User Manual

Allen-Bradley

Using the Mining, Mineral, and Cement Library (MMCL) in RSLogix 5000 Applications

Allen-Bradley • Rockwell Software

Rockwell Automation

Important User Information

Solid-state equipment has operational characteristics differing from those of electromechanical equipment. Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls (publication SGI-1.1 available from your local Rockwell Automation sales office or online at http://www.rockwellautomation.com/literature/) describes some important differences between solid-state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid-state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

	**WARNING:** Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
	**ATTENTION:** Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence
	**SHOCK HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
	**BURN HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

Chapter 5

Inter Process Communication

Chapter 6

Application Examples

Appendix A

Additional Information

Introduction

This document describes how to create an application with RSLogix 5000 using the Mining, Mineral, and Cement Library (MMCL). It does not show product installation or setup of the IT infrastructure.

Requirements

Item	Requirements
Software	• RSLogix 5000 version 17 or later • Data Retrieval Tool Tag Import Files[(a)]: CLX_TAGS_OUT.csv CLX_STRUCTURES_OUT.csv
Library	MMCL_V200_AOI_20100501.ACD or later
Hardware	ControlLogix controller, 1756-L6x, firmware revision 17.xx
Skills	Knowledge of communication networks and I/O modules

(a) These files may be generated by the Data Retrieval Tool and created automatically by the MMCL (MMCL_HDRS_DataTool_V132.mdb).

Before You Begin

The creation of an RSLogix application is based on the MMCL and the following data files.

Item	Requirements	Description
Library	MMCL_V200_AOI_20100501.ACD	Basic application with Add-On Instructions, provided in the MMCL
Data Retrieval Tool	CLX_TAGS_OUT.csv	Option to automatically create module tags, created in the Data Retrieval Tool
	CLX_STRUCTURES_OUT.csv	Option to automatically create Add-On Instruction structures, created in the Data Retrieval Tool

MMCL Deliverables

The base library project contains the following Add-On Instructions.

Name of Element	Description
SysGrp_AOI	System Group (one only per CLX)
CtrlGrp_AOI	Control Group
MaGrp_AOI	Machine Group
IPCom_AOI	Inter-process Communication
MotorN_AOI	Motor Normal Drive (one direction)
MotorR_AOI	Motor Forward/Reverse Drive (two directions)
MotorD_AOI	Motor Damper/Flap Drive
E3p_AOI	RA E3 Plus Motor Starter
SubSys_AOI	Sub-System
Valve1_AOI	Valve with 1 Coil
Valve2_AOI	Valve with 2 Coils
DigInp_AOI	Digital Input
DigInp2_AOI	Digital Input for two input (drift switch)
Digpulse_AOI	Digital Pulse Input
AnInp_AOI	Analog Input
AninpC_AOI	Analog Input and Control Outputs
ActMod_AOI	Actuator Module
ActPos_AOI	Actuator Positioning
PidMod_AOI	PID Module
MotorN_Sim_AOI	Motor Normal Drive Simulator
MotorR_Sim_AOI	Motor Forward/Reverse Drive Simulator
MotorD_Sim_AOI	Motor Damper/Flap Drive Simulator
MotorNE3p_Sim_AOI	Motor Normal Drive with E3P Simulator
MotorRE3p_Sim_AOI	Motor Forward/Reverse Drive with E3P Simulator
MotorDE3p_Sim_AOI	Motor Damper/Flap Drive with E3P Simulator
Valve1_Sim_AOI	Valve with 1 Coil Simulator
Valve2_Sim_AOI	Valve with 2 Coils Simulator
DigInp_Sim_AOI	Digital Input Simulator
DigInp2_Sim_AOI	Digital Input for 2 Inputs Simulator
DigPulse_Sim_AOI	Digital Pulse Input Simulator
AnaInp_Sim_AOI	Analog Input Simulator
ActMod_Sim_AOI	Actuator Module Simulator
PID_SIM_AOI	PID Module Simulator

Name of Element	Description
L_CPU_17_AOI	Processor Utilization
P_Intlk_AOI	Interlocks
P_Perm_AOI	Permissives

Reference Documents

These documents contain additional information concerning related Rockwell Automation products.

- Integrating Mining, Mineral, and Cement Library (MMCL) into RSLogix 5000 Software Reference Manual, publication RA-RM002
- Platform Architecture Guide rev2.0.pdf or later

Notes:

Developing an RSLogix 5000 Application

Creating a New Project

1. In RSLogix, open the MMCL_V200_AOI_YYYYMMDD.acd file provided in the MMCL.

   This application contains all Add-On Instructions.

2. Under File, select Save As.

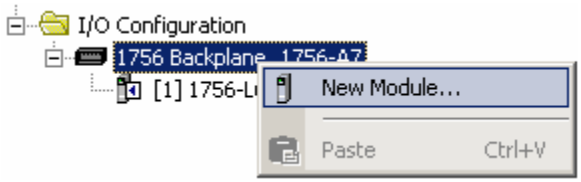
3. Type your desired project name (for example, UserProject_yyyy_mm_dd.acd) and click Save.

Configure Hardware I/O Modules

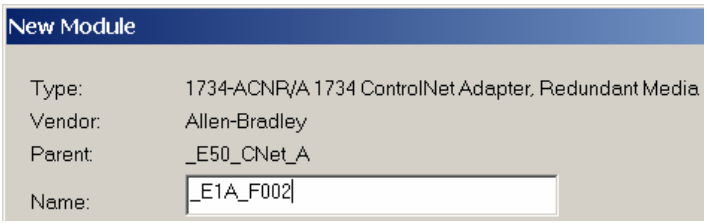
All I/O modules used by the application are inserted and configured with the I/O configuration tool.

1. Configure all hardware I/O modules located in the chassis.

   For remote I/O modules (Networks), the adapters and required I/O modules must be configured.



IMPORTANT The I/O module Name must correspond to the Data Retrieval Tool tag designation (import file).



This is necessary for later export of I/O Module data and backup import to the Data Retrieval Tool data base.

The backup import is used to store the proper hardware addresses, in the Data Retrieval Tool data base.

For Tag names and Alias designations using Asset Code (AC), refer to N_050817_HDRS_RSLogix_Concept.pdf.

Import Tags with the Data Retrieval Tool CSV Files

When using the AC for tag designations, you can export a.csv file, from the Data Retrieval Tool and import the data to RSLogix 5000. This import automatically creates the tags and its members, for all devices specified in Data Retrieval Tool. The .csv files are created by the Data Retrieval Tool export function and imported into RSLogix 5000.

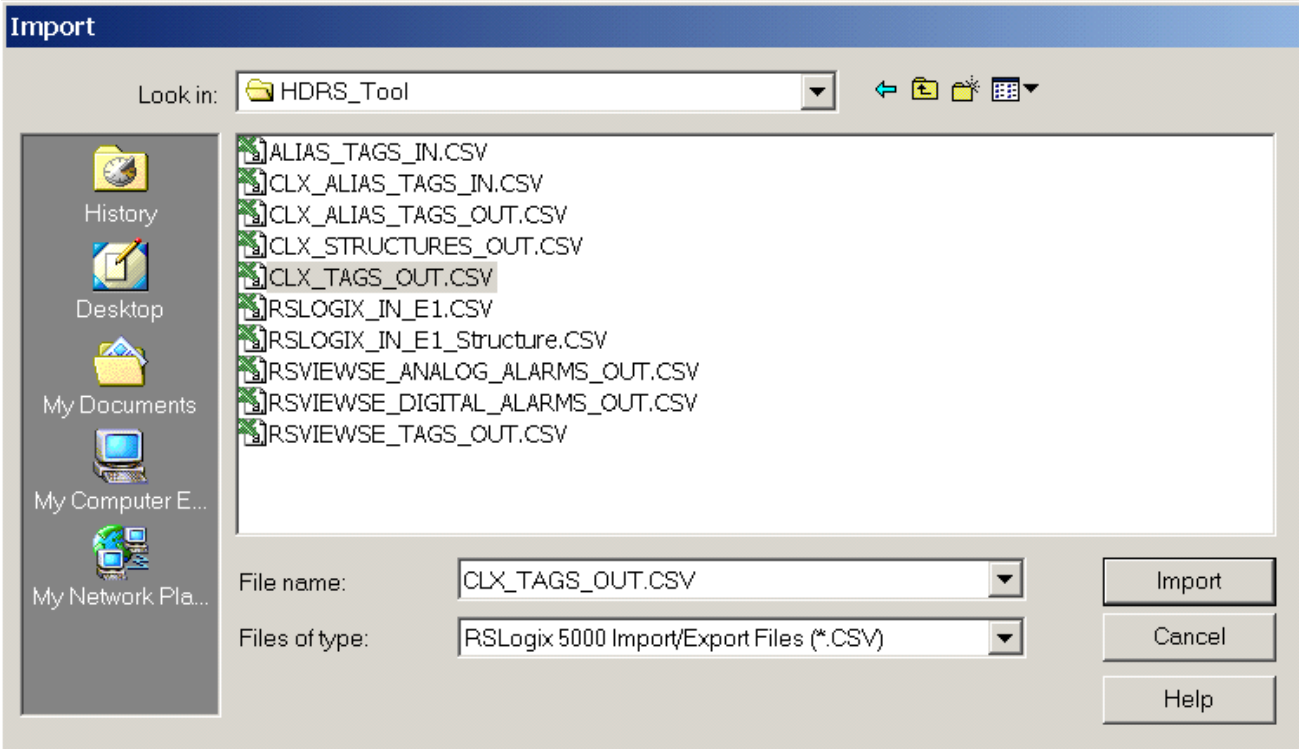
The Data Retrieval Tool export procedure is described in document: HDRS-DataRetrievalTool_100.pdf

The RSLogix 5000 import procedure requires Microsoft ACCESS program: MMCL_HDRS_DataTool_V132.mdb

The import procedure is described in document: MMCL_HDRS-DataRetrievalTool_V130.pdf

1. Under Tools, select Import.

2. Browse to the CLX_TAGS_OUT.CSV file and click Import.



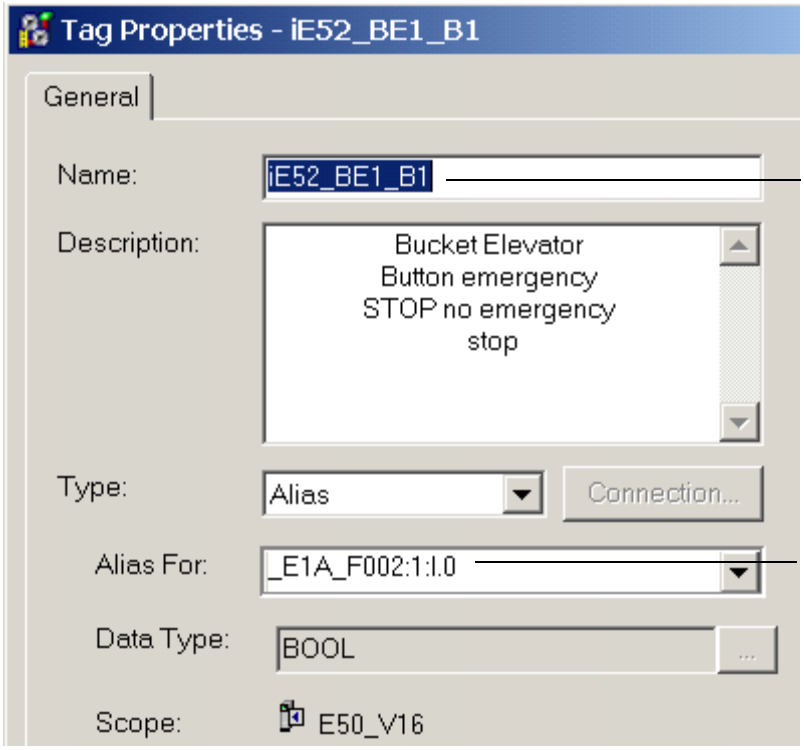
3. Complete this process for the CLX_STRUCTURES_OUT.CSV file.

Refer to the Workflow Data Retrieval Tool on page 60 for more information.

Alias I/O Descriptor

The Alias I/O descriptor specifies the exact hardware terminals and the particular I/O module. It is therefore, necessary to know how the I/O modules are installed and wired.

Example of Tag Properties



IMPORTANT **Do not** assign the same Alias twice. We recommended that you check for duplicate addresses prior to using the application. Select Controller Tags and sort Alias by ascending order, then check the list for possible duplications.

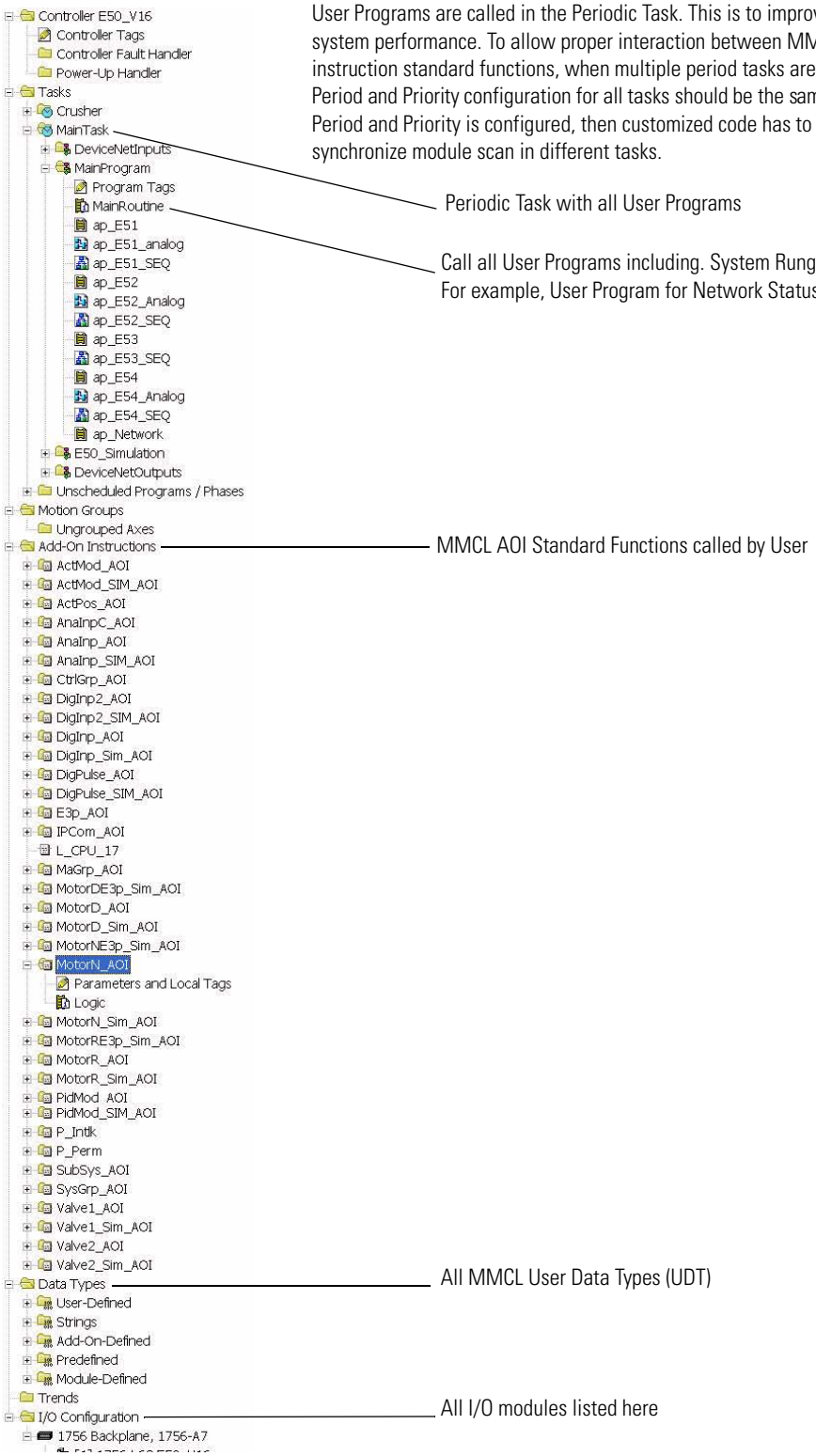
The following is an example I/O Configuration with Controller Tags and Alias I/O addresses:

Scope: E50_V16 Show... Show All

Name	Alias For	Base Tag	Data Type	Style
iE52_BE1_B1	_E1A_F002:1:I.0	_E1A_F002:I.Data[1].0	BOOL	Decimal
iE52_BE1_BG	_E1A_F002:1:I.1	_E1A_F002:I.Data[1].1	BOOL	Decimal
iE52_BE1_BS	_E1A_F002:1:I.2	_E1A_F002:I.Data[1].2	BOOL	Decimal
iE52_BE1_D3	_E1A_F002:1:I.3	_E1A_F002:I.Data[1].3	BOOL	Decimal
iE52_BE1_D4	_E1A_F002:2:I.0	_E1A_F002:I.Data[2].0	BOOL	Decimal
iE52_BE1_L1	_E1A_F002:2:I.1	_E1A_F002:I.Data[2].1	BOOL	Decimal
iE52_BE1_S1	_E1A_F002:2:I.2	_E1A_F002:I.Data[2].2	BOOL	Decimal
iE53_BC1_D1	_E1A_F002:2:I.3	_E1A_F002:I.Data[2].3	BOOL	Decimal
iE53_BC1_D2	_E1A_F002:3:I.0	_E1A_F002:I.Data[3].0	BOOL	Decimal
iE53_BC1_D3	_E1A_F002:3:I.1	_E1A_F002:I.Data[3].1	BOOL	Decimal
iE53_BC1_D4	_E1A_F002:3:I.2	_E1A_F002:I.Data[3].2	BOOL	Decimal
iE53_BC1_M1_G	_E1A_F002:3:I.3	_E1A_F002:I.Data[3].3	BOOL	Decimal
iE53_BC1_M1_S	_E1A_F002:4:I.0	_E1A_F002:I.Data[4].0	BOOL	Decimal
iE53_BC1_M1_U	_E1A_F002:4:I.1	_E1A_F002:I.Data[4].1	BOOL	Decimal
iE53_BC1_R1	_E1A_F002:4:I.2	_E1A_F002:I.Data[4].2	BOOL	Decimal
iE53_BC1_R2	_E1A_F002:4:I.3	_E1A_F002:I.Data[4].3	BOOL	Decimal
iE53_BC1_R3	_E1A_F002:5:I.0	_E1A_F002:I.Data[5].0	BOOL	Decimal
iE53_BC1_R4	_E1A_F002:5:I.1	_E1A_F002:I.Data[5].1	BOOL	Decimal
iE53_BC1_S1	_E1A_F002:5:I.2	_E1A_F002:I.Data[5].2	BOOL	Decimal
⊞-_E1A_F002:1:I	_E1A_F002:I.Data[1]	_E1A_F002:I.Data[1]	SINT	Binary
⊞-_E1A_F002:2:I	_E1A_F002:I.Data[2]	_E1A_F002:I.Data[2]	SINT	Binary
⊞-_E1A_F002:3:I	_E1A_F002:I.Data[3]	_E1A_F002:I.Data[3]	SINT	Binary

Creating User Programs

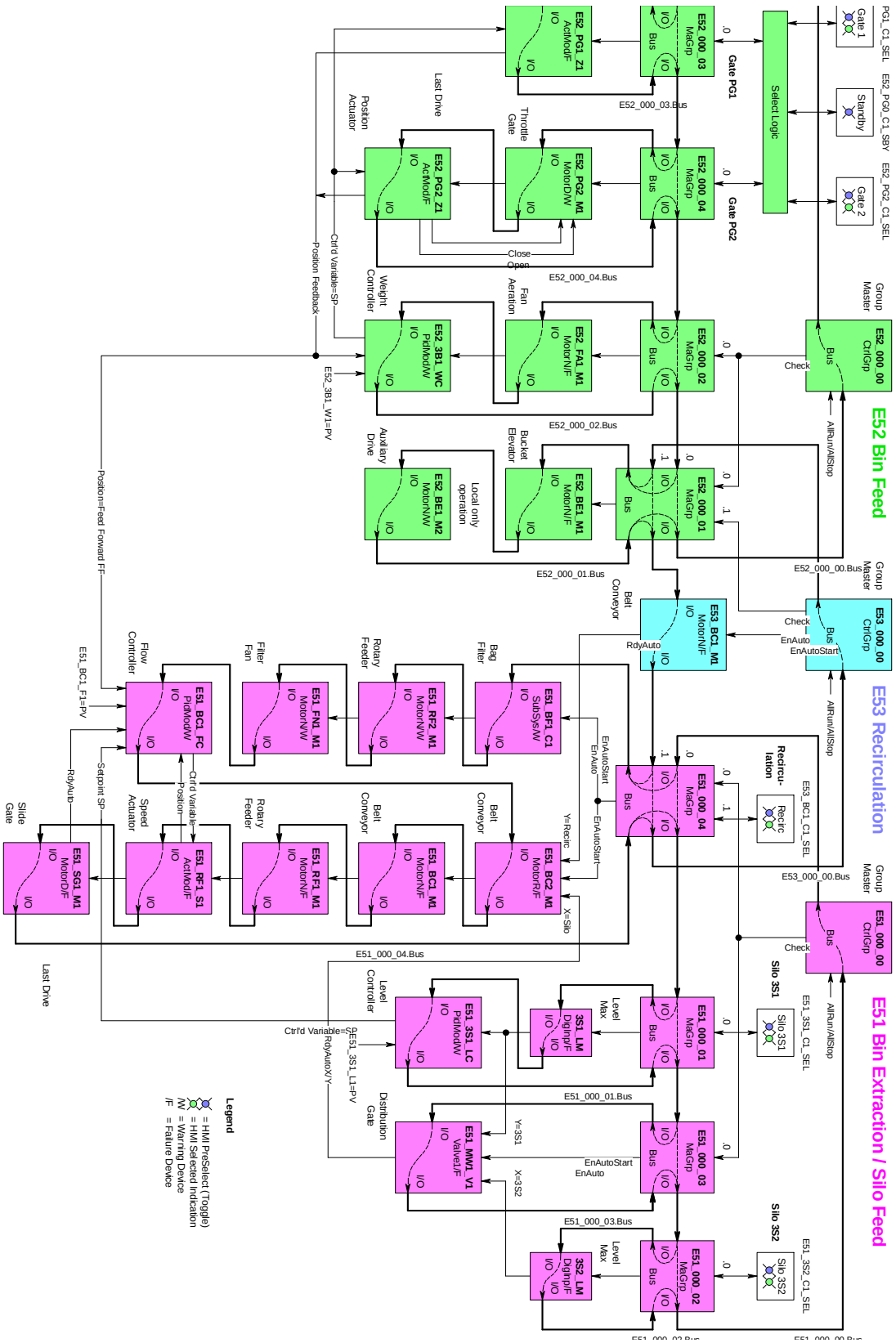
The RSLogix 5000 project originates from the MMCL_V200_20100501.acd file. The following program and data folders are included in the project.



Program Design and Application Tips

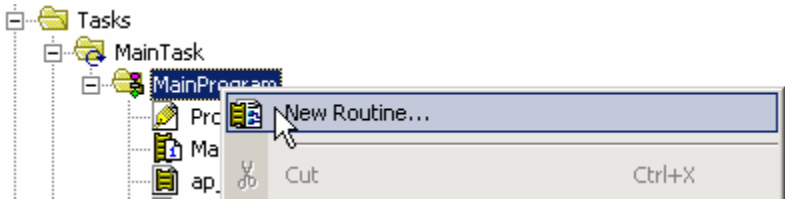
- User Programs can be called by the Continuous or Period Tasks. When Periodic Tasks are used, certain rules have to be followed because the MMCL Add-On Instruction Standard Functions are originally designed for Continuous Tasks.
- Setup the I/O module, or device parameters, immediately after a new module is installed.
- The System Group Module, SysGrp_AOI, must be called only once in the application. Its input, ApplyPar, signals all analog modules to read changed parameters on-line.
- The User Program, ap_Network, is an example that shows how to get the Network Status from an I/O Module and make it visible to the HMI.
- The main program, MainRoutine, contains some System Rungs. These rungs may be extended and/or adapted as required.
- Analyze the desired functions before programming. Outline the Control and Machine Groups. Specify the calling order and start and stop sequences of Modules within a Group.

Example Application Overview



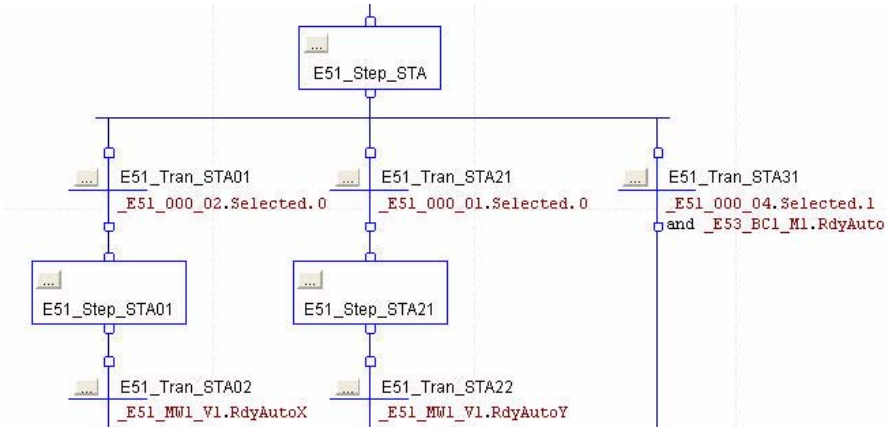
Grouping of Programs

For a clear program structure, it is recommended, to specify separate programs for each Control Group. To start a new program, right-click the MainProgram and select New Routine.

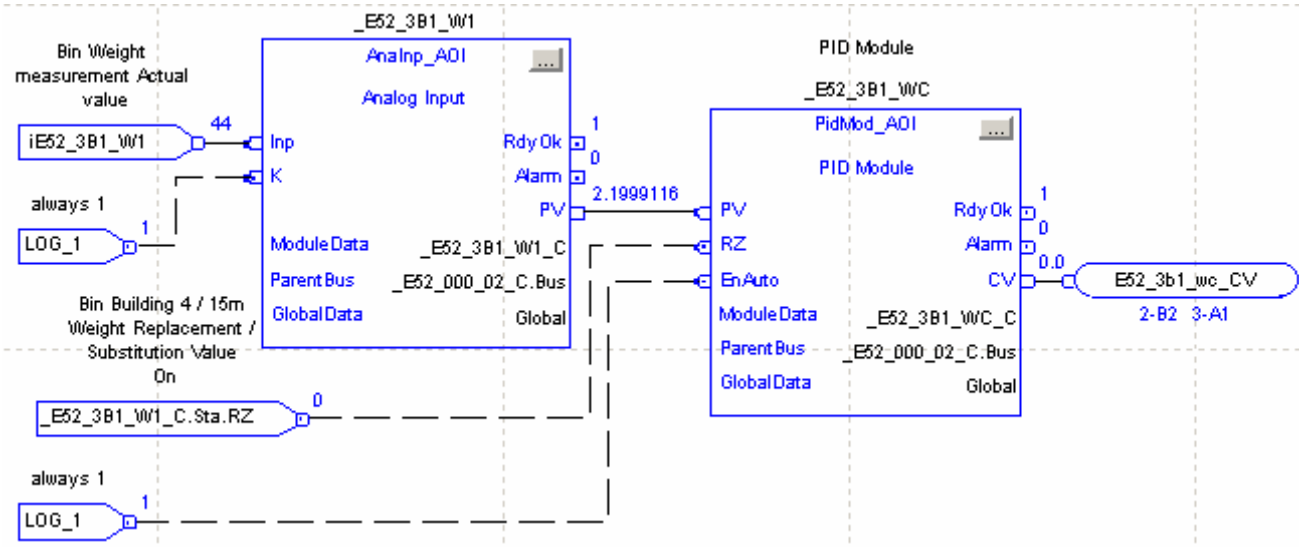


A Control Group may also be split functionally, using a **ladder program,** for motor control I/O status and interlocking, a **Sequential Function Chart** (SFC), for module start and stop sequences (including structured text) and a **Function Block Diagram** (FBD), for analog process controls. The different methods are supported by the corresponding RSLogix 5000 Editors. The MMCL Add-On Instructions are available for Ladder, Function Block and Structured Text.

For **automatic start and stop sequences,** use an SFC, especially if devices must be stopped individually, rather than by a common shutdown command. If, however, a common shutdown or delay time is suitable, then an SFC is not required and a group can be stopped by the Control Group's built-in stop-delay timer, using standard ladder interlocking only.



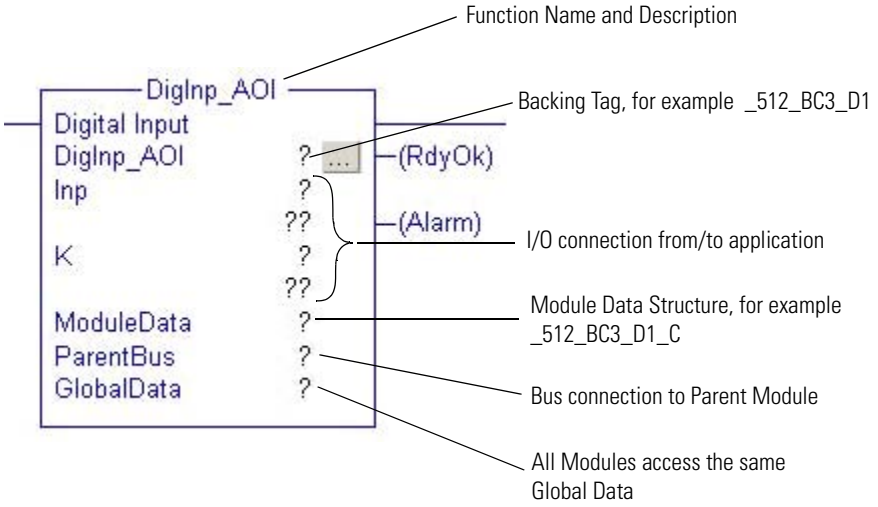
For **analog signal processing,** use a FBD**,** which is more comprehensive, showing the signal flow better than a Ladder diagram.


_E52_3B1_W1
AnaInp_AOI
Analog Input
Bin Weight measurement Actual value
iE52_3B1_W1
44
Inp
K
always 1
LOG_1
1
Module Data
Parent Bus
Global Data
_E52_3B1_W1_C
_E52_000_02_C.Bus
Global
Rdy Ok
Alarm
PV
1
0
2.1999116
Bin Building 4 / 15m Weight Replacement / Substitution Value On
_E52_3B1_W1_C.Sta.RZ
0
always 1
LOG_1
1
PID Module
_E52_3B1_WC
PidMod_AOI
PID Module
PV
RZ
EnAuto
Module Data
Parent Bus
Global Data
_E52_3B1_WC_C
_E52_000_02_C.Bus
Global
Rdy Ok
Alarm
CV
1
0
0.0
E52_3b1_wc_CV
2-B2 3-A1

Notes:

Rules and Recommendations

Add-On Instruction Interface Definition

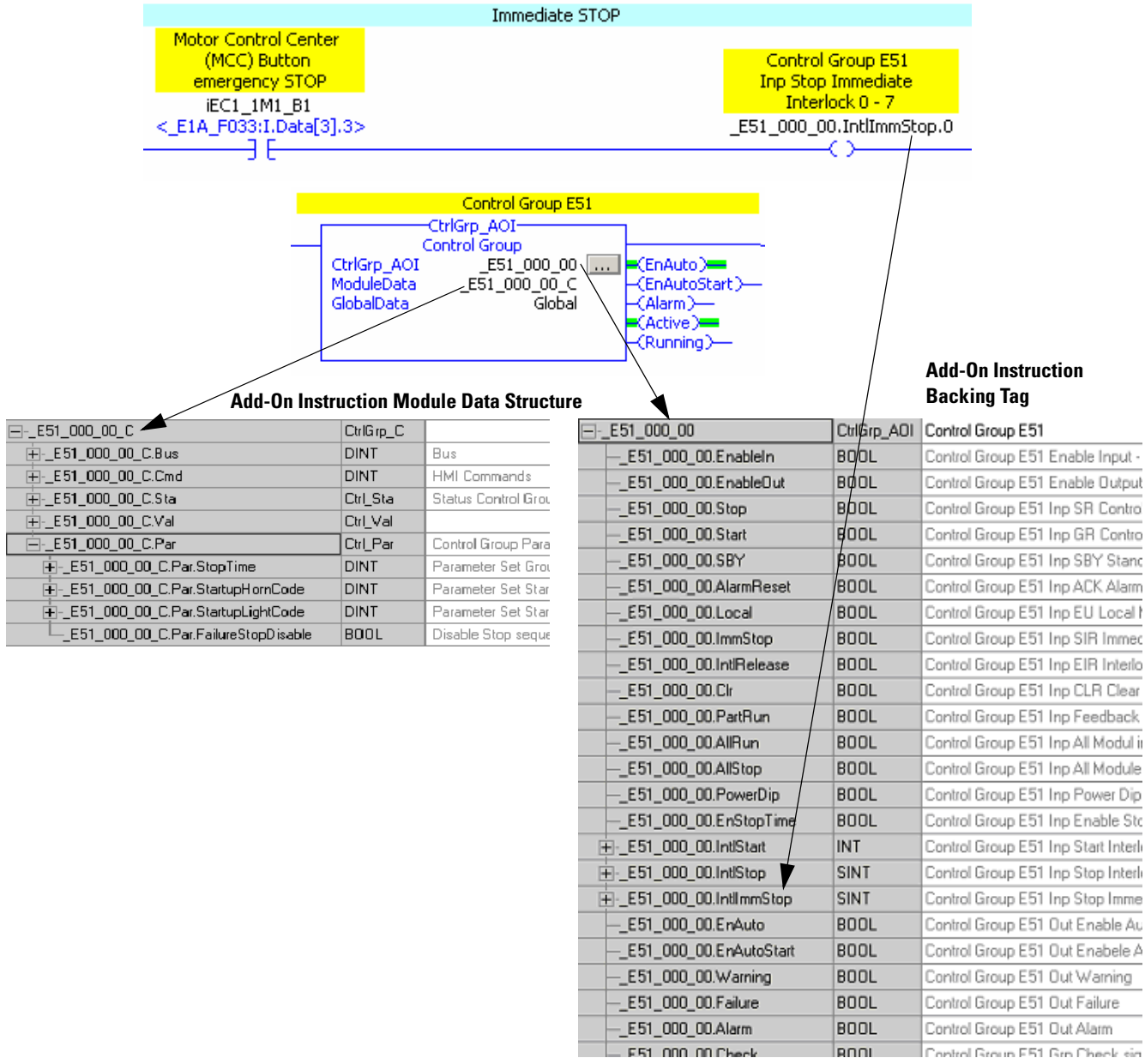


The Backing Tag (instance name of the Add-On Instruction) must be unique. The name of the ModuleData Tag is the same as the Backing Tag extended by "_C " (for control). For example, if the Backing Tag is _512_BC3_D1, then the ModuleData Tag is _512_BC3_D1_C.

