# EuroSystem
# EuroStep

## Hardware Reference Guide

Issue 2.3

Ref: MN00100-003;f:\ocl\manuals\user manuals\eurosystem family\eurosystem &
eurostep\hardware\i2_3\esd2_3.doc/MC/0496

Mint
THE MOTION LANGUAGE

## Optimised Control World-wide Offices:

### Europe (Head Office):

Optimised Control Ltd
178-180 Hotwell Road
Bristol
BS8 4RP
U.K.
Tel: (+44) (117) 987 3100
FAX: (+44) (117) 987 3101
BBS: (+44) (117) 987 3102

### United States:

Optimised Control Inc
3923 Coconut Palm Drive
Suite 107
Tampa
Florida
USA
Tel: (+1) (813) 626 0780
Fax: (+1) (813) 626 0361

### Pacific Rim:

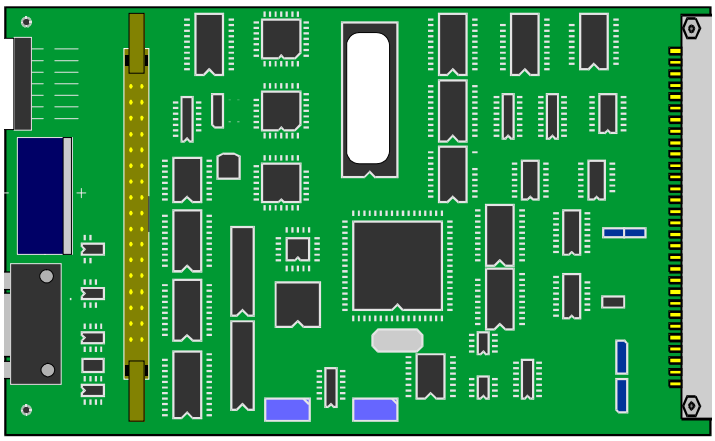
Optimised Control (NZ) Ltd
5 Matija Place
Red Beach
Hibiscus Coast
New Zealand
Tel: (+64) (0) 9426 6627
Fax: (+64) (0) 9426 6762

# Manual Revision History

| Issue | Revision | Date | Reference | Comments |
|---|---|---|---|---|
| 2.0 | 000 | Oct 91 | MN00100; hard2/mc/1091 | Include sections on keypad and display and revise for clarity and completeness |
| 2.1 | 001 | Nov 93 | MN00100-001; ESD2_1/MC/1193 | Revised for clarity and completeness<br>Remove servo setup section. Now covered in Getting Started Guide.<br>Include details on options board and the 3rd axis servo board |
| 2.2 | 002 | Nov 95 | MN00100-002, | Add section on step outputs being FETs on issue 4 boards, add comment on battery life, improve diagram of board to include jumper positions |
| 2.3 | 003 | Apr 96 | MN00100-003 | Tidied up for release as Word file<br>Added Overview section |

# 1. Overview

EuroSystem and EuroStep are both 3 axis intelligent motor controllers that provide a comprehensive range of features for controlling servo and step motors. EuroSystem allows servo and step motors to be mixed in the same multi-axis system with a highly flexible programming language, MINT™. EuroStep provides support for up to three open loop step motors using the same programming language, MINT™.



## Features:

- Stand-alone operation or controlled by host over RS232/485 serial link, up to 16 cards on multidrop
- Easy to use Basic like motion control language, MINT™
- 28k bytes non-volatile program/data memory
- On board program editor
- Circular and linear interpolation
- Microstepping control up to 200kHz
- Step, Direction and Boost outputs compatible with industry standard drives
- 8 uncommitted digital inputs and outputs for machine control
- 3 Limit switches, 3 Home switches and Error input
- Two 10 bit analogue inputs for interface to joy-stick or sensors
- Pulse follower input
- +5V, ±12V power requirement
- Expansion port for option boards such as extended I/O, keypad and display

For servo systems, you are advised to read the section 'Servo System Set-up' which explains, in detail, how to test for the correct wiring of amplifiers to EuroSystem and the setting of system gains.

## 1.1 Anti-Static Precautions

Both EuroSystem and EuroStep contain components sensitive to electrostatic discharge (static). The following precautions should always be followed when handling EuroSystem or EuroStep controllers.

Before handling the controller, discharge your body's static electric charge by touching a grounded surface. If the system into which you are fitting your controller is connected to a grounded outlet, you can touch any part of the system's metal chassis.

Do not remove the controller from its antistatic bag until you are ready to install it.

Do not lay the controller on the antistatic bag. The bag is not conductive but acts as a shield.

When handling the controller, hold it by its edge where possible, avoid touching components on the board.

Never slide the controller across any surface.

Avoid plastic, vinyl, Styrofoam and furs in your work area.

Wear a grounding wrist strap if one is available.

# 1.2 Technical Specification

## 1.2.1 Machine Control I/O

The following specifications apply to a non-isolated backplane.

| | |
|---|---|
| **Encoder inputs*** : | ➥ Minimum requirements: Channel A, Channel B single ended TTL |
| | ➥ Preferred: Channel A, Channel B, Index, differential TTL line driver |
| | ➥ Encoder frequency 1MHz maximum |
| | ➥ 9 way D-type female connector on backplane |
| **Analogue outputs***: | ➥ ±10V, 10 mA sink/source |
| | ➥ 12 bit resolution |
| **Stepper outputs:** | ➥ Step/Direction/Boost |
| | ➥ Axis 0,1,2 open collector |
| | ➥ 100 mA sink each |
| | ➥ 10 Hz to 200Hz frequency output |
| **Limit Inputs:** | ➥ 1 input per axis. Provides end of travel protection. Crash stop all axes when active. |
| | ➥ NPN non-isolated. Connect to normally closed switch to digital ground. |
| **Home Inputs:** | ➥ 1 input per axis. Provides reference position for the axis. |
| | ➥ NPN non-isolated. Connect to normally closed switch to digital ground. |
| **Stop Input:** | ➥ 1 input per controller. Brings all axes to a controlled stop when active. |
| | ➥ NPN non-isolated. Connect to normally closed switch to digital ground. |
| **Reset input:** | ➥ Pull low for hardware reset |
| **Error input:** | ➥ Motion inhibited. Acitive high or low, configured by software. |
| **Enable output:** | ➥ Active high (12V) or low (0V), hardware configured. |
| | ➥ 100mA maximum sink/source, totem pole. |
| **User Digital Inputs:** | ➥ 8 input lines. |
| | ➥ NPN non-isolated. |
| | ➥ Logical one when floating or high. |
| | ➥ Logical zero when pulled low. |
| **User Digital Outputs:** | ➥ 8 output lines driven by ULN2803. |
| | ➥ 50mA continuous source on all channels. |
| | ➥ 400mA† max source per channel, 800mA‡ max for all 8 channels. |
| **Fast Interrupt:** | ➥ 1 input per controller. |
| | ➥ NPN non-isolated. |
| | ➥ Latches position of all axes within 50 microseconds when pulled low. |
| **Analogue Inputs:** | ➥ 2 independent analogue channels. |
| | ➥ 10 bit resolution. |
| | ➥ Jumper selectable for ±10V (differential) or 0-5V operation. |
| **Pulse Counter:** | ➥ Counts rising and falling edge of pulses. Used for software gearboxes. |
| | ➥ TTL, max input frequency of 500kHz. |
| | ➥ Non-isolated |
| | ➥ Non-isolated NPN direction input to change operation of up/down counter. |
| | ➥ Non-isolated NPN reset input clears counter on a rising edge. Tie to |

* EuroSystem only

† Absolute maximum value

‡ Absolute maximum value

ground if not used.

**Serial Port:**
- RS232 or full duplex 4 wire RS485. Factory set.
- Connections brought out on 9-way male D-type connector.
- 9600 baud, 1 start bit, 8 data bits, 1 stop bit, no parity.

## 1.3 Miscellaneous Specification

**Power Input:**
- +5V at 500mA.
- ±12V at 50mA.

**Connectors:**
- Backplane connector: DIN 41612, 96-way
- Option bus connector: 50 way IDC header
- Power/drive demands: 10 way IDC headers

**Operating Temperature:**
- 0 - 45°.

**Battery Life:**
- 5 years.
- Will retain non-volatile RAM contents for up to 12 months when fully charged.

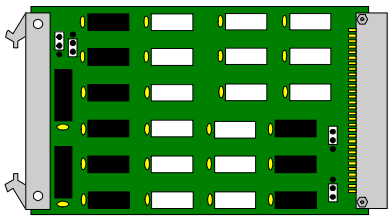
**Warranty:**
- 5 year return to manufacturer.

## 1.4 Expansion Boards

A number of expansion boards are available for EuroSystem (EuroStep) for such options as expanded I/O and an operator panel. The expansion boards are connected to the EuroSystem (EuroStep) controller via an IDC 50-way header (see section 3). Contact your representative for further information on these boards.

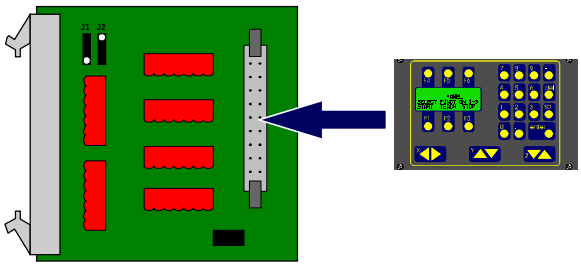
### 1.4.1 24 I/O Board

Provides the capability of expanding the I/O on EuroSystem and EuroStep by a further 24 inputs or 24 outputs. All the I/O is available optically isolated, either PNP or NPN. As standard, the 24 I/O board is supported in MINT using the XIO keyword.

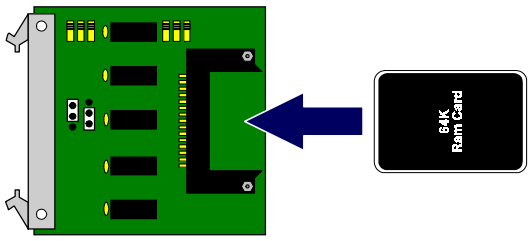


### 1.4.2 Operator Panel and Keypad Interface

Connected via an interface unit, the operator panel can be used to provide an operator interface for standalone operation. Both the keypad and display are supported as standard within MINT. Full details are provided in section 8.1.1.



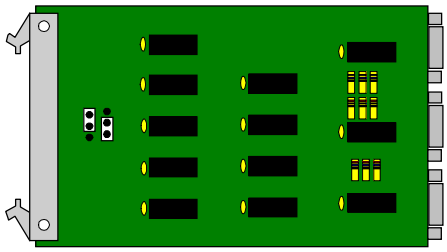
## 1.4.3 Memory Card Interface




The memory card interface can be used to provide memory expansion of array data and program storage as standard within MINT. An optional version of MINT allows the memory card to be used to expand the user program area.

## 1.4.4 Three Channel Encoder Interface

The three channel encoder interface board can be used to provide position verification of the stepper motor position. This board is supported as standard within MINT through the use of the XENCODER keyword.



## 1.4.5 Third Axis Servo Board

The third axis servo board, for use with EuroSystem, provides EuroSystem with an additional third axis of servo control. This is supported as standard within MINT. See section 7 for full details on the board.

# 1.5 Firmware Options

EuroSystem and EuroStep come as standard with Interpolation MINT™. A number of other firmware options are also available:

**Process MINT§**

Process MINT, as standard with SmartMove, incorporates such motion control features as software gearboxes, cam profiles and flying shears. Process MINT supports up to 3 axes of linear interpolation but does not support circular interpolation.

Is must be noted that Process MINT supports cam profiles and flying shears on the first 2 axes only (Axes 0 and 1).

**Interpolation MINT**

Interpolation MINT provides full linear and circular interpolation within the MINT environment. Interpolation MINT does not support the cam profiling and flying shear capabilities of Process MINT. A subset of Process MINT's software gearboxes are supported.

**MINT/3.28**

MINT/3.28 is intended specifically for systems where a host computer sends motion control commands to the controller in real time. Motion control programs are not supported on the controller, but commands are sent by a host computer by means of datapackets.

MINT/3.28 only supports a subset of the MINT command set, namely the motion control commands. The Process MINT command set is not supported.

MINT/3.28 will operate over either an RS232 or RS485 link. The physical constraints of RS232 allow only point-to-point communication, i.e. one host computer can talk to one controller, RS485 provides longer transmission distances and allows a single host computer to communicate with up to 16 controllers on one multi-drop link.

Within a multi-drop 485 system using MINT/3.28, a controller cannot act as a host to other controllers on the system.

cTERM provides the facility to send instructions as MINT/3.28 datapackets to facilitate testing. The Applications and Utilities Diskette also contains the C source code (CLIB sub-directory) for creating MINT/3.28 datapackets for transmission.

**HPGL**

The HPGL EPROM (sometimes referred to as OCGL) provides a subset of the HPGL graphics language for use with pen plotters, routers and knife cutters. The following features are not supported:

- ➥ No support for text strings (LB command) or character fonts.
- ➥ No cross hatching (fill types)
- ➥ No scaling or plot windows
- ➥ Router mode (or Z control) does not support tool offsets.
- ➥ XON/XOFF software handshaking is not supported.

HPGL is not a programming language, but is a sequential command processor. Commands for vectored moves and arcs are sent, for example by a drawing package, for execution. In order to facilitate the setting up of a system, extended commands are implemented which are prefixed with !. Features available with the extended

§ Supported only by EuroSystem

commands are:

- Position the Z axis to an upper or lower limit
- Set speeds and accelerations
- Switch outputs to drive solenoids

A limited macro facility is available allowing macros to be defined for:

- A pen up command (PU). This may control an output or drive the Z axis to a particular position.
- A pen down command (PD).
- A page feed. Commands can be used to page feed on receiving the !PG command which is available within Roland plotter as an extended command.

Macros can also be attached to the selected pen command (SP) for the following:

- Drive the Z axis to a lower position. Up to 9 tool depths can be defined using the SP macro. A different colour within the drawing would reflect a different depth on the work piece.
- Selecting a pen from a pen carousel. Both the X and Y axes can be moved to place a pen at the plotting position.

Due to the limitations of the macro language and the fact that HPGL is not a programming language, it is recommended that MINT™ is used to set up the system prior to inserting the HPGL EPROM. The calculated speeds and accelerations can be used to create an HPGL configuration file. Please also note that HPGL does not echo back characters typed in at the terminal screen. In order to see what is being typed, switch the local echo facility in cTERM to ON.

