



Process Expert - General Purpose Library Classic

Process Control Services Reference Manual

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Safety Information

Important Information

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



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



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

DANGER

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

WARNING

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

CAUTION

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

NOTICE

NOTICE is used to address practices not related to physical injury.

Please Note

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

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

Qualification of Personnel

A qualified person is one who has the following qualifications:

- Skills and knowledge related to the construction and operation of electrical equipment and the installation.
- Knowledge and experience in industrial control programming.
- Received safety-related training to recognize and avoid the hazards involved.

The qualified person must be able to detect possible hazards that may arise from parameterization, modifying parameter values and generally from mechanical,

electrical, or electronic equipment. The qualified person must be familiar with the standards, provisions, and regulations for the prevention of industrial accidents, which they must observe when designing and implementing the system.

Proper Use

This product is a library to be used together with the automation control systems and is intended solely for the purposes described in the present documentation as applied in the industrial sector.

Always observe the applicable safety-related instructions, the specified conditions, and the technical data.

Perform a risk evaluation concerning the specific use before using the product. Take protective measures according to the result.

Since the product is used as a part of an overall system, you must ensure the safety of the personnel by means of the concept of this overall system (for example, machine concept).

Any other use is not intended and may be hazardous.

Before You Begin

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

WARNING

UNGUARDED EQUIPMENT

- Do not use this software and related automation equipment on equipment which does not have point-of-operation protection.
- Do not reach into machinery during operation.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

This automation equipment and related software is used to control a variety of industrial processes. The type or model of automation equipment suitable for each application will vary depending on factors such as the control function required, degree of protection required, production methods, unusual conditions, government regulations, etc. In some applications, more than one processor may be required, as when backup redundancy is needed.

Only you, the user, machine builder or system integrator can be aware of all the conditions and factors present during setup, operation, and maintenance of the machine and, therefore, can determine the automation equipment and the related safeties and interlocks which can be properly used. When selecting automation and control equipment and related software for a particular application, you should refer to the applicable local and national standards and regulations. The National Safety Council's Accident Prevention Manual (nationally recognized in the United States of America) also provides much useful information.

In some applications, such as packaging machinery, additional operator protection such as point-of-operation guarding must be provided. This is necessary if the operator's hands and other parts of the body are free to enter the pinch points or other hazardous areas and serious injury can occur. Software products alone cannot protect an operator from injury. For this reason the software cannot be substituted for or take the place of point-of-operation protection.

Ensure that appropriate safeties and mechanical/electrical interlocks related to point-of-operation protection have been installed and are operational before

placing the equipment into service. All interlocks and safeties related to point-of-operation protection must be coordinated with the related automation equipment and software programming.

NOTE: Coordination of safeties and mechanical/electrical interlocks for point-of-operation protection is outside the scope of the Function Block Library, System User Guide, or other implementation referenced in this documentation.

Start-up and Test

Before using electrical control and automation equipment for regular operation after installation, the system should be given a start-up test by qualified personnel to verify correct operation of the equipment. It is important that arrangements for such a check are made and that enough time is allowed to perform complete and satisfactory testing.

⚠ WARNING

EQUIPMENT OPERATION HAZARD

- Verify that all installation and set up procedures have been completed.
- Before operational tests are performed, remove all blocks or other temporary holding means used for shipment from all component devices.
- Remove tools, meters, and debris from equipment.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

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

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

Verify that the completed system is free from all short circuits and temporary grounds that are not installed according to local regulations (according to the National Electrical Code in the U.S.A, for instance). If high-potential voltage testing is necessary, follow recommendations in equipment documentation to prevent accidental equipment damage.

Before energizing equipment:

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

Operation and Adjustments

The following precautions are from the NEMA Standards Publication ICS 7.1-1995:

(In case of divergence or contradiction between any translation and the English original, the original text in the English language will prevail.)

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

- It is sometimes possible to misadjust the equipment and thus produce unsatisfactory or unsafe operation. Always use the manufacturer's instructions as a guide for functional adjustments. Personnel who have access to these adjustments should be familiar with the equipment manufacturer's instructions and the machinery used with the electrical equipment.
- Only those operational adjustments required by the operator should be accessible to the operator. Access to other controls should be restricted to prevent unauthorized changes in operating characteristics.

About the Book

Document Scope

This document describes the function blocks (DFBs) and variables that are encapsulated in the Control facets referenced by the process control module templates to provide Control services.

For a list of templates and the services that they provide, refer to the user guides mentioned in this document.

This document does not cover any development procedures and internal functionality details of EcoStruxure Process Expert.

This document is for users with knowledge of EcoStruxure Process Expert, and of the Supervision and Control Participants.

Validity Note

This document has been updated for the release of EcoStruxure™ Process Expert 2023.

Related Documents

The characteristics that are described in the present document, as well as those described in the documents included in the Related Documents section below, can be found online. To access the information online, go to the Schneider Electric home page www.se.com/ww/en/download/.

The characteristics that are described in the present document should be the same as those characteristics that appear online. In line with our policy of constant improvement, we may revise content over time to improve clarity and accuracy. If you see a difference between the document and online information, use the online information as your reference.

Title of Documentation	Reference Number
EcoStruxure™ Process Expert - General Purpose Library Classic Process Templates Reference Manual	EIO0000000987
EcoStruxure™ Process Expert - General Purpose Library Classic Process Supervision Services Reference Manual	EIO0000000989
EcoStruxure Process Expert User Guide	EIO0000001114

Technical Support

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Product Related Information

⚠ WARNING

LOSS OF CONTROL

- Perform a Failure Mode and Effects Analysis (FMEA), or equivalent risk analysis, of your application, and apply preventive and detective controls before implementation.
- Provide a fallback state for undesired control events or sequences.
- Provide separate or redundant control paths wherever required.
- Supply appropriate parameters, particularly for limits.
- Review the implications of transmission delays and take actions to mitigate them.
- Review the implications of communication link interruptions and take actions to mitigate them.
- Provide independent paths for control functions (for example, emergency stop, over-limit conditions, and error conditions) according to your risk assessment, and applicable codes and regulations.
- Apply local accident prevention and safety regulations and guidelines.¹
- Test each implementation of a system for proper operation before placing it into service.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

¹ For additional information, refer to NEMA ICS 1.1 (latest edition), *Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control* and to NEMA ICS 7.1 (latest edition), *Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems* or their equivalent governing your particular location.

Examples described in this manual are provided for information only.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Adapt examples that are given in this manual to the specific functions and requirements of your industrial application before you implement them.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Terminology Derived from Standards

The technical terms, terminology, symbols and the corresponding descriptions in this manual, or that appear in or on the products themselves, are generally derived from the terms or definitions of international standards.

In the area of functional safety systems, drives and general automation, this may include, but is not limited to, terms such as safety, safety function, safe state, fault, fault reset, malfunction, failure, error, error message, dangerous, etc.

Among others, these standards include:

Standard	Description
IEC 61131-2:2007	Programmable controllers, part 2: Equipment requirements and tests.
ISO 13849-1:2015	Safety of machinery: Safety related parts of control systems. General principles for design.
EN 61496-1:2013	Safety of machinery: Electro-sensitive protective equipment.

Standard	Description
	Part 1: General requirements and tests.
ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction.
EN 60204-1:2006	Safety of machinery - Electrical equipment of machines - Part 1: General requirements.
ISO 14119:2013	Safety of machinery - Interlocking devices associated with guards - Principles for design and selection.
ISO 13850:2015	Safety of machinery - Emergency stop - Principles for design.
IEC 62061:2015	Safety of machinery - Functional safety of safety-related electrical, electronic, and electronic programmable control systems.
IEC 61508-1:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: General requirements.
IEC 61508-2:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: Requirements for electrical/electronic/programmable electronic safety-related systems.
IEC 61508-3:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: Software requirements.
IEC 61784-3:2016	Industrial communication networks - Profiles - Part 3: Functional safety fieldbuses - General rules and profile definitions.
2006/42/EC	Machinery Directive
2014/30/EU	Electromagnetic Compatibility Directive
2014/35/EU	Low Voltage Directive

In addition, terms used in the present document may tangentially be used as they are derived from other standards such as:

Standard	Description
IEC 60034 series	Rotating electrical machines
IEC 61800 series	Adjustable speed electrical power drive systems
IEC 61158 series	Digital data communications for measurement and control – Fieldbus for use in industrial control systems

Finally, the term zone of operation may be used in conjunction with the description of specific hazards, and is defined as it is for a hazard zone or danger zone in the Machinery Directive (2006/42/EC) and ISO 12100:2010.

NOTE: The aforementioned standards may or may not apply to the specific products cited in the present documentation. For more information concerning the individual standards applicable to the products described herein, see the characteristics tables for those product references.

Overview

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Overview

The EcoStruxure Process Expert software provides the resources that have been pre-configured and tested by Schneider Electric and that were specifically designed for automating a large variety of processes.

The control resources for process control provide the common required functions, facilitating the development of control systems.

To automate and simplify the implementation process of control systems, you can use these resources together with tools for code generation and for the synchronization of control and monitoring subsystems.

This document describes the basic concepts and details behind each one of the function blocks (DFBs) for implementing the common cross-process and cross-market EcoStruxure Control functions.

Process Templates

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Overview

This chapter describes how the Control services of the process control module templates are made available to you through EcoStruxure Process Expert and the embedded Control Participant.

Delivering Control Services

Introduction

Inside process control module templates, the resources providing Control services are organized in composite and facet templates. They are *elements* of the control module template and its instances.

Interfaces link these elements within the control module and allow making links to instances of other templates.

Control Facet Templates

The facet template is the smallest component of a process template.

It encapsulates the constituents of the Control Participant, which are the function blocks and variables described in this document.

During generation (see EcoStruxure™ Process Expert, User Guide), these constituents create the logic of the Control (see EcoStruxure™ Process Expert, User Guide) Participant project that you have created in EcoStruxure Process Expert.

Control Composite Templates

The Control composite template is a container for Control elements and/or other composite references.

They help organizing Control services inside the control module template.

Configuring Control Services

Typically, process control module templates contain core and optional services.

To customize the services provided by an instance that uses the control module template, the **Properties** window of the instance allows you to:

- Activate/deactivate optional resources.
- Configure the parameters of core resources and selected optional resources.

In addition, you can modify the logic of the Control Participant project during refinement.

List of Function Blocks

List of Families

The function blocks described in this document are grouped by family.

The families are the same as the ones used to group the process control module templates (see EcoStruxure™ Process Expert - General Purpose Library Classic Process Templates Reference Manual).

Each DFB is assigned to the same family as the control module template that references it.

For example, the \$Motor control module template belongs to the on/off device control family. It references the DEVCTL, DEVL, and DEVMNT DFBs. Therefore, these 3 DFBs are also part of the on/off device control family.

Description

The table lists the function blocks of each family:

Family Name	Function Blocks	Description
Signal processing	ACALC, page 28	Analog calculations
	AALARM, page 32	Analog alarm
	AINPUT, page 36	Analog input conditioning
	AINPUT1, page 40	Configurable-range analog input conditioning
	ALINEAR, page 45	Linearization
	AOUTPUT, page 47	Analog output conditioning
	AOUTPUTLP, page 52	Local panel for controlling analog outputs
	DCALC, page 59	Digital calculations
	DINPUT, page 62	Digital input conditioning
	DOUTPUT, page 66	Digital output conditioning
	MAINPUT1, page 70	Multiple analog inputs with configurable range
	TOTAL, page 77	Totalizer
On/Off device control	DEVCTL, page 88	On-off device
	DEVL, page 97	Local panel for controlling on-off devices
	DEVMNT, page 104	On-off device maintenance
	DUALOP, page 107	Dual output
	HVALVE, page 111	Hand valve
	MOTOR2, page 115	2-speed/2-rotation direction motor
	MOTOR2LP, page 127	Local panel for controlling 2-speed/2-rotation direction motor
	MVALVED, page 134	Motorized valve without positioner
	MVALVEDLP, page 140	Local panel for controlling motorized on-off valves
Analog device control	CVALVE, page 148	Control valve
	CVALVELP, page 155	Local panel for controlling control valves
	MVALVE, page 162	Motorized valve with positioner
	MVALVELP, page 169	Local panel for controlling motorized valves
	SDDEVCTL, page 177	Motor with variable speed drive
	SDDEVL, page 188	Local panel for controlling devices with variable-speed drive

Family Name	Function Blocks	Description
Process control	ARAMP, page 198	Ramp
	IMCTL, page 203	Internal model controller
	LDLGCTL, page 210	Lead-Lag controller
	PIDCTL, page 215	PID controller
	PIDMUX, page 221	Multiplexer for 2 groups of PIDCTL parameters
	PWMCTL, page 225	Pulse width modulated controller
	RATIOCTL, page 230	Ratio controller
	SPLRGCTL, page 234	Split-range controller
	STEP3CTL, page 239	3-Step controller/positioner
Sequential control	SEQCTL1, page 252	Advanced sequential control
	SEQPARxx, page 266	Sequential parameter management
Batch Phase Manager	IBPHASE, page 284	Individual Batch Phase Manager
	IBPARXX, page 299	Batch Phase Parameter Management
Auxiliary functions	ASELECT, page 313	Analog signal selector
	ASELECT1, page 315	Analog signal selector with monitoring variables
	CONDSUM, page 320	Summary of conditions
	CONDSUM1, page 324	Interlock condition summary
	MSGBOX, page 329	Messages to the operator

General Function Block Concepts

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Overview

This chapter describes the basic concepts that the process control resources implement.

Modularity

Overview

The function blocks are designed in such a way that the functions they implement are cumulative.

This way, you can incorporate the functions required for each specific case into the system.

Example

An example featuring three function blocks connected to each other to provide the necessary functions to set up an on-off motor with interlocking and maintenance. A `DEVCTL` block (core service) provides on-off motor functionalities. Additionally, you can integrate `CONDSUM` block (optional service) to achieve interlock functionalities and `DEVMNT` block (optional service) to provide maintenance functionalities (number of switch operations and hours of operation).

Function Block Interface

Overview

The function blocks for Process provide an interface that allows them to be configured, monitored, and controlled both from the monitoring subsystem and the control subsystem (continuous and/or sequential control).

The following interfaces are provided:

- Basic Configuration
- Continuous Control
- Sequential Control
- States and Monitoring

Basic Configuration

DFB input pins are usually connected to static data and recognized in engineering time (for example, input channel range or limit switch enabling on an on-off device).

Continuous Control

DFB input and output pins:

- allow receiving commands from other blocks.
- provide block status to other blocks to enable implementing switching operations (for example, remote set-point -RSP-), detected alarms (for example, high-level alarm -HIHI-), interlocking (for example, activation of interlocking ILCK, or interlocking set-point -ILCKSP-), and so on.

Sequential Control

SC public and structured variable publishes the block status and allows its control from the control sequences (commands not kept).

States and Monitoring

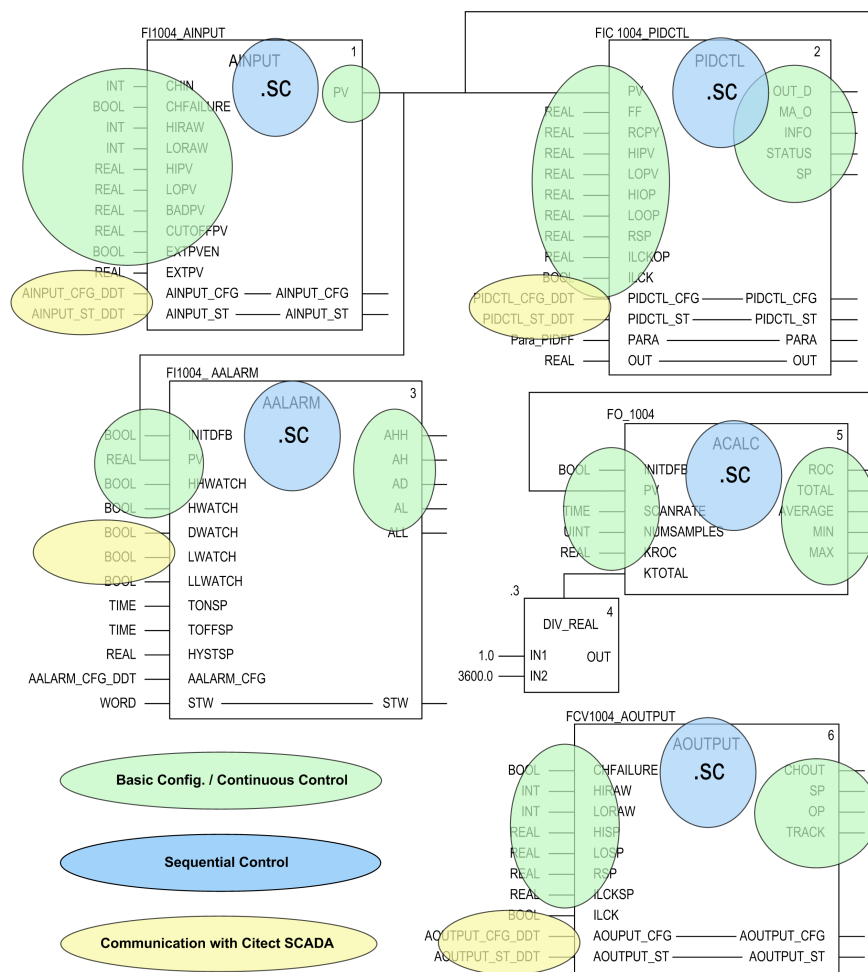
Depending on their types, the blocks feature up to 2 input/output pins that need to be connected to variables used to maintain the pin states of the blocks. In addition, these variables allow the commands and parameters received from the monitoring subsystem to be managed.

The frequently considered variables are:

- State (identified with the _ST suffix): These variables hold the state and control characteristics used from the first monitoring subsystem level (dynamic symbols in the flowcharts).
- Configuration (identified with the _CFG suffix): These variables hold second-level information for the parameter configuration of the block. This information is accessible from the monitoring subsystem faceplates.

Illustration

The following figure illustrates the previous provided interface.

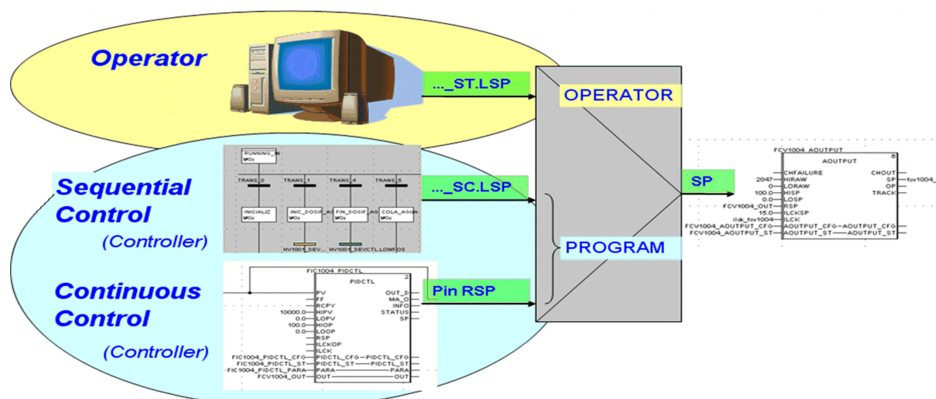


Set-Point Management

Overview

The blocks for device control manage the set-points coming from the following sources according to the owner:

- Operator
- Program



To avoid unwanted transitions in the set-point, continuously set the local set-points (Operator or Program) to match the selected set-point.

In principle, the owner (Operator or Program) of the function block is not modified from the control subsystem (through the program in the Controller) because the control subsystem is mechanism that stops the Program from affecting the block. This is to confirm that the commands send towards the block are those generated from the monitoring subsystem.

Operator

Operator/Local set-point commands received from the monitoring subsystem (Supervision). These commands arrive at the function blocks.

Program

Commands generated from the control program (Control).

Two different possible sources within the Program are as follows:

- Continuous Control (usually identified as a Program/Remote or Program/Cascade set-point): The set-points generated from the Continuous Control strategies report to the function blocks through a specific pin which is usually identified as Remote Set-Point (*RSP*). These commands are given by level.
- Sequential Control (Local Set-Point): The set-points generated from the control sequences (for example, for starting a continuous process section or a batch process stage) send the commands to the function blocks through the public data structure of the block (*SC* – Sequential Control – variable).

Simulation and Interlocking

Simulation

Function blocks connected to physical inputs (digital or analog) feature a simulation mode that enables you to enter the value that needs to be considered as an input through the Supervision system during operation.

This simulates the position of the associated device (*DEVCTL* and *SDDEVCTL* blocks) as the position defined by the setpoint or interlock, regardless of the actual state of the physical inputs.

You can use this operating mode:

- In case an input loop is not working properly.
- To perform programming tests when the signals and instruments associated with the function block are not available.

Interlocking

You can interlock function blocks that are connected to physical outputs (digital or analog) at a determined configurable position.

Signal Processing

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Overview

This part provides a detailed description of the functions, pins, pin layout, and variables of the function blocks of the signal processing family.

These function blocks do not reflect any specific installation.

WARNING

LOSS OF CONTROL

- Perform a Failure Mode and Effects Analysis (FMEA), or equivalent risk analysis, of your application, and apply preventive and detective controls before implementation.
- Provide a fallback state for undesired control events or sequences.
- Provide separate or redundant control paths wherever required.
- Supply appropriate parameters, particularly for limits.
- Review the implications of transmission delays and take actions to mitigate them.
- Review the implications of communication link interruptions and take actions to mitigate them.
- Provide independent paths for control functions (for example, emergency stop, over-limit conditions, and error conditions) according to your risk assessment, and applicable codes and regulations.
- Apply local accident prevention and safety regulations and guidelines.¹
- Test each implementation of a system for proper operation before placing it into service.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

¹ For additional information, refer to NEMA ICS 1.1 (latest edition), *Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control* and to NEMA ICS 7.1 (latest edition), *Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems* or their equivalent governing your particular location.

ACALC - Analog Calculation

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Overview

This chapter describes the ACALC DFB.

Description

General

The ACALC DFB is used to perform calculations based on an analog signal.

The DFB can perform the following calculations:

- Derivative Rate of Change (ROC)
- Totalizing (integral with the trapezoidal rule)
- Average
- Minimum
- Maximum

The DFB memorizes up to a maximum of 20 samples of the measurement (Present Value PV), and calculations are performed based on them.

This DFB can supplement the General Purpose Library AINPUT DFB providing calculations based on previously scaled analog inputs.

In turn, the DFB can provide calculated data to AINPUT DFBs (configured with an external PV input) to provide the standard interface to the monitoring subsystem so that these calculations can be represented in the user interface or detected alarms can be applied through AALARM-type DFBs.

Function Description

The main functions of the DFB are described in the following table:

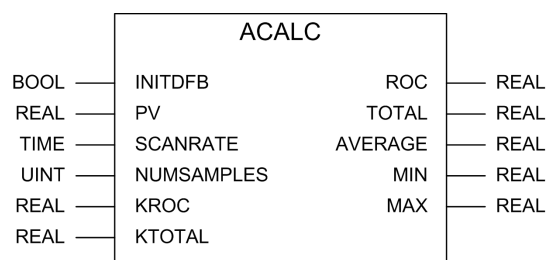
Function	Description
Derivative	The slope of the measurement development is calculated with linear regression.
Totalizing	The totalization (for example, for flows) is calculated with the trapezoidal rule algorithm.
Average	Calculates the average of the values memorized in the DFB.
Maximum	Calculates the maximum value of the measurement among those stored in the DFB.
Minimum	Calculates the minimum value of the measurement among those stored in the DFB. The DFB allows alarm monitoring to be enabled/disabled individually.

NOTE: The function block uses the Freerun function for time calculations. Therefore, the ACALC DFB is only available if the controller CPU supports this function.

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
INITDFB	BOOL	0 = Indicates rising edge on this input is detected, the DFB internal timers are reset and the first sample (time and value) is stored in the memory. NOTE: The input is not reset (0) by the DFB.
PV	REAL	Calculated value of the measurement in engineering units.
SCANRATE	TIME	Allows you to configure the sample acquisition time. The DFB takes a sample each time a time equal to or greater than the one configured for this input has elapsed. For calculation purposes, the time elapsed between one DFB execution and another is taken into account. NOTE: You need to verify that the DFB execution parameters are compatible with the time configured in the <code>SCANRATE</code> parameter; this allows the DFB to run with a high enough frequency to carry out sampling with the configured time including latency times. In any case, the DFB considers any possible execution delays regarding the theoretical time adjusted in this parameter when it comes to the calculations.
NUMSAMPLES	UINT	Maximum number of samples that need to be stored and that are used in the calculations. Configuration range: From 2 to 20 Default value: 20 NOTE: During the first runs of the DFB, a smaller number of samples than those configured may be used.
KROC	REAL	Conversion factor applied to the derivative calculation <code>ROC</code> output pin, page 30. Allows the derivative to be calculated in the desired engineering units. If this signal is 0, the DFB applies a default factor of 1.0.
KTOTAL	REAL	Conversion factor applied to the totalizing calculation <code>TOTAL</code> output pin, page 30. Allows the totalization to be calculated in the desired engineering units. If this signal is 0, the DFB applies a default factor of 1.0.

Outputs

Output Parameter Description

Parameter	Type	Description
ROC	REAL	The derivative is calculated (in engineering units/sec for a KROC of 1.0) through linear regression. Calculation is based on the formula provided in this topic.
TOTAL	REAL	Totalization is calculated with a trapezoidal sum between the current and the previous sample (Therefore, it is only calculated starting with the second sample and is 0 in the meantime) Calculation is based on the formula provided in this topic.
AVERAGE	REAL	Calculates the average value of the stored samples. It is calculated as the measurement is present at the PV input during the first run.
MIN	REAL	Calculates the minimum value among the stored samples. It is calculated as the measurement is present at the PV input during the first run.
MAX	REAL	Calculates the maximum value among the stored samples. It is calculated as the measurement is present at the PV input during the first run.

Calculation formula for the derivative:

$$KROC \times \left(\frac{n \sum (t \times PV) - \sum t \times \sum PV}{n \sum t^2 - (\sum t)^2} \right)$$

Where:

KROC	Conversion factor applied to the derivative calculation. Refer to the KTOTAL input, page 29.
n	Number of samples (up to 20 after the whole internal sample table is loaded).
t	Relative time elapsed from the first sample to the sample used in the calculation (corresponding PV value).
PV	Sample value.

Calculation formula for the totalization:

$$KTOTAL \times (t_1 - t_0) \times \left(\frac{PV_1 + PV_0}{2} \right)$$

Where:

KTOTAL	Refer to the KROC input, page 29.
t ₁	Time in which the current sample is taken.
t ₀	Time in which the previous sample was taken.
PV ₁	Value of the current measurement.
PV ₀	Value of the previous measurement.

The calculation is carried out with a value relative to 0, that is, values under 0 will be deducted from the cumulative calculation. The calculation is only performed if it is enabled and resetting is available (refer to the SC public variable, page 31).

Public Variables

Public Variable Description

Variable	Type	Description
SC	ACALC_SC_DDT	Provides the data frequently needed data to monitor the status of the alarms from the sequential control.

ACALC_SC_DDT Type

Name	Type	Description
PV	REAL	Read-only access. Refer to the PV input pin, page 29.
ROC	REAL	Read-only access, page 30.
TOTAL	REAL	Read-only access, page 30.
AVERAGE	REAL	Read-only access, page 30.
MIN	REAL	Read-only access, page 30.
MAX	REAL	Read-only access, page 30.
TOTALEN	BOOL	Read/write access. 1 = Enables the totalizing calculation 0 = Disables the totalizing calculation. Does not set the totalizer to 0.
TOTALRST	BOOL	Read/write access. 1 = Resets the totalized value (TOTAL output pin). 0 = The signal is processed.

AALARM - Analog Alarm

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Overview

This chapter describes the AALARM DFB.

Description

General

The AALARM DFB is used to evaluate detected timed alarms associated with an analog signal.

The DFB provides detected alarm functions by level (very high, high, low and/or very low) and by deviation in relation to a set-point value.

This evaluation can be activated/deactivated individually according to the specific needs of the process both from the continuous and sequential control strategies implemented in the controller as well as from the monitoring system.

Function Description

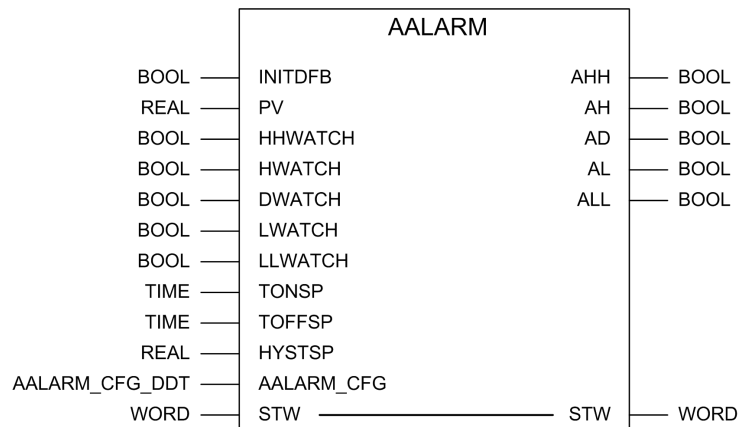
The main functions of the DFB are described in the following table:

Function	Description
Level alarm	Evaluates detected timed alarms by level. The detected alarm connection can be timed. Timing and/or hysteresis can be applied to the disconnection.
Deviation alarm	Evaluates the detected alarm for maximum deviation in relation to a set-point.
Enabling	The DFB allows detected alarm monitoring to be enabled/disabled individually.

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
INITDFB	BOOL	1 = Indicates rising edge is detected on this input, the DFB internal timers are reset and detected alarms are set to 0.
PV	REAL	Value of the measurement with which the detected alarms are evaluated.
HHWATCH	BOOL	1 = Allows very-high-level alarm monitoring to be enabled or disabled depending on the dynamic conditions of the process.
HWATCH	BOOL	1 = Allows high-level alarm monitoring to be enabled or disabled depending on the dynamic conditions of the process.
DWATCH	BOOL	1 = Allows dynamic alarm monitoring to be enabled (1) or disabled (0) depending on the dynamic conditions of the process.
LOWATCH	BOOL	1 = Allows low-level alarm monitoring to be enabled (1) or disabled (0) depending on the dynamic conditions of the process.
LLWATCH	BOOL	1 = Allows very-low-level alarm monitoring to be enabled (1) or disabled (0) depending on the dynamic conditions of the process.
TONSP	TIME	Timing set-point for connecting the detected alarms.
TOFFSP	TIME	Timing set-point for disconnecting the detected alarms.
HYSTSP	REAL	Hysteresis set-point for disconnecting the detected alarms (in engineering units).
AALARM_CFG	AALARM_CFG_DDT	Configuration data necessary for evaluating the detected alarms. This data can be defined from the monitoring subsystem or from the control program.

AALARM_CFG Type

Name	Type	Description
SPHH	REAL	Very-high-level set-point in engineering units (those associated with the corresponding PV)).
SPH	REAL	High-level set-point in engineering units (those associated with the corresponding PV)).

Name	Type	Description
SP	REAL	set-point level used as a reference for deviation alarm evaluation in engineering units (those associated with the corresponding PV)).
SPD	REAL	Set-point for the maximum deviation allowed in the measurement in relation to the set-point configured in <code>AALARM_CFG.SP</code> in engineering units (those associated with the corresponding PV).
SPL	REAL	Low-level set-point in engineering units (those associated with the corresponding PV)).
SPLL	REAL	Very-low-level set-point in engineering units (those associated with the corresponding PV)).
CFGW	WORD	DFB configuration word. Detected alarms configuration.
		Bit 0 ENHH Enables very-high-level alarm evaluation.
		Bit 1 ENH Enables high-level alarm evaluation.
		Bit 2 END Enables deviation alarm evaluation.
		Bit 3 ENL Enables low-level alarm evaluation.
		Bit 4 ENLL Enables very-low-level alarm evaluation.

Outputs

Output Parameter Description

Parameter	Type	Description
AHH	BOOL	1 = Very-high-level alarm activated.
AH	BOOL	1 = High-level alarm activated.
AD	BOOL	1 = Deviation alarm activated).
AL	BOOL	1 = Low-level alarm activated.
ALL	BOOL	1 = Very-low-level alarm activated.

NOTE: Each detected alarm is timed independently according to the configuration of the `TONSP` (for detected alarm activation) and `TOFFSP` (for detected alarm deactivation) inputs. For disconnection purposes, the configured hysteresis is also considered.

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
STW	WORD	Provides the data necessary to monitor the detected alarms status.

STW Word Structure

This pin `STW` is connected to the `STW` field of the `AINPUT_ST` data structure of the related analog variable in the event that the latter has been processed through an `AINPUT`-type DFB. This way, information generated from the `AALARM` DFB is added to the information that the `AINPUT` DFB has generated in its status word. As a result, the diagnosis status (generated from the `AINPUT` DFB) and you can

include detected alarms status (generated from the AALARM DFB) in the same word.

Bit	Name	Description
3	HHWATCH	Indicates if the very-high-level alarm is being monitored. Reproduces the value of the HHWATCH input pin.
4	HWATCH	Indicates if the high-level alarm is being monitored. Reproduces the value of the HWATCH input pin.
5	DWATCH	Indicates if the deviation alarm is being monitored. Reproduces the value of the DWATCH input pin.
6	LWATCH	Indicates if the low-level alarm is being monitored. Reproduces the value of the LWATCH input pin.
7	LLWATCH	Indicates if the very-low-level alarm is being monitored. Reproduces the value of the LLWATCH input pin.
8	AHH	Read-only access. Refer to the AHH output pin, page 34.
9	AH	Read-only access. Refer to the AH output pin, page 34.
10	AD	Read-only access. Refer to the AD output pin, page 34.
11	AL	Read-only access. Refer to the AL output pin, page 34.
12	ALL	Read-only access. Refer to the ALL output pin, page 34.

Public Variables

Public Variable Description

Variable	Type	Description
SC	AALARM_SC_DDT	Provides the frequently needed data to monitor the status of the detected alarms from the sequential control.

AALARM_SC_DDT Type

Name	Type	Description
AHH	BOOL	Read-only access Refer to the AHH output pin, page 34.
AH	BOOL	Read-only access Refer to the AH output pin, page 34.
AD	BOOL	Read-only access Refer to the AD output pin, page 34.
AL	BOOL	Read-only access Refer to the AL output pin, page 34.
ALL	BOOL	Read-only access Refer to the ALL output pin, page 34.

AINPUT - Analog Input Conditioning

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Overview

This chapter describes the `AINPUT` DFB.

Description

General

The `AINPUT` DFB is used for conditioning an analog signal that usually comes from a physical input.

The DFB provides linear scaling, cut-off, diagnosis, and simulation functions.

User can supplement `AINPUT` with two other DFBs of the General Purpose library:

- **AALARM**: Allows you to incorporate functions to evaluate the alarms associated with the measurement.
- **ACALC**: Allows you to incorporate calculations on the analog input.

Function Description

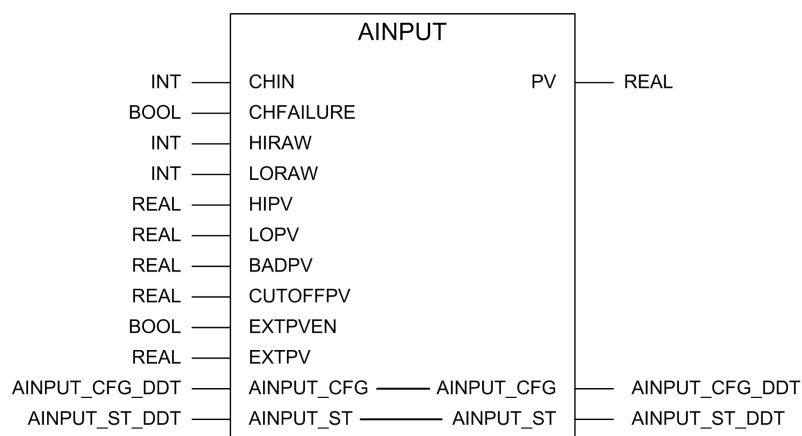
The main functions of the DFB are described in the table:

Function	Description
Scaling	The DFB scales the input signal (usually in raw data) to engineering units through a linear function.
Cut-Off	You can configure a minimum value, which is called the cut-off value. If the measured value received from the transmitter is below the cut-off value, the measured value is non-useable. In such case, the cut-off value is being considered.
Diagnosis	The DFB manages the diagnostic status of the signal if the peripherals used provide the signal, and assigns the value that is to be used if the signal is not working properly.
Simulation	You can configure the DFB to allow you to enter the value that needs to be used (in engineering units). This option enables you to conduct tests on the programming associated with the DFB from the Supervision system.
External PV	The DFB enables you to connect a signal that is already in engineering units (and therefore does not need scaling, diagnosis, or cut-off operations) while maintaining the simulation function.

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
CHIN	INT	Input signal. Corresponds to a value in raw data coming from the input/output peripherals.
CHFAILURE	BOOL	1 = Indicates to the DFB that the input channel associated with the CHIN input is operational.
HIRAW	INT	High range of the CHIN input signal.
LORAW	INT	Low range of the CHIN input signal.
HIPV	REAL	High range of the measurement in engineering units (PV output) corresponds to the maximum value (configured in the HIRAW input) of the CHIN input.
LOPV	REAL	Low range of the measurement in engineering units (PV output) corresponds to the minimum value (configured in the LORAW input) of the CHIN input.
BADPV	REAL	Default value in engineering units (PV output signal) when the channel is not operational.
CUTOFFPV	REAL	Value (in engineering units) resulting from the scaling calculation, and below which the value entered into the LOPV input needs to be considered as the measurement value (PV output).
EXTPVEN	BOOL	1 = Enables you to configure the DFB to accept an analog input in engineering units (EXTPV). 0 = Enables you to use the input in raw data (CHIN).
EXTPV	REAL	Input signal in engineering units (refer to the EXTPVEN input pin).

Outputs

Output Parameter Description

Parameter	Type	Description
PV	REAL	Calculated measurement value usually in engineering units.

The table describes how the DFB calculates the measurement value *PV* based on the value of the inputs and the `AINPUT_ST` input/output:

EXTPVEN	AINPUT_ST.CFGW. SIMMD	CHFAILURE	CHIN	PV is calculated as:
-	ON	-	-	AINPUT_CFG.SIM
ON	OFF	-	-	EXTPV
OFF	OFF	ON	-	BADPV
OFF	OFF	OFF	<= LORAW	LOPV
OFF	OFF	OFF	>LORAW and =<HIRAW	Refer to the linear scaling formula.
OFF	OFF	OFF	>=HIRAW	HIPV

Linear scaling formula:

$$\left(\frac{HIPV - LOPV}{HIRAW - LORAW} \times CHIN \right) + LOPV - \left(\frac{HIPV - LOPV}{HIRAW - LORAW} \times LORAW \right)$$

If the resulting value of the calculation is less than cut-off (and the signal comes from the `CHIN` input), the `PV` output is matched to the `LOPV` input.

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
AINPUT_ST	AINPUT_ST_DDT	Provides the necessary data for monitoring the state of the input analog signal and configuring its simulation when required.
AINPUT_CFG	AINPUT_CFG_DDT	Provides the data necessary to configure the DFB usually from the monitoring subsystem.

AINPUT_ST_DDT Type

Name	Type	Description
STW	WORD	Read-only access
		Bit 0 BADST Indicates whether the input channel is operational. Reproduces the value of the <code>CHFAILURE</code> input if the <code>CHIN</code> input signal (<code>EXTPVEN</code> = 0) is used.
CFGW	WORD	DFB configuration word

Name	Type	Description		
		Bit 0	SIMMD	Read/write access Enables you to put the analog input in simulation (1) mode or normal (0) mode.
PV	REAL	Read-only access		

AINPUT_CFG_DDT Type

Name	Type	Description
SIM	REAL	Read/write access Simulated value of the measurement in engineering units. Default value: 0 NOTE: In case of a physical input (EXTPVEN = 0), the value that you enter in the <code>AINPUT_CFG.SIM</code> input/output needs to be within the range delimited by <code>LOPV</code> and <code>HIPV</code> . If you enter a value outside of this range, the DFB uses the current value of the <code>AINPUT_CFG.SIM</code> input/output instead.

Public Variables

Public Variable Description

Variable	Type	Description
SC	AINPUT_SC_DDT	Provides the frequently needed data to monitor the analog input status from the sequential control.

AINPUT_SC_DDT Type

Name	Type	Description
BADST	BOOL	Read-only access Refer to the <code>AINPUT.STW.BADST</code> input/output pin, page 38.
PV	REAL	Read-only access Refer to the <code>PV</code> output pin, page 38.

AINPUT1 - Configurable Range Analog Input Conditioning

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Overview

This chapter describes the `AINPUT1` DFB.

Description

General

The *AINPUT1* DFB is used to condition an analog signal usually coming from a physical input. In contrast to the *AINPUT*, the *AINPUT1* DFB allows you to configure the corresponding range from the Supervision system.

The DFB provides linear scaling, cut-off, diagnosis, and simulation functions.

You can supplement *AINPUT1* with two other DFBs of the General Purpose library:

- *AALARM*: Allows you to incorporate functions to evaluate the alarms associated with the measurement.
- *ACALC*: Allows you to incorporate calculations on the analog input.

Function Description

The main functions of the DFB are described in the table:

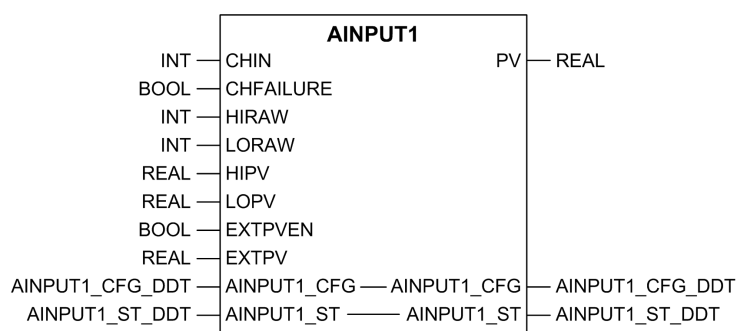
Function	Description
Scaling	<p>The DFB scales the input signal (usually in raw data) to engineering units by using a linear function.</p> <p>You can configure the signal range externally (usually through the Supervision system) within the range that is configured in the program, which is running in the controller. Enter values in engineering units.</p>
Cut-Off	<p>You can configure a minimum value, which is called the cut-off value. If the measured value received from the transmitter is below the cut-off value, the measured value is non-useable. In such case, the cut-off value is being considered.</p> <p>You can configure the cut-off value externally; usually through the Supervision system. Enter a value in engineering units within the range that is configured in the program, which is running in the controller</p>
Diagnosis	<p>The DFB manages the diagnostic status of the signal if the peripherals used provide this signal and assigns the value that is to be used if the signal is not working properly.</p> <p>You can externally configure the value (usually through the Supervision system) that is to be used if the signal is not working properly. Enter a value in engineering units within the range that is configured in the program, which is running in the controller.</p>

Function	Description
Simulation	<p>You can configure the DFB to allow you to enter the value that needs to be used (in engineering units).</p> <p>This option enables you to conduct tests on the programming associated with the DFB from the Supervision system.</p>
External PV	The DFB allows you to connect a signal that is already in engineering units (and therefore does not need scaling, diagnosis, or cut-off operations) while maintaining the simulation function.

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
CHIN	INT	Input signal. Corresponds to a value in raw data coming from the input/output peripherals.
CHFAILURE	BOOL	1 = Indicates to the DFB that the input channel associated with the CHIN input is operational.
HIRAW	INT	High range of the CHIN input signal.
LORAW	INT	Low range of the CHIN input signal.
HIPV	REAL	<p>Maximum permissible value of the high range measurement in engineering units (PV output) corresponding to the maximum value (configured in the HIRAW input) of the CHIN input.</p> <p>Used as the high range by default if the high range is not modified from the monitoring subsystem (AINPUT1_CFG.CHIPV).</p>
LOPV	REAL	<p>Minimum permissible value of the low range measurement in engineering units (PV output) corresponding to the minimum value (configured in the LORAW input) of the CHIN input.</p> <p>Used as the low range by default if the high range is not modified from the monitoring subsystem (AINPUT1_CFG.CLOPV).</p>

Parameter	Type	Description
EXTPVEN	BOOL	1 = Enables you to configure the DFB to accept an analog input in engineering units (EXTPV). 0 = Enables you to configure the DFB to use the input in raw data (CHIN).
EXTPV	REAL	Input signal in engineering units (refer to the EXTPVEN input pin).

Outputs

Output Parameter Description

Parameter	Type	Description
PV	REAL	Calculated measurement value usually in engineering units.

The table describes how the DFB calculates the measurement value *PV* based on the value of the inputs and the AINPUT1_ST input/output:

EXTPVEN	AINPUT1_ST. CFGW. SIMMD	CHFAILURE	CHIN	PV is calculated as:
-	ON	-	-	AINPUT1_CFG.SIM
ON	OFF	-	-	EXTPV
OFF	OFF	ON	-	AINPUT1_CFG.BADPV
OFF	OFF	OFF	<= LORAW	AINPUT1_CFG.CLOPV
OFF	OFF	OFF	>LORAW and <HIRAW	Refer to the linear scaling formula.
OFF	OFF	OFF	>=HIRAW	AINPUT1_CFG.CHIPV

Linear scaling formula:

$$\left(\frac{(CHIPV - CLOPV)}{(HIRAW - LORAW)} \times CHIN \right) + CLOPV - \left(\frac{(CHIPV - CLOPV)}{(HIRAW - LORAW)} \times LORAW \right)$$

If the resulting value of the calculation is less than AINPUT1_CFG.CUTOFFPV (and the signal comes from the CHIN input), the PV output is set to match the AINPUT1_CFG.CLOPV input/output.

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
AINPUT1_ST	AINPUT1_ST_DDT	Provides the necessary data for monitoring the state of the input analog signal and configuring its simulation when required.
AINPUT1_CFG	AINPUT1_CFG_DDT	Provides the data necessary to configure the DFB usually from the monitoring subsystem.

AINPUT1_ST_DDT Type

Name	Type	Description
STW	WORD	Read-only access
		Bit 0 BADST Indicates whether the input channel is operational or not. Reproduces the value of the CHFAILURE input if the CHIN input signal (EXTPVEN = 0) is used.
CFGW	WORD	DFB configuration word
		Bit 0 SIMMD Read/write access Enables you to put the analog input in Simulation (1) mode or Normal (0) mode.
PV	REAL	Read-only access Refer to the PV output pin, page 42.

AINPUT1_CFG_DDT Type

Name	Type	Description
SIM	REAL	Read/write access Simulated value of the measurement in engineering units. Default value: 0 NOTE: In case of a physical input (EXTPVEN = 0), the value that you enter in the AINPUT1_CFG.SIM input/output needs to be within the range delimited by LOPV and HIPV. If you enter a value outside of this range, the DFB uses the current value of the AINPUT1_CFG.SIM input/output instead.
CHIPV	REAL	High range of the measurement in engineering units (PV output) corresponding to the maximum value (configured in the HIRAW input) of the CHIN input pin. The maximum value that this variable can assume is limited by the value of the HIPV input pin. If the range entered from the monitoring system is incorrect (AINPUT1_CFG.CLOPV = AINPUT1_CFG.CHIPV = 0.0), it is initialized with the value of the HIPV input pin.
CLOPV	REAL	Low range of the measurement in engineering units (PV output) corresponding to the minimum value (configured in the LORAW input) of the CHIN input pin. The minimum value that this variable can assume is limited by the value of the LOPV input pin. If the range entered from the monitoring system is incorrect (AINPUT1_CFG.CLOPV = AINPUT1_CFG.CHIPV = 0.0), it is initialized with the value of the LOPV input pin.
BADPV	REAL	Value needs to be used in engineering units (PV output signal) when the channel is not operational. The value that this variable can assume is limited by the range configured in engineering units (AINPUT1_CFG.CLOPV and AINPUT1_CFG.CHIPV). If the range entered from the monitoring system is incorrect (AINPUT1_CFG.CLOPV = AINPUT1_CFG.CHIPV = 0.0), it is initialized with the value of the HIPV input pin.

Name	Type	Description
CUTOFFPV	REAL	<p>Value (in engineering units) resulting from the scaling calculation and below which the value entered into the <code>AINPUT1_CFG.CLOPV</code> input/output needs to be used as the measurement value (PV output).</p> <p>The value that this variable can assume is limited by the low range configured in engineering units (<code>AINPUT1_CFG.CLOPV</code>).</p> <p>If the range entered from the monitoring system is incorrect (<code>AINPUT1_CFG.CLOPV = AINPUT1_CFG.CHIPV = 0.0</code>), it is initialized with the value of the <code>LOPV</code> input pin.</p>
INPUTVALUE	REAL	Input value (in engineering units). If external PV is enable from the control, then input value is equal to external PV. If external PV is disable from the control, then input value is equal to channel value.

Public Variables

Public Variable Description

Variable	Type	Description
SC	AINPUT1_SC_DDT	Provides the frequently needed data to monitor the analog input status from the sequential control.

AINPUT1_SC_DDT Type

Name	Type	Description
PV	REAL	<p>Read-only access</p> <p>Refer to the PV output pin, page 42.</p>
BADST	BOOL	<p>Read-only access</p> <p>Refer to the <code>AINPUT1.STW.BADST</code> input/output pin, page 42.</p>

ALINEAR - Linear Interpolation

What's in This Chapter

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Overview

This chapter describes the ALINEAR DFB.

Description

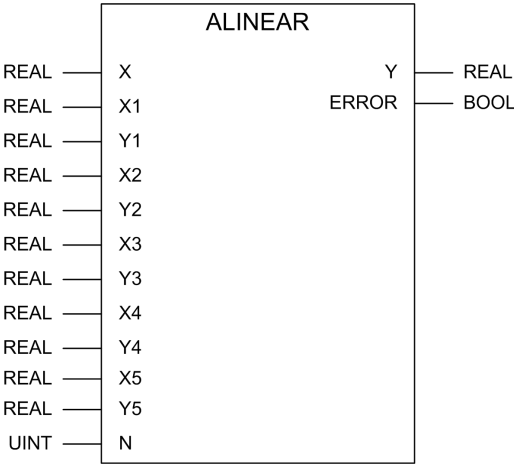
General

The ALINEAR DFB is used to transform a signal by means of a linear characterization function. The characterization function is defined with the use of points (up to 5).

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
X	REAL	Value of the analog signal to be transformed.
X _i , Y _i	REAL	Definition of the characterization function points. NOTE: Enter the points in ascending order in relation to the X axis, that is, from the lowest X value to the highest.
N	UINT	Number of points used (2...5).

Outputs

Output Parameter Description

Parameter	Type	Description						
Y	REAL	<p>Value calculated from the X signal and the characterization function defined with the points (X1, Y1) to (X5, Y5).</p> <p>It is calculated as followed:</p> <table><tr><td>Y=Y1</td><td>for $X \leq X1$</td></tr><tr><td>Y=f(X)</td><td>by linear interpolation according to the points entered for $X > X1$ and $X < Xn$</td></tr><tr><td>Y=Yn</td><td>for $X \geq Xn$</td></tr></table> <p>Where n corresponds to the number of points selected on the N input. If the N input is less than or equal to 2, Y is unconditionally assigned to Y2. If N is greater than 5, the characterization function is applied as if the value were 5.</p>	Y=Y1	for $X \leq X1$	Y=f(X)	by linear interpolation according to the points entered for $X > X1$ and $X < Xn$	Y=Yn	for $X \geq Xn$
Y=Y1	for $X \leq X1$							
Y=f(X)	by linear interpolation according to the points entered for $X > X1$ and $X < Xn$							
Y=Yn	for $X \geq Xn$							
ERROR	BOOL	<p>1 = High-level alarm.</p> <p>The parameter is set to 1 if:</p> <ul style="list-style-type: none">• The N input is not within range.• The (X,Y) points are not correctly ordered (X axis).						

AOUTPUT - Analog Output Conditioning

What's in This Chapter

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Overview

This chapter describes the AOUTPUT DFB.

Description

General

The AOUTPUT DFB is used to condition an analog signal usually associated with a physical output.

The DFB provides linear scaling, interlocking, diagnosis, and owner management functions.

Function Description

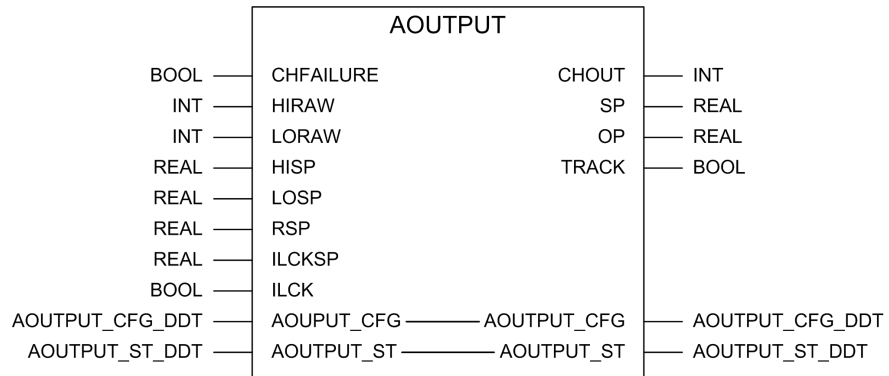
The main functions of the DFB are described in the following table:

Function	Description
Scaling	The DFB scales the input signal in engineering units (for example, %) to raw data through a linear function.
Diagnosis	The DFB manages the diagnostic status of the signal if the periphery used provides the signal.
Interlocking	The DFB enables to move to the defined position if an active interlock that requires this move is detected. An interlocking bypass function is available.
Owner	The DFB manages control system level, which is the owner (Operator or Program). As a result, it is responsible for setting the set-point to the desired position.

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
CHFAILURE	INT	Indicates to the DFB whether the output channel associated with the CHOUT output is operational (1) or not (0).
HIRAW	INT	High range of the CHOUT output signal.
LORAW	INT	Low range of the CHOUT output signal.
HISP	REAL	High range of the set-point (SP) in engineering units corresponding to the maximum value (configured in the HIRAW input) of the CHOUT output.
LOSP	REAL	Low range of the set-point (SP) in engineering units corresponding to the minimum value (configured in the LORAW input) of the CHOUT output.
RSP	REAL	Remote set-point. Usually set by the continuous control; for example, by a PID controller output.
ILCKSP	REAL	Use set-point when the DFB is interlocked. Refer to the ILCK input pin.
ILCK	BOOL	1 = Interlocks the device at the defined position.

Outputs

Output Parameter Description

Parameter	Type	Description	
CHOUT	INT	Calculated value of the output in raw data.	
		Output calculation based on the OP value is detailed in the following table:	
		OP	CHOUT
		<= LOSP	LORAW

Parameter	Type	Description			
		> LOSP and < HISP	Is calculated with the following linear formula.		
		>= HISP	HIRAW		
SP	REAL	Current set-point.			
		Set-point calculation based on the value of the input value and the AOUTPUT_ST input/output is detailed in the following table:			
		OWNER (OFF: Program, ON: Operator)	REM	SP	
		OFF	OFF	SC.LSP	
		OFF	ON	RSP	
ON	-	AOUTPUT_CFG.LSP			
OP	REAL	Output in engineering units.			
		Set-point calculation based on the SC.ILCKD public variable value is detailed in the following table:			
		SC.ILCKD	OP		
		ON	ILCKSP		
OFF	SP				
TRACK	BOOL	Determines whether the remote set-point (RSP input) is one being considered (0) or not (1) for the CHOUT output calculation.			
		1 = Report whether the control loop is open to the algorithm connected to the RSP input (for example, a PID) so that it can readjust itself based on the output that is really taking place (the one present at the OP output).			
		ILCKD	OWNER	REM	TRACK is calculated as:
		ON	-	-	ON
		OFF	OFF	OFF	ON
		OFF	OFF	ON	OFF
OFF	ON	-	ON		

Linear scaling formula:

$$\left(\frac{HIRAW - LORAW}{HISP - LOSP} \times SP \right) + LORAW - \left(\frac{HIRAW - LORAW}{HISP - LOSP} \times LOSP \right)$$

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
AOUTPUT_ST	AOUTPUT_ST_DDT	Provides the data necessary to monitor the DFB status.
AOUTPUT_CFG	AOUTPUT_CFG_DDT	Provides the necessary data to control the DFB.

AOUTPUT_ST_DDT Type

Name	Type	Description
OP	REAL	Read-only access Refer to the OP output pin, page 48.
STW	WORD	Provides the device status usually used from the monitoring subsystem, and allows data to be kept in the memory. Read-only access to the data contained in this word.
CFGW	WORD	Provides the means to control the device from the monitoring subsystem. Read/write access to the data contained in this word.

AOUTPUT_ST.STW Word Structure

Bit	Name	Description
0	BADST	Indicates whether the output channel is operational or not. Reproduces the CHFAILURE input value.
1	ILCK	Refer to the ILCK input pin, page 48.
2	REM	Refer to the SC.REM public variable, page 51.

AOUTPUT_ST.CFGW Word Structure

Bit	Name	Description				
0	OWNER	<div>Read/write access</div> <div>Enables to configure whether the set-point is set by the:</div> <table><tr><td>0</td><td>Program</td></tr><tr><td>1</td><td>Operator</td></tr></table>	0	Program	1	Operator
0	Program					
1	Operator					
1	ILCKBP	<div>Read/write access</div> <div>Allows the interlock to be bypassed (1).</div>				

AOUTPUT_CFG_DDT Type

Name	Type	Description
LSP	REAL	Read/write access This variable indicates current set-point and is calculated internally in the DFB as long as the owner is not the Operator (is set to match the SP output). In which case, you can modify it from the monitoring subsystem.

Public Variables

Public Variable Description

Variable	Type	Description
SC	AOUTPUT_SC_DDT	Provides the frequently needed data to monitor and control the analog output status from the sequential control.

AOUTPUT_SC_DDT Type

Name	Type	Description		
LSP	REAL	Read/write access Allows to assign the local set-point usually for the sequential control if the owner is the Program (OWNER input/output is set to 0) and the selected set-point is the Local on (SC.REM public variable is set to 0). Otherwise, the current set-point (SP output) is continuously copied to this variable.		
SP	REAL	Refer to the SP output pin, page 48.		
OP	REAL	Read-only access Refer to the OP output pin, page 48.		
OWNER	BOOL	Read-only access Refer to the AOUTPUT_ST.CFGW.OWNER input/output pin, page 49.		
REM	BOOL	Read/write access Allows the DFB to be configured to remote set-point—RSP—(1) or local set-point—LSP— (0).		
TRACK	BOOL	Read-only access Refer to the TRACK output pin, page 48.		
BADST	BOOL	Read-only access Refer to the AOUTPUT.STW.BADST input/output pin, page 49.		
ILCKD	BOOL	Read-only access The signal evaluation depending on the ILCK input and the AOUTPUT_ST.CFGW.ILCKBP input/output is shown in the following table:		
		ILCK	ILCKBP	SC.ILCKD is calculated as:
		OFF	-	OFF
		ON	OFF	ON
		ON	ON	OFF

AOUTPUTLP - Local Panel for Analog Output Conditioning

What's in This Chapter

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Overview

This chapter describes the AOUTPUTLP DFB.

Description

General

The main objective of the AOUTPUTLP DFB is to manage a local panel that controls an analog output implemented by means of an AOUTPUT function DFB.

Function Description

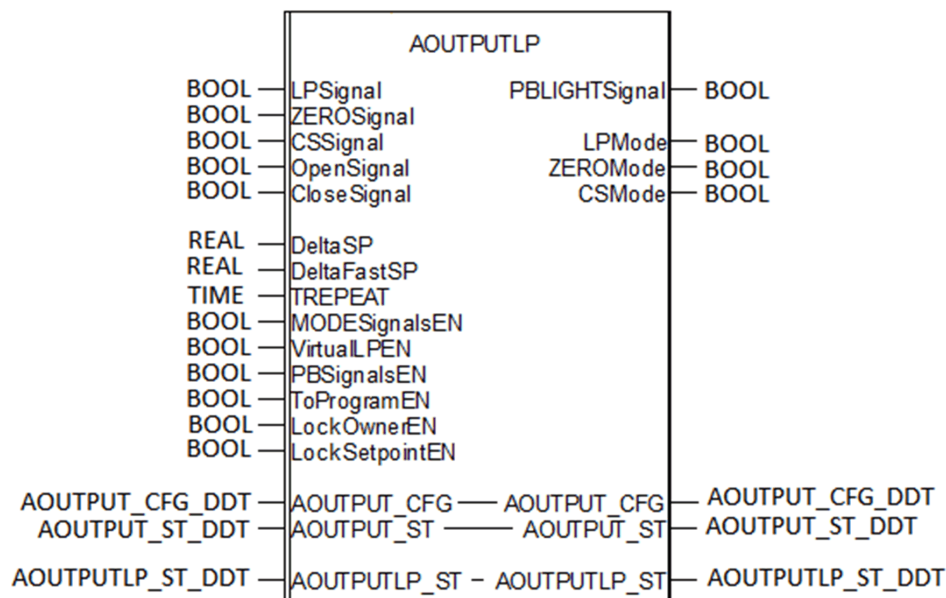
The main functions of the DFB are described in the following table:

Function	Description
Mode Switch	Optionally manages the signals coming from an operating mode switch in a local panel with the following configuration: Local - Zero - Control System. The Zero mode signal is optional. However the user can enable Local/Control System mode from the faceplate also, when <i>VirtualLPEN</i> input pin signal is high and <i>MODESignalsEN</i> signal is low in the DFB.
Push buttons	The DFB manages up to two signals coming from OPEN and CLOSE push buttons giving the CLOSE push button signal higher priority.
Owner Management	The DFB enables to configure whether the Program needs to be the analog output owner or not, after switching to the Control System mode again.
Owner Locking	The DFB enables to configure whether the monitoring (HMI) system needs to block access to the drop-down list or not. It disables to change the owner (Operator/Program) while the analog output is controlled from the Local Panel.
Set-point Lock	The DFB enables to configure whether or not the monitoring (HMI) system needs to block access to the drop-down list or not. It disables to change the set-point (Operator/Program) while the analog output is controlled from the Local Panel.
Push button Enabling/Disabling	The push buttons on the Local Panel can be enabled/disabled through the DFB configuration (input pin) and/or from control sequences.
Enabled Panel Signaling	The DFB provides a signal that can be used to illuminate a light source on the Local Panel to indicate when the push buttons are enabled for operation.
Virtual Panel Enabling/Disabling	This signal enables the operator to select the Local/Control System mode of operation from the HMI so that the push button signals are enabled for operation. NOTE: <i>VirtualLPEN</i> input pin signal is applicable when Modicon Libraries - General Purpose is used along with Modicon Libraries - General Purpose for Wonderware System Platform.

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
LPSignal	BOOL	1 = The local panel mode switch is in the Local Panel position. Refer to the table included with the description of the LPMODE output pin, page 55.
ZEROSignal	BOOL	1 = The local panel mode switch is in the zero position. This signal is optional even if a mode switch is available on the local panel. When this signal is a logical high, user is not allowed to operate the device from the faceplate and also from the DFB. Hence, all the functions in the faceplate will be disabled. Refer to the table included with the description of the LPMODE output pin, page 55.
CSSignal	BOOL	1 = The local panel mode switch is in the Control System position. Refer to the table included with the description of the LPMODE output pin, page 55.
OpenSignal	BOOL	1= Indicates to the DFB that the OPEN push button on the local panel is pressed.
CloseSignal	BOOL	1 = Indicates to the DFB that the CLOSE push button on the local panel is pressed.
DeltaSP	REAL	Absolute set-point increase or decrease value when the OPEN or CLOSE push button is pressed.
DeltaFastSP	REAL	Absolute set-point increase or decrease value when the OPEN and CLOSE push buttons are being held down.
TREPEAT	TIME	Indicates the maximum time that should elapse before the system interprets that a command has been repeated when the push button is being held down. This time also determines when a DeltaFastSP increase or decrease has to be applied when the OPEN or CLOSE push button is being held down.

Parameter	Type	Description																				
MODESignal-sEN	BOOL	<p>1 = Enables the use of the Local Panel/Zero/Control System (or Local Panel - Control System) mode switch on the local panel. usually configured in development phase based on the characteristics of the local panel being used. If the mode switch is enabled, the LPSignal, ZEROSignal, and CSSignal inputs are considered to determine the operating modes of the local panel. Refer to the table included with the description of the LPMode output pin, page 55.</p> <p>NOTE: MODESignal-sEN input pin has higher priority than the VirtualLPEN input pin signal.</p>																				
VirtualLPEN	BOOL	<p>1 = This signal enables the operator to select the Local/Control System mode of operation from the HMI, so that the push button signals are enabled for operation.</p> <p>NOTE:</p> <ul style="list-style-type: none">When the owner is program, the Local/Control System mode selection drop-down list will be visible but disabled for operation however, when the owner is operator the Local Panel drop-down list will be accessible for operation.VirtualLPEN input pin signal is applicable only for Modicon Libraries - General Purpose for Wonderware System Platform offer only, however there is no impact of this input signal in Modicon Libraries - General Purpose for Plant SCADA offer. <p>Refer to the table included with the description of the LPMode output pin, page 55.</p>																				
PBSignalsEN	BOOL	<p>1 = Enables to accept OPEN and CLOSE push button signals from the local panel. This signal is not applicable if the mode switch is enabled (refer to the MODESignal-sEN input pin). This means that the push button signals are considered in the Local Panel mode.</p> <p>When the mode switch is disabled (MODESignal-sEN = 0), PBSignalsEN signal enables/disables the push buttons from control system itself based on relevant process conditions. SC.DisableLP public variable is also considered for determining whether the push buttons are enabled or not when LPMode pin signal is high, as shown in the following table.</p> <table><tr><th>MODESignal-sEN</th><th>PBSignal-sEN</th><th>SC.DisableLP</th><th>Push buttons enabled?</th></tr><tr><td>OFF</td><td>OFF</td><td>-</td><td>NO</td></tr><tr><td>OFF</td><td>-</td><td>ON</td><td>NO</td></tr><tr><td>OFF</td><td>ON</td><td>OFF</td><td>YES</td></tr><tr><td>ON</td><td>-</td><td>-</td><td>YES</td></tr></table> <p>Therefore, you can use this signal to enable/disable the push buttons on a simple local panel that does not feature a mode switch (Local Panel/Zero/Control System) based on the relevant process conditions.</p>	MODESignal-sEN	PBSignal-sEN	SC.DisableLP	Push buttons enabled?	OFF	OFF	-	NO	OFF	-	ON	NO	OFF	ON	OFF	YES	ON	-	-	YES
MODESignal-sEN	PBSignal-sEN	SC.DisableLP	Push buttons enabled?																			
OFF	OFF	-	NO																			
OFF	-	ON	NO																			
OFF	ON	OFF	YES																			
ON	-	-	YES																			
ToProgramEN	BOOL	<p>1 = Enables the functionality to change the owner of analog output to Program when mode switch on the local panel returns to control system position (only when the mode is switched). If this functionality is disabled, operator of the monitoring (HMI) system switches to Program owner when the operator deems it appropriate. Refer to the table included with the description of the LockOwnerEN input pin.</p>																				
LockOwnerEN	BOOL	<p>1 = Disables the access of the owner of analog output remaining as Operator while the local panel mode is Local Panel.</p> <p>The following table depicts how the owner of analog output is evaluated based on ToProgramEN and LockOwnerEN inputs and the local panel operating mode:</p> <table><tr><th>Local Panel Mode</th><th>ToProgramEN</th><th>LockOwnerEN</th><th>Owner</th></tr><tr><td>Zero</td><td>-</td><td>-</td><td>Operator</td></tr><tr><td>Switch to Local Panel</td><td>-</td><td>-</td><td>Operator</td></tr><tr><td>Local Panel</td><td>-</td><td>ON</td><td>Operator</td></tr><tr><td>Switch to Control System</td><td>ON</td><td>-</td><td>Program</td></tr></table>	Local Panel Mode	ToProgramEN	LockOwnerEN	Owner	Zero	-	-	Operator	Switch to Local Panel	-	-	Operator	Local Panel	-	ON	Operator	Switch to Control System	ON	-	Program
Local Panel Mode	ToProgramEN	LockOwnerEN	Owner																			
Zero	-	-	Operator																			
Switch to Local Panel	-	-	Operator																			
Local Panel	-	ON	Operator																			
Switch to Control System	ON	-	Program																			

Parameter	Type	Description
		<p>In remaining cases, owner of the analog output ceases to be defined from the AOUTPUTLP DFB and it becomes possible to change it from monitoring (HMI) system with the command word in the AOUTPUT_ST.CFGW input/output of the corresponding AOUTPUT DFB.</p> <p>In any case, consider that the analog output owner that had been set before switching to the local panel mode is not memorized.</p>
LockSet-PointEN	BOOL	<p>1 = Disables the setpoint of the analog output and lock it into the one defined on the local panel while the local panel mode is local panel and the device owner is the Operator. User can switch to Program mode based on the signals that have been previously described even if the local panel mode is set to Local Panel.</p> <p>Therefore, user can activate (1) this signal to lock setpoint operation from the monitoring system while the analog output is controlled from the local panel.</p>

Outputs

Output Parameter Description

Parameter	Type	Description																																																																																																									
PBLIGHT-Signal	BOOL	1 = The push buttons on the local panel are fully operational, that is, the local panel is in Local Panel mode (either because the mode is selected with the corresponding switch or because the push buttons are enabled in the event that there is no selector switch available or the <i>VirtualLPEN</i> is high with the local panel mode enabled).																																																																																																									
LPMode	BOOL	<div><div>1 = The local panel mode is in Local Panel.</div><div>The following table depicts how the local panel operating mode is determined based on the <i>MODESignalsEN</i>, <i>VirtualLPEN</i>, <i>PBSignalsEN</i>, <i>LPSignal</i>, <i>CSSignal</i> and <i>ZEROSignal</i>, input signals:</div><table><tr><th>MOD-ESi-gna-lsEN</th><th>Vir-tual-LPEN</th><th>PBSi-gnal-sEN</th><th>LPSig-nal</th><th>CSSi-gnal</th><th>ZERO-Signal</th><th>OUTPUT</th></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>CS mode</td></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>Zero mode</td></tr><tr><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>LP mode and PBLIGHT-Signal</td></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>CS mode</td></tr><tr><td>0</td><td>1</td><td>1</td><td>NA</td><td>NA</td><td>NA</td><td>CS mode</td></tr><tr><td>0</td><td>1</td><td>0</td><td>NA</td><td>NA</td><td>NA</td><td>CS mode</td></tr><tr><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>LP mode and PBLIGHT-Signal</td></tr><tr><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>LP mode and PBLIGHT-Signal</td></tr><tr><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>Zero mode</td></tr><tr><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>Zero mode</td></tr><tr><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>CS mode</td></tr><tr><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>CS mode</td></tr><tr><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>CS mode</td></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>Zero mode</td></tr></table></div>	MOD-ESi-gna-lsEN	Vir-tual-LPEN	PBSi-gnal-sEN	LPSig-nal	CSSi-gnal	ZERO-Signal	OUTPUT	0	0	0	0	0	0	CS mode	1	0	0	0	0	0	Zero mode	1	0	0	1	0	0	LP mode and PBLIGHT-Signal	1	0	0	0	1	0	CS mode	0	1	1	NA	NA	NA	CS mode	0	1	0	NA	NA	NA	CS mode	0	0	1	0	0	0	LP mode and PBLIGHT-Signal	1	1	0	1	0	0	LP mode and PBLIGHT-Signal	1	1	0	0	0	0	Zero mode	1	1	0	0	0	1	Zero mode	1	1	0	0	1	0	CS mode	1	0	1	0	1	0	CS mode	1	1	1	0	1	0	CS mode	1	0	0	0	0	1	Zero mode
MOD-ESi-gna-lsEN	Vir-tual-LPEN	PBSi-gnal-sEN	LPSig-nal	CSSi-gnal	ZERO-Signal	OUTPUT																																																																																																					
0	0	0	0	0	0	CS mode																																																																																																					
1	0	0	0	0	0	Zero mode																																																																																																					
1	0	0	1	0	0	LP mode and PBLIGHT-Signal																																																																																																					
1	0	0	0	1	0	CS mode																																																																																																					
0	1	1	NA	NA	NA	CS mode																																																																																																					
0	1	0	NA	NA	NA	CS mode																																																																																																					
0	0	1	0	0	0	LP mode and PBLIGHT-Signal																																																																																																					
1	1	0	1	0	0	LP mode and PBLIGHT-Signal																																																																																																					
1	1	0	0	0	0	Zero mode																																																																																																					
1	1	0	0	0	1	Zero mode																																																																																																					
1	1	0	0	1	0	CS mode																																																																																																					
1	0	1	0	1	0	CS mode																																																																																																					
1	1	1	0	1	0	CS mode																																																																																																					
1	0	0	0	0	1	Zero mode																																																																																																					

Parameter	Type	Description
ZEROMode	BOOL	1 = The local panel mode is in Zero. User is not allowed to operate the device from the faceplate and also from DFB. Hence, all the functions in the faceplate will be disabled. Refer to the table included with the description of the LPMODE output.
CSMode	BOOL	1 = The local panel mode is in Control System. Refer to the table included with the description of the LPMODE output.

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
AOUTPUT_CFG	AOUTPUT_CFG_DDT	Data structure belonging to the analog output is to be controlled from the local panel (for detailed information regarding this structure, refer to the AOUTPUT DFB, page 47). The structure provides information needed for the operation of the AOUTPUTLP DFB. It enables this DFB to control the setpoint for the analog output.
AOUTPUT_ST	AOUTPUT_ST_DDT	Data structure corresponding to the analog output is to be controlled from the local panel (for detailed information regarding this structure, refer to the AOUTPUT DFB, page 47). The structure provides information needed for the operation of AOUTPUTLP DFB and enables this DFB to control the owner of the analog output.
AOUTPUTLP_ST	AOUTPUTLP_ST_DDT	Data structure that is used as an interface with the monitoring (HMI) system.

AOUTPUT_CFG.DDT Type

Name	Type	Description
LSP	REAL	Read/write access Allows local set-point of the operator (OWNER = 1) to be set from the monitoring (HMI) system. If setpoint is set by the Program (OWNER = 0), the DFB continuously assigns it the value of the current set-point.

AOUTPUT_ST.DDT Type

Name	Type	Description
STW	WORD	Provides the device status usually used from the monitoring subsystem, and allows data to be kept in the memory. Read-only access to the data contained in this word.
CFGW	WORD	Provides the means to control the device from the monitoring subsystem. Read/write access to the data contained in this word.
OP	REAL	Read-only access Refer to the OP output pin, page 48.

AOUTPUTLP_ST.DDT Type

Name	Type	Description
STW	WORD	Read-only access Bits word with the status of the local panel.

AOUTPUT_ST.CFGW Word

The following table describes the AOUTPUT_ST.CFGW word:

Bit	Name	Description
0	OWNER	The control modes for the analog output Read/write access Enables to configure whether the set-point is set by the Program (0) or by the Operator (1). Refer to the table included with the description of the LPMODE output , which specifies the cases in which the AOUTPUTLP DFB can interact with this signal.

AOUTPUTLP_ST.CFGW Word

Bit	Name	Description
0	LocalModeOn	Read/write access only <ul style="list-style-type: none"> 1 = Enables the Local Panel mode. 0 = Enables the Control System mode.

AOUTPUTLP_ST.STW Word

Read-only access. Status word. The following table describes the AOUTPUTLP_ST.STW word:

Bit	Name	Description
0	LPMODE	Local panel in Local Panel mode. Refer to the LPMODE output .
1	ZEROMODE	Local panel in zero mode. Refer to the ZEROMODE output .
2	CSMODE	Local panel in Control System mode. Refer to the CSMODE output .
3	LockedOwner	Indicates whether the owner change buttons in the monitoring (HMI) system needs to be locked (1) or not (0). Is activated when: <ul style="list-style-type: none"> The Local Panel mode is set to Zero or It is set to Local Panel and the LockOwnerEN input signal has been configured as active (1).
4	SPLocked	Indicates whether the set-point change and START buttons in the monitoring (HMI) system needs to be locked (1) or not (0). Is activated when: <ul style="list-style-type: none"> The local panel mode is set to Zero or It is set to Local Panel and the LockSetPointEN input signal has been configured as active (1).
5	MODESignalsEN	Indicates the state of the MODESignalsEN input signal, that is, whether there is a mode switch (1) or not (0).

