2 Introduction

2.1 Features for Different Module Variants

Modern variable speed drives offer a multitude of in-built features such as ramp control, PID loops, simple position control, etc. However this functionality is limited. The drive can only do so many things and when it comes to controlling more complex applications, users often have to resort to using external equipment such as PLCs to control the drive from a system point of view.

However the flexibility of certain drives can be substantially increased by using the Second Processors. These Second Processors provide an additional processor for the drive and allow the user to utilise existing, or write their own, application-specific software. They also offer powerful networking capabilities so many drives (and other equipment) can be connected together to communicate process wide information thus offering a complete application solution. The Second Processors are solutions modules that can be fitted to expansion slots in the supported drives or are embedded in the Digitax drives. The Second Processor are powered from the drive's internal power supply

Specifications for SM-Applications

- High speed dedicated microprocessor
- 384 kb Flash memory for user program
- 80 kb user program memory
- EIA-RS485 port offering ANSI, Modbus-RTU slave and master and Modbus-ASCII slave and master protocols
- CTNet high speed network connection offering up to 5 Mbit/s data rate.
- Two 24V digital inputs
- Two 24V digital outputs
- Task based programming system allowing for real-time control of drive and process
- CTSync

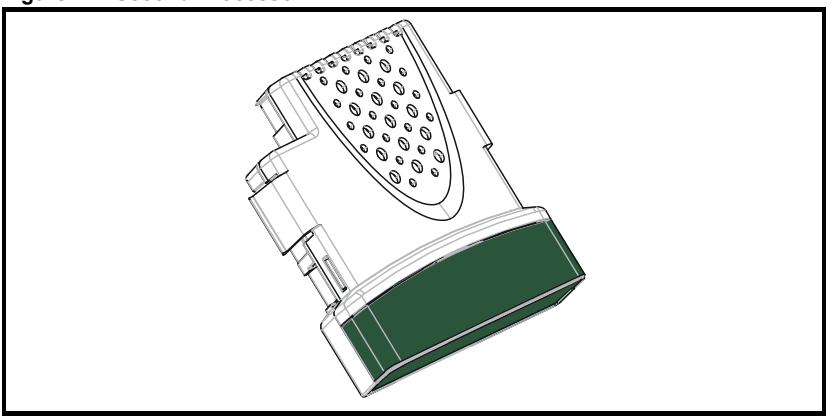
Specifications for SM-Applications Lite

- High speed dedicated microprocessor
- SyPTLite 10 kb executable memory
- SyPTPro V2.3.1 or later 384 kb executable memory, 80 kb user memory.
- SyPTPro V2.2.0 150 kb executable memory, 20 kb user memory.
- Versions prior to V2.2.0 100 kb executable memory, 20 kb user memory.
- Task based programming system allowing for real-time control of drive and process.

NOTE The SM-Applications Plus module, SM-Applications Lite V2 module and the Digitax ST Plus has a slightly faster variant of the SM-Applications microprocessor, thereby increasing performance of the module over the SM-Applications.

2.2 Solutions Module identification

Figure 2-1 Second Processor



The Second Processors can be identified by:

1. The label located on the underside of the Solutions Module.
2. The colour coding across the front of the Solutions Module.

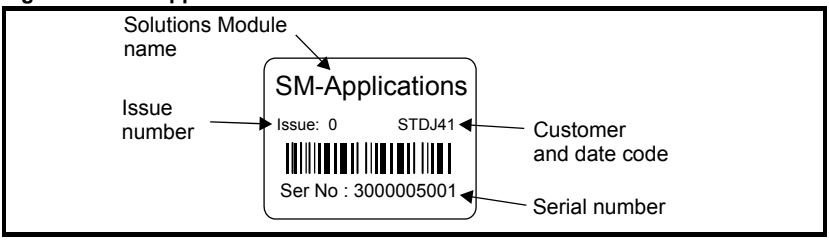
   SM-Applications: Mint Green

   SM-Applications Lite: White

   SM-Applications Plus: Light Moss Green

   SM-Applications Lite V2: White

Figure 2-2 SM-Applications label



2.3 Conventions used in this guide

This manual contains information relating to the SM-Applications, SM-Applications Lite, SM-Applications Lite V2 and SM-Applications Plus option modules and embedded processors on Digitax ST Indexer and Digitax ST Plus.
Throughout the manual these will be referred to generically as Second Processors or modules. Should a particular section refer to one or two of these modules only, the reference will be to those modules by their name directly.

