**EMERSON**
Industrial Automation

*User Guide*

# SM-I/O 24V Protected

Solutions Module for:

- Unidrive SP
- Commander SK
- Commander GP20

Part Number: 0471-0072-02
Issue: 2



**CONTROL TECHNIQUES**

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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.

## Drive software version

The SM-I/O 24V Protected can only be used with the following drive software version:

Unidrive SP:       ≥V01.07.00
Commander SK:    ≥V01.06.00
Commander GP20: ≥V01.07.00

# Contents

# 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 and diagnosis information. Additional to the aforementioned are the specifications of the Solutions Module.

# 2 Introduction

## 2.1 Features

The SM-I/O 24V Protected is designed as an over voltage protected I/O Solution Module.

The Solutions Module is able to withstand a +48V input voltage being applied to the +24V Digital I/O terminals.

The SM-I/O 24V Protected can be used on the following products:

- Unidrive SP
- Commander SK
- Commander GP20

The SM-I/O 24V Protected increases the I/O capability of the drive by adding the following to the existing I/O:

- 2 x Analogue current outputs
- 4 x Digital inputs/outputs*
- 3 x Digital inputs
- 2 x Relay (30Vdc contact rating)**

All connections from the Solutions Module to the drive are made via the drive connector.

Connections from external equipment to the relay, digital I/O and analogue outputs are made via a 17-way pluggable screw connector.

On the Unidrive SP a total of three SM-I/O 24V Protected modules can be fitted at any one time. On the Commander SK only one can be fitted, on the Commander GP20 two can be fitted.

*Only three digital outputs are available with Commander SK.

**1 relay on Commander SK

## 2.2 Solutions Module identification

**Figure 2-1  SM-I/O 24V Protected**
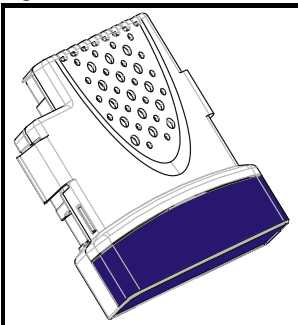


The SM-I/O 24V Protected can be identified by:

1. The label located on the underside of the Solutions Module.
2. The colour coding across the front of the Solutions Module, with the SM-I/O 24V Protected being cobalt blue.

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**Figure 2-2  SM-I/O 24V Protected label**
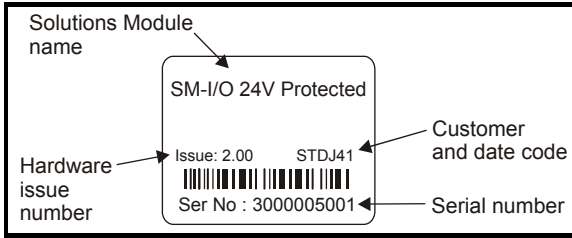


## 2.2.1 Date code format

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.

## 2.3 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 and 15, 16 on the Commander GP20 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, 15 or 16 on Commander GP20 but will always be 15 on the Commander SK) and **XX** signifies the parameter number.

## 2.4 Solutions Module I/O

NOTE Solution Module I/O only operates in positive logic mode.

NOTE All I/O and relays are user programmable for function and signal processing.

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

NOTE By default, the digital inputs/outputs on the Solutions Module are configured to operate as inputs, except Digital I/O 4 which is configured as an output (input only for Commander SK).

NOTE The logic state of a digital input will operate even without a destination parameter programmed.

## 2.5 Digital I/O

All digital I/O complies with IEC 61131-2, clause 3.3.1 type 1, (i.e. >2mA @ +15Vdc). For type 2 input, the user will need to add extra load externally.

| Function | Quantity |
|----------|----------|
| Digital inputs | 3 (4 on Commander SK) |

Three terminals are dedicated digital inputs (4 with Commander SK); the functionality of these inputs is as follows:
- The logic state of the input is monitored by a 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.

| Function | Quantity |
|----------|----------|
| Programmable digital inputs / outputs | 4** |

Four terminals are programmable as either digital inputs or output terminals (3 with Commander SK), the functionality of these terminals is as follows:

**Input**
- 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 unprotected parameter. The destination parameter value will always be either 0 or 1 depending on the state of the input

**Output**
- The logic state of each output is monitored by a RO parameter
- The logic state can be inverted
- The digital outputs can be sourced from any 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
- The digital outputs can only source current

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- The four digital outputs of the Solutions Module (three digital outputs with Commander SK) are able to source 40 mA to the total combination of output channels (e.g. 4 x 10mA or 1 x 40mA). When the current drawn exceeds safe limits, all the outputs will be disabled through hardware and trip the drive to alert the user to the fault condition.

**A maximum of three digital outputs are available with Commander SK.

## 2.6    Analogue output

| Function | Quantity |
|---|---|
| Unipolar current output | 2 |

Two terminals have a dedicated analogue output with the following functions:

- The output can be used to convey the value of any valid source parameter to external equipment*.
- The output operates in one of the following modes as set in Pr **x.39**: 0-20, 20-0, 4-20 and 20-4.
- A scaling factor can be applied to the analogue output signal*

*Only available on analogue output 1 with Commander SK.

## 2.7    Relays

| Function | Quantity |
|---|---|
| Number of relays | 2 (1 on Commander SK) |

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

- Any source parameter is assigned to relay.
- The logic state can be inverted.
- The software state of the coil is monitored by a parameter.

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# 3 Safety Information

## 3.1 Warnings, Cautions and Notes

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

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

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

## 3.2 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.

## 3.3 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.**

Note that the SECURE DISABLE function is only available as standard on the Unidrive SP and Commander GP20. The Commander SK does not have a SECURE DISABLE input.

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

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in case of loss of motor braking.

The SECURE DISABLE function and secure input meet the requirements of EN954-1 category 3 for the prevention of unexpected starting of the drive. They 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.**

## 3.4 Environmental limits

Instructions in the *Unidrive SP User Guide*, *Commander GP20 User Guide*, *Commander SK Getting Started Guide*, *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.

## 3.5 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, Commander GP20 User Guide* and *Commander SK Technical Data 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.

## 3.6 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 / Commander GP20 and Pr **06** in Commander SK. This affects the thermal protection of the motor.

## 3.7 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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# 4 Installing the Solutions Module

**WARNING**

Before installing the Solutions Module, refer to Chapter 3 *Safety Information* on page 9.

**CAUTION**

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

## 4.1 Installation

### 4.1.1 Unidrive SP / Commander GP20

Three Solutions Module slots are available on Unidrive SP and two on Commander GP20. 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 (slot 2 and then slot 1 on Commander GP20). This ensures the maximum mechanical support for the Solutions Module once fitted. See Figure 4-2.

