

MANGO TECH PTY LTD

MANGO
MANUALS
AUTOMATION

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TABLE OF CONTENTS

<u>OVERVIEW</u>	3
<u>UNPACKING AND SETTING UP YOUR MANGO AUTOMATION</u>	4
<u>GETTING STARTED</u>	5
<u>CALIBRATION</u>	5
<u>THE TEST CUT</u>	6
<u>ADJUSTING THE CALIBRATION</u>	7
<u>USING THE MANGO</u>	8
<u>CUTTING PROCEDURE</u>	10
<u>COMPUTER SHUTDOWN</u>	12
<u>TROUBLE SHOOTING</u>	13
<u>MACHINE HAZARDS</u>	16

Overview

Congratulations on your purchase of a *MANGO* Automation System that will revolutionise your work place. The *MANGO* System comes in a range of options that include some of the following Products.

- ✘ MANGO Length Stop
- ✘ MANGO Angulation
- ✘ MANGO Manual Mitre Pins
- ✘ MANGO Mitre Pins (Auto)
- ✘ MANGO Plate Progressor
- ✘ MANGO Trencher

Each MANGO Product has been designed to make your work place more efficient, eliminate bottlenecks and free staff from the cutting face for extra hands at assembly.

Mango Automation consists of

- ✘ Mango Length Stop system
- ✘ Mango Angulation System
 - ☐ The Mango Length Stop is used to accurately measure and cut lengths of timber
 - ☐ The Mango Angulation system sets the required angles to complete the cut on the truss component that is currently being manufactured.

Length and angle measurements can be entered into the computer in three ways.

- ✘ The data can be downloaded automatically from the design computer
- ✘ The data can be loaded into the computer by floppy disk.
- ✘ The operator can manually enter measurements using the keyboard.

Under Normal conditions Mango Automation is accurate to within ± 0.5 mm, and $\pm 0.1^\circ$. It will introduce massive efficiency gains in your production line. In fact **Mango Automation can change the length and angle of a cut in the time it takes to place a new piece of timber on the cutting table. The saw will be ready for the next cut before the operator.**

Unpacking and setting up Your MANGO Automation

Chapter

1

This page is to familiarise yourself with the workings of your Mango Automation. While an authorised installer will do all the hard work for you, it still pays to learn what is going on.

THe components of a MANGO Automation System

The Saw... This can be an existing saw that has been upgraded to the *Automation System* or it may be supplied with the *Automation System*. Either way it is sharp and capable of cutting off your arm so be careful.

The Computer... This is the Y2K compliant engine that drives everything. The detail information is taken from the office computer and placed into the Mango computer. The Mango computer then moves the *Length Stop* and the saw head into appropriate positions and waits for the operator to place some timber on the cutting table and make the required cut before moving to the next angle and length.

The Length Stop... This is a sophisticated measuring tape. Accurate to 0.5mm. All you have to do is type in the length required in mm and press Enter and hey presto.

The Angulation System... This is the automatic protractor. Again it is accurate to 0.5° and beats having to lump the saw from angle to angle especially when there are 4 angle cuts to be made on the one piece of wood.

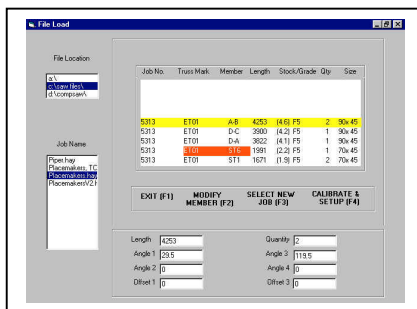
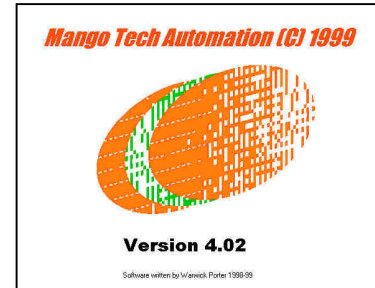
In Essence plumbing is added to the saw to make it go from angle to angle, and a runner and stop are added to the roller tables to make the length measurements. Best of all for the first time in apprentice HISTORY you too can have a LEFT HANDED Automated SAW. (No joke we can construct the system to work right to left or left to right.)

Getting Started

1. When You turn the Computer on:

The *Automation Software* will automatically start when you turn on the computer.

The first screen you will see is the **TITLE** screen, which will remain visible for approximately 7 seconds before switching to the **FILE OPERATIONS** screen. The **TITLE** screen carries the software revision number. Please make a note of this, as you may be asked for it should you require technical support.



The **FILE LOAD** screen should now be visible as shown.

Now you need to calibrate the Mango Auto, otherwise neither the length nor the angle will move.

Calibration

Calibration sets the minimum length and angle measurements for the saw. This allows the machine to work out where it is.

