dest)`
SUB	`dest := sourceA - sourceB;`
SWPB	`SWPB(Source,OrderMode,Dest);`
TAN	`dest := TAN(source);`
TOFR	`TOFR(TOFR_tag);`
TONR	`TONR(TONR_tag);`
TOT	`TOT(TOT_tag);`
TRUNC	`dest := TRUNC(source);`
UID	`UID();`
UIE	`UIE();`
UPDN	`UPDN(UPDN_tag);`
UPPER	`UPPER(Source,Destination);`

WHILE...DO	`WHILE bool_expression DO`
	`  <statement>;`
	`END_WHILE;`

XIC	`IF data_bit THEN`
	`  <statement>;`
	`END_IF;`

Instruction:	Neutral text format:

XIO	`IF NOT data_bit THEN`
	`  <statement>;`
	`END_IF;`

XOR	`dest := sourceA XOR sourceB;`
XPY	`dest := sourceX XPY sourceY;`

Notes:

Entering Sequential Function Chart Logic

Introduction

This chapter explains how to enter sequential function chart logic in a complete import/export file.

For more information on creating SFCs and correct syntax, see the *Logix5000 Controller Common Procedures Programming Manual*, publication 1756-PM001.

Entering a Sequential Function Chart Routine

You enter sequential function chart logic in an SFC_ROUTINE component in an import/export file. Each routine follows this structure:

```
SFC_ROUTINE <routine_name> [Attributes]
       <STEP_component>
       <TRANSITION_componment>
       <SBR_RET_component>
       <STOP_component>
       <BRANCH_component>
       <DIRECTED_LINK_component>
       <TEXT_BOX_component)
       <ATTACHMENT_component>
END_SFC_ROUTINE
```

Where:

Item:	Identifies:
routine_name	the name of the SFC routine.
Attributes	attributes of the SFC routine see page 7-3
STEP_component	SFC step block, contains actions see page 7-11
TRANSITION_component	SFC transition block see page 7-15
SBR_RET_component	subroutine call see page 7-17
STOP_component	SFC stop block see page 7-18
BRANCH_component	SFC branch see page 7-19
DIRECTED_LINK_component	SFC directed link see page 7-21
TEXT_BOX_component	SFC text box see page 7-22
ATTACHMENT_component	SFC attachment see page 7-23

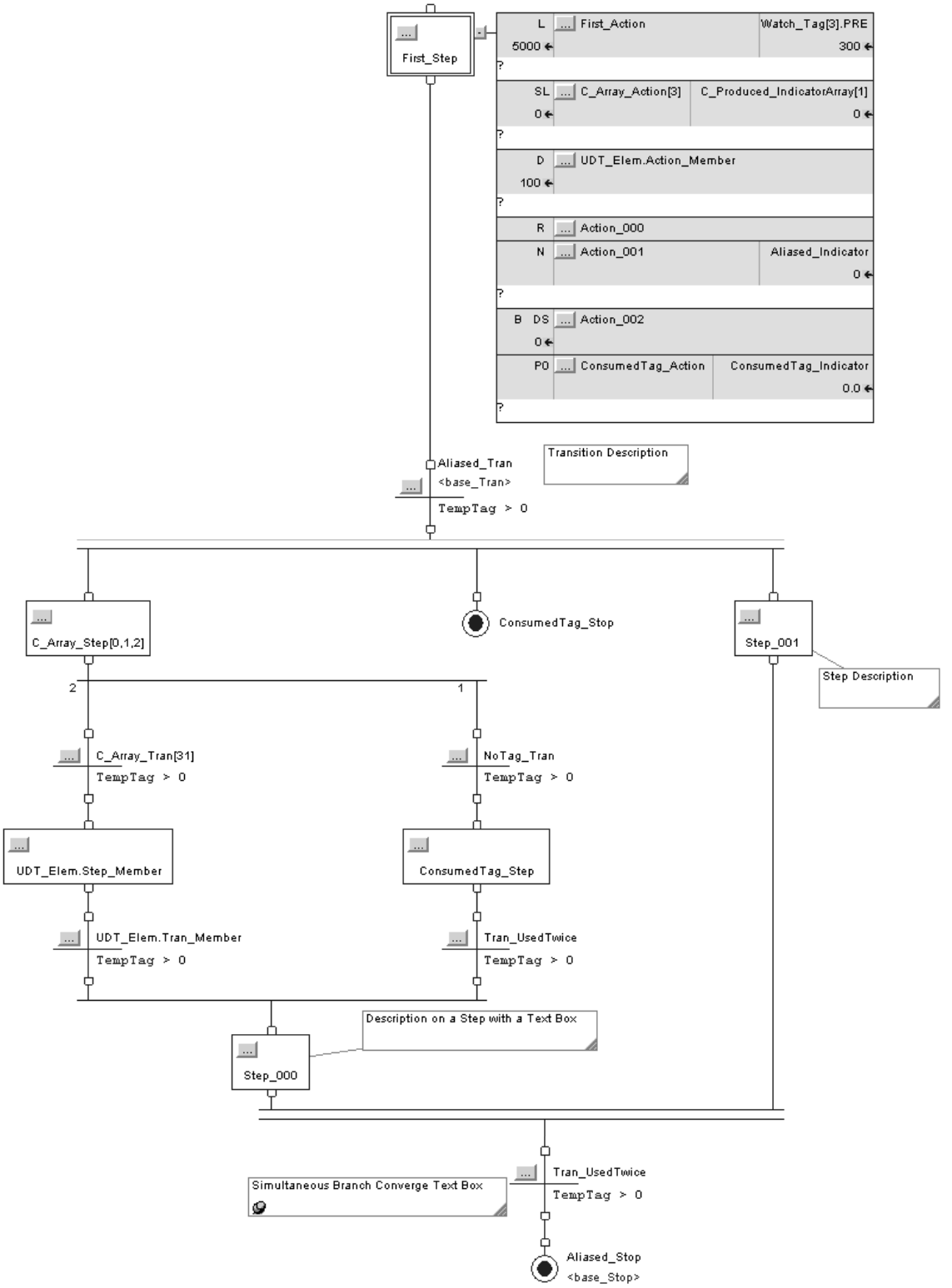
Specifying SFC_ROUTINE attributes

Where:

Item:	Identifies:
`Description`	Provide information about the routine. Specify: `Description := "text"`
`SheetSize`	the size of the SFC. Select one of these options: • Letter (8.5x11in) • Legal (8.5x14in) • Tabloid (11x17in) • A4 (210x297mm) • A3 (297x420mm) Specify: `SheetSize := option`
`SheetOrientation`	the orientation of the SFC sheet. Select Portrait or Landscape. Specify: `SheetOrientation := option`
`StepName`	the prefix for the name of the step blocks within this SFC routine. RSLogix 5000 software uses this prefix when it automatically generates an SFC_STEP tag. Specify: `StepName := name`
`TransitionName`	the prefix for the name of the transition blocks with this SFC routine. RSLogix 5000 software uses this prefix when it automatically generates a transition tag. Specify: `TransitionName := name`
`ActionName`	the prefix for the name of the action blocks in this SFC routine. RSLogix 5000 software uses this prefix when it automatically generates an SFC_ACTION tag. Specify: `ActionName := name`
`StopName`	the prefix for the name of the stop blocks in this SFC routine. RSLogix 5000 software uses this prefix when it automatically generates an SFC_STOP tag. Specify: `StopName := name`

SFC_ROUTINE example

This SFC routine:



