

MANUFACTURER DOCUMENT PACKAGE

Manufacturer's Manual

Selected official pages for procurement and maintenance review

PRODUCT BRAND

ABB

PRODUCT MODEL

NWPM-01

Modbus drive adapter. Selected safety, compatibility, installation, communication and diagnostic pages retain their original ABB layout and printed page numbers.

OFFICIAL SOURCE

NWPM-01 User Manual: 3AUA0000020296 Rev A, 28 April 2008.

Open current manufacturer source

Selected original pages: 3, 5, 15-17, 19-27, 33-34, 37-38 and 61. Consult the complete source for referenced drive-program and register details.

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Amikon Limited prepared this independent reference package. Original manufacturer pages follow unchanged.

Modbus Adapter Module NWPM-01

User's Manual

3AUA0000020296 Rev A
EN
EFFECTIVE: 28.04.2008

Safety instructions

Overview

This chapter states the general safety instructions that must be followed when installing and operating the NWPM-01 Modbus Adapter module.

The material in this chapter must be studied before attempting any work on 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.

Overview

Overview

This chapter describes the NWPM-01 Modbus Adapter module, and gives the warranty and liability information of the manufacturer. (Information about the Modbus protocol see the chapter [Modbus protocol](#)).

Introduction to Modbus

Modbus is a serial, asynchronous protocol. The Modbus protocol does not specify the physical interface. The typical physical interfaces are RS-232 and RS-485. The NWPM-01 uses the RS-485 interface.

Modbus is designed for integration with Modicon PLCs or other automation devices, and the services closely correspond to the PLC architecture. The NWPM-01 and its associated drive can be seen on the network as a "Modicon PLC", which contains holding registers in the range 40001...49999.

The NWPM-01 uses the RS-485 two-wire interface.

The NWPM-01 Modbus Adapter module

The NWPM-01 Modbus Adapter module is an optional device for ABB Drives which enables the connection of the drive to a Modbus system. The Drive is considered as a slave in the Modbus network. Through the NWPM-01 Modbus 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 commands and services supported by the NWPM-01 Modbus 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 onto a standard mounting rail inside or outside the drive unit, depending on drive type and configuration. See the user's manual of the drive for module placement options.

The main differences between the NWPM-01 Modbus Adapter and the "Standard" Modbus Adapter NMBA-01 are:

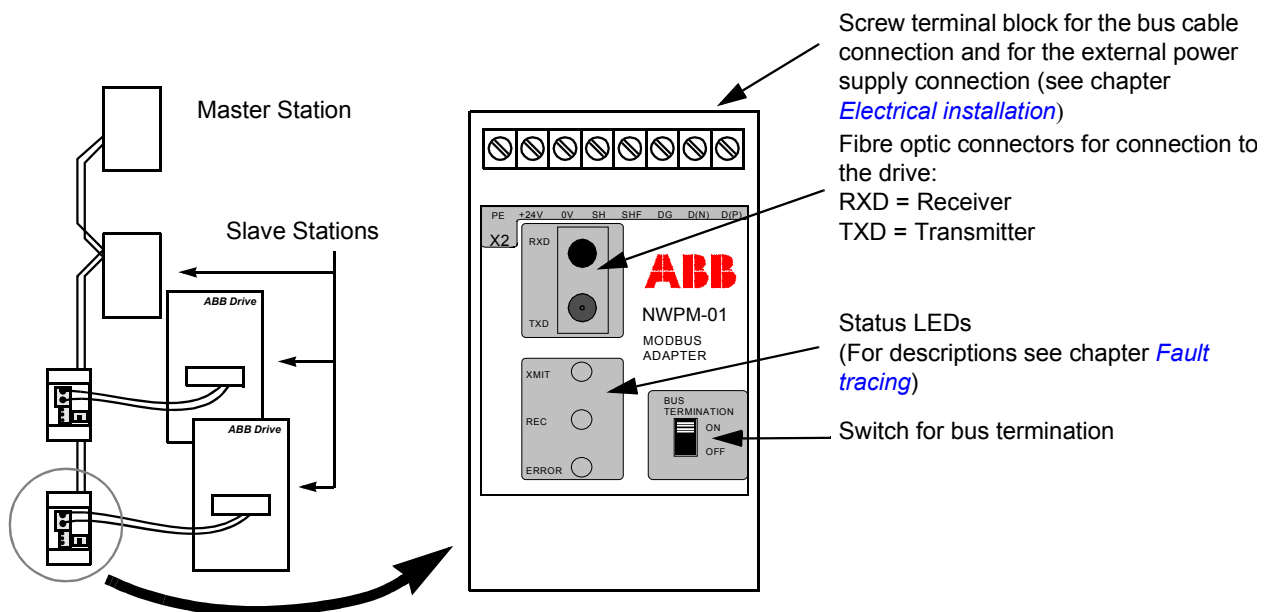
- NWPM-01 operates at communication speeds of 2400...38400 baud (NMBA-01 supported 1200...19200 baud)
- NWPM-01 has different mapping between the holding register addresses to the dataset addresses of ABB Drives systems.

