MOTION CONTROL

NextMove ST
Motion Controller

Installation Manual

01/10 **MN1929**

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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.

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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.

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.

WARNING: MEDICAL DEVICE / PACEMAKER DANGER: Magnetic and electromagnetic fields in the vicinity of current carrying conductors and industrial motors can result in a serious health hazard to persons with cardiac pacemakers, internal cardiac defibrillators, neurostimulators, metal implants, cochlear implants, hearing aids, and other medical devices. To avoid risk, stay away from the area surrounding a motor and its current carrying conductors.

WARNING: 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.

WARNING: 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. Peak torque of several times the rated motor torque can occur during control failure.

CAUTION: The safe integration of this equipment into a machine system is the responsibility of the machine designer. Be sure to comply with the local safety requirements at the place where the machine is to be used. In Europe these are the Machinery Directive, the Electromagnetic Compatibility Directive and the Low Voltage Directive. In the United States this is the National Electrical code and local codes.

CAUTION: Electrical components can be damaged by static electricity. Use ESD (electrostatic discharge) procedures when handling this drive.

2.1 NextMove ST features

NextMove ST is a high performance multi-axis intelligent controller for stepper motors.

NextMove ST features the MintMT motion control language. MintMT is a structured form of Basic, custom designed for stepper or servo motion control applications. It allows you to get started very quickly with simple motion control programs. In addition, MintMT includes a wide range of powerful commands for complex applications.

Standard features include:

- Three stepper drive outputs, with control for a fourth external stepper axis.
- Integral AC/DC power supply.
- Point to point moves, software cams and gearing.
- 24 general purpose 5V digital inputs, software configurable as level or edge triggered.
- 16 general purpose digital outputs (open collector Darlington type).
- 2 differential ±10V analog inputs with 12-bit resolution.
- 1 single-ended 0-11V analog output with 8-bit resolution for control of a fifth axis or other equipment.
- USB serial port.
- RS232 or RS485 serial port (model dependent).
- CANopen or proprietary Baldor CAN protocol for communication with MintMT controllers and other third party devices.
- Programmable in MintMT.

Included with NextMove ST is the Baldor Motion Toolkit CD. This contains a number of utilities and useful resources to get the most from you MintMT controller. These include:

- Mint WorkBench
  This is the user interface for communicating with the NextMove ST. Installing Mint WorkBench will also install firmware for NextMove ST.
- PC Developer Libraries
  Installing Mint WorkBench will install ActiveX interfaces that allow PC applications to be written that communicate with the NextMove ST.

This manual is intended to guide you through the installation of NextMove ST.

The chapters should be read in sequence.

The *Basic Installation* section describes the mechanical installation of the NextMove ST. The following sections require knowledge of the low level input/output requirements of the installation 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 firmware and Mint WorkBench releases by visiting the website *www.baldormotion.com/supportme*.

2.2 Receiving and inspection

When you receive your NextMove ST, 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 NextMove ST.
2. Remove the NextMove ST 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 NextMove ST 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 NextMove ST for external damage during shipment and report any damage to the carrier that delivered it.
5. If the NextMove ST 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 NextMove ST 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.

NextMove ST catalog number: **NST002-501 or NST002-502**

Installed in: _____ **Date:** _____

A description of the catalog numbers are shown in the following table:

Catalog number	Description
NST002-501	NextMove ST controller with USB and RS232 serial connections
NST002-502	NextMove ST controller with USB and RS485 serial connections

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
Ω . . . . . Ohm
mΩ . . . . . milliohm
µF . . . . . microfarad
pF . . . . . picofarad
mH . . . . . millihenry

Φ . . . . . phase
ms . . . . . millisecond
µs . . . . . microsecond
ns . . . . . nanosecond

mm . . . . . millimeter
m . . . . . meter
in . . . . . inch
ft . . . . . feet
lbf-in . . . . . pound force inch (torque)
N·m . . . . . Newton meter (torque)

ADC . . . . . Analog to Digital Converter
ASCII . . . . . American Standard Code for Information Interchange
AWG . . . . . American Wire Gauge
CAL . . . . . CAN Application Layer
CAN . . . . . Controller Area Network
CDROM . . . . . Compact Disc Read Only Memory
CiA . . . . . CAN in Automation International Users and Manufacturers Group e.V.
CTRL+E . . . . . on the PC keyboard, press **Ctrl** then **E** at the same time.
DAC . . . . . Digital to Analog Converter
DS301 . . . . . CiA CANopen Application Layer and Communication Profile
DS401 . . . . . CiA Device Profile for Generic I/O Devices
DS403 . . . . . CiA Device Profile for HMIs
EDS . . . . . Electronic Data Sheet
EMC . . . . . Electromagnetic Compatibility
HMI . . . . . Human Machine Interface
ISO . . . . . International Standards Organization
Kbaud . . . . . kilobaud (the same as Kbit/s in most applications)
LCD . . . . . Liquid Crystal Display
MB . . . . . megabytes
Mbps . . . . . megabits/s
(NC) . . . . . Not Connected
RF . . . . . Radio Frequency

3.1 Introduction

You should read all the sections in *Basic Installation*.
It is important that the correct steps are followed when installing the NextMove ST.
This section describes the mechanical installation of the NextMove ST.

3.1.1 Location requirements

You must read and understand this section before beginning the installation.


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


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


CAUTION: Avoid locating the NextMove ST immediately above or beside heat generating equipment, or directly below water steam pipes.


CAUTION: Avoid locating the NextMove ST in the vicinity of corrosive substances or vapors, metal particles and dust.

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

- The NextMove ST is designed to be mounted indoors, permanently fixed and located.
- The NextMove ST must be secured by the slots in the metal carrier.
- The NextMove ST must be installed in an ambient temperature of 0°C to 40°C (32°F to 104°F).
- The NextMove ST must be installed in relative humidity levels of less than 80% for temperatures up to 31°C (87°F) decreasing linearly to 50% relative humidity at 40°C (104°F), non-condensing.
- The NextMove ST must be installed where the pollution degree according to IEC664 shall not exceed 2.
- There shall not be abnormal levels of nuclear radiation or X-rays.

3.1.2 Mounting the NextMove ST

CAUTION: Before touching the unit be sure to discharge static electricity from your body and clothing by touching a grounded metal surface. Alternatively, wear an earth strap while handling the unit.

Ensure you have read and understood the location requirements in section 3.1.1. Mount the NextMove ST by the four slots in the metal carrier / heat sink assembly. M5 bolts or screws are recommended.

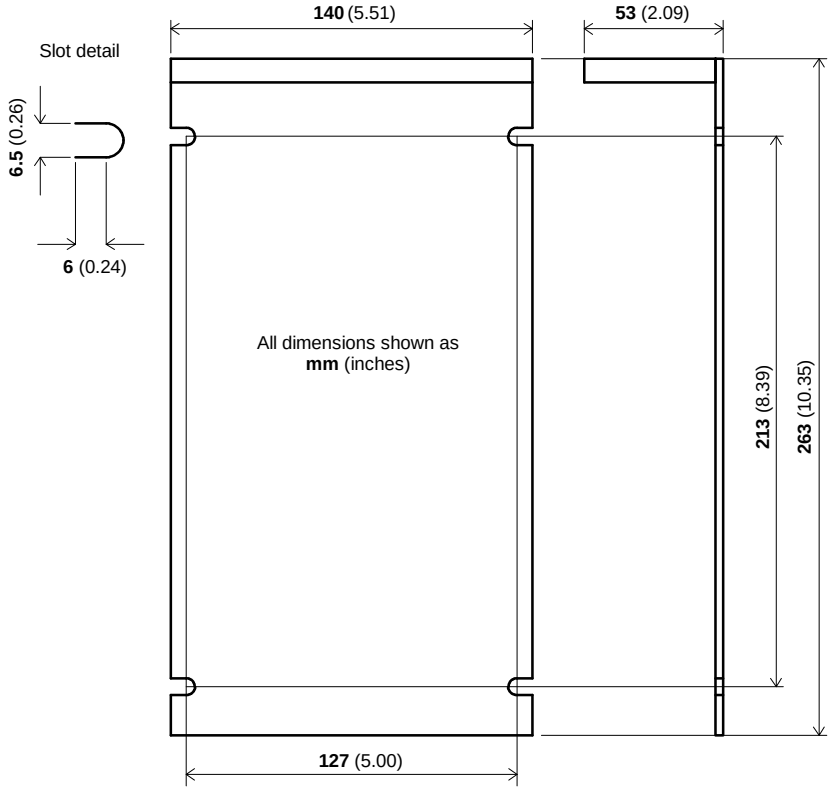


Figure 1 - Package dimensions

There must be at least 20mm clearance between the NextMove ST and neighboring equipment to allow sufficient cooling by natural convection. Remember to allow additional space around the edges to accommodate the mating connectors and associated wiring leading to the NextMove ST.

3.1.3 Other requirements for installation

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

	Minimum specification	Recommended specification
Processor	Intel PentiumIII 500MHz	Intel PentiumIII / 4 or equivalent 1 GHz or faster
RAM	128 MB	1 GB
Hard disk space	50 MB	50 MB
CD-ROM	A CD-ROM drive	
Serial port	USB port or RS232 or RS485 serial port (depending on NextMove ST model)	
Screen	1024 x 768, 16-bit color	1152 x 864, 16-bit color
Mouse	A mouse or similar pointing device	
Operating system	Windows 95, Windows NT	Windows 98*, Windows ME*, Windows NT*, Windows 2000 or Windows XP

* For USB support, Windows 2000 or Windows XP is required. Software installation will be described later, in section 5.

- A serial cable (connected as shown in section 4.6.2) or a USB cable.
- Your PC operating system user manual might be useful if you are not familiar with Windows.

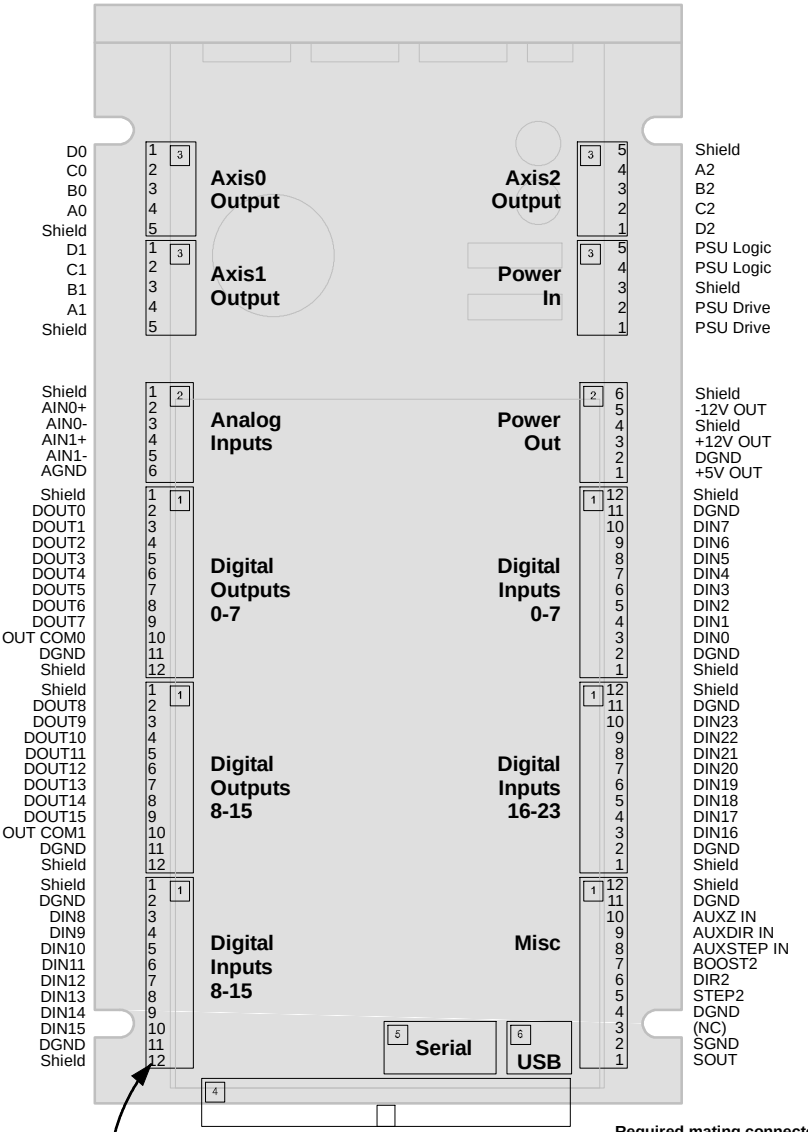
4.1 Introduction

This section describes the digital and analog input and output capabilities of the control card.

The following conventions will be used to refer to the inputs and outputs:

I/O . . . . . Input / Output
DIN . . . . . Digital Input
DOUT . . . . . Digital Output
AIN . . . . . Analog Input
AOUT . . . . . Analog Output

4.1.1 Connector locations



Tightening torque for terminal block connections is 0.25 N·m (2.2 lbf-in)

Required mating connectors:

1	Weidmüller Omnimate BL 3.5/12
2	Weidmüller Omnimate BL 3.5/6
3	Weidmüller Omnimate BLZ 5.08/5
4	50-pin connector (not used)
5	9-pin D-type socket (female)
6	USB type B plug

4.2 Power connections

The NextMove ST can accept AC or DC power supplies, and has connections for separate drive and logic supplies. However, the NextMove ST can operate from a single combined supply if necessary.