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

Pz2
1 N m (8.8 lb in)

**Figure 4-2 Fitting and removing a Solutions Module into the Unidrive SP**
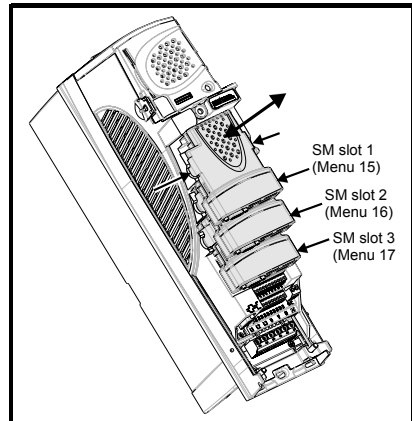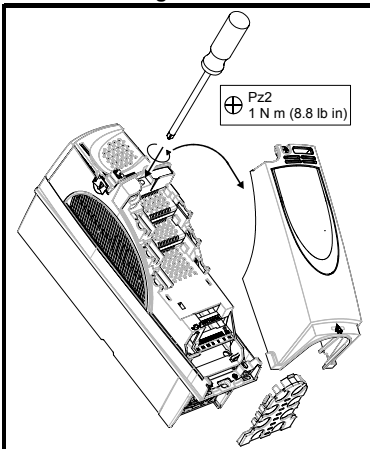
SM slot 1
(Menu 15)

SM slot 2
(Menu 16)

SM slot 3
(Menu 17

1. Before installing a Solutions Module in any drive, 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. Push the Solutions Module towards the rear of the drive until it locks into place. Make the connections to the Solutions Module as appropriate.
7. Re-fit the terminal cover to the drive by reversing the procedure shown in Figure 4-1.

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8. Connect the AC supply or low voltage DC supply (if used) to the drive.

9. When a Solutions Module is fitted to a Unidrive SP / Commander GP20 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 (SL1.dF or SL2.dF on Commander GP20). 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.

**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.

10. To access the advanced parameters refer to the *Unidrive SP User Guide / Commander GP20 User Guide*.

11. Check that Menu 15 (slot 1), 16 (slot 2), or 17 (slot 3) parameters are now available (depending on which slot is used). Menu 15 (slot1), or 16 (slot 2) on Commander GP20.

12. Check that Pr **15.01**, Pr **16.01** or Pr **17.01** shows the correct code for the SM-I/O 24V Protected: 205. (Pr **15.01** or Pr **16.01** on Commander GP20).

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

**NOTE** If the SM-I/O 24V Protected is changed for another type of Solutions Module, the drive will trip as in step 9. Follow the above procedure.

14. If the checks in step 11 and step 12 fail, either the Solutions Module is not fully inserted, or it is faulty.

15. If a trip code is now present refer to *Chapter 6 Diagnostics* on page 32.

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### 4.1.2   Commander SK

One Solutions Module slot is available on Commander SK. See Figure 4-4.

⚠️ **WARNING**

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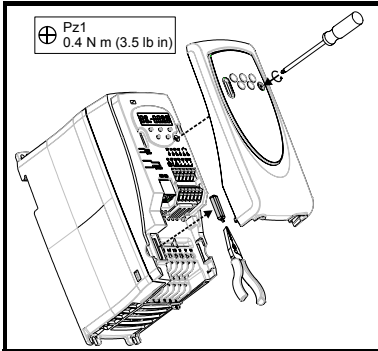
**Figure 4-4  Fitting and removing a Solutions Module into the Commander SK**
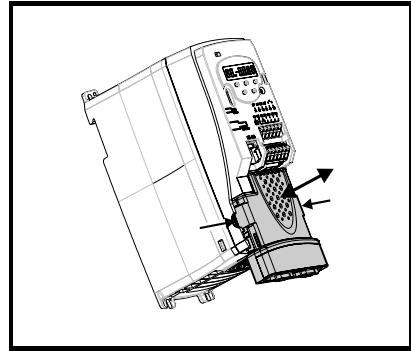


1.  Before installing a Solutions Module in any drive, ensure the AC supply has been disconnected for at least 10 minutes.
2.  Check that the exterior of the Solutions Module is not damaged and the multiway connector on the underside of the module is free from dirt and debris.
3.  Do not install a damaged or dirty Solutions Module in the drive.
4.  Remove the terminal cover from the drive as shown in Figure 4-3.
5.  Ensure that the plastic tab which covers the drive's Solutions Module connector is removed before fitting any option. See Figure 4-4.
    Position the drive connector of the Solutions Module over the appropriate connector of the drive. Push the Solutions Module towards the rear of the drive until it locks into place. Make the connections to the Solutions Module as appropriate.
6.  Re-fit the terminal cover to the drive by reversing the procedure shown in Figure 4-3.
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.

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11. Check that Pr **15.01** shows the correct code for the SM-I/O 24V Protected: 205.

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

If the SM-I/O 24V Protected is changed for another type of Solutions Module, the drive will trip as in step 8. Follow the above procedure.

13. If the checks in step 10 and step 11 fail, either the Solutions Module is not fully inserted, or it is faulty.

14. If a trip code is now present refer to *Chapter 6 Diagnostics* on page 32*.

## 4.2 Terminal descriptions

**Figure 4-5  SM-I/O 24V Protected terminals**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |

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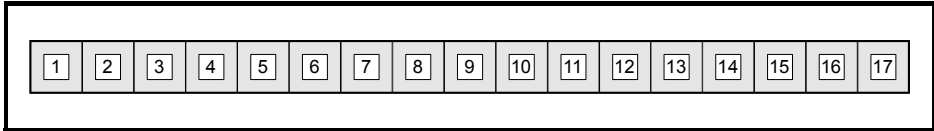
Provide fuse or other over-current protection in the relay circuit.

**Table 4-1  Terminal descriptions**

| Term | Function |
|------|----------|
| 1 | 0V common |
| 2 | 0V common |
| 3 | Digital I/O 1 |
| 4 | Digital I/O 2 |
| 5 | Digital I/O 3 |
| 6 | Digital I/O 4* |
| 7 | Digital input 5 |
| 8 | Digital input 6 |
| 9 | Digital input 7 |
| 10 | Analogue output 1 |
| 11 | 0V common |
| 12 | Analogue output 2 |
| 13 | 0V common |
| 14 | Relay 1 contact 1 |
| 15 | Relay 1 contact 2 |
| 16 | Relay 2 contact 1** |
| 17 | Relay 2 contact 2** |

17-way 3.81mm pluggable screw connector.

*Digital input only with Commander SK

**Not available on Commander SK

## 4.3 Wiring, shield connections

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

If used, 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 if available. The termination of the shield should be kept as short as possible to prevent any noise being induced at this point.

**Figure 4-6 Shield connections (current mode)**

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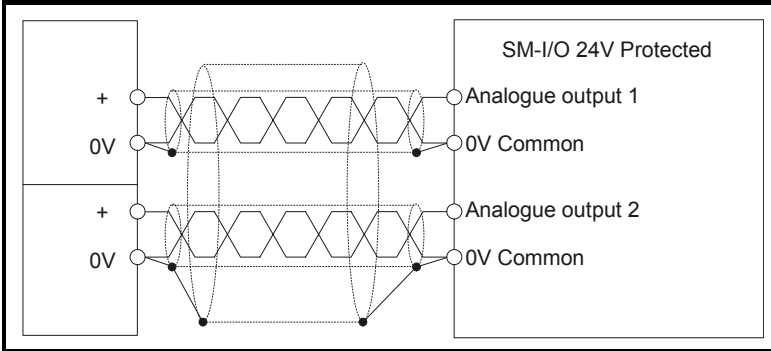
# 5    Parameters

## 5.1    Introduction

The parameters listed in this chapter are used for programming and monitoring the SM-I/O 24V Protected.

### 5.1.1    Parameter update times

The SM-IO 24V Protected is an intelligent Solutions Module. The update times for the parameters are defined by the drive type in use. The following apply only when the Solutions Module is used with a Unidrive SP:

Parameters shown as "Background" are updated at least once every 30ms.

If a destination pointer parameter is set up to pass data to a drive parameter including parameters in the menu for this option module, the parameter is updated once every 4ms.

