



# **OPERATORS MANUAL FOR 2D & 3D ULTRASONIC CUTTING MACHINES**

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# PREFACE

This Operator's training manual was prepared with the machine operator in mind. Some sections are specific to certain machine types and will be annotated as such. Also, individual machines will have different options installed.

This manual has been designed primarily as a teaching aid to be used in structured learning situations and for hands-on training. It is also designed to be used as a reference on the floor when performing cutting operations. It is divided into five major sections, each covering a specific subject. The sections are designed to take the trainee smoothly through each phase of operator personnel training. Some maintenance functions for the control are included at the end of this manual since we recognize that maintenance personnel must know how to operate the equipment, and they too will read this book for a basic understanding of how the equipment operates. Mechanical maintenance of the machine is covered comprehensively in another manual.

This manual covers the following general subjects:

1. Basic components of the machine and their function.
2. Operation of the machine.
3. Basic machine programming.
4. Recognizing faults and problems.
5. Information for high priority users.

The illustrations in this manual are for instructional purposes only and are not intended to be used as blue prints. If more accurate information is needed, the reader should consult the AGFM Maintenance Manual or contact AGFM.

Additional pages are included at the end of this manual. The extra pages are for notes when there is insufficient space to make notes in the original pages, and may be inserted wherever desired.

AGFM's goal in publishing this manual is to supply the trainee with an organized approach to learning the safety requirements and the operation of the US-40 Ultrasonic Cutting Machine.

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# 1 American GFM and GFM Austria

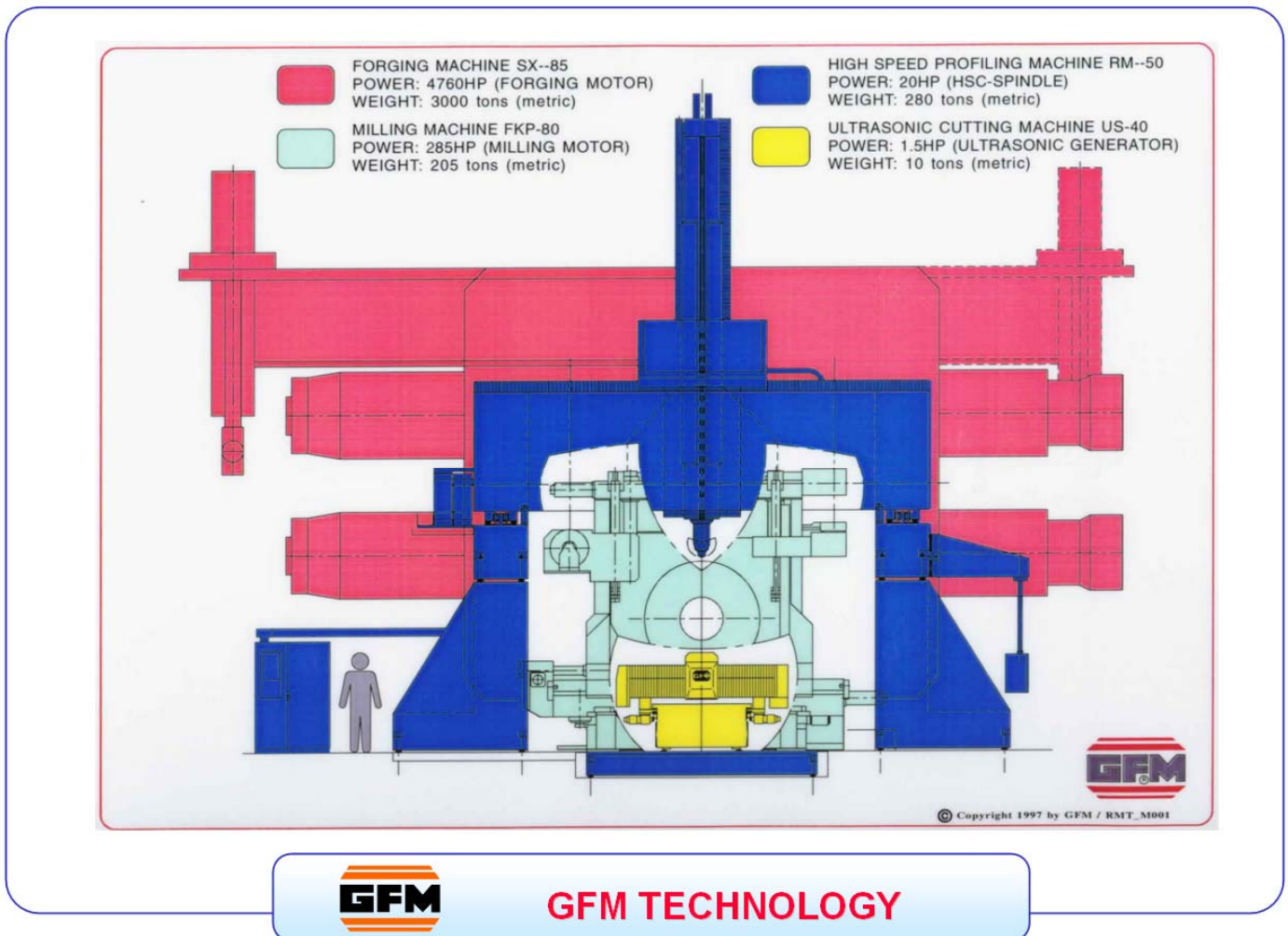
American GFM, located in Chesapeake, VA, is the sister company of GFM Austria.

GFM Austria, the parent company, was founded in 1945 by Dr. Bruno Kralowetz. GFM's initial product was a small radial Forging Machine built in the 1940's. American GFM was started in 1978, and has ever since, been a leading manufacture of high precision machine tools for the North American continent. AGFM and GFM Austria are now builders of many different types of machine tools to satisfy the world's needs for advanced machining of complex parts.



## 1.1 History of Evolution

This graphic shows a representation the various sizes of machines that American GFM and GFM Austria currently manufacture. Over the years, the evolution of machine types and sizes has grown to an unprecedented manufacturing process that only GFM and AGFM can duplicate. This illustration shows the dedication that GFM has put forth to providing all industries solutions to their machining needs. A US40 machine is represented with the yellow shading in this illustration.



## 2 Machine Description

The machine consists of an advanced CNC controlled ultrasonic cutting or routing machine with various options. Options include, but are not limited to: ultrasonic generator with horn assembly, inkjet, labeler, material dispenser and handling equipment, conveyor, tool change assist pin, and vacuum unit. See AGFM machine documentation for a list of specific options installed on your machine. Technical data will vary between different machine types and options. Refer to your maintenance manual for machine specific data.

### 2.1 Ultrasonic Cutting and Ultrasonic Routing Machines

The machine is an advanced CNC controlled cutting machine with an ultrasonic knife, with which it is possible to cut glass fiber, carbon fiber, Kevlar, and other materials at high speeds. The cutting blades can be refurbished.

#### 2.1.1 Principles of Ultrasonic Operation

Ultrasonic energy is simple mechanical vibratory energy which, by definition, operates beyond threshold of human hearing. During activation, large amounts of energy are imparted to the cutting blade without large displacements or large amounts of force. Generating ultrasonic energy starts with conversion of simple electrical power to high frequency electrical energy by a solid state generator. The high frequency electrical energy is sent to a transducer (converter) for conversion to up-and-down mechanical vibrations. These vibrations are then directed and amplified by an amplitude transformer (ultrasonic horn) before being applied to the cutting blade. The ultrasonic vibrations significantly reduce friction between the blade and the material being cut which results in faster, easier, more precise cutting of composite materials than conventional methods. Ultrasonic technology applied to composite materials has permitted rapid cutting of multiple plies of prepreg and a variety of other materials.

### 2.2 Foundation

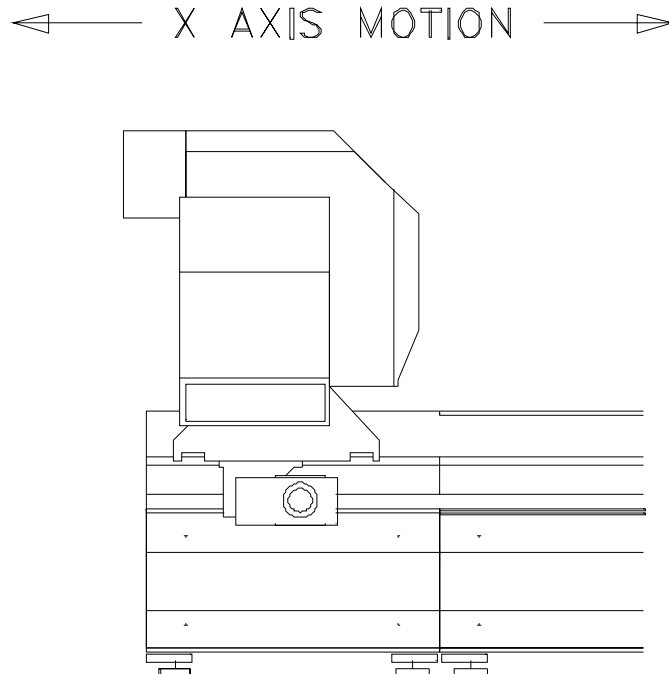
Special foundations are not required, as the machine can be positioned on a solid, single-slab reinforced concrete floor, and has its own leveling feet.

### 2.3 Base Frame

The machine base frame is a rigid welded steel structure, incorporating a sectional design which allows different length machines to be constructed from basic components.

## 2.4 2D Ultrasonic Cutting Machine Axis Layout

### 2.4.1 X Axis



The x axis is the movement of the crossbeam along the length of the machine.

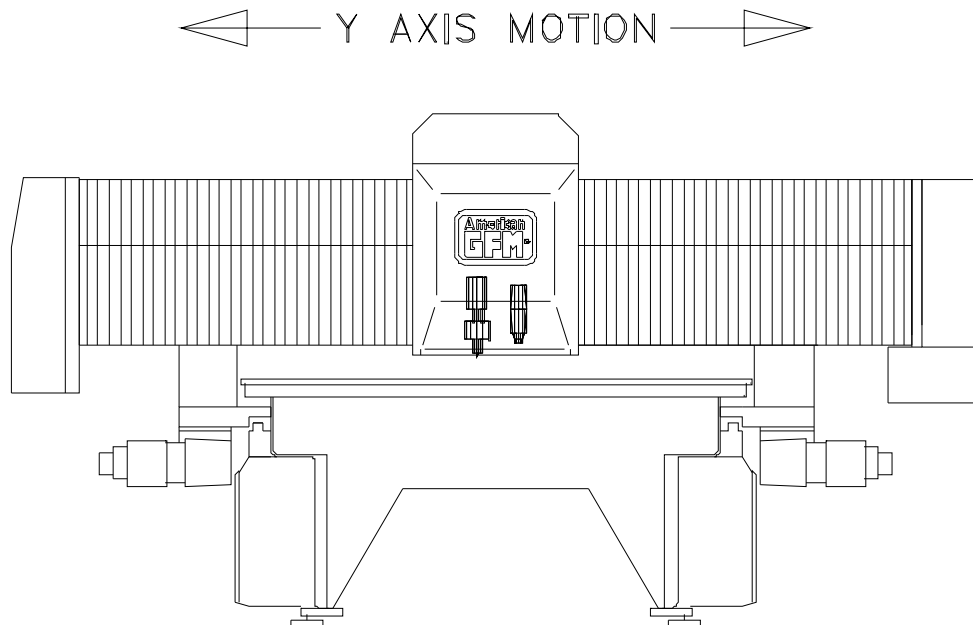
The crossbeam runs on linear bearings, along hardened guideways mounted on a continuous support section. The crossbeam is used to automatically dispense material onto the vacuum table and is able to park outside of the cutting area to allow for ease of manually unloading cut parts.

The guideways and racks are mounted along the side of the base frame, which facilitates automatic material loading and manual unloading of material, and keeps the operator from being injured or getting dirty.

The mechanism used to propel the crossbeam is a rack and pinion system on both ends of the gantry. Each pinion is driven by separate servomotor/encoder units which are electronically synchronized to each other.



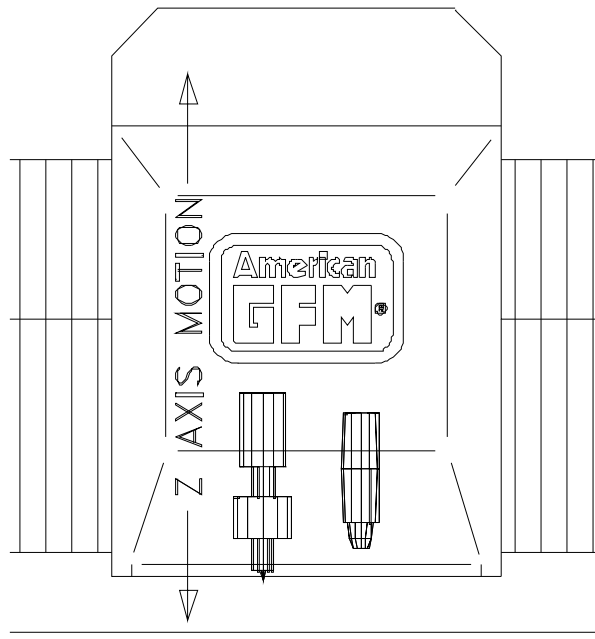
## 2.4.2 Y Axis



The y axis is the movement of the carriage, carrying the ultrasonic knife cutting head and inkjet printhead or labeler units, across the length of the crossbeam.

The carriage runs on linear bearings mounted to the crossbeam, and is propelled by means of a rack and pinion system. The pinion is coupled through a toothed belt to a servomotor/encoder unit.

### 2.4.3 Z Axis



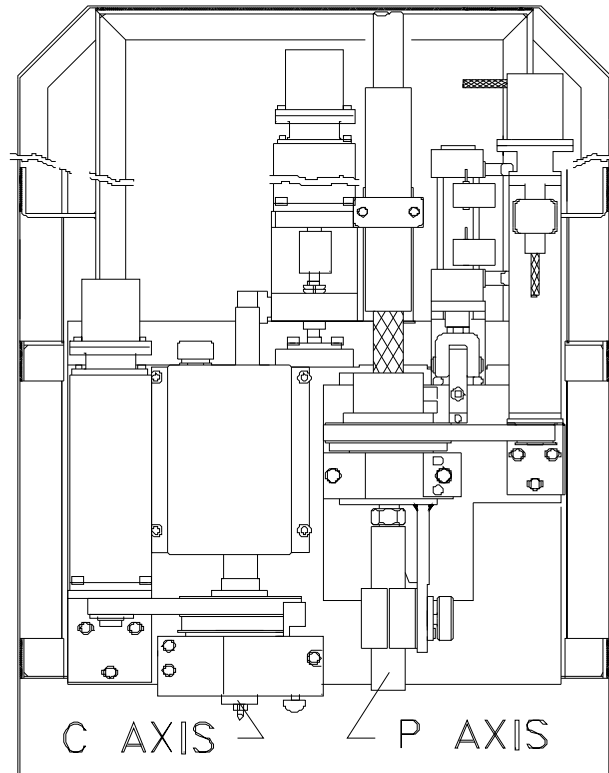
The z axis is the vertical movement of the cutting head and inkjet printhead. This movement allows the cutting blade to cut through the material into a sacrificial vacuum table surface called Vyon. The operator controls the depth of this cut using tool offsets and must always be careful not to set the blade too deep in order to avoid Vyon table surface damage! **THE BLADE TIP PENETRATION INTO THE VYON TABLE SURFACE SHOULD ONLY BE SET TO APPROXIMATELY 0.02 MM (0.001 INCH) DEEP! NOTE THAT AN AUTOMATIC TOOLSET MUST BE PERFORMED AFTER EVERY BLADE CHANGE!**

The height following system in the CNC 6000, which controls the cutting depth of the z axis, is a feature which is crucial to the proper functioning of the machine. In order to cut to a specified depth in the cutting table surface, the machine measures and stores the exact height coordinates, or topography, of the cutting table surface, through a process known as "mapping." These coordinates are then constantly referred to at the time of cutting to maintain a constant cutting blade height. This is a non-contact method of implementing precise height control.

The z axis position is controlled by servomotor/encoder unit, directly driving a threaded roller drive assembly.

To ensure proper cutting depth after the blade is replaced, the CNC calculates and uses new blade length offset values using an automated toolsetting procedure with the M37/M62 M-Code.

### 2.4.4 C and P Axes



The c axis is the rotational movement of the cutting blade.

The c axis is commanded by the CNC 6000 control so that the blade is always kept tangent to the cutting direction. This is necessary so that cutting quality is maintained, and tool life is kept at a maximum.

The cutting blade is fixed to the ultrasonic horn, which in turn is attached to a pulley and rotary bearing. This pulley is driven via a toothed belt by another pulley mounted to a servomotor/encoder unit.

The p axis is the rotational movement of the inkjet printhead (provided the inkjet printing option is purchased) or the labeler stamping foot (provided the labeler option is purchased).

During printing, the inkjet must be positioned so that the slot in the printhead nozzle is perpendicular to the direction of printing, or the labeler stamping foot must be positioned to place the label at the desired angle. This positioning is directed by the CNC 6000 control through a servomotor/encoder unit, via a pulley and toothed belt.

The p axis is limited by software and hardware to the rotational range of  $\pm 90^\circ$  measured off of the positive x axis for the inkjet and to  $0^\circ - 180^\circ$  for the labeler.

## 2.5 Vacuum Table

The vacuum table consists of a steel plate which has a grid of small holes drilled in it. This plate is welded in place to form the top of a vacuum chamber, which may be subdivided into sections (if zoning option was purchased, although this does not work well with a Vyon table surface) which can be turned on and off independently of each other. Applying a vacuum to the table creates a pressure differential, which holds the material to the surface during cutting. Highly porous materials will usually require the use of a non-porous cover sheet to maintain enough of a pressure differential to hold the material effectively.

When through cutting material (as opposed to controlled depth cutting), the tip of the ultrasonic knife is set so that it is just below the top surface of the Vyon (approx. -0.001" CORRECTION value in the Axis Offset screen. **THE OPERATOR CONTROLS THE DEPTH OF THIS CUT USING TOOL OFFSETS (CORRECTION VALUE IN THE OFFSET SCREEN) AND MUST ALWAYS BE CAREFUL NOT TO SET THE BLADE TOO DEEP IN ORDER TO AVOID VYON TABLE SURFACE DAMAGE!** If this table covering were not used, the knife would shatter when it touched the steel table top. Vyon is a micro-porous material which allows the vacuum to pass through it and is glued to the steel table top thereby acting as a sacrificial surface. A polyethylene 0.006" thick cover sheet must always be used to prevent vacuum loss. The cover sheet can be automatically dispensed by the machine, or the operator can use pre-cut strips manually placed along both sides of the material to seal the vacuum while always justifying the cutting material in the center of the vacuum table. For multiple layer cutting, a cover sheet must be used across the entire width of the vacuum table.

## 2.6 3D Ultrasonic Routing Machines Axis Layout

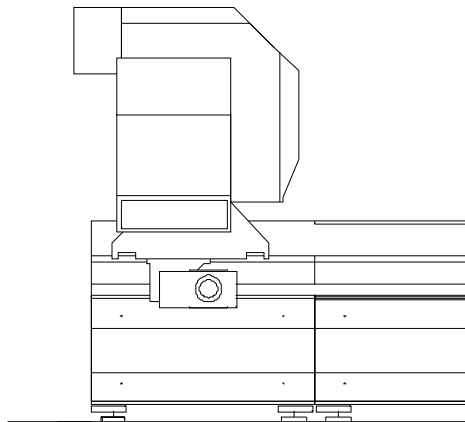
### 2.7 X Axis

The x axis is the movement of the crossbeam along the length of the machine. The crossbeam runs on linear bearings, along hardened guideways mounted on a continuous support section. The crossbeam is able to park outside of the cutting area to allow manual material loading to take place, and for ease of manually unloading cut parts.

The guideways and gear racks are mounted along the sides of the base frame, which facilitates the manual loading and unloading of material, and keeps the operator from being injured or getting dirty.

The mechanism used to propel the crossbeam is a rack and pinion system on both ends of the gantry. Each pinion is driven by separate servomotor/encoder units which are electronically synchronized to each other.

← X AXIS MOTION →



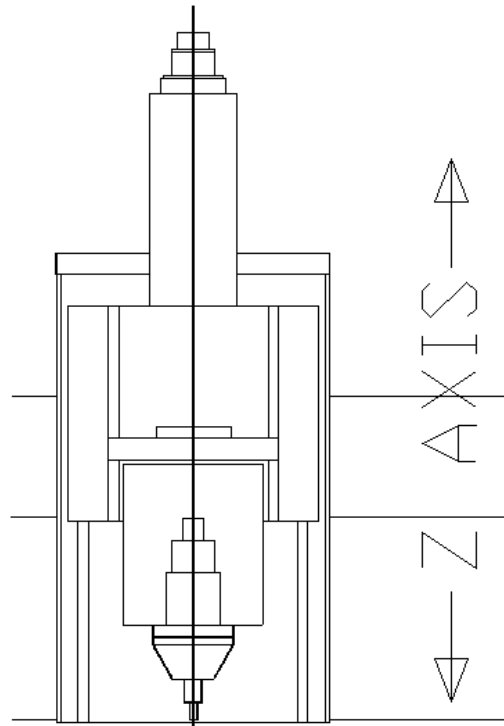
### 2.8 Y Axis

The y axis is the movement of the carriage carrying the ultrasonic knife cutting head across the length of the crossbeam. The carriage runs on linear bearings mounted to the crossbeam, and is propelled by means of a rack and pinion system powered by a servomotor/encoder unit.

## 2.9 Z Axis

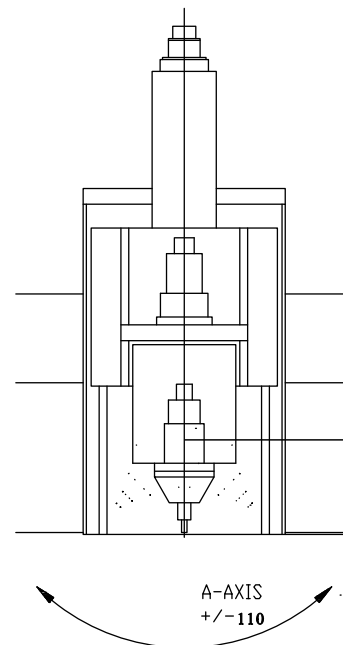
The z axis is the vertical movement of the cutting head. This movement allows the cutting blade to cut through the material into a sacrificial vacuum table surface called Vyon. The operator controls the depth of this cut using z-axis offsets in the OFFSET screen and tool data in the TOOLDATA screen and must always be careful not to set the blade too deep in order to avoid Vyon table surface damage! **THE BLADE TIP PENETRATION INTO THE VYON TABLE SURFACE SHOULD ONLY BE SET TO APPROXIMATELY 0.02 MM (0.001 INCH) DEEP! NOTE THAT AN AUTOMATIC TOOLSET WILL BE PERFORMED AFTER EVERY TOOL CHANGE, AND MUST BE PERFORMED MANUALLY IF THE AUTOMATIC TOOLCHANGE OR BLADE CHANGE SEQUENCE IS INTERRUPTED!** The height following system in the CNC 6000, which controls the cutting depth of the z axis, is a feature which is crucial to the proper functioning of the machine. In order to cut to a specified depth in the cutting table surface, the machine measures and stores the exact height coordinates, or topography, of the cutting table surface, through a process known as "mapping." These coordinates are then constantly referred to at the time of cutting to maintain a constant cutting blade height. This is a non-contact method of implementing precise height control.

The z axis position is controlled by a servomotor/encoder unit, directly driving a ball screw assembly. To ensure that repeatable cutting tool depth is maintained after a blade is replaced, the control enters new blade offset figures using an automated toolsetting procedure when prompted.



## 2.10 A Axis

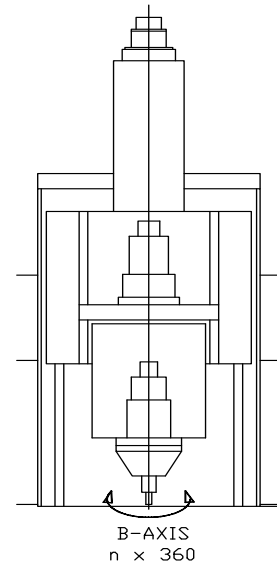
The a axis is the angular pivoting movement of the cutting blade. The a axis is commanded by the CNC 6000 control so that the cutting blade can follow three dimensional contours or make angular cuts. The ultrasonic horn is mounted in the a axis, which is driven by a cyclo gear that is attached to a pulley and rotary bearing. This pulley is driven via a toothed belt by another pulley mounted to a servomotor/encoder unit. The a axis is limited by software and hardware to the rotational range of  $\pm 110$  on RMT-50 machines and  $\pm 90^\circ$  on US-50 machines with speeds up to 25RPM.



## 2.11 B Axis

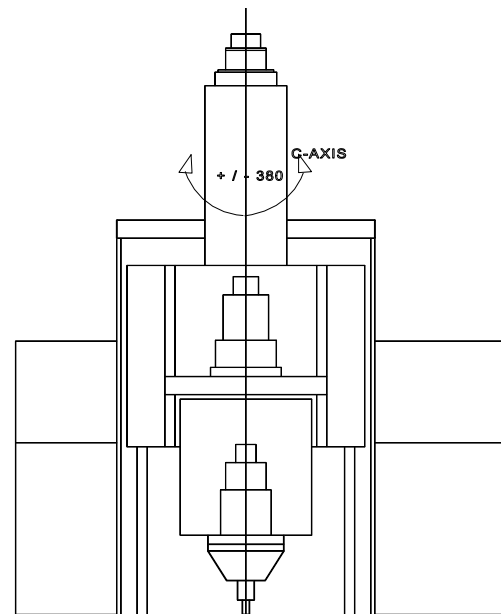
The b axis is the rotational movement of the cutting blade. The b axis is commanded by the CNC 6000 control so that the blade is always kept tangent to the cutting direction during M34 (cutter mode). This is necessary so that cutting quality is maintained, and tangential knife tool life is kept at a maximum.

The cutting blade is fixed to the ultrasonic horn or tool holder, which in turn is attached to a pulley and rotary bearing. This pulley is driven via a toothed belt by another pulley mounted to a servomotor/encoder unit. The b axis is capable of unlimited rotation at variable rpm rates up to 1500 RPM.



## 2.12 C Axis

The c axis is the rotational movement of the cutting head assembly. The c axis is commanded by the CNC 6000 control so that the cutting head assembly can follow the x and y axis contour of the part being cut, during M35 router mode only. The c axis position is controlled by a servomotor/encoder unit, directly driving a rotary bearing assembly. The c axis is limited by software and hardware to the rotational range of +/- 380° on RMT-50 machines and +/-360° on US-50 machines and moves at speeds up to 60 RPM.



## 3 Machine Safety

### 3.1 Introduction

The operator of the machine has a great deal of influence over how safely the machine functions. The operator should make sure that no one is near the moving parts of the machine both before machine movement is initiated, and also during machine movement. Operators should never place themselves in positions in which they may be harmed by the equipment. Simple things, such as turning the feedrate override to zero and depressing the E-stop button to disable all axis movement before working on the machine, can make all the difference in the unlikely situation where multiple component failure causes one of the axes to "run away" possibly causing injury. Most of safety is common sense. Have a good knowledge of the machine you are operating and think ahead.

The AGFM machine is a multi-axis high speed CNC cutting machine. Operating a high performance, high precision machine requires the same degree of expertise, skill, and care as it does to design and manufacture it. Observing good work habits and methods will preclude any significant problems in the safe use of this machine. This chapter is intended to draw attention to built-in safety features of this machine and to recommend procedures for safe work practices.

The machine uses high quality safety relays by Banner. These relays are designed for use in functional stop Category 0 and 1 applications (per ISO/EN 60204-1 and NFPA79). The machine uses Category 1 ESTOP functionality for ESTOP pushbuttons.



#### 3.1.1 Danger due to sharp blades

The cutting knives used on the machine have extremely sharp cutting edges. Careless handling of these parts or close to them may lead to serious injuries

- Never place your hand close the blades or points even when the machine is switched off.
- When working on and around the cutting head, remove the tool from the tool holder.
- Always wear protection gloves during a manual tool change, when loading the tool changer or when working on the cutting blades or in the vicinity of the cutting head.
- Always wear gloves when working with material with sharp edges.

### 3.2 Safety Components

#### 3.2.1 Emergency Stop Pushbuttons



Several E-stop pushbuttons are located around the machine and on the AGFM CNC 6000 operator control console. Pressing any of these emergency stops will cause the machine movement to cease, and the machine will remain inactive until the emergency has been cleared. Note, however, that power is not removed from the CNC when an E-stop button has been depressed. All power will be removed from axis servo drive systems and pneumatic solenoids with any emergency stop condition.



### 3.2.2 Safety Light Curtains (if equipped)

Photoelectric transmitters and Receivers form a system of protective light curtains on the machine. They detect any object, which breaks the beam and moves into the crossbeam's operating path. There are two separate light beam paths, one on each side of the base frame. When a human body or any other object is placed between a light beam transmitter and its receiver, the beam is broken and the machine goes into an emergency shut down mode where all axes are stopped as fast as possible. After all axes have stopped, all power is removed from the servo drive system, ultrasonic system, and pneumatic solenoids. Once the problem or the event, which caused the curtains to be broken, has been corrected, the program can be restarted where it was interrupted. To do this, you must cycle the CONFIRM SAFETY DEVICE keyswitch on the AGFM CNC 6000 to restart the servo drive system. After the servo drives are back in regulation, the machine is ready to operate again. If an automatic program was running when the interruption occurred, the program can be re-started from the last rapid traverse position (G0) that was encountered in the program by pressing CYCLE START. A detailed schematic of the safety device stop circuit can be found in the electrical prints, sheet 6.



**Important:** To ensure proper operation of the safety system, the transmitter / receiver devices should be inspected for proper operation at monthly intervals.

### 3.2.3 Safety Mats (if equipped)

There are mats placed along either side of the machine that halt machine movement if a weight is placed on them. This protects a person from being hit by the crossbeam should they wander into the operations area.

### 3.2.4 Light Guards (if equipped)

Photoelectric light beams guard against people or objects which could be harmed should they enter the operating area of the crossbeam. Four transmitter/receiver assemblies send light beams out to end reflectors (two beams on each side of the machine), and then detect the returning beams. Should one of the beams be broken, machine movement is halted. The red lights on the safety devices will be illuminated when it is unsafe to enter a safety zone, indicating the gantry is working in that area. The yellow lights will be illuminated when a safety zone can be entered with **extreme caution**, knowing that the gantry may return to this area at any time! The cutting program should issue a message to the operator at the control console when it is safe to enter a safety zone for removing cut parts.

### 3.2.5 Safety Bumpers (if equipped)

Four safety switches, one on the front and back of each side, are mounted on the crossbeam, which halt machine movement when pressure is applied to them. These switches are much like those found on the doors of elevators, and perform the function of placing the machine in an emergency stop state in the event that a person or object is in the operating zone of the crossbeam during machine movement and is struck by the safety bumper.

### 3.2.6 Machine disconnect switch

A machine disconnect switch is attached to the right hand door of the power cabinet. This switch can only be moved to the "on" position when the door of the power cabinet is closed. When the door is open, the switch remains in the "off" position and the machine is disconnected from all electric power. Each door of the multi-door cabinet is interlocked with the main door. The main door is located on the far right side of cabinet.

Only qualified electrical and electronic personnel should be allowed to adjust or to service equipment on this machine, especially inside of the power cabinet. Whenever possible, work should be carried out with the power disconnected; i.e. the main disconnect switch in the "OFF" position. Only when working on the drive modules in the power cabinet and when setting up the machine should it be necessary to work with "live" power.



## 4 Vacuum System

The machine is equipped with a high pressure vacuum pump. Because the pump is remote controlled, it can be installed in an optional sound enclosure away from the machine; however, care must be taken to prevent overheating of the vacuum pump unit. Many different types of vacuum pumps are used, depending on the machine size, and type of cutting being performed. It is impossible to discuss all the different types of vacuum pumps in the document. Please consult your mechanical documentation for more details on your particular vacuum pump system.

### 4.1 Control of Vacuum System

The main vacuum system is activated with programmable "M" codes. Vacuum butterfly valves which control the various vacuum sections are activated with solenoid type directional valves, which in turn are controlled by the CNC. Monitoring for a low vacuum level is accomplished by the CNC through vacuum pressure switches. These pressure switches are normally adjusted to show proper vacuum pressure at 300 millibars (mbar) of mercury absolute.

## 5 Pneumatic System

The machine is supplied with oil free compressed air. The max air pressure should always be adjusted according to the mechanical documentation, but normally is set to 90psi. This air pressure is always monitored by the CNC for pressure drops, and an error will occur if this ever occurs.

### 5.1 Cutting Unit

The converter of the ultrasonic cutting head is forced air-cooled during operation. Whenever the M8 command is issued, a valve will open allowing air to flow to the US converter.



### 5.2 Inkjet Printhead, Lift Table, Gripper Bar, and Clamp Unit (if equipped)

The vertical positioning of the inkjet printhead, lift table, and clamp bar, when enabled, are accomplished by pneumatic cylinders. Opening and closing of the gripper bar is accomplished by pneumatic cylinders. Proximity switches are positioned to sense the extremes of travel.

### 5.3 Inkjet (if equipped)

By using the inkjet, it is possible to print characters parallel to the x axis, or  $\pm 90^\circ$  to the x axis, or at any angular orientation within these limits. Printing modes that are supported are single and twin line 10 x 16 matrix ASCII-Mode, and single line 10 x 16 matrix barcode (numeric or alphanumeric). Parts may be printed either by commanding the inkjet in MDI mode, or by using a CNC program. Vector printing, or drawing with the inkjet, is also supported. Further control over the inkjet printer, such as programmable font control, is available as an option.

## 6 CNC and other Machine Control Hardware

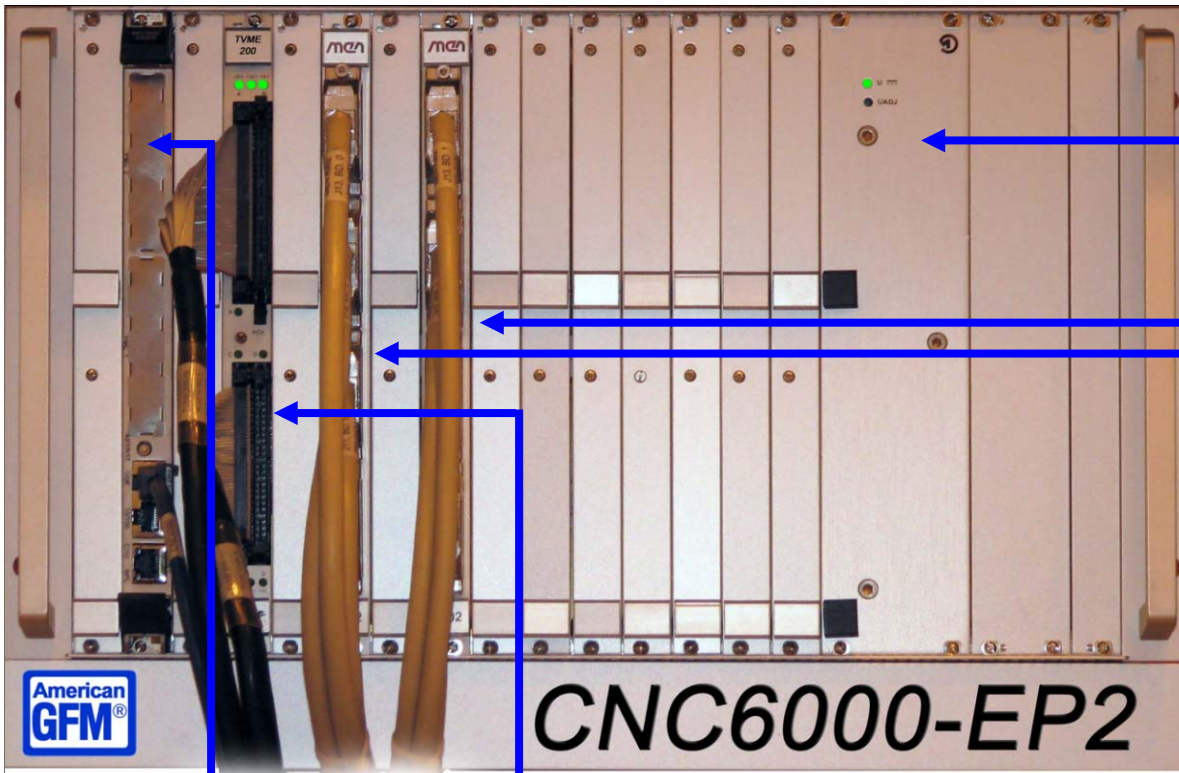
### 6.1 CNC6000-EP

The machine is equipped with a numerical control GFM CNC6000-EP.

**EP = Ethernet Version which uses on-board 1GB Ethernet on the MVME 5500 CPU.**

The CNC can control up to 16 axes simultaneously. System hardware features include the following:

- 0.0001 mm control resolution at max. machine speed.
- Floating point programming.
- Automatic speed optimization.
- Linear, circular, or spline interpolation in the xyz plane with simultaneous automatic tangential alignment of the knife angle (B or C axis).
- Pentium Based Human Interface PC running Windows 2000, or Windows XP.



#### POWER SUPPLY

Manufacturer: Schroff  
 Type: MPS-022  
 Description: Provides +5VDC & ±12VDC to the VME bus and boards. Rated at +5VDC @ 30A and ±12VDC @ 4A.

#### I/O BOARDS

Manufacturer: MEN  
 Type: A302  
 Description: Each board provides 64 inputs and 64 universals, configurable as inputs or outputs. I/O voltage is 24VDC. All outputs are short circuit protected and can handle up to 0.5A (with a maximum 12A per board). Up to ten boards may be installed in a 19 inch rack.