- After you see the FILE OPERATIONS screen, push in the emergency stop button. (*The big red knob near or under the saw bench*)
 - ✘ This is like a clutch and disconnects the motors from the electronic gearing
- (Using your hands), **Pull** the LENGTH-STOP **towards** the saw until it reaches its minimum length. (Pull until stop won't move anymore).
- Pivot the saw angle around **towards** the LENGTH-STOP until it can move no more (ie the saw frame hits the saw table)
- Press the **[F4]** button.
 - You will be asked "DO YOU WANT TO CALIBRATE THE SAW?" (the NO option is the default)
 - Select YES by using the arrow button on the keyboard to move the highlight to the "YES" option (the highlight starts on the NO option). Once the highlight is on the YES option, push the ENTER button on the keyboard.
 - You will be asked another question: "ARE YOU SURE YOU HAVE MOVED THE LENGTH AND SAW TO THEIR MINIMUM POSITIONS"
 - When you are sure you have done so answer "YES" to this question
 - ✘ *This will calibrate the machine.*
 - ✘ *and bring up a calibrated label at the top of the screen*

- 🖥️ The CALIBRATED label will appear whether you are on the FILE OPERATIONS screen or the CUTTING SCREEN.

👉 Don't forget to release the *EMERGENCY STOP BUTTON*

Now the saw is calibrated. To finish the process of calibrating, you must check the length and angle, and make any changes as may be required.

The Test Cut

To check the length and angle, you must cut a piece of timber and check the length and angle on the resulting cut timber.

You will be taken automatically to the TEST CUT Screen.

Here the programme chooses a length of 1000mm and 90°.

Press Enter (which tells the computer you want to cut a 1000mm member with 90° cuts at each end)

- 🖥️ **A box appears telling you** "The next setup is about to commence. Do you want to continue".

👉 Check the *EMERGENCY STOP BUTTON* and release if engaged still.

👉 Select Yes and press **[Enter]**

IMPORTANT: You must release the *EMERGENCY STOP BUTTON* before the length and angle can move.

The Length and angle will move to approx 1000 and 90

If they do not move then you most probably still have not released the EMERGENCY STOP BUTTON.....

Place a discarded piece of timber and cut one end square.

Push trimmed end up to Stop.

Cut other end of timber

Measure Length of timber

If length is not 1000mm then you must adjust the Length as described below.

Measure Angle of the cut.

If Angle is Not 90° then adjust the Angle.

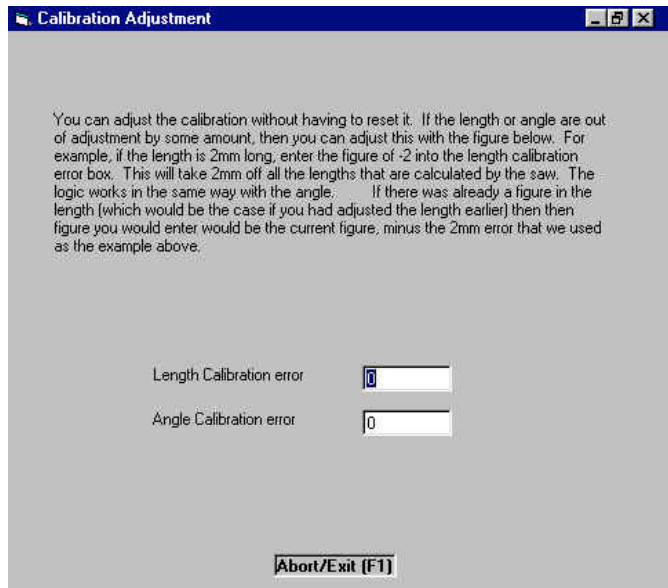
Adjusting the Calibration

(in the File or Cutting Screen) Press [F4]

Answer **NO** to the Question “Do you want to recalibrate the Saw”.

Answer **YES** to “Do you want to Adjust the Calibration”

You Enter the Calibration Screen. It looks like this:



To Adjust the Length:

1. Calculate the ADJUST DIFFERENCE which equals $1000 - \text{Cut Length}$.
 - a. If Cut length is 1008 then the ADJ DIFF is -8
 - b. If Cut Length is 998 then the ADJ DIFF is $+2$
2. Add the Number already in the computer to the ADJ DIFF. (This usually though not always 0)

$$\text{Length Calibration Error} = \text{EXISTING NUMBER} + \text{ADJ DIFF}$$

To Adjust the Angle

1. Calculate the ADJUST ANGLE which equals $90 - \text{Measured Angle}$.
 - a. If Measured Angle is 89 then the ADJ ANG is $+1$ ($90-89=1$)
 - b. If Measured Angle is 94 then the ADJ ANG is -4 ($90-94=-4$)
2. Add the Number already in the computer to the ADJ ANG.

$$\text{Angle Calibration Error} = \text{EXISTING NUMBER} + \text{ADJ ANG}$$

Press [Enter] a couple of times to make sure the new numbers are registered in the computer.

Press [F1] to exit the screen

Press [Enter] again and you will be told “The next set-up is about to commence. Do you want this to happen”

Answer YES and you will be returned to the Cutting Screen.