The main reason for new mapping is that the input and output datasets of ABB Drives are interleaved, and this fact was not considered in design of NMBA-01.

The messages from the PLC to the drive should be sent to holding registers 40028...40051 (i.e. to addresses 27...50), which are mapped to datasets 10, 12, 14, 16, 18, 20, 22 and 24.

The messages from the drive to the PLC should be read from holding registers 40073...40096 (i.e. addresses 72...95), which are mapped from datasets 11, 13, 15, 17, 19, 21, 23 and 25.

The NWPM-01 offers a higher communication speed and the possibility to transfer efficiently more than 3 values in one message in the same direction, which increases the throughput of ABB drives' Modbus interface considerably.



The construction of the Modbus link and the NWPM-01 Adapter module.

Compatibility

The NWPM-01 is compatible with:

- ACS800 SingleDrive
- ACS800 MultiDrive
- ACS 600 Drives
- All master stations that support the Modicon-defined Modbus serial communication protocol.

Delivery check

The option package for the NWPM-01 Modbus Adapter module contains:

- Modbus Adapter module, type NWPM-01
- two pairs (four pieces) of fibre optic cables for connecting the adapter to the drive
- mounting rail
- 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.

Mechanical installation

Overview

This chapter contains module mounting instructions. Depending on the drive, the module can be installed either inside or outside the drive housing or cabinet. See the user's manual of the drive for module placement options.

Mounting outside the drive

Choose the location for the module. Note the following:

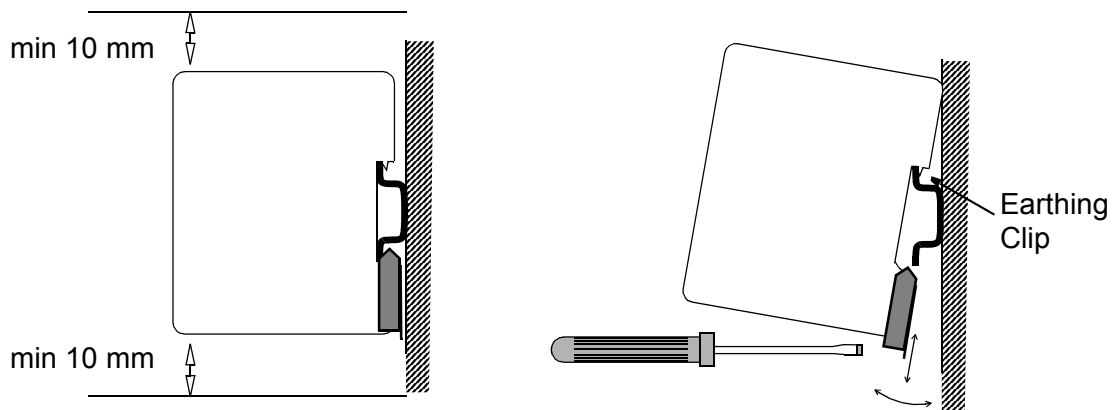
- The cabling instructions in chapter [Electrical installation](#) must be followed. Also, the length of the fibre optic cables included in the option package restrict the distance between the module and the drive.
- Observe the free space requirements for the module^{*)} (see the figure next page) and the drive (see the drive documentation).
- The ambient conditions should be taken into account (see chapter [Ambient conditions](#)). The degree of protection of the module is IP 20.
- Module earth is connected to the mounting rail by means of an earthing clip (see the figure next page). The mounting rail onto which the option module is to be mounted must be earthed to a noiseless earth. If the rail is not mounted on a properly earthed base, a separate earthing conductor must be used. The conductor must be as short as possible and its cross-sectional area must be 6 mm² at least.