If a source pointer parameter is set up to get data from a drive parameter including parameters in the menu for this option, the drive parameter is read once every 4ms.

The following apply only when the Solutions Module is used with a Commander SK:

The module has two parameter update times; background and fast update. The actual update times for the two types of parameter are dependent upon the number of I/O used (i.e. that are mapped to a valid source or destination) on the module.

The update rate for fast update parameters can be calculated with the following expression:

$$t_{FU}(ms) = ((Number\ of\ I/O\ used) + 2 ) * 2ms$$

The update time for background level parameters can be calculated with the following expression:

$$t_{BU}(ms)\ = t_{FU} * 33$$

Only source and destination parameters that are routed to a valid parameter are updated at the fast rate.

| Number of I/O source/ destinations active | Fast Update Time (ms) | Background Update Time (ms) |
|---|---|---|
| 1 | 6 | 198 |
| 2 | 8 | 264 |
| 3 | 10 | 330 |
| 4 | 12 | 396 |
| 5 | 14 | 462 |
| 6 | 16 | 528 |
| 7 | 18 | 594 |
| 8 | 20 | 616 |
| 9 | 22 | 726 |
| 10 | 24 | 792 |

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**NOTE** The analogue output 2 source is always active (source always Pr **4.02** with Commander SK), therefore the minimum fast update time with any other I/O active will be 8ms. The background update time will be a minimum of 264ms.

**NOTE** On the Unidrive SP, the "**x**" in the parameter number (e.g. Pr **x.01**), is either Menu 15 (slot 1), 16 (slot 2) or 17 (slot 3) depending on which slot is used.
On the Commander GP20, the "**x**" in the parameter number (e.g. Pr **x.01**), is either Menu 15 (slot 1), or 16 (slot 2) depending on which slot is used.
On Commander SK the "**x**" in the parameter number is Menu 15.

⚠ **WARNING** Before attempting to adjust any parameters, refer to Chapter 3 *Safety Information* on page 9.

**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 / SmartSticks when the rating of the destination drive is different from the source drive. |
| 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. |

## 5.2    Single line descriptions

| | Parameter | Range($\updownarrow$) | Default($\Rightarrow$) | Type | | | | |
|---|---|---|---|---|---|---|---|---|
| **x.01** | Solutions Module ID | 0 to 599 | 205 | RO | Uni | | PT | US |
| **x.02** | Solutions Module Main Software Version | 0.00 to 99.99 | | RO | Uni | | NC | PT |
| **x.03** | T5 digital I/O 3 state | OFF (0) or On (1) | | RO | Bit | | NC | PT |
| **x.04** | T6 digital I/O 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** | T9 digital input 7 state | OFF (0) or On (1) | | RO | Bit | | NC | PT |
| **x.08** | Relay 1 state | OFF (0) or On (1) | | RO | Bit | | NC | PT |
| **x.09** | T3 digital I/O 1 state | OFF (0) or On (1) | | RO | Bit | | NC | PT |
| **x.10** | T4 digital I/O 2 state | OFF (0) or On (1) | | RO | Bit | | NC | PT |
| **x.11** | T3 digital I/O 1 invert | OFF (0) or On (1) | OFF (0) | RW | Bit | | | US |
| **x.12** | T4 digital I/O 2 invert | OFF (0) or On (1) | OFF (0) | RW | Bit | | | US |
| **x.13** | T5 digital I/O 3 invert | OFF (0) or On (1) | OFF (0) | RW | Bit | | | US |
| **x.14** | T6 digital I/O 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** | T9 digital input 7 invert | OFF (0) or On (1) | OFF (0) | RW | Bit | | | US |
| **x.18** | Relay 1 invert | OFF (0) or On (1) | OFF (0) | RW | Bit | | | US |
| **x.19** | Not used | | | | | | | |
| **x.20** | Digital I/O read word | 0 to 255 | | RO | Uni | | NC | PT |
| **x.21** | T3 digital I/O 1 source/destination | Pr **0.00** to Pr **21.51** | Pr **0.00** | RW | Uni | DE | | US |
| **x.22** | T4 digital I/O 2 source/destination | Pr **0.00** to Pr **21.51** | Pr **0.00** | RW | Uni | DE | | US |
| **x.23** | T5 digital I/O 3 source/destination | Pr **0.00** to Pr **21.51** | Pr **0.00** | RW | Uni | DE | | US |
| **x.24** | T6 digital I/O 4 source/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** | T9 digital input 7 destination | Pr **0.00** to Pr **21.51** | Pr **0.00** | RW | Uni | DE | | US |
| **x.28** | Relay 1 source | Pr **0.00** to Pr **21.51** | Pr **0.00** | RW | Uni | | | US |
| **x.29*** | T6 digital I/O 4 output select | OFF (0) or On (1) | On (1) | RW | Bit | | | US |
| **x.30** | Not used | | | | | | | |
| **x.31** | T3 digital I/O 1 output select | OFF (0) or On (1) | OFF (0) | RW | Bit | | | US |
| **x.32** | T4 digital I/O 2 output select | OFF (0) or On (1) | OFF (0) | RW | Bit | | | US |
| **x.33** | T5 digital I/O 3 output select | OFF (0) or On (1) | OFF (0) | RW | Bit | | | US |
| **x.34** | Not used | | | | | | | |
| **x.35** | Not used | | | | | | | |
| **x.36** | Not used | | | | | | | |
| **x.37** | Not used | | | | | | | |
| **x.38** | Not used | | | | | | | |
| **x.39** | Analogue output mode | 0-20, 20-0, 4-20, 20-4 | 0-20 | RW | Uni | | | US |
| **x.40** | Relay 2 state | OFF (0) or On (1) | | RO | Bit | | NC | PT |
| **x.41** | Not used | | | | | | | |
| **x.42** | Relay 2 invert | OFF (0) or On (1) | OFF (0) | RW | Bit | | | US |
| **x.43** | Relay 2 source | Pr **0.00** to Pr **21.51** | Pr **0.00** | RW | Uni | | | US |
| **x.44** | Not used | | | | | | | |
| **x.45*** | Analogue output 2 scaling | 0.000 to 4.000 | 1.000 | RW | Uni | | | US |
| **x.46** | Not used | | | | | | | |
| **x.47*** | Analogue output 2 source | Pr **0.00** to Pr **21.51** | Pr **0.00** | RW | Uni | | | US |
| **x.48** | Analogue output 1 source | Pr **0.00** to Pr **21.51** | Pr **0.00** | RW | Uni | | | US |
| **x.49** | Analogue output 1 scaling | 0.000 to 4.000 | 1.000 | 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 |

\*       Parameter not available with Commander SK
\*\*      Digital input only with Commander SK
\*\*\*     Destination only with Commander SK