Calibration is COMPLETE you can now operate Machine accurately

USING THE MANGO

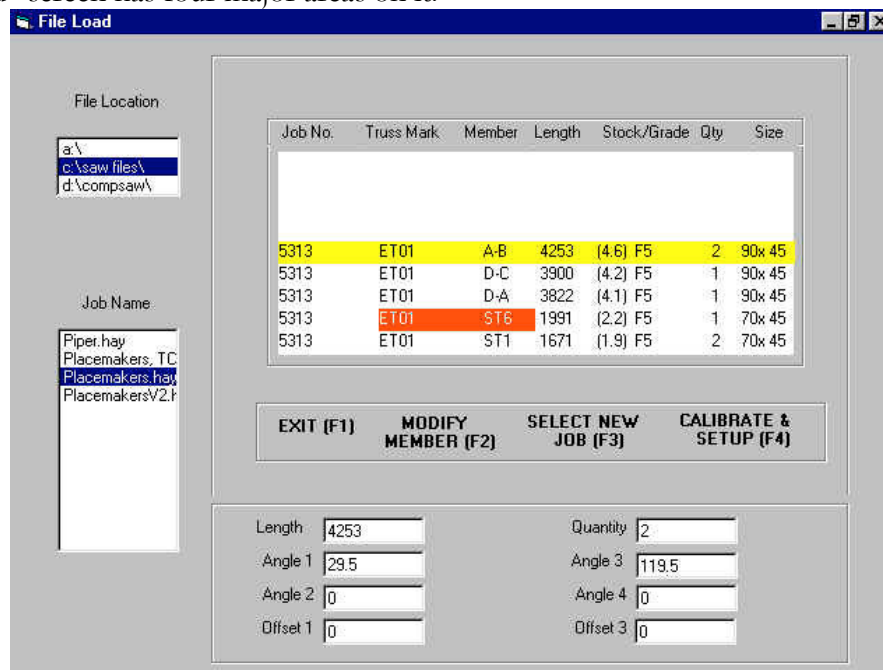
There are 2 screens that control the cutting operation.

FILE LOAD screen: used to select and load cutting jobs, and to manually enter cutting sizes.

CUTTING OPERATIONS: displays the current status of the saw and length stop. This screen is the one the operator will spend most of their time seeing. The components that the operator wants to cut can be selected on this screen.

FILE LOAD SCREEN

The "File Load" screen has four major areas on it:



File Location: The place the cutting files are stored

- 🖥️ If the jobs come in little disks (about 90mm X 95mm) then select "a:\ ".
- 🖥️ If the job is already in the computer for you then select "c:\saw files
- 🖥️ If the system is on a network then choose "d:\compsaw".

Job Name: Lists the jobs that are currently in the selected folder.

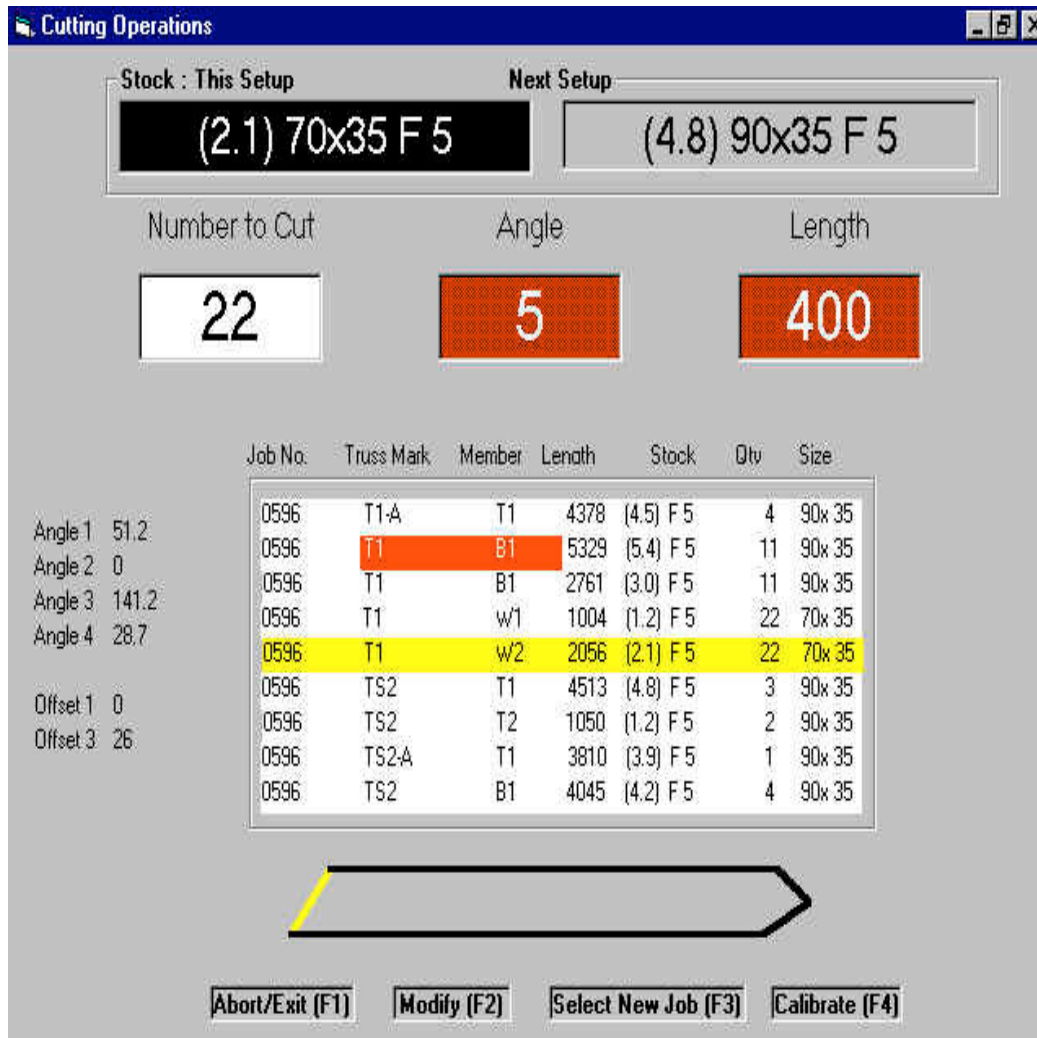
Choose the job you wish (arrow Keys and press **[Enter]**)

