

A2MC Machine Installation and Training Manual



MULTICAM
CNC ROUTING MACHINERY

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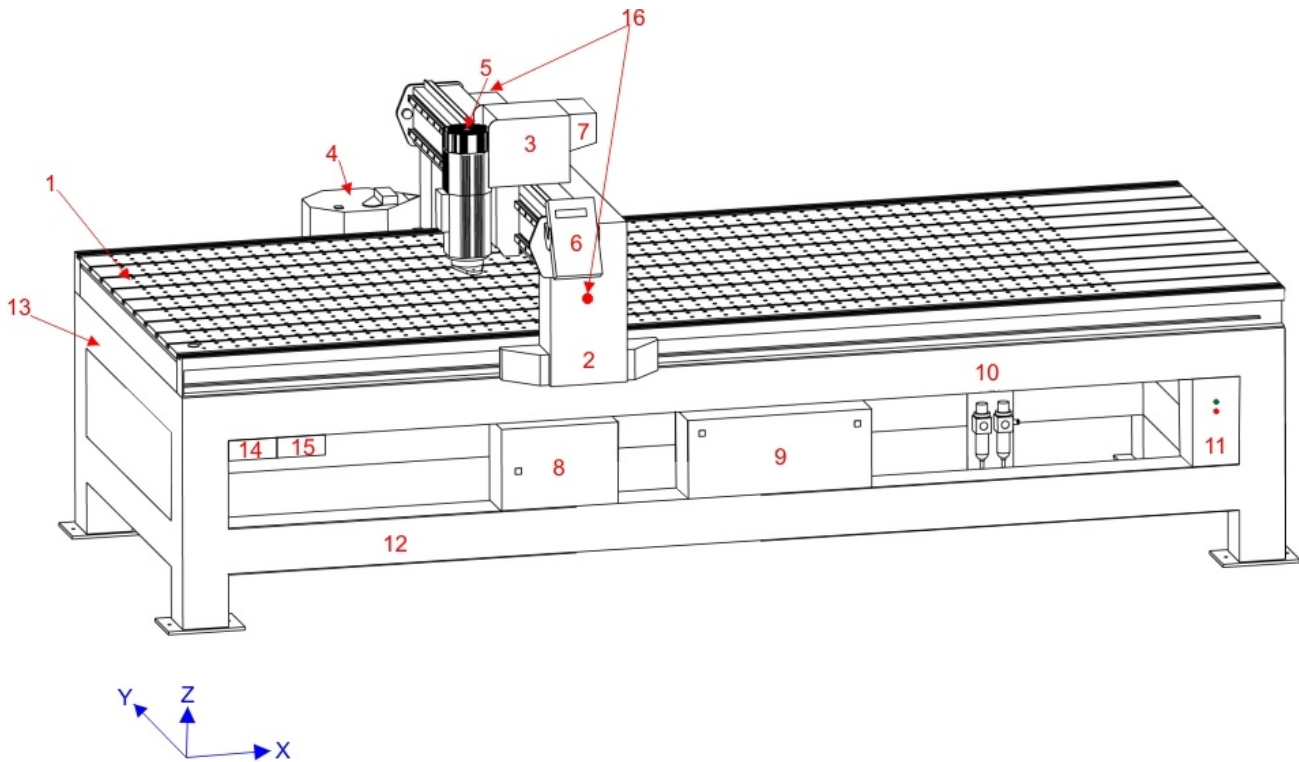
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Machine Component Identification

The following diagram and table indicates the location of major components of the machine. There may be variations depending on individual size, configuration and options fitted.



Item	Description	Items marked * are optional and may not be present on all machines
1	Machine bed. Aluminium vacuum hold down table or t-slot table	
2	Travelling steel gantry. Contains X axis drives	
3	Machine head. Contains Y and Z axis drives	
4	Travelling rotary tool changer*	
5	Location of cutting spindle/s*, knife head/s*, camera*	
5	Location of Air assist head attachment*	
6	Operator's sub console unit	
7	Mist sprayer attachment*	
8	Inverter enclosure - Danger High Voltage	
9	A2MC controller enclosure - Danger High Voltage	
10	Micro air filter inlet and distribution	
11	Power Box Master On/Off control for machine - Danger High Voltage	
12	Machine frame	
13	Linear tool changer*	
14	Machine air supply, tool change and vacuum pressure gauges*	
15	Additional switches for dust collectors, vacuum pumps, other ancillary devices*	
16	Emergency stop buttons, operator's and off side of gantry	

HEALTH AND SAFETY

WARNING

Machine must only be operated by persons trained and accredited by Multicam Systems

General Safety And Machine Specifications

This manual and the safety guidelines contained within it are designed to enable the user to obtain the best performance from the machine over a long lifetime and to ensure the safety of the operator. Each person who will operate the equipment, perform a service or maintenance, or supervise its use must read the safety instructions in this manual. Please read it carefully before using or working on the machine.

The machine is a 3-axis router designed to cut and shape a variety of materials using either vacuum or manual clamping. The correct method of using these mechanisms is covered elsewhere in the users manual.

Ensure that you have read and understood the operational and health and safety sections of the manual before beginning to use the machine.

The machine has been designed and constructed to prevent the build-up of electrostatic charges during operation.

The machine is not intended for use in an explosive environment.

ALWAYS CONSULT SEPARATE MANUALS FOR ANCILLARY DEVICES SUCH AS OSCILLATING TANGENTIAL KNIFE HEADS AND GANG DRILL HEADS FOR SAFE OPERATION.

Placement of the Machine and machine attachments

The machine must be placed with consideration given to the following;

- The actual floor space required by the machine and associated accessories and attachments.
- Adequate free air flow around vacuum pumps to reduce the risk of overheating.
- How you intend to move material to and from the cutting surface.
- OH&S requirements in relation to safe work practices. Refer to AS4024 & AS1473 for specific details in regards to placement of machinery. We recommend a minimum of 1meter of space around the machine. The amount of space left behind a machine, especially when placed in close proximity to a wall, must be sufficient so that workers, and our technicians can have safe and unobstructed access to allow for service and maintenance.

General Requirements

Noise Emission

The noise level produced by the machine will be dependant on;

- the material being cut
- ancillary devices being used (knife heads, drill heads etc)
- attachments to the machine (vacuum pumps, dust collectors, air compressors etc)
- the individual workplace environment.

The appropriate health and safety regulations must be consulted when considering the location of the machine in the workplace, any sound-proofing or acoustic enclosure to be erected, or the provision of personal protective equipment (PPE) in the form of hearing protection.

A noise survey and specific risk assessments should be undertaken by a competent person in each workplace and for each work situation and material being cut, but in general the noise levels produced by the machine may be found to be in the region of the following readings:

Equivalent continuous A-weighted sound pressure level, LAEQ above 90dB (A) when machining aluminium.

Equivalent continuous A-weighted sound pressure level, LAEQ above 90dB (A) when machining medium density fibreboard (MDF).

There is not normally any impulsive noise from the machine.

It is recommended that precautions are taken against injury to machine operators and others from long-term exposure to noise, either by:

- enclosing the machine in an acoustic enclosure or booth fitted with closing doors
- requiring the operator, and other persons working or having cause to be nearby, to wear a suitable form of hearing protection.

Suitable mandatory hearing protection signs should be displayed on or adjacent to the acoustic enclosure or in the zone where the machine is located. The wearing of adequate protective equipment should be enforced.

Operating Temperatures

The machines are designed to be operated between temperatures of -5°C and +40°C.

During operation machine components such as spindles, vacuum pumps and cutting tools will become hot. Care must be exercised when coming in to contact with these or any other items likely to become affected by heat.

Vacuum Pumps:

Vacuum pumps expel hot air at high velocity. Adequate provision must be made to allow for the safe and unrestricted expulsion of the exhaust air. DO NOT

- block the exhaust manifold
- place objects in close proximity to the exhaust air
- place vacuum pumps in confined spaces
- touch the surface of the vacuum pump as it will become hot during operation resulting in burns and scalding

Materials Suitable for Cutting

The machine is designed to cut, engrave and form a wide range of materials, as detailed below:

- Plastics - all plastics can be cut, including the 'hard' plastics such as polycarbonate.
- Woods -the majority of wood-based materials can be readily cut, including MDF, plywood and other composite boards.

Note. When cutting some types of hard wood, e.g. mahogany, jarrah etc an appropriate form of jiggging will need to be considered.

- Metals - aluminium, brass and other soft metals can be readily cut. The hard metals such as stainless steel can be cut, but due care must be taken regarding the depth of cut, feed rate and cutter used. If in doubt, consult an appropriate person or the manufacturers agent or machine supplier.

Other hard materials, such as carbides, should not be cut on the machine due to the risk of damaging the machine or endangering the operator.

Note. When cutting metals a suitable lubricant should be used.

- Foams - all foam-based materials, such as sign foam, can be readily cut.
- Composites and Laminates - some composites and laminates, such as fibreglass, can be cut. Please contact the manufacturers agent or machine supplier for more information.

Dust Extraction

Dust may be produced during machining operations and this may introduce a risk of fire or exposure of the operator to a hazardous substance. A suitable form of local exhaust ventilation (LEV) must be fitted to the machine to remove machining dust. Outlets for extraction hoses are fitted to the dust pickup head supplied with the machine. The hose must be firmly secured to the fitting.

Note. Always ensure that the extraction system is clear of obstructions and is in correct working order before using the machine. On dust extraction systems with manual cleaning devices follow the manufacturers recommendation for regular cleaning. Filters should be cleaned daily.

Corrosion

Some of the components of the machine may be subject to corrosion in unfavourable conditions. The machine should be used in a dry, moisture free atmosphere and should not be exposed to water-based fluids or lubricants. The machine should not be exposed to acidic or alkaline substances and it should be maintained in accordance with the servicing schedule.

General Safety Rules

WARNING
**Machine must only be operated by
persons trained and accredited by
Multicam Systems**

It is essential that these instructions are made available to the machine operators. It is also important to hand them on if the machine is sold or given to another user.

The machine should only be used by a suitably trained operator. Other personnel within the organisation should be aware of the methods to stop the machine in an emergency.

The machine is intended for use solely as a 3-axis router and cutter of materials. It should never be hammered on, nor used as a general workbench, or for any other purpose than that for which it was designed. This is likely to damage the machine and may compromise operator safety. It may also void the manufacturers warranty.

The machine must not be operated after the consumption of alcohol or the taking of any medication or drugs which may cause drowsiness or loss of attention.

Machine must only be operated with all safety guarding in place. The machine cutting heads including spindles and oscillating knife heads are supplied with safety guarding. Do not operate the machine with safety guards removed. Do not activate clamping systems unless it is safe to do so. Ensure all clamping devices are clear of obstruction and that machine operators or other personnel cannot be injured prior to activating the device.

All emergency stop devices must be in full working order before operating machine.

We STRONGLY RECOMMEND that safety mats, laser safety curtains or other safety barrier devices be fitted to machines with a process area exceeding 3600mm in length or are fitted with aggregate head attachments or any other attachment that can pose a safety risk. Safety interlock outputs are available on the controller for the connection of these devices.

Machine must not be operated with danger or non-operation tags in place.

The machine must not be left unattended whilst in operation.

Personal Protective Equipment

It is recommended that the operator, and other persons working in the vicinity of the machine, use the following personal protective equipment in conjunction with the machine:



- Hearing protection
- Eye protection
- Gloves when handling materials to be machined
- Cut proof gloves when changing router bits, knife blades or other cutting tools.

Note: The supply and wearing of personal protective equipment is regulated by Workcover.

Safe Operation of Machines

The machine must only be operated by persons trained and accredited by Multicam Systems.

The machine should be operated only in a well-lit environment in order that the operator can monitor the working of the machine and carry out safe loading and unloading. If the workplace is poorly lit, then additional lighting will need to be provided.

The machine's safety devices should be checked regularly for correct operation, e.g. the emergency stop mechanism and guarding.

When the machine is running, keep clear of any rotating or moving parts, e.g. the cutting bit, spindle, moving gantry and head parts.

Do not stand or lean on the machine whilst it is in operation. No persons other than the operator, or other authorised persons, should enter the working area whilst the machine is in operation.

Parts of the machine, particularly the cutting bit, may become hot during use. Take care when handling these parts and wear protective gloves if necessary.

Prior to operating the machine the following safety checks must be performed:

- Ensure that there are no tools or materials left on or near the rack and bearing rails of the gantry and the axis of movement.
- Ensure all guarding is in place including dust extraction devices. The machine cutting heads including spindles and oscillating knife heads are supplied with safety guarding. Do not operate the machine with safety guards removed.
- Ensure that all clamping systems are free of obstructions and that no other personnel are likely to be injured or engaged prior to activating the clamps.
- Ensure that all tools have been removed from the cutting area.
- Ensure that the guards are in place and correctly positioned.
- Ensure that the material being cut and the sacrificial board is no wider or thicker at any point than the width and height under the gantry and does not impede the movement of the gantry.
- Ensure that all cutting tools to be used are sharp and in correct working order.
- Ensure that the filter for the vacuum pump is clean and that the correct vacuum valves are On/Off and are clear of any obstructions.
- Ensure that there is at least 500mm of clear open space around the machine.
- Ensure that all electrical and air supply components are in correct working order and have not been damaged in any way.
- Ensure that the vacuum pump inlet/outlet ports and pressure release valve are not covered.
- Ensure that the area around the machine is clean and free from obstructions which could lead to slips, trips or falls.
- Ensure that tools are correctly fitted in to collets and that collets are free from wear or damage.
- Ensure that ISO tool holders are in good condition and are free from wear or damage.
- If manually changing tools in a quick tool change motor ensure that the tool holder is correctly engaged in the motor. Do this by firmly grasping the nut on the tool holder and pulling in a downward and sideways movement and checking for looseness. If you are able to "wobble" the tool holder it is not correctly engaged.

It is recommended that checklists are used and logged at the end of each shift.

Safety During Maintenance

Changes or additions to the main electrical system in connection with the installation and operation of the machine should always be carried out by a suitably competent and licenced electrical engineer.

Repairs carried out by untrained or unauthorised personnel may result in personal injury or serious malfunction and damage to the machine.

Do not alter or modify the specification of the machine as this may introduce an uncontrolled hazard or risk.

Servicing and maintenance of the machine should be carried out on a regular, planned basis and by a trained and authorised engineer.

Before working on any component or part of the machine always isolate the machine from the mains electrical and air supplies. These should be locked off.

Safety During Cleaning

To maintain optimum performance and obtain the longest service life from the machine, it must be cleaned regularly, either with a vacuum cleaner or a suitable cleaning solution. When cleaning, the machine must not be in operation. Compressed air must not be used to clean down the machine due the risk of particles being blown into the eyes or working parts of the machine.

Do not use pressurised jet washers or free flowing liquids to clean the machine. These will damage the machine.

Warning Labels

The following chart details the warning signs and labels and their locations on the machine. They are designed to assist and remind the operator to exercise caution when approaching the machine and the working area.

Operators should read carefully and take due note of the warnings and instructions for safe operation before operating the machine.

In addition to the warning labels on the machine the workplace should also be adequately signed for the wearing of personal protective equipment, e.g. eye and hearing protection, and the zones where these precautions are necessary clearly marked.

HAZARD NOTICE TABLE		
Hazard	Requirement	Location
Hearing Protection	Mandatory	On the Machine Head
Eye Protection	Mandatory	On the Machine Head
Electrical Power	Warning	On the Inverter Box
Electrical Power	Warning	On the Controller Box
Electrical Power	Warning	On the Power Box
Cutting Hazard	Warning	On the Machine Spindle On Knife head attachments
Emergency Stops	Mandatory	On both ends of the Gantry
Air Pressure	Warning	On the Machine Frame
Striking	Warning	On the X axis Bearing Cover
Striking	Warning	On the Tool Changer Cover
Striking	Warning	On the Machine Head
Pinch Point	Mandatory	Near clamp activation switch
Cutting Hazard	Mandatory	On the Spindle pickup housing On Knife head attachments
Position or appearance of labels may vary in accordance with devices that form part of the work cell. Always observe all safety labels and advisory notices.		

Note. The warning labels must not be removed from the machine.

Safety Rules

WARNING
**Machine must only be operated by persons trained
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MANUALS. Always read the appropriate manual or instructions before attempting to operate or maintain equipment. Make sure that you understand all instructions.

CORRECT SUPERVISION. When in doubt as to the correct way to operate the equipment always consult your supervisor.

OPERATION OF EQUIPMENT. Do not operate equipment unless maintenance has been performed on a regular basis, and the equipment is known to work properly. Do not operate the machine with safety guards removed. The machine must not be left unattended whilst in operation.

EMERGENCY SWITCHES. Ensure that you know where all emergency switches and stop buttons are, and you know how to isolate the machine from the main power supply.

WARNING NOTICES. Do not remove any of the warning notices or mandatory signs from the machine. Ensure that you comply with all such information.

SAFETY DEVICES AND GUARDS. Inspect all safety devices and guards to be certain that they are in good condition and functioning properly before any operation. The machine is supplied with guarding required for safe operation. Do not use the machine unless safety guards are in place.

HAZARDOUS CONDITIONS. Do not operate the machine if unusual or excessive heat, noise, smoke or vibration occurs. Switch off the machine and report any unusual occurrence.

EARTHING. Ensure that the equipment is properly earthed. The equipment contains digital signal systems, which are effected by electrical spikes and noise.

ELECTRICAL ISOLATION. Before any repair or maintenance work is undertaken on the machine ensure that the main electrical power is fully isolated.

MAINTENANCE WORK. Do not reach into any control or power box unless the electrical power is turned off, do not touch any electrical equipment if hands are wet or when standing on a wet surface.

AUTHORISED PERSONNEL. Do not allow unauthorized personnel to have access to electrical enclosures containing electrical equipment. Do not allow untrained personnel to operate or repair the equipment.

REPLACEMENT EQUIPMENT. Always replace blown fuses with fuses of the same rating, size and type as the original.

PERSONAL PROTECTIVE EQUIPMENT. Wear the correct safety glasses, ear protection and foot protection at all times.

LOOSE EQUIPMENT. Do not operate any machine while wearing rings, watches, jewellery, loose clothing, neckties or untied long hair.

SAFE WORKING AREA. Keep the area around the equipment well lit, dry and free from external obstructions and waste material.

FLAMMABLE EQUIPMENT. Keep chemical and flammable material away from electrical or operating equipment.

FIRE EXTINGUISHER. Always have the correct type of fire extinguisher ready when machining combustible material and keep chips clear of the work area.

MACHINE OPERATION. Do not operate any equipment while anyone is close to any potentially hazardous area.

PINCH POINTS. Always beware of pinch points created by moving components of equipment including automatic, semi-automatic or manual clamping devices.

LOOSE TOOLS AND EQUIPMENT. Remove any loose parts, work pieces, or tools left in the operating area of the equipment, which may come into contact with moving machinery.

WASTE MATERIAL. Do not remove splinters, chips, swarf or waste material with bare hands. Beware of sharp and burred edges on newly machined work pieces.

ADJUSTMENT OF MACHINERY. Do not adjust tooling or misters or extractor hoses while the machine is running.

CUT MATERIAL. Do not attempt to remove any cut material while the machine is running.

BRAKING OF MACHINERY. Do not attempt to brake or slow down the machine with your hands or any foreign device.

CUTTING TOOLS. Be cautious when working around cutting tools, their cutting edges are very sharp and can cause injury.

MOUNTING TOOL SURFACES. Make certain that all tool-mounting surfaces are clean before mounting tools.

LOADING AND UNLOADING THE MACHINE. Ensure correct manual handling procedures are observed when loading and material and product from the machine. DO NOT attempt to remove items from the machine bed whilst the machine is in operation.

ALWAYS THINK SAFETY FIRST

Job Design Considerations

Before designing a job for cutting on the machine there are a number of factors that must be taken in to account. A designer must always consider how the component is to be produced using the machine, tooling and materials available. Sometimes the design requirements will place demands on the tooling that could lead to undesirable practices such as the use of small diameter or extra long tooling. These must be avoided as far as practicable and attempts should be made to alter the design to reduce these practices.

It is essential that when designing a job for manufacture the programmer is conversant with the machine capabilities, characteristics of the materials being cut and the available tooling.

In cases where there is no control over the design of the component to be cut then the overriding consideration must then be to the safe and efficient cutting of the component. The order of priority of these considerations will be dependent upon the nature of the job.

Physicality of the component

The physical nature of the component (i.e shape and material to be used) to be machined will determine factors such as;

- work holding
- cutter selection (diameter, length, flute geometry)
- cutting speeds and feed rates
- number of cutting passes
- edge finish

Work Holding

The material to be cut must be safely secured to the machine bed. The use of jigs or manual clamping methods may be required depending on the size and shape of the item to be machined and the material it is to be cut from.

If using vacuum tables the operator must ensure that minimal "leakage" is present to maximise the effectiveness of the system. If too much leakage is present then materials and components may move during the cutting process. The number and size of through cuts, the size of the component being cut, the condition of the sacrificial board, the speed of cut and diameter of the cutter being used will all influence the performance of the vacuum system.

If using manual clamping methods or jiggling, consideration must be given to the placement of clamps, height of clamps, number of clamps and proximity of clamps to machining paths. The programmer and machine operator must ensure that travel clearance heights and clamp location will not cause the cutter or any other part of the machine to strike any of these items.

If automatic, semi-automatic or manually activated clamping devices are fitted to the machine, care must be exercised to ensure that there is no risk of injury or engagement with the devices by operators or other persons.

Cutter Selection

Choose a cutter that is appropriate for the material to be cut and the edge finish required. Use of a tooling catalogue will assist in this process. The number of flutes, the flute profile, the direction of the flute will all affect speed of cut and edge finish. There will always be a trade off in speed of cut, edge quality and cutter life that should be considered in your production process.

Always use a cutter with the shortest possible length to safely machine the part. This will assist in reducing breakage, vibration and wear. It will also aid in increasing cutter life and improving edge finish. As a general rule the cutter edge length (CEL) should not be greater than three times diameter of the cutter, however tooling manufacturers do produce cutters that exceed this for specialist operations.

For a detailed explanation of cutters and their use refer to your cutter supplier catalogue. Cutter manufacturers offer technical specifications and recommendations for their products.

Cutting Speeds and Feed Rates

These are determined by the following factors

- Material to be cut
- Edge finish required
- Cutter selected
- Machine properties
- Production requirements
- Cutter life span
- Work holding method

The order of priority of these factors is the responsibility of the Production Manager and is usually made on a job by job basis. Sometimes speed of production will outweigh the importance of edge finish or vice versa. The programmer must be made aware of these requirements prior to programming the job for the machine.

In determining cutting speeds and feed rates the machine operator and programmer need to know the cutting properties of the material being cut. This information is obtainable from the material supplier who can usually provide chip thickness information and optimal cutting rates.

Tooling manufacturers can provide specific cutting data for their tooling.

Obviously it becomes impractical to look up this information every time you commence a job. For this purpose we have provided general information and a cutting table in this manual on page [99](#).

Most tool catalogues will also have this type of information for quick reference.

Number of Cutting Passes

The number of cutting passes required is determined by the following factors;

- Depth of cut
- Diameter of cutter in use
- Material being cut
- Edge finish

The order of priority of these factors is the responsibility of the Operator and Production Manager and is usually made on a job by job basis. Sometimes two passes at a high feed rate will actually produce a shorter cycle time than a single deeper pass that requires a reduction in feed rate. The programmer must be made aware of these requirements prior to programming the job for the machine.

Edge Finish

The quality of the edge finish is determined by the following factors;

- Requirement of the finished product
- Depth of cut
- Diameter of cutter in use
- Material being cut
- Wear of the cutter

The order of priority of these factors is the responsibility of the Operator and Production Manager and is usually made on a job by job basis. Sometimes the edge finish is paramount in the final product so all care is taken to ensure this result. On other occasions edged finish can be sacrificed for the sake of higher productivity. The programmer must be made aware of these requirements prior to programming the job for the machine.

A reduction in edge finish can generally be attributed wear on the cutting edge of the cutter. When this becomes apparent the cutter must be replaced to prevent sudden and unexpected breakage.

Cutter and Collet Usage

Handling Cutters

- Cutters are extremely sharp. Extreme care must be observed when handling cutters to prevent injury. The use of gloves is recommended.
- Always store cutters in their cases when not in use
- Always wear protective eye wear when handling cutters.
- Do not drop cutters as this can cause micro fractures leading to unexpected breakage once in use.

Inspecting Cutters

- Before using a cutter inspect it for any sign of damage or wear.
- Cutters that show chipping on the edge must not be used.
- Cutters with scored, bruised or marked shanks must not be used.

Determining Cutter Life

The life expectancy of any cutter is directly affected by the following factors;

RPM

Cutters running at too high an RPM will wear prematurely due to excessive heat and friction. Typically this can be observed by very fine chips, squealing whilst cutting, burring along the top of the cutting edge, “loading” of material in the cutter flutes (especially in non ferrous materials) or burning on the cutting edge, especially in corners.

Running a cutter at too low an RPM will result in breakage.

Feed Rate

Cutters running at too low an feed rate will wear prematurely due to excessive heat and friction. Typically this can be observed by very fine chips, squealing whilst cutting, burring along the top of the cutting edge, “loading” of material in the cutter flutes (especially in non ferrous materials) or burning on the cutting edge, especially in corners.

Running a cutter at too high a feed rate will result in poor edge finish and cutter breakage

Vibration

Excessive vibration during the cutting process will affect cutter life and edge finish. Steps should be taken to ensure that the workpiece is as rigid as possible. This will include keeping cutter length to a minimum, using as large a cutter diameter as possible, ensuring adequate work holding. In some cases, especially when machining extrusions, vibration will be difficult to control.

Collets

Worn or dirty collets will mean that the cutter is not being held securely thus resulting in vibration and breakage. Ensure collets are clean and replaced at the end of their duty cycle. Please refer to page [193](#) for further information on collet maintenance.

Vacuum Pump Operating Information

To protect the vacuum pump from premature failure it is important that the following procedures be adhered to;

Maximum Pressure

The maximum allowable pressure is not exceed -40kPa. Exceeding this value will cause the pump to overheat causing severe damage and voiding warranty.

Operating Temperature

The vacuum pump surface will become extremely hot during operation. Care must be exercised when coming in to contact with the surface of the pump or any other items likely to become affected by heat.

Vacuum pump performance is affected by the ambient and inlet temperatures. Vacuum pumps must not be operated where the inlet temperature exceeds 50°C. As the inlet temperature approaches 40°C the vacuum pump must operate at a reduced duty cycle allowing time for adequate cooling of the pump between cycles. Duty cycle is determined by ambient temperature. The higher the ambient temperature the shorter the duty cycle.

Vacuum pumps expel hot air at high velocity. Adequate provision must be made to allow for the safe and unrestricted expulsion of the exhaust air.

DO

- ensure that there is adequate space around the vacuum pumps to allow a free flow of air on all sides. We recommend a least 1m of free, unobstructed space on all sides.
- keep vacuum pumps clear of debris.
- check correct function of relief valve regularly.
- consult with specialists if you intend to duct exhaust from the pump. Incorrect ducting will affect vacuum pump performance and can lead to failure of the pump and overheating leading to injury or fire.

DO NOT

- exceed the maximum operating pressure.
- exceed the maximum inlet operating temperature.
- block the exhaust manifold.
- place objects in close proximity to the exhaust air.
- place vacuum pumps in confined spaces.
- enclose the vacuum pumps in enclosed spaces.
- place vacuum pumps under machines unless absolutely necessary. This will result in limited air flow around the pump causing premature failure and a drop in performance and cause surrounding machinery to become affected by heat.
- touch the surface of the vacuum pump as it will become hot during operation resulting in burns.
- move the vacuum pump from its originally installed location.

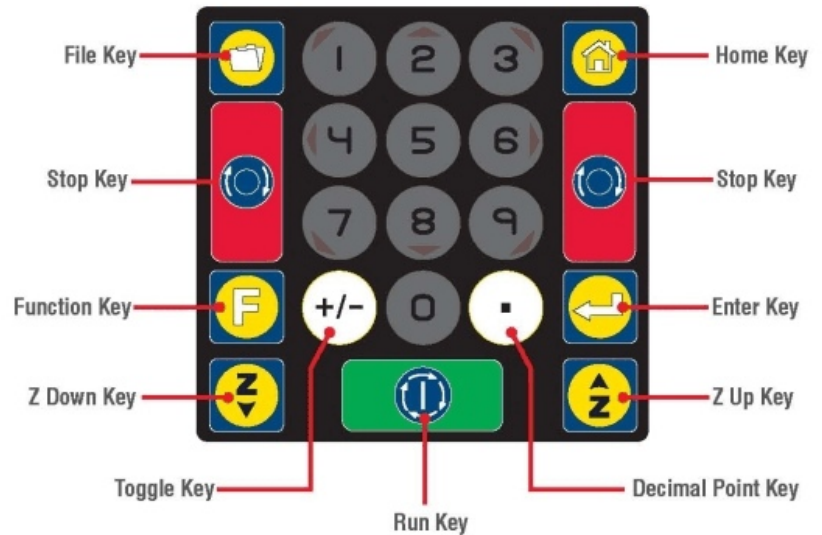
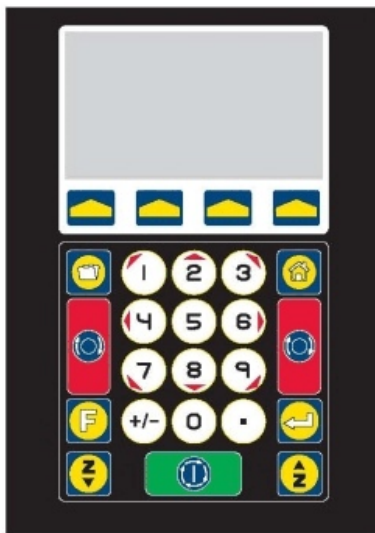
Failure to follow these instructions will void your warranty

SMART Console Quick Reference Guide



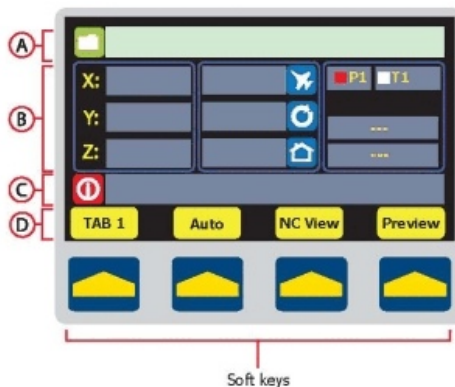
QUICK REFERENCE GUIDE

SmartConsole Keys



SmartConsole General Navigation Interface

A - File Display C- Information Display
B - Tab Modes D - Navigation tabs



FILE KEY:

Press to cycle through the list of jobs making the displayed job active.



RUN KEY:

Press to start the active job. See below, RUNNING A JOB.



FUNCTION KEY:

Access all of the machine functions, also takes you out of a FUNCTION.



ENTER KEY:

Pressing completes a function, or numeric value input. During the start sequence, press ENTER to select the starting shape.



STOP KEY:

Press to stop machine movement and pause the running job. Press start to resume job.



TOGGLE KEY:

In jog mode, toggles between FAST, MEDIUM, SLOW and INCREMENT. Use it also to enter negative numbers.



DECIMAL POINT KEY: Add Decimal points.



TAB KEY: Navigation between screens.

SMART Console Quick Function Guide



QUICK FUNCTION GUIDE

Function 1 Machine Properties



Displays the A2MC CE version, the FPGA version and the A2MC IP Address.

Function 5 Execute M-Code



This function executes M codes exactly as if it was in a NC file.

Function 6 Execute G-Code



This function executes G codes exactly as if it was in a NC file.

Function 9 Delete/Abort Job



Ends the running of the NC file at the current position in the file.

Function 10 Set user XY origin (G55)



This sets the G55 origin and makes this origin the active origin.

Function 11 Choose Current Origin (G54 to G59)



This function selects the current machine origin.

Function 12 Seek machine origin (G54)



Head will seek first the Z axis sensor then the X axis sensor and then Y. Origin will be set to G54.

Function 13 Seek origin

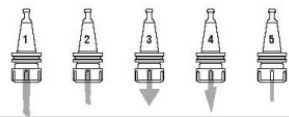


Head will return to active origin.

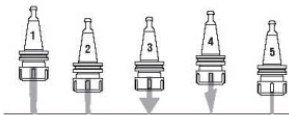
Function 25 Set tool Heights



Sets up the tool height for a specified tool.



Before F25



After F25

Function 31 Change current tool



Is used to change the active tool.
F31.1 - Tool 1 is active.
F31.2 - Tool 2 is active.

Function 32 Load ATC Tool



Is used to load a specified tool into either the 21G or rotary tool changer.

Function 41 Set feed rate



Set speed in in/min or mm/sec.
Positive numbers 0.1 min to max. speed.

Function 45 Plunge Speed



Set speed of vertical plunge into the material. Positive numbers 0.1 min to max. Plung speed. Use in/min or mm/sec.

Machine Start-up and Shut-down Procedure

WARNING
**Machine must only be operated by persons trained
and accredited by Multicam Systems**


In order to comply with safety issues it is important that the correct start-up and shut-down sequence is followed. These procedures are designed to ensure operator safety and machine longevity.

Start-Up Procedure.

- Ensure all safety guards are fitted to the spindle or knife heads.
- Turn on the air supply to the machine.
- Turn on the power to the machine.
- Turn on the machine



After boot up procedure is completed the display will read;

**Seek X, Y Origin (G54).
Press Enter**

Press  the machine will travel to its true 0,0 origin.

The display will read;

Warm up spindle? Yes

Use the  key to select Yes or No then  by selecting Yes the spindle will run for 10 minutes then stop.

Note: During the warm up cycle the spindle RPM will reach 9000. To stop warm up cycle once it has commenced press the  key.

After the warm up cycle has been completed the machine will move to its programmed home position (G56)

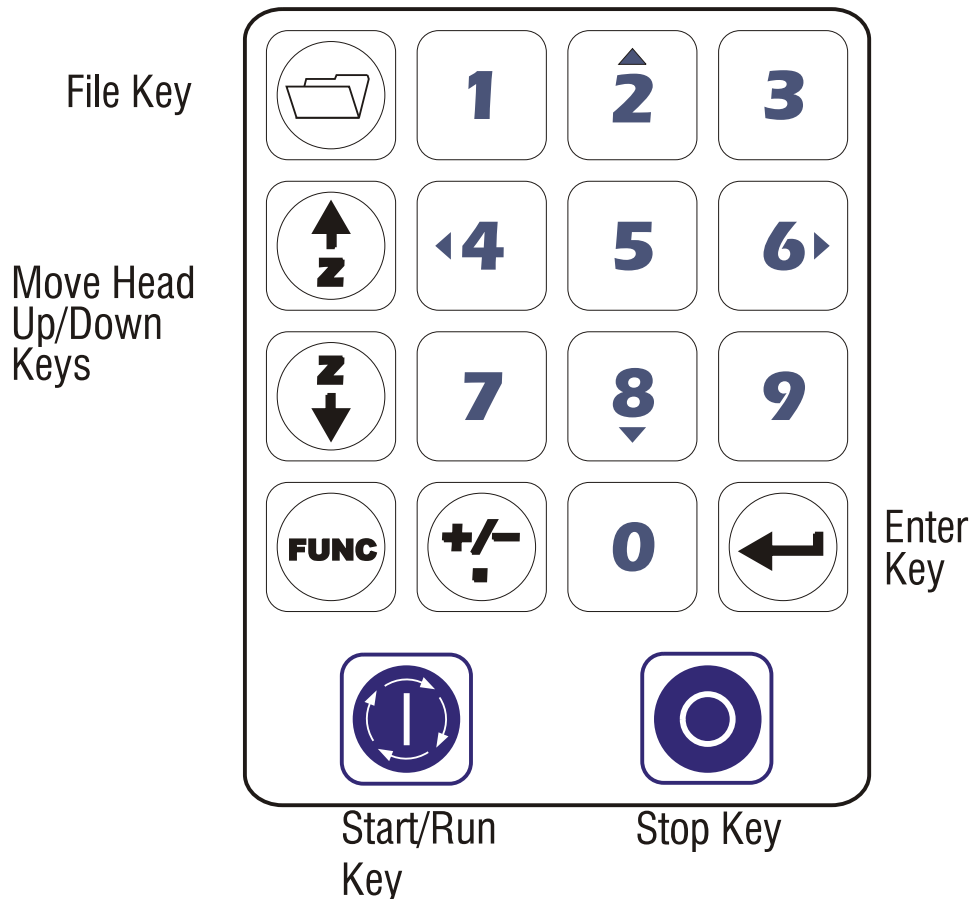
Shut-Down Procedure.

