RS
Data Sheet

Programmable stepper motor control board (2 axis)

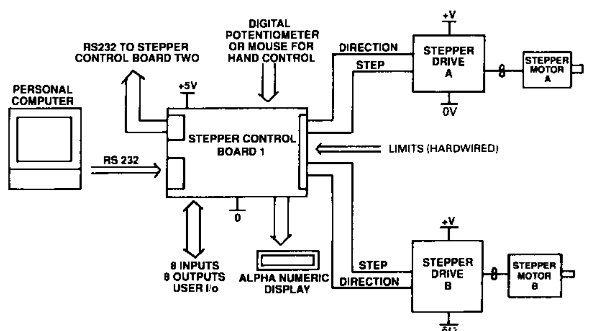
Control board RS stock no. 440-098
Control software RS stock no. 440-105

General (RS stock no. 440-098)

This board is designed to control one or two stepper motors via stepper motor drive boards. The board is programmed from an RS-232 serial link with a suitable programming device which can produce ASCII characters ie a personal computer, Psion Organiser II etc... If communication with additional control boards is required then the extra control board can be 'daisy chained' using the slave RS-232 channel. Both axis of control can be moved at the same time allowing linear and circular interpolation. Other features like alphanumeric display driver and hand control of the stepper motor via a mouse or digital potentiometer are also available on board.

The board is supplied with 20k of user RAM; this can be upgraded to non-volatile RAM if stand alone operation is required. If user I/O is required standard opto isolators can be fitted for the number of I/O to be utilised. These can be used for control functions such as hand shaking with a PLC, activating a relay or reading sensors.

Figure 1 **Typical system block diagram**



Specification

Axis	2 axis both can be moved at the same time and completely independent of each other.
Board supply	5V regulated dc at <1A.
Velocity	0.002 steps per second to 250,000 steps per second ie $^1/_6$ rev per second upwards
Position range	1 in 2,000,000,000.
Period of acc/dec	acc/dec has to occur within 4 sec.
User inputs voltage	5-15Vdc
User output current	Dependent on the opto couplers utilised.
Limit voltage/current	5-15V of 2mA.
Usable ambient temp range	0 to +40°C.
Acceleration range	0.5 steps/sec^2 to 250M steps/sec^2

RS-232

Three wire Xon, Xoff with software hand shake 1200-19200 baud (7 or 8 data bits, 1 or 2 stop bits, odd, even or no parity).

Memory size (RAM) user space 20k.

User upgradeable parts

Non-volatile memory (RS stock no. 659-781)

This is only required if the control board is likely to lose power at any time therefore suffering loss of its program. **RS** stock no. 659-781 provides 32k × 8 bits of memory usually adequate for most programs except the very longest. To insert the non-vol. memory remove the existing RAM chip with the power down and insert the new chip, making sure it is correctly orientated.

User I/O opto couplers

Darlington output opto coupler (RS stock no. 590-430.)

This should be inserted in the relevant chip sockets as indicated on the board layout, in the correct orientation. When these devices are inserted the relevant outputs can then be programmed for driving other equipment in the system. The typical output current is 10-20mA depending on the voltage used, ie 5-15V.

RS-232 daisy chain expansion

(RS stock no. 655-290)

This device should be fitted if a second card is required in the system (ie. 3rd and 4th axis). The RS-232 driver/receiver should be inserted in the RS-232 socket; see board layout for location.

