EcoStruxure Machine Expert

EMailHandling Library Guide

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www.schneider-electric.com

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All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

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Safety Information

Important Information

NOTICE

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 about providing machine functionality in software implementation.
- 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 control systems and servo amplifiers intended solely for the purposes as 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 design of this overall system (for example, machine design).

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 be 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 (English version prevails):

- 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 actually 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

At a Glance

Document Scope

This document describes the library EmailHandling.

The library allows your controller to send and receive an email, including attachments, to or from one or several recipients with the possibility to customize the content.

Validity Note

This document has been updated for the release of EcoStruxure™ Machine Expert V1.1.

The technical characteristics of the devices described in the present document also appear online. To access the information online:

Step	Action
1	Go to the Schneider Electric home page *www.schneider-electric.com*.
2	In the **Search** box type the reference of a product or the name of a product range. ● Do not include blank spaces in the reference or product range. ● To get information on grouping similar modules, use asterisks (*).
3	If you entered a reference, go to the **Product Datasheets** search results and click on the reference that interests you. If you entered the name of a product range, go to the **Product Ranges** search results and click on the product range that interests you.
4	If more than one reference appears in the **Products** search results, click on the reference that interests you.
5	Depending on the size of your screen, you may need to scroll down to see the datasheet.
6	To save or print a datasheet as a .pdf file, click **Download XXX product datasheet**.

The characteristics that are presented 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.

Product Related Information

⚠ WARNING

LOSS OF CONTROL

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop, power outage and restart.
- Separate or redundant control paths must be provided for critical control functions.
- System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.
- Observe all accident prevention regulations and local safety guidelines.[1]
- Each implementation of this equipment must be individually and thoroughly tested for proper operation before being placed 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.

Before you attempt to provide a solution (machine or process) for a specific application using the POUs found in the library, you must consider, conduct and complete best practices. These practices include, but are not limited to, risk analysis, functional safety, component compatibility, testing and system validation as they relate to this library.

⚠ WARNING

IMPROPER USE OF PROGRAM ORGANIZATION UNITS

- Perform a safety-related analysis for the application and the devices installed.
- Ensure that the Program Organization Units (POUs) are compatible with the devices in the system and have no unintended effects on the proper functioning of the system.
- Use appropriate parameters, especially limit values, and observe machine wear and stop behavior.
- Verify that the sensors and actuators are compatible with the selected POUs.
- Thoroughly test all functions during verification and commissioning in all operation modes.
- Provide independent methods for critical control functions (emergency stop, conditions for limit values being exceeded, etc.) according to a safety-related analysis, respective rules, and regulations.

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

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Only use software approved by Schneider Electric for use with this equipment.
- Update your application program every time you change the physical hardware configuration.

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

Incomplete file transfers, such as data files, application files and/or firmware files, may have serious consequences for your machine or controller. If you remove power, or if there is a power outage or communication interruption during a file transfer, your machine may become inoperative, or your application may attempt to operate on a corrupted data file. If an interruption occurs, reattempt the transfer. Be sure to include in your risk analysis the impact of corrupted data files.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION, DATA LOSS, OR FILE CORRUPTION

- Do not interrupt an ongoing data transfer.
- If the transfer is interrupted for any reason, re-initiate the transfer.
- Do not place your machine into service until the file transfer has completed successfully, unless you have accounted for corrupted files in your risk analysis and have taken appropriate steps to prevent any potentially serious consequences due to unsuccessful file transfers.

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

Care must be taken and provisions made for use of this library for machine control to avoid inadvertent consequences of commanded machine operation, state changes, or alteration of data memory or machine operating elements.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Place operator devices of the control system near the machine or in a place where you have full view of the machine.
- Protect operator commands against unauthorized access.
- If remote control is a necessary design aspect of the application, ensure that there is a local, competent, and qualified observer present when operating from a remote location.
- Configure and install the Run/Stop input, if so equipped, or, other external means within the application, so that local control over the starting or stopping of the device can be maintained regardless of the remote commands sent to it.

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

⚠ WARNING
UNINTENDED EQUIPMENT OPERATION Do not put any application program file (receipt file, G-Code file, firmware file) that you received as an email attachment into service unless you have thoroughly tested it for proper operation. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Related Documents

Document title	Reference
EcoStruxure Machine Expert Functions and Libraries User Guide	*EIO0000002829 (ENG)*; *EIO0000002830 (FRE)*; *EIO0000002831 (GER)*; *EIO0000002832 (ITA)*; *EIO0000002833 (SPA)*; *EIO0000002834 (CHS)*;
EcoStruxure Machine Expert Programming Guide	*EIO0000002854 (ENG)*; *EIO0000002855 (FRE)*; *EIO0000002856 (GER)*; *EIO0000002857 (ITA)*; *EIO0000002858 (SPA)*; *EIO0000002859 (CHS)*;

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. Part 1: General requirements and tests.
ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction

Standard	Description
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.

