LEROY SOMER ®

POWERDRIVE MD

POWERDRIVE FX

This manual is to be given to the end user

Hardwired master

Analog 1   Analog 2
Digital 1A Digital 1B   Digital 2A Digital 2B

Slave Number 1

Digital 1A
Analog 1
Digital 1B

Slave Number 2

Digital 2A
Analog 2
Digital 2B
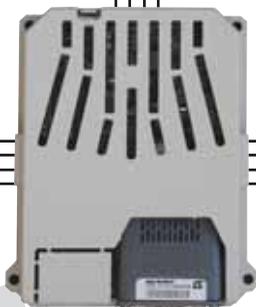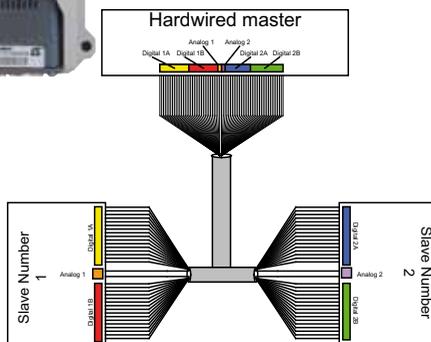
MDX-PROFIBUS

Module drive for fieldbus communication

User guide

NOTE

LEROY-SOMER reserves the right to modify the characteristics of its products at any time in order to incorporate the latest technological developments. The information contained in this document may therefore be changed without notice.

⚠️
WARNING

The MDX-PROFIBUS is an optional module which is intended to be fitted in a variable speed drive. For the user's own safety, this variable speed drive must be connected to an approved earth (⏚ terminal).

If accidentally starting the installation is likely to cause a risk to personnel or the machines being driven, it is essential to comply with the power connection diagrams recommended in the drive installation manual.

The variable speed drive is fitted with safety devices which can, in the event of a problem, control stopping and thus stop the motor. The motor itself can become jammed for mechanical reasons. Voltage fluctuations, and in particular power cuts, may also cause the motor to stop. The removal of the causes of the shutdown can lead to restarting, which may be dangerous for certain machines or installations.
In such cases, it is essential that the user takes appropriate precautions against the motor restarting after an unscheduled stop.

The variable speed drive is designed to be able to supply a motor and the driven machine above its rated speed. If the motor or the machine are not mechanically designed to withstand such speeds, the user may be exposed to serious danger resulting from their mechanical deterioration. Before programming a high speed, it is important that the user checks that the installation can withstand it.

The variable speed drive intended for use with the module which is the subject of this manual is designed to be integrated in an installation or an electrical machine, and can under no circumstances be considered to be a safety device. It is therefore the responsibility of the machine manufacturer, the designer of the installation or the user to take all necessary precautions to ensure that the system complies with current standards, and to provide any devices required to ensure the safety of equipment and personnel.

LEROY-SOMER declines all responsibility in the event of the above recommendations not being observed.

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This manual only describes the general features, characteristics and installation of the MDX-PROFIBUS. For the variable speed drive commissioning, refer to the appropriate manuals.

Contents

1 Safety and operating instructions for variable speed drives

(In accordance with the low voltage directive 73/23/EEC modified by 93/68/EEC).

1.1 Warning

WARNING — Throughout the manual, this symbol warns of consequences which may arise from inappropriate use of the drive, since electrical risks may lead to material or physical damage as well as constituting a fire hazard.

1.2 General

Depending on their degree of protection, the variable speed drives may contain unprotected live parts, which may be moving or rotating, as well as hot surfaces, during operation.

Unjustified removal of protection devices, incorrect use, faulty installation or inappropriate operation could represent a serious risk to personnel and equipment.

For further information, consult the documentation.

All work relating to transportation, installation, commissioning and maintenance must be performed by experienced, qualified personnel (see IEC 364 or CENELEC HD 384, or DIN VDE 0100 and national specifications for installation and accident prevention).

In these basic safety instructions, qualified personnel means persons competent to install, mount, commission and operate the product and possessing the relevant qualifications.

1.3 Use

Variable speed drives are components designed for integration in installations or electrical machines.

When integrated in a machine, commissioning must not take place until it has been verified that the machine conforms with directive 2006/42/EC (Machinery Directive). It is also necessary to comply with standard EN 60204, which stipulates in particular that electrical actuators (which include variable speed drives) cannot be considered as circuit-breaking devices and certainly not as isolating switches.

Commissioning can take place only if the requirements of the Electromagnetic Compatibility Directive (EMC 2004/108/EC) are met.

The variable speed drives meet the requirements of the Low Voltage Directive 2006/95/ EC. The harmonised standards of the DIN VDE 0160 series in connection with standard VDE 0660, part 500 and EN 60146/VDE 0558 are also applicable.

The technical characteristics and instructions concerning the connection conditions specified on the nameplate and in the documentation provided must be observed without fail.

The SAFE TORQUE OFF (SECURE DISABLE) function meets the requirements of EN954-1 category 3 for the prevention of unexpected starting of the drive, which allows it to be used in a safety-related application. **The system designer is responsible for ensuring that the complete system is safe and designed correctly according to the relevant safety standards.**

1.4 Transportation storage

All instructions concerning transportation, storage and correct handling must be observed.

The climatic conditions specified in the technical manual must be observed.

1.5 Installation

The installation and cooling of equipment must comply with the specifications in the documentation supplied with the product.

The variable speed drives must be protected against any excessive stress. In particular, there must be no damage to parts and/or modification of the clearance between components during transportation and handling. Avoid touching the electronic components and contact parts.

The variable speed drives contain parts which are sensitive to electrostatic stresses and may be easily damaged if handled incorrectly. Electrical components must not be exposed to mechanical damage or destruction (risks to health!).

1.6 Electrical connection

When work is performed on variable speed drives which are powered up, the national accident prevention regulations must be respected.

The electrical installation must comply with the relevant specifications (for example conductor cross-sections, protection via fused circuit-breaker, connection of protective conductor). More detailed information is given in the documentation.

Instructions for an installation which meets the requirements for electromagnetic compatibility, such as screening, earthing, presence of filters and correct insertion of cables and conductors, are given in the documentation supplied with the variable speed drives. These instructions must be followed in all cases, even if the variable speed drive carries the CE mark. Adherence to the limits given in the EMC legislation is the responsibility of the manufacturer of the installation or the machine.

1.7 Operation

Installations in which variable speed drives are to be integrated must be fitted with additional protection and monitoring devices as laid down in the current relevant safety regulations, such as the law on technical equipment, accident prevention regulations, etc. Modifications to the variable speed drives using control software are permitted.

Active parts of the device and the live power connections must not be touched immediately after the variable speed drive is powered down, as the capacitors may still be charged. In view of this, the warnings fixed to the variable speed drives must be observed.

During operation, all doors and protective covers must be kept closed.

1.8 Servicing and maintenance

Refer to the manufacturer's documentation.

This manual is to be given to the end user.

2 Introduction

2.1 What is PROFIBUS-DP?

PROFIBUS-DP (Decentralized Peripheral) is a networking system that falls into the generic category of fieldbus. Fieldbuses are generally defined as industrial networking systems that are intended to replace traditional wiring systems. Figure 2-1 shows the traditional cabling requirements to transfer signals between 2 slaves and a master.

Figure 2-1 Traditional cable layout
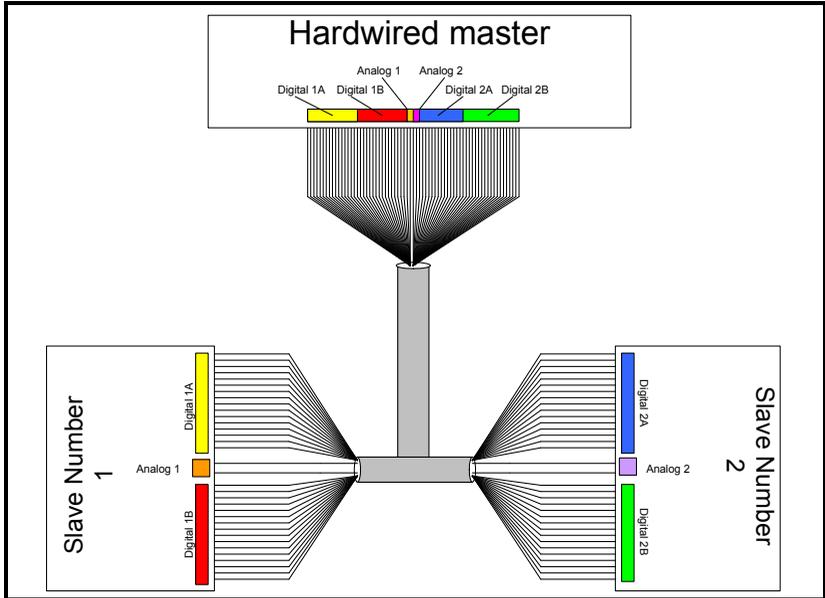
Table 2.1 details how the wiring is used to communicate data between the master and the slaves. Each signal that is communicated requires one signal wire giving a total of 66 signal wires plus a 0V return.