Connecting additional axis

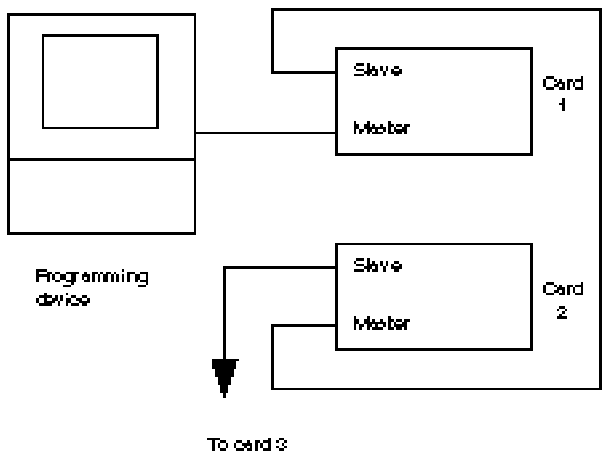


Figure 2 **Din 41612 64 way connector pin out**

		b	a	
	Supply 5V	1	1	5V supply
LCD Driver	N/C	2	2	N/C
	N/C	3	3	N/C
	LCD bit 4	4	4	LCD bit 5
	LCD bit 6	5	5	LCD bit 7
	LCD register select	6	6	LCD read/write
	LCD enable	7	7	N/C
Morse inputs	A phase for X axis	8	8	B phase for X axis
	A phase for Y axis	9	9	B phase for Y axis
Limit inputs	Negative Y axis limit (–)	10	10	Negative Y axis limit (+)
	Positive Y axis limit (–)	11	11	Positive Y axis limit (+)
	Negative X axis limit (–)	12	12	Negative X axis limit (+)
	Positive X axis limit (–)	13	13	Positive X axis limit (+)
Stepper drive output	X axis direction	14	14	Y axis direction
	X axis clock pulse	15	15	Y axis clock pulse
8 outputs	Output zero (–)	16	16	output zero (+)
	Output 1 (–)	17	17	output 1 (+)
	Output 2 (–)	18	18	output 2 (+)
	Output 3 (–)	19	19	output 3 (+)
	Output 4 (–)	20	20	output 4 (+)
	Output 5 (–)	21	21	output 5 (+)
	Output 6 (–)	22	22	output 6 (+)
	Output 7 (–)	23	23	output 7 (+)
8 inputs	Input zero (–)	24	24	Input zero (+)
	Input 1 (–)	25	25	Input 1 (+)
	Input 2 (–)	26	26	Input 2 (+)
	Input 3 (–)	27	27	Input 3 (+)
	Input 4 (–)	28	28	Input 4 (+)
	Input 5 (–)	29	29	Input 5 (+)
	Input 6 (–)	30	30	Input 6 (+)
	Input 7 (–)	31	31	Input 7 (+)
	Supply 0V	32	32	0V supply

