TRM

Guillotine Control System

Installation Guide

Table of Contents

Health and Safety

 Warning! Dangerous voltages are present when mains supply is connected.

 Warning! Even when the motor is stopped there are dangerous voltages present at Power Circuit terminals.

1. The user should ensure that safe working practices are adhered to and that correct Personal Protective Equipment (PPE) is used at all times relevant to the nature of work undertaken and the type of machinery being operated.

2. Before powering up or using PROCUT, the user should ensure that the machine being operated is clean, debris free and is being operated in a safe manner as required by the Laws, Rules, Regulations and Best Working Practices in force for the Country in which the equipment is being operated and that all safety devices are in undamaged and correct operating order.

3. This software (PROCUT) should not be used by personnel that have not been trained in the use of such software or the machinery it is used on.

4. TRM cannot be held liable for the miss-operation or incorrect programming of the system be it operating program or setup parameters.

5. Training and operation of machinery is solely the user's/owners responsibility and appropriate Risk Assessment records should be kept at all times.

System Overview

The guillotine backgauge control system normally includes all the electrical and mechanical parts needed for the installation and operation of the guillotine machine backgauge. In some circumstances it may be necessary for the installer to modify the supplied components or manufacture new parts to suit the machine.

The installation is divided in 2 main parts:

Mechanical Installation:
- Servomotor and pulleys
- Electrical cabinet
- Motion controller
- Sensors (Home, Clamp, Knife, False Plate)
- Start/Stop unit
- Wiring the air cushion
- Motor connection
- Mains connection

Programming:
- Motion Control Parameters
- Speed Setup
- Options Setup
- Stability Test
- Test Run

<p style="color:red; text-align:center">IMPORTANT!</p>

All supplied cables are 4 meters long, it is possible that the cable will be longer than the distance between components, if this happens **<u>DO NOT CUT THE CABLE</u>**, simply roll up the cable until it is the desired length and clip together.

Cables can be ordered at different lengths if required.

Be sure the cables do not obstruct any movement and are safely placed tight against the machine, this will prevent any future problems.

Do not coil the MOTOR wires or MAINS wires with encoder signal wires, keep them separate.

Mechanical Installation

Component Location & Overview
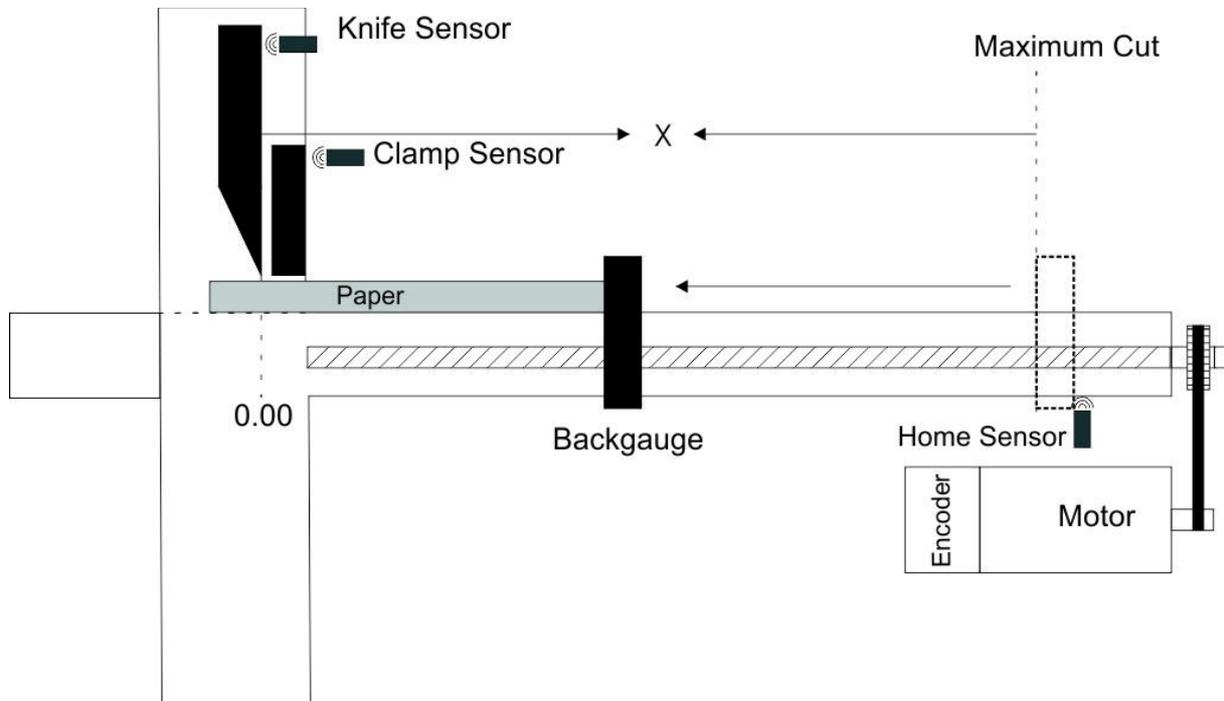
Note:

The False Clamp sensor is intended to detect the false clamp when not in use. Therefore the sensor is located where the False Clamp is stored. Not all machines have a False Clamp.

The Encoder can be placed in different parts of the machine however when using a servomotor it would normally be mounted on the servo motor. When using an AC motor it may have to be driven from the leadscrew however the installer should minimise any backlash in the system.

Installation of Servomotor and Pulleys

There are many different ways of installing a replacement motor depending on the bed of the machine. We supply a flat plate mount normally or as an alternate a 90' mounting plate is available.

As we can see below the servo motor is located parallel to the lead screw and both pulleys are aligned. If the belt drops off the pulley then alignment should be checked and adjusted as needed.
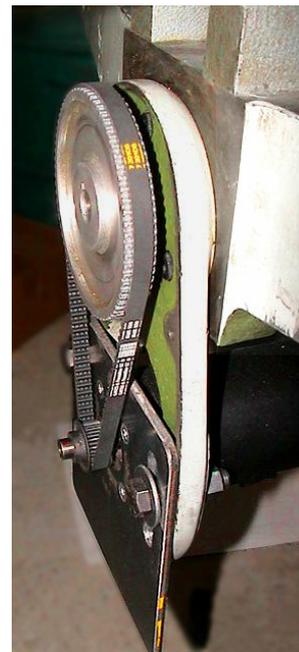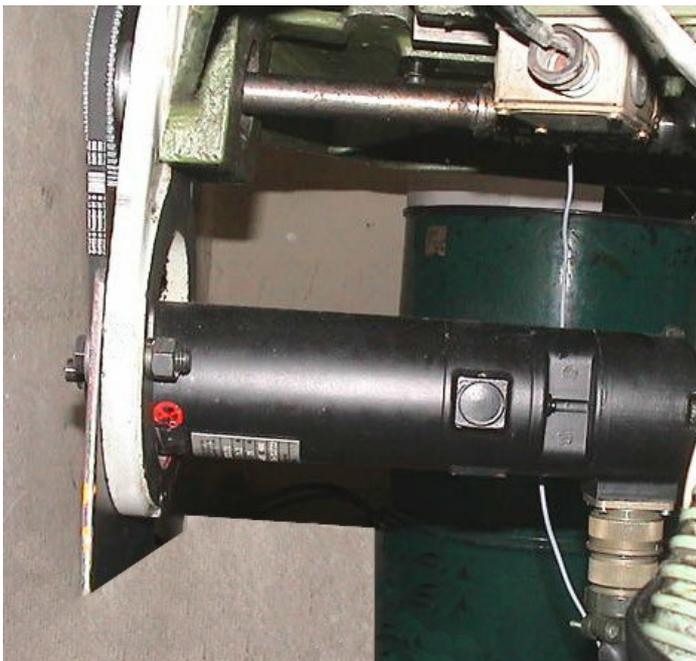
1. In order to provide a clear space to mount the new motor and pulleys, remove the old motor and pulleys.

2. The Motor is usually shipped with the pulley fitted, the installer then needs to fit the larger pulley to the machine, these can be bored and broached at the time of order. The pulley needs to be fitted to the leadscrew first as it will be needed in the next step.

3. Decide where best to mount the motor bracket and remember that a timing belt is going to be installed so the distance needs to suit the belt. On some machines it could be necessary for the installer to change the toothed belt or use an extra bracket to ensure the alignment and centres are correct.

4. Mount the bracket to the machine so that the tension in the belt and alignment between both pulleys can be adjusted.

5. Mount the Motor to the Bracket and ensure cables are clear of any moving parts.

6. Install and tension the Belt.

7. Rotate the leadscrew by hand at least 10 turns in both directions to check alignment and belt runout.

8. **Remove the belt to aid further commissioning.**

Installation of the Electrical Cabinet

The electrical cabinet is normally located at the back of the machine in a convenient location between the motion controller and the servomotor. Please be aware that the length of the cables is enough to connect the encoder, Start/Stop switches, Sensors and D-type connectors, these are normally supplied at 4 meters long however on particularly large machines the cables can be supplied longer if needed.

The electrical cabinet is supplied with mounting brackets to ease the installation, please ensure it is securely mounted and free from vibration.

Installation of the Motion Controller

The motion controller is normally installed into the front of the machine and is intended to be easily accessed by the operator. A hole should be cut according to the supplied drawing and the controller inserted. Use the brackets provided to secure the controller in place. The Nylon bolts supplied should be tightened against the backside of the plate the controller is mounted in.

Alternatively the controller can be mounted by using the TRM POD system. The POD and Mechanical arm are ordered as an optional extra, please see our website for further details. These allow the controller to be mounted to the side or in front as needed.

Once the controller and the electrical cabinet are in position you can route and connect the 44 and 37 way cables to the controller.

Installation of Sensors

The sensors provided are capable of detecting steel upto 4mm away however it is usually good practice to install within 2-3mm of the object to ensure good accuracy. It should also be positioned so that the face being detected has a 90º edge to it rather than rounded or sloping as these will give variable results and mis-measurement will occur.