Bit	Name	Description
6	PBEnabled	Indicates whether the push buttons of the local panel are enabled (1) or not (0). The signal is activated when at least one of the <code>MODESignalsEN</code> and <code>PBSignalsEN</code> signal inputs is active.
7	VirtualLPEN	Enables the drop-down list for the Local Panel / Control System mode selection.
8	LPSignal	Indicates the state of the <code>LPSignal</code> input signal.
9	ZEROSignal	Indicates the state of the <code>ZEROSignal</code> input signal.
10	CSSignal	Indicates the state of the <code>CSSignal</code> input signal.
11	OpenSignal	Indicates the state of the <code>OpenSignal</code> input signal.
12	CloseSignal	Indicates the state of the <code>CloseSignal</code> input signal.

Public Variables

Public Variable Description

Variable	Type	Description
SC	AOUTPUTLP_SC_DDT	Provides the frequently needed data to monitor and control the DFB.

AOUTPUTLP_SC_DDT Type

Name	Type	Description
LPMode	BOOL	Read-only access Refer to the <code>LPMode</code> output .
ZEROMode	BOOL	Read-only access Refer to the <code>ZEROMode</code> output .
CSMode	BOOL	Read-only access Refer to the <code>CSMode</code> output .
DisableLP	BOOL	Read/write access 1 = Disables the push buttons on the local panel. Only applicable when a local panel without mode switch configuration is used (<code>MODESignalsEN</code> = 0).

DCALC - Digital Calculation

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Overview

This chapter describes the `DCALC` DFB.

Description

General

The `DCALC` DFB is used to perform calculations based on a digital signal; the calculations performed are frequency and totalizing calculations.

The DFB memorizes up to 20 time samples with rising edges in the measurement (`PV` - Present Value) based on which the calculations are performed.

Calculations are based on values of type `REAL`.

Function Description

The main functions of the DFB are described in the following table:

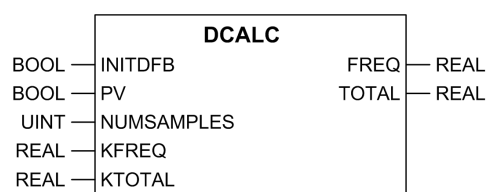
Function	Description
Frequency	The frequency at which the input signal oscillates is calculated.
Totalizing	The totalization is calculated by counting pulses and scaling to engineering units.

NOTE: The function block uses the `FREERUN` function for time calculations. Therefore, the `DCALC` DFB is only available if the controller CPU supports this function.

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
INITDFB	BOOL	0 = Rising edge on this input is detected, the DFB internal timers are reset and the first sample (time and value) is stored in the memory. In the same execution cycle, the value of the outputs is generated. NOTE: The input is not reset (0) by the DFB.
PV	BOOL	1 = Value of the measurement. NOTE: You need to verify that the execution characteristics of the DFB are compatible with the input frequency of the signal; so, no edges are lost and the accuracy of the frequency calculation is adequate for the requirements of the process.
NUMSAMPLES	UINT	Maximum number of samples that need to be stored and that are used in the calculations. Configuration range: From 2 to 20 Default value: 20 NOTE: During the first runs of the DFB, a smaller number of samples than those configured may be used.
KFREQ	REAL	Conversion factor applied to the frequency calculation (refer to the <i>FREQ</i> , page 60 output). Allows the frequency to be calculated in the desired engineering units (for example, RPM). If this signal is 0, the DFB applies a default factor of 1.0.
KTOTAL	REAL	Conversion factor applied to the totalizing calculation <i>TOTAL</i> , page 60 output. Allows the total to be calculated in the desired engineering units. If this signal is 0, the DFB applies a default factor of 1.0.

Outputs

Output Parameter Description

Parameter	Type	Description
FREQ	REAL	The frequency is calculated (in Hz when <i>KFREQ</i> is 1.0) based on the time samples in which the rising edges of the measurement have taken place (<i>PV</i>). Frequency calculation is based on the following formula.
TOTAL	REAL	Calculates the totalization while it is activated (refer to the <i>SC . TOTALEN</i> public variable, page 61). A unit is accumulated (scaled with <i>KTOTAL</i> , when applicable) each time a rising edge occurs on the input signal. The calculation is only made if it has been enabled and you can set it to 0 (refer to <i>SC</i> public variable, page 61).

Frequency calculation formula:

$$KFREQ \times \left(\frac{\sum_{i=1}^{NUMSAMPLES} \frac{i^2}{t_i}}{\sum_{i=1}^{NUMSAMPLES} i} \right)$$

Where:

KFREQ	Conversion factor applied to the frequency calculation. Refer to the <i>KREQ</i> input, page 60.
n	Number of samples (up to 20 after the whole internal sample table is loaded).
t	Relative time elapsed from the first edge to the corresponding edge.

Checking the Saturation Limit of the Output

Calculations based on values of type REAL may give incorrect results. For example, if the increment (*KTOTAL*) that is used in the calculation of the output is smaller than the precision of the output, the output may be wrong.

You can check whether the output is correct by using the *SATURATION* function block.

For more information, refer to *SATURATION* in the help of Control Participant.

Public Variables

Public Variable Description

Variable	Type	Description
SC	DCALC_SC_DDT	Provides the frequently needed data to monitor and control the DFB.

DCALC_SC_DDT Type

Name	Type	Description
PV	BOOL	Read-only access Refer to the <i>PV</i> input pin, page 60.
FREQ	REAL	Read-only access Refer to the <i>FREQ</i> output pin, page 60.
TOTAL	REAL	Read-only access Refer to the <i>TOTAL</i> output pin, page 60.
TOTALEN	BOOL	Read/write access 1 = Enables the totalizing calculation. 0 = Disables the totalizing calculation. Does not set the totalizer to 0.
TOTALRST	BOOL	Read/write access 1 = Resets the totalized value (<i>TOTAL</i> output). 0 = After processing, the DFB sets this signal to 0.

DINPUT - Digital Input Conditioning

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Overview

This chapter describes the `DINPUT` DFB.

Description

General

The *DINPUT* DFB is used to condition a digital signal usually coming from a physical input.

The DFB provides timing functions for the connection and/or disconnection, simulation, and can use the signal status as an alarm function.

Function Description

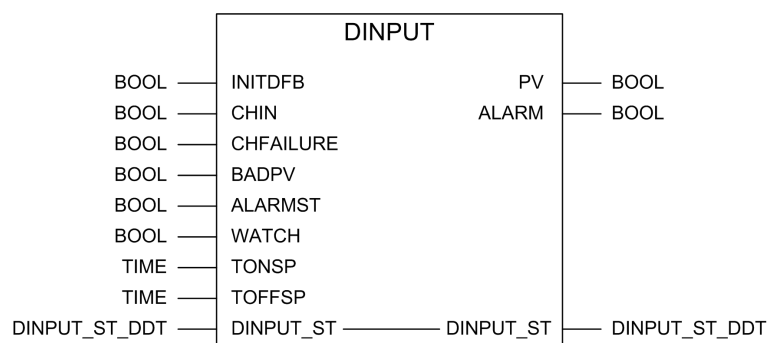
The main functions of the DFB are described in the table:

Function	Description
Timing	The input signal is timed to evaluate an output logic signal that absorbs rapid changes in the input signal.
Alarm	You can enable/disable the evaluation of an alarm and indicate the status that needs to be considered for the alarm. . You need to incorporate an external logic to evaluate this alarm.
Diagnosis	The DFB manages the diagnostic status of the signal if the peripherals used provide it and assigns the value that is to be used if the signal is not working properly.
Simulation	You can configure the DFB to allow you to enter the value that needs to be used (in engineering units). This option enables you to conduct tests on the programming associated with the DFB from the Supervision system.

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
INITDFB	BOOL	0 = Rising edge is produced on this input, the internal timers of the DFB are reset. If the input and the detected alarm status are timed, the detected alarm and the PV are set to 0.
CHIN	BOOL	1 = Input signal Usually corresponds to a value coming from the input peripherals.
CHFAILURE	BOOL	1 = Indicates to the DFB whether the input channel that is associated with the CHIN input is operational.
BADPV	BOOL	0 = Value needs to be used (PV output signal and for the purposes of detected alarm evaluation).
ALARMST	BOOL	1 = PV value needs to be considered as a detected alarm.
WATCH	BOOL	1 = Enables the detected alarm monitoring depending on the dynamic conditions of the process.
TONSP	TIME	Timing set-point for digital input connection (CHIN).
TOFFSP	TIME	Timing set-point for digital input disconnection (CHIN).

Outputs

Output Parameter Description

Parameter	Type	Description		
PV	BOOL	Timed input value		
		The PV calculation that the DFB performs based on the value of the inputs and the STW input/output is detailed in the following table:		
		STW.SIMMD	CHFAILURE	PV
		ON	-	STW.SIM
		OFF	ON	BADPV

Parameter	Type	Description		
		OFF	OFF	Timed CHIN (TONSP/TOFFSP)
ALARM	BOOL	1 = Detected alarm evaluated based on the PV value and the DFB configuration is described in the following table:		
STW.ALARMEN		WATCH	PV	ALARMST
OFF		-	-	OFF
-		OFF	-	OFF
ON		ON	OFF	ON
ON		ON	OFF	OFF
ON		ON	ON	OFF
ON		ON	ON	ON

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
DINPUT_ST	DINPUT_ST_DDT	Provides the DFB status and configuration.

DINPUT_ST_DDT Type

Name	Type	Description
STW	WORD	Provides the discrete input status usually used from the monitoring subsystem. Read-only access to the data contained in this word.
CFGW	WORD	Provides the means to configure the DFB behavior. Read-only access to the data contained in this word.

DINPUT_ST.CFGW Word Structure:

Bit	Name	Description
0	ALARMEN	Enables the detected alarm evaluation to be enabled (1) or disabled (0).
1	SIMMD	Enables the digital input to be set to simulation mode (1) or normal (0).
2	SIM	Enables the simulated input value to be selected.

DINPUT_ST.STW Word Structure:

Bit	Name	Description
0	PV	Refer to the PV output pin, page 63.
1	ALARM	Refer to the ALARM output pin, page 63.
2	BADST	Indicates whether the input channel is operational or not. Reproduces the CHFAILURE input value.
3	WATCH	Indicates if the detected alarm is being monitored. Reproduces the WATCH input value.

Bit	Name	Description
4	ALARMST	PV value needs to be considered as a detected alarm. Reproduces the ALARMST input value.
5	INPUTVALUE	Indicates the channel value.

Public Variables

Public Variable Description

Variable	Type	Description
SC	DINPUT_SC_DDT	Provides the frequently needed data to monitor the discrete input status from the sequential control.

DINPUT_SC_DDT Type

Name	Type	Description
PV	BOOL	Read-only access Refer to the PV output pin, page 63.
ALARM	BOOL	Read-only access Refer to the DINPUT_ST.STW.ALARM input/output pin, page 64.

DOUPTUT - Digital Output Conditioning

What's in This Chapter

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DFB Representation

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Overview

This chapter describes the DOUPTUT DFB.

Description

General

The DOUPTUT DFB is used to condition a digital signal usually associated with a physical output.

The DFB provides interlocking, diagnosis, and owner management functions.

Function Description

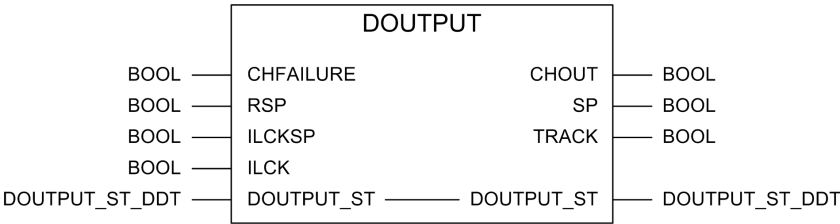
The main functions of the DFB are described in the following table:

Function	Description
Diagnosis	The DFB manages the diagnostic status of the signal if the periphery used provides it.
Interlocking	The DFB enables to move to the defined position if an active interlock that requires this move is detected. An interlock bypass function is available.
Owner	The DFB manages control system level, which is the owner (Operator or Program). As a result, it is responsible for setting the set-point to the desired position.

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
CHFAILURE	BOOL	1 = Indicates to the DFB that the output channel associated with the CHOUT output is operational.
RSP	BOOL	1 = Remote set-point. Usually set by the continuous control; for example, by a PID controller output.
ILCKSP	BOOL	1 = Set-point needs to be used when the DFB is interlocked. Refer to the ILCK input.
ILCK	BOOL	1 = Interlocks the device at the defined position.

Outputs

Output Parameter Description

Parameter	Type	Description			
CHOUT	BOOL	1 = Calculated value of the output.			
		The output calculation that the DFB performs is detailed in the following table:			
		SC . ILCKD		CHOUT	
		ON		ILCKSP	
OFF		SP			
SP	BOOL	1 = Current set-point.			
		The output calculation that the DFB performs is detailed in the following table:			
		OWNER OFF: Program; ON: Operator		REM	SP
		OFF	OFF	SC . LSP	
		OFF	ON	RSP	
		ON	-	DOUTPUT_ST.CFGW.LSP	
TRACK	BOOL	1 = Determines that the remote set-point (RSP input) is one being considered for the CHOUT output calculation. This output is usually used to report to the algorithm connected to the RSP input (that is, a PID) whether the control loop is open (TRACK is 1) or not (TRACK is 0) so that it can be repositioned based on the output set-point that is actually in effect.			
		The output calculation that the DFB performs is detailed in the following table:			
		SC . ILCKD	OWNER	REM	TRACK
		ON	-	-	ON
		OFF	OFF	OFF	ON
		OFF	OFF	ON	OFF
		OFF	ON	-	ON

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
DOUTPUT_ST	DOUTPUT_ST_DDT	Provides the DFB status and configuration.

DOUTPUT_ST_DDT Type

Name	Type	Description
STW	WORD	Provides the device status usually used from the monitoring subsystem, and allows data to be kept in the memory. Read-only access to the data contained in this word.
CFGW	WORD	Provides the means to control the device from the monitoring subsystem. Read/write access to the data contained in this word.

DOUTPUT_ST.CFGW Word Structure:

Bit	Name	Description
0	OWNER	Read/write access Enables to configure whether the set-point is set by the Program (0) or the Operator (1).
1	ILCKBP	Read/write access Enables the interlock to be bypassed (1).
2	LSP	Read/write access This variable indicates the current set-point and is internally calculated in the DFB when the owner is not the Operator (if equal to the SP output). In which case, you can modify it from the monitoring subsystem.

DOUTPUT_ST.STW Word Structure

Bit	Name	Description
0	BADST	Indicates if the output channel is not operational. Reproduces the CHFAILURE input value.
1	ILCK	Refer to the ILCK input pin, page 67
2	REM	Refer to the SC.REM public variable, page 68.
3	OP	DFB status.

Public Variables

Public Variable Description

Variable	Type	Description
SC	DOUTPUT_SC_DDT	Provides the frequently needed data to monitor and control the analog output status from the sequential control.

DOUTPUT_SC_DDT Type

Name	Type	Description												
OWNER	BOOL	Read-only access Refer to the <code>DOUTPUT_ST.CFGW.OWNER</code> input/output pin, page 68.												
LSP	BOOL	Read/write access Enables the sequential control to assign the local set-point if the owner is the Program (<code>OWNER</code> is 0), and the selected set-point is Local (<code>SC.REM</code> is 0). Otherwise, the current set-point (<code>SP</code> output) is continuously copied to this variable.												
REM	BOOL	Read/write access Enables the DFB to be configured for remote set-point— <code>RSP</code> —(1) or local set-point— <code>LSP</code> – (0).												
SP	BOOL	Read-only access Refer to the <code>SP</code> output pin, page 67.												
OP	BOOL	Read-only access												
TRACK	BOOL	Read-only access Refer to the <code>TRACK</code> output pin, page 67.												
BADST	BOOL	Read-only access, page 68												
ILCKD	BOOL	Read-only access The signal evaluation depending on the <code>ILCK</code> input and the <code>DOUTPUT_ST.CFGW.ILCKBP</code> input/output is shown in the following table:												
		<table><tr><th>ILCK</th><th>ILC-KBP</th><th>SC.ILCKD</th></tr><tr><td>OFF</td><td>-</td><td>OFF</td></tr><tr><td>ON</td><td>OFF</td><td>ON</td></tr><tr><td>ON</td><td>ON</td><td>OFF</td></tr></table>	ILCK	ILC-KBP	SC.ILCKD	OFF	-	OFF	ON	OFF	ON	ON	ON	OFF
		ILCK	ILC-KBP	SC.ILCKD										
		OFF	-	OFF										
		ON	OFF	ON										
ON	ON	OFF												

MAINPUT1 - Conditioning of Multiple Analog Inputs with Configurable Range

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Overview

This chapter describes the `MAINPUT1` DFB.

Description

General

The *MAINPUT1* DFB is used to condition up to four analog signals usually coming from physical inputs and allows selecting one of them based on the chosen criterion. You can configure the range from the Supervision system.

The DFB provides linear scaling, cut-off, diagnosis, and simulation functions.

You can supplement *MAINPUT1* with two other DFBs of the General Purpose library:

- *AALARM*: Allows you to incorporate functions to evaluate the alarms associated with the measurement.
- *ACALC*: Allows you to incorporate calculations on the analog input.

Function Description

The main functions of the DFB are described in the table:

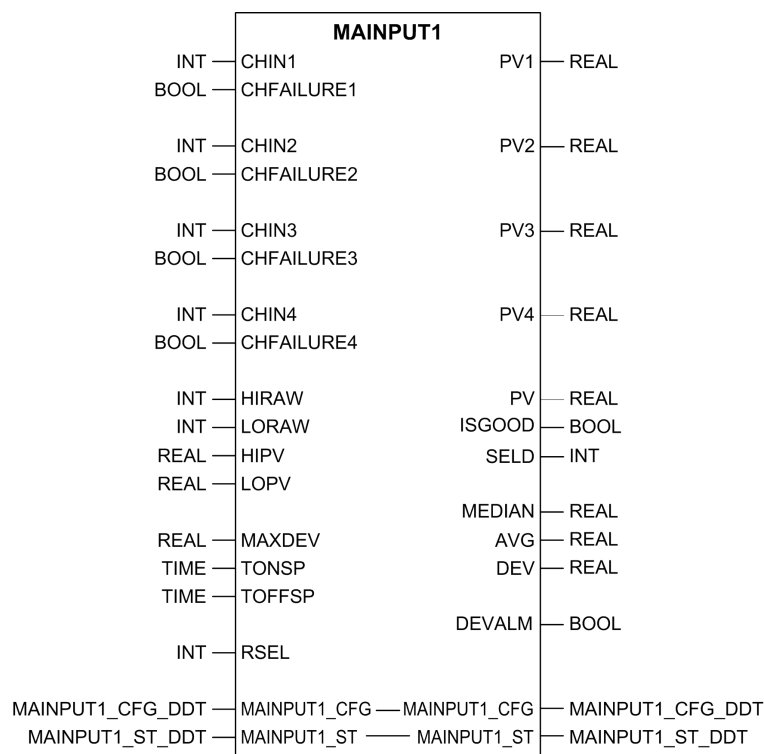
Function	Description
Scaling	<p>Scales the input signals (usually in raw data) to engineering units by using a linear function.</p> <p>You can configure the range of the signals externally (usually from the Supervision system) within the range that is configured in the program, which is running in the controller. Enter values in engineering units.</p>
Cut-Off	<p>You can configure a minimum value, which is called the cut-off value. If the measured value received from the transmitter is below the cut-off value, the measured value is not useable. In such case, the cut-off value is considered.</p> <p>You can configure the cut-off value externally; usually through the Supervision system. Enter a value in engineering units within the range that is configured in the program, which is running in the controller</p>
Diagnosis	<p>The DFB manages the diagnostic status of the signal if the peripherals used provide this signal, and assigns the value that is to be used if the signal is not working properly.</p> <p>You can configure the value (usually through the Supervision system) that is to be used if the signal is not working properly externally. Enter a value in engineering units within the range that is configured in the program, which is running in the controller.</p>

Function	Description
Simulation	<p>You can configure the DFB to allow you to enter the value that needs to be used (in engineering units).</p> <p>This option enables you to conduct tests on the programming associated with the DFB from the Supervision system.</p>
Selection	<p>The DFB allows you to select one analog signal among the input signals based on one of the following criteria:</p> <ul style="list-style-type: none"> • Priority • Direct selection • Median • Average • Minimum • Maximum

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
CHIN1	INT	Channel 1 input signal. usually corresponds to a value in raw data coming from the input/output peripherals.
CHFAILURE1	BOOL	1 = Indicates to the DFB that the input channel associated with the CHIN1 input is operational.

Parameter	Type	Description	
CHIN2	INT	Channel 2 input signal. usually corresponds to a value in raw data coming from the input/output peripherals.	
CHFAILURE2	BOOL	1 = Indicates to the DFB that the input channel associated with the CHIN2 input is operational.	
CHIN3	INT	Channel 3 input signal. usually corresponds to a value in raw data coming from the input/output peripherals.	
CHFAILURE3	BOOL	1 = Indicates to the DFB that the input channel associated with the CHIN3 input is operational.	
CHIN4	INT	Channel 4 input signal. usually corresponds to a value in raw data coming from the input/output peripherals.	
CHFAILURE4	BOOL	1 = Indicates to the DFB that the input channel associated with the CHIN4 input is operational.	
HIRAW	INT	High range of the CHIN1 to CHIN4 input signals.	
LORAW	INT	Low range of the CHIN1 to CHIN4 input signals.	
HIPV	REAL	Maximum permissible value of the high range of measurement in engineering units (PV output) corresponding to the maximum value (configured in the HIRAW input) of the CHIN1 to CHIN4 inputs. Used as the high range by default if the high range has not been modified from the monitoring subsystem (MAINPUT1_CFG.CHIPV).	
LOPV	REAL	Minimum permissible value of the low range of measurement in engineering units (PV output) corresponding to the minimum value (configured in the LORAW input) of the CHIN1 to CHIN4 inputs. Used as the low range by default if the low range has not been modified from the monitoring subsystem (MAINPUT1_CFG.CLOPV).	
MAXDEV	REAL	Maximum permissible standard deviation for showing a detected alarm.	
TONSP	TIME	Time for connecting the detected alarm due to standard deviation.	
TOFFSP	TIME	Time for disconnecting the detected alarm due to standard deviation.	
RSEL	INT	Enables to select the selection method as shown in the following table:	
		RSEL	PV is calculated as:
		0	First value of the possible PVx signals that are enabled and without a detected fault. (PV1 has maximum priority, PV4 has minimum priority).
		1	PV1
		2	PV2
		3	PV3
		4	PV4
		5	Median of signals enabled and without a detected fault.
		6	Average value of signals enabled and without a detected fault.
		7	Minimum value among the enabled PVx signals.
8	Maximum value among the enabled PVx signals.		

Outputs

Output Parameter Description

Parameter	Type	Description		
PV1..PV4	REAL	Calculated measurement value usually in engineering units.		
		The DFB calculates the PV _x measurement based on the value of the inputs and of the MAINPUT1_ST and MAINPUT1_CFG inputs/outputs. PV _x measurement is shown in the following table:		
		CHFAILURE _x	CHIN _x	PV _x is calculated as:
		ON	-	MAINPUT1_CFG.BADPV
		OFF	<= LORAW	MAINPUT1_CFG.CLOPV
		OFF	> LORAW and < HIRAW	Refer to the formula.
OFF	>= HIRAW	MAINPUT1_CFG.CHIPV		
PV	REAL	Value of the output (PV _x) selected with the input signal.		
ISGOOD	BOOL	1 = Indicates the following: <ul style="list-style-type: none">quality of the current selectionselection is correctchannel is functionalsimulation mode is inactive		
SELD	INT	Selected selection method.		
MEDIAN	REAL	Median of PV _x signals enabled and without a detected fault.		
AVG	REAL	Average of PV _x signals enabled and without a detected fault.		
DEV	REAL	Standard deviation of the channels that are enabled and without a detected fault.		
DEVALM	BOOL	1 = The standard deviation is higher than the maximum value specified with the MAXDEV input.		

Linear Scaling formula:

$$\left(\frac{(CHIPV - CLOPV)}{(HIRAW - LORAW)} \times CHIN_x \right) + CLOPV - \left(\frac{(CHIPV - CLOPV)}{(HIRAW - LORAW)} \times LORAW \right)$$

If the resulting value of the calculation is less than MAINPUT1_CFG.CUTOFFPV (and the signal comes from the CHIN_x input), the PV_x output is set to match the MAINPUT1_CFG.CLOPV input/output.

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
MAINPUT1_ST	MAINPUT1_ST_DDT	Provides the necessary data for monitoring the DFB status and configuring its simulation when required.
MAINPUT1_CFG	MAINPUT1_CFG_DDT	Provides the data needed to configure the DFB usually from the monitoring subsystem.

MAINPUT1_ST_DDT Type

Name	Type	Description
STW	WORD	Provides the device status usually used from the monitoring subsystem, and allows data to be kept in the memory. Read-only access to the data contained in this word.
CFGW	WORD	Provides the means to control the device from the monitoring subsystem. Read/write access to the data contained in this word.
PV	REAL	Read-only access Refer to the PV output pin, page 73.

MAINPUT1_CFG_DDT Type

Name	Type	Description
PV1	REAL	Read-only access Refer to the PV1 output pin, page 73.
PV2	REAL	Read-only access Refer to the PV2 output pin, page 73.
PV3	REAL	Read-only access Refer to the PV3 output pin, page 73.
PV4	REAL	Read-only access Refer to the PV4 output pin, page 73.
SIM	REAL	Read/write access Enables to select the value of the simulated measurement in engineering units.
CHIPV	REAL	High range of the measurement in engineering units (PV _x outputs) corresponding to the maximum value (configured in the HIRAW input) of the CHIN _x inputs. The maximum value that this variable can assume is limited by the value of the HIPV input. If the range entered from the monitoring system is incorrect (MAINPUT1_CFG.CLOPV = MAINPUT1_CFG.CHIPV = 0.0), it is initialized with the value of the HIPV input.
CLOPV	REAL	Low range of the measurement in engineering units (PV _x outputs) corresponding to the minimum value (configured in the HIRAW input) of the CHIN _x inputs. The minimum value that this variable can assume is limited by the value of the LOPV input. If the range entered from the monitoring system is incorrect (MAINPUT1_CFG.CLOPV = MAINPUT1_CFG.CHIPV = 0.0), it is initialized with the value of the LOPV input.
BADPV	REAL	Value needs to be used in engineering units (PV _x output signals) when the channel is not operational. The value that this variable can assume is limited by the range configured in engineering units (MAINPUT1_CFG.CLOPV and MAINPUT1_CFG.CHIPV). If the range entered from the monitoring system is incorrect (MAINPUT1_CFG.CLOPV = MAINPUT1_CFG.CHIPV = 0.0), it is initialized with the value of the HIPV input.
CUTOFFPV	REAL	Value (in engineering units) resulting from the scaling calculation and below which the value entered into the MAINPUT1_CFG.CLOPV input/output needs to be used as the measurement value (PV _x outputs). The value that this variable can assume is limited by the low range configured in engineering units (MAINPUT1_CFG.CLOPV).

Name	Type	Description
		If the range entered from the monitoring system is incorrect (MAINPUT1_CFG.CLOPV = MAINPUT1_CFG.CHIPV = 0.0), it is initialized with the value of the LOPV input.
PVW	WORD	Status word for the various PVx input channels.
LSEL	INT	Read/write access Enables to select the selection criterion of the operator (OWNER = 1) from the monitoring subsystem. As long as the set-point is defined by the Program (OWNER = 0), the DFB will update the value continuously.

MAINPUT1_ST.STW Word Structure

Bit	Name	Description
0	BADST	Indicates whether or not the input channel is operational. Reproduces the value of the CHFAILURE input if the CHIN input signal (EXTPVEN = 0) is used.
1	CHFAIL	One or more non-operational channel.
2	DEVALM	Refer to the DEVALM output pin, page 73.

MAINPUT1_ST.CFGW Word Structure

Bit	Name	Description
0	SIMMD	Read/write access Enables to put the analog input in Simulation (1) mode or Normal (0) mode.
1	OWNER	Read/write access Enables to configure whether the set-point is set by the Program (0) or Operator (1).

MAINPUT1_CFG.PVW Word Structure

Bit	Name	Description
0	PV1EN	PV1 selection enabled Enabled when a variable or value is connected to input CHIN1.
1	PV2EN	PV2 selection enabled Enabled when a variable or value is connected to input CHIN2.
2	PV3EN	PV3 selection enabled Enabled when a variable or value is connected to input CHIN3.
3	PV4EN	PV4 selection enabled Enabled when a variable or value is connected to input CHIN4.
4	PV1FAIL	Detected error on signal PV1. PV1EN = 1 and CHFAILURE1 = 1.
5	PV2FAIL	Detected error on signal PV2. PV2EN = 1 and CHFAILURE2 = 1.
6	PV3FAIL	Detected error on signal PV3. PV3EN = 1 and CHFAILURE3 = 1.
7	PV4FAIL	Detected error on signal PV4. PV4EN = 1 and CHFAILURE4 = 1.

Public Variables

Public Variable Description

Variable	Type	Description
SC	MAINPUT1_SC_DDT	Provides the frequently needed data to monitor the status of the DFB from the sequential control.

MAINPUT1_SC_DDT Type

Name	Type	Description
PV	REAL	Read-only access Refer to the PV output pin, page 73.
LSEL	INT	Read/write access. Enables to assign the local set-point usually for the sequential control if the owner is the Program (OWNER input/output is set to 0), and the selected set-point is Local (SC.REM public variable is set to 0). Otherwise, the current set-point (SELD output) is continuously copied to this variable.
ISGOOD	BOOL	Read-only access Refer to the ISGOOD output pin, page 73.
REM	BOOL	Read/write access Allows the DFB to be configured for a remote set-point -RSEL- (1) or local set-point -LSEL- (0).
OWNER	BOOL	Read/write access Refer to the MAINPUT1_ST.CGFW.OWNER input/output pin, page 73.

TOTAL - Totalizing Function

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Overview

This chapter describes the TOTAL DFB.

Description

General

The objective of TOTAL block is to perform totalizer calculation based on 3 inputs (analog signal, digital pulses, counter).

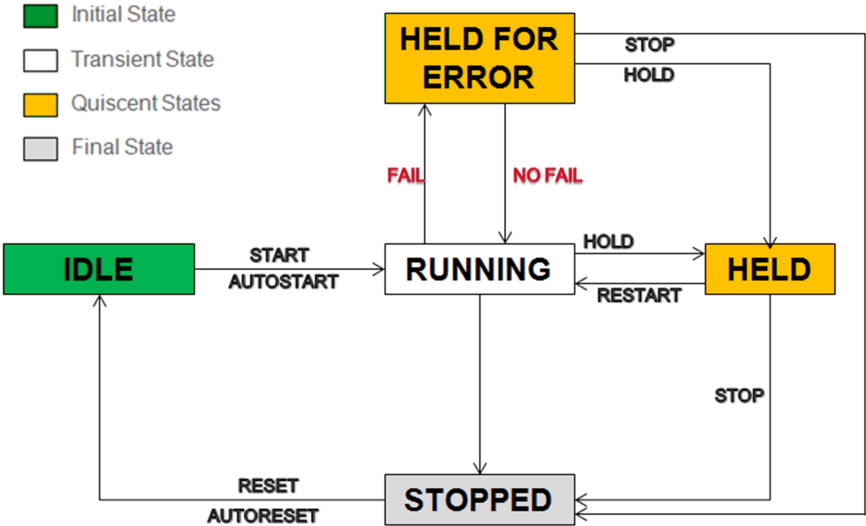
Function Description

The main functions of the DFB are described in the following table:

Function	Description
Control	Controls start and stop of totalization of the input from field equipment/instrument.
Owner selection	The DFB manages the control system level, as to which is the owner (operator or program). As a result, it is responsible for setting the setpoint for the desired position.
Totalizing	The totalization is done using trapezoidal rule algorithm for analog inputs, while it is summation for digital as well as counter values.
Monitoring	Enables the user to monitor the totalized value, last totalized value, setpoint and active operation state.
Processing states and Commands	The DFB processes the commands received from Supervision function and determines the active operation state.
Local and remote setpoint	Enables to monitor totalized value with the setpoint that is determined through a setpoint selector (local or remote). The local set-point is assigned to the sequential control or to command received from the monitoring system. At the same time, remote setpoint is assigned to DFB control from the logic implemented in continuous control.

State Chart

State chart explains the totalization operation



Commands and States

Command	State
DFB initialization	<i>IDLE</i>
Start	<i>IDLE → RUNNING</i>
Hold	<ul style="list-style-type: none"><i>RUNNING → HELD</i><i>HELD FOR ERROR → HELD</i>
Restart	<i>HELD → RUNNING</i>
Stop	<ul style="list-style-type: none"><i>HELD → STOPPED</i><i>HELD FOR ERROR → STOPPED</i>
Reset	<i>STOPPED → IDLE</i>
AutoReset	<i>STOPPED → IDLE</i> (automatically performs reset operation without consuming any extra execution cycle)
AutoStart	<i>IDLE → RUNNING</i> (automatically performs start operation without consuming any extra execution cycle)

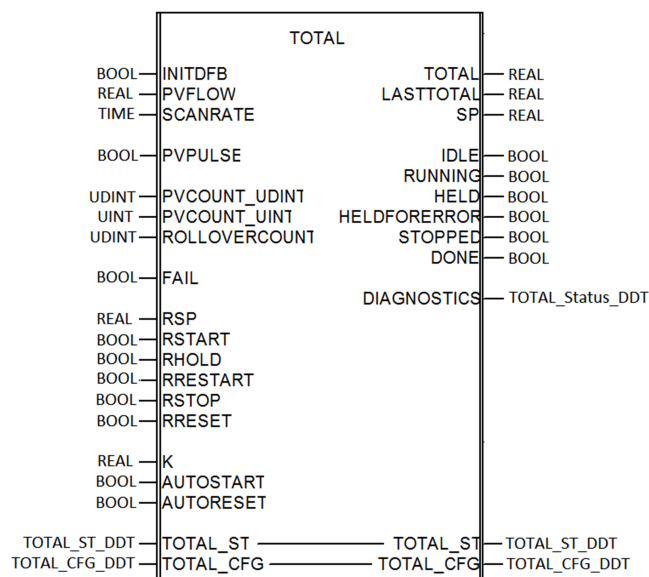
Commands and States with respect to *FAIL* Input pin

<i>FAIL</i> Input Pin Value	Last Active State	Command	Current Active State
0	<i>IDLE</i>	Start	<i>RUNNING</i>
0	<i>RUNNING</i>	Hold	<i>HELD</i>
0	<i>RUNNING</i>	Stop	<i>STOPPED</i>
0	<i>HELD</i>	Restart	<i>RUNNING</i>
0	<i>STOPPED</i>	Reset	<i>IDLE</i>
1	<i>IDLE</i>	Start	<i>HELD FOR ERROR</i>
1	<i>RUNNING</i>	-	<i>HELD FOR ERROR</i>
1	<i>HELD FOR ERROR</i>	Hold	<i>HELD</i>
1	<i>HELD FOR ERROR</i>	Stop	<i>STOPPED</i>
1	<i>HELD</i>	-	<i>HELD</i>
1	<i>STOPPED</i>	-	<i>STOPPED</i>
1	<i>STOPPED</i>	Reset	<i>IDLE</i>

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller



Inputs

Input Parameter Description

Parameter	Type	Description
INITDFB	BOOL	Rising edge on this input resets DFB internal timers, data, etc. NOTE: <ul style="list-style-type: none"> The input is not reset (0) by the DFB. The reference value is updated with the latest value.
PVFLOW	REAL	Process flow value of the measurement in engineering units. NOTE: <ul style="list-style-type: none"> It is mandatory to connect the input pin to either a variable or other blocks to use this DFB in this mode. Negative values of PV are not considered for totalization.
PVPULSE	BOOL	This input pin accepts series of pulses sent from the field equipment/instrument. NOTE: <ul style="list-style-type: none"> Only rising edge is considered. It is mandatory to connect the input pin to either a variable or other blocks to use this DFB in this mode.
PVCOUNT_UDINT	UDINT	This input pin accepts a count value of an unsigned double integer data type sent from the field equipment/instrument. NOTE: <ul style="list-style-type: none"> Only upcounter is supported. It is mandatory to connect the input pin to, either a variable or other blocks to use this DFB in this mode.

Parameter	Type	Description
		<ul style="list-style-type: none"> If <i>ROLLOVERCOUNT</i> is not declared then the rollover count is considered to be 4294967295 in this mode.
<i>PVCOUNT_UINT</i>	<i>UINT</i>	<p>This input pin accepts a count value of an unsigned integer data type sent from the field equipment/instrument.</p> <p>NOTE:</p> <ul style="list-style-type: none"> Only upcounter is supported. It is mandatory to connect the input pin to, either a variable or link to other blocks to use this DFB in this mode. If <i>ROLLOVERCOUNT</i> is not declared then the rollover count is considered to be 65535 in this mode.
<i>SCANRATE</i>	<i>TIME</i>	<p>Only applicable for <i>PVFLOW</i>. Allows the user to configure sample acquisition time. The DFB takes a sample each time, a time equal to or greater than the one configured for this input has elapsed. For calculation purposes, the time elapsed between one DFB execution and another is taken into account.</p> <p>NOTE: If no value provided, then default value T#1s is considered as <i>SCANRATE</i>. User need to verify that the DFB execution parameters are compatible with the time configured in <i>SCANRATE</i> parameter; this allows the DFB to run with a high frequency to carry out sampling with the configured time including latency time. In any case, the DFB considers any possible execution delays regarding the theoretical time adjusted in this parameter when it comes to calculations.</p>
<i>K</i>	<i>REAL</i>	<p>Conversion factor is applied to the totalizing calculation output. This allows the total to be calculated in the desired engineering units.</p> <p>NOTE:</p> <ul style="list-style-type: none"> Constant <i>K</i> is one time configuration. <i>K</i> is considered only when the DFB has a transition from <i>IDLE</i> state to <i>RUNNING</i> state. Negative integers are not valid. If <i>K</i>=0. Then, the default value taken will be 1.0. <p>For example, Case 1</p> <ul style="list-style-type: none"> <i>SCANRATE</i> = 1s Constant flow rate = 1 Litre per hour at 9.00 AM. <p>Totalized value in Litres at 11.00 AM is as below.</p> <p>AuxTotal is considered to be internal variable. Total is the output of DFB.</p> <p>$AuxTotal = 7200L \times \text{second} / \text{hr.}$</p> <p><i>K</i> to be configured as (second / hour) which turns out to be,</p> $K = (1/3600) = 0.00027$ $Total = AuxTotal \times K$ $Total = 7200 \times 0.00027$ <p>Total = 2 Litres.</p> <p>Case 2</p> <ul style="list-style-type: none"> Scanrate = 500ms Constant Flow rate = 1 Litre per hour at 9.00 AM. <p>User wants to see totalized value in Litres at 11.00 AM.</p> <p>AuxTotal is considered to be internal variable. Total is the output of DFB.</p> $AuxTotal = 14400 [(L \times 500ms)/hr.]$ <p><i>K</i> to be configured as (millisecond/hour).</p> $[(500 \times 0.001)/3600] = 0.000139$ $Total = AuxTotal \times K$

Parameter	Type	Description
		<p>Total = 14400×0.000139</p> <p>Total=2 Litres.</p>
<i>ROLLOVER-COUNT</i>	<i>UDINT</i>	<p>The rollover to be declared as the maximum PV value provided to the input pin of <i>PVCOUNT_UDINT</i> or <i>PVCOUNT_UINT</i>.</p> <p>NOTE:</p> <ul style="list-style-type: none"> It is mandatory to connect the input pin to, either a variable or link to other blocks to use this DFB in this mode. If <i>ROLLOVERCOUNT</i> is not declared then <ul style="list-style-type: none"> if <i>PVCOUNT_UDINT</i> is selected then rollover count is considered to be 4294967295. If <i>PVCOUNT_UINT</i> is selected then rollover count is considered to be 65535. If <i>ROLLOVERCOUNT</i> is not declared, also if <i>PVCOUNT_UDINT</i> is not selected or if <i>PVCOUNT_UINT</i> is not selected then rollover count is set to 0. If input value is greater than rollover count then totalizing is deemed to be valid. Although rollover is not considered after this scenario. In case the counter is restarted, wherein rollover is invalid, then user has to verify that the rising edge is triggered to <i>INITDFB</i> to reinitialize totalizing operation before providing new input to the DFB. The total value is not affected during reinitialize. <p>For example,</p> <p>Case 1: If rollover count is 10. The total when input value changes from 0 to 5 is, 5. Continuing, when input value changes from 5 to 9, the total will be 9. Further, when the input value rolls back from 9 to 1, the total will be 11.</p> <p>Case 2: If rollover count is not configured and <i>PVCOUNT_UINT</i> is selected. The total when input value changes from 0 to 5 is, 5. Continuing, when input value changes from 5 to 9, the total will be 9. Further, when the input value rolls back from 9 to 2, the total will be 65537.</p>
<i>FAIL</i>	<i>BOOL</i>	<p>A detected error in the device/ module is indicated to the DFB.</p> <p>NOTE: When channel becomes healthy, <i>TOTAL</i> starts to run automatically</p>
<i>RSTART</i>	<i>BOOL</i>	A rising edge sends a start command only when program/ remote-cascade mode is configured.
<i>RHOLD</i>	<i>BOOL</i>	A rising edge sends a hold command only when program/ remote-cascade mode is configured.
<i>RRESTART</i>	<i>BOOL</i>	A rising edge sends a restart command only when program/ remote-cascade mode is configured.
<i>RSTOP</i>	<i>BOOL</i>	A rising edge sends a stop command only when program/ remote-cascade mode is configured.
<i>RRESET</i>	<i>BOOL</i>	A rising edge sends a reset command only when program/ remote-cascade mode is configured.
<i>AUTORESET</i>	<i>BOOL</i>	When <i>STOPPED</i> state is reached, the function acts as it is receiving a <i>RESET</i> command automatically (without consuming any extra execution cycle). After <i>RESET</i> command, the operation will move to <i>IDLE</i> state

Parameter	Type	Description
<i>AUTOSTART</i>	<i>BOOL</i>	When <i>IDLE</i> state is reached, the function acts as it is receiving a <i>START</i> command automatically (without consuming any extra execution cycle). After <i>START</i> command, the operation will move to <i>RUNNING</i> state.
<i>RSP</i>	<i>REAL</i>	<p>This setpoint will be considered for processing <i>DONE</i> status.</p> <p>The remote set point is considered only if the below conditions are satisfied:</p> <ul style="list-style-type: none"> • <i>SC.REM</i> = 1 • Owner = Program <p>NOTE: The range of setpoint is:</p> <ul style="list-style-type: none"> • Lower value: 0.0 • Higher value: 999999999.9999999

NOTE: Priorities are set based on the inputs that are selected for totalization.

Default priorities set for the inputs:

- *PVFLOW* = 0
- *PVPULSE* = 1
- *PVCOUNT_UDINT* = 2
- *PVCOUNT_UINT* = 3

Lower the value, higher the priority, that is, 0 is the maximum priority. If more than one input is connected, detected configuration error occurs. During detected configuration error, totalization continues without any interruption based on the priorities of inputs that are set. Only during *IDLE* state the user can change the input priorities.

Outputs

Output Parameter Description

Parameter	Type	Description
<i>TOTAL</i>	<i>REAL</i>	<p>Present totalized value in engineering units. Refer Formula for Totalization topic for additional information.</p> <p>NOTE: <i>TOTAL</i> is reset to 0 when reset command given.</p>
<i>LASTTOTAL</i>	<i>REAL</i>	Holds the last <i>TOTAL</i> value when reset command is executed.
<i>SP</i>	<i>REAL</i>	Current set point.
<i>IDLE</i>	<i>BOOL</i>	Inactive operation. Waiting for <i>START</i> command to start totalizer operation.
<i>RUNNING</i>	<i>BOOL</i>	<i>RUNNING</i> state is reached after the <i>START</i> command is processed. Totalizer operation starts calculating.
<i>HELD</i>	<i>BOOL</i>	<i>HELD</i> state is reached after the <i>HOLD</i> command is processed. Totalizer operation is paused.
<i>HELDFORER-ROR</i>	<i>BOOL</i>	<p><i>HELDFORERROR</i> state is reached when failure is detected during <i>RUNNING</i> state, due to which totalizer operation is paused.</p> <p>NOTE: Totalizer operation runs automatically, if a failure is not detected during <i>HELDFORERROR</i> state considering latest PV as reference PV.</p>
<i>STOPPED</i>	<i>BOOL</i>	<i>STOPPED</i> state is reached after <i>STOP</i> command is processed. Requires an initialization command (<i>RESET</i>) to go to inactive (<i>IDLE</i>) state.
<i>DONE</i>	<i>BOOL</i>	<p><i>DONE</i> state will be high when present total value reaches <i>SP</i> (setpoint). Despite <i>DONE</i> state being high, <i>TOTAL</i> output will keep calculating/ totalizing.</p> <p>NOTE: <i>DONE</i> state is not applicable when setpoint is 0.</p>

Parameter	Type	Description
DIAGNOSTICS	TOTALStatus_DDT	Structure reporting the detected errors and status of the DFB.
	Parameter	Description
	KApplied	Value of <i>KApplied</i> is captured for calculation when the state of DFB is changed from <i>IDLE</i> state to <i>RUNNING</i> state.
	INFO	<p>A word with a series of bits reporting the detected errors and status of the DFB.</p> <p>NOTE: In case the user requires an alarm to be generated for conditions in the <i>INFO</i> word, the bit representing the detected error can be connected to the <i>CONDSUM</i> DFB, which in turn is connected to the <i>FAIL</i> input of <i>TOTAL</i> DFB.</p> <ul style="list-style-type: none"> Bit 0: Detected configuration error. <p>NOTE: This condition is true when:</p> <p>More than one input PV or no PV, which are <i>PVFLOW</i>, <i>PVPULSE</i>, <i>PVCOUNT_UDINT</i> and <i>PVCOUNT_UINT</i> are connected.</p> <p><i>PVCOUNT_UDINT</i>, <i>PVCOUNT_UINT</i> value is more than the configured value of <i>ROLLOVERCOUNT</i>.</p> Bit 1: Input <i>K</i> is not valid. <p>NOTE:</p> <ul style="list-style-type: none"> Range of <i>K</i> which can be configured is 0 to 1000 inclusive. <i>KNOTVALID</i> is checked only during <i>RUNNING</i> or <i>HELD</i> or <i>HELDFORERROR</i> state. PV value is not added to total, when the value of <i>K</i> is out of range. Bit 2: Rollover flag. <p>NOTE: True of bit represents <i>TOTAL</i> has crossed 999999999.99999999 The totalizing operation is reset automatically.</p> Bit 3: <i>PVFLOW</i> selected for totalization. Bit 4: <i>PVPULSE</i> selected for totalization. Bit 5: <i>PVCOUNT_UDINT</i> selected for totalization. Bit 6: <i>PVCOUNT_UINT</i> selected for totalization. Bit 7: Negative <i>PVFlow</i> value. <p>NOTE: PV value is not added to <i>TOTAL</i>, when <i>PVFlow</i> value is negative.</p>

Formula for Totalization

The Control function offers totalization of 3 type of inputs:

- Analog (*REAL*) - based on trapezoidal rule
$$\text{Aux} = (b-a) \times [f(b)+f(a)]/2$$

$$\text{AuxTotal} = \text{AuxTotal} + \text{Aux}$$

$$\text{Total} = \text{AuxTotal} \times K$$
- Digital Pulses (*BOOL*)
$$\text{AuxTotal} = \text{AuxTotal} + [\text{Rising edge (Digital input)}]$$

$$\text{Total} = \text{AuxTotal} \times K$$
- Counter (*LONG*)
$$\text{AuxTotal} = \text{AuxTotal} + (\text{Current} - \text{Last})$$

$$\text{Total} = \text{AuxTotal} \times K$$

Where:

b = Time in which the current sample is taken.

a = Time in which the previous sample was taken.

f(b) = Value of the current measurement.

f(a) = Value of the previous measurement.

NOTE: AuxTotal and Aux variables are used for internal calculation.

SP Calculation

Owner	SC.REM	Output SP is calculated as
Program	0 = OFF	SC.LSP (Local Set Point)
Program	1 = ON	SetPoint (Remote Setpoint from input pin of TOTAL DFB)
Operator	-	HMI/ faceplate of TOTAL function block

Inputs/Outputs

Inputs/Outputs Parameter Description

Parameter	Type	Description
TOTAL_ST	TOTAL_ST_DDT	Data structure holds the minimum information required for performing controlling and monitoring functions. The information used by the operator screen is readable and writable from the HMI/ SCADA system.
TOTAL_CFG	TOTAL_CFG_DDT	Provides the data necessary to configure the DFB (usually from the monitoring subsystem).

TOTAL_ST_DDT Type

Parameter	Type	Description
STATE	INT	Provides active state of the operation. Read-only access to the data is contained in the integer. State info: <ul style="list-style-type: none"> State = 1 (IDLE) State = 2 (RUNNING) State = 4 (HELD) State = 8 (HELDFOREERROR) State = 16 (STOPPED)
COMMAND	INT	Enable commands to perform operation from the Supervision system. Command Info: <ul style="list-style-type: none"> Command = 1 (Start) Command = 2 (Hold) Command = 4 (Restart) Command = 8 (Stop) Command = 16 (Reset)
STW	WORD	Status Word. <ul style="list-style-type: none"> Bit 0: REM (0= Local; 1=Remote). Bit 1: DONE Bit 2: Alarm (HELDFOREERROR)

Parameter	Type	Description
		<ul style="list-style-type: none"> Bit 3: Rollover flag. Refer <i>INFO</i> parameter in Output Parameter Description topic (see Modicon Libraries General Purpose, Process Components User Guide). Bit 4: <i>AUTOSTART</i> Bit 5: <i>AUTORESET</i>
<i>CFGW</i>	<i>WORD</i>	Provides the data needed to configure the DFB (usually from the monitoring system). Enables to configure whether the set-point is set by: <ul style="list-style-type: none"> Bit 0: Owner (0= Program; 1=Operator) Bit 3: Reset rollover flag
<i>TOTAL</i>	<i>REAL</i>	Present totalized value in engineering units. Refer Formula for Totalization topic for additional information (see Modicon Libraries General Purpose, Process Components User Guide).
<i>TOTALINT</i>	<i>UDINT</i>	Integer part of <i>TOTAL</i> in engineering units.
<i>TOTALDEC</i>	<i>REAL</i>	Decimal part of <i>TOTAL</i> in engineering units.
<i>SP</i>	<i>REAL</i>	<p>This variable indicates what the current set-point is, and is calculated internally in the DFB as long as the owner is not the operator.</p> <p>When owner is operator, the setpoint is configured from the HMI system.</p> <p>NOTE: The range of setpoint is:</p> <ul style="list-style-type: none"> Lower value: 0.0 Higher value: 999999999.9999999

TOTAL_CFG_DDT Type

Parameter	Type	Description
<i>LASTTOTAL</i>	<i>REAL</i>	The value on current total in engineering units when it was reset.
<i>LASTTOTALINT</i>	<i>UDINT</i>	Integer part of <i>LASTTOTAL</i> in engineering units.
<i>LASTTOTALDEC</i>	<i>REAL</i>	Decimal part of <i>LASTTOTAL</i> in engineering units.

Public Variables

Public Variable Description

Parameter	Type	Description
<i>SC</i>	<i>TOTAL_SC_DDT</i>	Provides the frequently needed data for monitoring and controlling of the DFB.

TOTAL_SC_DDTType

Parameter	Type	Description
<i>LSP</i>	<i>REAL</i>	<p>Enables to assign the local target set-point for the sequential control if the program is the owner (OWNER input/output = OFF) and the selected set point is local (SC.REM public variable = OFF). Otherwise, the current target set-point is continuously copied to this variable.</p> <p>NOTE: The range of setpoint is:</p> <ul style="list-style-type: none"> • Lower value: 0.0 • Higher value: 999999999.9999999
<i>TOTAL</i>	<i>REAL</i>	<p>Present totalized value in engineering units. Refer Formula for Totalization topic for additional information (see Modicon Libraries General Purpose, Process Components User Guide).</p> <p>NOTE: <i>TOTAL</i> is reset to 0 when reset command given.</p>
<i>PROPERTIES</i>	<i>WORD</i>	<p><i>WORD</i> bits are expressed as <i>RANKED</i> bit</p> <p>Bit0 (REM):</p> <ul style="list-style-type: none"> • 1 = Allows the DFB to consider commands from program remote mode. • 0 = Allows the DFB to consider commands from program local mode <p>Bit 1 (OWNER): Provides the data needed to configure the DFB usually from the monitoring subsystem. Enables to configure whether the set-point is set by</p> <ul style="list-style-type: none"> • 0 = Program • 1 = Operator <p>Bit 2 (START): Command to start the operation of the <i>TOTAL</i> DFB from <i>IDLE</i> to <i>RUNNING</i> state. It is only valid if the state is inactive (<i>IDLE</i>).</p> <p>Bit 3 (HOLD): Command to hold the operation of the <i>TOTAL</i> DFB from <i>RUNNING</i> to <i>HELD</i> or <i>HELDFORERROR</i> to <i>HELD</i> state</p> <p>Bit 4 (RESTART): Command to restart the operation of <i>TOTAL</i> DFB from <i>HELD</i> to <i>RUNNING</i> state.</p> <p>Bit 5 (STOP): Command to stop the operation of <i>TOTAL</i> DFB from <i>RUNNING</i> to <i>STOPPED</i> or <i>HELD</i> to <i>STOPPED</i> state.</p> <p>Bit 6 (RESET): Command to reset the operation of <i>TOTAL</i> DFB from <i>STOPPED</i> to <i>IDLE</i> State.</p> <p>Bit 7 (IDLE): Inactive operation. Waiting for <i>START</i> command to start totalizer operation.</p> <p>Bit 8 (RUNNING): <i>RUNNING</i> state is reached after the <i>START</i> command is processed. Totalizer operation starts calculating.</p> <p>Bit 9 (HELD): <i>HELD</i> state is reached after the <i>HOLD</i> command is processed. Totalizer operation is paused.</p> <p>Bit 10 (HELDFORERROR): <i>HELDFORERROR</i> state is reached when failure is detected during <i>RUNNING</i> state, due to which totalizer operation is paused.</p> <p>Bit 11 (STOPPED): <i>STOPPED</i> state is reached after <i>STOP</i> command is processed. Requires an initialization command (<i>RESET</i>) to go to inactive (<i>IDLE</i>) state.</p> <p>Bit 12 (CONFIGURATIONERROR): If more than one input is connected, detected configuration error occurs.</p> <p>Bit 13 (DONE): <i>DONE</i> state will be high when present total value reaches <i>SP</i> (setpoint). Total output will keep calculating/totalizing. <i>DONE</i> state is not applicable when setpoint is 0.</p>

On/Off Device Control

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Overview

This part provides a detailed description of the functions, pins, pin layout, and variables of the function blocks of the on/off device control family.

These function blocks do not reflect any specific installation.

⚠ WARNING

LOSS OF CONTROL

- Perform a Failure Mode and Effects Analysis (FMEA), or equivalent risk analysis, of your application, and apply preventive and detective controls before implementation.
- Provide a fallback state for undesired control events or sequences.
- Provide separate or redundant control paths wherever required.
- Supply appropriate parameters, particularly for limits.
- Review the implications of transmission delays and take actions to mitigate them.
- Review the implications of communication link interruptions and take actions to mitigate them.
- Provide independent paths for control functions (for example, emergency stop, over-limit conditions, and error conditions) according to your risk assessment, and applicable codes and regulations.
- Apply local accident prevention and safety regulations and guidelines.¹
- Test each implementation of a system for proper operation before placing it into service.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

¹ For additional information, refer to NEMA ICS 1.1 (latest edition), *Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control* and to NEMA ICS 7.1 (latest edition), *Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems* or their equivalent governing your particular location.

DEVCTL - On/Off Device

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Overview

This chapter describes the DEVCTL DFB.

Description

General

The DEVCTL DFB is used to manage on-off device-type control modules, such as on-off actuated valves and discrete motors (without variable-frequency drives).

The DFB allows management of the associated devices from the sequential control, the continuous control, and/or the monitoring subsystem. It depends on their configuration and the system needs.

User can supplement the DFB with the DEVMNT, CONDSUM, and CONDSUM1 DFB from the General Purpose Library.

Function Description

The main functions of the DFB are described in the following table:

Function	Description
Control	Controls the digital control signal of the element based on the configuration and the commands that the DFB receives according to the functions.
Owner selection	The DFB manages the control system level, which is the owner (operator or program). As a result, it is responsible for setting the set-point for the desired position.
Local and remote set-point	Enables to control the DFB with a set-point that is determined through a set-point selector (local or remote) in program owner. The local set-point is assigned from the sequential control while the remote set-point is assigned to the DFB control from the logic implemented in the continuous control.
Position detection	Allows to determine the actual position of the element to be controlled and monitored with the help of high and low limit switch.
Interlocking	The DFB gives a command to the device to move to the defined position in case of an active interlock. An interlock bypass function is available.
Simulation	The DFB can be switched to simulation mode. Thus, the actual position of the controlled device is considered to be the same as its desired position regardless of the signals received from the position detectors.

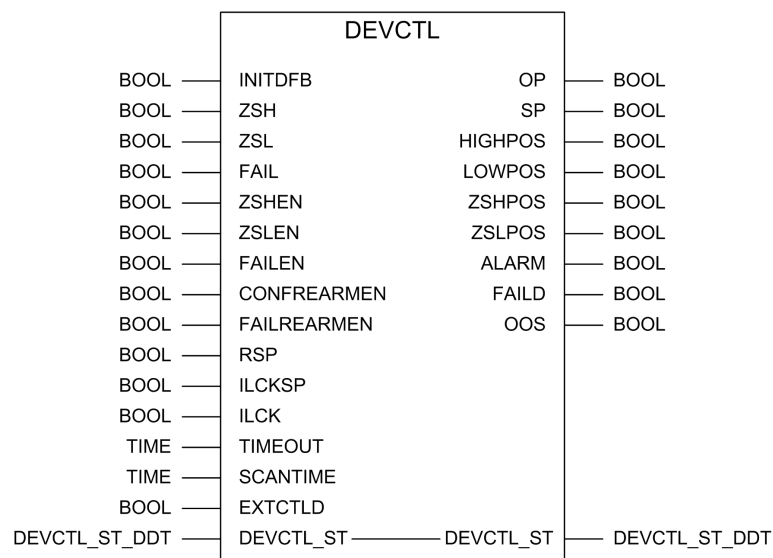
The optional functions of the DFB are described in the following table:

Function	Description
Inoperable device	Allows to monitor inoperable device condition (optional). DFB can be configured to withdraw output based on this condition.
Detection of unsuccessful operation	If position is unsuccessful within a configured time after the output command is activated, DFB detects unsuccessful operation.
Manual resetting	Allows you to reset manually after the detection of an inoperable device condition or a unsuccessful operation. After reset, device output will follow set point.

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
INITDFB	BOOL	If a rising edge is detected on this input, the internal timers of the block are reset and detected alarms are set to 0.
ZSH	BOOL	1 = Indicates to the DFB that high limit position is reached. Usually, it is used to connect the digital input of a positioner limit switch. Refer the ZSHEN input.
ZSL	BOOL	1 = Indicates to the DFB that low limit position is reached. Usually, it is used to connect the digital input of a positioner limit switch. Refer the ZSLEN input.
FAIL	BOOL	1 = Indicates to the DFB a detected error in the device. Usually used to connect the digital thermal trip input of a motor switch. Refer the FAILEN input.
ZSHEN	BOOL	1 = Enables ZSH position detector monitoring.
ZSLEN	BOOL	1 = Enables ZSL position detector monitoring.

Parameter	Type	Description
FAILEN	BOOL	1 = Enables the <code>FAIL</code> parameter.
CONFREARMEN	BOOL	<ul style="list-style-type: none"> 1 = Withdraws the output <code>OP</code> when a non-confirmed operation is detected (<code>ALARM</code> = 1) and requires a mandatory manual resetting once the <code>ALARM</code> condition disappears. 0 = The output <code>OP</code> remains in its previous state when a non-confirmed operation is detected (<code>ALARM</code> = 1) and does not need manual resetting once the <code>ALARM</code> condition disappears. <p>Refer the <code>TIMEOUT</code> input and the <code>DEVCTL_ST.STW.ALARM</code> input/output.</p>
FAILREARMEN	BOOL	<ul style="list-style-type: none"> 1 = Withdraws the output <code>OP</code> upon a detected error condition (<code>FAILD</code> = 1) and requires a mandatory manual resetting once the <code>FAIL</code> condition disappears. 0 = The output <code>OP</code> remains in its previous state upon a detected error condition (<code>FAILD</code> = 1) and does not need manual resetting once the <code>FAIL</code> condition disappears.
RSP	BOOL	Remote set-point by the continuous control.
ILCKSP	BOOL	1 = Set-point needs to be used when the DFB is interlocked. Refer to the <code>ILCK</code> input.
ILCK	BOOL	1 = Interlocks the device at the defined position. NOTE: If the device requires resetting (<code>STW.REAMR</code> = 1), the <code>OP</code> takes the value = 0 regardless of the <code>ILCKSP</code> value waiting for the operator to carry out the reset.
TIMEOUT	TIME	Enables to configure the maximum time that the device takes to reach defined position. When the output is triggered, if the limit switch is not detected even after the <code>TIMEOUT</code> time is elapsed. The device is switched to detected alarm state if the limit switch is not detected. When it has a value of 0, monitoring is deactivated.
SCANTIME	TIME	The minimum time for which the detected alarm signals are kept active. <code>SCANTIME</code> confirms that the supervision system acquires the data for detected alarms that are automatically reset.
EXTCTLD	BOOL	1 = Indicates to the DFB whether the device is being controlled from outside of the system. Monitoring of confirmation alarms is stopped during external control. The <code>FAIL</code> input continues to be evaluated.

Outputs

Output Parameter Description

Parameter	Type	Description
OP	BOOL	<p>1 = Command signal Active</p> <p>Allows the control signal of the device to be connected.</p> <p>Refer to the <code>OP</code> Calculation, page 91.</p>
SP	BOOL	<p>1 = Current device set-point</p> <p>Refer to the <code>SP</code> Calculation, page 92.</p>
HIGHPOS	BOOL	<p>1 = Determines if the device has reached the position corresponding to the set-point (<code>SP</code>) with a value of 1. It is evaluated by considering any detectors. Refer to the output <code>LOWPOS</code> and input/output <code>DEVCTL_ST.CFGW.SIMMD</code>, page 93.</p> <p>Refer the <code>HIGHPOS</code> and <code>LOWPOS</code> Calculation, page 92.</p>
LOWPOS	BOOL	<p>1 = Determines if the device has reached the position corresponding to the set-point (<code>SP</code>) with a value of 0. It is evaluated by considering any detectors. Refer to the output <code>HIGHPOS</code> and input/output <code>DEVCTL_ST.CFGW.SIMMD</code>, page 93.</p>

Parameter	Type	Description
		Refer to the HIGHPOS and LOWPOS Calculation, page 92.
ZSHPOS	BOOL	1 = Indicates whether the position corresponding to the set-point (SP) with a value of 1 has been reached. It is independent from the other detector if the ZSH detector is available. Refer to the ZSHPOS and ZSLPOS Calculation, page 92.
ZSLPOS	BOOL	1 = Indicates whether the position corresponding to the set-point (SP) with a value of 0 has been reached. It is independent of the other detector if the ZSL detector is available. Refer to the ZSHPOS and ZSLPOS Calculation, page 92.
ALARM	BOOL	1 = The detection of a unsuccessful operation has occurred. Refer the AArm Behavior , page 92 for monitoring details.
FAILD	BOOL	1 = Indicates an inoperable device. It is evaluated according to the value of the FAIL and FAILEN inputs. When it is activated, it is timed so that the signal is maintained for a minimum of SCANTIME . 0 = After the minimum activation time has passed, it is only deactivated if the FAIL input signal is deactivated. Refer to the FAILD Calculation, page 92.
OOS	BOOL	1 = Indicates the device is out of service.

OP Calculation

The evaluation of the device control depending on the interlock status, the current set-point, and if the DFB requires resetting is shown in the following table:

STW.REARMR	SC.ILCKD	ILCKSP	OP is calculated as:
ON	-	-	OFF
OFF	ON	ON	ON
OFF	ON	OFF	OFF
OFF	OFF	-	DEVCTL_ST.STW.SP

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- The **CONFREARMEN** pin has to be set to 1 for the **OP** pin to become 0, under non-confirmed operations.
- The **FAILREARMEN** pin has to be set to 1 for the **OP** pin to become 0, under detected error conditions.
- Changes to the configuration of these parameters have to be performed by competent personnel only.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

FAILEN input	FAILREARMEN input	OP output when FAIL = 1 (assume OP = 1 before the detected error)
0	0	1
0	1	1
1	0	1
1	1	0

SP Calculation

The signal evaluation depending on the `SC.REM` and `RSP` inputs and the `DEVCTL_ST.CFGW.OWNER` input/output is shown in the following table:

OWNER	REM	SP is calculated as
OFF	OFF	SC.LSP
OFF	ON	RSP
ON	-	DEVCTLST.CFGW.LSP

HIGHPOS and LOWPOS Calculation

ZSHEN	ZSLEN	SIMMD	HIGHPOS is calculated as:	LOWPOS is calculated as:
-	-	ON	OP	not OP
OFF	OFF	OFF	OP	not OP
ON	OFF	OFF	ZSH	not ZSH
OFF	ON	OFF	not ZSL	ZSL
ON	ON	OFF	ZSH and (not ZSL)	ZSL and (not ZSH)

ZSHPOS and ZSLPOS Calculation

The signal evaluation depending on the `ZSHEN` and `ZSLEN` inputs and the `DEVCTL_ST.CFGW.SIMMD` input/output is shown in the following table:

ZSHEN	ZSLEN	SIMMD	ZSHPOS is calculated as:	ZSLPOS is calculated as:
-	-	ON	OP	not OP
OFF	OFF	OFF	OP	not OP
OFF	ON	OFF	not ZSL	ZSL
ON	OFF	OFF	ZSH	not ZSH
ON	ON	OFF	ZSH	ZSL

FAILD Calculation

The signal evaluation depending on the `FAIL` and `FAILEN` inputs is shown in the following table:

FAIL	FAILEN	FAILD is calculated as:
-	OFF	OFF
OFF	ON	OFF
ON	ON	ON (minimum SCANTIME)

Alarm Behavior

Monitoring is carried out on the detector signals after they have been evaluated (`ZSHPOS` and `ZSLPOS`) according to the DFB configuration. It is activated when the control signal (`OP` output) switches (0 to 1 or 1 to 0) as long as the timer preselection value is greater than 0 (`TIMEOUT` input in) and the device is not being controlled externally (`EXTCTLD` to 1). After the control signal switching has

occurred, the DFB internal timer is activated. As long as the timer is running, the position of the device is not monitored. Once the time has elapsed, inoperable device condition causes the alarm to be activated.

The detected error signal is maintained for a minimum of `SCANTIME`. After the time has elapsed, the signal is recovered in the following conditions:

- If the detectors position (`HIGHPOS` and `LOWPOS`) becomes the desired position (according to the `OP` value) or
- If the device is reset (through the `DEVCTL_ST.CFGW.REARM` input/output, and as long as the `CONFREARMEN` input is `1`)

In both cases, the internal timer is restarted with the `TIMEOUT` value.

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
<code>DEVCTL_ST</code>	<code>DEVCTL_ST_DDT</code>	Data structure of the DFB status.

`DEVCTL_ST_DDT` Type

Name	Type	Description
<code>STW</code>	WORD	Provides the device status usually used from the monitoring subsystem, and allows data to be kept in the memory. Read-only access to the data contained in this word.
<code>CFGW</code>	WORD	Provides the means to control the device from the monitoring subsystem. Read-only access to the data contained in this word.

This table describes the `DEVCTL_ST.STW` word:

Bit	Name	Description
0	<code>ZSHPOS</code>	Refer to the <code>ZSHPOS</code> output pin, page 90.
1	<code>ZSLPOS</code>	Refer to the <code>ZSLPOS</code> output pin, page 90.
2	<code>SP</code>	Refer to the <code>SP</code> output pin, page 90.
3	<code>OP</code>	Refer to the <code>OP</code> output pin, page 90.
4	<code>ALARM</code>	Refer to the <code>ALARM</code> output pin, page 90.
5	<code>FAILD</code>	Refer to the <code>FAILD</code> output pin, page 90.
6	<code>REM</code>	Refer to the <code>REM REM</code> , page 95.
7	<code>ILCK</code>	Refer to <code>ILCK</code> input pin, page 89.

Bit	Name	Description
8	REARMR	<p>Indicates if the device requires resetting (1) after the detection of an inoperable device condition if it has been configured through the CONFREARMEN and/or FAILREARMEN inputs.</p> <p>The signal activation logic included in the DFB is as follows.</p> <pre> graph LR S1["(ALARM and CONFREARMEN) or (FAILD and FAILREARMEN)"] --> S S --> Q R1["CFGW.REARM"] --> R R --> Q Q --> AND OP --> AND NOT_FAILD["NOT FAILD"] --> AND AND --> STW_REARMR["STW.REARMR"] </pre>
9	EXTCTLD	<p>Read-only access</p> <p>Refer to EXTCTLD input pin, page 89.</p>

DEVCTL_ST.CFGW Word Structure

Bit	Name	Description
0	OWNER	<p>Read/write access</p> <p>Allows you to configure whether the setpoint is set by the program (0) or by the operator (1).</p>
1	ILCKBP	<p>Read/write access</p> <p>Enables the interlock to be bypassed (1).</p>
2	SIMMD	<p>Read/write access</p> <p>Enables the device to switch to Simulation mode to stop it from reading the actual position signals (ZSL and ZSH inputs). Also SIMMD simulates that the device is in the desired position (according to the OP output) and that it is functional (as if the FAIL input was reset (0)).</p>
3	REARM	<p>Write access</p> <p>Enables the device to reset (1). The DFB sets the signal to 0 after each run and sets the signal, which indicates that the resetting is required (CFGW.REARM) to 0.</p>
4	LSP	<p>Read/write access</p> <p>Enables the operator local setpoint (OWNER is 1) to be set from the monitoring subsystem. As long as the setpoint is set by the Program (OWNER is 0), the DFB continuously assigns it the value of the current setpoint (DEVCTL_ST.STW.SP input/output).</p>
15	OOS	<p>Out of Service</p> <p>Read/write access</p> <p>Enables to determine whether the device is out of service (1) or in use (0).</p>

NOTE: The outputs (SP and OP) are de-energized when the device is in an out-of-service state even if an interlock that requests the device to be started is active.

Public Variables

Public Variable Description

Variable	Type	Description
SC	DEVCTL_SC_DDT	Provides the frequently needed data to monitor the device status and to control it from the sequential control.

DEVCTL_SC_DDT Type

Name	Type	Description		
EXTCTLD	BOOL	Read-only access Refer to the EXTCTLD Input pin, page 89		
REM	BOOL	Read/write access 1 = Enables the DFB to be configured to remote set-point RSP 0 = Enables the DFB to be configured to local set-point LSP.		
LSP	BOOL	Read/write access 1 = Enables to assign the target local set-point usually for the sequential control if the owner is the Program (OWNER input/output is OFF) and the selected set-point is Local (SC.REM public variable is OFF). 0 = The block automatically assigns the current value of the resulting set-point. It is described as follows:		
		OWNER	REM	SC.LSP
		OFF (Program)	OFF	SC.LSP (last value or new value assigned from the sequential control)
		OFF	ON	SP (calculated from the RSP)
		ON (Operator)	ON	SP (last value or new value assigned by the Operator)
OP	BOOL	Read-only access Refer to the OP output pin, page 90.		
SP	BOOL	Read-only access Refer to the SP output pin, page 90		
HIGHPOS	BOOL	Read-only access Refer to the HIGHPOS output pin, page 90.		
LOWPOS	BOOL	Read-only access Refer to the LOWPOS output pin, page 90.		
ZSHPOS	BOOL	Read-only access Refer to the ZSHPOS output pin, page 90.		
ZSLPOS	BOOL	Read-only access Refer to the ZSLPOS output pin, page 90.		
ALARM	BOOL	Read-only access Refer to the DEVCTL_ST.STW.ALARM Input/output pin, page 93.		
FAILD	BOOL	Read-only access Refer to the DEVCTL_ST.STW.FAILD Input/output pin, page 93.		
REARMR	BOOL	Read-only access		

Name	Type	Description		
		Refer to the DEVCTL_ST.STW.REARMR Input/output pin, page 93.		
ILCKD	BOOL	Read-only access		
		The signal evaluation depending on the ILCK input and the DEVCTL_ST.CFGW.ILCKBP input/output is shown as follows:		
		ILCKD	ILCKBP	SC.ILCKD
		OFF	OFF	OFF
		OFF	ON	OFF
		ON	OFF	ON
ON	ON	OFF		
OWNER	REAL	Read-only access		
		Refer to the DEVCTL_ST.CFGW.OWNER Input/output pin, page 93.		
OOS	BOOL	Read-only access		
		Refer to the DEVCTL_ST.CFGW.OOS Input/output pin, page 93.		

DEVLP - Local Panel for Controlling On/Off Devices

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Overview

This chapter describes DEVLP DFB.

Description

General

The DEVLP DFB is used to manage a local panel that controls an on-off device (for example, an on-off motor) implemented with a DEVCTL (device control) function DFB and with signals that are connected to the controller so that the latter defines the target position of the device.

Function Description

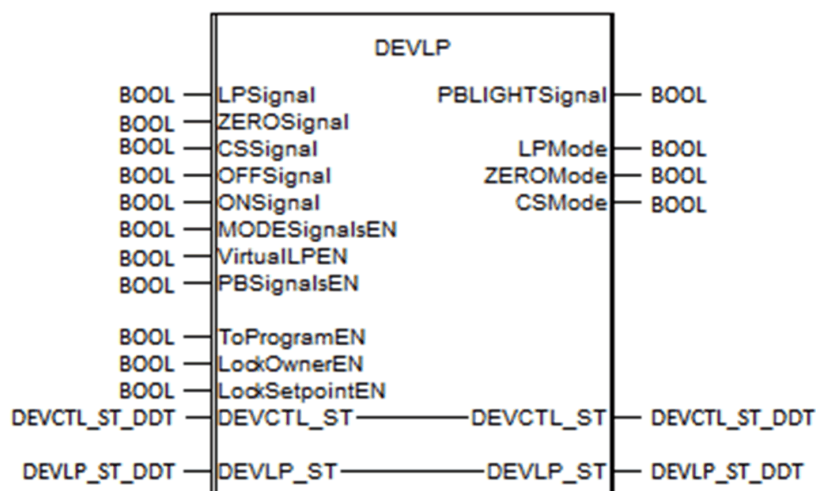
The main functions of the module are described in the following table:

Function	Description
Mode Switch	Optionally manages the signals coming from an operating mode switch in a local panel with the following configuration: Local - Zero - Control System. The Zero mode signal is optional. However the user can enable Local/Control System mode from the faceplate also, when <i>VirtualLPEN</i> input pin signal is high and <i>MODESignalsEN</i> signal is low in the DFB.
Push buttons	The DFB manages up to two signals coming from OFF and ON push buttons of local panel, giving the OFF push button higher priority.
Owner Management	The DFB enables to configure whether the Program needs to be the device owner or not, after switching to the Control System mode again.
Owner Locking	The DFB enables to configure whether the monitoring (HMI) system needs to block access to the drop-down list or not, it disables the access to change the owner (Operator/Program) while the device is controlled from the Local Panel.
Set-point Lock	The DFB enables to configure whether the monitoring (HMI) system needs to block access to the drop-down list or not. It disables to change the set-point while the device is controlled from the Local Panel.
Push button Enabling/Disabling	The push button signals from the Local Panel can be enabled/disabled through the DFB configuration (input pin) and/or from control sequences.
Enabled Panel Signaling	The DFB provides a signal that can be used to illuminate a light source on the Local Panel to indicate when the push buttons are enabled for operation.
Virtual Panel Enabling/Disabling	This signal enables the operator to select the Local / Control System mode of operation from the HMI so that the push button signals are enabled for operation. NOTE: <i>VirtualLPEN</i> input pin signal is applicable when Modicon Libraries - General Purpose is used along with Modicon Libraries - General Purpose for Wonderware System Platform.

