# ABB Drives

## User's Manual
## Ethernet Adapter Module
## RETA-02

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# User's Manual

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# Safety instructions

## Overview

This chapter states the general safety instructions that must be followed when installing and operating the RETA-02 Ethernet Adapter module.

The material in this chapter must be studied before attempting any work on, or with, the unit.

In addition to the safety instructions given below, read the complete safety instructions of the specific drive you are working on.

## General safety instructions

**WARNING!** All electrical installation and maintenance work on the drive should be carried out by qualified electricians. The drive and adjoining equipment must be properly earthed.

Do not attempt any work on a powered drive. After switching off the mains, always allow the intermediate circuit capacitors to discharge for 5 minutes before working on the frequency converter, the motor or the motor cable. It is good practice to check (with a voltage indicating instrument) that the drive is in fact discharged before beginning work.

The motor cable terminals of the drive are at a dangerously high voltage when mains power is applied, regardless of motor operation.

There can be dangerous voltages inside the drive from external control circuits even when the drive mains power is shut off. Exercise appropriate care when working on the unit. Neglecting these instructions can cause physical injury or death.

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***Diagnostics***



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# Introduction

## Intended audience

The manual is intended for the people who are responsible for commissioning and using an RETA-02 Ethernet Adapter module. The reader is expected to have a basic knowledge of electrical fundamentals, electrical wiring practices and how to operate the drive.

## Before you start

It is assumed that the drive is installed and ready to operate before starting the installation of the extension module.

In addition to conventional installation tools, have the drive manuals available during the installation as they contain important information not included in this manual. The drive manuals are referred to at various points of this document.

## What this manual contains

This manual contains information on the wiring, configuration and use of the RETA-02 Ethernet Adapter module.

*Safety instructions* are featured in the first few pages of this manual.

*Overview* contains a short description of the Ethernet protocols and the RETA-02 Ethernet Adapter module, a delivery checklist, and information on the manufacturer’s warranty.

*Quick start-up guide* contains a short description of how to set up the RETA-02 Ethernet Adapter module.

*Mechanical installation* contains placing and mounting instructions for the module.

*Electrical installation* contains wiring, bus termination and earthing instructions.

*Drive configuration* contains a description of bus configuration and activation of the communication

*Network configuration* explains the different methods of setting up the network configuration.

*Master configuration* explains the basic principle on how to configure the master system to communicate with the drive

*Communication profiles* describes the PROFIdrive drive profile and the ABB Drives profile

*Communication* contains a description of how data is transmitted through the RETA-02 module.

*Diagnostics* explains how to trace faults with the status LEDs on the RETA-02 module.

*Definitions and abbreviations* explains the definitions and abbreviations concerning the PROFINET IO product family

*Technical data* contains information on physical dimensions, configurable settings and connectors of the module and the specification of the Ethernet link.

## Terms used in this manual

*Communication Module*

Communication Module is a name for a device (e.g. a fieldbus adapter) through which the drive is connected to an external communication network (e.g. a fieldbus). The communication with the module is activated with a drive parameter.

*MAC ID*

Every node on Ethernet network has to have a unique identifier. This node number is called MAC ID (Media Access Control ID).

*Data Sets and Data Words*

Each data set consists of three 16-bit words, i.e. data words. The Control (or Command) Word and the Status Word, References and Actual Values (see chapter *Communication)* are types of data words; the contents of some data words are user-definable.

*RETA-02 Ethernet Adapter module*

The RETA-02 Ethernet Adapter module is one of the optional fieldbus adapter modules available for ABB drives. The RETA-02 is a device through which a drive is connected to an Ethernet network.

*Parameter*

A parameter is an operating instruction for the drive. Parameters can be read and programmed with the drive control panel, or through the RETA-02 module.

## Product and service inquiries

Address any inquiries about the product to your local ABB representative, quoting the type code and serial number of the unit in question. A listing of ABB sales, support and service contacts can be found by navigating to www.abb.com/drives and selecting *Drives – Sales, Support and Service network*.

## Product training

For information on ABB product training, navigate to www.abb.com/drives and select *Drives – Training courses*.

## Providing feedback on ABB Drives manuals

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# Overview

## Overview

The RETA-02 Adapter module supports the Modbus/TCP and PROFINET IO network protocols. This chapter contains a short description of the above protocols and the RETA-02 Adapter module, a delivery checklist and warranty information.

## Modbus/TCP

Modbus/TCP is a variant of the Modbus family of simple, vendor-neutral communication protocols intended for supervision and control of automation equipment. Specifically, it covers the use of Modbus messaging in an Ethernet environment using the TCP/IP protocols.

The implementation of the Modbus/TCP server in the RETA-02 module is done according to the Modbus/TCP Specification 1.0. The supported Modbus commands are listed in chapter *Communication*.

The Modbus/TCP protocol allows the RETA-02 module to be used as an Ethernet bridge to control the drive. The RETA-02 module supports eight simultaneous IP connections.

Further information can be obtained from www.modbus.org.

## PROFINET IO

PROFINET IO uses traditional Ethernet hardware and software to define a network that structures the task of exchanging data, alarms and diagnostics with Programmable Controllers and other automation controllers.

PROFINET IO can be thought as PROFIBUS on Ethernet. PROFINET IO uses two different communication channels to exchange data with programmable controllers and other devices. The standard TCP/IP channel is used for parameterization, configuration and acyclic read/write operations. The RT or Real

Time channel is used for standard cyclic data transfer and alarms. There is no theoretical limit for the amount of connected nodes in PROFINET IO network, but in practise, the programmable controllers and number of available network addresses limits the size.

The PROFINET IO protocol is specified in the IEC standards 61158 and 61784. The communication with a drive is specified in the PROFIdrive profile (v4) published by PROFIBUS INTERNATIONAL.

Further information can be obtained from www.profinet.com.

## The RETA-02 Ethernet Adapter module

The RETA-02 Ethernet Adapter module is an optional device for ABB drives, which enables the connection of the drive to a Ethernet network. The drive is considered as a slave on the Ethernet network. Through the RETA-02 Ethernet Adapter module, it is possible to:

- give control commands to the drive (Start, Stop, Run enable, etc.)
- feed a motor speed or torque reference to the drive
- give a process actual value or a process reference to the PID controller of the drive
- read status information and actual values from the drive
- change drive parameter values
- reset a drive fault.

The Modbus/TCP and PROFINET commands and services supported by the RETA-02 Ethernet Adapter module are discussed in chapter *Communication*. Please refer to the user documentation of the drive as to which commands are supported by the drive.

The adapter module is mounted into an option slot on the motor control board of the drive. See the *Hardware Manual* of the drive for module placement options.

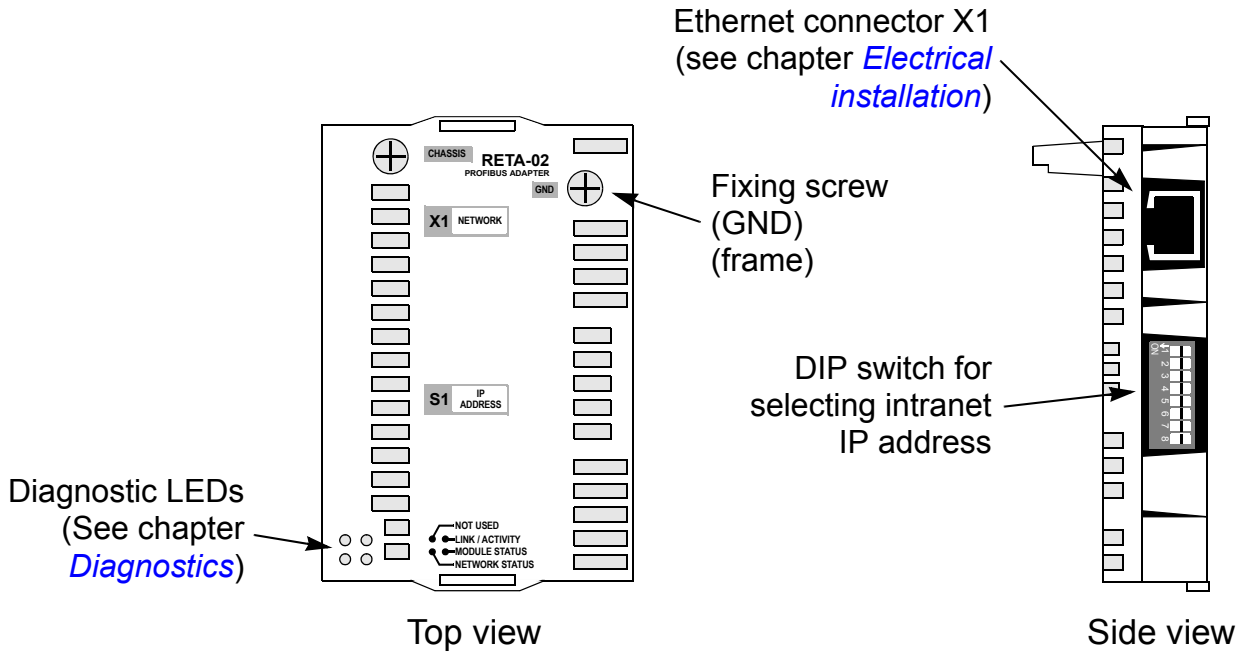


*Figure 1. The RETA-02 Adapter module.*

## Compatibility

The RETA-02 is compatible with all master stations that support the Modbus/TCP. PROFINET IO can be used with master stations that support PROFINET IO and sub-slots. Functionality of the RETA-02 is limited if master station doesn't support multiple sub-slots per slot.

## Delivery check

The option package for the RETA-02 Ethernet Adapter module contains:

- Ethernet Adapter module, type RETA-02
- two screws (M3x10)
- this manual.

## Warranty and liability information

The manufacturer warrants the equipment supplied against defects in design, materials and workmanship for a period of twelve (12) months after installation or twenty-four (24) months from date of manufacturing, whichever first occurs. The local ABB office or distributor may grant a warranty period different to the above and refer to local terms of liability as defined in the supply contract.

The manufacturer is not responsible for

- any costs resulting from a failure if the installation, commissioning, repair, alternation, or ambient conditions of the drive do not fulfil the requirements specified in the documentation delivered with the unit and other relevant documentation
- units subjected to misuse, negligence or accident
- units comprised of materials provided or designs stipulated by the purchaser.

In no event shall the manufacturer, its suppliers or subcontractors be liable for special, indirect, incidental or consequential damages, losses or penalties.

If you have any questions concerning your ABB drive, please contact the local distributor or ABB office. The technical data, information and specifications are valid at the time of printing. The manufacturer reserves the right to modifications without prior notice.

# Quick start-up guide

## Overview

This chapter presents the steps to take during the start-up of the RETA-02 Ethernet Adapter module. For more detailed information, see chapters *Mechanical installation*, *Electrical installation*, *Network configuration*, *Master configuration* and *Communication* elsewhere in this manual.

**WARNING!** Follow the safety instructions given in this manual and the *Hardware Manual* of the drive.

## Mechanical installation

- Insert the RETA-02 into its specified slot in the drive (SLOT2 for ACS550, SLOT1 for ACS800).
- Fasten the two screws.

## Electrical installation

- Connect the Ethernet network cable (RJ-45 connector) to the RETA-02 module. Standard CAT 5 UTP or STP cables can be used. Avoid parallel runs with power (e.g. motor) cables.

## Drive configuration

- Power up the drive. In Modbus/TCP mode the “MODULE STATUS” LED should be green. If the network cable is connected to an active network, the green “LINK/ACTIVITY” LED should also be lit or blinking. In PROFINET IO mode the “MODULE STATUS” led should be blinking red because the name of the device has not been assigned yet.
- The detailed procedure of activating the drive for communication with the module is dependent on the drive type. Normally, a parameter must be adjusted to activate the

communication. Refer to the *Firmware Manual* of the drive for information on the communication settings. With an ACS550 drive, set parameter 98.02 COMM PROT SEL to EXT FBA. With an ACS800, set parameter 98.02 COMM. MODULE LINK to FIELDBUS and parameter 98.07 COMM PROFILE to ABB DRIVES or GENERIC according to the selected communication protocol and profile.

*Table 1. Possible protocol and profile combinations*

| Communication protocol | Communication profile | Drive profile |
|---|---|---|
| Modbus/TCP | ABB Drives profile | ABB Drives profile |
| PROFINET IO | Vendor profile | ABB Drives profile |
| PROFINET IO | PROFIdrive profile | Generic drive profile |

- If the configuration is correct, parameter group 51 should appear in the parameter list of the drive and show the status of the RETA-02 configuration parameters.
- Select communication protocol with a configuration parameter 51.16 ‘PROTOCOL’

  0 = Modbus/TCP
  1 = PROFINET IO

## Network configuration

To enable communication through the Ethernet network, the module needs a valid IP address. There are numerous ways of setting the module IP address; see chapter *Network configuration*.

- One way to set the static IP address is to use the panel of the drive. Set IP address to bus configuration parameters 51.04 - 51.07, subnet mask to parameters 51.08 - 51.11 and gateway address to parameters 51.12 - 51.15 if necessary. Set bus configuration parameter 51.27 to REFRESH to enable the network settings.
- If PROFINET IO protocol is activated also device name is required to identify the drive. IO controllers and some configuration tools have a protocol called Discovery and

Configuration Protocol (DCP) for assigning the IP address and the device name. Also methods described in chapter *Network configuration* can be used to set the IP address of the module.

## Communication

The module is now ready to operate with Modbus/TCP protocol according to Modbus/TCP specification 1.0 or PROFINET IO protocol. For more detailed information on modifying the protocol specific settings, see chapter *Drive configuration*.

### Modbus/TCP configuration

Modbus TCP is based on data registers, which hold IO and parameter values. See chapter *Communication* for register mapping and supported function codes.

### PROFINET IO configuration

Install the RETA-02 GSDML file (e.g. GSDML-V2.0-ABBDrives-RETA02-yyyymmdd.xml, where yyyy = year, mm = month, dd = day of the month when the file was created) and after that update the device catalog.

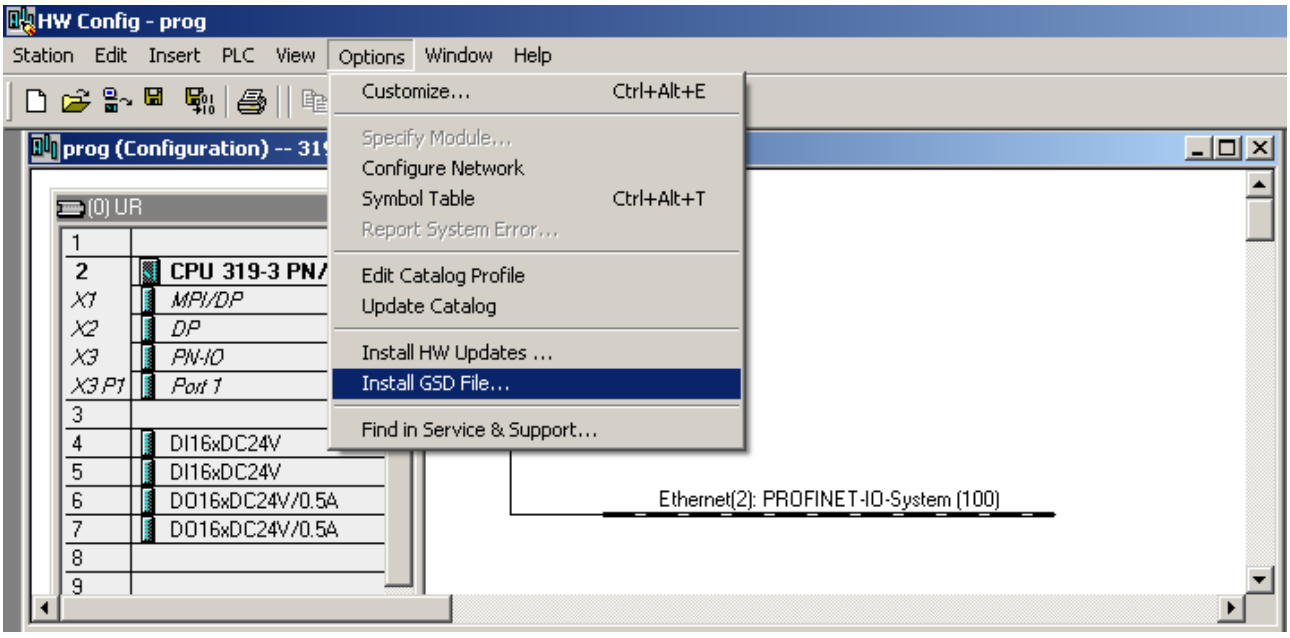


*Figure 2. Menu selection for installing the GSD file*

RETA-02 Vendor and PROFIdrive objects should be available in the product catalog.

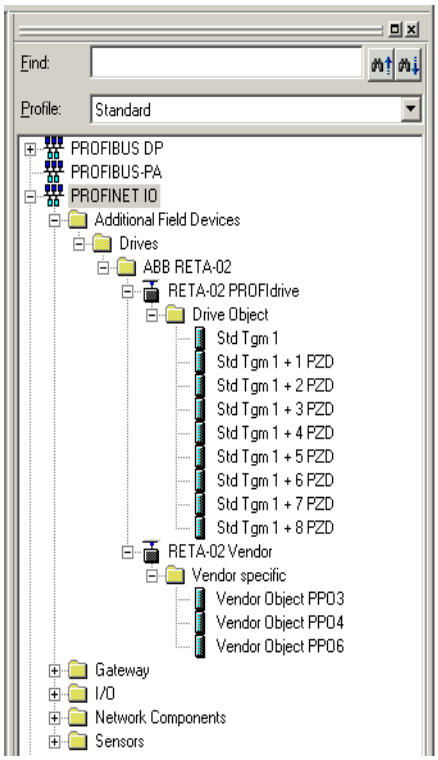


*Figure 3. Product catalog*

*Example 1: PLC configuration in Vendor mode*

PPO 6 consists of 10 input and output parameters. Eight of the inputs and outputs are freely configurable parameters. The first four of them can be mapped either with the bus configuration parameters or the initial record data of the PLC. The last four inputs and outputs can be mapped only with the initial record data of the PLC. In this example the bus configuration parameters are used to map the first four and initial record data the last four of the input and output parameters.

- Drag-and-drop the RETA-02 Vendor object from the device catalog to the PROFINET-IO-System. Also drag-and-drop the Vendor Object PPO 6 to slot one.

