

## *User Guide*

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# ***SM-I/O 120V***

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Solutions Module for:

- Unidrive SP
- Commander SK

Part Number: 0471-0054-02

Issue Number: 2

## **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 120V can only be used with the following drive software version:

Unidrive SP:  $\geq$  V01.08.00

Commander SK:  $\geq$  V01.06.00

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# 1 How to use this guide

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## 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.

Note that the SECURE DISABLE function is only available as standard on the Unidrive SP. The Commander SK does not have a SECURE DISABLE input.

**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<sup>1</sup> 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.**

<sup>1</sup>Independent approval by BGIA has been given.

## 2.4 Environmental limits

Instructions in the *Unidrive SP User Guide*, *Commander SK getting started guide* and *Commander SK Technical data 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* and *Commander SK EMC guide* contain instructions for achieving compliance with specific EMC standards.

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

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 the motor rated current parameter: Pr **0.46** for Unidrive SP and Pr **0.06** in Commander SK. 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.

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# 3 Introduction

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## 3.1 Features

The SM-I/O 120V solutions module can be used on the following products:

- Unidrive SP
- Commander SK

All connections from the Solutions Module to the drive are made via the drive connector. Connections from external equipment to the SM-I/O 120V are made via a 12-way plugable screw connector.

The SM-I/O 120V increases the I/O capability of the Unidrive SP and Commander SK.

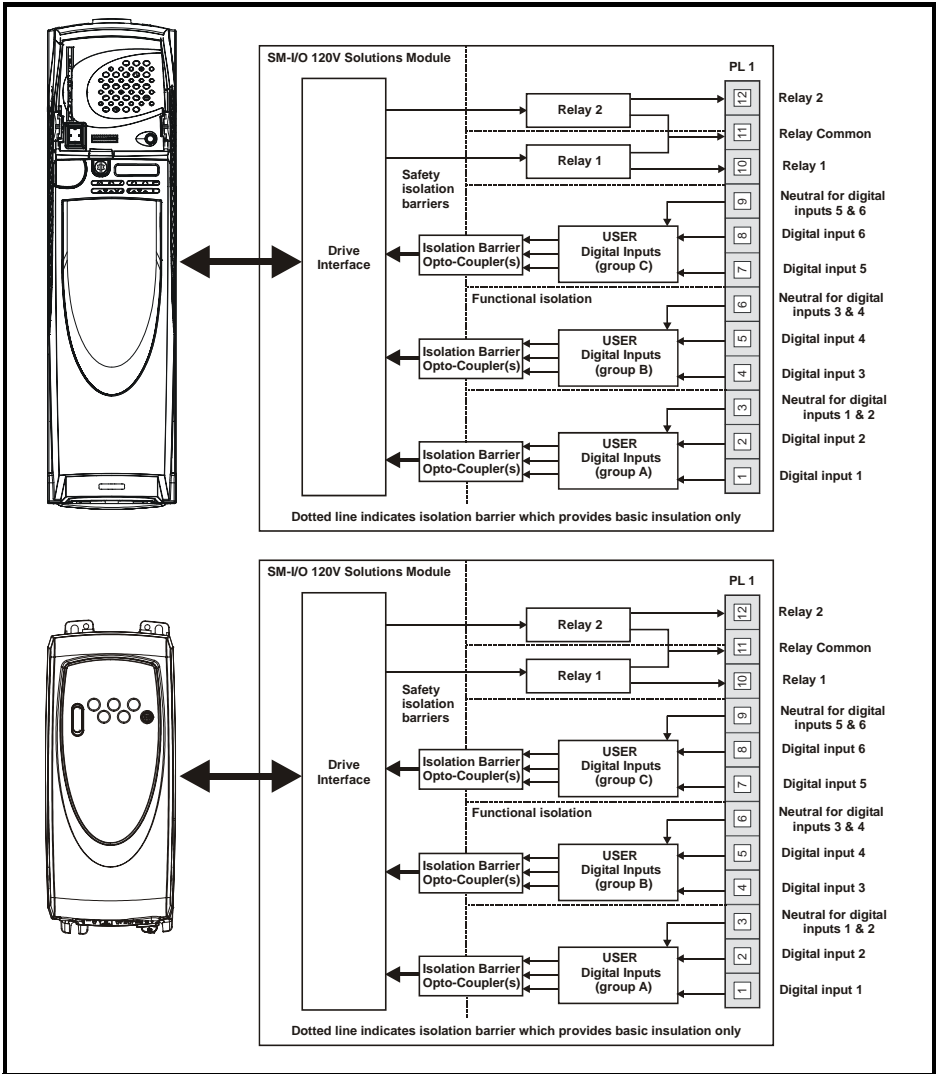
The extra I/O consists of:

- Six digital inputs (120Vac)
- Two relay outputs (120Vav 2A resistive)

The input terminals are organised in three groups of three. Each group serves two inputs with the first two terminals as inputs and the third terminal as the common neutral for the group. Groups are isolated from each other, allowing inputs derived from up to three different voltage sources or branch circuits without regard to phase. The two inputs within a group must be powered from one single-phase circuit. Each common neutral must be ground referenced at its source (see Figure 3-1).

All the I/O in the SM-I/O 120V are user programmable for function and signal processing.

