



User Guide

SM-I/O 32

Solutions Module for:

Unidrive SP
Commander GP20
Digitax ST
Affinity
Commander SK

Part Number: 0471-0113-01
Issue: 1

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 this guide, without notice.

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Drive software version

The SM-I/O 32 can only be used with the following drive software versions or later:

Unidrive SP:	V01.14.00
Digitax ST:	V01.01.00
Commander GP20:	V01.04.00
Affinity:	V01.01.00
Commander SK:	Any

If the SM-I/O 32 module is fitted to a drive with a software version earlier than stated above, it will show all the parameters in the Solutions Module menu including the unused ones. The unused parameters are masked in the software versions listed above and higher. On any version of Commander SK, the unused parameters are not masked.

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1 How to use this guide

1.1 Intended personnel


This guide is intended for personnel who have the necessary training and experience in system design, installation, commissioning and maintenance.

1.2 Information


This guide contains information covering the identification of the Solutions Module, terminal layout for installation, fitting of the Solutions Module to the drive, parameter details, diagnosis information and specifications of the Solutions Module.

2 Safety information

2.1 Warnings, Cautions and Notes



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



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

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

2.2 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.

2.3 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.

Where present, the STOP and SAFE TORQUE OFF (SECURE DISABLE) 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 (SECURE DISABLE) 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.

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

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

2.4 Environmental limits

Instructions in the appropriate drive manual 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.

2.5 Compliance with regulations

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

The appropriate drive manual contains instruction 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:

98/37/EC: Safety of machinery.

2004/108/EC: Electromagnetic Compatibility.

2.6 Motor

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

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

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

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

It is essential that the correct value is entered in Pr **0.46** (Pr **06** for Commander SK) *Motor rated current*. This affects the thermal protection of the motor.

2.7 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.

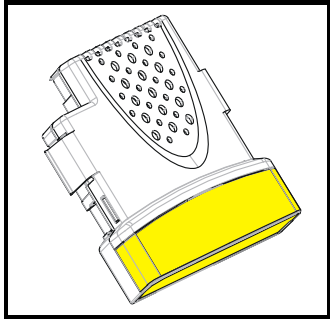
3 Introduction

3.1 Features

The SM-I/O 32 has thirty two digital I/O lines, any of which can be programmed as either an input or output, and a 24V power supply output (24Vout). If any I/O line that is programmed as an output or the 24V power supply is overloaded the outputs are turned off and the 24V power supply is disabled. The digital I/O lines on the SM-I/O 32 can be used in two ways depending on the update rate and the number of digital I/O lines required. See section 3.4 *Update methods* on page 8 for more information.

3.2 Solutions Module identification

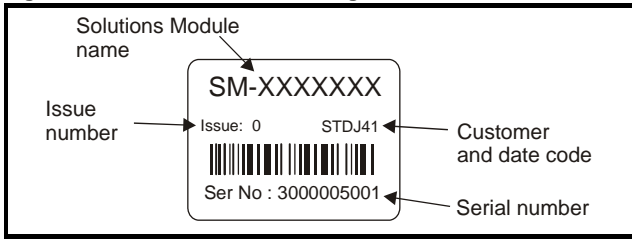
Figure 3-1 SM-I/O 32



The SM-I/O 32 can be identified by:

1. The label located on the underside of the Solutions Module
2. The color coding across the front of the Solutions Module and the connector type
SM-I/O 32: Yellow with a 37 way D-type connector

Figure 3-2 Solutions Module rating label



3.2.1 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 Solutions Module was built.

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

Example:

A date code of L35 would correspond to week 35 of year 2002.

3.3 Set-up parameters

All parameters associated to the SM-I/O 32 can be found in either menu 15, 16, or 17. Each of menus 15, 16, and 17 refer to one of the available slots into which the Solutions Module can be fitted. Slot 1 = Menu 15, Slot 2 = Menu 16, Slot 3 = Menu 17.

NOTE There are only two available slots for Unidrive SP size 0, Affinity, Commander GP20 and Digitax ST; and only one slot available for Commander SK (except size A which does not have any).

3.4 Update methods

NOTE All 32 digital I/O are configured as positive logic only.

3.4.1 Fast update method

The fast update method allows all 32 I/O lines (DIO1 to DIO32) to be accessed with an update rate of 500µs on all drives except Commander SK which is 30ms. Three drive parameters are used as registers for the interface; a read register to obtain the state of inputs, a write register to control the state of outputs and a direction register to set up the direction of each I/O line. The drive parameters used for these registers are defined by three Solutions Module parameters:

Pr **x.43** defines the direction register parameter

Pr **x.47** defines the read register parameter

Pr **x.48** defines the write register parameter

Individual bits within the registers map to I/O lines as given in Table 3-1.