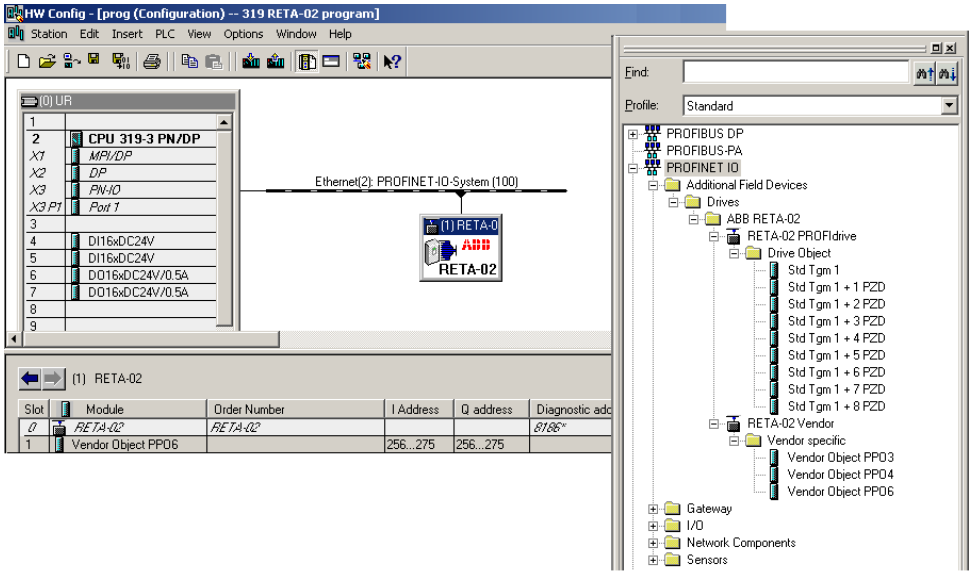


*Figure 4. Adding RETA-02 Vendor object to configuration*

- Right click the device object and open the *Object Properties* menu. Through this menu it is possible to change the device name in the hardware configuration.

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**Note:** The DCP configuration tool, like Step7 must be connected to the Ethernet network to be able to set the name of the device.

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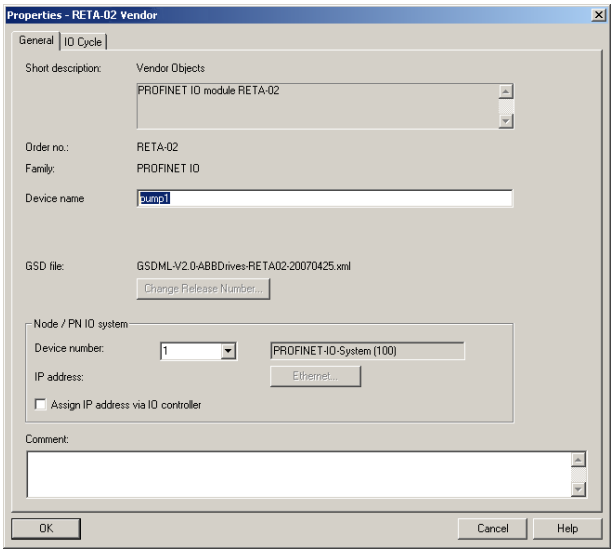


*Figure 5. RETA-02 object properties*

- Assign device name.

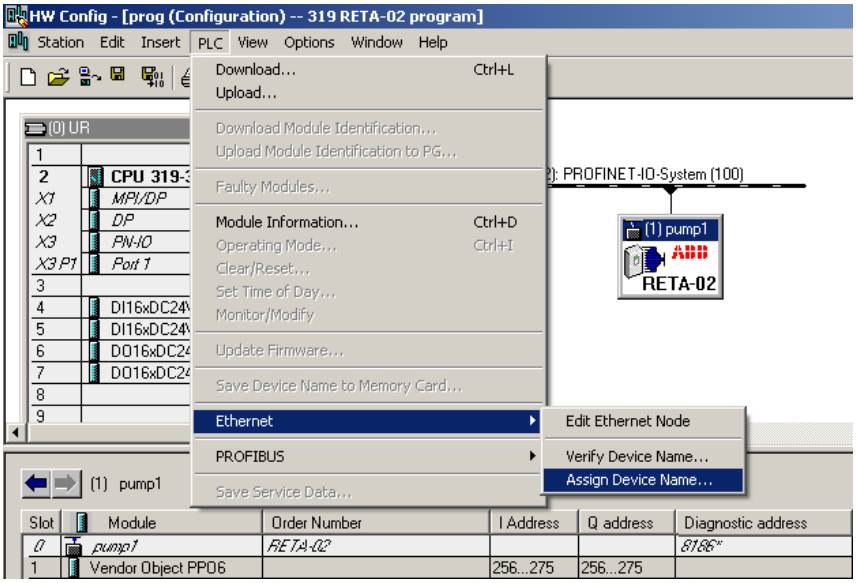


*Figure 6. Menu selection for assigning the device name*

- Set *Bus Configuration parameters* as the source for the input and output parameters 1-4 through the *Properties* menu of the Vendor Object PPO6. Configure the last four inputs and outputs. If *Stop Action selection* is set to *Fail-safe values* configure them as well.

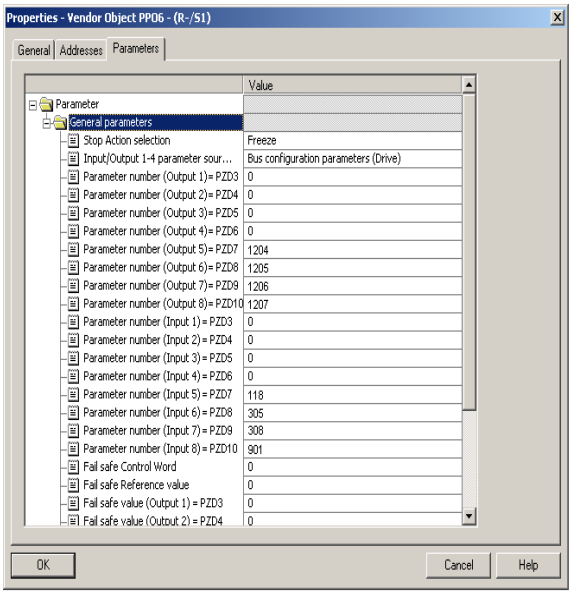


*Figure 7. Properties menu of the Vendor Object PPO6*

*Table 2. ACS800 parameter settings with PPO 6*

| **Drive parameter** | **Example setting for ACS800** |
|---|---|
| 10.01 EXT1 STRT/STP/DIR | COMM.CW |
| 10.03 REF DIRECTION | REQUEST |
| 11.03 EXT1 REF1 SELECT | COMM.REF |
| 16.04 FAULT RESET SEL | COMM.CW |
| 98.02 COMM. MODULE LINK | FIELDBUS |
| 98.07 COMM PROFILE | ABB DRIVES |
| 51.01 MODULE TYPE | PROFINET IO |
| 51.02 COMM RATE | 0 (Auto-negotiation) |
| 51.03 DHCP | 0 (Disabled) |
| 51.04 - 51.07 IP ADDRESS | 10.0.0.6 |
| 51.08 - 51.11 SUBNET MASK | 255.255.255.0 |
| 51.12 - 51.15 GW ADDRESS | 0.0.0.0 |
| 51.16 PROTOCOL | 1 (PROFINET IO) |
| 51.18 OUTPUT 1 | 4001 (Gain for PID) |
| 51.19 OUTPUT 2 | 2202 (Accel time 1) |
| 51.20 OUTPUT 3 | 2203 (Decel time 1) |
| 51.21 OUTPUT 4 | 3401 (Process variable) |
| 51.22 INPUT 1 | 103 (Frequency) |
| 51.23 INPUT 2 | 104 (Current) |
| 51.24 INPUT 3 | 106 (Power) |
| 51.24 INPUT 4 | 107 (DC bus voltage) |
| 51.26 In/out 1-4 src | 2 Disabled (Source of the parameters selected on the PLC side) |

*Example 2: PROFIdrive profile with Std telegram 1 + 4 PZD*

Standard telegram 1 is specified in the PROFIdrive specification 4.01. To include more inputs and outputs without changing the telegram structure different number of PZD's (process data) can be added. The notation used here is ABB specific. In this example, standard telegram 1 and four inputs and outputs are configured with the initial record data.

- After installing the GSD file drag-and-drop the RETA-02 PROFIdrive object to the PROFINET-IO-System. Also drag-and-drop the Std Tgm 1 + 4 PZD to the configuration.

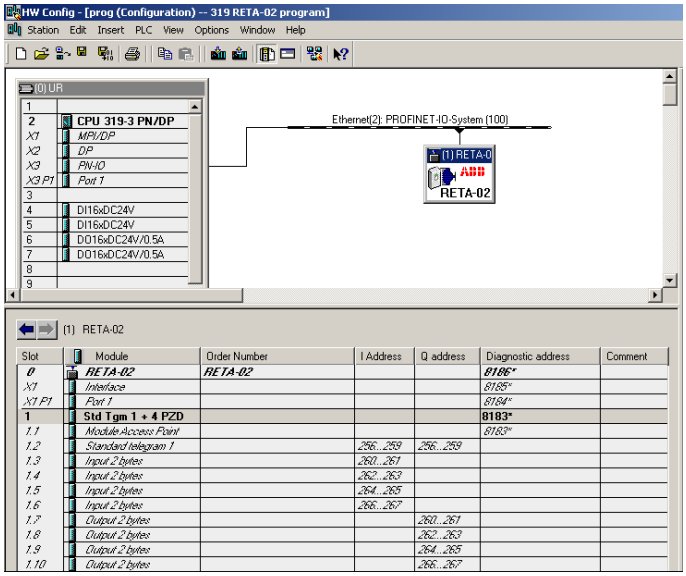


*Figure 8. Adding PROFIdrive object to configuration*

- Right click the device object and open the *Object Properties* menu. Through this menu it is possible to change the device name in the hardware configuration.
- Assign device name.
- Set *Initial Record Data* as the source for the input and output parameters 1-4 through the *Properties* menu of the *Standard telegram 1*. If *Stop Action selection* is set to *Fail-safe values* configure them as well.

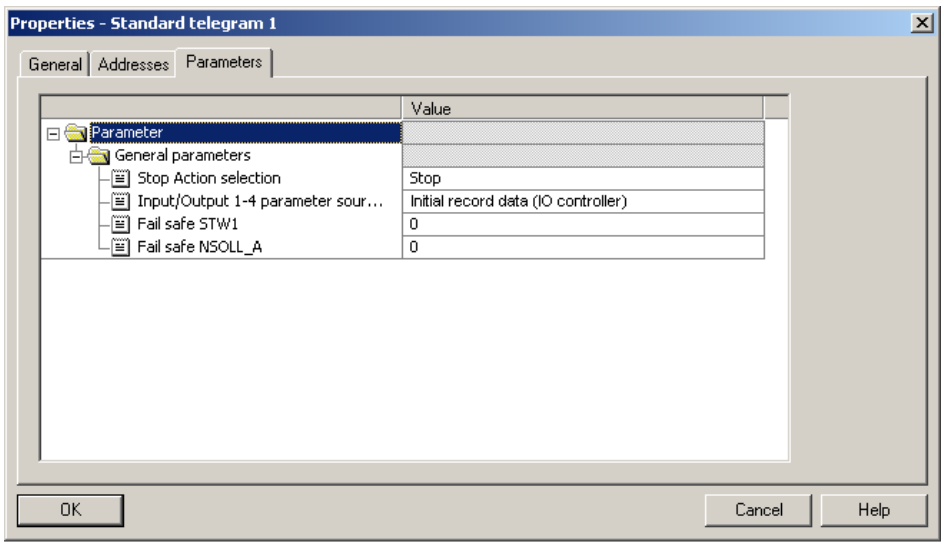


*Figure 9. Properties menu of the Standard Telegram 1*

- Mapping of the inputs and outputs has to be done through the *Properties* menu of the corresponding PZD. Input 1 could be for example 103 (Frequency).

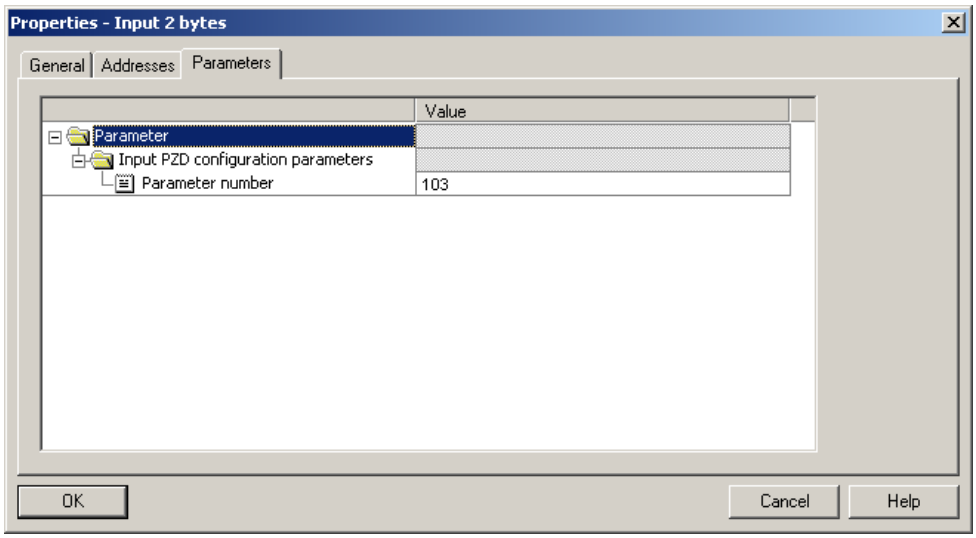


*Figure 10. Properties menu of a PZD*

- After mapping the inputs and outputs they are visible also in the bus configuration parameters 18-24. The mapping cannot be

changed through the configuration parameters unless parameter 26 is set to 1 (Bus configuration parameters).

*Table 3. ACS550 parameter settings with Std Telegram 1 + 4 PZD*

| **Drive parameter** | **Example setting for ACS550** |
|---|---|
| 10.01 EXT1 COMMANDS | COMM |
| 10.03 DIRECTION | REQUEST |
| 11.03 REF1 SELECT | COMM |
| 16.04 FAULT RESET SEL | COMM |
| 98.02 COMM PROT SEL | EXT FBA |
| 51.01 MODULE TYPE | PROFINET IO |
| 51.02 COMM RATE | 0 (Auto-negotiation) |
| 51.03 DHCP | 0 (Disabled) |
| 51.04 - 51.07 IP ADDRESS | 10.0.0.6 |
| 51.08 - 51.11 SUBNET MASK | 255.255.255.0 |
| 51.12 - 51.15 GW ADDRESS | 0.0.0.0 |
| 51.16 PROTOCOL | 1 (PROFINET IO) |
| 51.18 OUTPUT 1 (Read only) | 4001 (Gain for PID) |
| 51.19 OUTPUT 2 (Read only) | 2202 (Accel time 1) |
| 51.20 OUTPUT 3 (Read only) | 2203 (Decel time 1) |
| 51.21 OUTPUT 4 (Read only) | 3401 (Process variable) |
| 51.22 INPUT 1 (Read only) | 103 (Frequency) |
| 51.23 INPUT 2 (Read only) | 104 (Current) |
| 51.24 INPUT 3 (Read only) | 106 (Power) |
| 51.25 INPUT 4 (Read only) | 107 (DC bus voltage) |
| 51.26 In/out 1-4 src | 2 Disabled (Source of the parameters selected on the PLC side) |

# Mechanical installation

**WARNING!** Follow the safety instructions given in this manual and in the *Hardware Manual*.

## Mounting

The RETA-02 is to be inserted into its specific position in the drive. The module is held in place with plastic retaining clips and two screws. The screws also provide the earthing of the CAT 5 STP cable shield connected to the module, and interconnect the GND signals of the module and the control board of the drive.

On installation of the module, the signal and power connection to the drive is automatically made through a 34-pin connector.

Mounting procedure:

- Insert the module carefully into its position inside the drive until the retaining clips lock the module into position.
- Fasten the two screws (included) to the stand-offs.
- Set the IP address DIP switch of the module to the required position.

**Note:** Correct installation of the screws is essential for fulfilling the EMC requirements and for proper operation of the module.

# Electrical installation

**WARNING!** Before installation, switch off the drive power supply. Wait five minutes to ensure that the capacitor bank of the drive is discharged. Switch off all dangerous voltages connected from external control circuits to the inputs and outputs of the drive.

## General cabling instructions

Arrange the network cable as far away from the motor cables as possible. Avoid parallel runs. Use bushings at cable entries.

## Ethernet connection

The network cable is connected to the RJ45 connector (X1) on the RETA-02 module. Standard CAT 5 UTP and CAT 5 STP (recommended) cables can be used. In case CAT 5 STP is used, the cable shield is connected via rc filter to drive frame through the module.

# Drive configuration

## Overview

This chapter gives information on configuring the RETA-02 Ethernet Adapter module and the drive.

## RETA-02 configuration

After the RETA-02 Ethernet Adapter module has been mechanically and electrically installed according to the instructions in chapters *Mechanical installation* and *Electrical installation*, the drive must be prepared for communication with the module.

ABB drives can receive control information from multiple sources including digital inputs, analogue inputs, the drive control panel and a communication module (e.g. RETA-02). ABB drives allow the user to separately determine the source for each type of control information (Start, Stop, Direction, Reference, Fault Reset, etc.). In order to give the fieldbus master station the most complete control over the drive, the communication module must be selected as source for this information.The detailed procedure of activating the drive for communication with the module is dependent on the drive type. Normally, a parameter must be adjusted to activate the communication. Please refer to the drive documentation.

As communication between the drive and the RETA-02 is established, several configuration parameters are copied to the drive. These parameters must be checked first and adjusted if necessary. The alternative selections for these parameters are discussed in more detail below the table.

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**Note:** The new settings take effect only when the module is powered up the next time or when the module receives a ‘Fieldbus Adapter parameter refresh’ (Parameter 51.27) command from the drive.