Figure 3-1 Solutions Module internal isolation barriers

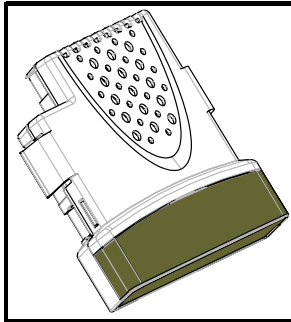


The I/O connections direct to the drive itself have basic (single) insulation from live parts.



## 3.2 Solutions Module identification

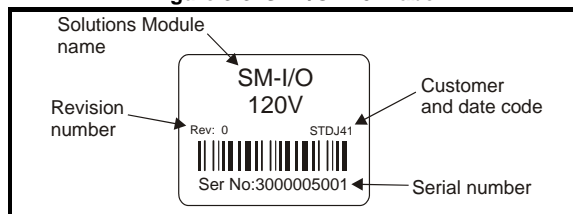
Figure 3-2 SM-I/O 120V



The SM-I/O 120V can be identified by:

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

Figure 3-3 SM-I/O 120V label



2. The colour coding across the front of the Solutions Module. SM-I/O 120V being olive.

### 3.2.1 Date code format

The date code is split into two sections: a letter followed by a number. (see Figure 3-3 *SM-I/O 120V label* on page 9)

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

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

#### Example:

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

## 3.3 Conventions used in this guide

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

In the case of a Solutions Module, the parameters will appear in menu 15 for the Commander SK, and in menu 15, 16 or 17 for the Unidrive SP depending on the slot the module is fitted into. 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 menu allocated to the Solutions Module (this could be 15, 16 or 17 on the Unidrive SP but will always be 15 on the Commander SK) and **XX** signifies the parameter number.

## 3.4 Solutions Module I/O

**NOTE** Solutions Module inputs only operate in positive logic mode.

**NOTE** All inputs and relays are user programmable for function and signal processing

**NOTE** All new source and destination routing only change to new set up locations when the drive is reset

### 3.4.1 Digital inputs

Function	Quantity
Digital inputs	6

Nine terminals are used to wire six dedicated digital inputs, the functionality of these inputs is as follows:

- The logic state of each input is monitored by a read only (RO) parameter
- The logic state can be inverted
- The digital input can be programmed to any unprotected parameter. The destination parameter value will always be either 0 or 1 depending on the state of the input.

Inputs are nominally 120Vac signals. They are positive logic so that with no voltage applied (open) it is logic zero and with voltage applied it is logic one.

For applications not required to meet UL requirements and with certain other restrictions, a 240Vac nominal signal may be applied to a pair of inputs with the common neutral for the group left unconnected. Both inputs respond to the applied signal so either one may be programmed to any suitable destination parameter.

If the supply source for the I/O circuit is an ungrounded (IT) source, the supply must not exceed 240Vac phase to phase.

### 3.4.2 Relays

Function	Quantity
Number of relays	2

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

- The logic state can be inverted.
- The software state of the relay coil is monitored by a parameter.
- The relay outputs can be sourced from any suitable bit or integer parameter. In the case where an integer parameter is used as the source, the threshold of the output switching between low and high states is 50% of the parameter's maximum.

E.g. Source parameter = Pr **18.11** (maximum = 32767)

50% of 32767 = 16383 (due to integer truncation)

Therefore, if Pr **18.11**  $\geq$  16383 the output will be high

if Pr **18.11**  $<$  16383 the output will be low

# 4 Installing the SM-I/O 120V

## 4.1 Solutions Module slots



Before installing the Solutions Module, refer to Chapter 2 *Safety Information* on page 5.



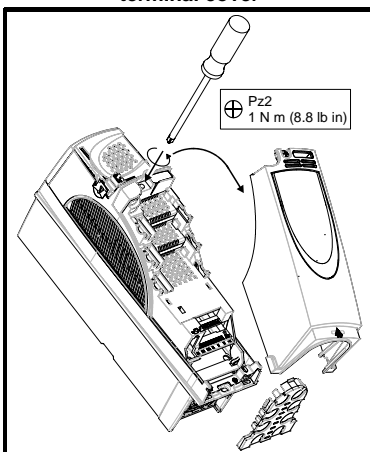
Do not remove the Solutions Module when the drive is powered-up. This could damage the drive and/or the Solutions Module.

## 4.2 General installation

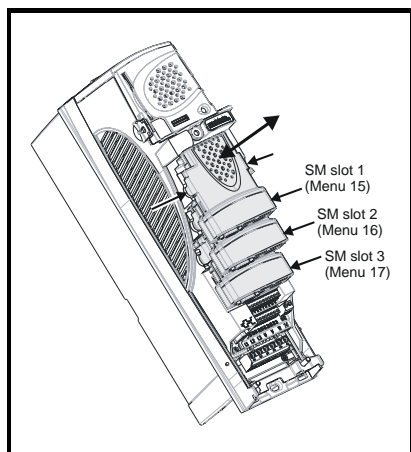
### 4.2.1 Installation on Unidrive SP

Three Solutions Module slots are available on Unidrive SP. The Solutions Module can be plugged into any of these slots but it is recommended that slot 3 be used for the first Solutions Module, then slot 2 and then slot 1. This ensures the maximum mechanical support for the Solutions Module once fitted (see Figure 4-2).