# 2. EuroSystem/EuroStep I/O

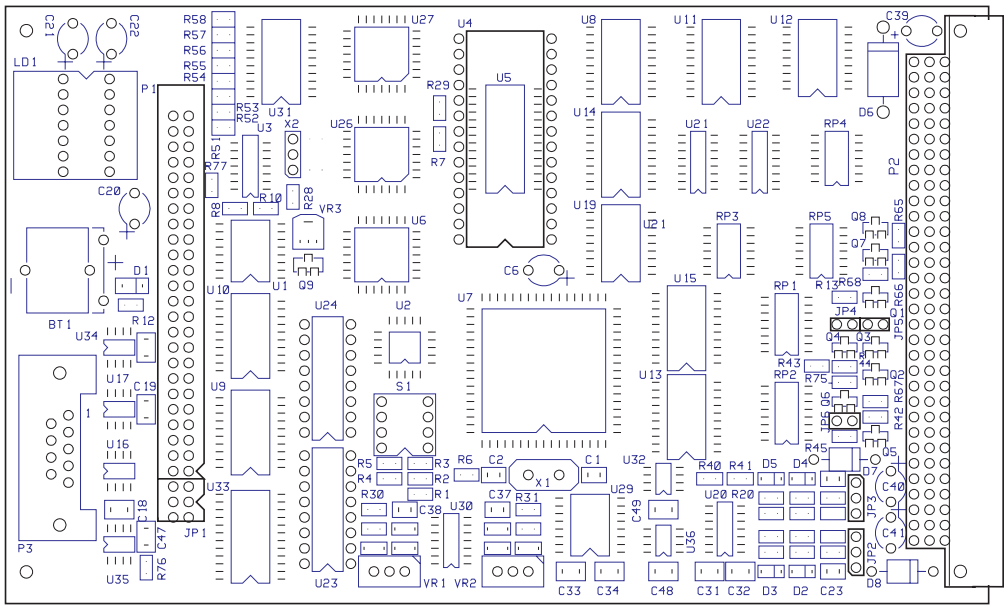



Figure 1.1:EuroSystem/EuroStep Controller layout.

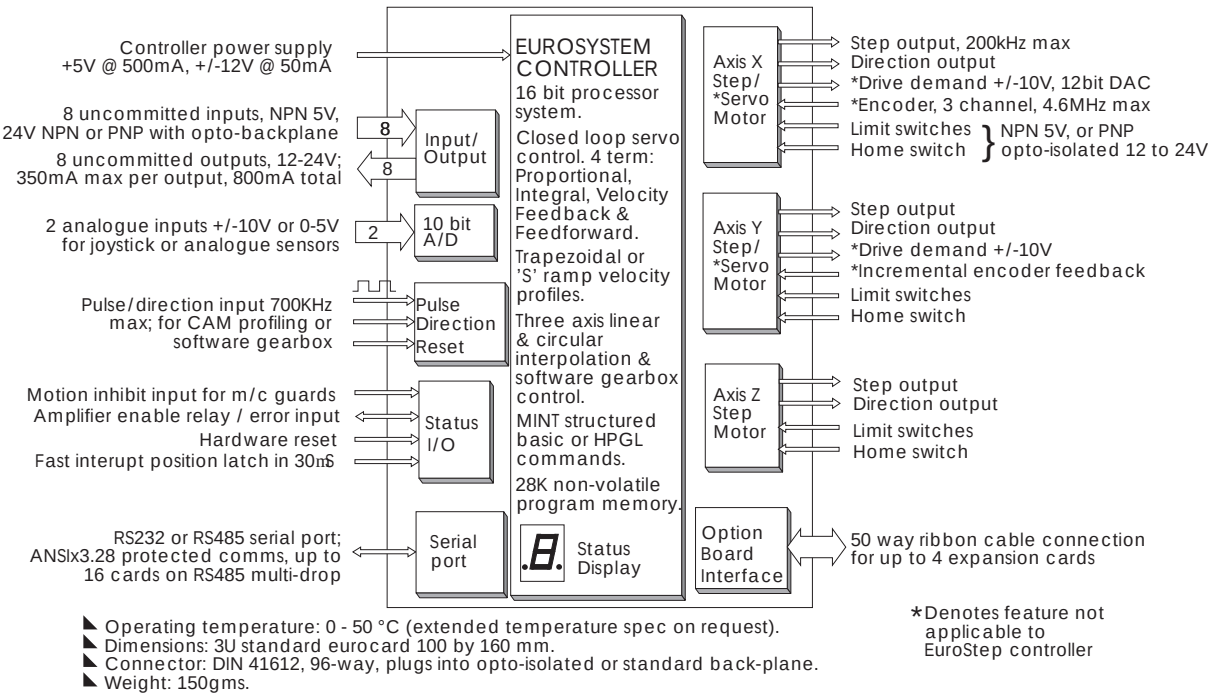



Figure 1.2: EuroSystem/EuroStep Controller Block Diagram

## 2.1 96-way DIN Connector Pinout

I/O associated with EuroSystem and EuroStep are illustrated in Figures 1.2 and Figures 1.3. They include limit switch inputs, home switch inputs, amplifier demand outputs and error output. All connections are brought out at one end of the board on a DIN 41612 96-way connector. Normally you would use a backplane (isolated or non-isolated) for your connections, but for OEM applications the pin-out is explained in more detail below:

| c | | | b | | | a | | |
|---|---|---|---|---|---|---|---|---|
| VCC | 1 | ❑ | VCC | 1 | ❑ | VCC | 1 | ❑ |
| VCC | 2 | ❑ | VCC | 2 | ❑ | VCC | 2 | ❑ |
| GND | 3 | ❑ | GND | 3 | ❑ | GND | 3 | ❑ |
| USR-OUT-6 | 4 | ❑ | USR-OUT-7 | 4 | ❑ | USR-OUT-COM | 4 | ❑ |
| USR-OUT-3 | 5 | ❑ | USR-OUT-4 | 5 | ❑ | USR-OUT-5 | 5 | ❑ |
| USR-OUT-0 | 6 | ❑ | USR-OUT-1 | 6 | ❑ | USR-OUT-2 | 6 | ❑ |
| CHB-1 | 7 | ❑ | CHA-0 | 7 | ❑ | CHB-0 | 7 | ❑ |
| IDX-1 | 8 | ❑ | IDX-0 | 8 | ❑ | CHA-1 | 8 | ❑ |
| ICHA-1 | 9 | ❑ | IIDX-0 | 9 | ❑ | IIDX-1 | 9 | ❑ |
| ICHB-0 | 10 | ❑ | ICHA-0 | 10 | ❑ | ICHB-1 | 10 | ❑ |
| ERROR-IN | 11 | ❑ | ERROR-OUT | 11 | ❑ | GND | 11 | ❑ |
| RESET-IN | 12 | ❑ | GND | 12 | ❑ | GND | 12 | ❑ |
| GND | 13 | ❑ | BOOST-1 | 13 | ❑ | BOOST-0 | 13 | ❑ |
| PULSE-2 | 14 | ❑ | PULSE-1 | 14 | ❑ | PULSE-0 | 14 | ❑ |
| DIR-2 | 15 | ❑ | DIR-1 | 15 | ❑ | DIR-0 | 15 | ❑ |
| BOOST-2 | 16 | ❑ | GND | 16 | ❑ | DSR | 16 | ❑ |
| GND | 17 | ❑ | GND | 17 | ❑ | DTS | 17 | ❑ |
| USR-IN-4 | 18 | ❑ | FAST-INT | 18 | ❑ | USR-IN-2 | 18 | ❑ |
| USR-IN-3 | 19 | ❑ | USR-IN-5 | 19 | ❑ | USR-IN-7 | 19 | ❑ |
| USR-IN-6 | 20 | ❑ | USR-IN-1 | 20 | ❑ | RXD | 20 | ❑ |
| USR-IN-0 | 21 | ❑ | RTS | 21 | ❑ | TXD | 21 | ❑ |
| OPT-4 | 22 | ❑ | OPT-2 | 22 | ❑ | CTS | 22 | ❑ |
| HOME-2 | 23 | ❑ | OPT-3 | 23 | ❑ | OPT-1 | 23 | ❑ |
| PULSE-IN | 24 | ❑ | HOME-1 | 24 | ❑ | LIMIT-2 | 24 | ❑ |
| DIR-IN | 25 | ❑ | LIMIT-1 | 25 | ❑ | STOP | 25 | ❑ |
| HOME-0 | 26 | ❑ | RESET-CNTR | 26 | ❑ | LIMIT-0 | 26 | ❑ |
| DEMAND-0 | 27 | ❑ | DEMAND-1 | 27 | ❑ | -ANALOGUE-2 | 27 | ❑ |
| +ANALOGUE-2 | 28 | ❑ | +ANALOGUE-1 | 28 | ❑ | -ANALOGUE-1 | 28 | ❑ |
| +12V | 29 | ❑ | +12V | 29 | ❑ | +12V | 29 | ❑ |
| AGND | 30 | ❑ | AGND | 30 | ❑ | AGND | 30 | ❑ |
| -12V | 31 | ❑ | -12V | 31 | ❑ | -12V | 31 | ❑ |
| SCRN | 32 | ❑ | SCRN | 32 | ❑ | SCRN | 32 | ❑ |

96-way connector pin-out

| Signal | Comments | Pin No. |
|---|---|---|
| **Drive Demands** | | |
| DEMAND-0 | Demand signal out, +/-10V, axis 0 | c27 |
| DEMAND-1 | Demand signal out, +/-10V, axis 1 | b27 |
| **Encoders** | | |
| CHA-0 | Encoder channel A, true, axis 0 | b7 |
| !CHA-0 | Encoder channel A, compliment, axis 0 | b10 |
| CHB-0 | Encoder channel B, true, axis 0 | a7 |
| !CHB-0 | Encoder channel B, compliment, axis 0 | c10 |
| IDX-0 | Encoder INDEX, true, axis 0 | b8 |
| !IDX-0 | Encoder INDEX, compliment, axis 0 | b9 |
| | | |
| CHA-1 | Encoder channel A, true, axis 1 | a8 |
| !CHA-1 | Encoder channel A, compliment, axis 1 | c9 |
| CHB-1 | Encoder channel B, true, axis 1 | c7 |
| !CHB-1 | Encoder channel B, compliment, axis 1 | a10 |
| IDX-1 | Encoder INDEX, true, axis 1 | c8 |
| !IDX-1 | Encoder INDEX, compliment, axis 1 | a9 |
| **Home/Limits** | | |
| LIMIT-0 | Limit input, axis 0 | a26 |
| HOME-0 | Home input, axis 0 | c26 |
| LIMIT-1 | Limit input, axis 1 | b25 |
| HOME-1 | Home input, axis 1 | b24 |
| LIMIT-2 | Limit input, axis 2 | a24 |
| HOME-2 | Home input, axis 2 | c23 |
| **Miscellaneous** | | |
| PULSE-IN | Pulse input, pulse follower | c24 |
| DIR-IN | Direction input, pulse follower | c25 |
| RESET-CNTR | Timer 2 reset input | b26 |
| RST-IN | System reset, input | c12 |
| STOP | Stop execution, input | a25 |
| ERROR-OUT | Motion/System error output | b11 |
| ERROR-IN | Motion/System error input | c11 |
| FAST-INT | User hardware INTERRUPT | b18 |
| **Digital Inputs** | | |
| USR-IN-0 | User input, bit 0 | c21 |
| USR-IN-1 | User input, bit 1 | b20 |
| USR-IN-2 | User input, bit 2 | a18 |
| USR-IN-3 | User input, bit 3 | c19 |
| USR-IN-4 | User input, bit 4 | c18 |
| USR-IN-5 | User input, bit 5 | b19 |
| USR-IN-6 | User input, bit 6 | c20 |
| USR-IN-7 | User input, bit 7 | a19 |
| **Digital Outputs** | | |
| USR-OUT-0 | User output, bit 0 | c6 |
| USR-OUT-1 | User output, bit 1 | b6 |
| USR-OUT-2 | User output, bit 2 | a6 |
| USR-OUT-3 | User output, bit 3 | c5 |
| USR-OUT-4 | User output, bit 4 | b5 |
| USR-OUT-5 | User output, bit 5 | a5 |
| USR-OUT-6 | User output, bit 6 | c4 |
| USR-OUT-7 | User output, bit 7 | b4 |
| USR-OUT-COM | Common diode clamp | a4 |
| **Analogue Inputs** | | |
| +ANALOGUE-1 | Analogue input 1, non-inverting | b28 |
| -ANALOGUE-1 | Analogue input 1, inverting | a28 |
| +ANALOGUE-2 | Analogue input 2, non-inverting | c20 |
| -ANALOGUE-2 | Analogue input 2, inverting | a27 |

| Stepper | | |
|---|---|---|
| PULSE-0 | Pulse output stepper axis 0 | a14 |
| DIR-0 | Direction output stepper axis 0 | a15 |
| BOOST-0 | Boost or full/half step output stepper axis 0 | a13 |
| PULSE-1 | Pulse output stepper axis 1 | b14 |
| DIR-1 | Direction output stepper axis 1 | b15 |
| BOOST-1 | Boost or full/half step output stepper axis 1 | b13 |
| PULSE-2 | Pulse output stepper axis 2 | c14 |
| DIR-2 | Direction output stepper axis 2 | c15 |
| BOOST-2 | Boost or full/half step output stepper axis 2 | c16 |
| **Serial Port** | | |
| TXD | Transmitted data (TxD true) | a21 |
| RXD | Received data (RxD true) | a20 |
| RTS | Request to send (TxD compliment) | b21 |
| CTS | Clear to send (RxD compliment) | a22 |
| DSR | Connected to DTR | a16 |
| DTR | Connected to DSR | a17 |
| **Option Board** | | |
| OPT-1 | Option board I/O | a23 |
| OPT-2 | Option board I/O | b22 |
| OPT-3 | Option board I/O | b23 |
| OPT-4 | Option board I/O | c22 |
| **Power Supply and References** | | |
| -12V | -12V @ 100mA | c31,b31,a31 |
| +12V | +12V @ 100mA | c29,b29,a29 |
| 5V | + 5V @ 500mA | c1,c2,b1,b2,a1,a2 |
| GND | 0V Digital ground | |
| AGND | 0V Analogue ground | c30,b30,a30 |
| SCRN | 0V Power ground / Cable screen | c32,b32,a32 |

Inputs are always in their active (high) state unless they are pulled low by external circuitry, providing fail safe operation. Before the system will operate, you must connect the limit switches and the stop switch either to their respective switches or to ground. Failure to do so will result in a limit error on the controller and a stop condition. This is indicated by the LED status display showing either an 'L' or an 'S'.

