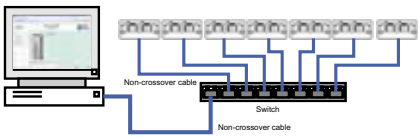
LEROY SOMER

4579 en - 2011.11 / a

POWERDRIVE MD

POWERDRIVE FX

This manual is to be given to the end user



MDX-ETHERNET

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.

The MDX-ETHERNET 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-ETHERNET. 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

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 MDX-ETHERNET ?

The MDX-ETHERNET is a fieldbus option module that can be fitted to the expansion slot in the drives to provide slave MODBUS on Ethernet connectivity.

Figure 2-1 MDX-ETHERNET

2.2 Features

The MDX-ETHERNET is an option module that can be used on the following products to provide Ethernet slave connectivity:

- POWERDRIVE FX and POWERDRIVE MD.

The following list gives an overview of the functionality available within MDX-ETHERNET.

- Galvanically isolated bus electronics.
- Dual RJ45 connectivity with support for shielded twisted pair.
- Both RJ45 ports operate in full duplex mode as a network switch.
- 10/100Mbs Ethernet with auto-negotiation.
- Full and half duplex operation with auto-negotiation.
- TCP/IP.
- Modbus TCP/IP (up to 4 simultaneous connections).
- Embedded web pages for configuration.
- Event driven E-mail generation.
- MDX Soft over Ethernet.
- Static IP configuration or DHCP client.
- SMTP.
- SNTP.
- Multiple language support.

MDX-ETHERNET is powered from the host drive's internal power supply and draws 200mA from the supply.

2.3 Backup/auxiliary supply

The drives provide a method of powering up the control circuits (and therefore any options modules installed) if the AC supply is removed, this allows the MDX-ETHERNET to continue operating when the main AC supply is switched off. For every MDX-ETHERNET module installed allow for an extra 200mA of supply current to be drawn from the backup supply.

2.4 Option module identification

The MDX-ETHERNET can be identified by the label located on the underside of the option module.

3 Mechanical installation

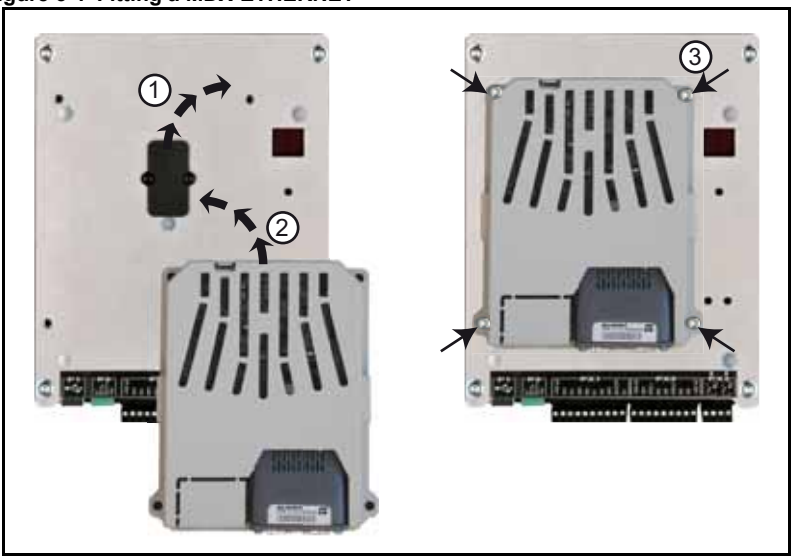
WARNING

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 options modules.

3.1 General Installation

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

Figure 3-1 Fitting a MDX-ETHERNET



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

MDX-ETHERNET provides a standard RJ45 UTP/STP (Un-shielded/Shielded Twisted Pair) connection to a 10Mbs or 100Mbs Ethernet system. MDX-ETHERNET provides 4 diagnostic LEDs for status and information purposes.
Figure 4-1 shows an overview of the module connections and indicators.

Figure 4-1 MDX-ETHERNET terminals

#	Item
3	Link/Activity Port 1
4	Link/Activity Port 2

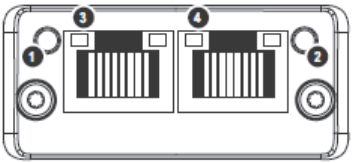


Figure 4-2 MDX-ETHERNET Module Layout

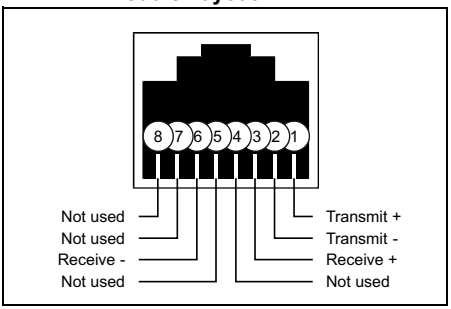


Table 4.1 RJ45 pin out details

1	Transmit + Ve
2	Transmit - Ve
3	Receive + Ve
4	-
5	-
6	Receive - Ve
7	-
8	-

4.2 Cabling considerations

To ensure long-term reliability it is recommended that any cables used to connect a system together are tested using a suitable Ethernet cable tester, this is of particular importance when cables are constructed on site.

4.3 MDX-ETHERNET cable shield connections

Standard Ethernet UTP or STP cables do not require supplementary grounding.

4.4 Cable

It is recommended that a minimum specification of CAT5e is installed on new installations, as this gives a good cost/performance ratio. If you are using existing cabling this may limit the maximum data rate depending on the cable ratings. In noisy environments the use of STP or fiber optic cable will offer additional noise immunity.

NOTE Cabling issues are the single biggest cause of network down-time. Ensure cabling is correctly routed, wiring is correct, connectors are correctly installed and any switches or routers used are rated for industrial use. Office grade Ethernet equipment does not generally offer the same degree of noise immunity as equipment intended for industrial use.

4.5 Maximum network length

The main restriction imposed on Ethernet cabling is the length of a single segment of cable as detailed in Table 4.2. If distances greater than this are required it may be possible to extend the network with additional switches or by using a fiber optic converter.

Table 4.2 Ethernet maximum network lengths

Type of cable	Data rate (bit/s)	Maximum trunk length (m)
Copper - UTP/STP CAT 5	10 M	100
Cooper - UTP/STP CAT 5	100 M	100
Fiber optic - Multi mode	10 M	2000
Fiber optic - Multi mode	100 M	3000
Fiber optic - Single mode	10 M	No standard
Fiber optic - Single mode	100 M	Up to 100000

NOTE The distances specified are absolute recommended maximums for reliable transmission of data. The distances for the fiber optic sections will be dependent on the equipment used on the network. The use of wireless networking products is not recommended for control systems, as performance may be affected by many external influences.

4.6 Minimum node to node cable length

There is no minimum length of cable recommended in the Ethernet standards for UTP or STP. For consistency across fieldbus modules, LEROY-SOMER recommends a minimum network device to device distance of 1 metre of cable. This minimum length helps to ensure good bend radii on cables and avoids unnecessary strain on connectors.

4.7 Network topology

4.7.1 Hubs

A hub provides a basic connection between network devices. Each device is connected to one port on the hub. Any data sent by a device is then sent to all ports on the hub. The use of hubs is not recommended for use within control systems due to the increased possibility of collisions. Collisions can cause delays in data transmission and are best avoided, in severe cases a single node can prevent other nodes on the same hub (or collision domain) from accessing the network.
If using hubs or repeaters you must ensure that the path variability value and propagation equivalent values are checked. This is, however, beyond the scope of this document.

NOTE LEROY-SOMER do not recommend the use of un-switched hubs.

4.7.2 Switches

Switches offer a better solution to hubs, because after initially learning the addresses of connected devices the switch will only send data to the port that has the addressed device connected to it, thus reducing network traffic and possible collisions. The difference in price between the hub and a switch means that in almost all cases the switch is the preferred choice. Some managed switches allow the switching of data to be controlled and monitored, this may be of particular importance on large or high performance systems.

NOTE Some switches require a certain time to initialise (typically 30 to 60 seconds) if MDX-ETHERNET is reset.

4.7.3 Routers

A router is used to communicate between two physical networks (or subnets) and provides some degree of security by allowing only defined connections between the two networks. A typical use would be connecting the office and manufacturing networks or connecting a network to an ISP (Internet Service Provider). A router is sometimes known as a gateway as it provides a "gateway" between two networks. It is generally recommended that a firewall is used when connecting networks as this provides additional security features.

4.7.4 Firewalls

A firewall allows separate networks to be connected together in a similar way to a router. The firewall however offers significantly more security features and control. Typical features include address translation, port filtering, protocol filtering, URL filtering, port mapping, service attack prevention, monitoring and virus scanning. This is usually the preferred method of allowing traffic from a manufacturing network to the business network. The setup and installation of the firewall should be done by a suitably qualified engineer and is beyond the scope of this document.

4.7.5 VPN

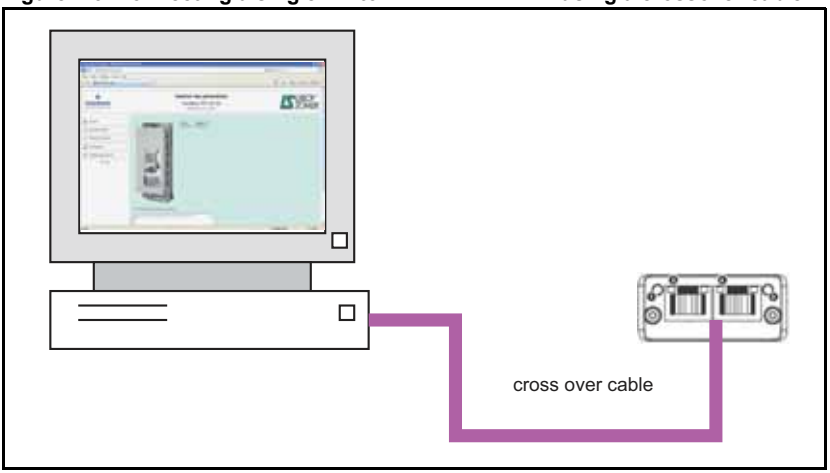
A VPN (Virtual Private Network) is a method of using a non-secure or public network that allows devices to be connected together as if they were connected on a private network. A typical example would be the connection of two remote offices such as London and New York. Each office would require a high speed Internet connection and a firewall (or VPN device). In order to configure the VPN, encryption keys are exchanged so that both offices can communicate. The data is then sent across the Internet (or shared network) in an encrypted form, giving the illusion of a single connected network (speed limitations may apply). This is generally used as a low-cost alternative to a private leased line. Configuration of VPNs is beyond the scope of the document.