**Figure 4-1 Removing the Unidrive SP terminal cover**



**Figure 4-2 Fitting and removing a Solutions Module into the Unidrive SP**



1. Before installing a Solutions Module, ensure the AC supply has been disconnected for at least 10 minutes.
2. Ensure that any +24V and low voltage DC power supplies (if used) have been disconnected from the drive.
3. Check that the exterior of the Solutions Module is not damaged and the multiway connector on the underside of the module is free from dirt and debris.
4. Do not install a damaged or dirty Solutions Module in the drive.
5. Remove the terminal cover from the drive as shown in Figure 4-1.
6. Position the drive connector of the Solutions Module over the appropriate connector of the drive and push downwards until it locks into place. Make any wiring

connections as appropriate. Re-fit the terminal cover to the drive by reversing the procedure shown in Figure 4-1.

7. Connect the AC supply or low voltage DC supply (if used) to the drive.
8. When a Solutions Module is fitted for the first time, as the drive is powered-up, the drive will trip on SL1.dF or SL2.dF or SL3.dF depending on which slot the Solutions Module is fitted to. A parameter save must be performed. Set Pr **xx.00** = 1000 (or 1001 in the case of solely using the 24V back-up power supply) and press the Stop/Reset button. If a parameter save is not performed, the drive will trip on the above trips the next time the drive is powered up.
9. To access the advanced parameters refer to the *Unidrive SP User Guide*.
10. Check that Menu 15 (slot 1), 16 (slot 2), or 17 (slot 3) parameters are now available (depending on which slot is used).
11. Check that Pr **15.01**, Pr **16.01** or Pr **17.01** shows the correct code for the SM-I/O 120V: 206.
12. Power the drive down and back up. The Solutions Module is now ready for programming.

**NOTE** If the Solutions Module is changed for another, the drive will trip as in step 8. Follow the above procedure. If the checks in steps 10 and 11 fail, either the Solutions Module is not fully inserted, or it is faulty. If a trip code is now present refer to Chapter 6 *Diagnostics* on page 24.

**NOTE** When using the 24V back-up power supply only, the SLx.dF trip will not occur (as the drive is already displaying a UU trip).

**NOTE** When fitting two or more Solutions Modules simultaneously, the SLx.dF trip is only applicable to the module fitted in the lowest numerical slot.

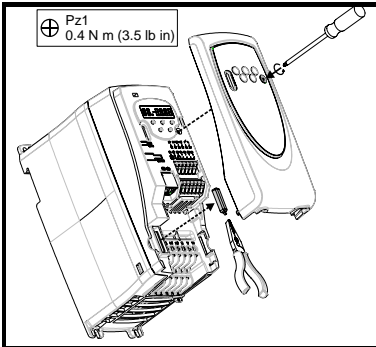
**NOTE** If an SLx.dF trip is not seen after the first power-up, the Solutions Module is not fitted properly to the drive. Power down the drive, remove and re-fit the Solutions Module. Then power can be re-applied to the drive.

## 4.2.2 Installation on Commander SK

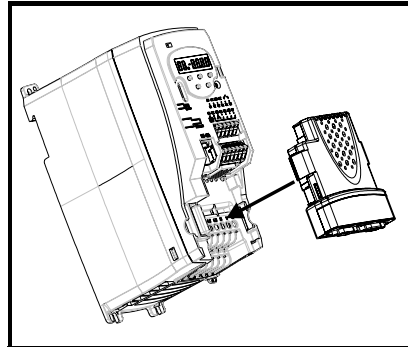


To allow a Solutions Module to be fitted to Commander SK, a protective cover must be removed to allow access to the PCB edge connector (see Figure 4-3). This protective cover provides protection from direct contact of the PCB edge connector by the user. When this cover is removed and Solutions Module 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.

**Figure 4-3 Removing the Commander SK terminal cover**



**Figure 4-4 Fitting and removing a Solutions Module into the Commander SK**



1. Before installing a Solutions Module, ensure the AC supply has been disconnected for at least 10 minutes.
  2. Check that the exterior of the Solutions Module is not damaged and the multiway connector on the underside of the module is free from dirt and debris.
  3. Do not install a damaged or dirty Solutions Module in the drive.
  4. Remove the terminal cover from the drive as shown in (see Figure 4-3).
  5. Position the drive connector of the Solutions Module over the appropriate connector of the drive and push downwards until it locks into place. Make any wiring connections as appropriate. Ensure that the plastic tab, which covers the drive's Solutions Module connector, is removed before fitting any option (see Figure 4-4).
  6. Re-fit the terminal cover to the drive by reversing the procedure shown in (see Figure 4-4).
  7. Connect the AC supply to the drive.
  8. When a Solutions Module is fitted to a Commander SK for the first time, as the drive is powered-up, the drive will trip on SL.dF. Press the STOP/RESET button to clear the trip. The Commander SK automatically saves the Solutions Module identity details to memory which will avoid any future SL.dF trips.
  9. To access the advanced parameters refer to the *Commander SK Getting Started Guide*.
- NOTE** If an SL.dF trip is not seen after the first power-up, the Solutions Module is not fitted properly to the drive. Power down the drive, remove and re-fit the Solutions Module. Then power can be re-applied to the drive.
10. Check that Menu 15 parameters are now available.
  11. Check that Pr **15.01** shows the correct code for SM-I/O 120V: 206.

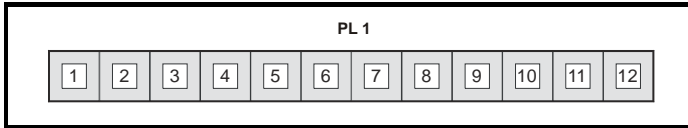
12. Power the drive down and back up. The Solutions Module is now ready for programming.