Table 3-1 Fast update method

D-type terminal pin	Digital I/O	Register bit
1	DIO1	0
2	DIO2	1
...
32	DIO32	31

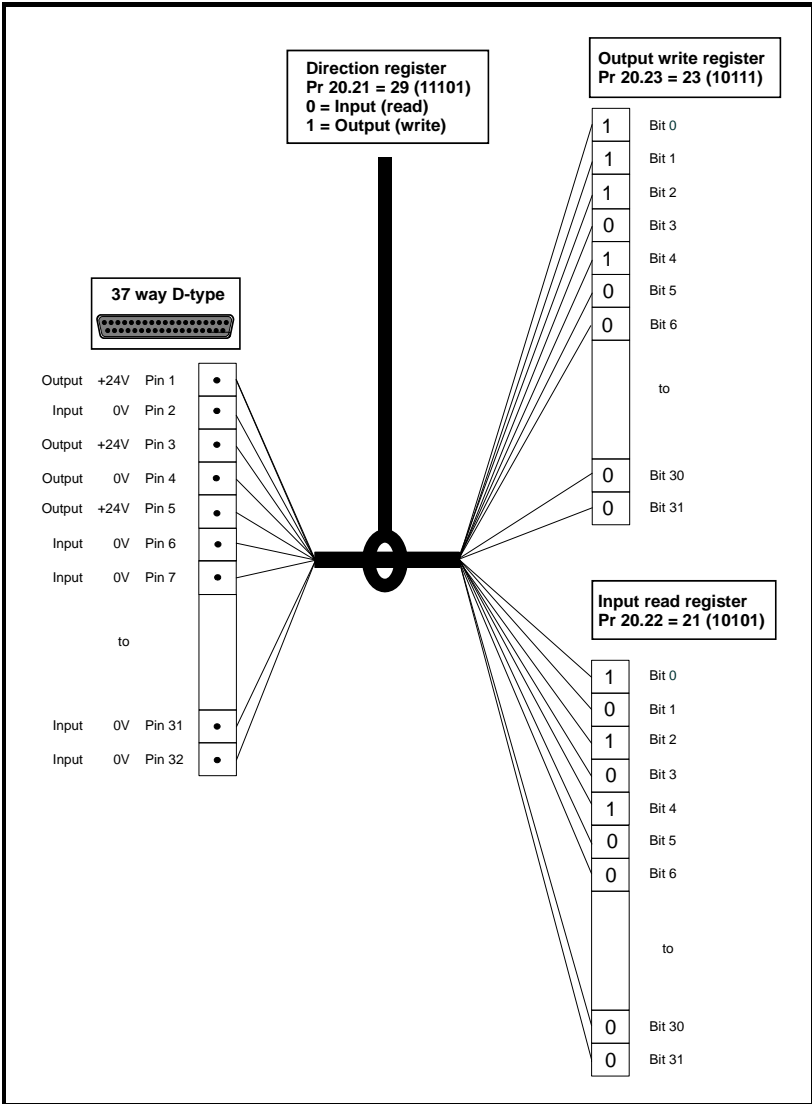
Worked Example:

By storing 20.21 in Pr **x.43**, Pr **20.21** will become the direction register for the digital I/O lines on the SM-IO 32 module. Storing 20.22 in Pr **x.47** will make Pr **20.22** the read register. Storing 20.23 in Pr **x.48** will make Pr **20.23** the write register.

Storing a value of 29 (11101 in binary) in Pr **20.21** will make digital I/O lines 1, 3, 4 and 5 (which correspond to bit 0, 2, 3 and 4) as digital outputs and the remaining I/O lines will remain as digital input. Now these digital outputs can be written to using the write register Pr **20.23**. Storing a value of 23 (10111 in binary) in Pr **20.23** will set digital I/O 1, 3 and 5 high (ON) and digital I/O 4 low (OFF). The write register will have no effect on digital I/O 2 when it tries to set it high (ON) because this digital I/O line has not been set as a digital output line by direction register. The read register Pr **20.23** will show a value of 21 (binary 10101). Figure 3-3 *Worked example* on page 9 shows a block diagram of above example.

NOTE The control of the 32 digital I/O is limited by the range of the controlling parameter. Control of all the 32 digital I/O lines can only be achieved using software like SyPTLite and SyPTPro. For example, with Pr **18.13** as the write register, 16 digital outputs can be written and with Pr **20.23** as the write register, all the 32 digital outputs can be written.

Figure 3-3 Worked example



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3.4.2 Standard update method

Standard update allows I/O lines DIO1 to DIO8 to be used in the same way as with other I/O Solutions Modules. DIO1 to DIO4 can be used as inputs or outputs with this method and DIO5 to DIO8 can be used as inputs only with this method. As with other I/O Solutions Modules, destination/source parameters are used to define the drive parameter that is controlled by or controls the input/output. The update rate for this method is 4ms except for Commander SK which is 750ms.

Table 3-2 Standard update method

Terminal	Type	I/O state	Invert		Source/ Destination		Output select	
		Pr	Pr	Default	Pr	Default	Pr	Default
1	DIO1	x.09	x.11	0	x.21	00.00	x.31	0
2	DIO2	x.10	x.12	0	x.22	00.00	x.32	0
3	DIO3	x.03	x.13	0	x.23	00.00	x.33	0
4	DIO4	x.04	x.14	0	x.24	00.00	x.29	0
5	DIO5	x.05	x.15	0	x.25	00.00		
6	DIO6	x.06	x.16	0	x.26	00.00		
7	DIO7	x.07	x.17	0	x.27	00.00		
8	DIO8	x.08	x.18	0	x.28	00.00		

3.4.3 Fast and standard update methods

Both methods can be active at the same time for an I/O line set-up as an input, so that the state of the input is shown in the read register (fast update) and the state of the input is passed to the destination parameter (standard update). If an I/O line is used on an input or output using the standard update method, the data from the write register (fast update) has no effect. It should be noted that the invert parameters associated with the standard update method have no effect on the data transfer to the read register or from the write register associated with the fast update method.

All I/O lines use positive logic.

Inputs	<5V = 0, >15V = 1
Outputs	1 = >15V (high side drivers only)

3.5 SM-I/O 32 digital outputs

The digital outputs on the SM-I/O 32 are arranged in eight groups. Each group has a total of four digital outputs.

Table 3-3 SM-I/O 32 Digital Outputs

Group	Digital Output
1	1 to 4
2	5 to 8
3	9 to 12
4	13 to 16
5	17 to 20
6	21 to 24
7	25 to 28
8	29 to 32

Each group of 4 outputs can supply a total of 16mA, so each output is able to supply at least 4mA. A digital output can supply up to a maximum of 16mA as long as the total output current for the group does not exceed 16mA, (for example, one digital I/O set as an output and the other three digital I/O in the group set to inputs).