Part I
General Information

Chapter 1
Presentation of the Library

General Information

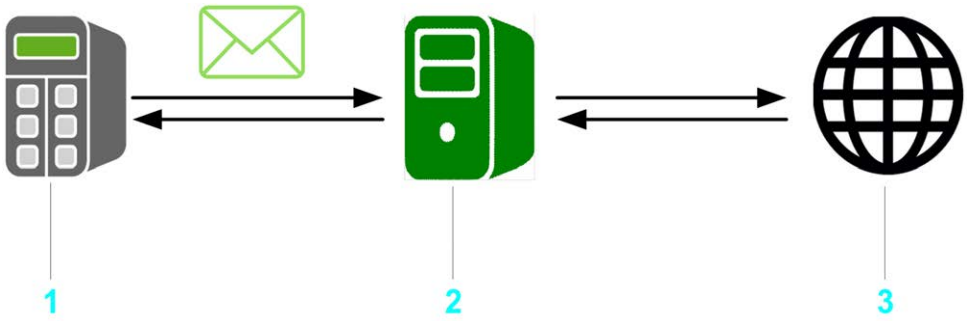
Library Overview

The EmailHandling library provides email client functions that allow your controller to send emails to one or several recipients with the possibility to customize the content. The protocol type used is SMTP as standard for email traffic. It is also possible to receive or delete emails from a server using the Post Office Protocol 3 (POP3).

This library supports SMTP and POP3 via a secured connection using TLS.

Whether a connection using TLS is supported depends on the controller where the `FB_TcpClient2` is used. Refer to the specific manual of your controller to verify if TCP communication using TLS is supported.

You can connect your controller to an email server to send emails that inform about your machine status or report on key performance indicators.



1 Controller
2 Email server
3 Recipients/Sender

Characteristics of the Library

The following table indicates the characteristics of the library:

Characteristic	Value
Library title	EmailHandling
Company	Schneider Electric
Category	**Communication**

Characteristic	Value
Component	**Internet Protocol Suite**
Default namespace	**SE_EMail**
Language model attribute	Qualified-access-only *(see EcoStruxure Machine Expert, Functions and Libraries User Guide)*
Forward compatible library	Yes (FCL)

NOTE: For this library, qualified-access-only is set. This means, that the POUs, data structures, enumerations, and constants have to be accessed using the namespace of the library. The default namespace of the library is **SE_EMail**.

Example Project

In conjunction with the library, the example project EMailHandlingExample.project is provided. The example project shows how to implement the components from the EmailHandling library.

The example project is installed on your PC along with the programming software. To open the project example, proceed as follows:

Step	Action	Comment
1	In the EcoStruxure Machine Expert Logic Builder, execute the command **New Project**.	–
2	In the **New Project** dialog box, select **From Example** from the **Project type** list.	–
3	On the right-hand side of the **New Project** dialog box, select the controller (1) from the **Controller** list.	**Result**: Available examples are listed in the **Matching Examples** text box.
4	Select your example from the **Matching Examples** list.	–
5	Enter a name for the new project, and select the file location.	–
6	Click the **OK** button.	**Result**: A new project is created based on the selected example.

(1) PacDrive LMC Pro/Pro2, TM251MESE, TM262M25MESS8T

General Considerations

Consider the following limitations for email transfer:

- Only ASCII symbols are supported.
- Only IPv4 IP addresses are supported.
- The EmailHandling incorporates pointers on addresses.
- Receive acknowledgement is not supported.
- Sending or receiving files via email leads to loss of file attributes.

- In case the address of a recipient does not exist, it depends on the configuration of the server whether a feedback mail is created or whether the `FB_SendEMail` is able to create a diagnostic message.
- Archiving emails (sent and received items) has to be performed in the application program. Automatic storage of email traffic on the controller file system is not implemented because emails are mainly handled in the controller RAM (Random Access Memory).

Executing the **Online Change** command can change the contents of addresses.

⚠ CAUTION
INVALID POINTER Verify the validity of the pointers when using pointers on addresses and executing the Online Change command. **Failure to follow these instructions can result in injury or equipment damage.**

The library described in this document internally uses the TcpUdpCommunication library.

The TcpUdpCommunication (Schneider Electric) and the CAA Net Base Services library (CAA Technical Workgroup) use the same system resources on the controller. The simultaneous use of both libraries in the same application may lead to disturbances during the operation of the controller.

⚠ WARNING
UNINTENDED EQUIPMENT OPERATION Do not use the library TcpUdpCommunication (Schneider Electric) together with the library CAA Net Base Services (CAA Technical Workgroup) simultaneously in the same application. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

NOTE: Schneider Electric adheres to industry best practices in the development and implementation of control systems. This includes a "Defense-in-Depth" approach to secure an Industrial Control System. This approach places the controllers behind one or more firewalls to restrict access to authorized personnel and protocols only.

⚠ WARNING

UNAUTHENTICATED ACCESS AND SUBSEQUENT UNAUTHORIZED MACHINE OPERATION

- Evaluate whether your environment or your machines are connected to your critical infrastructure and, if so, take appropriate steps in terms of prevention, based on Defense-in-Depth, before connecting the automation system to any network.
- Limit the number of devices connected to a network to the minimum necessary.
- Isolate your industrial network from other networks inside your company.
- Protect any network against unintended access by using firewalls, VPN, or other, proven security measures.
- Monitor activities within your systems.
- Prevent subject devices from direct access or direct link by unauthorized parties or unauthenticated actions.
- Prepare a recovery plan including backup of your system and process information.

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

By configuring a white list with the input `i_pbyWhiteListSender`, the entries of this list will be compared to the sender email specified in the header of the received email. This feature does not provide any protection against intentional manipulation of the header field `From:` inside the received email.

No antivirus program is available on the controller. Consider configuring one on server side.

Part II
Enumerations and Structures

What Is in This Part?

This part contains the following chapters:

Chapter	Chapter Name	Page
2	Enumerations	23
3	Structures	35

Chapter 2
Enumerations

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
ET_AuthenticationMode	24
ET_Command	25
ET_EMailStatus	26
ET_Priority	28
ET_Protocol	29
ET_Result	30

ET_AuthenticationMode

Overview

Type:	Enumeration
Available as of:	V1.0.0.0

Description

The enumeration ET_AuthenticationMode defines the mode of authentication that is required to log into an email server.

