



# **DSM S-Series Integrated Stepper Motor / Driver**

**Installation Manual**



---

# Contents

|       |  |      |
|-------|--|------|
| 1     | General Information .....                        | 1-1  |
| 2     | Introduction .....                               | 2-1  |
| 2.1   | DSM S-Series integrated motor and driver .....   | 2-1  |
| 2.1.1 | Option availability .....                        | 2-2  |
| 2.2   | Receiving and inspection .....                   | 2-3  |
| 2.2.1 | Identifying the catalog number .....             | 2-3  |
| 2.3   | Units and abbreviations .....                    | 2-4  |
| 3     | Basic Installation .....                         | 3-1  |
| 3.1   | Introduction .....                               | 3-1  |
| 3.1.1 | Location requirements .....                      | 3-1  |
| 3.1.2 | Mounting the DSM .....                           | 3-2  |
| 3.1.3 | Other requirements for installation .....        | 3-6  |
| 4     | Input / Output .....                             | 4-1  |
| 4.1   | Introduction .....                               | 4-1  |
| 4.1.1 | Basic connections .....                          | 4-1  |
| 4.2   | Motor power input .....                          | 4-2  |
| 4.2.1 | Wire sizes .....                                 | 4-3  |
| 4.3   | Logic inputs .....                               | 4-4  |
| 4.3.1 | Logic input descriptions .....                   | 4-4  |
| 4.3.2 | Input timing .....                               | 4-5  |
| 4.3.3 | Sinking / sourcing input configuration .....     | 4-6  |
| 4.4   | SPI interface .....                              | 4-8  |
| 4.4.1 | SPI connector .....                              | 4-8  |
| 4.4.2 | SPI signal descriptions .....                    | 4-9  |
| 4.5   | Connection summary - minimum system wiring ..... | 4-10 |
| 5     | Operation .....                                  | 5-1  |
| 5.1   | Introduction .....                               | 5-1  |
| 5.1.1 | Connecting the DSM to the PC .....               | 5-1  |
| 5.1.2 | Installing the USB driver .....                  | 5-1  |
| 5.1.3 | Installing the virtual COM port driver .....     | 5-1  |
| 5.1.4 | Determining the virtual COM port number .....    | 5-2  |
| 5.1.5 | Installing Baldor SPI Interface .....            | 5-2  |
| 5.1.6 | Starting the controller and DSM .....            | 5-3  |

---

|       |                                     |     |
|-------|-------------------------------------|-----|
| 5.2   | Baldor SPI Interface .....          | 5-4 |
| 5.2.1 | Starting Baldor SPI Interface ..... | 5-4 |
| 5.2.2 | Configuration parameters .....      | 5-4 |
| 6     | Troubleshooting .....               | 6-1 |
| 6.1   | Introduction .....                  | 6-1 |
| 6.1.1 | Problem diagnosis .....             | 6-1 |
| 6.1.2 | Further support .....               | 6-1 |
| 6.1.3 | Communication problems .....        | 6-1 |
| 6.1.4 | Motor control problems .....        | 6-2 |
| 7     | Specifications .....                | 7-1 |
| 7.1   | Introduction .....                  | 7-1 |
| 7.1.1 | Input power .....                   | 7-1 |
| 7.1.2 | Motor speed & torque - DSMS17 ..... | 7-2 |
| 7.1.3 | Motor speed & torque - DSMS23 ..... | 7-4 |
| 7.1.4 | Motor speed & torque - DSMS34 ..... | 7-6 |
| 7.1.5 | Digital inputs .....                | 7-9 |

LT0227A02 Copyright Baldor (c) 2007. All rights reserved.

This manual is copyrighted and all rights are reserved. This document or attached software may not, in whole or in part, be copied or reproduced in any form without the prior written consent of BALDOR. BALDOR makes no representations or warranties with respect to the contents hereof and specifically disclaims any implied warranties of fitness for any particular purpose. The information in this document is subject to change without notice.

BALDOR assumes no responsibility for any errors that may appear in this document.

Mint™ is a registered trademark of Baldor.

Windows 95, Windows 98, Windows ME, Windows NT, Windows 2000 and Windows XP are registered trademarks of the Microsoft Corporation.

#### Limited Warranty:

For a period of two (2) years from the date of original purchase, BALDOR will repair or replace without charge controls and accessories which our examination proves to be defective in material or workmanship. This warranty is valid if the unit has not been tampered with by unauthorized persons, misused, abused, or improperly installed and has been used in accordance with the instructions and/or ratings supplied. This warranty is in lieu of any other warranty or guarantee expressed or implied. BALDOR shall not be held responsible for any expense (including installation and removal), inconvenience, or consequential damage, including injury to any person or property caused by items of our manufacture or sale. (Some countries and U.S. states do not allow exclusion or limitation of incidental or consequential damages, so the above exclusion may not apply.) In any event, BALDOR's total liability, under all circumstances, shall not exceed the full purchase price of the control. Claims for purchase price refunds, repairs, or replacements must be referred to BALDOR with all pertinent data as to the defect, the date purchased, the task performed by the control, and the problem encountered. No liability is assumed for expendable items such as fuses. Goods may be returned only with written notification including a BALDOR Return Authorization Number and any return shipments must be prepaid.

Baldor UK Ltd  
Mint Motion Centre  
6 Bristol Distribution Park  
Hawkey Drive  
Bristol, BS32 0BF  
Telephone: +44 (0) 1454 850000  
Fax: +44 (0) 1454 850001  
Email: [technical.support@baldor.co.uk](mailto:technical.support@baldor.co.uk)  
Web site: [www.baldor.co.uk](http://www.baldor.co.uk)

Baldor Electric Company  
Telephone: +1 479 646 4711  
Fax: +1 479 648 5792  
Email: [sales@baldor.com](mailto:sales@baldor.com)  
Web site: [www.baldor.com](http://www.baldor.com)

Baldor ASR GmbH  
Telephone: +49 (0) 89 90508-0  
Fax: +49 (0) 89 90508-491

Baldor ASR AG  
Telephone: +41 (0) 52 647 4700  
Fax: +41 (0) 52 659 2394  
Email: [technical.support@baldor.ch](mailto:technical.support@baldor.ch)

Australian Baldor Pty Ltd  
Telephone: +61 2 9674 5455  
Fax: +61 2 9674 2495

Baldor Electric (F.E.) Pte Ltd  
Telephone: +65 744 2572  
Fax: +65 747 1708

Baldor Italia S.R.L.  
Telephone: +39 (0) 11 56 24 440  
Fax: +39 (0) 11 56 25 660

## Safety Notice

Only qualified personnel should attempt the start-up procedure or troubleshoot this equipment. This equipment may be connected to other machines that have rotating parts or parts that are controlled by this equipment. Improper use can cause serious or fatal injury.

## Precautions



**WARNING**

Do not touch any circuit board, power device or electrical connection before you first ensure that no high voltage is present at this equipment or other equipment to which it is connected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt to start-up, program or troubleshoot this equipment.



**WARNING**

Be sure that you are completely familiar with the safe operation and programming of this equipment. This equipment may be connected to other machines that have rotating parts or parts that are controlled by this equipment. Improper use can cause serious or fatal injury.



**CAUTION**

The stop input to this equipment should not be used as the single means of achieving a safety critical stop. Drive disable, motor disconnect, motor brake and other means should be used as appropriate.



**CAUTION**

Improper operation or programming may cause violent motion of the motor shaft and driven equipment. Be certain that unexpected motor shaft movement will not cause injury to personnel or damage to equipment.



**CAUTION**

Be sure all wiring complies with the National Electrical Code and all regional and local codes. Improper wiring may result in unsafe conditions.



**CAUTION**

The DSM has components which are sensitive to Electrostatic Discharge (ESD). All handling should be done at an ESD protected workstation.



**NOTICE**

To prevent equipment damage, be certain that input and output signals are powered and referenced correctly.



**NOTICE**

To ensure reliable performance of this equipment be certain that all signals to/from the DSM are shielded correctly.



**NOTICE**

Avoid locating the DSM immediately above or beside heat generating equipment, or directly below water steam pipes.



**NOTICE**

Avoid locating the DSM in the vicinity of corrosive substances or vapors, metal particles and dust.

## 2.1 DSM S-Series integrated motor and driver

The DSM S-Series high-torque integrated motor and driver is ideal for designers who want the simplicity of a motor with on-board electronics. The DSM allows the system designer to decide the best method of control. The drive's integrated electronics eliminates the need to run the motor cabling through the machine, reducing the potential for problems due to electrical noise. The DSM is a small, powerful and inexpensive solution that will reduce system cost, design and assembly time for a large range of stepping motor applications.



The DSM family use a NEMA17, NEMA23 or NEMA34 1.8° high torque motor combined with a microstepping drive, and accept up to 14 resolution settings from 1/2 to 256 microsteps per step. Setup parameters can be changed 'on-the-fly' or downloaded and stored in non-volatile memory with the use of a simple user interface program which is provided, eliminating the need for external switches or resistors. The versatile, compact DSM is available in multiple configurations to fit various system needs.

Features include:

- Integrated microstepping drive/NEMA high torque motor.
- Available in various stack lengths from 13 to 47 (model dependent).
- +12 to +75 VDC input voltage (+12 to +48 VDC on DSMS17).
- Optically isolated +5 to +24 VDC inputs, sourcing or sinking.
- Automatic current reduction.
- Automatic communication configuration.
- Rear knob for manual positioning (option M).
- Interfacing by 30 cm (12 in) flying leads (optional 7-pin terminal block on DSMS17/23).
- Graphical User Interface (GUI) for easy parameter setup.
- Extremely compact.

A "Baldor Motion Toolkit CD" is available. This contains the Baldor SPI Interface software, used for communicating and configuring the DSM.

This manual is intended to guide you through the installation of the DSM. The chapters should be read in sequence.