Supply connection	Recommended supply voltage	Supply voltage range	Power requirement
Logic	24VDC	12-35VDC	60W
	24VAC	12-30VAC	60VA
Drive	24VDC	12-35VDC (must not exceed 6A)	150W
	24VAC	12-30VAC (must not exceed 6A RMS)	150VA
Combined drive and logic	24VDC	12-35VDC (must not exceed 8.5A)	210W
	24VAC	12-30VAC (must not exceed 8.5A RMS)	210VA

4.2.1 Operation using combined drive and logic supply

To operate the NextMove ST using a combined drive and logic supply, it is necessary to connect links between the power input connections as shown in Figure 2. The drive and logic supply inputs have independent bridge rectifiers so polarity is not important. The NextMove ST creates its own ±12V and +5V supplies for the control card and internal circuitry by deriving power from the drive supply.

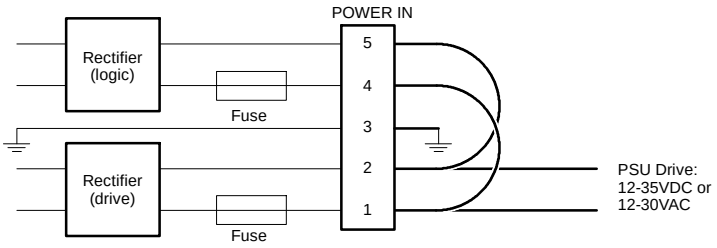


Figure 2 - Linking supply inputs to operate from drive supply only

The regulated ±12V and +5V supplies are made available on the power out connector for use with low power external circuitry, such as input potentiometers. Current demand must not exceed 10mA from the ±12V supply and 200mA from the 5V supply.

4.2.2 Operation using separate drive and logic supplies

For improved noise immunity, the ±12V and +5V supplies used for the control card and internal circuitry can be derived from a separate logic supply. To operate the NextMove ST using separate drive and logic supplies, do not link power input connector pins. Connect power as shown in Figure 3.

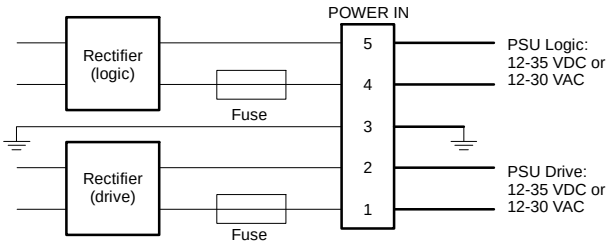


Figure 3 - Connecting separate drive and logic supplies

4.3 Stepper outputs

The NextMove ST provides three 37VDC (max), 2A stepper axes drive outputs, operating at 10Hz to 200kHz. Logic level outputs are provided to control a fourth stepper axis.

If required, the output current for individual axes can be derated. This can only be achieved by making precise alterations to the NextMove ST circuitry. Please contact Baldor Technical Support for details.

4.3.1 Stepper axes 0-2 drive outputs

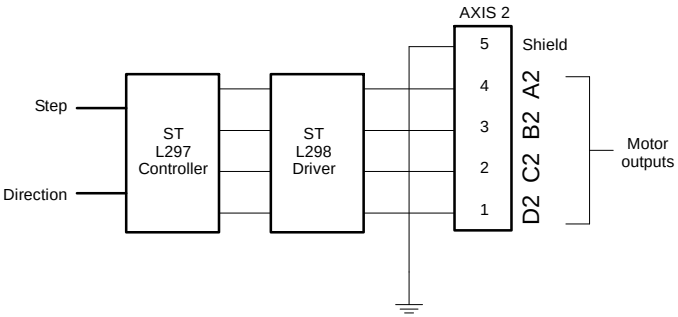


Figure 4 - Stepper output - axis 2 shown

The stepper axis drive outputs operate in half stepping mode.

4.3.1.1 Connecting a 4-wire motor

Four-wire bipolar motors can be used with the NextMove ST. Connections are shown in Figure 5. If the motor turns in the wrong direction, reverse the connections from one of the phase outputs AB or CD, but not both.

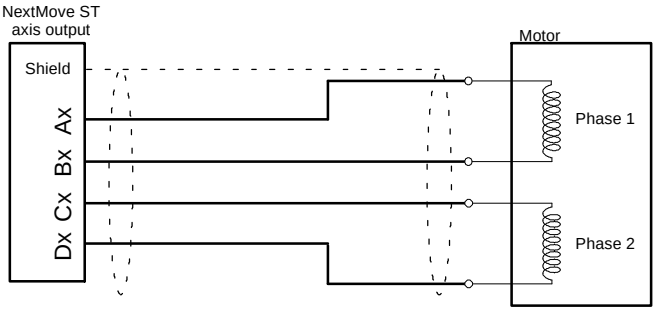


Figure 5 - Connecting a 4-wire motor

4.3.1.2 Connecting a 6-wire motor

Six-wire unipolar motors can be used with the NextMove ST. Six-wire motors are similar to eight-wire motors except the coils in each phase have a permanent center tap connection. Connections are shown in Figure 6. If the motor turns in the wrong direction, reverse the connections from one of the phase outputs AB or CD, but not both. Always leave the common center tap wires unconnected.

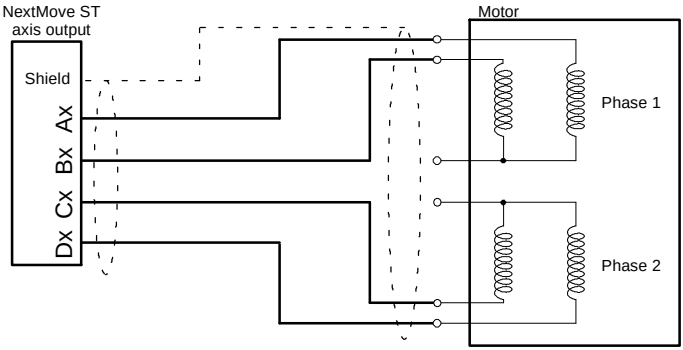


Figure 6 - Connecting a 6-wire motor

4.3.1.3 Connecting an 8-wire motor

Eight-wire (universal) motors can be used with the NextMove ST. Connections are shown in Figures 7 and 8. If the motor turns in the wrong direction, reverse the connections from one of the phase outputs AB or CD, but not both. Eight-wire motors can be connected in two ways, depending on the required torque and speed characteristics.

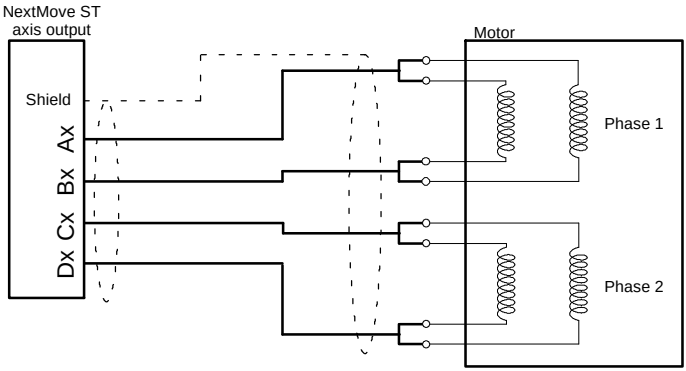


Figure 7 - Connecting an 8-wire motor, parallel windings

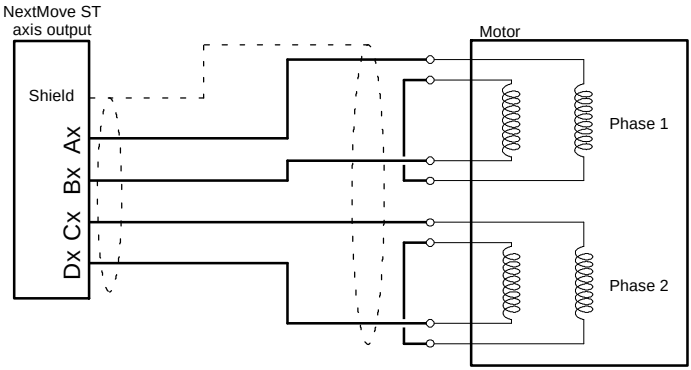


Figure 8 - Connecting an 8-wire motor, series windings

4.3.2 Stepper axes 0-3 logic outputs

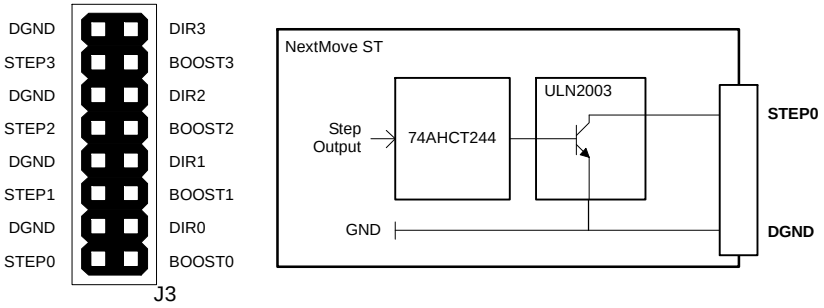


Figure 9 - Stepper output pin header J3, and output circuit (STEP0 shown)

To allow external stepper amplifiers to be used, all of the stepper output signals from the NextMove ST control card are output on a 16-pin header, J3, mounted on the card. There are four sets of stepper motor control outputs, operating in the range 10Hz to 1MHz. The step (pulse), direction and boost signals from the NextMove ST control card are divided into two groups, each group driven by an ULN2003 open collector Darlington output device.

Each ULN2003 has a maximum power dissipation of 900mW at 25°C. The total combined output requirements for the group DIR0 - DIR2 and STEP0 - STEP2 must not exceed this limit. The total combined output requirements of the group DIR3, STEP3 and BOOST0 - BOOST3 must not exceed this limit. The maximum current limit for any individual output in a group is 400mA if only one output is in use, reducing to 50mA if all outputs in the group are in use. These limits are for a 100% duty cycle.

It is recommended to use separate shielded cables for the step outputs. The shield should be connected at one end only.

The STEP2, DIR2 and BOOST2 outputs are also duplicated on the MISC connector.

CAUTION: The ULN2003 drivers are static sensitive devices. Take appropriate ESD precautions when handling the NextMove ST.

4.4 Analog I/O

The NextMove ST provides:

- Two 12-bit resolution analog inputs.
- One 0-11V analog output.

4.4.1 Analog inputs

- Differential inputs.
- Voltage range: ±10V.
- Resolution: 12-bit with sign.
- Input impedance: 120kΩ.
- Sampling frequency: 4kHz maximum, 2kHz if both inputs are enabled.

The analog inputs pass through a differential buffer and second order Butterworth filter with a cut-off frequency of approximately 1kHz.

Both inputs are normally sampled at 2kHz. However, an input can be disabled by setting `ADCMODE` to 4 (`_acOFF`). With one input disabled, the remaining input will be sampled at 4kHz. In MintMT, analog inputs can be read using the `ADC` keyword. See the MintMT help file for full details of `ADC` and `ADCMODE`.

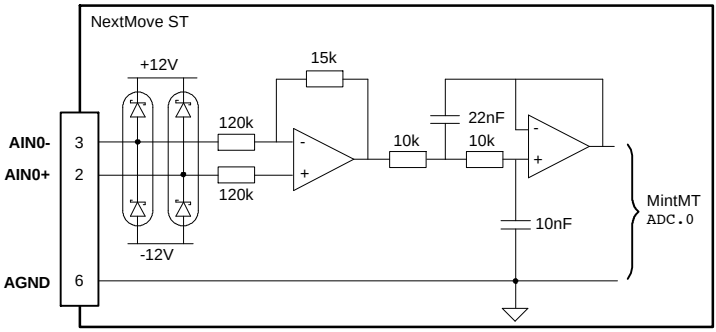


Figure 10 - Analog input, AIN0 shown

For differential inputs connect input lines to AIN+ and AIN-. Leave AGND unconnected.

4.4.2 Analog output

- Single ended output.
- Voltage range: 0-11V.
- Output current: 30mA maximum.

The analog output provides an independent opto-isolated 0-11V output for controlling an additional axis or other external equipment. The output is controlled using the `AUXDAC` keyword - see the MintMT help file. Output offset voltage can be controlled by the variable resistor R35, located just behind the SOUT and SGND pins of the Misc connector.