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 menu 15, 16 or 17 for the drive depending on the slot the module is fitted into. In the case of embedded solutions these will appear in menu 17. The menu is determined 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 **x.XX** - where **x** signifies the the menu allocated to the Solutions Module (this could be 15, 16 or 17) and **XX** signifies the parameter number.

2.4 PC Development Software

Application programs for the Second Processors may be developed by the user with the SyPT software tools. Users who are familiar with the UD70 product for the Unidrive Classic may already be familiar with this software.

SyPTPro offers various tools to help in developing solutions:

- Configuration editor for configuring drives and connections on CTNet, EtherNet, CT-RTU, CT-TCP and MD29MON networks.
- IEC61131-3 based ladder and function block programming
- Native DPL language programming.
- Watch window for monitoring drive and option parameters, and program variables.
- Single-stepping and breakpoint debugging facilities.

With SyPTPro you may connect to the Second Processors by either:

- Direct connection to the EIA-RS485 port on the front of the Drive.
- Connecting to one or more options on a CTNet network (a CTNet interface card for the PC will be required). See section *Features* on pages 8, 9 & 10 for availability of CTNet on your Second Processor
- Ethernet.

SyPTPro runs under Microsoft Windows™ NT4/2000/XP.

2.5 User Knowledge

If developing custom application software it is beneficial to have some understanding of real-time task and event driven programming. A rudimentary understanding of the BASIC programming language is also beneficial but not essential. The ladder diagram (LD) and function block diagram (FBD) facilities of SyPTPro make it much easier for people familiar with PLCs to migrate.

This User Guide assumes the user has at least superficial knowledge of Microsoft Windows™.

3 Installation

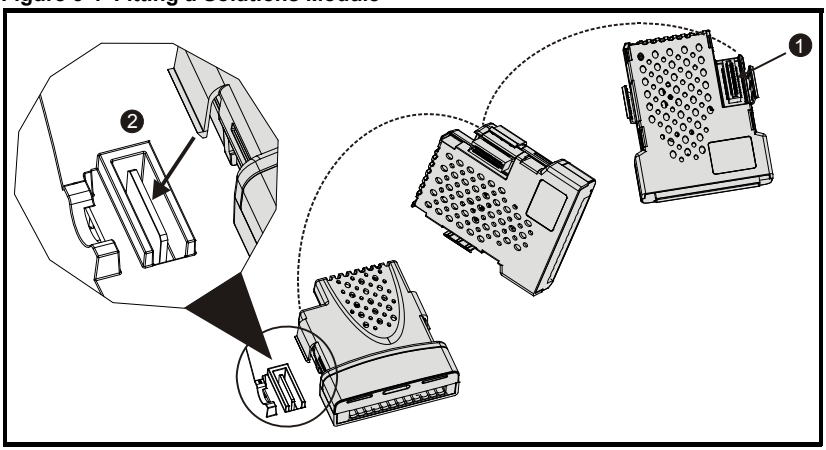
WARNING

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 7. 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



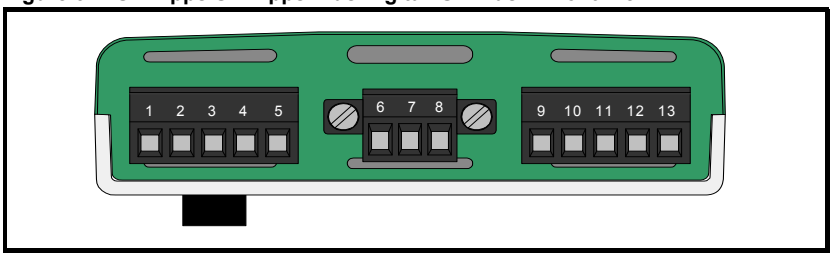
The Solutions Module connector is located on the underside of the module (1). Push this into the Solutions Module slot located on the drive until it clicks into place (2). Note that some drives require a protective tab to be removed from the Solutions Module slot. For further information, refer to the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

3.2 SMARTCARD Installation

Refer to the relevant drive documentation for SMARTCARD support.

3.3 Electrical Connections

Figure 3-2 SM-Apps/SM-Apps Plus/Digitax ST Plus - Front View



The terminal functions are given in Table 3-1.

