ENGINEERING
TOMORROW

Programming Guide

Add-on Instructions with Rockwell Studio 5000

drives.danfoss.com | VLT®

Contents

1 Introduction

1.1 Disclaimer

The software is provided "as is", without warranty of any kind, expressed or implied, including, but not limited to, the warranties of merchantability, fitness for a particular purpose, and noninfringement. In no event shall the authors or any legal entity part of Danfoss group be liable for any claim, damages, or other liability, whether in an action of contract, tort, or otherwise, arising from, out of, or in connection with the software, or the use, or other dealings in the software.

1.2 Purpose of the User Guide

The add-on instructions show examples on how it is possible to integrate Danfoss VLT® drives in a Rockwell Studio 5000 Logix Designer system. The add-on instructions are not protected and can be altered to serve the specific needs for the application. Danfoss takes no responsibility to losses due to code faults in these add-on instructions or wrong use.

This manual provides:

- Step-by-step approach on how to integrate Danfoss VLT® drives into a Rockwell Studio 5000 Logix Designer system.
- Procedure on using the library to communicate with Danfoss VLT® drives in Rockwell Studio 5000 Logix Designer system, including examples.

Add-on instructions for Rockwell Automation Studio supporting Danfoss VLT® drives.

Danfoss VLT® drives with the following options:

- VLT® EtherNet/IP MCA 121

The manual is intended for use by qualified personnel.

1.3 Abbreviations

Abbreviation	Description
AOI	Add-on instruction
RPM	Revolution per minute
STW	Status word
CTW	Control word
Amp	Ampere
FC	Frequency converter
DDT	Derived data types
UDT	User-defined data types
LIB	Library

1.4 What are Add-on Instructions?

Add-on instructions are predefined programs or functions contained within a single program element that can be used in the PLC program.

1.4.1 Advantages of Using Add-on Instructions

- Basic skeleton:
  - AOIs provide the basic infrastructure towards the user.
  - Frees up time to focus on complex and application-specific implementation of the external device.
  - Reuse of an AOI several times in a program without rewriting the AOI.
  - Easy to use - knowledge of the internal operation of the drive or complex algorithms is not required.
- Pretested function:
  - The AOI is pretested for working and functionality.
- Extensibility:
  - AOIs can be extended in future by Danfoss. It is possible to incorporate the AOIs with minimal modification in the existing program.

1.5 Overview of the Danfoss Library (VLT_EIP_LIB_V1_00)

The *VLT_EIP_LIB_V1_00* library is a collection of predefined add-on instructions provided by Danfoss. Use these AOIs as an aid to simplify programs containing standard functionality for programming Rockwell systems and Danfoss drives.

The library contains the following AOIs:

- **Basic operation add-on instruction (VLT_EIP_FC_BASIC)**: dedicated to handle the basic operation of the drive and connected motor operations.
- **Flexible control add-on instruction (VLT_EIP_FC_FLEXIBLE_CTRL)**: the cyclic communication with the drive and representation of process data in user-accessible structure for read and write operation.

The add-on instructions are designed to work with Danfoss proprietary *FC profile* only.

1.6 Basic Operation Add-on Instruction (VLT_EIP_FC_BASIC)

The add-on instruction provides the following functionalities:

- **Control and monitoring**: monitor the drive and control the command or setpoint from the controller to/from the drive.
- **Reverse**: forward or reverse the direction of the motor.
- **Speed regulation**: allows the speed reference of the drive.
- **Failure management**: the *FAULT* output pin is set to *TRUE* if there is a drive fault. This drive fault must be reset by the input pin *RESET* to close the fault. The fault only disappears if the actual root cause of the fault has disappeared.

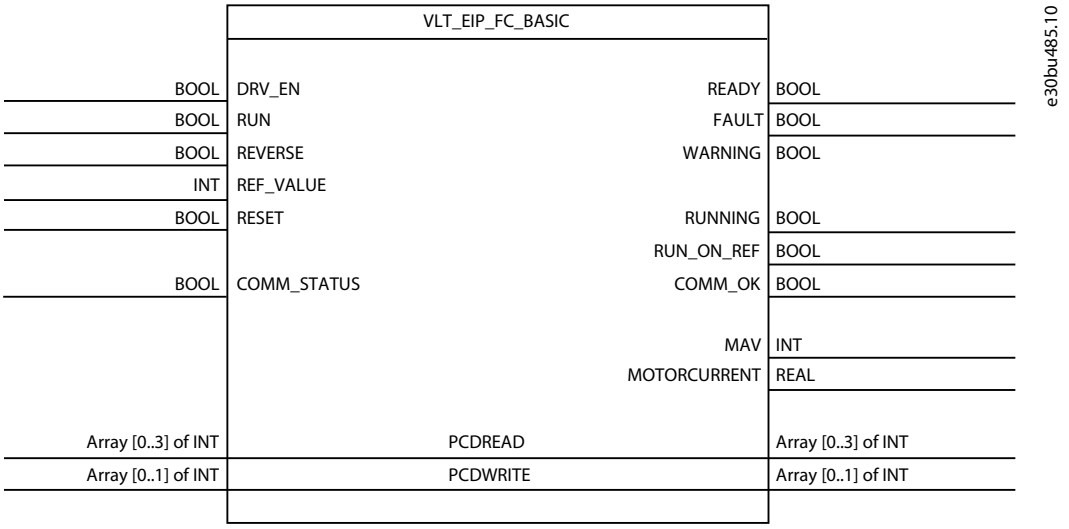

Illustration 1: Basic Operation Add-on Instruction Layout

Table 1: Input Parameter

Parameter	Type	Description
DRV_EN	BOOL	*TRUE* = enabling drive. Setting the drive in *Ready to Start* mode. The 4 bits, CTW.02 (DC brake), CTW.03 (coasting), CTW.04 (quick stop), CTW.05 (hold output frequency) are set to *TRUE* to move the drive to *READY* state.
RUN	BOOL	*TRUE* = starts the motor run in the direction selected based on the *REVERSE* input variable. The CTW.06 (ramp start) bit is set to *TRUE* to start the motor.
REVERSE	BOOL	The direction of rotation of the motor. *FALSE* = activates the forward direction. *TRUE* = activates the reverse direction. The CTW.15 (reverse) bit is set to *TRUE* to change the direction of the motor.
REF_VALUE	INT	The reference value requests to the drive to run at reference speed and only accepts positive values. The range value 0–10000 equal to 0.00% to 100.00%. Enter the reference value without decimal. For example: To run the drive at 56.75%, enter *REF_VALUE* as 5675 to achieve the motor speed.
RESET	BOOL	*TRUE* = resets the device failure and resets the *FAULT* output to 0. The CTW.07 (reset) bit is set to *TRUE* to reset the failure.
COMM_STA-TUS	BOOL	Connect the *ConnectionFaulted* process variable from the slave device.

Table 2: Output Parameter

Parameter	Type	Description
READY	BOOL	*TRUE* = the drive is ready for operation. The 4 bits STW.00 (control ready), STW.01 (drive ready), STW.02 (coast stop), STW0.9 (bus control) are considered for *READY* state.
FAULT	BOOL	*TRUE* = a detected failure in the control block. To reset the *FAULT* output pin, the *RESET* input to be activated. The 3 bits, STW.03 (drive trips), STW.04 (displays error but not tripped), STW.06 (trip lock), are considered for *FAULT* state.
WARNING	BOOL	*TRUE* = a warning has been activated for the drive. It cannot be reset because the signal remains active until the cause of the warning is removed. The STW.07 (warning) bit is considered for *WARNING* state.
RUNNING	BOOL	*TRUE* = the drive is running and has an output frequency (MAV>0). The STW.11 (in operation) bit is considered for motor running status.
RUN_ON_REF	BOOL	*TRUE* = the actual motor speed reaches the preset speed reference. The STW.08 (speed = reference) bit is considered for motor running on preset speed reference.
COMM_OK	BOOL	TRUE = The communication between the device and PLC is healthy.
MAV	INT	Main actual value in %, expressed in integer value 0–10000. For example: the MAV value is 9949 means that the drive is running at 99.49%.
MOTORCURRENT	REAL	Motor current in Amps.

Table 3: Inout Parameter

Parameter	Type	Description	
PCDREAD	INT [4]	Process data sent from the drive contains information about the current state of the drive. Holds a structure with the data obtained from the drive. This input is reserved for the add-on instruction, and it is recommended not using this input directly.	
	Parameter	**Type**	**Description**
	PCDREAD [0]	INT	Status word.
	PCDREAD [1]	INT	MAV (main actual value).
	PCDREAD [2]	INT	Motor current (least significant bit).
	PCDREAD [3]	INT	Motor current (most significant bit).

Parameter	Type	Description	
PCDWRITE	INT [2]	Process data sent from the PLC to the drive. Holds a structure with data sent to the drive. Control the drive with this output variable.	
	Parameter	**Type**	**Description**
	PCDWRITE [0]	INT	Control word.
	PCDWRITE [1]	INT	Reference value.