The total output current that can be drawn from the digital outputs on the SM-I/O 32 module (excluding the 24V user output) is 128mA. The maximum output current that can be drawn from the 24V user output is 100mA. The total output current that can be drawn from the SM-I/O 32 is 228mA (128mA from the digital outputs and 100mA from the 24V user output).

3.6 Optional items

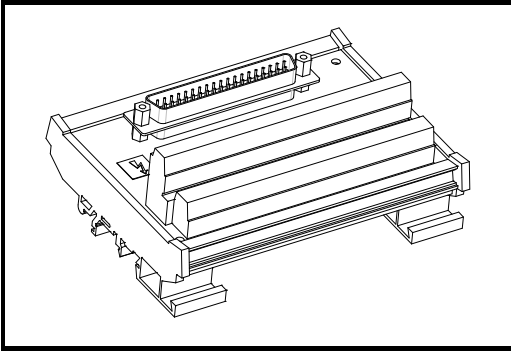
The following optional items are available for the SM-I/O 32 module. The optional items can be ordered separately or with the module. The part numbers for these are:

Table 3-4 Optional items

Optional items	Part Number
SM-IO 32 Full Kit (comes with SM-I/O 32 module, Break-out box and a 1m cable)	82000000014702
SM-I/O 32 module only	82000000014700
SM-I/O 32 Break-out box only	82000000014701
1m 37 way D-type cable only	3470-0029-00

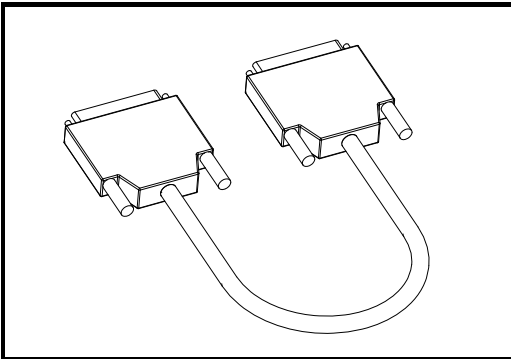
3.6.1 SM-I/O 32 Break-out box

Figure 3-4 SM-I/O 32 Break-out box



3.6.2 1m 37 way D-type cable

Figure 3-5 1m 37 way D-type cable



4 Installing the Solutions Module

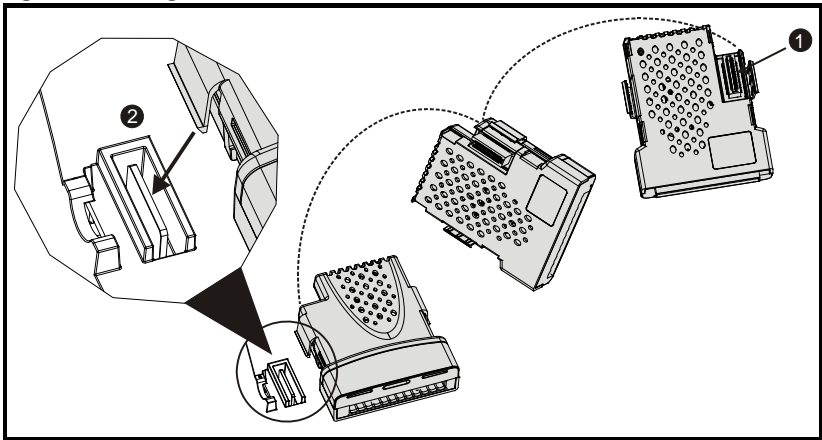


Before installing or removing a Solutions Module in any drive, ensure the AC supply has been disconnected for at least 10 minutes and refer to Chapter 2 *Safety information* on page 5. If using a DC bus supply ensure this is fully discharged before working on any drive or Solutions Module.

4.1 General Installation

The installation of a Solutions Module is illustrated in Figure 4-1.

Figure 4-1 Fitting a Solutions Module



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

4.2 Terminal descriptions

Figure 4-2 SM-I/O 32 D-type connector

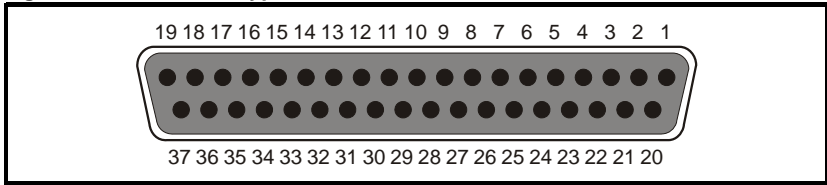


Table 4-1 SM-I/O 32 terminal descriptions

Term	Description	Term	Description	Term	Description
1	Digital input/output 1 (DI01)	14	Digital input/output 14 (DI014)	27	Digital input/output 27 (DI027)
2	Digital input/output 2 (DI02)	15	Digital input/output 15 (DI015)	28	Digital input/output 28 (DI028)
3	Digital input/output 3 (DI03)	16	Digital input/output 16 (DI016)	29	Digital input/output 29 (DI029)
4	Digital input/output 4 (DI04)	17	Digital input/output 17 (DI017)	30	Digital input/output 30 (DI030)
5	Digital input/output 5 (DI05)	18	Digital input/output 18 (DI018)	31	Digital input/output 31 (DI031)
6	Digital input/output 6 (DI06)	19	Digital input/output 19 (DI019)	32	Digital input/output 32 (DI032)
7	Digital input/output 7 (DI07)	20	Digital input/output 20 (DI020)	33	+24Vout
8	Digital input/output 8 (DI08)	21	Digital input/output 21 (DI021)	34	0V
9	Digital input/output 9 (DI09)	22	Digital input/output 22 (DI022)	35	
10	Digital input/output 10 (DI010)	23	Digital input/output 23 (DI023)	36	
11	Digital input/output 11 (DI011)	24	Digital input/output 24 (DI024)	37	
12	Digital input/output 12 (DI012)	25	Digital input/output 25 (DI025)		
13	Digital input/output 13 (DI013)	26	Digital input/output 26 (DI026)		

4.3 SM-I/O 32 Break-out box and cable

The SM-I/O 32 provides a load of approximately 0.5mA per input. However, with the Break-out box fitted, this is increased to approximately 2.2mA. IEC 61131-2 requires a minimum of 2mA @ 15V input, and so the Break-out box should be used for this standard to be met. The SM-I/O 32 Break-out box can be bought separately from the supplier of the module.