The following sections explain each of the I/O types in detail. A pin-out table lists all the relevant pins on the DIN connector and the backplane for that I/O function. The pin number on the DIN connector is given in brackets. The backplane detail shows the connector block followed by the pin name.

## 2.2 Switch Types

The inputs are active high and must be tied to ground through normally closed switches. The system will fail to operate with normally open switches.

## 2.3 Limit Inputs

Pinout:

| Din Connector | Backplane | Description |
|---|---|---|
| LIMIT-0 (a26) | HOME/LIMIT: L0 | Limit switch axis 0 |
| LIMIT-1 (b25) | HOME/LIMIT: L1 | Limit switch axis 1 |
| LIMIT-2 (a24) | HOME/LIMIT: L2 | Limit switch axis 2 |
| GND | HOME/LIMIT: Gnd | Digital ground |

In a typical application, the limit switch inputs would be connected to normally closed micro switches on the axis. Hitting the limit switch will cause the switch to become open circuit, the respective input is pulled high internally, resulting in a limit error and the axis coming to an immediate stop. This is indicated by an 'L' on the LED status display and the ERROR keyword which will return 3. See the MINT Programming Guide for more details on the ERROR keyword and error handling within MINT.

Because there is only one limit input per axis, if two end-of-travel limit switches are fitted then they must both be connected in series as shown below.

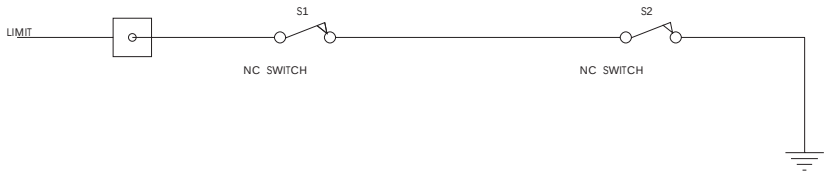



Figure 2.1 Dual Limit input switch connection.

A possible problem with this arrangement is that it is not possible to determine in software which end-of-travel switch has been hit by simply reading the limit input. This can be overcome by introducing a double pole limit switch at one end of the axis and connecting this to the home input or a spare digital input. This means that when a limit switch is hit the program can determine whether this is the forward or reverse limit by reading the status of the home switch or relevant digital input.

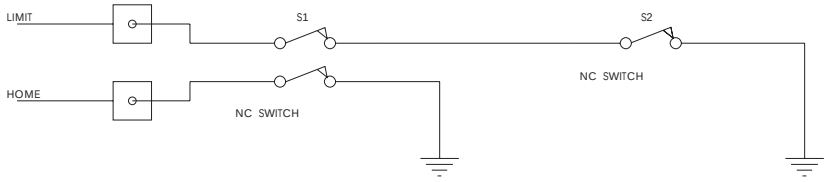



Figure 2.2 Dual Limit and Home/Input connection.

In many applications it is necessary to have separate limit and home switches. Since the controller has only one limit input per axis it is best to arrange the active areas of the switches as shown below.

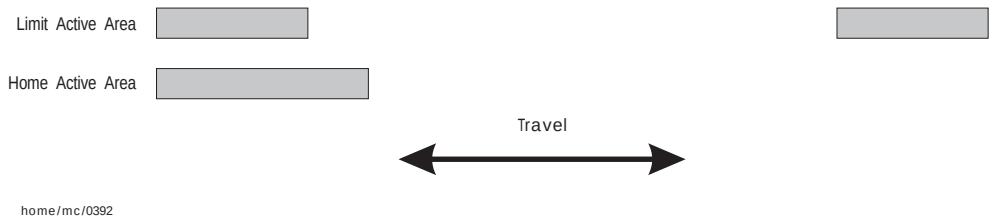



Figure 2.3 Limit/Home switch active areas.

Hitting a limit switch causes an error which is handled in software by the ONERROR subroutine (see the MINT Programming Guide). By reading both the state of the limit and home inputs, the left or right limit switch can be determined as shown in the table..

| HOME | LIMIT | |
|---|---|---|
| on | on | Left limit hit |
| off | on | Right limit hit |

If the home position is midway between the two limits, the active area of the home should be made to extend to either the right or the left of the limit active area.

In an application where not all 3 axes are used, the redundant axes must have their respective limit switches grounded for normal operation. Alternatively the MINT keyword DISLIMIT can be used to disable the detection of limit switches.

The state of the limit switches can be read using the MINT LIMIT keyword. A value of 1 (logical one) will be returned if the limit switch is high or floating and 0 (logical zero) if grounded.

Figure 2.4 shows the input buffer circuit and normal connections for all motion inputs.

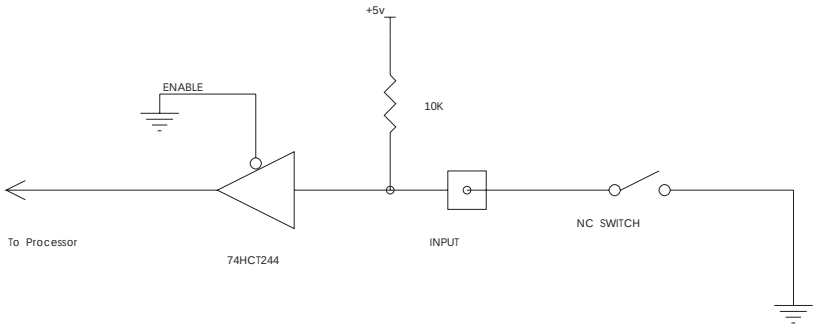



Figure 2.4 Input buffer circuit for Limit, Home, Stop, Error in, Pulse, Dir and Reset counter.

## 2.4 Home Inputs

Pinout:

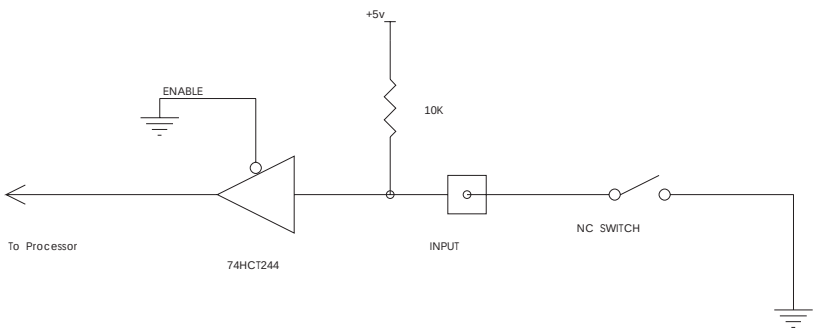
| Din Connector | Backplane | Description |
|---|---|---|
| HOME-0 (c26) | HOME/LIMIT: H0 | Home switch axis 0 |
| HOME-1 (b24) | HOME/LIMIT: H1 | Home switch axis 1 |
| HOME-2 (c23) | HOME/LIMIT: H2 | Home switch axis 2 |
| GND | HOME/LIMIT: Gnd | Digital Ground |

Three home inputs are provided, one for each axis. Like the limit switches these are active high and require normally closed switches for normal operation. Unlike the limit switches however, they do not have to be grounded if they are not used.

If the limit switch is used as a datum point, both the limit input and the home input must be connected together. Noisy environments can cause glitches on the limit switches which may result in a limit error during homing. A 100nF ceramic capacitor connected between the limit input and ground should eliminate this problem.

The state of the home switches can be read using the MINT HOME keyword. A value of 1 will be returned if the home switch is high or floating and 0 if grounded.

The input buffer circuit is shown below:



# 2.5 General I/O

EuroSystem/EuroStep provide 8 uncommitted digital inputs and 8 uncommitted digital outputs. These are accessed through the MINT keywords IN and OUT.

## 2.5.1 Digital Inputs

Pinout:

| Din Connector | Backplane | Description |
|---|---|---|
| USR-IN-0 (c21) | IN: 0 | User input bit 0 |
| USR-IN-1 (b20) | IN: 1 | User input bit 1 |
| USR-IN-2 (a18) | IN: 2 | User input bit 2 |
| USR-IN-3 (c19) | IN: 3 | User input bit 3 |
| USR-IN-4 (c18) | IN: 4 | User input bit 4 |
| USR-IN-5 (b19) | IN: 5 | User input bit 5 |
| USR-IN-6 (c20) | IN: 6 | User input bit 6 |
| USR-IN-7 (a19) | IN: 7 | User input bit 7 |
| GND | IN: Gnd | Digital ground |

The 8 inputs are active high with schmitt trigger buffers, the controller will read a logical 1 if the input is +5V or unconnected and logical 0 if the input is grounded. The inputs can take a maximum voltage input of 5V using the standard backplane. Using the opto-isolated backplane, voltages up to 24V may be connected to the inputs.

The input buffer circuit for the user inputs is slightly different from that for motion inputs. The circuit is shown in figure 2.5, along with some input configurations.

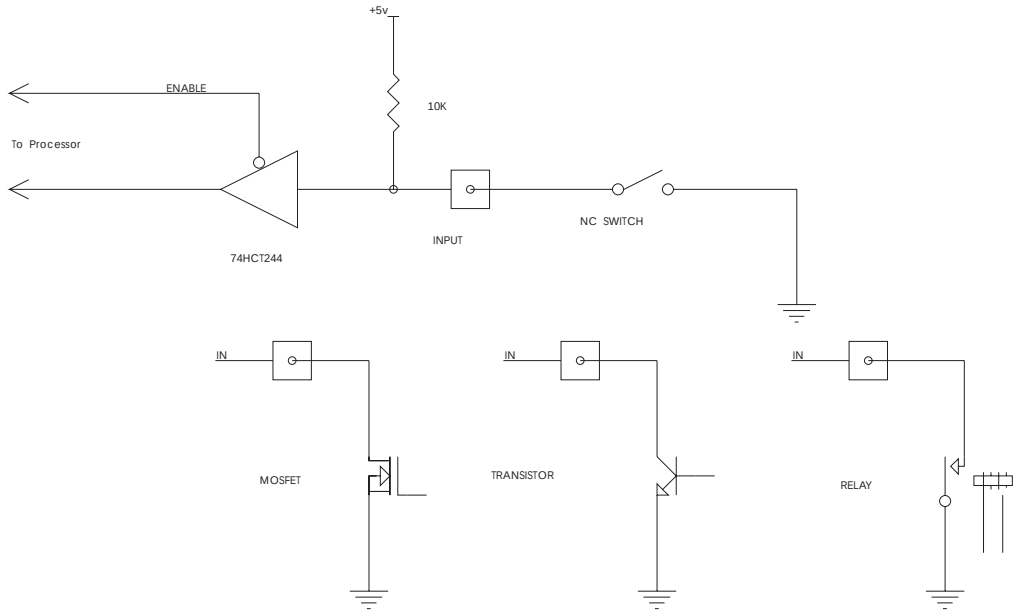



Figure 2.5 User inputs buffer circuit and some input connections.

## 2.5.2 Digital Outputs

### Pinout:

| Din Connector | Backplane | Description |
|---|---|---|
| USR-OUT-0 (c6) | OUT: 0 | User output bit 0 |
| USR-OUT-1 (b6) | OUT: 1 | User output bit 1 |
| USR-OUT-2 (a6) | OUT: 2 | User output bit 2 |
| USR-OUT-3 (c5) | OUT: 3 | User output bit 3 |
| USR-OUT-4 (b5) | OUT: 4 | User output bit 4 |
| USR-OUT-5 (a5) | OUT: 5 | User output bit 5 |
| USR-OUT-6 (c4) | OUT: 6 | User output bit 6 |
| USR-OUT-7 (b4) | OUT: 7 | User output bit 7 |
| USR-OUT-COM (a4) | OUT:CM | Common diode clamp |
| GND | OUT: Gnd | Digital ground |

The uncommitted digital outputs are driven by an octal darlington array (ULN2803 device). Each output is capable of sinking 50mA when ON, and can withstand 50V when OFF. The outputs have a Common diode clamp connection accessible from the backplane through USR-OUT-COM. This should be connected to the external supply from which you are sourcing current. The circuit is shown in figure 2.6.

For switching high currents it is recommended that the outputs be used to drive solid state relays.

### Example:

```
OUT = 15
```

this example in MINT will turn on outputs 0 to 3 (i.e. outputs are grounded) and turn outputs 4 to 7 off. See the MINT Programming Guide for more details on the OUT keyword.

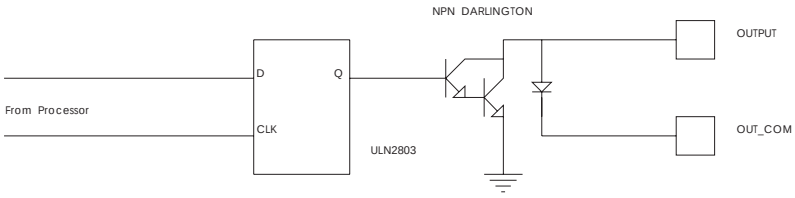



Figure 2.6 Output driver circuit.

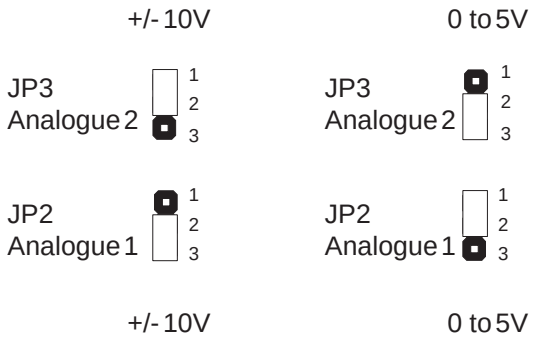
## 2.5.3 Analogue Inputs

### Pinout:

| Din Connector | Backplane | Description |
|---|---|---|
| +ANALOGUE-1 (b28) | ANALOGUE: 1+ | Analogue input 1, non-inverting |
| -ANALOGUE-1 (a28) | ANALOGUE: 1- | Analogue input 1, inverting |
| +ANALOGUE-2 (c28) | ANALOGUE: 2+ | Analogue input 2, non-inverting |
| -ANALOGUE-2 (a27) | ANALOGUE: 2- | Analogue input 2, inverting |
| AGND (c30,b30,a30) | ANALOGUE: AG | Analogue Ground |
| SCRN (c32,b32,a32) | ANALOGUE: SC | Power ground/Screen |

Two independent analogue inputs are provided, each with 10 bit resolution in the range of ±10V or 0-5V. These may be used for analogue sensor input or to provide a low cost joy-stick interface.