Table 2.1 Traditional wiring details

Number of signals	Type	Source / Destination	Description
16	digital Inputs	slave 1 to master	status signals
16	digital outputs	master to slave 1	control signals
1	analog output	master to slave 1	control signal
16	digital inputs	slave 2 to master	status signals
16	digital outputs	master to slave 2	control signals
1	analog output	master to slave 2	control signal

A fieldbus topology such as PROFIBUS-DP allows the same configuration to be realized using only two signal wires plus a shield. This method of communication saves significantly on the amount of cabling required and can improve overall system reliability as the number of interconnections is greatly reduced.

Figure 2-2 shows a typical PROFIBUS-DP network system transferring the same signals as given in the traditionally wired example. The signals are now transmitted by converting them into a serial data stream which is received by the master as if they were connected using traditional wiring. The data stream on PROFIBUS-DP allows up to 20 (10 inputs and 10 outputs) independent values to be sent or received by the master, in addition to a single channel allowing for random access to drive parameters.

Figure 2-2 PROFIBUS-DP cable layout
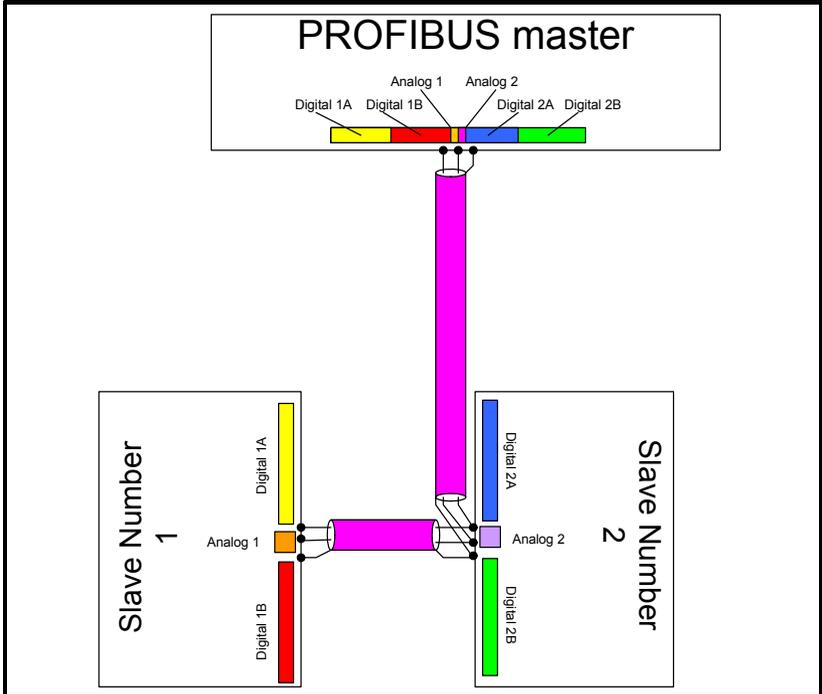
Table 2.2 Data mappings for MDX-PROFIBUS

Number of network words	Type	Source / Destination	Description
1	digital Inputs	slave 1 to master	status signals
1	digital outputs	master to slave 1	control signals
1	analog output	master to slave 1	control signal
1	digital inputs	slave 2 to master	status signals
1	digital outputs	master to slave 2	control signals
1	analog output	master to slave 2	control signal

Table 2.2 details the number of data words used to communicate the signals using the PROFIBUS-DP network. It can be seen that the resulting reduction in cabling is significant.

PROFIBUS-DP can transfer data using two distinct modes. The first of these modes is cyclic where signals are sent in predefined blocks at regular intervals. This is the equivalent of the hard-wired example in Figure 2-1.

The second method of transfer is called non-cyclic data and is used for sending values that only need to be changed occasionally or where the source or destination of the signal changes. This is the equivalent of a temporary patch lead that is removed after use.

2.2 What is MDX-PROFIBUS?

The MDX-PROFIBUS is a fieldbus option module that can be fitted to the expansion slot in the drives to provide PROFIBUS-DP-V1 slave connectivity.

Figure 2-3 MDX-PROFIBUS

2.3 General specification

Features

The following section gives a brief overview of the functionality available within MDX-PROFIBUS.

- Supported data rates (bit/s): 12M, 6.0M, 3.0M, 1.5M, 500k, 187.5k, 93.75k, 45.45k, 19.2k, 9.6k.
- Maximum of 10 input and 10 output cyclic drive parameters supported
- PROFIdrive profiles not supported
- Non-cyclic MDX-PROFIBUS supported
- Parallel acyclic/cyclic data communication

The MDX-PROFIBUS is powered from the host drive's internal power supply.

2.4 Option module identification

The MDX-PROFIBUS can be identified by the label located on the option module.

2.5 Backup / Auxiliary Supply

The drive can be connected to a back-up power supply. This keeps the control electronics and option module powered up, allowing the MDX-PROFIBUS to continue communicating with the PROFIBUS DP master controller when the main supply to the drive is switched off. For every MDX-PROFIBUS fitted allow for an extra 230mA of supply current to be drawn from the backup supply.

3 Mechanical installation

⚠️ **WARNING**
Before installing or removing an option module in any drive, ensure the AC supply has been disconnected for at least 10 minutes and refer to Chapter 1 Safety and operating instructions. If using a DC bus supply ensure this is fully discharged before working on any drive or option module.

3.1 General Installation

The installation of an option module is illustrated in Figure 3-1.

Figure 3-1 Fitting an option module
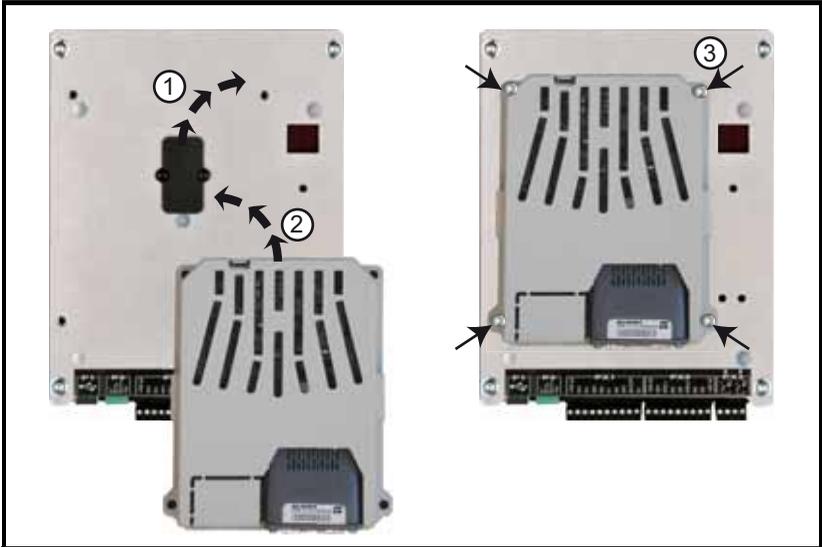
First, remove the mask which protects the option connector slot on the drive control board (1). The option module connector is located on the underside of the module.
Push this into the option module slot located on the drive until it clicks into place (2).
Screw the module to secure it onto the drive (3).
For further information, refer to the appropriate drive manual.

4 Electrical installation

4.1 Terminal descriptions

The MDX-PROFIBUS has a standard 9-way female D-type connector for the PROFIBUS-DP network.

Figure 4-1 MDX-PROFIBUS terminals
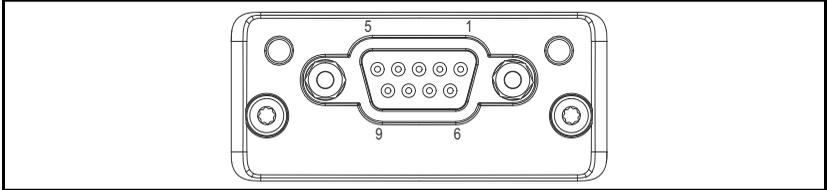
Figure 4-2 MDX-PROFIBUS D-Type pin out
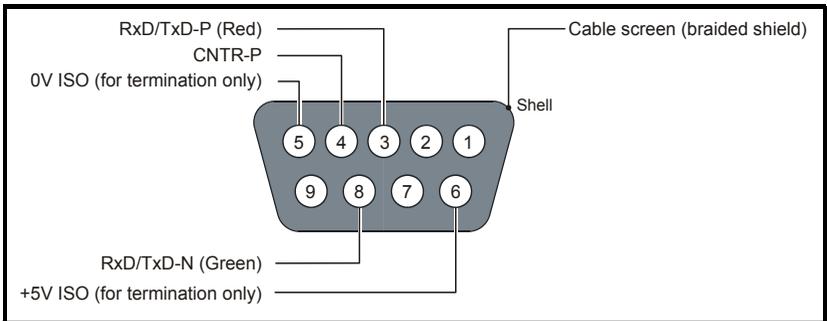
Table 4.1 D-Type connections

D-type Terminal	Function	Description
3	RxD/TxD-P	Positive data line (B) - Red
8	RxD/TxD-N	Negative data line (A) - Green
6	+5V ISO	+5V isolated, use only for termination resistors
5	0V ISO	0V isolated, use only for termination resistors
4	CNTR-P	RTS line
1, Shell	Shield	Cable shield connection

LEROY-SOMER recommend using connectors approved by PROFIBUS-DP International at all times.

