SM-I/O Plus

Solutions Module

User Guide

Unidrive SP

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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 Plus can only be used with drive software version 00.11.00 onwards.

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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, diagnostic information and the 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 and maintenance must be carried out by personnel who have the necessary training and experience. They must read this safety information and this User Guide carefully.

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

With the sole exception of the SECURE DISABLE 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 behaviour 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 SECURE DISABLE function has been approved[1] as meeting 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.**

[1]Independent approval by BIA has been given for sizes 1 to 3.

2.4 Environmental limits

Instructions in the *Unidrive SP 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.

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 *Unidrive SP User Guide* 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.

89/336/EEC: 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** 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.

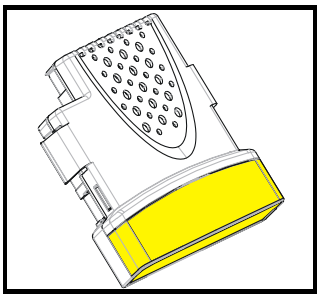
3 Introduction

3.1 Features

All connections from the Solutions Module to the drive are made via the drive connector. Connections from external equipment to the SM-I/O Plus are made via a 3-way plugable screw connector for the two relays, and a 12-way plugable screw connector for the digital and analog I/O.

A total of three SM-IO Plus' can be fitted at any one time.

Figure 3-1 SM-I/O Plus



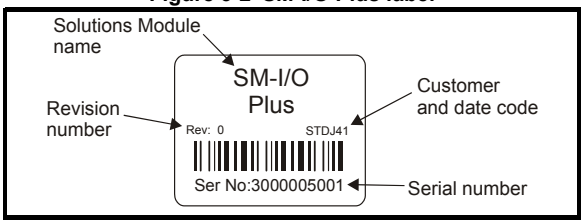
All parameters associated to the SM-I/O Plus can be found in either menu 15, 16 or 17, with each menu referring to a separate slot. See Figure 4-1 on page 11.

3.2 Solutions Module identification

The SM-I/O Plus 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. All Unidrive SP Solutions Modules are colour coded, with the SM-I/O Plus being yellow.

Figure 3-2 SM-I/O Plus label



The SM-I/O Plus increases the I/O capability of the Unidrive SP by adding the following to the existing I/O in the drive. The SM-I/O Plus can be fitted into any one of the three Solutions Module slots provided, with a maximum of three SM-I/O Plus being fitted to a single drive.

3.2.1 Date code format

The date code is split into two sections: a letter followed by a number.

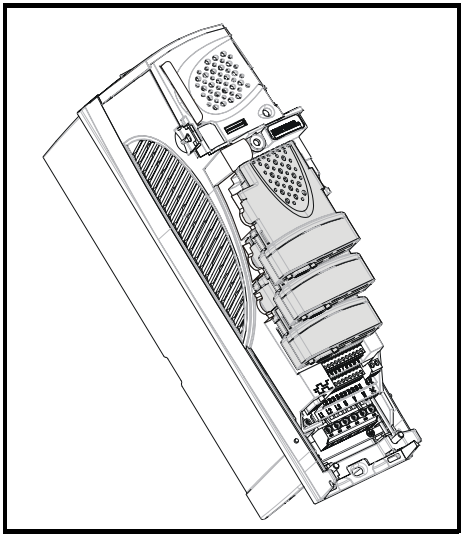
The letter indicates the year, and the number indicates the week number (within the year) in which the Solutions Module was built.

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.

Figure 3-3 Unidrive SP with three Solutions Modules fitted



All the I/O in the SM-I/O Plus are user programmable for function and signal processing.

3.3 Digital I/O

NOTE By default, the digital inputs/outputs on the Solutions Module are configured to operate in positive logic.

NOTE Configuration of the six programmable digital inputs for positive/negative logic is carried out by setting Pr **x.29**.

Function	Quantity
Digital inputs	3

Three terminals are dedicated digital inputs, the functionality of these inputs is as follows:

- The logic sense selected can be positive or negative
- The logic state of each input is monitored by a RO parameter
- The logic state can be inverted
- The digital input can be programmed to any suitable destination bit parameter

Function	Quantity
Programmable digital inputs / outputs	3

Three terminals are programmable as either digital inputs or outputs, the functionality of these terminals is as follows:

Input

- The logic sense selected can be positive or negative
- The logic state of each input is monitored by a RO parameter
- The logic state can be inverted
- The digital input can be programmed to any suitable destination bit parameter

Output

- The logic state of each output is monitored by a RO parameter
- The logic state can be inverted
- The digital output can be sourced from any suitable bit parameter
- The transistor output can only source current

Update time	8ms: 1 x SM-I/O Plus fitted 16ms: 2 x SM-I/O Plus fitted 24ms: 3 x SM-I/O Plus fitted

NOTE The three digital outputs operate in positive logic only.

NOTE All digital outputs are disabled when the drive is in the 'UU' (under-voltage) condition.

3.4 Analog I/O

Function	Quantity
Analog voltage inputs	2

Two terminals are dedicated analog inputs, the functionality of these inputs is as follows:

- Both analog inputs operate in voltage mode from 0 to ±9.8Vdc
- A scaling factor can be applied to the analog input signal
- The analog input signal can be inverted
- The analog input can be programmed to any suitable destination parameter

Function	Quantity
Analog voltage output	1

One terminal has a dedicated analog output with the following functionality:

- The analog output can be used to convey the value of any suitable source parameter to external equipment.
- The analog output operates in voltage mode 0 to ±10Vdc
- A suitable source parameter is assigned to the analog output
- A scaling factor can be applied to the analog output signal

Update time	8ms: 1 x SM-I/O Plus fitted 16ms: 2 x SM-I/O Plus fitted 24ms: 3 x SM-I/O Plus fitted

3.5 Relays

Function	Quantity
Number of relays	2

The relays can be used to convey the logic state of any suitable parameter to external equipment. The logic state is processed as follows:

- A suitable source parameter is assigned to each relay.
- The logic state can be inverted.
- The state of the relay is monitored by a parameter.