Each input is buffered and has a low pass filter to reject noise, (-3dB @ 2Khz). For ±10V operation, the inputs are differential which helps reduce the problems associated with differing ground potentials. This may be by-passed using jumpers JP2 and JP3 to allow 0 to 5V single ended operation, see figure 1.1 for location of jumpers.




| Jumper Connection | Voltage Range |
|---|---|
| 1 and 2 | ±10V |
| 2 and 3 | 0 to 5V |

**On no account must the input voltage exceed the maximum rating shown above.**

In the 5V configuration the inputs are single ended inputs through the positive input and are referenced to the controller analogue ground. In ±10V configuration the inputs are differential and not referenced to the controller ground. Normally the negative input is connected to the analogue ground of the external equipment. It is important that this connection is made to external **analogue** ground, and not to external **system** ground. Connection to the external system ground may result in erroneous input readings caused by the large return currents associated with motor control.

Each analogue input signal should be connected to EuroSystem using a screened twisted pair cable, and the cable screen should be connected to the SCRN (SC) input on the EuroSystem backplane. No other connection should be made to the cable screen, ie. connect the screen at one end only.

The analogue inputs can be read in MINT as 10 bit values using the keywords ANALOGUE1 (A1) and ANALOGUE2 (A2).

## 2.5.4 Pulse and Direction

Pinout:

| Din Connector | Backplane | Description |
|---|---|---|
| PULSE-IN (c24) | MISC: PI | Pulse follower input |
| DIR-IN (c25) | MISC: DI | Pulse follower direction |
| RESET-CNTR (b26) | MISC: RC | Reset counter |
| GND | MISC: G | Digital ground |

EuroSystem/EuroStep provide a pulse follower input which consists of 3 signals:

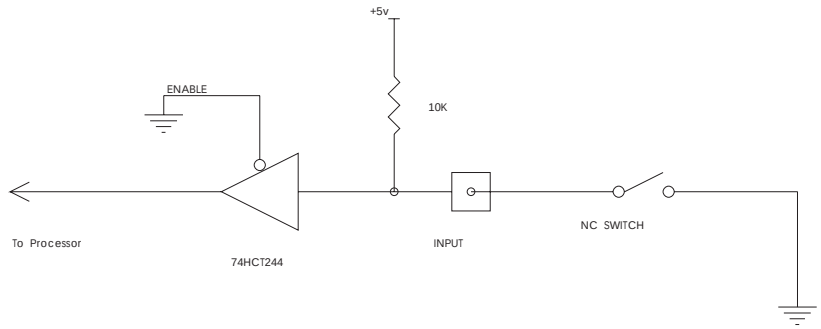
- PULSE-IN: Pulse train input
- DIR-IN: Direction of pulse train
- RESET-CNTR: Reset pulse counter

The pulse and direction inputs (TTL level or open collector signals) go directly into an up-down counter. This counter changes on BOTH the rising and falling edges of the incoming pulse train. RESET-CNTR will reset the counter to 0 on a falling edge and should be tied to ground if not used. The counter value can be read in MINT using the TIMER keyword. This would commonly be used where one channel of an encoder provides the pulse train, and the index pulse resets the counter every revolution. The direction input, DIR-IN, determines whether the counter increments or decrements on each edge. If the direction signal is left unconnected or taken high (5V) then the counter will increment, if it is taken low (0V) then the counter will decrement.

The pulse input has a very fast response time, maximum input frequency 500kHz, and will capture spurious voltage spikes if care is not taken over cable connections. An individually screened cable should be used to connect to this signal, and the neighbouring Gnd connection may be used to earth the respective screen.

By using an external conversion circuit, the counter input can be used to accept a quadrature encoder signal.

The buffer circuit for these inputs is shown below:




## 2.6 Stepper Outputs

Pinout:

| Din Connector | Backplane | Description |
|---|---|---|
| PULSE-0 (a14) | STEP: P0 | Pulse output stepper axis 0 |
| DIR-0 (a15) | STEP: D0 | Direction output stepper axis 0 |
| BOOST-0 (a13) | STEP: B0 | Boost output stepper axis 0 |
| PULSE-1 (b14) | STEP: P1 | Pulse output stepper axis 1 |
| DIR-1 (b15) | STEP: D1 | Direction output stepper axis 1 |
| BOOST-1 (b13) | STEP: B1 | Boost output stepper axis 1 |
| PULSE-2 (c14) | STEP: P2 | Pulse output stepper axis 2 |
| DIR-2 (c15) | STEP: D2 | Direction output stepper axis 2 |
| BOOST-2 (c16) | STEP: B2 | Boost output stepper axis 2 |
| GND | STEP: Gnd | Digital ground |

EuroSystem and EuroStep provide PULSE, DIRECTION and BOOST signals for 3 independent stepper motor drives or micro stepper drives with a maximum output frequency of 200kHz.

On issue 3 boards and below all the stepper outputs are open collector and are driven using a darlington array (ULN2803 device). The BOOST output for the 3rd axis is driven using an npn transistor (BC817 device).

On issue 4 boards all the stepper outputs are open drain Feild Effect Transistors (2N7002).

Each output is capable of sinking 100mA continuously when ON, and can withstand 50V when OFF.

The boost outputs can be turned on and off using the MINT keywords, BOOSTON and BOOSTOFF respectively. This output can also be used for FULL/HALF STEP control or other drive control inputs.

The drive circuits for these outputs are shown in Figure 2.7.

**The pulse outputs from the controller have fast fall times and as such can be a source of interference to neighbouring signals. You are strongly recommended to use an individually screened cable for the pulse signal and to run other signals separately. The screen for this signal should be connected to a good ground point , e.g. the ground stud on the backplane and should only be connected at one end.**

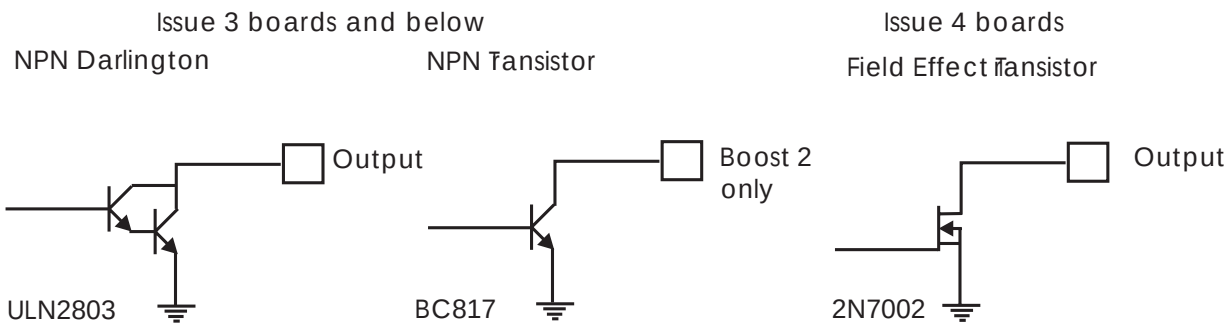



Figure 2.7 Stepper output driver circuits.

## 2.7 Servo Outputs

**Not applicable to EuroStep**

Pinout:

| Din Connector | Backplane | Description |
|---|---|---|
| DEMAND-0 (c27) | ANALOGUE: D0 | Demand signal out ±10V |
| DEMAND-1 (b27) | ANALOGUE: D1 | Demand signal out ±10V |
| AGND (c30,b30,a30) | ANALOGUE: AG | Analogue Ground |
| SCRN (c32,b32,a32) | ANALOGUE: SC | Power Ground/Screen |

EuroSystem provides two ±10V (±5%) analogue outputs for motor demand, one for each servo axis. A 12 bit DAC is used which gives a resolution of 4.9mV. The signals are brought out on screw terminals on the backplane and are repeated on a 10 way IDC connector labelled 'DRIVE DEMANDS'.

During power up, both the analogue outputs are disabled so that no demand is given to the drives before the controller has control over the system. The output voltage will fall to less than 100mV when the outputs are disabled.

After connecting motor, encoder and the required inputs you must ensure that the sense of your encoder is correct with respect to the motor armature connections. This is covered in detail in the Getting Started Guide.

## 2.8 Power

Pinout:

| Din Connector | Backplane | Description |
|---|---|---|
| VCC (c1,c2,b1,b2,a1,a2) | POWER: +5 | +5V @ 500mA |
| +12V (c29,b29,a29) | POWER: +12 | +12V @ 50mA |
| -12V (c31,b31,a31) | POWER: -12 | -12V @ 50mA |
| GND | POWER: G | Digital Ground |

The power connections are also brought out through a 10 way IDC connector, 'power' on the backplane. The connector is compatible with our own EuroAmp/8 and EuroAmp/2 backplanes.

Power requirements for EuroSystem/EuroStep are:

- +5V at 500mA
- ±12V at 50mA
- Ground

**The voltage must be kept at strictly +5V (±5%). Should the voltage drop below 4.75V (approx.) the controller will be reset and held in that state until the voltage rises to above 4.8V (approx.). Reset is characterised by the LED status display showing an '8' with the decimal dot lit or being blank. The controller will be held in reset for a further 50ms once the voltage is restored.**

Two other ground potential signals are used: analogue ground (AGND), used in the analogue input/output circuit, and screen (SCRN), a cable screen connection for the serial link and encoder inputs.

## 2.8.1 Battery Back-up

Program and data are retained in battery backed RAM while the controller is turned off. The battery, a rechargeable Nickel Cadmium (NiCad), is charged when the controller is powered up and will retain memory contents for at least 12 months if not recharged. The battery will take approximately 6 days to recharge after a complete discharge and has an expected life of four years.

## 2.9 Encoder

### Not applicable to EuroStep

Pinout:

| Din Connector | Backplane | Description |
|---|---|---|
| CHA-0 (b7) | Brought out on D-type | Channel A axis 0 |
| CHB-0 (a7) | | Channel B |
| IDX-0 (b8) | | Index |
| !CHA-0 (b10) | | Channel A complement |
| !CHB-0 (c10) | | Channel B complement |
| !IDX-0 (b9) | | Index complement |
| CHA-1 (a8) | | Channel A axis 1 |
| CHB-1 (c7) | | Channel B |
| IDX-1 (c8) | | Index |
| !CHA-1 (c9) | | Channel A complement |
| !CHB-1 (a10) | | Channel B complement |
| !IDX-1 (a9) | | Index complement |

EuroSystem provides an interface for two independent three channel incremental encoders (CHA, CHB, INDEX) and operates with both single ended TTL or differential TTL output types. It is recommended that line driver outputs be used in all applications, since this gives increased noise immunity. It is important that each encoder cable is screened independently and that the screen is connected at the controller end only. Maximum cable length is dependent on the encoder specification, but should be kept as short as possible.

The input receiver circuit allows encoders with either single ended or differential line drivers to be used and is shown in figure 2.8.

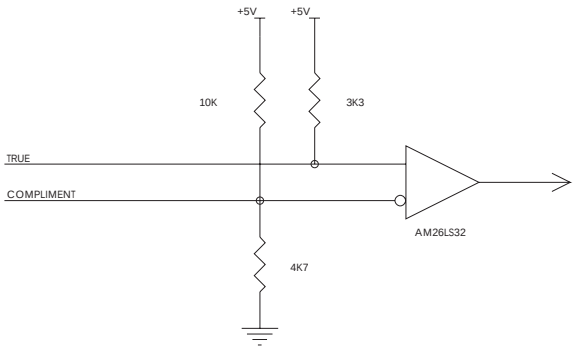



Figure 2.8 Encoder line receiver circuit.

# 2.10 Miscellaneous

## 2.10.1 Error Output

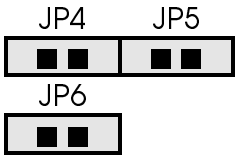
Pinout:

| Din Connector | Backplane | Description |
|---|---|---|
| ERROR-OUT (b11) | MISC: EO | Error out signal |
| GND | MISC: G | Digital Ground |

The error output provides a signal to external devices such as motor drives. The error signal is given when the controller detects a fault such as an end-of-travel limit switch open, maximum following error exceeded or a programming error. The output is jumper selectable as shown in the table below.

It is essential that the error output is connected to the drive and configured to the correct polarity with servo drives, since the state of the analogue outputs is undefined (but always below 100mV) during power-up. The error output ensures that the drive is disabled during this period. Once powered-up the error signal is maintained until deliberately removed by software. This allows time for system gains to be set before the motors are enabled. For stepper drives the error signal may be connected or not as desired. If not used all jumpers should be removed.

The jumpers JP4 to JP6, found next to the 96 way DIN connector, are used to select the output type.




| JP6 | JP5 | JP4 | Normal | Error |
|---|---|---|---|---|
| | | ❑ | Floating | 12V |
| | ❑ | | 0V | Floating |
| | ❑ | ❑ | 0V | 12V |
| ❑ | | ❑ | 12V | Floating |
| ❑ | ❑ | | Floating | 0V |
| ❑ | ❑ | ❑ | 12V | 0V |

JP6 is used to invert the sense of the signals.

## 2.10.2 Stop Input

Pinout:

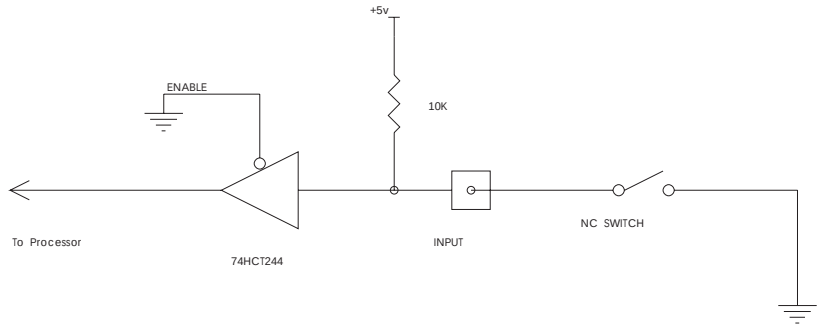
| Din Connector | Backplane | Description |
|---|---|---|
| STOP (a25) | HOME/LIMIT: ST | Stop input |
| GND | HOME/LIMIT: Gnd | Digital Ground |

The stop input provides a controlled stop on all axes when asserted. The stop input is active high and must be connected to a normally closed switch. If the stop input is not used it must be connected to ground otherwise the controller will be in stop condition, indicated by an 'S' on the LED status display.