#### SYSTEM CPU

Manufacturer: Motorola  
 Type: MVME 5500 Series  
 Processor: PowerPC MPC7455  
 Description: 32-Bit PowerPC MPC7455 microprocessor running at 1Ghz. VME Bus interface, PCI onboard bus. 512MB onboard DRAM. Onboard Ethernet interface. This board serves as the system controller, interpolator CPU, programmable logic (PLI) controller, and axis controller. An ETHERNET Interface connects the CNC to a PC running the operator interface. Multiple

#### INDUSTRY PACK CARRIER

Manufacturer: TEWS  
 Type: TVME200  
 Description: provisions for four single high IP`s or two double high IP`s. Four 50-pin flat cable headers accessible on front panel for interfacing to industry pack modules. Installed industry pack modules are the TIP119-50 and the ADA-08. Included IP`s:  
**AXIS INTERFACE:** Type *TIP119-50*, with 6 channels of differential quadrature decoder inputs. Each channel has a dedicated 16 bit input counter. All machine axis encoder signals are connected to this interface. Axis position signal are routed from here to the MVME5500 board via the vme bus.  
**DAC/ADC INTERFACE** Type *ADA-08*, with one octal 12 bit digital to analog (DAC) converter and one 12 bit +sign analog to digital converter (ADC). The DAC provides eight single ended analog outputs. The ADC provides eight single ended or four differential analog inputs. All analog signals to and from the machine are routed through the ADA-08 to the MVME 5500 via the VME bus.

## 6.2 Operator Console

Most of the control of the machine operation is performed with the use of the main keyboard and control panel. The following is a list of the main components and their functions:



<b>Keyboard</b>	Used to enter MDI commands, step through the menus, select items and edit programs.
<b>Mode buttons</b>	Used to change the machine mode to one of the following modes: <b>REF</b> erence mode <b>JOG</b> mode <b>MDI</b> mode <b>AUTO</b> matic mode.
<b>Axis Override</b>	This switch overrides the programmed feed rate of all axes in all modes from 0% (stop) to 100% (full speed) in steps of 10%
<b>Spindle Override</b>	This switch overrides the programmed feed rate of the spindle when installed from 60% (stop) to 120% (full speed) in steps of 5%
<b>Axis select</b>	This switch selects between the axes for jog mode movements (X, Y, Z, C, A, B, or W axis)
<b>Plus/Minus</b>	These buttons only work when the control is in the JOG mode. Pressing the plus button moves the selected axis in the + direction.
<b>Cycle Start</b>	Starts an active program when the control is in the AUTOmatic mode, begins the referencing procedure when the control is in the REFerence mode, and restarts the control after a feedhold condition.
<b>Cycle Stop</b>	Performs a feedhold at the end of a program block on a running program if pressed, and a full reset if held down for approximately 2 seconds. Also halts the referencing procedure.

**Incremental Jog** Performs an incremental move of the selected axis in JOG MODE in any of the following increments.

CONT	will jog the axis continuously
0.001	will jog the selected axis by 0.001
0.01	will jog the selected axis by 0.01
0.1	will jog the selected axis by 0.1
1.0	will jog the selected axis by 1
10.0	will jog the selected axis by 10
100.0	will jog the selected axis by 100

**Handwheel Jog** Performs an incremental move of the selected axis in HANDWHEEL MODE in any of the following increments.

0.001	will jog the selected axis by 0.001
0.01	will jog the selected axis by 0.01
0.1	will jog the selected axis by 0.1
1.0	will jog the selected axis by 1

**Select. Switch** Selects whether the control will accept commands from the console pushbuttons or from the jog box.

**Spindle Switch** Allows the user to manually switch off the spindle for tool inspection

**Dust Extraction** Switches on the Dust Extraction by means of this pushbutton

**Emergency Stop** Halts all movement in an emergency situation and cuts power to the drives.

**Master Control** These two pushbuttons will energize or de-energize all electrical circuits on the machine. When master control is off, all machine functions are disabled.

**No Emerg. Stops** This is an indicator light that when illuminated, shows that no Emergency Stops are active

**Main Power On** This indicator light shows that Main Power is applied to the electrical cabinet.

### 6.3 Personal Computer



This Pentium IV based CPU, with Ethernet interface to a VME based processor (MVME 5500), performs the download of the CNC software via the Ethernet interface during the startup. This system also compiles SRC source files to OV2 object files and transfers these files to the CNC for execution. The computer also runs the MMI, which is the interface between the operator and the machine. The computer can also connect to any standard Microsoft network protocols for connection to a host system for program download. The PC runs Microsoft Windows XP Professional.

### 6.4 Electrical Cabinets

The main electrical cabinets contain several high power compartments. The layout of the compartments from left to right is as follows:

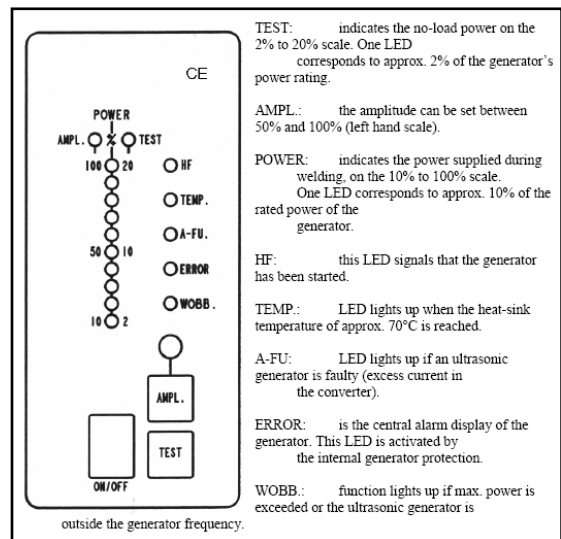
- GFM CNC6000 control
- General operation and control switches and transformers
- Drive modules and related power supplies and transformers
- Main disconnect, motor protection, and other fuses



### 6.5 Ultrasonic Generator

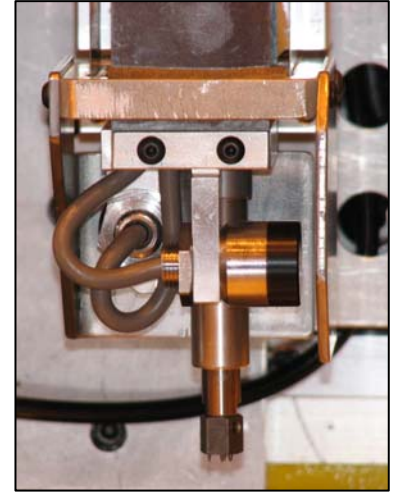


The machine uses a high power multi-frequency ultrasonic generator. The generator is mounted on the base frame. The generator is self tuning to the proper resonant frequency of each horn. The ultrasonic output amplitude is activated with the M08 M-Code. The generator has several LED indicators as well. Their meaning are described in the below illustration.



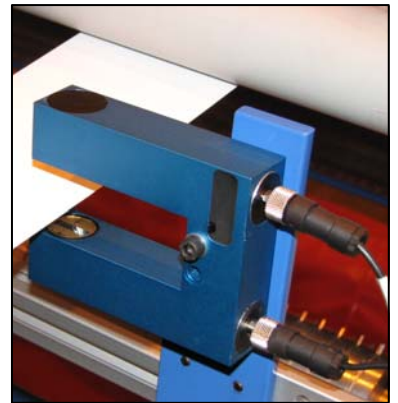
## 6.6 Conveyor Deviation System (if equipped)

The machine is equipped with a continuous conveyor belt that covers both machine tables. In order to accurately cut shapes continuously over multiple windows, perfect positioning accuracy would be required from the conveyor belt. The conveyor belt can not be positioned accurately enough to perform window cutting of continuous parts due to the elasticity of the belt material and other mechanical factors. Therefore, the machine is equipped with a system capable of measuring the amount of conveyor belt deviation during the M36 material pull-out macro. This system has 2 independent inductive sensors. One sensor is used to measure the X-Axis deviation and the other is used to measure the Y-Axis deviation. Each sensor has a mechanical stroke of +/- 5mm, meaning the system can correct up to 5mm of belt deviation in XY axis. When the M34 command is issued (Grip Material), the sensors are lowered via a pneumatic cylinder. After the sensors are down for 1 second, the CNC then reads the values from both sensors as the "Starting Value". Then the M36 macro is executed to pull the material with X/U axis synchronized. As the X/U axis move, there will be some movement of the sensors caused by the belt deviation. When the M35 command is issued (Release Material), the CNC reads the sensors again and stores the values as the "Ending Value". The CNC then calculates how much deviation occurred during the M36 pull-out and automatically makes a correction to XY axis compensate for the belt deviation. This correction occurs after every M36 so that every window is accurately cut. This system is accurate to within +/- 0.20mm.



## 6.7 Material Edge Guidance (if equipped)

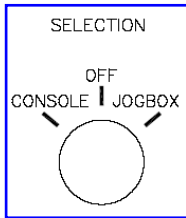
The machine is capable of maintaining the edge of the material exactly on the Y-Axis zero point during the automatic material dispensing macro, M36. This is very useful when very little waste material is a requirement at the edges to achieve maximum material utilization. The system consists of an analog laser sensor with a 16x2mm laser beam. The material is fed through the laser sensor during the material dispensing process. The output of the laser sensor feeds a servo drive (W-Axis) which moves the roll +/- relative to the position of the material position in the laser sensor. The drive will regulate the material's edge, keeping it at the mid point of the 16mm laser beam at all times during the M36 macro.



**NOTE:** If the material falls out of the laser sensor during M36 dispensing macro, the material dispenser will move all the way to a hardware limit switch, thus misaligning the material on the table. It is very important to keep the tension on the roll brake tight enough so that the material stays taught during the dispensing process and moves smoothly through the laser sensor.



### 6.8 Jog Pendant



The Jog Box allows the operator to manually move the axes to a desired position without having to stand at the operator console. AUTO mode is also available, however, automatic programs must be started from the main console first, then can be switched over to the jogbox after the program is running.. The Jog Box has a magnetic base so it may be attached to any ferrous material. In order to activate the Jog Box controls, the operator must place the machine in JOG mode from the operator console and turn the selector switch to jog pendant on the operator console. Additionally, there are two buttons on the jog pendant, one on each side, which must be pressed to initiate any movement from the pendant. The selector switch must be placed in the console position before the operator console controls are reactivated.



- Stop button** Stops the current program cycle.
- Auto button** Selects AUTO mode.
- Start button** Begins the current program cycle.
- Minus button** Moves selected axis in minus direction if in JOG mode.
- Jog button** Selects JOG mode.
- Plus button** Moves selected axis in plus direction if in JOG mode.
- Axis Select** Selects desired axis to jog. The "Vector" position allows jogging in the plus direction of the current tool vector angle.
- Cont/Incr Jog** If set to *Cont. Jog*, the axis will move continuously at the selected feedrate (blue dial) when the plus or minus button is pressed. If set to *Incr. Jog*, the machine will move in the increment selected (green dial) for every push of the plus or minus button. If set to the region pointing to the *Wheel*, the handwheel will move the axis in the selected increment (black dial) for each "click" of the handwheel.
- Handwheel** Used to move the axis the selected increment for each "click".
- Deadman Sw.** These are 2 single contact safety rated pushbuttons that must be depressed to use the jogbox.
- Override** It is possible to control the machine override with the jog box. The right side rotary switch is used to control the speed of the machine. When in JOG mode, only a *LOW*, *MEDIUM*, & *HIGH* speeds are available and indicated with the blue dial. In AUTO Mode, this same rotary switch is used to select the override percentage between 0-100%, and is indicated as the red dial.

**Caution:** *Safety Curtains and Safety Mats are NOT active during JOG mode with the Jogbox. This allows the operator to move close to the machine while using the jogbox. The 2 deadman switches must be depressed to move any axis with the jogbox. Care must be taken when moving the axes with JOG mode*

## 7 MMI Operation and Machine Startup

The MMI is the operators interface to the machine. It allows the operator to perform all of the functions required to successfully operate the machine and produce the highest quality parts possible. It is important for the operator to fully understand the operation of the MMI and to be aware of what the results will be after issuing any command. The MMI is also a very powerful tool for maintenance personnel, as it provides information on the operating condition of the machine. Various screens are available for troubleshooting and debugging in the service level access levels.

### 7.1 Preparation for Machine Startup

A few initial checks should be performed before machine startup to ensure safe operation.

#### 7.1.1 Initial Checks

Before start up of the machine, the operator should make certain that the machine is in operable condition, and that all mechanical and electrical parts are correctly installed and secured. This is especially applicable to covers and safety equipment. It is also very important to make sure that there are no foreign objects on the table surface or near moving parts of the machine.

#### 7.1.2 Turning the Machine On

After performing the initial checks, the machine is ready to be turned on.

- Make sure that an emergency stop button is depressed (safety measure during power-up).
- Make sure that compressed air is supplied to the machine and that the main valve is in the open position.
- Check to make sure that the system air pressure registers 6 Bar (~90 psi).
- If it is not already on, turn on the electrical power with the main switch on the electric cabinet. The control should go through the "boot up" procedure.

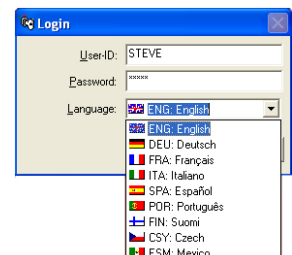
#### 7.1.3 Start Up Procedure

After turning on the main disconnect switch on the electric cabinet, the PC in the operator console will boot up. After Windows finishes loading, the MMI will automatically begin, download required system files to the CNC, and display the user login screen. Enter your user name, press the *ENTER* key to move to the password field, and enter your password. Both the user name and password are CASE SENSITIVE.



#### 7.1.4 Language Selection

Many different languages are supported with the CNC6000/EP. After the USER-ID and Password has been entered, choose the desired language from the drop down list as shown to the left, and then click OK to login.



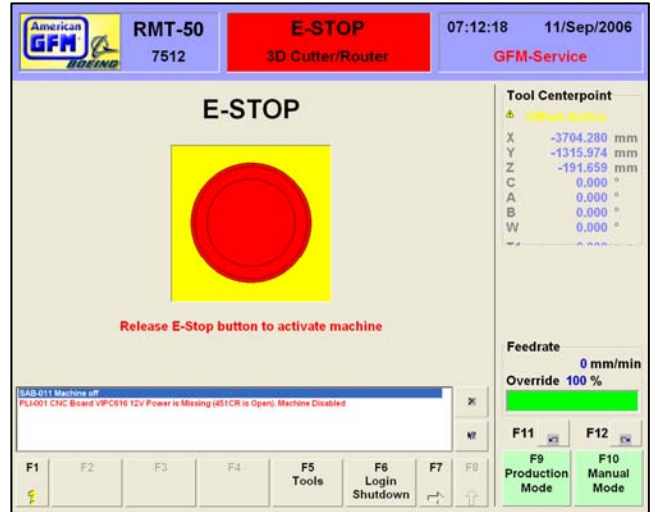
### 7.1.5 Master Control

After the CNC has booted up and the user has successfully logged into the MMI, press the "Master Control ON" pushbutton. Ensure the lamp illuminates. Switching Master Control ON enables many power supplies to be powered up.



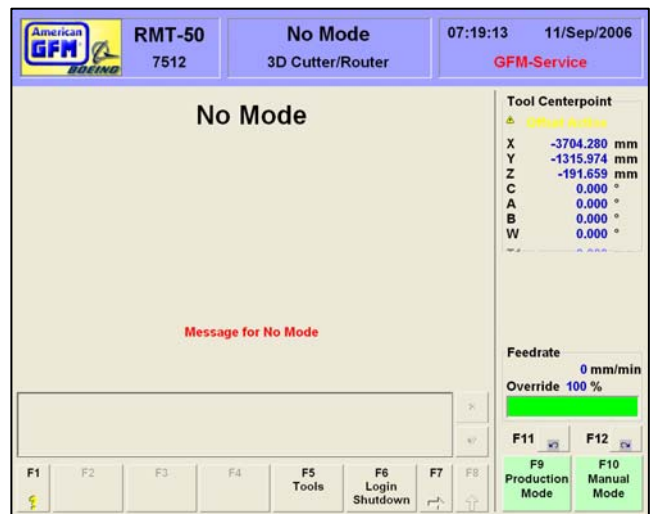
### 7.1.6 E-Stop

After successful login, the E-STOP screen will appear provided an E-Stop button is pressed. If an E-Stop button is not pressed, the machine will switch into the last active mode. If the machine and the surrounding area is clear release the E-Stop button. The machine will switch into a No Mode condition with all of available the mode buttons flashing.

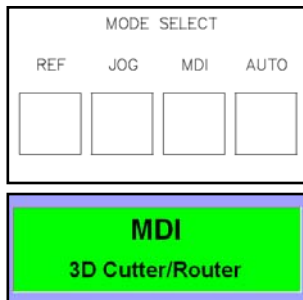


### 7.1.7 No Mode

A No Mode condition will be active after an E-Stop condition has been cleared. All of the available mode buttons will be flashing. AUTO mode will not be available until successful reference and toolsetting procedures have been completed.



### 7.1.8 Machine Mode Selections



The desired machine mode is selected with the mode buttons on the operator console. Certain conditions must be met prior to any given mode being available to the operator. Each mode will have its own display showing information pertinent to that particular mode. There are also areas on the display that are common to almost all modes. These areas are located at the top, bottom, and the right side of the display. The active machine mode is also shown in the MMI Header at the top of the screen.

## 7.2 Changing the Knife

In the event that the cutting knife breaks or becomes dull, causing poor cutting results, the “Knife Change” macro is used to replace the damaged knife. This is done using a special M-Code, which, when entered in MDI mode will position the machine to a predefined position. This is the position where the operator will enter the machine moving area to exchange the knife. Once the M-Code is executed, Z-Axis will move to the maximum upper position, and then XY axis will move to the knife change position, as defined in the USER.CNF. Once this position is reached, the machine’s servo drives are deactivated for safety. A message will appear on the MMI screen prompting the operator to **“Replace the knife, and then press “CYCLE START”**. At this time the operator should walk over to the machine, release the turning axis locking pin (if equipped) to lock the knife axis to allow the supplied torque wrench to be used to unscrew the old knife. After the old knife has been removed, follow the below guidelines to install the new knife.

The M-Code to execute the knife change macro is:

**M42 → 2D Cutters**

**M61 → 3D Cutters**

1. Every blade should be degreased and completely cleaned prior to installation, with solvents similar to CRC Brand Heavy Degreaser solvent, electronic contact cleaner, acetone or denatured alcohol (please check with your internal Hazardous Communication Program).
2. Use a brass wire or stiff bristle brush to remove debris and oil from the threads, and then rinse the entire blade with an approved solvent. We recommend wearing safety glasses during this procedure.
3. Blades should be blown completely dry using dry, filtered and oil-free air prior to installation. We recommend wearing safety glasses during this procedure.
4. Interior features of the horn should be cleaned in a similar fashion. No oil or solvent should remain in the horn or on the blades. This should be done each time the blade is changed.
5. The face of the horn where the blade seats should be carefully stoned flat if any sign of galling or scoring is found during routine maintenance. Steps greater than 0.05mm, (0.0019”), can have an effect on tuning. Removal of as little as .02mm of material may affect the ultrasonic horns tuning, so this should be done only when necessary and should be carefully done by a technically astute technician. The entire horn should be clean inside and out.
6. Check, by hand, to make sure that the blade seats completely flat against the horn face. If any force greater than what can be exerted by hand is necessary to seat the blade to the horn, there may be a problem with the threads in the horn, locating diameter, (10.00mm), or on the knife. After several blades are checked and are not able to be screwed in by hand, contact American GFM for further instructions. Under no circumstance should a tap be used to “chase” the threads in your horn unless instructed to do so by AGFM personnel. **Blades should be installed to 24 foot pounds of torque with an open end torque adapter and torque wrench.** Most machines are equipped with the correct tools, and training is provided during machine installation. If a torque adapter is used, make certain the appropriate torque to be set, or read is recalculated according to documentation contained with your torque measuring equipment. This information is also available through American GFM.
7. Heat build up is usually an indication of a problem. Isolate the problem and correct it before continuing. Some things to check are: loose horn and converter assembly, incorrect ultrasonic generator output, carbon brushes worn or different lengths, damaged horn or converter threads. Some heat build up is normal. Temperatures exceeding 120F are not common. Build up of melted coversheet on the horn is a common problem after a vacuum hold down failure and must be removed without damaging the original polished surface on the horn. Leaving any liquid substances on the blade or in the horn usually creates excessive heat.
8. A loud shrieking or ticking sound emanating from the horn or knife is often an indication that the blade is not properly tightened inside of the horn or the horn/converter assembly is loose. Ensure that the blade is securely tightened and disassemble the horn/converter assembly if required. The face between the horn and converter should be clean and stoned if necessary. Securely tighten the horn and converter, being careful not to strip the pin spanner wrench holes. Estimated torque for this assembly is 80-100 ft. lbs. Also ensure that the threads inside of the horn are not damaged. Check that the carbon brushes are seating properly and are the same length.

### 7.2.1 Horn Inspection

All Ultrasonic Horns should be inspected on a regular basis, based on usage, especially Horns operating on 3D Machines, (US-50, RMT). It is recommended that any Horns running in production for period of one year should be returned to AGFM, for inspection to ensure the reliability of these horns.

### 7.2.2 Cleaning the converter contact surfaces

The entire ultrasonic assembly area must remain clean for the ultrasonics to function properly. This cleaning procedure should be done at least once a month, depending on conditions. Avoid any build up of glass fibers or dust in the brush contact area. The frequency and voltage often attracts fine airborne particles, which could arc across the brushes and potentially damage components.

1. Stop machine and turn off ultrasonic generator. Follow your company's Lock-Out Procedure.
  2. Remove carbon brushes.
  3. Clean converter contact surface with a cloth dampened with acetone, denatured alcohol or an electronic cleaning solvent. **DO NOT GET SOLVENT INSIDE OF THE CONVERTER !**
  4. Wipe dry and clean with soft, dry cloth or "dry" clean with dry, filtered, oil-free quality air. Fine "Scotch Brite" or other mild abrasive fabric may be used lightly to remove heavy carbon build up. Prevent debris from falling into the converter. Pack a small rag or use tape to cover the ventilation holes in the top of the converter.
  5. Reinstall brushes, wiping them down with a dry rag first. The carbon brushes must be the same length within 2mm of each other.
  6. With brushes completely installed, take a piece of fine emery cloth and place the abrasive side toward the brushes, in between the brush and the converter. Rotate converter and emery cloth under the brush to match the brush contact surface. Be careful not to allow the sanding dust to fall into the converter. Do this to both brushes until the bottom of the brush is flat with the mating surface.
- Clean any carbon brush dust from the converter, then test the ultrasonics by bringing the machine out of E-Stop, switching the generator on, and depressing the "TEST" button on the ultrasonic generator and note the generators' digital display. The value displayed should remain fairly constant. It is normal for the display to fluctuate slightly.

### 7.3 Displays Common to All Modes

#### 7.3.1 Display Header

The Display Header shows general machine information. The left section shows the machine type and the AGFM



machine number. The center section shows the current machine mode. Different background colors in this section indicate different machine statuses within the selected mode. A red background will be displayed when in an E-Stop condition. Blue indicates that no current mode is selected. Yellow indicates that the mode is active and no axis is moving. Green indicates that the mode is active and at least one axis is moving. The right section shows the current user, date, and time.

#### 7.3.2 Axis Display

The upper area shows the axis display mode: Tool Center point, Nominal, Actual, Error, Distance To Go, or TCP Absolute. Double clicking on top of the current axis display mode and choosing the desired display mode from the drop down window that appears can change the display mode. Below the display mode “Offset Active” will appear if any machine offsets are active. Next, each axis is shown with a position display. The display will change depending on which display mode is selected:

<b>Tool Centerpoint</b>	Machine position in relation to the tip of the current tool including any active offsets.
<b>Nominal</b>	Machine position being commanded by the CNC without the tool length considered.
<b>Actual</b>	Machine position determined from positioning system feedback without the tool length considered.
<b>Error</b>	Difference between Nominal and Actual position.
<b>Distance To Go</b>	Distance remaining until axis reaches the commanded end point.
<b>TCP Absolute</b>	Machine position in relation to the tip of the current tool not including any active offsets (from true machine zero).

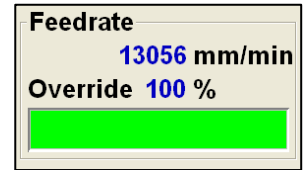
#### 7.3.3 Ultrasonic and Spindle Power Display

The middle area shows Ultrasonic or Spindle information. The percentage of amplitude or RPM's and the real-time ultrasonic power level or spindle power level is displayed in WATTS. A bar graph shows the current power level. If the power level is within normal operating range, the bar graph will be green. If the power level is in the warning range, it will be yellow. If the power level is yellow, the operator should perform some basic ultrasonic system checks. These checks include, but are not limited to:

- Is the knife damaged?
- Is the knife dirty?
- Is the knife installed properly in the ultrasonic horn?
- Is the feedrate too high for the type of material being cut?

### 7.3.4 Feedrate and Axis Override Display

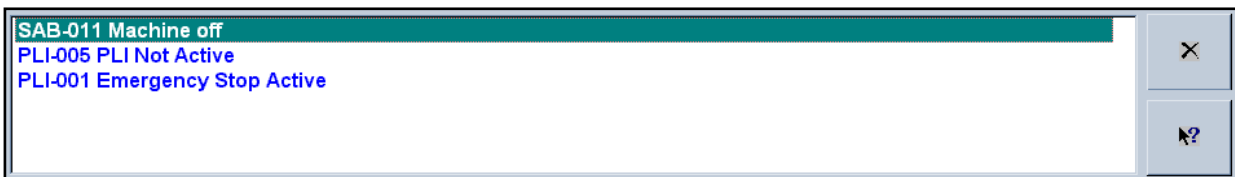
The lower area shows feedrate and machine override information. The current feedrate will be shown in either mm/min or inch/min. This is selectable via a G Code (G70/G71). The override display shows the position of the override switch on the operator panel. The bar graph below the override percentage displays in green the percentage of the current override adjustment. If override is set to zero, the override text background will flash yellow.



### 7.3.5 The Message Window

The message window is the most useful tool the operator has. This is the area where messages from the machine and the CNC6000 will appear whenever faults and/or warnings occur. In the event that the machine stops running, a message will appear with a brief description as to why the machine stopped. Reading and understanding these messages is vital to keeping the machine running production. Hundreds of different messages are possible. The “X” button on the right side deletes the message at the top of the box. The arrow button will bring up a help screen, which has information on the message at the top of the box. Alternately, double clicking on the message with the mouse will also bring up a help screen about the displayed message.

Messages are generated by many different parts of the system. Each message will have a unique format. This format included 2-3 letters followed by a 3-digit number.



Example:

**PLI-001 Emergency Stop pushbutton is pressed**

Whereas,

**PLI** means that the PLI Control Logic generated the message

**001** means the message number inside the PLI Fault logic

Messages can have other letters as part of their number. They are as follows:

- PLI-xxx            Indicates that the message was generated by the PLI Logic
- SAB-xxx           Indicates that the message was generated by the CNC Block controller
- AXC-xxx           Indicates that the message was generated by the Axis controller
- ITP-xxx           Indicates that the message was generated by the Interpolator
- MMI-xxx           Indicates that the message was generated by the MMI software

#### 7.3.5.1 Clearing Messages

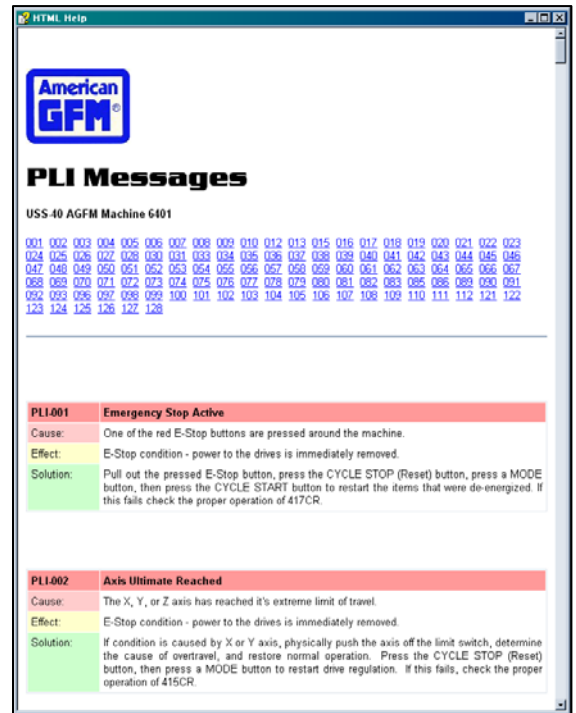
There are three ways to clear fault messages. One way is to click the “X” button with the mouse to the right of the message window, or press the RED STOP button on the operator console, or press the DEL key on the keyboard. Some messages are “self-clearing”, meaning they will disappear automatically when the condition that caused the message has gone “false”



### 7.3.5.2 Getting Online Help for Faults

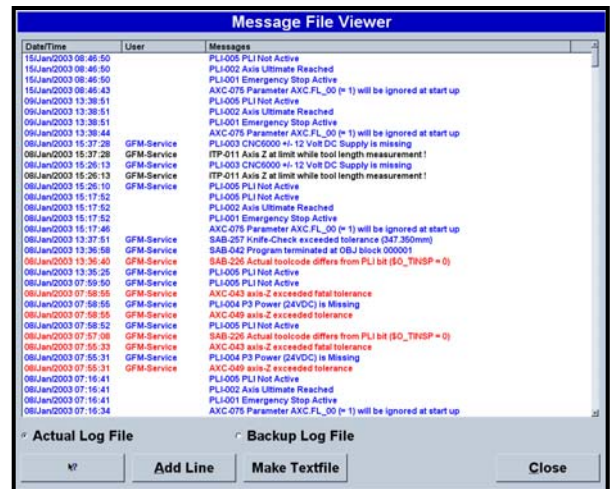


Whenever a message appears in the message window, additional help can be displayed about the message. If this is necessary, use the mouse to double click on the message or click on the “?” button. Upon pressing this help button, the following screen will appear with more detailed help about the message. This detailed help screen gives a “Cause”, “Effect”, and a “Solution” for the chosen message. Every message is described in detail in the Online Help. At this point, the operator can scroll up or down to see other possible messages if desired.



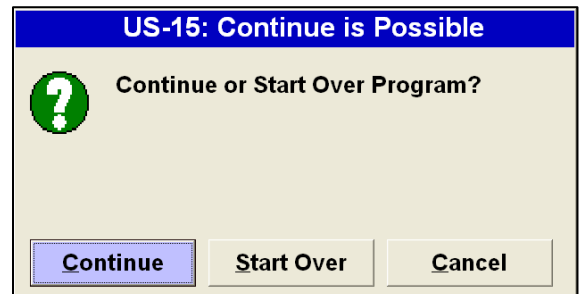
### 7.3.5.3 Viewing the ERROR Log

Every message that ever appears in the message window on the machine will be stored in an online ERROR LOG. This log shows the time and date of the fault occurrence and the User-ID and the priority that was in effect at the time of the fault. To view this error log, activate the SYSTEM SUPPORT menu from the Production screen from the 2<sup>nd</sup> row of softkeys using F6 System Support. The Error Log is found by choosing the Group 1. Highlight “Show Error Log File” ENTER. The screen here will appear. Comments can be added to this file at any time by pressing the “Add Comment” button and typing your comment in. A backup of older messages is also available by clicking “Backup Log File”. This backup log file will be created whenever the current log file size reaches 100K Bytes. To see the online help screen described above, double click any of these messages, or highlight the fault and click the “?” button.



### 7.3.6 Using the Online RESTART Feature

If the machine is stopped for any reason before the end of the program is reached (i.e. blade breakage, machine faults...ect), the remaining portion of the program, which has not yet been cut, can easily be finished. The CNC6000 will use its online RESTART feature to achieve this. Provided that a new program has not been loaded, or the power has not been cycled, since the program was





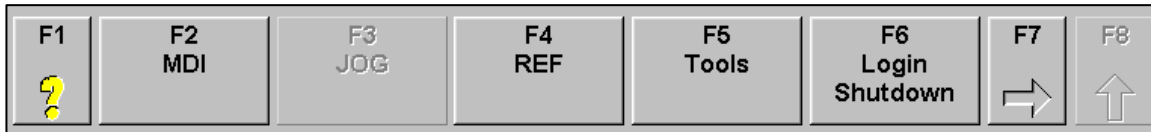
stopped, upon pressing the CYCLE START button, the dialog to the right will appear.

If "Continue" is clicked, the machine will be positioned to the LAST G00 movement, and continue the program from that point till the end.

If "Start Over" is chosen, the program will be executed from the beginning again.

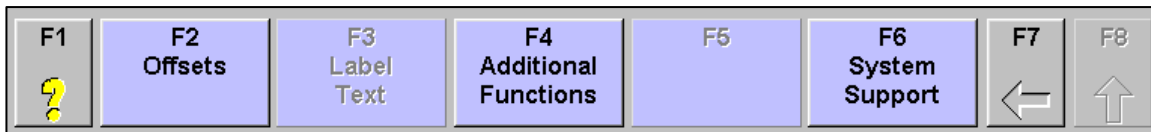
### 7.3.7 Softkey Lines (REF, JOG, and MDI modes)

The softkey line at the bottom of the display allows the operator to move between different screens. The softkey lines are the same for REF, JOG, and MDI modes. AUTO mode has a unique set of softkeys and will be covered in a later section. There are two levels of softkeys.



Softkey line one is shown above. If a button is grayed out, it is either already active or unavailable. A softkey can be selected by using the corresponding key on the keyboard (F1, F2, etc.) or by clicking on the button with the mouse.

- F1** Opens a PDF manual and jumps to the corresponding page number related to the displayed screen.
- F2** Selects MDI mode
- F3** Selects JOG mode
- F4** Selects REF mode
- F5** Opens the Tool Editor
- F6** Opens the initial login screen. The current user will no longer be active. It will be necessary to login again.
- F7** Changes to the next of softkey line (line two)
- F8** Returns to the lowest level softkey line (line one)



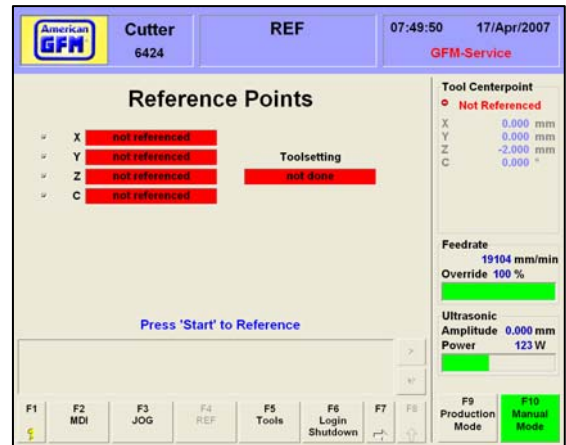
Softkey line is shown above. The blue buttons indicate that this is the next level of softkeys. If a button is grayed out, it is either already active or unavailable.

- F1** Opens a PDF manual and jumps to the corresponding page number related to the displayed screen.
- F2** Opens the Offset Editor
- F3** Opens the Label Text Editor
- F4** Opens the Additional Functions display
- F5** Not Used
- F6** Opens the System Support menu
- F7** Changes to the previous softkey line
- F8** Returns to the lowest level softkey line

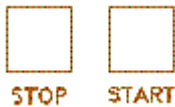
### 7.4 REF Mode

If the CNC control has been rebooted either by a power down/power up or by selecting the Reboot CNC icon from the Windows desktop, the machine must be referenced. This is done in REF mode. The only function for REF mode is to perform a machine reference cycle.

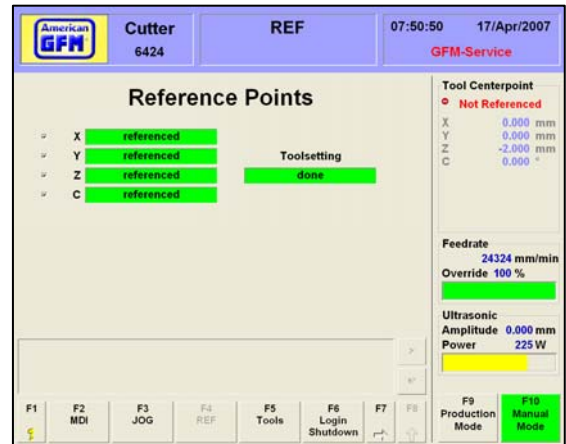
When REF mode is chosen and the machine is not currently referenced, this display will appear. Each axis is shown with its current reference status as well as the toolsetting status of the current tool. To begin the reference cycle, press START on the operator console.



As the machine is performing the reference cycle, the “not referenced” graphic will change to “in progress”



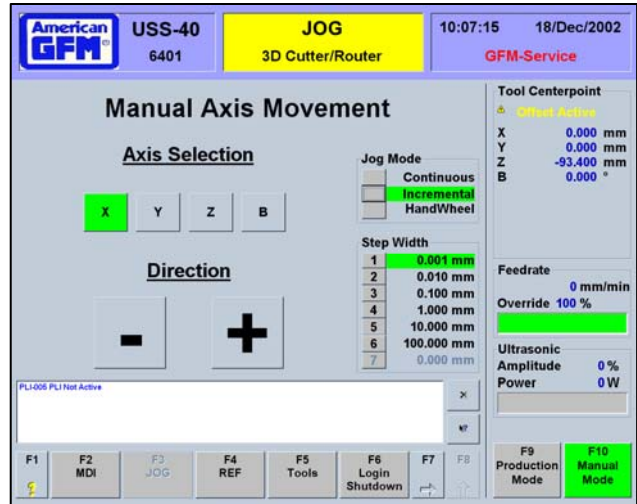
After a successful reference cycle and toolsetting cycle, this screen appears. Each axis shows that it is referenced and a successful toolsetting has been completed. After a successful reference and toolsetting procedure, it is safe to change to a REF, JOG, or AUTO mode.



If the machine is not set up to perform an automatic toolsetting cycle after reference, a toolsetting must be performed in MDI mode. The method is different for 2D and 3D machines. Manual toolsetting is covered in the MDI Mode section below.

