



*User Guide*

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***SM-Ethernet***

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Solutions Module for:

- Unidrive SP
- Commander SK
- Digitax ST
- Mentor MP
- Affinity

Part Number: 0471-0047-06  
Issue: 6

## General Information

The manufacturer accepts no liability for any consequences resulting from inappropriate, negligent or incorrect installation or adjustment of the optional parameters of the equipment or from mismatching the variable speed drive with the motor.

The contents of this guide are believed to be correct at the time of printing. In the interests of commitment to a policy of continuous development and improvement, the manufacturer reserves the right to change the specification of the product or its performance, or the content of the guide without notice.

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## Environmental Statement

Control Techniques is committed to minimising the environmental impacts of its manufacturing operations and of its products throughout their life cycle. To this end, we operate an Environmental Management System (EMS) which is certified to the International Standard ISO 14001. Further information on the EMS, our Environment Policy and other relevant information is available on request, or can be found at [www.greendrives.com](http://www.greendrives.com).

The electronic variable speed drives manufactured by Control Techniques have the potential to save energy and (through increased machine/process efficiency) reduce raw material consumption and scrap throughout their long working lifetime. In typical applications, these positive environmental effects far outweigh the negative impacts of product manufacture and end-of-life disposal.

Nevertheless, when the products eventually reach the end of their useful life, they must not be discarded but should instead be recycled by a specialist recycler of electronic equipment. Recyclers will find the products easy to dismantle into their major component parts for efficient recycling. Many parts snap together and can be separated without the use of tools, while other parts are secured with conventional fasteners. Virtually all parts of the product are suitable for recycling.

Product packaging is of good quality and can be re-used. Large products are packed in wooden crates, while smaller products come in strong cardboard cartons which themselves have a high-recycled fibre content. If not re-used, these containers can be recycled. Polythene, used on the protective film and bags from wrapping product, can be recycled in the same way. Control Techniques' packaging strategy prefers easily recyclable materials of low environmental impact, and regular reviews identify opportunities for improvement.

When preparing to recycle or dispose of any product or packaging, please observe local legislation and best practice.

## Software Statement

This Solutions Module (SM) is supplied with the latest software version. When retro-fitting to an existing system, all software versions should be verified to confirm the same functionality as Solutions Modules of the same type already present. This also applies to products returned from a Control Techniques Service Centre or Repair Centre. If there is any doubt please contact the supplier of the product.

The software version of the Solutions Module can be identified by looking at Pr **MM.02** and Pr **MM.51**, where **MM** is the relevant menu number for the Solutions Module slot being used.

See Pr **MM.02** and Pr **MM.51** description later in this manual for more information.

The software version takes the form of xx.yy.zz, where Pr **MM.02** displays xx.yy and Pr **MM.51** displays zz (e.g. for software version 01.01.00 Pr **MM.02** will display 1.01 and Pr **MM.51** will display 0).

## REACH legislation

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For current information on how this requirement applies in relation to specific Control Techniques products, please approach your usual contact in the first instance. Control Techniques position statement can be viewed at:

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# 1 Safety information

## 1.1 Warnings, cautions and notes



A **Warning** contains information, which is essential for avoiding a safety hazard.



A **Caution** contains information, which is necessary for avoiding a risk of damage to the product or other equipment.

**NOTE** A **Note** contains information, which helps to ensure correct operation of the product.

## 1.2 Electrical safety - general warning

The voltages used in the drive can cause severe electrical shock and/or burns, and could be lethal. Extreme care is necessary at all times when working with or adjacent to the drive.

Specific warnings are given at the relevant places in this User Guide.

## 1.3 System design and safety of personnel

The drive is intended as a component for professional incorporation into complete equipment or a system. If installed incorrectly, the drive may present a safety hazard.

The drive uses high voltages and currents, carries a high level of stored electrical energy, and is used to control equipment which can cause injury.

Close attention is required to the electrical installation and the system design to avoid hazards, either in normal operation or in the event of equipment malfunction. System design, installation, start up and maintenance must be carried out by personnel who have the necessary training and experience. They must read this safety information and this User Guide carefully.

The STOP and SECURE DISABLE / SAFE TORQUE OFF functions of the drive do not isolate dangerous voltages from the output of the drive or from any external option unit. The supply must be disconnected by an approved electrical isolation device before gaining access to the electrical connections.

**With the sole exception of the SECURE DISABLE / SAFE TORQUE OFF function, none of the drive functions must be used to ensure safety of personnel, i.e. they must not be used for safety-related functions.**

The SECURE DISABLE / SAFE TORQUE OFF function is only available as standard on the Unidrive SP / Digitax ST.

The SECURE DISABLE function on Unidrive SP and the SAFE TORQUE OFF function on Digitax ST meet the requirements of EN954-1 category 3 for the prevention of unexpected starting of the drive. They may 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.**

Careful consideration must be given to the functions of the drive which might result in a hazard, either through their intended behavior or through incorrect operation due to a fault. In any application where a malfunction of the drive or its control system could lead to or allow damage, loss or injury, a risk analysis must be carried out, and where necessary, further measures taken to reduce the risk - for example, an over-speed protection device in case of failure of the speed control, or a fail-safe mechanical brake in case of loss of motor braking.

## 1.4 Environmental limits

Instructions regarding transport, storage, installation and use of the drive must be complied with, including the specified environmental limits. Drives must not be subjected to excessive physical force.

For more information on these limits see the relevant drive user guide.

## 1.5 Compliance with regulations

The installer is responsible for complying with all relevant regulations, such as national wiring regulations, accident prevention regulations and electromagnetic compatibility (EMC) regulations. Particular attention must be given to the cross-sectional areas of conductors, the selection of fuses or other protection, and protective earth (ground) connections.

For instructions in achieving compliance with specific EMC standards, please refer to the relevant drive user guide.

Within the European Union, all machinery in which this product is used must comply with the following directives:

98/37/EC: Safety of machinery.

89/336/EEC: Electromagnetic Compatibility.

## 1.6 Motor

Ensure the motor is installed in accordance with the manufacturer's recommendations. Ensure the motor shaft is not exposed.

Standard squirrel cage induction motors are designed for single speed operation. If it is intended to use the capability of the drive to run a motor at speeds above its designed maximum, it is strongly recommended that the manufacturer is consulted first.

Low speeds may cause the motor to overheat because the cooling fan becomes less effective. The motor should be installed with a protection thermistor. If necessary, an electric forced vent fan should be used.

The values of the motor parameters set in the drive affect the protection of the motor. The default values in the drive should not be relied upon.

It is essential that the correct value is entered in the motor rated current parameter, Pr **0.46** for Unidrive SP, Affinity and Digitax ST, Pr **0.06** in Commander SK and Pr **0.28** in Mentor MP. This affects the thermal protection of the motor.

## 1.7 Adjusting parameters

Some parameters have a profound effect on the operation of the drive. They must not be altered without careful consideration of the impact on the controlled system.

Measures must be taken to prevent unwanted changes due to error or tampering especially if a remote user can access the drive over Ethernet.

## 1.8 General safety considerations for remote operation

SM-Ethernet enables the possibility of remotely controlling a machine from a distance. It is vital that when connecting to a machine remotely, adequate safety procedures are implemented to prevent damage to the machine or injury to personnel.

Any connection to a “live” system has the possibility of altering the state of the machine, adequate procedures must be implemented to cover this situation.

**It is the responsibility of the machine builder to ensure that such a system is safe and complies with current legislation.**

|                           |
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## 2 Introduction

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### 2.1 Features

The SM-Ethernet is a Solutions Module that can be used on the following products to provide Ethernet slave connectivity:

- Unidrive SP
- Commander SK
- Affinity
- Digitax ST
- Mentor MP

With the exception of Commander SK, it is possible to use more than one SM-Ethernet module or a combination of SM-Ethernet and other Solutions Modules to add additional functionality such as extended I/O, gateway functionality, or additional PLC features.

The following list gives an overview of the functionality available within SM-Ethernet.

- Single RJ45 connectivity with support for shielded twisted pair.
- 10/100Mbps Ethernet with auto-negotiation.
- Full and half duplex operation with auto-negotiation.
- Auto crossover detection.
- TCP/IP.
- Modbus TCP/IP.
- EtherNet/IP.
- Embedded web pages for configuration.
- Event driven E-mail generation.
- SyPTPro over Ethernet.
- OPC server over Ethernet.
- CTSofT over Ethernet.
- Static IP configuration or DHCP client.
- SMTP.
- SNTP.
- Firmware updates over Ethernet using web pages.
- User defined web pages.
- Integrated security.
- 4kV impulse isolation.
- Help files integrated into the module.
- Multiple language support.

SM-Ethernet is powered from the host drive's internal power supply and draws 280mA from the supply.

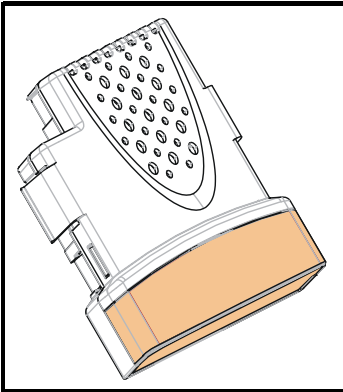
#### 2.1.1 Backup/auxiliary supply

Unidrive SP, Affinity and Digitax ST drives provide a method of powering up the control circuits (and therefore any Solutions Modules installed) if the AC supply is removed, this allows the SM-Ethernet to continue operating when the main AC supply is switched off. For every SM-Ethernet module installed allow for an extra 280mA of supply current to be drawn from the backup supply.



## 2.2 Solutions Module identification

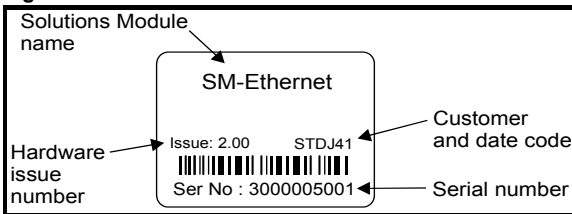
Figure 2-1 SM-Ethernet



The SM-Ethernet can be identified by:

1. The label located on the underside of the Solutions Module.

Figure 2-2 SM-Ethernet label



2. The color coding across the front of the Solutions Module. SM-Ethernet being beige.

### 2.2.1 Date code format

The date code is split into two sections: a letter followed by a number. (see Figure 2-2 *SM-Ethernet label* on page 9)

The letter indicates the year, and the number indicates the week number (within the year) in which the Solutions Module was built.

The letters go in alphabetical order, starting with A in 1990 (B in 1991, C in 1992 etc.).

**Example:**

A date code of R35 would correspond to week 35 of year 2008.

## 2.3 Product conformance

SM-Ethernet complies with IEEE 802.3 and meets the isolation requirements of safety standard EN50178.

## 2.4 Conventions used in this guide

The configuration of the host drive and Solutions Module is done using menus and parameters. A menu is a logical collection of parameters that have similar functionality.

In the case of a Solutions Module, the parameters will appear in one of three menus 15, 16 or 17 depending on the drive type and slot the module is installed into as shown in Table 2.1 *Drive menu availability* below. The menu is denoted by the number before the decimal point.

The method used to determine the menu or parameter is as follows:

- Pr **xx.00** - signifies any menu and parameter number 00.
- Pr **MM.xx** - where **MM** signifies the menu allocated to the solutions module (as shown in Table 2.1 *Drive menu availability* ) and **xx** signifies the parameter number.

**Table 2.1 Drive menu availability**

| Drive Type   | Slot 1<br>15.xx | Slot 2<br>16.xx | Slot 3<br>17.xx |
|--------------|-----------------|-----------------|-----------------|
| Unidrive SP  | Yes             | Yes             | Yes             |
| Affinity     | Yes             | Yes             | No              |
| Mentor MP    | Yes             | Yes             | Yes             |
| Commander SK | Yes             | No              | No              |
| Digitax ST   | Yes             | Yes             | No              |

## 3 Mechanical installation

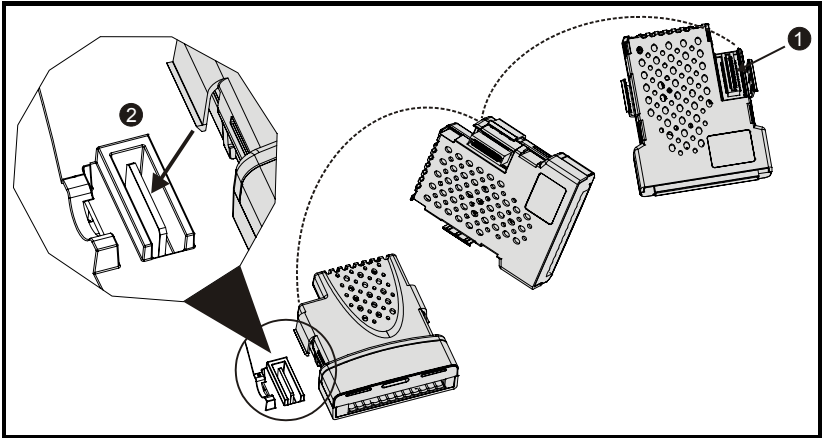


Before installing or removing a Solutions Module in any drive, ensure the AC supply has been disconnected for at least 10 minutes and refer to Chapter 1 *Safety information* on page 5. If using a DC bus supply ensure this is fully discharged before working on any drive or Solutions Module.

### 3.1 General installation

The installation of a Solutions Module is illustrated in Figure 3-1.

**Figure 3-1 Fitting a Solutions Module**



The Solutions Module connector is located on the underside of the module (1). Push this into the Solutions Module slot located on the drive until it clicks into place (2). Note that some drives require a protective tab to be removed from the Solutions Module slot. For further information, refer to the appropriate drive manual.

# 4 Electrical installation

## 4.1 SM-Ethernet module information

SM-Ethernet provides a standard RJ45 UTP/STP (*Un-shielded/Shielded Twisted Pair*) connection to a 10Mbps or 100Mbps Ethernet system. In addition to the RJ45 connector a grounding tag is supplied for supplementary bonding. SM-Ethernet provides 4 diagnostic LEDs for status and information purposes.

Figure 4-1 SM-Ethernet terminals

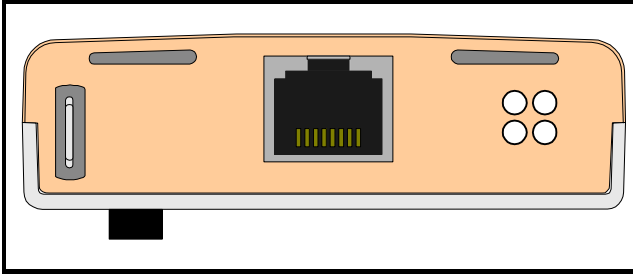


Figure 4-1 shows an overview of the module connections and indicators. The default mode for the RJ45 is crossover.

Figure 4-2 SM-Ethernet Module Layout

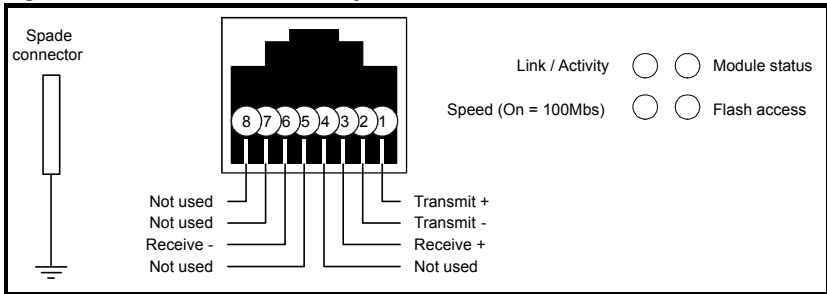


Table 4.1 RJ45 pin out details

| RJ45 Terminal | Internal Crossover Disabled (Pr MM.43=0) | Internal Crossover Enabled (Pr MM.43=1) |
|---------------|--|---|
| 1             | Transmit +Ve                             | Receive +Ve                             |
| 2             | Transmit -Ve                             | Receive -Ve                             |
| 3             | Receive +Ve                              | Transmit +Ve                            |
| 4             | -  | -                                       |
| 5             | -  | -                                       |
| 6             | Receive -Ve                              | Transmit -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 Module grounding

SM-Ethernet is supplied with a grounding tag on the module that should be connected to the closest possible grounding point using the minimum length of cable. This will greatly improve the noise immunity of the module.

## 4.4 SM-Ethernet cable shield connections

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

## 4.5 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.

## 4.6 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    | 10M               | 100                      |
| Copper - UTP/STP CAT 5    | 100M              | 100                      |
| fiber Optic - Multi-mode  | 10M               | 2000                     |
| fiber Optic - Multi-mode  | 100M              | 3000                     |
| fiber Optic - Single-mode | 10M               | no standard              |
| fiber Optic - Single-mode | 100M              | 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.

## 4.7 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, *Control Techniques* 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.

## 4.8 Network topology

### 4.8.1 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** *Control Techniques* do not recommend the use of un-switched hubs.

### 4.8.2 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 SM-Ethernet is reset.

### 4.8.3 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.

### 4.8.4 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.

## 4.8.5 VPN

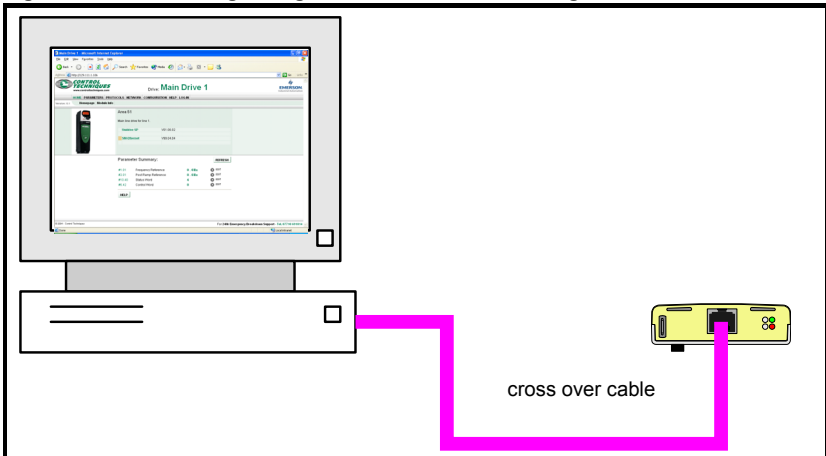
A VPN (*Virtual Private Network*) is a method of using a non-secure or public network that allows devices to be connected together as if they were connected on a private network. A typical example would be the connection of two remote offices such as London and New York. Each office would require a high 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.

## 4.9 Typical network connections

### 4.9.1 Single PC to SM-Ethernet

To connect a PC to the SM-Ethernet using the default setting of Pr **MM.43** requires a crossover cable. This allows the two devices to communicate without the need to change any settings on SM-Ethernet or the use of a switch or hub.

**Figure 4-3 Connecting a single PC to SM-Ethernet using a crossover cable**



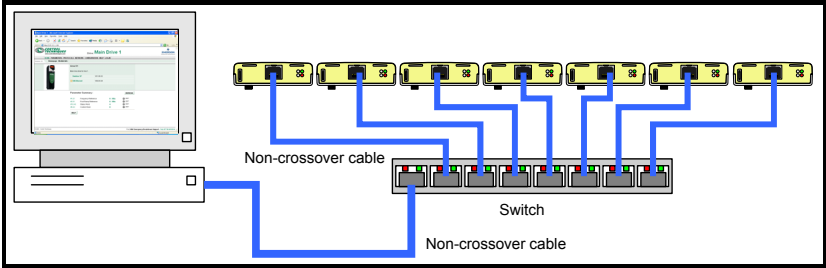
**NOTE** When purchasing network cables it is recommended that a different color (*e.g. pink*) is used for crossover cables to allow easy recognition. When connecting as in Figure 4-3, to avoid the need for crossover cables it is possible to change the SM-Ethernet RJ45 port to use a non-crossover cable by setting Pr **MM.43** to 1. This will force SM-Ethernet to detect the type of cable used when it initialises allowing either type to be used. If auto-detect is disabled (Pr **MM.43**=0) a cross-over cable is needed or you need to connect via a switch. For more information see *SM-Ethernet enable auto-crossover detection* on page 95.

**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.

### 4.9.2 Single PC to multiple SM-Ethernet using a single switch

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

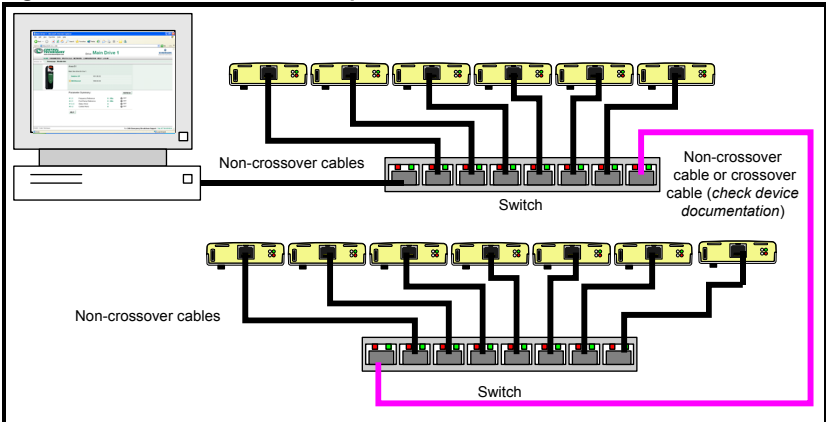
**Figure 4-4 Single PC to multiple SM-Ethernet modules using a switch**



### 4.9.3 Single PC to multiple SM-Ethernet using more than one switch

When using more than one switch, ensure that the cables connecting the switches are of the correct type. This will normally be a crossover cable, unless the switch supports auto crossover correction or has a switch to convert the socket, if this is the case a non-cross-over lead may be used. Please consult the documentation supplied with the switch for more information.

**Figure 4-5 Connections with multiple switches**



### 4.9.4 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 5.7.1 *The IP address* on page 19 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

## 5.1 Minimum software versions required for Ethernet

Table 5.1 below, lists the minimum versions of software required for Ethernet communication.

**Table 5.1 Required software versions for communication over Ethernet**

| Product         | Software Version          |
|-----------------|---------------------------|
| Unidrive SP     | Version 01.06.00 or later |
| Commander SK    | Version 01.06.00 or later |
| Digitax ST      | Version 01.00.00 or later |
| Affinity        | Version 01.00.00 or later |
| Mentor MP       | Version 01.00.00 or later |
| SM-Applications | Version 01.04.05 or later |
| SM-Ethernet     | Version 01.02.00 or later |
| OPC Server      | Version 03.01.00 or later |
| CTScope         | Version 01.00.00 or later |
| SyPTPro         | Version 02.01.00 or later |
| CTSoft          | Version 01.05.00 or later |

## 5.2 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.

**NOTE** The use of un-switched hubs is not recommended.

## 5.3 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 5.7.1 The IP address on page 19*). Generally devices on different subnets can only communicate by using a gateway (*typically a router or firewall*).

## 5.4 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.

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## 5.5 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.

## 5.6 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 5.2 shows an overview of how the class types are defined and Table 5.3 shows how each class separates the subnet and host ID.

**Table 5.2 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 5.3 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.

### 5.6.1 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 organisations 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.

### 5.6.2 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.

### 5.6.3 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.

### 5.6.4 Class D & E addresses

These addresses are reserved for multicasting and experimental use.

## 5.7 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.

### 5.7.1 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 example 192.168.0.1 (*class c*)

### 5.7.2 The subnet mask

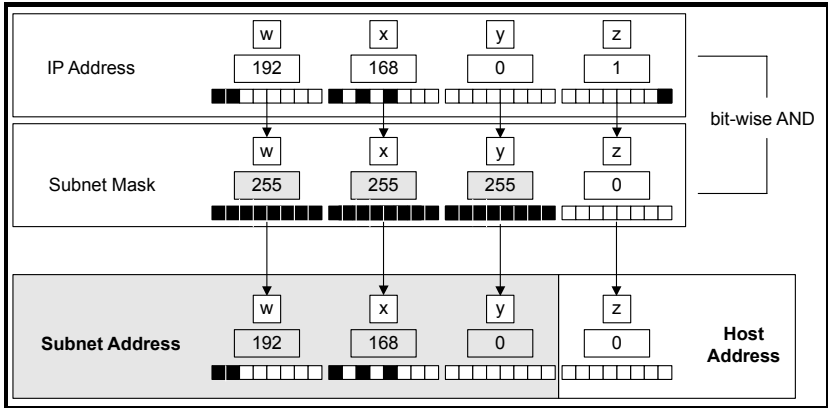
The subnet mask defines what part of the address constitutes the subnet within the IP address and what part of the address constitutes the host address. The subnet mask is bit-wise ANDed with the address to give the subnet to which the host belongs. A typical class C subnet mask would be 255.255.255.0, 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

### 5.7.3 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**



## 5.8 DHCP considerations

### 5.8.1 Using fixed IP addressing

Using fixed IP addresses (*manually configured*) on SM-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 SM-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. For more information on manual configuration see section 7.2.6 *Network* on page 72.

### 5.8.2 Using DHCP

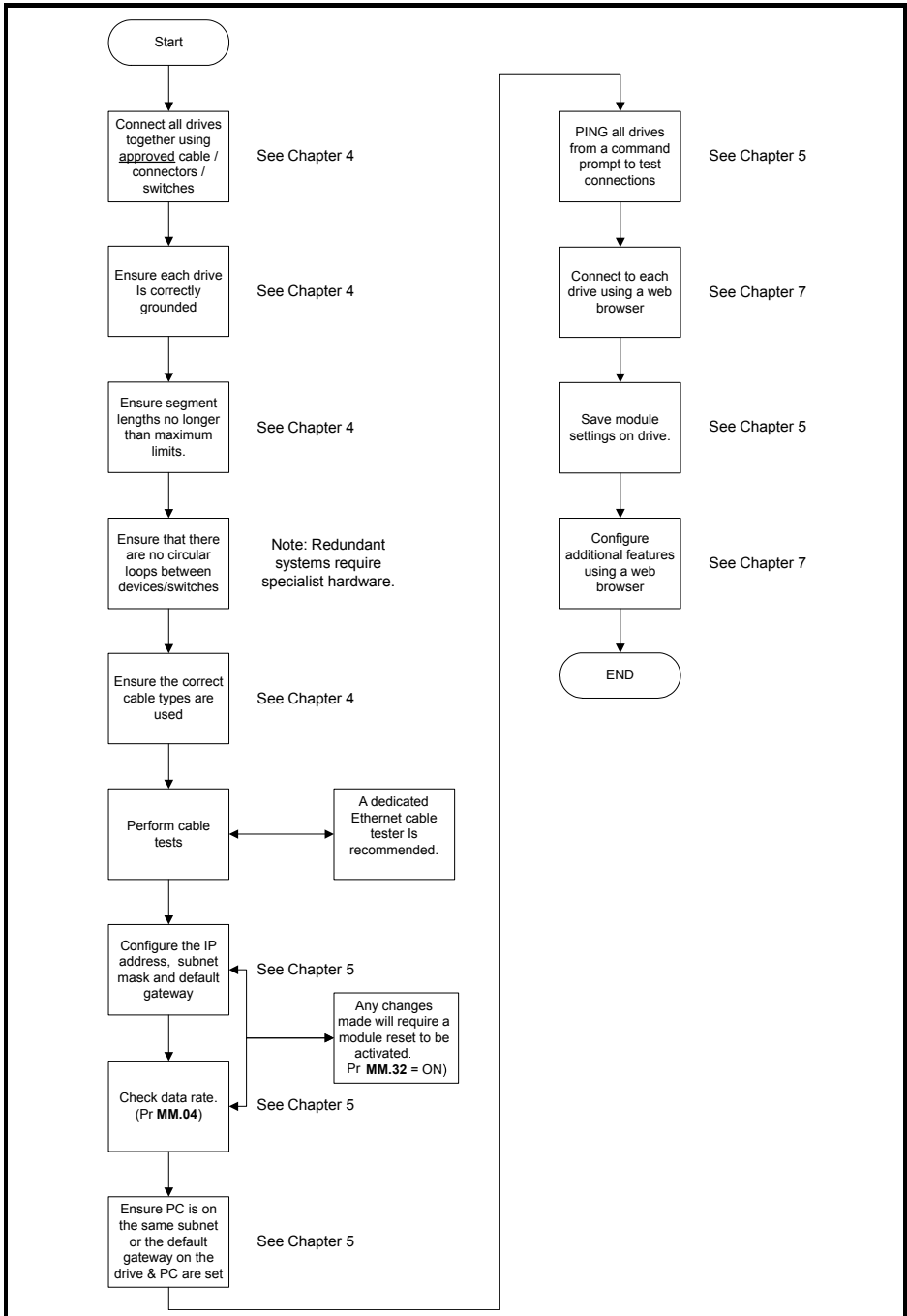
If DHCP is used it is recommended that the allocated IP address is allocated SM-Ethernet's MAC address, this strategy prevents the IP address changing on the SM-Ethernet. Any leased addresses should be leased permanently to prevent IP address changes.

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

## 5.9 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.

# 5.10 Set-up flow chart



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## 5.11 Setting the IP address

The SM-Ethernet IP address is formed by taking the component parts of the address from parameters Pr **MM.10** to Pr **MM.13** and combining them as in Figure 5-2. The address is then used in conjunction with the subnet mask.

**Figure 5-2 The IP address**

|                        |                 |                 |                 |                 |
|------------------------|-----------------|-----------------|-----------------|-----------------|
| SM-Ethernet IP address | $W_{ip}$        | $X_{ip}$        | $Y_{ip}$        | $Z_{ip}$        |
|                        | Pr <b>MM.10</b> | Pr <b>MM.11</b> | Pr <b>MM.12</b> | Pr <b>MM.13</b> |

**NOTE** When DHCP is enabled (see section 5.15 *DHCP (Dynamic Host Configuration Protocol)* on page 25) 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.

### 5.11.1 SM-Ethernet IP address $W_{ip}$

| SM-Ethernet IP address $W_{ip}$ |         |          |
|---------------------------------|---------|----------|
| Pr <b>MM.10</b>                 | Default | 192      |
|                                 | Range   | 0 to 255 |
|                                 | Access  | RW       |

This is the most significant octet of SM-Ethernet's IP address. When using DHCP this will be updated from the DHCP server.

### 5.11.2 SM-Ethernet IP address $X_{ip}$

| SM-Ethernet IP address $X_{ip}$ |         |          |
|---------------------------------|---------|----------|
| Pr <b>MM.11</b>                 | Default | 168      |
|                                 | Range   | 0 to 255 |
|                                 | Access  | RW       |

This is the second most significant octet of SM-Ethernet's IP address. When using DHCP this will be updated from the DHCP server.

### 5.11.3 SM-Ethernet IP address $Y_{ip}$

| SM-Ethernet IP address $Y_{ip}$ |         |          |
|---------------------------------|---------|----------|
| Pr <b>MM.12</b>                 | Default | 1        |
|                                 | Range   | 0 to 255 |
|                                 | Access  | RW       |

This is the third most significant octet of SM-Ethernet's IP address. When using DHCP this will be updated from the DHCP server.

### 5.11.4 SM-Ethernet IP address $Z_{ip}$

| SM-Ethernet IP address $Z_{ip}$ |         |          |
|---------------------------------|---------|----------|
| Pr <b>MM.13</b>                 | Default | 100      |
|                                 | Range   | 0 to 255 |
|                                 | Access  | RW       |

This is the least significant octet of SM-Ethernet's IP address. When using DHCP this will be updated from the DHCP server.

## 5.12 Setting the subnet mask

The SM-Ethernet subnet mask is formed by taking the component parts of the subnet mask from parameters Pr **MM.14** to Pr **MM.17** and combining them as in Figure 5-3. The subnet mask is then used in conjunction with the IP address.

**Figure 5-3 The subnet mask**

|                            |                     |                     |                     |                     |
|----------------------------|---------------------|---------------------|---------------------|---------------------|
| SM-Ethernet<br>subnet mask | $W_{\text{subnet}}$ | $X_{\text{subnet}}$ | $Y_{\text{subnet}}$ | $Z_{\text{subnet}}$ |
|                            | Pr <b>MM.14</b>     | Pr <b>MM.15</b>     | Pr <b>MM.16</b>     | Pr <b>MM.17</b>     |

**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.

### 5.12.1 SM-Ethernet IP subnet mask $W_{\text{subnet}}$

| SM-Ethernet IP subnet mask $W_{\text{subnet}}$ |                |          |
|--|----------------|----------|
| Pr <b>MM.14</b>                                | <b>Default</b> | 255      |
|  | <b>Range</b>   | 0 to 255 |
|  | <b>Access</b>  | RW       |

This is the most significant octet of SM-Ethernet's IP subnet mask. When using DHCP this will be updated from the DHCP server.