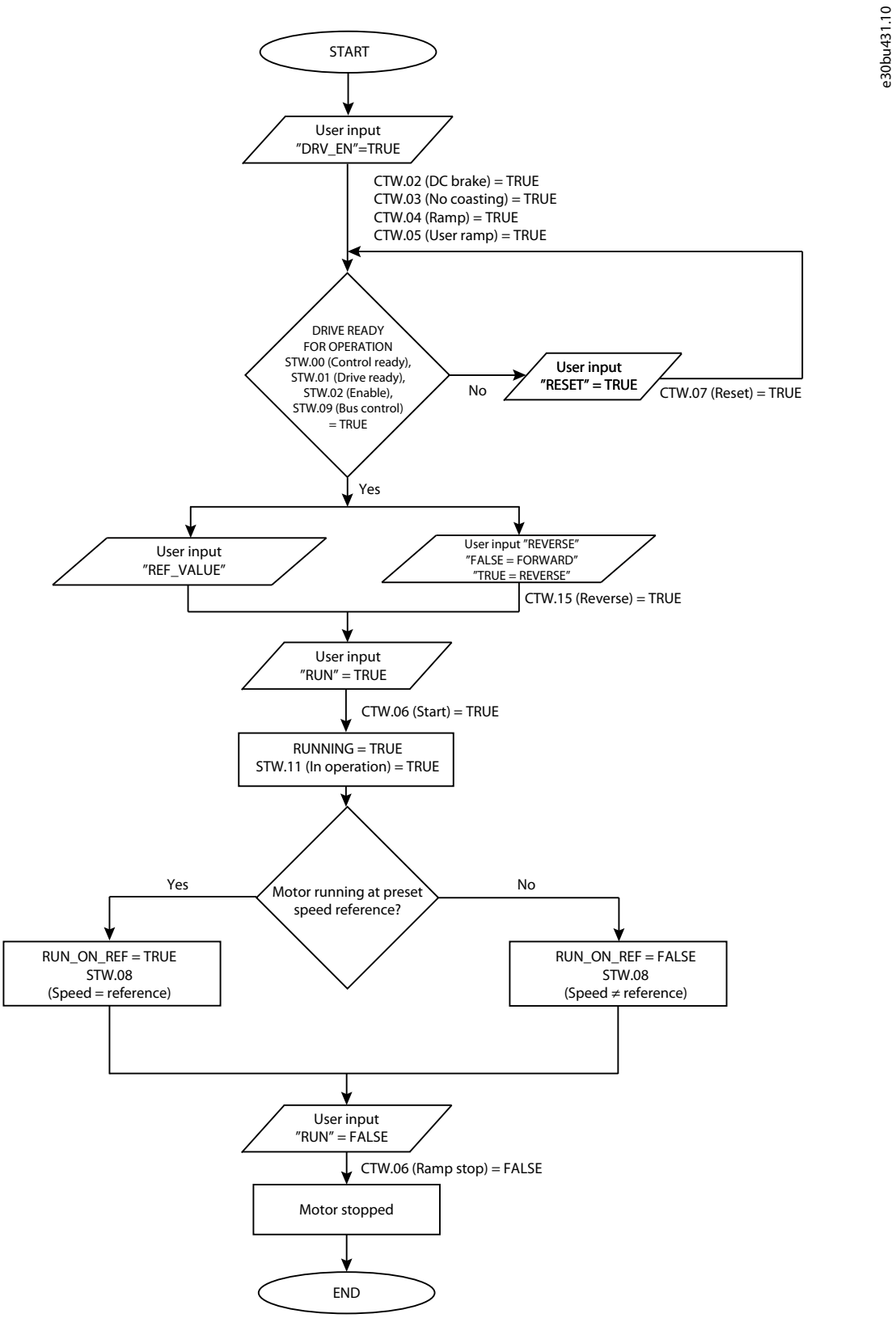

Illustration 2: Flow Chart for Basic Operation Of Drive Control

1.7 Flexible Control Add-on Instruction (VLT_EIP_FC_FLEXIBLE_CTRL)

The add-on instruction supports the following functionalities:

- Control basic motor operations and monitor drive status during operation.
- Reads and writes cyclic process data (*parameter 12-21 Process Data Config Write* and *parameter 12-22 Process Data Config Read*) from/to the drive and stores the data in a data structure which is accessible to develop an application program.
- Continuously monitor the drive communication status, and use the status as an interlock for write operation.
- Report active alarm, warning, and communication error.
- Manipulation of CTW words is only up to the user to control the drive.
- Work with *FC profile* only.

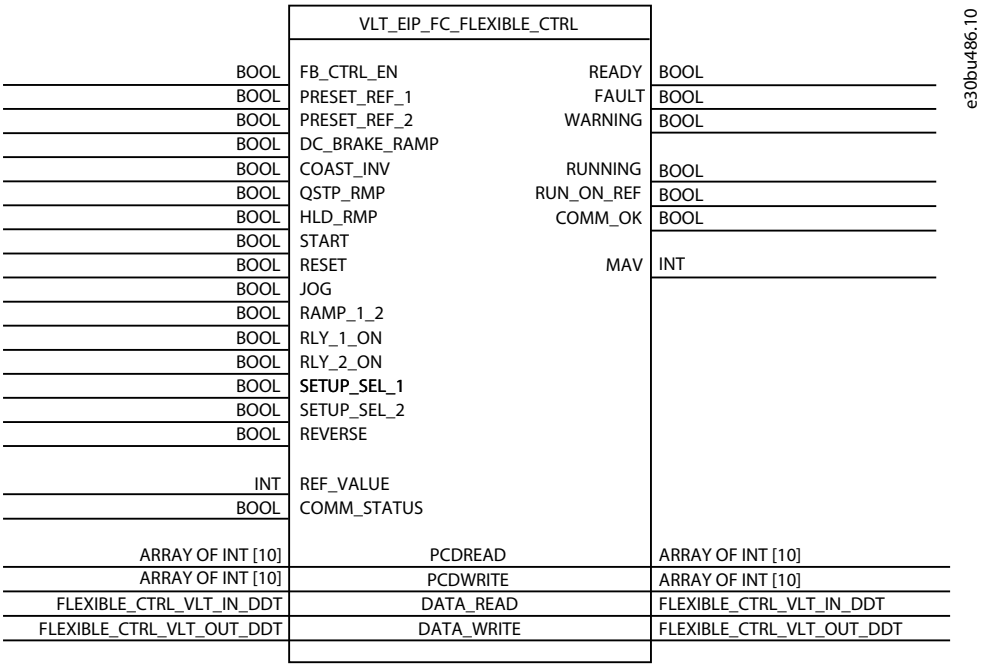

Illustration 3: Flexible Control Add-on Instruction Layout

Table 4: Input Parameter

Parameter	Type	Description
FB_CTRL_EN	BOOL	1=enabling the drive to control from the add-on instruction. The CTW.10 (bus control) bit is set to 1 to control the drive via bus control.
PRESET_REF_1	BOOL	Reference value *PRESET_REF_1* and *PRESET_REF_2* are used to select among the 4 reference values which are pre-programmed in *parameter 3-10 Preset Reference*.
PRESET_REF_2	BOOL	
DC_BRAKE_RAMP	BOOL	0: leads to DC brake and stop. 1: leads to ramping.
COAST_INV	BOOL	0: causes the drive to immediately coast the motor to a standstill. 1: enables the drive to start the motor if other starting conditions have been fulfilled.

Parameter	Type	Description
QSTP_RMP	BOOL	0: causes a quick stop, ramp, and motor speed down to stop. 1: leads to ramping.
HLD_RMP	BOOL	0: freezes the current frequency of the motor. 1: uses the freeze frequency.
START	BOOL	0: leads to ramp down to stop. 1: Allows the drive to start the motor if other starting conditions have been fulfilled.
RESET	BOOL	0: no reset. 1: resets the drive. Reset is edge triggered.
JOG	BOOL	0: no function. 1: the output frequency is determined by *parameter 3-19 Jog Speed [RPM]*.
RAMP_1_2	BOOL	0: ramp 1 is selected. 1: ramp 2 is selected.
RLY_1_ON	BOOL	0: relay 01 is deactivated. 1: relay 01 is activated.
RLY_2_ON	BOOL	0: relay 02 is deactivated. 1: relay 02 is activated.
SETUP_SEL_1	BOOL	Set-up selections *SETUP_SEL_1* and *SETUP_SEL_2* inputs are used to select the active set-up.
SETUP_SEL_2	BOOL	
REVERSE	BOOL	The direction of rotation of the motor. 0=activates the forward direction. 1=activates the reverse direction.
REF_VALUE	INT	The reference value requests to the drive to run at reference speed and only accepts positive values. The range value is -16384 to 16384.
COMM_STATUS	BOOL	Connect the *ConnectionFaulted* process variable from the slave device.

Table 5: Output Parameter

Parameter	Type	Description
READY	BOOL	1=the drive is ready for operation. The 4 bits STW.00 (control ready), STW.01 (drive ready), STW.02 (coast stop), STW0.9 (bus control) are considered for *READY* state.
FAULT	BOOL	1=a detected failure in the control block. To reset the *FAULT* output pin, the *RESET* input to be activated. The 3 bits, STW.03 (drive trips), STW.04 (shows error but is not tripped), STW.06 (trip lock) are considered for *FAULT* state.

Parameter	Type	Description
WARNING	BOOL	1=a warning has been activated for the drive. It cannot be reset because the signal remains active until the cause of the warning is removed. The STW.07 (warning) bit is considered for *WARNING* state.
RUNNING	BOOL	1=the drive is running and has an output frequency (MAV > 0). The STW.11 (in operation) bit is considered for motor running status.
RUN_ON_REF	BOOL	1=the actual motor speed reaches the preset speed reference. The STW.08 (speed = reference) bit is considered for motor running on preset speed reference.
COMM_OK	BOOL	1=the communication between the device and PLC is OK.
MAV	INT	Measured actual value (speed). The range is (-16384) to (+16384).

Table 6: Inout Parameter

Parameter	Type	Description	
PCDREAD	INT [10]	Process data sent from the drive contains information about the current state of the drive. Holds a structure with the data obtained from the drive. This input is reserved for the AOIs and it is not recommended to be used directly.	
	Parameter	**Type**	**Description**
	PCDREAD [0]	INT	Status word.
	PCDREAD [1]	INT	MAV (main actual value).
	PCDREAD [2]	INT	Parameter 12–22 [2].
	PCDREAD [3]	INT	Parameter 12–22 [3].
	PCDREAD [4]	INT	Parameter 12–22 [4].
	PCDREAD [5]	INT	Parameter 12–22 [5].
	PCDREAD [6]	INT	Parameter 12–22 [6].
	PCDREAD [7]	INT	Parameter 12–22 [7].
	PCDREAD [8]	INT	Parameter 12–22 [8].
	PCDREAD [9]	INT	Parameter 12–22 [9].

Parameter	Type	Description	
PCDWRITE	INT [10]	Process data sent from the PLC to the drive. This output is reserved for the AOIs and it is not recommended to be used directly.	
	Parameter	**Type**	**Description**
	PCDWRITE [0]	INT	Control word.
	PCDWRITE [1]	INT	Reference value.
	PCDWRITE [2]	INT	Parameter 12–21 [2]
	PCDWRITE [3]	INT	Parameter 12–21 [3]
	PCDWRITE [4]	INT	Parameter 12–21 [4]
	PCDWRITE [5]	INT	Parameter 12–21 [5]
	PCDWRITE [6]	INT	Parameter 12–21 [6]
	PCDWRITE [7]	INT	Parameter 12–21 [7]
	PCDWRITE [8]	INT	Parameter 12–21 [8]
	PCDWRITE [9]	INT	Parameter 12–21 [9]
DATA_READ	FLEXIBLE_CTRL_VLT_IN_DDT	Holds the data structure obtained from the process data (PCDREAD) and expressed in user data accessible format.	
	UDT name	**Type**	**Description**
	STW	STATUS_WORD	Status Word. Refer to table 7 for more information.
	MAV	INT	Main actual value.
	PCD_02	INT	Depends on the drive configuration.
	PCD_03	INT	Depends on the drive configuration.
	PCD_04	INT	Depends on the drive configuration.
	PCD_05	INT	Depends on the drive configuration.
	PCD_06	INT	Depends on the drive configuration.
	PCD_07	INT	Depends on the drive configuration.
	PCD_08	INT	Depends on the drive configuration.
	PCD_09	INT	Depends on the drive configuration.