### 7.5 JOG Mode

JOG Mode allows the operator to manually move each of the machine axes independently. Choose the desired axes using the axis selector switch on the operator console (or jog box) and move the axis using the PLUS or MINUS buttons on the operator console (or jog box). The operator can jog each axis to its user limit. Therefore, it is extremely important to be careful when jogging any axis, since they can be moved all the way through the machine min/max limits. If an axis is jogged to its user limit position, axis movement will stop. Jog the opposite direction to move away from the user limit. Each axis has a different maximum velocity (feedrate) and acceleration while in jog mode. This is a safety feature, which allows the operator more reaction time to control and stop the axes while jogging.



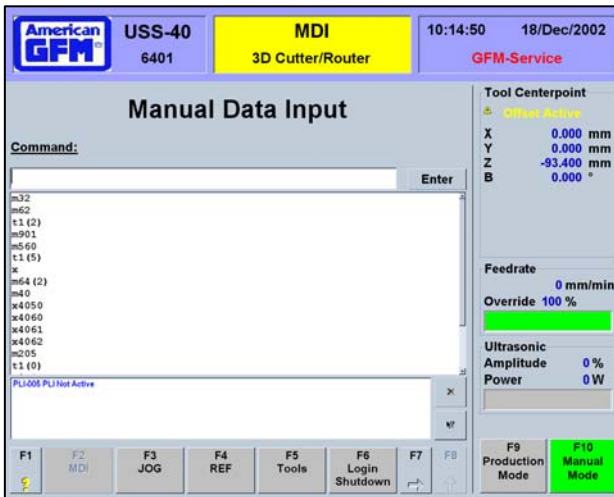
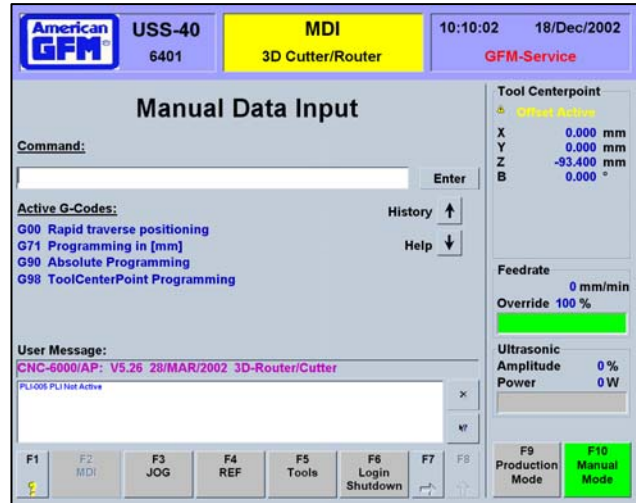
The selected axis will be highlighted in green. As the PLUS or MINUS buttons on the operator console are pressed, the corresponding “+” or “-” button on the MMI will also be highlighted in green. While the selected axis is moving, the position display in the top right corner will increment.

There are two jog modes available to the operator; Continuous and Incremental. In Continuous jog mode, the selected axis will move as long as one of the direction buttons on the operator console is pressed. In Incremental jog mode, the axis will move as long as one of the direction buttons is pressed and the axis has reached the selected incremental jog distance. If the direction button is released before the selected incremental jog distance has been reached, axis movement will stop.

The jog box also has a jog wheel, which may be used to move an axis. With Handwheel jog mode selected, the jog wheel will move the selected axis the distance of the step width for each “step” the jog wheel is turned. The jog wheel is turned clockwise to move an axis plus and counter-clockwise to move an axis minus.

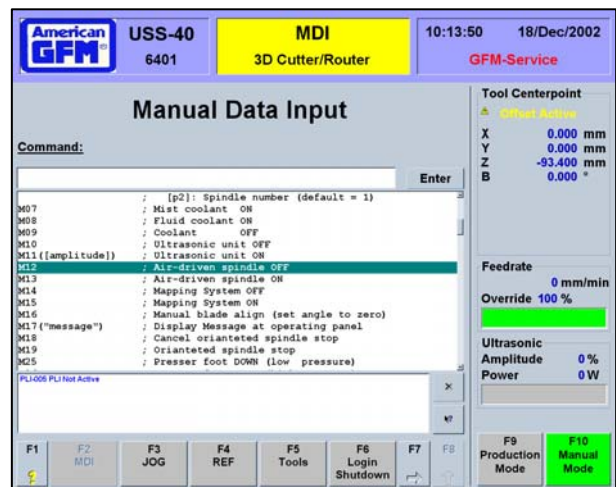
### 7.6 MDI Mode

MDI mode allows the operator to perform many manual operations on the machine. MDI mode uses G-Codes and M-Codes entered by the operator to give commands to the CNC. The Manual Data Input (MDI) display has its own set of unique features. The main interface with the MDI display is the Command: window. This is where the operator enters the M and G codes used to issue commands to the CNC. Below the Command: line the currently active g-codes are displayed. Use the keyboard to enter the desired M and G codes. Press enter to send the commands to the CNC. Alternately, the mouse can be used to click on the Enter button to send the command to the CNC.



The History button will open a drop-down menu showing the most recently entered commands in the command line. Clicking on a command in the history menu will enter the command into the Command: window. Pressing enter will send the command to the CNC.

The Help button will open a drop-down menu that displays the available M and G codes and give a brief description of their function. Right clicking on any of the codes in the help menu will bring additional help about that code.

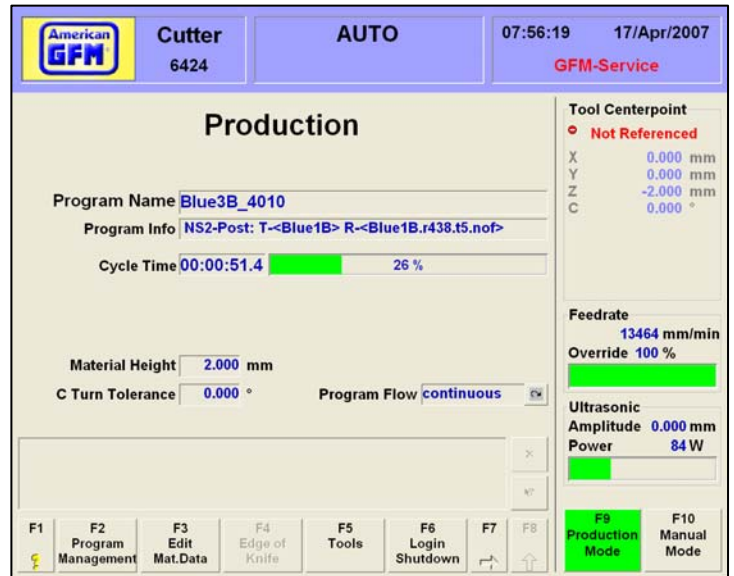


### 7.7 Production Mode (AUTO)

AUTO Mode allows the operator to automatically run cutting programs. In AUTO Mode, cutting programs can be loaded to the CNC, graphically viewed, edited, and/or compiled. Auto mode has a unique set of softkeys from REF, JOG, and MDI mode. The Production screen gives the operator general information about the current program.

The currently loaded **Program Name** and **Program Info** are shown.

The **Cycle Time** will begin incrementing when the program is started. It will continue to accumulate until the end of the program is reached. The bar graph to the right shows the amount of progress of the running program in percent.



The **Fitted Tool** shows the current tool that is loaded in the head.

The **Edge of Knife** selection is done by clicking “1” or “2”. By clicking on one of these buttons, the opposite knife-edge will be used and can be done during a cutting cycle.

**Program Flow** shows the current program flow state. Possible choices are:

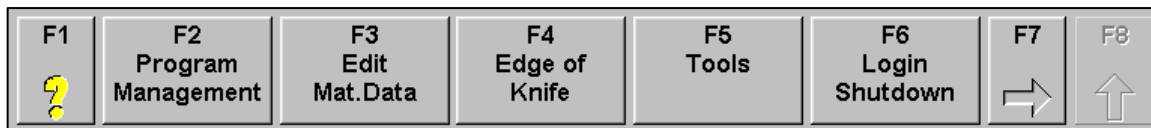
CONTINUOUS cutting will not stop until an end of program code in the program is reached,

BLOCKWISE cutting will pause at the end of every program G0 block

STOP ON M01 cutting will stop at every M01 in the program.

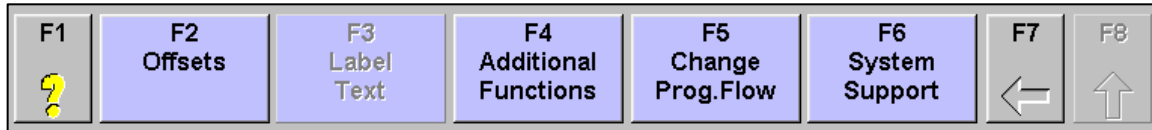
Press START to continue cutting if Program Flow is set to Blockwise or Stop on M01.

#### 7.7.1 Softkey Lines (AUTO Mode)



Softkey line one is shown above.

- F1** Opens a PDF manual and jumps to the corresponding page number related to the displayed screen.
- F2** Opens the Program Management screen
- F3** Opens the Material Data Editor
- F4** Changes the Knife Edge being used
- F5** Opens the Tool menu
- F6** Returns to the initial login screen
- F7** Switches to the next softkey line



Softkey line two is shown above.

- F1** Opens a PDF manual and jumps to the corresponding page number related to the displayed screen.
- F2** Opens the Offset Editor
- F3** Opens the Label Text Editor (if labeler is installed)
- F4** Opens the Machine State screens
- F5** Changes Program Flow to continuous, blockwise, or stop on M01
- F6** Opens the System Support menu
- F7** Switches to the previous softkey line

### 7.7.2 F2 Program Management

The Program Management screen shows the programs available for cutting. The icons to the left of the program name have different meanings:

- Only a SRC file exists. (Not yet compiled.)
- SRC and Object files exist. (Compiled)
- Only an Object file exists. (Compiled)

If there is no icon beside a program name, the program exists on the hard drive but is not a valid type. The Search Criteria box is used to search for certain programs. Standard Windows operators can be entered to perform searches.

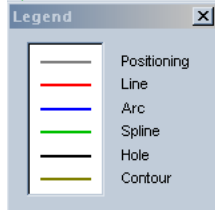


#### 7.7.2.1 F2 Load

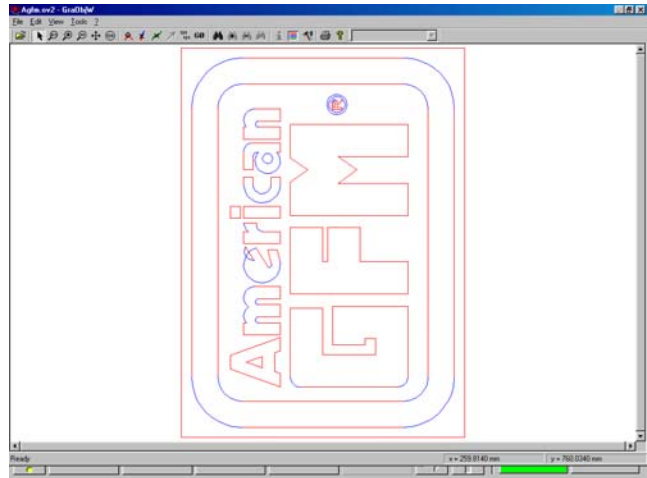
F2 Load will download a part program to the CNC. The program must be compiled before a download can occur. Highlight the desired part program on the list and use F2 LOAD to download the cutting program to the CNC. Double clicking on the desired program will also perform a download. If the program is not a valid program, a message window will appear. If only a SRC file is available, the F2 Load and F3 Graphic buttons will be grayed out. Once the cutting program has been successfully downloaded, the Production screen will automatically be displayed.

### 7.7.2.2 F3 Graphic

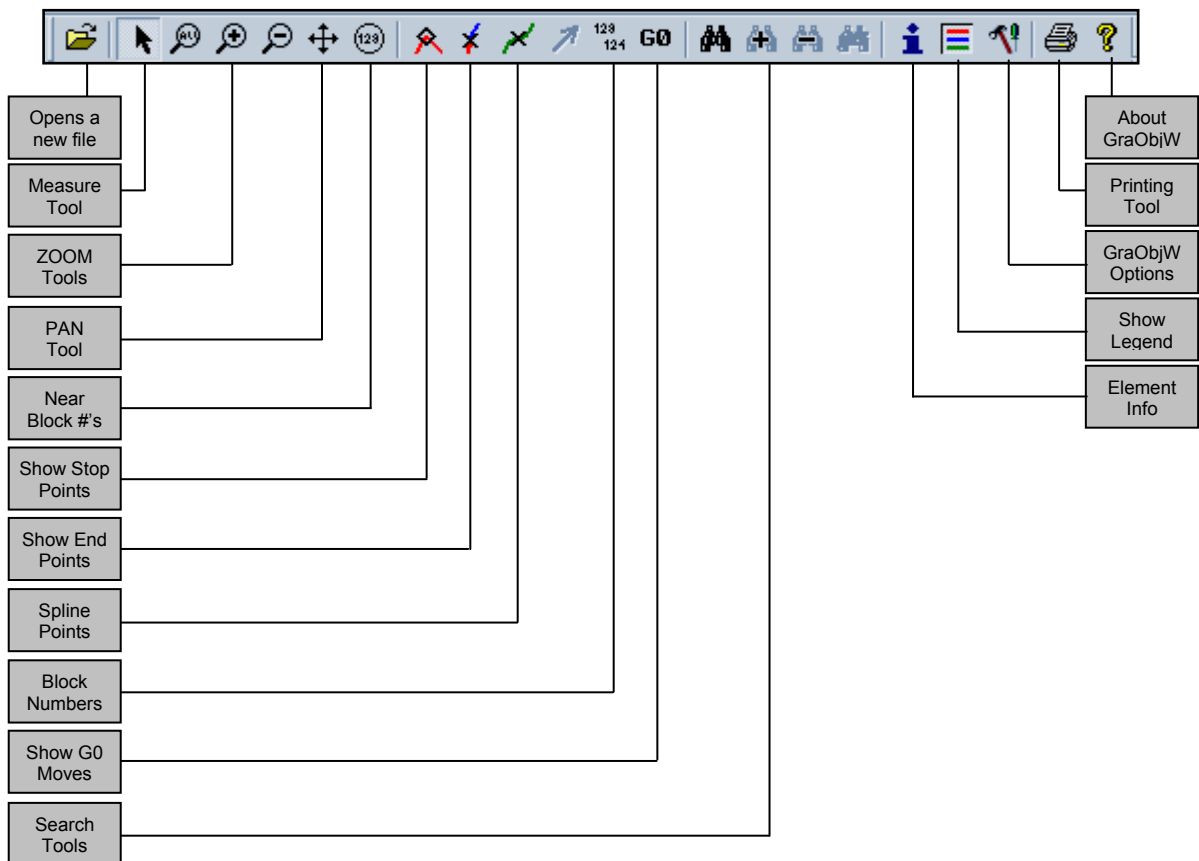
F3 Graphic will open a graphical part program viewer. Highlight the desired part program and use F3 to open the viewer. The graphical viewer displayed different elements of the geometry in different colors.



The LEGEND button in tool bar will display a legend of the possible colors.



The tool bar of the graphical viewer has many other features.



### 7.7.2.3 F4 Info

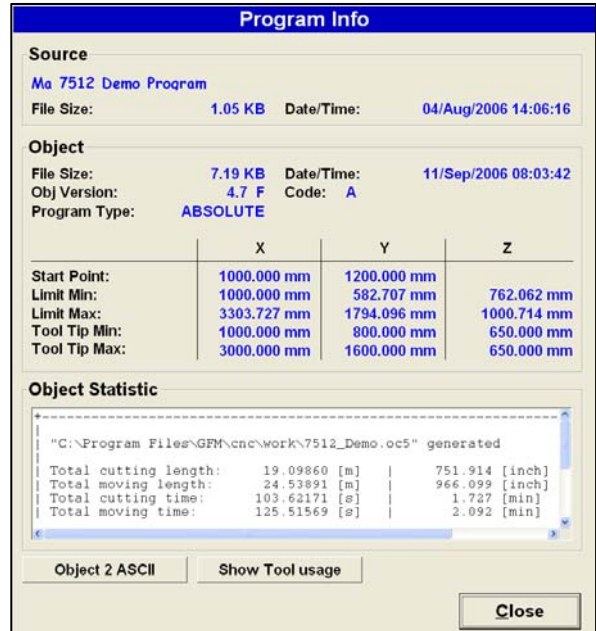
F4 Info will open an information window. Highlight the desired part program and use F4 to view the part program information. This info screen shows some various information about the selected object SRC and OC5 files.

The date, time, and size of the SRC file is shown at the top of the form

The time, date, and size of the OC5 file is shown in the middle of the form

The MIN/MAX limits are also shown for the OC5 file. This is helpful to see when "ToolTip out limit" errors occur when starting programs.

The bottom of the INFO screen shows the object statistics, which is an OST file generated at the time of compilation of the SRC file.



### 7.7.2.4 F5 Partial Pre-Cal

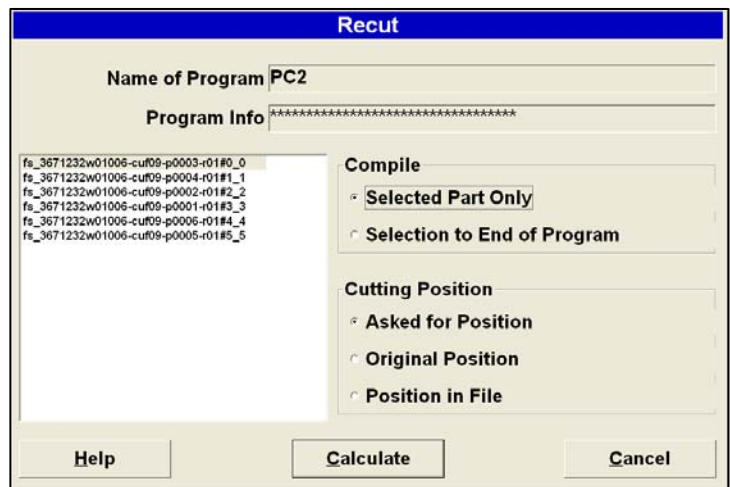
The F5 Partial PreCal button allows a portion of an SRC file to be executed. This is useful when the need for restarting a program somewhere in the middle is required. This feature requires special codes to be programmed in the SRC file.

These codes are called "Part Markers" and begin with ;\$\$ <Text to display>

If this button is pressed, and these special codes are found in the SRC file, the screen to the right will appear. The dialog shows all of the programmed part marker names, and provides options for cutting the selected part only, or from the selected part till the end.

When the **Calculate** button is pressed, a temporary program is created and automatically downloaded to the CNC for cutting.

**NOTE: No spaces are allowed in the part marker names.**

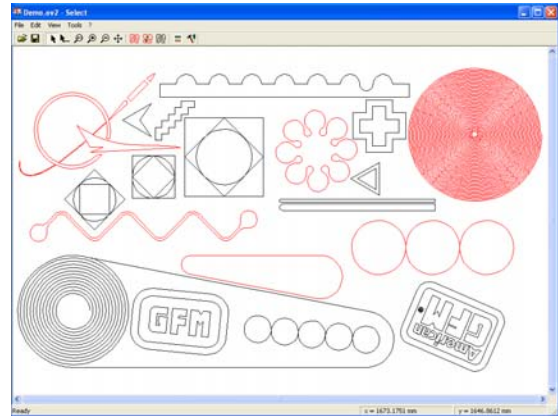




### 7.7.2.5 F5 Select

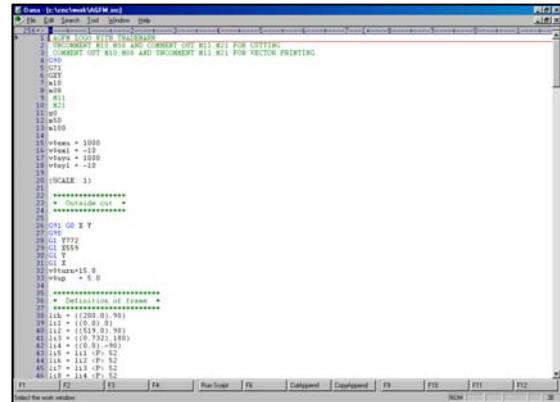
Pressing F5 will start the SELECT Utility. This utility allows operators to “Select” individual parts of geometry out of an entire part program, for purposes of restarting a program in the middle (i.e. after a knife breakage). After all items are selected, a new temporary program is created and downloaded to the CNC automatically, upon exiting the utility. To use this utility, highlight the desired part program and press F5. Use the mouse to click on the desired part(s). Selected Parts will turn RED. You may select multiple parts if required.

Choose File → Exit. Make sure the file is saved in the current selected mount point. The new temporary file will be created and automatically downloaded to the CNC.



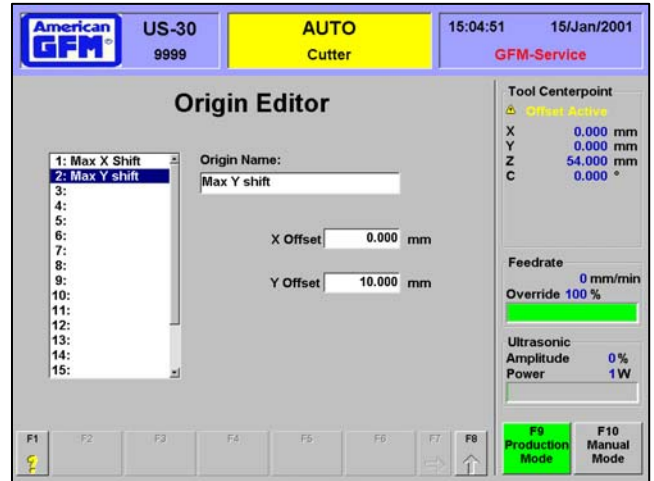
### 7.7.2.6 F7→F2 Edit

F7 will bring up the next row of softkeys in the Program Management screen. F2 Edit will open the Dana Editor so the user can edit program files. Highlight the desired file and choose F2 EDIT. The program will be opened in the Dana Editor and may now be edited. Only SRC files, may be edited. After editing is complete, save the file using File → Save. The program file must be re-compiled and downloaded before the changes will take effect.



### 7.7.2.9 F7 → F5 Origin Editor

The F5 Origin Editor softkey will open the Origin editor screen. Multiple origins may be created using the Origin Editor. By using the (orgsel,xx) statement in the SRC file, the cutting process will use origin number xx, whereas xx is the origin number. To use this feature, define an XY value for the programmed ORGSEL statement in the SRC file using this Origin Editor.



### 7.8 F3 Edit Material Data (2D Cutter Mode Only)

F3 Edit Material Data will highlight the Material Height box in the Production screen. Entering the nominal material height will maximize cutting results. This value is the Z-Axis position that the blade will be positioned to for blade angle changes. The C Turn Tolerance value is a value in degrees which is the maximum allowable C axis angle change that can occur without a Z axis retract being performed.



### 7.9 F4 Edge of Knife

The F4 Edge of Knife softkey will change the knife edge being used. If it is chosen during an automatic cutting cycle, the knife-edge will change at the next G0 program block. The highlighted number is the current active knife-edge.



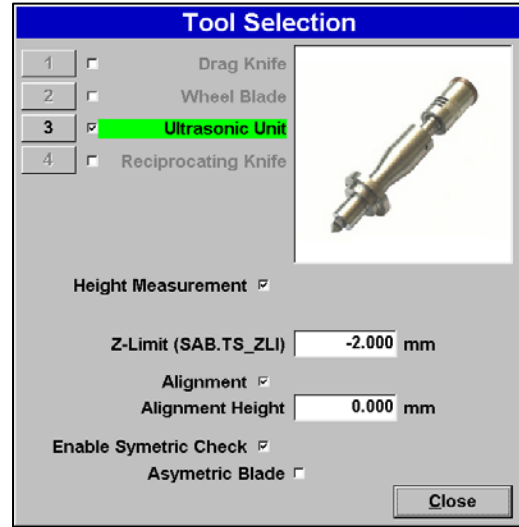
### 7.10 F5 Tools (CM10 Machines Only)

On CM10 machines, 4 different tool types are possible. They are as follows:

- Drag Knife (uses no ultrasonics)
- Wheel Blade (looks like a pizza cutter)
- Ultrasonic Knife (uses ultrasonics)
- Reciprocating Knife (uses pneumatics)

Press F5 Tools to open the Tool Selection screen. Place a check mark in the box beside your available tool types. To change settings for one of the available tools, highlight the active tool, then choose *Height Management* to activate and use automatic toolsetting for the current tool type. In the *Z-Limit* window enter the minimum allowable tool-tip z position during toolsetting. This provides some safety in case a toolsetting is executed with out a knife installed. Check the *Alignment* box to activate angular tool alignment for the current tool. In the *Alignment Height* window, enter the z position for the angular alignment procedure.

Check the *Enable Symmetric Check* to allow the angular alignment procedure to check for a symmetric tool. Check the *Asymmetric blade* if an asymmetric blade is installed. When the Tool Selection window is closed, the highlighted tool will be used by the CNC. In order to activate the tool, switch to MDI mode and enter an M64(1).



### 7.11 F5 Tools (All other 2D Cutters)

All other 2D Cutters are fitted with the ultrasonic unit; therefore, a different tool editor screen is shown. Upon pressing F5 Tools, the screen to the right will appear.

Choose the type of tool to be used from the *Type* drop down list. On 2D cutters, only:

Tang Knife (sym) and Tang Knife (asym) are the commonly used tools. Enter the following to adjust the settings for the selected tool:

- Length of tool
- Minimum Length
- Included Angle of tool
- Alignment Height
- Min/Max Ultrasonic amplitude

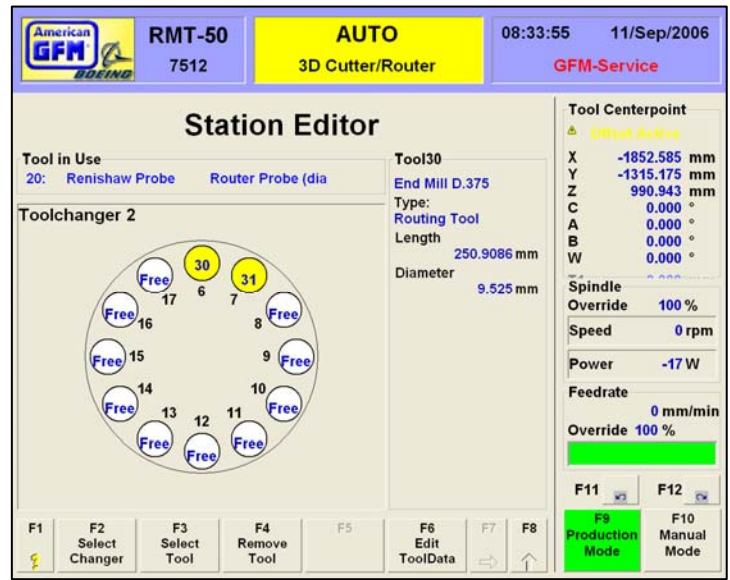
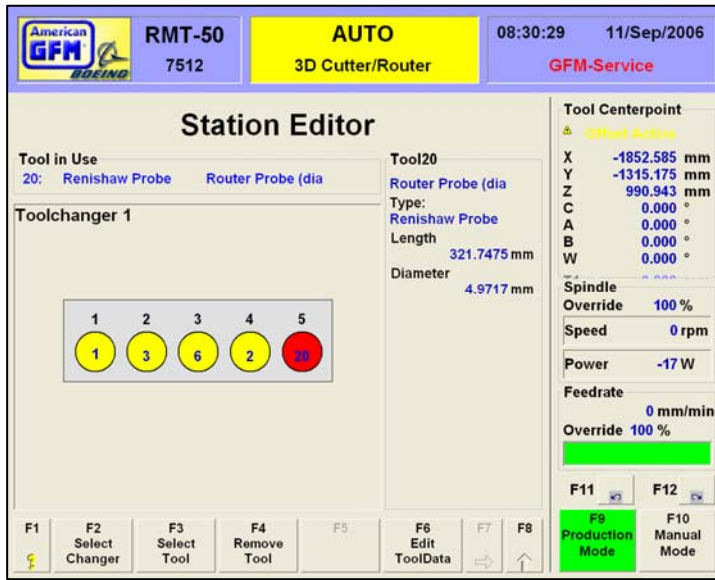


## 7.12 F5 Tools (3D Machines)

3D cutting machines offer an advanced Station Editor and Tool Data Editor for defining up to 120 different tools. Upon pressing F5 Tools, the Tool Station Editor will appear.

### 7.12.1 Choosing the Station

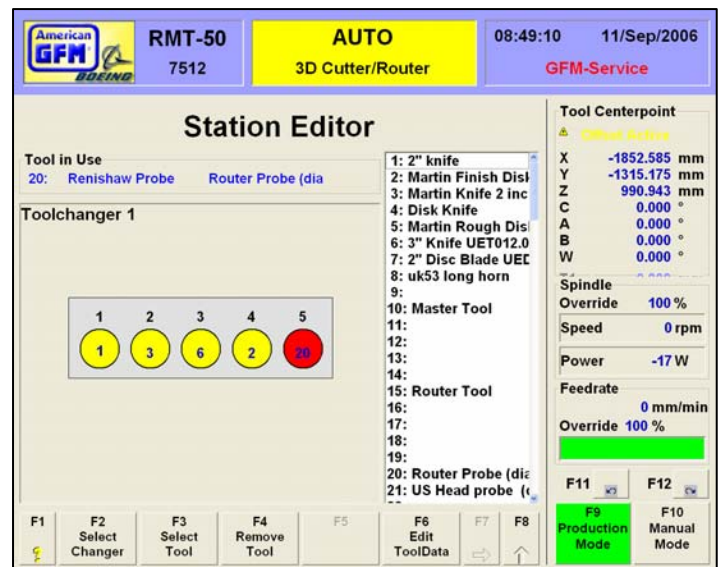
When the F5 Tools softkey is pressed, the Station Editor screen is displayed. A representation of the 5-pocket linear toolchanger is shown for the ultrasonic tool changer. To choose the routing tool changer, simply choose F2 “Select Changer”.



### 7.12.2 Assigning Tool Pockets

Each circle represents a physical tool pocket in the toolchanger. The number above each circle represents the tool pocket number. “Free” indicates that a tool has not been assigned to that pocket. If tool is assigned, the pocket will turn to red or yellow. A yellow circle indicates that a tool is assigned to that pocket, but **IS NOT** the tool currently loaded in the head. A red circle indicates that a tool has been assigned to that pocket and **IS** currently loaded in the head. The number inside the circle indicates the tool number that has been assigned to the pocket. As each pocket is clicked, the information about that assigned tool is displayed to the right. If a picture has been assigned to the tool, it will also be displayed, as shown here. To remove an assigned tool from a pocket, click on the desired pocket, until the circle begins to flash. Then press F4 Remove Tool. The circle should turn WHITE, and indicate Free.

To assign a new tool to a pocket, press F3 Select Tool. The window will display all of the defined tools. The number to the left of the tool is the *tool* number. Do not confuse this with the *station* number! For example, tool number 3 may be placed in tool station number 4 as shown to the left. Find the desired tool number of the tool to be assigned to the pocket. Double click on the tool to assign it to the pocket. Once a tool number has been assigned to a pocket, insure that the tool physically exist in that pocket. If this is not the case, open the tool changer using the Machine State screens, or by issuing the appropriate M Code, and place the correct tool in the assigned pocket.



**7.12.3 F6 Edit Tool Data**

The F6 Edit Tool Data softkey will open the Tool Editor display. The tool editor is used to add, modify, and delete available tools. Each tool must have all of the defined data to be valid.

To add a new tool, highlight an empty line number in the window on the left. This line number will become the tool number for the new tool.

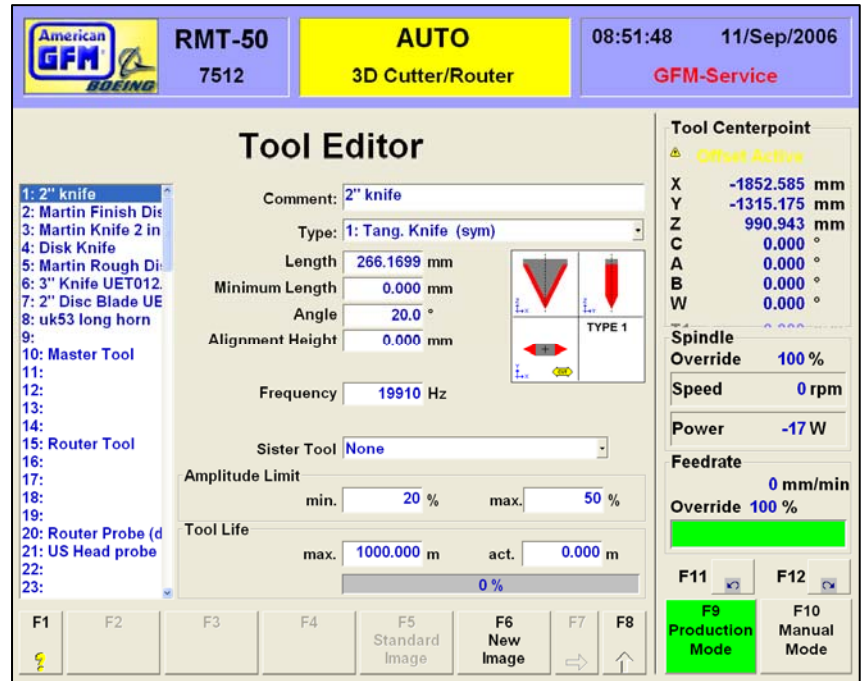
Fill in the following information about the new tool. See the table below for a description about the needed information.

A picture may also be assigned to a tool for easier identification. Highlight the desired tool and choose F6 to see a list of available tool pictures. Double click on a file name to assign it to the tool. The picture will now appear when the tool is highlighted. All pictures must be located in the folder:

**..\USERDATA\TOOLPIC**

Any standard graphical format is supported, including JPG, BMP, GIF and TIF

Any picture files located in that folder will be available for assigning to a tool.



### 7.12.4 Tool Types

<b>Comment</b>	Description of tool																										
<b>Type</b>	<p>Choose one of the following tool types from the drop down list</p> <table border="1"> <tr><td>1</td><td>Tangential Knife (symetric)</td></tr> <tr><td>2</td><td>Tangential Knife (asymetric)</td></tr> <tr><td>3</td><td>Disk Knife</td></tr> <tr><td>4</td><td>Routing Tool</td></tr> <tr><td>5</td><td>Drill</td></tr> <tr><td>6</td><td>Renishaw Probe</td></tr> <tr><td>7</td><td>Disc Knife (no Toolsetting)</td></tr> <tr><td>8</td><td>Virtual Disc Knife</td></tr> <tr><td>9</td><td>Virtual tang. Knife (symetric)</td></tr> <tr><td>10</td><td>Routing Tool (no Detag)</td></tr> <tr><td>11</td><td>Peeling Knife</td></tr> <tr><td>12</td><td>Tangential Knife (asymetric2) known as Stringer Knife</td></tr> <tr><td>13</td><td>Mapping Tool</td></tr> </table>	1	Tangential Knife (symetric)	2	Tangential Knife (asymetric)	3	Disk Knife	4	Routing Tool	5	Drill	6	Renishaw Probe	7	Disc Knife (no Toolsetting)	8	Virtual Disc Knife	9	Virtual tang. Knife (symetric)	10	Routing Tool (no Detag)	11	Peeling Knife	12	Tangential Knife (asymetric2) known as Stringer Knife	13	Mapping Tool
1	Tangential Knife (symetric)																										
2	Tangential Knife (asymetric)																										
3	Disk Knife																										
4	Routing Tool																										
5	Drill																										
6	Renishaw Probe																										
7	Disc Knife (no Toolsetting)																										
8	Virtual Disc Knife																										
9	Virtual tang. Knife (symetric)																										
10	Routing Tool (no Detag)																										
11	Peeling Knife																										
12	Tangential Knife (asymetric2) known as Stringer Knife																										
13	Mapping Tool																										
<b>Length</b>	Estimated length of tool																										
<b>Minimum Length</b>	Minimum length of tool for safety																										
<b>Angle</b>	Included angle of blade																										
<b>Alignment Height</b>	Height of blade when doing tool alignments																										
<b>Cutting Edge</b>	Select which edge of the knife to use																										
<b>Sister Tool</b>	If defined, this tool will automatically be used in place of the main tool if the specified tool life has expired																										
<b>Amplitude Limit</b>	These values are used to protect the tool from programming errors for the ultrasonic amplitude percentage. The amplitude limits for each tool can be defined to limit the amount of amplitude to the tool to these limit values																										
<b>Tool Life</b>	These values are used to monitor the tool's cutting life. Enter the designed tool life in "meters" to activate this monitor. If 0.00 is used, the tool life monitor is disabled for that tool																										

**NOTE:** *It is important to remember that when the data is changed for the tool number which is currently loaded in the cutting head, the operator **MUST** change to MDI mode and enter M64(n), where n is the loaded tool number. This M-Code will update the tool data in the CNC memory. The changed data will not take effect until this has been performed!*

### 7.13 F7 → F2 Offsets

The F2 Offsets softkey opens the Offset Editor screen. The offset editor allows the user to shift the 0-point of any axis. This is useful when small depth changes in Z-Axis are required during cutting provided that the parameter “Enable Hot Z-Offset Changes” is enabled in System.CNF. The user can create a new offset, modify an existing offset, or delete one of the previously defined offsets. The current defined offsets are shown in the window on the left.

To create a new offset, choose F2 New. The cursor will move to the **Offset Name** box. Enter a meaningful description of the new offset. This will become the name of the offset. The new offset name will appear in the window on the left.

In the X Offset, Y Offset, and Z Offset fields, enter the desired amount of offset value for each axis. A plus value will shift the zero point in the plus direction.

The F4 “Use TCP” softkey provides a convenient method for obtaining an offset value from the current position of the tool tip. The operator can jog the tool tip anywhere in the working area, then press F4. The current tool center point values will be automatically entered in the X,Y and Z Offset fields.

To activate any of the defined offsets, highlight one of the offset names from the list window and choose F5 Activate. The text **Offset Active**, will appear in the top right corner of the screen above the axis display as a confirmation that the offset was activated. To verify which offset is active, place the mouse cursor over the Offset Active text above the axis display. Windows tool tip text should appear next to the mouse that shows which offset was activated. To deactivate any active offset, choose the F6 Deactivate softkey.