The Break-out box must be connected to the SM-I/O 32 module by a shielded cable.

The shield connections should be terminated at the drive using the grounding bracket. The termination of the shield should be kept as short as possible to prevent any noise being induced at this point.

The cable supplied by the supplier of the module is a 1m, round shielded cable set with 37-way, D-type male and female connectors. If a cable with a different length is required it can be ordered from Phoenix Contact with the order number as given below.

Table 4-2 Phoenix Contact part numbers

Order number	Cable length (m)
2302214	1.5
2302227	2
2302230	3
2302243	4
2302256	6
2302240	Variable

For more information on above cables visit <http://www.phoenixcontact.com>.

4.4 Recommended relay

Should a digital output be required to drive a relay, then a suitable relay is a Tyco Electronics/Schrack; manufacturer's part number ST3P2LC4.

5 Getting started

5.1 Installation



WARNING

The control circuits are isolated from the power circuits in the drive by basic insulation only, as specified in IEC60664-1. The installer must ensure that the external control circuits are isolated from human contact by at least one layer of insulation rated for use at the AC supply voltage.

If the control circuits are to be connected to other circuits classified as Safety Extra Low Voltage (SELV) (e.g. a personal computer) an additional isolating barrier must be included in order to maintain the SELV classification.



WARNING

The above warning also applies to the PCB edge connector for the optional Solutions Modules. To allow a Solutions Module to be fitted to Digitax ST, Unidrive SP size 0 or Commander SK, a protective cover must be removed to allow access to the PCB edge connector. This protective cover provides protection from direct contact of the PCB edge connector by the user. When this cover is removed and a Solutions Module fitted, the Solutions Module provides the protection from direct contact by the user. If the Solutions Module is then removed, this PCB edge connector becomes exposed. The user is required to provide protection in this case, to protect against direct contact of this PCB edge connector.

Table 5-1 SM-I/O 32 set-up

Action	Detail
Before power up	Ensure: <ul style="list-style-type: none">• Solutions Module is fitted correctly
Power up drive	Ensure: <ul style="list-style-type: none">• The drive displays 'inh', except Commander SK which displays 'ih'• If the drive trips, see <i>Chapter 7 Diagnostics</i> on page 27.
Module identification	Slot 1 - menu 15 appears Pr 15.01 Slot 2 - menu 16 appears Pr 16.01 Slot 3 - menu 17 appears Pr 17.01 208 - SM-I/O 32 Note that there are only two available slots for Unidrive SP size 0, Affinity, Commander GP20 and Digitax ST, and only one on Commander SK (sizes B to D and 2 to 6).

6 Parameters

6.1 Introduction

The parameters listed in this chapter are used for programming and monitoring the SM-I/O 32.



Before attempting to adjust any parameters, refer to Chapter 2 *Safety information* on page 5.

Table 6-1 Key to parameter coding

Coding	Attribute
RW	Read/write: can be written by the user
RO	Read only: can only be read by the user
Bit	1 bit parameter
Bi	Bipolar parameter
Uni	Unipolar parameter
Txt	Text: the parameter uses text strings instead of numbers.
FI	Filtered: some parameters which can have rapidly changing values are filtered when displayed on the drive keypad for easy viewing.
DE	Destination: indicates that this parameter can be a destination parameter.
NC	Not cloned: not transferred to or from SMARTCARDS/SmartSticks during cloning.
PT	Protected: cannot be used as a destination.
US	User save: saved in drive EEPROM when the user initiates a parameter save.
PS	Power-down save: automatically saved in drive EEPROM at power-down when the under volts (UV) trip occurs.