exports to this:

```
SFC_ROUTINE Sample_SFC_Routine1 (SheetSize := "Letter (8.5x11in)",
                                 SheetOrientation := Landscape, StepName := "Step",
                                 TransitionName := "Tran", ActionName := "Action",
                                 StopName := "Stop")
        TRANSITION  (ID := 0, X := 120, Y := 1000, Operand := C_Array_Tran[31],
                       HideDescription := Yes, DescriptionX := 155, DescriptionY := 985,
                       DescriptionWidth := 0)
                CONDITION  (LanguageType := ST)
                       'TempTag > 0
                END_CONDITION
        END_TRANSITION
        BRANCH  (ID := 2, Y := 820, BranchType := Simultaneous, BranchFlow := Diverge)
                LEG  (ID := 3)
                END_LEG
                LEG  (ID := 4)
                END_LEG
                LEG  (ID := 5)
                END_LEG
        END_BRANCH
        TRANSITION  (ID := 6, X := 420, Y := 760, Operand := Aliased_Tran,
                       HideDescription := No, DescriptionX := 520, DescriptionY := 740,
                       DescriptionWidth := 0)
                CONDITION  (LanguageType := ST)
                       'TempTag > 0
                END_CONDITION
        END_TRANSITION
        STOP  (ID := 8, X := 460, Y := 880, Operand := ConsumedTag_Stop,
                HideDescription := Yes, DescriptionX := 565, DescriptionY := 865,
                DescriptionWidth := 0)
        END_STOP
        TRANSITION  (ID := 10, X := 520, Y := 1360, Operand := Tran_UsedTwice,
                       HideDescription := Yes, DescriptionX := 555, DescriptionY := 1345,
                       DescriptionWidth := 0)
                CONDITION  (LanguageType := ST)
                       'TempTag > 0
                END_CONDITION
        END_TRANSITION
        TRANSITION  (ID := 12, X := 460, Y := 1160, Operand := Tran_UsedTwice,
                       HideDescription := Yes, DescriptionX := 495, DescriptionY := 1145,
                       DescriptionWidth := 0)
                CONDITION  (LanguageType := ST)
                       'TempTag > 0
                END_CONDITION
        END_TRANSITION
```

```
BRANCH  (ID := 14, Y := 940, BranchType := Selection, BranchFlow := Diverge,
        Priority := UserDefined)
        LEG  (ID := 15)
        END_LEG
        LEG  (ID := 16)
        END_LEG
END_BRANCH
BRANCH  (ID := 17, Y := 1320, BranchType := Simultaneous, BranchFlow := Converge)
        LEG  (ID := 18)
        END_LEG
        LEG  (ID := 19)
        END_LEG
END_BRANCH
STOP  (ID := 20, X := 520, Y := 1440, Operand := Aliased_Stop, HideDescription := No,
        DescriptionX := 400, DescriptionY := 1480, DescriptionWidth := 0)
END_STOP
STEP  (ID := 22, X := 420, Y := 360, Operand := First_Step, HideDescription := Yes,
        DescriptionX := 478, DescriptionY := 345, DescriptionWidth := 0,
        InitialStep := Yes, PresetUsesExpression := No, LimitHighUsesExpression := No,
        LimitLowUsesExpression := No, ShowActions := Yes)
        ACTION  (ID := 24, Operand := First_Action, Qualifier := L, IsBoolean := No,
                PresetUsesExpression := No, IndicatorTag := Watch_Tag[3].PRE)
                BODY  (LanguageType := ST)
                        '
                END_BODY
        END_ACTION
        ACTION  (ID := 25, Operand := C_Array_Action[3], Qualifier := SL,
                IsBoolean := No, PresetUsesExpression := No,
                IndicatorTag := C_Produced_IndicatorArray[1])
                BODY  (LanguageType := ST)
                        '
                END_BODY
        END_ACTION
        ACTION  (ID := 26, Operand := UDT_Elem.Action_Member, Qualifier := D,
                IsBoolean := No, PresetUsesExpression := No, IndicatorTag := "")
                BODY  (LanguageType := ST)
                        '
                END_BODY
        END_ACTION
        ACTION  (ID := 27, Operand := Action_000, Qualifier := R, IsBoolean := No,
                PresetUsesExpression := No, IndicatorTag := "")
                BODY  (LanguageType := ST)
                        '
                END_BODY
        END_ACTION
```

```
        ACTION  (ID := 28, Operand := Action_001, Qualifier := N, IsBoolean := No,
                PresetUsesExpression := No, IndicatorTag := Aliased_Indicator)
                BODY  (LanguageType := ST)
                        '
                END_BODY
        END_ACTION
        ACTION  (ID := 29, Operand := Action_002, Qualifier := DS, IsBoolean := Yes,
                PresetUsesExpression := No, IndicatorTag := "")
        END_ACTION
        ACTION  (ID := 30, Operand := ConsumedTag_Action, Qualifier := P0,
                IsBoolean := No, PresetUsesExpression := No,
                IndicatorTag := ConsumedTag_Indicator)
                BODY  (LanguageType := ST)
                        '
                END_BODY
        END_ACTION
END_STEP
STEP  (ID := 31, X := 120, Y := 880, Operand := "C_Array_Step[0,1,2]",
        HideDescription := Yes, DescriptionX := 179, DescriptionY := 865,
        DescriptionWidth := 0, InitialStep := No, PresetUsesExpression := No,
        LimitHighUsesExpression := No, LimitLowUsesExpression := No, ShowActions := Yes)
END_STEP
TRANSITION  (ID := 33, X := 460, Y := 1000, Operand := NoTag_Tran,
                HideDescription := Yes, DescriptionX := 495, DescriptionY := 985,
                DescriptionWidth := 0)
        CONDITION  (LanguageType := ST)
                'TempTag > 0
        END_CONDITION
END_TRANSITION
STEP  (ID := 35, X := 120, Y := 1080, Operand := UDT_Elem.Step_Member,
        HideDescription := Yes, DescriptionX := 199, DescriptionY := 1065,
        DescriptionWidth := 0, InitialStep := No, PresetUsesExpression := No,
        LimitHighUsesExpression := No, LimitLowUsesExpression := No, ShowActions := Yes)
END_STEP
STEP  (ID := 37, X := 720, Y := 880, Operand := Step_001, HideDescription := No,
        DescriptionX := 760, DescriptionY := 940, DescriptionWidth := 0,
        InitialStep := No, PresetUsesExpression := No, LimitHighUsesExpression := No,
        LimitLowUsesExpression := No, ShowActions := Yes)
END_STEP
BRANCH  (ID := 39, Y := 1220, BranchType := Selection, BranchFlow := Converge)
        LEG  (ID := 40)
        END_LEG
        LEG  (ID := 41)
        END_LEG
END_BRANCH
```

```
STEP  (ID := 42, X := 280, Y := 1260, Operand := Step_000, HideDescription := No,
       DescriptionX := 360, DescriptionY := 1240, DescriptionWidth := 0,
       InitialStep := No, PresetUsesExpression := No, LimitHighUsesExpression := No,
       LimitLowUsesExpression := No, ShowActions := Yes)
END_STEP
STEP  (ID := 44, X := 460, Y := 1080, Operand := ConsumedTag_Step,
       HideDescription := Yes, DescriptionX := 514, DescriptionY := 1065,
       DescriptionWidth := 0, InitialStep := No, PresetUsesExpression := No,
       LimitHighUsesExpression := No, LimitLowUsesExpression := No, ShowActions := Yes)
END_STEP
TRANSITION  (ID := 46, X := 120, Y := 1160, Operand := UDT_Elem.Tran_Member,
              HideDescription := Yes, DescriptionX := 155, DescriptionY := 1145,
              DescriptionWidth := 0)
       CONDITION  (LanguageType := ST)
              'TempTag > 0
       END_CONDITION
END_TRANSITION
DIRECTED_LINK  (FromElementID := 46, ToElementID := 41, ShowLink := True)
END_DIRECTED_LINK
DIRECTED_LINK  (FromElementID := 15, ToElementID := 33, ShowLink := True)
END_DIRECTED_LINK
DIRECTED_LINK  (FromElementID := 35, TToElementID := 46, ShowLink := True)
END_DIRECTED_LINK
DIRECTED_LINK  (FromElementID := 3, ToElementID := 37, ShowLink := True)
END_DIRECTED_LINK
DIRECTED_LINK  (FromElementID := 5, ToElementID := 31, ShowLink := True)
END_DIRECTED_LINK
DIRECTED_LINK  (FromElementID := 6, ToElementID := 2, ShowLink := True)
END_DIRECTED_LINK
DIRECTED_LINK  (FromElementID := 22, ToElementID := 6, ShowLink := True)
END_DIRECTED_LINK
DIRECTED_LINK  (FromElementID := 16, ToElementID := 0, ShowLink := True)
END_DIRECTED_LINK
DIRECTED_LINK  (FromElementID := 44, ToElementID := 12, ShowLink := True)
END_DIRECTED_LINK
DIRECTED_LINK  (FromElementID := 33, ToElementID := 44, ShowLink := True)
END_DIRECTED_LINK
DIRECTED_LINK  (FromElementID := 17, ToElementID := 10, ShowLink := True)
END_DIRECTED_LINK
DIRECTED_LINK  (FromElementID := 42, ToElementID := 19, ShowLink := True)
END_DIRECTED_LINK
DIRECTED_LINK  (FromElementID := 37, ToElementID := 18, ShowLink := True)
END_DIRECTED_LINK
DIRECTED_LINK  (FromElementID := 4, ToElementID := 8, ShowLink := True)
END_DIRECTED_LINK
```

```
        DIRECTED_LINK  (FromElementID := 39, ToElementID := 42, ShowLink := True)
        END_DIRECTED_LINK
        DIRECTED_LINK  (FromElementID := 10, ToElementID := 20, ShowLink := True)
        END_DIRECTED_LINK
        DIRECTED_LINK  (FromElementID := 0, ToElementID := 35, ShowLink := True)
        END_DIRECTED_LINK
        DIRECTED_LINK  (FromElementID := 31, ToElementID := 14, ShowLink := True)
        END_DIRECTED_LINK
        DIRECTED_LINK  (FromElementID := 12, ToElementID := 40, ShowLink := True)
        END_DIRECTED_LINK
        TEXT_BOX  (ID := 48, X := 260, Y := 1380, Width := 0,
                       Text := "Simultaneous Branch Converge Text Box")
        END_TEXT_BOX
        ATTACHMENT  (FromElementID := 48, ToElementID := 17)
        END_ATTACHMENT
END_SFC_ROUTINE
```

Exporting Sequentical Function Chart Logic While Editing Online

If you export sequential function chart logic that contains online edits, the export file exports LOGIC blocks to indicate the original, test edits, and pending edits states. If there are no online edits, you will not see these LOGIC blocks. The LOGIC blocks follow this format:

Example 1: Both Test edits and Pending edits exist

```
SFC_ROUTINE MySFCRoutine (SheetSize := "Letter (8.5x11in)",
                          SheetOrientation := Landscape, StepName := "Step",
                          TransitionName := "Tran", ActionName := "Action",
                          StopName := "Stop")
       LOGIC (Online_Edit_Type := Orig)
              (* SFC logic here *)
       END_LOGIC

       LOGIC (Online_Edit_Type := Test)
              (* SFC logic here *)
       END_LOGIC

       LOGIC (Online_Edit_Type := Pend)
              (* SFC logic here *)
       END_LOGIC
END_SFC_ROUTINE
```

Example 2: Only Pending edits exist

```
SFC_ROUTINE MySFCRoutine (SheetSize := "Letter (8.5x11in)",
                          SheetOrientation := Landscape, StepName := "Step",
                          TransitionName := "Tran", ActionName := "Action",
                          StopName := "Stop")
       LOGIC (Online_Edit_Type := Orig)
              (* SFC logic here *)
       END_LOGIC

       LOGIC (Online_Edit_Type := Pend)
              (* SFC logic here *)
       END_LOGIC
END_SFC_ROUTINE
```

Where:

Item:	Identifies:
`Online_Edit_Type`	whether online edits exist when the logic is exported. If online edits exist, there will be a LOGIC block for Online_Edit_Type := Orig and then the appropriate LOGIC block for the existing edits. Online_Edit_Type : = Pend indicates pending edits. Online_Edit_Type := Test indicates test edits. If there are no online edits when the logic is exported, there are no LOGIC blocks and the main components in the routine are SFC logic components.

Entering Steps

Steps follow this format:

```
STEP (
       ID := <unique_identifier>,
       X := <internal_grid_x_location>,
       Y := <internal_grid_y_location>,
       Operand := <tag_reference>,
       HideDescription := <yes|no>
       DescriptionX := <numerical_value>,
       DescriptionY := <numerical_value>,
       DescriptionWidth := <numerical_value>,
       InitialStep := <yes|no>,
       PresetUsesExpression := <yes|no>,
       LimitHighUsesExpression := <yes|no>,
       LimitLowUsesExpression := <yes|no>,
       ShowActions := <yes|no>)
       <PRESET_block>
       <LIMIT_HIGH_block>
       <LIMIT_LOW_block>
       <ACTION_LIST_block>
END_STEP
```

Where:

Item:	Identifies:
ID	the step identifier. This ID uniquely identifies this step from all other blocks. Enter an unsigned, 32-bit integer value. Specify: `ID := number`
X	x-coordinate on internal grid. Enter an unsigned, 32-bit integer value. Specify: `X := number`
Y	y-coordinate on internal grid. Enter an unsigned, 32-bit integer value. Specify: `Y := number`
Operand	the step tag. Enter a tag of datatype SFC_STEP. The import process uses this tag name to name the step. Specify: `Operand := tag`
HideDescription	whether or not to hide the step description. Enter Yes or No. Specify: `HideDescription := text`
DescriptionX	x-coordinate on internal grid of the description box. Enter an unsigned, 32-bit integer value. Specify: `DescriptionX := number`
DescriptionY	y-coordinate on internal grid of the description box. Enter unsigned, 32-bit integer value. Specify: `DescriptionY := number`
DescriptionWidth	this attribute is not currently used; it is there for future use. Enter 0. Specify: `DescriptionWidth := 0`

Item:	Identifies:
`InitialStep`	whether this step is the initial step of the routine. Enter Yes or No. If you have multiple steps identified as the initial step (this is incorrect syntax), the import process designates the last initial step it encounters as the initial step and removes the initial step indicators from any other steps. Specify: `InitialStep := text`
`PresetUsesExpression`	whether the preset for the step timer is a structured text expression. Enter Yes if you plan to enter an expression in a PRESET block, otherwise, enter No. Specify: `PresetUsesExpression := text`
`LimitHighUsesExpression`	whether the preset for the limit high alarm is a structured text expression. Enter Yes if you plan to enter an expression in a LIMIT_HIGH block, otherwise, enter No. Specify: `LimitHighUsesExpression := text`
`LimitLowUsesExpression`	whether the preset for the limit low alarm is a structured text expression. Enter Yes if you plan to enter an expression in a LIMIT_LOW block, otherwise, enter No. Specify: `LimitLowUsesExpression := text`
`ShowActions`	whether to show or hide the step's actions. Enter Yes or No. Specify: `ShowActions := text`
`PRESET_block`	a structured text expression that specifies the preset time in milliseconds for the step timer. If the PresetUsesExpression attribute (above) is Yes, enter a PRESET block. see page 7-12
`LIMIT_HIGH_block`	a structured text expression that specifies the preset time in milliseconds for a limit high alarm. If the LimitHighUsesExpression attribute (above) is Yes, enter a LIMIT_HIGH block. see page 7-13
`LIMIT_LOW_block`	a structured text expression that specifies the preset time in milliseconds for a limit low alarm. If the LimitLowUsesExpression attribute (above) is Yes, enter a LIMIT_LOW block. see page 7-13
`ACTION_LIST_block`	the actions in the step. see page 7-13

Entering the PRESET block

The preset block contains a structured text expression that specifies the preset time in milliseconds for the step timer. Each line of structured text begins with a single quote (').

```
PRESET (LanguageType := ST)
       '<structured_text>
END_PRESET
```

Entering the LIMIT_HIGH block

The limit high block contains a structured text expression that specifies the preset time in milliseconds for a limit high alarm. Each line of structured text begins with a single quote (').

```
LIMITHIGH (LanguageType := ST)
       '<structured_text>
END_LIMITHIGH
```

Entering the LIMIT_LOW block

The limit low block contains a structured text expression that specifies the preset time in milliseconds for a limit low alarm. Each line of structured text begins with a single quote (').

```
LIMITLOW (LanguageType := ST)
       '<structured_text>
END_LIMITLOW
```

Entering the ACTION_LIST block

Each step can contain multiple actions. Each action follows this format:

```
ACTION (
       ID := <unique_identifier>,
       Operand := <tag_reference>,
       Qualifier := <character(s)>,
       IsBoolean := <yes|no>,
       PresetUsesExpression := <yes|no>,
       IndicatorTag := <tag_reference>)
       <PRESET_block>
       <BODY_block>
END_ACTION
```

Where:

Item:	Identifies:
`ID`	the action identifier. This ID uniquely identifies this action from all other blocks. Enter an unsigned, 32-bit integer value. Specify: `ID := number`
`Operand`	the action tag. Enter a tag of datatype SFC_ACTION. The import process uses this tag name to name the action. Specify: `Operand := tag`
`Qualifier`	the action qualifier. Enter one of these character(s): **Character(s):** **Description:** N non-stored R reset S stored L time limited D time delayed P pulse P1 pulse (rising edge) P0 pulse (falling edge) SL stored and time limited SD stored and time delayed DS time delayed and stored Specify: `Qualifier := character(s)`
`IsBoolean`	whether or not the action is boolean. Enter Yes or No. Specify: `IsBoolean := text`
`PresetUsesExpression`	whether the preset for the action timer is a structured text expression. Enter Yes if you plan to enter an expression in a PRESET block, otherwise, enter No. Specify: `PresetUsesExpression := text`
`IndicatorTag`	the indicator tag. Enter tag. Specify: `IndicatorTag := tag`

`PRESET_block`	the preset value of the action. If the PresetUsesExpression attribute (above) is Yes, enter a PRESET block.
	
