EMERSON
Industrial Automation

User Guide

SI-PROFINET RT

Part Number: 0478-0125-02
Issue Number: 2

CONTROL TECHNIQUES

www.controltechniques.com

General information

The manufacturer accepts no liability for any consequences resulting from inappropriate, negligent or incorrect installation or adjustment of the optional operating 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 a 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 contents of the guide, without notice.

All rights reserved. No parts of this guide may be reproduced or transmitted in any form or by any means, electrical or mechanical including photocopying, recording or by an information storage or retrieval system, without permission in writing from the publisher.

Firmware version

This product is supplied with the latest firmware version. If this product is to be connected to an existing system or machine, all firmware versions should be verified to confirm the same functionality as products of the same model already present. This may also apply 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 firmware version can be checked by looking at Pr **xx.002**.

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 Environmental Policy and other relevant information is available on request, or can be found at 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 for 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.

REACH legislation

EC Regulation 1907/2006 on the Registration, Evaluation, Authorisation and restriction of Chemicals (REACH) requires the supplier of an article to inform the recipient if it contains more than a specified proportion of any substance which is considered by the European Chemicals Agency (ECHA) to be a Substance of Very High Concern (SVHC) and is therefore listed by them as a candidate for compulsory authorisation.

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:

http://www.controltechniques.com/REACH

Contents

Safety information

Introduction

Mechanical installation

Electrical installation

Getting started

Additional features

Parameter descriptions

Diagnostics

Glossary

1 Safety information

1.1 Warnings, Cautions and Notes

> ⚠️ **WARNING**
>
> A Warning contains information which is essential for avoiding a safety hazard.

> ⚠️ **CAUTION**
>
> 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, Commissioning/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 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 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.

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.

The system designer is responsible for ensuring that the complete system is safe and designed correctly according to the relevant safety standards.

1.4 Environmental limits

Instructions in the *Unidrive M User Guide* 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.

1.5 Access

Drive access must be restricted to authorized personnel only. Safety regulations which apply at the place of use must be complied with.

1.6 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.

The *Unidrive M User Guide* contains instructions for achieving compliance with specific EMC standards.

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

- 2006/42/EC: Safety of machinery.
- 2004/108/EC: Electromagnetic Compatibility.

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.

1.7.1 Stored charge

The drive contains capacitors that remain charged to a potentially lethal voltage after the AC supply has been disconnected. If the drive has been energized, the AC supply must be isolated at least ten minutes before work may continue.

Safety information

Introduction

Mechanical installation

Electrical installation

Getting started

Additional features

Parameter descriptions

Diagnostics

Glossary

2 Introduction

2.1 What is PROFINET?

PROFINET is an Ethernet based industrial network protocol adapting Ethernet hardware and protocols to the real time needs of industrial automation. It is similar to PROFIBUS in that it enables distributed IO control from a PLC.

2.2 Introduction to SI-PROFINET RT

SI-PROFINET RT is an option module that allows any suitable Control Techniques variable speed drive to be connected to a PROFINET network as a PROFINET IO slave device.

It is possible to use more than one SI-PROFINET RT or a combination of SI-PROFINET RT and other option modules, to add additional functionality such as extended I/O, gateway functionality, or additional PLC features.

2.3 Option module identification

The SI-PROFINET RT module can be identified by:
1. The label located on the option module.
2. The color coding across the front of the SI-PROFINET RT module (yellow/green).

Figure 2-1 SI-PROFINET RT label details
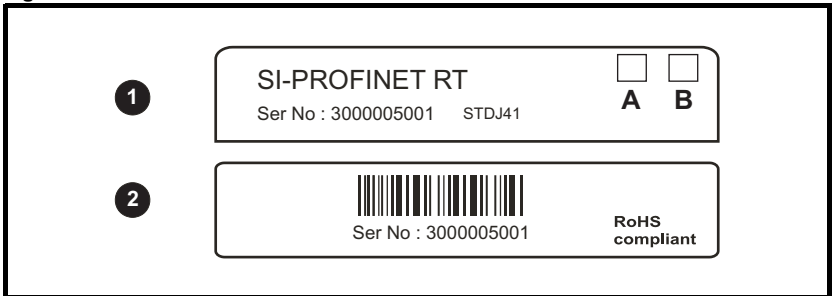
2.3.1 Date code format

The date code is split into two sections: a letter followed by a number.
The letter indicates the year, and the number indicates the week number (within the year) in which the option module was built. The letters start with A for 1991 (B for 1992, C for 1993 etc.).
Example: A date code of W31 would correspond to week 31 of year 2013.

2.4 Features / specification

The following features are included in the SI-PROFINET RT option module:
- Dual 100 BASE-TX RJ45 connectors with support for shielded twisted pair, full-duplex 100 M bps connectivity with auto crossover correction
- Both RJ45 ports operate in full duplex mode as a network switch
- PROFINET Real Time class RT_Class_1 and conformance class A
- Cycle times from 2 ms to 512 ms specified during configuration
- Automatic device replacement using the LLDP protocols
- LED indication of network port activity
- Up to 64 cyclic IO module slots (maximum 32 inputs and 32 outputs configured by network configuration tool and GSDML file)
- Identification and Maintenance functions I&M0 to I&M4 supported

2.5 Conventions used in this guide

The configuration of the host drive and option module is done using menus and parameters. A menu is a logical collection of parameters that have similar functionality. In the case of an options module, the parameters will appear in menu 15, 16 or 17 depending on which slot the module is installed to. The menu is determined by the number before the decimal point.

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

- Pr **S.mm.ppp** - Where S signifies the option module slot number and mm.ppp signifies the menu and parameter number of the option module's internal menus and parameters.
- Pr **MM.ppp** - Where MM signifies the menu allocated to the option module set-up menu and ppp signifies the parameter number.
- Pr **mm.000** - Signifies parameter number 000 in any drive menu.

2.6 SI-PROFINET RT conventions

When referring to the cyclic data, the terms input and output are with respect to the PROFINET IO controller (PLC).

2.7 PROFINET network controller or PLC?

The terms 'network controller' and 'PLC' are mutually used in this manual to refer to the PROFINET network controller. This is generally a PLC with a PROFINET interface and possibly a programming interface to connect to the programming device or PC. However this interface is not necessary, as the PROFINET interface can be used to program the PLC.

Introduction

Mechanical installation

Electrical installation

Getting started

Additional features

Parameter descriptions

Diagnostics

Glossary

3 Mechanical installation

> ⚠️ **WARNING**
>
> Before installing or removing an option module from any drive, ensure the AC supply has been disconnected for at least 10 minutes and refer to section 1 *Safety information* on page 4. If using a DC bus supply ensure this is fully discharged before working on any drive or option module.

3.1 General installation

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

Figure 3-1 Installing an option module
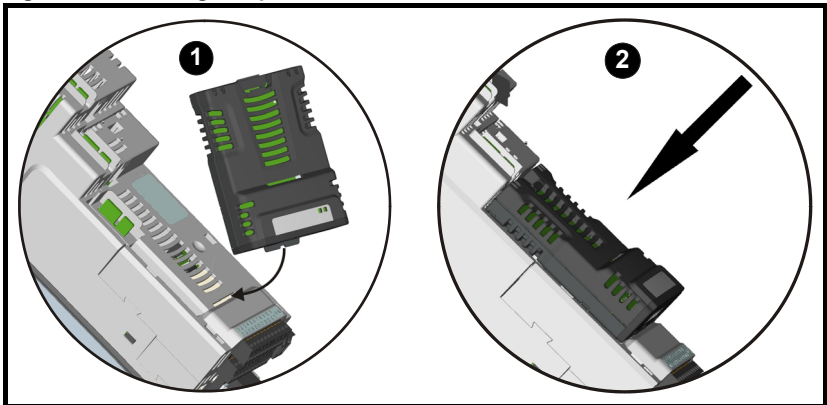
- Option module slots must be used in the following order: slot 3 (lower), slot 2 (middle) and slot 1 (upper).
- Orientate the option module above the drive as shown (1) in the first image above.
- Align and insert the option module tab into the slot and press down until the option module locks into place.

4 Electrical installation

4.1 Bus media

The SI-PROFINET RT option module incorporates two 100 BASE-TX RJ45 interfaces operating in full duplex mode with auto crossover correction.
Both ports have integrated switches and can be connected to other PROFINET devices to create a line network.

4.2 Cabling considerations

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

When installing fieldbus or communications cables (especially high speed data cables such as PROFINET), consideration should be given to the physical layout and positioning of the cables, in particular the positioning with regards to other cables (power cables etc.). The recommended distances between different category cables is shown in Table 4-1 *Cable properties* on page 10.

Cables belonging to the same category may be placed adjacent to each other with no danger of cross-interference.

Similar category cables can be installed in an earthed metal cable tray / trunking separated from other category cables by earthed metal partitions, provided the cable tray or trunking has a lid so the cables are completely surrounded in an earthed metal enclosure.

Figure 4-1 Recommended cable distances

Category I – sensitive and safe cables.
Communication cables
Data cables
Low voltage power (AC up to 25V / DC up to 60V)

Category II – medium voltage cables.
Cables carrying AC voltages between 25V and 400V
Cables carrying DC voltages between 60V and 400V

Category III – high voltage cables.
Cables carrying AC or DC voltages above 400V
Motor / drive inverter cables

Category IV – water industry cables.
Any cables at risk of direct lightning strikes (e.g. cables running outside, between buildings)

Cables should not be distorted, stretched, crushed or otherwise damaged in any way as this may cause future reliability issues.