Note: No solid copper conductor may be used (stranded wire allowed only).

Mounting instructions:

- Switch off all dangerous voltages in the enclosure that the module is to be mounted in.
- Fasten the rail and ensure the proper earthing as described above.

- Push the module onto the rail. The module can be released by pulling the locking spring with a screwdriver (see below).



*) Minimum of 10 mm from adjoining equipment or wall.

Mounting inside the drive

Only a qualified electrician should carry out the work inside the drive.



WARNING! Pay attention to the slowly discharging voltage of the capacitor bank and the voltages that are connected from external control circuits to the inputs and outputs of the drive.



WARNING! Do not touch the printed circuit boards. The integrated circuits are extremely sensitive to electrostatic discharge.

Mounting instructions:

- Stop the drive.
- Switch off the power supply of the drive and all dangerous voltages connected to the inputs and outputs.
- Wait for five minutes to ensure that the capacitors in the intermediate circuit have discharged.
- Remove the front cover of the drive.
- Ensure that the mains cable, motor cable and capacitor bank (UDC+ and UDC-) are not powered.
- Locate the position for the module (see the drive documentation). Fasten the mounting rail to its place if not already installed. Observe the free space requirements for the module (see the figure above).
- Push the module onto the rail. The module can be released by pulling the locking spring with a screwdriver (see the figure above).

Electrical installation

Overview

This chapter contains:

- General cabling instructions
- Instructions for bus termination
- Connection and earthing instructions for the NWPM-01 Module and earthing instructions for the bus cable.



WARNING! Before installation, switch off the drive power supply. Wait for 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

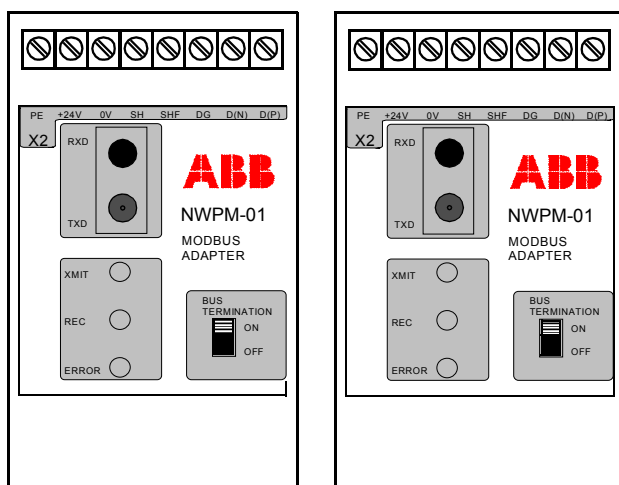
Arrange the bus cables as far away from the motor cables as possible. Avoid parallel runs. Use bushings at cable entries.

Handle fibre optic cables with care. When unplugging optic cables, always grab the connector, not the cable itself. Do not touch the ends of the fibres with bare hands, as the fibre is extremely sensitive to dirt.

The maximum long-term tensile load for the fibre optic cables is 1 N.
The minimum short-term bend radius is 25 mm.