	The preset block contains a structured text expression that specifies the preset time in milliseconds for the action. Each line of structured text begins with a single quote (').
	`PRESET (LanguageType := ST)`
	`'<structured_text>`
	`END_PRESET`

`BODY_block`	the structured text of the action.
	
	The body block uses structured text to define an action. It can contain multiple structured text statements. Each line of structured text begins with a single quote (').
	`BODY (LanguageType := ST)`
	`'<structured_text>`
	`END_BODY`

STEP example

```
STEP (ID := 16, X := 420, Y := 360, Operand := LastStep, HideDescription := Yes,
       DescriptionX := 474, DescriptionY := 345, DescriptionWidth := 0,
       InitialStep := No, PresetUsesExpression := No, LimitHighUsesExpression := No,
       LimitLowUsesExpression := No, ShowActions := Yes)
       ACTION (ID := 18, Operand := LastAction, Qualifier := N, IsBoolean := No,
              PresetUsesExpression := No, IndicatorTag := "")
              BODY (LanguageType := ST)
                     'LastExecuted := 1;
              END_BODY
       END_ACTION
END_STEP
```

Entering Transitions

Transitions follow this format:

```
TRANSITION (
       ID := <unique_identifier>,
       X := <internal_grid_x_location>,
       Y := <internal_grid_y_location>,
       Operand := <tag_reference>,
       HideDescription := <yes|no>,
       DescriptionX := <numerical_value>,
       DescriptionY := <numerical_value>,
       DescriptionWidth := <numerical_value>,
       Force := <TRUE|FALSE>)
       <CONDITION_block>
END_TRANSITION
```

Where:

Item:	Identifies:
ID	the transition identifier. This ID uniquely identifies this transition from all other blocks. Enter an unsigned, 32-bit integer value. Specify: `ID := number`
X	x-coordinate on internal grid. Enter an unsigned, 32-bit integer value. Specify: `X := number`
Y	y-coordinate on internal grid. Enter an unsigned, 32-bit integer value. Specify: `Y := number`
Operand	the transition tag. Enter a boolean tag. The import process uses this tag name to name the transition. Specify: `Operand := tag`
HideDescription	whether or not to hide the transition description. Enter Yes or No. Specify: `HideDescription := text`
DescriptionX	x-coordinate on internal grid of the description box. Enter an unsigned, 32-bit integer value. Specify: `DescriptionX := number`
DescriptionY	y-coordinate on internal grid of the description box. Enter unsigned, 32-bit integer value. Specify: `DescriptionY := number`
DescriptionWidth	this attribute is not currently used; it is there for future use. Enter 0. Specify: `DescriptionWidth := 0`
Force	the transition is forced. Enter TRUE for forced true (set) or enter FALSE for forced false (cleared). If the transition is not forced, do not enter this attribute. Specify: `Force := text`
CONDITION_block	the condition to evaluate for the transition. see page 7-16

Entering the CONDITION block

The condition block uses a structured text expression to specify a condition to evaluate for the transition. Each line of structured text begins with a single quote (‘).

```
CONDITION (LanguageType := ST)
       ‘<structured_text>
END_CONDITION
```

TRANSITION example

```
TRANSITION (ID := 14, X := 420, Y := 280, Operand := AlwaysTrue_002,
            HideDescription := Yes, DescriptionX := 455, DescriptionY := 265,
            DescriptionWidth := 0)
            CONDITION (LanguageType := ST)
                  '1
            END_CONDITION
END_TRANSITION
```

Entering Subroutine Calls

The subroutine calls let you pass values into and out of the SFC routine. Subroutine calls follow this format:

```
SBR_RET (
      ID := <unique_identifier>,
      X := <internal_grid_x_location>,
      Y := <internal_grid_y_location>,
      In := <"list">,
      Out := <"list">)
END_SBR_RET
```

Where:

Item:	Identifies:
ID	the SBR_RET identifier. This ID uniquely identifies this subroutine call from all other blocks. Enter an unsigned, 32-bit integer value. Specify: `ID := number`
X	x-coordinate on internal grid. Enter an unsigned, 32-bit integer value. Specify: `X := number`
Y	y-coordinate on internal grid. Enter an unsigned, 32-bit integer value. Specify: `Y := number`
In	list of values to receive from the calling routine. Enter list of tags or literal values and separate each entry by a comma (,). Enter empty quotes if there are no values to receive. Specify: `In := "list"`
Out	list of values to pass to the calling routine. Enter list of tags or literal values and separate each entry by a comma (,). Enter empty quotes if there are no values to pass. Specify: `Out := "list"`

SBR_RET example

```
SBR_RET (ID := 2, X := 80, Y := 40,
             In := "Input_000, Input_001, Input_002",
             Out := "")
END_SBR_RET
```

Entering Stops

Stops follow this format:

```
STOP (
       ID := <unique_identifier>,
       X := <internal_grid_x_location>,
       Y := <internal_grid_y_location>,
       Operand := <tag_reference>,
       HideDescription := <yes|no>
       DescriptionX := <numerical_value>,
       DescriptionY := <numerical_value>,
       DescriptionWidth := <numerical_value>)
END_STOP
```

Where:

Item:	Identifies:
`ID`	the stop identifier. This ID uniquely identifies this stop from all other blocks. Enter an unsigned, 32-bit integer value. Specify: `ID := number`
`X`	x-coordinate on internal grid. Enter an unsigned, 32-bit integer value. Specify: `X := number`
`Y`	y-coordinate on internal grid. Enter an unsigned, 32-bit integer value. Specify: `Y := number`
`Operand`	the stop tag. Enter a tag of datatype SFC_STOP. The import process uses this tag name to name the stop. Specify: `Operand := tag`
`HideDescription`	whether or not to hide the stop description. Enter Yes or No. Specify: `HideDescription := text`
`DescriptionX`	x-coordinate on internal grid of the description box. Enter an unsigned, 32-bit integer value. Specify: `DescriptionX := number`
`DescriptionY`	y-coordinate on internal grid of the description box. Enter unsigned, 32-bit integer value. Specify: `DescriptionY := number`
`DescriptionWidth`	this attribute is not currently used; it is there for future use. Enter 0. Specify: `DescriptionWidth := 0`

STOP example

```
STOP (ID := 10, X := 420, Y := 520, Operand := NeverGetsHere, HideDescription := Yes,
       DescriptionX := 505, DescriptionY := 505, DescriptionWidth := 0)
END_STOP
```

Entering Branches

The branch blocks in an SFC routine identify simultaneous or selection branches in the routine. Branches follow this format:

```
BRANCH (
       ID := <unique_identifier>,
       Y := <internal_grid_y_location>,
       BranchType := <text>,
       BranchFlow := <text>,
       Priority := <text>)
       <LEG_block>
END_BRANCH
```

Where:

Item:	Identifies:
ID	the branch identifier. This ID uniquely identifies this branch from all other blocks. Enter an unsigned, 32-bit integer value. Specify: `ID := number`
Y	y-coordinate on internal grid. Enter an unsigned, 32-bit integer value. Specify: `Y := number`
BranchType	the type of branch. Enter Simultaneous or Selection. Specify: `BranchType := text`
BranchFlow	the direction of the branch. Enter Converge or Diverge. Specify: `BranchFlow := text`
Priority	whether the priority of a divergent selection branch is defined by the user. This attribute only applies to divergent selection branches. Enter Default or UserDefined. Specify: `Priority := text`
LEG_block	the individual legs of the branch. Enter one leg block for each leg of the branch. see page 7-20

Entering the LEG block

The leg block identifies a leg of a branch. Legs follow this format:

```
LEG (
       ID := <unique_identifier>,
       Force := <FALSE>)
END_LEG
```

Where:

Item:	Identifies:
ID	the leg identifier. This ID uniquely identifies this leg from all other blocks. Enter an unsigned, 32-bit integer value. Specify: `ID := number`
Force	whether the leg is forced or not. You can only force a leg in a simultaneous branch. Either omit this attribute (for no forces) or enter FALSE to force the leg false. Specify: `Force := text`

BRANCH example

```
BRANCH (ID := 4, Y := 200, BranchType := Simultaneous,
             BranchFlow := Diverge)
       LEG (ID := 5)
       END_LEG

       LEG (ID := 6)
       END_LEG

       LEG (ID := 7)
       END_LEG

END_BRANCH
```

Entering Directed Links

The directed link blocks in an SFC routine identify the links between SFC components. Directed links follow this format:

```
DIRECTED_LINK (
        FromElementID := <unique_identifier>,
        ToElementID := <unique_identifier>,
        ShowLink := <TRUE|FALSE>)
END_DIRECTED_LINK
```

Where:

Item:	Identifies:
FromElementID	the source element of the link. Enter an unsigned, 32-bit integer value. Specify: `FromElementID := number`
ToElementID	the destination element of the link. Enter an unsigned, 32-bit integer value. Specify: `ToElementID := number`
ShowLink	whether or not to show the link. Enter TRUE or FALSE. Specify: `ShowLink := text`

DIRECTED_LINK guidelines

- All DIRECTED_LINK blocks must come after all STEP, TRANSITION, STOP, and BRANCH blocks.
- A directed link links only one element to one other element.

DIRECTED_LINK example

```
DIRECTED_LINK (FromElementID := 16, ToElementID := 12, ShowLink := True)
END_DIRECTED_LINK
```

Entering Text Boxes

The text box blocks in an SFC routine hold descriptions about SFC components. Text boxes follow this format:

```
TEXT_BOX (
       ID := <unique_identifier>,
       X := <internal_grid_x_location>,
       Y := <internal_grid_y_location>,
       Width := <numerical_value>
       Text := <"text">)
END_TEXT_BOX
```

Where:

Item:	Identifies:
ID	the text box identifier. This ID uniquely identifies this text box from all other blocks. Enter an unsigned, 32-bit integer value. Specify: `ID := number`
X	x-coordinate on internal grid. Enter an unsigned, 32-bit integer value. Specify: `X := number`
Y	y-coordinate on internal grid. Enter an unsigned, 32-bit integer value. Specify: `Y := number`
Width	this attribute is not currently used; it is there for future use. Enter 0. Specify: `Width := 0`
Text	the descriptive text. Specify: `Text := text`

TEXT_BOX guidelines

- All TEXT_BOX blocks must come after all DIRECTED_LINK blocks.
- Text boxes can be free-standing or they can be attached to SFC elements.

TEXT_BOX example

```
TEXT_BOX (ID := 7, X := 40, Y := 80, Width := 0,
       Text := "Action Body makes recursive call")
END_TEXT_BOX
```

Entering Attachments

The attachment blocks in an SFC routine identify the attachments from text boxes to other SFC elements. Attachments follow this format:

```
ATTACHMENT (
        FromElementID := <unique_identifier>,
        ToElementID := <unique_identifier>,
END_ATTACHMENT
```

Where:

Item:	Identifies:
`FromElementID`	the ID of the attached object. Enter an unsigned, 32-bit integer value. Specify: `FromElementID := number`
`ToElementID`	the ID of the object that the FromID object is attached to. Enter an unsigned, 32-bit integer value. Specify: `ToElementID := number`

ATTACHMENT guidelines

- Use an attachment to link a text box to an SFC element.
- All ATTACHMENT blocks must come after all TEXT_BOX blocks.

ATTACHMENT example

```
ATTACHMENT (FromElementID := 7, ToElementID := 2)
END_ATTACHMENT
```

Notes:

Structuring the Tag/Comments (.CSV) Import/Export File Format

Introduction

This chapter explains the overall structure of the .CSV file that can store exported tags and rung comments.