Safety information

Introduction

Mechanical installation

Electrical installation

Getting started

Additional features

Parameter descriptions

Diagnostics

Glossary

Avoid excessive bending during installation, the maximum recommended bending radius is 10 times the cable diameter 75 mm (3.0 in).

NOTE

Cabling issues are the single most frequent cause of network downtime.
- Ensure cables are correctly routed i.e. not adjacent to high-power cables etc.
- Wiring must be correct, and the connectors should be of industrial grade with metal shielding.
- Routers or switches must be of industrial and not 'office' quality, as they do not provide the same degree of noise immunity as their industrial counterparts.

4.3   Cable

Copper cables should be shielded twisted pair (STP) and, as a minimum, meet TIA Cat 5e requirements and be certified for use on a PROFINET network. The coloring of the outer sheath is not critical but should be consistent (where possible) to simplify system maintenance and, preferably, for identification purposes comply with the standard PROFINET coloring (yellow/green).

PROFINET copper cables are categorized into three different types, the actual type used is mainly determined by the relevant application.
- **Type A** cables are designed for fixed installations where the cable is not subject to any movement.
- **Type B** cables are designed for flexible installations where the cable can be subject to occasional movement or vibration.
- **Type C** cables are designed for special applications where the cable will be subject to frequent or continuous movement or vibration.

4.3.1   Cable properties

The properties for all three types of cables are similar, the only difference between the three types are the size of the individual wires used.

Table 4-1 Cable properties

Impedance	100 Ω ±15 Ω
Loop resistance	<115 Ω/km
Transmission rate	100 M Bit/s
Maximum length	100 m
Number of wires	4
Sheath color	Green
Insulation color	White, Blue, Yellow, Orange

	Type A	Type B	Type C
Wire diameter	0.64 mm	0.75 mm	0.13 mm
Wire CSA	0.32 mm^2 (AWG 22/1)	0.36 mm^2 (AWG 22/7)	AWG 22/7 or AWG 22/19

NOTE

Special properties of some copper cables use flame retardant materials which can reduce the maximum length of the cable to less than 100 m. For more information please refer to the cable manufacturer's documentation.

4.4 Maximum network length

The main restriction imposed on Ethernet cabling is the length of a single segment of cable. The SI-PROFINET RT module has two 100 BASE-TX Ethernet ports, which support segment lengths of up to 100 m. This means that the maximum cable length which can be used between one SI-PROFINET RT port and another 100 BASE-TX port is 100 m, however it is not recommended that the full 100 m cable length is used.

NOTE

The total network length is not restricted by the Ethernet standard, but depends on the number of devices on the network and the transmission media (copper, fibre optic, etc).

4.5 SI-PROFINET RT terminal descriptions

The SI-PROFINET RT module has two RJ45 Ethernet ports for connection to a PROFINET network. Each Ethernet port operates in full duplex mode as a network switch and has an LED associated with it to indicate the connection status as shown in Table 4-2.

Table 4-2 LED functionality

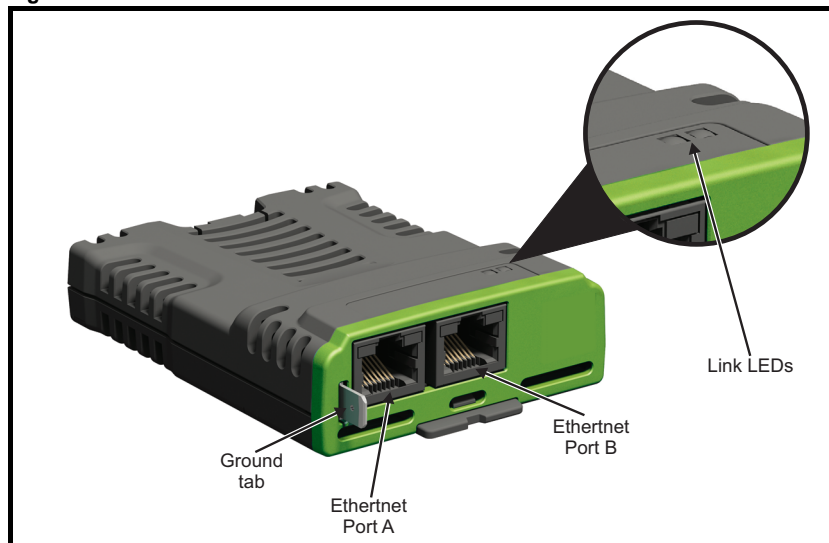| State	Meaning
OFF	No Ethernet network connection detected
Steady green	Ethernet connection established
Flashing green	Ethernet message frame detected

Figure 4-2 SI-PROFINET RT connections

Link LEDs

Ground tab

Ethertnet Port A

Ethertnet Port B

Table 4-3 SI-PROFINET RT Ethernet connections

Port A / B	
Pin	**Function**
1	Transmit +
2	Transmit -
3	Receive +
4	Not used
5	Not used
6	Receive -
7	Not used
8	Not used

8 7 6 5 4 3 2 1

4.6   Module grounding

SI-PROFINET RT 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.

NOTE

For information on the drive grounding arrangement refer to the relevant drive documentation.

4.7   Network topology

The SI-PROFINET RT module has two PROFINET ports with integrated switches to allow the use of line networks (see Figure *For the device replacement feature to work, the physical network topology must be configured in the PLC, for further information please refer to the PLC documentation.*). However, when using line networks, a break in the connection (for example when replacing a device) will cause all devices downstream from the failure to also stop communicating with the controller.

Other Ethernet network topologies can be used but care must be taken to ensure that the system still operates within the constraints specified by the designer.
Generally a star or tree network structure using separate switches gives improved availability in the event of device failure or replacement. Also, managed switches have a web page interface which can be used to configure the switch to monitor the data traffic on specific ports using any appropriate protocol analyzer.
Although the PROFINET protocol does support all major topologies, line topology networks are normally used for practical and financial reasons, other Ethernet topologies (e.g. star) may not be suitable for real time communications due to their inherent use of switches or other network equipment.

Any network devices used, such as switches, must be capable of RT communications and ideally, also IRT (Isochronous Real Time) communications, although SI-PROFINET RT does not currently support this protocol. Standard office equipment is not normally suitable and should not be used.

NOTE

For the device replacement feature to work, the physical network topology must be configured in the PLC, for further information please refer to the PLC documentation.

4.8 Minimum node-to-node cable length

There is no minimum length of cable recommended in the Ethernet standards. To avoid possible cabling problems, it is recommended that sufficient cable length is provided to ensure adequate bend radii on cables and avoid unnecessary strain on the connectors.

Safety information

Introduction

Mechanical installation

Electrical installation

Getting started

Additional features

Parameter descriptions

Diagnostics

Glossary

5   Getting started

This chapter is intended to provide a generic guide for setting up SI-PROFINET RT on a PROFINET network. The setup flowchart (*SI-PROFINET RT setup flowchart* on page 17) is intended as a guide only, and is provided to detail the stages that are required to achieve a functioning network. It is recommended that this entire chapter is read before attempting to configure a system.

5.1   SI-PROFINET RT XML file (or GSDML file)

A GSDML (General Station Description Markup Language) file is required to describe the drive interface to a PROFINET controller or PLC. This is an XML file, the structure of which is specified by the PROFIBUS INTERNATIONAL organization (www.profibus.org).

The GSDML file is used in conjunction with the network configuration software to configure the SI-PROFINET RT module for cyclic data exchange. All relevant drive parameters are available as a 'module' to be added to the cyclic data 'slots'.

A non-specific 'module' is also provided so that the user can allocate a parameter within the drive (or option module), that is not directly available as a specific 'module'. Some 'modules' require the slot position to be specified and the menu and parameter to be specified. These options will be available from a drop-down selection list within the 'Parameters' tab of the 'module' properties.

The GSDML file for SI-PROFINET RT can be downloaded from the Control Techniques support website (www.ctsupport.com), providing you are registered or from the main Control Techniques company website (www.controltechniques.com), providing you are registered or, alternatively, requested from your local Control Techniques Drive Centre or supplier.

NOTE

For further information regarding the use of the GSDML file please refer to the PLC documentation.

5.2   Configuring the PROFINET IO communications

SI-PROFINET RT does not require the module parameters to be configured by the user in order to achieve PROFINET cyclic communications. All the necessary configuration is undertaken by the network controller or PLC during the start-up sequence, and after the network configuration is programmed into the network controller or PLC.

It must be noted that when configuring the cyclic data modules, if a module is configured but the associated drive parameter does not actually exist in the drive, then the PLC will not start up correctly and will indicate a configuration fault.

If a cyclic module which requires the drive slot position is used, but the drive slot position is not specified, then no fault indication will be indicated on the PLC and no data will be returned by the module.

5.3 Setting the IP address

Each device on a network must have it's own unique IP address, if the network is not to be connected to other networks or the Internet, then the assignment of the IP addresses is not critical (although using a standard system is recommended). The issue of address assignment becomes more important when connecting multiple networks together or connecting to the Internet where there is a strong possibility of address duplication unless a standard addressing system is used.