Job No: The yellow bar highlights the member being cut. Choose the member by using the arrows and *Enter* key.

Modify Area: Contains details of the member being cut. Here you can modify these details if needed.

Cutting Operations Screen

This also has 4 major areas.



Stock: Which timber stock is required for the current member and the next member in the list. The background colour changes according to the grade of timber required.

Number to Cut/Angle/Length:

Indicates the number of members of current type yet to be cut.
The angle and length boxes will change colour.

- RED means the saw and Stop are not in position (DO NOT CUT)
- GREEN means everything is ready for the Cut.

Job No. Details: As in the FILE LOAD Screen

Cut No.: Here is indicated which cut the saw is set up for. In some versions this is replaced with a graphic representation.

CUTTING PROCEDURE

AUTO OPERATION

The following procedure will guide you through the Automatic cutting routine:

1. Start up the system and Calibrate
2. From the FILE LOAD screen select the drive and folder containing the job lots
3. Select the required job lot
4. Select the member from the job lot for cutting and press Enter.
5. A "setup warning" will appear on the screen.
6. Highlight **Yes** and press Enter.
 - a. As soon as you choose YES, the *Length Stop* and the *Saw Angle* will begin to move and you enter the *Cutting Screen*.
 - b. When both of the background colours on the Angle and Length Boxes of the cutting screen turn green, the saw is ready to cut the timber.
7. Place member firmly against Length Stop and pull the saw through the timber.
8. Once the cut is completed the angle and length stop will automatically move to the next positions.

MANUAL OPERATION (member modification)

The *Mango Automation* software allows you to make modifications to each member detail, and also gives you the possibility of cutting a totally new member that hasn't been downloaded onto the computer.

If you wish to change any of the features of the current member, follow the procedure below:

1. From either the FILE LOAD or CUTTING OPERATION screens, press the [F2] button.
2. You will be put into the FILE LOAD screen, with the length box highlighted.
 - ✘ You are now able to modify any of the details (Length/Angle/Offset or Quantity) in this area of the screen by typing in the desire number.
3. Use [**Enter**] to move between boxes.
 - ✘ If you do not want to change the details in the box just press [Enter] to move to the next box.
4. Keep pressing [Enter] until you are told "The next setup is about to commence. Do you want this to happen?"
5. Press [Enter] to accept this
6. You will be returned to the CUTTING OPERATION screen and the saw will be ready to cut to your new dimensions/quantities.

There are several points to remember when modifying a member:

1. If you fail to enter an offset when the system requires one (if cutting 2 angles on one end), then the mango will assume the offset is the centre line of the timber.
2. The width of the timber used to calculate the centre line will be the width of the member currently highlighted in yellow on the screen. If there are no jobs loaded, then you will be prompted to enter a timber width.

3. If you only want to change the length of a member, press F2 to get to the modification screen. Enter the new length and then quickly press [Enter] twice. This is a shortcut that will save you having to scroll through all of the other details.
4. When modifying a member, or cutting a new member, remember that, depending on Nail Plate Supplier, there are some simple rules to follow.

GangNail / Bostitch

Type in the figures as you see them in your standard cutting list. The figures given. Ensure that the detailer has got the programme to print out the angles to show above 90 where needed. A 4 cut web should show angle 1 <90 angle 2 >90 angle 3 > 90 angle 4 <90. IF the programme does not print the angles above 90 you will have to add 90 in the appropriate places.

Pryda

Type in the values as supplied on cutting sheets. However, in a 3 cut web the length value is different to that from other suppliers. In order for the 3 cut web to work properly ensure that the Cutting Setup option dealing with manual cutting length is set to "THROUGH OFFSET".

Multi Nail

Type in the figures as on the cutting sheet, but realise the angles are all below 90 for webs and sometimes above 90 for chords. This is allowed for in the computer.

CUTTING METHODS (What is the order that members are cut)

There is a general rule that needs to be followed when cutting any member on the Mango Auto saw.

