ABB Drives

**Installation and
Start-up Guide**

Modbus Plus Adapter Module
NMBP-01

ABB

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Safety Instructions

Overview

This chapter states the safety instructions that must be followed when installing and operating the NMBP-01 Modbus Plus Adapter Module. If neglected, physical injury and death may follow, or damage may occur to the frequency converter, the motor and driven equipment. The material in this chapter must be studied before attempting any work on, or with, the unit.

Warnings and Notes

This manual distinguishes two sorts of safety instructions. Warnings are used to inform of conditions which can, if proper steps are not taken, lead to a serious fault condition, physical injury and death. Notes are used when the reader is required to pay special attention or when there is additional information available on the subject. Notes are less crucial than Warnings, but should not be disregarded.

Warnings

Readers are informed of situations that can result in serious physical injury and/or serious damage to equipment with the following symbols:

Dangerous Voltage Warning: warns of situations in which a high voltage can cause physical injury and/or damage equipment. The text next to this symbol describes ways to avoid the danger.

General Warning: warns of situations which can cause physical injury and/or damage equipment by means other than electrical. The text next to this symbol describes ways to avoid the danger.

Electrostatic Discharge Warning: warns of situations in which an electrostatic discharge can damage equipment. The text next to this symbol describes ways to avoid the danger.

Safety Instructions

Notes Readers are notified of the need for special attention or additional information available on the subject with the following symbols:

CAUTION! **Caution** aims to draw special attention to a particular issue.

Note: **Note** gives additional information or points out more information available on the subject.

General Safety Instructions

WARNING! All electrical installation and maintenance work on the ABB drive should be carried out by qualified electricians.

The drive and adjoining equipment must be properly grounded.

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

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

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

WARNING! There are several automatic reset functions in the ABB drive. If selected, they reset the unit and resume operation after a fault. These functions should not be selected if other equipment is not compatible with this kind of operation, or dangerous situations can be caused by such action.

More Warnings and Notes are printed at appropriate instances throughout this manual.

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Chapter 1 – Introduction

This chapter introduces the contents and divisions of this Guide.

How to Use this Guide

The purpose of this Guide is to provide the information necessary to install, commission, use, and to fault diagnose the Modbus Plus communication adapter.

Safety Instructions gives the general safety instructions which apply to the ABB drive and all of its option modules. This chapter also describes the formats and meanings for various warnings used within this guide.

Chapter 1 – Introduction, the chapter you are reading now, contains a short description of this manual and a list of related publications.

Chapter 2 – Overview contains a short description of the Modbus Plus network and of the Modbus Plus Adapter module. Delivery check list for field installation, and liability of manufacturer.

Chapter 3 – Mechanical Installation contains instructions for module placing and mounting.

Chapter 4 – Electrical Installation contains instructions for wiring the module to power supply, Modbus Plus network, and to the ABB drive.

Chapter 5 – Programming explains how to program the ABB drive for Modbus Plus communication, and what additional parameters are available with the module.

Chapter 6 – Communication describes which drive features and parameters can be accessed through the Modbus Plus communication module. There is also information on drive control and how to read the drive actual values and status information through the Modbus Plus connection.

This chapter also discusses the performance of the Modbus Plus connection.

Chapter 7 – Fault Tracing describes how to fault diagnose the Modbus Plus connection during installation, commissioning, and normal operation.

Appendix A – Technical Data contains the technical information on the Modbus Plus module.

Appendix B – Parameter Scaling contains a complete list of all the parameters, their 4xxxx register addresses, and the scaling accessible through the Modbus Plus network.

Conventions Used in this Guide

This Guide uses some terms and conventions that all readers might not be familiar with. Some of these terms are described here.

Data set

Data set is a fast control and feedback value area in the ABB drive. Data sets give the fastest possible control to the drive.

Global Data

The Modbus Plus network has a service called Global Data. This is a fast data transfer between devices on the Modbus Plus network. Global Data is designed for sending time-critical control or feedback values to and from devices on the network. Modicon PLCs and ABB drives support the Global Data transfer.

4XXXX Register Area   Modicon PLCs have a signed integer data table area, which is used for Analog output modules and for storing temporary or set-point values. These registers are in the address area starting from 40001. The last register address available on PLCs depends on the available memory, but is less than 49999.

The ABB drive simulates this area by providing a read and write access to its parameters through this register address area.

Related Publications   Your ABB Drive *Firmware Manual*

Modicon *Modbus Plus Network Planning and Installation Guide.*

Chapter 2 – Overview

This chapter describes the NMBP-01 Module, and gives the Warranty and Liability information of the Manufacturer.

Overview

The NMBP-01 Modbus Plus Adapter Module is for connecting the ABB drive directly to the Modicon Modbus Plus network.

The NMBP-01 supports read and write access to the drive parameters and data sets, as well as receiving and sending global data for critical drive control and feedback values.

The NMBP-01 Modbus Plus Adapter Module

The NMBP-01 Modbus Plus Adapter Module is an optional device for ABB drives which enables the connection of the drive to a Modbus Plus system. The drive acts like a Modicon PLC on the network. Through the NMBP-01 Modbus Plus 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 Plus commands and services supported by the NMBP-01 Adapter Module are discussed in Chapter 6. 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 NMBP-01 module has multiple connectors on its front plate. These are shown in 'Figure 2-1" on page 2-3.