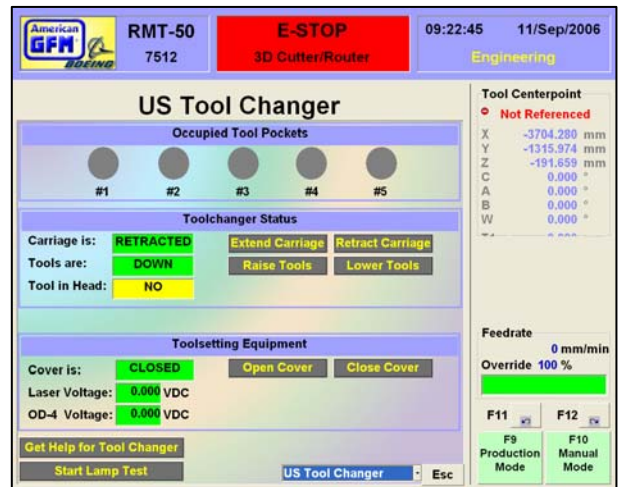
### 7.14 F7 → F4 Machine States (Additional Functions)

**F4  
Machine  
States**

The F4 Machine States softkey will display several screens that provide the operator with convenient pushbuttons to perform various functions. Use the PageUp/PageDown keys to move from one status screen to the next. A list box is also provided at the bottom to choose different screens. In the next pages are described the various Machine State screens provided on the machine.

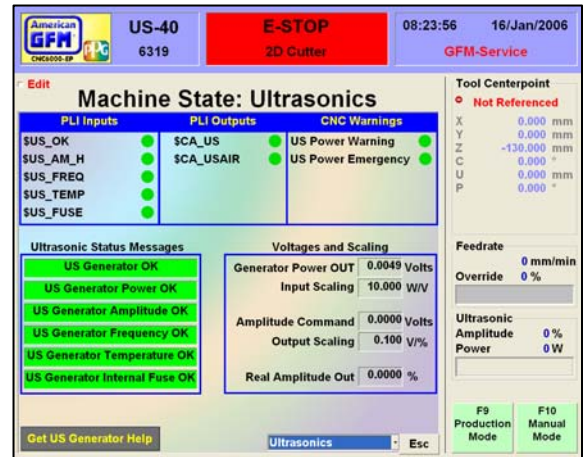
#### 7.14.1 Tool Changer Status

Upon pressing this softkey, the 1<sup>st</sup> screen displayed will be for the toolchanger. The 4 pockets are shown at the top. If the circle is GRAY, the pocket is empty. If the circle is GREEN, the pocket has a tool in it. Colorful indicators are also provided to show the state of the switches on the toolchanger, such as the cover door, and the tool carriage. Buttons are provided to open, close, raise and lower the tools. The voltage from the toolsetting equipment is also displayed near the bottom. If help is needed about the tool changer, a help button is provided.



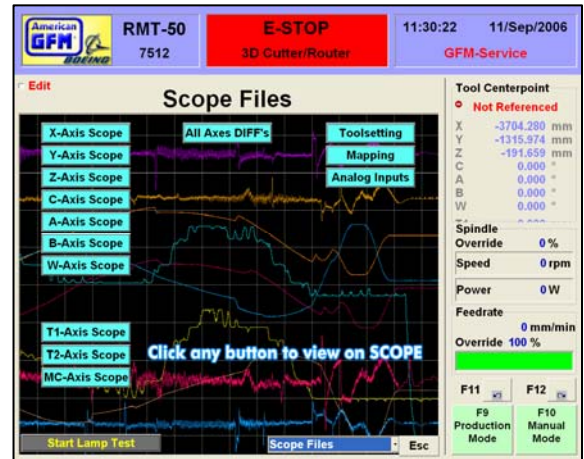
### 7.14.2 Ultrasonic Status

The next available status screen from the Machine State section of the MMI is the Ultrasonics screen shown here. It shows GREEN or RED indicators from status bits from the ultrasonic generator. The voltage output from the generator indicating the ultrasonic power is shown along with the amplitude command voltage from the CNC. Related PLI I/O signals are also provided at the top of the screen with the associated PLI equate names.



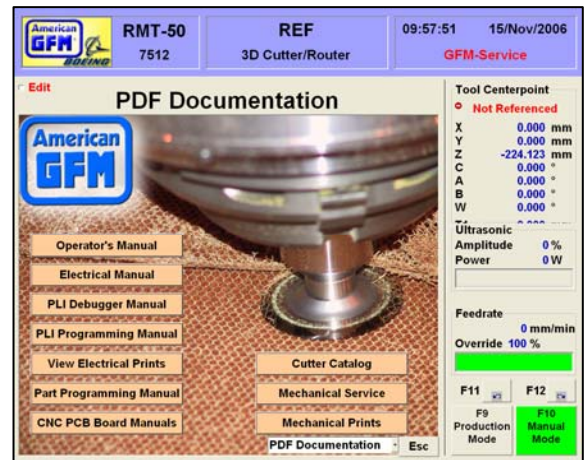
### 7.14.3 Scope Files

For advanced users only, the Scope Files machine state screen allows any of the configured axes to be displayed using the built-in software O-Scope. Only qualified personnel should use this particular screen. For more information on the use of the software o-scope, please see the online help built-in to Scope.



### 7.14.4 PDF Documentation

All of the documentation, which was shipped with the machine, is also available for viewing on the MMI computer. Each of the different manuals are viewable by clicking the provided button on this screen.





### 7.14.5 F7 → F3 Label Text

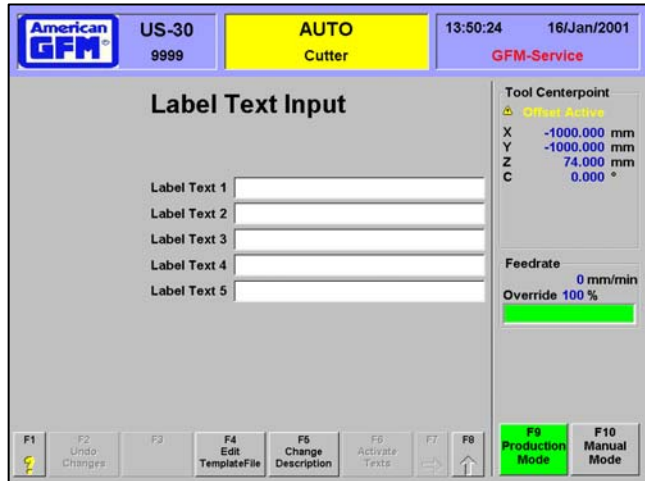
F3 opens the Label Text Input editor if the machine is equipped with a labeler unit. The editor allows the operator to edit the text on up to five labels. The labels are defined in the labeler template file.

Use F4 Edit Template File to edit the labeler template file. Refer to the labeler documentation for proper structure and syntax.

The operator may use F5 Change Description to change each labels description from “Label Text 1”, etc., to something more descriptive.

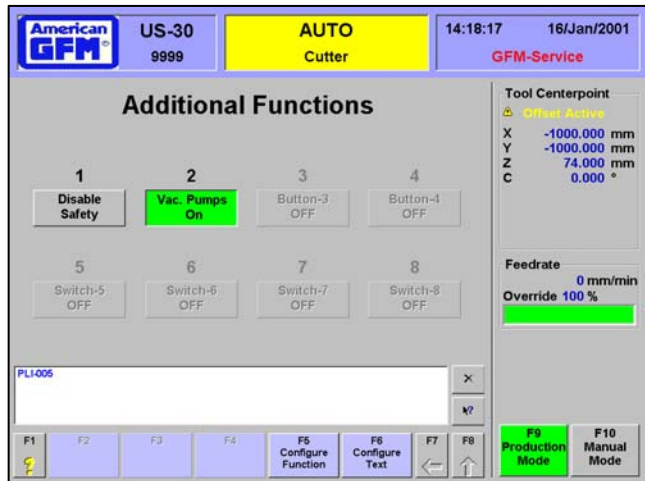
Use F6 Activate Texts to activate text changes.

F2 Undo Changes will undo text changes.



### 7.14.6 F7 → F4 Additional Functions

The F4 Additional Functions screen shows a set of buttons or switches that may be programmed to perform certain functions when pressed. They are mainly for use by service personnel and will be programmed by AGFM if needed. They may perform such functions as turning on / turning off vacuum pumps, ultrasonics, etc.



### 7.15 F7 → F5 Change Program Flow

Clicking the circular arrow button to the right of the Program Flow field changes the Program Flow selection. This button will allow choosing between Continuous, Blockwise, or Stop on M01.



**Continuous** program flow will run the program from beginning to end without stopping.

**Blockwise** program flow will run the program until the next G0 block is encountered and then stop. Pressing Cycle Start will allow the program to continue.

**Stop on M01** program flow will run the program until an M01 is encountered and then stop. Pressing Cycle Start will allow the program to continue until the next M01.

### 7.16 F7 → F6 System Support

The F6 System Support menu contains tools and applications mainly intended for service and maintenance personnel. There are five different sub menus within the system support menu. Within each sub menu are various applications and tools. Highlighting a sub menu and double clicking on an item will open the item. Not all user levels have access to all of the system support items. The System Support menu can be displayed at any time by pressing the hotkey combination <CTRL-S>.

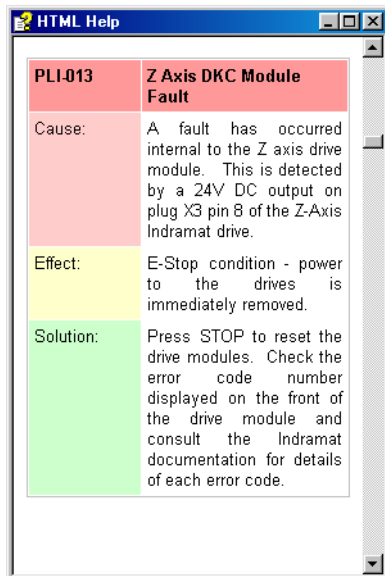
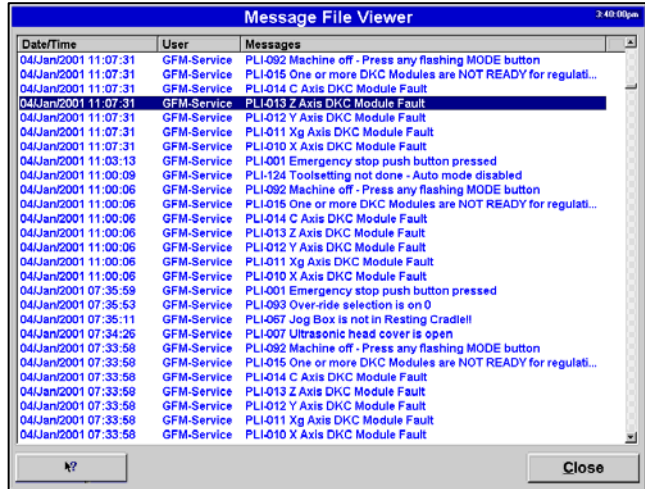


#### 7.16.1 System Support Group 1

- Group 1 contains:
- Show Error Log File
  - View Protocols
  - Mount Points
  - Add line to Protocol

#### 7.16.2 Show Error Log File

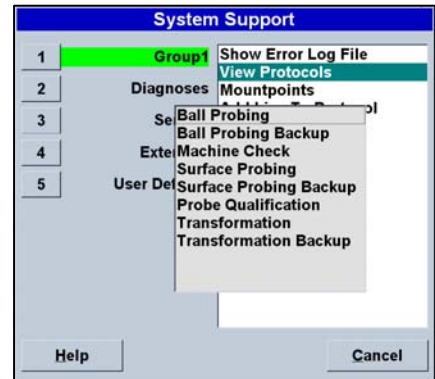
An error log file is written each time an error occurs on the machine. The file will help in debugging machine problems. Each error that occurs will have the Time and Date the error occurred, The current user that was logged in to the MMI, and the error itself.



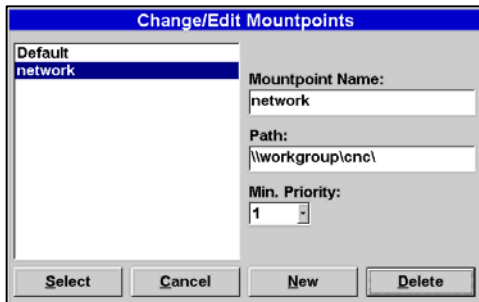
The operator can double click on a message to open an HTML Help application. The HELP file gives a description of the possible cause of the error as well as a possible solution to the error. The help file gives detailed information such as device numbers in the electrical prints that can point the user in the right direction when solving errors.

### 7.16.3 View Protocols

This system support entry allows the user to view all of the log files (Protocols) generated during probing functions. A different log file is generated for each type of probing function. A list of the protocols is shown here. Double click one these protocols to view its log file. The log file will be displayed in the Dana editor and can be printed if desired.



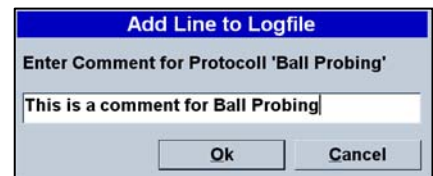
### 7.16.4 Mount Points



Mount points allows the user to select a path to where the cutting programs are located. The path may be on the local machine or may be on a network drive. If on a network drive, the Network Neighborhood must be correctly set up in Windows 98. To create a new mountpoint, choose New. Enter a mountpoint name, the path, and the desired minimum user priority. To select a mountpoint, highlight the desired mountpoint name and choose Select. To delete a mountpoint, highlight the desired mountpoint and choose Delete.

### 7.16.5 Add line to Protocol

If a comment is needed in a log file, the user may choose “Add line to Protocol” from Group 1. Any text can be written in a Logfile to be used as a note in the file.



### 7.16.6 System Support - Diagnostics

- Diagnostics contains:
- Value Display
  - Additional Auto Data
  - Monitor Analog Inputs
  - Analog Outputs
  - Axis Monitor
  - Machine State
  - View Mapping



### 7.16.7 Value Display

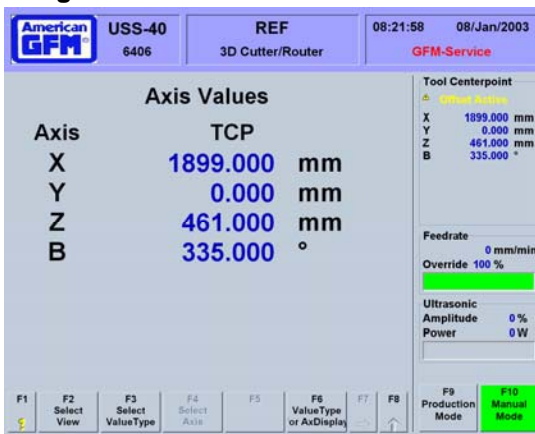
Value Display opens the Axis Values screen. This screen provides an easy way to all values of all axis with one view. The first view will show **All Values**. Choose F2 **Select View** to change to the other available display views. When the view is set to X-Large, the F4 **Select Axis** softkey will appear allowing which of the 3 axes to display. Below are examples of the different views when choosing F2.

Choose F6 **Value Type for Ax Display** to change the displayed value type for the Axis Display in the top right corner of the display. F8 will exit the Value Display screen.

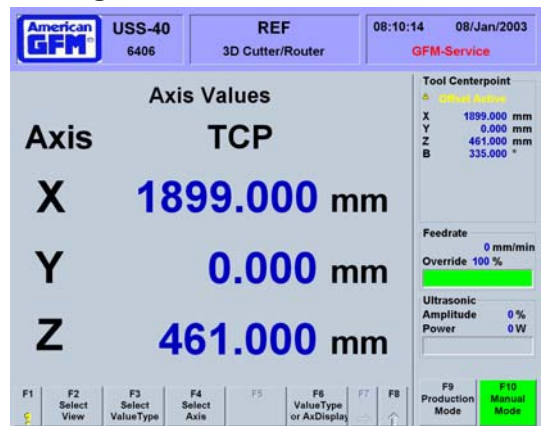
#### All Values



#### Large Values



#### X-Large Values



### 7.16.8 Additional Auto Data

Additional Auto Data shows real-time data of the current cutting cycle.

**Actual Tool Length** shows the tool length entered in the Tool Editor screen

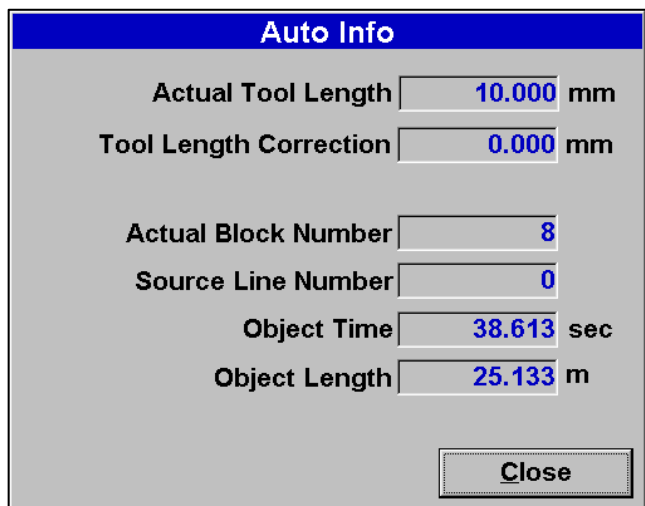
**Tool Length Correction** is the difference between the tool length in entered in the Tool Editor screen and the length measured by the M62 toolsetting macro.

**Actual Block Number** shows the current object block of the OC5 cutting program.

**Source Line Number** shows the current line number of the SRC cutting program.

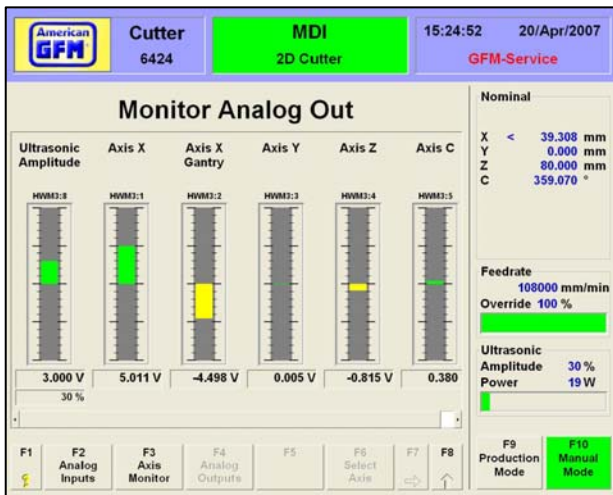
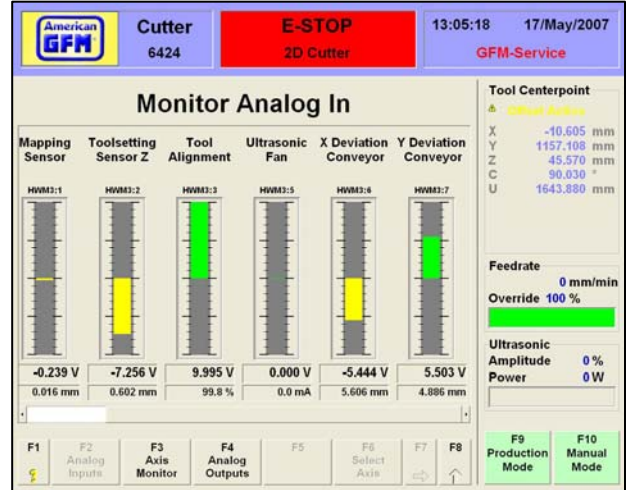
**Object Time** shows the accumulated cutting time of the current program.

**Object Length** shows the accumulated distance cut of the cutting program.



### 7.16.9 Analog Input Monitor

Monitor Analog Inputs will open the Analog Inputs Monitor screen. This screen shows a graphical representation of analog input voltages from the machine such as: toolsetting sensor, tool alignment sensor, mapping sensor, etc. The HWM number above the bar graph is the analog input hardware module input number. A numerical value of the voltage is displayed under the graphic as well as the units of the signal after the CNC scaling factor has been used for the corresponding input voltage.

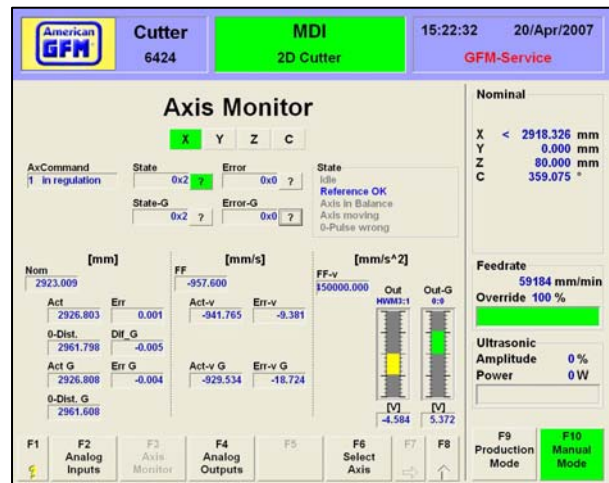


### 7.16.10 Analog Output Monitor

This screen also shows a graphical representation of the voltage to the servo drives and ultrasonic generator. Each of these devices uses a +/- 10VDC analog signal as the command voltage to command motion for the axes. The HWM number above the bar graph is the analog output hardware module output number.

### 7.16.11 Axis Monitor

F3 Axis Monitor will open the Axis Monitor screen. The Axis Monitor is useful for axis setup and debugging. Each axis may be displayed by clicking on one of the axis buttons at the top of the screen or by choosing F6 Select Axis. Diagnostic messages are displayed in the State box. The bar graphic in the bottom right shows the current drive command voltage from the CNC. Axis nominal, actual, error, and zero pulse positions are shown in the bottom left of the screen.

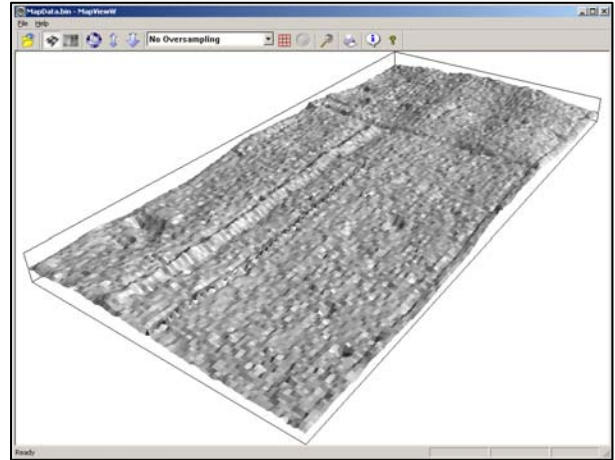


### 7.16.12 Machine States

The Machine States entry on the system support menu is used to display the Machine State screens. These screens were already described in an earlier section of this manual. (Section 2.2.7.8)

### 7.16.13 View Mapping

View Mapping opens the graphical table mapping viewer. The view shows a graphical view of the table mapping file. Buttons are provided to rotate the view in 3 dimensions.



### 7.16.14 System Support - Service

Service contains:

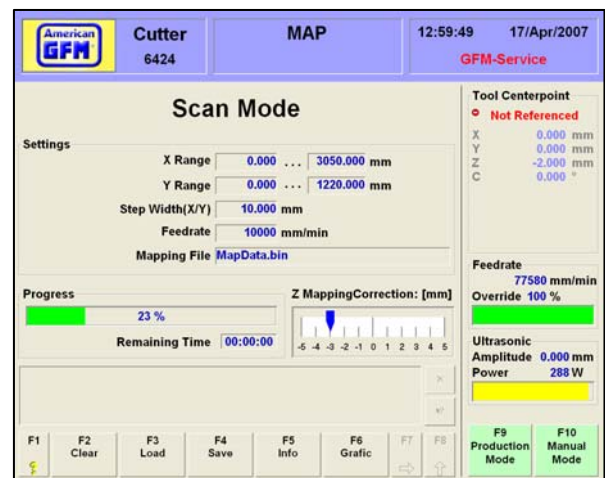
- Scan Mode
- View Knife Alignment
- Oscilloscope
- PLI Debugger
- Parameter Editor
- View Versions

These items are only useful to service personnel.

### 7.16.15 Scan Mode

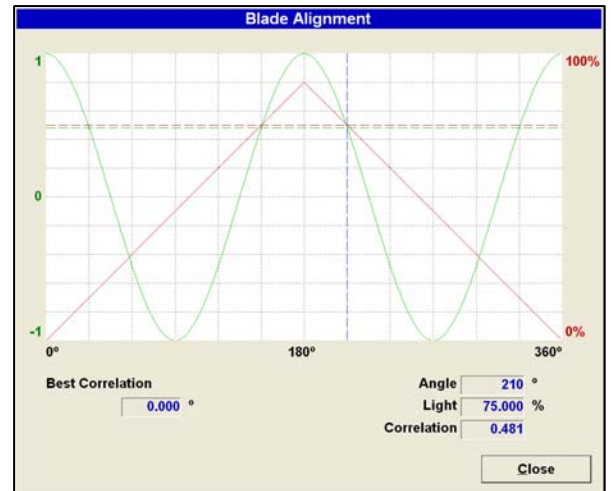
Scan Mode is used to perform a table mapping sequence. Under normal conditions, table mapping only needs to be performed once. If this option is installed, table mapping is done by AGFM service personnel during machine installation.

To begin a scanning cycle, first re-reference the machine but *do not* perform a toolsetting cycle. Next, go back to Scan Mode and choose F2 Clear to clear the current mapping file. Next, save the cleared mapping file with the F4 softkey. Now, press START, remove the cutting tool, and click on the X to confirm the message. The machine will now move to the starting scanning position and begin scanning. The scanning progress is shown on the screen. Z Mapping Correction shows the movement of the mapping sensor in the Z direction. When the scanning cycle is complete, choose F4 Save to save the mapping data to the mapping file. Lastly, choose F3 Load to load the mapping file to the CNC. The View Mapping utility is also available by choosing F6 Graphic.



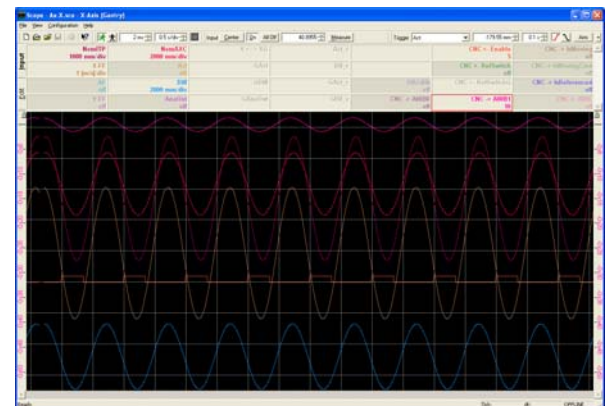
### 7.16.16 View Knife Alignment

View Knife Alignment is used to set up the knife angular alignment system. A graph shows the amount of light transmitted from the sending unit to the receiving unit at a given angular knife position. The mouse can be used to move the dashed blue line across the graph. The angle, received light percentage, and the angular correlation of the blade will be displayed in the bottom right corner. The best correlation is shown in the bottom left corner. This value is usually a good starting point for the blade alignment offset value in the user.cnf file. The RED line indicates the amount of light detected while the GREEN line indicates the blade angle.



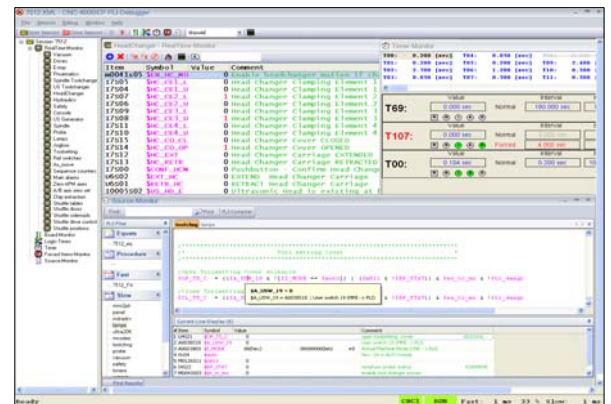
### 7.16.17 Oscilloscope

The software oscilloscope is used to tune the servo drive speed and position regulators. Refer to the AGFM Software Oscilloscope Manual for more information.



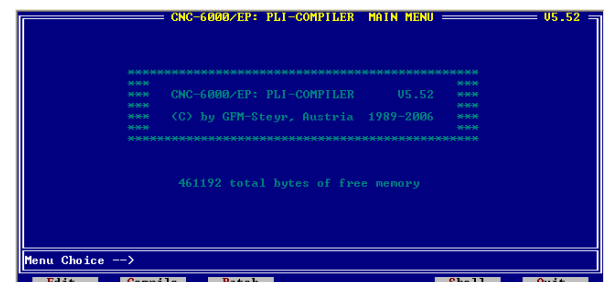
### 7.16.18 PLI Debugger

The PLI Debugger is used to debug the PLI program. Refer to the AGFM PLI Manual for more information.



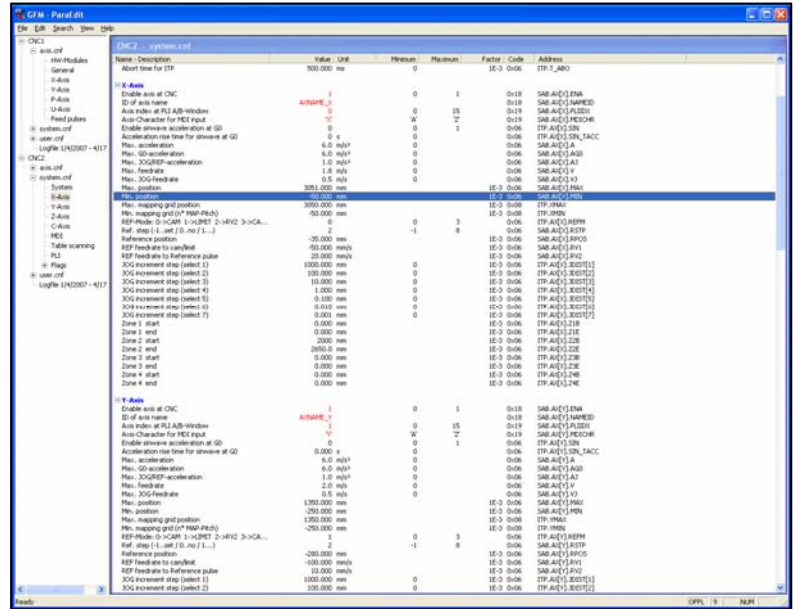
### 7.16.19 PLI Compiler

The PLI Compiler is used to compile and download the PLI program. Refer to the AGFM PLI Manual for more information. This feature is only available to AGFM service personnel.



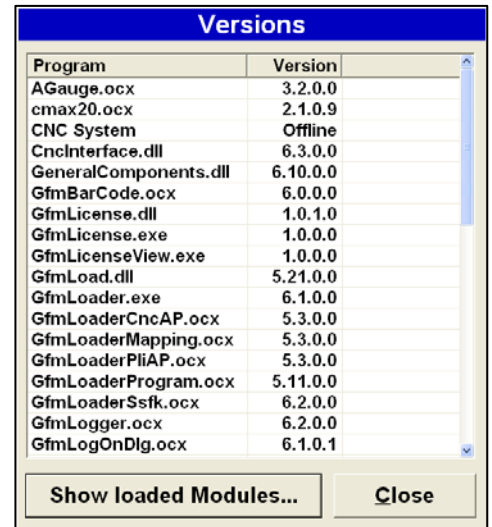
### 7.16.20 Parameter Editor

The Parameter Editor is used to edit the **AXIS.CNF**, **SYSTEM.CNF**, and **USER.CNF** files. These files should not be edited without first checking with AGFM. Double click on a heading in the left window to jump to that topic in the editor window on the right. To change a parameter value, double click on the value, enter the new value, and hit the enter key. After editing is complete, close the editor, switch to a different mode, and then return to the previous mode. This will send the changed value to the CNC. If the value is shown in red, it is a boot parameter only. The CNC must be re-booted in order for the parameter to take effect.



### 7.16.21 View Versions

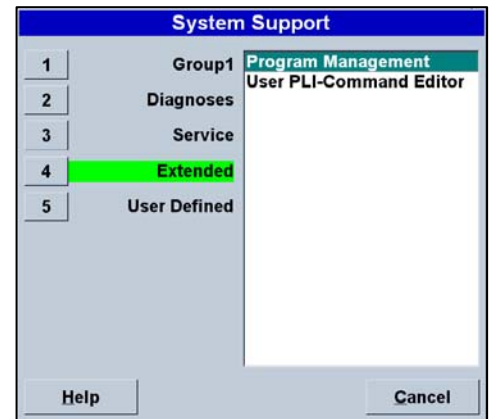
View Versions displays the version numbers for the MMI software components. In the event AGFM ask for the software version running on your machine, use this screen to determine the versions.



### 7.16.22 System Support - Extended

The Extended group of system support contains MMI integrated functions. As future MMI updates become available, they will be added under this group. Extended contains:

- Program Management
- User PLI Command Editor



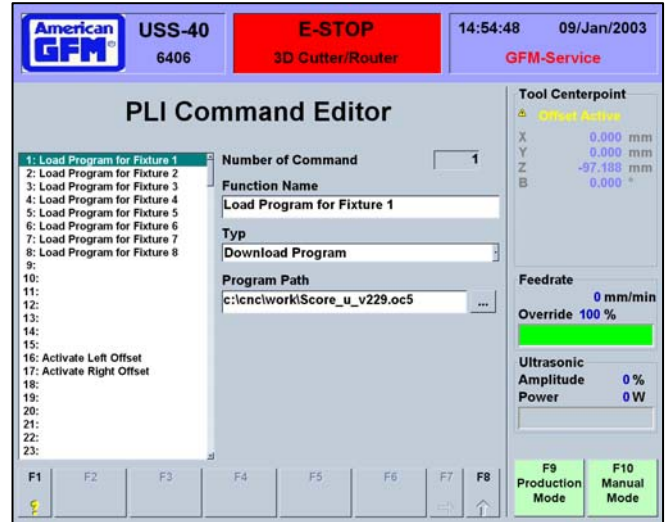


### 7.16.23 Program Management

This is an easy way to access the Program Management screen if AUTO mode is not available. For example, if the machine is in ESTOP, the Program Management screen is still accessible via this system support entry. The Program Management section is described in detail in section 2.4.4.2 of this manual.

### 7.16.24 User PLI Command Editor

This feature of the MMI is used to associate an internal PLI command with external program applications. This feature is setup up to call the USS40 Utility with many different command line arguments to perform different functions related to scanning and scoring part program generation.

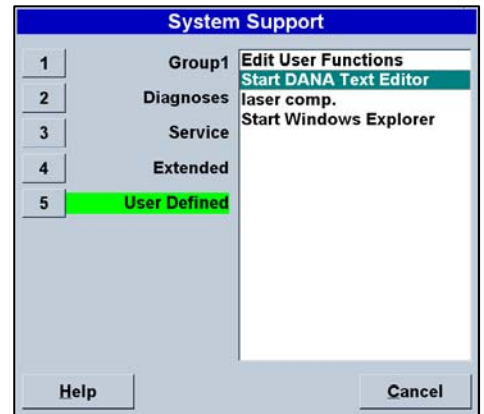


### 7.16.25 System Support - User Defined

The User Defined group of system support contains external applications defined by the user. If 3<sup>rd</sup> party software applications are required to be started while running the MMI, they can be configured here.

User Defined contains:

- Edit User Functions
- Functions configured by AGFM

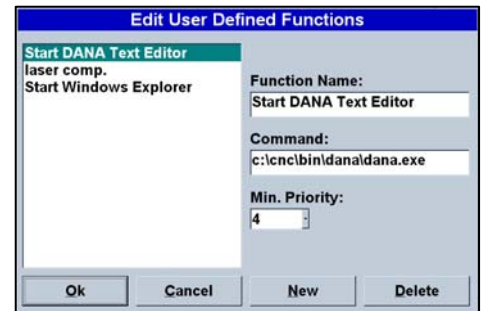


### 7.16.26 Edit User Functions

Edit User Functions allows the user to set up links to external applications. If a 3<sup>rd</sup> party application needs to be executed, use Edit User Functions from this group to configure the application.

To add a new function, click on New. Enter a description in the Function Name box. Enter the complete command line for the application in the Command box. Choose the minimum user priority for access to the application. When all information is entered, choose OK. The editor will close and the new function will be shown in the User Defined window.

To delete a function, highlight the function and choose Delete.



## 7.17 Using Simple Production Log Files

The CNC6000 is capable of logging many events into a file for later use by production management to track the machine's production capacity. This file, by default, is called PRODUCTION1.CSV and is stored in the CNC\USERDATA folder. The max file size of the CSV file is configured via GFMLogger.INI, using the key "MaxFileSize". The default value for the file size is 10485760 bytes (or 10MB). When this limit is reached, the oldest 20% of the file will be cut off.

The production log data is stored in CSV (Comma Separated Values) format. Each line in the log has the following entries:

- Timestamp (date and time)
- Name of the currently logged on user
- An Event ID number (see the following table for possible events)
- Short description of the Event (in defined language)
- Additional data depending on the event.