Enumeration Elements

Name	Data type	Value	Description
NoAuthentication	INT	0	No user authentication required.
Login	INT	10	LOGIN mechanism used for authentication.
Plain	INT	20	PLAIN mechanism used for authentication.

Used By

- FB_SendEMail

ET_Command

Overview

Type:	Enumeration
Available as of:	1.1.2.0

Description

The enumeration ET_Command indicates the command that is executed.

Enumeration Elements

Name	Data type	Value	Description
NoCommand	INT	0	No command is executed.
CheckInbox	INT	1	The number of emails available on the server is verified.
Receive	INT	2	The emails are received from the server.
Delete	INT	3	The email specified with the unique ID at the input i_sUniqueID is deleted from the server.

Used By

- FB_Pop3EMailClient

ET_EMailStatus

Overview

Type:	Enumeration
Available as of:	1.1.2.0

Description

The enumeration ET_EMailStatus provides status information of the email.

Enumeration Elements

Name	Data type	Value	Description
Empty	INT	0	The structure is empty or the email data is not valid.
Ok	INT	1	The email has been successfully received.
SenderBlocked	INT	2	The sender address is blocked by the white list, or is not found in the header of the email, or exceeds the maximum length of 200 bytes.
NotSupported	INT	3	The format of the email is not supported. Supported Content-Types (not valid for the file attachment part): ● text/plain ● multipart/mixed Supported Content-Transfer-Encoding schemes: ● 7-bit ● quoted-printable ● base 64
InvalidHeader	INT	4	The header of the email is invalid.
InvalidAttachmentPath	INT	5	The path to the attachment of the email is invalid: ● The path exceeds the maximum length of 255 bytes, or ● No file name is provided.

Name	Data type	Value	Description
`InvalidAttachmentExtension`	INT	6	The attachment of the email has an invalid extension. It is not possible to receive an attachment with one of the following extensions: ● .ap_ ● .app ● .cf_ ● .cfg ● .crc ● .err ● .frc ● .log ● .prj ● .rcp ● .rsi ● .urf

Used By

- `FB_Pop3EMailClient`

ET_Priority

Overview

Type:	Enumeration
Available as of:	1.1.2.0

Description

The enumeration `ET_Priority` defines the priority level that is assigned to the email.

Enumeration Elements

Name	Data type	Value	Description
`Normal`	INT	0, 3	The email priority level is set to normal.
`VeryHigh`	INT	1	The email priority level is set to very high.
`High`	INT	2	The email priority level is set to high.
`Low`	INT	4	The email priority level is set to low.
`VeryLow`	INT	5	The email priority level is set to very low.

Used By

- `FB_SendEMail`

ET_Protocol

Overview

Type:	Enumeration
Available as of:	V1.0.0.0

Description

The enumeration ET_Protocol defines the type of protocol that is used for email transfer.

Enumeration Elements

Name	Data type	Value	Description
SMTP	INT	0	SMTP (Simple Mail Transfer Protocol) is used for email transfer.
eSMTP	INT	1	eSMTP (extended Simple Mail Transfer Protocol) is used for email transfer. Select this protocol to use additional protocol extensions, for example authentication, attachment, or email priority.

Used By

- FB_SendEMail

ET_Result

Overview

Type:	Enumeration
Available as of:	V1.0.0.0

Description

The enumeration ET_Result contains the possible values that indicate the result of operations executed by the function block.

Enumeration Elements

Name	Data type	Value	Description
If q_xError of a function block *(see page 50)* is FALSE, one of the following status messages is shown.			
Ok	UDINT	0	The operation completed successfully.
Disabled	UDINT	1	The function block is disabled.
Initializing	UDINT	2	The function block is initializing.
Ready	UDINT	4	The function block is ready.
ConnectingToServer	UDINT	5	The client is connecting to the server.
DisconnectingFromServer	UDINT	6	The client is disconnecting from the server.
NoCommand	UDINT	7	No command selected.
SendingEMail	UDINT	8	An email is being sent to the server.
ConnectedToServer	UDINT	50	A connection to the server has been established.
MessageFromServerReceived	UDINT	52	Data exchange with server: A message has been received.
MessageToServerSent	UDINT	54	Data exchange with server: A message has been sent to the server.
SendingMessageToServer	UDINT	55	Data exchange with server: A message is being sent to the server.
Busy	UDINT	56	The function block is busy.
WaitingForExpectedMessage	UDINT	58	Data exchange with server: Waiting for expected message to continue.
OpeningAttachment	UDINT	60	The attachment is opened on the file system of the controller.
SendingAttachment	UDINT	62	The process of sending the attachment is in progress.