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*Table 4. The RETA-02 configuration parameters*

| Par. no. | Parameter name | Alternative settings | Default setting |
|---|---|---|---|
| 1 | MODULE TYPE | (Read-only) | PROFINET IO |
| 2 | Comm rate | **(0)** Auto-negotiate; **(1)** 100 Mbit/s, full duplex; **(2)** 100 Mbit/s, half duplex; **(3)** 10 Mbit/s, full duplex; **(4)** 10 Mbit/s, half duplex | **(0)** Auto-negotiate |
| 3 | DHCP | **(0)** DHCP disabled; **(1)** DHCP enabled | **(1)** DHCP enabled |
| 4 | IP address 1 | 0…255 | 0 |
| 5 | IP address 2 | 0…255 | 0 |
| 6 | IP address 3 | 0…255 | 0 |
| 7 | IP address 4 | 0…255 | 0 |
| 8 | Subnet mask 1 | 0…255 | 0 |
| 9 | Subnet mask 2 | 0…255 | 0 |
| 10 | Subnet mask 3 | 0…255 | 0 |
| 11 | Subnet mask 4 | 0…255 | 0 |
| 12 | GW address 1 | 0…255 | 0 |
| 13 | GW address 2 | 0…255 | 0 |
| 14 | GW address 3 | 0…255 | 0 |
| 15 | GW address 4 | 0…255 (0) | 0 |
| 16 | Protocol | **(0)** Modbus/TCP;<br>**(1)** PROFINET IO | **(0)** Modbus/TCP |
| 17 | Modbus timeout | 0…65535 | 0 |
| 18 | Output 1 | 0…65535 | 0 |
| 19 | Output 2 | 0…65535 | 0 |
| 20 | Output 3 | 0…65535 | 0 |
| 21 | Output 4 | 0…65535 | 0 |
| 22 | Input 1 | 0…65535 | 0 |

| | | | |
|---|---|---|---|
| 23 | Input 2 | 0…65535 | 0 |
| 24 | Input 3 | 0…65535 | 0 |
| 25 | Input 4 | 0…65535 | 0 |
| 26 | In/Out 1-4 src | **(0)** Initial record data;<br>**(1)** Bus configuration parameters;<br>**(2)** Disable | 2 |

*1 MODULE TYPE*

This parameter shows the module type as detected by the drive. The value cannot be adjusted by the user.

If this parameter is undefined, the communication between the drive and the module has not been established.

*2 Comm rate*

Defines the baud rate for the Ethernet interface.

0 = Auto-negotiate
1 = 100 Mbit/s, full duplex
2 = 100 Mbit/s, half duplex
3 = 10 Mbit/s, full duplex
4 = 10 Mbit/s, half duplex

*3 DHCP*

The Dynamic Host Configuration Protocol (DHCP) is an Internet protocol for automating the configuration of computers that use TCP/IP. DHCP can be used to automatically assign IP addresses, to deliver TCP/IP stack configuration parameters such as the subnet mask and default router, and to provide other configuration information.

0 = DHCP disabled
1 = DHCP enabled

*4 IP address 1*
*5 IP address 2*
*6 IP address 3*
*7 IP address 4*

An IP address is assigned to each TCP/IP node on an Ethernet network. IP addresses consist of four decimal integers in the range of 0…255 separated by periods, each integer representing the value of one byte (8 bits, octet) in the IP address. These parameters define the four octets of the IP address.

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**Note:** Setting any actuator of DIP switch S1 enables hardware address selection, in which case the IP address is of the format 192.168.0.xxx. The fourth octet is defined by the DIP switch. See chapter *Network configuration*.

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*8 Subnet mask 1*
*9 Subnet mask 2*
*10 Subnet mask 3*
*11 Subnet mask 4*

Subnet masks are used for splitting networks into subgroups, or subnets. A subnet mask is a binary pattern that is matched up with the IP address to turn part of the address field into a field for subnets. These parameters define the four octets of the subnet mask.

*12 GW address 1*
*13 GW address 2*
*14 GW address 3*
*15 GW address 4*

Gateways connect individual physical networks into a system of networks. When a node needs to communicate with a node on another network, the gateway transfers the data between the two networks. These parameters define the four octets of the gateway address.

*16 Protocol*

Selects the application protocol and communication profile for the network communication.

0 = Modbus/TCP

1 = PROFINET IO

*17 Modbus timeout*

The Modbus protocol does not have an implementation for time-out on application layer and this may be required when controlling a drive. A supervision method has been implemented for this purpose. If modbus timeout is set to zero, this feature is disabled. The unit of the parameter is 100 milliseconds (e.g. ‘22’ will give a timeout of 2.2 seconds).

If the communication fault function is activated, Modbus timeout is the sum of communication fault time and the time defined here.

*18 Output 1*
*19 Output 2*
*20 Output 3*
*21 Output 4*

When Modbus/TCP protocol is in use, these parameters define the output (from master to drive) data words or drive parameters that are updated more frequently. Writing to and reading from the Modbus/TCP register corresponding to the parameter is faster.

When PROFINET IO protocol is in use, these parameters define the output (from master to drive) data words or drive parameters that can be used with the vendor specific PPO’s or in addition to the Standard telegram 1 (see chapter *Communication*). Output words correspond to PZD's according to the table below.

| Output | PZD |
|---|---|
| Output 1 | PZD3 |
| Output 2 | PZD4 |
| … | … |
| Output 8* | PZD10 |

*Outputs from 4 to 10 are defined separately in the PLC.

The contents are defined by a decimal number in the range of 0 to 65535 as follows:

| | | |
|---|---|---|
| 0 | Not used | |
| 1…99 | Data set area of the drive | |
| | 1 | Data set 1 word 1 |
| | 2 | Data set 1 word 2 |
| | 3 | Data set 1 word 3 |
| | 4 | Data set 2 word 1 |
| | 5 | Data set 2 word 2 |
| | • • • | • • • |
| | 99 | Data set 33 word 3 |
| 101…9999 | Parameter area of the drive | |
| | Format: (x)xyy, where (x)x = actual signal group or parameter group; yy = actual signal or parameter index. E.g. 103 = actual signal 01.03; 2202 = parameter 22.02. | |
| 10000…65535 | Not supported by the drive | |

*22 Input 1*
*23 Input 2*
*24 Input 3*
*25 Input 4*

When Modbus/TCP protocol is in use, these parameters define the input (from drive to master) data words or drive parameters

that are updated more frequently. Reading from the Modbus/TCP register corresponding to the parameter is faster.

When PROFINET IO protocol is in use, these parameters define the input (from drive to master) data words or drive parameters that can be used with the vendor specific PPO's or in addition to the Standard telegram 1 (see chapter *Communication*). Input words correspond to PZD's according to the table below.

| **Input** | **PZD** |
|---|---|
| Input 1 | PZD3 |
| Input 2 | PZD4 |
| … | … |
| Input 8* | PZD10 |

*Inputs from 4 to 10 are defined separately in the PLC.

The contents are defined by a decimal number in the range of 0 to 65535 as follows:

<table>
<tr><td>0</td><td colspan="2">Not used</td></tr>
<tr><td rowspan="8">1…99</td><td colspan="2">Data set area of the drive</td></tr>
<tr><td>1</td><td>Data set 1 word 1</td></tr>
<tr><td>2</td><td>Data set 1 word 2</td></tr>
<tr><td>3</td><td>Data set 1 word 3</td></tr>
<tr><td>4</td><td>Data set 2 word 1</td></tr>
<tr><td>5</td><td>Data set 2 word 2</td></tr>
<tr><td>• • •</td><td>• • •</td></tr>
<tr><td>99</td><td>Data set 33 word 3</td></tr>
<tr><td rowspan="2">101…9999</td><td colspan="2">Parameter area of the drive</td></tr>
<tr><td colspan="2">Format: (x)xyy, where (x)x = actual signal group or parameter group; yy = actual signal or parameter index. E.g. 103 = actual signal 01.03; 2202 = parameter 22.02.</td></tr>
<tr><td>10000…65535</td><td colspan="2">Not supported by the drive</td></tr>
</table>

*26 In/Out 1-4 src*

Selects the source for the first four inputs and outputs when PROFINET IO is used. User can map parameters to the first four inputs and outputs with the initial record data of the IO controller or by using the RETA-02 configuration parameters described above. Initial record data has a parameter that can be used to select the source in similar way.

0 = Initial record data (IO Controller assigns input and output 1-4 values)

1 = RETA-02 configuration parameters 18-25 are used

2 = Disable (Use ‘Input/Output 1-4 parameter source selection’ parameter of the initial record data to select the source for the first four inputs and output)

# Network configuration

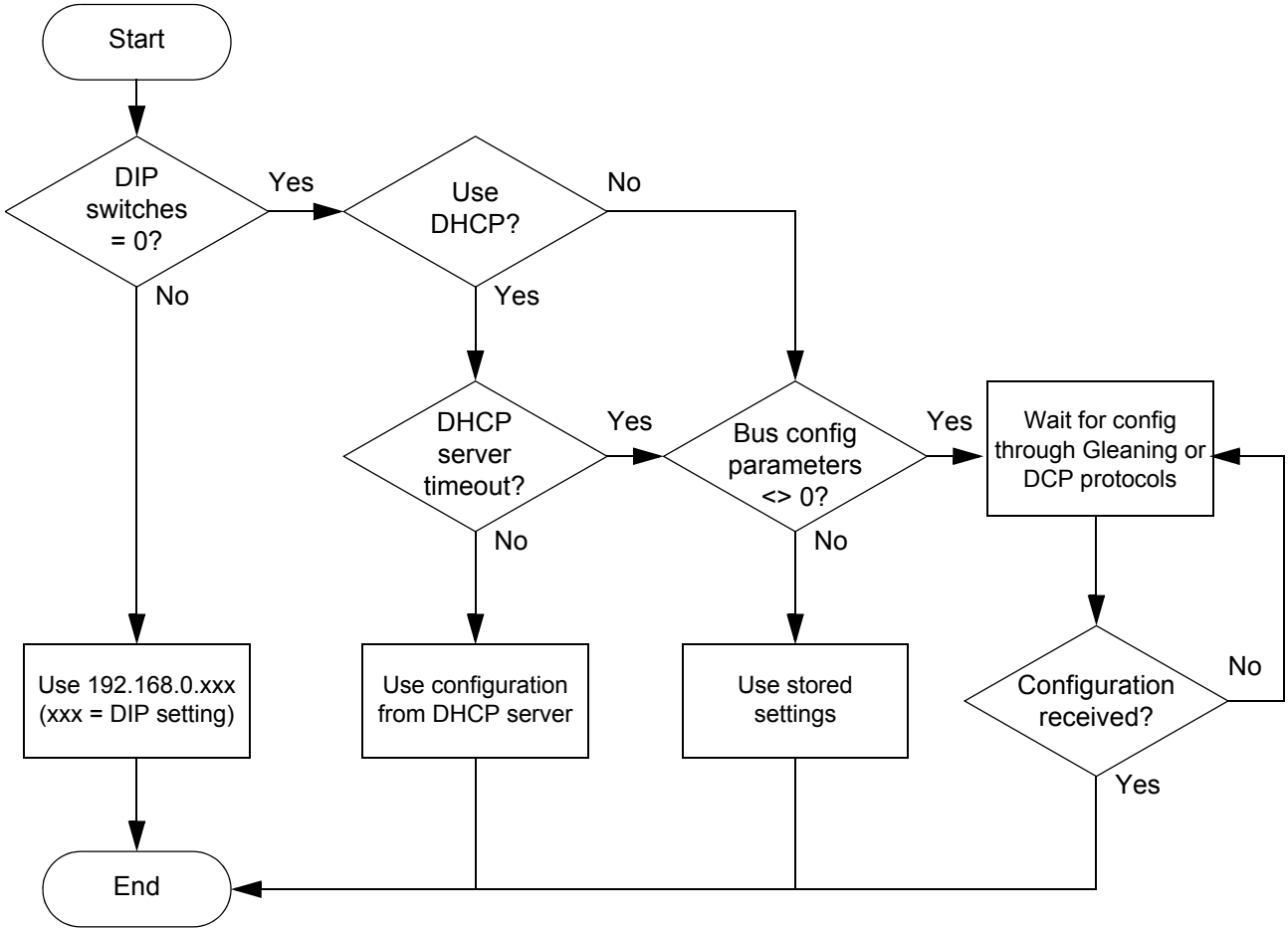
## Overview

RETA-02 supports 10 Mbit/s and 100 Mbit/s data transfer rates and automatically detects the data transfer rate used in the network.

**Note:** PROFINET IO uses only 100 Mbit/s in Full-duplex mode.

The network configuration of the RETA-02 can be done using several methods. The following flowchart shows the sequence in which different settings are read. The table below gives detailed information on each different configuration methods.

# IP settings configuration



<table>
<tr><th>Method</th><th>Description</th><th>Note</th></tr>
<tr><td>DIP switch (S1)</td><td>By default, the IP address is defined by software. Setting any DIP actuator to ON enables hardware selection. DIP actuators 1 to 8 define the last octet (1 to 254) of the IP address in binary. Actuator 8 represents the least significant bit.
<table>
<tr><td>IP address:</td><td>192.168.0.xxx</td></tr>
<tr><td>Subnet mask:</td><td>255.255.255.0</td></tr>
<tr><td>Gateway:</td><td>0.0.0.0</td></tr>
</table>
where xxx stands for a value between 1 and 254 and is selected by DIP switch S1.<br>Example DIP settings:
<table>
<tr><th>Intranet IP address</th><th>S1 actuator positions</th></tr>
<tr><td>(Selected by software)</td><td>OFF oooooooo<br>ON<br>12345678</td></tr>
<tr><td>192.168.0.1</td><td>OFF ooooooo<br>ON o<br>12345678</td></tr>
<tr><td>192.168.0.2</td><td>OFF oooooo o<br>ON o<br>12345678</td></tr>
<tr><td>• • •</td><td>• • •</td></tr>
<tr><td>192.168.0.255</td><td>OFF<br>ON oooooooo<br>12345678</td></tr>
</table>
</td><td>Only read at start-up.<br>Only for intranet use.</td></tr>
<tr><td>DHCP/BOOTP</td><td>Automatically receive the configuration from a DHCP server.</td><td>A DHCP server is required on the network.</td></tr>
</table>

| Method | Description | Note |
|---|---|---|
| Settings stored in RETA-02 configuration parameters | Use the configuration stored in the RETA-02 configuration parameters. See *Table 4.* in chapter *Drive configuration*. | RETA-02 must be started for any configuration changes to take effect. |
| Gleaning (ARP) | Change the IP address from a PC using the following commands:<br><br>`arp -s <IP address> <MAC address>`<br>`ping <IP address>`<br>`arp -d <IP address>`<br><br>The `arp -s` command will store the IP and MAC addresses in the PC ARP table. When the `ping` command is executed, the PC will send the message to the module using the MAC address. The module changes its IP address to the given one. | The MAC address of the module can be found on a label on the RETA-02 module. |
| DCP (Discovery and Configuration Protocol) | The DCP protocol is used for setting the IP address and for assigning a station name of a PROFINET IO node. | Usually included to a configuration tool, like Step7.<br>This protocol cannot be used with Modbus/TCP. |

### PROFINET IO and DCP

DCP can only be used in the PROFINET IO mode. When the module is initialized, the IP address is transferred to the PROFINET IO communication stack. If there is a need to change the IP address it should be done with a DCP tool (like Siemens Step7). If some of the other methods is used to change the IP address, the module must be restarted to enable any changes.

### Duplicate IP address detection

RETA-02 has a duplicate IP address detection mechanism when using Modbus/TCP. If the module detects another device on the network, which has the same IP address, it lids the Network status led in red and starts to blink the Module status led in red.

In PROFINET IO network the controller has the duplicate IP address detection mechanism.

# Master configuration

## Overview

This chapter describes the principle of configuring the PROFINET IO master station for communication through the RETA-02 PROFINET IO Adapter module.

## Configuring the system

After the RETA-02 PROFINET IO Adapter module has been mechanically and electrically installed according to the instructions in previous chapters, and has been initialised by the drive, the master station must be prepared for communication with the module.

Configuration of the master station requires a type definition (GSD) file. In PROFINET IO the GSD file is written in XML based language called GSDML. RETA-02 has a GSD file, which is available from www.profinet.com, www.abb.com or your local ABB representative. The filename is **GSDML-Vx.x-ABB-RETA02-yyyymmdd.xml**.

The GSD file describes vendor specific features and PROFIdrive specific features of the adapter. Vendor specific features can be used e.g. in ABB Drives communication profile. PROFIdrive mode supports a set of services described in the PROFIdrive specification.

Please refer to the master station documentation for more information on activating PROFINET IO devices with GSD file.

## System requirements

To use the vendor specific features the master station should support GSDML v1.0 and one subslot per slot. To use the PROFIdrive mode the master system should support GSDML 2.0 or 2.1 and multiple subslots per slot.

# Communication profiles

## Overview

This chapter describes the communication profiles used in the communication between the PROFINET IO network, the RETA-02 module, and the drive.

## Communication profiles

Communication profiles are ways of conveying control commands (Control word, Status word, references and actual values) between the master station and the drive. With the RETA-02 module, the PROFINET IO network may employ either the PROFIdrive profile or the ABB Drives profile.

The following sections describe the Control word, the Status word, references and actual values for the PROFIdrive and ABB Drives communication profiles.

# The PROFIdrive communication profile

## The Control Word and the Status Word

The Control Word is the principal means for controlling the drive from a fieldbus system. It is sent by the fieldbus master station to the drive through the adapter module. The drive switches between its states according to the bit-coded instructions on the Control Word, and returns status information to the master in the Status Word.

The contents of the Control Word and the Status Word are detailed in *Table 5.* and *Table 6.* respectively; see the drive documentation for information on the drive-specific bits. The drive states are presented in the PROFIdrive State Machine (*Figure 11.*).