4.8 Typical network connections

4.8.1 Single PC to MDX-ETHERNET

To connect a PC to the MDX-ETHERNET requires a crossover cable. This allows the two devices to communicate without the use of a switch or hub.

Figure 4-3 Connecting a single PC to MDX-ETHERNET using a crossover cable



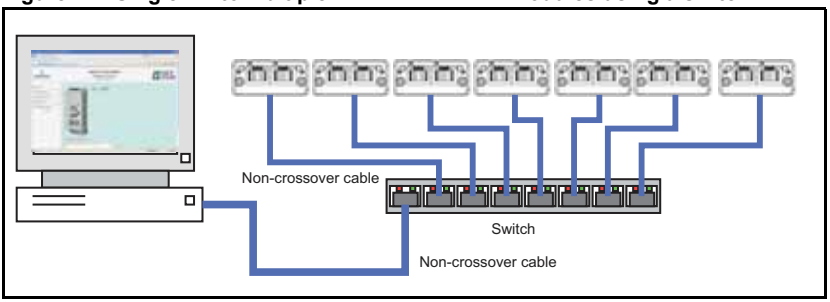
NOTE When purchasing network cables it is recommended that a different color (e.g. pink) is used for crossover cables to allow easy recognition. If no cross-over cable you need to connect via a switch

NOTE Some PCs and network switches provide auto-crossover correction and therefore the need for a crossover cable may not be necessary. Refer to the PC or network switch documentation for confirmation.

4.8.2 Single PC to multiple MDX-ETHERNET using a single switch

Connecting multiple MDX-ETHERNET modules should be done using an industrial grade switch. Each MDX-ETHERNET or PC is connected to the switch using a standard RJ45 lead (patch lead).

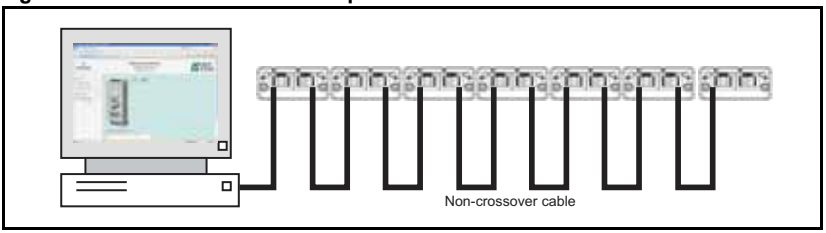
Figure 4-4 Single PC to multiple MDX-ETHERNET modules using a switch



4.8.3 Single PC to multiple MDX-ETHERNET using a daisy chain

Connecting multiple MDX-ETHERNET modules should be done using daisy chain on networks (see figure 4-5).
Other Ethernet network topologies can be used but care must be taken to ensure that the system still operates within the constraints specified by the designer.

Figure 4-5 Connections with multiple switches



4.8.4 Connection of network subnets

When connecting multiple network subnets a router or firewall should be used to allow effective management of network traffic. A subnet is identified by the change in the network section of the IP address (see section 5.6.1 The IP address for more information). A subnet boundary is usually designated by a router or firewall. The design of larger networks, however, is beyond the scope of this document.

5 Getting started

This section is intended to provide a generic guide for setting up MDX-ETHERNET 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 Modbus TCP 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 12 Diagnostics 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-ETHERNET.
- The MDX-ETHERNET firmware version.

5.1 Network design considerations

Ethernet is an open system allowing many different vendors to design and supply equipment. When designing an industrial network you must carefully consider the topology and data traffic on the network to avoid potential problems.
To avoid bandwidth issues it is recommended that the control network is logically separate from any other network. Where possible a physically separate network should be used. If this is not possible, the use of managed network devices should be considered to prevent unnecessary traffic such as broadcasts reaching the control network.

5.2 Addressing

The addressing system used on Ethernet uses two essential numbers for making connection, these are the IP address and the subnet mask. The address allows a specific device to be located and the subnet mask defines how many bits represent the subnet part of the address and how many bits represent the node address (see section 5.6.1 The IP address). Generally devices on different subnets can only communicate by using a gateway (typically a router or firewall).

NOTE The MAC address may be found on the product label on the underside of MDX-ETHERNET option.

5.3 Where do IP addresses come from ?

Every address on a network must be unique. If you do not connect your network to any other networks the assignment of IP addresses is not critical (although using a standard system is recommended), as you have full control of the addresses used. The issue of addressing becomes important when connecting multiple networks together or connecting to the Internet where there is a strong possibility of duplication of addresses if a scheme is not followed.

5.4 Addressing etiquette

The following list details some points that should be considered when selecting addresses :

- **Reserve address space :** Ensure you have enough reserve address space on your chosen addressing scheme to allow for future expansion.
- **Uniqueness :** Ensure your addresses are unique, every device on a subnet must have a unique address.
- **Avoid reserved addresses :** For example the address 127.0.0.1 is reserved as the loop back address.
- **Broadcast and system addresses :** The highest and lowest host address on a subnet are reserve addresses.
- **Use a system :** Have a scheme for assigning your addresses, for example typically servers may have a low IP address and routers a high IP address. It is not necessary to allocate consecutive IP addresses so it is possible to reserve ranges for specific uses such as servers, work stations or routers.

5.5 Class types

IP addresses are grouped into ranges called classes, each class has a specific set of addresses and has a typical situation where it is used.
When selecting the class of IP address required, consideration must be given to how many subnets you need, how many hosts are required and if you will need a public (worldwide) or a private (local) addressing scheme. Table 5.1 shows an overview of how the class types are defined and Table 5.2 shows how each class separates the subnet and host ID.

Table 5.1 Subnets and hosts supported by class type

Address Class	First Octet Decimal range	Number of subnets	Number of hosts
A	1-126.x.y.z	126	16,777,214
B	128-191.x.y.z	16,382	65,534
C	192-223.x.y.z	2,097,150	254

Table 5.2 Address components

Address Class	IP address	Subnet component	Host component
A	w.x.y.z	w	x.y.z
B	w.x.y.z	w.x	y.z
C	w.x.y.z	w.x.y	z

NOTE Using the subnet mask it is possible to modify the IP addressing such that the ratio of subnets and host addresses may be changed. This gives you the facility to "adjust" standard classes to suit your specific requirements.

5.5.1 Class A addresses

A class A address only uses the first octet to represent the subnet, the remaining octets are used to represent the host id. These addresses are intended for large organizations such as universities and the military. These addresses must be requested from the governing body (InterNIC) when using them publicly (on the Internet) to avoid duplication.

5.5.2 Class B addresses

A class B address uses the first two octets to represent the subnet, the remaining octets are used to represent the host id. These addresses are intended for medium to large size networks. These addresses must be requested from the governing body (InterNIC) when using them publicly (on the Internet) to avoid duplication. Class B addresses are generally used on public or private networks.

5.5.3 Class C addresses

Class C addresses use the first 3 octets as the subnet address and the remaining octet as the host id. A class C address is normally used on a private network only, due to the restriction on the number of hosts on the network. Class C addresses will not be routed onto the Internet.

5.5.4 Class D & E addresses

These addresses are reserved for multicasting and experimental use.

5.6 Generating the complete address

A complete IP address consists of an IP address and a subnet mask, these two numbers are required to allow communication on Ethernet using TCP/IP.

5.6.1 The IP address

The IP address is made up from four 8 bit decimal numbers (octets) and is written as follows : w.x.y.z for example192.168.0.1 (class c).

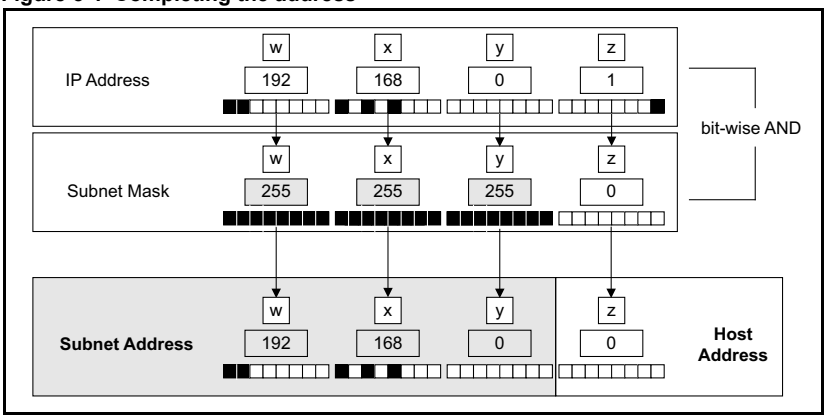
5.6.2 The subnet mask

The subnet mask defines what part of the address constitutes the subnet within the IP address and what part of the address constitutes the host address. The subnet mask is bit-wise ANDed with the address to give the subnet to which the host belongs. A typical class C subnet mask would be 255.255.255.0, this may alternatively be written as '/24' as in the example below, showing an IP address of 192.168.0.1 with a subnet mask of 255.255.255.0. This alternative notation indicates the number of bits representing the subnet part of the address, starting from the most significant bit.
Alternative subnet mask notation : 192.168.0.1 /24.

5.6.3 Completing the address

To determine which part of the address constitutes the network address and which part constitutes the node address, the IP address is bit-wise ANDed with the subnet mask. Figure 5-1 shows how the IP address and subnet mask are used to determine the subnet address and the host address.