### 5.12.2 SM-Ethernet IP subnet mask $X_{\text{subnet}}$

| SM-Ethernet IP address $X_{\text{subnet}}$ |                |          |
|--|----------------|----------|
| Pr <b>MM.15</b>                            | <b>Default</b> | 255      |
|  | <b>Range</b>   | 0 to 255 |
|  | <b>Access</b>  | RW       |

This is the second most significant octet of SM-Ethernet's IP subnet mask. When using DHCP this will be updated from the DHCP server.

### 5.12.3 SM-Ethernet IP subnet mask $Y_{\text{subnet}}$

| SM-Ethernet IP subnet mask $Y_{\text{subnet}}$ |                |          |
|--|----------------|----------|
| Pr <b>MM.16</b>                                | <b>Default</b> | 255      |
|  | <b>Range</b>   | 0 to 255 |
|  | <b>Access</b>  | RW       |

This is the third most significant octet of SM-Ethernet's IP subnet mask. When using DHCP this will be updated from the DHCP server.

### 5.12.4 SM-Ethernet IP subnet mask $Z_{\text{subnet}}$

| SM-Ethernet IP subnet mask $Z_{\text{subnet}}$ |                |          |
|--|----------------|----------|
| Pr <b>MM.17</b>                                | <b>Default</b> | 0        |
|  | <b>Range</b>   | 0 to 255 |
|  | <b>Access</b>  | RW       |

This is the least significant octet of SM-Ethernet's IP subnet mask. When using DHCP this will be updated from the DHCP server.

## 5.13 Setting the default gateway

The SM-Ethernet's default gateway is formed by taking the component parts of the default gateway from parameters Pr **MM.18** to Pr **MM.21** 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.

**Figure 5-4 The default gateway**

|                            |                      |                      |                      |                      |
|----------------------------|----------------------|----------------------|----------------------|----------------------|
| SM-Ethernet<br>subnet mask | $W_{\text{gateway}}$ | $X_{\text{gateway}}$ | $Y_{\text{gateway}}$ | $Z_{\text{gateway}}$ |
|                            | Pr <b>MM.18</b>      | Pr <b>MM.19</b>      | Pr <b>MM.20</b>      | Pr <b>MM.21</b>      |

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.

### 5.13.1 SM-Ethernet IP default gateway $W_{\text{gateway}}$

| SM-Ethernet IP default gateway $W_{\text{gateway}}$ |         |          |
|---|---------|----------|
| Pr <b>MM.18</b>                                     | Default | 192      |
|   | Range   | 0 to 255 |
|   | Access  | RW       |

This is the most significant octet of SM-Ethernet's default gateway address. When using DHCP this will be updated from the DHCP server.

### 5.13.2 SM-Ethernet IP default gateway $X_{\text{gateway}}$

| SM-Ethernet IP default gateway $X_{\text{gateway}}$ |         |          |
|---|---------|----------|
| Pr <b>MM.19</b>                                     | Default | 168      |
|   | Range   | 0 to 255 |
|   | Access  | RW       |

This is the second most significant octet of SM-Ethernet's default gateway address. When using DHCP this will be updated from the DHCP server.

### 5.13.3 SM-Ethernet IP default gateway $Y_{\text{gateway}}$

| SM-Ethernet IP default gateway $Y_{\text{gateway}}$ |         |          |
|---|---------|----------|
| Pr <b>MM.20</b>                                     | Default | 1        |
|   | Range   | 0 to 255 |
|   | Access  | RW       |

This is the third most significant octet of SM-Ethernet's default gateway address. When using DHCP this will be updated from the DHCP server.



### 5.13.4 SM-Ethernet IP default gateway $Z_{gateway}$

| SM-Ethernet IP default gateway $Z_{gateway}$ |         |          |
|--|---------|----------|
| Pr MM.21                                     | Default | 254      |
|  | Range   | 0 to 255 |
|  | Access  | RW       |

This is the least significant octet of SM-Ethernet's default gateway address. When using DHCP this will be updated from the DHCP server.

## 5.14 SM-Ethernet baud rate

| SM-Ethernet baud rate |         |        |
|-----------------------|---------|--------|
| Pr MM.04              | Default | 0      |
|                       | Range   | 0 to 2 |
|                       | Access  | RW     |

SM-Ethernet can be set to automatically detect the baud rate or be fixed at either 10Mbps or 100Mbps. Pr MM.44 will indicate the data rate that is being used by the SM-Ethernet.

**Table 5.4 SM-Ethernet baud rate**

| Pr MM.04 | baud rate   |
|----------|-------------|
| 0        | Auto detect |
| 1        | 10Mbps      |
| 2        | 100Mbps     |

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

## 5.15 DHCP (Dynamic Host Configuration Protocol)

### 5.15.1 DHCP enable

| DHCP enable |         |        |
|-------------|---------|--------|
| Pr MM.05    | Default | 0      |
|             | Ranges  | 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 SM-Ethernet.

**Table 5.5 DHCP options**

| Pr MM.05 | DHCP enable             |
|----------|-------------------------|
| 0        | Use local configuration |
| 1        | Use DHCP server         |

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

### 5.15.2 DHCP server configuration

When using DHCP it is possible that every time SM-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 re-configuration.

*Control Techniques* recommend that the leased IP address for SM-Ethernet is allocated to SM-Ethernet's MAC address. This will prevent SM-Ethernet's IP address changing when it re-initialises or when the DHCP server renews the SM-Ethernet's lease.

## 5.16 SM-Ethernet operating status

| SM-Ethernet operating status |         |             |
|------------------------------|---------|-------------|
| Pr <b>MM.06</b>              | Default | N/A         |
|                              | Range   | -95 to 9999 |
|                              | Access  | RO          |

This parameter gives an approximation of the number of packets per second processed on SM-Ethernet, a value of zero indicates that SM-Ethernet is initialised and ready to communicate.

If this parameter is a negative value this indicates that the module is initialising or there is a fault. If this value is still negative after 3 minutes see section 11.5.1 *SM-Ethernet diagnostic information* on page 97.

## 5.17 Re-initialising SM-Ethernet

| Re-initialising SM-Ethernet |         |          |
|-----------------------------|---------|----------|
| Pr <b>MM.32</b>             | Default | OFF      |
|                             | Range   | OFF / ON |
|                             | Access  | RW       |

Changes to the SM-Ethernet configuration will not take effect until the SM-Ethernet has been re-initialised.

To re-initialise SM-Ethernet:

1. Set Pr **MM.32** to ON.
2. Before the reset takes place Pr **MM.32** will be reset to OFF.
3. The SM-Ethernet will re-initialise using the updated configuration.

**NOTE** This sequence does NOT store the SM-Ethernet configuration parameters in the host drive or the SM-Ethernet FLASH memory. Pr **MM.32** will revert to OFF immediately and may not be visible on the display.

## 5.18 Re-initialise all Solutions Modules

To re-initialise all Solutions Modules installed on a drive:

1. Set Pr **MM.00** to 1070. (See note regarding Commander SK).
2. Press the red RESET button on the drive.

**NOTE** This sequence does NOT store the SM-Ethernet configuration parameters in the drive or the SM-Ethernet FLASH memory. The 1070 reset will not work in the SM-Ethernet module if Pr **MM.37** is set to ON, although it will work for any other modules.

**NOTE** On Commander SK drives, Pr **00.00** is not available, a different menu number must be used, e.g. Pr **01.00**.

## 5.19 Saving parameters to the drive

To avoid loss of the configured settings when the drive is powered down it is necessary to write 1000 to Pr **MM.00** and then press the reset button to perform a drive save.

To store drive parameters:

- Set Pr **MM.00** to 1000. (See notes).
- Press the red RESET button.

The drive will store all parameters (except Menu 20), but the operation of the SM-Ethernet will not be affected. Changes made to the SM-Ethernet configuration parameters will not take effect until the SM-Ethernet is re-initialised.

**NOTE** Menu 20 may be saved in memory (not Commander SK) if an SM-Applications is installed. See the *SM-APPLICATIONS/SM-APPLICATIONS LITE User Guide* documentation for more information. If the host drive is running on a low voltage supply only or has a UU trip active the value 1001 must be used instead of 1000.

**NOTE** On Commander SK drives, Pr **00.00** is not available, a different menu number must be used, e.g. Pr **01.00**.

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## 6 Protocols

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SM-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 SM-Ethernet, then both SM-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 SM-Ethernet implementation of Modbus TCP/IP follows the specification provided by the Modbus organisation. 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                               |
|------|---|
| 3    | Read multiple 16 bit registers.           |
| 6    | Write single 16 bit register.             |
| 16   | Write multiple 16 bit registers.          |
| 23   | Read and write multiple 16 bit registers. |

#### Modbus TCP/IP port

The port number used for Modbus TCP/IP may be reconfigured to a different port number using Pr **62.04** as detailed in Table 6.2 *SM-Ethernet Modbus TCP/IP configuration*.

**Table 6.2 SM-Ethernet Modbus TCP/IP configuration**

| SM-Ethernet Modbus TCP/IP configuration |                |            |
|---|----------------|------------|
| Pr <b>62.04</b>                         | <b>Default</b> | 502        |
|   | <b>Range</b>   | 0 to 65535 |
|   | <b>Access</b>  | RW         |

A timer is available under the MODBUS IP configuration section of the web pages to allow loss of MODBUS communications to be managed (see Chapter 12 *Advanced features* on page 101 for more Modbus I/P options).

**NOTE** Unidrive SP versions prior to V01.06.00 with SM-Ethernet versions after V01.01.00 are not capable of supporting CMP Port-ID 0. This will prevent communications to the drive, ensure the latest drive and SM-Ethernet firmware are used.

**NOTE** The SM-Ethernet module must request control of the EIA-485 (RS-485) buffer to enable reliable communication in this mode. This is done by setting Pr **MM.37** to ON.

## 6.3 Web pages (HTTP)

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

In addition to the standard web pages it is possible to generate custom pages for displaying drive parameters for diagnostic or basic HMI (human machine interface) style displays. For more information on custom web pages please refer to Chapter 8 *FTP/custom pages* on page 73.

To view web pages on SM-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:

- Parameters.
- Protocol configuration.
- Network configuration.
- General configuration.
- Help pages providing guidance on use.
- System file updates for SM-Ethernet.
- Language support.

For details of the web pages please see Chapter 7 *Web page basics* on page 66.

## 6.4 FTP

FTP will allow custom web page changes on SM-Ethernet. If an appropriate network infrastructure exists it will be possible to perform these updates remotely.

SM-Ethernet has a basic file system that will allow the user to upload files. The following facilities are supported:

- Web page languages
- Custom web pages

See Chapter 8 *FTP/custom pages* on page 73 for more details.

## 6.5 SMTP (email)

SM-Ethernet provides a method for sending Emails based on events. Up to 3 Email messages may be configured to transmit on a pre-defined condition. For more information on SMTP see section 12.1 *Email configuration* on page 101.

## 6.6 SNTP (clock synchronisation)

SNTP allows synchronisation of SM-Ethernet's real-time clock with the time on a server. This time information can be written to parameters or can be used to trigger events specified in the 'Scheduled Events'. For more information on SNTP and scheduled events see section 12.2 *Scheduled events* on page 102.

## 6.7 EtherNet/IP

SM-Ethernet (v01.03.00 and later) supports the EtherNet/IP protocol and conforms to the EtherNet/IP adaptation of the Common Industrial Protocol (CIP) Specification. This is the same upper-layer protocol and object model as used in DeviceNet.

The SM-Ethernet module will operate as a slave device and the following functionality is supported.

- Variable length input assembly object (instance 100).
- Variable length output assembly object (instance 101).
- Maximum assembly object size of 160 bytes (40 parameters).
- Explicit (non-cyclic) access to parameters.
- A.C. and D.C. Drive Profiles.
- Management of consistent data transfer between SM-Ethernet and SM-Applications modules.
- Configuration via the web page interface.

### 6.7.1 Performance

The performance of EtherNet/IP will depend on several factors, including the data rate, EtherNet/IP thread priority and network traffic. If the EtherNet/IP thread is allocated a high priority and the network traffic is dominated by EtherNet/IP then the following performance should be achieved.

- Turn around time for polled (implicit) data of 2ms.
- Turn around time for non-cyclic (explicit) data of 5ms.

**NOTE** Access to SM-Applications using the inter-option communication channel will extend these times.

**NOTE** These network performance timings are not guaranteed and will vary depending on the network configuration.

**NOTE** The performance values stated above will also be slower on Commander SK due to the hardware differences of the Commander SK.

### 6.7.2 Configuration

The EtherNet/IP configuration can be accessed from the top-level **PROTOCOLS** menu of the web page interface. From this page, the following general configuration settings can be viewed or changed.

- Connection status (view only).
- Advanced EDS file - *disabled* or *enabled*.
- Requested packet interval (RPI) timeout trip - *disabled* or *enabled*.
- Read consistency - *disabled* or *enabled*.
- Write consistency - *disabled* or *enabled*.

The cyclic (implicit) data parameter mapping configuration can also be changed from this page. For more information on cyclic data parameter mappings see section 6.7.10 *Configuring SM-Ethernet cyclic parameters* on page 33.

**NOTE** The user must be logged in as an "Administrator" or "Super user" to change the configuration settings.

### 6.7.3 Connection Status

This indicates if a cyclic (implicit) connection has been made and whether cyclic data transfer is in progress. If no cyclic connection has been made then the status will indicate “Awaiting Connection”, if a cyclic connection has been made then the status will indicate “Connected”.

### 6.7.4 Advanced EDS File

If the advanced EDS file is disabled, then the identity object will only contain the product code and revision number, if the advanced EDS file is enabled, then the information in the identity object will also contain details of other option modules installed in the other option slots and an appropriate EDS file containing a comprehensive parameter list will be required by the PLC.

*Control Techniques* does not currently provide advanced EDS files, but suitable generic files are usually available from the PLC supplier.

For more information on the identity object see section 6.7.23 *Identity object* on page 47.

### 6.7.5 Requested Packet Interval (RPI) timeout trip

This timeout is defined by the EtherNet/IP protocol and is configured in the PLC master. If enabled, then SM-Ethernet will monitor the data traffic and if data is not received within the specified time, it will force a drive trip (SL1.Er, SL2.Er or SL3.Er, depending on which slot the solutions module is installed to, for Unidrive SP/Affinity/Digitax ST/Mentor MP or SL.Er for Commander SK) and a trip code in Pr **MM.50** of 50. This indicates that SM-Ethernet has detected that the cyclic data communication has been interrupted.

**NOTE** The trip will only occur if the drive experiences a loss of network traffic for the specified duration, i.e. if data was being received but was then interrupted. The trip will not occur if no network traffic has been detected.

### 6.7.6 Read consistency (data skew)

Under normal conditions, cyclic data is sampled at the EtherNet/IP task tick rate and transmitted at the Requested Packet Interval (RPI). However, if another option module was in the process of modifying the mapped parameters while these parameters were being sampled, then the data transmitted across the network may not be consistent across the entire assembly object. If read consistency is enabled (and a trigger parameter specified) then data will only be sampled when the trigger parameter contains a non-zero value. This trigger parameter will then be set to zero after the data has been sampled.

It is therefore possible, by controlling the trigger parameters, that an SM-Applications module can ensure that the values in the cyclic data parameters are not sampled until all values are updated.

Whether consistency is enabled or not, data will always be consistent for an individual parameter, i.e. all 4 bytes of a 32 bit value will be consistent.

**NOTE** The trigger parameter is a parameter that is used by SM-Ethernet to allow cyclic parameters to be sampled and is configured from the **EtherNet/IP** sub-menu of the **PROTOCOLS** menu. This parameter value will be set to zero when either the SM-Ethernet module or the drive is reset.

### 6.7.7 Write consistency (data skew)

Under normal conditions, cyclic data is written whenever a value in the assembly object changes. However, if another option module was in the process of reading the mapped parameters while these parameters were being written, then the data obtained will not be consistent. If write consistency is enabled (and a trigger parameter specified) then data will only be written when the trigger parameter contains a value of zero. This trigger parameter will then be set to one after the data has been written.

It is therefore possible, by controlling the trigger parameters, that an SM-Applications module can ensure that the values sampled are consistent.

Whether consistency is enabled or not, data will always be consistent for an individual parameter, i.e. all 4 bytes of a 32 bit value will be consistent.

**NOTE** The trigger parameter is a parameter that is used by SM-Ethernet to allow cyclic parameters to be written and is configured from the **EtherNet/IP** sub-menu of the **PROTOCOLS** menu. This parameter value will be set to zero when either the SM-Ethernet module or the drive is reset.

#### Example

In this example, Pr **20.01** is set as the “read trigger” parameter and Pr **20.02** set as the “write trigger” parameter in the SM-Ethernet module, the PLC master is configured to add the values of Pr **20.11**, Pr **20.12** and Pr **20.13**, and write the result to Pr **20.21**, the SM-Applications module is configured to increment the values of Pr **20.11**, Pr **20.12** and Pr **20.13** by 1 each time the background task is executed.

With read and write consistency enabled, SM-Ethernet will sample the cyclic data parameters when the value of Pr **20.01** is not zero and write the cyclic data when the value of Pr **20.02** is zero.

The DPL code in the SM-Application module may be written as follows:

```
Initial{
// Initialise variable
    newvalue=0
} //Initial

Background{
top:
    if #20.02=1 then
        newvalue=#20.11           // Store #20.11 value
        #20.11=newvalue+1        // Increment #20.11 by 1
        newvalue=#20.12         // Store #20.12 value
        #20.12=newvalue+1        // Increment #20.12 by 1
        newvalue=#20.13         // Store #20.13 value
        #20.13=newvalue+1        // Increment #20.13 by 1
        #20.01=1                 // Enable sampling
        #20.02=0                 // Enable PLC writes
    endif
goto top: // main background loop
} //Background
```



### 6.7.8 Non-cyclic (explicit) data transfer

Non-cyclic or explicit messaging is used to read and write parameters non-cyclically by means of assembly objects. All of the AC Drives profile attributes can be accessed using explicit messaging. For more information on the AC Drives profile see section 6.7.26 *AC/DC Drive object* on page 60.

The *Control Techniques* object (class 100 or 0x64) provides access to all drive parameters using the following format.

|                    |                   |                             |
|--------------------|-------------------|-----------------------------|
| <i>Class code:</i> | <i>100 (0x64)</i> |                             |
| <i>Instance:</i>   | <i>Menu</i>       |                             |
| <i>Attribute:</i>  | <i>Parameter</i>  |                             |
| <i>Read code:</i>  | <i>14 (0x0E)</i>  | <i>Get_Attribute_Single</i> |
| <i>Write code:</i> | <i>16 (0x10)</i>  | <i>Set_Attribute_Single</i> |

**NOTE** An instance value of 0 is not a valid value in this context, therefore an instance value of 200 (0xC8) should be used to access menu 0 parameters. For more information on the *Control Techniques* object see section 6.7.27 *Control Techniques object* on page 64.

### 6.7.9 Cyclic (implicit or polled) data transfer

Cyclic data is a method of data transfer that must be set-up during network configuration, but is transmitted automatically once configuration is complete.

EtherNet/IP transfers cyclic data using assembly objects, “cyclic data” is also sometimes referred to as “polled data” or “implicit data”. The terms “input” and “output” refer to data from the perspective of the PLC, an “output” assembly object is used to transfer cyclic data from the PLC to SM-Ethernet, conversely, an “input” assembly object transfers data from SM-Ethernet to the PLC.

**NOTE** Some PLCs provide the option of transmitting a configuration assembly object. The SM-Ethernet module does not use a configuration object, if one is required by the PLC configuration tool, then instance 1 should be specified with a length of 0 bytes.

**NOTE** The web pages are used to configure the parameter information that is transmitted within the assembly objects. For more information on configuring the mapping parameters see section 6.7.10 *Configuring SM-Ethernet cyclic parameters* on page 33.

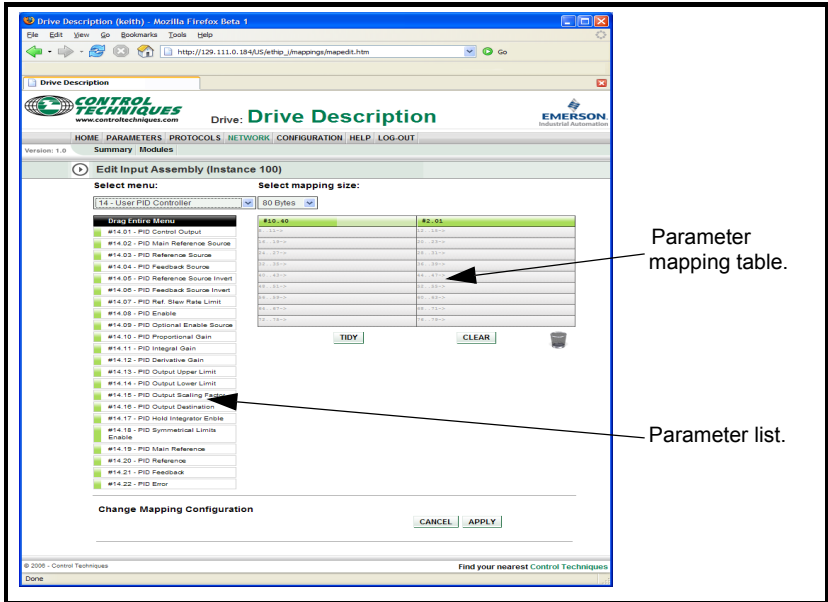
### 6.7.10 Configuring SM-Ethernet cyclic parameters

In order to use cyclic data over EtherNet/IP, SM-Ethernet must be configured to map the required parameter data to the assembly object. Object 100 (0x64) is used for reading parameters and object 101 (0x65) is used for writing parameters. To change the mapping configuration, open the web page “EtherNet/IP” from the **PROTOCOLS** menu, and select the appropriate assembly object, from here the required parameters may be mapped to the selected assembly object. Figure 6-1 on page 34, shows a sample web page configuration screen for mapping parameters.

The first requirement is to set the number of bytes to be allocated (mapping size), this can range from 4 to 160 bytes in increments of 4. Each drive parameter requires 4 bytes of data, this means that the minimum number of parameters that can be allocated is 1 and the maximum is 40.

**NOTE** The SM-Ethernet parameter mapping configuration screen refers to bytes of data, the PLC configuration tool may refer to words of data, a data word consists of 2 bytes or 16 bits of data. A double word (32 bits or 4 bytes) is used for each drive parameter.

**Figure 6-1 SM-Ethernet parameter mapping configuration**



A single parameter may be selected by “dragging” it from the parameter list on the left side of the page to the parameter mapping table on the right side of the page or, alternatively, “double-clicking” on it will append it to the end of the list in the table.

A range of parameters may be selected by “double-clicking” on the ‘Parameter mapping table’ at the position required to be allocated up to, the table will be automatically filled up to this position. If no parameter has been previously allocated, the first parameter in the parameter list will be used.

The “TIDY” button can be used to remove any un-allocated spaces in the parameter mapping table by moving allocated parameters up.

To remove all allocated mappings in the table, the “CLEAR” button can be pressed.

To accept the changes made, click on the “APPLY” button. To cancel the changes and revert back to the previous configuration, click on the “CANCEL” button.

**NOTE**

If the web pages are not displayed as shown or do not function correctly then the browser settings may need to be checked to allow the Java script controls to function correctly.

## 6.7.11 Configuring the PLC

Due to the many different makes of PLCs available, the information in this section may not be relevant to all types of PLCs. The information supplied in this section relates to the “ControlLogix” family of controllers supplied by “Allen Bradley”.

### NOTE

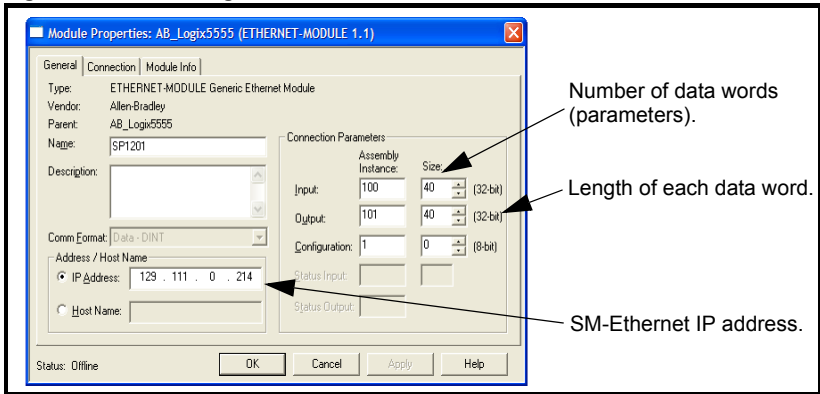
Although the Allen Bradley PLCs are mentioned in this document, this does not represent an endorsement of any particular PLC type or PLC manufacturer.

When configuring the PLC for cyclic communication with SM-Ethernet, the length of each parameter data word and the number of parameters must be specified correctly, Figure 6-2, shows the PLC configuration for 40 input parameters and 40 output parameters, as each parameter consists of 32 bits (4 bytes), the length of each data word should be set to 32 bits (DINT - double integer word).

The length of each data word (*Comm Format in the PLC configuration in Figure 6-2*) must normally be configured when the Ethernet module is created within the PLC and can not be changed. If a different length is required then a new Ethernet module must be created.

In order to communicate with the SM-Ethernet, the PLC must have the SM-Ethernet IP address set correctly as illustrated in Figure 6-2.

**Figure 6-2 PLC configuration**



## 6.7.12 Assembly objects

An assembly object is an object which contains a group of attributes to control or monitor the drive operation. These attributes can be members of EtherNet/IP objects or drive parameters. SM-Ethernet supports a series of standard assembly objects (see section 6.7.13 *Supported drive assembly objects* on page 36) and two *Control Techniques* objects to access the drive parameters.

**Table 6.3 Control Techniques assembly objects**

| Number                    | Type   | Length (bytes) | Default Length (bytes) | Default Mappings |                |
|---------------------------|--------|----------------|------------------------|------------------|----------------|
|                           |        |                |                        | Bytes 0 to 3     | Bytes 4 to 7   |
| 0x64 (100 <sub>10</sub> ) | Input  | 4 to 160       | 8                      | Pr <b>10.40</b>  | Pr <b>2.01</b> |
| 0x65 (101 <sub>10</sub> ) | Output | 4 to 160       | 8                      | Pr <b>6.42</b>   | Pr <b>1.21</b> |

### 6.7.13 Supported drive assembly objects

The EtherNet/IP protocol includes a series of pre-defined assembly objects to control and monitor the drive operation. Table 6.4 *Pre-defined drive assembly objects* on page 36 lists these assembly objects and their functions.

**NOTE**

Conformance with the pre-defined assembly objects specification can only be guaranteed if the speed reference configuration of the drive has not been changed from the default settings. For information on setting default values, refer to the appropriate drive user guide.

**Table 6.4 Pre-defined drive assembly objects**

| Object                   | Type   | Object name                               |
|--------------------------|--------|---|
| 0x14 (20 <sub>10</sub> ) | Output | Basic speed control output.               |
| 0x15 (21 <sub>10</sub> ) | Output | Extended speed control output.            |
| 0x16 (22 <sub>10</sub> ) | Output | Speed and torque control output.          |
| 0x17 (23 <sub>10</sub> ) | Output | Extended speed and torque control output. |
| 0x46 (70 <sub>10</sub> ) | Input  | Basic speed feedback.                     |
| 0x47 (71 <sub>10</sub> ) | Input  | Extended speed feedback.                  |
| 0x48 (72 <sub>10</sub> ) | Input  | Basic speed and torque feedback.          |
| 0x49 (73 <sub>10</sub> ) | Input  | Extended speed and torque feedback.       |

### 6.7.14 Basic speed control

#### Output assembly object 0x14 (20<sub>10</sub>)

The PLC or scanner must be configured for 4 output bytes (or 2 output words) if this assembly object is to be used.

**Table 6.5 Basic speed control**

| Data word | Function                             |
|-----------|--------------------------------------|
| Word 0    | Basic control word.                  |
| Word 1    | Speed reference ( <i>SpeedRef</i> ). |

#### Basic control word

The basic control word consists of 2 bytes (16 bits), with only 2 bits of the low byte being used as shown below.

|            |            |            |            |            |            |           |           |
|------------|------------|------------|------------|------------|------------|-----------|-----------|
| <b>b15</b> | <b>b14</b> | <b>b13</b> | <b>b12</b> | <b>b11</b> | <b>b10</b> | <b>b9</b> | <b>b8</b> |
|            |            |            |            |            |            |           |           |
| <b>b7</b>  | <b>b6</b>  | <b>b5</b>  | <b>b4</b>  | <b>b3</b>  | <b>b2</b>  | <b>b1</b> | <b>b0</b> |
|            |            |            |            |            | FaultRst   |           | RunFwd    |

The individual bit functions are described as follows:

| Name     | Control Word | Description  |
|----------|--------------|--|
| RunFwd   | b0           | Set this bit to command the drive to run in the forward direction.         |
| FaultRst | b2           | A 0 to 1 transition will reset the drive if the drive was in a trip state. |

**NOTE** For the drive to run at the speed specified in Word 1, Pr **6.43** must be *ON* and bit 0, bit 7 and bit 8 of the drive control word (Pr **6.42**) must all be set to 1 and the external hardware enable signal must be present.

The individual bit functions for the drive control word are shown in Table 6.6 below.

**Table 6.6 Drive control word bit functions**

| Bit | Function                 | Equivalent parameter |
|-----|--------------------------|----------------------|
| 0   | Drive enable.            | Pr <b>6.15</b>       |
| 1   | Run forward.             | Pr <b>6.30</b>       |
| 2   | Jog forward.             | Pr <b>6.31</b>       |
| 3   | Run reverse.             | Pr <b>6.32</b>       |
| 4   | Forward/reverse.         | Pr <b>6.33</b>       |
| 5   | Run.                     | Pr <b>6.34</b>       |
| 6   | Not stop.                | Pr <b>6.39</b>       |
| 7   | Auto/manual.             | N/A                  |
| 8   | Analog/preset reference. | Pr <b>1.42</b>       |
| 9   | Jog reverse.             | Pr <b>6.37</b>       |
| 10  | Reserved.                | N/A                  |
| 11  | Reserved.                | N/A                  |
| 12  | Trip drive.              | N/A                  |
| 13  | Reserved.                | Pr <b>10.33</b>      |
| 14  | Keypad watchdog.         | N/A                  |

### Speed reference (*SpeedRef*)

The speed reference word utilises 2 bytes (16 bits) as shown below.

|                      |            |            |            |            |            |           |           |
|----------------------|------------|------------|------------|------------|------------|-----------|-----------|
| <b>b15</b>           | <b>b14</b> | <b>b13</b> | <b>b12</b> | <b>b11</b> | <b>b10</b> | <b>b9</b> | <b>b8</b> |
| SpeedRef (high byte) |            |            |            |            |            |           |           |
| <b>b7</b>            | <b>b6</b>  | <b>b5</b>  | <b>b4</b>  | <b>b3</b>  | <b>b2</b>  | <b>b1</b> | <b>b0</b> |
| SpeedRef (low byte)  |            |            |            |            |            |           |           |

For more information on the setting of the speed reference see section 6.7.26 *AC/DC Drive object* on page 60.

### 6.7.15 Extended speed control

#### Output assembly object 0x15 (21<sub>10</sub>)

The PLC or scanner must be configured for 4 output bytes (or 2 output words) if this assembly object is to be used.

**Table 6.7 Extended speed control**

| Data word | Function                             |
|-----------|--------------------------------------|
| Word 0    | Extended control word.               |
| Word 1    | Speed reference ( <i>SpeedRef</i> ). |

### Extended control word

The extended control word consists of 2 bytes (16 bits), with only the low byte used as shown.

|     |        |         |     |     |          |        |        |
|-----|--------|---------|-----|-----|----------|--------|--------|
| b15 | b14    | b13     | b12 | b11 | b10      | b9     | b8     |
|     |        |         |     |     |          |        |        |
| b7  | b6     | b5      | b4  | b3  | b2       | b1     | b0     |
|     | NetRef | NetCtrl |     |     | FaultRst | RunRev | RunFwd |

The individual bit functions are described as follows:

| Name     | Control Word | Description   |
|----------|--------------|---|
| RunFwd   | b0           | Set this bit to command the drive to run in the forward direction.                                |
| RunRev   | b1           | Set this bit to command the drive to run in the reverse direction.                                |
| FaultRst | b2           | A 0 to 1 transition will reset the drive if the drive was in a trip state.                        |
| NetCtrl  | b5           | Used in conjunction with Pr 6.43 to enable the drive control word bits b0-b6 and bit 9 (Pr 6.42). |
| NetRef   | b6           | Set this bit to command the drive to use the remote speed reference value specified in Word 1.    |

**NOTE** For the drive to run at the speed specified in Word 1, Pr 6.43 must be ON and bit 0, bit 7 and bit 8 of the drive control word (Pr 6.42) must all be set to 1 and the external hardware enable signal must be present.