The *Basic Installation* section describes the mechanical installation of the DSM. The following sections require knowledge of the low level input/output requirements of the device that will control the DSM, and an understanding of computer software installation. If you are not qualified in these areas you should seek assistance before proceeding.

**Note:** You can check that you have the latest releases by visiting the website [www.baldormotion.com/supportme](http://www.baldormotion.com/supportme).

### 2.1.1 Option availability

| Model      | 'F'<br>flying leads<br>option | 'P'<br>connector<br>option | 'M'<br>control knob<br>option |
|------------|-------------------------------|----------------------------|-------------------------------|
| DSMS<br>17 | Yes<br>All models             | Yes<br>All<br>models       | Yes<br>All<br>models          |
| DSMS<br>23 | Yes<br>All models             | Yes<br>All<br>models       | Yes<br>All<br>models          |
| DSMS<br>34 | Yes<br>All models             | No                         | Yes<br>All<br>models          |

## 2.2 Receiving and inspection

When you receive your DSM, there are several things you should do immediately:

1. Check the condition of the packaging and report any damage immediately to the carrier that delivered your DSM.
2. Remove the DSM from the shipping container and remove all packing material. The container and packing materials may be retained for future shipment.
3. Verify that the catalog number of the DSM you received is the same as the catalog number listed on your purchase order. The catalog/part number is described in the next section.
4. Inspect the DSM for external damage during shipment and report any damage to the carrier that delivered it.
5. If the DSM is to be stored for several weeks before use, be sure that it is stored in a location that conforms to the storage humidity and temperature specifications shown in section 3.1.1.

### 2.2.1 Identifying the catalog number

Different models of DSM are available. As a reminder of which product has been installed, it is a good idea to write the catalog number in the space provided below.

**DSM catalog number:** **DSMS** \_\_\_\_\_ - \_\_\_\_\_ - \_\_\_\_\_

**Installed in:** \_\_\_\_\_

**Date:** \_\_\_\_\_

A description of a catalog number is shown here, using the example **DSMS34F-3B-M**:

|             | Meaning  | Alternatives   |
|-------------|--|--|
| <b>DSMS</b> | DSM S-series family                                  | -  |
| <b>34</b>   | NEMA 34 frame size                                   | <b>17</b> =NEMA 17;<br><b>23</b> =NEMA 23                  |
| <b>F</b>    | Flying lead connections                              | <b>P</b> =7-pin terminal block                             |
| <b>3</b>    | Large stack size                                     | <b>1</b> =Small stack size;<br><b>2</b> =Medium stack size |
| <b>B</b>    | Supply voltage 12 - 75 VDC<br>(DSMS23 / DSMS34 only) | <b>A</b> =Supply voltage 12 - 48 VDC                       |
| <b>M</b>    | (Optional) Manual control knob                       | -  |

## 2.3 Units and abbreviations

The following units and abbreviations may appear in this manual:

|            |   |
|------------|---|
| V          | Volt (also VAC and VDC)   |
| W          | Watt  |
| A          | Ampere  |
| $\Omega$   | Ohm   |
| m $\Omega$ | milliohm  |
| $\mu$ F    | microfarad  |
| pF         | picofarad   |
| mH         | millihenry  |
| $\Phi$     | phase   |
| ms         | millisecond   |
| $\mu$ s    | microsecond   |
| ns         | nanosecond  |
| mm         | millimeter  |
| m          | meter   |
| in         | inch  |
| ft         | feet  |
| lb-in      | pound inch (torque)   |
| N-m        | Newton meter (torque)   |
| ADC        | Analog to Digital Converter   |
| ASCII      | American Standard Code for Information Interchange                    |
| AWG        | American Wire Gauge   |
| CDROM      | Compact Disc Read Only Memory   |
| CTRL+E     | on the PC keyboard, press <b>Ctrl</b> then <b>E</b> at the same time. |
| DAC        | Digital to Analog Converter   |
| EMC        | Electromagnetic Compatibility   |
| HMI        | Human Machine Interface   |
| ISO        | International Standards Organization                                  |
| Kbaud      | kilobaud (the same as Kbit/s in most applications)                    |
| MB         | megabytes   |
| Mbps       | megabits/s  |
| (NC)       | Not Connected   |
| NEMA       | National Electrical Manufacturers Association                         |
| RF         | Radio Frequency   |
| SPI        | Serial Peripheral Interface   |

## 3.1 Introduction

**You should read all the sections in *Basic Installation*.**

It is important that the correct steps are followed when installing the DSM. This section describes the mechanical installation of the DSM.

### 3.1.1 Location requirements

Ensure you have read and understood the warnings and cautions in section 1.

The safe operation of this equipment depends upon its use in the appropriate environment. The following points must be considered:

- The DSM is designed to be mounted indoors, permanently fixed and located.
- The DSM must be secured by the holes in the faceplate.

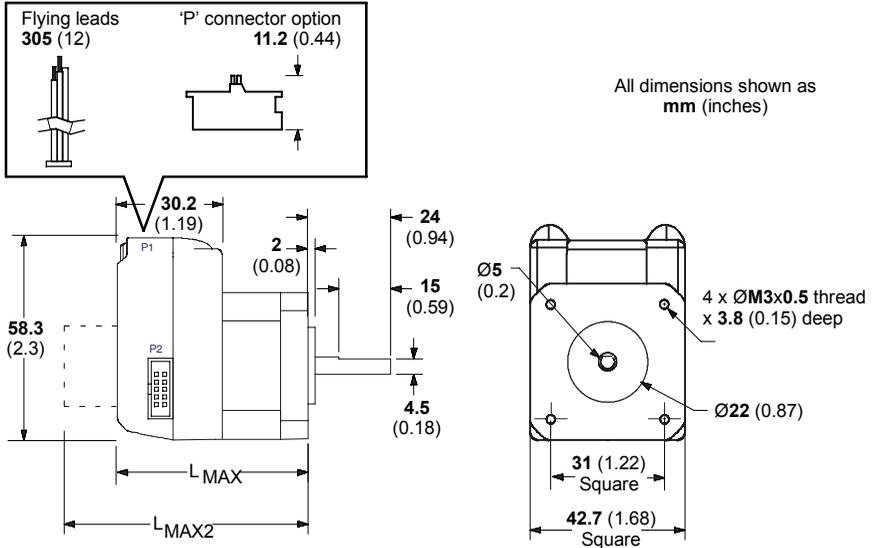
Because the DSM consists of two core components, a drive and a motor, attention must be paid to the thermal specifications of both the motor and the electronics. The following maximum temperatures apply to the DSM:

- The DSM heat sink temperature must not exceed 85 °C (185 °F).
- The DSM motor temperature must not exceed 100 °C (212 °F).

### 3.1.2 Mounting the DSM

Ensure you have read and understood the location requirements in section 3.1.1. Mount the DSM by the four holes in the faceplate. M5 bolts or screws are recommended.

#### 3.1.2.1 Dimensions - DSMS17

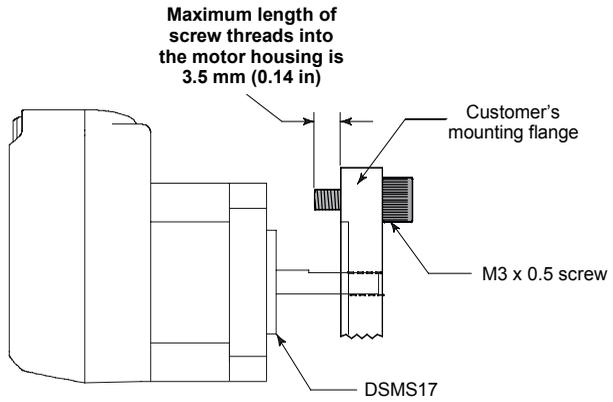


| DSM Model  | Dimensions (mm / inches) |                                | Weight g / oz |
|------------|--------------------------|--------------------------------|---------------|
|            | $L_{MAX}$                | $L_{MAX2}$ (with control knob) |               |
| DSMS17x-1A | 55.9 (2.20)              | 70.9 (2.79)                    | 277.8 (9.8)   |
| DSMS17x-2A | 61.7 (2.43)              | 76.7 (3.02)                    | 297.7 (10.5)  |
| DSMS17x-3A | 70.4 (2.77)              | 85.6 (3.37)                    | 428.1 (15.1)  |

Figure 1 - Package dimensions - DSMS17

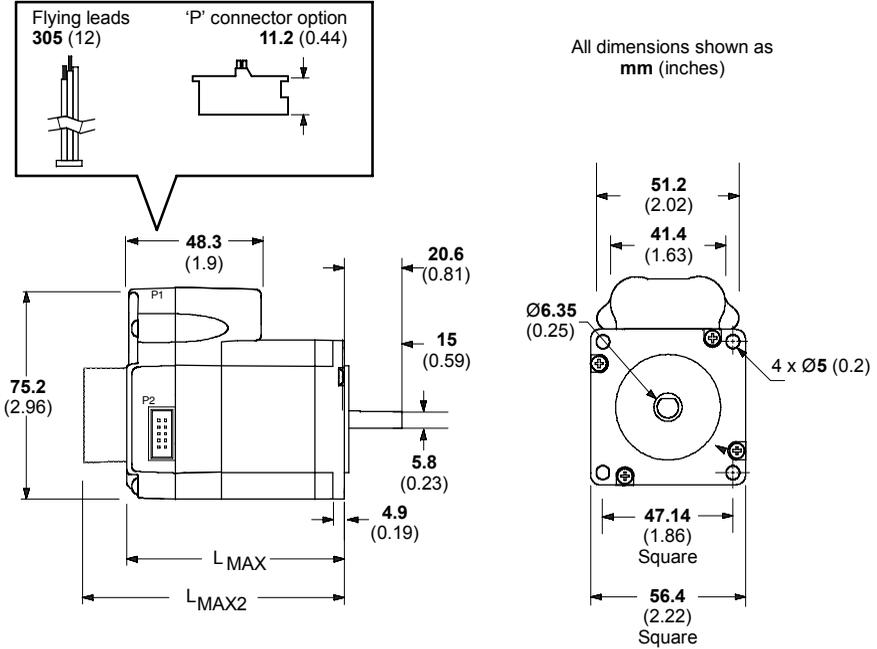


Use care when installing the mounting screws on all DSMS17 models. The mounting holes on the flange are not drilled through, so the maximum length for screw threads into the motor flange is 3.5 mm (0.14 in). See Figure 2. The maximum torque for the M3x0.5 screw is 9 kg·cm (7.8 lb-in).