Figure 5-1 Completing the address



5.7 DHCP considerations

5.7.1 Using fixed IP addressing

Using fixed IP addresses (manually configured) on MDX-ETHERNET means that if a module fails, the IP address can be restored to a replacement module without the need to reconfigure the DHCP server. Using fixed addresses also prevents the DHCP server from changing the address. When using fixed IP addresses, it is vital that the MDX-ETHERNET IP address is reserved on the DHCP server to prevent duplicate addressing.

NOTE If using manual IP address configuration please note that the IP address subnet mask and the default gateway must also be set manually.

5.7.2 Using DHCP

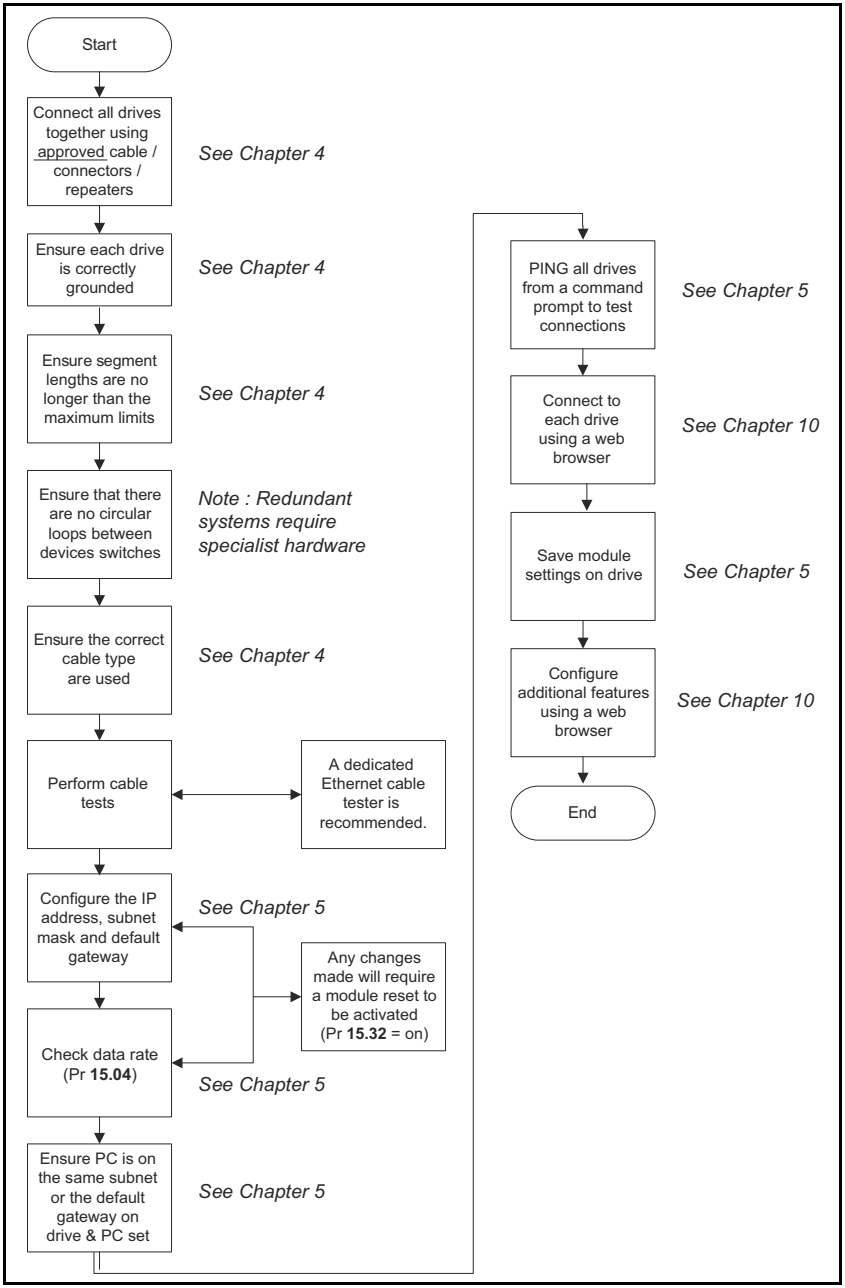
If DHCP is used it is recommended that the allocated IP address is allocated MDX-ETHERNET's MAC address, this strategy prevents the IP address changing on the MDX-ETHERNET.
Any leased addresses should be leased permanently to prevent IP address changes.

NOTE If MDX-ETHERNET is configured to use DHCP and the module requires exchanging, the new MDX-ETHERNET module will have a different MAC address and hence the DHCP server will issue the new module with a different IP address.

5.8 Basic principles of routing

Routing is required to get TCP/IP packets from one subnet to another. In an IP network nodes from one subnet cannot communicate directly with nodes on a different subnet. To allow nodes to communicate, a router (or similar device) is required to allow the two subnets to exchange data. This means that any node wishing to communicate with a node that is not on its own subnet, must know the address of a router that is on its own subnet. This is sometimes called a gateway or default gateway.

5.9 Set-up flow chart



5.10 Setting the IP address

The MDX-ETHERNET IP address is formed by taking the component parts of the address from parameters Pr **15.60** to Pr **15.63** and combining them as in Figure 5-2. The address is then used in conjunction with the subnet mask. Adress modification is activated by resetting the MDX-ETHERNET (Pr **15.32** = ENABLED).

Figure 5-2 The IP address

Wip	Xip	Yip	Zip
Pr **15.60**	Pr **15.61**	Pr **15.62**	Pr **15.63**

NOTE When DHCP is enabled (see section 5.14 DHCP (Dynamic Host Configuration Protocol) the whole IP address is acquired from the DHCP server and written to the parameters in the drive during start-up. This could take several minutes depending on server availability and network status.

5.10.1 MDX-ETHERNET IP address Wip

IP address Wip

Pr **15.60**	**Default**	192
	Range	0 to 255
	Access	RW

This is the most significant octet of MDX-ETHERNET IP address. When using DHCP this will be updated from the DHCP server.

5.10.2 MDX-ETHERNET IP address Xip

IP address Xip

Pr **15.61**	**Default**	168
	Range	0 to 255
	Access	RW

This is the second most significant octet MDX-ETHERNET IP address. When using DHCP this will be updated from the DHCP server.

5.10.3 MDX-ETHERNET IP address Yip

IP address Yip

Pr **15.62**	**Default**	1
	Range	0 to 255
	Access	RW

This is the third most significant octet of MDX-ETHERNET IP address. When using DHCP this will be updated from the DHCP server.

5.10.4 MDX-ETHERNET IP address Zip

IP address Zip

Pr **15.63**	**Default**	100
	Range	0 to 255
	Access	RW

This is the least significant octet of MDX-ETHERNET IP address. When using DHCP this will be updated from the DHCP server.

5.11 Setting the subnet mask

The MDX-ETHERNET subnet mask is formed by taking the component parts of the subnet mask from parameters Pr **15.64** to Pr **15.67** and combining them as in Figure 5-3.

The subnet mask is then used in conjunction with the IP address. Subnet mask modification is activated by resetting the MDX-ETHERNET (Pr **15.32** = ENABLED).

Figure 5-3 The subnet mask

Wsubnet	Xsubnet	Ysubnet	Zsubnet
Pr **15.64**	Pr **15.65**	Pr **15.66**	Pr **15.67**

NOTE When DHCP is enabled the whole subnet mask address is acquired from the DHCP server and written to the parameters in the drive during start-up. This could take several minutes depending on server availability and network status.

5.11.1 MDX-ETHERNET IP subnet mask Wsubnet

IP address Wsubnet

Pr **15.64**	**Default**	255
	Range	0 to 255
	Access	RW

This is the most significant octet of MDX-ETHERNET IP subnet mask. When using DHCP this will be updated from the DHCP server.

5.11.2 MDX-ETHERNET IP subnet mask Xsubnet

IP address Xsubnet

Pr **15.65**	**Default**	255
	Range	0 to 255
	Access	RW

This is the second most significant octet MDX-ETHERNET IP subnet mask. When using DHCP this will be updated from the DHCP server.

5.11.3 MDX-ETHERNET IP subnet mask Ysubnet

IP address Ysubnet

Pr **15.66**	**Default**	255
	Range	0 to 255
	Access	RW

This is the third most significant octet of MDX-ETHERNET IP subnet mask. When using DHCP this will be updated from the DHCP server.

5.11.4 MDX-ETHERNET IP subnet mask Zsubnet

IP address Zsubnet

Pr **15.67**	**Default**	0
	Range	0 to 255
	Access	RW

This is the least significant octet of MDX-ETHERNET IP subnet mask. When using DHCP this will be updated from the DHCP server.

5.12 Setting the default gateway

The MDX-ETHERNET default gateway is formed by taking the component parts of the default gateway from parameters Pr **15.68** to Pr **15.71** and combining them as in Figure 5-4. The default gateway is then used in conjunction with the IP address and subnet mask to locate hosts on different subnets. Gateway address modification is activated by resetting the MDX-ETHERNET (Pr **15.32** = ENABLED).

Figure 5-4 The default gateway

Wgateway	Xgateway	Ygateway	Zgateway
Pr **15.68**	Pr **15.69**	Pr **15.70**	Pr **15.71**

The default gateway is a routing device that allows a host to reach other devices that are not on the same subnet. The default gateway must be on the same subnet as the host that is trying to use it.

NOTE When DHCP is enabled the whole default gateway address is acquired from the DHCP server and written to the parameters in the drive during start-up. This could take several minutes depending on server availability.

NOTE When communication is performed through a gateway, the devices on both sides of the gateway must be configured to see their side of the gateway for communications to be established.

5.12.1 MDX-ETHERNET IP default gateway Wgateway

IP default gateway Wgateway

Pr **15.68**	**Default**	192
	Range	0 to 255
	Access	RW

This is the most significant octet of MDX-ETHERNET IP default gateway address. When using DHCP this will be updated from the DHCP server.

5.12.2 MDX-ETHERNET IP default gateway Xgateway

IP default gateway Xgateway

Pr **15.69**	**Default**	168
	Range	0 to 255
	Access	RW

This is the second most significant octet MDX-ETHERNET IP default gateway address. When using DHCP this will be updated from the DHCP server.