Typical Add-On Instruction Function Call

Each MMCL Add-On Instruction function has three data structures:

- All direct Inputs/Outputs are specified by the Backing Tag (instance name of Add-On Instruction).
- The ModuleData Tag is referenced by the Add-On Instruction, this data may be read and written by other modules/devices. It contains HMI data (Sta, Cmd, and Val) or Parameters (Par).
- The Global Tag is used by all modules and contains common Parameters or, for example, the interface for the Startup Warnings (Horn/Flash) and Alarm Gong.



_E51_000_00_C	CtrlGrp_C	
_E51_000_00_C.Bus	DINT	Bus
_E51_000_00_C.Cmd	DINT	HMI Commands
_E51_000_00_C.Sta	Ctrl_Sta	Status Control Grou
_E51_000_00_C.Val	Ctrl_Val	
_E51_000_00_C.Par	Ctrl_Par	Control Group Para
_E51_000_00_C.Par.StopTime	DINT	Parameter Set Grou
_E51_000_00_C.Par.StartupHornCode	DINT	Parameter Set Star
_E51_000_00_C.Par.StartupLightCode	DINT	Parameter Set Star
_E51_000_00_C.Par.FailureStopDisable	BOOL	Disable Stop seque

_E51_000_00	CtrlGrp_AOI	Control Group E51
_E51_000_00.EnableIn	BOOL	Control Group E51 Enable Input -
_E51_000_00.EnableOut	BOOL	Control Group E51 Enable Output
_E51_000_00.Stop	BOOL	Control Group E51 Inp SR Contro
_E51_000_00.Start	BOOL	Control Group E51 Inp GR Contro
_E51_000_00.SBY	BOOL	Control Group E51 Inp SBY Stanc
_E51_000_00.AlarmReset	BOOL	Control Group E51 Inp ACK Alarm
_E51_000_00.Local	BOOL	Control Group E51 Inp EU Local I
_E51_000_00.ImmStop	BOOL	Control Group E51 Inp SIR Immec
_E51_000_00.IntlRelease	BOOL	Control Group E51 Inp EIR Interlo
_E51_000_00.Clr	BOOL	Control Group E51 Inp CLR Clear
_E51_000_00.PartRun	BOOL	Control Group E51 Inp Feedback
_E51_000_00.AllRun	BOOL	Control Group E51 Inp All Modul i
_E51_000_00.AllStop	BOOL	Control Group E51 Inp All Module
_E51_000_00.PowerDip	BOOL	Control Group E51 Inp Power Dip
_E51_000_00.EnStopTime	BOOL	Control Group E51 Inp Enable Sto
_E51_000_00.IntlStart	INT	Control Group E51 Inp Start Interl
_E51_000_00.IntlStop	SINT	Control Group E51 Inp Stop Interl
_E51_000_00.IntlImmStop	SINT	Control Group E51 Inp Stop Imme
_E51_000_00.EnAuto	BOOL	Control Group E51 Out Enable Au
_E51_000_00.EnAutoStart	BOOL	Control Group E51 Out Enabele A
_E51_000_00.Warning	BOOL	Control Group E51 Out Warning
_E51_000_00.Failure	BOOL	Control Group E51 Out Failure
_E51_000_00.Alarm	BOOL	Control Group E51 Out Alarm
_E51_000_00.Check	BOOL	Control Group E51 Grp Check sig

Using Parameters

It is important to set device parameters correctly in order to avoid malfunctioning devices. After creating the tags, when importing the .csv file from the Data Retrieval Tool, you should download the default parameter values created by the Data Retrieval Tool, using the built in Tag Up-/Download tool.

When you program a device, we recommend that you immediately verify the parameter settings, according to your application.

For detailed information about parameters, see the Integrating the Mining, Mineral, and Cement Library (MMCL) into RSLogix 5000 Reference Manual, publication RA-RM002.

Add-On Instruction Module Parameter

The user can determine certain functions and/or the behavior of an Add-On Instruction module by setting the parameter. The parameters are part of the ModuleData Tag and defined as Tag members Par.xxx. Global Parameters, that are valid for multiple Add-On Instructions, are specified by Tag members Global.Par.xxx.

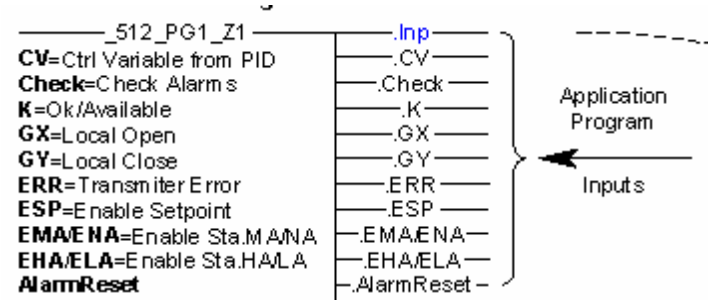
IMPORTANT Carefully adjust and check adjust all Parameter settings before testing your software. We recommended that you set the parameters immediately after a new Add-On Instruction function is applied. Make sure Module Type, Timers [in ms], PID Gains, Filters, Alarm, Control Thresholds, etc. are set correctly. Trouble shooting, may be made difficult, if parameters are wrong, or not set.

Global Apply Parameter

This parameter is a special function within the System Group. If you set the Global.ApplyPar parameter to 1, it will apply all the changes made to parameters in the AnaInp_AOI, AnaInpC_AOI, ActMod_AOI, and PidMod_AOI used for scaling and sample rate. If this parameter is changed, the change does not take effect until the ApplyPar is toggled.

Enable Alarming in Analog Modules

To use the alarming capabilities of the AnaInp, AnaInpC and ActMod modules, you must enable each alarm individually. This can be done by either setting the tags <DEVICE>.EMA/.EHA/.ELA/.ENA to 1 while you are programming the device, or by switching the tags dynamically from On to Off through the logic program according to the application requirements.



Control Group

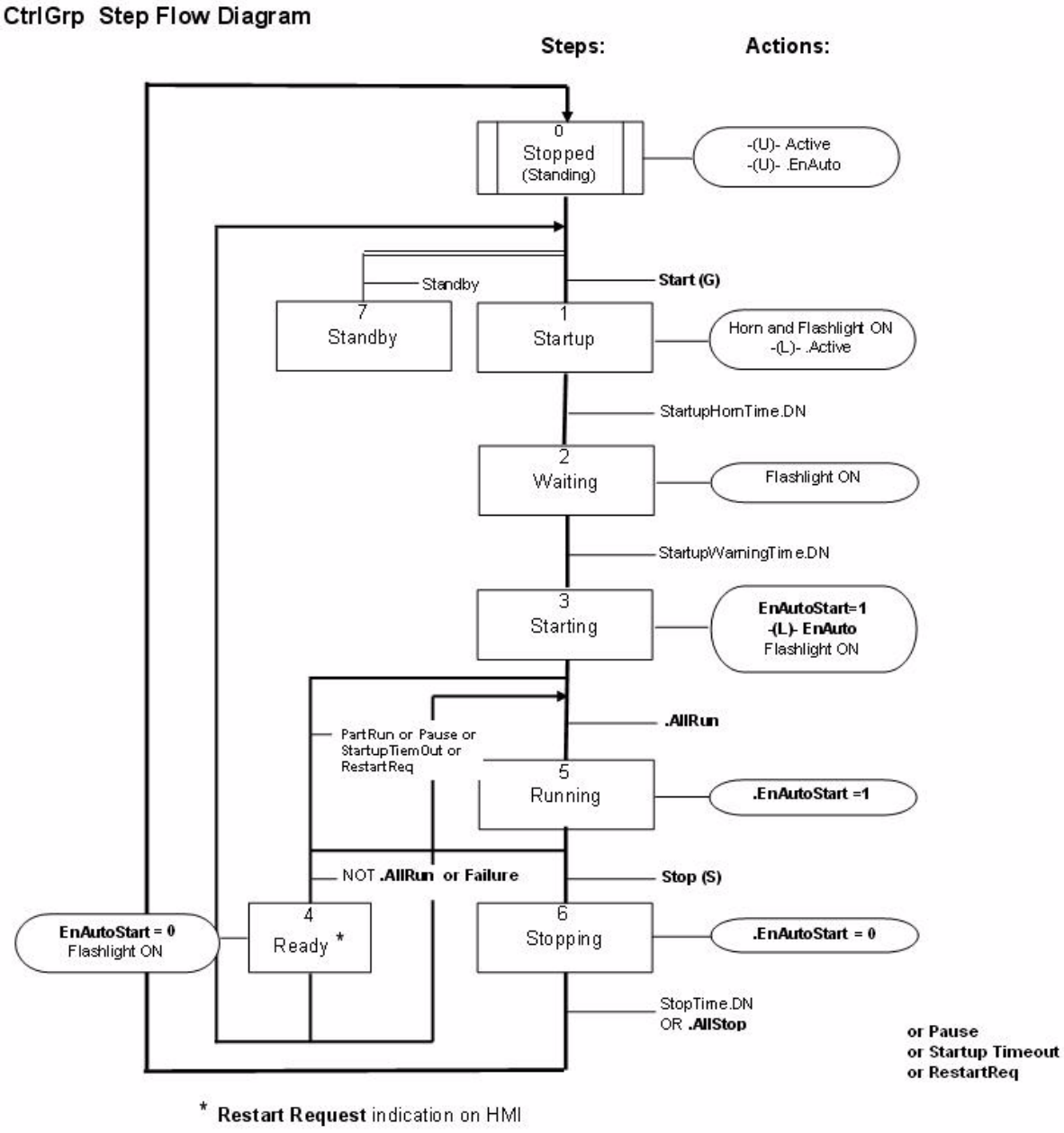
The Control Group Module (CtrlGrp) provides the Human Machine Interface (HMI) and the main control circuit, for a group of machines, or devices that are started and stopped as an entire group. The term Group, refers to the Asset Code (AC) definition, with the assumption that one AC Group can be controlled by one CtrlGrp, but also may be controlled by several CtrlGrps.

The CtrlGrp accepts commands from FactoryTalk View SE. Local operator stations, with separate start/stop pushbuttons, can also be connected. It further accepts (for example, power failure input) or stop interlocks and it provides outputs for the operator station, or the control room indication (for example, mimic, alarm indication), as well as for start warning and motor sequence control.

The CtrlGrp automatically receives/sends data from/to other modules (for example, local enable or alarm feedback of motor modules), through its Bus interface, in order to reduce programming workload, as well as programming errors. The release of alarms within a group, depends on the status of the group. If the group is active, then messages from the related modules are sent to FactoryTalk View SE.

Group Sequence Step Controller

The central part of the CtrlGrp is a seven-step controller, of which status is available to the user. The steps 0..6 shown below, represent the actual group status, in automatic mode. Status 0 is stopped, a normal start/stop sequence runs the steps from 1 through 6, one after the other, and terminates at status 0, if the group is stopped again.



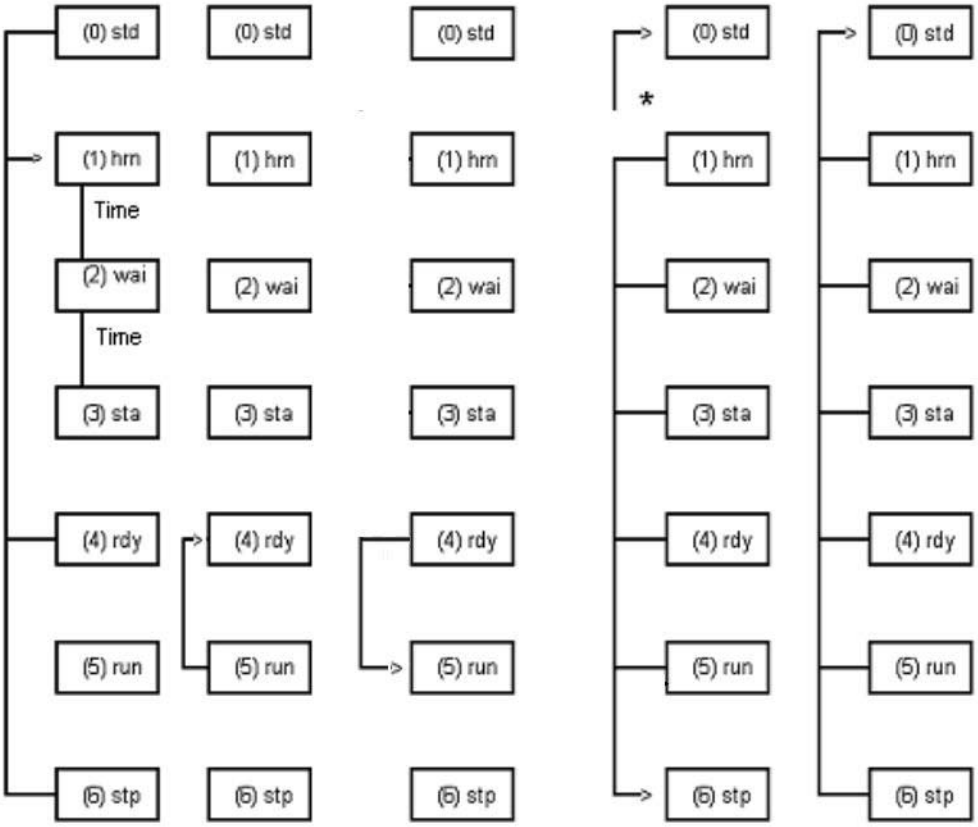
Note: An additional status "Standby" is shown for information only and has no influence on the sequence described. The state -bit, can be used in the application as a memory flag, to trigger an automatic start of the sequence.

Step "Ready"

Group has the ability to re-start, if step 4 "Ready" is active. Step Ready, is active, until Group (restart) is started again. When step Ready is active, there is a blue indication on the HMI Control- Group Popup. If the Group is restarted with the Start button, it jumps directly to step 1 "Startup". During this re-starting situation, the Automatic Signal "EnAuto(X/Y)" is always true. Only the Signal "EnAutoStart", stays false during step 1+2 (Startup+Waiting) and will pass over to true, if you remain at step 3 "Starting".

The step controller not only increments steps consecutively, but may switch (jump) to any step, in order to set a status, that complies with the new situation. As an example, an operator Immediate Stop will, regardless of the current status, immediately select status 0 and shutdown any control within the group. The table below shows the additional jumps.

Start	Ready	Failure	Normal Stop	Fast Stop
Start Button OR Restart	Loss of last drive AllRun=0 OR PartRun=1 OR Starting Pause OR Starting Times Out	If Parameter FailureStopDisable=1 AND Failure=1	Stop Button=1 OR IntlStop.0.. 7=1 OR FailureStopDisable=0 AND Failure=1	ImmStop=1 OR IntlImmStop.0..7=1; OR PowerDip



* If the group has not already started a motor, status 1 and 2, will directly pass over to status 0.

Each status change, further causes an output ResetSFC, that can be used to initialize (reset) the Sequential Function Chart (SFC). The SFC then selects the actual sequence (e.g. stop sequence).

Local Operation

Local operation can at any time be selected, i.e. a group may be running, while certain machines within the same group, can be started and stopped locally.

Automatic operation uses the control sequence described above and is transferred from the operator panel (template), by means of the group start/stop pushbuttons and monitors for mimic displays and alarming. Regardless of local operation, a group sequence can, at any time, be started, when all start interlocks are satisfied.

Local operation is required for maintenance and test purposes. It is only possible, with operator permission, to allow, or deny, local operation, for an entire group, by means of the local button. Local operation, is always cancelled by the CtrlGrp, if the sequence is interrupted by a Immediate Stop.

Interlock Release

Each group can be operated with released interlocks, for commissioning, or other special purposes. In the interlocked released mode, the inputs IntlStart/IntlStop/IntlImmStop 0..n are inactive, however the messages are still displayed (see CtrlGrp ModuleData Tag .Var.INR).

Power-Dip Suppression

Power-dip refers to short (less than 300 ms) main power interruptions, caused by lighting, high voltage switching etc.

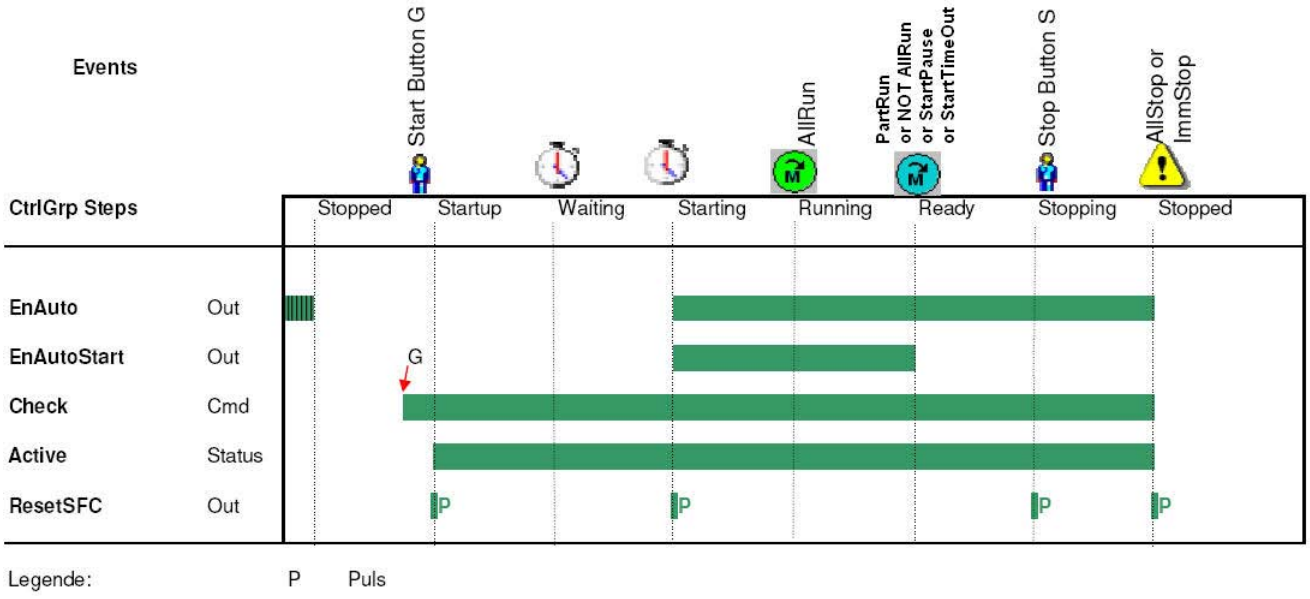
Because the main control equipment (field devices, interposing relays, I/O-racks and PLCs as well as HMI PC's) are fed by uninterrupted power supplies (UPS), it is possible to monitor power interruptions continuously and prevent unnecessary shutdowns, as well as alarm messages, i.e. ignore short power interruptions and suppress incorrect alarms caused by power outages.