**Figure 2 - Screw thread limitation - DSMS17**

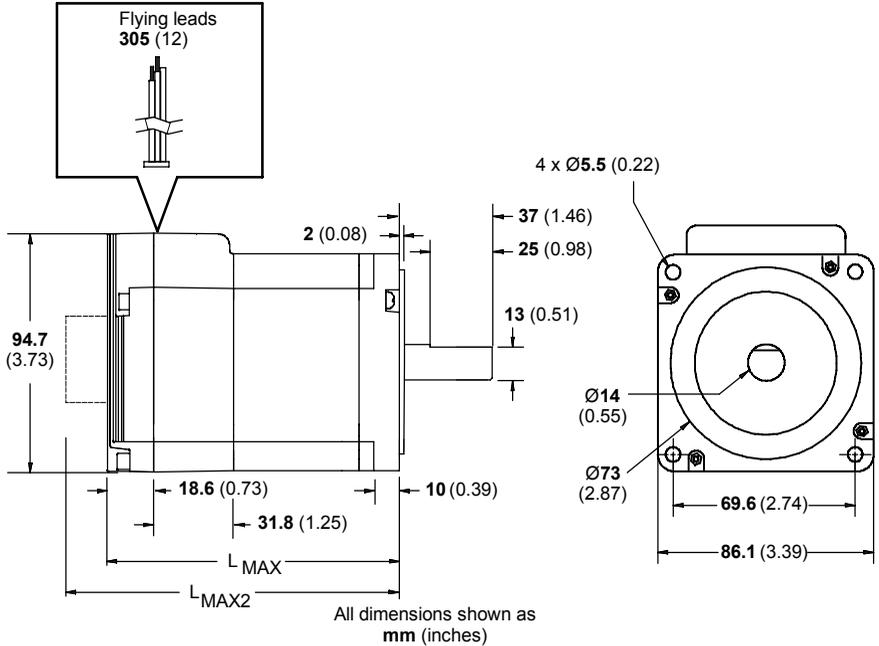
3.1.2.2 Dimensions - DSMS23



| DSMS Model | Dimensions (mm / inches) |  | Weight<br>kg / lb |
|------------|--------------------------|--|-------------------|
|            | L <sub>MAX</sub>         | L <sub>MAX2</sub><br>(with control knob) |                   |
| DSMS23x-1B | 67.31 (2.65)             | 85.34 (3.36)                             | 0.61 (1.35)       |
| DSMS23x-2B | 76.71 (3.02)             | 94.74 (3.73)                             | 0.75 (1.65)       |
| DSMS23x-3B | 98.55 (3.88)             | 116.6 (4.59)                             | 1.11 (2.45)       |

Figure 3 - Package dimensions - DSMS23

### 3.1.2.3 Dimensions - DSMS34



| Motor Stack       | Dimensions<br>(mm / inches) |  | Weight<br>kg / lb |
|-------------------|-----------------------------|--|-------------------|
|                   | L <sub>MAX</sub>            | L <sub>MAX2</sub><br>(with control knob) |                   |
| <b>DSMS34F-1B</b> | 94.2 (3.71)                 | 112.3 (4.42)                             | 1.9 (4.19)        |
| <b>DSMS34F-2B</b> | 114.3 (4.50)                | 132.3 (5.21)                             | 2.5 (5.5)         |
| <b>DSMS34F-3B</b> | 154.2 (6.07)                | 172.2 (6.78)                             | 4.0 (8.8)         |

Figure 4 - Package dimensions - DSMS34

### 3.1.2.4 Securing DSM cables

Some applications may require that the DSM moves with the axis motion. If this is a requirement of your application, the motor leads must be properly anchored. Secure the flying leads to the motor body using adhesive cable clamps. This will prevent flexing and tugging which can cause damage at critical connection points in the DSM electronics.

Do not bundle the logic leads together with the DSM power leads.

### 3.1.3 Other requirements for installation

- The DSM requires a power supply as described in section 4.2.
- A PC that fulfills the following specification:

|                         | Minimum specification              | Recommended specification  |
|-------------------------|------------------------------------|--|
| <b>Processor</b>        | Intel Pentium 133 MHz              | Intel PentiumII 400 MHz or faster                                  |
| <b>RAM</b>              | 32MB                               | 128 MB   |
| <b>Hard disk space</b>  | 40 MB                              | 60 MB  |
| <b>CD-ROM</b>           | A CD-ROM drive                     |  |
| <b>USB port</b>         | USB port                           |  |
| <b>Screen</b>           | 800 x 600, 256 colors              | 1024 x 768, 16-bit color   |
| <b>Mouse</b>            | A mouse or similar pointing device |  |
| <b>Operating system</b> | Windows 95, Windows NT             | Windows 98, Windows ME, Windows NT, Windows 2000 SP1 or Windows XP |

- A USB-SPI cable (connected as shown in section 4.4.1). Part CBL055-501 is recommended.
- Your PC operating system user manual might be useful if you are not familiar with Windows.

## 4.1 Introduction

This section describes the input and output connections of the DSM.

Logic level cables must not run parallel to power cables. Power cables will introduce noise into the logic level cables and make the system unreliable. Logic level cables must be shielded to reduce the chance of induced noise. The shield needs to be grounded at the signal source to AC ground; the other end of the shield must not be connected. This allows the shield to act as a drain.



Do not connect or disconnect any wiring when power is applied! Disconnect the AC power side to power down the DC power supply. For battery operated systems, connect a transient suppressor across the power switch to prevent arcs and high voltage spikes.

### 4.1.1 Basic connections

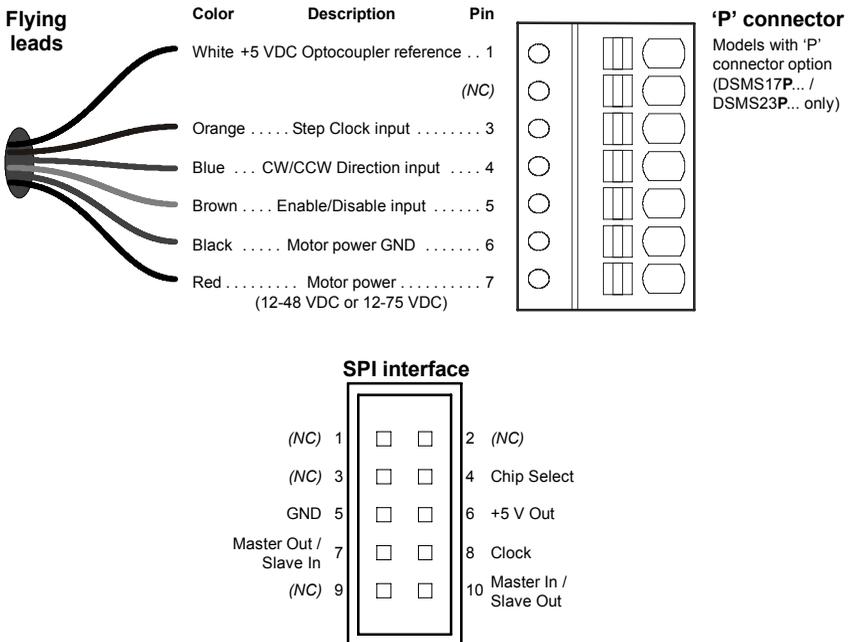


Figure 5 - Basic connection summary

## 4.2 Motor power input

The DSM requires an unregulated DC power supply. The power supply current will depend upon voltage and load, but will not exceed 2 A (DSMS17 / DSMS23) or 4 A (DSMS34).

|                            |  |
|----------------------------|--|
| <b>Location</b>            | Flying leads (red and black), 'P' connector                |
| <b>Input voltage range</b> | +12 to +48 VDC (DSMS17)<br>+12 to +75 VDC (DSMS23, DSMS34) |
| <b>Voltage ripple</b>      | ±10%   |
| <b>Input current</b>       | 2 A maximum (DSMS17 / DSMS23)<br>4 A maximum (DSMS34)      |



The maximum input voltage of the DSM includes motor back EMF, power supply ripple and high line.

### CAUTION

A characteristic of all motors is back EMF. Back EMF is a source of current that can push the output of a power supply beyond the maximum operating voltage of the driver. As a result, damage to the stepper driver could occur over a period of time. Care should be taken so that the back EMF does not exceed the maximum input voltage rating of the DSM.

Cable length, wire gauge and power conditioning devices play a major role in the performance of the DSM. The length of the DC power supply cable to a DSM should not exceed 15 m (50 ft). If cabling of 15 m (50 ft) or longer is required, the additional length may be gained by adding an AC power supply cable (see Figures 6 and 7). Power supply leads to the DSM need to be twisted. If more than one DSM is to be connected to the same power supply, run separate power and ground leads from the supply to each driver.