Please note that SM-Applications Lite, SM-Applications Lite V2 and ST Indexer do not have these terminals.

NOTE Please ensure that the drive is off before removing any modules.
Please refer to your installation sheet for more information.

Table 3-1 Module Connectors

Terminal	Function	Description
1	0V SC	0V connection for EIA-RS485 port
2	/RX	EIA-RS485 Receive line (negative). Incoming.
3	RX	EIA-RS485 Receive line (positive). Incoming.
4	/TX	EIA-RS485 Transmit line (negative). Outgoing.
5	TX	EIA-RS485 Transmit line (positive). Outgoing.
6	CTNet A	CTNet data line
7	CTNet Shield	Shield connection for CTNet
8	CTNet B	CTNet data line
9	0V	0V connection for digital I/O
10	DIO	Digital input 0
11	DI1	Digital input 1
12	DO0	Digital output 0
13	DO1	Digital output 1

Table 3-2 Digital Input Specifications

Terminal 10 / Digital Input 0	
Terminal 11 / Digital Input 1	
Type	Positive logic IEC 61131-2
Maximum Input Voltage	+/- 30V
Switching Threshold	9.5 V +/- 0.3 V
Load	2 mA at +15 V

Table 3-3 Digital Output Specifications

Terminal 12 / Digital Output 0	
Terminal 13 / Digital Output 1	
Type	Positive logic when active
Output Voltage	0 / 24V
Nominal max. output	20 mA

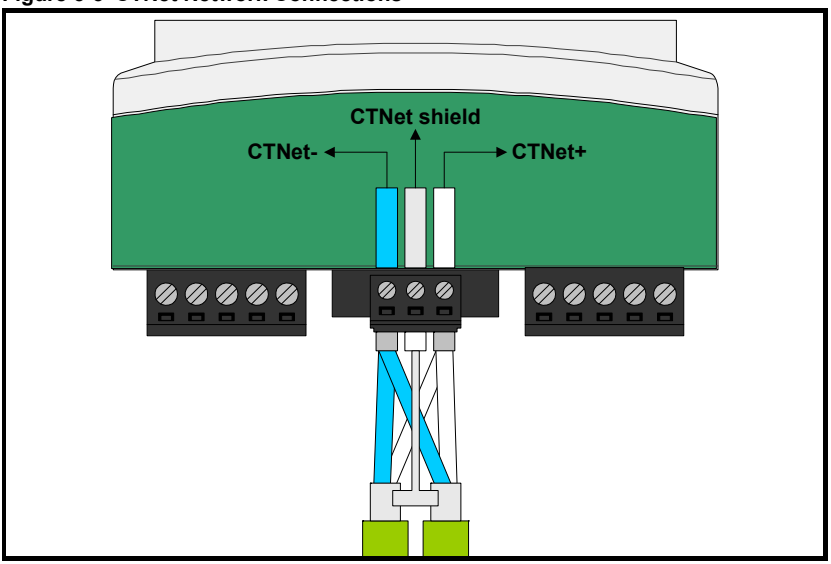
NOTE When inactive they are effectively floating.

3.4 Connections

NOTE This User Guide covers only the basics of connecting a CTNet network. Please refer to the CTNet *User Guide* for full information. Digitax connections are given in the Digitax ST Plus manual. SM-Applications Lite, SM-Applications Lite V2 and ST Indexer do not have these CTNet Connections.

To connect the module to the CTNet network, make the connections as shown in the diagram below.

Figure 3-3 CTNet Network Connections



The shields of both cables should be twisted together and connected into the centre terminal of the 3-way terminal block. This “pigtail” should be kept as short as possible. This design guarantees shield continuity.

3.5 CTNet Cable

CTNet cable has a single twisted pair plus overall screening. One set of data terminals is provided. This has the advantage that if the terminal block is unplugged the continuity of the CTNet network is not broken.

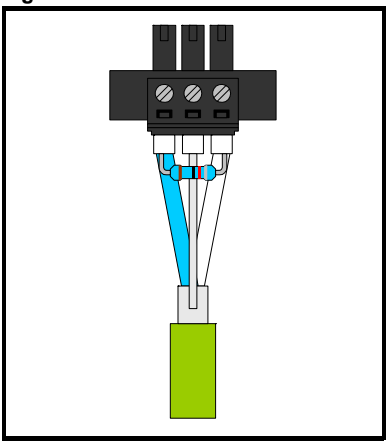
CTNet networks run at high data rates, and require cable specifically designed to carry high frequency signals. Low quality cable will attenuate the signals, and may render the signal unreadable for the other nodes on the network.The only approved CTNet cable is that supplied by Control Techniques.