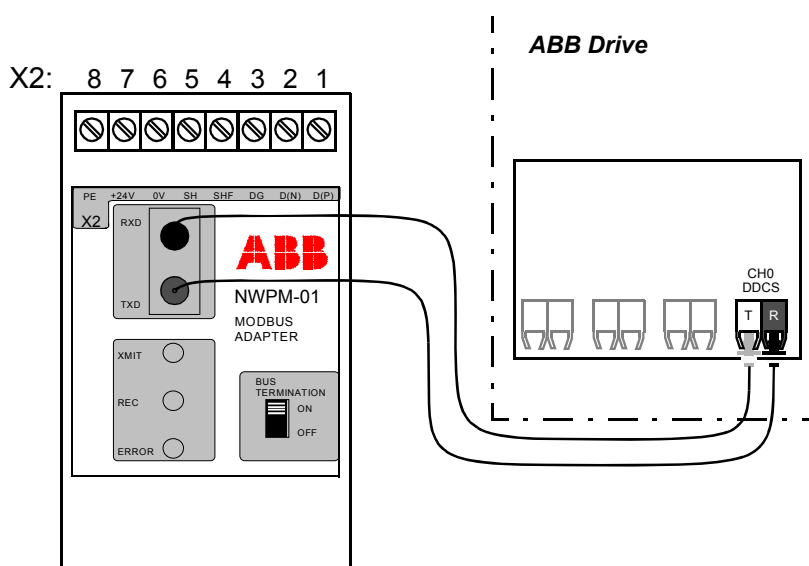
Bus termination

The built-in terminating resistors must be switched on if the NWPM-01 module is installed at the end of the bus. Otherwise the resistors must be switched off. Terminating resistors prevent signal reflections from the bus cable ends.



Terminating resistors on (left) and off (right).

NWPM-01 connections



Fibre optic link connecting the NWPM-01 adapter to the drive.

The NWPM-01 module is connected to the drive using a fibre optic cable link. Consult the drive documentation as to the corresponding terminals inside the drive.

The bus cable and the external power supply are connected to terminal block X2 on the NWPM-01.

Description of terminal block X2.

X2		Description
1	D(P)	D(P) = B = Data Positive (Conductor 1 in twisted pair) D(N) = A = Data Negative (Conductor 2 in twisted pair) DG = Data Ground
2	D(N)	
3	DG	
4	SHF	Cable screen AC earthing (via an RC filter)
5	SH	Cable screen earthing (directly earthed)
6	0V	Power supply for the module (24 V DC. $\pm 10\%$); screened cable.
7	+24 V	
8	PE	Earth

Earthing the module

The NWPM-01 module earth is connected to the rail onto which the module is mounted. If the rail is fastened to an earthed metallic assembly plate, the module is automatically earthed, and no external earthing wire is needed. If the rail is fastened to a base that is not earthed, the rail must be connected to the nearest earthing terminal. However, the earthing wire should not be connected to the same terminal as the power cable screens. (See the mounting instructions in chapter [Mechanical installation](#).)

In the NWPM-01 module there are several built-in earthing terminals (see figures [Two-wire connection](#) and [Three-wire connection. \(Preferred Practice.\)](#) on page 24):