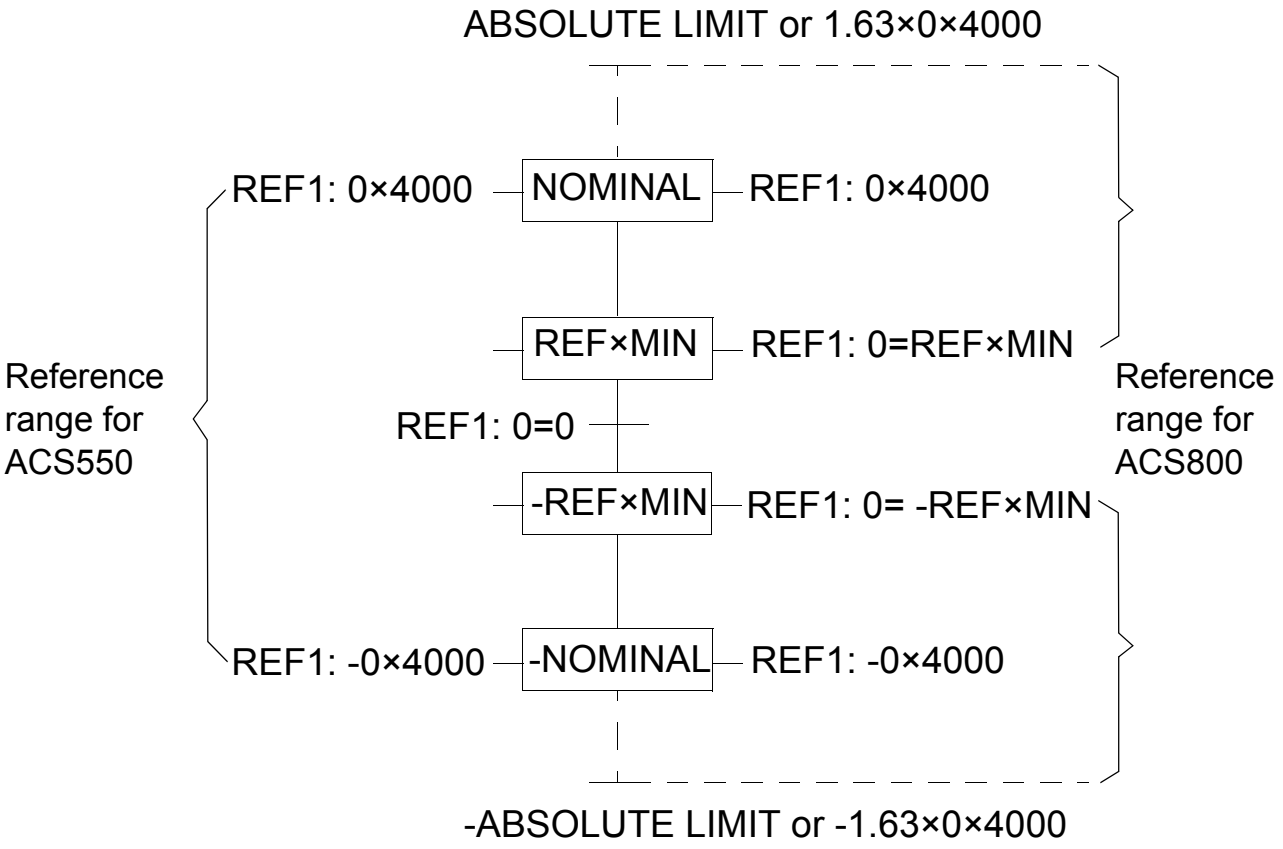
## References

References are 16-bit words containing a sign bit and a 15-bit integer. A negative reference (indicating reversed direction of rotation) is formed by calculating the two's complement from the corresponding positive reference.

ABB drives can receive control information from multiple sources including analogue and digital inputs, the drive control panel and a communication module (e.g. RETA-02). In order to have the drive controlled through PROFINET IO, the communication module must be defined as the source for control information, e.g. Reference.

*Scaling*

The speed reference (REF) in hexadecimal (0 … 4000h) corresponds to 0 … 100% of Nominal Speed or Maximum Reference depending on the drive type.



### Actual values

Actual values are 16-bit words containing information on the operation of the drive. The functions to be monitored are selected by a drive parameter.

*Scaling*

The actual speed (ACT) in hexadecimal (0 … 4000h) corresponds to 0 … 100% of Nominal Speed or Maximum Reference depending on the drive type.

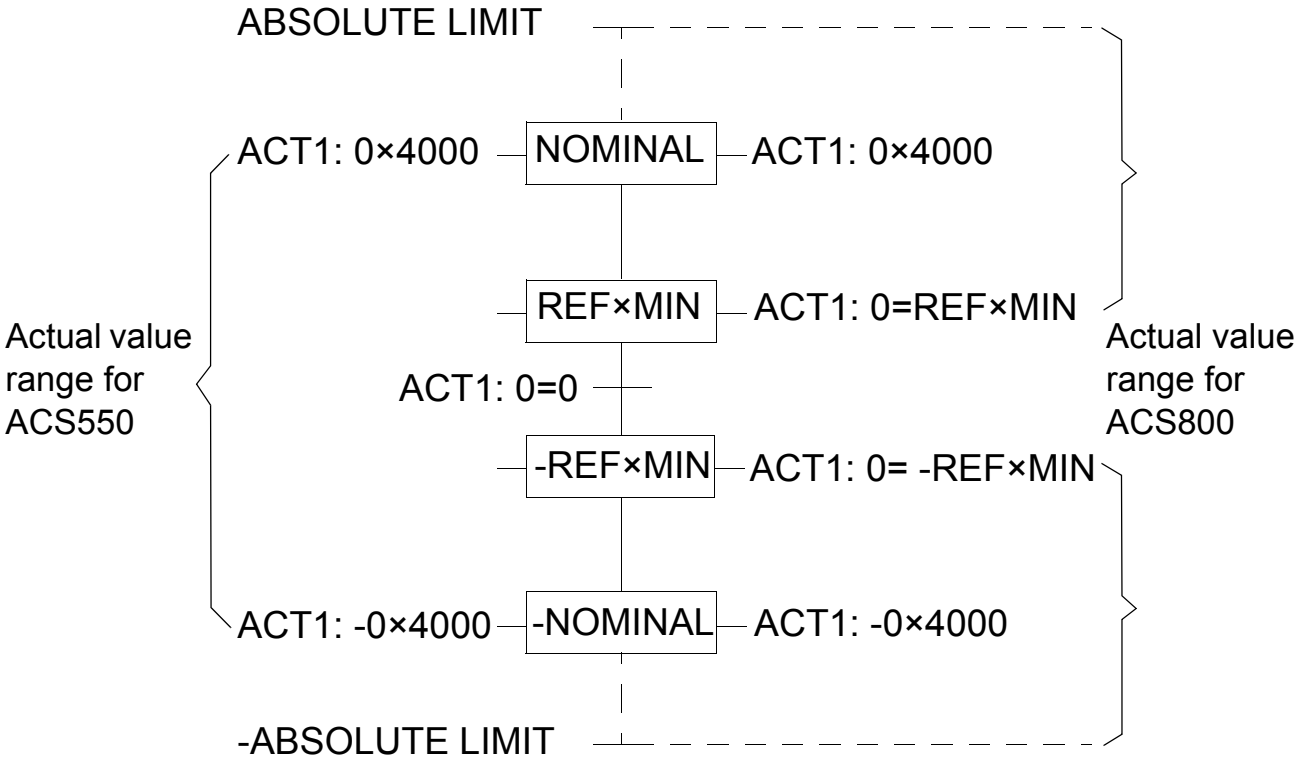


*Table 5. The Control Word for the PROFIdrive communication profile. The upper case boldface text refers to the states shown in Figure 11.*

| Bit | Name | Value | Proceed to **STATE/Description** |
|---|---|---|---|
| 0 | ON | 1 | Proceed to **READY TO OPERATE**. |
| | OFF1 | 0 | Emergency OFF, stop by the selected deceleration ramp. Proceed to **OFF1 ACTIVE;** proceed further to **READY TO SWITCH ON** unless other interlocks (OFF2, OFF3) are active. |
| 1 | OFF2 | 1 | Continue operation (OFF2 inactive). |
| | | 0 | Emergency OFF, coast to stop.<br>Proceed to **OFF2 ACTIVE**; proceed further to **SWITCH-ON INHIBIT**. |
| 2 | OFF3 | 1 | Continue operation (OFF3 inactive). |
| | | 0 | Emergency stop, stop according to fastest possible deceleration mode. Proceed to **OFF3 ACTIVE**; proceed further to **SWITCH-ON INHIBIT. Warning:** Ensure motor and driven machine can be stopped using this stop mode. |
| 3 | OPERATION_ ENABLE | 1 | Proceed to **ENABLE OPERATION**. |
| | | 0 | Inhibit operation. Proceed to **OPERATION INHIBIT**. |
| 4 | RAMP_OUT_ ZERO | 1 | Normal operation.<br>Proceed to **RAMP FUNCTION GENERATOR: ENABLE OUTPUT**. |
| | | 0 | Stop according to selected stop type. |
| 5 | RAMP_HOLD | 1 | Normal operation.<br>Proceed to **RAMP FUNCTION GENERATOR: ENABLE ACCELERATOR**. |
| | | 0 | Halt ramping (Ramp Function Generator output held). |
| 6 | RAMP_IN_ ZERO | 1 | Normal operation. Proceed to **OPERATING**.<br>**Note:** This bit is effective only if the fieldbus interface is set as the source for this signal by drive parameters. |
| | | 0 | Force Ramp Function Generator input to zero. |

| Bit | Name | Value | Proceed to **STATE/Description** |
|---|---|---|---|
| 7 | RESET | 0 ⇒ 1 | Fault reset if an active fault exists. Proceed to **SWITCH-ON INHIBIT.**<br>**Note:** This bit is effective only if the fieldbus interface is set as the source for this signal by drive parameters. |
| | | 0 | (Continue normal operation) |
| 8 | INCHING_1 | | Inching 1. (Not supported by all drive types) |
| 9 | INCHING_2 | | Inching 2. (Not supported by all drive types) |
| 10 | REMOTE_ CMD | 1 | Fieldbus control enabled. |
| | | 0 | Control Word <> 0 or Reference <> 0: Retain last Control Word and Reference.<br>Control Word = 0 and Reference = 0: Fieldbus control enabled. |
| 11 to 15 | | | Drive specific |

*Table 6. The Status Word for the PROFIdrive communication profile. The upper case boldface text refers to the states shown in Figure 11.*

| Bit | Name | Value | STATE/Description |
|---|---|---|---|
| 0 | RDY_ON | 1 | **READY TO SWITCH ON**. |
| | | 0 | **NOT READY TO SWITCH ON**. |
| 1 | RDY_RUN | 1 | **READY TO OPERATE**. |
| | | 0 | **OFF1 ACTIVE**. |
| 2 | RDY_REF | 1 | **ENABLE OPERATION**. |
| | | 0 | **DISABLE OPERATION**. |
| 3 | TRIPPED | 1 | **FAULT**. |
| | | 0 | No fault. |
| 4 | OFF_2_STA | 1 | OFF2 inactive. |
| | | 0 | **OFF2 ACTIVE**. |
| 5 | OFF_3_STA | 1 | OFF3 inactive. |
| | | 0 | **OFF3 ACTIVE**. |
| 6 | SWC_ON_INHIB | 1 | **SWITCH-ON INHIBIT ACTIVE**. |
| | | 0 | **SWITCH-ON INHIBIT NOT ACTIVE**. |
| 7 | ALARM | 1 | Warning/Alarm. |
| | | 0 | No Warning/Alarm. |
| 8 | AT_SETPOINT | 1 | **OPERATING.** Actual value equals reference value (i.e. is within tolerance limits). |
| | | 0 | Actual value differs from reference value (= is outside tolerance limits). |
| 9 | REMOTE | 1 | Drive control location: REMOTE. |
| | | 0 | Drive control location: LOCAL. |
| 10 | ABOVE_LIMIT | 1 | Actual frequency or speed value equals or is greater than supervision limit. |
| | | 0 | Actual frequency or speed value is within supervision limit. |

| Bit | Name | Value | STATE/Description |
|---|---|---|---|
| 11 to 15 | | | Drive specific |

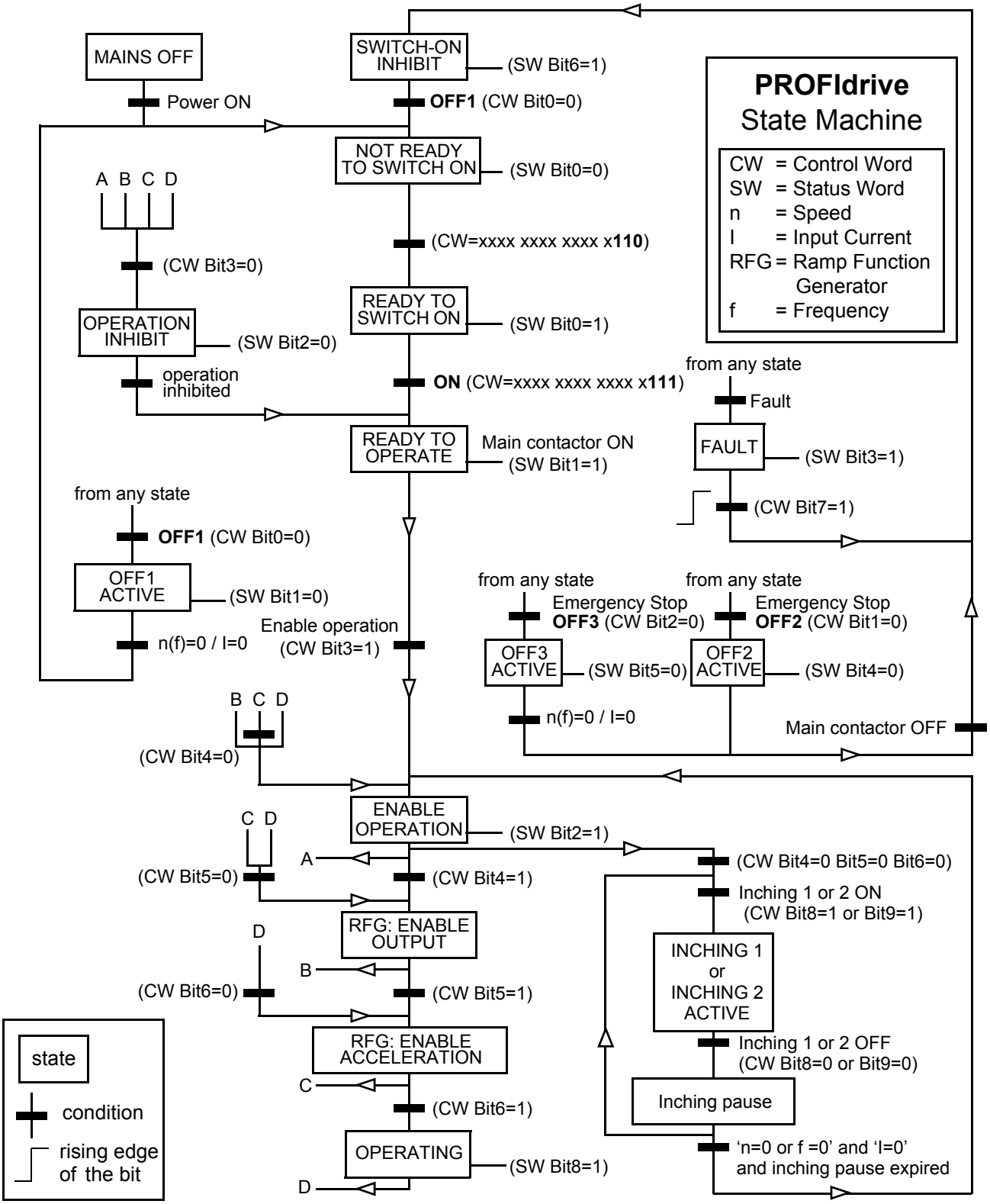



*Figure 11. The PROFIdrive state machine*

# The ABB Drives communication profile

## The Control Word and the Status Word

The Control Word is the principal means for controlling the drive from a fieldbus system. It is sent by the fieldbus master station to the drive through the adapter module. The drive switches between its states according to the bit-coded instructions on the Control Word, and returns status information to the master in the Status Word.

The contents of the Control Word and the Status Word are detailed in *Table 7.* and *Table 8.* respectively. The drive states are presented in the ABB Drives profile state machine (*Figure 12.*).

## References

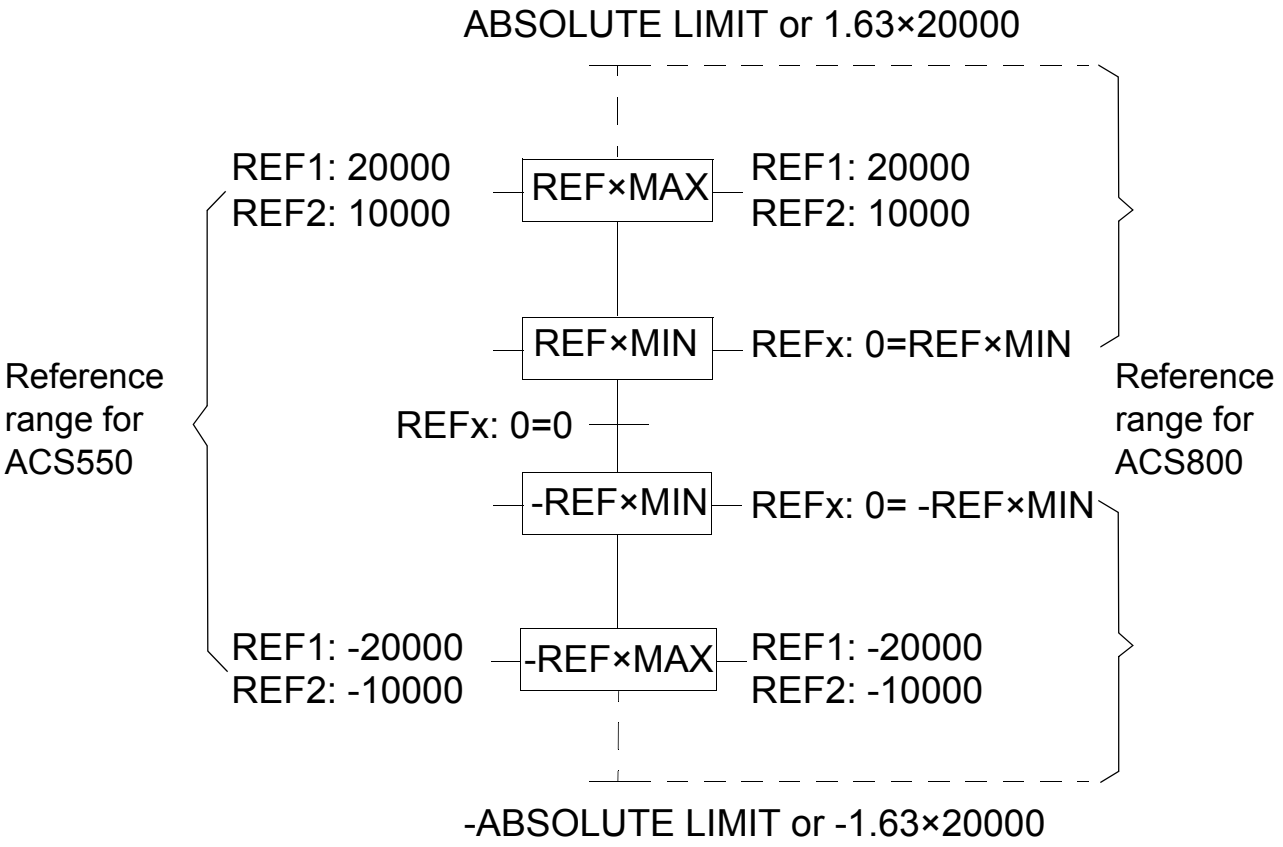
References are 16-bit words containing a sign bit and a 15-bit integer. A negative reference (indicating reversed direction of rotation) is formed by calculating the two’s complement from the corresponding positive reference.