4.2 PROFIBUS-DP connectors

There are many manufacturers of PROFIBUS-DP connectors. Always ensure that any connectors used on the network are fully approved for use with PROFIBUS-DP. Some of the connector types available include built in termination that allows the network to be isolated, this can be very useful when fault finding. For data rates above 1.5Mbs connectors fitted with integrated inductors should be used.

4.3 PROFIBUS-DP cable

PROFIBUS-DP networks can run at high data rates and require cable specifically designed to carry high frequency signals. Low quality cable will attenuate the signals, and may render the signal unreadable for the other nodes on the network. Cable specifications and a list of approved manufacturers of cable for use on PROFIBUS-DP networks are available on the PROFIBUS-DP Nutzerorganization (PNO) web site at *www.profibus.com*.

NOTE LEROY-SOMER can only guarantee correct and reliable operation of the MDX-PROFIBUS if all other equipment on the PROFIBUS-DP network (including the network cable) has been approved by the PNO and is correctly installed.

4.4 Cable shielding

Correct shielding of the PROFIBUS-DP cable is required for reliable operation at high data rates, this can be achieved by exposing the cable shield of each PROFIBUS-DP cable and ensuring that they are clamped to the drive grounding metalwork as close as possible to the drive termination, contact LEROY-SOMER for more information.

NOTE Unless there are specific reasons for not grounding the network it is recommended that all drive network connections are correctly grounded. Failure to do so may reduce the noise immunity of the system. If there are specific issues with grounding, alternative methods of connection should be considered such as the use of fibre optic cable.

4.5 General grounding considerations

It is essential that good grounding is provided not only for network stability but more importantly electrical safety. In all instances electrical regulations should be adhered to. As a guide the network cable should be grounded at least once per cabinet, ideally on each drive.

4.6 Network termination

It is very important in high-speed communications networks that the network communications cable is fitted with the specified termination resistor network at each end of each segment. This prevents signals from being reflected back down the cable and causing interference.

Most ranges of connectors provide specific parts that incorporate the termination network. Such connectors derive the power from the host device and if the host device is switched off the termination will be lost. To avoid this situation a separate termination device is available that is powered independently of the network devices. For more information go to *www.profibus.com*.

NOTE Failure to terminate a network correctly can seriously affect the operation of the network. If the correct termination networks are not fitted, the noise immunity of the network is greatly reduced. Each network segment must be correctly terminated.

4.7 Maximum network length / device loading

The maximum number of devices that can be connected to a single PROFIBUS-DP network segment is 32, this includes all nodes and any repeaters. The maximum lengths of cable for a segment depend on the data rate and are shown in Table 4.2.

Repeaters or fiber optic segments can be used to extend the network, allowing more than 32 nodes to be connected on the network. The maximum number of nodes on a single network is 125.

NOTE For full details on designing and installing a PROFIBUS-DP network, refer to *Installation Guidelines for PROFIBUS-DP/FMS*. This document is available from the MDX-PROFIBUS web site at www.profibus.com.

Table 4.2 MDX-PROFIBUS maximum network lengths

Data rate (bit/s)	Maximum trunk length (m)
12M	100
6.0M	100
3.0M	100
1.5M	200
500k	400
187.5k	1000
93.75k	1200
45.45k	1200
19.2k	1200
9.6K	1200

4.8 Node addressing

MDX-PROFIBUS has a valid address range of 1 to 125. Addresses 126 and 0 are reserved for system use and should not be used. The addressing scheme used is at the discretion of the end user however it is recommended that nodes are numbered in order as they appear on the physical network. It is not necessary to use consecutive numbers and gaps in the addressing scheme may be left to allow for future expansion.

4.9 Spurs

The PROFIBUS-DP specification allows spurs at data rates less than 1.5Mbits/s. At data rates below 1.5Mbits/s there are specific requirements for capacitance and length of cable allowed when using spurs. LEROY-SOMER recommend that spurs are not used as extreme care is required at the design stage to avoid network problems. More information on spurs can be found on the PROFIBUS-DP web site at www.profibus.com.

4.10 Minimum node to node cable length

The minimum recommended node to node distance is one metre of network cable. This distance is necessary to avoid multiple nodes generating a single large reflection on the network, using less than one metre of cable between nodes can have serious implications for network reliability.

5 Getting started

This section is intended to provide a generic guide for setting up MDX-PROFIBUS and a master controller. Figure 5-1 is intended as a guide only and is provided to detail the stages that are required to achieve a functioning network. It is recommended that all of this chapter is read, before attempting to configure a system.

NOTE Due to the large number of PLCs/masters that support PROFIBUS-DP only generic details can be provided. Support is available through your supplier or LEROY-SOMER.

NOTE Before contacting your supplier or LEROY-SOMER for support ensure you have read Chapter 10 on page 28 of this manual and check you have configured all parameters correctly.

Ensure the following information is available before calling :

- A list of all parameters in MDX-PROFIBUS.
- The drive firmware version (*see the relevant drive user guide*).
- The MDX-PROFIBUS firmware version.

## 5.1 Conventions used in this guide

The configuration of the host drive and option module is done using menus and parameters. A menu is a logical collection of parameters that have similar functionality. In the case of a MDX Module, the parameters will appear in menu 15.

The menu is determined by the number before the decimal point and the parameter by the number following the decimal point.

5.2   Set-up flow chart

Figure 5-1 Set-up flow chart

```
                    ┌─────────────┐
                    │    Start    │
                    └──────┬──────┘
                           │
            ┌──────────────────────────┐
            │ Connect all drives       │
            │ together using           │      See Section 4
            │ approved cable /         │
            │ connectors /             │
            │ repeaters                │
            └──────────────────────────┘
                           │
            ┌──────────────────────────┐
            │ Ensure all               │
            │ segments correctly       │
            │ terminated and           │      See Section 4
            │ termination              │
            │ powered                  │
            └──────────────────────────┘
                           │
            ┌──────────────────────────┐
            │ Ensure segment           │
            │ lengths are no           │
            │ longer than the          │      See Section 4
            │ maximum limits           │
            └──────────────────────────┘
                           │
            ┌──────────────────────────┐
            │ Ensure a minimum         │
            │ node to node             │      See Section 4
            │ cable distance           │
            │ of 1m                    │
            └──────────────────────────┘
                           │
            ┌──────────────────────────┐
            │ Ensure no more           │
            │ than 32 devices          │
            │ per segment              │      See Section 4
            │ (including               │
            │ repeaters)               │
            └──────────────────────────┘
                           │
            ┌──────────────────────────┐
            │ Ensure there are         │
            │ no more than 125         │
            │ addressed devices        │      See Section 4
            │ on the network           │
            └──────────────────────────┘
                           │
            ┌──────────────────────────┐       ┌──────────────────────┐
            │ Perform cable            │◄─────►│ A dedicated          │
            │ tests                    │       │ PROFIBUS-DP          │
            │                          │       │ tester is            │
            │                          │       │ recommended.         │
            └──────────────────────────┘       └──────────────────────┘
                           │
            ┌──────────────────────────┐
            │ Configure each           │
            │ node address on          │
            │ the system               │      See Section 5
            │ (MDX-PROFIBUS            │
            │ DP Pr 15.03)             │
            └──────────────────────────┘
                           │
            ┌──────────────────────────┐
            │ Ensure all third         │
            │ party devices use        │      See Section 5
            │ the same data rate       │
            └──────────────────────────┘
                           │
            ┌──────────────────────────┐       ┌──────────────────────┐
            │ Perform a network        │◄─────►│ A dedicated          │
            │ scan using the           │       │ PROFIBUS-DP          │
            │ master or tester         │       │ tester is            │
            │                          │       │ recommended.         │
            └──────────────────────────┘       └──────────────────────┘
                           │
                        ( A )
```

```
                        ( A )
                           │
            ┌──────────────────────────┐
            │ Set data size on         │
            │ node                     │      See Section 5
            │ (Pr 15.39,               │
            │ Pr 15.40)                │
            └──────────────────────────┘
                           │
            ┌──────────────────────────┐
            │ Reset and save           │
            │ parameters               │      See Section 5
            │ (Pr 15.32 =              │
            │ ENABLED)                 │
            └──────────────────────────┘
                           │
            ┌──────────────────────────┐
            │ Set mapping              │
            │ parameters in the        │
            │ drive                    │      See Section 7
            │ (Pr 15.10,               │
            │ Pr 15.29)                │
            └──────────────────────────┘
                           │
            ┌──────────────────────────┐
            │ Set data size in         │      See master
            │ master for each          │      documentation
            │ node (use GSD            │      and Section 6
            │ file if required)        │
            └──────────────────────────┘
                           │
            ┌──────────────────────────┐
            │ Map data to              │      See master
            │ master program           │      documentation
            │ variables                │
            └──────────────────────────┘
                           │
            ┌──────────────────────────┐
            │ Start master and         │      See master
            │ ensure there are         │      documentation
            │ no errors                │
            └──────────────────────────┘
                           │
            ┌──────────────────────────┐
            │ Check data flow in       │      See master
            │ both directions          │      documentation
            └──────────────────────────┘
                           │
                    ┌─────────────┐
                    │     End     │
                    └─────────────┘
```