1. The operation of the saw requires that the saw always remains in the 0-90° quadrant. The saw will never go over the 90° mark. To cut an angle over 90°, you need to flip the timber over. The question is...."When do you flip the timber over?"

The answer is.....Keep your eye on the list of angles that are shown down the left hand side of the CUTTING SCREEN and the cut number that you are currently completing (shown at the bottom of the screen). If you are on cut 1 (shown on the bottom of the screen) then you are cutting angle 1 as shown on the left-hand side of the screen. The next cut that you will carry out is the next non-zero angle as shown down the left-hand side of the screen. If this angle is in the opposite quadrant to the one that you just cut, then you need to flip the member that you are cutting over.

If it is in the same quadrant, don't flip it over. This means that if the last angle cut was less than 90o and the next angle is also less than 90o then they are in the same quadrant.

The only time that you will have to use slightly different cutting rules is when you are cutting mitres.

SINGLE MITRES: the cutting method is the same as for an unmitred piece of timber.

If you are cutting single mitred member, you can also perform a little trick that will save some cutting time. Jacks and creepers are commonly cut on pairs. If the pieces are small enough to allow to be cut from one stock length, then you can cut the mitre first by cutting through the middle of the stock piece, with the stock pushed up to the length stop. This gives a left and right mitre. Flip the offcut that is on the infeed side of the saw over so that the second piece is now on top of the first piece that was cut. Dock the two pieces to length and you get a pair of jacks or creepers cut with only 2 cuts instead of 4.

DOUBLE MITRES: you must cut the unmitred end of the timber first, then slide this up the stop and cut the mitred end.

COMPUTER SHUTDOWN

At the end of the day (or some other time) when you come to shut down the computer YOU MUST FIRST exit out of the *Mango Automation* software.

DO NOT JUST TURN OFF THE COMPUTER... PULL THE PLUG or any such nefarious things. Else you will really STUFF up WINDOWS. Bill Gates WON'T LIKE YOU and neither will we.

From the FILE OPERATIONS screen, press F1.

You will be asked "Do you want to exit the program and shut down Windows?" Answer Yes.

✘ You will now be reminded to push in the EMERGENCY STOP BUTTON. Make sure you have done this before selecting OK. Failing to do this could result in damage to the servo driver card. (It will have to be replaced at your expense -Over \$2000)

The computer will now shut down.

Do not power off until you see the message

"It is Safe to turn off your Computer"

NB A real modern computer (Pentium3 200+) with the new wider mainboard that sits in the new "Fat" case will now turn itself off

Trouble Shooting

There are very few things that can go wrong with the Mango Automation system, but if it does, here are a few of the problems you may encounter

The length of the cut timber is not correct.

Carry out a TEST CUT as described earlier in this manual, and adjust the length calibration if required.

If the test cut length is correct then there could be a mechanical problem with the saw. If there is no fault with the saw, and problems persists contact MangoTech.

The Mango sets the correct length for shorter lengths, but goes wrong towards 6m

The gear ratio is not correctly set or has been mistakenly changed.

Go to the CALIBRATION and SETTINGS section of the Electronic manual and change the *Length Gear Ratio* as described.

The angle is correct at 90 and wrong at lower angles (say 10 deg).

The gear ratio is not correctly set or has been mistakenly changed.

Go to the CALIBRATION and SETTINGS section of the Electronic manual and change the Angle Gear Ratio as described.

The Length Stop is easily knocked out of position when the timber is pushed up to it.

The Length Power setting is too low.

Go to the CALIBRATION and SETTINGS screen and increase the power in small (1-5) increments upto a maximum of 400.

DO NOT go above this value without first consulting Mango Tech.

The Mango keeps jamming for no apparent reason

If this starts to happen after a long period of normal operation, then the slider or driveline has become too stiff for the electronic clutch to overcome.

From one end of the Length Stop Rail, look down it's entire length to ensure there are no obvious bends or twists. Pay particular attention to the join. If there is a bend, it may be caused by some of the holding bolts working loose. Check all these.

Check there has not been an excessive build up of dirt or sawdust in the tracks of the Length Stop Rail. Blow these clean with an airline to remove any contamination.

Push the Emergency Stop Button in to release the Length Stop Motor. Now drag the Length Stop Slider the entire length of the rail to check for any tight spots. (Never do this directly after calibration on software versions older than 4.02. Do at least one cut first and this will ensure you do not damage the servo driver card).

If none of the above correct the problem then go to the CALIBRATION and SETTINGS screen and increase the Length Stop Power in small increments upto a maximum of 400. DO NOT go above this value without first consulting Mango Tech.

The slider has too much "slop" or play in it.

This will occur after some time of operation. The solution is to use the shims that have been provided with the machine (the small blue plastic pieces) to pack out the nylon pads so the slider is firm on the rail, but not so firm that the stop keeps jamming.

When Adjusting Calibration I cannot enter the length of block I want.

This is very likely to be because you are entering a value that is below the minimum block Length allowed (Less than the distance from the Saw Blade to the Mango-Stop at its closest position to the Blade). Try a bigger Value.

