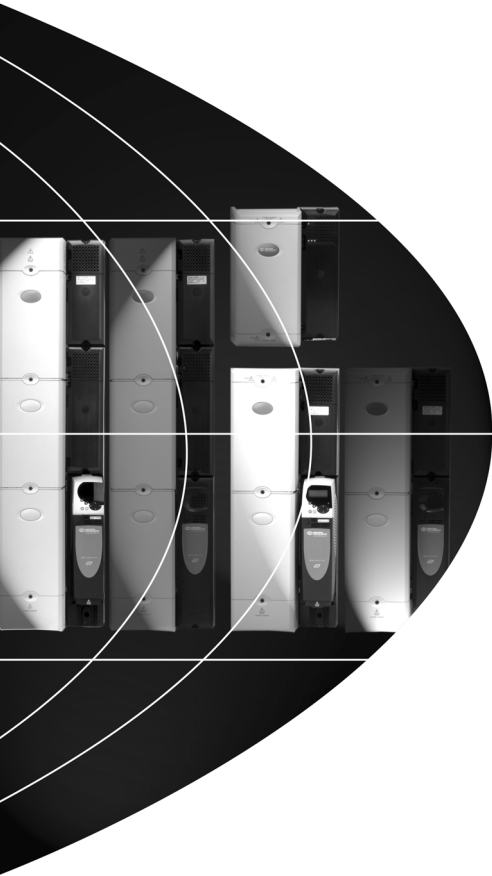




EMERSON[™]
Industrial Automation



Installation Guide

SPM Power Selector Module

Part Number: 0471-0144-02

Issue Number: 2



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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.

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<http://www.controltechniques.com/REACH>

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Issue Number: 2

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Declaration of Conformity

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The SPM Power Selector Module as described in this manual has been designed and manufactured in accordance with the following European harmonized standards:

EN 61800-5-1:2007	Adjustable speed electrical power drive systems - safety requirements - electrical, thermal and energy
EN 61800-3:2004	Adjustable speed electrical power drive systems. EMC product standard including specific test methods
EN 61000-6-2:2005	Electromagnetic compatibility (EMC). Generic standards. Immunity standard for industrial environments
EN 61000-6-4:2007	Electromagnetic compatibility (EMC). Generic standards. Emission standard for industrial environments
EN 61000-3-2:2006	Electromagnetic compatibility (EMC), Limits, Limits for harmonic current emissions (equipment input current <16A per phase)
EN 61000-3-3:2008	Electromagnetic compatibility (EMC), Limits, Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current <16A

EN 61000-3-2:2006 Applicable where input current <16A. No limits apply for professional equipment where input power >1kW.

These products comply with the Low Voltage Directive 2006/95/EC and the Electromagnetic Compatibility (EMC) Directive 2004/108/EC.



T. Alexander
Executive VP Technology
Date: 8th June 2010

These electronic drive products are intended to be used with appropriate motors, controllers, electrical protection components and other equipment to form complete end products or systems. Compliance with safety and EMC regulations depends upon installing and configuring drives correctly, including using the specified input filters. The drives must be installed only by professional assemblers who are familiar with requirements for safety and EMC. The assembler is responsible for ensuring that the end product or system complies with all the relevant laws in the country where it is to be used. Refer to the User Guide. An EMC Data Sheet is also available giving detailed EMC information.

1 Safety information

1.1 Intended personnel

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

1.2 Information

This guide contains information covering the identification of the SPM Power Selector Module, control terminal layout for installation, connections for the SPM Power Selector Module to the Unidrive SPM, parameter details and diagnostic information.

1.3 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.

1.4 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 in the relevant places throughout this guide.

1.5 System design and safety of personnel

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

With the sole exception of the SAFE TORQUE OFF 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 behavior or through incorrect operation due to a fault. In any application where a malfunction of the drive or its control system could lead to or allow damage, loss or injury, a risk analysis must be carried out, and where necessary, further measures taken to reduce the risk - for example, an over-speed protection device in case of failure of the speed control, or a fail-safe mechanical brake in case of loss of motor braking.

The SAFE TORQUE OFF function has been approved by BGIA as meeting the requirements of the following standards, for the prevention of unexpected starting of the drive:

EN 61800-5-2:2007SIL 3

EN ISO 13849-1:2006PL e

EN 954-1:1997 Category 3

The SAFE TORQUE OFF function may be used in a safety-related application. The system designer is responsible for ensuring that the complete system is safe and designed correctly according to the relevant safety standards.

1.6 Environmental limits

Instructions 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.

1.7 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 ground (earth) connections. Within the European Union, all machinery in which this product is used must comply with the following directives:

2006/42/EC: Safety of machinery.

2004/108/EC: Electromagnetic Compatibility.

1.8 Motor

Ensure the motor is installed in accordance with the manufacturer's recommendations. Ensure the motor shaft is not exposed. The values of the motor parameters set in the drive affect the protection of the motor. The default values in the drive should not be relied upon. It is essential that the correct value is entered in Pr **0.46** Motor rated current. This affects the thermal protection of the motor.

1.9 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.

1.10 Electrical installation

1.10.1 Electric shock risk

The voltages present in the following locations can cause severe electric shock and may be lethal:

- AC supply cables and connections
- DC bus, dynamic brake cables and connections
- Output cables and connections
- Many internal parts of the drive, and external option units unless otherwise indicated, control terminals are single insulated and must not be touched.

1.10.2 Isolation device

The AC supply must be disconnected from the drive using an approved isolation device before any cover is removed from the drive or before any servicing work is performed.

2 Product information

2.1 Introduction

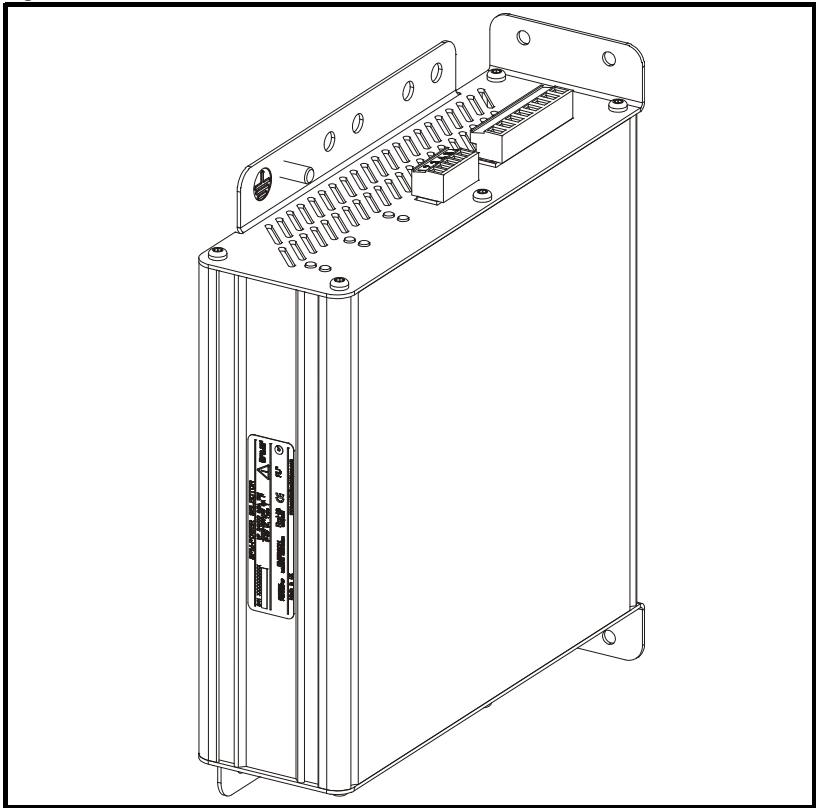
This installation guide provides complete information for installing and operating the SPM Power Selector Module. The SPM Power Selector Module is intended for use with Unidrive SPMA/D parallel drive systems.