ABB drives can receive control information from multiple sources including analogue and digital inputs, the drive control panel and a communication module (e.g. RETA-02). In order to have the drive controlled through the fieldbus, the module must be defined as the source for control information, e.g. Reference.

*Scaling*

References are scaled as shown below.

**Note:** The values of REF1 MAX and REF2 MAX are set by drive parameters. See the drive documentation for further information.



### Actual values

Actual values are 16-bit words containing information on the operation of the drive. The functions to be monitored are selected by a drive parameter.

*Scaling*

Actual values are scaled as shown below.

---

**Note:** The values of REF1 MAX and REF2 MAX are set by drive parameters. See the drive documentation for further information.

---

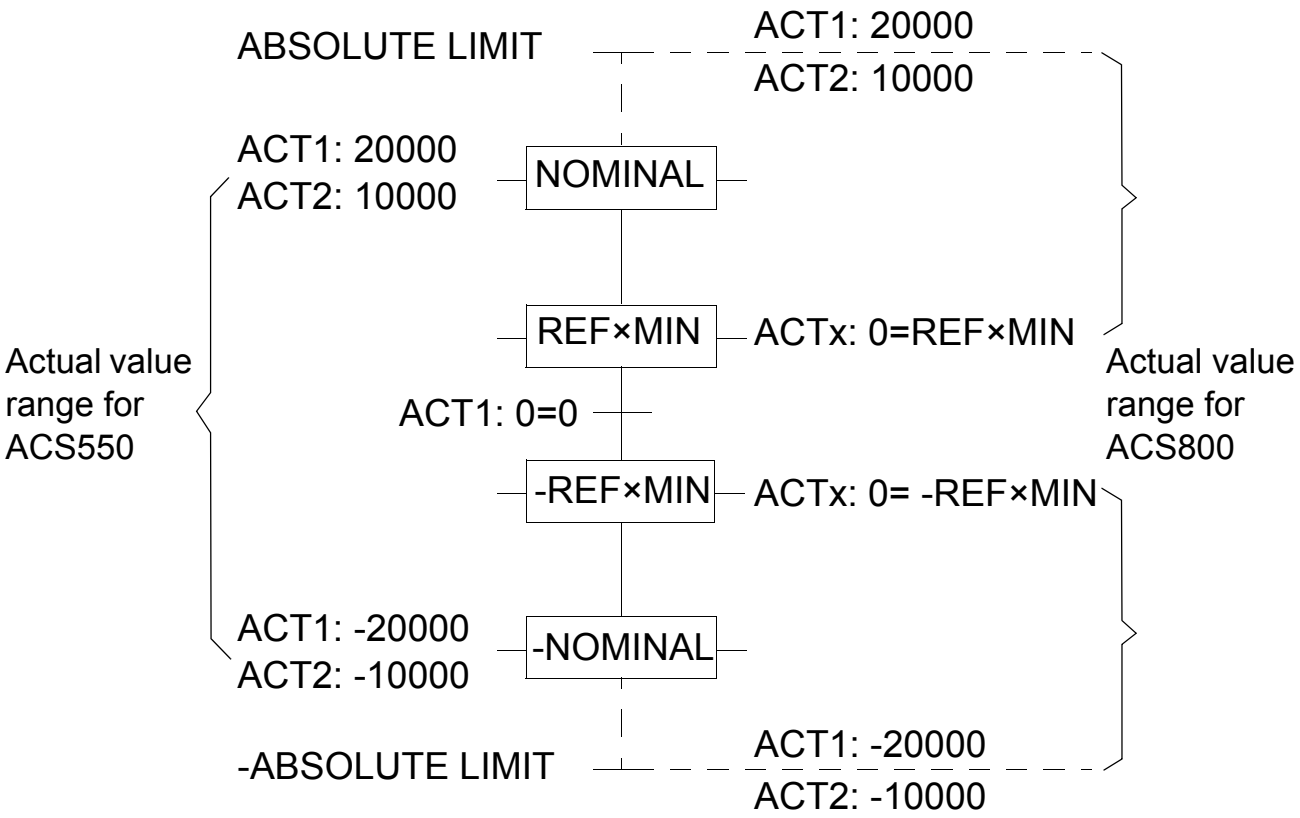


*Table 7. The Control Word for the ABB Drives communication profile. The upper case boldface text refers to the states shown in Figure 11.*

| Bit | Name | Value | STATE/Description |
|---|---|---|---|
| 0 | OFF1_ CONTROL | 1 | Proceed to **READY TO OPERATE**. |
| | | 0 | Stop along currently active deceleration ramp. Proceed to **OFF1 ACTIVE**; proceed to **READY TO SWITCH ON** unless other interlocks (OFF2, OFF3) are active. |
| 1 | OFF2_ CONTROL | 1 | Continue operation (OFF2 inactive). |
| | | 0 | Emergency OFF, coast to stop. Proceed to **OFF2 ACTIVE**, proceed to **SWITCH-ON INHIBITED**. |
| 2 | OFF3_ CONTROL | 1 | Continue operation (OFF3 inactive). |
| | | 0 | Emergency stop, stop within time defined by drive parameter. Proceed to **OFF3 ACTIVE**; proceed to **SWITCH-ON INHIBITED**.<br>**Warning:** Ensure motor and driven machine can be stopped using this stop mode. |
| 3 | INHIBIT_ OPERATION | 1 | Proceed to **OPERATION ENABLED**.<br>**Note:** Run enable signal must be active; see drive documentation. If the drive is set to receive the Run enable signal from the fieldbus, this bit activates the signal. |
| | | 0 | Inhibit operation. Proceed to **OPERATION INHIBITED**. |
| 4 | RAMP_OUT_ ZERO | 1 | Normal operation. Proceed to **RAMP FUNCTION GENERATOR: OUTPUT ENABLED**. |
| | | 0 | Force Ramp Function Generator output to zero. Drive ramps to stop (current and DC voltage limits in force). |

| Bit | Name | Value | STATE/Description |
|---|---|---|---|
| 5 | RAMP_HOLD | 1 | Enable ramp function.<br>Proceed to **RAMP FUNCTION GENERATOR: ACCELERATOR ENABLED**. |
| | | 0 | Halt ramping (Ramp Function Generator output held). |
| 6 | RAMP_IN_ ZERO | 1 | Normal operation. Proceed to **OPERATING**.<br>**Note:** This bit is effective only if the fieldbus interface is set as the source for this signal by drive parameters. |
| | | 0 | Force Ramp Function Generator input to zero. |
| 7 | RESET | 0=>1 | Fault reset if an active fault exists. Proceed to **SWITCH-ON INHIBITED**.<br>**Note:** This bit is effective only if the fieldbus interface is set as the source for this signal by drive parameters. |
| | | 0 | Continue normal operation. |
| 8 to 9 | Reserved. | | |
| 10 | REMOTE_ CMD | 1 | Fieldbus control enabled. |
| | | 0 | Control Word <> 0 or Reference <> 0: Retain last Control Word and Reference.<br>Control Word = 0 and Reference = 0: Fieldbus control enabled. Reference and deceleration/ acceleration ramp are locked. |
| 11 | EXT_CTRL_ LOC | 1 | Select External Control Location EXT2. Effective if control location parameterised to be selected from fieldbus. |
| | | 0 | Select External Control Location EXT1. Effective if control location parameterised to be selected from fieldbus. |
| 12 to 15 | Reserved. | | |

*Table 8. The Status Word for the ABB Drives communication profile. The upper case boldface text refers to the states shown in Figure 12.*

| Bit | Name | Value | STATE/Description |
|---|---|---|---|
| 0 | RDY_ON | 1 | **READY TO SWITCH ON**. |
| | | 0 | **NOT READY TO SWITCH ON**. |
| 1 | RDY_RUN | 1 | **READY TO OPERATE**. |
| | | 0 | **OFF1 ACTIVE**. |
| 2 | RDY_REF | 1 | **OPERATION ENABLED**. |
| | | 0 | **OPERATION INHIBITED**. |
| 3 | TRIPPED | 1 | **FAULT**. |
| | | 0 | No fault. |
| 4 | OFF_2_STA | 1 | OFF2 inactive. |
| | | 0 | **OFF2 ACTIVE**. |
| 5 | OFF_3_STA | 1 | OFF3 inactive. |
| | | 0 | **OFF3 ACTIVE**. |
| 6 | SWC_ON_ INHIB | 1 | **SWITCH-ON INHIBITED**. |
| | | 0 | – |
| 7 | ALARM | 1 | Warning/Alarm. |
| | | 0 | No warning/alarm. |
| 8 | AT_ SETPOINT | 1 | **OPERATING**. Actual value equals reference = is within tolerance limits, i.e. in speed control, speed error is 10% max. of nominal motor speed. |
| | | 0 | Actual value differs from reference = is outside tolerance limits. |
| 9 | REMOTE | 1 | Drive control location: REMOTE (EXT1 or EXT2). |
| | | 0 | Drive control location: LOCAL. |

| Bit | Name | Value | STATE/Description |
|---|---|---|---|
| 10 | ABOVE_ LIMIT | 1 | Actual frequency or speed equals or exceeds supervision limit (set by drive parameter). Valid in both directions of rotation. |
| | | 0 | Actual frequency or speed within supervision limit. |
| 11 | EXT_CTRL_ LOC | 1 | External Control Location EXT2 selected. |
| | | 0 | External Control Location EXT1 selected. |
| 13 to 14 | Reserved. | | |
| 15 | | 1 | Communication error detected by fieldbus adapter module. |
| | | 0 | Fieldbus adapter communication OK. |

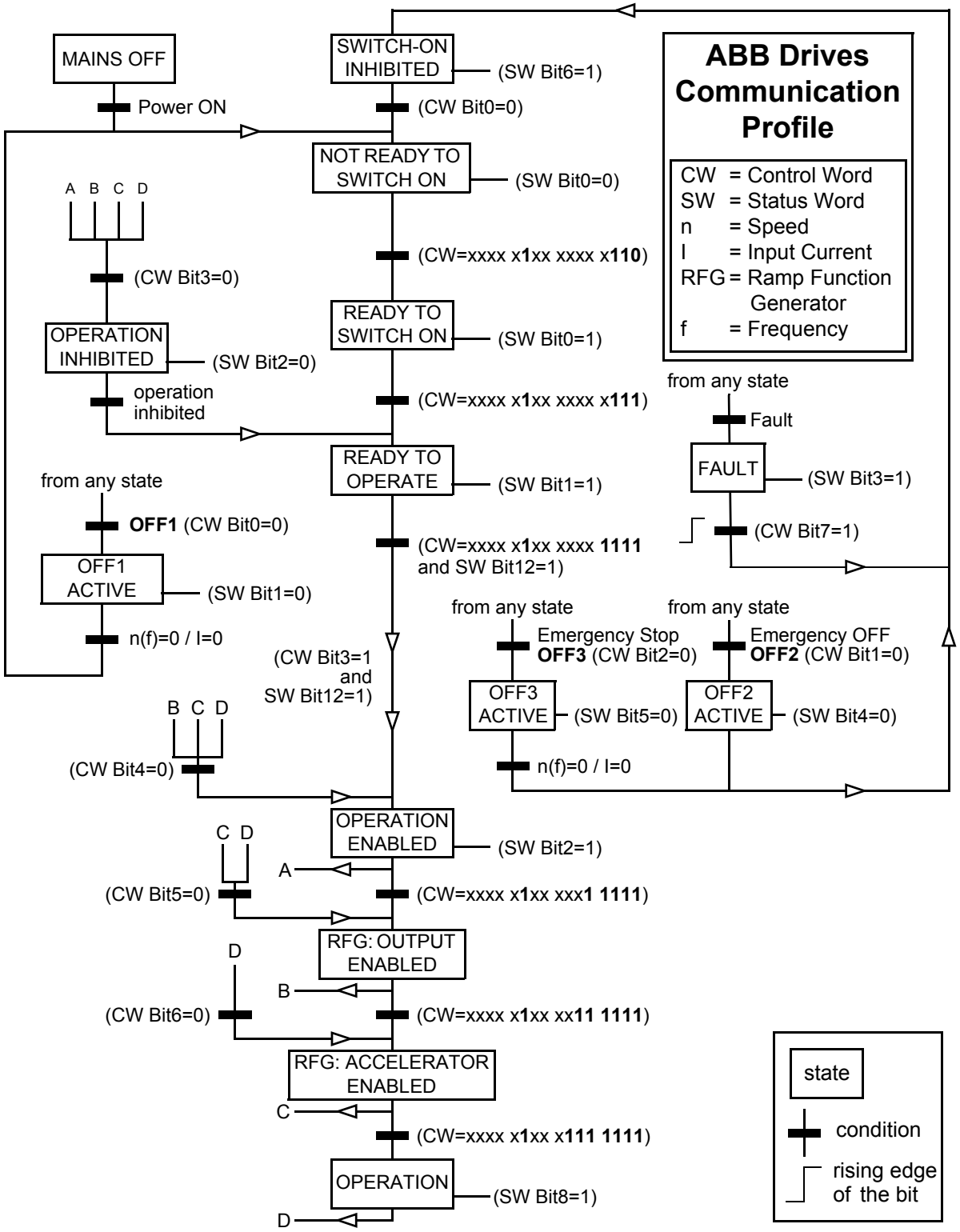



*Figure 12. State machine, ABB Drives communication profile*

# Communication

## Overview

This chapter describes the Modbus/TCP and PROFINET IO messaging used in the communication with the drive.

## Protocols

The RETA-02 module supports the Modbus/TCP protocol according to Modbus/TCP Specification 1.0, and the PROFINET IO protocol. Protocol can be selected with a parameter PROTOCOL.

| **Selection parameter 51.16 (PROTOCOL)** | **Communication protocol** |
|---|---|
| 0 | Modbus/TCP |
| 1 | PROFINET IO |

## Modbus/TCP

### Register read and write

The drive parameter and data set information is mapped into a 4xxxx register area. This holding register area can be read from an external device, and an external device can modify the register values by writing to them.

There are no set-up parameters for mapping the data to the 4xxxx register area. The mapping is predefined and corresponds directly to the drive parameter grouping.

All mapped parameters are available for reading. The parameter writes are verified for correct value, and for valid register addresses. Some parameters never allow writing (e.g. actual signals), some allow writing only when the drive is stopped (e.g. set-up variables), and some can be modified at any time (e.g. actual reference values).

---

**Note:** Some of the drive parameters are not accessible via fieldbus. These are e.g. 32 bit parameters.

---

### Register mapping

The drive parameters are mapped to the 4xxxx area as follows:

40001…40096 are reserved for data sets

40101…49999 are reserved for parameters.

In this mapping, the thousands and hundreds correspond to the group number, while the tens and ones correspond to the parameter number within a group. Register addresses 4GGPP are shown in the table below. In the table, GG represents the group number while PP is the parameter index within the group.

*Table 9.Parameter mapping*

| **Parameter** | 4**GGPP** | **GG** | **PP** |
|---|---|---|---|
| Data sets<br><br>Each data set consists of 3 data words. For example, ‘Data word 2.3’ refers to the 3rd word in data set 2. | 4**0001**…4**0096** | **00** Data sets | **01** Data word 1.1<br>**02** Data word 1.2<br>**03** Data word 1.3<br>**04** Data word 2.1<br>**05** Data word 2.2<br>**06** Data word 2.3<br>**07** Data word 3.1<br>**…**<br>**94** Data word 32.1<br>**95** Data word 32.2<br>**96** Data word 32.3 |
| Parameters | 4**0101**…4**0199** | **01** Group 01 | **01** Index 01<br>**02** Index 02<br>**…**<br>**99** Index 99 |
| | 4**0201**…4**0299** | **02** Group 02 | **01** Index 01<br>**02** Index 02<br>**…**<br>**99** Index 99 |
| | … | … | … |
| | 4**9901**…4**9999** | **99** Group 99 | **01** Index 01<br>**02** Index 02<br>**…**<br>**99** Index 99 |

Register addresses, which are not allocated to any drive parameter or data set, are invalid. Attempting to read from or write to such an address will make the Modbus/TCP interface return an exception code to the controller.

Refer to the drive manuals for drive-specific information such as the data sets supported, and parameter numbers. Data set registers are updated in a cyclic interval. Updating of parameter registers happens at a slower interval.

*Exception codes*

The RETA-02 supports the Modbus exception codes shown below.

*Table 10.Supported exception codes*

| Exception code | Name | Description |
|---|---|---|
| 01 | Illegal function | Unsupported command |
| 02 | Illegal data address | Address does not exist or is read/write-protected |
| 03 | Illegal data value | Value is outside minimum and maximum limits. Parameter is read-only |

*Function codes*

The RETA-02 supports the Modbus function codes shown below.

*Table 11.Supported function codes*

| Function code | Name | Description | Modbus class |
|---|---|---|---|
| 03 | Read holding registers | Reads the binary contents of the holding registers (4X references) in the slave. | 0 |
| 06 | Preset single register | Presets a value into a single holding register (4X reference). | 1 |
| 16 (10h) | Preset multiple registers | Presets values into a sequence of holding registers (4X references). | 0 |
| 23 (17h) | Read/Write registers | Performs a combination of one read and one write operation in a single Modbus transaction. The function first reads a group of 4XXXX registers and then writes new contents to a another group of 4XXXX registers. | 2 |

# PROFINET IO

## Overview

This chapter describes the PROFINET IO communication protocol for RETA-02. For detailed information on PROFINET IO communication, refer to *PROFINET specification Application Layer protocol for decentralized periphery and distributed automation v2.0*.