The Saw moves but the Length Stop doesn't, or visa versa.

The first thing to check is the wiring to the respective axis.

Has anyone been playing with the wiring?

Has anything out of the ordinary happened lately (electrical storm, power failures etc).

Has anyone pulled the power cabling to the motors on the length or the angle?

Check that the emergency stop button is pulled out correctly.

Is the emergency stop button damaged?

Blow the stop button out with compressed air while the button pushed in (there may be dust under the contacts).

The final option is to go into the SETTINGS and CALIBRATION screen and push and hold the F3 button. Both axis should move. If the axis that you are concerned about doesn't move (and you have got the emergency stop button released) then the servo driver card has probably failed. **Call Mango Tech.**

The Angle and the length don't move

This is generally caused by a problem with the emergency stop button. Blow the button out with compressed air (with the button pushed in). This will remove any dust that may have gathered between the contact in the switch.

Has the emergency stop button been hit or damaged at all. If so, replace it. To check if the problem is the button, you can remove the wires from the switch and join them together by hand (twist them together). This must be done when the computer is turned off.

If this corrects the problem then replace the Emergency Stop button.

The angle won't move when you pull the saw out then back in

If you pull the saw out while the angle is still moving it will lock in place and will not move again until you hit the enter button. This is a safety feature.

The Angle doesn't move onto the next cut, but you can get it to move by hitting the [Enter] button.

The saw stroke switch has failed.

These switches are readily available from electrical wholesalers or contact Mango Tech.

The screen "locks up". I cannot get any of your commands to work. The keyboard and the mouse don't work and you can't get the computer to respond.

The card has fallen out of the computer. If the card is not completely plugged in, then the computer can lock up. Call a qualified electrician to remove the cover from the computer and reseat the card.

There is a cutting length error which varies inconsistently.

The grub screw on the motor shaft of the length stop can sometimes come loose. Re-tighten it. Perhaps use a locking compound such as "Loctite"

The saw blade touches the timber when the saw is behind the fence at low angles

Some older (and more damaged) saws can have the blade almost touching the timber when the saw is at low angles. In these cases you need to delay the movement of the saw so that you have time to remove the timber before the saw moves to it's next position and perhaps grabs the timber. This is an option that can be set in the CUTTING SETTINGS screen.

Chapter

4

The length and angle don't appear to move at all, but the readouts on the screen move a very small amount.

The saw stroke switch has probably failed. Remove the two wires from the switch on the saw arm and short them together. The voltage is 24VAC, so there is no danger. Try and set the saw up. If it works, then the switch needs to be replaced. If it doesn't, check the input into the computer. This is a job for a qualified electrician.

The angle jams. It cannot be moved by hand or by the computer.

Problem with the gearbox. Check the movement of the saw. Is there timber jammed under the turntable or drive belt. If there are not any visible problems, take the front off the gearbox. This requires a 4mm hex key. Have a look at the internals. Is there any timber or dust jammed in the movements? Have any of the belts fallen off? Have any of the pulleys moved so they are no longer running freely?

If the front of the saw has been hit by anything heavy (ie a forklift or timber pack), it is possible for the gearbox mounts to be moved slightly and cause it to jam on some parts of the saw frame.

Machine hazards

The following section contains the Hazard and Risk Assessment that was carried out on the Mango Automation as required by the Occupational Health and Safety (Plant) Regulations 1995.

Mango Tech has taken care in the design and manufacture of this equipment to reduce or eliminate where possible all the potential hazard sources in order to minimise the operating risks. However, as with all equipment of this type, it is never possible to remove all potential hazard sources. It is therefore essential you read this assessment so that you are familiar with the residual hazards associated with this equipment and the methods that Mango Tech have used to safeguard you the user, and other personnel in the vicinity of the saw.

RISK ASSESSMENT/HAZARD IDENTIFICATION

Hazard 01: The operator may pull the saw out while the angle is changing

Risk to OH&S?: If the blade angle is changed while it is cutting a piece of timber, the blade will “bite” into the timber and tend to push violently towards the operator. The final resting position of the blade is unknown for this type of occurrence, therefore the operator cannot get his body parts out of the way and the risk of being cut is high.

Possibility of removing hazard : The operator is the source of this hazard. Training will have some effect as to when the operator will pull the saw out (ie. only when the saw is not changing angle), but will not remove the hazard. The only way to remove the risk is to stop the movement of the angle and length if the saw is taken off its home position (either intentionally or by accident)

Likelihood of exposure : The operator is commonly going to pull the saw out when the angle is moving. This will occur commonly by accident (the saw head will bounce off the switch when the operator pushed the saw back too vigorously). The saw will not bounce enough to allow the blade to extend over the cutting bench (ie. near the operators’ fingers). The other way that this situation often occurs is for the operator to anticipate when the saw will be at the desired angle and pull the saw out just a bit too early (ie. the saw may still 1 or 2 degrees short of it’s target). The angle will stop moving in this case.