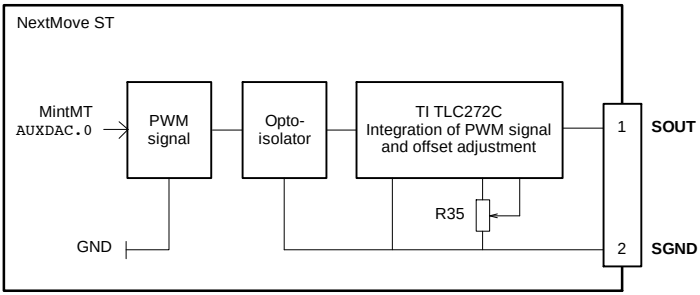


Figure 11 - Analog output

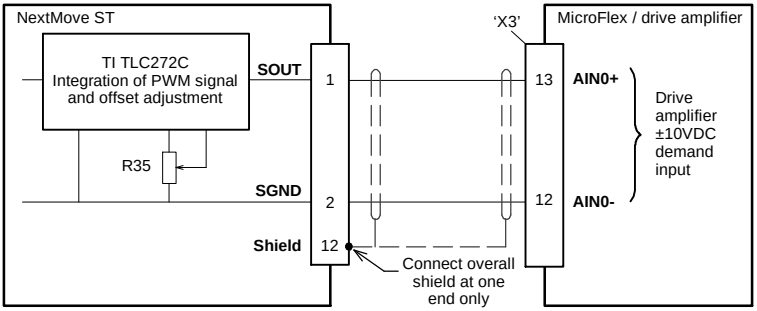


Figure 12 - Analog output - typical connection to a Baldor MicroFlex

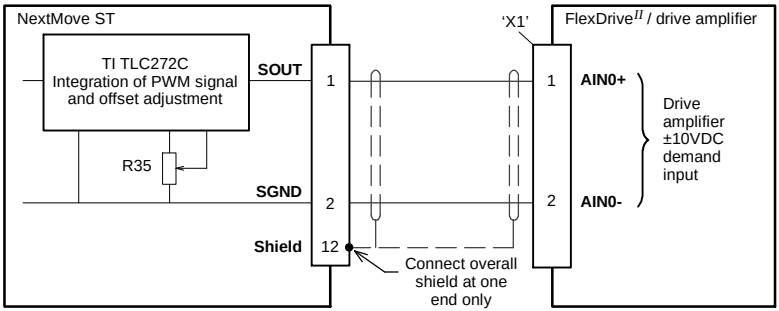


Figure 13 - Analog output - typical connection to a Baldor FlexDrive^{II}, Flex+Drive^{II} or MintDrive^{II}

4.5 Digital I/O

The NextMove ST provides:

- 24 general purpose digital inputs.
- 16 general purpose digital outputs.

Note: It is recommended to use separate shielded cables for the digital inputs. The shield should be connected to the input connector's shield pin.

4.5.1 Digital inputs

The digital inputs are available across a range of connectors, as shown in section 4.1.1.
All digital inputs have a common specification:

- General purpose 5V TTL digital inputs with internal pull-up resistors. Can also be assigned to special purposes such as Home, Limit, Stop and Error inputs.
- Sampling frequency: 1kHz

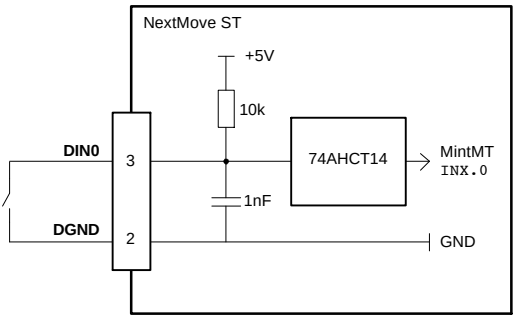


Figure 14 - General purpose digital input - DIN0 shown

CAUTION: Do not connect 24V signals to the digital inputs.

These are unprotected inputs connected directly to 74AHCT14 devices. If an input is configured as edge triggered, the triggering pulse must have a duration of at least 1ms (one software scan) to guarantee acceptance by MintMT. The use of shielded cable for inputs is recommended.

The 24 general purpose digital inputs can be shared between axes and can be configured using Mint WorkBench (or the Mint keywords beginning `INPUT`...) to determine their active level and other properties. The state of individual inputs can be read directly using the `INX` keyword. See the MintMT help file.

4.5.1.1 Typical digital input wiring

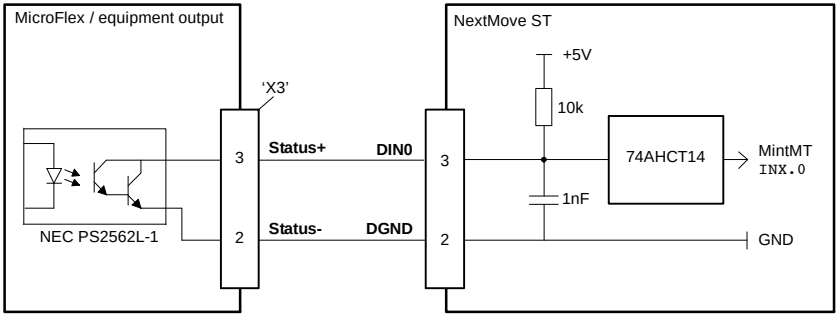


Figure 15 - Digital input - typical connections from a Baldor MicroFlex

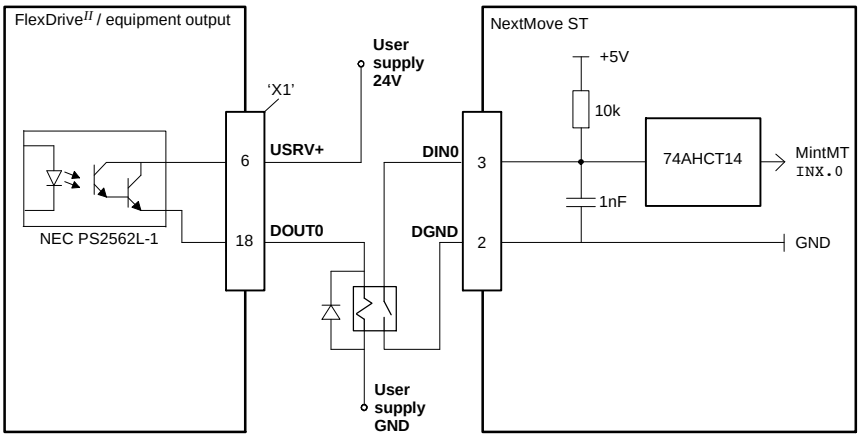


Figure 16 - Digital input - typical connections from a Baldor FlexDrive^{II}, Flex+Drive^{II} or MintDrive^{II}

Using a digital input as a LIMIT or HOME input

An input can be configured as a Limit or Home input for any axis, using the LIMITFORWARDINPUT, LIMITREVERSEINPUT or HOMEINPUT keywords. Typically, limit and home inputs will be grounded by normally closed switches. When a limit or home switch is activated, the switch will become open-circuit. If two or more limit switches are to be used they can be connected in series. If it is necessary to determine which limit has been reached, a double pole switch can be used at one limit to trigger an additional general purpose digital input.

Using a digital input as a STOP input

An input can be configured as a Stop input for any axis, using the STOPINPUT keyword. Typically, a stop input will be grounded by a normally closed switch. When a stop switch is activated, the switch will become open-circuit. The action of a STOP input can be controlled using the STOPINPUTMODE keyword. Typically, it is used as a safety interlock to stop all axes.

Using a digital input as an ERROR input

An input can be configured as an Error input for any axis, using the ERRORINPUT keyword. This input can be used to stop the NextMove ST in the event of an error occurring elsewhere in the system. The action of an ERROR input can be controlled using the ERRORSWITCH and ERRORINPUTMODE keywords.

See the MintMT help file for details of each keyword.

4.5.1.2 Auxiliary Encoder inputs - AUXSTEP IN, AUXDIR IN, AUXZ IN

These inputs accept step (pulse) and direction signals, allowing an external source to provide the reference for the speed and direction of an axis. The step frequency (20MHz maximum) determines the speed, and the direction input determines the direction of motion. Both the rising and falling edges of the AUXSTEP IN input cause an internal counter to be changed. If 5V is applied to the AUXDIR IN input (or it is left unconnected) the counter will increment. If the direction input is grounded the counter will be decremented.

Typically, one channel of an encoder signal (either A or B) would be used to provide the AUXSTEP IN signal, allowing the input to be used as an auxiliary (master) encoder input. The input can be used as a master position reference for cam, fly and follow move types. For this, the MASTERSOURCE keyword must be used to configure the pulse input as a master (auxiliary) encoder input. The master position reference can then be read using the AUXENCODER keyword.

Since a secondary encoder channel is not used, the AUXDIR IN input allows the direction of motion to be determined. The AUXZ IN input can be supplied from the encoder's index signal, and may be read using the AUXENCODERZLATCH keyword.

See the MintMT help file for details of each keyword.

Note: The AUXSTEP IN and AUXDIR IN inputs use the same type of input circuitry as the other digital inputs (see Figure 14). However, due to the faster internal processing required for these signals, they are particularly sensitive to noise. For this reason, connections must use shielded twisted pair cable.

4.5.2 Digital outputs

The digital outputs are available across a range of connectors, as shown in section 4.1.1.

- 16 general purpose digital outputs
- Update frequency: Immediate

There are 16 general purpose digital outputs, arranged in two groups; DOUT0-DOUT7 and DOUT8-DOUT15. Each group is driven by a ULN2803 device. The outputs are designed to sink current from an external supply (typically 24VDC), but have no overcurrent or short circuit protection. When an output is activated, it is grounded through the ULN2803.

The ULN2803 has a maximum power dissipation of 2W at 25°C. The total output requirements of each group must not exceed this limit. The maximum current limit for any output within a group is 500mA if only one output is in use, reducing to 150mA if all outputs in the group are in use. These limits are for a 100% duty cycle.

If the outputs are driving inductive loads such as relays, connect the group's OUT COMx connection to the output's power supply, as shown in Figure 17. This will connect internal clamp diodes on all outputs in the group.

An output can be configured in MintMT as a general purpose output, a drive enable output or a global error output. Outputs can be shared between axes and can be configured using Mint WorkBench (or the `OUTPUTACTIVELEVEL` keyword) to determine their active level.

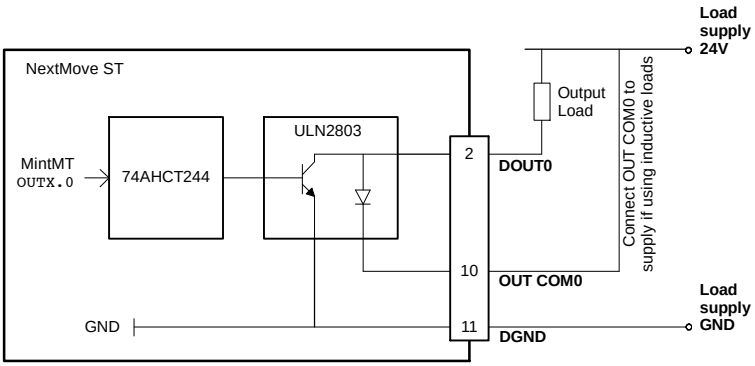


Figure 17 - Digital output - DOUT0 shown

4.5.3 Error output

The NextMove ST control card has an internal error output connected directly to the enable inputs of the ST L297 stepper controllers (see section 4.3.1). The error output must therefore be used to enable the axes. There are a number of methods for controlling the error output.

4.5.3.1 RELAY keyword

Because the NextMove ST control card is used in products that include a hardware relay, the error output may be controlled directly by the `RELAY` keyword. The command `RELAY=1` will enable the stepper controllers; the command `RELAY=0` will disable them.

4.5.3.2 DRIVEENABLEOUTPUT keyword

The `DRIVEENABLEOUTPUT` keyword can be used to configure the error output as the drive enable output. For example, the command `DRIVEENABLEOUTPUT.1=_RELAY0` will mean that the error output will be the drive enable output for axis 1. When axis 1 is enabled, the error output will be activated and the axis enabled. If multiple axes are configured to use the error output as their drive enable output, enabling one axis will enable all of them. Similarly, if one axis is disabled, all will be disabled.

The `RELAY` keyword cannot control the error output if it is configured as a drive enable output.

4.5.3.3 GLOBALERROROUTPUT keyword

By default, the error output is used as the global error output. In the event of an error on any axis, the global error output will be deactivated, disabling all axes. This action overrides the state of the error output defined by other methods, such as the drive enable status or `RELAY` keyword. Alternatively, the `GLOBALERROROUTPUT` keyword can be used to configure a general purpose digital output to be the global error output.

See the MintMT help file for details of each keyword.

4.5.3.4 Jumper settings

The operation of the error output is dependent on jumpers JP1, JP3, JP4 and JP5. Jumper JP1 is situated next to the POWER IN connector on the baseboard, and must be set as shown in Figure 18.

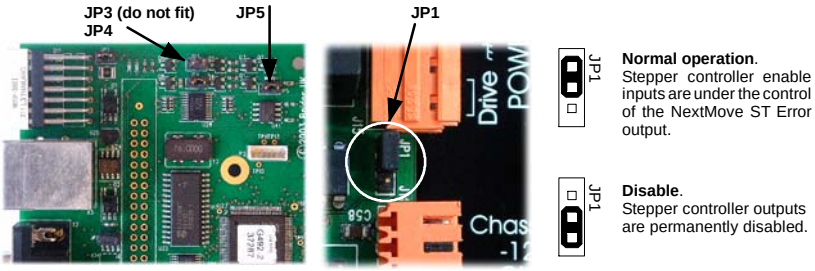
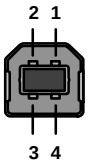


Figure 18 - Error output jumper JP1

Jumpers JP3, JP4 and JP5 are situated at the edge of the NextMove ST control card, near the end of the 50-pin expansion header. JP4 and JP5 must be fitted to allow correct operation of the error output. The neighboring jumper JP3 must not be fitted.