The SPM Power Selector Module is an interface device that allows the user to easily connect or disconnect a Unidrive SPM module from a Unidrive SPM parallel drive system.

The SPM Power Selector Module can connect or disconnect the parallel cable connections between Unidrive SPM Power Modules and also provides relay outputs to allow switching of power contactors.

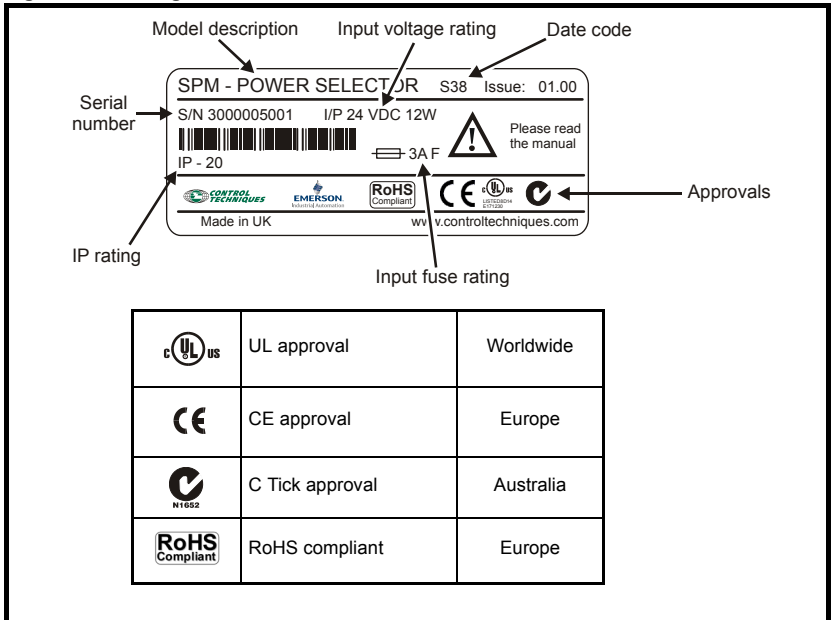
The SPM Power Selector Module can be considered as a multi way switch for the paralleling connections of Unidrive SPM Modules. The SPM Power Selector Module acts as a switch by connecting either the Master 1 or the Master 2 inputs to the slave output.

Figure 2-1 SPM Power Selector Module



2.2 Rating label

Figure 2-2 Rating label



2.2.1 Date code format

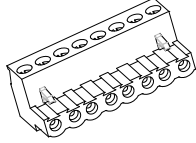
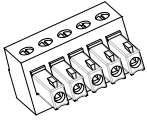


The date code is split into two sections: a letter followed by a number. The letter indicates the year and the number indicates the week in which the module was manufactured.

Example: A date code of S40 would correspond to week 40 of year 2009.

2.3 Items supplied with the module

The SPM Power Selector Module is supplied with a copy of the *SPM Power Selector Module User Guide* and a Kit box including the items shown in the table below.

Table 2-1 Items supplied with the SPM Power Selector Module

Description	Part / component	Quantity
Power/contactor connector		1
Control connector		1
M5 Lock nut		1
1m Paralleling cable		1

NOTE Mounting screws are not provided with the SPM Power Selector Module.

NOTE The SPM Power Selector Module is supplied with a 1m paralleling cable. Additional paralleling cables may be required depending on the application and the configuration method.

Paralleling cables are available in both 1m and 2m lengths, and may be purchased directly from Control Techniques.

Table 2-2 Ordering paralleling cables

Description	CT part number
1m paralleling cable	3471-9842
2m paralleling cable	3471-0013

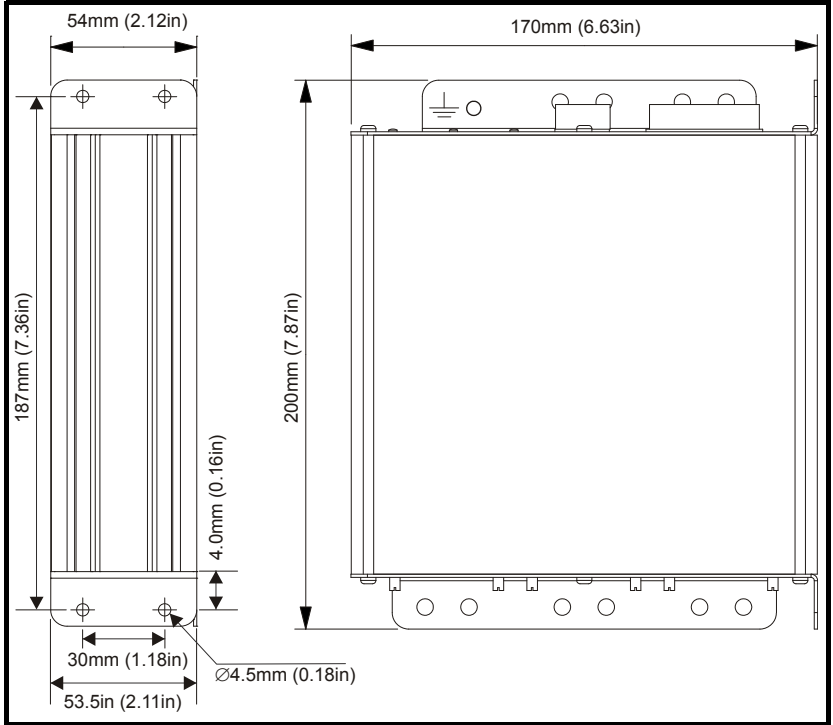
3 Mechanical installation

This chapter details the installation of the SPM Power Selector Module. The SPM Power Selector Module is intended for installation within an enclosure.

3.1 Dimensions and mounting holes

The SPM Power Selector Module is only suitable for surface mounting.