1. Home Sensor
   The home sensor is used to detect the travel limit of the backgauge. Every time the Controller is turned ON and a program is executed the controller will search for the home sensor, once detected and with the machine sizes correctly set, the controller will know the exact position of the backgauge and proceed with the program created by the user.

   The Home Sensor should be plugged in to the Home Sensor connector on the electrical cabinet. The Home sensor itself must be placed under the table using the sensor brackets, please note that depending on the distance between the sensor and the knife the maximum cut will vary. The maximum cut is not from the

knife to the home sensor, it is from the knife to the front of the backgauge when the sensor is detecting the backgauge.

IMPORTANT! - To avoid damage to the sensor and machine, NEVER INSTALL THE SENSOR TOWARDS THE ONCOMING BACKGAUGE. The object should be able to pass across the face of the sensor without damage.

When the sensor is powered up it can detect up to a distance of 4 mm on steel and will light when detecting the backgauge. Move the backgauge forwards and backwards to ensure the light turns on and off and to check clearance and sensing distance.

2. Knife Sensor
   The Knife Sensor should be plugged in to the Knife Sensor connector on the electrical cabinet.

   The Knife Sensor is intended to sense the knife when it is in rest position, which is when the knife is up. Find a suitable position for the sensor bracket on the back side of the machine so that when the knife moves down and up the sensor will detect the movement. Please be sure the sensor is close enough to the knife so it will detect it and will light when detecting the knife.

3. Clamp Sensor
   The Clamp Sensor should be plugged in to the Clamp Sensor connector on the electrical cabinet.

   The Clamp Sensor is intended to sense the clamp when it is in rest position, which it is when the clamp is up. The clamp sensor is normally located close to the knife sensor and same recommendations for the installation apply.

4. False Clamp (shoe) Sensor
   The sensor will be placed where the false clamp is stored when not in use. If the sensor does not detect the False Clamp, the software assumes it IS in use and the controller will use the minimum cut setting "Min Cut (clamp shoe)" as the minimum cut. If the sensor does detect the False Clamp the controller will assume it is NOT in use and will use the minimum cut setting "Min Cut (no shoe)". The minimum cut settings are in the "Calibration Menu" explained in the second part of this manual.

Installation of the START and STOP Buttons

The Start and Stop buttons can be mounted into the front of the machine for easy access or into the POD if supplied. The Green Start button uses a N/O (normally open) contact block with Red/Blue wires and the Black Stop button uses a N/C (normally closed) contact block with Yellow/Green wires. These are normally supplied pre-wired and the contact blocks just need to be clipped onto the rear of the buttons once they are fastened in place.

AUX CONNECTOR WIRING

Clamp enable relay

Foot Pedal IN 0V ⸺⟋⸺ Foot Pedal IN 0V
Foot Pedal IN +V ⸺⟋⸺ Foot Pedal IN +V
Output 11 (PURPLE or ORANGE) ⸺▭⸺ GND (BLACK)
24 v 16 AMP

Cut enable safety relay

CUT BUTTON RIGHT ⸺⟋⸺ CUT BUTTON LO RIGHT
CUT BUTTON LEFT ⸺⟋⸺ CUT BUTTON HI LEFT
Output 10 (WHITE) ⸺▭⸺ GND (BLACK)
24 v 16 AMP

Air enable relay

Air table IN 0V ⸺⟋⸺ Air table IN 0V
Air table IN +V ⸺⟋⸺ Air table IN +V
Output 9 (BROWN) ⸺▭⸺ GND (BLACK)
24 v 16 AMP
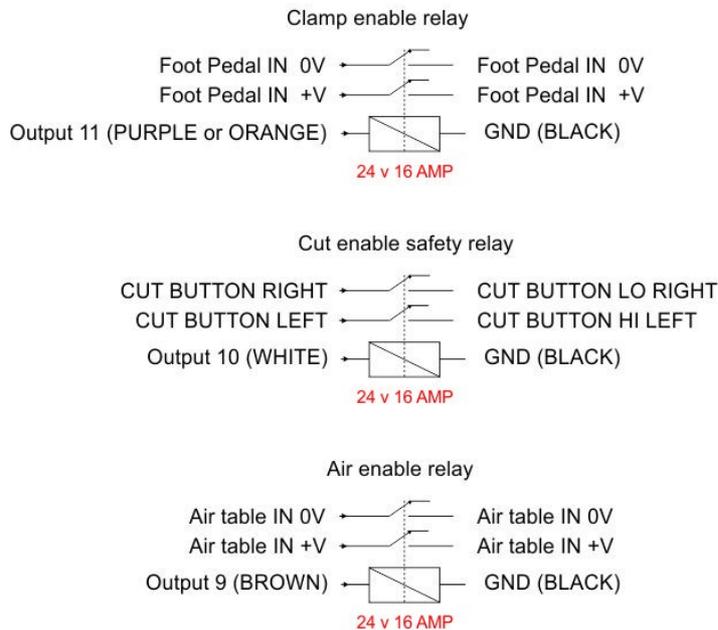
Wire Colour	Description
Yellow	Emergency Stop
Green	Emergency Stop
Black	0 Volts
Red	+24 Volts DC
Purple or Orange	Clamp Enable
White	Ready to Cut
Brown	Air Enable

Wiring the air table connection

PROCUT has a parameter column in the Edit/Create screen called 'AIR' and the user can select 2 options for this parameter 'YES' or 'NO'. If the parameter is set to 'YES' it means that the 'Air Table enable' signal will be active when the backgauge is moving to that position. This enable signal will be inactive when the backgauge has stopped and the machine is ready to cut. If the AIR parameter is set to 'NO' the enable signal will always be inactive.

In some cases is not necessary to wire up this connection as the machine already turns the air ON or OFF without using the 'Air Table Enable' signal.

For wiring up the air table please look at the diagram "Air Enable Relay" shown above.

Cut Enable and Hold Down enable

PROCUT has 2 outputs to enable a Cut and to enable the Hold Down (clamp). This is optional and requires the user to install the connections as in the previous diagram. This should be installed in series with the operator buttons.

Please note that this is not intended as a safety circuit or to override the operator buttons, more to ensure the knife and clamp are not active when the backgauge is moving. The safety circuits of the machine should not be tampered with and should still be effective in preventing accidents as originally intended.

Motor Connection

As we supply different motors depending on price and power there are a number of different connector options. Normally the pre-wired motor connector should be plugged into the motor connector on the electrical cabinet and locked in place with the integral locking ring. This connector is polarised to the connection can only be made one way. In the case of the AC Servo system the in-line plugs should be connected and the encoder connected to the cabinet.

Handwheel

It is important to ensure that the original handwheel is not a danger to the operator when powered. This should be assessed and changed to a safer handwheel if necessary.

Installing the Electronic Jog Wheel

The Jog wheel is an optional feature and it is intended to replace the hand wheel. When installed, it allows the user to make fine accurate adjustments of the backgauge which can then be stored in the program.

The Jog Wheel provided by TRM is to be plugged to the Jog Wheel connector on the electrical cabinet.

Mains Connection

The system can be connected to 120 AC or to 230 AC mains at either 50 or 60Hz, however internal modification has to be made to change the power supply. To avoid damage the system will be shipped set to 230V unless otherwise requested. Please verify what voltage is to be used before connecting it to the mains supply.

Mains connections are noisy signals and could affect the motion control signals, in order to avoid this, ensure the mains cable is routed away from the control cables.

Please contact us for information on how to change voltages.

Please note that in all cases the Earth pin must be connected otherwise damage to the system may occur.

Data Installation

Quick Start

Once the mechanical installation is finished you are ready to start the software setup. The values setup here are different from machine to machine though some values are common.

Please remember that the data entered in the technical menu has to be as accurate as possible in order to have an accurate cut and to avoid over-shooting axis limits.

Normally the controller will be shipped from the factory with default values set and fully tested. If the backup battery has become flat over time (>6 months) then it may be necessary to clear all data and programming to ensure the memory is clean and only holds good data.

From the Welcome Menu shown above select 'Technical Menu' (F5 key) and enter the master password.
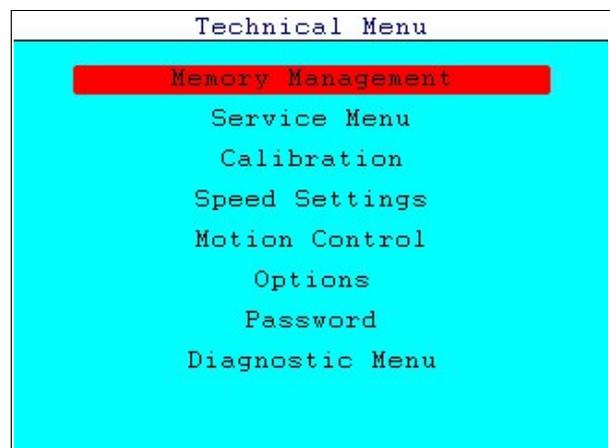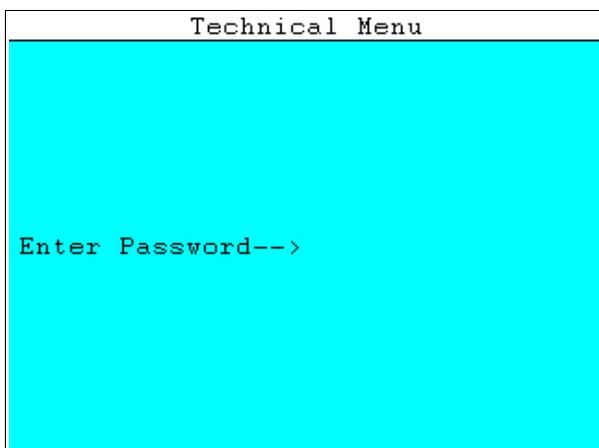
Defaults

To clear the controller and setup as new, from the 'Service Menu' select 'Factory Defaults' and enter the master password. Please note if your system has been shipped with a specific motor and encoder combination this option should not be used unless the correct settings have been obtained. The Factory defaults assume a basic DC motor setting.