Standard 9-pin Modbus
Plus connector

Fiber optic connectors for
connection to the drive

Reset button

Status LEDs

Power connections

Master

Controllers
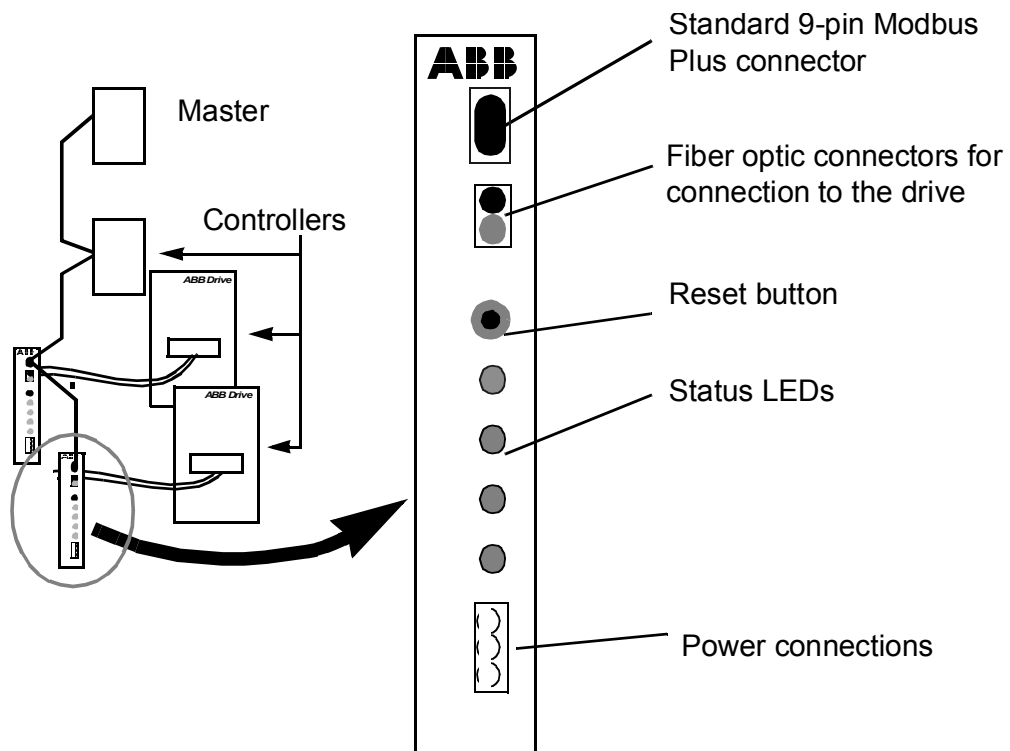
Figure 2-1 NMBP-01 Front Connections

Compatibility

The NMBP-01 has been tested and approved
by Modicon as a part of the ModConnect
program acceptance.

The NMBP-01 is compatible with:

- ACS 400
- ACS 600 SingleDrive
- ACS 600 MultiDrive
- ACS 600 MotionControl (ACP 600)
- ACS 600 CraneDrive (ACC 600)
- ACS 600 Pump and Fan Drive
  (ACF 600)
- DCS 500 (software version 21 x 226 or
  later)

Delivery Check

The field installable Modbus Plus option package includes:

• NMBP-01 Adapter Module

• Fiber optic cables for connecting the adapter to the drive

• Mounting rail

• *Installation and Start-up Guide for NMBP-01.*

Warranty and Liability Information

The warranty for your ABB drive and options covers manufacturing defects. The manufacturer carries no responsibility for damage due to transport or unpacking.

In no event and under no circumstances shall the manufacturer be liable for damages and failures due to misuse, abuse, improper installation, or abnormal conditions of temperature, dust, or corrosives, or failures due to operation above rated capacities. Nor shall the manufacturer ever be liable for consequential and incidental damages.

The period of manufacturer's warranty is 12 months, and not more than 18 months, from the date of delivery.

Extended warranty may be available with certified start-up. Contact your local distributor for details.

Your local ABB Drives company or distributor may have a different warranty period, which is specified in their sales terms, conditions, and warranty terms.

If you have any questions concerning your ABB drive, contact your local distributor or ABB Drives office.

The technical data and specifications are valid at the time of printing. ABB reserves the right to subsequent alterations.

Chapter 3 – 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 must be followed (see Chapter 4). Also, the length of the fiber optic cables included in the option package restrict the distance between the module and the drive.
- Observe the free space requirements for the module (min. 10 mm from adjoining equipment or wall) and the drive (see the drive documentation).
- The ambient conditions should be taken into account. The degree of protection of the module is IP 20.

Mounting instructions:

1. Switch off all dangerous voltages in the enclosure which will house the module.
2. Fasten the rail.
3. Push the module onto the rail. The module can be released by pulling the locking spring with a screwdriver, see "Figure 3-1" on page 3-2.
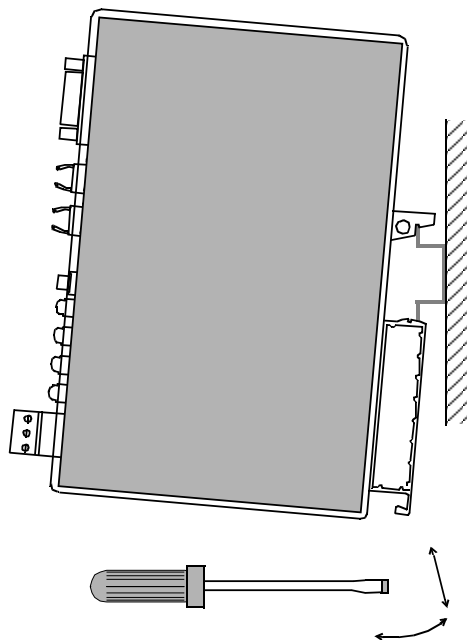
Figure 3-1 Mounting and removing the module.

Mounting Inside the Drive

The work inside the drive should ONLY be carried out by a qualified electrician.