Figure 3-1 Mounting the SPM Power Selector Module

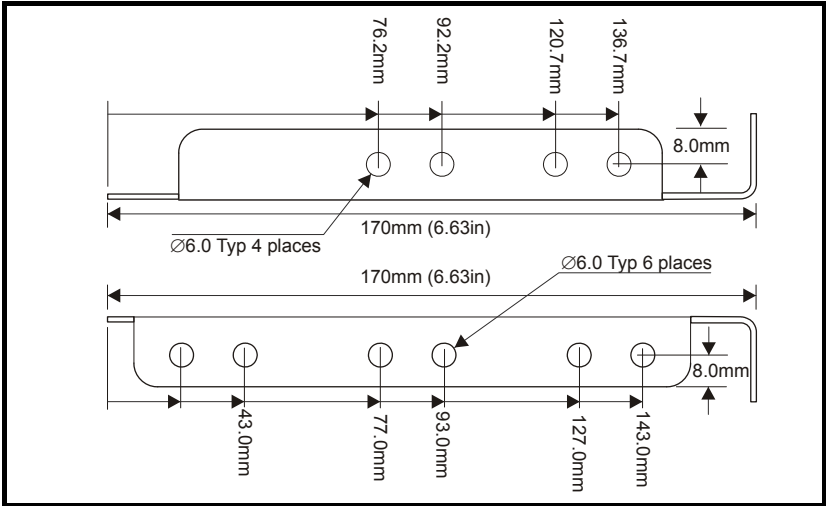


NOTE There are different sizes of through holes on the SPM Power Selector Module which are provided for various purposes. Table 3-1 below details the purpose of both hole sizes.

Table 3-1 Mounting hole identification

Hole size	Purpose	Position
4.5mm	Mounting	4
6mm	Cable management	10

Figure 3-2 Cable management hole detail

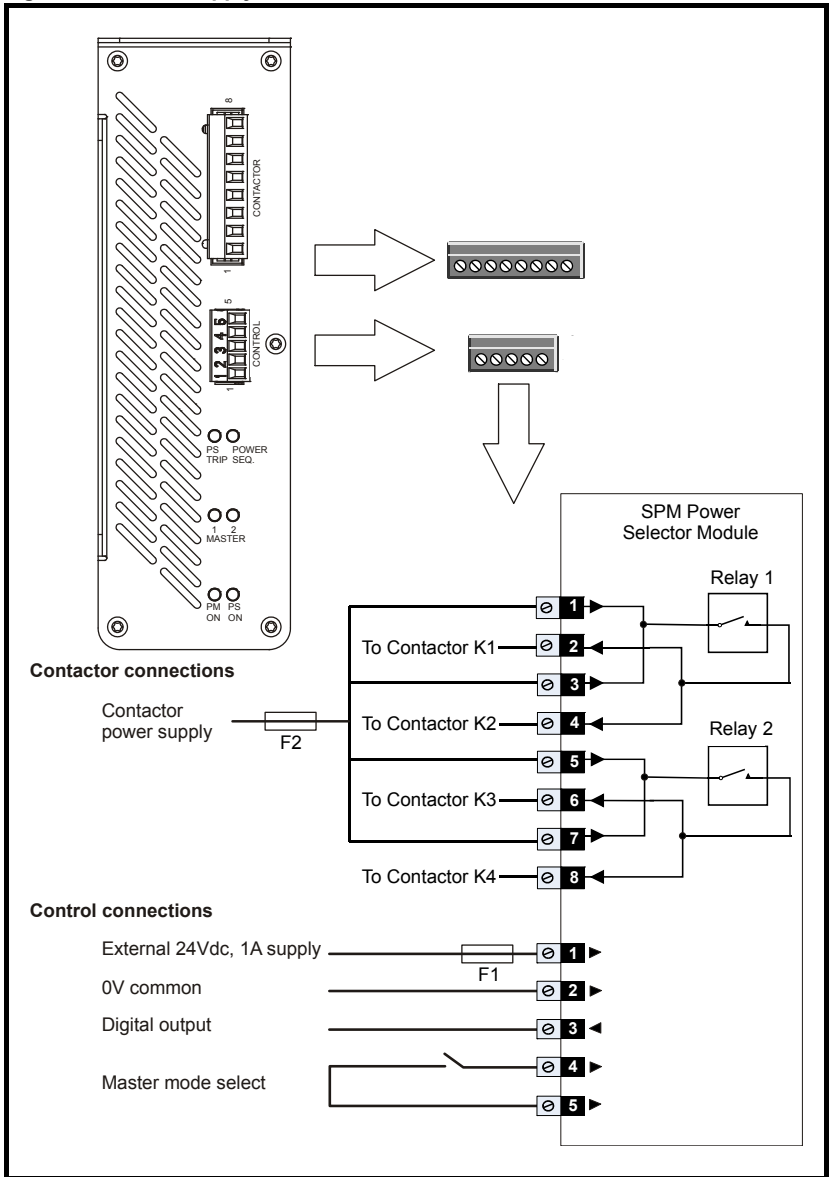



4 Electrical installation


4.1 SPM Power Selector Module


Figure 4-1 below shows the power supply and control connections for the SPM Power Selector Module.

Figure 4-1 Power supply and control connections



 The external 24Vdc supply to the SPM Power Selector Module must be provided with either a 3A fuse or other over-current protection device as specified in section 7.3 *Fusing* on page 29.

 Provide a fuse or other over-current protection device in the contactor relay circuit with a rating not greater than that specified in section 7.3 *Fusing* on page 29.

 Do not attempt to carry out internal repairs. Return faulty units to the supplier for repair.

4.2 Terminal descriptions

Power supply and control connections to the SPM Power Selector Module are shown in Figure 4-2 and Table 4-1 below.

Figure 4-2 Control connections

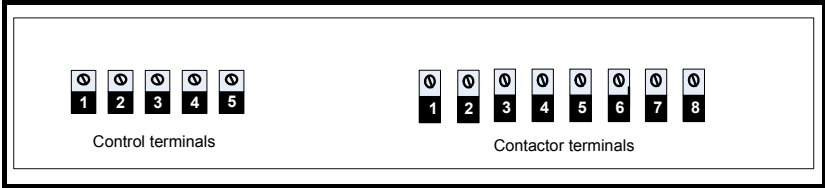


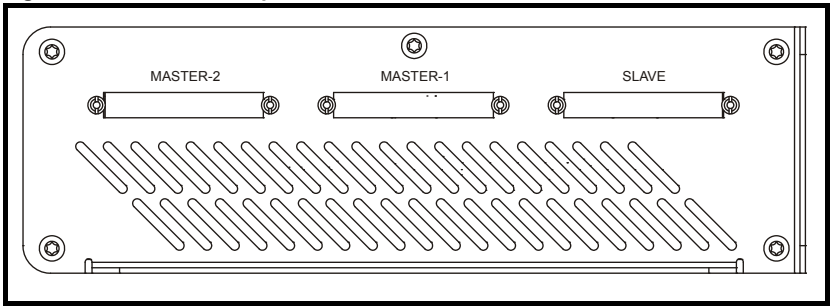
Table 4-1 Terminal connections

Contactor terminal	Function
1	Contactor 1+2 power supply
2	Contactor output 1
3	Contactor 1+2 power supply
4	Contactor output 2
5	Contactor 3+4 power supply
6	Contactor output 3
7	Contactor 3+4 power supply
8	Contactor output 4

Control	Function
1	+ 24 Vdc
2	0 Volt
3	Digital output
4	24V Master Mode Select
5	Master Mode Select

NOTE Refer to *Technical data* on page 28 for Terminal data on control terminals, contactor terminals and 24Vdc power supply requirements.

Figure 4-3 Master / slave parallel connections



4.3 SPM Power Selector Module control connections

As shown in Figure 4-1 on page 12, the SPM Power Selector Module requires an external 24Vdc power supply. The recommended power supply rating is detailed in section 7 *Technical data* on page 28.