A yellow pop up menu will appear on screen with 2 options, select the machine type from the options. If your machine is not shown select a similar machine type.

When asked 'Restore the factory defaults settings?', select OK

```
          Restore Factory Defaults


 Restore the factory
 default settings?








                                    ✓OK    ✗NO
```
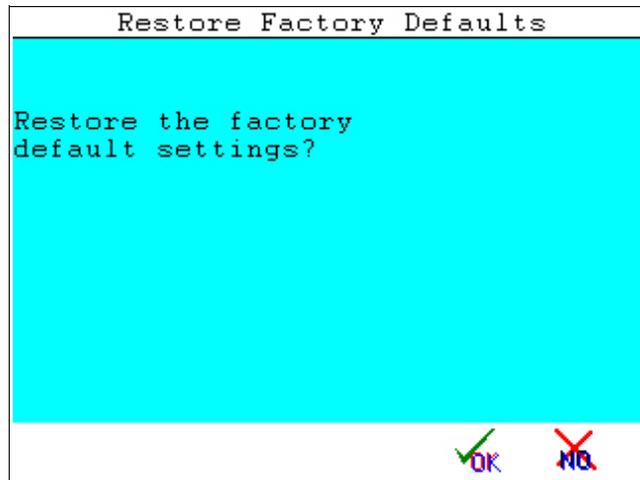
When asked 'Delete database also?' select OK.

```
          Restore Factory Defaults

        Delete database also?
 Restore the factory
 default settings?








                                    ✓OK    ✗NO
```
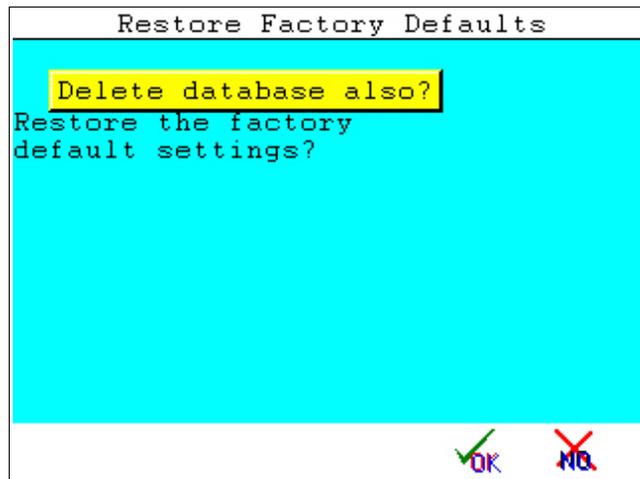
Service Record

From 'Service Menu' Select 'Service Record', the screen below will be shown:

```
               Service Record Menu
Total Distance Moved    (M) :    00000002.6
Moved Since Service     (M) :    00000001.6
Actuator Service Interval (M) :  00100000.0
Total No. Cuts             :     00000019
Cuts Since Service         :     00000002
Machine Service Interval Cuts :  00010000

Commission date                 01-01-2016
Last Serviced on                14-11-2016
Service Interval                0030
Service Number                  000000
```

Some parameters are calculated by the system, these are:
 • Total Distance Moved
 • Moved Since Service
 • Total Number of Cuts
 • Cuts Since Service

The remaining parameters are to be set at installation and at each service. In this current mode these parameters cannot be edited.

In order to edit these the installer needs to press the F7 key followed by entering the system password when prompted. The screen will then change to a white background and the parameters can be edited.

The installer can now clear the system calculated data if required. The remaining parameters should now be set and updated each time the machine is serviced.

Total Distance Moved – This is calculated every time the system moves forwards or backwards to a position. Normally this will never be reset unless a leadscrew or ballscrew is changed and the life of the screw needs to be recorded.

Moved Since Service – Usually this is set to zero following a machine service and is used by the system to generate warning messages based on the "Actuator Service Interval" setting. This is used with the "Actuator Service Interval" to alert the operator that the machine needs to be serviced.

Actuator Service Interval – This distance is used to alert the operator that the leadscrew or ballscrew needs to be serviced based on distance moved as failure to do so will result in greater wear and higher power required to move the backgague.

Total Number of Cuts – This is a calculated field and is incremented after every knife operation. Normally this can be left unless a blade has been changed and can be set to zero to record the life of each blade.

Cuts Since Service – This is updated by the system following every cut made, it can be set to zero following each service and is used by the system and the "Machine Service Interval Cuts" to calculate and warn the operator when service is due.

Machine Service Interval Cuts – The number of cuts can be set here that it is estimated will be done before the blade needs sharpening or replacing. This is usually set at installation only.

Commission Date – This can be set as a record of the date the system was installed.

Last Service Date – This can be set as a record of the date of last service.

Service Interval – The number of days between service should be set here.

Service Number – This should be incremented by the service engineer to record each time the machine is serviced.

Return to the 'Technical Menu' by pressing the MENU key.

Test IO

From the Technical Menu select 'Diagnostic Menu', enter the system password and then select 'Test I/O' you will see the screen shown below (the PMC controller has more outputs than the SMC version):

In this menu you can verify if the sensors and its connections are working properly.

If you want to test the Home Sensor, place a metallic object in front of the sensor and

verify that the input is switching from '1' to '0' on the screen. Do the same test with the other sensors. If one of the sensors is not working, check that the light on the rear of the sensor turns on and off, this indicates power is present at the sensor. Trace the wiring and ensure all connections are good if any input does not work.

It will not be possible to check the emergency stop input in this menu as the servo motor is not running at this stage!

In the same Test I/O Menu you can test the digital outputs shown in the lower bar. In hexadecimal Output 0 is on the right moving to F on the left:

<div align="center">3 2 1 0 F E D C B A 9 8 7 6 5 4 3 2 1 0</div>

If you have connected the Clamp Enable, Cut Enable and Air Enable relays you can turn ON or OFF the relays manually from this screen. By using the Left and Right arrow keys in order to move the cursor along the different outputs and pressing '1' for turning a particular output ON or '0' for turning it OFF.

The outputs used are:
- 9 = Air enable
- A = Cut Enable
- B = Clamp Enable

Turn them ON and OFF and verify the relays are working, if not trace cable routing and connections and verify that all are correct.

Calibration

From the 'Technical Menu' select 'Calibration'.

Complete all the values in the calibration menu to suit your size of machine, for now leave the 'Maximum Cut' , 'Zero offset', 'Play in mm' unless you know the values to enter.

For more information refer to the complete Data Installation section in this manual.

Motion Control – Basic Setup

From the 'Technical Menu' select 'Motion Control' please verify all the values are the same as shown below. This is the default setting for an AC motor however these should be adjusted to suit each individual machine as mechanical changes and size of machine can have an effect on stability.

```
          Motion Control Setup
         Gain   Fil A  Fil B  IGAIN Ilim   Enc Phs
Axis 0   0256   0210   0128   0004  2048    ___ ___
Axis 1   0256   0210   0128   0004  2048    ___ ___

Following Error                  0000
No. Active axis                  1
Motor Activation Delay           1500




         DAC      Encoder    Integral
Ax0 =    00001    00000      00384
Ax1 =    00000    00000      00160
```

You are now ready to test the encoder connection. If the encoder is connected to the motor directly move the motor shaft exactly one turn (360º) and verify if E0 equals the expected number of pulses. i.e. if using a 1000ppr quadrature encoder the value will be 4000. AC Servo drives are usually preset to 3000ppr. If the Value is +/-4000 or near then move the lead screw one turn back to its original position. Now verify E0 = 00000. If you were unable to obtain both numbers then verify the encoder connections and try again. If you obtained both numbers or very close to those numbers (4000 and 00000) then your encoder is working well and you can continue with the next step.

Remember if you turn the leadscrew and the encoder is mounted on the motor you will need to take account of the gear ratio used in one revolution.

You are now ready to test the motor with no load, please verify that the motor is free to revolve and **the toothed belt is not fitted**. Also verify all connectors are plugged firmly in the electrical cabinet and the controller, including the aux connector as this carries an ESTOP signal which if broken will prevent the system starting up.

Press the Start button on the controller   F7 key and press the external green START button (supplied with full kits) when prompted. If there are no problems the motor should be stood still holding position. If the motor is unstable or not holding position refer to the troubleshooting manual. Press Stop and then MENU to return to the technical menu.

If the motor was holding position increase the 'Axis Gain 0' in units of 50 up to the maximum value in which the motor is stable and motor stiffness is as required. Each

time you make a change in a 'Motion Control' Menu parameter press the ENTER key so the controller acknowledges the new value and proceed to test if the motor is still stable by turning the motor. If the motor becomes unstable at some point when increasing this value, use the previous value at which the motor was still stable.

Options Setup

Now that the motor is stable, select 'Options' from the 'Technical Menu' and Setup all the data required or leave the default values as shown in the image below.
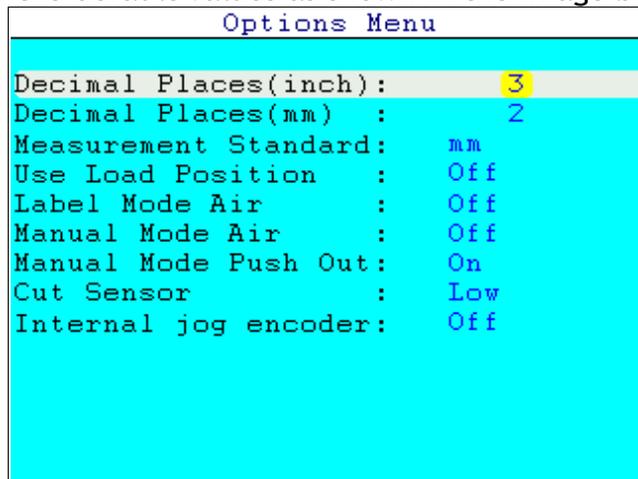
There is one particularly important parameter here and it is 'Blade Sensor'. Blade Sensor has 2 states and its selection depends on the type of sensor used. These come in NPN and PNP types. The supplied TRM sensor is a Low type.