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
LPSignal	BOOL	1 = The local panel mode switch is in the Local Panel position. Refer to the table included with the description of the <i>LPMode</i> output pin, page 100.
ZEROSignal	BOOL	1 = The local panel mode switch is in the zero position. This signal is optional even if a mode switch is available on the local panel. When this signal is a logical high, user is not allowed to operate the device from the faceplate and also from the DFB. Hence, all the functions in the faceplate will be disabled. Refer to the table included with the description of the <i>LPMode</i> output pin, page 100.
CSSignal	BOOL	1 = The local panel mode switch is in the Control System position. Refer to the table included with the description of the <i>LPMode</i> output pin, page 100.
OFFSignal	BOOL	1 = The OFF push button on the local panel is pressed. NOTE: OFF push button signal has higher priority than ON push button signal.
ONSignal	BOOL	1 = The ON push button on the local panel is pressed.
MODESignalsEN	BOOL	1 = Enables the use of the Local Panel/Zero/Control System (or Local Panel - Control System) mode switch on the local panel. usually configured in development phase based on the characteristics of the local panel being used. If the mode switch is enabled, the <i>LPSignal</i> , <i>ZEROSignal</i> , and <i>CSSignal</i> inputs are considered to determine the operating modes of the local panel. Refer to the table included with the description of the <i>LPMode</i> output pin, page 100. NOTE: <i>MODESignalsEN</i> input pin has higher priority than the <i>VirtualLPEN</i> input pin signal.
VirtualLPEN	BOOL	1 = This signal enables the operator to select the Local/Control System mode of operation from the HMI, so that the push button signals are enabled for operation.

Parameter	Type	Description																				
		<p>NOTE:</p> <ul style="list-style-type: none">When the owner is program, the Local/Control System mode selection drop-down list will be visible but disabled for operation however, when the owner is operator the Local Panel drop-down list will be accessible for operation.<i>VirtualLPEN</i> input pin signal is applicable only for Modicon Libraries - General Purpose for Wonderware System Platform offer only, however there is no impact of this input signal in Modicon Libraries - General Purpose for Citect SCADA offer. <p>Refer to the table included with the description of the <i>LPMode</i> output pin, page 100.</p>																				
PBSignalsEN	BOOL	<p>1 = Enables to accept the OFF and ON push button signals from the local panel. This signal is not applicable if the mode switch is enabled (refer to the <i>MODESignalsEN</i> input). It means that push button signals are considered when in Local Panel mode.</p> <p>When the mode switch is disabled (<i>MODESignalsEN</i> = 0), the <i>PBSignalsEN</i> signal enables/disables the push button signals from the control system itself based on the relevant process conditions. The <i>SC.DISABLELP</i> public variable is also considered for determining whether the push buttons are enabled or not when <i>LPMode</i> pin signal is high, as shown in the following table.</p> <table><tr><th><i>MODESignalsEN</i></th><th><i>PBSignal-sEN</i></th><th><i>SC.Disa-bleLP</i></th><th>Push buttons enabled?</th></tr><tr><td>OFF</td><td>OFF</td><td>-</td><td>NO</td></tr><tr><td>OFF</td><td>-</td><td>ON</td><td>NO</td></tr><tr><td>OFF</td><td>ON</td><td>OFF</td><td>YES</td></tr><tr><td>ON</td><td>-</td><td>-</td><td>YES</td></tr></table> <p>Therefore, this signal can be used to enable/disable the push buttons on a simple local panel that does not feature a mode switch (Local Panel/Zero/Control System) based on relevant process conditions.</p>	<i>MODESignalsEN</i>	<i>PBSignal-sEN</i>	<i>SC.Disa-bleLP</i>	Push buttons enabled?	OFF	OFF	-	NO	OFF	-	ON	NO	OFF	ON	OFF	YES	ON	-	-	YES
<i>MODESignalsEN</i>	<i>PBSignal-sEN</i>	<i>SC.Disa-bleLP</i>	Push buttons enabled?																			
OFF	OFF	-	NO																			
OFF	-	ON	NO																			
OFF	ON	OFF	YES																			
ON	-	-	YES																			
ToProgramEN	BOOL	<p>1 = Enables the functionality to change the owner from operator to program, only when the mode is switched to control system mode. Refer to the table included with the description of the <i>LockOwnerEN</i> input.</p>																				
LockOwnerEN	BOOL	<p>1 = Disables the access of changing the owner from HMI while the mode switch is in local panel. The following table depicts how the on-off device owner is evaluated based on <i>ToProgramEN</i>, <i>LockOwnerEN</i> input signals and the local panel operating mode:</p> <table><tr><th>Local Panel Mode</th><th><i>ToProgra-mEN</i></th><th><i>LockOw-nerEN</i></th><th>Owner</th></tr><tr><td>Zero mode</td><td>-</td><td>-</td><td>Operator</td></tr><tr><td>Switch to Local Panel</td><td>-</td><td>-</td><td>Operator</td></tr><tr><td>Local Panel</td><td>-</td><td>ON</td><td>Operator</td></tr><tr><td>Switch to Control System</td><td>ON</td><td>-</td><td>Program</td></tr></table> <p>In remaining cases, owner of the on/off device ceases to be defined from the <i>DEVLP</i> DFB and it enables to change it from monitoring (HMI) system with the command word in <i>DEVCTL_ST.CFGW</i> input/output of the corresponding <i>DEVCTL</i> DFB.</p> <p>In any case, consider that, the device owner that had been set before switching to the local panel mode is not memorized.</p>	Local Panel Mode	<i>ToProgra-mEN</i>	<i>LockOw-nerEN</i>	Owner	Zero mode	-	-	Operator	Switch to Local Panel	-	-	Operator	Local Panel	-	ON	Operator	Switch to Control System	ON	-	Program
Local Panel Mode	<i>ToProgra-mEN</i>	<i>LockOw-nerEN</i>	Owner																			
Zero mode	-	-	Operator																			
Switch to Local Panel	-	-	Operator																			
Local Panel	-	ON	Operator																			
Switch to Control System	ON	-	Program																			
LockSetpoint-EN	BOOL	<p>1 = Disables the access to set point of on/off devices in the monitoring (HMI) system when it is in local panel mode only, and the owner is operator.</p> <p>Therefore, user can activate this signal to lock setpoint operation from the monitoring (HMI) system while on/off device is controlled from the local panel.</p>																				

Outputs

Output Parameter Description

Parameter	Type	Description																																																																																																									
PBLIGHT-Signal	BOOL	1 = The push buttons on the local panel are fully operational, that is, the local panel is in Local Panel mode (either because the mode is selected with the corresponding switch or because the push buttons are enabled in the event that there is no selector switch available or the <i>VirtualLPEN</i> is high with the local panel mode enabled).																																																																																																									
LPMode	BOOL	1 = The local panel mode is in Local Panel. The following table depicts how the local panel operating mode is determined based on the <i>MODESignalsEN</i> , <i>VirtualLPEN</i> , <i>PBSignalsEN</i> , <i>LPSignal</i> , <i>CSSignal</i> and <i>ZEROSignal</i> , input signals:																																																																																																									
		<table><tr><th>MOD-ESignalsEN</th><th>Virtual-LPEN</th><th>PBSignalsEN</th><th>LPSignal</th><th>CSSignal</th><th>ZERO-Signal</th><th>OUTPUT</th></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>CS mode</td></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>Zero mode</td></tr><tr><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>LP mode and PBLIGHT-Signal</td></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>CS mode</td></tr><tr><td>0</td><td>1</td><td>1</td><td>NA</td><td>NA</td><td>NA</td><td>CS mode</td></tr><tr><td>0</td><td>1</td><td>0</td><td>NA</td><td>NA</td><td>NA</td><td>CS mode</td></tr><tr><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>LP mode and PBLIGHT-Signal</td></tr><tr><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>LP mode and PBLIGHT-Signal</td></tr><tr><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>Zero mode</td></tr><tr><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>Zero mode</td></tr><tr><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>CS mode</td></tr><tr><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>CS mode</td></tr><tr><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>CS mode</td></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>Zero mode</td></tr></table>	MOD-ESignalsEN	Virtual-LPEN	PBSignalsEN	LPSignal	CSSignal	ZERO-Signal	OUTPUT	0	0	0	0	0	0	CS mode	1	0	0	0	0	0	Zero mode	1	0	0	1	0	0	LP mode and PBLIGHT-Signal	1	0	0	0	1	0	CS mode	0	1	1	NA	NA	NA	CS mode	0	1	0	NA	NA	NA	CS mode	0	0	1	0	0	0	LP mode and PBLIGHT-Signal	1	1	0	1	0	0	LP mode and PBLIGHT-Signal	1	1	0	0	0	0	Zero mode	1	1	0	0	0	1	Zero mode	1	1	0	0	1	0	CS mode	1	0	1	0	1	0	CS mode	1	1	1	0	1	0	CS mode	1	0	0	0	0	1	Zero mode
		MOD-ESignalsEN	Virtual-LPEN	PBSignalsEN	LPSignal	CSSignal	ZERO-Signal	OUTPUT																																																																																																			
		0	0	0	0	0	0	CS mode																																																																																																			
		1	0	0	0	0	0	Zero mode																																																																																																			
		1	0	0	1	0	0	LP mode and PBLIGHT-Signal																																																																																																			
		1	0	0	0	1	0	CS mode																																																																																																			
		0	1	1	NA	NA	NA	CS mode																																																																																																			
		0	1	0	NA	NA	NA	CS mode																																																																																																			
		0	0	1	0	0	0	LP mode and PBLIGHT-Signal																																																																																																			
		1	1	0	1	0	0	LP mode and PBLIGHT-Signal																																																																																																			
		1	1	0	0	0	0	Zero mode																																																																																																			
		1	1	0	0	0	1	Zero mode																																																																																																			
		1	1	0	0	1	0	CS mode																																																																																																			
		1	0	1	0	1	0	CS mode																																																																																																			
		1	1	1	0	1	0	CS mode																																																																																																			
1	0	0	0	0	1	Zero mode																																																																																																					
ZEROMode	BOOL	1 = The local panel mode is in Zero. User is not allowed to operate the device from the faceplate and also from DFB. Hence, all the functions in the faceplate will be disabled. Refer to the table included with the description of the <i>LPMode</i> output.																																																																																																									
CSMode	BOOL	1 = The local panel mode is in Control System. Refer to the table included with the description of the <i>LPMode</i> output.																																																																																																									

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
DEVCTL_ST	DEVCTL_ST_DDT, page 93	Data structure corresponding to the on-off device is to be controlled from the local panel (for detailed information regarding this structure, refer to the DEVCTL DFB, page 88. The structure provides the information needed for the operation of the DEVLP DFB and enables this DFB to control the owner and set-point for the on-off device.
DEVLP_ST	DEVLP_ST_DDT	Data structure is used as an interface with the monitoring (HMI) system.

DEVCTL_ST.CFGW Type

The following table describes the logic applied to the signals controlled from the DEVLP DFB:

Name	Type	Description
CFGW	WORD	Provides the means to control the device from the monitoring (HMI) system. Read-only access to the data contained in this word.

DEVCTL_ST.CFGW Word

The following table describes the DEVCTL_ST.CFGW word:

Bit	Name	Description																								
0	OWNER	<p>Read/write access</p> <p>Enables to configure whether the set-point is set by the Program (0) or by the Operator (1).</p> <p>Refer to the following table included with the description of the <code>LPMode</code> output, which specifies the cases in which the <code>DEVLP</code> DFB can interact with this signal.</p>																								
4	LSP	<p>It is a device command which has read write access. Allows the local set-point of the Operator (<code>OWNER</code> is 1) to be set from the monitoring (HMI) system. As long as the set-point is set by the Program (<code>OWNER</code> = 0), the DFB continuously assigns it the value of the current set-point (<code>DEVCTL_ST.STW.SP</code> input/output).</p> <table><tr><th>The <code>DEVLP</code> DFB determines the set-point for the On-Off</th><th>Owner</th><th>OFFSignal</th><th>ONSignal</th><th>Lock-Set-PointEN</th><th>LSP is calculated as:</th></tr><tr><td>0</td><td>- The Owner signal is forced to 1 (Operator).</td><td>-</td><td>-</td><td>-</td><td>OFF</td></tr><tr><td>Local Panel</td><td>Operator</td><td>ON</td><td>-</td><td>-</td><td>OFF</td></tr><tr><td>Local Panel</td><td>Operator</td><td>OFF</td><td>Switch to ON</td><td>-</td><td>ON</td></tr></table>	The <code>DEVLP</code> DFB determines the set-point for the On-Off	Owner	OFFSignal	ONSignal	Lock-Set-PointEN	LSP is calculated as:	0	- The Owner signal is forced to 1 (Operator).	-	-	-	OFF	Local Panel	Operator	ON	-	-	OFF	Local Panel	Operator	OFF	Switch to ON	-	ON
The <code>DEVLP</code> DFB determines the set-point for the On-Off	Owner	OFFSignal	ONSignal	Lock-Set-PointEN	LSP is calculated as:																					
0	- The Owner signal is forced to 1 (Operator).	-	-	-	OFF																					
Local Panel	Operator	ON	-	-	OFF																					
Local Panel	Operator	OFF	Switch to ON	-	ON																					

Bit	Name	Description					
		Local Panel	Operator	OFF	OFF	ON	Last Value
		In other cases, the LSP signal is not modified from the DEVLP DFB					

DEVLP_ST.CFGW Word

Bit	Name	Description
0	<i>LocalModeOn</i>	Read/write access <ul style="list-style-type: none"> 1 = Enables the Local Panel mode. 0 = Enables the Control System mode.

DEVLP_ST.DDT Type

Name	Type	Description
STW	WORD	Read-only access Bits word with the local panel status.

DEVLP_ST.STW Word

Read-only access. Bits word with input conditions (refer to the CONDxx inputs) and their evaluation summary (refer to the ILCK output). The following table describes the DEVLP_ST.STW word:

Bit	Name	Description
0	LPMODE	Local panel in Local Panel mode. Refer to the LPMODE .
1	ZEROMODE	Local panel in zero mode. Refer to the ZEROMODE .
2	CSMODE	Local panel in Control System mode. Refer to the CSMODE .
3	LockedOwner	Indicates whether the owner change buttons in monitoring (HMI) system needs to be locked (1) or not (0). Is activated when: <ul style="list-style-type: none"> The Local Panel is set to zero mode. The local panel is set to local panel mode and the <i>LockOwnerEN</i> input signal has been configured as active (1).
4	SPLocked	Indicates whether the set-point change buttons in the monitoring (HMI) system should be locked (1) or not (0). Is activated when: <ul style="list-style-type: none"> The Local Panel is set to zero mode. The local panel is set to local panel mode and the <i>LockSetpointEN</i> input signal has been configured as active (1).
5	MODESignalsEN	Indicates the state of the MODESignalsEN input signal, that is, whether there is a mode switch (1) or not (0).
6	PBEnabled	Indicates whether the push buttons of the local panel are enabled (1) or not (0). The signal is activated when at least one of the MODESignalsEN and PSignalsEN signal inputs is active.
7	VirtualLPEN	Enables the drop-down list for the Local Panel / Control System mode selection.
8	LPSignal	Indicates the state of the LPSignal input signal.
9	ZEROSignal	Indicates the state of the ZEROSignal input signal.

Bit	Name	Description
10	CSSignal	Indicates the state of the CSSignal input signal.
11	OFFSignal	Indicates the state of the OFFSignal input signal.
12	ONSignal	Indicates the state of the ONSignal input signal.

Public Variables

Public Variable Description

Variable	Type	Description
SC	DEVLP_SC_DDT	Provides the frequently needed data for monitoring and controlling the DFB.

DEVLP_SC_DDT Type

Name	Type	Description
LPMode	BOOL	Read-only access Refer to the LPMode output pin, page 100.
ZEROMode	BOOL	Read-only access Refer to the ZEROMode output pin, page 100.
CSMode	BOOL	Read-only access Refer to the CSMode output pin, page 100.
DisableLP	BOOL	Read/write access 1 = Disables the push buttons on the local panel. Only applicable when a local panel without mode switch configuration is used (MODESignalSEN = 0).

DEVMNT - Device Maintenance

What's in This Chapter

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Overview

This chapter describes the DEVMNT DFB.

Description

General

The DEVMNT DFB is used to provide data that is useful for device maintenance.

You can use this DFB as a supplement to the DEVCTL DFB or independently. This DFB allows the incorporation of totalizing functions for hours of operation and switching operations.

Function Description

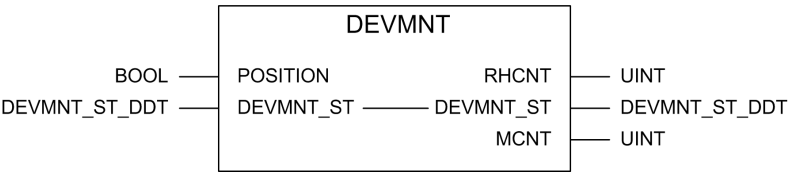
The main functions of the DFB are described in the following table:

Function	Description
Switching Operation Totalization	Counts the number of switching operations that have been performed on the device since the totalizer last reset.
Hours of Operation Totalization	Counts the number of hours of operation that the device has been in operation since the totalizer last reset.
Reset	The DFB allows to reset the described totalizers individually.

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
POSITION	BOOL	1 = ON (running, open, and so on) Provides the device status information with which the totalizers are calculated.

Outputs

Output Parameter Description

Parameter	Type	Description
RHCNT	UINT	Totalizes the number of hours device is in running operation. The calculation is done based on the position indicator of the device shown by the POSITION input.
MCNT	UINT	Totalizes the number of switching operations that the device has performed. The calculation is done based on the position indicator of the device shown by the POSITION input. A new switching operation is added each time a rising edge is detected.

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
DEVMT_ST	DEVMT_ST_DDT	Data structure that is used as an interface with the monitoring subsystem.

DEVMT_ST_DDT Type

Name	Type	Description
STW	WORD	Provides the DFB status usually used from the monitoring subsystem. Read-only access to the data contained in this word.
CFGW	WORD	Provides the means to control the DFB. Read-only access to the data contained in this word.
RHCNT	UINT	Read-only access Refer to the RHCNT output pin, page 105.
MCNT	UINT	Read-only access Refer to the MCNT output pin, page 105.

DEVMNT_ST.STW Word Structure

Bit	Name	Description
0	HOV	HOV is activated when the hours counter exceeds the maximum representable value (65535). Is deactivated through DEVMNT_ST.STW.RSTH.
1	MOV	MOV is activated when the switching operations counter exceeds the maximum representable value (65535). Is deactivated through DEVMNT_ST.STW.RSTM.

DEVMNT_ST.CFGW Word Structure

Bit	Name	Description
0	RSTH	Enables to reset the hours of operation totalizer. Also resets the internal seconds subtotal from the last hour of operation fraction and from the DEVMNT_ST.HOV signal. The DFB sets this signal to 0 after it has been processed.
1	RSTM	Enables to reset the switching operation totalizer. Also resets the DEVMNT_ST.MOV signal. The DFB sets this signal to 0 after it has been processed.

Public Variables

Public Variable Description

Variable	Type	Description
SC	DEVMNT_SC_DDT	Provides the frequently needed data to monitor the DFB status from the sequential control.

DEVMNT_SC_DDT Type

Name	Type	Description
RHCNT	UINT	Read-only access Refer to the DEVMNT_ST.RHCNT input/output pin, page 105.
MCNT	UINT	Read-only access Refer to the DEVMNT_ST.MCNT input/output pin, page 105.

DUALOP - Dual Output

What's in This Chapter

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Overview

This chapter describes the DUALOP DFB.

Description

General

The DUALOP is used to generate continuous or pulse type digital output based on digital input and different modes of configuration.

Function Description

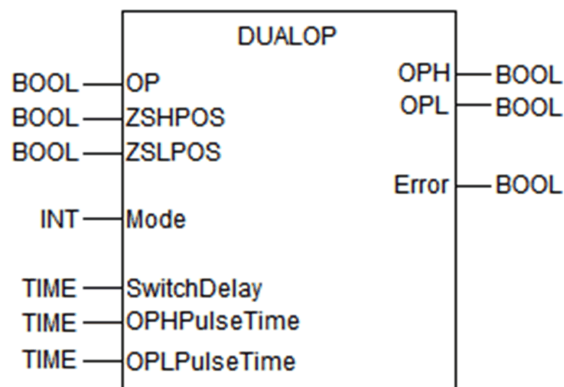
The main functions of the DFB are described in the following table:

Function	Description
Digital Input	The DFB can generate two outputs based on one logical input.
Operating modes	<p>The DFB provides continuous or pulse type digital output based on the digital input, limit switches and selected mode.</p> <p>This control function provides five different modes of operation:</p> <ul style="list-style-type: none"> MODE 0: Continuous (continuous start/open or stop/close command). <ul style="list-style-type: none"> When an input is set to true, OPH is set to true. When an input is set to false, OPL is set to true. After initialization, outputs are triggered based on the input signal. MODE 1: Pulse based on continuous input signal (pulse type start/open or stop/close command). <ul style="list-style-type: none"> When input OP is set to true, OPH is set to true for the defined pulse duration (OPHPulseTime). When input OP is set to false, OPL is set to true for the defined pulse duration (OPLPulseTime). Outputs (OPH or OPL) should always follow the state of input (OP) signal condition. After initialization, outputs are triggered based on the input signal. MODE 2: Pulse based on input rising/falling trigger (pulse type start/open or stop/close command). <ul style="list-style-type: none"> When input OP is set to true, OPH is set to true for the defined pulse duration (OPHPulseTime). When input OP is set to false, OPL is set to true for the defined pulse duration (OPLPulseTime). After initialization, outputs (OPH or OPL) are set to low. The outputs are triggered by getting new command/transition in the input. MODE 3: Till position is confirmed (release the start/open or stop/close command once the position is reached). <ul style="list-style-type: none"> When input OP is set to true, OPH is set to true until the high position (ZSHPOS) is reached. When input OP is set to false, OPL is set to true until the low position (ZSLPOS) is reached. After initialization, outputs (OPH or OPL) are triggered based on the input signal and position feedback signals. MODE 4: Till position is confirmed + extra time (release the start/open or stop/close command once the position is reached + extra pulse time to stroke the output) <ul style="list-style-type: none"> When input OP is set to true, OPH is set to true until the high position (ZSHPOS) is reached + defined pulse time duration (OPHPulsetime). When input OP is set to false, OPL is set to true until the low position is reached (ZSLPOS) + defined pulse time duration (OPLPulsetime). After initialization, outputs (OPH or OPL) are triggered based on the input signal and position feedback signals. <p>NOTE: For invalid entry of MODE (for example, MODE < 0 or MODE > 4) the DFB defaults to MODE 0.</p>

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
OP	BOOL	Digital input signal This input signal will be linked to the output signal <code>OP</code> from the device management blocks.
ZSHPOS	BOOL	High position status 1 = High position confirmed
ZSLPOS	BOOL	Low position status 1 = Low position confirmed
MODE	INT	This input is used to select the operating modes of the <code>DUALOP</code> DFB. Initialization is triggered whenever there is a <code>MODE</code> change. Valid entry is 0, 1, 2, 3, and 4, refer to Functional Description (see Modicon Libraries General Purpose, Process Components User Guide)
SWITCH-DELAY	TIME	This input is used to set a delay between output switching. Default value will be 0 seconds. For the delay duration set in this input, both the outputs will be low. Then after the delay, output (<code>OPH</code> or <code>OPL</code>) gets triggered based on the selected mode and input signal condition.
OPHPulseTime	TIME	This input is used to set the pulse time duration for which output <code>OPH</code> will be high, when the input signal (<code>OP</code>) is high. Once the pulse time duration elapses, the output <code>OPH</code> will go low and both the outputs remain low.
OPLPulseTime	TIME	This input is used to set the pulse time duration for which output <code>OPL</code> will be high, when the input signal (<code>OP</code>) is low. Once the pulse time duration elapses, the output <code>OPL</code> will go low and both the outputs remain low.

Outputs

Outputs Parameter Description

Parameter	Type	Description
OPH	BOOL	This output will be high when the Input signal OP is high. Duration of OPH remaining in high status depends on the operating mode selected.
OPL	BOOL	This output will be high when the Input signal OP is low. Duration of OPL remaining in high status depends on the operating mode selected.
ERROR	BOOL	<p>This output is generated when there is a detected configuration error in the DUALOP control function.</p> <ul style="list-style-type: none">• In MODE 1, MODE 2 and MODE 4, ERROR is high if OPHPulseTime or OPLPulseTime is set as 0 seconds.• In MODE 3 and MODE 4, ERROR is high if ZSHPOS and ZSLPOS input pins are not linked or assigned.

HVALVE - Manual Valve

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Overview

This chapter describes the HVALVE DFB.

Description

General

The main objective of the HVALVE DFB is to manage valves without actuators and with 1 or 2 limit switches or any other type of positioner with 2 final positions.

User can supplement this DFB with DINPUT DFBs from the General Purpose Library. It enables you to incorporate conditioning functions for the digital signals of the limit switches.

Function Description

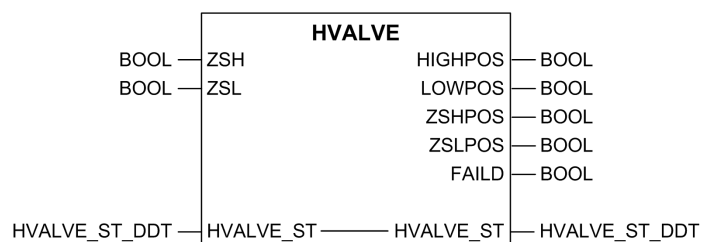
The main functions of the DFB are described in the following table:

Function	Description
Position Detection	Allows to determine the actual position of the element to be controlled and monitored with the help of high and low limit switch.
Simulation	The DFB can be switched to simulation mode. Thus, the actual position of the controlled device is considered to be the same as its desired position regardless of the signals received from the position detectors.

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
ZSH	BOOL	1 = Indicates to the DFB that high limit position is reached. Usually, it is used to connect the digital input of a positioner high limit switch. The input pin is considered, if an input parameter is connected or linked.
ZSL	BOOL	1 = Indicates to the DFB that low limit position is reached. Usually, it is used to connect the digital input of a positioner low limit switch. The input pin is considered, if an input parameter is connected or linked.

Outputs

Output Parameter Description

Parameter	Type	Description				
HIGHPOS	BOOL	1 = Determines the device has reached the open-valve position considering the status of the connected detectors and/or the simulated status. Refer to the following table.				
LOWPOS	BOOL	1 = Determines the device has reached the closed-valve position considering the status of the connected detectors and/or the simulated status. Refer to the following table:				
		ZSH connected	ZSL connected	SIMMD	HIGHPOS is calculated as:	LOWPOS is calculated as:
		-	-	ON	ZSSIM	not ZSSIM
		OFF	OFF	OFF	OFF	OFF
		ON	OFF	OFF	ZSH	not ZSH
		OFF	ON	OFF	Not ZSL	ZSL
		ON	ON	OFF	ZSH and not ZSL	ZSL and not ZSH
ZSHPOS	BOOL	1 = Indicates the high position has been reached based on the detector connected on ZSH.				
ZSLPOS	BOOL	1 = Indicates the low position has been reached based on the detector connected on ZSL.				
FAILD	BOOL	1 = Indicates an inoperable device when the ZSH and ZSL inputs are active at the same time.				

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
HVALVE_ST	HVALVE_ST_DDT	Provides the data necessary to monitor the DFB status.

HVALVE_ST_DDT Type

Name	Type	Description
STW	WORD	Provides the device status usually used from the monitoring subsystem, and allows data to be kept in the memory. Read-only access to the data contained in this word.
CFGW	WORD	Provides the means to control the device from the monitoring subsystem. Read/write access to the data contained in this word.

HVALVE_ST.STW Word Structure

Bit	Name	Description
0	ZSHPOS	Refer to the ZSHPOS output pin, page 112.
1	ZSLPOS	Refer to the ZSLPOS output pin, page 112.
2	FAILD	Refer to the FAILD output pin, page 112.

HVALVE_ST.CFGW Word Structure

Bit	Name	Description
0	SIMMD	Read/write access Enables you to place the device in simulation mode so that the actual position signals (ZSL and ZSH inputs) are ignored and the ZSSIM simulated status signal is used instead.
1	ZSSIM	Read/write access Enables you to define the value of ZSHPOS and ZSLPOS when the device is in simulation mode. The options available are: Open (1) (ZSHPOS = 1 and ZSLPOS = 0) and Closed (0) (ZSHPOS = 0 and ZSLPOS = 1).

Public Variables

Public Variable Description

Variable	Type	Description
SC	HVALVE_SC_DDT	Provides the frequently needed data to monitor the DFB status.

HVALVE_SC_DDT Type

Name	Type	Description
HIGHPOS	BOOL	Read-only access Refer to the HIGHPOS output pin, page 112.
LOWPOS	BOOL	Read-only access Refer to the LOWPOS output pin, page 112.

Name	Type	Description
ZSHPOS	BOOL	Read-only access Refer to the ZSHPOS output pin, page 112.
ZSLPOS	BOOL	Read-only access Refer to the ZSLPOS output pin, page 112.
FAILD	BOOL	Read-only access Refer to the FAILD output pin, page 112.

MOTOR2 - 2 Speed/2 Rotation Direction Motor

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Overview

This chapter describes the MOTOR2 DFB.

Description

General

The MOTOR2 DFB is used to control on-off motors with two rotation directions (forward/reverse) or with two speeds (for example, slow speed and fast speed).

The DFB allows the management of associated motors from the sequential control, the continuous control, and/or the Supervision system depending on their configuration and the system needs.

User can supplement the DFB with the MOTOR2LP, DEVMNT, CONDSUM, and CONDSUM1 DFB from the General Purpose Library.

Function Description

The main functions of the DFB are described in the following table:

Function	Description
Control	Controls the digital control signal of the element based on the configuration and commands that the DFB receives according to the functions.
Owner selection	The DFB manages control system level, which is the owner (operator or program). As a result, it is responsible for setting the set-point for the desired position.
Local and remote setpoint	Enables the DFB with a set-point (stop/run and speed/rotation direction) that is determined through a set-point selector (local or remote) in program owner. The local set-point is assigned from the sequential control while the remote set-point is assigned to the DFB control from the logic implemented in the continuous control.
Position detection	Allows to determine the actual position of the element to be controlled and monitored with the help of two limit switch (ZSH1 and ZSH2).
Inoperable motor	Allows to monitor inoperable device condition. DFB can be configured to withdraw output based on this condition.
Interlocking	The DFB gives a command to the device to move to the defined position in case of an active interlock. An interlock bypass function is available.

Function	Description
Setpoint blocking	You can configure the DFB to avoid the activation of a certain setpoint (rotation direction or speed) depending on the conditions evaluated outside the DFB (for example, to avoid reverse speeds from being activated when the motor is already rotating in the forward direction).
Simulation	You can switch the DFB to Simulation mode. Thus, the operation confirmations for the controller motor are considered to be the same as the desired confirmations regardless of the actual signals for detection of unsuccessful operation and inoperable device.

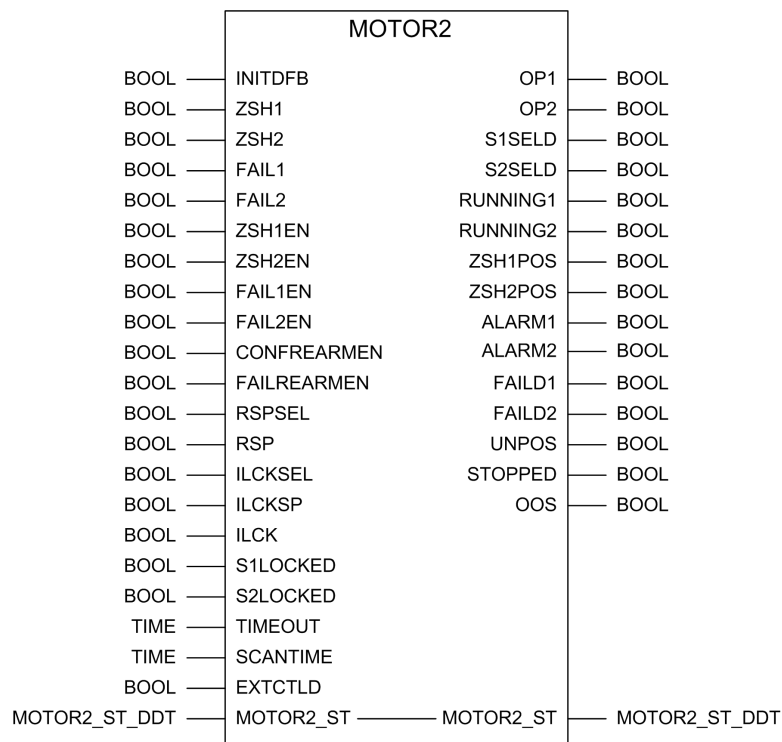
The optional functions of the DFB are described in the following table:

Function	Description
Detection of unsuccessful operation	If position is unsuccessful within a configured time after the output command is activated, DFB detects unsuccessful operation.
Manual resetting	Allows you to reset manually after the detection of an inoperable device condition or a unsuccessful operation. After reset, device output will follow set point.

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
INITDFB	BOOL	If a rising edge is detected on this input, the internal timers of the block are reset and detected alarms are set to 0.
ZSH1	BOOL	1 = Indicates to the DFB that switching operation corresponding to the set-point ($SP = 1$) is activated in the forward direction/speed 1 ($SPSEL = 0$). It is used to connect the digital input of a motor switching operation confirmation. Refer to the <code>ZSH1EN</code> input.
ZSH2	BOOL	1 = Indicates to the DFB that switching operation corresponding to the set-point ($SP = 1$) is activated in the forward direction/speed 2 ($SPSEL = 1$). It is used to connect the digital input of a motor switching operation confirmation. Refer to the <code>ZSH2EN</code> input.
FAIL1	BOOL	1 = Indicates to the DFB if a detected error has occurred when activating forward direction/speed 1 of the motor. Used to connect the digital thermal trip input of a motor switch. Refer to the <code>FAIL1EN</code> input. This detected error will affect both operations.
FAIL2	BOOL	1 = Indicates to the DFB if a detected error has occurred when activating reverse direction/speed 2 of the motor. Used to connect the digital thermal trip input of a motor switch. Refer to the <code>FAIL2EN</code> input. This detected error will affect both operations.
ZSH1EN	BOOL	1 = Enables <code>ZSH1</code> position detector monitoring.
ZSH2EN	BOOL	1 = Enables <code>ZSH2</code> position detector monitoring.
FAIL1EN	BOOL	1 = Enables the <code>FAIL1</code> parameter.
FAIL2EN	BOOL	1 = Enables the <code>FAIL2</code> parameter.
CONFREARMEN	BOOL	<ul style="list-style-type: none"> 1 = Withdraws the output OPx ($x = 1$ or 2) when a non-confirmed operation is detected ($ALARM = 1$) and requires a mandatory manual resetting once the $ALARM$ condition disappears. 0 = The output OPx ($x = 1$ or 2) remains in its previous state when a non-confirmed operation is detected ($ALARM = 1$) and does not need manual resetting, once the $ALARM$ condition disappears. <p>Refer to the <code>TIMEOUT</code> input and the <code>MOTOR2.ST.STW.ALARM</code> input/output pin, page 122.</p>
FAILREARMEN	BOOL	<ul style="list-style-type: none"> 1 = Withdraws the output OPx ($x = 1$ or 2) upon a detected error condition ($FAILD = 1$) and requires a mandatory manual resetting once the $FAIL$ condition disappears. 0 = The output OPx ($x = 1$ or 2) remains in its previous state upon a detected error condition ($FAILD = 1$) and does not need manual resetting, once the $FAIL$ condition disappears.
RSPSEL	BOOL	Remote set point selection. 0 = Forward direction/Speed 1 set point. 1 = Reverse direction/Speed 2 set point.
RSP	BOOL	Remote set-point by the continuous control. 1 = The set point selected in <code>RSPSEL</code> is considered. 0 = Stop command
ILCKSEL	BOOL	Interlock set point selection. 0 = Forward direction/Speed 1 set point. 1 = Reverse direction/Speed 2 set point.
ILCKSP	BOOL	1 = Run Set-point needs to be used when the block is interlocked.

Parameter	Type	Description
		Refer to the <code>ILCK</code> input.
<code>ILCK</code>	BOOL	1 = Interlocks the motor at the defined position. NOTE: If the motor requires resetting (<code>STW.REARMR = 1</code>), the <code>OP1</code> and <code>OP2</code> outputs are set to 0 if the <code>FAILD1</code> or <code>FAILD2</code> signals are active regardless of the value of <code>ILCKSP</code> and will wait for the operator to reset the motor.
<code>S1LOCKED</code>	BOOL	1 = Enables to block the activation of the actuator 1 (forward direction/speed 1) setpoint in case of an <code>OP1</code> transition from 0 to 1.
<code>S2LOCKED</code>	BOOL	1 = Enables to block the activation of the actuator 2 (reverse direction/speed 2) setpoint in case of an <code>OP2</code> transition from 0 to 1.
<code>TIMEOUT</code>	TIME	1 = Enables to configure the time during which confirmation alarm monitoring is disabled. 0 disables confirmation alarm monitoring. After the configured time has elapsed, the confirmation alarm is generated. Refer to the <code>MOTOR2LST.STW.ALARM</code> input/output pin, page 122.
<code>SCANTIME</code>	TIME	1 = Enables to configure the time that the detected alarm signals are kept active. This helps the Supervision system to acquire the data for detected alarms that are automatically reset.
<code>EXTCTLD</code>	BOOL	1 = Indicates to the DFB the motor is being controlled from outside the system. Avoids the generation of erroneous confirmation messages while the motor is being controlled from outside the system (for example, from an electrical switch controlled by local push buttons that does not reach the control system). Monitoring of the confirmation alarm ceases while the motor is being externally controlled. The motor detected error (<code>FAILX</code>) continues to be evaluated. NOTE: If <code>EXTCTLD = 1</code> , the <code>OP1</code> and <code>OP2</code> outputs can still be manipulated.

Outputs

OP1, OP2, S1SELD, S2SELD Outputs

Parameter	Type	Description
<code>OP1</code>	BOOL	1 = Forward direction/speed 1 command active. Allows the control signal of the device to be connected.
<code>OP2</code>	BOOL	1 = Reverse direction/speed 2 command active. Allows the control signal of the device to be connected.

When `STW.8` is ON, `OP1` and `OP2` are OFF. When `STW.8` is OFF and `ILCKD` is OFF, the following table depicts the status of `OP1` and `OP2`:

FAIL	ALARM	S1SELD	S2SELD	OP1	OP2
ON	OFF/ON	OFF/ON	OFF/ON	S1SELD	S2SELD
OFF	ON	OFF/ON	OFF/ON	S1SELD	S2SELD
OFF	OFF	OFF/ON	OFF/ON	S1SELD	S2SELD
ON	OFF/ON	ON	ON	OFF	OFF
OFF/ON	ON	ON	ON	OFF	OFF

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- The *CONFREARMEN* pin has to be set to 1 for the *OPx* ($x = 1$ or 2) pin to become 0, under non-confirmed operations.
- The *FAILREARMEN* pin has to be set to 1 for the *OPx* ($x = 1$ or 2) pin to become 0, under detected error conditions.
- Changes to the configuration of these parameters have to be performed by competent personnel only.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

<i>FAIL</i> EN input	<i>FAILREARMEN</i> input	<i>OPx</i> output when <i>FAIL</i> = 1 (assume <i>OP</i> = 1 before the detected error)	<i>OPx</i> output when <i>FAIL</i> = 1 (assume <i>OP</i> = 0 before the detected error)
0	0	1	0
0	1	1	0
1	0	1	0
1	1	0	0
NOTE: $x=1$ or 2			

The following table depicts how the *ILCKD* variable is calculated in the public variables section:

STW. 8	FAIL	ALARM	ILCKD	ILCKSEL	ILCKSP	OPn	OP1	OP2
ON	-	-	-	-	-	-	OFF	OFF
OFF	ON	-	ON	OFF/ON	OFF/ON	ON	Not ILCK- SEL and ILCKSP	ILCKSEL and ILCKSP
OFF	OFF	ON	ON	OFF/ON	OFF/ON	ON	Not ILCK- SEL and ILCKSP	ILCKSEL and ILCKSP
OFF	OFF	OFF	ON	OFF/ON	OFF/ON	-	Not ILCK- SEL and ILCKSP	ILCKSEL and ILCKSP
OFF	ON	-	ON	ON	ON	OFF	OFF	OFF
OFF	-	ON	ON	ON	ON	OFF	OFF	OFF

Parameter	Type	Description
S1SELD	BOOL	1 = Run command with forward direction/speed 1 selected and with the command not blocked at the time of OP1 activation (refer to the S1LOCKED input pin, page 117).
S2SELD	BOOL	1 = Run command with reverse direction/speed 2 selected and with the command not blocked at the time of OP2 activation (refer to the S2LOCKED input pin, page 117).

RUNNING1 and RUNNING2 Outputs

Parameter	Type	Description
RUNNING1	BOOL	1 = The motor has reached the position corresponding to setpoint SP = 1 and SPSEL = 0. It is evaluated by considering any detectors. Refer to the RUNNING2 output and MOTOR2_ST.CFGW.SIMMD input/output pin, page 122.
RUNNING2	BOOL	1 = The motor has reached the position corresponding to setpoint SP = 1 and SPSEL = 1. It is evaluated by considering any detectors. Refer to the RUNNING1 output and MOTOR2_ST.CFGW.SIMMD input/output pin, page 122.

The evaluation of the motor position depending on the configuration implemented with the ZSH1EN and ZSH2EN inputs and on the MOTOR2_ST.CFGW.SIMMD input/output is shown in the following table:

EXTCTLD	ZSH1EN	ZSH2EN	SIMMD	RUNNING1	RUNNING2
-	-	-	ON	OP1	OP2
OFF	OFF	OFF	OFF	OP1	OP2
OFF	OFF	ON	OFF	ZSH2 and OP1	ZSH2 and OP2
OFF	ON	OFF	OFF	ZSH1 and OP1	ZSH1 and OP2
OFF	ON	ON	OFF	ZSH1 and (not ZSH2)	ZSH2 and (not ZSH1)
OFF	OFF	-	OFF	OFF	OFF
ON	-	OFF	OFF	OFF	OFF
ON	ON	ON	OFF	ZSH1 and (not ZSH2)	ZSH2 and (not ZSH1)

ZH1POS and ZH2POS Outputs

Parameter	Type	Description
ZSH1POS	BOOL	Forward direction/speed 1 position status. 1 = Forward direction/speed 1 position confirmed. It is independent from the other detector if the ZSH1 detector is available.
ZSH2POS	BOOL	Reverse direction/speed 2 position status. 1 = Reverse direction/speed 2 position confirmed. It is independent from the other detector if the ZSH2 detector is available.

ALARM1 Output

ALARM1 output activates based on the detection of a limit position switch confirmation.

The detected alarm activates in the following scenario:

- When the DFB output (OP1) is switches from 0 to 1 as long as TIMEOUT timer is running, the operation confirmations are not monitored, when the time is elapsed and position limit (ZSH1POS) is unsuccessful. The alarm is not evaluated if device is controlled externally (EXTCTLD = 1).
- If both the limit switch positions (ZSH1POS and ZSH2POS) detect at same time. This alarm is continued to evaluated even (EXTCTLD = 1).

After the time has elapsed, the alarm is deactivated based on the following conditions:

- if the operation confirmation signal becomes the desired signal (according to the OP1 value) or

- if the motor is reset (through the `MOTOR2ST.CFGW.REARM` input/output, and as long as the `CONFREARMEN` input is 1).

In both cases, the internal timer is restarted with the `TIMEOUT` value.

ALARM2 Output

ALARM2 output activates based on the detection of a limit position switch confirmation.

The detected alarm activates in the following scenario:

- When the DFB output (OP2) is switches from 0 to 1 as long as `TIMEOUT` timer is running, the operation confirmations are not monitored, when the time is elapsed and position limit (ZSH2POS) is unsuccessful. The alarm is not evaluated if device is controlled externally (`EXTCTLD` = 1).
- If both the limit switch positions (ZSH1POS and ZSH2POS) detect at same time. This alarm is continued to evaluated even (`EXTCTLD` = 1).

Once the time has elapsed, the detected alarm is deactivated based on the following conditions:

- if the operation confirmation signal becomes the desired signal (according to the `OP2` value) or
- if the motor is reset (through the `MOTOR2ST.CFGW.REARM` input/output, and as long as the `CONFREARMEN` input is 1).

In both cases, the internal timer is restarted with the `TIMEOUT` value.

FAILD1 and FAILD2 Outputs

Parameter	Type	Description
FAILD1	BOOL	1 = Indicates motor detected error in the forward direction/speed 1. It is evaluated according to the value of the <code>FAIL1</code> and <code>FAIL1EN</code> inputs. It is timed so that the signal is maintained for a minimum of <code>SCANTIME</code> . 0 = After the minimum activation time has elapsed, it deactivates if the <code>FAIL1</code> input signal is de-activated (0).
FAILD2	BOOL	1 = Indicates motor detected error in the reverse direction/speed 2. It is evaluated according to the value of the <code>FAIL2</code> and <code>FAIL2EN</code> inputs. It is timed so that the signal is maintained for a minimum of <code>SCANTIME</code> . 0 = After the minimum activation time has elapsed, it deactivates if the <code>FAIL2</code> input signal is de-activated (0). Refer to the <code>FAILD1</code> output.

The signal evaluation depending on the `FAILx` and `FAILxEN` inputs is shown in the following table:

FAILx	FAILxEN	FAILD
-	OFF	OFF
OFF	ON	OFF
ON	ON	ON (minimum <code>SCANTIME</code>)

UNPOS Output

Parameter	Type	Description
UNPOS	BOOL	1 = Indicates that there is no way of finding out which operation is active. This can take place when only one confirmation input is enabled. <code>ZH1EN</code> / <code>≠ ZSH2EN</code>

The evaluation of the ZSH1POS, ZSH2POS, and UNPOS signals depending on the EXTCTLD, ZSH1EN and ZSH2EN inputs and the MOTOR2ST.CFGW.SIMMD input/output is shown in the following table:

EXTCTLD	ZSH1EN	ZSH2EN	SIMMD	ZSH1POS	ZSH2POS	UNPOS
OFF	-	-	ON	OP1	OP2	OFF
OFF	OFF	OFF	OFF	OP1	OP2	OFF
OFF	OFF	ON	OFF	ZSH2 and OP1	ZSH2 and OP2	ZSH2 and (not OP1 and not OP2)
OFF	ON	OFF	OFF	ZSH1 and OP1	ZSH1 and OP2	ZSH1 and (not OP1 and not OP2)
-	ON	ON	OFF	ZSH1	ZSH2	OFF
ON	OFF	OFF	OFF	OFF	OFF	ON
ON	OFF	ON	OFF	OFF	OFF	ON
ON	ON	OFF	OFF	ZSH1	ZSH2	ON

STOPPED and OOS Outputs

Parameter	Type	Description
STOPPED	BOOL	1 = Indicates that the motor is stopped. It is activated when neither the ZSH1POS nor the ZSH2POS output signals are active.
OOS	BOOL	1 = Indicates whether the equipment is Out of Service.

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
MOTOR2_ST	MOTOR2_ST_DDT	Data structure of the DFB control and status.

MOTOR2_ST_DDT Type

Name	Type	Description
STW	WORD	Provides the device status usually used from the monitoring subsystem, and allows data to be kept in the memory. Read-only access to the data contained in this word.
CFGW	WORD	Provides the means to control the device from the monitoring subsystem. Read/write access to the data contained in this word.

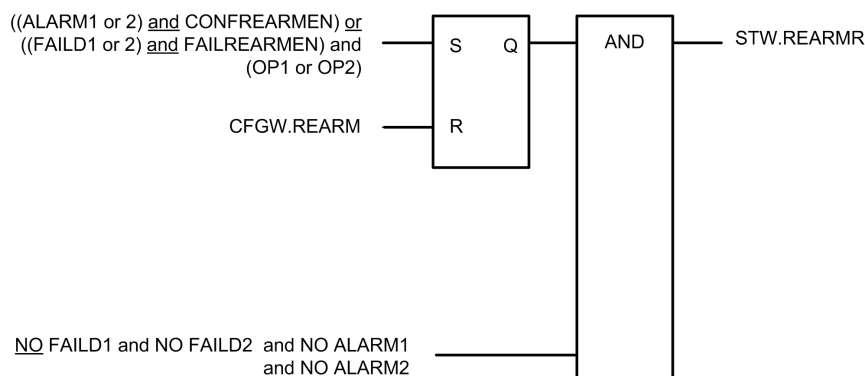
MOTOR2_ST.STW Word

The following table describes the MOTOR2_ST.STW word:

Bit	Name	Description
0	ZSH1POS	Refer to the ZSH1POS output pin, page 118.
1	ZSH2POS	Refer to the ZSH2POS output pin, page 118.
2	UNPOS	Refer to the UNPOS output pin, page 118.

Bit	Name	Description
4	OP1	Refer to the OP1 output pin, page 118.
5	OP2	Refer to the OP2 output pin, page 118.
6	REM	Indicates if the current setpoint (SP) is local (0) or remote (1). The set-point is local when the owner is the Operator (OWNER = 1). When the owner is the Program (OWNER = 0), the setpoint is selected with the SC.REM public signal (1: remote, 0: local).
7	ILCK	Refer to the ILCK input pin, page 117.
8	REARMR	Indicates if the motor requires resetting (1) after the detection of an inoperable device condition that has been configured as requiring resetting through the CONFREARMEN and/or FAILREARMEN inputs. The activation logic of the signal included in the DFB is shown in the following figure.
9	EXTCTLD	Refer to the EXTCTLD input pin, page 117.
10	ALARM1	Refer to the ALARM1 output pin, page 118.
11	ALARM2	Refer to the ALARM2 output pin, page 118.
12	FAILD1	Indicates an inoperable device (1). Refer to the FAILD1 output pin, page 118.
13	FAILD2	Indicates an inoperable device (1). Refer to the FAILD2 output pin, page 118.
14	S1LOCKED	Refer to the S1LOCKED input pin, page 117.
15	S2LOCKED	Refer to the S2LOCKED input pin, page 117.

Activation logic of REARMR signal



MOTOR2_ST_DDT.CFGW Word

The following table describes the MOTOR2_ST_DDT.CFGW word:

Bit	Name	Description		
0	OWNER	Read/write access		
		Enables to configure whether the set-point is set by		
		<table><tr><td>0</td><td>Program</td></tr><tr><td>1</td><td>Operator</td></tr></table>	0	Program
0	Program			
1	Operator			
1	ILCKBP	Read/write access		
		Enables the interlock to be bypassed (1).		
2	SIMMD	Read/write access		
		Allows putting the motor into simulation mode so that: <ul style="list-style-type: none">• The actual confirmation signals (ZSHx inputs) are ignored.• The operation confirmations (according to the OP1 and OP2 outputs) are simulated.		

Bit	Name	Description
		<ul style="list-style-type: none"> The motor is considered to be functional (as if the <code>FAIL1</code> and <code>FAIL2</code> inputs were reset (0)).
3	REARM	<p>Write access</p> <p>Enables the motor to be reset (1). The DFB sets the signal to 0 after each run and sets the signal indicating that resetting is required (<code>CFGW.REARM</code>) to 0.</p>
4	LSPSEL	<p>Read/write access</p> <p>Enables to select the actuator to be affected by the local setpoint of the operator (<code>OWNER</code> is 1) from the Supervision system :</p> <p>0 = forward direction/speed 1. 1 = reverse direction/speed 2.</p> <p>If the selection is set by the program (<code>OWNER</code> is 0), the DFB continuously assigns it the value of the current selection.</p>
5	LSP	<p>Read/write access</p> <p>Enables local set-point (<code>OWNER</code> is 1) of the operator to be set from the monitoring subsystem.</p> <p>If the setpoint is set by the program (<code>OWNER</code> is 0), the DFB continuously assigns it the value of the current setpoint.</p>
15	OOS	<p>Out of service</p> <p>Read/write access</p> <p>Indicates whether the equipment is out of service (1) or in use (0).</p>

NOTE: The outputs (`SP` and `OP`) are de-energized when the device is in an out-of-service state even if an interlock that requests the device to be started is active.

Public Variables

Public Variable Description

Variable	Type	Description
SC	MOTOR2_SC_DDT	Provides the frequently needed data to monitor motor status and to control it from the sequential control.

MOTOR2_SC_DDT Type

Name	Type	Description
EXTCTLD	BOOL	<p>Read-only access</p> <p>1 = Shows the value of the <code>EXTCTLD</code> input so that you can modify it from the sequential control.</p>
REM	BOOL	<p>Read/write access</p> <p>1 = Enables the DFB to be configured to remote set-point—<code>RSP</code>—(1) or local set-point—<code>LSP</code>—(0).</p>
LSPSEL	BOOL	<p>Read/write access</p> <p>1 = Enables to select the actuator to be affected by the local set-point (0 corresponds to the forward direction/speed 1 and 1 corresponds to the reverse direction/speed 2) usually for the sequential control if the owner is the Program (<code>OWNER</code> is 0) and the selected set-point is Local (<code>REM</code> is 0).</p>

Name	Type	Description		
		In any other case, the DFB continuously assigns <code>LSPSEL</code> one of following value:		
		OWNER	REM	SC . <code>LSPSEL</code> is calculated as:
		OFF	OFF	SC . <code>LSPSEL</code> (last value or new value assigned from the sequential control)
		OFF	ON	SPSEL (calculated from the <code>RSPSEL</code> input)
		ON	ON	SPSEL (last value or new value assigned by the Operator)
LSP	BOOL	Read/write access		
		1 = Enables to assign the local set-point usually for the sequential control if the owner is the Program (<code>OWNER</code> is 0), and the selected set-point is Local (<code>REM</code> public variable is 0).		
		0 = The block automatically assigns <code>LSP</code> the value of the resulting set-point as described in the following table:		
		OWNER	REM	SC . <code>LSP</code> is calculated as:
		OFF	OFF	SC . <code>LSP</code> (last value or new value assigned from the sequential control)
		OFF	ON	SP (calculated from the <code>RSP</code> input)
ON	ON	SP (last value or new value assigned by the Operator)		
OP1	BOOL	Read-only access Refer to the <code>OP1</code> output pin, page 118.		
OP2	BOOL	Read-only access Refer to the <code>OP2</code> output pin, page 118.		
S1SELD	BOOL	Read-only access Refer to the <code>S1SELD</code> output pin, page 118.		
S2SELD	BOOL	Read-only access Refer to the <code>S2SELD</code> output pin, page 118.		
RUNNING1	BOOL	Read-only access Refer to the <code>RUNNING1</code> output pin, page 118.		
RUNNING2	BOOL	Read-only access Refer to the <code>RUNNING2</code> output pin, page 118.		
ZSH1POS	BOOL	Read-only access Refer to the <code>ZSH1POS</code> output pin, page 118.		
ZSH2POS	BOOL	Read-only access Refer to the <code>ZSH2POS</code> output pin, page 118.		
STOPPED	BOOL	Read-only access Refer to the <code>STOPPED</code> output pin, page 118.		
UNPOS	BOOL	Read-only access Refer to the <code>UNPOS</code> output pin, page 118.		
ALARM1	BOOL	Read-only access Refer to the <code>MOTOR2_ST.STW.ALARM1</code> input/output pin, page 122.		
ALARM2	BOOL	Read-only access Refer to the <code>MOTOR2_ST.STW.ALARM2</code> input/output pin, page 122.		
FAILD1	BOOL	Read-only access		

Name	Type	Description		
		Refer to the MOTOR2_ST.STW.FAILD1 input/output pin, page 122.		
FAILD2	BOOL	Read-only access Refer to the MOTOR2_ST.STW.FAILD2 input/output pin, page 122.		
REARMR	BOOL	Read-only access Refer to the MOTOR2_ST.STW.REARMR input/output pin, page 122.		
ILCKD	BOOL	Read-only access The signal evaluation depending on the ILCK input and the MOTOR2ST.CFGW.ILCKBP input/output is shown in the following table:		
		ILCK	ILCKBP	SC.ILCKD
		OFF	OFF	OFF
		OFF	ON	ON
		ON	OFF	OFF
		ON	ON	OFF
OWNER	BOOL	Read-only access Refer to the OWNER input/output pin, page 122.		
S1LOCKED	BOOL	Read-only access Refer to the S1LOCKED input pin, page 117.		
S2LOCKED	BOOL	Read-only access Refer to the S2LOCKED input pin, page 117.		
OOS	BOOL	Read/write access 1 = Indicates whether the equipment is Out of Service (1)		

MOTOR2LP - Local Panel for Controlling 2 Speed/2 Rotation Direction Motors

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Overview

This chapter describes the MOTOR2LP DFB.

Description

General

The objective of the MOTOR2LP DFB is to manage a local panel that controls a motor with 2 directions of rotation or 2 speeds. This motor is implemented with a MOTOR2 DFB and with signals that are wired to the controller so that the latter determines the target position for the device.

Function Description

The main functions of the module are described in the following table:

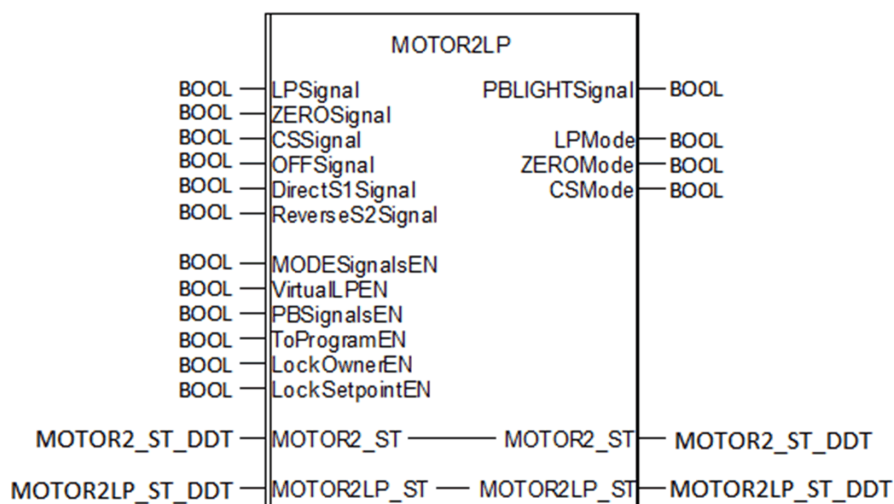
Function	Description
Mode Switch	Optionally manages the signals coming from an operating mode switch in a local panel with the following configuration: Local - Zero - Control System. The Zero mode signal is optional. However the user can enable Local/Control System mode from the faceplate also, when <i>VirtualLPEN</i> input pin signal is high and <i>MODESignalsEN</i> signal is low in the DFB.
Push buttons	The DFB manages up to three signals coming from OFF, ON - forward direction of rotation/speed 1 and ON - reverse direction of rotation/speed two push buttons. The priority is given to the OFF push button signal and then to the closing (ON) push button signal.
Owner Management	The DFB enables to configure whether the Program needs to be the valve owner or not, after switching to the Control System mode again.
Owner Locking	The DFB enables to configure whether the monitoring (HMI) system needs to block access to the drop-down list or not, it disables the access to change the owner (Operator/Program) while the valve is controlled from the Local Panel.
Set-point Lock	The DFB enables to configure whether the monitoring (HMI) system needs to block access to the drop-down list or not. It disables to change the set-point while the analog output is controlled from the Local Panel.
Push button Enabling/Disabling	The push button signals from the Local Panel can be enabled/disabled through the DFB configuration (input pin) and/or from control sequences.

Function	Description
Enabled Panel Signaling	The DFB provides a signal that can be used to illuminate a light source on the Local Panel to indicate when the push buttons are enabled for operation.
Virtual Panel Enabling/Disabling	This signal enables the operator to select the Local / Control System mode of operation from the HMI so that the push button signals are enabled for operation. NOTE: VirtualLPEN input pin signal is applicable when Modicon Libraries - General Purpose is used along with Modicon Libraries - General Purpose for Wonderware System Platform.

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
LPSignal	BOOL	1 = The local panel mode switch is in the Local Panel position. Refer to the table included with the description of the LPMode output pin, page 130.
ZEROSignal	BOOL	1 = The local panel mode switch is in the zero position. This signal is optional even if a mode switch is available on the local panel. When this signal is a logical high, user is not allowed to operate the device from the faceplate and also from the DFB. Hence, all the functions in the faceplate will be disabled. Refer to the table included with the description of the LPMode output pin, page 130.
CSSignal	BOOL	1 = The local panel mode switch is in the Control System position. Refer to the table included with the description of the LPMode output pin, page 130.
OFFSignal	BOOL	1 = The OFF push button on the local panel is pressed.
DirectS1Signal	BOOL	1 = Indicates the DFB that forward direction/speed 1 operation push button on the local panel is pressed.

Parameter	Type	Description																				
ReverseS2Signal	BOOL	1 = Indicates the DFB that reverse direction/speed 2 operation push button on the local panel is pressed.																				
MODESignalsEN	BOOL	<p>1 = Enables the use of the Local Panel/Zero/ Control System (or Local Panel - Control System) mode switch on the local panel. usually configured in development phase based on the characteristics of the local panel being used. If the mode switch is enabled, the <i>LPSignal</i>, <i>ZEROSignal</i>, and <i>CSSignal</i> inputs are considered to determine the operating modes of the local panel. Refer to the table included with the description of the <i>LPMode</i> output pin, page 130.</p> <p>NOTE: <i>MODESignalsEN</i> input pin has higher priority than the <i>VirtualLPEN</i> input pin signal.</p>																				
VirtualLPEN	BOOL	<p>1 = This signal enables the operator to select the Local/ Control System mode of operation from the HMI, so that the push button signals are enabled for operation.</p> <p>NOTE:</p> <ul style="list-style-type: none">When the owner is program, the Local/Control System mode selection drop-down list will be visible but disabled for operation however, when the owner is operator the Local Panel drop-down list will be accessible for operation.<i>VirtualLPEN</i> input pin signal is applicable only for Modicon Libraries - General Purpose for Wonderware System Platform offer only, however there is no impact of this input signal in Modicon Libraries - General Purpose for Citect SCADA offer. <p>Refer to the table included with the description of the <i>LPMode</i> output pin, page 130.</p>																				
PBSignalsEN	BOOL	<p>1 = Enables to accept the OFF, ON - forward direction of rotation/speed 1, and ON - reverse direction of rotation/ speed 2 push button signals from the local panel. This signal is not applicable if the mode switch is enabled (refer to the <i>MODESignalsEN</i> input). It means that the push button signals are considered in Local Panel mode.</p> <p>When the mode switch is disabled (<i>MODESignalsEN</i> = 0), the <i>PBSignalsEN</i> signal enables/disables the push button signals from the control system itself based on the relevant process conditions. The <i>SC.DISABLELPP</i> public variable is also considered when determining whether the push buttons are enabled or not when <i>LPMODE</i> pin signal is high, as shown in the following table:</p> <table><tr><th>MODESignal-sEN</th><th>PBSigna-lsEN</th><th>SC. Disa-bleLP</th><th>Push buttons enabled</th></tr><tr><td>OFF</td><td>OFF</td><td>-</td><td>NO</td></tr><tr><td>OFF</td><td>-</td><td>ON</td><td>NO</td></tr><tr><td>OFF</td><td>ON</td><td>OFF</td><td>YES</td></tr><tr><td>ON</td><td>-</td><td>-</td><td>YES</td></tr></table> <p>Therefore, this signal can be used to enable/disable the push buttons on a simple local panel that does not feature a mode switch (Local Panel/ Zero/Control System) based on the relevant process conditions.</p>	MODESignal-sEN	PBSigna-lsEN	SC. Disa-bleLP	Push buttons enabled	OFF	OFF	-	NO	OFF	-	ON	NO	OFF	ON	OFF	YES	ON	-	-	YES
MODESignal-sEN	PBSigna-lsEN	SC. Disa-bleLP	Push buttons enabled																			
OFF	OFF	-	NO																			
OFF	-	ON	NO																			
OFF	ON	OFF	YES																			
ON	-	-	YES																			
ToProgramEN	BOOL	1 = Enables the functionality to change the owner of 2-speed/2-rotation direction motor to Program when the mode switch on local panel returns to control system position (only when the mode is switched). If this functionality is disabled, the operator of monitoring (HMI) system will have to switch to Program owner when the operator deems it as appropriate. Refer to the table included with the description of the <i>LockOwnerEN</i> input.																				
LockOwnerEN	BOOL	<p>1 = Disables the access of owner of the 2-speed/2-rotation direction motor remaining as Operator while the local panel mode is Local Panel.</p> <p>The following table depicts how the owner of the 2-speed/2-rotation direction motor is evaluated based on the <i>ToProgramEN</i> and <i>LockOwnerEN</i> inputs and the operating mode of the local panel:</p>																				

Parameter	Type	Description			
		Local Panel Mode	ToProgramEN	LockOwnerEN	Owner
		0	-	-	Operator
		Switch to Local Panel	-	-	Operator
		Local Panel	-	ON	Operator
		Switch to Control System	ON	-	Program
		<p>In the remaining cases, the owner of the 2-speed/2-rotation direction motor ceases to be defined from the MOTOR2LP DFB and it enables to change it from the monitoring (HMI) system with the command word in the MOTOR2_ST.CFGW input/output of the corresponding MOTOR2 DFB.</p> <p>In any case, take into account that the owner of the 2-speed/2-rotation direction motor that had been set before switching to the local panel mode is not memorized.</p>			
LockSetpoint-EN	BOOL	<p>1 = Disables the access to the set-point of 2-speed/2-rotation direction motor and lock it into the one defined on the local panel while the local panel mode is Local Panel and the device owner is Operator. Take into account that the user can switch to Program mode based on the signals that has been previously described even if the local panel mode is set to Local Panel.</p> <p>Therefore, this signal needs to be activated if user wants to lock setpoint operation from the monitoring (HMI) system while the 2-speed/2-rotation direction motor is controlled from the local panel.</p>			

Outputs

Output Parameter Description

Parameter	Type	Description						
PBLIGHT-Signal	BOOL	1 = The push buttons on the local panel are fully operational, that is, the local panel is in Local Panel mode (either because the mode is selected with the corresponding switch or because the push buttons are enabled in the event that there is no selector switch available or the VirtualLPEN is high with the local panel mode enabled).						
LPMode	BOOL	1 = The local panel mode is in Local Panel.						
		The following table depicts how the local panel operating mode is determined based on the MODSignalsEN, VirtualLPEN, PBSignalsEN, LPSignal, CSSignal and ZEROSignal, input signals:						
		MOD-ESi-gna-lsEN	Vir-tual-LPEN	PBSi-gnal-sEN	LPSig-nal	CSSi-gnal	ZERO-Signal	OUTPUT
		0	0	0	0	0	0	CS mode
		1	0	0	0	0	0	Zero mode
		1	0	0	1	0	0	LP mode and PBLIGHT-Signal
		1	0	0	0	1	0	CS mode
		0	1	1	NA	NA	NA	CS mode
		0	1	0	NA	NA	NA	CS mode
		0	0	1	0	0	0	LP mode and

Parameter	Type	Description						
								PBLIGHT-Signal
		1	1	0	1	0	0	LP mode and PBLIGHT-Signal
		1	1	0	0	0	0	Zero mode
		1	1	0	0	0	1	Zero mode
		1	1	0	0	1	0	CS mode
		1	0	1	0	1	0	CS mode
		1	1	1	0	1	0	CS mode
		1	0	0	0	0	1	Zero mode
ZEROMode	BOOL	1 = The local panel mode is in Zero. User is not allowed to operate the device from the faceplate and also from DFB. Hence, all the functions in the faceplate will be disabled. Refer to the table included with the description of the LPMODE output.						
CSMode	BOOL	1 = The local panel mode is in Control System. Refer to the table included with the description of the LPMODE output.						

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
MOTOR2_ST	MOTOR2_ST_DDT	<p>Data structure corresponding to the 2-speed/2-rotation direction motor is to be controlled from the local panel (for detailed information regarding this structure, refer to the MOTOR2 DFB, page 115).</p> <p>The structure provides the information needed for the operation of the MOTOR2LP DFB and enables this DFB to control the owner of the 2-speed/2-rotation direction motor.</p>
MOTOR2LP_ST	MOTOR2LP_ST_DDT	Data structure that is used as an interface with the monitoring (HMI) system.

MOTOR2_ST.DDT Type

Name	Type	Description
CFGW	WORD	Provides the means to control the device from the monitoring (HMI) system. Read-only access to the data contained in this word.

MOTOR2LP_ST.DDT Type

Name	Type	Description
STW	WORD	Provides the device status usually used from the monitoring subsystem, and allows data to be kept in the memory. Read-only access to the data contained in this word.

MOTOR2_ST.CFGW Word

The following table describes the MOTOR2_ST.CFGW word:

Bit	Name	Description							
0	OWNER	Read/write access Enables to configure whether the set-point is set by the Program (0) or by the Operator (1). Refer to the following table included with the description of the LPMoDe output, which specifies the cases in which the MOTOR2LP DFB can interact with this signal.							
4	LSPSEL	Read/write access Enables to set the LSPSEL command from the monitoring (HMI) system when the owner is the Operator (OWNER = 1). As long as the set-point is set by the Program (OWNER = 0), the DFB continuously assigns it the value of the current command (MOTOR2_ST.STW.LSPSEL input/output). Refer to the LSP bit.							
5	LSP	Read/write access Enables to set the LSPSEL command from the monitoring (HMI) system when the owner is the Operator (OWNER = 1). As long as the set-point is set by the Program (OWNER = 0), the DFB continuously assigns it the value of the current command (MOTOR2_ST.STW.LSPSEL input/output). Refer to the LSP bit.							
		The MOTOR2LP DFB determines the set-point for the 2-speed/2-rotation direction motor.	Owner	OFFSignal	Di-rec-tS1Signal	Rever-seS2Signal	Lock-Set-PointEN	LSP is calculated as:	LSPSEL is calculated as:
		0	The OWNER signal is forced to 1 (Operator).	-	-	-	-	OFF	Last value
		Local Panel	Operator	ON	-	-	-	OFF	Last value
		Local Panel	Operator	OFF	ON	-	-	ON	OFF
		Local Panel	Operator	OFF	-	ON	-	ON	ON
		Local Panel	Operator	OFF	OFF	OFF	ON	Last value	Last value
In other cases, the LSP and LSPSEL signals are not modified from the MOTOR2LP DFB.									

MOTOR2LP_ST.CFGW Word

Bit	Name	Description
0	LocalModeOn	Read/write access <ul style="list-style-type: none"> 1 = Enables the Local Panel mode. 0 = Enables the Control System mode.

MOTOR2LP_ST.STW Word

Read-only access. Status word. The following table describes the MOTOR2LP_ST.STW word:

Bit	Name	Description
0	LPMODE	Local panel in Local Panel mode. Refer to the LPMODE .
1	ZEROMODE	Local panel in zero mode. Refer to the ZEROMODE .
2	CSMODE	Local panel in Control System mode. Refer to the CSMODE .

Bit	Name	Description
3	LockedOwner	Indicates whether the owner change buttons in the monitoring (HMI) system needs to be locked (1) or not (0). Is activated when: <ul style="list-style-type: none"> The Local Panel mode is set to Zero or It is set to Local Panel and the LockOwnerEN input signal has been configured as active (1).
4	SPLocked	Indicates whether the set-point change buttons in monitoring (HMI) system needs to be locked (1) or not (0). Is activated when: <ul style="list-style-type: none"> The Local Panel mode is set to Zero or It is set to Local Panel and the LockSetpointEN input signal has been configured as active (1).
5	MODEsignalsEN	Indicates the state of the MODEsignalsEN input signal, that is, whether there is a mode switch (1) or not (0).
6	PBEnabled	Indicates whether the push buttons of the local panel are enabled (1) or not (0). The signal is activated when at least one of the MODEsignalsEN and PBSignalsEN signal inputs is active.
7	VirtualLPEN	Enables the drop-down list for the Local Panel / Control System mode selection.
8	LPSignal	Indicates the state of the LPSignal input signal.
9	ZEROSignal	Indicates the state of the ZEROSignal input signal.
10	CSSignal	Indicates the state of the CSSignal input signal.
11	OFFSignal	Indicates the state of the OFFSignal input signal.
12	DirectS1Signal	Indicates the state of the DirectS1Signal input signal.
13	ReverseS2Signal	Indicates the state of the ReverseS2Signal input signal.

Public Variables

Public Variable Description

Variable	Type	Description
SC	MOTOR2LP_SC_DDT	Provides the frequently needed data for monitoring (HMI) and controlling the DFB.

MOTOR2LP_SC_DDT Type

Name	Type	Description
LPMode	BOOL	Read-only access Refer to the LPMode output pin, page 130.
ZEROMode	BOOL	Read-only access Refer to the ZEROMode output pin, page 130.
CSMode	BOOL	Read-only access Refer to the CSMode output pin, page 130.
DisableLP	BOOL	Read/write access 1 = Disables the push buttons on the local panel. Only applicable when a local panel without mode switch configuration is used (MODEsignalsEN = 0).

MVALVED - Discrete Motorized Valve

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Overview

This chapter describes the MVALVED DFB.

Description

General

The MVALVED DFB is designed to control a motorized valve, or a gate, with two limit switches (open-valve and closed-valve) and a two-rotation-directions-motor based control.

User can combine the MVALVED DFB with the following Control Expert components from the General Purpose Library:

- MOTOR2
- DINPUT

Function Description

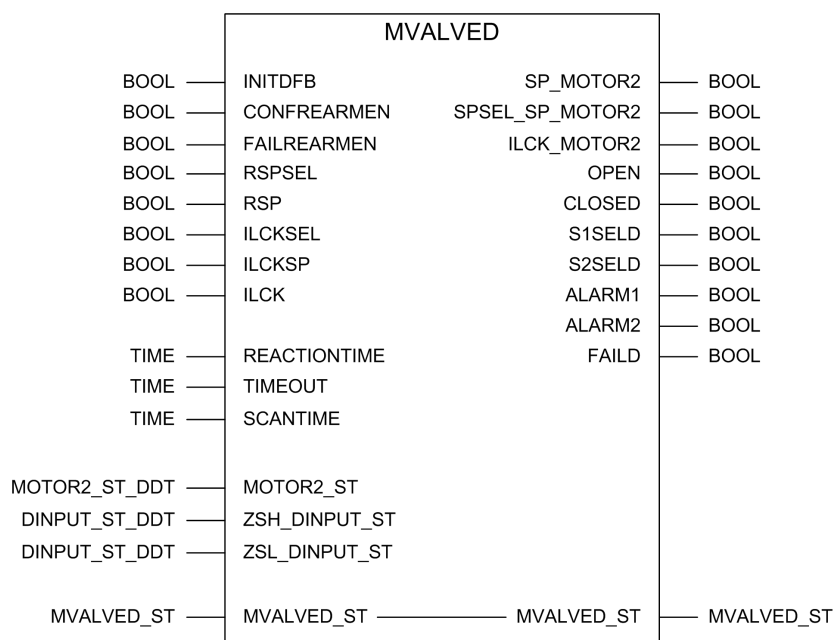
The main functions of the DFB are described in this table:

Function	Description
Control	Controls the digital control signal of the element based on the configuration and the commands that the block receives according to the functions that are described below.
Owner selection	The module manages the control system level (operator or program), which is the owner. As a result, it is responsible for setting the setpoint for the target position.
Local and remote setpoint	Enables to control the DFB with a set-point that is determined through a set-point selector (local or remote) in program owner. The local set-point is assigned from the sequential control while the remote set-point is assigned to the DFB control from the logic implemented in the continuous control.
Position detection	Allows to determine the actual position of the element to be controlled and monitored with the help of high and low limit switch.
Inoperable device	Allows to monitor inoperable device condition. DFB can be configured to withdraw output based on this condition.
Interlocking	The DFB gives a command to the device to move to the defined position in case of an active interlock. An interlock bypass function is available.
Detection of unsuccessful operation	If position is unsuccessful within a configured time after the output command is activated, DFB detects unsuccessful operation.
Manual resetting	Allows you to reset manually after the detection of an inoperable device condition or a unsuccessful operation. After reset, device output will follow set point.