NOTE The recommended 24Vdc power supply fuse (F1) is 3A, 50Vdc. This information is listed on the SPM Power Selector rating label.

A digital output (control terminal 3) is available from the SPM Power Selector Module. This goes active high when Master 2 is selected. This digital output can be connected to a digital input on the drive or Solutions Module to pass the selected operating mode.

A switch is required between control terminals 4 and 5 on the SPM Power Selector Module to select between Master 1 and 2. When the switch is open, Master 1 (Parallel module operation) is selected. Master 1 indicator LED will be lit and relay contacts 5, 6 and 7, 8 are closed. When the switch is closed, Master 2 (Single module operation) is selected. Master 2 indicator LED will be lit and relay contacts 1, 2 and 3, 4 are closed.

NOTE The state of the switch connected between the control terminals 4 and 5 is only monitored at power up.

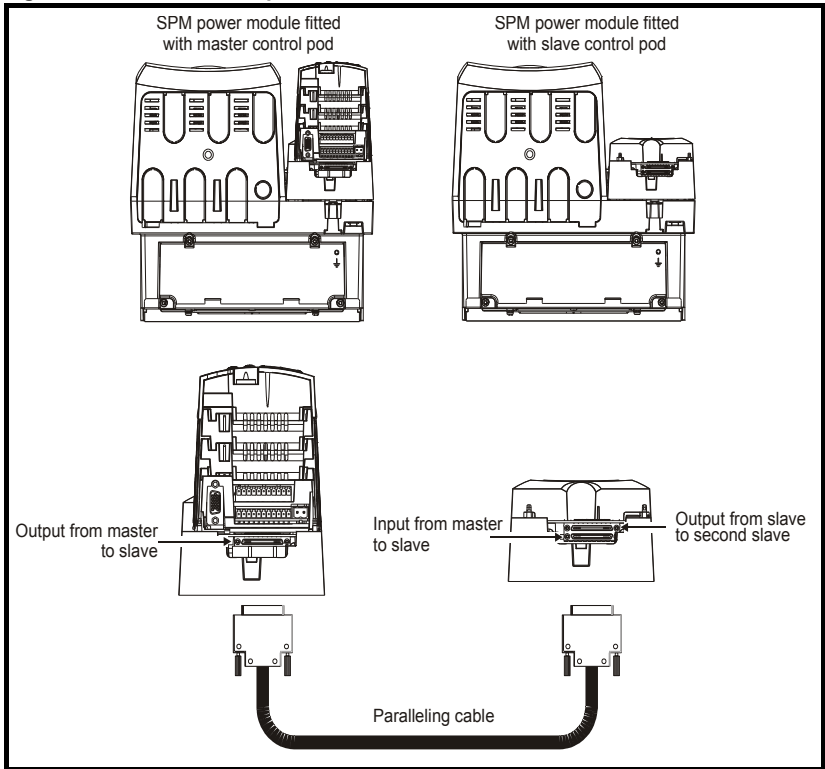
Table 4-2 Selection of operating modes

Control Terminals 4 and 5	Master selected	Digital output (Control terminal 3)	Relay 1 Contactor terminals 1 & 2 (K1) and 3 & 4 (K2)	Relay 2 Contactor terminals 5 & 6 (K3) and 7 & 8 (K4)
Open	1	0V	Open	Closed
Closed	2	24V	Closed	Open

4.3.1 Connecting the Parallel cables to SPM modules

The SPM parallel cables should be routed as shown in Figure 4-4 below. The screw locks on the parallel cable must be fully tightened.

Figure 4-4 Connection of parallel cables



Additional SPM paralleling cables may be required depending on the configuration or type of installation see section 2-2 *Ordering paralleling cables* on page 9 for details.

4.4

SPM Power Selector Module power connections

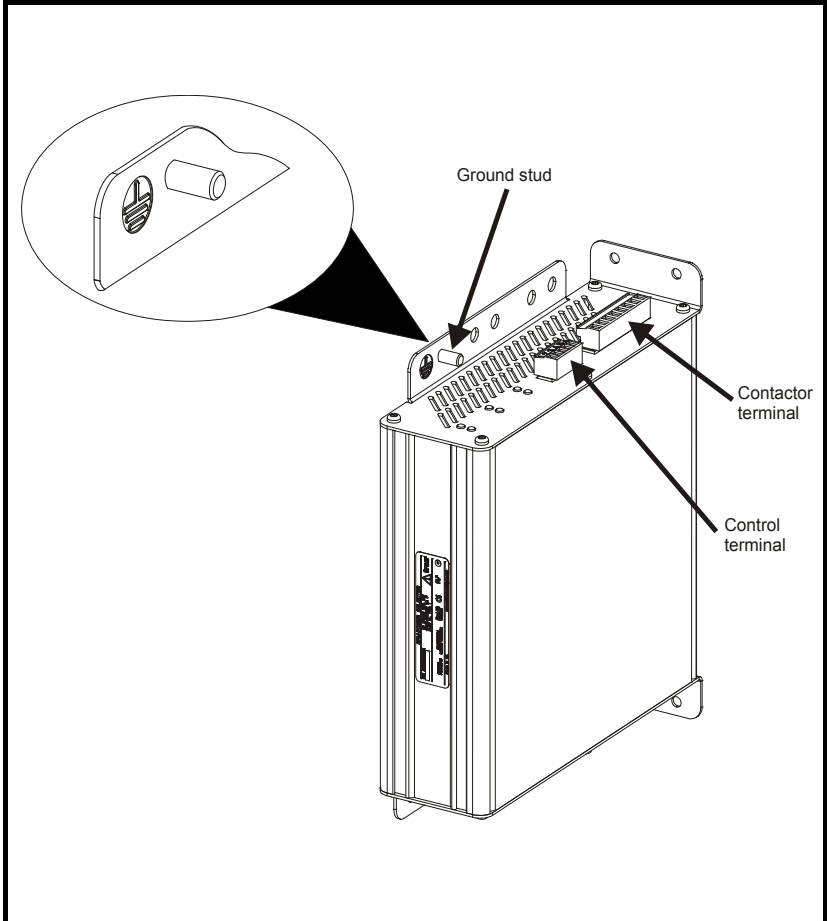
The output motor contactor should be selected based upon user defined maximum drive output rating.

It is strongly recommended that the power supply for the output motor contactor coils at input control terminals 1, 3, 5 and 7 on the SPM Power Selector Module should be protected with the appropriate fuse.

The output motor contactor terminals on the SPM Power Selector Module 2, 4, 6 & 8 are connected directly to the output motor contactor coils.

Ground connections to the SPM Power Selector Module should be made using the ground stud on the module as shown in Figure 4-5.

Figure 4-5 Contactor, control and ground connections



4.5 Operating status LEDs

There are six operating status LEDs on the top cover of the SPM Power Selector Module. Table 4-3 below provides the key for each LED indicator.