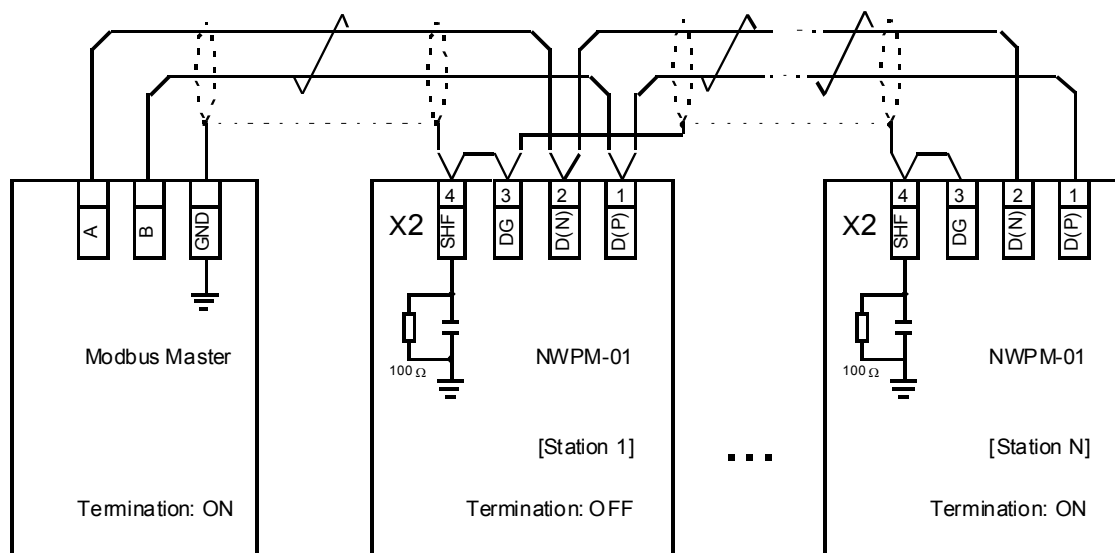
- The **PE** terminal is internally connected to the NWPM-01 module earth. Normally, no external wires need to be connected to this terminal.
- The **SH** terminal is internally connected to the NWPM-01 module earth. The SH terminal is normally used for earthing the Modbus cable shield if there is no other station at which the cable shield is directly earthed.
- The **SHF** terminal is internally connected to the NWPM-01 module earth via an RC filter. The SHF terminal is typically used for earthing the Modbus cable shield.
- The **DG** terminal is isolated from the NWPM-01 module earth. This terminal is used for connecting the third conductor of the bus cable. The third conductor – Data Ground – offers a common reference or comparison potential to all modules on the bus.

Note: The use of Data Ground is recommended as it improves noise immunity. See figures [Two-wire connection](#) and [Three-wire connection. \(Preferred Practice.\)](#) on page 24.

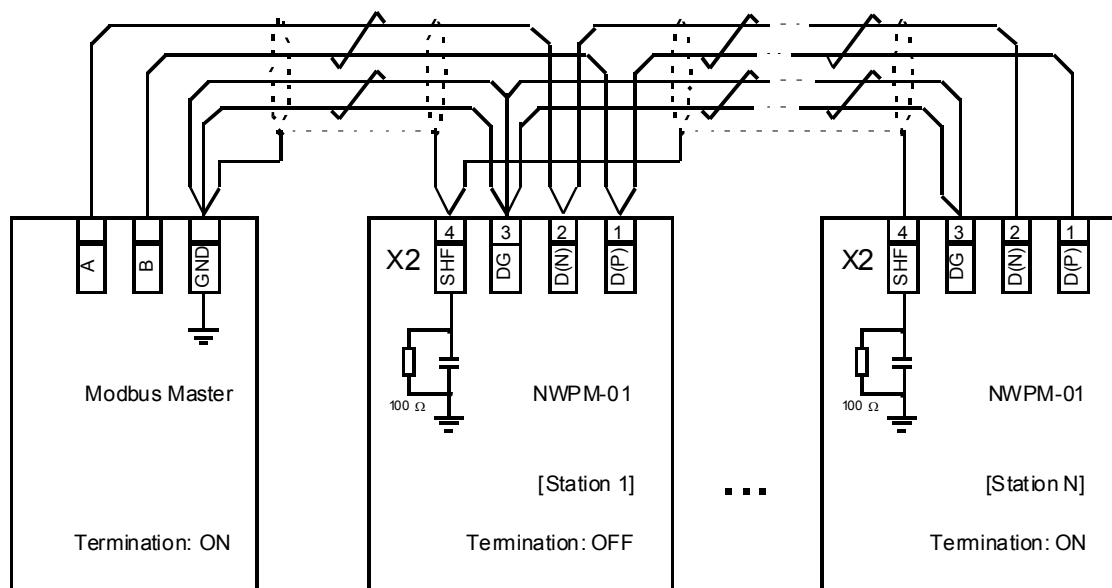
Earthing the Modbus cable shields

The Modbus cable shield may be directly earthed at one station only. At other stations the cable shield should be earthed via an RC filter.