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:

1. Stop the drive.
2. Switch off the power supply of the drive and all dangerous voltages connected to the inputs and outputs.
3. Wait for five minutes to ensure that the capacitors in the intermediate circuit have discharged.
4. Remove the front cover of the drive.
5. Ensure that the input power cable, motor cable and capacitor bank (UDC+ and UDC-) are not powered.
6. Locate the position for the module (see the user's manual of the drive). Fasten the mounting rail to its place if not already installed. Observe the free space requirements for the module (min. 10 mm from adjoining equipment/wall).
7. Push the module onto the rail. The module can be released by pulling the locking spring with a screwdriver, see "Figure 3-1" on page 3-2.

Chapter 4 – Electrical Installation

This chapter gives wiring instructions for wiring the NMBP-01 Modbus Plus option module to 24 VDC power, fiber link connection to the drive, and to the Modbus Plus network.

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.

Cabling

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

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

The maximum long term tensile load for the fiber optic cable is 1 N. The minimum short term bend radius is 25 mm.

NMBP-01 Connectors The NMBP-01 module has multiple connectors on its front plate. These are shown in Figure 4-1 below.
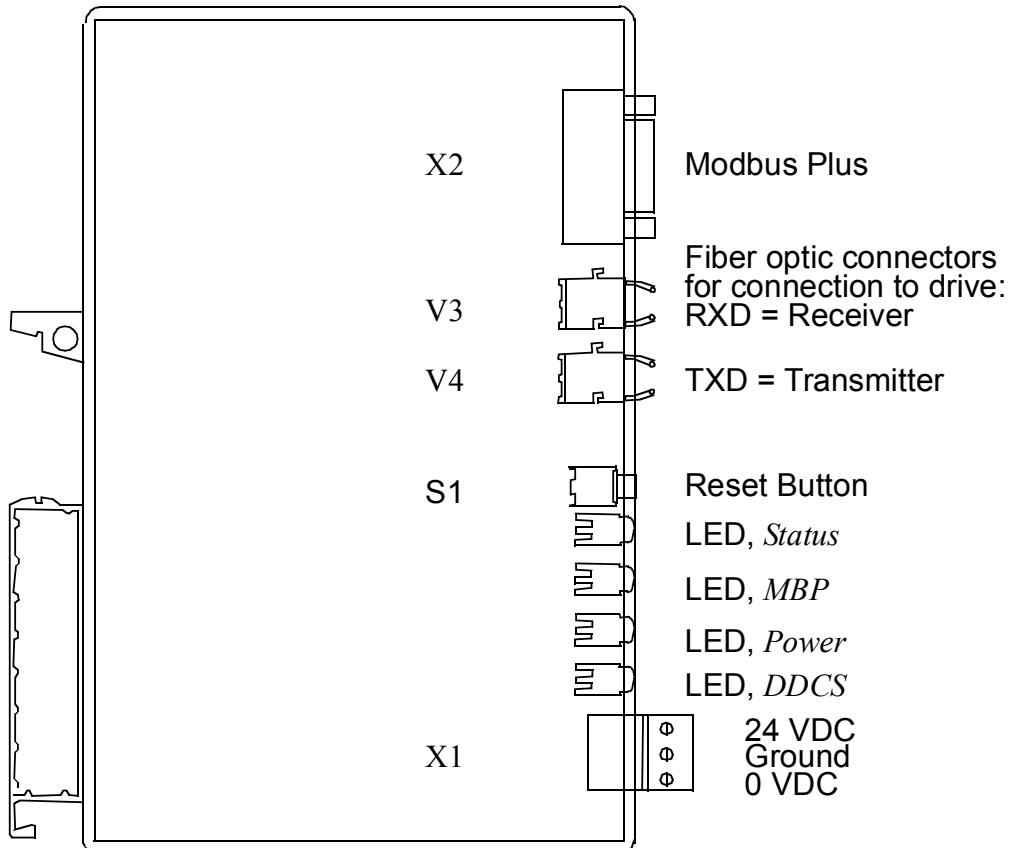
Figure 4-1 NMBP-01 Front Connections.

X1	This is the power connector for the module with the following terminals:

- X1:1 is for regulated 24 VDC
- X1:2 is for grounding the shield of the X2 Modbus Plus network
- X1:3 is for 0 VDC

X2	This is the standard Modbus Plus connector.
V3	This is the DDCS link receive from the drive.
V4	This is the DDCS link transmit to the drive.

Wiring

The 24 VDC power should be connected to the NMBP-01 using 16 – 20 AWG (0.5 to 1.5 mm^2) insulated wire.

The power and grounding connector is on the bottom of the option module. The connection is shown in Figure 4-2 below.

X1:1 +24 VDC

X1:2 GND (Signal ground)

X1:3 GND (0 VDC)
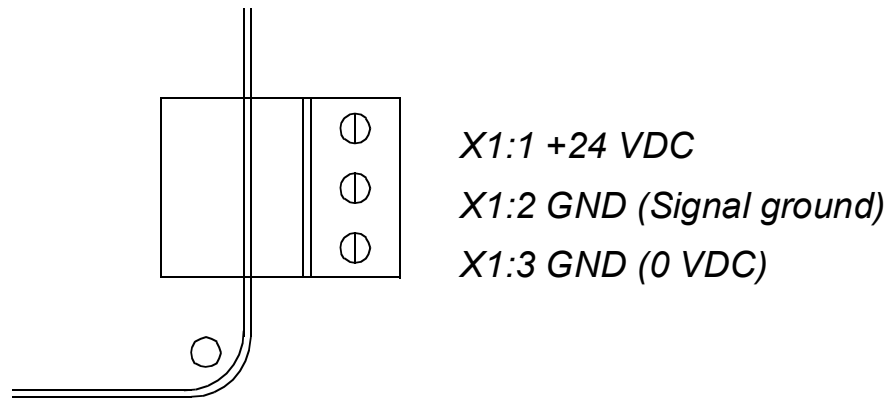
Figure 4-2 NMBP-01 Power Connector.