Placing Information in a .CSV File

The CSV import/export file contains these components of information:

Item:	Identifies:
remark	comment within the CSV file
TAG	tag
RCOMMENT	rung comment

Internal file comments

You can enter comments to document your import files. The import process ignores these comments. You can place comments anywhere in an import/export file, except in names and descriptions. You enter comments by starting the line (record) with REMARK and a comma.

Specifying a Tag Record

Each tag record defines a tag within a controller project. A TAG record includes this information:

Item:	Identifies:
Type	the type of tag valid types are: TAG tag ALIAS alias tag COMMENT tag operand component
Scope	what part of the project owns the tag if no scope is specified, the scope is controller if a scope is specified, it identifies the program
Name	name of the tag
Description	description of the tag (optional)
Datatype	datatype of the tag - use any valid datatype name
Specifier	optional • for an alias, specifies base tag • for a tag comment, specifies the tag name and member or bit

TAG type record

Each TAG record defines a tag within a controller project. A TAG record follows this format:

```
TAG,"Scope","Name","Description","Datatype","Specifier"
```

You specify tag dimensions on the Datatype as:

To specify:	Enter:
1 dimension	[a]
2 dimensions	[a,b]
3 dimensions	[a,b,c]

The following examples show TAG records.

26	TYPE	SCOPE	NAME	DESCRIPTION	DATATYPE	SPECIFIER
27	TAG	MainProgram	ADD_01	look at this tag value	FBD_MATH	
28	TAG	MainProgram	array_1		DINT[8]	
29	TAG	MainProgram	bits		SINT	
30	TAG	MainProgram	MyReference	this tag is a reference point	BOOL	
31	TAG	MainProgram	Step_000		SFC_STEP	

ALIAS type record

Each ALIAS record defines an alias within a controller project. An ALIAS record follows this format:

```
ALIAS,"Scope","Name","Description","Datatype","Specifier"
```

The following examples show ALIAS records.

33	TYPE	SCOPE	NAME	DESCRIPTION	DATATYPE	SPECIFIER
34	ALIAS	MainProgram	alias_1	alias example		Local:1:I.Data.11
35	ALIAS	MainProgram	alias_2	another alias		Local:2:I.Data.12

COMMENT type record

Each COMMENT record defines a comment about a component of a tag, such as a bit member, structure member, or an array element. A COMMENT record follows this format:

```
COMMENT,"Scope","Name","Description","Datatype","Specifier"
```

The following examples show COMMENT records.

37	TYPE	SCOPE	NAME	DESCRIPTION	DATATYPE	SPECIFIER
38	COMMENT	MainProgram	array_1	array element 1		array_1[1]
39	COMMENT	MainProgram	bits	bit comment		bits.1
40	COMMENT	MainProgram	timer_1	comment on structure member		timer_1.TT

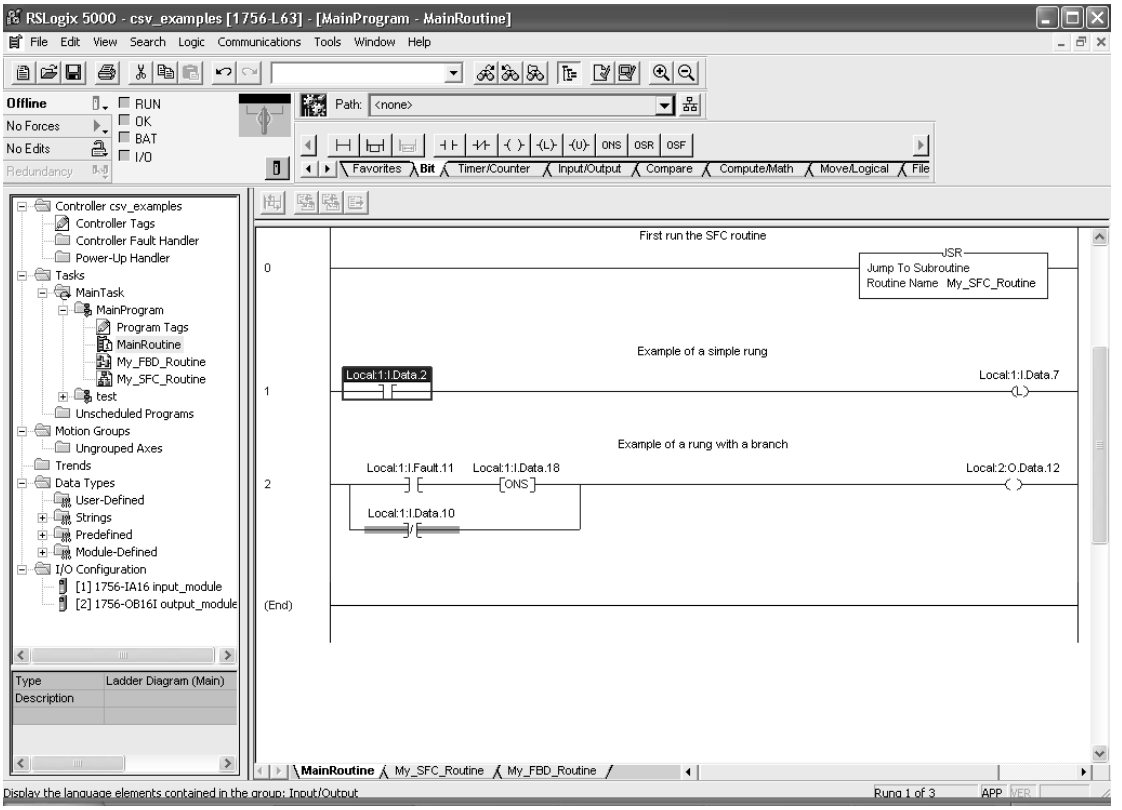
Specifying a Rung Comment Record

Each rung comment record defines a rung comment within a controller project. This is different than the COMMENT type that defines a comment about a tag component (see above). A rung comment record includes this information:

Item:	Identifies:
Type	the type of comment valid types are: RCOMMENT ladder rung comment
Scope	what part of the project owns the comment a program must be specified
Routine	name of the routine
Comment	text of the comment
Owning Element	neutral text for the last instruction on the rung that owns the comment if there is no element on the rung, the Owning Element is a semi-colon (;) by default, the Owning Element is used to match the comment to a rung on import; see page 1-6
Location	rung number of comment the rung number in the Location column is used to match the comment to a rung if either the Owning Element is blank for that comment or if you override the import default by selecting the “Match all RLL rung comments by rung number only”; see page 1-6

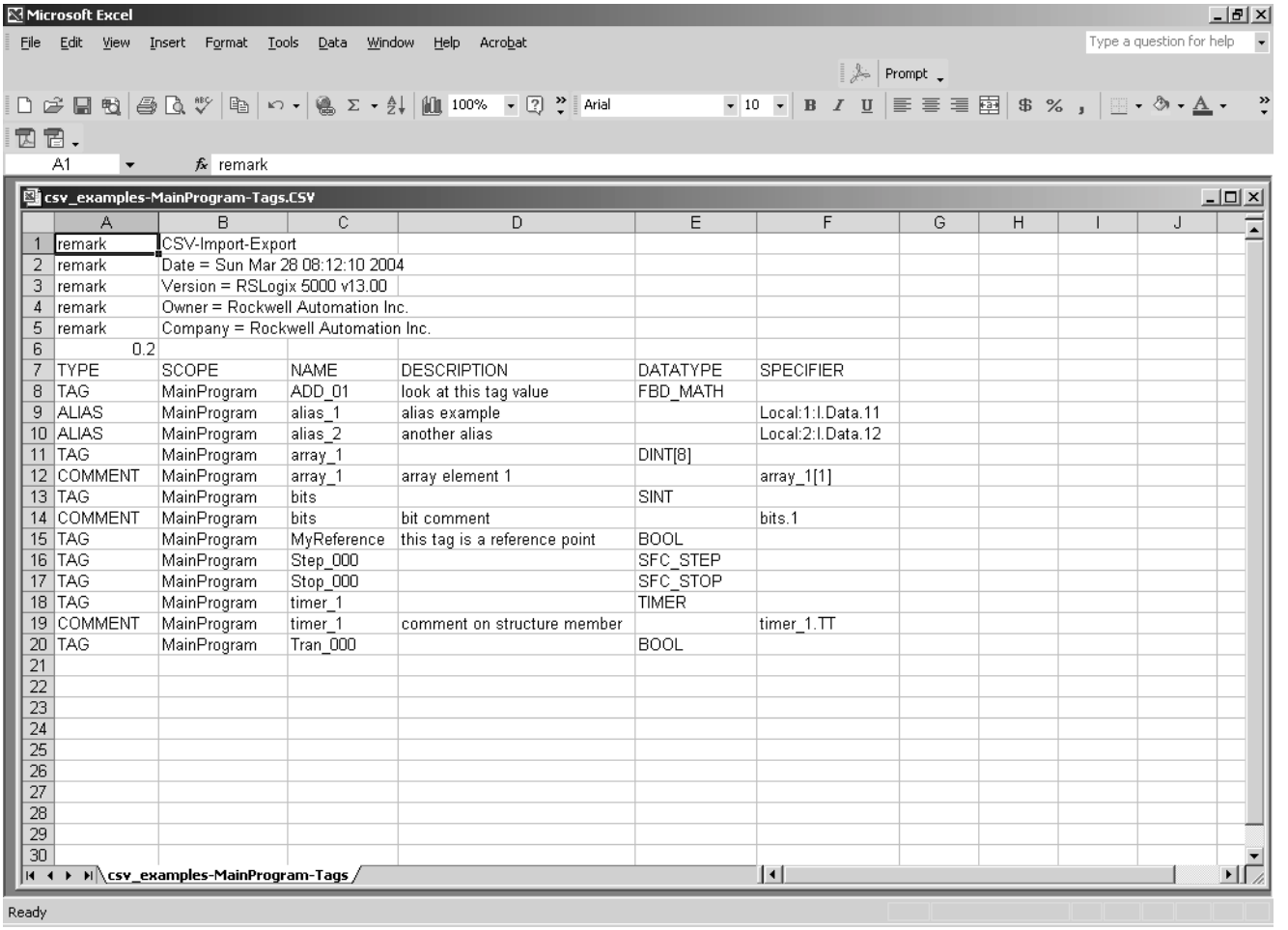
Example CSV Files

The following examples use this ladder file:



Exporting only tags

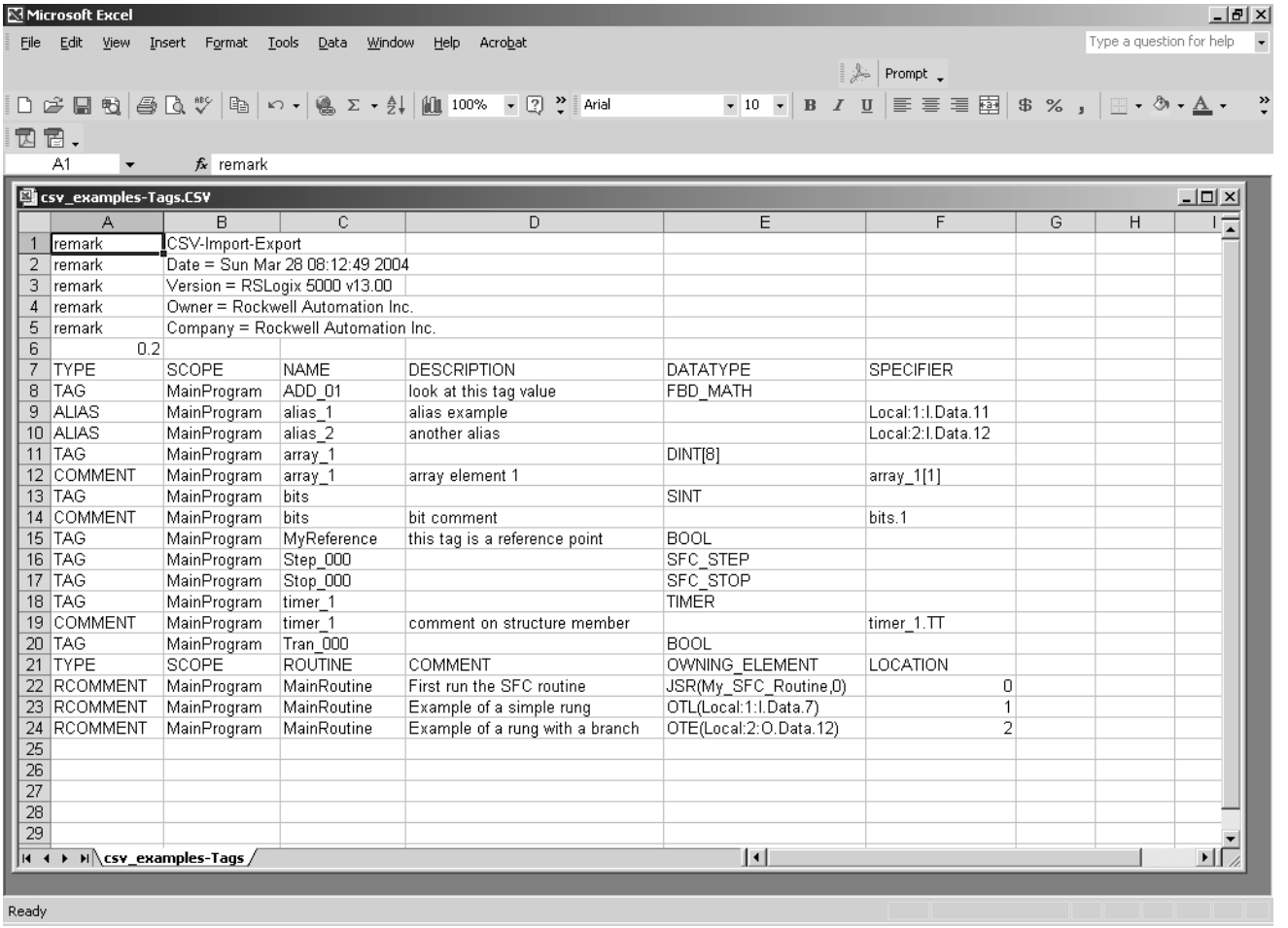
Exporting only tags for MainProgram results in this CSV file:



	A	B	C	D	E	F	G	H	I	J
1	remark	CSV-Import-Export								
2	remark	Date = Sun Mar 28 08:12:10 2004								
3	remark	Version = RSLogix 5000 v13.00								
4	remark	Owner = Rockwell Automation Inc.								
5	remark	Company = Rockwell Automation Inc.								
6	0.2									
7	TYPE	SCOPE	NAME	DESCRIPTION	DATATYPE	SPECIFIER				
8	TAG	MainProgram	ADD_01	look at this tag value	FBD_MATH					
9	ALIAS	MainProgram	alias_1	alias example		Local:1:I.Data.11				
10	ALIAS	MainProgram	alias_2	another alias		Local:2:I.Data.12				
11	TAG	MainProgram	array_1		DINT[8]					
12	COMMENT	MainProgram	array_1	array element 1		array_1[1]				
13	TAG	MainProgram	bits		SINT					
14	COMMENT	MainProgram	bits	bit comment		bits.1				
15	TAG	MainProgram	MyReference	this tag is a reference point	BOOL					
16	TAG	MainProgram	Step_000		SFC_STEP					
17	TAG	MainProgram	Stop_000		SFC_STOP					
18	TAG	MainProgram	timer_1		TIMER					
19	COMMENT	MainProgram	timer_1	comment on structure member		timer_1.TT				
20	TAG	MainProgram	Tran_000		BOOL					
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										

Exporting ladder rung comments

Exporting all controller tags, program tags, and comments for only MainProgram results in this CSV file:



Microsoft Excel

File Edit View Insert Format Tools Data Window Help Acrobat — Type a question for help — Prompt

100% Arial 10

A1 remark

csv_examples-Tags.CSV

	A	B	C	D	E	F	G	H	I
1	remark	CSV-Import-Export							
2	remark	Date = Sun Mar 28 08:12:49 2004							
3	remark	Version = RSLogix 5000 v13.00							
4	remark	Owner = Rockwell Automation Inc.							
5	remark	Company = Rockwell Automation Inc.							
6	0.2								
7	TYPE	SCOPE	NAME	DESCRIPTION	DATATYPE	SPECIFIER			
8	TAG	MainProgram	ADD_01	look at this tag value	FBD_MATH				
9	ALIAS	MainProgram	alias_1	alias example		Local:1:I.Data.11			
10	ALIAS	MainProgram	alias_2	another alias		Local:2:I.Data.12			
11	TAG	MainProgram	array_1		DINT[8]				
12	COMMENT	MainProgram	array_1	array element 1		array_1[1]			
13	TAG	MainProgram	bits		SINT				
14	COMMENT	MainProgram	bits	bit comment		bits.1			
15	TAG	MainProgram	MyReference	this tag is a reference point	BOOL				
16	TAG	MainProgram	Step_000		SFC_STEP				
17	TAG	MainProgram	Stop_000		SFC_STOP				
18	TAG	MainProgram	timer_1		TIMER				
19	COMMENT	MainProgram	timer_1	comment on structure member		timer_1.TT			
20	TAG	MainProgram	Tran_000		BOOL				
21	TYPE	SCOPE	ROUTINE	COMMENT	OWNING_ELEMENT	LOCATION			
22	RCOMMENT	MainProgram	MainRoutine	First run the SFC routine	JSR(My_SFC_Routine,0)	0			
23	RCOMMENT	MainProgram	MainRoutine	Example of a simple rung	OTL(Local:1:I.Data.7)	1			
24	RCOMMENT	MainProgram	MainRoutine	Example of a rung with a branch	OTE(Local:2:O.Data.12)	2			
25									
26									
27									
28									
29									

csv_examples-Tags

Ready

Notes:

Structuring the (.L5X) Partial Import/Export File Format

Introduction

This chapter explains the overall structure of the .L5X (Logix5000 XML) file that can store a portion of an RSLogix 5000 project. With RSLogix 5000 version 13, this includes ladder diagram logic fragments and the configuration for graphical trends..

The L5X file is an ASCII file that is based on the format of the .L5K file but is structured using Extensible Markup Language (XML) tags. In addition to being able to open and modify the file .L5X file in a text editor, such as Notepad, you can also view the contents of the file in Microsoft Internet Explorer and other tools that work with XML files.

If you use:	You see:
a text editor, such as Notepad	a text file, such as: <?xml version="1.0" encoding="UTF-8" standalone="yes"?> <RSLogix5000Content SchemaRevision="1.0" SoftwareRevision="13.00" TargetType="Rung" ContainsContext="true" Owner="Rockwell Automation, Rockwell Automation" ExportDate="Tue Mar 30 09:59:21 2004" ExportOptions="References Context ReferencesByUId RoutineLabels UIds AliasExtras IOTags NoStringData"> <Controller Use="Context" Name="test13" UId="f90ef335"> <DataTypes Use="Context" UId="d0c0ad05"> <DataType Name="SampleDT" Family="NoFamily" Class="User" UId="23e0ab2b"> <Members> <Member Name="Sample_DINT_Member" DataType="DINT" Dimension="0" Radix="Decimal" Hidden="false"> <Description> <![CDATA[This is a DINT member of the UDT]]> </Description> </Member> You can edit this file in the text editor.
an Internet browser, such as Internet Explorer	an XML file, such as: <?xml version="1.0" encoding="UTF-8" standalone="yes" ?> – <RSLogix5000Content SchemaRevision="**1.0**" SoftwareRevision="**13.00**" TargetType="**Rung**" ContainsContext="**true**" Owner="**Rockwell Automation, Rockwell Automation**" ExportDate="**Tue Mar 30 09:59:21 2004**" ExportOptions="**References Context ReferencesByUId RoutineLabels UIds AliasExtras IOTags NoStringData**"> – <Controller Use="**Context**" Name="**test13**" UId="**f90ef335**"> + <DataTypes Use="**Context**" UId="**d0c0ad05**"> + <Tags Use="**Context**" UId="**d5a18dfb**"> + <Programs Use="**Context**" UId="**3238c36d**"> </Controller> </RSLogix5000Content> In the Internet browser, you can only view the file. Use the plus (+) and minus (-) signs to expand and collapse the viewable content. To edit the file, you must open the file in a text editor.

The examples in this chapter use Internet Explorer to display content.

You can create .L5X files for:

.L5X File:	Description:
ladder rungs	To create the .L5X file for ladder rungs: 1. Select one or more rungs in a ladder routine. 2. Right-click on the selected rungs and select Export Rungs. The resulting .L5X files contains the rung logic, tag definitions, user-defined structures, and all associated descriptions. To bring the contents of an .L5X file back into a projecT: 1. Navigate to where you want to import the rungs in a ladder routine. 2. Right-click and select Import Rungs. When you import an .L5X file, RSLogix 5000 software provides a list of the tags and user-defined structures in the .L5X file and lets rename them and their associated descriptions prior to the import process.
trends	You can also select a trend to export to an .L5X file: 1. Select the trend icon in the Controller Organizer of the project. 2. Right-click on the trend and select Export Trend. The trend .L5X file just contains the configuration for the trend and its associated pens. It does not contain any tag definitions. If you import a trend, it will not operate correctly if its tags are not defined in the project. To import a trend: 1. Select the trend icon in the Controller Organizer of the project. 2. Right-click on the trend and select Import Trend.

Identifying components in .L5X files

Each component in an .L5X file has an associated UID (unique identifier). This identifier is a combination of letters and numbers and it links the associated component of the file with some object that is defined earlier. For example a tag definition uses a UID to link to a user-defined structure that is defined earlier in the project. A single UID can be defined only once in an .L5X file. You cannot reuse the same UID to define two components in the same file.

RSLogix 5000 software creates UIDs to provide an abstraction layer between definitions and their respective names. For example, the instructions refer to a UID for the tags that they use. By doing this, the tag can be renamed without having to search and replace all of the logic references within the rungs.

UIDs are not optional. They are required for each component in an .L5X file. See the rest of this chapter for descriptions of the supported component types.

Placing Information in a Ladder Rung .L5X File

The .L5X file for ladder rungs contains these components:

Component:	Identifies:
CONTROLLER	name of the controller
DATATYPE	user-defined and I/O data structures
MODULE	modules in the controller organizer
TAG	controller-scope tags
PROGRAM	program files and program-scope tags

The ladder rung file uses this structure:

```
<?xml version="1.0" encoding="UTF-8" standalone="yes" ?>
<RSLogix5000Content SchemaRevision="1.0" SoftwareRevision="13.00" TargetType="Rung"
  ContainsContext="true" Owner="Rockwell Automation, Rockwell Automation" ExportDate="Fri
  Jan 23 09:05:31 2004" ExportOptions="References Context ReferencesByUId RoutineLabels
  UIds AliasExtras IOTags NoStringData">
  <Controller Use="Context" Name="Test13" UId="f90ef335">
    <DataTypes Use="Context" UId="d0c0ad05">
    <Modules Use="Context" UId="cb15434a">
    <Tags Use="Context" UId="d5a18dfb">
    <Programs Use="Context" UId="3238c36d">
  </Controller>
</RSLogix5000Content>
```

where:

Controller Item:	Identifies:
Use	the use of the controller project specify “Context” or “Target”
Name	the name of the controller project
UID	the controller project with a unique combination of numbers and letters
Component Item:	**Contains:**
DataTypes	data type definitions
Modules	I/O module definitions
Tags	tag definitions
Programs	program and routine(s) containing the rung logic

The first part of the .L5X file is the header that defines the version of the import/export utility. Following the header is the Controller component, which is the overall structure for an .L5X file.