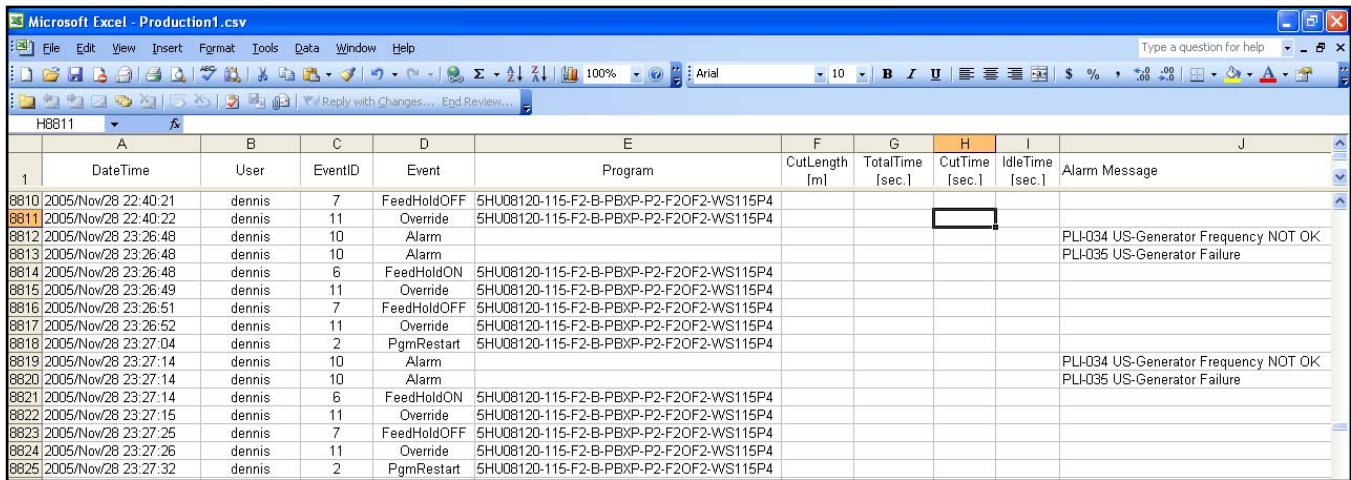
EVENT ID	Logged Event	Event Description
0	Program Loaded	Loading of a program to the CNC-control Additional data: - Name of the loaded program
1	Program Begin	When the operator start an automatic program Additional data: - Name of the currently loaded program
2	Program Restarted	When the operator continuous an previously not finished program Additional data: - Name of the currently loaded program
3	Program End	After finishing a program Additional data: - Name of the currently loaded program - Cutting length - Total processing time between start end end of the program - Cutting Time = G1 - Idle Time: Difference between Total and Cutting time
4	Program Abort	Abortion of a program ( <b>This event is not implemented yet</b> ) Additional Data: - Name of the currently loaded program
5	Window Transfer	Documents the conveyor transfer when window cutting is used Additional data: - Name of the currently loaded program
6	Feedhold ON	logs when feed hold is activated Additional data: - Name of the currently loaded program
7	Feedhold OFF	logs when feed hold is deactivated Additional data: - Name of the currently loaded program
8	Log Begin	Start of the MMI
9	Log End	Closing of the MMI
10	Alarm Active	Error during a program run Additional data: - Alarm number and text in defined language
11	Override Value	Changes of Override value Additional data: - Name of the currently loaded program - new Override value in percent
12	Tool Change	Logs the tool change Additional data: - Name of the currently loaded program - number of the actual tool

Below is an example of the PRODUCTION1.CSV file output from the CNC6000. This file type can be opened directly with Microsoft Excel and formatted to desired needs as shown below.

```

DateTime,User,Event ID,Event,Program,CutLength [m],TotalTime [sec.],CutTime [sec.],IdleTime [sec.],Alarm Message
2004/Jun/24 10:20:54,, 8,LogBegin,,,,,
2004/Jun/24 10:26:22,User1, 0,PgmLoad,Prog1,,,,,
2004/Jun/24 10:26:34,User1, 1,PgmBegin,Prog1,,,,,
2004/Jun/24 10:26:54,User1, 2,PgmRestart,Prog1,,,,,
2004/Jun/24 10:32:17,User1, 2,PgmRestart,Prog1,,,,,
2004/Jun/24 10:33:29,User1, 6,FeedHoldON,Prog1,,,,,
2004/Jun/24 10:44:21,User1, 7,FeedHoldOFF,Prog1,,,,,
2004/Jun/24 10:46:13,User1, 10,Alarm,,,,,SAB-049 axis-X exceeded tolerance
2004/Jun/24 10:53:07,User1, 2,PgmRestart,Prog1,,,,,
2004/Jun/24 11:01:09,User1, 4,PgmEnd,Prog1, 47.986, 2075.26, 698.64, 1376.62,
...
...
...
...

```



The log file can be configured via GFMLogger.INI in the CNC\UserData folder. Below is an example of this INI file:

```

[General]
LogFileNames = path of Log file           Path to log file
LogFileSize  = max. size of log file      Maximum size of log file
BackupName   = path of backup file        Path of Backup file
ExportX      = Name of Export section      X is an ascending index.
                                           For each Export you need a separate Key (and a separate section).

[Export Section]
Export Section is an unique identifier for this Element.
In this Section the Filepath, and the format of the export file are defined.

FileName     = file path                   Path of the export file
FileType     = CSV                         CSV: Export file is a csv file
                                           see the description of an csv output file
Language     = Language Key                Language for texts in export file
                                           If key is missing, the actual language of MMI will be used.
DateTimeFormat =                          defines the Date and Time Format in Export file
                                           Default: ??
MaxFileSize  = limit                       defines the maximum size of the export file. If the limit is reached, the oldest 20% of the file will be cut off.
                                           Default is 10485760 (= 10MB)

Events: The following keys enables or disables several events.
The Events FeedHold, LogBegin, LogEnd, PgmAbort, PgmBegin, PgmEnd, PgmLoad, PgmStart and WindowTransfer are always enabled.

Event_Alarm  = 0                           = default. No logging of Alarms
              = 1                           Alarms will be logged.


Event_Override = 0                         = default. No logging of Override changes
              = 1                           Changes of Override value will be logged.

Event_ToolChange = 0                       = default. No logging of tool changes
              = 1                           Tool changes will be logged.

```

## 7.18 Using Advanced Production Log Files

If more information is needed in the log files that the simple logging does not provide, a more advanced logging method is available to use. This logging feature was made available in April 2008 with MMI Version 6.40.1. If the configuration file **“logging.ini”** exists in the Userdata folder, the advance logging method will be enabled. A help file is available called **“logging.ini.chm”** and is located in the Cnc\Help folder. Below is a copy of this help file.

[General]		
<b>Language</b>	=	<language key> (default = <b>"ENG"</b> ) defines the language of the protocol file. Possible Keys are: ENG, DEU, ITA, ...
<b>DateTimeFormat</b>	=	<format string> default = "yyyy/mm/dd Hh:Nn:Ss" defines the format of date and time in the log file Here the VB-Format function will be used. For detailed information see VB-Doku.
<b>Format</b>	=	<a href="#">CSV</a> default = <b>CSV</b> , defines the output format of the log file. CSV = Character Separated Values)
		<a href="#">CSV-ParametersOnly</a> With this format only Parameters will be logged, not the events. CSV = Character Separated Values.
		... additional formats will follow if required.
<b>CSV_Separator</b>	=	<character> Default is comma ",". If Format = CSV this entry defines the separator character. If more than 1 character is defined, only the most left one will be used. If you want use the tabulator for separator (ASCII-Code 0x9) type <b>"TAB"</b> . If Format is not CSV, this entry will be ignored.
<b>MaxFileSize</b>	=	<bytes> default = 1000000. defines the maximum file size of the log file in bytes. Minimum file size is 10000, maximum file size is 10000000.
<b>BackupStyle</b>	=	MaxSize-Move MaxSize-Cut default = MaxSize-Move. Defines the behavior if the size of the log file exceeds the maximum file size. MaxSize-Move will make a backup of the current logfile, and starts a new log file. MaxSize-Move will cut the oldest entries of the file, and will continue the log file.
<b>BackupPrefix</b>	=	<backup prefix> default = "Backup_". If BackupStyle is MaxSize_Move this defined prefix will put in front of the filename. If Format is not MaxSize-Move, this entry will be ignored.
<b>PercentToCut</b>	=	<percent value> default = 20. If BackupStyle is MaxSize-Cut, this value defines the amount of old entries to cut in percent Minimum is 1, maximum is 50 If Format is not MaxSize-Cut, this entry will be ignored.
<b>LogFolder</b>	=	<folder> defines the folder were the log files will be written to. The folder must exist.  The maximum size of each individual log file will be checked, but not the size of all files in this folder. If you use dynamic elements in filename many small log files can exist.
<b>FileName</b>	=	<log file name> <ul style="list-style-type: none"> <li>defines file name of the log file. This name can have some dynamic elements:</li> <li>%PgmName% will be replaced by the file name of the currently loaded part program.</li> <li>%Zone% will be replaced by the currently active zone (therefore sab.UsedZoneX will be used. This is either 0 or 1)</li> <li>%Year% will be replaced with the actual year.</li> <li>%Month% will be replaced with the actual month.</li> <li>%Day% will be replaced with the actual day.</li> <li>&lt;PLI address&gt; will be replaced with the value of the given PLI address. The PLI-address must be in the following format: &lt; -- E, D or M -- Address -- L, W, B or S -- Index of Word, Byte or Single bit -- &gt; Examples: &lt;E100L&gt;, &lt;M255S17&gt;, &lt;D35W1&gt;</li> </ul> <p><b>Example of different log file names:</b>                      FileName = Production.log                      FileName = Part_%PgmName%.csv                      FileName = LogFile&lt;E100B0&gt;.csv</p>

### 7.18.1 Logging Section:

For each log file a separate section with a unique name must exist. In this section the style and the content of the log file is defined. If the FileName contains dynamic elements, it is possible that multiple sections refer to the same log file. (then you should use also the same file format).

Each event which should be logged to the defined file must be defined in this section. If you want additional parameters on events, these parameters must also be defined there.

<b>[Logging section] must be a unique name. The name is not used in log files.</b>		
<b>Language</b>	=	<language key> default = section <a href="#">[General]</a> key <a href="#">Language</a> . defines the language of the protocol file. see description of key <a href="#">Language</a> in section <a href="#">[General]</a>
<b>DateTimeFormat</b>	=	<format string> default = section <a href="#">[General]</a> key <a href="#">DateTimeFormat</a> . defines the format of date and time in the log file. see description of key <a href="#">DateTimeFormat</a> in section <a href="#">[General]</a>
<b>Format</b>	=	CSV default = section <a href="#">[General]</a> key <a href="#">Format</a> . defines the output format of the log file. see description of key <a href="#">Format</a> in section <a href="#">[General]</a>
		...
<b>CSV_Separator</b>	=	<character> default = section <a href="#">[General]</a> key <a href="#">CSV_Separator</a> . defines the separator character in CSV Format see description of key <a href="#">CSV_Separator</a> in section <a href="#">[General]</a>
<b>MaxFileSize</b>	=	<bytes> default = section <a href="#">[General]</a> key <a href="#">MaxFileSize</a> . Defines the maximum file size of the log file in bytes. see description of key <a href="#">MaxFileSize</a> in section <a href="#">[General]</a>
<b>BackupStyle</b>	=	MaxSize-Move MaxSize-Cut default = section <a href="#">[General]</a> key <a href="#">BackupStyle</a> . Defines the behavior if the size of the log file exceeds the maximum file size. see description of key <a href="#">BackupStyle</a> in section <a href="#">[General]</a>
<b>BackupPrefix</b>	=	<backup prefix> default = section <a href="#">[General]</a> key <a href="#">BackupPrefix</a> . defines prefix of the log file name see description of key <a href="#">BackupPrefix</a> in section <a href="#">[General]</a>
<b>PercentToCut</b>	=	<percent value> default = section <a href="#">[General]</a> key <a href="#">PercentToCut</a> . defines the amount of old entries to cut in percent see description of key <a href="#">PercentToCut</a> in section <a href="#">[General]</a>
<b>FileName</b>	=	<log file name> defines file name of the log file. see description of key <a href="#">FileName</a> in section <a href="#">[General]</a>
<b>List of events with the requested parameters, which should be logged in the above defined file</b>		
<b>Event_?????</b>	=	<Parameters> Therefore see the table with <a href="#">available events</a> and <a href="#">parameters</a> .

### 7.18.2 Available Events:

Some of the events have standard parameters which are logged always. Each event can also have additional parameters. These parameters must be defined as a comma separated list. The parameter will be logged in the same order as they are defined.

If the special parameter NoStd is defined, the standard parameters will not be logged.

Possible Event keys:			
Entry name	Event-ID	Meaning	Standard Parameters
Event_LogBegin	1	Occurs on MMI-Start	---
Event_LogEnd	2	Occurs on MMI-End	---
Event_UserChanged	3	Occurs on every Login	---
Event_PgmLoad	10	When a part program is loaded	<a href="#">PgmName</a>
Event_PgmStart	11	When a part program is started	---
Event_PgmContinue	12	when continuing a interrupted part program	---
Event_PgmEnd	15	When a program finishes	---
Event_PgmUnload	16	when a part program in CNC is deleted	---
Event_WindowTransfer	21	On conveyor moves	
Event_ToolChange	22	when the clamped toll changes	<a href="#">ClampedTool</a>
Event_HeadChange	23	When active laying head / cassette changes	<a href="#">LayingHead</a>
Event_StripeLaid	25	On TapeLayers when a stripe has laid	<a href="#">Stripe data</a>
Event_FeedHold	30	when feed hold state changes ( <b>\$B_HOLIFT</b> )	<a href="#">FeedHoldOnOff</a>
Event_OverrideChanged	32	when override changes Override, Override for G0 movements and Override for APM axis will be checked	<a href="#">Override</a>
Event_Alarm	40	when an alarm is pending	<a href="#">AlarmMessage</a>
Event_OffsetChanged	50	when offset data changes	---
Event_PrinterData	51	when labeler data changes	<a href="#">PrinterData</a>
Event_MappingLoaded	60	when mapping data are loaded	<a href="#">MappingFile</a>
Event_MappingSaved	61	when mapping data are saved	<a href="#">MappingFile</a>
Event_MappingCleared	62	when mapping data are cleared	---
Event_PliData1Loaded	65	when PLI-Data1 are loaded	<a href="#">PliDataIndex1</a>
Event_PliData2Loaded	66	when PLI-Data2 are loaded	<a href="#">PliDataIndex2</a>
Event_PliLogRequest	67	when PLI send log command <b>\$CP_Call_Logging</b> (=0x600) to MMI	
Event_PliLogRequestX	67	when PLI send log command <b>\$CP_Call_Logging</b> to MMI with command extension <b>\$B_CMDEXT</b> unequal to 0. <b>X</b> must match the command extension to log the event.	<a href="#">PliRequestIndex</a>
Event_TapeChanged	80	when new tape data are loaded	<a href="#">LayingHead</a> , <a href="#">TapeID</a> , <a href="#">MaterialID</a> , <a href="#">TapeLength</a>
Event_BarCodeReceived	90	when a Barcode is received	Barcode reader, Barcode, Barcode alias
Event_1s	100	Every second. Event will only be logged if additional parameters are defined.	
Event_10s	101	every 10 seconds. Event will only be logged if additional parameters are defined.	
Event_1m	102	every minute. Event will only be logged if additional parameters defined.	

### 7.18.3 Special Parameters:

These parameters have a special meaning and don't supply data.

Paramter name	Meaning
⚡NoStd	Standard parameters of events, listed in the table above, will not be logged.

### 7.18.4 Available Parameters:

Each parameter has an ID. Not every parameter can be used as additional parameter on events.

Parameters marked with "✚" can be used as additional parameters, parameters marked with a "⊖" can't be used as additional parameters.

Parameter name	Parameter ID	Meaning
✚Override	500	Override value in percent [%]
✚OverrideG0	530	Override value for G0 movements in percent [%]
✚OverrideAPM	531	APM axes override in percent [%]
✚PgmName	501	file name of the currently loaded part program
✚PgmTime	502	program cycle time in seconds [sec]
✚ObjCutLen	504	cutting length from object file in meters [m]
✚ObjTime	503	object time in seconds [sec]
✚TransferCount	505	Window transfer counter.
✚ClampedTool	507	number of the currently clamped tool
✚FeedHoldOnOff	506	1 for feed hold active, 0 for feed hold inactive
✚PrinterData	509	provides printer text 1 to 5 ( <a href="#">PrinterData1</a> ... <a href="#">PrinterData5</a> )
✚PrinterData1	525	Printer text 1
✚PrinterData2	526	Printer text 2
✚PrinterData3	527	Printer text 3
✚PrinterData4	528	Printer text 4
✚PrinterData5	529	Printer text 5
⊖AlarmMessage	508	last alarm message (provided in the defined language)
✚ObjLimits	510	provides the object limits ( <a href="#">ObjLimitXMin</a> , <a href="#">ObjLimitXMax</a> , <a href="#">ObjLimitYMin</a> and <a href="#">ObjLimitYMax</a> ) of the currently loaded program.
✚ObjPosition	511	provides the area ( <a href="#">ObjLimitXMin</a> , <a href="#">ObjLimitXMax</a> , <a href="#">ObjLimitYMin</a> and <a href="#">ObjLimitYMax</a> ) where the currently loaded program is cut.
⊖ObjLimitXMin	512	Object minimum in X axis in meters [m]
⊖ObjLimitXMax	513	Object maximum in X axis in meters [m]
⊖ObjLimitYMin	514	Object minimum in Y axis in meters [m]
⊖ObjLimitYMax	515	Object maximum in Y axis in meters [m]
✚OffsetName	516	Name of last loaded offset set
✚OffsetData	517	provides the currently active Offsets: <a href="#">OffsetX</a> , <a href="#">OffsetY</a> , <a href="#">OffsetZ</a> , <a href="#">OffsetDrill</a> and <a href="#">OffsetPgmShift</a>
✚OffsetX	518	currently active X Offset in meters [m]
✚OffsetY	519	currently active Y Offset in meters [m]
✚OffsetZ	520	currently active Z Offset in meters [m]
✚OffsetDrill	521	currently active drill correction in meters [m]
✚OffsetPgmShift	522	0: not shifted 1: corner X min. / Y min. 2: corner X max. / Y min. 3: corner X max. / Y max. 4: corner X min. / Y max.
✚UserName	523	Name of the currently logged on user
✚UserID	533	ID of the currently logged on user
✚LanguageKey	532	Key of the currently active language
✚UserPriority	524	Priority of the currently logged on user
✚MappingFile	534	path of the last loaded mapping file
✚PliDataIndex1	535	Index of the last loaded PLI data from file 1
✚PliDataIndex2	536	Index of the last loaded PLI data from file 2
⊖PliLogRequestIndex	537	PLI command extension
✚PliValue_<PLI address>	538	records the value of the given PLI address. <PLI address> must be in the following format: < -- E, D or M -- Address -- L, W, B or S -- Index of Word, Byte or Single bit --> Examples: PliValue_<E100L>, PliValue_<M255S17>, PliValue_<D35W1>

✚ActiveLayingHead	539	Number of active laying head / Cassette
✚TapeID	540	ID of tape. If used as additional parameter, ID of tape clamped in active laying head will be logged.
✚MaterialID	541	material ID of tape. If used as additional parameter, material ID of tape clamped in active laying head will be logged.
✚TapeLength	542	length of tape in [m]. If used as additional parameter tape length of tape in active laying head will be logged.
▢Barcode reader	543	Number of the barcode reader where the code is from.
▢Barcode value	544	Received barcode value
▢Barcode alias	545	Barcode related alias value
✚TapeDefects	546	TapeDefects: Count of tape defects and a list of <a href="#">TapeDefect</a> Elements
▢TapeDefect	547	TapeDefect contains a <a href="#">Tape defect begin</a> and a <a href="#">tape defect end</a> parameter
▢TapeDefectBegin	548	begin of tape defect in meters [m]
▢TapeDefectEnd	549	End of tape defect in meters [m]
✚TapeDataCasX	2000	Data of Tape clamped in Cassette / Head X: Cassette / Head number X, <a href="#">Tape ID</a> , <a href="#">Material ID</a> , <a href="#">Tape length</a> , <a href="#">Tape defects</a>
▢StripeData	1000	Data of last laid stripe: <a href="#">StripeNumber</a> , <a href="#">ActiveLayingHead</a> , <a href="#">TapeID</a> , <a href="#">StripeType</a> , <a href="#">StripeStartX</a> , <a href="#">StripeStartY</a> , <a href="#">StripeLength</a> , <a href="#">TapeRollStart</a> , <a href="#">Pressure</a> , <a href="#">Temperature</a>
▢StripeNumber	1001	Stripe number
▢StripeType	1002	Stripe Type: 1 = Good 4 = Waste 5 = Error
▢StripeStartX	1003	Start of stripe in X direction in [m]
▢StripeStartY	1004	Start of stripe in Y direction in [m]
▢StripeLen	1005	stripe length in [m]
▢TapeRollStart	1006	Start position of stripe on roll in [m]
▢PressureData	1007	Pressure data of last laid stripe: <a href="#">Pressure-Min</a> , <a href="#">Pressure-Max</a> , <a href="#">Pressure-Avg</a>
▢Pressure-Min	1008	pressure minimum in [N]
▢Pressure-Max	1009	Pressure maximum in [N]
▢Pressure-Avg	1010	Pressure average in [N]
▢TemperatureData	1011	Temperature data of last laid stripe: <a href="#">Temperature-Min</a> , <a href="#">Temperature-Max</a> , <a href="#">Temperature-Avg</a>
▢Temperature-Min	1012	Temperature minimum in [°C]
▢Temperature-Max	1013	Temperature maximum in [°C]
▢Temperature-Avg	1014	Temperature average in [°C]



## 7.18.5 Log file formats

### CSV Format

This format logs the events and the parameters in a plain text file. The values will be separated with the defined CSV separator character in the according logging section. If the size of the file exceeds the maximum file size according to the Backup style either a backup of the log file will be made and log file starts new or the oldest part of the file will be cut. Each line in the file has at least 4 columns:

- Date and time formatted according the defined date and time format string.
- Name of the currently logged on user
- Event ID
- Event Name in the defined language.

Some events can have additional values (parameters) according to the settings in the logging section.

### Example of a CSV log file:

```
2007.12.10 16:27:37,,1,Log Begin
2007.12.10 16:27:37,,50,Offset changed,1.000000,0.200000
2007.12.10 16:27:38,,10,Program load,cipolr.oc5
2007.12.10 16:27:38,GFM-Service,3,Operator changed,9,ENG
2007.12.10 16:27:40,GFM-Service,32,Override,100,0,0
2007.12.10 16:27:59,GFM-Service,10,Program load,Test_Rampe1.oc5
2007.12.10 16:28:07,GFM-Service,11,Program start,2.500000,2.800000,0.200000,0.200000,Text 5
2007.12.10 16:28:11,GFM-Service,21,Window transfer,Test_Rampe1.oc5,1
2007.12.10 16:28:15,GFM-Service,15,Program end,Test_Rampe1.oc5,46.673,0.000,0.000
2007.12.10 16:28:24,GFM-Service,16,Program unloaded
2007.12.10 16:28:37,GFM-Service,40,Error message,MMI-105 GfmLicense: Authorization period expires in 21 days
2007.12.10 16:30:52,GFM-Service,2,Log End
```

### CSV-ParametersOnly:

This format logs the parameters of the defined events in a plain text file. The event itself will not be logged, only the standard parameters if they are not blended out by parameter NoStd and the defined additional parameters will be logged. Each parameter will be written in a separate line. The values will be separated with the defined CSV separator character in the according logging section. If the size of the file exceeds the maximum file size according to the Backup style either a backup of the log file will be made and log file starts new or the oldest part of the file will be cut.

Each line in the file has at least 5 columns:

- Date and time formatted according the defined date and time format string.
- Name of the currently logged on user
- Parameter ID
- Parameter name in the defined language.
- Parameter value

### Example of CSV-ParametersOnly log file entries:

```
2008.02.13 14:17:07;GFM-Service;525;Printer data 1;Hello, how are you?
2008.02.13 14:17:07;GFM-Service;526;Printer data 2;Printertext 2
2008.02.13 14:17:07;GFM-Service;516;Offset Name;Part 27
2008.02.13 14:17:07;GFM-Service;2000;Tape data;3;Steve;80gUD;300;3;0,000;1,050;12,200;16,700;99,800;102,200
```

**Example of the logging.ini file:****[General]**

```
DateTimeFormat = mm/dd/yyyy Hh:Nn:Ss
MaxFileSize = 1000000
BackupStyle = MaxSize-Move
BackupPrefix = Backup_
LogFolder = ..\logging
```

**[ProductionLog]**

```
CSV_Separator = ;
FileName = Production_log.csv
Event_LogBegin = PgmName, Override
Event_LogEnd =
Event_PgmStart = ObjPosition
Event_PgmLoad =
Event_PgmEnd = PgmName, PgmTime, ObjCutLen, ObjTime
Event_WindowTransfer = PgmName, TransferCount
Event_PgmContinue = PgmName
Event_ToolChange =
Event_Alarm =
Event_Feedhold =
Event_OverrideChanged =
Event_PrinterData = NoStd, PrinterData5
Event_OffsetChanged = OffsetX, OffsetY
Event_UserChanged = UserID, UserName, UserPriority, LanguageKey
Event_MappingLoaded =
Event_MappingCleared =
Event_MappingSaved =
Event_PliData1Loaded =
Event_PliData2Loaded =
Event_PgmUnload =
```

**[PartHistory\_Shuttle1]**

```
CSV_Separator = ;
Filename = PartHistory_0.log.csv
Event_LogBegin =
Event_LogEnd =
Event_UserChanged = UserPriority, LanguageKey
Event_Alarm =
Event_Feedhold =
Event_OverrideChanged = OverrideG0, OverrideAPM
Event_PrinterData = NoStd, PrinterData5
Event_OffsetChanged = OffsetX, OffsetY
Event_PliData1Loaded =
Event_PgmLoad =
Event_PgmUnload =
Event_MappingCleared =
```

```
[PartHistory_Shuttle2]
CSV_Separator = ;
Filename = PartHistory_1.log.csv
Event_LogBegin =
Event_LogEnd =
Event_UserChanged = UserPriority, LanguageKey
Event_Alarm =
Event_Feedhold =
Event_OverrideChanged = OverrideG0, OverrideAPM
Event_PrinterData = NoStd, PrinterData5
Event_OffsetChanged = OffsetX, OffsetY
Event_PliData2Loaded =
Event_PgmLoad =
Event_PgmUnload =
Event_MappingCleared =

[PartHistory_ZoneDependingEvents]
CSV_Separator = ;
FileName = PartHistory_%Zone%.log.csv
Event_PgmStart = ObjPosition, ToolName, PrinterData5
Event_WindowTransfer = PgmName, TransferCount
Event_PgmContinue = PgmName
Event_PgmEnd = PgmName, PgmTime, ObjCutLen, ObjTime
Event_ToolChange =

[PartHistory_Mapping]
CSV_Separator = ;
FileName = PartHistory_<E11L>.log.csv
Event_MappingLoaded =
Event_MappingSaved =
```

### 7.19 Adding New Users

New users with unique passwords and user levels may be added from the login screen. Choose the Configure button to access the configure screen. Only personnel with user level 8 have access to the configure user screen.



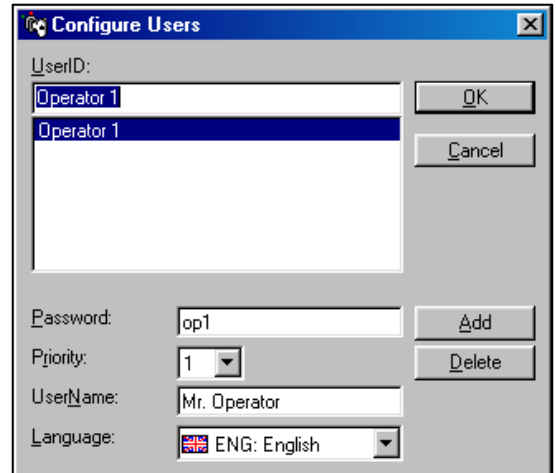
To add a new user, first enter a User ID in the UserID: window and then choose Add. Next enter a password, a priority, and a user name. Choose OK to exit the Configure User window. To delete a user, highlight the user id and in the user list window and choose Delete. The User ID and Password are used for logging on to the MMI. The User Name will be displayed in the top right corner of the MMI. Passwords are case sensitive.

### 7.20 Priority Levels

The MMI uses user priority levels to disable features that are not needed by all users. Each subsequent priority level allows access to higher-level user functions. The priority level structure is:

Operators	Priority Levels 1, 2, and 3
Programmers	Priority Levels 4, 5, and 6
Maintenance	Priority Levels 7 and 8

All priority levels have full access to REF, JOG, MDI, and AUTO modes. Access is limited by priority level to Program Management and System Support menu functions.



### 7.20.1 Program Management Priority Level Access

Program Management Features								
Priority Level	Load	Graphic	Info	Select	Delete	Edit	Generate Part Prog.	Origin Editor
1	*	*	*	*				
2	*	*	*	*	*			
3	*	*	*	*	*	*	*	*
4	*	*	*	*	*	*	*	*
5	*	*	*	*	*	*	*	*
6	*	*	*	*	*	*	*	*
7	*	*	*	*	*	*	*	*
8	*	*	*	*	*	*	*	*

### 7.20.2 System Support Priority Level Access

System Support Features - Group 1			
Priority	Online Graphic	View Log File	Mountpoints
1	*	*	*
2	*	*	*
3	*	*	*
4	*	*	*
5	*	*	*
6	*	*	*
7	*	*	*
8	*	*	*

System Support Features - Diagnostics					
Priority	Value Display	Auto Data	Analog Monitor	Axis Monitor	View Mapping
1	*	*	*	*	*
2	*	*	*	*	*
3	*	*	*	*	*
4	*	*	*	*	*
5	*	*	*	*	*
6	*	*	*	*	*
7	*	*	*	*	*
8	*	*	*	*	*

System Support Features - Service						
Priority	View Knife Align.	View Versions	Parameter Editor	Scan Mode	PLI Debugger	Oscilloscope
1	*					
2	*					
3	*					
4	*	*	*			
5	*	*	*			
6	*	*	*	*		
7	*	*	*	*		
8	*	*	*	*	*	*

System Support Features - Extended						
Priority			Select			
1						
2						
3			*			
4			*			
5			*			
6			*			
7			*			
8			*			

System Support Features - User Defined						
Priority			Edit User Functions			
1						
2						
3						
4						
5						
6						
7						
8			*			

For Priority Level 8 only – *ALT + F4* will exit the MMI to the Windows desktop.

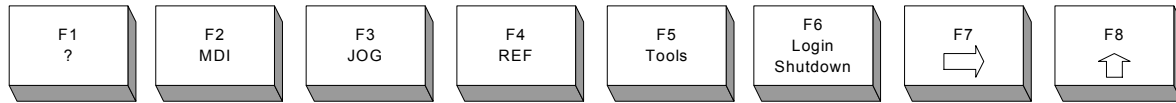
## 7.21 MMI Softkey Flow Diagrams

The following diagrams show the MMI softkey strokes used to move between different softkey lines and MMI functions. Not all softkeys are used on all machines. The diagrams are separated according to Manual mode softkeys and Production mode softkeys. The last diagram shows the flow of the System Support menu.