6.2 Single line descriptions

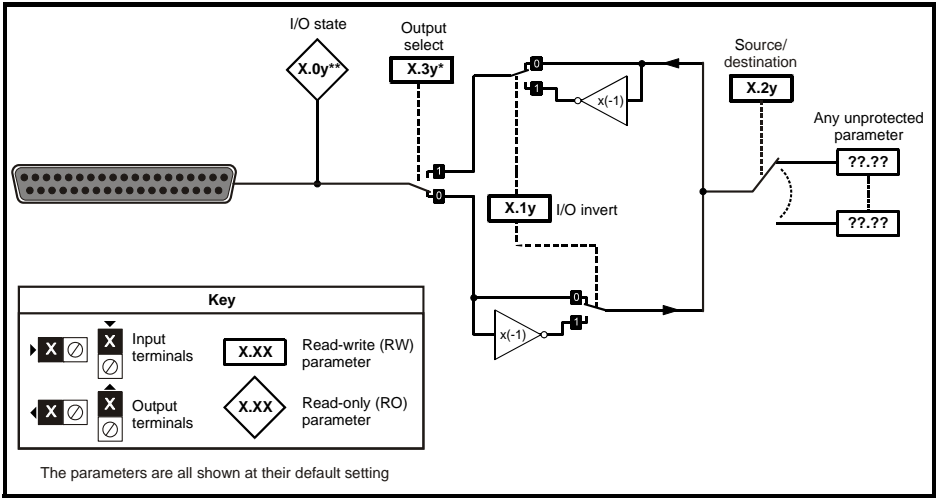
Parameter		Range(⇅)	Default(⇔)	Type					
x.01	Solutions Module ID code	0 to 599	208	RO	Uni			PT	US
x.02	Solutions Module main software version	0.00 to 99.99		RO	Uni		NC	PT	
x.03	Digital I/O 3 state	OFF (0) or On(1)	OFF (0)	RO	Bit		NC	PT	
x.04	Digital I/O 4 state	OFF (0) or On(1)	OFF (0)	RO	Bit		NC	PT	
x.05	Digital I/O 5 state	OFF (0) or On(1)	OFF (0)	RO	Bit		NC	PT	
x.06	Digital I/O 6 state	OFF (0) or On(1)	OFF (0)	RO	Bit		NC	PT	
x.07	Digital I/O 7 state	OFF (0) or On(1)	OFF (0)	RO	Bit		NC	PT	
x.08	Digital I/O 8 state	OFF (0) or On(1)	OFF (0)	RO	Bit		NC	PT	
x.09	Digital I/O 1 state	OFF (0) or On(1)	OFF (0)	RO	Bit		NC	PT	
x.10	Digital I/O 2 state	OFF (0) or On(1)	OFF (0)	RO	Bit		NC	PT	
x.11	Digital I/O 1 invert	OFF (0) or On(1)	OFF (0)	RW	Bit				US
x.12	Digital I/O 2 invert	OFF (0) or On(1)	OFF (0)	RW	Bit				US
x.13	Digital I/O 3 invert	OFF (0) or On(1)	OFF (0)	RW	Bit				US
x.14	Digital I/O 4 invert	OFF (0) or On(1)	OFF (0)	RW	Bit				US
x.15	Digital I/O 5 invert	OFF (0) or On(1)	OFF (0)	RW	Bit				US
x.16	Digital I/O 6 invert	OFF (0) or On(1)	OFF (0)	RW	Bit				US
x.17	Digital I/O 7 invert	OFF (0) or On(1)	OFF (0)	RW	Bit				US
x.18	Digital I/O 8 invert	OFF (0) or On(1)	OFF (0)	RW	Bit				US
x.20	Digital I/O read word	0 to 255	0	RO	Uni		NC	PT	
x.21	Digital I/O 1 source/destination	Pr 0.00 to Pr 21.51	Pr 0.00	RW	Uni	DE		PT	US
x.22	Digital I/O 2 source/destination	Pr 0.00 to Pr 21.51	Pr 0.00	RW	Uni	DE		PT	US
x.23	Digital I/O 3 source/destination	Pr 0.00 to Pr 21.51	Pr 0.00	RW	Uni	DE		PT	US
x.24	Digital I/O 4 source/destination	Pr 0.00 to Pr 21.51	Pr 0.00	RW	Uni	DE		PT	US
x.25	Digital I/O 5 source/destination	Pr 0.00 to Pr 21.51	Pr 0.00	RW	Uni	DE		PT	US
x.26	Digital I/O 6 source/destination	Pr 0.00 to Pr 21.51	Pr 0.00	RW	Uni	DE		PT	US
x.27	Digital I/O 7 source/destination	Pr 0.00 to Pr 21.51	Pr 0.00	RW	Uni	DE		PT	US
x.28	Digital I/O 8 source/destination	Pr 0.00 to Pr 21.51	Pr 0.00	RW	Uni	DE		PT	US
x.29	Digital I/O 4 output select*	OFF (0) or On (1)	OFF (0)	RW	Bit			PT	US
x.31	Digital I/O 1 output select	OFF (0) or On (1)	OFF (0)	RW	Bit			PT	US
x.32	Digital I/O 2 output select	OFF (0) or On (1)	OFF (0)	RW	Bit			PT	US
x.33	Digital I/O 3 output select	OFF (0) or On (1)	OFF (0)	RW	Bit			PT	US
x.43	Fast update method direction register	Pr 0.00 to Pr 21.51	Pr 0.00	RW	Uni	DE		PT	US
x.47	Fast update method read register**	Pr 0.00 to Pr 21.51	Pr 0.00	RW	Uni	DE		PT	US
x.48	Fast update method write register	Pr 0.00 to Pr 21.51	Pr 0.00	RW	Uni			PT	US
x.50	Solutions Module error status	0 to 255		RO	Uni		NC	PT	
x.51	Solutions Module software sub-version	0 to 99		RO	Uni		NC	PT	

*For Commander SK only, this parameter does not exist and the value is fixed at 0.

**For Commander SK only, this parameter does not exist and the value is fixed at 20.21.

RW	Read / Write	RO	Read only	Uni	Unipolar	Bi	Bi-polar
Bit	Bit parameter	Txt	Text string	Fl	Filtered	DE	Destination
NC	Not cloned	RA	Rating dependent	PT	Protected	US	User save
PS	Power down save						

Figure 6-1 SM-I/O 32 logic diagram



Where y = the digital I/O number, except:

*Digital I/O 4 which is Pr **x.29**

Digital I/O 1 which is Pr **x.09 and digital I/O 2 which is Pr **x.10**

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6.3 Parameter descriptions

x.01		Solutions Module ID code							
RO	Uni						PT	US	
↕	0 to 599				⇒	208			
Update rate: Write on power-up									

The menu for the relevant slot appears for the new Solutions Module category with the default parameter values for the new category, except for Commander SK which will always be menu 15.

When no Solutions Module is fitted in the relevant slot this parameter is zero. When a Solutions Module is fitted this parameter displays the identification code as shown below.