- Remove any tools from the spindle using Function 34
- Turn off the power to the machine.
- Turn off the air supply to the machine.
- Clean down the machine bed.

User Guide

This user guide is designed to help the operator to communicate with the machine across a console with multiple functions.

Sub Console Overview



The operator uses the 18 keys on the operator console to control the machine. This console includes an LCD display that provides the operator with the essential and basic feed back and instructions. In addition to this display the A2MC also has a “big screen” output that can be displayed on an optional monitor.

There are four “console groups”:

1. Jogging
2. File Management
3. Running Jobs
4. Functions

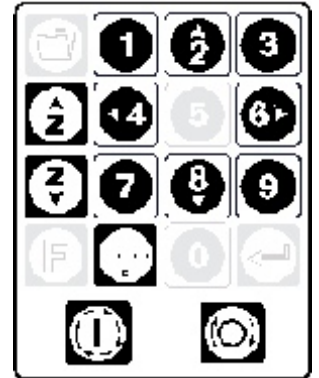
Each console group has associated keys that are briefly described below.

Note that many keys are used in more than one group.

Jogging Keys

These keys are used for jogging the machine. The machine can be jogged vertically (+Z and –Z), horizontally along either the X and Y axis as well as diagonally on the X and Y axis.

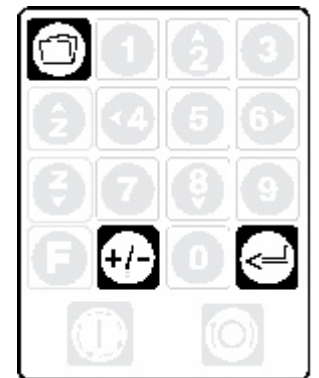
The **[+/-]** key is used to control the speed of the jogging (fast, medium, slow, incremental).



File Management Keys

These keys are used to select the current job file.

The file key is used to select the desired job. The **[+/-]** key is used confirm changing the job in the folder, and the **[Enter]** key is used to make the selected job the current job.



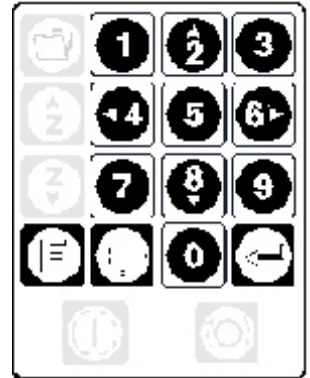
Running Job Keys

The start and stop keys are used to control the running of the current NC file.



Function Keys

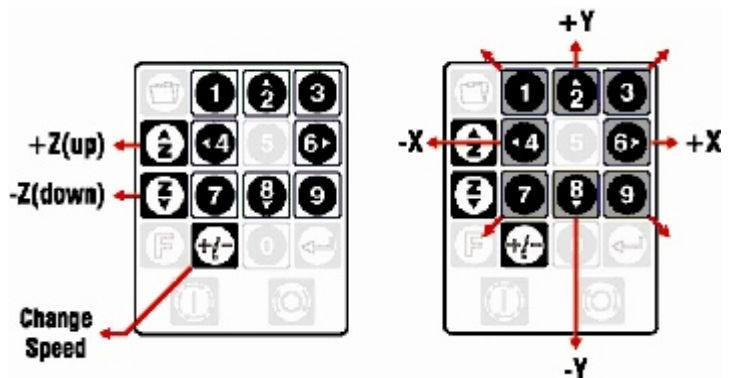
Functions are initiated using the function [F] key, the number keys, and the [Enter] key.



Jogging The Machine

The jogging directions are shown in the diagrams.

While jogging, the operator console display will show the co-ordinate of the active tool in the user units relative to the current origin.



X:125.00 Y:56.00 Z:22.05

Jogging Speed

The maximum jogging speed is programmed in the A2MC Configuration Utility in the Motion tab. Jogging speed can be controlled by the operator by pressing the [+/-] key:

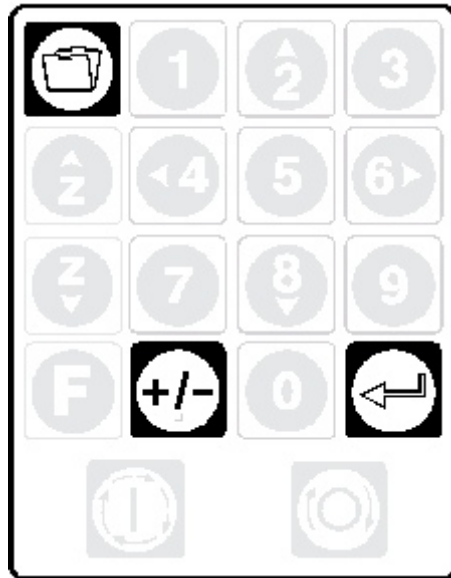
- Fast jog
- Medium jog (50% of fast jog)
- Slow jog (10% of fast jog)
- Step (each key press moves approximately 0.25 mm)

Jogging Limits

The machine will not jog outside the machine size limits unless limits are turned off using function 3.

If an attempt is made to jog outside the limits the machine will not move.

A2MC File Management



The A2MC runs NC file "jobs" that is stored in the jobs folder on the A2MC. The jobs folder is a shared folder and is visible on the network as:

A2MC-143344532\hdd1\release\jobs

Where A2MC-143344532 is the IP address of the A2MC.

In order to work correctly job files must have the extension ".nc" and be located in the jobs folder (main directory folder) or a sub folder of the jobs folder.

For example the following directory tree is a typical example:

```
\\A2MC-143344532
  \hdd1
    \release
      \jobs
        test1.nc
        multicam.nc
        plate.nc
      \Enroute
        side panel.nc
        end panel.nc
      \Customer1
        profile 1.nc
        profile 2.nc
```

This directory has seven jobs, three in the main directory (\jobs), and four more in two sub folders (\Enroute and \Customer1).

Creating Sub Job Directories


Directories/folders can be added or deleted by using any Windows browser or explorer and using standard windows functions such as "add folder", "delete folder", and "copy folder".

There is no restriction on the number of sub folders.

The folder's name can be any length but it is recommended that the name lengths be kept to 8 characters or less so that the full name can be displayed on the operator console screen.

Selecting an NC File


Normally the display will show the active job file:




(T1/G56) Test1

This display shows that the active tool is T1, the active origin is G56, and the active NC job is Test1.

Pressing the FILE key will simply toggle to the next job in sequence:



(T1/G56) Multicam



(T1/G56) Plate

Once the A2MC has toggled through the list of NC files in the main directory folder it will show the sub folders:



Folder Enroute(2)? No

This shows that there are two NC files in the Enroute sub folder. To access these files simply press the **[+/-]** key to indicate "YES" and press **[ENTER]**.

Pressing the File key will now toggle through the files in the sub folder.

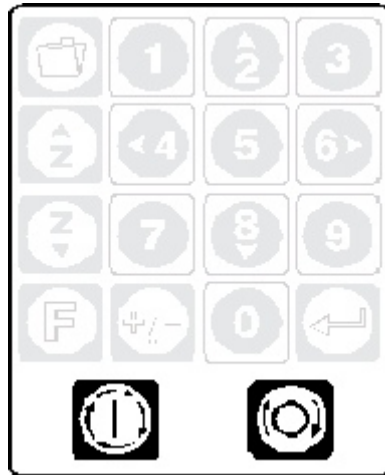
To return to the root folder simply toggle the FILE key until this display appears:



Main Directory? No

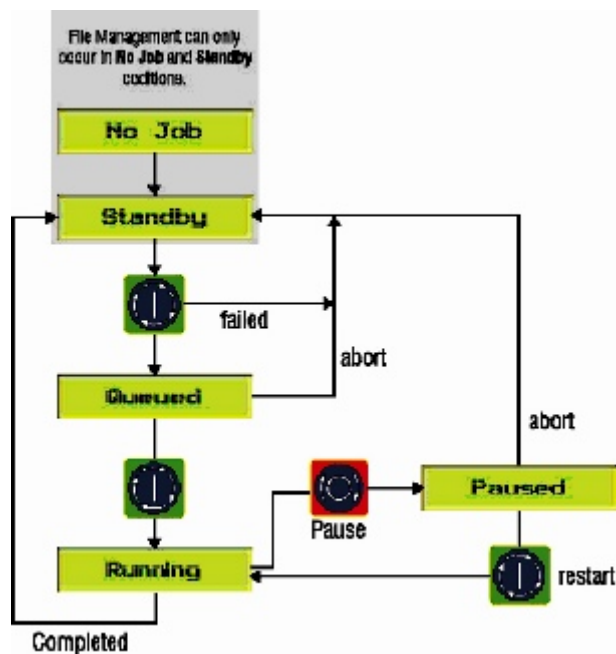
Use the **[+/-]** to select YES and press **[ENTER]** and the operator console will return to the main directory folder.

A2MC Running Jobs



The purpose of an A2MC machine is, of course, to run NC jobs. There are five job conditions:

1. No Job. This means no job has been selected and there is no current job.
2. Standby. A current job has been selected and is on standby to be run.
3. Queued. The current job has been initiated and the pre-run tests are completed and have passed. The job is ready to run.
4. Running. The current job is actually running and the machine is under control of the job's NC file.
5. Paused. The current job is paused and the processing of NC code is suspended pending either an abort or a restart.



No Job and Job Standby

The machine will power up in the "No Job" condition. The operator console display will show:



(T0) No Jobs

(T0) indicates that there is no active tool and "No Job" indicates that there is no current job.

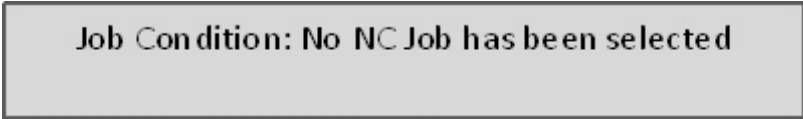
Using the instructions in the File Management section the operator will select an NC job to be current. This job will be considered to be on "standby". The operator console display will now show:



(T0) Folder\Testjob

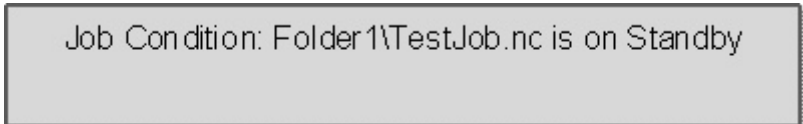
In this example "TestJob" from Folder1 is now on standby.

The Job Condition line on the A2MC GUI screen will show:



Job Condition: No NC Job has been selected

or



Job Condition: Folder1\TestJob.nc is on Standby

All the A2MC functions, file management features, and jogging features are fully functional in the No Job and Job Standby conditions.

Queuing a Job

A job is "Queued" by pressing the Start key when the current job is displayed.

The A2MC will perform the following tests on the job prior to putting it into the "Queued" condition:

1. Check all the M and G codes in the current job file to ensure that they are all valid codes and can be interpreted by the A2MC.
2. Check all the tools used in the current job file to ensure that they are all valid tools and are mapped in the system's tool map.
3. Check the boundary conditions of the current job and the active origin to make sure the job file will not cause the machine to exceed its limits. This particular test is not performed if the limits have been disabled using function 3. See the instructions on function 3.

While checking the NC job the console display and the A2MC GUI will track the testing progress:

Test 25% complete

Job Condition: Testing Folder1\TestJob.nc.25% Complete

Large files may take a considerable time to test so the operator may bypass the remainder of the test after a minimum of 1000 lines have been tested by pressing



If any of the tests fail the following Error Codes will be displayed:

- Error ??? Invalid M or G code found. The NC file must be reviewed for invalid codes.
- Error 4?? An invalid tool was found in the NC code.
- Error 1?? The NC file will cause the machine to exceed its limits.

Provided the tests pass or the operator has bypassed the tests the A2MC will change the job condition to "Queued".

**TestJob.nc: Ready
Press Start**

Job Condition: Folder1\TestJob.nc is queued and ready to run





Once a job is queued the only keys that can be used are the



to begin the job running or

to abort the job and return the current job back to "Standby".

Job Running


Once the current job is queued pressing  will turn over control of the machine to the content of the NC file. The commands in the NC file now control the machine and none of the features or functions of the operator console will work. The only key that will work on the operator console is the  key.

While the job is running the displays will show the NC line that is currently being processed:

N100 GO X50.23 Y230.35

Job Condition: Folder1\TestJob.nc is running NC Line: N 100 GO X 14.90 Y 23.456


The job will run until one of the following conditions occur:

1. The operator has pressed 
2. The NC code hits a programmed pause; M0.
3. The NC code hits a tool change command, M6, that requires a manual tool change.
4. The machine has run into a limit sensor.
5. The machine has detected an error with one of its devices.
6. The machine has run into NC code that it cannot interpret. This may occur if the queue tests were bypassed by the operator.
7. The end of the file was reached.


In the case of end of file the job condition will return to "standby". In all the other cases the current job condition will go to "paused" condition.

Job Paused

There are a number of reasons the running job be paused:

1. The operator has pressed 
2. The NC code hits a programmed pause; M0.
3. The NC code hits a tool change command, M6, that requires a manual tool change.
4. The machine has run into a limit sensor.
5. The machine has detected an error with one of its devices.
6. The machine has run into NC code that it cannot interpret. This may occur if the queue tests were bypassed by the operator.

In all cases the spindle will stop and the machine will be brought into a "safe" mode. The safe mode depends on why the machine stopped.

Under some pause conditions the job can be restarted by pressing  , in other cases the reason the machine stopped is because of a fatal error and the job cannot be restarted. In all cases the job can be or must be aborted by using function 9 and returning the current job condition to "standby".


Operator Pause

NOTE: The pause function is designed to temporarily stop a job so that some immediate inspection can be made. It must never be used to pause a job for extended periods such as shift breaks or overnight. In the latter cases you must abort the job rather than pause it.

This occurs when the operator intentionally presses the  key in order to pause the job.

**Paused on shape #
Press Start or F9 to abort**

During an operator pause the operator may:

- Use the jog keys.
- Use and execute "pause valid" functions such as functions 4, 25, 27, 41, and 45.
- Abort the job using function 9.
- Restart the job using the  key on the paused line shown on the display.

If restart is chosen the machine will automatically return to position at the beginning of the current NC line and restart the job from there. Note that this may not be the position that it was stopped as it could have been stopped partially through an NC line. It will do this portion of the line over again.


Programmed Pause (M0)

This occurs when the execution of the NC file reaches a programmed pause command, M0.

M0 Pause N100 M0

Job Condition: Folder1\TestJob.nc has been paused by M0 on line N100

During an M0 programmed pause the operator may:

- Use the jog keys.
- Use and execute "pause valid" functions such as function 4, 25, 27, 41, and 45.
- Abort the job using function 9.
- Restart the job using the  key on the paused line shown on the display.

If restart is chosen the machine will automatically return to position at the beginning of the next NC line and restart the job from there.

Tool Change Pause (M6)

This occurs when the execution of the NC program reaches a M6 tool change command where the tool change is manual.


M0 Pause N100 M0

Job Condition: Folder1\TestJob.nc paused for a manual tool change to T5

When a manual tool change is required the A2MC will:

1. Stop all the spindles.
2. Lift the required spindle to machine top.
3. Automatically move the machine to the machine origin (G54) so it is close to the operator for the tool change.

During an M6 tool change pause the operator may:

- Use the jog keys.
- Use and execute "pause valid" functions such as function 4, 25, 27, 41, and 45.
- Abort the job using function 9.
- Restart the job using the  key on the paused line shown on the display.

If restart is chosen the machine will automatically restart the spindles and return to position at the beginning of the next NC line and restart the job from there.


Limit Violation Pause

This occurs when the machine runs into a limit sensor or the limits of the machine

Error 47 Paused

Job Condition: Folder1\TestJob.nc paused due to limits violation. Error 47

During a limit violation pause the operator may:

- Use the jog keys.
- Use and execute "pause valid" functions such as function 4, 25, 27, 41, and 45.
- Abort the job using function 9.
- Restart the job using the  key on the paused line shown on the display.

If restart is chosen the A2MC will first check if the limit violation is cleared. If the limit violation is not cleared the error will be repeated. If it cannot be cleared aborting the job is the only option. If the limit violation can be cleared then the machine will automatically return to position at the beginning of the current NC line.

NC Code Error Pause

This occurs when the machine runs into an NC Code that is recognized.

NC Error??? Pause

Job Condition: Folder1\TestJob.nc paused due to NC Code error.

There are many possible NC Code error pauses that are identified by the error number.

Code errors cannot be cleared and the only option for the operator is to use function 9 and abort the job. The code must be corrected and the job re-run.

A2MC Functions Overview



The A2MC functions are divided into a number of groups:

1. Functions 0-9 are General User functions and enable the user to control the displays and modes of the machine.
2. Functions 10-19 are XY Co-ordinate functions and are used to set co-ordinates and origins in the XY plane.
3. Functions 20-29 are Z Co-ordinate functions and are used to set co-ordinates and origins in the Z axis.
4. Functions 30-39 are Tool Control functions and are used to manage the machine's tooling.
5. Functions 40-49 are Productivity functions that can be used to enhance the productivity of the machine.
6. Functions 50-99 are device specific features and functions.
7. Functions 100-199 are supervisor functions not generally available to the machine operator or user.
8. Functions 300-400 are device operation functions.
9. Functions 600-799 are diagnostic functions that can be used to monitor the machine operation.
10. Functions 800-899 are setup functions for peripheral devices.
11. Functions 900-999 are currently not assigned.

Functions 0-9 - General User Functions

A2MC Function	Description	Pause Valid?	Tool Param?
0	Not assigned		
1	Machine Properties	No	No
2	Verify job		
3	Machine Limits Control (Co-ordinate display)	No	No
4	A2MC General User Interface control		
5	Send M-Code	No	Yes
6	Send G-Code	No	Yes
7	Enable/Disable Machine's motors	No	No
8	Not assigned		
9	Abort job	Yes	No

Functions 10-19 - XY Co-ordinate Functions

A2MC Function	Description	Pause Valid?	Tool Param?
10	Set User XY Origin (G55 Origin)	No	No
11	Choose Current Origin (G54 to G59)	No	No
12	Seek Machine Origin (G54 Origin)	No	No
13	Go to current Origin	No	No
14	Not assigned		
15	Not assigned		
16	Set parking Position		
17	Not assigned		
18	Not assigned		
19	Not assigned		

Functions 20-29 - Z Co-ordinate Functions

A2MC Function	Description	Pause Valid?	Tool Param?
20	Set material height		
21	Not assigned		
22	Not assigned		
23	Not assigned		
24	Set Tool Height of tangential knife heads.	Yes	Yes
25	Set Tool Height	Yes	Yes
26	Set ATC Tool Heights	No	No
27	Set User Z Origin	Yes	No
28	Set and plane waste board		
29	Not assigned		

Functions 30-39 - Tool Control

A2MC Function	Description	Pause Valid?	Tool Param?
30	Edit Tools		
31	Change Current Tool	No	Yes
32	Load ATC Tool	No	Yes
33	Not assigned		
34	Unload tools	No	No
35	Set spacing (Dual carriage)		
36	Not assigned		
37	Not assigned		
38	Not assigned		
39	Not assigned		

Functions 40-49 - Job Productivity Functions

A2MC Function	Description	Pause Valid?	Tool Param?
40	Job Timer	No	No
41	Feed Speed	Yes	No
42	Spindle Control	No	No
43	Job Repeat	No	No
44	Job Array	No	No
45	Plunge Speed	Yes	No
46	Measured Move	No	No
47	Rectangle	No	No
48	Not assigned		
49	Delete Current NC File	No	No

Functions 50-99 - Device Specific Functions

A2MC Function	Description	Pause Valid?	Tool Param?
50	Vacuum Pump, Dust Collector and Mist Control	No	
50.1	Vacuum Pump, Dust Collector and Mist Control	No	
51	Digitise 2D & 3D Jobs	No	
52	Plasma Control - Not Implemented		
53	Laser Control - Not Implemented		
54	Safety Interlock		
55	Not assigned		
56	G41/G42 Compensation		
57	Not assigned		
58	Multi XML Control		
59	G41/G42 Modal Preset		

Functions 300-900 - Peripheral Device Specific Functions

A2MC Function	Description	Pause Valid?	Tool Param?
301	Set up material lifter, scraper and off loading table	No	
302	Use Material lifter, scraper and table	No	
303.1	Material Loader arm down	No	
303.2	Material Loader arm up	No	
304.1	Scraper arm up	No	
304.2	Scraper arm down	No	
305.1	Conveyer start	No	
305.2	Conveyer stop	No	
306.1	Material Lifter up	No	
307.1	Pop up pins activate	No	
307.2	Pop up pins de-activate	No	
311.1	Turn ON locking pin sensor for saw blade	No	
311.2	Turn OFF locking pin sensor for saw blade	No	
312.1	Turn ON X direction sensor for saw blade	No	
312.2	Turn OFF X direction sensor for saw blade	No	
313.1	Turn ON Y direction sensor for saw blade	No	
313.2	Turn OFF Y direction sensor for saw blade	No	
314	Set saw direction to X axis	No	
315	Set saw direction to Y axis	No	
320	Scraper Arm setup	No	
321	Use Scraper Arm	No	
801	Set Static IP Address	No	
810	Setup ATC	No	
821	Setup Tool tip sensor	No	
893	Co-Linear Filter value	No	

General User Functions

General user functions are numbered functions 0 through 9:

A2MC Function	Description
0	Not assigned
1	Machine Properties
2	Verify job
3	Machine Limits Control (Co-ordinate display)
4	A2MC General User Interface control
5	Send M-Code
6	Send G-Code
7	Enable/Disable Machine's motors
8	Not assigned
9	Abort job

Function 1 - Machine Properties

Displays version and connection information including the A2MC CE version, the FPGA version and the A2MC IP Address. It also shows version and connection status of modbus devices.

Function 2 - Verify Job

Function 3 - Machine Limits Control (Co-ordinate display)

Function 5 - Execute M-Code.

This function allows the user to execute M codes exactly as if it was in a NC file.

Function 6 - Execute G-Code.

This function allows the user to execute G codes exactly as if it was in a NC file.

Function 7 - Enable/Disable Machine's Motors.

This function will disable and re-enable the machine's motors.

Function 9 - Abort Job.

This function is used when during a job the user wishes to abandon the job. It simply ends the running of the NC file at the current position in the file.

Function 1- Connections and Versions

Function 1 is an information function providing the user with important connection and version information on the A2MC controller.

The valid entry for function 1 is simply:



Once inside function 1 there are a succession of screen displays. Each screen is accessed by pressing Enter.

1. A2MC software version number is displayed. For example "A2MC r3.745". This is the version number of the A2MC CE.exe which runs the machine and is installed on the A2MC controller.
2. If the A2MC is not connected to a network the display will show "No Network" and the display will resume to the point below, otherwise the connection IP address will be shown. For example "IP: 192.168.197.108". This is the connection IP address that the network has assigned to the A2MC controller. This is the address that must be used to communicate with the controller via the A2MC Setup utility or accessing the shared folders on the A2MC across a network. Note that this address can change if your network setup is altered.
3. Connection IP address. For example "A2MC-14494606". This is a unique address assigned by the A2MC controller. It will not change if your network setup is altered and can also be used to communicate with the controller via the A2MC Setup utility or accessing the shared folders on the A2MC across a network.
4. The machine serial number will be displayed. This is a unique production number for the machine and cannot be changed.
5. FPGA version number. For example "FPGA 4.5". The actual machine motion is directly controlled by the FPGA board which is part of the A2MC controller system. This version number identifies the firmware that is installed on this board.
6. Current Controller time and date will be displayed.
7. Odometer reading will be displayed. This is the distance the machine has traveled since manufacture.
8. Hours will be displayed. This is the number of hours the controller has been on since manufacture.

IP Address

The IP address is the way other computers can identify and communicate with the A2MC. The IP address is assigned by the network router when the A2MC is first connected to the network. This address is what is used when connecting with the A2MC Configuration Utility as well the address to access the shared folders on the A2MC.

Function 2 - Verify Job

This function is used to verify an NC file. It will scan through the file and check if the codes are understood and if the file stays within the boundaries of the machine.

Before entering function 2 use the FILE button to select the file you wish to verify.

The valid entry for function 2 is:



The display will read;

Fault Unknown G/M? No

Select YES if you want to present an error for unknown G or M codes. Select NO if you want to ignore unknown G or M codes.

Verify: Testjob? Yes

Select YES to begin scanning the file and verifying it. If successful the display will show;

Verify Successful.

This indicates that the file verification was successful and the file can be properly run.

If verification was not successful an error code will be displayed on the user console. Use the error code help files to help you determine exactly why the file failed.

Function 3 - Machine Limits Control (Co-ordinate display)

Normally the machine operates within the soft limits of the machine. Function 3 allows the user to operate outside of the soft limits and to change the display type from job name to co-ordinate readings.



Functionality

If the A2MC currently has soft limits enabled (default mode) then it will turn them off:

1. The operator display will show "Soft Limits Disabled" for two seconds or until the operator presses any key, whichever occurs first.
2. The display will go into co-ordinate mode showing the XYZ co-ordinate of the active tool and relative to the current origin. See function 31 and function 11 respectively.

If the A2MC currently has soft limits disabled then it will turn them on:

1. The operator display will show "Soft Limits Enabled" for two seconds or until the operator presses any key, whichever occurs first.
2. The display will go into Job Display mode showing the currently active NC job.

If the soft limits are disabled then:

1. The operator can jog the machine outside the soft limits right to the hard limits. The software does not know where the hard limits are so the operator can "smash" into the limits!
2. Jobs can also run outside of the soft limits. Limit checking before and during the running of a job is turned off. Running jobs with limits disabled is not generally recommended!

If the soft limits are enabled then:

1. The operator cannot jog outside the soft limits. The A2MC will display Error 47 if repeated attempts are made to jog outside the limits.
2. The system will check a job's extents and compare them to the soft limits prior to running a job. If the job will go outside the limits an error will be shown and the job will not be started. This is the recommended way to run jobs.

Common Uses

Generally the machine should always be left with the soft limits enabled however there are reasons to disable them temporarily:

1. The most common reason is to measure dimensions and positions with the machine. For example when measuring the position of the table surface sensor in order to enter the parameter into the A2MC Configuration Utility. Sometimes the required positions are outside of the soft limits.

Definition of Limits

The machine has hard limits which are literally rubber bump stops that mechanically prevent the carriage and gantry from running off the end of the machine. The machine's drives and motors will detect hard contact with these limits and automatically shut down the drives of the motors.

Although safe, hitting bump stops is not recommended on a routine basis and since the system will shut down any job or operation will be ruined.

The machine also has soft limits which are determined by a sensor on one side and a programmed "size" on the other. The size is programmed in the A2MC Configuration Utility in the "Calibration" tab.

The A2MC will track these soft limits and unless they are turned off with function 3 will prevent motion or jobs from operating outside these limits.

Function 5 - Execute M-Codes

This function allows for the direct execution of valid M-Codes from the operator console.

A valid entry is the function number followed by the  followed by the desired M-Code number:



This example will directly execute an M6 (change tool) command.

The A2MC will automatically execute the M-code command and display:

Executing M6

If an invalid M-Code is selected then the function will return an error.

Functionality

Most M-Codes that the A2MC accepts will be also valid for direct entry by function 5. The actual M-Codes are listed in the "A2MC G-M Code Guide"

Many M-Codes require additional parameters. For example M6 is not valid by itself as it requires a "T" parameter to identify the tool it needs to change to. In this case the display will show:

M6T:_

The operator will enter in the desired tool number.

Another example is:

M5S:_

The operator will enter in the desired spindle RPM.

Other M-Codes such as M3 (turn on spindles) do not require further parameters and will execute without further user interaction.

Common Uses

Some of the M-Code commands such as M6 and M5 are operator functions. For example changing tool can be done using Function 5 M-Code 6 then followed by the T number, however function 31 can be used instead and is likely easier to use.

However, many features and devices on the machine can only be used by executing M-Codes. Turning on the mister or firing a drill are examples. Rather than having to go and create and execute a whole NC file just to test if the mister is working the function 5 direct M-Code feature is used.

Function 6 - Execute G-Codes

This function allows for the direct execution of valid G-Codes from the operator console.

A valid entry is the function number followed by the  followed by the desired G-Code number:



This example will directly execute a G54 (set to machine origin) command.



This example will directly execute a G21 (operate file in metric) command.

The A2MC will automatically execute the G-code command and display:



This display will remain for two seconds or until another key is pressed, whichever is first. If an invalid G-Code is selected then the function will return an error.

Functionality

Most G-Codes that the A2MC accepts will be also valid for direct entry by function G. The actual G-Codes are listed in the "A2MC G-M Code Guide".

Some G-Codes such as G0 and G1 require X, Y, and Z co ordinates to be entered. In this case the user will be prompted with the following series of displays:



Enter Z:

For each co ordinate enter a value or if the value is to be zero then press enter without entering a value. Once all three co ordinates are entered the enter G command line will be executed.

Still other commands such as G2 and G3 will require further parameters such as "R". In this case a further display will appear:

Enter R:

The A2MC will actually create an NC job with the single line created in function 6 and execute it so whatever the command does in an actual job will also happen with this function.

Common Uses

Most features that are accessible using function 6 direct G Code can be done other ways using some of the productivity functions. However, drawing a circle (for example) is not available using a standard function so it can be achieved by using the function 6 features.

Function 7 - Enable/Disable Motors

This feature will simply disable the motors and reset the drives.

Valid Entry



Motors are disabled and drives are reset. Press Enter

Motors are re-enabled.

If the system is running on stepper motors the function will be valid but nothing will happen. Stepper motors automatically reset themselves and do not require this function.

Common Uses

The most common use is to reset a drive that has somehow crashed through hitting a hard stop or jamming on materials or a job. Overloading an axis will also crash the drive and require a reset.

Function 9 - Abort Job

This function allows the user to abort a job that is running.

Valid Entry



This function is only valid if a job has been running and is paused. It will do nothing while a job is running that is not paused or there is no job running at all.

Functionality

This function simply terminates a job that is running and raises all the spindles and positions to the machine top.

XY Co-ordinate Functions

A2MC Function	Description
10	Set User XY Origin (G55 Origin)
11	Choose Current Origin (G54 to G59)
12	Seek Machine Origin (G54 Origin)
13	Go to current Origin
14	Not assigned
15	Not assigned
16	Set parking Position
17	Not assigned
18	Not assigned
19	Not assigned

Function 10 - Set User XY Origin.

This is the old function 3 and sets the current user origin to the current active tool XY position. This also sets the G55 origin and makes this origin the current origin.

Function 11 - Choose Current Origin.

This function allows the user to select the current machine origin. This can be the machine origin set by function 12 (also referred to as G54 origin), user origin set by function 10 (also referred to as G55 origin), or one of four programmed origins set in the A2MC Configuration Utility (referred to as G56, G57, G58, and G59 origins).

Function 12 - Seek Machine Origin.

This function will cause the machine to seek the X, Y, and Z origins. It will set the current origin to the machine origin (also referred to as the G54 origin).

Function 13 - Go to Current Origin.

The machine will return the active tool from where ever it currently is to current origin. This could be origin G54, G55, G56, G57, G58, or G59.

Function 16 - Set Parking Position.

This function enables and sets the machine's parking position. If enable the machine will automatically go to the parking position at the end of job.

The "Current Origin" is defined as the origin that the machine is currently using.

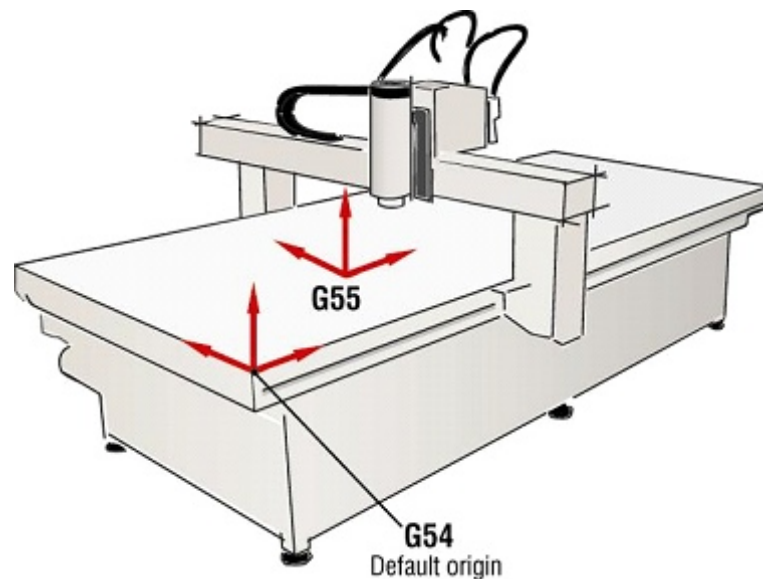
Using the Origins

The NC file can use G-codes G54 through G59 to specify different origins from which to reference NC files.

G54 is fixed by the machine at start up as the position of the X and Y machine sensor and for the Z axis is the table surface. This origin is reset by using function 12. Note that the G54 origin may actually be off the table surface if the machine has a cantilevered gantry.

(Sample file showing use of G54, G55, and G56)		
G54		Select machine origin
G0	X10Y10	Move to (10,10) relative to machine origin
G55		Switch to user origin defined by Function 10
G0	X10Y10	Move to (10,10) relative to user origin
G56		Switch to G56 programmed origin defined in A2MC Configuration Utility
G0	X10Y10	Move to (10,10) relative to G56 origin

If the NC file does not specify any origins then the current origin will be used.



G55 can be set by the machine operator by using function 10 for the X and Y co-ordinates and function 27 for the Z co-ordinate.

G56 through G59 are set in the "Origins" tab in the A2MC Configuration Utility. This utility will set all three co-ordinates (X,Y,Z).







Function 10 - Set User XY Origin

This function sets the User XY Origin (G55) to the current active tool XY position.

Valid Entry



Operation

1. Select the job to run.
2. Press A square key with a circular icon containing a vertical line and a horizontal line.
3. Type in    A sequence of four touchscreens: 'F', '1', '0', and a jog key.
4. Jog the machine to the lower left corner of the material you wish to cut the job in. This is also referred to as the G55 Origin.
5. Press A square key with a left-pointing arrow and a small 'L' in the bottom right corner.

The X and Y co-ordinates of the active tool will become X=0 and Y=0.

Once the job has been completed the G55 origin is no longer active.

On the status tab of the A2MC GUI the active tool co-ordinate will become X=0, Y=0 and the current origin will become G55.

Common Uses

Function 10 is generally used to move the origin to the start point of a piece material.

If a job is designed to fit on a sheet of material and the material is not necessarily placed on the origin of the machine then it is convenient simply to jog the machine over to the lower left corner of the material and enter function 10 to set the user origin. The current origin is moved to the corner of the material and the job can be run from there.

Note that if the job file has a G54 in it the current origin will be moved back to the G54 machine origin!

Function 11 - Choose Current XY Origin

This function allows the user to select the current origin. The A2MC controller can have up to six origins:

G54	Machine Origin	Fixed by machine and set by function 12
G55	User Origin	Set by machine operator using function 10*
G56	Programmed Origin 1	Set in A2MC Configuration Utility in Origin Tab
G57	Programmed Origin 2	Set in A2MC Configuration Utility in Origin Tab
G58	Programmed Origin 3	Set in A2MC Configuration Utility in Origin Tab
G59	Programmed Origin 4	Set in A2MC Configuration Utility in Origin Tab

* Function 10 sets the XY User Origin, Function 27 sets the Z User Origin.

Also see A2MC Configuration Utility manual under Origin Tab.