The stop input is useful where a controlled stop is required such as machine guards where free wheeling could be dangerous.

The state of the stop input can be read in MINT using the STOPSW keyword. A subroutine within MINT can be called in response to a rising edge on the stop input.

The stop input buffer circuit is shown below:




## 2.10.3 Reset Input

Pinout:

| Din Connector | Backplane | Description |
|---|---|---|
| RESET-IN (c12) | HOME/LIMIT: RS | Reset input |
| GND | HOME/LIMIT: Gnd | Digital Ground |

The reset input will perform a hardware reset when the line is pulled low. This can be useful to provide an external reset of the system where turning the power off to the controller would prove to be inconvenient.

## 2.10.4 Error Input

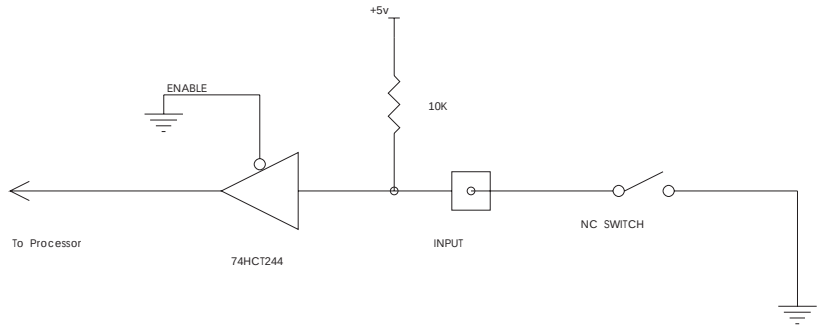
Pinout:

| Din Connector | Backplane | Description |
|---|---|---|
| ERROR-IN (c11) | MISC: EI | Error input |
| GND | MISC: G | Digital Ground |

The error input is used to detect error conditions in other parts of the system such as PLCs, or from the motor drives so that if a fault occurs on one motor the whole system is stopped.

The sense of this input is software selectable for active high or active low, it may also be disabled in software. The input is pulled up internally if no external connection in made.

The error input buffer circuit is shown below:




## 2.10.5 Fast Interrupt

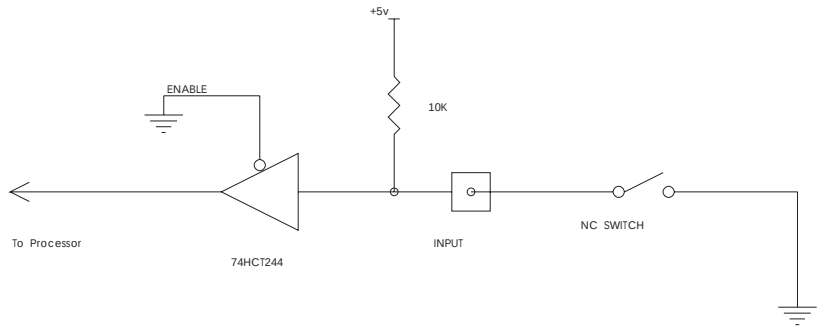
Pinout:

| Din Connector | Backplane | Description |
|---|---|---|
| FAST-INT (c50) | MISC: FI | Error input |
| GND | MISC: G | Digital Ground |

The fast interrupt is an external interrupt into the processor available with custom software only. This has a service time in the region of 25 microseconds as opposed to MINT interrupts which have a service time in the region of milliseconds. The primary function of the fast interrupt is to record axis positions which is provided as an option to the standard MINT software.

The Fast Interrupt has a very fast response time and will capture spurious voltage spikes if care is not taken over cable connections. An individually screened cable should be used to connect to this signal, and the neighbouring Gnd connection may be used to earth the respective screen.

The fast-interrupt buffer circuit is shown below:



## 2.10.6 Option Board Connections

Pinout:

| Din Connector | Backplane | Description |
|---|---|---|
| OPT-1 (a23) | PWR/OPT: O1 | Option 1 |
| OPT-2 (b22) | PWR/OPT: O2 | Option 2 |
| OPT-3 (b23) | PWR/OPT: O3 | Option 3 |
| OPT-4 (c22) | PWR/OPT: O4 | Option 4 |
| GND | PWR/OPT: G | Digital Ground |

OPT-1 to OPT-4 are connections which allow signals from custom designed option boards to be brought out to the backplane. These signals are only required when the option board is physically mounted on the option header and has only a small number of connections, for example a 4th stepper drive output which only requires three outputs and two chips.

# 2.11 Serial Port

EuroSystem/EuroStep has a full duplex serial port which can be either RS232 or RS485. The serial port is set up for the following configuration:

- 9600 Baud
- 1 start bit
- 8 data bits
- 1 stop bit
- No parity

MINT will transmit a carriage return/line feed (<LF><CR>) combination but only expects a carriage return (<CR>) from the host terminal.

cTERM is pre-configured for use with EuroSystem/EuroStep.

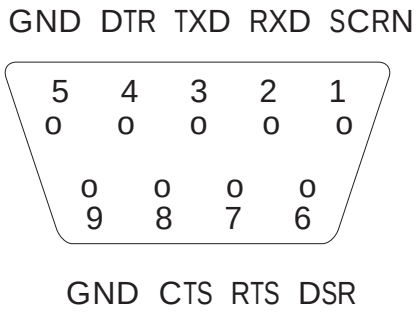
## 2.11.1 RS232

Pinout:

| Din Connector | Backplane | Description |
|---|---|---|
| RXD (a20) | Brought out on D-type | Receive Data |
| TXD (a21) | | Transmit Data |
| CTS (a22) | | Clear to Send |
| RTS (b21) | | Request to Send |
| DSR (a16) | | Data Set Ready |
| DTR (a17) | | Data Terminal Ready |
| SCRN (c32,b32,a32) | | Screen |

The RS232 connections are brought out onto a male 9-way D-type connector on the front of the controller. The same signals are also brought out onto the backplane.

The RS232 port is configured as a DTE (Data Terminal Equipment) unit so it is possible that EuroSystem will operate with any DCE (Data Communications Equipment) or DTE equipment. Full duplex transmission with CTS/RTS handshaking is supported. Both the output and input circuitry are single ended and operate between ±12V.




serial/mc

RS232 D-Type connector pinout

| Pin No. | Signal Name & Function | Type |
|---|---|---|
| 1 | SCRN : Cable screen | Input |
| 2 | RXD : Receive Data | Input |
| 3 | TXD : Transmit Data | Output |
| 4 | DTR : Data Terminal Ready | Output |
| | (Internal connection to pin 6) | |
| 5 | GND : Signal Ground | |
| 6 | DSR : Data Set Ready | Input |
| | (Internal Connection to pin 4) | |
| 7 | RTS : Request to Send | Output |
| 8 | CTS : Clear to Send | Input |
| 9 | GND : Signal Ground | |

The following table shows the wiring required for a standard IBM PC 25 way or 9 way connector:

| Controller Pin No. | Signal Name and Function | Wire to: 25 Way | Wire to: 9 Way |
|---|---|---|---|
| 1 | SCRN : Cable screen | - | - |
| 2 | RXD : Receive Data | 2 | 3 |
| 3 | TXD : Transmit Data | 3 | 2 |
| 4 | DTR : Data Terminal Ready (Internal connection to pin 6) | 6 | 6 |
| 5 | GND : Signal Ground | 7 | 5 |
| 6 | DSR : Data Set Ready (Internal Connection to pin 4) | 20 | 4 |
| 7 | RTS : Request to Send | 5 | 8 |
| 8 | CTS : Clear to Send | 4 | 7 |
| 9 | GND : Signal Ground | 7 | 9 |

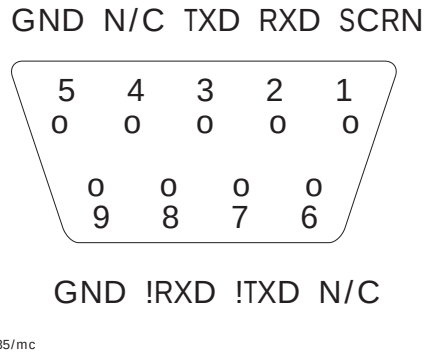
Pinout:

| Din Connector | Backplane | Description |
|---|---|---|
| RXD (a20) | Brought out on D-type | Receive Data True |
| TXD (a21) | | Transmit Data True |
| CTS (a22) | | Receive Data Compliment |
| RTS (b21) | | Transmit Data Compliment |
| DSR (a16) | | Data Set Ready |
| DTS (a17) | | Data Terminal Ready |
| SCRN (c32,b32,a32) | | Screen |

The RS485 connections are brought out onto the male 9-way D-type connector on the front of the controller and on the backplane.

The RS485 supports a full multi-drop protocol. Both the output and input signals are differential and operate between 0 and 5V.

The D-Type signals are also brought out on the 96-way connector.




RS485/mc

RS485 D-Type connector pinout

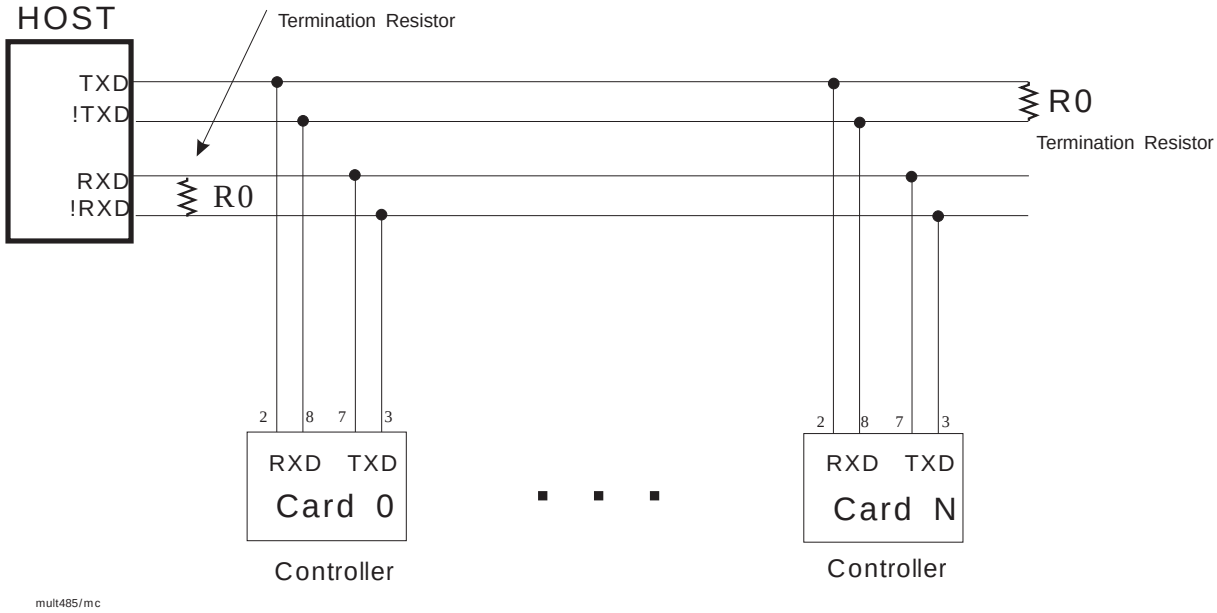
| Pin No. | Signal Name & Function | Type |
|---|---|---|
| 1 | SCRN : Cable screen | Input |
| 2 | RXD : Receive Data | Input |
| 3 | TXD : Transmit Data | Output |
| 4 | Not connected | |
| 5 | GND : Signal Ground | |
| 6 | Not connected | |
| 7 | !TXD : Transmit Data Compliment | Output |
| 8 | !RXD : Receive Data Compliment | Input |
| 9 | GND : Signal Ground | |

## 2.11.2.1 RS485 Multi-Drop

A multi-drop system can be easily configured using a ribbon cable and IDC D-Type connectors to the controller cards. A multi-drop layout is shown in the diagram below.

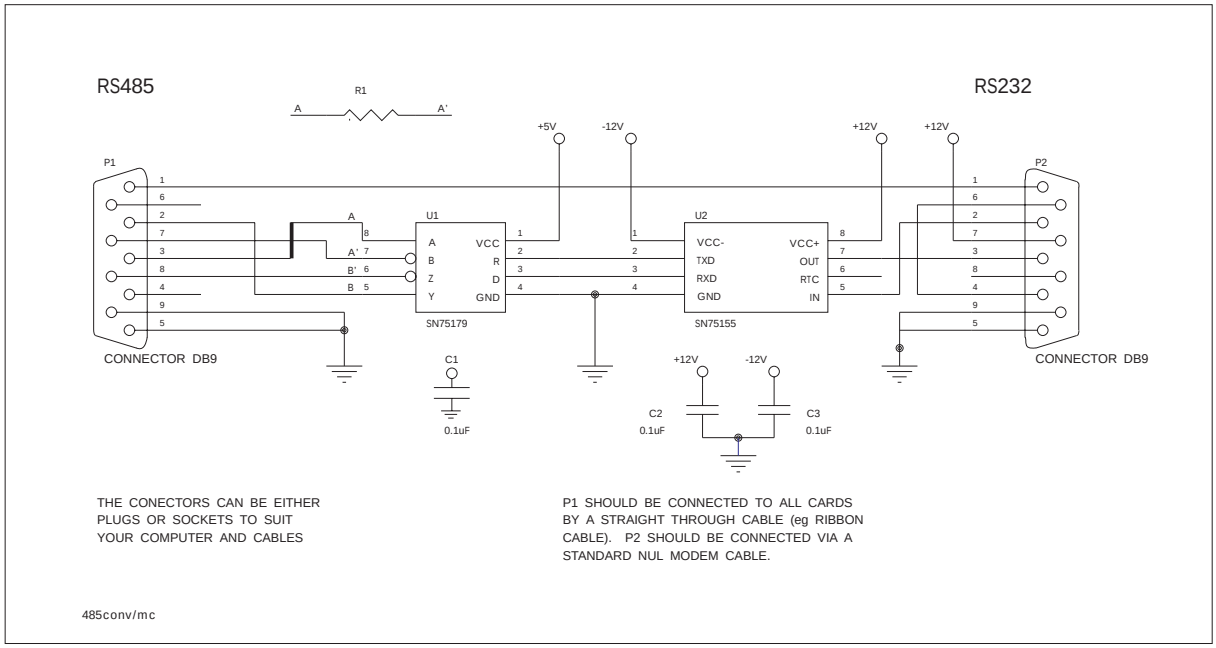
EuroSystem supports up to 16 cards on the serial line, where each card is distinguished by a unique address set by a 4 bit DIP switch. See section 3 for more details on the card address. Software details on multi-drop can be found in the MINT Programming Guide.