Solutions Module ID	Module	Category
0	No module fitted	
101	SM-Resolver	
102	SM-Universal Encoder Plus	Feedback
104	SM-Encoder Plus and SM-Encoder Output Plus	
201	SM-I/O Plus	Automation (I/O Expansion)
203	SM-I/O Timer	
204	SM-I/O PELV	
205	SM-I/O 24V Protected	
206	SM-I/O 120V	
207	SM-I/O Lite	
208	SM-I/O 32	
301	SM-Applications	
302	SM-Applications Lite	
303	SM-EZMotion	
304	SM-Applications Plus	
305	SM-Applications Lite V2	
401	SM-LON	Fieldbus
403	SM-PROFIBUS-DP	
404	SM-INTERBUS	
406	SM-CAN	
407	SM-DeviceNet	
408	SM-CANopen	
409	SM-SERCOS	
410	SM-Ethernet	
501	SM-SLM	SLM

Unidrive SP, Digitax ST, Affinity, Commander GP20

The new parameter values are not stored in the drive EEPROM until the user performs a parameter save by setting Pr **xx.00** to 1000 and pressing the stop/reset button. When parameters are saved by the user in the drive EEPROM, the option code of the currently fitted Solutions Module is saved in the drive EEPROM. If the drive is subsequently powered-up with a different Solutions Module fitted, or no Solutions Module is fitted when one was previously fitted, the drive will trip on SLx.dF or SLx.nF.

Commander SK

The new parameter values are stored automatically by the drive. If the drive is subsequently powered up with a different Solutions Module fitted, or no Solutions Module is fitted when one was previously fitted, the drive will trip on SL.dF or SL.nF.

x.02		Solutions Module main software version							
RO	Uni					NC	PT		
↕	00.00				⇒				
Update rate: Write on power-up									

This parameter shows the version of software programmed into the Solutions Module. The software sub version is displayed in Pr x.51.

These two parameters display the software version in the form of:

Pr x.02 = xx.yy

Pr x.51 = zz

x.03	Digital I/O 3 state								
x.04	Digital I/O 4 state								
x.05	Digital I/O 5 state								
x.06	Digital I/O 6 state								
x.07	Digital I/O 7 state								
x.08	Digital I/O 8 state								
x.09	Digital I/O 1 state								
x.10	Digital I/O 2 state								
RO	Bit					NC	PT		
↕	OFF (0) or On (1)				⇒	OFF (0)			
Update rate: 4ms write									

Pr x.03 to Pr x.10 show the state of I/O lines DIO1 to DIO8. These bits reflect the I/O state even if fast update mode is being used.

x.11	Digital I/O 1 invert									
x.12	Digital I/O 2 invert									
x.13	Digital I/O 3 invert									
x.14	Digital I/O 4 invert									
x.15	Digital I/O 5 invert									
x.16	Digital I/O 6 invert									
x.17	Digital I/O 7 invert									
x.18	Digital I/O 8 invert									
RW	Bit								US	
⇕	OFF (0) or On (1)				⇒	OFF (0)				
Update rate: Background read										

Pr **x.11** to Pr **x.18** inverts DIO1 to DIO8 respectively for the standard update method. Each bit (DIO1 to DIO8) can be inverted individually.

x.20	Digital I/O read word									
RO	Uni					NC	PT			
⇕	0 to 255				⇒					
Update rate: 4ms write										

This parameter allows the state of DIO1 to DIO8 to be monitored by reading one parameter. It is a read only parameter which shows value of bits 0 to 7 (or DIO1 to DIO8) in decimal from 0 to 255. DIO9 to DIO32 have no affect on this parameter. The bits in this parameter reflect the state of Pr **x.03** to Pr **x.10** as follows:

Bit	Digital I/O	Parameter
0	DIO1	Pr x.09
1	DIO2	Pr x.10
2	DIO3	Pr x.03
3	DIO4	Pr x.04
4	DIO5	Pr x.05
5	DIO6	Pr x.06
6	DIO7	Pr x.07
7	DIO8	Pr x.08

x.21	Digital I/O 1 source/destination										
x.22	Digital I/O 2 source/destination										
x.23	Digital I/O 3 source/destination										
x.24	Digital I/O 4 source/destination										
x.25	Digital I/O 5 source/destination										
x.26	Digital I/O 6 source/destination										
x.27	Digital I/O 7 source/destination										
x.28	Digital I/O 8 source/destination										
RW	Uni					DE		PT	US		
↕	Pr 0.00 to Pr 21.51					⇒	Pr 0.00				
Update rate: Read on drive reset											

The parameter specified in these parameters by the user is the source parameter when corresponding digital I/O line is set as an output or destination parameter when corresponding digital I/O line is set as an input. A total of 8 source or destination parameters can be defined. Pr **x.21** to Pr **x.28** corresponds to bits 0 to 7 (DIO1 to DIO8) respectively.

x.29	Digital I/O 4 output select*										
RW	Bit							PT	US		
↕	OFF (0) or On (1)					⇒	OFF (0)				
Update rate: Background read											

*For Commander SK only, this parameter does not exist and the value is fixed at 0.

x.31	Digital I/O 1 output select										
x.32	Digital I/O 2 output select										
x.33	Digital I/O 3 output select										
RW	Bit								US		
↕	OFF (0) or On (1)					⇒	OFF (0)				
Update rate: Background read											

When the output select parameter for an I/O line is set to On, the I/O is set up as an output as follows:

Digital I/O	Output select
DIO1	Pr x.31
DIO2	Pr x.32
DIO3	Pr x.33
DIO4	Pr x.29

x.43		Fast update method direction register							
RW	Uni				DE		PT	US	
↕	Pr 0.00 to Pr 21.51				⇒	Pr 0.00			
Update rate: Read on drive reset									