**NOTE** For information on the drive control word see Table 6.6 *Drive control word bit functions* on page 37.

### Speed reference (*SpeedRef*)

The speed reference word utilises 2 bytes (16 bits) as shown below.

|                      |     |     |     |     |     |    |    |
|----------------------|-----|-----|-----|-----|-----|----|----|
| b15                  | b14 | b13 | b12 | b11 | b10 | b9 | b8 |
| SpeedRef (high byte) |     |     |     |     |     |    |    |
| b7                   | b6  | b5  | b4  | b3  | b2  | b1 | b0 |
| SpeedRef (low byte)  |     |     |     |     |     |    |    |

For more information on the setting of the speed reference see section 6.7.26 *AC/DC Drive object* on page 60.

## 6.7.16 Basic speed and torque control

### Output assembly object 0x16 (22<sub>10</sub>)

The PLC or scanner must be configured for 6 output bytes (or 3 output words) if this assembly object is to be used.

**Table 6.8 Basic speed and torque control**

| Data Word | Function                               |
|-----------|--|
| Word 0    | Basic control word.                    |
| Word 1    | Speed reference ( <i>SpeedRef</i> ).   |
| Word 2    | Torque reference ( <i>TorqueRef</i> ). |

## Basic control word

The basic control word consists of 2 bytes (16 bits), with only 2 bits of the low byte being used as shown below.

|     |     |     |     |     |          |        |    |
|-----|-----|-----|-----|-----|----------|--------|----|
| b15 | b14 | b13 | b12 | b11 | b10      | b9     | b8 |
|     |     |     |     |     |          |        |    |
| b7  | b6  | b5  | b4  | b3  | b2       | b1     | b0 |
|     |     |     |     |     | FaultRst | RunFwd |    |

The individual bit functions are described as follows:

| Name     | Control Word | Description  |
|----------|--------------|--|
| RunFwd   | b0           | Set this bit to command the drive to run in the forward direction.         |
| FaultRst | b2           | A 0 to 1 transition will reset the drive if the drive was in a trip state. |

**NOTE** For the drive to run at the speed specified in Word 1, Pr **6.43** must be *ON* and bit 0, bit 7 and bit 8 of the drive control word (Pr **6.42**) must all be set to 1.

**NOTE** For information on the drive control word see Table 6.6 *Drive control word bit functions* on page 37.

## Speed reference (*SpeedRef*)

The speed reference word utilises 2 bytes (16 bits) as shown below.

|                      |     |     |     |     |     |    |    |
|----------------------|-----|-----|-----|-----|-----|----|----|
| b15                  | b14 | b13 | b12 | b11 | b10 | b9 | b8 |
| SpeedRef (high byte) |     |     |     |     |     |    |    |
| b7                   | b6  | b5  | b4  | b3  | b2  | b1 | b0 |
| SpeedRef (low byte)  |     |     |     |     |     |    |    |

For more information on the setting of the speed reference see section 6.7.26 *AC/DC Drive object* on page 60.

## Torque reference (*TorqueRef*)

The torque reference word utilises 2 bytes (16 bits) as shown below.

|                       |     |     |     |     |     |    |    |
|-----------------------|-----|-----|-----|-----|-----|----|----|
| b15                   | b14 | b13 | b12 | b11 | b10 | b9 | b8 |
| TorqueRef (high byte) |     |     |     |     |     |    |    |
| b7                    | b6  | b5  | b4  | b3  | b2  | b1 | b0 |
| TorqueRef (low byte)  |     |     |     |     |     |    |    |

For more information on the setting of the torque reference see section 6.7.26 *AC/DC Drive object* on page 60.

## 6.7.17 Extended speed and torque control

### Output assembly object 0x17 (23<sub>10</sub>)

The PLC or scanner must be configured for 6 output bytes (or 3 output words) if this assembly object is to be used.

**Table 6.9 Extended speed and torque control**

| Data word | Function                               |
|-----------|--|
| Word 0    | Extended control word.                 |
| Word 1    | Speed reference ( <i>SpeedRef</i> ).   |
| Word 2    | Torque reference ( <i>TorqueRef</i> ). |

### Extended control word

The extended control word consists of 2 bytes (16 bits), with only 5 bits of the low byte used as shown below.

|     |        |         |     |     |          |        |        |
|-----|--------|---------|-----|-----|----------|--------|--------|
| b15 | b14    | b13     | b12 | b11 | b10      | b9     | b8     |
|     |        |         |     |     |          |        |        |
| b7  | b6     | b5      | b4  | b3  | b2       | b1     | b0     |
|     | NetRef | NetCtrl |     |     | FaultRst | RunRev | RunFwd |

The individual bit functions are described as follows:

| Name     | Control Word | Description   |
|----------|--------------|---|
| RunFwd   | b0           | Set this bit to command the drive to run in the forward direction.                                |
| RunRev   | b1           | Set this bit to command the drive to run in the reverse direction.                                |
| FaultRst | b2           | A 0 to 1 transition will reset the drive if the drive was in a trip state.                        |
| NetCtrl  | b5           | Used in conjunction with Pr 6.43 to enable the drive control word bits b0-b6 and bit 9 (Pr 6.42). |
| NetRef   | b6           | Set this bit to command the drive to use the remote speed reference value specified in Word 1.    |

**NOTE** For the drive to run at the speed specified in Word 1, Pr 6.43 must be ON and bit 0, bit 7 and bit 8 of the drive control word (Pr 6.42) must all be set to 1 and the external hardware enable signal must be present.

**NOTE** For information on the drive control word see Table 6.6 *Drive control word bit functions* on page 37.

### Speed reference (*SpeedRef*)

The speed reference word utilises 2 bytes (16 bits) as shown below.

|                      |     |     |     |     |     |    |    |
|----------------------|-----|-----|-----|-----|-----|----|----|
| b15                  | b14 | b13 | b12 | b11 | b10 | b9 | b8 |
| SpeedRef (high byte) |     |     |     |     |     |    |    |
| b7                   | b6  | b5  | b4  | b3  | b2  | b1 | b0 |
| SpeedRef (low byte)  |     |     |     |     |     |    |    |

For more information on the setting of the speed reference see section 6.7.26 *AC/DC Drive object* on page 60.



## Torque reference (*TorqueRef*)

The torque reference word utilises 2 bytes (16 bits) as shown below.

|                       |            |            |            |            |            |           |           |
|-----------------------|------------|------------|------------|------------|------------|-----------|-----------|
| <b>b15</b>            | <b>b14</b> | <b>b13</b> | <b>b12</b> | <b>b11</b> | <b>b10</b> | <b>b9</b> | <b>b8</b> |
| TorqueRef (high byte) |            |            |            |            |            |           |           |
| <b>b7</b>             | <b>b6</b>  | <b>b5</b>  | <b>b4</b>  | <b>b3</b>  | <b>b2</b>  | <b>b1</b> | <b>b0</b> |
| TorqueRef (low byte)  |            |            |            |            |            |           |           |

For more information on the setting of the torque reference see section 6.7.26 *AC/DC Drive object* on page 60.

## 6.7.18 Basic speed feedback

### Input assembly object 0x46 (70<sub>10</sub>)

The PLC or scanner must be configured for 4 input bytes (or 2 input words) if this assembly object is to be used.

**Table 6.10 Basic speed feedback**

| Data word | Function                               |
|-----------|--|
| Word 0    | Basic status word.                     |
| Word 1    | Speed feedback ( <i>SpeedActual</i> ). |

### Basic status word

The basic status word consists of 2 bytes (16 bits), with only 2 bits of the low byte used as shown below.

|     |     |     |     |     |                |    |         |
|-----|-----|-----|-----|-----|----------------|----|---------|
| b15 | b14 | b13 | b12 | b11 | b10            | b9 | b8      |
|     |     |     |     |     |                |    |         |
| b7  | b6  | b5  | b4  | b3  | b2             | b1 | b0      |
|     |     |     |     |     | Running1 (Fwd) |    | Faulted |

The individual bit functions are described as follows:

| Bit | Name           | Description   |
|-----|----------------|---|
| b0  | Faulted        | Indicates whether the drive is OK or tripped (0=OK, 1=Tripped).               |
| b2  | Running1 (Fwd) | Indicates if the drive is running in the forward direction (0=False, 1=True). |

### Speed feedback (*SpeedActual*)

The speed feedback word utilises 2 bytes (16 bits) as shown below.

|                         |            |            |            |            |            |           |           |
|-------------------------|------------|------------|------------|------------|------------|-----------|-----------|
| <b>b15</b>              | <b>b14</b> | <b>b13</b> | <b>b12</b> | <b>b11</b> | <b>b10</b> | <b>b9</b> | <b>b8</b> |
| SpeedActual (high byte) |            |            |            |            |            |           |           |
| <b>b7</b>               | <b>b6</b>  | <b>b5</b>  | <b>b4</b>  | <b>b3</b>  | <b>b2</b>  | <b>b1</b> | <b>b0</b> |
| SpeedActual (low byte)  |            |            |            |            |            |           |           |

For more information on the speed feedback see section 6.7.26 *AC/DC Drive object* on page 60.

|                         |
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## 6.7.19 Extended speed feedback

### Input assembly object 0x47 (71<sub>10</sub>)

The PLC or scanner must be configured for 4 input bytes (or 2 input words) if this assembly object is to be used.

**Table 6.11 Extended speed feedback**

| Data word | Function                               |
|-----------|--|
| Word 0    | Extended status word.                  |
| Word 1    | Speed feedback ( <i>SpeedActual</i> ). |

### Extended status word

The extended status word consists of 2 bytes (16 bits), with the bits having functions as shown below.

| b15          | b14         | b13          | b12   | b11            | b10            | b9      | b8      |
|--------------|-------------|--------------|-------|----------------|----------------|---------|---------|
| DriveState   |             |              |       |                |                |         |         |
| b7           | b6          | b5           | b4    | b3             | b2             | b1      | b0      |
| At Reference | RefFrom Net | CtrlFrom Net | Ready | Running2 (Rev) | Running1 (Fwd) | Warning | Faulted |

The DriveState byte returns a code to indicate the operating state of the drive as shown in Table 6.12 below.

**Table 6.12 DriveState codes**

| Code | b15 - b8 | State           | Description  |
|------|----------|-----------------|--|
| 1    | 00000001 | Startup         | This state is skipped over on CT drives.                             |
| 2    | 00000010 | Not_Ready       | Inhibit.   |
| 3    | 00000011 | Ready           | Ready.   |
| 4    | 00000100 | Enabled         | Run or Stop (Stop is only enabled by default in Servo mode).         |
| 5    | 00000101 | Stopping        | Deceleration or Injection.   |
| 6    | 00000110 | Fault_Stop      | AC_UU (this will only occur if Mains Loss is enabled).               |
| 7    | 00000111 | Faulted         | Tripped.   |
| 0    | 00000000 | Vendor Specific | All other DriveType states, e.g. Scan, Orienting, Regen Active, etc. |

The individual bits of the low byte of the extended status word are described in Table 6.13 *Extended status word (low byte)* on page 43.

**Table 6.13 Extended status word (low byte)**

| Name           | Bit | Description   |
|----------------|-----|---|
| Faulted        | b0  | Indicates whether the drive is OK or tripped.<br>0=OK (Pr <b>10.01</b> =1).<br>1=Tripped (Pr <b>10.01</b> =0).  |
| Warning        | b1  | Indicates if one of the drive alarms is active.   |
| Running1 (Fwd) | b2  | Indicates if the drive is running in the forward direction.<br>0=False, 1=True.   |
| Running2 (Rev) | b3  | Indicates if the drive is running in the reverse direction.<br>0=False, 1=True.   |
| Ready          | b4  | The 'Ready' bit is set depending on which state the drive is in.<br>Ready = True.<br>Enabled = True.<br>Stopping = True.<br>All others = False.                               |
| CtrlFromNet    | b5  | Indicates if the drive is being controlled from the 'Drive Control Word'.<br>0=False, 1=True.   |
| RefFromNet     | b6  | Indicates if the speed reference is derived from Pr <b>1.21</b> .<br>0=False (Pr <b>1.50</b> <>1 OR Pr <b>1.49</b> <>3).<br>1=True (Pr <b>1.50</b> =1 AND Pr <b>1.49</b> =3). |
| AtReference    | b7  | Indicates if the drive speed has reached the set reference.<br>0=False (Pr <b>10.06</b> =0).<br>1=True (Pr <b>10.06</b> =1).  |

**Speed feedback (*SpeedActual*)**

The speed feedback word utilises 2 bytes (16 bits) as shown below.

|                        |            |            |            |            |            |           |           |
|------------------------|------------|------------|------------|------------|------------|-----------|-----------|
| <b>b15</b>             | <b>b14</b> | <b>b13</b> | <b>b12</b> | <b>b11</b> | <b>b10</b> | <b>b9</b> | <b>b8</b> |
| SpeedActual(high byte) |            |            |            |            |            |           |           |
| <b>b7</b>              | <b>b6</b>  | <b>b5</b>  | <b>b4</b>  | <b>b3</b>  | <b>b2</b>  | <b>b1</b> | <b>b0</b> |
| SpeedActual (low byte) |            |            |            |            |            |           |           |

For more information on the speed feedback see section 6.7.26 *AC/DC Drive object* on page 60.

**6.7.20 Basic speed and torque feedback****Input assembly object 0x48 (72<sub>10</sub>)**

The PLC or scanner must be configured for 6 input bytes (or 3 input words) if this assembly object is to be used.

**Table 6.14 Basic speed and torque feedback**

| Data word | Function                                 |
|-----------|--|
| Word 0    | Basic status word                        |
| Word 1    | Speed feedback ( <i>SpeedActual</i> ).   |
| Word 2    | Torque feedback ( <i>TorqueActual</i> ). |

### Basic status word

The basic status word consists of 2 bytes (16 bits), with only the low byte used as shown below.

|     |     |     |     |     |                   |    |         |
|-----|-----|-----|-----|-----|-------------------|----|---------|
| b15 | b14 | b13 | b12 | b11 | b10               | b9 | b8      |
|     |     |     |     |     |                   |    |         |
| b7  | b6  | b5  | b4  | b3  | b2                | b1 | b0      |
|     |     |     |     |     | Running1<br>(Fwd) |    | Faulted |

The individual bit functions are described as follows:

| Bit | Name              | Description   |
|-----|-------------------|---|
| b0  | Faulted           | Indicates whether the drive is OK or tripped (0=OK, 1=Tripped).               |
| b2  | Running1<br>(Fwd) | Indicates if the drive is running in the forward direction (0=False, 1=True). |

### Speed feedback (*SpeedActual*)

The speed feedback word utilises 2 bytes (16 bits) as shown below.

|                         |     |     |     |     |     |    |    |
|-------------------------|-----|-----|-----|-----|-----|----|----|
| b15                     | b14 | b13 | b12 | b11 | b10 | b9 | b8 |
| SpeedActual (high byte) |     |     |     |     |     |    |    |
| b7                      | b6  | b5  | b4  | b3  | b2  | b1 | b0 |
| SpeedActual (low byte)  |     |     |     |     |     |    |    |

For more information on the speed feedback see section 6.7.26 *AC/DC Drive object* on page 60.

### Torque feedback (*TorqueActual*)

The torque feedback word utilises 2 bytes (16 bits) as shown below.

|                          |     |     |     |     |     |    |    |
|--------------------------|-----|-----|-----|-----|-----|----|----|
| b15                      | b14 | b13 | b12 | b11 | b10 | b9 | b8 |
| TorqueActual (high byte) |     |     |     |     |     |    |    |
| b7                       | b6  | b5  | b4  | b3  | b2  | b1 | b0 |
| TorqueActual (low byte)  |     |     |     |     |     |    |    |

For more information on the torque feedback see section 6.7.26 *AC/DC Drive object* on page 60.

## 6.7.21 Extended speed and torque feedback

### Input assembly object 0x49 (73<sub>10</sub>)

The PLC or scanner must be configured for 6 input bytes (or 3 input words) if this assembly object is to be used.

**Table 6.15 Basic speed and torque feedback**

| Data word | Function                                 |
|-----------|--|
| Word 0    | Extended status word.                    |
| Word 1    | Speed feedback ( <i>SpeedActual</i> ).   |
| Word 2    | Torque feedback ( <i>TorqueActual</i> ). |

### Extended status word

The extended status word consists of 2 bytes (16 bits), with the bits having functions as shown below.

|              |             |              |       |                |                |         |         |
|--------------|-------------|--------------|-------|----------------|----------------|---------|---------|
| b15          | b14         | b13          | b12   | b11            | b10            | b9      | b8      |
| DriveState   |             |              |       |                |                |         |         |
| b7           | b6          | b5           | b4    | b3             | b2             | b1      | b0      |
| At Reference | RefFrom Net | CtrlFrom Net | Ready | Running2 (Rev) | Running1 (Fwd) | Warning | Faulted |

The DriveState byte returns a code to indicate the operating state of the drive as shown in Table 6.16.

**Table 6.16 DriveState codes**

| Code | b15 - b8 | State           | Description  |
|------|----------|-----------------|--|
| 1    | 00000001 | Startup         | This state is skipped over on CT drives.                             |
| 2    | 00000010 | Not_Ready       | Inhibit.   |
| 3    | 00000011 | Ready           | Ready.   |
| 4    | 00000100 | Enabled         | Run or Stop (Stop is only enabled by default in Servo mode).         |
| 5    | 00000101 | Stopping        | Deceleration or Injection.   |
| 6    | 00000110 | Fault_Stop      | AC_UU (this will only occur if Mains Loss is enabled).               |
| 7    | 00000111 | Faulted         | Tripped.   |
| 0    | 00000000 | Vendor Specific | All other DriveType states, e.g. Scan, Orienting, Regen Active, etc. |

The individual bits of the low byte of the extended status word are described in Table 6.17 *Extended status word (low byte)* on page 46.

**Table 6.17 Extended status word (low byte)**

| Name           | Bit | Description   |
|----------------|-----|---|
| Faulted        | b0  | Indicates whether the drive is OK or tripped.<br>0=OK (Pr <b>10.01</b> =1).<br>1=Tripped (Pr <b>10.01</b> =0).  |
| Warning        | b1  | Indicates if one of the drive alarms is active.   |
| Running1 (Fwd) | b2  | Indicates if the drive is running in the forward direction.<br>0=False, 1=True.   |
| Running2 (Rev) | b3  | Indicates if the drive is running in the reverse direction.<br>0=False, 1=True.   |
| Ready          | b4  | The 'Ready' bit is set depending on which state the drive is in.<br>Ready = True.<br>Enabled = True.<br>Stopping = True.<br>All others = False.                               |
| CtrlFromNet    | b5  | Indicates if the drive is being controlled from the 'Drive Control Word'.<br>0=False, 1=True.   |
| ReffFromNet    | b6  | Indicates if the speed reference is derived from Pr <b>1.21</b> .<br>0=False (Pr <b>1.50</b> <>1 OR Pr <b>1.49</b> <>3).<br>1=True (Pr <b>1.50</b> =1 AND Pr <b>1.49</b> =3). |
| AtReference    | b7  | Indicates if the drive speed has reached the set reference.<br>0=False (Pr <b>10.06</b> =0).<br>1=True (Pr <b>10.06</b> =1).  |

**Speed feedback (*SpeedActual*)**

The speed feedback word utilises 2 bytes (16 bits) as shown below.

|                        |            |            |            |            |            |           |           |
|------------------------|------------|------------|------------|------------|------------|-----------|-----------|
| <b>b15</b>             | <b>b14</b> | <b>b13</b> | <b>b12</b> | <b>b11</b> | <b>b10</b> | <b>b9</b> | <b>b8</b> |
| SpeedActual(high byte) |            |            |            |            |            |           |           |
| <b>b7</b>              | <b>b6</b>  | <b>b5</b>  | <b>b4</b>  | <b>b3</b>  | <b>b2</b>  | <b>b1</b> | <b>b0</b> |
| SpeedActual (low byte) |            |            |            |            |            |           |           |

For more information on the speed feedback see section 6.7.26 *AC/DC Drive object* on page 60.

**Torque feedback (*TorqueActual*)**

The torque feedback word utilises 2 bytes (16 bits) as shown below.

|                          |            |            |            |            |            |           |           |
|--------------------------|------------|------------|------------|------------|------------|-----------|-----------|
| <b>b15</b>               | <b>b14</b> | <b>b13</b> | <b>b12</b> | <b>b11</b> | <b>b10</b> | <b>b9</b> | <b>b8</b> |
| TorqueActual (high byte) |            |            |            |            |            |           |           |
| <b>b7</b>                | <b>b6</b>  | <b>b5</b>  | <b>b4</b>  | <b>b3</b>  | <b>b2</b>  | <b>b1</b> | <b>b0</b> |
| TorqueActual (low byte)  |            |            |            |            |            |           |           |

For more information on the torque feedback see section 6.7.26 *AC/DC Drive object* on page 60

## 6.7.22 Object Model

The Object Model has the following object classes present.

**Table 6.18 Supported Objects**

| Object Class             | Class Code                | No. of Instances | Effect   |
|--------------------------|---------------------------|------------------|--|
| Identity                 | 0x01 (1 <sub>10</sub> )   | 1                | Provides device information (See Table 6.19 on page 47)  |
| Motor Data               | 0x28 (40 <sub>10</sub> )  | 2                | Defines the motor data (For AC motors, see Table 6.25 on page 52) (For DC motors, see Table 6.27 on page 53) |
| Control Supervisor       | 0x29 (41 <sub>10</sub> )  | 1                | Provides drive control and monitoring information (See Table 6.28 on page 56)                                |
| AC/DC Drive              | 0x2A (42 <sub>10</sub> )  | 1                | Provides information on the drive running state (See Table 6.32 on page 60)                                  |
| Control Techniques Group | 0x64 (100 <sub>10</sub> ) | 45               | Provides an interface to drive parameters (See Table 6.34 on page 64)  |
| TCP/IP Interface         | 0xF5 (245 <sub>10</sub> ) | 1                | Provides the mechanism to configure the TCP/IP interface (See Section 6.7.28)                                |
| Ethernet Link            | 0xF6 (246 <sub>10</sub> ) | 1                | Maintains link specific counters and status information (See Section 6.7.29)                                 |

## 6.7.23 Identity object

**Class: 0x01 (1<sub>10</sub>)**

The identity object provides identification of and general information about the device.

**Table 6.19 Identity object**

| Attribute | Access | Name         | Data Type    |
|-----------|--------|--------------|--------------|
| 1         | Get    | VendorID     | UINT         |
| 2         | Get    | DeviceType   | UINT         |
| 3         | Get    | ProductCode  | UINT         |
| 4         | Get    | Revision     | USINT        |
| 6         | Get    | SerialNumber | UDINT        |
| 7         | Get    | ProductName  | SHORT_STRING |

### Vendor ID

|                  |          |                  |                            |
|------------------|----------|------------------|----------------------------|
| <b>Name:</b>     | VendorID |                  |                            |
| <b>Class</b>     | 0x01     | <b>Default</b>   | 0x101 (257 <sub>10</sub> ) |
| <b>Instance</b>  | 0x01     | <b>Data Type</b> | UINT                       |
| <b>Attribute</b> | 0x01     | <b>Access</b>    | Get                        |

Returns the vendor ID code 0x101 (257<sub>10</sub>) for *Control Techniques*.

## Device type

|                  |                   |                  |      |
|------------------|-------------------|------------------|------|
| <b>Name:</b>     | <b>DeviceType</b> |                  |      |
| <b>Class</b>     | 0x01              | <b>Default</b>   | 0x02 |
| <b>Instance</b>  | 0x01              | <b>Data Type</b> | UINT |
| <b>Attribute</b> | 0x02              | <b>Access</b>    | Get  |

Returns the device type code. The following codes are used:

| Device Type code | Drive type |
|------------------|------------|
| 0x02             | AC Drive   |
| 0x13             | DC Drive   |

## Product code

|                  |                    |                  |           |
|------------------|--------------------|------------------|-----------|
| <b>Name:</b>     | <b>ProductCode</b> |                  |           |
| <b>Class</b>     | 0x01               | <b>Default</b>   | See below |
| <b>Instance</b>  | 0x01               | <b>Data Type</b> | UINT      |
| <b>Attribute</b> | 0x03               | <b>Access</b>    | Get       |

Returns a 16 bit value to identify the drive type, major revision number and drive mode and also links a node to the installed EDS files. If a basic EDS file is used then the product code is calculated as shown in Table 6.20 *Basic product code* below.

**Table 6.20 Basic product code**

| b15     | b14 | b13 | b12            | b11 | b10 | b9 | b8   | b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 |
|---------|-----|-----|----------------|-----|-----|----|------|----|----|----|----|----|----|----|----|
| Product |     |     | Major Revision |     |     |    | Mode |    |    | 0  |    |    |    |    |    |

### Product (b15 to b13)

The product code is defined as follows:

| Product Code | Description           |                       |
|--------------|-----------------------|-----------------------|
|              | AC Drive (Type: 0x02) | DC Drive (Type: 0x13) |
| 1            | Unidrive SP           | Mentor MP             |
| 2            | Commander SK          | <i>Reserved</i>       |
| 4            | GP20                  | <i>Reserved</i>       |
| 5            | Digitax ST            | <i>Reserved</i>       |
| 6            | Affinity              | <i>Reserved</i>       |

### Major Revision (b12 to b9)

The major revision returned will be calculated from the formula:

$$\#11.29 * 3.$$

Where #11.29 is the value of Pr 11.29 before the decimal point.

e.g. For a value of "1.09" in Pr 11.29, the major revision returned is 3.



### Mode (b8 to b6)

The mode value is defined as follows:

| Mode | Description           |                       |
|------|-----------------------|-----------------------|
|      | AC Drive (Type: 0x02) | DC Drive (Type: 0x13) |
| 0    | Commander SE          | Reserved              |
| 1    | Open Loop             | Reserved              |
| 2    | Closed Loop Vector    | Mentor MP             |
| 3    | Servo                 | Reserved              |
| 4    | Regen                 | Reserved              |

Bits **b5** to **b0** are not used and will be set to 0.

If an advanced EDS file is used then the product code is calculated as shown in Table 6.21 *Advanced product code* below.

**Table 6.21 Advanced product code**

| b15     | b14 | b13 | b12                   | b11 | b10 | b9 | b8   | b7 | b6 | b5     | b4 | b3 | b2     | b1 | b0 |
|---------|-----|-----|-----------------------|-----|-----|----|------|----|----|--------|----|----|--------|----|----|
| Product |     |     | Major Revision + Slot |     |     |    | Mode |    |    | Slot X |    |    | Slot Y |    |    |

#### Product (b15 to b13)

(See Table 6.20 *Basic product code* on page 48).

#### Major Revision + Slot (b12 to b9)

The value contains the major revision number of the drive firmware and the slot that the SM-Ethernet module is installed in.

The value returned will be calculated from the formula:

$$\#11.29 * 3 + (Slot - 1)$$

Where **#11.29** is the value of Pr **11.29** before the decimal point and *Slot* is the slot number that the SM-Ethernet module is installed in.

e.g. For a value of "1.09" in Pr **11.29** and the SM-Ethernet module installed in slot 3, the value returned will be 5.

#### Mode (b8 to b6)

(See Table 6.20 *Basic product code* on page 48).

#### Slot X (b5 to b3)

This indicates the option module family type installed in the lowest numbered slot, excluding the slot where this SM-Ethernet is installed.

$$\text{Slot X} = \text{Pr MM.01}/100. \text{ (Any fractional part of result ignored)}$$

#### Slot Y (b2 to b0)

This indicates the option module family type installed in the highest numbered slot, excluding the slot where this SM-Ethernet is installed.

$$\text{Slot Y} = \text{Pr MM.01}/100. \text{ (Any fractional part of result ignored)}$$

For the option module ID codes see Table 6.22 *Option modules ID codes* on page 50).

**NOTE** The advanced EDS file mode is not supported on Commander SK.

**Table 6.22 Option modules ID codes**

| <b>b5 - b3 (Slot X)<br/>b2 - b0 (Slot Y)</b> | <b>Value</b> | <b>Module Family</b> | <b>Module ID</b> | <b>Module</b>              |
|--|--------------|----------------------|------------------|----------------------------|
| 001  | 1            | Feedback             | 101              | SM-Resolver.               |
| 001  | 1            | Feedback             | 102              | SM-Universal Encoder Plus. |
| 001  | 1            | Feedback             | 104              | SM-Encoder Plus.           |
| 001  | 1            | Feedback             | 104              | SM-Encoder Output Plus.    |
| 010  | 2            | I/O                  | 201              | SM-I/O Plus                |
| 010  | 2            | I/O                  | 203              | SM-I/O Timer               |
| 010  | 2            | I/O                  | 204              | SM-I/O PELV                |
| 010  | 2            | I/O                  | 205              | SM-I/O 24V                 |
| 010  | 2            | I/O                  | 206              | SM-I/O 120V                |
| 010  | 2            | I/O                  | 207              | SM-I/O Lite                |
| 010  | 2            | I/O                  | 208              | SM-I/O 32                  |
| 011  | 3            | Applications         | 301              | SM-Applications            |
| 011  | 3            | Applications         | 302              | SM-Applications Lite       |
| 011  | 3            | Applications         | 303              | SM-EZMotion                |
| 011  | 3            | Applications         | 304              | SM-Applications Plus       |
| 011  | 3            | Applications         | 305              | SM-Applications Lite V2    |
| 100  | 4            | Fieldbus             | 401              | SM-LON                     |
| 100  | 4            | Fieldbus             | 403              | SM-PROFIBUS DP             |
| 100  | 4            | Fieldbus             | 404              | SM-Interbus                |
| 100  | 4            | Fieldbus             | 406              | SM-CAN                     |
| 100  | 4            | Fieldbus             | 407              | SM-DeviceNet               |
| 100  | 4            | Fieldbus             | 408              | SM-CANopen                 |
| 100  | 4            | Fieldbus             | 409              | SM-Sercos                  |
| 100  | 4            | Fieldbus             | 410              | SM-Ethernet                |
| 100  | 4            | Fieldbus             | 421              | SM-EtherCAT                |
| 101  | 5            | Position             | 501              | SM-SLM                     |

**Revision**

|                  |                 |                  |                |
|------------------|-----------------|------------------|----------------|
| <b>Name:</b>     | <b>Revision</b> |                  |                |
| <b>Class</b>     | 0x01            | <b>Default</b>   | N/A            |
| <b>Instance</b>  | 0x01            | <b>Data Type</b> | ARRAY of USINT |
| <b>Attribute</b> | 0x04            | <b>Access</b>    | Get            |

Returns 2 bytes to indicate the minor and sub-version revision numbers.

If a basic generic EDS file is used then only the minor revision in the upper byte is returned as shown in Table 6.23 *Basic revision* on page 51.

**Table 6.23 Basic revision**

| b15            | b14 | b13 | b12 | b11 | b10 | b9 | b8 | b7 | b6 | b5                                    | b4 | b3 | b2 | b1 | b0 |
|----------------|-----|-----|-----|-----|-----|----|----|----|----|---------------------------------------|----|----|----|----|----|
| Minor Revision |     |     |     |     |     |    |    |    | 0  | 127 <sub>10</sub> (All bits set to 1) |    |    |    |    |    |

The minor revision returned will be calculated from the formula:

$$\#11.29 \text{ Mod } 100 + 1.$$

Where “#11.29 Mod 100” refers to the fractional value of Pr 11.29, (the value after the decimal point).

e.g. For a value of “1.09” in Pr 11.29, the minor revision returned is 10.

Bits **b0** to **b6** are used to inform the configuration tool that the advanced EDS file is not enabled and each bit will be set to 1.

If an advanced EDS file is used then the revision number is calculated as shown below.