Note that the RXD and TXD lines must be terminated with 120 ohm resistors.



## 2.11.2.2 RS485 to RS232 Converter

The following shows a schematic for an RS485 to RS232 converter. This is useful for connecting an IBM PC, using a null modem cable, to a multi-drop link and using the PC as a host.




The 485 line must be correctly terminated by placing 120 ohm resistors across A and !A (A complement) and B and !B as near to the driver (SN75179) as possible. If the 485 line is not correctly terminated, characters transmitted over the serial link may be corrupted*.

The 232 connector must be connected as close to the PC serial output as is possible to effectively give the PC an RS485 output.

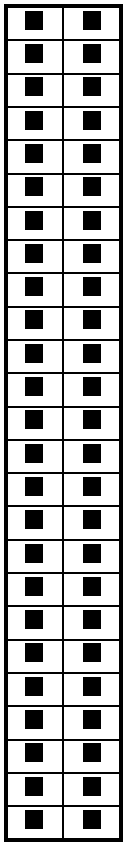
* Termination of a RS485 line is only necessary at 9600 baud if the line is over 1000m in length. Termination is important in high speed systems.

# 3. Option Card Header

The option card header (50-way IDC) allows the controller to access additional peripherals as discussed in section 1.4 to give additional functionality which is not part of the controller. This section describes the option card header in more detail.

The header interface consists of the Data Bus part of the Address bus some control signals and some power rails. All of the high speed signals are separated by ground lines to reduce any cross-talk or interference.

## 3.1 Pin Arangement



| | | | | | | |
|---|---|---|---|---|---|---|
| Data bus bit 0 | AD0 | *1* | | *2* | GND | 0V |
| Data bus bit 1 | AD1 | *3* | | *4* | GND | 0V |
| Data bus bit 2 | AD1 | *5* | | *6* | GND | 0V |
| Data bus bit 3 | AD1 | *7* | | *8* | GND | 0V |
| Data bus bit 4 | AD1 | *9* | | *10* | GND | 0V |
| Data bus bit 5 | AD1 | *11* | | *12* | GND | 0V |
| Data bus bit 6 | AD1 | *13* | | *14* | GND | 0V |
| Data bus bit 7 | AD1 | *15* | | *16* | GND | 0V |
| Address Latch Enable | ALE | *17* | | *18* | GND | 0V |
| Read Strobe | !RD | *19* | | *20* | GND | 0V |
| Write Strobe | !WR | *21* | | *22* | GND | 0V |
| Address bit 0 | MA0 | *23* | | *24* | GND | 0V |
| Address bit 1 | MA1 | *25* | | *26* | GND | 0V |
| Address bit 2 | MA2 | *27* | | *28* | GND | 0V |
| Address bit 3 | MA3 | *29* | | *30* | GND | 0V |
| Address bit 4 | MA4 | *31* | | *32* | GND | 0V |
| Address bit 5 | MA5 | *33* | | *34* | GND | 0V |
| Option Card Select | !OCS | *35* | | *36* | EXTINT | External Interrupt |
| Reset Out | !RSTOUT | *37* | | *38* | !RSTIN | Reset Input |
| Error In | ERRIN | *39* | | *40* | ERROR | Error output |
| 0V | GND | *41* | | *42* | Vcc | +5V |
| +5V | Vcc | *43* | | *44* | Vcc | +5V |
| 0V | GND | *45* | | *46* | +12V | +12V |
| +12V | +12V | *47* | | *48* | GND | 0V |
| -12V | -12V | *49* | | *50* | -12V | -12V |

### 3.1.1 Signal Discriptions

| Signal | Description |
|---|---|
| *Data Bus* | These signals are bidirectionally buffered connections to the processors' multiplexed data/address bus and are used to convey data to and from the option cards. |
| *ALE* | This signal allows the use of peripherals which need to connect to a multiplexed bus and demultiplex it internally. (Currently unused) |
| *Read/Write* | These signals are buffered connections to the processor read and write pins, they are used as normal to indicate the direction of data flow and when data is available on the bus. Read is also used to set the direction of the data bus buffers on the controller and the option cards. |
| *Address Bus* | These signals are buffered connections to the processor address bus. They are used, with OCS to determine which card and then which location on the card is accessed. Bits 5 and 4 determine which card, giving a maximum of 4 |

| Signal | Description |
|---|---|
| | cards. And bits 3-0 are used on each card to give a maximum of 16 bytes per card, 64 bytes in total. |
| *OCS* | This option card select signal indicates when access to one of the option cards occurs. |
| *EXTINT* | This signal is an open drain common interrupt signal from all option cards for any cards that require it. (Currently unused) |
| *RSTOUT* | This signal indicates when the processor or voltage monitor has caused a system reset. Any peripherals with hardware reset inputs are connected to this line. |
| *RSTIN* | Pulling this line low will cause a system reset. (Currently unused) |
| *ERRIN* | This signal is connected in paralell with the standard error in input. |
| *ERROR* | This signal is connected directly to the controller error output. |
| *Power Rails* | These are connected directly to the controller rails. |

## 3.2 Prototyping

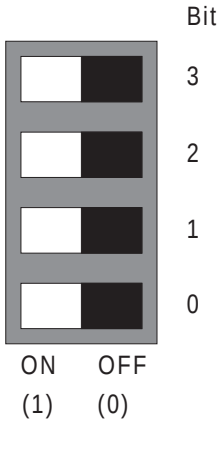
A prototyping board is available, for those who want to design their own option cards, which consists of:

- a connector
- data buffer
- PAL socket
- links for board number (0-3) selection
- a wire wrapping area
- space for a DIN41612 B,C,D or F connector

# 4. Card Address

Up to 16 controllers can be connected together over a multi-drop RS485 link for host control. Each card on the link is distinguished by a unique address set by a 4 bit DIP switch located next to the processor.

Controller Address Switch:




| Switch Position 3 2 1 0 | Address | LED |
|---|---|---|
| 0 0 0 0 | 0 | 0 |
| 0 0 0 1 | 1 | 1 |
| 0 0 1 0 | 2 | 2 |
| 0 0 1 1 | 3 | 3 |
| 0 1 0 0 | 4 | 4 |
| 0 1 0 1 | 5 | 5 |
| 0 1 1 0 | 6 | 6 |
| 0 1 1 1 | 7 | 7 |
| 1 0 0 0 | 8 | 8 |
| 1 0 0 1 | 9 | 9 |
| 1 0 1 0 | 10 | A |
| 1 0 1 1 | 11 | b |
| 1 1 0 0 | 12 | C |
| 1 1 0 1 | 13 | d |
| 1 1 1 0 | 14 | E |
| 1 1 1 1 | 15 | F |

On power up, the controller will show the address number on the LED status for about 1 second. The DIP switch value can be read in MINT using the CARD keyword.

If the controller is used in a stand-alone system, the card address should be set to address 0. A RS232 controller will always default to address 0 regardless of the switch positions.

# 5. EuroSystem/EuroStep Backplane Connections

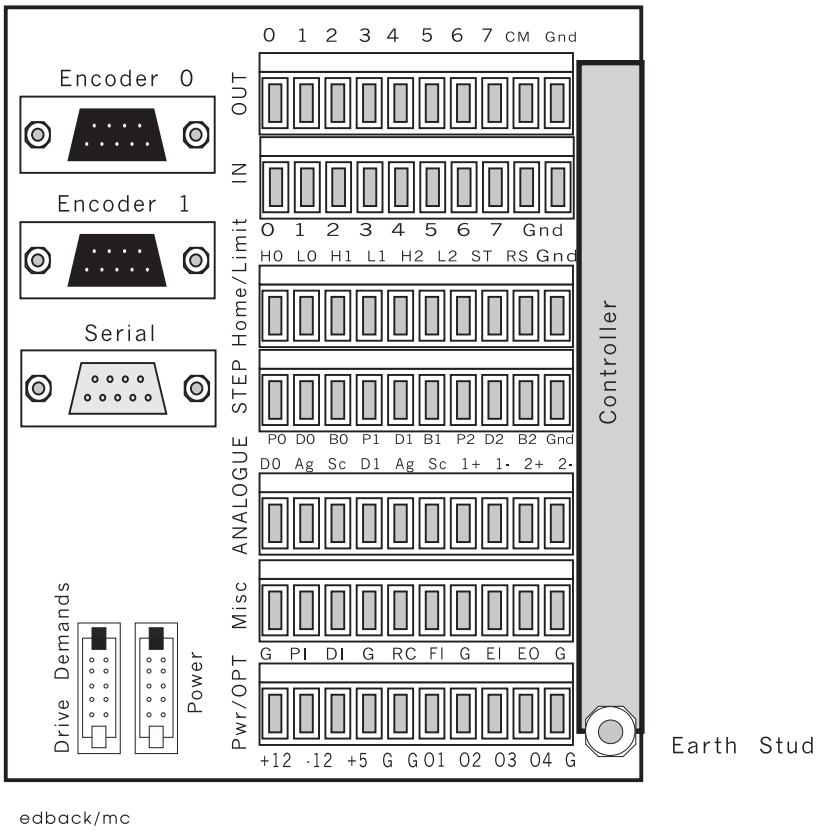



Figure 4.1: EuroSystem/EuroStep Backplane

Your backplane, figure 4.1, has been designed to provide easy connection between EuroSystem/EuroStep and your application signals. All signals with the exception of the encoders and RS232/485 are connected to via seven removable ten way connectors. Encoders and RS232/485 are connected to via nine pin D type connectors.

You may also link directly to our range of stepper and servo products and their respective backplanes with the simple addition of a ribbon cable. Stepper signals for all three axes have been duplicated and made available on three, ten way ribbon cable headers. Servo drive signals and power are also available on independent ten way ribbon cable headers.

Connections to the backplane are as follows. For a full description of the function of each signal refer to section 2.

## 5.1 Digital Outputs: OUT

| Signal | Function |
|---|---|
| O0 | Digital output bit 0 |
| O1 | Digital output bit 1 |
| O2 | Digital output bit 2 |
| O3 | Digital output bit 3 |
| O4 | Digital output bit 4 |
| O5 | Digital output bit 5 |
| O6 | Digital output bit 6 |
| O7 | Digital output bit 7 |
| CM | Common diode connection |
| Gnd | Digital ground |

The outputs have a Common diode clamp connection accessible from the backplane through USR-OUT-COM. This connection is for use with inductive loads and should be to the external supply from which you are sourcing current.

## 5.2 Digital Inputs: IN

| Signal | Function |
|---|---|
| I0 | Digital input bit 0 |
| I1 | Digital input bit 1 |
| I2 | Digital input bit 2 |
| I3 | Digital input bit 3 |
| I4 | Digital input bit 4 |
| I5 | Digital input bit 5 |
| I6 | Digital input bit 6 |
| I7 | Digital input bit 7 |
| GND | |
| GND | Digital ground |

## 5.3 HOME/LIMIT

| Signal | Function |
|---|---|
| H0 | Home Input 0 |
| L0 | Limit Input 0 |
| H1 | Home Input 1 |
| L1 | Limit Input 1 |
| H2 | Home Input 2 |
| L2 | Limit Input 2 |
| ST | Stop Input |
| RS | Reset Card Input |
| Gnd | Digital Ground |

**Note: The limit and stop inputs must be grounded if not used for the system to operate correctly.**

## 5.4 Stepper Drive Connections: STEP

| Signal | Function |
|---|---|
| P0 | Pulse Output 0 |
| D0 | Direction Output 0 |
| B0 | Boost Output 0 |
| P1 | Pulse Output 1 |
| D1 | Direction Output 1 |
| B1 | Boost Output 1 |
| P2 | Pulse Output 2 |
| D2 | Direction Output 2 |
| B2 | Boost Output 2 |
| Gnd | Digital Ground |

The pulse output from the controller has a fast fall time and as such it can be a source of interference to neighbouring signals. You are strongly recommended to use an individually screened cable for the pulse signal and to run other signals separately. The screen for this signal should be connected to the ground stud on the backplane and not at the drive end.

## 5.5 Servo Drive Connections: ANALOGUE

Some of the signals on this connector are duplicated on the servo ribbon header (see later). It is possible to use either the ribbon cable connection or this connection for any axis, but not both.

| Signal | Function |
|---|---|
| D0 | Demand Output 0 (demand +) |
| AG | Analogue Ground (demand -) |
| SC | Cable Screen |
| D1 | Demand Output 1 (demand +) |
| AG | Analogue Ground (demand -) |
| SC | Cable Screen |
| 1+ | Analogue Input 1 (differential +ve) |
| 1- | Analogue Input 1 (differential -ve) |
| 2+ | Analogue Input 2 (differential +ve) |
| 2- | Analogue Input 2 (differential -ve) |

## 5.6 Miscellaneous: MISC

The Fast Interrupt and Pulse input have very fast response times and will capture spurious voltage spikes if care is not taken over cable connections. Individually screened cables should be used to connect to these signals, and the neighbouring Gnd connection may be used to earth the respective screen.

| Signal | Function |
|---|---|
| G | Ground |
| PI | Pulse Input |
| DI | Direction Input |
| G | Ground |
| RC | Reset Counter Input |
| FI | Fast Interrupt Input |
| G | Ground |
| EI | Error Input |
| EO | Error Output |
| G | Ground |

## 5.7 Power: PWR/OPT

The power signals are duplicated on a ten way ribbon connector and as such care should be taken not to connect to both of these simultaneously.

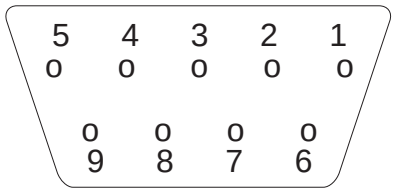
| Signal | Function |
|---|---|
| +12 | +12V power supply input |
| -12 | -12V power supply input |
| +5 | +5V power supply input |
| G | Digital Ground |
| G | Digital Ground |
| O1 | Option 1 |
| O2 | Option 2 |
| O3 | Option 3 |
| O4 | Option 4 |
| G | Digital Ground |

O1 to O4 are used to bring out signals from option boards.

## 5.8 Encoder Connections

The encoder inputs are brought out onto 9 pin 'D' type female sockets. The encoder should be wired to a 9 pin 'D' male plug.