The IP address and subnet mask will be determined during the network configuration setup and, along with the device name, programmed into the module during parameterization.

When selecting IP addresses, the following points should be considered:
- **Reserve adequate address space**: Ensure you have enough reserve address space on your chosen addressing scheme to allow for future expansion
- **Uniqueness**: Ensure all your addresses are unique
- **Avoid reserved addresses**: Some addresses are reserved and should not be used. (e.g. 127.0.0.1 is a loop-back address)
- **Broadcast and system addresses**: The highest and lowest host addresses are used for broadcasts and system addressing and should not be used
- **Use a system**: Adopt a scheme to assign IP addresses, for example, reserve ranges of addresses for specific uses such as servers, routers, work stations etc.

5.4 IP address classes

IP addresses are grouped into five classes, each class has a specific set of addresses and typical situation where it is used. When selecting the class of IP addresses to use, consideration must be given to the number of subnets and hosts that are required. Table 5-1 *IP address class configuration* on page 15 shows how the class types are defined.

Table 5-1 IP address class configuration

Class	First byte range	Valid networks	Number of subnets	Host component	Number of hosts
A	1 - 126	1.0.0.1 to 126.255.255.254	126	x.y.z	16,777,214
B	128 - 191	128.0.0.1 to 191.254.255.254	16,382	y.z	65,534
C	192 - 223	192.0.0.1 to 223.255.254.254	2,097,150	z	254
D	224 - 239	Multicast group ID			
E	240 - 255	Reserved			

NOTE

Network ID's and host ID's with all 0's or all 1's specify a broadcast address and are therefore not included as valid networks.

Getting started

Introduction

Mechanical installation

Electrical installation

Getting started

Additional features

Parameter descriptions

Diagnostics

Glossary

Table 5-2 IP address classes

	W				X	Y	Z
Class A	0	Net ID (7 bits)			Host ID (24 bits)		
Class B	1	0	Net ID (14 bits)			Host ID (16 bits)	
Class C	1	1	0	Net ID (21 bits)			Host ID (8 bits)
Class D	1	1	1	0	Multicast group ID (28 bits)		
Class E	1	1	1	1	Reserved (28 bits)		

5.5   Subnet mask

The subnet mask defines which part of the IP address constitutes the subnet address and which part constitutes the host address.

The subnet mask is bit-wise ANDed with the IP address to give the network ID, the host ID portion of the IP address is bit-wise ORed with the subnet mask to give the host ID.

- A '1' in the subnet mask indicates that the corresponding bit in the IP address is part of the network or subnet ID address
- A '0' in the subnet mask indicates that the corresponding bit in the IP address is a part of the host ID address

Figure 5-1 *Network and host ID* illustrates an example with a class C IP address.

Figure 5-1 Network and host ID
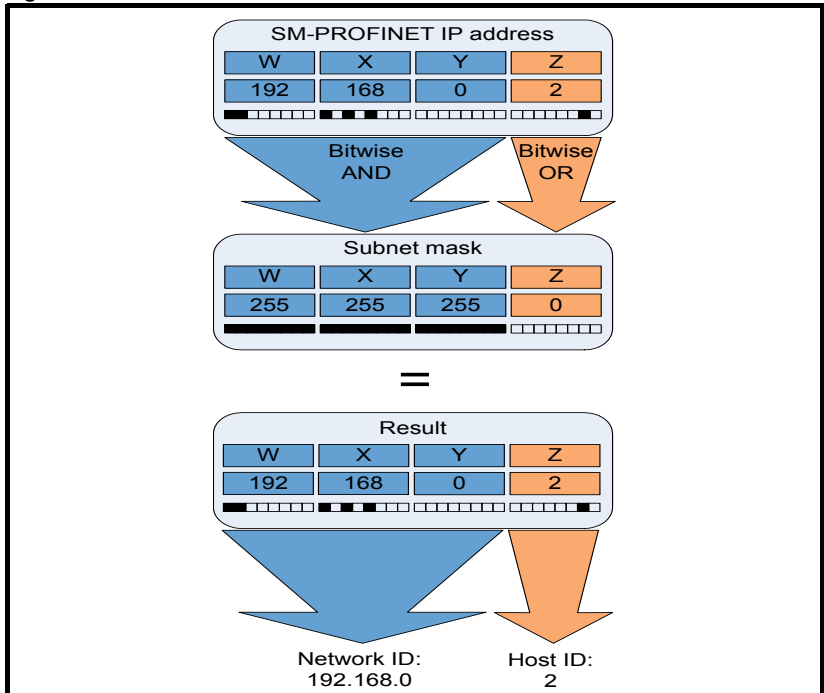
5.6 PROFINET device name

Every PROFINET device must have a unique device name assigned to it during network configuration. Device names are used by the PLC to communicate with the device for RT messages (cyclic data and alarms). Without a device name, the device will not enter data exchange with the PLC.

The actual choice of device name is not important to the PROFINET IO system itself, however a suitable name should be chosen so that it is easily recognized on the network and identifies the location and function of the device.

A typical device name may contain up to four labels, each label is separated by a dot (.) and may be up to 63 characters long. The device name must also satisfy DNS naming conventions, therefore the following rules must be observed when choosing a device name:
- Maximum length of 127 characters
- Characters must be either letters (lower case), numbers, dashes (-) or dots (.)
- The device name must start with a letter and end with either a letter or number
- The device name must not be of the format n.n.n.n (where n is a number from 0 to 999)
- The device name must not begin with the character sequence 'port-xyz-' (where x,y,z is a number from 0 to 9)

A typical example of a device name could be: **motor-1.conveyor-2.line-3.ct-4**

NOTE

The default name is specified in the GSDML file in the string value 'DNS_CompatibleName'.

Figure 5-2 SI-PROFINET RT setup flowchart

Getting started

Introduction

Mechanical installation

Electrical installation

Getting started

Additional features

Parameter descriptions

Diagnostics

Glossary
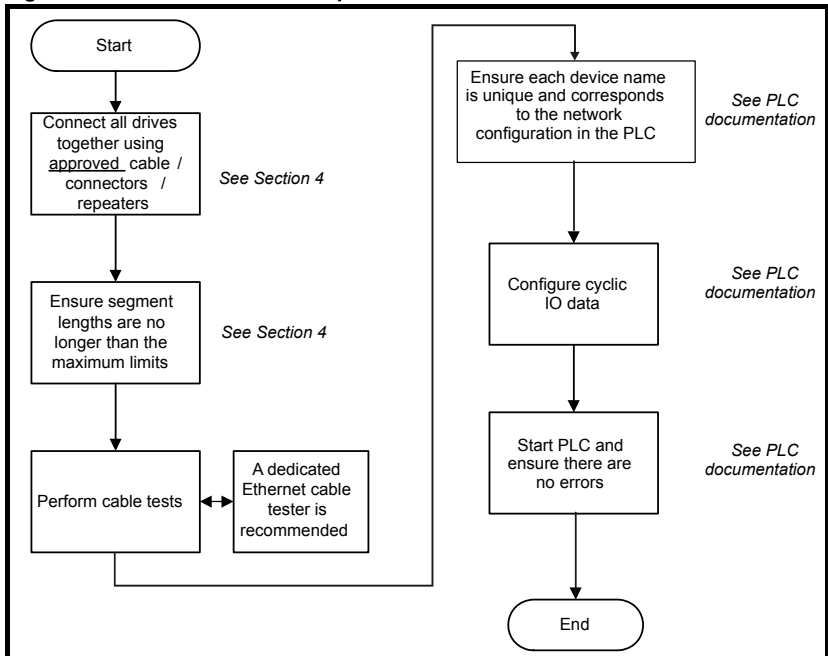
6   Additional features

This chapter provides information on the additional functions and features of the SI-PROFINET RT option module.

6.1   Update time

In contrast to some other fieldbus networks, PROFINET has no single bus cycle where the slowest device determines the update rate for all devices, PROFINET allows different update rates for each device. SI-PROFINET RT can be configured with an update rate of between 2 ms to the slowest rate of 512 ms; the possible update rates are 2, 4, 8, 16, 32, 64, 128, 256 and 512 ms.

When selecting the update time, it is recommended that the slowest rate necessary is used, this is to minimize the possibility of overloading the network.

6.2   PROFINET transmission cycle

The PROFINET transmission cycle is the time required to update all the devices on the PROFINET network; the length of the PROFINET transmission cycle (send cycle) is determined by the PROFINET device which has the slowest update rate.

The transmission cycle can be split into a number of phases where each phase contains one or more devices with similar update rates, the duration of each phase will be equal to the fastest update rate.

Example:

In the following example (Figure 6-1 *PROFINET transmission cycle example*), a system uses four PROFINET devices, device 1 has an update rate of 8 ms, device 2 has an update rate of 4 ms, device 3 has an update rate of 2 ms and device 4 has an update rate of 1 ms.