**Table 6.24 Advanced revision**

| b15         | b14 | b13 | b12 | b11 | b10 | b9 | b8 | b7 | b6 | b5             | b4 | b3 | b2 | b1 | b0 |
|-------------|-----|-----|-----|-----|-----|----|----|----|----|----------------|----|----|----|----|----|
| Sub-version |     |     |     |     |     |    |    |    | 0  | Minor Revision |    |    |    |    |    |

**Minor revision**

The minor revision returned will be calculated from the formula:

$$\#11.29 \text{ Mod } 100 + 1.$$

Where “#11.29 Mod 100” refers to the fractional value of Pr 11.29, (the value after the decimal point).

e.g. For a value of “1.09” in Pr 11.29, the minor revision returned is 10.

**Sub-version**

The sub-version returned will be calculated from the formula:

$$\#11.34 + 1.$$

e.g. For a value of “1” in Pr 11.34, the sub-version returned is 2.

**Serial Number**

| Name:            | SerialNumber |                  |       |
|------------------|--------------|------------------|-------|
| <b>Class</b>     | 0x01         | <b>Default</b>   | N/A   |
| <b>Instance</b>  | 0x01         | <b>Data Type</b> | UDINT |
| <b>Attribute</b> | 0x06         | <b>Access</b>    | Get   |

Returns the least 3 significant bytes of the SM-Ethernet MAC address. The MAC address is set during production, and cannot be changed. This value is also displayed in Pr **MM.35**.

**NOTE** This can be used to find the complete MAC address of the module by combining the numbers with 00:0D:1E:xx.xx.xx. Where xx.xx.xx. is a value in Pr **MM.35** converted to base 16 (HEX). e.g. If Pr **MM.35** contains the value of 1193046, this would give the complete MAC address of 00 0D 1E 12 34 56.

## Product Name

|                  |                    |                  |              |
|------------------|--------------------|------------------|--------------|
| <b>Name:</b>     | <b>ProductName</b> |                  |              |
| <b>Class</b>     | 0x01               | <b>Default</b>   | SM-Ethernet  |
| <b>Instance</b>  | 0x01               | <b>Data Type</b> | SHORT_STRING |
| <b>Attribute</b> | 0x07               | <b>Access</b>    | Get          |

Returns 12 bytes (ASCII) to indicate the product name as a short string. The first byte specifies the number of following bytes that constitute the product name. The SM-Ethernet returns the string "SM-Ethernet".

### 6.7.24 Motor data object

**Class: 0x28 (40<sub>10</sub>)**

There are 2 instances of the Motor data object. Instance 1 will represent menu 5 motor information (motor map 1) and instance 2 will represent menu 21 motor information (motor map 2). The instance being used by the other dependant objects will be determined by Pr **21.15**, to use the second motor map objects (instance 2), Pr **21.15** should be set to *ON*. Pr **21.15** is polled in the background task, so the user should be aware that during motor map changeover, the RPM speed reference may not be accurate. The available attributes and associated functions for the AC motor data object are shown in Table 6.25 *AC Motor data object attributes* below, the available attributes and associated functions for the DC motor data object are shown in Table 6.27 *DC Motor data object attributes* on page 53.

**Table 6.25 AC Motor data object attributes**

| AC Motor Instance Attributes |               |            | Drive Parameter                           |  |
|------------------------------|---------------|------------|---|--|
| Attribute ID                 | Name          | Access     | Instance 1                                | Instance 2                                 |
| 0x03 (3 <sub>10</sub> )      | MotorType (*) | Get/Set    | Pr <b>64.13</b>                           | Pr <b>64.14</b>                            |
| 0x06 (6 <sub>10</sub> )      | RatedCurrent  | Get/Set    | Pr <b>5.07</b><br>(scaled to 100mA units) | Pr <b>21.07</b><br>(scaled to 100mA units) |
| 0x07 (7 <sub>10</sub> )      | RatedVoltage  | Get/Set    | Pr <b>5.09</b>                            | Pr <b>21.09</b>                            |
| 0x09 (9 <sub>10</sub> )      | RatedFreq     | Get/Set    | Pr <b>5.06</b><br>(scaled to Hz)          | Pr <b>21.06</b><br>(scaled to Hz)          |
| 0x0F (15 <sub>10</sub> )     | BaseSpeed     | Get/Set    | Pr <b>5.08</b><br>(scaled to rpm units)   | Pr <b>21.08</b><br>(scaled to rpm units)   |
| 0x64 (100 <sub>10</sub> )    | Motor2Select  | Get<br>Set | Pr <b>21.15</b><br>Pr <b>11.45</b>        | Pr <b>21.15</b><br>Pr <b>11.45</b>         |

(\* The MotorType attribute has no effect on drive operation, it is only used to provide information to the user as shown in Table 6.26 *Supported motor types* below).

**NOTE** In Open loop mode, only attributes 6 and 7 will be supported.

**Table 6.26 Supported motor types**

| Value | Motor Type                              |             |
|-------|---|-------------|
|       | AC                                      | DC          |
| 2     | Reserved                                | FC DC motor |
| 6     | Wound rotor induction motor             | Reserved    |
| 7     | Squirrel cage induction motor (default) | Reserved    |
| 9     | Sinusoidal PM BL motor                  | Reserved    |
| 10    | Trapezoidal PM BL motor                 | Reserved    |

**Table 6.27 DC Motor data object attributes**

| DC Motor Instance Attributes |                |            | Drive Parameter  |  |
|------------------------------|----------------|------------|--|--|
| Attribute ID                 | Name           | Access     | Instance 1   | Instance 2   |
| 0x03 (3 <sub>10</sub> )      | MotorType (*)  | Get/Set    | Pr <b>64.13</b>  | Pr <b>64.14</b>  |
| 0x06 (6 <sub>10</sub> )      | RatedCurrent   | Get/Set    | Pr <b>5.07</b><br>(scaled to 100mA units)  | Pr <b>21.07</b><br>(scaled to 100mA units)   |
| 0x07 (7 <sub>10</sub> )      | RatedVoltage   | Get/Set    | Pr <b>5.09</b>   | Pr <b>21.09</b>  |
| 0x0F (15 <sub>10</sub> )     | BaseSpeed      | Get/Set    | Pr <b>5.08</b><br>(scaled to rpm units)  | Pr <b>21.08</b><br>(scaled to rpm units)   |
| 0x10 (16 <sub>10</sub> )     | RatedFieldCur  | Get/Set    | Pr <b>5.70</b><br>(scaled to 100mA units)  | Pr <b>21.24</b><br>(scaled to 100mA units)   |
| 0x11 (17 <sub>10</sub> )     | MinFieldCur    | Get<br>Set | Pr <b>5.70</b> * Pr <b>5.69</b> / 100<br>Pr <b>5.69</b> = MinFieldCur *<br>100 / Pr <b>5.70</b><br>(scaled to 100mA units)<br><br>Pr <b>5.69</b> will be written with<br>the appropriate instance<br>value, depending on which<br>motor map is selected. | Pr <b>21.24</b> * Pr <b>5.69</b> / 100<br>Pr <b>5.69</b> = MinFieldCur *<br>100 / Pr <b>21.24</b><br>(scaled to 100mA units)<br><br>Pr <b>5.69</b> will be written with<br>the appropriate instance<br>value, depending on which<br>motor map is selected. |
| 0x12 (18 <sub>10</sub> )     | RatedFieldVolt | Get/Set    | Pr <b>5.73</b>   | Pr <b>21.23</b>  |
| 0x64 (100 <sub>10</sub> )    | Motor2Select   | Get<br>Set | Pr <b>21.15</b><br>Pr <b>11.45</b>   | Pr <b>21.15</b><br>Pr <b>11.45</b>   |

(\* The MotorType attribute has no effect on drive operation, it is only used to provide information to the user as shown in Table 6.26 *Supported motor types* on page 52).

### Motor type

|                  |                   |                  |         |
|------------------|-------------------|------------------|---------|
| <b>Name:</b>     | <b>MotorType1</b> |                  |         |
| <b>Class</b>     | 0x28              | <b>Default</b>   | 7       |
| <b>Instance</b>  | 0x01              | <b>Data Type</b> | USINT   |
| <b>Attribute</b> | 0x03              | <b>Access</b>    | Get/Set |

Returns or sets the motor type to be used by the drive for instance 1.

|                  |                   |                  |         |
|------------------|-------------------|------------------|---------|
| <b>Name:</b>     | <b>MotorType2</b> |                  |         |
| <b>Class</b>     | 0x28              | <b>Default</b>   | 7       |
| <b>Instance</b>  | 0x02              | <b>Data Type</b> | USINT   |
| <b>Attribute</b> | 0x03              | <b>Access</b>    | Get/Set |

Returns or sets the motor type to be used by the drive for instance 2.

## Rated current

|                  |                      |                  |              |
|------------------|----------------------|------------------|--------------|
| <b>Name:</b>     | <b>RatedCurrent1</b> |                  |              |
| <b>Class</b>     | 0x28                 | <b>Default</b>   | Pr 5.07 / 10 |
| <b>Instance</b>  | 0x01                 | <b>Data Type</b> | USINT        |
| <b>Attribute</b> | 0x06                 | <b>Access</b>    | Get/Set      |

Returns or sets the rated motor current in Amps for instance 1. This attribute is linked to Pr 5.07.

Set Pr 5.07 = RatedCurrent1 \* 10.

Get RatedCurrent1 = Pr 5.07 / 10.

|                  |                      |                  |               |
|------------------|----------------------|------------------|---------------|
| <b>Name:</b>     | <b>RatedCurrent2</b> |                  |               |
| <b>Class</b>     | 0x28                 | <b>Default</b>   | Pr 21.07 / 10 |
| <b>Instance</b>  | 0x02                 | <b>Data Type</b> | USINT         |
| <b>Attribute</b> | 0x06                 | <b>Access</b>    | Get/Set       |

Returns or sets the rated motor current in Amps for instance 2. This attribute is linked to Pr 21.07.

Set Pr 21.07 = RatedCurrent2 \* 10.

Get RatedCurrent2 = Pr 21.07 / 10.

## Rated voltage

|                  |                      |                  |         |
|------------------|----------------------|------------------|---------|
| <b>Name:</b>     | <b>RatedVoltage1</b> |                  |         |
| <b>Class</b>     | 0x28                 | <b>Default</b>   | Pr 5.09 |
| <b>Instance</b>  | 0x01                 | <b>Data Type</b> | USINT   |
| <b>Attribute</b> | 0x07                 | <b>Access</b>    | Get/Set |

Returns or sets the rated motor voltage in Volts for instance 1. This attribute is linked to Pr 5.09.

|                  |                      |                  |          |
|------------------|----------------------|------------------|----------|
| <b>Name:</b>     | <b>RatedVoltage2</b> |                  |          |
| <b>Class</b>     | 0x28                 | <b>Default</b>   | Pr 21.09 |
| <b>Instance</b>  | 0x02                 | <b>Data Type</b> | USINT    |
| <b>Attribute</b> | 0x07                 | <b>Access</b>    | Get/Set  |

Returns or sets the rated motor voltage in Volts for instance 2. This attribute is linked to Pr 21.09.

## Rated frequency

|                  |                   |                  |                     |
|------------------|-------------------|------------------|---------------------|
| <b>Name:</b>     | <b>RatedFreq1</b> |                  |                     |
| <b>Class</b>     | 0x28              | <b>Default</b>   | Pr <b>5.06</b> / 10 |
| <b>Instance</b>  | 0x01              | <b>Data Type</b> | USINT               |
| <b>Attribute</b> | 0x09              | <b>Access</b>    | Get/Set             |

Returns or sets the rated motor frequency in Hertz for instance 1. This attribute is linked to Pr **5.06**.

Set Pr **5.06** = RatedFreq1 \* 10.

Get RatedFreq1 = Pr **5.06** / 10.

|                  |                   |                  |                      |
|------------------|-------------------|------------------|----------------------|
| <b>Name:</b>     | <b>RatedFreq2</b> |                  |                      |
| <b>Class</b>     | 0x28              | <b>Default</b>   | Pr <b>21.06</b> / 10 |
| <b>Instance</b>  | 0x02              | <b>Data Type</b> | USINT                |
| <b>Attribute</b> | 0x09              | <b>Access</b>    | Get/Set              |

Returns or sets the rated motor frequency in Hertz for instance 2. This attribute is linked to Pr **21.06**.

Set Pr **21.06** = RatedFreq2 \* 10.

Get RatedFreq2 = Pr **21.06** / 10.

## Base speed

|                  |                   |                  |                |
|------------------|-------------------|------------------|----------------|
| <b>Name:</b>     | <b>BaseSpeed1</b> |                  |                |
| <b>Class</b>     | 0x28              | <b>Default</b>   | Pr <b>5.08</b> |
| <b>Instance</b>  | 0x01              | <b>Data Type</b> | USINT          |
| <b>Attribute</b> | 0x0F              | <b>Access</b>    | Get/Set        |

Returns or sets the base speed of the motor in RPM for instance 1. This attribute is linked to Pr **5.08**.

|                  |                   |                  |                 |
|------------------|-------------------|------------------|-----------------|
| <b>Name:</b>     | <b>BaseSpeed2</b> |                  |                 |
| <b>Class</b>     | 0x28              | <b>Default</b>   | Pr <b>21.08</b> |
| <b>Instance</b>  | 0x02              | <b>Data Type</b> | USINT           |
| <b>Attribute</b> | 0x0F              | <b>Access</b>    | Get/Set         |

Returns or sets the base speed of the motor in RPM for instance 2. This attribute is linked to Pr **21.08**.

## Motor2Select

|                  |                     |                  |         |
|------------------|---------------------|------------------|---------|
| <b>Name:</b>     | <b>Motor2Select</b> |                  |         |
| <b>Class</b>     | 0x28                | <b>Default</b>   |         |
| <b>Instance</b>  | 0x01                | <b>Data Type</b> | USINT   |
| <b>Attribute</b> | 0x64                | <b>Access</b>    | Get/Set |

Selects between Motor Map 1 and Motor Map 2. This attribute is linked to Pr **11.45**. When this bit is set to 1, Motor Map 2 will be active.

**NOTE** Any change in this attribute will be implemented when the drive is disabled.

## 6.7.25 Control Supervisor object

**Class:** 0x29 (41<sub>10</sub>)

The Control Supervisor object provides access to various attributes which control or monitor the drive running state. The available attributes and their associated functions are shown in Table 6.28 below.

**Table 6.28 Control Supervisor object attributes**

| Attribute ID              | Name        | Access  | Parameter dependence   |
|---------------------------|-------------|---------|--|
| 0x03 (3 <sub>10</sub> )   | RunFwd      | Get/Set | Pr 6.42 b1   |
| 0x04 (4 <sub>10</sub> )   | RunRev      | Get/Set | Pr 6.42 b3   |
| 0x05 (5 <sub>10</sub> )   | NetCtrl     | Get/Set | Pr 6.42 b7   |
| 0x06 (6 <sub>10</sub> )   | State       | Get     | (See Table 6.29 on page 57)                                  |
| 0x07 (7 <sub>10</sub> )   | RunningFwd  | Get     | 1 Pr 10.14=0 AND Pr 10.02=1                                  |
|                           |             |         | 0 Pr 10.14=1 OR Pr 10.02=0                                   |
| 0x08 (8 <sub>10</sub> )   | RunningRev  | Get     | 1 Pr 10.14=1 AND Pr 10.02=1                                  |
|                           |             |         | 0 Pr 10.14=0 OR Pr 10.02=0                                   |
| 0x09 (9 <sub>10</sub> )   | Ready       | Get     | (See Table 6.30 on page 58)                                  |
| 0x0A (10 <sub>10</sub> )  | Faulted     | Get     | Inverse of Pr 10.01  |
| 0x0B (11 <sub>10</sub> )  | Warning     | Get     | Pr 10.19   |
| 0x0C (12 <sub>10</sub> )  | FaultRst    | Get/Set | Dummy parameter, sets Pr 10.38 to 100 on a 0 to 1 transition |
| 0x0D (13 <sub>10</sub> )  | FaultCode   | Get     | (See Table 6.31 on page 59)                                  |
| 0x0F (15 <sub>10</sub> )  | CtrlFormNet | Get     | 1 Pr 6.42 b7=1 AND Pr 6.43=1                                 |
|                           |             |         | 0 Pr 6.42 b7=0 OR Pr 6.43=0                                  |
| 0x66 (102 <sub>10</sub> ) | DriveEnable | Get/Set | Pr 6.42 b0   |

### RunFwd

|                  |        |                  |         |
|------------------|--------|------------------|---------|
| <b>Name:</b>     | RunFwd |                  |         |
| <b>Class</b>     | 0x29   | <b>Default</b>   | N/A     |
| <b>Instance</b>  | 0x01   | <b>Data Type</b> | USINT   |
| <b>Attribute</b> | 0x03   | <b>Access</b>    | Get/Set |

Set to 1 to run the drive in the forward direction.

Get/Set Pr 6.42 (bit 1).

### RunRev

|                  |        |                  |         |
|------------------|--------|------------------|---------|
| <b>Name:</b>     | RunRev |                  |         |
| <b>Class</b>     | 0x29   | <b>Default</b>   | N/A     |
| <b>Instance</b>  | 0x01   | <b>Data Type</b> | USINT   |
| <b>Attribute</b> | 0x04   | <b>Access</b>    | Get/Set |

Set to 1 to run the drive in the reverse direction.

Get/Set Pr 6.42 (bit 3).



## NetCtrl

|                  |         |                  |         |
|------------------|---------|------------------|---------|
| <b>Name:</b>     | NetCtrl |                  |         |
| <b>Class</b>     | 0x29    | <b>Default</b>   | N/A     |
| <b>Instance</b>  | 0x01    | <b>Data Type</b> | USINT   |
| <b>Attribute</b> | 0x05    | <b>Access</b>    | Get/Set |

Switches between terminal and fieldbus control.

Get/SetPr **6.42** (bit 7)

0 = Terminal control.

1 = Fieldbus control.

## State

|                  |       |                  |       |
|------------------|-------|------------------|-------|
| <b>Name:</b>     | State |                  |       |
| <b>Class</b>     | 0x29  | <b>Default</b>   | N/A   |
| <b>Instance</b>  | 0x01  | <b>Data Type</b> | USINT |
| <b>Attribute</b> | 0x06  | <b>Access</b>    | Get   |

This returns a code to indicate the current running state of the drive as shown in Table 6.29 below.

**Table 6.29 Control Supervisor state attribute**

| Code | State           | Description   |
|------|-----------------|---|
| 1    | Startup         | This state is skipped over on CT drives                                 |
| 2    | Not_Ready       | Inhibit   |
| 3    | Ready           | Ready   |
| 4    | Enabled         | Run or Stop (Stop is only enabled by default in Servo mode)             |
| 5    | Stopping        | Decelerating or DC injection braking                                    |
| 6    | Fault_Stop      | ACUU (AC Under Voltage) - this will only occur if mains loss is enabled |
| 7    | Faulted         | Tripped   |
| 0    | Vendor Specific | All other DriveType states, e.g. Scan, Orienting, Regen Active, etc.    |

## RunningFwd

|                  |            |                  |       |
|------------------|------------|------------------|-------|
| <b>Name:</b>     | RunningFwd |                  |       |
| <b>Class</b>     | 0x29       | <b>Default</b>   | N/A   |
| <b>Instance</b>  | 0x01       | <b>Data Type</b> | USINT |
| <b>Attribute</b> | 0x07       | <b>Access</b>    | Get   |

Indicates that the drive is running in the forward direction.

This attribute will be set to 1 when Pr **10.14** = 0 and Pr **10.02** = 1.

## RunningRev

|                  |            |                  |       |
|------------------|------------|------------------|-------|
| <b>Name:</b>     | RunningRev |                  |       |
| <b>Class</b>     | 0x29       | <b>Default</b>   | N/A   |
| <b>Instance</b>  | 0x01       | <b>Data Type</b> | USINT |
| <b>Attribute</b> | 0x08       | <b>Access</b>    | Get   |

Indicates that the drive is running in the reverse direction.

This attribute will be set to 1 when Pr **10.14**=1 and Pr **10.02**=1.

## Ready

|                  |              |                  |       |
|------------------|--------------|------------------|-------|
| <b>Name:</b>     | <b>Ready</b> |                  |       |
| <b>Class</b>     | 0x29         | <b>Default</b>   | N/A   |
| <b>Instance</b>  | 0x01         | <b>Data Type</b> | USINT |
| <b>Attribute</b> | 0x09         | <b>Access</b>    | Get   |

The Ready attribute will be set in accordance with the state as shown in Table 6.30 below.

**Table 6.30 Control Supervisor Ready attribute**

| Code       | State    | Ready state |
|------------|----------|-------------|
| 3          | Ready    | True        |
| 4          | Enabled  | True        |
| 5          | Stopping | True        |
| All others |          | False       |

## Faulted

|                  |                |                  |       |
|------------------|----------------|------------------|-------|
| <b>Name:</b>     | <b>Faulted</b> |                  |       |
| <b>Class</b>     | 0x29           | <b>Default</b>   | N/A   |
| <b>Instance</b>  | 0x01           | <b>Data Type</b> | USINT |
| <b>Attribute</b> | 0x0A           | <b>Access</b>    | Get   |

Indicates that the drive is tripped, i.e. not OK (inverse of Pr **10.01**).

Get 1 = Pr **10.01** = 0.

Get 0 = Pr **10.01** = 1.

## Warning

|                  |                |                  |       |
|------------------|----------------|------------------|-------|
| <b>Name:</b>     | <b>Warning</b> |                  |       |
| <b>Class</b>     | 0x29           | <b>Default</b>   | N/A   |
| <b>Instance</b>  | 0x01           | <b>Data Type</b> | USINT |
| <b>Attribute</b> | 0x0B           | <b>Access</b>    | Get   |

Indicates that one of the drive alarms is active.

Get Pr **10.19**.

## FaultRst

|                  |                 |                  |         |
|------------------|-----------------|------------------|---------|
| <b>Name:</b>     | <b>FaultRst</b> |                  |         |
| <b>Class</b>     | 0x29            | <b>Default</b>   | N/A     |
| <b>Instance</b>  | 0x01            | <b>Data Type</b> | USINT   |
| <b>Attribute</b> | 0x0C            | <b>Access</b>    | Get/Set |

Resets the drive from a tripped condition.

Sets Pr **10.38** to 100 on a 0 to 1 transition.

## FaultCode

|                  |                  |                  |       |
|------------------|------------------|------------------|-------|
| <b>Name:</b>     | <b>FaultCode</b> |                  |       |
| <b>Class</b>     | 0x29             | <b>Default</b>   | N/A   |
| <b>Instance</b>  | 0x01             | <b>Data Type</b> | USINT |
| <b>Attribute</b> | 0x0D             | <b>Access</b>    | Get   |

The fault code attribute will return the ODVA fault code as follows:

If the drive is not OK, the drive fault code is obtained from Pr **10.20**, if the drive fault code is listed in Table 6.31, then SM-Ethernet will return the ODVA fault code as shown in Table 6.31 below.

If the drive fault code is not listed in Table 6.31 then SM-Ethernet will return the ODVA code as follows:

ODVA Fault Code = 0x1000 + drive fault code.

**Table 6.31 Control Supervisor fault code attribute**

| Drive Fault Code | ODVA Fault Code | Drive Fault Code | ODVA Fault Code |
|------------------|-----------------|------------------|-----------------|
| 1                | 0x3220          | 20               | 0x2310          |
| 2                | 0x3210          | 21               | 0x4300          |
| 3                | 0x2300          | 26               | 0x5112          |
| 4                | 0x7112          | 32               | 0x3130          |
| 6                | 0x9000          |                  |                 |

## CtrlFromNet

|                  |                    |                  |       |
|------------------|--------------------|------------------|-------|
| <b>Name:</b>     | <b>CtrlFromNet</b> |                  |       |
| <b>Class</b>     | 0x29               | <b>Default</b>   | N/A   |
| <b>Instance</b>  | 0x01               | <b>Data Type</b> | USINT |
| <b>Attribute</b> | 0x0F               | <b>Access</b>    | Get   |

Indicates whether the drive is operating under fieldbus or terminal control.

This attribute will be set to 1 if Pr **6.42** (bit 7) = 1 and Pr **6.43** = 1 (fieldbus).

## DriveEnable

|                  |                    |                  |         |
|------------------|--------------------|------------------|---------|
| <b>Name:</b>     | <b>DriveEnable</b> |                  |         |
| <b>Class</b>     | 0x29               | <b>Default</b>   | N/A     |
| <b>Instance</b>  | 0x01               | <b>Data Type</b> | USINT   |
| <b>Attribute</b> | 0x66               | <b>Access</b>    | Get/Set |

Enables the drive. This puts the drive into the “Ready” state, allowing the **RunFwd** and **RunRev** attributes to control the drive. **RunFwd** and **RunRev** will have no effect if **DriveEnable** is not set to 1.

Get/Set Pr **6.42** bit 0.

**NOTE** The external hardware enable signal must also be present before the drive will enter the Ready state.

## 6.7.26 AC/DC Drive object

**Class:** 0x2A (42<sub>10</sub>)

The AC/DC Drive object provides information on the drive running state and supports the following attributes:

**Table 6.32 AC/DC Drive object attributes**

| Attribute ID             | Name         | Access  | Parameter dependence   |
|--------------------------|--------------|---------|--|
| 0x03 (3 <sub>10</sub> )  | AtReference  | Get     | Pr 10.06   |
| 0x04 (4 <sub>10</sub> )  | NetRef       | Get/Set | Pr 6.42 (bit 8)  |
| 0x06 (6 <sub>10</sub> )  | DriveMode    | Get/Set | (See Table 6.33 on page 61)  |
| 0x07 (7 <sub>10</sub> )  | SpeedActual  | Get     | Closed Loop Pr 3.02<br>Open Loop Pr 5.04   |
|                          |              | Get/Set | Closed Loop Pr 1.21<br>(scaled to 0 decimal places)                              |
| 0x08 (8 <sub>10</sub> )  | SpeedRef     | Get     | Open Loop Pr 1.21 * 60 / <i>NofPP</i><br>(scaled to 0 decimal places)            |
|                          |              | Set     | Open Loop Pr 1.21 = SpeedRef * <i>NofPP</i> / 60<br>(scaled to 0 decimal places) |
| 0x0B (11 <sub>10</sub> ) | TorqueActual | Get     | Pr 4.20<br>(scaled to 1 decimal place)   |
| 0x0C (12 <sub>10</sub> ) | TorqueRef    | Get/Set | Pr 4.08<br>(scaled to 1 decimal place)   |
| 0x1D (29 <sub>10</sub> ) | RefFromNet   | Get     | 1 Pr 1.49=3 AND Pr 1.50=1  |
|                          |              |         | 0 Pr 1.49<>3 OR Pr 1.50<>1   |

**NOTE** *NofPP* = Number of Pole Pairs.

**NOTE** NetRef can only be changed between local and remote when the drive is in speed control mode. If a change is requested when in torque mode then an error code will be returned.

### AtReference

|                  |             |                  |       |
|------------------|-------------|------------------|-------|
| <b>Name:</b>     | AtReference |                  |       |
| <b>Class</b>     | 0x2A        | <b>Default</b>   | N/A   |
| <b>Instance</b>  | 0x01        | <b>Data Type</b> | USINT |
| <b>Attribute</b> | 0x03        | <b>Access</b>    | Get   |

Indicates that the drive is running at the requested speed.

Get Pr 10.06

0 = Drive not running at requested speed.

1 = Drive running at requested speed.

### NetRef

|                  |        |                  |         |
|------------------|--------|------------------|---------|
| <b>Name:</b>     | NetRef |                  |         |
| <b>Class</b>     | 0x2A   | <b>Default</b>   | N/A     |
| <b>Instance</b>  | 0x01   | <b>Data Type</b> | USINT   |
| <b>Attribute</b> | 0x04   | <b>Access</b>    | Get/Set |

Selects the source of the speed reference.

Get/SetPr 6.42 bit 8

0 = analog speed reference.

1 = digital speed reference.

**NOTE** The NetRef can only be changed between local and remote when the drive is configured in speed control mode. If a change is requested when in torque mode then a 'Device State Conflict' error code 0x10 will be returned.

### DriveMode

|                  |           |                  |         |
|------------------|-----------|------------------|---------|
| <b>Name:</b>     | DriveMode |                  |         |
| <b>Class</b>     | 0x2A      | <b>Default</b>   | N/A     |
| <b>Instance</b>  | 0x01      | <b>Data Type</b> | USINT   |
| <b>Attribute</b> | 0x06      | <b>Access</b>    | Get/Set |

DriveMode does not allow the operating mode of the drive to be changed. Pr 4.11 will be written to as shown in Table 6.33 below, provided that the drive is already in the correct operating mode.

**Table 6.33 AC/DC Drive object DriveMode attribute**

| Access | Value | Mode (Pr 4.11)   | Current drive mode (Pr 11.31)  |
|--------|-------|--|--|
| Get    | 1     | Open Loop Speed (0)  | Open loop (1)  |
|        | 2     | Closed Loop Speed (0)  | Closed loop vector (2)   |
|        | 2     | Closed Loop Speed (0)  | Servo (3)  |
|        | 2     | Closed Loop Speed (0)  | Mentor MP  |
|        | 3     | Torque Control (1)   | Open loop (1)  |
|        | 3     | Torque Control (1)   | Closed loop vector (2)   |
|        | 3     | Torque Control (1)   | Servo (3)  |
|        | 3     | Torque Control (1)   | Mentor MP  |
|        | 0     | Don't care   | Regen (4)  |
|        | 0     | User defined<br>Torque control with speed override (2) OR<br>Coiler/uncoiler mode (3) OR<br>Speed control with torque feed-forward (4) | Don't care   |
| Set    | 0     | Invalid Attribute Value (0x09)   | Don't care   |
|        | 1     | Open Loop Speed (0)  | Open loop (1)  |
|        | 1     | Device State Conflict (0x10)   | Closed loop vector (2) OR<br>Servo (3) OR<br>Regen (4) OR<br>Mentor MP     |
|        | 2     | Closed Loop Speed (0)  | Closed loop vector (2) OR<br>Servo (3) OR<br>Mentor MP                     |
|        | 2     | Device State Conflict (0x10)   | Open loop (1) OR<br>Regen (4)  |
|        | 3     | Torque Control (1)   | Open loop (1) OR<br>Closed loop vector (2) OR<br>Servo (3) OR<br>Mentor MP |
|        | 3     | Device State Conflict (0x10)   | Regen (4)  |

**NOTE** Pr 11.31 will never be changed by setting the DriveMode attribute. An error (0x10) will be generated if the requested DriveMode value does not correspond to the current DriveType operating mode.

## SpeedActual

|                  |                    |                  |       |
|------------------|--------------------|------------------|-------|
| <b>Name:</b>     | <b>SpeedActual</b> |                  |       |
| <b>Class</b>     | 0x2A               | <b>Default</b>   | N/A   |
| <b>Instance</b>  | 0x01               | <b>Data Type</b> | USINT |
| <b>Attribute</b> | 0x07               | <b>Access</b>    | Get   |

Returns the actual speed of the motor in RPM. The source of the motor speed depends on the operating mode of the drive.

Get Pr **5.04** (Open Loop).

Get Pr **3.02** (Closed Loop or Servo).

## SpeedRef

|                  |                 |                  |         |
|------------------|-----------------|------------------|---------|
| <b>Name:</b>     | <b>SpeedRef</b> |                  |         |
| <b>Class</b>     | 0x2A            | <b>Default</b>   | N/A     |
| <b>Instance</b>  | 0x01            | <b>Data Type</b> | USINT   |
| <b>Attribute</b> | 0x08            | <b>Access</b>    | Get/Set |

Sets or returns the speed reference in RPM.

### Closed loop, Servo

Get/Set SpeedRef = Pr **1.21** (Scaled to 0 decimal places).

### Open loop

Get SpeedRef = (Pr **1.21** \* 60) / Pole Pairs (Scaled to 0 decimal places).

Set Pr **1.21** = (SpeedRef \* Pole Pairs) / 60 (Scaled to 0 decimal places).

## TorqueActual

|                  |                     |                  |       |
|------------------|---------------------|------------------|-------|
| <b>Name:</b>     | <b>TorqueActual</b> |                  |       |
| <b>Class</b>     | 0x2A                | <b>Default</b>   | N/A   |
| <b>Instance</b>  | 0x01                | <b>Data Type</b> | USINT |
| <b>Attribute</b> | 0x0B                | <b>Access</b>    | Get   |

Returns the actual load on the motor as a percentage of the rated motor load. This attribute has 1 decimal place precision, a value of 1000 represents 100.0% load.

Get Pr **4.20**.