Parameter	Type	Description	
DATA_WRITE	FLEXIBLE_CTRL_VLT_OUT_DDT	Holds the data structure in user data accessible format to send the process data (PCDWRITE) to the drive.	
	UDT name	**Type**	**Description**
	CTW	CONTROL_WORD	Control word. Refer to table 8 for more information.
	MRV	INT	Main Reference Value.
	PCD_02	INT	Depends on the drive configuration.
	PCD_03	INT	Depends on the drive configuration.
	PCD_04	INT	Depends on the drive configuration.
	PCD_05	INT	Depends on the drive configuration.
	PCD_06	INT	Depends on the drive configuration.
	PCD_07	INT	Depends on the drive configuration.
	PCD_08	INT	Depends on the drive configuration.
	PCD_09	INT	Depends on the drive configuration.

Table 7: User-defined Data Type: STATUS_WORD

UDT name	Variable name	Type	Description
STATUS_WORD	BIT_00_CTRL_RDY	BOOL	0=control not ready. 1=control ready.
	BIT_01_DRV_RDY	BOOL	0=drive. 1=drive ready.
	BIT_02_COAST_RDY	BOOL	0=coasting. 1=enable.
	BIT_03_TRIP	BOOL	0=no error. 1=trip.
	BIT_04_ERROR	BOOL	0=no error. 1=error (no trip).
	BIT_05	BOOL	0=reserved. 1=---.
	BIT_06_TRIPLOCK	BOOL	0=no error. 1=trip lock.
	BIT_07_WARNING	BOOL	0=no warning. 1=warning.
	BIT_08_RUNNING_REF	BOOL	0=speed<>reference. 1=speed=reference.
	BIT_09_CTRL_SOURCE	BOOL	0=local operation. 1=bus control.
	BIT_10_F_LIMIT_OK	BOOL	0=out of frequency limit. 1=frequency limit ok.
	BIT_11_IN_OPR	BOOL	0=no operation. 1=in operation.
	BIT_12_IN_AUTOSTART	BOOL	0=drive ok. 1=stopped, auto start.
	BIT_13_VOLT_MAX	BOOL	0=voltage ok. 1=voltage exceeded.
	BIT_14_TORQ_MAX	BOOL	0=torque ok. 1=torque exceeded.
	BIT_15_TIMER_EXD	BOOL	0=timer ok. 1=timer exceeded.

Table 8: User-defined Data Type: CONTROL_WORD

UDT name	Variable name	Type	Description
CONTROL_WORD	BIT_00_PRESET_REF_1	BOOL	0=reference value. 1=selection lsb.
	BIT_01_PRESET_REF_2	BOOL	0=reference value. 1=selection msb.
	BIT_02_DC_BRAKE_RAMP	BOOL	0=DC brake. 1=ramp.
	BIT_03_COAST_INV	BOOL	0=coasting. 1=no coasting.
	BIT_04_RAMP	BOOL	0=quick stop. 1=ramp.
	BIT_05_RAMP	BOOL	0=hold output frequency. 1=use ramp.
	BIT_06_STARTv	BOOL	0=ramp stop. 1=start.
	BIT_07_RESET_ERR	BOOL	0=no function. 1=reset.
	BIT_08_JOG	BOOL	0=no function. 1=jog.
	BIT_09_RAMP_1_2	BOOL	0=ramp 1. 1=ramp 2.
	BIT_10_USE_CTRL_WORD	BOOL	0=donot use CTW. 1=use CTW.
	BIT_11_RLY_1_ON	BOOL	0=relay 01 deactived. 1=relay 01 active.
	BIT_12_RLY_2_ON	BOOL	0=relay 02 deactived. 1=relay 02 active.
	BIT_13_SETUP_SEL_1	BOOL	0=parameter set-up. 1=selection lsb.
	BIT_14_SETUP_SEL_2	BOOL	0=parameter set-up. 1=selection msb.
	BIT_15_REVERSE	BOOL	0=no reverse. 1=reverse.

2 Using AOIs in Studio 5000 Logix Designer

2.1 Importing Danfoss Library into a Project

Context:

The following steps explain how to add an add-on instruction for drives in the Studio 5000 Logix Designer.

Procedure

1. Navigate to *Controller Organizer⇒Assets⇒Add-On Instructions*, right-click *Add-On Instructions*.
2. Click *Import Add-On Instruction*.

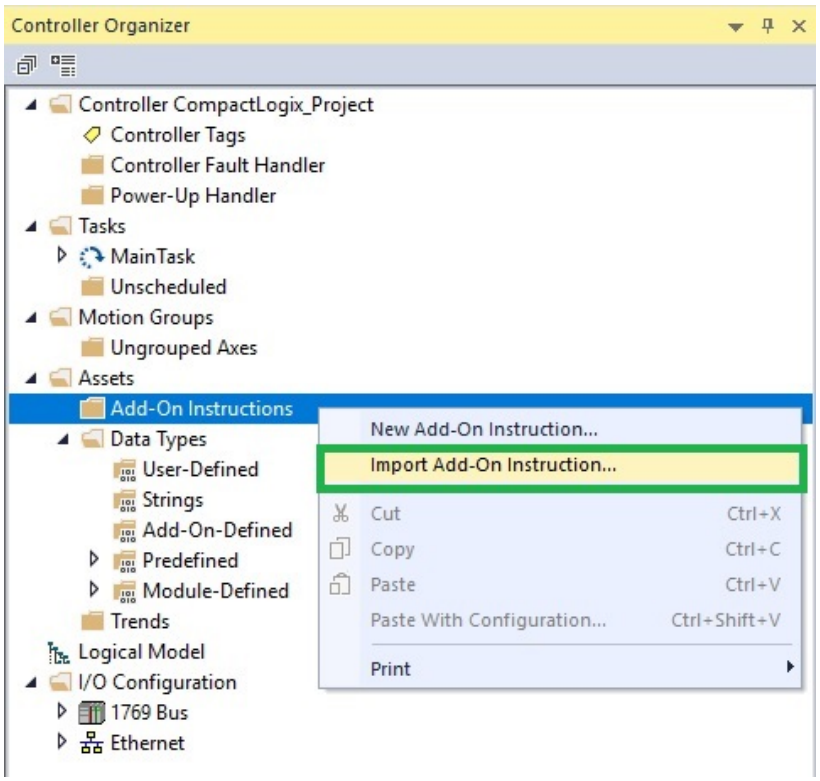

Illustration 4: Importing Add-on Instruction

3. Select the necessary add-on instruction from the *Import Add-On Instruction* dialog window.
4. Click *Open*.

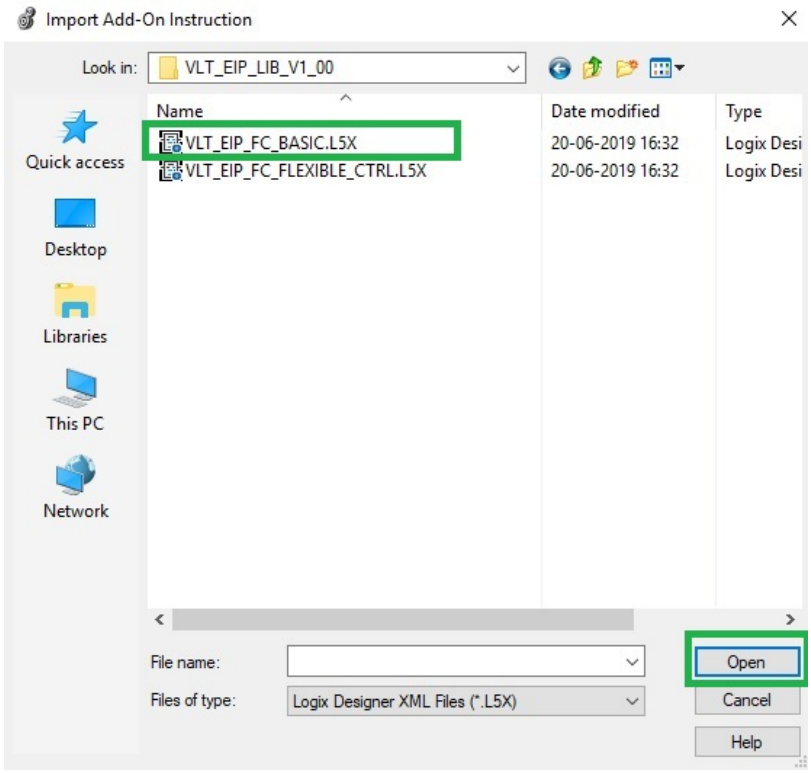

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Illustration 5: Selecting Add-on Instruction

5. Click *OK* in the *Import Configuration- VLT_EIP_FC_BASIC.L5X* dialog window.

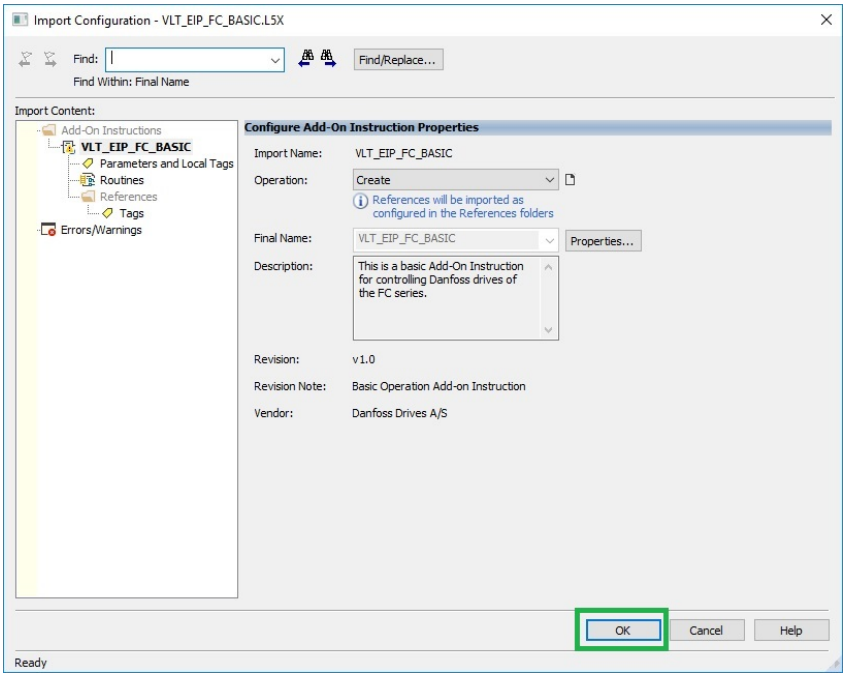

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Illustration 6: Importing Add-on Instruction

→ The *VLT_EIP_FC_BASIC* add-on instruction is successfully imported in the project.