In this figure, the 24 VDC is connected to terminal 1, and the power 0 VDC to 3. Terminal 2 is for signal ground, which is used to terminate the shield of the Modbus Plus network. This signal ground must be connected to a noise-free ground, and not to a ground where high power devices are grounded.

Drive Connection

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

Two fibers are needed to connect the Modbus Plus module to the drive.

Modbus Plus

The NMBP-01 option module has the standard 9-pin D-shell Modbus Plus connector on the top of the front plate.

Pin Number	Connection
1	Common
2	B
3	A
4-9	NC

Table 4-1   Modbus Plus Network Connector

The following chapters are used by permission of Modicon. These chapters are taken from Modicon publication *"Modbus Plus Network Planning and Installation Guide"* (GM-MBPL-001 Rev. D).

Modbus Plus Cable

The cable type specified for network use is:

Manufacturer: Belden Corporation

Telephone: (317) 983-5200

Cable Type: 9841

Description: Twisted pair, shielded, with insulating outer jacket NEC/UL CM (communications) for use in industrial environments

This cable is available from Modicon as the following part numbers:

97-9841-100 MBPlus 100 Foot Reel

97-9841-500 MBPlus 500 Foot Reel

97-9841-01K MBPlus 1000 Foot Reel

For ordering information, contact Modicon Customer Service at the following telephone numbers. Ask for Customer Service Order Entry.

North America: (800) 468-5342

International: (508) 794-0800

Your cable will run directly between the network device locations. Each cable segment must be a continuous run between the device connectors at two locations. The use of splices, taps, splitters, or any other configurations such as 'star' or 'tree' configurations, is not allowed. The only allowed media components are the network cable and network device connectors.

You will typically plan your cable runs according to the vertical rises and horizontal distances between sites. When you order cable, you will be ordering it by reels of fixed length. Order reels of sufficient length to allow continuous runs between the network devices. Provide excess length at each site for service loops, strain reliefs, and dressing.

Modbus Plus Connectors

Two types of connectors are available from Modicon for connecting devices to the network:

- Each in-line drop requires a line connector, Modicon part number AS-MBKT-085. This part number contains one connector.
- The drops at the two ends of the cable each require a terminating connector, Modicon part number AS-MBKT-185. This part number contains two connectors.

You should plan to order a sufficient quantity of connectors to allow extra ones for service access and spares.

Modbus Plus Connector Installation Tool

A special tool is available from Modicon for installing connectors on the network cable. Use of the tool will ensure positive electrical contact between the connector and cable, as well as shorten the time required for installation. Its use is highly recommended. Its part number is:

AS-MBPL-001 Modbus Plus Connector Assembly Tool

Modbus Plus Cable Impedance Termination

When the terminating connectors are installed on the two extreme ends of the cable, they furnish the proper terminating impedance for the network. The cable termination is maintained regardless of whether a node device is connected to either end of the cable. No other termination is required.

It is not necessary to provide an external matching termination to any connector. Any connector can be disconnected from its device without affecting the network impedance.

Modbus Plus Network Earthing

The entire network cable, including its shield, should remain isolated from external ground sources. No connection should be made between the cable and the plant grounding system or the panel grounding connection at any point.

Grounding systems should connect to each device's dedicated ground terminal, not to the network cable. The cable ground will be supplied by its network cable connection to the device.

The cable shield ground is connected to terminal X1:3 on the power connector of the Modbus Plus Module, see "Figure 4-2" on page 4-3.

Chapter 5 – Programming

Overview

This chapter gives information on configuring the Modbus Plus master station and the drive for communication through the NMBP-01 Modbus Plus Adapter Module.

Configuring the System

After the NMBP-01 Modbus Plus Adapter Module has been mechanically and electrically installed according to the instructions in Chapters 3 and 4, 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 NMBP-01.

Modbus Plus 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 NMBP-01 is established, several configuration parameters are copied to the drive. These parameters must be checked first and adjusted if necessary, see 'Table 5-1' on page 5-3. 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 or the RESET button is pressed 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 contents of the Fieldbus group is listed as well, see 'Table 5-1' on page 5-3.

Fieldbus Par. No.	Parameter Name	Alternative Settings	Default Setting
1	MODULE TYPE	NMBP-01 v1.x	NMBP-01 v1.x
2	PROTOCOL	**(0)** MODBUS PLUS; **(1)** MBP FAST	**(0)** MODBUS PLUS
3	Station	1 – 64	64
4	Good Msg	0 – 32767	0
5	Bad Msg	0 – 32767	0
6	GD Out 1	0 – 96	4
7	GD Out 2	0 – 96	5
8	GD Out 3	0 – 96	6
9	GD In1 Stn	0 – 64	0
10	GD In1 Wrd	0 – 31	0
11	GD In2 Stn	0 – 64	0
12	GD In2 Wrd	0 – 31	0
13	GD In3 Stn	0 – 64	0
14	GD In3 Wrd	0 – 31	0

Table 5-1   The NMBP-01 configuration parameters.

Note: The Default values are used when the module is connected to the drive the first time. The parameters in the Fieldbus Group must be set up for the current application. By default, no global data is being used, and the Modbus Plus module is station 64.

Note: The version number in Fieldbus Parameter 1 is only visible from version v1.4 and up.

01 MODULE TYPE   Shows the connected communication option module type and version. For Modbus Plus communication this is NMBP-01.

02 PROTOCOL   Shows the logical protocol on the hardware communication option module. For Modbus Plus module, there are two selections.

0 MODBUS PLUS
This is the Modbus Plus protocol option, with diagnostic counter updates (Parameters 04 and 05).

1 MBP FAST
This selection allows faster updates of drive data because diagnostic counters are not updated (Parameter 04 and 05). In this mode, these diagnostic counters remain in their last value.