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
<i>INITDFB</i>	BOOL	When a rising edge is detected on this input, the internal timers of the block are reset and detected alarms are set to 0.
<i>CONFREARMEN</i>	BOOL	<ul style="list-style-type: none"> 1 = Withdraws the output <i>SP_MOTOR2</i> when a non-confirmed operation is detected (<i>ALARM</i> = 1) and requires a mandatory manual resetting once the <i>ALARM</i> condition disappears. 0 = The output <i>SP_MOTOR2</i> remains in its previous state when a non-confirmed operation is detected (<i>ALARM</i> = 1) and does not need manual resetting, once the <i>ALARM</i> condition disappears. Refer to the <i>REACTIONTIME</i> inputs, page 135 and <i>TIMEOUT</i> inputs pin, page 135.
<i>FAILREARMEN</i>	BOOL	<ul style="list-style-type: none"> 1 = Withdraws the output <i>SP_MOTOR2</i> upon a detected error condition (<i>FAILD</i> = 1) and requires a mandatory manual resetting once the <i>FAIL</i> condition disappears. 0 = The output <i>SP_MOTOR2</i> remains in its previous state upon a detected error condition (<i>FAILD</i> = 1) and does not need manual resetting, once the <i>FAIL</i> condition disappears.
<i>RSPSEL</i>	BOOL	Remote set point selection 1 = Valve closing set point 0 = Valve opening set point
<i>RSP</i>	BOOL	Remote set-point by the continuous control. 1 = The set point selected in <i>RSPSEL</i> is considered. 0 = Stop command

Parameter	Type	Description
<i>ILCKSEL</i>	BOOL	Interlock set point selection 1 = Valve closing set point 0 = Valve opening set point
<i>ILCKSP</i>	BOOL	1 = Run Setpoint needs to be used when the block is interlocked. Refer to the <i>ILCK</i> input pin, page 135.
<i>ILCK</i>	BOOL	1 = Interlocks the valve at the defined position.
<i>REACTIONTIME</i>	TIME	Enables to configure the time during which monitoring for the valve switching operations is enabled. During this time, a check is run to verify that the valve leaves the limit switch opposite to the operation that is carried out. When it has a value of 0, monitoring is disabled. This time is useful for detecting irregularity behavior in the valve and does not wait until the maximum stroke time is elapsed to detect them.
<i>TIMEOUT</i>	TIME	Enables to configure the maximum time that the valve takes to complete its stroke for closing and opening. When the output is triggered, if the limit switch is not detected even after the <i>TIMEOUT</i> time is elapsed. The device is switched to detected alarm state if the limit switch is not detected. When it has a value of 0, monitoring is deactivated.
<i>SCANTIME</i>	TIME	The minimum time for which the detected alarm signals are kept active. <i>SCANTIME</i> confirms that the Supervision system acquires the data for detected alarms that are automatically reset.
<i>MOTOR2_ST</i>	MO-TOR2-ST-DDT	Enables to find out the status of the device. Provides the current status, inoperable device conditions, detected alarms, lack of setpoint follow-up, owner, and simulation of the motor that actuates the valve.
<i>ZSH_DINPUT_ST</i>	DIN-PUT-ST-DDT	1 = Indicates to the DFB that high limit position has been reached Provides the quality of the channel and allows simulating the high limit switch.
<i>ZSL_DINPUT_ST</i>	DIN-PUT-ST-DDT	1 = Indicates to the DFB that low limit position has been reached. Provides the quality of the channel and allows simulating the low limit switch.

Outputs

Output Parameter Description

Parameter	Type	Description
<i>SP_MOTOR2</i>	BOOL	1 = Provides the remote setpoint for motor control (RSP). Refer to the RSP, page 117 input of <i>MOTOR2</i> block.
<i>RSPSEL_MOTOR2</i>	BOOL	1 = Provides the setpoint for selecting the actuator to be affected by the <i>SP_MOTOR2</i> setpoint. Refer to the <i>RSPSEL</i> input, page 117 of <i>MOTOR2</i> block.
<i>ILCK_MOTOR2</i>	BOOL	1 = Interlocks the motor when one of the limit switches is detected and the travel direction command remains in place.
<i>OPEN</i>	BOOL	1 = Indicates the open-valve position is reached.
<i>CLOSED</i>	BOOL	1 = Indicates the closed-valve position is reached.
<i>S1SELD</i>	BOOL	1 = Valve opening command is not blocked when <i>OP1</i> is activated.
<i>S2SELD</i>	BOOL	1 = Valve closing command is not blocked when <i>OP2</i> is activated.
<i>ALARM1</i>	BOOL	1 = Indicates a limit switch has not responded during valve opening. Monitoring begins when <i>MOTOR2</i> is actuated and continues until the open-valve limit switch is detected. If the time defined in <i>TIMEOUT</i> is exceeded, the alarm function of the device is activated.

Parameter	Type	Description
<i>ALARM2</i>	BOOL	1 = Indicates a limit switch has not responded during valve closing. Monitoring begins when <i>MOTOR2</i> is actuated and continues until the close-valve limit switch is detected. If the time defined in <i>TIMEOUT</i> is exceeded, the alarm function of the device is activated.
<i>FAILED</i>	BOOL	1= Irregularity in one of the auxiliary devices.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- The *CONFREARMEN* pin has to be set to 1 for the *SP_MOTOR2* pin to become 0, under non-confirmed operations.
- Changes to the configuration of these parameters have to be performed by competent personnel only.
- The *FAILREARMEN* pin has to be set to 1 for the *SP_MOTOR2* pin to become 0, under non-confirmed operations. Changes to the configuration of these parameters have to be performed by competent personnel only.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
<i>MVALVED_ST</i>	MVALVED_ST_DDT	Provides the data needed to monitor and/or control the block status.

MVALVED_ST_DDT Type

Name	Type	Description
<i>STW</i>	WORD	Provides the device status usually used from the monitoring subsystem, and allows data to be kept in the memory. Read-only access to the data contained in this word.
<i>CFGW</i>	WORD	Provides the means to control the device from the monitoring subsystem. Read/write access to the data contained in this word.

MVALVED_ST.STW Type

Bit	Name	Description
0	<i>OPEN</i>	Refer to the <i>OPEN</i> output pin, page 136.
1	<i>CLOSED</i>	Refer to the <i>CLOSED</i> output pin, page 136.
6	<i>REM</i>	Refer to the <i>SC.REM</i> public variable, page 138.
7	<i>ILCK</i>	Refer to the <i>ILCK</i> input pin, page 135.
8	<i>REARMR</i>	Reset required (1).
10	<i>ALARM1</i>	Refer to the <i>ALARM1</i> output pin, page 136.

Bit	Name	Description
11	<i>ALARM2</i>	Refer to the <i>ALARM2</i> output pin, page 136.
12	<i>FAILED</i>	Refer to the <i>FAILED</i> output pin, page 136.

MVALVED_ST.CFGW Type

Bit	Name	Description
0	<i>OWNER</i>	Allows you to configure whether the set-point is set by the program (0) or by the operator (1).
1	<i>ILCKBP</i>	Enables the interlock to be bypassed (1).
3	<i>REARM</i>	Write access Reset the valve (1). The DFB sets the signal to 0 after each run and sets the signal indicating that the resetting is required (<i>CFGW.REARM</i>) to 0.
4	<i>LSPSEL</i>	Read/write access Enables to select the action that has to be carried out by the operator local setpoint (<i>OWNER</i> = 1) from the Supervision system (0 corresponds to opening and 1 to closing). If the selection is set by the program (<i>OWNER</i> = 0), the block continuously assigns it the value of the current selection.
5	<i>LSP</i>	Read/write access Allows the operator local setpoint (<i>OWNER</i> is 1) to be set from the Supervision system. If the setpoint is set by the program (<i>OWNER</i> = 0), the block continuously assigns it the value of the current setpoint.

Public Variables

Public Variable Description

Variable	Type	Description
SC	MVALVED_SC_DDT	Provides the common data required to monitor and control the valve status from the sequential control.

MVALVED_SC_DDT Type

Name	Type	Description			
<i>REM</i>	BOOL	Read/write access 1 = Enables the DFB to be configured to remote set-point RSP. 0 = Enables the DFB to be configured to local set-point LSP.			
<i>LSPSEL</i>	BOOL	Read/write access Enables the sequential control to select the actuator to be affected by the local set-point 1 = Corresponds to the closing direction when the owner is the Program (<i>OWNER</i> = 0) and the selected set-point is local (<i>REM</i> = 0). 1 = Corresponds to the opening direction when the owner is the Program (<i>OWNER</i> = 0) and the selected set-point is local (<i>REM</i> = 0). Calculation for LSPSEL:			
		<table> <tr> <td><i>OWNER</i></td><td><i>REM</i></td><td><i>SC.LSPSEL</i></td></tr> </table>	<i>OWNER</i>	<i>REM</i>	<i>SC.LSPSEL</i>
<i>OWNER</i>	<i>REM</i>	<i>SC.LSPSEL</i>			

Name	Type	Description		
		OFF	OFF	SC.LSPSEL (last value or new value is assigned from the sequential control).
		OFF	ON	SPSEL (calculated on the basis of the RSPSEL input).
		ON	ON	SPSEL (last value or new value is assigned by the Operator).
LSP	BOOL	Read/write access 1 = Enables the sequential control to assign the local set-point if the owner is the Program (OWNER = 0) and the selected set-point is local (REM public variable = 0). 0 = The block automatically assigns the current value of the resulting set-point as described below:		
		OWNER	REM	SC.LSP is calculated as:
		OFF	OFF	SC.LSP (last value or new value is assigned from the sequential control).
		OFF	ON	SP (calculated based on the RSP input).
		ON	ON	SP (last value or new value is assigned by the Operator).
S1SELD	BOOL	Read-only access Refer to the S1SELD output pin, page 136.		
S2SELD	BOOL	Read-only access Refer to the S2SELD output pin, page 136.		
OPEN	BOOL	Read-only access Refer to the OPEN output pin, page 136.		
CLOSED	BOOL	Read-only access Refer to the CLOSED output pin, page 136.		
ALARM1	BOOL	Read-only access Refer to the ALARM1 output pin, page 136.		
ALARM2	BOOL	Read-only access Refer to the ALARM2 output pin, page 136.		
FAILED	BOOL	Read-only access Refer to the FAILED output pin, page 136.		
REARMR	BOOL	Read-only access		
ILCKD	BOOL	Read-only access The way in which the signal is evaluated based on the ILCK input and the MVALVED_ST.CFGW.ILCKBP input/output is shown below:		
		ILCK	ILCKBP	SC.ILCKD calculated as:
		OFF	–	OFF
		ON	OFF	ON
		ON	ON	OFF
OWNER	BOOL	Read-only access		
SP_MOTOR2	BOOL	Read-only access Refer to the SP_MOTOR2 output pin, page 136.		
SPSEL_MOTOR2	BOOL	Read-only access Refer to the SPSEL_MOTOR2 output pin, page 136.		
ILCK_MOTOR2	BOOL	Read-only access Refer to the ILCK_MOTOR2 output pin, page 136.		

MVALVEDLP - Local Panel for Controlling Motorized On/Off Valves

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Overview

This chapter describes the MVALVEDLP DFB.

Description

General

The objective of the MVALVEDLP DFB is to manage a local panel that controls a motorized on-off valve. This valve is implemented with an MVALVED DFB and with signals that are wired to the controller so that the latter defines the target position for the device.

Function Description

The main functions of the module are described in the following table:

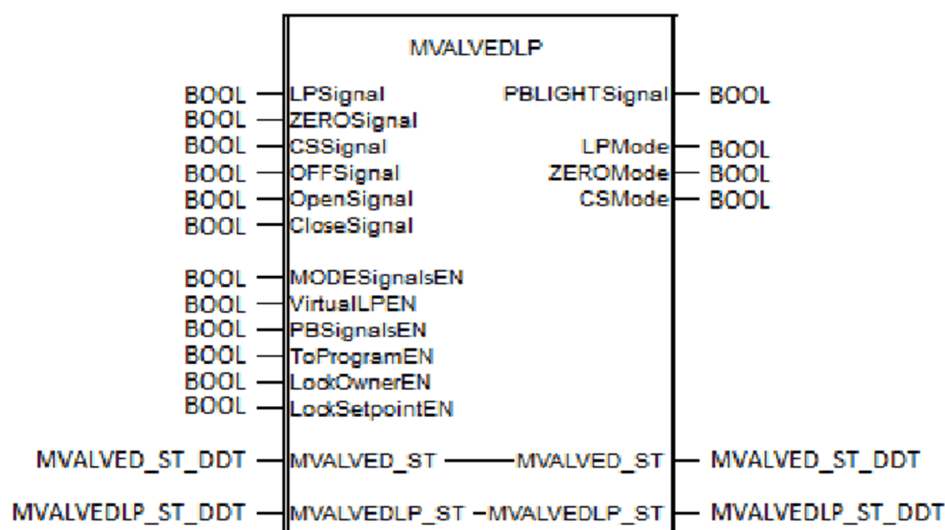
Function	Description
Mode Switch	Optionally manages the signals coming from an operating mode switch in a local panel with the following configuration: Local - Zero - Control System. The Zero mode signal is optional. However the user can enable Local/Control System mode from the faceplate also, when <i>VirtualLPEN</i> input pin signal is high and <i>MODESignalsEN</i> signal is low.
Push buttons	The DFB manages up to three signals coming from OFF, OPEN and CLOSE push buttons. The highest priority is given to the OFF push button signal followed by the CLOSE push button signal.
Owner Management	The DFB enables to configure whether the Program needs to be the valve owner or not, after switching to the Control System mode again.
Owner Locking	The DFB enables to configure whether the monitoring (HMI) system needs to block access to the drop-down list or not, it disables the access to change the owner (Operator/Program) while the valve is controlled from the Local Panel.
Set-point Lock	The DFB enables to configure whether the monitoring (HMI) system needs to block access to the drop-down list or not. It disables to change the set-point while the valve is controlled from the Local Panel.
Push button Enabling/Disabling	The push button signals from the Local Panel can be enabled/disabled through the DFB configuration (input pin) and/or from control sequences.

Function	Description
Enabled Panel Signaling	The DFB provides a signal that can be used to illuminate a light source on the Local Panel to indicate when the push buttons are enabled for operation.
Virtual Panel Enabling/Disabling	This signal enables the operator to select the Local / Control System mode of operation from the HMI so that the push button signals are enabled for operation. NOTE: VirtualLPEN input pin signal is applicable when Modicon Libraries - General Purpose is used along with Modicon Libraries - General Purpose for Wonderware System Platform.

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
LPSignal	BOOL	1 = The local panel mode switch is in the Local Panel position. Refer to the table included with the description of the LPMode output pin, page 143.
ZEROSignal	BOOL	1 = The local panel mode switch is in the zero position. This signal is optional even if a mode switch is available on the local panel. When this signal is a logical high, user is not allowed to operate the device from the faceplate and also from the DFB. Hence, all the functions in the faceplate will be disabled. Refer to the table included with the description of the LPMode output pin, page 143.
CSSignal	BOOL	1 = The local panel mode switch is in the Control System position. Refer to the table included with the description of the LPMode output pin, page 143.
OFFSignal	BOOL	1 = The OFF push button on the local panel is pressed.
OpenSignal	BOOL	1 = Indicates to the DFB the OPEN push button on the local panel is pressed.

Parameter	Type	Description																				
CloseSignal	BOOL	1 = Indicates to the DFB the CLOSE push button on the local panel is pressed.																				
MODESignalsEN	BOOL	<p>1 = Enables the use of the Local Panel/Zero/Control System (or Local panel - Control System) mode switch on the local panel. usually configured in development phase based on the characteristics of the local panel being used. If the mode switch is enabled, the LPSignal, ZEROSignal, and CSSignal inputs are considered to determine the operating modes of the local panel. Refer to the table included with the description of the LPMode output pin, page 143.</p> <p>NOTE: MODESignalsEN input pin has higher priority than the VirtualLPEN input pin signal.</p>																				
VirtualLPEN	BOOL	<p>1 = This signal enables the operator to select the Local/Control System mode of operation from the HMI, so that the push button signals are enabled for operation.</p> <p>NOTE:</p> <ul style="list-style-type: none">When the owner is program, the Local/Control System mode selection drop-down list will be visible but disabled for operation however, when the owner is operator the Local Panel drop-down list will be accessible for operation.VirtualLPEN input pin signal is applicable only for Modicon Libraries - General Purpose for Wonderware System Platform offer only, however there is no impact of this input signal in Modicon Libraries - General Purpose for Citect SCADA offer. <p>Refer to the table included with the description of the LPMode output pin, page 143.</p>																				
PBSignalsEN	BOOL	<p>1 = Enables to accept the OFF, OPEN and CLOSE push buttons from the local panel. This signal is not applicable if the mode switch is enabled (refer to the MODESignalsEN input). It means that the push button signals are considered in the local panel mode.</p> <p>When the mode switch is disabled (MODESignalsEN = 0), the PBSignalsEN signal enables/disables the push button signals from the control system itself based on the relevant process conditions. The SC.DISABLELP public variable is also considered when determining whether the push buttons are enabled or not when LPMode pin signal is high, as shown in the following table:</p> <table><tr><th>MODESignalsEN</th><th>PBSignal-sEN</th><th>SC. Disa-bleLP</th><th>Push buttons enabled ?</th></tr><tr><td>OFF</td><td>OFF</td><td>-</td><td>NO</td></tr><tr><td>OFF</td><td>-</td><td>ON</td><td>NO</td></tr><tr><td>OFF</td><td>ON</td><td>OFF</td><td>YES</td></tr><tr><td>ON</td><td>-</td><td>-</td><td>YES</td></tr></table> <p>Therefore, this signal can be used to enable/disable the push buttons on a simple local panel that does not feature a mode switch (Local Panel/Zero/Control System) based on the relevant process conditions.</p>	MODESignalsEN	PBSignal-sEN	SC. Disa-bleLP	Push buttons enabled ?	OFF	OFF	-	NO	OFF	-	ON	NO	OFF	ON	OFF	YES	ON	-	-	YES
MODESignalsEN	PBSignal-sEN	SC. Disa-bleLP	Push buttons enabled ?																			
OFF	OFF	-	NO																			
OFF	-	ON	NO																			
OFF	ON	OFF	YES																			
ON	-	-	YES																			
ToProgramEN	BOOL	1 = Enables the functionality to change the owner of the corresponding motorized valve to Program when the mode switch on the local panel returns to the control system position (only when the mode is switched). If this functionality is disabled, the operator of the monitoring (HMI) system switches to Program owner when the operator deems it appropriate. Refer to the table included with the description of the LockOwnerEN input.																				
LockOwnerEN	BOOL	<p>1 = Disables the access of the owner of the motorized valve remaining as Operator while the local panel mode is Local Panel.</p> <p>The following table depicts how the owner of the motorized valve is evaluated based on the ToProgramEN and LockOwnerEN inputs and operating mode of the local panel:</p> <table><tr><th>Local Panel Mode</th><th>ToProgra-mEN</th><th>LockOw-nerEN</th><th>Owner</th></tr><tr><td>Zero</td><td>-</td><td>-</td><td>Operator</td></tr><tr><td>Switch to Local Panel</td><td>-</td><td>-</td><td>Operator</td></tr></table>	Local Panel Mode	ToProgra-mEN	LockOw-nerEN	Owner	Zero	-	-	Operator	Switch to Local Panel	-	-	Operator								
Local Panel Mode	ToProgra-mEN	LockOw-nerEN	Owner																			
Zero	-	-	Operator																			
Switch to Local Panel	-	-	Operator																			

Parameter	Type	Description			
		Local Panel	-	ON	Operator
		Switch to Control System	ON	-	Program
		<p>In the remaining cases, the owner of the motorized valve ceases to be defined from the MVALVEDLP DFB. It becomes possible to change it from the monitoring (HMI) system with the command word in the MVALVED_ST.CFGW input/output variable of the corresponding MVALVED DFB.</p> <p>In any case, consider that the valve owner that had been set before switching to the local panel mode is not memorized.</p>			
LockSetPointEN	BOOL	<p>1 = Disables the access to the setpoint of the motorized valve and lock it into the one defined on the local panel while the local panel mode is Local Panel and the device owner is the Operator. You can switch to the Program mode based on the signals that have been previously described even if the local panel mode is set to Local Panel.</p> <p>Therefore, user can activate (1) this signal to lock setpoint operation from the monitoring (HMI) system while the motorized valve is controlled from the local panel.</p>			

Outputs

Output Parameter Description

Parameter	Type	Description						
PBLIGHT-Signal	BOOL	1 = The push buttons on the local panel are fully operational, that is, the local panel is in Local Panel mode (either because the mode is selected with the corresponding switch or because the push buttons are enabled in the event that there is no selector switch available or the VirtualLPEN is high with the local panel mode enabled).						
LPMode	BOOL	1 = The local panel mode is in Local Panel.						
		The following table depicts how the local panel operating mode is determined based on the MODESignalsEN, VirtualLPEN, PBSignalsEN, LPSignal, CSSignal and ZEROSignal, input signals:						
		MOD-ESi-gna-lsEN	Vir-tual-LPEN	PBSi-gnal-sEN	LPSig-nal	CSSi-gnal	ZERO-Signal	OUTPUT
		0	0	0	0	0	0	CS mode
		1	0	0	0	0	0	Zero mode
		1	0	0	1	0	0	LP mode and PBLIGHT-Signal
		1	0	0	0	1	0	CS mode
		0	1	1	NA	NA	NA	CS mode
		0	1	0	NA	NA	NA	CS mode
		0	0	1	0	0	0	LP mode and PBLIGHT-Signal
		1	1	0	1	0	0	LP mode and PBLIGHT-Signal
		1	1	0	0	0	0	Zero mode
		1	1	0	0	0	1	Zero mode

Parameter	Type	Description						
		1	1	0	0	1	0	CS mode
		1	0	1	0	1	0	CS mode
		1	1	1	0	1	0	CS mode
		1	0	0	0	0	1	Zero mode
ZEROMode	BOOL	1 = The local panel mode is in Zero. User is not allowed to operate the device from the faceplate and also from DFB. Hence, all the functions in the faceplate will be disabled. Refer to the table included with the description of the LPMODE output.						
CSMode	BOOL	1 = The local panel mode is in control system. Refer to the table included with the description of the LPMODE output.						

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
MVALVED_ST	MVALVED_ST_DDT	Data structure corresponding to the motorized on-off valve is to be controlled from the local panel (for detailed information regarding this structure, refer to the MVALVED DFB, page 134. The structure provides the information needed for the operation of the MVALVEDLP DFB and enables this DFB to control the owner of the motorized valve.
MVALVEDLP_ST	MVALVEDLP_ST_DDT	Data structure that is used as an interface with the monitoring (HMI) system.

MVALVED_ST.DDT Type

Name	Type	Description
CFGW	WORD	Provides the means to control the device from the monitoring (HMI) system. Read-only access to the data contained in this word.

MVALVEDLP_ST.DDT Type

Name	Type	Description
STW	WORD	Read-only access Bits word with the status of the local panel.

MVALVE_ST.CFGW Word

The following table describes the MVALVED_ST.CFGW word:

Bit	Name	Description																														
0	OWNER	<p>Read/write access</p> <p>Enables to configure whether the set-point is set by the Program (0) or by the Operator (1).</p> <p>Refer to the table included with the description of the <code>LPMODE</code> output pin, which specifies the cases in which the <code>MVALVEDLP</code> DFB can interact with this signal.</p>																														
4	LPSEL	<p>Read/write access</p> <p>Enables to set the LPSEL command from the monitoring (HMI) system when the owner is the Operator (<code>OWNER = 1</code>). As long as the set-point is set by the Program (<code>OWNER = 0</code>), the DFB continuously assigns it the value of the current command (<code>MVALVED_LP.STW.START</code> input/output).</p> <table><tr><th>The <code>MVALVEDLP</code> DFB determines the set-point command.</th><th>OWNER</th><th>OFFSignal</th><th>ONSignal</th><th>LockSetPoint-EN</th><th>LPSEL is calculated as:</th></tr><tr><td>0</td><td>- (The <code>OWNER</code> signal is forced to 1 (Operator)).</td><td>-</td><td>-</td><td>-</td><td>OFF</td></tr><tr><td>Local Panel</td><td>Operator</td><td>ON</td><td>-</td><td>-</td><td>OFF</td></tr><tr><td>Local Panel</td><td>Operator</td><td>OFF</td><td>Switch to ON</td><td>-</td><td>ON</td></tr><tr><td>Local Panel</td><td>Operator</td><td>OFF</td><td>OFF</td><td>ON</td><td>Last value</td></tr></table> <p>In other cases, the <code>START</code> signal is not modified from the <code>MVALVEDLP</code> DFB.</p>	The <code>MVALVEDLP</code> DFB determines the set-point command.	OWNER	OFFSignal	ONSignal	LockSetPoint-EN	LPSEL is calculated as:	0	- (The <code>OWNER</code> signal is forced to 1 (Operator)).	-	-	-	OFF	Local Panel	Operator	ON	-	-	OFF	Local Panel	Operator	OFF	Switch to ON	-	ON	Local Panel	Operator	OFF	OFF	ON	Last value
The <code>MVALVEDLP</code> DFB determines the set-point command.	OWNER	OFFSignal	ONSignal	LockSetPoint-EN	LPSEL is calculated as:																											
0	- (The <code>OWNER</code> signal is forced to 1 (Operator)).	-	-	-	OFF																											
Local Panel	Operator	ON	-	-	OFF																											
Local Panel	Operator	OFF	Switch to ON	-	ON																											
Local Panel	Operator	OFF	OFF	ON	Last value																											
5	LSP	-																														

MVALVEDLP_ST.CFGW Word

Bit	Name	Description
0	<i>LocalModeOn</i>	<p>Read/write access only</p> <ul style="list-style-type: none"> 1 = Enables the Local Panel mode. 0 = Enables the Control System mode.

MVALVEDLP_ST.STW Word

Read-only access. Status word. The following table describes the MVALVEDLP_ST.STW word:

Bit	NAME	Description
0	<code>LPMODE</code>	Local panel in Local Panel mode. Refer to the <code>LPMODE</code> output pin.
1	<code>ZEROMODE</code>	Local panel in zero mode. Refer to the <code>ZEROMODE</code> output pin.
2	<code>CSMODE</code>	Local panel in Control System mode. Refer to the <code>CSMODE</code> output pin.
3	<code>LockedOwner</code>	<p>Indicates whether the owner change buttons in the monitoring (HMI) system needs to be locked (1) or not (0).</p> <p>Is activated when:</p> <ul style="list-style-type: none"> The Local Panel mode is set to Zero or It is set to Local Panel and the <code>LockOwnerEN</code> input signal has been configured as active (1).
4	<code>SPLocked</code>	<p>Indicates whether the set-point change and <code>START</code> buttons in the monitoring (HMI) system needs to be locked (1) or not (0).</p> <p>Is activated when:</p>

Bit	NAME	Description
		<ul style="list-style-type: none"> The Local Panel mode is set to Zero or It is set to Local Panel and the LockSetpointEN input signal has been configured as active (1).
5	MODESignalSEN	Indicates the state of the MODESignalSEN input signal, that is, whether there is a mode switch (1) or not (0).
6	PBEnabled	Indicates whether the push buttons of the local panel are enabled (1) or not (0). The signal is activated when at least one of the MODESignalSEN and PBSignalSEN signal inputs is active.
7	VirtualLPEN	Enables the drop-down list for the Local Panel / Control System mode selection.
8	LPSignal	Indicates the state of the LPSignal input signal.
9	ZEROSignal	Indicates the state of the ZEROSignal input signal.
10	CSSignal	Indicates the state of the CSSignal input signal.
11	OFFSignal	Indicates the state of the OFFSignal input signal.
12	OpenSignal	Indicates the state of the OpenSignal input signal.
13	CloseSignal	Indicates the state of the CloseSignal input signal.

Public Variables

Public Variable Description

Variable	Type	Description
SC	MVALVEDLP_SC_DDT	Provides the frequently needed data for monitoring and controlling the block.

MVALVEDLP_SC_DDT Type

NAME	Type	Description
LPMode	BOOL	Read-only access Refer to the LPMode output pin, page 143.
ZEROMode	BOOL	Read-only access Refer to the ZEROMode output pin, page 143.
CSMode	BOOL	Read-only access Refer to the CSMode output pin, page 143.
DisableLP	BOOL	Read/write access 1 = Disables the push buttons on the local panel. Only applicable when a local panel without mode switch configuration is used (MODESignalSEN = 0).

Analog Device Control

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Overview

This part provides a detailed description of the functions, pins, pin layout, and variables of the function blocks of the analog device control family.

These function blocks do not reflect any specific installation.

WARNING

LOSS OF CONTROL

- Perform a Failure Mode and Effects Analysis (FMEA), or equivalent risk analysis, of your application, and apply preventive and detective controls before implementation.
- Provide a fallback state for undesired control events or sequences.
- Provide separate or redundant control paths wherever required.
- Supply appropriate parameters, particularly for limits.
- Review the implications of transmission delays and take actions to mitigate them.
- Review the implications of communication link interruptions and take actions to mitigate them.
- Provide independent paths for control functions (for example, emergency stop, over-limit conditions, and error conditions) according to your risk assessment, and applicable codes and regulations.
- Apply local accident prevention and safety regulations and guidelines.¹
- Test each implementation of a system for proper operation before placing it into service.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

¹ For additional information, refer to NEMA ICS 1.1 (latest edition), *Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control* and to NEMA ICS 7.1 (latest edition), *Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems* or their equivalent governing your particular location.

CVALVE - Control Valve with Position Feedback

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Overview

This chapter describes the CVALVE DFB.

Description

General

The main objective of the CVALVE DFB is to manage control valves with optional position feedback (position and/or limit switches).

User can supplement this DFB with DINPUT DFBs from the General Purpose Library. This DFB enables to incorporate conditioning functions for the digital signals of the limit switches.

Function Description

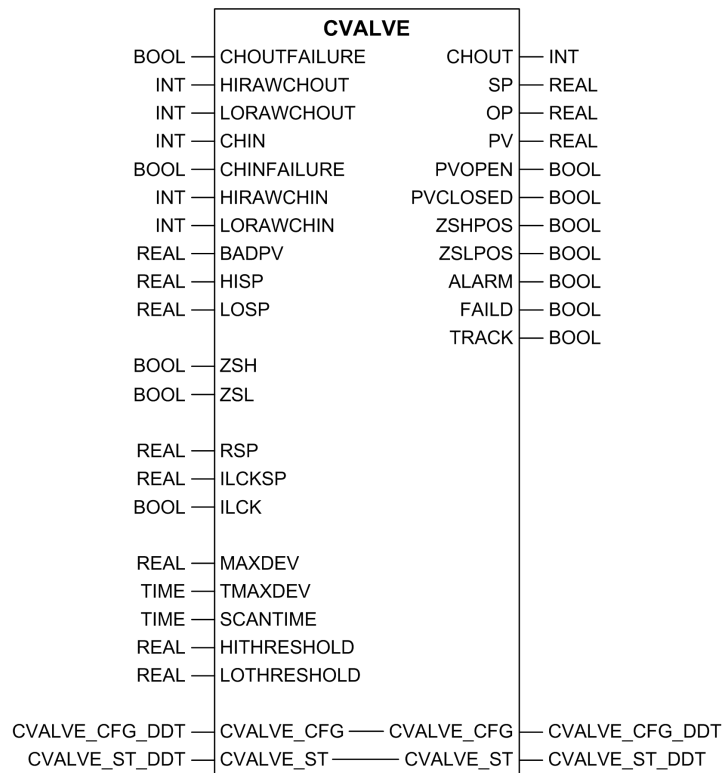
The main functions of the DFB are described in the following table:

Function	Description
Owner	The DFB manages the control system level which is the owner (Operator or Program). As a result, it is responsible for setting the set-point and activation for the control.
Interlocking	The DFB gives a command to the device to move to the defined position in case of an active interlock. An interlock bypass function is available.
Set-point	The DFB enables to work under a remote (usually set from the continuous control) or local (set from the program or by the operator depending on the active owner) set-point.
Simulation	The target position of the valve is used as the current position in simulation mode. The position limits that are usually determined based on the limit switches are simulated based on the analog position.
Tracking	The DFB activates monitoring for tracking the actual position in relation to the target position.

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Description Table

Parameter	Type	Description
CHOUTFAILURE	BOOL	1 = Indicates to the DFB the output channel associated with the CHOUT output is operational.
HIRAWCHOUT	INT	High range for the CHOUT output signal in raw data.
LORAWCHOUT	INT	Low range for the CHOUT output signal in raw data.
CHIN	INT	Input signal that indicates the position of the valve. Usually corresponds to a value in raw data coming from the input/output peripherals. Connecting a variable or value to this DFB pin enables analog position feedback.
CHINFFAILURE	BOOL	1 = Indicates to the DFB the input channel associated with the CHIN input is operational as long as position feedback is enabled (refer to the CHIN input).
HIRAWCHIN	INT	High range for the CHIN input signal.
LORAWCHIN	INT	Low range for the CHIN input signal.
BADPV	REAL	Value in engineering units (PV output signal) needs to be used when the channel is non-operational.
HISP	REAL	High range for the set-point (SP) corresponding to the maximum value (configured in the HIRAWCHOUT input) of the CHOUT output in engineering units.
LOSP	REAL	Low range for the set-point (SP) in engineering units corresponding to the minimum value (configured in the LORAWCHOUT input) of the CHOUT output in engineering units.
ZSH	BOOL	1 = Indicates that the open valve position is reached. Used to connect to the digital input of the open-valve limit switch. Disabled internally by the DFB if no variable or value is connected.
ZSL	BOOL	1 = indicates that the closed valve position is reached.

Parameter	Type	Description
		Used to connect to the digital input of the closed-valve limit switch. Disabled internally by the DFB if no variable or value is connected.
RSP	REAL	Remote set-point by the continuous control for control PID controller output.
ILCKSP	REAL	1 = Run Set-point needs to be used when the block is interlocked.
ILCK	BOOL	1 = Interlocks the device at the defined position.
MAXDEV	REAL	Enables to set the maximum permissible deviation between the current set-point and the actual position. If the difference is greater than the value of this parameter for a certain period (refer to the TMAXDEV input), the follow-up detected error alarm is activated.
TMAXDEV	TIME	Maximum permissible time during which there can be a follow-up detected fault. The follow-up detected error is generated if the difference between the set-point and the actual position is greater than the value entered in the MAXDEV input. You can deactivate follow-up alarm monitoring by setting this parameter to 0 (T#0s).
SCANTIME	TIME	Enables to configure the time during which the follow-up alarm signal is kept active. This helps the monitoring subsystem to acquire the data in case of brief alarms detected.
HITHRESHOLD	REAL	Enables to configure the open-valve threshold for the analog position measurement as a percentage, that is, the threshold after which it is considered that the valve is completely opened.
LOTHRESHOLD	REAL	Enables to configure the closed-valve threshold for the analog position measurement as a percentage, that is, the threshold after which it is considered that the valve is completely closed.

Outputs

Output Parameter Description

Parameter	Type	Description		
CHOUT	INT	Calculated value of the output in raw data is used to position the valve. The CHOUT calculation is shown in the following table.		
		OP	CHOUT is calculated as:	
		<= LOSP	LORAW	
		> LOSP and < HISP	Refer to the following linear scaling formula.	
		>= HISP	HIRAW	
SP	REAL	Current valve set-point. The SP calculation is shown in the following table:		
		OWNER (OFF: Program, ON: Operator)	REM	SP is calculated as:
		OFF	OFF	SC.LSP
		OFF	ON	RSP
		ON	-	CVALVE_CFG.LSP
OP	REAL	Valve positioning output in engineering units. The OP calculation is shown in the following table:		
		SC.ILCKD	OP is calculated as:	
		ON	ILCKSP	

Parameter	Type	Description
		OFF SP
PV	REAL	Current valve position in engineering units.
PVOPEN	BOOL	1 = Indicates the open-valve position has been reached. This is verified by checking whether or not the analog input falls within the threshold specified by means of the HITHRESHOLD input.
PVCLOSED	BOOL	1 = Indicates the closed-valve position has been reached. This is verified by checking whether or not the analog input falls within the threshold specified by means of the LOTHRESHOLD input.
ZSHPOS	BOOL	1 = Indicates the open-valve position has been reached. If ZSHPOS is not operational, PVOPEN is used as a basis for the indication instead.
ZSLPOS	BOOL	1 = Indicates the closed-valve position has been reached. If ZSLPOS is not operational, PVCLOSED is used as a basis for the indication instead.
ALARM	BOOL	1 = Indicates a follow-up detected error (1) has occurred. The analog position signal is monitored. Refer to the MAXDEV and TMAXDEV inputs, page 149.
FAILD	BOOL	1 = Indicates an inoperable device (1) in the either of the following cases: <ul style="list-style-type: none"> when the ZSH and ZSL inputs are active simultaneously when the limit switches do not correspond to the maximum and minimum values that are determined based on the measurement of current position.
TRACK	BOOL	1 = Indicates that the tracking current output is not effective.

Linear Scaling Formula:

$$\left(\frac{(HIRAW - LORAW)}{(HISP - LO SP)} \times SP \right) + LORAW - \left(\frac{(HIRAW - LORAW)}{(HISP - LO SP)} \times LO SP \right)$$

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
CVALVE_CFG	CVALVE_CFG_DDT	Provides the data necessary to configure the DFB (usually from the monitoring subsystem).
CVALVE_ST	CVALVE_ST_DDT	Provides the data necessary to monitor the DFB status.

CVALVE_CFG_DDT Type

Name	Type	Description
LSP	REAL	Read/write access This variable indicates the current set-point. It is calculated internally in the DFB if the Program is the owner. It is set to match the SP output. If the Operator is the owner, you can modify it from the monitoring subsystem.

CVALVE_ST_DDT Type

Name	Type	Description
STW	WORD	Provides the device status usually used from the monitoring subsystem, and allows data to be kept in the memory. Read-only access to the data contained in this word.
CFGW	WORD	Provides the means to control the device from the monitoring subsystem. Read/write access to the data contained in this word.
PV	REAL	Read-only access Refer to the PV output pin, page 150.
OP	REAL	Read-only access Refer to the OP output pin, page 150.

CVALVE_ST.STW Word Structure

DFB status word. Read-only access. The following table describes CVALVE_ST.STW word:

Bit	Name	Description
0	CHINFAILURE	Refer to the CHINFAILURE input pin, page 149.
1	ILCK	Refer to the ILCK input pin, page 149.
2	REM	Refer to the SC.REM public variable, page 153.
4	CHOUTFAILURE	Refer to the CHOUTFAILURE input pin, page 149.
6	PVOPEN	Refer to the PVOOPEN output pin, page 150.
7	PVCLOSED	Refer to the PVCLOSED output pin, page 150.
9	FAIL	Refer to the FAIL output pin, page 150.
10	ALARM	Refer to the ALARM output pin, page 150.
11	ZSLPOS	Refer to the ZSLPOS output pin, page 150.
12	ZSHPOS	Refer to the ZSHPOS output pin, page 150.
13	ZSLEN	ZSL is connected.
14	ZSHEN	ZSH is connected.

CVALVE_ST.CFGW Word Structure

Provides the data needed to configure the DFB usually from the monitoring subsystem. The following table describes CVALVE_ST.CFGW word:

Bit	Name	Description
0	OWNER	Read/write access Enables to configure whether the set-point is set by the Program (0) or by the Operator (1).
1	ILCKBP	Read/write access Allows the interlock to be bypassed (1).
2	SIMMD	Read/write access Enables you to place the device in Simulation mode so that the actual position signals (CHIN, ZSL, and ZSH inputs) are ignored, and the current position is considered to be the target position.

Public Variables

Public Variable Description

Variable	Type	Description
SC	CVALVE_SC_DDT	Provides the frequently needed data to monitor the DFB status.

CVALVE_SC_DDT Type

Name	Type	Description		
LSP	REAL	Read/write access Enables the sequential control to assign the local set-point if the owner is the Program (OWNER input/output is set to 0), and the selected set-point is the local one (SC.REM public variable is set to 0). Otherwise, the current set-point (SP output) is copied continuously to this variable.		
OP	REAL	Read-only access Refer to the OP output pin, page 150.		
PV	BOOL	Read-only access Refer to the PV output pin, page 150.		
OWNER	BOOL	Read-only access Refer to the CVALVE_ST.CFGW.OWNER input/output pin, page 151.		
REM	BOOL	Read/write access Allows the DFB to be configured for a remote set-point - RSP-(1) or local set-point - LSP - (0).		
ILCKD	BOOL	Read-only access Indicates whether the motor is interlocked. The signal evaluation depending on the ILCK input and the CVALVE_ST.CFGW.ILCKBP input/output is shown in the following table:		
		ILCK	ILCKBP	SC.ILCKD.LSP
		OFF	-	OFF
		ON	OFF	ON
		ON	ON	OFF
PVOPEN	BOOL	Read-only access Refer to the PVOPEN output pin, page 150.		
PVCLOSED	BOOL	Read-only access Refer to the PVCLOSED output pin, page 150.		
FAILD	BOOL	Read-only access Refer to the FAILD output pin, page 150.		
ALARM	BOOL	Read-only access Refer to the ALARM output pin, page 150.		
BADSTIN	BOOL	Read-only access Refer to the CHINFAILURE input pin, page 149.		
BADSTOUT	BOOL	Read-only access Refer to the CHOUTFAILURE input pin, page 149.		

Name	Type	Description
ZSLPOS	BOOL	Read-only access Refer to the ZSLPOS output pin, page 150.
ZSHPOS	BOOL	Read-only access Refer to the ZSHPOS output pin, page 150.

CVALVELP - Local Panel for Controlling Control Valves

What's in This Chapter

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Overview

This chapter describes CVALVELP DFB.

Description

General

The main objective of the CVALVELP DFB is to manage a local panel that controls a control valve with position feedback. This valve is implemented with a CVALVE function block and with signals that are wired to the controller so that the latter defines the target position for the device.

Function Description

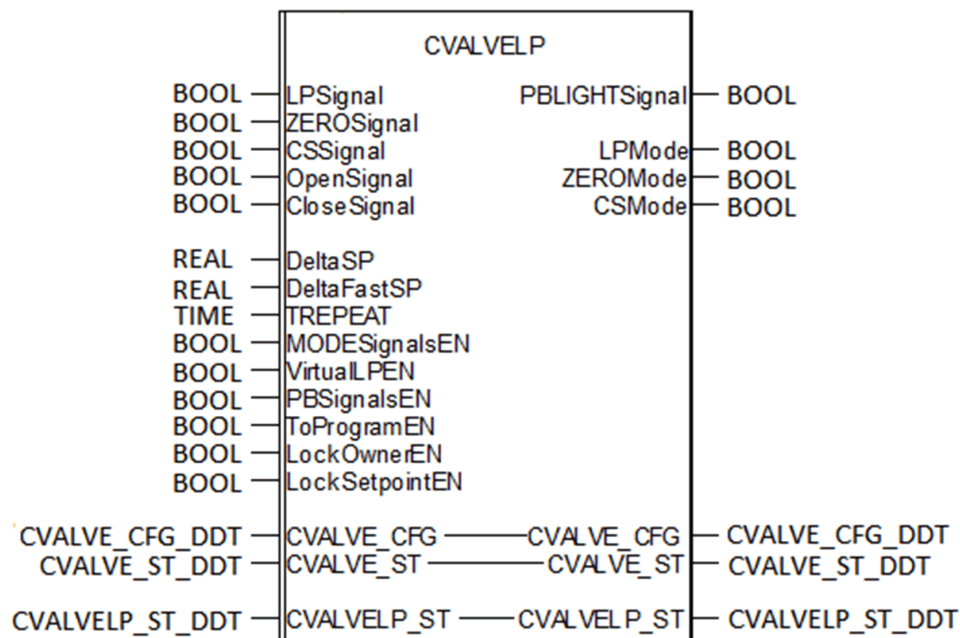
The main functions of the module are described in the following table:

Function	Description
Mode Switch	Optionally manages the signals coming from an operating mode switch in a local panel with the following configuration: Local - Zero - Control System. The Zero mode signal is optional. However the user can enable Local/Control System mode from the faceplate also, when <i>VirtualLPEN</i> input pin signal is high and <i>MODESignalsEN</i> signal is low.
Push buttons	The DFB manages up to two signals coming from OPEN and CLOSE push buttons, giving the CLOSE push button higher priority.
Owner Management	The DFB enables to configure whether the Program needs to be the valve owner or not, after switching to the Control System mode again.
Owner Locking	The DFB enables to configure whether the monitoring (HMI) system needs to block access to the drop-down list or not, it disables the access to change the owner (Operator/Program) while the valve is controlled from the Local Panel.
Set-point Lock	The DFB enables to configure whether the monitoring (HMI) system needs to block access to the drop-down list or not. It disables to change the set-point while the valve is controlled from the Local Panel.
Push button Enabling/Disabling	The push button signals from the Local Panel can be enabled/disabled through the DFB configuration (input pin) and/or from control sequences.
Enabled Panel Signaling	The DFB provides a signal that can be used to illuminate a light source on the Local Panel to indicate when the push buttons are enabled for operation.
Virtual Panel Enabling/Disabling	This signal enables the operator to select the Local / Control System mode of operation from the HMI so that the push button signals are enabled for operation. NOTE: <i>VirtualLPEN</i> input pin signal is applicable when Modicon Libraries - General Purpose is used along with Modicon Libraries - General Purpose for Wonderware System Platform.

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
LPSignal	BOOL	1 = The local panel mode switch is in the Local Panel position. Refer to the table included with the description of the LPMODE output pin, page 158.
ZEROSignal	BOOL	1 = The local panel mode switch is in the zero position. This signal is optional even if a mode switch is available on the local panel. When this signal is a logical high, user is not allowed to operate the device from the faceplate and also from the DFB. Hence, all the functions in the faceplate will be disabled. Refer to the table included with the description of the LPMODE output pin, page 158.
CSSignal	BOOL	1 = The local panel mode switch is in the Control System position. Refer to the table included with the description of the LPMODE output pin, page 158.
OpenSignal	BOOL	1 = Indicates to the DFB the OPEN push button on the local panel is pressed.
CloseSignal	BOOL	1 = Indicates to the DFB the CLOSE push button on the local panel is pressed.
DeltaSP	REAL	Absolute set-point increase or decrease value when the OPEN or CLOSE push buttons are pressed.
DeltaFastSP	REAL	Absolute set-point increase or decrease value when the OPEN and CLOSE push buttons are being pressed.
TREPEAT	TIME	Indicates the maximum time that needs to elapse before the system interprets that a command has been repeated when the push button is pressed. This time also determines when a DeltaFastSP increase or decrease has to be applied when the OPEN or CLOSE push button is pressed.

Parameter	Type	Description																				
MODESignalsEN	BOOL	<p>1 = Enables the use of the Local Panel/Zero/ Control System (or Local Panel - Control System) mode switch on the local panel. Usually configured in development phase based on the characteristics of the local panel being used. If the mode switch is enabled, the LPSignal, ZEROSignal, and CSSignal inputs are considered to determine the operating modes of the local panel. Refer to the table included with the description of the LPMode output pin, page 158.</p> <p>NOTE: MODESignalsEN input pin has higher priority than the VirtualLPEN input pin signal.</p>																				
VirtualLPEN	BOOL	<p>1 = This signal enables the operator to select the Local/Control System mode of operation from the HMI, so that the push button signals are enabled for operation.</p> <p>NOTE:</p> <ul style="list-style-type: none">When the owner is program, the Local/Control System mode selection drop-down list will be visible but disabled for operation however, when the owner is operator the Local Panel drop-down list will be accessible for operation.VirtualLPEN input pin signal is applicable only for Modicon Libraries - General Purpose for Wonderware System Platform offer only, however there is no impact of this input signal in Modicon Libraries - General Purpose for Citect SCADA offer. <p>Refer to the table included with the description of the LPMode output pin, page 158.</p>																				
PBSignalsEN	BOOL	<p>1 = Enables to accept the OPEN and CLOSE push buttons from the local panel. This signal is not applicable if the mode switch is enabled (refer to the MODESignalsEN input). This means that the push button signals are considered in the Local Panel mode.</p> <p>When the mode switch is disabled (MODESignalsEN = 0), PBSignalsEN signal enables/disables the push button signals from control system itself based on relevant process conditions. SC.DISABLELPP public variable is also considered for determining whether the push buttons are enabled or not when LPMode pin signal is high as shown in the following table.</p>																				
		<table><tr><th>MODESIGNALSEN</th><th>PBSIGNAL-SEN</th><th>SC.DISA-BLELP</th><th>Push buttons enabled?</th></tr><tr><td>OFF</td><td>OFF</td><td>-</td><td>NO</td></tr><tr><td>OFF</td><td>-</td><td>ON</td><td>NO</td></tr><tr><td>OFF</td><td>ON</td><td>OFF</td><td>YES</td></tr><tr><td>ON</td><td>-</td><td>-</td><td>YES</td></tr></table>	MODESIGNALSEN	PBSIGNAL-SEN	SC.DISA-BLELP	Push buttons enabled?	OFF	OFF	-	NO	OFF	-	ON	NO	OFF	ON	OFF	YES	ON	-	-	YES
		MODESIGNALSEN	PBSIGNAL-SEN	SC.DISA-BLELP	Push buttons enabled?																	
		OFF	OFF	-	NO																	
		OFF	-	ON	NO																	
		OFF	ON	OFF	YES																	
		ON	-	-	YES																	
Therefore, user can use this signal to enable/disable the push buttons on a simple local panel that does not feature a mode switch (Local Panel/Zero/Control System) based on the relevant process conditions.																						
ToProgramEN	BOOL	<p>1 = Enables the functionality that enables to change the owner of the valve to Program when mode switch on the local panel returns to control system position (only when the mode is switched). If this functionality is disabled, the operator of the monitoring (HMI) system switches to Program owner when the operator deems it appropriate. Refer to the table included with the description of the LockOwnerEN input.</p>																				
LockOwnerEN	BOOL	<p>1 = Disables the access of owner of the valve remaining as Operator while the local panel mode is Local Panel.</p> <p>The following table depicts how the valve owner is evaluated based on the ToProgramEN and LockOwnerEN inputs and operating mode of the local panel:</p>																				
		<table><tr><th>Local Panel Mode</th><th>ToProgramEN</th><th>LockOwnerEN</th><th>Owner</th></tr><tr><td>Zero</td><td>–</td><td>–</td><td>Operator</td></tr><tr><td>Switch to Local Panel</td><td>–</td><td>–</td><td>Operator</td></tr><tr><td>Local Panel</td><td>–</td><td>ON</td><td>Operator</td></tr></table>	Local Panel Mode	ToProgramEN	LockOwnerEN	Owner	Zero	–	–	Operator	Switch to Local Panel	–	–	Operator	Local Panel	–	ON	Operator				
		Local Panel Mode	ToProgramEN	LockOwnerEN	Owner																	
		Zero	–	–	Operator																	
		Switch to Local Panel	–	–	Operator																	
Local Panel	–	ON	Operator																			

Parameter	Type	Description			
		Switch to Control System	ON	–	Program
		In remaining cases, owner of the valve ceases to be defined from the CVALVELP DFB, and it enables to change it from the monitoring (HMI) system with the command word in the CVALVE_ST.CFGW input/output of the corresponding CVALVE DFB. In any case, consider that the owner of valve that had been set before switching to Local Panel mode is not memorized.			
LockSetpointEN	BOOL	1 = Disables the setpoint of the valve device and lock it into the one defined on the local panel while the local panel mode is Local Panel and the device owner is the Operator. You can switch to the Program mode based on the signals that have been previously described even if the local panel mode is set to Local Panel. Therefore, user can activate (1) this signal to lock setpoint operation from the monitoring (HMI) system while the valve is controlled from the local panel.			

Outputs

Output Parameter Description

Parameter	Type	Description																																																																																											
PBLIGHT-Signal	BOOL	1 = The push buttons on the local panel are fully operational, that is, the local panel is in Local Panel mode (either because the mode is selected with the corresponding switch or because the push buttons are enabled in the event that there is no selector switch available or the <i>VirtualLPEN</i> is high with the local panel mode enabled).																																																																																											
LPMode	BOOL	<div><div>1 = The local panel mode is in Local Panel.</div><div>The following table depicts how the local panel operating mode is determined based on the <i>MODESignalsEN</i>, <i>VirtualLPEN</i>, <i>PBSignalsEN</i>, <i>LPSignal</i>, <i>CSSignal</i> and <i>ZEROSignal</i>, input signals:</div><table><tr><th>MOD-ESi-gna-lsEN</th><th>Vir-tual-LPEN</th><th>PBSi-gnal-sEN</th><th>LPSig-nal</th><th>CSSi-gnal</th><th>ZERO-Signal</th><th>OUTPUT</th></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>CS mode</td></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>Zero mode</td></tr><tr><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>LP mode and PBLIGHT-Signal</td></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>CS mode</td></tr><tr><td>0</td><td>1</td><td>1</td><td>NA</td><td>NA</td><td>NA</td><td>CS mode</td></tr><tr><td>0</td><td>1</td><td>0</td><td>NA</td><td>NA</td><td>NA</td><td>CS mode</td></tr><tr><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>LP mode and PBLIGHT-Signal</td></tr><tr><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>LP mode and PBLIGHT-Signal</td></tr><tr><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>Zero mode</td></tr><tr><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>Zero mode</td></tr><tr><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>CS mode</td></tr><tr><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>CS mode</td></tr></table></div>	MOD-ESi-gna-lsEN	Vir-tual-LPEN	PBSi-gnal-sEN	LPSig-nal	CSSi-gnal	ZERO-Signal	OUTPUT	0	0	0	0	0	0	CS mode	1	0	0	0	0	0	Zero mode	1	0	0	1	0	0	LP mode and PBLIGHT-Signal	1	0	0	0	1	0	CS mode	0	1	1	NA	NA	NA	CS mode	0	1	0	NA	NA	NA	CS mode	0	0	1	0	0	0	LP mode and PBLIGHT-Signal	1	1	0	1	0	0	LP mode and PBLIGHT-Signal	1	1	0	0	0	0	Zero mode	1	1	0	0	0	1	Zero mode	1	1	0	0	1	0	CS mode	1	0	1	0	1	0	CS mode
MOD-ESi-gna-lsEN	Vir-tual-LPEN	PBSi-gnal-sEN	LPSig-nal	CSSi-gnal	ZERO-Signal	OUTPUT																																																																																							
0	0	0	0	0	0	CS mode																																																																																							
1	0	0	0	0	0	Zero mode																																																																																							
1	0	0	1	0	0	LP mode and PBLIGHT-Signal																																																																																							
1	0	0	0	1	0	CS mode																																																																																							
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0	0	1	0	0	0	LP mode and PBLIGHT-Signal																																																																																							
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1	1	0	0	0	0	Zero mode																																																																																							
1	1	0	0	0	1	Zero mode																																																																																							
1	1	0	0	1	0	CS mode																																																																																							
1	0	1	0	1	0	CS mode																																																																																							

Parameter	Type	Description						
		1	1	1	0	1	0	CS mode
		1	0	0	0	0	1	Zero mode
ZEROMode	BOOL	1 = The local panel mode is in Zero. User is not allowed to operate the device from the faceplate and also from DFB. Hence, all the functions in the faceplate will be disabled. Refer to the table included with the description of the LPMODE output.						
CSMode	BOOL	1 = The local panel mode is in Control System. Refer to the table included with the description of the LPMODE output.						

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
CVALVE_CFG	CVALVE_CFG_DDT	<p>Data structure belonging to the control valve is to be controlled from the local panel (for detailed information regarding this structure, refer to the CVALVE DFB, page 148).</p> <p>The structure provides the information needed for the operation of the CVALVELP DFB. It enables this DFB to control the setpoint for the control valve.</p>
CVALVE_ST	CVALVE_ST_DDT	<p>Data structure belonging to the valve is to be controlled from the local panel (for detailed information regarding this structure, refer to the CVALVE DFB, page 148).</p> <p>The structure provides the information needed for the operation of the CVALVELP DFB and enables this DFB to control the owner of the valve.</p>
CVALVELP_ST	CVALVELP_ST_DDT	Data structure that is used as an interface with the monitoring (HMI) system.

CVALVE_CFG.DDT Type

Name	Type	Description
LSP	REAL	<p>Read/write access</p> <p>Allows local set-point of the operator (OWNER = 1) to be set from the monitoring (HMI) system. If set-point is set by the Program (OWNER = 0), the DFB continuously assigns it the value of the current set-point.</p>

CVALVE_ST.DDT Type

Name	Type	Description
STW	WORD	<p>Read-only access</p> <p>Bits word with the status of the local panel.</p>
CFGW	WORD	Provides means to control the device from the monitoring (HMI) system. Read-only access to the data contained in this bits word.

Name	Type	Description
PV	REAL	Read-only access Refer to the PV output pin, page 150.
OP	REAL	Read-only access Refer to the OP output pin, page 150.

CVALVE_ST.CFGW Word

The following table describes the CVALVE_ST.CFGW word:

Bit	Name	Description
0	OWNER	Read/write access Enables to configure whether the set-point is set by the Program (0) or by the Operator (1). Refer to the table included with the description of the LPMODE output pin, which specifies the cases in which the CVALVELP DFB can interact with this signal.

CVALVELP_ST.CFGW Word

Bit	Name	Description
0	<i>LocalModeOn</i>	Read/write access only <ul style="list-style-type: none"> 1 = Enables the Local Panel mode. 0 = Enables the Control System mode.

CVALVELP_ST.DDT Type

Name	Type	Description
STW	WORD	Read-only access Bits word with the status of the local panel.

CVALVELP_ST.STW Word

Read-only access. Status word. The following table describes the CVALVELP_ST.STW word:

Bit	Name	Description
0	LPMODE	Local panel in Local Panel mode. Refer to the LPMODE output pin.
1	ZEROMODE	Local panel in zero mode. Refer to the ZEROMODE output pin.
2	CSMODE	Local panel in Control System mode. Refer to the CSMODE output pin.
3	LockedOwner	Indicates whether the owner change buttons in the monitoring (HMI) system needs to be locked (1) or not (0). Is activated when: <ul style="list-style-type: none"> The local panel mode is set to Zero or It is set to Local Panel, and the LockOwnerEN input signal has been configured as active (1).
4	SPLocked	Indicates whether the set-point change and START buttons in the monitoring (HMI) system needs to be locked (1) or not (0).

Bit	Name	Description
		Is activated when: <ul style="list-style-type: none"> The local panel mode is set to Zero or It is set to Local Panel, and the <code>LockSetpointEN</code> input signal has been configured as active (1).
5	<code>MODEsignalsEN</code>	Indicates the state of the <code>MODEsignalsEN</code> input signal, that is, whether there is a mode switch (1) or not (0).
6	<code>PBEnabled</code>	Indicates whether the push buttons of the local panel are enabled (1) or not (0). The signal is activated when at least one of the <code>MODEsignalsEN</code> and <code>PBSignalsEN</code> signal inputs is active.
7	<code>VirtualLPEN</code>	Enables the drop-down list for the Local Panel / Control System mode selection.
8	<code>LPSignal</code>	Indicates the state of the <code>LPSignal</code> input signal.
9	<code>ZEROSignal</code>	Indicates the state of the <code>ZEROSignal</code> input signal.
10	<code>CSSignal</code>	Indicates the state of the <code>CSSignal</code> input signal.
11	<code>OpenSignal</code>	Indicates the state of the <code>OpenSignal</code> input signal.
12	<code>CloseSignal</code>	Indicates the state of the <code>CloseSignal</code> input signal.

Public Variables

Public Variable Description

Variable	Type	Description
SC	<code>CVALVELP_SC_DDT</code>	Provides the frequently needed data for monitoring and controlling the DFB.

CVALVELP_SC_DDT Type

Name	Type	Description
<code>LPMode</code>	BOOL	Read-only access Refer to the <code>LPMode</code> output pin, page 158.
<code>ZEROMode</code>	BOOL	Read-only access Refer to the <code>ZEROMode</code> output pin, page 158.
<code>CSMode</code>	BOOL	Read-only access Refer to the <code>CSMode</code> output pin, page 158.
<code>DisableLP</code>	BOOL	Read/write access 1 = Disables the push buttons on the local panel. Only applicable when a local panel without mode switch configuration is used (<code>MODEsignalsEN</code> = 0).

MVALVE - Motorized Valve with Positioner

What's in This Chapter

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Overview

This chapter describes the MVALVE DFB.

Description

General

The MVALVE DFB is designed to control a motorized valve, or a gate with position feedback and 2-rotational-direction-motor-based control.

User combine the MVALVE DFB with the following Control Expert components from the General Purpose Library:

- AINPUT
- MOTOR2
- DINPUT

Function Description

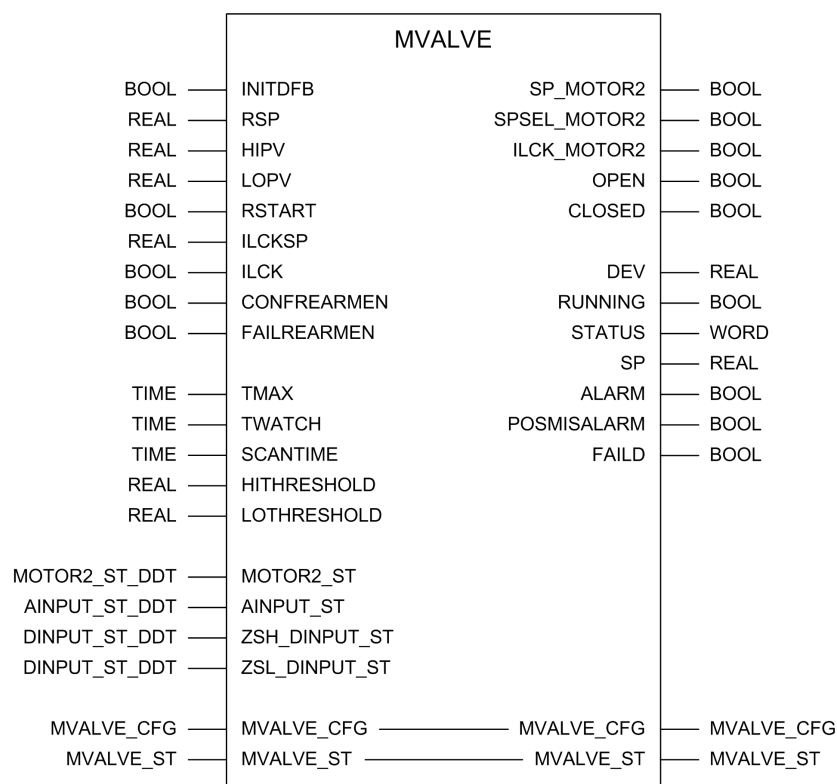
The main functions of the DFB are described in the following table:

Function	Description
STEP3	The DFB includes and incorporates the functions provided by the STEP3 controller from the standard CONT_CTL Control Expert library.
Owner	The DFB manages the control system level which is the owner (Operator or Program). As a result, it is responsible for setting the set-point and activation for the control
Interlocking	The DFB gives a command to the device to move to the defined position in case of an active interlock. An interlock bypass function is available.
Set-point	The DFB enables to work under a remote (usually set from the continuous control) or local (set from the program or by the operator depending on the active owner) set-point.
Mode	You can enable (<i>START</i> = 1) the <i>STEP3CTL</i> module to operate as described in the STEP3 module in Automatic mode or disable (<i>START</i> = 0), in which case the module continues calculating but forces the outputs to 0.

DFB Representation

Representation

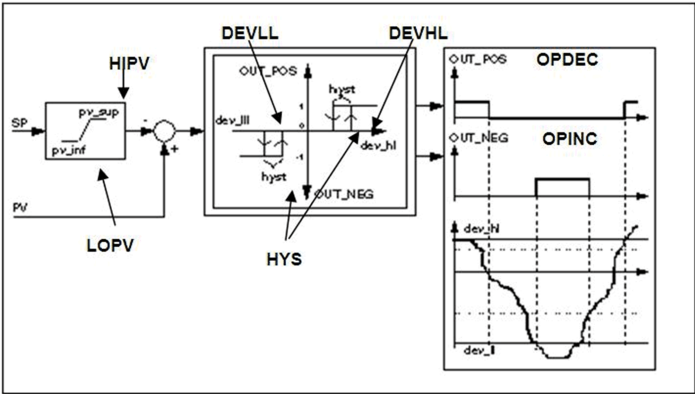
This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
INITDFB	BOOL	When a rising edge occurs on this input, the internal timers of the DFB are reset and alarms are set to 0.
RSP	REAL	1 = Remote speed set-point is usually set by the continuous control. Refer to the <i>SC.REM</i> public variable, page 168.
HIPV	REAL	Higher value of measurement range. This input limits the maximum set-point admitted by the controller. This input is internally connected to the <i>PARA.PV_SUP</i> parameter of the <i>STEP3</i> controller.
LOPV	REAL	Lower value of measurement range. This input limits the minimum set-point admitted by the controller. This input is internally connected to the <i>PARA.PV_INF</i> parameter of the <i>STEP3</i> controller.

Parameter	Type	Description												
														
RSTART	BOOL	<p>1 = Enables the operation of the STEP3 block in automatic mode as described in the Control Expert document.</p> <p>0 = It forces the OPINC and OPDEC outputs to 0, but the STEP3 continues to run internally and to calculate the outputs.</p> <p>The valid Start command for the calculation is obtained from the following truth table.</p> <table border="1"> <thead> <tr> <th>OWNER</th><th>REM</th><th>Start is calculated as</th></tr> </thead> <tbody> <tr> <td>OFF</td><td>OFF</td><td>SC.LSTART</td></tr> <tr> <td>OFF</td><td>ON</td><td>RSTART</td></tr> <tr> <td>ON</td><td>-</td><td>MVALVE_ST.CFGW.START</td></tr> </tbody> </table> <p>You can modify the set-point directly from the monitoring subsystem while this mode is active.</p>	OWNER	REM	Start is calculated as	OFF	OFF	SC.LSTART	OFF	ON	RSTART	ON	-	MVALVE_ST.CFGW.START
OWNER	REM	Start is calculated as												
OFF	OFF	SC.LSTART												
OFF	ON	RSTART												
ON	-	MVALVE_ST.CFGW.START												
ILCKSP	REAL	Set-point needs to be used when the block is interlocked. Refer to the ILCK input.												
ILCK	BOOL	<p>1 = Forces the DFB to run with the set-point defined on the ILCKSP input. You can use the ILCKSP and ILCK combination to force the set-point of a motorized valve to a certain position, for example, the value corresponding to a 0% aperture. In this case, the DFB controls the outputs until an aperture of 0% is reached.</p> <p>If de-energizing the outputs is desired, set the RSTART to 0. In any case, if deactivating the control signals is desirable, interlock the corresponding operations (using DEVCTL, MOTOR2, DOUTPUT, and so on.).</p>												
CONFREARMEN	BOOL	<ul style="list-style-type: none"> 1 = Withdraws the output SP_MOTOR2 when a non-confirmed operation is detected (ALARM = 1) and requires a mandatory manual resetting once the ALARM condition disappears. 0 = The output SP_MOTOR2 remains in its previous state when a non-confirmed operation is detected (ALARM = 1) and does not need manual resetting, once the ALARM condition disappears. <p>Refer to the TMAX input, TWATCH input and the MVALVE_ST.STW.ALARM input/output pin, page 183.</p>												
FAILREARMEN	BOOL	<ul style="list-style-type: none"> 1 = Withdraws the output SP_MOTOR2 upon a detected error condition (FAILD = 1) and requires a mandatory manual resetting once the FAIL condition disappears. 0 = The output SP_MOTOR2 remains in its previous state upon a detected error condition (FAILD = 1) and does not need manual resetting, once the FAIL condition disappears. 												
TMAX	TIME	Enables to configure the maximum time that the valve needs to take in completing its stroke, both for opening and closing. This input is used to evaluate the detected alarm situation in the device.												
TWATCH	TIME	<p>Enables to configure the time during which monitoring for the switching operations of the valve is enabled (0s = Disabled).</p> <p>After this time, a check is run to verify that the valve has moved the distance that was expected according to the maximum opening time (TMAX) that was configured.</p>												
SCANTIME	TIME	Enables the time that the detected alarm signals are kept active to be configured. Enables the monitoring subsystem to acquire the data for detected alarms that are automatically reset.												
HITHRESHOLD	REAL	Enables to configure the open-valve threshold for the analog position measurement as a percentage, that is, the threshold after which it is considered that the valve is completely open.												

Parameter	Type	Description
LOTHRESHOLD	REAL	Enables to configure the closed-valve threshold for the analog position measurement as a percentage, that is, the threshold after which it is considered that the valve is completely closed.
MOTOR2_ST	MOTOR2_ST_DDT	Enables to find out the device status. This input is used to know the current status, detected errors, detected alarms, lack of set-point follow-up, owner, and simulation of the motor that actuates the valve.
AINPUT_ST	AINPUT_ST_DDT	Enables to find out the device status. This input is used to know the current status, detected errors in channels, and simulation of the analog valve position measurement.
ZSH_DINPUT_ST	DINPUT_ST_DDT	Enables to find out the device status. This input is used to know the current status, detected errors in channels, and simulation of the open-valve limit switch.
ZSL_DINPUT_ST	DINPUT_ST_DDT	Enables to find out the device status. This input is used to know the current status, detected errors in channels, and simulation of the closed-valve limit switch.

Outputs

Output Parameter Description

Parameter	Type	Description																														
SP_MOTOR2	BOOL	1 = Provides the remote set-point for motor control (RSP). Read-only access. Refer to the <i>RSPinput</i> , page 117 of the <i>MOTOR2</i> block.																														
SPSEL_MOTOR2	BOOL	1 = Provides the set-point for selecting the actuator to be affected by the <i>SP_MOTOR2</i> set-point. Read-only access. Refer to the <i>RSPSEL</i> input, page 117 of the <i>MOTOR2</i> block.																														
ILCK_MOTOR2	BOOL	1 = Interlocks the motor. The DFB calculates the interlocking conditions of the motor internally. Read-only access.																														
OPEN	BOOL	1 = Indicates the maximum opening position is reached. It is calculated based on the states obtained from the analog input and/or the digital input belonging to the open-valve limit switch.																														
CLOSED	BOOL	1 = Indicates the closed-valve position is reached. It is calculated based on the states obtained from the analog input and/or digital input belonging to the closed-valve limit switch.																														
DEV	REAL	Deviation (<i>PV-SP</i>) extracted directly from the <i>STEP3</i> controller.																														
RUNNING	BOOL	1 = Extracted from the <i>STEP3</i> controller.																														
STATUS	WORD	States output by the <i>STEP3</i> controller on the <i>STATUS</i> output. For more details, see the <i>Control Expert</i> documentation for the <i>STEP3</i> controller. <div><table><tr><th>Bit</th><th>Valor en dec.</th><th>Valor en hex.</th><th>Estado ENO</th><th>Significado</th></tr><tr><td>Bit 0 = 1</td><td>1</td><td>0x0001</td><td>False</td><td>Error en un cálculo con valores de coma flotante</td></tr><tr><td>Bit 1 = 1</td><td>2</td><td>0x0002</td><td>False</td><td>Detección de un valor no permitido en una de las entradas de valores con coma flotante</td></tr><tr><td>Bit 2 = 1</td><td>4</td><td>0x0004</td><td>False</td><td>División por cero en un cálculo de valores con coma flotante</td></tr><tr><td>Bit 3 = 1</td><td>8</td><td>0x0008</td><td>False</td><td>Desborde de capacidad durante el cálculo de valores con coma flotante</td></tr><tr><td>Bit 4 = 1</td><td>16</td><td>0x0010</td><td>True</td><td>Se mostrarán los siguientes comportamientos:<ul style="list-style-type: none">• <i>SP</i> se encuentra fuera de rango [<i>pv_inf</i>, <i>pv_sup</i>]: en este caso, <i>SP</i> se limita a <i>pv_inf</i> o <i>pv_sup</i>.• <i>dev_h1</i> > 0 o <i>dev_h1</i> < 0: el módulo utiliza el valor 0.• <i>hyat</i> se encuentra fuera del rango [0, mínimo (<i>dev_h1</i>, -<i>dev_h1</i>)]: el módulo utiliza un valor limitado a cero o al mínimo (<i>dev_h1</i>, -<i>dev_h1</i>).</td></tr></table></div>	Bit	Valor en dec.	Valor en hex.	Estado ENO	Significado	Bit 0 = 1	1	0x0001	False	Error en un cálculo con valores de coma flotante	Bit 1 = 1	2	0x0002	False	Detección de un valor no permitido en una de las entradas de valores con coma flotante	Bit 2 = 1	4	0x0004	False	División por cero en un cálculo de valores con coma flotante	Bit 3 = 1	8	0x0008	False	Desborde de capacidad durante el cálculo de valores con coma flotante	Bit 4 = 1	16	0x0010	True	Se mostrarán los siguientes comportamientos: <ul style="list-style-type: none">• <i>SP</i> se encuentra fuera de rango [<i>pv_inf</i>, <i>pv_sup</i>]: en este caso, <i>SP</i> se limita a <i>pv_inf</i> o <i>pv_sup</i>.• <i>dev_h1</i> > 0 o <i>dev_h1</i> < 0: el módulo utiliza el valor 0.• <i>hyat</i> se encuentra fuera del rango [0, mínimo (<i>dev_h1</i>, -<i>dev_h1</i>)]: el módulo utiliza un valor limitado a cero o al mínimo (<i>dev_h1</i>, -<i>dev_h1</i>).
Bit	Valor en dec.	Valor en hex.	Estado ENO	Significado																												
Bit 0 = 1	1	0x0001	False	Error en un cálculo con valores de coma flotante																												
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Bit 4 = 1	16	0x0010	True	Se mostrarán los siguientes comportamientos: <ul style="list-style-type: none">• <i>SP</i> se encuentra fuera de rango [<i>pv_inf</i>, <i>pv_sup</i>]: en este caso, <i>SP</i> se limita a <i>pv_inf</i> o <i>pv_sup</i>.• <i>dev_h1</i> > 0 o <i>dev_h1</i> < 0: el módulo utiliza el valor 0.• <i>hyat</i> se encuentra fuera del rango [0, mínimo (<i>dev_h1</i>, -<i>dev_h1</i>)]: el módulo utiliza un valor limitado a cero o al mínimo (<i>dev_h1</i>, -<i>dev_h1</i>).																												
SP	REAL	Current set-point is used by the <i>STEP3</i> algorithm. The manner in which the block calculates the set-point is based on the signal statuses, is given below:																														
		OWNER	REM	SP is calculated as:																												
		OFF	OFF	OFF																												
		OFF	ON	RSP																												
		ON	—	MVALVE_ST.SP. You can modify the set-point directly from the monitoring subsystem while this mode is active.																												
ALARM	BOOL	1 = Indicates a switching operation fault detected has occurred. The analog position signal is monitored. When the valve is operating, a maximum time during which a certain path needs to be completed is determined; if this minimum path is not completed, the detected alarm of the device is activated. (Refer to the <i>TMAX</i> and <i>TWATCH</i> inputs, page 163).																														
POSMISALARM	BOOL	1 = Indicates a position mismatch between digital and analog feedbacks.																														
FAILD	BOOL	1 = Irregularity or wrong operation detected in one of the auxiliary devices.																														