Figure 6-1 PROFINET transmission cycle example
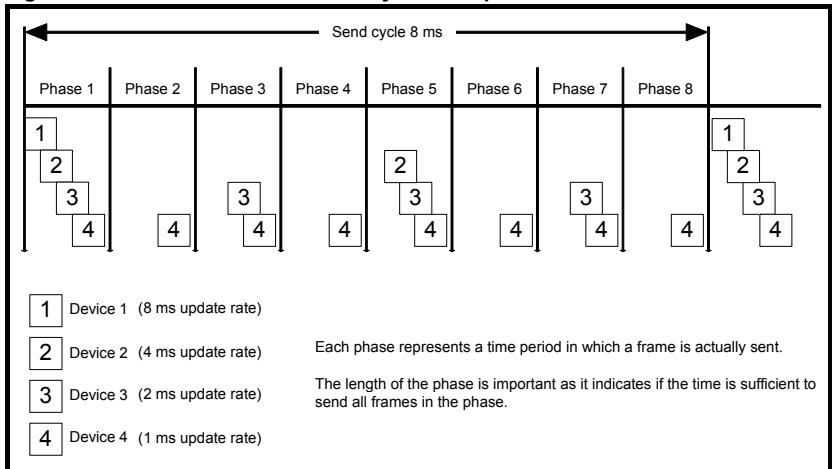
The PROFINET transmission cycle is effectively the slowest update rate (8 ms in this example), and the phase time is effectively the quickest update rate (1 ms in this example). The following information is provided for use when designing a PROFINET network to calculate the total and individual transmission cycle times.

Safety information

Introduction

Mechanical installation

Electrical installation

Getting started

Additional features

Parameter descriptions

Diagnostics

Glossary

6.2.1 Number of phases
The number of phases is determined by the formula:
Number Of Phases = Send Cycle / Fastest Update Rate = 8 ms / 1 ms = 8

6.2.2 Length of phase
The length of each phase is determined by the formula:
Length Of Phase = SendClockFactor x 31.25 μs = 32 x 31.25 μs = 1 ms
Where:
SendClockFactor is specified in the GSDML file as the 'MinDeviceInterval' value.

6.2.3 Reduction ratio
The reduction ratio acts as a multiplier of the minimum update time and is determined by the formula:
Reduction ratio = Send Cycle Device / Length Of Phase
In this example,
Reduction ratioDevice 1 = 8 ms / 1 ms = 8
Reduction ratioDevice 2 = 4 ms / 1 ms = 4
Reduction ratioDevice 3 = 2 ms / 1 ms = 2
Reduction ratioDevice 4 = 1 ms / 1 ms = 1

The SI-PROFINET RT module allows the update rate to be configured in one of three ways:
1. **Automatic** - the update time selected is the time that the IO system calculates, based on the configuration, that can be reliably achieved.
2. **Fixed update time** - the user selects the device update rate directly from a selection.
3. **Fixed factor** - the user selects the reduction ratio to be used to multiply the minimum transmission cycle time by to give the device update rate.

6.3 Discovery and Configuration Protocol (DCP)
SI-PROFINET RT supports the discovery and configuration protocol. This protocol (when correctly configured), is used in the event of device replacement to automatically configure the new device. All the necessary configuration is done by the neighbouring devices when the new device is detected.

6.3.1 Link Layer Discovery Protocol (LLDP)
LLDP is a manufacturer independent layer 2 protocol, defined in accordance with the IEEE802.1AB standard.

During startup and also at regular intervals, LLDP is used to send and receive device information between neighboring devices. This information includes the device name and port numbers. LLDP messages use a special multicast destination MAC address that 802.1D compliant bridges do not forward, i.e. the LLDP message is only seen by neighboring devices. If all devices in a network support the LLDP protocol then an accurate network topology view can be presented in the diagnostic tool or PLC.

Information received via LLDP is stored locally on every device, in a structure called Management Information Base (MIB). This information can be retrieved using SNMP (Simple Network Management Protocol) messages.

6.3.2 Configuring the network topology for DCP

In order to use the network discovery and configuration protocol, the PLC must be correctly configured and programmed with the physical network topology, the following information is intended as a guide only, for more specific information (in particular for other types of PLC's), then please consult the PLC documentation.

NOTE

Although the Siemens PLC is mentioned in this manual, Control Techniques does not recommend or endorse any particular PLC or controller manufacturer.

The following information relates to the Siemens S7-315 2 PN/DP PLC.
The PLC must be configured to support device replacement, this is an option in the properties of the PROFINET port. In the hardware configuration screen of the SIMATIC STEP7 application, either double click the port, or alternatively select the port, right click it and select 'Object Properties…' as shown in Figure 6-2. Ensure the option 'Support device replacement without exchangeable medium' is selected then click the 'OK' button.

Figure 6-2 PLC device replacement option
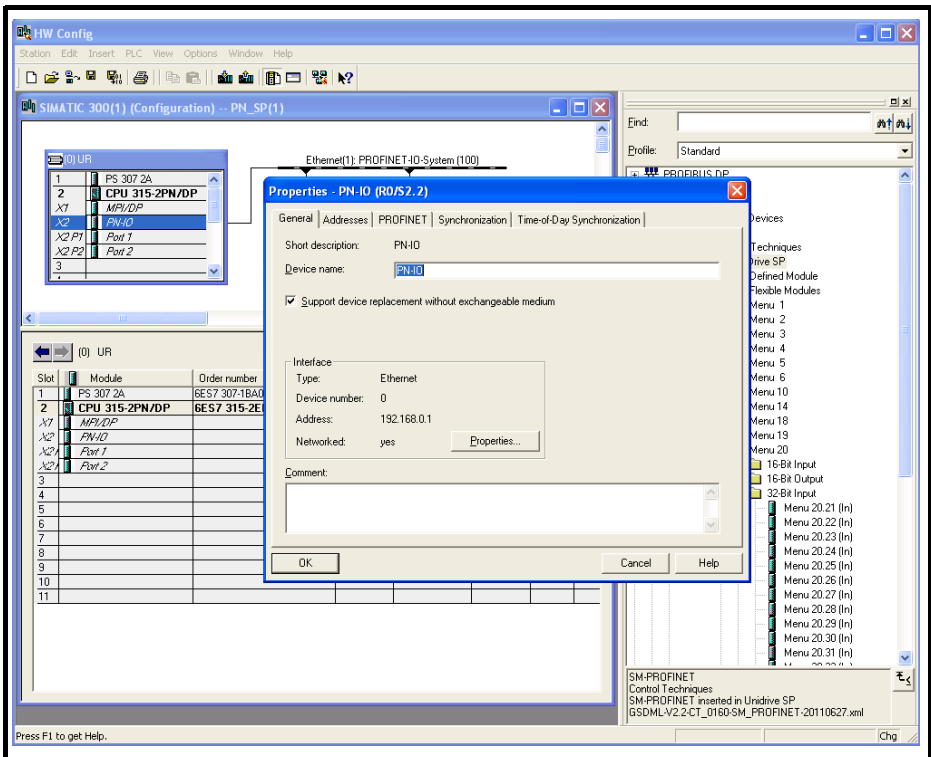
The network topology must now be configured. From the hardware configuration screen, select the port, right click it and select 'PROFINET IO Topology…', the topology editor will be displayed, select the 'Graphic view' tab and using 'drag and drop', connect the relevant device ports together to match the physical network wiring. The program must then be compiled and downloaded to the PLC in the normal manner.

Once the PLC has been configured, if a device is replaced then the new device will be automatically configured with the original device's properties, including the device name and IP address.

NOTE

For the discovery protocol to work, the replacement device must not have a device name programmed, i.e. it must be blank or unused. If a device name exists in the module and that name is different to the device name set in the network configuration then the PLC will indicate a configuration error and will not enter data exchange with it.

6.4 Identification and Maintenance (I&M)

Identification and Maintenance (I&M) functions can be used to read and change various information about devices, such as manufacturer, ordering information, serial number, etc. This information can be used to assist the user in tracking the drive's life cycle through commissioning/start-up, parameterization, diagnosis, repair, etc. SI-PROFINET RT supports I&M0 to I&M4 inclusively; I&M0 is mandatory for all PROFINET devices, I&M1 to I&M4 are optional.

Each I&M function returns specific information about the device and is explained in the following tables.

6.4.1 I&M0

Table 6-1 I&M0 Description

Attribute	Value (Read only)
Manufacturer ID	0x0160
Order ID	SI-PROFINET RT
Serial number	(Pr **S.00.005** x **1,000,000,000** + Pr **S.00.006**)
Hardware revision	(Pr **S.00.003**)
Software revision	(Pr **S.00.002**)
Revision counter	(as read)
Profile ID	(as read)
Profile specific type	(as read)
I&M version	(as read)
I&M supported	(as read)

Manufacturer ID: 2-byte unsigned hexadecimal number assigned by the PROFIBUS business office and specified in the GSDML file.
For Control Techniques this value is 0x0160.

Order ID: 20-byte string to identify the device.
This value is specified in the GSDML file.
For Control Techniques this value is 'SI-PROFINET RT'.

Serial number: 16-byte string indicating the module serial number.
This value is read from Pr **S.00.005** and Pr **S.00.006** of the SI-PROFINET RT module.

Hardware revision: 2-byte unsigned hexadecimal number indicating the hardware revision of the SI-PROFINET RT module.
This value is read from Pr **S.00.003** of the SI-PROFINET RT module.

Safety information

Introduction

Mechanical installation

Electrical installation

Getting started

Additional features

Parameter descriptions

Diagnostics

Glossary

Software revision: 4-byte value consisting of a single character 'V' and 3 unsigned 8-bit decimal numbers indicating the software revision of the SI-PROFINET RT module. This value is taken from Pr **S.00.002** of the SI-PROFINET RT module.