03 Station   Sets the node number for the module on Modbus Plus network.

1 – 64

04 Good Msg   This diagnostics counter increases by one every time a valid Modbus Plus message has been received by the NMBP-01 Module. This counter will roll over from 32767 back to 0. During normal operation, this counter is increasing constantly. Valid messages are message numbers 0x03, 0x06, and 0x10, with read and write addresses within groups.

0 – 32767

05 Bad Msg   This diagnostics counter increases by one every time the NMBP-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. Communication errors are increased by one whenever the NMBP-01 Module receives an unsupported command, or a parameter read or write to addresses outside parameter group ranges.

0 – 32767

06 GD Out 1

All Modbus Plus nodes can send up to 32 words of global data to all other drives on the network. Each node reads this information and selectively use the global data from specific nodes. NMBP-01 sends out 3 words of global data. This parameter defines what is sent out on the first word of the drive's global data. The selection is limited to the high-speed data set information of the ABB drive. Please note that different drives support different numbers of data sets; see the drive documentation.

0
Nothing selected.

1 Data Word 1.1
Typically the Control Word of the drive. The Control Word is used for start/stop control, and for resetting the faults on the drive. For details see the drive documentation.

2 Data Word 1.2
Typically the Reference 1 of the drive. Selection sends out the current Reference 1 value.

3 Data Word 1.3
Typically the Reference 2 of the drive.Selection sends out the current Reference 2 value.

4 Data Word 2.1
Typically the Status Word of the drive. Selection sends out the current Status Word.

5 Data Word 2.2
Typically the Actual Value 1 of the drive. Selection sends out the current Actual Value 1.

6 Data Word 2.3
Typically the Actual Value 2 of the drive. Selection sends out the current Actual Value 2.

7- 96 Data Word 3.1- 32.3

07 GD Out 2

Defines what is sent out on the second word of global data. The selection is limited to high-speed data set information on the ABB drive. The choices are the same as Parameter 06 (GD Out 1).

08 GD Out 3	Defines what is sent out on the third word of global data. The selection is limited to high-speed data set information on the ABB drive. The choices are the same as Parameter 06 (GD Out 1).
09 GD In1 Stn	This parameter and Parameter 10 GD In1 Wrd defines what data is received for Data Word 1.1. This parameter defines the source station for global data which is placed to the Data Word 1.1.

0
Identifies that the control word is not received through global data.

1 – 64
Identifies the source station for global data.

10 GD In1 Wrd	This parameter and Parameter 09 GD In1 Stn defines what data is received for Data Word 1.1. This parameter defines the word number on the global data which is placed to the Data Word 1.1.

0 – 31
The word number of the global data.

11 GD In2 Stn	This parameter and Parameter 12 GD In2 Wrd defines what data is received for Data Word 1.2. This parameter defines the source station for global data which is placed to the Data Word 1.2. The choices are the same as Parameter 09 (GD In1 Stn).
12 GD In2 Wrd	This parameter and Parameter 11 GD In2 Stn defines what data is received for Data Word 1.2. This parameter defines the word number on global data which is placed to the Data Word 1.2. The choices are the same as Parameter 10 (GD In1 Wrd).
13 GD In3 Stn	This parameter and Parameter 14 GD In3 Wrd defines what data is received for Data Word 1.3. This parameter defines the source station for global data which is placed to the Data Word 1.3. The choices are the same as Parameter 9 (GD In1 Stn).

14 GD In3 Wrd

This parameter and Parameter 13 GD In3 Stn defines what data is received for Data Word 1.3. This parameter defines the word number on global data which is placed to the Data Word 1.3. The choices are the same as Parameter 10 (GD In1 Wrd).

Note: The changes to the parameters in the Fieldbus Group do not take effect immediately. To change the module settings, either the reset button on the front of the module must be pressed, or the power must be disconnected from the Modbus Plus communication module.

Control Locations

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

Chapter 6 – Communication

This chapter describes the Modbus Plus communication with ABB drives.

Introduction to Modbus Plus

Modbus Plus is a 1 MBit/s, transformer-coupled network. The transformer coupling isolates all the nodes galvanically from the network.

Modbus Plus is designed for Modicon PLCs, and the services closely correspond to the PLC architecture. The ABB drive acts like a Modicon PLC on the network.

Program Paths

The Modbus Plus network always uses five address fields for addressing nodes on the network. Unused fields must be set to zero. The purpose of these fields is device-dependent.

Examples of addresses are:

- PLCs. Only one address, which is the node number on the Modbus Plus network

- Bridge/Mux. Two or three fields. First one is the node number on the Modbus Plus network. The second one is the serial port number. The third one is the slave number if in network mode.

- ABB Drives. Two fields. The first field is the station number on the Modbus Plus network set with the parameter 03 in the Fielbus Group of the drive. The second field is the node number of the drive on the DDCS fiber link ring. Drives on the fiber ring are automatically numbered by the order they are on the ring.

This multilevel addressing allows the user to build a large and extensive network, tying together individual segments with Bridges.

Routing for ABB drive   The ABB drive requires two fields of addressing. The first field is the Modbus Plus node number, and the second field is the node number of the drive on the DDCS fibre link. Valid numbers for the second field are 1, 2, …, 8. The second field is mandatory, even if there is only one drive per adapter.