4.6 Other I/O

4.6.1 USB port

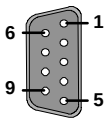


Location	USB Mating connector: USB Type B (downstream) plug	
Pin	**Name**	**Description**
1	VBUS	USB +5V
2	D-	Data-
3	D+	Data+
4	GND	Ground

The USB connector can be used as an alternative method for connecting the NextMove ST to a PC running Mint WorkBench. The NextMove ST is a self-powered, USB 1.1 (12Mbps) compatible device. If it is connected to a slower USB1.0 host PC or hub, communication speed will be limited to the USB1.0 specification (1.5Mbps). If it is connected to a faster USB2.0 (480Mbps) host PC or hub, communication speed will remain at the USB1.1 specification of the NextMove ST.

Ideally, the NextMove ST should be connected directly to a USB port on the host PC. If it is connected to a hub shared by other USB devices, communication could be affected by the activity of the other devices. A 2m (6.5 ft) standard USB cable is supplied. The maximum recommended cable length is 5m (16.4 ft).

4.6.2 Serial port



Location	Serial Mating connector: 9-pin female D-type	
Pin	**RS232 name**	**RS485 / RS422 name**
1	Shield	*(NC)*
2	RXD	RX- (input)
3	TXD	TX- (output)
4	*(NC)*	*(NC)*
5	DGND	0V DGND
6	*(NC)*	*(NC)*
7	RTS	TX+ (output)
8	CTS	RX+ (input)
9	DGND	*(NC)*

NextMove ST is available with either an RS232 or RS485 serial port (see section 2.2.1). The port is fully ESD protected to IEC 1000-4-2 (15kV). When the NextMove ST is connected to Mint WorkBench, the Tools, Options menu item can be used to configure the serial port. The configuration can also be changed using the Mint keyword `SERIALBAUD` (see the Mint help file for details). It is stored in EEPROM and restored at power up. The port is capable of operation at up to 115.2 Kbaud on RS232.

4.6.3 Using RS232

The NextMove ST has a full-duplex RS232 serial port with the following preset configuration:

- 57.6 Kbaud
- 1 start bit
- 8 data bits
- 1 stop bit
- No parity
- Hardware handshaking lines (RS232) RTS and CTS must be connected.

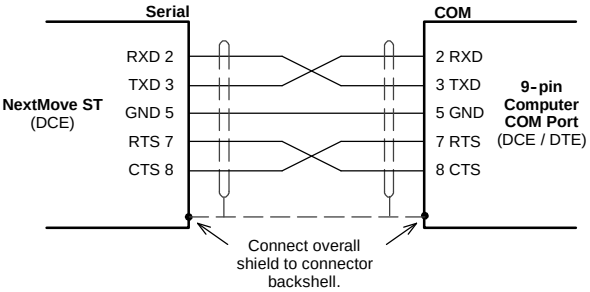


Figure 19 - RS232 serial port connections

The RS232 port is configured as a DCE (Data Communications Equipment) unit so it is possible to operate the controller with any DCE or DTE (Data Terminal Equipment). Full duplex transmission with hardware handshaking is supported. Only the TXD, RXD and 0V GND connections are required for communication, but since many devices will check the RTS and CTS lines, these must also be connected. Pins 4 and 6 are linked on the NextMove ST.

The maximum recommended cable length is 3m (10ft) at 57.6 Kbaud. When using lower baud rates, longer cable lengths may be used up to maximum of 15m (49ft) at 9600 baud. A suitable cable is available from Baldor, catalog number CBL001-501.

4.6.4 Multidrop using RS485 / RS422

Multidrop systems allow one device to act as a 'network master', controlling and interacting with the other (slave) devices on the network. The network master can be a controller such as NextMove ST, a host application such as Mint WorkBench (or other custom application), or a programmable logic controller (PLC). RS422 may be used for multi-drop applications as shown in Figure 20. Four-wire RS485 may be used for single point-to-point applications involving only one Baldor controller. If firmware is updated over RS485/RS422, it can only be downloaded to the controller that was chosen in the Select Controller dialog in Mint WorkBench.

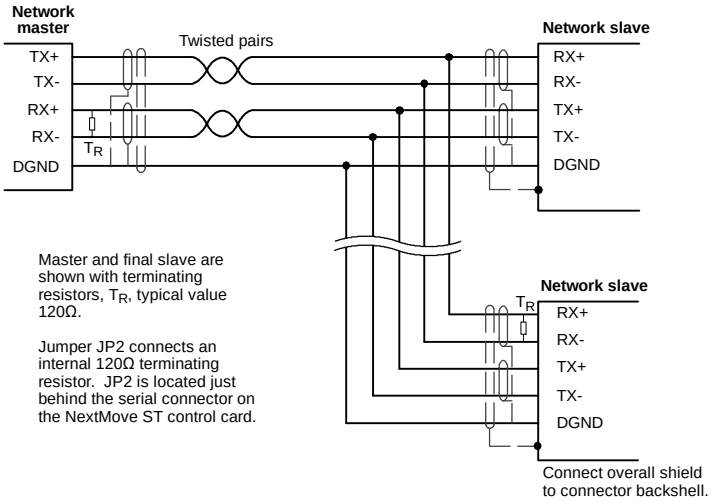


Figure 20 - 4-wire RS422 multi-drop connections

Each transmit/receive (TX/RX) network requires a termination resistor at the final RX connection, but intermediate devices must not be fitted with termination resistors. An exception is where repeaters are being used which may correctly contain termination resistors. Termination resistors are used to match the impedance of the load to the impedance of the transmission line (cable) being used. Unmatched impedance causes the transmitted signal to not be fully absorbed by the load. This causes a portion of the signal to be reflected back into the transmission line as noise. If the source impedance, transmission line impedance, and load impedance are all equal, the reflections (noise) are eliminated. Termination resistors increase the load current and sometimes change the bias requirements and increase the complexity of the system.

4.6.5 Connecting serial Baldor HMI Operator Panels

Serial Baldor HMI Operator Panels use a 15-pin male D-type connector (marked PLC PORT), but the NextMove ST Serial connector uses a 9-pin male D-type connector. The NextMove ST may be connected with or without hardware handshaking, as shown in Figure 21:

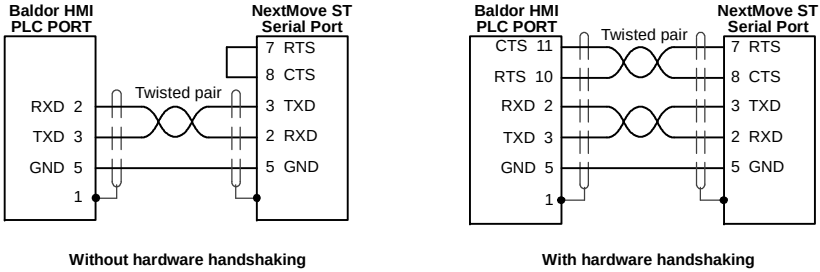


Figure 21 - RS232 cable wiring

Alternatively, the Baldor HMI panel may be connected using RS485/422, as shown in Figure 22:

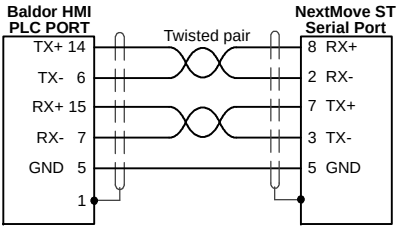


Figure 22 - RS485/422 cable wiring

4.6.6 50-pin edge connector

This connector (if present) is fitted for development purposes only and is not used for normal operation of the NextMove ST.

4.7 CAN

The CAN bus is a serial based network originally developed for automotive applications, but now used for a wide range of industrial applications. It offers low-cost serial communications with very high reliability in an industrial environment; the probability of an undetected error is $4.7x10^{-11}$. It is optimized for the transmission of small data packets and therefore offers fast update of I/O devices (peripheral devices) connected to the bus.

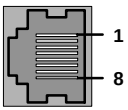
The CAN protocol only defines the physical attributes of the network, i.e. the electrical, mechanical, functional and procedural parameters of the physical connection between devices. The higher level network functionality is defined by a number of standards and proprietary protocols; CANopen is one of the most used standards for machine control within industries such as printing and packaging machines.

In addition to supporting CANopen, Baldor have developed a proprietary protocol called Baldor CAN. Both protocols are supported by NextMove ST, but unlike other Baldor devices both cannot be supported at the same time. This is because NextMove ST only has a single hardware CAN channel. Separate firmware builds are available to support each of the protocols.

To determine which firmware is currently installed, start Mint WorkBench and connect to the NextMove ST (see section 5). At the bottom of the Mint WorkBench window, the status bar will show the name of the controller, followed by 'CANopen' or 'Baldor CAN'. If the correct option is not shown, it will be necessary to download alternative firmware by using the Install System File and/or Download Firmware menu items in Mint WorkBench. The firmware file can be found on the Baldor Motion Toolkit CD supplied with your product, or downloaded from www.baldormotion.com. See the MintMT help file for details about downloading firmware.

4.7.1 CAN connector

The CAN connection is made using the RJ45 connector on the NextMove ST control card.



Location	NextMove ST control card	
Pin	**Name**	**Description**
1	CAN+	CAN channel positive
2	CAN-	CAN channel negative
3	-	*(NC)*
4	CAN 0V	Ground/earth reference for CAN signals
5	CAN V+	CAN power V+ (12-24V)
6	-	*(NC)*
7	-	*(NC)*
8	-	*(NC)*
Description Opto-isolated CAN interface using a RJ45 connector.		

The maximum (default) transmission rate on NextMove ST is 500Kbit/s.

4.7.2 CAN wiring

A very low error bit rate over CAN can only be achieved with a suitable wiring scheme, so the following points should be observed:

- The two-wire data bus line may be routed parallel, twisted and/or shielded, depending on EMC requirements. Baldor recommend a twisted pair cable with the shield/screen connected to the connector backshell, in order to reduce RF emissions and provide immunity to conducted interference.
- The bus must be terminated at both ends only (not at intermediate points) with resistors of a nominal value of 120Ω. This is to reduce reflections of the electrical signals on the bus, which helps a node to interpret the bus voltage levels correctly. If the NextMove ST is at the end of the network then ensure that jumper JP1, located just behind the status display, is in position. This will connect an internal terminating resistor.

- All cables and connectors should have a nominal impedance of 120Ω. Cables should have a length related resistance of 70mΩ/m and a nominal line delay of 5ns/m. A range of suitable CAN cables are available from Baldor, with catalog numbers beginning CBL004-5... .
- The maximum bus length depends on the bit-timing configuration (baud rate). The table opposite shows the approximate maximum bus length (worst-case), assuming 5ns/m propagation delay and a total effective device internal in-out delay of 210ns at 1Mbit/s, 300ns at 500 - 250Kbit/s, 450ns at 125Kbit/s and 1.5ms at 50 - 10Kbit/s.

CAN Baud Rate	Maximum Bus Length
1Mbit/s	25m
500Kbit/s	100m
250Kbit/s	250m
125Kbit/s	500m
100Kbit/s (1)	600m
50Kbit/s	1000m
20Kbit/s	2500m(2)
10Kbit/s	5000m(2)

(1) CAN baud rate not supported on Baldor CAN.
(2) For bus lengths greater than about 1000m, bridge or repeater devices may be needed.

- The compromise between bus length and CAN baud rate must be determined for each application. The CAN baud rate can be set using the BUSBAUD keyword. It is essential that all nodes on the network are configured to run at the same baud rate.
- The wiring topology of a CAN network should be as close as possible to a single line/bus structure. However, stub lines are allowed provided they are kept to a minimum (<0.3m at 1Mbit/s).
- The 0V connection of all of the nodes on the network must be tied together through the CAN cabling. This ensures that the CAN signal levels transmitted by NextMove ST or CAN peripheral devices are within the common mode range of the receiver circuitry of other nodes on the network.

4.7.2.1 Opto-isolation

On the NextMove ST, the CAN channel is opto-isolated. A voltage in the range 12-24V must be applied to pin 5 of the CAN connector. From this supply, an internal voltage regulator provides the 5V at 100mA required for the isolated CAN circuit. CAN cables supplied by Baldor are ‘category 5’ and have a maximum current rating of 1A, so the maximum number of NextMove ST units that may be used on one network is limited to ten. Practical operation of the CAN channel is limited to 500Kbit/s owing to the propagation delay of the opto-isolators.

4.7.3 CANopen

The NextMove ST must have the CANopen firmware loaded to use this protocol.

Baldor have implemented a CANopen protocol in MintMT (based on the 'Communication Profile' CiA DS-301) which supports both direct access to device parameters and time-critical process data communication. The NextMove ST design does not comply with a specific CANopen device profile (DS4xx), although it is able to support and communicate with the following devices:

- Any third party digital and analog I/O device that is compliant with the 'Device Profile for Generic I/O Modules' (CiA DS-401).
- Baldor HMI (Human Machine Interface) operator panels, which are based on the 'Device Profile for Human Machine Interfaces' (DS403).
- Other Baldor controllers with CANopen support for peer-to-peer access using extensions to the CiA specifications (DS301 and DS302).

The functionality and characteristics of all Baldor CANopen devices are defined in individual standardised (ASCII format) Electronic Data Sheets (EDS) which can be found on the Baldor Motion Toolkit CD supplied with your product, or downloaded from www.supportme.net.