Valid Entry



The console display show the current origin, for example:

G54-Machine Origin

Pressing the  key will sequence through the origins in sequence:

- G54 - Machine Origin
- G55 - User Origin
- G56 - Programmed 1
- G57 - Programmed 2
- G58 - Programmed 3
- G59 - Programmed 4

The sequence repeats as long as the  key is pushed. The function exists by 
The last displayed origin will become the current origin.

Operation

On the status tab of the A2MC GUI the current origin will become whatever was selected in function 11.

			Position 2	Position 1
			Spindle	Spindle
X Position (G57)			25.00	0.00
Y Position (G57)			200.00	0.00
Z Position (G57)			135.00	157.00

Common Uses

Function 11 is used to select which origin is going to be used for a job.

Note that G54 through G59 in the NC file will over ride the current origin.

Function 12 - Seek and Set Machine XY Origin

This function seeks and sets the Machine XY Origin. This also resets the G54 origin and makes this origin the current XY origin.

At power up the A2MC will automatically execute a function 12 sequence followed by a function 10 sequence. This will set both G54 and G55 origins to the same place at the machine's origin.

Valid Entry



Operation

Once entered the function will:

1. Seek the Z sensor of the active tool.
2. Seek the X sensor by moving from the back of the machine towards the front.
3. Seek the Y sensor by moving towards the operator end of the gantry.
4. Sets the Machine XY Origin to the point where the machine found the X and Y sensors.
5. Sets the current XY origin to the Machine XY Origin (G54 Origin).
6. The tool in position 1 will become the active tool.

The X and Y co-ordinates of the active tool will become X=0 and Y=0. Note that the tool in position 1 will automatically become the active tool.

On the status tab of the A2MC GUI the active tool co-ordinate will become X=0, Y=0 and the current origin will become G55.

			Position 2	Position 1
			Spindle	Spindle
X Position (G54)			25.00	0.00
Y Position (G54)			200.00	0.00
Z Position (G54)			135.00	157.00

Common Uses

Function 12 is generally used to reset the machine origin and set the current origin to the machine origin.

Function 13 - Seek Current XY Origin

This function seeks the Current XY Origin and moves the active tool to that origin.

Valid Entry



Operation

Once entered the function will:

1. Seek the Z sensor of the active tool.
2. Move the active tool directly to the Current XY Origin.

The X and Y co-ordinates of the active tool will become X=0 and Y=0.

On the status tab of the A2MC GUI the active tool co-ordinate will become X=0, Y=0. In this example the current origin was the machine origin (G54) and the active tool is (T1) in position 1.

			Position 2	Position 1
			Spindle	Spindle
X Position (G54)			25.00	0.00
Y Position (G54)			200.00	0.00
Z Position (G54)			135.00	157.00
Active Tool			T4	(T1)

Common Uses

Function 13 is generally used to move the active tool back to the current XY origin in order to start another job.

Function 16 - Set Parking Position

This function enables and sets the machine's parking position. If enabled the machine will automatically go to the parking position at the end of job.

Valid Entry



Operation

Enable Parking? No

If parking is enabled then the following prompts will appear and allow the operator to set the X and Y park positions.

Reference Origin (G54)

Use the keys on the subconsole to either **CHANGE** the reference origin, accept the reference origin **YES** or **CANCEL** the command.

NOTE the park position is set relative to the current origin.

Enter the park position

Park at X=2400

Park at Y=1200

and then alternatively move to the park position.

Parking will always default to "disabled" after a power up of the machine, however the machine will remember the last entered park position figures.

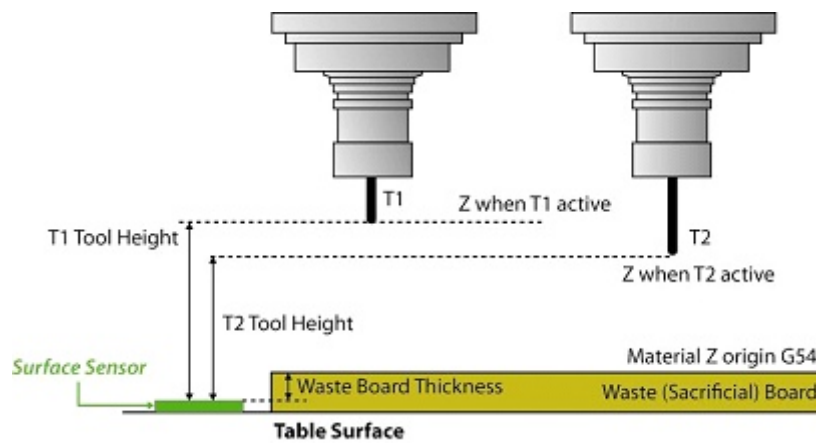
Common Uses

Function 16 is generally used in situations where the operator wants the machine to move out of the way (usually to the back of the machine) after a job has been run.

Functions 20-29 Z Co-ordinate Functions

A2MC Function	Description	Pause Valid?	Tool Param?
20	Set material thickness		
21	Not assigned		
22	Not assigned		
23	Not assigned		
24	Set Tool Height of tangential knife heads.	Yes	Yes
25	Set Tool Height	Yes	Yes
26	Set ATC Tool Heights	No	No
27	Set User Z Origin	Yes	No
28	Set and plane waste board		
29	Not assigned		

These functions are used to set the Z origins and tool heights



Function 20 - Set Material Thickness

sets the material thickness for processing from material surface.

Function 24 - Set Tool Height of tangential knife heads

is used specifically for setting the tool heights of tangential knife heads.

Function 25 - Set Tool Height

sets up the tool height for a specified tool. The waste board thickness is specified in the A2MC Configuration Utility so as the above diagram shows the Z co-ordinate relative to the Material Z Origin (G54) is simply equal to Tool Height - Waste Board Thickness.

Function 26 - Set ATC Tool Heights

is similar to function 25 except that instead of doing one tool at a time it will automatically measure all the tool heights of all the tools in the automatic tool changer.

Function 27 - Set User Z Origin

is used to set the User Z Origin (G55) offset. If the G55 origin is the current origin the Z co-ordinate is equal to Tool Height - (Waste Board Thickness + User Z Offset).

Function 20 - Set Material Thickness

Overview

This function helps to establish the thickness of the material to work from the surface of it. Your NC file must be written with Z0 reference at material surface not bed surface.

Valid Entry

The valid entry for function 20 is simply:



Once inside function 20 there are 2 screen displays asking you material reference, and thickness. Each screen is accessed by pressing Enter.

Material Reference?

Thickness: 12.70

Function 24 - Set Knife Tool Height

Overview


This function is an alternative to function 25 and is used specifically for setting the tool heights of tangential knife heads. Knife heads are two dimensional devices and it is often inconvenient to use the function 25 sensor. Oscillating knives in particular do not function well with the function 25 sensor so function 24 should be used instead.

Valid Entry

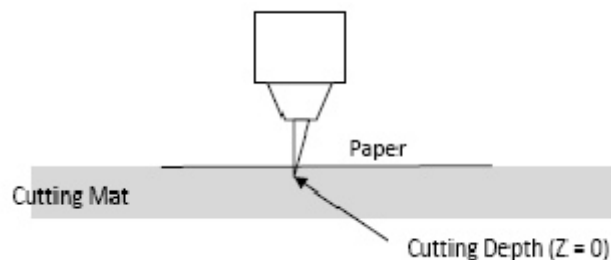
Function 24 must specify the tool that it applies to so the entry should be FUNC 24.1, 24.2, etc. The function will only work if the specified tool is a tangential or oscillating knife head, otherwise it will show "F24 not applicable."

Functionality

The function works by the operator jogging the head down such that the tip of the knife is positioned at the desired cut depth. The recommended procedure is:

1. Lay a piece of paper on the cutting surface.
2. Jog the knife head over the piece of paper.
3. Enter function 24.
4. If using an oscillating knife with automatic controls the knife will come on automatically otherwise turn it on manually.
5. Adjust the air pressure to the desired knife frequency.
6. Jog down until the knife tip punctures the paper.
7. Press . The head will return to the Z top.

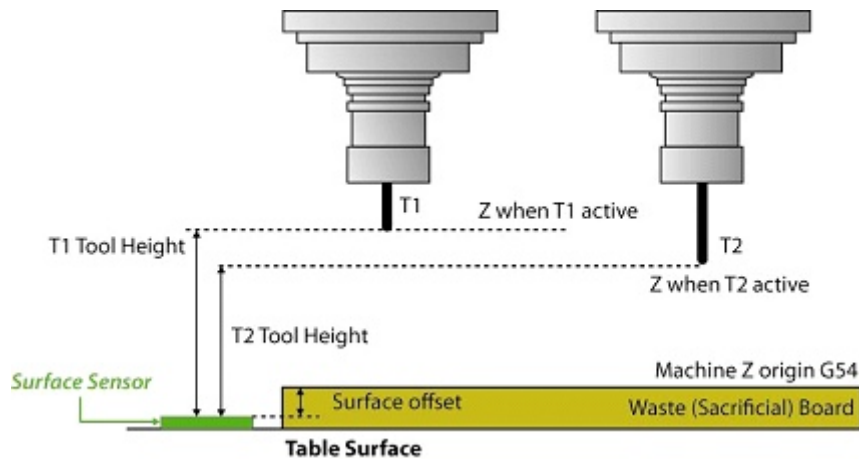
The knife tool height will be stored such that the set height will be $Z=0$ for the knife tool.



Function 25 - Set Tool Height

Overview

This function is used to set the tool height of a specified tool. All tools must have a valid and correct tool height in order to properly run a job. An incorrect tool height can damage the machine by causing the tool to plunge into the machine bed!



Each tool that is to be used in a job must have a tool height so that the machine can figure out where it is relative to the Material Z Origin (G54) (surface of the waste or sacrificial board).

The tool height is defined as the vertical distance from the Tool Height Sensor to the tip of the selected tool when the z axis is in the machine top position.

Valid Entry

Function 25 must specify the tool number to which it applies. Valid tool numbers can be from 1 to 999 therefore entries of function 25.1, 25.2, 25.3... etc to function 25.999 are valid provided the specified tool has been set up in the tool map.

Function 25 or Function 25.0 is not valid and you will get an "Invalid Function" error.

If the tool map only has tools 1, 2, 3, and 4 assigned then only functions 25.1, 25.2, 25.3, and 25.4 are valid. All the remaining function 25 calls are invalid.

Functionality

Function 25 works in three steps:

1. Change active tool to the specified tool. For example function 25.1 specifies tool 1. Note this part works exactly like function 31.
2. Travel to the surface sensor position
3. Seek the surface sensor.

All three steps must be successfully completed in order to generate a valid tool height for the selected tool.

Change the Tool to the Specified Tool

Function 25 measures the tool height of the active tool. The active tool is indicated by the tool number shown on the left side of the sub console screen in brackets:

For example "(T2)" indicates that the active tool is tool number 2.

If function 25.2 is entered the specified tool (T2) is the ACTIVE tool and the machine will automatically go to step two; travel to surface sensor. However if the specified tool is not the active tool then the machine must change the tool prior to travelling to the surface sensor.

Depending on the type of spindles and tool changing devices the machine comes equipped with the process of changing tools can vary:

1. Collet Tool Change. This type of spindle does not have a tool holder and the tools have to be directly clamped into the collet. All tool changes are manual.
2. Quick Tool Change. This type of spindle does handle tool holders but there is no ATC installed. All tool changes are manual.
3. ATC Tool Change. This means there is an automatic tool changer installed. In this case some tool changes are automatic while others can be manual.

The actual various processes involved with each type of tool change is described in Function 31.

Travel to the Surface Sensor

Once the first step described above has changed the tool, the machine will travel to the surface sensor position and show "Measure T1 Height. Jog then press Enter". Press the Enter key to confirm the operation.

If the machine has multiple spindle positions, "multi-position", it will place the correct spindle above the surface sensor.

Resetting the Surface Offset





If the waste board thickness is changed either by installing a different thickness of board or planning it the waste board thickness must be changed in the A2MC Configuration Tool.

The easiest is to do it in two steps:

1. First set the waste surface offset to zero.
2. Do the process described above.

Seek the Surface Sensor

Once the machine has positioned the spindle over the sensor the display will show "Press Start". There are three options:

1. Press  and the machine will automatically go down and touch the sensor.
2. Press the Z down jog key to move the tip closer to the sensor manually and then press . It will go automatically from  is pressed. The reason to do this is to speed things up as machine seeks the sensor rather slowly.
3. If the sensor is non-functional you may manually touch off the sensor by pressing  first then using the Z jog keys. This is used to operate the machine if the sensor is not working or there is no sensor installed.

Errors

There are a number of error codes associated to function 25:

1. E402 - No Tool. This means you have entered either function 25 or 25.0 which indicates there is no tool to get the tool height of.
2. E401 - Invalid Tool. This means that the tool you have specified is not in the tool map.
3. E403 - No Tool Height. This means that there is no tool height for this tool and you must do a function 25 for this tool before using it.

Configuring the Surface Sensor

The surface sensor is configured in the A2MC Configuration Tool under the calibration tab. This must be done during the initial configuration of the machine.

1. Select the correct type of surface sensor, either gantry mount or table mount.
2. At the machine select function 12 to home the machine then select function 3 to reset the coordinate origin of the machine at the home position. Use function 3 to switch to co-ordinate display. The display should show the x and y positions at 0,0.
3. Jog the machine over to center the spindle in position 1 over the center of the surface sensor. Record the x and y positions.
4. Use the positions recorded in step 3 to enter the values into the appropriate boxes in the configuration tool. Note that gantry mount sensors only require the y value. Set the waste board thickness to zero.

The next step is to set the surface offset:

1. Install a tool and run a function 25 on a valid tool so that it has tool height.
2. Use function 3 to put the display into co-ordinate mode.
3. Using the z jogging touch the waste board with the tip of the tool. Record this co-ordinate as this is the surface offset.
4. Enter the surface offset from step 3 into the A2MC Configuration Tool.

Function 26 Set ATC Tool Heights

This function will automatically measure all the tool heights of all the valid tools in the automatic tool changer

Valid Entry



Functionality

This function works automatically in the following sequence:

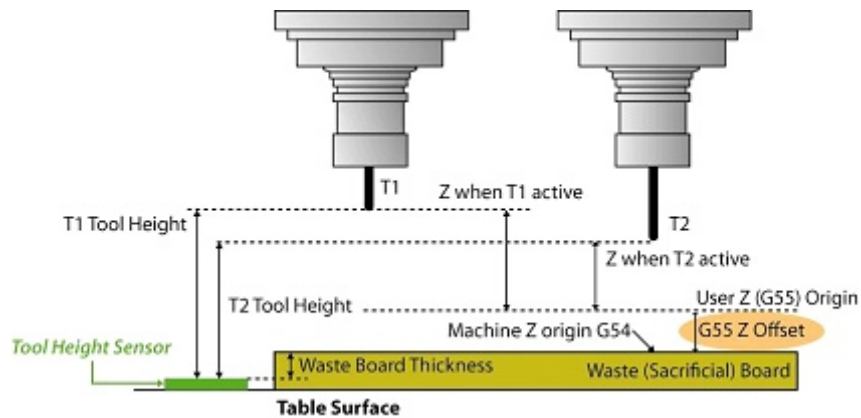
1. The controller will figure out all the valid tools in the tool changer.
2. Beginning with the lowest numbered tool it will pick up the tool from the tool changer, go over to the surface sensor and touch off the sensor. It will record the tool height.
3. It will repeat step 2 until all the tools in the ATC have been touched off.

The actual operation of each tool is exactly the same as function 25. See function 25 for further details.

Function 27 - Set User (G55) Z Origin

Overview

This function is used to set the User Z Origin. This User Z Origin is used when the current origin is the user origin (also referred to as the G55 origin). See also Function 10 which sets the User XY Origin.



Valid Entry



The console display will show:

G55 Z Offset: 25.00

(In this example the current offset is 25.00)

From this point the G55 Z Offset can be set two ways:

1. The desired offset value can be entered in the user units.
2. Touch off the desired new G55 Z Origin.

Enter Offset Value

Enter a new offset from the Machine (G54) Z Origin. This value is entered in the user units (inches, cm, or mm). The value cannot be less than negative 2 inches or 5 mm greater than positive Z range.

NOTE: Changing this value does shift NC jobs and may cause them to move outside the mechanical bounds of the machine. In this case boundary errors will be generated before or during run jobs.

Touch Off New G55 Z Origin

Instead of entering a new value press the function key:



Now using the Z up and Z down jog keys jog the active tool down to touch the surface that is to be the G55 Z Origin

The display will track the Z offset.

Press Enter and the current position will be stored as the offset.

Functionality

The G55 Origin is always reset to zero when the machine is powered up.

Once a new value is entered the current origin will switch to the User (G55) Origin automatically.

The G55 Origin in the A2MC Configuration Utility "Origins" tab will change to show whatever value is entered.

The function is primarily used for two reasons:

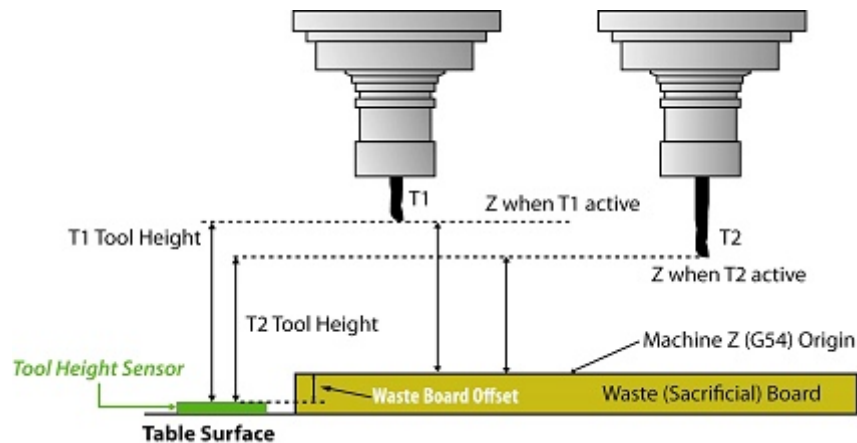
1. The cut depth is slightly off and rather than resending the job the operator can make small adjustments right at the machine with function 27. If the job is not cutting quite deep enough simply enter a negative number, if it is too deep move the job up by entering a positive number.
2. If the operator wants to test a file by doing a "dry run" well away from the table surface put in a larger positive distance (2 inches or 50mm) to move the job well above the table surface.

NOTE: In order for this feature to work the job must run using the User (G55) Origin. If the job itself calls for any other origin (such as G56) this feature will be over ridden.

Function 28 - Set and Plane Waste Board

Overview

This function is used to set a new waste board and plane an existing waste board. It defines the waste board offset shown below which is the offset difference between the tool height sensor and the surface of the waste board.



Valid Entry

Before entering this function use functions 31 and/or 25 to put the desired planning tool into the spindle and make it the current tool.



There are two parts to this function:

1. Reset the waste board offset when a new waste board sheet is placed on the machine.
2. Plane an existing waste board to flatten the table and/or get plane out grooves.

Reset Waste Board

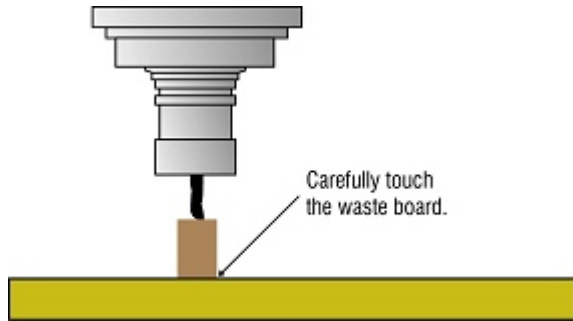
This feature is primarily used when changing the waste board. The waste board offset needs to be reset to account for the new thickness of the waste board. Prior to using this function make sure that the vacuum is on to firmly pull down the waste board. Also ensure there is a larger diameter tool in the spindle as it is easier to be more accurate.

New Waste Board? Yes

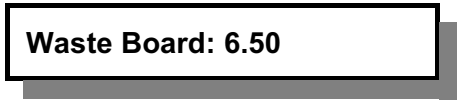
Then;

Touch Waste Board

Now use the jog keys to touch the surface of the waste board:



Press enter. The display will show the waste board offset in the user units:



At this point a new value can be typed in but usually it is just to confirm that the measured value makes sense.

Press enter and the displayed value will be saved as the waste board offset.

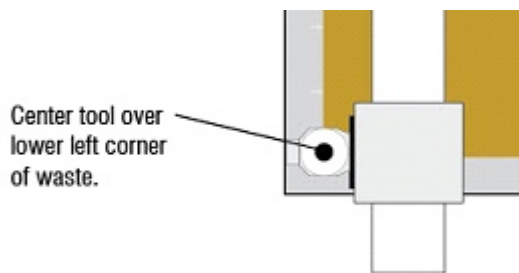
Plane Existing Waste Board

This feature will automatically generate a table plane pattern and adjust the waste board offset to the new planed surface.



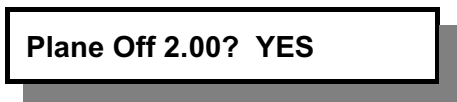
Before doing this function make sure the desired plane tool is in the spindle!

The first step is to jog to the start point of the plane pattern:



Once in position enter the required parameters:

- Enter the plane tool diameter:
- Length of waste board (along X axis):
- Width of waste board (along Y axis):
- Depth of plane (maximum of 5 mm)
- Plane feed speed:
- Finally the message will show



Before selecting yes make sure the vacuum hold down and the dust collection are turned on.

Select "yes" and the machine will:

1. Start the spindle.
2. Lower the tool into waste board to the specified depth.
3. Cut a raster pattern along the Y axis moving down the table in the positive X direction.
4. When it gets to the end of the waste board it will lift up and move back to the starting point.
5. Lower down and do a finishing cut around the edge of the waste board.
6. Finish up at the start point, raise and turn off the spindle.
7. The waste board offset is adjusted to the new waste board thickness.

Functions 30-39 Tool Control Functions

A2MC Function	Description	Pause Valid?	Tool Param?
30	Edit tools		
31	Change Current Tool	No	YES
32	Load ATC Tool	No	YES
33	Not assigned		
34	Unload tools	No	No
35	Set spacing (Dual carriage)		
36	Not assigned		
37	Not assigned		
38	Not assigned		
39	Not assigned		

These functions enable the operator to manage tools.

Overview

An A2MC machine can handle up to 999 tools number T1 to T999. Tool numbers are assigned to devices which are installed on one of up to eight device positions on A2MC machines. There is no limit to the number of tools that can be assigned to one device.

Tool Map

The tool map is a table that links the tools to devices and positions as well as identifying tools as manual or automatic. An example of a tool map:

Tool Number	Device Type	Position	Index
T1	Spindle	1	3
T2	Spindle	1	4
T5	Spindle	1	5
T7	Drill	2	0 (manual)
T19	Spindle	1	6
T67	Knife	3	0 (manual)
T867	Spindle	1	0 (manual)

This tool map may have up to 999 entries.

Definitions

There are a number of tool definitions used throughout the tool documentation:

Active Tool. This is the tool that is currently active and in use by the machine. This is the tool that is actually doing the "cutting". Normally there is only one active tool, however when the copy tool feature is used two tools can be active. The active tool is always indicated by brackets, for example "(T4)" means that tool T4 is active.

Loaded Tool. Many machines have more than one device that can have tools in the collet. Since generally only one tool is active the tools that are loaded into devices that are not active are referred to as loaded tools.

Unknown Tool. It is possible that the machine detects a tool in the active device or spindle but does not know which tool it is. This is referred to as an unknown tool and indicated by "(T?)". This often occurs when tools are manually changed or when the machine is powered up.

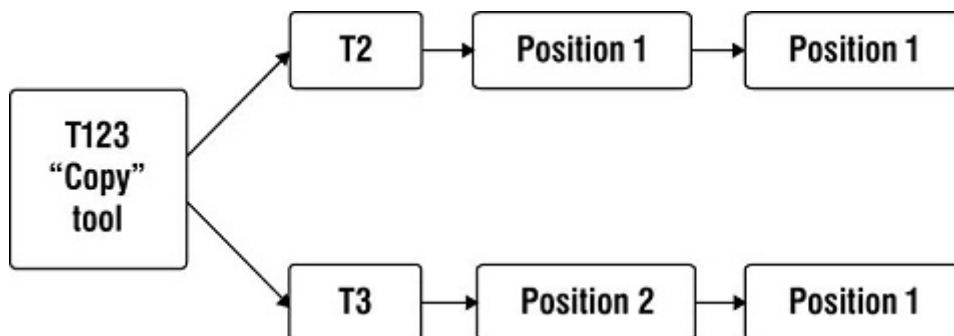
No Tool. This means that there is no tool detected in the active spindle. It is indicated by "(T0)". In the case of a ATC style spindle it means there is no tool in the spindle, or if it's a collet spindle or other device that does not have a tool sensor then it simply means that no tool is detected even though there may be one there.

Manual Tool. This means that this tool is not present in an automatic tool changer and needs to be changed manually. If a tool is not a manual tool it is an automatic tool.

Automatic Tool. This tool is present in a tool changer and will be changed automatically. Automatic tools are assigned a tool changer index number in the tool map so the A2MC knows where to go and get the tool from. Tools that are not automatic are manual.

Index. Automatic tools have a tool changer index which indicates which "slot" in the tool changer the tool is. An index of 0 indicates that it is a manual tool.

Copy Tool. A tool can be mapped to two other tools instead of a device and a position



Copy tools are used when a job requires two tools to cut simultaneously.

Functions

- Function 30 Edit tools for setting tool RPM and feed speed.
- Function 31 is the most commonly used function and is used to actually change the active tool.
- Function 32 is used to load a specified tool into either the 21G or rotary tool changer.
- Function 34 is used to unload a spindle. This is generally used at the end of the day to empty the spindle and relax the tool clamps and springs.

Function 30 - Edit Tools

Overview

This function is used to edit the maximum spindle speed and feed speed of a mapped tool. This is often used if the operator wishes to change the feed speed and spindle speed settings of a tool. It will only work on tools already mapped by the A2MC Configuration utility.

Valid Entry



Function 30 must specify the tool number to which it applies. Valid tool numbers can be from 1 to 999 therefore entries of function 30.1, 30.2, 30.3... etc to function 30.999 are valid provided the specified tool has been set up in the tool map.

Function 31 or Function 31.0 is not valid on its own but you will be prompted to enter a valid tool number.

If the tool map only has tools 1, 2, 3, and 4 assigned then only functions 30.1, 30.2, 30.3, and 30.4 are valid. All the remaining function 30 calls are invalid.

Functionality

First the maximum RPM for the selected tool is entered:

T4 Max RPM: 18000

The range of RPM is from 0 to the maximum RPM programmed for that device in the A2MC Configuration utility. Note that this sets the maximum RPM so if it's set to zero then this spindle cannot be turned on.

Secondly the maximum feed speed for the tool is entered:

T4 Max F: 24000

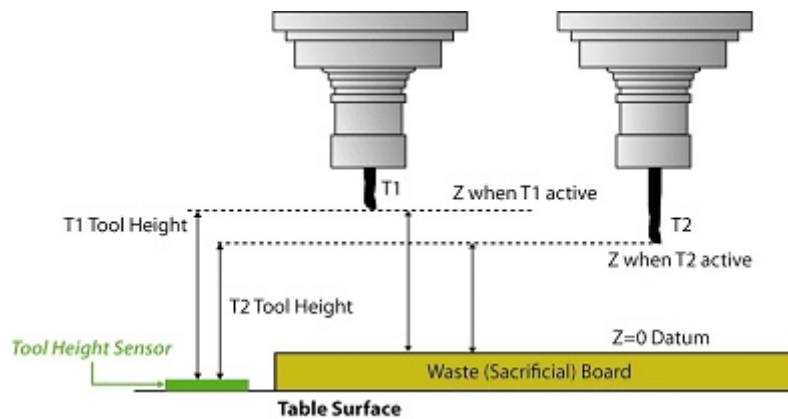
The range is from 25 mm/min to the maximum speed of the machine.

All the other tool features and edits have to be done through the A2MC Configuration utility.

Function 31 - Change Active Tool

Overview

This function is used to change the active tool to the one specified in the function. All tools must have a valid and correct tool height set up by Function 31 in order to properly run a job. **An incorrect tool height can damage the machine by causing the tool to plunge into the machine bed!**



Each tool that is to be used in a job must have a tool height so that the machine can figure out where it is relative to the Z=0 datum (surface of the waste or sacrificial board).

The tool height is defined as the vertical distance from the Tool Height Sensor to the tip of the selected tool when the z axis is in the machine top position.

Valid Entry

Function 31 must specify the tool number to which it applies. Valid tool numbers can be from 1 to 999 therefore entries of function 31.1, 31.2, 31.3... etc to function 31.999 are valid provided the specified tool has been set up in the tool map.

Function 31 or Function 31.0 is not valid and you will get an "Invalid Function" error.

If the tool map only has tools 1, 2, 3, and 4 assigned then only functions 31.1, 31.2, 31.3, and 31.4 are valid. All the remaining function 31 calls are invalid.

Functionality

Function 31 simply changes the active tool to the specified tool. The active tool is indicated by the tool number shown on the left side of the sub console screen in brackets:

For example "(T2)" indicates that the active tool is tool number 2.

If function 31.2 is entered the specified tool (T2) is the ACTIVE tool nothing will happen as the specified tool is already in the machine. However if the specified tool is not the active tool then the machine must change the active tool.

Depending on the type of spindles and tool changing devices the machine comes equipped with the process of changing tools can vary:

1. Collet Tool Change. This type of spindle does not have a tool holder and the tools have to be directly clamped into the collet. All tool changes are manual.
2. Quick Tool Change. This type of spindle does handle tool holders but there is no ATC installed. All tool changes are manual.
3. ATC Tool Change. This means there is an automatic tool changer installed. In this case

some tool changes are automatic while others can be manual.

The actual various processes involved with each type of tool change is described in Function 31 documentation.



Collet Tool Change

With a collet tool change system there can be a two initial tool conditions:

1. Unknown tool installed. (T?) will be indicated on the screen. This happens on power up as the system has no way of knowing if there is a tool in the collet or not and if there is one there no way of knowing which tool is there.
2. Known tool installed. (T1) or (T2) etc. Once the tools are initialized the active tool is tracked through function 31, function 31, and M6 tool changes.

The following tool change processes are possible:

- If the active tool is (T?) and function 31.1 is entered the machine will automatically return to the manual tool change position and show "Insert T1 and Press Enter". Manually remove any existing tool and replace it with T1 and press enter. The machine will now return to where it was when the function was entered. If the correct tool is already in the collet simply press enter.
- If the active tool is (T1) and function 31.2 is entered the machine will automatically return to the manual tool change position and show "Insert T2 and Press Enter". Manually remove tool T1 and replace it with T2 and press enter. The machine will now return to where it was when the function was entered.
- If the active tool is (T2) and function 31.2 is entered no tool change is required and the machine will now travel to the surface sensor to determine the tool height for T2.

Pressing the   key during this tool change process will abort the tool change and the entire function 31 process. No tool height will be determined.



Quick Tool Change

This is essentially the same as the collet tool change system except that the spindle(s) have tool holder clamps as well as tool holder sensors. With Quick change tool systems there can be three initial conditions:

1. Unknown active tool installed. (T?) will be indicated on the screen. This means that there is a tool holder in the clamp but the system does not know which tool it is. This will happen on power when there is a tool clamped or if the operator changes the tool without using function 31 or 31.
2. Known active tool installed. (T1) or (T2) etc. Once the tools are initialized the current tool is tracked through function 31, function 31, and M6 tool changes.
3. No active tool is installed. (T0) will be indicated on the screen.

The following tool change processes are possible:

- If the active tool is (T?) and function 31.1 is entered the machine will automatically return to the manual tool change position and show "Insert T1 and Press Enter". Manually remove any existing tool and replace it with T1 and press enter. The machine will now return to where it was when the function was entered. If the correct tool is already in the spindle simply press enter. T1 will become the active tool after the function is complete.
- If the active tool is (T1) and function 31.2 is entered the machine will automatically return to the manual tool change position and show "Insert T2 and Press Enter". Manually remove tool T1 and replace it with T2 and press enter. The machine will now return to where it was when the function was entered. T2 will become the active tool when the function is complete.
- If the active tool is (T2) and function 31.2 is entered no tool change is required and nothing will happen.
- If there is no active tool (T0) and function 31.2 is entered the machine will automatically return to the manual tool change position and show "Insert T2 and Press Enter". Manually insert tool T2 and press enter. The machine will now return to where it was when the function was entered. T2 will become the active tool when the function is complete.

Pressing the   key during this tool change process will abort the tool change and the entire function 31 process. No tool height will be determined.

Automatic Tool Change

These systems have automatic tool changers that will change the tools automatically. However, not all the tools specified in the tool map are necessarily automatic tools, there may be manual tools as well. The manual tools work just like a Quick Change System. With Automatic Tool Change tool system there can be three initial conditions:

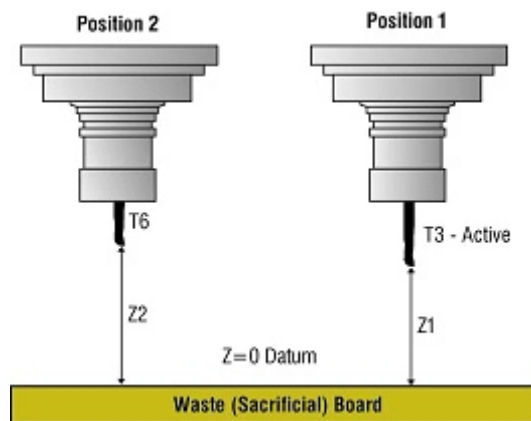
1. Unknown active tool installed. (T?) will be indicated on the screen. This means that there is a tool holder in the clamp but the system does not know which tool it is. This will happen on power when there is a tool clamped or if the operator changes the tool without using function 31 or 31.
2. Known active tool installed. (T1) or (T2) etc. Once the tools are initialized the current tool is tracked through function 31, function 31, and M6 tool changes.
3. No active tool is installed. (T0) will be indicated on the screen.

The following tool change processes are possible:

- **If the active tool is (T?) and function 31.1 is entered and tool T1 is an automatic tool** the machine will automatically return to the manual tool change position and show "Remove T? Press Enter. Manually remove any existing tool and press Enter. The machine will now travel to the tool changer and install tool T1 automatically. The machine will now return to where it was when the function was entered. T1 will become the active tool after the function is complete.
- **If the active tool is (T1) and function 31.2 is entered and both T1 and T2 tools are automatic tools** the machine will automatically change the tool and returns to the position where the function was entered. T2 will become the active tool when the function is complete.
- **If the active tool is (T2) and function 31.2 is entered** no tool change is required and nothing will happen.
- **If there is no active tool (T0) and function 31.2 is entered and tool T2 is an automatic tool** the machine will automatically change the tool and return back to the starting position. T2 will become the active tool when the function is complete.
- **If the active tool is (T35) and function 31.1 is entered and tool T35 is a manual tool and T1 is an automatic tool** the machine will automatically return to the manual tool change position and show "Remove T35 Press Enter" . Manually remove T35 and press Enter. The machine will now travel to the tool changer and install tool T1 automatically. The machine will now return to where it was when the function was entered. T1 will become the active tool after the function is complete.
- **If the active tool is (T1) and function 31.35 is entered and tool T35 is a manual tool and T1 is an automatic tool** the machine will first drop tool T1 in the tool changer and then return to the manual tool change position and show "Insert T35 Press Enter" Manually insert T35 and press Enter. The machine will now return to where it was when the function was entered. T35 will become the active tool after the function is complete.
- **If the active tool is (T31) and function 31.32 is entered and both T31 and T32 are manual tools** the machine will automatically return to the manual tool change position and show "Insert T32 and Press Enter". Manually remove tool T31 and replace it with T32 and press Enter. The machine will now return to where it was when the function was entered. T32 will become the active tool when the function is complete.

Multi Position Machines

In addition to having different types of spindles and tool change methods Multicam machines can also have multiple positions.



Positions are always numbered from right to left and there can be up to eight position of which four can have a Z axis. The Z axis are referred to as Z1, Z2, Z3, and Z4 from right to left.