5.12.3 MDX-ETHERNET IP default gateway Ygateway

IP default gateway Ygateway

Pr **15.70**	**Default**	1
	Range	0 to 255
	Access	RW

This is the third most significant octet of MDX-ETHERNET IP default gateway address. When using DHCP this will be updated from the DHCP server.

5.12.4 MDX-ETHERNET IP default gateway Zgateway

IP default gateway Zgateway

Pr **15.71**	**Default**	254
	Range	0 to 255
	Access	RW

This is the least significant octet of MDX-ETHERNET IP default gateway address. When using DHCP this will be updated from the DHCP server.

5.13 MDX-ETHERNET baud rate

MDX-ETHERNET baud rate

Pr **15.04**	**Default**	0 (automatic)
	Range	0 to 4
	Access	RW

MDX-ETHERNET can be set to automatically detect the baud rate or be fixed at either 10Mbs or 100Mbs.

Table 5.3 MDX-ETHERNET baud rate

Pr 15.04 (LCD display)	Baud rate
0 (Automatic)	Automatic detect
1 (10 MB half DX)	10 MB half Duplex
2 (10 MB full DX)	10 MB full Duplex
3 (100 MB half DX)	100 MB half Duplex
4 (100 MB full DX)	100 MB full Duplex

NOTE This parameter should normally be left in the auto detect state.

5.14 DHCP (Dynamic Host Configuration Protocol)

5.14.1 DHCP enable

Pr **15.55**	**Default**	0 (no)
	Range	0 to 1
	Access	RW

This parameter determines if the module gets it's network configuration (IP address, subnet mask, etc.) from the host drive parameters or from a DHCP server on the network. The DHCP server can be configured to give the module the next free address or an address based on the MAC address of MDX-ETHERNET.

Table 5.4 MDX-ETHERNET DHCP enable

Pr 15.55 (LCD display)	DHCP enable
0 (no)	Use local configuration
1 (yes)	Use DHCP server

A DHCP server will typically provide MDX-ETHERNET with an IP address, subnet mask, default gateway and DNS information.

5.14.2 DHCP server configuration

When using DHCP it is possible that every MDX-ETHERNET re-initialises it will receive a new IP address. This will make it difficult to keep track of what IP address is allocated to a particular module and when using a Modbus IP master this would also require reconfiguration.
LEROY-SOMER recommend that the leased IP address for MDX-ETHERNET is allocated to MDX-ETHERNET MAC address. This will prevent MDX-ETHERNET IP address changing when it re-initialises or when the DHCP server renews the MDX-ETHERNET lease.

5.15 MDX-ETHERNET operating status

Operating status

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

This parameter gives operating status of MDX-ETHERNET, a value of 2 (inactive network process data) indicates that MDX-ETHERNET is initialised and ready to communicate. For more information see section 12.7 Fieldbus option state.

5.16 Re-initialising MDX-ETHERNET

Re-initialising MDX

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

Changes to the MDX-ETHERNET configuration will not take effect until the MDX-ETHERNET has been re-initialised.
To re-initialise MDX-ETHERNET:
1. Set Pr **15.32** to ENABLED.
2. Before the reset takes place Pr **15.32** will be reset to DISABLED.
3. The MDX-ETHERNET will re-initialise using the updated configuration.

NOTE This sequence does NOT store the MDX-ETHERNET configuration parameters in the host drive.
Pr **15.32** will revert to OFF immediately and may not be visible on the display.

5.17 Saving parameters to the drive

Drive parameters are automatically save if is change by keypad or PC software.
If parameters are change by Ethernet :
To avoid loss of the configured settings when the drive is powered down it is necessary to store the parameters.
To store drive parameters:
- Set Pr **11.65** to 0. (See note regarding drive).
- Set Pr **11.64** to yes (1).
- if **11.64** returns to no (0), the storing is finished.

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

6 PROTOCOL

MDX-ETHERNET supports a wide range of protocols for communicating over Ethernet, each protocol has a specific use and it is important to understand how to use each protocol before designing a system.

6.1 PC/PLC considerations

If the subnet of the host PC/PLC is different to the subnet of MDX-ETHERNET, then both MDX-ETHERNET and the PC/PLC must be configured with the address of a gateway that allows communication between the two devices.

6.2 Modbus TCP/IP

Modbus TCP/IP is one of the most widely supported industrial Ethernet based protocols offering the functionality and simplicity of the Modbus protocol, with the flexibility of Ethernet. Table 6.1 shows the supported Modbus function codes.
The MDX-ETHERNET implementation of Modbus TCP/IP follows the specification provided by the Modbus organization. Modbus TCP/IP uses the standard Protocol Data Unit (PDU) but without the CRC bytes and encapsulates it within a Modbus TCP/IP Application Data Unit (ADU) for transmission. This means that the Modbus PDU is the same for both standard and Ethernet based transmission.

Table 6.1 Supported Modbus function codes

Code	Description
FC1	Read Coils
FC2	Read Discrete Inputs
FC3	Read holding Registers
FC4	Read Input Registers
FC5	Write Single Coil
FC6	Write Single Register
FC15	Write Multiple Coils
FC16	Write Multiple Registers
FC23	Read/Write Multiple Registers

Modbus TCP/IP port
The port number used for Modbus TCP/IP is 502.

A timer is available under the MODBUS Pr **15.07** to allow loss of MODBUS communications to be managed (see Chapter 13 Advanced features 1 for more Modbus options).

Configuration
The cyclic (implicit) data parameter mapping configuration can be changed from keypad or the web page. For more information on cyclic data parameter mappings see section 7.2 Data format.

NOTE The user must be logged in as an "Administrator" to change the configuration settings by web page.

6.3 Web pages (HTTP)

Web page access is provided to allow configuration of the drive and option(s) module(s). The web pages also allow parameters to be monitored and configuration settings to be uploaded or downloaded.

To view web pages on MDX-ETHERNET one of the following web browsers should be used :

- Microsoft Internet Explorer (version 5.0 or later).
- Netscape (version 6.0 or later).
- Mozilla (version 1 or later).
- Opera (version 8 or later).

The standard web pages provide access to the following features :

- Advanced Parameters.
- General configuration (network setting, e-mail, user settings).
- Backup (uploaded or downloaded parameters).
- Supervising menu (customers select parameters they want to supervise).
- Language support.

For details of the web pages please see Chapter 10 Web page basics.

6.4 SMTP (e-mail)

MDX-ETHERNET provides a method for sending E-mails when Pr **15.54** is changed from 0 (OFF) to 1 (ON). For more information on SMTP see section 13.5 E-mail configuration.

7 Cyclic data

Modbus does not feature a dedicated cyclic data channel in the same sense as many other networks. In the MDX-ETHERNET implementation, cyclic data can however still be accessed from the network via dedicated entries in the Modbus register map. Just as with regular Parameter's, the cyclic data is converted to a format suitable for Modbus.

Cyclic data is more easy and fast acess than acyclic, when various parameters is needed (no contiguous). it is strongly recommended to use cyclic.

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 Modbus TCP network and using local mapping information within the MDX-ETHERNET and Modbus TCP master controller to ensure that the correct data is sent to the correct locations. The flexibility of the MDX-ETHERNET 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-ETHERNET.
- 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 mapping parameters that is possible is : 10 (20 words).

See section 13.2 Compression of Cyclic data for information on using data compression with 8 or 16-bit parameters.

7.2 Data formats

The MDX-ETHERNET can be configured with up to ten 32-bit or ten 16-bit cyclic OUT and IN data. OUT and IN cyclic data 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 16-bits.
Any 32-bit parameters mapped will still require two 16-bit words even with compression turned on.

Table 7.1 IN/OUT cyclical data formats

Pr **15.40** Output cyclical data parameters	Default	2
And	Range	0 to 10
Pr **15.39** Input cyclical data parameters	Access	RW

The method used to map data to and from the MDX-ETHERNET module 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-ETHERNET mapping parameters

IN channel	Mapping parameter
0	Pr **15.10**
1	Pr **15.11**
2	Pr **15.12**
3	Pr **15.13**
4	Pr **15.14**
5	Pr **15.15**
6	Pr **15.16**
7	Pr **15.17**
8	Pr **15.18**
9	Pr **15.19**

OUT channel	Mapping parameter
0	Pr **15.20**
1	Pr **15.21**
2	Pr **15.22**
3	Pr **15.23**
4	Pr **15.24**
5	Pr **15.25**
6	Pr **15.26**
7	Pr **15.27**
8	Pr **15.28**
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 place. 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-ETHERNET will indicate a configuration error by the mapping status parameter (Pr **15.49**). Refer to section 12.8 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	Cyclic Data word length on master	Mapping
Out channel 0	2 OUT (Word 0,1) +	Pr **15.20** = 642 Pr **6.42**, Control word
Out channel 1	2 OUT (Word 2,3) +	Pr **15.21** = 121 Pr **1.21**, Digital speed reference 1
In channel 0	2 IN (Word 0,1) +	Pr **15.10** = 1040 Pr **10.40**, Status word
In channel 1	2 IN (Word 2,3)	Pr **15.11** = 201 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	Cyclic Data word length on master	Mapping
Out channel 0	2 OUT (Word 0,1) +	Pr **15.20** = 642 Pr **6.42**, Control word
Out channel 1	2 OUT (Word 2,3) +	Pr **15.21** = 121 Pr **1.21**, Digital speed reference 1
Out channel 2	2 OUT (Word 3,4) +	Pr **15.22** = 211 Pr **2.11**, Ramp
In channel 0	2 IN (Word 0,1) +	Pr **15.10** = 1040 Pr **10.40**, Status word
In channel 1	2 IN (Word 2,3) +	Pr **15.11** = 201 Pr **2.01**, Post ramp speed reference
In channel 2	2 IN (Word 3,4) +	Pr **15.12** = 402 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	Cyclic Data word length on master	Mapping
Out channel 0	1 OUT (Word 0) +	Pr **15.20** = 642 Pr **6.42**, Control word
Out channel 1	2 OUT (Word 1,2) +	Pr **15.21** = 121 Pr **1.21**, Digital speed reference 1
Out channel 2	1 OUT (Word 3) +	Pr **15.22** = 211 Pr **2.11**, Ramp
In channel 0	1 IN (Word 0) +	Pr **15.10** = 1040 Pr **10.40,** Status word
In channel 1	2 IN (Word 1,2) +	Pr **15.11** = 201 Pr **2.01**, Post ramp speed reference
In channel 2	2 IN (Word 3,4)	Pr **15.12** = 402 Pr **4.02**, Current

7.3 Mapping conflicts

The Drive indicates if there is a mapping conflict like other MDX-ETHERNET cyclic OUT channels, analog inputs or other.