## TorqueRef

|                  |      |                  |         |
|------------------|------|------------------|---------|
| <b>Name:</b>     |      |                  |         |
| <b>Class</b>     | 0x2A | <b>Default</b>   | N/A     |
| <b>Instance</b>  | 0x01 | <b>Data Type</b> | USINT   |
| <b>Attribute</b> | 0x0C | <b>Access</b>    | Get/Set |

Sets the load (torque) reference as % of rated motor load (torque). This attribute has 1 decimal place precision, so a value of 1000 represents 100.0% load.

Set Pr **4.08** = TorqueRef / 10.

Get TorqueRef = Pr **4.08** \* 10.

## RefFromNet

|                  |            |                  |       |
|------------------|------------|------------------|-------|
| <b>Name:</b>     | RefFromNet |                  |       |
| <b>Class</b>     | 0x2A       | <b>Default</b>   |       |
| <b>Instance</b>  | 0x01       | <b>Data Type</b> | USINT |
| <b>Attribute</b> | 0x1D       | <b>Access</b>    | Get   |

Indicates the source of the speed reference.

TRUE if Pr **1.49** = 3 and Pr **1.50** = 1.

FALSE otherwise.

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## 6.7.27 Control Techniques object

**Class: 0x64 (100<sub>10</sub>)**

The Control Techniques object provides access to all drive parameters. For example, parameter Pr 4.20 would be accessed as Class 100, Instance 4, Attribute 20.

**Table 6.34 Control Techniques object**

| Instance   | Menu      | Name   |
|--|-----------|--|
| 0x01 (1 <sub>10</sub> )                                  | 1         | Frequency / speed reference.                                       |
| 0x02 (2 <sub>10</sub> )                                  | 2         | Ramps control.   |
| 0x03 (3 <sub>10</sub> )                                  | 3         | Speed control.   |
| 0x04 (4 <sub>10</sub> )                                  | 4         | Current control.   |
| 0x05 (5 <sub>10</sub> )                                  | 5         | Motor control.   |
| 0x06 (6 <sub>10</sub> )                                  | 6         | Sequencing.  |
| 0x07 (7 <sub>10</sub> )                                  | 7         | Analog I/O.  |
| 0x08 (8 <sub>10</sub> )                                  | 8         | Digital I/O.   |
| 0x09 (9 <sub>10</sub> )                                  | 9         | Logic.   |
| 0x0A (10 <sub>10</sub> )                                 | 10        | Drive status.  |
| 0x0B (11 <sub>10</sub> )                                 | 11        | Drive set-up.  |
| 0x0C (12 <sub>10</sub> )                                 | 12        | Programmable thresholds.   |
| 0x0D (13 <sub>10</sub> )                                 | 13        | Position control.  |
| 0x0E (14 <sub>10</sub> )                                 | 14        | Process PID loop.  |
| 0x0F (15 <sub>10</sub> )                                 | 15        | Slot 1 configuration.  |
| 0x10 (16 <sub>10</sub> )                                 | 16        | Slot 2 configuration.  |
| 0x11 (17 <sub>10</sub> )                                 | 17        | Slot 3 configuration.  |
| 0x12 (18 <sub>10</sub> )                                 | 18        | User application menu 1.   |
| 0x13 (19 <sub>10</sub> )                                 | 19        | User application menu 2.   |
| 0x14 (20 <sub>10</sub> )                                 | 20        | User application menu 3.   |
| 0x15 (21 <sub>10</sub> )                                 | 21        | Second motor map.  |
| 0x16 (22 <sub>10</sub> )                                 | 22        | Additional menu 0 setup  |
| 0x17 (23 <sub>10</sub> )                                 | 23        | Header selections  |
| 0x3C (60 <sub>10</sub> )                                 | 60        | Fieldbus virtual parameter menu.                                   |
| 0x3D (61 <sub>10</sub> )                                 | 61        | General module virtual parameter menu.                             |
| 0x3E (62 <sub>10</sub> )                                 | 62        | DNS server virtual parameter menu.                                 |
| 0x3F (63 <sub>10</sub> )                                 | 63        | Modbus TCP/IP virtual parameter menu.                              |
| 0x40 (64 <sub>10</sub> )                                 | 64        | EtherNet/IP virtual parameter menu.                                |
| 0x46 (70 <sub>10</sub> ) -<br>0x57 (87 <sub>10</sub> )   | 70 - 87   | Menus of option module (if installed) in the lowest numbered slot. |
| 0x64 (100 <sub>10</sub> ) -<br>0x7F (127 <sub>10</sub> ) | 100 - 127 | Menus of option module (if installed) in slot 1.                   |
| 0x82 (130 <sub>10</sub> ) -<br>0x9D (157 <sub>10</sub> ) | 130 - 157 | Menus of option module (if installed) in slot 2.                   |
| 0xA0 (160 <sub>10</sub> ) -<br>0xBB (187 <sub>10</sub> ) | 160 - 187 | Menus of option module (if installed) in slot 3.                   |
| 0xC8 (200 <sub>10</sub> )                                | 0         | Menu 0.  |



### 6.7.28 TCP/IP Interface object

**Class:** 0xF5 (245<sub>10</sub>)

The TCP/IP Interface object provides the mechanism to configure the SM-Ethernet TCP/IP network interface. Examples of configurable items include the device IP address, network mask and gateway address.

**NOTE** This object is normally configured by the PLC software.

### 6.7.29 Ethernet Link object

**Class:** 0xF6 (246<sub>10</sub>)

The Ethernet Link object maintains link-specific counters and status information for the Ethernet 802.3 communication interface.

**NOTE** This object is normally configured by the PLC software.

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# 7 Web page basics

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## 7.1 Connecting to SM-Ethernet

If you are using DHCP, all settings on the SM-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 **MM.10** to Pr **MM.13**. 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 SM-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 5.11 *Setting the IP address* on page 22.

### 7.1.1 Making a connection

To connect to SM-Ethernet, enter the address of the SM-Ethernet module (*see section 5.11 Setting the IP address* on page 22) 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 SM-Ethernet module you wish to communicate with.

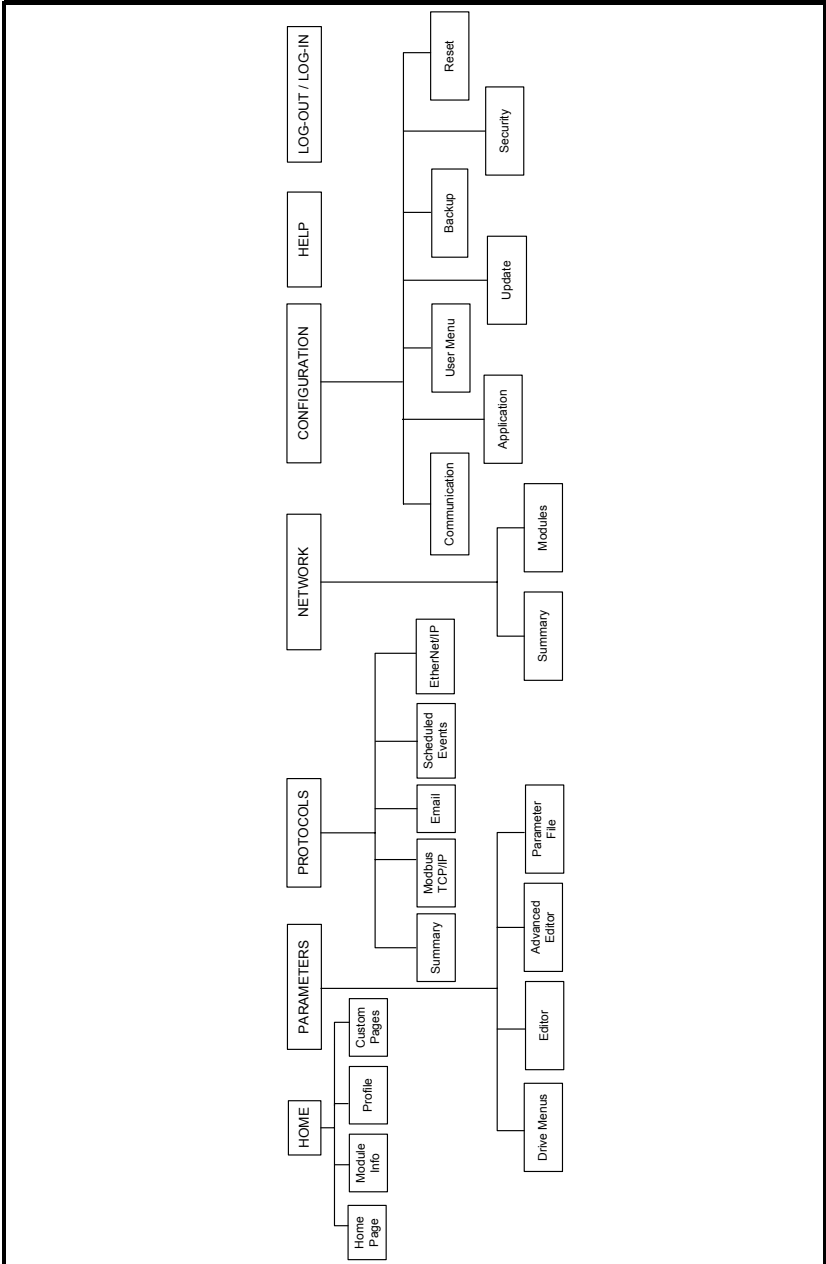
**NOTE**

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 SM-Ethernet will also require a gateway configured to communicate with the PC in this case.

## 7.2 Web page menu structure

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

Figure 7-1 Web page structure

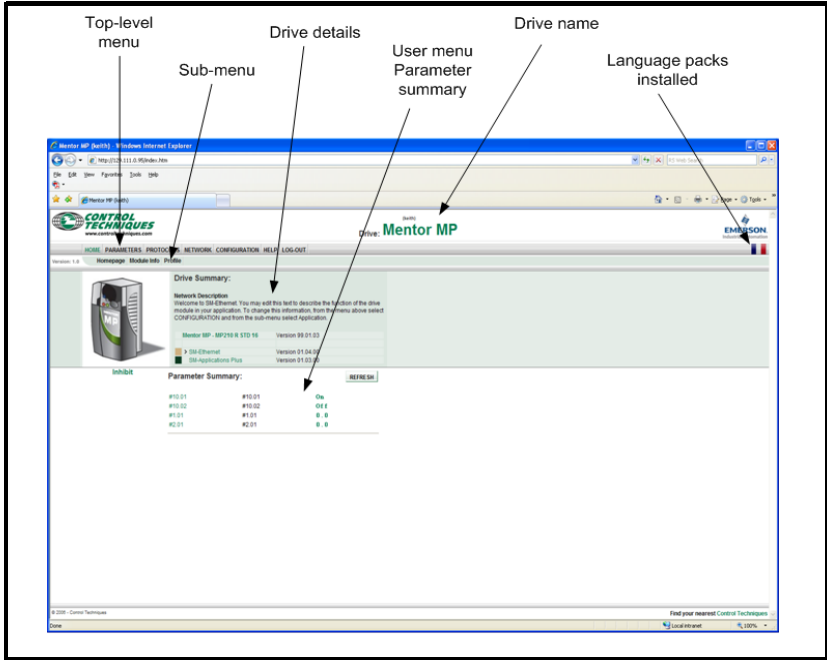


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## 7.2.1 The home page

Figure 7-2 shows the initial home page when connected to SM-Ethernet.

**Figure 7-2 The home page**



The home page contains the following main areas:

- **Top-level menu** - this is the menu that is used to navigate to the menus on SM-Ethernet. Click on the items to make a selection.
- **Sub-menu** - the sub-menu sub divides the top-level menu in to more sub-sections. Click on the items to make a selection.
- **Drive details** - contains more details about the SM-Ethernet usage and settings. The section also details any Solutions Modules installed to the drive and their firmware versions.
- **User menu parameter summary** - details the parameters that the user has previously defined to appear in this menu.
- **Drive name** - this is the name allocated to SM-Ethernet during set-up.
- **Language packs installed** - this area of the screen will indicate whether any languages (other than English) are installed in the module. Click on the image to select that language display or alternatively the language can be changed from within the user profile menu.

## 7.2.2 Logging in

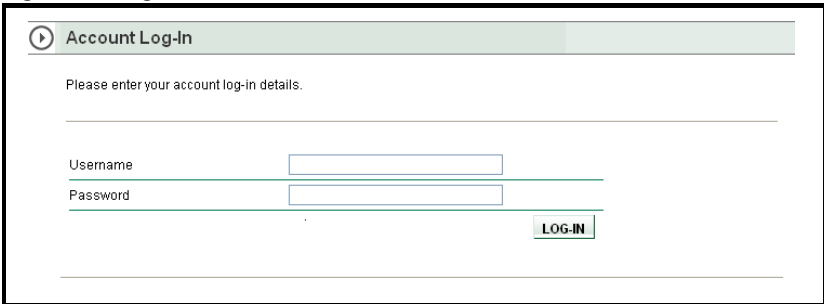
Before you can view any additional screens you must login to SM-Ethernet. The default *username* is **root** and the default *password* is **ut72**. The **root** *username* cannot be changed, but the password should be changed to prevent unauthorized access to SM-Ethernet. This account is not appropriate for day to day use, and an Administrator account should be created as soon as is practically possible. The password for the **root** account should be noted in a secure place as this password is not reset when the module is defaulted.

Figure 7-3 shows the login screen, after entering the details click the “LOG-IN” button to login. If you lose your passwords you will need to contact your supplier or local drive centre for instructions on how to change the password. The inactivity logout is configurable per account, although it cannot be set to ‘Disabled’ for Super User and Administrator accounts.

**NOTE** Passwords are case sensitive and must be at least 6 characters in length and limited to a maximum of 15 characters. For security reasons passwords should be recorded in a secure location known only to the account user.

**NOTE** The root account password cannot be reset back to the default (**ut72**) as this would be less than the minimum length allowed for a password.

**Figure 7-3 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 SM-Ethernet.

Depending on which page is active, after a period of inactivity you may be automatically logged out. This can be configured from the **Profile** sub-menu of the **HOME** page to one of the following options:

- Default (10 minutes)
- 5 minutes
- 15 minutes
- 30 minutes
- 60 minutes
- Disabled ('Read Only' and 'General User' accounts only)

## 7.2.3 Home

**Homepage** - Displays information about the drive and user configured parameters.

**Module Info** - Shows technical information about SM-Ethernet. This information includes the MAC address, SM-Ethernet firmware version, the power-up time, file system availability and other parameters.

**Profile** - Allows users to change passwords, languages and session timeout lengths.

**Custom pages** - Only present if custom pages have been defined.

## 7.2.4 Parameters

**Drive Menus** - Displays a list of the menus within the host drive.

**Editor** - Shows the parameter editor interface.

The “operators” and “source” options supported by the “Advanced Editor” can also be used in the “Update Value” box to modify the selected parameter.

**Advanced Editor** - Allows direct parameter access by means of a command line instruction, in a similar way to the immediate window in SyPTPro.

The syntax of the command instruction is as follows:

```
{#[int]mm.pp} {[operator][-][source]}
```

**NOTE** For clarity, spaces may be inserted between command arguments as required.

The terminology is described in Table 7.1 *Advanced editor command line syntax*.

**Table 7.1 Advanced editor command line syntax**

| Command                                 | Description   | Example         | Result  |
|---|---|-----------------|---|
| <b>Destination parameter (required)</b> |   |                 |   |
| #mm.pp                                  | Represents the destination menu and parameter.  | #20.21          | Returns the value of Pr 20.21.                            |
| <b>Integer function (optional)</b>      |   |                 |   |
| int                                     | Forces parameter data type to be treated as an integer.                                 | # int 1.21 = 50 | Pr 1.21 displays the value “5.0”.                         |
| <b>Operator (required)</b>              |   |                 |   |
| =                                       | Use source value directly (optional).   | #20.21 = 123    | Writes the value “123” to Pr 20.21.                       |
| ++                                      | Increment destination value by 1.<br><i>Note: Cannot be used with the “-” function.</i> | #20.21 ++       | Increments the value of Pr 20.21 value by 1.              |
| --                                      | Decrement destination value by 1.<br><i>Note: Cannot be used with the “-” function.</i> | #20.21 --       | Decrements the value of Pr 20.21 value by 1.              |
| +=                                      | Increment destination value by source value.  | #1.21 += #20.21 | Increments the value of Pr 1.21 by the value of Pr 20.21. |
| -=                                      | Decrement destination value by source value.  | #1.21 -= #20.21 | Decrements the value of Pr 1.21 by the value of Pr 20.21. |

**Table 7.1 Advanced editor command line syntax**

| Command   | Description   | Example  | Result  |
|---|---|--|---|
| $\wedge$ =  | Exclusive OR destination value with source value.   | #20.20 $\wedge$ = #20.21                                     | Exclusively ORs the value of Pr <b>20.20</b> with the value of Pr <b>20.21</b> and writes the result to Pr <b>20.20</b> . |
| $\&$ =  | AND destination value with source value.  | #20.20 $\&$ = #20.21   | ANDs the value of Pr <b>20.20</b> with the value of Pr <b>20.21</b> and writes the result to Pr <b>20.20</b> .            |
| $ $ =   | OR destination value with source value.   | #20.20 $ $ = #20.21  | ORs the value of Pr <b>20.20</b> with the value of Pr <b>20.21</b> and writes the result to Pr <b>20.20</b> .             |
| <b>Negate function (optional)</b>                                     |   |  |   |
| -   | Negates the source value<br><br><i>Note: Cannot be used without the source parameter specified.</i><br><br><i>Note: Cannot be used with the “++” or “--” operators.</i> | #20.20 = - #20.21  | Writes Pr <b>20.20</b> with a value equal, but of opposite polarity, to the value of Pr <b>20.21</b> .                    |
| <b>Source parameter (required unless “++” or “--” operators used)</b> |   |  |   |
| #mm.pp  | Represents the source menu and parameter.   | #20.20 = <b>#20.21</b>                                       | Writes the value of Pr <b>20.21</b> into Pr <b>20.20</b>  |
| n<br>or<br>0xn  | Represents a number to be used for the source value.<br><br><i>Note: Can be specified in decimal or hexadecimal.</i>  | #20.20 = <b>1500</b><br><br>or<br><br>#20.20 = <b>0x05DC</b> | Writes the value “1500” into Pr <b>20.20</b>  |

**Parameter File** - Allows a CTSOft parameter file to be downloaded from the host drive for setting up parameters.

### 7.2.5 Protocols

**Summary** - Displays and allows editing of the protocol thread priority levels.

**Modbus TCP/IP** - Displays and allows editing of the TCP/IP settings for Modbus TCP/IP.

**Email** - Allows setting up of event triggered e-mails and configuration of the mail server settings.

**Scheduled Events** - Configure events to trigger at certain times or on certain event conditions, also configures the time source server.

**EtherNet/IP** - Displays and allows editing of the EtherNet/IP settings and parameter mappings.

## 7.2.6 Network

**Summary** - Allows SM-Ethernet to scan the local subnet for other SM-Ethernet modules.

**Modules** - The network scan option scans for any module that is within broadcast range. This is not limited by subnets, but by gateways and proxy servers. It can be on the same subnet, or a different subnet, as long as it is not behind a gateway that does not forward broadcast messages. The web pages will only show the first 250 modules found. The modules web page can also be used to configure the IP address settings of other modules on the network, other modules do not have to have valid IP settings to be found. This means that when manually configuring IP addresses, only one module needs to be configured through parameters, the others can all be left with the default settings and configured through the web page of the module that has a valid IP address.

### NOTE

The Ethernet discovery protocol is not compatible across versions. Modules running firmware version V01.00.00 may not locate modules running version V01.01.00 and above and visa-versa.

## 7.2.7 Configuration

**Communications** - Displays and allows changes to the Ethernet and TCP/IP settings. The Ethernet settings which can be changed here are baud rate, duplex mode and crossover compensation. (The only possible change in the TCP/IP section is the option to enable or disable the DHCP server).

**Application** - Allows the displayed information on the Homepage to be viewed or changed. This includes the drive name, network name, drive function and contact details.

**User Menu** - Allows configuration of the user menu (*as shown on the home page under Parameter Summary*) to be changed.

**Update** - Allows system files, language files and backup files to be uploaded to the SM-Ethernet module.

**Backup** - Allows data from the module to be downloaded for backup and security reasons. This file can include the application configuration, module parameter values and module security settings. This file can be uploaded to any SM-Ethernet module (*Decrypt module security settings* not selected) or only to the SM-Ethernet module that was used to create the backup file (*Decrypt module security settings* selected) using the **Update** menu option.

**Security** - Provides user accounts and password management facilities along with a facility to configure the connection filters.

**Reset** - Allows the module to be reset.

## 7.2.8 Help

These pages provide a basic level of help on the features of the SM-Ethernet module.

## 7.2.9 Log-Out

This option logs the current user out of the web pages.

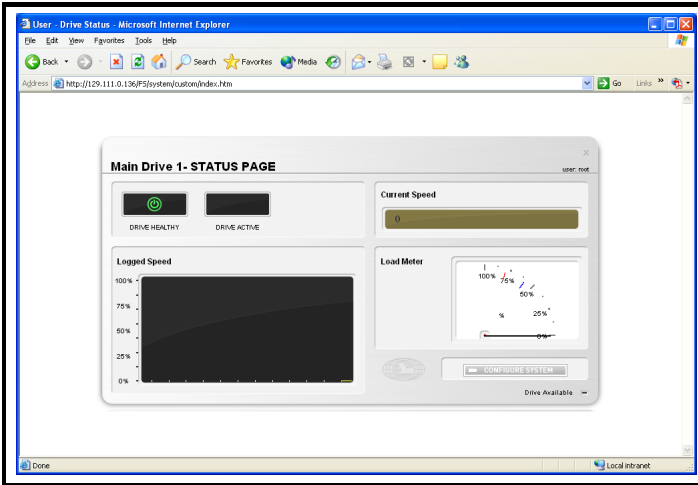


# 8 FTP/custom pages

## 8.1 Introduction

SM-Ethernet gives you the facility to generate customised web pages (*similar to HMI screens*) that can be viewed using a web browser. Figure 8-1 shows one of the supplied custom web pages that can be used as a starting point for your own pages.

Figure 8-1 Custom web page



**NOTE** To avoid potential problems *Control Techniques* recommend that custom web page design is performed only by suitably experienced personnel. Support on this subject will be limited to interfacing to the drive only. General web design techniques will not be supported.

## 8.2 Managing files

In order to upload to SM-Ethernet and download from SM-Ethernet custom web pages on the drive you must connect to the drive using an FTP program. Most popular FTP programs should be suitable for this purpose.

## 8.3 Connections using FTP

These instructions are generic and should be suitable for most FTP programs.

- Open the FTP program.
- Set the host to the IP address of the drive you wish to communicate with.
- Set the port to 21.
- Bypass any proxy server.
- Set server type to ftp.
- Enter the *user name* and *password* for an Administrative account. See section 10.4 *Account management* on page 86.
- Select active mode.
- Set the default remote directory to */system/*.
- Connect to SM-Ethernet.

## 8.4 Custom files

After connecting to SM-Ethernet you should see a listing of the file structure.

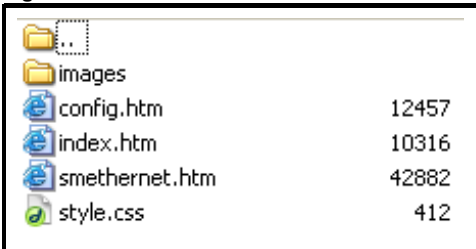
**Figure 8-2 Directory structure**



|          |        |
|----------|--------|
| ..       | Folder |
| config   | Folder |
| custom   | Folder |
| database | Folder |
| language | Folder |
| user     | Folder |

Figure 8-2 shows an example of the directory structure on SM-Ethernet, the files required to generate custom pages are contained within the *custom* directory.

**Figure 8-3 Custom files**



|                |       |
|----------------|-------|
| images         |       |
| config.htm     | 12457 |
| index.htm      | 10316 |
| smethernet.htm | 42882 |
| style.css      | 412   |

Figure 8-3 shows the files for the custom pages that are installed by default on SM-Ethernet, however *index.htm* is the only required file, and if this exists the custom pages will appear in the sub-menu when logged in. The files are defined as follows.

- **smethernet.htm** - contains the Javascript for connecting to the drive parameters and should not be changed.
- **index.htm** - contains examples of how to use the Javascript to display pages on a web page for monitoring of values.
- **config.htm** - contains examples of how to use Javascript to write to parameters in the drive.
- **style.css** - contains the cascading style sheet definitions for the web pages.
- **images** - contains the images for the custom pages, these may be added to if required.

**NOTE**

If these files are not present then please contact your supplier or local drive centre as the custom pages will need to be uploaded into the SM-Ethernet module using the FTP connection.

## 8.5 Generating your own pages

Before starting to modify the pages on SM-Ethernet it is recommended that the current files are backed up onto your PC. This will enable you to restore the files to a known working state. The procedure for modifying the pages is as follows:

- Copy the directory structure to your local hard disk.
- Edit the *index.htm* and *config.htm* to your requirements.
- Add any additional web pages following the structure of *index.htm* and *config.htm*.
- Insert any additional images in the *images* directory.
- Upload the files to the drive and test them.

### NOTE

To test the web pages on the module you will need to log-in to the web pages then select *custom pages* from the *home page* option. You can access the pages directly as *http://WWW.XXX.YYY.ZZZ/FS/system/custom/index.htm* (where *WWW.XXX.YYY.ZZZ* is the target SM-Ethernet module's IP address). You must still be logged in to view these pages (some user accounts can be configured to be permanently logged in see section 10.6 *Security levels* on page 87).

## 8.6 Understanding custom pages

The custom pages are controlled exclusively by the Javascript contained in the library file *smethernet.htm*, this contains the code required to communicate with parameters in the SM-Ethernet and the host drive. The *index.htm* and *config.htm* contain a link to *smethernet.htm* as a reference for the Javascripts required for displaying state, updating values and for producing some of the on-screen objects such as sliders and switches.

From within *index.htm* and *config.htm* there are entries that use the features of *smethernet.htm* for displaying and updating values. These are contained within `<script>` and `</script>` tags as shown below:

```
<script>
new Light("light1", "10.1", {imageOn:"images/healthy_on.gif",
imageOff:"images/illum_off.gif"});
</script>
```

This process is transparent to the end user and the only browser support required is Javascript.

The final stage of the process is the method that SM-Ethernet uses to communicate to the drive. The Javascript in *smethernet.htm* requests a URL from the drive in the format:

```
http://129.111.0.136/US/20.21=5/dynamic/writeparval.xml
```

This is decoded as write the value 5 to Pr **20.21** and return the result of this request in an XML web page on SM-Ethernet with address 129.111.0.136.

SM-Ethernet then decodes the information in the address and returns an XML stream containing the results of the operation, as detailed below, indicating the success of the operation.

```
<status value="0" text="OK" />
```

Reading of parameters is performed in a similar way but uses the URL as follows:

```
http://129.111.0.136/US/1.21/dynamic/readparval.xml
```

This is decoded as a single read of Pr 1.21 from the SM-Ethernet module with the address 129.111.0.136. For multiple parameters each parameter is separated by the underscore character as follows:

```
http://129.111.0.136/US/1.21_1.24/dynamic/readparval.xml
```

The response to the URL request above would be:

```
<parameters>  
<parameter name="1.21" value="55" dp="1" text="5.5Hz" />  
<parameter name="1.24" value="0" dp="1" text="0.0Hz" />  
</parameters>
```

showing the values read from each parameter along with the number of decimal places for the parameter.

**NOTE** To read or write the parameters you must be logged in with appropriate security access.

# 9 Applications

SM-Ethernet provides an alternative to the EIA-485 (RS-485) connections provided on the front of the drive. By using SM-Ethernet it is possible to communicate to the drive using the following range of *Control Techniques* products.

- CTSOft.
- CTScope
- SyPTPro.
- SyPTLite.
- OPC server.

This means that any applications that are familiar to the engineer can now be used over Ethernet as if the user were connected locally.



Some parameters have a profound effect on the operation of the drive. They must not be altered without careful consideration of the impact on the controlled system. Measures must be taken to prevent unwanted changes due to error or tampering especially if a remote user can access the drive over Ethernet.

## 9.1 Minimum software versions required for Ethernet

Table 9.1 below, lists the products used in this chapter and their minimum versions of software required for Ethernet communication.

**Table 9.1 Required software versions for communication over Ethernet**

| Product         | Software Version          |
|-----------------|---------------------------|
| Unidrive SP     | Version 01.06.00 or later |
| Commander SK    | Version 01.06.00 or later |
| Digitax ST      | Version 01.00.00 or later |
| Affinity        | Version 01.00.00 or later |
| Mentor MP       | Version 01.00.00 or later |
| SM-Applications | Version 01.04.05 or later |
| SM-Ethernet     | Version 01.02.00 or later |
| OPC Server      | Version 03.01.00 or later |
| CTScope         | Version 01.00.00 or later |
| SyPTPro         | Version 02.01.00 or later |
| CTSOft          | Version 01.05.00 or later |

## 9.2 CTSOft

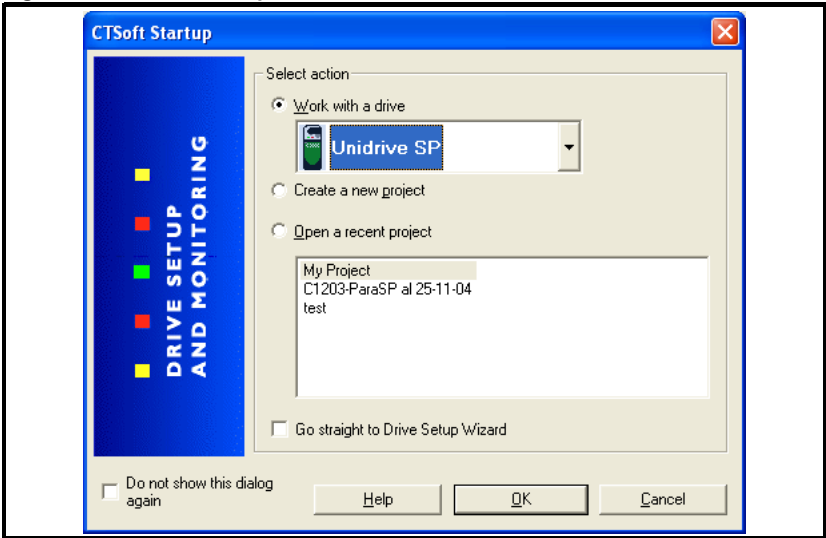
### 9.2.1 Installing CTSOft

To install CTSOft follow the instructions provided with the software. To use CTSOft with Ethernet will require a version of CTSOft that has support for Ethernet and the associated API or communication server. Please contact the supplier of the drive for more information.

## 9.2.2 Basic configuration of CTSOft

After installing CTSOft double click on the program icon. The window shown in Figure 9-1 on page 78 will be displayed. Ensure the drive is connected to the Ethernet network and the PC is on the same subnet (or the drive and PC have suitable gateway addresses configured).

**Figure 9-1 CTSOft start-up**



Select the “Work with a drive” option and select the correct drive type followed by clicking on the “OK” button.

From the navigation panel (Explorer) double click on the drive properties from the list as shown in Figure 9-2 *Drive properties* on page 78.