Example: Routing from PLC A to the ABB drive shown in Figure 6-1 below is 12.2.5.1.0.

```
          ┌─────────┐
          │  PLC A  │
          └────┬────┘
              1│
  ────────────┴──────────────────────────────
                          │12
                     ┌────┴─────┐      ┌─────────┐
                     │  Bridge  │      │  PLC B  │
                     └──────────┘      └────┬────┘
                     Port 2│20              │2
  ──────────────────────┴─────────────────┴──
                          │5
                     ┌────┴─────┐
                     │ ABB Drive│
                     └──────────┘
```
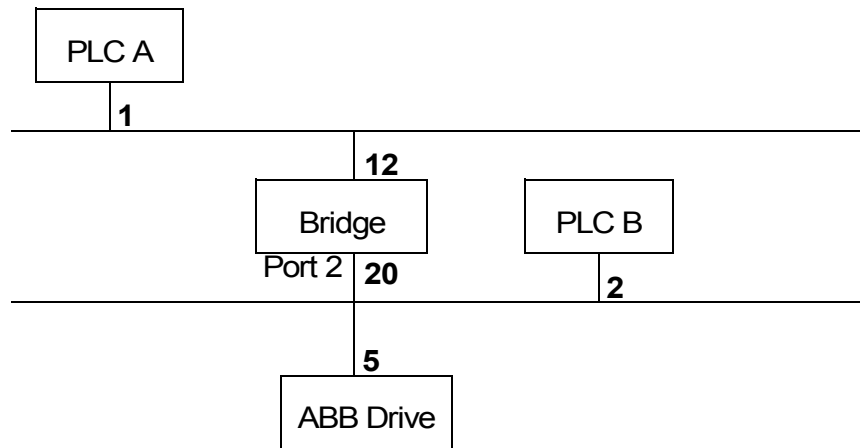
Figure 6-1   Routing Example.

In this example, the bold numbers are node numbers for devices on Modbus Plus network.

The PLC communicates to the drive through the Bridge device on node address 12 using port 2.

Note: The global data can not be transferred through the Bridge. In the above example the global data from the ABB drive is available for PLC B, but not for PLC A.

Register Read and Write

ABB drives have all the drive parameter and data set information 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 setup parameters for mapping the data to the 4xxxx register. The mapping is pre-defined, and corresponds directly to the drive parameter grouping which is being used by the local control panel.

All parameters are available for both reading and writing. The parameter writes are verified for correct value, and for valid register addresses. Some parameters never allow writes (including actual values), some parameters allow write only when the drive is stopped (including setup variables), and some can be modified at any time (including actual reference values).

Register Mapping

The drive parameters are mapped to the 4xxxx area so that:

- 40001 – 40096 are reserved for data words.

- 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 Table 6-1 below. In this table GG is the group number, and PP is the parameter number within the group.

	4GGPP	**GG**	**PP**
Data Sets	40001 – 40096	**00** Data sets	**01** Data word 1.1 **02** Data word 1.2 **03** Data word 1.3 **04** Data word 2.1 **05** Data word 2.2 **06** Data word 2.3 **07** Data word 3.1 … **94** Data word 32.1 **95** Data word 32.2 **96** Data word 32.3
Parameters	40101 – 40199	**01** Group01	**01** Parameter 01 **02** Parameter 02 … **99** Parameter 99
	40201 – 40299	**10** Group 02	**01** Parameter 01 **02** Parameter 02 … **99** Parameter 99
	…	…	…
	49901 – 49909	**99** Group 99	**01** Parameter 01 … **99** Parameter 99

Table 6-1   Parameter Mapping.

The register addresses between the groups are invalid. No reads or writes are allowed for these addresses. If there is an attempt to read or write outside the parameter addresses, the Modbus Plus interface will return an exception code back to the controller.

Exception Codes The ABB drive supports the standard Modbus Plus exception codes. These are shown in Table 6-2 below.

Code	Name	Meaning
01	ILLEGAL FUNCTION	The function code received in the query is not an allowable action for the slave. If a Poll Program Complete command was issued, this code indicates that no program function preceded it. ABB drive: Unsupported Command.
02	ILLEGAL DATA ADDRESS	The data address received in the query is not an allowable address for the slave. ABB drive: Address outside groups
03	ILLEGAL DATA VALUE	A value contained in the query data field is not an allowable value for the slave. ABB drive: Value outside min-max limits ABB drive: Parameter is read-only

Table 6-2   Exception Codes.

Global Data The ABB drive supports global data on the Modbus Plus network. global data is a service on Modbus Plus, intended for fast control or actual value transfer.

Every node on the Modbus Plus network can 'broadcast' with the token pass data to other nodes on the network. This global data is fixed in length (up to 32 words), and the data contents are defined by the sending station.

An ABB drive can receive up to 3 words from stations on the network, and it can transmit up to 3 words to the network. The global data can be used for receiving or transmitting information contained in the data sets in the drive.

The global data is configured using the setup parameters in the Fieldbus Group. See *Chapter 5 – Programming, Modbus Plus Configuration* for details.

Note: If more than one drive has been connected to one NMBP-01 adapter, global data is supported only with the first drive on the fiber ring.

Data Update

The NMBP-01 module has been designed for fast and reliable data transfer between the Modbus Plus network and the ABB drive. To get the maximum through put from the Modbus Plus network, the data is transferred according Table 6-3 below.

Action	Response
READ Data word	Data is read immediately from the drive
READ Parameter	Data is updated from the drive with the external read interval.
WRITE Data word	Data is written immediately to the drive. The validity of write (value range and address range) is checked, and if violation, an exception is generated.
WRITE Parameter	Data is written directly to the drive. The validity of write (value range and address range) is checked, and if violation, an exception is generated.

Table 6-3   Transfer Modes.

Note: Register writes have priority over reads. If your PLC program performs continuous writes, the read data could be obsolete.

Multiple Drive Control It is possible to connect multiple (maximum 8) drives to one NMBP-01. Multiple Drive Control has the same control principle as the point-to-point connection.