Figure 3 **Wiring diagram**

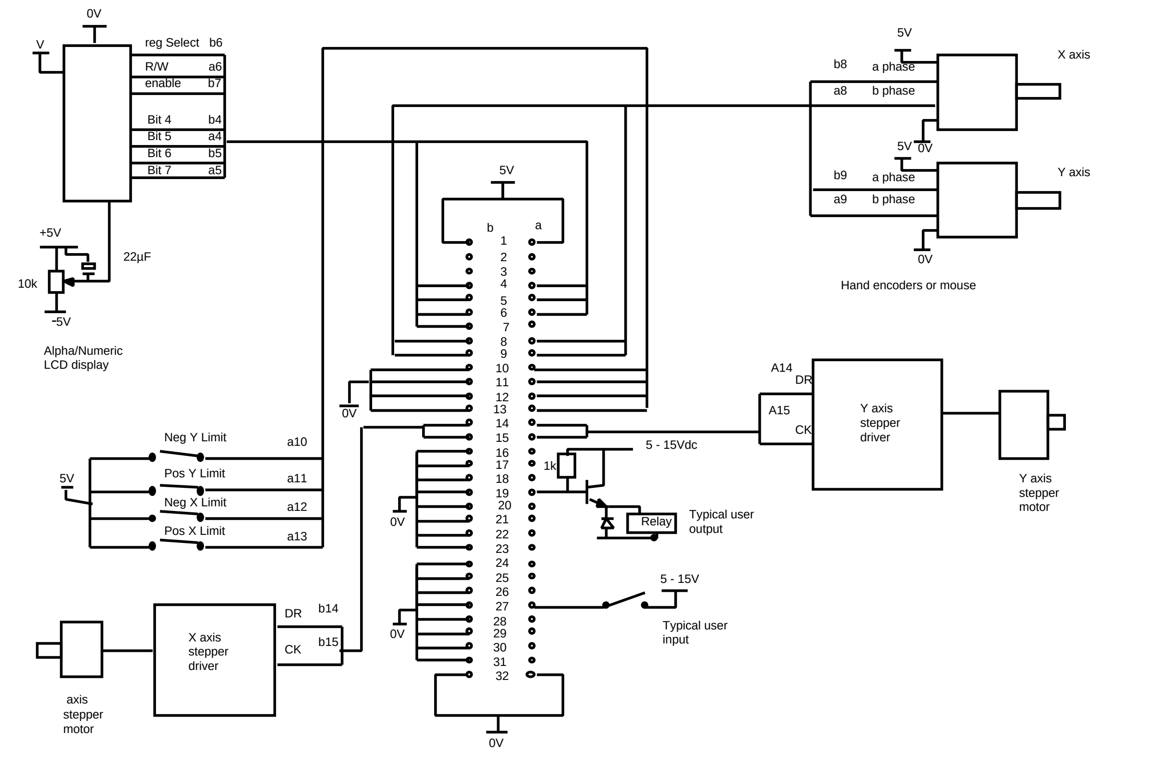
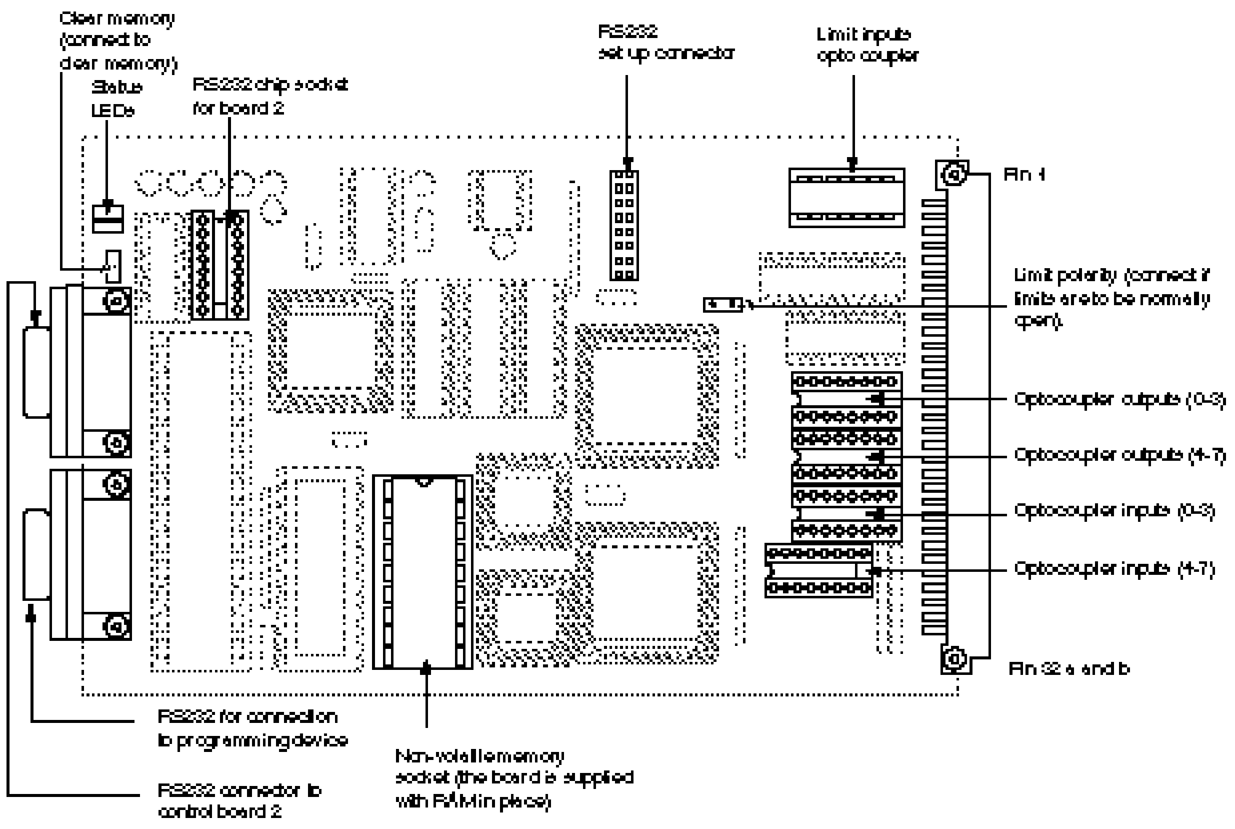


Figure 4 **Board layout**


Clear memory (connect to clear memory)
Status LEDs
RS232 chip socket for board 2
RS232 set up connector
Limit inputs opto coupler
Pin 1
Limit polarity (connect if limits are to be normally open)
Optocoupler outputs (0-3)
Optocoupler outputs (4-7)
Optocoupler inputs (0-3)
Optocoupler inputs (4-7)
Pin 32 a and b
RS232 for connection to programming device
Non-volatile memory socket (the board is supplied with RAM in place)
RS232 connector to control board 2

Installation recommendations

The board can be mounted in two ways:

1. Incorporated within a standard eurocard format racking system along with suitable stepper drivers.

Basic racking (**RS** stock no. 500-392) kM6-II Subrack System.