**Figure 9-2 Drive properties**

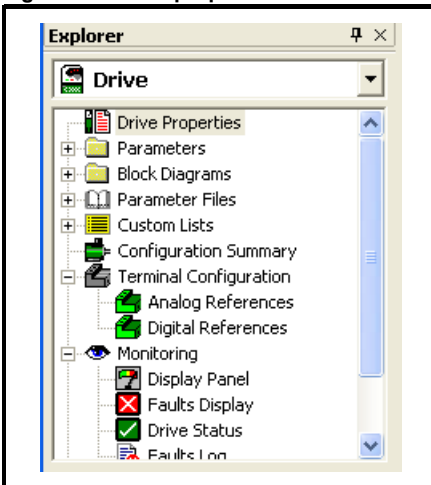
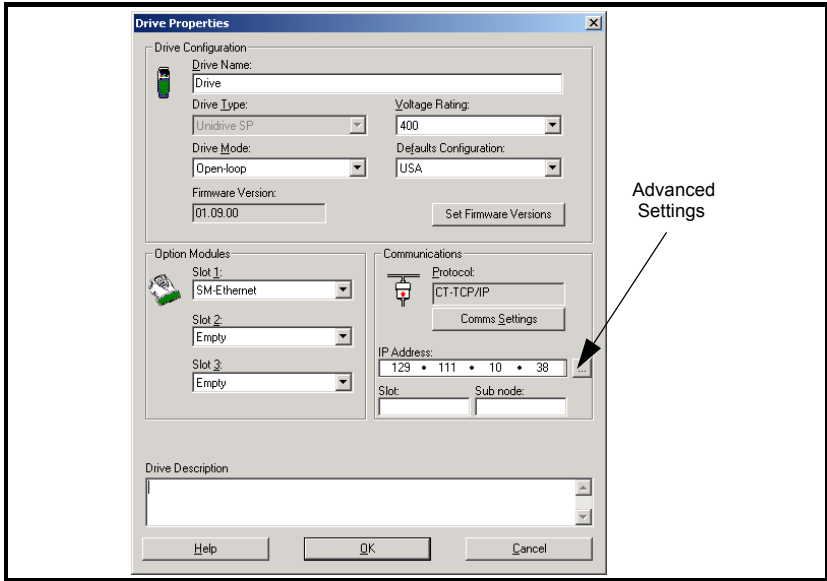


Figure 9-3 Drive properties settings



From the drive properties menu shown in Figure 9-3 click on the “Comms Settings” button and select “CT-TCP/IP” from the protocol drop down box, then click on “advanced” and change the “TCP/IP Extra Timeout” to 2000. Click “OK” and “OK” again to return to the screen shown in Figure 9-3.

Figure 9-3 shows the settings required to specify the IP address of the SM-Ethernet module that the software will directly connect to. The IP address is always required.

To connect to a single drive via Ethernet all that is required is the IP address. The Slot and Sub node fields should be left blank.

To communicate through the host drive via the SM-Ethernet module to a second drive on a CNet network, the “Slot” and “Sub node” values must be entered.

The “Slot” is the slot number of the host drive which contains the SM-Applications module used to route the CNet messages onto the CNet network. The “Sub node” is the CNet node address of the drive to be communicated with.

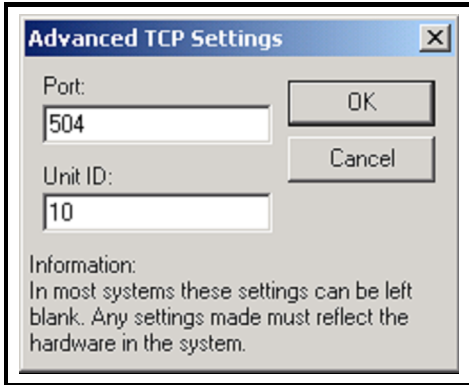
For example, if the host drive has a SM-Ethernet installed in Slot 3 and a SM-Applications installed in Slot 2, to communicate to a drive with a CNet node address of 5, a “slot” number of 2 and a “Sub node” of 5 should be entered.

### 9.2.3 Advanced settings

These are accessed using the button (as shown in Figure 9-3). The Port number will affect all communications and should not usually be changed, any changes to this Port must be matched on the SM-Ethernet module. The Unit ID should normally be blank, if not this informs the software that a third party gateway is in use and communications via SM-Ethernet will not be possible (for a gateway example see Knowledge Base Article COMMS024).

|                         |
|-------------------------|
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**Figure 9-4 Advanced TCP settings**



Finally click “OK” to finish the configuration process. Follow the instructions provided with CTSOft to use the product.

The only configuration possible using CTSOft over SM-Ethernet is a single SM-Ethernet module on a solitary network drive at the same time.

**NOTE** Support for the SM-Ethernet was included in CTSOft Version 01.05.00 and above. Support for using SM-Ethernet as a gateway to CTNet was included in CTSOft Version 01.06.01 and above.

**NOTE** For communication to be established, the serial priority parameter Pr **MM.37** must be set to ON in SM-Ethernet.

## 9.3 CTScope

### 9.3.1 Installing CTScope

To install CTScope, follow the instructions provided with the software.

### 9.3.2 CTScope configuration

All the appropriate configuration settings are displayed on the main screen for communication over TCP/IP with CTScope.

**NOTE** For communication to be established, the serial priority parameter Pr **MM.37** must be set to ON in SM-Ethernet.

## 9.4 SyPTPro

### 9.4.1 Installing SyPTPro

To install SyPTPro follow the instructions provided with the software. To use SyPTPro with Ethernet will require a version of SyPTPro that has support for Ethernet. Table 9.1 below lists the minimum software version required for communication over Ethernet for the *Control Techniques* products used in this section.



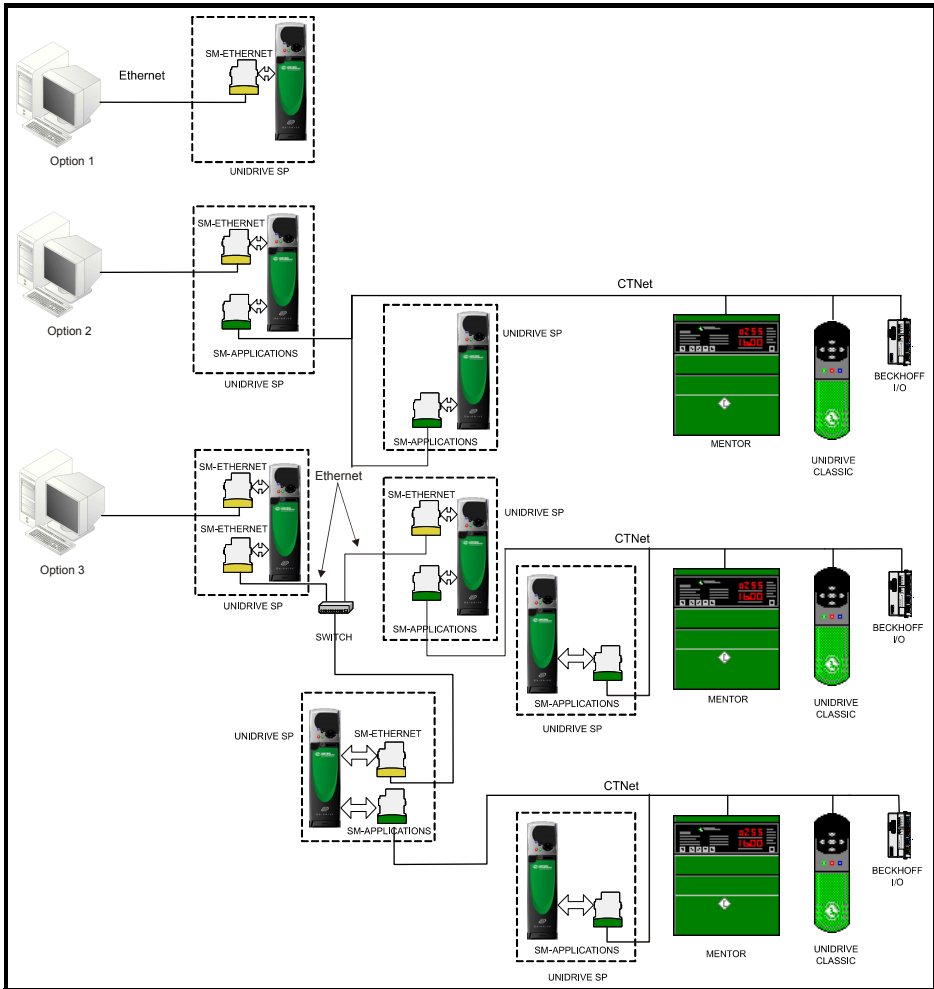
## 9.4.2 SyPTPro configuration

There are a number of possible configurations for using SyPTPro over Ethernet.

1. A single SM-Ethernet module on a solitary network drive.
2. A first drive hosting a single SM-Ethernet module with a single SM-Applications networked to a second CTNet enabled drive or Beckhoff bus coupler.
3. A first drive hosting two SM-Ethernet modules networked to a second CTNet drive hosting a single SM-Ethernet module.

Figure 9-5 illustrates these three configurations.

**Figure 9-5 SyPTPro over Ethernet routing options**

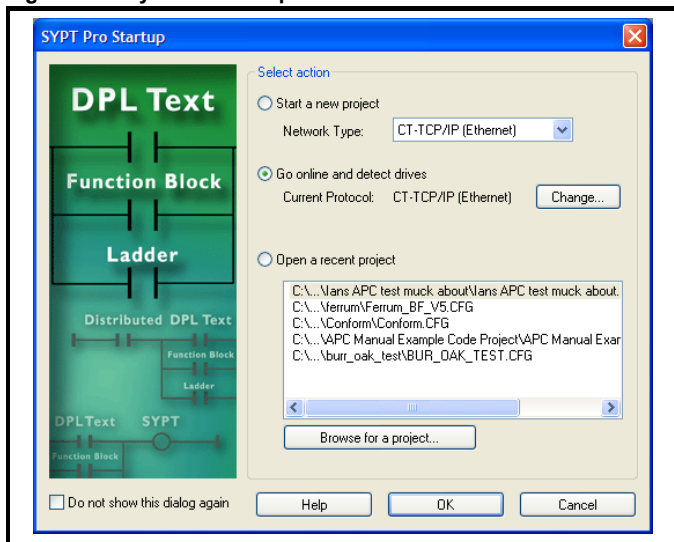


For each configuration the following steps must be taken:

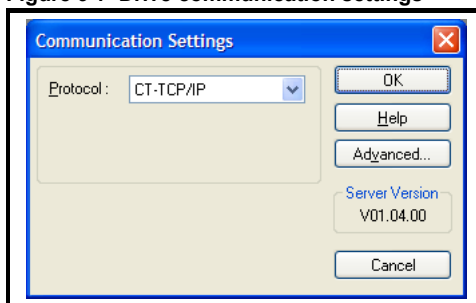
1. After installing SyPTPro double click on the program icon. The window shown in Figure 9-6, below, will be displayed. If the current protocol is not set to "CT-TCP/IP

- (Ethernet)", then click the "Change" button and a window similar to Figure 9-7, below, will be displayed, select the "CT-TCP/IP" protocol and click "OK".
2. Select the "Go online and detect drives" option and click "OK", the communication settings window will be displayed as shown in Figure 9-8 on page 83.
  3. From the communication settings window, select the "Automatically scan local network" option. (SyPTPro can be instructed to search for all nodes on the local network, specific nodes grouped together on a particular network or additional networks (Ethernet or CNet) via specified IP address(es), these addresses are added by selecting the "Connect to/through specific nodes" option and clicking on the "Add" button. Each IP address and port number (if necessary) may now be added, click on "OK" to accept the changes and return to the PC communication settings window).
  4. When all network options are configured as required, click on "OK" and SyPTPro will browse the network to find all drives resident on it (depending on the configured network settings).

**Figure 9-6 SyPTPro startup**

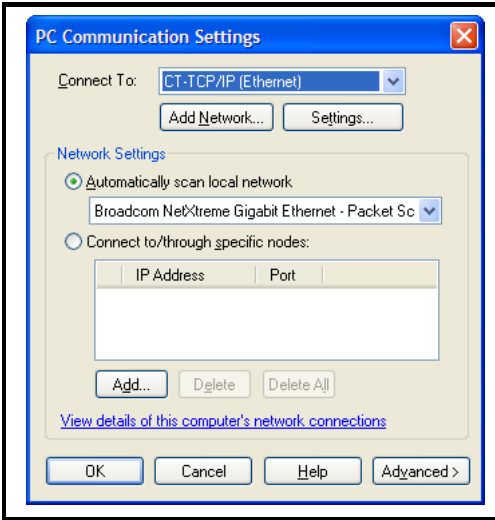


**Figure 9-7 Drive communication settings**



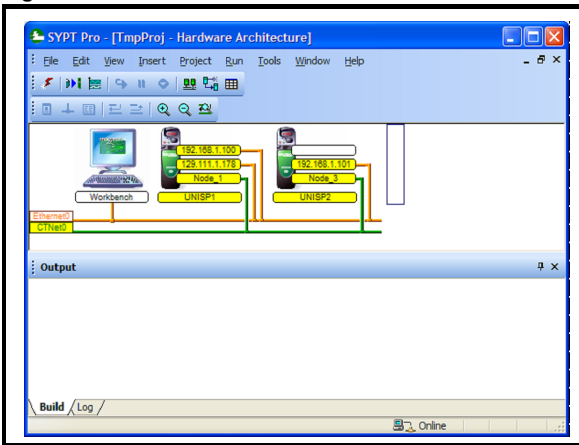
**NOTE** For communication to be established, the serial priority parameter Pr **MM.37** must be set to ON in SM-Ethernet.

Figure 9-8 PC Communication settings



5. A graphical representation of the network is displayed. Figure 9-9, below, shows the third configuration type. A first drive hosting two SM-Ethernet modules networked to a second CTNet drive hosting a single SM-Ethernet module.

Figure 9-9 Hardware architecture



**NOTE**

For a system with multiple networks Pr **MM.38** can be used to define the group in which the module is found, this is reflected in SyPTPro by the network number, for example if a module is set to group 2 it will appear on network Ethernet2 in SyPTPro. Pr **MM.38** must match the network number that the module is connected to in SyPTPro otherwise the node may not be detected.

## 9.5 SyPTLite

SyPTLite is currently only supported if launched from SyPTPro.

## 9.6 OPC server

The *Control Techniques* OPC server can be used to provide communication between an OPC client (which supports the OPC data access specification) and any suitable *Control Techniques* drive. The OPC client configures the OPC server on which drive parameters to read and the cyclic rate at which they will be read. The OPC server will notify the client if any of the configured parameter values change, the OPC client then requests the updated value from the OPC server.

The *Control Techniques* OPC server version 03.01.00 and above support the TCP/IP protocol used over Ethernet.

**NOTE** For further information please contact the supplier of the drive.

# 10 Security

## 10.1 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.

## 10.2 General site security issues

### 10.2.1 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.

### 10.2.2 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** *Control Techniques* 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.

### 10.2.3 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.

## 10.3 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 **MM.36** (please see section 12.4.7 *SM-Ethernet disable full access* on page 106 for more information).

### 10.3.1 Disable Full Access

The global write enable Pr **MM.36** is set to 0 by default. This will allow parameters to be changed within the drive. To prevent changes to drive parameters over Ethernet, Pr **MM.36** should be set to a 1. This will prevent changes via Modbus IP, EtherNet/IP and the web pages.

## 10.4 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 **root** and password **ut72** 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 on the number of active user accounts allowed, this limit is fixed at 10 and includes logged-in users and any communication accounts in use (e.g. FTP, EtherNet/IP, etc.).

The maximum number of active logged-in user accounts is 5.

**NOTE** A good company policy on passwords can help prevent problems occurring due to lost passwords.

## 10.5 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 *root* or an *administrator* account.
2. Choose the top level **CONFIGURATION** menu then the **Security** menu.
3. Select "Add/Modify/Remove user accounts".
4. Click on "New".
5. Enter the details as requested in the menu.
6. Click "Apply" to finish.

**NOTE** Following changes to the *root* account password SM-Ethernet should be reset using the reset function on the web pages.

### 10.5.1 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, SM-Ethernet and the system. Where possible more than one person should be given administration privileges. An administrative account is required for adding/removing accounts.

### 10.5.2 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 10.6 *Security levels* on page 87.

## 10.6 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 10.1 Security levels**

|               | View Home Page | View Help Pages | View Parameters | View Status Pages | View Config Overviews | Edit Parameters | Edit Configuration | View Security Settings | Edit Security Settings | Enable Features | Upload Firmware | Disable session timeout |
|---------------|----------------|-----------------|-----------------|-------------------|-----------------------|-----------------|--------------------|------------------------|------------------------|-----------------|-----------------|-------------------------|
| Open Access   | Yes            | No              | No              | No                | No                    | No              | No                 | No                     | No                     | No              | No              | N/A                     |
| Read Only     | Yes            | Yes             | Yes             | Yes               | No                    | No              | No                 | No                     | No                     | No              | No              | Yes                     |
| General User  | Yes            | Yes             | Yes             | Yes               | Yes                   | Yes             | No                 | No                     | No                     | No              | No              | Yes                     |
| Super User    | Yes            | Yes             | Yes             | Yes               | Yes                   | Yes             | Yes                | Yes                    | No                     | No              | No              | No                      |
| Administrator | Yes            | Yes             | Yes             | Yes               | Yes                   | Yes             | Yes                | Yes                    | Yes                    | Yes             | Yes             | No                      |

### 10.6.1 Limiting access

SM-Ethernet will prevent a single user logging in more than once. A maximum of 5 simultaneous web based connections are possible. It is always possible for an administrator to log in.

### 10.6.2 Protocol authentication

Certain protocols and services will require a user to authenticate using a password and a username. This protection is detailed in the relevant protocol section of the user guide.

### 10.6.3 Connection filtering

It is possible to configure SM-Ethernet to only accept connections from trusted IP, network or MAC addresses. This is a very secure method of preventing unauthorized access to the drive.

A list of trusted hosts is stored in the module and only addresses on this list are able to communicate with SM-Ethernet.

#### NOTE

Be careful when enabling connection filtering as it is possible to lose the ability to communicate with SM-Ethernet. If this situation occurs it is possible to disable connection filtering by setting Pr **MM.39** to 0.

# 11 Diagnostics

This section of the manual provides basic diagnostic information intended to enable resolution of the most common problems encountered when setting up an SM-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. Start by using the *Diagnostic flow chart* on page 89 to determine the possible cause of a problem. If after following the flow chart 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.

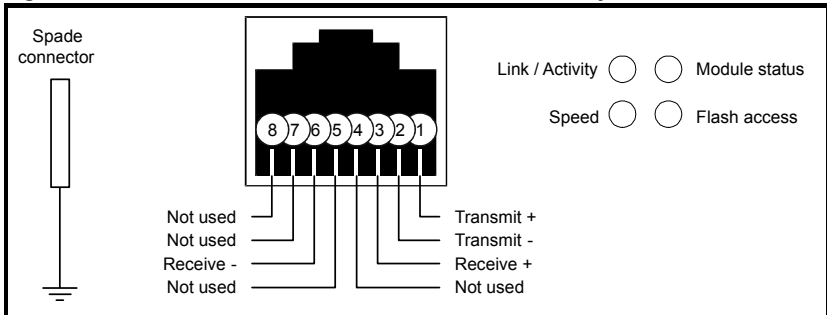
## 11.1 LED diagnostics

The SM-Ethernet module is equipped with 4 LEDs on the front panel to aid in the diagnostics procedure. The functions of these LEDs are described in Table 11.1 *LED functionality* below.

**Table 11.1 LED functionality**

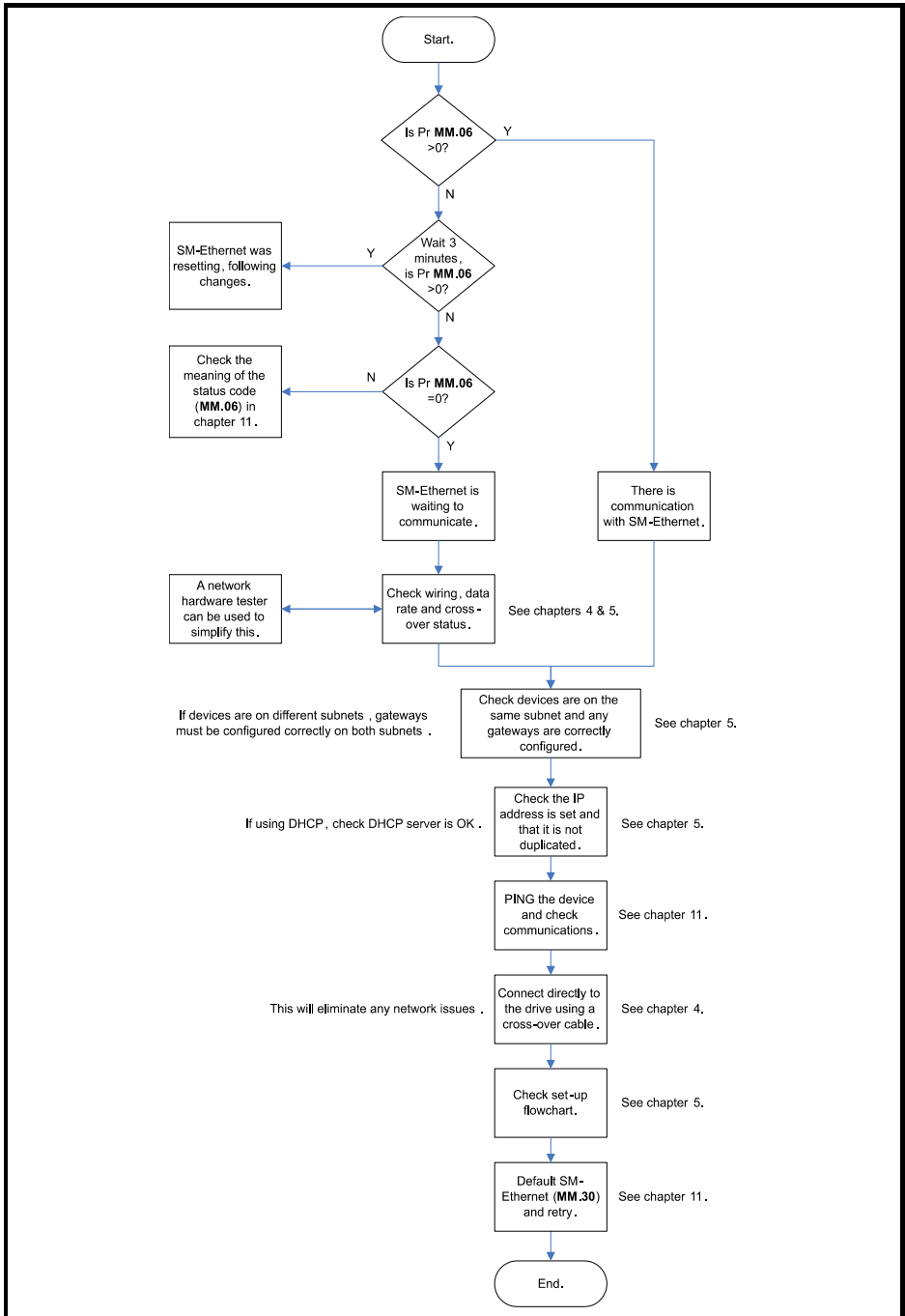
| LED Name        | LED State              | Description                            |
|-----------------|------------------------|--|
| Link / Activity | Off                    | Ethernet connection not detected.      |
|                 | Steady green           | Ethernet connection detected.          |
|                 | Flashing green         | Ethernet communication detected.       |
| Speed           | Off                    | 10Mb/s data rate.                      |
|                 | On                     | 100Mb/s data rate.                     |
| Module status   | Flashing green (slow)  | Running RAM bootloader image.          |
|                 | Flashing green (fast)  | Initialising main image.               |
|                 | Steady green           | Running.                               |
|                 | Flashing green and red | Warning (slot or configuration error). |
|                 | Steady red             | Major fault.                           |
| Flash access    | Steady green           | Reading from flash memory.             |
|                 | Steady red             | Writing to flash memory.               |

**Figure 11-1 SM-Ethernet connections and LED indicator layout**





## 11.2 Diagnostic flow chart



|                         |
|-------------------------|
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| Electrical installation |
| Getting started         |
| Protocols               |
| Web page basics         |
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| <b>Diagnostics</b>      |
| Advanced features       |
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## 11.3 Module identification parameters

The basic SM-Ethernet configuration parameters can be accessed through the slot menu in the drive, Pr **MM.xx** where **MM** is the menu for SM-Ethernet in the host drive.

### 11.3.1 SM-Ethernet module ID code

| SM-Ethernet - module ID code |         |                   |
|------------------------------|---------|-------------------|
| Pr <b>MM.01</b>              | Default | 410 (SM-Ethernet) |
|                              | Range   | -                 |
|                              | Access  | RO                |

The module ID code indicates the type of module installed into the slot corresponding to menu **MM**. This is useful for checking the module installed is of the correct type, especially when used with DPL code. The ID code for SM-Ethernet is 410.

### 11.3.2 SM-Ethernet firmware version

| SM-Ethernet firmware - major version (xx.yy) |         |                |
|--|---------|----------------|
| Pr <b>MM.02</b>                              | Default | N/A            |
|  | Range   | 00.00 to 99.99 |
|  | Access  | RO             |

| SM-Ethernet firmware - minor version (zz) |         |         |
|---|---------|---------|
| Pr <b>MM.51</b>                           | Default | N/A     |
|   | Range   | 0 to 99 |
|   | Access  | RO      |

#### Unidrive SP (Sizes 1 to 6) / Unidrive SPM / Mentor MP

The software version of the Solutions Modules can be identified by looking at Pr **15.02** or Pr **16.02** or Pr **17.02** and Pr **15.51** or Pr **16.51** or Pr **17.51**.

Menu 15,16 or 17 is Solutions Module slot dependent with menu 17 being the lowest position nearest the control terminal connections.

The software version takes the form of xx.yy.zz, where Pr **15.02** or Pr **16.02** or Pr **17.02** displays xx.yy and Pr **15.51** or Pr **16.51** or Pr **17.51** displays zz (e.g. for software version 01.01.00 on a module in the middle Solutions Module slot, Pr **16.02** will display 1.01 and Pr **16.51** will display 0).

#### Unidrive SP (Size 0) / Digitax ST / Unidrive ES / Affinity

The software version of the Solutions Modules can be identified by looking at Pr **15.02** or Pr **16.02** and Pr **15.51** or Pr **16.51**.

Menu 15 or 16 is Solutions Module slot dependent with menu 15 (Unidrive SP size 0 and Digitax ST) or menu 16 (Unidrive ES and Affinity) being the position nearest the control terminal connections.

The software version takes the form of xx.yy.zz, where Pr **15.02** or Pr **16.02** displays xx.yy and Pr **15.51** or Pr **16.51** displays zz (e.g. for software version 01.01.00 on a module in the middle Solutions Module slot (Unidrive ES and Affinity) or for Unidrive SP size 0 and Digitax ST, the Solutions Module slot nearest the incoming supply terminals), Pr **16.02** will display 1.01 and Pr **16.51** will display 0).

#### Commander SK (Sizes B to D and 2 to 6)

The software version of the Solutions 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).

### 11.3.3 SM-Ethernet user allocated address

| SM-Ethernet - user allocated address |         |            |
|--------------------------------------|---------|------------|
| Pr MM.03                             | Default | 0          |
|                                      | Range   | 0 to 65535 |
|                                      | Access  | RW         |

This is used as a way to identify the node on the network independently of the IP address. This is not the IP address. This allows SM-Ethernet to be identified without knowing the IP address and is used in conjunction with Pr **MM.38** (see section 12.4.9 *SM-Ethernet user allocated group* on page 107).

## 11.4 Network configuration parameters

### 11.4.1 SM-Ethernet data rate

| SM-Ethernet - data rate |         |        |
|-------------------------|---------|--------|
| Pr MM.04                | Default | 0      |
|                         | Range   | 0 to 2 |
|                         | Access  | RW     |

The SM-Ethernet will automatically detect the network data rate when set to 0. When using auto-detect, information about the negotiated setting will be stored in Pr **MM.44**.

**Table 11.2 SM-Ethernet baud rates**

| Pr MM.04 | bit/s       |
|----------|-------------|
| 0        | Auto-detect |
| 1        | 10Mbps      |
| 2        | 100Mbps     |

### 11.4.2 SM-Ethernet DHCP enable

| SM-Ethernet - DHCP enable |         |              |
|---------------------------|---------|--------------|
| Pr MM.05                  | Default | 0 (disabled) |
|                           | Ranges  | 0 to 1       |
|                           | Access  | RW           |

If set to a 0 the module will use static IP addressing and get its address, subnet mask and default gateway from parameters Pr **MM.10** to Pr **MM.13**, Pr **MM.14** to Pr **MM.17** and Pr **MM.18** to Pr **MM.21** respectively. When set to 1 the module will obtain this information from a DHCP server on the network.

**NOTE** It is recommended that the MAC address of the SM-Ethernet module is used to allocate the IP address when DHCP is enabled.

### 11.4.3 SM-Ethernet IP address $W_{ip}$

| SM-Ethernet - IP address $W_{ip}$ |         |       |
|-----------------------------------|---------|-------|
| Pr MM.10                          | Default | 192   |
|                                   | Range   | 0-255 |
|                                   | Access  | RW    |

This is the most significant octet of the module's IP address. When using DHCP this will be updated from the DHCP server. The IP address is in the format W.X.Y.Z.

If DHCP is disabled, (**MM.05=0**), then this parameter should be saved (**xx.00=1000** or **xx.00=1001** if using a DC supply to power the drive) and activated by resetting the SM-Ethernet module (**MM.32=ON**).

#### 11.4.4 SM-Ethernet IP address $X_{ip}$

| SM-Ethernet - IP address $X_{ip}$ |         |       |
|-----------------------------------|---------|-------|
| Pr <b>MM.11</b>                   | Default | 168   |
|                                   | Range   | 0-255 |
|                                   | Access  | RW    |

This is the second most significant octet of the module's IP address. When using DHCP this will be updated from the DHCP server. The IP address is in the format W.X.Y.Z.

If DHCP is disabled, (**MM.05=0**), then this parameter should be saved (**xx.00=1000** or **xx.00=1001** if using a DC supply to power the drive) and activated by resetting the SM-Ethernet module (**MM.32=ON**).

#### 11.4.5 SM-Ethernet IP address $Y_{ip}$

| SM-Ethernet - IP address $Y_{ip}$ |         |       |
|-----------------------------------|---------|-------|
| Pr <b>MM.12</b>                   | Default | 1     |
|                                   | Range   | 0-255 |
|                                   | Access  | RW    |

This is the third most significant octet of the module's IP address. When using DHCP this will be updated from the DHCP server. The IP address is in the format W.X.Y.Z.

If DHCP is disabled, (**MM.05=0**), then this parameter should be saved (**xx.00=1000** or **xx.00=1001** if using a DC supply to power the drive) and activated by resetting the SM-Ethernet module (**MM.32=ON**).

#### 11.4.6 SM-Ethernet IP address $Z_{ip}$

| SM-Ethernet - IP address $Z_{ip}$ |         |       |
|-----------------------------------|---------|-------|
| Pr <b>MM.13</b>                   | Default | 100   |
|                                   | Range   | 0-255 |
|                                   | Access  | RW    |

This is the least significant octet of the module's IP address. When using DHCP this will be updated from the DHCP server. The IP address is in the format W.X.Y.Z.

If DHCP is disabled, (**MM.05=0**), then this parameter should be saved (**xx.00=1000** or **xx.00=1001** if using a DC supply to power the drive) and activated by resetting the SM-Ethernet module (**MM.32=ON**).

#### 11.4.7 SM-Ethernet IP subnet mask $W_{subnet}$

| SM-Ethernet - IP subnet mask $W_{subnet}$ |         |       |
|---|---------|-------|
| Pr <b>MM.14</b>                           | Default | 255   |
|   | Range   | 0-255 |
|   | Access  | RW    |

This is the most significant octet of the module's IP subnet mask. When using DHCP this will be updated from the DHCP server. The IP subnet mask is in the format W.X.Y.Z.

If DHCP is disabled, (**MM.05=0**), then this parameter should be saved (**xx.00=1000** or **xx.00=1001** if using a DC supply to power the drive) and activated by resetting the SM-Ethernet module (**MM.32=ON**).

#### 11.4.8 SM-Ethernet IP subnet mask $X_{\text{subnet}}$

| SM-Ethernet - IP address $X_{\text{subnet}}$ |         |       |
|--|---------|-------|
| Pr <b>MM.15</b>                              | Default | 255   |
|  | Range   | 0-255 |
|  | Access  | RW    |

This is the second most significant octet of the module's IP subnet mask. When using DHCP this will be updated from the DHCP server. The IP subnet mask is in the format W.X.Y.Z.

If DHCP is disabled, (**MM.05=0**), then this parameter should be saved (**xx.00=1000** or **xx.00=1001** if using a DC supply to power the drive) and activated by resetting the SM-Ethernet module (**MM.32=ON**).

#### 11.4.9 SM-Ethernet IP subnet mask $Y_{\text{subnet}}$

| SM-Ethernet IP subnet mask $Y_{\text{subnet}}$ |         |       |
|--|---------|-------|
| Pr <b>MM.16</b>                                | Default | 255   |
|  | Range   | 0-255 |
|  | Access  | RW    |

This is the third most significant octet of the module's IP subnet mask. When using DHCP this will be updated from the DHCP server. The IP subnet mask is in the format W.X.Y.Z.