Update time	8ms: 1 x SM-I/O Plus fitted 16ms: 2 x SM-I/O Plus fitted 24ms: 3 x SM-I/O Plus fitted

3.6 24V internal power supply

If the user load exceeds 240mA at 24V, (24V internal power supply), then an external 24V power supply will be required which should be connected to the drive's control terminals 1 and 2.

The user load comprises of:

- The drives digital outputs plus the SM-I/O Plus digital outputs

Or

- The drives main encoder supply plus the SM-Universal Encoder Plus encoder supply

The maximum output current from the drive's digital output terminals 22, 24, 25 and 26 is 240mA at 24V, exceeding this will result in an 'O.Ld1' digital output overload trip.

The SM-I/O Plus has a maximum output current of 250mA at 24V across all three digital outputs.

NOTE If the maximum current of the drive and Solutions Modules is exceeded a 'PS.24V' 24V internal power supply overload trip will result.

4 Installing the SM-I/O Plus

4.1 Solutions Module slots

WARNING

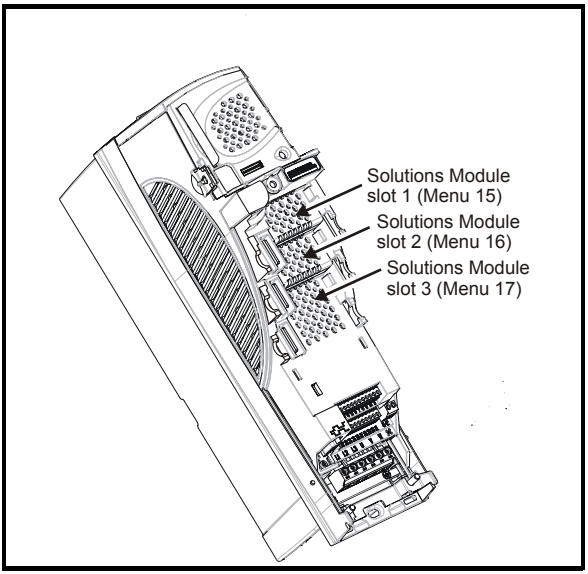
Before installing the SM-I/O Plus, refer to Chapter 2 *Safety information* on page 5.

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 insulated 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. to a personal computer) an additional isolating barrier must be included in order to maintain the SELV classification.

There are three slots available, which the Solutions Module can be plugged into as shown in Figure 4-1. The Solutions Module can be plugged into any one of these, but it is recommended that slot 3 be used for the first Solutions Module then slot 2 and slot 1. This ensures maximum mechanical support for the Solutions Module once fitted.

Figure 4-1 Location of slots 1, 2 and 3 on the Unidrive SP

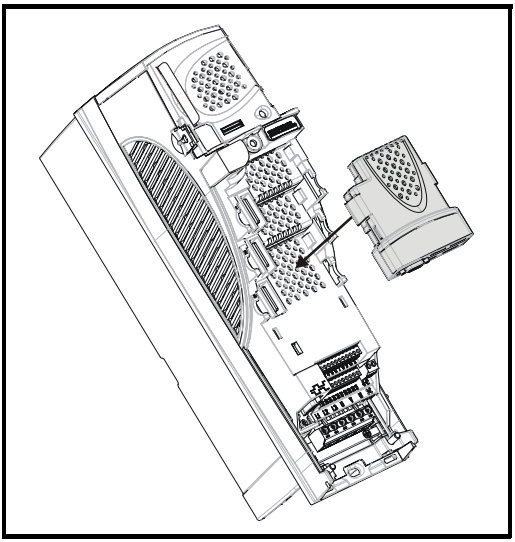


4.2 Installation

1. Before installing the SM-I/O Plus in the Unidrive SP, ensure the AC supply has been disconnected from the drive for at least 10 minutes.
2. Ensure that both the +24V, and +48V backup power supplies are disconnected from the drive for at least 10 minutes.

3. Check that the exterior of the SM-I/O Plus is not damaged, and that the multi-way connector is free from dirt and debris.
4. Do not install a damaged or dirty SM-I/O Plus in the drive.
5. Remove the terminal cover from the drive. (For removal / re-fitting instructions, see the *Unidrive SP Solutions Module Installation Sheet* provided with the Solutions Module.)
6. Position the drive connector of the SM-I/O Plus over the connector of the appropriate slot in the drive and push downwards until it locks into place.

Figure 4-2 Fitting the SM-I/O Plus



7. Re-fit the terminal cover to the drive. (For removal / re-fitting instructions, see the *Unidrive SP Solutions Module Installation Sheet* provided with the Solutions Module.)
8. Connect the AC supply to the drive.
9. Set Pr **0.49** to L2 to unlock read only security.
10. Check that Menu 15 (slot 1), 16 (slot 2), or 17 (slot 3) parameters are now available.
11. Check that Pr **15.01**, Pr **16.01** or Pr **17.01** show the correct code for the SM-I/O Plus (code = 201).
12. If the checks in steps 10 and 11 fail, either the SM-I/O Plus is not fully inserted, or the Solutions Module is faulty.
13. If a trip code is now present refer to *Chapter 6 Diagnostics* on page 27.

4.3 Terminal descriptions

Figure 4-3 SM-I/O Plus terminal descriptions

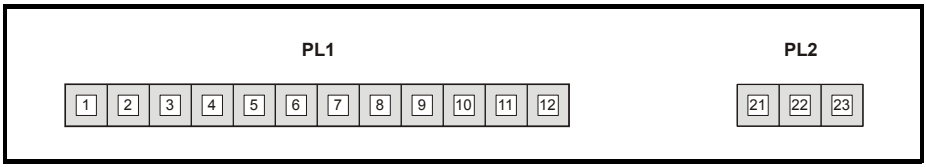


Table 4.1 12-way user connector and relay pin numbering

PL1	Function
T1	0V common
T2	Digital input/output 1
T3	Digital input/output 2
T4	Digital input/output 3
T5	0V common
T6	Digital input 4
T7	Digital input 5
T8	Digital input 6
T9	Analog input 4
T10	Analog input 5
T11	0V common
T12	Analog output 3