For more information refer to the complete Data Installation section.

Calibration Menu

Press the MENU key to return to the 'technical menu' and select 'Calibration' in order to set up the maximum cut.
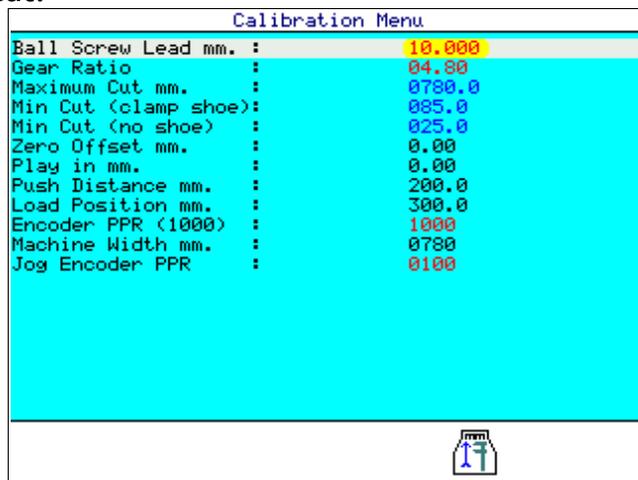
Press the F7 key under the icon shown on the bottom of the screen, and press START when prompted. IMPORTANT: If you need to set the "Maximum cut" again you need to turn OFF-ON the controller before doing it so the Home position will clear.

Now the motor should start moving slowly, please verify the motor is moving in the correct direction, the backgauge should be moving backwards in the case that the toothed belt was fitted.

If the motor is moving in the wrong direction, press STOP and MENU to return to the 'Technical Menu'. Select 'Motion Control'. Now edit the Axis 0 end column "Enc Phs" to INV_INV and return to this section.

If the motor is moving in the correct direction, turn the power OFF by pressing STOP, disconnect the power to the cabinet and proceed to fit the toothed belt, tensioning it correctly.

With the toothed belt fitted, go to calibration again and press the F7 key under the icon and the START button when prompted, now the motor and backgauge should start moving backwards and looking for the home sensor.

When the sensor detects the backgauge the motor will stop and hold position, this is the HOME position of the backgauge. A message on screen will be displayed asking for the Maximum Cut. The maximum cut is the distance from the front of the backgauge to the knife. Measure the distance from the knife to the front of the backgauge enter the value and press ENTER. The 'Maximum Cut' should be set now.

You are now ready to use the system in the Edit/Create Menu. Please refer to the User's Manual to create a short program for testing the accuracy and movement of the backgauge. When making the test program is good practice to enter whole numbers, for example 900.00, 700.00, 500.00.

Below is a screen showing the Motor Power Graph, Actual Position and Programmed Position.

Actual position   Motor Power Graph

Time & Date

Programmed Position (Cut Length)

No.	Length	Push	Air	Cuts	Type	Loop	Adj	Count
00	100.00		NO	1	✂	NO		0
01	150.00		NO	1	✂	NO		0
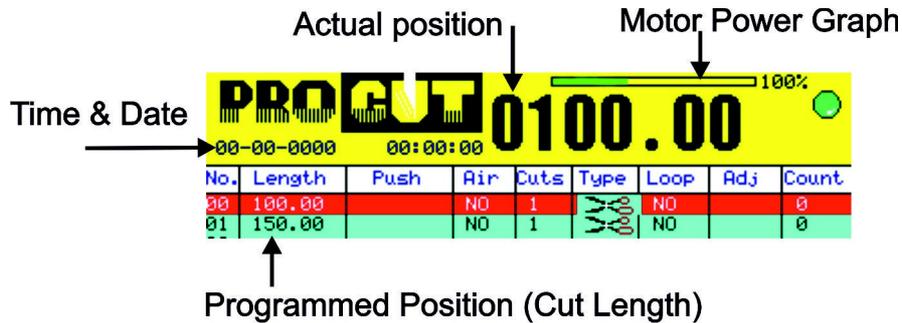
Once you have created the test program, you are ready to run the program by pressing F7, the backgauge will start moving towards the program's first position.

Select one of the following options:

1. When the backgauge is moving from one position to the other, the motor Power Graph (shown above in the screen shot) becomes Red all the time during movement.

   Action: Ensure all mechanical items are correctly lubricated and clean. Stop the program by pressing F8 Key. Go to 'Speed Settings' in the 'Technical Menu' and decrease the 'Max Acc Lim' in units of 5 and repeat the test until the graph is never in red. The motor max speed, as indicated in the bottom blue bar, should never be exceeded. This can be checked on the motor name plate and is adjusted by the 'Max Velocity' parameter. If the graph continues to be in the red this can be reduced to slow the speed of the motor.

2. When the backgauge is moving from one position to the other, the motor Power Graph (shown above in the screen shot) becomes Red at the start or end of the move.

   Action: Ensure all mechanical items are correctly lubricated and clean. Stop the program by pressing F8 Key. Go to 'Speed Settings' in the 'Technical Menu' and decrease the 'Max Acc Lim' and 'Max De-Acc Lim' in units of 5 and repeat the test until the graph is never in red.

3. When the backgauge is moving from one position to the other the Power Graph is in Green.

   Action: If the power graph is never in red, you can set the acceleration at a higher value. Once you have selected the highest possible value for 'Max Acc Lim' and the Power Graph is never in red, continue with next step.

```
            Speed  Setup  Menu

 Max. Acc lim.      :      040
 Max. De-Acc lim.   :      040
 Max Velocity       :      200.0
 Forward Vel. in %  :      075.0
 Return  Vel. in %  :      100.0
 Max Home Vel       :      010.0
 Default Jog Spd %  :      025.0




          Motor  Speed  RPM=4000
```
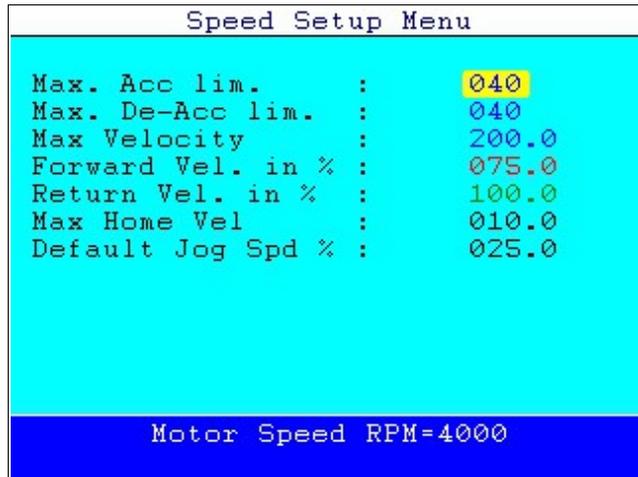
On the Edit/Create Menu Execute the test program and check if the control of the backgauge is working well and that the Motor Power Graph is never in red. Proceed to verify the accuracy of the positioning. Select one of the following options:

1. When the backgauge moves to a position and stops, the error between the programmed position and the actual position (see the above graph) shown on the controller has an error. For example:

Programmed Position ('Length' column on controller)	Actual position (Displayed on big numbers on controller)	Error (+/-) (Actual position - Programmed position)
900.00	900.85	0.85

   Action: Stop the program and go to Motion Control in the Technical Menu. In Motion Control Menu press F7 and increase 'Axis Gain 0' in units of 5 up to a value in which the motor is still stable (firm in position without vibration). Each time you make a change in a 'Motion Control' Menu parameter press the ENTER key so the controller acknowledges the new value and proceed to test if the motor is still stable by moving the backgauge by hand. If the motor becomes unstable at some point when increasing this value, use the previous value at which the motor was still stable.

   Once you have obtained the maximum value at which the motor is stable proceed to do the same with the 'Int Limit' (Integral Limit) but in this case increasing the value in units of 50 up to a value in which the motor is still stable. Each time you make a change in a 'Motion Control' Menu parameter test if the motor is still stable by moving the backgauge with the front wheel. If the motor becomes unstable at some point when increasing this value, use the previous value at which the motor was still stable and repeat this step.

2. When the backgauge moves to a position programmed on the controller and there is no error between the actual position and the programmed position, however there is an error between actual position and the real measured

position.

Action: Go to Calibration Menu and set the values as accurately as possible. The more accurate the values you enter here the more accurate the machine will be. Maximum cut is very important as if this value is wrong all position control will be wrong! An explanation of each parameter follows below:

Ball Screw Lead mm.

This setting varies depending on the machine and indicates how much the backgauge moves in one revolution of the leadscrew or ballscrew. In order to find this value, move the backgauge to the middle of the table. Then move it forward (towards the knife) manually for at least 20mm. This will be the starting position of the measurement you are about to do. Mark the starting position with a line.

Turn ON the controller and go to the "Motion Control" menu (in the technical menu). On the lower part of the screen, you should see $E0=0000$. Now proceed to move the backgauge forward 20 revolutions of the lead screw until: $E0=[qppr \times (gear ratio)]$. Now proceed to mark this position in the paper with a line.

Measure the distance between the first mark and the second mark, and divide that value by 20, the result will be your Ball Screw lead. Please note that if the lead screw is metric the result should be a whole number, for example 25.00mm, 10.00mm, 9.00mm, 6.00mm etc. If it is Imperial enter the metric converted value. i.e. 1" = 25.4

Encoder PPR

Indicates the number of encoder pulses in 1 revolution, normally 1000 if using the DC motor encoder supplied by TRM or 3000 on AC Servos.

Gear Ratio

This is the gear ratio between the motor and the lead screw, if the encoder is mounted directly in the lead screw the gear ratio is 1 otherwise standard ratio supplied is:

Large pulley 72 teeth and small pulley is 15 teeth = 4.8:1
Large pulley 72 teeth and small pulley is 24 teeth = 3:1
Large pulley 72 teeth and small pulley is 36 teeth = 2:1

Maximum Cut

The Maximum cut represents the maximum distance in millimetres between the knife and the front of the backgauge when the home sensor is detecting the backgauge. The value set here is used by the controller to ensure that the operator sets movements within the

system boundaries. The controller will not allow the operator to enter position data greater than the Maximum length.