2. Surface mounting using the two holes provided on the PCB and the two holes accessible when the connector nuts and bolts are removed. Plastic spacers should be used to prevent metal screws or washers shorting tracks on the PCB.

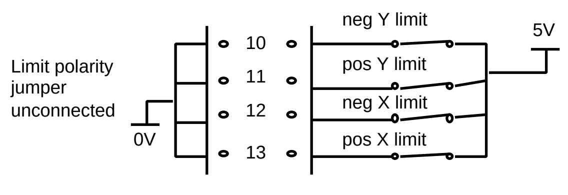
Wiring precautions

- ● Do not make or break any electrical connectors to the control board while there is power applied to it.
- ● Low voltage signal cables should be kept away from any high voltage cables, ie. in separate trunking or conduit.

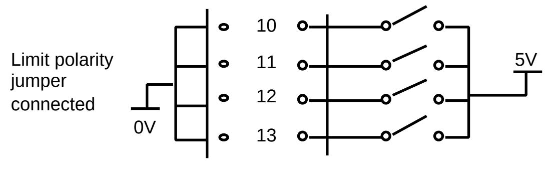
  Note: in particular keep well away from the leads of the stepper motors.
- ● Shield all signal cables against noise and interference, one end of all the cable shielding should be connected to one suitable earth point to the control board end. The remote end should be left unconnected thus ensuring there are no circulating earth loop currents within the wiring system.

Limit inputs

Positive and negative travel limits are provided for each stepper motor. When the board is supplied these are set up so they must be active for the stepper motors to move (ie. as the wiring diagram). If the limit polarity is required to be changed, connect the limit polarity jumper. Once the jumper is connected then the limit inputs have to be non-active for the stepper motors to move.



Limit inputs have to be active for motors to move



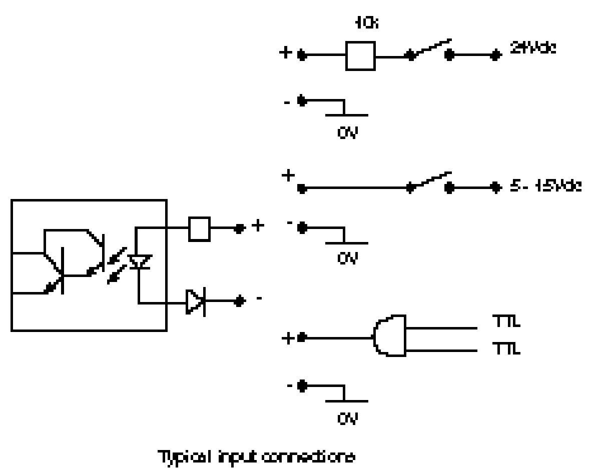
Limit inputs have to be inactive for motors to move

User input and output facilities

Axis limits – These are for connection to the directional limit switches and are not programmable (ie. hardwired). The board is supplied with the limits set for normally closed operation, if the application does not require the limits (or normally open operation is desirable) the limit polarity connector should be connected (see board layout for locations. In the normally closedmode all the limits should be closed for the stepper motor to move. If a limit is opened during operation the relevant stepper motor will stop immediately.

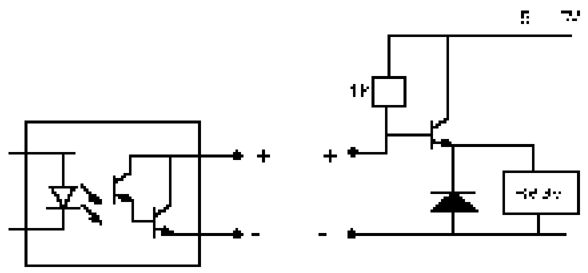
8 user inputs – For the user to programme and use as the application requires.

Figure 5 **Typical input connections**



8 user outputs – For the user to programme as the application requires sending signals to other equipment within the system.

Typical output connection (output current dependent on opto coupler used).



L.C.D. alpha/numeric display driver

This is provided so process messages can be built into the program. The messages may be both alpha and numeric in construction. Possible applications may be giving the operator general prompts such as start, stop, etc . . . for connections see the wiring diagram.