3.6 CTNet Network Termination

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

The termination resistance should match as closely as possible the impedance of the cable. For the recommended Control Techniques green CTNet cable, an 82 Ω 0.25 W termination resistor should be fitted across the CTNet+ and CTNet- data lines at BOTH ends of the cable run.

Figure 3-4 CTNet Network Termination



WARNING

Failure to terminate a network correctly can seriously affect the operation of the network. If the correct termination resistors are not fitted, the noise immunity of the network is greatly reduced.

NOTE If too many termination resistors are fitted on a CTNet network, the network will be overloaded, resulting in reduced signal levels. This may cause nodes to miss some bits of information, resulting in transmission errors being reported. If network overload is excessive, the signal levels may be so low that nodes cannot detect any network activity at all.

3.6.1 CTNet Cable Screen Connections

The cable shields should be linked together at the point where they emerge from the cable, and formed into a short pigtail to be connected to CTNet shield connection on the terminal block, as already shown.

For safety, the CTNet shield must be connected to earth at one point. This earth connection is to prevent the cable screen from becoming live in the event of catastrophic failure of another device on the CTNet network or along the cable run.

3.6.2 Maximum Network Length and Number of Nodes

The maximum number of nodes that can be connected to a single CTNet network is 255, however a network may need to be split into segments, separated by repeaters. The maximum length of network cable for a CTNet network is dependent on the baud rate and number of nodes...Refer to CTNet user guide.

Repeaters can be purchased from Control Techniques. The table below shows the part numbers for the different repeaters available.

Part Numer	Description
4500-0033	AI3-485X - *Rev A*
4500-0083	AI3-485X-CT - *Rev D (Port 1), Rev A (Ports 2 and 3)*
4500-0082	AI3-CT - *Rev D*
4500-0032	AI2-485X/FOG-ST - *Rev A* (Fibre Optic)
4500-0081	AI2-CT/FOG-ST - *Rev D* (Fibre-Optic)

Please refer to the CTNet *User Guide* for further guidance on these points.

3.7 EIA-RS485 Connections

Please note that SM-Applications Lite, SM-Applications Lite V2 and ST Indexer do not have these connections.

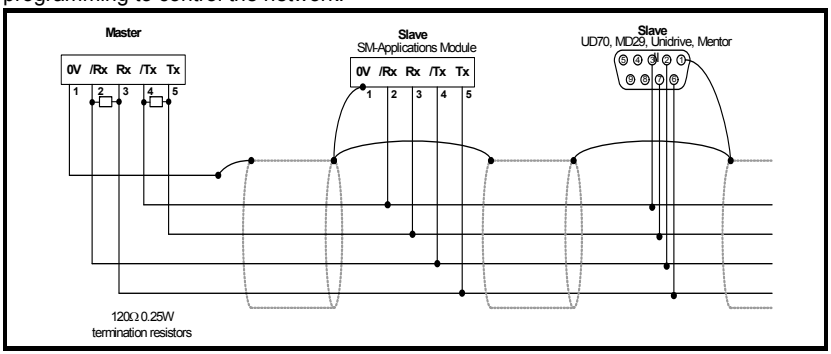
The EIA-RS485 port is available for lower-speed communications (up to 115,200bit/s). As standard the port supports the CT-ANSI slave, Modbus-RTU master and slave, and Modbus-ASCII master and slave protocols. Both 2 and 4-wire connections are possible.

More information on the use of the EIA-RS485 port can be found in Chapter 6 *Communications* on page 69.

A host controller can operate up to thirty-two EIA RS485 devices with the use of line repeaters. Each transmitter and receiver of Control Techniques devices loads the line by 2 unit loads. Therefore in two-wire mode, each Control Techniques device loads the line by 4 unit-loads. This means that no more than a total of seven devices can be connected in a single group, allowing up to 4 unit-loads for the line repeater. Up to 15 devices can be connected if four-wire mode is used.

