Redundant Power Supply
Management Functions

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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.

Table of Contents

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.

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 function blocks that manage redundant power supplies in a rack.

Validity Note

This document is valid for Unity Pro 11.1 or later.

For product compliance and environmental information (RoHS, REACH, PEP, EOLI, etc.), go to *www.schneider-electric.com/green-premium*.

The technical characteristics of the devices described in this document also appear online. To access this 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 data sheet.
6	To save or print a data sheet as a .pdf file, click **Download XXX product datasheet**.

The characteristics that are presented in this manual 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 manual and online information, use the online information as your reference.

Related Documents

Title of documentation	Reference number
Unity Pro System Block Library	33002539 (English) 33002540 (French) 33002541 (German) 33003688 (Italian) 33002542 (Spanish) 33003689 (Chinese)
Modicon M580 Hardware Reference Manual	EIO0000001578 (English) EIO0000001579 (French) EIO0000001580 (German) EIO0000001582 (Italian) EIO0000001581 (Spanish) EIO0000001583 (Chinese)

You can download these technical publications and other technical information from our website at *http://download.schneider-electric.com*.

Part I
Power Supply Maintenance

Introduction

The advanced diagnostics for redundant power supplies use a specific protocol for power supplies installed in a main rack with an Ethernet backplane.

These function blocks are used for redundant power supplies that are located:

- Within a Modicon M580 configuration.
- In a main rack *(see Modicon M580, Hardware, Reference Manual)*. Therefore they do not apply to power supplies located in an extension rack (using a BMXXBE•••• extender module).
- In a dedicated BMEXBP••02 rack *(see Modicon M580, Hardware, Reference Manual)*.

What Is in This Part?

This part contains the following chapters:

Chapter 1
PWS_DIAG: Redundant Power Supply Diagnostics

Description

Description of the Function

The `PWS_DIAG` function block is used to read the status of redundant power supplies *(see Modicon M580, Hardware, Reference Manual)* in a Modicon M580 PAC main rack with an Ethernet backplane (local or remote rack *(see Modicon M580, Hardware, Reference Manual)*, other connected Modicon M580 PAC).

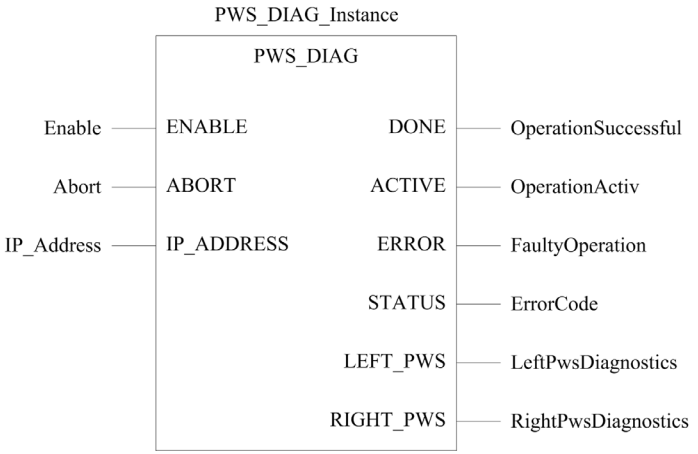
The power supply status is interpreted with the PWS_DIAG_DDT *(see page 17)* DDT type.

The additional parameters `EN` and `ENO` may also be configured.

NOTE: Redundant power supplies function is available on CPUs with OS firmware V2.12 or later, and BMECRA31210 communication adapters with firmware V2.16 or later.