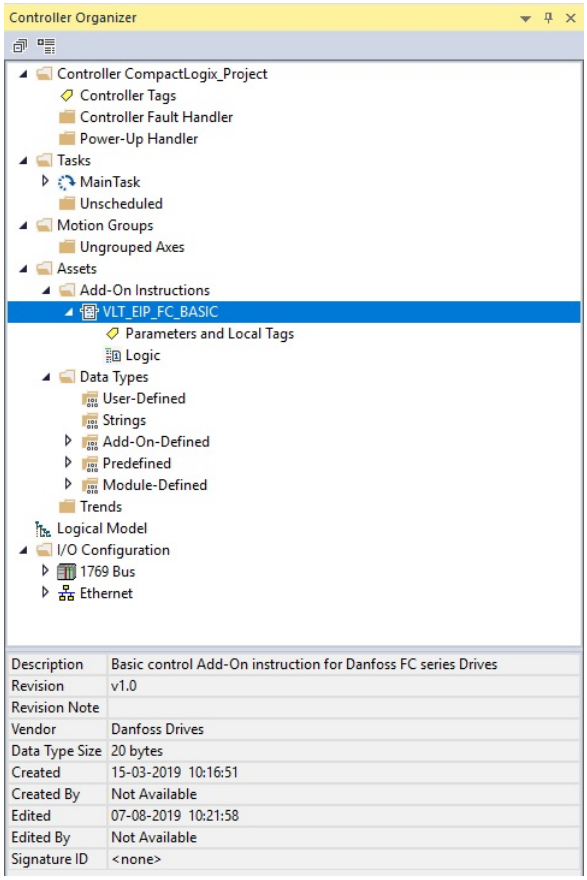

Illustration 7: Add-on Instruction Imported Successfully

2.2 Installing EDS File

Context:

The following steps explain how to add EDS file in the Studio 5000 Logix Designer.

Procedure

1. Download EDS file from the Danfoss Fieldbus configuration files website and save it in local drive.
2. Unzip the file.

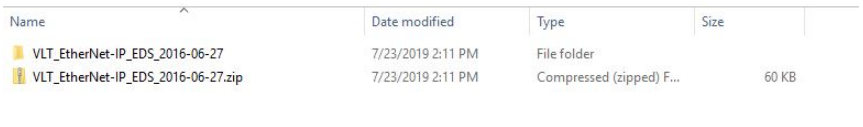

Illustration 8: Downloaded EDS file From Danfoss Website

3. Click *Tools⇒EDS Hardware Installation Tool*.

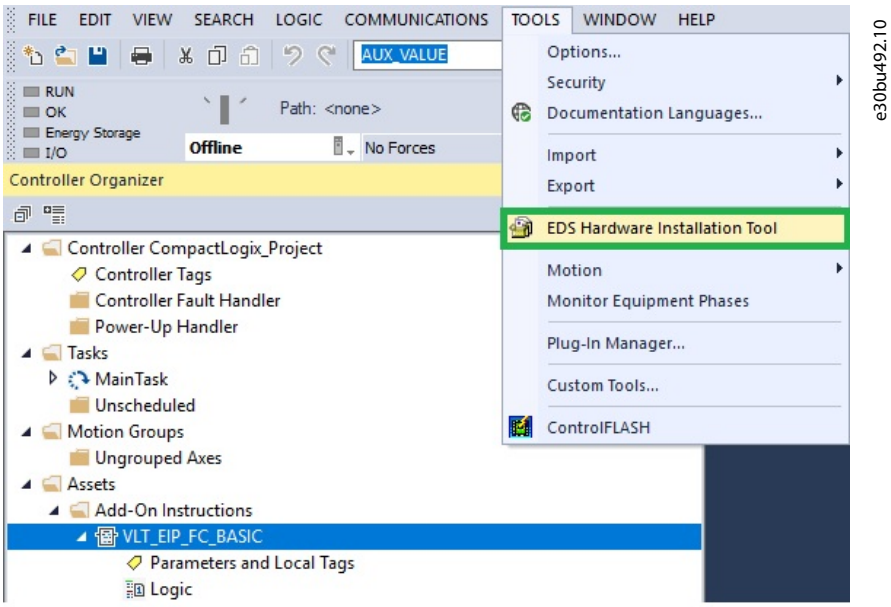

Illustration 9: EDS Hardware Installation Tool

4. Click *Next* in the *Rockwell Automation's EDS Wizard*.

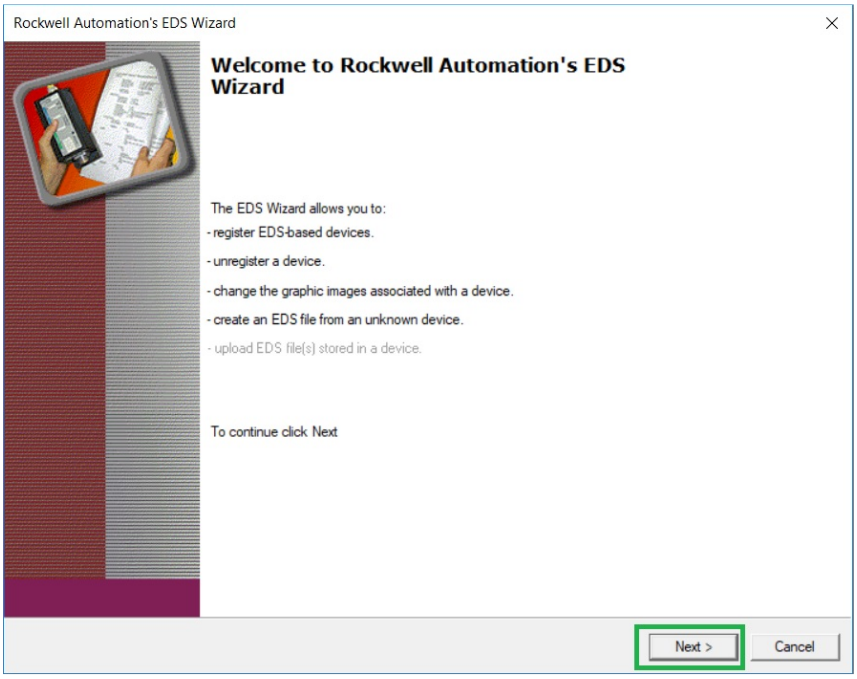

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Illustration 10: Rockwell Automation's EDS Wizard

5. Select *Register an EDS file(s)*.
6. Click *Next*.

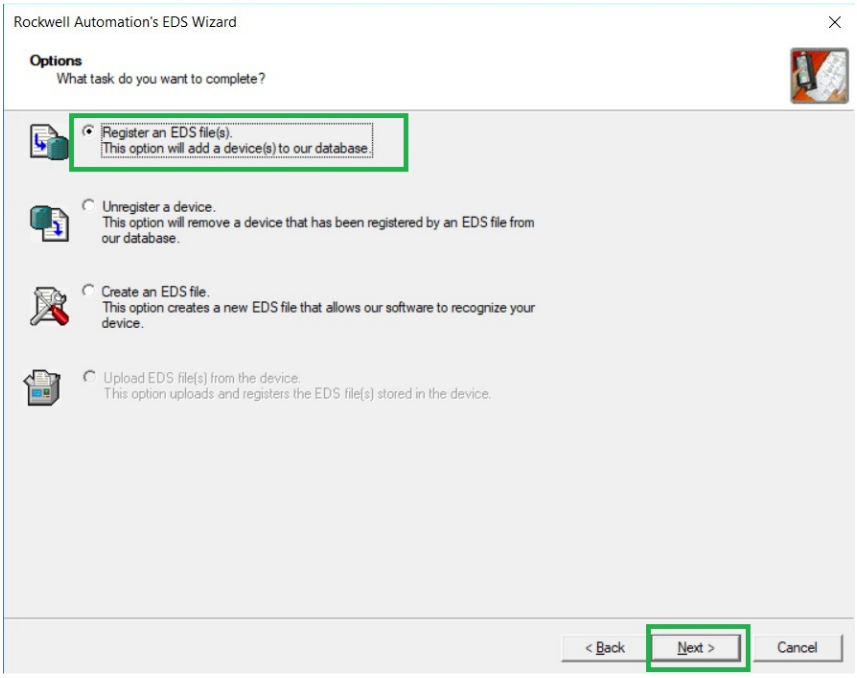

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Illustration 11: Register an EDS File

7. Browse the downloaded EDS file (for example, *FC302_EIP_16_12.eds*), and click *Next*.

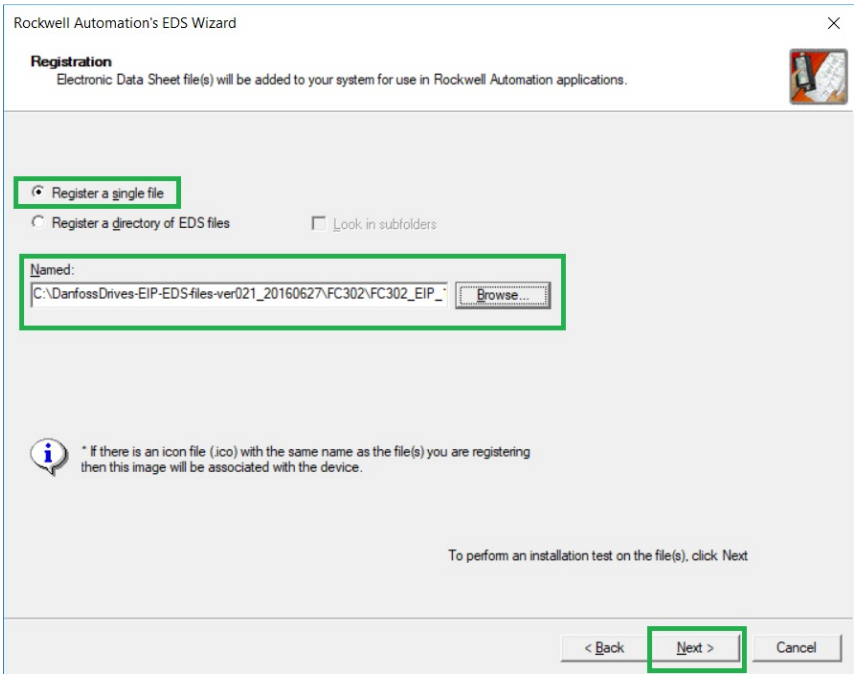

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Illustration 12: Browse the Downloaded EDS File