5.3 Node address

Table 5.1 PROFIBUS-DP node address

Pr **15.03**	Default	126
	Range	0 to 126
	Access	RW

Every node on a PROFIBUS-DP network must be given a unique network node address. To activate a change in the node address value the MDX-PROFIBUS must be re-initialised (Pr **15.32** = ON). Addresses 0 and 126 are reserved for system use.

5.4 Network data rate

The MDX-PROFIBUS will automatically detect the PROFIBUS-DP network data rate and synchronize to it.

5.5 Data format

Table 5.2 Read OUT cyclic data format, number of data bytes

Pr **15.41**	Default	8
	Range	0 to 20
	Access	RO

Table 5.3 Write OUT cyclic data format, number of channels (parameter)

Pr **15.40**	Default	2
	Range	0 to 10
	Access	RW

Table 5.4 Read IN cyclic data format, number of data bytes

Pr **15.38**	Default	8
	Range	0 to 20
	Access	RO

Table 5.5 Write IN cyclic data format, number of channels (parameter)

Pr **15.39**	Default	2
	Range	0 to 10
	Access	RW

The default data format is four cyclic words (8 bytes), each cyclic data channel is mapped to a drive parameter. The default mappings are shown in Table 5.6.

NOTE The maximum number of parameter data that is possible is 10 with only cyclic data.

Table 5.6 Default data mapping

Cyclic word	Data word	Default mapping status
OUT channel 0	word 0, 1	Pr **6.42**, control word
OUT channel 1	word 2, 3	Pr **1.21**, digital speed reference 1
IN channel 0	word 0, 1	Pr **10.40**, status word
IN channel 1	word 2, 3	Pr **2.01**, post-ramp speed reference

Other data formats are also supported. For further details see section 7.2 *Data formats* on page 19. The directions specified in Table 5.6 relate to the data direction as seen by the master.

5.6 Network operating status

Table 5.7 Fielbus option state

Pr **15.06**	Default	N/A
	Range	0 (set up in progress) to 14 (Reserve)
	Access	RO

The PROFIBUS-DP network activity can be monitored in the MDX-PROFIBUS operating status parameter, Pr **15.06**. When the MDX-PROFIBUS is communicating successfully with the PROFIBUS-DP master controller, Pr **15.06** will give «Host supervising». For further details, see section 10.5 Fieldbus option state on page 29.

5.7 Re-initialising the MDX-PROFIBUS

Table 5.8 MDX-PROFIBUS re-initialise

Pr **15.32**	Default	0 (DISABLED)
	Range	0 to 1
	Access	RW

Changes to the MDX-PROFIBUS configuration in menu 15 parameters will not take effect until the MDX-PROFIBUS has been re-initialised.

To re-initialise MDX-PROFIBUS :

- Set Pr **15.32** to ENABLED.
- When the sequence has been completed, Pr **15.32** will be reset to DISABLED.
- The MDX-PROFIBUS will re-initialise using the updated configuration.

5.8 Saving parameters to the drive

Drive parameters are automatically stored if they are changed by keypad or PC software.
If parameters are changed by PROFIBUS-DP:
To avoid loss of the configured settings when the drive is powered down it is necessary to write 0 to Pr **11.65** followed by Pr **11.64** to Yes (1).

To store drive parameters:
- Set Pr **11.65** to 0 (See note regarding drive).
- Set Pr **11.64** to yes (1)
If Pr **11.64** returns to no (0) the storing is finished.

NOTE The drive will store all the drive parameters but the operation of the MDX-PROFIBUS will not be affected. Any changes made to the MDX-PROFIBUS configuration parameters (mapping etc.) will not take effect until the MDX-PROFIBUS module is reset.

6   GSD Files

6.1   What are GSD Files?

GSD files are text files that are used by the PROFIBUS-DP network configuration software tools. They contain information about the device timings, supported features and available data formats for the PROFIBUS-DP device. Drive icon files are also supplied for use with the PROFIBUS-DP configuration software. GSD files are available from your supplier, LEROY-SOMER or the LEROY-SOMER website (www.leroy-somer.com).

6.2   Data configuration

The GSD file describes the modules of input or output words that may be combined to configure the input and output configuration for a specific node. The complete input and output configuration for the node is built by adding the required modules until all of the node's inputs and outputs are defined.

NOTE A module consists of a block of input or output data. Put simply this is a logical collection of data words.

The number of input or output words configured in the drive must match the number of input or output words defined in the master; if the master has eight IN and four OUT words the drive must use the same settings to communicate correctly.

The MDX-PROFIBUS module uses Pr **15.40** and Pr **15.39** to set the number of parameters. The configuration of the number of output and input bytes (8-bit) cant be seen in parameters Pr **15.41** and Pr **15.38**.

NOTE The master needs to declare firstly OUT words and after IN words. Also each parameter needs to be declared one by one (eg. By default master configuration declares 2 OUT + 2 OUT + 2 IN + 2 IN).

7 Cyclic data

7.1 What is cyclic data ?

Cyclic data transfer is a method of transferring data on a regular time period, often known as 'polled data'. High-speed data transfer is achieved by transmitting only data bytes over the PROFIBUS-DP network and using local mapping information within the MDX-PROFIBUS and PROFIBUS-DP master controller to ensure that the correct data is sent to the correct locations. The flexibility of the MDX-PROFIBUS means that each cyclic data OUT channel can be directed to any read/write drive parameter. Similarly each cyclic data IN channel can use any drive parameter as a source of data.

NOTE

- The term OUT data refers to data that is transmitted out of the master to the slave.
- The term IN data refers to data that is returned from a slave into the master.
- Cyclic data mapping cannot be changed dynamically, as changes to the configuration (mapping parameters, etc.) will only take effect during initialisation of the MDX-PROFIBUS.
- The maximum number of 8-bit mappings parameters that is possible is : 10 (10 bytes if cyclic data compression is on and 20 words if cyclic data compression is off).
- The maximum number of 16-bit mappings parameters that is possible is : 10 (10 words if cyclic data compression is on and 20 words if cyclic data compression is off).
- The maximum number of 32-bit mappings parameters that is possible is : 10 (20 words).

See section 11.2 *Compression of cyclical data* for information on using data compression with 8 or 16-bit parameters.

7.2 Data formats

The MDX-PROFIBUS can be configured with up to ten 32-bit, ten 16-bit or ten 8-bit cyclic OUT and IN data words. OUT and IN cyclic data words are mapped using ten mapping (pointer) parameters, one for each mapping.

NOTE By default all drive parameters are cast as 32-bit (two 16-bit words) therefore twenty cyclic words give ten possible drive parameters. Data compression reduces the number of cyclic words required for drive parameters of 16-bit to 16-bits and 8-bit (or less) to 8-bits.

Any 32-bit parameters mapped will still require two 16-bit words even with compression turned on.

Table 7.1 Valid PROFIBUS-DP data formats

Pr **15.40** OUT cyclic, number of channel (parameter)	Default	2
And	Range	0 to 10
Pr **15.39** IN cyclic, number of channel (parameter)	Access	RW

NOTE The master needs to declare firstly OUT words and after IN words. Also each parameter needs to be declared one by one (eg. By default master configuration declares 2 OUT + 2 OUT + 2 IN + 2 IN).