Name	Data type	Value	Description
DownloadingEMail	UDINT	64	The email is downloaded from the server.
SavingAttachment	UDINT	66	The process of saving the attachment in the file system of the controller is in progress.
DeletingEMail	UDINT	68	The email is deleted from the server.
ServerOk	UDINT	70	The server is in operational state.
DeletingFile	UDINT	72	The invalid file is deleted from the system.
If q_xError of a function block *(see page 50)* is TRUE, one of the following status messages is shown.			
InvalidAuthenticationMode	UDINT	101	It has been detected that the value of i_etAuthenticationMode is not valid.
InvalidServerIP	UDINT	102	It has been detected that i_sServerIP is empty. This is not valid.
InvalidDomainName	UDINT	104	It has been detected that i_sDomainName is empty. This is not valid.
InvalidSenderEMail	UDINT	106	It has been detected that i_sSenderEMail is empty. This is not valid.
InvalidRecipientEMail	UDINT	108	It has been detected that i_sRecipientEMail is empty. This is not valid.
InvalidProtocol	UDINT	110	It has been detected that the value of i_etProtocol is not valid.
InvalidMessageAddress	UDINT	111	It has been detected that the value of i_pbyMessage is not valid.
AuthenticationFailed	UDINT	112	Authentication has not been successful: Username (i_sUsername) or password (i_sPassword) are not correct.
AuthenticationRequired	UDINT	113	Authentication is required: Enable an authentication mode.
InvalidUsername	UDINT	114	It has been detected that i_sUsername is empty. This is not valid.
InvalidPassword	UDINT	116	It has been detected that i_sPassword is empty. This is not valid.
FunctionNotSupported	UDINT	118	The selected function, such as the selected authentication mode, is not supported. Set i_etProtocol to ET_Protocol.eSMTP or try to use another i_etAuthenticationMode.
SyntaxError	UDINT	120	A syntax error, such as empty recipient address, has been detected.

Name	Data type	Value	Description
RecipientAddressTooLong	UDINT	122	It has been detected that the recipient address exceeds the allowed length of 200 bytes.
MailboxUnavailable	UDINT	124	The requested action has not been performed because the mailbox is not available.
OpenAttachmentFailed	UDINT	126	Unable to open the attachment.
ReadAttachmentFailed	UDINT	128	Unable to read the attachment.
CloseAttachmentFailed	UDINT	130	Unable to close the attachment.
MessageRejectedFromRecipient	UDINT	132	The email has been rejected by the recipient.
EMailNotFound	UDINT	133	Corresponding email has not been found on the server. Verify the value of i_sUniqueId.
InvalidPriority	UDINT	134	The value of i_etPriority is invalid.
InvalidNumberEMailsToReceive	UDINT	135	It has been detected that the value of i_uiEMailsToReceive is not valid. It must be greater than 0 and less or equal to GPL.Gc_uiInboxSize.
ServerError	UDINT	136	The server has detected an error.
InvalidWhiteListSize	UDINT	137	It has been detected that the value of i_udiWhiteListSize is not valid. It must be greater than 0.
InvalidFilePath	UDINT	138	It has been detected that the value of i_sFilePath is not valid.
InvalidMaxNumberOfAttachments	UDINT	139	The value of GPL.Gc_udiMaxNumberOfAttachments is not valid. It must be greater than 0.
InvalidMailboxBuffer	UDINT	140	The value of i_pbyMailboxBuffer is not valid.
InvalidCommand	UDINT	141	The value of i_etCommand is not valid.
InvalidBufferSize	UDINT	142	The value of i_udiBufferSize is not valid. It must be greater than 0.
NotSupported	UDINT	143	This function is not supported.
InvalidInboxSize	UDINT	144	The value of Gc_udiInboxSize is not valid. It must be greater than 0.
InvalidUniqueId	UDINT	145	The value of i_sUniqueID is not valid.
SaveAttachmentFailed	UDINT	146	The attempt to save the attachment to the file system of the controller was not successful.

Name	Data type	Value	Description
InvalidWhiteList	UDINT	147	The value of i_pyWhiteListSender is not valid. As i_udiWhiteListSize is greater than 0, i_pyWhiteListSender must have a valid address (>0).
MailboxBufferFull	UDINT	148	The buffer of the mailbox is full. The number of received bytes is greater than i_udiBufferSize.
DecodingError	UDINT	149	An internal error has been detected while decoding an email.
FailedToConnectToServer	UDINT	150	The connection to the server has not been established. Verify the Ethernet connection or the parameters i_sServerIP / i_sServerPort.
InvalidMessageFromServer	UDINT	152	It has been detected that the message received from the server is invalid.
UnexpectedMessageFromServer	UDINT	153	An unexpected message has been received from the server.
FailedToReceiveMessageFromServer	UDINT	154	A timeout has expired: No answer has been received from the server within the given time.
FailedToSendMessageToServer	UDINT	156	A communication error has been detected: Unable to send message to server.
UnexpectedProgramBehavior	UDINT	200	An internal error has been detected.

Used By

- FB_SendEMail
- FB_PopEMailClient

Chapter 3
Structures

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
ST_CredentialsSendEMail	36
ST_CredentialsReceiveEMail	37
ST_EMail	38
ST_TlsSettings	39

ST_CredentialsSendEMail

Overview

Type:	Structure
Available as of:	V1.0.0.0
Inherits from:	–

Description

The structure ST_CredentialsSendEMail contains the user-specific information for connecting to an external email server for sending emails.

Structure Elements

Name	Data type	Description
i_sServerIP	STRING[GPL.Gc_uiIpStringSize]	The IP address of the external email server.
i_uiServerPort	UINT	The port of the external email server.
i_etProtocol	ET_Protocol *(see page 29)*	Enumeration which indicates the protocol.
i_sDomainName	STRING[200]	The domain of the client.
i_sSenderEMail	STRING[200]	The email address of the sender.
i_sUsername	STRING[60]	The username to access the external email server.
i_sPassword	STRING[60]	The password to access the external email server.
i_etAuthenticationMode	ET_AuthenticationMode *(see page 24)*	Enumeration which indicates the authentication mode.
stTlsSettings	ST_TlsSettings *(see page 39)*	Structure to specify the TLS (Transport Layer Security) configuration.