Min Cut (clamp shoe)

This setting, in millimetres, represents the smallest cut with the false clamp (shoe) fitted. The value set here is used by the controller to ensure that the operator sets movements within the travel limits. The controller will not allow the operator to enter a position lower than the minimum cut length.

3. When the backgauge goes to a position programmed on the controller and there is no error between the actual position and the programmed position the system is set accurately.

Congratulations you have successfully installed PROCUT! Go to the Edit/Create Menu and start using PROCUT.

For further explanation of the technical menu and installation settings please refer to the complete Installation Manual.

Technical Setup

When a controller is turned on for the first time the opening menu will be displayed.

The Installation Menu

To begin installation select option 5 **installation** from the menu, the controller will change to the password screen shown below:

```
Technical Menu




Enter Password-->
```
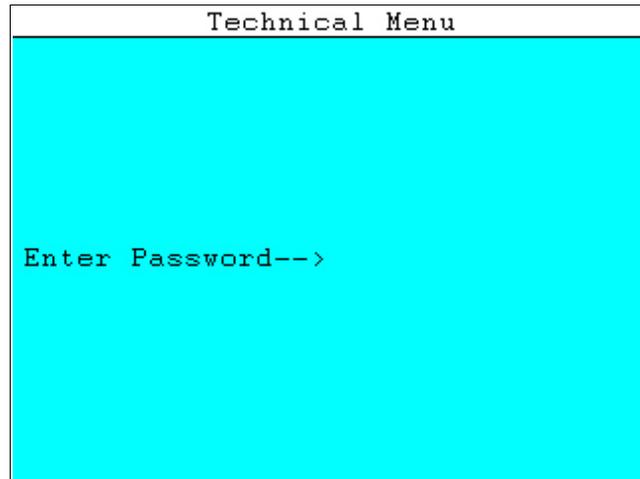
If the correct password is entered the controller will display the installation menu as shown below:

```
Technical Menu
Memory Management
Service Menu
Calibration
Speed Settings
Motion Control
Options
Password
Diagnostic Menu
```
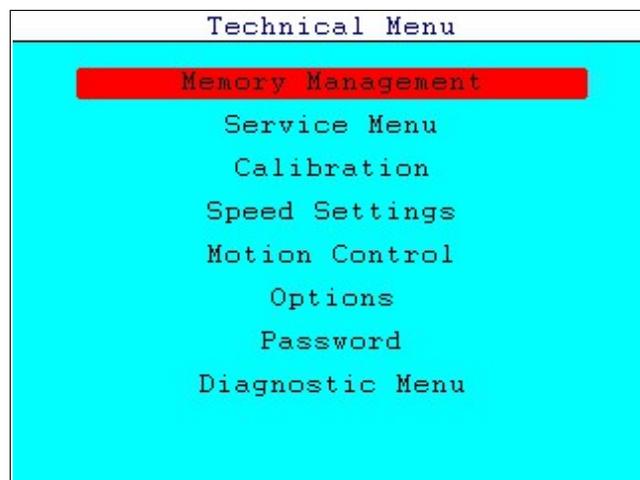
The menu is laid out in the order in which the information is needed, this makes it easier to enter the information the system needs.

Memory Management

The memory management screen is where user files can be backed up and restored along with the system files.

```
              Memory Management Menu

              Backup all CUT files
              Backup a CUT file
              Delete a CUT file
             Restore all CUT files
              Restore a CUT file
           Backup the Environment file
          Restore the Environment file
                 Defragment A:
                 Defragment B:
                Drive Properties
```
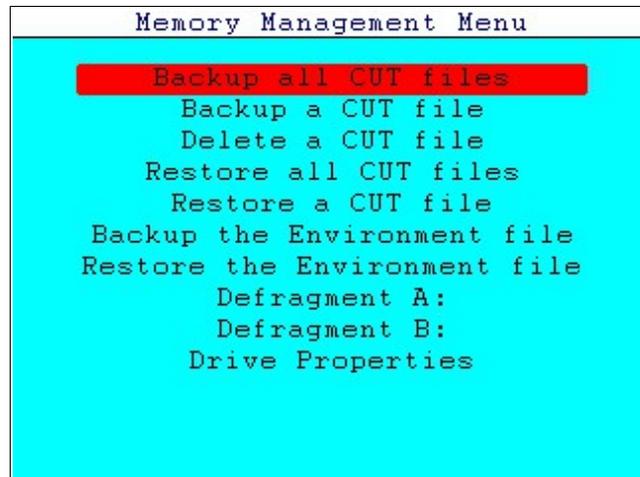
The first four items to backup and restore CUT files are the files that the operators will have created for jobs. It allows the company to keep a job for recall at sometime in the future and to then cut in exactly the same way.

The Environment backup and restore is for the system settings. A backup should be taken once the machine has been installed and deemed to be working and accurate. This will allow re-installation following unintentional data loss or software upgrade.

Defragmentation of the A and B drives will only need to be done rarely as files accumulate and are deleted. A and B drives are those allocated within the controller. C drive is the pendrive designation and we do not provide any formatting facilities for pendrives.

Drive Properties is a menu that displays capacity and fragmentation information about the drives.

Service Menu

This screen enables the service team to keep track of the distance moved by each axis in Meters. It shows the total moved for each axis since installation, what the accrued distance is since last service and what interval has been set for each axis. When the interval is reached a warning message will start to be displayed that the operator will have to acknowledge before continuing to operate the machine. If the interval is set to 0 no message will be displayed and the operator/installer/owner needs to have a maintenance schedule inplace to ensure safe operation of the machine.
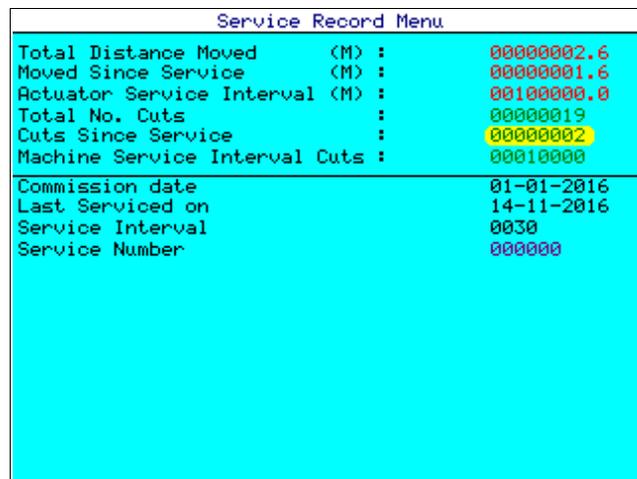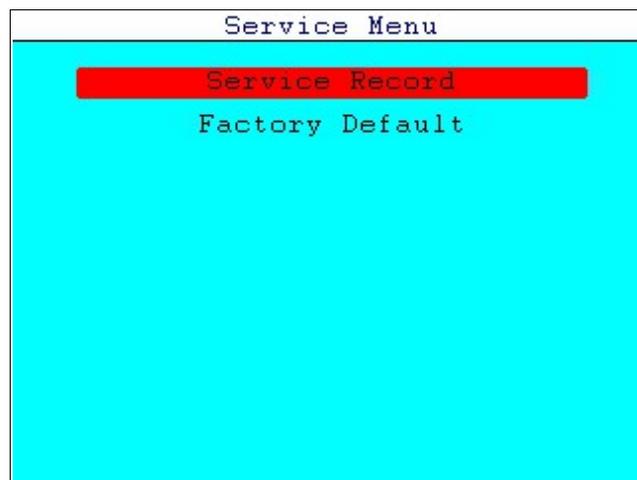
```
                    Service Menu

              Service Record

             Factory Default
```

```
                Service Record Menu
Total Distance Moved      (M) :      00000002.6
Moved Since Service       (M) :      00000001.6
Actuator Service Interval (M) :      00100000.0
Total No. Cuts                :      00000019
Cuts Since Service            :      00000002
Machine Service Interval Cuts :      00010000

Commission date                      01-01-2016
Last Serviced on                     14-11-2016
Service Interval                     0030
Service Number                       000000
```

A description of each setting follows below:

Total Distance Moved

This setting cannot be changed by the user. Total distance moved indicates the total distance in meters that the backgauge has travelled since installed.

Moved Since Service

This setting cannot be changed by the user. Moved Since Service indicates the

distance in meters that the backgauge has moved since last time serviced.

Actuator Service Interval

This setting can be set up and indicates the distance in meters that the backgauge has to move before the operator is prompted for service.

Total No. Cuts

This setting cannot be changed by the user. Total No. Cuts indicates the total number of cuts executed in the machine since the software was installed. A Reset to defaults will not clear the counter, if it becomes necessary to clear this, please contact the factory for the correct code.

Cuts Since Service

This setting cannot be changed by the user. 'Cuts Since Service' indicates the number of cuts executed in the machine since last time serviced.

Machine Service Interval Cuts

This setting can be set up and indicates the number of cuts to be made before the machine requires a general service.

Commission Date

A date can be set by the installer to record what date the machine was commissioned on. This date will then be used for calculating the "Service Interval" if this has been set (number of days).

Last Serviced On

Once the machine has been serviced a date can be entered to record that.

Service Interval

For future use.

Service Number

For future use.