There are two wiring examples in the figures below. The three-wire connection is the preferred one because of its the better noise immunity.



Two-wire connection



Three-wire connection. (Preferred Practice.)

Drive configuration

Overview

This chapter gives information on configuring the Modbus master station and the drive for communication through the NWPM-01 Modbus Adapter module.

Configuring the system

After the NWPM-01 Modbus Adapter module has been mechanically and electrically installed according to the instructions in chapters [Mechanical installation](#) and [Electrical installation](#), the master station and the drive must be prepared for communication with the module.

Please refer to the master station documentation for information on configuring the system for communication with the NWPM-01.

Modbus connection configuration

The detailed procedure of activating the module for communication with the drive is dependent on drive type. (Normally, a parameter must be adjusted to activate the communication. See the drive documentation.)

As communication between the drive and the NWPM-01 is established, several configuration parameters are copied to the drive. These parameters – shown in table [The NWPM-01 configuration parameters](#) – must be checked first and adjusted if necessary. The alternative selections for these parameters are discussed in more detail below the table. (Note that the new settings take effect only when the module is powered up for the next time.)

Note: The grouping, numbering, and adjustment procedure of parameters vary from drive to drive. See the drive documentation for information.

The NWPM-01 configuration parameters.

Fieldbus Par. No.	Parameter name	Alternative settings	Default setting
1	MODULE TYPE		NWPM-01 Vx.x
2	MODBUS MODE	(0) RTU wdg:flt; (1) RTU wdg:rst	(0) RTU wdg:flt
3	STATION NUMBER	1 – 247	1
4	BAUD RATE	(0) 2400; (1) 4800; (2) 9600; (3) 19200; (4) 38400	(3) 19200
5	PARITY	(0) EVEN; (1) ODD; (2) NONE 2 S.BIT; (3) NONE 1 S.BIT	(2) NONE 2 S.BIT
6	GOOD MESSAGES	0 – 32767	0
7	BAD MESSAGES	0 – 32767	0
8	DDCS CHANNEL	(0) CH0; (1) CH3	(0) CH0

MODULE TYPE

This parameter shows the module type and SW version number 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.)

MODBUS MODE

Shows the logical protocol on the hardware communication option module (the NWPM-01 supports only the RTU mode) and the operating mode of the watch-dog reset. There are two selections:

RTU wdg:flt

Remote Terminal Unit (RTU) mode. On a watch-dog error, the module will indicate a watch-dog error. The module has to be reset (power off) manually.

RTU wdg:rst

Remote Terminal Unit (RTU) mode. On a watch-dog error, the module will reset itself.

STATION NUMBER

Each device on the Modbus link must have a unique station number. This parameter is used to define a station number for the drive it is connected to.

BAUD RATE

Defines the communication speed in Baud. There are five selections: **2400**, **4800**, **9600**, **19200** and **38400** Baud.

PARITY

Defines the parity to be used with the Modbus communication. This parameter also defines the number of stop bits in use. Typically with Modbus communication the number of stop bits is 2 with no parity bit, and 1 with even or odd parity. There are

four selections:

EVEN, ODD, NONE 1 S.BIT and NONE 2 S.BIT.

GOOD MESSAGES

This diagnostics counter increases by one every time a valid Modbus message has been received by the NWBM-01. This counter will roll over from 32767 back to 0. During normal operation, this counter is increasing constantly. However, this counter variable is not updated to the drive except if there are new BAD MESSAGES, too.

So, if there are only good messages, their number cannot be seen, except by monitoring the blinking rate of the green XMIT and REC lights on the module front panel.

This "anomaly" is intentional, and its purpose is to maximize the throughput of the communication module.

BAD MESSAGES

This diagnostics counter increases by one every time the NMBA-01 Module finds any kind of communication error. This counter will roll over from 32767 back to 0. During normal operation, this counter hardly ever increases.

DDCS CHANNEL

Selects the DDCS CHANNEL of the drive to which the fibre optics are connected. This parameter is only used with ACS 600.