12-way 3.81mm plugable screw connector

PL2	Function
T21	Relay 1
T22	Relay common
T23	Relay 2

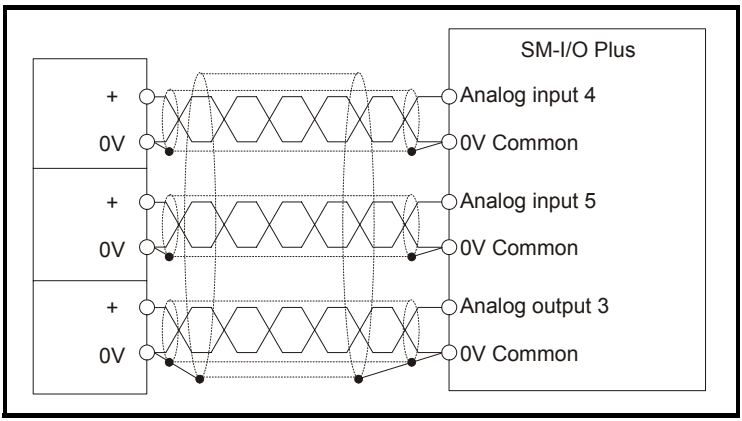
3-way 5.08mm plugable screw connector

4.4 Wiring, Shield connections

To prevent noise being induced onto any of the analog inputs or outputs it is advisable to use a twisted pair cable shielded with overall shield.

The shield connections should be terminated at one of the zero volts terminals on the Solutions Module and to the zero volts of the signal source. The termination of the shield should be kept as short as possible to prevent any noise being induced at this point.

Figure 4-4 Shield connections



5 Parameters

5.1 Introduction

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

The SM-I/O Plus is classed as a dumb module as it does not have its own processor and as a result all parameters are updated by the drive processor.

The SM-I/O Plus parameters are read/written by the drive background task or at the combined update time for time critical parameters. The combined update time depends on the number and type of dumb modules fitted to the drive. For each dumb module the update rate of these parameters is specified as either 4 or 8ms. The combined update time is the total of the update times for all dumb modules fitted. (E.g. if two modules with 4ms and 8ms update times are fitted to the drive, then the combined update time for the time critical parameters of each module will be 12ms.)

Dumb module	Update time
SM-I/O Plus	8ms
SM-Encoder Plus	4ms
SM-Resolver	4ms

NOTE The same parameter structure is available in menu 15, 16 and 17 referring to slots 1, 2 and 3.

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

Table 5.1 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.
RA	Rating dependant: this parameter is likely to have different values and ranges with drives of different voltage and current ratings. These parameters are not transferred by SMARTCARDs when the rating of the destination drive is different from the source drive.
NC	Not cloned: not transferred to or from SMARTCARDs 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.

5.2 Single line descriptions

Parameter		Range(⇳)		Default(⇨)			Type					
		OL	CL	OL	VT	SV						
x.01	Solutions Module ID	0 to 599		201			RO	Uni			PT	US
x.02	Solutions Module software version	0.00 to 99.99					RO	Uni		NC	PT	
x.03	T4 digital I/O 3 state	OFF (0) or On (1)					RO	Bit		NC	PT	US
x.04	T6 digital input 4 state	OFF (0) or On (1)					RO	Bit		NC	PT	US
x.05	T7 digital input 5 state	OFF (0) or On (1)					RO	Bit		NC	PT	US
x.06	T8 digital input 6 state	OFF (0) or On (1)					RO	Bit		NC	PT	US
x.07	Relay 1 state	OFF (0) or On (1)					RO	Bit		NC	PT	US
x.08	Relay 2 state	OFF (0) or On (1)					RO	Bit		NC	PT	US
x.09	T2 digital I/O 1 state	OFF (0) or On (1)					RO	Bit		NC	PT	US
x.10	T3 digital I/O 2 state	OFF (0) or On (1)					RO	Bit		NC	PT	US
x.11	T2 digital I/O 1 invert	OFF (0) or On (1)		OFF (0)			RW	Bit				US
x.12	T3 digital I/O 2 invert	OFF (0) or On (1)		OFF (0)			RW	Bit				US
x.13	T4 digital I/O 3 invert	OFF (0) or On (1)		OFF (0)			RW	Bit				US
x.14	T6 digital input 4 invert	OFF (0) or On (1)		OFF (0)			RW	Bit				US
x.15	T7 digital input 5 invert	OFF (0) or On (1)		OFF (0)			RW	Bit				US
x.16	T8 digital input 6 invert	OFF (0) or On (1)		OFF (0)			RW	Bit				US
x.17	Relay 1 invert	OFF (0) or On (1)		OFF (0)			RW	Bit				US
x.18	Relay 2 invert	OFF (0) or On (1)		OFF (0)			RW	Bit				US
x.19	T2 digital I/O 1 invert	OFF (0) or On (1)		OFF (0)			RW	Bit				US
x.20	Digital I/O read word	0 to 511					RO	Uni		NC	PT	US
x.21	T2 digital I/O 1 source/destination	Pr **0.00** to Pr **21.51**		Pr **0.00**			RW	Uni	DE		PT	US
x.22	T3 digital I/O 2 source/destination	Pr **0.00** to Pr **21.51**		Pr **0.00**			RW	Uni	DE		PT	US
x.23	T4 digital I/O 3 source/destination	Pr **0.00** to Pr **21.51**		Pr **0.00**			RW	Uni	DE		PT	US
x.24	T6 digital I/O 4 destination	Pr **0.00** to Pr **21.51**		Pr **0.00**			RW	Uni	DE		PT	US
x.25	T7 digital I/O 5 destination	Pr **0.00** to Pr **21.51**		Pr **0.00**			RW	Uni	DE		PT	US
x.26	T8 digital I/O 6 destination	Pr **0.00** to Pr **21.51**		Pr **0.00**			RW	Uni	DE		PT	US
x.27	Relay 1 source	Pr **0.00** to Pr **21.51**		Pr **0.00**			RW	Uni	DE		PT	US
x.28	Relay 2 source	Pr **0.00** to Pr **21.51**		Pr **0.00**			RW	Uni	DE		PT	US
x.29	Input polarity select	OFF (0) or On (1)		On (1)			RW	Bit	DE		PT	US
x.30	No function											
x.31	T2 digital I/O 1 output select	OFF (0) or On (1)		OFF (0)			RW	Bit				US
x.32	T3 digital I/O 2 output select	OFF (0) or On (1)		OFF (0)			RW	Bit				US
x.33	T4 digital I/O 3 output select	OFF (0) or On (1)		OFF (0)			RW	Bit				US
x.34	No function											
x.35	No function											
x.36	No function											
x.37	No function											
x.38	No function											
x.39	No function											
x.40	Analog input 1	±100.0%					RO	Bi		NC	PT	
x.41	Analog input 1 scaling	0.000 to 4.000		1.000			RW	Uni				US
x.42	Analog input 1 invert	OFF (0) or On (1)		OFF (0)			RW	Bit				US
x.43	Analog input 1 destination	Pr **0.00** to Pr **21.51**		Pr **0.00**			RW	Uni	DE		PT	US
x.44	Analog input 2	±100.0%					RO	Bi		NC	PT	
x.45	Analog input 2 scaling	0.000 to 4.000		1.000			RW	Uni				US
x.46	Analog input 2 invert	OFF (0) or On (1)		OFF (0)			RW	Bit				US
x.47	Analog input 2 destination	Pr **0.00** to Pr **21.51**		Pr **0.00**			RW	Uni	DE		PT	US
x.48	Analog output 1 source	Pr **0.00** to Pr **21.51**		Pr **0.00**			RW	Uni			PT	US
x.49	Analog output 1 scaling	0.000 to 4.000		1.000			RW	Uni				US