Used By

- FB_SendEMail

ST_CredentialsReceiveEMail

Overview

Type:	Structure
Available as of:	V1.1.2.0
Inherits from:	–

Description

The structure ST_CredentialsReceiveEMail contains the user-specific information for connecting to an external email server for receiving and deleting emails using POP3.

Structure Elements

Name	Data type	Description
i_sServerIP	STRING[GPL.Gc_uiIpStringSize]	The IP address of the external email server.
i_uiServerPort	UINT	The port of the external email server.
i_sUsername	STRING[200]	The username to access the external email server.
i_sPassword	STRING[60]	The password to access the external email server.
i_pbyWhiteListSender	POINTER TO BYTE	The start address of the string containing the address(es) of the white list. If this list contains more than one entry, the email addresses must be separated by a semicolon. The maximum size of a single address is restricted to 200 bytes. An empty string blocks all emails. Enter an asterisk in combination with a domain (*@yourdomain.com) to allow receiving emails from senders of this domain. Emails from other domains are blocked.
i_udiWhiteListSize	UDINT	Size of the white list.
i_xOverwriteAttachment	BOOL	If TRUE, attachments stored in the EMailAttachments folder are overwritten if an attachment with the same name is downloaded from the server. If FALSE, the receive process is aborted as soon as a second attachment with identical name is to be downloaded. The output q_sResultMsg indicates the file name that generated the error.
stTlsSettings	ST_TlsSettings *(see page 39)*	Structure to specify the TLS (Transport Layer Security) configuration.

Used By

- FB_Pop3EMailClient

ST_EMail

Overview

Type:	Structure
Available as of:	V1.1.2.0
Inherits from:	–

Description

The structure ST_EMail contains the information of a received email.

Structure Elements

Name	Data type	Description
q_etEMailStatus	ET_EMailStatus	Status of the email *(see page 26)*.
q_pbyDate	POINTER TO BYTE	The start address of the string containing the date.
q_udiLengthOfDate	UDINT	Length of the date string.
q_pbySenderEMail	POINTER TO BYTE	The start address of the string containing the sender email address.
q_udiLengthOfSenderEMail	UDINT	Length of the sender email address string.
q_pbySubject	POINTER TO BYTE	The start address of the string containing the subject of the email.
udiLengthOfSubject	UDINT	Length of the subject string.
q_pbyMessage	POINTER TO BYTE	The start address of the string containing the email message.
q_udiLengthOfMessage	UDINT	Length of the message string.
q_asAttachmentPath	ARRAY [1..GPL.Gc_udiMaxNumberOfAttachments] OF STRING[255]	Relative or absolute path(s) to the attachment file(s) on the file system.
q_audiSizeOfAttachment	ARRAY [1..GPL.Gc_udiMaxNumberOfAttachments] OF UDINT	Size(s) of the attachment file(s) on the file system.
q_sUniqueID	STRING[70]	Unique ID of the email.

Used By

- FB_Pop3EMailClient

ST_TlsSettings

Overview

Type:	Structure
Available as of:	V1.0.0.0
Inherits from:	-

Description

The structure ST_TlsSettings contains the parameter used for the connection to the server and contains the TLS (Transport Layer Security).

Structure Elements

Element	Data type	Default value	Description
xUseTls	BOOL	FALSE	If TRUE, the connection is established using TLS.
xSendClientCert	BOOL	FALSE	Set to TRUE if a client certificate is required.
sCertName	STRING[255]	-	Specifies the client certificate file. If the value is a null string, the default certificate of the controller is used. The name corresponds to the value “Issued for” from the controller certificate. The name can be obtained from the certificate using the **Security Screen** in Logic Builder.
etProtocol	TCPUDP.ET_TlsProtocol	TCPUDP.ET_TlsProtocol.TLSv12	Protocol used for secured connection. Refer to ET_TlsProtocol *(see EcoStruxure Machine Expert, TcpUdpCommunication, Library Guide)*.
etCertVerifyMode	TCPUDP.ET_CertVerifyMode	TCPUDP.ET_CertVerifyMode.TrustedOnly	Mode for the certificate verification. Refer to ET_CertVerifyMode *(see EcoStruxure Machine Expert, TcpUdpCommunication, Library Guide)*.

Part III
Global Variables

What Is in This Part?

This part contains the following chapters:

Chapter	Chapter Name	Page
4	Global Parameter List	43
5	Global Variable List	45

Chapter 4
Global Parameter List

Global Parameter List (GPL)

Overview

Type:	Global parameters
Available as of:	V1.0.0.0

Description

The global parameter list contains the global parameters of the EmailHandling library. They can be overwritten specifically for your project in the **Library Manager**.

Global Parameters

Variable	Data type	Default value	Description
`Gc_udiRecipientEMailSize`	UDINT	200	Maximum number of bytes of `i_sRecipientEMail`.
`Gc_tTimeOut`	TIME	TIME#10m0s0ms	Maximum time to receive an answer from the server.
`Gc_uiIpStringSize`	UINT	15	Maximum size for IP addresses, such as `i_sServerIP`.
`Gc_udiReceiveBufferSize`	UDINT	1000	Maximum size of the receive buffer that is required to communicate with the server.
`Gc_xUseControllerTime`	BOOL	FALSE	If TRUE, the controller time is used for creating the time stamp indicating when the email was sent.
`Gc_udiInboxSize`	UDINT	10	Maximum size of the inbox. This value determines the maximum number of emails that can be downloaded with one receive command.