**NOTE**

If the Solutions Module is changed for another, the drive will trip as in step 8. Follow the above procedure. If the checks in steps 10 and 11 fail, either the Solutions Module is not fully inserted, or it is faulty. If a trip code is now present refer to Chapter 6 *Diagnostics* on page 24.

### 4.3 Terminal descriptions

Figure 4-5 SM-I/O 120V terminals



Provide fuse or other over-current protection in the relay circuit.

Table 4-1 Terminal descriptions

PL1	Function
T1	Digital input 1
T2	Digital input 2
T3	Neutral for digital inputs 1 & 2
T4	Digital input 3
T5	Digital input 4
T6	Neutral for digital inputs 3 & 4
T7	Digital input 5
T8	Digital input 6
T9	Neutral for digital inputs 5 & 6
T10	Relay 1
T11	Relay common
T12	Relay 2

12-way 5.08mm plugable screw connector.

# 5 Parameters

## 5.1 Introduction

The parameters listed in this chapter are used for programming and monitoring the SM-I/O 120V.

### 5.1.1 Parameter update times

The SM-I/O 120V is an intelligent Solutions Module. The update times for the parameters are defined by the processor within the Solutions Module. Parameters shown as “Background” are updated at least once every 100ms for Unidrive SP or 400ms for Commander SK. The parameters are updated at the rate given in Chapter 8 *Parameter update times* on page 29. When the digital inputs are the source for a parameter outside the Solutions Module menu the data is written to the destination parameter every 1.5ms for Unidrive SP or 6ms for Commander SK. When the relay output is the destination for parameters outside the Solutions Module menu, the data is taken from the source parameter every 150ms for Unidrive SP or 600ms for Commander SK.

#### NOTE

On the Unidrive SP, the same parameter structure is available in menu 15, 16 and 17 referring to slots 1, 2 and 3. Therefore, 'x' in the single line description table and the logic diagram represents either Menu 15, 16 or 17. However, for Commander SK it only represents Menu 15.



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

**Table 5-1 Key to parameter coding**

<b>Coding</b>	<b>Attribute</b>
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 SMARTCARD/SMARTSTICK when the rating of the destination drive is different from the source drive.
NC	Not cloned: not transferred to or from SMARTCARD/SMARTSTICK 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						
			RO	Uni		NC	PT	US	
x.01 Solutions Module ID	0 to 599	206	RO	Uni			NC	PT	US
x.02 Solutions Module software version	0.00 to 99.99		RO	Uni		NC	PT		
x.03 T4 digital input 3 state	OFF (0) or On (1)		RO	Bit		NC	PT		
x.04 T5 digital input 4 state	OFF (0) or On (1)		RO	Bit		NC	PT		
x.05 T7 digital input 5 state	OFF (0) or On (1)		RO	Bit		NC	PT		
x.06 T8 digital input 6 state	OFF (0) or On (1)		RO	Bit		NC	PT		
x.07 Relay 1 state	OFF (0) or On (1)		RO	Bit		NC	PT		
x.08 Relay 2 state	OFF (0) or On (1)		RO	Bit		NC	PT		
x.09 T1 digital input 1 state	OFF (0) or On (1)		RO	Bit		NC	PT		
x.10 T2 digital input 2 state	OFF (0) or On (1)		RO	Bit		NC	PT		
x.11 T1 digital input 1 invert	OFF (0) or On (1)	OFF (0)	RW	Bit					US
x.12 T2 digital input 2 invert	OFF (0) or On (1)	OFF (0)	RW	Bit					US
x.13 T4 digital input 3 invert	OFF (0) or On (1)	OFF (0)	RW	Bit					US
x.14 T5 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.20 Digital I/O read word	0 to 255		RO	Uni		NC	PT		
x.21 T1 digital input 1 destination	Pr 0.00 to Pr 21.51	Pr 0.00	RW	Uni	DE				US
x.22 T2 digital input 2 destination	Pr 0.00 to Pr 21.51	Pr 0.00	RW	Uni	DE				US
x.23 T4 digital input 3 destination	Pr 0.00 to Pr 21.51	Pr 0.00	RW	Uni	DE				US
x.24 T5 digital input 4 destination	Pr 0.00 to Pr 21.51	Pr 0.00	RW	Uni	DE				US
x.25 T7 digital input 5 destination	Pr 0.00 to Pr 21.51	Pr 0.00	RW	Uni	DE				US
x.26 T8 digital input 6 destination	Pr 0.00 to Pr 21.51	Pr 0.00	RW	Uni	DE				US
x.27 Relay 1 source	Pr 0.00 to Pr 21.51	Pr 0.00	RW	Uni					US
x.28 Relay 2 source	Pr 0.00 to Pr 21.51	Pr 0.00	RW	Uni					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		

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 5-1 Digital input logic diagram