7.4 Cyclic data mapping errors

The MDX-ETHERNET module will scan and check the Modbus mapping parameter configuration for errors during initialisation (ex. Pr **15.32** = ENABLED). If an error is detected, then the MDX-ETHERNET configuration error detected will be indicated in mapping status parameter, Pr **15.49**. See section 12.8 Cyclic parameter number (Mapping 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	16	32
8	16	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 at 2 (Pr **15.39** and Pr **15.40**).

The following settings is show:

- Pr **15.38** = 6 (4 + 2),
- Pr **15.41** = 6 (4 + 2).

Pr **15.38** and Pr **15.41** allow to know number of data bytes for de input and output mapping.

Input cyclical data bytes

Pr **15.38**	**Default**	8
	Range	0 to 127
	Access	RO

output cyclical data bytes

Pr **15.41**	**Default**	8
	Range	0 to 127
	Access	RO

7.6 Disabling mappings

Any unused mapping parameters (Pr **15.10** to Pr **15.19** and Pr **15.20** to Pr **15.29**) are disable by the number of parameter 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 parameter (Pr **15.39** and Pr **15.40**) include this unmapped channel.

7.7 How to read and write cyclic Modbus

MDX-ETHERNET supported various Modbus function codes to write and read cyclic. The modbus address for IN and OUT cyclic is dependent of the function use see table 7.7 for more information.

Table 7.7 Cyclic Modbus address for IN and OUT

Drive mode is in default parameter Pr 15.09 = 2 registers or Pr 15.09 = 1 register	First address for cyclic IN data (Pr 15.10 to Pr 15.19) Master PLC ← drive	First address for cyclic OUT data (Pr 15.20 to Pr 15.29) Master PLC → drive	Register Type and address range
FC1 Read Coils		Modbus address = 000	Coils (0x) 000-FFF cyclic area
FC2 Read Discrete Inputs	Modbus address = 000		Discrete Inputs (1x) 000-FFF cyclic area
FC3 Read holding Registers	Modbus address = 256	Modbus address = 000	Holding Registers (4x) 000 -1FF cyclic area 210 -FFFF non-cyclic area
FC4 Read Input Registers	Modbus address = 000		Input Registers (3x) 000-FFF cyclic area
FC5 Write Single Coil		Modbus address = 000	Coils (0x) 000-FFF cyclic area
FC6 Write Single Register	Modbus address = 256	Modbus address = 000	Holding Registers (4x) 000 -1FF cyclic area 210 -FFFF non-cyclic area
FC15 Write Multiple Coils		Modbus address = 000	Coils (0x) 000-FFF cyclic area
FC16 Write Multiple Registers	Modbus address = 256	Modbus address = 000	Holding Registers (4x) 000 -1FF cyclic area 210 -FFFF non-cyclic area
FC23 Read/Write Multiple Registers	Modbus address = 256	Modbus address = 000	Holding Registers (4x) 000 -1FF cyclic area 210 -FFFF Non-cyclic area

NOTE - Parameter Pr **15.34** (Compression of cyclical data) define if each parameter take 1 or 2 words in only cyclic data.
- Parameter Pr **15.09** (Modbus register number by acyclic parameter) define if each parameter take 1 or 2 words in only non-cyclic data.

Example with function code FC16: if drive mode is in default parameter
(Pr **15.34** = disabled, Pr **15.20** = 642 and Pr **15.21** = 121) Modbus address 0 allow to write to Pr **6.42** and address 2 to Pr **1.21**.

NOTE With Master PLC, LEROY-SOMER advise to used Function 03 to read and Function 16 to write (this functions is generally used in all PLC).

8 Non-cyclic data (acyclic)

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 setup or archiving of drive settings.

8.2 Modbus register number by acyclic parameter

Modbus register number by acyclic parameter

Pr **15.09**	**Default**	1 (2 registers by parameter)
	Range	0 (1 register by parameter) to 1
	Access	RW

This parameter defines if a register take one or two word in modbus (for read or write non-cyclic).

NOTE If Pr **15.09** = 1 register, it's not possible to access at all parameters 32 bits.

8.3 How to read and write non-cyclic Modbus

MDX-ETHERNET supported various Modbus function codes to write and read non-cyclic:

- Function 03 (FC3) Read holding Registers
- Function 06 (FC6) Write Single Register
- Function 16 (FC16) Write Multiple Registers
- Function 23 (FC23) Read/Write Multiple Registers

The modbus address for read and write non-cyclic is dependent of the parameter Pr **15.09** and if master manage address -1. See table 8.1 for more information.

Table 8.1 How define non-Cyclic Modbus address

Drive mode	**Calculate Modbus address**	**Example 1 :** - Modbus address for read or write to Pr **1.21** - Master software with no management of address -1 (modbus address = real address)	**Example 2 :** - Modbus address for read or write to Pr **1.21** - Master software with management of address -1 (modbus address = real address -1)
Pr **15.09** = 2 registers (drive default parameter)	First address non-cyclic = 0x210 = 528 Address = 528 + [(parameter - 1) *2]	528+ [(121-1)*2] = 768 Modbus address = 768	528+ [(121-1)*2] +1 = 769 Modbus address = 769
Pr **15.09** = 1 register	First address non-cyclic = 0x210 = 528 Address = 528 + parameter -1	528 + 121-1 = 648 odbus address = 648	528 + 121 = 649 Modbus address = 649

NOTE - Function 06 (FC06) is not work with parameter 32 bits.
- All Function is not work with parameter 32 bits if length access is less than 32 bits.

NOTE With PLC Master, LEROY-SOMER advise to used Function 03 to read and Function 16 to write (this functions is generally used in all PLC).

NOTE At the first read or write acyclic function and if Cyclic is not used, OUT mapping parameter (see Pr **15.20** to Pr **15.29**) are set to zero.

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

Reserved bits must be kept at 0.

To enable fieldbus control the fieldbus enable signal must both be set to '1' (change Pr **6.43** Run/Stop source by fieldbus). When 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-ETHERNET 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 Pr 10.40	Decimal conversion	Functions	Equivalent parameter
0	1	Drive healthy	**Pr 10.01**
1	2	Drive active	**Pr 10.02**
2	4	Zero speed	**Pr 10.03**
3	8	Running at minimum speed	**Pr 10.04**
4	16	Below set speed	**Pr 10.05**
5	32	At speed	**Pr 10.06**
6	64	Above set speed	**Pr 10.07**
7	128	Nominal load reached	**Pr 10.08**
8	256	Drive out at current limit	**Pr 10.09**
9	512	Drive regenerating	**Pr 10.10**
10	1024	Braking IGBT active	**Pr 10.11**
11	2048	Braking resistor alarm	**Pr 10.12**
12	4096	Direction commanded	**Pr 10.13**
13	8192	Direction running	**Pr 10.14**
14	16384	Mains loss	**Pr 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 reference 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.
5	Pr **10.06**	**At speed** Only set if the drive is running at set speed. Refer to Pr **3.06**, Pr **3.07** and Pr **3.09** 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 transferred 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 Web page basics

10.1 Connecting to MDX-ETHERNET

If you are using DHCP, all settings on the MDX-ETHERNET module will be configured by the network DHCP server, you can confirm this is working by checking the IP address has been correctly configured in parameters Pr **15.60** to Pr **15.63**. In order to communicate, the PC must be on the same subnet as the drive or you must have a gateway specified for the host PC and the MDX-ETHERNET module.

NOTE If you are not using DHCP you will need to manually configure the address, subnet mask and default gateway (if you are connecting from a different subnet) see section 5.10 Setting the IP address.

10.1.1 Making a connection

To connect to MDX-ETHERNET, enter the address of the MDX-ETHERNET module (see section 5.10 Setting the IP address) into the browser window as follows : http://192.168.1.100 (this is the default address).

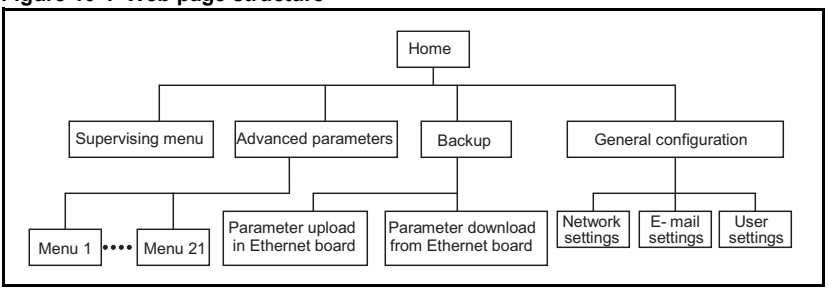
Replacing the address (192.168.1.100) with the address of the MDX-ETHERNET module you wish to communicate with.

NOTE The default IP address when not using DHCP is 192.168.1.100. In order to communicate with this address your PC will need to be on the same subnet or have a gateway capable of reaching this address, additionally MDX-ETHERNET will also require a gateway configured to communicate with the PC in this case.

10.2 Web page menu structure

The menu structure on MDX-ETHERNET is logically grouped by function to allow for ease of navigation.