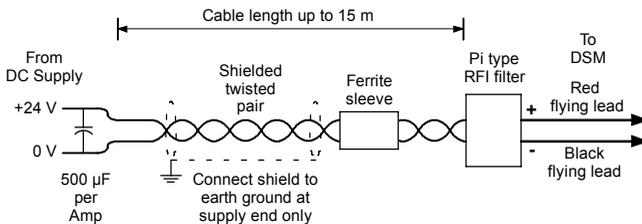


Figure 6 - Power supply connections, cable length less than 15 m

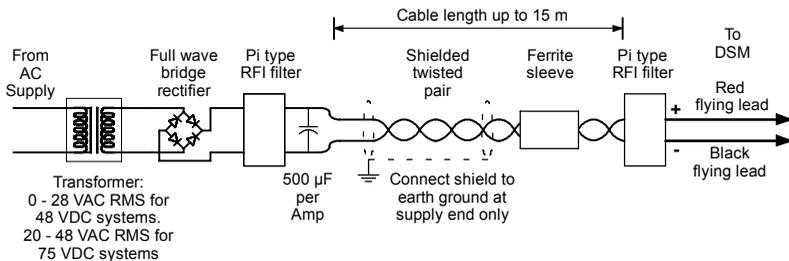


Figure 7 - Power supply connections, cable length more than 15 m

## 4.2.1 Wire sizes

Table 1 describes the wire sizes to provide optimal protection against EMI and RFI. Correct wire size is determined by the current requirement and the cable length. The actual cable type, wire gauge, shield type and filtering devices used are dependent on the customer's application and system. Always use shielded twisted pairs for AC and DC supply cables. For logic wiring (see section 4.3) AWG22 wire is recommended.

| Supply current | Cable length<br>(meters) | Cable length<br>(feet) | Minimum<br>Wire Gauge |                 |
|----------------|--------------------------|------------------------|-----------------------|-----------------|
|                |                          |                        | AWG                   | mm <sup>2</sup> |
| 1 A peak       | 3                        | 10                     | 20                    | 0.5             |
|                | 8                        | 25                     | 20                    | 0.5             |
|                | 15                       | 50                     | 18                    | 1.0             |
|                | 23                       | 75                     | 18                    | 1.0             |
|                | 30                       | 100                    | 16                    | 1.3             |
| 2 A peak       | 3                        | 10                     | 20                    | 0.5             |
|                | 8                        | 25                     | 18                    | 1.0             |
|                | 15                       | 50                     | 16                    | 1.3             |
|                | 23                       | 75                     | 14                    | 2.0             |
|                | 30                       | 100                    | 14                    | 2.0             |
| 3 A peak       | 3                        | 10                     | 18                    | 1.0             |
|                | 8                        | 25                     | 16                    | 1.3             |
|                | 15                       | 50                     | 14                    | 2.0             |
|                | 23                       | 75                     | 12                    | 3.3             |
|                | 30                       | 100                    | 12                    | 3.3             |
| 4 A peak       | 3                        | 10                     | 18                    | 1.0             |
|                | 8                        | 25                     | 16                    | 1.3             |
|                | 15                       | 50                     | 14                    | 2.0             |
|                | 23                       | 75                     | 12                    | 3.3             |
|                | 30                       | 100                    | 12                    | 3.3             |

Table 1 - Power wire ratings

## 4.3 Logic inputs

The DSM has three optically isolated logic inputs. These inputs are isolated to minimize or eliminate electrical noise coupled onto the drive control signals, and are over-voltage protected. The inputs may be configured as either sinking inputs or sourcing inputs (model dependent, see section 4.3.3), with the Optocoupler Reference (white) lead as the reference. This allows the DSM to be interfaced to a variety of controllers.

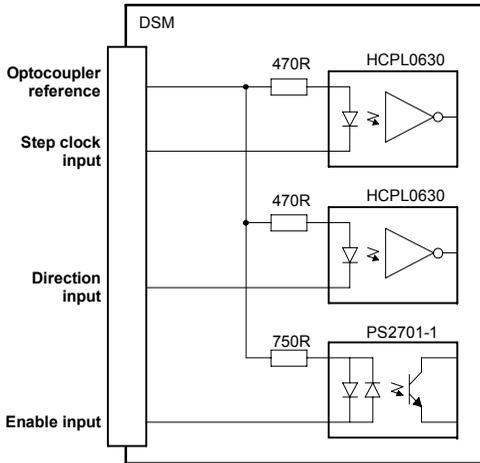


Figure 8 - Opto-isolated digital input circuit (sinking only)

### 4.3.1 Logic input descriptions

#### 4.3.1.1 Step clock (orange flying lead)

The step clock input is where the motion clock from the control circuitry will be connected. The motor will advance one microstep in the plus or minus direction (based upon the state of the direction input) on the step clock edge that causes the opto-isolator to be active. The size of this increment or decrement will depend on the microstep resolution setting. The maximum frequency on the step clock input is 2.0 MHz, with a minimum pulse width of 400 ns.

#### 4.3.1.2 Direction (blue flying lead)

The direction input controls the CW/CCW direction of the motor. A logic high (default, unconnected) will cause the motor to rotate in the CW direction (seen while looking at the face of the motor). A logic low on the input will cause the motor to rotate in the CCW direction. This input is synchronized to the positive going edge of the step clock input. The direction input may be connected by means of a switch.

#### 4.3.1.3 Enable (brown flying lead)

This input can be used to enable or disable the driver output circuitry. A logic high (when the enable switch is open, see Figures 9 and 10), causes the driver outputs to be enabled and step clock pulses will cause the motor to advance. A logic low (when the input switch is

closed) will cause the driver output circuitry to be disabled. Note that the internal sine/cosine position generator will continue to increment or decrement as long as step clock pulses are being received by the DSM. The enable input is not synchronized to any other input and may be changed at any time.

### **4.3.2 Input timing**

The direction input and the microstep resolution inputs are internally synchronized to the positive going edge of the step clock input. When a step clock transitions from low to high on the positive going edge, the state of the direction input and microstep resolution settings are latched. Any changes made to the direction and/or microstep resolution will occur on the rising edge of the step clock pulse following this change. Run Current and Hold Current changes are updated immediately (see section 5.2.2).

### 4.3.3 Sinking / sourcing input configuration

All DSMS17, 23 and 34 models can be wired to create sinking inputs, where a reference voltage between +5 and +24 VDC is connected to the Optocoupler Reference (white) lead. The isolated inputs are then interfaced to a sinking output (which utilizes the same supply as the opto coupler reference input) such as a switch, open collector, or PLC output. To maintain isolation, the input power source should not be connected to the motor power source.

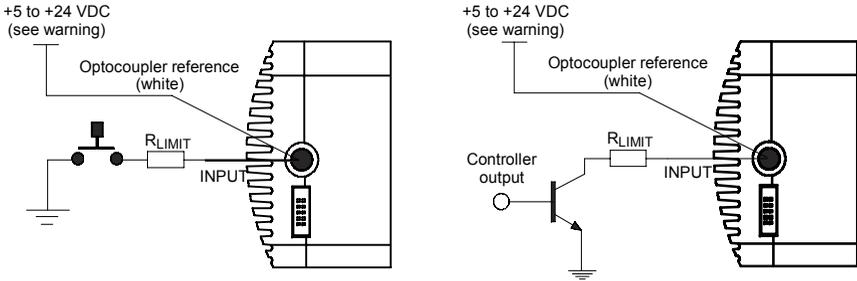


Figure 9 - Sinking input configurations

Alternatively, sourcing inputs may be used where the Optocoupler Reference (White) lead is connected to ground. The isolated inputs are then sourced to between +5 to +24 VDC from a switch, open collector, or PLC output.

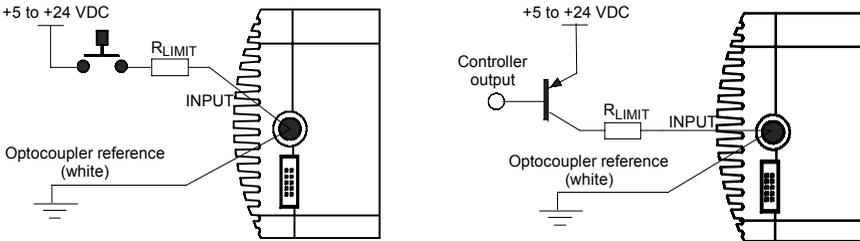
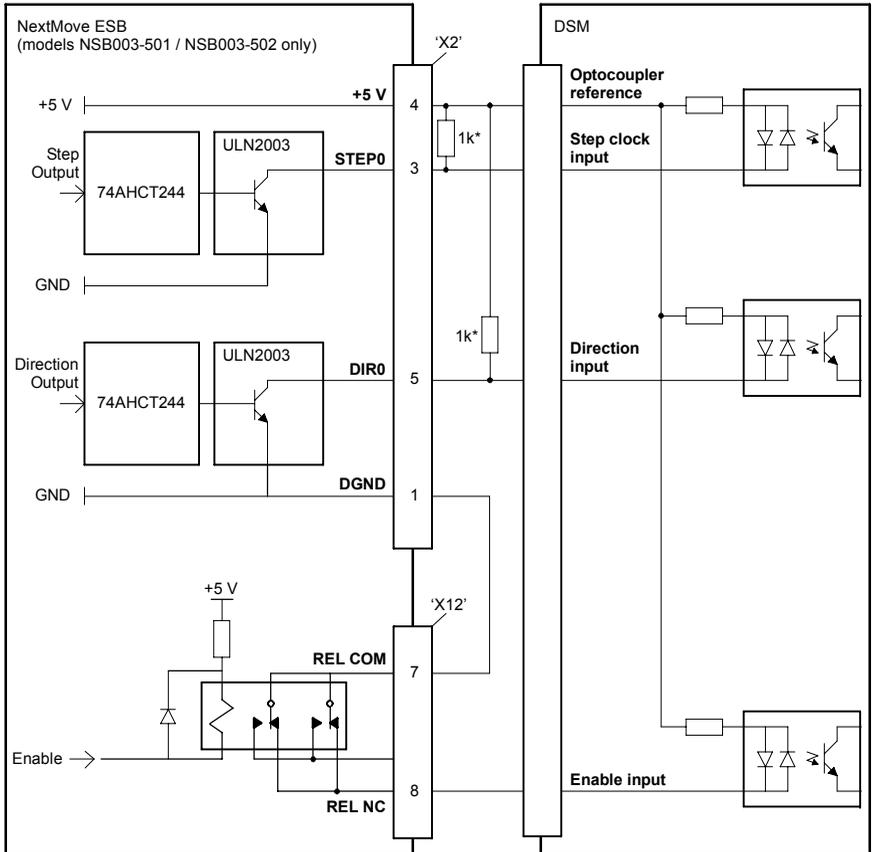


Figure 10 - Sourcing input configurations



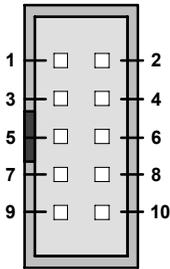
**Figure 11 - Sourcing input connections from a typical controller (e.g. NextMove ESB models NSB003-501/502)**

**Note:** \* The 1kΩ pull up resistors are optional, but can help prevent noise affecting the DSM's inputs.

## 4.4 SPI interface

DSM setup parameters are changed via an SPI (Serial Peripheral Interface) port. This port uses a 10-pin IDC header, and connects to a USB port on your PC. The recommended method of connecting the SPI port to the PC is by using parameter setup cable CBL055-501. The PC requires a standard USB port.