Parameter		Range(⇳)		Default(⇨)			Type					
		OL	CL	OL	VT	SV						
x.50	Solutions Module error status	0 to 255					RO	Uni		NC	PT	
x.51	No function											

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

Figure 5-1 Digital I/O logic diagram

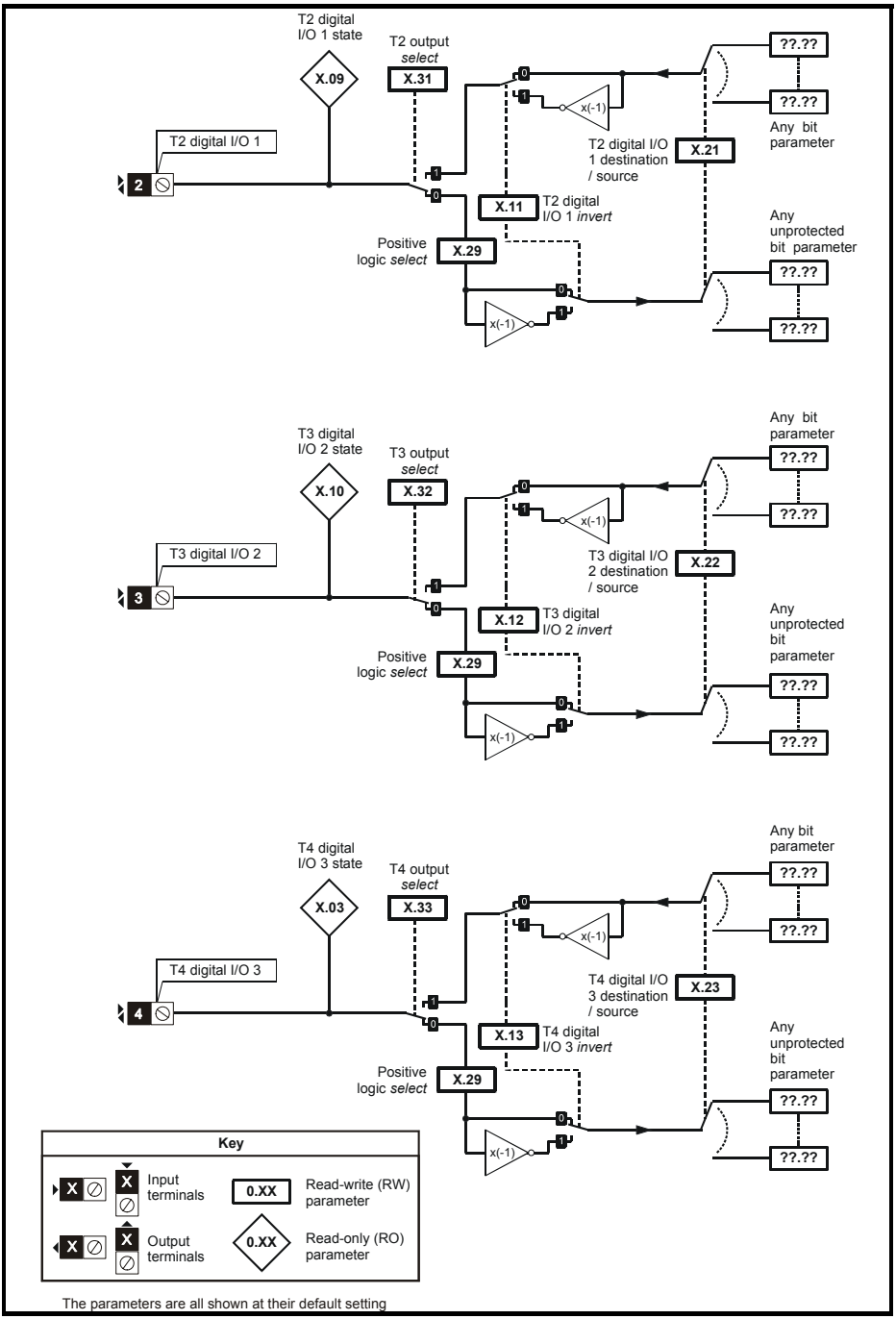


Figure 5-2 Digital Input logic diagram

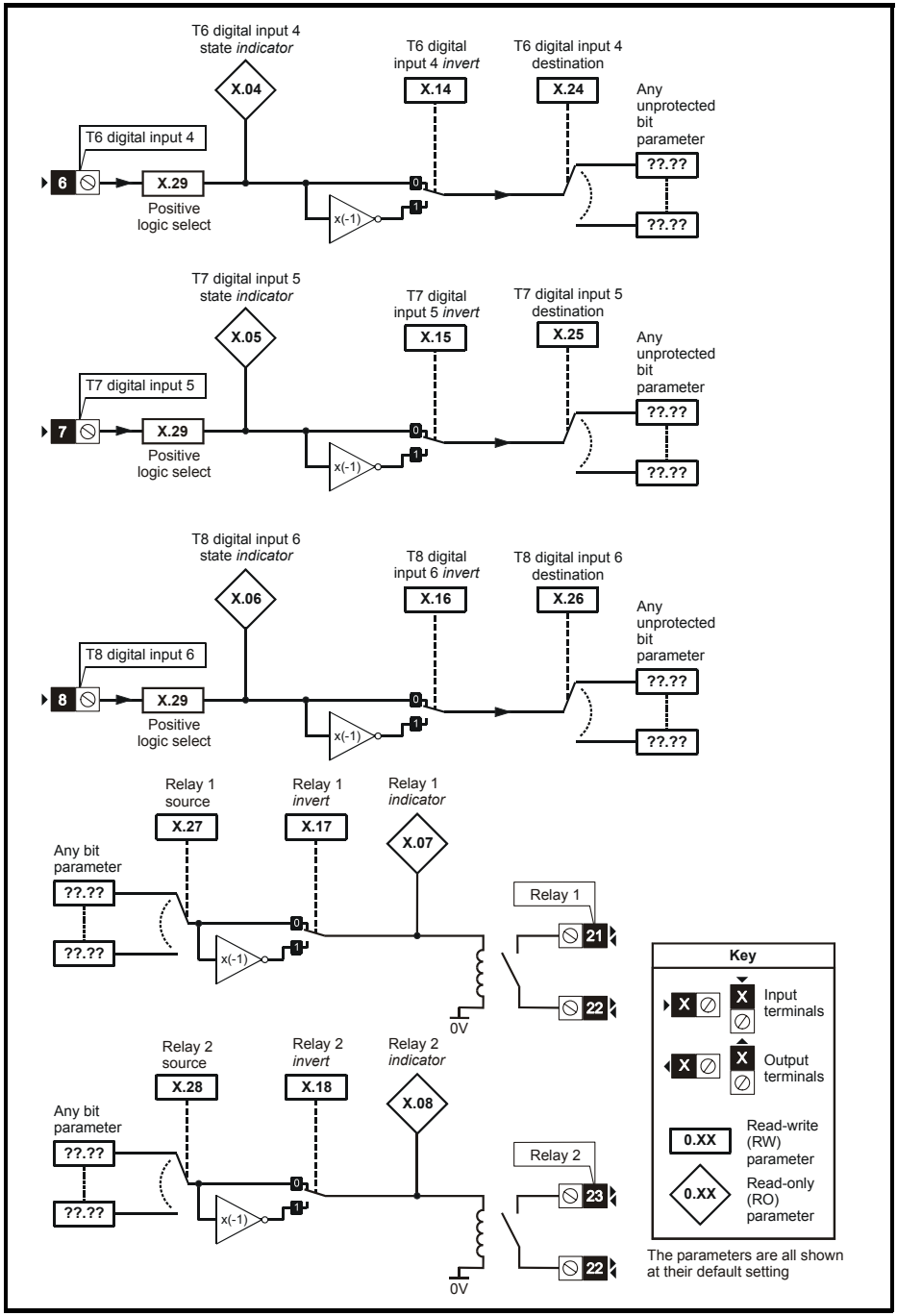
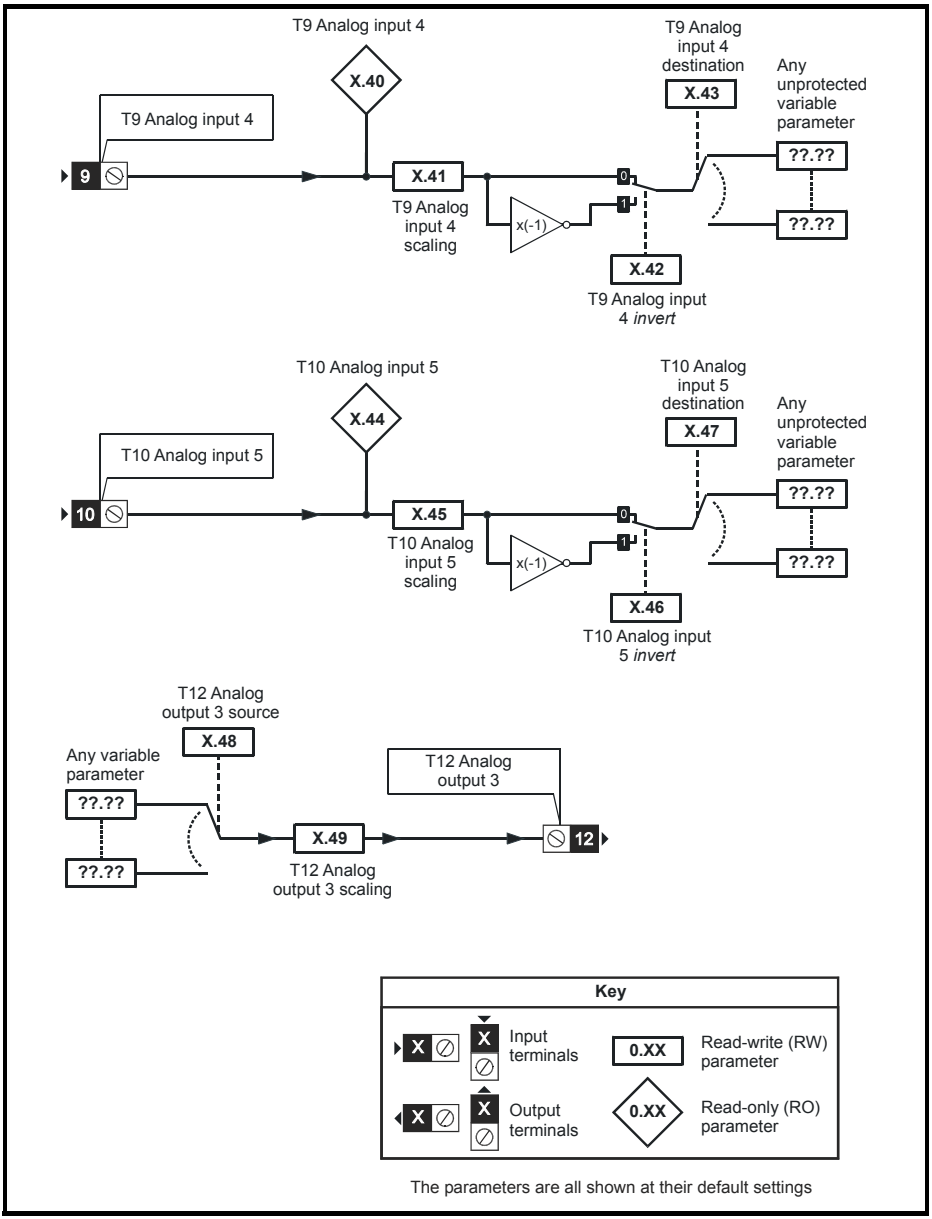