If DHCP is disabled, (**MM.05=0**), then this parameter should be saved (**xx.00=1000** or **xx.00=1001** if using a DC supply to power the drive) and activated by resetting the SM-Ethernet module (**MM.32=ON**).

#### 11.4.10 SM-Ethernet IP subnet mask $Z_{\text{subnet}}$

| SM-Ethernet - IP subnet mask $Z_{\text{subnet}}$ |         |       |
|--|---------|-------|
| Pr <b>MM.17</b>                                  | Default | 0     |
|  | Range   | 0-255 |
|  | Access  | RW    |

This is the least significant octet of the module's IP subnet mask. When using DHCP this will be updated from the DHCP server. The IP subnet mask is in the format W.X.Y.Z.

If DHCP is disabled, (**MM.05=0**), then this parameter should be saved (**xx.00=1000** or **xx.00=1001** if using a DC supply to power the drive) and activated by resetting the SM-Ethernet module (**MM.32=ON**).

#### 11.4.11 SM-Ethernet IP default gateway $W_{\text{gateway}}$

| SM-Ethernet IP - default gateway $W_{\text{gateway}}$ |         |       |
|---|---------|-------|
| Pr <b>MM.18</b>                                       | Default | 192   |
|   | Range   | 0-255 |
|   | Access  | RW    |

This is the most significant octet of the module's IP default gateway address. When using DHCP this will be updated from the DHCP server. The default gateway address is in the format W.X.Y.Z.

If DHCP is disabled, (**MM.05=0**), then this parameter should be saved (**xx.00=1000** or **xx.00=1001** if using a DC supply to power the drive) and activated by resetting the SM-Ethernet module (**MM.32=ON**).

#### 11.4.12 SM-Ethernet IP default gateway $X_{gateway}$

| SM-Ethernet IP - default gateway $X_{gateway}$ |                |       |
|--|----------------|-------|
| Pr <b>MM.19</b>                                | <b>Default</b> | 168   |
|  | <b>Range</b>   | 0-255 |
|  | <b>Access</b>  | RW    |

This is the second most significant octet of the module's IP default gateway address. When using DHCP this will be updated from the DHCP server. The default gateway address is in the format W.X.Y.Z.

If DHCP is disabled, (**MM.05=0**), then this parameter should be saved (**xx.00=1000** or **xx.00=1001** if using a DC supply to power the drive) and activated by resetting the SM-Ethernet module (**MM.32=ON**).

#### 11.4.13 SM-Ethernet IP default gateway $Y_{gateway}$

| SM-Ethernet IP - default gateway $Y_{gateway}$ |                |       |
|--|----------------|-------|
| Pr <b>MM.20</b>                                | <b>Default</b> | 1     |
|  | <b>Range</b>   | 0-255 |
|  | <b>Access</b>  | RW    |

This is the third most significant octet of the module's IP default gateway address. When using DHCP this will be updated from the DHCP server. The IP subnet mask is in the format W.X.Y.Z.

If DHCP is disabled, (**MM.05=0**), then this parameter should be saved (**xx.00=1000** or **xx.00=1001** if using a DC supply to power the drive) and activated by resetting the SM-Ethernet module (**MM.32=ON**).

#### 11.4.14 SM-Ethernet IP default gateway $Z_{gateway}$

| SM-Ethernet IP - default gateway $Z_{gateway}$ |                |       |
|--|----------------|-------|
| Pr <b>MM.21</b>                                | <b>Default</b> | 254   |
|  | <b>Range</b>   | 0-255 |
|  | <b>Access</b>  | RW    |

This is the least significant octet of the module's IP default gateway address. When using DHCP this will be updated from the DHCP server. The default gateway address is in the format W,X,Y,Z.

If DHCP is disabled, (**MM.05=0**), then this parameter should be saved (**xx.00=1000** or **xx.00=1001** if using a DC supply to power the drive) and activated by resetting the SM-Ethernet module (**MM.32=ON**).

#### 11.4.15 SM-Ethernet Duplex mode

| SM-Ethernet Duplex mode |                |                 |
|-------------------------|----------------|-----------------|
| Pr <b>MM.42</b>         | <b>Default</b> | 0 (auto-detect) |
|                         | <b>Range</b>   | 0 to 2          |
|                         | <b>Access</b>  | RW              |

This parameter determines how the duplex mode is set on SM-Ethernet. When set to 0 the module will auto-negotiate the duplex mode.

**Table 11.3 Duplex mode**

| Pr MM.42 | bit/s        |
|----------|--------------|
| 0        | Auto-detect. |
| 1        | full duplex. |
| 2        | half duplex. |

If this parameter value is changed, then a module save should be performed (**xx.00**=1000 or **xx.00**=1001 if using a DC supply to power the drive) followed by resetting the SM-Ethernet module (**MM.32**=ON) to activate the change.

**11.4.16 SM-Ethernet enable auto-crossover detection**

| SM-Ethernet - Enable crossover detection |         |              |
|--|---------|--------------|
| Pr MM.43                                 | Default | 0 (disabled) |
|  | Range   | 0 to 1       |
|  | Access  | RW           |

This parameter is used to determine if the module should use auto-crossover detection or use a standard (*patch*) cable. If it is set to 0 you either need a cross-over cable or you need to connect via a switch.

**Table 11.4 Crossover detection**

| Pr MM.43 | Crossover detection |
|----------|---------------------|
| 0        | Disabled.           |
| 1        | Enabled.            |

If this parameter value is changed, then a module save should be performed (**xx.00**=1000 or **xx.00**=1001 if using a DC supply to power the drive) followed by resetting the SM-Ethernet module (**MM.32**=ON) to activate the change.

**11.4.17 SM-Ethernet actual baud rate**

| SM-Ethernet Actual baud rate |         |        |
|------------------------------|---------|--------|
| Pr MM.44                     | Default | 0      |
|                              | Range   | 0 to 2 |
|                              | Access  | R      |

Displays the baud rate at which SM-Ethernet is operating.

**Table 11.5 Actual baud rate**

| Pr MM.44 | Actual baud rate   |
|----------|--------------------|
| 0        | Baud rate not set. |
| 1        | 10Mbs.             |
| 2        | 100Mbs.            |

**11.4.18 SM-Ethernet actual duplex mode**

| SM-Ethernet Actual duplex mode |         |        |
|--------------------------------|---------|--------|
| Pr MM.45                       | Default | 0      |
|                                | Range   | 0 to 2 |
|                                | Access  | R      |

Displays the duplex mode that SM-Ethernet is currently using.

**Table 11.6 Actual duplex mode**

| Pr MM.45 | Actual duplex mode   |
|----------|----------------------|
| 0        | Duplex mode not set. |
| 1        | Full duplex mode.    |
| 2        | Half duplex mode.    |

**11.4.19 SM-Ethernet MAC address U<sub>MAC</sub>**

| SM-Ethernet MAC address U <sub>MAC</sub> |                |                         |
|--|----------------|-------------------------|
| Pr 61.01                                 | <b>Default</b> | 00 (Control Techniques) |
|  | <b>Range</b>   | 0 to 255                |
|  | <b>Access</b>  | R                       |

The most significant byte of the MAC address. The MAC address is a unique value specific to only a single SM-Ethernet module and takes the form U:V:W:X:Y:Z. The MAC address may be found on the product label on the outside of SM-Ethernet. This part of the MAC address will always be set to 00 as the first 3 bytes of the MAC address defines the manufacturer (Control Techniques).

**11.4.20 SM-Ethernet MAC address V<sub>MAC</sub>**

| SM-Ethernet MAC address V <sub>MAC</sub> |                |                         |
|--|----------------|-------------------------|
| Pr 61.02                                 | <b>Default</b> | 0D (Control Techniques) |
|  | <b>Range</b>   | 0 to 255                |
|  | <b>Access</b>  | R                       |

The second most significant byte of the MAC address. The MAC address is a unique value specific to only a single SM-Ethernet module and takes the form U:V:W:X:Y:Z. The MAC address may be found on the product label on the outside of SM-Ethernet. This part of the MAC address will always be set to 0D as the first 3 bytes of the MAC address defines the manufacturer (Control Techniques).

**11.4.21 SM-Ethernet MAC address W<sub>MAC</sub>**

| SM-Ethernet MAC address W <sub>MAC</sub> |                |                         |
|--|----------------|-------------------------|
| Pr 61.03                                 | <b>Default</b> | 1E (Control Techniques) |
|  | <b>Range</b>   | 0 to 255                |
|  | <b>Access</b>  | R                       |

The third most significant byte of the MAC address. The MAC address is a unique value specific to only a single SM-Ethernet module and takes the form U:V:W:X:Y:Z. The MAC address may be found on the product label on the outside of SM-Ethernet. This part of the MAC address will always be set to 1E as the first 3 bytes of the MAC address defines the manufacturer (Control Techniques).



### 11.4.22 SM-Ethernet MAC address $X_{MAC}$

| SM-Ethernet MAC address $X_{MAC}$ |         |          |
|-----------------------------------|---------|----------|
| Pr 61.04                          | Default | -        |
|                                   | Range   | 0 to 255 |
|                                   | Access  | R        |

The fourth most significant byte of the MAC address. The MAC address is a unique value specific to only a single SM-Ethernet module and takes the form U:V:W:X:Y:Z. The MAC address may be found on the product label on the outside of SM-Ethernet. The last 3 bytes form a unique serial number for a specific SM-Ethernet.

### 11.4.23 SM-Ethernet MAC address $Y_{MAC}$

| SM-Ethernet MAC address $Y_{MAC}$ |         |          |
|-----------------------------------|---------|----------|
| Pr 61.05                          | Default | -        |
|                                   | Range   | 0 to 255 |
|                                   | Access  | R        |

The fifth most significant byte of the MAC address. The MAC address is a unique value specific to only a single SM-Ethernet module and takes the form U:V:W:X:Y:Z. The MAC address may be found on the product label on the outside of SM-Ethernet. The last 3 bytes form a unique serial number for a specific SM-Ethernet.

### 11.4.24 SM-Ethernet MAC address $Z_{MAC}$

| SM-Ethernet MAC address $Z_{MAC}$ |         |          |
|-----------------------------------|---------|----------|
| Pr 61.06                          | Default | -        |
|                                   | Range   | 0 to 255 |
|                                   | Access  | R        |

The least significant byte of the MAC address. The MAC address is a unique value specific to only a single SM-Ethernet module and takes the form U:V:W:X:Y:Z. The MAC address may be found on the product label on the outside of SM-Ethernet. The last 3 bytes form a unique serial number for a specific SM-Ethernet.

## 11.5 Diagnostic parameters

### 11.5.1 SM-Ethernet diagnostic information

| SM-Ethernet - diagnostic information |         |             |
|--------------------------------------|---------|-------------|
| Pr MM.06                             | Default | N/A         |
|                                      | Range   | -99 to 9999 |
|                                      | Access  | RO          |

The diagnostic information for the SM-Ethernet can be viewed in the diagnostic information parameter (Pr **MM.06**). When the SM-Ethernet is communicating successfully over Ethernet, Pr **MM.06** will give an indication of the number of frames that are being processed per second. For a list of operating status codes see Table 11.7 *SM-Ethernet operating status codes* on page 98.

**Table 11.7 SM-Ethernet operating status codes**

| Pr MM.06                      | Status                       | Description  |
|-------------------------------|------------------------------|--|
| <b>Running states</b>         |                              |  |
| >0                            | Network ok                   | Indicates the number of frames the SM-Ethernet has transmitted and received per second.  |
| 0                             | Link established             | A link has been established but no frames are being transmitted or received.   |
| -1                            | Initialisation complete      | The Solutions Module has initialised correctly but no network communication is taking place on Ethernet.   |
| <b>Initialisation states</b>  |                              |  |
| -2                            | Protocols                    | The user protocols such as the web server, discovery, modbus, etc. are being initialised.  |
| -4                            | Ethernet                     | DHCP (if used) has configured the module address. The security and application settings are being loaded from the file system.                                     |
| -6                            | File                         | Configuration files are being handled.   |
| -8                            | Drive                        | The drive interface is being initialised.  |
| -10                           | Storage                      | The file system and memory manager are being initialised.  |
| <b>Boot loader states</b>     |                              |  |
| -14                           | Launch                       | The application image was successfully extracted and about to be executed.   |
| -15                           | Firmware ok                  | Firmware is tested and is valid and about to be extracted to RAM.  |
| -16                           | FLASH ok                     | FLASH programming with new firmware finished.  |
| -17                           | Program FLASH                | Downloaded firmware being written to FLASH.  |
| -18                           | Download                     | New firmware is being downloaded from the FTP server.  |
| -19                           | Ethernet interface           | The Ethernet interface is being initialised.   |
| -20                           | Start                        | Boot loader RAM image has started.   |
| <b>Functional test states</b> |                              |  |
| -81                           | Functional test complete     | The functional test has completed successfully.  |
| -85                           | Functional test fail         | The module cannot communicate successfully with its link partner (e.g. connected PC).  |
| -86                           | Drive functional test fail   | The module cannot communicate successfully with the host drive.  |
| -87                           | Thermal functional test fail | The thermal monitoring circuit on the SM-Ethernet module is not working correctly.   |
| -88                           | RAM test fail                | The SDRAM memory is not working correctly.   |
| -89                           | FLASH test fail              | The FLASH memory is not working correctly.   |
| <b>Error Codes</b>            |                              |  |
| -92                           | Major hardware fault         | The Solutions Module hardware is not working correctly. Remove and then re-apply power to the drive. If the problem persists the module should be replaced.        |
| -93                           | Invalid Configuration        | The module's parameters have been incorrectly configured which is preventing the module from continuing with its initialisation. Check the module's configuration. |
| -94                           | Major software fault         | The Solutions Module has encountered an unexpected error. Remove and then re-apply power to the drive. If the problem persists the module should be replaced.      |
| -95                           | Initialisation Failed        | The Solutions Module has encountered an unexpected error. Remove and then re-apply power to the drive. If the problem persists the module should be replaced.      |

If the SM-Ethernet module does not initialise correctly when the drive is powered up, remove the power from the module, wait for the drive under-voltage ('UU') trip to disappear and re-apply the power, if the problem persists then the SM-Ethernet module should be changed.

### 11.5.2 SM-Ethernet non-critical warning

| SM-Ethernet Solutions Module error status |         |          |
|---|---------|----------|
| Pr MM.49                                  | Default | 0        |
|   | Range   | 0 to 255 |
|   | Access  | R        |

This parameter provides an indication for the user that a non-critical warning condition has been encountered. Bit 0 is set if any Solutions Module warning is active. Bits 1 through 7 can be mapped to specific warnings within the module, (this is not currently possible as there are insufficient warning types to make it necessary).

### 11.5.3 SM-Ethernet error status

| SM-Ethernet Solutions Module error status |         |          |
|---|---------|----------|
| Pr MM.50                                  | Default | 0        |
|   | Range   | 0 to 255 |
|   | Access  | R        |

If an error occurs the reason for the error is written to this parameter and the drive may produce a slot error. A value of 0 indicates that the module has not detected an error. For a list of SM-Ethernet error codes see Table 11.8 *SM-Ethernet error codes* on page 100.

**NOTE** This parameter is reset to 0 if SM-Ethernet is reset.

**Table 11.8 SM-Ethernet error codes**

| <b>Pr MM.50</b> | <b>Error Description</b>                                     |
|-----------------|--|
| 50              | EtherNet/IP Requested Packet Interval (RPI) timeout.         |
| 51              | EtherNet/IP stack has run out of memory.                     |
| 52              | EtherNet/IP socket error.                                    |
| 53              | Maximum EtherNet/IP sessions reached.                        |
| 54              | Maximum EtherNet/IP connections reached.                     |
| 55              | EtherNet/IP request limit reached.                           |
| 61              | Invalid configuration parameters.                            |
| 62              | Error initialising drive database.                           |
| 63              | Error initialising file system.                              |
| 65              | Invalid read consistency parameter.                          |
| 66              | Invalid write consistency parameter.                         |
| 70              | No valid menu data available for the module from the drive.  |
| 74              | The Solutions Module has overheated.                         |
| 75              | The drive is not responding.                                 |
| 76              | The Modbus connection has timed out.                         |
| 80              | Inter-option communication failure.                          |
| 81              | Inter-option communication to slot 1 timeout.                |
| 82              | Inter-option communication to slot 2 timeout.                |
| 83              | Inter-option communication to slot 3 timeout.                |
| 84              | Memory allocation error.                                     |
| 85              | File system error.   |
| 86              | Configuration file error.                                    |
| 87              | Language file error.   |
| 90              | Drive not supported.   |
| 91              | Drive mode not supported.                                    |
| 96              | EtherNet/IP error.   |
| 97              | Missed event task.   |
| 98              | The Solutions Module background task has not been completed. |
| 99              | Software fault.  |

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# 12 Advanced features

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## 12.1 Email configuration

SM-Ethernet provides the facilities for sending email alerts. These emails are configured based on a trigger condition contained within a parameter.

### 12.1.1 Requirements

In order to send emails you will need the following:

- A mail server that accepts SMTP connections without a password.
- An email address for SM-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. *SMEthernet1@mycompany.com*), contact your system administrator for advice on obtaining an email address. SM-Ethernet will not receive email, and facilities should be put in place to prevent mail going to this account residing on the server.

### 12.1.2 Setup

To setup email on SM-Ethernet you must first be logged in with appropriate permissions. From the **PROTOCOLS** menu select **Email** then select the **Modify Configuration** option on the menu. Enter the IP address of the mail server and the port number required (normally 25) click on "APPLY" to save the settings. You can now add up to 3 configurable email messages.

### 12.1.3 Email triggers

Under the individual email configuration screens you can configure the individual message setup for the email. The trigger requires one parameter to trigger the event and one parameter to re-arm the trigger. The parameter may be the same parameter or a different parameter depending on the application. For both trigger and re-arm you must specify the condition that must be true to generate the event.

The re-arm inhibit should be used to limit the number of mails that could be sent. This is important as SM-Ethernet has the potential to generate a high volume of email, if the trigger and re-arm conditions are continuously met. Setting this parameter will prevent messages from the same source being re-sent until the inhibit time has expired.

To complete the process you need to enter an appropriate email source name, a destination email address, the title of the email, any text you wish to send and then select if you wish to include a parameter file in the email. Sending a parameter file in the email is useful for determining the nature of any problems as a snapshot of the drive at the time of trigger is produced.

If all settings are correct, then the email may be enabled in the 'Options' section of the configuration page.

A test email may also be generated to test the server settings.

#### NOTE

Some email servers and clients may convert the '.par' file to '.dat' if this occurs you should contact your systems administrator for assistance.

#### NOTE

If the 'From' field of an email is left blank the email will automatically be sent from the modules drive name. The drive name can be specified in the application details of the module, which is accessed from the **Application** menu.

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## 12.2 Scheduled events

It is possible to configure the SM-Ethernet module to trigger certain events at certain times. The following examples show what can be achieved:

- The SM-Ethernet module could be configured to send an email once every month. Note that an event cannot send an email directly but it can change the value of a parameter. The email handler can then be configured to monitor the same parameter and to transmit when the value changes.
- Once every 200ms the SM-Ethernet module could trigger an “*Event*” task in an SM-Applications module, causing it to sample data.
- A number of SM-Ethernet modules could write the current date and time to drive parameters once every second, within 50ms of each other. Thus providing each drive with a timestamp for scheduling coordinated (not synchronised) motion.

**NOTE** Care must be taken to prevent a large amount of emails from being transmitted too quickly, otherwise the Ethernet network or server may be compromised.

**NOTE** As the module has no back-up for the real-time clock it will need synchronising with an external clock every time the module is reset (except if the module has requested control of the serial communications buffer, where the reset is inhibited). In order for the clock to maintain accuracy it is important that re-synchronisation is carried out regularly. This synchronisation signal can come from a few different sources, but the module can only be configured to use a single method at any one time.

### 12.2.1 Requirements

In order to schedule events based upon the time you will need a SNTP server IP address that does not require a login or a SNTP server that is broadcasting the time on the same network as the SM-Ethernet module.

### 12.2.2 SNTP Setup

To setup SNTP on SM-Ethernet you must first be logged in with appropriate permissions. From the **PROTOCOLS** menu select **Scheduled Events** then select the “Modify Configuration” option. You must now choose which type of SNTP source you wish to use.

#### SNTP Broadcast

The module can be set to receive a SNTP timestamp from a server at regular time intervals. This mechanism involves very little network traffic or configuration on the module, but does not take into account network transmission delays.

#### SNTP Requests

The module can request the time from a specified time server at regular intervals, each node would need to request the time individually when required. This mechanism is potentially more accurate than the broadcast mechanism but does require each node to be configured individually and produces more network traffic than a broadcast.

If the source type is set to *request* you must specify the server IP address and the time interval between requests.

If the SNTP source is enabled and a time duration is selected for the *Update Warning Delay*, then, if SM-Ethernet does not receive a time update from the specified server within the selected time, a value of 3 is written to Pr **MM.49** (non-critical warning).

## 12.2.3 Events

A total of 10 events can be configured on each SM-Ethernet module. Each event has the following:

- Summary - Each event can be given a descriptive name and independently enabled and disabled. To delete an event, tick the "Remove" option and then "APPLY". The "Missed Event Trip" option can be used to cause a trip if more than one event is missed.
- Time of first event - This section is used to specify when the event will first occur. When entering "Hour", "Minute", "Second" and "Millisecond" data, no information of a higher resolution can be omitted. e.g. If you wish the first event to occur at 30 minutes past the next hour, then the values "--:30:00:00" must be entered (the "Second" and "Millisecond" information must be included).
- Event condition - This section has two options, the first option will trigger the event if the set conditions are met, the second option will trigger the event if the specified parameter contains a non-zero value.
- Event action - This section is used to specify what action is to be taken on the event being triggered.
- Recurrence rule - This section is used to specify when the event will re-occur following the start condition being met. The minimum recurrence interval is 100ms.

## 12.3 Updating and backup

### 12.3.1 Updating SM-Ethernet firmware

The SM-Ethernet module firmware and associated files can be updated using the internal web pages from the **CONFIGURATION** menu then select the **Update** menu. Browse for the file (\*.pkg) then click "UPLOAD". Firmware uploads can take a few minutes and the status of the update will be shown on screen.

#### NOTE

Do not reset or power down the drive when uploading firmware as this may result in data loss or corruption of the system file.

### 12.3.2 Updating SM-Ethernet language files

The SM-Ethernet module supports multiple languages, the language files are supplied as .pkg files (e.g. english.pkg) and can be updated (or added) using the internal web pages in the same way that the firmware is updated.

#### NOTE

Do not reset or power down the drive when uploading the language file as this may result in data loss or corruption of the system file.

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### 12.3.3 Backup

To backup parameters in the drive using the internal web pages use the **CONFIGURATION** menu and select the **Backup** submenu. Select the options you require from the following:

- *Application configuration data* - contains information such as drive name and the information from the *Current Application Configuration* pages.
- *Saved module parameter values* - All the internal menus, Pr **60.xx**, Pr **61.xx**, Pr **62.xx** and Pr **MM.xx**.
- *Module specific security settings* - All the usernames, passwords and security related functions. If you do not select the decrypt option below these values may only be used on the module they came from.
- *Decrypted module security settings* - Ticking this box allows the security settings above to be restored to any module. This option is only available to Administrative users.

Click on the "SUBMIT" button and choose a filename and location to save the file.

#### NOTE

It is recommended that before and after any changes are made a sequentially named backup is made. This means that at any point it is possible to restore the module to a previous state. In the event of data corruption or module failure the data can then be restored.

## 12.4 Advanced parameters

The parameters listed in this section are for advanced use only. You should only adjust the following parameters if you have a thorough understanding of SM-Ethernet and the application.

### 12.4.1 SM-Ethernet module management

| SM-Ethernet - module management |         |              |
|---------------------------------|---------|--------------|
| Pr <b>MM.29</b>                 | Default | 0            |
|                                 | Range   | 1000 to 1999 |
|                                 | Access  | RO           |

Setting this parameter to 1500 and re-initialising the module activates the protocol "fail safe" mode. All user protocols (modbus, FTP etc.) are disabled except for the web interface, which will start with default thread priority.

#### NOTE

This does not reset passwords.

### 12.4.2 SM-Ethernet load defaults (reset memory)

| SM-Ethernet - load option defaults |         |        |
|------------------------------------|---------|--------|
| Pr <b>MM.30</b>                    | Default | OFF    |
|                                    | Range   | OFF/ON |
|                                    | Access  | RW     |

When set to *ON* and the SM-Ethernet module is reset (Pr **MM.32** set to *ON*), the module will change it's parameter values stored in the module's local memory to default values. Any user changes or user web pages in the module will be lost. During this operation communications will be stopped. This parameter will automatically revert to *OFF* following the operation. Pr **MM.32** must be set to *ON* to activate the change (see section 5.17 *Re-initialising SM-Ethernet* on page 26).



**NOTE** The use of this parameter will lose any configuration in the module. Unless you have made a backup copy of the module's configuration you will lose all settings. All passwords and users are deleted, the root password remains unchanged.

### 12.4.3 SM-Ethernet save option parameters (backup)

| SM-Ethernet - save option parameters |         |        |
|--------------------------------------|---------|--------|
| Pr <b>MM.31</b>                      | Default | OFF    |
|                                      | Range   | OFF/ON |
|                                      | Access  | RW     |

This will save the module's current configuration in its local memory. During this operation communications will be stopped. This will save menu 60 (*Pr MM.xx*), menu 61, web page customisations, email settings, etc. This parameter should only be used to transfer a SM-Ethernet module to a different drive or when you wish to save any internal parameters directly (i.e. Pr **61.10**). In order to save these parameters in the drive's memory a drive save must be performed. This is required as SM-Ethernet will take its operating parameters directly from the slot memory on the host drive at startup.

**NOTE** To save the parameters in the drive, a value of 1000 should be entered in Pr **xx.00** followed by a drive reset (press the reset button, or toggle the reset input, or write the value 100 to Pr **10.38**).

\* If the drive is in the under-voltage trip state or is fed from a low voltage backup supply, the value 1001 should be used and not 1000.

### 12.4.4 SM-Ethernet re-initialise

| SM-Ethernet re-initialise |         |        |
|---------------------------|---------|--------|
| Pr <b>MM.32</b>           | Default | OFF    |
|                           | Range   | OFF/ON |
|                           | Access  | RW     |

This will force the module to re-initialise and start up with the values contained in the slot menu of the host drive (**MM.xx**). This parameter will automatically reset to *OFF* after completion. During this operation communications will be stopped.

**NOTE** The transition of **MM.32** from *OFF* to *ON* may not be visible on the drive display due to the update rate of the display.

**NOTE** Writing 1070 to menu Pr **MM.00** (to re-initialise all option modules) may not re-initialise the SM-Ethernet module. The handling of 1070 within SM-Ethernet is dependent on the state of Pr **MM.37**. See section 12.4.8 *SM-Ethernet reduce serial interface priority* on page 107 for further information.

## 12.4.5 SM-Ethernet restore parameters

| SM-Ethernet - restore parameters |         |        |
|----------------------------------|---------|--------|
| Pr <b>MM.33</b>                  | Default | OFF    |
|                                  | Range   | OFF/ON |
|                                  | Access  | RW     |

This will change the operating parameters for the module by copying the configuration from the backup copy in the SM-Ethernet module. During this operation communications will be stopped. The restored parameters will include menu 60 (*Pr MM.xx*), menu 61, web page customisations, email settings, etc. This will not save the current operating menu of the drive (*Pr MM.xx*), a drive save must be performed to achieve this.

## 12.4.6 SM-Ethernet serial number

| SM-Ethernet - serial number |         |           |
|-----------------------------|---------|-----------|
| Pr <b>MM.35</b>             | Default | N/A       |
|                             | Range   | 0 to 9999 |
|                             | Access  | R         |

The serial number is programmed into the module at the time of manufacture and consists of the least significant 3 bytes of the MAC address in decimal format.

### NOTE

This can be used to find the complete MAC address of the module by combining the numbers with 00:0D:1E:xx.xx.xx. Where xx.xx.xx. is a value in Pr **MM.35** converted to base 16 (HEX). e.g. If Pr **MM.35** contains the value of 1193046, this would give the complete MAC address of 00 0D 1E 12 34 56.

## 12.4.7 SM-Ethernet disable full access

| SM-Ethernet - disable full access |         |               |
|-----------------------------------|---------|---------------|
| Pr <b>MM.36</b>                   | Default | OFF (enabled) |
|                                   | Range   | OFF/ON        |
|                                   | Access  | RW            |

This parameter will restrict a remote user's access to the drive. Pr **MM.36** = ON ensures that write access to the drive is disabled. Pr **MM.36** = OFF allows full access to the drive parameters. With this parameter enabled access to the following is not allowed.

- Modbus TCP/IP write.
- EtherNet/IP write.
- FTP upload.
- Web page write access to SM-Ethernet.

## 12.4.8 SM-Ethernet reduce serial interface priority

| SM-Ethernet reduce serial interface priority |         |        |
|--|---------|--------|
| Pr MM.37                                     | Default | OFF    |
|  | Range   | OFF/ON |
|  | Access  | RW     |

**NOTE** It is not possible for the drive and SM-Ethernet module to support all of the available serial communication protocols simultaneously. This parameter, when set, allows SM-Ethernet to request the highest priority (not relevant for Commander SK).

### When on:

The SM-Ethernet module will request highest priority (it's actual state is shown in Pr **6.50**) and the following restrictions will be applied:

- The drive's serial interface will only be able to handle messages of 32 bytes or less. This will restrict the use of the software tools CTSoft, CTScope, OPC server, SyPTPro and SyPTLite when communicating via the RJ45 serial interface connector.
- An LCD keypad mounted directly to the drive will not work.
- A remote LCD keypad will work when connected to the RJ45 serial communications port.
- A Solutions Module reset using Pr **MM.00** = 1070 may not work.

### When off:

- Access to drive parameters and SM-Application parameters will still be allowed.
- This will restrict the use of the software tools CTSoft, CTScope, OPC server, SyPTPro and SyPTLite over Ethernet as SM-Ethernet will not be able to route messages using inter-option communications.

**NOTE** When routing through SM-Ethernet to CTNet, this parameter must be set to *ON*. Failure to set this parameter *ON* will result in communication loss or unstable communications.

**NOTE** For a system with multiple modules installed, the priority should be set for the module that is receiving the incoming request.

**NOTE** Only one option module can have priority of the serial communications buffer at any time, priority access will be given to the first module requesting it.

## 12.4.9 SM-Ethernet user allocated group

| SM-Ethernet - User allocated group |         |            |
|------------------------------------|---------|------------|
| Pr MM.38                           | Default | 0          |
|                                    | Range   | 0 to 65535 |
|                                    | Access  | RW         |

This parameter can be used to provide logical groups for *Control Techniques* drives. This will allow grouping independently of the IP settings. This is used in conjunction with parameter Pr **MM.03** (see section 12.4.10 *SM-Ethernet user allocated address* on page 108).

## 12.4.10 SM-Ethernet user allocated address

| SM-Ethernet - user allocated address |         |            |
|--------------------------------------|---------|------------|
| Pr MM.03                             | Default | 0          |
|                                      | Range   | 0 to 65535 |
|                                      | Access  | RW         |

This is used as a way to identify the node on the network independently of the IP address.

## 12.4.11 SM-Ethernet connection filtering

| SM-Ethernet - Connection filtering |         |              |
|------------------------------------|---------|--------------|
| Pr MM.39                           | Default | 0 (disabled) |
|                                    | Range   | 0 or 1       |
|                                    | Access  | RW           |

When set to a 1 the connection filter list will be enabled. If you make a mistake configuring the connection filtering and cannot connect to the module, setting this parameter to 0 will allow communication to be restored.

## 12.5 Modbus TCP/IP (CT 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 SM-Ethernet implementation of Modbus TCP/IP uses a subset of the standard protocol provided by the Modbus organisation.

Modbus TCP/IP is an application layer protocol for communication between automation devices utilising an Ethernet network connection. It is a client-server protocol where the client sends a request and waits for the server to respond.

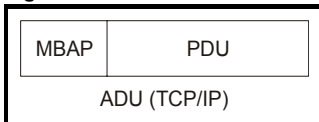
### NOTE

The default port for Modbus TCP/IP communication is 502, but this may be reconfigured using Pr **63.01** on SM-Ethernet.

### 12.5.1 Data structure

Communication between devices is based upon Application Data Units (ADUs) as shown in Figure 12-1. The ADU consists of two parts, the Modbus Application Protocol (MBAP) (Table 12.1) and the Protocol Data Units (see Table 12.2). Modbus TCP/IP extends the standard PDU to include an IP specific 7-byte header called the Modbus Application Protocol (MBAP).