### 4.4.1 SPI connector



| Location | 10-pin IDC header (DSMS17... / DSMS23...)<br>Additional flying leads (DSMS34...)<br>Typical mating connector: AMPMODU MT (Amp 102398-3) |                       |
|----------|---|-----------------------|
| Pin      | Name  | Description           |
| 1        | (NC)  |                       |
| 2        | (NC)  |                       |
| 3        | (NC)  |                       |
| 4        | CS  | Chip select           |
| 5        | GND   | Communication ground  |
| 6        | +5V out   | +5 VDC output         |
| 7        | MOSI  | Master Out / Slave In |
| 8        | CLK   | Clock                 |
| 9        | (NC)  |                       |
| 10       | MISO  | Master In / Slave Out |



The +5 VDC output on the SPI connector is used for the setup cable only. This output is not designed to power external devices.

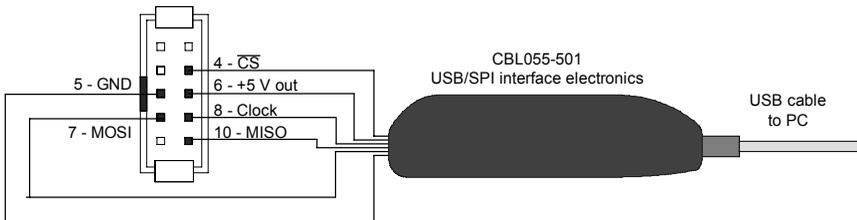


Figure 12 - SPI interface wiring

## **4.4.2 SPI signal descriptions**

### **4.4.2.1 +5 V out**

This output is a voltage supply for the setup cable only. It is not designed to power any external devices

### **4.4.2.2 CLK**

The clock is driven by the master and regulates the flow of the data bits. The master may transmit data at a variety of baud rates. The clock cycles once for each bit that is transferred.

### **4.4.2.3 MISO**

Carries output data from the DSM back to the SPI master. Only one DSM can transmit data during any particular transfer.

### **4.4.2.4 CS**

This signal is used to turn multiple DSMs on or off.

### **4.4.2.5 MOSI**

Carries output data from the SPI Master to the DSM.

## 4.5 Connection summary - minimum system wiring

As a guide, Figure 13 shows an example of the typical minimum wiring required to operate the DSM in conjunction with a NextMove ESB controller.

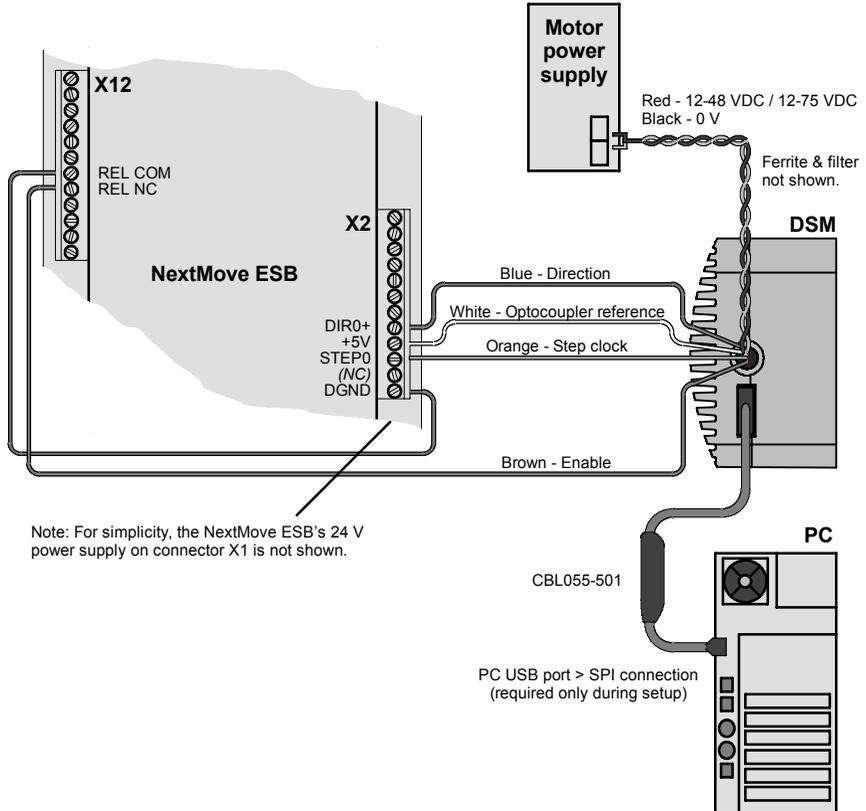


Figure 13 - Example minimum system wiring (flying leads)

## 5.1 Introduction

The motor interface is accessed through the Baldor SPI Interface software, which is an easy to install and easy to use program used to set the DSM's parameters. The Baldor SPI Interface is included on the Baldor Motion Toolkit CD.

### 5.1.1 Connecting the DSM to the PC

The DSM is connected to the PC using a standard USB port. It is recommended to use the optional CBL055-501 parameter setup cable (see section 4.4).

### 5.1.2 Installing the USB driver

When the parameter setup cable (CBL055-501) is connected to the PC, Windows XP will automatically detect it and display the Found New Hardware Wizard. It is now necessary to install the drivers, which are provided on the CD supplied with the cable. Alternatively, the driver files can be downloaded from [www.baldormotion.com/supportme](http://www.baldormotion.com/supportme) and placed in a temporary folder on the PC.

1. Choose the *No, not this time* option and click **Next >**.
2. Choose the *Install from a list or specific location (Advanced)* option and click **Next >**.
3. Check the *Include this location in the search* option. Click **Browse** and locate the drivers folder on the CD. For downloaded files, locate the temporary folder containing the extracted files. Click **Next >**.
4. When Windows finds the required driver files, a dialog will warn that they have not passed 'Windows Logo testing'. This is normal for the parameter setup cable's USB driver, so click **Continue Anyway** to continue with the installation.
5. When the *Completing the Found New Hardware Wizard* message appears, click **Finish**.

After a few moments, the Found New Hardware Wizard will appear a second time, ready to install the virtual COM port driver.

### 5.1.3 Installing the virtual COM port driver

As soon as the USB driver has been installed, the PC starts to communicate with the parameter setup cable's interface. This immediately reveals the other part of the interface's hardware, the virtual communications port (VCP), which provides communication with the DSM motor. The VCP also requires drivers to be installed, which is why the Found New Hardware Wizard appears a second time.

1. Choose the *No, not this time* option and click **Next >**.
2. Choose the *Install from a list or specific location (Advanced)* option and click **Next >**.
3. Check the *Include this location in the search* option. The previously used location should already be selected, but if not click **Browse** and locate the required folder. Click **Next >**.

4. When Windows finds the required VCP driver files, a dialog will warn that they have not passed 'Windows Logo testing'. This is normal for the parameter setup cable's VCP driver, so click **Continue Anyway** to continue with the installation.
5. When the *Completing the Found New Hardware Wizard* message appears, click **Finish**.

A final Found New Hardware message will appear on the task bar to inform you that the hardware is now ready to use.

**Note:** If the MotiFlex e100 is later connected to a different USB port on the host computer, Windows may report that it has found new hardware. Either install the driver files again for the new USB port, or connect the MotiFlex e100 to the original USB port where it will be recognized in the usual way.

### 5.1.4 Determining the virtual COM port number

The parameter setup cable's virtual COM port appears as a normal COM (serial) port in Windows, and is automatically allocated a COM port number. The *Baldor SPI Interface* software normally auto-detects the motor regardless of the allocated COM port. If for any reason the *Baldor SPI Interface* software fails to auto-detect the motor (section 5.2.1), it may be necessary to manually select this COM port.

1. In Windows, right-click the My Computer icon and choose Properties.
2. Choose the Hardware tab and click **Device Manager**.
3. Expand the *Ports (COM & LPT)* item.
4. Look for the entry named *Baldor USB to SPI Parameter Setup Cable (COM...)*. The value that appears after COM is the port number. Make a note of this number.

### 5.1.5 Installing Baldor SPI Interface

You will need to install the Baldor SPI Interface software to configure the DSM.

1. Insert the CD into the drive.
2. After a few seconds the setup wizard should start automatically. If the setup wizard does not appear, select Run... from the Windows Start menu and type

**d:\Baldor\_SPI\_Interface.exe**

where **d** represents the drive letter of the CD device.

Follow the on-screen instructions to install the software. The setup Wizard will copy the files to appropriate folders on the hard drive.