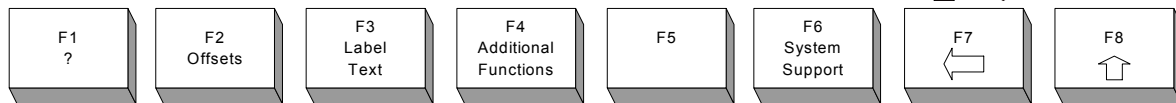
### 7.21.1 Manual Mode Softkeys

#### Manual Mode Soft Keys

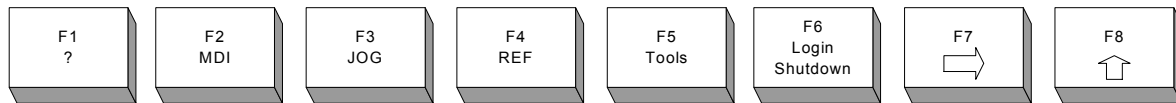
##### Soft Key Level 1



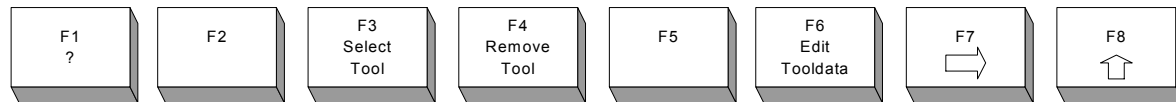
##### Soft Key Level 2



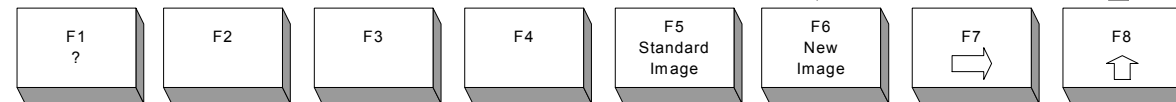
##### Soft Key Level 1



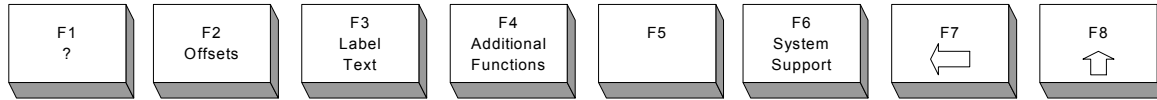
##### Soft Key Level 1- F5



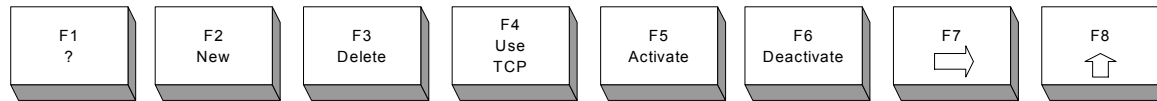
##### Soft Key Level 1- F5 -F6



**Soft Key Level 2**



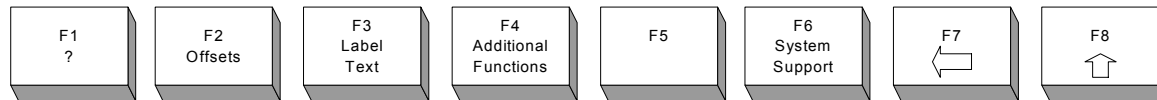
**Soft Key Level 2 - F2**



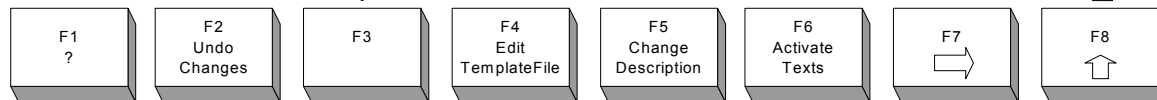
**Soft Key Level 2 - F2 - F7**



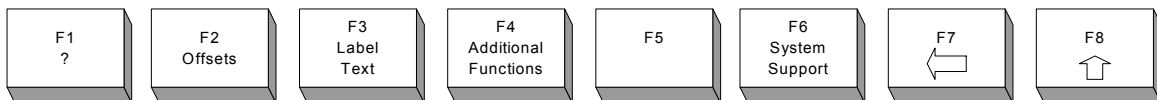
**Soft Key Level 2**



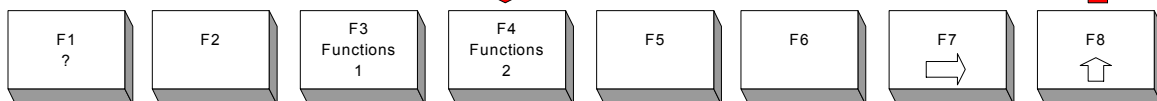
**Soft Key Level 2 - F3**



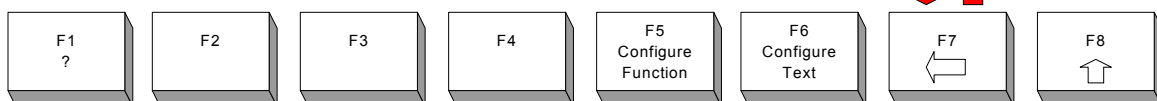
**Soft Key Level 2**



**Soft Key Level 2 - F4**



**Soft Key Level 2 - F4 - F7**

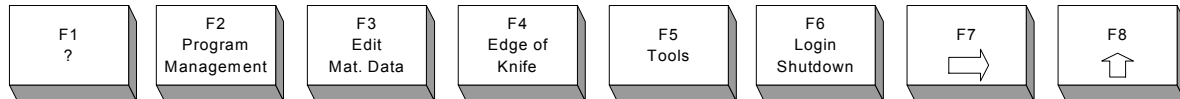




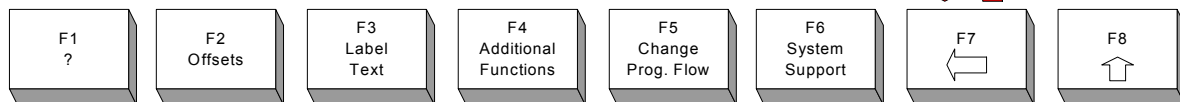
### 7.21.2 Production Mode Softkeys

#### Production Mode Soft Keys

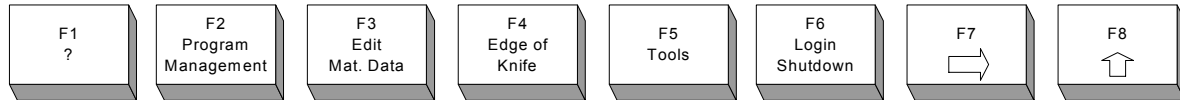
**Soft Key Level 1**



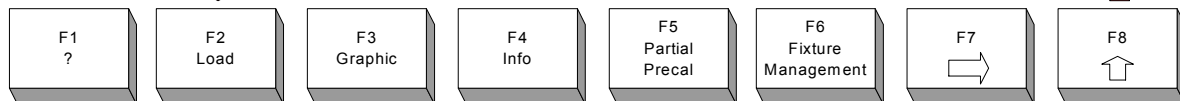
**Soft Key Level 2**



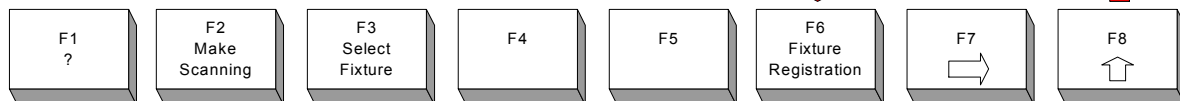
**Soft Key Level 1**



**Soft Key Level 1- F2**

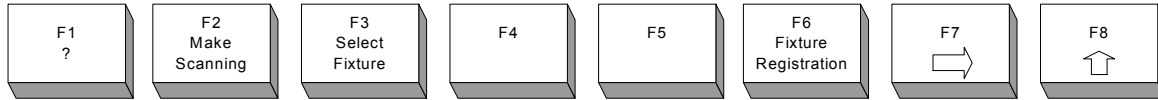


**Soft Key Level 1- F2 - F6**

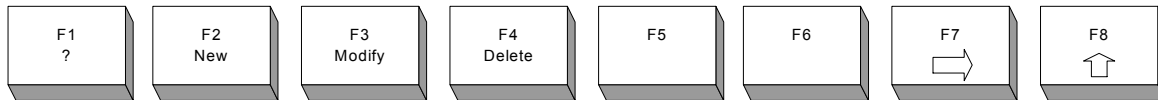




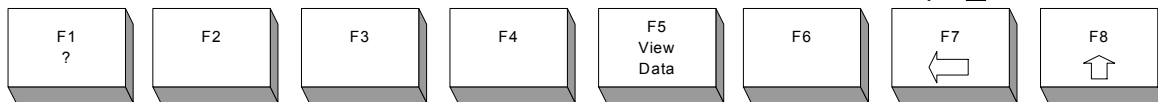
**Soft Key Level 1 - F2 - F6**



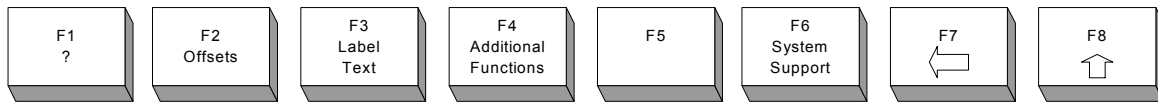
**Soft Key Level 1 - F2 - F6 - F6**



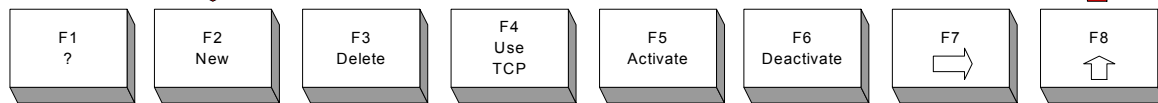
**Soft Key Level 1 - F2 - F6 - F7**



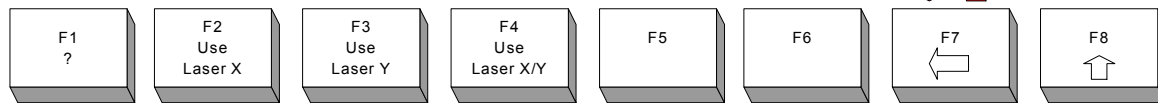
**Soft Key Level 2**



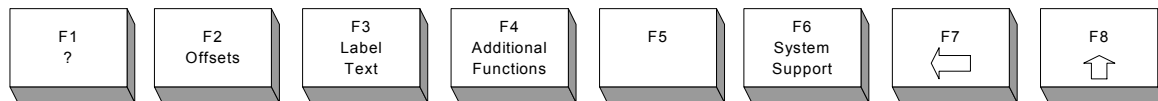
**Soft Key Level 2 - F2**



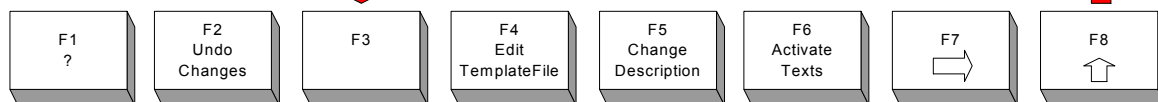
**Soft Key Level 2 - F2 - F7**



**Soft Key Level 2**

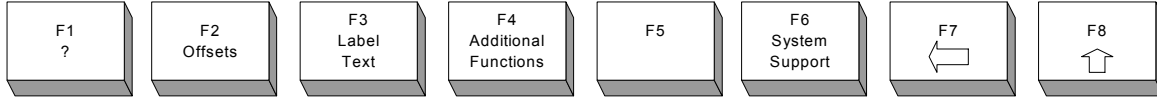


**Soft Key Level 2 - F3**

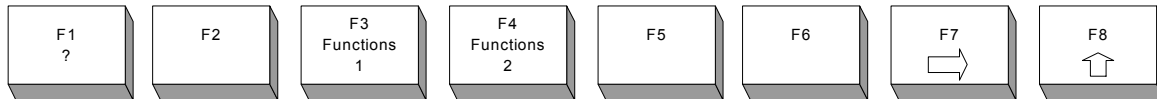




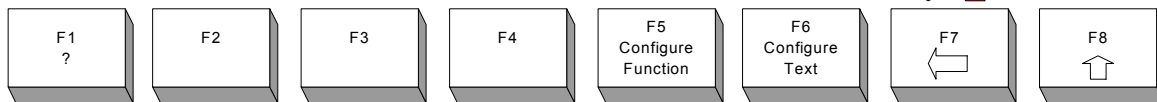
**Soft Key Level 2**



**Soft Key Level 2 - F4**

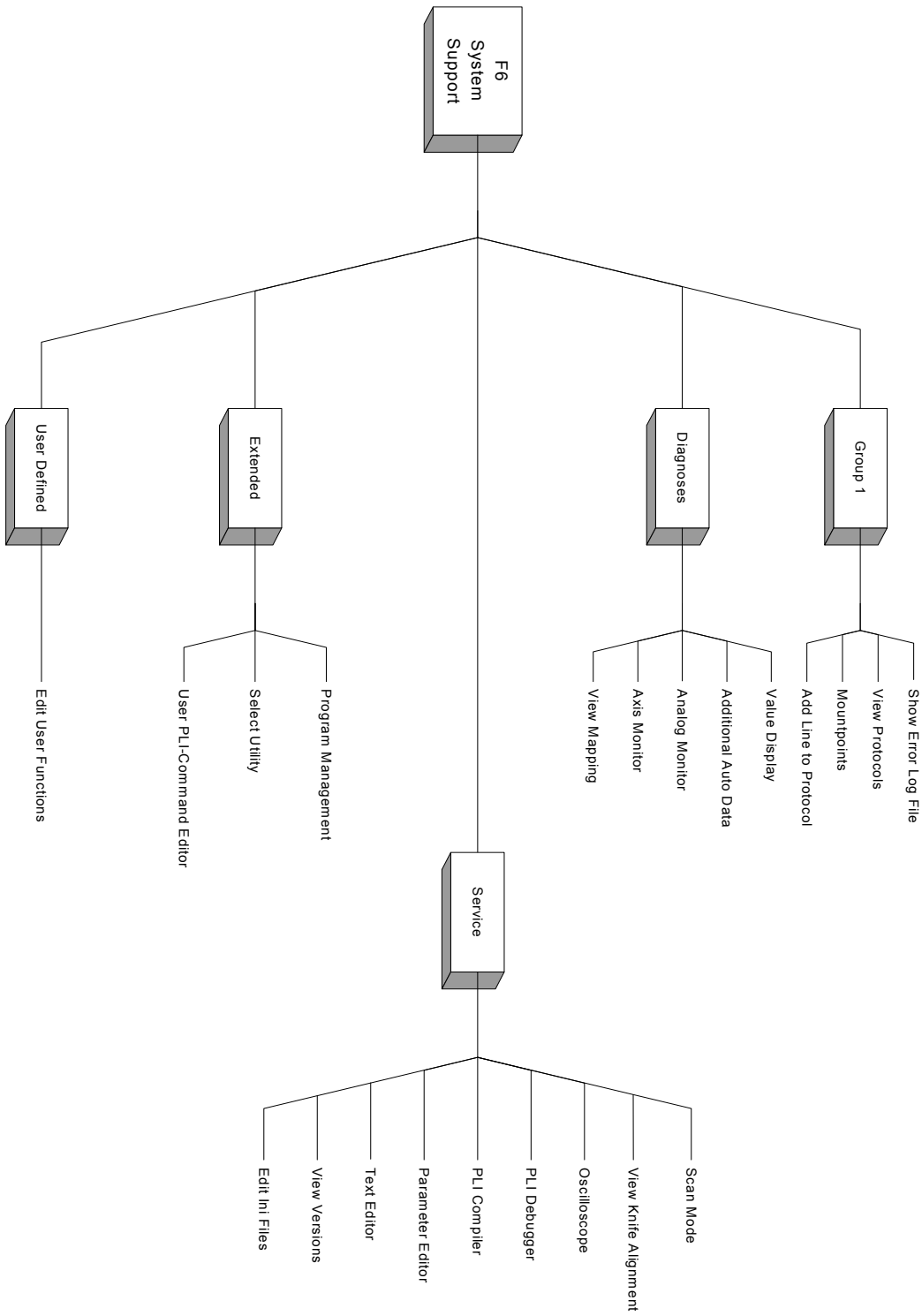


**Soft Key Level 2 - F4 - F7**



## **7.22 System Support Menu Tree**

**System Support Menu \***

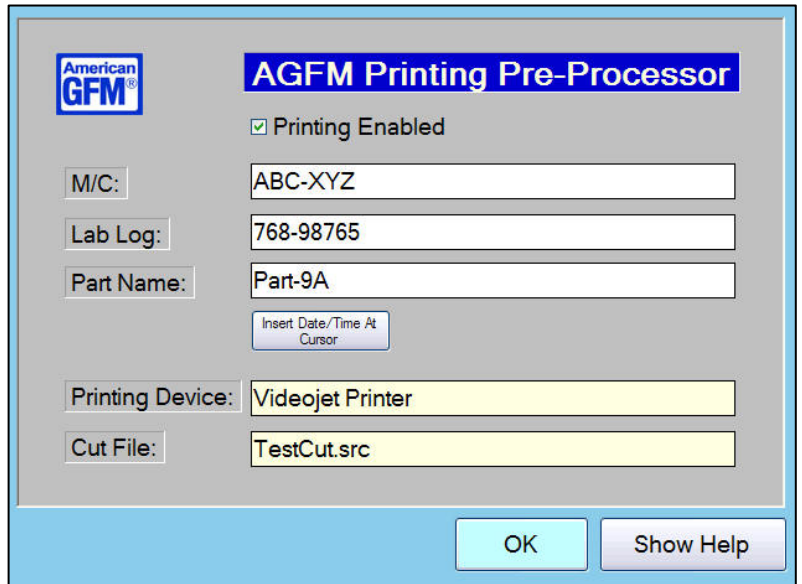


\* Available menu options will depend on the current user's priority level.

## 8 Machine Options

### 8.1 Printing Pre-Processor (PrePrint.EXE)

This application is used to provide additional printed data at cut time. This application is called at compile time via **ScriptCompile2.vbs**. When launched, the operator then can add 3 text strings via text boxes. Pressing ENTER or TAB moves from one field to the next. Upon pressing ENTER the 4th time, or clicking the OK button at any time, PrePrint.EXE will then make the changes to the SRC file's M18 (or M20) print commands to add the user input data from the text boxes, allowing the entered data to be printed on the cut parts at run time. By default, the *tildee* (~) character is used as a mask. The M18 command in the incoming SRC file **MUST** contain the 3 masks so that PrePrint knows what to replace them with from the 3 text boxes.



- Text Box 1 (M/C) will be used to replace mask 1 (~~1)*
- Text Box 2 (Lab Log) will be used to replace mask 2 (~~~~~~2)*
- Text Box 3 (Part Name) will be used to replace mask 3 (~~~~~~3)*

- The incoming SRC format is controlled by the AGFM Nesting System using the LAYOT.TXT file shown below. For more information about LAYOT.TXT, consult the NS2 Nesting documentation.

#### Sample LAYOT.TXT in the NS2 Nesting software

```

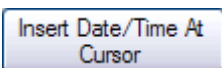
pppppppppppppppppppppppppppppppppppppp
"MC: ~~~1"h "L/L: ~~~~~~2"h
###/###/## ##:##:##h "~~~~~3"h

```

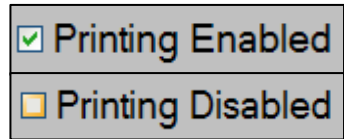
#### Example of an Incoming SRC file.

M18(270.000000,2.000000,"MC: ~~~1 L/L: ~~~~~~2","01/16/08-09:59am ~~~~~~3")  
will be changed to:  
M18(270.000000,2.000000,"MC: **ABC-XYZ** L/L: **768-98765**", "01/16/08-09:59am **Part-9A**")

- The application also supports Topex Labelers. The file USER.CNF is used to determine which device is used. The enabled printing device is shown on the main form  
Parameters used are:
- **SAB.IJ\_ENA** = 1 Inkjet Enabled  
**SAB.LAB\_ENA** = 1 Topex Enabled
- Date & Time can be inserted in any text box by clicking the provided button.



- By default, printing is always ENABLED. If printing should be skipped, uncheck the box. When the check is removed, Printing will be disabled.



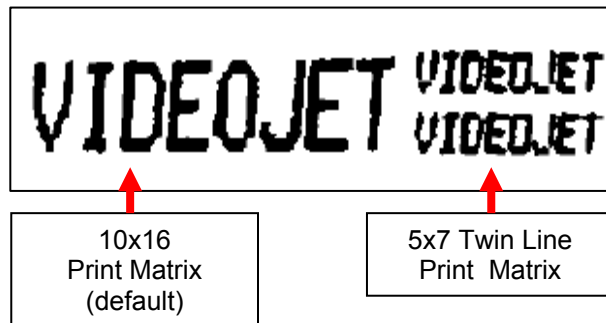
- Font Control** with the Inkjet allows higher quality printing. The default print matrix on AGFM machines is a 10x16 print matrix. This is a somewhat of a large print font. Some machines require the printed text to be smaller in size due to small parts. Therefore, the font control feature can be utilized to reduce the text size. If enabled, via PrePrint.INI, the standard single line print command which uses the 10x16 print matrix will be changed to a **5x7 Single Line** print matrix. Likewise, the standard twin line print command, which uses a 5x7 lower quality print matrix, will be changed to **5x7 Twin Line - High Quality** as shown below. The 5x7 print matrix will be approximately half the size of the 10x16 print matrix.

Font: **5x7 Single Line**  
M18(270.000000,10,1,"buyoffa904.p6")

Font: **5x7 Twin Line - High Quality**  
M18(270.000000,10,5,"MC: ABC-XYZ L/L: 768-98765", "%D2%-%T2% Part-9A")

To enable/disable the font control feature, see the following parameter in **PrePrint.INI**  
*use\_font\_control = 1 (or 0)*

This example shows the difference between the 10x16 print matrix (default), compared to the 5x7 twin line print matrix. As shown in this illustration, the larger 10x16 font (default) is twice the size of the 5x7 font.



- The "Show Help" button will display this help file.

**PrePrint.INI Settings**

Below is a sample PrePrint.INI file. The names of the text fields can be changed at any time, by changing them in PrePrint.INI. This INI file is stored in the CNC\PrePrint folder

```
[settings]
src_caption = "Cut File:"           "Text for source file label name."
label1 = M/C:                       "Text for label 1."
label2 = "Lab Log:"                 "Text for label 2."
label3 = "Part Name:"               "Text for label 3."
use_font_control = 1                 "Switch m18 m-codes to use font control for ink jet printing."
mask1 = ~~~1                        "Mask for the first text string to be replaced for inkjet printing."
mask2 = ~~~~~~2                     "Mask for the second text string to be replaced for inkjet printing."
mask3 = ~~~~~~3                     "Mask for the third text string to be replaced for inkjet printing."
helpfile = "C:\Program Files\GFM\cnc\preprint\AGFM Printing Pre-Processor.pdf" "Name of the help file."
```

## 9 General Information

### 9.1 Backing Up the Machine Software

#### 9.1.1 Backing up the entire hard drive with Acronis True Image

The machine is equipped with a powerful backup software package called **ACRONIS True Image**. This software allows the ENTIRE C DRIVE to be backed up to DVD-RW disks. This includes the operating system along with all other applications currently installed on the hard drive. DVD-RW disks can be re-used over and over, making it possible over write a previous backup if desired.



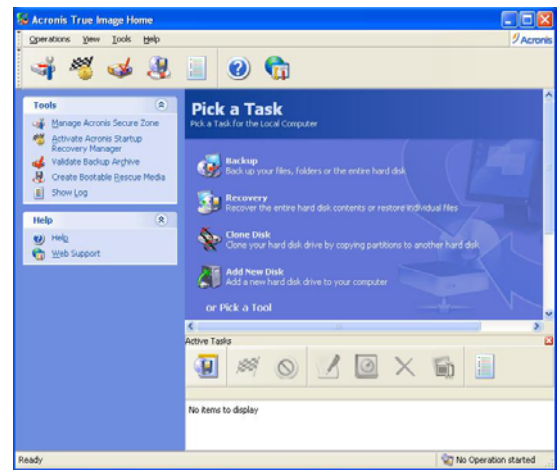
**NOTE: It is the customer’s responsibility to make periodic back up’s. Failure to do so will result a machine down time when least expected!!**

Tips: These are some things that should be done prior to running Acronis True Image. These tips will help reduce the amount of required DVD’s to perform the backup should more than one be required:

- Empty the Recycle Bin
- Delete unnecessary applications
- Run Scan Disk
- Run Disk Defragmenter
- Insure no viruses are on the system
- Disable Virus Scanners



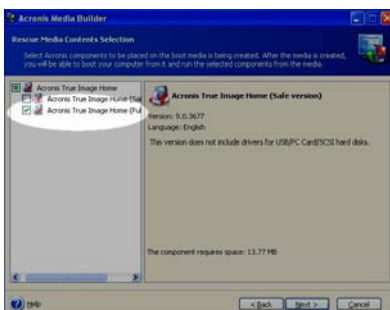
To launch the drive image software, click on desktop icon provided. The screen to the right will appear.



Next, the DVD-RW disk must be erased and re-formatted as a bootable disk. To do this click on the link in the “Tools” section “Create Bootable Rescue Media”. The below screen should appear.



Click NEXT to continue.

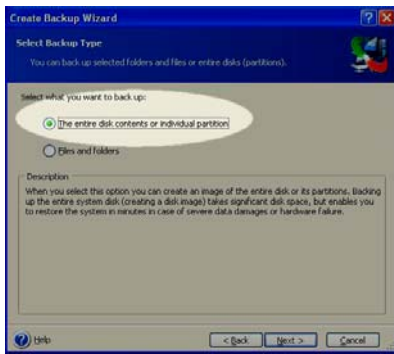


Check the box as shown here. Only choose the “Full Version”. Click NEXT to continue.

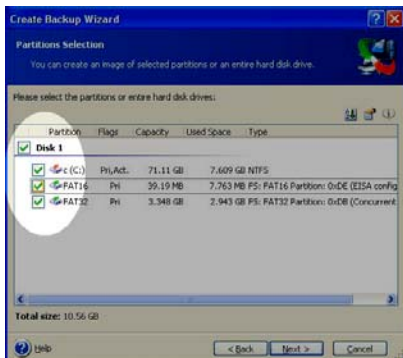




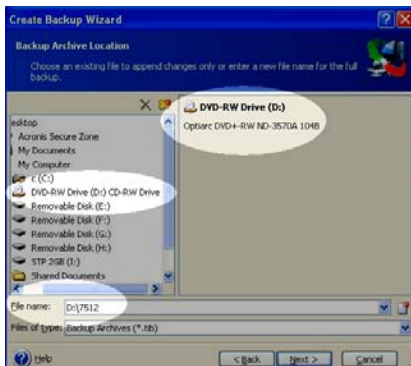
Click NEXT to continue.



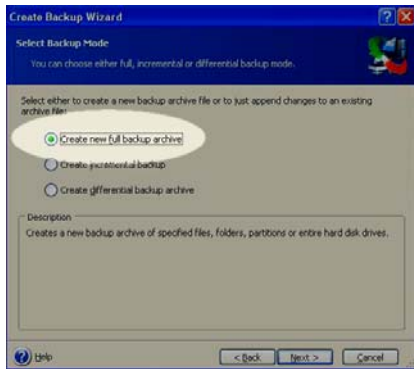
Choose the entire hard disk as shown here. Click NEXT to continue.



Check all check boxes as shown here. Click NEXT to continue.



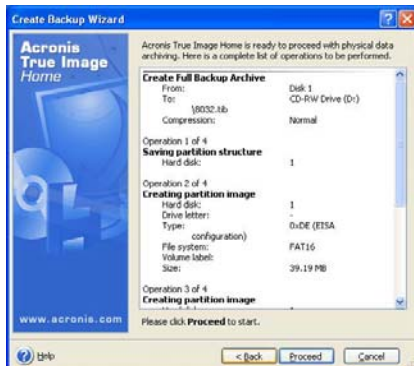
Choose the Backup Achieve location here. Give the backup a valid name. Ensure the DVD-RW drive is chosen. In this example, D: drive is the DVD-RW drive. In the "Filename" text box, make sure that the D: drive letter is shown at the beginning of the filename. Click NEXT to continue.



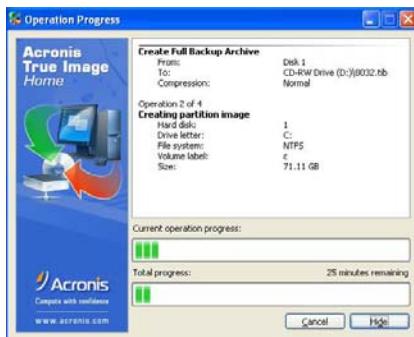
Choose “Create new full backup archive” as shown here. Click NEXT to continue.



Choose “Default Options” as shown here. Click NEXT to continue.



You are now ready to proceed with the full backup. This screen is a summary of all settings, and can be verified before proceeding. If any changes are desired, click BACK. At this point, we recommend to use these settings, and click PROCEED.

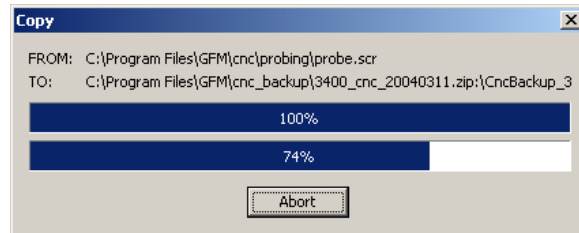
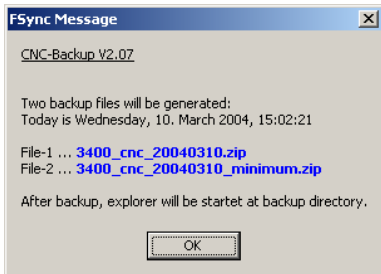
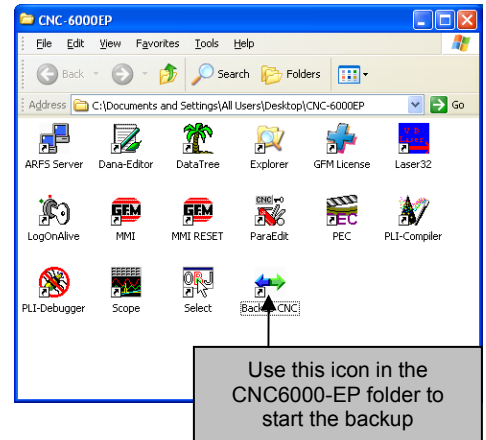


The backup process to the DVD-RW disk is now in process, and will take several minutes to complete. When this process is complete, store the DVD in a safe place in case it is needed to restore a defective hard drive.

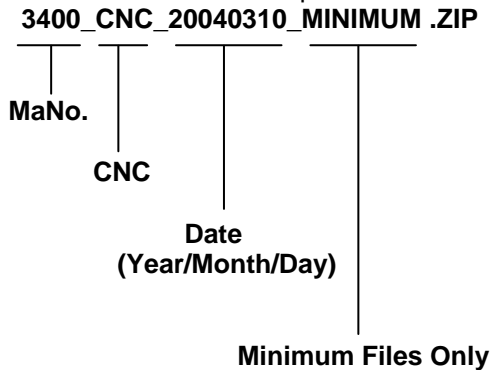
### 9.1.2 Backing up the CNC6000 software only

If a backup of only the CNC6000 software is required, without backing up the entire hard drive, such as for AGFM service technicians, a utility is provided to do so. Open the CNC-6000AP folder on the desktop, and double click on the "Backup CNC" icon as shown in the picture to the right. Two files will be created with this method. These two files will be located in the CNC\_BACKUP folder. After the 2 zip files are created, they can be copied to a network drive, burned to a CD, or copied to a USB flash drive for later extraction.

The below dialog will appear, confirming that 2 files will be created. Click OK to continue.



The file names are composed as follows:

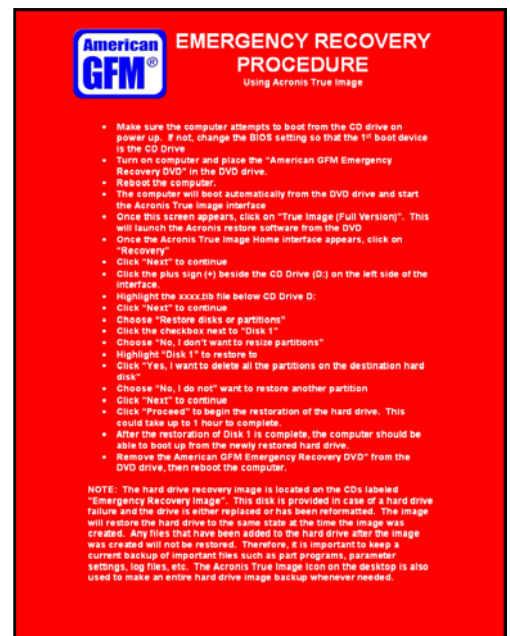


### 9.2 Restoring the Drive Image DVD

In the event that the hard drive needs to be replaced or formatted, the DVD-RW containing the hard drive image is used to restore the new or formatted hard drive to the state at which it was when the last image was created.

To restore the hard drive using the image DVD, insert the DVD CD drive and re-boot the computer. The DVD is bootable, which allows the drive restoration to begin automatically after the computer is re-booted. Once the restoration screen appears, any existing partitions that exist on the drive will be destroyed and re-created before the image restoration begins.

A RED Emergency Recovery procedure was shipped with the machine documentation. This red sheet should always stay with the image DVD-RW disk.



### **9.3 Other AGFM Manuals**

Other AGFM Manuals that may be relevant to the machine are:

- Machine Safety
- Machine Description
- Machine Operator Manual (this document)
- Fixture Registration Manual
- CNC6000 Programmer's Manual
- Compiler Parameter Manual
- M and G Code Description
- Electrical Service Manual
- 28 Channel Oscilloscope Manual
- Hardware Reference Manual
- System Parameter Manual
- Ultrasonic Generator Manual
- PLI & CNF File Program Print-out

## 10 G-Codes, M-Codes, and H-Codes for 2D Machines

### G00 ... Rapid traverse

The axes will be set independent of each other with max. speed to the defined end point.  
... see also [G01](#).

e.g.: G0 X3900 Y1250

### G01 ... Linear interpolation

The axes will be interpolated linear to the indicated end point with a programmed speed.  
... see also [G00](#).

e.g.: G1 X200 Y300 F20000

### G04 ... Dwell time at end of move

A delay time (default 1s) will be executed at the end of the block .

### G70 ... Programming in [inch]

... see also [G71](#).

### G71 ... Programming in [mm]

... see also [G70](#).

### G79 ... Programming based on machine origin

The programmed coordinates are related to the absolute machine origin, this means active offsets will be ignored.

### G90 ... Absolute value programming

... see also [G91](#).

### G91 ... Incremental value programming

... see also [G90](#).

**G98 ... Tool-Center-Mode active (TCP positions)**

The programmed coordinates are related to the tool center point.  
 ... see also [G99](#).

**G99 ... Tool-Center-Mode inactive (NOM positions)**

The programmed coordinates are related to the axes.  
 ... see also [G98](#).

**M00 ... Unconditional stop**

The function M00 causes an interruption of the program at the block in which it is located.  
 Press <START> to continue the cutting program.

**M01 ... Optional stop**

The cutting program stops only at the programmed code M01 (=optional stop), if the mode of the program flow is preselected with "stop on M01" in the menu 'production'. Press <START> to continue the cutting program.

**M05() ... Drilling command**

<i>p1</i>	Feed Rate	Drilling speed in [mm/min] or [inch/min]
-----------	-----------	--

The function starts the drilling cycle defined before with function [M24](#).

e. g.: M24 ( 20.0 , 10.0 , -0.5 , "1")  
 G0 X100 Y200  
 M5 ( 100.0 )  
 G0 X100 Y210  
 M5 ( 100.0 )

**M06 ... Send product detect signal to inkjet**

Will be generated automatically by [M18](#) and releases the inkjet to print.

M07() ... Place a label		
[p1]	Angle	Angle of the label in [deg]
<p>Places the label. If the label unit has a rotation axis, the specified angle will be used.                      See also <a href="#">M13</a> to activate the labeler and <a href="#">M20</a> for printing the labels.</p> <p>e.g.: M13                      M20 ( 1 , 1 , "TESTPRINT" )                      G0 X3000 Y500                      M07 ( 45.0 )                      M20 ( 1 , 12 , "American" , "GFM" , 4400 )                      G0 X3200 Y600                      M07 ( 90.0 )</p>		

M08() ... Ultrasonic unit ON		
p1	Amplitude	Ultrasonic-amplitude in [%]
<p>Switch on the ultrasonic unit for the cutting knife.                      ... see also <a href="#">M09</a>.</p> <p>e.g.: M08 ( 30 )</p>		

M09 ... Ultrasonic unit OFF		
<p>Switch off the ultrasonic unit for the cutting knife.                      ... see also <a href="#">M08</a>.</p>		

M10 ... Cutting-Head enabled		
<p>In cutting mode the automatic lift of the Z-axis between cutting and position processes will be executed on the value defined in the parameter V\$UP                      In the same way the Z-axis will be lowered automatically between position and cutting processes on the value defined in the parameter V\$DOWN                      At all corners including a greater edge than indicated in the parameter V\$TURN the tool will be lifted out of the material with a defined value                      ... see also <a href="#">machining modes</a>.</p>		

**M11 ... Inkjet enabled for text print**

This function activates the inkjet. The text can be printed with [M18](#).

... see also [machining modes](#).

e.g.: M11  
 G0 X500 Y300  
 M18 ( +30.0 , 0, "TESTPRINT" )  
 G0 X600 Y300  
 M18 ( -45.0 , 2, "AMERICAN" , "GFM" )

**M12() ... Enable pen-marker for drawing or textprint**

<i>p1</i>	Height1	Marker height for G0-positioning to start of text in [mm] or [inch]
<i>p2</i>	Height2	Marker height for positioning within a text in [mm] or [inch]
<i>p3</i>	Height3	Marker height for writing in [mm] or [inch]
<i>["t1"]</i>	Marker-No	Number of the marker (default "1")

This function activates the marker. The positions of the marker will be defined with the parameter during the process.

Then the text can be printed with [M22](#).

Furthermore the cutting commands G1,G2,G3,... will not be cut, but they will be drawn with the marker.

... see also [machining modes](#).

e.g.: M12 ( 20.0 , 2.5 , -0.1 , "1" )  
 G0 X500 Y300  
 M22 ( 45.0 , 10.0 , "TESTPRINT" )  
 G0 X500 Y200  
 M22 ( 180.0 , 8.0 , "AMERICAN GFM" )

**M13 ... Labeler enabled**

This function activates the labeler. If the labeler is on a separate Y-slide, so it will be connected automatically with [M54](#).

The labels can be printed with [M20](#) and placed with [M7](#).

... see also [machining modes](#).

e.g.: M13  
 M20 ( 1 , 1 , "TESTPRINT" )  
 G0 X3000 Y500  
 M07 ( 45.0 )  
 M20 ( 1 , 12 , "American" , "GFM" , 4400 )  
 G0 X3200 Y600  
 M07 ( 90.0 )



**M14 ... Mapping system OFF**

... see also [M15](#).

**M15 ... Mapping system ON**

Tooltip cutting depth will be held constant with this function; used for possible table inaccuracies.  
 ... see also [M14](#).

**M16 ... Manual blade align (set angle to zero)**

The actual position of the rotation axis of the cutting knife can be defined as 0°-position with this function.

**M18() ... Inkjet printing parameter**

M18 has two different modes.  
[Standard print command which works on all inkjet printers](#)  
[Print command with font control which works only on special printers](#)

**M18 - Standard print command**

<i>p1</i>	Angle	Print direction 0..360°
<i>p2</i>	Mode	0 ... single line text (ASCII) 1 ... single line bar code 2 ... double line text (ASCII) 10 .... <a href="#">Font control</a>
"t1"	Line-1	Text for the upper line or for a single line
"t2"	Line-2	Text for the lower line

If the printing operation is activated with [M11](#), the text will be printed with this function.

```
e.g.: M11
G0 X500 Y300
M18 ( +30.0 , 0 , "TESTPRINT" )
G0 X600 Y300
M18 ( -45.0 , 10 , 5 , "AMERICAN" , "GFM" )
```

**M18 - Print command with font control**

Font control is only possible on printers which supports the V-Link™ interface from Videojet®.

<i>p1</i>	Angle	Print direction 0..360°
<i>p2</i>	Mode	10 ... Font control with <i>p3</i>
<i>p3</i>	Font	0 ... 5x5 single line matrix 1 ... 5x7 single line matrix 2 ... 7x9 single line matrix 3 ... 10x16 single line matrix 4 ... 5x7 twin line matrix 5 ... 5x7 twin line matrix (High Quality)

"t1"	Line-1	Text for the upper line or for a single line
"t2"	Line-2	Text for the lower line

If the printing operation is activated with [M11](#), the text will be printed with this function.

e.g.: M11  
 G0 X500 Y300  
 M18 ( +30.0 , 10 , 2 , "TESTPRINT" )  
 G0 X600 Y300  
 M18 ( -45.0 , 10 , 5 , "AMERICAN" , "GFM" )

M19() ... Display message at operating panel		
"t1"	Text	Text of message to display

This function activates the message window above the display field "Errors and Messages" in the "Production" and "MDI" screens.  
 The message will remain until M19 is issued again.

e.g.: M19 ( "Remove waste" )  
 M0  
 M19 ; Message will be deleted

**M20() ... Output data via template (Print label)**

M20 has two different functions.

[Print label](#)

[Initialize configuration data](#)

**M20 - Print label**

<i>p1</i>	Command	1 ... Output
<i>p2</i>	Mask	Mask number 0..15 for print format
<i>["t1"]</i>	Text1	Text data for label print
<i>["t2"]</i>	Text2	Text data for label print
<i>[p3]</i>	Value1	Value for label print
<i>[p4]</i>	Value2	Value for label print
<i>[p5]</i>	Value3	Value for label print
<i>[p6]</i>	Value4	Value for label print
<i>[p7]</i>	Value5	Value for label print

Sends data for label print with template (mask definition) to RS-232-interface. It is possible to transmit up to 5 parameters 'p3...p7' and up to 2 texts 't1...t2' to the template. See also [M13](#) to activate the labeler and [M7](#) to place the labels.

e.g.: M13  
M20 ( 1 , 1 , "TESTPRINT" )  
G0 X3000 Y500  
M07 ( 45.0 )  
M20 ( 1 , 12 , "American" , "GFM" , 4400 )  
G0 X3200 Y600  
M07 ( 90.0 )

**M20 - Initialize configuration data**

<i>p1</i>	Command	0 ... Initializing
-----------	---------	--------------------

Reads the configuration data from the NET-disk and executes a syntax check. This will be executed automatically during control startup !

e.g.: M20 ( 0 )

**M21 ... Inkjet enabled for shaping**

With this function the programmed shape can be drawn on the processing material with the inkjet.

... see also [machining modes](#).

M22() ... Pen-marker textprint parameter		
<i>p1</i>	Angle	Printing direction 0..360°
<i>p2</i>	Size	Text height in [mm] or [inch]
<i>"t1"</i>	Text	text to be print

If the marker operation is activated with [M12](#), the text will be printed with this function.

e.g.: M12 ( 20.0 , 2.5 , -0.1 , "1")  
 G0 X500 Y300  
 M22 ( 45.0 , 10.0 , "TESTPRINT" )  
 G0 X500 Y200  
 M22 ( 180.0 , 8.0 , "AMERICAN GFM" )

M23 ... LPA-Offsets enabled (Laser Part Alignment)	
<p>This function activates the LPA (Laser-Part-Alignment) operation mode. LPA finds out the actual position of a work piece in the X/Y coordinate system. On the work piece (material) are two defined markers. Their position will be determined with help of the function <a href="#">M52</a>. Then the coordinates of the part program will be transformed (moved and rotated) to the position of the work piece.</p> <p>... see also <a href="#">machining modes</a>.</p> <p>e.g.: M23                      G0 X50 Y70                      M52 ( 1 )                      G0 X2000 Y56                      M52 ( 2 )                      M72</p>	

M24() ... Drill-Offsets enabled		
<i>p1</i>	Height1	Height of the G0-positioning in [mm] or [inch]
<i>p2</i>	Height2	Start height of the drilling in [mm] or [inch]
<i>p3</i>	Height3	Stop height (depth) of the drilling in [mm] or [inch]
<i>["t1"]</i>	Drill-No	Number of the drill (default "1")

With this function the determination of the operation follows for the [M05](#) drilling cycle.

... see also [machining modes](#).

e.g.: M24 ( 20.0 , 10.0 , -0.5 , "1")  
 G0 X100 Y200  
 M5 ( 100.0 )  
 G0 X100 Y210  
 M5 ( 100.0 )

**M25 ... Peeling head enabled**

During X/Y positioning commands the peeling knife will be automatically lifted out of the material (Z axis up).  
 During X/Y interpolation commands the peeling knife will be automatically lowered into the material (Z axis down).  
 ... see also [machining modes](#).

**M26 ... Camera offsets enabled**

This function will activate the camera. X/Y positions inside the part program are related to the camera.  
 ... see also [machining modes](#).

**M30 ... End of program**

This function marks the end of the program and is always in a separate block.

**M31 ... Move to basic position 1A (or 1B ...PLI)**

... see also [M32](#).

**M32 ... Move to basic position 2**

... see also [M31](#).