Figure 4-6 Operating status LEDs

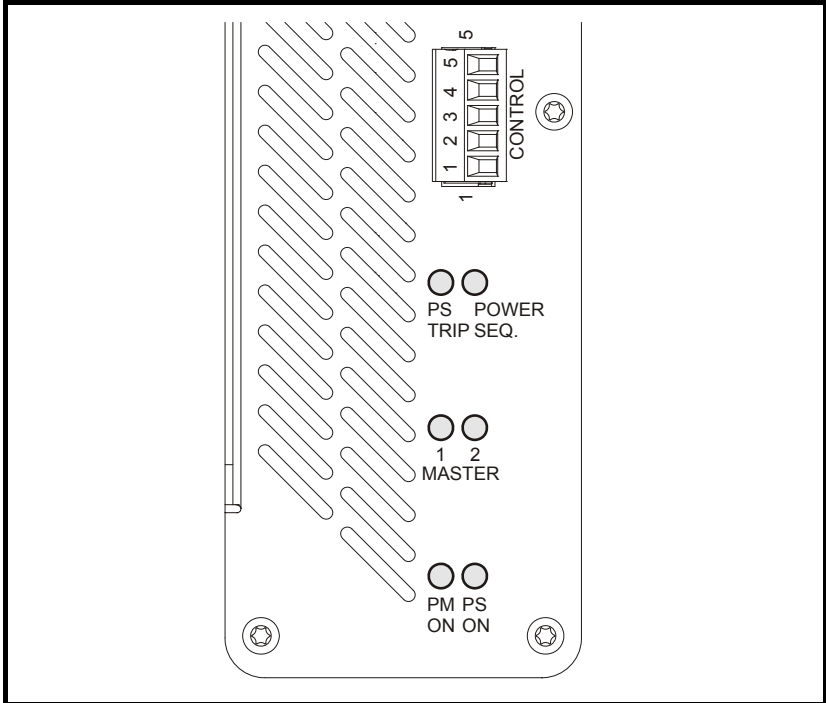


Table 4-3 Operating status LED indication

Label	Actual Indication
PS TRIP	24V supply to the SPM Power Selector is not available
POWER SEQ	Incorrect power up sequence
MASTER 1	Master 1 mode selected
MASTER 2	Master 2 mode selected
PM ON	Unidrive SPM Power Module on
PS ON	User 24V is available

4.6 Power cycling

4.6.1 Power up sequence

The 24V supply to the SPM Power Selector Modules must be applied before the Unidrive SPM power and control modules are powered up. Failure to do so will cause the 'POWER SEQ' LED to light on the SPM Power Selector and the Unidrive SPM will trip.

When the 24V supply is applied to the SPM Power Selector Module, the 'PS ON' LED will light along with either the 'Master 1' or 'Master 2' LED depending on the state of the 'Master mode select' input.

When the Unidrive SPM power modules are powered up, the 'PM ON' LED will light.

NOTE Unidrive SPM power and control modules along with the SPM Power Selector Module must be powered down when changing operating modes.

4.6.2 Power down sequence

Unidrive SPM power and control modules must be powered down before the SPM Power Selector Module.

4.6.3 Mode Select

When changing between operation modes (Master 1, Master 2) ensure that the Power and control modules along with the SPM Power Selector Modules are powered down during mode change.

4.7 SPM Power Selector Module configurations

SPM Power Selector Modules can be used in different configurations depending on the application. Examples of possible configurations are listed below.

The following should be noted prior to design and/or choosing a particular configuration.

NOTE A maximum of 10 SPM Power Modules may be paralleled. The combined length of all paralleling cables between the power modules and the SPM Power Selector Modules, must be no more than 20m in total. A 1m paralleling cable is supplied with the SPM Power Selector Module and a 2m paralleling cable is supplied with an SM Control Slave module.

NOTE For the SPM Power Selector to function correctly, the paralleling cables should be connected to the appropriate ports on the SPM Power Selector as shown in the block diagrams under each configuration.

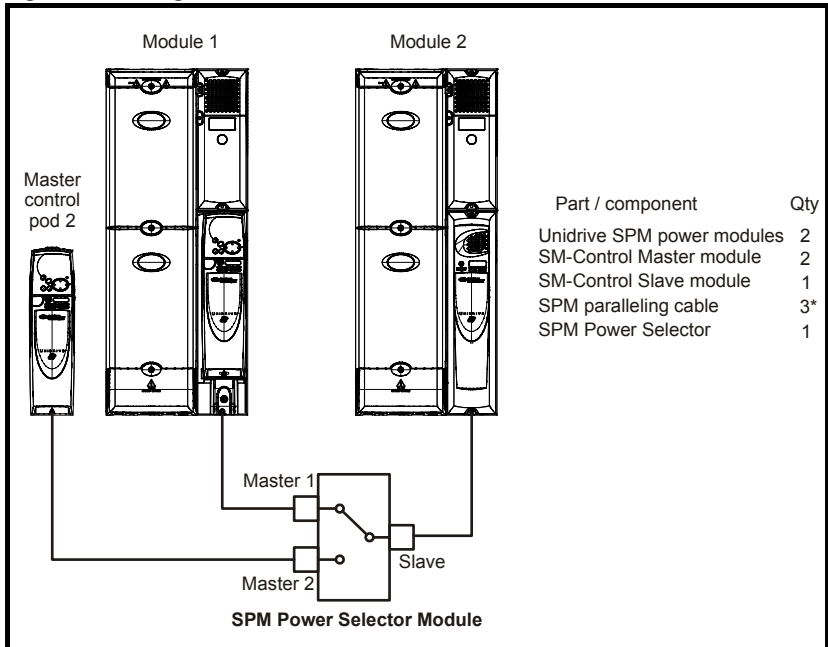
NOTE When installing paralleling cables between the SPM modules, the information given in section 4.3.1 *Connecting the Parallel cables to SPM modules* on page 15 should be adhered to.

4.7.1 Configuration 1

This configuration allows two Unidrive SPM drives to be connected to two separate motors or alternatively, will allow the drives to be paralleled together to run a larger motor.

For example as shown in Figure 4-7 and Figure 4-8, if drive 1 is connected to Motor 1 and drive 2 is connected to Motor 2, drive 1 and 2 can be paralleled together to run a larger motor (Motor 3).

Figure 4-7 Configuration 1



* An additional SPM paralleling cable will need to be obtained for this configuration, as each SM-Control Slave module and SPM Power Selector Module is supplied with one paralleling cable as standard.