Figure 23 shows a typical CANopen network with two NextMove ST units and a Baldor HMI operator panel:

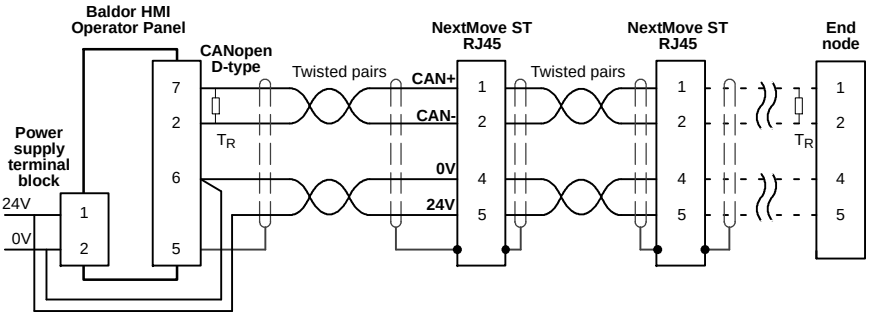


Figure 23 - Typical CANopen network connections

Note: The NextMove ST CAN channel is opto-isolated, so a voltage in the range 12-24V must be applied to pin 5 of the CAN connector. An additional adaptor (e.g. RS Components part 186-3105) or modifications to the cable may be required to facilitate the power connection.

The configuration and management of a CANopen network must be carried out by a single node acting as the network master. This role can be performed by the NextMove ST when it is configured to be the Network Manager node (node ID 1), or by a third party CANopen master device.

Up to 126 CANopen nodes (node IDs 2 to 127) can be added to the network by a NextMove ST Manager node using the MintMT `NODESCAN` keyword. If successful, the nodes can then be connected to using the MintMT `CONNECT` keyword. Any network and node related events can then be monitored using the MintMT `BUS1` event.

Note: All CAN related MintMT keywords are referenced to either CANopen or Baldor CAN using the 'bus' dot parameter. Although the NextMove ST has a single physical CAN bus channel that may be used to carry either protocol, MintMT distinguishes between the protocols with the 'bus' dot parameter. For CANopen the 'bus' dot parameter must be set to 1.

Please refer to the MintMT help file for further details on CANopen, MintMT keywords and dot parameters.

4.7.4 Baldor CAN

The NextMove ST must have the Baldor CAN firmware loaded to use this protocol.

Baldor CAN is a proprietary CAN protocol based on CAL. It supports only the following range of Baldor CAN specific I/O nodes and operator panels:

- InputNode 8 (Baldor part ION001-503) - an 8 x digital input CAN node.
- OutputNode 8 (Baldor part ION003-503) - an 8 x digital output CAN node.
- RelayNode 8 (Baldor part ION002-503) - an 8 x relay CAN node.
- IoNode 24/24 (Baldor part ION004-503) - a 24 x digital input and 24 x digital output CAN node.
- KeypadNode (Baldor part KPD002-501) - an operator panel CAN node with 4 x 20 LCD display and 27 key membrane labeled for control of 3 axes (X, Y, Z).
- KeypadNode 4 (Baldor part KPD002-505) - an operator panel CAN node with 4 x 20 LCD display and 41 key membrane labeled for control of 4 axes (1, 2, 3, 4).

A typical Baldor CAN network with a NextMove ST and a Baldor CAN operator panel is shown in Figure 18.

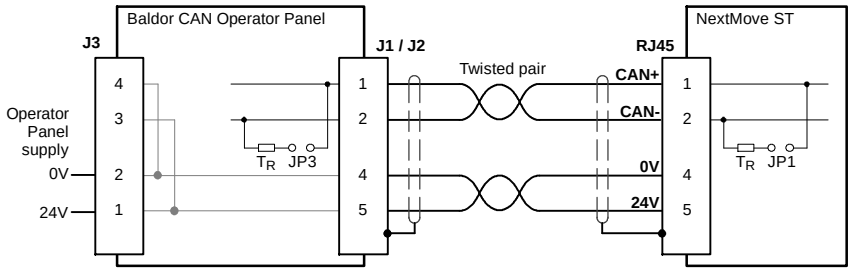


Figure 24 - Baldor CAN operator panel connections

The NextMove ST CAN channel is opto-isolated, so a voltage in the range 12-24V must be applied to pin 5 of the CAN connector. From this supply, an internal voltage regulator provides the 5V required for the isolated CAN circuit. The required 12-24V can be sourced from the Baldor CAN I/O node or operator panel's supply, which is internally connected to the CAN connector as shown in Figure 24.

On Baldor CAN I/O nodes and operator panels, jumpers JP1 and JP2 must be set to position '1' (the lower position) for the network to operate correctly. This configures the node's CAN

channel to operate on pins 1 and 2 of the RJ45 connectors. On the Baldor CAN node, jumper JP3 can be used to connect an internal 120Ω terminating resistor, provided the node is at the end of the network. Jumpers JP4 and JP5 can be used to configure the node ID and baud rate.

Up to 63 Baldor I/O nodes (including no more than 4 operator panels) can be added to the network by the NextMove ST using the MintMT `NODETYPE` keyword. Any network and node related events can then be monitored using the MintMT `BUS2` event.

Note: All CAN related MintMT keywords are referenced to either CANopen or Baldor CAN using the 'bus' dot parameter. Although the NextMove ST has a single physical CAN bus channel that may be used to carry either protocol, MintMT distinguishes between the protocols with the 'bus' dot parameter. For Baldor CAN the 'bus' dot parameter must be set to 2.

Please refer to the MintMT help file for further details on Baldor CAN, MintMT keywords and dot parameters.

4.8 Connection summary - minimum system wiring

As a guide, Figure 25 shows an example of the typical minimum wiring required to allow the NextMove ST to control a single stepper motor. The diagram shows the logic supply being derived from the main Drive supply (see section 4.2.1).

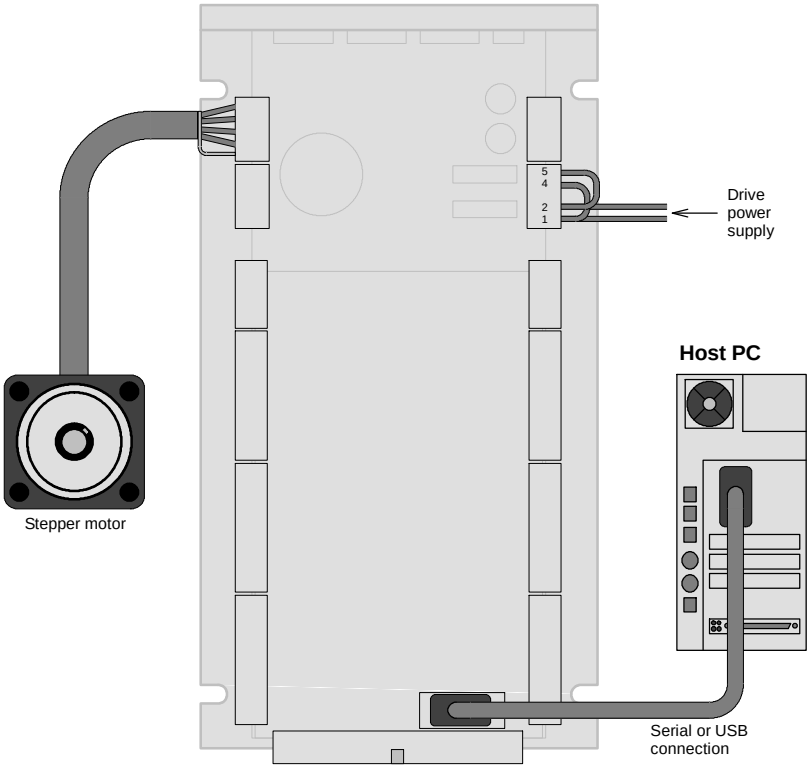


Figure 25 - Example minimum system wiring

5.1 Introduction

The software provided includes a number of applications and utilities to allow you to configure, tune and program the NextMove ST. The Baldor Motion Toolkit CD containing the software can be found separately within the packaging.

5.1.1 Connecting the NextMove ST to the PC

The NextMove ST can be connected to the PC using either RS232 or RS485 (model dependent), or USB (all models).

To use RS232 or RS485, connect an appropriate serial cable between a PC serial port (often labeled as “COM”) and the NextMove ST Serial connector. If you are using an intermediate RS232 to RS485 converter, connect this as specified by the manufacturer. Mint WorkBench can scan all the PC’s COM ports, so you can use any port. If you are not using the Baldor serial cable CBL001-501, your cable must be wired in accordance with Figure 19 in section 4.6.3.

To use USB, connect a USB cable between a PC USB port and the NextMove ST USB connector. Your PC must be using Windows 2000, XP, or Vista.

5.1.2 Installing Mint WorkBench

You will need to install Mint WorkBench to configure the NextMove ST. Any previous version of Mint WorkBench must be uninstalled before proceeding with this installation:

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:\start

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

   Follow the on-screen instructions to install Mint WorkBench. The setup wizard will copy the files to appropriate folders within the C:\Program Files folder, and place shortcuts on the Windows Start menu.

5.1.3 Starting the NextMove ST

If you have followed the instructions in the previous sections, you should have now connected power sources, your choice of inputs and outputs, and a serial or USB cable linking the PC with the NextMove ST.

5.1.4 Preliminary checks

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.
- Verify that the NextMove ST is properly earthed/grounded.
- Check all signal wiring for accuracy.

5.1.5 Power on checks

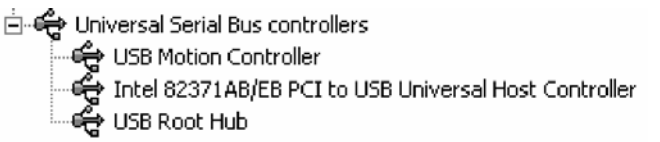
1. Turn on the Logic supply (if separate from the Drive supply).
2. Turn on the Drive supply.
3. After a brief test sequence, (8 followed by -.), the Status display should show the node number, for example 2, the factory default. If the display is not lit then re-check the power supply connections. A green surface mount LED (D16) near the center of the control card should also be flashing once every two seconds. The NextMove ST is now ready to be configured using Mint WorkBench.

   Note: If the red LED (D4) near the center of the control card remains illuminated, then the supply voltage to the NextMove ST control card is too low. See section 6.2.2 for LED locations. If the status display shows one of the digits 0 - 7 with a flashing decimal point, this indicates that the NextMove ST has detected a fault. In this unlikely event, please contact Baldor technical support.

5.1.5.1 Installing the USB driver

If you have connected the NextMove ST to the PC using the USB connection, it will be necessary to install the USB driver. When the NextMove ST is powered, Windows (2000, XP, or Vista only) will automatically detect the controller and request the driver. The driver consists of two files, *USBmotion.inf* and *USBmotion.sys*. Both files must be present for installation.

1. Follow the on-screen instructions to select and install the driver. The driver files are available on the supplied Baldor Motion Toolkit CD. If you are using a copy of the driver located on the hard disk, a floppy disk or another CD, the two driver files should be in the same folder.
2. During installation, Windows may report that the driver is 'unsigned'. This is normal for the NextMove ST driver, so click the Continue Anyway button to continue with the installation. When installation is complete, a new USB Motion Controller device will be listed in the *Universal Serial Bus controllers* section of Windows Device Manager.



The NextMove ST is now ready to be configured using Mint WorkBench.

Note: If the NextMove ST 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 NextMove ST to the original USB port where it will be recognized in the usual way.

5.2 Mint WorkBench

Mint WorkBench is a fully featured application for programming and controlling the NextMove ST. The main Mint WorkBench window contains a menu system, the Toolbox and other toolbars. Many functions can be accessed from the menu or by clicking a button - use whichever you prefer. Most buttons include a 'tool-tip'; hold the mouse pointer over the button (don't click) and its description will appear.

5.2.1 Help file

Mint WorkBench includes a comprehensive help file that contains information about every MintMT keyword, how to use Mint WorkBench and background information on motion control topics. The help file can be displayed at any time by pressing F1. On the left of the help window, the Contents tab shows the tree structure of the help file; each book contains a number of topics. The Index tab provides an alphabetic list of all topics in the file, and allows you to search for them by name. The Search tab allows you to search for words or phrases appearing anywhere in the help file. Many words and phrases are underlined and highlighted with a color (normally blue) to show that they are links. Just click on the link to go to an associated keyword. Most keyword topics begin with a list of relevant *See Also* links.

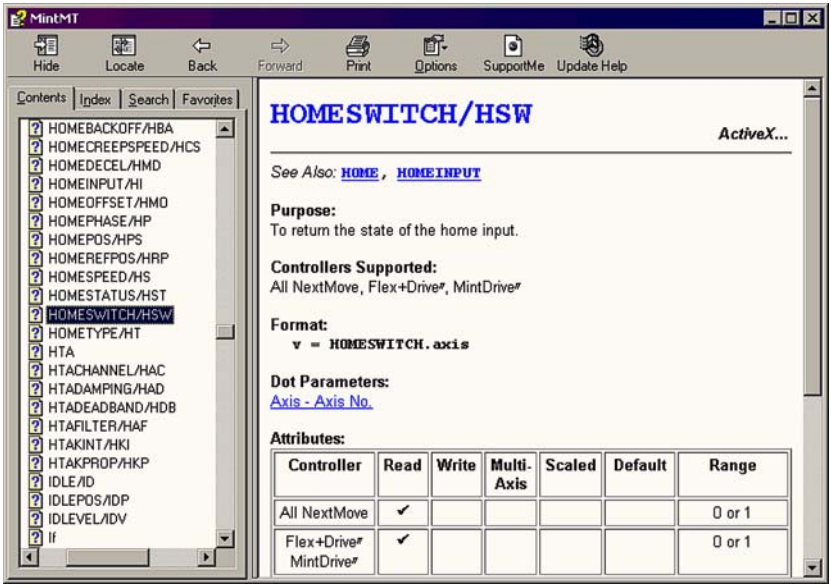


Figure 26 - The Mint WorkBench help file

For help on using Mint WorkBench, click the **Contents** tab, then click the small plus sign beside the **Mint WorkBench & Mint Machine Center** book icon. Double click a topic name to display it.