CHA SCRN !CHB INDEX +5V




!CHA CHB GND !INDEX

encoder/mc

| Pin No. | Signal Name & Function | Type |
|---|---|---|
| 1 | +5V : Power to Encoder | Output |
| 2 | INDEX : Index Mark | Input |
| 3 | !CHB : Channel B Compliment | Input |
| 4 | SCRN : Cable Screen | Input |
| 5 | CHA : Channel A | Input |
| 6 | !INDEX : Index Complement | Input |
| 7 | GND : Signal Ground | |
| 8 | CHB : Channel B | Input |
| 9 | !CHA : Channel A Compliment | Input |

## 5.9 Servo Drive: IDC Connector

| Function | Pin | | | Pin | Function |
|---|---|---|---|---|---|
| Servo Error Out | 1 | ❑ | ❑ | 2 | Error In |
| Cable Screen | 3 | ❑ | ❑ | 4 | Analogue Ground |
| Demand_0 +ve out | 5 | ❑ | ❑ | 6 | Demand_0 +ve out |
| Demand_0 -ve (Agnd) | 7 | ❑ | ❑ | 8 | Demand_1 -ve (Agnd) |
| Demand_1 +ve Out | 9 | ❑ | ❑ | 10 | Demand_1 +ve Out |

**Note: Demand _0 -ve and demand _1 -ve are common and are connected to analogue ground.**

## 5.10 Power: IDC Connector

| Function | Pin | | | Pin | Function |
|---|---|---|---|---|---|
| Dgnd | 1 | ❑ | ❑ | 2 | Dgnd |
| Dgnd | 3 | ❑ | ❑ | 4 | Dgnd |
| +5V | 5 | ❑ | ❑ | 6 | +5V |
| +12V | 7 | ❑ | ❑ | 8 | +12V |
| -12V | 9 | ❑ | ❑ | 10 | -12V |

## 5.11 Earth Stud

This connection should be used as the main earth point for your controller. It should be connected to a low impedance star earth point within the system.

## 5.12 RS232/485

The RS232/485 port available on the front of the card is duplicated on the backplane.

# 6. Optically Isolated Backplane

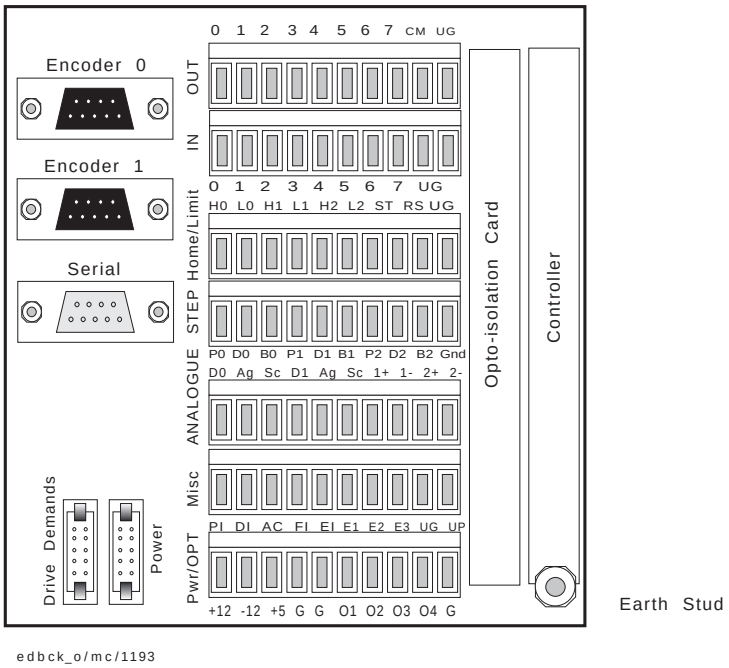



Figure 6.1: Optically Isolated Backplane

The optically isolated backplane isolates the following signals:

- Digital user inputs
- Digital user outputs
- Pulse following inputs (PULSE, DIRECTION, RESET)
- Limit inputs
- Home inputs
- Reset input
- Stop input
- Error input
- Fast interrupt
- Error output

The optically isolated backplane has been designed to have the same connection details as the standard backplane, with the exceptions of the miscellaneous block (see section 6.1).

In the optically isolated backplane system all active components are mounted on a small signal conditioning card which connects to the backplane via a 96 way DIN 41612 'R' type connector. This allows different signal conditioning options to be offered, such as NPN or PNP type inputs and outputs, or custom conditioning cards, for instance, connection to proximity sensors.

# 6.1 Technical Specification: Isolated

All isolated signals are marked with *.

## 6.1.1 Motor Control I/O

| | |
|---|---|
| **Stepper ouputs:** | ➥ Step/Direction/Boost<br>➥ Axis 0,1,2 open collector<br>➥ 100 mA sink each<br>➥ 10 Hz to 200Hz frequency output |
| **Analogue outputs:** | ➥ ±10V, 10 mA sink/source<br>➥ 12 bit resolution |
| **Encoder inputs:** | ➥ Minimum requirements: Channel A, Channel B single ended TTL<br>➥ Preferred: Channel A, Channel B, Index, differential TTL line driver<br>➥ Encoder frequency 1MHz maximum<br>➥ 9 way D-type female connector on backplane |
| **Limit inputs*:** | ➥ Axis 0,1,2<br>➥ Connect to ground (NPN)/power (PNP) through normally closed switches |
| **Home inputs*:** | ➥ Axis 0,1,2<br>➥ Connect to ground (NPN)/power (PNP) through normally closed switches |
| **Stop input*:** | ➥ Motion inhibited when active, axes decelerate to stop |
| **Reset input*:** | ➥ Pull low for hardware reset |
| **Error input*:** | ➥ Motion inhibited. Acitive high or low, configured by software. |
| **Enable output*:** | ➥ Active high (12V) or low (0V) on 10 way IDC, hardware configured<br>➥ Change over relay on screw terminations |

## 6.1.2 Machine Control I/O

| | |
|---|---|
| **User inputs*:** | ➥ 8 input lines, logical one when in-active, logical zero when active |
| **User outputs*:** | ➥ 8 output lines, open collector<br>➥ NPN:400 mA max sink per output, 800mA total sink<br>➥ PNP:300 mA max sink per output, 750mA total sink |
| **Analogue inputs:** | ➥ 2 inputs<br>➥ ±10V or 0-5V jumper selectable<br>➥ 10 bit resolution |
| **Pulse/Direction*:** | ➥ TTL 50kHz maximum<br>➥ Pulse input counts rising and falling edges<br>➥ Reset counter edge triggered, tie to ground if not used |
| **Serial Port:** | ➥ RS232 or duplex RS485<br>➥ 9 way D-type male connector on front panel, duplicated on backplane<br>➥ 9600 baud, 1 start bit, 8 data bits, 1 stop bit, no parity<br>➥ No handshaking (Hardware handshaking for HPGL)<br>➥ RS485 supports multi-drop of up to 16 cards |

## 6.1.3 General

| | |
|---|---|
| **Power:** | ➥ +5V at 500mA<br>➥ ±12V at 50mA<br>➥ Isolated supply voltage |
| **Operating temperature:** | ➥ 0 - 45°C |

**Connectors:**
- Backplane connector: DIN 41612, 96-way
- Option bus connector: 50 way IDC header
- Power/drive demands: 10 way IDC header, not isolated

## 6.2 Differences from Standard Backplane

### 6.2.1 Error Output

The error output is isolated with a change over relay because of the wide variety of voltages and polarities the output may be connected to. The contact rating of the relay is 2A @ 30Vdc or 0.6A @ 150Vac. The connections to the relay are brought out on the MISC connector through E1, E2, E3.

| Connector | Function |
|---|---|
| E1 | Error output common |
| E2 | Error output normally open |
| E3 | Error output normally closed |

### 6.2.2 MISC Connector

Because of the additional power requirements and extra Error output connections, the MISC connector is re-arranged as follows.

| | |
|---|---|
| PI | Pulse Input |
| DI | Direction Input |
| AC | Accumulator Clear (reset counter) Input |
| FI | Fast Interrupt Input |
| EI | Error Input |
| E1 | Error Output Common |
| E2 | Error Output Normally Open |
| E3 | Error Output Normally Closed |
| UG | User (Isolated) Ground |
| UP | User (Isolated) Power |

### 6.2.3 User (Isolated) Power

The opto isolated backplane system is designed to interface EuroSystem to external voltages of up to 24V. If a voltage other than 24V is used, some component values must be changed to suit the voltage used, contact Optimised Control for details. With a 24V voltage, the card is compatible with most PLC's.

Power is connected through the MISC connector on pins 9 and 10, labelled UP (user power) and UG (user ground) respectively.

The Limit/Home, Digital Inputs and Pulse following inputs, being isolated, have a User Ground (UG) reference connection. The stepper outputs (pulse, direction and boost), which are not isolated, have a controller ground (Gnd) reference connection.

The user outputs have their own power connections. See section 6.2.2 for details.

## 6.3 Signal Connections

### 6.3.1 All Inputs

All inputs applies to user inputs, homes, limits, reset, stop, fast interrupt, pulse, direction and reset counter.

When using the **NPN** signal conditioning card (current sink) the inputs will become active when taken to isolated ground (UG), providing the switch can sink 10mA.

When using the **PNP** signal conditioning card (current source), connections to the inputs must be able to source 10mA (5mA min) into a 2k2 load (24V will give 11mA) for the input to become active. This current must drop to less than 1mA to ensure that the input becomes inactive.

### 6.3.2 User Outputs

**This applies to user outputs only.**

Two power connections are specific to the output driver circuit, they are OG and CM. These terminals are connected differently for the different signal conditioning cards (NPN or PNP).

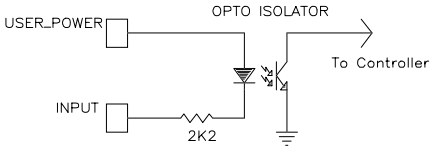
For NPN outputs, OG is connected to UG, and CM is a flyback diode connection for inductive loads. The NPN output driver can sink a maximum of 400mA continuous on a single channel, with a total maximum of 800mA for all 8 channels.

For PNP outputs, OG is connected to UP, and CM is connected to UG. Note that with this driver the flyback diodes are connected internally. The PNP output drivers can source a maximum of -350mA continuous on a single channel, with a total maximum of -750mA for all 8 channels.

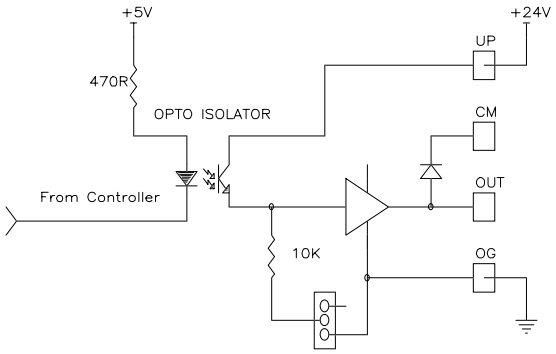
### 6.3.3 Jumpers

The jumper, J1, on the signal conditioning card is factory set and must not be moved.

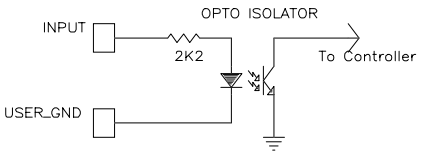
## 6.3.4 Opto Isolation Circuit Diagrams



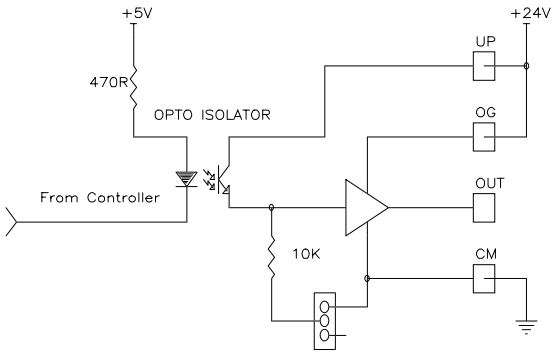

NPN INPUTS




NPN OUTPUTS



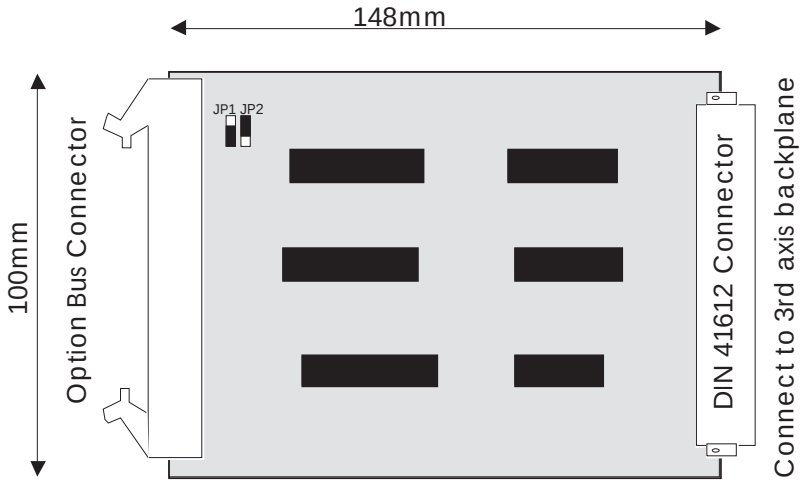

PNP INPUTS



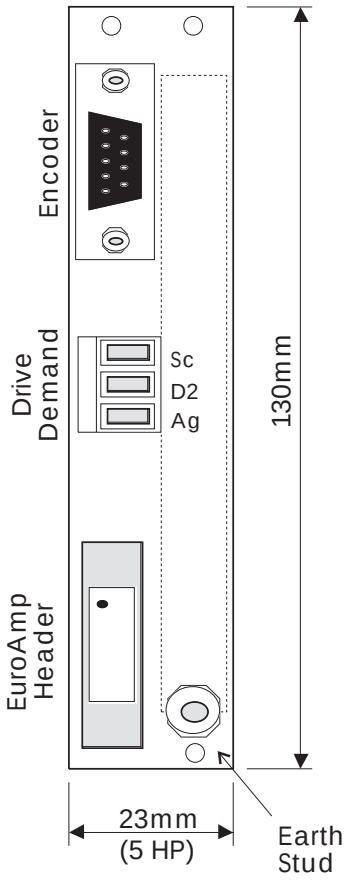

PNP OUTPUTS

# 7. 3rd Axis Servo Option Board

The 3rd axis servo option board provides additional hardware to control a third axis of servo motion for the EuroSystem controller. The board has an incremental encoder input which supports three channel differential or single-ended encoders, and a 12 bit resolution analogue output to control high performance servo drives. Limits and home inputs are provided as standard on the EuroSystem controller for the 3rd axis servo, as is support by MINT.