Hand encoder (digital pot) or mouse input

This facility is provided so the stepper motors may be moved manually from the signals of the input device, ie. if the system was set up so the hand encoder was turned one way or the other the stepper motor would step forward or backwards. A typical use would be to move the motors to a suitable position prior to the main program being run.

Note: Only Quadrature output devices such as hand-encoders 164-2633 are suitable for connecting to these inputs. The motion obtained from any such device will be slow, due to the cycle time of the interrupt generated.

Other hardware features

Status LEDs.

The green LED will be on all the time the board is running a program.

If an error occurs on the board the red and green LEDs will flash in different ways to indicate different errors.

Status table

Red LED	Green LED	Status
off	on	executed program
off	flashing	program is being entered
flashing	flashing	program entered has a syntax error
on	off	an error has been detected during execution

Clear memory (user abort)

1. During switch on:

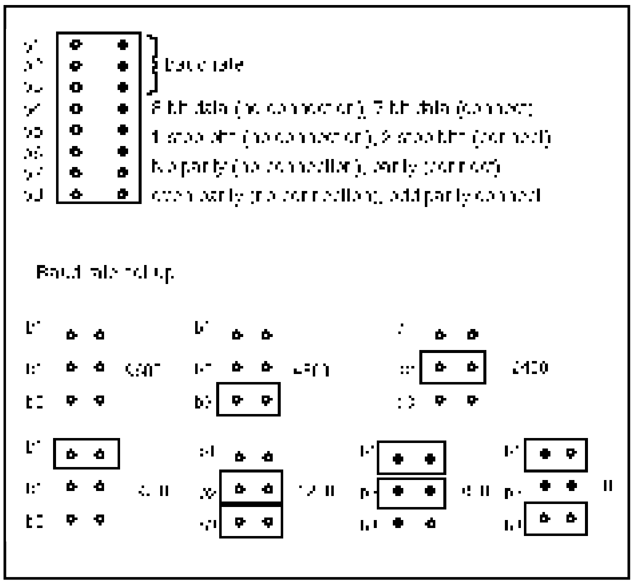
   If the clear memory jumper is connected and the power switched on to the control board the user memory stored in the non-volatile memory will be cleared.

2. During program execution:

   If the clear memory jumper is connected when a program is running it will have the effect of stopping the program execution with no loss of memory. This could be used if the control board enters an endless loop and cannot be accessed via software means.

RS-232 set up connector

The board is supplied set up for 9600 baud rate, 8 data bits, 1 stop bit, no parity and Xon/Xoff.


baud rate
8 bit data (no connection), 7 bit data (connect)
1 stop bit (no connection), 2 stop bits (connect)
No parity (no connection), parity (connect)
even parity (no connection), odd parity connect
Baud rate set up
2400

Connecting the control board to a programming device

The control board requires connection with the programming device via a null modem cable.

The pin out is as follows:

9 way to 9 way 'D' connector

pc function		control board function
DI (data in)	2–3	(DO) data out
(DO) data out	3–2	(DI) data in
(DTR) data terminal ready	4–6	(DSR) data set ready
	1	(DCD) carrier detect
(SG) signal ground	5–5	(SG)
(DSR) data set ready	6–4	(DTR) data terminal ready
(DCD) carrier detect	1	
(RTS) request to send	7–8	(CTS) request to send
(CTS) clear to send	8–7	(RTS) request to send

25 way to 9 way 'D' connector

pc function		control board function
(DO) data out	2–2	(DI) data in
(DI) data in	3–3	(DO) data out
(RTS) request to send	4–8	(CTS) clear to send
(CTS) clear to send	5–7	(RTS) request to send
(DSR) data set ready	6–4	(DTR) data terminal ready
(DCD) carrier detect	8	
(SG) signal ground	7–5	(SG) signal ground
(DTR) data terminal ready	20–6	(DSR) data set ready
	1	(DCD) carrier detect

Stepper motor control language provided on the control board

The command software provided on the control board has the following commands:

ARC – Circular interpolation.
CMOVE – Constant move of steppers.
CVEL – Setting constant velocity.
DATUM – Setting datum.
HALT – Stop the movement with deceleration.
IN – Looks at user inputs.
LCD – Send expression to LCD.
LIMIT – Status of limit inputs.
MOVE – Move the stepper motors.
MEMFREE – Free memory.
NEW – Clear memory.
OUT – Set user output.
PARM – Set parameters of the motors.
TIME – Time since prog. run.
WAIT – Wait 'n' milliseconds.
WHERE – Returns the position of the motors.
+ others allowing a very flexible usable command structure.