Figure 4-8 SPM Power Selector Module with two SPM drives and three motors

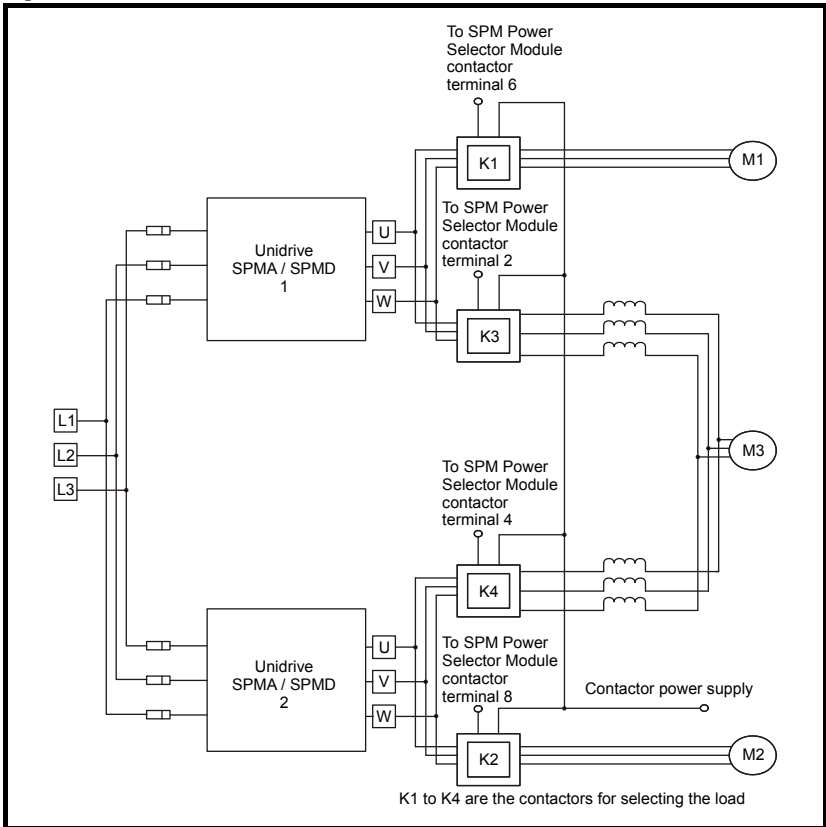


Figure 4-7 illustrates configuration 1, which comprises a single SPM Power Selector Module, two Unidrive SPM power modules and multiple motors. The drive output will be connected through output motor contactors, which are controlled by the contactor outputs on the SPM Power Selector Module.

The mode of operation (Master 1 or Master 2), is selected via the master mode select switch connected between control terminals 4 and 5 of the SPM Power Selector Module. When the Master Mode Select switch is open (OFF), Master 1 is selected providing parallel operation of the power modules with Motor M3 connected. When the switch is closed (ON), Master 2 mode is selected, enabling single module operation of the power modules with motors M2 and M1 connected.

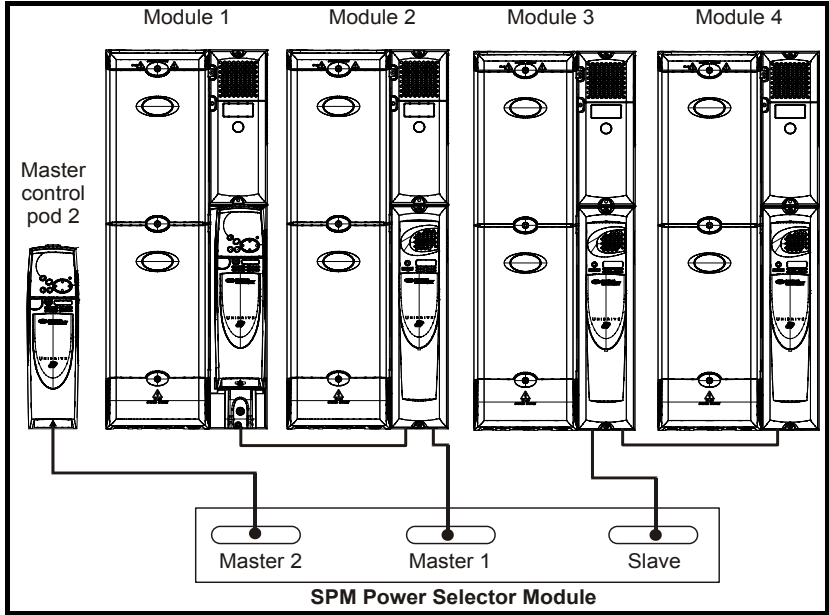
NOTE SPM power and control modules along with the SPM Power Selector Module must be powered down, when changing operating modes.

Table 4-4 Selection of operating modes

Master Mode Select Switch	Selected Mode	Mode of Operation
Open	Master 1	Parallel Operation of Power Modules Contactors K3 and K4 are Closed Motor M3 Selected
Closed	Master 2	Single Module Operation Contactors K1 and K2 are Closed

If the required number of SPM power modules is more than two, the system could be configured as shown below in Figure 4-9.

Figure 4-9 Interconnection when using more than two SPM modules

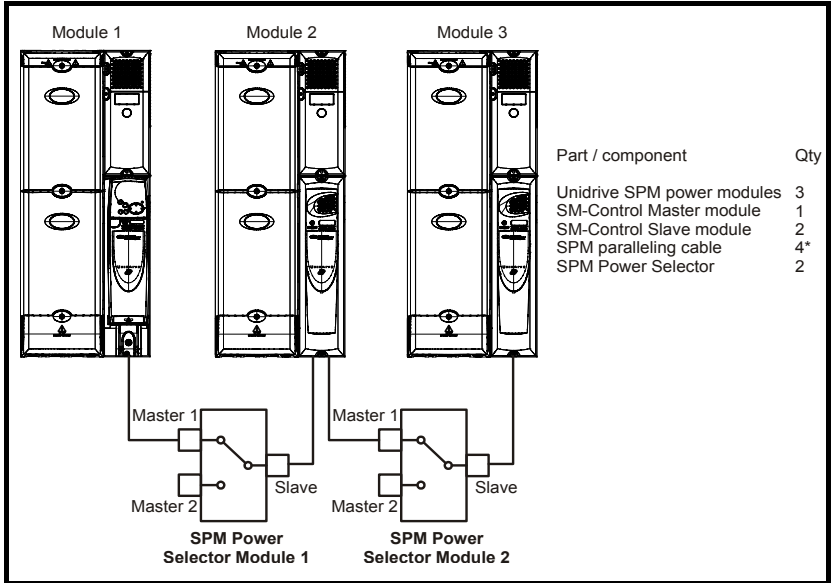


4.7.2 Configuration 2

This configuration allows the SPM power modules to be switched out of circuit when the output power demand is reduced, and conversely for the modules to be re-connected when the output power demand increases.

If the Master Mode Select switch 1 is connected to SPM Power Selector Module 1, and Master Mode select switch 2 is connected to SPM Power Selector Module 2, then the selected mode of operation is as indicated in Table 4-5.

Figure 4-10 Configuration 2



* No additional parallel cables are required for this configuration.