Figure 5-3 Analog I/O logic diagram



5.3 Parameter descriptions

Programmable digital inputs, outputs and relays						
Terminal	**Input**	**Destination / Source**	**State**	**Invert**	**Output select**	**Positive / negative logic select**
2	Input / Output 1	Pr **x.21**	Pr **x.09**	Pr **x.11**	Pr **x.31**	Pr **x.29**
3	Input / Output 2	Pr **x.22**	Pr **x.10**	Pr **x.12**	Pr **x.32**	Pr **x.29**
4	Input / Output 3	Pr **x.23**	Pr **x.03**	Pr **x.13**	Pr **x.33**	Pr **x.29**
6	Input 4	Pr **x.24**	Pr **x.04**	Pr **x.14**		Pr **x.29**
7	Input 5	Pr **x.25**	Pr **x.05**	Pr **x.15**		Pr **x.29**
8	Input 6	Pr **x.26**	Pr **x.06**	Pr **x.16**		Pr **x.29**
21	Relay 1	Pr **x.27**	Pr **x.07**	Pr **x.17**		
23	Relay 2	Pr **x.28**	Pr **x.08**	Pr **x.18**		

x.01	**Solutions Module ID code**								
RO	Uni						PT	US	
⇳	0 to 599				⇨	201			
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. 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.

Code	Solutions Module	Category	Dumb module
0	No Solutions Module fitted		
101	SM-Resolver	Feedback	✓
102	SM-Universal Encoder Plus	Feedback	
104	SM-Encoder Plus	Feedback	✓
201	SM-I/O Plus	Automation	✓
301	SM-Applications	Automation	
302	SM-Application Lite	Automation	
401	reserved	Fieldbus	
402	reserved	Fieldbus	
403	SM-PROFIBUS-DP	Fieldbus	
404	SM-Interbus	Fieldbus	
405	reserved	Fieldbus	
406	SM-CAN	Fieldbus	
407	SM-DeviceNet	Fieldbus	
408	SM-CANopen	Fieldbus	
501	SM-SLM	SLM	

The new parameters values are not stored in EEPROM until the user performs a parameter save. When parameters are saved by the user in the drive EEPROM the option code of the currently fitted Solutions Module is saved in EEPROM. If the drive is subsequently powered-up with a different Solutions Module fitted, or no Solutions Module fitted where one was previously fitted, the drive gives a Slot.dF or SLot.nf trip.

x.02	Solutions Module software version								
RO	Uni					NC	PT		
⇳	00.00 to 99.99				⇨				
Update rate: Write on power-up									

The SM-I/O Plus is a dumb module, and contains no software. This parameter is therefore non applicable.

x.03	T4 digital I/O 3 state								
x.04	T6 digital input 4 state								
x.05	T7 digital input 5 state								
x.06	T8 digital input 6 state								
x.07	Relay 1 state								
x.08	Relay 2 state								
x.09	T2 digital I/O 1 state								
x.10	T3 digital I/O 2 state								
RO	Bit					NC	PT	US	
⇳	OFF (0) or On (1)				⇨				
Update rate: 8ms x number of dumb modules									

x.11	T2 digital I/O 1 invert								
x.12	T3 digital I/O 2 invert								
x.13	T4 digital I/O 3 invert								
x.14	T6 digital input 4 invert								
x.15	T7 digital input 5 invert								
x.16	T8 digital input 6 invert								
x.17	Relay 1 invert								
x.18	Relay 2 invert								
x.19	T2 digital I/O 1 invert								
RW	Bit							US	
⇳	OFF (0) or On (1)				⇨	OFF (0)			
Update rate: 8ms x number of dumb modules									

x.20	Digital I/O read word								
RO	Uni					NC	PT	US	
⇳	0 to 511				⇨				
Update rate: 8ms x number of dumb modules									

This word is used to determine the status of the digital I/O by reading one parameter. The bits in this word reflect the state of Pr **x.03** to Pr **x.10**.

Bit	Digital I/O
0	I/O 1
1	I/O 2
2	I/O 3
3	I/O 4
4	I/O 5
5	I/O 6
6	I/O 7
7	I/O 8

x.21	T2 digital I/O 1 source/destination
x.22	T3 digital I/O 2 source/destination
x.23	T4 digital I/O 3 source/destination
x.24	T6 digital input 4 destination
x.25	T7 digital input 5 destination
x.26	T8 digital input 6 destination
x.27	Relay 1 source
x.28	Relay 2 source

RW	Uni		DE				PT	US	
⇳	Pr **0.00** to Pr **21.51**				⇨	Pr **0.00**			
Update rate: Read on drive reset									

x.29	Input polarity select								
RW	Bit		DE				PT	US	
⇳	OFF (0) or On (1)				⇨	On (1)			
Update rate: Background read									

This parameter changes the logic polarity for digital inputs, but not digital outputs or relay outputs.