Factory Defaults

The second option on the Service Menu is Factory defaults as shown below, it is designed to load all the default data into the controller should a memory corruption or unusual behaviour occurs.
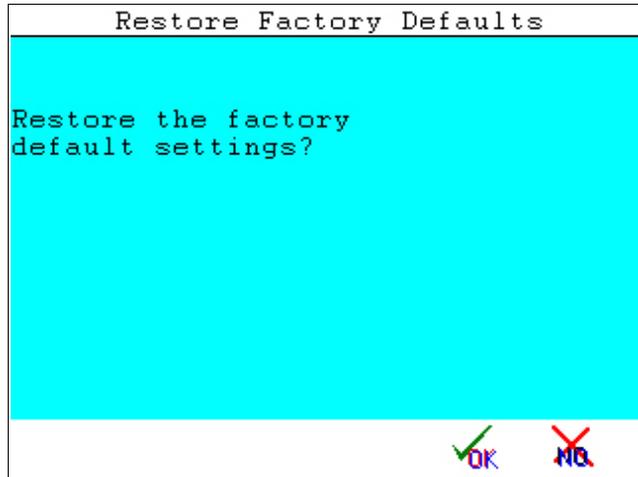
Select 'Factory Defaults' and enter the master password.

A pop up menu will appear on screen, select the machine type from the options. If your machine is not shown select a similar machine type and then goto the Calibration menu to correct any dimensions needed.
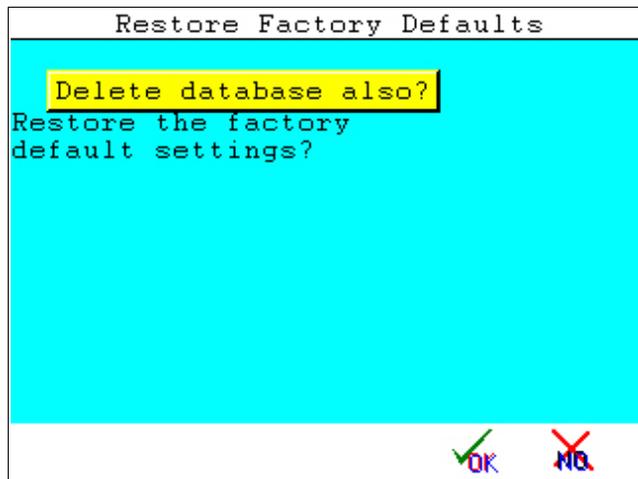
You will also be prompted "Delete database also?" if confirmed this will clear any stored files on older systems and does not apply to the new SMC/PMC controllers with A, B and C drive allocations. (older controllers had no USB and no drive allocations)

Calibration Menu

From the technical menu select 'Calibration', the controller will display the Calibration Menu as shown below:
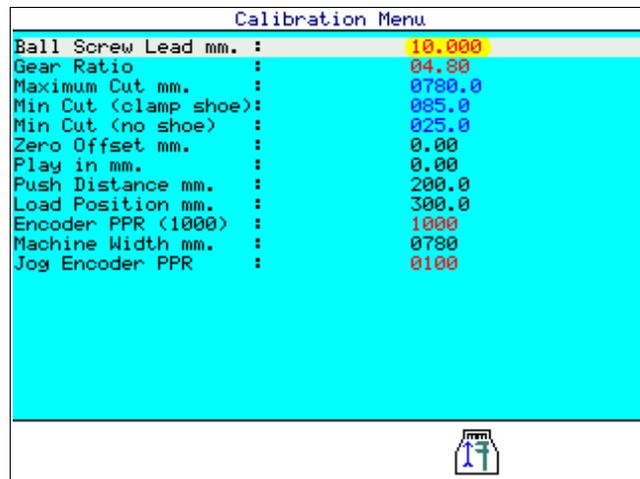
```
                    Calibration Menu
Ball Screw Lead mm. :         10.000
Gear Ratio          :         04.80
Maximum Cut mm.     :         0780.0
Min Cut (clamp shoe):         085.0
Min Cut (no shoe)   :         025.0
Zero Offset mm.     :         0.00
Play in mm.         :         0.00
Push Distance mm.   :         200.0
Load Position mm.   :         300.0
Encoder PPR (1000)  :         1000
Machine Width mm.   :         0780
Jog Encoder PPR     :         0100
```

Inside the Calibration menu is stored all the data the controller needs to make accurate movements between the machine limits.

A description of each setting follows below:

Ball Screw Lead mm.

This setting varies depending on the machine and indicates how much the backgauge moves in one revolution of the leadscrew or ballscrew. Do not confuse "lead" with "pitch" - Ballscrews can have a different lead to pitch in the case of a double screw.

In order to find this value, move the backgauge to the middle of the table. Then move it backwards two turns and place a mark on the table where the front face of the backgauge is. Also place two marks, on on the leadscrew or manual wheel and the other aligned with it on the machine body. Rotate the leadscrew 5 times backwards and bring the alignment marks together on the leadscrew.

Measure the distance between the backgauge and the mark on the table and divide by 5. This will be the amount of lead that you need to program. For a metric leadscrew the result should be a round number like 20mm 9mm etc. For an imperial leadscrew you may get 25.4 for 1" or 12.7 for 1/2". This part of the calibration does need to be done accurately otherwise there will be a cumulative error over distance.

Gear Ratio

TRM supplies various types of gear ratio, 4.8:1, or 3:1 etc., verify what gear ratio you have ordered and enter the value here. To calculate this it is the number of teeth on the large pulley divided by the number of teeth on the small pulley.

Maximum Cut

The Maximum cut represents the maximum distance in millimetres between the knife and the front of the backgauge when the home sensor is detecting the backgauge. The value set here is used by the controller to ensure that the operator sets movements within the system boundaries. Please note that if the value is set to zero the system will not test the data entered by the operator. The controller will not allow the operator to enter position data greater than the Maximum length.

In order to measure the maximum distance between the knife and the front of the backgauge, (once all the settings in the technical menu has been set up) press the F7 key below the only icon shown on the Calibration menu. The back gauge should start moving backwards in search for the home sensor and will stop just when the home sensor detects the backgauge, this allows to measure the maximum distance between the knife and the front of the backgauge.

IMPORTANT: If you are doing this for second time you need to turn OFF-ON the controller before doing it so the home position will clear up.

Min Cut (clamp shoe)

This setting, in millimetres, represents the smallest possible cut when the false clamp is in position. The value set here is used by the controller to ensure that the operator sets movements within the travel limits. The controller will not allow the operator to enter a position lower than the minimum cut length.

Min Cut (no shoe)

This setting, in millimetres, represents the smallest cut without the false clamp (shoe) in. The value set here is used by the controller to ensure that the operator sets movements within the travel limits. The controller will not allow the operator to enter a position lower than the minimum cut length.

Zero Offset mm.

This setting, in millimetres, is designed to ease the installation of the Home Sensor. For example if the system is installed in a 92 cm machine and maximum cut is therefore 920 mm, the sensor can actually be placed a little bit further back, lets say 5 mm. If the Zero Offset setting is set to 0 mm the maximum cut would be 925.00 mm but if the Zero Offset setting is set to 5 mm the maximum cut will be 920.00 mm.

Play in mm.

This setting is designed to minimise the error due to the leadscrew wear and is only

functional when the backgauge is moving backwards. The system moves back beyond the set position by the programmed distance and then moves forward to the actual position. This ensures that all positions are moved to in the forwards direction and are therefore consistent.

To set this, first go to the technical menu. Then move the back gauge manually towards the front of the machine using the mechanical wheel for at least 5 turns, mark the position of the backgauge on the table and proceed to pull backwards the backgauge using both hands (Not using the mechanical wheel) as much as you can and mark on the table the new position. Now measure the distance between the 2 marks. The result is your Play in millimetres.

Push Position

This setting, in millimetres, is used mainly by the 'Label optimise' menu when the program is created automatically or in manual mode. The subtraction between the "length" value and "Knock position" is the one the system will enter into the 'Push' column in the Edit/Create menu.

Load Position

This setting, in millimetres, is used in automatic mode when turning ON the setting "Load Position" located in options.

Encoder PPR

Indicates the number of encoder pulses in 1 revolution, normally 1000 if using the encoder supplied for a DC System or 3000 for an AC Servo system.

Machine Width

This setting is in millimetres and is designed for the system to be able to make the calculations when using the 'label optimisation mode'.

Jog Encoder PPR

This is where the installer sets the number of pulses being used by the Jog encoder. This is normally 100ppr for most systems.

Once Calibration menu is set up press the **MENU** key twice to go back to the *Installation menu*

Speed Settings

From the installation menu, using the arrow keys move the cursor to the Speed Settings option and press ENTER. **Note the user must ensure that the maximum speeds are properly set up**. It is vital that the maximum speeds of each axis are correctly set, if the maximum motor speed is set higher than the motor can attain, the system will lose control of the motor. The motor speeds are set normally in quadrature pulses per sample period (QPSP). This makes setting the system up simple as it is very easy to calculate the maxim motor speeds and enter the value. When setting the motor speed one must ensure that the limits of the system are respected, always set motors to run at a safe speed. Please see the speed set up menu below:

```
        Speed Setup Menu

  Max. Acc lim.      :      040
  Max. De-Acc lim.   :      040
  Max Velocity       :      200.0
  Forward Vel. in %  :      075.0
  Return Vel. in %   :      100.0
  Max Home Vel       :      010.0
  Default Jog Spd %  :      025.0



        Motor Speed RPM=4000
```

Max Acceleration / Deceleration Limit

Both the acceleration and deceleration of both axis is controlled in the same manner. It is set in units of travel per period. This can be either quadrature pulses per sample period or units of travel per second. The normal system is set in QPSP unless stated on the menu. The formula for acceleration is given by:

Vi = (Ap / 255) x 1250.

Where Vi = velocity increase per second squared, and Ap is the acceleration parameter entered by the user.

In reality it is almost impossible for users to calculate the optimum maximum acceleration which often has to be set by measuring the motor current during acceleration and deceleration and ensuring that these are within design limits. Where the system is set up in units per minute or second the acceleration and deceleration is set to reach a velocity increase per second of the acceleration parameter. For example an axis which has been calibrated in millimetres will accelerate at the rate of acceleration units per millimetre squared. In this case an axis will accelerate at the programmed number of units per millimetre second squared. If the figure 10 is entered for acceleration then the axis will accelerate at

the rate of 10 millimetres per second squared.