Enabling Automatic Operation

Each Control Group CtrlGrp provides two outputs, an EnAutoStart (enable automatic start) and an EnAuto (enable automatic operation) signal, that are used for motor control and that may be switched by Machine Group Modules MaGrp. The bits are used in the application, to interlock the automatic operation of modules, such as Motors/Valves etc., that use the signals as inputs. A module will start only if both EnAutoStart AND EnAuto are ON and it will stop if the EnAuto is OFF. A restart is only possible if the EnAutoStart (OR the EnAuto) was set OFF for a cycle.

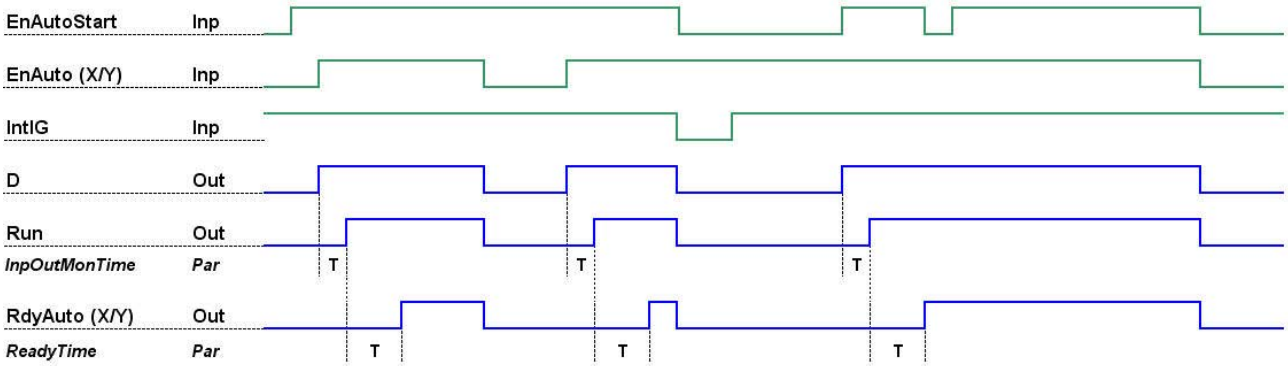
Note: In a chain of Devices the EnAuto Input is normally used as a process Interlock.A following Device, has controlled his EnAuto from the previous Module, connected to their RdyAuto.Control Group Module automatic start /-stop timing

ControlModul (CtrlGrp) Signal Flow



EnAutoStart changes, in case of Restart conditions, to OFF, until CtrlGrp Sequence “Starting”, then its turn ON again.

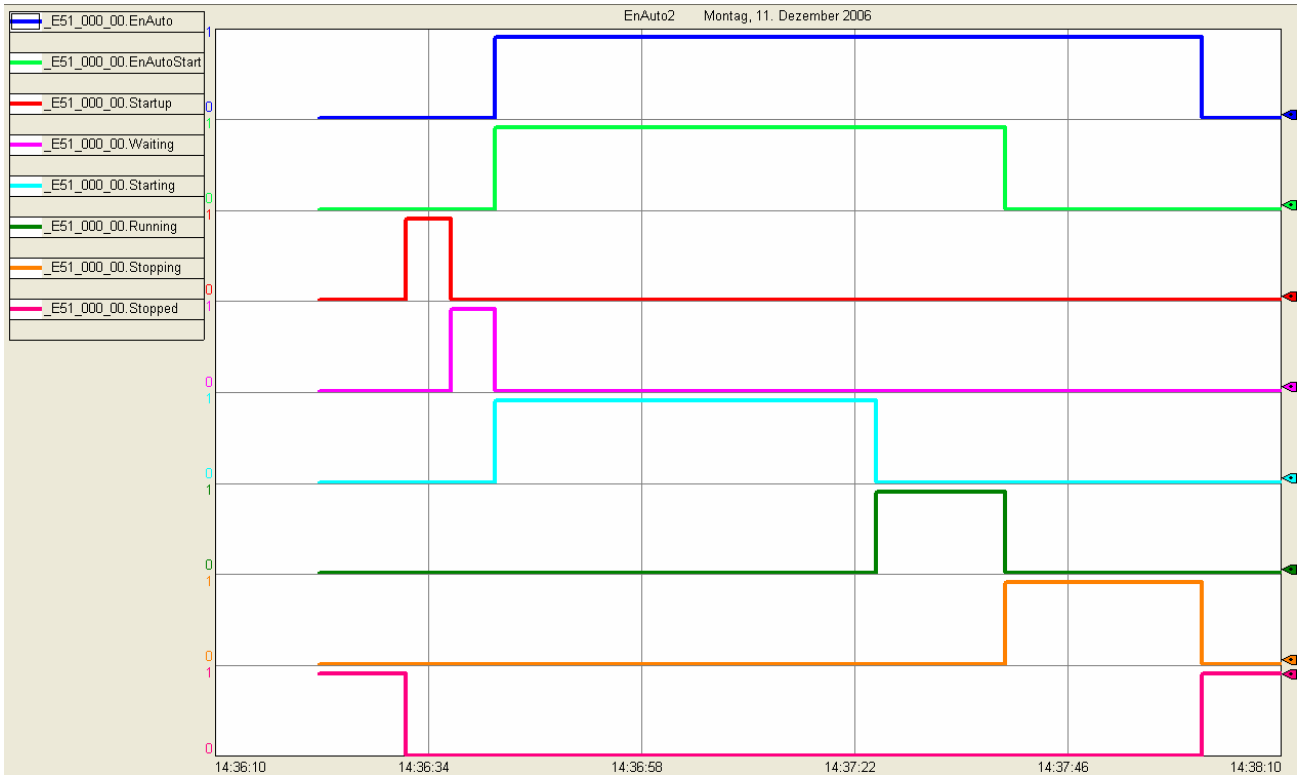
Motor module automatic start / stop timing



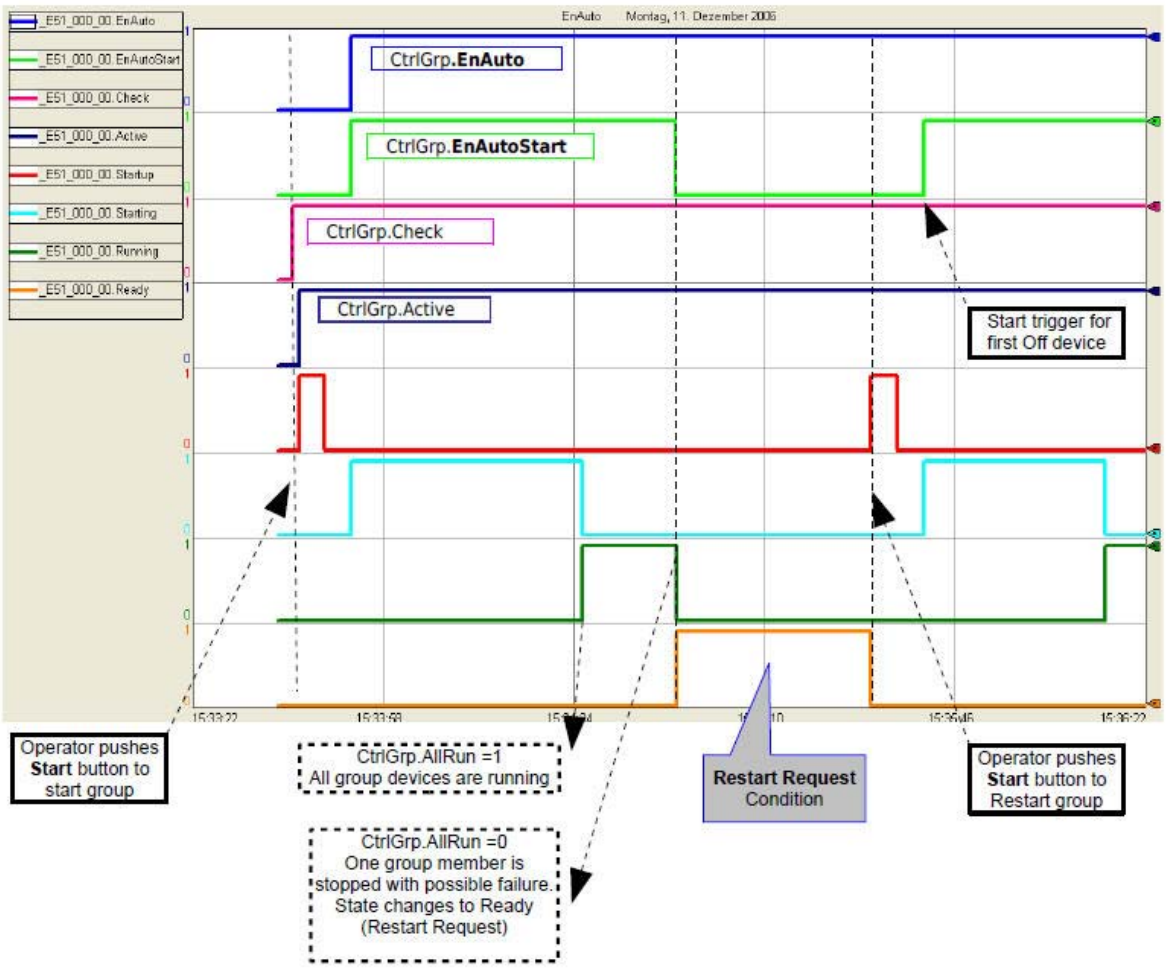
Note: Bi-directional modules as MotorR, MotorD, Valve1/2 have an EnAutoX and an EnAutoY input, for either direction.

Signal timing EnAuto / EnAutoStart

Normal Group -start and -stop situation



Timing situation with Restart condition (Restart Request)



The following conditions changes the Group to “Restart Request”:

1. If any of the Alarms are on “move” - Devices such as MotorN/R/D or Valve1,2. These Modules bring the alarm condition over the linked Bus -chain up to the Group.

2. If the Group is in “Starting” -state and the CtrlGrp Input .*PartRun* is true.

3. Or the Group is in “Running” -state and the CtrlGrp Input .AllRun changes to false.

4. If the group is in "Starting" -state and the operator presses "Pause" button on CtrlGrp HMI faceplate.

5. If the Group is in "Starting" -state and Starting Time Out timer times out.

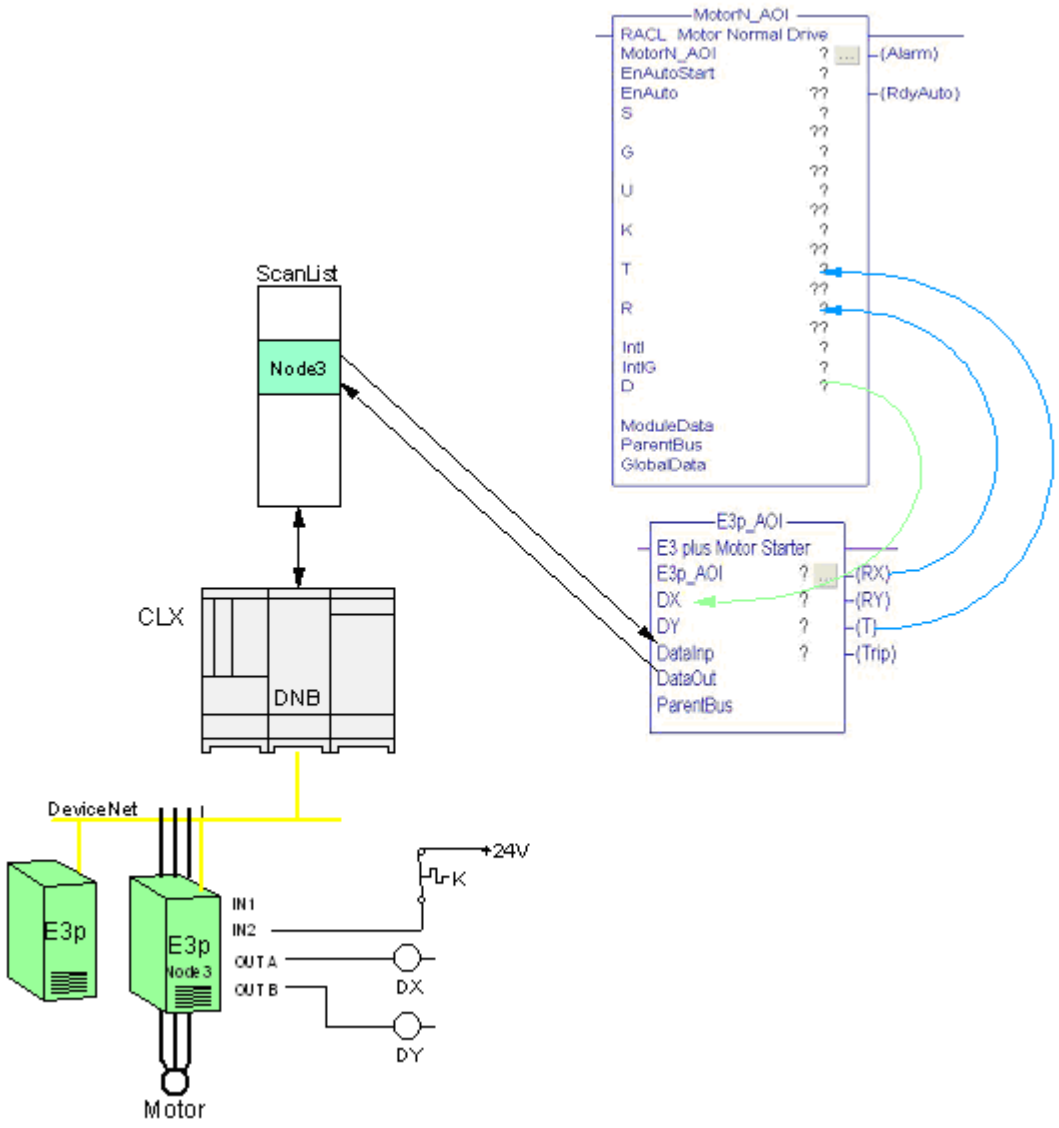
Using the E3 Module

Introduction

The E3p_AOI module is an interface block between Network (scanner) and Motor block. Templates using the E3 module operate the same as regular Motor*X* module but with the add-on information from the E3 module: warning status, trip status, therm., utilized and average current. The E3p_AOI does not have a specific HMI Template. Each Motor Device with E3plus Overload Relay will call a specific HMI Template such as 03_MotorN_E3_small or 03_MotorN_E3_largel.

There are no parameters to configure inside the E3 module structure.

Principal Diagram



E3 Installation and Wiring

Refer to the E3 and E3 Plus Solid-State Overload Relay User Manual, publication 193-UM002, for installation and wiring details.

System

The E3 Overload Relays provide for data exchange over the Network of configurable Input and Output Assemblies. Inputs (Data from E3) are 8 Bytes (4Words) and Outputs (Data to E3) are 1Byte.

Note: You can read more data out of the E3 then we have the possibility to reach with explicit messaging. However this asynchronous messaging will generate a high communication load at the processor.

IMPORTANT Do not use a MSG (explicit message) operation to get data from the E3 Device.