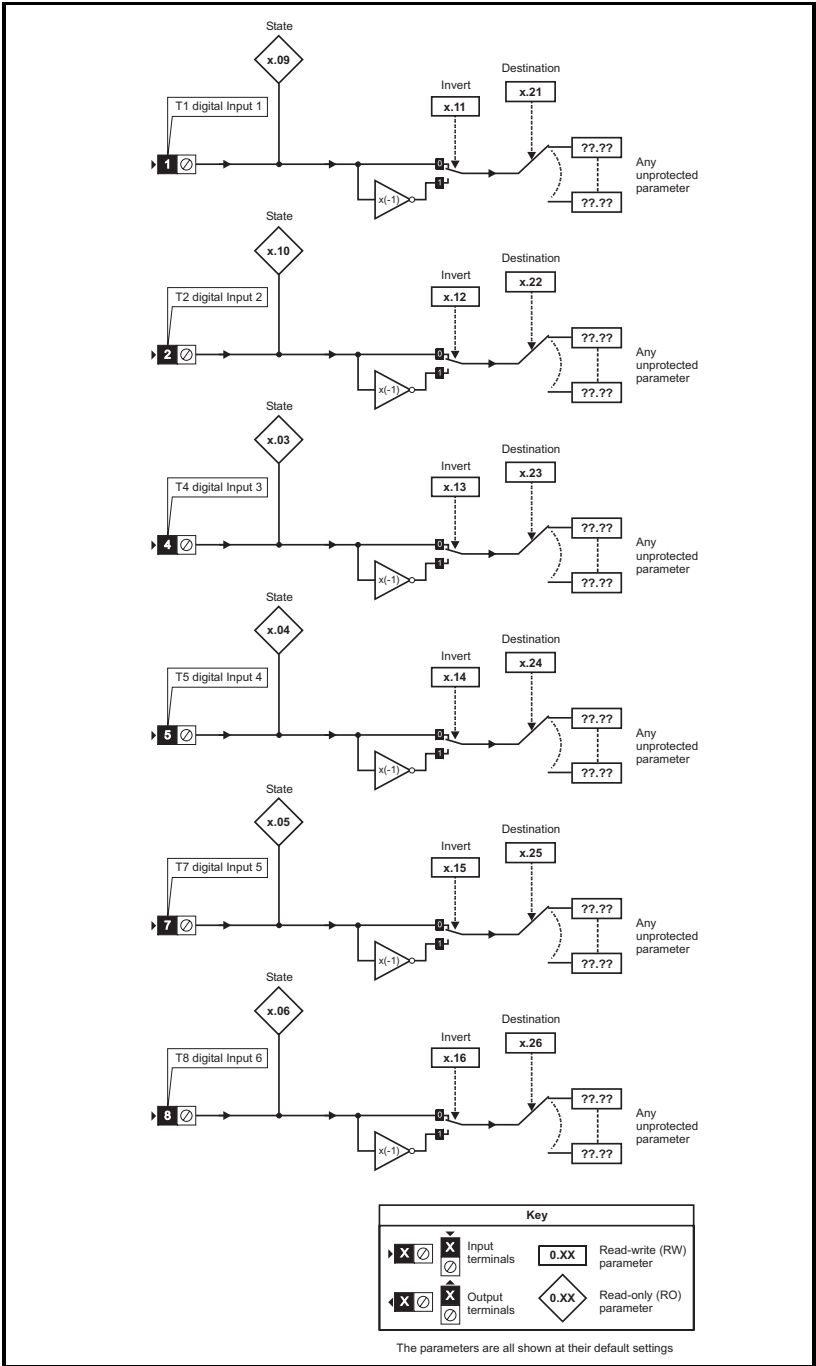
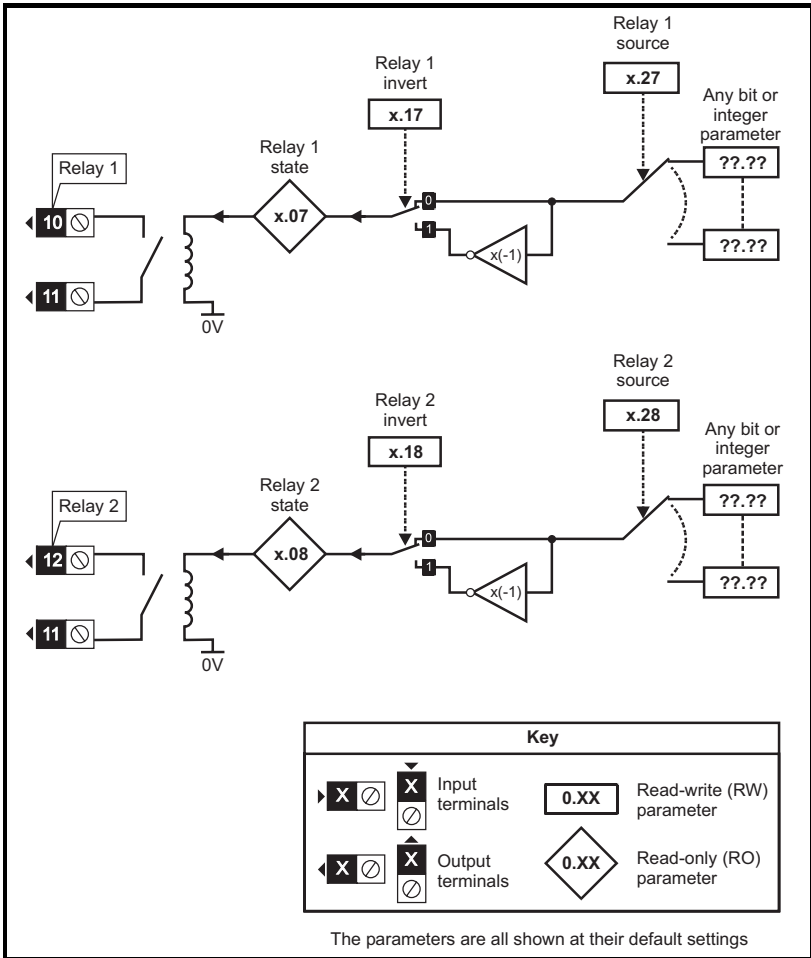