8. Click *Next*.

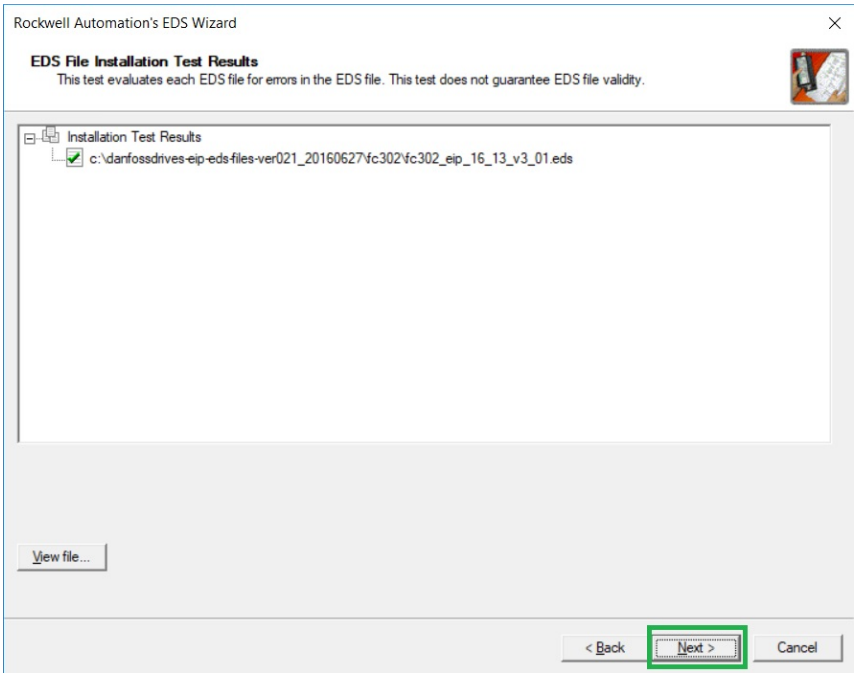

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Illustration 13: EDS File Installation Test Results

9. To select the graphics to show associated with a device, click *Next*.

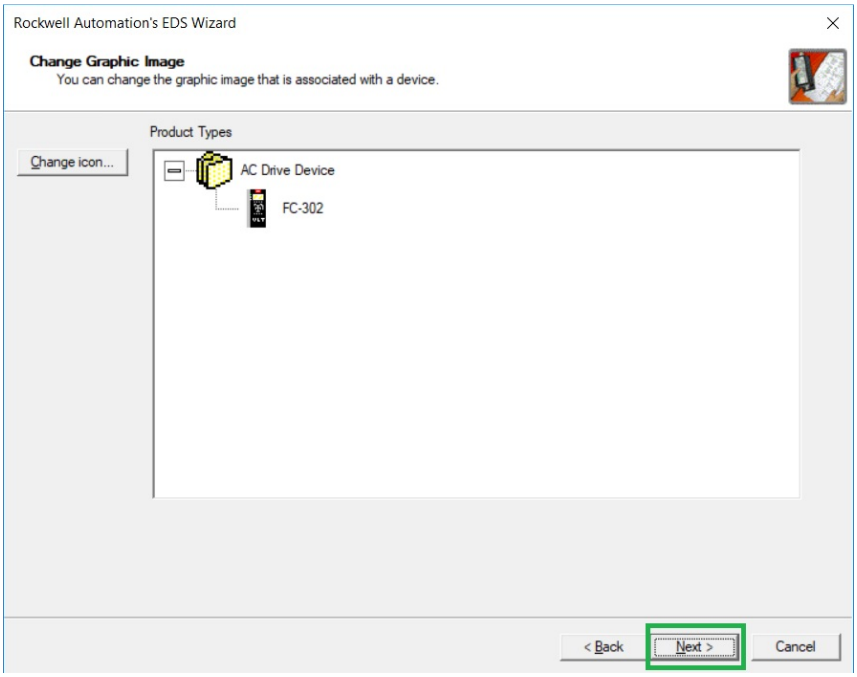

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Illustration 14: Changing Graphic Image

10. To complete the task, click *Next*.

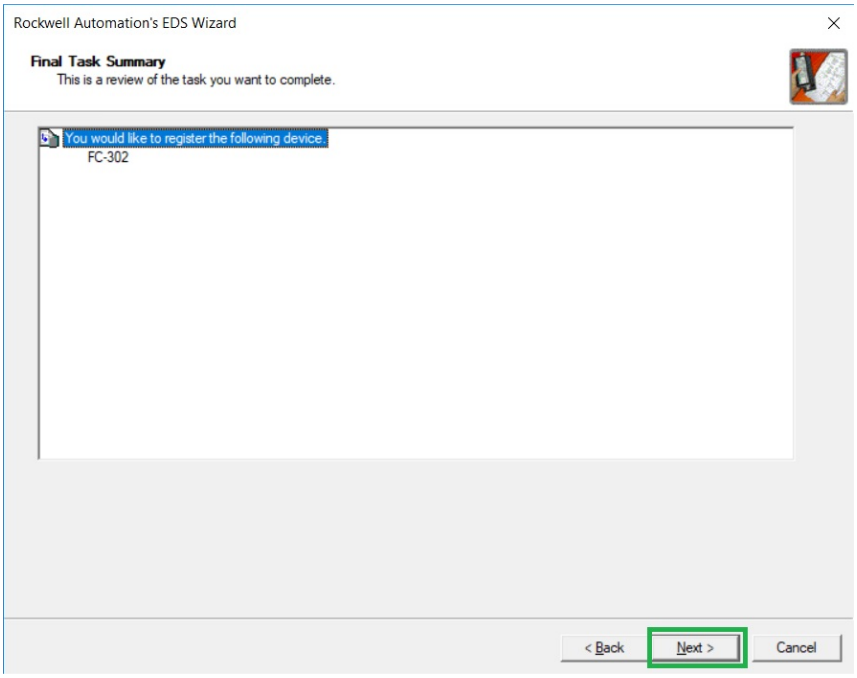

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Illustration 15: Final Task Summary

11. To complete the installation of the EDS file, click *Finish*.

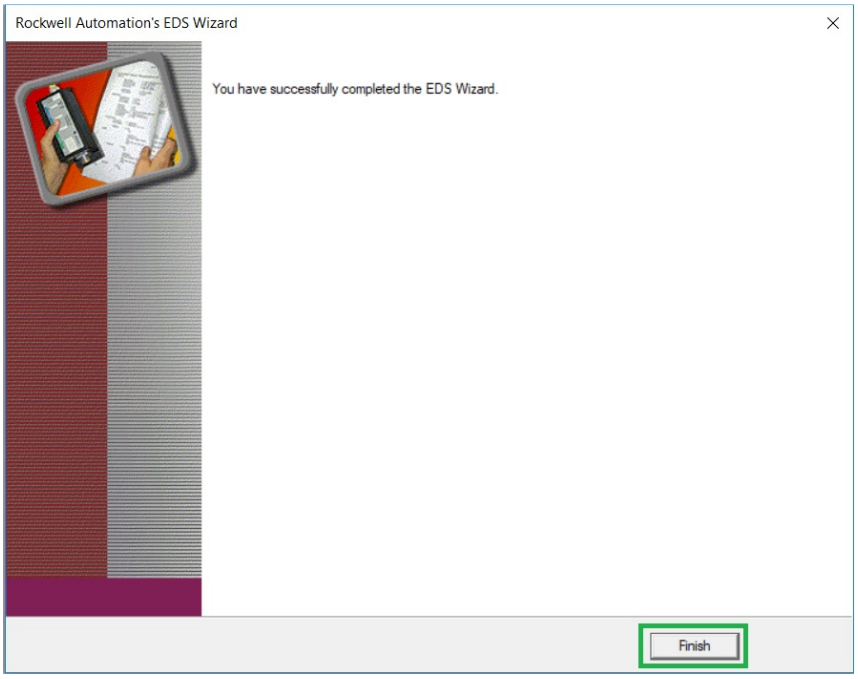

Illustration 16: EDS File Successfully Added

2.3 Adding Danfoss Module

Context:

The following steps explain how to add Danfoss FC series module in the Studio 5000 Logix Designer.

Procedure

1. From *Controller Organizer* window, navigate to *I/O Configuration⇒Ethernet*, right-click *Ethernet* and select *New Module*.

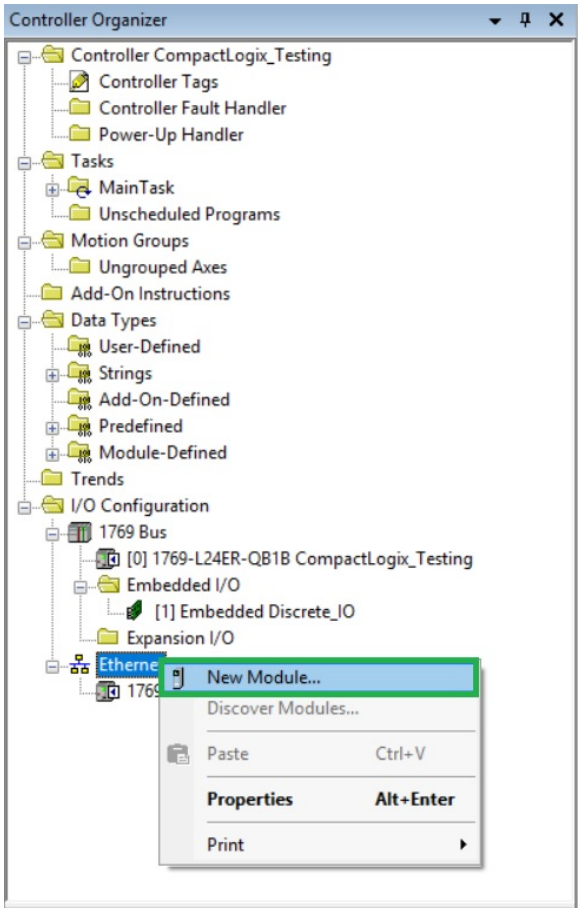

Illustration 17: Adding Slave Device

2. From *Select Module Type* window, navigate to *Catalog* tab.
3. Enter *Danfoss* in the search box.
4. Select *FC-302*.
5. Click *Create*.