⚠ WARNING**UNINTENDED EQUIPMENT OPERATION**

- The *CONFREARMEN* pin has to be set to 1 for the *SP_MOTOR2* pin to become 0, under non-confirmed operations.
- Changes to the configuration of these parameters have to be performed by competent personnel only.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
<i>MVALVE_CFG</i>	<i>MVALVE_CFG_DDT</i>	Provides the data needed to configure the block from the monitoring subsystem or the sequential control.
<i>MVALVE_ST</i>	<i>MVALVE_ST_DDT</i>	Provides the data needed to monitor and/or control the block status.

MVALVE_CFG_DDT Type

Name	Type	Description
<i>DEVLL</i>	REAL	Enables to define the lower deviation threshold for the error detected (<i>PV-SP</i>). This value needs to be ≥ 0 ; otherwise, the DFB considers it 0. Refer to the operation graph, page 163 in <i>LOPV</i> and <i>STEP3</i> function block.
<i>DEVHL</i>	REAL	Enables to define the upper deviation threshold for the error detected (<i>PV-SP</i>). This value needs to be ≥ 0 ; otherwise, the DFB considers it 0. Refer to the operation graph, page 163 in <i>LOPV</i> and <i>STEP3</i> function block.
<i>HYS</i>	REAL	<p>Defines the hysteresis value, which is considered by the <i>STEP3</i> algorithm when calculating the <i>OPINC</i> and <i>OPDEC</i> outputs. This value falls between 0 and the minimum value among <i>DEVHL</i> and <i>DEVLL</i> without considering the sign.</p> <p>The DFB avoids wrong hysteresis inputs with the following rules:</p> <ul style="list-style-type: none"> • If <i>CFG_HYS</i> < 0 it is considered 0. • If <i>CFG_HYS</i> > <i>DEVHL</i> it is considered to be <i>DEVHL</i>. • If <i>CFG_HYS</i> > <i>DEVLL</i> (unsigned) it is considered to be <i>DEVLL</i> (unsigned).
<i>TARGETSP</i>	REAL	<p>Read access</p> <p>This variable indicates the current set-point status before interlocking.</p>

MVALVE_ST_DDT Type

Name	Type	Description
<i>STW</i>	WORD	Provides the device status usually used from the monitoring subsystem, and allows data to be kept in the memory. Read-only access to the data contained in this word.
<i>CFGW</i>	WORD	Provides the means to control the device from the monitoring subsystem. Read/write access to the data contained in this word.

Name	Type	Description
<i>PV</i>	REAL	Read-only access Refer to the <i>PV</i> input pin, page 163. This variable indicates the current measurement.
<i>SP</i>	REAL	Read/write access Refer to the <i>SP</i> output pin, page 165. This variable indicates the current set-point and is calculated internally in the block until the owner is not changed to the operator. You can modify it from the monitoring subsystem.

MVALVE_ST_STW Type

Bit	Name	Description
0	<i>REM</i>	Refer to the <i>SC.REM</i> public variable, page 168.
2	<i>ILCK</i>	Refer to the <i>ILCK</i> input pin, page 163.
3	<i>SP_MOTOR2</i>	Refer to the <i>SP_MOTOR2</i> output pin, page 165.
4	<i>SPSEL_MOTOR2</i>	Refer to the <i>SPSEL_MOTOR2</i> output pin, page 165.
5	<i>ILCK_MOTOR2</i>	Refer to the <i>ILCK_MOTOR2</i> output pin, page 165.
6	<i>OPEN</i>	Refer to the <i>OPEN</i> output pin, page 165.
7	<i>CLOSED</i>	Refer to the <i>CLOSED</i> output pin, page 165.
8	<i>REARMR</i>	Reset required (1).
9	<i>FAILED</i>	Refer to the <i>FAILED</i> output pin, page 165.
10	<i>ALARM</i>	Refer to the <i>ALARM</i> output pin, page 165.
14	<i>POSMI-SALARM</i>	Refer to the <i>POSMI-SALARM</i> output pin, page 165.

MVALVE_ST_CFGW Type

Bit	Name	Description
0	<i>OWNER</i>	Read/write access Configures whether the set-point is set by the Program (0) or by the Operator (1).
1	<i>ILCKBP</i>	Read/write access. Allows the interlock to be bypassed (1).
2	<i>START</i>	<i>START</i> command while the owner is the Operator; otherwise, the valid <i>START</i> is copied to <i>ST.CFGW.START</i> . Refer to the <i>RSTART</i> input pin, page 163.
3	<i>REARM</i>	Write access Allows the device to be reset (1). The block sets the signal to 0 after each execution and sets the signal indicating that the resetting is required (<i>CFGW.REARM</i>) to 0.

Public Variables

Public Variable Description

Variable	Type	Description
SC	MVALVE_SC_DDT	Provides the common data required to monitor and control the valve status from the sequential control.

MVALVE_SC_DDT Type

Name	Type	Description		
LSP	REAL	Read/write access Enables the sequential control, to assign the local set-point if the owner is the Program (<i>OWNER</i> is 0), the selected mode is <i>Auto</i> , and the selected set-point is local (<i>SC.REM</i> is 0). Otherwise, the current set-point (<i>SP</i> output) is copied continuously to this variable.		
TARGETSP	REAL	Read access This variable indicates the current set-point status before interlocking.		
PV	REAL	Read-only access Refer to the <i>PV</i> input pin, page 163.		
LSTART	BOOL	Read/write access 1 = allows to enable <i>START</i> command while the owner is the Program and Local; otherwise, the valid <i>START</i> is copied to <i>SC.LSTART</i> . Refer to the <i>RSTART</i> input pin, page 163.		
OWNER	BOOL	Read-only access Refer to the <i>MVALVE_ST.CFGW.OWNER</i> input/output pin, page 166.		
REM	BOOL	Read/write access 1 = Allows the block to configure for a remote set-point (RSP) 0 = Allows the block to configure for a local set-point (LSP), if the owner is the Program and the mode is <i>Auto</i> .		
ILCKD	BOOL	Read-only access The way in which the signal is evaluated, based on the <i>ILCK</i> input and the <i>MVALVED_ST.CFGW.ILCKBP</i> input/output is shown below:		
		<i>ILCK</i>	<i>ILCKBP</i>	<i>SC.ILCKD</i> is calculated as:
		OFF	–	OFF
		ON	OFF	ON
		ON	ON	OFF
OPEN	BOOL	Read-only access Refer to the <i>OPEN</i> output pin, page 165.		
CLOSED	BOOL	Read-only access Refer to the <i>CLOSED</i> output pin, page 165.		
REARMR	BOOL	Read-only access Refer to the <i>MVALVE_ST.STW.REARM</i> input/output pin, page 166.		
FAILED	BOOL	Read-only access Refer to the <i>FAILED</i> output pin, page 165.		
ALARM	BOOL	Read-only access Refer to the <i>ALARM</i> output pin, page 165.		
POSMISALARM	BOOL	Read-only access Refer to the <i>POSMISALARM</i> output pin, page 165.		

MVALVELP - Local Panel for Controlling Motorized Valves

What's in This Chapter

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Inputs/Outputs	173
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Overview

This chapter describes the MVALVELP DFB.

Description

General

The objective of the MVALVELP DFB is to manage a local panel that controls a motorized valve. This valve is implemented with an MVALVE DFB and with signals that are wired to the controller so that the latter defines the target position for the device.

Function Description

The main functions of the module are described in the following table:

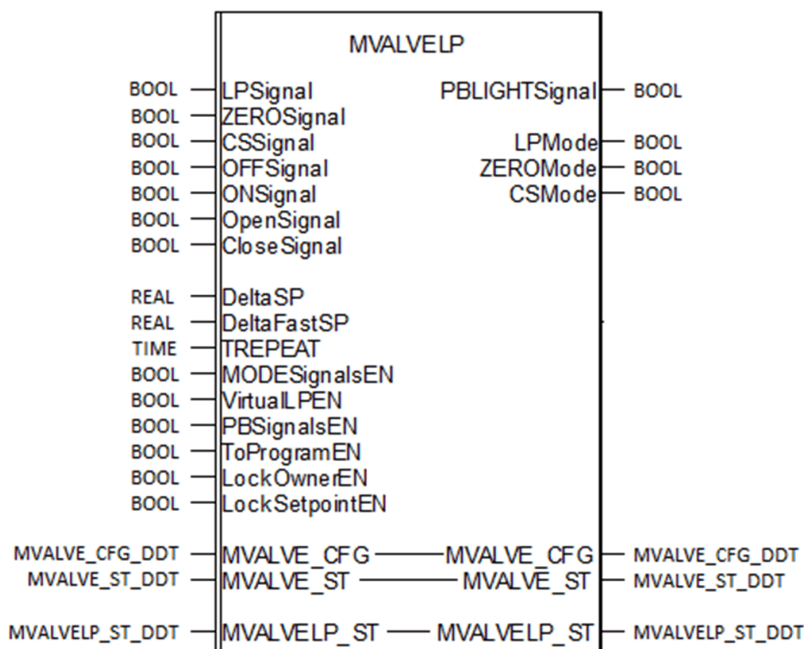
Function	Description
Mode Switch	Optionally manages the signals coming from an operating mode switch in a local panel with the following configuration: Local - Zero - Control System. The Zero mode signal is optional. However the user can enable Local/Control System mode from the faceplate also, when <i>VirtualLPEN</i> input pin signal is high and <i>MODESignalsEN</i> signal is low.
Push buttons	The DFB manages up to six signals coming from OFF, ON, OPEN, CLOSE, OPEN QUICKLY and CLOSE QUICKLY push buttons. The priority is given to the OFF push button and then to the closing function push buttons.
Owner Management	The DFB enables to configure whether the Program needs to be the valve owner or not, after switching to the Control System mode again.
Owner Locking	The DFB enables to configure whether the monitoring (HMI) system needs to block access to the drop-down list or not, it disables the access to change the owner (Operator/Program) while the valve is controlled from the Local Panel.
Set-point Lock	The DFB enables to configure whether the monitoring (HMI) system needs to block access to the drop-down list or not. It disables to change the set-point while the valve is controlled from the Local Panel.
Push button Enabling/Disabling	The push button signals from the Local Panel can be enabled/disabled through the DFB configuration (input pin) and/or from control sequences.

Function	Description
Enabled Panel Signaling	The DFB provides a signal that can be used to illuminate a light source on the Local Panel to indicate when the push buttons are enabled for operation.
Virtual Panel Enabling/Disabling	This signal enables the operator to select the Local / Control System mode of operation from the HMI so that the push button signals are enabled for operation. NOTE: VirtualLPEN input pin signal is applicable when Modicon Libraries - General Purpose is used along with Modicon Libraries - General Purpose for Wonderware System Platform.

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
LPSignal	BOOL	1 = The local panel mode switch is in the Local Panel position. Refer to the table included with the description of the LPMode output pin, page 172.
ZEROSignal	BOOL	1 = The local panel mode switch is in the zero position. This signal is optional even if a mode switch is available on the local panel. When this signal is a logical high, user is not allowed to operate the device from the faceplate and also from the DFB. Hence, all the functions in the faceplate will be disabled. Refer to the table included with the description of the LPMode output pin, page 172.
CSSignal	BOOL	1 = The local panel mode switch is in the Control System position. Refer to the table included with the description of the LPMode output pin, page 172.

Parameter	Type	Description																				
OFFSignal	BOOL	1 = The OFF push button on the local panel is pressed.																				
ONSignal	BOOL	1 = The ON push button on the local panel is pressed.																				
OpenSignal	BOOL	1 = Indicates to the DFB that OPEN push button on the local panel is pressed.																				
CloseSignal	BOOL	1 = Indicates to the DFB that CLOSE push button on the local panel is pressed.																				
DeltaSP	REAL	Absolute set-point increase or decrease value when the OPEN or CLOSE push button is pressed.																				
DeltaFastSP	REAL	Absolute set-point increase or decrease value when the OPEN and CLOSE push buttons are pressed.																				
TREPEAT	TIME	Indicates the maximum time that elapses before the system interprets that a command has been repeated when the push button is pressed.																				
MODESignalsEN	BOOL	<p>1 = Enables the use of the Local Panel/Zero/ Control System (or local panel - control system) mode switch on the local panel. Usually configured in development phase based on the characteristics of the local panel being used. If the mode switch is enabled, the <i>LPSignal</i>, <i>ZEROSignal</i>, and <i>CSSignal</i> inputs are considered to determine the operating modes of the local panel. Refer to the table included with the description of the <i>LPMode</i> output pin, page 172.</p> <p>NOTE: <i>MODESignalsEN</i> input pin has higher priority than the <i>VirtualLPEN</i> input pin signal.</p>																				
VirtualLPEN	BOOL	<p>1 = This signal enables the operator to select the Local/Control System mode of operation from the HMI, so that the push button signals are enabled for operation.</p> <p>NOTE:</p> <ul style="list-style-type: none">When the owner is program, the Local/Control System mode selection drop-down list will be visible but disabled for operation however, when the owner is operator the Local Panel drop-down list will be accessible for operation.<i>VirtualLPEN</i> input pin signal is applicable only for Modicon Libraries - General Purpose for Wonderware System Platform offer only, however there is no impact of this input signal in Modicon Libraries - General Purpose for Citect SCADA offer. <p>Refer to the table included with the description of the <i>LPMode</i> output pin, page 172.</p>																				
PBSignalsEN	BOOL	<p>1 = Enables to accept the OFF, OPEN and CLOSE push buttons from the local panel. This signal is not applicable if the mode switch is enabled (refer to the <i>MODESignalsEN</i> input). This means that the push button signals are considered when in Local Panel mode.</p> <p>When the mode switch is disabled (<i>MODESignalsEN</i> = 0), <i>PBSignalsEN</i> signal enables/disables the push button signals from control system itself based on relevant process conditions. <i>SC.DisableLP</i> public variable is also considered for determining whether the push buttons are enabled or not when <i>LPMode</i> pin signal is high, as shown in the following table:</p> <table><tr><th><i>MODESignalsEN</i></th><th><i>PBSignal-sEN</i></th><th><i>SC . Disa-bleLP</i></th><th>Push buttons enabled?</th></tr><tr><td>OFF</td><td>OFF</td><td>-</td><td>NO</td></tr><tr><td>OFF</td><td>-</td><td>ON</td><td>NO</td></tr><tr><td>OFF</td><td>ON</td><td>OFF</td><td>YES</td></tr><tr><td>ON</td><td>-</td><td>-</td><td>YES</td></tr></table> <p>Therefore, this signal can be used to enable/disable the push buttons on a simple local panel that does not feature a mode switch (Local Panel/Zero/Control System) based on relevant process conditions.</p>	<i>MODESignalsEN</i>	<i>PBSignal-sEN</i>	<i>SC . Disa-bleLP</i>	Push buttons enabled?	OFF	OFF	-	NO	OFF	-	ON	NO	OFF	ON	OFF	YES	ON	-	-	YES
<i>MODESignalsEN</i>	<i>PBSignal-sEN</i>	<i>SC . Disa-bleLP</i>	Push buttons enabled?																			
OFF	OFF	-	NO																			
OFF	-	ON	NO																			
OFF	ON	OFF	YES																			
ON	-	-	YES																			
ToProgramEN	BOOL	1 = Enables the functionality to change the owner of the motorized valve to Program when mode switch on the local panel returns to the control system position (only when the mode is switched). If this functionality is disabled, the operator of the monitoring (HMI) system switches to Program owner when the operator deems it																				

Parameter	Type	Description																				
		appropriate. Refer to the table included with the description of LockOwnerEN input.																				
LockOwnerEN	BOOL	<p>1 = Disables the access of owner of the motorized valve remaining as Operator while the local panel mode is Local Panel.</p> <p>The following table depicts how the owner of motorized valve is evaluated based on ToProgramEN and LockOwnerEN inputs and the operating mode of local panel:</p> <table><tr><th>Local Panel Mode</th><th>ToProgramEN</th><th>LockOwnerEN</th><th>Owner</th></tr><tr><td>Zero</td><td>-</td><td>-</td><td>Operator</td></tr><tr><td>Switch to Local Panel</td><td>-</td><td>-</td><td>Operator</td></tr><tr><td>Local Panel</td><td>-</td><td>ON</td><td>Operator</td></tr><tr><td>Switch to Control System</td><td>ON</td><td>-</td><td>Program</td></tr></table> <p>In remaining cases, owner of the motorized valve ceases to be defined from the MVALVELP DFB and it becomes possible to change it from the monitoring (HMI) system with the command word in MVALVE_ST.CFGW input/output of the corresponding MVALVE DFB.</p> <p>In any case, consider that the valve owner that had been set before switching to the local panel mode is not memorized.</p>	Local Panel Mode	ToProgramEN	LockOwnerEN	Owner	Zero	-	-	Operator	Switch to Local Panel	-	-	Operator	Local Panel	-	ON	Operator	Switch to Control System	ON	-	Program
Local Panel Mode	ToProgramEN	LockOwnerEN	Owner																			
Zero	-	-	Operator																			
Switch to Local Panel	-	-	Operator																			
Local Panel	-	ON	Operator																			
Switch to Control System	ON	-	Program																			
LockSetPointEN	BOOL	<p>1 = Disables the setpoint of motorized valve and lock it into the one which is defined on the local panel while the local panel mode is Local Panel and the device owner is operator. User can switch to Program mode based on the signals that have been previously described even if the local panel mode is set to Local Panel.</p> <p>Therefore, user can activate (1) this signal to lock setpoint operation from the monitoring (HMI) system while motorized valve is controlled from the local panel.</p>																				

Outputs

Output Parameter Description

Parameter	Type	Description																																										
PBLIGHT-Signal	BOOL	1 = The push buttons on the local panel are fully operational, that is, the local panel is in Local Panel mode (either because the mode is selected with the corresponding switch or because the push buttons are enabled in the event that there is no selector switch available or the <i>VirtualLPEN</i> is high with the local panel mode enabled).																																										
LPMode	BOOL	<div><div>1 = The local panel mode is in Local Panel.</div><div>The following table depicts how the local panel operating mode is determined based on the <i>MODESignalsEN</i>, <i>VirtualLPEN</i>, <i>PBSignalsEN</i>, <i>LPSignal</i>, <i>CSSignal</i> and <i>ZEROSignal</i>, input signals:</div><table><tr><th>MOD-ESi-gna-lsEN</th><th>Vir-tual-LPEN</th><th>PBSi-gnal-sEN</th><th>LPSig-nal</th><th>CSSi-gnal</th><th>ZERO-Signal</th><th>OUTPUT</th></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>CS mode</td></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>Zero mode</td></tr><tr><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>LP mode and PBLIGHT-Signal</td></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>CS mode</td></tr><tr><td>0</td><td>1</td><td>1</td><td>NA</td><td>NA</td><td>NA</td><td>CS mode</td></tr></table></div>	MOD-ESi-gna-lsEN	Vir-tual-LPEN	PBSi-gnal-sEN	LPSig-nal	CSSi-gnal	ZERO-Signal	OUTPUT	0	0	0	0	0	0	CS mode	1	0	0	0	0	0	Zero mode	1	0	0	1	0	0	LP mode and PBLIGHT-Signal	1	0	0	0	1	0	CS mode	0	1	1	NA	NA	NA	CS mode
MOD-ESi-gna-lsEN	Vir-tual-LPEN	PBSi-gnal-sEN	LPSig-nal	CSSi-gnal	ZERO-Signal	OUTPUT																																						
0	0	0	0	0	0	CS mode																																						
1	0	0	0	0	0	Zero mode																																						
1	0	0	1	0	0	LP mode and PBLIGHT-Signal																																						
1	0	0	0	1	0	CS mode																																						
0	1	1	NA	NA	NA	CS mode																																						

Parameter	Type	Description						
		0	1	0	NA	NA	NA	CS mode
		0	0	1	0	0	0	LP mode and PBLIGHT-Signal
		1	1	0	1	0	0	LP mode and PBLIGHT-Signal
		1	1	0	0	0	0	Zero mode
		1	1	0	0	0	1	Zero mode
		1	1	0	0	1	0	CS mode
		1	0	1	0	1	0	CS mode
		1	1	1	0	1	0	CS mode
		1	0	0	0	0	1	Zero mode
ZEROMode	BOOL	1 = The local panel mode is in Zero. User is not allowed to operate the device from the faceplate and also from DFB. Hence, all the functions in the faceplate will be disabled. Refer to the table included with the description of the LPMODE output.						
CSMode	BOOL	1 = The local panel mode is in Control System. Refer to the table included with the description of the LPMODE output.						

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
MVALVE_ST	MVALVE_ST_DDT	<p>Data structure corresponding to the motorized valve is to be controlled from the local panel (for detailed information regarding this structure, refer to the MVALVE DFB, page 162).</p> <p>The structure provides the information needed for the operation of the MVALVELP DFB and enables this DFB to control the owner of the motorized valve.</p>
MVALVE_CFG	MVALVE_CFG_DDT	<p>Data structure corresponding to the motorized valve is to be controlled from the local panel (for detailed information regarding this structure, refer the MVALVE DFB). The structure provides the information needed for the operation of the MVALVELP DFB. It enables this DFB to control the set-point for the motorized valve.</p>
MVALVELP_ST	MVALVELP_ST_DDT	Data structure that is used as an interface with the monitoring (HMI) system.

MVALVE_ST.DDT Type

Name	Type	Description
CFGW	WORD	Provides the means to control the device from the monitoring (HMI) system. Read-only access to the data contained in this word.

MVALVE_CFG.DDT Type

Name	Type	Description
TARGETSP	REAL	Read/write access Allows the local set-point of the operator ($OWNER = 1$) to be set from the monitoring (HMI) system. If the set-point is set by the Program ($OWNER = 0$), the DFB continuously assigns it the value of the current set-point.

MVALVELP_ST.DDT Type

Name	Type	Description
STW	WORD	Read-only access Bits word with the status of the local panel.

MVALVE_ST.CFGW Word

The following table describes the MVALVE_ST.CFGW word:

Bit	Name	Description					
0	OWNER	Read/write access Enables to configure whether the set-point is set by the Program (0) or by the Operator (1). Refer to the table included with the description of LPMODE output pin, which specifies the cases in which the MVALVELP DFB can interact with this signal.					
2	START	Read/write access Enables to set the Start command from the monitoring (HMI) system when the owner is the Operator (OWNER = 1). As long as the set-point is set by the Program (OWNER = 0), the DFB continuously assigns it the value of the current command (MVALVE_ST.STW.START input/output).					
		The MVALVELP DFB determines the set-point for the motorized valve.	OWNER	OFFSignal	ONSignal	LockSetPointEN	START is calculated as:
		0	- (The OWNER signal is forced to 1 (Operator)).	-	-	-	OFF
		Local Panel	Operator	ON	-	-	OFF
		Local Panel	Operator	OFF	Switch to ON	-	ON
		Local Panel	Operator	OFF	OFF	ON	Last value
		In other cases, the START signal is not modified from the MVALVELP DFB.					

MVALVELP_ST.CFGW Word

Bit	Name	Description
0	LocalModeOn	Read/write access <ul style="list-style-type: none">1 = Enables the Local Panel mode.0 = Enables the Control System mode.

MVAVELP_ST . STW Word

Read-only access. Status word. The following table describes the MVALVELP_ST . STW word:

Bit	Name	Description
0	LPMODE	Local panel in Local Panel mode. Refer to the LPMODE output pin.
1	ZEROMODE	Local panel in zero mode. Refer to the ZEROMODE output pin.
2	CSMODE	Local panel in Control System mode. Refer to the CSMODE output pin.
3	LockedOwner	Indicates whether the owner change buttons in the monitoring (HMI) system needs to be locked (1) or not (0). Is activated when: <ul style="list-style-type: none"> The Local Panel mode is set to Zero or It is set to Local Panel and the LockOwnerEN input signal has been configured as active (1).
4	SPLocked	Indicates whether the set-point change and START buttons in the monitoring (HMI) system needs to be locked (1) or not (0). Is activated when: <ul style="list-style-type: none"> The Local Panel mode is set to Zero or It is set to Local Panel and the LockSetpointEN input signal has been configured as active (1).
5	MODESignalsEN	Indicates the state of the MODESignalsEN input signal, that is, whether there is a mode switch (1) or not (0).
6	PBENABLED	Indicates whether the push buttons of the local panel are enabled (1) or not (0). The signal is activated when at least one of the MODESignalsEN and PBSignalsEN signal inputs are active.
7	VirtualLPEN	Enables the drop-down list for the Local Panel / Control System mode selection.
8	LPSignal	Indicates the state of the LPSignal input signal.
9	ZEROSignal	Indicates the state of the ZEROSignal input signal.
10	CSSignal	Indicates the state of the CSSignal input signal.
11	OFFSignal	Indicates the state of the OFFSignal input signal.
12	ONSignal	Indicates the state of the ONSignal input signal.
13	OpenSignal	Indicates the state of the OpenSignal input signal.
14	CloseSignal	Indicates the state of the CloseSignal input signal.

Public Variables

Public Variable Description

Variable	Type	Description
SC	MVALVEDLP_SC_DDT	Provides the frequently needed data for monitoring and controlling the DFB.

MVALVEDLP_SC_DDT Type

NAME	Type	Description
LPMode	BOOL	Read-only access Refer to the LPMode output pin, page 172.
ZEROMode	BOOL	Read-only access Refer to the ZEROMode output pin, page 172.
CSMode	BOOL	Read-only access Refer to the CSMode output pin, page 172.
DisableLP	BOOL	Read/write access 1 = Disables the push buttons on the local panel. Only applicable when a local panel without mode switch configuration is used (MODESignalsEN = 0).

SDDEVCTL - Device with Variable Speed Drive

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Overview

This chapter describes the SDDEVCTL DFB.

Description

General

The SDDEVCTL DFB is used to manage control modules for motors with a variable speed drive whether the speed drive is switched through communication, I/O wiring, or a mix of both.

The DFB allows management of the associated devices from the sequential control, the continuous control, and/or the monitoring subsystem. It depends on the user configuration and the system needs.

User can supplement the DFB with the SDDEVLP, DEVMNT, CONDSUM, and CONDSUM1 DFB from the General Purpose Library.

Function Description

The main functions of the DFB are described in the following table:

Function	Description
Control	Controls the forward/reverse rotation direction based on the configuration and the commands that the DFB receives according to the functions.
Owner selection	The DFB manages control system level which is the owner (operator or program). As a result, it is responsible for setting the setpoint for the desired position.
Local and remote setpoint	Enables to control the DFB with a setpoint that is determined through a set-point selector (local or remote). The local setpoint is assigned to the sequential control or to the command received from the Supervision system while the remote setpoint is assigned to the DFB control from the logic implemented in the continuous control.
Position detection	Allows to determine the actual position of the element to be controlled and monitored with the help of limit switch.
Interlocking	The DFB gives a command to the device to move to the defined position in case of an active interlock. An interlock bypass function is available.
Multispeed	Enables to select between speed configurable through an analog signal or between 3 preset speeds in the speed drive.
Simulation	You can switch the DFB to simulation mode so that the actual position of the controlled device is considered to be the same as its desired position, regardless of the signals received from the position detectors.

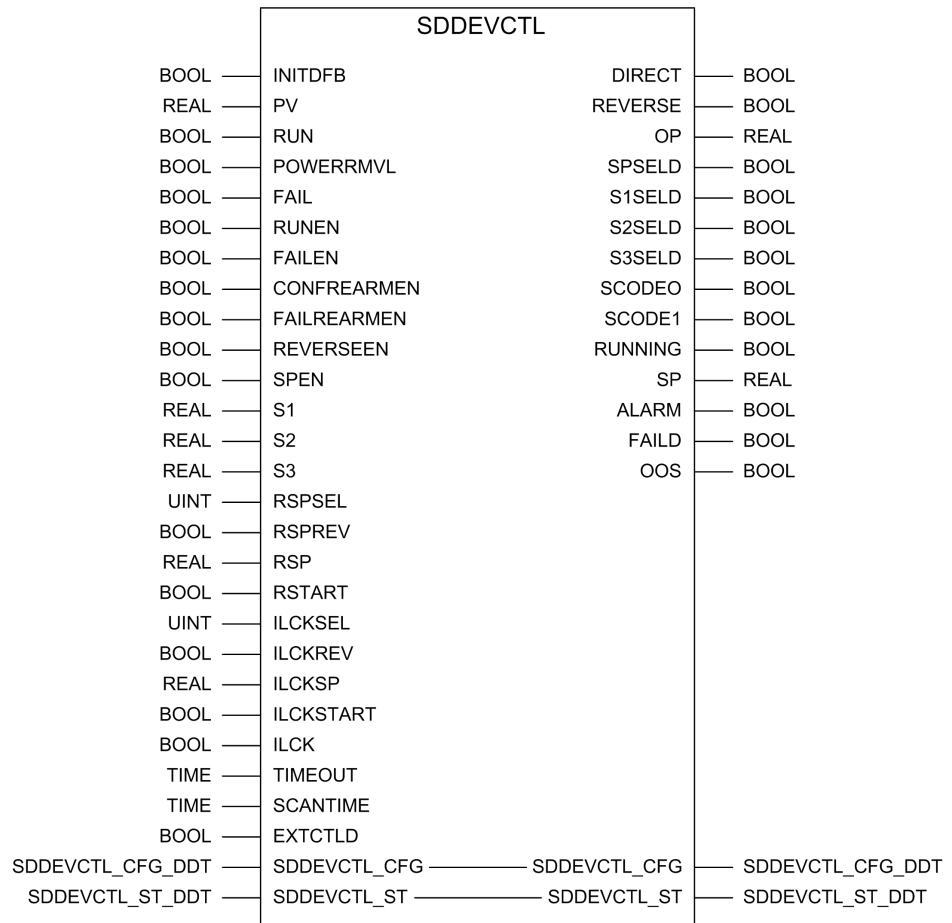
The optional functions of the DFB are described in the following table:

Function	Description
Inoperable device	Allows to monitor inoperable device condition (optional). DFB can be configured to withdraw output based on this condition. Commonly used for detecting whether or not the motor switch has tripped due to thermal overload.
Detection of unsuccessful operation	If position is unsuccessful within a configured time after the output command is activated, DFB detects unsuccessful operation.
Manual resetting	Allows you to reset manually after the detection of an inoperable device condition or a unsuccessful operation. After reset, device output will follow set point.

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description								
INITDFB	BOOL	If a rising edge is detected on this input, the internal timers of the block are reset and detected alarms are set to 0.								
PV	REAL	Current value of the speed measurement. Comes from the speed drive or from a measurement device.								
RUN	BOOL	1 = Indicates to the DFB that the speed drive is generating an output frequency. Refer to the <code>RUNEN</code> input.								
POWERRMVL	BOOL	1 = Indicates to the DFB that the speed drive is disabled (Power Removal). After activating this signal, the system requires resetting. <code>SDDEVCTLST.CFGW.REARM = 1</code> . If you use the <code>POWERMVL</code> signal of the speed drive without requiring resetting wire it to a <code>CONDSUM</code> DFB input that does not require resetting and the output of the latter to the <code>ILCK</code> input.								
FAIL	BOOL	1 = Indicates to the DFB a detected error in the device. Refer to the <code>FAILEN</code> input.								
RUNEN	BOOL	1 = Allows the availability of the <code>RUN</code> input signal to be enabled.								
FAILEN	BOOL	1 = Enables the <code>FAIL</code> parameter.								
CONFREARMEN	BOOL	<ul style="list-style-type: none">1 = Withdraws the output <code>OP</code> when a non-confirmed operation is detected (<code>ALARM = 1</code>) and requires a mandatory manual resetting once the <code>ALARM</code> condition disappears.0 = The output <code>OP</code> remains in its previous state when a non-confirmed operation is detected (<code>ALARM = 1</code>) and does not need manual resetting, once the <code>ALARM</code> condition disappears. Refer to the <code>TIMEOUT</code> input and the <code>SDDEVCTLST.STW.ALARM</code> input/output pin, page 183.								
FAILREARMEN	BOOL	<ul style="list-style-type: none">1 = Withdraws the output <code>OP</code> upon a detected error condition (<code>FAILD = 1</code>) and requires a mandatory manual resetting once the <code>FAIL</code> condition disappears.0 = The output <code>OP</code> remains in its previous state upon a detected error condition (<code>FAILD = 1</code>) and does not need manual resetting, once the <code>FAIL</code> condition disappears.								
REVERSEEN	BOOL	1 = Enable to configure whether the speed drive can operate in forward and reverse rotation 0 = Enable to configure whether the speed drive can operate in only forward.								
SPEN	BOOL	1 = Allows enabling the analog speed set-point (<code>SP</code> — analog setpoint). Applies both to the local/remote mode and to the program/operator owner.								
S1 S2 S3	REAL	Enables (1) the availability of the multispeed setpoint x (value of the signal other than 0) and reports the speed configured on the speed drive as <code>Sx</code> to the Supervision system.								
RSPSEL	UInt	Enables to select which remote setpoint should be considered in the rogram/remote mode. <code>RSPSEL</code> The remote set-point is calculated as follows: <table><tr><th><code>RSPSEL</code></th><th>The remote set-point is:</th></tr><tr><td>0</td><td><code>RSP</code></td></tr><tr><td>1</td><td>Speed 1 (<code>S1</code> —configured in the speed drive)</td></tr><tr><td>2</td><td>Speed 2 (<code>S2</code> —configured in the speed drive)</td></tr></table>	<code>RSPSEL</code>	The remote set-point is:	0	<code>RSP</code>	1	Speed 1 (<code>S1</code> —configured in the speed drive)	2	Speed 2 (<code>S2</code> —configured in the speed drive)
<code>RSPSEL</code>	The remote set-point is:									
0	<code>RSP</code>									
1	Speed 1 (<code>S1</code> —configured in the speed drive)									
2	Speed 2 (<code>S2</code> —configured in the speed drive)									

Parameter	Type	Description
		3 Speed 3 (S3 –configured in the speed drive)
		NOTE: If the analog setpoint is selected ($xSPSEL = 0$) and the signal has not been enabled ($SPEN = 0$), the setpoint indicated by S1 will be considered as the active setpoint regardless of its state.
RSPREV	BOOL	1 = Selects rotation in reverse direction for the remote setpoint in program/remote mode. 0 = 1 = Selects rotation in forward direction for the remote setpoint in program/remote mode.
RSP	REAL	Enables the remote speed setpoint, which is usually set by the continuous control, to be connected in program/remote mode with the selected SP speed ($RSPSEL = 0$).
RSTART	BOOL	1 = Enables the speed drive to be run in program/remote mode.
ILCKSEL	Uint	Enables to select which remote setpoint needs to be considered in the case of interlocking. Refer to the possible RSPSEL values.
ILCKREV	BOOL	1 = Selects rotation in reverse direction when the interlock is activated. 0 = Selects rotation in forward direction when the interlock is activated. Refer to the ILCKSEL, ILCKSP, and ILCK inputs.
ILCKSP	REAL	Setpoint needs to be considered when the DFB is interlocked and the analog setpoint is selected ($ILCKSEL = 0$). Refer to the ILCKSEL and ILCK inputs.
ILCKSTART	BOOL	1 = Enables to define the interlock position on run.
ILCK	BOOL	1 = Interlocks the device at the defined position. Refer to the ILCKSEL, ILCKSP, and ILCKREV inputs. NOTE: The signal connected to this input will not be effective if the device requires resetting. In which case, it will be de-energized (FORWARD and REVERSE signals to 0).
TIMEOUT	TIME	Allows configuring the time during which the detection of unsuccessful operations is disabled. 0 disables the detection. After the configured time has elapsed, an alarm is generated. Refer to the ALARM output, page 181 output and SDDEVCTL_ST.STW.ALARM input/output pin, page 183.
SCANTIME	TIME	Allows configuring the time during which the detected alarm signals are kept active. Allows the Supervision system to acquire the data for alarms that are automatically reset. Refer to the ALARM and FAILD outputs, page 181.
EXTCTLD	BOOL	1 = Indicates to the DFB the speed drive is being controlled from outside (for example, from the console or from a push-button panel) the system. Enables to avoid the generation of erroneous detections of unsuccessful operation while the device is being controlled from outside the system. Monitoring of the alarm for the detection of unsuccessful operations stops when the device is externally controlled.

Outputs

Output Parameter Description

Parameter	Type	Description
DIRECT	BOOL	1 = Forward direction drive signal to the speed drive.
REVERSE	BOOL	1 = Reverse direction drive signal to the speed drive.
OP	REAL	Speed value corresponding to the current output of the speed drive. The signal (coming from the speed drive) that provides this speed in the engineering units desired for representation in the monitoring subsystem (the DFB does not scale this signal) needs to be connected.
SPSELD	BOOL	1 = Analog setpoint input activated in the speed drive.
S1SELD S2SELD S3SELD	BOOL	1 = Multispeed x activated in the speed drive.
SCODE0 SCODE1	BOOL	1 = Encodes the selected speed.

The table depicts the value of the coding based on the status of the SPSELD, S1SELD, S2SELD, and S3SELD outputs:

Selected multispeed	SCODE0	SCODE1
SP (SPSELD = ON)	OFF	OFF
S1 (S1SELD = ON)	ON	OFF
S2 (S2SELD = ON)	OFF	ON
S3 (S3SELD = ON)	ON	ON

Parameter	Type	Description
RUNNING	BOOL	1 = Allows you to determine the speed drive is delivering a frequency to the output. Is evaluated considering the RUN, RUNEN inputs, and the simulation status.

The evaluation of this signal depending on the configuration implemented on the RUNEN input and on the SDDEVCTLST.CFGW.SIMMD input/output is shown in the table:

RUNEN	SIMMD	RUNNING
-	ON	FORWARD or REVERSE
OFF	OFF	FORWARD or REVERSE
ON	OFF	RUN

Parameter	Type	Description
SP	BOOL	1 = Current speed setpoint in the speed drive.

SP calculation depending on the selected operating mode is shown in the table:

OWNER	REM	SP
OFF	OFF	Speed selected (in terms of the SC.LSP, SC.LSPSEL public variables and the S1, S2, and S3 inputs) from the sequential control
OFF	ON	Speed selected from the continuous control (in terms of the RSP, RSPSEL, S1, S2, and S3 inputs).
ON	-	Speed selected from the continuous control (in terms of the SDDEVCTL.ST.CFGW.LSP and LSPSEL inputs/outputs and the S1, S2, and S3 inputs).

Parameter	Type	Description
ALARM	BOOL	1 = Indicates if the detection of a unsuccessful operation has occurred. Refer to the <code>ALARM</code> behavior for more details.
FAILD	BOOL	1 = Indicates a speed drive detected error. It is evaluated according to the value of the <code>FAIL</code> and <code>FAILEN</code> inputs. When it is activated (1), it is timed so that the signal is maintained for a minimum of <code>SCANTIME</code> . After the minimum activation time has elapsed, it is only deactivated if the <code>FAIL</code> input signal is deactivated (0).
OOS	BOOL	1 = Indicates the equipment is out of service.

The table depicts the `FAILD` signal evaluation depending on the `FAIL` and `FAILEN` inputs:

FAIL	FAILEN	FAILD
-	OFF	OFF
OFF	ON	OFF
ON	ON	ON (minimum <code>SCANTIME</code>)

OP Calculation

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- The `CONFREARMEN` pin has to be set to 1 for the `OP` pin to become 0, under non-confirmed operations.
- The `FAILREARMEN` pin has to be set to 1 for the `OP` pin to become 0, under detected error conditions.
- Changes to the configuration of these parameters have to be performed by competent personnel only.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

FAILEN input	FAILREARMEN input	OP output when <code>FAIL</code> = 1 (assume <code>OP</code> = 1 before the detected error)	OP output when <code>FAIL</code> = 1 (assume <code>OP</code> = 0 before the detected error)
0	0	1	0
0	1	1	0
1	0	1	0
1	1	0	0

ALARM Behavior

Monitoring is carried out on the `RUNNING` output signal and is activated when one of the control signals (`FORWARD` and `REVERSE` outputs) is switched (0 to 1 or 1 to 0) as long as the preselection value of the timer is greater than 0 (`TIMEOUT` input) and the speed drive is not being controlled from outside the control system (`EXTCTLD` to 1).

After the control switching has occurred, the DFB internal timer is activated.

As long as the timer is running, the position of the speed drive is not monitored (`RUN` input).

After the time has elapsed, any detection of unsuccessful operation causes the alarm to be generated immediately.

The detected error signal is maintained for a minimum of `SCANTIME`.

After this time has elapsed, the signal is recovered (0) based on the following conditions:

- If the position becomes correct (`RUNNING` output) according to the control status (`FORWARD` and `REVERSE` outputs) or
- If the device is reset (through the `SDDEVCTLST.CFGW.REARM` input/output and as long as the `CONFREARMEN` input is 1).

In both cases, the internal timer is restarted with the `TIMEOUT` value.

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
<code>SDDEVCTL_ST</code>	<code>SDDEVCTL_ST_DDT</code>	Data structure of the DFB status. Usually used from the monitoring subsystem for monitoring the status of the speed drive.
<code>SDDEVCTL_CFG</code>	<code>SDDEVCTL_CFG_DDT</code>	Data structure of the DFB configuration.

SDDEVCTL_ST_DDT Type

Name	Type	Description
<code>PV</code>	<code>REAL</code>	Current speed of the output of the speed drive. Read-only access Refer to the <code>PV</code> input pin, page 179.
<code>SP</code>	<code>REAL</code>	Current speed set-point. Refer to the <code>SP</code> output pin, page 181. The DFB continuously copies the value of the current set-point in this signal if the mode is not the Operator (Local) mode. In which case, you can modify it from the monitoring subsystem.
<code>OP</code>	<code>REAL</code>	Current output to the speed drive. Refer to the <code>OP</code> output pin, page 181.
<code>STW</code>	<code>WORD</code>	Provides the status of the device usually used from the monitoring subsystem and allows data to be retained in the memory. Read-only access to the data contained in this word.
<code>CFGW</code>	<code>WORD</code>	Provides the means to control the device from the monitoring subsystem. Read-only access to the data contained in this word.

SDDEVCTL_ST.STW Word Structure

Bit	Name	Description
0	<code>RUNNING</code>	Refer to the <code>RUNNING</code> output pin, page 181.
1	<code>DIRECT</code>	Refer to the <code>DIRECT</code> output pin, page 181.
2	<code>REVERSE</code>	Refer to the <code>REVERSE</code> output pin, page 181.
3	<code>REVERSEEN</code>	Refer to the <code>REVERSEEN</code> input pin, page 179.
4	<code>ALARM</code>	Refer to the <code>ALARM</code> output pin, page 181.

Bit	Name	Description
5	FAILD	Indicates an inoperable device condition. Refer to the FAILD output pin, page 181.
6	REM	Indicates if the current setpoint (SP) is local (0) or remote (1). The setpoint is local when the owner is the operator (OWNER = 1). When the owner is the program (OWNER = 0), the setpoint is selected with the SC. REM public signal (1: remote, 0: local).
7	ILCK	Refer to the ILCK input pin, page 179.
8	REARMR	Indicates if the device requires resetting (1) after the detection of an inoperable device condition (with control order set to 1) that has been configured as requiring resetting through the CONFREARMEN and/or FAILREARMEN input pins.
9	EXTCTLD	Read-only access Refer to the EXTCTLD input pin, page 179.
10	SPSELD	Read-only access Refer to the SPSELD output pin, page 181. The current speed setpoint is set through continuous set-point.
11	S1SELD	Read-only access Refer to the S1SELD.
12	S2SELD	Read-only access Refer to the S2SELD.
13	S3SELD	Read-only access Refer to the S3SELD.
14	SPEN	Read-only access Refer to the SPEN input pin, page 179.
15	POWERRMVL	Read-only access Refer to the POWERMVL input pin, page 179.

SDDEVCTL_ST.CFGW Word Structure

Bit	Name	Description
0	OWNER	Read/write access Enables one to configure whether the setpoint is set by the program (0) or by the operator (1).
1	ILCKBP	Read/write access Allows the interlock to be bypassed (1).
2	SIMMD	Read/write access Enables to set the device to simulation mode so that the actual position signals (RUN input) are ignored. It is simulated that the device is in the desired position (according to the OP output pin) and is functional (as if the FAIL input pin is reset (0)).
3	REARM	Write Access Enables the device to reset (1). The DFB sets the signal to 0 after each execution and sets the signal indicating that resetting is required (CFGW. REARM) to 0.
4	LSPREV	Read/write access Allows setting the rotation direction (0: forward, 1: reverse) from the Supervision system if the mode is operator (OWNER is 1). When the setpoint is set by the program (OWNER is 0), the DFB continuously assigns it the rotation direction set from the program.

Bit	Name	Description
5	LSTART	Read/write access Enables the speed drive to run (1) or stop (0) in the operator mode.
15	OOS	Read/write access Indicates whether the equipment is out of service (1) or In use (0).

NOTE: The outputs (SP and OP) are de-energized when the device is in an out-of-service state; even if an interlock that requests the device to be started is active.

SDDEVCTL_CFG_DDT Type

Name	Type	Description
SPSEL	UINT	Enables to select which local setpoint needs to be used if the owner is the operator. This data is write-only if the owner is the operator (OWNER is 1), and is loaded with the selected value if the owner is the program (OWNER is 0).
S1	REAL	Read-only access Refer to the S1 input pin, page 179.
S2	REAL	Read-only access Refer to the S2 input pin, page 179.
S3	REAL	Read-only access Refer to the S3 input pin, page 179.
Reserved	INT	Reserved

Public Variables

Public Variable Description

Variable	Type	Description
SC	SDDEVCTL_SC_DDT	Provides the frequently needed data to monitor and control the regulator status from the sequential control.

SDDEVCTL_SC_DDT Type

Name	Type	Description
PV	REAL	Current value of the speed measurement. Comes from the speed drive or from a measurement device, page 183.
SP	REAL	Read-only access Refer to the SP output pin, page 181.
OP	REAL	Read-only access Refer to the OP output pin, page 181.
DIRECT	BOOL	Read-only access Refer to the DIRECT output pin, page 181.
REVERSE	BOOL	Read-only access

Name	Type	Description															
		Refer to the REVERSE output pin, page 181.															
RUNNING	BOOL	Read-only access Refer to the RUNNING output pin, page 181.															
ILCKD	BOOL	Read-only access Indicates the motor is interlocked. The signal evaluation depending on the ILCK input and the SDDEVCTLST.CFGW.ILCKBP input/output is shown in the following table:															
		<table> <tr> <th>ILCK</th><th>ILCKBP</th><th>SC.ILCKD.LSP</th></tr> <tr> <td>OFF</td><td>OFF</td><td>OFF</td></tr> <tr> <td>OFF</td><td>ON</td><td>OFF</td></tr> <tr> <td>ON</td><td>OFF</td><td>ON</td></tr> <tr> <td>ON</td><td>ON</td><td>OFF</td></tr> </table>	ILCK	ILCKBP	SC.ILCKD.LSP	OFF	OFF	OFF	OFF	ON	OFF	ON	OFF	ON	ON	ON	OFF
ILCK	ILCKBP	SC.ILCKD.LSP															
OFF	OFF	OFF															
OFF	ON	OFF															
ON	OFF	ON															
ON	ON	OFF															
OWNER	BOOL	Read-only access Refer to the SDDEVCTL_ST.CFGW.OWNER input/output pin, page 183.															
EXTCTLD	BOOL	Read-only access Refer to the EXTCTLD input pin, page 179.															
SPSELD	BOOL	Read-only access Refer to the SPSELD output pin, page 181.															
S1SELD S2SELD S3SELD	BOOL	Read-only access Refer to the S1SELD, S2SELD, or S3SELD output pin, page 181.															
ALARM	BOOL	Read-only access Refer to the SDDEVCTL_ST.STW.ALARM input/output pin, page 183.															
POWERRMVL	BOOL	Read-only access Refer to the POWERRMVL input pin, page 179.															
FAILD	BOOL	Read-only access Refer to the SDDEVCTL_ST.STW.FAILD input/output pin, page 183.															
REM	BOOL	1 = Allows the DFB to be configured to remote set-point RSP 0 = Allows the DFB to be configured to local set-point—LSP if the owner is the Program (OWNER = 0). Read/write access.															
LSPREV	BOOL	1 = Enables to set the reverse rotation direction (0: forward, 1: reverse) in Program/Local mode. 0 = Enables to set the forward rotation direction in Program/Local mode. In other modes, the DFB continuously assigns the current rotation direction set-point to it.															
LSTART	BOOL	1 = Enables the speed driver to run in Program/Local mode. Read/write access Enables to set the applicable speed set-point in Program/Local mode when the speed has been selected through the SC.SELSP variable. The DFB sets this signal to 0 after the signal has been processed.															
LSP	REAL	Enables to assign the local set-point usually for the sequential control if the owner is the Program (OWNER is 0) and the selected set-point is Local (REM is 0). In any other case, the DFB automatically assigns it the current value of the resulting set-point to it (refer to the SP output pin, page 181).															

Name	Type	Description
SELSP	BOOL	Read/write access Enables the speed set-point to be set in Program/Local mode to the SC.LSP speed. 1 allows this speed to be selected. The DFB sets this signal to 0 after the signal has been processed.
SELS1 SELS2 SELS3	BOOL	Read/write access 1 = Enables the speed set-point to be set in Program/Local mode to the speed driver multispeed x. 1 enables this speed to be selected. The DFB sets this signal to 0 after the signal has been processed. NOTE: If more than one speed is selected simultaneously, the following order of priority applies: SP, S1, S2, and S3.
OOS	BOOL	Read/write access 1 = Indicates the equipment is Out of Service.

SDDEVLP - Local Panel for Controlling Devices with a Variable Speed Drive

What's in This Chapter

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Overview

This chapter describes the `SDDEVLP` DFB.

Description

General

The objective of the `SDDEVLP` DFB is to manage a local panel that controls a motor with a variable-speed drive. This variable-speed drive is implemented with an `SDDEVCTL` DFB and with signals that are wired to the controller so that the latter defines the target position for the device.

Function Description

The main functions of the module are described in the following table:

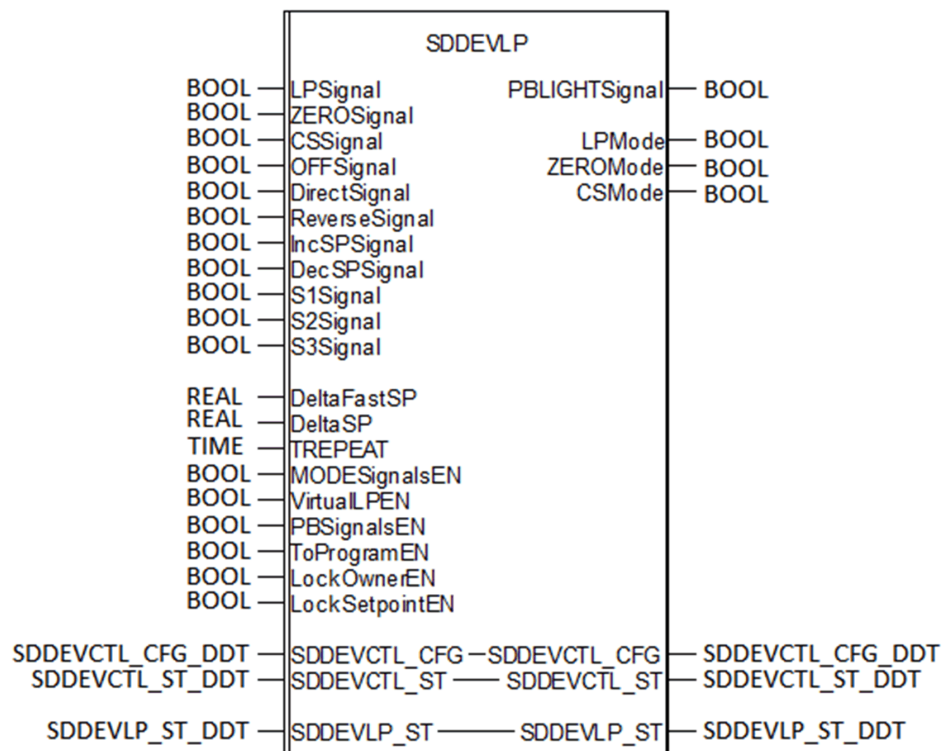
Function	Description
Mode Switch	Optionally manages the signals coming from an operating mode switch in a local panel with the following configuration: Local - Zero - Control System. The Zero mode signal is optional. However the user can enable Local/Control System mode from the faceplate also, when <i>VirtualLPEN</i> input pin signal is high and <i>MODESignalsEN</i> signal is low.
Push buttons	The DFB manages up to eight signals coming from OFF, Forward ON, Reverse ON, Increase speed, Decrease speed, S1 set-point pre-established, S2 set-point pre-established, and S3 set-point pre-established push buttons, giving the OFF push button signal priority.
Owner Management	The DFB enables to configure whether the Program needs to be the owner of the speed driver-equipped motor or not, after switching to the Control System mode again.
Owner Locking	The DFB enables to configure whether the monitoring (HMI) system needs to block access to the drop-down list or not, it disables the access to change the owner (Operator/Program) while the speed driver-equipped motor is controlled from the Local Panel.
Set-point Lock	The DFB enables to configure whether the monitoring (HMI) system needs to block access to the drop-down list or not. It disables to change the set-point while the speed driver-equipped motor is controlled from the Local Panel.
Push button Enabling/Disabling	The push button signals from the Local Panel can be enabled/disabled through the DFB configuration (input pin) and/or from control sequences.

Function	Description
Enabled Panel Signaling	The DFB provides a signal that can be used to illuminate a light source on the Local Panel to indicate when the push buttons are enabled for operation.
Virtual Panel Enabling/Disabling/	This signal enables the operator to select the Local / Control System mode of operation from the HMI so that the push button signals are enabled for operation. NOTE: VirtualLPEN input pin signal is applicable when Modicon Libraries - General Purpose is used along with Modicon Libraries - General Purpose for Wonderware System Platform.

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
LPSignal	BOOL	1 = The local panel mode switch is in the Local Panel position. Refer to the table included with the description of the LPMODE output pin, page 191.
ZEROSignal	BOOL	1 = The local panel mode switch is in the zero position. This signal is optional even if a mode switch is available on the local panel. When this signal is a logical high, user is not allowed to operate the device from the faceplate and also from the DFB. Hence, all the functions in the faceplate will be disabled. Refer to the table included with the description of the LPMODE output pin, page 191.

Parameter	Type	Description				
CSSignal	BOOL	1 = The local panel mode switch is in the Control System position. Refer to the table included with the description of the <code>LPMode</code> output pin, page 191.				
OFFSignal	BOOL	1 = The OFF push button on the local panel is pressed.				
DirectSignal	BOOL	1 = Indicates to the DFB that the Forward Direction ON push button on the local panel is pressed.				
ReverseSignal	BOOL	1 = Indicates to the DFB that the Reverse Direction ON push button on the local panel is pressed.				
IncSPSignal	BOOL	1 = Indicates to the DFB that the Increase set-point push button on the local panel is pressed.				
DecSPSignal	BOOL	1 = Indicates to the DFB that the Decrease set-point push button on the local panel is pressed.				
S1Signal	BOOL	1 = Indicates to the DFB that the S1 pre-established speed push button on the local panel is pressed.				
S2Signal	BOOL	1 = Indicates to the DFB that the S2 pre-established speed on the local panel is pressed.				
S3Signal	BOOL	1 = Indicates to the DFB that the S3 pre-established speed push button on the local panel is pressed.				
DeltaFastSP	REAL	Absolute set-point increase or decrease value when the Increase and Decrease push buttons are pressed.				
DeltaSP	REAL	Absolute set-point increase or decrease value when the Increase or Decrease push button is pressed.				
TREPEAT	TIME	Indicates the maximum time that needs to elapse before the system interprets that a command has been repeated when the push button is being pressed.				
MODESignalsEN	BOOL	<div>1 = Enables the use of the local panel/zero/ control system (or local panel - control system) mode switch on the local panel. Usually configured in development phase based on the characteristics of the local panel being used. If the mode switch is enabled, the <code>LPSignal</code>, <code>ZEROSignal</code>, and <code>CSSignal</code> inputs are considered to determine the operating modes of the local panel. Refer to the table included with the description of the <code>LPMode</code> output pin, page 191.</div> <div>NOTE: <i>MODESignalsEN</i> input pin has higher priority than the <i>VirtualLPEN</i> input pin signal.</div>				
VirtualLPEN	BOOL	<div>1 = This signal enables the operator to select the Local/Control System mode of operation from the HMI, so that the push button signals are enabled for operation.</div> <div>NOTE:<ul style="list-style-type: none">When the owner is program, the Local/Control System mode selection drop-down list will be visible but disabled for operation however, when the owner is operator the Local Panel drop-down list will be accessible for operation.<i>VirtualLPEN</i> input pin signal is applicable only for Modicon Libraries - General Purpose for Wonderware System Platform offer only, however there is no impact of this input signal in Modicon Libraries - General Purpose for Citect SCADA offer.</div> <div>Refer to the table included with the description of the <code>LPMode</code> output pin, page 191.</div>				
PBSignalsEN	BOOL	<div>1 = Enables to accept the OFF, Forward ON, Reverse ON, Increase, Crease, S1 Preset, S2 Preset and S3 Preset buttons from the local panel. This signal is not applicable if the mode switch is enabled (refer to the <code>MODESIGNALSEN</code> input). It means that the push button signals are considered in the Local Panel mode.</div> <div>When the mode switch is disabled (<code>MODESIGNALSEN</code> = 0), <code>PBSIGNALSEN</code> signal enables/disables the push button signals from control system itself based on relevant process conditions. <code>SC.DISABLELP</code> public variable is also considered for determining whether the push buttons are enabled or not when <i>LPMode</i> pin signal is high, as shown in the following table.</div> <table><tr><th><code>MODESignalsEN</code></th><th><code>PBSignal-sEN</code></th><th><code>SC.Disa-bleLP</code></th><th>Push buttons enabled?</th></tr></table>	<code>MODESignalsEN</code>	<code>PBSignal-sEN</code>	<code>SC.Disa-bleLP</code>	Push buttons enabled?
<code>MODESignalsEN</code>	<code>PBSignal-sEN</code>	<code>SC.Disa-bleLP</code>	Push buttons enabled?			

Parameter	Type	Description																							
		OFF	OFF	-	NO																				
		OFF	-	ON	NO																				
		OFF	ON	OFF	YES																				
		ON	-	-	YES																				
		Therefore, this signal can be used to enable/disable the push buttons on a simple local panel that does not feature a mode switch (Local Panel/Zero/Control System) based on relevant process conditions.																							
ToProgramEN	BOOL	1 = Enables the functionality to change the owner of the speed-driver-equipped motor to Program when the mode switch on local panel returns to the control system position (only when the mode is switched). If this functionality is disabled, the operator of monitoring (HMI) system switches to Program owner when the operator deems it appropriate. Refer to the table included with description of the LockOwnerEN input.																							
LockOwnerEN	BOOL	<p>1 = Disables the access of owner of the speed-driver-equipped motor remaining as Operator while the local panel mode is Local Panel.</p> <p>The following table depicts how the owner of the speed-driver-equipped motor is evaluated based on ToProgramEN and LockOwnerEN inputs and the operating mode of the local panel:</p> <table><tr><th>Local Panel Mode</th><th>ToProgram- mEN</th><th>LockOw- nerEN</th><th>Owner</th></tr><tr><td>0</td><td>-</td><td>-</td><td>Operator</td></tr><tr><td>Switch to Local Panel</td><td>-</td><td>-</td><td>Operator</td></tr><tr><td>Local Panel</td><td>-</td><td>ON</td><td>Operator</td></tr><tr><td>Switch to Control System</td><td>ON</td><td>-</td><td>Program</td></tr></table> <p>In remaining cases, owner of the speed-driver-equipped motor ceases to be defined from the SDDEVLP DFB and it becomes possible to change it from monitoring (HMI) system with the command word in the SDDEVCTL_ST.CFGW input/output variable of the corresponding SDDEVCTL DFB.</p> <p>In any case, consider that the owner of speed-driver-equipped motor that had been set before switching to the local panel mode is not memorized.</p>				Local Panel Mode	ToProgram- mEN	LockOw- nerEN	Owner	0	-	-	Operator	Switch to Local Panel	-	-	Operator	Local Panel	-	ON	Operator	Switch to Control System	ON	-	Program
Local Panel Mode	ToProgram- mEN	LockOw- nerEN	Owner																						
0	-	-	Operator																						
Switch to Local Panel	-	-	Operator																						
Local Panel	-	ON	Operator																						
Switch to Control System	ON	-	Program																						
LockSetPointEN	BOOL	<p>1 = Disables the setpoint of device and lock it into the one defined on the local panel while local panel mode is Local Panel and the device owner is Operator. You can switch to Program mode based on the signals that have been previously described even if the local panel mode is set to Local Panel.</p> <p>Therefore, user can activate (1) this signal to lock setpoint operation from the monitoring (HMI) system while speed-driver-equipped motor is controlled from the local panel.</p>																							

Outputs

Output Parameter Description

Parameter	Type	Description
PBLIGHT-Signal	BOOL	1 = The push buttons on the local panel are fully operational, that is, the local panel is in Local Panel mode (either because the mode is selected with the corresponding switch or because the push buttons are enabled in the event that there is no selector switch available or the VirtualLPEN is high with the local panel mode enabled).
LPMode	BOOL	1 = The local panel mode is in Local Panel.

Parameter	Type	Description						
		The following table depicts how the local panel operating mode is determined based on the MODESignalsEN , VirtualLPEN , PBSignalsEN , LPSignal , CSSignal and ZEROSignal , input signals:						
		MOD-ESi-gna-lsEN	Vir-tual-LPEN	PBSi-gnal-sEN	LPSig-nal	CSSi-gnal	ZERO-Signal	OUTPUT
		0	0	0	0	0	0	CS mode
		1	0	0	0	0	0	Zero mode
		1	0	0	1	0	0	LP mode and PBLIGHT-Signal
		1	0	0	0	1	0	CS mode
		0	1	1	NA	NA	NA	CS mode
		0	1	0	NA	NA	NA	CS mode
		0	0	1	0	0	0	LP mode and PBLIGHT-Signal
		1	1	0	1	0	0	LP mode and PBLIGHT-Signal
		1	1	0	0	0	0	Zero mode
		1	1	0	0	0	1	Zero mode
		1	1	0	0	1	0	CS mode
		1	0	1	0	1	0	CS mode
		1	1	1	0	1	0	CS mode
		1	0	0	0	0	1	Zero mode
ZEROMode	BOOL	1 = The local panel mode is in Zero. User is not allowed to operate the device from the faceplate and also from DFB. Hence, all the functions in the faceplate will be disabled. Refer to the table included with the description of the LPMode output.						
CSMode	BOOL	1 = The local panel mode is in Control System. Refer to the table included with the description of the LPMode output.						

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
SDDEVCTL_CFG	SDDEVCTL_CFG_DDT	Data structure corresponding to the speed-driver-equipped motor is to be controlled from the local panel (for detailed information regarding this structure, refer the SDDEVCTL DFB in the Process manual). The structure provides the information needed for the operation of the SDDEVLP DFB. It enables this DFB to control the set-point for the speed-driver-equipped motor.
SDDEVCTL_ST	SDDEVCTL_ST_DDT	Data structure corresponds to the on-off device to be controlled from the local panel (for detailed information regarding this structure, refer to the SDDEVCTL DFB, page 177. The structure provides the information needed for the operation of the SDDEVLP DFB and enables this DFB to control the owner of the speed-driver-equipped motor.
SDDEVLP_ST	SDDEVLP_ST_DDT	Data structure that is used as an interface with the monitoring (HMI) system.

SDDEVCTL_CFG.DDT Type

Name	Type	Description
SPSEL	UINT	Read/write access Enables to select from the monitoring (HMI) system the local set-point that needs to be used when owner is the Operator (OWNER = 1). If the set-point is set by the Program (OWNER = 0), the DFB continuously assigns it the current value.

SDDEVCTL_ST.DDT Type

Name	Type	Description
SP	WORD	Current speed set-point. The DFB continuously copies the value of the current set-point to this signal if the mode is not the Operator (Local) mode. In this case, you can modify it from the monitoring (HMI) system. The SDDEVLP DFB determines the set-point for the speed-driver-equipped motor based on the operating mode of the control panel, the owner, the status of the push button, and the set-point locking (LockSetPointEN) signal.
CFGW	WORD	Provides the means to control the device from the monitoring (HMI) system. Read-only access to the data contained in this word.

SDDEVLP_ST.DDT Type

Name	Type	Description
STW	WORD	Read-only access Bits word with the status of the local panel.

SDDEVCTL_ST.CFGW Word

The following table describes the SDDEVCTL_ST.CFGW word:

Bit	Name	Description																																																
0	OWNER	<p>Read/write access</p> <p>Enables to configure whether the set-point is set by the Program (0) or by the Operator (1).</p> <p>Refer to the table included with the description of the LPMoDe output pin, which specifies the cases in which the SDDEVLP DFB can interact with this signal.</p>																																																
4	LSPREV	<p>Read/write access</p> <p>Enables to set the rotation direction (0:forward, 1: reverse) from the monitoring (HMI) system if the owner is the Operator (OWNER = 1). When the set-point is set by the Program (OWNER = 0), the DFB continuously assigns it the direction of the rotation set from the Program.</p>																																																
5	LSTART	<p>Read/write access</p> <p>Enables to start running (1) or stop (0) from the monitoring (HMI) system when the owner is the Operator (OWNER = 1). As long as the set-point is set by the Program (OWNER = 0), the DFB continuously assigns it the value of the current command (SDDEVCTL_ST.STW.LSTART input/output).</p> <table><tr><th>The SDDEVLP DFB determines the set-point for the speed-driver-equipped motor.</th><th>OWNER</th><th>OFFSignal</th><th>Direct-Signal</th><th>Reverse-Signal</th><th>Lock-Set-PointEN</th><th>LSTART is calculated as:</th><th>LSPREV is calculated as:</th></tr><tr><td>0</td><td>- (The OWNER signal is forced to 1 (Operator).</td><td>-</td><td>-</td><td>-</td><td>-</td><td>OFF</td><td>Last value</td></tr><tr><td>Local Panel</td><td>Operator</td><td>ON</td><td>-</td><td>-</td><td>-</td><td>OFF</td><td>Last value</td></tr><tr><td>Local Panel</td><td>Operator</td><td>OFF</td><td>ON</td><td>-</td><td>-</td><td>ON</td><td>OFF</td></tr><tr><td>Local Panel</td><td>Operator</td><td>OFF</td><td>-</td><td>ON</td><td>-</td><td>ON</td><td>ON</td></tr><tr><td>Local Panel</td><td>Operator</td><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td><td>Last value</td><td>Last value</td></tr></table> <p>In other cases, the LSTART signal is not modified from the SDDEVLP DFB.</p>	The SDDEVLP DFB determines the set-point for the speed-driver-equipped motor.	OWNER	OFFSignal	Direct-Signal	Reverse-Signal	Lock-Set-PointEN	LSTART is calculated as:	LSPREV is calculated as:	0	- (The OWNER signal is forced to 1 (Operator).	-	-	-	-	OFF	Last value	Local Panel	Operator	ON	-	-	-	OFF	Last value	Local Panel	Operator	OFF	ON	-	-	ON	OFF	Local Panel	Operator	OFF	-	ON	-	ON	ON	Local Panel	Operator	OFF	OFF	OFF	ON	Last value	Last value
The SDDEVLP DFB determines the set-point for the speed-driver-equipped motor.	OWNER	OFFSignal	Direct-Signal	Reverse-Signal	Lock-Set-PointEN	LSTART is calculated as:	LSPREV is calculated as:																																											
0	- (The OWNER signal is forced to 1 (Operator).	-	-	-	-	OFF	Last value																																											
Local Panel	Operator	ON	-	-	-	OFF	Last value																																											
Local Panel	Operator	OFF	ON	-	-	ON	OFF																																											
Local Panel	Operator	OFF	-	ON	-	ON	ON																																											
Local Panel	Operator	OFF	OFF	OFF	ON	Last value	Last value																																											

SDDEVLP_ST.CFGW Word

Bit	Name	Description
0	LocalModeOn	Read/write access only <ul style="list-style-type: none"> 1 = Enables the Local Panel mode. 0 = Enables the Control System mode.

SDDEVLP_ST.STW Word

Read-only access. Status word. The following table describes the SDDEVLP_ST.STW word:

Bit	Name	Description
0	LPMode	Local panel in Local Panel mode. Refer to the LPMode output pin.
1	ZEROMode	Local panel in zero mode. Refer to the ZEROMode output pin.
2	CSMode	Local panel in Control System mode. Refer to the CSMode output pin.

Bit	Name	Description
3	LockedOwner	Indicates whether the owner change buttons in the monitoring (HMI) system needs to be locked (1) or not (0). Is activated when: <ul style="list-style-type: none"> The Local Panel mode is set to Zero or It is set to Local Panel and the <code>LockOwnerEN</code> input signal has been configured as active (1).
4	SPLocked	Indicates whether the set-point change and START buttons in the monitoring (HMI) system needs to be locked (1) or not (0). Is activated when: <ul style="list-style-type: none"> The Local Panel mode is set to Zero or It is set to Local Panel and the <code>LockSetpointEN</code> input signal has been configured as active (1).
5	MODEsignalsEN	Indicates the state of the <code>MODEsignalsEN</code> input signal, that is, whether there is a mode switch (1) or not (0).
6	PBEnabled	Indicates whether the push buttons of the local panel are enabled (1) or not (0). The signal is activated when at least one of the <code>MODEsignalsEN</code> and <code>PBsignalsEN</code> signal inputs is active.
7	VirtualLPEN	Enables the drop-down list for the Local Panel / Control System mode selection.
8	LPSignal	Indicates the state of the <code>LPSignal</code> input signal.
9	ZEROSignal	Indicates the state of the <code>ZEROSignal</code> input signal.
10	CSSignal	Indicates the state of the <code>CSSignal</code> input signal.
11	OFFSignal	Indicates the state of the <code>OFFSignal</code> input signal.
12	DirectSignal	Indicates the state of the <code>DirectSignal</code> input signal.
13	ReverseSignal	Indicates the state of the <code>ReverseSignal</code> input signal.
14	IncSPSignal	Indicates the state of the <code>IncSPSignal</code> input signal.
15	DecSPSignal	Indicates the state of the <code>DecSPSignal</code> input signal.

Public Variables

Public Variable Description

Variable	Type	Description
SC	SDDEVLP_SC_DDT	Provides the common data needed for monitoring and controlling the DFB.

SDDEVLP_SC_DDT Type

Name	Type	Description
LPMode	BOOL	Read-only access Refer to the <code>LPMode</code> output pin, page 191.
ZEROMode	BOOL	Read-only access Refer to the <code>ZEROMode</code> output pin, page 191.

Name	Type	Description
CSTMode	BOOL	Read-only access Refer to the CSTMode output pin, page 191.
DisableLP	BOOL	Read/write access 1 = Disables the push buttons on the local panel. Only applicable when a local panel without mode switch configuration is used (MODESignalsEN = 0).

Process Control

What's in This Part

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Overview

This part provides a detailed description of the functions, pins, pin layout, and variables of the function blocks of the process control family.

These function blocks do not reflect any specific installation.

⚠ WARNING

LOSS OF CONTROL

- Perform a Failure Mode and Effects Analysis (FMEA), or equivalent risk analysis, of your application, and apply preventive and detective controls before implementation.
- Provide a fallback state for undesired control events or sequences.
- Provide separate or redundant control paths wherever required.
- Supply appropriate parameters, particularly for limits.
- Review the implications of transmission delays and take actions to mitigate them.
- Review the implications of communication link interruptions and take actions to mitigate them.
- Provide independent paths for control functions (for example, emergency stop, over-limit conditions, and error conditions) according to your risk assessment, and applicable codes and regulations.
- Apply local accident prevention and safety regulations and guidelines.¹
- Test each implementation of a system for proper operation before placing it into service.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

¹ For additional information, refer to NEMA ICS 1.1 (latest edition), *Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control* and to NEMA ICS 7.1 (latest edition), *Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems* or their equivalent governing your particular location.

ARAMP - RAMP

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Overview

This chapter describes the ARAMP DFB.

Description

General

The ARAMP DFB is used to generate rising or falling set-point ramps for other control modules, such as PID regulators, direct analog outputs, and so on.

The ARAMP DFB is based on and internally instantiates a standard ARAMP DFB from the Control library.

The DFB provides tracking functions (for example, for set-points or measurements, as required), temporary ramp shutdown due to maximum deviation, management of set-points from monitoring and/or control, and so on.

Function Description

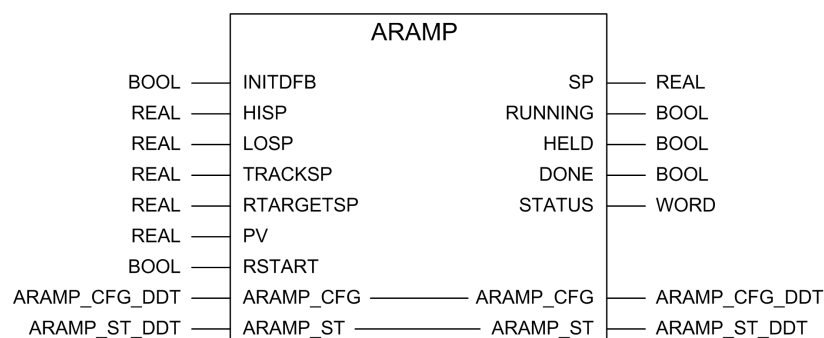
The main functions of the DFB are described in the following table:

Function	Description
Ramp	The DFB allows to generate rising and/or falling ramps with different slopes as required.
Maximum Deviation	Optionally, configure the DFB so that the ramp is held until the deviation between the measurement and the set-point is less than the maximum deviation allowed.
Tracking	While the ramp DFB is not in operation, the signal on one of its pins is tracked (usually the pin connected to the measurement that needs to be controlled or to the last position of the control element – for example, a control valve).
Owner	The DFB manages control system level, which is the owner (Operator or Program). Therefore, it is responsible for setting the ramp set-points.
Local/Remote Set-point	If the Program is the owner, you can set the ramp set-point from continuous control (with the input pin designated for this purpose) or from the sequence (with the SC public variable).