Revision counter: 2-byte unsigned decimal number.
This value is not changed by SI-PROFINET RT but can be changed by the network controller.

Profile ID: 2-byte unsigned hexadecimal number indicating the application profile. Devices not following any particular profile use the generic profile value 0xF600.

Profile specific type: 2-byte unsigned hexadecimal number indicating the application profile specific type. This value is not applicable to devices using the generic profile and in these instances this value will be zero.

I&M version: 2 unsigned 8-bit numbers indicating the version of the implemented I&M functions.

I&M supported: 2-byte unsigned number indicating the availability of the implemented I&M functions as shown in Table 6-2.

Table 6-2 Supported I&M bit descriptions

Bit	Value	Description
0		Profile specific I&M
1	0	I&M1 Not supported
	1	I&M1 Supported
2	0	I&M2 Not supported
	1	I&M2 Supported
3	0	I&M3 Not supported
	1	I&M3 Supported
4	0	I&M4 Not supported
	1	I&M4 Supported
5 to 15		Reserved

6.4.2   I&M1

Table 6-3 I&M1 Description

Attribute	Value (Read/Write)
Drive function (32 bytes)	(User defined)
Drive location (22 bytes)	(User defined)

Drive function: 32-byte string indicating the drive function.
Drive location: 22-byte string indicating the drive location.

6.4.3   I&M2

Table 6-4 I&M2 Description

Attribute	Value (Read/Write)
Installation date	(User defined)

Installation date: 16-byte string indicating the installation or commissioning date of the device. The installation date is in the format DD/MM/YYYY.

6.4.4 I&M3

Table 6-5 I&M3 Description

Attribute	Value (Read/Write)
Descriptor (54 bytes)	(User defined)

Descriptor: 54-byte string used to store additional information on the location, function or maintenance status of the device.

6.4.5 I&M4

Table 6-6 I&M4 Description

Attribute	Value (Read/Write)
Signature (54 bytes)	(User defined)

Signature: 54-byte octet string used to allow parameterization tools to store a security code as a reference for a particular parameterization session and audit trail tools to retrieve the code for integrity checks.

NOTE

All unused bytes of the I&M functions will be set to 0x20 (space).

Safety information

Introduction

Mechanical installation

Electrical installation

Getting started

Additional features

Parameter descriptions

Diagnostics

Glossary

7 Parameter descriptions

7.1 Single line parameter descriptions

7.1.1 Menu 0 - Setup

Parameter		Range	Default	Type				
S.00.001	Module ID	0 to 65535		RO	Num	ND	NC	PT
S.00.002	Software Version	00.00.00.00 to 00.99.99.99		RO	Ver	ND	NC	PT
S.00.003	Hardware Version	00.00 to 99.99		RO	Ver	ND	NC	PT
S.00.004	Serial Number LS	0 to 99999999		RO	Num	ND	NC	PT
S.00.005	Serial Number MS	0 to 99999999		RO	Num	ND	NC	PT
S.00.006	Module Status	Initializing (0), OK (1), Config (2), Error (3)		RO	Txt	ND	NC	PT
S.00.007	Module reset	Off (0) or On (1)	Off (0)	RW	Bit		NC	
S.00.008	Module Default	Off (0) or On (1)	Off (0)	RW	Bit		NC	
S.00.030	Slot Indicator	0 to 8		RO	Num	ND		
S.00.031	Slot Menu Number	0 to 255		RO	Num	ND		

RW	Read / Write	RO	Read-only	Bit	Bit parameter	Txt	Text string	Date	Date parameter	Time	Time parameter
Chr	Character parameter	Bin	Binary parameter	IP	IP address	Mac	MAC address	Ver	Version number	SMP	Slot, menu, parameter
Num	Number parameter	DE	Destination	ND	No default value	RA	Rating dependent	NC	Non-copyable	PT	Protected
FI	Filtered	US	User save	PS	Power-down save						

7.1.2 Menu 2 - PROFINET Ethernet configuration

Parameter		Range	Default	Type				
S.02.003	Network Status	Initializing (0), Links Down (1), No Address (3), Ready (4), Active (5)		RO	Num	ND	NC	PT
S.02.004	Network Message Count	0 to 65535 Msg/s		RO	Num	ND	NC	PT
S.02.006	IP Address	0.0.0.0 to 255.255.255.255	0.0.0.0	RO	IP		NC	PT
S.02.007	Subnet Mask	0.0.0.0 to 255.255.255.255	0.0.0.0	RO	IP		NC	PT
S.02.008	Default Gateway	0.0.0.0 to 255.255.255.255	0.0.0.0	RO	IP		NC	PT
S.02.011	MAC Address	0:0:0:0:0:0 to FF:FF:FF:FF:FF:FF		RO	Mac	ND	NC	PT

RW	Read / Write	RO	Read-only	Bit	Bit parameter	Txt	Text string	Date	Date parameter	Time	Time parameter
Chr	Character parameter	Bin	Binary parameter	IP	IP address	Mac	MAC address	Ver	Version number	SMP	Slot, menu, parameter
Num	Number parameter	DE	Destination	ND	No default value	RA	Rating dependent	NC	Non-copyable	PT	Protected
FI	Filtered	US	User save	PS	Power-down save						

Safety information

Introduction

Mechanical installation

Electrical installation

Getting started

Additional features

Parameter descriptions

Diagnostics

Glossary

7.1.3 Menu 5 - PROFINET configuration

Parameter		Range	Default	Type				
S.05.004	Configuration Error	No Error (0), Input Mapping Error (1), Output Mapping Error (2), Data Size Error (3), Parameter Configuration Error (4)	No Error (0)	RO	Txt		NC	PT
S.05.006	Module Revision Counter	0 to 65535		RO	Num	ND	NC	PT
S.05.007	Profile ID	0 to 65535	62976	RO	Num			PT
S.05.008	Installation Date	00-00-00 to 31-12-99		RO	Date	ND	NC	PT
S.05.009	Timeout	1 to 10000 ms	100	RW	Num			PT
S.05.010	Timeout Action	Trip (0), SendFaultValues (1), Clear output (2), Hold last (3), No action (4)	No action (4)	RW	Txt			US
S.05.011	Timeout Event Destination	This slot (0), Slot 1 (1), Slot 2 (2), Slot 3 (3), Slot 4 (4)	This slot (0)	RW	Txt			US
S.05.012	Timeout Event Type	No event (0), Trigger Event (1), Trigger Event 1 (2), Trigger Event 2 (3), Trigger Event 3 (4), Trigger Event 4 (5)	No event (0)	RW	Txt			US

RW	Read / Write	RO	Read-only	Bit	Bit parameter	Txt	Text string	Date	Date parameter	Time	Time parameter
Chr	Character parameter	Bin	Binary parameter	IP	IP address	Mac	MAC address	Ver	Version number	SMP	Slot, menu, parameter
Num	Number parameter	DE	Destination	ND	No default value	RA	Rating dependent	NC	Non-copyable	PT	Protected
FI	Filtered	US	User save	PS	Power-down save						

7.2   Menus

The table below details each of the module's internal menus.

Menu	Description
S.00	Module information
S.02	PROFINET Ethernet Configuration
S.05	PROFINET Configuration

S is the slot number where the module is installed.

The module's menu 0 is also displayed in menu 15, 16 or 17 depending on which slot the module in installed in. The table below shows the location of the module's menu 0 on the drive.

Slot number	Menu 0 location
1	15
2	16
3	17

Menu 0 - Module Set-up

All parameters in **S.00.ppp** (i.e. menu 0 within the option module menus) are also present in menus 15, 16 or 17 depending on the slot that the module is installed to e.g. Pr **3.00.007** is also present as 17.007.

The functionality and properties of the parameters are identical between the two menus.

S.00.001	Module ID		
Minimum	0	Maximum	65535
Default	432	Units	
Type	16 Bit Volatile	Update Rate	Power-up write
Display Format	None	Decimal Places	0
Coding	RO, ND, NC, PT, BU		

Pr **S.00.001** displays the ID number for the Option Module. For SI-PROFINET RT, this is 432.

S.00.002	Firmware version		
Minimum	0 (Display 00.00.00.00)	Maximum	99999999 (Display 99.99.99.99)
Default		Units	
Type	32 Bit Volatile	Update Rate	Power-up write
Display Format	Version Number	Decimal Places	0
Coding	RO, ND, NC, PT		

The firmware version of the option module is in the format of **ww.xx.yy.zz**

Safety information

Introduction

Mechanical installation

Electrical installation

Getting started

Additional features

Parameter descriptions

Diagnostics

Glossary

S.00.003	Hardware version		
Minimum	00.00	Maximum	99.99
Default		Units	
Type	16 Bit Volatile	Update Rate	Power-up write
Display Format	None	Decimal Places	2
Coding	RO, ND, NC, PT		

The hardware version of the option module is in the format of **ww.xx.yy.zz.**

S.00.004	Serial Number LS		
S.00.005	Serial Number MS		
Minimum	0	Maximum	99999999
Default		Units	
Type	32 Bit Volatile	Update Rate	Power-up write
Display Format	None	Decimal Places	0
Coding	RO, ND, NC, PT		

The module serial number is available as a pair of 32-bit values where Serial Number LS (Pr **S.00.004**) provide the least significant 8 decimal digits, and Serial Number MS (Pr **S.00.005**) provides the most significant 8 decimal digits. The reconstructed serial number is ((**S.00.005** x 100000000) + **S.00.004**). For example serial number "0001234567898765" would be stored as **S.00.005** = 123456 and **S.00.004** = 67898765.