## Introduction to PROFINET IO

PROFINET IO is a fieldbus protocol that enables communication between programmable controllers and distributed field devices in Ethernet network. The protocol classifies devices into IO controllers, IO supervisors and IO devices, which have a specific collection of services.

PROFINET IO uses three different communication channels to exchange data. The standard UDP/IP and TCP/IP channel is used for parameterization and configuration of devices and for acyclic operations. The Real Time (RT) channel is used for cyclic data transfer and alarms. The third channel, Isochronous Real Time (IRT) channel, is used e.g. in motion control applications (not implemented in RETA-02).

PROFINET IO devices are structured in slots, sub-slots, which can contain modules and submodules correspondingly. Device can have almost any number of slots and sub-slots and they can be virtual or real. Device specific data is represented in slot 0, module and submodule specific data in subsequent slots and sub-slots.

One of the benefits of PROFINET IO is the diagnostics and alarm mechanism. Every module and sub-module provide alarm data to the IO controller using the cyclic channel. Diagnostic data can be read non-cyclically from the device by using record data.

Properties and services of a PROFINET IO device are described in a GSD file that is written in GSDML (General Station Description Markup Language). GSD file describes the device specific

modules and the method of assigning modules and sub-modules to predefined slots and sub-slots. For more information see chapter *Master configuration*.

### PROFINET IO in RETA-02

When PROFINET IO is selected as the communication protocol RETA-02 adapter can operate in two modes, Vendor mode and PROFIdrive mode. The mode can be selected with a GSD file in a PROFINET IO hardware configuration tool. User can select the appropriate device access point (DAP) and functional module with the tool as well.

RETA-02 uses slots 0 and 1. Slot 0 doesn't have any sub-slots and the DAP module attached to it represents the device itself. Other functional modules and sub-modules, which are described in the GSD file can be assigned to slot 1 and its sub-slots. In Vendor mode:

- Slot 0 = Device access point (DAP)
- Slot 1, sub-slot 1 = Vendor object (PPO types)
- Slot 1, sub-slot 1 = Acyclic parameter access (MAP/PAP)

In PROFIdrive mode:

- Slot 0 = Device access point
- Slot 1 = Drive Object
- Slot 1, sub-slot 1 = Acyclic parameter access (MAP/PAP)
- Slot 1, sub-slot 2 = Standard telegram 1
- Slot 1, sub-slots 3-18 = Freely configurable inputs and outputs

RETA-02 adapter provides the following services:

- Cyclic messaging in Vendor mode (e.g. ABB Drives profile)
- Cyclic messaging in PROFIdrive mode
- Acyclic parameter access mechanism
- Identification & Maintenance functions (I&M)
- PROFIdrive parameters (limited in Vendor mode)
- Diagnostic and alarm mechanism (Only in PROFIdrive mode)
- Fault buffer mechanism (limited in Vendor mode)

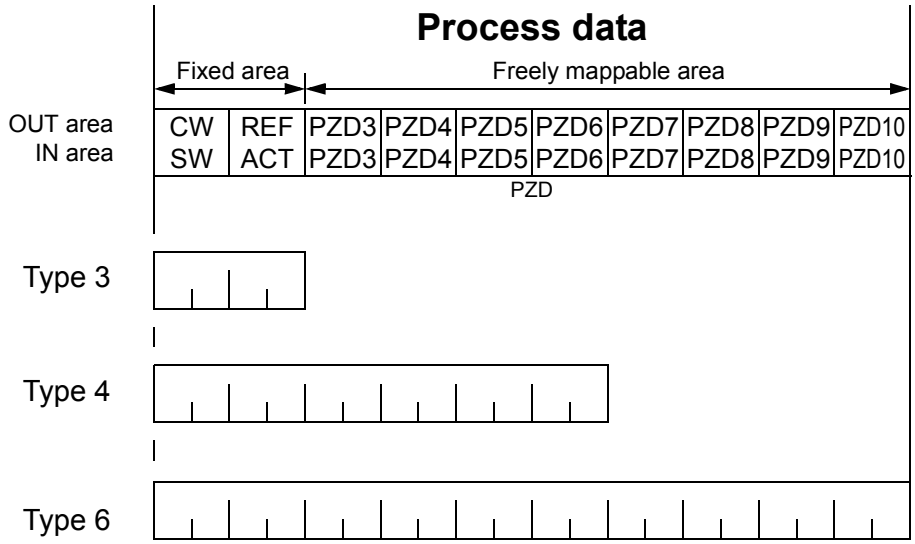
**Note**: Only part of the PROFIdrive parameters are supported in the Vendor mode. See section *PROFIdrive profile-specific parameters* for more information.

## Cyclic messaging in Vendor mode

In vendor mode the drive can be controlled according to ABB Drives communication profile.

*PPO types*

The adapter has three different PPO types, which differ only by the amount of freely configurable inputs and outputs.




**OUT area** – Data sent from Master to Slave (control data)
**IN area** – Data sent from Slave to Master (actual data)

**Process Data:**
CW – Control Word
SW – Status Word
REF – Reference
ACT – Actual Value
PZD – Process Data (application-specific)

## Cyclic messaging in PROFIdrive mode

*Standard telegram 1*

RETA-02 supports Standard telegram 1. It is possible to add inputs and outputs as separate PZD's. GSD file contains special collections where standard telegram 1 has been extended with inputs and outputs.

| | | PZD1 | PZD2 |
|---|---|---|---|
| Standard telegram 1 | OUT area | Control Word | Speed set-point |
| | IN area | Status Word | Speed actual value |

---

**Note:** For the contents of the Control Word, the Status Word, References, and Actual Values, see the chapter *Communication profiles*.

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## Acyclic parameter access mechanism

Acyclic parameter access mechanism can be used to access PROFIdrive parameters, drive parameters and the Identification & Maintenance functions.

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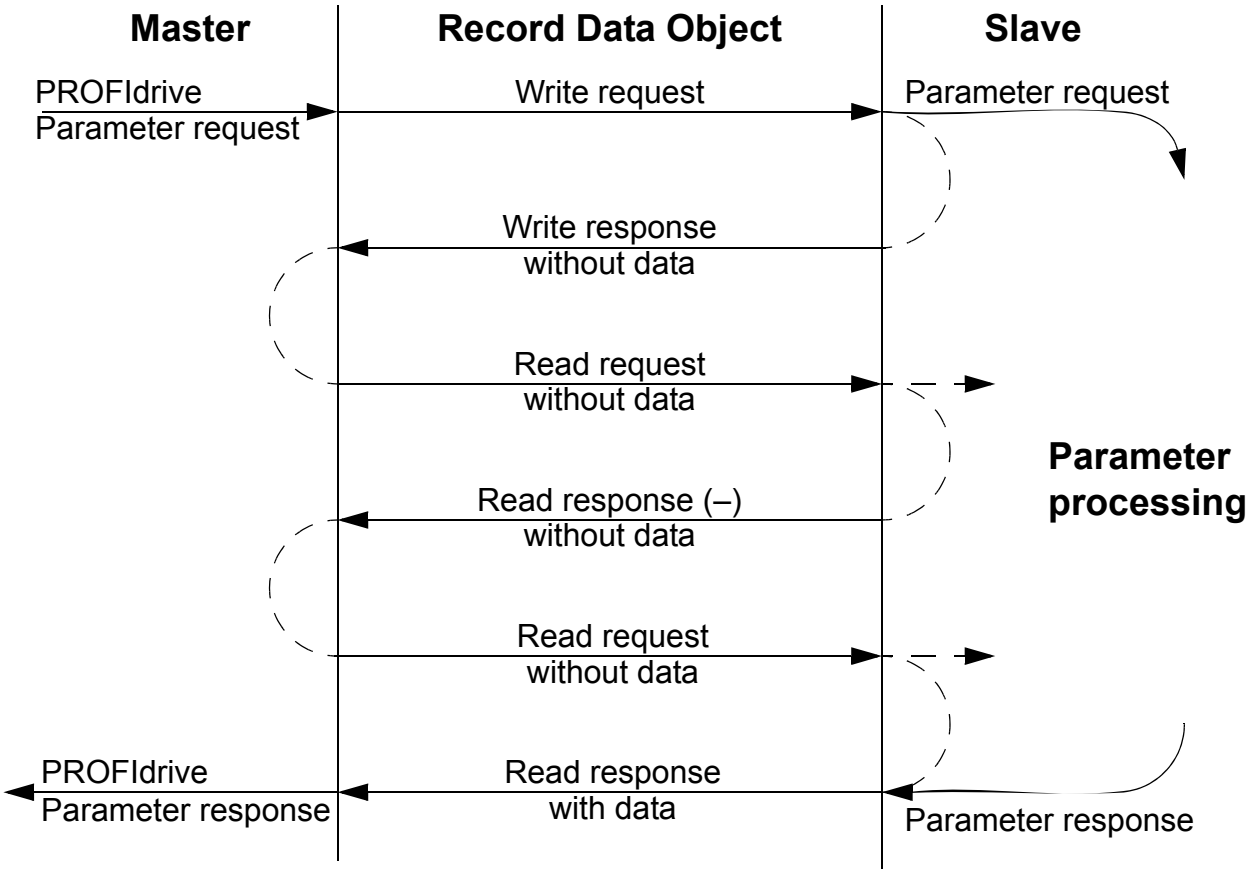
**Note:** Acyclic parameter access mechanism can have delays up to two seconds and thus should not be used for time-critical data.

---

Requests and responses between the IO device and the IO controller or the IO supervisor are transferred with the Record Data Objects.

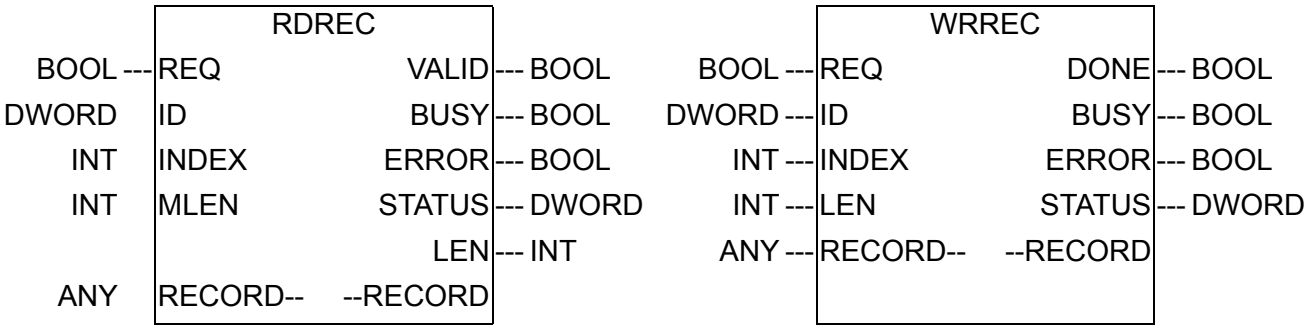



A write request is first sent containing the parameter request.

If the write request is valid, the RETA-02 acknowledges it with request accepted. The master should then send a read request. If the RETA-02 is still busy performing the internal parameter request, it will return a negative response with the error code 0xB5 (State conflict). In this case, the read request will be repeated by the master until the RETA-02 has the PROFIdrive response data ready.

If the write request is invalid, a negative response is returned with an error code.

**Note:** In IEC 61131-3 compatible systems function blocks are provided for accessing data non-cyclically. In Siemens S7, SFB 52 "RDREC" can be used for reading and SFB53 "WRREC" for writing Data Records.




For more information on above function blocks, see document *Communication Function Blocks for PROFIBUS DP and PROFINET IO v2.0* available at www.profibus.com.

Supported Record Data Objects and their indices are listed in the table below.

*Table 12.Record Data Objects*

| **Parameter Access Service** | **Index** |
|---|---|
| Base Mode Parameter Access - Local | 0xB02E |
| Base Mode Parameter Access - Global | 0xB02F |
| User Specific Record Data (For compatibility reasons) | 0x2F |

*Base Mode Parameter Access - Local*

The DO-ID field in the Record Data Object request header is not evaluated by the parameter manager and a valid Parameter Access Point (PAP) should be used to access record data. The PAP is located in subslot 1 of the slot 1.

*Base Mode Parameter Access - Global*

The slot and subslot fields in the Record Data Object request header are not evaluated by the parameter manager. The DO-ID is used instead and it should have either value 0x00 or 0x01.

*User Specific Record Data*

User Specific Record Data can be used for global parameter access. This index is supported for compatibility reasons.

*Header and frame structures*

PROFINET IO uses DCE RPC (Distributed Computing Environment Remote Procedure Call) protocol for acyclic read and acyclic write services. IO controllers and supervisors will take care of formulating most of the request frames. However, it is possible that handling the PROFIdrive request and response headers must be performed in the application logic. The acyclic frame structure, headers and error codes are described further below.

*Table 13.Ethernet frame structure*

| **Frames** | **Dest addr.** | **Src addr.** | **Ether type** | **IP UDP** | **RPC** | **NDR** | **Read or Write** | **Data** |
|---|---|---|---|---|---|---|---|---|
| Bytes | 6 | 6 | 2 | 28 | 80 | 20 | 64 | ... |

**Dest addr.** and the **Src addr.** are the destination and the source of the communication relationship. The addresses are in hexadecimal format, e.g. 00-30-11-02-57-AD.

**Ether type** is 0x800 for non-real-time communication.

**IP** and **UDP** fields contain the IP address of the source and the destination as well as the communication ports and length of the message.

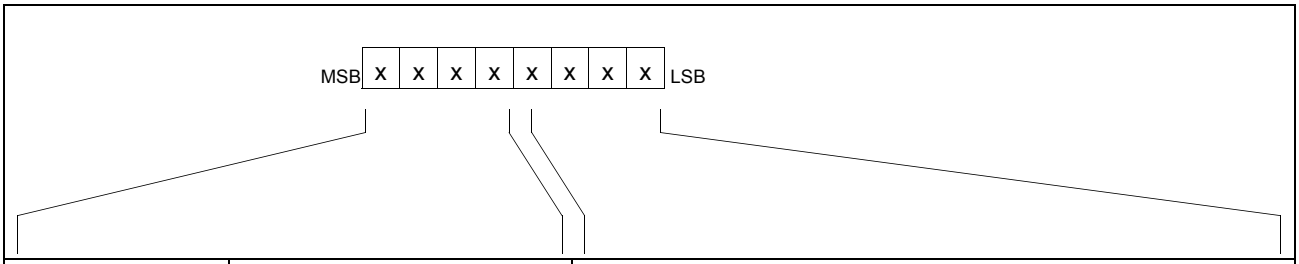
**RPC** contains for example the *read* or *write* service ID, interface description and selected objects.

**NDR** request block describes the length of the following data block. The response block also contains bytes *ErrorCode*, *ErrorDecode*, *ErrorCode1* and *ErrorCode2* for presenting the status of the request.

*Table 14. Response error codes*

| Byte | Value and meaning |
|---|---|
| ErrorCode | 0xDF (Error Write) |
| | 0xDE (Error Read) |
| ErrorDecode | 0x80 (PNIORW) ErrorCode1 decoded according to *Table 15.* ErrorCode2 is ‘0’. |
| | 0x81 (PNIO) ErrorCode1 and ErrorCode2 decoded according to *Table 15.* |
| ErrorCode1 | Error class and error code (see *Table 15.* below). |
| ErrorCode2 | Not described here |

*Table 15. ErrorCode1 with PNIORW decoding*




| Error class | Meaning | Error code |
|---|---|---|
| 0 … 9 | (Reserved) | |
| 10 (0x0A) | Application | 0 = Read error<br>1 = Write error<br>2 = Module failure<br>3 … 7 = Reserved<br>8 = Version conflict<br>9 = Feature not supported<br>10 … 15 = User-specific |
| 11 (0x0B) | Access | 0 = Invalid index<br>1 = Write length error<br>2 = Invalid slot<br>3 = Type conflict<br>4 = Invalid area<br>5 = State conflict<br>6 = Access denied<br>7 = Invalid range<br>8 = Invalid parameter<br>9 = Invalid type<br>10 … 15 = User-specific |
| 12 (0x0C) | Resource | 0 = Read constraint conflict<br>1 = Write constraint conflict<br>2 = Resource busy<br>3 = Resource unavailable<br>4 … 7 = Reserved<br>8 … 15 = User-specific |
| 13 … 15 | User-specific | |

**Read** block is used in read requests and responses. **Write** block is used in write requests and responses. The request consists of

unique identifiers for the connection, addressing information and length of the record data. The response also contains two additional fields for transferring information. See *Table 16.* for details.