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
INITDFB	BOOL	1 = When a rising edge is produced on this input, the signal connected to the TRACKSP input pin is tracked.
HISP	REAL	High range of the set-point (SP) in engineering units. Enables to set set-points to match this maximum value if it exceeds this maximum value.
LOSP	REAL	Low range of the set-point (SP) in engineering units. Enables to set set-points to match this minimum value if it falls below it.
TRACKSP	REAL	Tracking set-point in engineering units that the DFB needs to generate while the ramp is not in operation. Refer to the SP output pin, page 200.
RTARGETSP	REAL	Target set-point in engineering units to be applied in the Program/Remote mode. Refer to the SP output pin, page 200.
PV	REAL	Current value of the measurement in engineering units. This input is only used for the purpose of holding the ramp if the measurement is excessively delayed in relation to the set-point generated by the DFB itself (SP output). Refer to the ARAMP_CFG . MAXDEV output pin, page 201.
RSTART	BOOL	1 = Run in the Program/Remote mode. 0 = Ramp Stop in the Program/Remote mode

Outputs

Output Parameter Description

Parameter	Type	Description			
SP	REAL	Calculated value of the set-point. In any event, this value is limited according to the range specified in the <code>HISP</code> and <code>LOSP</code> inputs.			
		The set-point calculation performed by the DFB is detailed in the following table:			
		RUNNING	SP		
		OFF	TRACKSP		
	ON	SP value is calculated based on the last value generated depending on the slopes configured (<code>ARAMP_CFG.INCRATE</code> and <code>DECRATE</code>) and the target set-point. The ramp is held if distance between the <code>PV</code> input and the <code>SP</code> is greater than the maximum deviation allowed (you can deactivate this monitoring by canceling the <code>ARAMP_CFG.MAXDEV</code> signal).			
The following configuration data is considered according to the operating mode selected:					
ARAMP_ST.CFGW.OWNER		SC.REM		TARGET SET-POINT and RUN COMMAND	
OFF (Program)		OFF (Local)		SC.LTARGETSP and SC.LSTART	
OFF		ON (Remote/Cascade - applicable while the Program is the OWNER)		RTARGETSP and RSTART	
ON (Operator)		-		ARAMP_CFG.LTARGETSP and ARAMP_ST.CFGW.LSTART	
RUNNING	BOOL	1 = Indicates that the ramp is active. This signal responds to the <code>xSTART</code> command depending on the operating mode that is running.			
		The <code>RUNNING</code> signal calculation based on the DFB operating mode is detailed in the following table:			
		OWNER	REM	RUNNING	
		OFF	OFF	SC.LSTART	
		OFF	ON	RSTART	
	ON	-	ARAMP_CFG.CFGW.LSTART		
HELD	BOOL	1 = Indicates that the ramp is held. The ramp is held if a maximum deviation greater than 0.0 (<code>ARAMP_CFG.MAXDEV</code>) has been configured and the distance between the set-point (<code>SP</code>) and the measurement (<code>PV</code>) is greater than this deviation. While this signal is active, the set-point is maintained at its last value and the ramp does not go on.			
		The calculation of the <code>HELD</code> signal based on the DFB operating mode is detailed in the following table:			
		ARAMP_CFG.MAXDEV		RUNNING	HELD
		-		OFF	OFF
		0.0		-	OFF
>0.0		ON	Distance between <code>PV</code> and <code>SP</code> greater than <code>ARAMP_CFG.MAXDEV</code>		
DONE	BOOL	1 = Indicates that the set-point (<code>SP</code> output) has reached the set target. The module stays active even if this signal is activated so that if the target set-point is modified, the necessary ramp (rising or falling) is generated in order to reach it.			
		The <code>DONE</code> signal calculation based on the DFB operating mode is detailed in the following table:			
		RUNNING		DONE	
		OFF		OFF	
	ON	PV = RTARGETSP			
STATUS	WORD	Status word generated by the standard Control RAMP DFB instantiated within the <code>ARAMP</code> DFB. Refer Control Help for more details.			

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
ARAMP_ST	ARAMP_ST_DDT	Provides the data necessary to monitor and/or control the DFB status.
ARAMP_CFG	ARAMP_CFG_DDT	Provides the data necessary to configure the DFB (Usually from the monitoring subsystem).

ARAMP_ST_DDT Type

The following table describes the ARAMP_ST_DDT type:

Name	Type	Description
STW	WORD	Provides the device status usually used from the monitoring subsystem, and allows data to be kept in the memory. Read-only access to the data contained in this word.
CFGW	WORD	Provides the means to control the device from the monitoring subsystem. Read/write access to the data contained in this word.
SP	REAL	Current set-point generated by the DFB. Refer to the SP output pin, page 200.

The following table describes the ARAMP_ST.STW word:

Bit	Name	Description
0	REM	Refer to the SC.REM public variable, page 202.
1	HELD	Refer to the HELD output pin, page 200.
2	DONE	Refer to the DONE output pin, page 200.
3	RUNNING	Refer to the RUNNING output pin, page 200.

The following table describes the ARAMP_ST.CFGW word:

Bit	Name	Description
0	OWNER	Read/write access Enables to configure whether the set-point parameters of the ramp are set by the Program (0) or by the Operator (1).
1	LSTART	Read/write access Enables the ramp to be activated (1) or de-activated (0). This signal is loaded with the current DFB activation value if the Program is the DFB owner.

ARAMP_CFG_DDT Type

Name	Type	Description
LTARGETSP	REAL	Read/write access This variable indicates what the target set-point is and is calculated internally in the DFB as long as the Operator is not the owner. In which case, you can modify it from the monitoring subsystem.
INCRATE	REAL	Read/write access

Name	Type	Description
		This variable indicates the rising slope that has been configured. User can modify this variable from the monitoring subsystem.
DECRATE	REAL	Read/write access This variable indicates the falling slope that has been configured. User can modify this variable from the monitoring subsystem.
MAXDEV	REAL	Read/write access This variable indicates the maximum deviation allowed between measurement (PV) and set-point (SP). If it is 0, this monitoring is canceled. You can modify it from the monitoring subsystem.

Public Variables

Public Variable Description

Variable	Type	Description
SC	ARAMP_SC_DDT	Provides the frequently needed data to monitor and control the DFB status from the sequential control.

ARAMP_SC_DDT Type

Name	Type	Description
LTARGETSP	REAL	Read/write access Enables to assign the local target set-point for the sequential control if the Program is the owner (OWNER input/output = OFF) and the selected set-point is the Local one (SC.REM public variable = OFF). Otherwise, the current target set-point is continuously copied to this variable.
SP	REAL	Read-only access. Refer to the SP output pin, page 200.
LSTART	BOOL	Read/write access 1 = Allows the ramp to be activated if the Program is the owner (OWNER input/output is 0) and the selected set-point is the Local one (public variable SC.REM is 0). Otherwise, the current activation command is continuously copied to this variable.
OWNER	BOOL	Read-only access Refer to the ARAMP_ST.CFGW.OWNER input/output pin, page 201.
REM	BOOL	Read/write access 1 = Allows the DFB to be configured to remote set-point RSP. 0 = Allows the DFB to be configured to local set-point LSP. Only applicable if the Program is the owner.
RUNNING	BOOL	Read-only access Refer to the RUNNING output pin, page 200.
HELD	BOOL	Read-only access Refer to the HELD output pin, page 200.
DONE	BOOL	Read-only access Refer to the DONE output pin, page 200.

IMCTL - IMC Controller with Monitoring Interface

What's in This Chapter

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Overview

This chapter describes the `IMCTL` DFB.

Description

General

The `IMCTL` DFB is used to condition the signals associated with the control of a standard Control library IMC controller (Internal Model Controller). This helps to monitor and control the controller from the monitoring subsystem and to provide the operating modes used in the rest of the General Purpose library process function blocks.

The IMC internal model controller is specifically designed to control processes with pure delays as well as non-linear processes.

Function Description

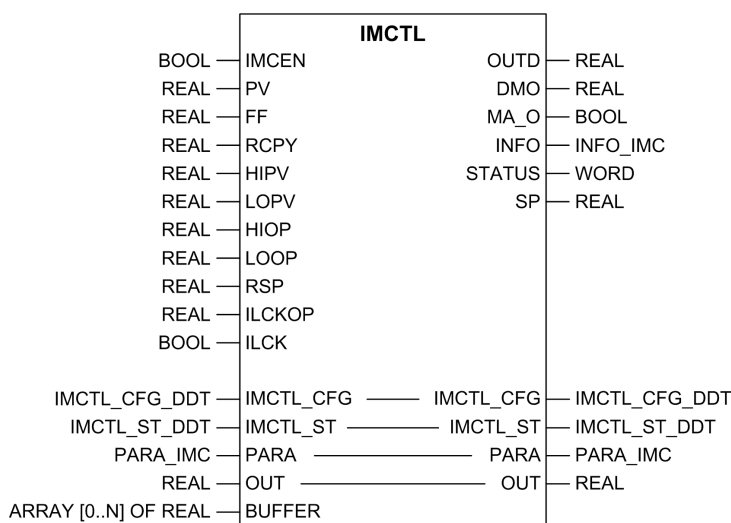
The main functions of the DFB are described in the following table:

Function	Description
IMC	The DFB includes and incorporates functions provided by the IMC controller from the standard <code>CONT_CTL</code> library. You can directly configure the IMC controller functions that have not been shown through the DFB interface by accessing the DFB configuration parameters (for example, FeedForward, variable gain, and so on). Refer to the Control Help for more details.
Owner	The DFB manages the control system level, which is the owner (Operator or Program). As a result, it is responsible for setting the set-point to the target position (in the Auto mode of the IMC controller) or the manual output (in the Manual mode of the IMC controller).
Interlocking	The DFB enables to move to the defined position if an active interlock that requires this move is detected. An interlock bypass function is available.
Set-point	The DFB enables to work under a remote (usually set from the continuous control) or local (set from the program or by the operator depending on the active owner) set-point.
Override	<p>You can combine several <code>IMCTL</code> or other DFBs to control one single control module. This way, the DFB that is not controlling this DFB at a certain point of time works with an external output, that is, calculating the new output based on the position of control module instead of the last position calculated by the DFB itself.</p> <p>These functions are internally provided by the standard IMC controller.</p>

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
IMCEN	BOOL	1 = Enables the internal IMC DFB. The standard Control library IMC DFB needs to be periodically executed by having its EN input enabled. This input is internally connected to the IMCEN input belonging to the IMCTL DFB. Usually, this input is connected to a DFB that defines the execution frequency (for example, SAMPLETM). The frequency with which this input is activated should match the value that is configured on the Para.T_ECH input/output (time in seconds).
PV	REAL	Current value of the measurement in engineering units.
FF	REAL	Value of the variable that disrupts the behavior of the measurement. This input is internally connected to the FF input of the IMC controller. Refer to the PARA.ff_inf, PARA.ff_sup, PARA.otff_inf, and PARA.otff_sup parameters of the IMC controller. These values are initialized to zero by default.
RCPY	REAL	Value of the current (actual) status of the output. You can use this input to feed back the occurring output if multiple controllers controlling a single output (OVERRIDE). This input is internally connected to the RCPY input of the IMC controller. Refer to the PARA.EN_RCPY input.
HIPV	REAL	Upper value of the measurement range. Used for limiting the maximum set-point admitted by the controller. This input is internally connected to the PARA.PV_SUP parameter of the IMC controller (therefore, this parameter cannot be set from outside the IMCTL DFB because it would be overwritten).
LOPV	REAL	Lower value of the measurement range. Used for limiting the minimum set-point admitted by the controller. This input is internally connected to the PARA.PV_INF parameter of the IMC controller (therefore, this parameter cannot be set from outside the IMCTL DFB because it would be overwritten).
HIOP	REAL	Upper value of the output range. Used for limiting the maximum output generated by the controller. This input is internally connected

Parameter	Type	Description
		to the <code>PARAM.OUT_SUP</code> parameter of the IMC controller (therefore, this parameter cannot be set from outside the IMCTL DFB because it would be overwritten).
LOOP	REAL	Lower value of the output range. Used for limiting the minimum output generated by the controller. This input is internally connected to the <code>PARAM.OUT_INF</code> parameter of the IMC controller (therefore, this parameter cannot be set from outside the IMCTL DFB because it would be overwritten).
RSP	REAL	Remote set-point. Usually set by the continuous control, for example, by a PID controller output. Operates in Program/Casc mode (Automatic + Remote). Refer to the <code>SC.REM</code> public variable, page 208.
ILCKOP	REAL	Output needs to be used when the DFB is interlocked. Refer to the <code>ILCK</code> input.
ILCK	BOOL	1 = Interlocks the controller at a defined position with the <code>ILCKOP</code> input. Internally, the IMC controller is set to Tracking mode.
BUFFER	Array [0..n] of REAL	This table of real values enables to store the measurement value for the IMC controller so that they can be delayed. The programmer needs to set the size of the table of real values that is connected to this input in such a way that the table can store the necessary data during the pure delay time of the configured process (refer to the <code>IMCTL_CFG.T_DELAY</code> input/output pin, page 206). This way and depending on the configured sampling time (refer to the <code>PARAM.T_ECH</code> input/output), it will be possible to store a sample every <code>T_ECH</code> seconds, a sample every <code>2xT_ECH</code> seconds, and so on. Refer to the Control Help for more details.

Outputs

Output Parameter Description

Parameter	Type	Description
OUTD	REAL	Differential output generated from the <code>OUTD</code> output of the IMC controller.
DMO	REAL	Output including delay generated from the <code>DMO</code> output of the IMC controller.
MA_O	BOOL	1 = Current operating mode generated based on the <code>MA_O</code> output of the IMC controller. Refer to IMC controller for more details.
INFO	Info_IMC	Variables output by the IMC controller on the <code>INFO</code> output. Refer to the IMC controller for more details.
STATUS	WORD	Statuses output by the IMC controller on the <code>STATUS</code> output. Refer to the IMC controller for more details.
SP	REAL	Current set-point that is being considered by the IMC algorithm. You can modify the set-point directly from the monitoring subsystem while this mode is active.

The set-point calculation that the DFB performs based on the signal status is detailed in the following table:

OWNER (OFF: Program; ON: Operator)	REM	SP is calculated as:
OFF	OFF	<code>SC.LSP</code>
OFF	ON	<code>RSP</code>
ON	-	<code>IMCTL_ST.SP</code> You can modify the set-point directly from the monitoring subsystem while this mode is active.

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
IMCTL_CFG	IMCTL_CFG_DDT	Provides the data needed to configure the DFB usually from the monitoring subsystem or the sequential control.
IMCTL_ST	IMCTL_ST_DDT	Provides the data needed to monitor and/or control the DFB status.
PARAM	PARAM_IMC	Configuration data structure of the IMC controller within the IMCTL DFB. Refer standard IMCTL DFB in the Control documentation for more details.
OUT	REAL	Output signal of the controller. Refer standard IMCTL DFB in the Control documentation for more details.

IMCTL_CFG_DDT Type

Name	Type	Description
OPHILIM	REAL	Enables to define the maximum value of the output for the automatic operation of the controller. This input is internally connected to the <code>PARAM.OUT_MAX</code> parameter of the IMC controller (therefore, the parameter cannot be set from outside the IMCTL DFB because it would be overwritten).
OPLOLIM	REAL	Enables to define the minimum value of the output for the automatic operation of the controller. This input is internally connected to the <code>PARAM.OUT_MIN</code> parameter of the IMC controller (therefore, the parameter cannot be set from outside the IMCTL DFB because it would be overwritten).
KS	REAL	Enables to set the proportional gain parameter of the controller. This input is internally connected to the <code>PARAM.KP</code> parameter of the IMC controller (therefore, the parameter cannot be set from outside the IMCTL DFB because it would be overwritten).
OL_TIME	REAL	Enables to define the time constant for the open-loop process. This input is internally connected to the <code>PARAM.OL_TIME</code> parameter of the IMC controller (therefore, this parameter cannot be set from outside the IMCTL DFB because it would be overwritten).
CL_PERF	REAL	Enables to set the parameter defining the relationship between the natural time constants of the open-loop/closed-loop process. This input is internally connected to the <code>PARAM.C_PERF</code> parameter of the IMC controller (therefore, this parameter cannot be set from outside the IMCTL DFB because it would be overwritten).
T_DELAY	REAL	Enables to set the pure delay parameter in seconds. This input is internally connected to the <code>PARAM.T_DELAY</code> parameter of the IMC controller (therefore, this parameter cannot be set from outside the IMCTL DFB because it would be overwritten).

IMCTL_ST_DDT Type

Name	Type	Description
STW	WORD	Provides the device status usually used from the monitoring subsystem, and allows data to be kept in the memory. Read-only access to the data contained in this word.
CFGW	WORD	Provides the means to control the device from the monitoring subsystem. Read/write access to the data contained in this word.
PV	REAL	Read access Refer to the PV input, page 204.

Name	Type	Description
		This variable indicates the current measurement.
SP	REAL	Read/write access Refer to the SP output, page 205. This variable indicates the current set-point and is calculated internally in the DFB as long as the owner is not the Operator. In this case, you can modify it from the monitoring subsystem.
OP	REAL	Read/write access This variable indicates the current output and is calculated internally in the DFB as long as the owner is not the Operator. In this case, you can modify it from the monitoring subsystem.

IMCTL_ST.STW Word Structure

DFB status word. Read-only access. The following table describes the IMCTL_ST.STW Word structure.

Bit	Name	Description
0	REM	Refer to the SC.REM public variable, page 208.
2	ILCK	Refer to the ILCK input pin, page 204.
3	OVERRIDE	Enables to determine if the DFB is operating with external output (1 – Override) or not (0 – Normal). Refer to the PARA.EN_RCPY input.

IMCTL_ST.CFGW Word Structure

DFB configuration word. Read/write access. The following table describes the IMCTL_ST.CFGW Word structure

Bit	Name	Description
0	OWNER	Read/write access Enables to configure whether the set-point is set by the Program (0) or the Operator (1).
1	ILCKBP	Read/write access Allows the interlock to be bypassed (1).
2	MODE	Read/write access Reports the Operating mode of the IMC controller if the owner is the Program, and enables the Operating mode to be configured if the owner is the Operator. 1 corresponds to Auto and 0 to Manual.
3	ACTION	Read/write access Enables you to configure the action of the IMC controller. 0 corresponds to Reverse and 1 to Forward. The DFB automatically assigns the value of this signal to the PARA.rev_dir signal of the IMC controller.

Public Variables

Public Variable Description

Variable	Type	Description
SC	IMCTL_SC_DDT	Provides the frequently needed data to monitor and control the controller status from the sequential control.

IMCTL_SC_DDT Type

Name	Type	Description	
LSP	REAL	Read/write access Enables the sequential control to assign the local set-point if the owner is the Program (OWNER is 0), the selected mode is Auto, and the selected set-point is Local (SC.REM is 0). Otherwise, the current set-point (SP output) is continuously copied to this variable.	
LOP	REAL	Read/write access. Enables the sequential control to assign the local output if the owner is the Program (OWNER is 0) and the mode is Manual. Otherwise, the current output (OP output) is continuously copied to this variable.	
PV	REAL	Read-only access Refer to the PV input pin, page 204.	
OWNER	BOOL	Read-only access Refer to the IMCTL_ST.CFGW.OWNER input/output pin, page 206.	
MAN	BOOL	Write access 1 = Allows the controller to switch to Manual mode if the owner is the Program. 0 = The DFB automatically sets the signal to 0 after processing the signal.	
AUTO	BOOL	Write access 1 = Allows the controller to switch to Auto mode if the owner is the Program. 1 = The DFB automatically sets the signal to 0 after processing the signal.	
MODE	BOOL	Read-only access 1 = Auto 0 = Manual Refer to the IMCTL_ST.CFGW.MODE input/output pin, page 206.	
REM	BOOL	Read-only access 1 = Allows the DFB to be configured for a remote set-point -RSP, if the owner is the Program and the mode is Auto. 0 = Allows the DFB to be configured for a local set-point -LSP,if the owner is the Program and the mode is Auto.	
ILCKD	BOOL	Read-only access The signal evaluation depending on the ILCK input and the IMCTL_ST.STW.ILCKBP input/output is shown in the following table:	
	ILCK	ILCKBP	SC.ILCKD is calculated as:
	OFF	-	OFF

Name	Type	Description	
	ON	OFF	ON
	ON	ON	OFF

LDLGCTL - Lead/Lag Controller with Monitoring Interface

What's in This Chapter

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Overview

This chapter describes the `LDLGCTL` DFB.

Description

General

The `LDLGCTL` DFB is used to condition the signals associated to the control of a LEAD-LAG controller. This DFB helps to monitor and control the controller from the monitoring subsystem and to provide the operating modes used in the rest of the General Purpose library process function blocks.

Function Description

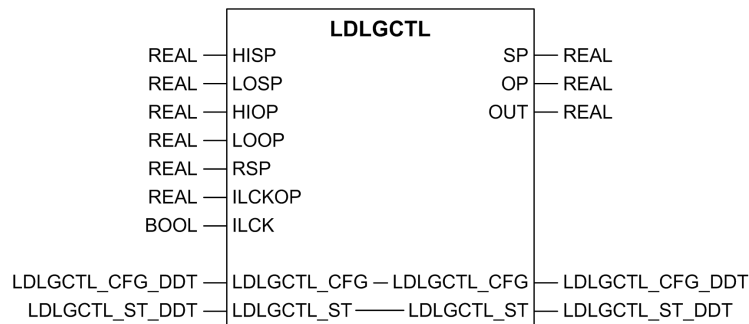
The main functions of the DFB are described in the following table:

Function	Description
LEAD-LAG	The DFB includes and incorporates functions provided by the LEAD-LAG controller from the standard <code>CONT_CTL</code> Control library.
Owner	The DFB manages control system level, which is the owner (Operator or Program). As a result, it is responsible for setting the set-point to the desired position (in the Auto mode of the LEAD-LAG controller) or the manual output (in the Manual mode of the LEAD-LAG controller).
Interlocking	The DFB enables to move to the defined position if an active interlock that requires this move is detected. An interlock bypass function is available.
Set-point	The DFB enables you to work under a remote (usually set from the continuous control) or local (set from the program or by the operator depending on the active owner) set-point.

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
HISP	REAL	Upper value of the set-point range. Used to limit the maximum value of the set-point admitted by the controller.
LOSP	REAL	Lower value of the set-point range. Used to limit the minimum value of the set-point admitted by the controller.
HIOP	REAL	Upper value of the output range. Used to limit the maximum value of the output admitted by the controller.
LOOP	REAL	Lower value of the output range. Used to limit the minimum value of the output admitted by the controller.
RSP	REAL	Remote set-point usually set by the continuous control, for example, by a PID controller output. Operates in Program/Casc mode (Automatic + Remote). Refer to the <code>SC.REM</code> public variable, page 213.
ILCKOP	REAL	Output needs to be considered when the DFB is interlocked. Refer to the <code>ILCK</code> input.
ILCK	BOOL	1 = Interlocks the controller at a defined position with the <code>ILCKOP</code> input. Internally, the LEAD-LAG controller is set to Tracking mode.

Outputs

Output Parameter Description

Parameter	Type	Description		
SP	REAL	Current set-point that is being used by the LEADLAG DFB.		
		The set-point calculation that the DFB performs based on the signal status is detailed in the following table:		
		OWNER (OFF: Program; ON: Operator)	REM	SP is calculated as:
		OFF	OFF	SC.LSP
		OFF	ON	RSP
		ON	-	LDLGCTL_ST.SP You can modify the set-point directly from the monitoring subsystem while this mode is active.

Parameter	Type	Description
OP	REAL	Output calculated in engineering units by the DFB.
OUT	REAL	Output calculated by the DFB. Refer to the LEADLAG controller for more details.

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
LDLGCTL_CFG	LDLGCTL_CFG_DDT	Provides the data needed to configure the DFB usually from the monitoring subsystem or the sequential control.
LDLGCTL_ST	LDLGCTL_ST_DDT	Provides the data needed to monitor and/or control the DFB status.

LDLGCTL_CFG_DDT Type

Name	Type	Description
GAIN	REAL	Enables to set the proportional gain parameter of the controller.
LEAD	TIME	Enables to set the derivative time parameter of the controller.
LAG	TIME	Enables to set the delay time parameter of the controller.

LDLGCTL_ST_DDT Type

Name	Type	Description
STW	WORD	Provides the device status usually used from the monitoring subsystem, and allows data to be kept in the memory. Read-only access to the data contained in this word.
CFGW	WORD	Provides the means to control the device from the monitoring subsystem. Read/write access to the data contained in this word.
SP	REAL	Read/write access Refer to the SP output pin, page 211. This variable indicates the current setpoint and is calculated internally in the DFB as long as the owner is not the Operator. In this case, you can modify it from the monitoring subsystem.
OP	REAL	Read/write access Refer to the OP output pin, page 211. This variable indicates the current output and is calculated internally in the DFB as long as the owner is not the Operator. In this case, you can modify it from the monitoring subsystem.

LDLGCTL_ST.STW Word Structure

DFB status word. Read-only access. The following table describes the LDLGCTL_ST.STW Word structure:

Bit	Name	Description
0	REM	Refer to the SC.REM public variable, page 213.
2	ILCK	Refer to the ILCK input pin, page 211.

LDLGCTL_ST.CFGW Word Structure

DFB configuration word. Read/write access. The following table describes the LD LGCTL_ST.CFGW Word structure

Bit	Name	Description
0	OWNER	Read/write access Enables to configure whether the set point is set by the Program (0) or the Operator (1).
1	ILCKBP	Read/write access Allows the interlock to be bypassed (1).
2	MODE	Read/write access Reports the operating mode of the LEAD-LAG controller if the owner is the Program and enables to configure the operating mode if the owner is the Operator. 1 corresponds to Auto and 0 corresponds to Manual.

Public Variables

Public Variable Description

Variable	Type	Description
SC	LDLGCTL_SC_DDT	Provides the frequently needed data to monitor and control the controller status from the sequential control.

LDLGCTL_SC_DDT Type

Name	Type	Description
LSP	REAL	Read/write access Enables to assign the local set-point for the sequential control if the owner is the Program (OWNER is 0), the selected mode is Auto, and the selected set-point is Local (SC.REM is 0). Otherwise, the current set-point (SP output) is continuously copied to this variable.
LOP	REAL	Read/write access Enables to assign the local output for the sequential control if the owner is the Program (OWNER is 0) and the mode is Manual. Otherwise, the current output (OP output) is continuously copied to this variable.
OWNER	BOOL	Read-only access Refer to the LD LGCTL_ST.CFGW.OWNER input/output pin, page 212.
MAN	BOOL	Write access. 1 = Allows to switch the controller to Manual mode if the owner is the Program. The DFB automatically sets the signal to 0 after processing the signal.
AUTO	BOOL	Write access

Name	Type	Description	
		1 = Allows to switch the controller to Auto mode if the owner is the Program. The DFB automatically sets the signal to 0 after processing the signal.	
MODE	BOOL	Read-only access 1 = Auto 0 = Manual Refer to the <code>LDLGCTL_ST.CFGW.MODE</code> input/output pin, page 212.	
REM	BOOL	Read-only access 1 = Allows the DFB to be configured for a remote set-point -RSP if the owner is the Program and the mode is Auto. 0 = Allows the DFB to be configured for a local set-point -LSP if the owner is the Program and the mode is Auto.	
ILCKD	BOOL	Read-only access The signal evaluation depending on the <code>ILCK</code> input and the <code>LDLGCTL_ST.STW.ILCKBP</code> input/output is shown in the following table:	
	ILCK	ILCKBP	SC . ILCKD is calculated as:
	OFF	-	OFF
	ON	OFF	ON
	ON	ON	OFF

PIDCTL - PIDFF Regulator with Monitoring Interface

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Overview

This chapter describes the `PIDCTL` DFB.

Description

General

The `PIDCTL` DFB is used to condition the signals associated with the control of a PIDFF-type controller. This DFB helps to monitor and control the controller from the monitoring subsystem and to provide the operating modes used in the rest of the General Purpose library process function blocks.

Function Description

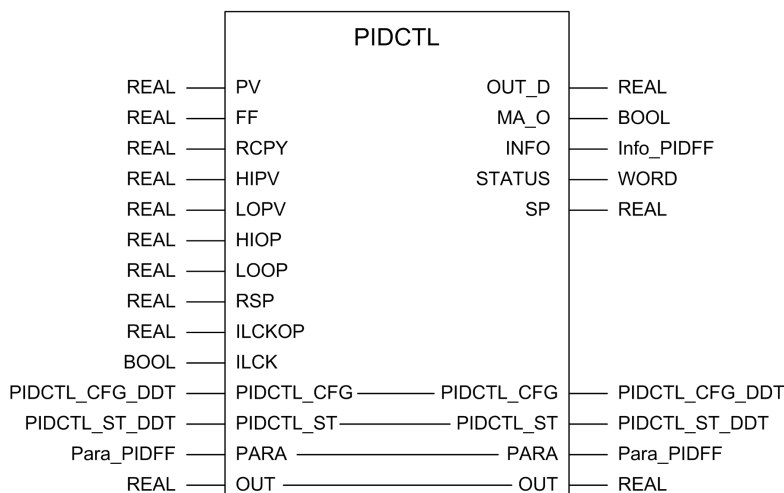
The main functions of the DFB are described in the following table:

Function	Description
PIDFF	The DFB includes and incorporates functions provided by the PIDFF controller from the standard <code>CONTR_CTL</code> library. You can directly configure the PIDFF controller functions that have not been shown through the DFB interface by accessing its configuration parameters (for example, FeedForward, variable gain, and so on).
Owner	The DFB manages control system level, which is the owner (Operator or Program). As a result, it is responsible for setting the set-point to the desired position (in the Auto mode of the PID controller) or the manual output (in the Manual mode of the PID controller).
Interlocking	The DFB enables to move to the defined position if an active interlock that requires this move is detected. An interlock bypass function is available.
Set-point	The DFB enables to work under a remote (usually set from the continuous control) or local (set from the program or by the operator depending on the active owner) set-point.
Override	<p>You can combine several <code>PIDCTL</code> or other DFBs to control one single control module. This way, the DFB that is not controlling this DFB at a certain point in time works with an external output, that is, calculating the new output based on the position of control module instead of the last position calculated by the DFB itself.</p> <p>These functionalities are internally provided by the standard PIDFF controller.</p>

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
PV	REAL	Current value of the measurement in engineering units.
FF	REAL	Value of the variable that disrupts the behavior of the measurement. This input is internally connected to the FF input of the PIDFF controller. By default, a disruption value does not have any repercussion on the output. Refer to the <code>Para.ff_inf</code> , <code>Para.ff_sup</code> , <code>Para.otff_inf</code> , and <code>Para.otff_sup</code> parameters of a PIDFF controller. These values are initialized to zero by default.
RCPY	REAL	Value of the output current (actual) status. You can use this input to feed back the output in case of multiple controllers working against the same output (Override). This input is internally connected to the RCPY input of the PIDFF controller. Refer to the <code>Para.EN_RCPY</code> input.
HIPV	REAL	Upper value of the measurement range. Used for limiting the maximum set-point admitted by the controller. This input is internally connected to the <code>Para.PV_SUP</code> parameter of the PIDFF controller (therefore, you cannot set this parameter from outside the PIDCTL DFB because it would be overwritten).
LOPV	REAL	Lower value of the measurement range. Used for limiting the minimum set-point admitted by the controller. This input is internally connected to the <code>Para.PV_INF</code> parameter of the PIDFF controller (therefore, you cannot set this parameter from outside the PIDCTL DFB because it would be overwritten).
HIOP	REAL	Upper value of the output range. Used for limiting the maximum output generated by the controller. This input is internally connected to the <code>Para.OUT_SUP</code> parameter of the PIDFF controller (therefore, you cannot set this parameter from outside the PIDCTL DFB because it would be overwritten).
LOOP	REAL	Lower value of the output range. Used for limiting the minimum output generated by the controller. This input is internally connected to the <code>Para.OUT_INF</code> parameter of the PIDFF controller (therefore, you cannot set this parameter from outside the PIDCTL DFB because it would be overwritten).

Parameter	Type	Description
RSP	REAL	Remote set-point. Usually set by the continuous control; for example, by a PID controller output. Operates in Program/Casc mode (Automatic + Remote). Refer to the <code>SC.REM</code> public variable, page 219.
ILCKOP	REAL	Use this output when the DFB is interlocked. Refer to the <code>ILCK</code> input.
ILCK	BOOL	1 = Interlocks the controller at a defined position with the <code>ILCKOP</code> input. Internally, the PIDFF controller is set to Tracking mode.

Outputs

Output Parameter Description

Parameter	Type	Description
OUTD	REAL	Differential output. Is generated based on the <code>OUTD</code> output of the PIDFF controller.
MA_O	BOOL	1 = Current operating mode. Is generated based on the <code>MA_O</code> output of the PIDFF controller. Refer to PIDFF controller for more details.
INFO	Info_PIDFF	Variables output by the PIDFF controller on the <code>INFO</code> output. Refer to the PIDFF controller for more details.
STATUS	WORD	Statuses output by the PIDFF controller on the <code>STATUS</code> output. Refer to the PIDFF controller for more details.
SP	REAL	Current set-point that is being considered by the PID algorithm.

The set-point calculation that the DFB performs based on the signal status is detailed in the following table:

OWNER (OFF: Program; ON: Operator)	REM	SP is calculated as:
OFF	OFF	<code>SC.LSP</code>
OFF	ON	<code>RSP</code>
ON	-	<code>PIDCTL_ST.SP</code> You can modify the set-point directly from the monitoring subsystem while this mode is active.

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
PIDCTL_CFG	PIDCTL_CFG_DDT	Provides the data necessary to configure the DFB from the monitoring subsystem or the sequential control.
PIDCTL_ST	PIDCTL_ST_DDT	Provides the data necessary to monitor and/or control the DFB status.
PARA	PARA_PIDFF	Data structure of the PIDFF controller configuration within the <code>PIDCTL</code> DFB. Refer standard <code>PIDFF</code> DFB in the Control documentation for more details.
OUT	REAL	Output signal of the controller. Refer standard <code>PIDFF</code> DFB in the Control documentation for more details.

PIDCTL_CFG_DDT Type

Name	Type	Description
OPHILIM	REAL	Enables to define the maximum value of the output for the Automatic operation of the controller. This input is internally connected to the <code>PARAM.OUT_MAX</code> parameter of the PIDFF controller (therefore, you cannot set the parameter from outside the <code>PIDCTL</code> DFB because it would be overwritten).
OPLOLIM	REAL	Enables to define the minimum value of the output for the Automatic operation of the controller. This input is internally connected to the <code>PARAM.OUT_MIN</code> parameter of the PIDFF controller (therefore, you cannot set the parameter from outside the <code>PIDCTL</code> DFB because it would be overwritten).
GAIN	REAL	Enables to set the proportional gain parameter of the controller. This input is internally connected to the <code>PARAM.KP</code> parameter of the PIDFF controller (therefore, you cannot set the parameter from outside the <code>PIDCTL</code> DFB because it would be overwritten).
TI	TIME	Enables to set the integral time parameter of the controller. This input is internally connected to the <code>PARAM.TI</code> parameter of the PIDFF controller (therefore, you cannot set the parameter from outside the <code>PIDCTL</code> DFB because it would be overwritten).
TD	TIME	Enables to set the derivative time parameter of the controller. This input is internally connected to the <code>PARAM.TD</code> parameter of the PIDFF controller (therefore, you cannot set the parameter from outside the <code>PIDCTL</code> DFB because it would be overwritten).
KD	REAL	Enables to set the derivative gain parameter of the controller. This input is internally connected to the <code>PARAM.KD</code> parameter of the PIDFF controller (therefore, you cannot set the parameter from outside the <code>PIDCTL</code> DFB because it would be overwritten).

PIDCTL_ST_DDT Type

Name	Type	Description
PV	REAL	Read access Refer to the <code>PV</code> input pin, page 216. This variable indicates what the current measurement is.
SP	REAL	Read/write access Refer to the <code>SP</code> output pin, page 217. This variable indicates what the current set-point is, and is calculated internally in the DFB as long as the owner is not the Operator. In which case, you can modify it from the monitoring subsystem.
OP	REAL	Read/write access Refer to the <code>OUT</code> input/output. This variable indicates what the current set-point is, and is calculated internally in the DFB as long as the owner is not the Operator. In which case, you can modify it from the monitoring subsystem.
STW	WORD	Provides the device status usually used from the monitoring subsystem, and allows data to be kept in the memory. Read-only access to the data contained in this word.
CFGW	WORD	Provides the means to control the device from the monitoring subsystem. Read/write access to the data contained in this word.

PIDCTL_ST.STW Word Structure

Bit	Name	Description
0	REM	Refer to the SC.REM public variable, page 219.
2	ILCK	Refer to the ILCK input pin, page 216.
3	OVERRIDE	Determines whether the DFB is operating with external output (1 – Override) or not (0 – Normal). Refer to the PARA.EN_RCPY input.

PIDCTL_ST.CFGW Word Structure

Bit	Name	Description
0	OWNER	Read/write access Enables to configure whether the set-point is set by the Program (0) or the Operator (1).
1	ILCKBP	Read/write access Enables the interlocking to be bypassed (1).
2	MODE	Read/write access Reports the operating mode of the PIDFF controller if the owner is the Program, and enables the operating mode to be configured if the owner is the Operator. 1 corresponds to AUTO and 0 to MANUAL.
3	ACTION	Read/write access Enables the PIFF controller action to be configured. 0 corresponds to reverse and 1 to forward. The DFB automatically assigns the value of this signal to the PARA.rev_dir signal of the IMC controller.
4	PVDEV	Read/write access Enables to configure whether the derivative action applies only to the development of the measurement (PV) or the detected error (PV-SP or SP-PV depending on the configured action). 0 corresponds to considering the measurement only, and 1 to the detected error. The DFB automatically assigns the value of this signal to the PARA.pv_dev signal of the PIDFF controller.
5	MIXPAR	Read/write access Enables to configure whether the PIDFF controller calculation formula is mixed (proportional gain affects integral and derivative terms) or parallel (the action only affects the proportional term). 0 corresponds to mixed and 1 to parallel. The DFB automatically assigns the value of this signal to the PARA.MIX_PAR signal of the PIDFF controller.

Public Variables

Public Variable Description

Variable	Type	Description
SC	PIDCTL_SC_DDT	Provides the frequently needed data to monitor and control the regulator status from the sequential control.

PIDCTL_SC_DDT Type

Name	Type	Description
LSP	REAL	Read/write access Enables to assign the local set-point for the sequential control if the owner is the Program (OWNER is 0), the selected mode is AUTO, and the selected set-point is Local (SC.REM is 0). Otherwise, the current set-point (SP output) is continuously copied to this variable.
LOP	REAL	Read/write access Enables to assign the local output for the sequential control if the owner is the Program (OWNER is 0) and the mode is MANUAL. Otherwise, the current output (OP output) is continuously copied to this variable.
PV	REAL	Read-only access Refer to the PV input pin, page 216.
OWNER	BOOL	Read-only access Refer to the PV input/output pin, page 217.
MAN	BOOL	Write access 1 = Allows the controller to be changed to Manual mode if the owner is the Program. The DFB automatically sets the signal to 0 after processing the signal.
AUTO	BOOL	Write access 1 = Allows the controller to be switched to Auto mode (if the owner is the Program. The DFB automatically sets the signal to 0 after processing the signal.
MODE	BOOL	Read-only access 1 = Auto 0 = Manual Refer to the PIDCTL_ST.CFGW.MODE input/output pin, page 217.
REM	BOOL	Read/write access 1 = Allows the DFB to be configured for a remote set-point -RSP, if the owner is the Program and the mode is Auto. 0 = Allows the DFB to be configured for a local set-point -LSP, if the owner is the Program and the mode is Auto.
ILCKD	BOOL	Read-only access The signal evaluation depending on the ILCK input and the PIDCTL_ST.STW.ILCKBP input/output is shown in the following table.

ILCK	ILCKBP	SC.ILCKD is calculated as:
OFF	-	OFF
ON	OFF	ON
ON	ON	OFF

PIDMUX - Multiplexer for 2 Groups of PIDCTL Parameters

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Overview

This chapter describes the PIDMUX DFB.

Description

General

The PIDMUX DFB is used to multiplex 2 different parameter configurations that affect a single PID controller. This way, you can use one single PID controller with different configurations (for example, split-range PID for cooling or heating).

You can monitor and control the DFB from the monitoring subsystem.

Function Description

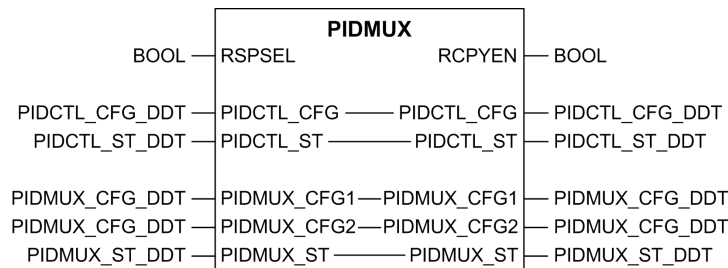
The main functions of the DFB are described in the following table:

Function	Description
Parameter Switching	During a scan cycle, the DFB activates the RCPY signal. This enables you to use the signal to set the PIDCTL controller so that it uses an external output during the parameter configuration change. This way, the controller initializes its integral term and any jumps when switching outputs are stopped.
Owner	The DFB manages control system level, which is the owner (Operator or Program). Therefore, it is responsible for setting the active parameter set.
Parameter Selection	You can control the parameter selector remotely (usually set from the continuous control) or locally (set from the program or by the operator depending on the active owner).

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
RSPSEL	BOOL	Remote set point for selecting the parameter set usually set by the continuous control. Operates in Program /Casc mode (Automatic + Remote). Refer to the <code>SC.REM</code> public variable, page 224. 0 = Corresponds to select parameter configuration 1 (<code>PIDMUX_CFG1</code>) 1 = Corresponds to select parameter configuration 2 (<code>PIDMUX_CFG2</code>).

Outputs

Output Parameter Description

Parameter	Type	Description
RCPYEN	BOOL	1 = Activates output during a scan cycle when the parameter configuration change is made. This output can be used to override the PIDCTL controller (<code>PIDCTL.RCPY</code> input) for which the parameter configuration change is being made. The change takes place without any jumps occurring on the output.

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
PIDCTL_CFG	PIDMUX_CFG_DDT, page 223	The configuration data structure belonging to the PIDCTL module for which the parameters need to be configured (<code>PIDCTL.PIDCTL_ST</code> input/output) needs to be connected to this input. Refer to the PIDCTL module in the PIDCTL module user manual for more details.
PIDCTL_ST	PIDCTL_ST_DDT, page 218	The status data structure belonging to the PIDCTL module for which the parameters need to be configured (<code>PIDCTL.PIDCTL_ST</code> input/output) needs to be connected to this input. Refer to the PIDCTL module in the PIDCTL module user manual for more details.

Parameter	Type	Description
PIDMUX_CFGx	PIDMUX_CFG_DDT, page 223	Provides the data needed to configure the configuration parameters for the associated PIDCTL module. This data can be accessed from the monitoring subsystem.
PIDMUX_ST	PIDMUX_ST_DDT, page 223	Provides the data needed to monitor and/or control the DFB status.

PIDMUX_CFG_DDT Type

Name	Type	Description
CFGW	WORD	Configuration word belonging to the associated PIDCTL controller.
RESERVE	WORD	Reserved
OPHILIM	REAL	Enables to define the maximum value of the output for the Automatic operating mode of the controller.
OPLOLIM	REAL	Enables to define the minimum value of the output for the Automatic operating mode of the controller.
GAIN	REAL	Enables to set the proportional gain parameter of the controller.
TI	TIME	Enables to set the integral time parameter of the controller.
TD	TIME	Enables to set the derivative time parameter of the controller.
KD	REAL	Enables to set the derivative gain parameter of the controller.

PIDMUX_ST_DDT Type

Name	Type	Description
STW	WORD	Provides the device status usually used from the monitoring subsystem, and allows data to be kept in the memory. Read-only access to the data contained in this word.
CFGW	WORD	Provides the means to control the device from the monitoring subsystem. Read/write access to the data contained in this word.

PIDMUX_ST.STW Word Structure

DFB status word. Read-only access. The following table describes the PIDMUX_ST.STW Word structure.

Bit	Name	Description
0	REM	Refer to the SC.REM public variable, page 224.

PIDMUX_ST.CFGW Word Structure

DFB configuration word. Read/write access. The following table describes the PIDMUX_ST.CFGW Word structure.

Bit	Name	Description
0	OWNER	Read/write access Enables to configure whether the set-point is set by the Program (0) or by the Operator (1).
1	LSPSEL	Read/write access This variable indicates which parameter configuration is selected (0: parameter configuration 1; 1: parameter configuration 2) and is calculated internally in the DFB as long as the Operator is not the owner. In this case, it can be modified from the monitoring subsystem.

Public Variables

Public Variable Description

Variable	Type	Description
SC	PIDMUX_SC_DDT	Provides the frequently needed data to monitor and control the module status from the sequential control.

PIDMUX_SC_DDT Type

Name	Type	Description
LSPSEL	BOOL	Read/write access 1 = Enables the sequential control to select the parameter configuration if the owner is the Program/Local (OWNER and SC.REM set to 0). 0 = The current selection set-point (SP output) is continuously copied to this variable.
OWNER	BOOL	1 = Refer to the PIDMUX_ST.CFGW.OWNER input/output pin, page 222. Read-only access
REM	BOOL	Read/write access 1 = Enables to configure the DFB for remote parameter configuration selection -RSP while the owner is the Program. 0 = Enables to configure the DFB for local parameter configuration selection -LSP while the owner is the Program.

PWMCTL - Pulse Width Modulated Controller

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Overview

This chapter describes the PWMCTL DFB.

Description

General

The PWMCTL DFB is used to condition the signals associated with pulse-width modulated (PWM) control.

Function Description

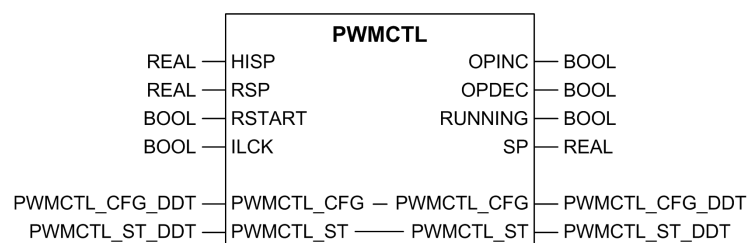
The main functions of the DFB are described in the following table:

Function	Description
Owner	The DFB manages the control system level, which is the owner (operator or program). As a result, it is responsible for setting the setpoint for the desired position.
Interlocking	The DFB gives a position command to the device to move to the defined position in case of an active interlock. An interlock bypass function is available.
Set-point	The DFB enables to work under a remote (usually set from the continuous control) or local (set from the program or by the operator depending on the active owner) set-point.

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
HISP	REAL	Scale limit (positive or negative) for the set-point range. Used to limit the maximum value of the set-point admitted by the controller. The minimum absolute value for the set-point is 0 just as implemented in the standard Control DFB. Therefore, if $HISP > 0$, the set-point range is $0 - HISP$. If $HISP < 0$, the set-point range is $HISP - 0$. Depending on the sign of this signal and the set-point (SP), either the output that acts to increase or decrease the measurement will be activated. Refer to the OPINC and OPDEC outputs.
RSP	REAL	Remote set-point Usually set by the continuous control, for example, by a PID controller output. Operates in Program/Casc mode (Automatic + Remote). Refer to the SC.REM public variable, page 228.
RSTART	BOOL	1 = Enables the operation of the PWM DFB in Automatic mode as described in the Control documentation. When it has a value of 0, it forces the OPINC and OPDEC outputs to 0.
ILCK	BOOL	1 = Interlocks and de-energizes the outputs OPINC and OPDEC.

Outputs

Output Parameter Description

Parameter	Type	Description
OPINC	BOOL	1 = Calculates output for positive set-points ($SP > 0$) by the controller.
OPDEC	BOOL	1 = Calculates output for negative set-points ($SP < 0$) by the controller.
RUNNING	BOOL	1 = Indicates the controller is active.
SP	REAL	Current set-point that is being considered by the controller.

The DFB performs the set-point calculation based on the signal status. The set-point calculation is detailed in the following table:

OWNER (OFF: Program; ON: Operator)	REM	SP is calculated as:
OFF	OFF	SC.LSP
OFF	ON	RSP
ON	—	PWMCTL_ST.SP You can modify the set-point directly from the monitoring subsystem while this mode is active.

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
PWMCTL_CFG	PWMCTL_CFG_DDT	Provides the data needed to configure the DFB usually from the monitoring subsystem.
PWMCTL_ST	PWMCTL_ST_DDT	Provides the data needed to monitor and/or control the DFB status.

PWMCTL_CFG_DDT Type

Name	Type	Description
TPERIOD	TIME	Enables you to set the period for the output signal.
TMIN	TIME	Enables you to set the minimum pulse time (ON or OFF).

PWMCTL_ST_DDT Type

Name	Type	Description
STW	WORD	Provides the device status usually used from the monitoring subsystem, and allows data to be kept in the memory. Read-only access to the data contained in this word.
CFGW	WORD	Provides the means to control the device from the monitoring subsystem. Read/write access to the data contained in this word.
SP	REAL	Read/write access Refer to the SP output pin, page 226. This variable indicates the current set-point and is calculated internally in the DFB as long as the owner is not the Operator. In this case, you can modify it from the monitoring subsystem.

PWMCTL_ST.STW Word Structure

Bit	Name	Description
0	REM	Refer to the SC.REM public variable, page 228.
2	ILCK	Refer to the ILCK input pin, page 226.
3	OPINC	Refer to the OPINC output pin, page 226.
4	OPDEC	Refer to the OPDEC output pin, page 226.

PWMCTL_ST.CFGW Word Structure

Bit	Name	Description
0	OWNER	Read/write access Enables to configure whether the set-point is set by the Program (0) or the Operator (1).
1	ILCKBP	Read/write access Allows the interlock to be bypassed (1).
2	START	Read/write access Reports whether or not the controller is in operation if the owner is the Program and enables to activate/deactivate the controller if the owner is the Operator. 1 corresponds to activating and 0 to deactivating.

Public Variables

Public Variable Description

Variable	Type	Description
SC	PWMCTL_SC_DDT	Provides the frequently needed data to monitor and control the controller status from the sequential control.

PWMCTL_SC_DDT Type

Name	Type	Description	
LSP	REAL	Read/write access Enables the sequential control to assign the local set-point if the owner is the Program (OWNER is 0), the selected mode is Auto, and the selected set-point is Local (SC.REM is 0). Otherwise, the current set-point (SP output) is continuously copied to this variable.	
LSTART	BOOL	Read/write access 1 = Enables the sequential control to activate/deactivate the controller if the owner is the Program (OWNER is 0) and the mode is Manual. Otherwise, the current input (RSTART output) is continuously copied to this variable.	
OWNER	BOOL	Read-only access Refer to the PWMCTL_ST.CFGW.OWNER input/output pin, page 227.	
REM	BOOL	Read-only access 1 = Allows the DFB to be configured for a remote set-point -RSP, if the owner is the Program and the mode is Auto. 0 = Allows the DFB to be configured for local set-point -LSP, if the owner is the Program and the mode is Auto.	
ILCKD	BOOL	Read-only access The signal evaluation depending on the ILCK input and the PWMCTL_ST.STW.ILCKBP input/output is shown in the following table:	
	ILCK	ILCKBP	SC.ILCKD is calculated as:
	OFF	-	OFF
	ON	OFF	ON

Name	Type	Description	
	ON	ON	OFF

RATIOCTL - Ratio Controller

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Overview

This chapter describes the `RATIOCTL` DFB.

Description

General

The `RATIOCTL` DFB is used to condition the signals associated to a standard Control library `RATIO` controller. This helps to monitor and control the controller from the monitoring subsystem and to provide the operating modes used in the rest of the General Purpose library process function blocks.

The `RATIO` controller sets a set-point based on a measurement signal and the ratio that needs to be maintained between them (that is, between the measurement signal and the set-point). This DFB is especially used for dosing materials that should have a certain ratio in relation to one another.

Function Description

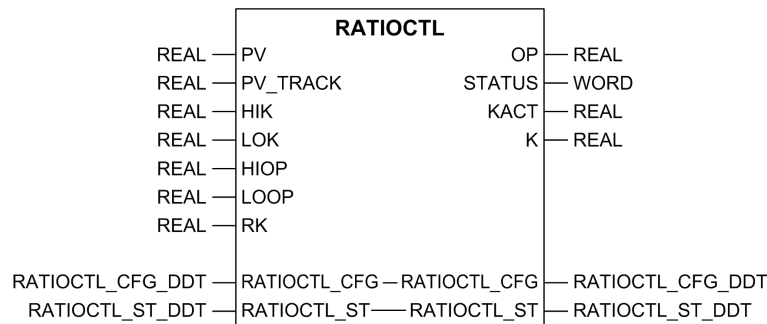
The main functions of the DFB are described in the following table:

Function	Description
Ratio	The DFB includes and incorporates functions provided by the <code>RATIO</code> controller from the standard <code>CONT_CTL</code> Control library.
Owner	The DFB manages the control system level, which is the owner (operator or program). As a result, it is responsible for setting the setpoint for the desired position.
Interlocking	The DFB gives a position command to the device to move to the defined position in case of an active interlock. An interlock bypass function is available.
Set-point	The DFB enables to work under a remote (usually set from the continuous control) or local (set from the program or by the operator depending on the active owner) set-point.

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
PV	REAL	Current value of the variable that is being controlled by the controller.
PV_TRACK	REAL	Current value of the reference variable.
HIK	REAL	Upper value of the ratio that needs to be maintained between PV and PV_TRACK. Used to limit the maximum constant admitted by the controller. This input is internally connected to the <code>PARAM.K_MAX</code> parameter of the RATIO controller.
LOK	REAL	Lower value of the ratio that needs to be maintained between PV and PV_TRACK. Used to limit the minimum constant admitted by the controller. This input is internally connected to the <code>PARAM.K_MIN</code> parameter of the RATIO controller.
HIOP	REAL	Upper range of the output (OP) calculated by the RATIO controller. Used to limit the output calculated by the controller. This input is internally connected to the <code>PARAM.SP_MAX</code> parameter of the RATIO controller.
LOOP	REAL	Lower range of the output (OP) calculated by the RATIO controller. Used to limit the output calculated by the controller. This input is internally connected to the <code>PARAM.SP_MIN</code> parameter of the RATIO controller.
RK	REAL	Remote ratio set-point. Enables to define the desired ratio from the continuous control. Refer to the <code>SC.REM</code> public variable, page 233.

Outputs

Output Parameter Description

Parameter	Type	Description
OP	REAL	Output generated by the RATIO controller based on the measurement and the configured ratio. OP is calculated as: $K \times PV_TRACK + RATIOCTL_CFG.BIAS$.
STATUS	WORD	Statuses output by the RATIO controller on the STATUS output. Refer to the RATIO controller in Control documentation for more details.
KACT	REAL	Actual ratio coefficient generated by the RATIO controller. KACT is calculated as: $(PV - RATIOCTL_CFG.BIAS) / PV_TRACK$.
K	REAL	Ratio coefficient for the ratio between the generated output and the measurement that is being applied on the basis of the operating mode.

The DFB performs the ratio coefficient calculation based on the signal statuses. The ratio coefficient calculation is detailed in the following table:

OWNER	REM	KD is calculated as:
OFF	OFF	SC.LK
OFF	ON	RK
ON	-	RATIOCTL_ST.LK You can modify the ratio coefficient directly from the monitoring subsystem while this mode is active.

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
RATIOCTL_CFG	RATIOCTL_CFG_DDT	Provides the data needed to configure the DFB usually from the monitoring subsystem.
RATIOCTL_ST	RATIOCTL_ST_DDT	Provides the data needed to monitor and/or control the DFB status.

RATIOCTL_CFG_DDT Type

Name	Type	Description
BIAS	REAL	Enables to define the bias parameter for the RATIO controller. Used for calculating the OP output.
KACT	REAL	Read-only access Refer to the KACT output pin, page 231.

RATIOCTL_ST_DDT Type

Name	Type	Description
STW	WORD	Provides the device status usually used from the monitoring subsystem, and allows data to be kept in the memory. Read-only access to the data contained in this word.
CFGW	WORD	Provides the means to control the device from the monitoring subsystem. Read/write access to the data contained in this word.
PV	REAL	Read-only access Refer to the PV input pin, page 231.
PV_TRACK	REAL	Read-only access Refer to the PV_TRACK input pin, page 231.
OP	REAL	Read-only access Refer to the OP output pin, page 231.
LK	REAL	Read/write access Enables to set the ratio when the owner is the Operator (OWNER = 1).

RATIOCTL_ST.STW Word Structure

Bit	Name	Description
0	REM	Refer to the SC.REM public variable, page 233.

RATIOCTL_ST.CFGW Word Structure

Bit	Name	Description
0	OWNER	Read/write access Enables to configure whether the ratio set-point is set by the Program (0) or the Operator (1).

Public Variables

Public Variable Description

Variable	Type	Description
SC	RATIOCTL_SC_DDT	Provides the frequently needed data to monitor and control the controller status from the sequential control.

RATIOCTL_SC_DDT Type

Name	Type	Description
OP	REAL	Read-only access Refer to the OP output pin, page 231.
PV_TRACK	REAL	Read-only access Refer to the PV_TRACK input pin, page 231.
PV	REAL	Read-only access Refer to the PV input pin, page 231.
OWNER	BOOL	Read-only access Refer to the RATIOCTL_ST.CFGW.OWNER input/output pin, page 232.
REM	BOOL	Read-only access 1 = Allows to configure the DFB for a remote set-point -RSP, if the owner is the Program 0 = Allows to configure the DFB for a local set-point -LSP, if the owner is the Program.
LK	REAL	Read/write access Enables the sequential control to assign the local ratio set-point if the owner is the Program (OWNER is 0) and the selected set-point is local (SC.REM is 0). Otherwise, the current set-point (K output) is continuously copied to this variable.

SPLRGCTL - Split Range Controller

What's in This Chapter

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Overview

This chapter describes the `SPLRGCTL` DFB.

Description

General

The `SPLRGCTL` DFB is used to condition the signals associated to the standard Control library `SPLRG` DFB. This helps to monitor and control the controller from the monitoring subsystem and to provide the operating modes used in the rest of the General Purpose library process function blocks.

The standard Control library `SPLRG` DFB is used for split-range controllers (for example, cold/heat) because it enables to generate 2 output signals based on a single signal that could come, for instance, from the output of a PID controller.

You can combine this DFB with the `PIDCTL` and `PIDMUX` DFBs when you want to control a process with 2 control modules (for example, 2 modulating valves) and PID control.

Function Description

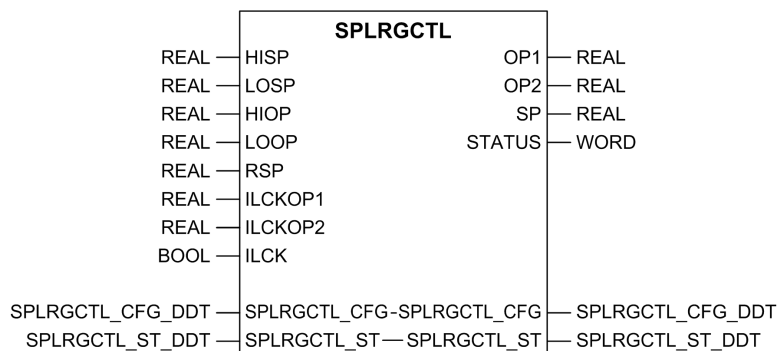
The main functions of the DFB are described in the following table:

Function	Description
SPLRG	The DFB includes and incorporates functions provided by the <code>SPLRG</code> controller from the standard <code>CONT_CTL</code> library.
Owner	The DFB manages the control system level, which is the owner (operator or program). As a result, it is responsible for setting the setpoint for the desired position.
Interlocking	The DFB gives a position command to the device to move to the defined position in case of an active interlock. An interlock bypass function is available.
Set-point	The DFB enables to work under a remote (usually set from the continuous control) or local (set from the program or by the operator depending on the active owner) set-point.

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
HISP	REAL	High range for the set-point (SP) in engineering units. Enables to set set-points to this maximum value in the event that they exceed it.
LOSP	REAL	Low range for the set-point (SP) in engineering units. Enables to set set-points to this minimum value in the event that they fall below it.
HIOP	REAL	High range of the output (OP) in engineering units. Enables to set the output to this maximum value in the event that the output exceeds it.
LOOP	REAL	Low range of the output (OP) in engineering units. Enables to set the output to this minimum value in the event that the output falls below it.
RSP	REAL	Remote set-point is usually set by the continuous control.
ILCKOP1	REAL	Value to which the OP1 output is forced when the DFB is interlocked. Refer to the ILCK input.
ILCKOP2	REAL	Value to which the OP2 output is forced when the DFB is interlocked. Refer to the ILCK input.
ILCK	BOOL	1 = Interlocks the device at the defined position.

Outputs

Output Parameter Description

Parameter	Type	Description
OP1	REAL	Output 1 generated by the SPLRG controller based on the parameters defined in the SPLRGCTL_CFG configuration structure and the set-point range (LOSP...HISP).
OP2	REAL	Output 2 generated by the SPLRG controller based on the parameters defined in the SPLRGCTL_CFG configuration structure and the set-point range (LOSP...HISP).
SP	REAL	Current set-point.

Parameter	Type	Description		
		The DFB performs set-point calculation based on the value of the inputs and of the <code>SPLRGCTL_ST</code> input/output and the set-point calculation is detailed in the following table:		
		OWNER (OFF: Program; ON: Operator)	REM	SP is calculated as:
		OFF	OFF	<code>SC.LSP</code>
		OFF	ON	<code>RSP</code>
		ON	-	<code>SPLRGCTL_CFG.LSP</code>
STATUS	WORD	Statuses output by the SPLRG controller on the <code>STATUS</code> output. Refer to the SPLRG controller in Control for more details.		

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
<code>SPLRGCTL_CFG</code>	<code>SPLRGCTL_CFG_DDT</code>	Provides the data needed to configure the DFB usually from the monitoring subsystem.
<code>SPLRGCTL_ST</code>	<code>SPLRGCTL_ST_DDT</code>	Provides the data needed to monitor and/or control the DFB status.

`SPLRGCTL_CFG_DDT` Type

Name	Type	Description
<code>OUT1_TH1</code>	REAL	Value that the set-point (SP) should have so that the value specified in <code>OUT1_INF</code> is applied on the <code>OP1</code> output.
<code>OUT1_TH2</code>	REAL	Value that the set-point (SP) should have so that the value specified in <code>OUT1_SUP</code> is applied on the <code>OP1</code> output.
<code>OUT1_INF</code>	REAL	Value of the <code>OP1</code> output when the set-point (SP) assumes a value less than or equal to the value specified in <code>OUT1_TH1</code> .
<code>OUT1_SUP</code>	REAL	Value of the <code>OP1</code> output when the set-point (SP) assumes a value greater than or equal to the value specified in <code>OUT1_TH2</code> .
<code>OUT2_TH1</code>	REAL	Value that the set-point (SP) should have so that the value specified in <code>OUT2_INF</code> is applied on the <code>OP2</code> output.
<code>OUT2_TH2</code>	REAL	Value that the set-point (SP) should have so that the value specified in <code>OUT2_SUP</code> is applied on the <code>OP2</code> output.
<code>OUT2_INF</code>	REAL	Value of the <code>OP2</code> output when the set-point (SP) assumes a value less than or equal to the value specified in <code>OUT2_TH1</code> .
<code>OUT2_SUP</code>	REAL	Value of the <code>OP2</code> output when the set-point (SP) assumes a value greater than or equal to the value specified in <code>OUT2_TH2</code> .

SPLRGCTL_ST_DDT Type

Name	Type	Description
STW	WORD	Provides the device status usually used from the monitoring subsystem, and allows data to be kept in the memory. Read-only access to the data contained in this word.
CFGW	WORD	Provides the means to control the device from the monitoring subsystem. Read/write access to the data contained in this word.
SP	REAL	Read/write access Allows to set the local set-point of the Operator (OWNER = 1) from the monitoring subsystem. If the set-point is set by the Program (OWNER = 0), the DFB continuously assigns it the value of the current set-point.
OP1	REAL	Read-only access Refer to the OP1 output pin, page 235.
OP2	REAL	Read-only access Refer to the OP2 output pin, page 235.

SPLRGCTL_ST.STW Word Structure

DFB status word. Read-only access. The following table describes the SPLRGCTL_ST.STW Word structure:

Bit	Name	Description
0	REM	Refer to the SC.REM public variable, page 237.
2	ILCK	Refer to the ILCK input pin, page 235.

SPLRGCTL_ST.CFGW Word Structure

DFB configuration word. Read/write access. The following table describes the SPLRGCTL_ST.CFGW Word structure:

Bit	Name	Description
0	OWNER	Read/write access Enables to configure whether the set-point is set by the Program (0) or by the Operator (1).
1	ILCKBP	Read/write access Allows the interlock to be bypassed (1).

Public Variables

Public Variable Description

Variable	Type	Description
SC	SPLRGCTL_SC_DDT	Provides the frequently needed data to monitor and control the controller status from the sequential control.

SPLRGCTL_SC_DDT Type

Name	Type	Description		
LSP	REAL	Read/write access Enables to assign the local set-point usually for the sequential control if the owner is the Program (OWNER input/output = 0) and the selected set-point is local (SC.REM public variable = 1). In any other case, the DFB automatically assigns it the current value of the resulting set-point (refer to the SP output pin, page 235).		
OWNER	BOOL	Read-only access Refer to the SPLRGCTL_ST.CFGW.OWNER input/output pin, page 236.		
REM	BOOL	Read-only access 1 = Enables to configure the DFB for a remote set-point -RSP while the owner is the Program, 0 = Enables to configure the DFB for a local set-point -LSP while the owner is the Program.		
ILCKD	BOOL	Read-only access The signal evaluation based on the ILCK input and the SPLRGCTL_ST.CFGW.ILCKBP input/output is shown in the following table:		
		ILCK	ILCKBP	SC.ILCKD is calculated as:
		OFF	-	OFF
		ON	OFF	ON
		ON	ON	OFF
OP1	REAL	Read-only access Refer to the OP1 output pin, page 235.		
OP2	REAL	Read-only access Refer to the OP2 output pin, page 235.		

STEP3CTL - 3 Step Controller/Positioner

What's in This Chapter

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Overview

This chapter describes the STEP3CTL DFB.

Description

General

The STEP3CTL DFB is used to condition the signals associated with the control of a STEP3-type controller. This helps to monitor and control the controller from the monitoring subsystem and to provide the operating modes used in the rest of the General Purpose library process function blocks.

The STEP3CTL DFB is designed for controlling process variables through discrete control modules (for example, temperature control through hot liquid/cold liquid on-off valves) or for positioning of analog components with discrete drives (for example, a motorized valve or a gate with position and control feedback through a 2-direction motor). Because of this, combine the STEP3CTL DFB with other library components such as AINPUT, DEVCTL, MOTOR2, DOUTPUT, and so on.

Function Description

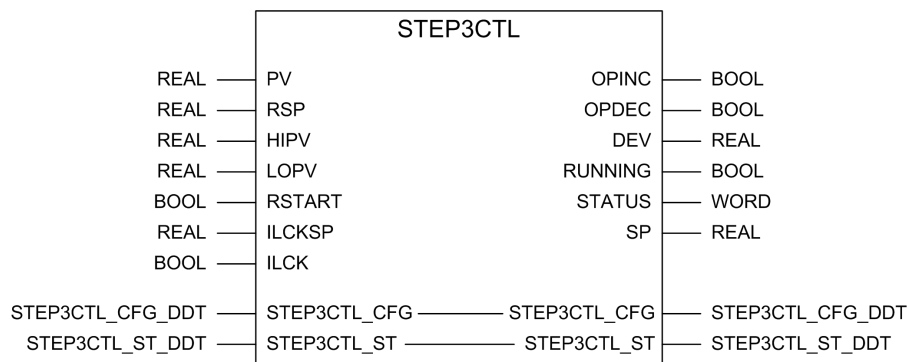
The main functions of the DFB are described in the following table:

Function	Description
STEP3	The DFB includes and incorporates functions provided by the STEP3 controller from the standard CONT_CTL library.
Owner	The DFB manages the control system level, which is the owner (operator or program). As a result, it is responsible for setting the setpoint for the desired position.
Interlocking	The DFB gives a command position to the device to move to the defined position in case of an active interlock. An interlock bypass function is available.
Set-point	The DFB enables to work under a remote (usually set from the continuous control) or local (set from the program or by the operator depending on the active owner) set-point.
Mode	You can enable the STEP3CTL DFB (Start=1) to operate as described in the STEP3 DFB in automatic mode, or disable (Start=0). In this case, the DFB continues calculating but forces the outputs to 0.

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



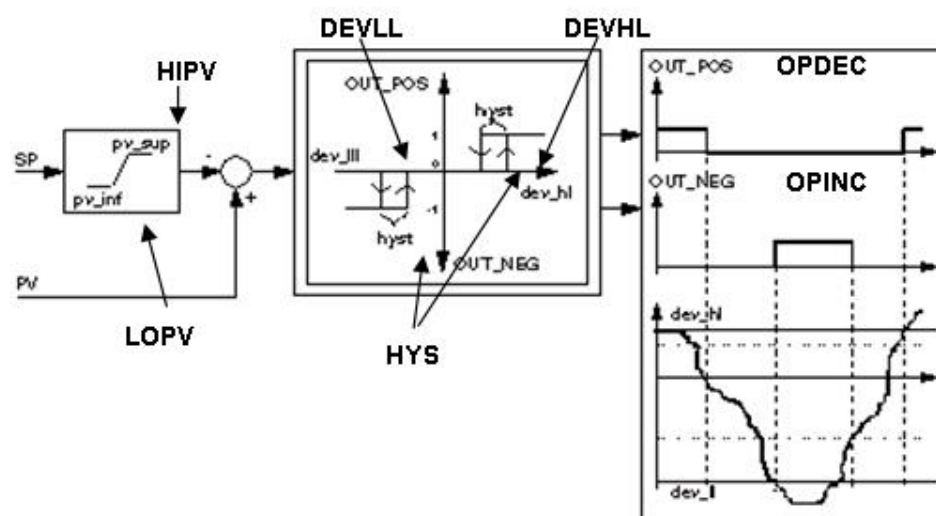
Inputs

Input Parameter Description

Parameter	Type	Description		
PV	REAL	Current value of the measurement in engineering units.		
RSP	REAL	Remote set-point. Is set by the continuous control. Acts in Program/Remote mode. Refer to the <code>SC.REM</code> public variable, page 244.		
HIPV	REAL	Upper value of the measurement range. Used for limiting the maximum set-point admitted by the controller. This input is internally connected to the <code>PARA.PV_SUP</code> parameter of the STEP3 controller.		
LOPV	REAL	Lower value of the measurement range. Used for limiting the minimum set-point admitted by the controller. This input is internally connected to the <code>PARA.PV_INF</code> parameter of the STEP3 controller. Check STEP3 operating graph in the following.		
RSTART	BOOL	1 = Enables the operation of the STEP3 DFB in Automatic mode as described in the Control documentation. With a 0 value, it forces the <code>OPINC</code> and <code>OPDEC</code> outputs to 0, but the STEP3 continues to run internally and calculate the outputs. The valid START command for the calculation is obtained from the following truth table:		
		OWNER	REM	START
		OFF (Program)	OFF	<code>SC.LSTART</code>
		OFF	ON	<code>RSTART</code>
		ON (Operator)	-	<code>STEP3CTL_ST.CFGW.START</code> You can modify the set-point directly from the monitoring subsystem while this mode is active.

Parameter	Type	Description
ILCKSP	REAL	Set-point needs to be considered when the DFB is interlocked. Refer to the ILCK input pin.
ILCK	BOOL	<p>1 = Forces the STEP3 DFB to run with the set-point defined in the ILCKSP input.</p> <p>You can use the ILCKSP and ILCK combination to force the set-point of a motorized valve to a pre-defined position. For example, the value corresponding to 0% aperture. In this case, the STEP3CTL module controls the outputs until 0% aperture is reached. If de-energizing the outputs is desired, acting on the RSTART input (set to 0) is recommended. In any case, if deactivating the control signals is desirable, deactivate the control signals by interlocking the corresponding operations (using DEVCTL, MOTOR2, DOUTPUT, and so on).</p>

STEP3 operating graph:



Outputs

Output Parameter Description

Parameter	Type	Description	
OPINC	BOOL	1 = Enabled in case of negative deviations. This output corresponds to the operation that increases PV.	
		It is calculated according to the following table:	
		START	OPINC
		0	0
1	Refer to the STEP3 operation graph, page 240		
OPDEC	BOOL	1 = Enabled in case of positive deviations. This output corresponds to the operation that decreases PV.	
		It is calculated according to the following table:	
		START	OPDEC
		0	0
1	Refer to the STEP3 operation graph, page 240		
RUNNING	BOOL	1 = Indicates the controller is running. Read-only access.	
DEV	REAL	Deviation (PV-SP) directly extracted from the STEP3 controller.	

Parameter	Type	Description		
STATUS	WORD	Statuses output by the STEP3 controller on the STATUS output.		
SP	REAL	Current set-point that is being considered by the STEP3 algorithm.		
		The set-point calculation that the DFB performs based on the signal status is detailed in the following table:		
		OWNER	REM	SP
		OFF	OFF	SC.LSP
		OFF	ON	RSP
		ON	-	STEP3CTL_ST.SP
		You can modify the set-point directly from the monitoring subsystem while this mode is active.		

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
STEP3CTL_CFG	STEP3CTL_CFG_DDT	Provides the data necessary to configure the DFB usually from the monitoring subsystem or the sequential control.
STEP3CTL_ST	STEP3CTL_ST_DDT	Provides the data necessary to monitor and/or control the DFB status.

STEP3CTL_CFG_DDT Type

Name	Type	Description
DEVLL	REAL	Enables to define the lower deviation threshold for the detected error (PV-SP). This value needs to be less than or equal to 0. Otherwise, the DFB considers it as 0. Refer to the operating graph in LOPV, page 240 and FB STEP3.
DEVHL	REAL	Enables to define the higher deviation threshold for the detected error (PV-SP). This value needs to be greater than or equal to 0. Otherwise, the DFB will consider it as 0. Refer to the operating graph in LOPV, page 240 and FB STEP3.
HYS	REAL	<p>Enables to define the hysteresis value to be taken into account for calculating the OPINC and OPDEC outputs by the STEP3 algorithm. This value needs to be between 0 and the minimum between DEVHL and DEVLL without taking the sign into account.</p> <p>The DFB shields erroneous hysteresis inputs with the following rules:</p> <ul style="list-style-type: none"> If CFG_HYS is < 0, it is considered as 0. If CFG_HYS is > DEVHL, it is considered as DEVHL. <p>If CFG_HYS is > DEVLL (unsigned), it is considered as DEVLL (unsigned).</p>
TARGETSP	REAL	<p>Read access</p> <p>This variable indicates what the current set-point is before interlocking.</p>

Highlight particular operation of the controller and the configuration of the three parameters above; going through the operation graph is recommended.

For example, in case of temperature regulation with a cold liquid valve and a hot liquid valve (the cold liquid valve is connected to OPDEC and the hot liquid valve to OPINC), the following assumption is made:

- the set-point is 21° (SP).
- a maximum detected error of 1° above and below with a hysteresis of 0.5% is being considered ($DEVHL=1$, $DEVLL=1$, $HYS=0.5$).

In this initial case, $PV-SP = -11$ ($<DEVLL$), and, as a result, $OPINC=1$ (output that corresponds to increasing PV).

As PV increases, the detected error decreases in absolute value until the detected error is less than -0.5, that is, $DEVLL+HYS=-1+0.5=-0.5$, when $OPINC$ becomes 0. Verify that the output stops at the $DEVLL+HYS$ threshold and not at $DEVLL$.

Hysteresis will be achieved if the detected error drops below the $DEVLL$ value, at which point the $OPINC$ will return to the value of 1.

On the positive side of the detected error, you can consider the event in which the temperature is 30° with the same $DEVHL$, $DEVLL$, and HYS values.

In this initial case $PV-SP = 9$ ($>DEVHL$), and, as a result, $OPDEC=1$ (output that corresponds to decreasing PV).

As PV drops, the detected error decreases in absolute value, until the detected error is less than 0.5, that is $DEVHL-HYS=1-0.5=0.5$, at which point $OPDEC$ becomes 0. Verify that the output stops at the $DEVLL+HYS$ threshold and not at $DEVLL$.

Hysteresis will be achieved if the detected error rises above the $DEVLL$ value, at which time the $OPINC$ will return to a value of 1.

STEP3CTL_ST_DDT Type

Name	Type	Description
PV	REAL	Read access Refer to the PV input pin, page 240. This variable indicates what the current measurement is.
SP	REAL	Read/write access Refer to the SP output pin, page 241. This variable indicates which is the current set-point and is calculated internally in the DFB as long as the owner is not the Operator. In which case, you can modify it from the monitoring subsystem.
STW	WORD	Provides the device status usually used from the monitoring subsystem, and allows data to be kept in the memory. Read-only access to the data contained in this word.
CFGW	WORD	Provides the means to control the device from the monitoring subsystem. Read/write access to the data contained in this word.

STEP3CTL_ST.STW Word

Bit	Name	Description
0	REM	Refer to the SC.REM public variable, page 244.
2	ILCK	Refer to the ILCK input pin, page 240.
3	OPINC	Refer to the OPINC output pin, page 241.
4	OPDEC	Refer to the OPDEC output pin, page 241.