The method used to map data to and from the PROFIBUS-DP network is similar to the method used in the drive for mapping analog and digital I/O. The reference for the source or target parameter is entered in the mapping parameter in the form **MMPP**, where:

MM = menu number of the target/source parameter.

PP = parameter number of the target/source parameter.

Table 7.2 MDX-PROFIBUS mapping parameters

IN channel	Mapping parameter		OUT channel	Mapping parameter
0	Pr **15.10**		0	Pr **15.20**
1	Pr **15.11**		1	Pr **15.21**
2	Pr **15.12**		2	Pr **15.22**
3	Pr **15.13**		3	Pr **15.23**
4	Pr **15.14**		4	Pr **15.24**
5	Pr **15.15**		5	Pr **15.25**
6	Pr **15.16**		6	Pr **15.26**
7	Pr **15.17**		7	Pr **15.27**
8	Pr **15.18**		8	Pr **15.28**
9	Pr **15.19**		9	Pr **15.29**

NOTE A cyclic data channel does not use decimal points. For example, digital speed reference 1 (Pr **1.21**) has units of RPM, accurate to 2 decimal places. To write a value of 2.46 RPM to Pr **1.21**, the value must be transmitted as 246.

If number of channels (Pr **15.39** or Pr **15.40**) is set to an invalid value (e.g. Pr **15.39** = 3 and Pr **15.10** = 1040, Pr **15.11** = 201 and Pr **15.12** = 0), the MDX-PROFIBUS will indicate a configuration error by the mapping status parameter (Pr **15.49**).

Refer to section 10.6 Cyclic parameter number (Mapping status) for more details. The following sections show some example data formats that can be selected, and the parameter mapping that will apply (by default) to each format.

7.2.1 Two cyclic channels only (default - compression off)

This data format provides two cyclic data channels with no non-cyclic data. The total data length is four words OUT and four words IN.

To select this data format, set Pr **15.40** and Pr **15.39** = 2. This data format is selected by default.

Table 7.3 Mapping for four cyclic data words

Cyclic word	Data word configuration on master	Parameter	Mapping
Out channel 0	2 OUT (Word 0, 1)	Pr **15.20**	Pr **6.42**, Control word
Out channel 1	2 OUT (Word 2, 3)	Pr **15.21**	Pr **1.21**, Digital speed reference 1
In channel 0	2 IN (Word 0, 1)	Pr **15.10**	Pr **10.40**, Status word
In channel 1	2 IN (Word 2, 3)	Pr **15.11**	Pr **2.01**, Post ramp speed reference

7.2.2 Three cyclic channels only (compression off)

This data format provides example of three cyclic data channels.
The total data length is six words OUT and six words IN.
To select this data format, set Pr **15.40** and Pr **15.39** = 3

Table 7.4 Mapping for five cyclic channels

Cyclic word	Data word configuration on master	Parameter	Mapping
Out channel 0	2 OUT (Word 0, 1)	Pr **15.20**	Pr **6.42**, Control word
Out channel 1	2 OUT (Word 2, 3)	Pr **15.21**	Pr **1.21**, Digital speed reference 1
Out channel 2	2 OUT (Word 3, 4)	Pr **15.22**	Pr **2.11**, Ramp
In channel 0	2 IN (Word 0, 1)	Pr **15.10**	Pr **10.40**, Status word
In channel 1	2 IN (Word 2, 3)	Pr **15.11**	Pr **2.01**, Post ramp speed reference
In channel 2	2 IN (Word 3, 4)	Pr **15.12**	Pr **4.02**, Current

7.2.3 Three cyclic channels only (compression on)

This data format provides example of three cyclic data channels with compression on (Pr **15.34** = ENABLED).
The total data length is four words OUT and five words IN.
To select this data format, set Pr **15.40** and Pr **15.39** = 3.

Table 7.5 Mapping for five cyclic channels

Cyclic word	Data word configuration on master	Parameter	Mapping
Out channel 0	1 OUT (Word 0)	Pr **15.20**	Pr **6.42**, Control word
Out channel 1	2 OUT (Word 1, 2)	Pr **15.21**	Pr **1.21**, Digital speed reference 1
Out channel 2	1 OUT (Word 3)	Pr **15.22**	Pr **2.11**, Ramp
In channel 0	1 IN (Word 0)	Pr **15.10**	Pr **10.40**, Status word
In channel 1	2 IN (Word 1, 2)	Pr **15.11**	Pr **2.01**, Post ramp speed reference
In channel 2	2 IN (Word 3, 4)	Pr **15.12**	Pr **4.02**, Current

NOTE The master needs to declare firstly OUT words and after IN words. Also each parameter needs to be declared one by one following their number of bytes (eg. 1 OUT + 2 OUT + 1 OUT + 1 IN + 2 IN + 1 IN).

7.3 Mapping conflicts

The drive indicates if there is a mapping conflict like MDX-PROFIBUS channel configuration error, analog input error or other.

7.4 Cyclic data mapping errors

The MDX-PROFIBUS module will scan and check the PROFIBUS-DP mapping parameter configuration for errors during initialisation (ex: Pr **15.32** = ENABLED). If an error is detected, then the MDX-PROFIBUS configuration error detected will be indicated in mapping status parameter, Pr **15.49**. See section 10.6 Cyclic parameter number (Mapping status) status for full details.

7.5 Mapping data sizes

The data size depends on the size of the mapped parameter and if data compression is turned on or not (see Table 7.6).

Table 7.6 Actual data sizes

Parameter size (bits)	Actual data size (bits) compression enabled (Pr 15.34)	Actual data size (bits) compression disabled (Pr 15.34)
1	8	32
8	8	32
16	16	32
32	32	32

Consider the following example :
- mapping Pr **15.10** to a 32-bit value and Pr **15.11** to a 16-bit value,
- mapping Pr **15.20** to a 32-bit value and Pr **15.21** to a 1-bit value,
- data compression turned on (Pr **15.34** set to ENABLED),
- the mapping length is 2 (Pr **15.39** and Pr **15.40**).

Pr **15.38** and Pr **15.41** settings are then automatically modified:
- Pr **15.38** = 6 (4 + 2)
- Pr **15.41** = 5 (4 + 1)

7.6 Disabling mappings

Any unused mapping parameters (Pr **15.10** to Pr **15.19** and Pr **15.20** to Pr **15.29**) are disabled by the number of parameters in the mapping (Pr **15.39** and Pr **15.40**).

NOTE
- Having unmapped channels between valid mapped channels is not permitted.
- Having unmapped channels (mapping to 0) is not permitted if the number of parameters in the mapping (Pr **15.39** and Pr **15.40**) is in this configuration channels.

8 Non-cyclic data

8.1 What is non-cyclic data ?

Non-cyclic data allows access to any parameter without the need to use cyclic data transfers. This is particularly useful when accessing many different parameters for set-up or archiving of drive settings. There is one method of using non-cyclic data on the MDX-PROFIBUS :

- • DP-V1 Parameter Access.

8.2 DP-V1 Parameter Access

Non-cyclic data is transmitted after all the cyclic data within the PROFIBUS-DP cycle, depending on the length of the non-cyclic data, this may take several cycles to complete.

8.3 PROFIBUS-DP-V1 Overview

The MDX-PROFIBUS specification allows for the standard cyclic process data (as defined in the DP-V0 specification) and the additional acyclic parameter data to be transmitted in the same bus cycle.

The DP-V1 message is contained within the acyclic part of the PROFIBUS-DP cycle and uses the slave node address to access the parameter channel.

For further details of the PROFIBUS-DP-V1 functionality refer to the official PROFIBUS-DP website at www.profibus.com.

The following services will be supported:

- • Class 1 Master Read and Write
- • Class 2 Master Read and Write
- • Class 2 Master Initiate Connection
- • Class 2 Master Abort Connection

A class 1 master must be in data exchange with the slave before it can perform a request via the DP-V1 channel. A class 2 master must initiate the connection with the slave before sending the DP-V1 message, likewise it must then abort the connection when it is no longer required.

DP-V1 Parameter Access

Parameters are mapped to slots and indexes as follows.
Correlation:
parameter = slot . 255 + index + 1
slot = (parameter - 1) / 255
index = (parameter -1) modulo 255 or index = (parameter -1) - (slot x 255)

Table 8.1 Examples

Drive parameter	Parameter	Slot	Index
Pr **1.26**	126	0	125
Pr **2.53**	253	0	254
Pr **15.02**	1502	5	226

Example with parameter Pr **15.02** :
Slot = (1502 -1) / 255 = 5,8862
Slot = 5
Index = (1502 -1) - (5 x 255) = 1501 - 1275
Index = 226

9 Control and status words

9.1 What are control and status words ?

The control and status words allow the digital control and monitoring of the drive to be implemented using a single data word for each function. Each bit in the control word has a particular function and provides a method of controlling the output functions of the drive, such as run and direction.