*Table 16.Structure of the Read and Write blocks*

| Field(s) | Description | Range | Type |
|---|---|---|---|
| Service | Request or Response service. | Request (0x00)<br>Response (0x80) | UI8 |
| Operation | Read or Write operation. | Write (0x08)<br>Read (0x09) | UI8 |
| Block length | Length of the block. | 0 … 0xFFFF | UI16 |
| ARUUID | Identifier<br>- time low<br>- time mid<br>- time high and version<br>- clock<br>- node | | <br>UI32<br>UI16<br>UI16<br>Octet[2]<br>Octet[6] |
| API | Application Process Identifier | Device Access Point (0x0000)<br>PROFIdrive (0x3A00) | UI32 |
| Slot | Slot of the Module Access Point (MAP/PAP) | 0x01 | UI16 |
| Subslot | Subslot of the Module Access Point (MAP/PAP) | 0x01 | UI16 |
| Padding | 2 bytes | | |
| Index | Index of the Record Data Object | 0x2F<br>0xB02E<br>0xB02F | UI16 |
| Data length | Length of the data block | 0…0xFFFFFFFF | UI32 |

| | | | |
|---|---|---|---|
| Additional value 1 **(response only)** | Field for transferring additional data | | UI16 |
| Additional value 2 **(response only)** | Field for transferring additional data | | UI16 |
| Padding | 24 bytes for request, 20 bytes for response. | | |
| Data block | Used only with write request and read response. | | |

**Data** block contains PROFIdrive specific request or response header. See below for more details.

*Table 17. PROFIdrive Request header*

| Field(s) | Description | Range | Byte/ Word |
|---|---|---|---|
| Request Reference | Unique identification set by the master. Changed for each new request. | 1 … 255 | Byte |
| Request ID | Request type for the issued block. | Request Parameter (0x01) Change Parameter (0x02) | Byte |
| DO-ID | To be set to 0x01. | 0 … 255 | Byte |
| No. of Parameters | Number of parameters that are present in the request. | 1 … 37 | Byte |
| Attribute | Type of object being accessed. **Note:** “Text” is not supported. | Value (0x10) Description (0x20) Text (0x30) | Byte |
| No. of Elements | Number of array elements accessed or length of string accessed. Set to 0 if non-array parameters are used. | 0, 1 … 234 | Byte |
| Parameter Index (group) | Address of the PROFIdrive parameter that is being accessed. Also "0" is allowed by RETA-02. Parameter group of the drive when accessing drive parameters. | 1 … 65535 | Word |
| Subindex (parameter) | Addresses the first array element of the parameter or the beginning of a string access or the text array, or the description element that is being accessed. Parameter number if accessing drive parameters. | 0 … 65535 | Word |
| Format* | See *Table 21.* | See *Table 21.* | Byte |
| Number of Values* | Number of values following. | 0 … 234 | Byte |

| | | | |
|---|---|---|---|
| Values* | The values of the request. In case of odd number of bytes, a zero byte is appended to ensure the word structure of the telegram. | – | See Format field |
| *Only if Request ID is 0x02 (Change Parameter). The Format, Number of Values and Values fields are repeated for other parameters. | | | |

*Table 18. PROFIdrive Response header*

| Field(s) | Description | Range |
|---|---|---|
| Response Reference | Mirrored from the request. | 1 … 255 |
| Response ID | Response from the slave. In case any requested services fail, a “not acknowledged” (NAK) response will be indicated. | Request Param OK (0x01)<br>Request Param NAK (0x81)<br>Change Param OK (0x02)<br>Change Param NAK (0x82) |
| DO-ID | To be set to 1. | 0 … 255 |
| No. of Parameters | Number of parameters that are present in the response. | 1 … 37 |
| Format* | See *Table 21.* | See *Table 21.* |
| Number of Values* | Number of values following. | 0 … 234 |
| Values* | The values of the request. In case of odd number of bytes, a zero byte is appended to ensure the word structure of the telegram. | – |
| *Only if Response ID is 0x01 (Request Parameter OK). The Format, Number of Values and Values fields are repeated for other parameters. | | |

*Table 19. Data types for Format field*

| Code | Type |
|---|---|
| 0x00 | (Reserved) |
| 0x01…0x36 | Standard data types |
| 0x37…0x3F | (Reserved) |
| 0x40 | Zero |
| 0x41 | Byte |
| 0x42 | Word |
| 0x43 | Double word |
| 0x44 | Error |
| 0x45 … 0xFF | (Reserved) |

*Table 20. PROFIdrive Parameter Request error codes*

| Error # | Meaning | Used at |
|---|---|---|
| 0x00 | Impermissible parameter number | Access to unavailable parameter |
| 0x01 | Parameter value cannot be changed | Change access to a parameter value that cannot be changed |
| 0x02 | Low or high limit exceeded | Change access with value outside the limits |
| 0x03 | Invalid subindex | Access to unavailable subindex |
| 0x04 | No array | Access with subindex to non-indexed parameter |
| 0x05 | Incorrect data type | Change access with value that does not match the data type of the parameter |
| 0x06 | Setting not permitted (can only be reset) | Change access with value unequal to 0 when this is not permitted |
| 0x07 | Description element cannot be changed | Change access to a description element that cannot be changed |
| 0x09 | No description data available | Access to unavailable description (parameter value is available) |
| 0x0B | No operation priority | Change access rights without rights to change parameters |
| 0x0F | No text array available | Access to text array that is not available (parameter value is available) |
| 0x11 | Request cannot be executed because of operating mode | Access is temporarily not possible for reasons that are not specified in detail |
| 0x14 | Value impermissible | Change access with a value that is within limits but is not permissible for other long-term reasons (parameter with defined single values) |
| 0x15 | Response too long | The length of the current response exceeds the maximum transmittable length |

| | | |
|---|---|---|
| 0x16 | Parameter address impermissible | Illegal value or value that is not supported for the attribute, number of elements, parameter number or sub-index, or a combination |
| 0x17 | Illegal format | Write request: Illegal format or format of parameter data that is not supported |
| 0x18 | Number of values inconsistent | Write request: Number of values of parameter data does not match number of elements at the parameter address |
| 0x19 | DO nonexistent | Request to DO, which does not exist |
| 0x65… 0xFF | Manufacturer-specific | – |
| 0x65 | Vendor-specific error | Vendor-specific error |
| 0x66 | Request not supported | Request not supported |
| 0x67 | Communication error | Request cannot be completed because of communication error |
| 0x6F | Time-out error | Request aborted due to time-out |
| 0x78 | PZD map failure | Parameter cannot be mapped to PZD (size mismatch or non-existent) |
| 0x79 | PZD memory failure | Parameter cannot be mapped to PZD (out of memory) |
| 0x7A | Multiple PZD map | Parameter cannot be mapped to PZD (multiple PZD write) |
| 0x8C | Set torque mode error | Cannot change mode to TORQUE (frequency is used) |
| 0x90 | Illegal Request ID | The request ID of the response is illegal |

## Parameter data transfer examples

The following example shows how parameter data is transferred using the acyclic parameter access mechanism's READ and WRITE.

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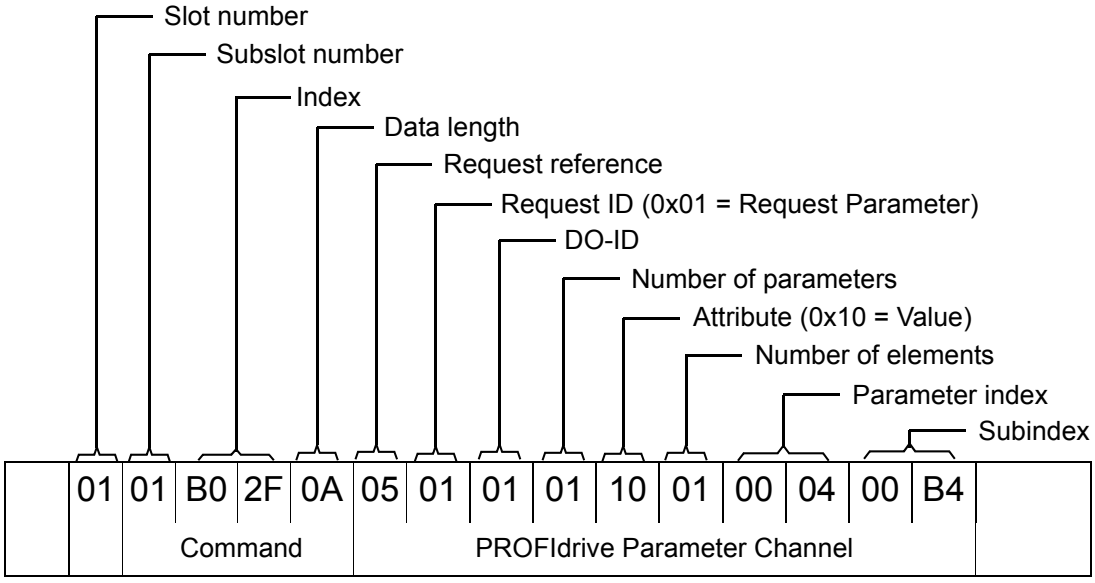
**Note:** Only the part of the acyclic frame is presented in the examples. The padding zeroes are not presented.

---

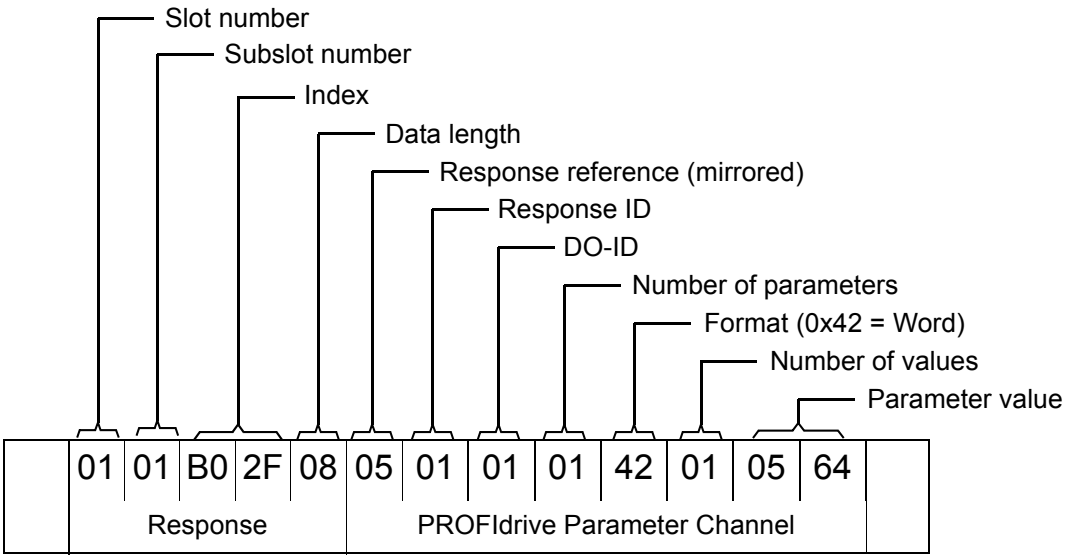
*Example 1: Reading a drive parameter*

To determine the parameter number and subindex for drive parameter reading, multiply the parameter number by one hundred and then convert it to hexadecimal. The low byte is the subindex (IND), and the high byte is the parameter index (PNU). For example, drive parameter number 12.04 corresponds to 12.04 × 100 = 1204 = 0x04B4.

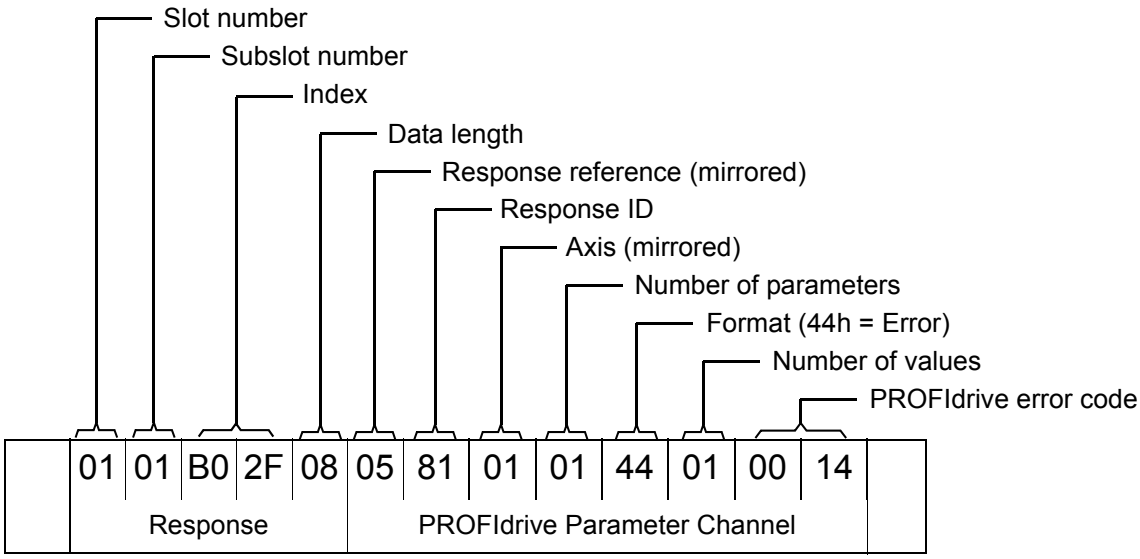
**Write request (Read parameter value):**



### Positive Read response to Read request:




### Negative response to PROFIdrive Read request:




## Identification and maintenance functions (I&M)

The purpose of the I&M functions is to provide support for the customer during commissioning, parametrization and repair of the module. RETA-02 supports I&M functions 0 - 4, which can be accessed with a qualified configuration tool (like DTM Tool) or using the Record data object's read request.

| Function | Record Data Index |
|---|---|
| I&M 0 | 0xAFF0 |
| I&M 1 | 0xAFF1 |
| I&M 2 | 0xAFF2 |
| I&M 3 | 0xAFF3 |
| I&M 4 | 0xAFF4 |

Structure of the I&M functions is described in the following tables.

*I&M0 Device identification (read-only)*

| Content | Size | Description |
|---|---|---|
| Header | 10 bytes | - |
| Vendor ID | 2 bytes | PROFINET Vendor ID of ABB, which is 26 (0x001A) |
| Order ID | 20 bytes | Order number of the RETA-02 adapter kit |
| Serial number | 16 bytes | Serial number of the adapter |
| Hardware revision | 2 bytes | Hardware revision of the RETA-02 adapter |
| Software revision | 4 bytes | Revision of the software |
| Revision counter | 2 bytes | Number of revision |
| Profile ID | 2 bytes | PROFIdrive (0x3A00) |
| Profile specific type | 2 types | No profile specific type (0x0000) |
| I&M version | 2 types | Version is 1.1 (0x0101) |
| Supported I&M functions | 2 types | I&M0-I&M4 are supported (0x0017) |

*I&M1 Task identification*

| Content | Size | Description |
|---|---|---|
| Header | 10 bytes | - |
| TAG_FUNCTION | 32 bytes | The function or task of the drive can be described here |
| TAG_LOCATION | 22 bytes | The location of the drive can be described here |

*I&M2 Installation date*

| Content | Size | Description |
|---|---|---|
| Header | 10 bytes | - |
| INSTALLATION_DATE | 16 bytes | This parameter indicates the date and time of installation. Date and time according to ISO 8601. Example: 2007-02-28 13:30 (YYYY-MM-DD hh:mm) |

*I&M3 Additional data*

| Content | Size | Description |
|---|---|---|
| Header | 10 bytes | - |
| DESCRIPTOR | 54 bytes | Any additional data set by the user |

*I&M4 Signature*

| Content | Size | Description |
|---|---|---|
| Header | 10 bytes | - |
| SIGNATURE | 54 bytes | Security code for identifying sessions and changes |

### PROFIdrive profile-specific parameters

PROFIdrive parameters contain data of the drive in standard form. The table below describes the supported PROFIdrive parameters.

| Para-meter | Mode *** | R/W* | Data type | Description |
|---|---|---|---|---|
| 915 | V/P | R | Array [10] Unsigned16 | Assignment PZD1 to PZD10 in setpoint telegram |
| 916 | V/P | R/ | Array [10] Unsigned16 | Assignment PZD1 to PZD10 in actual value telegram |
| 919 | V/P | R | Visible String16 | Device system number. |
| 922 | P | R | Unsigned16 | Telegram selection |
| 923 | P | R | Array[n]Unsigned16 | List of all parameters for signals |
| 927 | V/P | R/W | Unsigned16 | Operator control rights<br>**Value** **Mode**<br>0 Parameters cannot be written, only read (927 can be written)<br>1 Parameters can be written and read (default). |

| Para-meter | Mode *** | R/W* | Data type | Description | |
|---|---|---|---|---|---|
| 928 | P | R/W | Unsigned16 | Control rights (process data, PZD). | |
| | | | | **Value** | **Mode** |
| | | | | 0 | No control through the PROFINET IO. Setpoint telegram not used. |
| | | | | 1 | IO-controller will control the drive through IO data (default) |
| | | | | 2 | IO-supervisor will control the drive through parameters 900 and 907 (Not supported at) |
| 930 | P | R/W | Unsigned16 | Selection switch for operating mode. | |
| | | | | **Value** | **Mode** |
| | | | | 1 | Speed control mode |
| | | | | 0x8001 | Torque control mode |
| 944 | V/P | R | Unsigned16 | Fault message counter | |
| 945 | V/P | R | Array[64] Unsigned16 | Fault code (Channel Error Type, table 23). **Note:** The drive may limit the actual number of faults recorded. | |
| | | | | **Subindex** | **Contents** |
| | | | | 0 | Active fault |
| | | | | 8 | **Last ackn. fault |
| | | | | 16 | **Second last ackn. fault |
| | | | | 24 | **Third last ackn. fault |
| | | | | 32 | **Fourth last ackn. fault |
| | | | | 40 | **Fifth last ackn. fault |
| 946 | V/P | R | Array[n] Unsigned16 | Fault code list. Fault code list contains mapping between DRIVECOM fault codes and Channel Error Types. Using DRIVECOM fault code as an index when reading PNU946 the corresponding Channel Error Type is returned. | |

| Para-meter | Mode *** | R/W* | Data type | Description |
|---|---|---|---|---|
| 947 | V/P | R | Array [64] Unsigned16 | Fault number. (coded according to DRIVECOM profile)<br>**Subindex Contents**<br>See parameter 945. |
| 948 | V/P | R | Array [n] TimeDifference | Fault time |
| 952 | V/P | R/W | Unsigned16 | Number of faults occured. Writing a zero clears the value. |
| 953 | V/P | R | Unsigned16 | **Last alarm |
| 954 | V/P | R | Unsigned16 | **Second last alarm |
| 955 | V/P | R | Unsigned16 | **Third last alarm |
| 956 | V/P | R | Unsigned16 | **Fourth last alarm |
| 957 | V/P | R | Unsigned16 | **Fifth last alarm |
| 964 | V/P | R | Array [6] Unsigned16 | Device identification<br>**Subindex Contents**<br>0 Manufacturer<br>1 Device type<br>2 Version<br>3 Firmware date (year)<br>4 Firmware date (day/month)<br>5 Number of Drive Objects (DO) |
| 965 | P | R | Octet String2 | Profile number of this device.<br>0329h = Profile 3, Version 41 |
| 967 | V/P | R | Unsigned16 | Control word (CW) |
| 968 | V/P | R | Unsigned16 | Status word (SW) |

| Para-meter | Mode *** | R/W* | Data type | Description |
|---|---|---|---|---|
| 972 | V/P | R/W | Unsigned16 | Software reset<br>**Value** **Description**<br>0 No action<br>1 Power-cycle PROFINET IO module<br>The parameter must do a zero-to-one transition and the motor must be stopped. |
| 975 | P | R | Array [8] Unsigned16 | Drive Object identification<br>**Subindex** **Contents**<br>0 Manufacturer<br>1 DO type<br>2 Version<br>3 Firmware date (year)<br>4 Firmware date (day/month)<br>5 PROFIdrive DO type class (0x0001-Axis)<br>6 PROFIdrive DO sub-class 1(Application class<br>7 Drive Object ID (0x0001) |
| 976 | V/P | R/W | Unsigned16 | Load device parameter set<br>**Value** **Description**<br>0 No action<br>1 Changes parameters to factory settings<br>The parameter must do a zero-to-one transition and the motor must be |

| Para-meter | Mode *** | R/W* | Data type | Description |
|---|---|---|---|---|
| 977 | V/P | R/W | Unsigned16 | Stores parameters to non-volatile memory<br>**Value** **Description**<br>0 No action<br>1 Stores parameters<br>The parameter must do a zero-to-one transition and the motor must be |
| 978 | P | R | Array [256] Unsigned8 | List of Drive Object IDs<br>(978[1] = 0x01, 978[2-255] = 0x00) |
| 980 | P | R | Array [n] Unsigned16 | Number list of defined PROFIdrive parameters |
| ... | | | | |
| 989 | P | R | Array [n] Unsigned16 | Number list of defined PROFIdrive parameters |
| 61000 | V/P | R | VisibleString24 | Name of station |
| 61001 | V/P | R | Unsigned32 | IP of station |
| 61002 | V/P | R | Array [6] Unsigned8 | MAC of station |
| 61003 | V/P | R | Unsigned32 | Default gateway of station |
| 61004 | V/P | R | Unsigned32 | Subnet mask of station |

* Read and/or Write

** Support depends on drive type

*** Supported in Vendor mode and/or PROFIdrive operating mode

### Diagnostic and alarm mechanism

RETA-02 has mechanisms for sending alarms and saving diagnostics data to fault buffer. Alarm will be triggered if the host or drive has faults in communication or operation. There are three types of faults:

| Fault | API / Slot / Subslot | Channel Error Type* |
|---|---|---|
| Temporary Host Communication Fault | 0x000 / 0 / 1 | INTCOMM |
| Permanent Host Communication Fault | 0x000 / 0 / 1 | INTCOMM |
| Drive Fault | 0x3A00 / 1 / 1 | See table 22. |

* Channel Error Type is PROFIdrive profile specific. See list of Channel Error Types in the table below.