5.2.2 Starting Mint WorkBench

1. On the Windows **Start** menu, select Programs, Mint Machine Center, Mint WorkBench.

   Mint WorkBench will start, and the Tip of the Day dialog will be displayed.

   You can prevent the Tip of the Day dialog appearing next time by removing the check mark next to Show tips at startup.

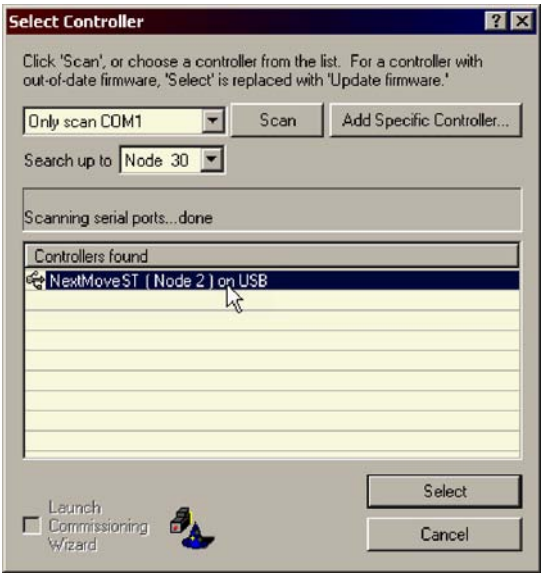
   Click **Close** to continue.

2. In the small opening dialog box, click **Start New Project...**

3. In the Select Controller dialog, go to the drop down box near the top and select the PC serial port to which the NextMove ST is connected. If you are unsure which PC serial port is connected to the NextMove ST, select **Scan all serial ports**. If the NextMove ST is connected using USB, it will be scanned automatically.

   Click **Scan** to search for the NextMove ST.

   When the search is complete, click NextMove ST in the list to select it, and click the **Select** button.



   Note: If the NextMove ST is not listed, check the serial or USB cable between the NextMove ST and the PC and that the NextMove ST is powered correctly. Click **Scan** to re-scan the ports.

4. A dialog box may be displayed to tell you that Mint WorkBench has detected new firmware.

   Click **OK** to continue. Mint WorkBench reads back data from the NextMove ST. When this is complete, Edit & Debug mode is displayed. This completes the software installation.

5.3 Configuring an axis

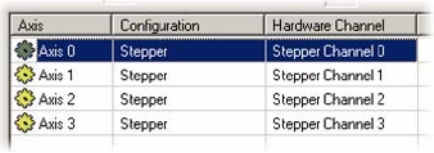
The NextMove ST is capable of controlling up to four stepper axes. This section describes the basic setup for these axes.

5.3.1 Choosing an axis

The factory preset configuration sets all axes as unassigned (off), so it is necessary to configure an axis as a stepper before it can be used. In the following example, the Mint WorkBench Axis Config Wizard will be used to assign axes:

1. In the Toolbox, click the Axis Config icon.

2. For each required axis, click in the Configuration column and select Stepper from the drop down box.



Axis	Configuration	Hardware Channel
Axis 0	Stepper	Stepper Channel 0
Axis 1	Stepper	Stepper Channel 1
Axis 2	Stepper	Stepper Channel 2
Axis 3	Stepper	Stepper Channel 3

   The Axis Config Wizard automatically assigns a Hardware Channel to the axis. For example, Stepper Channel 1 indicates the stepper axis will use the controller's Axis1 output (and the corresponding logic outputs STEP1 and DIR1). Optionally, the default hardware channel assignment can be altered by clicking in the Hardware Channel column and choosing an alternative channel. This means the axis will no longer use the correspondingly numbered physical outputs, so extra care must be taken when connecting and operating the NextMove ST.

3. Click **Finish** to complete the Axis Config Wizard. The axis configuration will be downloaded to the NextMove ST.

   Note: If a "Hardware channel required is in use" error message is displayed, the configuration is not downloaded, since the same hardware channel has been selected for more than one stepper axis.

It is recommended that unused axes are always set to OFF, as this provides more processing time for the axes that are in use. Setting an axis to Virtual means that it can be used to simulate motion within the controller, but uses no physical outputs (hardware channel).

See the MintMT help file for details of the `CONFIG` and `AXISCHANNEL` keywords.

5.3.2 Selecting a scale

When controlling stepper motors, MintMT defines all positional and speed related motion keywords in terms of steps. The number of steps is divided by the SCALEFACTOR allowing you to use units more suitable for your application. The unit defined by setting a value for scale is called the *user unit* (uu).

Consider a motor with a 1.8° step angle. The NextMove ST operates in half step mode, so there will be 400 steps per revolution. If SCALEFACTOR is not set, a MintMT command that involves distance, speed, or acceleration may need to use a large number to specify a significant move. For example MOVER=1600 (Move Relative) would rotate the motor by 1600 steps - only four revolutions. By setting a SCALEFACTOR of 400, the user unit becomes revolutions. The more understandable command MOVER=4 could now be used to move the motor four revolutions.

In applications involving linear motion a suitable value for SCALEFACTOR would allow commands to express values in linear distance, for example inches, feet or millimeters.

1. In the Toolbox, click the Parameters icon.

2. Click the Scale tab.

3. Click in the Axis drop down box to select the axis. Each axis can have a different scale if required.

4. Click in the Scale box and type a value.

5. Click **Apply**. This immediately sets the scaling factor for the selected axis, which will remain in the NextMove ST until another scale is defined or power is removed from the NextMove ST. See section 5.6 for details about saving configuration parameters.

5.3.3 Setting Relay0 as the drive enable output

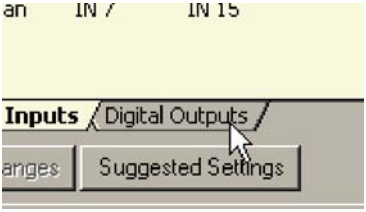
The NextMove ST control card has an internal error output connected directly to the enable inputs of the ST L297 stepper controllers (see section 4.3.1). The error output must therefore be used to enable the axes. Because the NextMove ST control card is used in products that include a hardware relay, the error output is referred to as Relay0.

The Digital I/O window's Digital Outputs tab allows you to configure Relay0 to be the drive enable output for each axis.

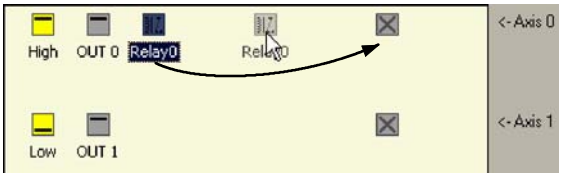
1. In the Toolbox, click the Digital I/O icon.

2. At the bottom of the Digital I/O screen, click the **Digital Outputs** tab.

   The left of the screen shows columns of grey icons, including one icon named Relay0.



3. Drag the **Relay0** icon onto the grey Axis 0 Drive Enable OP icon on the right of the screen. Repeat for the other axes. This will allow the NextMove ST control card to enable the axes.



4. Click **Apply** to send the changes to the NextMove ST. This immediately configures the drive enable output to be Relay0, which will remain until a different configuration is defined or power is removed from the NextMove ST. See section 5.6 for details about saving configuration parameters.

Note: The relay may also be controlled using other methods - see section 4.5.3.

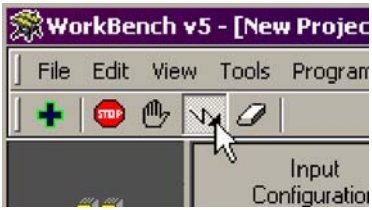
5.4 Stepper axis - testing

This section describes the method for testing a stepper axis. The stepper control is an open loop system so no tuning is necessary.

5.4.1 Testing the output

This section tests the operation and direction of the output. It is recommended that the system is initially tested and tuned with the motor shaft disconnected from other machinery.

1. Check that the Drive enable button is pressed (down).

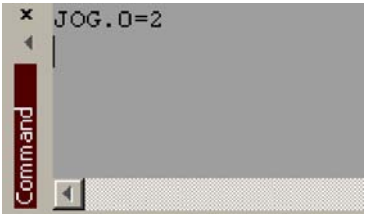


2. In the Toolbox, click the Edit & Debug icon.

3. Click in the Command window.

4. Type:
   `JOG.0=2`

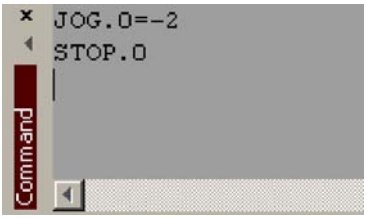
   where 0 is the axis (stepper output) to be tested and 2 is the speed.



   The `JOG` command specifies the speed in user units per second, so the speed is affected by `SCALEFACTOR` (section 5.3.2). If you have not selected a scale, the command `JOG.0=2` will cause rotation at only 2 half steps per second, so it may be necessary to increase this figure significantly, to 200 for example. If you have selected a scale that provides user units of revolutions (as described in section 5.3.2) `JOG.0=2` will cause rotation at 2 revolutions per second. If there appears to be no drive output, check that jumper JP1 has not been set to disable the outputs - see section 4.5.3.

5. To repeat the tests for reverse moves, type:
   `JOG.0 = -2`

6. To remove the demand and stop the test, type:
   `STOP.0`



5.5 Digital input/output configuration

The Digital I/O window can be used to setup other digital inputs and outputs.

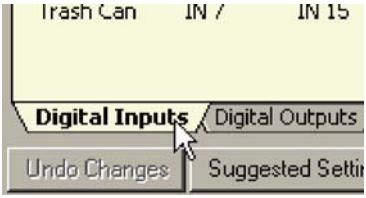
5.5.1 Digital input configuration

The Digital Inputs tab allows you to define how each digital input will be triggered, and if it should be assigned to a special purpose function such as a Home or Limit input. In the following example, digital input 1 will be set to trigger on a falling edge, and allocated to the forward limit input of axis 0:

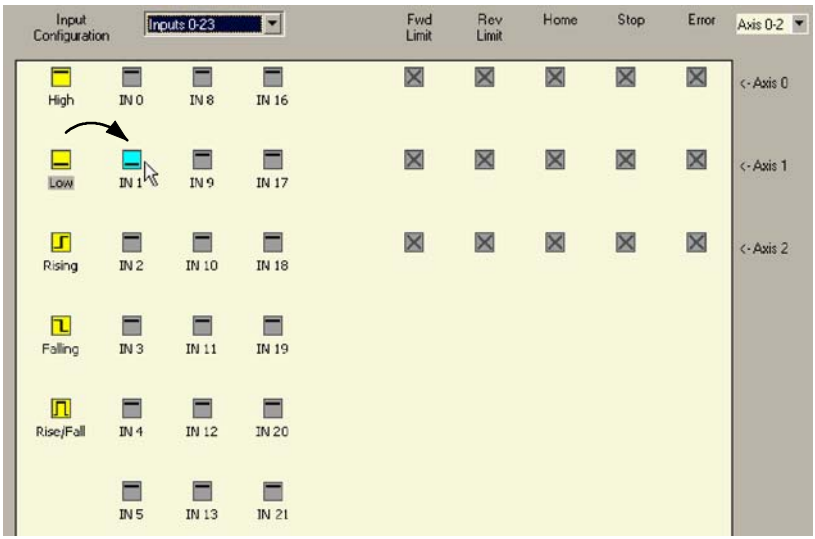
1. In the Toolbox, click the Digital I/O icon.

2. At the bottom of the Digital I/O screen, click the **Digital Inputs** tab.

   The left of the screen shows a column of yellow icons - High, Low, Rising, Falling and Rise/Fall. These describe how the input will be triggered.

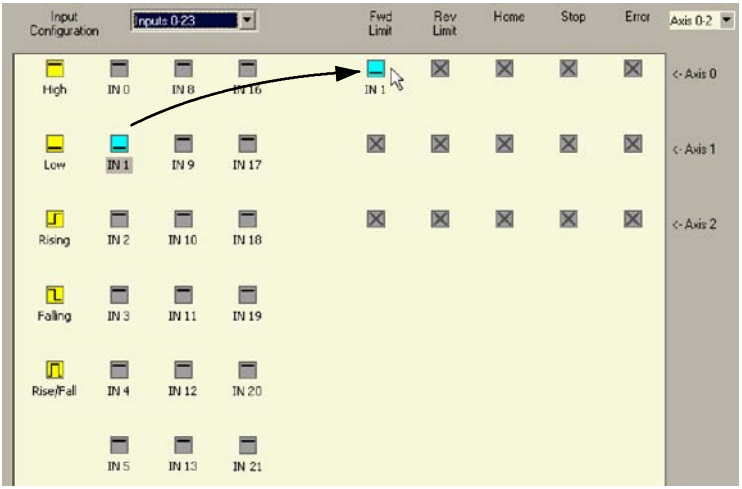


3. Drag the **Low** icon onto the **IN1** icon . This will setup IN1 to respond to low input.



4. Now drag the **IN1** icon  onto the **Fwd Limit** icon  .

   This will setup IN1 as the Forward Limit input of axis 0.