Variable	Data type	Default value	Description
Gc_udiMaxNumberOfAttachmentPaths	UDINT	1	Maximum size of the array ST_EMail.asAttachmentPath. It contains absolute or relative path(s) on the file system of the controller where downloaded attachments are stored. This variable does not limit the number of downloaded attachments.
Gc_xUseTop	BOOL	TRUE	If TRUE, internally the TOP0 command is used to download only the header of the email. This is useful if the white list feature is used to verify the email address of the sender before the entire message is downloaded. If the TOP command is not supported by your email server (indicated by q_sResultMsg), set this variable to FALSE.
Gc_xUseUniqueId	BOOL	TRUE	If TRUE, the UIDL command is used to retrieve the unique ID of the email. If the UIDL command is not supported by your email server (indicated by q_sResultMsg), set this variable to FALSE.

Chapter 5
Global Variable List

Global Variable List (GVL)

Overview

Type:	Global variables
Available as of:	V1.0.0.0

Description

The global variables list contains the global variables of the library.

Global Variables

Variable	Data Type	Default value	Description
`Gc_xOnlineChangeAllowed`	BOOL	FALSE	If TRUE, the online change detection is successfully initialized. Execute an online change while the POU is busy only if `Gc_xOnlineChangeAllowed` = TRUE.

Part IV
Program Organization Units (POU)

What Is in This Part?

This part contains the following chapters:

Chapter	Chapter Name	Page
6	Function Blocks	49
7	Functions	59

Chapter 6
Function Blocks

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
FB_SendEMail	50
FB_Pop3EMailClient	54

FB_SendEMail

Overview

Type:	Function block
Available as of:	V1.0.0.0

Task

The FB_SendEMail function block includes the related functions for sending emails. Each instance handles one SMTP connection.

Functional Description

The FB_SendEMail function block is the user-interface to interact with an external email server. It allows you to send emails.

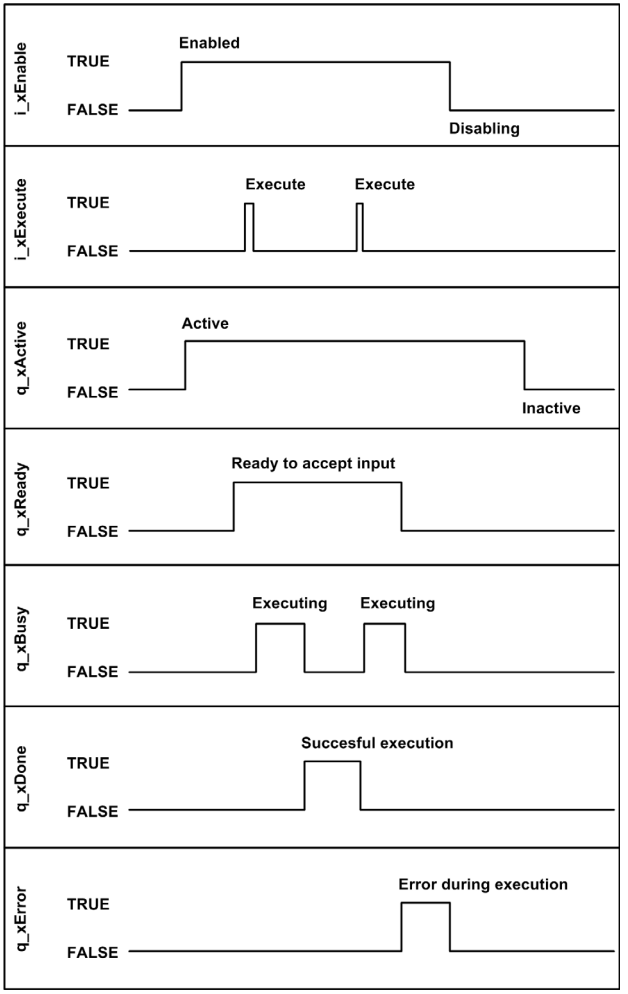
After the function block has been enabled and is being executed, a TCP connection to the email server is established using the user credentials that have been submitted using iq_stCredentials. As soon as the connection has been established, email data is transferred to the server. When the data transfer is completed, the TCP connection to the email server is automatically closed by the function block.

When executing the function block, the input i_pbyMessage is stored internally for further use. In case an online change event is detected while the function block is executed (q_xBusy = TRUE), the internally used variables are updated with the present value of the input.

NOTE: Do not reassign the i_pbyMessage to a different memory area while the function block is executed.

As long as the function block is executed, the output q_xBusy is set to TRUE. The output q_xDone is set to TRUE after the function block has been executed successfully.

The diagram shows the signal behavior of the inputs and outputs of the function block:



Status messages and diagnostic information are provided using the outputs `q_xError` (TRUE if an error has been detected), `q_etResult`, and `q_etResultMsg`.

To acknowledge detected errors, disable and re-enable the function block to be able to resend an email.

Interface

Input	Data type	Description
i_xEnable	BOOL	Activation and initialization of the function block.
i_xExecute	BOOL	The function block sends an email upon rising edge of this input.
i_sRecipientEMail	STRING [GPL.Gc_udiRecipientEMailSize]	The string containing the recipient email address(es).(1)
i_sSubject	STRING[200]	Subject of the email.
i_pbyMessage	POINTER TO BYTE	Start address of the string in which the message is stored.
i_udiSizeOfMessage	UDINT	Size of message data.
i_etPriority	ET_Priority	The enumeration indicating the priority level that is assigned to the email *(see page 28)*.
i_sAttachmentPath	STRING[255]	Absolute or relative path to the attachment located on the controller file system. If this string is empty, no attachment is sent.
i_sCcRecipientEMail	STRING [GPL.Gc_udiRecipientEMailSize]	The string containing the recipient email address(es) assigned to the **CC** field.(1)
i_sBccRecipientEMail	STRING [GPL.Gc_udiRecipientEMailSize]	The string containing the recipient email address(es) assigned to the **BCC** field.(1)
(1) If more than one recipient, the email addresses must be separated by a semicolon. The maximum size of a single address is restricted to 200 bytes.		