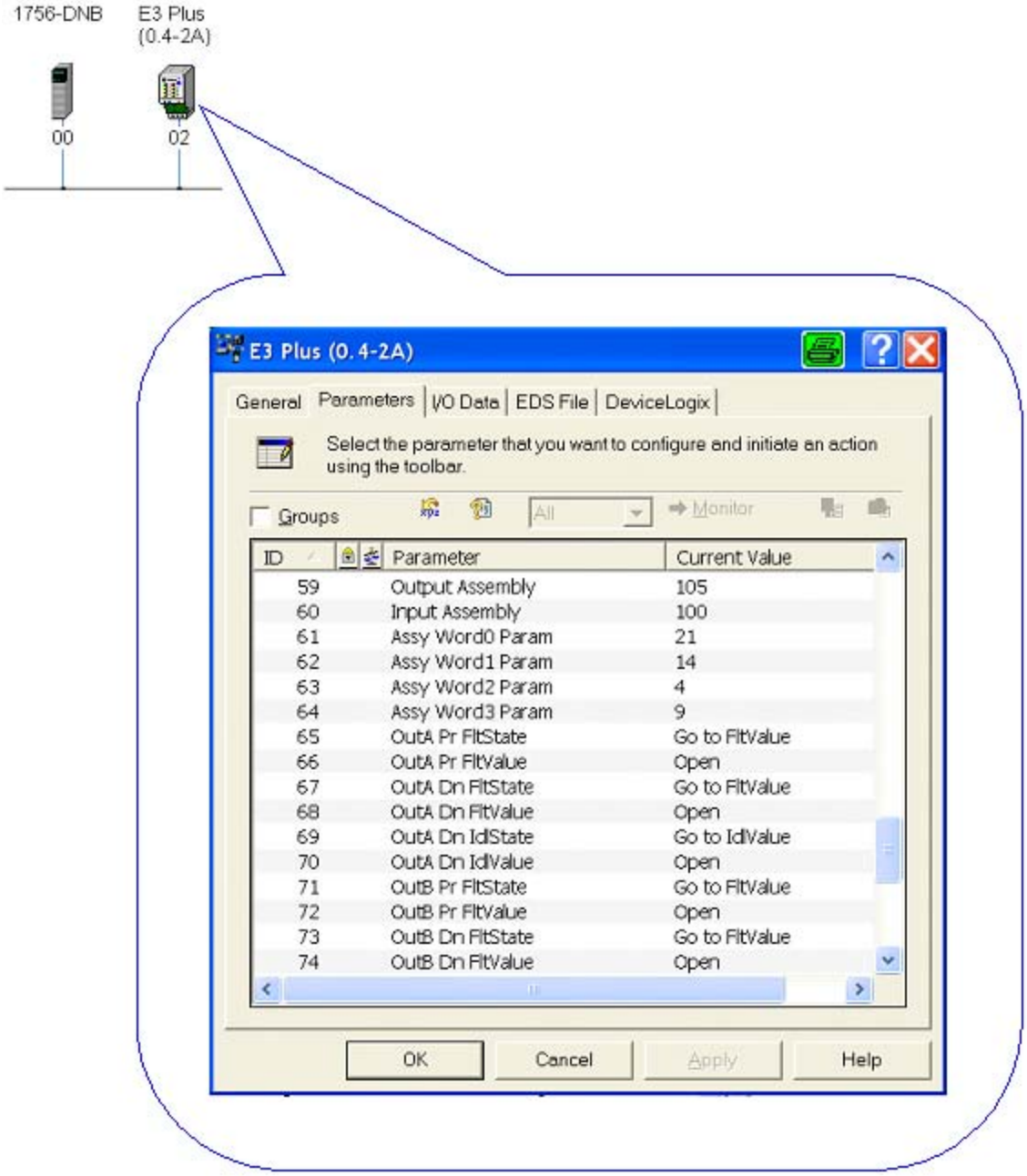
Recommended Workflow

1. Configuration of the whole DeviceNet network related to a DNB-Scanner Module. This is possible in Online or Offline Mode. Remember to set the E3plus Parameter.
2. Use the DeviceNet Tag Generator to generate all Tags and Structures of the DeviceNet Network.
3. Exchange all Data Types of E3 Data Tags which are created in the previous step by the DeviceNet Tag Generator with common UDT, E3_Inp and E3_Out, respectively.
4. Code programming in your application routine.

RSNetworx for DeviceNet Software

Use the RSNetworx software to configure all E3 Overload Relays that are connected to your network. Refer to the E3 and E3 Plus Solid-State Overload Relay User Manual, publication 193-UM002, for more information

This document provides additional configuration information.



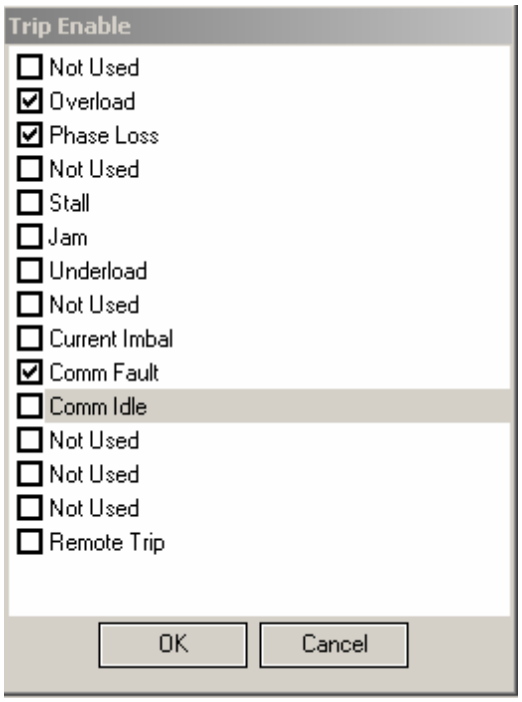
E3 Operational Parameters

The following is a list of all parameters that must be set correctly in the E3. All others that are not in this list should be left at their default value or do not take effect with the E3p_AOI.

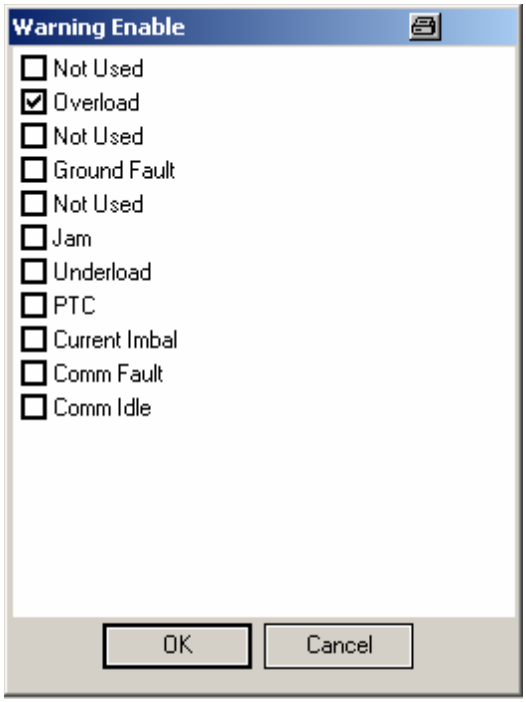
General Parameters

Parameter	Description	Required Setting
24	Trip enable	See graphic on page 36
25	Warning enable	See graphic on page 36
27	Single/three phase	Three phases
28	FLA setting	Full load amps from the motor nameplate
30	OL/PTC reset mode	Manual E3 will not reset automatically
31	OL reset level	75% (default) User will not be able to reset E3 until therm util. is below this value.
32	OL warning level	85% (default) E3 will show an overload warning when therm util. is equal or above this value.
59	Output assembly	105
60	Input assembly	100
61	Assy word 0	21 (device status)
62	Assy word 1	14 (trip status)
63	Assy word 2	4 (Therm. Util.)
64	Assy word 3	9 (Average current)

Parameter 24 Trip enable (default)



Parameter 25 Warning enable



DeviceNet Tag Generator

We recommend using the RSLogix 5000 tool, DeviceNet Tag Generator, to automatically create all tags and structures in to your RSLogix 5000 project. This tool is available on the RSLogix 5000 Optional Software CD or on the DeviceNet Optional Tools CD.

This tool also creates additional Routines and code in your .acd project file. The created code handles all Data exchange between the DeviceNet Scanner Data list and your Application. This tool also creates structures and all Tags related to each E3 with unique tag names.

The tag names take the following structure:
ScannerName_Note#_Polled_Input/Output

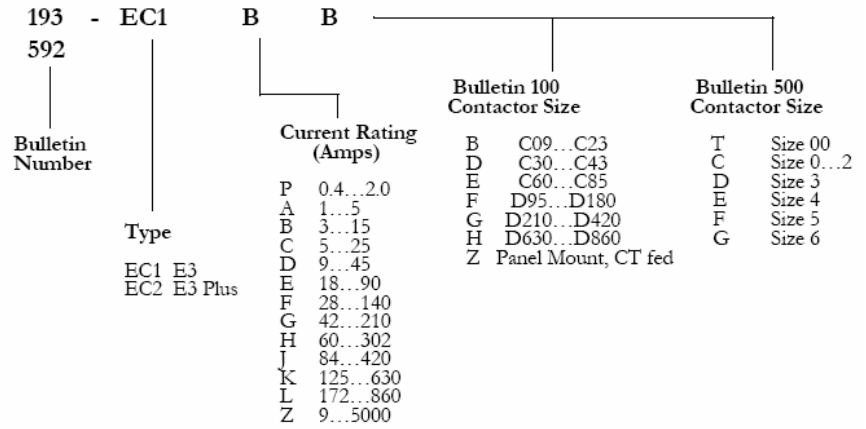
For example, DNB_N03_POL_I = DeviceNet Input Data from Note 3, and DNB_N03_POL_O = DeviceNet Output Data to Note 3

The Data Type that the DeviceNet Tag Generator automatically creates is named by the Catalog Number explanation and parameter configuration.

For example, AB_193592_EC2P_I_70847BCC

where 70847BCC is a unique code# which depends on the parameter configuration.

Catalog Number Explanation

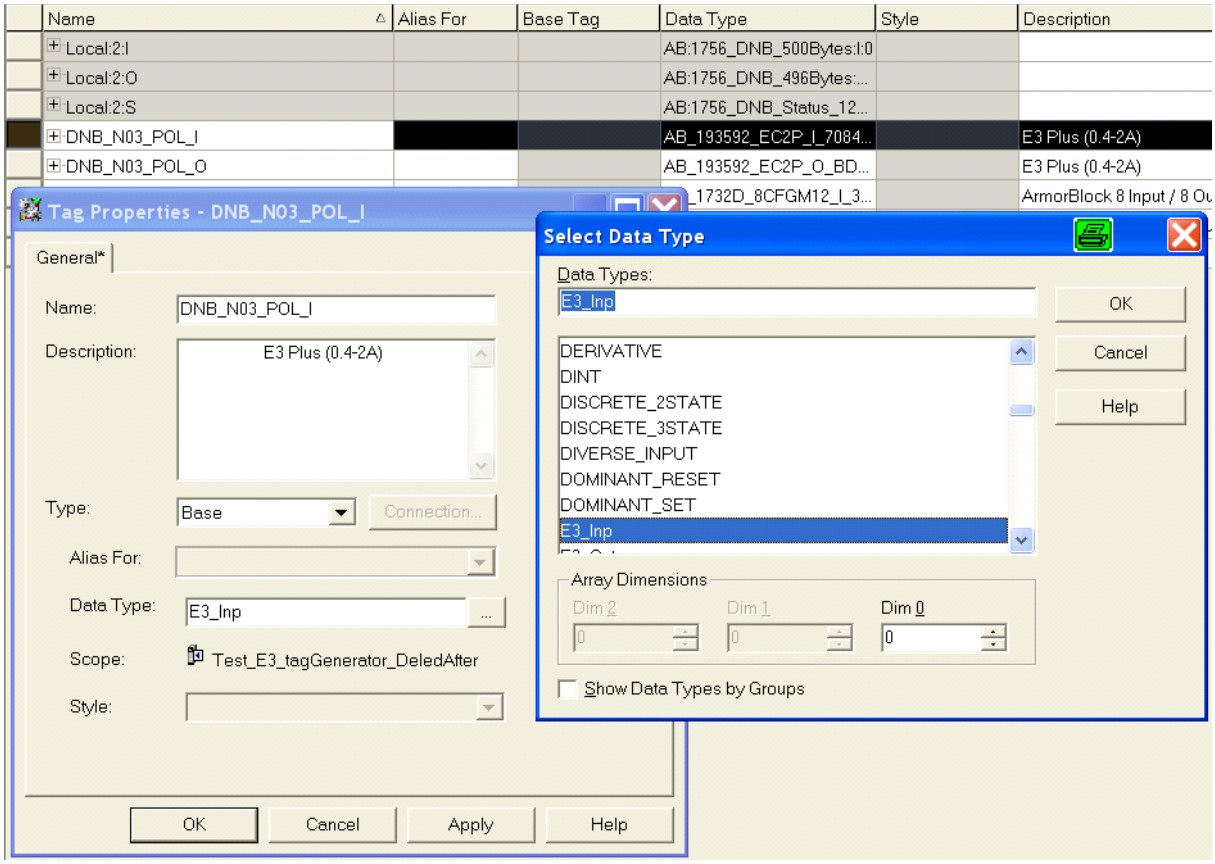


Exchange Data Type

To match the tags to the E3p_AOI DataInp and DataOut, you must change the Data Type of each E3 related Tag.

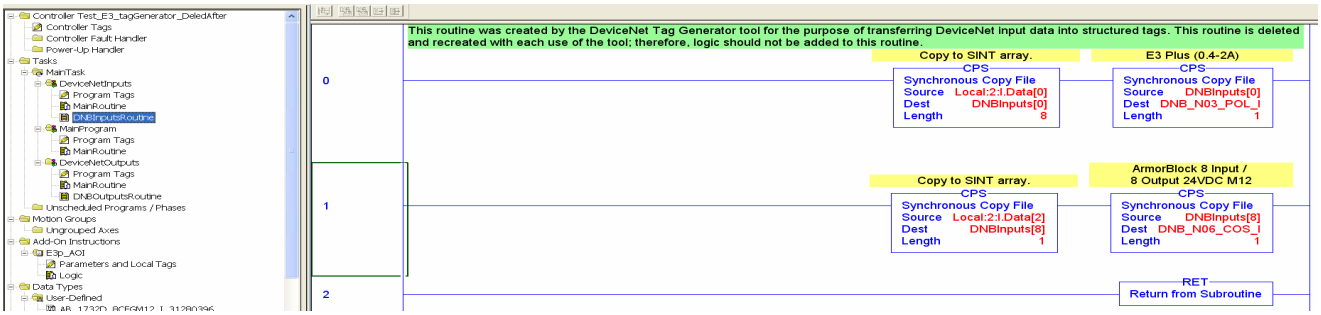
Change the tags one by one in the Controller Tag Database or use the Tag export/import function and change the Data Type in an Excel csv file.

Note: You must know which Note Number corresponds to an E3.

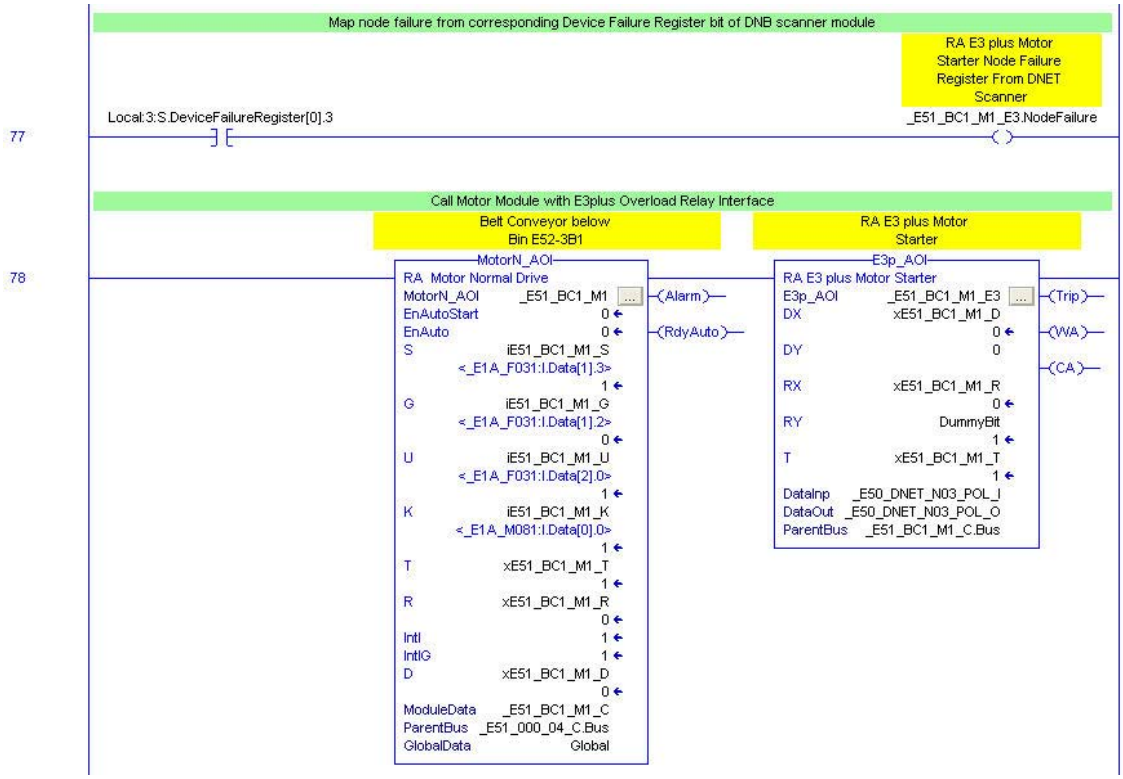


RSLogix 5000 Application

The DeviceNet Tag Generator also creates new program routines for all DeviceNet scanner data read/write commands.



Application code example:



IMPORTANT Always program the E3p_AOI after a Motor block. The ParentBus is always linked to the Motor local Bus, for example MotorName_C.Bus.

Notes:

Inter-process Communication

The IPCom module is used for inter-process communication between two programmable automation controllers.

With this module, the communication to a remote controller is set up and supervising.

The main function of IPCom is to distribute the bus-data. At the same time, it also transfers various numbers of user data, which can be allocated optionally and, for example, used for interlocks and user data transfer to other controllers.

The communication basis of the IPCom module uses the ControlLogix system's produced/consumed tags. After the programmer has created and configured a produced/consumed tag structure, the IPCom modules plug on to this tag, as a communication channel.

Establish Produced/Consumed Controller Tags

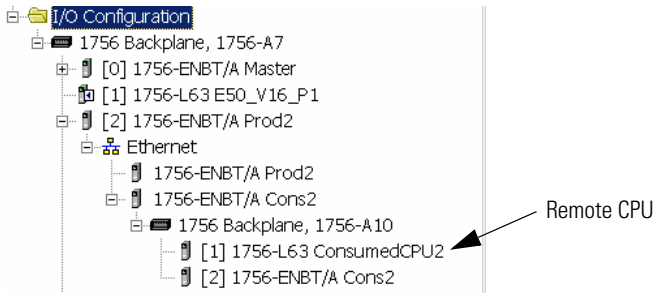
To establish produced/consumed controller tags, complete the following steps.