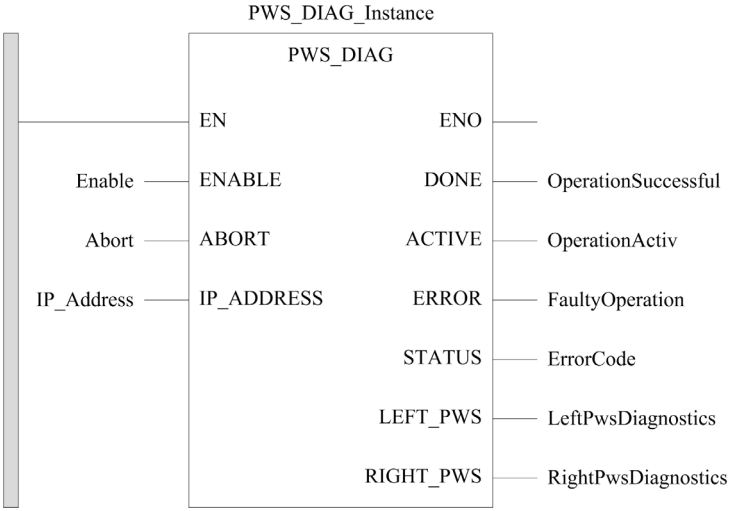
FBD Representation

Representation:



LD Representation

Representation:



IL Representation

Representation:

```
CAL PWS_DIAG_Instance (ENABLE:=Enable, ABORT:=Abort,
IP_ADDRESS:=IP_Address, DONE=>OperationSuccessful,
ACTIVE=>OperationActiv, ERROR=>FaultyOperation, STATUS=>ErrorCode,
LEFT_PWS=>LeftPwsDiagnostics, RIGHT_PWS=>RightPwsDiagnostics)
```

ST Representation

Representation:

```
PWS_DIAG_Instance (ENABLE:=Enable, ABORT:=Abort, IP_ADDRESS:=IP_Address,
DONE=>OperationSuccessful, ACTIVE=>OperationActiv, ERROR=>FaultyOp-
eration, STATUS=>ErrorCode, LEFT_PWS=>LeftPwsDiagnostics,
RIGHT_PWS=>RightPwsDiagnostics);
```

Description of Parameters

The following table describes the input parameters:

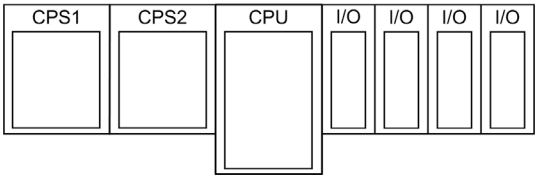
Parameter	Type	Comment
Enable	BOOL	Set to 1 to diagnose the status of a power supply.
Abort	BOOL	Set to 1 to abort the current operation.
IP_Address	STRING	The IP_Address parameter value depends on the location of the redundant power supplies to diagnose: **In the local rack of the CPU:** Leave the parameter empty, or use a variable with an empty string, or enter the CPU IP address. **In a distant rack:** Enter the IP address of the communication adapter of the rack that contains the power supply module to diagnose. Example of IP address: *192.168.10.5* or *192.168.010.005*

The following table describes the output parameters:

Parameter	Type	Comment
OperationSuccessful	BOOL	Operation completed indication. Set to 1 when the execution of the operation is completed successfully.
OperationActiv	BOOL	Operation in progress indication. Set to 1 when the execution of the operation is in progress.
FaultyOperation	BOOL	Set to 1 if an error is detected by the function block.
ErrorCode	WORD	Code providing the detected error identification *(see page 27)*.
LeftPwsDiagnostics	PWS_DIAG_DDT	Diagnostic data *(see page 17)* for the power supply located on the left side of the rack (CPS1 marking on the rack).
RightPwsDiagnostics	PWS_DIAG_DDT	Diagnostic data *(see page 17)* for the power supply located on the right side of the rack (CPS2 marking on the rack).

Terminology Used in PWS_DIAG_DDT Type and Power Supply Concerned

Redundant power supplies representation in a rack:



CPS1: Left-most power supply marking on the rack.
CPS2: Right-most power supply marking on the rack.

Description of the power supply concerned by the `State` field bits of the function block output parameters:

Parameter	PWS_DIAG_DDT Field	Bits of the State Field	Concerned Power Supply
LeftPwsDiagnostics	State	Bits 0...4 (Pws•••)	CPS1 (left-most power supply)
		Bits 5...7 (OtherPws•••)	CPS2 (right-most power supply)
RightPwsDiagnostics	State	Bits 0...4 (Pws•••)	CPS2 (right-most power supply)
		Bits 5...7 (OtherPws•••)	CPS1 (left-most power supply)

NOTE: The power supply (Pws••• field or bit) is the one that currently provides the diagnostic data that appear in the structure. The other power supply (OtherPws••• bit) is the second power supply located on the same backplane that communicates some of its diagnostic data to the power supply currently diagnosed.