*Alarm mechanism*

When a fault situation occurs the RETA-02 adapter will send an alarm notification (see table below), which the master station has to acknowledge. Alarm notifications can be acknowledged, viewed and handled with e.g. Siemens S7 blocks OB82, OB83, OB86 and OB122. The block OB82 is used to make sure that the drive does not go to stop mode during a diagnostic alarm. The OB83 is called if module is inserted or removed from the system or if it is modified. OB86 indicates if there is a failure or event in the distributed periphery. If the CPU calls a device that is not accessible the OB122 is called.

*Table 21. Alarm notification*

| **Attribute** | **Description** |
|---|---|
| BlockHeader | - |
| AlarmType | PROFINET specific alarm type |
| API | 0x3A00 (PROFIdrive profile) |
| SlotNumber | Slot number of the Drive Object (DO) |
| SubslotNumber | Subslot number of the subslot where the diagnosis object is related to |
| ModuleIdentNumber | Module Ident number of the DO |
| SubmoduleIdentNumber | 0xFFFF |
| AlarmSpecifier | Diagnosis type |
| UserStructureIdentifier | 0x8000 (Channel Diagnosis Data) |
| ChannelNumber | 0x8000 (whole submodule) |
| ChannelProperties | Structure describing the channel properties |
| ChannelErrorType | See *Table 22.* below. |

*Table 22. Channel Error types*

| ChannelError Type | Abbreviation | Description | Corresponding DRIVECOM fault numbers* |
|---|---|---|---|
| 0x9000 | MICRO_HW | Microcontroller hardware or software | 6000, 6010, 6100, 6306-630F, 6320 |
| 0x9001 | MAINS | Mains supply | 3210, 3211 |
| 0x9002 | LOW_VOLT | Low voltage supply | 3130, 3220 |
| 0x9003 | DC_OVERV | DC link overvoltage | - |
| 0x9004 | POWER_ELEC | Power electronics | 2211, 2212, 2300, 2310, 2312, 2340, 3381, 5410, 5441, 5442, 5481, 5482, 7110-7114 |
| 0x9005 | OVERTEMP | Overtemperature electronic device | 4110, 4210, 4280, 4310 |
| 0x9006 | EARTH | Earth/ground fault | 2330 |
| 0x9007 | MOTOR_OVR | Motor overload | 7121, 7122 |
| 0x9008 | FB | Fieldbus system | - |
| 0x9009 | SAFETY | Safety channel | - |
| 0x900A | FEEDBACK | feedback | 5210 |
| 0x900B | INTCOMM | Internal communication | 7500, 7510, 7520 |
| 0x900C | INFEED | Infeed | - |
| 0x900D | BRAKE_RES | Brake resistor | - |
| 0x900E | LINE_FILTER | Line filter | - |
| 0x900F | EXT | External | 9000 |
| 0x9010 | TECH | Technology | - |
| 0x9011 | ENGINEER | Engineering | - |
| 0x9012 | OTHER | Other | 3220, 5300, 7000, 7301-7303, 7310, 8110, 8500, 8612 |

*See drive manuals for detailed list of supported DRIVECOM faults and corresponding internal fault codes. Drives also have manufacturer specific DRIVECOM faults that are not visible via fieldbus.

### Fault buffer mechanism

PROFIdrive profile has a mechanism that can store eight fault situations to PROFIdrive parameters. Fault and diagnostic data, like fault number, fault code and fault time can be accessed simultaneously with only one subindex. The mechanism consists of six PROFIdrive parameters:

- PNU944: Fault message counter
- PNU945: PROFIdrive fault codes presented in the table above
- PNU946: Fault code list converts fault numbers to fault codes
- PNU947: Fault numbers according to DRIVECOM profile
- PNU948: Fault time
- PNU952: Fault situation counter

| | PNU947 Fault number | PNU945 Fault code | PNU948 Fault time | Sub-index |
|---|---|---|---|---|
| Actual fault situation n | 0×4210 | 0×9005 | TimeX | 0 |
| | 0 | 0 | 0 | 1 |
| | 0 | 0 | 0 | 2 |
| | 0 | 0 | 0 | 3 |
| | 0 | 0 | 0 | 4 |
| | 0 | 0 | 0 | 5 |
| | 0 | 0 | 0 | 6 |
| | 0 | 0 | 0 | 7 |
| Fault situation n-1 | 0×7510 | 0×900B | TimeY | 8 |
| | 0 | 0 | 0 | 9 |
| | 0 | 0 | 0 | 10 |
| | 0 | 0 | 0 | 11 |
| | 0 | 0 | 0 | 12 |
| | 0 | 0 | 0 | 13 |
| | 0 | 0 | 0 | 14 |
| | 0 | 0 | 0 | 15 |
| … | … | … | … | |
| … | … | … | … | |
| … | … | … | … | |
| … | … | … | … | |
| Fault situation n-7 | 0 | 0 | 0 | 56 |
| | 0 | 0 | 0 | 57 |
| | 0 | 0 | 0 | 58 |
| | 0 | 0 | 0 | 59 |
| | 0 | 0 | 0 | 60 |
| | 0 | 0 | 0 | 61 |
| | 0 | 0 | 0 | 62 |
| | 0 | 0 | 0 | 63 |

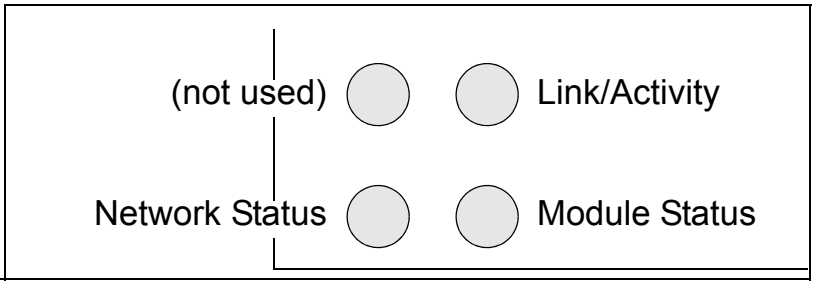
*Figure 13. Fault buffer example*

*Figure 13.* illustrates the structure of a fault buffer. The fault buffer is composed of four parameters, fault number (PNU 947), fault code (PNU 945), fault time (PNU 948) and fault value (PNU 949). The rows of the fault buffer are represented by the parameter sub-indices. Fault messages are entered into the buffer in the sequence they are detected. Each line in the fault buffer represents a fault message, which is a part of a fault situation. Fault situation lasts from a detection of a fault to its acknowledgement. Faults that are detected during an active fault are included to the fault situation.

# Diagnostics

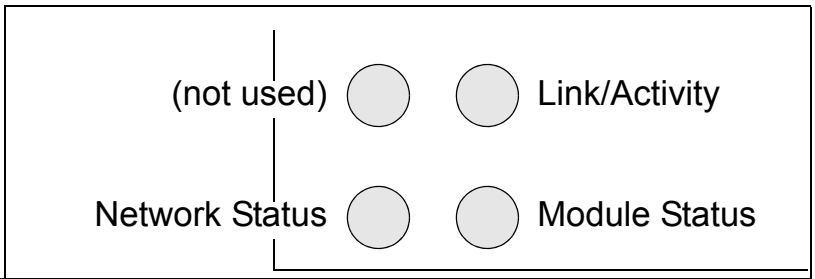
## LED indications

The RETA-02 module is equipped with three diagnostic LEDs. The description of the LEDs in Modbus/TCP is presented below.




| Name | Colour | Function |
|---|---|---|
| Link/Activity | Green | **Off** - Module cannot detect a link<br>**Flashing green** - Module is receiving/transmitting on Ethernet<br>**Steady green** - Module has detected a link |
| Network Status | Red/ Green | **Off** - No power or IP address<br>**Flashing green** - Waiting for connections<br>**Steady green** - At least one Modbus/TCP connection is open against the module<br>**Flashing red** - Connection timed out. No message has been received within configured time<br>**Steady red** - Duplicate IP address |
| Module Status | Red/ Green | **Steady green** - Normal operation<br>**Flashing red** - Minor fault (e.g. communication with application lost but recoverable)<br>**Steady red** - Major fault (e.g. bad flash, failed memory test, non-recoverable communication problem with host) |

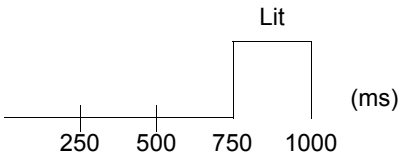
The description of the LEDs in PROFINET IO is presented below.



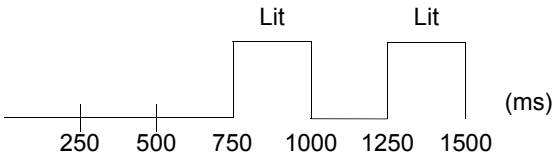

| Name | Colour | Function |
|---|---|---|
| Link/Activity | Green | **Off** - Module cannot detect a link<br>**Flashing green** - Module is receiving/transmitting on Ethernet<br>**Steady green** - Module has detected a link |
| Network Status | Red/ Green | **Off** - No connection with IO-controller<br>**Flashing green (pattern 1)** - Connection with IO-controller established (STOP mode)<br>**Steady green** - Connection with IO-controller established (RUN mode) |
| Module Status | Red/ Green | **Off** - Module not powered or initialized<br>**Steady green** - Module initialized<br>**Flashing green (pattern 1)** - Diagnostic data available<br>**Flashing green (pattern 2)** - Used by a configuration tool to identify the device with a blink<br>**Steady red** - Permanent host communication lost<br>**Flashing red (pattern 1)** - Configuration error<br>**Flashing red (pattern 2)** - No IP address<br>**Flashing red (pattern 3)** - No station name<br>**Flashing red (pattern 4)** - Failed to initialize the module<br>**Flashing red (pattern 5)** - Temporary host communication lost |

## Led patterns

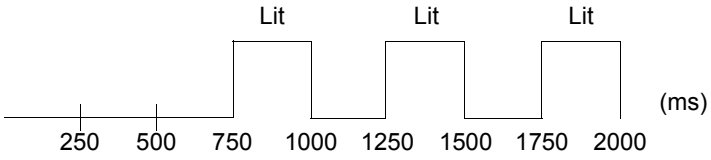
*Pattern 1*



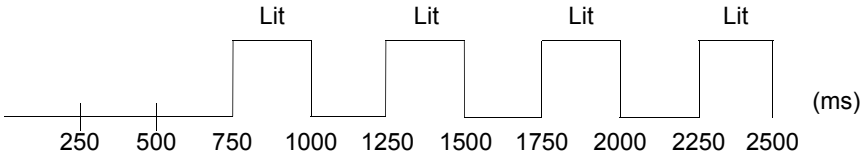

*Pattern 2*



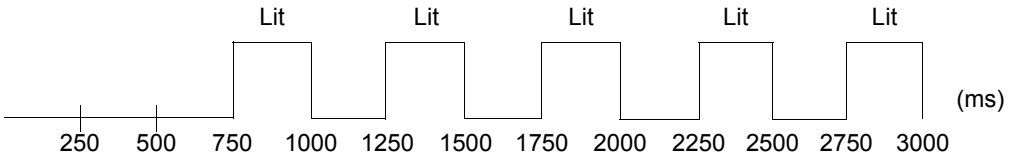

*Pattern 3*




*Pattern 4*




*Pattern 5*



# Definitions and abbreviations

## PROFINET IO definitions

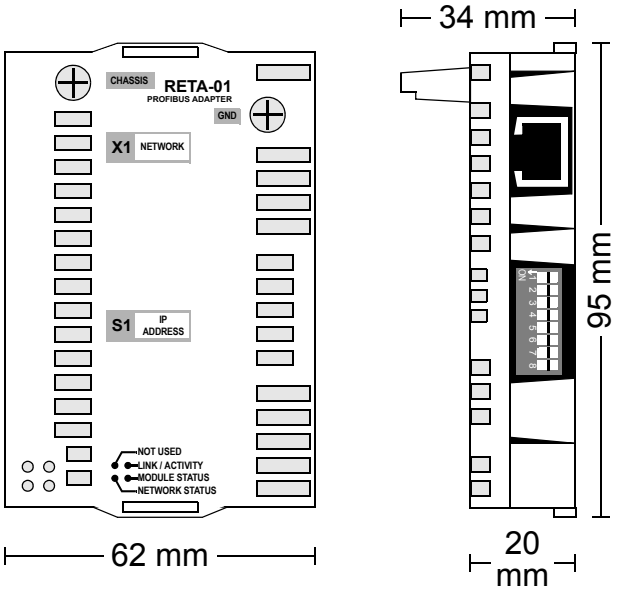
| | |
|---|---|
| *Acyclic Communication* | Communication in which messages are sent only once on request |
| *Array* | Parameter consisting of data fields of equal data type |
| *Broadcast* | Non-acknowledged message from master to all bus participants (compare Multicast) |
| *Command Word* | See Control Word |
| *Communication Object* | Any object of a real device that can be communicated with (variable, program, data range, etc.). Stored locally in the Object Dictionary. |
| *Control Word* | 16-bit word from master to slave with bit-coded control signals (sometimes called the Command Word). |
| *Cyclic Communication* | Communication in which Parameter-/Process Data-Objects are sent cyclically at predefined intervals |
| *Device Class* | Classification according to the number of profile functions included in the device |
| *Fault* | Event that leads to tripping of the device |
| *GSD File* | ASCII-format device description file in a specified form. Each device (active & passive stations) on PROFIBUS has to have its own GSD File. GSD files in PROFINET IO are written with GSDML. |
| *Index* | Access reference for Objects in PROFIBUS |
| *IO-controller* | Control system with bus initiative. In PROFINET IO terminology, IO-controllers are also called master stations. |
| *Multicast* | Non-acknowledged message from master to one group of bus participants (compare Broadcast) |

| | |
|---|---|
| *Name* | Symbolic name of a parameter |
| *Nibble* | Set of 4 bits |
| *Object Dictionary* | Local storage of all Communication Objects recognised by a device |
| *Object List* | List of all accessible objects |
| *Parameter* | Value that can be accessed as Object, e.g. variable, constant, signal |
| *Parameter Number* | Parameter address |
| *Parameter/Process Data Object* | Special object that contains Parameter and Process Data |
| *Process Data* | Data that contains Control Word and Reference value or Status Word and Actual value. May also contain other (user-definable) control information. |
| *Profile* | Adaptation of the protocol for certain application field, e.g. drives |
| *Request Label* | Coded information specifying the required service for the parameter part sent from master to slave |
| *Response Label* | Coded information specifying the required service for the parameter part sent from slave to master |
| *Slave* | Passive bus participant. In PROFINET IO terminology, slave stations (or slaves) are also called IO-devices. Also referred to as node. |
| *Status Word* | 16-bit word from slave to master with bit-coded status messages |
| *Warning* | Signal caused by an existing alarm which does not lead to tripping of the device |

# Technical data

## RETA-02

### Enclosure:




**Mounting:** Into the option slot on the control board of the drive.

**Degree of protection:** IP20

**Ambient conditions:** The applicable ambient conditions specified for the drive in its *Hardware Manual* are in effect.

**Settings:**

- Parameters (set through the drive)
- 8-way DIP switch for intranet IP address selection

**Connectors:**

- 34-pin parallel bus connector
- RJ-45 connector

**Current consumption:**

- 380 mA average (5 V), supplied by the control board of the drive

**General:**

- Estimated min. lifetime: 100 000 h
- All materials UL/CSA-approved
- Complies with EMC standards EN 50081-2 and EN 50082-2

## Ethernet link

**Compatible devices:** Ethernet standard IEEE 802.3 and 802.3u devices

**Medium:** 10base-TX or 100base-TX

- Termination: Internal
- Wiring: CAT 5 UTP, CAT 5 FTP* or CAT 5 STP* (*Recommended)
- Connector: RJ-45
- Maximum segment length: 100 m

**Topology:** Bus, star

**Serial communication type:** Half and full Duplex

**Transfer rate:** 10/100 Mbps

**Carrier protocol:** TCP/IP

**Application protocols:**

- Modbus/TCP
- PROFINET IO

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