STEP3CTL_ST.CFGW Word

Bit	Name	Description
0	OWNER	Read/write access Enables configuration whether the set-point is set by the Program (0) or by the Operator (1).
1	ILCKBP	Read/write access Enables the interlock to be bypassed (1).
2	START	Read/write access START command while the owner is the Operator; otherwise, the valid START is copied to ST.CFGW.START. Refer to the RSTART input pin, page 240.

Public Variables

Public Variable Description

Variable	Type	Description
SC	STEP3CTL_SC_DDT	Provides the frequently needed data to monitor and control the regulator status from the sequential control.

STEP3CTL_SC_DDT Type

The following table describes the STEP3CTL_SC_DDT type:

Name	Type	Description		
LSP	REAL	Read/write access Enables to assign the local set-point for the sequential control if the owner is the Program (OWNER is 0), the selected mode is Auto, and the selected set-point is Local (SC.REM is 0). Otherwise, the current set-point (SP output) is continuously copied to this variable.		
TARGETSP	REAL	Read access This variable indicates what the current set-point is before interlocking.		
PV	REAL	Read-only access Refer to the PV input pin, page 240.		
LSTART	BOOL	Read/write access Refer to the RSTART input pin, page 240. START command while the owner is the Program and Local; otherwise, the valid START is copied to SC.LSTART.		
OWNER	BOOL	Read-only access Refer to the STEP3CTL_ST.CFGW.OWNER input/output pin, page 242.		
ILCKD	BOOL	Read-only access The signal evaluation depending on the ILCK input and the STEP3CTLST.STW.ILCKBP input/output is shown in the following table:		
		ILCK	ILCKB-P	SC.ILCKD
		OFF	-	OFF
		ON	OFF	ON

Name	Type	Description		
		ON	ON	OFF
REM	BOOL	<p>Read/write access</p> <p>1 = Allows the DFB to be configured to remote set-point <small>RSP</small>, if the owner is the Program and the mode is Auto.</p> <p>0 = Allows the DFB to be configured to local set-point <small>LSP</small>, if the owner is the Program and the mode is Auto.</p>		

Sequential Control


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Overview

This part provides a detailed description of the functions, pins, pin layout, and variables of the function blocks of the sequential control family.

These function blocks do not reflect any specific installation.

 **WARNING**

LOSS OF CONTROL

- Perform a Failure Mode and Effects Analysis (FMEA), or equivalent risk analysis, of your application, and apply preventive and detective controls before implementation.
- Provide a fallback state for undesired control events or sequences.
- Provide separate or redundant control paths wherever required.
- Supply appropriate parameters, particularly for limits.
- Review the implications of transmission delays and take actions to mitigate them.
- Review the implications of communication link interruptions and take actions to mitigate them.
- Provide independent paths for control functions (for example, emergency stop, over-limit conditions, and error conditions) according to your risk assessment, and applicable codes and regulations.
- Apply local accident prevention and safety regulations and guidelines.¹
- Test each implementation of a system for proper operation before placing it into service.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

¹ For additional information, refer to NEMA ICS 1.1 (latest edition), *Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control* and to NEMA ICS 7.1 (latest edition), *Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems* or their equivalent governing your particular location.

Sequential Control

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Overview

This chapter describes the sequential control management.

Description of Sequential Control

Overview

The operation of the function block that is available for sequence control is described in this chapter.

The `SEQCTL1` DFB belongs to the General Purpose library and is used to monitor and manage control sequences. The module is based on the ISA-S88 Standard, Part 1 (S88.01) and implements the status controller defined in this standard for controlling procedure model components (phases, operations, and so on).

Function Description

You can use this DFB to change states in the process. In compliance with ISA-S88.01I, you can use this DFB in continuous processes to initiate start, stop or emergency sequences. In batch processes, this DFB can be used to set up phases and operations.

The DFB implements sequence state management and processes the commands received from:

- The Supervision system (when sequences are manually controlled by the operator)
- The batch control subsystem (in which case the subsystem sends the commands and checks the status of the sequence to determine what action to take)
- Other control sequences

For example, sequences that implement operations defined in the ISA-S88 standard can control the phases and can also be implemented through sequences managed from the component.

The table compares the functions that are available in the DFB:

Function	SEQCTL1
Management of state machine and commands according to ISA-S88	x
Management of messages for the operator integrated with the sequence	—
Management of operating modes according to ISA-S88: Manual (enables to change from one sequence step to any other sequence step), Semi (step advance with confirmation from the operator), and Auto	x
Owner Management: Operator/Program	x
Step time automatically calculated by the control block	x

Function	SEQCTL1
Automatic management of transitions through the SEQTRANS function block	x
Automatic management of sequence detected error through the SEQFAILED function block	x
Automatic management of sequence steady-step marking through the SEQSTABLESTEP function block	x
Possibility of displaying the sequence graphically (active step and next level of transitions and steps) from the monitoring subsystem	x
NOTE: 'x' indicates that the functions are available in the DFB.	

Program the steps and transitions that the sequences implement (through ST or SFC language) while the component (SEQCTL or SEQCTL1) allows the programmer to:

- manage the statuses of the sequence and
- process the commands received from other levels as described above.

As a minimum, implement the subsequence that implements normal operation (RUNNING, page 271).

Other you can implement subsequences that attend to commands received from other levels of the control system or that react to detected error in the process (HOLDING, RESTARTING, STOPPING, and ABORTING) detected by the sequence itself.

The table describes the main functions of the DFB:

Function	Description
Processing States and Commands	The DFB processes the commands received and determines the status of the control sequence with the objective of determining the subsequences (normal, hold, continue, abort, so on.) and which step needs to run in each cycle of the program.
Managing Entry Points in the Sequence	The DFB enables to retain the step number with which the execution of the normal sequence (Running) needs to be restarted (Restart) after being restarted from held status (Held).
Handling of Detected error	The component manages controller detected error (without user intervention from the Supervision system). The component manages this detected error and triggers the execution of the detected error handling subsequence.

Definition of Status and Commands

Statuses

The table describes the possible sequence statuses along with the code that identifies each status:

Status	Code	Description
Idle	303	Inactive operation. Waiting for command to start (Start) running.
Running	302	Normal operation.
Complete	301	Normal operation has finished. Requires an initialization order (Reset) to return to the Idle status.
Pausing	314	A pause (Pause) command is received for a short period while the normal operation was being executed (Running). The normal sequence runs until it automatically goes to paused (Paused) status.
Paused	315	Status reached after the pause sequence is completed and the next steady status is reached. Upon receiving the command to continue (Resume), the sequence continues with the next step of the normal operation sequence (Running).

Status	Code	Description
Holding	316/ 326	A hold (Hold) command is received or a detected error is automatically detected in the process (for example, a detected error in a control module), and the sequence that allows the process to be changed to a known status is executed. After this sequence is finished, it automatically goes to the held (Held) status. Code 316 corresponds to having received a Hold and 326 to a detected error.
Held	317/ 327	Status reached after the pause sequence is completed and the next steady status is reached. Code 317 corresponds to having received a Hold command and 327 to a detected error.
Restarting	318	A restart command (Restart) is received while the sequence is being held (Held). The sequence runs to return to the normal operation sequence (Running). The normal operation status (Running) is set automatically after the sequence is complete.
Stopping	312	An order to stop (Stop) has been received. The sequence to finish the sequence in a controlled way is executed (it is not possible to continue with it). The stopped operation status (Stopped) is automatically activated after the sequence is complete.
Stopped	313	The stop sequence (Stopping) is completed. Requires an initialization command (Reset) to go to inactive (Idle) status.
Aborting	310	An order to end (Abort) has been received. A fast stop, which is not necessarily controlled is executed. The aborted operation status (Aborted) is automatically activated after the sequence is completed.
Aborted	311	An aborting sequence (Aborting) has been completed. Requires an initialization command (Reset) to go to inactive (Idle) status.

The (Held) status can also be reached (without receiving a command) if the control sequence itself detects a problem situation. The DFB has a signal that allows this situation to be communicated.

The DFB has the necessary means to be able to restart the Running sequence from the last steady step in which the initial run was held by a **Hold** command.

Commands

The table describes the commands that can be sent to the sequence along with the code and description of each command:

Status	Code	Description
Start	1	Allows the normal operation of the sequence (Running) to be started. It is only valid if the status is inactive (Idle).
Stop	2	Allows the sequence execution to be stopped (Running, Pausing, Paused, Holding, Held, or Restarting) and the stopping sequence to be run (Stopping).
Hold	3	Allows the sequence to be stopped (Running, Pausing, Paused, Holding, Held, or Restarting) and the stopping sequence to be run (Stopping).
Restart	5	Allows the sequence for continuing the operation (Restarting) and resume normal operation (Running).
Abort	4	Allows the sequence to be aborted (in any status except Idle, Complete, Aborting, and Aborted) and the aborting sequence to be run (Aborting).
Reset	8	Triggers the transition to idle status (in Complete, Aborted, or Stopped status).
Pause	6	Allows normal execution (Running) to be paused in the next steady Sequence status.
Resume	7	Allows normal operation of the sequence (Running) to be resumed from the paused (Paused) status.

Status Matrix

Description

The following table describes the finite status controller that the DFB implements:

Initial State	Command	Activity	Final State (without command)
Idle	Start	Running	–
Running	Stop	Stopping	Stopped
	Hold	Holding	Held
	Pause	Pausing	Paused
	Abort	Aborting	Aborted
Complete	Reset	Idle	–
Pausing	Stop	Stopping	Stopped
	Hold	Holding	Held
	Abort	Aborting	Aborted
Paused	Stop	Stopping	Stopped
	Resume		Running
	Abort	Aborting	Aborted
Holding	Stop	Stopping	Stopped
	Abort	Aborting	Aborted
Held	Stop	Stopping	Stopped
	Restart	Restarting	Running
	Abort	Aborting	Aborted
Restarting	Stop	Stopping	Stopped
	Hold	Holding	Held
	Abort	Aborting	Aborted
Stopping	Abort	Aborting	Aborted
Stopped	Reset	Idle	–
	Abort	Aborting	Aborted
Aborting	No action possible		
Aborted	Reset	Idle	–

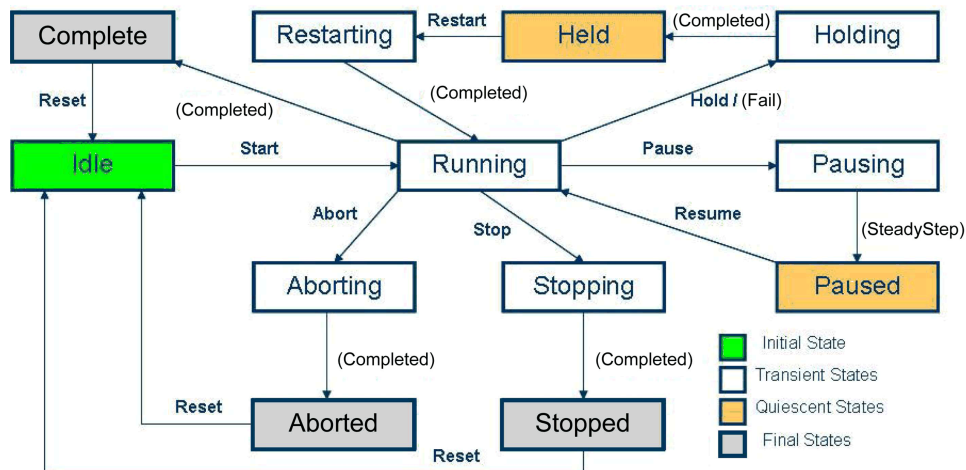
The Held status can also be reached (without receiving a command) if the control sequence itself encounters a detected error. The block has a signal that allows this situation to be communicated.

The block has the necessary means to be able to restart the Running sequence from the last steady step in which the initial run was held by a **Hold** command.

Status Controller

Description

The following diagram describes the possible statuses and commands that the Control Expert component manages according to the ISA-S88 standard:



Next to the transition arrows, the commands that the component receives (from the Supervision system or another higher level sequence) are shown in black, and the flags that the sequence itself generates are shown in red in parentheses.

Operating Modes

Mode Table

The following table provides the description of the sequence operating modes of SEQCTL1 DFB:

Software	Implemented as:
Automatic	It is the normal running mode. The sequence runs automatically based on the transitions defined in the controller.
Semiautomatic	In this operating mode, after the conditions defined in the transitions are met, you need to confirm the move to the next step.
Manual	The sequence does not automatically advance to a step; user can manually change from one sequence step to another. Once the sequence step is selected, operating mode will change to semi-automatic and starts the sequence step selected in manual mode.

SEQCTL1 - Advanced Sequential Control

What's in This Chapter

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DFB Representation	252
Inputs/Outputs	252
Public Variables	254

Overview

This chapter provides a detailed description of the functions, pins, pin layout, and variables of the SEQCTL1 DFB.

Description

Initialization

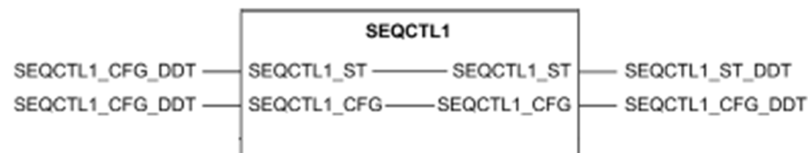
If the sequence status is unknown, it is initialized as Idle regardless of whether a controller has restarted or not. This initialization is done automatically.

DFB Representation

Representation

The DFB that is used in the program has the following aspect at the section level when imported. You can use it in any of the programming languages, although it is designed for use with the FBD language.

The figure shows an example of the SEQCTL1 DFB instance:



Implement the sequence logic that controls the component in ST language to take advantage of the sequence control potentials making the sequence reusable. That is, you can run simultaneously several instances of the sequence that you have implemented. This reduces engineering and maintenance efforts when it is necessary to set up the same control sequences in several process units.

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
SEQCTL1_ST	SEQCTL1_ST_DDT	Provides the necessary data for monitoring and controlling sequence execution.
SEQCTL1_CFG	SEQCTL1_CFG_DDT	Provides the necessary data for background monitoring.

SEQCTL1_ST_DDT Type

Name	Type	Description
STATE	UINT	Provides the status of the sequence. Read-only access to the data is contained in this bits word. Refer to the Definition of States and Commands section, page 248.
COMMAND	UINT	Enables commands to be sent to the sequence usually from the Supervision system. Write access to the data is contained in this bits word. The DFB sets the command to 0 after processed (successfully or not). Refer to the Definition of States and Commands section, page 248.
STW	WORD	Sequence status word. In this word, the SEQTRANS auxiliary DFB is used to load the status of the transitions (maximum of 6) from the current step of the sequence to the steps in the next level of the sequence, where 0 means that the conditions in the transition are not fulfilled and 1 means they are fulfilled.
CFGW	WORD	Provides the means to control the device from the monitoring subsystem. Read/write access to the data contained in this word.
ETIME	UDINT	The DFB calculates the execution time elapsed in tenths of a second for the current step of the control sequence. If execution of the program is stopped and resumed, the accumulated execution time is considered but not the time that the program was stopped.
CSTEPD	String [22]	Current step description (three characters for step number concatenated with seventeen characters for description).

SEQCTL1_ST.STW Word

In this word, the SEQTRANS auxiliary DFB is used to load the status of the transitions (maximum of 6) from the current step of the sequence to the steps in the next level of the sequence where 0 means that the conditions in the transition are not fulfilled and 1 means that they are fulfilled.

Bit	Description
0	Status of the first transition
1	Status of the second transition
...	...
5	Status of the sixth transition

SEQCTL1_ST.CFGW Word

The following table describes the SEQCTL1_ST.CFGW word:

Bit	Name	Description
0	OWNER	Read/write access Enables to configure whether the sequence commands will come from the program (0) or the operator (1).
1	SEMI	Read/write access Enables to configure the sequence in automatic (0) or semi-automatic (1) mode.
2	MANUAL	Read/write access Enables to configure the sequence in automatic/semi-automatic (0) or manual (1) mode.

Bit	Name	Description		
		The meaning of the 1 and 2 bits combined is shown in the following table:		
		Bit 2	Bit 1	Mode
		OFF	OFF	auto
		OFF	ON	semi-automatic
		ON	—	manual
3	NEXTSTEP	Read/write access Enables to confirm the change of steps to the next sequence step in Semi mode. The DFB sets the signal to 0 after it is processed.		
5	SCROLL_UP	Read/write access Enables to show the steps previous to the one being shown on the current window in manual mode. The DFB sets the signal to 0 after it is processed.		
6	SCROLL_DOWN	Read/write access Enables to show the steps following the one being shown on the current window in manual mode. The DFB sets the signal to 0 after it is processed.		

SEQCTL1_CFG_DDT Type

Name	Type	Description
NSTEP	INT	Number of the new step at which the subsequence needs to be positioned in manual mode. The DFB sets this variable to 0 after it is processed.
STEPD	STRING[122]	Description of steps. Limited to 6 steps. In automatic and semi-automatic mode, it shows the destination steps specified in the current step transitions. In manual mode, it shows the list of the steps defined in the sequence. This variable format is: 6 steps, 20 characters each. Of the 20 characters of each step, the first 3 are for the step number and the next 17 are for its description. The value of this variable is assigned for the auxiliary functions.
TRANSD	STRING[122]	Description of transitions. Limited to 6 transitions. This variable format is 6 transitions, 20 characters each. The 20 characters are for its description. The value of this variable is assigned for the auxiliary functions.

Public Variables

Public Variable Description

Variable	Type	Description
SC	SEQCTL1_SC_DDT	Provides the frequently needed data to monitor the sequence status and control it from the sequential control.

SEQCTL1_SC_DDT Type

Name	Type	Description
STATE	UNIT	Read-only access Refer to the SEQCTL1_ST.STATE input/output pin, page 252.
CSTEP	INT	Read-only access Number of the active sequence current step (Running, Pausing, Holding, Restarting, Stopping, or Aborting). The value 0 corresponds to the initial step of each subsequence.
OWNER	BOOL	Read-only access, page 252.
START	BOOL	Write access 1 = Sends a start sequence (Start) command if the owner is the program (SC.OWNER is 0). 0 = The signal is automatically set to 0 by the DFB after the signal is processed.
STOP	BOOL	Write access 1 = Sends a stop sequence (Stop) command if the owner is the program (SC.OWNER is 0). 0 = The signal is automatically set to 0 by the DFB after the signal is processed.
HOLD	BOOL	Write access 1 = Sends a hold sequence (Hold) command if the owner is the program (SC.OWNER is 0). 0 = The signal is automatically set to 0 by the DFB after the signal is processed.
PAUSE	BOOL	Write access 1 = Sends a pause sequence (Pause) command if the owner is the program (SC.OWNER is 0). 0 = The signal is automatically set to 0 by the DFB after the signal is processed.
RESTART	BOOL	Write access 1 = Sends a command to continue the sequence (Hold) if the owner is the program (SC.OWNER is 0). 0 = The signal is automatically set to 0 by the DFB after the signal is processed.
ABORT	BOOL	Write access 1 = Sends a command to abort the sequence (Abort) if the owner is the program (SC.OWNER is 0). 0 = The signal is automatically set to 0 by the DFB after the signal is processed.
RESET	BOOL	Write access 1 = Sends a command to reset the sequence to be able to start it (Reset) if the owner is the program (SC.OWNER is 0). 0 = The signal is automatically set to 0 by the DFB after the signal is processed.
RESUME	BOOL	Write access 1 = Sends a command to resume the sequence execution (Resume) if the owner is the program (SC.OWNER is 0). 0 = The signal is automatically set to 0 by the DFB after the signal is processed.

Name	Type	Description
ONENTRY	BOOL	<p>Read-only access</p> <p>1 = Reports that a new sequence step has just been started.</p> <p>You can use this event in the logic of the sequence step actions to run any actions. The actions run only when the step starts.</p>
ONEXIT	BOOL	<p>Read-only access</p> <p>1 = Reports that the execution of the sequence current step is about to finish.</p> <p>You can use this event in the logic of the sequence step actions to run any actions. The actions run only when the step ends.</p>
STABLESTEP	BOOL	<p>Write access</p> <p>1 = Sends a command to mark the current step as a steady step, that is:</p> <ul style="list-style-type: none"> the step with which the sequence will resume after its is held or the step on which the sequence will be held after the sequence is paused. <p>0 = The signal is automatically set to 0 by the DFB after the signal is processed.</p> <p>As an alternative, forcing the value of this variable to 1 by using the SEQSTABLESTEP auxiliary DFB is recommended.</p>
COMPLETED	BOOL	<p>Write access</p> <p>1 = Sends a command to finish the current subsequence (Running, Holding, Restarting, Stopping, and so on).</p> <p>0 = The signal is automatically set to 0 by the DFB after the signal is processed.</p> <p>As an alternative, forcing the value of this variable to 1 by using the SEQTRANS auxiliary DFB is recommended.</p>
FAIL	BOOL	<p>Write access</p> <p>1 = Sends a command to stop the sequence normal execution.</p> <p>0 = The signal is automatically set to 0 by the DFB after the signal is processed.</p> <p>With the activation of this signal, the <i>Holding For Detected Error</i> subsequence is run next if the <i>Running</i>, <i>Pausing</i>, <i>Restarting</i>, or <i>Paused</i> subsequence was running previously.</p>
NEXTSTEP	INT	<p>Write access</p> <p>Enables the number of the next step to be run in the sequence to be set.</p> <p>The signal is automatically set to 0 by the DFB after the signal is processed. As an alternative, forcing the value of this variable to 1 by using the SEQTRANS auxiliary DFB is recommended.</p>
MODE	INT	<p>Read-only access, page 252 (bits 1 and 2).</p> <p>Mode is encoded as:</p>
	VALUE	MODE
	0	Automatic
	1	Semi-automatic
	2	Manual
DEST	ARRAY[1..6] of INT	<p>Write access</p> <p>Defines the possible destination steps for the current step; it is limited to 6 transitions. As an alternative, forcing the value of this variable by using the SEQTRANS auxiliary DFB is recommended.</p>

Name	Type	Description
		The signals are automatically set to 0 by the DFB after the signal is processed.
DESTW	WORD	Write access Allows the definition of the state of up to 6 transitions (bits 0 to 5) that originate with the current step. As an alternative, forcing the value of this variable by using the SEQTRANS auxiliary DFB is recommended. The signals are automatically set to 0 by the DFB after the signal is processed.
ETIME	BOOL	Read-only access, page 252
RUNNINGX	BOOL	Read-only access 1 = Indicates that the current state of the sequence is Holding or Holding for Detected Error.
HOLDINGX	BOOL	Read-only access 1 = Indicates that the current state of the sequence is Holding or Holding for Detected Error.
CURRENTITEM	BOOL	Read-only access 1 = Indicates the current position of the list of steps in Manual mode. The value -1 indicates that there has been a mode change and -2 indicates that the mode change has been identified.
NEWCYCLE	BOOL	Read-only access 1 = Indicates that a new sequence state machine execution cycle has started.
UPDATES-TEPD	BOOL	Read-only access 1 = Internal mark indicates the need for updating the steps descriptions.

The following elements (status) are described in the Status Controller section, page 251. The Definition of Statuses and Commands, page 248 shows the sequence finite state controller.

Status	Type	Description
Idle	BOOL	Read-only access 1 = Indicates that the current state of the sequence is Idle.
Running	BOOL	Read-only access 1 = Indicates that the current state of the sequence is Running.
Complete	BOOL	Read-only access 1 = Indicates that the current state of the sequence is Complete.
Pausing	BOOL	Read-only access 1 = Indicates that the current state of the sequence is Pausing.
Paused	BOOL	Read-only access 1 = Indicates that the current state of the sequence is Paused.
Holding	BOOL	Read-only access 1 = Indicates that the current state of the sequence is Holding.
HoldingFE	BOOL	Read-only access 1 = Indicates that the current state of the sequence is Holding or Holding for Detected Error.

Status	Type	Description
Held	BOOL	Read-only access 1 = Indicates that the current state of the sequence is Held.
HeldFE	BOOL	Read-only access 1 = Indicates that the current state of the sequence is Held for detected error.
Restarting	BOOL	Read-only access 1 = Indicates that the current state of the sequence is Restarting.
Stopping	BOOL	Read-only access 1 = Indicates that the current state of the sequence is Stopping.
Stopped	BOOL	Read-only access 1 = Indicates that the current state of the sequence is Stopped.
Aborting	BOOL	Read-only access 1 = Indicates that the current state of the sequence is Aborting.
Aborted	BOOL	Read-only access 1 = Indicates that the current state of the sequence is Aborted.

Auxiliary Functions of Sequential Control

What's in This Chapter

SEQTRANS	259
SEQFAILED	261
SEQSTABLESTEP	262
SEQSTEPDESC	263

Overview

This section describes the function blocks that supplement the `SEQCTL1` DFB and that have the objective of facilitating the programming of the control sequence.

SEQTRANS

Overview

This section describes the `SEQTRANS` DFB.

Description

General

The main objective of `SEQTRANS` DFB is to set up the control sequence transitions based on the condition to be evaluated and the next step to be executed when this expression is fulfilled.

Additionally, the DFB manages the information necessary to graphically represent the state of the transitions and steps following the current step (`DEST` and `DESTW` fields of the `SEQCTL1_ST_DDT` sequence state structure).

Include call to this function in the logic of the steps (usually in ST language) to program the transitions between the sequence steps.

Function Call

The function call is carried out from the steps of the control subsequences (Running, Restarting, Holding, and so on) usually in ST language to program the transitions between these steps.

If several `SEQTRANS` calls are included in the same step and if more than one of them is fulfilled in the same step execution cycle, the step corresponding to the transition that is fulfilled and was programmed first will run. The number of `SEQTRANS` calls from one single step is limited to 6.

```
TRANS (CONDITION := (*BOOL*),
DESC := (*string[22]*),
NEXTSTEP := (*INT*),
SEQCTL1_SC := (*SEQCTL1_SC_DDT*),
SEQCTL1_ST := (*SEQCTL1_ST_DDT*),
SEQCTL1_CFG := (*SEQCTL1_CFG_DDT*))
```

A function call example is included below:

4: (Wait for end of reactive dosing)

```

if SSC.ONENTRY then

BISEN2_REACT.REM:=false;

BISEN2_REACT.LSP:=true;

end_if;

BISEN2_REACT.LSPSEL:=(OP01 < (IP01 - 10.0)); (Speed 1 or 2)

TRANS ((IP01 - COLA_REACT) <= OP01, 'Dosing finished?', SSC.
CSTEP+1, SSC, SST, SCFG);

```

In the previous example, the TRANS call included in step 4 of the sequence corresponds to a SEQTRANS block instance to which the following parameters are passed:

- `(IP01 - COLA_REACT) <= OP01`: Corresponds to the expression of the condition that needs to be fulfilled for the transition to be executed. You can include complex expressions that result in a Boolean value (true or false).
- `Dosing finished?`: Corresponds to the description of the transition.
- `SSC.CSTEP+1`: Corresponds to the next step that needs to be executed when the transition is fulfilled. In this case, the next step (step 5) is executed after the current step (step 4). You can include any expression jumping to an existing step in the sequence.
- `SSC`: Corresponds to the SC public variable of the SEQCTL1 block instance that is controlling the sequence execution.
- `SST`: Corresponds to the DDT_ST variable of the SEQCTL1 block instance that is controlling the sequence execution.
- `SCFG`: Corresponds to the DDT_CFG variable of the SEQCTL1 block instance that is controlling the sequence execution.

Inputs

Input Parameter Description

Parameter	Type	Description
CONDITION	BOOL	1 = Indicates that the condition for executing the transition is fulfilled.
DESC	STRING[22]	Provides the description of the transition to be represented in the monitoring program. The character string is limited to 20 characters.
NEXTSTEP	INT	Subsequence step number to which a jump needs to be made when the transition is fulfilled. Refer to the CONDITION input. The permissible values for the steps go from 1 to 999 with the exception of NEXTSTEP to -1. This indicates that when the transition is fulfilled, the corresponding subsequence (to go, for example, from Running to Complete, from Holding to Held, and so on) will be completed.

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
SEQCTL1_SC	SEQCTL1_SC_DDT	Corresponds to the SC public variable of the SEQCTL1 block instance that is controlling the sequence execution.
SEQCTL1_ST	SEQCTL1_ST_DDT	Provides the data necessary to communicate with the SEQCTL1 block that is controlling the sequence. Refer to the SEQCTL1 block, page 252 for more details.
SEQCTL1_CFG	SEQCTL1_CFG_DDT	Provides the data necessary to communicate with the SEQCTL1 block that is controlling the sequence. Refer to the SEQCTL1 block, page 252 for more details.

SEQFAILED

Overview

This section describes the SEQFAILED DFB.

Description

General

The main objective of the SEQFAILED DFB is to report detected errors to the sequence management block (SEQCTL1) during sequence execution so that the *HoldingFE* subsequence is triggered.

Function Call

The function call is made from the Running, Restarting, Pausing, or Paused control subsequence steps usually in ST language with the purpose of reporting detected errors in the process that is being controlled. The detected error requires the hold sequence to be executed (*HoldingFE*).

A function call example is included below:

(Detected error condition monitoring after initializations)

```
if SEQCTL1.CSTEP > 0 and CONDFALLO then
  FAILED (SeqCtl1) ; (Trigger execution of the Hold sequence)
end_if;
```

In the previous example, the *FAILED* call that is included in the logic monitors the detected error conditions in each execution cycle (in this particular case, but could be associated with a specific step) corresponds to a SEQFAILED DFB block instance to which the following parameters are passed:

- Seqctl1: Corresponds to the name of the SC public variable of the SEQCTL1 block instance that is controlling the execution of the sequence.

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
SEQCTL1_SC	SEQCTL1_SC_DDT	Provides the data necessary to communicate with the SEQCTL1 block that is controlling the sequence. Refer to the SEQCTL1 block, page 252 for more details.

SEQSTABLESTEP

Overview

The section describes the SEQSTABLESTEP DFB.

Description

General

The main objective of the SEQSTABLESTEP DFB is to report to the sequence management block (SEQCTL1) that the current running sequence step corresponds to a step, that is, the re-entry point in the normal execution (Running) sequence executes after restarting execution (Restarting).

Function Call

The function call is performed from the Running control subsequence steps usually in ST language for the purpose of reporting. The current step is the entry point to which the program should return when the Running subsequence is resumed after finishing the Restarting subsequence. Basically, it enables to resume the sequence execution that verifies the appropriate actions are performed or not.

For example, suppose a valve has to be opened. After the valve is opened, the next step involves turning on a pump. While waiting for the valve to open, a detected error that makes the sequence stop occurs (Holding subsequence execution). You can resume execution by running the restart (Restarting) subsequence. After this, the program returns to the normal running subsequence (Running). After the program goes back to this Running subsequence, the intention is to make another attempt at opening the valve (because most likely, it has been closed during the Holding subsequence) not to start the pump in proceeding directly. Therefore, in the valve opening step, the step is marked and does not call the function SEQSTABLESTEP in the pump starting step.

The following is an example of a function call:

0: (End Water dosing)

```
if SeqCtl1.ONENTRY then
RAMP_AGUA.LSTART:=false;
FIC_AGUA.REM:=false;
FIC_AGUA.MAN:=true;
FIC_AGUA.LOP:=0.0;
VALV_AGUA.LSP:=false;
```

```
STABLESTEP (SeqCtl1);  
  
end_if;  
  
TRANS (VALV_AGUA.LOWPOS, SEQCTL1.CSTEP+1, SeqCtl1);
```

In the previous example, the STABLESTEP call included in the logic that monitors detected error conditions in each execution cycle (in this particular case, but it could be associated with a specific step) corresponds to a SEQSTABLESTEP DFB block instance to which the following parameters are passed:

- Seqctl1: Corresponds to the name of the SC public variable of the SEQCTL1 block instance that is controlling the sequence execution.

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
SEQCTL1_SC	SEQCTL1_SC_DDT	Provides the data necessary to communicate with the SEQCTL1 block that is controlling the sequence. Refer to the SEQCTL1 block, page 252 for more details.

SEQSTEPDESC

Overview

This section describes the SEQSTEPDESC DFB.

Description

General

The main objective of the SEQSTEPDESC DFB is to assign descriptions to the steps that are defined in the sequence to allow you to monitor them from the Supervision system.

Function Calls

The function call is made from the control subsequence steps (Running, Restarting, Holding, and so on) at the beginning of the code to provide the description of the subsequence steps for their representation in the monitoring program. It is usually written in ST language.

Include as many SEQSTEPDESC calls as there are steps defined in the subsequence or as there are steps that need to be represented in the Supervision system.

The syntax of the function is the following:

```
STEPDESC (STEPNUMBER := (INT),  
  
DESC := (string[18]),  
  
SEQCTL1_SC := (SEQCTL1_SC_DDT),  
  
SEQCTL1_ST := (SEQCTL1_ST_DDT),  
  
SEQCTL1_CFG := (SEQCTL1_CFG_DDT),
```

The following is an example of a function call:

(Running or Pausing Subsequence (302 / 314))

(Step descriptions)

```
STEPDESC (1, 'Init', SSC, SST, SCFG);
STEPDESC (2, 'Valves ON', SSC, SST, SCFG);
STEPDESC (3, 'Wait Valves ON', SSC, SST, SCFG);
STEPDESC (4, 'Dosing Reactive', SSC, SST, SCFG);
STEPDESC (5, 'Motor OFF', SSC, SST, SCFG);
STEPDESC (6, 'Waiting for queue', SSC, SST, SCFG);
```

(Steps and Transitions)

case SSC.CSTEP of

1: (#RunningStep0# Initial Step)

(Check initial conditions)

```
if IC_FAIL then
FalloCI := true;
FAILED (SSC); (Initial conditions not satisfied)
else
FalloCI := false;
```

(Initialization)

In the above example, the STEPDESC calls included at the beginning of the subsequence correspond to a SEQSTEPDESC DFB block instance to which the following parameters are passed in case of the first call:

- 1: Corresponds to step number 1.
- Init: Corresponds to the definition of the step.
- SSC: Corresponds to the SC public variable of the SEQCTL1 block instance that is controlling the sequence execution.
- SST: Corresponds to the DDT_ST variable of the SEQCTL1 block instance that is controlling the sequence execution.
- SCFG: Corresponds to the DDT_CFG variable of the SEQCTL1 block instance that is controlling the sequence execution.

Inputs

Input Parameter Description

Parameter	Type	Description
STEPNUMBER	INT	Number of the subsequence step. The values allowed for the steps are from 1 to 999.
DESC	STRING[22]	Description of the number of the subsequence step. The character string is limited to 17 characters. This is the value that will be shown in the sequence monitoring program.

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
SEQCTL1_SC	SEQCTL1_SC_DDT	Provides the data necessary to communicate with the SEQCTL1 block that is controlling the sequence. Refer to the SEQCTL1, page 252 block for more details.
SEQCTL1_ST	SEQCTL1_ST_DDT	Provides the data necessary to communicate with the SEQCTL1 block that is controlling the sequence. Refer to the SEQCTL1, page 252 block for more details.
SEQCTL1_CFG	SEQCTL1_CFG_DDT	Provides the data necessary to communicate with the SEQCTL1 block that is controlling the sequence. Refer to the SEQCTL1, page 252 block for more details.

Public Variables

Public Variable Description

Parameter	Type	Description
ORDERNUMBER	INT	Read-only public variable reserved for building the list of steps in manual mode that will be shown in the monitoring program.
MAXORDERNUMBER	INT	Read-only public variable reserved for building the list of steps in manual mode that will be shown in the monitoring program.

SEQPARxx - Sequence Parameter Management

What's in This Chapter

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Overview

This chapter describes the SEQPARxx DFB.

Description

General

The SEQPAR05, SEQPAR10 and SEQPAR16 DFBs manage up to 5, 10, and 16 sequence parameters (input, output, and reports) respectively. The DFBs facilitate the management of parameters from advanced control sequences implemented with the General Purpose Library SEQCTL1 DFB.

These DFBs manage the sequence parameters with a data structure (DDT) making it easier to implement reusable control sequences (the number of pins in a DFB is limited to 32 input pins and 32 output pins) because a single variable is used to provide access to the data that the sequence manages.

Function Description

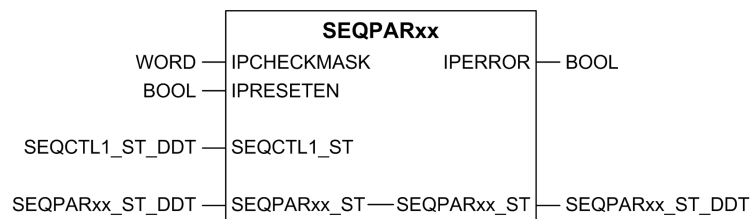
The main functions of the DFB are described in the following table:

Function	Description
Input Parameter Consistency	Optionally, the DFB initializes the values of the input parameters with a value (-0.0) that enables to determine whether or not the applicable parameters of the sequence have been correctly downloaded onto the controller. This way, the sequence can be stopped from starting with an incomplete or inconsistent set of input parameters.
Owner	The DFB manages control system level, which is the owner (Operator or Program) based on the owner of the associated sequence. As a result, it is responsible for defining the input parameters of the sequence.
Output Parameters	The DFB manages the output parameters generated from the control sequence.
Report Parameters	The DFB copies the output parameters to report parameters when the sequence ends and maintains them until the next sequence end. This facilitates the acquisition of these parameters from the monitoring subsystem to generate reports.

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
IPCHECKMASK	WORD	Optionally, enables to connect a bits word (16) to configure applicable input parameters. Only the applicable parameters will be checked for consistency. Refer to the <code>IPRESETEN</code> input and <code>IPERROR</code> output pin, page 268.
		If no data is connected to this input, the consistency check for input parameter is disabled.
		Bit SP is calculated as:
		0 (2 ⁰) Input parameter 1 is applicable (1) or not (0).
		1 (2 ¹) Input parameter 2 is applicable (1) or not (0).
	
IPRESETEN	BOOL	1 = Enables to configure the input parameters need to be initialized with the -0.0 value when the associated control sequence switches to an Idle status.
		This configuration together with the <code>IPCHECKMASK</code> input pin is used to determine whether or not the input parameters are correctly downloaded (refer to the <code>IPERROR</code> output pin, page 268).
SEQCTL1_ST	SEQCTL1_ST_DDT	Enables to connect the state structure of the control sequence for which the parameters need to be managed. The DFB uses this structure to determine the state of the sequence (Idle, Running and so on) and its owner (Operator or Program).

Outputs

Output Parameter Description

Parameter	Type	Description
IPERROR	BOOL	<p>1 = A detected error in the assignment.</p> <p>0 = The check is not activated.</p> <p>The check is only carried out if the <code>IPCHECKMASK</code> input is connected. If the <code>IPCHECKMASK</code> input is connected, a check is run to verify whether the applicable parameters as defined in the connected bit mask have a value other than -0.0 or not. The responsibility of assigning the -0.0 value belongs to the DFB or the programmer depending on how the <code>IPRESETEN</code> input is configured.</p>

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
SEQPARxx_ST	SEQPARxx_ST_DDT	Provides the data that is necessary for managing the types of parameters that the DFB manages input, output, and report.

SEQPARxx_ST_DDT Type

Name	Type	Description
STW	WORD	Provides the device status usually used from the monitoring subsystem, and allows data to be kept in the memory. Read-only access to the data contained in this word.
CFGW	WORD	Provides the means to control the device from the monitoring subsystem. Read/write access to the data contained in this word.
IP01	REAL	<p>Read/write access</p> <p>Input parameter 1.</p> <p>Input parameter management:</p> <ul style="list-style-type: none"> The DFB initializes the input parameters with a value of -0.0 if the <code>IPRESETEN</code> input is enabled when the sequence state switches to Idle. If the owner of the control sequence is the Operator (<code>SEQCTL1_ST.CFGW.0 = 1</code>), this data is copied to the <code>IPxx</code> fields of the <code>SC</code> public variable. In other words, the input parameters are received from the monitoring or batch control subsystem in the Operator mode. If the owner of the control sequence is the Program (<code>SEQCTL1_ST.CFGW.0 = 0</code>), the input parameters are overwritten with the data in the <code>IPxx</code> fields of the <code>SC</code> public variable.
...		...
IPxx	REAL	<p>Read/write access</p> <p>Input parameter xx.</p>
OP01	REAL	<p>Read-only access</p> <p>Output parameter 1.</p> <p>Output parameter management:</p>

Name	Type	Description
		<ul style="list-style-type: none"> The values in the OPxx fields of the SC public variable are continuously copied to these output parameters so that they can be accessed from the monitoring subsystem. Therefore, the control sequence of the user needs to define the value of the OPxx parameters of the SC public variable to indicate the results of the execution of the sequence.
...		...
OPxx	REAL	Read-only access Output parameter xx.
RPT01	REAL	Read-only access Report parameter 1. Report parameter management: <ul style="list-style-type: none"> The SEQPARxx DFB copies the values of the output parameters to the report parameters when the execution of the associated control sequence ends (it switches to the Complete, Stopped, or Aborted state) to facilitate their acquisition from the report subsystem. Refer to the NEWDATA (SEQPARxx_ST.STW.0) input/output.
...		...
RPTxx	REAL	Read-only access Report parameter xx.

SEQPARxx_ST.STW Word Structure

DFB status word. Read-only access. The following table describes the SEQPARxx_ST.STW Word structure:

Bit	Name	Description
0	NEWDATA	Indicates that new data (1) is available in the report parameters (RPTxx fields of the SEQPARxx_ST structure). The DFB activates this signal when the control sequence switches to Complete, Stopped, or Aborted and deactivates this signal (0) when its processing is confirmed from the RPTACK (SEQPARxx_ST.CFGW.0) signal.
1	IPERROR	Refer to the IPERROR output pin, page 268.

SEQPARxx_ST.CFGW Word Structure

Provides the data needed to configure the DFB usually from the monitoring subsystem. The following table describes the SEQPARxx_ST.CFGW Word structure:

Bit	Name	Description
0	RPTACK	Read/write access Enables to reset the NEWDATA (SEQPARxx_ST.STW.0) signal. This signal is automatically set to 0 by the DFB after it has been processed.

Public Variables

Public Variable Description

Variable	Type	Description
SC	SEQPAR _{xx} _SC_DDT	Provides the data needed to manage the parameters of a sequence from the control sequence itself or from a different external mechanism.

SEQPAR_{xx}_SC_DDT Type

Name	Type	Description
IPELOR	BOOL	Read-only access Refer to the IPELOR output pin, page 268.
IP01	REAL	Read/write access Input parameter 1. Input parameter management: <ul style="list-style-type: none"> The DFB initializes the input parameters with a value of -0.0 if the IPRESETEN input is enabled when the sequence status switches to Idle. If the owner of the control sequence is the Operator (SEQCTL1_ST.CFGW.0 = 1), this data is copied to the IP_{xx} fields of the SC public variable. In other words, the input parameters are received from the monitoring or batch control subsystem in the Operator mode. If the owner of the control sequence is the Program (SEQCTL1_ST.CFGW.0 = 0), the input parameters are overwritten with the data in the IP_{xx} fields of the SC public variable.
...		...
IP _{xx}	REAL	Read/write access Input parameter xx.
OP01	REAL	Read/write access Output parameter 1. Output parameter management: <ul style="list-style-type: none"> The values in the OP_{xx} fields of the SC public variable are continuously copied to these output parameters so that you can access the parameters from the monitoring subsystem. Therefore, the control sequence of the user needs to define the value of the OP_{xx} parameters of the SC public variable to indicate the results of the sequence execution.
...		...
OP _{xx}	REAL	Read/write access Output parameter xx.

SEQCTL1 - Example of Use

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Overview

This chapter describes the example use of the SEQCTL1DFB.

Description

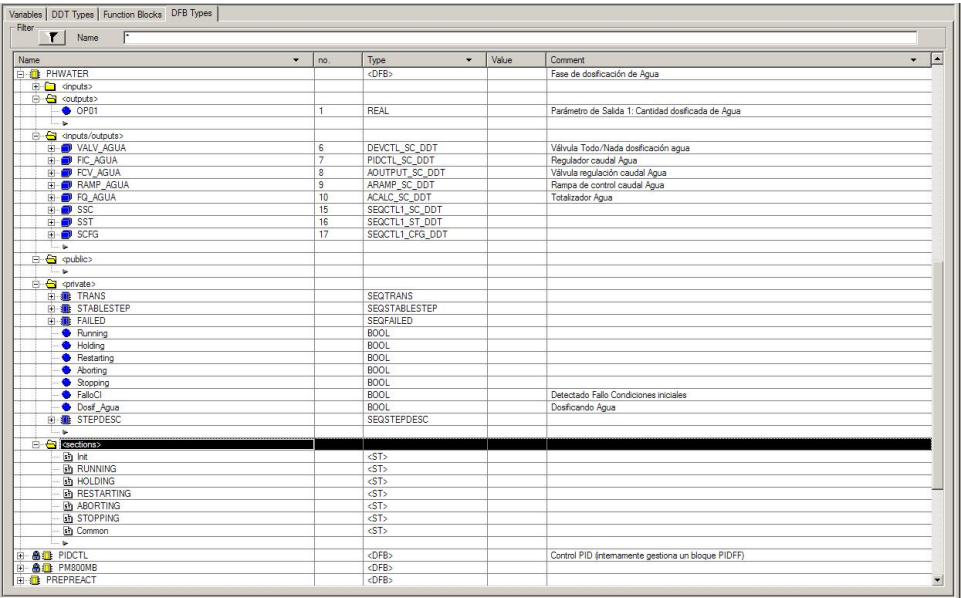
General

This chapter gives an example of an advanced control sequence controlled by the SEQCTL1, SEQTRANS, SEQSTABLESTEP, SEQFAILED, and SEQSTEPDESC DFBs.

The objective of the sequence is to control the loading of water in a process unit. For this purpose, a reusable component (DFB) is created so that you can use this sequence in different process units by only changing the connections of the component pins.

Reusable Sequence Definition

The reusable DFB of the user, PHWATER, declares the SEQCTL1 SEQCTL_ Instance variable to manage the state of the sequence.



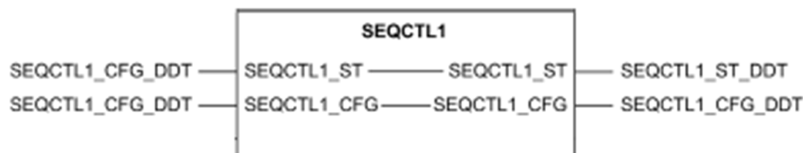
Name	no.	Type	Value	Comment
PHWATER		<DFB>		Fase de dosificación de Agua
input>				
output>				
DPD1	1	REAL		Parámetro de Salida 1: Cantidad dosificada de Agua
input/output>				
VALV_AGUA	6	DEVCTL_SC_DDT		Válvula Todo/Nada dosificación agua
FCV_AGUA	7	PIDCTL_SC_DDT		Regulador caudal Agua
RAMP_AGUA	8	AOUTPUT_SC_DDT		Válvula regulación caudal Agua
FO_AGUA	9	ARAMP_SC_DDT		Rampa de control caudal Agua
SST	10	ACALC_SC_DDT		Totalizador Agua
SCFG	15	SEQCTL1_SC_DDT		
SCFG	16	SEQCTL1_ST_DDT		
SCFG	17	SEQCTL1_CFG_DDT		
public>				
private>				
TRANS		SEQTRANS		
STABLESTEP		SEQSTABLESTEP		
FAILED		SEQFAILED		
Running		BOOL		
Holding		BOOL		
Restarting		BOOL		
Aborting		BOOL		
Stopping		BOOL		
FalloCI		BOOL		Detectado Fallo Condiciones Iniciales
Dosif_Agua		BOOL		Dosificando Agua
STEPDESC		SEQSTEPDESC		
sections>				
init		<ST>		
RUNNING		<ST>		
HOLDING		<ST>		
RESTARTING		<ST>		
ABORTING		<ST>		
STOPPING		<ST>		
Common		<ST>		
PIDCTL		<DFB>		Control PID (internamente gestiona un bloque PIDFF)
PM800MB		<DFB>		
PREPREACT		<DFB>		

NOTE: Declaration of the auxiliary components manages the transitions (SEQTRANS), steady-step flags (SEQSTABLESTEP), and notifications to trigger the holding subsequence (SEQFAILED).

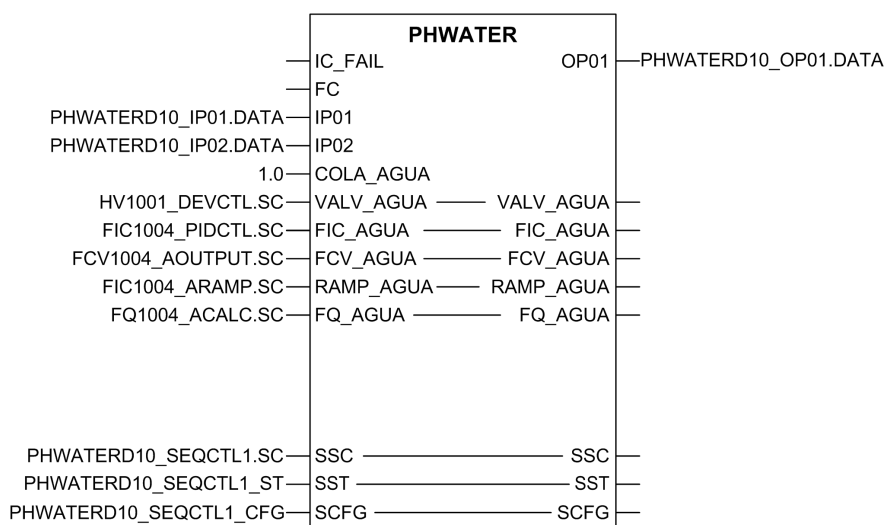
DFB Representation

Representation

The following diagrams include the calls to the sequence created by the user as well as to the control block that will control it (SEQCTL1).



NOTE: The call to the block controls the execution of the advanced control sequence.



NOTE: The call to the functional block implements the control sequence of the user and will reuse for different process units if needed.

Reusable Sequence Logic

Sequence Logic With Description

The basic structure of the sequence as well as the steps that are defined for the sequence objective are included: water dosing. The parts of the code that make up the basic structure of the sequence are marked in bold.

(Initialization)

The following common actions have to be executed before the sequence execution:

```
Running := SSC.RUNNINGX;
Holding := SSC.HOLDINGX;
Restarting := SSC.RESTARTINGX;
Aborting := SSC.ABORTINGX;
Stopping := SSC.STOPPINGX;
```

NOTE: The default actions to be taken by DFB are defined in this section. However, if any section has to be added by user and actions need to be taken before execution of that section, it has to be added here.

(Running or Pausing Subsequence (302/314))

```
STEPDESC (1, 'Init', SSC, SST, SCFG);  
STEPDESC (2, 'Valves ON', SSC, SST, SCFG);  
STEPDESC (3, 'Wait Valves ON', SSC, SST, SCFG);  
STEPDESC (4, 'Dosing Water', SSC, SST, SCFG);  
STEPDESC (5, 'Valves OFF', SSC, SST, SCFG);  
STEPDESC (6, 'Waiting for queue', SSC, SST, SCFG);
```

NOTE: Definition of the descriptions for the subsequence steps.
(Steps and Transitions)

```
case SSC.CSTEP of
```

1: (#RunningStep0# Initial Step)

NOTE: First step with a value of 1. The allowed values for steps are 1 to 999.

(Check initial conditions)

```
if IC_FAIL then
```

```
FalloCI := true;
```

```
FAILED (SSC); (Initial conditions not satisfied)
```

NOTE: Report detected error to trigger the holding subsequence.

```
else
```

```
FalloCI := false;
```

(Initializations)

```
OP01:=0.0;
```

(Reset and water totalizer activation)

```
FQ_AGUA.TOTALRST:=true;
```

```
FQ_AGUA.TOTALEN:=true;
```

```
TRANS (true, 'True', SSC.CSTEP+1, SSC, SST, SCFG); (Next Step)
```

NOTE: Unconditional transition to the next step.

```
end_if;
```

2: (Start Water dosing)

```
if SSC.ONENTRY then
```

```
STABLESTEP (SSC); (In this step, execution would restart in the event of Hold/  
Continue)
```

NOTE: Execute the actions only for the first time.

NOTE: Flag this step as steady.

```
DOSIF_AGUA:=true;
```

```
VALV_AGUA.REM:=false;
```

```
VALV_AGUA.LSP := true;
```

```
FCV_AGUA.REM:=true;
```

```
FIC_AGUA.REM:=false;
```

```
FIC_AGUA.MAN:=true;
```

```
FIC_AGUA.LOP:=10.0; (Initial valve opening)
```

```
end_if;
```

```
TRANS (true, 'trans1', SSC.CSTEP+1, SSC, SST, SCFG); (Next step)
```

```
TRANS (false, 'trans2', SSC.CSTEP+2, SSC, SST, SCFG); (Next step)
```

```
TRANS (false, 'trans3', SSC.CSTEP+3, SSC, SST, SCFG); (Next step)
TRANS (false, 'trans4', SSC.CSTEP+4, SSC, SST, SCFG); (Next step)
TRANS (false, 'trans5', SSC.CSTEP+5, SSC, SST, SCFG); (Next step)
TRANS (false, 'trans6', SSC.CSTEP+6, SSC, SST, SCFG); (Next step)
```

NOTE: The evaluation priority for these transitions is the order in which they are shown (up down; these transitions are not functional, and have only been included as an example in this case). You can define a maximum of 6 transitions.

3: (Wait for open valve)

```
TRANS (VALV_AGUA.HIGHPOS, 'Valve open?', SSC.CSTEP+1, SSC, SST, SCFG); (Next step)
```

4: (Wait for end of Water dosing)

```
if SSC.ONENTRY then
RAMP_AGUA.REM := false; (Setpoint flow ramp)
RAMP_AGUA.LTARGETSP:=IP02; (Target set-point)
RAMP_AGUA.LSTART:=true
FIC_AGUA.REM:=true;
FIC_AGUA.AUTO:=true;
FIC_AGUA.LSP:=IP02; (Flow regulation)
end_if;

TRANS ((IP01 - COLA_AGUA) <= OP01, 'Dosing finished?', SSC.CSTEP
+ 1, SSC, SST, SCFG);
```

5: (End Water dosing)

```
if SSC.ONENTRY then
RAMP_AGUA.LSTART:=false;
FIC_AGUA.REM:=false;
FIC_AGUA.MAN:=true;
FIC_AGUA.LOP:=0.0;
VALV_AGUA.LSP:=false;

STABLESTEP (SSC); (In this step, execution will restart in the event of Hold/
Continue)
end_if;

TRANS (VALV_AGUA.LOWPOS, 'Valve Closed?', SSC.CSTEP+1, SSC,
SST, SCFG);
```

6: (Wait for Water queue)

```
if SSC.ONENTRY then

(Wait for COLA_AGUA (Water queue) to fall)

STABLESTEP (SSC); (In this step, execution will restart in the event of Hold/
Continue)
end_if;

TRANS (SSC.ETIME >= 50, 'Waiting for queue', -1, SSC, SST, SCFG);
(End of sequence)
```

NOTE: Complete sequence (go to COMPLETE) when the transition condition is met.

```
end_case;
(Actions common to several steps)
(Detected error condition monitoring after initializations)
if SSC.CSTEP > 0 and FC then
FAILED (SSC) ; (Trigger execution of the Hold sequence)
end_if;
(Holding Subsequence (316/326))
STEPDESC (1, 'Init', SSC, SST, SCFG);
STEPDESC (1, 'Closing Valves', SSC, SST, SCFG);
Steps and Transitions)
case SSC.CSTEP of
1: (Initial Step)
if FalloCI then
dosif_agua:=false;
end_if;
TRANS (FalloCI, 'Not InitCond', -1, SSC, SST, SCFG) ; (End of
sequence)
TRANS (NOT FalloCI, 'InitCond OK', SSC.CSTEP+1, SSC, SST, SCFG);
(Next step)
2:
if SSC.ONENTRY then
VALV_AGUA.LSP:=false;
RAMP_AGUA.LSTART:=false;
FIC_AGUA.MAN:=true;
FIC_AGUA.LOP:=0.0; (Close control valve)
end_if;
If (dosif_agua) AND SSC.ETIME >= 50 then
dosif_agua:=false;
end_if;
TRANS (SSC.ETIME >= 50 or not dosif_agua, 'Waiting for queue', -1,
SSC, SST, SCFG) ; (End of sequence)
end_case;
(Restarting subsequence(318))
STEPDESC (1, 'Init', SSC, SST, SCFG);
(Steps and Transitions)
case SSC.CSTEP of
1: (Initial Step)
TRANS (true, 'True', -1, SSC, SST, SCFG) ; (End of sequence)
end_case;
(Aborting subsequence(310))
STEPDESC (1, 'Closing Valves', SSC, SST, SCFG);
```

(Steps and Transitions)

```
case SSC.CSTEP of
```

1: (Initial Step)

```
VALV_AGUA.REM:=false;
```

```
VALV_AGUA.LSP:=false;
```

```
RAMP_AGUA.LSTART:=false;
```

```
FIC_AGUA.MAN:=true;
```

```
FIC_AGUA.LOP:=0.0; (Close control valve)
```

```
dosif_agua:=false;
```

```
TRANS (true, 'True', -1, SSC, SST, SCFG); (End of sequence)
```

```
end_case;
```

(Stopping subsequence(312))

```
STEPDESC (1, 'Closing Valves', SSC, SST, SCFG);
```

```
STEPDESC (2, 'Waiting for queue', SSC, SST, SCFG);
```

Steps and Transitions)

```
case SSC.CSTEP of
```

1: (Initial Step)

```
VALV_AGUA.REM:=false;
```

```
VALV_AGUA.LSP:=false;
```

```
RAMP_AGUA.LSTART:=false;
```

```
FIC_AGUA.MAN:=true;
```

```
FIC_AGUA.LOP:=0.0; (Close control valve)
```

```
TRANS (true, 'True', SSC.CSTEP+1, SSC, SST, SCFG); (Next step)
```

2:

```
If (dosif_agua) AND SSC.ETIME >= 50 then
```

```
dosif_agua:=false;
```

```
end_if;
```

```
TRANS (SSC.ETIME >= 50 or not dosif_agua, 'Waiting for queue', -1,  
SSC, SST, SCFG); (End of sequence)
```

```
end_case;
```

Common

Common actions to be executed after the sequence execution.

NOTE: No default actions are defined in this section. However, if any action has to be taken after execution of section, it has to be added here.

Batch Phase Manager

What's in This Part

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USERPHASExx - User Defined Process Logic	304
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Overview

This part provides a detailed description of the functions, pins, pin layout, and variables of the function blocks of the Batch phase manager.

These function blocks do not reflect any specific installation.

<div>⚠ WARNING</div> <div>LOSS OF CONTROL<ul style="list-style-type: none">• Perform a Failure Mode and Effects Analysis (FMEA), or equivalent risk analysis, of your application, and apply preventive and detective controls before implementation.• Provide a fallback state for undesired control events or sequences.• Provide separate or redundant control paths wherever required.• Supply appropriate parameters, particularly for limits.• Review the implications of transmission delays and take actions to mitigate them.• Review the implications of communication link interruptions and take actions to mitigate them.• Provide independent paths for control functions (for example, emergency stop, over-limit conditions, and error conditions) according to your risk assessment, and applicable codes and regulations.• Apply local accident prevention and safety regulations and guidelines.¹• Test each implementation of a system for proper operation before placing it into service.<p>Failure to follow these instructions can result in death, serious injury, or equipment damage.</p></div>
--

¹ For additional information, refer to NEMA ICS 1.1 (latest edition), *Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control* and to NEMA ICS 7.1 (latest edition), *Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems* or their equivalent governing your particular location.

Batch Phase Manager

What's in This Chapter

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Status Controller	282
Operating Modes.....	283

Overview

This chapter describes the Batch phase management.

Description of Batch Phase Manager

Overview

The operation of the function block that is available for Batch Phase Manager is described in this chapter.

The **IBPHASE** DFB belongs to the General Purpose Library and is used to monitor and manage control phases with InBatch tool. The module is based on the ISA-S88 Standard, Part 1 (S88.01i) and implements the status controller defined in this standard for controlling procedure model components (phases, operations, and so on). Prior knowledge about the InBatch tool will facilitate to understand the Batch phase manager block.

Function Description

You can use this DFB to change states in the process. In compliance with ISA-S88.01i, you can use this DFB to initiate start, stop or emergency phases. In batch processes, this DFB can be used to set up phases and operations.

The DFB implements phase state management and processes the commands received from:

- The Supervision system (when phases are manually controlled by the operator)
- The batch control subsystem (in which case the subsystem sends the commands and checks the status of the phase to determine what action to take)
- Other control phases

The table compares the functions that are available in the DFB:

Function	IBPHASE
Management of state machine and commands according to ISA-S88	x
Management of operating modes according to ISA-S88: Manual (enables to change from one phase step to any other phase step), Semi (step advance with confirmation from the operator), and Auto	x
Owner Management: Operator/Program	x
Step time automatically calculated by the control block	x
Automatic management of transitions through the IBTRANS function block	x
Automatic management of phase detected error through the IBFAILED function block	x

Function	IBPHASE
Automatic management of phase steady-step marking through the <code>IBSTABLESTEP</code> function block	x
Possibility of displaying the phase graphically (active step and next level of transitions and steps) from the monitoring subsystem	x
NOTE: 'x' indicates that the functions are available in the DFB.	

Program the steps and transitions that the phases implement (through ST or SFC language) while the component (`IBPHASE`) allows the programmer to:

- Manage the statuses of the phase and
- Process the commands received from other levels as described above.

As a minimum, implement the subphase that implements normal operation (`RUNNING`).

Other user can implement subphases that attend to commands received from other levels of the control system or that react to detected error in the process (`HOLDING`, `RESTARTING`, `STOPPING`, and `ABORTING`) detected by the phase itself.

The table describes the main functions of the DFB:

Function	Description
Processing States and Commands	The DFB processes the commands received and determines the status of the control phase with the objective of determining the subphases (normal, hold, continue, abort, so on.) and which step needs to run in each cycle of the program.
Managing Entry Points in the Phase	The DFB enables to retain the step number with which the execution of the normal phase (<code>Running</code>) needs to be restarted (<code>Restart</code>) after being restarted from held status (<code>Held</code>).
Handling of Detected error	The component manages controller detected error (without user intervention from the Supervision system). The component manages this detected error and triggers the execution of the detected error handling subphase.
Auto reset disable	Automatic reset (<code>STOPPED</code> → <code>IDLE</code> , automatically performs reset operation without consuming any extra execution cycle) can be disabled by setting the input pin (<code>AUTORESETDIS</code>) to a logical high when Owner is Operator.

Definition of Phase Statuses, Batch Phase Statuses, Phase Commands and Batch Phase Commands

Statuses

The table describes the phase statuses and their descriptions:

Status	Description
Idle	Inactive operation. Waiting for command to start (Start) running.
Running	Normal operation.
Held	Operation put on hold. Waiting for command to Restart (Restart) to get operation to running.
HeldForError	Operation put on hold due to detected error condition. Waiting for command to Restart (Restart) to get operation to running.
Stopped	Operation stopped. Waiting for command to get state (Reset) to Idle.
Paused	Operation paused. Waiting for command to get state (Resume) to running.
Aborted	Operation canceled. Waiting for command to get state (Reset) to get operation to Idle.

Status	Description
Complete	Normal operation has finished. Requires an initialization order (Reset) to return to the Idle status.
Holding	A hold (Hold) command is received and the phase that allows the process to be changed to a known status is executed. After this phase is finished, it automatically goes to the held (Held) status.
HoldingForError	A detected error is automatically detected in the process (for example, a detected error in a control module), and the phase that allows the process to be changed to a known status is executed. After this phase is finished, it automatically goes to the held (HeldForError) status.
Restarting	A restart command (Restart) is received while the phase is being held (Held). The phase returns to the normal operation phase (Running). The normal operation status (Running) is set automatically after the phase is complete.
Pausing	A pause (Pause) command is received for a short period while the normal operation was being executed (Running). The normal phase runs until it automatically goes to paused (Paused) status.
Stopping	An order to stop (Stop) has been received. To finish the phase in a controlled way is executed (it is not possible to continue with it). The stopped operation status (Stopped) is automatically activated after the phase is complete.
Aborting	An order to end (Abort) has been received. A fast stop, which is not necessarily controlled is executed. The aborted operation status (Aborted) is automatically activated after the phase is completed.
Interlocked	Operation cannot start as initial conditions are not met.

The (Held) status can also be reached (without receiving a command) if the control phase itself detects a problem situation. The DFB has a signal that allows this situation to be communicated.

The DFB has the necessary means to be able to restart the Running phase from the last steady step in which the initial run was held by a **Hold** command.

Batch Phase Statuses

The table describes the Batch phase statuses and their descriptions:

IBSTATE	Description
IBREADY	Ready for operation. The phase state is in Idle.
IBRUN	Normal operation. The phase can be in Running, Restarting, Stopping, Aborting, Holding, Pausing and Paused states.
IBHELD	Operation put on hold. The phase state is in Held.
IBABORTED	Operation canceled. The phase can be in Stopped or Aborted states.
IBDONE	Normal operation has finished. The phase state is in Completed.
IBINTERLOCKED	Operation cannot start from InBatch tool as initial conditions are not met or Owner is Operator. The phase state is in Interlocked.

Commands

The table describes the phase commands and their descriptions:

Status	Description
Start	Allows the normal operation of the phase (Running) to be started.
Hold	Allows the phase state to be put on hold (Holding, HoldingForError).
Restart	Allows the phase state for continuing the operation (Restarting) and resume normal operation (Running).
Stop	Allows the phase state to be stopped (Running, Pausing, Paused, Holding, Held, or Restarting) and the transition of state from running to stopping (Stopping).

Status	Description
Reset	Triggers the transition to idle status (in Complete, Aborted, or Stopped status).
Pause	Allows normal execution (Running) to be paused in the next steady phase status.
Resume	Allows normal operation of the phase (Running) to be resumed from the paused (Paused) status.
Abort	Allows the phase state to be aborted (in any status except Idle, Complete, Aborting, and Aborted) and the aborting state achieved from running (Aborting).
Completed	Allows phase state to reach quiescent states or final state from certain transient states.
Stablestep	1 = Sends a command to mark the current step as a steady step, that is, the step with which the phase will resume after its is held or the step on which the phase will be held after the phase is paused. 0 = The signal is automatically set to 0 by the DFB after the signal is processed.

Batch Phase Commands

The table describes the Batch phase commands and their descriptions:

IBCOMMAND	Description
IBSTART	Allows the normal operation of the phase (<i>IBRUN</i>) to be started.
IBHOLD	Allows the InBatch to be put on hold (<i>IBHELD</i>).
IBRESTART	Allows the InBatch for continuing the operation and resume normal operation (<i>IBRUN</i>).
IBRESET	Triggers the transition to Ready status <i>IBREADY</i> when batch phase state is in <i>IBDONE</i> or <i>IBABORTED</i> . The command is automatically triggered by InBatch tool when <i>IBSTATE</i> is Done or Aborted.
IBABORT	Allows the InBatch to be aborted (in any batch phase status except Ready, Done, Run (Aborting phase state) and Aborted).

Status Matrix

Description

The following table describes the phase status controller that the DFB implements:

Initial State	Command	Activity	Final State (without command)
Idle	Start	Running	–
Running	Stop	Stopping	Stopped
	Hold	Holding	Held
	Pause	Pausing	Paused
	Abort	Aborting	Aborted
Complete	Reset	Idle	–
Pausing	Stop	Stopping	Stopped
	Hold	Holding	Held
	Abort	Aborting	Aborted
Paused	Stop	Stopping	Stopped
	Resume	-	Running
	Abort	Aborting	Aborted

Initial State	Command	Activity	Final State (without command)
	Hold	Holding	Held
Holding	Stop	Stopping	Stopped
	Abort	Aborting	Aborted
Held	Stop	Stopping	Stopped
	Restart	Restarting	Running
	Abort	Aborting	Aborted
Restarting	Stop	Stopping	Stopped
	Hold	Holding	Held
	Abort	Aborting	Aborted
Stopping	Abort	Aborting	Aborted
Stopped	Reset	Idle	–
	Abort	Aborting	Aborted
Aborting	No action possible		
Aborted	Reset	Idle	–

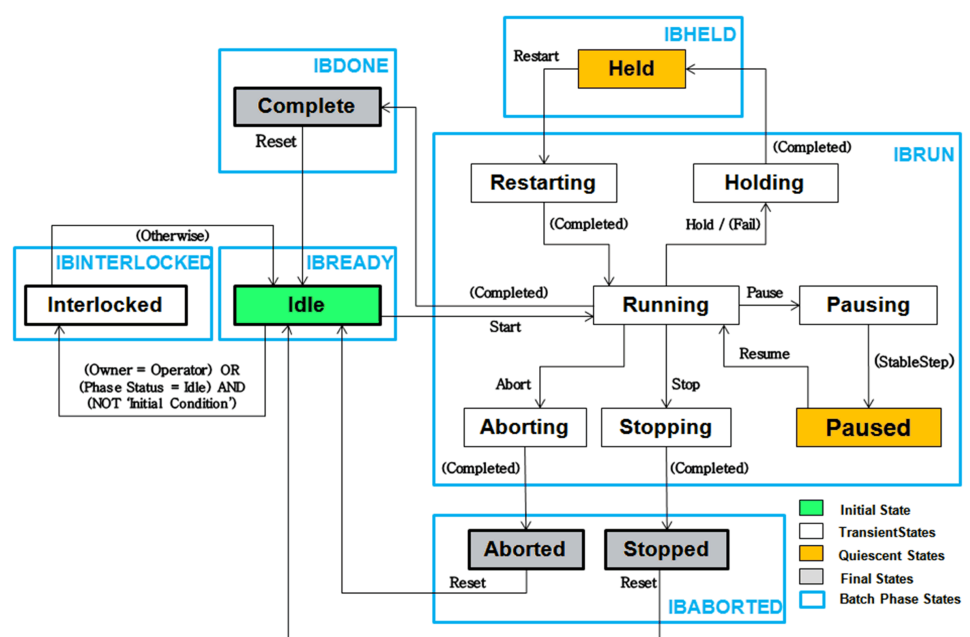
The Held status can also be reached (without receiving a command) if the control phase itself encounters a detected error. The block has a signal that allows this situation to be communicated.

The block has the necessary means to be able to restart the **Running** phase from the last steady step in which the initial run was held by a **Hold** command.

Status Controller

Description

The following diagram describes the possible phases statuses and phase commands that the Control Expert component manages according to the ISA-S88 standard:



Next to the transition arrows, the phase commands that the component receives (from the Supervision system or another higher level phase) are shown in black,

and status/commands that phase obtains from other blocks (for example, user logic) are shown in parenthesis.

Operating Modes

Mode Table

The following table provides the description of the phase operating modes of IBPHASE DFB:

Operating mode	Implemented as:
Automatic	It is the normal running mode. The phase runs automatically based on the transitions defined in the controller.
Semiautomatic	In this operating mode, after the conditions defined in the transitions are met, you need to confirm the move to the next step.
Manual	The phase does not automatically advance to a step; user can manually change from one phase step to another. Once the phase step is selected, operating mode will change to semi-automatic and starts the phase step selected in manual mode.

IBPHASE - Individual Batch Phase Manager

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Overview

This chapter provides a detailed description of the functions, pins, pin layout, and variables of the `IBPHASE` DFB.

Description

Initialization

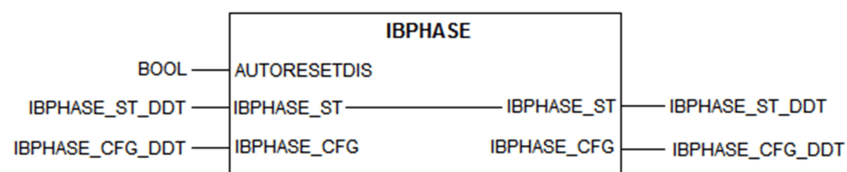
If either the phase status is unknown or unlike any of the normal states or section is beginning with the execution then normal state is initialized as `Idle`, regardless of whether a controller has restarted or not. This initialization is done automatically.

DFB Representation

Representation

The DFB that is used in the program has the following aspect at the section level when imported. You can use it in any of the programming languages, although it is designed for use with the FBD language.

The figure shows an example of the `IBPHASE` DFB instance:



Implement the phase logic that controls the component in ST language to take advantage of the phase control potentials making the phase reusable. That is, you can run simultaneously several instances of the phase that you have implemented. This reduces engineering and maintenance efforts when it is necessary to set up the same control phases in several process units.

Inputs

Input Parameter Description

Parameter	Type	Description
AUTORESETDIS	BOOL	Disabling the automatic reset of the phase state, when Owner is Operator.

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
IBPHASE_ST	IBPHASE_ST_DDT	Provides the necessary data for monitoring and controlling phase execution.
IBPHASE_CFG	IBPHASE_CFG_DDT	Provides the necessary data for background monitoring.

IBPHASE_ST_DDT Type

Name	BitRank Name (if any)	Bit Number (if any)	Type	Description
ETIME	-		UDINT	The DFB calculates the execution time elapsed in tenths of a second for the current step of the control phase. If execution of the program is stopped and resumed, the accumulated execution time is considered but not the time that the program was stopped
IBSTATE	-		UINT	Provides the status of the batch phase
	IBREADY	0		Inactive operation. Waiting for command to start (Start) running.
	IBRUN	1		Normal operation.
	IBHELD	2		Operation put on hold. Waiting for command to Restart (Restart) to get operation to running.
	IBABORTED	6		Operation canceled. Waiting for command to get state (Reset) to get operation to Idle
	IBDONE	14		Operation completed. Waiting for command to get state (Reset) to get operation to Idle.
	IBINTERLOCKED	15		Operation cannot start from InBatch tool as initial conditions are not met. or Owner is Operator.
IBCOM-MAND	-		UINT	Enables commands to be sent to the phase from the InBatch. The DFB sets the command to 0 after processed (successfully or not).
	IBSTART	0		Allows the normal operation of the InBatch (Running) to be started.
	IBHOLD	1		Allows the InBatch to be put on hold (Holding, HoldingForError).

Name	BitRank Name (if any)	Bit Number (if any)	Type	Description
	IBRESTART	2		Allows the InBatch for continuing the operation (Restarting) and resume normal operation (Running).
	IBRESET	4		Triggers the transition to idle status (in Complete, Aborted, or Stopped status).
	IBABORT	7		Allows the InBatch for continuing the operation (Restarting) and resume normal operation (Running).
STATE	-		UINT	Provides the current status of the Phase.
	IDLE	0		Inactive operation. Waiting for command to start (Start) running.
	RUNNING	1		Normal operation.
	HELD	2		Operation put on hold. Waiting for command to Restart (Restart) to get operation to running.
	HELDFORERROR	3		Operation put on hold due to detected error condition. Waiting for command to Restart (Restart) to get operation to running.
	STOPPED	4		Operation stopped. Waiting for command to get state (Reset) to Idle
	PAUSED	5		Operation paused. Waiting for command to get state (Resume) to running
	ABORTED	6		Operation canceled. Waiting for command to get state (Reset) to get operation to idle
	COMPLETE	7		Normal operation has finished. Requires an initialization order (Reset) to return to the Idle status.
	HOLDING	8		A hold (Hold) command is received and the phase that allows the process to be changed to a known status is executed. After this phase is finished, it automatically goes to the held (Held) status.
	HOLDINGFORERROR	9		A detected error is automatically detected in the process (for example, a detected error in a control module), and the phase that allows the process to be to a known status is executed. After this phase is finished, it automatically goes to the held (HeldForError) status.
	RESTARTING	10		Restart command (Restart) is received while the phase is being held (Held). The phase returns to the normal operation phase (Running).
	PAUSING	11		Operation cannot start from InBatch tool as initial conditions are not met.
	STOPPING	12		An order to stop (Stop) has been received. The phase to finish the order in a controlled way is executed (it is not possible to continue with it). The stopped operation status (Stopped) is automatically activated after the (Stopping) sub phase is completed.
	ABORTING	13		An order to end (Abort) has been received. A fast stop, which is not necessarily controlled is executed. The aborted operation status (Aborted) is automatically activated after the (Aborting) sub phase is completed.
	INTERLOCKED	15		Operation cannot start as initial conditions are not met.