Each position can have a "loaded" tool, the example above T3 is loaded in position 1 and T6 is loaded in position 2. Of these two only one will be active, T3 in the above example. The co-ordinates shown on the sub console display will be (X1,Y1,Z1).

When changing tools using function 31.6 the A2MC will refer to the tool map and identify that tool 6 belongs in position two and switch the position to position 2 and make tool 6 active.

If the tool 6 is not already in position two the system will change the tool in position 2 to the selected tool.

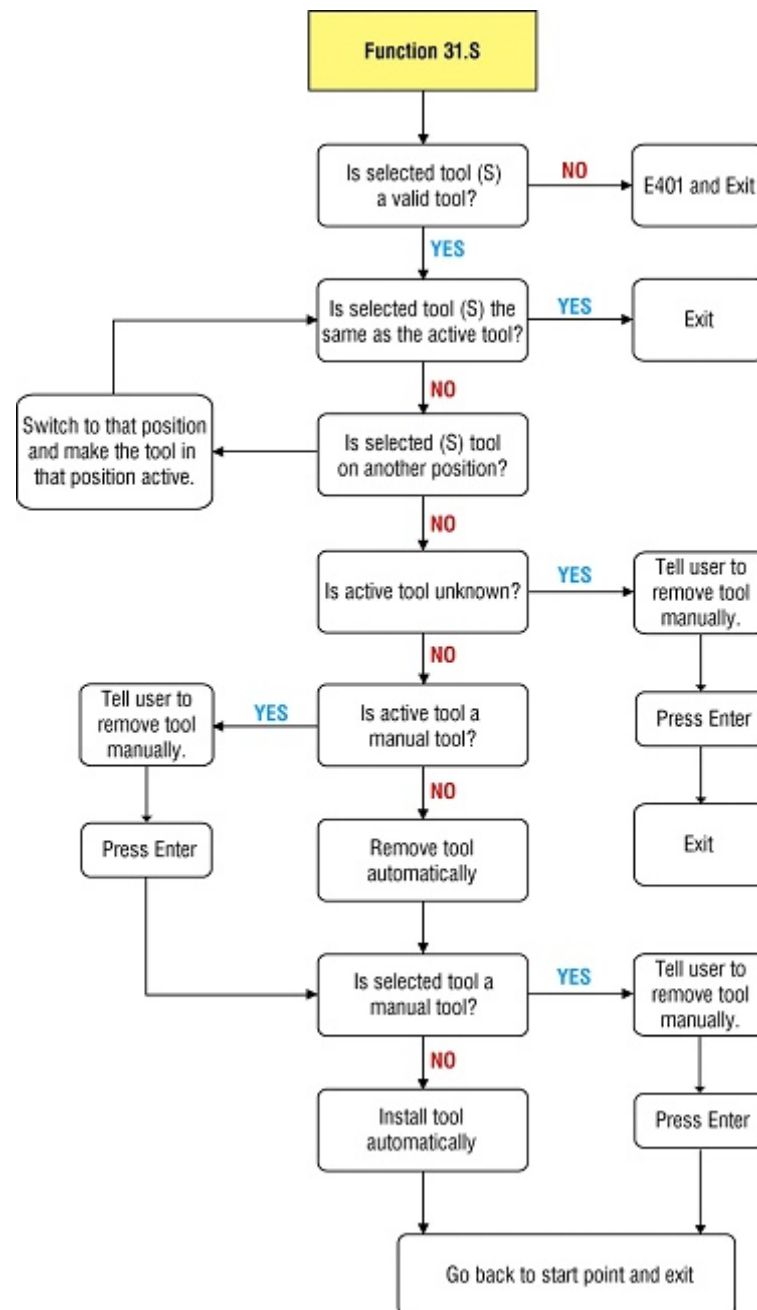
Errors

There are a number of error codes associated to function 31:

- E402 - No Tool. This means you have entered either function 31 or 31.0 which indicates there is no selected tool entered.
- E401 - Invalid Tool. This means that the tool you have specified is not in the tool map.
- E403 - No Tool Height. This means that there is no tool height for this tool and you must do a function 25 for this tool before using it.

In addition there are automatic tool changer errors:

Flow Chart



Function 34 - Unload Spindles

This function should be used to unload the spindles. This is normally done at the end of the day in order that the spindles are empty. Having tools clamped in the spindles while not in use will prematurely wear out the springs in the spindle tool clamps.

Valid Entry



The operator console screen will show:

Unloading T4

This function will be invalid if the system does not have either ATC or quick change spindles.

Functionality

The A2MC will, in sequence, unload all the loaded tools that are currently in positions with either quick change or ATC spindles.

For example on a machine with two valid spindles in positions 1 and 2 with tools T3 and T7 respectively the function will:

1. Unload T3 first from position 1 spindle. If T3 is an automatic tool the system will automatically return it to the tool changer carousel. If it is a manual tool the operator will be prompted to automatically remove the tool. The console display will show "Unloading T3".
2. Unload T7 secondly from position 2 spindle. If T7 is an automatic tool the system will automatically return it to the tool changer carousel. If it is a manual tool the operator will be prompted to automatically remove the tool. The console display will show "Unloading T7".
3. Exit the function.

Function 35 - Set dual carriage spacing

This function allows us to set the distance between carriages. (This function works in machines with dual carriage.)

Valid Entry



The operator console will show:

Y2 Separation: 0.00

Function 40 to 49 Job Productivity Functions

These functions are used to improve the productivity of the machine.

None of these functions are valid and can be used if there is an active job running on the machine

A2MC Function	Description	Pause Valid?	Tool Param?
40	Job Timer	No	No
41	Feed Speed	Yes	No
42	Spindle Control	No	No
43	Job Repeat	No	No
44	Job Array	No	No
45	Plunge Speed	Yes	No
46	Measured Move	No	No
47	Rectangle	No	No
48	Not assigned		
49	Delete Current NC File	No	No

Function 40 - Current Job Properties.

This function displays properties and statistics of the current job including time of last run, estimated cut time, and job extents.

Function 41 - Feed Speed

is used for manual cut functions as well as setting a maximum for NC jobs.

Function 42 - Spindle Control

allows the user to turn on and off and control the RPM of the active tool. It is generally used for manual cutting.

Function 43 - Job Repeat

can be used to cycle the current job repeatedly.

Function 44 - Job Array

can be used to repeat the current job in a specified array.

Function 45 - Plunge Speed

sets a maximum plunge speed as well as setting plunge speed for manual cut functions.

Function 46 - Measured Move

is a manual cut function that simply cuts a specified straight line.

Function 47 - Cut Rectangle

is a manual cut function that cuts a specified rectangle.

Function 40 - Current Job Properties

This function will display run time of the last job.

Job Time: 3min 45sec

The time the last job took to run. Press



Function 41 - User Feed Speed

This function allows the user to set a default feed speed. The default feed speed is active for:

1. Other job productivity functions such as functions 46 and 47.
2. It is the modal feed speed at the start of any NC job.
3. It sets an up a limit on the feed speeds of tools inside of NC jobs.

Valid Entry



The display will show the current User Feed Speed:

Using the console key pad this can be changed to any value.

Functionality

At power up the feed speed will be set automatically to whatever the feed speed is set in the A2MC Configuration Utility. This is set under "Travel Rate" in the "Motion" tab. See the A2MC Configuration Utility manual.

The User Feed Speed has three functions:

1. The User Feed Speed will be the speed the machine will move when using functions 46 and 47. See those functions for more details.
2. The User Feed Speed will be the modal feed speed at the start of an NC job. Therefore, if there are no "F" commands (feed speed commands) in the NC code the User Feed Speed will be used.
3. The User Feed Speed is also part of the maximum feed speed calculation. See the sub section

Maximum Feed Speed

There are four places that the feed speed is set in the A2MC system:

1. Machine Feed Rate is set for the entire machine operation in the A2MC Configuration Utility Motion tab. This value is in the field labeled "FeedRate".
2. Tool Feed Speed. Each tool in the tool map can be assigned a maximum feed rate which is generally the highest feed rate that that particular tool should operate at. This value is set tool by tool in the Program Tool tab in the A2MC Configuration Utility.
3. F Command. This is the feed speed set inside the NC file using the F command.
4. User Feed Speed. This is the feed speed set using function 41.

Whenever a G1, G2, or G3 interpolation move is run inside an NC file the feed speed that is used will be the lowest of the four feed speeds defined above. Therefore function 41 will allow the user to lower the feed speed, however the user cannot use function 41 to increase the speed higher than the lowest of the other three feed speeds.

Common Uses

Function 41 is used for four main purposes:

1. Setting the feed speed for functions 46 and 47.
2. Setting a modal feed speed for jobs that do not have feed speeds programmed in them.
3. Setting modal feed speeds for direct G commands in function 6.
4. Slowing down a job if it is running too fast with the F commands that are in the job.

Maximum Feed Speed

There are four places that the feed speed is set in the A2MC system:

1. Machine Feed Rate is set for the entire machine operation in the A2MC Configuration Utility Motion tab. This value is in the field labeled "FeedRate".
2. Tool Feed Speed. Each tool in the tool map can be assigned a maximum feed rate which is generally the highest feed rate that that particular tool should operate at. This value is set tool by tool in the Program Tool tab in the A2MC Configuration Utility.
3. F Command. This is the feed speed set inside the NC file using the F command.
4. User Feed Speed. This is the feed speed set using function 41.

Whenever a G1, G2, or G3 interpolation move is run inside an NC file the feed speed that is used will be the lowest of the four feed speeds defined above. Therefore function 41 will allow the user to lower the feed speed, however the user cannot use function 41 to increase the speed higher than the lowest of the other three feed speeds.

Common Uses

Function 41 is used for four main purposes:

1. Setting the feed speed for functions 46 and 47.
2. Setting a modal feed speed for jobs that do not have feed speeds programmed in them.
3. Setting modal feed speeds for direct G commands in function 6.
4. Slowing down a job if it is running too fast with the F commands that are in the job.

Function 42 - Spindle Control

This function enables the operator to turn on and control the RPM of the active tool.


Valid Entry



If the active tool is mapped to a spindle device type then the display will show:

(T1) RPM: 16500



The RPM value can be changed. When the operator presses  after adjusting or confirming the RPM the spindle will start.

If the spindle is already running then the RPM will change to the entered RPM.


This function is invalid if the active tool is not a spindle.

To turn off the spindle press




Functionality

Function 42 will operate as follows:

1. The active tool is checked to ensure that it is mapped to a spindle device type. If it is not a spindle device type the device does not have an inverter so RPM cannot be controlled by the A2MC and function 42 is invalid. An error will be displayed and the function will end.
2. The A2MC will look up the maximum RPM allowed for the active tool from the tool map and that will be the default RPM shown on the console display.
3. The operator can program any RPM that is less than the default RPM and greater than 100 RPM. If values are entered outside these values then the RPM will revert to the default value.
4. Pressing  will start the spindle.
5. The console display will show "(T1) to 16,500 RPM" during the acceleration or deceleration of the spindle. This display will show until the spindle has reached the programmed RPM. The display will then show the co-ordinate display while the spindle is running.

NOTE that if any spindle is running on the machine only functions in the job productivity group will be valid. All other functions will be invalid until the spindle(s) have been turned off.

Spindle(s) are turned off using the  key.

Function 42 has no affect on the "modal" value of the S command in the NC files. If there is no S command specifying the spindle RPM in an NC file then the modal RPM will be the tool RPM from the tool map.

Common Uses

The general use of function 42 is to turn on the spindle(s) in order to use functions 46 and 47 to do manual cuts on the machine.

It is also used to test spindle operation.

Function 43 - Job Repeat

This function sets the current job to repeat a specified number of times.

Valid Entry



The console display will show;



Any number between 1 and 999 may entered. Numbers less than 1 and greater than 999 will not be accepted.

Functionality

This function will set the repeats for the next job run. As soon as that job run is over then the repeats will be set back to one.

If for any reason the job is paused and restarted the A2MC will finish the job but not continue the repeats.

Function 44 - Job Array

This function sets the current job to repeat in a specified array.

Valid Entry



The console display will show two displays in sequence:



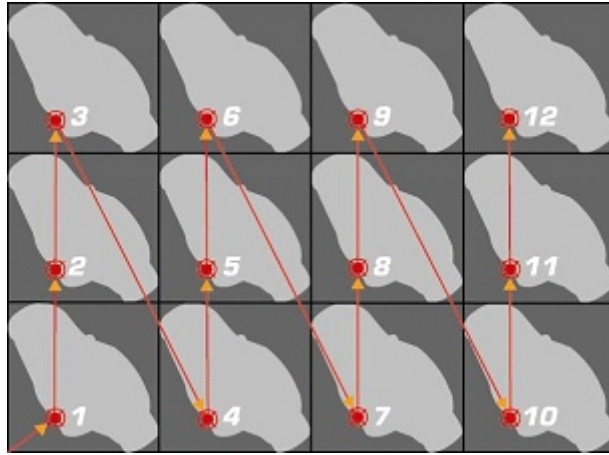
Any number between 1 and 99 may entered representing the number of rows and columns respectively of the desired array.

Functionality

This function will set the arrayed repeats for the next job run. As soon as that job run is over then the repeats will be set back to one.

If for any reason the job is paused and restarted the A2MC will finish the job but not continue the repeats.

The sequence will run as shown below. The job cells will be adjacent to each other.



Common Uses

This function is used to create a simple nest of job repeats. It is useful for creating a large number of repeats on a sheet without having to download a large NC file.

Function 45 - User Plunge Speed

This function allows the user to set a default plunge (-Z axis feed speed). The default plunge speed is active for:

1. Other job productivity functions such as functions 46 and 47.
2. It sets an up a limit on the plunge speeds of tools inside of NC jobs.

Valid Entry



The display will show the current User Plunge Speed:

Plunge Speed: 2700mm/min

Using the console key pad this can be changed to any value.

Functionality

At power up the feed speed will be set automatically to whatever the plunge speed is set in the A2MC Configuration Utility. This is set under "Plunge Rate" in the "Motion" tab. See the A2MC Configuration Utility manual.

Plunge speed is defined as the speed that a tool will plunge into the material. Therefore it applies only to negative G1 Z moves.

The User Plunge Speed has two functions:

1. The User Plunge Speed will be the speed the machine will plunge when using functions 46 and 47. See those functions for more details.
2. The User Plunge Speed is also part of the maximum plunge speed calculation. See the sub section on Maximum Plunge Speed.

Maximum Plunge Speed

There are three places that the plunge speed is set in the A2MC system:

1. Machine Plunge Rate is set for the entire machine operation in the A2MC Configuration Utility Motion tab. This value is in the field labeled "PlungeRate". This is actually the maximum value that the Z axis will move up and down.
2. F Command. This is the feed speed set inside the NC file using the F command.
3. User Plunge Speed. This is the plunge speed set using function 45.

The plunge calculation on a job is only done when the command is G1Z(-value). When ever this command is encountered the A2MC will compare the three plunge values above and apply the lowest.

Common Uses

Function 45 is used for two main purposes:

1. Setting the plunge speed for functions 46 and 47.
2. Slowing down the plunge rate in a job if the F commands in the job are not operating it slow enough.

Function 46 - Measured Move

This function allows the user to move the machine a specified amount in the X and Y axes

Valid Entry



The display will show:

X Move: 0.00

Type in the amount that you would like to move in the X axis and press



The display will show:

Y Move: 0.00

Type in the amount that you would like to move in the Y axis and press



The display will show:

User Z: 112.50

Press



and the machine will move the desired amount.

Functionality

When traversing the move programmed move will be executed at the current jog speed. If the jog speed is fast, medium, or slow it will be executed at that speed. If the jog speed is in increment then the move will be executed at slow jog speed.

When cutting the program will move the active tool negative Z at the plunge speed programmed in function 45. It will then execute the move at the feed speed programmed in function 41. Finally the head will return up in positive Z at the Z travel rate.

Note that the spindle will not turn on by itself, function 42 needs to be used to turn on the spindle to the desired RPM.

If at any time the operator presses



the function will abort and the move will stop where ever it is and stay there. If the spindle was on it will stop as well.

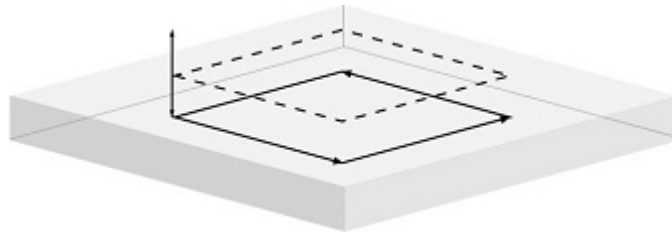
Common Uses

Function 46 is used for two main purposes:

1. Traverse a specified distance in order to set a User Origin (Function 10) at a specific co-ordinate position.
2. Cut a sheet into parts without having to create an NC file.

Function 47 - Cut a Rectangle

This function allows the user to cut a rectangle of a specified size.



Valid Entry



The Z co-ordinate for the cut depth will be requested:

Rectangle Z: 0.00

The default cutting Z will be 0.00 as that is the waste board surface of the active tool however another value can be entered. Note that the cutting Z is an absolute value measured relative to the current Z origin which is usually the surface of the waste board.

The X and Y relative rectangle size is now programmed:

Rectangle X: 0.00



Rectangle Y: 0.00

In both cases a relative move is programmed in the user units. Once Enter is pressed after programming the Rectangle Y the move itself will be executed.

Functionality

When cutting the program will move the active tool negative Z at the plunge speed programmed in function 45. It will then execute the moves at the feed speed programmed in function 41. Finally the head will return up in positive Z at the Z travel rate.

Note that the spindle will not turn on by itself, function 42 needs to be used to turn on the spindle to the desired RPM.



If at any time the operator presses the emergency stop button the function will abort and the move will stop where ever it is and stay there. If the spindle was on it will stop as well.

Common Uses

Function 47 is used primarily to cut rectangles out of sheets of material without having to create an NC file.

Functions 50 to 99 Device Specific Functions

These functions are used to activate devices or set up the way that devices are activated during machine operation.

A2MC Function	Description	Pause Valid?	Tool Param?
50	Vacuum Pump, Dust Collector and Mist Control	No	
50.1	Vacuum Pump, Dust Collector and Mist Automatic Control	No	
51	Digitise 2D & 3D Jobs		
52	Plasma Control - Not Implemented		
53	Laser Control - Not Implemented		
54	Safety Interlock		
55	Not assigned		
56	G41/G42 Compensation		
57	Not assigned		
58	Multi XML Control		
59	G41/G42 Modal Preset		

Function 50 Vacuum Pump, Dust Collector and Mist Control

This function enables the operator to turn the vacuum, dust collector, and mister on and off.

Function 50.1 Vacuum Pump, Dust Collector and Mist Automatic Control

This function allows you to set up the way that the Vacuum Pump, Dust Collector or Mist dispenser behave during machine operation. They can be set to either be off or be automatically activated. In the case of the dust collector you can also set a delay for the collector to turn off at the completion of the job.

Function 50 - Set device On/Off

This function allows you to instantly turn on or off the Vacuum Pump, Dust Collector or Mist dispenser.



Note that the automatic vacuum and dust collector only works if there is a Modbus vacuum controller installed.

Valid Entry





The display will read



Using the  key on the key pad this can be toggled between OFF or ON.  to accept your selection



If the machine has the electronics installed for dual vacuum pumps a second prompt will appear to manage the second pump;



Using the  key on the key pad this can be toggled between OFF or ON.  to accept your selection



The display will read



Using the  key on the key pad this can be toggled between OFF or ON.  to accept your selection

The display will read



Using the  key on the key pad this can be toggled between OFF or ON.  to accept your selection

Function 50.1 - Vacuum Pump, Dust Collector and Mist Control Automatic Operation

This function allows you to set up the way that the Vacuum Pump, Dust Collector or Mist dispenser behave during machine operation. They can be set to either be off or be automatically activated. In the case of the dust collector you can also set a delay for the collector to turn off at the completion of the job.



Valid Entry



The display will read



Auto Vacuum? YES

If YES is selected the vacuum pump will automatically come on when a job starts and automatically shut off when the job ends. If the machine has the equipment for dual pumps you will be prompted for enabling pendulum processing. See the section on pendulum processing at the end of this section (page [99](#)).

Using the  key on the key pad this can be toggled between OFF or ON. Press  to accept your selection


The display will read

Auto Collector? YES

Using the  key on the key pad this can be toggled between OFF or ON. Press  to accept your selection

The display will read

Off delay (sec): 3.00



Type in the desired time you would like the Dust Collector to stay on after the job has completed and Press 

This delay allows the dust collector to purge the collection lines before shutting down. A delay of between 0 and 120 seconds is allowed. This delay timer is set when the job ends and will run in the background until the delay time expires. This means there will be no further operator prompts indicating when the dust collector will shut down. The dust collector can still be shut down manually using function 50 during the delay time.

Note that shutting down the dust collector with function 50 will shut it off immediately with no delay regardless of what delay has been programmed.

The display will read



Using the  key on the key pad this can be toggled between OFF or ON. Press the  key to accept your selection

These automatic settings are stored in non-volatile memory so they will be saved even while the machine is shut down.



Function 50.1 - Pendulum Processing

Large, dual work zone machines, are sometimes set up for pendulum processing which means the machine alternately runs jobs on the first zone and second zone of the machine. This allows for the machine to operate continuously as the “quiet” end of the machine is unloaded and loaded with new material while the live end cuts.

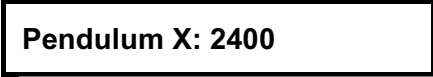
To facilitate this the system can be installed with two vacuum pumps that alternate operation depending on the start position of the job. To enable this type of operation Pendulum Vacuum needs to be enabled:

The display will read



Using the  key on the key pad this can be toggled between OFF or ON. Press the  key to accept your selection

If pendulum vacuum is enabled then you type in an X table co-ordinate that specifies where the vacuum is switched between vacuum 1 and vacuum 2:



In this example vacuum 1 is used for job start positions less than X = 2400 mm, and vacuum 2 is used for job start position greater than X = 2400 mm.

Function 51 - Digitise 2D & 3D Jobs

The digitizing function allows the operator to jog the machine and record positions. Both an NC file and DXF release 12 file will be created. Digitizing can be done in two or three dimensions.

Valid Entry



Entering Function 51 will begin the digitizing process.

Functionality

There are four steps to the digitising process:

1. Create a file name and open the file. Both an NC and DXF file will be created with the same name.
2. Choose the digitizing parameters such as two or tree dimensions.
3. Conduct the actual digitizing.
4. Close and save the files.

Create a File Name

Immediately after entering Function 51 a file name must be selected:

Digitize DJob: 1

The files are named "DJobXX" where "XX" can be any number from 1 to 99. Simply enter the desired number.

The default file number will be whichever number is next in sequence. If a number is selected where a file already exists that file can be overwritten by choosing:

Replace DJob1? NO

Digitising Parameters

Digitising may be done in two or three dimensions:

3D Digitize? NO

The default is two dimensional digitisation. If two dimensions is selected "Z top" and "Z bottom" values must be selected in order that the Z dimensions in the NC file get values assigned to them:

Z bottom: 0.50

and

Z top: 50.00

In this example the NC file will use Z=0.50 for the G1/G2/G3 moves and Z=50.00 for the G0 moves.


If three dimensional digitising is selected then only Z top is required as the G1 Z values are digitised.

For digitising in two dimensions the following geometric shapes can be digitised:

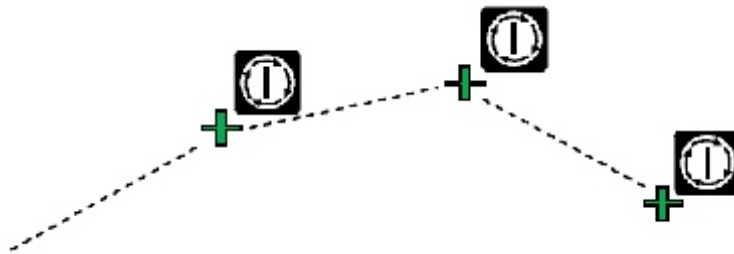
- ◆ Lines
- ◆ Arcs
- ◆ Circles
- ◆ Points

For three dimensional digitising only lines may be digitised.

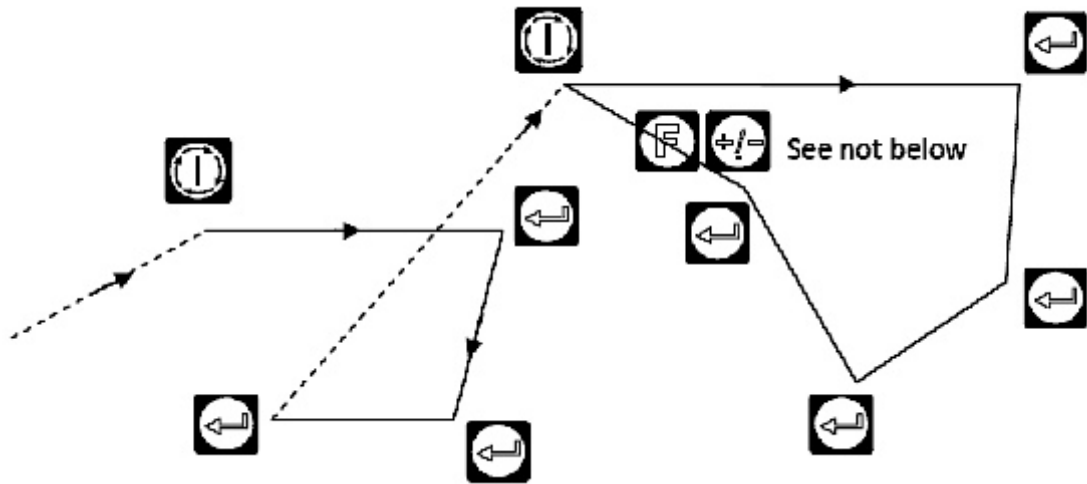
Digitising Process

You always must start any shape with the  button.

If all you are doing are **points** then just JOG then , JOG , etc for however many points you want.

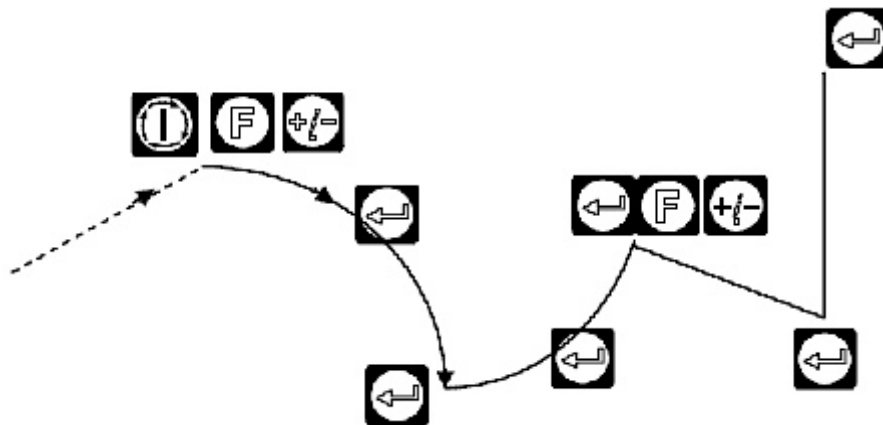


To join segments into shapes use the START key to begin a shape and the ENTER key to digitise the vertices:

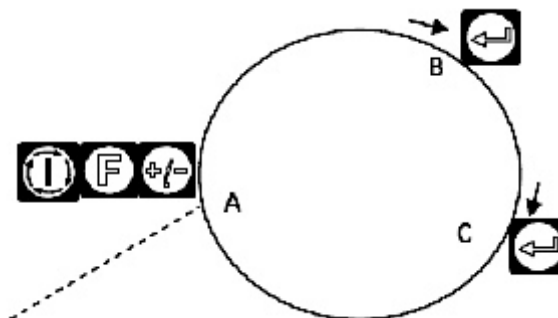


To close a shape press the FUNC key then use the “+/-“ key to select “Close Shape”.

To digitise an arc use the FUNC key to select G2/G3 arcs. By using the FUNC and “+/-“ key you can alternate between arc segments and line segments. Arc segments require a mid point and end point to form the arc, line segments only require an end point:



Note that a mid point can be anywhere along the arc, it does not have to be exactly at the mid point.



Three points are required to digitize a circle, A, B, and C:

The example will generate a clockwise circle, digitising the circle the other way around will

produce a counterclockwise circle.

Saving the Digitised Job

Pressing "FILE" or "STOP" will end the digitising process, close the file and save it into two locations:

1. The digitised NC file will be stored as \\hdd1\release\jobs\Djob\DJob1.nc. This file can be run by simply starting it as any normal nc file job.
2. The dxf file will be stored as \\hdd1\release\dxfdigitize\DJob1.dxf. This file can be opened with any CAD or CAM program that can open AutoCAD release 12 dxf files.

Function 54 - Safety Interlock

If a safety interlock system such as a light curtain, pressure mat, or interlock access door is installed with the A2MC system function 54 allows the user to set it up.

The safety interlock is wired directly to the A2MC controller on a dedicated input marked "ATC Sensor".

This sensor is normally "closed" or normally "on" which means the signal from the safety interlock device must be present for the controller to function. If the signal disappears the controller will stop the machine. This means if the interlock system is not present function 54 must be used to disable it, otherwise the machine can never operate!

Once set the parameters of this function will remain in memory and are not lost when the system is powered off.

Operation

There are two parameters that are set in function 54:

Interlock is ON

Interlock can be turned on or off with the "+/-" button.

Delay (sec): 5

If the interlock is set to ON then you can set an interlock delay time. This delay time is similar to a security system and allows you the specified time to get out of the room and close the door, or get off the pressure mat, or clear the light curtain after the job is started.

Operations like jogging and setting functions are not influenced by the safety interlock system. The system is armed only during the running of jobs and then only after the delay time has expired.

Once the system is armed the machine does monitor the interlock and should anything trigger it the machine will automatically pause, exactly as if an operator presses STOP:

1. Processing of the job is immediately stopped.
2. All the devices will go into "safe mode" which generally means they go to the top position and shut down.
3. The job itself goes into pause.

You can now do one of two things:

1. The job can be aborted by selecting function 9.
2. The job can be restarted by pressing START. If restarted the safety interlock system will rearm itself after the delay time.

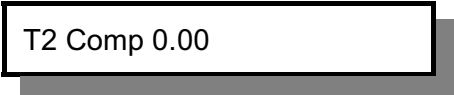
Function 56 - G41/G42 Compensation

This function allows you to set a compensation value for a specified tool for use by G41 or G42 compensation.

The function can be called by either selecting "FUNC 56" or by "FUNC 56.X" where "X" is the tool number that is to be compensated. For example "FUNC 56.2" will set the compensation for tool number 2.

If just FUNC 56 is used then you will be prompted to enter a tool number.

Once a tool number is determined:



T2 Comp 0.00

Enter the desired compensation for tool number 2.

This function can be repeated for any valid tool.

Also see documentation on G41 and G42 for details on how G41 and G42 function as well as see documentation of function 59 will allow you to preset a modal G41 or G42.

Function 58 - Multi XML Control

This function enables the machine to save and retrieve multiple XML Setup files. This is useful in situations where the devices on a machine are routinely changed.

For example, a machine may normally be set up with a spindle as device one, however, occasionally the spindle will be removed and replaced with a tangential knife. Without function 58 the user would have to go to the Setup GUI and change the configuration of the machine. When the spindle was re-installed the procedure would have to be repeated.

Function 58 allows the user simply to flip between several previously configured XML setups.

There are two parts to function 58:

1. Function 58 will copy a previously saved XML into the active XML setup.
2. Function 58.1 will save the current XML into a saved XML chosen by the operator.

Function 58.1 Saving an XML Setup File

The first step is setup the configuration of the machine using the Setup GUI program. Once the desired setup has been stored to the machine select function 58.1:



The display will show:



Save As XML#1

Enter in any number between 1 and 10 and press enter. The currently active XML setup will be saved as XML1, or XML2, etc. If this saved XML has been previously assigned then the operator can choose to over write it.

Function 58 Copying a Saved XML Setup File

Copying works in reverse from saving. A previously saved XML is copied into the active XML setup and the machine is automatically rebooted. Once the reboot is complete the machine will operate in the new configuration:



The display will show:



Copy XML#1

Enter in the XML number that needs to be copied and press enter. The display will now prompt for a reboot of the controller and the new configuration will be enabled.

XML Setup Files

The XML Setup files are stored in the \HDD1\Release directory on the A2MC controller:

\HDD1\Release\XMLMachineAdjustableParams.xml Active XML Setup File
\HDD1\Release \XMLMachineAdjustableParams1.xml Saved XML#1
\HDD1\Release \XMLMachineAdjustableParams2.xml Saved XML#2
\HDD1\Release \XMLMachineAdjustableParams7.xml Saved XML#7

Note that the Setup GUI program will only “see” the active XML Setup File.

Function 59 - G41/G42 Modal Preset

This function presets the modal compensation (G41/G42) prior to running a job. It can be preset to:

- ◆ G40 which cancels modal compensation.
- ◆ G41 modal compensation to the left.
- ◆ G42 modal compensation to the right.



Initial Comp=G40

Enter either 40, 41, or 42 to set the preset modal compensation.

Also see documentation on Function 56 and on G41/G42.

Functions 300-900 Peripheral Device Specific Functions

These functions are used to set up peripheral devices or set up the way that these devices are used during machine operation.

A2MC Function	Description	Pause Valid?	Tool Param?
301	Set up material lifter, scraper and off loading table	No	
302	Use Material lifter, scraper and table	No	
303.1	Material Loader arm down	No	
303.2	Material Loader arm up	No	
304.1	Scraper arm up	No	
304.2	Scraper arm down	No	
305.1	Conveyer start	No	
305.2	Conveyer stop	No	
306.1	Material Lifter up	No	
307.1	Activate Pop Up Pins	No	
307.2	De-activate Pop Up Pins	No	
320	Set up Scraper Arm	No	
321	Use Scraper Arm	No	
801	Set Static IP Address	No	
810	Setup ATC	No	
821	Setup Tool tip sensor	No	

Function 301 - Set up material handling system

Function 301 is used to set up the material handling system. It is used to enable the material lifter, scraper (off loader) and off loading table. The following parameters need to be set:



1. **Auto Start** This is tells the machine if the sheet loading system is to run automatically before the start of each job in order to clear the previous sheet off the bed and load the next sheet.
2. **Sheet Lift Position** is the position where the sheet lifter can pick the sheet up from the sheet stacker.
3. **Scraper Engage Position.** This is the x position at the back of the table where the scraper arm is to lower in order to push the existing sheet off the machine's bed. It must lower behind the sheet.
4. **First Drop Position** is where the lifter system will drop the sheet for the first time during the sheet loading cycle.
5. **Second Lift Position** is where the lifter system will pick up the sheet the second time.
6. **Final Drop Position** is where the lifter system will drop the sheet it is loading for the last time.
7. **Scraper Drag Speed.** This is sets the feed rate that the machine will move while pushing the material off of the machines bed.

Valid Entry





The display will read

Autostart? NO

Using the  key on the key pad this can be toggled between YES or NO.  to accept your selection. If you select YES the machine will automatically pick up and unload a sheet when a job is started.

The display will read

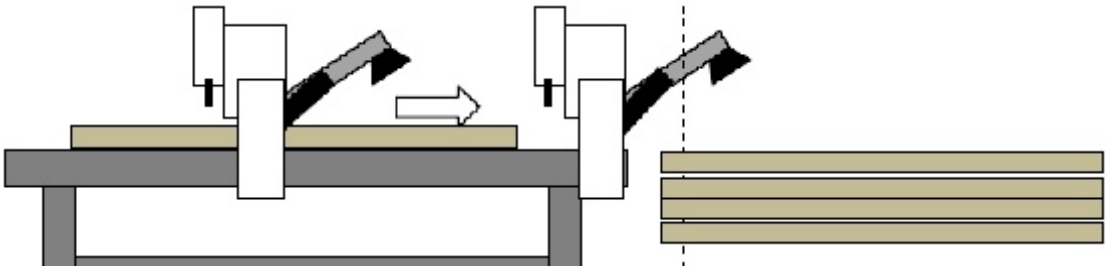
Set lifter position? NO

Using the  key on the key pad this can be toggled between YES or NO.  to accept your selection. If you select YES you will continue to on to set up the lifter position as follows. To cancel the function select NO.