Input / Output	Data type	Description
iq_stCredentials	ST_CredentialsSendEMail	Used to pass the structure containing user settings, such as user name or password.

Output	Data type	Description
q_xActive	BOOL	If the function block is active, this output is set to TRUE.
q_xReady	BOOL	If the initialization is successful, this output signals a TRUE as long as the function block is capable of accepting inputs.
q_xBusy	BOOL	If this output is set to TRUE, the function block execution is in progress.
q_xDone	BOOL	If this output is set to TRUE, the execution has been completed successfully.
q_xError	BOOL	If this output is set to TRUE, an error has been detected. For details, refer to q_etResult and q_etResultMsg.
q_etResult	ET_Result	Provides diagnostic and status information.
q_sResultMsg	STRING[80]	Provides additional diagnostic and status information.

Usage of Variables of Type `POINTER TO ... or REFERENCE TO ...`

The function block provides inputs and/or in/outputs of type `POINTER TO`… or `REFENCE TO`…. With the use of such a pointer or reference, the function block accesses the addressed memory area. In case of an online change event, it may happen that memory areas are moved to new addresses and in consequence a pointer or reference becomes invalid. To prevent errors associated with invalid pointers, variables of type `POINTER TO`… or `REFERENCE TO`… must be updated cyclically or at least at the beginning of the cycle in which they are used.

⚠ CAUTION

INVALID POINTER

Verify the validity of the pointers when using pointers on addresses and executing the Online Change command.

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

FB_Pop3EMailClient

Overview

Type:	Function block
Available as of:	V1.1.2.0

Task

The `FB_Pop3EMailClient` function block includes the related functions for receiving and deleting emails using POP3. Each instance handles one POP3 connection.

Functional Description

The `FB_Pop3EMailClient` function block is the user-interface to interact with an external POP3 (email) server. It allows you to receive and delete emails. By using attachments of received emails you are able to get input for several system features which are based on files located on the system memory. Certain file extensions are not allowed to be stored on the controller file system via `FB_Pop3EMailClient` (refer to the `ET_EmailStatus.InvalidAttachmentExtension` parameter *(see page 26)*). This applies to files that are handled automatically by the controller and to system files, such as the controller firmware to help to prevent unintended overwriting.

⚠ CAUTION

INVALID POINTER

Verify the validity of the pointers when using pointers on addresses and executing the Online Change command.

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

After the function block has been enabled and is being executed, a TCP connection to the POP3 server is established using the user credentials that have been submitted using `iq_stCredentials`. As soon as the connection has been established, the command specified with `i_etCommand` is executed.

When executing the function block, the pointers at `i_pbyMessage` and `iq_stCredentilas.i_pbyWhiteListSender` are stored internally for further use. In case an online change event is detected while the function block is executed (`q_xBusy` = TRUE), the internally used variables are updated with the present value of the pointers.

NOTE: Do not reassign the `i_pbyMessage` and `iq_stCredentilas.i_pbyWhiteListSender` to a different memory area while the function block is executed.

When the data transfer is completed, the TCP connection to the POP3 server is closed by the function block. Received emails are deleted from the POP3 server.

The function block `FB_Pop3EMailClient` saves the information of received emails in the memory area addressed by the pointer `i_pbyMailboxBuffer`. The positions inside the buffer, which contain the respective information of the several emails, is indicated by the pointers inside the structure `iq_astInbox`. In case the function block `FB_Pop3EMailClient` is enabled and an online change event is detected, the function block recognizes a possible change of the pointer at `i_pbyMailboxBuffer` and so the pointers provided within the structure `iq_astInbox` are updated accordingly.

NOTE: Process the information from the received emails before modifying the address of the pointer i_pbyMailboxBuffer for the next execution.

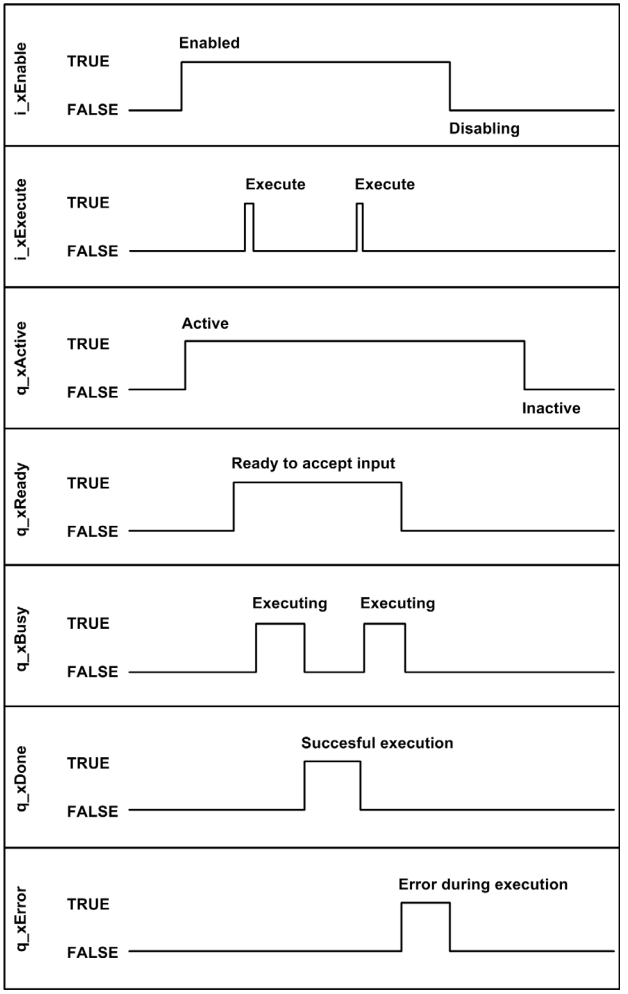
You can manually delete emails by specifying the email with the unique ID at the input `i_sUniqueId` and executing the delete command with `i_etCommand`. By executing further commands, the inbox structure available at `q_astInbox` containing the references to the email data are reset.