Table 4-5 Selecting the mode of operation

Master Mode Select Switch 1	Master Mode Select Switch 2	Mode of operation
Open	Open	Modules 1, 2 and 3 in parallel
Open	Closed	Modules 1 and 2 in parallel
Closed	Open	Module 1 only
Closed	Closed	Module 1 only

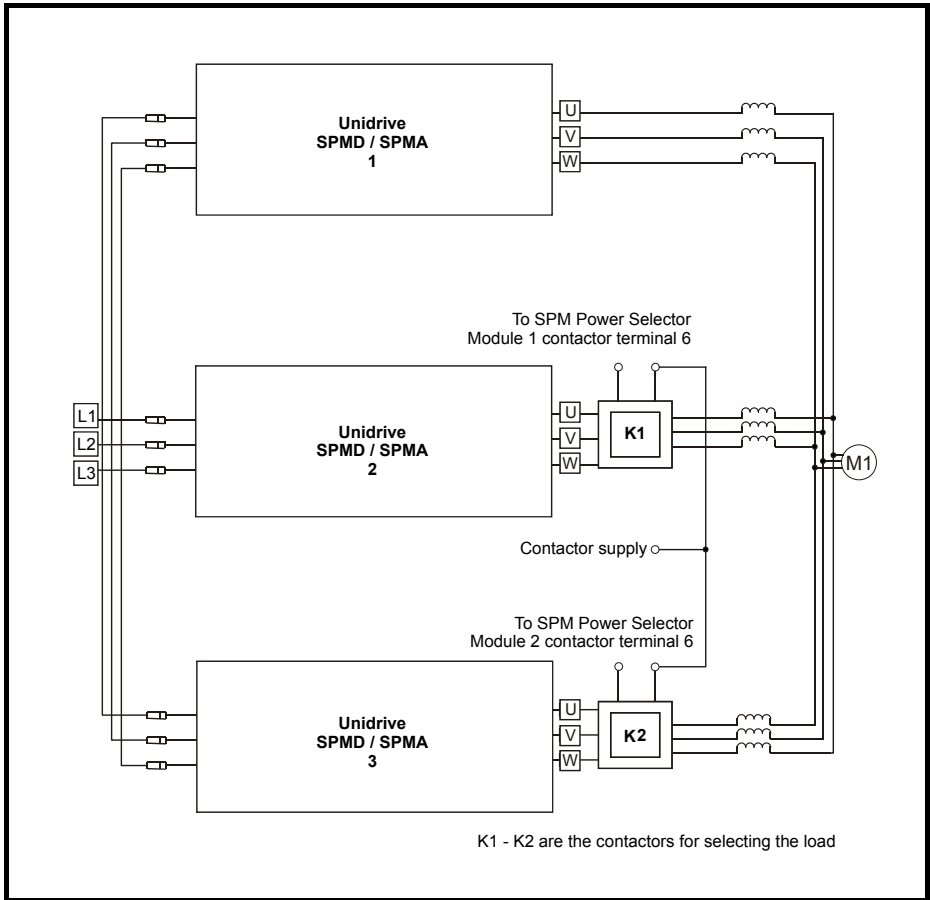
The maximum number of modules that can be paralleled, is limited by the number and length of parallel cables being used. Refer to section 4.7 *SPM Power Selector Module configurations* on page 18 to determine the maximum number of SPM Power Modules which can be paralleled in this, or any other configuration.

Required Number of SPM Power Selector Modules = N - 1.

Where N - Number of power modules.

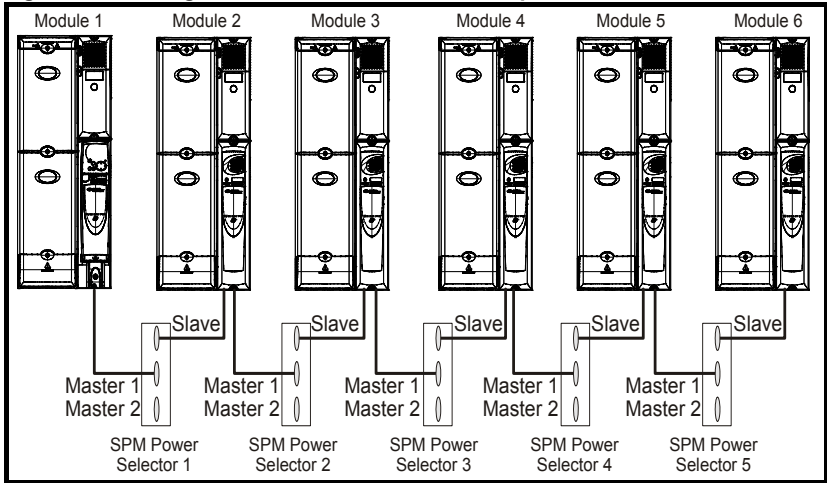
If more than two motors are to be used with this configuration, an SM-Applications module will be required to store the motor map parameters.

Figure 4-11 SPM Power Selector Module utilizing three SPM drives and a motor



Example application

Figure 4-12 Configuration 2 with six Unidrive SPM power modules

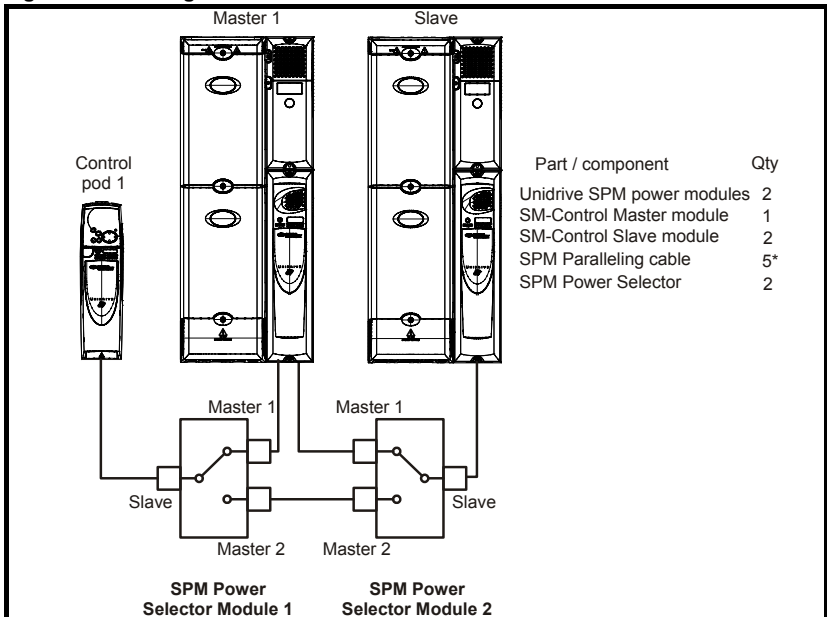


4.7.3 Configuration 3

This configuration allows the user to operate, either with both modules or with one individual module (when low current required / a module is faulty) thereby providing redundancy. In the event of power module failure, this configuration allows operation to be continued with the healthy / OK module at lower current profile.

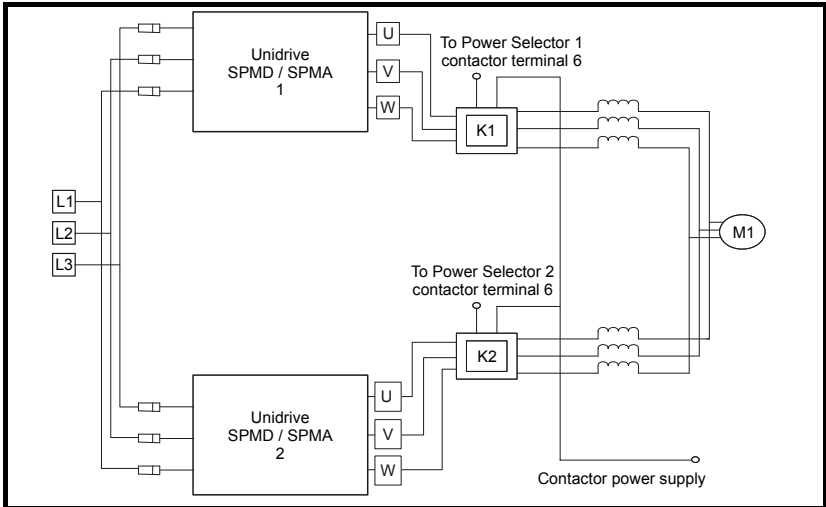
A block diagram for configuration 3 is shown in Figure 4-13. The items shown in Figure 4-13 may be required for this configuration.