Description of PWS_DIAG_DDT Type

Detailed description of PWS_DIAG_DDT structure:

Field	Size	Value
PwsMajorVersion	1 BYTE	Power supply major firmware version.
PwsMinorVersion	1 BYTE	Power supply minor firmware version.
Model	1 BYTE	Model identifier.
State (1 BYTE)	Bit 0	PwsDiag
		Operating mode of the power supply: ● 0: Normal mode. ● 1: Diagnostic ongoing. **NOTE:** The diagnostics occurs when the power supply performs an auto-test every 10 hours of cumulated operating time.
State *(continued)*	Bit 1	PwsDefect
		Status of the power supply: ● 0: Healthy. ● 1: At least one defect detected (minor or major). ❍ Possible cause if an under voltage is detected: internal defect detected, or over current. ❍ Possible cause if an over current is detected: internal defect detected, or too many modules on the configuration, or any module defect detected, or backplane defect detected, or module hot-plugged.
State *(continued)*	Bit 2	PwsMode
		Role of the power supply: ● 0: Slave (ready to provide full power to the rack). ● 1: Master (currently providing full power to the rack).
State *(continued)*	Bit 3	PwsPosition
		Position of the power supply: ● 0: Left side of the rack (CPS1). ● 1: Right side of the rack (CPS2).
State *(continued)*	Bit 4	PwsDefectVoltage
		Major status of the power supply: ● 0: Healthy. ● 1: Detected a major defect on output voltage that generates a role swap (the power supply role changed from master to slave, or the power supply remains slave). **NOTE:** When this bit is set, PwsDefect (Bit 1) is also set.

Field	Size	Value
State *(continued)*	Bit 5	OtherPwsDefectVoltage
		Major status of the other power supply: ● 0: Healthy or no communication with the other power supply. ● 1: Detected a major defect on output voltage that generates a role swap (the power supply role changed from slave to master, or the power supply remains master). **NOTE:** When this bit is set, OtherPwsDefect (Bit 7) is also set.
State *(continued)*	Bit 6	OtherPwsComOK
		Communication of the diagnosed power supply with the other power supply: ● 0: No communication. ● 1: Communication established.
State *(continued)*	Bit 7	OtherPwsDefect
		Status of the other power supply: ● 0: Healthy or no communication with the other power supply. ● 1: At least one defect detected (minor or major). ❍ Possible cause if an under voltage is detected: internal defect detected, or over current. ❍ Possible cause if an over current is detected: internal defect detected, or too many modules on the configuration, or any module defect detected, or backplane defect detected, or module hot-plugged.
I33BacPos	1 UINT	Current drawn on the 3.3 Vdc *(see Modicon M580, Hardware, Reference Manual)* power supply internally and delivered to the rack as a producer (unit: mA, accuracy: +/-5%, value range: 20...4500 mA). The master delivers current to the rack, the slave does not deliver current to the rack.
V33Buck	1 UINT	Voltage measured on the 3.3 Vdc *(see Modicon M580, Hardware, Reference Manual)* power supply output (unit: mV, accuracy: +/-2%, value range: 3238...3471 mV). **NOTE:** On a master power supply, the voltage on the output corresponds to the rack voltage. On a slave, the voltage on the output represents the voltage that can be applied to the rack if it becomes a master.
I24Bac	1 UINT	Current drawn on the 24 Vdc *(see Modicon M580, Hardware, Reference Manual)* power supply internally and delivered to the rack as a producer (unit: mA, accuracy: +/-5%, value range: 36...1750 mA). The master delivers current to the rack, the slave does not deliver current to the rack.
V24Int	1 UINT	Voltage measured on the 24 Vdc *(see Modicon M580, Hardware, Reference Manual)* power supply output (unit: mV, accuracy: +/-2%, value range: 23512...24593 mV). **NOTE:** On a master power supply, the voltage on the output corresponds to the rack voltage. On a slave, the voltage on the output represents the voltage that can be applied to the rack if it becomes a master.