## 5.1.6 Starting the controller and DSM

If you have followed the instructions in the previous sections, you should have now connected power sources, inputs and outputs, and the USB cable linking the PC with the DSM. Before you apply power for the first time, it is very important to verify the following:

- Inspect all power connections for accuracy, workmanship and tightness.
  - Verify that all wiring conforms to applicable codes.
  - Check all signal wiring for accuracy.
1. Turn on the controller (e.g. NextMove ESB, if connected).
  2. Turn on the motor power supply.

## 5.2 Baldor SPI Interface

The Baldor SPI Interface is a simple application for configuring all aspects of the DSM.

### 5.2.1 Starting Baldor SPI Interface

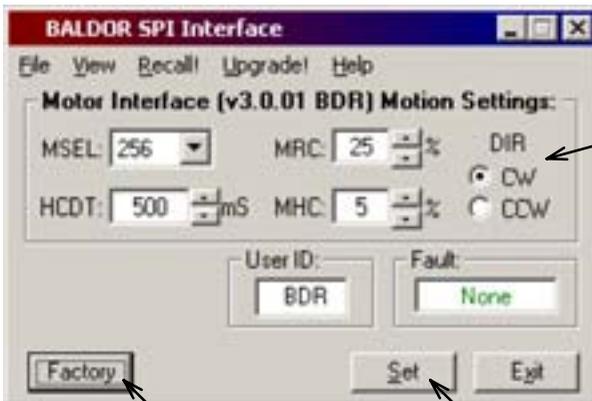
On the Windows **Start** menu, select Programs, BALDOR SPI Interface, BALDOR SPI Interface. The software will immediately try to establish communication with the DSM. If this step fails, the word "Disconnected" will appear in red. Check that the DSM is powered and that the cable is connected, then choose the Port menu item. Select the appropriate USB port from the list of USB/Serial port options (this is the COM port number found in Windows Device Manager - see section 5.1.4).

### 5.2.2 Configuration parameters

These parameters may all be changed 'on-the-fly'. To select different views, choose the View menu item.

#### 5.2.2.1 Motion settings view

The motion settings view shows the main configuration parameters for the DSM:



Click in the boxes or use the arrow buttons to adjust values.

To revert to default settings, click **Factory**, followed by **Set**.

To send the changes to the DSM, click **Set**.

| Parameter | Name                          | Range     | Units               | Default |
|-----------|-------------------------------|-----------|---------------------|---------|
| MSEL      | Microstep resolution          | 1 - 256   | microsteps per step | 256     |
| MRC       | Motor run current             | 1 - 100   | %                   | 25      |
| HCDT      | Motor hold current delay time | 0 - 65000 | ms                  | 500     |
| MHC       | Motor hold current            | 0 - 100   | %                   | 5       |
| DIR       | Motor direction override      | CW or CCW |                     | CW      |

### Microstep Resolution Select (MSEL)

The MSEL parameter specifies the microstep resolution of the DSM. The following table lists valid MSEL parameter settings:

| MSEL value: | Steps per revolution | MSEL value: | Steps per revolution                  |
|-------------|----------------------|-------------|---------------------------------------|
| 1           | 200                  | 64          | 12800                                 |
| 2           | 400                  | 100         | 20000                                 |
| 4           | 800                  | 108         | 21600<br>(1 microstep = 1 arc minute) |
| 5           | 1000                 | 125         | 25000                                 |
| 8           | 1600                 | 127         | 25400<br>(1 microstep = 0.001 mm)     |
| 10          | 2000                 | 128         | 25600                                 |
| 16          | 3200                 | 180         | 36000 (1 microstep = 0.01°)           |
| 25          | 5000                 | 200         | 40000                                 |
| 32          | 6400                 | 250         | 50000                                 |
| 50          | 10000                | 256         | 51200                                 |

### Motor Run Current (MRC)

The Motor Run Current (MRC) parameter sets the motor run current to a percentage of the full output current of the DSM driver section.

### Hold Current Delay Time (HCDT)

The HCDT parameter sets the delay time between the last clock pulse and the application of the holding current.

### Motor Hold Current (MHC)

The MHC parameter sets the motor hold current as a percentage of the full output current of the driver. If the hold current is set to 0, the output circuitry of the driver section will disable when the hold current setting becomes active. Following the last step clock pulse, the hold current setting becomes active after the period specified by HCDT.

### Direction Override (DIR)

The DIR parameter changes the motor direction relative to the direction input signal, adapting the direction of the DSM to operate as your system requires.

### Factory button

The Factory button resets each parameter in the software to factory default values. Click **Set** to apply these values.

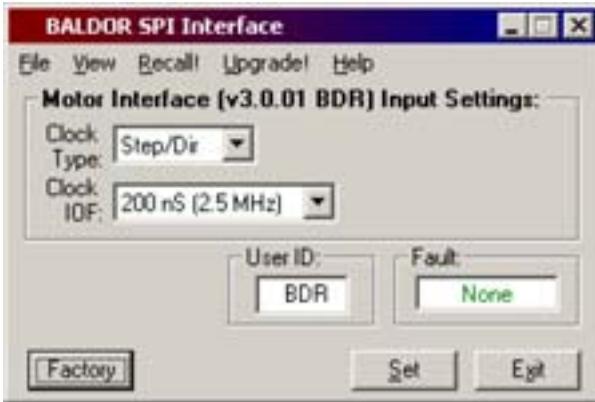
### Recall! and Upgrade! menu options

The Recall! option uploads the existing parameter settings from the DSM.

**The Upgrade! option (if present) must not be used!** It currently has no purpose and will erase the firmware on the DSM, leaving it inoperable. If you have accidentally selected the Upgrade! option, please contact Baldor customer support.

### 5.2.2.2 I/O settings view

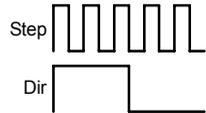
The I/O settings view shows two additional parameters for the DSM:



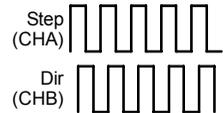
#### Clock Type

The Clock Type parameter configures the step and direction inputs for the type of input signals being supplied to the motor.

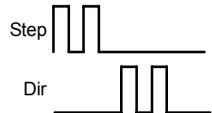
- Step/Dir is the default setting. A waveform supplied to the step input causes the motor to advance one step for each rising edge. The direction input is held either high or low to determine the direction of motion.



- Quadrature requires a pair of waveforms, such as those typically produced by an incremental encoder. The two waveforms are at the same frequency but approximately 90° out of phase (i.e. 'in quadrature'). One is supplied to the step input, the other to the direction input. Each edge causes the motor to advance one step, with the direction being determined by the relative timing of the waveforms. For example, if the rising edge on the step input waveform is received before the rising edge on the direction input waveform, the motor will turn in one direction. If the rising edge on the direction input is received first, the motor will turn in the opposite direction.



- Up / Down requires a waveform to be supplied to either the step input or the direction input. If the waveform is supplied to the step input, the motor will turn in one direction. If the waveform is supplied to the direction input, the motor will turn in the opposite direction.



#### Clock IOF

The Clock IOF parameter sets the frequency of the clock input filter. Values in the range 50 ns to 12.9  $\mu$ s (10 MHz to 38.8 kHz) are available.

## 6.1 Introduction

This section explains common problems and their solutions.

### 6.1.1 Problem diagnosis

If you have followed all the instructions in this manual in sequence, you should have few problems installing the DSM. If you do have a problem, read this section first.

### 6.1.2 Further support

If you need to contact Baldor technical support by telephone or fax, contact details are provided at the front of this manual. Please have the following information ready:

- The model number or serial number of your DSM (if known).
- A clear description of what you are trying to do.
- A clear description of the symptoms that you can observe.
- The type of motion generated in the motor shaft.
- Give a list of any parameters that you have setup.

### 6.1.3 Communication problems

If the problem is not listed below please contact Baldor technical support.

| Symptom                                    | Check  |
|--|--|
| Baldor SPI interface cannot detect the DSM | <p>Check that the DSM is powered.</p> <p>Check that the SPI interface cable is properly connected. If you have made your own SPI cable, check that it is wired correctly and properly connected.</p> |

### 6.1.4 Motor control problems

| Symptom   | Check   |
|---|---|
| Controller outputs appears to be working, but will not cause DSM to turn. | <p>Check that the DSM is powered.</p> <p>Check that the logic connections between motor and controller are correct.</p> <p>Confirm that the sense of the enable input is correct to enable the motor (section 4.3.1.3).</p> |
| Controller reports that the DSM is not moving and drops the enable line.  | <p>If the controller is expecting a feedback signal but does not receive one, it may assume the DSM is not turning. This could cause the controller to report a following error, to disable the DSM, or both.</p>           |

## 7.1 Introduction

This section provides technical specifications of all DSM models.

### 7.1.1 Input power

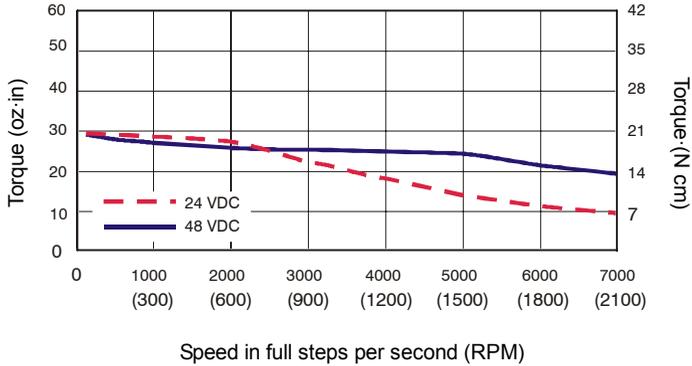
| <i>Description</i>             | <b>DSMS17...</b> | <b>DSMS23...</b> | <b>DSMS34...</b> |
|--------------------------------|------------------|------------------|------------------|
| <b>Required supply type</b>    | Unregulated DC   |                  |                  |
| <b>Ripple voltage</b>          | ±10%             |                  |                  |
| <b>Minimum supply voltage</b>  | +12VDC           | +12VDC           | +12VDC           |
| <b>Maximum supply voltage</b>  | +48VDC           | +75VDC           | +75VDC           |
| <b>Input current (maximum)</b> | 2A               | 1.5A             | 4A               |



The maximum input voltage of the DSM includes motor back EMF, power supply ripple and high line.