Defining a DataType Component

The DataType component defines the data types used in the section of rungs you export. The DataType component uses this structure:

```
<DataTypes Use="Context" UId="d0c0ad05">
  <DataType Name="SampleDT" Family="NoFamily" Class="User" UId="23e0ab2b">
    <Members>
  </DataType>
</DataTypes>
```

Specifying a DataType

Each data type declaration within this component defines a data type and the members of that data type. Repeat this structure for each data type.

```
<DataType Name="SampleDT" Family="NoFamily" Class="User" UId="23e0ab2b">
  <Members>
    <Member Name="Sample_DINT_Member" DataType="DINT" Dimension="0"
      Radix="Decimal" Hidden="false">
      <Description>
        <![CDATA[ This is a DINT member of the UDT  ]]>
      </Description>
    </Member>
    <Member Name="ZZZZZZZZZZSampleDT1" DataType="SINT" Dimension="0"
      Radix="Decimal" Hidden="true" />
    <Member Name="Sample_BOOL_Member" DataType="BIT" Dimension="0"
      Radix="Decimal" Hidden="false" Target="ZZZZZZZZZZSampleDT1"
      BitNumber="0">
      <Description>
        <![CDATA[ This is a BOOL Member of the UDT  ]]>
      </Description>
    </Member>
  </Members>
</DataType>
```

where:

Controller Item:	Identifies:
Name	the name of the data type
Family	specify StringFamily for a string data type specify NoFamily for all other data types
Class	type of data type specify User for user-defined
UID	the controller project with a unique combination of numbers and letters

Specifying a Member

Each member declaration within a data type declaration defines the members of that data type. Repeat this structure for each member.

```
<Members>
  <Member Name="Sample_DINT_Member" DataType="DINT" Dimension="0"
    Radix="Decimal" Hidden="false">
    <Description>
      <![CDATA[ This is a DINT member of the UDT  ]]>
    </Description>
  </Member>
  <Member Name="ZZZZZZZZZZSampleDT1" DataType="SINT" Dimension="0"
    Radix="Decimal" Hidden="true" />
  <Member Name="Sample_BOOL_Member" DataType="BIT" Dimension="0"
    Radix="Decimal" Hidden="false" Target="ZZZZZZZZZZSampleDT1"
    BitNumber="0">
    <Description>
      <![CDATA[ This is a BOOL Member of the UDT  ]]>
    </Description>
  </Member>
</Members>
```

where:

Controller Item:	Identifies:
Name	the name of the member
DataType	the data type of the member, such as SINT, INT, DINT, REAL, BOOL
Dimension	specify 0 (not an array) or 1, 2, 3 if an array
Radix	specify decimal, hex, octal, binary, exponential, float, or ASCII
Hidden	whether the member is a hidden member of the structure
UID	the controller project with a unique combination of numbers and letters

For more information on DataType attributes, see the DataType information on page 3-1.

DataType example

```
<DataTypes Use="Context" UId="d0c0ad05">
  <DataType Name="SampleDT" Family="NoFamily" Class="User" UId="23e0ab2b">
    <Members>
      <Member Name="Sample_DINT_Member" DataType="DINT" Dimension="0"
        Radix="Decimal" Hidden="false">
        <Description>
          <![CDATA[ This is a DINT member of the UDT  ]]>
        </Description>
      </Member>
      <Member Name="ZZZZZZZZZZSampleDT1" DataType="SINT" Dimension="0"
        Radix="Decimal" Hidden="true" />
      <Member Name="Sample_BOOL_Member" DataType="BIT" Dimension="0"
        Radix="Decimal" Hidden="false" Target="ZZZZZZZZZZSampleDT1"
        BitNumber="0">
        <Description>
          <![CDATA[ This is a BOOL Member of the UDT  ]]>
        </Description>
      </Member>
    </Members>
  </DataType>
</DataTypes>
```

Defining a Module Component

The Module component defines any modules associated with the section of rungs you export. For example, the Module component can contain I/O modules referenced by I/O tags, modules accessed by GSV/SSV instructions, or controllers referenced in consumed tags. The Module component uses this structure:

```
<Modules Use="Context" UId="cb15434a">
  <Module Use="Context" Name="Local" UId="42741be5" />
  <Module Use="Context" UId="29b0c934" />
  <Module Use="Context" UId="fcfdb37a" />
</Modules>
```

where:

Controller Item:	Identifies:
`Use`	the use of the module specify “Context” or “Target”
`Name`	the name of the module
`UID`	the controller project with a unique combination of numbers and letters

Defining a Tag Component

The Tag component defines the tags, either associated with the section of rungs you selected or within the program you selected. The Tag component uses this structure:

```
<Tags Use="Context" UId="d5a18dfb">
  <Tag Name="Sample_Tag" UId="3ad464e2" TagType="Base" DataType="SampleDT">
</Tags>
```

where:

Controller Item:	Identifies:
`Use`	the use of the tags specify "Context" or "Target"
`Tag Name`	the name of the tag
`UID`	the tag with a unique combination of numbers and letters
`TagType`	specify "Alias" or "Base"
`DataType`	the data type of the tag, such as SINT, INT, DINT, REAL, BOOL
`Radix`	specify decimal, hex, octal, binary, exponential, float, or ASCII
`AliasFor`	the base tag for an alias tag

Within the .L5X file, Tag declarations before the Program component are for controller-scope tags. Tag declarations within a Program component are program-scope tags for that program.

For more information on Tag attributes, see the Tag information on page 3-11.

Tag example

```
<Tags Use="Context" UId="d5a18dfb">
  <Tag Name="Estop_Disabled" UId="a07e31ed" TagType="Alias" DataType="BOOL" Radix="Decimal"
    AliasFor="Local:1:I.Data.0">
    <Description>
      <![CDATA[ No Estop pressed ]]>
    </Description>
    <Data>00</Data>
  </Tag>
  <Tag Name="CN1_M" UId="10ff31dc" TagType="Alias" DataType="BOOL" Radix="Decimal"
    AliasFor="Local:2:O.Data.0">
    <Description>
      <![CDATA[ Conveyor CN1 Motor Starter Output ]]>
    </Description>
    <Data>00</Data>
  </Tag>
  <Tag Name="Local:2:O" UId="df5ca2c0" TagType="Base" DataType="AB:1756_DO:O:0" IO="true">
    <Data>00 00 00 00</Data>
    <ForceData>00 00 00 00 00 00 00 00 00 00 00 00</ForceData>
  </Tag>
  <Tag Name="Local:1:I" UId="547c3ce8" TagType="Base" DataType="AB:1756_DI:I:0" IO="true">
    <Data>00 00 00 00 00 00 00 00</Data>
    <ForceData>00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00</ForceData>
  </Tag>
</Tags>
```

Defining a Program Component

The Program component defines the programs used in the section of rungs you export. The Program component uses this structure:

```
<Programs Use="Context" UId="3238c36d">
  <Program Use="Context" Name="MainProgram" UId="d06d4be1">
</Programs>
```

Specifying a Program

Each program declaration within this component defines a program and the routines within that program. Repeat this structure for each program.

```
<Program Use="Context" Name="MainProgram" UId="d06d4be1">
  <Tags Use="Context" UId="f54231b5">
  <Routines Use="Context" UId="4fca5a03">
</Program>
```

where:

Controller Item:	Identifies:
Use	the use of the program specify "Context" or "Target"
Name	the name of the program
UID	the program with a unique combination of numbers and letters

Specifying a Routine

Each routine declaration within a program declaration defines the routines of that program. Repeat this structure for each routine.

```
<Routine Use="Context" Name="MainRoutine" UId="80080377">
  <RLLContent Use="Context">
    <Rung Use="Target" Number="0" Type="N" UId="cc69634c">
      <Text>
        <![CDATA[ XIC(@3ad464e2@.Sample_BOOL_Member)OTE
        (@3ad464e2@.Sample_DINT_Member.0);  ]]>
      </Text>
    </Rung>
  </RLLContent>
</Routine>
```

where:

Controller Item:	Identifies:
Use	the use of the routine or rung specify "Context" or "Target"
Name	the name of the routine
Number	the rung number
Type	the type of rung, such as N for normal or I for insert
UID	the routine or rung with a unique combination of numbers and letters

For more information on Program attributes, see the Program information on page 3-28. For more information on ladder logic, see chapter 4.

Program example

```
<Programs Use="Context" UId="3238c36d">
  <Program Use="Context" Name="MainProgram" UId="d06d4be1">
    <Tags Use="Context" UId="f54231b5">
      <Tag Name="CN1" UId="2e15ff86" TagType="Base" DataType="Conveyor_Type">
        <Description>
          <![CDATA[ Conveyor CN1  ]]>
        </Description>
        <Data>00 00 00 00 00 00 00 00 A0 86 01 00 00 00 00 00 00 00 00 00 D0 07 00 00 00 00 00 00 00 00
          00 00 88 13 00 00 00 00 00 00 00 00 00 00 88 13 00 00 00 00 00 00</Data>
      </Tag>
    </Tags>
    <Routines Use="Context" UId="4fca5a03">
      <Routine Use="Context" Name="MainRoutine" UId="80080377">
        <RLLContent Use="Context">
          <Rung Use="Target" Number="8" Type="N" UId="24cc887b">
            <Text>
              <![CDATA[ XIO(@a07e31ed@)XIC(@2e15ff86@.Motor_Run)XIO(@2e15ff86@.Motor_Fault)XIO
              (@2e15ff86@.Jam_Fault_Entry_PE)XIO(@2e15ff86@.Jam_Fault_Exit_PE)OTE(@10ff31dc@);  ]]>
            </Text>
          </Rung>
        </RLLContent>
      </Routine>
    </Routines>
  </Program>
</Programs>
```

Example Ladder Rung .L5X File

This example shows all the ladder rung components in one .L5X file.

```
<?xml version="1.0" encoding="UTF-8" standalone="yes" ?>
<RSLogix5000Content SchemaRevision="1.0" SoftwareRevision="13.00" TargetType="Rung" ContainsContext="true"
  Owner="Rockwell Automation, Rockwell Automation" ExportDate="Fri Jan 23 09:05:31 2004" ExportOptions="References
  Context ReferencesByUId RoutineLabels UIds AliasExtras IOTags NoStringData">
  <Controller Use="Context" Name="Test13" UId="f90ef335">
    <DataTypes Use="Context" UId="d0c0ad05">
      <DataType Name="Conveyor_Type" Family="NoFamily" Class="User" UId="23e0ab2b">
        <Description>
          <![CDATA[ Parameters associated with conveyor operation ]]>
        </Description>
        <Members>
          <Member Name="ZZZZZZZZZZConveyor_T0" DataType="SINT" Dimension="0" Radix="Decimal"
            Hidden="true" />
          <Member Name="Motor_Run" DataType="BIT" Dimension="0" Radix="Decimal" Hidden="false"
            Target="ZZZZZZZZZZConveyor_T0" BitNumber="0">
            <Description>
              <![CDATA[ Run The Motor ]]>
            </Description>
          </Member>
        </Members>
      </DataType>
    </DataTypes>
    <Modules Use="Context" UId="cb15434a">
      <Module Use="Context" Name="Local" UId="42741be5" />
      <Module Use="Context" UId="29b0c934" />
      <Module Use="Context" UId="fcfdb37a" />
    </Modules>
    <Tags Use="Context" UId="d5a18dfb">
      <Tag Name="CN1_M" UId="10ff31dc" TagType="Alias" DataType="BOOL" Radix="Decimal"
        AliasFor="Local:2:O.Data.0">
        <Description>
          <![CDATA[ Conveyor CN1 Motor Starter Output ]]>
        </Description>
        <Data>00</Data>
      </Tag>
    </Tags>
    <Programs Use="Context" UId="3238c36d">
      <Program Use="Context" Name="MainProgram" UId="d06d4be1">
        <Tags Use="Context" UId="f54231b5">
          <Tag Name="CN1" UId="2e15ff86" TagType="Base" DataType="Conveyor_Type">
            <Description>
              <![CDATA[ Conveyor CN1 ]]>
            </Description>
            <Data>00 00 00 00 00 00 00 00 A0 86 01 00 00 00 00 00 00 00 00 00 D0 07 00 00 00 00 00 00 00 00
              00 00 88 13 00 00 00 00 00 00 00 00 00 00 88 13 00 00 00 00 00 00</Data>
          </Tag>
        </Tags>
```

```
<Programs Use="Context" UId="3238c36d">
  <Program Use="Context" Name="MainProgram" UId="d06d4be1">
    <Tags Use="Context" UId="f54231b5">
      <Tag Name="CN1" UId="2e15ff86" TagType="Base" DataType="Conveyor_Type">
        <Description>
          <![CDATA[ Conveyor CN1  ]]>
        </Description>
        <Data>00 00 00 00 00 00 00 00 A0 86 01 00 00 00 00 00 00 00 00 00 D0 07 00 00 00 00 00 00 00 00
          00 00 88 13 00 00 00 00 00 00 00 00 00 00 88 13 00 00 00 00 00 00</Data>
      </Tag>
    </Tags>
    <Routines Use="Context" UId="4fca5a03">
      <Routine Use="Context" Name="MainRoutine" UId="80080377">
        <RLLContent Use="Context">
          <Rung Use="Target" Number="8" Type="N" UId="24cc887b">
            <Text>
              <![CDATA[ XIO(@a07e31ed@)XIC(@2e15ff86@.Motor_Run)XIO(@2e15ff86@.Motor_Fault)XIO
              (@2e15ff86@.Jam_Fault_Entry_PE)XIO(@2e15ff86@.Jam_Fault_Exit_PE)OTE(@10ff31dc@);  ]]
            </Text>
          </Rung>
        </RLLContent>
      </Routine>
    </Routines>
  </Program>
 </Programs>
</Controller>
</RSLogix5000Content>
```