3rd axis servo board



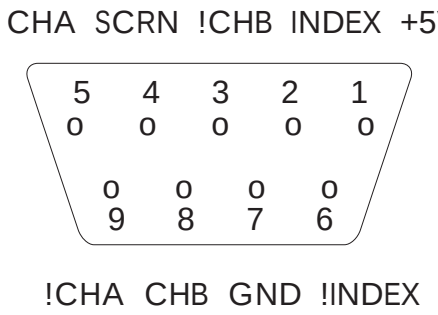

Ref: 3axis/mc/1193

3rd axis backplane

Connection between EuroSystem and the 3rd axis board board is provided by a ribbon cable from the EuroSystems's option bus connector. Connections to the servo drive and encoder are made via a backplane which sits along side the EuroSystem backplane. The connection details of the backplane are as follows:

## 7.1 Encoder Connections

The encoder input is brought out onto 9 pin 'D' type female sockets. The encoder should be wired to a 9 pin 'D' male plug.




encoder/mc

| Pin No. | Signal Name & Function | Type |
|---|---|---|
| 1 | +5V : Power to Encoder | Output |
| 2 | INDEX : Index Mark | Input |
| 3 | !CHB : Channel B Compliment | Input |
| 4 | SCRN : Cable Screen | Input |
| 5 | CHA : Channel A | Input |
| 6 | !INDEX : Index Complement | Input |
| 7 | GND : Signal Ground | |
| 8 | CHB : Channel B | Input |
| 9 | !CHA : Channel A Compliment | Input |

## 7.2 Drive Demand Terminal Block

| Terminal | Function |
|---|---|
| Sc | Cable Screen |
| D2 | Demand output 2 (demand +) |
| Ag | Analogue Ground (demand -) |

## 7.3 EuroAmp Header: IDC Connector

The EuroAmp header provides a direct connection to the EuroAmp range of amplifiers via a 10 way IDC connector.

| Function | Pin | | Pin | Function |
|---|---|---|---|---|
| Drive enable (error out) | 1 | | 2 | Error In |
| Cable Screen | 3 | | 4 | Analogue Ground |
| Demand_2 +ve Out | 5 | | 6 | Demand_2 +ve Out |
| Demand_2 -ve (Agnd) | 7 | | 8 | Demand_2 -ve (Agnd) |
| Not connected | 9 | | 10 | Not connected |

## 7.4 Earth Stud

This connection should be taken to a low impedance star earth point within the system.

# 8. Keypad and Display Option

The keypad and operator terminal provide a general purpose operator terminal suitable for stand alone machines of all types. The operator terminal is cost effective for simple functions, such as replacing thumb wheel switches and providing simple diagnostics, or may be used as a fully interactive programming panel for special purpose machine control.

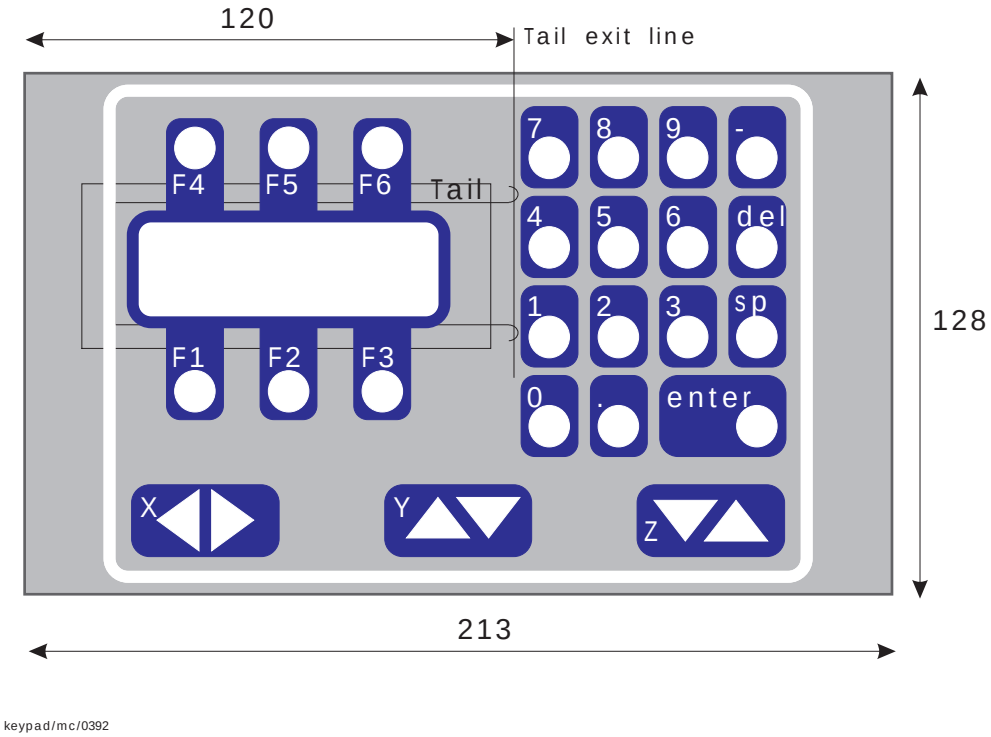



Figure 7.1: Operator Panel Layout

The keypad interface board allows Hitachi LCD displays or compatible units to be driven from the EuroSystem controller directly. The board also provides connection for up to 64 keys arranged on an 8 by 8 matrix using normally open switches. MINT allows users to define the value of each key in the matrix using a keyword KEYS, which means that the physical order of connection is not important.

Alphanumeric LCD displays of up to 40 characters by 2 lines or 20 by 4 lines may be used. Connection is made via a 34 way IDC ribbon cable between the interface board and a daughter board mounted on the panel. The Keypad and Display draws 150mA.

A piezoelectric buzzer is attached to the display panel. A short beep (using the BEEP keyword) can be used to acknowledge a key press, whilst a series of beeps can be used to attract operator attention. The high pitch of the buzzer makes it audible over general industrial noise from machinery.

MINT software supports the keypad and display as if it were a standard serial terminal. MINT statements PRINT, INPUT, CLS, LOCATE etc. can be used with the display, BEEP activates the buzzer. Key presses cause characters to be placed in the serial port buffer so that they can be read as normal by INKEY and INPUT. The READKEY function returns the value of the key that is currently pressed. This is an enhancement not normally available on serial terminals, very useful for jogging motors when the operator holds his finger on a key. The following keywords are supported:

| Keyword | Description |
|---|---|
| BEEP | Sound the buzzer |
| BINARY | Print a binary number |
| BOL | Send cursor to beginning of line |
| CLS | Clear screen |
| INKEY | Read a key from the serial port buffer |
| INPUT | BASIC formatted input |
| KEYS | Define layout of keyboard |
| LOCATE | Locate cursor at column, row |
| PRINT | BASIC formatted print |
| READKEY | Read value of key currently pressed |
| TERM | Direct output to LCD or serial port |

A general purpose operator panel is available, suitable for many machine control applications. The panel is available as a kit of parts, comprising of adhesive matrix board and display, so that it can be mounted on the front of a machine control panel with a cut-out for the display. The matrix panel is designed so that the connecting tail exits from the middle of the board, through the side of the display cut-out. Therefore when stuck in place, the operator panel is sealed to IP65.

A fully assembled panel is also available, comprising the display and matrix board mounted on an aluminium panel. The assembled operator panel occupies half a standard 19" 3U high eurocard rack.

The keypad interface makes it easy to build your own operator panel, using push buttons and a display, which is exactly suited to your application. For a really professional finish, it may be preferable to commission a custom keypad, but this is expensive. An alternative is to custom print the front of our standard keypad, which we can arrange for quantities of 25 off, which gives savings on tooling.

The operator panel incorporates six function keys placed above and below the display, so that the function of each key can be indicated by printing a legend on the top and bottom lines of the display. This allows menu driven operator interfaces to be written readily, with the function of each function key changing depending on the menu. The middle two lines are used for messages or operator prompts.

# 8.1 Specification

## 8.1.1 Keypad and Display Interface Board

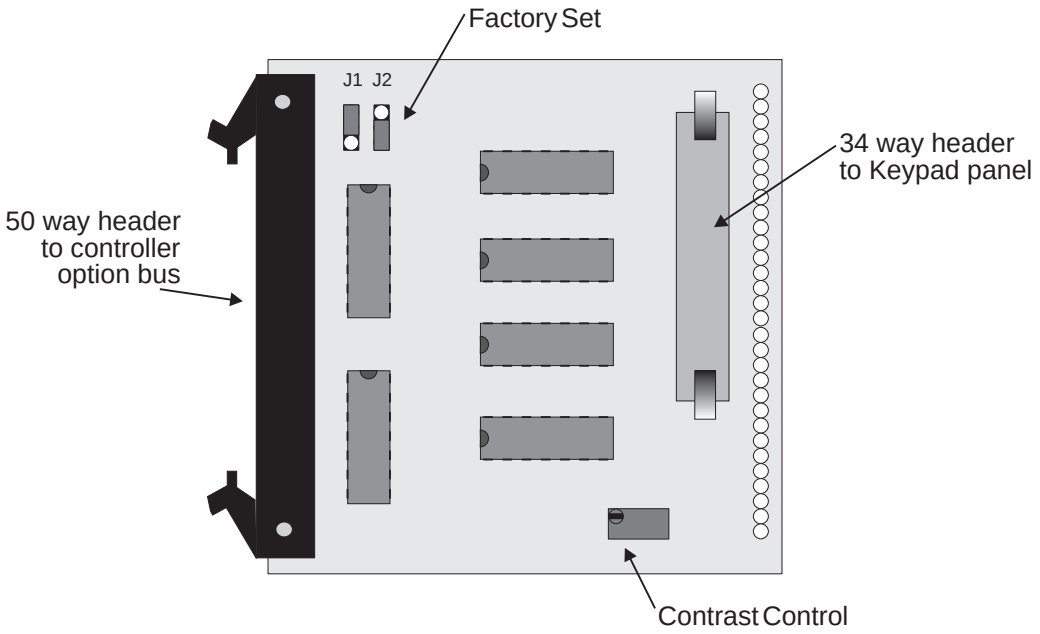



Figure 7.2: Keypad and Display Interface Board

- Maximum cable run between interface board and operator panel 5M
- Display types: Hitachi or compatible alphanumeric LCD modules.
- Keypad interface: 64 keys maximum on 8x8 matrix. Operating voltage 5V, keys should be normally open types, 200mOhm maximum contact resistance.
- Piezoelectric Buzzer: 6.5 KHz, 80 Db @ 10cm mounted on the back of the display

### Operator Panel:

- Overall dimemsions: 128 x 213mm. Occupies half a standard 19" 3U high eurocard rack.
- 27 keys: X, Y, Z cursor keys, numeric keypad and 6 user definable function keys.
- Self adhesive backing providing protection against ingress of fluid and dust to IP65.
- 20 character by four line green backlit LCD display. Character height: 4.75mm. Viewing area: 76.0 x 25.5mm

# 8.2 Interface Connection Details

## 8.2.1 Connecting to EuroSystem

The keypad and display interface board is connected to EuroSystem on the option bus via a 50 way IDC connector. Ensure that pin 1 of EuroSystem to connected to pin 1 of the keypad and display interface board.

## 8.2.2 Connecting to the Panel

The keypad interface is connected to the panel via a 34 way IDC cable. The maximum permissible length of the cable is 5m.

The 34 way pin out is given below:

| | | | | | | |
|---|---|---|---|---|---|---|
| Keyboard Input 7 | KIN7 | *1* | | *2* | GND | Ground |
| Keyboard Input 6 | KIN6 | *3* | | *4* | Vcc | +5v |
| Keyboard Input 5 | KIN5 | *5* | | *6* | VO | Contrast Voltage |
| Keyboard Input 4 | KIN4 | *7* | | *8* | RS | Regiser Select |
| Keyboard Input 3 | KIN3 | *9* | | *10* | GND | Ground (R/W) |
| Keyboard Input 2 | KIN2 | *11* | | *12* | E1 | Timing signal |
| Keyboard Input 1 | KIN1 | *13* | | *14* | SOUT0 | Display Data bit 0 |
| Keyboard Input 0 | KIN0 | *15* | | *16* | SOUT1 | Display Data bit 1 |
| Keyboard Output 0 | KOUT0 | *17* | | *18* | SOUT2 | Display Data bit 2 |
| Keyboard Output 1 | KOUT1 | *19* | | *20* | SOUT3 | Display Data bit 3 |
| Keyboard Output 2 | KOUT2 | *21* | | *22* | SOUT4 | Display Data bit 4 |
| Keyboard Output 3 | KOUT3 | *23* | | *24* | SOUT5 | Display Data bit 5 |
| Keyboard Output 4 | KOUT4 | *25* | | *26* | SOUT6 | Display Data bit 6 |
| Keyboard Output 5 | KOUT5 | *27* | | *28* | SOUT7 | Display Data bit 7 |
| Keyboard Output 6 | KOUT6 | *29* | | *30* | Vcc | +5V |
| Keyboard Output 7 | KOUT7 | *31* | | *32* | RED | Positive Buzzer con. |
| Negative Buzzer con. | BLACK | *33* | | *34* | BLUE | Buzzer Feedback |

Alternatively, the connections are brought out onto a 41612 Type B DIN connector for use with custom backplanes etc. The connector supports the buzzer, the LCD display and an 8 row by 6 column keypad. The connector has the following pin out:

### Signal Descriptions:

| Signal | Description |
|---|---|
| *Keyboard Inputs (Rows)* | The controller reads these lines to determine if any of the switches on the current column are closed. |
| *Keyboard Outputs (Columns)* | These lines are pulled low one at a time. |
| *Display Data Bus* | These signals pass data to the display device |
| *RS* | This signal differentiates between the data and control registers in the display device. |
| *GND(R/W)* | This is the display read/write signal, it is held permanently at 0V (write). |
| *E1* | This signal is the timing signal for data transfer. |
| *VO* | This voltage controls the contrast of the display and can be adjusted over the range -12V to +5V. |
| *Buzzer connections* | These signals connect to a self resonating Pizo sounder unit. The drive for this is built in to the controller. |

# I



# K



# L



# M



# N



# O



# P



# R



# S

# T



# U