Figure 5-2 Relay logic diagram



## 5.3 Parameter descriptions

Digital inputs and relay outputs					
Terminal	Input	Destination	Source	State	Invert
1	Input 1	Pr x.21		Pr x.09	Pr x.11
2	Input 2	Pr x.22		Pr x.10	Pr x.12
4	Input 3	Pr x.23		Pr x.03	Pr x.13
5	Input 4	Pr x.24		Pr x.04	Pr x.14
7	Input 5	Pr x.25		Pr x.05	Pr x.15
8	Input 6	Pr x.26		Pr x.06	Pr x.16
10	Relay 1		Pr x.27	Pr x.07	Pr x.17
12	Relay 2		Pr x.28	Pr x.08	Pr x.18

x.01		Solutions Module ID code							
RO	Uni						PT	US	
↕	0 to 599			⇒	206				
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.

Solutions Module ID	Module	Category	Dumb module
0	No module fitted		
101	SM-Resolver	Feedback	✓
102	SM-Universal Encoder Plus		
104	SM-Encoder Plus		✓
201	SM-I/O Plus	Automation	✓
203	SM-I/O Timer		
204	SM-I/O PELV		
206	SM-I/O 120V		
207	SM-I/O Lite		
301	SM-Applications		
302	SM-Applications Lite		
303	SM-EZMotion	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	

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 SLx.dF/SL.dF or SLx.nf/SL.nf trip.

<b>x.02</b>		<b>Solutions Module software version</b>							
RO	Uni					NC	PT		
⇅	00.00 to 99.99				⇒				
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

<b>x.03</b>	<b>T4 digital input 3 state</b>								
<b>x.04</b>	<b>T5 digital input 4 state</b>								
<b>x.05</b>	<b>T7 digital input 5 state</b>								
<b>x.06</b>	<b>T8 digital input 6 state</b>								
<b>x.07</b>	<b>Relay 1 state</b>								
<b>x.08</b>	<b>Relay 2 state</b>								
<b>x.09</b>	<b>T1 digital input 1 state</b>								
<b>x.10</b>	<b>T2 digital input 2 state</b>								
RO	Bit					NC	PT		
⇅	OFF (0) or On (1)				⇒				
Update rate: Background write									

<b>x.11</b>	<b>T1 digital input 1 invert</b>								
<b>x.12</b>	<b>T2 digital input 2 invert</b>								
<b>x.13</b>	<b>T4 digital input 3 invert</b>								
<b>x.14</b>	<b>T5 digital input 4 invert</b>								
<b>x.15</b>	<b>T7 digital input 5 invert</b>								
<b>x.16</b>	<b>T8 digital input 6 invert</b>								
<b>x.17</b>	<b>Relay 1 invert</b>								
<b>x.18</b>	<b>Relay 2 invert</b>								
RW	Bit							US	
⇅	OFF (0) or On (1)				⇒	OFF (0)			
Update rate: Background read									

<b>x.20</b>		<b>Digital inputs/ relay outputs read word</b>							
RO	Uni					NC	PT		
⇅	0 to 255			⇒					
Update rate: Background write									

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

Bit	Digital input/ relays
0	Digital input 1
1	Digital input 2
2	Digital input 3
3	Digital input 4
4	Digital input 5
5	Digital input 6
6	Relay 1
7	Relay 2

<b>x.21</b>		<b>T1 digital input 1 destination</b>							
<b>x.22</b>		<b>T2 digital input 2 destination</b>							
<b>x.23</b>		<b>T4 digital input 3 destination</b>							
<b>x.24</b>		<b>T5 digital input 4 destination</b>							
<b>x.25</b>		<b>T7 digital input 5 destination</b>							
<b>x.26</b>		<b>T8 digital input 6 destination</b>							
RW	Uni		DE					US	
⇅	Pr <b>0.00</b> to Pr <b>21.51</b>			⇒	Pr <b>0.00</b>				
Update rate: Read on drive reset									

<b>x.27</b>		<b>Relay 1 source</b>							
<b>x.28</b>		<b>Relay 2 source</b>							
RW	Uni							US	
⇅	Pr <b>0.00</b> to Pr <b>21.51</b>			⇒	Pr <b>0.00</b>				
Update rate: Read on drive reset									

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

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 a SLx.Er/SL.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 on Unidrive SP or 20s on Commander SK). 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.

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

When a Solutions Module is fitted that does not contain software, both Pr **x.02** and Pr **x.51** appear as zero.

## 6 Diagnostics

If the drive trips, the output is disabled so that the drive stops controlling the motor. The display indicates that a trip has occurred as shown in Figure 6-1 and Figure 6-3.

Trips are listed in section 6.2 *Unidrive SP trip descriptions* on page 26 and section 6.3 *Commander SK trip descriptions* on page 26 based on the trip indication shown on the drive display. Refer to Figure 6-1 for Unidrive SP and Figure 6-3 for Commander SK. If a display is not used on the Unidrive SP, 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

#### 6.1.1 Unidrive SP

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 from 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 section 6.2 *Unidrive SP trip descriptions* on page 26 is the value transmitted.