## 5.3 Logic diagrams

**Figure 5-1 Digital I/O logic diagram (Unidrive SP / Commander GP20 only)**
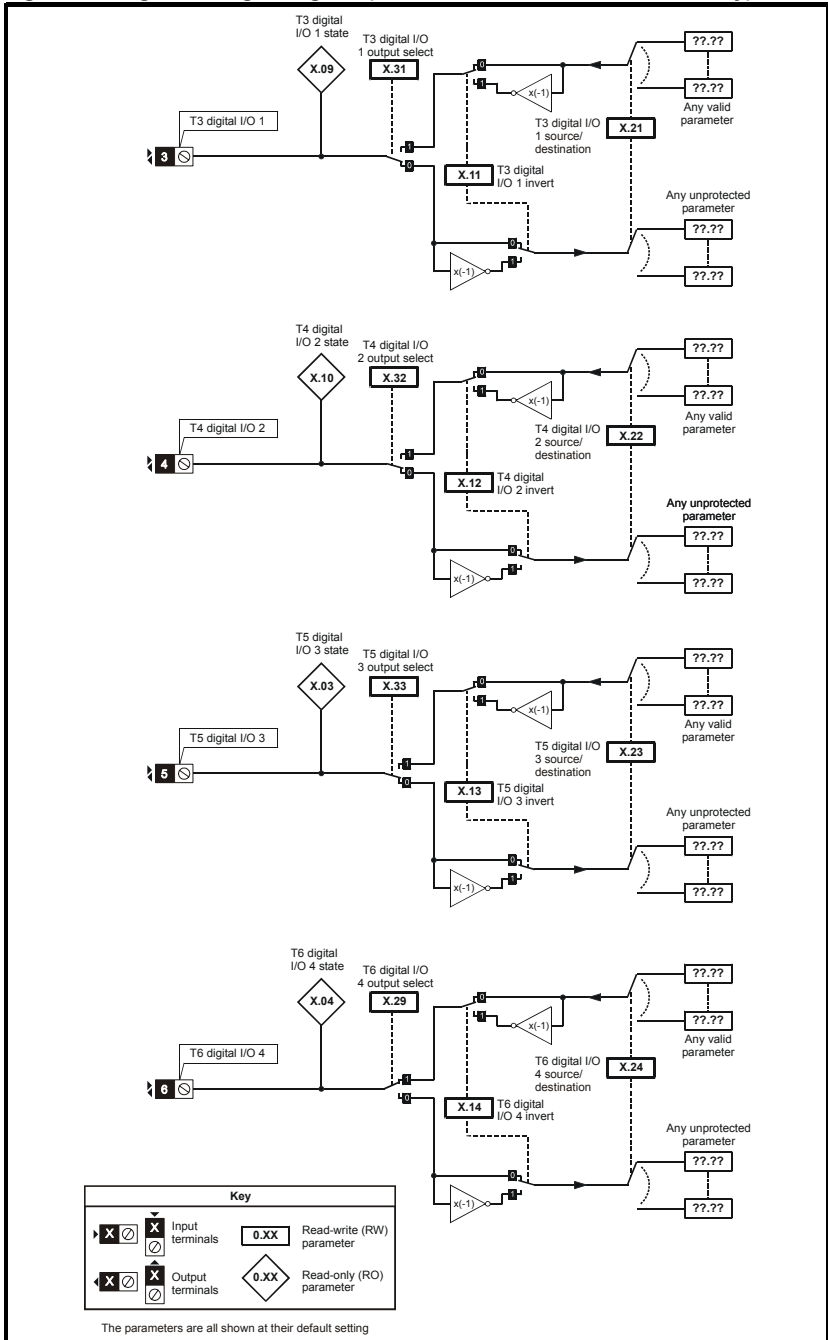
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**Key**

| Input terminals | Read-write (RW) parameter |
| Output terminals | Read-only (RO) parameter |

The parameters are all shown at their default setting

**Figure 5-2 Digital I/O logic diagram (Commander SK only)**



The parameters are all shown at their default setting

**Figure 5-3  Digital input logic diagram**

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**Figure 5-4  Relay logic diagram**



Relay 1 indicator — X.08

Relay 1 invert — X.18

Relay 1 source — X.28

Any bit or integer parameter — ??.??   ??.??

Relay 1 — 14, 15 — 0V

Relay 1 indicator — X.40

Relay 1 invert — X.42

Relay 1 source — X.43

Any bit or integer parameter — ??.??   ??.??

Relay 2 — 16, 17 — 0V

**Key**

| X | Input terminals | 0.XX | Read-write (RW) parameter |
| X | Output terminals | 0.XX | Read-only (RO) parameter |