Hazard Reduction Measures : If the operator pulls the saw out from behind the fence while the angle is changing or tries to induce the movement of the angle or length, the angle and length movements will cease immediately. This is part of the software for the Automation. The movement of the length and angle cannot be started again without a specific command from the operator. The angle and length will only move if the saw blade is behind the fence.

The safety feature in the software will therefore be used regularly to stop the saw moving while the blade is engaged in the timber.

Hazard 02: The saw stroke switch fails

Risk to OH&S?: The saw stroke switch is wired in the same way as an emergency stop button. That is, if the switch fails, the saw automation will not work. Therefore the operator will have to manually ask the computer to select the next angle, as this will no longer be done automatically done by the saw stroke switch.

Possibility of removing hazard : The hazard has been removed by the wiring method that has been chosen.

Likelihood of exposure : There is no hazard that the saw operator is likely to experience.

Hazard Reduction Measures : The switch on the saw that gives the signal to the computer to indicate whether the saw is being pulled out works on a normally open contact. That means that if the saw stroke switch fails, the saw angle and length will not longer move automatically after the operator pulls the saw through to perform a cut. It will require that the operator manually select which cut to proceed to next, then manually ask the saw to move to position.

The consequence of this type of logic on the switch means that if it fails while the angle or length are moving, the movements will stop immediately (as per item above)

Hazard 03: The length stop moves without a command and pushes the timber into the blade

Risk to OH&S?: The timber will hit the side of the blade. This is unlikely to cause a risk of injury. The length stop drive system does not have enough power break the blade by hitting it from the side in this way. The max force the length stop can produce (when set as per Mango Tech's settings) is not enough to break the skin on the operators hand if it hits him, therefore the blade will not be damaged. If the blade is not far into the timber, then the risk is higher of injury to the operator. The timber may jam on the blade and the blade will be pushed out towards the operator.

Possibility of removing hazard : The software has been written to ensure that this does not happen. If either axis (length or angle) is moving while the saw is off it's home position, then the movements are stopped immediately (as per the hazard above)

Likelihood of exposure : In order for the length to move while the blade is in the timber, the software and/or the hardware have to fail. For the either of the axis to fail to the ON position (ie. moving the axis) is unknown in the history of the electronics (approx. 10 years operation) or the software (reference : Controller card manufacturers experience).

Hazard Reduction Measures : If the operator pulls the saw out from behind the fence while the angle is changing or tries to induce the movement of the angle or length, the angle and length movements will cease immediately. This is part of the software for the Automation. The movement of the length and angle cannot be started again without a specific command from the operator. The angle and length will only move if the saw blade is behind the fence.

The training of the operator will also include some mention of the recommended operating position (for the operator to stand while cutting) so that they will have the greatest control over the saw if it jams on a piece of timber.

Hazard 04: The angle moves while a person is behind the saw bench

Risk to OH&S?: The angle movement has considerable power. The person who is behind the saw while the angle is moving is at risk of being crushed by this movement. This crushing will not be fatal as the drive system does not have the available torque, but certainly very painful.

Possibility of removing hazard : The hazard can only be removed by training. It is not practical to make it impossible to access the rear of the saw and still give the operator enough access to the front of the saw to allow him to cut timber.

There should not be anyone behind the saw while the saw is operating. The movement of the blade and possible movement of the angle combine to make it very dangerous for the person that is behind the fence. The blade and angle movements should be turned off before anyone enters the area behind the saw.

Likelihood of exposure : If the operator climbs behind the saw while emergency stop button has not been engaged, then it is very difficult to eliminate the risk of injury to the operator. The drive system for the angle has some power limitations programmed into it to reduce the chance of the person that has placed themselves in this situation being hurt. Some minor crushing injury is still likely if the angle movement has not been electrically isolated before the person enters the area at the rear of the saw.

Hazard Reduction Measures : Operator training covers this hazard. The computer and saw blade should be turned off before cleaning or maintenance (ie. before a person enters the area behind the saw) is carried out. If the training is ignored, then the drive system for the angle has it's power limited by the Automation software to reduce the severity of the potential injury.

Hazard 05: The length moves to a shorter length while the operators fingers are near the centerpoint of the saw

Risk to OH&S?: The operator may have his fingers cut by being crushed between the timber and the sharp edge of the fence.

Possibility of removing hazard : The fence will always have a sharp edge to it. This is caused by the saw blade striking the fence whilst at a low angle. To remove this sharp edge involves removing a section of the fence (so that the saw never hits the fence). This adds the hazard of a larger opening in the fence, which is a greater hazard than the one we are trying to remove.

The other option for removing this hazard is to ensure that the length always goes to a longer length during the cutting operation. This is impractical because of the number of variations of members that need to be cut. The result if this approach is taken is that the various similar members that have to be cut will be cut with a different method (particularly 3 cut webs). This will inevitably result in the timber being cut incorrectly.

Likelihood of exposure : If the operator is not concentrating while cutting, and places his hand through the hole in the fence, then the length moves, the operators fingers will be crushed between the timber and the fence. This MAY cause his fingers to be cut.