Each bit in the status word provides feedback about the drive's state of health and operational condition, such as drive healthy, drive at speed, etc...

9.2 Control word

The MDX-PROFIBUS control word consists of sixteen control bits some of which are reserved. See Table 9.1 for the individual bit function descriptions.

Table 9.1 Control word

Control word bits 6.42	Decimal conversion	Functions	Equivalent parameter
0	1	Drive enable	**6.15**
1	2	Run forward	**6.30**
2	4	Jog	**6.31**
3	8	Run reverse	**6.32**
4	16	Forward/Reverse	**6.33**
5	32	Run	**6.34**
6	64	Reserved	
7	128	Reserved	
8	256	Analog ref./Preset ref.	**1.42**
9	512	Reserved	
10	1024	Reserved	
11	2048	Reserved	
12	4096	Reserved	
13	8192	Drive reset	**10.33**
14	16384	Reserved	

⚠️ **CAUTION**

Reserved bits must be kept at 0.
To enable fieldbus control the fieldbus enable signal must be set to '1' (Change Pr **6.43** Run/Stop source by fieldbus). For safety reasons, the external HARDWARE ENABLE (STO-1 and STO-2) signal must be present before the fieldbus control word can be used to start the drive. This terminal is normally controlled by an external "Emergency Stop" circuit to ensure that the drive is disabled in an emergency situation.

The control word ANALOG REF/PRESET REF bit directly controls the drive parameter Pr **1.42**, the function of which is to select the digital speed reference as the source of the drive's speed reference. When the ANALOG REF/PRESET REF bit is reset to 0 the drive will revert to using the external analog speed reference.

The actual digital speed reference selected when ANALOG REF/PRESET REF is set to 1 will be Pr **1.21**, which is also the default mapping for the fieldbus speed reference. However Pr **1.15** can be used to change which of the digital references is selected. For further details on the drive digital speed reference, please refer to the appropriate drive user guide.

Table 9.2 lists in detail the function of each control word bit. For further in-depth details about drive control words and sequencing bits please refer to the appropriate drive User and Advanced User Guides.

NOTE By default data compression is off and therefore the control word will be cast as 32-bit with bits 16 to 31 reserved.

Table 9.2 Control word bit functions

Bit	Function	Description
0	ENABLE	Set to 1 to enable the drive. Resetting to 0 will immediately disable the drive, and the motor will coast to a stop. The external HARDWARE ENABLE signal must also be present before the drive can be enabled.
1	RUN FWD	Set to 1 (with ENABLE set to 1) to run the motor in the forward direction. When reset to 0, the drive will decelerate the motor to a controlled stop.
2	JOG FWD	Set to 1 to jog the motor forward. This signal needs to be used in conjunction with the ENABLE bit. This signal is overridden by a RUN, RUN REV or RUN FWD signal.
3	RUN REV	Set to 1 (with ENABLE set to 1) to run the motor in the reverse direction. When reset to 0, the drive will decelerate the motor to a controlled stop.
4	FWD REV	Set to 1 to select the reverse direction. Set to 0 to run in the forward direction. The RUN signal is used to start and stop the motor
5	RUN	Set to 1 to run the motor. FWD REV is used to select the direction of motor rotation. When reset to 0, the drive will decelerate the motor to a controlled stop.
6	Reserved	
7	Reserved	
8	Analog ref./Preset ref.	Set to 1 to select digital speed reference 1 (Pr **1.21**), and reset to 0 to select analog reference 1 (Pr **1.36**). ANALOG REF/PRESET REF directly controls Pr **1.42**, so reference selector (Pr **1.14**) and preset selector (Pr **1.15**) must both be set to 0 (default) for the ANALOG REF/PRESET REF bit to work properly.
9	Reserved	
10	Reserved	
11	Reserved	
12	Reserved	
13	Drive reset	A 0-1 transition of the RESET bit will reset the drive from a trip condition. If the reason for the trip is still present, or another fault condition has been detected, the drive will immediately trip again. When resetting the drive, it is recommended to check the status word to ensure that the reset was successful, before attempting to re-start the drive.
14	Reserved	
15	Reserved	

9.3 Status word

The MDX-PROFIBUS status word consists of sixteen control bits some of which are reserved. See Table 9.3 for the individual bit function descriptions.

Table 9.3 Status word

Status word bits 10.40	Decimal conversion	Functions	Equivalent parameter
0	1	Drive healthy	**10.01**
1	2	Drive active	**10.02**
2	4	Zero speed	**10.03**
3	8	Running at minimum speed	**10.04**
4	16	Below set speed	**10.05**
5	32	At speed	**10.06**
6	64	Above set speed	**10.07**
7	128	Nominal load reached	**10.08**
8	256	Drive out at current limit	**10.09**
9	512	Drive regenerating	**10.10**
10	1024	Braking IGBT active	**10.11**
11	2048	Braking resistor alarm	**10.12**
12	4096	Direction commanded	**10.13**
13	8192	Direction running	**10.14**
14	16384	Mains loss	**10.15**
15	32768	Reserved	

The fieldbus status word is mapped directly from the drive status word, Pr **10.40**.

Pr **10.40** is generated by the values of several individual drive status bits ; Table 9.4 shows the function indicated by each bit in the status word when set to 1.

Table 9.4 Drive status word bit functions

Bit	Parameter	Description
0	Pr **10.01**	**bit 0 = 0 :** Drive in stop mode. **bit 0 = 1 :** Drive in ready state.
1	Pr **10.02**	**Drive active** When bit 1 = 1, the drive is in run mode.
2	Pr **10.03**	**Zero speed** Zero speed indicates that the absolute value of the speed is at or below the zero speed threshold defined by Pr **3.05.**
3	Pr **10.04**	**Running at or below minimum speed** In bipolar mode (Pr **1.10** = 1) Pr **10.04** is the same as zero speed, Pr **10.03**. (See above). In unipolar mode, Pr **10.04** is set if the absolute value of the post-ramp speed reference (Pr **2.01**) is at or below minimum speed (minimum speed is defined by Pr **1.07**.) This parameter is only set if the drive is running.
4	Pr **10.05**	**Below set speed** Only set if the drive is running at below set speed. Refer to Pr **3.06**, in the drive User Guide for more details.

Table 9.4 Drive status word bit functions

Bit	Parameter	Description
5	Pr **10.06**	**At speed** Only set if the drive is running at set speed. Refer to Pr **3.06** in the drive user guide.
6	Pr **10.07**	**Above set speed** Only set if the drive is running at above set speed. Refer to Pr **3.06**, in the drive user guide for more details.
7	Pr **10.08**	**Nominal load reached** Indicates that the modulus of the active current is greater or equal to the rated active current, as defined in menu 4. Refer to the drive Advanced User Guide for more details.
8	Pr **10.09**	**Drive out at current limit** Indicates that the current limits are active.
9	Pr **10.10**	**Drive Regenerating** This parameter is set to ENABLED (1) when the power is being transfered from the motor to the DC Bus.
10	Pr **10.11**	**Braking IGBT active** Indicates that the braking IGBT is active. If the IGBT becomes active, this parameter will remain on for at least one second.
11	Pr **10.12**	**Braking resistor alarm** Dynamic brake alarm is set when the braking IGBT is active, and the braking energy accumulator is greater than 75%.
12	Pr **10.13**	**Direction commanded** Direction commanded is set to 1 if the Pre-ramp speed reference (Pr **1.03**) is negative and reset to 0 if the Pre-ramp speed reference is zero or positive.
13	Pr **10.14**	**Direction running** A 0 indicates forward direction and a 1 indicates reverse direction. The source of this bit is Pr **2.01**.
14	Pr **10.15**	**Mains loss** Mains loss indicates that the drive has detected a mains loss from the level of the DC bus voltage. This parameter can only become active if mains loss ride through or mains loss stop modes are selected. Refer to Pr **6.03** in the *drive Advanced User Guide* for more details.
15	Not Used	Reserved

10 Diagnostics

This section provides basic diagnostic information intended to enable resolution of the most common problems encountered when setting up a MDX-PROFIBUS on a PROFIBUS-DP network.

A high percentage of problems reported are basic set-up problems that can be avoided by using the information in this chapter.

NOTE Please note that support will be limited to the setting up and networking of the drive.

10.1 Module ID code

Table 10.1 Module ID code

Pr **15.01**	Default	5
	Range	0 to 499
	Access	RO

The module ID code indicates the type of module fitted in to the drive corresponding to menu 15. The module ID code for MDX-PROFIBUS is 5.