If YES has been chosen then the process to setting up the scraper parameters will be begin by dropping the scraper arm down:

The display will read

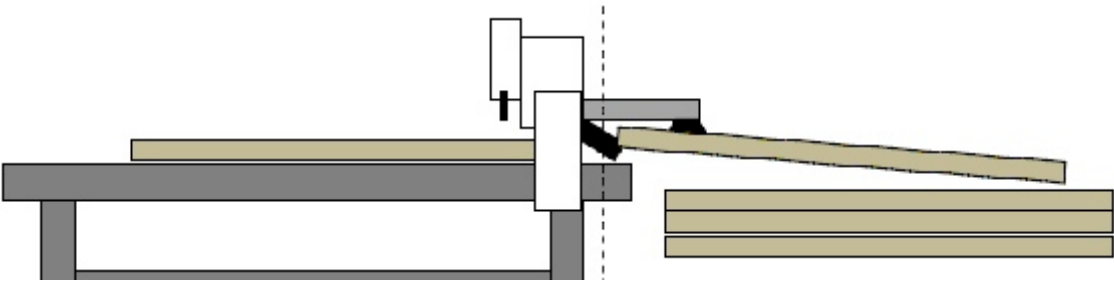
Jog to lift position: ENTER



Jog the machine so that the Suction Cups are positioned over the material on the Material Lifter and press



A sheet of material will be picked up and the scraper arm will lower.



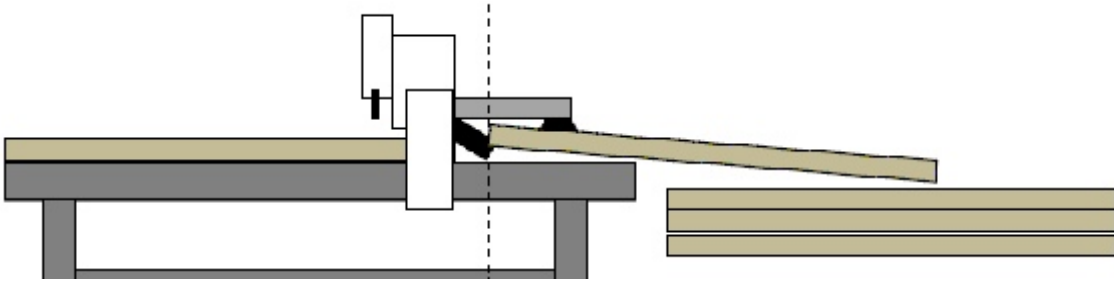
The display will read

Jog to scrape start: ENTER

Jog the machine so that the scraper arm is approx 5mm from the end of the sacrificial sheet and press



to change the jog speed to medium, slow or incremental for greater accuracy.



The display will read

Jog to first drop position: ENTER


Next jog to the first drop position. The machine needs to drop the sheet part way on to the machine so it can back up and pick up the sheet again further back. This is required so it can properly position the sheet at the front of the table.

Jog the machine to the first drop position and press  . This will set the “First Drop Position”.

The machine will now drop the sheet and lift the scraper.

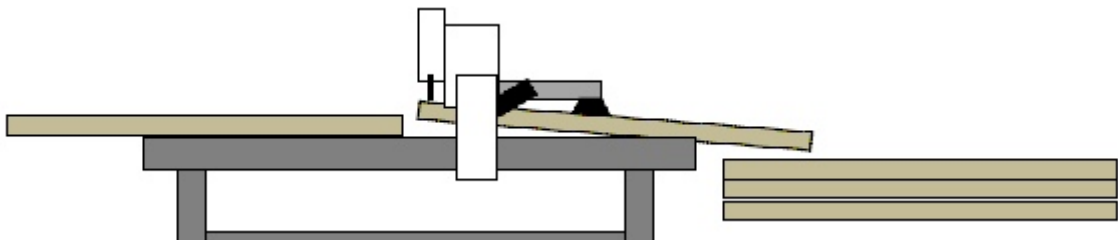
The display will read


Jog to second lift position: ENTER

Jog the machine back approx 500mm to the second lift position and press  . The machine will pick up the sheet again.

The display will read


Jog to second drop position: ENTER



Jog the machine so that the material is close to the home position. You do not need to be exact as you can add an adjustment in later. Press  . The sheet will be dropped.

The display will read

Adjustment: 0.000

Measure the distance that the sheet is from the home position. Type that figure in here so that the sheet will line up exactly. Press  .

The display will read

Speed: 0.000

Type in the speed in mm/min that you would like the sheets to be loaded. 8000mm/min is recommended and press



The material loader has now been setup and can be used in Auto mode or FUNC 302.

Function 302 - Use material lifter, scraper and off loading table

Use this function to load a sheet of material on to the machine bed.

Valid Entry



This function will run one cycle of the sheet loading system in the following sequence:

Move to Lift the Sheet	The machine will move back to the sheet lift position.
Activate Scissor Lift	The scissor lift will shift the sheet stack up so the lifter can reach the top sheet.
Lift Sheet	The sheet lifter will go down to engage the top sheet, turn on the suction cups, and lift the sheet up.
Deactivate Pop Up Pins	The pop up pins will be dropped down and out of the way so the sheets can be shifted without colliding with the pop up pins.
Start Conveyor	The conveyor belt is started up in order to pull the old sheet off the front of the machine.
Drop Scraper	The scraper arm is dropped down behind the old sheet of material.
Move to start scraping	The machine will move to the position where the scraper arm is just behind the old sheet of material. It will momentarily stop at this position.
Move to first drop	The machine will move to the first sheet drop position.
Drop Sheet	The new sheet of material will be dropped here for the first time.
Lift Scraper	The scraper arm is lifted out of the way.
Move to 2nd Lift Position	The machine will move back to a position to lift the new sheet again.
Lift Sheet	The sheet lifter will go down to engage the top sheet, turn on the suction cups, and lift the sheet up.
Move to Final Drop Position	The machine will now move forward to the final drop position for the new sheet. It will also be pushing the old sheet forward and on to the conveyor belt.
Drop Sheet	The new sheet is dropped into position. The old sheet will have be pushed entirely off the machine bed and on to the conveyor belt.
Activate Pop Up Pins	The pop up pins will be popped back up around the new sheet.

The sheet loading cycle is now complete. The old sheet will have been pushed off the machine and the new sheet automatically loaded and ready for processing.

Function 303.1 - Material loader arm down

Use this function to assist in manually loading a sheet of material on to the machine bed.

Valid Entry



The sheet lifter will go down to engage the top sheet, turn on the suction cups, and lift the sheet up.

Function 303.2 - Material loader arm up

Use this function to assist in manually loading a sheet of material on to the machine bed.

Valid Entry



The suction cups will deactivate and the material loader arm will rise.

Function 304.1 - Scraper arm up

Use this function to assist in manually loading a sheet of material on to the machine bed.

Valid Entry



The scraper arm will raise.

Function 304.2 - Scraper arm down

Use this function to assist in manually loading a sheet of material on to the machine bed.

Valid Entry



The scraper arm will lower

Function 305.1 - Conveyor start

Use this function to assist in manually removing a sheet of material from the machine bed.

Valid Entry



The conveyer will start.

Function 305.2 - Conveyor stop

Use this function to assist in manually removing a sheet of material from the machine bed.

Valid Entry



The conveyer will start.

Function 306.1 - Material lifter up

Use this function to raise the material lifting table ready to load a sheet of material.

Valid Entry



The material lifter will raise until the sensor is activated.

Function 307.1 - Activate Pop Up Pins

This function will manually activate the pop up pins.

Valid Entry



The pop up pins will rise.

Function 307.2 - De-activate Pop Up Pins

This function will manually deactivate the pop up pins

Valid Entry



The pop up pins will retract.

311.1 - Turn ON locking pin sensor for saw blade

Turn on the locking pin sensor for the saw blade attachment. By default the sensor is set to on.

Valid Entry



The sensor will be set to on if off

311.2 - Turn OFF locking pin sensor for saw blade

Turn off the locking pin sensor for the saw blade attachment. By default the sensor is set to on.

Valid Entry



The sensor will be set to off if on

312.1 - Turn ON X direction sensor for saw blade

Turn on the X direction sensor for the saw blade attachment. By default the sensor is set to on.

Valid Entry



The sensor will be set to on if off

312.2 - Turn OFF X direction sensor for saw blade

Turn off the X direction sensor for the saw blade attachment. By default the sensor is set to on.

Valid Entry



The sensor will be set to off if on

313.1 - Turn ON Y direction sensor for saw blade

Turn on the Y direction sensor for the saw blade attachment. By default the sensor is set to on.

Valid Entry



The sensor will be set to on if off

313.2 - Turn OFF Y direction sensor for saw blade

Turn off the Y direction sensor for the saw blade attachment. By default the sensor is set to on.

Valid Entry



The sensor will be set to off if on

314 - Set saw direction to X axis

Aligns the axis of the saw blade with the X axis of the machine

Valid Entry



The saw blade will rotate to align with the X axis of the machine if it is currently aligned Y axis.

315 - Set saw direction to Y axis

Aligns the axis of the saw blade with the Y axis of the machine

Valid Entry



The saw blade will rotate to align with the Y axis of the machine if it is currently aligned X axis.

Function 320 - Setup Scraper Arm

This function is used to set up the parameters to run the scraper arm. The following parameters need to be set:

1. **Auto Start.** This tells the machine if the scraper arm is to run automatically before the start of each job in order to clear the previous sheet off the bed.
2. **Scraper Engage Position.** This is the x position at the back of the table where the scraper arm is to lower. It must lower behind the sheet.
3. **Scraper Drag Speed.** This sets the feed rate that the machine will move while pushing the material off of the machine's bed.
4. **Scraper Drop Position.** This is the X position at the front of the table where the scraper arm will disengage.



Valid Entry



The display will read



Auto Start? Yes

Turning on Auto Start will automatically run the scraper arm prior to each job in to clear the previously cut sheet off of the machine bed.

Using the  key on the key pad this can be toggled between YES or NO.  to accept your selection. If you select YES the machine will automatically run the scraper arm prior to each job in to clear the previously cut sheet off of the machine bed.

The display will read

Set Scraper Position? No

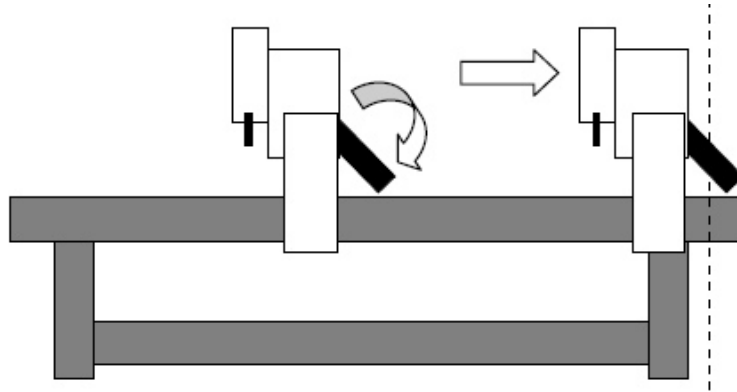
Using the  key on the key pad this can be toggled between YES or NO.  to accept your selection. Choose YES to continue with setting up the scraper or NO to exit the function.


If YES has been chosen then the process to setting up the scraper parameters will begin by lowering the scraper arm.

The display will read

Jog to Scrape Start

Jog the machine back to the position where you want the scraper arm to drop down behind the back side of the material.

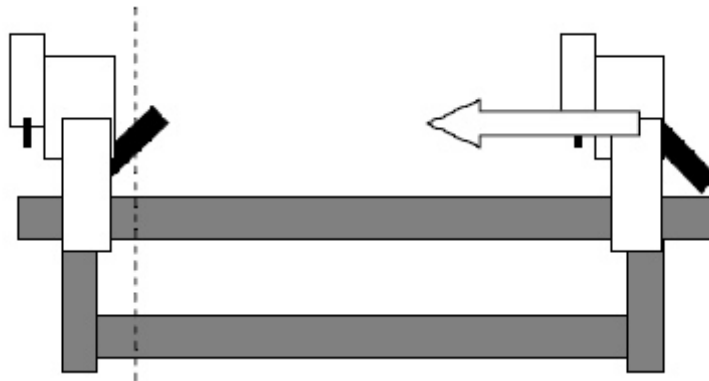


Press  to set the “Scrape Engage Position”.

The display will read

Jog to Scrape End

Jog the machine to the position where you want the scraping process to end. This is usually as far forward on the machine as possible.



Press  to set the “Scaper Drop Position”. The scraper arm will lift.

The display will read

Speed 5000

Type in the desired drag speed and press



Press ENTER to exit this function.

Function 321 - Run Scraper Arm

This function will run one cycle of the scraper arm in the following sequence:

1. The machine will position to the “Scraper Engage Position”.
2. If activated the pop up pins will deactivate (go down) in order to enable the material to be pushed off the machine.
3. The scraper arm will go down. The machine will wait two seconds for the scraper arm to be fully engaged and the pop up pins fully down.
4. The machine will move forward with the scraper arm down pushing the material off of the front of the machine. It will move forward at the “Scraper Drag Speed” to the “Scraper Drop Position”. At this point the scraper arm will lift and the machine will return to the original position when the function 321 was called.

Function 801 - Set Static IP Address

Use this function to set a static IP address on the machine. In some network situations it may be desirable to fix the IP address for security or connectivity reasons.

Before you start you will need to get the following information from your network administrator;

1. The IP address that you wish to set for the machine
2. The Subnet Mask of the network
3. The Default Gateway of the network

Some of this information (items 2 and 3) can be obtained by using the IPCONFIG command in Windows on a computer that is on the same network as the machine.

The *format* of the IP address can also be determined using this method but the exact IP address must be assigned by the network administrator. They will assign the last set of digits for the address.

```
C:\ipconfig

Windows IP Configuration

Ethernet adaptor Local Area Connection:

    IP Address          :192.168.1.xxx
    Subnet Mask         : 255.255.255.1
    Default Gateway     : 192.168.1.1


C:\>
```

Valid Entry



The display will read

Set Static IP: NO

Use the  key to change the display to YES.

The display will read;

IP:

Type in the desired IP address then press the Enter key.

The display will read;

MASK:

Type in the desired Subnet Mask then press the Enter key.

The display will read;

GATE:

Type in the desired Gateway address then press the Enter key.

You will then be prompted to re-boot the machine for the changes to take effect.

Function 810 - Set up Automatic Tool Change (ATC)

Use this function to set up the automatic tool changer (if fitted) on the machine.

Valid Entry





The display will read

21G ATC at P1: ENTER

MC ATC TEST AT P1


Test passed: ENTER


Set up 1G now? YES

Using the  key on the key pad this can be toggled between YES or NO. Press  to accept your selection. If you select YES you will continue on to set up the ATC as follows.

The display will read

Jog to ATC cup.

If this is the first time the ATC is being set up, use the direction keys on the sub console to jog the head to line up with the ATC, then press  .

If the ATC has previously been set up and you have the co-ordinates press  to enter these figures.

The display will read

Offset Y: 0.000

Enter the Y co-ordinate in here and press



The display will read

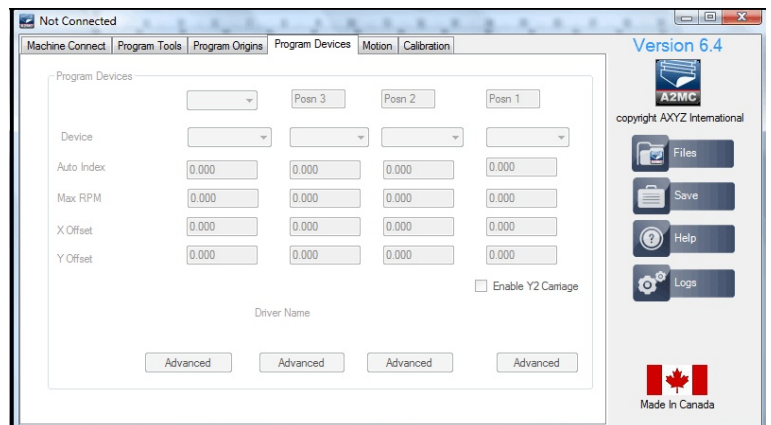
Offset Z: 0.000

Enter the Z co-ordinate in here and press



The Automatic Tool Changer has now been set up.

These co-ordinates can also be entered in the GUI in the Program Devices TAB Under Position 1



Function 821 - Set up Tool Tip Sensor



Sets up the Tool Tip sensor position and bed surface.

Valid Entry



The display will read

Table Mount F25

Using the  key on the key pad this can be toggled between Table Mount or Gantry Mount. Press  to accept your selection.

You can choose to jog keys to move the machine to the center of the tool tip sensor or type in the X and Y axis co-ordinates if known.

The display will read

Y Location: 0.00

type in the Y co-ordinate to the Tool tip sensor and press



The display will read

X Location: 0.00



type in the X co-ordinate to the Tool tip sensor and press



The next part of the operation is to set up the waste board surface position.

The display will read

Set waste board: YES

Using the  key on the key pad this can be toggled between YES or NO. Press  to accept your selection.


If you select NO the operation will be completed.

If you select YES you will continue to on to set up the waste board surface as follows.

Note: You need to have tool number 1 in the spindle to set the waste board surface.

The display will read

Jog to waste board surface:

Use the jog keys to move the machine to the waste board surface and press 

The waste board surface has now been set.

It is also possible to set the tool tip sensor position through the GUI in the Calibration tab under Table Surface Sensor Location.

Function 822 - Setting up Tangential Knives

This function sets up the RPM and RPM/second parameters of tangential or oscillating knives. Also see function 24 for further tangential knife settings.

Once the settings are done you can choose to run a tangential knife cycle test.

Valid Entry



A tangential knife can be:

- Standard tangential knife.
- “Pizza wheel” knife.
- Creasing wheel.
- Oscillating knife.

The tangential parameters used are the same for all these devices.

Tangential Maximum RPM



Max RPM: 50



The tangential maximum RPM is the maximum revolutions per minute that the knife will rotate at. The knife is driven by a stepper motor with a gear ratio of four to one so every revolution of the knife will be four motor revolutions.


Generally maximum RPM should be set to 50. That will work in most applications and is considered medium speed. Setting it up to 75 RPM will run the knife quicker whereas 25 RPM will run it slower.

Once the RPM and RPM/second is set the knife will seek its origin and should go to 0 degrees which is pointing along the positive X direction. The display will show:



Set Knife? YES

If the knife is not aligned with the positive X axis select YES to set the knife. If it is then you can select NO as setting the knife origin is not required. If YES use the  

jog the knife clockwise and counter clockwise until it is aligned with the positive X direction. You can use the  key to slow it down.

keys

Once this is done the knife will go to +90 degrees and display:

Knife at +90? YES

Check that the knife is actually at +90 degrees which means that the knife blade is pointing in the positive Y direction. If it is pointing in the positive Y direction simply press ENTER as that is the correct direction. If it is pointing in the negative Y direction it is rotating backwards and you must select NO. The knife will reset itself again and again you must check if it goes to 0 degrees, if not select Set Knife again and reset it back to 0 degrees. Again it will go to +90 and ask you to confirm that it is at +90. This time it should be.

Knife set up is complete.

Tangential Knife Cycle Test

This feature is offered at the end of the function 822:

Test Knife? YES

If "YES" the knife will run 100 test cycles which consists of swinging the knife 360 degrees clockwise then 360 degrees counterclockwise at full speed. After each cycle the tangential sensor will be checked to see if the knife has lost position.

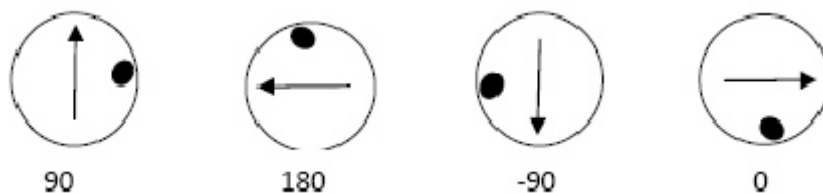
The knife should pass all 100 test cycles. If there is a failure it will show the failure count on the display.

Tangential Knife Knowledge

Proper Direction of Tangential Motion

It is fairly easy to wire the tangential knife in reverse. In order to know if the knife is working in the right direction select the tangential knife as the current tool and select function 42.

Function 42 sets the spindle speed if the current tool is a spindle but it allows the operator to set the knife angle if the current tool is a tangential knife. Set the angles for 90, 180, •]90, and 0 and check that the knife is actually positioned as shown below:



If the knife is operating backwards the 90 and •]90 directions will be reversed. Generally this means the motor wiring is reversed.

Stepper Motor Settings

The tangential knife heads have a 34 frame sized motor and the oscillating knives will have a much smaller 23 frame sized motor. Both run off the same drive and the settings are:

1600 steps per revolution
5.5 Amps

The 23 frame motors on the oscillating knife will get quite hot, often to 100 degrees Celsius! They are inside an enclosure but if it's open don't touch the motors!

Skew Error Checking

The tangential knife does not have a real time feedback loop so if the knife operates faster than it can handle or the knife gets jammed the knife direction will become skewed. If it gets skewed the knife will cut off angle and if it's off angle enough it will usually break the knife.

The A2MC will check and straighten out the knife every 50 knife "lifts". The errors are recorded in the activity log so if there is suspicion that there are skewing problems simply upload the activity log and take a look. A properly operating tangential knife will have knife errors of less than 0.5 degrees. If the error exceeds 1 degree then the A2MC will display an error 726 and show the actual skew error in degrees.

Other Knife Errors

There are three error codes associated with the tangential and oscillating knives:

Error 724 Knife Error Reset
Error 725 Knife Error Setup
Error 726 Knife Skew Error

Error 724 is caused when the knife cannot find the tangential sensor. The knife sensor is plugged into the carriage board. If this error is occurring then either the sensor is not working, the wiring is wrong, or the carriage board is either faulty or not connecting to the A2MC.

Error 725 is a set up error indicating that a tangential knife is set up where there is no tangential (W) axis.

Error 726 The knife skew error is already covered in the previous section.

Setting Knife Depth

Tangential and oscillating knives require tool height settings just like spindle tools.

Tangential knives can use function 25 and they can be automatically set exactly the same as a router tool. The tangential knife will automatically rotate to 90 degrees for the automatic sensing of the knife tip. This is required to clear the waste board on some configurations of machines.

Oscillating knives are more problematic because their length changes when the oscillation is on. Do not try to use function 25 with an oscillating knife. The knife will break!

Use function 24 instead:

- The surface of the table needs to be some sort of padded material such as foam matting. This provides the knife space under the material.
- Lay a piece of paper on the foam matting.
- Enter Function 24. The oscillating knife will come on.
- Lower the knife until it is punching holes in the paper. Press enter and the A2MC will properly calculate the oscillating knife length.

Tangential Knife NC Code

Tangential knives do not need a specific NC code or special post. The A2MC will calculate all the required lifts and rotations on its own. Actually it better if specialized posts are not used as they can mix everything up!

M3 and M5 will turn on and off the oscillating knife. S (spindle speed) commands are ignored. Tangential knives will ignore M3 and M5.

The tangential knife will automatically lift and rotate as required to manage a clean cutting process. The height it lifts is the “**most recent G0Z height**”. For example:

G91G20	Absolute co-ordinates in mm
G0X10Y10	
G0Z20	G0Z = 20mm
G1Z0	Knife rotated to 0 Cut depth is 0
G1X20	Cut from X=10 to X=20
Y20	Lift to 20mm, rotate to 90, lower and cut to Y = 20
X10	Lift to 20mm, rotate to 180, lower and cut to X = 10
G0Z30	G0Z = 30mm
G0X30Y20	
G1Z0	Knife rotated to 90 Cut depth is 0
G1Y30	Cut from Y=10 to Y=20
X20	Lift to 20mm, rotate to 0, lower and cut to X = 20

Function 893 - Co-Linear filter value

Enter a value between 0 and 5.

If you set to 0 then the filter is off, you can set any number up to 5 which is a pretty heavy filter and you might lose detail at that level. A setting of 1 is what would be a normal setting and still maintain good detail. A setting of less than 0.25 doesn't seem to do much.

What it does is get rid of tiny little lines that do not alter the contour substantially. The setting is in thousands of inches so a setting of 1 will get rid of lines that alter the contour less than 0.001 inches (0.025mm). A setting of 2 would be 0.002 inches and so on.

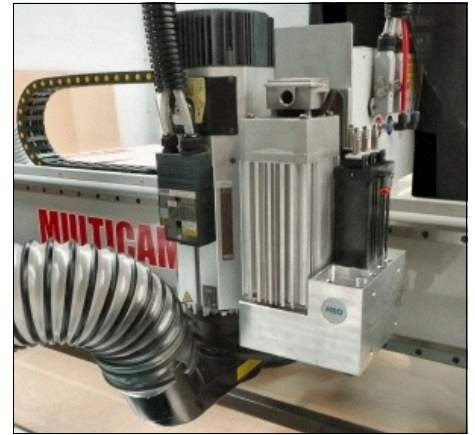
In the GUI there is a slider in the Calibration tab that will allow you to set this value as well. Pulling the slider all the way left will set it to 0 so the co-linear filter is disabled. All the way right will be quite a strong filter and you could lose accuracy. It is suggested that you use about $\frac{1}{4}$ to $\frac{1}{2}$ way.

Appendix A - Gang Drill Setup

The Multicam Gang Drill attachment is aimed at increasing productivity in situations where multiple drilling processes need to be carried out.

Setting up the drill attachment involves the following processes:

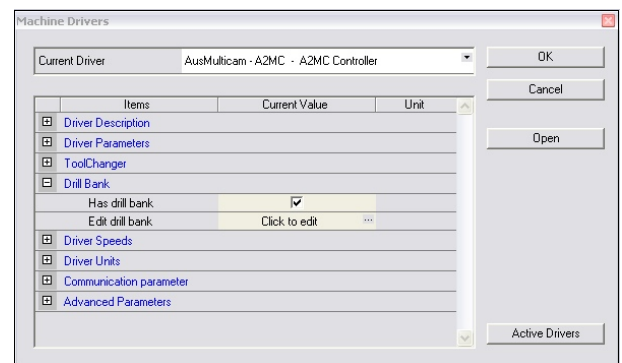
- Setup Enroute.
- Setup machine GUI



Setting Up Gang Drill in Enroute:

1. Open the Machine Setup screen.
2. Click on the **+** next to Drill Bank.
3. Click on the **Has drill bank** tick box
4. Click on **Click to edit**.

The **Define Drill Bank** window will open.

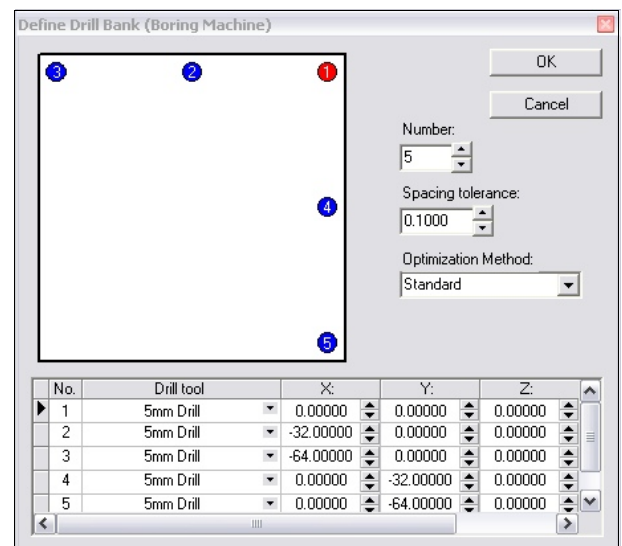


Select the number of drills that the Drill Head has. In this example we are using 5 Drills.

The spacing tolerance should be 0.1000, if it is not set to 0.1000 you may find that the drill holes do not output correctly.

Optimization Method should be set to Standard.

Each drill position will need to be setup in relation to each other. Select the drill tool you wish to use in the drop down box next to the each drill number (remember that the drill must be set up in the tool library prior to setting it in the Drill Bank).



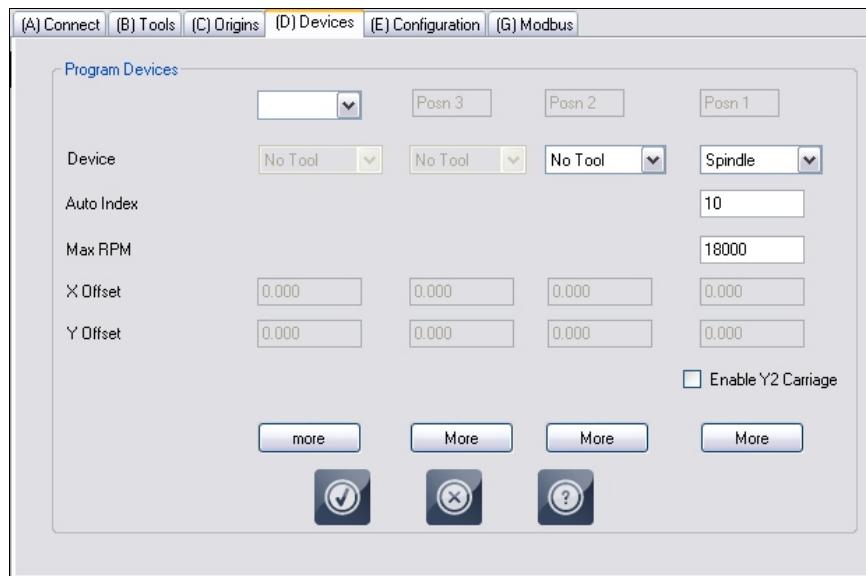
Drill number 1 will always be set at position X=0, Y=0, Z=0. All other drills will then be offset from Drill Number 1. As you can see in the example drills 2 to 5 have X or Y offsets applied to them. In this example we are using a Drill Bank that has 32mm centres. Click OK once the Drill Bank has been set up then Click OK in the Machine Drivers Window to accept the changes.

The Gang Drill has now been setup in Enroute. Any time that Enroute sees a group of holes that have 32mm centres and is using the Drill associated to the Gang Drill the NC code will be written to use the Gang Drill.

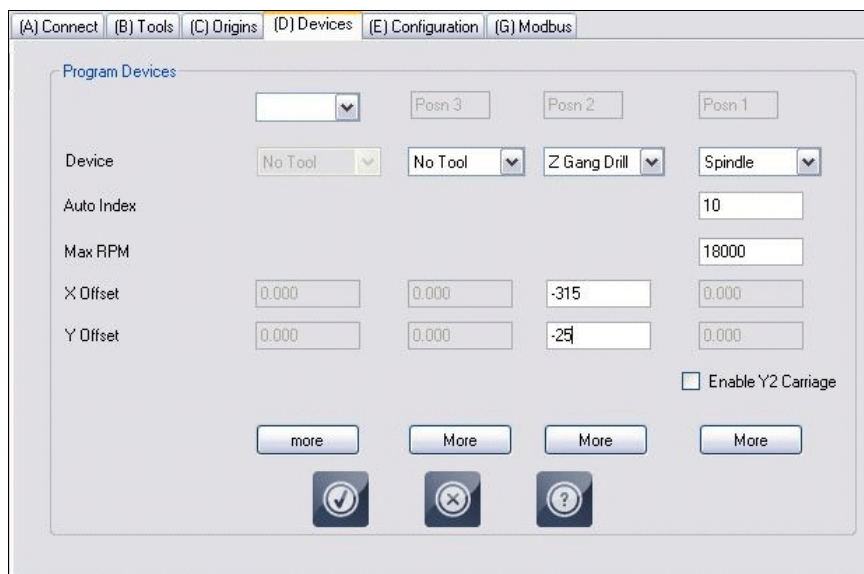
Setting Up Gang Drill in GUI:

Connect to the GUI and change Permission to Supervisor.

Click on the Devices Tab. Below is a typical setup for a machine that has 1 Z axis and a Spindle.



1. Change the configuration to the following for Posn2.
2. Select Z Gang Drill for Device. This will then allow a X and Y offset to be added.
3. The X and Y offset is the difference between Posn1 and Posn2 in millimetres so that the Gang Drill will drill in the correct position. To find this figure simply put the same tool in the Posn1 and Posn2, run a job that should plunge 2 holes in the same position, measure the difference between to 2 holes and enter the figures into the X and Y offset fields and save the settings.
4. Below is an example of what the devices Tab will look like.



Example NC file using the Gang Drill:

(Multicam Australia A2MC Post)

```
G90 G56
G00 Z21.0000
M800 D7
G00 X140.8182 Y62.7273
G01 Z4.0000 F4000.0000
G00 Z21.0000
M800 D3
G00 X204.8182 Y62.7273
G01 Z4.0000 F4000.0000
G00 Z21.0000
M800 D24
G00 X76.8182 Y237.7273
G01 Z4.0000 F4000.0000
G00 Z21.0000
G00 X76.8182 Y163.7273
G01 Z4.0000 F4000.0000
M800 D0
N40 M5
N50 G28
N60 M30
```

NC file explanation:

M800: This is set in the NC file to tell the A2MC to use the Gang Drill. A D will be placed after the M800 to assign what drills are to be used. The D number uses Binary code to assign the appropriate drills. The Drill numbers are as follows:

Turn off Gang Drill = D0

Drill 1 = D1

Drill 2 = D2

Drill 3 = D4

Drill 4 = D8

Drill 5 = D16

The following D numbers will be assigned to use different combinations:

Drill 1 = D1

Drill 1 & 2 = D3

Drill 2 & 3 = D6

Drill 1, 2 & 3 = D7

Drill 1 & 4 = D9

Drill 4 & 5 = D24

Drill 1, 4 & 5 = D25

Appendix B - Setting Up the Chisel Head to Square Corners

In order to run the a chisel head on an A2MC machine, there are 4 processes to setup the Chisel Head up. These are:

- Setup the GUI
- Create a Chisel Tool in the GUI
- Create a Chisel Tool in Enroute
- Assign a Chisel toolpath to your job

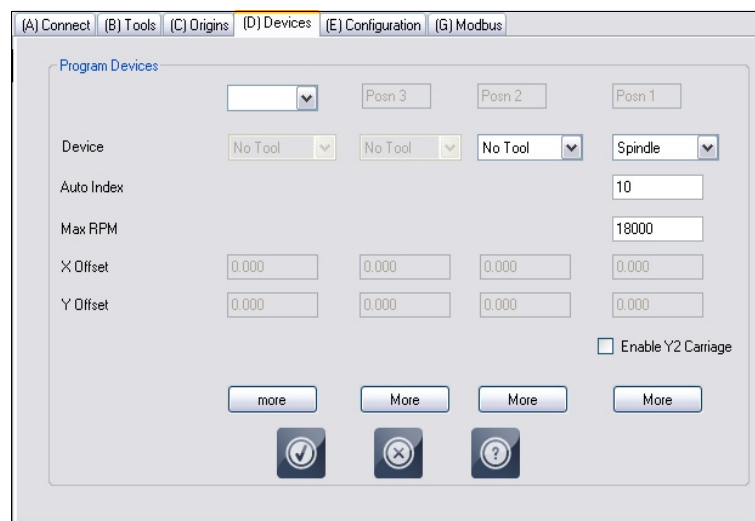


Setting Up Chisel Head in GUI and Creating Chisel Tool

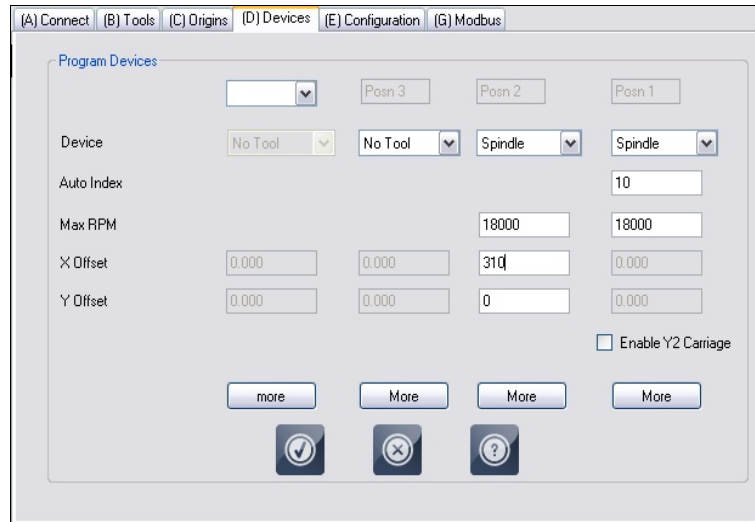
The Chisel head is an ISO30 attachment and thus fits into HSD QTC spindles. A customer could use the Chisel Head as a manual tool to be loaded into a HSD spindle when needed. If this is the case goto step 3.