S.00.006	Module Status		
Minimum	0	Maximum	101
Default		Units	
Type	8 Bit Volatile	Update Rate	Background read
Display Format	Text	Decimal Places	0
Coding	RO, TE, ND, NC, PT		

This parameter displays the current status of the module. All possible values are shown in the table below.

Value	Text	Description
-2	Bootldr-Update	The bootloader is performing a flash update.
-1	Bootldr-Idle	The bootloader is idle.
0	Initializing	Module is currently initializing.
1	Ok	Module has initialized and has found no errors.
2	Config	A configuration error has been detected in one of the communications protocols or user program
3	Error	An error has occurred preventing the firmware or user program from running correctly.

Safety information

Introduction

Mechanical installation

Electrical installation

Getting started

Additional features

Parameter descriptions

Diagnostics

Glossary

S.00.007		**Reset Module**		
Minimum	0	Maximum	1
Default	0	Units	
Type	1 Bit Volatile	Update Rate	Read every 200 ms
Display Format	None	Decimal Places	0
Coding	RW, NC		

Changes to the module's configuration will not take effect until the module has been reset.

To reset the module:

• Set Pr **S.00.007** to On (1).
• When the sequence has been completed, Pr **S.00.007** will be reset to Off (0).
• The module will reset using the updated configuration.

NOTE

This sequence does NOT store the module's configuration parameters in the drive or the module's flash memory. This parameter will change back to Off immediately, and as such the change may not be visible in the display.

S.00.008		**Default Module**		
Minimum	0	Maximum	1
Default	0	Units	
Type	1 Bit Volatile	Update Rate	Read on module reset
Display Format	None	Decimal Places	0
Coding	RW, NC		

If the host drive is defaulted (see the drive user guide for details), it will also clear the current configuration for the slot the module is installed to.

This can be performed as follows:

• Set Pr **S.00.008** to On.
• Reset the module by setting Pr **S.00.007** to On.
• Default parameter values for the module will be loaded.
The module will reset using the default values.

S.00.030		**Slot Indicator**		
Minimum	0	Maximum	8
Default		Units	
Type	8 Bit Volatile	Update Rate	Written on power-up
Display Format	None	Decimal Places	0
Coding	RO, ND, PT		

This parameter displays the number of the virtual option slot on the drive that the module is connected to.

S.00.031	Slot Menu Number		
Minimum	0	Maximum	255
Default		Units	
Type	8 Bit Volatile	Update Rate	Written on power-up
Display Format	None	Decimal Places	0
Coding	RO, ND, PT		

This parameter displays the menu number of the option slot on the drive.

e.g.

Slot 1 - Menu 15

Slot 2 - Menu 16

Slot 3 - Menu 17

Menu 2 - PROFINET Ethernet Configuration
Menu 2 contains all the parameters relating to the configuration of the Ethernet interface on the module.

S.02.003	Network Status		
Minimum	0	Maximum	5
Default	0	Units	
Type	8 Bit Volatile	Update Rate	1 s write
Display Format	Text	Decimal Places	0
Coding	RO, ND, NC, PT, BU		

This parameter displays the current status of the PROFINET network as shown in the table below.

Value	Text	Description
0	Initializing	The network interface is being initialized
1	Links Down	No link connection has been detected on either of the Ethernet ports
2	Reserved	Reserved
3	No Address	The module does not have an IP address.
4	Ready	The network interface has been successfully configured but no data is being received or transmitted
5	Active	The network interface is receiving or transmitting data

S.02.004	Network Message Count		
Minimum	0	Maximum	65535
Default		Units	M sg/s
Type	16 Bit Volatile	Update Rate	1 s write
Display Format	None	Decimal Places	0
Coding	RO, ND, NC, PT, BU		

This parameter displays the number of frames that the module is transmitting and/or receiving every second.

Safety information

Introduction

Mechanical installation

Electrical installation

Getting started

Additional features

Parameter descriptions

Diagnostics

Glossary

S.02.006	**IP Address**		
Minimum	0.0.0.0	Maximum	255.255.255.255
Default	0.0.0.0	Units	
Type	32 Bit Volatile	Update Rate	
Display Format	IP address	Decimal Places	0
Coding	RO, NC, PT, BU		

In the PROFINET environment, the controller (CONTROLLER) normally provides the IO device (PROFINET option module mounted on a drive) with its IP address, subnet mask and default gateway address. As a group, these are set as either permanent or temporary values. (Temporary values are cleared by any reset). In an already operational environment, IO devices are recognized by their name of station - an ASCII descriptive name defined during system start-up via the supervisor (an engineering workstation). When IO device replaced in the field, it will not normally have a name of station, so when it starts up it uses LLDP and DCP to determine from its neighbours the name of station of the device replacing. When successful, it adopts that name of station and the controller can then initialize it. During the start-up the supervisors will normally locates and identify unnamed devices by their MAC and IP address.

When the IP address and subnet mask are set to change and drive parameters saved, the new IP address is saved as permanent in the drive. Note that the controller may later override the setting and alter these values.

S.02.007	**Subnet Mask**		
Minimum	0.0.0.0	Maximum	255.255.255.255
Default	0.0.0.0	Units	
Type	32 Bit Volatile	Update Rate	
Display Format	IP address	Decimal Places	0
Coding	RO, NC, PT, BU		

The subnet mask is normally written to by the controller during the parameterization phase.

The subnet mask supports IP address routing by allowing the module to determine if destination addresses are either:

- On the same subnet and can therefore be transmitted directly, or
- On a remote network and should therefore, be transmitted through the default gateway.

S.02.007	**Default Gateway**		
Minimum	0.0.0.0	Maximum	255.255.255.255
Default	0.0.0.0	Units	
Type	32 Bit Volatile	Update Rate	
Display Format	IP address	Decimal Places	0
Coding	RO, NC, PT, BU		

This parameter displays the default gateway IP address given to the module by the controller.

S.02.011	MAC Address		
Minimum	0:0:0:0:0:0	Maximum	FF:FF:FF:FF:FF:FF
Default		Units	
Type	64 bit volatile	Update Rate	Power-up write
Display Format	MAC address	Decimal Places	0
Coding	RO, ND, NC, PT, BU		

Display the MAC address for the Ethernet interface as a 48 bit hexadecimal value.

This is the base MAC address for the module. Because the PROFINET option is a switch, the base MAC is the address used to talk to the option but each port is also a switch port needing its own MAC address. The switch ports are assigned the next two sequential MAC address following the base MAC address.

Only the base MAC address needs to be displayed on the option.

Most significant byte of the MAC address will always be set to 00. The Second most significant byte of the MAC address will always to be set to 0D. The third most significant byte of the MAC address will always to be set to 1E and last three bytes forms the serial number.

Menu 5 - PROFINET Configuration
Menu 5 contains all the parameters relating the configuration of the PROFINET interface.

S.05.004	Configuration Error		
Minimum	0	Maximum	4
Default	0	Units	
Type	8 Bit Volatile	Update Rate	On connect request from controller
Display Format	Text	Decimal Places	0
Coding	RO, TE, NC, PT, BU		

This parameter displays the current status of the PROFINET communications and will also display any errors that are detected on the module.

Value	Text	Description
0	No Error	No error detected.
1	Input Mapping Error	More than 32 parameters (slots) are configured as inputs.
2	Output Mapping Error	More than 32 parameters (slots) are configured as outputs.
3	Data Size Error	Data size given in GSDML file does not match actual parameter size.
4	Param Config	Parameter given in connect request is either non-existent or the validation has failed.

Safety information

Introduction

Mechanical installation

Electrical installation

Getting started

Additional features

Parameter descriptions

Diagnostics

Glossary

S.05.006	Module Revision Counter		
Minimum	0	Maximum	65535
Default	0	Units	
Type	16 Bit Volatile	Update Rate	On Module Reset
Display Format	None	Decimal Places	0
Coding	RO, ND, PT, BU		

A changed value of the revision counter parameter of PROFINET marks a change of hardware or its parameters. At production, the counter will be set to zero. This value is reserved for the first installation and the first increment. The counter increments from 1 to 65535, wrapping over back to 1 when required.

Criteria to increment the revision counter

- If any other than the SI-PROFINET RT module is removed or inserted then configuration counter will increment since that is a configuration change.
- Any write access of parameters within the module and its activation.
- If any user save in the drive or in the module.

The counter will reset to zero when the module is defaulted.

S.05.007	Profile ID		
Minimum	0	Maximum	65535
Default	62976	Units	
Type	16 Bit volatile	Update Rate	Background read
Display Format	None	Decimal Places	0
Coding	RO, PT, BU		

This parameter displays the supported PROFIdrive profile ID. This is fixed at 62976 (0xF600).

S.05.008	Installation Date		
Minimum	00-00-00	Maximum	31-12-99
Default		Units	
Type	32 Bit volatile	Update Rate	Module reset / initialization
Display Format	Date	Decimal Places	0
Coding	RO, ND, PT, BU		

This parameter indicates that the date of installation or commissioning of a device or module. This date will be written by controller and cannot be modified by the user via the keypad or comms.