Note: The changes to the parameters do not take effect immediately. To change the module settings, the power must be disconnected from the NWPM-01.

Control locations

ABB drives can receive control information from multiple sources including digital inputs, analogue inputs, the drive control panel and a communication module (e.g. NWPM-01). 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. See the user documentation of the drive for information on the selection parameters.

Fault tracing

Overview

This chapter gives step-by-step diagnostics information for finding out the root causes and corrections to the most common problems with the NWPM-01 module.

This section is divided into different sections, which lists first the symptoms, then possible causes, and remedies for them.

Installation problems

Verify all the connections on the module. Check that

- the Modbus cable is connected correctly to terminal block X2.
- 24 V DC power is connected to the power connectors.
- the fibre cables between the drive and the NWPM-01 are correctly connected.
- the fibre link connector colours match the drive and NWPM-01 connector colours.

Drive setup

Fieldbus parameter group is not visible on the control panel.

- Activate the fieldbus module according to the instructions in the drive manual.

Drive parameters can be read, but control commands (Start/Stop or Reference) do not work.

- Check that the drive has the fieldbus adapter selected as the source of these commands (see the drive manual).
- DDCS communication is set to regeneration mode. In ACS800 System Control program parameter 70.19 CH0 HW CONNECTION = RING.
- Drivebus mode is disabled. In ACS800 System Control program parameter 71.01 CH0 DRIVEBUS MODE = NO.
- Control location is selected to data set 10. In ACS800 System Control program parameter 98.02 COMM. MODULE = ADVANT/N-FB.

PLC programming

PLC program is beyond ABB support. Contact the manufacturer for assistance.

Status LEDs

The NWPM-01 has three status LEDs. These are from top to bottom:

- *XMIT* LED. This LED will flash each time the NWPM-01 transmits a response or an exception on the Modbus network.

- **REC LED.** This LED will flash each time the NWPM-01 receives a command from the Modbus network.
- **ERROR LED** for combined error and module status indication. This LED will flash for the following reasons:
 - If the received command had a parity error.
 - If the received command had a CRC error.
 - If the received command was not supported by the NWPM-01 module. In this case the *XMIT* LED will also flash.
 - If the NWPM-01 module has found an error. The error codes are described in table [Modbus error codes during operation](#) below.

Module diagnostics

On module power-up, the NWPM-01 goes through a power-up self-test sequence. During this, the test state is indicated by the front three LEDs. The normal power-up procedure is as follows:

- All LEDs are turned on for the duration of the RAM/ROM test. If the test is passed, all LEDs will be turned off.
- The **ERROR** LED will flash rapidly for few seconds as the DDCS link between the NWPM-01 and the drive is initialised.
- **REC** and **XMIT** LEDs will flash according to the data transferred between the NWPM-01 and the drive.

Modbus error codes during initialization

Flash Code	Status	Correction
XMIT, REC, and ERROR LEDs on	ROM checksum test failed	Hardware failure. Replace NWPM.
REC and ERROR LEDs on	RAM test failed	Hardware failure. Replace NWPM.
ERROR LED on	DDCS ASIC register access test failed	Hardware failure. Replace NWPM.

Modbus error codes during operation

Flash Code	Status	Correction
Occasional flash on Error LED	Module on-line. Parity, CRC or unsupported command received.	Check the wiring and earthing of the module. Verify that only supported commands are sent to the module.
Error LED flashes continuously	NWPM is OK, no response from the drive on fibre link.	Power on the drive. Check the fibre link wiring.

Technical data

DDCS link

Compatible devices: All ABB Fieldbus Adapter modules, ACS800, ACS 600, DCS 500 Drives.