Name	BitRank Name (if any)	Bit Number (if any)	Type	Description
COMMAND	-		UINT	InBatch commands from HMI
	START	0		Allows the normal operation of the phase (Running) to be started.
	HOLD	1		Allows the InBatch to be put on hold (Holding, Holdingforerror).
	RESTART	2		Allows the InBatch for continuing the operation (Restarting) and resume normal operation (Running).
	STOP	3		Allows the InBatch to be stopped (Running, Pausing, Paused, Holding, Held, or Restarting) and the transition of state from running to stopping (Stopping).
	RESET	4		Triggers the transition to idle status (in Complete, Aborted, or Stopped status).
	PAUSE	5		Allows normal execution (Running) to be paused in the next steady phase status.
	RESUME	6		Allows normal operation of the phase (Running) to be resumed from the paused (Paused) status.
	ABORT	7		Allows the InBatch to be aborted (in any status except Idle, Complete, Aborting, and Aborted) and the aborting state achieved from running (Aborting).
STW	-		WORD	Phase status word. In this word, the <i>IBTRANS</i> auxiliary DFB is used to load the status of the transitions (maximum of six) from the current step of the phase to the steps in the next level of the phase, where 0 means that the conditions in the transition are not fulfilled and 1 means they are fulfilled.
	STATUS1Transi- tion	0		Status of the first transition
	STATUS2Transi- tion	1		Status of the second transition
	STATUS3Transi- tion	2		Status of the third transition
	STATUS4Transi- tion	3		Status of the fourth transition
	STATUS5Transi- tion	4		Status of the fifth transition
	STATUS6Transi- tion	5		Status of the sixth transition
	INITCONDFAIL	14		Enables to confirm if initial condition is met.
	AUTORESETDIS	15		Disable Auto-reset
CFGW	-		WORD	Phase configuration word.
	OWNER	0		Read/write access. Enables to configure whether the phase commands will come from the program (0) or the operator (1).
	SEMI	1		Read/write access. Enables to configure the phase in automatic (0) or semi-automatic (1) mode.
	MANUAL	2		Read/write access. Enables to configure the phase in automatic/semi-automatic (0) or manual (1) mode.
				<div>Bit 1 (SEMI))</div> <div>Bit 2 (MAN-UAL))</div> <div>Mode</div>

Name	BitRank Name (if any)	Bit Number (if any)	Type	Description		
				OFF	OFF	Auto
				ON	OFF	Semi-Auto
				-	ON	Manual
	NEXTSTEP	3		Read/write access. Enables to confirm the change of steps to the next phase step in Semi-Automatic mode. The DFB sets the signal to 0 after it is processed.		
	SCROLL_UP	5		Read/write access. Enables to show the steps previous to the one being shown on the current window in manual mode. The DFB sets the signal to 0 after it is processed.		
	SCROLL_DOWN	6		Read/write access. Enables to show the steps following the one being shown on the current window in manual mode. The DFB sets the signal to 0 after it is processed.		
	BUTTON1	14		User configurable control button in InBatch and Supervision function.		
	BUTTON2	15		User configurable control button in InBatch and Supervision function.		
CSTEPD	-		String [22]	Current step description (three characters for step number concatenated with seventeen characters for description).		

IBPHASE_CFG_DDT Type

Name	Type	Description
NSTEP	INT	Number of the new step at which the sub phase needs to be positioned in manual mode. The DFB sets this variable to 0 after it is processed.
STEPD	STRING[122]	Description of steps. Limited to six steps. In automatic and semi-automatic mode, it shows the destination steps specified in the current step transitions. In manual mode, it shows the list of the steps defined in the phase. This variable format is: six steps, twenty characters each. Of the twenty characters of each step, the first three are for the step number and the next seventeen are for its description. The value of this variable is assigned for the auxiliary functions.
TRANSD	STRING[122]	Description of transitions. Limited to six transitions. This variable format is six transitions, twenty characters each. The twenty characters are for its description. The value of this variable is assigned for the auxiliary functions.

Public Variables

Public Variable Description

Variable	Type	Description
SC	IBPHASE_SC_DDT	Provides the frequently needed data to monitor the phase status and control it from the Batch phase control.

IBPHASE_SC_DDT Type

Name	BitRank Name (if any)	Bit Number (if any)	Type	Description
ETIME	-		UDINT	Elapsed time in the current step (dsec).
STATE	-		UINT	Current phase state.
	IDLE	0		Inactive operation. Waiting for command to start (Start) running.
	RUNNING	1		Normal operation.
	HELD	2		Operation put on hold. Waiting for command to Restart (Restart) to get operation to running.
	HELDFORError	3		Operation put on hold due to detected error condition. Waiting for command to Restart (Restart) to get operation to Running.
	STOPPED	4		Operation stopped. Waiting for command to get state (Reset) to Idle.
	PAUSED	5		Operation paused. Waiting for command to get state (Resume) to Running.
	ABORTED	6		Operation canceled. Waiting for command to get state (Reset) to get operation to Idle
	COMPLETE	7		Normal operation has finished. Requires an initialization order (Reset) to return to the Idle status.
	HOLDING	8		A hold (Hold) command is received and the phase that allows the process to be changed to a known status is executed. After this phase is finished, it automatically goes to the held (Held) status.
	HOLDINGFORError	9		A detected error is automatically detected in the process (for example, a detected error in a control module), and the phase that allows the process to be to a known status is executed. After this phase is finished, it automatically goes to the held (HeldForError) status.
	RESTARTING	10		Restart command (Restart) is received while the InBatch is being held (Held). The InBatch runs to return to the normal operation phase (Running). The normal operation status (Running) is set automatically after the InBatch is complete.
	PAUSING	11		A pause (Pause) command is received for a short period while the normal operation was being executed (Running). The normal InBatch runs until it automatically goes to paused (Paused) status.
	STOPPING	12		An order to stop (Stop) has been received. The phase to finish the order in a controlled way is executed (it is not possible to continue with it). The stopped operation status (Stopped) is automatically activated after the phase is complete.
	ABORTING	13		An order to end (Abort) has been received. A fast stop, which is not necessarily controlled is executed. The aborted operation status (Aborted) is automatically activated after the phase is completed.
	INTERLOCKED	15		Operation cannot start from InBatch tool as initial conditions are not met.
COMMAND	-		UINT	Commands for transition states
	START	0		Allows the normal operation of the phase (Running) to be started.
	HOLD	1		Allows the InBatch to be put on hold (Holding, HoldingForError).
	RESTART	2		Allows the InBatch for continuing the operation (Restarting) and resume normal operation (Running).
	STOP	3		Allows the InBatch to be stopped (Running, Pausing, Paused, Holding, Held, or Restarting) and the transition of state from running to stopping (Stopping).
	RESET	4		Triggers the transition to idle status (in Complete, Aborted, or Stopped status).

Name	BitRank Name (if any)	Bit Number (if any)	Type	Description
	PAUSE	5		Allows normal execution (Running) to be paused in the next steady phase status.
	RESUME	6		Allows normal operation of the phase (Running) to be resumed from the paused (Paused) status.
	ABORT	7		Allows the InBatch to be aborted (in any status except Idle, Complete, Aborting, and Aborted) and the aborting state achieved from running (Aborting).
	COMPLETED	8		Write access 1 = Sends a command to finish the current sub phase (Running, Holding, Restarting, Stopping, and so on). 0 = The signal is automatically set to 0 by the DFB after the signal is processed. As an alternative, forcing the value of this variable to 1 by using the IBTRANS auxiliary DFB is recommended.
	STABLESTEP	9		Write access 1 = Sends a command to mark the current step as a steady step, that is, the step with which the phase will resume after its is held or the step on which the phase will be held after the phase is paused. 0 = The signal is automatically set to 0 by the DFB after the signal is processed.
CSTEP	-		INT	Read-only access Number of the active phase current step (Running, Pausing, Holding, Restarting, Stopping, or Aborting). The value 0 corresponds to the initial step of each sub phase.
NEXTSTEP	-		INT	Write access Enables the number of the next step to be run in the phase to be set. The signal is automatically set to 0 by the DFB after the signal is processed. As an alternative, forcing the value of this variable to 1 by using the IBTRANS auxiliary DFB is recommended.
MODE	-		INT	Read-only access, page 285 Operating modes
			VALUE	MODE
			0	Automatic
			1	Semi-Automatic
			2	Manual
CURRENTITEM	-		INT	Read-only access 1 = Indicates the current position of the list of steps in Manual mode. The value -1 indicates that there has been a mode change and -2 indicates that the mode change has been identified.
DEST	-		ARRAY [1...6] of INT	Destinations steps after transitions
DESTW	-		WORD	Transitions Conditions word
PROPERTIES	-		WORD	Collective word of necessary boolean variables.
	OWNER	0		Read only access Enables to configure whether the commands will come from the InBatch (0) or the operator (1).
	ONENTRY	1		Read-only access 1 = Reports that a new phase step has just been started. User can use this event in the logic of the phase step actions to run any actions. The actions run only when the step starts.
	ONEXIT	2		Read-only access

Name	BitRank Name (if any)	Bit Number (if any)	Type	Description
				<p>1 = Reports that the execution of the phase current step is about to finish.</p> <p>User can use this event in the logic of the phase step actions to run any actions. The actions run only when the step ends.</p>
	INITCONDFAIL	3		1 = Initial conditions are not met to start the batch phase.
	FAIL	4		<p>Write access</p> <p>1 = Sends a command to stop the phase normal execution.</p> <p>0 = The signal is automatically set to 0 by the DFB after the signal is processed.</p> <p>With the activation of this signal, the <i>Holding For Detected Error</i> sub phase is run next if the <i>Running</i>, <i>Pausing</i>, <i>Restarting</i>, or <i>Paused</i> sub phase was running previously. As an alternative, forcing the value of this variable to 1 by using the <i>IBFAILED</i> auxiliary DFB is recommended.</p>
	NEWCYCLE	5		<p>Read-only access</p> <p>1 = Indicates that a new phase state machine execution cycle has started.</p>
	UPDATESTEP	6		<p>Read-only access</p> <p>1= Internal mark indicates the need for updating the steps descriptions.</p>
	RUNNINGX	7		<p>Read-only access</p> <p>1 = Indicates that the current state of the phase is <i>Running</i> or <i>Pausing</i></p>
	HOLDINGX	8		<p>Read-only access</p> <p>1 = Indicates that the current state of the phase is <i>Holding</i> or <i>Holding for Detected Error</i>.</p>
	BUTTON1	14		User configurable control button in InBatch.
	BUTTON2	15		User configurable control button in InBatch.

Auxiliary Functions of Batch Phase

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Overview

This section describes the function blocks that supplement the `IBPHASE` DFB and that have the objective of facilitating the programming of the control batch phase.

IBTRANS

Overview

This section describes the `IBTRANS` DFB.

Description

General

The main objective of `IBTRANS` DFB is to set up the control phase transitions based on the condition to be evaluated and the next step to be executed when this expression is fulfilled.

Additionally, the DFB manages the information necessary to graphically represent the state of the transitions and steps following the current step (`DEST` and `DESTW` fields of the `IBPHASE_ST_DDT` phase state structure).

Include call to this function in the logic of the steps (usually in ST language) to program the transitions between the phase steps.

Function Call

The function call is carried out from the steps of the control subphases (Running, Restarting, Holding, and so on) usually in ST language to program the transitions between these steps.

If several `IBTRANS` calls are included in the same step and if more than one of them is fulfilled in the same step execution cycle, the step corresponding to the transition that is fulfilled and was programmed first will run. The number of `IBTRANS` calls from one single step is limited to 6.

```
TRANS (CONDITION := (*BOOL*),
DESC := (*string[22]*),
NEXTSTEP := (*INT*),
IBPHASE_SC := (*IBPHASE_SC_DDT*)
IBPHASE_ST := (*IBPHASE_ST_DDT*),
IBPHASE_CFG := (*IBPHASE_CFG_DDT*))
```

A function call example is included below:

4: (Wait for end of reactive dosing)

```

if IBSC.ONENTRY then
  BISEN2_REACT.REM:=false;
  BISEN2_REACT.LSP:=true;
end_if;

BISEN2_REACT.LSPSEL:=(OP01 < (IP01 - 10.0)); (Speed 1 or 2)

TRANS ((IP01 - COLA_REACT) <= OP01, 'Dosing finished?', IBSC.
CSTEP+1, IBSC, IBST, IBCFG);

```

In the previous example, the TRANS call included in step 4 of the phase corresponds to a IBTRANS block instance to which the following parameters are passed:

- (IP01 - COLA_REACT) <= OP01OS: Corresponds to the expression of the condition that needs to be fulfilled for the transition to be executed. You can include complex expressions that result in a Boolean value (true or false).
- Dosing finished?: Corresponds to the description of the transition.
- IBSC.CSTEP+1: Corresponds to the next step that needs to be executed when the transition is fulfilled. In this case, the next step (step 5) is executed after the current step (step 4). You can include any expression jumping to an existing step in the phase.
- IBSC: Corresponds to the SC public variable of the IBPHASE block instance that is controlling the phase execution.
- IBST: Corresponds to the DDT_ST variable of the IBPHASE block instance that is controlling the phase execution.
- IBCFG: Corresponds to the DDT_CFG variable of the IBPHASE block instance that is controlling the phase execution.

Inputs

Input Parameter Description

Parameter	Type	Description
CONDITION	BOOL	1 = Indicates that the condition for executing the transition is fulfilled.
DESC	STRING[22]	Provides the description of the transition to be represented in the monitoring program. The character string is limited to 20 characters.
NEXTSTEP	INT	Sub phase step number to which a jump needs to be made when the transition is fulfilled. Refer to the CONDITION input. The permissible values for the steps go from 1 to 999 with the exception of NEXTSTEP to -1. This indicates that when the transition is fulfilled, the corresponding sub phase (to go, for example, from Running to Complete, from Holding to Held, and so on) will be completed.

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
IBPHASE_SC	IBPHASE_SC_DDT	Corresponds to the SC public variable of the IBPHASE block instance that is controlling the phase execution.
IBPHASE_ST	IBPHASE_ST_DDT	Provides the data necessary to communicate with the IBPHASE block that is controlling the phase. Refer to the IBPHASE block, page 284 for more details.
IBPHASE_CFG	IBPHASE_CFG_DDT	Provides the data necessary to communicate with the IBPHASE block that is controlling the phase. Refer to the IBPHASE block, page 284 for more details.

IBFAILED

Overview

This section describes the IBFAILED DFB.

Description

General

The main objective of the IBFAILED DFB is to report detected errors to the batch phase management block (IBPHASE) during phase execution so that the *HoldingFE* subphase is triggered.

Function Call

The function call is made from the Running, Restarting, Pausing, or Paused control sub phase steps usually in ST language with the purpose of reporting detected errors in the process that is being controlled. The detected error requires the hold phase to be executed (*HoldingFE*).

A function call example is included below:

(Detected error condition monitoring after initializations)

```
if IBPHASE.CSTEP > 0 and FAILCOND then
  FAILED (IBSC) ; (Trigger execution of the Hold phase)
end_if;
```

In the previous example, the *FAILED* call that is included in the logic monitors the detected error conditions in each execution cycle (in this particular case, but could be associated with a specific step) corresponds to a IBFAILED DFB block instance to which the following parameters are passed:

- IBPhase: Corresponds to the name of the SC public variable of the IBPHASE block instance that is controlling the execution of the phase.

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
IBPHASE_SC	IBPHASE_SC_DDT	Provides the data necessary to communicate with the IBPHASE block that is controlling the phase. Refer to the IBPHASE block, page 284 for more details.

IBTABLESTEP

Overview

The section describes the IBTABLESTEP DFB.

Description

General

The main objective of the IBTABLESTEP DFB is to report to the batch phase management block (IBPHASE) that the current running phase step corresponds to a step, that is, the re-entry point in the normal execution (Running) phase executes after restarting execution (Restarting).

Function Call

The function call is performed from the Running control sub phase steps usually in ST language for the purpose of reporting. The current step is the entry point to which the program should return when the Running sub phase is resumed after finishing the Restarting sub phase. Basically, it enables to resume the phase execution that verifies the appropriate actions are performed or not.

For example, suppose a valve has to be opened. After the valve is opened, the next step involves turning on a pump. While waiting for the valve to open, a detected error that makes the phase stop occurs (Holding sub phase execution). You can resume execution by running the restart (Restarting) sub phase. After this, the program returns to the normal running sub phase (Running). After the program goes back to this Running sub phase, the intention is to make another attempt at opening the valve (because most likely, it has been closed during the Holding sub phase) not to start the pump in proceeding directly. Therefore, in the valve opening step, the step is marked and does not call the function IBTABLESTEP in the pump starting step.

The following is an example of a function call:

0: (End Water dosing)

```
if IBSC.ONENTRY then
RAMP_AGUA.LSTART:=false;
FIC_AGUA.REM:=false;
FIC_AGUA.MAN:=true;
FIC_AGUA.LOP:=0.0;
VALV_AGUA.LSP:=false;
```

```

STABLESTEP (IBSC);

end_if;

TRANS (VALV_AGUA.LOWPOS, 'Valve Closed?', IBSC.CSTEP+1, IBSC,
IBST, IBCFG);

```

In the previous example, the STABLESTEP call included in the logic that monitors detected error conditions in each execution cycle (in this particular case, but it could be associated with a specific step) corresponds to a IBSTABLESTEP DFB block instance to which the following parameters are passed:

- **IBPhase:** Corresponds to the name of the SC public variable of the IBPHASE block instance that is controlling the phase execution.

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
IBPHASE_SC	IBPHASE_SC_DDT	Provides the data necessary to communicate with the IBPHASE block that is controlling the phase. Refer to the IBPHASE block, page 284 for more details.

IBSTEPDESC

Overview

This section describes the IBSTEPDESC DFB.

Description

General

The main objective of the IBSTEPDESC DFB is to assign descriptions to the steps that are defined in the phase to allow you to monitor them from the Supervision system.

Function Calls

The function call is made from the control sub phase steps (Running, Restarting, Holding, and so on) at the beginning of the code to provide the description of the sub phase steps for their representation in the monitoring program. It is usually written in ST language.

Include as many IBSTEPDESC calls as there are steps defined in the sub phase or as there are steps that need to be represented in the Supervision system.

The syntax of the function is the following:

```

STEPDESC STEPNUMBER := (INT),

DESC := (string[18]),

IBPHASE_SC := (IBPHASE_SC_DDT),

IBPHASE_ST := (IBPHASE_ST_DDT),

IBPHASE_CFG := (IBPHASE_CFG_DDT),

```

The following is an example of a function call:

(Running or Pausing Sub phase (302 / 314))

(Step descriptions)

```
STEPDESC (1, 'Init', IBSC, IBST, IBCFG);
STEPDESC (2, 'Valves ON', IBSC, IBST, IBCFG);
STEPDESC (3, 'Wait Valves ON', IBSC, IBST, IBCFG);
STEPDESC (4, 'Dosing Reactive', IBSC, IBST, IBCFG);
STEPDESC (5, 'Motor OFF', IBSC, IBST, IBCFG);
STEPDESC (6, 'Waiting for queue', IBSC, IBST, IBCFG);
```

(Steps and Transitions)

```
case IBSC.CSTEP of
1: (#RunningStep0# Initial Step)
```

(Check initial conditions)

```
if IC_FAIL then
FalloCI := true;
FAILED (IBSC); (Initial conditions not satisfied)
else
FalloCI := false;
```

(Initialization)

In the above example, the STEPDESC calls included at the beginning of the sub phase correspond to a IBSTEPDESC DFB block instance to which the following parameters are passed in case of the first call:

- 1: Corresponds to step number 1.
- Init: Corresponds to the definition of the step.
- IBSC: Corresponds to the SC public variable of the IBPHASE block instance that is controlling the phase execution.
- IBST: Corresponds to the DDT_ST variable of the IBPHASE block instance that is controlling the phase execution.
- IBCFG: Corresponds to the DDT_CFG variable of the IBPHASE block instance that is controlling the phase execution.

Inputs

Input Parameter Description

Parameter	Type	Description
STEPNUMBER	INT	Number of the sub phase step. The values allowed for the steps are from 1 to 999.
DESC	STRING[22]	Description of the number of the sub phase step. The character string is limited to 17 characters. This is the value that will be shown in the phase monitoring program.

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
IBPHASE_SC	IBPHASE_SC_DDT	Provides the data necessary to communicate with the IBPHASE block that is controlling the phase. Refer to the IBPHASE, page 284 block for more details.
IBPHASE_ST	IBPHASE_ST_DDT	Provides the data necessary to communicate with the IBPHASE block that is controlling the phase. Refer to the IBPHASE, page 284 block for more details.
IBPHASE_CFG	IBPHASE_CFG_DDT	Provides the data necessary to communicate with the IBPHASE block that is controlling the phase. Refer to the IBPHASE, page 284 block for more details.

Public Variables

Public Variable Description

Parameter	Type	Description
ORDERNUMBER	INT	Read-only public variable reserved for building the list of steps in manual mode that will be shown in the monitoring program.
MAXORDERNUMBER	INT	Read-only public variable reserved for building the list of steps in manual mode that will be shown in the monitoring program.

IBPARxx - Batch Phase Parameter Management

What's in This Chapter

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Inputs/Outputs	301
Public Variables	302

Overview

This chapter describes the IBPARxx DFB.

Description

General

The IBPAR05, IBPAR10 and IBPAR16 DFBs manage up to 5, 10, and 16 phase parameters (input and output) respectively. The DFBs facilitate the management of parameters from advanced control phases implemented with the General Purpose Library IBPHASE DFB.

These DFBs manage the phase parameters with a data structure (DDT) making it easier to implement reusable control phases (the number of pins in a DFB is limited to 32 input pins and 32 output pins) because a single variable is used to provide access to the data that the phase manages.

Function Description

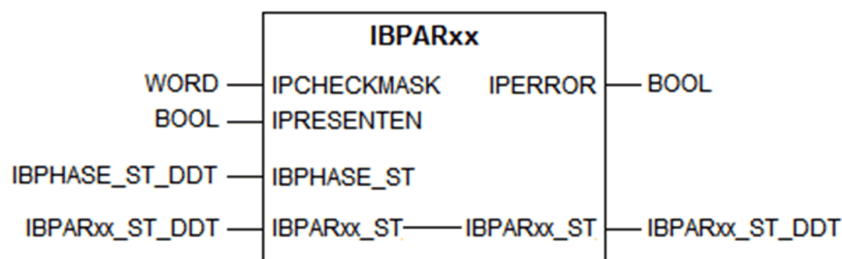
The main functions of the DFB are described in the following table:

Function	Description
Input Parameter Consistency	Optionally, the DFB initializes the values of the input parameters with a value (-0.0) that enables to determine whether or not the applicable parameters of the phase have been correctly downloaded onto the controller. This way, the phase can be stopped from starting with an incomplete or inconsistent set of input parameters.
Owner	The DFB manages control system level, which is the owner (Operator or Program) based on the owner of the associated phase. As a result, it is responsible for defining the input parameters of the phase.
Output Parameters	The DFB manages the output parameters generated from the control phase.

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
IPCHECKMASK	WORD	Optionally, enables to connect a bits word (16) to configure applicable input parameters. Only the applicable parameters will be checked for consistency. Refer to the <code>IPRESETEN</code> input and <code>IPERROR</code> output pin, page 268.
		If no data is connected to this input, the consistency check for input parameter is disabled.
		Bit SP is calculated as:
		0 (2 ⁰) Input parameter 1 is applicable (1) or not (0).
		1 (2 ¹) Input parameter 2 is applicable (1) or not (0).
IPRESETEN	BOOL	...
		15 (2 ¹⁵) Input parameter 16 is applicable (1) or not (0).
		1 = Enables to configure the input parameters need to be initialized with the -0.0 value when the associated control phase switches to an Idle status.
IBPHASE_ST	IBPHASE_ST_DDT	This configuration together with the <code>IPCHECKMASK</code> input pin is used to determine whether or not the input parameters are correctly downloaded (refer to the <code>IPERROR</code> output pin, page 301).
		Enables to connect the state structure of the control phase for which the parameters need to be managed. The DFB uses this structure to determine the state of the phase (Idle, Running and so on) and its owner (Operator or Program).

Outputs

Output Parameter Description

Parameter	Type	Description
IPERROR	BOOL	<p>1 = A detected error in the assignment.</p> <p>0 = The check is not activated.</p> <p>The check is only carried out if the <code>IPCHECKMASK</code> input is connected. If the <code>IPCHECKMASK</code> input is connected, a check is run to verify whether the applicable parameters as defined in the connected bit mask have a value other than -0.0 or not. The responsibility of assigning the -0.0 value belongs to the DFB or the programmer depending on how the <code>IPRESETEN</code> input is configured.</p>

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
IBPARxx_ST	IBPARxx_ST_DDT	Provides the data that is necessary for managing the types of parameters that the DFB manages input, output, and report.

IBPARxx_ST_DDT Type

Name	Type	Description
STW	WORD	Provides the device status usually used from the monitoring subsystem, and allows data to be kept in the memory. Read-only access to the data contained in this word.
CFGW	WORD	Provides the means to control the device from the monitoring subsystem. Read/write access to the data contained in this word.
IP01	REAL	<p>Read/write access</p> <p>Input parameter 1.</p> <p>Input parameter management:</p> <ul style="list-style-type: none"> The DFB initializes the input parameters with a value of -0.0 if the <code>IPRESETEN</code> input is enabled when the phase state switches to Idle. If the owner of the control phase is the Operator (<code>IBPHASE_ST.CFGW.0 = 1</code>), this data is copied to the <code>IPxx</code> fields of the <code>SC</code> public variable. In other words, the input parameters are received from the monitoring or batch control subsystem in the Operator mode. If the owner of the control phase is the Program (<code>IBPHASE_ST.CFGW.0 = 0</code>), the input parameters are overwritten with the data in the <code>IPxx</code> fields of the <code>SC</code> public variable.
...		...
IPxx	REAL	<p>Read/write access</p> <p>Input parameter xx.</p>
OP01	REAL	<p>Read-only access</p> <p>Output parameter 1.</p> <p>Output parameter management:</p>

Name	Type	Description
		<ul style="list-style-type: none"> The values in the <code>OPxx</code> fields of the <code>SC</code> public variable are continuously copied to these output parameters so that they can be accessed from the monitoring subsystem. Therefore, the control phase of the user needs to define the value of the <code>OPxx</code> parameters of the <code>SC</code> public variable to indicate the results of the execution of the phase.
...		...
<code>OPxx</code>	REAL	Read-only access Output parameter xx.

IBPARxx_ST.STW Word Structure

DFB status word. Read-only access. The following table describes the `IBPARxx_ST.STW` Word structure:

Bit	Name	Description
1	<code>ERRDWLDIP-PAR</code>	Detected error downloading input parameter.

Public Variables

Public Variable Description

Variable	Type	Description
<code>SC</code>	<code>IBPARxx_SC_DDT</code>	Provides the data needed to manage the parameters of a phase from the control phase itself or from a different external mechanism.

IBPARxx_SC_DDT Type

Name	Type	Description
<code>IPERROR</code>	BOOL	Read-only access Refer to the <code>IPERROR</code> output pin, page 301.
<code>IP01</code>	REAL	Read/write access Input parameter 1. Input parameter management: <ul style="list-style-type: none"> The DFB initializes the input parameters with a value of -0.0 if the <code>IPRESETEN</code> input is enabled when the phase status switches to Idle. If the owner of the control phase is the Operator (<code>IBPHASE_ST.CFGW.0 = 1</code>), this data is copied to the <code>IPxx</code> fields of the <code>SC</code> public variable. In other words, the input parameters are received from the monitoring or batch control subsystem in the Operator mode. If the owner of the control phase is the Program (<code>IBPHASE_ST.CFGW.0 = 0</code>), the input parameters are overwritten with the data in the <code>IPxx</code> fields of the <code>SC</code> public variable.
...		...
<code>IPxx</code>	REAL	Read/write access Input parameter xx.
<code>OP01</code>	REAL	Read/write access

Name	Type	Description
		Output parameter 1. Output parameter management: <ul style="list-style-type: none">The values in the OP_{xx} fields of the SC public variable are continuously copied to these output parameters so that you can access the parameters from the monitoring subsystem. Therefore, the control phase of the user needs to define the value of the OP_{xx} parameters of the SC public variable to indicate the results of the phase execution.
...		...
OP _{xx}	REAL	Read/write access Output parameter xx.

USERPHASExx - User Defined Process Logic

What's in This Chapter

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Overview

This chapter describes the *USERPHASExx* DFB.

Description

General

It is an unprotected function block in which user can add the logic to manage phase states, strategies depending upon the process controlled by the user. Sample codes are available in the function block for the user reference.

Inputs

Input Parameter Description

Parameter	Type	Description
INITCONDFAIL	BOOL	User can leverage on this input pin to connect to interlock conditions summary (<i>CONDSUM</i>) or other DFBs to take necessary actions depending on the value of <i>INITCONDFAIL</i> .
FAILCOND	BOOL	User can leverage on this input pin to connect to detected error conditions summary (<i>CONDSUM</i>) to take necessary actions depending on the value of <i>FAILCOND</i> .

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
IBPHASE_SC	IBPHASE_SC_DDT	Corresponds to the <i>SC</i> public variable of the <i>IBPHASE</i> block instance that is controlling the phase execution.
IBPHASE_ST	IBPHASE_ST_DDT	Provides the data necessary to communicate with the <i>IBPHASE</i> block that is controlling the phase. Refer to the <i>IBPHASE</i> block, page 284 for more details.
IBPHASE_CFG	IBPHASE_CFG_DDT	Provides the data necessary to communicate with the <i>IBPHASE</i> block that is controlling the phase. Refer to the <i>IBPHASE</i> block, page 284 for more details.

IBPHASE - Example of Use

What's in This Chapter

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DFB Representation	306
Reusable Phase Logic	306

Overview

This chapter describes the example use of the IBPHASE DFB.

Description











































General

This chapter gives an example of Batch phase manager controlled by the IBPHASE, IBTRANS, IBSTABLESTEP, IBFAILED, and IBSTEPDESC DFBs.

The objective of the phase is to control the loading of water in a process unit. For this purpose, a reusable component (DFB) is created so that user can use this phase in different process units by only changing the connections of the component pins.

Reusable Phase Definition

The reusable DFB of the user, PHWATER, declares the IBPHASE IBPHASE_Instance variable to manage the state of the phase.

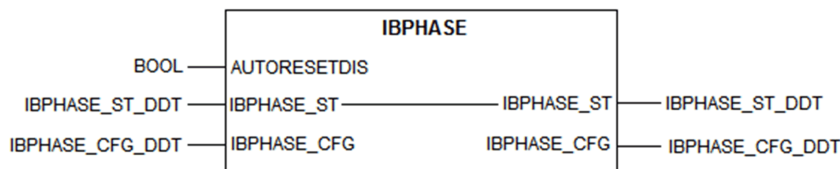
Variables					
DDT Types					
Function Blocks					
DFB Types					
Filter  					
Name 		*PHWATER*			
Name	no.	Type	Value	Comment	
 PHWATER_IB		<DFB>		Phase of water dosing	
 <inputs>					
 <outputs>					
 <inputs/outputs>					
 PARAM05	4	IBPAR05_SC_DDT			
 WATER_VALVE	6	DEVCTL_SC_DDT		Water dosing On/Off valve	
 WATER_FIC	7	PIDCTL_SC_DDT		Water flow regulator	
 WATER_FCV	8	AOUTPUT_SC_DDT		Water flow regulating valve	
 WATER_RAMP	9	ARAMP_SC_DDT		Water flow control ramp	
 WATER_FQ	10	ACALC_SC_DDT		Water totalisers	
 IBSC	15	IBPHASE_SC_DDT			
 IBST	16	IBPHASE_ST_DDT			
 IBCFG	17	IBPHASE_CFG_DDT			
 >					
 <public>					
 >					
 <private>					
 TRANS		IBTRANS			
 STABLESTEP		IBSTABLESTEP			
 FAILED		IBFAILED			
 Running		BOOL			
 Holding		BOOL			
 Restarting		BOOL			
 Aborting		BOOL			
 Stopping		BOOL			
 FaultCI		BOOL		Initial conditions fault detected	
 Dosing_water		BOOL		Dosing water	
 STEPDESC		IBSTEPDESC			
 var1		BOOL			
 >					
 <sections>					
 Init		<ST>			
 RUNNING		<ST>			
 HOLDING		<ST>			
 RESTARTING		<ST>			
 ABORTING		<ST>			
 STOPPING		<ST>			
 Common		<ST>			
 >					

NOTE: Declaration of the auxiliary components manages the transitions (IBTRANS), steady-step flags (IBSTABLESTEP), and notifications to trigger the holding sub phase (IBFAILED).

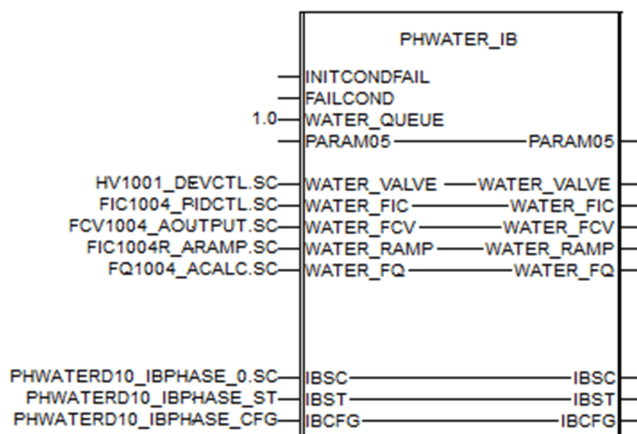
DFB Representation

Representation

The following diagrams include the calls to the phase created by the user as well as to the control block that will control it (IBPHASE).



NOTE: The call to the block controls the execution of the advanced equipment module.



NOTE: The call to the functional block implements the control phase of the user and will reuse for different process units if needed.

Reusable Phase Logic

Phase Logic With Description

The basic structure of the phase as well as the steps that are defined for the phase objective are included: water dosing. The parts of the code that make up the basic structure of the phase are marked in bold.

(Initialization)

The following common actions have to be executed before the phase execution:

```
Running := IBSC.RUNNINGX;
Holding := IBSC.HOLDINGX;
Restarting := IBSC.Restarting;
Aborting := IBSC.Aborting;
Stopping := IBSC.Stopping;
IBSC.INITCONDFAIL := INITCONDFAIL;
```

NOTE: The default actions to be taken by DFB are defined in this section. However, if any section has to be added by user and actions need to be taken before execution of that section, it has to be added here.

(Running or Pausing Subphase)

```

STEPDESC (1, 'Init', IBSC, IBST, IBCFG);
STEPDESC (2, 'Valves ON', IBSC, IBST, IBCFG);
STEPDESC (3, 'Wait Valves ON', IBSC, IBST, IBCFG);
STEPDESC (4, 'Dosing Water', IBSC, IBST, IBCFG);
STEPDESC (5, 'Valves OFF', IBSC, IBST, IBCFG);
STEPDESC (6, 'Waiting for queue', IBSC, IBST, IBCFG);

```

NOTE: Definition of the descriptions for the subphase steps.
(Steps and Transitions)

```
case IBSC.CSTEP of
```

1: (#RunningStep0# Initial Step)

NOTE: First step with a value of 1.

(Check initial conditions)

```
if INITCONDFAIL then
```

```
FaultCI := true;
```

```
FAILED (IBSC); (Initial conditions not satisfied)
```

NOTE: Report detected error to trigger the holding subphase.

```
else
```

```
FaultCI := false;
```

(Initializations)

```
PARAM05.OP01:=0.0;
```

(Reset and water totalizer activation)

```
WATER_FQ.TOTALRST:=true;
```

```
WATER_FQ.TOTALEN:=true;
```

```
TRANS (TRUE, 'True', IBSC.CSTEP + 1, IBSC, IBST, IBCFG); (Next Step)
```

NOTE: Unconditional transition to the next step.

```
end_if;
```

2: (Start Water dosing)

```
if IBSC.ONENTRY then
```

STABLESTEP (IBSC); (In this step, it will initialize the execution in case of Stop/Continue)

NOTE: Execute the actions only for the first time.

NOTE: Flag this step as steady.

```
Dosing_water:=true;
```

```
WATER_VALVE.REM:=false;
```

```
WATER_VALVE.LSP := true;
```

```
if PARAM05.IP01 = 2.0 then
```

```
WATER_FCV.REM:=true;
```

```
WATER_FIC.REM:=false;
```

```
WATER_FIC.MAN:=true;
```

```
WATER_FIC.LOP:=10.0;
```

```
else
```

```
WATER_FCV.REM:=false;
```

```

WATER_FCV.LSP:=100.0;

end_if;

end_if;

TRANS (TRUE, 'True', IBSC.CSTEP + 1, IBSC, IBST, IBCFG) ; (Next step)

```

NOTE: The evaluation priority for these transitions is the order in which they are shown (up down; these transitions are not functional, and have only been included as an example in this case). You can define a maximum of 6 transitions.

3: (Wait for open valve)

```

TRANS (WATER_VALVE.HIGHPOS, 'Valve open?', IBSC.CSTEP + 1, IBSC,
IBST, IBCFG) ; (Next step)

```

4: (Wait for end of Water dosing)

```

if IBSC.ONENTRY then

if PARAM05.IP01 = 2.0 then (Dose)

WATER_RAMP.REM := false; (Set point of flow ramp)

WATER_RAMP.LTARGETSP:=PARAM05.IP03; (Desired set point)

WATER_RAMP.LSTART:=true;

WATER_FIC.REM:=true;

WATER_FIC.AUTO:=true;

WATER_FIC.LSP:=PARAM05.IP03; (Flow regulation)

end_if;

end_if;

TRANS ((PARAM05.IP02 - WATER_QUEUE) <= PARAM05.OP01, 'Dosing
finished?', IBSC.CSTEP + 1, IBSC, IBST, IBCFG);

```

5: (End Water dosing)

```

if IBSC.ONENTRY then

if PARAM05.IP01 = 2.0 then

WATER_RAMP.LSTART:=false;

WATER_FIC.REM:=false;

WATER_FIC.MAN:=true;

WATER_FIC.LOP:=0.0;

else

WATER_FCV.LSP:=0.0;

end_if;

WATER_VALVE.LSP:=false;

STABLESTEP (IBSC) ; (In this step, it will initialize the execution in case of Stop/
Continue)

end_if;

TRANS (WATER_VALVE.LOWPOS, 'Valve Closed?', IBSC.CSTEP + 1,
IBSC, IBST, IBCFG);

```

6: (Wait for Water queue)

```

if IBSC.ONENTRY then

(Wait for COLA_AGUA (Water queue) to fall)

```


STABLESTEP (IBSC) ; (In this step, it will initialize the execution in case of Stop/Continue)

end_if;

TRANS (IBSC.ETIME >= 50, 'Waiting for queue', -1, IBSC, IBST, IBCFG) ; (End of phase)

NOTE: Complete phase (go to COMPLETE) when the transition condition is met.

end_case;

(Actions common to several steps)

(Detected error condition monitoring after initializations)

if IBSC.CSTEP > 0 and FAILCOND then

FAILED (IBSC) ; (* It causes Hold phase execution *)

end_if;

(Holding Subphase)

STEPDESC (1, 'Init', IBSC, IBST, IBCFG) ;

STEPDESC (2, 'Closing Valves', IBSC, IBST, IBCFG) ;

(Steps and Transitions)

case IBSC.CSTEP of

1: (Initial Step)

if FaultCI then

Dosing_water:=false;

end_if;

TRANS (FaultCI, 'Not InitCond', -1, IBSC, IBST, IBCFG) ; (End of phase)

TRANS (NOT FaultCI, 'InitCond OK', IBSC.CSTEP + 1, IBSC, IBST, IBCFG) ; (Next step)

2:

if IBSC.ONENTRY then

WATER_VALVE.LSP:= false;

WATER_RAMP.LSTART:=false;

WATER_FIC.MAN:=true;

WATER_FIC.LOP:=0.0; (To close regulating valve)

end_if;

If (Dosing_water) AND IBSC.ETIME >= 50 then

Dosing_water:=false;

end_if;

TRANS (IBSC.ETIME >= 50 OR NOT Dosing_water, 'Waiting for queue', -1, IBSC, IBST, IBCFG) ; (End of phase)

end_case;

(Restarting subphase)

STEPDESC (1, 'Init', IBSC, IBST, IBCFG) ;

(Steps and Transitions)

```

case IBSC.CSTEP of
  1: (Initial Step)
    TRANS (TRUE, 'True', -1, IBSC, IBST, IBCFG) ; (End of phase)
  end_case;
  (Aborting subphase)
    STEPDESC (1, 'Closing Valves', IBSC, IBST, IBCFG) ;
  (Steps and Transitions)
    case IBSC.CSTEP of
      1: (Initial Step)
        WATER_VALVE.REM:=false;
        WATER_VALVE.LSP:=false;
        WATER_RAMP.LSTART:=false;
        WATER_FIC.MAN:=true;
        WATER_FIC.LOP:=0.0; (Close control valve)
        Dosing_water:=false;
        TRANS (TRUE, 'True', -1, IBSC, IBST, IBCFG) ; (End of phase)
      end_case;
      (Stopping subphase)
        STEPDESC (1, 'Closing Valves', IBSC, IBST, IBCFG) ;
        STEPDESC (2, 'Waiting for queue', IBSC, IBST, IBCFG) ;
      (Steps and Transitions)
        case IBSC.CSTEP of
          1: (Initial Step)
            WATER_VALVE.REM:=false;
            WATER_VALVE.LSP:= false;
            WATER_RAMP.LSTART:=false;
            WATER_FIC.MAN:=true;
            WATER_FIC.LOP:=0.0; (To close regulating valve)
            TRANS (TRUE, 'True', IBSC.CSTEP + 1, IBSC, IBST, IBCFG) ; (Next step)
          2:
            If (Dosing_water ) AND IBSC.ETIME >= 50 then
              Dosing_water:=false;
            end_if;
            TRANS (IBSC.ETIME >= 50 OR NOT Dosing_water, 'Waiting for queue',
              -1, IBSC, IBST, IBCFG) ; (End of phase)
          end_case;
          Common actions to be executed after the phase execution.
          if Dosing_water then
            PARAM05.OP01 := WATER_FQ.TOTAL;
          end_if;

```

NOTE: No default actions are defined in this section. However, if any action has to be taken after execution of section, it has to be added here.

Auxiliary Functions

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Overview

This part provides a detailed description of the functions, pins, pin layout, and variables of the function blocks of the auxiliary functions family.

Auxiliary function blocks can be used in conjunction with other DFBs to provide additional services and data.

These function blocks do not reflect any specific installation.

⚠ WARNING

LOSS OF CONTROL

- Perform a Failure Mode and Effects Analysis (FMEA), or equivalent risk analysis, of your application, and apply preventive and detective controls before implementation.
- Provide a fallback state for undesired control events or sequences.
- Provide separate or redundant control paths wherever required.
- Supply appropriate parameters, particularly for limits.
- Review the implications of transmission delays and take actions to mitigate them.
- Review the implications of communication link interruptions and take actions to mitigate them.
- Provide independent paths for control functions (for example, emergency stop, over-limit conditions, and error conditions) according to your risk assessment, and applicable codes and regulations.
- Apply local accident prevention and safety regulations and guidelines.¹
- Test each implementation of a system for proper operation before placing it into service.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

¹ For additional information, refer to NEMA ICS 1.1 (latest edition), *Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control* and to NEMA ICS 7.1 (latest edition), *Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems* or their equivalent governing your particular location.

ASELECT - Analog Signal Selector

What's in This Chapter

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Overview

This chapter describes the ASELECT DFB.

Description

General

The ASELECT DFB elects an analog signal from among a maximum of four signals based on the chosen selection criterion.

This DFB can supplement the PIDCTL and AOUTPUT DFBs from the General Purpose Library.

Function Description

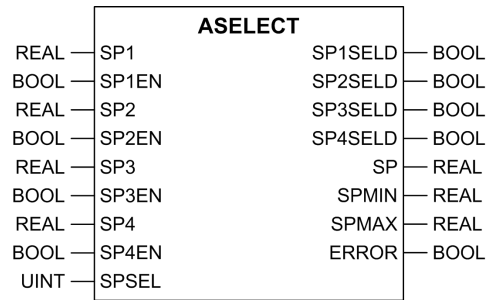
The main functions of the DFB are summarized in the following table:

Function	Description
Selection	The DFB selects the analog signal from among the input signals according to one of the following criteria: <ul style="list-style-type: none">• Maximum• Minimum• Direct selection
Feedback	The DFB generates the signals needed to report to the DFBs. These DFBs generate the analog signals whether or not their signals have been selected. This functionality is especially useful when PID control is implemented in Override mode.

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
SP1..SP4	REAL	Value of the analog signals to be selected.
SP1EN..SP4EN	BOOL	1 = Enables the corresponding input signal.
SPSEL	UINT	Enables to select the selection method used:
		SPSEL SP is calculated as:
		0 Minimum value among the enabled SP _x signals (refer to the SPMIN, page 314 output pin).
		1 SP1
		2 SP2
		3 SP3
		4 SP4
		5 Maximum value among the enabled SP _x signals (refer to the SPMAX, page 314 output pin).

Outputs

Output Parameter Description

Parameter	Type	Description
SP1SELD..SP4SELD	BOOL	1 = Indicates the corresponding input (SP _x) has been selected depending on the enabled signals and the selector value (refer to the SPSEL, page 314 input). No signal is activated if the selected signal (1..4) is not enabled or if the selector value is not valid (SPSEL>5).
SP	REAL	Input value (SP1-SP4) selected with the SPSEL input signal. Refer to the SP1SELD-SP4SELD outputs for more details. Set to 0 when none of these outputs is activated.
SPMIN	REAL	Minimum input value (SP1-SP4) among those enabled. Set to 0 if no output is enabled.
SPMAX	REAL	Maximum input value (SP1-SP4) among those enabled. Set to 0 if no output is enabled.
ERROR	BOOL	1 = Is activated if: <ul style="list-style-type: none"> The SPSEL input value is out of range. The selected signal is not enabled. No input signal is enabled (SP_xEN).

ASELECT1 - Selector for Analog Signals with Monitoring Variables

What's in This Chapter

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Overview

This chapter describes the ASELECT1 DFB.

Description

General

The ASELECT1 DFB features the same functionalities of the ASELECT component except for the fact that it has variables designed for monitoring the DFB and owner management purposes.

The component is designed to select an analog signal from among a maximum of 4 signals depending on the chosen selection criterion.

You can supplement this DFB with the PIDCTL and AOUTPUT (as well as other) DFBs from the General Purpose Library.

Function Description

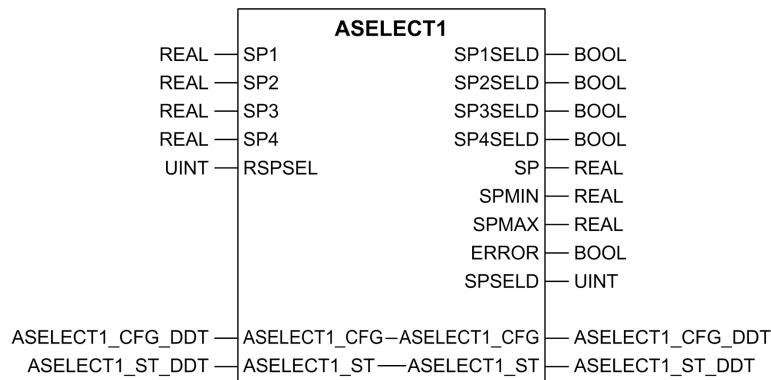
The main functions of the DFB are summarized in the following table:

Function	Description
Selection	The DFB selects the analog signal from among the input signals according to one of the following criteria: <ul style="list-style-type: none">• Maximum• Minimum• Direct selection
Feedback	The DFB generates the signals needed to report to the DFBs. These DFBs generate the analog signals whether or not their signals have been selected. This functionality is especially useful when PID control is implemented in Override mode.
Owner	The DFB manages control system level, which is the owner (Operator or Program). Therefore, it is responsible for selecting the signal.

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
SP1..SP4	REAL	Value of the analog signals to be selected. The connection or non-connection of a value or variable to the DFB pin enables/disables the corresponding signal.
RSPSEL	UINT	Enables to select the selection method used:
		RSPSEL SP is calculated as:
		0 Minimum value among the enabled SP _x signals (refer to the SPMIN, page 316 output).
		1 SP1
		2 SP2
		3 SP3
		4 SP4
		5 Maximum value among the enabled SP _x signals (refer to the SPMAX, page 316 output).

Outputs

Output Parameter Description

Parameter	Type	Description
SP1SELD..SP4SELD	BOOL	1 = Indicates the corresponding input (SP _x) has been selected depending on the enabled signals and the selector value (refer to the RSPSEL, page 316 input). No signal is activated if the selected signal (1..4) is not enabled or if the selector value is not valid (SPSEL>5).
SP	REAL	Input value (SP1-SP4) selected with the SPSEL input signal. Refer to the SP1SELD-SP4SELD outputs for more details. Set to 0 when none of these outputs is activated.
SPMIN	REAL	Minimum input value (SP1-SP4) among those connected. Set to 0 if no output is connected.
SPMAX	REAL	Maximum input value (SP1-SP4) among those connected. Set to 0 if no output is connected.

Parameter	Type	Description
ERROR	BOOL	1 = Is activated if: <ul style="list-style-type: none"> The RSPSEL input value is out of range. The selected signal is not connected. No signal is selected. No input signal is connected.
SPSELD	UINT	Selected selection method. Refer to the table for the RSPSEL, page 316 input pin.

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
ASELECT1_ST	ASELECT1_ST_DDT	Provides the data needed to monitor and/or control the DFB status.
ASELECT1_CFG	ASELECT1_CFGW_DDT	Provides the data necessary to configure the DFB usually from the monitoring subsystem.

ASELECT1_ST_DDT Type

Name	Type	Description
STW	WORD	Provides the device status usually used from the monitoring subsystem, and allows data to be kept in the memory. Read-only access to the data contained in this word.
CFGW	WORD	Provides the means to control the device from the monitoring subsystem. Read/write access to the data contained in this word.
SP	REAL	Current set-point generated by the DFB. Refer to the SP, page 316 output.

ASELECT1_ST.STW Word Structure

DFB status word. Read-only access. The following table describes the ASELECT1_ST.STW word:

Bit	Name	Description
0	MINSELD	Minimum selected input (SPSELD = 0).
1	SP1SELD	Refer to the SP1SELD, page 316 output pin.
2	SP2SELD	Refer to the SP2SELD, page 316 output pin.
3	SP3SELD	Refer to the SP3SELD, page 316 output pin.
4	SP4SELD	Refer to the SP4SELD, page 316 output pin.
5	MAXSELD	Maximum selected input (SPSELD = 5).
6	MINEN	Enables (1) the selection of the lowest SP _x value. Enabled when more than one set-point is connected.
7	SP1EN	SP1 selection enabled. Enabled when a variable or value is connected to input SP1.
8	SP2EN	SP2 selection enabled. Enabled when a variable or value is connected to input SP2.

Bit	Name	Description
9	SP3EN	SP3 selection enabled. Enabled when a variable or value is connected to input SP3.
10	SP4EN	SP4 selection enabled. Enabled when a variable or value is connected to input SP4.
11	MAXEN	Enables (1) the selection of the highest SP _x value. Enabled when more than one set-point is connected.
12	ERROR	Refer to the ERROR, page 316 output pin.

ASELECT1_ST.CTGW Word Structure

Provides the data needed to configure the DFB usually from the monitoring subsystem. The following table describes the ASELECT1_ST.CFGW word:

Bit	Name	Description
0	OWNER	Read/write access Enables to configure whether the set-point selection parameters are set by the Program (0) or by the Operator (1).
1	MINSEL	Read/write access Enables to select the minimum local set-point (OWNER = 1) of the Operator from the monitoring subsystem. If the set-point is set by the Program (OWNER = 0), the DFB continuously updates the value.
2	SP1SEL	Read/write access Enables to select the local SP1 set-point (OWNER = 1) of the Operator from the monitoring subsystem. If the set-point is set by the Program (OWNER = 0), the DFB continuously updates the value.
3	SP2SEL	Read/write access Enables to select the local SP2 set-point (OWNER = 1) of the Operator from the monitoring subsystem. If the set-point is set by the Program (OWNER = 0), the DFB continuously updates the value.
4	SP3SEL	Read/write access Enables to select the local SP3 set-point (OWNER = 1) of the Operator from the monitoring subsystem. If the set-point is set by the Program (OWNER = 0), the DFB continuously updates the value.
5	SP4SEL	Read/write access Enables to select the local SP4 set-point (OWNER = 1) of the Operator from the monitoring subsystem. If the set-point is set by the Program (OWNER = 0), the DFB continuously updates the value.
6	MAXSEL	Read/write access Enables to select the maximum local set-point (OWNER = 1) of the Operator from the monitoring subsystem. If the set-point is set by the Program (OWNER = 0), the DFB continuously updates the value.

ASELECT1_CFG_DDT Type

Name	Type	Description
SP1	REAL	Read-only access Value on SP1 input.
SP2	REAL	Read-only access Value on SP2 input.

Name	Type	Description
SP3	REAL	Read-only access Value on SP3 input.
SP4	REAL	Read-only access Value on SP4 input.

Public Variables

Public Variable Description

Variable	Type	Description
SC	ASELECT1_SC_DDT	Provides the frequently needed data to monitor and/or control the DFB status from the sequential control.

ASELECT1_SC_DDT Type

Name	Type	Description
REM	BOOL	Read/write access 1 = Allows the DFB to be configured for a remote set-point -RSPSEL. 0 = Allows the DFB to be configured for a local set-point -LSPSEL- (0).
OWNER	BOOL	Read-only access Refer to the ASELECT1_ST.CFGW.OWNER input/output pin, page 317.
SP	REAL	Read-only access. Refer to the SP output pin, page 316.
LSPSELD	UINT	Read/write access Enables the sequential control to assign the local set-point if the owner is the Program (OWNER input/output is set to 0) and the selected set-point is the local one (SC.REM public variable is set to 0). Otherwise, the current set-point (SPSELD output) is continuously copied to this variable.
SP1SELD	BOOL	Read-only access Refer to the SP1SELD output pin, page 316.
SP2SELD	BOOL	Read-only access Refer to the SP2SELD output pin, page 316.
SP3SELD	BOOL	Read-only access Refer to the SP3SELD output pin, page 316.
SP4SELD	BOOL	Read-only access Refer to the SP4SELD output pin, page 316.
ERROR	BOOL	Read-only access Refer to the ERROR output pin, page 316.

CONDSUM - Summary of Conditions

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Overview

This chapter describes the CONDSUM DFB.

Description

General

The CONDSUM DFB is used to evaluate up to 15 signals that can be used, for example, as interlocks or initial conditions. The DFB allows to evaluate the logic OR of these conditions to be evaluated. Each of them can require individual resetting or be ignored according to the DFB configuration.

You can use this DFB as a supplement to the rest of the General Purpose Library DFBs to evaluate their interlocking inputs.

Function Description

The main functions of the DFB are described in the following table:

Function	Description
Summary Condition Evaluation	The DFB ORs the conditions.
Manual Reset Conditions	Conditions configured this way require resetting from the monitoring system.
Bypass	Enables the corresponding condition (one by one) to be ignored when evaluating the expression.

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

Parameter	Type	Description
CONDxx	BOOL	1 = Condition activated
REQREARMxx	BOOL	1 = Enables to require manual resetting when the corresponding input condition (CONDxx) is activated.

Bit	Description
...	...
14	COND15
15	RESULT

The following table describes the `CONDSUM_ST.BYPASSW` word:

Bit	Description
0	BYPASS01
1	BYPASS02
...	...
14	BYPASS15

The following table describes the `CONDSUM_ST.REARMREQW` word:

Bit	Description
0	REARMREQ01
1	REARMREQ02
...	...
14	REARMREQ15

Public Variables

Public Variable Description

Variable	Type	Description
SC	CONDSUM_SC_DDT	Provides the frequently needed data to monitor the DFB status from the sequential control.

CONDSUM_SC_DDT Type

Name	Type	Description
RESULT	BOOL	Read-only access Refer to the <code>RESULT</code> output pin, page 322.

CONDSUM1 - Interlock Condition Summary

What's in This Chapter

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Overview

This chapter describes the CONDSUM1 DFB.

Description

General

The features of the CONDSUM1 DFB are similar to those of the CONDSUM DFB. The CONDSUM1 DFB is used to evaluate up to 7 conditions to implement interlocking strategies. The DFB allows to evaluate the logic OR of these conditions. Each of them can require individual resetting or be ignored (bypassed) according to the DFB configuration.

You can link this DFB to other DFBs of the General Purpose library to evaluate their interlocking inputs and positions.

The table compares the functions of the CONDSUMx DFBs:

Function	CONDSUM	CONDSUM1
Maximum number of conditions	15	7
Condition prioritization	N	Y
Evaluation of interlock positions	N	Y
Possibility of inhibiting bypassing on a condition-by-condition basis	N	Y

Function Description

The main functions of the DFB are described in the following table:

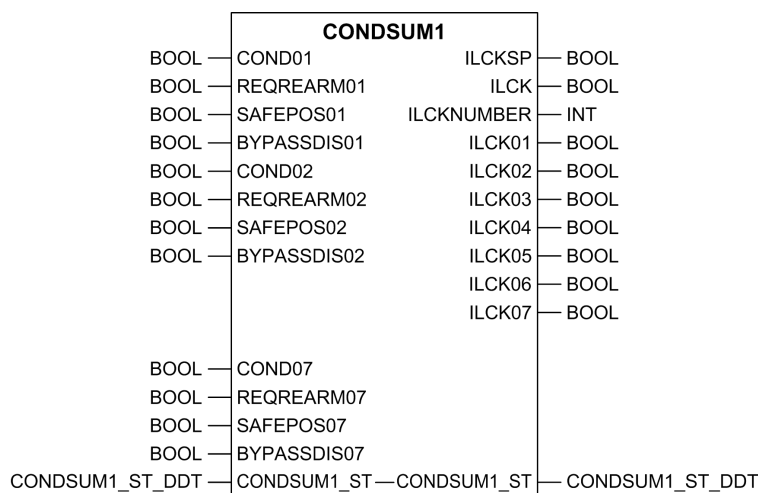
Function	Description
Interlock Evaluation	The DFB ORs the conditions giving Condition 1 priority over Condition 2, Condition 2 priority over Condition 3, and so on.
Evaluation of interlock positions	Each condition has a discrete position associated with it. The DFB evaluates the position of each condition based on the active conditions evaluated according to priority.
Interlocks Featuring Manual Resetting	Process conditions configured this way require resetting from the Supervision system.

Function	Description
Bypass	Allows to bypass interlock conditions one by one. The DFB allows to configure conditions that can be bypassed and others that cannot.
Active Interlock Indication	The DFB features output signals that report the state of each interlock condition after internal logic has been applied (resetting and bypassing). These signals can be used to implement program logic, or to select the analog position for other DFBs that require it (for example, AOUTPUT) by using an external multiplexer (for example, ASELECT1).

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

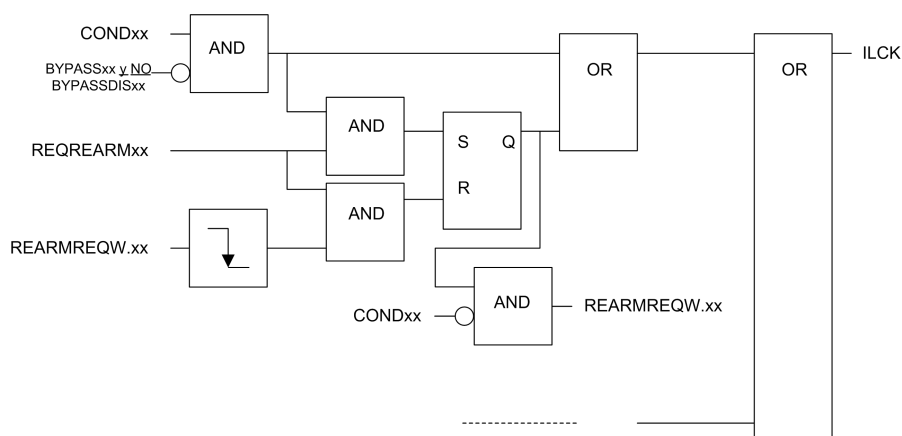
Input Parameter Description

Parameter	Type	Description
CONDxx	BOOL	1 = Interlock condition activated
REQREARMxx	BOOL	1 = Enables to configure for manual resetting to be required when the corresponding input condition (CONDxx) is activated.
SAFEPOSxx	BOOL	1 = Enables to configure which is the position (0 or 1) that is associated to each interlock condition (CONDxx).
BYPASSDISxx	BOOL	1 = Bypassing Disabled. Makes it possible to disable bypassing for the corresponding interlock conditions (CONDxx).

Outputs

Output Parameter Description

Parameter	Type	Description
ILCKSP	BOOL	1 = Indicates the interlock position (refer to the <i>SAFEPOSxx</i> , page 325 inputs) that is associated to the active interlock after priorities have been applied (refer to the <i>ILCK</i> output). If no interlocks are active, the <i>ILCKSP</i> output is set to 0 by default.
ILCK	BOOL	1 = Summarizes the status of the interlock after ORing the conditions according to priority and the following logic: In contrast to the <i>CONDSUM</i> DFB, conditions are applied with priority. Every condition is evaluated every time, but the position (refer to the <i>ILCKSP</i> output) is determined solely based on the first active interlock condition (the one with the highest priority is condition 01 while the one with the lowest priority is condition 07).
ILCKNUMBER	INT	Indicates the index of the active interlock (1..7). Set to 0 by default if no interlocks are active.
ILCKxx	BOOL	1 = Activated depending on the corresponding interlock condition is active (considering both bypassing and whether or not the condition requires manual resetting). Each output is independent from the previous one so that the number of <i>ILCKxx</i> outputs activated corresponds to the number of simultaneous active interlocks.



Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
CONDSUM1_ST	CONDSUM1_ST_DDT	Data structure that is used as an interface with the monitoring subsystem.

CONDSUM1_ST_DDT Type

Name	Type	Description
CONDW	WORD	Read-only access Bits word with the status for each interlock and the summary of the corresponding evaluation (refer to the ILCKxx, page 326 outputs).
BYPASSW	WORD	Read/write access Bits word with the bypass signals set from the monitoring system. If the corresponding BYPASSDISxx input signal is active, the DFB forces the value of the corresponding bit in this word to 0.
REARMREQW	WORD	Read/write access Bits word with the required resetting signals (1) set from the DFB and forced resetting (0) signals set from the monitoring system.

CONDSUM1_ST.CONDW Word Structure

Read-only access. Bits word with input conditions (refer to the CONDxx, page 325 inputs) and their evaluation summary (refer to the ILCK, page 326 output). The following table describes the CONDSUM1_ST.CONDW word:

Bit	Description
0	Interlock 01. Refer to the ILCK01, page 326 output pin.
1	Interlock 02. Refer to the ILCK02, page 326 output pin.
...	...
6	Interlock 07. Refer to the ILCK07, page 326 output pin.
15	Resulting interlock. Refer to the ILCK, page 326 output pin.

CONDSUM1_ST.BYPASSW Word Structure

Read/write access. Bits word with the bypass signals set from the monitoring system. The following table describes the CONDSUM1_ST.BYPASSW word:

Bit	Description
0	Active bypass (1) for interlock 01
1	Active bypass (1) for interlock 02
...	...
6	Active bypass (1) for interlock 07.

CONDSUM1_ST.REARMREQW Word Structure

Read/write access. Bits word with the required resetting signals (1) set from the DFB and forced resetting (0) signals set from the monitoring system. The following table describes the CONDSUM1_ST.REARMREQW word:

Bit	Description
0	Interlock 01 requires resetting (1) or does not require resetting (0). Interlock 01 is reset by setting it to 0.
1	Interlock 02 requires resetting (1) or does not require resetting (0). Interlock 02 is reset by setting it to 0.
...	...
6	Interlock 07 requires resetting (1) or does not require resetting (0). Interlock 07 is reset by setting it to 0.

Public Variables

Public Variable Description

Variable	Type	Description
SC	CONDSUM1_SC_DDT	Provides the frequently needed data to monitor the status of the DFB from the sequential control.

CONDSUM1_SC_DDT Type

Name	Type	Description
ILCK	BOOL	Read-only access Refer to the <code>ILCK</code> output pin, page 326.
ILCKSP	BOOL	Read-only access Refer to the <code>ILCKSP</code> output pin, page 326.

MSGBOX - Messages to the Operator

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Overview

This chapter describes the MSGBOX DFB.

Description

General

The MSGBOX DFB offers a standard user interface mechanism and allows messages to be displayed for the operator. This DFB enables to request confirmations and/or data without having to configure customized interfaces to channel the messages

The DFB combined with the Modicon Libraries - General Purpose function blocks allows you to configure the format of the message for the operator so that you can format the message from the program in Control incorporating icons, buttons, and/or data entry fields.

Function Description

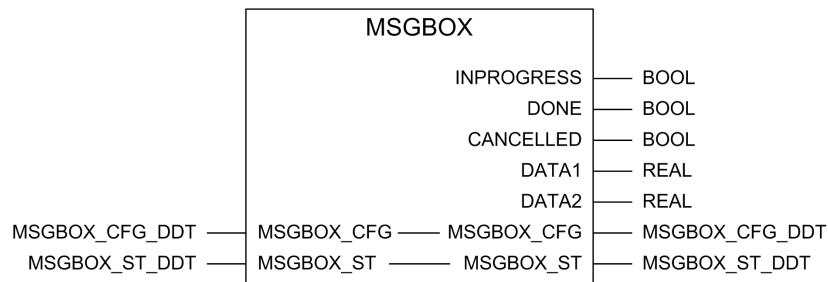
The main functions of the DFB are described in the following table:

Function	Description
Message Display Management	The DFB allows the message display to be activated/aborted. Only one message is managed at a time. Therefore, the number of MSGBOX DFBs instantiated needs to be equal to the number of simultaneous messages required per processing unit.
Icons	Allows you to select the icon that needs to be shown on the user interface. Enables to display the following icons: <ul style="list-style-type: none"> • Stop: To show diagnostics messages, for example. • Question mark: To show request messages for data entry, for example. • Exclamation mark: To show alert messages, for example. • Information: To show steps, or the status of the process in general, for example.
Buttons	Enables you to select the buttons that apply: <ul style="list-style-type: none"> • No buttons required (for alert messages, for example). • One single OK button (for example, for manual action confirmation messages). • An OK button and a Cancel button (for example, for messages in which the user needs to choose between two alternatives).
Optional Data	You can show up to 2 pieces of data stored in the controller along with the message. A request for the entry of those pieces of data can also be issued; for example, for entering process sampling results.

DFB Representation

Representation

This DFB has been specifically designed for use with the FBD language of the controller.



Inputs

Input Parameter Description

The function module does not have inputs. Its operation parameters are configured through the `SC` public variable and the `MSGBOX_CFG` and `MSGBOX_ST` data exchange structures.

Outputs

Output Parameter Description

Parameter	Type	Description
INPROGRESS	BOOL	1 = This signal is kept activated while a message is waiting for response, that is, if a request for a new message has been issued (<code>SC.SHOW = 1</code> and <code>SC.CODE <> 0</code>) and none of the selected buttons have been clicked on yet (OK → <code>MSGBOX_ST.CFGW.8</code> – or Cancel → <code>MSGBOX_ST.CFGW.9</code> –) or if an abort request has been issued (<code>SC.ABORT</code>) for the message (the only option to finalize the message for alert messages without waiting for an operator action).
DONE	BOOL	1 = This signal is activated upon accepting the message in progress, that is, when the OK button is clicked on <code>MSGBOX_ST.CFGW.OK</code> input/output pin, page 331 while a message is pending for response (<code>INPROGRESS = 1</code>). The signal is deactivated (0) when the message in progress is aborted or a new message is in progress.
CANCELLED	BOOL	1 = This signal is activated upon canceling the message in progress, that is, when the Cancel button is clicked on <code>MSGBOX_ST.CFGW.CANCEL</code> input/output pin, page 331 while a message is pending for response (<code>INPROGRESS = 1</code>). The signal is deactivated (0) when the message in progress is aborted or if a new message is in progress.
DATA1	REAL	Enables to check the first optional data shown to the operator and/or entered by the operator according to the type of message selected. This data is not exchanged until it has been confirmed by the operator (any values that could have possibly been entered previously during editing are not copied). This signal is only applicable if <code>MSGBOX_ST.STW.DATA1EN</code> is equal to 1.
DATA2	REAL	Enables to check the second optional data shown to the operator and/or entered by the operator according to the type of message selected. This data is not exchanged until it has been confirmed by the operator (any values that could have possibly been entered previously during editing are not copied). This signal is only applicable if <code>MSGBOX_ST.STW.DATA2EN</code> is equal to 1.

Inputs/Outputs

Input/Output Parameter Description

Parameter	Type	Description
MSGBOX_ST	MSGBOX_ST_DDT	Provides the data necessary for displaying the message, carrying out the applicable actions (OK and/or Cancel) and defining the message to be shown.
MSGBOX_CFG	MSGBOX_CFG_DDT	Provides the additional data (Data 1 and/or Data 2) that can be associated with the message in progress.

MSGBOX_ST_DDT Type

Name	Type	Description
STW	WORD	Provides the data necessary to display the message. Reproduces the values entered in <code>SC.MODE</code> (type of message to be shown). Read-only access
CFGW	WORD	Enables the applicable actions (OK and/or Cancel) to be carried out. Read/write access
MSG	STRING[40]	Main message to be shown. The character string is limited to 39 characters.

The following table describes the `MSGBOX_ST.STW` word:

Bit	Name	Description			
0	OKEN	Indicates that the OK button is applicable to the message in progress.			
1	OKCANCELEN	Indicates that the OK and Cancel buttons are applicable to the message in progress.			
2	DATA1EN	Indicates that Data 1 is applicable to the message in progress.			
3	DATA2EN	Indicates that Data 2 is applicable to the message in progress.			
4	ICON1EN	Refer to the MSGBOX_ST.STW.ICON3EN input/output.			
5	ICON2EN	Refer to the MSGBOX_ST.STW.ICON3EN input/output.			
6	ICON3EN	Combined with MSGBOX_ST.STW.ICON1EN and MSGBOX_ST.STW.ICON2EN, enables to select the icon to be shown with the message. Refer to the SC.Mode public variable, page 332.			
		ICON1EN	CON2EN	ICON3EN	Icon
		OFF	OFF	OFF	No icons are displayed
		OFF	OFF	ON	Information icon
		OFF	ON	OFF	Question icon
		OFF	ON	ON	Exclamation icon
		ON	OFF	-	Stop icon
		ON	ON	-	Exclamation icon

The following table describes the `MSGBOX_ST.CFGW` word:

Bit	Name	Description
8	OK	Setting this signal to 1 enables to OK the message. The DFB sets this signal to 0 after the signal has been processed.
9	Cancel	Setting this signal to 1 enables to Cancel the message. The DFB sets this signal to 0 after the signal has been processed.

MSGBOX_CFG_DDT Type

The following table describes the MSGBOX_CFG_DDT type:

Name	Type	Description
DATA1	REAL	Data 1 associated with the message. Loaded with SC.DATA1 when the latter is applicable (refer to the SC.MODE public variable, page 332) when showing the message. And vice-versa, the value in this signal is copied to SC.DATA1 after the message has been confirmed, provided that the data is applicable (refer to the SC.MODE public variable, page 332).
DATA2	REAL	Data 2 associated with the message. Loaded with SC.DATA2 when the latter is applicable (refer to the SC.MODE public variable, page 332) when showing the message. And, vice-versa, the value in this signal is copied to SC.DATA2 once the message has been confirmed, provided that the data is applicable (refer to the SC.MODE public variable, page 332).
MSG1	STRING[40]	Data 1 supplementary message. Limited to 39 characters. Loaded with SC.MSG1 when the latter is applicable (refer to the SC.MODE public variable, page 332) when showing the message.
MSG2	STRING[40]	Data 2 supplementary message. Limited to 39 characters. Loaded with SC.MSG2 when the latter is applicable (refer to the SC.MODE public variable, page 332) when showing the message.

Public Variables

Public Variable Description

Variable	Type	Description
SC	MSGBOX_SC_DDT	Provides the interface for configuring the messages that are to be shown, as well as their format (buttons, icons, and/or additional data).

The following table describes the MSGBOX_SC_DDT type:

Name	Type	Description
MSG	STRING[40]	Read/write access Defines the message to be shown. The character string is limited to 39 characters. The value set in this character string is transferred to MSGBOX_ST.MSG the moment that message activation (SC.SHOW = 1) is requested.
MSG1	STRING[40]	Read/write access Defines supplementary message 1 to be shown. It is applicable as a supplementary message for the main message, or as a descriptive message for data 1. The character string is limited to 39 characters. The value defined in this character string is transferred to MSGBOX_CFG.MSG1 the moment that message activation (SC.SHOW = 1) is requested.
MSG2	STRING[40]	Read/write access Sets the desired supplementary message 2 to be shown. It is applicable as a supplementary message for the main message, or as a descriptive message for data 2. The character string is limited

Name	Type	Description
		to 39 characters. The value defined in this character string is transferred to <code>MSGBOX_CFG.MSG2</code> the moment that message activation (<code>SC.SHOW = 1</code>) is requested.
MODE	UINT	Read/write access Refer to the <code>MODE</code> signal.
DATA1	REAL	Read/write access Needs to be set with the initial value to be shown in data 1 of the message if this data is applicable when the message is activated (<code>SC.SHOW = 1</code>). Also, it allows the value entered by the user to be captured after the message is confirmed with the OK button (<code>MSGBOX_ST.CFGW.OK</code>).
DATA2	REAL	Read/write access Needs to be set with the initial value to be shown in data 2 of the message if this data is applicable when the message is activated (<code>SC.SHOW = 1</code>). Also, it allows the value entered by the user to be captured after the message is confirmed with the OK button (<code>MSGBOX_ST.CFGW.OK</code>).
SHOW	BOOL	Read/write access 1 = Enables the message to be activated. 0 = The DFB sets the signal to 0 after the signal has been processed. Prior to activation of this signal, the text of the message to be shown (<code>SC.MSG</code>) and its format (<code>SC.MODE</code>) needs to be defined.
ABORT	BOOL	Read/write access 1 = Enables the display of the message in progress to be aborted. 1 = The DFB sets the signal to 0 after the latter is processed. It is used both to stop showing display-only messages and to abort messages that are awaiting the operator action.
INPROGRESS	BOOL	1 = Read-only access. Refer to the <code>INPROGRESS</code> output pin, page 330.
DONE	BOOL	Read-only access Refer to the <code>DONE</code> output pin, page 330.
CANCELLED	BOOL	Read-only access Refer to the <code>CANCELLED</code> output pin, page 330.

MODE Signal

Enables to configure the type of message that needs to be displayed and configure the icons (Stop, Question, Exclamation, or information), buttons (**OK** and/or **Cancel**), and/or additional data (up to 2) that needs to be shown together with the message. The configuration loaded in this signal is transferred to the low byte under the `MSGBOX_ST.STW` status word the moment that message activation (`SC.SHOW = 1`) is requested.

The `MODE` signal is defined by adding the codes associated with the different format types to those that can be shown in the message.

The codes as well as an example of their use is included in the following table:

Code	Format
1 (2 ⁰)	Enable the OK button
2 (2 ¹)	Enable the OK and Cancel buttons
4 (2 ²)	Additional data 1 is applicable
8 (2 ³)	Additional data 2 is applicable

Code	Format
16(2 ⁴)	Show the Stop icon
32 (2 ⁵)	Show the Question icon
48 (2 ⁴ and 2 ⁵)	Show the Exclamation icon
64 (2 ⁶)	Show the Information icon

For example, to configure the with: **OK** button,

(* Data 1, Data 2, and Question icon *)

```
MSG1_MSGBOX.SC.MODE:= 1 + 4 + 8 + 32;
```

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