S.05.009	Timeout		
Minimum	1	Maximum	10000
Default	100	Units	ms
Type	16 Bit volatile	Update Rate	Connect request from controller
Display Format	None	Decimal Places	0
Coding	RW, PT, BU		

This parameter defines the time period in which the module must receive a cyclic data frame from the controller before any specified action is performed. Default timeout value is 100 ms and it is over-written by the controller when a connect request is received.

S.05.010	Timeout Action		
Minimum	0	Maximum	4
Default	4	Units	
Type	8 Bit User Save	Update Rate	Module reset / initialization
Display Format	Text	Decimal Places	0
Coding	RW, BU		

This parameter defines the action to take when no cyclic message frame is received within the time period specified by the timeout value in Pr **S.05.009**. All possible values are shown in the table below.

Value	Text	Description
0	Trip	Trip drive with corresponding trip
1	SendFaultValues	Send configured fault values to output mappings
2	Clear output	PLC output parameter will have their values set to zero
3	Hold last	Hold the last value in output parameters
4	No action	No action

Safety information

Introduction

Mechanical installation

Electrical installation

Getting started

Additional features

Parameter descriptions

Diagnostics

Glossary

S.05.011	**Timeout Event Destination**		
Minimum	0	Maximum	4
Default	0	Units	
Type	8 Bit User Save	Update Rate	Module reset / initialization
Display Format	Text	Decimal Places	0
Coding	RW, BU		

This parameter defines the Event task destination if a specified Event task in a compatible module is set to run.

Value	Text	Description
0	This slot	Trigger event in this slot
1	Slot 1	Trigger event in slot 1
2	Slot 2	Trigger event in slot 2
3	Slot 3	Trigger event in slot 3
4	Slot 4	Trigger event in slot 4

S.05.012	**Timeout Event Type**		
Minimum	0	Maximum	4
Default	0	Units	
Type	8 Bit User Save	Update Rate	Module reset / initialization
Display Format	Text	Decimal Places	0
Coding	RW, BU		

Defines the event to trigger when a timeout occurs. Timeout Event Destination (Pr **S.05.011**) must specify an appropriate consumer (option slot) of the event. All event types are listed in the table below.

Value	Text	Description
0	No event	Trigger event in this slot
1	Trigger Event	Trigger module event
2	Trigger Event 1	Trigger module event 1
3	Trigger Event 2	Trigger module event 2
4	Trigger Event 3	Trigger module event 3
5	Trigger Event 4	Trigger module event 4

8   Diagnostics

Overview
This section provides basic diagnostic information intended to resolve the most common problems encountered when setting up an SI-PROFINET RT option module.

Link LEDs
Each of the Ethernet ports provide a status LED for diagnostics and information purposes.
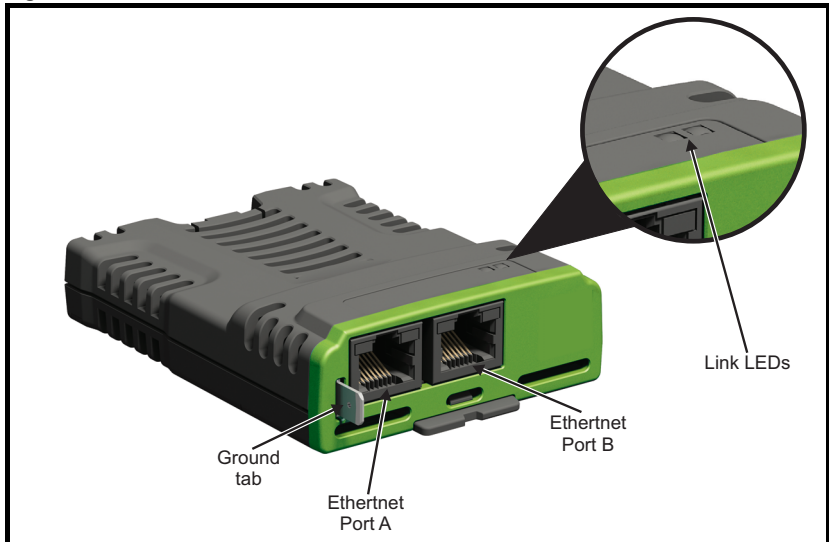
Figure 8-1 SI-PROFINET RT connections

Link LEDs

Ethertnet
Port B

Ground
tab

Ethertnet
Port A

Table 8-1 LED functionality

State	Meaning
OFF	No Ethernet network connection detected
Steady green	Ethernet connection established
Flashing green	Ethernet message frame detected

Drive trip display codes
If the option module detects an error during operation, it will force a trip on the drive. However, the trip string displayed on the drive will only indicate which slot initiated the trip. The exact reason for the trip will be indicated in the drive trip code parameters (Pr **10.020** and Pr **10.070**).
The table below shows the possible trips that will be displayed on the drive when a problem is detected with the option module or when the option module initiates a trip.

Safety information

Introduction

Mechanical installation

Electrical installation

Getting started

Additional features

Parameter descriptions

Diagnostics

Glossary

Trip	Description
SlotX HF	The drive has detected that an option module is present but is unable to communicate with it due to a hardware fault.
SlotX Error	User trip generated by the option module
SlotX Not Fitted	This trip will occur if a drive slot was previously configured with an option module but on power up, no option module was detected.
SlotX Different	This trip will occur if a drive slot was previously configured with an option module but on power up, a different option module was detected. Replacing the option module with another one of the same ID number will not initiate this trip. The trip will also occur if an option module is installed to a previously unused slot.

Module error codes

If the option module detects an internal error during operation, it will force a trip on the drive and provide a sub-trip string for a clearer definition of the trip. The table below shows the possible module error codes.

Value	Text	Description
200	Software Fault	Software Fault
201	BG Overrun	Background task overrun
202	Firmware Invalid	Invalid firmware for hardware version
203	Drive Unknown	Unknown drive type
204	Drive Unsupported	Unsupported drive type
205	Mode Unknown	Unknown drive mode
206	Mode Unsupported	Unsupported drive mode
207	FLASH Error	Corrupted Non-volatile FLASH
208	Database Init	Database initialization error
209	File System Init	File system initialization error
210	Mem Allocation	Memory allocation error
211	Filesystem Error	File system error
212	Config Save	Configuration file save error
213	Over Temperature	Overheated
214	Drive Timeout	the drive has not responded within watchdog period
215	eCMP Comms Error	eCMP communication failure
216	TO eCMP Slot1	eCMP communication to slot 1 timeout
217	TO eCMP Slot2	eCMP communication to slot 2 timeout
218	TO eCMP Slot3	eCMP communication to slot 3 timeout
219	Reserved	Reserved
220	Reserved	Reserved
221	Factory Settings	Missing factory settings
222	Functional Test	Functional test failure
223	Config Restore	Configuration file restore error
224	Self Test Error	Power on self test error
225	Runtime Config	Runtime configuration error

PROFINET error codes

If the option module detects a PROFINET error during operation, it will force a trip on the drive and provide a sub-trip string for a clearer definition of the trip.

The following table lists all possible PROFINET error codes:

Value	Text	Description
100	Link Loss	Network link has been lost
101	INIT Switch	Ethernet switch initialization error
102	INIT TCP/IP	TCP/IP initialization error
103	INIT Profinet	PROFINET initialization error
104	Profinet Start	PROFINET start error
105	Profinet Plug	PROFINET plug error
106	Invalid IM	Invalid IM data, EEPROM corrupted
107	CPM watchdog	Cyclic frame timeout
108	Ethernet Failure	Ethernet controller initialization error

PROFINET configuration error codes

Pr **S.05.004** provides further information if an error in the PLC configuration has been detected.

S.05.004		**Configuration Error**	
Minimum	0	Maximum	4
Default	0	Units	
Type	8 Bit Volatile	Update Rate	On connect request from controller
Display Format	Text	Decimal Places	0
Coding	RO, TE, NC, PT, BU		

This parameter displays the current status of the PROFINET communications and will also display any errors that are detected on the module.

Value	Text	Description
0	No Error	No error detected.
1	Input Mapping Error	More than 32 parameters (slots) are configured as inputs.
2	Output Mapping Error	More than 32 parameters (slots) are configured as outputs.
3	Data Size Error	Data size given in GSDML file does not match actual parameter size.
4	Param Config	Parameter given in connect request is either non-existent or the validation has failed.