Figure 6-1 Unidrive SP keypad status modes

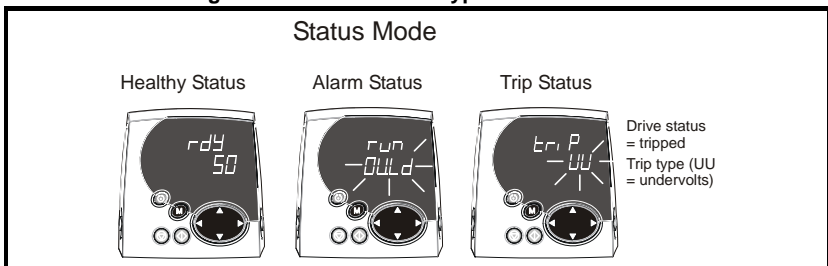
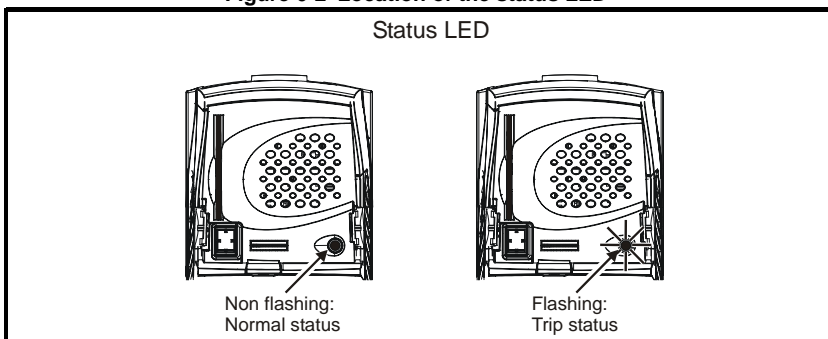


Figure 6-2 Location of the status LED





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*.

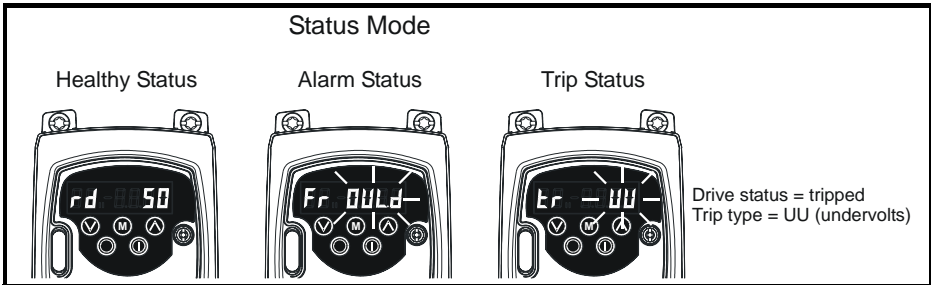
### 6.1.2 Commander SK

The drive retains a log of the last 10 trips that have occurred in Pr **10.20** to Pr **10.29**.

Pr **10.20** is the most recent trip, or the current trip if the drive is in a trip condition, and Pr **10.29** is the oldest trip. 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 the oldest trip is lost from 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 section 6.3 *Commander SK trip descriptions* on page 26 is the value transmitted.

**Figure 6-3 Commander SK keypad status modes**



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 "t0xx", where xx 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 *Commander SK Advanced User Guide*.

## 6.2 Unidrive SP trip descriptions

Trip no.	String	Diagnosis								
200, 205, 210	SLX.HF	<b>Solutions Module hardware fault</b> Ensure Solutions Module is fitted correctly Return Solutions Module to supplier								
201, 206, 211	SLX.tO	<b>Solutions Module watchdog time-out</b> Press reset If the trip persists, contact the supplier of the drive								
202, 207, 212	SLX.Er	<b>Error detected with Solutions Module where X is the slot number</b> <table border="1"> <thead> <tr> <th>Pr x.50</th> <th>Fault description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>No errors</td> </tr> <tr> <td>2</td> <td>Digital inputs overloaded</td> </tr> <tr> <td>74</td> <td>Solutions Module over temperature (&gt;100°C)</td> </tr> </tbody> </table>	Pr x.50	Fault description	0	No errors	2	Digital inputs overloaded	74	Solutions Module over temperature (>100°C)
Pr x.50	Fault description									
0	No errors									
2	Digital inputs overloaded									
74	Solutions Module over temperature (>100°C)									
203, 208, 213	SLX.nF	<b>Solutions Module has been removed</b> Ensure Solutions Module is fitted correctly Save parameters and reset drive Replace Solutions Module								
204, 209, 214	SLX.dF	<b>Solutions Module fitted in slot X has changed</b> Save parameters and reset								
215	SLX.rtd	<b>Drive mode has changed and Solutions Module parameter routing is now incorrect</b> Press reset If the trip persists, contact the supplier of the drive								