**M33() ... Cut off material**

[p1]	Position	Optional X-cut position in [mm] or [inch]
------	----------	---

Partial function of the material macros.  
 ... see also [M34](#) (grip), [M36](#) (pull out) and [M35](#) (release).

e.g.: M34  
 M36 ( 9500.0 , 1000.0 )  
 M35  
 M33 ( 100.0 )

**M34() ... Grip material**

[p1]	Position	Optional X-grip position in [mm] or [inch] if the material will be loaded with synchronous X/U-movement.
------	----------	--

Partial function of the material macros.  
 ... see also [M36](#) (pull out), [M35](#) (release) and [M33](#) (cut off).

e.g.: M34 ( 4000.0 )  
 M36 ( 1000.0 ) ; pull out 3m of material  
 M35  
 M33

**M35 ... Release material**

Partial function of the material macros.  
 ... see also [M34](#) (grip), [M36](#) (pull out) and [M33](#) (cut off).

e.g.: M34  
 M36 ( 9500.0 , 1000.0 )  
 M35  
 M33

**M36() ... Pull out material**

[p1]	Position	Absolute X-end position for material/foil-corner in [mm] or [inch]
[p2]	Speed	Pull out-speed in [mm/min] or [inch/min]

Partial function of the material/foil macros.  
 ... see also [M34](#) (grip), [M35](#) (release) and [M33](#) (cut off) of the material respectively [M44](#) (grip), [M45](#) (release) and [M46](#) (cut off) of the foil.

e.g.: M34  
 M36 ( 9500.0 , 1000.0 )  
 M35  
 M33

M44  
 M36 ( 9530.0 , 2000.0 )  
 M45  
 M46

**M37 ... Tool setting (and alignment) ... measure length**

This function executes the measuring of the tool length and the alignment of the knife edge.  
 The tool measuring will be executed automatically after the reference cycle of the axes.

**M38 ... Enable FRONT area for operator**

This function is only used for machines with 2-area-operation. It enables the front area of the machine for the operator.  
 The function has different meanings depending on the equipment used on the machine (light barrier, sound protection enclosure, etc.).  
 The light barriers of the front area are inactive.  
 The sound protection enclosure moves to the rear area of the machine.  
 ... see also [M39](#).

**M39 ... Enable REAR area for operator**

... see also [M38](#).

**M40 ... Move to last program start point**

This function enables to move to the last start point of a program written in an incremental programming way ([G91](#)).

**M41() ... Conveyor incremental move**

<i>p1</i>	Distance	Moving length of the conveyor in [mm] or [inch].
<i>[p2]</i>	Grip-Pos	Optional grip position in [mm] or [inch].

This function moves the conveyor with the indicated distance.  
 If the grip position is indicated, so the material will be clamped (with help of [M62](#)) during the movement between conveyor and X-axis.

e.g.: M41 ( 8000.0 , 1200.0 )

**M42 ... Knife change**

Cutting head will be moved to a special position. In this position it is possible to lock the movement of the tangential axis with a pin and to change the cutting knife. After changing the knife it is necessary to unlock the pin.

**M43 ... Tool probing**

The function measures the actual tool length and compares it with the length measured by [M37](#).  
 If a determined difference is exceeded (e.g. by break of knife or attrition) an error message will be caused.

**M44 ... Grip foil**

Partial function of the foil macros.  
 ... see also [M36](#) (pull out), [M45](#) (release) and [M46](#) (cut off).

e.g.: M44  
 M36 ( 9530.0 , 2000.0 )  
 M45  
 M46

**M45 ... Release foil**

Partial function of the foil macros.  
 ... see also [M44](#) (grip), [M36](#) (pull out) and [M46](#) (cut off).

e.g.: M44  
 M36 ( 9530.0 , 2000.0 )  
 M45  
 M46

**M46 ... Cut off foil**

Partial function of the foil macros.  
 ... see also [M44](#) (grip), [M36](#) (pull out) and [M45](#) (release).

e.g.: M44  
 M36 ( 9530.0 , 2000.0 )  
 M45  
 M46

**M48() ... Loop start**

<i>p1</i>	Number	0... <i>n</i> Number of execution
-----------	--------	-----------------------------------

The function enables to execute a part of a program several times.  
 The parameter *p1* defines the number of executions of a part of program between M48 and [M49](#).  
 If 0 is indicated, the inquiry of the number will be caused per MMI-dialog by the [H20](#) function.

e.g.: M48 ( 12 )  
 .....  
 .....  
 M49



**M49 ... Loop end**

... see also [M48](#).

e.g.: M48 ( 12 )  
 .....  
 .....  
 .....  
 M49

**M50 ... Remote vacuum pump 1 ON (Serial mode)**

... see also [M51](#) and [M70](#).

**M51 ... Remote vacuum pump 2 ON (Parallel mode)**

... see also [M50](#) and [M71](#).

**M52() ... LPA-Laser ON (Laser Part Alignment)**

p1	Point-No	Number of the align point (1 or 2)
----	----------	------------------------------------

This function determines the X/Y coordinates of the align point (marker) in the LPA-operation mode (see [M23](#)).  
 ... see also [M72](#).

e.g.: M23  
 G0 X50 Y70  
 M52 ( 1 )  
 G0 X2000 Y56  
 M52 ( 2 )  
 M72

**M53 ... Tile mode ON**

This function will be used during cutting of parallel straight lines. This function disables rotating of the cutting knife during setting to the next parallel straight line. The next parallel straight line will be cut with the other knife edge. Therefore minor inaccuracies caused by rotating the cutting knife can be avoided. So the cut parts are absolute parallel.  
 ... see also [M73](#).

**M54 ... Couple labeller**

This function will be executed automatically by the CNC, if the labeling-mode will be activated by [M13](#).  
 ... see also [M74](#).

**M55 ... Vacuum cleaner ON**

... see also [M75](#).

**M56 ... Release bar DOWN**

Code which can be generated automatically by the material macros [M34](#) (grip) and [M35](#) (release).  
... see also [M76](#).

**M57 ... Gripper jaws OPEN**

Code which can be generated automatically by the material macros [M34](#) (grip) and [M35](#) (release).  
... see also [M77](#).

**M58 ... Material UNCLAMPED**

Code which can be generated automatically by the material macros [M34](#) (grip) and [M35](#) (release).  
... see also [M78](#).

**M59 ... Lift table UP**

Code which can be generated automatically by the material macros [M34](#) (grip) and [M35](#) (release).  
... see also [M79](#).

**M61 ... Material holders (Pins) OUT**

Code which can be generated automatically by the material macros [M34](#) (grip) and [M35](#) (release).  
... see also [M81](#).

**M62 ... Needle gripper OUT (Presser bar DOWN)**

Code which can be generated automatically by the material macros [M34](#) (grip) and [M35](#) (release) respectively also by [M41](#) or [M165](#).  
... see also [M82](#).

**M63 ... Pneumatic knife DOWN**

... see also [M83](#).

**M64() ... Set tool number to <tool\_no>**

<i>p1</i>	Tool-No	0 ... no tool is in spindle 1 ... tool no. 1 is in spindle <i>n</i> ... tool no. <i>n</i> is in spindle
-----------	---------	---

If tool data does not exist (e.g. initial start-up, error of the control), the selected tool can be determined manually with this function.  
The number and the data of the selected tool is stored even after switching off the machine.

e.g.: M64 ( 1 )

**M66() ... Ultrasonic unit ON (for peeling knife)**

<i>p1</i>	Amplitude	Ultrasonic-amplitude in [%]
-----------	-----------	-----------------------------

Switch on the ultrasonic unit for the peeling knife.  
... see also [M86](#).

e.g.: M66 ( 35 )

**M69 ... Gripper arm to GRIP position**

Code which can be generated automatically by the material macros [M34](#) (grip) and [M35](#) (release).  
... see also [M89](#).

**M70 ... Remote vacuum pump 1 OFF**

... see also [M50](#).

**M71 ... Remote vacuum pump 2 OFF**

... see also [M51](#).

**M72 ... LPA-Laser OFF**

... see also [M52](#).

**M73 ... Tile mode OFF (default at program start)**

... see also [M53](#).

**M74 ... Decouple labeller**

This function will be executed automatically by the CNC, if the labeler-mode will be left with [M10](#), [M11](#), ...  
... see also [M54](#).

**M75 ... Vacuum cleaner OFF**

... see also [M55](#).

**M76 ... Release bar UP**

Code which can be generated automatically by the material macros [M34](#) (grip) and [M35](#) (release).  
... see also [M56](#).

**M77 ... Gripper jaws CLOSED**

Code which can be generated automatically by the material macros [M34](#) (grip) and [M35](#) (release).  
... see also [M57](#).

**M78 ... Material CLAMPED**

Code which can be generated automatically by the material macros [M34](#) (grip) and [M35](#) (release).  
... see also [M58](#).

**M79 ... Lift table DOWN**

Code which can be generated automatically by the material macros [M34](#) (grip) and [M35](#) (release).  
... see also [M59](#).

**M81 ... Material holders (Pins) IN**

Code which can be generated automatically by the material macros [M34](#) (grip) and [M35](#) (release).  
... see also [M61](#).

**M82 ... Needle gripper IN (Presser bar UP)**

Code which can be generated automatically by the material macros [M34](#) (grip) and [M35](#) (release) respectively also by [M41](#) or [M165](#).  
... see also [M62](#).

**M83 ... Pneumatic knife UP**  
 ... see also [M63](#).

**M86 ... Ultrasonic unit OFF (for peeling knife)**  
 Switch off the ultrasonic unit for the peeling knife.  
 ... see also [M66](#).

**M89 ... Gripper arm to BASIC position**  
 Code which can be generated automatically by the material macros [M34](#) (grip) and [M35](#) (release).  
 ... see also [M69](#).

**M91() ... START of conditional jump**

<i>p1</i>	Condition No	0... <i>n</i>
-----------	--------------	---------------

The function enables a jump over a part of the program.  
 The condition number will be sent to PLI, which then reports back the result on the variable **\$O\_MRETV** .  
**\$O\_MRETV** = 1 → Part of program between M91 and the next M92 will be ignored.  
**\$O\_MRETV** = 0 → Part of program between M91 and the next M92 will be executed.

e.g.: M91 ( 17 )  
 .....  
 .....  
 .....  
 M92

**M92 ... END of conditional jump**  
 ... see also [M91](#).

e.g.: M91 ( 1 )  
 .....  
 .....  
 .....  
 M92

**M100 ... Switch ON vacuum at section 1**  
 ... see also [M120](#).  
 Instead of this code, [M140](#) can be used also to switch on a vacuum section.

M101 ... Switch ON vacuum at section 2

... see also [M121](#).  
 Instead of this code, [M140](#) can be used also to switch on a vacuum section.

M102..108... Switch ON vacuum at section 3..9

... see also [M122..M128](#).  
 Instead of these codes, [M140](#) can be used also to switch on a vacuum section.

M109 ... Lift table vacuum ON (section 10)

Code which can be generated automatically by the material macros [M34](#) (grip), [M35](#) (release) and [M33](#) (cut off).  
 ... see also [M129](#).

M110 ... Foil table vacuum ON (section 11)

Service-Code which will be generated automatically by the foil macros [M44](#) (grip), [M45](#) (release) and [M46](#) (cut off).  
 ... see also [M130](#).

M111() ... Additional material clamp number <n> ON

<i>p1</i>	Clamp number	1..n
-----------	--------------	------

This function enables extending additional material grippers by pulling out of several layers of material on the cutting table. Thereby the material will be fixed by pulling out of further layers on the cutting table and cannot be moved (especially with adhesive materials).  
 ... see also [M131](#).

e.g.: M111 ( 1 )

M120 ... Switch OFF vacuum at section 1

... see also [M100](#).  
 Instead of this code, [M141](#) can be used also to switch off a vacuum section.

M121 ... Switch OFF vacuum at section 2

... see also [M101](#).  
 Instead of this code, [M141](#) can be used also to switch off a vacuum section.

M122..128... Switch OFF vacuum at section 3..9

... see also [M102..M108](#).  
Instead of these codes, [M141](#) can be used also to switch off a vacuum section.

M129 ... Lift table vacuum OFF (section 10)

Code which can be generated automatically by the material macros [M34](#) (grip), [M35](#) (release) and [M33](#) (cut off).  
... see also [M109](#).

M130 ... Foil table vacuum OFF (section 11)

Service-code which will be generated automatically by the foil macros [M44](#) (grip), [M45](#) (release) and [M46](#) (cut off).  
... see also [M110](#).

M131() ... Additional material clamp number <n> OFF

<i>p1</i>	Clamp no	1..n
-----------	----------	------

... see also [M111](#).

e.g.: M131 ( 1 )

M137 ... Tool change and alignment for peeling knife

Cutting head will be moved to a special position. In this position it is possible to lock the movement of the tangential axis with a pin and to change the peeling knife. After changing it is necessary to unlock the pin.  
&nbsp;  
After knife change the alignment of the cutting edge of the peeling knife will be performed.

M138 ... Camera to calibrate position

M140() ... Switch ON vacuum section

<i>p1</i>	SectionNum	1..n
-----------	------------	------

M140 can be use instead of [M100..M108](#) to switch on an vacuum section.  
... see also [M141](#).

e.g.: M140 ( 4 )

**M141() ... Switch OFF vacuum section**

<i>p1</i>	SectionNum	1..n
-----------	------------	------

M141 can be use instead of [M120..M128](#) to switch off an vacuum section.  
 ... see also [M140](#).

e.g.: M141 ( 4 )

**M142() ... Dynamic vacuum zone configuration**

This function activates the dynamic control of the vacuum zone on the cutting table of the machine. M142 possesses two different functions:  
[Configuration in rows](#)  
[Configuration by zone number](#)

---

**M142 - Configuration in rows**

<i>p1</i>	Row	Row number 1..n along the X-axis
<i>"t1"</i>	Column-Config	Column configuration as text consisting of the characters ... ' - ' ... The zone is always inactive. ' * ' ... The zone will be switched on/off <b>dynamically</b> . ' 1 ' ... The zone is <b>always</b> switched on.

With this function each vacuum row of the table can be configured.  
 The deletion of the configuration occurs with the function [M30](#).

e.g.: M142 ( 1 , "----\*----" )  
 M142 ( 2 , "--\*\*1\*--" )  
 M142 ( 3 , "\*1111\*\*" )  
 M142 ( 4 , "\*111111\*" )  
 M142 ( 5 , "\*1111\*\*" )  
 M142 ( 6 , "--\*111\*--" )  
 M142 ( 7 , "\*1111\*-" )  
 M142 ( 8 , "\*11111\*-" )  
 M142 ( 9 , "--\*1111\*-" )  
 M142 ( 10 , "\_\_\_\*\*\*\*\_" )  
 M142 ( 11 , "-----" )  
 M142 ( 12 , "-----" )

---

**M142 - Configuration by zone number**

<i>"t1"</i>	Address	single zone address "xxyy" or zone field "xxyy-xxyy" with indication of two corner points.
-------------	---------	---

With this function vacuum zones can be switched on single or as area.  
 Switch off (delete of the configuration) occurs with [M30](#).  
 Each zone will be addressed by a 4-digit number. The first both digits in the range 01..99 defines the row number along the X-axis and the second both digits 01..32 defines the column number along the Y-axis.



e.g.: M142 ( "0307" )  
 M142 ( "0602" )  
 M142 ( "1104" )

M142 ( "0203-0705" )  
 M142 ( "1106-1108" )

M143() ... Simple dynamic vacuum (full table area)

p1	Delta	0	Only that X/Y-zone will be activated, in which the operating tool is located at the moment.
		...	
		1	One rotating zone to the present X/Y-zone will be activated.
		...	
		2	Two rotating zones to the present X/Y-zone will be activated.
		...	

This function activates the dynamic vacuum zone on the full table area.  
 ... see also [M142](#).

e.g.: M143 ( 1 )

**M152() ... Control for material dispenser**

This function serves to control the material dispenser. There are two different styles for this function.  
[within a part program](#)  
[for service purposes](#)

---

**M152** within a part program

<i>p1</i>	Length	necessary material length in [mm] or [inch]
"t1"	Mat-ID	Material identification (name of the roll)
"t2"	Additional-Info	Up ... uncoil direction up Down ... uncoil direction down Grip1 ... grip position at height 1 (down) Grip2 ... grip position at height 2 (middle) Grip3 ... grip position auf height 3 (up)

Positions the material changer on the requested material. The additional information will be separated by commas within the text parameter.

e.g.: M152 ( 7500.0 , "CarbonFiber17" , "Up,Grip2" )

---

**M152** for service purposes

<i>p1</i>	Roll No	Number 1..n of the material roll
<i>p2</i>	Sub-Pos	0 ... Changing position 1 ... grip position at height 1 (corresponds "Grip1") 2 ... grip position at height 2 (corresponds "Grip2") 3 ... grip position at height 3 (corresponds "Grip3")

This variant will only be used for service purposes or for initiation of a machine.

e.g.: M152 ( 8 , 2 )

**M154 ... Enable 2nd cutting head**

... see also [M155](#).

**M155 ... Disable 2nd cutting head**

... see also [M154](#).

**M160 ... End of loading program section**

This function marks the end of a loading program section.  
 It will only be used for separated loading and cutting machines.  
 ... see also [M161](#).

**M161 ... End of cutting program section**

This function marks the end of the cutting program section.  
 It will only be used for separated loading and cutting machines.  
 ... see also [M160](#).

**M164() ... Posit conveyor (+) or (-) to a switch**

["t1"]	Direction	"+" ... movement occurs in direction X+ (standard) "- " ... movement occurs in direction X-
--------	-----------	--

This function activates the movement of the conveyor till a "switch" (light barrier), buffer,...) will be reached

e.g.: M164 ( "+" )

**M165() ... Material unloading sequence**

p1	Mode	0 ... without recognition of zones 1 ... with recognition of zones
	p2	Distance

This function activates a special loading and unloading process. Zones can exist for some materials, in which it is not allowed to cut. These zones will be recognized by the sensor while loading the material. Then the control determines the coordinates of the forbidden zone and checks, if the program reaches into this zone. If the coordinates are positioned out of the zone, the program will be executed, if they are positioned within the forbidden zone, a new loading and unloading process will be started.

e.g.: M165 ( 1 , 4000.0 )




**M810 ... CLOSE toolsetting equipment cover**

Service code which will be generated automatically by [M37](#) and [M43](#).  
 ... see also [M811](#).

**M811 ... OPEN toolsetting equipment cover**

Service code which will be generated automatically by [M37](#) and [M43](#).  
 ... see also [M810](#).

**M828() ... Oscillate axis for PID-Adjustment**

"t1"	Axis	Name of the axis
p1	Min-Pos	Minimum position in [mm] or [inch]
p2	Max-Pos	Maximum position in [mm] or [inch]
[p3]	Profile	<p>0 ...  sinusoidal G0 acceleration                      Parameter <b>ITP.AX[n].SIN</b> = 1                      For acceleration parameter <b>SAB.AX[n].AGO</b> will be used.</p> <p> rectangular G0 acceleration                      Parameter <b>ITP.AX[n].SIN</b> = 0</p> <p>1 ...  trapezoidal G1 acceleration                      For acceleration parameter <b>SAB.AX[n].A</b> will be used.  <b>SAB.TL.TAPE_t_Ruck</b> defines the raise time for TAPE axis,                      for all other axes <b>SAB.MDI_ADT</b> will be used.</p>

Oscillating function of the axis to adjust the control parameter manually.  
 The axis executes G0 or G1 movements between the indicated max/min positions until a <STOP> is pressed.

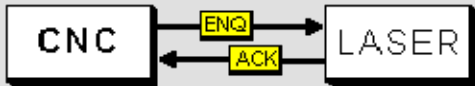
e.g.: **M828 ( "X" , 100.0 , 800.0 , 1 )**

**CNC-6000/EP**

The oscillating function can also be used for APM axes.  
 In this case the third parameter p3 will be ignored and for the profil the default parameters of the APM axis will be used.

e.g.: **M828 ( "U1" , -1000.0 , 2000.0 )**

**M830() ... Autom. calibration of axis with laser system**

"t1"	<b>Axis</b>	Name of axis
p1	<b>Start Pos</b>	Start position in [mm] or [inch]
p2	<b>End-Pos</b>	End position in [mm] or [inch]
p3	<b>Step</b>	Step size in [mm] or [inch]
p4	<b>Delay</b>	Dwell time in [s]
p5	<b>Mode</b>	0 ... Only dwell time 1 ... RS-232 handshake over console plug of the CNC-CPU  2 ... M830 handshake to PLI 3 ... <START> key

Function to determine the correction data of the pitch error compensation.

e.g.: **M830 ( "X" , 0.0 , 5000.0 , 25.0 , 0.8 , 1 )**

**CNC-6000/EP**

The function can also be used for APM axes.

e.g.: **M830 ( "U1" , 0.0 , 10000.0 , 100.0 , 1.0 , 0 )**

**M832 ... Toolsetting equipment to BASIC position**

Service code which will be generated automatically by [M37](#) and [M43](#).  
 ... see also [M833](#).

**M833 ... Toolsetting equipment to MEASURING position**

Service code which will be generated automatically [M37](#) and [M43](#).  
 ... see also [M832](#).

**M834 ... Label transfer (printer --> placing unit)**

Service code which generated automatically by [M20](#).  
 ... see also [M835](#).

**M835 ... Label transfer unit to basic position**

Service code which will be generated automatically by [M20](#).  
 ... see also [M834](#).

M836 ... Foil table UP

Service code which will be generated automatically by the foil macros [M44](#) (grip) and [M45](#) (release).  
... see also [M837](#).

M837 ... Foil table DOWN

Service code which will be generated automatically by the foil macros [M44](#) (grip) and [M45](#) (release).  
... see also [M836](#).

M838 ... Foil table OUT

Service code which will be generated automatically by the foil macros [M44](#) (grip) and [M45](#) (release).  
... see also [M839](#).

M839 ... Foil table IN

Service code which will be generated automatically by foil macros [M44](#) (grip) and [M45](#) (release).  
... see also [M838](#).

M840() ... Material gripper to Z position <posit>

<i>p1</i>	Pos-Index	1..n
-----------	-----------	------

Material gripper will be positioned to configured Z-heights.  
The positions are stored in the driving module.

e.g.: M840 ( 1 )

M842 ... Couple cabin

Service code which will be generated automatically by [M38](#) and [M39](#).  
... see also [M843](#).

M843 ... Decouple cabin

Service code which will be generated automatically by [M38](#) and [M39](#).  
... see also [M842](#).

M999() ... Display software info string		
p1	Info-No	0 ... CNC version (default)
		1 ... Compile date/time
		2 ... Compiler version
		3 ... Company
		4 ... Programmer
		10 ... Protocol and version of inkjet interface

Display of CNC version number and additional information related to the software.

e.g.: M999 ( 0 )

H10() ... Sync. ext. display device for window cutting		
p1	Code	1 ... Start of the part program
		2 ... Transfer of a window cutting ( <a href="#">M36</a> with conveyor)
		9 ... End of the part program

Synchronization of an external display device.  
The codes can be generated automatically by setting of the CNC-parameter [SAB.FL\\_17](#).

e.g.: H10 ( 9 )

H20 ... Request data string from MMI	
Will be generated automatically by <a href="#">M48(0)</a> and serves for the internal CNC/MMI communication.	

H40() ... Increment production counter at MMI		
p1	Increment	Amount of increments.

This function will increment the production counter at the MMI by the specified amount.

e.g.: H40 ( 3 )

## 11 G-Codes, M-Codes, T-Codes, and H-Codes for 3D Machines

### G00 ... Rapid traverse

The axes will be set independent of each other with max. speed to the defined end point.  
... see also [G01](#).

e.g.: **G0 X3900 Y1250 Z100 C90 A-90 B237**

### G01 ... Linear interpolation

The axes will be interpolated linear to the indicated end point with a programmed speed.  
... see also [G00](#).

e.g.: **G1 X200 Y300 Z70 F20000**

### G04 ... Dwell time at end of move

A delay time (default 1s) will be executed at the end of the block .

### G70 ... Programming in [inch]

... see also [G71](#).

### G71 ... Programming in [mm]

... see also [G70](#).

### G79 ... Programming based on machine origin

The programmed coordinates are related to the absolute machine origin, this means active offsets will be ignored.

### G90 ... Absolute value programming

... see also [G91](#).



**G91 ... Incremental value programming**

... see also [G90](#).

**G98 ... Tool-Center-Mode active (TCP positions)**

The programmed coordinates are related to the tool center point.  
 ... see also [G99](#).

**G99 ... Tool-Center-Mode inactive (NOM positions)**

The programmed coordinates are related to the axes.  
 ... see also [G98](#).

**T() ... Tool-Change command**

<i>p1</i>	<b>Tool No</b>	0 ... no tool is clamped
		1 ... tool no 1 is clamped
		<i>n</i> ... tool no <i>n</i> is clamped

Function to change the tool.

e.g.: **T ( 12 )**

**M00 ... Unconditional stop**

The function M00 causes an interruption of the program at the block in which it is located.  
 Press <START> to continue the cutting program.

**M01 ... Optional stop**

The cutting program stops only at the programmed code M01 (=optional stop), if the mode of the program flow is preselected with "**stop on M01**" in the menu 'production'. Press <START> to continue the cutting program.

M03() ... Spindle unit ON cw		
<i>p1</i>	<b>speed</b>	Number of rotational speed of a spindle [rpm]
<i>[p2]</i>	<b>spindle no</b>	Number of spindle (default 1)
<p>Start of the spindle clockwise. If the PLI signal <b>\$O_SPCOLD</b> is set, the spindle will be warmed up with a reduced spindle speed.                      ... see also <a href="#">M04</a> and <a href="#">M05</a>.</p> <p>e.g.: <b>M03 ( 20000 , 1 )</b></p>		

M04() ... Spindle unit ON ccw		
<i>p1</i>	<b>speed</b>	number of rotational speed of a spindle [rpm]
<i>[p2]</i>	<b>spindle no</b>	number of spindle (default 1)
<p>Start of the spindle counterclockwise (ccw). If the PLI signal <b>\$O_SPCOLD</b> is set, the spindle will be warmed up with a reduced spindle speed.                      ... see also <a href="#">M03</a> and <a href="#">M05</a>.</p> <p>e.g.: <b>M04 ( 20000 , 1 )</b></p>		

M05() ... Spindle unit and coolant OFF		
<i>[p1]</i>	<b>spindle no</b>	Number of spindle (default 1)
<p>Stop of the spindle.                      ... see also <a href="#">M03</a> and <a href="#">M04</a>.</p> <p>e.g.: <b>M05 ( 1 )</b></p>		

M07 ... Mist coolant ON		
<p>... see also <a href="#">M08</a> / <a href="#">M09</a>.</p>		

M08 ... Fluid coolant ON		
<p>... see also <a href="#">M07</a> / <a href="#">M09</a>.</p>		

**M09 ... Coolant OFF**

... see also [M07](#) / [M08](#).

**M10 ... Ultrasonic unit OFF**

**Switch off** the US-unit.  
... see also [M11](#).

**M11() ... Ultrasonic unit ON**

<i>p1</i>	<b>Amplitude</b>	Ultrasonic-amplitude in [%]
-----------	------------------	-----------------------------

**Switch on** the US-unit  
... see also [M10](#).

e.g.: **M11 ( 30 )**

**M12 ... Air-driven spindle OFF**

... see also [M13](#).

**M13 ... Air-driven spindle ON**

Switch **ON** the pneumatic air-driven spindle clamped instead of the ultrasonic tool.  
... see also [M12](#).

**M14 ... Mapping System OFF**

... see also [M15](#).

**M15 ... Mapping System ON**

Tooltip cutting depth will be held constant with this function; used for possible table inaccuracies.  
... see also [M14](#).

**M16 ... Manual blade align (set angle to zero)**

The actual position of the rotation axis of the cutting knife can be defined as 0°-position with this function.

**M17() ... Display message at operating panel**

"t1"	<b>Text</b>	Text of message to display
------	-------------	----------------------------

This function activates the message window above the display field "Errors and Messages" in the "Production" and "MDI" screens.

The message will remain until M17 is issued again.

e.g.: **M17 ( "Remove waste" )**  
**M0**  
**M17 ; Message will be deleted**

**M18 ... Cancel orientation mode for spindle stop**

... see also [M19](#).

**M19 ... Activate orientation mode for spindle stop**

... see also [M18](#).

**M20 ... Height following system OFF**

Prepares the height following system to be turned off.  
 The next Z position command will switch off the height following system.  
 ... see also [M21](#) and [M22](#).

**M21 ... Height following system ON without F.L.U.**

Prepares the height following system to be turned on.  
 The next Z position command will switch on the height following system without **Flute Length Utilization**.  
 ... see also [M20](#) and [M22](#).

**M22 ... Height following system ON with F.L.U. *MVA***

Prepares the height following system to be turned on.  
 The next Z position command will switch on the height following system with **Flute Length Utilization**.  
 ... see also [M20](#) and [M21](#).

**M23 ... Height following shoe DOWN**

... see also [M24](#).

**M24 ... Height following shoe UP**

... see also [M23](#).

**M25() ... Presser foot DOWN with low pressure**

<i>[p1]</i>	<b>HighPressZ</b>	0 ... Always low pressure (default) 1 ... High pressure for Z down movement
-------------	-------------------	--

Lowers the presser foot with low pressure for [routing](#).  
 If optional parameter *p1* is set to one, high pressure will be used for Z down movements.  
 This can be used to hold the material with higher force during drilling holes.  
 ... see also [M26](#) / [M27](#).

e.g.: **M25 ( 1 )**

**M26 ... Presser foot DOWN with high pressure**

Lowers the presser foot with high pressure for the [detagging mode](#).  
 ... see also [M25](#) / [M27](#).

**M27 ... Presser foot UP**

Lifts up the presser foot for [positioning](#) the X/Y-axes.  
 ... see also [M25](#) / [M26](#).

**M28 ... DISABLE tool lifting with an active feedhold (default)**

... see also [M29](#).

**M29 ... ENABLE tool lifting with an active feedhold**

... see also [M28](#).

**M30 ... End of program**

This function marks the end of the program and is always in a separate block.

**M31 ... Crossbeam (all axis) to basic position 1**

... see also [M32](#).

**M32 ... Crossbeam (all axis) to basic position 2**

... see also [M31](#).

**M34() ... CUTTER-Mode**

<i>p1</i>	<b>height1</b>	Z-height of the tool center point for G0-positioning in [mm] or [inch]
<i>p2</i>	<b>height2</b>	Z-height of the tool center point for change of direction (positioning of the rotation axis at corners) in [mm] or [inch]
<i>p3</i>	<b>height3</b>	Z-height of the tool center point for interpolations in [mm] or [inch]
<i>[p4]</i>	<b>speed</b>	Plunge speed ( <i>height2</i> → <i>height3</i> ) of the tool in [mm/min] or [inch/min]

This function activates the cutting mode.  
Z axis lifts up automatically between cutting and positioning with the heights defined in the parameters.

... see also [machining modes](#).

e.g.: **M34 ( 50.0 , 10.0 , -0.1 , 500.0 )**

**M35 ... ROUTER-Mode**

This function activates the routing mode.  
No automatic control of the Z-axis occurs in the routing operation in contrast to the cutting operation.

... see also [machining modes](#).

**M36 ... LPA-Offsets enabled (Laser Part Alignment)**

This function activates the LPA (Laser-Part-Alignment) operation mode. LPA finds out the actual position of a work piece in the X/Y coordinate system. On the work piece (material) are two defined markers. Their position will be determined with help of the function [M44](#). Then the coordinates of the part program will be transformed (moved and rotated) to the position of the work piece.

... see also [machining modes](#).

e.g.: **M36**  
**G0 X50 Y70**  
**M44 ( 1 )**  
**G0 X2000 Y56**  
**M44 ( 2 )**  
**M45**

**M37 ... LABEL-Mode**

This function activates the labeler.  
 The labels can be printed with [M80](#) and placed with [M81](#).

... see also [machining modes](#).

e.g.: **M37**  
**M80 ( 1 , 1 , "TESTPRINT" )**  
**G0 X3000 Y500**  
**M81 ( 45.0 )**  
**M80 ( 1 , 12 , "American" , "GFM" , 4400 )**  
**G0 X3200 Y600**  
**M81 ( 90.0 )**

**M38 ... Enable FRONT area for operator**

This function is only used for machines with 2-area-operation. It enables the front area of the machine for the operator.

The function has different meanings depending on the equipment used on the machine (light barrier, sound protection enclosure, etc.).

The light barriers of the front area are inactive.

The sound protection enclosure moves to the rear area of the machine.

... see also [M39](#).

**M39 ... Enable REAR area for operator**

... see also [M38](#).

**M40 ... Vacuum pump OFF**

... see also [M41](#).

**M41 ... Vacuum pump ON**

... see also [M40](#).

**M42() ... Conveyor incremental move**

<i>p1</i>	<b>Distance</b>	Moving length of the conveyor in [mm] or [inch].
-----------	-----------------	--

This function moves the conveyor with the indicated distance.

e.g.: **M42 ( 8000.0 )**

**M43 ... Material loading (conveyor and edge detect)**

Activates the loading sequence of the material stack.

The material will be pulled forward with the conveyor into the operation area of the machine. The front of the material stack will be detected and pulled forward to the position of the fixed clamping bar. The material can then be clamped with the function [M53](#).

**Note:** For machines without a conveyor, the loading/unloading of the material can be executed with the codes [M55/M56](#).

**M44() ... LPA-Laser ON (Laser Part Alignment)**

<i>p1</i>	<b>Point-No</b>	Number of the align point (1 or 2)
-----------	-----------------	------------------------------------

This function determines the X/Y coordinates of the align point (marker) in the LPA-operation mode (see [M36](#)).

... see also [M45](#).

e.g.: **M36**  
**G0 X50 Y70**  
**M44 ( 1 )**  
**G0 X2000 Y56**  
**M44 ( 2 )**  
**M45**

**M45 ... LPA-Laser OFF**

... see also [M44](#).



**M46 ... Measure stack thickness**

Measures the thickness of the material stack at the actual X/Y position.

**M50 ... Extraction motor OFF**

... see also [M51](#).

**M51 ... Extraction motor ON**

... see also [M50](#).

**M53 ... Material clamping sequence at current position**

Activates the clamping of the material stack.

The function will be called automatically within [M55](#).

The material will be clamped at the current X-position with a movable clamping bar. Then the movable clamping bar will be unclamped from the X-slide and the temporary operation limits of the machine will be set accordingly.

... see also [M54](#).

**M54 ... Material unclamping sequence**

Releases the clamping of the material stack.

The function will be called automatically within [M56](#).

The unclamped movable clamping bar will be clamped on the X-slide and the temporary operation limit of the machine will be canceled.

... see also [M53](#).

**M55 ... Material loading**

Activates the loading sequence of the material stack.

The material will be forwarded into the operation area of the machine and then clamped with the function [M53](#).

... see also [M56](#).

**M56 ... Material unloading (with movable clamps)**

Activates the unloading sequence of the material stack.

Clamping of the material will be released with the function [M54](#). Then the material stack will be forwarded out of the operation area of the machine.

... see also [M55](#).

**M57() ... Additional material clamp OFF**

<i>p1</i>	<b>Clamp number</b>	1..n
-----------	---------------------	------

... see also [M58](#).

e.g.: **M57 ( 1 )**

**M58() ... Additional material clamp ON**

<i>p1</i>	<b>Clamp number</b>	1..n
-----------	---------------------	------

This function enables extending additional material grippers for material handling.  
 ... see also [M57](#).

e.g.: **M58 ( 1 )**

**M61 ... Knife Change**

Cutting head will be moved to a special position. In this position it is possible to lock the movement of the tangential axis with a pin and to change the cutting knife. After changing the knife it is necessary to unlock the pin.

**M62 ... Tool setting (and alignment)**

This function executes the measuring of the tool length and the alignment of the knife edge. The tool measuring will be executed automatically after the reference cycle of the axes and a [tool change](#).

**M63 ... Tool probing (Length)**

The function measures the actual tool length and compares it with the length measured by [M62](#). If a determined difference is exceeded (e.g. by break of knife or attrition) an error message will be caused.

**M64() ... Set tool number to <tool\_no>**

<i>p1</i>	<b>Tool-No</b>	0 ... no tool is in spindle 1 ... tool no. 1 is in spindle <i>n</i> ... tool no. <i>n</i> is in spindle
-----------	----------------	---

If tool data does not exist (e.g. initial start-up, error of the control), the selected tool can be determined manually with this function.  
The number and the data of the selected tool is stored even after switching off the machine.

e.g.: **M64 ( 1 )**

**M65() ... Tool length correction for part programs**

<i>p1</i>	<b>Corr</b>	Correction value of the tool length in [mm] or [inch]
-----------	-------------	---

The actual length of the used tool will be changed according to the specified value.  
A negative correction will cut deeper.  
A positive correction will cut less material.

e.g.: **M65 ( -1.5 )**

**M71 ... Detag gantry ROUTING mode**

... see also [M72](#).

**M72 ... Detag gantry DETAGGING mode**

... see also [M71](#).

**M73 ... Position mode (for disc knife)**

Deactivates the rotation mode of the disc knife.  
... see also [M74](#).