The parameters are all shown at their default setting

**Figure 5-5 Analogue output logic diagram (Unidrive SP / Commander GP20 only)**

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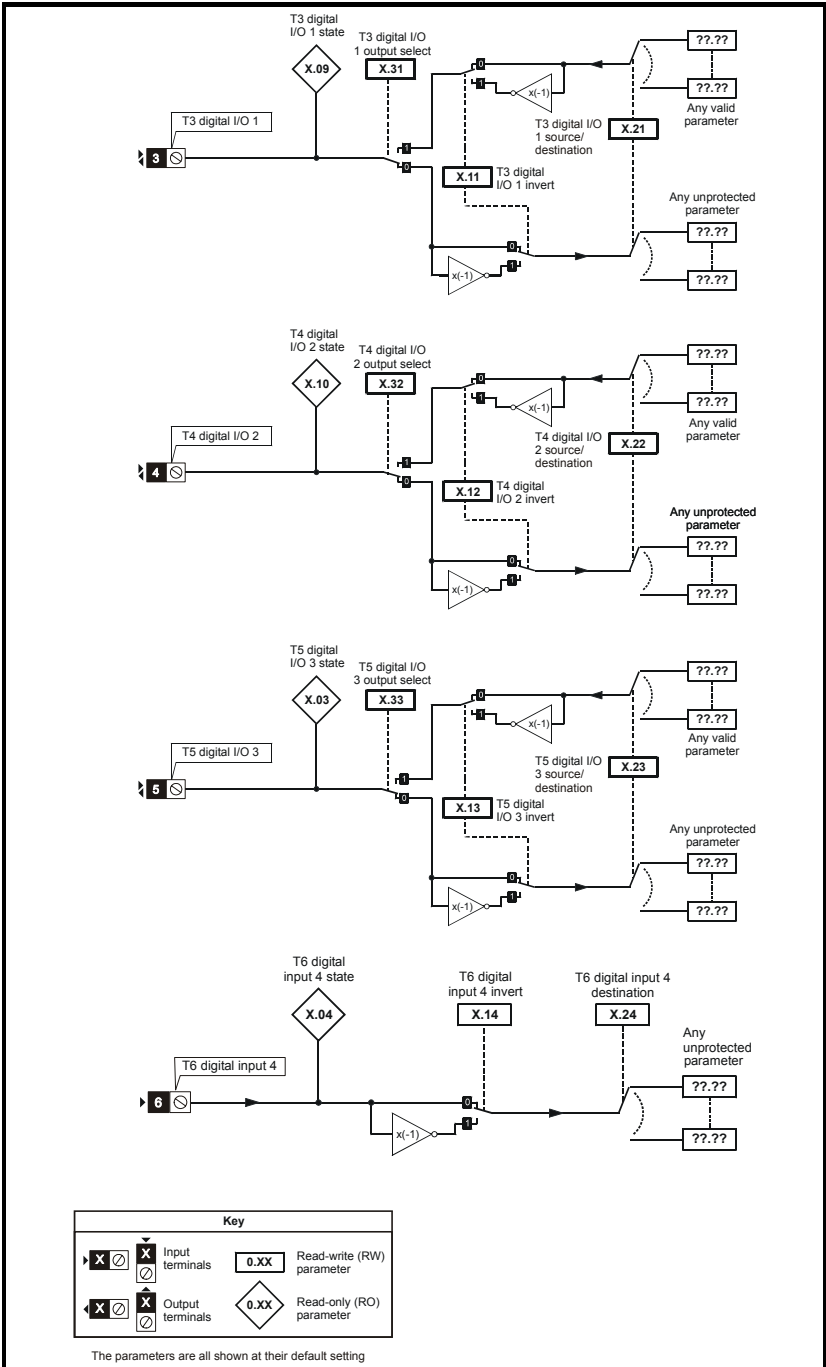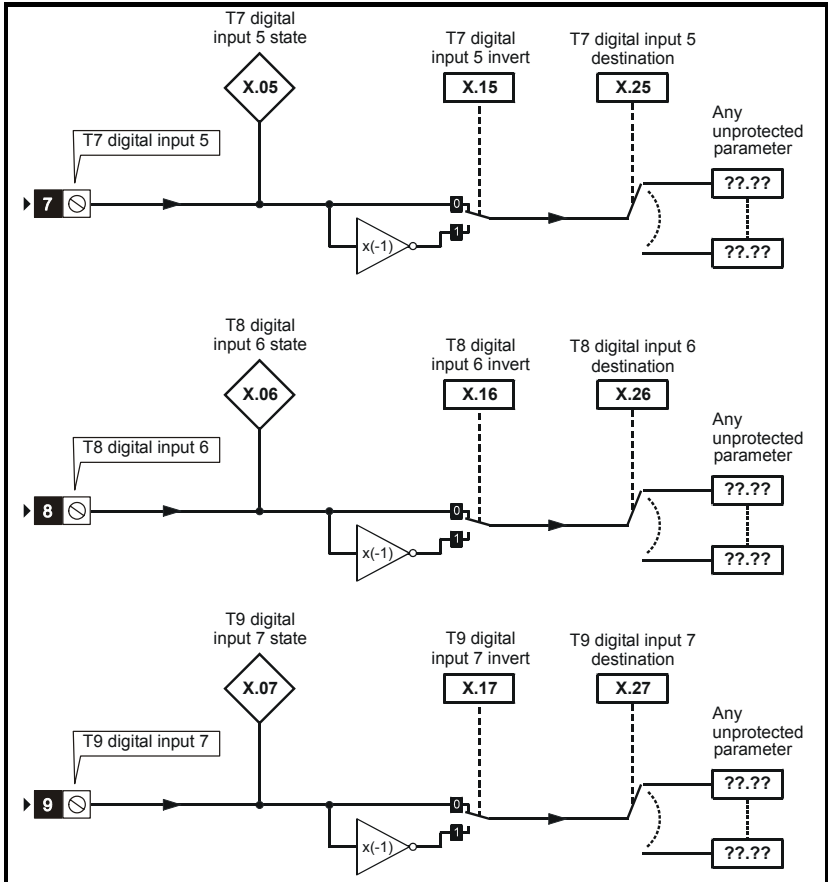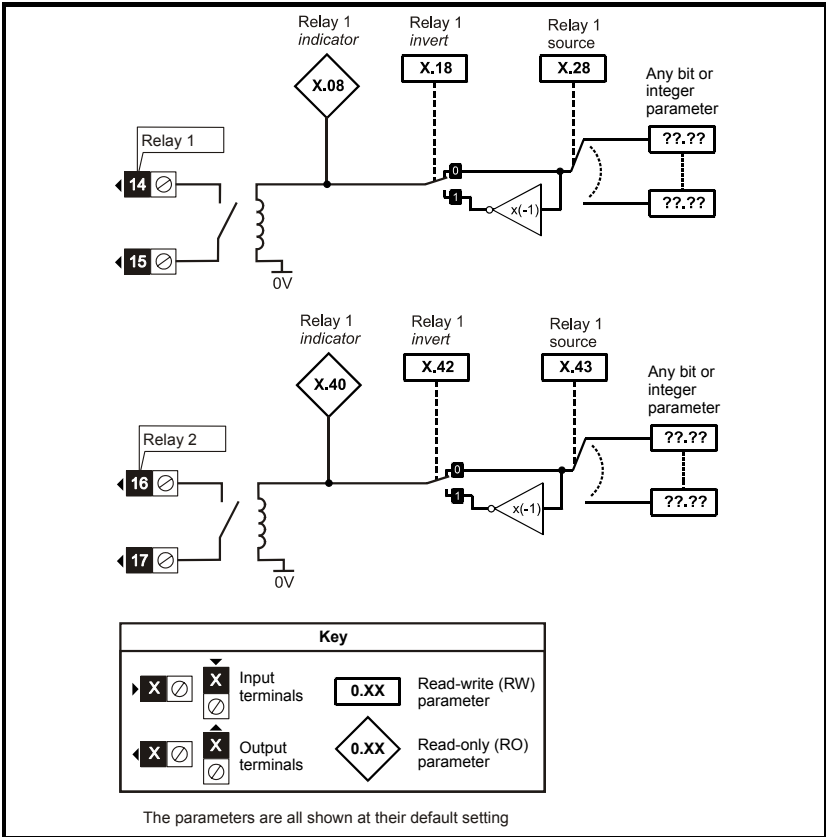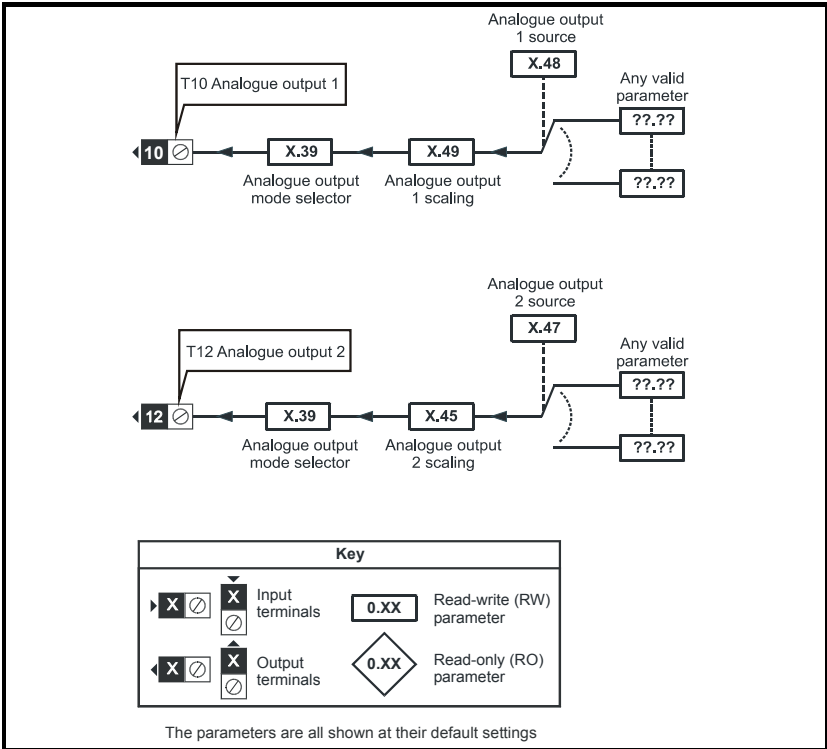**Figure 5-6  Analogue output logic diagram (Commander SK only)**