If a Dual Head setup is being used follow the steps below.

1. Connect to the GUI and change the Permission to Supervisor. Click on the Devices Tab. Below is a typical setup for a machine that has 1 Z axis and a Spindle.



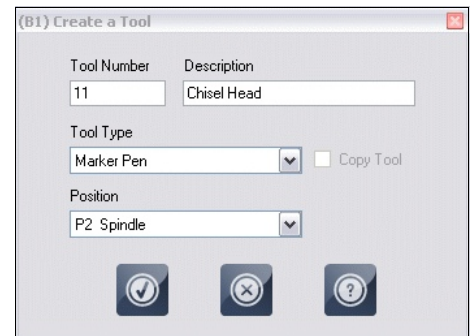
2. Change the configuration to the following for Posn2. Select Spindle for Device. This will then allow a X and Y offset to be added. The X and Y offset is the difference between Posn1 and Posn2 in millimeters so that the Spindle will move to the correct position. To find this figure simply put the same tool in the Posn1 and Posn2, run a job that should plunge 2 holes in the same position, measure the difference between to 2 holes and enter the figures into the X and Y offset fields and save the settings. Following is an example of what the devices tab will look like.



3. A tool will now need to be setup to run the Chisel Head. Click on the Tools Tab in the GUI. Click on the Add Tool icon.



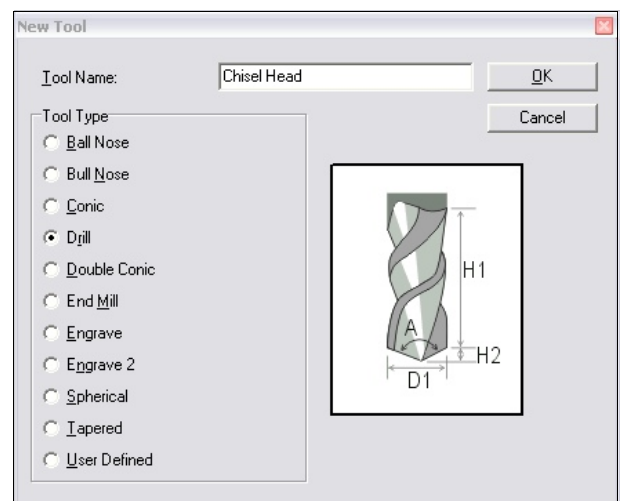
4. Enter the tool information for the Chisel Head. Enter the Tool number and Description. Select the Tool Type as Marker Pen (this is used as we do not want an RPM assigned to the chisel and Marker Pen does not assign an RPM to the tool). Select the Position, for a single head machine this will be P1 Spindle for a Dual head machine this will be P2 Spindle. Click the Tick to accept the tool. Save the information in the GUI



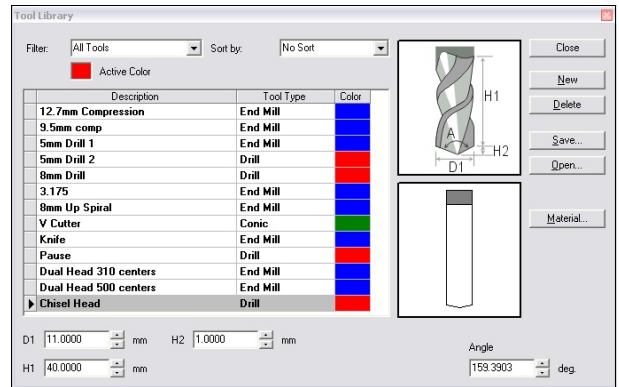
5. Perform a FUNC 25.11 to tip off the Chisel Head. The Chisel Head will now be setup ready to use.

Create Chisel in Enroute:

1. Click on the **Setup Menu** and Click on **Tool Library**.
2. The Tool Library window will open. A tool now needs to be created called Chisel Head.
3. Make the Tool name **Chisel Head** and select the Tool type as **Drill**. Click OK.

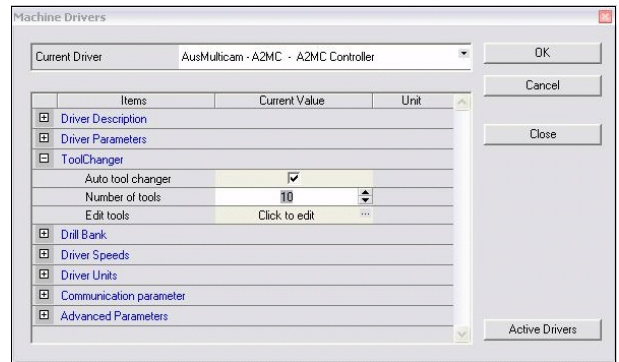


4. The Tool Library window will appear again. Assign the tool parameters for the Chisel Tool. For this example D1= 11mm, H1= 40mm and H2= 1mm. Save the tool library and click Close.

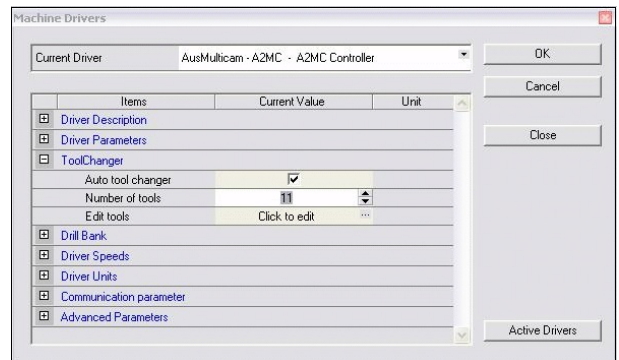


5. The Chisel Tool now needs to be assigned a tool position. If a position is not assigned when you create the NC file an error message will display that the tool is not assigned. Click on the **Setup Menu** and click on **Machine Setup**.

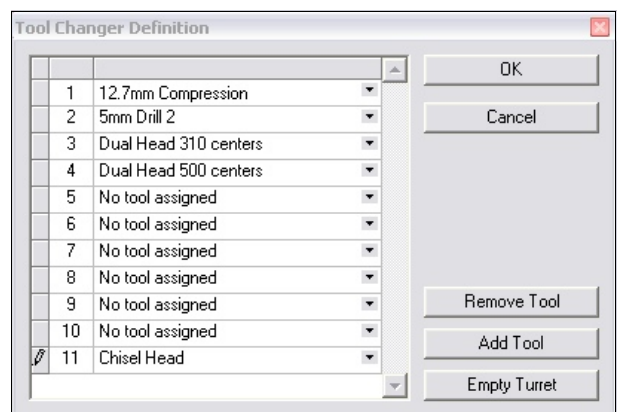
6. The Machine Drivers window will display. Click on the "+" next to ToolChanger to expand its contents. If you are using a Quick or Auto Tool Change machine the Auto tool changer tick box should be ticked



7. The number of Tools will need to be increased by 1 to assign the Chisel tool. This is because Chisel tool is not part of the ATC and if it is assign to an ATC position, a tool will not be able to be placed within that cup in the ATC. Click on Click to edit to add the Chisel Tool. This example is based on a 10 station ATC.



8. Add the Chisel Tool into the New Position (11) click **OK** to return to the Machine Drivers window and Click **OK** to save the new settings. Now that the tool is setup a Chisel point can be added into the job.



Assign Chisel Toolpath:

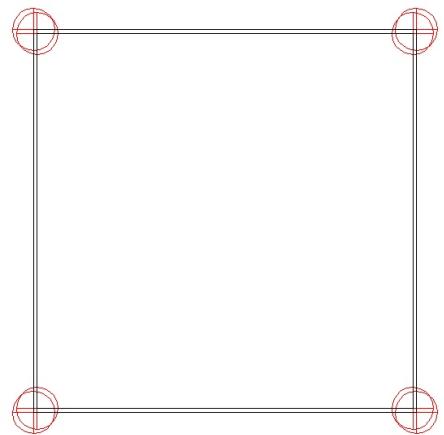
Before applying a the chisel tool to the corners of a cut out, please take the following into consideration.

- If there is no Drill in the center of the Chisel tool, the chisel will need to plunge 1mm away from the corner and then move to the corner and plunge the chisel.

To create the Chisel Points in the corners of a cut out there is a number of different ways to do this. Some ways are faster then others. It would appear that the easiest way to chisel the corners would be to use the Drill Point tool in Enroute and place the drill point where the chisel needs to plunge. But this would involve placing 2 Drill points in each corner and is quite time consuming. For this example a rectangle will be used and Enroute can then assign a Drill point to the corners of the rectangles. The following will show only the applying of the chisel points as other routes may vary.

1. Create a Job

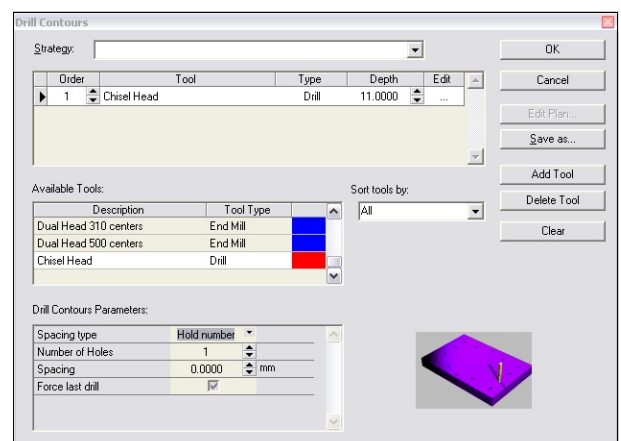
To add the Chisel Positions draw a rectangle. The corners of the rectangle should be at the center point of the chisel. So if an 11mm Chisel tool is being used the rectangle can be offset 5.5mm from the internal cut. Draw a second rectangle offset 1mm in from the original rectangle. It should look like the example on the right.



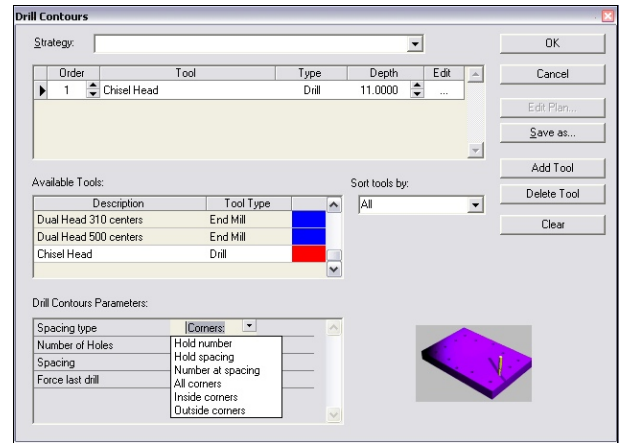
2. Select the outshape for the Chisel Points. Select the Drill Contours tool. This can be found under the Toolpath menu, Drill and Drill Contours, Click on the Drill Contours Icon.



3. In the Drill Contour window select the Chisel Tool and set the Depth, Feeds and Speeds.

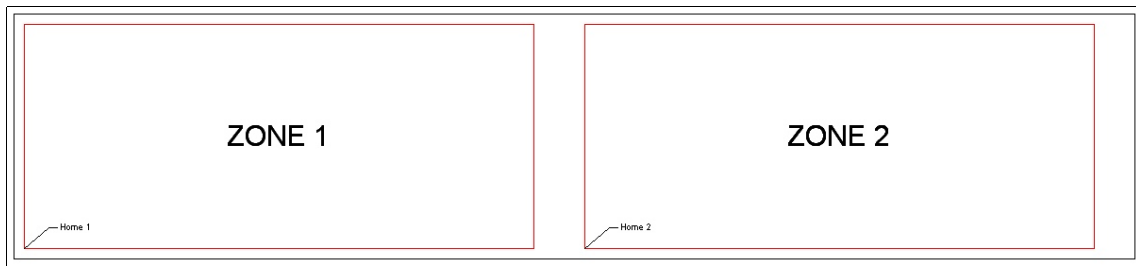


4. In the Drill Contour window change the spacing type to All Corners. This will apply drill points at each corner of the rectangles. Click OK.
5. Repeat steps 2, 3 and 4 for the inside shape for chisel points.
6. The rectangles will now have the drill points applied to each corner for the chisel tool. The chisel points will need to be sequenced from inside out for the chisel to work correctly.
7. Output the job to the machine.



Appendix C - Setting up Dual Vacuum Zones in Enroute

The A2MC controller has the ability to run 2 Vacuum Pumps and have them operate independently. This can be used on a machine that has 2 work zones as per the example below.



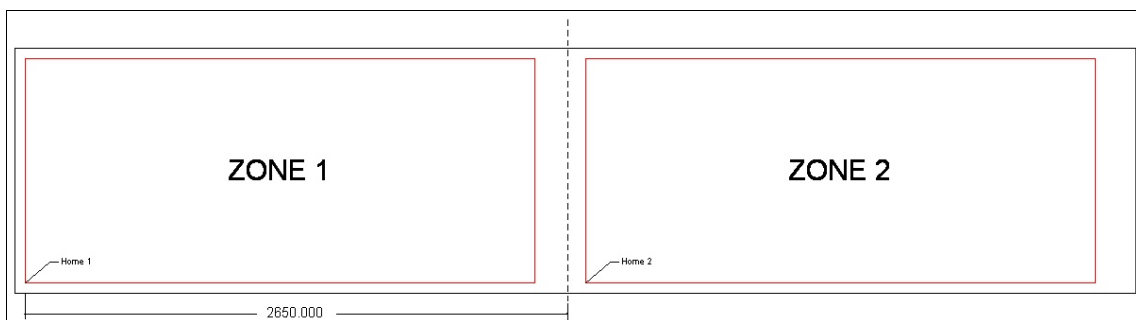
We can set a position in Enroute that will then place the appropriate M codes into the NC file to turn Vacuum Pumps 1 and 2 on and off at the appropriate time.

In this example the machine has Dual 2400mm X 1200mm work zones. Each lower left corner of the zone is considered to be the Home Position for that zone. Below are the steps involved in setting up a Dual Zone Vacuum System.

- Configure Enroute File: AusMulticam - A2MC
- Positioning parts in different zones in Enroute

Configure Enroute File:

For Enroute to create NC file for Dual Zone operation, the file AusMulticam - A2MC needs to be modified. The file can be found in the following directory: C:\EnRoute4_1\Ndrivers and has a file type of SpeedDial. It will need to be opened in either Wordpad or Notepad for modification.



1. The Zone positions now need to be determined, so that when an NC file is created the correct vacuum pumps will turn on and off. Find the position, this should be somewhere in the dead area between the 2 zones. On the picture above this is at 2650mm from Home 1.
2. Open Wordpad or Notepad
3. Click File Open and browse to C:\EnRoute4_1\Ndrivers

- Select the file AusMulticam - A2MC and open it. The file will display Enroute setup information, *under no circumstances change any of this data as it will affect the running of Enroute.*
- Add the following text at the bottom of the file:
 [ZONE]
 X= 2650
 Y=0

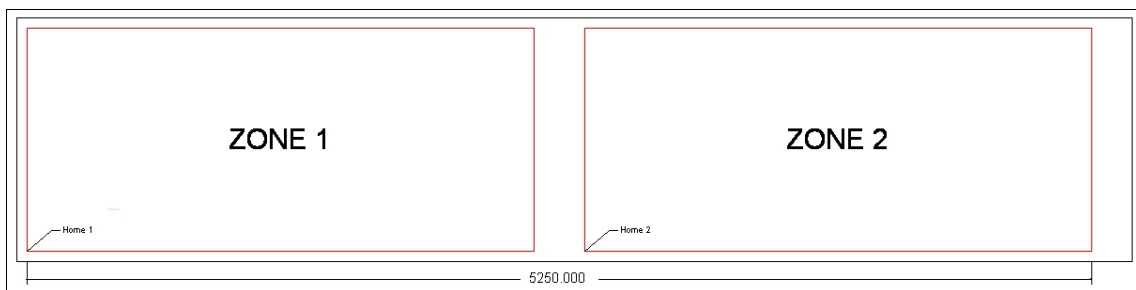
This information allows Enroute to operate different zones for the machine. If you wish to turn the Dual Zones off change to this:

[ZONE]
 X= -1
 Y=0

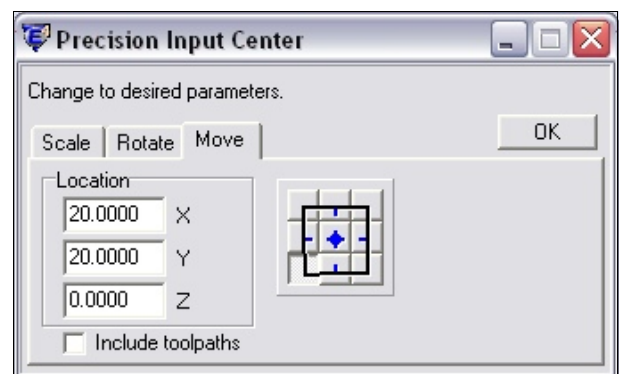
- Save the file and close Wordpad or Notepad.

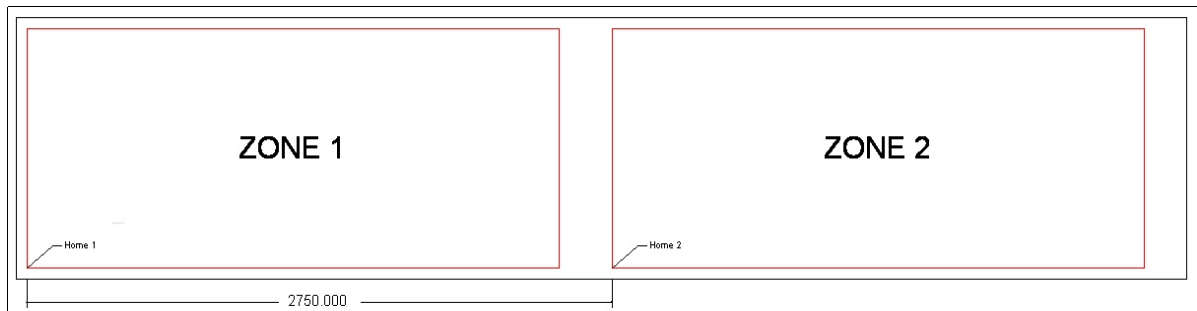
Enroute is now setup for running Dual Vacuum Zones.

Positioning parts in different zones in Enroute:

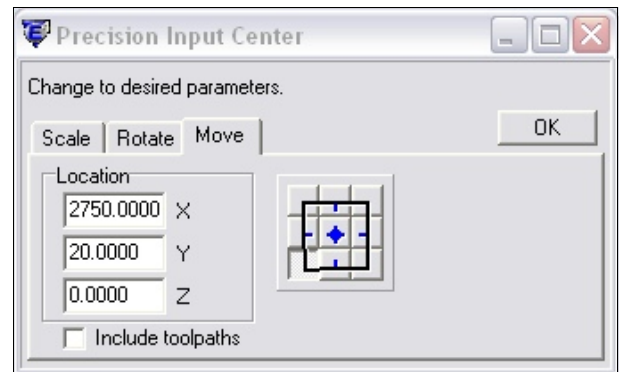


- Create a new job in Enroute and Define a Plate size. The Plate Size will need to be the 2 work zones plus the dead area between them. In the example below the X = 5250mm and the Y axis will be the width of the material.
- Import or create a job in Enroute. This example is using 2, 1000mm X 500mm rectangles.
- Select the first rectangle and press F2
- The Precision Input Center window will open. Click on the **Move Tab** and type in the position for the first part. This will be how far you wish the part to be offset from 0,0. Click **OK** and the part will move to that position.





5. Select the second rectangle. Repeat the steps as per the first rectangle but allowing for the different X position. The X position is the Distance between Home 1 and Home 2. Refer to the picture on the next page for details.
6. Apply Toolpaths and output the job to the machine.



When the parts are run in Zone 1 the vacuum pump for Zone 1 will turn on and the vacuum pump for Zone 2 remain off. When the parts in Zone 1 are completed the vacuum pump for Zone 1 will turn off and the vacuum for zone 2 will turn on and cut the parts in Zone 2.

The following page shows sample code with comments for your reference.

Sample NC Code for using Dual Zones:

(Multicam Australia A2MC Post)

G90 G56
N10 M808 Turn on Vacuum Zone 1
N20 M6 T1
N30 G0 X69.9359 Y1027.2226
N40 M3 S18000
N50 Z21.0000
N60 M8
N70 G1 F3000
N80 X19.9359 Y1026.3500 Z-0.5000
N90 X13.6500 F20000
N100 Y20.0000
N110 Y13.6500
N120 X1026.3500
N130 Y1026.3500
N140 X19.9359
N150 G0 Z21.0000 F3000
N160 M9
N170 M809 Turn off Vacuum Zone 1
N180 M814 Turn on Vacuum Zone 2
N190 X2791.0103 Y1027.2226
N200 Z21.0000
N210 M8
N220 G1
N230 X2743.6174 Y1026.3826 Z0.6351
N240 X2743.6500 Y1023.7103 Z-0.5000
N250 Y20.0000 F20000
N260 Y13.6500
N270 X3756.3500
N280 Y1026.3500
N290 X2743.6500
N300 Y1023.7103
N310 G0 Z21.0000 F3000
N320 M9
N330 M815 Turn off Vacuum Zone 2
N340 M5
N350 G28
N360 M30

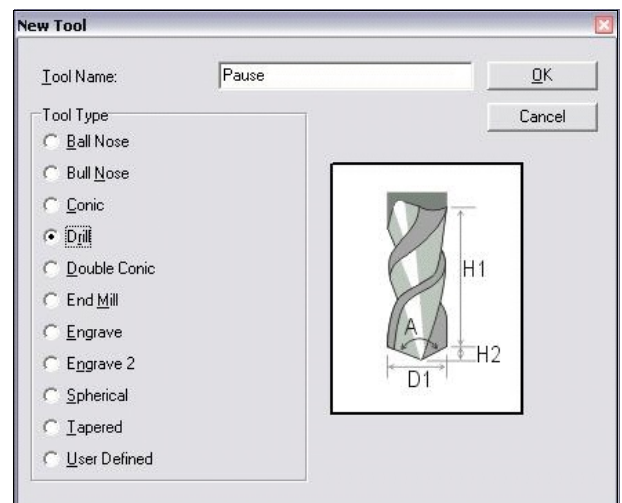
Appendix D - Adding a Pause Point into Enroute

Enroute has now got the ability to place 1 or more pause points within a job. These points can be placed anywhere within the process area of the machine. The machine will move to the position that the pause point is set in Enroute and the spindle and vacuum bed will turn off. Shown below are the steps involved in adding 1 or more pause points to a job.

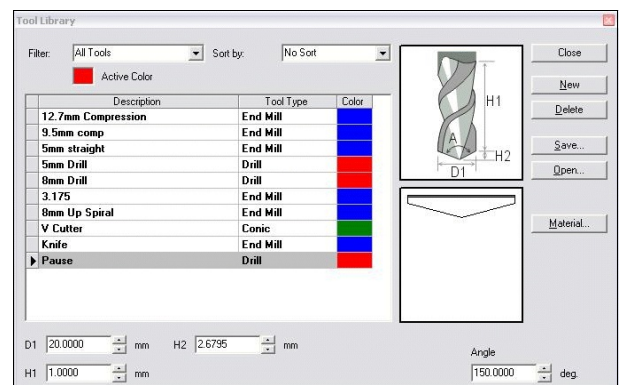
- Creating the Pause Tool
- Adding a Pause point into the job

Creating the Pause Tool:

1. Click on the **Setup Menu** and Click on **Tool Library**.
2. The **Tool Library** window will open. A tool now needs to be created called Pause. When a tool is called pause it will create an M0 command within the NC file. Anytime the machine reads an M0 command the machine will pause and wait for the user to continue running the job. Click on the New button to open the New Tool window.
3. Make the Tool name **Pause** and select the Tool type as **Drill**. Click **OK**.

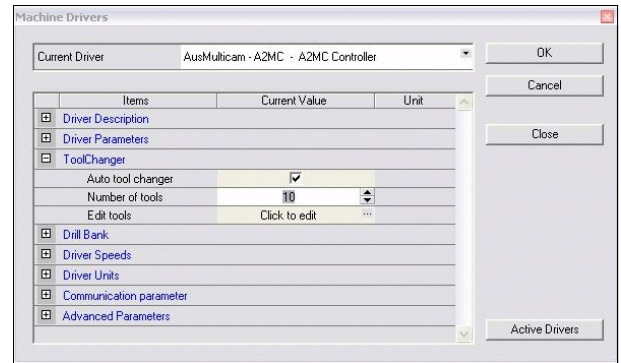


4. The Tool Library window will appear again. It is not necessary to assign tool parameters, although if you make **D1 (Tool Dia) approx 20mm** it will make it easier to see the pause point on the screen. Once the parameters are set click Save and save the Tool Library. Click Close to exit the tool library window.

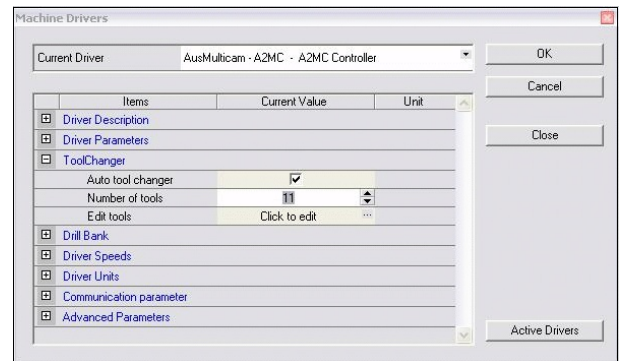


5. Although the Pause tool is not being used for drilling it still needs to be assigned a tool position. If a position is not assigned when you create the NC file an error message will display that the tool is not assigned. Click on the Setup Menu and click on Machine Setup.

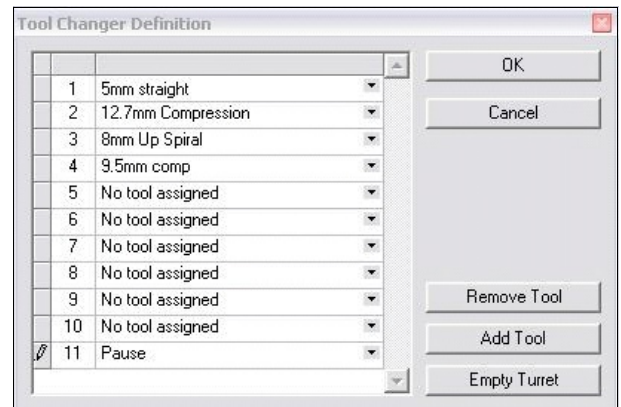
- The Machine Drivers window will display. Click on the "+" next to ToolChanger to expand its contents. If you are using a Quick or Auto Tool Change machine the Auto tool changer tick box should be ticked.



- The number of Tools will need to be increased by 1 to assign the Pause tool. This is because Pause tool is not part of the ATC and if it is assign to an ATC position, a tool will not be able to be placed within that cup in the ATC. Click on Click to edit to add the Pause Tool. This example is based on a 10 station ATC.

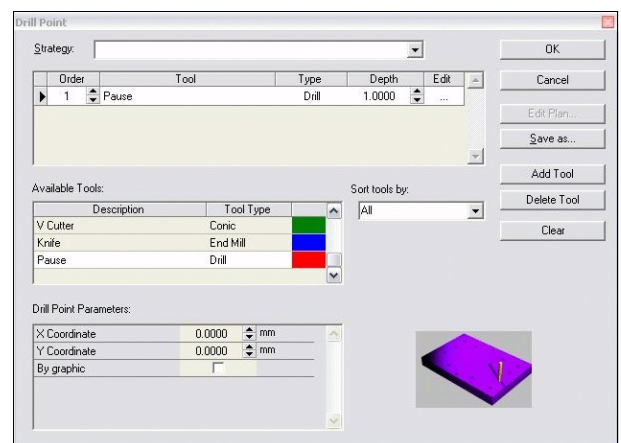


- Add the Pause Tool into the New Position (11) click OK to return to the Machine Drivers window and Click OK to save the new settings. Now that the tool is setup a pause point can be added into the job.

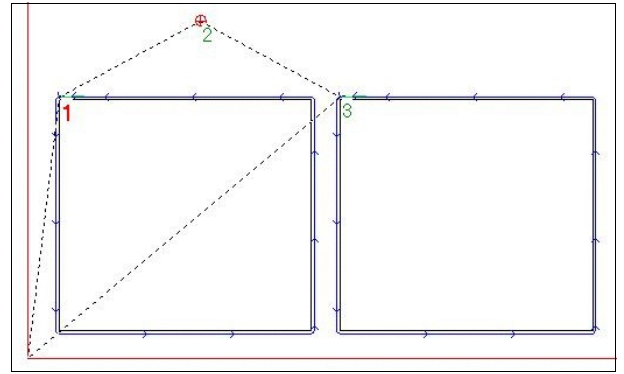


Adding a Pause point into the job:

- Create a Job in Enroute.
- To create pause point click on the Drill Point icon and the Drill Point window will open.
- In the Drill Point window select the Pause Tool. You must also set a depth for the tool, this depth is not used, but must be set for Enroute to accept the command. Something like 1mm will do. There are 2 ways of setting the pause point position within the job, these are using X and Y co-ordinates or By graphic which lets you set the position with the mouse. The pause point can also be saved as a strategy, this will remember whether it is using co-ordinates or By Graphic. You can also set multiple pause points and save them as strategies.



The Pause will display as a Drill Point on the screen. It is treated like any other shape within the job. It will need to be sequenced so that the pause command is activated at the appropriate time. Below is a sample job with 2 shapes and a pause point between them.



Sample NC file using a Pause Point:

```
(Multicam Australia A2MC Post)
G90 G56
N10 M814
N20 M6 T1
N30 G0 X110.3006 Y514.4953
N40 M3 S18000
N50 Z21.0000
N60 M8
N70 G1 F3000
N80 X60.3006 Y513.6227 Z-0.5000
N90 X54.1045 F20000
N100 Y54.5455
N110 Y48.1955
N120 X563.1682
N130 Y513.6227
N140 X60.3006
N150 G0 Z21.0000 F3000
N160 M9
N170 M5
N180 M809
N190 G0 X338.8445 Y662.2840
N200 M0
N210 M808
N220 M5
N230 M6 T1
N240 G0 X664.0642 Y514.4953
N250 M3 S18000
N260 Z21.0000
N270 M8
N280 G1
N290 X614.0642 Y513.6227 Z-0.5000
N300 X607.8682 F20000
N310 Y54.5455
N320 Y48.1955
N330 X1116.9318
N340 Y513.6227
N350 X614.0642
N360 G0 Z21.0000 F3000
N370 M9
N380 M809
N390 M815
N400 M5
N410 G28
```

Turns off Spindle
 Turns off Vacuum Pump
 Moves to Pause Position
 M0 to Pause machine, wait for user

Appendix E - Multicam Vision System Manual

The Multicam Vision System (MVS) is an optional accessory aimed at companies that require the ability to profile cut pre printed designs on rigid board. The primary application of the MVS system is digital print finishing where the camera is used to quickly locate registration marks and adjust the machine cutting path to achieve exact alignment with the printed shapes. It includes non-linear/linear distortion, skew and rotation correction and is tightly integrated in to the A2MC controller of the machine.

To use the MVS you will require the following options;

- MVS Camera mounted on the machine (Webcam or IP camera may be supplied)
- Activated MVS software.

The following pages describe the use of the Multicam Vision System.

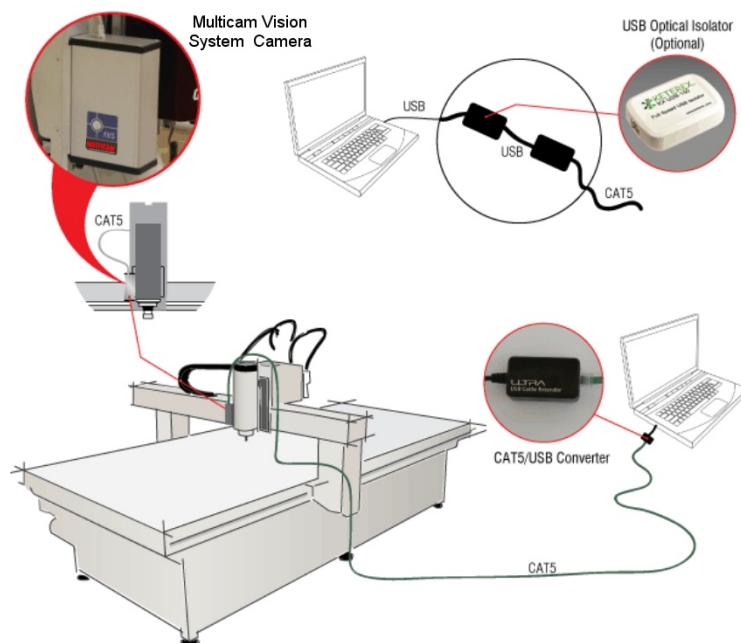
MVS Overview

The Multicam Vision System (MVS) allows for the automatic alignment and correction of printing errors in Cut to Print applications. It handles locating and rotating the image as well as adjusting for X and/or Y stretching and has a very easy to use visual interface that is connected to the A2MC via the local area network enabling very fast and smooth jogging and positioning. MVS operates in full colour with a very large viewing area for ease of use. It is able to operate with three different types of location dots to avoid the problems associated with getting the sequencing of dots mixed up or incorrect placement of the printed sheet on the machine bed.

The camera only requires a single CAT5 cable connection to the computer so it can be quickly and easily retrofitted to any existing A2MC controlled machine.

The Multicam Vision System is powered by A2MC vision registration software which offers a proven full non-linear/linear distortion, skew and rotation correction system.

The diagram below shows the components that make up the the Multicam Vision System.



Installing the Camera Software

Before commencing, device drivers for the camera must be installed on the computer that will be used with the Multicam machine as your print-to-cut workstation.

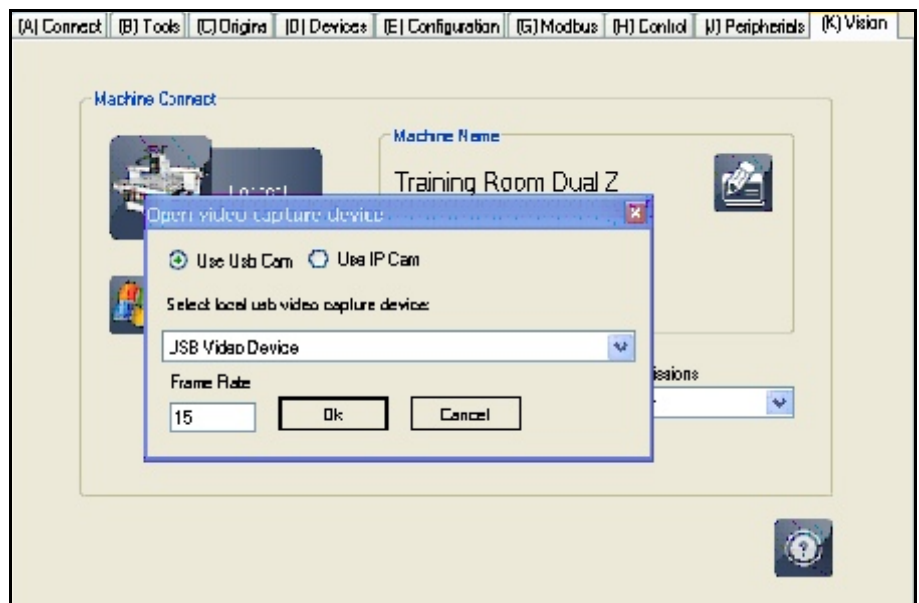
Follow the instructions supplied with the camera to install the device drivers.