Received emails are held in volatile memory. The volatile memory is cleared when power is removed, and all held emails are therefore deleted.

NOTICE
LOSS OF DATA Save incoming emails to non-volatile memory. **Failure to follow these instructions can result in equipment damage.**

As long as the function block is executed, the output `q_xBusy` is set to TRUE. The output `q_xDone` is set to TRUE after the function block has been executed successfully.

The diagram shows the signal behavior of the inputs and outputs of the function block:



Status messages and diagnostic information are provided using the outputs `q_xError` (TRUE if an error has been detected), `q_etResult`, and `q_etResultMsg`.

To acknowledge detected errors, disable and re-enable the function block to be able to receive or delete an email.

Interface

Input	Data type	Description
i_xEnable	BOOL	Activation and initialization of the function block.
i_xExecute	BOOL	The function block receives or deletes an email upon rising edge of this input.
i_etCommand	ET_Command	The enumeration indicating the command to be executed *(see page 25)*.
i_pbyMailboxBuffer	POINTER TO BYTE	Start address of the first byte in which the incoming emails are stored.
i_udiBufferSize	UDINT	Size of the mailbox buffer.
i_uiEMailsToReceive	UINT	Number of emails to receive from the server.
i_sFilePath	STRING[200]	Path to the folder in the controller file system where the folder EMailAttachments is created. Inside this folder, the attachments of the received emails are stored. The file extension defined with the ET_EMailStatus.InvalidAttachmentExtension parameter *(see page 26)* cannot be stored. **NOTE:** If you receive a second attachment with identical name as an already available attachment in this folder, the older file may be overwritten if the global parameter ST_CredentialsReceiveEMail.i_xOverwriteAttachment is set to TRUE. If this string is empty, the folder EMailAttachments is created at the default file path of the controller.
i_sUniqueID	STRING[70]	The unique ID that is required to delete an email. After the email has been received from the server, the unique ID is displayed at the output q_astInbox.

Input / Output	Data type	Description
iq_stCredentials	ST_CredentialsReceiveEMail	Used to pass the structure containing user settings, such as user name or password.
iq_astInbox	ARRAY [1…GPL.Gc_udiInboxSize] OF ST_EMail	Structure *(see page 38)* which contains the information of received emails.

Output	Data type	Description
q_xActive	BOOL	If the function block is active, this output is set to TRUE.
q_xReady	BOOL	If the initialization is successful, this output signals a TRUE as long as the function block is operational.
q_xBusy	BOOL	If this output is set to TRUE, the function block execution is in progress.
q_xDone	BOOL	If this output is set to TRUE, the execution has been completed successfully.
q_xError	BOOL	If this output is set to TRUE, an error has been detected. For details, refer to q_etResult and q_etResultMsg.
q_etResult	ET_Result	Provides diagnostic and status information.
q_sResultMsg	STRING[80]	Provides additional diagnostic and status information.
q_udiNumberOfEmails	UDINT	Depends on the executed i_etCommand: ● ET_Command.CheckInbox: Indicates the number of emails available on the server. ● ET_Command.Receive: Indicates the number of emails received from the server. If an error has been detected, this output provides the number of emails downloaded successfully. ● ET_Command.Delete: Indicates the number of emails deleted.

Usage of Variables of Type POINTER TO ... or REFERENCE TO ...

The function block provides inputs and/or in/outputs of type POINTER TO… or REFENCE TO…. With the use of such a pointer or reference, the function block accesses the addressed memory area. In case of an online change event, it may happen that memory areas are moved to new addresses and in consequence a pointer or reference becomes invalid. To prevent errors associated with invalid pointers, variables of type POINTER TO… or REFERENCE TO… must be updated cyclically or at least at the beginning of the cycle in which they are used.

⚠ CAUTION

INVALID POINTER

Verify the validity of the pointers when using pointers on addresses and executing the Online Change command.

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

Chapter 7
Functions

FC_EtResultToString

Overview

Type:	Function
Available as of:	V1.0.0.0
Inherits from:	–
Implements:	–

Task

Convert an enumeration element of type ET_Result to a variable of type STRING.

Functional Description

Using the function `FC_EtResultToString`, you can convert an enumeration element of type ET_Result to a variable of type STRING.

Interface

Input	Data type	Description
`i_etResult`	ET_Result	Enumeration with the result.

Return Value

Data type	Description
STRING(80)	The ET_Result converted to text. If `i_etResult` is indeterminable the return value is: `Unknown Result: <Value of the input i_etResult>`

Glossary

A

ASCII

(*American standard code for Information Interchange*) A protocol for representing alphanumeric characters (letters, numbers, certain graphics, and control characters).

F

FCL

(*forward compatible library*) A forward compatible library is developed in such a way that its functionalities are forward compatible. This means that every version of a forward compatible library contains all functionalities of the previous version and a newer library version can be easily used in already existing projects without any changes.

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