The drive parameter defined by this parameter is the direction register for the fast update method. Setting the relevant bit to 1 within the direction register parameter will select the corresponding I/O line to function as an output. If this parameter is set to **0.00** or a non-existent parameter then all I/O lines are defined as inputs for the fast update method. The direction register parameter range may not be large enough to allow all I/O lines to be controlled. Any bits that cannot be controlled are assumed to be zero and the corresponding I/O lines are defined as inputs for the fast update method. See section *Worked Example* on page 25.

x.47		Fast update method read register**							
RW	Uni				DE		PT	US	
↕	Pr 0.00 to Pr 21.51				⇒	Pr 0.00			
Update rate: Read on drive reset									

The drive parameter defined by this parameter is the read register for the fast update method. When an I/O line is set up as an input for the fast update method the corresponding bit in the read register shows the state of the input. Bits that correspond to I/O lines that are set as outputs in the direction register or in the direction registers for the standard update method show the state of the output I/O line. If this parameter is set to **0.00** or a non-existent parameter then no read register is defined. The read register parameter range may not be large enough to allow the state of all I/O lines to be shown; in this case the value containing the I/O status for all 32 I/O lines will be limited to the read register parameter range before being written to the read register parameter. See section *Worked Example* on page 25.

**For Commander SK only, this parameter does not exist and the value is fixed at 20.21.

x.48		Fast update method write register							
RW	Uni						PT	US	
↕	Pr 0.00 to Pr 21.51				⇒	Pr 0.00			
Update rate: Read on drive reset									

The drive parameter defined by this parameter is the write register for the fast update method. Each bit in the write register will control the corresponding I/O line provided it has been set up as an output in the direction register parameter. If this parameter is set to **0.00** or a non-existent parameter then all I/O lines set up as outputs are held in the non-active state. The write register parameter range may not be large enough to allow all I/O lines to be controlled. The value written to the write register is subject to the normal range limiting.

Worked Example

By storing 20.21 in **Pr x.43**, **Pr 20.21** will become the direction register for the digital I/O lines on the SM-I/O 32 module. Storing 20.22 in **Pr x.47** will make **Pr 20.22** the read register. Storing 20.23 in **Pr x.48** will make **Pr 20.23** the write register.

Storing a value of 29 (11101 in binary) in **Pr 20.21** will make digital I/O lines 1, 3, 4 and 5 (which corresponds to bit 0, 2, 3 and 4) as digital output bits and the remaining I/O lines will remain as digital input. Now these digital outputs can be written to using the write register **Pr 20.23**. Storing a value of 23 (10111 in binary) in **Pr 20.23** will set digital I/O 1, 3 and 5 high (ON) and digital I/O 4 low (OFF). The write register will have no effect on digital I/O 2 when it tries to set it high (ON) because this digital I/O line has not been set as a digital output line by direction register. The read register, **Pr 20.22** will show a value of 21 (binary 10101). Figure 3-3 on page 9 shows a block diagram of this example.

NOTE

The control of the 32 digital I/O is limited by the range of the controlling parameter. Control of all the 32 digital I/O lines can only be achieved using software like SyPTLite and SyPTPro. For example, with **Pr 18.13** as the write register, 16 digital outputs can be written and with **Pr 20.23** as the write register, all the 32 digital outputs can be written.

x.50		Solutions Module error status							
RO	Uni					NC	PT		
↕	0 to 255				⇒				
Update rate: Background write									

The error status is provided so that only one option error trip is required for each Solutions Module slot. If an error occurs, the reason for the error is written to this parameter and the drive may produce an 'SLX.Er' trip (where X is the slot number), or an 'SL.Er' trip on Commander SK. A value of zero indicates that the Solutions Module has not detected an error, a non-zero value indicates that an error has been detected. (See Chapter 7 *Diagnostics* on page 27 for the meaning of the values in this parameter.) When the drive is reset, this parameter is cleared for the relevant Solutions Module.

This Solutions Module includes a temperature monitoring circuit. If the PCB temperature exceeds 85°C (185°F), the drive fan is forced to operate at full speed (for a minimum of 10s). If the temperature falls below 75°C (167°F), the fan can operate normally again. If the PCB temperature exceeds 90°C (194°F), the drive will trip and the error status is set to 74.

NOTE

If the PCB temperature exceeds 85°C on the Commander SK, the fan will operate at full speed for a minimum of 20s.

x.51		Solutions Module software sub-version							
RO	Uni						NC	PT	
↕	0 to 99				⇒				
Update rate: Write on power-up									

The Solutions Module includes a processor with software. The software version is displayed in Pr **x.02** and Pr **x.51** in the form Pr **x.02** = xx.yy and Pr **x.51** = zz, where:

- xx specifies a change that affects hardware compatibility
- yy specifies a change that affects product documentation
- zz specifies a change that does not affect the product documentation.

7 Diagnostics

If the drive trips, the output is disabled so that the drive stops controlling the motor.

Trips are listed in Table 7-1 *Trip codes (except Commander SK)* on page 28 and Table 7-2 *Commander SK trip codes* on page 29 based on the trip indication shown on the drive display.

The trip indication can be read in Pr **10.20** providing a trip number.