Field	Size	Value
Temperature	1 INT	Internal power supply temperature measured (unit: °C, accuracy: +/-1%).
OperTimeMasterSincePO	1 UDINT	Operating time as master since last power on (unit: s).
OperTimeSlaveSincePO	1 UDINT	Operating time as slave since last power on (unit: s).
OperTimeMaster	1 UDINT	Operating time as master since manufacturing (unit: s).
OperTimeSlave	1 UDINT	Operating time as slave since manufacturing (unit: s).
Work	1 UDINT	Energy delivered by the power supply since manufacturing (unit: mWh).
RemainingLTPC	1 UINT	Estimated remaining life time in percent. **NOTE:** When the estimated remaining life time reaches 0, there is no automatic swap (the power supply is used as long as it delivers the requested current and voltages).
NbPowerOn	1 UINT	Number of power-on since manufacturing or since last clear command with PWS_CMD *(see page 21)*.
NbUnderVoltageLow	1 UINT	Number of under voltage detected below low threshold (94 Vac +/-5%) on primary voltage since manufacturing or since last clear command with PWS_CMD *(see page 21)*.
NbUnderVoltageHigh	1 UINT	Number of under voltage detected below high threshold (194 Vac +/-5%) on primary voltage since manufacturing or since last clear command with PWS_CMD *(see page 21)*.

Chapter 2
PWS_CMD: Redundant Power Supply Control

Description

Description of the Function

The PWS_CMD function block is used to control redundant power supplies *(see Modicon M580, Hardware, Reference Manual)* in a Modicon M580 PAC with an Ethernet backplane (local or remote rack *(see Modicon M580, Hardware, Reference Manual)*, other connected Modicon M580 PAC).

PWS_CMD function block provides the following command:

- Swap master and slave power supplies.
- Clear some diagnostic counters.
- Start a power supply auto-diagnostic.

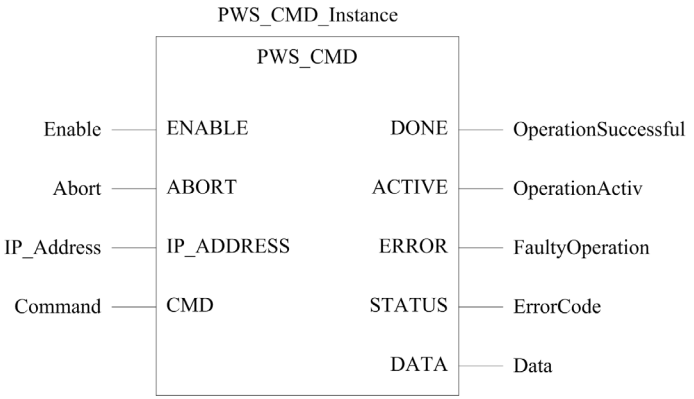
The power supply command is built with the PWS_CMD_DDT *(see page 24)* DDT type.

The additional parameters EN and ENO may also be configured.

NOTE: Redundant power supplies function is available on CPUs with OS firmware V2.12 or later, and BMECRA31210 communication adapters with firmware V2.16 or later.

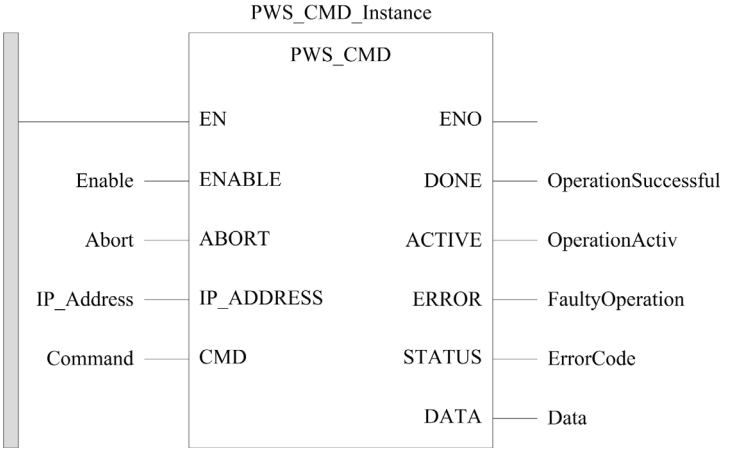
FBD Representation

Representation:



LD Representation

Representation:



IL Representation

Representation:

```
CAL PWS_CMD_Instance (ENABLE:=Enable, ABORT:=Abort,
IP_ADDRESS:=IP_Address, CMD:=Command, DONE=>OperationSuccessful,
ACTIVE=>OperationActiv, ERROR=>FaultyOperation, STATUS=>ErrorCode,
DATA=>Data)
```

ST Representation

Representation:

```
PWS_CMD_Instance (ENABLE:=Enable, ABORT:=Abort, IP_ADDRESS:=IP_Address,
CMD:=Command, DONE=>OperationSuccessful, ACTIVE=>OperationActiv,
ERROR=>FaultyOperation, STATUS=>ErrorCode, DATA=>Data);
```

Description of Parameters

The following table describes the input parameters:

Parameter	Type	Comment
Enable	BOOL	Set to 1 to send a command to a power supply.
Abort	BOOL	Set to 1 to abort the current operation.
IP_Address	STRING	The IP_Address parameter value depends on the location of the redundant power supplies to control: **In the local rack of the CPU:** Leave the parameter empty or use a variable with an empty string, or enter the CPU IP address. **In a distant rack:** Enter the IP address of the communication adapter of the rack that contains the power supply module to control. Example of IP address: *192.168.10.5* or *192.168.010.005*
Command	PWS_CMD_DDT	Command data *(see page 24)* for the power supply to control.

The following table describes the output parameters:

Parameter	Type	Comment
OperationSuccessful	BOOL	Operation completed indication. Set to 1 when the execution of the operation is completed successfully.
OperationActiv	BOOL	Operation in progress indication. Set to 1 when the execution of the operation is in progress.
FaultyOperation	BOOL	Set to 1 if an error is detected by the function block.
ErrorCode	WORD	Code providing the detected error identification *(see page 27)*.
Data	ANY	Data needs to be declared (as a simple UINT for example), but it remains empty.

Description of PWS_CMD_DDT Type

Detailed description of PWS_CMD_DDT structure:

Field	Size	Value
Code	1 BYTE	Command code: **1:** Swap power supply role. **NOTE:** Both power supplies need to be set as target (PwsTarget = 3) to apply the swap command. **2:** Reserved. **3:** Clear power supply diagnostic counters. The following counters are cleared: ❍ NbPowerOn ❍ NbUnderVoltageLow ❍ NbUnderVoltageHigh **NOTE:** This command applies to the power supply selected in the target (PwsTarget). **4:** Start power supply auto-diagnostic. This command triggers a sequence during which the slave power supply checks its capability to deliver the required current to the rack: ❍ During this sequence: The slave power supply temporarily delivers the power on the rack and PwsDiag bit is set to 1. If a failure is detected on the output voltage: PwsDefect and PwsDefectVoltage bits are set to 1 and maintained until the slave power supply is power-cycled or replaced. ❍ After this sequence: The master power supply plays its role again and provides full power to the rack. **NOTE:** Both power supplies need to be set as target (PwsTarget = 3) to apply the auto-diagnostic command.
PwsTarget	1 BYTE	Targeted power supply on the rack: **1:** Power supply on the left side of the rack (CPS1). **2:** Power supply on the right side of the rack (CPS2). **3:** Both power supplies.