## 6.3 Commander SK trip descriptions

Trip no.	String	Diagnosis								
200	SL.HF	<b>Solutions Module hardware fault</b> Ensure Solutions Module is fitted correctly Return Solutions Module to supplier								
201	SL.tO	<b>Solutions Module watchdog time-out</b> Press reset If the trip persists, contact the supplier of the drive								
202	SL.Er	<b>Error detected with Solutions Module</b> <table border="1"> <thead> <tr> <th>Pr x.50</th> <th>Fault description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>No errors</td> </tr> <tr> <td>2</td> <td>Digital inputs overloaded</td> </tr> <tr> <td>74</td> <td>Solutions Module over temperature (&gt;100°C)</td> </tr> </tbody> </table>	Pr x.50	Fault description	0	No errors	2	Digital inputs overloaded	74	Solutions Module over temperature (>100°C)
Pr x.50	Fault description									
0	No errors									
2	Digital inputs overloaded									
74	Solutions Module over temperature (>100°C)									
203	SL.nF	<b>Solutions Module has been removed</b> Ensure Solutions Module is fitted correctly Replace Solutions Module								
204	SL.dF	<b>Solutions Module fitted has changed</b> Power down and back up								

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

# 7 Technical data

## 7.1 Digital inputs

	120Vac operation	240Vac operation
Number of channels	6 (in three groups of 2 with a common return for each group)	3 (in three groups of two with neutrals unconnected)
Mode	Positive logic IEC 61131-2 120Vac Type 1	Positive logic IEC 61131-2 240Vac Type 1
Maximum input voltage	132Vac 50/60Hz	268Vac 50/60Hz
Nominal input voltage	120Vac 50/60Hz	240Vac 50/60Hz
Nominal input voltage range	96Vac to 132Vac (120Vac + 10% / -20%)	192Vac to 268Vac (240Vac + 10% / -20%)
Nom input freq range	47 to 53 Hz or 56 to 63 Hz	47 to 53 Hz or 56 to 63 Hz
Voltage for ON State	79Vac to 132Vac	164Vac to 264Vac
Current for ON State	2mA rms to 3mA rms	2mA rms to 3mA rms
Voltage for OFF State	0Vac to 20Vac	0Vac to 40Vac
Current for OFF State	0mA rms to 1.5mA rms	0mA rms to 1.5mA rms
Over voltage protection	Series resistor plus M.OV	Series resistor plus M.OV
Load	Compliant with 120Vac Type 1 (low current) inputs per IEC 61131-2. Must be used with low leakage sources. If leakage current >1mA refer to figure 7-1 on next page	Compliant with 240Vac Type 1 (low current) inputs per IEC 61131-2. Must be used with low leakage sources. If leakage current >1mA refer to figure 7-1 on next page
Maximum turn on delay*		
Maximum turn off delay*		
Maximum response time	Maximum delay time + Sampling interval	Maximum delay time + Sampling interval
Isolation	Each input circuit shall be separated from the drive by 'Basic Insulation' appropriate for 120Vac operation with overvoltage category III.	Input groups shall be separated from each other, from the relay circuit, and from the drive by 'Basic Insulation' appropriate for 240Vac with overvoltage category II. This will allow the two inputs in a group to be used as a single 240Vac input. All 240Vac circuits must be from a single phase and the source must have transients limited to overvoltage category II levels.
Update time*		

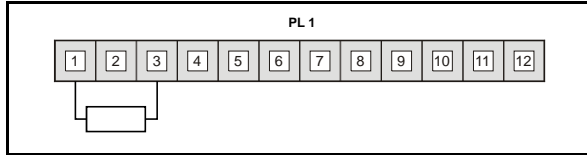
\*For update times see Chapter 8 *Parameter update times* on page 29.

Solid state relays and similar devices may have snubber circuits that have significant leakage current. If the leakage current is approximately >1mA, then the input may be detected as active. In this situation a resistor should be fitted externally as shown in Figure 7-1. Selecting an appropriate resistor can be done by using the formula:

$$R = 20V / (I_{\text{leakage}} - 1\text{mA}).$$

Ensure correct power rating resistor is selected and is located external to the drive's AC terminal cover.

**Figure 7-1 Location of resistor when required**



## 7.2 Relays

	120Vac operation	240Vac operation
Contact voltage rating	120Vac, installation over-voltage category III	240Vac, installation over-voltage category II
Contact maximum current rating	2A AC 120V 4A DC 30V resistive load (2A 35Vdc for UL requirements) 0.3A DC 30V inductive load (L/R = 40ms)	2A AC 240V 4A DC 30V resistive load (2A 35Vdc for UL requirements) 0.3A DC 30V inductive load (L/R = 40ms)
Contact minimum recommended rating	12V 100mA	12V 100mA
Default contact condition	Open when power applied	Open when power applied
Update time*		

\*For update times see Chapter 8 *Parameter update times* on page 29



Provide fuse or other over-current protection in relay circuit.



When the SM-I/O 120V option is used with Commander SK drives, the terminals are exposed. To ensure protection to IP20 and prevent accidental contact with live connections, the following precautions are required:

All terminal screws on live circuits to be tightened

Wire size not to exceed 12AWG or 4mm<sup>2</sup>

Wire insulation to be stripped by no more than 8mm, or use protective ferrule.

## 8 Parameter update times

Number of active I/O i.e. Source/ Destination $\neq$ 0.00	Unidrive SP		Commander SK	
	Fast Update time (ms)		Fast Update time (ms)	
	On	Off	On	Off
1	13.5	21.5	18	26
2	14	22	20	28
3	14.5	22.5	22	30
4	15	23	24	32
5	15.5	23.5	26	34
6	16	24	28	36
7	16.5	24.5	30	38
8	17	25	32	40

- Background update times for Unidrive SP can be up to 150ms.
- Background update times for Commander SK can be up to 600ms.

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