Hazard Reduction Measures : The movement of the length stop (therefore the speed of the timber), whilst cutting a member is approximately 20% of the speed of the length when setting up for a new member. This means that the movement of the timber to a shorter length (the hazard in this case) is very slow and should allow the operator time, after his fingers are hit and before they are pushed against the sharp edge of the fence, to move his fingers out of the way. This is relevant for the case of the operator's fingers on the timber or on the fence at the beginning of the incident. The time between being hit by the timber and being cut should be about 0.5sec. Experience has shown that this is enough time to move your hand out of the way.

Hazard 06: The angle goes to the minimum angle while the operator has his hand on the fence

Risk to OH&S?: The fingers of the person who is leaning against the fence may come in contact with the side of the blade. The fingers of the person will either contact the side of the blade or the side of the teeth. If the fingers touch the side of the blade, there will be no injury. If the fingers touch the side of the teeth, skin will be removed. The extent of the protection injury is uncertain, but not expected to be the loss of a finger.

The only way that the fingers of either the operator or a bystander will come to be on the fence is if they are not paying attention to the saw. It is not comfortable to lean on the fence in a way that will mean that the person doing the leaning is not facing the saw. This means that they likely to be watching the saw. This will allow them to move their hand from the fence before the blade gets there.

The operator will not be in a position to have their hands near the blade as they will be on the other side of the saw bench. That is, if the saw comes to its minimum angle on the left side, then the operator will be standing on the right hand side as this is where the controls for the saw are located and where the timber is fed from. The operator is therefore unlikely to find himself in this position

Possibility of removing hazard : It would be impractical to remove the hazard by use of a guard as this will limit the function of the saw (ie. the minimum angle of the machine will be reduced).

Likelihood of exposure : It is unlikely that the operator will have an increased chance of being exposed to this hazard due to the Automation. The blade is likely to be close to the rear edge of the fence during the normal operation of the saw (while it is a manual machine). Once automated, the blade will only go near the side of the bench that the operator does not use during operation of the saw. Therefore the person most likely to be exposed to the hazard is the bystander who is leaning over the saw bench.

Hazard Reduction Measures : This risk has been reduced by a function in the software which will prevent the saw going to angles less than 30° before the operator has confirmed it is safe to do so. Signage and operator training will also further help reduce the risk of injury. This will be covered in the formal training supplied as part of the Mango Tech installation.

There must be methods of work instituted by the management of the factory to ensure that bystanders are not resting against the machine while it is operating. The operator and associated staff need to be informed of the hazard during training.

Hazard 07: The length stop strikes the operators hand while moving

Risk to OH&S?: The fingers of the person who has been struck will be bruised, cut or jammed between the rollers and the length stop. The author of this report has volunteered his hand for this test. The damage sustained to the fingers was minor bruising only.

Possibility of removing hazard : The hazard is inherent in the movement of the length stop. It will always exist.

Likelihood of exposure : The bottom edge of the stop has been rounded off to reduce the point load on the body part that has been hit by the stop.

Hazard Reduction Measures : The power of the drive system for the length stop has been limited so that the stop will only bruise, not break the skin of the fingers that may get jammed.

Hazard 08: Main drive for the angle may be accessible by the operators fingers.

Risk to OH&S?: Fingers may be able to be caught in the main drive for the angle. This will cause a crushing injury to the finger. The damage to the finger will not include permanent or debilitating injury. This has been tested during installation by a Mango Tech employee.

Possibility of removing hazard : The hazard may be removed in some instances by the addition of a guard (as is done), but in some cases the guard cannot be fitted whilst maintaining the operability of the machine

Likelihood of exposure : The risk of exposure is low due to the layout of the machine. The design of the machine means that as the angle is turning the machine itself acts as a guard by sweeping the fingers of the person approaching the hazard harmlessly out of the way. The only way to get your fingers into the drive is to insert them, then start the movement.

Hazard Reduction Measures : The hazard will be highlighted at training. Any machines that do not have adequate guarding (as mentioned above) will have a guard fitted during the Automation installation process.

Hazard 09: Operator may choose to cut the heel cut first on a spliced bottom chord

Risk to OH&S? : The operator has to stand in an unbalanced way and pull the saw “awkwardly”. That is, the pulling of the saw through the timber is not done in a way that encourages good use of the back muscles of the operator. This reduces their control over the saw, which is the hazard. If the saw jams, the operator cannot attempt to control it and there is then a risk that the fingers or arms of the operator will get in way of the saw blade as goes out of control over the timber. There is then the possibility of having these body parts cut off.

Possibility of removing hazard : This hazard can be removed by cutting the 90-degree cut on a spliced bottom chord first. This is an option in the Automation software. There is a historical precedent that the heel cut is cut first. This means that many operators of the saw require that the cutting be done in this way. In order to satisfy the customer, the option of cutting the heel first remains in the software, but if selected, a warning is given that alerts the user to the hazard.

Likelihood of exposure : If the heel is cut first, then the risk of an incident is high. If the 90-degree cut is done first, then the risk is reduced dramatically.

Hazard Reduction Measures : The option that lets that operator cut the heel first has a warning on it that alerts the operator to the risk if injury if the heel cut is cut first.