5. Click **Apply** to send the changes to the NextMove ST.

Note: If required, multiple inputs can be configured before clicking **Apply**.

5.5.2 Digital output configuration

The Digital Outputs tab allows you to define how each digital output will operate and if it is to be configured as an error output. Remember to click **Apply** to send the changes to the NextMove ST.

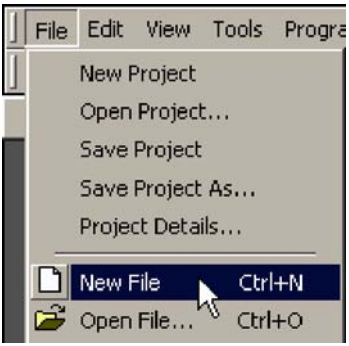
5.6 Saving setup information

When power is removed from the NextMove ST all data, including configuration parameters, is lost. You should therefore save this information in a file, which can be loaded when the unit is next used. Alternatively, the information can be included in program files as part of the Startup block.

1. In the Toolbox, click the Edit & Debug icon.

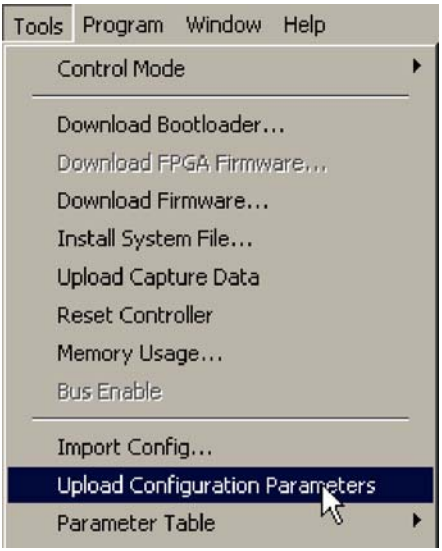
2. On the main menu, choose **File**, **New File**.

   A new program editing window will appear.



3. On the main menu, choose **Tools**, **Upload Configuration Parameters**.

   Mint WorkBench will read all the configuration information from the NextMove ST and place it in a Startup block. For details of the Startup block, see the MintMT help file.

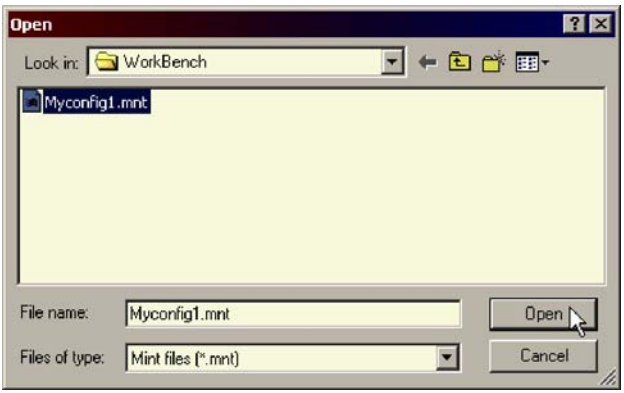


4. On the main menu, choose **File**, **Save File**. Locate a folder, enter a filename and click **Save**.

5.6.1 Loading saved information

1. In the Toolbox, click the Edit & Debug icon.

2. On the main menu, choose **File**, **Open File...**
   Locate the file and click **Open**.



A Startup block should be included in every Mint program, so that whenever a program is loaded and run the NextMove ST will be correctly configured. If the same program is used on a different NextMove ST installation, remember the Startup block might need to be changed to accommodate a different motor type.

6.1 Introduction

This section explains common problems and their solutions. If you want to know the meaning of the LED indicators, see section 6.2.

6.1.1 Problem diagnosis

If you have followed all the instructions in this manual in sequence, you should have few problems installing the NextMove ST. If you do have a problem, read this section first.
In Mint WorkBench, use the Error Log tool to view recent errors and then check the help file.
If you cannot solve the problem or the problem persists, the SupportMe feature can be used.

6.1.2 SupportMe feature

The SupportMe feature is available from the Help menu or by clicking the  button on the motion toolbar. SupportMe can be used to gather information which can then be e-mailed, saved as a text file, or copied to another application. The PC must have e-mail facilities to use the e-mail feature. If you prefer 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 serial number of your NextMove ST (if known).
- Use the Help, SupportMe menu item in Mint WorkBench to view details about your system.
- The type of motor that you are using.
- A clear description of what you are trying to do.
- A clear description of the symptoms that you can observe, for example error messages displayed in Mint WorkBench, or the current value of any of the Mint error keywords `AXISERROR`, `AXISSTATUS`, `INITERROR`, and `MISCERROR`.
- The type of motion generated in the motor shaft.
- Give a list of any parameters that you have setup, for example the scale settings you have entered.

6.2 NextMove ST indicators

6.2.1 Status display

The Status LED normally displays the unit's node number. To display information about a specific axis, use the LED keyword (see the MintMT help file). When a specific axis is selected, the following symbols may be displayed by the Status LED. Some characters will flash to indicate an error.

2	Spline. A spline move is being performed. See the SPLINE keyword and related commands.
8	Axis enabled.
9	Torque mode. The NextMove ST is in Torque mode. See the TORQUE keyword and related commands.
A	Hold to Analog. The axis is in Hold To Analog mode. See the HTA keyword and related commands.
d	Follow and offset. When an axis is following a demand signal it may be necessary to advance or retard the slave in relation to the master. To do this an offset move is performed in parallel with the follow. See the FOLLOW and OFFSET keywords.
C	Circle. A circle move is being performed. See the CIRCLEA or CIRCLER keywords.
c	Cam. A Cam profile is being profiled. See the CAM keyword.
E.	General error. See the AXISERROR keyword. The motion toolbar displays the status of AXISERROR, which is a bit pattern of all latched errors. See also the *Error Log* topics in the help file.
E.	Error input. The ERRORINPUT has been activated and generated an error.
F	Flying shear. A flying shear is being profiled. See the FLY keyword.
F	Follow mode. The axis is in Follow mode. See the FOLLOW keyword.
h	Homing. The axis is currently homing. See the HOME keyword.
I	Incremental move. An incremental move is being profiled. See the INCA and INCR keywords.
J	Jog. The axis is jogging. In the Mint help file, see the topics JOG, JOGCOMMAND and *Jog mode*.
o	Offset move. The axis is performing an offset move.
P	Positional Move. The axis is performing a linear move. See the MOVEA and MOVER keywords.
S	Stop. A STOP command has been issued or the stop input is active.

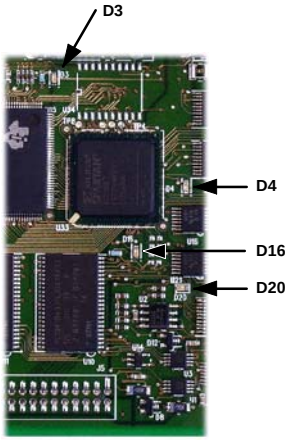
-	Axis disabled. The axis/drive must be enabled before operation can continue. See section 5.4.1. Click the **Drive enable** button in Mint WorkBench.
=	Suspend. The SUSPEND command has been issued and is active. Motion will be ramped to zero demand whilst active.
-1.	Reverse software or hardware limit. A reverse software limit has been activated. See AXISERROR and/or AXISSTATUS to determine which applies.
1.	Forward software or hardware limit. A forward software limit has been activated. See AXISERROR and/or AXISSTATUS to determine which applies.
≡	Firmware being updated (horizontal bars appear sequentially). New firmware is being downloaded to the NextMove ST.
!.	Initialization error. An initialization error has occurred at power on. See the *Error Log* or INITERROR topics in the help file. Initialization errors should not normally occur.

When a node number between 1 and 15 is displayed, it is shown in hexadecimal format (1 - F). For node numbers greater than 15, three horizontal bars are displayed. User defined symbols can be made to appear using the LED and LEDDISPLAY keywords.

See the MintMT help file for details of each keyword.

6.2.2 Surface mount LEDs D3, D4, D16 and D20

The NextMove ST control card contains a number of surface mount LEDs that indicate hardware status:



D3 (yellow):
Indicates that the FPGA is being initialized at startup. If this LED remains illuminated after power up, download a system file (which includes FPGA firmware) from Mint WorkBench.

D4 (red):
Indicates that the control card is in a hardware reset. If this LED remains illuminated after power up, the supply voltage to the control card is too low. Check power supply connections.

D16 (flashing green):
Flashes at 0.5Hz to indicate normal operation. If this LED stops flashing, the firmware has stopped running. Power cycle the NextMove ST to cause a reset.

D20 (flashing orange during serial communication)
Indicates that the control card is performing serial communication. If this LED fails to illuminate, download a system file (which includes communications firmware) from Mint WorkBench.

6.2.3 Communication

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

Symptom	Check
Cannot detect NextMove ST	Check that the NextMove ST is powered. For serial connections, check that the serial cable is wired correctly and properly connected. Check that no other application on the PC is attempting to use the same serial port. For USB connections, check that the cable is properly connected. Check the USB connector socket pins for damage or sticking. Check that the USB device driver has been installed; a “USB Motion Controller” device should be listed in Windows Device Manager.
Cannot communicate with the controller.	Verify that Mint WorkBench is loaded and that NextMove ST is the currently selected controller. Check that the NextMove ST control card is correctly connected to the baseboard.
Cannot communicate with the controller after downloading firmware.	After firmware download, always power cycle the controller (remove 24V power and then reconnect).

6.2.4 Motor control

Symptom	Check
Controller appears to be working but will not cause motor to turn.	Check that the connections between motor and drive are correct. Confirm that Relay0 has been configured as the drive enable output (see section 5.3.3). Use Mint WorkBench to perform the basic system tests (see section 5.4).
A motor that is controlled by the analog output runs as soon as the controller is switched on.	Adjust the Spindle output’s offset potentiometer to remove any offset voltage (see section 4.4.2). Use a digital output from the NextMove ST to control the enable input of the motor’s drive amplifier. This will allow the amplifier to be disabled at startup. Verify that the NextMove ST and drive are correctly grounded to a common ground point.
Motor is under control, but when moved to a position and then back to the start it does not return to the same position.	The motor is not maintaining synchronization with the NextMove ST drive output signals due to excessive acceleration, speed or load demands on the motor. Check that the acceleration, speed and load are within the capabilities of the motor.

6.2.5 Mint WorkBench

Symptom	Check
The Spy window does not update	The system refresh has been disabled. Go to the Tools, Options menu item, select the System tab and then choose a System Refresh Rate (500ms is recommended).
Firmware download fails	Confirm that you have the correct version of firmware. Attempting to download certain older versions of firmware (intended for models without USB), will cause the download to fail. Download the latest version of firmware.
Cannot communicate with the controller after downloading firmware.	After firmware download, always power cycle the controller (remove 24V power and then reconnect).
Mint WorkBench loses contact with NextMove ST while connected using USB	Check that the NextMove ST is powered. Check that a “USB Motion Controller” device is listed in Windows Device Manager. If not, there could be a problem with the PC’s USB interface.

6.2.6 CANopen

Symptom	Check
The CANopen bus is ‘passive’	This means that the internal CAN controller in the NextMove ST is experiencing a number of Tx and/or Rx errors, greater than the passive threshold of 127. Check: ■ 12-24V is being applied to pin 5 of the RJ45 CAN connector, to power the opto-isolators. ■ There is at least one other CANopen node in the network. ■ The network is terminated *only* at the ends, not at intermediate nodes. ■ All nodes on the network are running at the same baud rate. ■ All nodes have been assigned a unique node ID. ■ The integrity of the CAN cables. The NextMove ST should recover from the ‘passive’ state once the problem has been rectified (this may take several seconds).

Symptom	Check
The CANopen bus is 'off'	This means that the internal CAN controller in the NextMove ST has experienced a fatal number of Tx and/or Rx errors, greater than the off threshold of 255. At this point the node will have switched itself to a state whereby it cannot influence the bus. Check: ■ 12-24V is being applied to pin 5 of the RJ45 CAN connector, to power the opto-isolators. ■ There is at least one other CANopen node in the network. ■ The network is terminated *only* at the ends, not at intermediate nodes. ■ All nodes on the network are running at the same baud rate. ■ All nodes have been assigned a unique node ID. ■ The integrity of the CAN cables. To recover from the 'off' state the bus must be reset. This can be done using the MintMT `BUSRESET` keyword, or by resetting the NextMove ST.
The Manager node cannot scan/recognize a node on the network using the MintMT `NODESCAN` keyword.	Assuming that the network is working correctly (see previous symptoms) and the bus is in an 'Operational' state, check the following: ■ Only nodes that conform to DS401, DS403 and other Baldor CANopen nodes are supported by the MintMT `NODESCAN` keyword. ■ Check that the node in question has been assigned a unique node ID. ■ The node must support the node guarding process. NextMove ST does not support the Heartbeat process. ■ Try power-cycling the node in question. If the node in question does not conform to DS401 or DS403 and is not a Baldor CANopen node, communication is still possible using a set of general purpose MintMT keywords. See the MintMT help file for further details.
The node has been successfully scanned / recognized by the Manager node, but communication is still not possible.	For communication to be allowed, a connection must be made to a node after it has been scanned. ■ Baldor controller nodes are automatically connected to after being scanned. ■ Nodes that conform to DS401, DS403 must have the connections made manually using the MintMT `CONNECT` keyword. If a connection attempt using `CONNECT` fails then it may be because the node being connected to does not support an object which needs to be accessed in order to setup the connection.