**M74() ... Rotary knife mode (for disc knife)**

<i>p1</i>	<b>speed</b>	nominal speed value for the rotating axis in [rpm] + <i>n</i> ... rotation counterclockwise. - <i>n</i> ... rotation clockwise.
-----------	--------------	---

Activates the rotation mode for the disc knife.  
... see also [M73](#).

e.g.: **M74 ( +1300.0 )**

**M80() ... Output data via template (Print label)**

M80 has two different functions.  
[Print label](#)  
[Initialize configuration data](#)

---

[M80](#) - Print label

<i>p1</i>	<b>Command</b>	1 ... Output
<i>p2</i>	<b>Mask</b>	Mask number 0..15 for print format
<i>["t1"]</i>	<b>Text1</b>	Text data for label print
<i>["t2"]</i>	<b>Text2</b>	Text data for label print
<i>[p3]</i>	<b>Value1</b>	Value for label print
<i>[p4]</i>	<b>Value2</b>	Value for label print
<i>[p5]</i>	<b>Value3</b>	Value for label print
<i>[p6]</i>	<b>Value4</b>	Value for label print
<i>[p7]</i>	<b>Value5</b>	Value for label print

Sends data for label print with template (mask definition) to RS-232-interface. It is possible to transmit up to 5 parameters 'p3...p7' and up to 2 texts 't1...t2' to the template.  
See also [M37](#) to activate the labeler and [M81](#) to place the labels.

e.g.: **M37**  
**M80 ( 1 , 1 , "TESTPRINT" )**  
**G0 X3000 Y500**  
**M81 ( 45.0 )**  
**M80 ( 1 , 12 , "American" , "GFM" , 4400 )**  
**G0 X3200 Y600**  
**M81 ( 90.0 )**

---

[M80](#) - Initialize configuration data

<i>p1</i>	<b>Command</b>	0 ... Initializing
-----------	----------------	--------------------

Reads the configuration data from the NET-disk and executes a syntax check.  
This will be executed automatically during control startup !

e.g.: **M80 ( 0 )**

M81() ... Place a label		
[p1]	<b>Angle</b>	Angle of the label in [deg]
<p>Places the label. If the label unit has a rotation axis, the specified angle will be used.                      See also <a href="#">M37</a> to activate the labeler and <a href="#">M80</a> for printing the labels.</p>		
<p>e.g.: <b>M37</b>  <b>M80 ( 1 , 1 , "TESTPRINT" )</b>  <b>G0 X3000 Y500</b>  <b>M81 ( 45.0 )</b>  <b>M80 ( 1 , 12 , "GFM-Steyr" , "Austria" , 4400 )</b>  <b>G0 X3200 Y600</b>  <b>M81 ( 90.0 )</b></p>		

M87() ... Drill cycle macro		
p1	<b>Down</b>	Relative down movement from start-position with programmed feedrate in [mm] or [inch]
p2	<b>Up</b>	Relative up movement with maximum feedrate in [mm] or [inch]
"t1"	<b>FeedType</b>	"F" ... Feedrate in [mm/min] or [inch/min] "R" ... Feedrate in [mm/rev] or [inch/rev]
p3	<b>Feedrate</b>	Feedrate for down movement
<p>This function performs a drill cycle.</p>		
<p>e.g.: <b>M87 ( 10.0 , 10.0 , "F" , 120.0 )</b></p>		

M90() ... Vacuum Intensity		
p1	<b>Intensity</b>	0...100%
<p>Function to adjust the vacuum intensity.                      Only for systems with controllable vacuum.</p>		
<p>e.g.: <b>M90 ( 75 )</b></p>		

**M91() ... START of conditional jump**

<i>p1</i>	<b>Condition No</b>	0... <i>n</i>
-----------	---------------------	---------------

The function enables a jump over a part of the program.  
The condition number will be sent to PLI, which then reports back the result on the variable **\$O\_MRETV** .  
**\$O\_MRETV = 1** → Part of program between M91 and the next M92 will be **ignored**.  
**\$O\_MRETV = 0** → Part of program between M91 and the next M92 will be **executed**.

e.g.: **M91 ( 17 )**  
.....  
.....  
.....  
**M92**

**M92 ... END of conditional jump**

... see also [M91](#).

e.g.: **M91 ( 1 )**  
.....  
.....  
.....  
**M92**

**M100 ... Vacuum section 1 OFF**

... see also [M101](#).

**M101 ... Vacuum section 1 ON**

... see also [M100](#).

**M200 ... Vacuum section 2 OFF**

... see also [M201](#).

**M201 ... Vacuum section 2 ON**

... see also [M200](#).

**M400 ... Inkjet enabled for text print**

This function activates the inkjet. The text can be printed with M420.

... see also machining modes.

```
e.g.: M400
      G0 X500 Y300
      M420 ( +30.0 , 0 , "TESTPRINT" )
      G0 X600 Y300
      M420 ( -45.0 , 2 , "AMERICAN" , "GFM" )
```

**M401 ... Inkjet enabled for shaping (draw mode)**

With this function the programmed shape can be drawn on the processing material with the inkjet.

... see also [machining modes](#).

**M420() ... Inkjet printing parameter**

M420 has two different modes.

[Standard print command which works on all inkjet printers](#)

[Print command with font control which works only on special printers](#)

**M420** - Standard print command

<i>p1</i>	Angle	Print direction 0..360°
<i>p2</i>	Mode	0 ... single line text (ASCII) 1 ... single line bar code 2 ... double line text (ASCII) 10 .... <a href="#">Font control</a>
"t1"	Line-1	Text for the upper line or for a single line
"t2"	Line-2	Text for the lower line

If the printing operation is activated with [M400](#), the text will be printed with this function.

```
e.g.: M400
      G0 X500 Y300
      M420 ( +30.0 , 0 , "TESTPRINT" )
      G0 X600 Y300
      M420 ( -45.0 , 10 , 5 , "AMERICAN" , "GFM" )
```

**M420 - Print command with font control**

Font control is only possible on printers which supports the V-Link™ interface from Videojet®.

<i>p1</i>	Angle	Print direction 0..360°
<i>p2</i>	Mode	10 ... Font control with <i>p3</i>
<i>p3</i>	Font	0 ... 5x5 single line matrix 1 5x7 single line matrix

		2 ... 7x9 single line matrix 3 ... 10x16 single line matrix 4 ... 5x7 twin line matrix 5 ... 5x7 twin line matrix (High Quality)
"t1"	Line-1	Text for the upper line or for a single line
"t2"	Line-2	Text for the lower line

If the printing operation is activated with [M400](#), the text will be printed with this function.

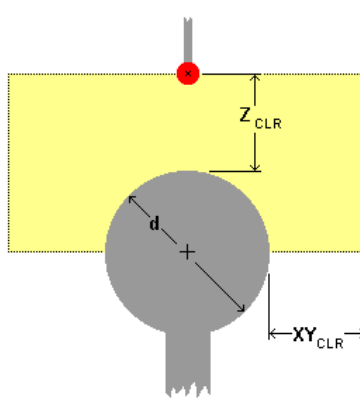
e.g.: M400  
G0 X500 Y300  
M420 ( +30.0 , 10 , 2 , "TESTPRINT" )  
G0 X600 Y300  
M420 ( -45.0 , 10 , 5 , "AMERICAN" , "GFM" )

**M429 ... Send product detect signal to inkjet**

Will be generated automatically by [M420](#) and releases the inkjet to print.

**M500() ... Probe a ball with sequence 'XY -> Z '**

p1	d	Diameter of the ball in [mm] or [inch]
p2	Z <sub>CLR</sub>	Free space of the Z-axis in [mm] or [inch]
p3	XY <sub>CLR</sub>	Free space of the X/Y-axes in [mm] or [inch]



**Measuring cycle 1 for a ball**

First the X/Y-coordinates of the ball center are determined and then the Z-coordinate.

With this function, in contrast to M501, an approximate distance between the probe and the ball ( $Z_{CLR}$ ) has to be known so that the ball will be encountered by the determination of the X/Y-coordinates. If  $XY_{CLR}$  is set to -1, the radius of the ball ( $d/2$ ) will be used as X/Y clearance.

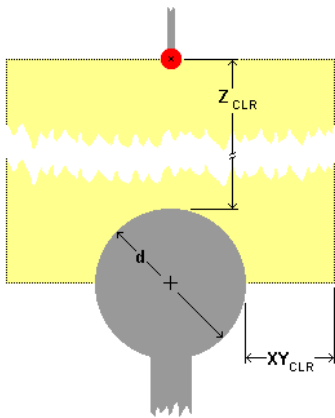
The CNC-parameter **SAB.AUTOM\_H** enables the code H500 to be generated automatically at the end of the measuring cycle.

e.g.: **M500 ( 50.0 , 30.0 , -1 )**



**M501() ... Probe a ball with sequence 'Z -> XY'**

p1	<b>d</b>	Diameter of ball in [mm] or [inch]
p2	<b>Z<sub>CLR</sub></b>	Free space of the Z-axis in [mm] or [inch]
p3	<b>XY<sub>CLR</sub></b>	Free space of the X/Y-axes in [mm] or [inch]



**Measuring cycle 2 for a ball**

First the Z-coordinate of the ball center is determined and then the X/Y-coordinates.

With this function, in contrast to M500, the distance between the probe and the ball ( $Z_{CLR}$ ) is not needed. The ball will be encountered by the determination of the X/Y-coordinates.

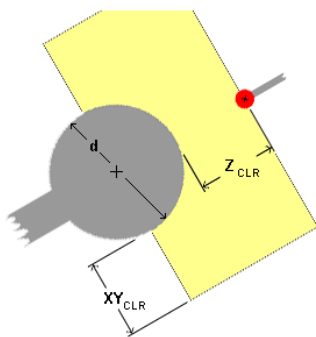
If  $XY_{CLR}$  is set to -1, the radius of the ball ( $d/2$ ) will be used as X/Y clearance.

The CNC-parameter **SAB.AUTOM\_H** enables the code H501 to be generated automatically at the end of the measuring cycle.

e.g.: **M501 ( 50.0 , 270.0 , -1 )**

**M502() ... Probe a ball along tool-vector**

p1	<b>d</b>	Diameter of ball in [mm] or [inch]
p2	<b>Z<sub>CLR</sub></b>	Free space of the virtual Z-axis in [mm] or [inch]
p3	<b>XY<sub>CLR</sub></b>	Free space of the virtual X/Y-axes in [mm] or [inch]



**Measuring cycle 3 for a ball**

This function works like [M500](#), except that the ball is mounted along the tool vector.

An approximate distance between the probe and the ball ( $Z_{CLR}$ ) has to be known so that the ball will be encountered by the determination of the virtual X/Y-coordinates.

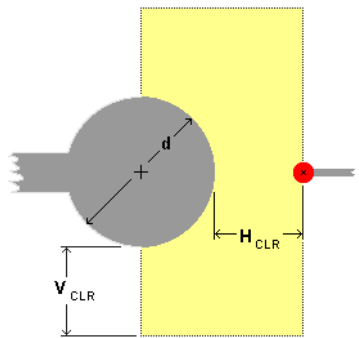
If  $XY_{CLR}$  is set to -1, the radius of the ball ( $d/2$ ) will be used as virtual X/Y clearance.

The CNC-parameter **SAB.AUTOM\_H** enables the code [H502](#) to be generated automatically at the end of the measuring cycle.

e.g.: **M502 ( 12.0 , 15.0 , -1 )**

**M505() ... Probe a ball vertically**

p1	<b>d</b>	Diameter of the ball in [mm] or [inch]
p2	<b>H<sub>CLR</sub></b>	Free horizontal space (X/Y plane) in [mm] or [inch]
p3	<b>V<sub>CLR</sub></b>	Free vertical space (X/Z or Y/Z plane) in [mm] or [inch]



**Measuring cycle 4 for a ball**

This function works like [M500](#), except that the ball is mounted on a vertical plane.

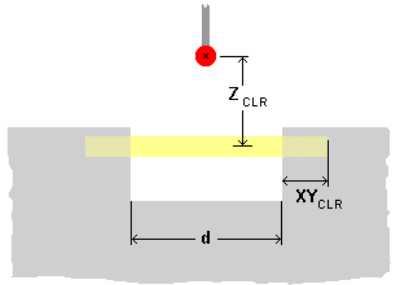
If V<sub>CLR</sub> is set to -1, the radius of the ball (d/2) will be used as vertical clearance.

The CNC-parameter **SAB.AUTOM\_H** enables the code [H505](#) to be generated automatically at the end of the measuring cycle

e.g.: **M505 ( 50.0 , 30.0 , -1 )**

**M520() ... Probe a hole in X/Y surface**

p1	<b>d</b>	Diameter of the hole in [mm] or [inch]
p2	<b>Z<sub>CLR</sub></b>	Free space of the Z-axis in [mm] or [inch]
p3	<b>XY<sub>CLR</sub></b>	Free space of the X/Y-axes in [mm] or [inch]



**Measuring cycle for a hole**

X,Y coordinate of a hole-center will be determined.

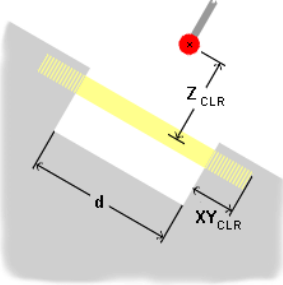
If XY<sub>CLR</sub> is set to -1, the radius of the hole (d/2) will be used as X/Y clearance.

The CNC-parameter **SAB.AUTOM\_H** enables the code H520 to be generated automatically at the end of the measuring cycle.

e.g.: **M520 ( 10.0 , 30.0 , -1 )**

**M521() ... Probe a hole along tool-vector**

p1	<b>d</b>	Diameter of the hole in [mm] or [inch]
p2	<b>Z<sub>CLR</sub></b>	Free space of the virtual Z-axis in [mm] or [inch]
p3	<b>XY<sub>CLR</sub></b>	Free space of the virtual X/Y-axes in [mm] or [inch]



**Measuring cycle 2 for a hole**

X,Y and Z coordinate of a hole-center will be determined.

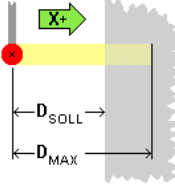
If XY<sub>CLR</sub> is set to -1, the radius of the hole (d/2) will be used as virtual X/Y clearance.

The CNC-parameter **SAB.AUTOM\_H** enables the code [H521](#) to be generated automatically at the end of the measuring cycle.

e.g.: **M521 ( 10.0 , 30.0 , -1 )**

**M530() ... Probe a surface in X/Y/Z-Direction with A0 & C0**

"t1"	<b>Direction</b>	Axis name and direction
p1	<b>D<sub>SOLL</sub></b>	Estimated distance between probe and surface in [mm] or [inch]
p2	<b>D<sub>MAX</sub></b>	Maximum distance between probe and surface in [mm] or [inch]



**Measuring cycle 1 for a surface**

X,Y or Z coordinate of a surface will be determined.

With this function, in contrast to M531, the A and C axes will be adjusted to 0°. i.e. the probe is located vertical to the X/Y-surface.

If the surface is not found within the distance D<sub>MAX</sub>, the measuring cycle will be interrupted and an error message will occur.

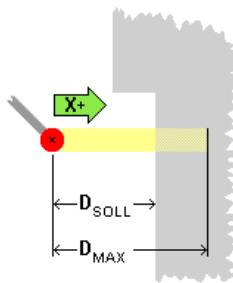
The CNC-parameter **SAB.AUTOM\_H** enables the code H530 to be generated automatically at the end of the measuring cycle.

e.g.: **M530 ( "X+" , 50.0 , 70.0 )**

**M531() ... Probe a surface in X/Y/Z-Direction at any A/C pos.**

"t1"	<b>Direction</b>	Axis name and direction
p1	<b>D<sub>SOLL</sub></b>	Estimated distance between probe and surface in [mm] or [inch]
p2	<b>D<sub>MAX</sub></b>	Maximum distance between probe and surface in [mm] or [inch]

**Measuring cycle 2 for a surface**



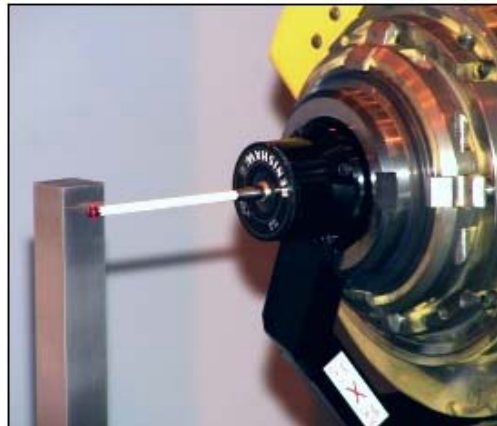
The X-, Y- or Z-coordinate of a surface will be determined.

With this function, in contrast to M530, the A and C axes can be positioned to **any angle** and will not be moved.

If the surface is not found within the distance  $D_{MAX}$ , the measuring cycle will be interrupted and an error message will occur.

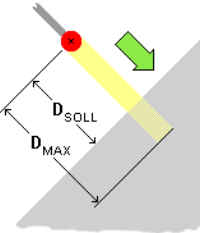
The CNC-parameter **SAB.AUTOM\_H** enables the code H531 to be generated automatically at the end of the measuring cycle.

e.g.: **G0 C90 A-90**  
**M531 ( "X+" , 50.0 , 70.0 )**



**M535() ... Probe a surface along tool-vector**

p1	<b>D<sub>SOLL</sub></b>	Estimated distance between probe and surface in [mm] or [inch]
p2	<b>D<sub>MAX</sub></b>	Maximum distance between probe and surface in [mm] or [inch]



**Measuring cycle 3 for a surface**

The X/Y/Z coordinate of touch-point on a surface will be determined.

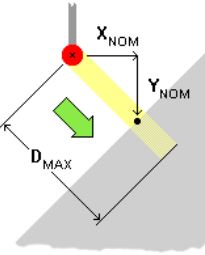
The probe will move along the current tool-vector.  
If the surface is not found within the distance  $D_{MAX}$ , the measuring cycle will be interrupted and an error message will occur.

The CNC-parameter **SAB.AUTOM\_H** enables the code H535 to be generated automatically at the end of the measuring cycle.

e.g.: **M535 ( 50.0 , 70.0 )**

**M536() ... Probe a surface along X/Y/Z vector**

p1	<b>X<sub>NOM</sub></b>	Estimated X coordinate (or distance) of touch-point in [mm] or [inch]
p2	<b>Y<sub>NOM</sub></b>	Estimated Y coordinate (or distance) of touch-point in [mm] or [inch]
p3	<b>Z<sub>NOM</sub></b>	Estimated Z coordinate (or distance) of touch-point in [mm] or [inch]
p4	<b>D<sub>MAX</sub></b>	Maximum distance between probe and touch-point in [mm] or [inch]
"t1"	<b>Mode</b>	"ABS" ... X <sub>NOM</sub> , Y <sub>NOM</sub> and Z <sub>NOM</sub> defines <b>absolute position</b> of touch-point "REL" ... X <sub>NOM</sub> , Y <sub>NOM</sub> and Z <sub>NOM</sub> defines <b>relative distance</b> to touch-point



**Measuring cycle 4 for a surface**

The X/Y/Z coordinate of touch-point on a surface will be determined.

The probe will move along the defined X/Y/Z vector.  
If the surface is not found within the distance  $D_{MAX}$ , the measuring cycle will be interrupted and an error message will occur.

The CNC-parameter **SAB.AUTOM\_H** enables the code H536 to be generated automatically at the end of the measuring cycle.

e.g.: **M536 ( 3400.0 , 780.0 , 120.0 , 20.0 , "ABS" )**  
**M536 ( -7.0 , +10.0 , +4.0 , 20.0 , "REL" )**

**M540 ... Probe Qualification**

It checks the data of the probe with the help of a calibrated measuring ball or cube mounted on the machine.

The CNC-parameter **SAB.AUTOM\_H** enables the code [H540](#) to be generated automatically at the end of the measuring cycle.

**M560 ... Machine Check**

It checks the precision of the machine axes with the help of a calibrated measuring ball or cube mounted on the machine and a calibrated probe.

The CNC-parameter **SAB.AUTOM\_H** enables the code [H560](#) to be generated automatically at the end of the measuring cycle.

**M561 ... Part align mode**

*p1* **PointNum**      Number of check points 1..2

This function activates the PA (**P**art-**A**lignment) operation mode. PA finds out the actual position of a work piece in the X/Y coordinate system. On the work piece (material) are defined probing targets. Their position will be determined with help of the function [M500](#). Then the coordinates of the part program will be transformed (moved and rotated) to the position of the work piece.

... see also [machining modes](#).

e.g.: **T1 (10)**  
**M561 ( 2 )**  
 G0 X0 Y0 Z20  
 M500 (20,20,-1)  
 G0 X2300 Y450 Z20  
 M500 (20,20,-1)

**M590 ... Clear probing tolerances**

This function clears a possibly active tolerance for the following probing cycles.

... see also [M591](#).

e.g.: **M591 ( 0.2 )**  
 G0 X3000 Y500  
 M500 ( 20 , 20 , -1 )  
**M590**

**M591 ... Set probing tolerances**

This function activates a tolerance for the following probing cycles. Exceeds the measured position of the probing target the tolerance, the part program will be terminated.

The tolerances can be deactivated with [M590](#).

The tolerances can be activated on two different ways:

[X/Y/Z tolerance](#)

[Vector tolerance](#)

**M591 X/Y/Z tolerance**

p1	X	tolerance for X position
p2	Y	tolerance for Y position
p3	Z	tolerance for Z position

e.g.: M591 ( 0.12 , 0.12 , 0.37 )  
 G0 X3000 Y500  
 M500 ( 20 , 20 , -1 )  
 M590

**M591 Vector tolerance**

p1	Vector	Vector tolerance
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e.g.: M591 ( 0.2 )  
 G0 X3000 Y500  
 M500 ( 20 , 20 , -1 )  
 M590

**M599 ... Activate external probe**

Activate external probe.  
 An external probe is mounted permanently beside the spindle.  
 On activation it will extend by a pneumatic cylinder.



**M800 ... CLOSE tool changer cover**

Service code which will be generated automatically during [tool change](#).  
... see also [M801](#).

**M801 ... OPEN tool changer cover**

Service code which will be generated automatically during [tool change](#).  
... see also [M800](#).

**M802 ... Tool clamping ON**

Service code which will be generated automatically during [tool change](#).  
... see also [M803](#).

**M803 ... Tool clamping OFF**

Service code which will be generated automatically during [tool change](#).  
... see also [M802](#).

**M804 ... Tool changer to BASIC position**

Service code which will be generated automatically during [tool change](#).  
... see also [M805](#).

**M805 ... Tool changer to CHANGE position**

Service code which will be generated automatically during [tool change](#).  
... see also [M804](#).

**M806 ... Prepare machine for tool change**

Service code which will be generated automatically during [tool change](#).

**M807 ... DISENGAGE tool from tool pocket**

Service code which will be generated automatically during [tool change](#).  
... see also [M808](#).



**M808 ... ENGAGE tool from tool pocket**

Service code which will be generated automatically during [tool change](#).  
 ... see also [M807](#).

**M809() ... Tool position selection at changer**

<i>p1</i>	<b>Station</b>	Station number 1.. <i>n</i> at respective tool changer.
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Service code which will be generated automatically during [tool change](#).

e.g.: **M809 ( 3 )**

**M810 ... CLOSE toolsetting equipment cover**

Service code which will be generated automatically by [M62](#) and [M63](#).  
 ... see also [M811](#).

**M811 ... OPEN toolsetting equipment cover**

Service code which will be generated automatically by [M62](#) and [M63](#).  
 ... see also [M810](#).

**M812 ... De-tagging gantry X COUPLED**

Service code which will be generated automatically by [M71](#) / [M72](#).  
 ... see also [M813](#).

**M813 ... De-tagging gantry X DECOUPLED**

Service code which will be generated automatically by [M71](#) / [M72](#).  
 ... see also [M812](#).

**M814 ... De-tagging gantry X brake INACTIVE**

Service code which will be generated automatically by [M71](#) / [M72](#).  
 ... see also [M815](#).

**M815 ... De-tagging gantry X brake ACTIVE**

Service code which will be generated automatically by [M71](#) / [M72](#).  
... see also [M814](#).

**M816 ... De-tagging gantry Y COUPLED**

Service code which will be generated automatically by [M71](#) / [M72](#).  
... see also [M817](#).

**M817 ... De-tagging gantry Y DECOUPLED**

Service code which will be generated automatically by [M71](#) / [M72](#).  
... see also [M816](#).

**M818 ... De-tagging gantry Y brake INACTIVE**

Service code which will be generated automatically by [M71](#) / [M72](#).  
... see also [M819](#).

**M819 ... De-tagging gantry Y brake ACTIVE**

Service code which will be generated automatically by [M71](#) / [M72](#).  
... see also [M818](#).

**M820 ... Fixed clamps UP**

Service code which will be generated automatically by [M53](#) / [M54](#).  
... see also [M821](#).

**M821 ... Fixed clamps DOWN**

Service code which will be generated automatically by [M53](#) / [M54](#).  
... see also [M820](#).

**M822 ... Movable clamps UP**

Service code which will be generated automatically by [M53](#) / [M54](#).  
... see also [M823](#).

**M823 ... Movable clamps DOWN**

Service code which will be generated automatically by [M53](#) / [M54](#).  
... see also [M822](#).

**M824 ... Movable clamps COUPLED**

Service code which will be generated automatically by [M53](#) / [M54](#).  
... see also [M825](#).

**M825 ... Movable clamps DECOUPLED**

Service code which will be generated automatically by [M53](#) / [M54](#).  
... see also [M824](#).




**M826 ... Movable clamps brake INACTIVE**

Service code which will be generated automatically by [M53](#) / [M54](#).  
... see also [M827](#).

**M827 ... Movable clamps brake ACTIVE**

Service code which will be generated automatically by [M53](#) / [M54](#).  
... see also [M826](#).

**M828() ... Oscillate axis for PID-Adjustment**

"t1"	<b>Axis</b>	Name of the axis	
p1	<b>Min-Pos</b>	Minimum position in [mm] or [inch]	
p2	<b>Max-Pos</b>	Maximum position in [mm] or [inch]	
[p3]	<b>Profile</b>	0 ...  sinusoidal G0 acceleration Parameter <b>ITP.AX[n].SIN</b> = 1   rectangular G0 acceleration Parameter <b>ITP.AX[n].SIN</b> = 0	For acceleration parameter <b>SAB.AX[n].AG0</b> will be used.
		1 ...  trapezoidal G1 acceleration	For acceleration parameter <b>SAB.AX[n].A</b> will be used. <b>SAB.TL.TAPE_t_Ruck</b> defines the raise time for TAPE axis, for all other axes <b>SAB.MDI_ADT</b> will be used.

Oscillating function of the axis to adjust the control parameter manually.  
 The axis executes G0 or G1 movements between the indicated max/min positions until a <STOP> is pressed.

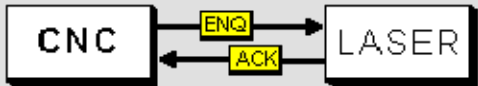
e.g.: **M828 ( "X" , 100.0 , 800.0 , 1 )**

**CNC-6000/EP**

The oscillating function can also be used for APM axes.  
 In this case the third parameter p3 will be ignored and for the profil the default parameters of the APM axis will be used.

e.g.: **M828 ( "U1" , -1000.0 , 2000.0 )**

**M830() ... Autom. calibration of axis with laser system**

"t1"	<b>Axis</b>	Name of axis
p1	<b>Start Pos</b>	Start position in [mm] or [inch]
p2	<b>End-Pos</b>	End position in [mm] or [inch]
p3	<b>Step</b>	Step size in [mm] or [inch]
p4	<b>Delay</b>	Dwell time in [s]
p5	<b>Mode</b>	0 ... Only dwell time 1 ... RS-232 handshake over console plug of the CNC-CPU  2 ... M830 handshake to PLI 3 ... <START> key

Function to determine the correction data of the pitch error compensation.

e.g.: **M830 ( "X" , 0.0 , 5000.0 , 25.0 , 0.8 , 1 )**

**CNC-6000/EP**

The function can also be used for APM axes.

e.g.: **M830 ( "U1" , 0.0 , 10000.0 , 100.0 , 1.0 , 0 )**

**M832 ... Toolsetting equipment to BASIC position**

Service code which will be generated automatically by [M62](#) and [M63](#).  
 ... see also [M833](#).

**M833 ... Toolsetting equipment to MEASURING position**

Service code which will be generated automatically by [M62](#) and [M63](#).  
 ... see also [M832](#).

**M834 ... Label transfer (printer --> placing unit)**

Service code which will be generated automatically by [M80](#).  
 ... see also [M835](#).

**M835 ... Label transfer unit to basic position**

Service code which will be generated automatically by [M80](#).  
 ... see also [M834](#).

**M842 ... COUPLE cabin**

Service code which will be generated automatically by [M38](#) and [M39](#).  
 ... see also [M843](#).

**M843 ... DECOUPLE cabin**

Service code which will be generated automatically by [M38](#) and [M39](#).  
 ... see also [M842](#).

**M844 ... Capture LPA point with camera**

**M860() ... Trimming counterholder INACTIVE (retracted)**

<i>p1</i>	<b>Number</b>	Counterholder number 1... <i>n</i>
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**TODO: Enter description here**  
 First used at machine #3503 (US-50).  
 ... see also [M861](#).

*z.B.:* **M860 ( 2 )**

**M861() ... Trimming counterholder ACTIVE (extended)**

<i>p1</i>	<b>Number</b>	Counterholder number 1... <i>n</i>
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**TODO: Enter description here**  
 First used at machine #3503 (US-50).  
 ... see also [M860](#).

*z.B.:* **M861 ( 2 )**

**M862() ... Trimming support cylinder INACTIVE (down)**

<i>p1</i>	<b>Number</b>	Support cylinder number 1... <i>n</i>
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**TODO: Enter description here**  
 First used at machine #3503 (US-50).  
 ... see also [M863](#).

*z.B.:* **M862 ( 15 )**

**M863() ... Trimming support cylinder ACTIVE (up)**

p1	<b>Number</b>	Support cylinder number 1...n
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**TODO: Enter description here**  
 First used at machine #3503 (US-50).  
 ... see also [M862](#).

z.B.: **M863 ( 15 )**

**M864() ... Trimming support cylinder UNCLAMPED**

p1	<b>Number</b>	Support cylinder number 1...n
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**TODO: Enter description here**  
 First used at machine #3503 (US-50).  
 ... see also [M865](#).

z.B.: **M864 ( 9 )**


**M865() ... Trimming support cylinder CLAMPED**

p1	<b>Number</b>	Support cylinder number 1...n
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**TODO: Enter description here**  
 First used at machine #3503 (US-50).  
 ... see also [M864](#).

z.B.: **M865 ( 9 )**


**M866 ... Headchanger to BASIC position (inactive)**

 Service code which will be generated automatically by [M66](#).  
 ... see also [M867](#).

**M867 ... Headchanger to CHANGE position (active)**

 Service code which will be generated automatically by [M66](#).  
 ... see also [M866](#).

**M868 ... Couple routing/ultrasonic head**

 Service code which will be generated automatically by [M66](#).  
 ... see also [M869](#).

**M869 ... Decouple routing/ultrasonic head**



Service code which will be generated automatically by [M66](#).  
... see also [M868](#).

**M870() ... Call mapping (scan) functions**

With this code several mapping functions can be called. **CNC-6000/EP**

- [Clear entire mapping data area](#)
- [Scan an area along X axis](#)
- [Scan 2 lines along X axis](#)
- [Mapping interpolation](#)
- [Correct every second row](#)

**M870** - Clear entire mapping data area

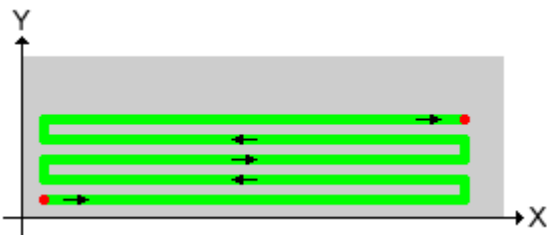
"t1"	<b>Function</b>	"ClearAll"
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The function clears the entire mapping data area at the interpolation CPU.  
This should be done before a new mapping scan will be started.

e.g.: **M870 ( "ClearAll" )**

**M870** - Scan an area along X axis

"t1"	<b>Function</b>	"ScanX"
p1	<b>Xmin</b>	X start position [mm] or [inch]
p2	<b>Xmax</b>	X end position [mm] or [inch]
p3	<b>Ymin</b>	Y start position [mm] or [inch]
p4	<b>Ymax</b>	Y end position [mm] or [inch]



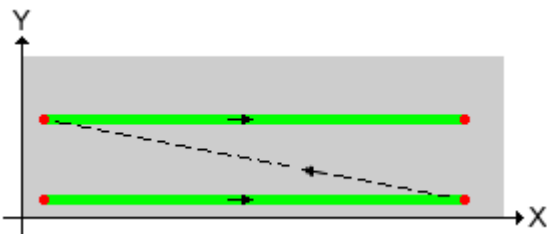
Scan an area along X axis.

e.g.: **M870 ( "ScanX" , 0 , 5000 , 0 x, 2000 )**

**M870** - Scan 2 lines along X axis



"t1"	<b>Function</b>	"ScanX2"
p1	<b>Xmin</b>	X start position [mm] or [inch]
p2	<b>Xmax</b>	X end position [mm] or [inch]
p3	<b>PosY1</b>	Y position for first line [mm] or [inch]
p4	<b>PosY2</b>	Y position for second line [mm] or [inch]

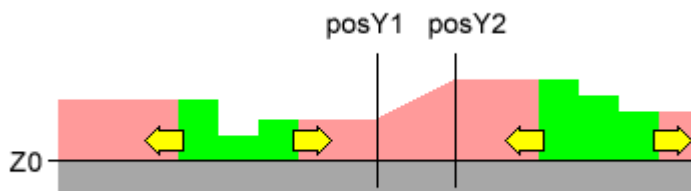


Scan 2 lines along X axis.

e.g.: M870 ( "ScanX2" , 0 , 5000 , 350 , 690 )

**M870** - Mapping interpolation

"t1"	<b>Function</b>	"Calc1"
p1	<b>PosY1</b>	Min. Y position for interpolation in [mm] or [inch]
p2	<b>PosY2</b>	Max. Y position for Interpolation in [mm] or [inch]



The function processes each Y row and does the following calculation:  
 Outside of the area **posY1** and **posY2** the found mapping values at the border will be extended accordingly.  
 Inside the area the mapping values will be interpolated.

e.g.: M870 ( "Calc1" , 400 , 650 )

**M870** - Correct every second row

"t1"	<b>Function</b>	"CorrectOddRows"
p1	<b>dVal</b>	Z Korrekturwert in [mm] oder [inch]

Correct every second row by **dVal**.

e.g.: M870 ( "CorrectOddRows" , +0.07 )

**M871 ... Save mapping data to hard disc**

**CNC-6000/EP**

This function copies the mapping data area from the interpolation CPU to the harddisk of the MMI.  
This should be done at the end of a mapping scan.

**M999() ... Display software info string**

<i>p1</i>	<b>Info-No</b>	0 ... CNC version (default)
		1 ... Compile date/time
		2 ... Compiler version
		3 ... Company
		4 ... Programmer
		10 ... Protocol and version of inkjet interface

Display of CNC version number and additional information related to the software.

```
User Message:
CNC-6000/AP: V5.24d 04/OCT/2001 3D-Router/Cutter
```

e.g.: **M999 ( 0 )**

**H10() ... Sync. ext. display device for window cutting**

<i>p1</i>	<b>Code</b>	1 ... Start of the part program
		2 ... Transfer of a window cutting ( <a href="#">M36</a> with conveyor)
		9 ... End of the part program

Synchronization of an external display device.  
The codes can be generated automatically by setting of the CNC-parameter **SAB.FL\_17**.

e.g.: **H10 ( 9 )**

**H20 ... Request data string from MMI**

Will be generated automatically by [M48\(0\)](#) and serves for the internal CNC/MMI communication.

**H21 ... Tool data updated by CNC**

Will be generated automatically at [M62](#) if after tool setting also the automatic amplitude measurement was executed.

**H40() ... Increment production counter at MMI**

<i>p1</i>	<b>Increment</b>	Amount of increments.
-----------	------------------	-----------------------

This function will increment the production counter at the MMI by the specified amount.

e.g.: **H40 ( 3 )**

**H50() ... LPA data from select program**

<i>p1</i>	<b>Alpha</b>	Rotation angle around zero point in [rad]
<i>p2</i>	<b>dX</b>	Shift in X direction (after rotation) in [m]
<i>p3</i>	<b>dY</b>	Shift in Y direction (after rotation) in [m]

This code will be inserted by the select utility in the new generated part program. It represents the LPA data of the original part program.

e.g.: **H50 ( 0.05585 , 1.234234 , 0.23237 )**

**H51 ... Internally used by select program**

This code will be used by the select utility for synchronization points within the new generated part program.

**H70 ... Activate X/Y/Z offset (from MMI)**

<i>p1</i>	<b>Name</b>	Offset-ID
-----------	-------------	-----------

Activate X/Y/Z offset which is stored at MMI.

z.B.: **H70 ( "FixturePos1" )**

**H500 ... Send tool-ball-data to MMI (after M500)**

Function to display the data determined by [M500](#) on MMI.

**H501 ... Send tool-ball-data to MMI (after M501)**

Function to display the data determined by [M501](#) on MMI.

**H502 ... Send tool-ball-data to MMI (after M502)**

p1	Para1	TODO: Description for Para1
"t1"	Text1	TODO: Description for Text1

TODO: Enter description here

e.g.: **TODO: Example** Mxx ( 0.000 , "Test" )

**H505 ... Send tool-ball-data to MMI (after M505)**

Function to display the data determined by [M505](#) on MMI.

**H510() ... Reset or perform fixture offset calculation**

p1	Command	0 ... reset 1 ... perform calculation
----	---------	--

Function to determine the position of a part (rotation and displacement) in 3D.  
Three different balls search for the X/Y/Z coordinates with the function [M500](#) or [M501](#).

e.g.: **H510 ( 0 )**

```
G0 X10 Y20 Z43
M500 ( 50.0 , 13.0 , -1 ) ; 1. Point
```

```
G0 X2000 Y20 Z43
M500 ( 50.0 , 13.0 , -1 ) ; 2. Point
```

```
G0 X200 Y700 Z43
M500 ( 50.0 , 13.0 , -1 ) ; 3. Point
```

**H510 ( 1 )**

**H520 ... Send hole-data to MMI (after M520)**

Function to display the data determined by [M520](#) on MMI.

**H521 ... Send hole-data to MMI (after M521)**

p1	Para1	TODO: Description for Para1
"t1"	Text1	TODO: Description for Text1

TODO: Enter description here

e.g.: **TODO: Example** Mxx ( 0.000 , "Test" )

**H530 ... Send surface-data to MMI (after M530)**

Function to display the data determined by [M530](#) on MMI.

**H531 ... Send surface-data to MMI (after M531)**

Function to display the data determined by [M531](#) on MMI.

**H535 ... Send surface-data to MMI (after M535)**

Function to display the data determined by [M535](#) on MMI.

**H536 ... Send surface-data to MMI (after M536)**

Function to display the data determined by [M536](#) on MMI.

**H540 ... Send probe-qualification-data to MMI (after M540)**

Function to display the data determined by [M540](#) on MMI.

**H560 ... Send machine-check-data to MMI (after M560)**

Function to display the data determined by [M560](#) on MMI.

**H591 ... Send probing target tolerance error to MMI (after M591)**

Function to display the data determined by [M591](#) on MMI.

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