The parameters are all shown at their default settings
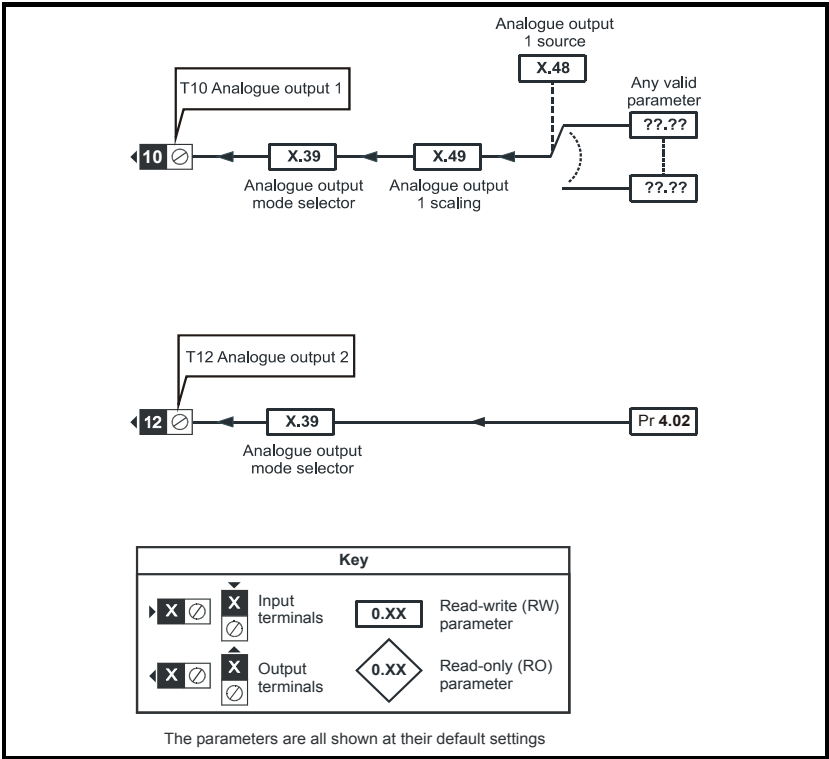
## 5.4 Parameter descriptions

| x.01 | Option ID code | | | | | | | | |
|------|------|------|------|------|------|------|------|------|------|
| RO | Uni | | | | | | PT | US | |

| ⇕ | 0 to 599 | ⇨ | |
|---|---|---|---|

| Update rate: Write on power-up |
|---|

On Unidrive SP / Commander GP20 the menu for the relevant slot appears for the new Solutions Module category with the default parameter values for the new category. For Commander SK it 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.

| Code | Solutions Module | Category | Dumb module | Compatibility | | |
|------|------------------|----------|-------------|--------|-----------|---------|
| | | | | Uni SP | Comm GP20 | Comm SK |
| 0 | No Solutions 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 | | | ✓ | ✓ | ✓ |
| 205 | SM-I/O 24V Protected | | | ✓ | ✓ | ✓ |
| 206 | SM-I/O 120V | | | ✓ | ✓ | ✓ |
| 207 | SM-I/O Lite | | | ✓ | ✓ | ✓ |
| 301 | SM-Applications | | | ✓ | | |
| 302 | SM-Application Lite | | | ✓ | | |
| 303 | SM-EZMotion | | | ✓ | | |
| 401 | reserved | Fieldbus | | ✓ | | |
| 402 | reserved | | | ✓ | | |
| 403 | SM-Profibus DP | | | ✓ | ✓ | ✓ |
| 404 | SM-Interbus | | | ✓ | ✓ | ✓ |
| 405 | reserved | | | ✓ | | |
| 406 | SM-CAN | | | ✓ | ✓ | |
| 407 | SM-DeviceNet | | | ✓ | ✓ | ✓ |
| 408 | SM-CANopen | | | ✓ | ✓ | ✓ |
| 409 | SM-SERCOS | | | ✓ | | |
| 410 | SM-Ethernet | | | ✓ | ✓ | ✓ |
| 501 | SM-SLM | Feedback | | ✓ | | |

**Unidrive SP / 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 (or 1001 in the case of solely using the 24V back-up power supply) 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.

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**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 to 99.99 | | | ⇨ | | | | | |
| Update rate: Write on power-up | | | | | | | | | |

This module contains two processors, and thus two software versions. Pr **x.02** shows the version number of the main module processor. Pr **x.51**, which is normally used to give a sub-version number, shows the software version in the slave processor.

| x.03 | T5 digital I/O 3 state | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| x.04 | T6 digital I/O 4 state* | | | | | | | | |
| x.05 | T7 digital input 5 state | | | | | | | | |
| x.06 | T8 digital input 6 state | | | | | | | | |
| x.07 | T9 digital input 7 state | | | | | | | | |
| x.08 | Relay 1 state | | | | | | | | |
| x.09 | T3 digital I/O 1 state | | | | | | | | |
| x.10 | T4 digital I/O 2 state | | | | | | | | |
| RO | Bit | | | | | NC | PT | | |
| ⇕ | OFF (0) or On (1) | | | ⇨ | | | | | |
| Update rate: 4ms write | | | | | | | | | |

These parameters indicate the input and output states of the terminals.

*Digital output 4 is not available with Commander SK.

**NOTE** The update rates stated are when used with Unidrive SP / Commander GP20.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **x.11** | **T3 digital I/O 1 invert** | | | | | | | | |
| **x.12** | **T4 digital I/O 2 invert** | | | | | | | | |
| **x.13** | **T5 digital I/O 3 invert** | | | | | | | | |
| **x.14** | **T6 digital I/O 4 invert\*** | | | | | | | | |
| **x.15** | **T7 digital input 5 invert** | | | | | | | | |
| **x.16** | **T8 digital input 6 invert** | | | | | | | | |
| **x.17** | **T9 digital input 7 invert** | | | | | | | | |
| **x.18** | **Relay 1 invert** | | | | | | | | |
| RW | Bit | | | | | | | US | |
| ⇕ | OFF (0) or On (1) | | | ⇨ | | OFF (0) | | | |
| Update rate: 4ms read | | | | | | | | | |

\*Digital output 4 is not available with Commander SK.

Setting these parameters to On(1) causes the input sense to the destination parameter to be inverted or the output sense from the source to be inverted.

| **x.20** | **Digital I/O read word** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| RO | Uni | | | | | NC | PT | US |
| ⇕ | 0 to 255 | | | ⇨ | | | | |
| Update rate: 500μs write | | | | | | | | |

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 | Parameter | Bit Update Rate Input/Output\* |
|---|---|---|---|
| 0 | T3 (Digital I/O 1) | Pr **x.09** | 500μs / 4ms |
| 1 | T4 (Digital I/O 2) | Pr **x.10** | 500μs / 4ms |
| 2 | T5 (Digital I/O 3) | Pr **x.03** | 500μs / 4ms |
| 3 | T6 (Digital I/O 4)\*\* | Pr **x.04** | 500μs / 4ms |
| 4 | T7 (Digital input 5) | Pr **x.05** | 500μs / - |
| 5 | T8 (Digital input 6) | Pr **x.06** | 500μs / - |
| 6 | T9 (Digital input 7) | Pr **x.07** | 500μs / - |
| 7 | T14 / T15 (Digital output 8 relay) | Pr **x.08** | - / 4ms |

\*Update rates when used with Unidrive SP / Commander GP20.

\*\*Digital input 4 state only with Commander SK.