10.2 Module firmware version

Table 10.2 MDX-PROFIBUS firmware - major version (xx.yy)

Pr **15.02**	Default	N/A
	Range	00.00 to 99.99
	Access	RO

Table 10.3 MDX-PROFIBUS firmware - minor version (zz)

Pr **15.51**	Default	N/A
	Range	0 to 99
	Access	RO

The software version of the option module can be identified by looking at Pr **15.02** and Pr **15.51**.

The software version takes the form of xx.yy.zz, where Pr **15.02** displays xx.yy and Pr **15.51** displays zz (e.g. for software version 01.01.00, Pr **15.02** will display 1.01 and Pr **15.51** will display 0).

10.3 MDX-PROFIBUS node address

Table 10.4 MDX-PROFIBUS node address

Pr **15.03**	Default	126
	Range	0 to 126
	Access	RW

Each node on a PROFIBUS-DP network must be given a unique network node address. The MDX-PROFIBUS must be re-initialised to make a change of node address active. Addresses 0 and 126 are reserved for system use and should not be used.

10.4 Data format

The default data format is 2 cyclic channel OUT and IN, each cyclic data channel is mapped to a drive parameter. The master needs to declare firstly OUT words and after IN words. Also each parameter needs to be declared one by one following their number of bytes. Default data format is 2 OUT + 2 OUT + 2 IN + 2 IN.

NOTE The maximum number of parameter data that is possible is 10 with only cyclic data.

10.5 Fieldbus option state

Table 10.5 Fieldbus option state

Pr **15.06**	Default	N/A
	Range	0 to 14
	Access	RO

The operating status of the MDX-PROFIBUS can be viewed in the fieldbus option state parameter (Pr **15.06**). When the MDX-PROFIBUS is communicating successfully with the PROFIBUS-DP master controller, Pr **15.06** will give Master read.

Table 10.6 MDX-PROFIBUS operating status codes

Pr 15.06	LCD display	Description
0	Set up in progress	MDX Setup in progress.
1	Network init.	The module is currently performing network-related initialisation tasks. Telegrams now contains Process Data (if such data is mapped), however the network Process Data channel is not yet active.
2	Network process data inactive	The network Process Data channel is temporarily inactive, wait cyclic.
3	IDLE	The network interface is idle. The exact interpretation of this state is network specific. Depending on the network type, the Read Process Data may be either updated or static (unchanged).
4	Process active	The network Process Data channel is active and error free.
5	Bus error	There is at least one serious network error.
6	Reserved	
7	Host error	The module has ceased all network participation due to a host application-related error. This state is unrecoverable, i.e. the module must be restarted in order to be able to exchange network data.
8	Option bus loss	Communication between MDX option and drive is lost.
9	Reserved	
10	Reserved	
11	Host supervising and IOLE	Perform normal data handing, but master progress is turned off.
12	Host supervising	Module is supervised by another network device, perform normal data handing.
13	Reserved	
14	Reserved	

If a mapping configuration error or network error is detected the drive may trip. Refer to section 10.7 Drive trip display codes on page 30 for details about the drive trip display.

10.6 Cyclic mapping status

Table 10.7 MDX-PROFIBUS mapping status

Pr **15.49**	Default	N/A
	Range	0 to 2
	Access	RO

The MDX-PROFIBUS mapping status parameter, Pr **15.49** indicates a mapping configuration error.

When a mapping error has been corrected, re-initialise the MDX-PROFIBUS by setting Pr **15.32** to ON (1).

The mapping error codes are described in Table 10.8.

Table 10.8 Mapping error codes

Pr 15.49	LCD display	Description
0	I/O good	Mapping channel is good
1	Input bad	IN Mapping channel is faulty (Pr **15.10** to Pr **15.19**)
2	Output Bad	OUT Mapping channel is faulty (Pr **15.20** to Pr **15.29**)

10.7   Drive trip display codes

If the MDX-PROFIBUS detects an error during operation, it will force a trip on the drive. However, the trip code displayed on the drive will only indicate that the MDX option is in fault. The exact reason for the trip will be indicated in the MDX-PROFIBUS error code parameter, Pr **15.50**.

Table 10.10 shows the possible trip codes that will be displayed on the drive when a problem is detected with the MDX-PROFIBUS or when the MDX-PROFIBUS initiates a trip.

10.8   Fieldbus trip

Table 10.9 Fieldbus trip

Pr **15.50**	Default	N/A
	Range	0 to 2
	Access	RO

If the MDX-PROFIBUS detects an error during operation, it will force a trip on the drive and update the error code parameter, Pr **15.50**. Table 10.10 shows the possible MDX-PROFIBUS error codes.

Table 10.10 MDX-PROFIBUS error codes

Error code	Fault display on LCD	Description
0	None	Indicates that the MDX-PROFIBUS module is healthy. It is possible to trip the drive externally via various communication channels.
1	bus loss	No new messages have been received for the specified network loss trip time.
2	Option loss	An inter-option communications time-out has occurred, but MDX-PROFIBUS is unable to determine the reason for the error.

10.9   Module serial number

Table 10.11 Module serial number

Pr **15.35**	Default	N/A
	Range	32 bit
	Access	RO

The serial number is loaded into the MDX-PROFIBUS during manufacture and cannot be changed. It contains the eight digit serial number on the label.

10.10 LED diagnostics

The MDX-PROFIBUS module is equipped with 2 LEDs on the front panel to aid in the diagnostics procedure. The functions of these LEDs are described in Table 10.12 LED functionality below.

Table 10.12 LED functionnality
Operation Mode (LED on the left)

State	Indication
Off	Not on line / No power
Green	On line, data exchange
Flashing green	On line, clear
Fashing red (1 flash)	Parametrization error
Flashing red (2 flashes)	MDX-PROFIBUS configuration error

Status (LED on the right)

State	Indication
Off	No power or not initialised
Green	Initialised
Flashing green	Initialised, diagnostic event(s) present
Red	Exception error

#	Item
1	Operation mode
2	Status
3	MDX-PROFIBUS connector
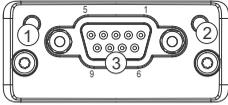
11 Advanced features

11.1 Data bytes order

Table 11.1 Data bytes order

Pr **15.08**	Default	0 (MSB first)
	Range	0 to 1
	Access	RW

When data is sent over the PROFIBUS-DP network it is transmitted as 8-bit bytes. Therefore when a 32-bit word or 16-bit word is transmitted it is split into four or two 8-bit bytes. It is important that the receiving node reconstructs the received 8-bit bytes in the correct order to arrive at the 32-bit or 16-bit data value that was originally transmitted, this order is known as the Data Endian Format and is shown in Table 11.2.

Table 11.2 Data endian format

Data endian format	Pr 15.08	16-bit value	32-bit value	
		Byte order	Word order	Byte order
Big	0 (MSB first)	High byte first Low byte second	High word first Low word second	High byte first Mid-high byte second Mid-low byte third Low byte fourth
Little	1 (LSB first)	Low byte first High byte second	Low word first High word second	Low byte first Mid-low byte second Mid-high byte third High byte fourth

Most PROFIBUS-DP master controllers use big endian format by default, many also support little endian, however some older PLCs do not offer the facility to select big endian format.

11.2 Compression of cyclical data

Table 11.3 Compression of cyclic data enable

Pr **15.34**	Default	0 (disabled)
	Range	0 to 1
	Access	RW

By default, the MDX-PROFIBUS uses 32-bits for each data channel, even if the target parameter in the drive is a 16-bit , 8 bit or 1 bit parameter. This strategy (known as casting) ensures that the cyclic data transmitted over the PROFIBUS-DP network is kept aligned with memory locations in 32-bit PLCs. When cyclic data compression is enabled (Pr **15.34** = ENABLED) a data channel will only use 32-bits if the target drive parameter is a 32-bit parameter. If the target drive parameter is 16-bits wide 16-bits will be used. If the target drive parameter is only 1 or 8-bits wide 8-bits will be used for that particular data channel. This is shown in Table 11.4.

Table 11.4 Actual data sizes

Parameter size (bits)	Actual data size (bits) compression enabled (Pr 15.34)	Actual data size (bits) compression disabled (Pr 15.34)
1	8	32
8	8	32
16	16	32
32	32	32

The following examples demonstrate setting up a network using five cyclic channels for both IN and OUT data with the cyclic data compression first disabled and then enabled.

Table 11.5 shows the mapping parameters where five OUT and five IN cyclic data channels are required. With data compression disabled each data channel uses 32-bits (two data words, so a total of ten words (20 bytes) are required, Pr **15.41** = 20, Pr **15.39** = 20).