Note: Only one type of drive (e.g. ACS 400 or ACS 600) can be connected to one Multiple Drive Control segment.
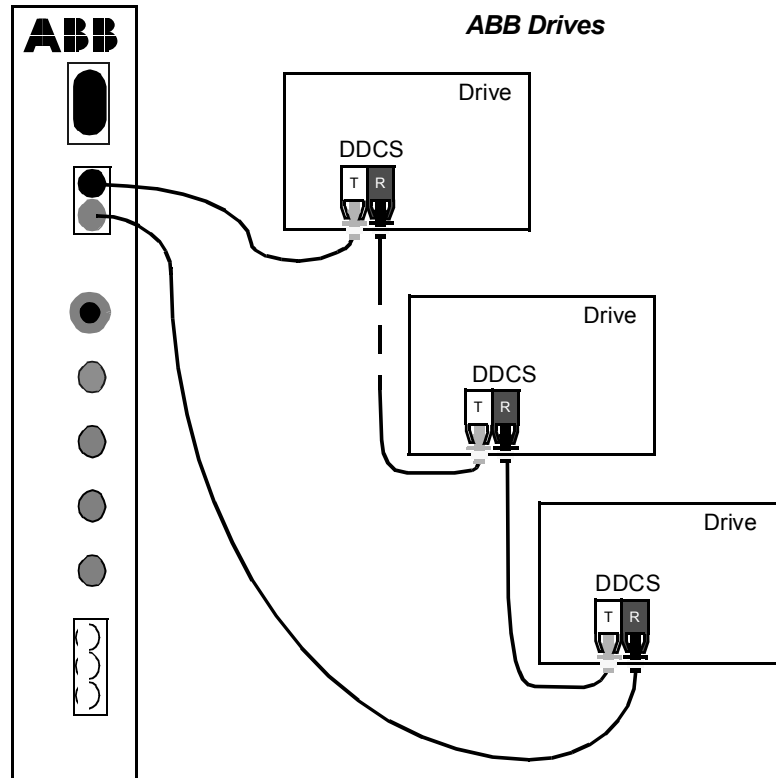

Figure 6-2   Multiple Drive Control Connection.

The Multiple Drive Control connection does not significantly add to the DDCS communication delay. The update interval of the data in the parameter registers is longer than in point-to-point connection, due to the fact that each parameter value is updated from the drive's internal memory. The delay is most noticeable when multiple parameter register read or write is requested.

Global data messages can be used only with the first drive on the ring.

Multiple Drive Control Set-up

To configure the Modbus Plus adapter, the fieldbus parameters of the first drive on the ring are set by means of its control panel. (See Chapter 5 for more specific information.)

During initialization of the NMBP-01, the number of drives connected to the ring is checked. The slaves are autonumbered starting from the first drive in the ring. The second field of ABB drive Modbus Plus address is the node number of the drive in the ring. In Multiple Drive Control, the NMBP-01 sends only one fieldbus parameter to all other drives in the ring. This parameter is *01 MODULE TYPE*.

Chapter 7 – Fault Tracing

This chapter gives step-by-step diagnostics information for determining root causes and corrections to the most usual problems with the NMBP-01 Module.

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

Installation Problems

Verify all the connections on the module:

- Modbus Plus cable is connected to the Modbus Plus terminal

- 24 VDC power is connected to the power terminal

- Fiber link cable is connected correctly between the drive and the NMBP-01 Module

- Check that the fiber link connector colors match the drive and NMBP-01 Module connector colors.

Drive Setup

Fieldbus parameter group is not visible on the control panel.

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

The NMBP-01 is using default values.

- Verify that the Fielbus Parameter Group in drive is setup correctly. If so, press the RESET button on the NMBP-01 which causes the module to re-read its setup parameters.

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).

PLC Programming   The PLC ladder program is beyond ABB Drives support.

Status LED   There is a diagnostics status LED on the NMBP-01 Modbus Plus module that indicates the current state of the module. A status code is indicated by a series of flashes at 250 ms intervals followed by 750 ms delay. Table 7-1 below shows every error code.

Flash Code	Status	Correction
No Flashes	OK	
1	NMBP-01 is OK, no response from the drive on fibre link	Power on the drive. Check the fibre link wiring.
2	Watchdog time out	Hardware failure on NMBP-01 module. Switch power off and on; if the problem persists, replace NMBP-01.
3	ROM checksum test failed	Hardware failure. Replace NMBP-01.
4	RAM test failed	Hardware failure. Replace NMBP-01.
5	Modbus Plus dual port RAM failed	Hardware failure. Replace NMBP-01.
6	DDCS ASIC register access test failed. DDCS Library initialisation failed.	Hardware failure. Replace NMBP-01. Switch power off and on; if the problem persists, replace NMBP-01.
7	Modbus Plus Hard Error	Hardware failure on NMBP-01 module. Switch power off and on; if the problem persists, replace NMBP-01.
8	Modbus Plus Soft Error	Software failure on NMBP-01 module. Switch power off and on; if the problem persists, replace NMBP-01.
9	Drive configuration write failed	Incorrect drive firmware. Change the downloaded drive application. Contact an ABB representative.

Table 7-1   Modbus Plus Module Status Codes.

Modbus Plus LED   The NMBP-01 module has the standard Modbus Plus diagnostic LED. This LED has the status codes shown in Table 7-2 below.