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| x.21 | T3 digital I/O 1 source/destination | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| x.22 | T4 digital I/O 2 source/destination | | | | | | | |
| x.23 | T5 digital I/O 3 source/destination | | | | | | | |
| x.24 | T6 digital I/O 4 source/destination* | | | | | | | |
| x.25 | T7 digital input 5 destination | | | | | | | |
| x.26 | T8 digital input 6 destination | | | | | | | |
| x.27 | T9 digital input 7 destination | | | | | | | |
| x.28 | Relay 1 source | | | | | | | |
| RW | Uni | | DE | | | | US | |
| ⇕ | Pr **0.00** to Pr **21.51** | | | ⇨ | | Pr **0.00** | | |
| Update rate: Read on drive reset | | | | | | | | |

*Digital input 4 destination only with Commander SK.

Source parameters define the parameter to be represented by the digital output terminal.

Destination parameters define the parameter each of the programmable inputs is to control.

| x.29* | T6 digital I/O 4 output select | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| RW | Bit | | | | | | US | |
| ⇕ | OFF (0) or On (1) | | | ⇨ | | On (1) | | |
| Update rate: Background read | | | | | | | | |

**\*Parameter not available with Commander SK (T6 is a digital input only).**

This parameter selects the function of terminal T6 as follows:

OFF (0) = digital input
On (1)   = digital output

| x.31 | T3 digital I/O 1 output select | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| x.32 | T4 digital I/O 2 output select | | | | | | | |
| x.33 | T5 digital I/O 3 output select | | | | | | | |
| RW | Bit | | | | | | US | |
| ⇕ | OFF (0) or On (1) | | | ⇨ | | OFF (0) | | |
| Update rate: Background read | | | | | | | | |

These parameters select the function of terminals T3 to T5 as follows:

OFF (0) = digital input
On  (1)  = digital output

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| **x.39** | **Analogue output mode** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| RW | Uni | | | | | | | US | |
| ↕ | 0-20, 20-0, 4-20, 20-4 | | | ⇨ | 0-20 | | | | |
| Update rate: Background read | | | | | | | | | |

This parameter sets the output mode for terminals 10 and 12 as follows:

| Parameter value | Parameter string | Mode |
|---|---|---|
| 0 | 0-20 | 0-20mA |
| 1 | 20-0 | 20-0mA |
| 2 | 4-20 | 4-20mA |
| 3 | 20-4 | 20-4mA |
| 4* | VoLt | Not useable |

*Only with Commander SK and not useable.

| **x.40** | **Relay 2 state** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| RO | Bit | | | | | NC | PT | | |
| ↕ | OFF (0) or On (1) | | | ⇨ | | | | | |
| Update rate: 4ms write | | | | | | | | | |

| **x.42** | **Relay 2 invert** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| RW | Bit | | | | | | | US | |
| ↕ | OFF (0) or On (1) | | | ⇨ | OFF (0) | | | | |
| Update rate: 4ms read | | | | | | | | | |

| **x.43** | **Relay 2 source** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| RW | Uni | | DE | | | | | US | |
| ↕ | Pr **0.00** to Pr **21.51** | | | ⇨ | Pr **0.00** | | | | |
| Update rate: 4ms read | | | | | | | | | |

| **x.45*** | **Analogue output 2 scaling** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| RW | Uni | | | | | | | US | |
| ↕ | 0.000 to 4.000 | | | ⇨ | 1.000 | | | | |
| Update rate: Background read | | | | | | | | | |

**\*Parameter not available with Commander SK.**

This parameter can be used to scale the analogue output if so desired

| x.47* | | Analogue output 2 source | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | Uni | | | | | | | | US | |
| ⇕ | | Pr **0.00** to Pr **21.51** | | ⇨ | | Pr **0.00** | | | | |
| Update rate: Read on reset | | | | | | | | | | |

**\*Parameter not available with Commander SK (Analogue output 2 is a load output only [Pr 4.02]).**

The parameter required to be represented as an analogue signal by the analogue output on terminal 12, should be programmed into this parameter.

| x.48 | | Analogue output 1 source | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | Uni | | | | | | | | US | |
| ⇕ | | Pr **0.00** to Pr **21.51** | | ⇨ | | Pr **0.00** | | | | |
| Update rate: Read on reset | | | | | | | | | | |

The parameter required to be represented as an analogue signal by the analogue output on terminal 10, should be programmed into this parameter.

| x.49 | | Analogue output 1 scaling | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RW | Uni | | | | | | | | US | |
| ⇕ | | 0.000 to 4.000 | | ⇨ | | 1.000 | | | | |
| Update rate: Background read | | | | | | | | | | |

This parameter can be used to scale the analogue output if so desired.

| 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' trip, where x is the slot number (SL.Er 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 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.

| NOTE | If the PCB temperature exceeds 90°C on the Commander SK, the fan will operate at full speed for a minimum of 20s.

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| **x.51** | | **Solutions Module software sub-version** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RO | Uni | | | | | NC | PT | | |
| ⇕ | | 0 to 99 | | ⇨ | | | | | |
| Update rate: Write on power-up | | | | | | | | | |

This module contains two processors, and thus two software versions. Pr **x.02** shows the version number of the main module processor. Pr **x.51**, which is normally used to give a sub-version number, shows the software version in the slave processor.

# 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 / Commander GP20 trip descriptions* on page 34 and section 6.3 *Commander SK trip descriptions* on page 35 based on the trip indication shown on the drive display. Refer to Figure 6-1 for Unidrive SP / Commander GP20 and Figure 6-3 for Commander SK.

If a display is not used on the Unidrive SP / Commander GP20, 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 / Commander GP20

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 / Commander GP20 trip descriptions* on page 34 is the value transmitted.

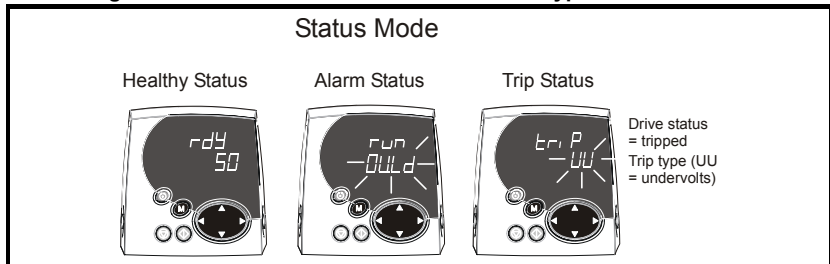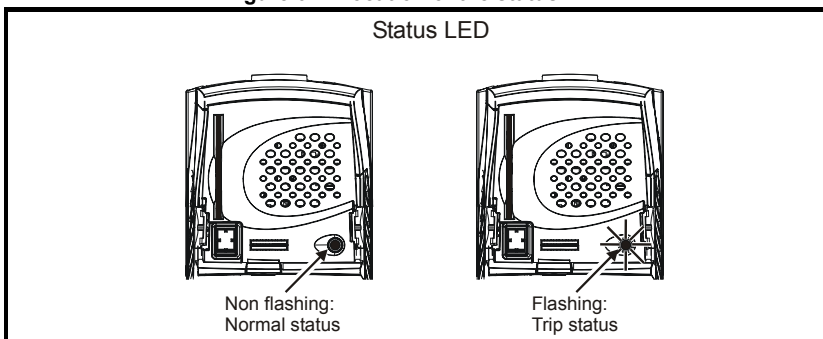**Figure 6-1  Unidrive SP / Commander GP20 keypad status modes**

**Figure 6-2 Location of the status LED**



Status LED

Non flashing:
Normal status

Flashing:
Trip status

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.