	Pr x.29=0 (negative logic)	Pr x.29=1 (positive logic)
Inputs	<5V = 1, >15V = 0	<5V = 0, >15V = 1
Non-relay outputs	1 = >15V (high side drivers only)	1 = >15V (high side drivers only)
Relay outputs	0 = open, 1 = closed	0 = open, 1 = closed

x.31	T2 digital I/O 1 output select								
x.32	T3 digital I/O 2 output select								
x.33	T4 digital I/O 3 output select								
RW	Bit							US	
⇳	OFF (0) or On (1)				⇨	OFF (0)			
Update rate: Background read									

Programmable analog inputs and output					
Terminal	**Input**	**Destination / Source**	**State**	**Invert**	**Scaling**
9	Input 1	Pr **x.43**	Pr **x.40**	Pr **x.42**	Pr **x.41**
10	Input 2	Pr **x.47**	Pr **x.44**	Pr **x.46**	Pr **x.45**
12	Output 1	Pr **x.48**			Pr **x.49**

x.40	Analog input 1								
RO	Bi					NC	PT		
⇳	±100.0%				⇨				
Update rate: 8ms x number of dumb modules									

x.41	Analog input 1 scaling								
RW	Uni							US	
⇳	0 to 4.000				⇨	1.000			
Update rate: Background read									

x.42	Analog input 1 invert								
RW	Bit							US	
⇳	OFF (0) or On (1)				⇨	OFF (0)			
Update rate: Background read									

x.43	Analog input 1 destination								
RW	Uni		DE				PT	US	
⇳	Pr **0.00** to Pr **21.51**				⇨	Pr **0.00**			
Update rate: Read on reset									

x.44	Analog input 2								
RO	Bi					NC	PT		
⇳	±100.0%				⇨				
Update rate: 8ms x number of dumb modules									

x.45	Analog input 2 scaling								
RW	Uni							US	
⇳	0.000 to 4.000			⇨	1.000				
Update rate: Background read									

x.46	Analog input 2 invert								
RW	Bit							US	
⇳	OFF (0) or On (1)			⇨	OFF (0)				
Update rate: Background read									

x.47	Analog input 2 destination								
RW	Uni		DE				PT	US	
⇳	Pr **0.00** to Pr **21.51**			⇨	Pr **0.00**				
Update rate: Read on reset									

x.48	Analog output 1 source								
RW	Uni						PT	US	
⇳	Pr **0.00** to Pr **21.51**			⇨	Pr **0.00**				
Update rate: Read on reset									

x.49	Analog output 1 scaling								
RW	Uni							US	
⇳	0.000 to 4.000			⇨	1.000				
Update rate: Background read									

x.50	Solutions Module error status								
RO	Uni					NC	PT		
⇳	0 to 255			⇨					
Update rate: Background read									

The error status is provided so that the 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 a 'SLotx.Er' trip, where x is the slot number. 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 6 *Diagnostics* 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 90°C, the drive fan is forced to operate at full speed (for a minimum of 10s). If the temperature falls below 90°C, the fan can operate normally again. If the PCB temperature exceeds 100°C, the drive is tripped and the error status is set to 74.

6 Diagnostics

If the drive trips, the output is disabled so that the drive stops controlling the motor. The lower display indicates that a trip has occurred and the upper display shows the trip.

Trips are listed alphabetically in Table 6.1 based on the trip indication shown on the drive display. Refer to Figure 6-1.

If a display is not used, the drive LED Status indicator will flash if the drive has tripped. Refer to Figure 6-2.

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

6.1 Displaying the trip history

The drive retains a log of the last 10 trips that have occurred in Pr **10.20** to Pr **10.29** and the corresponding time for each trip in Pr **10.43** to Pr **10.51**. The time of the trip is recorded from the powered-up clock (if Pr **6.28** = 0) or from the run time clock (if Pr **6.28** = 1).

Pr **10.20** is the most recent trip, or the current trip if the drive is in a trip condition (with the time of the trip stored in Pr **10.43**). Pr **10.29** is the oldest trip (with the time of the trip stored in Pr **10.51**). Each time a new trip occurs, all the parameters move down one, such that the current trip (and time) is stored in Pr **10.20** (and Pr **10.43**) and the oldest trip (and time) is lost out of the bottom of the log.

If any parameter between Pr **10.20** and Pr **10.29** inclusive is read by serial communications, then the trip number in Table 6-1 is the value transmitted.

Figure 6-1 Keypad status modes

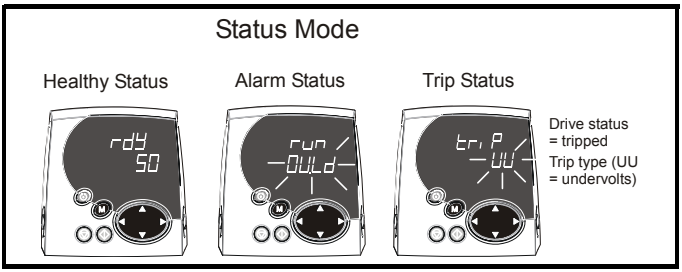
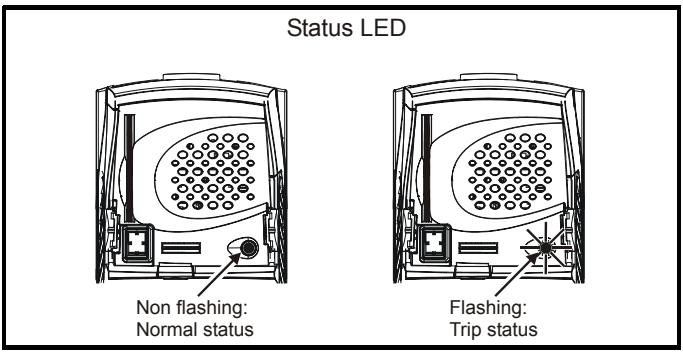


Figure 6-2 Location of the status LED



Any trip can be initiated by writing the relevant trip number to Pr **10.38**. If any trips shown as user trips are initiated the trip string is "txxx", where xxx is the trip number.