Diagnostics flowchart

Safety information

Introduction

Mechanical installation

Electrical installation

Getting started

Additional features

Parameter descriptions

Diagnostics
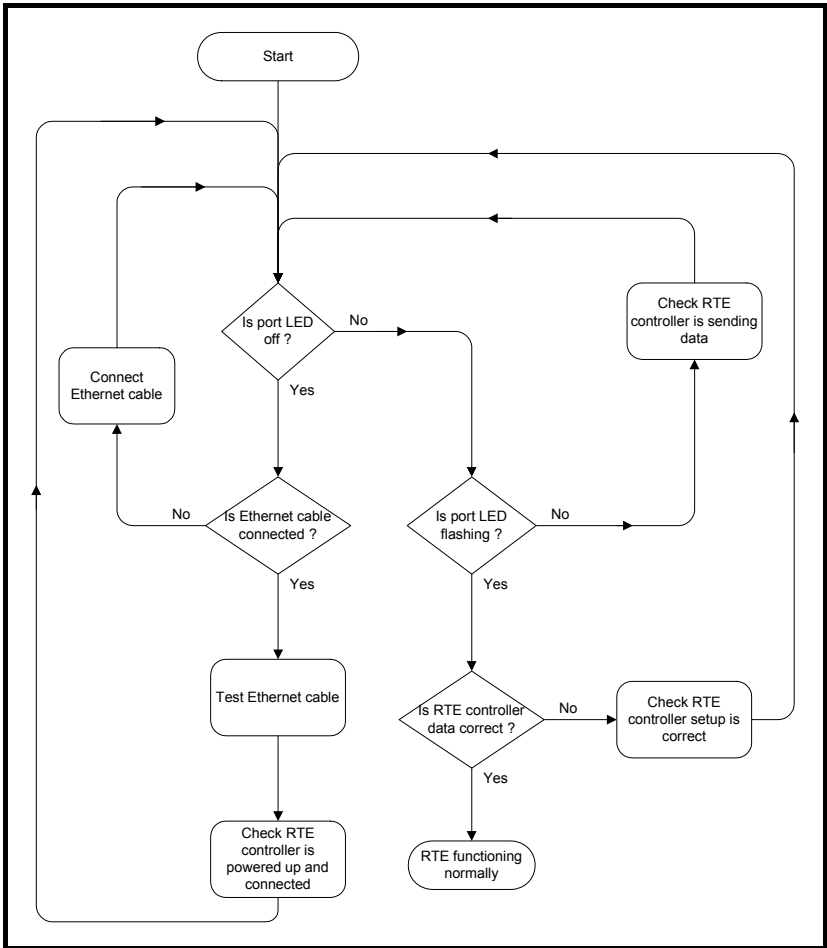
Glossary

9   Glossary

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.

ASCII (American Standard Code for Information Interchange): A standard character encoding mechanism established by ANSI to provide compatibility between data systems and services.

Asynchronous Transmission: Each character transmitted is individually synchronized using start and stop bits.

ANSI (American National Standards Institute): A voluntary organization that represents the USA in the ISO, and is responsible for defining ASCII. Members include manufacturers, common carriers, and other standards organizations such as the IEEE.

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

Bandwidth: The information-carrying capability of a communications channel or line, expressed in Hertz (Hz), between the highest and lowest frequencies of a band.

Baseband Transmission: Direct transmission method whereby the transmission medium carries only one signal at a time usually for distances under ten miles.

BCC (Block Check Character): A control character added to a block in character oriented protocols used for determining if the block was received in error -- such as CRC and LRC.

BCD (Binary Coded Decimal): A digital system that uses six-bit binary codes to represent decimal digits, providing 64 possible combinations.

Binary: A digital system with two states, 1 and 0.

Bit: A contraction of the phrase binary digit, representing the smallest unit of information and the basic unit in data communications, a bit may have the value of 1 or 0.

Bit Rate: The speed at which binary digits (bits) would be transmitted over a communications path and usually expressed in "bits per second" (bps). Bit rate should not be confused with Baud which defines the rate of signal state changes.

Byte: A collection of 8 binary digits that collectively store a value. This may be signed or unsigned.

CCITT (The Consultative Committee International Telegraph and Telephone): The international advisory committee, established under the United Nations that sets international recommendations which often are accepted as standards.

Channel: A data link which connects two devices allowing them to communicate with each other.

Character: Any letter, number, punctuation mark or other sign contained in a message, including characters for control functions and for special symbols.

Checksum: The sum of a group of data provided with the group, for checking purposes.

Control Character: A non-printing character used to initiate, modify, or stop a control function. LF (line feed) is an example of a control character.

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.

CRC (Cyclic Redundancy Check): An error checking control method in which the block check character (BCC) is the remainder after dividing all the serialized bits in a transmitted block by a prespecified binary number.

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.)

CSMA (Carrier Sense Multiple Access): A contention-based LAN access method where Ethernet devices listen prior to transmitting, send a packet of data, then free the line for other devices to transmit. While stations do not transmit until the line is clear, transmission collisions still occur.

CSMA/CA (Carrier Sense Multiple Access with Collision Avoidance): A CSMA protocol using a slotted TDM to minimize a collision reoccurrence. For optimum results, CSMA/CA will work best if the time slot is short as compared to the length of the packet.

CSMA/CD (Carrier Sense Multiple Access with Collision Detection): A LAN access method where all networked devices listen for transmissions before attempting to transmit. If two or more devices begin transmitting at the same time, each stops for a random period of time before attempting to re-transmit.

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.

Decentralized: A processing method where intelligence is located at several remote locations of the same processing system.

Deterministic: A system is deterministic when the output can be predicted with certainty. For communication systems, a deterministic system is one where the messages can be reliably delivered at precise time intervals.

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

Safety information

Introduction

Mechanical installation

Electrical installation

Getting started

Additional features

Parameter descriptions

Diagnostics

Glossary

DHCP (Dynamic Host Configuration Protocol): This is a protocol used to allocate dynamic IP addresses to network devices from a central server.

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.

Duplex: A communication facility providing transmission in either one direction only (half-duplex) or two directions simultaneously (full-duplex).

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

GSDML (General Station Description Markup Language) file: An XML based file that defines the properties of a network device and contains information describing the features available on the device.

Ethernet address: See MAC address.

Explicit data: See Non-cyclic data.

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

Frame: The entire sequence of bits and bytes in a transmitted block.

FTP (File Transfer Protocol): A protocol using the TCP/IP protocols commonly used for transferring files over the Internet.

Full-duplex: See Duplex

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

Half-duplex: See Duplex

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.

IEEE (Institute of Electrical and Electronic Engineers): An international institute that issues its own standards and is a member of ANSI and ISO.

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.

ISO (International Standards Organization): The International, voluntary standards organization, closely aligned with the CCITT perhaps best noted for its OSI model and OSI communications protocol. Membership includes other international organizations issuing standards, with ANSI being the American representative.

Jitter: A tendency toward a lack of synchronization or other impairment caused by the mechanical or electrical changes in communications equipment.

LAN (Local Area Network): The data communications facilities used to provide communications within a limited geographical area, normally up to 6 miles, using the higher data rates normally from 1 Mbps to 1 Gbps. LANs may have bridges or gateways to other networks but are usually confined to a building or cluster or buildings.

Latency: The waiting time, or delay between a device's request message and the response message.

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 SI-PROFINET RT 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.

MSB: Most Significant Bit/Byte.

Network controller: The network device which controls the cyclic communication on a network. (*See PLC*).

Network topology: The arrangement of devices and the links connecting the devices on a network.

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".

Non-deterministic: A non-deterministic system is one where the output can not be predicted with certainty. For communication systems, a non-deterministic system is one where the messages can not be delivered at precise time intervals.

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

Safety information

Introduction

Mechanical installation

Electrical installation

Getting started

Additional features

Parameter descriptions

Diagnostics

Glossary

OSI Model (Open Systems Interconnection Model): The 7-layer reference model recommended by the ISO to provide a logical structure for network operations protocol.

Parity Bit: An error-checking bit whose binary value (0 or 1) depends on whether the sum of bits with the value 1 in the unit of data being checked is odd or even. If the total number of bits with value 1, including the parity bit (or bits), is even, the unit of data is said to have even parity; if it is odd, it has odd parity.

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 (Programmable Logic Controller): A digital computer used for automation of electromechanical processes. Sometimes used as a communication specific network controller.

Poll rate: The rate at which cyclic data is sent and received on the network.

Polled data: See Cyclic data.

Protocol: The method of "line discipline" used to control the orderly exchange of information between the stations on a data link or on a data communications network or system.

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.

RT (Real Time): A communication system which can accurately deliver messages to within pre-determined time tolerances.

RTE (Real Time Ethernet): An Ethernet based communication system which can accurately deliver messages to within pre-determined time tolerances.

Scan rate: See Poll rate.

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

SMTP (Simple Mail Transfer Protocol): A protocol used for sending email.

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.

Synchronous Transmission: A constant time interval between characters is used to ensure that all data communications equipment is in step with each other. The opposite of asynchronous transmission, synchronous transmission, does not use start-stop bits surrounding each byte, but relies on the transmitter and receiver to be functioning at a fixed rate of transmission, thereby being a more efficient method of data communication.

TCP (Transmission Control Protocol): This protocol is responsible for ensuring that the data on the network reaches its destination.

TDM (Time Division Multiplexer): A multiplexer designed to apportion its composite link time between its available channels, interleaving data at a higher speed on the main or multiplexed channel. The data signals are then separated to restore the data to the individual input channels.

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.
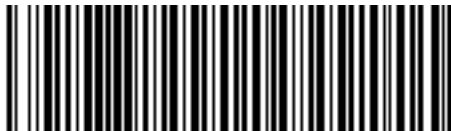
Word: A collection of 16 binary digits.

XML (Extensible Markup Language): A document definition that is intended to store and transfer data between applications.

Safety information

Introduction

Mechanical installation

Electrical installation

Getting started

Additional features

Parameter descriptions

Diagnostics

Glossary

Index

S

W

0478-0125-02