Figure 4-13 Configuration 3



* This configuration requires a total of five SPM Parallel cables. Consequently an additional SPM Paralleling cable will be required for this configuration.

Figure 4-14 Control connections for two drives and two SPM Power Selector Modules



The following table shows the modes of operation that are possible using mode selection on the SPM Power Selector Module, provided the Unidrive SPM modules and the power selector modules are configured in accordance with Figure 4-13 on page 24.

Table 4-6 Modes of operation

Master Mode Select switch on SPM Power Selector Module 1	Master Mode Select switch on SPM Power Selector Module 2	Mode of Operation
Open	Open	Unidrive SPM power modules 1 and 2 are selected
Open	Closed	Unidrive SPM power module 1 is selected
Closed	Open	No modules selected
Closed	Closed	Unidrive SPM power module 2 is selected

The parameters listed below may need to be adjusted manually, when switching from single SPM power module operation to parallel SPM power module operation. The following parameters will ensure the correct current ratings/limits are applied to prevent an overload condition when operating at lower power rating with a single SPM power module.

- Pr 5.07 (Motor rated current)
- Pr 5.10 (Power factor)
- Pr 4.05 (Motoring current limit)
- Pr 4.06 (Regen current limit)
- Pr 4.07 (Symmetrical current limit)
- Pr 4.24 (User Maximum current scaling)

NOTE Unidrive SPM power and control modules along with the SPM Power Selector Module must be powered down when changing between operating modes.

5 Parameter setup

5.1 Digital input to the drive

The SPM Power Selector Module mode of operation is passed to the Unidrive SPM control module via a digital input on either the drive or on an Solutions Module, to allow the appropriate motor parameter to be selected.

The second motor map parameters are selected on the SPM control module, using a digital input from the SPM Power Selector Module routed to Pr **11.45**.

Pr **11.45** = OFF (0) (Default), Motor Map 1 selected, Pr **11.45** = On (1) Motor Map 2 selected.

NOTE When the second motor parameters are active, the symbol 'Mot2' will appear in the lower left hand corner of the SM-Keypad Plus (LCD) display or the second decimal point from the right in the first row of the SM-Keypad (LED) display is lit.

If the possible number of motors to be controlled or used is more than three, then a program would be needed in conjunction with an SM-Applications Module.

5.2 Motor map

5.2.1 Configuration 1

If the Unidrive SPM drives and motors are configured in accordance with Figure 4-7 on page 19 then:-

1. The motor map parameters for motor 1 (M1) should be loaded into the SM-Control Master Module 1.
2. The motor map parameters for M2 should be loaded into SM-Control Master Module 2.
3. The motor parameters for M3 should be loaded into the second motor map (Menu 21) of the SM-Control Master Module 1.

5.2.2 Configuration 2

If the Unidrive SPM power modules are configured in accordance with Figure 4-10 on page 22, the motor map parameters should be loaded in the SM-Control Master Module.

5.2.3 Configuration 3

If the Unidrive SPM drives and motor are configured in accordance with Figure 4-13 and Figure 4-14 on page 25, the motor map parameters should be loaded in the SM-Control Master Module.

6 Diagnostics

The keypad display on the Unidrive SPM control module provides various items of information regarding the status of the Unidrive SPM power modules.

The keypad display provides information for the following categories:

1. Trip indications
2. Alarm indications
3. Status indications

During a trip condition, and where an SM-Keypad (LED) is being used, the display on the Unidrive SPM drive will alter between the trip code and the tripped SPM module number. If an SM-Keypad Plus (LCD) is used, then the tripped module number can be identified from Pr **10.41** to Pr **10.51** if Pr **6.49** is set to OFF(0).

Trip No	Diagnosis
Unid.P	Power module undefined trip
	Check all the interconnection / parallel cables between power modules. Ensure the correct power up sequence is used. The SPM Power Selector must be powered up before the Unidrive SPM power and control modules are powered up.
HF18	Multi-module system interconnect cable error
	Check all the interconnection / parallel cables between power modules to ensure they are connected to the appropriate ports.

For any other trip, please refer to the diagnostic section of the *Unidrive SPM User Guide*.

The following table details the possible trips indicated via the status LEDs on the SPM Power Selector Module and diagnosis.

LED on	Diagnosis
PS TRIP	User 24 Vdc is not available
	Check the power supply to SPM Power Selector
POWER SEQ	Incorrect Power Sequence
	Unit power sequence is incorrect - ensure the correct power up sequence is used. The SPM Power Selector must be powered up before the Unidrive SPM power and control modules are powered up.



Do not attempt to carry out internal repairs. Return faulty units to the supplier for repair.

7 Technical data

7.1 SPM Power Selector Module control terminals

1 +24V external input	
Nominal voltage	24Vdc
Minimum voltage	18.4Vdc
Maximum voltage	31.4Vdc
Current drawn	300mA Max
Recommended power supply	24Vdc, 1A

2 0V common	
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3 Digital output	
Voltage	0V with Master 1 selected 24V with Master 2 selected
Maximum output current	16mA

4 Master Mode Select	
5	
A switch connected between terminals 4 and 5 will enable switching between operating modes Master 1 and Master 2.	

7.2 SPM Power Selector Module contactor terminals

1 Contactor 1 & 2 Power Supply	
2 Contactor Output 1	
3 Contactor 1 & 2 Power Supply	
4 Contactor Output 2	
Contact Voltage Rating	240Vac, Installation over-voltage category
Contact maximum current rating	2A AC 240V 4A DC 30V resistive load 0.5A DC 30V inductive load (L/R = 40 ms)
Contact minimum recommended rating	12V 100mA
Contact Type	Normally Open

The above outputs use the same relay contacts, so the current ratings given above are applicable for contactor output 1 and 2 combined.

5	Contactors 3 & 4 Power Supply
6	Contactors Output 3
7	Contactors 3 & 4 Power Supply
8	Contactors Output 4
Contact Voltage Rating	240 Vac, Installation over-voltage category
Contact maximum current rating	2A AC 240V 4A DC 30V resistive load 0.5A DC 30V inductive load (L/R = 40 ms)
Contact minimum recommended rating	12V 100mA
Contact Type	Normally Open

The above outputs use the same relay contacts, so the current ratings given above are applicable for contactor output 3 and 4 combined.

7.3 Fusing

The recommended 24Vdc power supply fuses (F1) is 3A, 50Vdc. This information is stated on the SPM Power Selector label. Ensure that the contactor supply is appropriately fused as detailed in section 7.2.

7.4 IP rating

The SPM Power Selector Module is rated to IP 20.



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