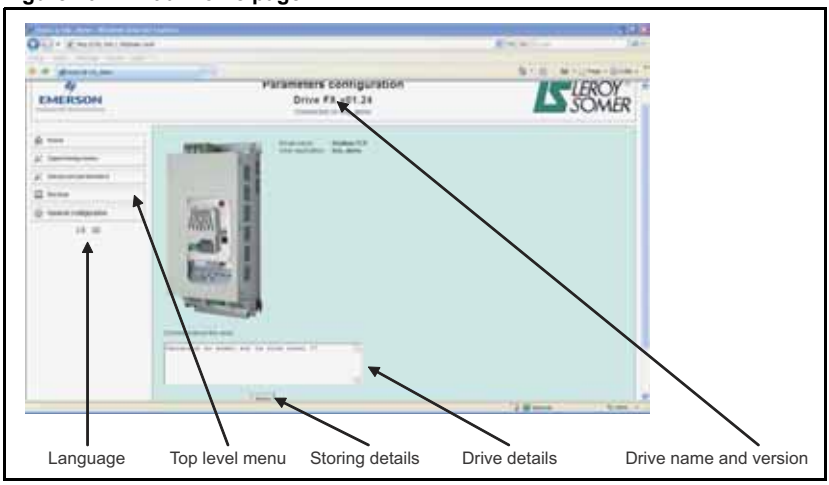
Figure 10-1 Web page structure



10.2.1 The home page

Figure 10-2 shows the initial home page when connected to MDX-ETHERNET.

Figure 10-2 Initial home page



The home page contains the following main areas:

- **Language:** click on the image to select the language display.
- **Top-level menu:** this is the menu that is used to navigate to the menus on MDX-ETHERNET. Click on the items to make a selection.
- **Storing details:** click on the Store button to storing drive details on the windows.
- **Drive details:** contains more details about the MDX-ETHERNET usage.
- **Drive name and version:** this is the name allocated to MDX-ETHERNET during set-up. The section also details the option module installed to the drive and its Web page firmware versions.

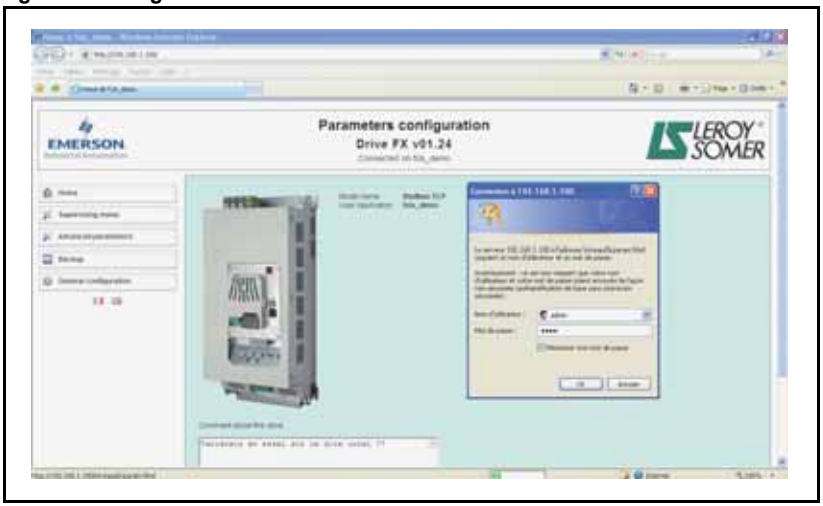
10.2.2 Logging in

Before you can view any additional screens you must login to MDX-ETHERNET. The default username is **admin** and the default password is **pass**. The **admin** cannot be deleted, but a new password should be created.

This account is not appropriate for day to day use, and an Administrator account should be created as soon as is practically possible. The password for the **admin** account should be noted in a secure place as this password is not reset when the module is defaulted.

Figure 10-3 shows the login screen, after entering the details click the "OK" button to login. If you lose your passwords you need to login with the default passwords.

Figure 10-3 Log-in

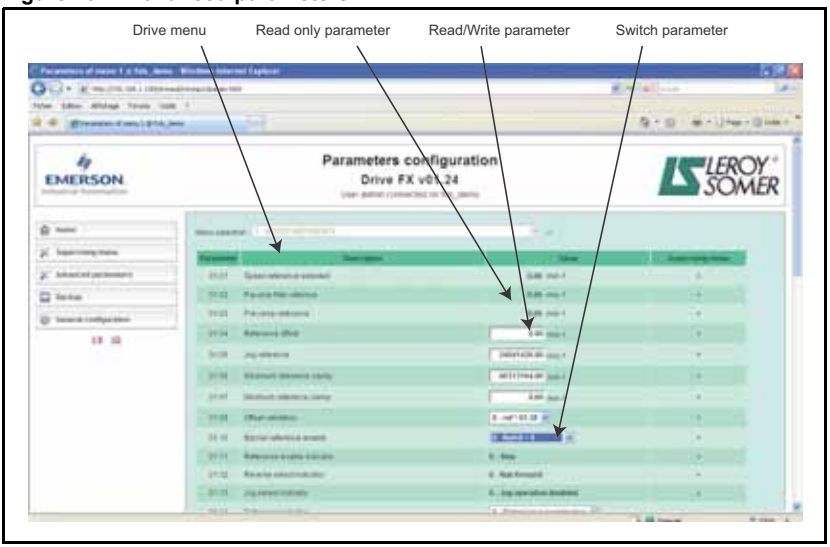


When you have finished working with the module you should log-out using the log out option in the top-level menu. This prevents unauthorized access to MDX-ETHERNET.

10.2.3 Advanced parameters

Displays a list of the menus within the host drive.

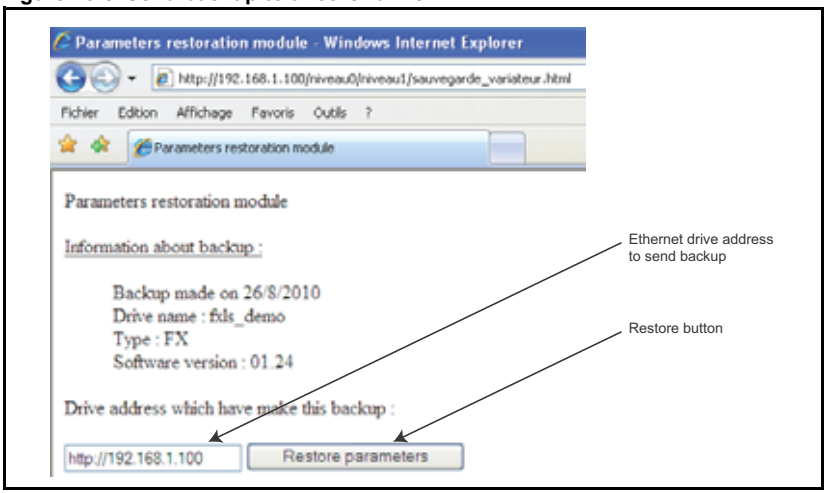
Figure 10-4 Advanced parameters



10.2.4 Backup

Allows data from the module to be uploaded for backup in module memory. This backup has all module parameter values. This backup can be downloaded to any MDX-ETHERNET module in the same network with its is Ethernet drive address.

Figure 10-5 Send backup to another drive



11 Security

11.1 Introduction

On open networked systems it is important that security is considered. Security covers aspects such as access to devices using passwords, network infrastructure, company procedures and backup procedures.

The physical system security should be enforced with acceptable user policies and appropriate employee guidelines.

11.2 General site security issues

11.2.1 Connecting your computer

It is important to remember that when connecting your computer to an existing network you will have an impact on the data and services on that network. Particular care should be taken not to interrupt the flow of data by disconnecting cables, powering down switches/routers, or interrupting data flow by sending large amounts of data over the network.

11.2.2 Virus considerations

Connecting your computer to a network carries the risk of transferring computer viruses to other computers on that network. It is vital that when connecting to a network you ensure that your anti-virus software is up to date and activated. Many operating system vendors offer regular product updates to increase stability and reduce the risk of malicious programs causing damage to your corporate infrastructure.

NOTE LEROY-SOMER recommend the use of a quality anti-virus solution on any networked system. The overall network security policy resides with the network administrators and any connections to a network should be approved by the network administrators.

11.2.3 Firewall issues

When a high level of security is required between the automation network and the business network a firewall should be used. This helps prevent unwanted traffic passing between the networks and can be used to restrict access to certain machines or users.

NOTE Some managed switches provide control methods for network traffic, however a firewall offers significantly more features. Configuration of a switch or firewall is beyond the scope of this document.

11.3 Default restrictions

By default, access to the drive over Ethernet is set to read/write access. By default, all services are available. This can be changed using Pr **15.36** (please see section 13.4 Disable full write access with acyclic for more information).

11.3.1 Disable Full Access

The global write enable Pr **15.36** is set to 0 (disabled) by default. This will allow parameters to be changed within the drive. To prevent changes to drive parameters over Ethernet web pages or modbus acyclic, Pr **15.36** should be set to a 1 (Enabled).

11.4 Account management

A user account system is provided to allow an administrator to give access rights to different classes of user. The system provides accounts for administrator and user account types. The default username admin and password pass should be used to gain initial access to the module. Once logged on, additional accounts should be added as required, with key members of the engineering staff having supervisor access. It is recommended that a policy is put into place to ensure that passwords are recorded elsewhere. There is a limit of one active user account.

11.5 Adding new accounts

In order to add a new account you will need to follow the instructions below:

1. Log on to the web pages using the admin or an administrator account.
2. Choose the top level General Configuration menu then the User setting menu.
3. Enter the details as requested in the menu.
4. Click "Create user" to finish.

11.5.1 Administrator accounts

Administrator accounts are intended to provide a high level of access to the drive and module settings. An administrator account should be reserved for engineering staff who have a thorough understanding of the drive, MDX-ETHERNET and the system. Where possible more than one person should be given administration privileges. An administrative account is required for adding/removing accounts.

11.5.2 Other user accounts

Other user accounts should be used for engineers that need to make changes to the system occasionally, different account types are available depending on the facilities and features required. For more information see section 11.6 Security levels .

11.6 Security levels

Security levels are provided to allow different types of users to be given different access rights to the drive and module parameters. Table 10.1 shows the access rights for specific user types.