Size of the link: 2 stations (3 to 248 in Multiple Drive Control)

Medium: Fibre optic cable

- Construction: Plastic core, diameter 1 mm, sheathed with plastic jacket
- Attenuation: 0.31 dB/m
- Maximum Length between Stations: 10 m
- Specifications:

Parameter	Minimum	Maximum	Unit
Storage Temperature	-55	+85	°C
Installation Temperature	-20	+70	°C
Short Term Tensile Force		50	N
Short Term Bend Radius	25		mm
Long Term Bend Radius	35		mm
Long Term Tensile Load		1	N
Flexing		1000	cycles

Topology: Point-to-point (Ring in Multiple Drive Control)

Serial communication type: Asynchronous, half Duplex

Transfer rate: 4 Mbit/s

Protocol: Distributed Drives Communication System (DDCS)

Connectors: Blue – receiver; grey – transmitter

Fieldbus link

Compatible devices: Any Modbus device capable of Modbus communication as a master.

Size of the link: 247 stations including repeaters (31 stations and 1 repeater per segment)

Medium: Shielded, twisted pair RS485 cable

- Termination: built in the NWPM-01 module
- Modbus cable: Belden 9841 (typical)
- Maximum bus length: 1200 m

Topology: Multi-drop

Serial communication type: Asynchronous half Duplex

Transfer rate: 2400, 4800, 9600, 19200 and 38400 bit/s

Protocol: Modbus

NWPM-01

Enclosure: Plastic, dimensions 45 × 75 × 105 mm (H×W×D); degree of protection IP 20

Mounting: Onto a standard mounting rail

Settings: Via drive interface (control panel)

Current consumption: 65 mA at 24 V DC

Connectors:

- Light transmitter (grey) and receiver (blue) (Hewlett-Packard Versatile Link) for connection to the drive
- One Combicon MVSTBW 2.5/8-ST-5,08 (8-pole, cross-section 2.5 mm² max.) screw terminal block for the fieldbus and power supply):

X2	Description
1 D(P)	D(P) = B = Data Positive (Conductor 1 in twisted pair) D(N) = A = Data Negative (Conductor 2 in twisted pair) DG = Data Ground
2 D(N)	
3 DG	
4 SHF	Cable screen AC earthing (via an RC filter)
5 SH	Cable screen earthing (directly earthed)
6 0V	Power supply for the module (24 V DC ± 10%); screened cable.
7 +24 V	
8 PE	Earth

Ambient conditions

Ambient conditions, operation

Ambient operating conditions refer to the conditions the option module is subjected to when installed for stationary use.

Air temperature: 0 to +50 °C

Relative humidity: 5 to 95%, no condensation allowed. Maximum allowed relative humidity is 60% in the presence of corrosive gases.

Contamination levels:

Chemical gases: IEC 721-3-3, Class 3C2

Solid particles: IEC 721-3-3, Class 3S2

Installation site altitude: 0 to 2000 m above sea level. If the installation site is higher than 2000 m above sea level, please contact your local ABB distributor or office for further information.

Vibration: Max 0.3 mm (2 to 9 Hz), max 1 m/s² (9 to 200 Hz) sinusoidal (IEC 68-2-6)

Shock: Max 70 m/s², 22 ms (IEC 68-2-27)

Ambient conditions, storage

Ambient storage conditions refer to the conditions the option module is subjected to during storage in the protective package.

Temperature: -40 to +70 °C.

Relative humidity: Less than 95%, no condensation allowed

Atmospheric pressure: 70 to 106 kPa

Vibration: Max 0.3 mm (2 to 9 Hz), max 1 m/s² (9 to 200 Hz) sinusoidal (IEC 68-2-6)

Shock: Max 100 m/s², 11 ms (IEC 68-2-27)

Ambient conditions, transportation

Ambient transportation conditions refer to the conditions the option module is subjected to during transportation in the protective package.

Temperature: -40 to +70 °C

Relative humidity: Less than 95%, no condensation allowed.

Atmospheric pressure: 60 to 106 kPa

Vibration: Max 3.5 mm (2 to 9 Hz), max 15 m/s² (9 to 200 Hz) sinusoidal (IEC 68-2-6)

Shock: Max 100 m/s², 11 ms (IEC 68-2-27)

Bump: Max 300 m/s², 6 ms (IEC 68-2-29)

Free fall: 250 mm