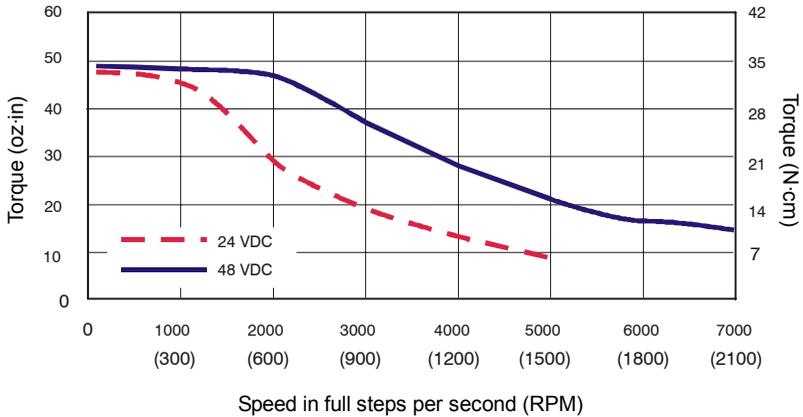
## 7.1.2 Motor speed & torque - DSMS17

### 7.1.2.1 DSMS17x-1A...



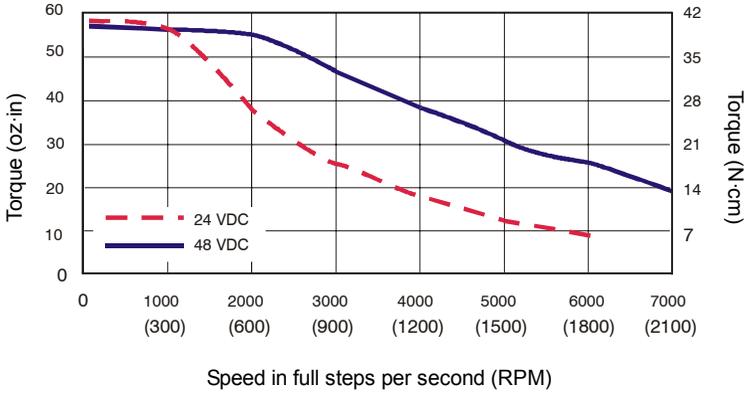
| Description           | Value  |
|-----------------------|--|
| <b>Holding torque</b> | 22.6 N-cm (32 oz-in)                                     |
| <b>Detent torque</b>  | 1.17 N-cm (1.66 oz-in)                                   |
| <b>Rotor inertia</b>  | 0.038 kg-cm <sup>2</sup> (0.00053 oz-in-s <sup>2</sup> ) |

### 7.1.2.2 DSMS17x-2A...



| Description           | Value  |
|-----------------------|--|
| <b>Holding torque</b> | 42.4 N-cm (60 oz-in)                                     |
| <b>Detent torque</b>  | 1.47 N-cm (2.08 oz-in)                                   |
| <b>Rotor inertia</b>  | 0.057 kg-cm <sup>2</sup> (0.00080 oz-in-s <sup>2</sup> ) |

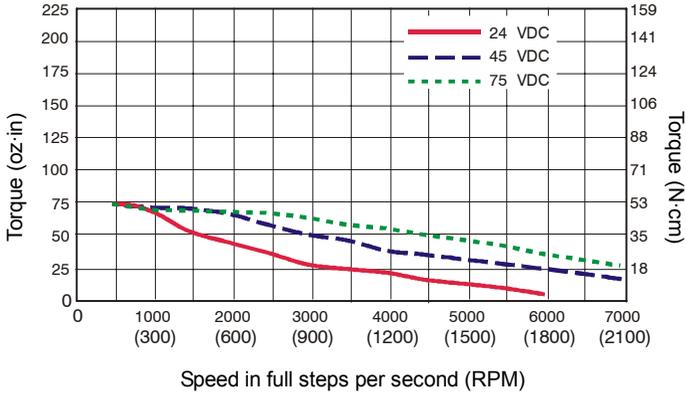
7.1.2.3 DSMS17x-3A...



| Description           | Value  |
|-----------------------|--|
| <b>Holding torque</b> | 52.9 N·cm (74.9 oz·in)                                   |
| <b>Detent torque</b>  | 2.45 N·cm (3.47 oz·in)                                   |
| <b>Rotor inertia</b>  | 0.082 kg·cm <sup>2</sup> (0.00116 oz·in·s <sup>2</sup> ) |

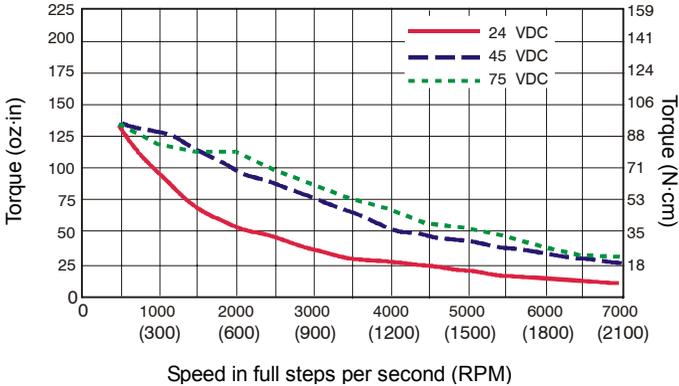
### 7.1.3 Motor speed & torque - DSMS23

#### 7.1.3.1 DSMS23x-1B...



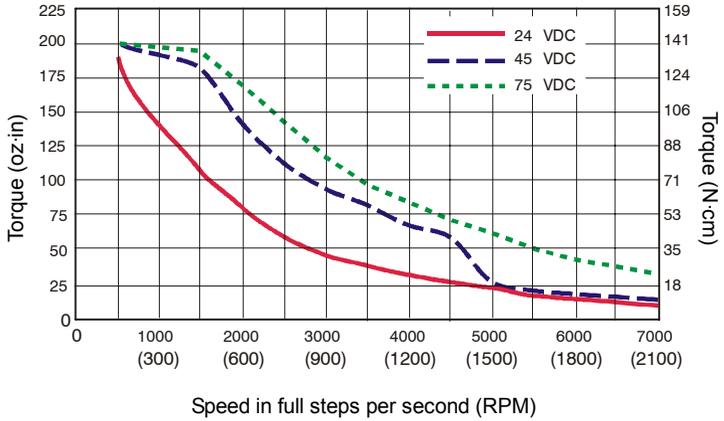
| Description    | Value  |
|----------------|--|
| Holding torque | 64 N·cm (90 oz·in)                                     |
| Detent torque  | 2.7 N·cm (3.9 oz·in)                                   |
| Rotor inertia  | 0.18 kg·cm <sup>2</sup> (0.0025 oz·in·s <sup>2</sup> ) |

#### 7.1.3.2 DSMS23x-2B...



| Description    | Value  |
|----------------|--|
| Holding torque | 102 N·cm (144 oz·in)                                   |
| Detent torque  | 3.92 N·cm (5.6 oz·in)                                  |
| Rotor inertia  | 0.26 kg·cm <sup>2</sup> (0.0037 oz·in·s <sup>2</sup> ) |

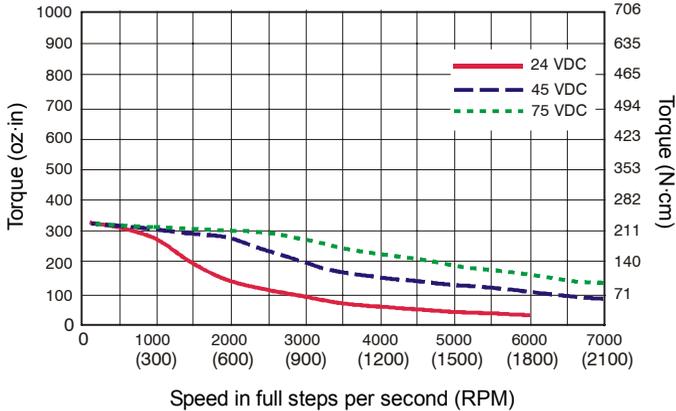
7.1.3.3 DSMS23x-3B...



| Description           | Value  |
|-----------------------|--|
| <b>Holding torque</b> | 169 N-cm (239 oz-in)                                   |
| <b>Detent torque</b>  | 6.86 N-cm (9.7 oz-in)                                  |
| <b>Rotor inertia</b>  | 0.46 kg-cm <sup>2</sup> (0.0065 oz-in-s <sup>2</sup> ) |