Placing Information in a Trend .L5X File

The .L5X file for trends contains these components:

Component:	Identifies:
CONTROLLER	name of the controller
TREND	the selected trends

The trend file uses this structure:

```
<?xml version="1.0" encoding="UTF-8" standalone="yes" ?>
<RSLogix5000Content SchemaRevision="1.0" SoftwareRevision="13.00" TargetType="Tren
  ContainsContext="true" Owner="Rockwell Automation, Rockwell Automation" Export[
  Jul 16 14:36:33 2003" ExportOptions="Context">
  <Controller Use="Context" Name="Conveyor">
    <Trends Use="Context">
      <Trend Use="Target" Name="Conveyor_Operation" SamplePeriod="10"
        NumberOfCaptures="1" CaptureSizeType="Samples" CaptureSize="60000"
        StartTriggerType="No Trigger" StopTriggerType="No Trigger" TrendxVersion="5.2
    </Trends>
  </Controller>
</RSLogix5000Content>
```

Specifying a Trend

Each trend declaration within this component defines a trend and the pens within that trend. Repeat this structure for each trend.

```
<Trends Use="Context">
  <Trend Use="Target" Name="Conveyor_Operation" SamplePeriod="10"
    NumberOfCaptures="1" CaptureSizeType="Samples" CaptureSize="60000"
    StartTriggerType="No Trigger" StopTriggerType="No Trigger" TrendxVersion="5.2">
    <Pens>
  </Trend>
</Trends>
```

where:

Controller Item:	Identifies:
`Use`	the use of the trend specify “Context” or “Target”
`Name`	the name of the trend

For more information on Trend and Pen attributes, see the Trend section on page 3-33.

Trend example

```
<?xml version="1.0" encoding="UTF-8" standalone="yes" ?>
<RSLogix5000Content SchemaRevision="1.0" SoftwareRevision="13.00" TargetType="Trend"
  ContainsContext="true" Owner="Rockwell Automation, Rockwell Automation" ExportDate="Wed
  Jul 16 14:36:33 2003" ExportOptions="Context">
  <Controller Use="Context" Name="Conveyor">
    <Trends Use="Context">
      <Trend Use="Target" Name="Conveyor_Operation" SamplePeriod="10"
        NumberOfCaptures="1" CaptureSizeType="Samples" CaptureSize="60000"
        StartTriggerType="No Trigger" StopTriggerType="No Trigger" TrendxVersion="5.2">
        <Pens>
          <Pen Name="M_T1" Color="16#00ff_0000" Visible="true" Width="1"
            Type="Analog" Style="0" Marker="0" Min="0.0" Max="100.0" />
          <Pen Name="MA_T1" Color="16#0000_ff00" Visible="true" Width="1"
            Type="Analog" Style="0" Marker="0" Min="0.0" Max="100.0" />
          <Pen Name="PE_T1_A" Color="16#0000_00ff" Visible="true" Width="1"
            Type="Analog" Style="0" Marker="0" Min="0.0" Max="100.0" />
          <Pen Name="FLT_T1" Color="16#00ff_00ff" Visible="true" Width="1"
            Type="Analog" Style="0" Marker="0" Min="0.0" Max="100.0" />
        </Pens>
      </Trend>
    </Trends>
  </Controller>
</RSLogix5000Content>
```

Notes:

Considerations for Using Microsoft Excel to Edit a .CSV File

Introduction

This appendix describes how using Microsoft Excel can affect a .CSV file.

IMPORTANT To edit the .CSV file, it is recommended that you use a database program tool, such as Microsoft Access, or a raw text editor. Many other desktop tools, such as Microsoft Word or Excel, might change the structure of the .CSV file and cause an import of the file to fail.

Recommendations

If you use Microsoft Excel to edit your .CSV tag file:

- Use single quotes instead of double quotes within descriptions and comments.
- Do not create descriptions or comments that consist only of numbers, have leading zeros, or have a leading symbol that Microsoft Excel treats specially. For example, do not create descriptions like:

  002
  +2
  =2
  -2
  .0

- Do not create descriptions or comments that start with a +, -, or = symbol. Even if you add text after the symbol, Excel displays `#NAME?` in the cell.

RSLogix 5000 Data Transformations

When RSLogix5000 programming software exports tags, it performs these conversions:

Original content:	Content in .CSV file after export:
'	$'
"	$Q
newline	NL
tab	$T
$	$$

Microsoft Excel Data Transformation

When you open the exported .CSV file in Excel, these conversions occur:

Original content:	Content in .CSV file after export:	Content after opening in Excel:	Content after saving from Excel:	Details:
.0	".0"	0	0	RSLogix5000 addresses this as the specifier for a tag. If you enter this as an entire comment, you lose any preceding period (.). If you enter any text before or after this, Excel maintains the content.
=2	"=2"	2	2	If you enter this as an entire comment, you lose any preceding equal sign (=). If you enter any text before or after this, Excel maintains the content.
+2	"+2"	2	2	If you enter this as an entire comment, you lose any preceding plus sign (+). If you enter any text before or after this, Excel maintains the content.
002	"002"	2	2	If you enter this as an entire comment, you lose any preceding zeros. If you enter any text before or after this, Excel maintains the content.
test string	"test string"	test string	test string	Excel puts quotes around cell contents only if there is an embedded comma. RSLogix5000 always places double quotes around text. But RSLogix5000 can still handle the description without quotes.
"test string"	"$"test string$""	$test string$""	"$test string$"""""	Both Excel and RSLogix5000 alter content when it includes a dollar sign ($).
has "quoted text" within string	"has $"quoted text$" within string"	has $quoted text$" within string"	"has $quoted text $"" within string"""	Both Excel and RSLogix5000 alter content when it includes a dollar sign ($).
this has 'embedded' text	this has $'embedded$' text	this has $'embedded$' text	this has $'embedded$' text	Single quotes work fine in both software packages.

Original content:	Content in .CSV file after export:	Content after opening in Excel:	Content after saving from Excel:	Details:
+text	"+text"	#NAME?	#NAME?	Do not start a description or comment with a plus sign (+).
-text	"-text"	#NAME?	#NAME?	Do not start a description or comment with a minus sign (-).
=text	"=text"	#NAME?	#NAME?	Do not start a description or comment with an equal sign (=).

Notes:

Import/Export Revision History

Introduction

This appendix contains a history of enhancements made to the import/export utility **since** version 1.1 (major revision 1, minor revision 1) that was included with RSLogix 5000 programming software, version 8.0.

These releases of the import/export utility correspond to these releases of RSLogix 5000 software:

RSLogix 5000 version	Import/Export utility version
12.xx	2.3
11.xx	2.2
10.xx	2.1
9.00	2.0
5.02	1.2
8.xx, 7.xx, 6.xx, 2.xx	1.1
1.23, 1.21	1.0
1.11, 1.10	0.4

Backward Compatibility

The import/export utility supports backward compatibility for import operations. This means that the RSLogix 5000 programming software can import .L5K files that were generated by a previous version of the programming software. In some cases, an older .L5K file might not correctly import into newer version of the programming software. The revision history in this appendix will list any conditions when backward compatibility for an import operation does not work as expected.

The import/export utility does not support backward compatibility for export operations. This means that older version of the RSLogix 5000 programming software cannot read .L5K files that were created with newer versions of the programming software.

Each version of the RSLogix 5000 programming software exports .L5K files with a specific import/export version number. The RSLogix 5000 programming software imports any .L5K file with the same major revision number and the same or lower minor revision number. The major revision number increments when there are conditions such that the programming software cannot support backward compatibility for import operations. The minor revision number increments whenever there is a change in the file (a new module, an attribute is added, the set of options for an attribute is changed, etc.) that does not affect backward compatibility for import operations.

IMPORTANT Be careful when copying and pasting between different versions of .L5K files. Do not paste objects from an older .L5K file into a newer version.

Import/Export Version 2.3 RSLogix 5000 Version 12.xx

Version 2.3 (major revision 2, minor revision 3) of the import/export utility that is included with RSLogix 5000 programming software, version 12.01 included these major enhancements:

- The structured text component changed from STX_ROUTINE to ST_ROUTINE. The LanguageType attribute in SFC routines for embedded structured text also changed from STX to ST.
- Support for new controllers.
- Addition of the ControlNetSignature attribute to the MODULE component.
- Addition of the ProgrammaticallySendEventTrigger attribute to the TAG component.
- New COORDINATE_SYSTEM tag.
- Addition of several new attributes to the axis tag types.
- Addition of DisableFlag attribute to the PROGRAM component.
- Addition of EventTrigger and EventTag attributes to the TASK component to support Event tasks.
- New EVENT, IOT, MCCD, MCCM, MCLM, MCS, MCSD, and MCSR instructions in ladder logic and structured text.
- Addition of information regarding the LOGIC block when exporting online function block logic.
- Addition of new modules and their valid CommMethod and ConfigMethod values.

Import/Export Version 2.2 RSlogix 5000 Version 11.xx

Version 2.2 (major revision 2, minor revision 2) of the import/export utility that is included with RSLogix 5000 programming software, version 11.10 included these major enhancements:

- Support for the 1756-L63 controller.
- New controller attributes to support sequential function charts.
- Corrected the DATATYPE attributes and added the FamilyType attribute.
- Additional information for the CompatibleModule and KeyMask attributes of the MODULE component.
- Addition of RSNetWorxFileName attribute to the MODULE component.
- Addition of SFC_ACTION, SFC_STEP, and SFC_STOP tag types.
- Addition of 38400 as a supported serial port baud rate.
- Addition of structured text instructions.
- Addition of EOT, SFR, and SFP instructions to relay ladder and structured text.
- Addition of sequential function chart components.
- Addition of an appendix that lists the valid CommMethod and ConfigMethod values for the supported I/O modules.

Beginning with version 2.2, multi-line rung comments (with hard returns) are no longer exported as one long string (in double-quotes). Instead, each line of a multi-line rung comment is on a separate line in the .L5K file with double-quotes around each line. When imported, the multiple quoted strings are concatenated to form the rung comment. This improves the readability of the .L5K text file using the existing multiple-string capability of the rung comment syntax. Older formats still work on import.

Import/Export Version 2.1 RSLogix 5000 Version 10.xx

Version 2.1 (major revision 2, minor revision 1) of the import/export utility that is included with RSLogix 5000 programming software, version 10.0 included these major enhancements:

- Removal of the characters **/A** when specifying a controller type.
- Addition of the SecurityCode atttribute to the Controller object.
- Enhancments to the Message tag structure (see page B-4).
- The Program object now includes a Mode attribute.
- Correction to valid values for Watchdog and Rate attributes of the Task object.
- Addition of MaxStationAddress and TokenHoldFactor attributes to the Config DF1 object.
- Addition of new instructions: SIZE, SWPB, LOWER, and UPPER.
- The NumberOfAppendChars of the Config ASCII object is no longer exported. If you have an import/export file with any of these attributes, the file will correctly import into the software. This attributes will be removed when you later export the file.

Changes to support MESSAGE tag enhancements

Version 2.1 (major revision 2, minor revision 1) of the import/export utility that is included with RSLogix 5000 programming software, version 10.0 made significant changes to the MESSAGE tag. For reference, the following table shows the MESSAGE tag structure of the previous import/export release.