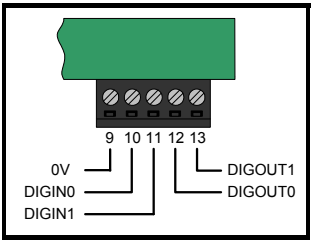
3.7.1 4 Wire EIA-RS485 Network

The diagram below shows the connections required for a 4 wire EIA-RS485 network, using a master controller with an EIA-RS485 port. SM-Applications Modules & Motion Processors can be configured to act as master controllers, but this requires DPL programming to control the network.



An EIA-RS232 to EIA-RS485 converter is required to allow a standard PC serial port to communicate with a 4 wire EIA-RS485 network.

3.8 Digital I/O Connections



The SM-Applications, SM-Applications Plus and Digitax ST Plus are equipped with 2 digital inputs, known as DIGIN0 and DIGIN1, and 2 digital outputs, known as DIGOUT0 and DIGOUT1. These inputs and outputs can be read/controlled from the user program loaded into the SM-Applications Modules & Motion Processors .

The digital outputs are a positive logic arrangement such that they are at +24V when active and will supply up to 20 mA of current. When inactive they are effectively floating. The digital outputs are protected against short-circuit or overload. The trip threshold is 20 mA, and if tripped both outputs will be deactivated.

The digital I/O are controlled using menu 86 - refer to section 5.6 *Menu 86 - Digital I/O Parameters* on page 46.

3.9 Port Isolation

The digital input/output ports are connected to the main drive control circuits.



The I/O circuits are isolated from the power circuits by basic insulation (single insulation) only. The installer must ensure that external control circuits are insulated from human contact by at least one layer of insulation (supplementary insulation) rated for the AC supply voltage

The CTNet and EIA-RS485 ports have supplementary insulation from the input/output ports, giving overall double insulation from the power circuit.
They have simple separation (functional insulation) from each other.



To maintain the double insulation status of the data ports:

- All circuits to which either port is connected must have protective separation (i.e. double insulation or single insulation with grounding)
- All circuits to which the drive control circuits are connected must have at least basic insulation from live parts.

4 Getting Started

This chapter describes the basics of a user program using the SM-Applications Modules & Motion Processors and some of the aspects of using SyPTPro.

Within the SM-Applications Modules & Motion Processors the current slot menu is aliased as menu 81. Therefore when connected to the module via a communications link or from the user program, it is easiest if configuration parameters are referenced as menu 81.

Throughout the remainder of this User Guide, when referring to a specific parameter for any slot the format **Pr 81.XX** will be used. e.g. The *Autorun* parameter will be referred to as **Pr 81.13**.

This is also an aid to portability, as SM-Applications modules with code using menu 81 can be fitted to any slot, and the code should run as normal.

When the SM-Applications Modules & Motion Processors are fitted, the module identification parameter **Pr 81.01** will show the following...

Apps	Apps Lite	Apps Plus	Lite V2	ST Plus	ST Indexer
301	302	304	305	304	305

The combination of parameters **Pr 81.02** and **Pr 81.51** provides the firmware version of the module. This User Guide is written for firmware version V01.04.07/V01.01.00.

Apps	Apps Lite	Apps Plus	Lite V2	ST Plus	ST Indexer
01.04.07	01.04.07	01.01.00	01.01.00	01.01.00	01.01.00

4.1 Using SyPTPro and SyPTLite

SyPTPro provides the development platform for the SM-Applications Modules & Motion Processors . For the SM-Applications Lite module and the Digitax ST Indexer, SyPTLite is available. It is possible to write a program within SyPTPro for an SM-Applications Lite module and Digitax ST Indexer but there are restrictions with the available memory. This is detailed within the SyPTPro Help file.

4.2 Connecting the PC to the Second Processor

There are two methods of connecting the programming PC to the Second Processor and these are outlined below:

4.2.1 CTNet

With a CTNet connection you may connect the PC to a network of drives thereby allowing you to program and control all the drives directly from the PC. However you will need to have a CTNet interface card in your PC. There are PCI and USB cards available from Control Techniques for desktop and laptop computers.

Refer to section 3.4 *Connections* on page 16 for details of the CTNet connections on the SM-Applications Modules & Motion Processors

Refer to 2.1 *Features on page 8* for availability of CTNet.

Apps	Apps Lite	Apps Plus	Lite V2	ST Plus	ST Indexer
✓	×	✓	×	✓	×