Table 11.5 Example cyclic data channel mapping with compression disabled

Cyclic word	Data word configuration on master	Mapping
Out channel 0	2 OUT (Word 0,1)	Pr **6.42**, Control word
Out channel 1	2 OUT (Word 2,3)	Pr **1.21**, Digital speed reference 1
Out channel 2	2 OUT (Word 4,5)	Pr **2.11**, Ramp
Out channel 3	2 OUT (Word 6,7)	Pr **4.07**, Symetric Current Limit
Out channel 4	2 OUT (Word 8,9)	Pr **4.10**, Torque Offset Selection
In channel 0	2 IN (Word 0,1)	Pr **10.40**, Status word
In channel 1	2 IN (Word 2,3)	Pr **2.01**, Post ramp speed reference
In channel 2	2 IN (Word 4,5)	Pr **4.02**, Current
In channel 3	2 IN (Word 6,7)	Pr **10.16**, DC Bus undervoltage
In channel 4	2 IN (Word 8,9)	Pr **10.17**, Motor overload alarm

It is advisable to keep 16-bit parameters paired together. This prevents mis-alignment of cyclic data with 32-bit PLC registers when using auto-mapping facilities to configure the PROFIBUS-DP network. By swapping the mappings for output channel 1 with output channel 2 and moving input channel 3 and 4 to input channel 1and 2, the data channel structure will appear as shown in Table 11.6.

Table 11.6 Example cyclic data channel mapping with compression enabled

Cyclic word	Data word configuration on master	Mapping
Out channel 0	1 OUT (Word 0)	Pr **6.42**, Control word
Out channel 1	1 OUT (Word 1)	Pr **2.11**, Ramp
Out channel 2	2 OUT (Word 2,3)	Pr **1.21**, Digital speed reference 1
Out channel 3	1 OUT (Word 4)	Pr **4.07**, Symetric Current Limit
Out channel 4	1 BYTE (Byte 0 of Word 5)	Pr **4.10**, Torque Offset Selection
In channel 0	1 IN (Word 0)	Pr **10.40**, Status word
In channel 1	1 BYTE (Byte 0 of Word 1)	Pr **10.16**, DC Bus undervoltage
In channel 2	1 BYTE (Byte 1 of Word 1)	Pr **10.17**, Motor overload alarm
In channel 3	2 IN (Word 2,3)	Pr **2.01**, Post ramp speed reference
In channel 4	2 IN (Word 4,5)	Pr **4.02**, Current

NOTE | The master needs to declare firstly OUT words and after IN words. Also each parameter needs to be declared one by one following their number of bits.

11.3 Restore defaults

Table 11.7 Restore defaults

Pr **15.30**	Default	0 (disabled)
	Range	0 to 1
	Access	RW

If the host drive is defaulted (see the drive user guide for details) it will also clear the current configuration of the fitted MDX-PROFIBUS.

This can be performed as follows :
- Set Pr **15.30** to 1 (ENABLED).
- PROFIBUS-DP communications will be stopped.
- The host drive will load and store its default parameter values.
- Default parameter values for the MDX-PROFIBUS will be loaded.
- The MDX-PROFIBUS will reset and re-initialise using the default values.

11.4 Disable full write access with acyclic

Table 11.8 Disable full write access

Pr **15.36**	Default	Read Write
	Range	0 to 1
	Access	RW

This parameter will restrict a remote user's access to the drive. Pr **15.36** = read ensures that write access to the drive is disabled. Pr **15.36** = read write allows full access to the drive parameters. With this parameter enabled access with acyclic is not allowed.

12 Quick reference

12.1 Complete parameter reference

Table 12.1 lists all the MDX-PROFIBUS set-up parameters that are required to configure the module.

Table 12.1 MDX-PROFIBUS parameter reference

Menu	Default	Cross reference	Description
15.01	5	Page 28	Plugged option ID code
15.02	----	Page 28	Module software version (XX,YY)
15.03	126	Page 16	Node address
15.06	---	Page 29	Fieldbus option state
15.08	MSB first	Page 32	Data bytes order
15.10	1040	Page 20	IN cyclic mapping 0
15.11	201	Page 20	IN cyclic mapping 1
15.12	0	Page 20	IN cyclic mapping 2
15.13	0	Page 20	IN cyclic mapping 3
15.14	0	Page 20	IN cyclic mapping 4
15.15	0	Page 20	IN cyclic mapping 5
15.16	0	Page 20	IN cyclic mapping 6
15.17	0	Page 20	IN cyclic mapping 7
15.18	0	Page 20	IN cyclic mapping 8
15.19	0	Page 20	IN cyclic mapping 9
15.20	642	Page 20	OUT cyclic mapping 0
15.21	121	Page 20	OUT cyclic mapping 1
15.22	0	Page 20	OUT cyclic mapping 2
15.23	0	Page 20	OUT cyclic mapping 3
15.24	0	Page 20	OUT cyclic mapping 4
15.25	0	Page 20	OUT cyclic mapping 5
15.26	0	Page 20	OUT cyclic mapping 6
15.27	0	Page 20	OUT cyclic mapping 7
15.28	0	Page 20	OUT cyclic mapping 8
15.29	0	Page 20	OUT cyclic mapping 9
15.30	DISABLED (0)	Page 34	Return MDX module to factory settings
15.32	DISABLED (0)	Page 17	Fieldbus option reset
15.34	DISABLED (0)	Page 32	Compression of cyclical data
15.35	---	Page 30	Serial number
15.36	Read write	Page 34	Disable full write access
15.38	8	Page 16	Input cyclical data bytes
15.39	2	Page 16	Input cyclical data parameters
15.40	2	Page 16	Output cyclical data parameters
15.41	8	Page 16	Output cyclical data bytes
15.49	---	Page 29	Cyclic mapping status
15.50	---	Page 30	Fieldbus trip
15.51	---	Page 28	Option minor firmware sub-version

13   Glossary of terms

Address : This is the unique network identification given to a networked device to allow communication on a network. When a device sends or receives data the address is used to determine the source and the destination of the message.

Bit : A binary digit, this may have the value of 1 or 0.

Byte : A collection of eight binary digits that collectively store a value. This may be signed or unsigned.

Casting : The process of changing between data sizes without changing the value represented, e.g. changing from 16-bit to 32-bit.

Compression : By default MDX-PROFIBUS transmits values as 32-bits on the network. It is possible by using data compression to reduce the number of bits transmitted when sending 16-bit (or smaller) values on the network to 16-bit or 8-bit (32-bit values will still be transmitted as 32-bit values). This has the advantage of reducing the volume of traffic on the network and allowing more parameters to be mapped within the MDX-PROFIBUS.

Control word : A collection of binary digits that are used to control the drive. Features typically include directional controls, run controls and other similar functions.

Cyclic channel : An area of the PROFIBUS-DP message frame used for cyclic communication to a single drive parameter.

Cyclic data : This consists of values that are sent at regular or cyclic intervals across the network. A typical use of cyclic data would be the transmission of a speed reference or a control word.

Data format : Determines the quantity and function of the network data.

Data rate : Determines the communication speed of the network, the higher the value the more data can be sent across the network in the same time period.

Device : A piece of equipment connected to a network, this may be any type of equipment including repeaters, hubs, masters or slaves.

Double word : A 32-bit word, this may be signed or unsigned.

DPV 0,1,2 : This describes the specification version of PROFIBUS-DP used.

Earthing : Describes the electrical safety or shielding connections for the module.

Endian format : When a value uses more than eight bits to represent its value it needs to be sent in sets of eight bits (bytes) across the network, the endian format determines the order the bytes that constitute the whole value are transmitted.

Grounding : See Earthing

GSD file : A file that defines the properties of a node. The file contains information describing the features available on the device.

IN data : Data that is returned from a slave device to the PROFIBUS-DP master.

Long word : A 32-bit data word that may be signed or unsigned.

Node : A device on the network. This may be either a device such as a drive or part of the network such as a repeater.

Non-Cyclic Data : Data that is requested or sent by the master as required. This is not sent on a regular basis and generally allows access to any parameter. This is useful for occasional changes or configuration purposes.

Mapping : The process of linking PROFIBUS-DP values to parameters within the drive.

Master : The controlling device on the network, generally this will include programming features.

Segment : An electrically separate part of the network. Each segment requires correct termination to ensure reliable operation. Due to electrical limitations the maximum number of devices on a segment is limited to 32.

Shielding : A connection to provide additional noise immunity on a network cable.

Slave : A device on the PROFIBUS-DP network such as a drive or sensor. A slave device will only respond to messages from a master.

Status word : A value that denotes the status of the drive. Each bit within the word will have a specific meaning.

Telegram : A message used within non-cyclic data communication. This term is sometimes used to represent a generic message on the network.

Termination : This is used at both ends of a network segment to prevent reflections and reduce noise. On PROFIBUS-DP, termination is provided by a powered network of resistors.

Word : A collection of 16 binary digits.

Note

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