6.2.7 Baldor CAN

Symptom	Check
The Baldor CAN bus is 'passive'	This means that the internal CAN controller in the NextMove ST is experiencing a number of Tx and/or Rx errors, greater than the passive threshold of 127. Check: ■ 12-24V is being applied to pin 5 of the RJ45 CAN connector, to power the opto-isolators. ■ There is at least one other Baldor CAN node in the network, with jumpers JP1 and JP2 in the '1' (lower) position. ■ The network is terminated *only* at the ends, not at intermediate nodes. ■ All nodes on the network are running at the same baud rate. ■ All nodes have been assigned a unique node ID. ■ The integrity of the CAN cables. The NextMove ST should recover from the 'passive' state once the problem has been rectified.
The Baldor CAN bus is 'off'	This means that the internal CAN controller in the NextMove ST has experienced a fatal number of Tx and/or Rx errors, greater than the off threshold of 255. At this point the node will have switched itself to a state whereby it cannot influence the bus. Check: ■ 12-24V is being applied to pin 5 of the RJ45 CAN connector, to power the opto-isolators. ■ There is at least one other Baldor CAN node in the network, with jumpers JP1 and JP2 in the '1' (lower) position. ■ The network is terminated *only* at the ends, not at intermediate nodes. ■ All nodes on the network are running at the same baud rate. ■ All nodes have been assigned a unique node ID. ■ The integrity of the CAN cables. To recover from the 'off' state the bus must be reset. This can be done using the MintMT `BUSRESET` keyword, or by resetting the NextMove ST.

7.1 Introduction

This section provides technical specifications of the NextMove ST.

7.1.1 Input power

Description	**Value**
Logic power	
Nominal supply voltage	24VDC / 24VAC
Minimum supply voltage	12VDC / 12VAC
Maximum supply voltage	35VDC / 30VAC
Power consumption	60W / 60VA
Drive power	
Nominal supply voltage	24VDC / 24VAC
Minimum supply voltage	12VDC / 12VAC
Maximum supply voltage	35VDC / 30VAC
Power consumption	150W / 150VA (current not to exceed 6A)
Combined drive & logic power	
Nominal supply voltage	24VDC / 24VAC
Minimum supply voltage	12VDC / 12VAC
Maximum supply voltage	35VDC / 30VAC
Power consumption	210W / 210VA (current not to exceed 8.5A)

7.1.2 Output power (Power Out connector)

Description	**Value**
Output power	±12V at 10mA and +5V at 200mA

7.1.3 Analog inputs

Description	**Unit**	**Value**
Type		Differential
Common mode voltage range	**VDC**	±10
Input impedance	**kΩ**	120
Input ADC resolution	**bits**	12 (includes sign bit)
Equivalent resolution (±10V input)	**mV**	±4.9
Sampling interval	**µs**	500 (both inputs enabled) 250 (one input disabled)

7.1.4 Analog output

Description	**Unit**	**Value**
Type		Single ended
Output voltage range	**VDC**	0-11V
Output current (max)	**mA**	1
Update interval		Immediate

7.1.5 Digital inputs

Description	**Unit**	**Value**
Type	**VDC**	+5V inputs, non-isolated
Input voltage Maximum Minimum High Low	**VDC**	 5.5 0 >3.5V <1.5V
Input current (approximate, per input)	**mA**	0.5
Sampling interval	**ms**	1

7.1.6 Digital outputs

Description	Unit	Value
Load supply voltage (maximum)	**V**	50
Output current (DOUT0-DOUT7) Per output, one output on Per output, all outputs on	**mA**	 500 150
Output current (DOUT8-DOUT15) Per output, one output on Per output, all outputs on	**mA**	 500 150
Update interval		Immediate

7.1.7 Stepper axis 0-2 drive outputs

Description	Unit	Value
Maximum output frequency	**kHz**	200
Output voltage	**VDC**	40
Output current (maximum, per axis)	**A**	2

7.1.8 Stepper axes 0-3 logic outputs

Description	Unit	Value
Output type		Darlington pulse (step), direction and boost
Maximum output frequency	**MHz**	3
Output current (maximum sink, per output)	**mA**	50

7.1.9 Serial RS232/RS485 port

	Unit	All models
Signal		RS232 non-isolated CTS/RTS or RS485 non-isolated (model dependent)
Bit rates	**baud**	9600, 19200, 38400, 57600 (default), 115200 (RS232 only)

7.1.10 CAN interface

Description	**Unit**	**Value**
Signal		2-wire, isolated
Channels		1
Protocols		CANopen or Baldor CAN (selected by choice of firmware)
Bit rates CANopen Baldor CAN	**Kbit/s**	 10, 20, 50, 100, 125, 250, 500, 1000 10, 20, 50, 125, 250, 500, 1000

7.1.11 Environmental

Description	**Unit**		
Operating temperature range		**Min**	**Max**
	°C	0	+40
	°F	+32	+104
Maximum humidity	**%**	80% for temperatures up to 31°C (87°F) decreasingly linearly to 50% relative humidity at 40°C (104°F), non-condensing (according to DIN40 040 / IEC144)	
Maximum installation altitude (above m.s.l.)	**m**	2000	
	ft	6560	

See also section 3.1.1.

7.1.12 Weights and dimensions

Description	**Value**
Weight	Approximately 880g (1.94 lb)
Nominal overall dimensions	263mm x 140mm x 53mm (10.35in x 5.51in x 2.09in)

A.1 Introduction

The output current for individual axes can be derated by making precise alterations to the NextMove ST circuitry, as explained in the following sections.

WARNING: **This operation should only be carried out by suitably qualified and experienced electronics technicians or engineers. Any product failures caused as a result of attempting to carry out this modification will not be covered by the warranty and any subsequent repair work will become chargeable. ESD precautions must be observed at all times.**

A.1.1 Overview

Each axis is independent so can be adjusted individually, provided the maximum drive current of 2A per axis is not exceeded. Each axis is driven by an L298 bridge driver, which integrates two power output stages A and B. External resistors, R_{sense}, allow detection of the intensity of the output current; it is these resistors that must be replaced to adjust the output current.

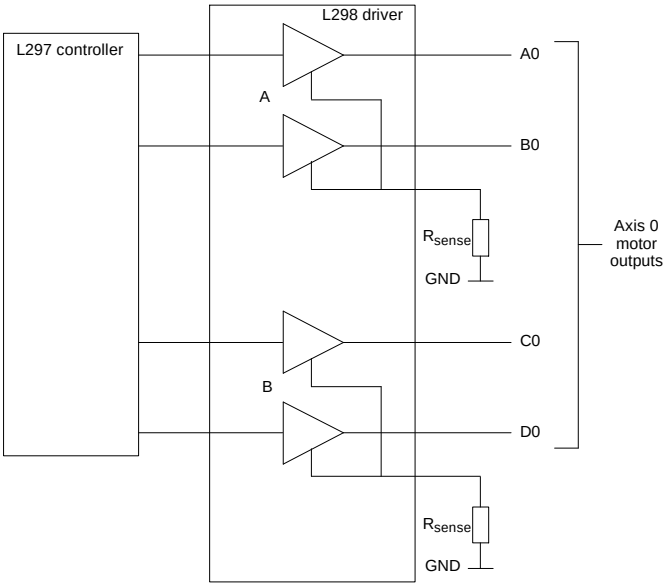


Figure 27 - L298 output driver

A.1.2 Selecting the resistor value and type

Two identical resistors are required for each axis. Resistor value, tolerance and power rating must all be considered. For example:

I_{output} = Maximum output current from the bridge.
R_{sense} = Output current sensing resistor.
V_{ref} = Reference Voltage (0.9V).

$$R_{sense} = \frac{V_{ref}}{I_{output}}$$

So, for 2A output capability:

$$R_{sense} = \frac{0.9}{2} = 0.45\,\Omega$$

The two R_{sense} resistors should be of low tolerance. For example, if ±2% resistors are used, the output current drive capability will be in the range 1.96A - 2.04A. If ±10% resistors are used, the output current drive capability will be in the range 1.82A - 2.22A.

It is also very important to consider the power rating of the resistors. This can be calculated from:

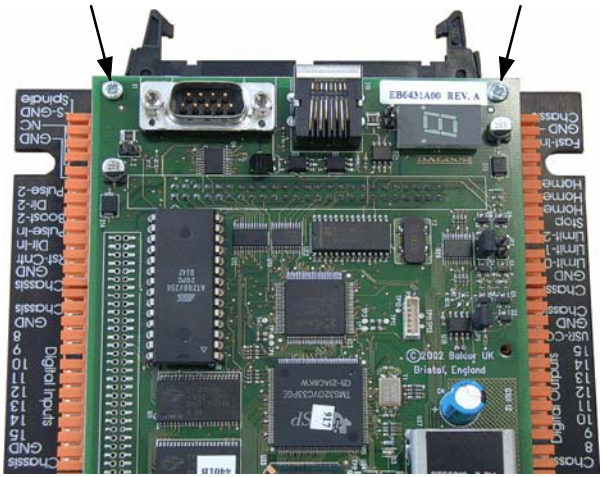
$$P = V_{ref} \times I_{output}$$

So for the example above, with 2A drive capability, the power rating must be at least:

$$P = 0.9 \times 2 = 1.8W$$

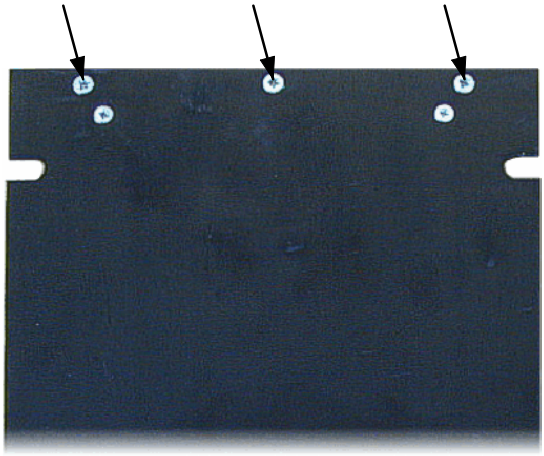
A.1.3 Replacing the resistors

1. Remove the screws securing the control card to the stepper driver base card.

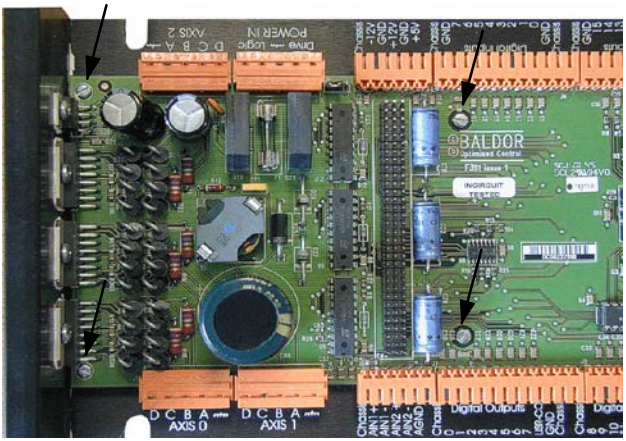


2. Carefully remove the control card from the stepper driver base card.

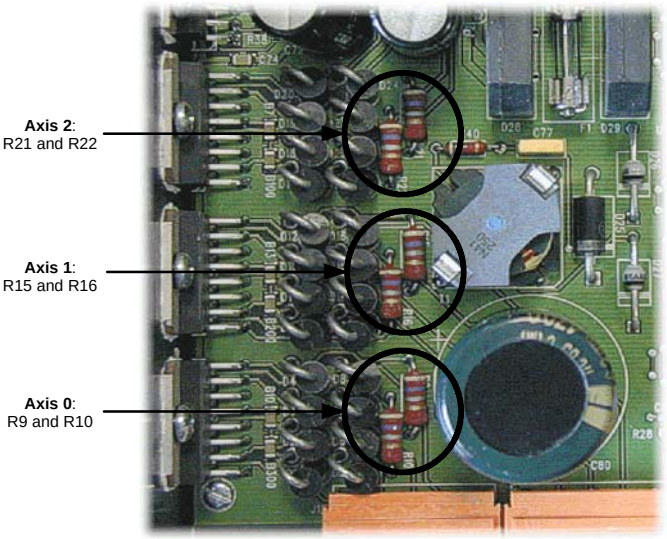
3. Turn the base card over and remove the 3 screws securing the metal backing plate to the heat-sink plate.



4. Remove the 4 screws securing the stepper drive base card to the metal backing plate.



5. Carefully desolder and remove the resistors for the axis / axes to be modified.



6. Insert and solder the new resistors selected in section A.1.2.

7. Reassemble the unit. Ensure that heat sink compound is used between the the stepper drive base card and the heat sink plate. Ensure that the control card is correctly fitted.

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