Step1

To use the IPCom modules, you must first create and configure the link to the remote controller.

Also, you must add the complete network, with all involved controllers, to the I/O Configuration tree, in the RSLogix 5000 project.

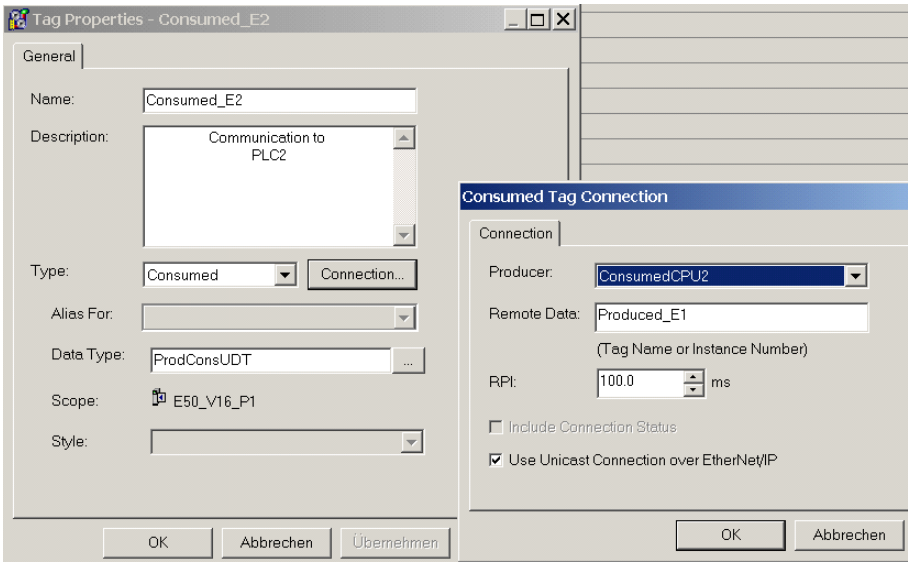
Example:



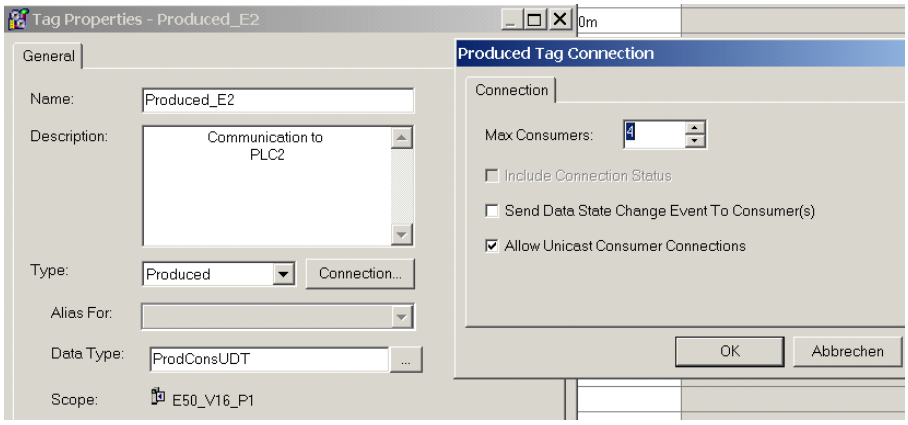
Step2

Create new Controller Tags. For each remote connection we have to create a separate Tag pair. One as produced and the other as consumed type.

Example: Consumed_E2 which is linked to remote controller, ConsumedCPU2
Produced_E2, which will produce and distribute this data.



Produced Tags have a limit of Max Consumers. It is important to specify only the maximum number of Consumers, consuming this tag.



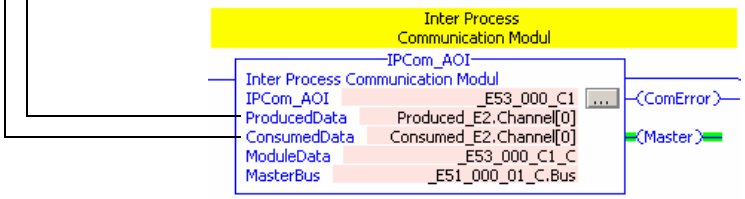
Step3

Link the communication channel (produced/consumed) to IPCom module.

If more than one remote connection to the same Controller is used, an array of IPC_Data is created and the array is extended on the required channels.

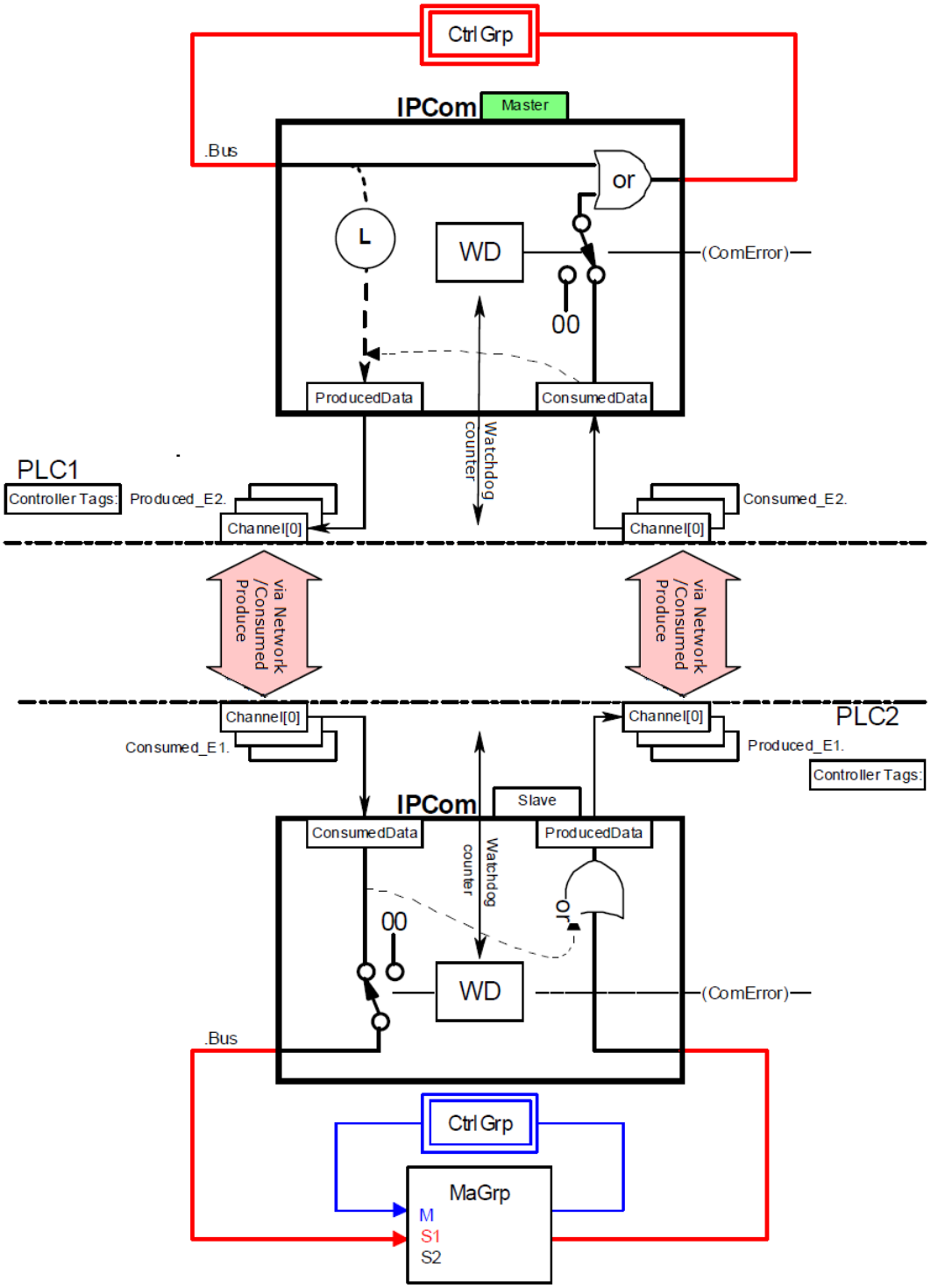
In this example, we prepared a Tag with three independent channels (to the same Controller).

Consumed_E2	ProdConsUDT	Communication to PLC2
Consumed_E2.Channel	IPC_Data[3]	Communication to PLC2
Consumed_E2.Channel[0]	IPC_Data	Communication to PLC2
Consumed_E2.Channel[0].Watchdog	DINT	Communication to PLC2
Consumed_E2.Channel[0].Bus	DINT	Communication to PLC2
Consumed_E2.Channel[0].Interlocks	DINT	Communication to PLC2
Consumed_E2.Channel[0].UserData	IPC_UData	Communication to PLC2 User data
Consumed_E2.Channel[0].UserData.Data	DINT[3]	Communication to PLC2 User data
Consumed_E2.Channel[0].UserData.Data[0]	DINT	Communication to PLC2 User data
Consumed_E2.Channel[0].UserData.Data[1]	DINT	Communication to PLC2 User data
Consumed_E2.Channel[0].UserData.Data[2]	DINT	Communication to PLC2 User data
Consumed_E2.Channel[1]	IPC_Data	Communication to PLC2
Consumed_E2.Channel[2]	IPC_Data	Communication to PLC2
Produced_E2	ProdConsUDT	Communication to PLC2
Produced_E2.Channel	IPC_Data[3]	Communication to PLC2
Produced_E2.Channel[0]	IPC_Data	Communication to PLC2
Produced_E2.Channel[0].Watchdog	DINT	Communication to PLC2
Produced_E2.Channel[0].Bus	DINT	Communication to PLC2
Produced_E2.Channel[0].Interlocks	DINT	Communication to PLC2
Produced_E2.Channel[0].UserData	IPC_UData	Communication to PLC2 User data
Produced_E2.Channel[0].UserData.Data	DINT[3]	Communication to PLC2 User data
Produced_E2.Channel[0].UserData.Data[0]	DINT	Communication to PLC2 User data
Produced_E2.Channel[0].UserData.Data[1]	DINT	Communication to PLC2 User data
Produced_E2.Channel[0].UserData.Data[2]	DINT	Communication to PLC2 User data
Produced_E2.Channel[1]	IPC_Data	Communication to PLC2
Produced_E2.Channel[2]	IPC_Data	Communication to PLC2



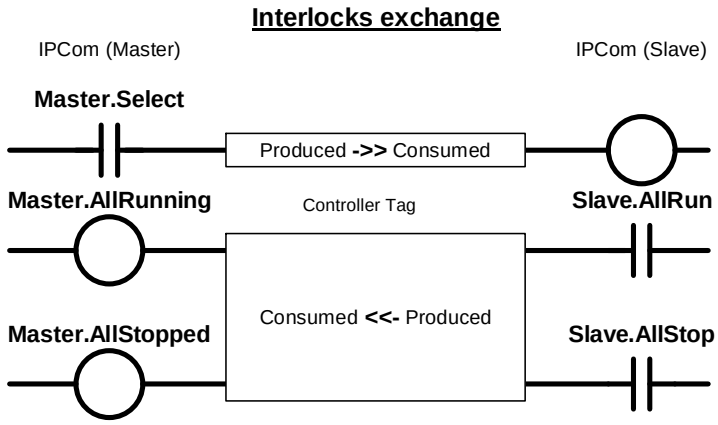
IPCom Bus Signal Marshaling Functions Diagram

The graph below shows how the Bus is transferred through the IPCom module and the data transmitted with Produced/Consumed function.



Interlock Exchange

This graph shows how the predefined Interlock signals are linked. This bidirectional signal exchange is used to control (select or deselect) one MaGrp and also to bring a Group, or Device Feedback, back to the Control Group.

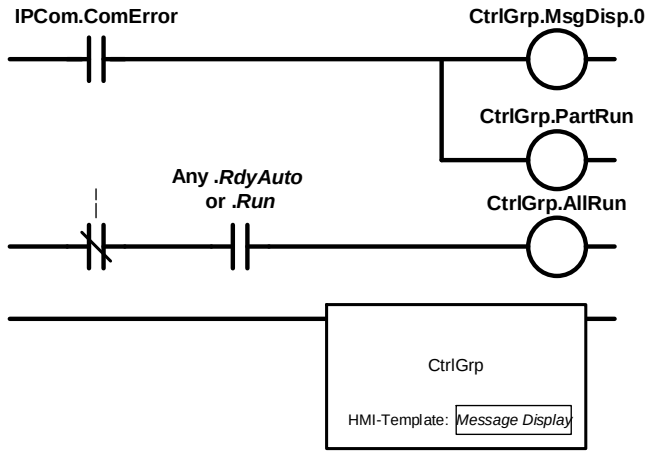


Communication Error Interlock

In case of a Communication Error, all Devices on Slave IPCom will stop immediately. The IPCom module does not have an HMI Template (popup), to indicate this Alarm to the Operator.

To bring this information to the Operator Screen, we can use a special input at CtrlGrp module, to show this information on the HMI CtrlGrp Popup. Connect CtrlGrp input *.MsgDisp.n* to indicate our Communication Error situation.

Furthermore, in case of failure, the CtrlGrp Input *AllRun* is switched off**,** in order to have the possibility to restart a CtrlGrp. In this case, the CtrlGrp changes into Ready-status.



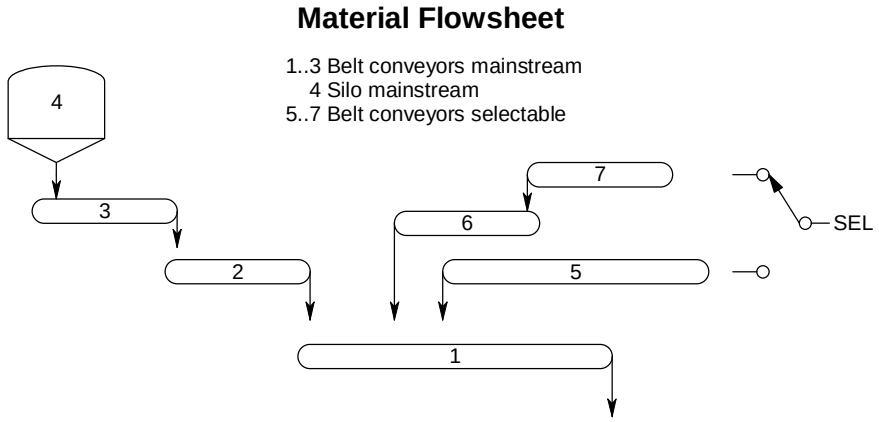
FactoryTalk View SE Alarm List

The *IPCom.Sta.CTA* Tag must be added in the HMI Tag Database. This HMI Tag is to configure as an Alarm Tag. (Sta.CTA is equal to module Output ComError)

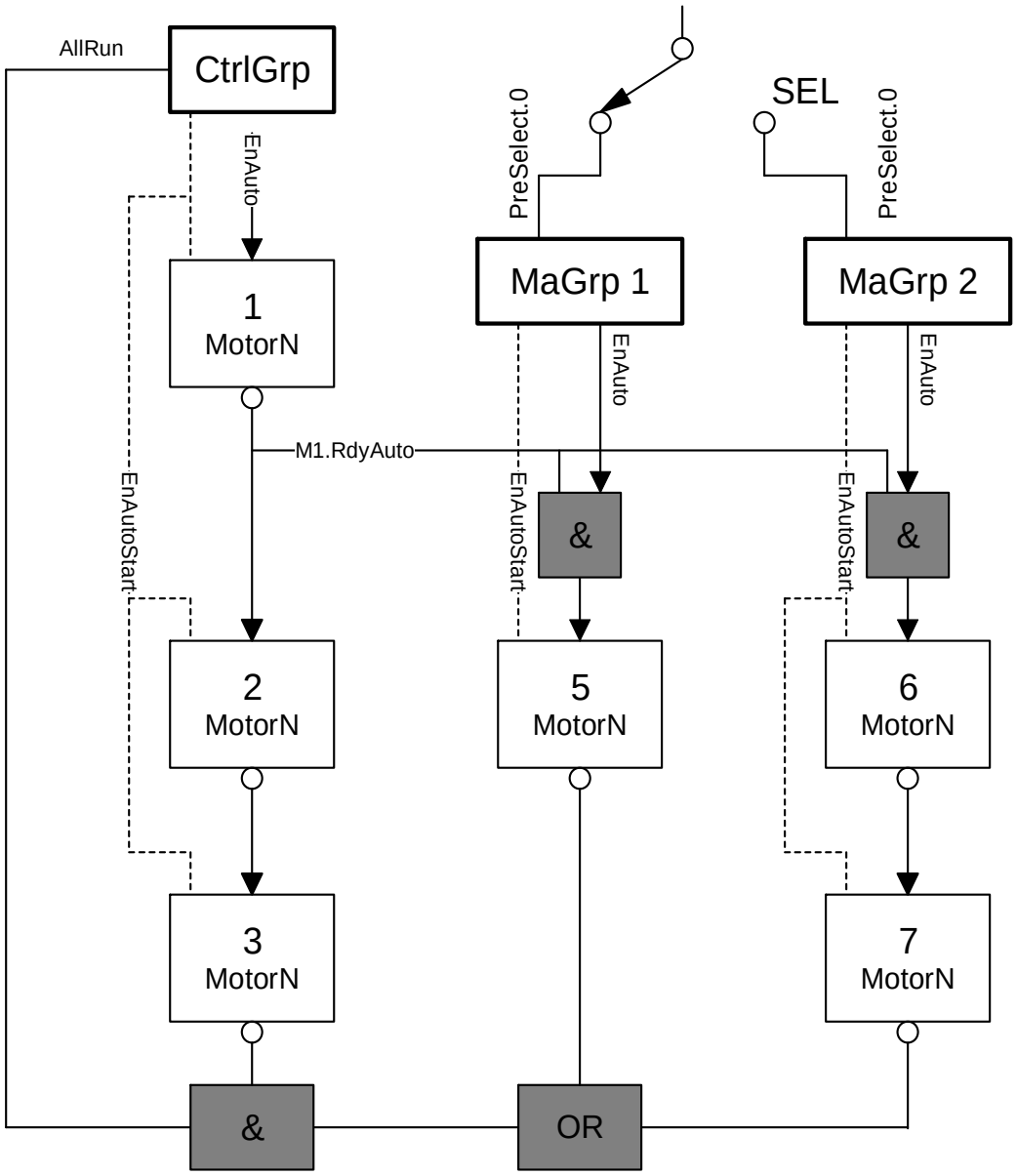
Application Examples

Example 1 – One Group with Two Selectable Feeders

One Control Group with common mainstream conveyors and selectable additional feed conveyors.