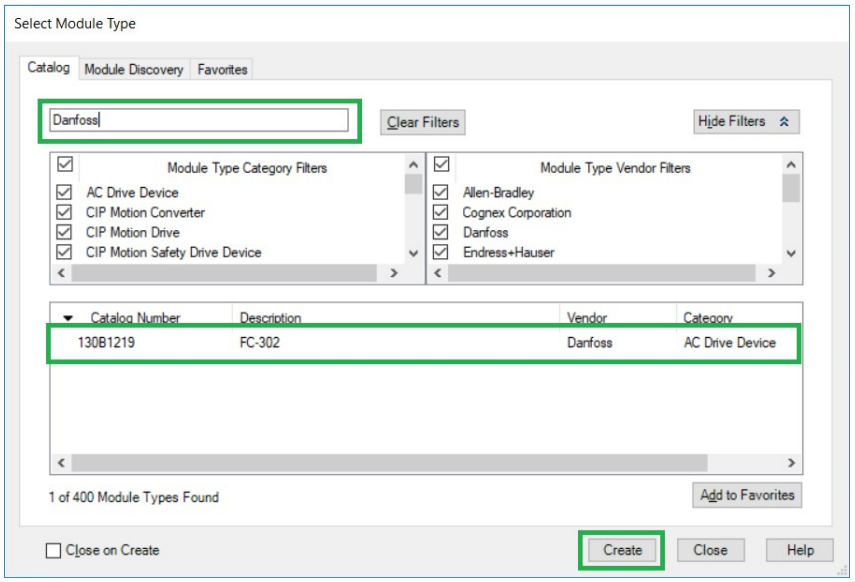

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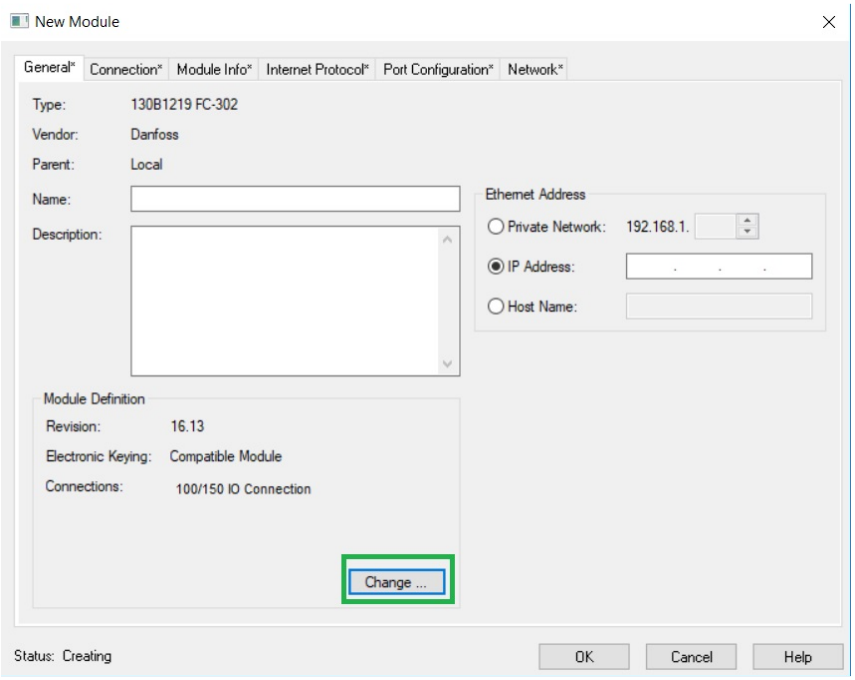
Illustration 18: Selecting Module Type

6. From *New Module* window, navigate to *General* tab.
7. Click *Change....*



e30bu502.10

Illustration 19: Slave Device Configuration

8. From *Module Definition* window, select *103/153 IO Connection* and *INT* data type.

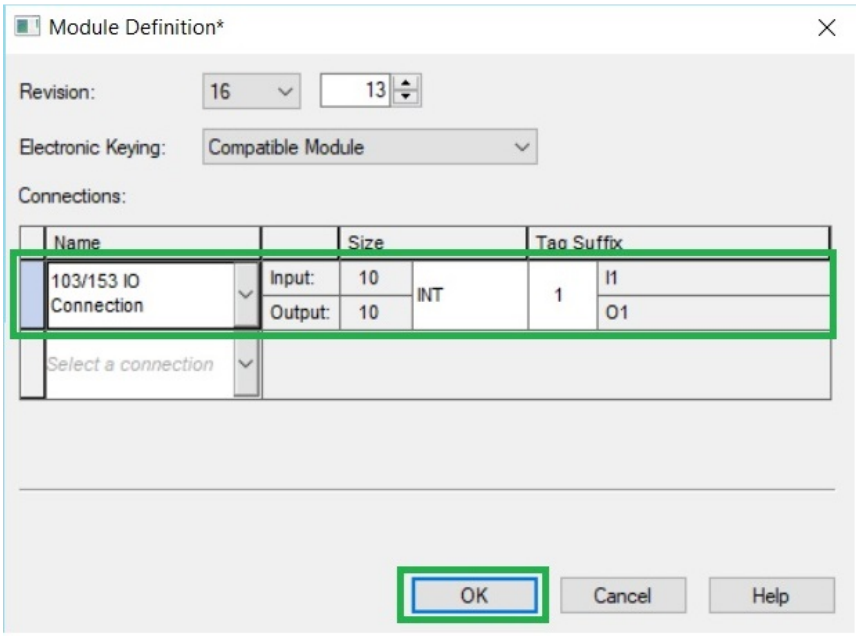


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Illustration 20: Slave Device Configuration

9. To confirm the change, click *Yes*.

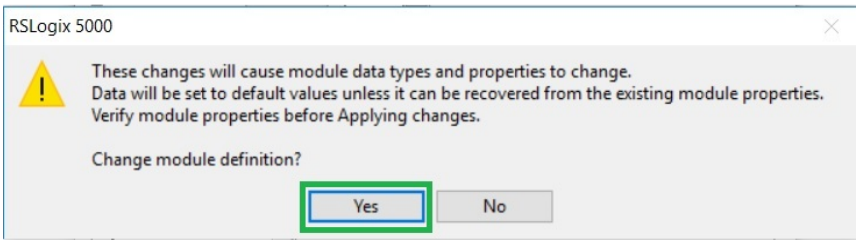

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Illustration 21: Slave Device Configuration Confirmation

→ The IO connection profile updated in the *New Module* window.

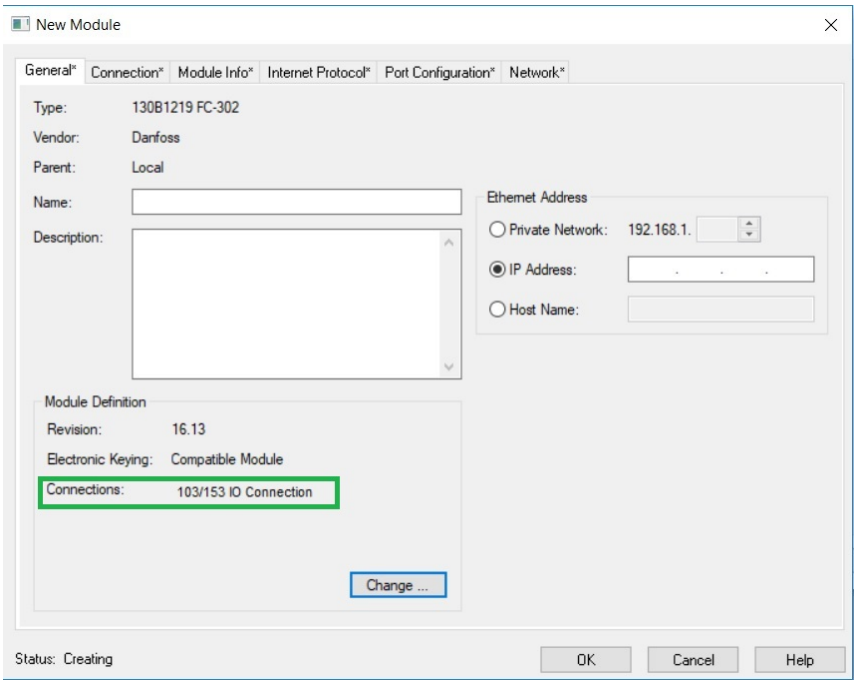

Illustration 22: Slave Device Configuration

10. Enter the name, description, and IP address of the module

11. Click *OK* to add Danfoss module under Ethernet module.

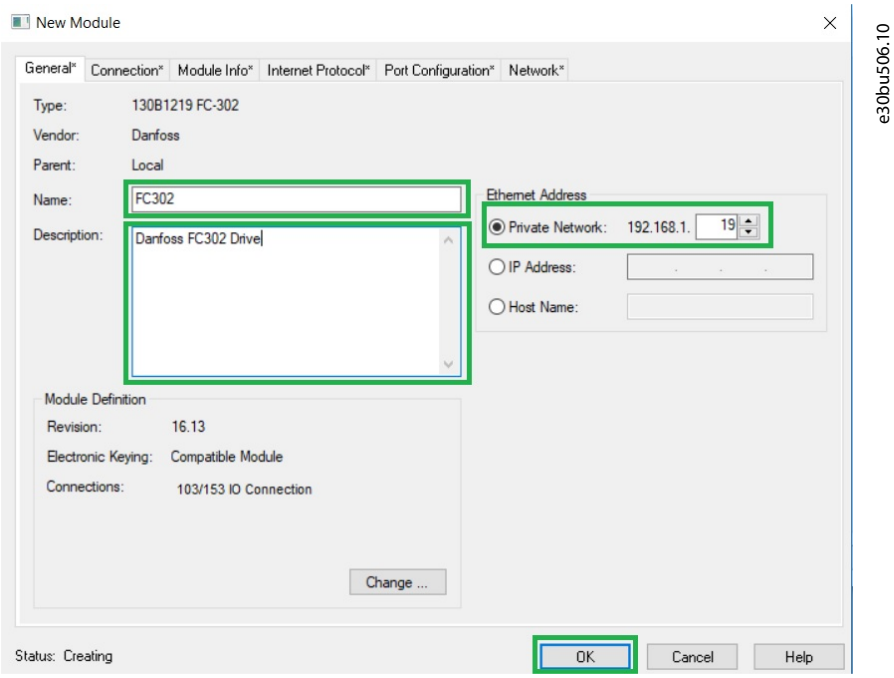

Illustration 23: Slave Device Configuration

2.4 Instantiating Add-on Instructions and Processing Variable Mapping

Context:

The following steps explain how to instantiate the add-on instructions in the main program and process variable mapping with the instance.