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Table 7-1 Trip codes (except Commander SK)

Trip no.	String	Diagnosis												
9	PS.24V	<p>24V internal power supply overload</p> <p>The total user load of the drive and Solutions Modules has exceeded the internal 24V power supply limit.</p> <p>The user load consists of the drive's digital outputs, the SM-I/O Plus digital outputs, the SM-I/O 32 digital outputs, the drive's main encoder supply and the SM-Universal Encoder Plus encoder supply.</p> <ul style="list-style-type: none"> • Reduce load and reset • Provide an external 24V >50W power supply • Remove any Solution Modules and reset. 												
204 209 214	SLX.dF	<p>Solutions Module slot X trip: Solutions Module type fitted in slot X changed</p> <p>Save parameters and reset</p>												
202 207 212	SLX.Er	<p>Solutions Module slot X trip: Error detected with Solutions Module, where X is the slot number</p> <table border="1" data-bbox="295 564 991 884"> <thead> <tr> <th data-bbox="295 564 389 596">Pr x.50</th> <th data-bbox="389 564 598 596">Reasons for fault</th> <th data-bbox="598 564 991 596">Comments</th> </tr> </thead> <tbody> <tr> <td data-bbox="295 596 389 628">0</td> <td data-bbox="389 596 598 628">No errors</td> <td data-bbox="598 596 991 628"></td> </tr> <tr> <td data-bbox="295 628 389 820">1</td> <td data-bbox="389 628 598 820">Digital output or 24Vout overload</td> <td data-bbox="598 628 991 820">If an output is overloaded all the output high side drivers are turned off automatically and the drive is tripped with this error code. If the overload is removed the outputs remain off and the drive remains tripped until the drive trip is reset.</td> </tr> <tr> <td data-bbox="295 820 389 884">74</td> <td data-bbox="389 820 598 884">Module over temperature</td> <td data-bbox="598 820 991 884">Solutions Module over temperature (>90°C [194°F])</td> </tr> </tbody> </table> <p>When the drive is reset this parameter is cleared for the relevant Solutions Module</p>	Pr x.50	Reasons for fault	Comments	0	No errors		1	Digital output or 24Vout overload	If an output is overloaded all the output high side drivers are turned off automatically and the drive is tripped with this error code. If the overload is removed the outputs remain off and the drive remains tripped until the drive trip is reset.	74	Module over temperature	Solutions Module over temperature (>90°C [194°F])
Pr x.50	Reasons for fault	Comments												
0	No errors													
1	Digital output or 24Vout overload	If an output is overloaded all the output high side drivers are turned off automatically and the drive is tripped with this error code. If the overload is removed the outputs remain off and the drive remains tripped until the drive trip is reset.												
74	Module over temperature	Solutions Module over temperature (>90°C [194°F])												
200 205 210	SLX.HF	<p>Solutions Module slot X trip: Solutions Module X hardware fault</p> <p>Ensure Solutions Module is fitted correctly</p> <p>Return Solutions Module to supplier</p>												
203 208 213	SLX.nF	<p>Solutions Module slot X trip: Solutions Module has been removed</p> <p>Ensure Solutions Module is fitted correctly</p> <p>Replace Solutions Module</p> <p>Save parameters and reset drive</p>												
203 208 211	SLX.tO	<p>Solutions Module slot X trip: Solutions Module watchdog time-out</p> <p>Press reset.</p> <p>If the trip persists, contact the supplier of the drive.</p>												
215	SL.rtd	<p>Solutions Module trip: Drive mode has changed and Solutions Module parameter routing is now incorrect</p> <p>Press reset.</p> <p>If the trip persists, contact the supplier of the drive.</p>												

For further information on the above trips, see Menu 10 in the appropriate *Advanced User Guide*.

Table 7-2 Commander SK trip codes

Trip no.	String	Diagnosis								
200	SL.HF	Solutions Module hardware fault Ensure Solutions Module is fitted correctly Return Solutions Module to supplier								
201	SL.tO	Solutions Module watchdog time-out Press reset If the trip persists, contact the supplier of the drive								
202	SL.Er	Error detected with Solutions Module <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 20%;">Pr 15.50</th> <th>Fault description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>No errors</td> </tr> <tr> <td>1</td> <td>Digital output or 24Vout overload</td> </tr> <tr> <td>74</td> <td>Solutions Module over temperature (>90°C [194°F])</td> </tr> </tbody> </table> When the drive is reset this parameter is cleared for the relevant Solutions Module	Pr 15.50	Fault description	0	No errors	1	Digital output or 24Vout overload	74	Solutions Module over temperature (>90°C [194°F])
Pr 15.50	Fault description									
0	No errors									
1	Digital output or 24Vout overload									
74	Solutions Module over temperature (>90°C [194°F])									
203	SL.nF	Solutions Module has been removed Ensure Solutions Module is fitted correctly Replace Solutions Module								
204	SL.dF	Solutions Module fitted has changed Power down and back up								

For further information on the above trips, see Menu 10 in the *Commander SK Advanced User Guide*.

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8 Terminal data

Type	Positive logic mode only Complies with IEC61131 only when the break-out box is used
Methods of operation	Standard update and Fast update
Standard update method, input/output mode controlled by:	Pr x.29* , Pr x.31 , Pr x.32 , Pr x.33
Fast update method, input/output mode controlled by:	Pr x.43
Voltage Range	0V to +24V
Absolute maximum voltage range	±30V
Input load	Approximately 0.5mA independently Approximately 2.2mA with the break-out box fitted
Input threshold	+10 Volts, ± 1 Volt
Isolation	Not isolated
Output current	<p>The digital outputs on the SM-I/O 32 are arranged in eight groups of four outputs.</p> <p>Each group of four outputs can supply a total of 16mA, so each output is able to supply at least 4mA. A digital output can supply up to a maximum of 16mA as long as the total output current for the group does not exceed 16mA, (for example, one digital I/O set as an output and the other three digital I/O in the group set to inputs).</p> <p>The total output current that can be drawn from the digital outputs on the SM-I/O 32 module (excluding the 24V user output) is 128mA. The maximum output current that can be drawn from the 24V user output is 100mA. The total output current that can be drawn from the SM-I/O 32 is 228mA (128mA from the digital outputs and 100mA from the 24V user output).</p>
Standard update method update rate	4ms with any number of SM-I/O 32 modules fitted, except for Commander SK which is 750ms
Fast update method update rate	500µs with any number of SM-I/O 32 modules fitted, except for Commander SK which is 30ms

*This parameter is not available for Commander SK.

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