You cannot proceed until the drivers are installed for the camera.

Starting the Multicam Vision System

To start the MVS

Application connect the A2MC Setup GUI to the machine and select the "Vision" tab. The "Open video capture device" form will open.

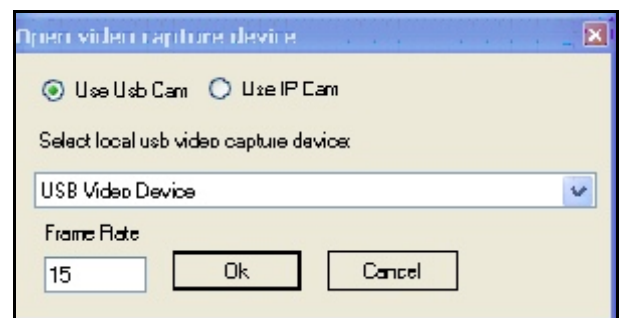


The MVS uses a USB "webcam" or an IP camera as the video capture device. From the drop down select the camera type that is connected to the machine. The drop down menu will show the name of the video device driver. In this example it is the generic Windows driver but can also be a Logitech driver or whatever will run the camera.

The frame rate can be set but is defaulted to 15 frames per second and it's usually best to just leave it at that speed. If you are operating on a very slow computer or a computer with a slow graphics card then you might have to slow this down in order to work. The AVS will still work but its performance will also slow down.

Click OK to accept.

You may get this warning displayed because the MVS Application does not recognize the camera driver or thinks the wrong driver is installed. Generally this problem occurs with Windows XP platforms. Usually the warning can be ignored and just click on the check button.



The MVS Application will now try to open up the camera and obtain a video image.

If everything is working right you will get a screen that looks like this after a few seconds. A full colour image should appear. If it fails, check the trouble shooting section at the end of this manual.

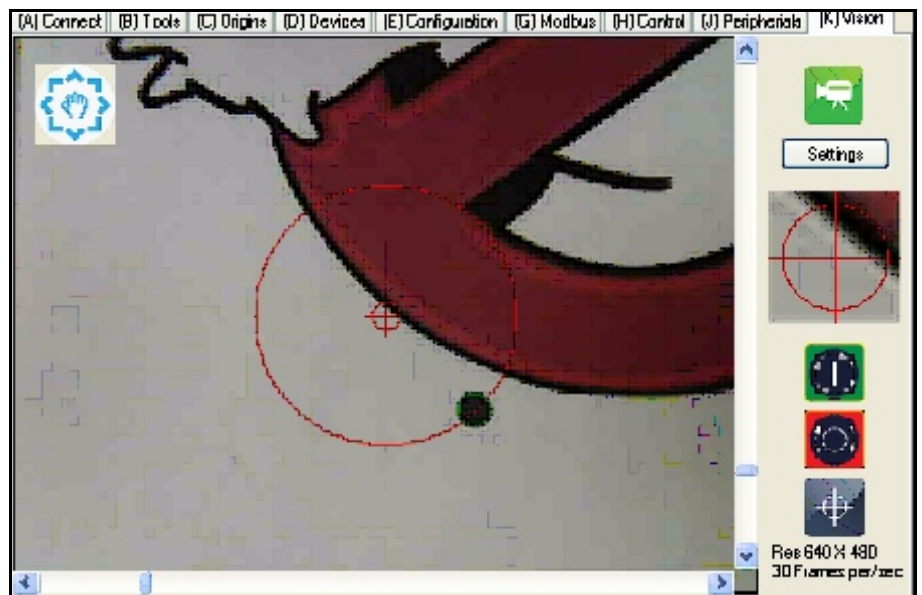
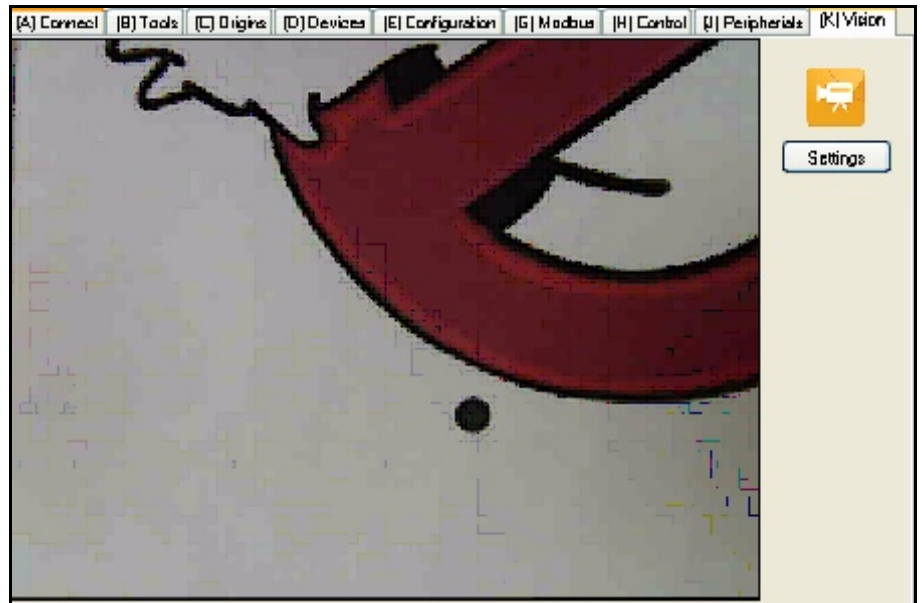
At this point the video image is connected to the MVS Application but the MVS Application is not yet connected to the machine. Click the orange “camera button”...

The operator console at the machine will ask to enable remote operation. This is a safety requirement of any application that will remotely operate the machine. You have 15 seconds to go to the machine and select “YES”.

Once the machine “remote” is enabled the full MVS Application will appear on the screen.

The resolution of the video and the frame rate is shown in the lower right and should be 640 x 480 and at least 15 frames per second.

The various features of the MVS Application are discussed in subsequent sections.



The MVS Licence

The MVS Application requires a valid license. The license is connected to the machine itself so any number of computers can have the MVS Application installed but the Application itself will only work on a licensed machine. If the machine does not have license then the following screen will appear:

“N1” is a number that is unique to every A2MC. It is actually part of the MAC ID of the mini ITX computer in the A2MC. “N2” is the table ID of the machine.

In order to obtain a license request the MVS key from your local Multicam office.

Once the key is obtained type it into the appropriate field and click the “check”.

The machine will now be MVS enabled.

A “KeyCodes.csv” file will be created on the A2MC controller in the **hdd1** folder.



As long as the “KeyCodes.csv” file, the A2MC itself, and the table ID stay the same the MVS Application will be enabled. If any change, by changing the A2MC hardware, losing the file, or changing the table ID the MVS Application will be disabled.

Since it is possible that the A2MC fails or something gets lost it is very important that the correct customer details are supplied with the license request so that replacement licenses can be issued if required.

MVS Jogging Control

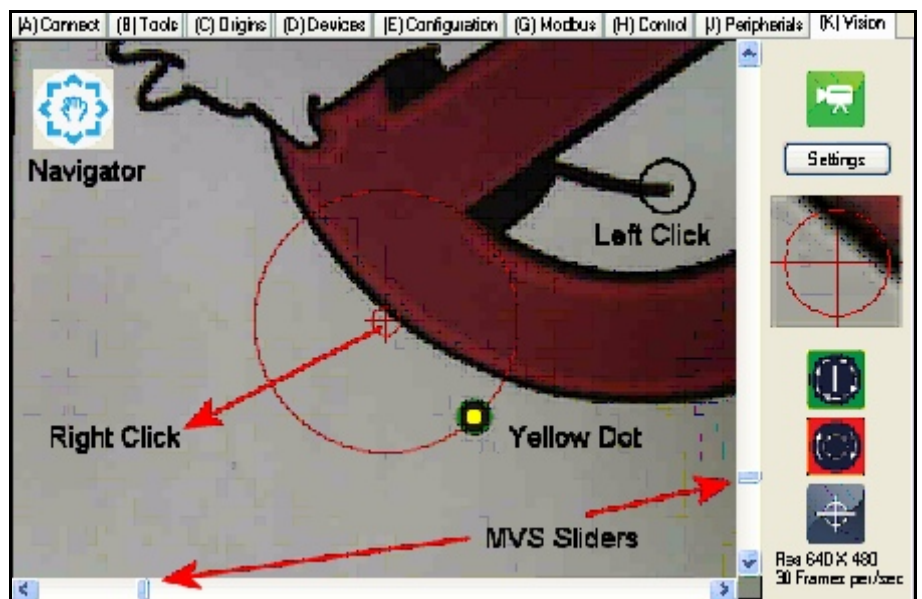
The MVS Application has a number of jogging controls:

There are five jogging methods; “Navigator”, “Left Click”, “Right Click”, “Sliders”, and “Yellow Dot”.

Navigator

This works just like the navigator on Google maps. Clicking on any arrow will simply jog the machine half a screen (about 75 mm) in the indicated direction.

Clicking on the “hand” in the middle will simply back up the moves. If the machine is too close to the edge of the table then the arrows in that direction will not work.



Left Click

Left click is used by simply pointing to a place on the screen where you want the machine to move and left clicking on the mouse. The machine will move to that position. You can left click anywhere on the screen.

Right Click

Right clicking anywhere on the screen will create a red arrow from the centre of the screen to the clicked location. As long as the right button on the mouse is held down this arrow will remain, when you let go the arrow disappears. The machine will jog in the direction of the arrow and at a speed proportional to the length of the arrow, short arrow is a slow jog, long arrow is a fast jog.

AVS Sliders

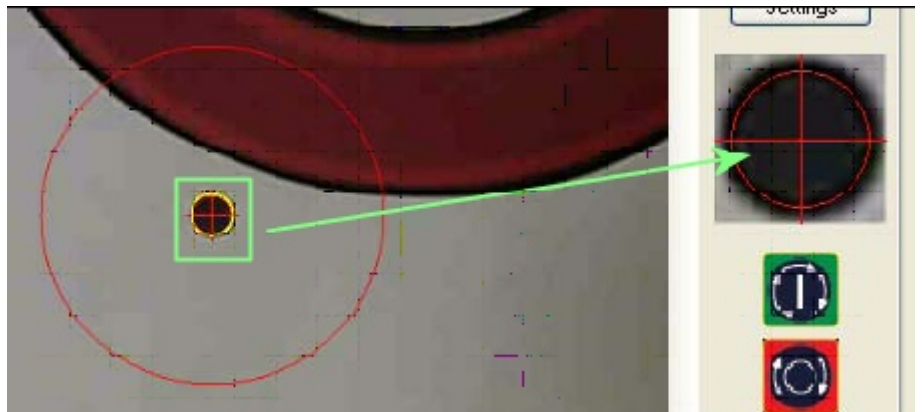
The sliders allow you to jog quickly anywhere on the table. There is an X and a Y slider. The ends of the sliders are the extents of the machine. Holding down and pulling the slider to any position will rapidly move the machine. Be careful with this control as you can move the machine from one end to the other at full speed!

Yellow Dot Command

Yellow dot commands are initiated by simply left clicking into the middle of any dot that is visible on the screen and has either a yellow or green border.




When you click on it a yellow dot will appear in the centre of the dot and the machine will automatically move to exactly center the dot:



Vision Controls

The Vision Controls are accessed by clicking the “Settings” button. A form will appear that controls how the MVS software will work:



Dot Size	Camera Calibration	Camera X Offset
21	117.303	0
Auto Diameter	Camera Angle	Camera Y Offset
225	-0.057	0

Calibrate

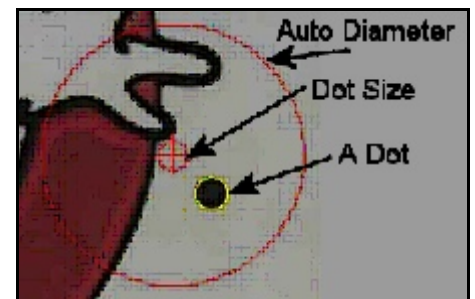
Show Filter Turn camera Off during job Dry Run

Dot Size and Auto Diameter

Both the dot size and the auto diameter are measured in “pixels”.

The dot size should be set to approximately match the size of the dots that will be normally used. Position the camera so that a dot is visible near the centre of the screen. Adjust the dot size until the dot is circumscribed by a yellow border.

The auto diameter determines the automatic search radius when the MVS system is looking for dots. This value varies by the operator preference. Set it initially to about 200 pixels and then as you use the system make adjustments that work best for your types of jobs.

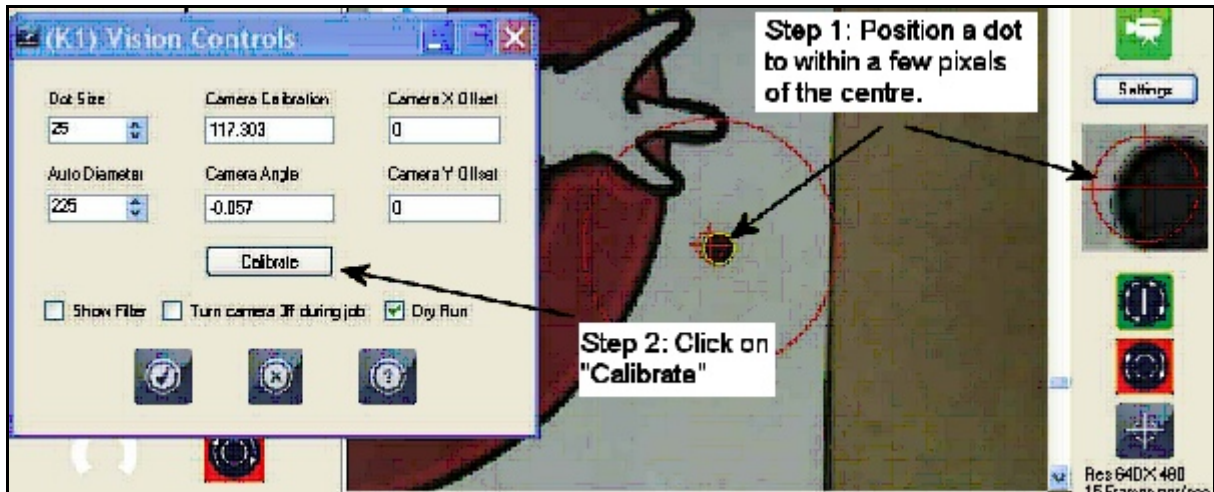


Camera Calibration and Camera Angle

Camera resolution is measured in pixels. The machine's resolution is in millimeters so there needs to be a conversion between pixels and millimeters.

The camera calibration will be in pixels per millimeter. The exact value will depend on how high the camera is actually installed above the material but is normally about 4 pixels per millimeter.

The camera is often not installed perfectly square to the X and Y axis so there is a camera angle adjustment for that measured in degrees. The camera should be mounted so "camera top" is the positive Y axis so the camera angle is usually quite small, normally between -2 and +2 degrees.



Calculating the camera calibration and the camera angle is done automatically by:

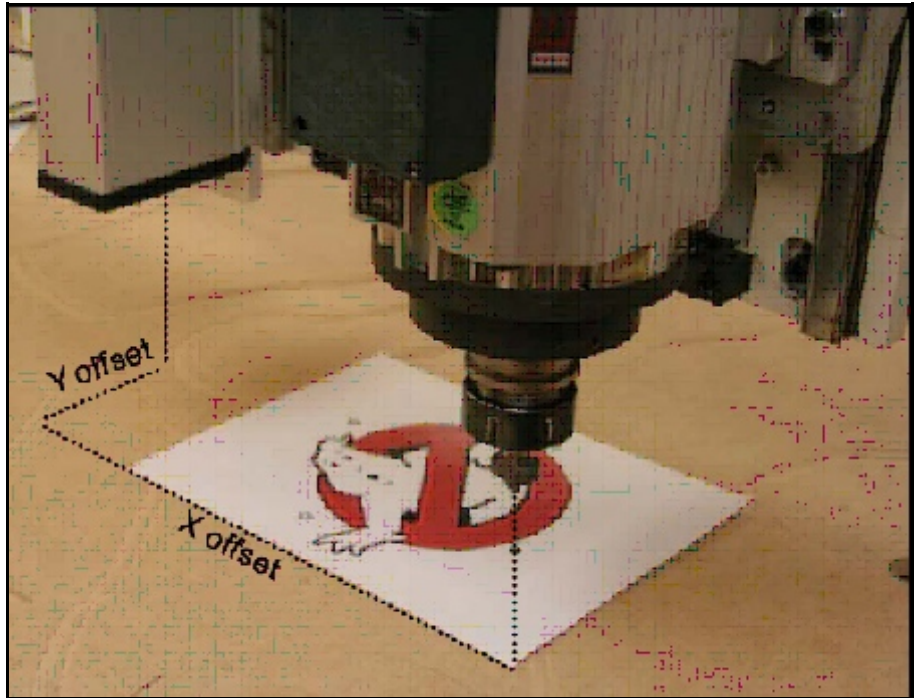
1. Position a dot within a few pixels of the centre of the screen as shown. The dot must be circumscribed with a yellow border. You can either jog the machine to the dot or simply move the dot under the camera.
2. Make sure the Auto Diameter is set to at least 200 pixels. You can always shrink it later but the calibration is more accurate if the auto diameter is set larger.
3. Press "Calibrate".
4. The machine will move the dot around the inside of the auto diameter and will take sufficient measurements to calculate both the camera calibration and the camera angle. These values will automatically be placed into the form.

Camera X and Y Offset

The camera X offset and camera Y offset is the distance from the centre of the tool in Position 1 to the centre of the camera image as shown on this diagram.

If you have a multiple position machine always measure the camera from position 1. Any other offsets will then be calculated correctly.

These offsets can be typed in manually, however they are also calculated as part of the calibration process. After the camera calibration and camera angle are calculated the operator console will prompt:

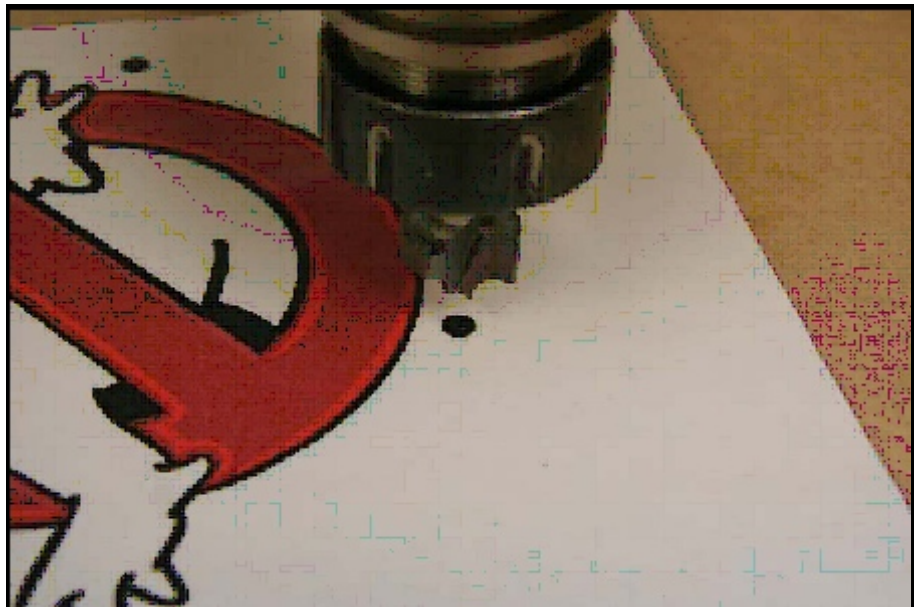


“Locate and Mark P1”

You can either use the jog keys to locate position 1 (P1) directly over a printed dot or you can drill a 6 mm hole with position 1 (P1) into a white piece of plastic.

Either way you need to align the centre of a dot exactly with the centre of the tool in P1.

Once the tool in P1 has been located the operator console will prompt, “Camera to P1 Mark”.

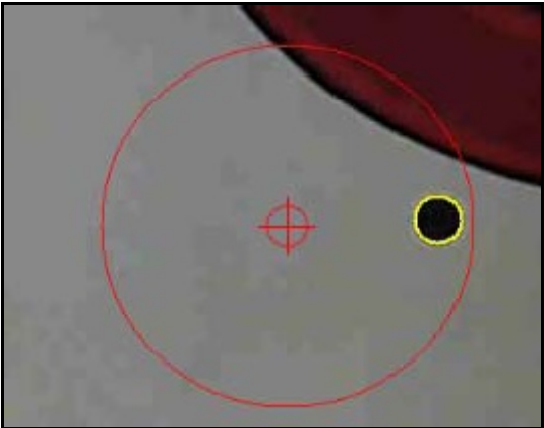


Note:

If you are using an Oscillating knife and camera system it can be difficult to accurately align the center of the knife head with the dot as the tip of the blade is often offset. Normal practice is to use a 6mm blank or dummy shaft that is placed in the knife head instead of a blade. This can then be used to accurately center the knife head in to the drilled hole. You can make a simple calibration plate with a 6mm hole in it and keep it for just this purpose.

You should always home the machine after swapping to or re-fitting the oscillating knife head.

Return to the MVS software and use the jog features to move close to the dot that was marked.



Once it is visible on the screen simply click into the middle of the dot and the MVS software will command the machine to find and centre the dot.

Once the dot is centered the Camera X Offset and Camera Y Offset will be calculated and the values filled into the form as shown below.

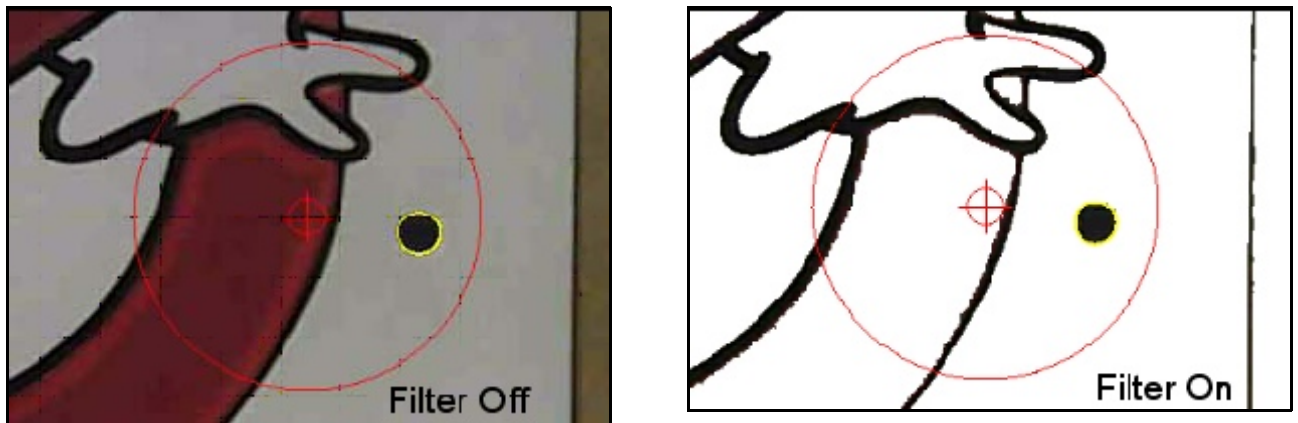
Dot Size	Camera Calibration	Camera X Offset
24	118.000	1.230
Auto Diameter	Camera Angle	Camera Y Offset
225	0	11.345

Show Filter Turn camera Off during job Dry Run

Camera Filter

In order to properly “find” black dots on white backgrounds the AVS software filters the camera image.

This filter can be viewed by checking the “Show Filter” feature in the Vision Controls form.



Normally leave the filter off in order to get a full colour image on the camera. However, the filter can be turned on to check if the camera is producing a clean image. If the camera is out of focus or the ambient light is insufficient then the filtered image will clearly show any problems.

Turn Camera Off During Job

Sometimes all the equipment such as vacuum pumps, spindles, and dust collectors will interfere with the camera and cause the software to crash or the camera to disconnect unexpectedly. The camera is not really needed while a job is running so it can be turned off to avoid these interference problems.

The camera will automatically re-connect after the job is complete.

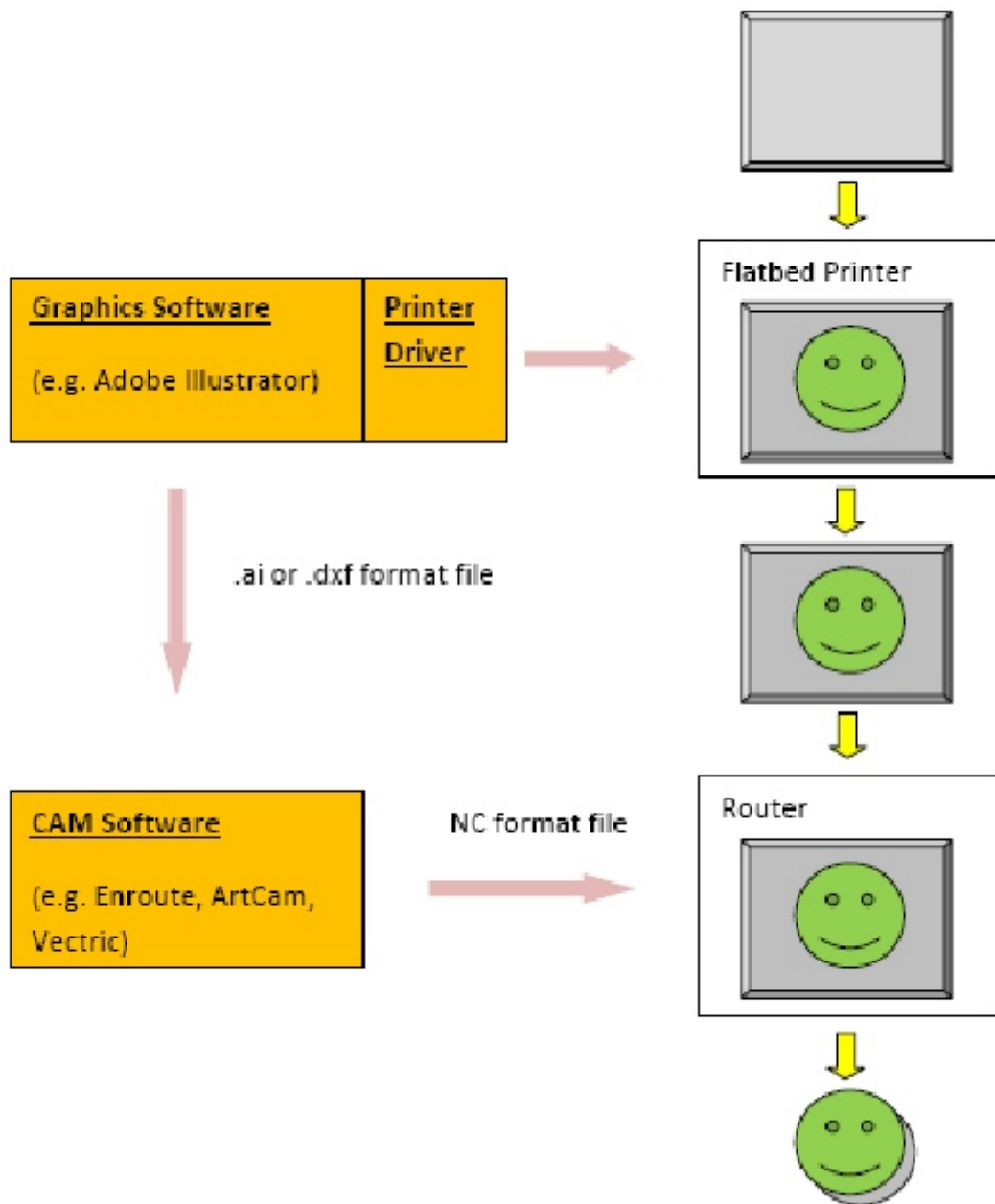
Dry Run

If Dry Run is selected the job will run without actually lowering the spindle and without turning the spindle on. This feature is very useful for training purposes as well as testing out a job to see if things line up before actually cutting into the material.

Print to Cut

Print to cut is a two step process:

1. An image is printed onto usually a rigid or semi rigid material using a flatbed printer.
2. The image is mechanically cut out using a router or knife.



The process starts by creating a graphic using some sort of graphics software. In the example above the graphic is a green smiley face. The graphics software can be anything that will operate the printer but likely the most popular is Adobe Illustrator.

The material is loaded on to the flatbed printer and the image from the graphics software is printed using the appropriate printer driver as shown on the right side of the diagram.

The graphics software also exports the cutting outline in either “.ai” or “.dxf” format. The “.ai” or “.dxf” file is then imported into a CAM (computer aided manufacturing) software such as Enroute, ArtCAM, or Vectric.

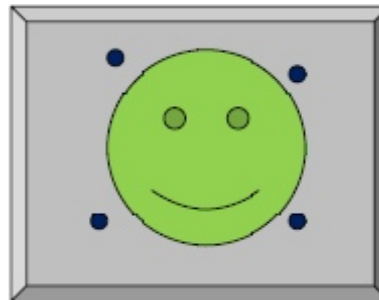
The CAM software then generates an “.nc” format file that the router table can understand.

Finally the router table runs the nc file and cuts out the printed image for the final product.

Alignment

The challenge of the above process is to accurately align the cut file being run on the router to the image printed on the material by the flat bed cutter.

This is done by printing a number of dots on the material outside of the image:



The dots should be black and about 6mm in diameter. They should be well spread out. There should be at least three dots with four or five being optimal. The centre of these dots are then located by the MVS camera, processed by the MVS software which then adjusts the cutting file to exactly match the printed image.

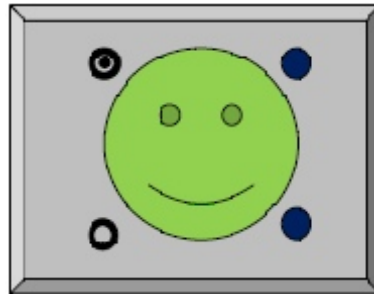
Dot Types

The dots can be all the same but this method has the disadvantage in that it is sometimes difficult to know which dot should be located first and which dot is second. The MVS software can recognize three different types of dots:



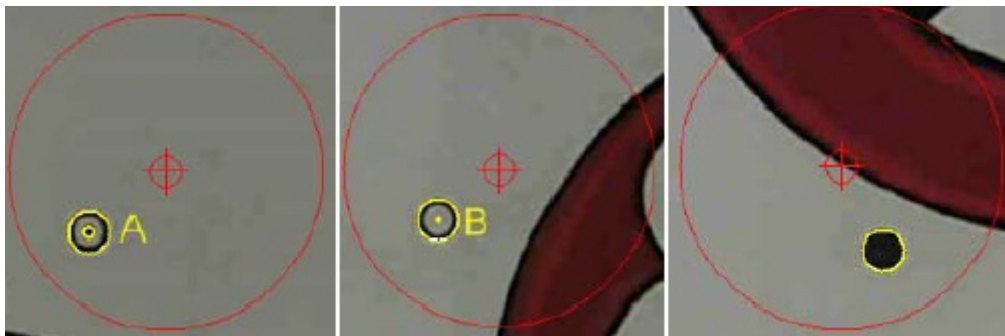
Type A is a “target” and is the first dot the software will search for, type B is a donut or annular ring and is the second dot the software will seek, all the rest of the dots are type C and are simply dots.

If dot types A and B are used then there must be only one of each in the printed image, all the remaining dots are then type C:



This diagram shows a typical printed output from the flatbed printer using one type A, one type B, and two type C dots.

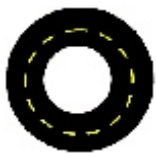
On the actual MVS operator's screen the different dot types appear as follows:



Note that dot type C is not labeled.

Creating Dot Types

It is important that the dot types are created properly in your graphics software.



When creating the annular ring or "type B" the wrong way is to create a circle and then give the outline a thickness as shown on the left. When this gets exported as an outline to the CAM program all you will get is a single circle indicated by the yellow dashes.



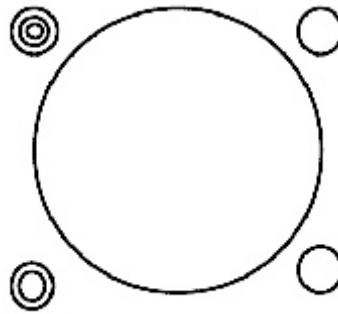
RIGHT!

The right way is on the right. Put a white dot into the centre of a black dot. Now you will get two outlines as shown. For a "type A" dot put a third black dot in the middle to get a third outline.



Importing into CAM Software

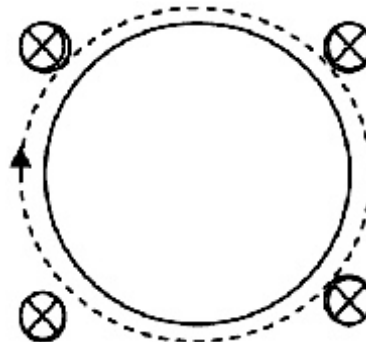
The next step is to export the cut outline and the dots to the CAM software. Once imported into the CAM software the file should appear as shown below:



Note that the cut file is now a single large circle as this is the outline of the smiley face. The type C dots are simply small circles. Type A dot are three concentric circles and type B dots are two concentric circles.

Tool Pathing the Cut Outline

The actual cutting outline is toolpathed using whichever tool is required to cut the material. All the dots must be defined as “drill” points and assigned as tool 1000 (T1000). The MVS system recognizes tool 1000 to be a dot that will be searched for by the camera.



The dots must be sequenced first, before any of cutting contours. It does not matter the order of the dots as the MVS software will find the type A dot first, the type B second, and it really doesn't matter what the order of the rest of the dots is. It also will not matter what the depth of the drill is.

The NC File

The nc file (smiley.nc) generated by the post from the CAM software must output the dots as drill points first followed by the normal tool path:

```
G21G90          mm and absolute mode
M6T1000         Set to tool 1000 (MVS camera)
G0X1Y1
G1Z0
G0Z3
G1Z0            This is a double drill point so dot type B
G0Z3
G0X1Y11
G1Z0
G0Z3
G1Z0
G0Z3
G1Z0            This is a triple drill point so dot type A
G0Z3
G0X11Y11
G1Z0            Single drill point so dot type C
G0Z3
G0X11Y1
G1Z0            Single drill point so dot type C
G0Z3
M6T1            Set to cutting tool T1
G0X1Y6
G1Z0
G2X1Y6I6J6F300 Cut the smiley face outline at 300
G0Z3
M30             End of cutting file
```

This is the file that must be downloaded to the A2MC controller to run the machine.

Sample Files

Sample MVS cut files are available on the A2MC CD so you can test out the MVS Application:

Each folder is separate job and will include 5 files:

1. An “.ai” file that is the entire graphic. This can be opened up in Adobe Illustrator.
2. An “.ai” file that contains just the outline of the graphic and the registration dots. This is the file that can be imported into your CAM package.
3. A “.dxf” file that contains just the outline of the graphic and the registration dots. This is the exact same file as number 2 except in “.dxf” format. Some CAM packages do not do well with “.ai” files so this is an alternative.
4. A “.pdf” file of the graphic. This can be used to print your own graphic to try out on the machine. All the graphics are small enough to fit on a normal printer.
5. Finally a “.nc” file which can be downloaded to the machine and run.

The quickest way to learn how to use the MVS system is to print the “.pdf” graphics supplied in the sample files and download the associated “.nc” files in the A2MC controller. Once you have the sample “.pdf” and “.nc” files running as you expect simply work backwards through your graphics and cam software using the attached “.ai” files.

Running Ghostbusters



One of the folders has the “Ghostbusters” MVS files.

Open the pdf file and you should see the image on the left. Print the image in either black or white or in colour.

Note the four registration dots on the image. There is one type A dot at the top, one type B on the left side and the lower and right hand ones are type C.