Procedure

1. Instantiate *VLT_EIP_FC_BASIC* in the main program.

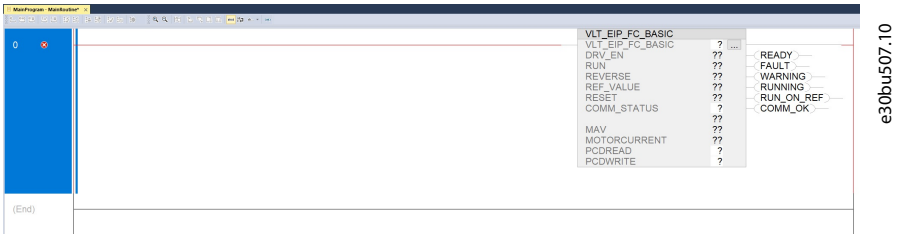

Illustration 24: Instantiation of Basic Operation Add-on Instruction

2. Create a controller tag *BASIC_OPERATION* of data type *VLT_EIP_FC_BASIC*.
3. In the rung 0, select the AOI, and double-click the text box (AOI instance name), then select the *BASIC_OPERATION* tag from the drop-down list.

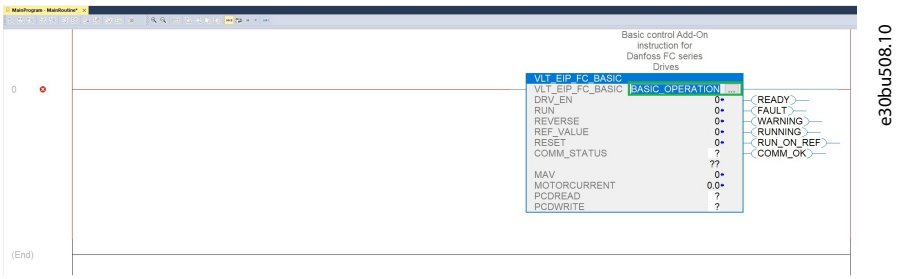

Illustration 25: Basic Operation Add-on Instruction

4. Assign process variables to the respective input and inout pins.

Table 9: Process Variables

Type	AOI pin name	Data type	Mapping address
Input	COMM_STATUS	BOOL	FC302:I1.ConnectionFaulted [1]
Inout	PCDREAD	INT [4]	FC302:I1.Data
Inout	PCDWRITE	INT [2]	FC302:O1.Data

[1] *FC302:I1.ConnectionFaulted indicates communication status between PAC controllers and the drive. The ConnectionFaulted is 0 means the I/O connection or communication between PAC controllers and the drive is OK.*

5. Double-click the text box against *COMM_STATUS* input pin, and select the respective mapping for the variable from the drop-down list.

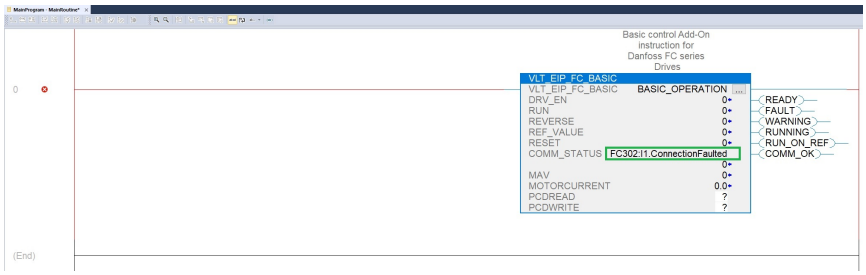

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Illustration 26: Basic Operation Add-on Instruction

6. Repeat step 5 for *PCDREAD* and *PCDWRITE* inout tags assignment.

e30bu510.10

Illustration 27: Basic Operation Add-on Instruction

7. To verify the rung in the main routine, right-click rung 0 and select *Verify rung*.

e30bu511.10

Illustration 28: Verification of Errors

8. Ensure that no error or warning appears on the *Errors* output window.

9. To download the configuration, select the controller status button and click *Download*.

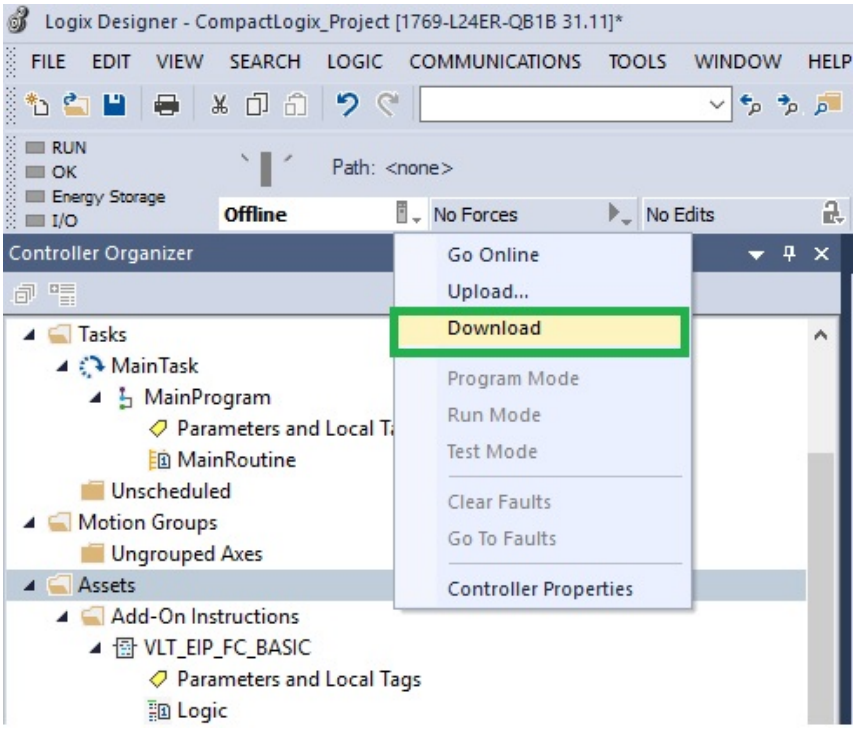

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Illustration 29: Download the Project

10. If the controller is not in *RUN* mode, switch to *RUN* mode.

3 Examples

3.1 General Configuration of the Drive

Procedure

1. When the drive is commissioned, set *parameter 0-03 regional settings* before any other changes are made to the drive through LCP.
2. Verify the following parameter settings to ensure that the PLC has control of the drive.

Table 10: Parameter Settings

Parameter	Value
Parameter 8-01 Control Site	*[0] Digital and ctrl.word*, or *[2] Control word only*
Parameter 8-02 Control Word Source	*[3] Option A*

3. When *parameter 8-01 Control Site* is set to *[0] Digital and Ctrl. Word*, establish a connection between terminal 12/13 and terminal 27 to control the motor.
4. The default setting of the drive allows the drive to continue operation if the communication is lost to the PLC. If this operation is not wanted, change *parameter 8-04 Control Word Timeout Function* via the Main Menu.

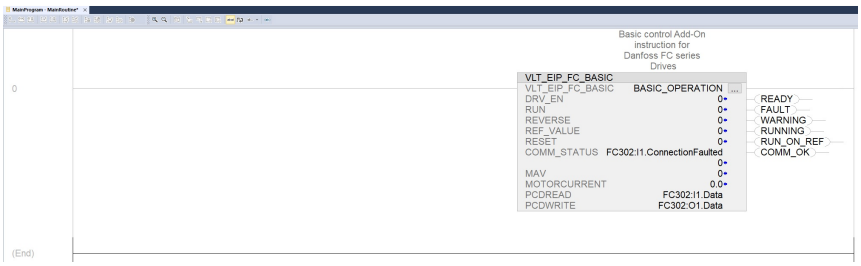
Table 11: Parameter Settings

Parameter	Value
Parameter 8-04 Control Word Timeout Function	*[0] Off*, or *[1] Freeze output*, or *[2] Stop*, or *[3] Jogging*, or *[4] Max. speed*, or *[5] Stop and trip*

5. The add-on instructions require that *parameter 8-10 Control Word Profile* is set to *[0] FC Profile (DEFAULT)*. If *parameter 8-10 Control Word Profile* is set to *[5] ODVA*, the add-on instruction does not work as expected and leads to malfunction. Verify that *parameter 8-10 Control Word Profile* is set correctly via the Main Menu.
6. Ensure physically that LCP mode is set to *Auto On* mode.

3.2 Basic Operation Add-on Instruction

Context:



e30bu513.10

Illustration 30: Basic Operation Add-on Instruction

Procedure

1. Enable the drive to *Ready* state.
   - **A** Verify the output pin *COMM_OK* is set to *TRUE*. That is, communication between PLC and the drive is OK.
   - **B** Set the value *TRUE* to *DRV_EN* input pin.
   - **C** Verify the following output values.

Table 12: Pin Name and Expected Value

Pin name	Expected value
READY	TRUE
FAULT	FALSE
WARNING	FALSE
RUNNING	FALSE
RUN_ON_REF	FALSE
COMM_OK	TRUE
MAV	0
MOTORCURRENT	Same as *parameter 16-14 Motor Current*.

   - **D** Set the value *TRUE* to the *RUN* input pin.
   - **E** Set the value *10000* to the *REF_VALUE* input pin.
   - **F** Verify the following output values.

Table 13: Pin Name and Expected Value

Pin name	Expected value
READY	TRUE
FAULT	FALSE
WARNING	FALSE
RUNNING	TRUE
RUN_ON_REF	TRUE
COMM_OK	TRUE
MAV	10000
MOTORCURRENT	Same as *parameter 16-14 Motor Current*.

   - **G** Set the value *FALSE* to the *DRV_EN* input pin.
   - **H** Verify the following output values.

Table 14: Pin Name and Expected Value

Pin name	Expected value
READY	FALSE
FAULT	FALSE
WARNING	FALSE
RUNNING	FALSE

Pin name	Expected value
RUN_ON_REF	FALSE
COMM_OK	TRUE
MAV	0
MOTORCURRENT	Same as *parameter 16-14 Motor Current*.

I Set the value *FALSE* to the *RUN* input pin.

2. Start the motor in forward direction.

A Set the value *TRUE* to the *DRV_EN* input pin.

B Set the value *TRUE* to the *RUN* input pin.

C Set the value *10000* to the *REF_VALUE* input pin.

D Verify the following output values.

Table 15: Pin Name and Expected Value

Pin name	Expected value
READY	TRUE
FAULT	FALSE
WARNING	FALSE
RUNNING	TRUE
RUN_ON_REF	TRUE
COMM_OK	TRUE
MAV	10000
MOTORCURRENT	Same as *parameter 16-14 Motor Current*.