Appendices

Appendix A
EFB Error Codes and Values

Error Codes of EFBs with STATUS parameter

Form of the Function Error Code

`STATUS` parameter error codes appear as **Mmss**, where:

- **M** is the high code
- **m** is the low code
- **ss** is a subcode

Common Error Codes

Hexadecimal error codes description:

Hex. Error Code	Description
1001	Abort by user.
1002	Warm Start initiated abort.
2001	An operation type that is not supported has been specified in the control block.
2002	One or more control block parameters were modified while the `MSTR` element was active (this only applies to operations which require several cycles for completion). Control block parameters may only be modified in inactive `MSTR` components.
2003	Invalid value in the length field of the control block.
2004	Invalid value in the offset field of the control block.
2005	Invalid value in the length and offset fields of the control block.
2006	Unauthorized data field on slave.
2007	Unauthorized network field on slave.
2008	Unauthorized network routing path on slave.
2009	Routing path equivalent to their own address.
200A	Attempt to get more global data words than available.
200B	Peer cop conflict on WR/RD global.
200C	Bad pattern for change address request.
200D	Bad address for change address request.
200E	The control block or data buffer is not assigned, or (incorrect size, parts of the control block or data buffer are located outside of the %MW (4x) range.
200F	Space for response in data buffer is too small.

Hex. Error Code	Description
2010	Control buffer length invalid.
2011	Invalid parameter.
2012	Syntax error in “rail.slot.chan” string.
2013	Module missing, not detected, or not configured.
2015	No channel data (channel out of bound).
2016	Abort on timeout.
2017	Invalid task context.
2018	Ethernet security system service error.
2019	Invalid answer data (received data do not correspond to the expected answer).
201A	Invalid answer checksum.
201B	Compatibility issue (for example, EF or DDT version not compatible with firmware version).
30ss	Exceptional response by the Modbus slave with specific **ss** exception code *(see page 29)*.
31ss	Exceptional Unity protocol error response by the Modbus slave with specific **ss** error code.
32ss	Exceptional Unity protocol IO request error acknowledgement by the Modbus slave with specific **ss** error code.
33ss	UNI-TE specific report.
34ss	Generic communication report (correspond to Communication Report field of Premium/M340 EF Management Parameters).
35ss	Generic Operation Report in case of correct exchange (correspond to Operation Report field of Premium/M340 EF Management Parameters when Communication Report = 16#00).
36ss	Generic Operation Report in case of refused message (correspond to Operation Report field of Premium/M340 EF Management Parameters when Communication Report = 16#FF).
4001	Inconsistent response by the Modbus slave.
4002	Inconsistent Modbus Umas response.
4003	Inconsistent UNI-TE response (depending on the module).
4004	Read request for the status words not accepted by the module channel.
4005	Command parameters not accepted by the module channel.
4006	Adjustment parameters not accepted by the module.
5mss	TCP/IP Ethernet specific error codes.
6mss	Modbus Plus specific routing path error. The subfield m shows where the error occurred (a 0 value means local node, 2 means 2nd device in route, and so on).
7mss	SY/MAX specific error codes.
F001	Wrong destination node was specified for the MSTR operation. Referenced S985 option not present or in reset mode.
F002	Component not fully initialized.

Modbus Specific Exception Function Codes (30ss)

This table lists the ss hexadecimal values in 30ss error codes:

Hex. Error Code	Description
3001	Slave does not support requested operation.
3002	Non-existing slave registers were requested.
3003	An unauthorized data value was requested.
3004	Unrecoverable error detected in the slave.
3005	Slave has accepted a lengthy program command.
3006	Function cannot currently be carried out: lengthy command running.
3007	Slave has rejected lengthy program command.
300A	Gateway unable to allocate an internal communication path.
300B	No response obtained from target device.