Trips can be reset after 1.0s if the cause of the trip has been rectified.

A full list of drive trips can be found in the *Unidrive SP User Guide.*

Table 6.1 Trip codes

<table>
<tr><th>Trip</th><th>Diagnosis</th></tr>
<tr><td>PS.24V</td><td>24V internal power supply overload</td></tr>
<tr><td>9</td><td>The total user load of the drive and Solutions Modules has exceeded the internal 24V power supply limit.
The user load consists of the drive’s digital outputs plus the SM-I/O Plus digital outputs, or the drive’s main encoder supply plus the SM-Encoder Plus encoder supply.
• Reduce load and reset
• Provide an external 24V >50W power supply
• Remove any Solutions Modules and reset</td></tr>
<tr><td>O.Ld1</td><td>Digital output overload: total current drawn from 24V supply and digital outputs exceeds 200mA</td></tr>
<tr><td>26</td><td>Check total load on digital outputs (terminals 24,25,26)and +24V rail (terminal 22)</td></tr>
<tr><td>SLX.dF</td><td>Solutions Module slot X trip: Solutions Module type fitted in slot X changed</td></tr>
<tr><td>204,209,214</td><td>Save parameters and reset</td></tr>
<tr><td>SLX.Er</td><td>Solutions Module slot X trip: Error detected with Solutions Module, where X is the slot number</td></tr>
<tr><td></td><td><table><tr><th>Pr x.50</th><th>Fault description</th></tr><tr><td>0</td><td>No errors</td></tr><tr><td>1</td><td>Digital output short circuit</td></tr><tr><td>74</td><td>Module over-temperature</td></tr></table>When the drive is reset this parameter is cleared for the relevant Solutions Module</td></tr>
<tr><td>SLX.HF</td><td>Solutions Module slot X trip: Solutions Module X hardware fault</td></tr>
<tr><td>200,205,210</td><td>Ensure Solutions Module is fitted correctly
Return Solutions Module to supplier</td></tr>
<tr><td>SLX.nF</td><td>Solutions Module slot X trip: Solutions Module has been removed</td></tr>
<tr><td>203,208,213</td><td>Ensure Solutions Module is fitted correctly
Replace Solutions Module
Save parameters and reset drive</td></tr>
<tr><td>SLX.tO</td><td>Solutions Module slot X trip: Solutions Module watchdog time-out</td></tr>
<tr><td>203,208,211</td><td>Press reset.
If the trip persists, contact the supplier of the drive.</td></tr>
<tr><td>SL.rtd</td><td>Solutions Module trip: Drive mode has changed and Solutions Module parameter routing is now incorrect</td></tr>
<tr><td>215</td><td>Press reset.
If the trip persists, contact the supplier of the drive.</td></tr>
</table>

7 Technical data

7.1 Digital inputs

Default function	**Positive logic mode**
Type	Positive or negative logic digital inputs
Logic mode controlled by…	Pr **x.29**
Voltage range	0V to +24V
Absolute maximum voltage range	±30V
Load	>2mA @ +15Vdc from IEC61131-2, clause 3.3.1 type 1 (For type 2 input the user will add extra load externally.)
Input thresholds	10V ±0.8V
Isolation	Not isolated from control electronics
Update time	8ms: 1 x SM-I/O Plus fitted 16ms: 2 x SM-I/O Plus fitted 24ms: 3 x SM-I/O Plus fitted

7.2 Programmable digital inputs/outputs

Default function	**Positive logic mode**
Type	Positive or negative logic digital inputs or positive logic only digital outputs. Complies with IEC61131(positive logic only).
Input/output mode controlled by…	Pr **x.31**, Pr **x.32** and Pr **x.33**
Operating as an input	
Logic mode controlled by…	Pr **x.29**
Absolute maximum voltage range	±30V
Load	>2mA @ +15Vdc from IEC61131-2, clause 3.3.1 type 1 (For type 2 input the user will add extra load externally.)
Input thresholds	10V ±0.8V
Operating as an output	
Maximum output current	250mA guaranteed. Short-circuit current of <500mA.
Common to all modes	
Isolation	Not isolated from control electronics
Update time	8ms: 1 x SM-I/O Plus fitted 16ms: 2 x SM-I/O Plus fitted 24ms: 3 x SM-I/O Plus fitted

7.3 Analog inputs

Type	Bipolar single-ended analog voltage
Nominal full-scale voltage	±9.8 V ±5%
Absolute maximum voltage range	±36V relative to 0V
Input resistance	>20kΩ
Resolution	10 bits plus sign
Input offset	30mV
Gain accuracy	2%
Gain asymmetry	0.5%
Error in change of sign	5mV relative to 0V
Isolation	Not isolated from control electronics
Update time	8ms: 1 x SM-I/O Plus fitted 16ms: 2 x SM-I/O Plus fitted 24ms: 3 x SM-I/O Plus fitted

7.4 Analog output

Type	Bipolar single-ended analog voltage
Nominal full-scale voltage	±10V ±7%
Maximum voltage at terminal	±30V
Maximum current	±20mA short-circuit protected
Load resistance	1kΩ to ∞
Protection	Short-circuit protection
Resolution	10bits + sign
Offset	±50mV
Gain asymmetry	0.1%
Settling time to within 100mV after a 10V change	300µs
Settling time to within 10mV after a 10V change	3ms
Error in change of sign	5mV relative to 0V
Isolation	Not isolated from control electronics
Update time	8ms: 1 x SM-I/O Plus fitted 16ms: 2 x SM-I/O Plus fitted 24ms: 3 x SM-I/O Plus fitted

7.5 Relays

Voltage rating	240Vac, Installation category II
Contact maximum current rating	2A AC 240V 4A DC 30V resistive load 0.5A DC 30V inductive load (L/R = 40ms)
Contact minimum recommended rating	12V 100mA
Contact form	Closed when power applied and drive healthy
Update time	8ms: 1 x SM-I/O Plus fitted 16ms: 2 x SM-I/O Plus fitted 24ms: 3 x SM-I/O Plus fitted

Category 1 installations must have suppression to limit supply-borne transients to a maximum of 1,500V peak.

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