A common mistake made by people setting up systems, is that the acceleration is set too high. If the acceleration is set too high then the motor will fail to reach the destination set by the controller and a huge following error will occur. Although the motor may recover its position in due course the motion profile will be wrong and ultimately the motor may burn out. This will be obvious in the run screen as the power graph will be showing red. Decrease the acceleration until the graph shows green.

Once the motion control speeds have been set the user may exit the menu by pressing the menu key.

Max Velocity

Unless stated otherwise on the menu the speeds are set in Quadrature pulses per sample period. This is given by the formula
- $V=((RPM\ motor \times PPR\ encoder) / 20520)$

Where RPM is the MAXIMUM working speed of the motor in RPM and PPR is the number of pulses per revolution of the encoder. Please see the table below. This shows speed settings for various motor speed ranges when fitted with 1000 pulse encoder. If the version of PROCUT you have has been configured in units per period (normally mm/min or mm/sec) values must be calculated by using the gear ratio and the speed of the motors etc.

Maximum RPM	Speed value	Maximum RPM	Speed Value
500	24	1,000	48
1,500	73	2,000	97
2,500	121	3,000	146
3,500	170	4,000	194
4,500	219	5,000	243
5,500	268	6,000	292
This table shows Maximum speeds for motors fitted with **1000** P.P.R. Encoder in QPSP			

Please note that this is the maximum speed the motor can run, however when the motor is with load the motor speed could be considerably less.

Return Vel. in %

The Return Velocity is the value at which the backgauge will move when moving backwards in the automatic mode. Note that this value is a % of the 'Max Speed' setting explained above therefore the maximum number allowed is 100%.

Forward Vel. in %

The Forward Velocity is the value at which the backgauge will move when moving in the forward direction in the automatic mode. Please note that this value is a % of

the 'Max Speed' setting explained above therefore the maximum number allowed is 100%. Generally it is a good idea to keep the forward speed lower than the return speed as the paper will have less tendency to slide on each other when stopping and reduce the time taken to "block" the paper back up again.

Max Home Velocity

This, unless stated otherwise on the menu, is set in percentage of maximum speed. See section above (Maximum Speed) for more information. The maximum home speed velocity is the velocity that the system returns to home at. This should normally be quite low. Remember that the zero point may be near the end of the axis travel and therefore if the velocity is high there is a chance of the axis hitting the end of travel.

Default Jog Spd.

The value entered for 'Default Jog Speed' governs the speed at which the backgauge will move when using the 'Fast forward' or 'Fast reverse' controls in the Manual mode.
Important! Enter a very low value to avoid crashes against the machine limits!

Motion Control

From the Technical menu select the option 'Motion Control'. Having calibrated and set the motion travel speeds etc. the user needs to set the motion parameters, these are in the form of gain and filter settings for the axis.

```
            Motion Control Setup
           Gain    Fil A  Fil B  IGAIN Ilim   Enc Phs
Axis 0     0256    0210   0128   0004  2048    ___ ___
Axis 1     0256    0210   0128   0004  2048    ___ ___

Following Error                        0000
No. Active axis                        1
Motor Activation Delay                 1500




       DAC       Encoder    Integral
Ax0 =  00001     00000      00384
Ax1 =  00000     00000      00160
```

Note that there is Axis 0 and Axis 1, this is because on some bigger machines there could be 2 servomotors, if you are using just 1 servomotor then the data to be set is just for Axis 0.

Gain Axis 'x'

Default Value = 800, Range = 0-9999
The gain setting is a figure that the controller uses to set the stiffness or tolerance of the axis positioning. The lower the gain is set the easier it is to get the system to become stable, therefore never set the gain higher than you need. When you set the gain you will be able to see how that affects the positioning of the axis by the encoder positions shown at the bottom of the screen. You will see that there are two sets of figures at the bottom of the screen these are DAC and Encoder Where DAC represents the current DAC output and Encoder represents the current encoder position, the controller will attempt to position all axis at zero. Note that the value for Gain is 0 and Encoder is 0 at this point as power has not been enabled.

Filter A 'x'

Default Value = 210, Range = 0-255
Filter A parameter represents the primary digital filter where the higher the value the lower the filtering frequency, for example a high speed motor normally requires a filter 'A' setting of approximately 210, a slower DC motor would require a setting of approximately 250, Note: this parameter has a maximum setting of 255.

Filter B 'x'

Default Value = 64, Range = 0-255

The 'Filter B' parameter represents the secondary digital filter, it tends to deal with high frequency isolation in the motor. Like the 'Filter A' parameter it is suggested that this is set with the gain relatively low and that the 'Filter A' parameter is set roughly to the correct value then the 'Filter B' parameter can be adjusted. Typical values are around 64.

Igain / Ilim

Igain Default Value = 256, Range = 0-999
Ilim Default Value = 1024, Range = 0-4000

These settings are designed to correct the positioning error when the motor is stationary.

The Integral value is shown at the bottom of the screen and becomes live when the motor is energised.

ENC / PHS

There are a combination of 4 settings here. Generally these are only changed when an axis is unstable or if the axis needs to operate in a different direction. After positioning the cursor over this column, press enter and a pop up box will appear as in the image below:
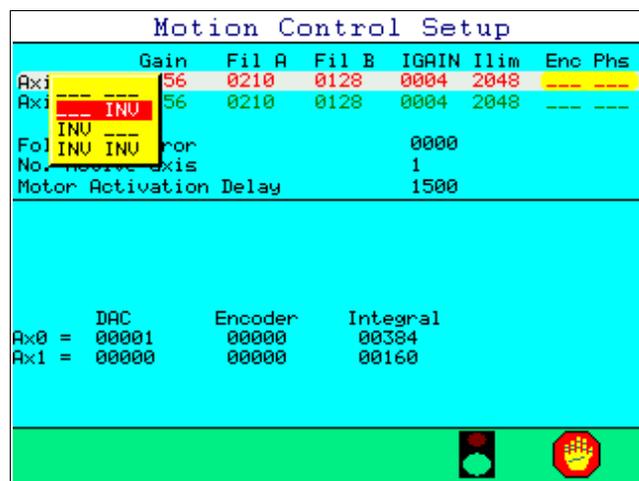
[--- ---] is the default setting where direction is normal and Encoder is normal.

[--- INV] is where the motor phase is inverted due to instability

[INV ---] is where the encoder is inverted due to instability but altering the phase would have the system operate in the wrong direction.

[INV INV] is where the system was stable but the operating direction needed to be changed.

Following Error

Following Error. This is the maximum permissible difference between the commanded position of an axis and its actual position. If no following error is set (0000) the controller will not look for any following error. When a following error is set, the bigger the value the bigger the following error tolerated. If the following error is bigger than the value set the controller will trip out and a message on screen will be shown. Maximum value is 9999. This can be used to trip the system in the event of a failure or if too much load is applied to an axis.

No of active axis

This value is normally set to 1 for a single motor system. On larger machines where 2 motors are used this would be set to 2.

Motor Activation Delay

On AC systems and some DC systems this value is set to allow a short delay for the drive to power up before motion is enabled. In some cases if the drive is enabled and the voltage is low the position desired will not be achieved and a larger command output given. Once the voltage has stabilised the motor could then jump causing erratic control during start up. This is set in milliseconds (ms) and a maximum of 2000 can be set.

IMPORTANT - Once the system is stable and has been thoroughly tested, it is recommended that the end user write the values down and store them in a safe place in-case they need to be reloaded in the future or use the "Backup Environment" in the memory menu.

Options Menu

From the Installation Menu select 'Options' and the following screen will appear:

```
              Options Menu

Decimal Places(inch):      3
Decimal Places(mm)  :      2
Measurement Standard:    mm
Use Load Position   :    Off
Label Mode Air      :    Off
Manual Mode Air     :    Off
Manual Mode Push Out:    On
Cut Sensor          :    Low
Internal jog encoder:    Off
```
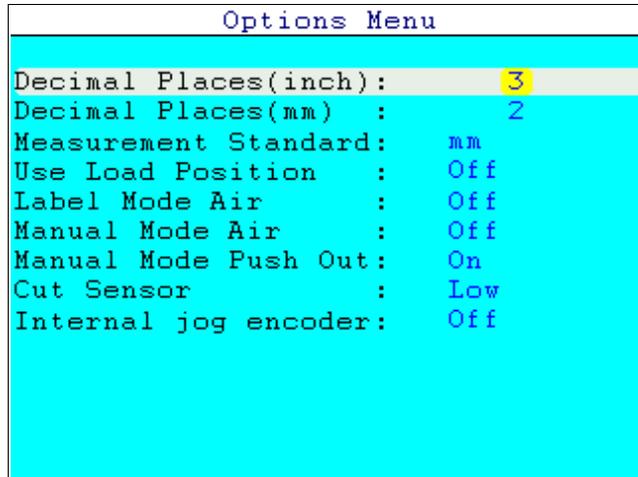
An explanation of each setting follows below:

Decimal Places (Inch)

This setting indicates the number of decimal places (when in inches) that the system will show on the Edit/Create screen when moving to position. When displaying the position in Inches the maximum number of decimal places is 3.

Decimal Places (mm)

This setting indicates the number of decimal places (when in millimetres) that the system will show on the Edit/Create screen when moving to position. When displaying the position in millimetres the maximum number of decimal places is 3.

Measurement Standard

Here the user can select in what unit to display the position, Inches or Millimetres. However when running a program in Edit/Create the user can still temporarily change between either standard from the local options menu.

Use Load Position

If selected 'On' the backgauge's first action when running a program will be to move to the 'Knock Position' set up in calibration, a message on the screen will prompt the user to load the paper into position and to press ENTER to continue with the job.

Label Mode Air

If the Air relay option is installed, this setting will turn On or turn Off the air when using the label optimisation mode. This automatically sets the Air column to Yes or No for every line that is programmed when using the Label Generator menu.

Manual Mode Air

If the Air relay option is installed, this setting will turn On or turn Off the air when using the manual mode.