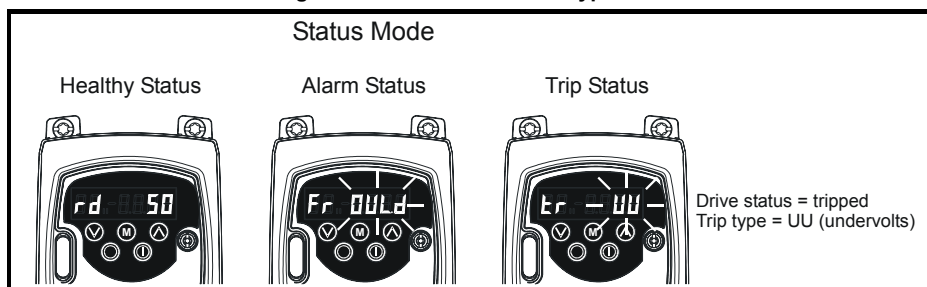A full list of drive trips can be found in the *Unidrive SP User Guide / Commander GP20 User Guide.*

### 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 35 is the value transmitted.

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



Status Mode

Healthy Status

Alarm Status

Trip Status

Drive status = tripped
Trip type = UU (undervolts)

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.*

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## 6.2 Unidrive SP / Commander GP20 trip descriptions

| Trip no. | String | Diagnosis |
|---|---|---|
| 200, 205, 210 | SLX.HF | **Solutions Module hardware fault**<br>Ensure Solutions Module is fitted correctly<br>Return Soltutions Module to supplier |
| 201, 206, 211 | SLX.tO | **Solutions Module watchdog time-out**<br>Press reset<br>If the trip persists, contact the supplier of the drive |
| 202, 207, 212 | SLX.Er | **Error detected with Solutions Module where X is the slot number**<br><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 outputs overloaded</td></tr><tr><td>2</td><td>Digital inputs overloaded</td></tr><tr><td>3</td><td>Communications Error</td></tr><tr><td>74</td><td>Solutions Module over temperature (>100°C)</td></tr></table> |
| 203, 208, 213 | SLX.nF | **Solutions Module has been removed**<br>Ensure Solutions Module is fitted correctly<br>Save parameters and reset drive<br>Replace Solutions Module |
| 204, 209, 214 | SLX.dF | **Solutions Module fitted in slot X has changed**<br>Save parameters and reset |
| 215 | SL.rtd | **Drive mode has changed and Solutions Module parameter routing is now incorrect**<br>Press reset<br>If the trip persists, contact the supplier of the drive |

For further information on the above trips, see the Diagnostics section of the *Unidrive SP User Guide or the Commander GP20 User Guide*.

## 6.3 Commander SK trip descriptions

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| Trip no. | String | Diagnosis |
|---|---|---|
| 200 | SL.HF | **Solutions Module hardware fault**<br>Ensure Solutions Module is fitted correctly<br>Return Solutions Module to supplier |
| 201 | SL.tO | **Solutions Module watchdog time-out**<br>Press reset<br>If the trip persists, contact the supplier of the drive |
| 202 | SL.Er | **Error detected with Solutions Module** |

| Pr x.50 | Fault description |
|---|---|
| 0 | No errors |
| 1 | Digital outputs overloaded |
| 2 | Digital inputs overloaded |
| 3 | Communications Error |
| 74 | Solutions Module over temperature (>100°C) |

| Trip no. | String | Diagnosis |
|---|---|---|
| 203 | SL.nF | **Solutions Module has been removed**<br>Ensure Solutions Module is fitted correctly<br>Replace Solutions Module |
| 204 | SL.dF | **Solutions Module fitted has changed**<br>Power down and back up |

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

# 7 Terminal specification

**NOTE** Digital inputs are positive logic only.

| 1 | 0V |
|---|----|

| 2 | 0V |
|---|----|

| 3 | **Digital I/O 1** |
|---|-------------------|
| 4 | **Digital I/O 2** |
| 5 | **Digital I/O 3** |
| 6 | **Digital I/O 4*** |

| Type | Programmable positive logic digital input or output |
|------|-----------------------------------------------------|
| **Operating as an input** | |
| Absolute maximum voltage range | +60V (drive trip generated when input exceeds +35V) -30V |
| Load | >2mA @ 15Vdc |
| Input switching threshold | 10V ±0.8V |
| **Operating as an output** | |
| Maximum output current | 40mA |
| Total of all 4 outputs | 40mA |
| Output voltage when servicing 10mA | 20.5V to 27V |
| Typical input current @ 15V | 2.8mA |
| Typical input current @ 5V | 0.9mA |

| 7 | **Digital input 5** |
|---|---------------------|
| 8 | **Digital input 6** |
| 9 | **Digital input 7** |

| Type | Positive logic digital input |
|------|------------------------------|
| Absolute maximum voltage range | +60V (drive trip generated when input exceeds +35V) -30V |
| Load | >2mA @ 15Vdc |
| Input switching threshold | 10V to ±0.8V |
| Typical input current @ 15V | 2.8mA |
| Typical input current @ 5V | 0.9mA |

*Digital input 4 only with Commander SK.

| 10 | **Analogue output 1** |
|----|-----------------------|

| Type of output | Unipolar current source |
|----------------|-------------------------|
| Current range | 0-20, 20-0, 4-20, 20-4 (mA) |
| Maximum offset (0Ω load) | ±1mA typical |
| Maximum output voltage for stated accuracy | 12V |
| Maximum load resistance | 600Ω |
| Resolution | 12 bits |
| Scale accuracy | 5% |

| 11 | 0V |
|----|----|

| 12 | Analogue output 2 | |
|----|-------------------|---|
| Type of output | | Unipolar current source |
| Current range | | 0-20, 20-0, 4-20, 20-4 (mA) |
| Maximum offset (0Ω load) | | ±1mA typical |
| Maximum output voltage for stated accuracy | | 12V |
| Maximum load resistance | | 600Ω |
| Resolution | | 12 bits |
| Scale accuracy | | 5% |

| 13 | 0V |
|----|----|

| 14 | Relay 1 contact 1 | |
|----|-------------------|---|
| 15 | Relay 1 contact 2 | Normally open contacts |
| 16 | Relay 2 contact 1* | |
| 17 | Relay 2 contact 2* | |
| Contact rating | | 2A AC 50Vrms<br>6A DC 30V resistive load (1.5A DC 60V for UL requirement)<br>0.3A DC 50V inductive load (L/R = 40ms) |
| Contact minimum recommended rating | | 12V 100mA |

*Not on Commander SK

⚠ **WARNING**

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

⚠ **WARNING**

The relay contacts give galvanic isolation from all other drive circuits. They do not provide additional safety isolation from other circuits on the Solutions Module.

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# 8    Protection

## 8.1    E.M.C immunity

The Solutions Module must not be damaged and performance must not be adversely affected.

**Fast transient burst EN61000-4-4**

2.2kV 5ns/50ns @ 5kHz 15ms burst duration and 300ms burst interval, 2kV wire clamp.

**RF Common mode**

**ENV 50141**

150kHz - 80MHz @ 10V + 20%

**ENV 50140**

80MHz - 1000MHz @ 10V + 20%

## 8.2    Incorrect wiring

Digital inputs / Digital IO can withstand + 60V with respect to the user terminal 0V. A drive trip is generated when the input voltage exceeds +35V.

Other terminals can withstand indefinitely without damage or degradation ±36V with respect to the user terminal 0V (user 0V or drive 0V) when the drive is powered, unpowered and during the transitions.

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