Module Interlocking Diagram



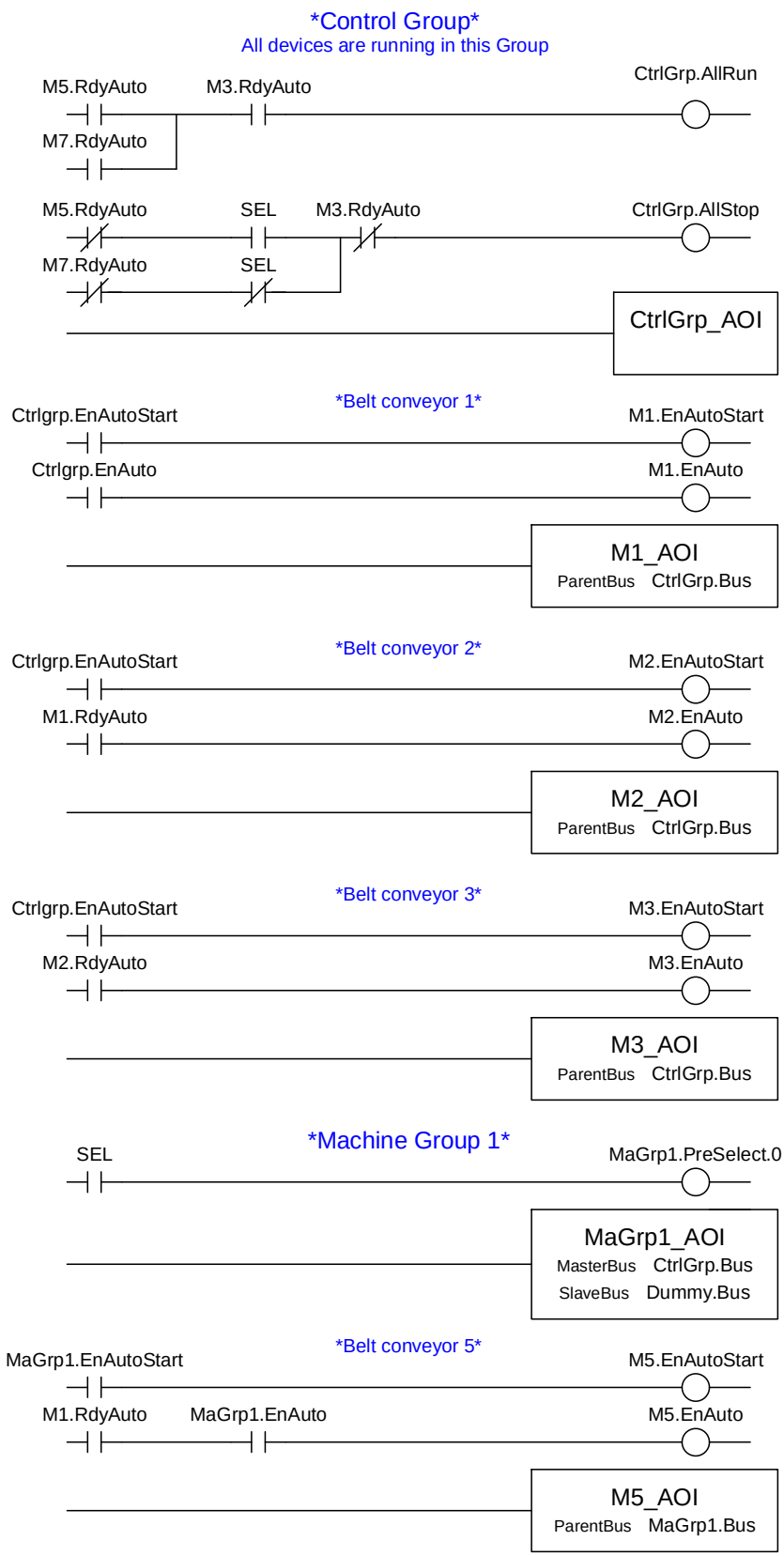
Legend:

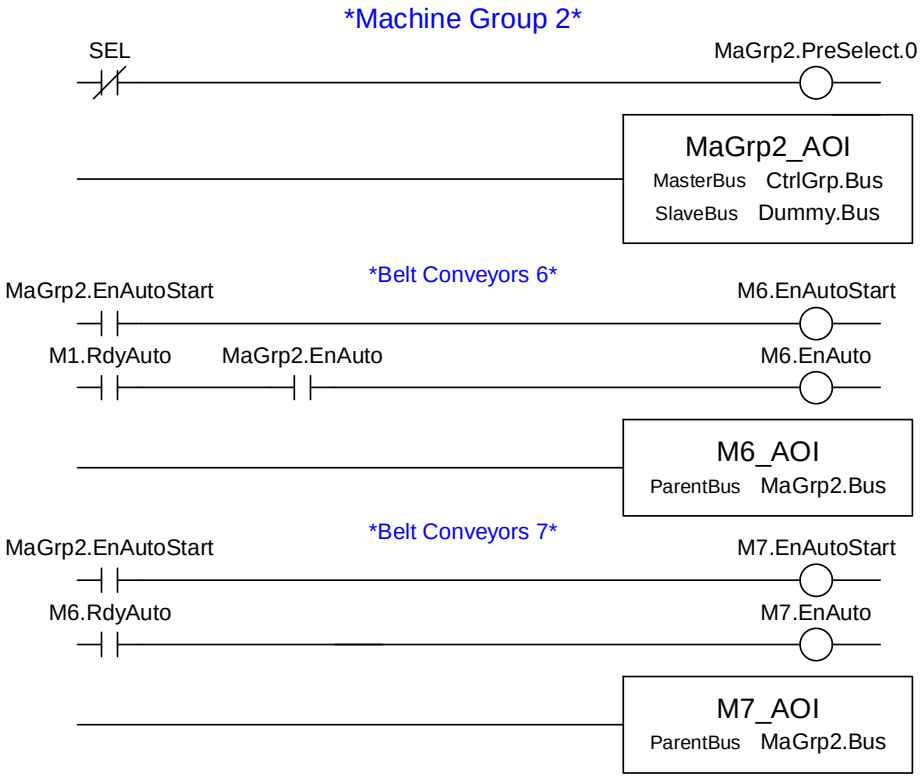
Module Output: **RdyAuto**

Module Input: **EnAuto**

Out: **RdyAuto** Inp: **EnAuto**

Ladder Program for Automatic Operation

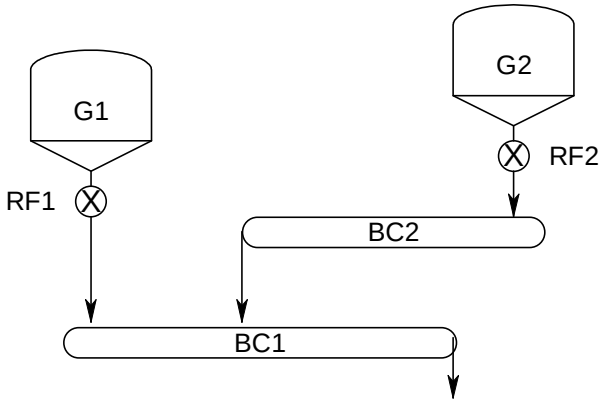



Machine Group 2
SEL
MaGrp2.PreSelect.0
MaGrp2_AOI
MasterBus CtrlGrp.Bus
SlaveBus Dummy.Bus
Belt Conveyors 6
MaGrp2.EnAutoStart
M6.EnAutoStart
M1.RdyAuto
MaGrp2.EnAuto
M6.EnAuto
M6_AOI
ParentBus MaGrp2.Bus
Belt Conveyors 7
MaGrp2.EnAutoStart
M7.EnAutoStart
M6.RdyAuto
M7.EnAuto
M7_AOI
ParentBus MaGrp2.Bus

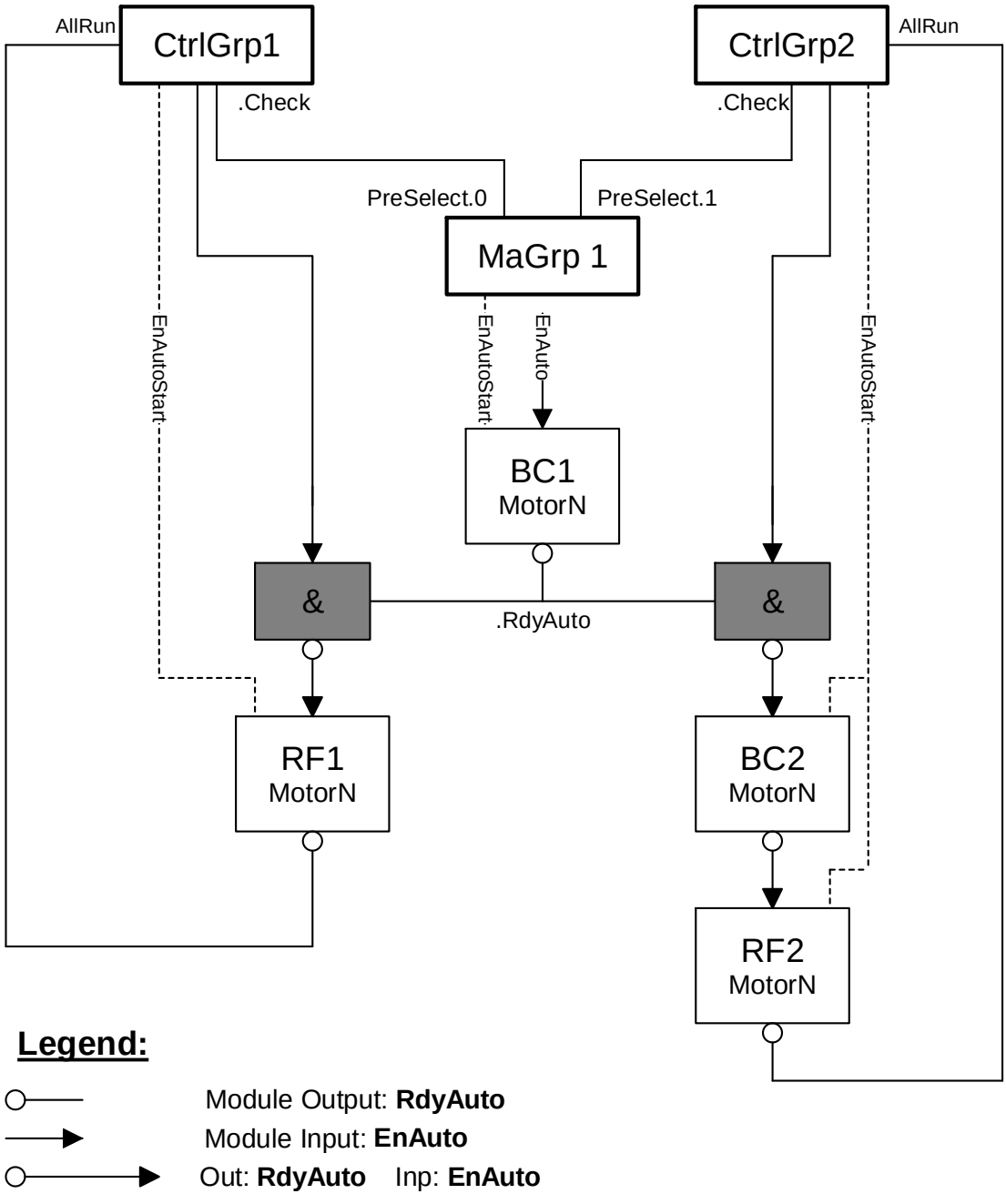
Example 2 – Two Groups with One Common Conveyor

Two Control Groups using a common conveyor.