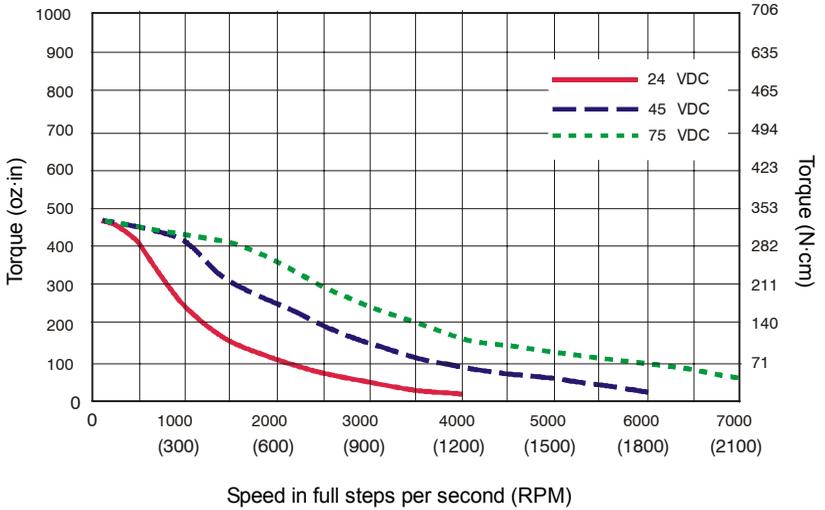
## 7.1.4 Motor speed & torque - DSMS34

### 7.1.4.1 DSMS34x-1B...



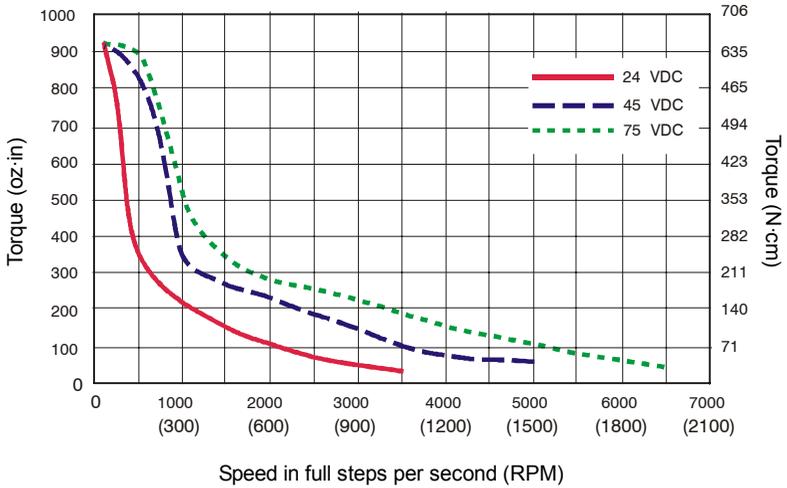
| Description    | Value  |
|----------------|--|
| Holding torque | 269 N·cm (381 oz·in)                                   |
| Detent torque  | 7.7 N·cm (10.9 oz·in)                                  |
| Rotor inertia  | 1.0 kg·cm <sup>2</sup> (0.01416 oz·in·s <sup>2</sup> ) |

7.1.4.2 DSMS34x-2B...



| Description           | Value  |
|-----------------------|--|
| <b>Holding torque</b> | 406 N·cm (575 oz·in)                                   |
| <b>Detent torque</b>  | 10.0 N·cm (14.16 oz·in)                                |
| <b>Rotor inertia</b>  | 1.6 kg·cm <sup>2</sup> (0.02266 oz·in·s <sup>2</sup> ) |

7.1.4.3 DSMS34x-3B...



| Description           | Value  |
|-----------------------|--|
| <b>Holding torque</b> | 749 N·cm (1061 oz·in)                                  |
| <b>Detent torque</b>  | 14.0 N·cm (19.83 oz·in)                                |
| <b>Rotor inertia</b>  | 3.4 kg·cm <sup>2</sup> (0.04815 oz·in·s <sup>2</sup> ) |

## 7.1.5 Digital inputs

| <i>Description</i>   | <b>Unit</b> | <b>Value</b>  |
|--|-------------|---------------|
| <b>Type</b>  |             | Opto-isolated |
| <b>Supply voltage</b><br>Maximum<br>Minimum                                  | <b>VDC</b>  | 24<br>5       |
| <b>Input forward voltage (max)</b><br>Step clock / Direction<br>Enable       | <b>VDC</b>  | 1.7<br>1.4    |
| <b>Input current (typical, 5V)</b><br>Step clock / Direction<br>Enable       | <b>mA</b>   | 10.6<br>6.7   |
| <b>Input current (maximum allowable)</b><br>Step clock / Direction<br>Enable | <b>mA</b>   | 15<br>9.4     |
| <b>Maximum input frequency</b>   | <b>MHz</b>  | 2.0           |



**A**

Abbreviations, 2-4

**B**

Baldor SPI Interface, 5-4  
  clock IOF, 5-6  
  clock type, 5-6  
  configuration parameters, 5-4  
  DIR (direction override), 5-5  
  direction override (DIR), 5-5  
  HCDT (hold current delay time), 5-5  
  hold current delay time (HCDT), 5-5  
  MHC (motor holding current), 5-5  
  microstep resolution select (MSEL), 5-5  
  motor holding current (MHC), 5-5  
  motor run current (MRC), 5-5  
  MRC (motor run current), 5-5  
  starting, 5-4

Basic Installation, 3-1  
  location requirements, 3-1  
  mounting, 3-2  
  securing DSM cables, 3-5

**C**

Catalog number, identifying, 2-3

Clock IOF, 5-6

Clock Type, 5-6

Connections  
  basic, 4-1  
  connector P2, 4-8  
  direction, 4-4  
  enable, 4-4  
  logic inputs, 4-4  
  motor power, 4-2  
  step clock, 4-4

**D**

Dimensions  
  DSMS17, 3-2  
  DSMS23, 3-4  
  DSMS34, 3-5

DIR (direction override), 5-5

Direction input, 4-4

**E**

Enable input, 4-4

Environmental, 1-2, 3-1

**F**

Features, 2-1

**H**

Hardware requirements, 3-6

HCDT (hold current delay time), 5-5

**I**

Input / Output, 4-1  
  basic connections, 4-1  
  connection summary, 4-10

Input timing, 4-5

Installation, 3-1  
  Baldor SPI Interface, 5-2  
  USB driver, 5-1  
  virtual COM port driver, 5-1  
  virtual COM port number, determining, 5-2

**L**

Logic inputs, 4-4  
  direction input, 4-4  
  enable input, 4-4  
  sinking / sourcing, 4-6  
  step clock input, 4-4  
  timing, 4-5

- 
- M**
    - MHC (motor holding current), 5-5
    - Mounting, 3-2
      - DSMS17, 3-2
      - DSMS23, 3-4
      - DSMS34, 3-5
      - securing DSM cables, 3-5
    - MRC (motor run current), 5-5
  - O**
    - Operation, 5-1
      - connecting to the PC, 5-1
      - installing Baldor SPI interface, 5-2
      - installing the USB driver, 5-1
      - installing the virtual COM port driver, 5-1
      - starting, 5-3
    - Options, availability, 2-2
  - P**
    - Power
      - connections, 4-2
      - sources, 7-1
    - Precautions, 1-2
  - R**
    - Receiving and Inspection, 2-3
  - S**
    - Safety Notice, 1-2
    - Setup, 5-1
    - Sinking / sourcing configuration, 4-6
    - Specifications, 7-1
      - digital inputs, 7-9
      - input power, 7-1
      - motor output - DSMS17x-1A, 7-2
      - motor output - DSMS17x-2A, 7-2
      - motor output - DSMS17x-3A, 7-3
      - motor output - DSMS23x-1B, 7-4
      - motor output - DSMS23x-2B, 7-4
      - motor output - DSMS23x-3B, 7-5
      - motor output - DSMS34x-1B, 7-6
      - motor output - DSMS34x-2B, 7-7
      - motor output - DSMS34x-3B, 7-8
  - SPI interface, 4-8**
    - CLK signal, 4-9
    - CS signal, 4-9
    - MISO signal, 4-9
    - MOSI signal, 4-9
    - signal descriptions, 4-9
    - SPI connector, 4-8
  - Step clock input, 4-4
  - T**
    - Troubleshooting, 6-1
  - U**
    - Units and abbreviations, 2-4
    - USB, installing the driver, 5-1
  - V**
    - Virtual COM port (VCP)
      - installing the driver, 5-1
      - number, determining, 5-2
  - W**
    - Wire sizes, 4-3

If you have any suggestions for improvements to this manual, please let us know. Write your comments in the space provided below, remove this page from the manual and mail it to:

Manuals  
Baldor UK Ltd  
Mint Motion Centre  
6 Bristol Distribution Park  
Hawkley Drive  
Bristol  
BS32 0BF  
United Kingdom.

Alternatively, you can e-mail your comments to:

[manuals@baldor.co.uk](mailto:manuals@baldor.co.uk)

**Comment:**

*continued...*



---

*Thank you for taking the time to help us.*





Baldor UK Ltd  
Mint Motion Centre  
6 Bristol Distribution Park  
Hawley Drive, Bristol  
BS32 0BF  
United Kingdom

Visit [www.baldormotion.com/supportme](http://www.baldormotion.com/supportme) for the latest documentation and software releases.

|  |   |
|--|---|
| <b>Australia</b><br>Australian Baldor PTY Ltd<br>Tel: +61 2 9674 5455<br>Fax: +61 2 9674 2495          | <b>Mexico</b><br>Baldor de Mexico<br>Tel: +52 477 761 2030<br>Fax: +52 477 761 2010                     |
| <b>Europe</b><br>Baldor ASR GmbH, Germany<br>Tel: +49 (0) 89 905 080<br>Fax: +49 (0) 89 905 08491      | <b>Singapore</b><br>Baldor Electric PTE Ltd<br>Tel: +65 744 2572<br>Fax: +65 747 1708                   |
| <b>Europe (Southern)</b><br>Baldor ASR AG, Switzerland<br>Tel: +41 52 647 4700<br>Fax: +41 52 659 2394 | <b>United Kingdom</b><br>Baldor UK Ltd<br>Tel: +44 1454 850000<br>Fax: +44 1454 859001                  |
| <b>Japan</b><br>Baldor Japan Corporation<br>Tel: +81 45 412 4506<br>Fax: +81 45 412 4507               | <b>U.S.A. (Headquarters)</b><br>Baldor Electric Company<br>Tel: +1 479 646 4711<br>Fax: +1 479 648 5792 |
| For additional office locations visit <a href="http://www.baldor.com">www.baldor.com</a>               |   |



LT0227A02

Printed in UK  
© Baldor UK Ltd