Figure 12-1 ADU



### NOTE

It is important that when you implement the Modbus TCP ADU as shown in Figure 12-1, you include the MBAP as well as the PDU.

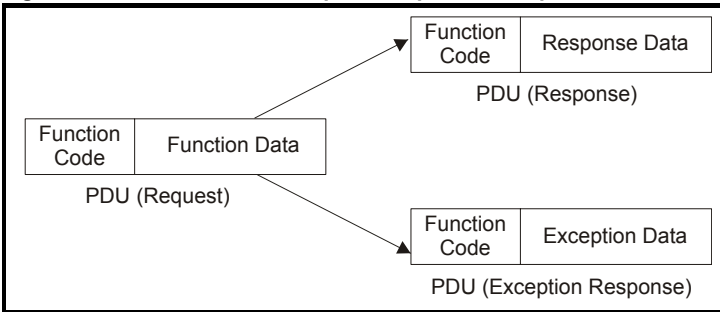
### NOTE

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

## 12.5.2 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 12-2. If no response is received this indicates that the message has not been received or the node is unable to reply.

**Figure 12-2 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 12.1 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 12.2 PDU**

| PDU                | Consists of                                      |
|--------------------|--|
| Request            | Function code, 1 byte<br>Function data, > 1 byte |
| Response           | Function code, 1 byte<br>Response data, > 1 byte |
| Exception Response | Error code, 1 byte<br>Exception code, 1 byte     |

**NOTE**

If accessing one of the SM-Applications parameters (menus 7x, 8x or 9x) on a drive with more than one SM-Applications module installed, the message will be routed to the SM-Applications module installed in the lowest slot number, if this is undesirable then the direct access parameters (menus 10x, 11x, 12x, etc) should be used.

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## 12.6 Supported Modbus function codes

Table 12.3 below, details the supported Modbus function codes on SM-Ethernet. All function codes write to 16 bit registers only, to write to a 32 bit destination see section 12.6.1 *Extended data types* on page 110.

**Table 12.3 Supported function codes**

| Code    |      | Description                               |
|---------|------|---|
| Decimal | Hex. |   |
| 3       | 0x03 | Read multiple 16 bit registers.           |
| 6       | 0x06 | Write single 16 bit register.             |
| 16      | 0x10 | Write multiple 16 bit registers.          |
| 23      | 0x17 | Read and write multiple 16 bit registers. |

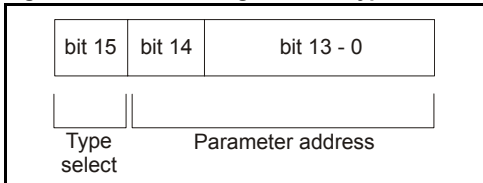
**NOTE**

*Control Techniques* register numbers are referenced from 0 to 65535 rather than the traditional 1 to 65536. This is because the *Control Techniques* implementation of Modbus in the receiving node adds 1 to the register number effectively preventing access to parameter Pr **00.00** within the drive.

### 12.6.1 Extended data types

Standard Modbus registers are 16 bits in size and reference a single drive parameter (Pr **xx.xx**). To support 32 bit data types (both integer and floating point) the Modbus multiple read and write services are used to transfer a contiguous array of 16 bit registers. *Control Techniques* products typically contain a mix of 16 bit and 32 bit registers. To permit the client to select the appropriate 16 bit or 32 bit access the top two bits of the register address are used to select the required data type as shown in Figure 12-3.

**Figure 12-3 Modbus register data type selection**



The extended data types are defined such that the type '00' allows for backwards compatibility.

**Table 12.4 Data type field**

| Type field bits 15-14 | Selected data type | Comments                                       |
|-----------------------|--------------------|--|
| 00                    | INT16              | Backward compatible.                           |
| 01                    | INT32              | None.  |
| 10                    | Float 32**         | IEEE794 standard not supported on all servers. |
| 11                    | Reserved           | None.  |

\*\*Not currently supported.

**NOTE**

*Control Techniques* drive parameters currently do not support *Float32*. To overcome this INT32 should be used to represent 32 bit values. If a 32 bit data type is selected then the server uses two consecutive 16 bit Modbus registers in 'big endian' format (MSB transmitted first). For details of the data types within each product please consult the documentation for that product or contact your supplier.

## 12.6.2 FC03-Read multiple registers

This function code allows a contiguous array of registers to be read. The server (drive) imposes an upper limit on the number of registers that may be read and if this is exceeded the server will issue an exception code 2.

**Table 12.5 Client request message**

| Byte | Description                                      |
|------|--|
| 0    | Server destination node address, 0 is broadcast. |
| 1    | Function code 0x03.                              |
| 2    | Start register address MSB.                      |
| 3    | Start register address LSB.                      |
| 4    | Number of 16 bit registers MSB.                  |
| 5    | Number of 16 bit registers LSB.                  |

**Table 12.6 Server (drive) response message**

| Byte | Description                      |
|------|----------------------------------|
| 0    | Server source node address.      |
| 1    | Function code 0x03.              |
| 2    | Length of register data (bytes). |
| 3    | Register data 0 MSB.             |
| 4    | Register data 0 LSB.             |
| 5    | Register data 1 MSB.             |
| 6    | Register data 1 LSB.             |

**NOTE** For each byte in the PDU message, the MSB is transmitted first, followed by the LSB.

**NOTE** If only one 16 bit register of a 32 bit register address is read the server returns the least significant word.

**NOTE** For multiple registers, the register data will be returned in ascending order, beginning with the start register address.

**NOTE** The Modbus CRC bytes are not required when using TCP/IP due to the ethernet frame providing the error checking.

## 12.6.3 FC06-Write single register

Writes a value to a single 16 bit register. The normal response is an echo of the request after the register contents have been successfully written. The register address can correspond to a 32 bit parameter but only the least significant 16 bits of data will be returned.

**Table 12.7 Client request message**

| Byte | Description                                      |
|------|--|
| 0    | Server destination node address, 0 is broadcast. |
| 1    | Function code 0x06.                              |
| 2    | Register address MSB.                            |
| 3    | Register address LSB.                            |
| 4    | Register data MSB.                               |
| 5    | Register data LSB.                               |

**Table 12.8 Server (drive) response message**

| Byte | Description                 |
|------|-----------------------------|
| 0    | Server source node address. |
| 1    | Function code 0x06.         |
| 2    | Register address MSB.       |
| 3    | Register address LSB.       |
| 4    | Register data MSB.          |
| 5    | Register data LSB.          |

**NOTE** To write 32 bits of data to a 32 bit register address, the extended data type must be used (see section 12.6.1 *Extended data types* on page 110).

**NOTE** For each byte in the PDU message, the MSB is transmitted first, followed by the LSB.

**NOTE** The Modbus CRC bytes are not required when using TCP/IP due to the ethernet frame providing the error checking.

## 12.6.4 FC16-Write multiple registers

Writes a contiguous array of registers. The server imposes an upper limit on the number of registers that can be written. If this is exceeded the server will discard the request and the client will time out.

**Table 12.9 Client request message**

| Byte | Description                                      |
|------|--|
| 0    | Server destination node address, 0 is broadcast. |
| 1    | Function code 0x10.                              |
| 2    | Start register address MSB.                      |
| 3    | Start register address LSB.                      |
| 4    | Number of 16 bit registers MSB.                  |
| 5    | Number of 16 bit registers LSB.                  |
| 6    | Length of register data to write (bytes).        |
| 7    | Register data 0 MSB.                             |
| 8    | Register data 0 LSB.                             |
| 9    | Register data 1 MSB.                             |
| 10   | Register data 1 LSB.                             |

**Table 12.10 Server (drive) response message**

| Byte | Description                             |
|------|---|
| 0    | Server source node address.             |
| 1    | Function code 0x10.                     |
| 2    | Start register address MSB.             |
| 3    | Start register address LSB.             |
| 4    | Number of 16 bit registers written MSB. |
| 5    | Number of 16 bit registers written LSB. |

**NOTE** For each byte in the PDU message, the MSB is transmitted first, followed by the LSB.

**NOTE** For multiple registers, the register data is transmitted in ascending order, beginning with the start register address.

**NOTE** The Modbus CRC bytes are not required when using TCP/IP due to the ethernet frame providing the error checking.



## 12.6.5 FC23-Read and write multiple registers

Reads and writes two contiguous arrays of registers. The server imposes an upper limit on the number of registers that can be written. If this is exceeded the server will discard the request and the client will time out.

**Table 12.11 Client request message**

| Byte | Description                                      |
|------|--|
| 0    | Server destination node address, 0 is broadcast. |
| 1    | Function code 0x17.                              |
| 2    | Start register address to read MSB.              |
| 3    | Start register address to read LSB.              |
| 4    | Number of 16 bit registers to read MSB.          |
| 5    | Number of 16 bit registers to read LSB.          |
| 6    | Start register address to write MSB.             |
| 7    | Start register address to write LSB.             |
| 8    | Number of 16 bit registers to write MSB.         |
| 9    | Number of 16 bit registers to write LSB.         |
| 10   | Length of register data to write (bytes).        |
| 11   | Register data 0 MSB.                             |
| 12   | Register data 0 LSB.                             |
| 13   | <i>Register data 1 MSB.</i>                      |
| 14   | <i>Register data 1 LSB.</i>                      |

**Table 12.12 Server (drive) response message**

| Byte | Description                              |
|------|--|
| 0    | Server source node address.              |
| 1    | Function code 0x17.                      |
| 2    | Length of register data in read (bytes). |
| 3    | Register data 0 MSB.                     |
| 4    | Register data 0 LSB.                     |
| 5    | <i>Register data 1 MSB.</i>              |
| 6    | <i>Register data 1 LSB.</i>              |

**NOTE** For each byte in the PDU message, the MSB is transmitted first, followed by the LSB.

**NOTE** For both the request and response message, the register data is transmitted in ascending order, beginning with the start register address.

**NOTE** The Modbus CRC bytes are not required when using TCP/IP due to the ethernet frame providing the error checking.

## 12.7 Modbus exception codes

Modbus exceptions are a response that indicates a failed operation by the client. This is signalled by the addition of 0x80 in the function code of the response. The specific error can be identified by the next byte which contains the error code ID, corresponding to the table below.

**Table 12.13 Exception error codes**

| ID Code | Name                        | Description   |
|---------|-----------------------------|---|
| 0x01    | FUNCTION_NOT_SUPPORTED      | The received function code is not supported on the server, i.e. not FC3, FC6, FC16 or FC23.                               |
| 0x02    | TOO_MANY_REGISTERS          | The parameter reference and/or the transfer length are/is invalid.  |
| 0x04    | SERVER_FAILURE              | This error is generated when a response to a routed message is found to be corrupt. CRC error occurred.                   |
| 0x06    | SERVER_BUSY                 | This can occur if the module is trying to route a message but it cannot get control of the drive's communications buffer. |
| 0x0B    | GATEWAY_PROBLEM_NO_RESPONSE | This occurs if there is no response to a routed message.  |

# 13 Quick reference

## 13.1 Complete parameter reference

The table below lists all the SM-Ethernet set-up parameters that are required to configure the module.

**Table 13.1 SM-Ethernet parameter reference**

| Parameter       | Default | Cross reference            | Description                             |
|-----------------|---------|----------------------------|---|
| Pr <b>MM.01</b> | 410     | Section 11.3.1 on page 90  | Module ID code.                         |
| Pr <b>MM.02</b> | -       | Section 11.3.2 on page 90  | Option software version.                |
| Pr <b>MM.03</b> | 0       | Section 11.3.3 on page 91  | User allocated address.                 |
| Pr <b>MM.04</b> | 0       | Section 11.4.1 on page 91  | Ethernet data rate.                     |
| Pr <b>MM.05</b> | 0       | Section 11.4.2 on page 91  | DHCP enable.                            |
| Pr <b>MM.06</b> | 0       | Section 11.5.1 on page 97  | Ethernet module diagnostic information. |
| Pr <b>MM.10</b> | 192     | Section 5.11 on page 22    | IP address $W_{ip}$ .                   |
| Pr <b>MM.11</b> | 168     |                            | IP address $X_{ip}$ .                   |
| Pr <b>MM.12</b> | 1       |                            | IP address $Y_{ip}$ .                   |
| Pr <b>MM.13</b> | 100     |                            | IP address $Z_{ip}$ .                   |
| Pr <b>MM.14</b> | 255     | Section 5.12 on page 23    | Subnet mask $W_{subnet}$ .              |
| Pr <b>MM.15</b> | 255     |                            | Subnet mask $X_{subnet}$ .              |
| Pr <b>MM.16</b> | 255     |                            | Subnet mask $Y_{subnet}$ .              |
| Pr <b>MM.17</b> | 0       |                            | Subnet mask $Z_{subnet}$ .              |
| Pr <b>MM.18</b> | 192     | Section 5.13 on page 24    | Default gateway $W_{gateway}$ .         |
| Pr <b>MM.19</b> | 168     |                            | Default gateway $X_{gateway}$ .         |
| Pr <b>MM.20</b> | 1       |                            | Default gateway $Y_{gateway}$ .         |
| Pr <b>MM.21</b> | 254     |                            | Default gateway $Z_{gateway}$ .         |
| Pr <b>MM.29</b> | 0       | Section 12.4.1 on page 104 | Module management.                      |
| Pr <b>MM.30</b> | OFF     | Section 12.4.2 on page 104 | Load option defaults.                   |
| Pr <b>MM.31</b> | OFF     | Section 12.4.3 on page 105 | Save option parameters.                 |
| Pr <b>MM.32</b> | OFF     | Section 12.4.4 on page 105 | Request to re-initialise.               |
| Pr <b>MM.33</b> | OFF     | Section 12.4.5 on page 106 | Restore parameters.                     |
| Pr <b>MM.35</b> | 0       | Section 12.4.6 on page 106 | Serial number (partial MAC address).    |
| Pr <b>MM.36</b> | OFF     | Section 12.4.7 on page 106 | Disable full access.                    |
| Pr <b>MM.37</b> | OFF     | Section 12.4.8 on page 107 | Reduce SP serial interface priority.    |

**Table 13.1 SM-Ethernet parameter reference**

| Parameter | Default | Cross reference             | Description                            |
|-----------|---------|-----------------------------|--|
| Pr MM.38  | 0       | Section 12.4.9 on page 107  | User allocated group.                  |
| Pr MM.39  | 0       | Section 12.4.11 on page 108 | Connection filtering.                  |
| Pr MM.42  | 0       | Section 11.4.15 on page 94  | Duplex mode.                           |
| Pr MM.43  | 0       | Section 11.4.16 on page 95  | Crossover detection.                   |
| Pr MM.44  | -       | Section 11.4.17 on page 95  | Actual baud rate.                      |
| Pr MM.45  | -       | Section 11.4.18 on page 95  | Actual duplex mode.                    |
| Pr MM.49  | 0       | Section 11.5.2 on page 99   | Non-critical warning condition.        |
| Pr MM.50  | 0       | Section 11.5.3 on page 99   | Solutions Module error status.         |
| Pr MM.51  | -       | Section 11.3.2 on page 90   | Solutions Module software sub-version. |

**Table 13.2 SM-Ethernet virtual parameter reference**

| Parameter | Default | Description                             |
|-----------|---------|---|
| Menu 60   |         |   |
| Pr 60.00  | 0       | Parameter zero.                         |
| Pr 60.01  | 410     | Module ID code.                         |
| Pr 60.02  | -       | Option software version.                |
| Pr 60.03  | 0       | User allocated address.                 |
| Pr 60.04  | 0       | Ethernet data rate.                     |
| Pr 60.05  | 0       | DHCP enable.                            |
| Pr 60.06  | 0       | Ethernet module diagnostic information. |
| Pr 60.10  | 192     | IP address $W_{ip}$ .                   |
| Pr 60.11  | 168     | IP address $X_{ip}$ .                   |
| Pr 60.12  | 1       | IP address $Y_{ip}$ .                   |
| Pr 60.13  | 100     | IP address $Z_{ip}$ .                   |
| Pr 60.14  | 255     | Subnet mask $W_{subnet}$ .              |
| Pr 60.15  | 255     | Subnet mask $X_{subnet}$ .              |
| Pr 60.16  | 255     | Subnet mask $Y_{subnet}$ .              |
| Pr 60.17  | 0       | Subnet mask $Z_{subnet}$ .              |
| Pr 60.18  | 192     | Default gateway $W_{gateway}$ .         |
| Pr 60.19  | 168     | Default gateway $X_{gateway}$ .         |
| Pr 60.20  | 1       | Default gateway $Y_{gateway}$ .         |
| Pr 60.21  | 254     | Default gateway $Z_{gateway}$ .         |
| Pr 60.29  | 0       | Module management.                      |
| Pr 60.30  | OFF     | Load option defaults.                   |
| Pr 60.31  | OFF     | Save option parameters.                 |
| Pr 60.32  | OFF     | Request to re-initialise.               |
| Pr 60.33  | OFF     | Restore parameters.                     |
| Pr 60.35  | 0       | Serial number (partial MAC address).    |

**Table 13.2 SM-Ethernet virtual parameter reference**

| Parameter | Default    | Description  |
|-----------|------------|--|
| Pr 60.36  | OFF        | Disable full access.   |
| Pr 60.37  | OFF        | Reduce SP serial interface priority.                             |
| Pr 60.38  | 0          | User allocated group.  |
| Pr 60.39  | 0          | Connection filtering.  |
| Pr 60.42  | 0          | Duplex mode.   |
| Pr 60.43  | 0          | Crossover detection.   |
| Pr 60.44  | -          | Actual baud rate.  |
| Pr 60.45  | -          | Actual duplex mode.  |
| Pr 60.49  | 0          | Non-critical warning condition.                                  |
| Pr 60.50  | 0          | Solutions Module error status.                                   |
| Pr 60.51  | -          | Solutions Module software sub-version.                           |
| Menu 61   |            |  |
| Pr 61.00  | 0          | Parameter zero.  |
| Pr 61.01  | -          | MAC address $U_{MAC}$ .  |
| Pr 61.02  | -          | MAC address $V_{MAC}$ .  |
| Pr 61.03  | -          | MAC address $W_{MAC}$ .  |
| Pr 61.04  | -          | MAC address $X_{MAC}$ .  |
| Pr 61.05  | -          | MAC address $Y_{MAC}$ .  |
| Pr 61.06  | -          | MAC address $Z_{MAC}$ .  |
| Pr 61.07  | -          | Slot indicator.  |
| Pr 61.10  | 4 (High)   | Modbus thread priority.  |
| Pr 61.11  | 3 (Medium) | FTP thread priority.   |
| Pr 61.12  | 3 (Medium) | SMTP thread priority.  |
| Pr 61.13  | 3 (Medium) | HTTP thread priority.  |
| Pr 61.14  | 4 (High)   | Event thread priority.   |
| Pr 61.15  | 4 (High)   | EtherNet/IP thread priority.                                     |
| Pr 61.20  | 5000       | Modbus thread tick time ( $\mu$ s).                              |
| Pr 61.21  | 2000       | EtherNet/IP thread tick time ( $\mu$ s).                         |
| Pr 61.30  | 2000       | Discovery and identification process silent period (ms).         |
| Pr 61.31  | 30000      | Discovery and identification process maximum search time (ms).   |
| Pr 61.32  | 30000      | Discovery and identification process search retention time (ms). |
| Pr 61.33  | 250        | IP communications timeout (ms).                                  |
| Pr 61.34  | 500        | IP routing timeout (ms).   |
| Pr 61.50  | -          | Bootloader software version.                                     |
| Pr 61.51  | -          | Bootloader software sub-version.                                 |
| Menu 62   |            |  |
| Pr 62.00  | 0          | Parameter zero.  |
| Pr 62.01  | 0          | Primary DNS server $W_{DNS1}$ .                                  |
| Pr 62.02  | 0          | Primary DNS server $X_{DNS1}$ .                                  |
| Pr 62.03  | 0          | Primary DNS server $Y_{DNS1}$ .                                  |
| Pr 62.04  | 0          | Primary DNS server $Z_{DNS1}$ .                                  |
| Pr 62.05  | 0          | Secondary DNS server $W_{DNS2}$ .                                |
| Pr 62.06  | 0          | Secondary DNS server $X_{DNS2}$ .                                |
| Pr 62.07  | 0          | Secondary DNS server $Y_{DNS2}$ .                                |

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**Table 13.2 SM-Ethernet virtual parameter reference**

| Parameter | Default | Description  |
|-----------|---------|--|
| Pr 62.08  | 0       | Secondary DNS server $Z_{DNS2}$ .                  |
| Pr 62.09  | 0       | Tertiary DNS server $W_{DNS3}$ .                   |
| Pr 62.10  | 0       | Tertiary DNS server $X_{DNS3}$ .                   |
| Pr 62.11  | 0       | Tertiary DNS server $Y_{DNS3}$ .                   |
| Pr 62.12  | 0       | Tertiary DNS server $Z_{DNS3}$ .                   |
| Menu 63   |         |  |
| Pr 63.00  | 0       | Parameter zero.                                    |
| Pr 63.01  | 502     | Listening Modbus TCP/IP port.                      |
| Pr 63.02  | 10      | Maximum number of concurrent Modbus connections.   |
| Pr 63.03  | 5       | Maximum number of priority Modbus connections.     |
| Pr 63.04  | 2       | Maximum number of priority connections per client. |
| Pr 63.05  | OFF     | Modbus timeout enable.                             |
| Pr 63.06  | 1000    | Modbus timeout time (ms).                          |
| Pr 63.10  | 0       | 1 <sup>st</sup> Priority connection.               |
| Pr 63.11  | 0       | 2 <sup>nd</sup> Priority connection.               |
| Pr 63.12  | 0       | 3 <sup>rd</sup> Priority connection.               |
| Pr 63.13  | 0       | 4 <sup>th</sup> Priority connection.               |
| Pr 63.14  | 0       | 5 <sup>th</sup> Priority connection.               |
| Pr 63.15  | 0       | 6 <sup>th</sup> Priority connection.               |
| Pr 63.16  | 0       | 7 <sup>th</sup> Priority connection.               |
| Pr 63.17  | 0       | 8 <sup>th</sup> Priority connection.               |
| Pr 63.18  | 0       | 9 <sup>th</sup> Priority connection.               |
| Pr 63.19  | 0       | 10 <sup>th</sup> Priority connection.              |
| Pr 63.20  | 0       | 11 <sup>th</sup> Priority connection.              |
| Pr 63.21  | 0       | 12 <sup>th</sup> Priority connection.              |
| Pr 63.22  | 0       | 13 <sup>th</sup> Priority connection.              |
| Pr 63.23  | 0       | 14 <sup>th</sup> Priority connection.              |
| Pr 63.24  | 0       | 15 <sup>th</sup> Priority connection.              |
| Pr 63.25  | 0       | 16 <sup>th</sup> Priority connection.              |
| Pr 63.26  | 0       | 17 <sup>th</sup> Priority connection.              |
| Pr 63.27  | 0       | 18 <sup>th</sup> Priority connection.              |
| Pr 63.28  | 0       | 19 <sup>th</sup> Priority connection.              |
| Pr 63.29  | 0       | 20 <sup>th</sup> Priority connection.              |
| Menu 64   |         |  |
| Pr 64.00  | 0       | Parameter zero.                                    |
| Pr 64.01  | 1       | Parameter alignment.                               |
| Pr 64.02  | ON      | Endianism.   |
| Pr 64.03  | OFF     | Read consistency.                                  |
| Pr 64.04  | 0       | Read consistency trigger parameter.                |
| Pr 64.05  | OFF     | Write consistency.                                 |
| Pr 64.06  | 0       | Write consistency trigger parameter.               |

**Table 13.2 SM-Ethernet virtual parameter reference**

| Parameter | Default | Description                                  |
|-----------|---------|--|
| Pr 64.10  | -       | Connection status                            |
| Pr 64.11  | ON      | RPI timeout trip enable.                     |
| Pr 64.12  | OFF     | Advanced EDS file enable.                    |
| Pr 64.13  | 7       | Motor 1 type.                                |
| Pr 64.14  | 7       | Motor 2 type.                                |
| Pr 64.15  | 8       | Primary input assembly object size (bytes).  |
| Pr 64.16  | 8       | Primary output assembly object size (bytes). |
| Pr 64.20  | 0       | Input mapping parameter 1.                   |
| Pr 64.21  | 0       | Input mapping parameter 2.                   |
| Pr 64.22  | 0       | Input mapping parameter 3.                   |
| Pr 64.23  | 0       | Input mapping parameter 4.                   |
| Pr 64.24  | 0       | Input mapping parameter 5.                   |
| Pr 64.25  | 0       | Input mapping parameter 6.                   |
| Pr 64.26  | 0       | Input mapping parameter 7.                   |
| Pr 64.27  | 0       | Input mapping parameter 8.                   |
| Pr 64.28  | 0       | Input mapping parameter 9.                   |
| Pr 64.29  | 0       | Input mapping parameter 10.                  |
| Pr 64.30  | 0       | Input mapping parameter 11.                  |
| Pr 64.31  | 0       | Input mapping parameter 12.                  |
| Pr 64.32  | 0       | Input mapping parameter 13.                  |
| Pr 64.33  | 0       | Input mapping parameter 14.                  |
| Pr 64.34  | 0       | Input mapping parameter 15.                  |
| Pr 64.35  | 0       | Input mapping parameter 16.                  |
| Pr 64.36  | 0       | Input mapping parameter 17.                  |
| Pr 64.37  | 0       | Input mapping parameter 18.                  |
| Pr 64.38  | 0       | Input mapping parameter 19.                  |
| Pr 64.39  | 0       | Input mapping parameter 20.                  |
| Pr 64.40  | 0       | Input mapping parameter 21.                  |
| Pr 64.41  | 0       | Input mapping parameter 22.                  |
| Pr 64.42  | 0       | Input mapping parameter 23.                  |
| Pr 64.43  | 0       | Input mapping parameter 24.                  |
| Pr 64.44  | 0       | Input mapping parameter 25.                  |
| Pr 64.45  | 0       | Input mapping parameter 26.                  |
| Pr 64.46  | 0       | Input mapping parameter 27.                  |
| Pr 64.47  | 0       | Input mapping parameter 28.                  |
| Pr 64.48  | 0       | Input mapping parameter 29.                  |
| Pr 64.49  | 0       | Input mapping parameter 30.                  |
| Pr 64.50  | 0       | Input mapping parameter 31.                  |
| Pr 64.51  | 0       | Input mapping parameter 32.                  |
| Pr 64.52  | 0       | Input mapping parameter 33.                  |
| Pr 64.53  | 0       | Input mapping parameter 34.                  |
| Pr 64.54  | 0       | Input mapping parameter 35.                  |
| Pr 64.55  | 0       | Input mapping parameter 36.                  |
| Pr 64.56  | 0       | Input mapping parameter 37.                  |
| Pr 64.57  | 0       | Input mapping parameter 38.                  |

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**Table 13.2 SM-Ethernet virtual parameter reference**

| <b>Parameter</b> | <b>Default</b> | <b>Description</b>           |
|------------------|----------------|------------------------------|
| Pr 64.58         | 0              | Input mapping parameter 39.  |
| Pr 64.59         | 0              | Input mapping parameter 40.  |
| Pr 64.60         | 0              | Output mapping parameter 1.  |
| Pr 64.61         | 0              | Output mapping parameter 2.  |
| Pr 64.62         | 0              | Output mapping parameter 3.  |
| Pr 64.63         | 0              | Output mapping parameter 4.  |
| Pr 64.64         | 0              | Output mapping parameter 5.  |
| Pr 64.65         | 0              | Output mapping parameter 6.  |
| Pr 64.66         | 0              | Output mapping parameter 7.  |
| Pr 64.67         | 0              | Output mapping parameter 8.  |
| Pr 64.68         | 0              | Output mapping parameter 9.  |
| Pr 64.69         | 0              | Output mapping parameter 10. |
| Pr 64.70         | 0              | Output mapping parameter 11. |
| Pr 64.71         | 0              | Output mapping parameter 12. |
| Pr 64.72         | 0              | Output mapping parameter 13. |
| Pr 64.73         | 0              | Output mapping parameter 14. |
| Pr 64.74         | 0              | Output mapping parameter 15. |
| Pr 64.75         | 0              | Output mapping parameter 16. |
| Pr 64.76         | 0              | Output mapping parameter 17. |
| Pr 64.77         | 0              | Output mapping parameter 18. |
| Pr 64.78         | 0              | Output mapping parameter 19. |
| Pr 64.79         | 0              | Output mapping parameter 20. |
| Pr 64.80         | 0              | Output mapping parameter 21. |
| Pr 64.81         | 0              | Output mapping parameter 22. |
| Pr 64.82         | 0              | Output mapping parameter 23. |
| Pr 64.83         | 0              | Output mapping parameter 24. |
| Pr 64.84         | 0              | Output mapping parameter 25. |
| Pr 64.85         | 0              | Output mapping parameter 26. |
| Pr 64.86         | 0              | Output mapping parameter 27. |
| Pr 64.87         | 0              | Output mapping parameter 28. |
| Pr 64.88         | 0              | Output mapping parameter 29. |
| Pr 64.89         | 0              | Output mapping parameter 30. |
| Pr 64.90         | 0              | Output mapping parameter 31. |
| Pr 64.91         | 0              | Output mapping parameter 32. |
| Pr 64.92         | 0              | Output mapping parameter 33. |
| Pr 64.93         | 0              | Output mapping parameter 34. |
| Pr 64.94         | 0              | Output mapping parameter 35. |
| Pr 64.95         | 0              | Output mapping parameter 36. |
| Pr 64.96         | 0              | Output mapping parameter 37. |
| Pr 64.97         | 0              | Output mapping parameter 38. |
| Pr 64.98         | 0              | Output mapping parameter 39. |
| Pr 64.99         | 0              | Output mapping parameter 40. |

**NOTE** The parameters in Table 13.2 are configured internally by the web pages and should not be altered via parameter access directly.



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# 14 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.

**Assembly object:** A software component within the SM-Ethernet which allows access to the parameters within the drive or which allows control and monitoring of the drive by using the EtherNet/IP protocol.

**Attribute:** A sub-division of a **Class** which uniquely identifies a specific command. e.g. The *VendorID* is an attribute of the *Identity object* class. Used in conjunction with the **Class** and **Instance** properties.

**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.

**Class:** A collection of properties which allow the control or monitoring of a device. Used in conjunction with the **Instance** and **Attribute** properties.

**Consistency:** A method of ensuring that the data transferred over the network is transmitted as a single entity, thus preventing data skew when multiple bytes are transmitted.

**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.

**Crossover lead:** A network cable where the terminal connections at one end of the cable are connected straight through to the other end with the exception of the data pair which are transposed. Normally used to connect two network devices together as a separate network.

**Cyclic (implicit or polled) data:** Data that is transmitted at regular intervals over the network. Sometimes referred to as "Implicit data" or "Polled data".

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

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

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**DNS:** Domain Name Server. This is a server that is used to convert a URL such as “www.controltechniques.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.

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

**EDS File:** Electronic Data Sheet file. A file which specifies the EtherNet/IP device functionality.

**Ethernet address:** See *MAC address*.

**EtherNet/IP:** An industrial application layer protocol for communicating to devices over Ethernet. The EtherNet/IP protocol communicates to the drive using assembly objects.

**Exception codes:** An error response from Modbus.

**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.

**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*.

**Instance:** A collection of properties (**Attributes**) that are contained within a **Class**. Used in conjunction with the **Class** and **Attribute** properties.

**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 Emitting Diode.

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

**LSB:** Least Significant Bit/Byte.

**MAC address:** This is a unique address that is assigned to SM-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 SM-Ethernet.

**MSB:** Most Significant Bit/Byte.

**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-crossover lead:** See *Patch lead*.

**Non-cyclic (explicit) data:** Data that is requested or sent as required and not on a regular basis. Sometimes referred to as "Explicit data".

**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.

**Poll rate:** The rate at which cyclic data is sent and received on the network.

**Polled data:** See *Cyclic data*.

**RPI:** Requested Packet Interval. Specifies the expected time for the device to respond to a request.

**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.

**Scan rate:** See *Poll rate*.

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

**SMTP:** Simple Mail Transfer Protocol. A protocol used for sending email.

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**SNTP:** Simple Network Time Protocol. A protocol used for synchronising 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.controltechniques.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.

**XML:** Extensible Markup Language. A document definition that is intended to transfer data.

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**0471-0047-06**