MESSAGE tag structure (version 2.0)

Attribute:	Description:
`Description`	Provide information about the tag. Specify: `Description := "text"`
`Comment`	Provide information about a tag component. Specify: `Comment<specifier> := "text"` Where the *specifier* is: *.bitnumber* for a bit in the tag [*element*] for an array element of the tag *.membername* for a structure member of the tag
`MessageType`	Enter Block Transfer Read, Block Transfer Write, CIP Data Table Read, CIP Data Table Write, CIP Generic, PLC2 Unprotected Read, PLC2 Unprotected Write, PLC3 Typed Read, PLC3 Typed Write, PLC3 Word Range Read, PLC3 Word Range Write, PLC5 Typed Read, PLC5 Typed Write, PLC5 Word Range Read, PLC5 Word Range Write, SLC Typed Read, or SLC Typed Write. Specify: `MessageType := text`
`RequestedLength`	Specify the number of elements in the message instruction (0-32,767). Specify: `RequestedLength := value`
`ConnectionPath`	Specify the connection path to the other device. Specify: `ConnectionPath := string`
`DF1DHFlag`	If the communication method uses DH+, enter 1. If the communication method does not use DH+, enter 0. Specify: `DF1DHFlag := value`
`LocalTag`	Specify the tag name of the element in the local device. Specify: `LocalTag := text`
`RemoteElement`	Specify the tag name of the element in the remote device. Specify: `RemoteElement := value`
`DHPlusSourceLink`	If the communication method uses DH+, specify the source link (0-65,535). Specify: `DHPlusSourceLink := value`
`DHPlusDestinationLink`	If the communication method uses DH+, specify the destination link (0-65,535). Specify: `DHPlusDestinationLink := value`
`DHPlusDestinationNode`	If the communication method uses DH+, specify the destination node number (0-63 octal). Specify: `DHPlusDestinationNode := value`
`DHPlusChannel`	If the communication method uses DH+, specify the DH+ channel. Enter either A or B. Specify: `DHPlusChannel := letter`
`CacheConnections`	If the message is to cache connections, enter TRUE. If the message is not to cache connections, enter FALSE. Specify: `CacheConnections := text`
`ServiceCode`	If the message type is CIP Generic, specify the service code (0-255 hexadecimal). Specify: `ServiceCode := #16value`
`ObjectType`	If the message type is CIP Generic, specify the object type (0-65,535 hexadecimal). Specify: `ObjectType := 16#value`

Attribute:	Description:
`TargetObject`	If the message type is CIP Generic, specify the target object (0-65,535 decimal). Specify: `TargetObject := value`
`AttributeNumber`	If the message type is CIP Generic, specify the attribute number (0-65,535 hexadecimal). Specify: `AttributeNumber := 16#value`
`DestinationTag`	Specify the tag name of the destination element. Specify: `DestinationTag := text`

Import/Export Version 2.0 RSLogix 5000 Version 9.00

Version 2.0 (major revision 2, minor revision 0) of the import/export utility that is included with RSLogix 5000 programming software, version 9.0 included these major enhancements:

- The AXIS tag was replaced with AXIS_CONSUMED, AXIS_SERVO, AXIS_SERVO_DRIVE, and AXIS_VIRTUAL tags.
- For any attribute that you can specify a "not applicable" state, you must enter <NA>, rather than just NA.
- This revision of the manual includes a description and example of the STRING data type.

IMPORTANT Version 9 of RSLogix 5000 programming software only supports ControlLogix processors.

Motion Changes to Support the SERCOS Protocol

Version 2.0 (major revision 2, minor revision 0) of the import/export utility that is included with RSLogix 5000 programming software, version 9.0 made significant changes to motion-related tags to support the SERCOS protocol:

- CoarseUpdatePeriod and AutoTagUpdate parameters were added to the MOTION_GROUP tag to support SERCOS. For reference, the previous structure is described below (page B-8).

- Earlier versions of the import/export utility supported one AXIS tag. To support SERCOS, the import/export utility replaced AXIS with four different axis tags: AXIS_CONSUMED, AXIS_SERVO, AXIS_SERVO_DRIVE, and AXIS_VIRTUAL. The previous AXIS tag is incorporated into these new tags, but no longer exists as its own tag. For reference, the AXIS structure is described below (page B-8).

  If you have a version 8.0 import/export file with AXIS tags that you import into version 9.0 software (after changing the import/export version line to 2.0), the AXIS tags convert to:

If the AXIS type is:	It converts to:
unused	AXIS_SERVO
position only	AXIS_SERVO
servo	AXIS_SERVO
consumed	AXIS_CONSUMED
virtual	AXIS_VIRTUAL

MOTION_GROUP tag structure (version 1.1)

Attribute:	Description:
`Description`	Provide information about the tag. Specify: `Description := "text"`
`Comment`	Provide information about a tag component. Specify: `Comment<specifier> := "text"` Where the *specifier* is: *.bitnumber* for a bit in the tag [*element*] for an array element of the tag *.membername* for a structure member of the tag
`GroupType`	Specify the type of motion group, such as Independent. Specify: `GroupType := text`
`CoarseUpdateMultiplier`	Specify the coarse update rate (5-320ms). Specify: `CoarseUpdateMultiplier := value`
`ServoUpdatePeriod`	Specify the servo update period in milliseconds (any positive number) Specify: `ServoUpdatePeriod := value`
`PhaseShift`	Specify the phase shift (0-65,535). Specify: `PhaseShift := value`
`GeneralFaultType`	Specify whether an error generates a major fault or a non-major fault. Enter "Major Fault" or "Non Major Fault." Specify: `GeneralFaultType := text`

AXIS tag structure (version 1.1)

Attribute:	Description:
`Description`	Provide information about the tag. Specify: `Description := "text"`
`Comment`	Provide information about a tag component. Specify: `Comment<specifier> := "text"` Where the *specifier* is: *.bitnumber* for a bit in the tag [*element*] for an array element of the tag *.membername* for a structure member of the tag
`MotionGroup`	Enter the name of the associated motion group, or enter NA. Specify: `MotionGroup := text`
`MotionModule`	Enter the name of the associated motion module, or enter NA. Specify: `MotionModule := text`
`AxisState`	Enter Axis-Ready, Direct Drive Control, Servo Control, Axis Faulted, or Axis Shutdown. Specify: `AxisState := text`
`PositionUnits`	Specify the type of units. Specify: `PositionUnits := text`
`TimeUnits`	Enter Seconds or Minutes. Specify: `TimeUnits := text`

Attribute:	Description:
InstructionSpeedUnits	Enter Percentage or Engineering Units. Specify: `InstructionSpeedUnits := text`
InstructionAccelDecelUnits	Enter Percentage or Engineering Units. Specify: `InstructionAccelDecelUnits := text`
InstructionMoveProfile	Enter Trapezoidal or S-Curve. Specify: `InstructionMoveProfile := text`
InstructionJogProfile	Specify Trapezoidal or S-Curve. Specify: `InstructionJogProfile := text`
ConversionConstant	Specify the conversion constant. Enter a real number from 1.0 to $1.0e^9$. Specify: `ConversionConstant := value`
HomeMode	Enter Passive or Active. Specify: `HomeMode := text`
HomeSequenceType	Enter Immediate Home, Home To Switch, Home To Marker Only, or Home To Switch With Marker. Specify: `HomeSequenceType := text`
HomePosition	Specify the home position (any positive number). Specify: `HomePosition := value`
HomeSpeed	Specify the home speed (any positive number). Specify: `HomeSpeed := value`
HomeReturnSpeed	Specify the home return speed (any positive number). Specify: `HomeReturnSpeed := value`
MaximumSpeed	Specify the maximum speed (any positive number). Specify: `MaximumSpeed := value`
MaximumAcceleration	Specify the maximum acceleration (any positive number). Specify: `MaximumAcceleration := value`
MaximumDeceleration	Specify the maximum deceleration (any positive number). Specify: `MaximumDeceleration := value`
ProgrammedStopMode	Enter Fast Stop, Fast Shutdown, or Hard Shutdown. Specify: `ProgrammedStopMode := text`
AverageVelocityTimebase	Specify the average velocity timebase (any positive number). Specify: `AverageVelocityTimebase := value`
ServoStatusUpdateBits	Specify the servo status update bits. Enter a hexadecimal number. Specify: `ServoStatusUpdateBits := 16#value`
MotionConfigurationBits	Specify the motion configuration bits. Enter a hexadecimal number. Specify: `MotionConfigurationBits := 16#value`
AxisType	Enter Unused, Position Only, Servo, Consumed, or Virtual. Specify: `AxisType := text`
PositionUnwind	Specify the unwind position (0-65,535). Specify: `PositionUnwind := value`
MaximumPositiveTravel	Specify the maximum positive travel (any positive number). Specify: `MaximumPositiveTravel := value`
MaximumNegativeTravel	Specify the maximum negative travel (any positive number). Specify: `MaximumNegativeTravel := value`
PositionErrorTolerance	Specify the position error tolerance (any positive number). Specify: `PositionErrorTolerance := value`

Attribute:	Description:
PositionLockTolerance	Specify the position local tolerance (any positive number). Specify: `PositionLockTolerance := value`
PositionProportionalGain	Specify position proportional gain (any positive number). Specify: `PositionProportionalGain := value`
PositionIntegralGain	Specify the position integral gain (any positive number). Specify: `PositionIntegralGain := value`
VelocityFeedforwardGain	Specify the velocity feedforward gain (any positive number). Specify: `VelocityFeedforwardGain := value`
AcclerationFeedforwardGain	Specify the acceleration feedforward gain (any positive number). Specify: `AccelerationFeedforwardGain := value`
VelocityProportionalGain	Specify the velocity proportional gain (any positive number). Specify: `VelocityProportionalGain := value`
VelocityIntegralGain	Specify velocity integral gain (any positive number). Specify: `VelocityIntegralGain := value`
OutputFilterBandwidth	Specify output filter bandwidth (any positive number). Specify: `OutputFilterBandwidth := value`
OutputScaling	Specify the output scaling (any positive number). Specify: `OutputScaling := value`
OutputLimit	Specify the output limit (any positive number). Specify: `OutputLimit := value`
OutputOffset	Specify output offset (any positive number). Specify: `OutputOffset := value`
FrictionCompensation	Specify friction compensation (any positive number). Specify: `FrictionCompensation := value`
SoftOvertravelFaultAction	Enter Shutdown, Disable Drive, Stop Motion, or Status Only. Specify: `SoftOvertravelFaultAction := text`
PositionErrorFaultAction	Enter Shutdown, Disable Drive, Stop Motion, or Status Only. Specify: `PositionErrorFaultAction := text`
EncoderLossFaultAction	Enter Shutdown, Disable Drive, Stop Motion, or Status Only. Specify: `EncoderLossFaultAction := text`
EncoderNoiseFaultAction	Enter Shutdown, Disable Drive, Stop Motion, or Status Only. Specify: `EncoderNoiseFaultAction := text`
DriveFaultAction	Enter Shutdown, Disable Drive, Stop Motion, or Status Only. Specify: `DriveFaultAction := text`
ServoConfigurationBits	Specify the servo configuration bits. Enter a hexadecimal number. Specify: `ServoConfigurationBits := 16#value`
MotorEncoderTestIncrement	Specify the motor encoder test increment (any positive number). Specify: `MotorEncoderTestIncrement := value`
TuningTravelLimit	Specify the tuning travel limit (any positive number). Specify: `TuningTravelLimit := value`
TuningSpeed	Specify the tuning speed (any positive number). Specify: `TuningSpeed := value`

Attribute:	Description:
`DampingFactor`	Specify the damping factor (any positive number). Specify: `DampingFactor := value`
`PositionServoBandwidth`	Specify position servo bandwidth (any positive number). Specify: `PositionServoBandwidth := value`
`TuningConfigurationBits`	Specify the tuning configuration bits. Enter a hexadecimal number. Specify: `TuningConfigurationBits := 16#value`

Import/Export Version 1.1 RSLogix 5000 Version 8.xx

Version 1.1 (major revision 1, minor revision 1) of the import/export utility that is included with RSLogix 5000 programming software, version 8.0 included these major enhancements:

- Addition of function block instructions and routines.
- Addition of ASCII instructions.
- Verification of all instruction attributes and parameters.

Notes:

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Notes:

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Corporate Headquarters
Rockwell Automation, 777 East Wisconsin Avenue, Suite 1400, Milwaukee, WI, 53202-5302 USA, Tel: (1) 414.212.5200, Fax: (1) 414.212.5201

Headquarters for Allen-Bradley Products, Rockwell Software Products and Global Manufacturing Solutions
Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
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Asia Pacific: Rockwell Automation, 27/F Citicorp Centre, 18 Whitfield Road, Causeway Bay, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Headquarters for Dodge and Reliance Electric Products
Americas: Rockwell Automation, 6040 Ponders Court, Greenville, SC 29615-4617 USA, Tel: (1) 864.297.4800, Fax: (1) 864.281.2433
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Asia Pacific: Rockwell Automation, 55 Newton Road, #11-01/02 Revenue House, Singapore 307987, Tel: (65) 351 6723, Fax: (65) 355 1733

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