Table 11.1 Security levels

	View HOME page	View supervising menu page	View advanced parameter pages	Backup	View general configuration page
Level 0	Yes	Yes	No	No	No
Level 1	Yes	Yes	Yes	Yes	No
Administrator	Yes	Yes	Yes	Yes	Yes

12 Diagnostics

This section of the manual provides basic diagnostic information intended to enable resolution of the most common problems encountered when setting up a MDX-ETHERNET module on an Ethernet network.
A high percentage of problems reported are basic setup problems that can be avoided by using the following pages. If after you are still experiencing problems please contact your supplier or local drive supplier for support.

NOTE Please note that support will be limited to the setting up and networking of the drive and not network infrastructure design.

12.1 LED diagnostics

The MDX-ETHERNET 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 12.1 LED functionality below.

Figure 12-1 LED functionality

#	Item
1	Network status LED
2	Module status LED
3	Link/Activity Port 1
4	Link/Activity Port 2

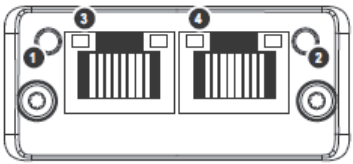


Table 12.1 Network status LED (LED on the left)

NOTE A test sequence is performed on this LED during startup.

LED State	Description
Off	No power or no IP address
Green	Module is in Process Active or Idle state
Green, flashing	Waiting for connections
Red	Duplicate IP address, or FATAL event
Red, flashing	Process Active Timeout.

Table 12.2 Module Status LED (LED on the right)

NOTE A test sequence is performed on this LED during startup.

LED State	Description
Off	No power
Green	Normal operation
Red	Major fault; module is in state EXCEPTION (or FATAL event)
Red, flashing	Minor fault in diagnostic object IP conflict

Table 12.3 LINK/Activity LED

LED State	Description
Off	No link, no activity
Green	Link established, 100 Mbit/s
Green, flickering	Activity, 100 Mbit/s
Yellow	Link established, 10 Mbit/s
Yellow, flickering	Activity, 10 Mbit/s

12.2 Module ID code

Module ID code

Pr **15.01**	**Default**	147
	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-ETHERNET is 147.

12.3 Module firmware version

Firmware - major version (xx.yy)

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

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).

12.4 Node address

Each node on a MDX-ETHERNET network must be given a unique network node address.

The MDX-ETHERNET must be re-initialised to make a change of node address active. See section 5.10 Setting the IP address or section 5.14 DHCP for more information.

12.5 MDX-ETHERNET baud rate

MDX-ETHERNET baud rate

Pr **15.04**	**Default**	0 (automatic)
	Range	0 to 4
	Access	RW

MDX-ETHERNET can be set to automatically detect the baud rate or be fixed at either 10Mbs or 100Mbs.

Table 12.4 Table 12.1 MDX-ETHERNET baud rate

Pr 15.04 (LCD display)	Baud rate
0 (Automatic)	Automatic detect
1 (10 MB half DX)	10 MB half Duplex
2 (10 MB full DX)	10 MB full Duplex
3 (100 MB half DX)	100 MB half Duplex
4 (100 MB full DX)	100 MB full Duplex

NOTE This parameter should normally be left in the auto detect state.

12.6 Data format

The default data format is 2 cyclic channel OUT and IN, each cyclic data channel is mapped to a drive parameter. See section 7 cyclic data and 8 non cyclic data for more information.

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

12.7 Fieldbus option state

Fieldbus option state

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

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

Table 12.5 MDX-ETHERNET operating status codes

Pr 15.06	LCD display	Description
0	Setup 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	Wait web update	Wait a few minutes until Data base of new drive version is loaded in MDX option. Do not switch off the product during this period.
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	reserved	
12	Host supervising	Module is supervised by another network device. Perform manual data handling.
13	reserved	
14	reserved	

If a mapping configuration error or network error is detected the drive may trip. Refer to Section 12.8 Cyclic parameter number (mapping status) for details about the trip display.

12.8 Cyclic mapping status

Mapping status

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

The MDX-ETHERNET mapping status parameter Pr **15.49** indicates a mapping configuration error. When a mapping error has been corrected, re-initialise the MDX-ETHERNET by setting Pr **15.32** to ON (1). The mapping error codes are described in Table 12.7.

Table 12.6 Mapping error codes

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

12.9 Drive trip display codes

If the MDX-ETHERNET 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 MDX option is in fault. The exact reason for the trip will be indicated in the MDX-ETHERNET error code parameter, Pr **15.50**. Table 12.8 shows the possible trip codes that will be displayed on the drive when a problem is detected with the MDX-ETHERNET or when the MDX-ETHERNET initiates a trip.

12.10 Fieldbus trip

Fieldbus trip

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

If the MDX-ETHERNET detects an error during operation, it will force a trip on the drive and update the error code parameter, Pr **15.50**. Table 12.8 shows the possible MDX-ETHERNET error codes.

Table 12.7 MDX-ETHERNET error codes

Error code	Fault display on LCD	Description
0	No error code	Indicates that the MDX-ETHERNET 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 the MDX-ETHERNET is unable to determine the reason for the error.

12.11 Module serial number

Module serial number

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

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

13 Advanced features

13.1 Data bytes order

Data bytes order

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

When data is sent over the Modbus TCP 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 13.1.

Table 13.1 Data endian format

Data endian format	Pr 15.08	16-bit value	32-bit value	
		Byte order	Word order	Byte order
Big	1 (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	0 (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 Modbus TCP master controllers use little endian format by default, many also support big endian.

13.2 Compression of cyclical data

Compression of cyclic data enable

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

By default, the MDX-ETHERNET 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 Modbus TCP 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 1or 8 -bits wide 16-bits will be used for that particular data channel. This is shown in Table 13.2.

Table 13.2 Actual data sizes

Parameter size (bits)	Actual data size (bits) compression enable (Pr 15.34)	Actual data size (bits) compression disabled (Pr 15.34)
1	16	32
8	16	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 13.3 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 13.3 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 Modbus TCP 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 13.4.

Table 13.4 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**, Symmetrical Current Limit
Out channel 4	1 OUT (Word 5)	Pr **4.10**, Torque Offset Selection
In channel 0	1 IN ((Word 0)	Pr **10.40**, Status word
In channel 1	1 IN (Word 1)	Pr **10.16**, DC Bus undervoltage
In channel 2	2 IN (Word 2,3)	Pr **4.02**, Current
In channel 3	2 IN (Word 4,5)	Pr **2.01**, Post ramp speed reference
In channel 4	1 IN (Word 6)	Pr **10.17**, Motor overload alarm

13.3 Restore defaults

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-ETHERNET. Setting Pr **15.30** to 1 additionally clears the backup copy of the stored MDX-ETHERNET configuration.
This can be performed as follows:

- Set Pr **15.30** to 1 (ENABLED).
- Modbus TCP communications will be stopped.
- The host drive will load and store its default parameter values.
- Default parameter values for the MDX-ETHERNET will be loaded.
- The MDX-ETHERNET will reset and re-initialise using the default values.

13.4 Disable full write access with acyclic or web page

Disable full write access

Pr **15.36**	**Default**	0 (read write)
	Range	0 to 1
	Access	RW

This parameter will restrict a remote user's access to the drive. Pr **15.36** = read only 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.

13.5 E-mail configuration

MDX-ETHERNET provides the facilities for sending e-mail alerts. These e-mails are configured based on a trigger condition with Pr **15.54**.

13.5.1 Requirements

In order to send e-mails you will need the following:

- A mail server that accepts SMTP connections and password if they have.
- An e-mail address for MDX-ETHERNET.
- The IP address of the mail server.

NOTE It is recommended that the address used is part of the standard corporate address structure (i.e. mdxethernet1@mycompany.com), contact your system administrator for advice on obtaining an e-mail address. MDX-ETHERNET will not receive e-mail, and facilities should be put in place to prevent mail going to this account residing on the server.

13.5.2 Setup

To setup e-mail on MDX-ETHERNET you must first be logged in with appropriate permissions. From the General configuration menu then select E-mail settings option on the menu. Enter the IP address and password of the mail server click on "store setting" to save the settings.

13.5.3 E-mail triggers

The trigger requires a transition from 0 to 1 on Pr **15.54**, after this transition e-mail is sent.
Pr **15.54** can be affected to a drive digital input.

Send e-mail on transition 0 -> 1

Pr **15.54**	**Default**	0 (OFF)
	Range	0 (OFF) to 1 (ON)
	Access	RW

To complete the process you need to enter an appropriate e-mail source name, a destination e-mail address, the title of the e-mail, any text you wish to send.

13.6 Modbus TCP/IP (LS implementation)

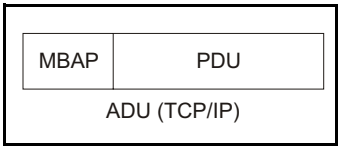
Modbus TCP/IP is one of the most widely supported Industrial Ethernet based protocols offering the functionality and simplicity of the Modbus protocol, combined with the flexibility of Ethernet. The MDX-ETHERNET implementation of Modbus TCP/IP uses a subset of the standard protocol provided by the Modbus organization. Modbus TCP/IP is an application layer protocol for communication between automation devices utilizing an Ethernet network connection. It is a client-server protocol where the client sends a request and waits for the server to respond.

NOTE The port for Modbus TCP/IP communication is 502.

13.6.1 Data structure

Communication between devices is based upon Application Data Units (ADUs) as shown in Figure 13-1. The ADU consists of two parts, the Modbus Application Protocol (MBAP) (Table 13.5) and the Protocol Data Units (see Table 13.6). Modbus TCP/IP extends the standard PDU to include an IP specific 7-byte header called the Modbus Application Protocol (MBAP).