Control software (RS stock no. 440-105)

This is a very simple programming option which can be loaded into a personal computer so the control board can be addressed.

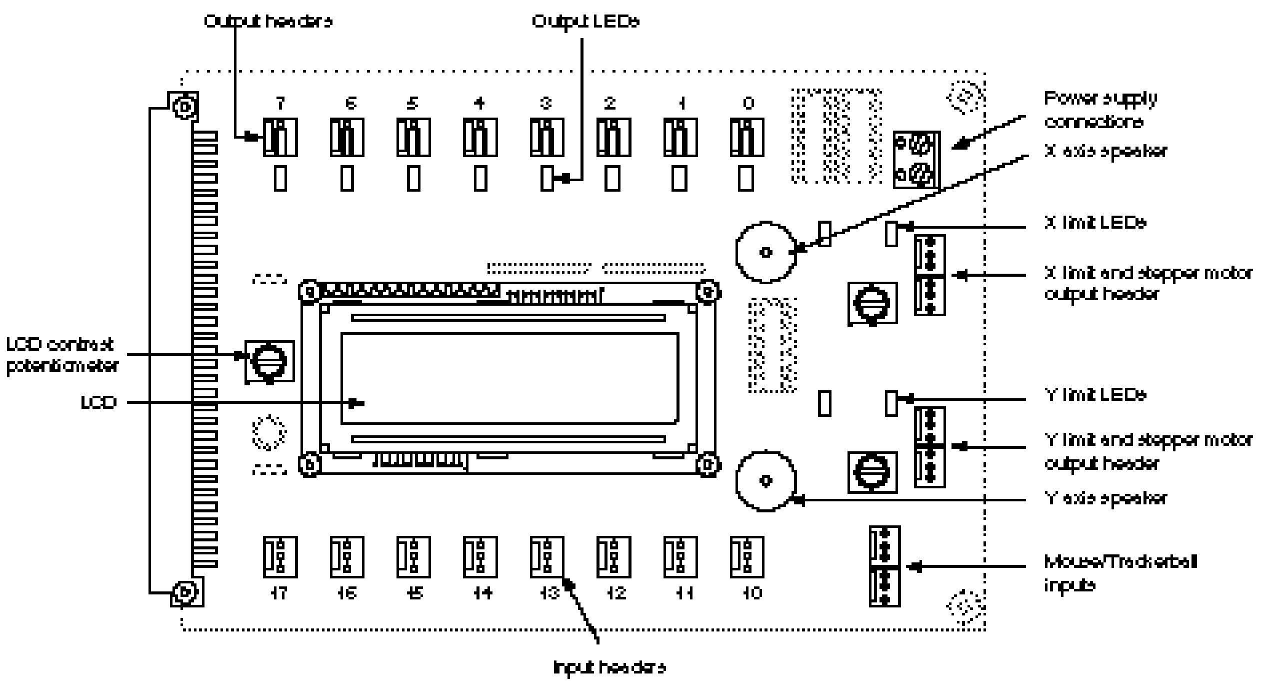
If long complex programs are envisaged, a standard text editor could be utilised, so long as the program can be passed down the RS-232 link.

Test and program development test board

(RS stock no. 718-824)

This board is designed to connect directly to the control board via the DIN 41612 64 way connector. With the test board connected all the outputs and inputs can be simulated to give a convenient method of testing faults and development of programs. User outputs are simulated on LEDs, inputs and limits via 3 pin headers and stepper motors are simulated by PCB mounted speakers which sound with the frequency of the stepper motor pulses.

Figure 6 **Board layout**



Enhanced software Eprom

(RS stock no. 718-830)

This has been developed to enhance the software functions which can be utilised while using the control board (**RS** stock no. 440-098). To install the chip remove the existing Eprom using a suitable chip remover and install the Eprom in the same orientation.

Once this enhance software has been installed there are various new commands which can be used, these are listed below. Due to the new functions some of the existing commands work in slightly different ways, the new key words are listed below:

New key words are:

- [ ]
- dim
- Eprom
- fprint
- fscan
- read

The new built-in functions are:

- Lcd-cmd ( )
- Lcd-stat ( )
- Lcd-read ( )
- Lcd-write ( )
- peak ( )
- poke ( )
- separated ( )
- sqrt ( )

These allow greater flexibility to the user particularly for the applications where the axis are to be used separately, and for using arrays and programming a Eprom with the user's program.