Manual Mode Pushout

When set to "On" a Pushout operation will be performed after a cut is made in manual mode. The amount that the paper will be pushed out is specified in the "Calibration Menu"

Cut Sensor

On some machines the blade sensor does not detect the blade when in 'rest' position but when the blade is down, therefore:
- Select 'Low' when the Sensor detects the blade when it is in 'rest' position.
- Select 'High' when the Blade sensor detects the blade when cutting.

Internal Jog Encoder

This is generally factory set to off for 5.7" controllers and to on for 10.4" controllers where a jog wheel is fitted to the front panel of the controller.

Password Menu

In installations where permission is required to enter data or to use certain menus it is a good idea to change the user passwords regularly. This is achieved via the Password menu.

```
                        Password Menu

      Diagnostics Menu    :
      Motion Control Menu:
      Technical Menu      :
      Delete File         :
      Delete Directory    :
      Password Menu       :
      Save File           :
      Restore Defaults    :
```
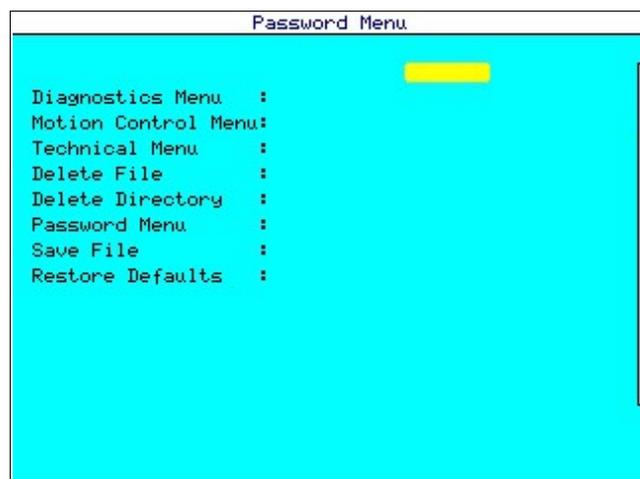
There are two levels of password these being the user passwords and the system master password. When first supplied, your distributor will advise you on the initial password settings. To make changes to the user passwords enter the password menu from the **Technical Menu** as shown in the figure above. The enter password screen will appear, at

the prompt enter either the master or the password menu user password.

Entering a New Password

Move the cursor to the line that requires editing. Overtype the existing password with up to 6 characters. Legal characters include alphanumeric and symbols. We would suggest that the passwords are written down and stored in a safe place for future reference should any be forgotten.

The Diagnostic Menu

From the technical menu shown above select 'Diagnostic Menu'. The menu allows basic controller testing and setting of the real time clock. Please see the diagnostic menu below:

```
                  Diagnostic Menu


                      Set Time
                      Set Date
                     Test Dacs
                     Test Adcs
                    Test Keypad
                     Test I/O
                  Test Jog encoders
                     Exit to OS
```
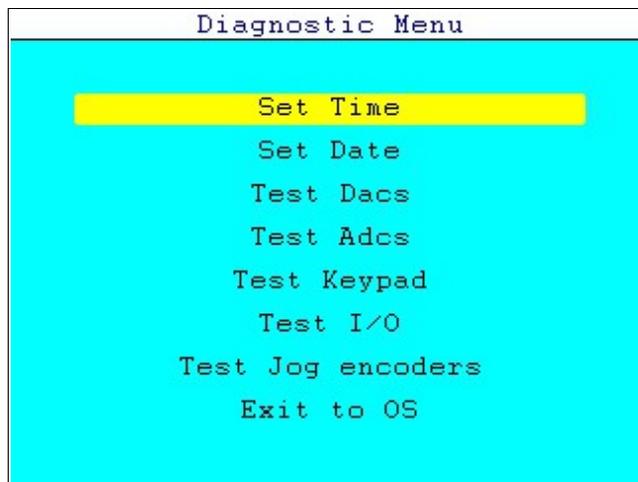
Set Time

From the diagnostic menu select item "Set Time". The set time menu will be drawn as shown below:

```
                  Set Time Menu



    HH:MM:SS->
```

The clock is set in only the 24 hour format. For example to set the time to 5:45:00 in the evening, enter 17 for the hour, the controller **will move to the next value field.** Then enter the minutes, in this case 45, the controller **will move to the next value field** so the display will read **17:45:** Now enter the zeros. The clock will start exactly when we finish typing the last digit in so enter the first 0 and wait for the reference clock to read 17:45:00 and enter the final 0.

The time will be set and the controller will return the display to the diagnostic menu. Please note that the clock is not self adjusting for winter/summer times and must be adjusted as required.

Setting the Date

Setting the data is similar to setting the time shown above. From the diagnostic menu select item "Set Date".

```
            Set Date Menu


DD-MM-YY->
```
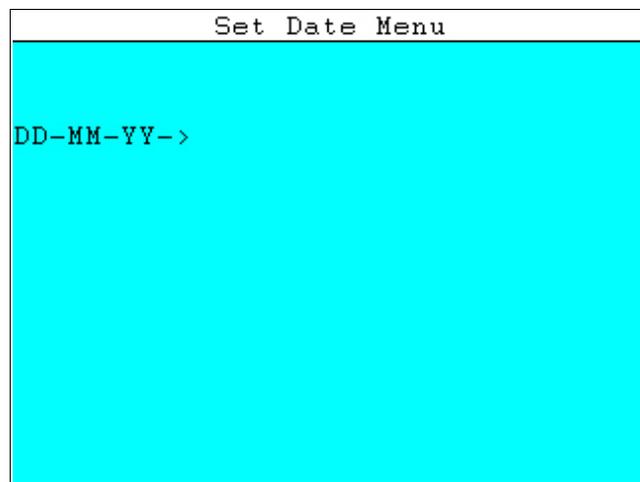
The set date is exactly the same as the set time menu shown except that the display reads "Set date menu and the prompt reads DD-MM-YY where DD represents the day of the month, MM the month and YY the last two digits of the year. At the prompt enter the date in the two digit format e.g. to enter the 1st of June 2002 enter 01-06-02. Note that the controller adds the hyphen '-' automatically.

The test DAC's Menu:

This menu can be used by engineers to test the controller and amplifiers, you will need a multimeter to test the values.

The controller uses analogue voltages to control the position of the motors during motion control. The voltage range is positive through negative 10 volts (+/- 10 V). This voltage is produced via a digital to analogue converter (DAC). The range is set at the factory

```
              DAC Test Menu

0) Zero volts
1) 10 Volts
2) -10 Volts
3) Ramp outputs
4) Ramp DACs
```

Zero Volts

Before checking anything else it is suggested that the zero volts is checked first. From the *DAC test menu* press 0. The controller will output zero volts to both DACS The controller will indicate that it has accepted the command by printing "O volts" two lines below the menu. This voltage will remain until the menu is exited or another key is pressed.

10 Volts

This is used to make the controller output 10 volts from it's DACS. From the *DAC test menu* press 1. The controller will output 10 volts to both DACS. The controller will indicate that it has accepted the command by printing "1O volts" on the screen. This voltage will remain until the menu is exited or another key is pressed.

-10 Volts

This is used to make the controller output minus 10 volts from it's DACS. From the *DAC test menu* press 2, *-10 volts*. The controller will output -10 volts to both DACS The controller will indicate that it has accepted the command by printing "-1O volts" on the screen. This voltage will remain until the menu is exited or another key is pressed.

Ramp Drivers

This function causes a saw tooth pattern to output to the drivers (digital outputs). Using suitable loads and an oscilloscope it is possible to check the drivers dynamically. The highest frequency is output to driver 0 and the lowest to driver 7. To use this function from the *DAC test menu,* press 3 Ramp drivers. The controller will output the sawtooth to the drivers and it will indicate that it has accepted the command by printing "Ramping Drv" on the screen. This voltage will remain until the menu is exited or another key is pressed.

Ramp DACS

This function causes a saw tooth pattern to output to the DACS. Using suitable loads and an oscilloscope it is possible to check the DACS dynamically. The iDACS produce a high quality linear sawtooth waveform. Any errors in the linear section of this waveform might indicate that the DACS have been damaged. To use this function from the *DAC test menu* press 4 Ramp DACS. The controller will output the sawtooth to the DACS and it will indicate that it has accepted the command by printing "Ramping DAC" on the screen. These voltages will remain until the menu is exited or another key is pressed.

Test I/O Menu

The test I/O menu is very useful as it allows the machine to be tested by controlling the drivers and monitoring the Home Sensor, Knife Sensor and Clamp Sensor. The menu displays both the state of the inputs and the outputs. The outputs can be individually set on or off.

```
            Test I/O Menu PMC4

FEDCBA9876543210 Inputs
1111111111111111 0xFFFF
0000011100000000 0x0700


3210FEDCBA9876543210 Outputs
0000000000000000000 0x0



           1111111111111111
```

The first line of the display shows the number of the input in hexadecimal with the **M**ost **S**ignificant **B**it (**MSB**) on the left hand side. To the right of the heading is the hexadecimal value of the inputs. On the second line there is a binary representation of the outputs where 1 is high and 0 is low. Now we are going to verify if the sensors being used are working.

First using the manual wheel move the backgauge to wards the home sensor. The value for input 0 (where the home sensor is connected) should change from 1 to 0 when detecting the backgauge. Now proceed to verify the Knife sensor and the Clamp sensor. When detecting the knife, the input 2 should change from 1 to 0, and finally when detecting the clamp the input 3 should change from 1 to 0. If in any case the sensor is not working properly verify the connection inside the electrical cabinet.

Next there is a heading for the drivers, these are MSB on the left hand side with the driver number directly above each driver. In this case 0 represents off and 1 is on. On entry to the menu all drivers are off.In the above image driver 0 is highlighted in white. To turn this driver on press '1' on the keypad to turn it off again use '0'. The left and right hand arrow keys are used to scroll left or right allowing access to all drivers. Drivers 9,10 and 11 are used for the Air, Cut and Clamp.

When testing is complete use the **MENU** key to exit to the diagnostic menu.

Exit to OS:

This option is used only under the instruction of your supplier and is normally for backing up/restoring or program updates.