Flash Code	Status	Correction
flash every 160ms	This node is working normally in that it is successfully receiving and passing the token. All nodes on the link should be flashing this pattern.	
flash every 1 second	This node is in the MONITOR_OFFLINE state, where it must monitor the link for 5 seconds, and it is not allowed to transmit any packets out onto the link. During this time it hears all other active nodes on the link, and builds the active station table.	NMBP-01 initializing. Wait for 5 seconds.
2 flashes, off 2 seconds	This node is permanently in the MAC_IDLE never-getting-token state, and it is hearing other nodes on the link pass the token to themselves, but the token is never passed to this node. This node may have a bad transmitter.	Switch module power off and on. If the problem persists, replace the module.
3 flashes, off 1.7 seconds	This node is not hearing any other nodes, so it is periodically claiming and winning the token, and then finding no other node to pass it to. It could be that this node is the only node on the link, or that there really are no other active nodes on the link, or this node has a bad receiver. In the latter case, this node will periodically disrupt communication on the link.	Check the Modbus Plus connection and wiring. Verify that there are other nodes on the network. If the problem is not cleared, replace the module.
4 flashes, off 1.4 seconds	This node has heard a valid packet that was duplicate-node-address sent from another node on the link that is using the same link address as this node. This node is now in the DUPLICATE_OFFLINE state where it will remain passively monitoring the link, until the duplicate node is not heard from for 5 seconds.	Check the Modbus Plus node numbering for the whole network. Renumber conflicting nodes, so that each node has a unique node number.

Table 7-2   Modbus Plus Status LED.

MSTR Block Error Codes

Modicon PLCs communicate on Modbus Plus using the MSTR block. This block is described in detail in the Modicon ladder logic programming manuals, but for reference purposes, the MSTR block error codes are listed below.

If the MSTR block detects an error, a hexadecimal error code will be displayed in the first implied register in the control block (the top node). The form of the code is Mmss, where

- M represents the major code
- m represents the minor code
- ss represents a sub-code.

Hex Error Code	Meaning
1001	User-initiated abort
2001	Invalid operation type
2002	User parameter changed
2003	Invalid length
2004	Invalid offset
2005	Invalid length and offset
2006	Invalid slave device data area
2007	Invalid slave device network area
2008	Invalid slave device network routing
2009	Route equal to your own address
200A	Attempting to obtain more global data words than available
30ss*	Modbus slave exception response
4001	Inconsistent Modbus slave response
5001	Inconsistent network response
6mss**	Routing failure

Table 7-3   MSTR block error codes.

The ss subfield in error code 30ss is:

ss Hex Value	Meaning
01	Slave device does not support the requested operation
02	Nonexistent slave device registers requested
03	Invalid data value requested
04	
05	Slave has accepted long-duration program command
06	Function cannot be performed now – long-duration command in effect
07	Slave rejected long-duration program command
08 … 255	

Table 7-4   MSTR block slave exception error codes.

The m subfield in error code 6mss is an index into the routing information indicating where an error has been detected – a value of 0 indicates the local node, a 2 the second device on the route, etc. The ss subfield in error code 6mss is:

ss Hex Value	Meaning
01	No response received
02	Program access denied
03	Node off-line and unable to communicate
04	Exception response received
05	Router node data paths busy
06	Slave device down
07	Bad destination address
08	Invalid node type in routing path
10	Slave has rejected the command
20	Initiated transaction forgotten by slave device
40	Unexpected master output path received
80	Unexpected response received
F001	Wrong destination node specified for the MSTR operation

Table 7-5   MSTR block routing failure error codes.

Hardware Failures   The NMBP-01 module has a combined Power and Watchdog LED. This LED is normally on. If the built-in watchdog 'kicks in', the power LED will go dim for half a second, and the NMBP-01 module will restart itself.

This restart can be caused by:

- Module failure. In this case the NMBP-01 Status LED will flash according to error code 2. This is the only non-normal condition

- Pressing the reset button

- Loss of drive power

- Loss of fiber link connection between the NMBP-01 and the ABB drive.

Appendix A – Technical Data

DDCS Link

Compatible Devices: All ABB Fieldbus Adapter modules,
ABB ACS 300, ACS/H 400, ACS/ACP/ACF 600, DCS 500 Drives

Size of the Link: 2 stations (and up to 9 in Multiple Drive Control)

Medium: Fiber optic cable

Construction: Plastic core, 1 mm diameter, sheathed with plastic jacket

Attenuation: 0.31 dB/m

Maximum Length between Stations: 10m

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: Synchronous, half Duplex

Transfer Rate: 4 Mbit/s

Protocol: Distributed Drives Communication System (DDCS)

Connectors: Blue – receiver; grey – transmitter

This chapter describes the technical information for the NMBP-01 module. The information given here is preliminary, subject to change.

Fieldbus Link

Compatible Devices: Any Modicon approved Modbus Plus device.

Communication Type: Modbus Plus

Transmission Speed: 1 MBit/s

Size of the Link: 64 stations including bridges

Modbus Plus Cable: Belden 9841

Topology: Bus

NMBP-01

Enclosure: Plastic, dimensions 71 mm (6 3/4") height, 35 mm (1 3/8") width, 140 mm (5 1/2") depth, IP 20 degree of protection

Mounting: Standard DIN mounting rail

Settings: Via drive interface (control panel)

Current Consumption: 80 mA at 24 VDC

Connectors:

- Light transmitter (grey) and receiver (blue) for connection to the drive
- Standard female DB-9 connnector for Modbus Plus network
- One Combicon MSTB 2,5/3-ST-5,08 (3-pole, cross-section 2.5 mm^2 max.) screw terminal block for the power supply:

	X1	**Description**
1	+24 V	Regulated 24 VDC power supply for module
2	Gnd	Shield ground
3	0 V	Power supply common

Noise Immunity / Emissions:

The fast transient burst immunity according to standard IEC 801-4: 4 kV 5/50 ns.

Noise emissions according to standard EN 55022 B.

General:

All materials are UL/CSA approved.

Appendix B – 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 $^\circ$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. If installation site is above 2000 m, contact your local ABB representative.

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

Shock: Max 70 m/s^2, 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/s^2 (9 to 200 Hz) sinusoidal (IEC 68-2-6)

Shock: Max 100 m/s^2, 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 $^{\circ}$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/s^2 (9 to 200 Hz) sinusoidal (IEC 68-2-6)

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

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

Free Fall: 250 mm

ABB

NMBP-01/EN
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