The ss value corresponds to the Modbus Exception code returned by the Modbus slave device in case of error (second byte of the Modbus exception PDU):

- exception-function_code = request function code + 0x80: 1 byte
- exception_code: 1 byte (returned as ss in 16#30ss error code

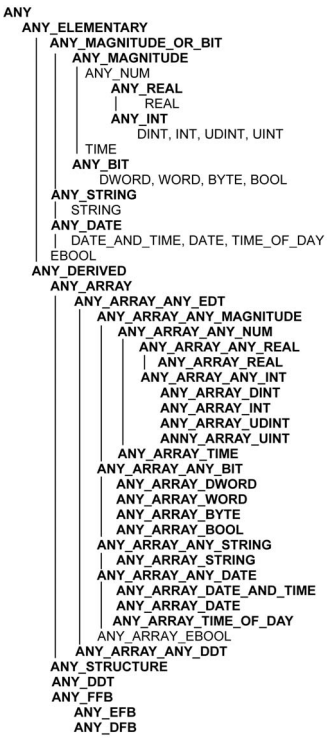
Glossary

A

ANY

There is a hierarchy among the various data types. In the DFBs, it is sometimes possible to declare variables that can contain several types of values. In that case we use `ANY_xxx` types.

The figure below describes this hierarchical structure:



B

BOOL

`BOOL` is the abbreviation for the Boolean type. This is the basic data type in computing. A `BOOL` variable can have either of the following two values: 0 (`FALSE`) or 1 (`TRUE`).

A bit extracted from a word is of type `BOOL`, for example: `%MW10.4`.

BYTE

When 8 bits are grouped together, they are called a BYTE. You can enter a BYTE either in binary mode or in base 8.

The BYTE type is encoded in an 8 bit format which, in hexadecimal format, ranges from 16#00 to 16#FF.

D

DDT

DDT is the abbreviation of Derived Data Type.

A derived data type is a set of elements with the same type (ARRAY) or with different types (structure).

E

EN

EN stands for **EN**able; it is an optional block input. When the EN input is enabled, an ENO output is set automatically.

If EN = 0, the block is not enabled; its internal program is not executed, and ENO is set to 0.

If EN = 1, the block's internal program is run and ENO is set to 1. If an error occurs, ENO is set to 0.

If the EN input is not connected, it is set automatically to 1.

ENO

ENO stands for **E**rror **NO**tification; this is the output associated with the optional input EN.

If ENO is set to 0 (because EN = 0 or in case of an execution error):

- the status of the function block outputs remains the same as it was during the previous scanning cycle that executed correctly;
- the output(s) of the function, as well as the procedures, are set to "0".

EOLI

End-of-Life instructions provide complete guidance on responsible product disposal and recycling of a product and help reduce environmental hazards and improve operational efficiency.

I

INT

INT is the abbreviation of single INTeger (encoded in 16 bits).

The upper/lower limits are as follows: -(2 to the power of 15) to (2 to the power of 15) - 1.

Example:

-32768, 32767, 2#1111110001001001, 16#9FA4.

P

PEP

The Product Environmental Profile (PEP) document provides detailed on the environmental impact of each product and its raw materials.

R

REACh

REACh regulation. This EU regulation governs the use of chemicals that can be harmful to health and the environment. It requires producers to develop plans to replace Substances of Very High Concern (SVHC).

RoHS

RoHS directive. The European Union's Restriction of Hazardous Substances directive calls for the elimination of harmful chemical substances; for example in circuit breakers and wiring devices.

S

STRING

A `STRING` variable is a series of ASCII characters. The maximum length of a string is 65,534 characters.

U

UDINT

`UDINT` is the abbreviation of Unsigned Double INTeger (encoded in 32 bits). The upper/lower limits are as follows: 0 to (2 to the power of 32) - 1.

Example:

`0, 4294967295, 2#11111111111111111111111111111111, 8#37777777777, 16#FFFFFFFF.`

UINT

`UINT` is the abbreviation of the Unsigned INTeger format (encoded in 16 bits). The upper/lower limits are as follows: 0 to (2 to the power of 16) - 1.

Example:

`0, 65535, 2#1111111111111111, 8#177777, 16#FFFF.`

W

WORD

The type `WORD` is encoded in a 16 bit format and is used to perform processing on series of bits.

This table shows the upper/lower limits of each of the bases that can be used:

Base	Lower limit	Upper limit
Hexadecimal	16#0	16#FFFF
Octal	8#0	8#177777
Binary	2#0	2#1111111111111111

Examples of representation

Data	Representation in one of the bases
0000000011010011	16#D3
1010101010101010	8#125252
0000000011010011	2#11010011

Index

E

P