3. Start the motor in reverse direction.

A Set the value *10000* to the *REF_VALUE* input pin.

B Set the value *TRUE* to the *REVERSE* input pin. Ensure that *parameter 4-10 Motor Speed Direction* is set to *[2] Both Directions*.

C Wait until the motor ramps down and running in the reverse direction.

D Verify the following output values.

Table 16: Pin Name and Expected Value

Pin name	Expected value
READY	TRUE
FAULT	FALSE
WARNING	FALSE
RUNNING	TRUE
COMM_OK	TRUE
MAV	-10000 [±1%]
MOTORCURRENT	Same as *parameter 16-14 Motor Current*.

E Set the value *FALSE* to the *RUN* input pin.

F Set the value *0* to the *REF_VALUE* input pin.

G Verify the following output values.

Table 17: Pin Name and Expected Value

Pin name	Expected value
READY	TRUE
FAULT	FALSE
WARNING	FALSE
RUNNING	FALSE
RUN_ON_REF	FALSE
COMM_OK	TRUE
MAV	0x0000
MOTORCURRENT	Same as *parameter 16-14 Motor Current*.

3.3 Flexible Control Add-on Instruction

Context:

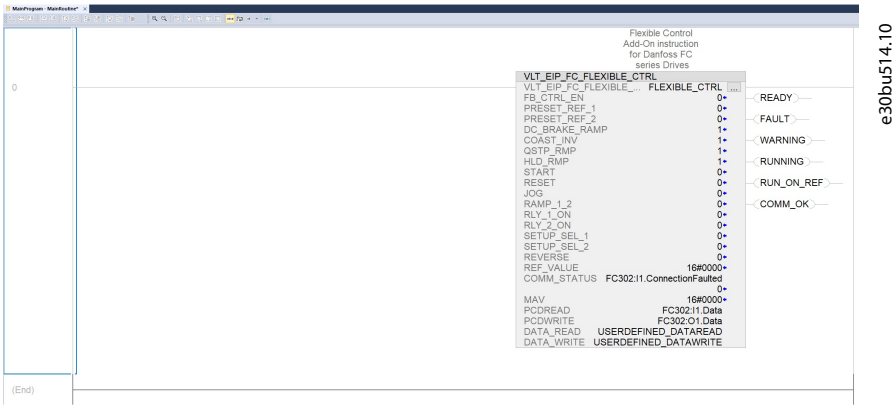


Illustration 31: Flexible Control Add-on Instruction

Procedure

1. Set the following parameter values in the drive using LCP.

Table 18: Parameter Settings

Parameter number	Parameter name	Modify value
12–21 [2]	Process Data Config Write	None
12–21 [3]	Process Data Config Write	*Parameter 4-12 Motor Speed Low Limit [Hz]*
12–21 [4]	Process Data Config Write	*Parameter 3-41 Ramp 1 Ramp Up Time*
12–21 [5]	Process Data Config Write	*Parameter 3-41 Ramp 1 Ramp Up Time*
12–21 [6]	Process Data Config Write	*Parameter 3-42 Ramp 1 Ramp Down Time*
12–21 [7]	Process Data Config Write	*Parameter 3-42 Ramp 1 Ramp Down Time*
12–21 [8]	Process Data Config Write	*Parameter 3-02 Minimum Reference*
12–21 [9]	Process Data Config Write	*Parameter 3-02 Minimum Reference*
12–22 [2]	Process Data Config Read	*Parameter 16-14 Motor Current*
12–22 [3]	Process Data Config Read	*Parameter 16-14 Motor Current*
12–22 [4]	Process Data Config Read	*Parameter 16-90 Alarm Word*
12–22 [5]	Process Data Config Read	*Parameter 16-90 Alarm Word*
12–22 [6]	Process Data Config Read	*Parameter 16-92 Warning Word*
12–22 [7]	Process Data Config Read	*Parameter 16-92 Warning Word*
12–22 [8]	Process Data Config Read	*Parameter 16-00 Control Word*
12–22 [9]	Process Data Config Read	*Parameter 0-15 Readout: actual setup*

2. Check whether the communication is OK.
   - **A** Verify whether the *READY* and *COMM_OK* output pins are set to *1*.

NOTICE

The default values of *DC_BRAKE_RAMP*, *COAST_INV*, *QSTP_RMP*, and *HLD_RMP* input pins are set to *1* for the flexible control add-on instruction.

   - **B** Switch off the drive.
   - **C** Verify the following output values.

Table 19: Pin Name and Expected Value

Pin name	Expected value
READY	0
FAULT	1
WARNING	0
RUNNING	0
RUN_ON_REF	0

Pin name	Expected value
COMM_OK	0
MAV	16#0000

D Switch on the drive.

E Wait until the I/O connection has been established.

F Verify the following output values.

Table 20: Pin Name and Expected Value

Pin name	Expected value
READY	1
FAULT	0
WARNING	0
RUNNING	0
RUN_ON_REF	0
COMM_OK	1
MAV	16#0000

G Set the value *1* to the *FB_CTRL_EN* input pin.

H Verify the following output values.

Table 21: Pin Name and Expected Value

Pin name	Expected value
READY	1
FAULT	0
WARNING	0
RUNNING	0
RUN_ON_REF	0
COMM_OK	1
MAV	16#0000

3. Start the motor in forward direction.

A Set the value *1* to the *COAST_INV* input pin.

B Verify the following output values.

Table 22: Pin Name and Expected Value

Pin name	Expected value
READY	1
FAULT	0
WARNING	0
RUNNING	0

Pin name	Expected value
RUN_ON_REF	0
COMM_OK	1
MAV	16#0000

C Set the value *1* to the *START* input pin.

D Set the value *16#3000* to the *REF_VALUE* input pin.

E Verify the following output values.

Table 23: Pin Name and Expected Value

Pin name	Expected value
READY	1
FAULT	0
WARNING	0
RUNNING	1
RUN_ON_REF	1
COMM_OK	1
MAV	16#3000

F Set the value *16#4000* to the *REF_VALUE* input pin.

G Verify the following output values.

Table 24: Pin Name and Expected Value

Pin name	Expected value
READY	1
FAULT	0
WARNING	0
RUNNING	1
RUN_ON_REF	1
COMM_OK	1
MAV	16#4000

4. Start the motor in reverse direction.

A Set the value *1* to the *REVERSE* input pin. Ensure that *parameter 4-10 Motor Speed Direction* is set to *[2] Both Directions*.

B Wait until the motor ramps down and running in the reverse direction.

C Verify the following output values.

Table 25: Pin Name and Expected Value

Pin name	Expected value
READY	1
FAULT	0

Pin name	Expected value
WARNING	0
RUNNING	1
RUN_ON_REF	1
COMM_OK	1
MAV	16#C000

D Set the value *0* to the *START* input pin.

E Set the value *0* to the *REVERSE* input pin.

F Verify the following output values.

Table 26: Pin Name and Expected Value

Pin name	Expected value
READY	1
FAULT	0
WARNING	0
RUNNING	0
RUN_ON_REF	0
COMM_OK	1
MAV	16#0000

G Set the value *1* to the *START* input pin.

H Set the value *16#C000* to the *REF_VALUE* input pin.

I Verify the following output values.

Table 27: Pin Name and Expected Value

Pin name	Expected value
READY	1
FAULT	0
WARNING	0
RUNNING	1
RUN_ON_REF	1
COMM_OK	1
MAV	16#C000

5. Read the process data.

A Set the value *1* to the *START* input pin.

B Set the value *16#2000* to the *REF_VALUE* input pin.

C Verify the *DATA_READ* inout parameter values for the drive using LCP.

Table 28: Parameter Settings

Parameter number	Parameter name	Parameter name in controller tags (monitor)	Values to be verified
12–22 [0]	Process Data Config Read	STW	Same as *parameter 16-03 Status Word*.
12–22 [1]	Process Data Config Read	MAV	Same as *parameter 16-82 Fieldbus REF 1*.
12–22 [2]	Process Data Config Read	PCD_02	Same as *parameter 16-14 Motor Current*.
12–22 [3]	Process Data Config Read	PCD_03	Same as *parameter 16-14 Motor Current*.
12–22 [4]	Process Data Config Read	PCD_04	Same as *parameter 16-90 Alarm Word*.
12–22 [5]	Process Data Config Read	PCD_05	Same as *parameter 16-90 Alarm Word*.
12–22 [6]	Process Data Config Read	PCD_06	Same as *parameter 16-92 Warning Word*.
12–22 [7]	Process Data Config Read	PCD_07	Same as *parameter 16-92 Warning Word*.
12–22 [8]	Process Data Config Read	PCD_08	Same as *parameter 16-00 Control Word*.
12–22 [9]	Process Data Config Read	PCD_09	Same as *parameter 0-15 Readout: actual setup*.

D Set the following values in the *DATA_WRITE* inout parameter values for the drive using LCP.

Table 29: Writing Values in DUT_1_DATA_WRITE Parameter for DUT_1_FLEXIBLE_CTRL

In/out parameter name in controller tags (monitor)	Values
PCD_02	0
PCD_03	20
PCD_04	800
PCD_05	0
PCD_06	800
PCD_07	0
PCD_08	10000
PCD_09	0

E Verify that the following values are updated in the drive parameters using LCP.

Table 30: Parameter Settings

Parameter number	Parameter name	Parameter name in controller tags (monitor)	Values to be verified
12–21 [0]	Process Data Config Write	CTW	Same as *parameter 16-80 Fieldbus CTW 1*.
12–21 [1]	Process Data Config Write	MAV	Same as *parameter 16-82 Fieldbus REF 1*.
12–21 [2]	Process Data Config Write	PCD_02	None.
12–21 [3]	Process Data Config Write	PCD_03	Same as *parameter 4-12 Motor Speed Low Limit [Hz]*.
12–21 [4]	Process Data Config Write	PCD_04	Same as *parameter 3-41 Ramp 1 Ramp Up Time*.
12–21 [5]	Process Data Config Write	PCD_05	Same as *parameter 3-41 Ramp 1 Ramp Up Time*.

Parameter number	Parameter name	Parameter name in controller tags (monitor)	Values to be verified
12–21 [6]	Process Data Config Write	PCD_06	Same as *parameter 3-42 Ramp 1 Ramp Down Time*.
12–21 [7]	Process Data Config Write	PCD_07	Same as *parameter 3-42 Ramp 1 Ramp Down Time*.
12–21 [8]	Process Data Config Write	PCD_08	Same as *parameter 3-02 Minimum Reference*.
12–21 [9]	Process Data Config Write	PCD_09	Same as *parameter 3-02 Minimum Reference*.

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