Figure 13-1 ADU



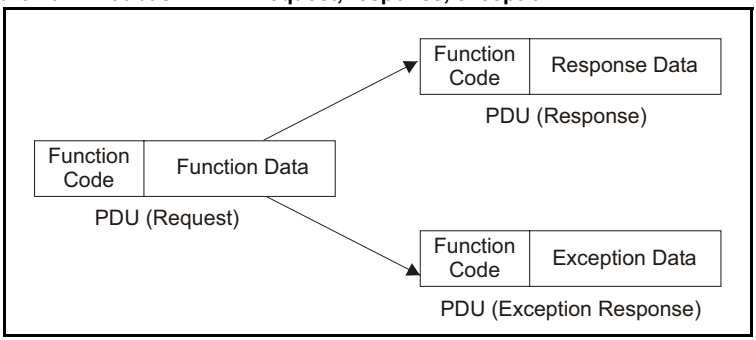
NOTE It is important that when you implement the Modbus TCP ADU as shown in Figure 13-1, you include the MBAP as well as the PDU.

NOTE The rest of this section does not repeat the MBAP header for each function code for reasons of clarity.

13.6.2 Data access

Data access using Modbus TCP/IP takes the form of a request for data by the master, followed by a response from the slave indicating either success (response), or failure (exception response) as shown in Figure 13-2. If no response is received this indicates that the message has not been received or the node is unable to reply.

Figure 13-2 Modbus TCP/IP- request, response, exception



MBAP and PDU message structure

The following tables document the structure of the MBAP and PDU, specifically the functions of each data byte within the overall message structure.

Table 13.5 MBAP

Byte	Description
0	Transaction identifier MSB
1	Transaction identifier LSB
2	Protocol identifier MSB
3	Protocol identifier LSB
4	Length MSB
5	Length LSB
6	Unit identifier

Table 13.6 PDU

PDU	Consist of
Request	Function code, 1 byte Function data, > 1 byte
Response	Function code, 1 byte Response data, > 1 byte
Exception Response	Error code, 1 byte Exception code, 1 byte

13.7 Supported Modbus function codes

Table 13.7 below, details the supported Modbus function codes on MDX-ETHERNET.

Table 13.7 Supported function codes

Code	Description
FC1	Read Coils
FC2	Read Discrete Inputs
FC3	Read holding Registers
FC4	Read Input Registers
FC5	Write Single Coil
FC6	Write Single Register
FC15	Write Multiple Coils
FC16	Write Multiple Registers
FC23	Read/Write Multiple Registers

13.8 Network loss trip

The network loss trip provides a method on the drive to ensure that communication with the master is still present. The MDX-ETHERNET resets an internal timer when a valid message is received from the MDX-ETHERNET network, if a message is not received within the specified period in ms, the network loss trip is triggered. If the trip is generated by MDX-ETHERNET, the trip display on the drive will be "TR 94". The MDX-ETHERNET error code parameter (Pr **15.50**) will show "Fieldbus loss" when a network loss trip has occurred.

Network loss trip timeout

Pr **15.07**	**Default**	1000
	Range	0 to 10000
	Access	RW

The network loss trip can be disabled by setting Pr **15.07** to 0. In this case, the drive will continue to operate using the last received values. It is the user's responsibility to ensure that adequate safety precautions are taken to prevent damage or injury by disabling the drive in the event of a loss of communications.

14 Quick reference

14.1 Complete parameter reference

Table 14.1 lists all the MDX-ETHERNET set-up parameters that are required to configure the module.

Table 14.1 MDX-ETHERNET parameter reference

Parameter	Default	Cross reference	Description
15.01	147	Page 43	plugged option ID code
15.02	----	Page 43	Module software version (XX,YY)
15.04	0 (automatic)	Page 22	MDX-ETHERNET baud rate
15.06	---	Page 44	Fieldbus option state
15.07	1000	Page 51	Network loss trip timeout in millisecond
15.08	0 (LSB first)	Page 46	Data bytes order
15.09	1 (2 registers by parameter)	Page 30	Modbus register number by acyclic parameter
15.10	1040	Page 27	IN cyclic mapping 0
15.11	201	Page 27	IN cyclic mapping 1
15.12	0	Page 27	IN cyclic mapping 2
15.13	0	Page 27	IN cyclic mapping 3
15.14	0	Page 27	IN cyclic mapping 4
15.15	0	Page 27	IN cyclic mapping 5
15.16	0	Page 27	IN cyclic mapping 6
15.17	0	Page 27	IN cyclic mapping 7
15.18	0	Page 27	IN cyclic mapping 8
15.19	0	Page 27	IN cyclic mapping 9
15.20	642	Page 27	OUT cyclic mapping 0
15.21	121	Page 27	OUT cyclic mapping 1
15.22	0	Page 27	OUT cyclic mapping 2
15.23	0	Page 27	OUT cyclic mapping 3
15.24	0	Page 27	OUT cyclic mapping 4
15.25	0	Page 27	OUT cyclic mapping 5
15.26	0	Page 27	OUT cyclic mapping 6
15.27	0	Page 27	OUT cyclic mapping 7
15.28	0	Page 27	OUT cyclic mapping 8
15.29	0	Page 27	OUT cyclic mapping 9
15.30	0 (Disabled)	Page 48	Return MDX module to default settings
15.32	0 (Disabled)	Page 23	Fieldbus option reset
15.34	0 (disabled)	Page 46	Compression of cyclical data
15.35	---	Page 45	Serial number
15.36	0 (Read write)	Page 48	Disable full write access
15.38	8	Page 29	Input cyclical data bytes
15.39	2	Page 27	IN cyclic, number of channel (parameter)
15.40	2	Page 27	OUT cyclic, number of channel (parameter)
15.41	8	Page 29	Output cyclical data bytes
15.49	---	Page 44	mapping status
15.50	0 (No error code)	Page 45	Fieldbus trip

Parameter	Default	Cross reference	Description
15.51	---	Page 43	Option minor firmware sub-version
15.54	0 (disabled)	Page 49	Send mail on transition 0 -> 1
15.55	0 (no)	Page 22	DHCP enable
15.60	192	Page 19	IP address Wip
15.61	168	Page 19	IP address Xip
15.62	1	Page 19	IP address Yip
15.63	100	Page 19	IP address Zip
15.64	255	Page 20	IP subnet mask Wsubnet
15.65	255	Page 20	IP subnet mask Xsubnet
15.66	255	Page 20	IP subnet mask Ysubnet
15.67	0	Page 20	IP subnet mask Zsubnet
15.68	192	Page 21	IP default gateway Wgateway
15.69	168	Page 21	IP default gateway Xgateway
15.70	1	Page 21	IP default gateway Ygateway
15.71	254	Page 21	IP default gateway Zgateway

15 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.

Auto-crossover detection : A method used to automatically detect if a crossover or non-crossover network cable is connected.

ADU : Application Data Unit. The complete Modbus message frame (ADU) consists of the Modbus Application Protocol (MBAP) and Protocol Data Unit (PDU).

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

Byte : A collection of 8 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-ETHERNET 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 (32-bit values will still be transmitted as 32-bit values). This has the advantage of reducing the volume of traffic on the network.

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.

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.

DNS : Domain Name Server. This is a server that is used to convert a URL such as "www.leroy-somer.com" to an IP address such as 129.254.254.106.

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

DHCP : Dynamic Host Configuration Protocol. This is a method of allocating IP settings of a node from a central server.

Ethernet address : See MAC address.

Explicit data : See Non-cyclic data.

Firewall : A computer or piece of software that restricts connections between different ports. This can be useful when restricting data flow between two network segments.

FTP : File Transfer Protocol. Used for transferring files.

Gateway : A device that allows devices on different subnets or networks to communicate with each other.

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

Hub : A method of connecting computers together on Ethernet. An un-switched hub will repeat any data received on one port to all ports.

HTTP : Hypertext transfer protocol. This is a document specification protocol. Commonly used in web pages.

Implicit data : See Cyclic data.

IN data : Data that is returned from a slave device to the ethernet master.

IP : Internet Protocol, this is the protocol used to transmit bytes across an IP network.

IP address : An address that identifies a node uniquely on a subnet or network.

IP subnet : A part of an IP network that consists of a range of addresses that may be accessed by all devices on the same network directly.

LED : Light Emmiting Diode.

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

LSB : Least Significant Bit/Byte.

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

MAC address : This is a unique address that is assigned to MDX-ETHERNET at the time of manufacture. No other device will have this address. The address is used to make connections to the module before the IP address is assigned.

MBAP : Modbus application protocol. This is a 7 byte header added to the main Modbus telegram (PDU) which contains IP specific identifiers.

Modbus IP : A protocol that allows Modbus to be sent over TCP/IP. The modbus protocol allows manipulation of the parameters within the host drive and MDX-ETHERNET.

MSB : Most Significant Bit/Byte.

Network Loss Trip : A way to determine when a node has lost contact with the master.

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.

Octet : A collection of 8 binary digits which form a byte.

Patch lead : A network cable where the terminal connections at one end of the cable are connected straight through to the other end on a pin to pin basis. Normally used to connect a network device to a network switch.

PC : Personal Computer.

PDU : Protocol Data Unit. This is the main Modbus message telegram, to which is added the MBAP header to form the complete Modbus telegram.

PLC : Programming Logic Controller.

Polled data : See Cyclic data.

Router : A device that is used to connect different networks or subnets, in a similar way to a firewall, however a router generally allows significantly less control of the data.

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

SMTP : Simple Mail Transfer Protocol. A protocol used for sending e-mail.

SNTP : Simple Network Time Protocol. A protocol used for synchronizing time over a network.

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

Subnet : A part of a network that has IP addresses in the same range. Devices on the same subnet may communicate directly with other devices on the same subnet without the use of a gateway.

Subnet mask : Defines which part of the IP address constitutes the subnet address and which part constitutes the host device address.

Switch : A device that allows Ethernet devices to be interconnected.

TCP : Transmission Control Protocol, this protocol is responsible for ensuring that the data on the network reaches it's destination.

URL : Uniform Resource Locator. A method used to give a web site a friendly name such as www.leroy-somer.com as an alternative to an IP address.

VPN : Virtual Private Network. A method of using a non-secure or public network that allows devices to be connected together as if they were a part of a private network.

Word : A collection of 16 binary digits.

Note

Note

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