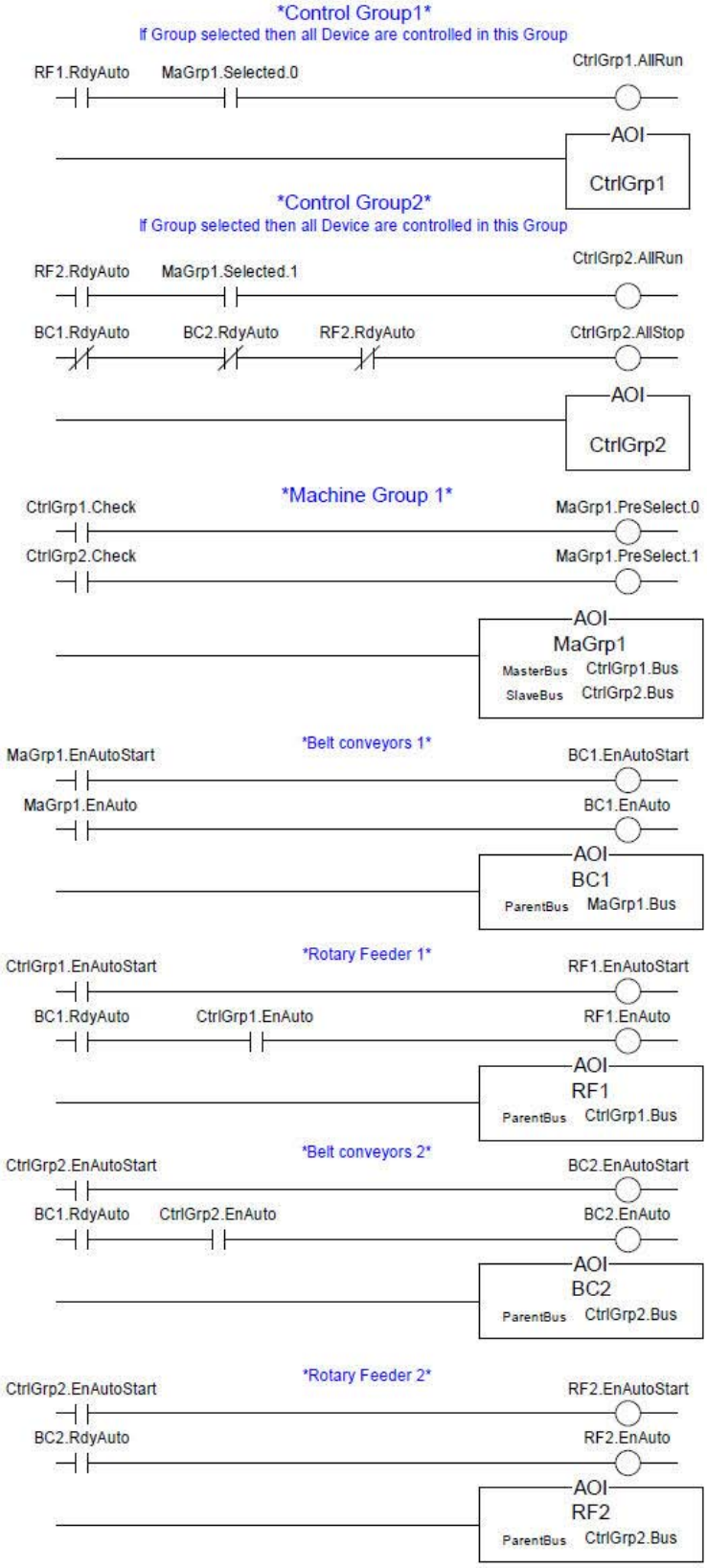
Material Flowsheet



Module Interlocking Diagram



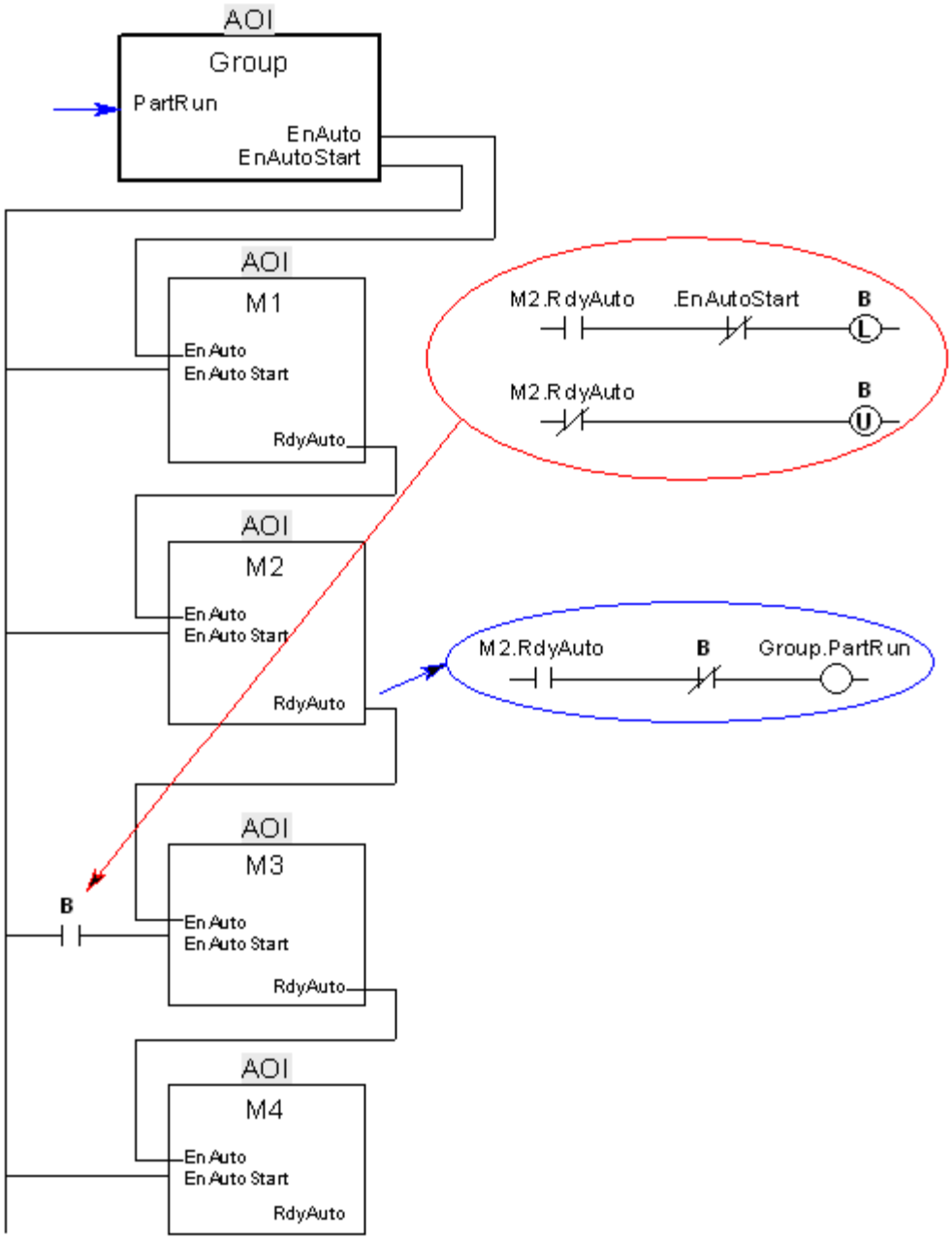
Ladder Program for Automatic Operation



Example 3 – One Group with Two Starts

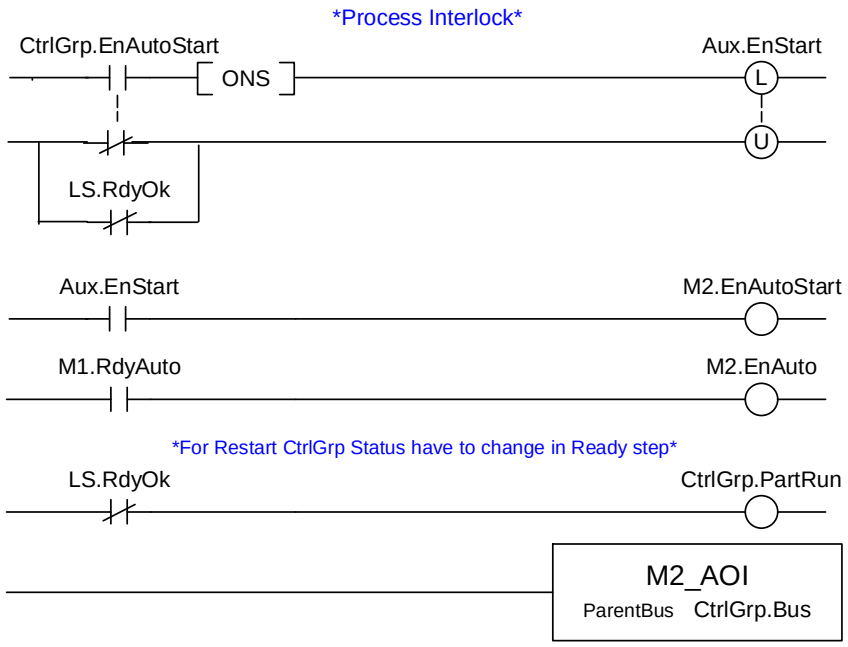
A Control Group may be started in multiple steps, if the start-up sequence is interrupted by switching the Group's PartRun input ON. In this case, the CtrlGrp selects the Ready state and waits for a restart command from the operator.

The diagram below shows how the output RdyAuto from Machine M2, can be used to interrupt the EnAutoStart command, by control bit B=0 and Group.PartRun=1. After restarting by the operator, the CtrlGrp starts again with normal startup warnings. During the startup phase, the EnAutoStart is cleared by the CtrlGrp and control bit B=1. Now Machine M3 and the following devices will start in programmed order.



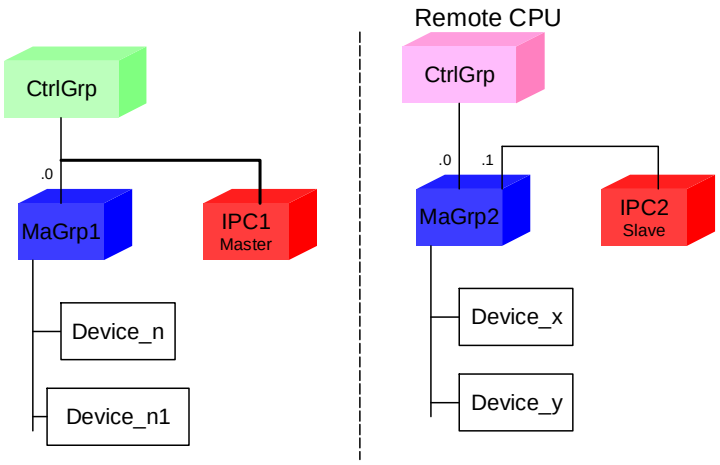
Example 4 - Process Interlock

In this example, a Level switch (LS) will detect an Overfill situation, the Conveyer (M2) will have to stop, until the Operator starts this group again (Restart).



Example 5 - Inter Process Communication IPCom

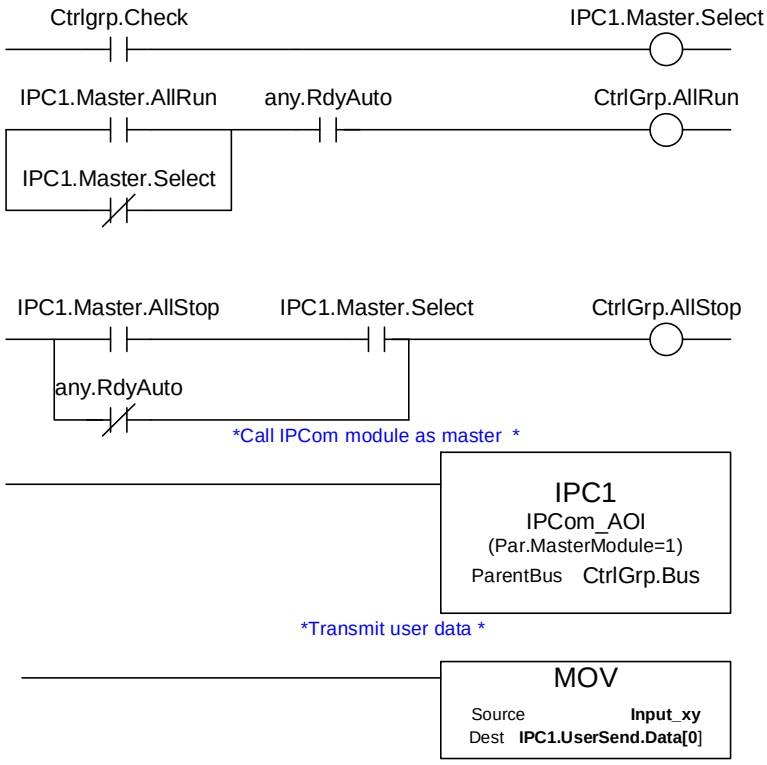
Module Diagram:



Program Code:

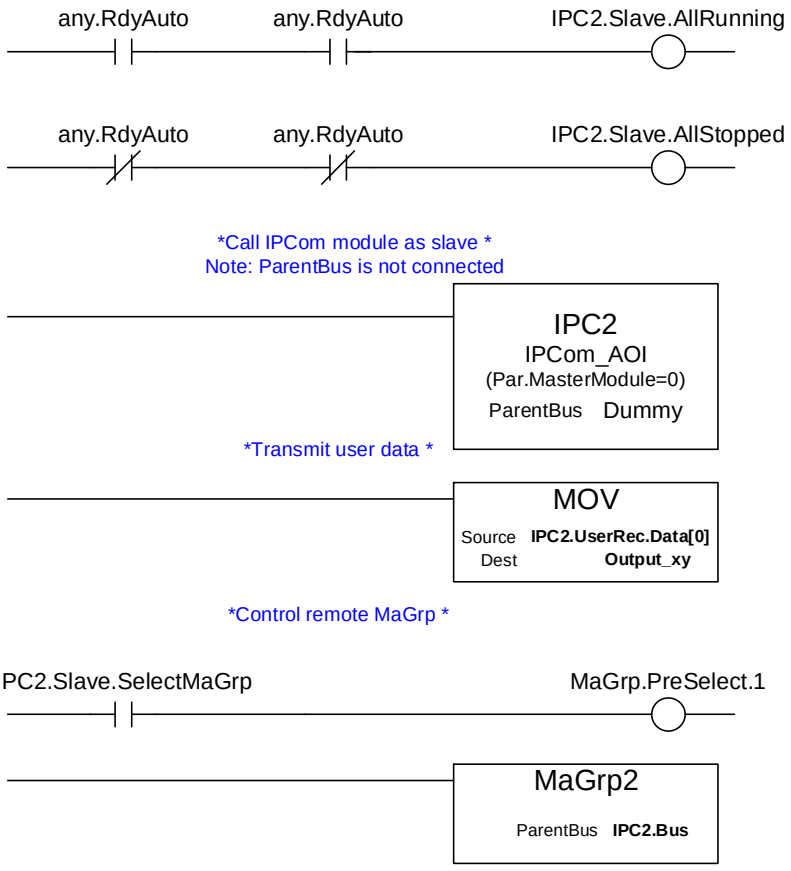
Program from CPU1

PLC 1 master site



Program from CPU2

PLC 2 server site

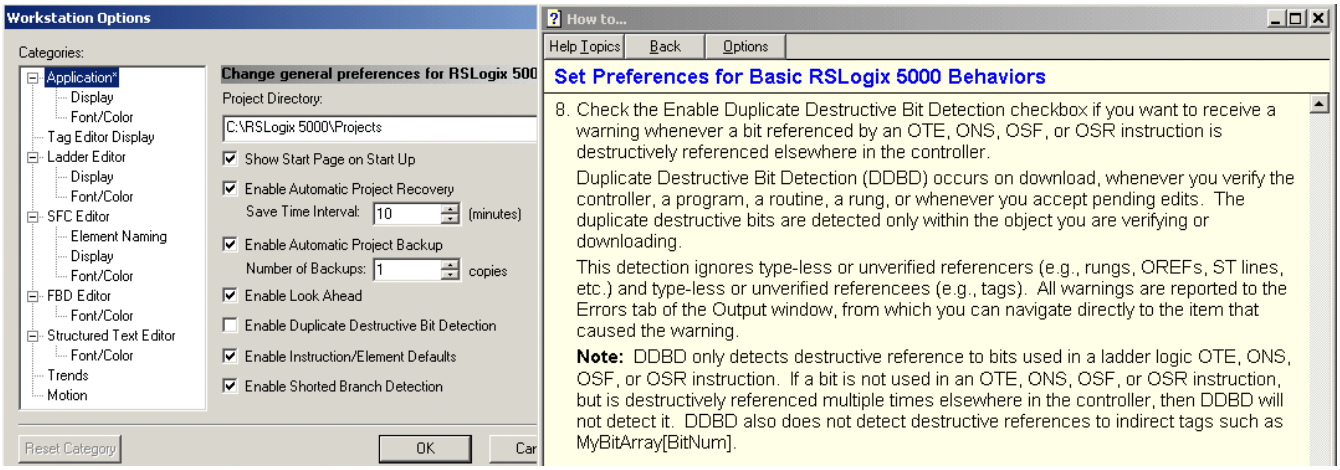


Notes:

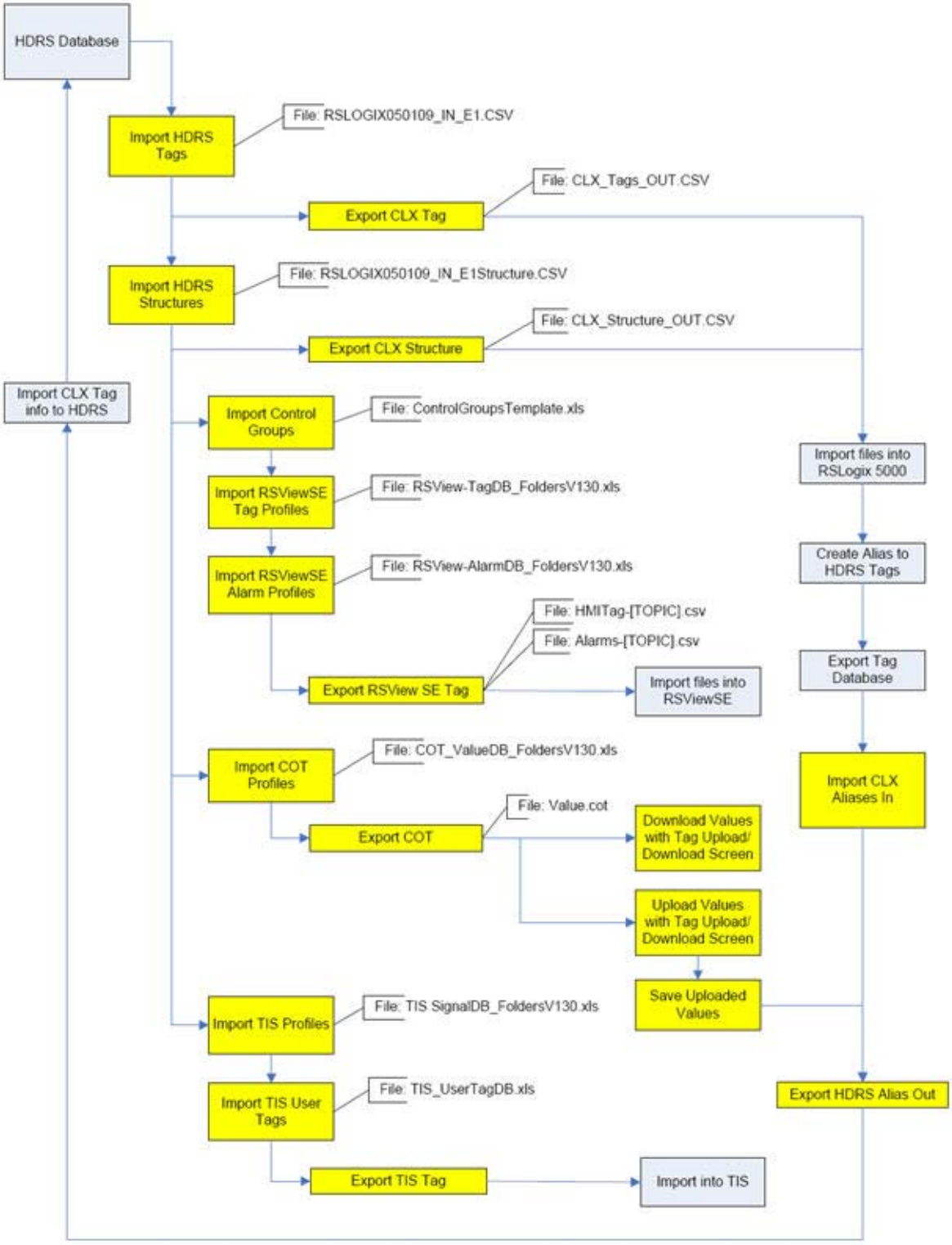
Additional Information

RSLogix 5000 Workstation Options

Disable Duplicate Destructive Bit Detection checkbox.



Workflow Data Retrieval Tool



Rockwell Automation Support

Rockwell Automation provides technical information on the Web to assist you in using its products.
At http://www.rockwellautomation.com/support/, you can find technical manuals, a knowledge base of FAQs, technical and application notes, sample code and links to software service packs, and a MySupport feature that you can customize to make the best use of these tools.

For an additional level of technical phone support for installation, configuration, and troubleshooting, we offer TechConnect support programs. For more information, contact your local distributor or Rockwell Automation representative, or visit http://www.rockwellautomation.com/support/.

Installation Assistance

If you experience a problem within the first 24 hours of installation, review the information that is contained in this manual. You can contact Customer Support for initial help in getting your product up and running.

United States or Canada	1.440.646.3434
Outside United States or Canada	Use the Worldwide Locator at http://www.rockwellautomation.com/support/americas/phone_en.html, or contact your local Rockwell Automation representative.

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Rockwell Automation tests all of its products to ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned, follow these procedures.

United States	Contact your distributor. You must provide a Customer Support case number (call the phone number above to obtain one) to your distributor to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for the return procedure.

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