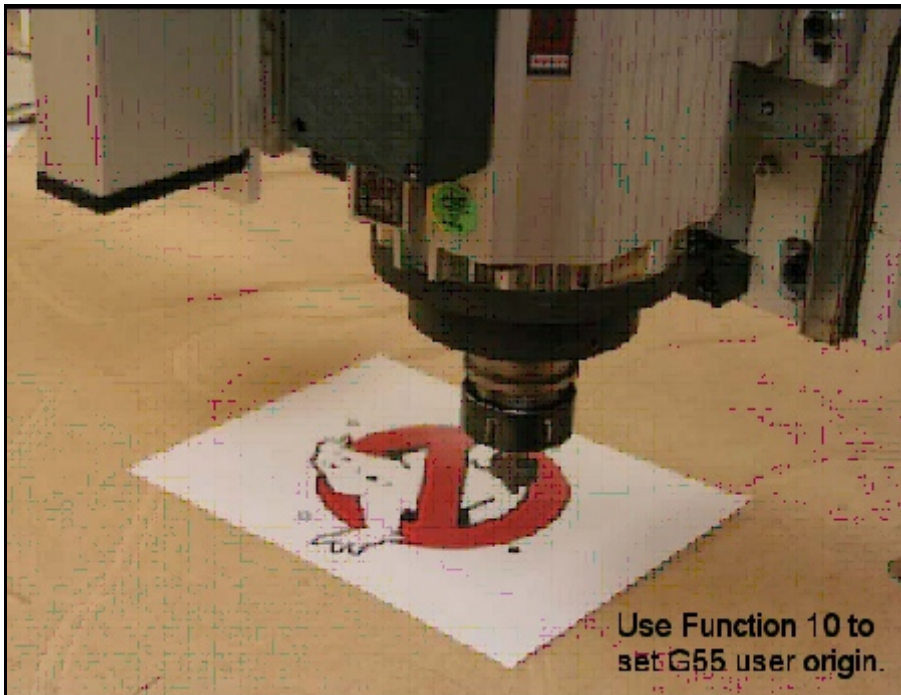
Lay the printed image on the machine bed.

Download the “ghostbusters.nc” file into the A2MC controller.

The first time you run the job you should put the MVS software into “Dry Run” mode by checking the box in the Vision Controls form. You get to this form by selecting “Settings” from the main Vision tab. The MVS Application will stay in “Dry Run” until you uncheck it.

Dry run will simply run the job in the air so you can see what is going on. Once you are ready uncheck it and the MVS system will run the full job.

The next step is to set the G55 origin of the job close to the lower left corner of the sheet of paper as shown below:



The next step is to set the G55 origin of the job close to the lower left corner of the sheet of paper.

Use Function 10 on the machine to select G55 user origin.

The reason you need to do this is so that the camera will get close enough to the first dot so that the MVS system can find it automatically.

The ghostbusters job then needs to be selected. This can be done by clicking on the file key in the Setup GUI:

Find the job in the directory, right click and click on "Select". Alternatively the file button can be used on the operator console. Either way "ghostbusters.nc" needs to become the active job.



Once the MVS software has been set to "Dry Run", the origin has been set to the lower left corner of the "material", and the ghostbusters.nc job has been selected, the job is ready to run.

Click on the green Run button to start the process.

The machine will now search for each of the dots in sequence starting with the Type A dot, then the Type B dot, and then all the rest.

In this job there are four dots.

Each one will be "found" and the machine will centre itself over the dot and move on to the next one as shown by the number diagrams following.

The machine will now search for each of the dots in sequence starting with the Type A dot, then the Type B dot, and then all the rest.

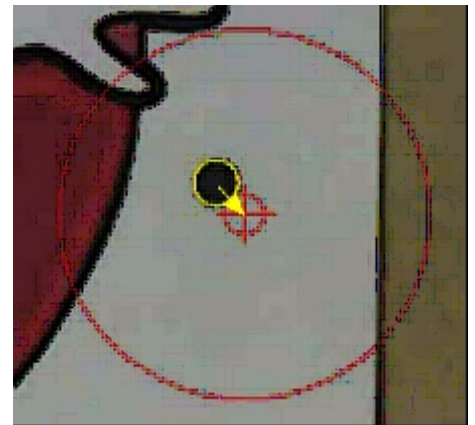
In this job there are four dots. Each one will be "found" and the machine will centre itself over the dot and move on to the next one as shown by the number diagrams on this page.



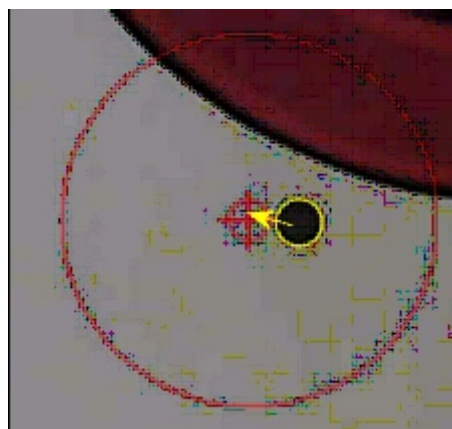
Step 1



Step 2



Step 4



Step 3

If the MVS is set to Dry Run the machine will retrace all the dots and check and report on the accuracy.

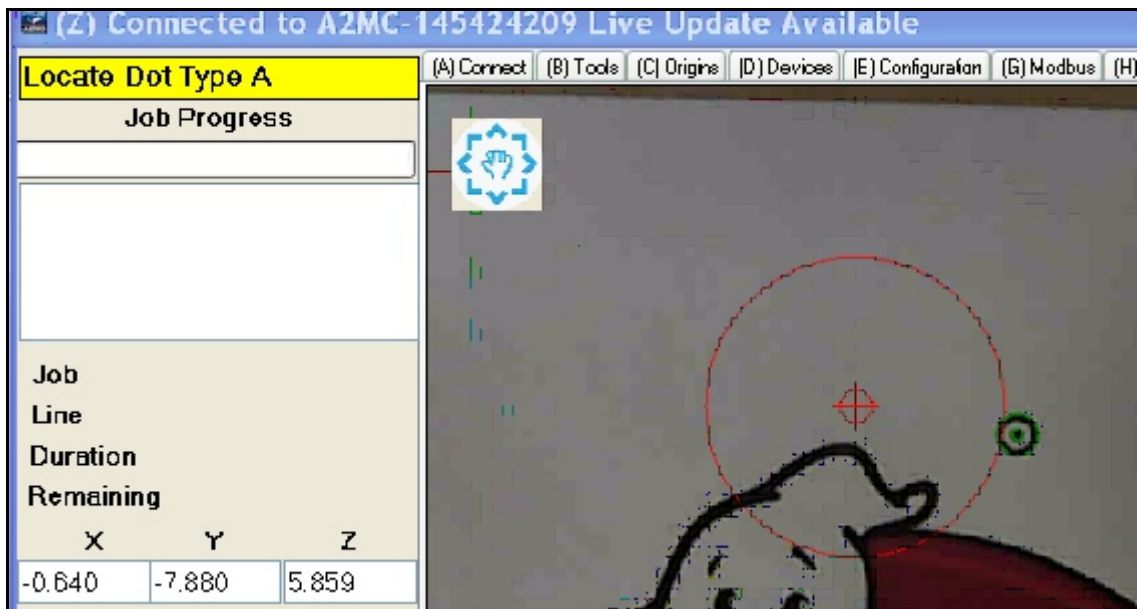
You will see this on the display. The results will also be written to the activity log:

1. 4:44:25 PM Dry run dot testing started...
2. 4:44:25 PM in stretchy. XSCos= 1.0014 YSSin= -0.0080 YSCos= 0.9997 XSSin= -0.0117
3. 4:44:25 PM offset X = -5.374 offset Y= -17.577
4. 4:44:29 PM dot #1 x=0.379 y= -8.049 dx=0.008 dy=0.000
5. 4:44:34 PM dot #2 x= -3.522 y= -10.217 dx=0.004 dy= -0.004
6. 4:44:38 PM dot #3 x= -1.529 y= -14.333 dx= -0.004 dy= -0.004
7. 4:44:42 PM dot #4 x=2.777 y= -12.179 dx=0.004 dy=0.000
8. 4:44:42 PMDry run dot testing ended.

The displacement values dx and dy are shown in inches and should be less than 0.01 inches if everything is working properly.

The operator console display will prompt you to start the job by pressing the **START** again. The job will run in dry run mode with the camera running exactly over the image so you can watch on the computer screen exactly how closely the image is traced out.

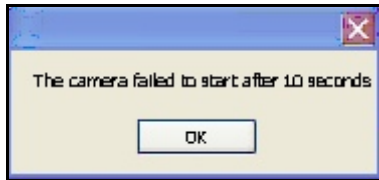
The only difference when not running in "dry mode" is that the dots are not retraced and the spindle will actually cut on the image.



If the origin is off by a considerable distance or the image is severely rotated out of place the first and/or second dot might be significantly out of place and outside the auto circle as shown in the example above. In this case the operator display will prompt you to locate the correct dot type. Simply jog until the correct dot appears on the screen and click on the dot. The dot will center and the MVS will proceed to find the rest of the dots. After the second dot the MVS system will have calculated the correct origin and rotation adjustment and it should find the rest of the dots without further operator intervention.

To get familiar with the MVS system use the sample files and practice rotating and shifting the sample jobs around on the table.

Trouble Shooting



The MVS software will attempt to connect to the camera and obtain a "live" image. If after 10 seconds it cannot "see" an image you will get this message.

This message usually indicates that the camera is not working or the camera driver is not working.

Often this is a result of the driver not being compatible to the version of Windows operating system you are using and needs to be checked.

If the MVS Application cannot see the camera then neither can other camera software utilities. The best way to troubleshoot this problem is to use the "Scanner and Camera Wizard" utility that can be found under "Accessories" in your programs list. This is a standard with Windows utility.



Warranty

Machine Type _____ Serial No. _____ Date Of Purchase _____

Warranty Period _____ months from date of purchase, non-transferrable.

Warranty Terms

Multicam Systems Pty Limited guarantees against defects in material and quality of manufacture for the period shown herein, subject to proper application, use and maintenance of the equipment. Specifically Multicam Systems Pty Limited warrants the Machine, on-board electronics, and drive systems for this period subject to proper use and maintenance of the machine.

A Line Conditioner must be fitted by a Licensed Electrician prior to or at the time of installation at the customers cost. The Line Conditioner is designed to provide constant output voltage when there are fluctuations in the supply voltage. Regular servicing of the System must be carried out at 3 monthly intervals or after 200 working hours whichever occurs first. Four weeks grace may be granted outside of the 3 months by Multicam Systems. You will be contacted prior by the relative State Service Manager. Failure to comply with these conditions of warranty will deem all Warranties Null and Void, without exception. Attempts at servicing any or all of the System, by someone other than Multicam Service technician, will void all warranties immediately.

All attachments and components, including but not limited to, spindles, vacuum pumps, dust collectors, material handling systems and knife cutting attachments, supplied by third party manufacturers such as HSD S.r.l, Walter Perske GMBH, Trico, UNIST, BFT, Rietschle, or any other supplier carry the warranty of their original manufacturer, with the exception of spindle bearings. Any warranty expressly stated or impliedly offered by Multicam Systems on these items is not in addition to the warranty offered by the original manufacturer. Spindle motor bearings are warranted for a period of six months from the date shown herein, subject to conditions of use and maintenance as outlined further in this manual. Use of non genuine tool holders or collets will void the manufacturers warranty.

Warranty on vacuum pumps is subject proper use and maintenance as detailed in this manual. Inlet temperature is not to exceed 50°C. Pumps are not to be enclosed and must have a minimum of 1m free space on all sides for ventilation.

Warranty Provisions

Multicam Systems Pty Limited will replace or repair, at our own discretion, any part found to be faulty in manufacture or workmanship for the period as stated on this document. All items submitted for warranty repair must be shipped to the offices of Multicam Systems Pty Ltd. All freight costs are to be borne by the customer and do not constitute part of the warranty provisions.

The warranty provided by Multicam Systems Pty Limited does not extend to:-

- i. any replacement or repair work carried out by any person other than an employee of Multicam Systems Pty Limited; or
- ii. any replacement or repair work required to be carried out as a result of damage or fault which arises as a consequence of the customers' inappropriate or incorrect operation of the Machine; or
- iii. any replacement or repair work required to be carried out as a consequence of the failure on the part of the customer to make available adequate or appropriate services and facilities advised by Multicam Systems Pty Limited as being necessary for the proper operation of the Machine, including but not being limited to adequate or appropriate power supply, or
- iv. any replacement or repair work required to be carried out as a consequence of use of non-genuine components, including but not being limited to tool holders and collets for spindles, or
- v. any labour costs for any replacement, maintenance or repair work of an electrical nature which relates to any electrical component on the Machine or the power supply to the Machine, machine accessories or to the building in which the Machine is located. Engagement of qualified electrical trades persons shall be at the expense of the customer and in accordance with state legislation.
- vi. Multicam Systems Pty Ltd is not liable for any claim, production loss, damage or expense, without limitations whether direct or indirectly arising out of machine down time caused by warranty claims.

Warranty is non-transferrable. Multicam Systems Pty Limited advises that any replacement or repair work of an electrical nature should always be carried out by persons holding appropriate qualifications to carry out such work including any qualifications required under any State or Federal law.

Signed on behalf of Multicam Systems Pty Ltd;

AUTHORISED SIGNATURE

NAME

DATE

Signed on behalf of (company name): _____

AUTHORISED SIGNATURE

NAME

DATE

Warranty

Machine Type _____ Serial No. _____ Date Of Purchase _____

Warranty Period _____ months from date of purchase, non-transferrable.

Warranty Terms

Multicam Systems Pty Limited guarantees against defects in material and quality of manufacture for the period shown herein, subject to proper application, use and maintenance of the equipment. Specifically Multicam Systems Pty Limited warrants the Machine, on-board electronics, and drive systems for this period subject to proper use and maintenance of the machine.

A Line Conditioner must be fitted by a Licensed Electrician prior to or at the time of installation at the customers cost. The Line Conditioner is designed to provide constant output voltage when there are fluctuations in the supply voltage. Regular servicing of the System must be carried out at 3 monthly intervals or after 200 working hours whichever occurs first. Four weeks grace may be granted outside of the 3 months by Multicam Systems. You will be contacted prior by the relative State Service Manager. Failure to comply with these conditions of warranty will deem all Warranties Null and Void, without exception. Attempts at servicing any or all of the System, by someone other than Multicam Service technician, will void all warranties immediately.

All attachments and components, including but not limited to, spindles, vacuum pumps, dust collectors, material handling systems and knife cutting attachments, supplied by third party manufacturers such as HSD S.r.l, Walter Perske GMBH, Trico, UNIST, BFT, Rietschle, or any other supplier carry the warranty of their original manufacturer, with the exception of spindle bearings. Any warranty expressly stated or impliedly offered by Multicam Systems on these items is not in addition to the warranty offered by the original manufacturer. Spindle motor bearings are warranted for a period of six months from the date shown herein, subject to conditions of use and maintenance as outlined further in this manual. Use of non genuine tool holders or collets will void the manufacturers warranty.

Warranty on vacuum pumps is subject proper use and maintenance as detailed in this manual. Inlet temperature is not to exceed 50°C. Pumps are not to be enclosed and must have a minimum of 1m free space on all sides for ventilation.

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- ii. any replacement or repair work required to be carried out as a result of damage or fault which arises as a consequence of the customers' inappropriate or incorrect operation of the Machine; or
- iii. any replacement or repair work required to be carried out as a consequence of the failure on the part of the customer to make available adequate or appropriate services and facilities advised by Multicam Systems Pty Limited as being necessary for the proper operation of the Machine, including but not being limited to adequate or appropriate power supply, or
- iv. any replacement or repair work required to be carried out as a consequence of use of non-genuine components, including but not being limited to tool holders and collets for spindles, or
- v. any labour costs for any replacement, maintenance or repair work of an electrical nature which relates to any electrical component on the Machine or the power supply to the Machine, machine accessories or to the building in which the Machine is located. Engagement of qualified electrical trades persons shall be at the expense of the customer and in accordance with state legislation.
- vi. Multicam Systems Pty Ltd is not liable for any claim, production loss, damage or expense, without limitations whether direct or indirectly arising out of machine down time caused by warranty claims.

Warranty is non-transferrable. Multicam Systems Pty Limited advises that any replacement or repair work of an electrical nature should always be carried out by persons holding appropriate qualifications to carry out such work including any qualifications required under any State or Federal law.

Signed on behalf of Multicam Systems Pty Ltd;

AUTHORISED SIGNATURE

NAME

DATE

Signed on behalf of (company name): _____

AUTHORISED SIGNATURE

NAME

DATE

Machine Configuration

Configuration Parameters				
Machine Serial No.		-		
GUI Version / Apps Version				
A2MC Release Version No.				
Machine IP Address				
Machine Memory Type & Capacity				
Program Origins		X Offset	Y Offset	
		Z Offset		
		G54 Machine Origin		
		G55 User Origin		
		G56 Programmed A		
		G57 Programmed B		
		G58 Programmed C		
G59 Programmed D				
		Surface Offset (G54)		
Program Devices (ATC)		X Offset	Y Offset	
		Z Offset		
		Rotary ATC		
		Fixed Linear Rack		
		Fixed Linear Rack Spacing	mm	mm
Moving Linear Rack				
Motion			mm/min	
			mm	
		Acceleration		
		Jerk		
		NC Filter		
		Co-linear Filter		
		X/Y Speed		
		Z Speed		
X/Y Seek				
Calibration		X Axis	Y Axis	
		Z Axis		
		Machine Size		
		Calibration		
Tool Tip Sensor Position				

Machine Configuration

Configuration Parameters					
Machine Serial No.		-			
GUI Version / Apps Version					
A2MC Release Version No.					
Machine IP Address					
Machine Memory Type & Capacity					
Program Origins		X Offset	Y Offset	Z Offset	
		G54 Machine Origin			
		G55 User Origin			
		G56 Programmed A			
		G57 Programmed B			
		G58 Programmed C			
		G59 Programmed D			
		Surface Offset (G54)			
Program Devices (ATC)		X Offset	Y Offset	Z Offset	
		Rotary ATC			
		Fixed Linear Rack			
		Fixed Linear Rack Spacing	mm	mm	
		Moving Linear Rack			
Motion			mm/min	mm	
		Acceleration			
		Jerk			
		NC Filter			
		Co-linear Filter			
		X/Y Speed			
		Z Speed			
		X/Y Seek			
Calibration		X Axis	Y Axis	Z Axis	
		Machine Size			
		Calibration			
		Tool Tip Sensor Position			

Machine Training Schedule

Company :	Date:
Contact :	Serial No:
Technician :	
The following persons have been trained in the basic procedures listed below:	
Trainee:	Trainee:
Trainee:	Trainee:
Description	Yes/No
Basic operation procedures in GUI software including:	
Adding Tools and Tool Descriptions	
Mapping Tools to ATC	
Other:	
Other:	
Other:	
Other:	
Basic operation procedures on the Multicam machine:	
Machine On/Off procedure	
Using Sub Console	
Selecting Folders and Files	
Starting a Job (Start Button)	
Pausing a Job (Stop Button)	
Seeking a shape within a job	
FUNC 9 Aborting a job	
FUNC 12 Machine Homing	
FUNC 25 Individual Tool Tip	
FUNC 26 Multiple Tool Tip	
FUNC 31 Pick Up a Tool	
FUNC 34 Put Tool Away	
FUNC 50 Turning Appliances ON/OFF	
FUNC 50.1 Setting Appliances AUTO/OFF	
Vacuum Table operation on material without bows	
Use of Clamps for bowed material	
Correct Lubrication procedure for Oscillating Knives	
Safe use of automatic, semi-automatic or manual clamping devices	
Use of PPE to prevent injury through cuts by cutting tools and blades	
Other	
Basic maintenance procedures on the Multicam machine:	
Draining Micro Filter	
Cleaning Air filter (if a vacuum table)	
Dust Extraction bag emptying	
General cleaning procedure	

Technician Signature _____

Customer Signature _____

Machine Training Schedule

Company :	Date:
Contact :	Serial No:
Technician :	
The following persons have been trained in the basic procedures listed below:	
Trainee:	Trainee:
Trainee:	Trainee:
Description	Yes/No
Basic operation procedures in GUI software including:	
Adding Tools and Tool Descriptions	
Mapping Tools to ATC	
Other:	
Other:	
Other:	
Other:	
Basic operation procedures on the Multicam machine:	
Machine On/Off procedure	
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Selecting Folders and Files	
Starting a Job (Start Button)	
Pausing a Job (Stop Button)	
Seeking a shape within a job	
FUNC 9 Aborting a job	
FUNC 12 Machine Homing	
FUNC 25 Individual Tool Tip	
FUNC 26 Multiple Tool Tip	
FUNC 31 Pick Up a Tool	
FUNC 34 Put Tool Away	
FUNC 50 Turning Appliances ON/OFF	
FUNC 50.1 Setting Appliances AUTO/OFF	
Vacuum Table operation on material without bows	
Use of Clamps for bowed material	
Correct Lubrication procedure for Oscillating Knives	
Safe use of automatic, semi-automatic or manual clamping devices	
Use of PPE to prevent injury through cuts by cutting tools and blades	
Other	
Basic maintenance procedures on the Multicam machine:	
Draining Micro Filter	
Cleaning Air filter (if a vacuum table)	
Dust Extraction bag emptying	
General cleaning procedure	

Technician Signature _____

Customer Signature _____

Machine Commissioning

Company :		Date:		
Contact :		Serial No:		
Technician :				
Description	Yes/No			
Check that all items have arrived undamaged				
Ensure availability of correct power for machine				
Ensure availability of correct power for additional appliances (if req'd)				
Machine is installed with adequate clearances all round.				
Explanation to customer of importance of correct placement of vacuum pump carried out				
Is machine frame earthed?				
Ensure availability of correct air supply for machine	110-120psi			
Check & tighten all screws incl spindle mounts & electrical connections				
Levels	Machine Frame:	Gantry: Level	Tilt:	Square
Install memory card/stick & check machine startup procedure				
Test X,Y & Z homing	FUNC 12			
Square spindle to machine table				
Test torque on X,Y & Z axes & inspect for excessive movement in drive system				
Install appliances (spindle, sub console, vac pumps, dust collector, overarm, mist sprayer etc)				
Have customer install tool mounting jig if supplied				
Record inverter settings	Acceleration:	Deceleration:		
Check motor direction for vac pump & dust collector correct (if supplied)				
Record vacuum readings Rietschle	zones closed: -38 kPa	with material: kPa		
Record vacuum readings Multicam	zones closed: -34 kPa	with material: kPa		
If fitted, record relief valve activation pressure		kPa		
Check table vacuum zoning is correct				
Setup Network communications.	Record IP Address:			
Install latest GUI / APPS software				
Square machine over maximum area				
Calibrate Machine X, Y and Z.				
Set up homing position	G56			
Test machine movement over entire process area				
Install Tool Changer				
Setup Automatic Tool Change position	FUNC 810			
Setup Tool Tip Sensor position & record surface offset (- mm)	FUNC 821			
Check configuration settings in GUI / APPS				
Set tool descriptions and allocations in Program Tools / APPS				
Perform multiple tool tip offset	FUNC 26			
Install Design software (if supplied)				
Install CAM software (if supplied)				
Install latest O/S shipping version				
Download several test jobs				
Set service interval	days			
Install labels, warning stickers & vacuum zone stickers				
Run test jobs (not in material)				
Warranty sighted				
Fill out Customer Information Sheet and Machine configuration in manual				
Copy System Parameters XML file from A2MC to local computer for backup				
Machine is in full working order				

Technician Signature _____ Customer Signature _____

Machine Commissioning

Company :		Date:	
Contact :		Serial No:	
Technician :			
Description			Yes/No
Check that all items have arrived undamaged			
Ensure availability of correct power for machine			
Ensure availability of correct power for additional appliances (if req'd)			
Machine is installed with adequate clearances all round.			
Explanation to customer of importance of correct placement of vacuum pump carried out			
Is machine frame earthed?			
Ensure availability of correct air supply for machine			110-120psi
Check & tighten all screws incl spindle mounts & electrical connections			
Levels	Machine Frame:	Gantry: Level	Tilt: Square
Install memory card/stick & check machine startup procedure			
Test X,Y & Z homing			FUNC 12
Square spindle to machine table			
Test torque on X,Y & Z axes & inspect for excessive movement in drive system			
Install appliances (spindle, sub console, vac pumps, dust collector, overarm, mist sprayer etc)			
Have customer install tool mounting jig if supplied			
Record inverter settings	Acceleration:	Deceleration:	
Check motor direction for vac pump & dust collector correct (if supplied)			
Record vacuum readings Rietschle	zones closed:	-38 kPa	with material: kPa
Record vacuum readings Multicam	zones closed:	-34 kPa	with material: kPa
If fitted, record relief valve activation pressure			kPa
Check table vacuum zoning is correct			
Setup Network communications.	Record IP Address:		
Install latest GUI / APPS software			
Square machine over maximum area			
Calibrate Machine X, Y and Z.			
Set up homing position			G56
Test machine movement over entire process area			
Install Tool Changer			
Setup Automatic Tool Change position			FUNC 810
Setup Tool Tip Sensor position & record surface offset (- mm)			FUNC 821
Check configuration settings in GUI / APPS			
Set tool descriptions and allocations in Program Tools / APPS			
Perform multiple tool tip offset			FUNC 26
Install Design software (if supplied)			
Install CAM software (if supplied)			
Install latest O/S shipping version			
Download several test jobs			
Set service interval			days
Install labels, warning stickers & vacuum zone stickers			
Run test jobs (not in material)			
Warranty sighted			
Fill out Customer Information Sheet and Machine configuration in manual			
Copy System Parameters XML file from A2MC to local computer for backup			
Machine is in full working order			

Technician Signature _____ Customer Signature _____

MULTICAM MACHINERY

GUIDE TO SAFE OPERATION

WARNING

Machine must only be operated by persons trained and accredited by Multicam Systems

To ensure the proper and safe operation of the machine it is important that the following points be observed.

1. The machine must only be operated by persons correctly trained in its full and proper use.
2. The machine must only be operated in accordance with instruction provided by Multicam Systems and with reference to the Machine User Manual.
3. Machine operators must wear appropriate safety clothing to prevent injury through cuts by cutting tools and blades. Eg cut proof gloves.
4. Ensure that clamping systems are free of obstructions and that no other personnel are likely to be injured or engaged prior to activating the clamps.
5. The machine must only be used for its designed purpose.
6. The machine must not be used with safety guards removed.
7. The machine must not be left unattended whilst in operation.
8. The machine must not be used if safety interlocks are faulty or inoperable.
9. All foreign or loose objects must be removed from the machine bed prior to operating the machine.
10. Flammable liquids must not be used on the machine.
11. Persons operating the machine must observe all safety notices.
12. Persons operating the machine must observe all safety directions as set down by the safety officer in the proper use of machinery and the principles of safe material handling of the company.
13. Persons operating the machine must wear suitable clothing. Loose or ill fitting clothing must not be worn. All jewellery capable of becoming entangled in moving parts or materials must be removed before operating the machine.
14. Personal safety devices such as, but not limited to, hearing protection, eye protection and hair nets must be worn by any person operating, or in attendance to, the machine.
15. Maintenance work must only be carried out by fully qualified persons.
16. If manually changing tools in a quick tool change motor ensure that the tool holder is correctly engaged in the motor. Do this by firmly grasping the nut on the tool holder and pulling in a downward and sideways movement and checking for looseness. If you are able to "wobble" the tool holder it is not correctly engaged.

To prevent damage to the machine or injury to machine operator it is imperative that all safety directions be fully observed when operating the Multicam machine.

Declaration by Safety Office/Owner

I acknowledge that safety aspects of the machine and its operation have been explained to me and persons trained to operate the machine. I acknowledge that future operators will receive appropriate training prior to being permitted to operate the machine and that all safety procedures associated with the operation of machinery will be strictly adhered to in accordance with our obligations under Occupational Health and Safety legislation.

PRINT NAME

SIGNED & DATE

MULTICAM MACHINERY

GUIDE TO SAFE OPERATION

WARNING

Machine must only be operated by persons trained and accredited by Multicam Systems

To ensure the proper and safe operation of the machine it is important that the following points be observed.

1. The machine must only be operated by persons correctly trained in its full and proper use.
2. The machine must only be operated in accordance with instruction provided by Multicam Systems and with reference to the Machine User Manual.
3. Machine operators must wear appropriate safety clothing to prevent injury through cuts by cutting tools and blades. Eg cut proof gloves.
4. Ensure that clamping systems are free of obstructions and that no other personnel are likely to be injured or engaged prior to activating the clamps.
5. The machine must only be used for its designed purpose.
6. The machine must not be used with safety guards removed.
7. The machine must not be left unattended whilst in operation.
8. The machine must not be used if safety interlocks are faulty or inoperable.
9. All foreign or loose objects must be removed from the machine bed prior to operating the machine.
10. Flammable liquids must not be used on the machine.
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Suggested Feed Rates

PRODUCT	FEEDRATE	PLUNGE RATE	DIRECTION	TOOL DIA	CAT PAGE*
3mm Acrylic	3000mm/min	1200mm/min	Climb	3.175mm	Page 8
4.5mm Acrylic	2500mm/min	1200mm/min	Climb	3.175mm	Page 8
6mm Acrylic	2500mm/min	1200mm/min	Climb	4.76mm	Page 8
10mm Acrylic	2000mm/min	1000mm/min	Climb	6.35mm	Page 8
20mm Acrylic	1500mm/min	800mm/min	Climb	6.35/8mm	Page 8
3mm Aluminium	2500mm/min	400mm/min	Conventional	3.175mm	Page 10
6mm Aluminium	1800mm/min	300mm/min	Conventional	4.76mm	Page 10
10mm Aluminium	1500mm/min	200mm/min	Conventional	6.35mm	Page 10
12mm Aluminium	1500mm/min	800mm/min 4 passes	Conventional	6.35mm	Page 10
10mm MDF	12000mm/min	1200mm/min	Conventional	4.76mm	Page 5
16mm MDF	12000mm/min	Ramp Plunge	Conventional	12.70mm	Page 4
16mm Whiteboard	12000mm/min	Ramp Plunge	Conventional	12.70mm	Page 4
20mm MDF	8000mm/min	800mm/min	Conventional	8/12mm	Page 5
10mm Plywood	8000mm/min	1200mm/min	Conventional	4.76mm	Page 2
16mm Plywood	7000mm/min	1200mm/min	Conventional	6.35mm	Page 2
25mm Plywood	6000mm/min	800mm/min	Conventional	8/12mm	Page 2
12mm Hardwood	6000mm/min	1000mm/min	Conventional	6.35mm	Page 2
19mm Hardwood	4000mm/min	800mm/min	Conventional	6/8mm	Page 2
35mm Hardwood	2000mm/min	700mm/min	Conventional	12/16mm	Page 2

Note: Hardwood Feed rates are based on medium hardwoods.

* Subject to change

The above settings are a guide only. A number of factors including spindle type, tool selection, sharpness, and material holding must be taken into account. There are a variety of tools that appear to have the same specifications, however differences such as spiral direction and length of cut to give different results in different materials. If you require tool assistance or recommendation please contact us.

TOOL GEOMETRY

STRAIGHT FLUTE: The straight flute design does not allow for lifting of material out of the cut.

SPIRAL FLUTE: The spiral flute will allow swarf to be lifted out or pushed into the cut depending on the flute geometry. Spiral flutes can be used with most materials.

FLUTE GEOMETRY

SINGLE FLUTE: Single flute cutters only have one cutting edge, use for faster feed rates in softer material.

DOUBLE FLUTE: Double flute cutters have two cutting edges, these tools provide a better finish in harder material at lower feed rates.

UPCUT SPIRAL: These cutters provide for upward chip evacuation. They should be used for grooving, slotting or whenever the best finish is needed on the bottom side of a part.

DOWNCUT SPIRAL: Used for downward chip flow, better hold down in fixture and best finish on the top side of the part.

COMPRESSION CUTTERS: Used for double laminated material and best finish on top and bottom side of the part.

O FLUTE: Identified by the half-moon shape of the cutter. The O Flute is classified as a single flute cutter. This bit is best suited for routing timbers and plastics. This design provides for optimum chip removal at very high feed rates.

How to Avoid Tool Breakage



Most CNC tool breakages are caused by incorrect or faulty colleting

A router tool spinning at 18,000rpm is in trouble if it's as little as 5 microns off centre. This is about how thick a deposit of resin or dust is when it's squashed inside the collet.

Collets are manufactured to exacting tolerances and when they are 5 microns out of round both the collet and the tool are strained because the distorted collet cannot grip the tool shank perfectly.

This results in

- Poor component edge finish
- Less than optimum tool life
- Metal fatigue and eventual breakage of the tool
- Increased noise.

The extra noise is a clue as to what is happening to the machine. Tool run out causes high frequency vibrations in the high speed motor bearings. This drastically reduces their service life.

Colleting and Collet life Span

Collets have a life span of 3 months if used 8 hours a day. Replacing the collets will ensure that your operation runs consistently and prevents tool breakage. When inserting a tool into the collet, make sure the flute fade out does not enter the collet. If the collet is gripping on the fadeout, it will cause runout and potentially tool breakage. To ensure proper clamping the tool shank should fill, at a minimum 80% of the depth of the collet.

Collet Maintenance

Cleaning is an essential part of collet maintenance. As material is cut, extremely fine dirt and resin migrates up the tool shaft into the collet, causing the collet, collet nut, toolholder and spindle interface to become dirty. This causes your tool to cut in an elliptical fashion which will decrease tool life and cause inconsistency in your operation.

Keeping collets and tool holders clean is as essential as it is easy.

- Do not allow dirt to build up in the collet, cover nut or tool holder.
- Always clean mating surfaces prior to fitting.
- Do not use damaged collets, tools or tool holders.
- Do not leave tools or tool holders in spindles for extended periods of time.
- Replace collets and tool holders if they show any signs of damage.

Machine Safety Hazard Identification, Assessment and Control

Note: Machine commissioning and training is not complete until this document has been signed and presented to the machine operator or chief safety officer.

Machine Description: Multicam CNC Flat Bed Routing Machine Model: _____ Serial No: _____

Item	Hazard Identification	Hazard Assessment	Risk Control Strategies (recommended for Purchaser/Buyer/User)
GANTRY	STRIKING CRUSHING	LOW	Do not lean on machine when in operation. Do not place loose objects in the path of the gantry. Remove all loose objects around moving parts. Keep well clear of moving parts.
CLAMPING SYSTEMS	STRIKING CRUSHING	MEDIUM	Ensure that all clamping systems are free of obstructions and that no other personnel are likely to be injured or engaged prior to activating the clamps.
SPINDLE	CUTTING ENTANGLEMENT STRIKING	MEDIUM	Isolate main power before changing/inspecting cutters in spindle. Ensure spindle is not rotating before changing/inspecting cutters. Hands must always be kept well clear from spindle and cutters when machine is in operation. Long or loose hair must be covered. Loose clothing/jewellery must not be worn when operating the machine or changing/inspecting cutters. All materials must be suitably clamped/held/secured before cutting.
AIR ASSIST	CUTTING CRUSHING SHEARING	MEDIUM	Air assist is used to control the weight of the spindle. A sudden release in air pressure or disruption of controlling circuitry will cause the spindle to drop rapidly. Even if power is off or air supply is not present. Keep hands and fingers clear of all moving parts and crush points.
CONTROLLER POWER BOX	ELECTRICAL	MEDIUM	All electrical enclosures should only be opened with the correct tool that is not to be kept with the machine. Electrical work should only be carried out by a licensed electrician.
TOOL CHANGER	ENTANGLEMENT STRIKING ELECTRICAL	LOW	Ensure all covers are secured before starting machine. Do not operate machine with tool change cabinet open. All electrical enclosures should only be opened with the correct tool that is not to be kept with the machine. Electrical work should only be carried out by a licensed electrician.
TABLE TOP	ERGONOMIC	MEDIUM	Heavy or large pieces must be carried by more than one person or loaded using mechanical methods
MIST SPRAYER	CONTAMINATION	LOW	Use only approved products in the Mist Sprayer Unit. Do not use flammable products in the Mist Sprayer Unit
GENERAL	OTHER HAZARDS. NOISE, DUST	LOW	Hearing and eye protection must be worn when operating the machine. Must be connected to a dust extraction system if cutting porous materials.

This programme is based upon the Australian Worksafe Standard for Plant (NOHSC:1010-1994)

Authorised and signed by Operator/Safety Officer: _____

Installer: _____

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