MACHINEMATE, INC.
845 South Main Street
Fond du Lac, WI 54935

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INFOMATE

Introduction

Welcome to the 10th issue of our newsletter. The newsletter is used to send product and information updates to our customers on a regular basis. Starting with issue 9, we added a brief technical review section to inform you of some of the MACHINEMATE® features and capabilities.

I News

IMTS 2002

MACHINEMATE, INC will exhibit in our booth D-4320 at IMTS 2002 in Chicago, Illinois. This booth is in the Controls Pavilion in Hall D, Level 3 of the Lakeside Center at McCormick Place. The show runs from September 4 to 11.

Stop and see the new products we will be introducing and learn about our new partnerships. Several OEMs will be using our CNC on their machines in their booths (in other buildings) at the show. We hope to see you there!

II Recent Unique Applications with MachineMate

Laser cutting of office furniture parts

Krueger International (KI, at www.ki.com), based here in Wisconsin, is a manufacturer of office furniture. Their engineering division in Bonduel, Wisconsin, develops the custom machines for their manufacturing facilities. This machine with the MACHINEMATE CNC was installed in Manitowoc, Wisconsin.

The MACHINEMATE helps control the laser that cuts the part (a piece of the office furniture) whose program is based on the operator defining the pattern to be cut. The pattern consists of the corners to be removed, allowing the remaining material to be folded, as well as an optional number of rectangular cut-outs (for outlets). KI used several MACHINEMATE features to complete this project.

1. Laser power control – to control the laser output voltage
   KI also programmed the optional laser feature for the voltage to be proportional to the path velocity as the laser decelerates/accelerates at corners.
2. Distance control – to control the distance of the laser head above the part
   This optional feature was required because the sheet metal would not lie completely flat on the machine table.
3. Part rotation – to provide the flexibility for the part's orientation on the table.
   This standard feature allows the part's coordinate system to be rotated (either in degrees or radians). This feature was required because the part had to be cut precisely aligned with the grain of the pattern within the part. By correctly rotating the part coordinates based on an optic sight with crosshairs for proper alignment (usually only a few degrees), the part was cut for the correct cosmetic appearance.

4. MM Visualizer – to provide customized operator data entry displays
   This optional feature was required because the operator would run a custom part each time. It was not practical for KI to write the multitude of part program variations. The operator would enter the specific part's dimensional requirements. The PLC would pass those data entry values to the CNC cycle parameters. The part program's path was defined by these cycle parameters.

   KI reports that with their customer operator displays, the machine is so easy to operate that the operators require no CNC background or special training.

MachineMate Helps Build a Log Home

Optimil Machinery Inc., a builder of custom woodworking machines in Delta, British Columbia (web site at www.optimil.com), recently completed the integration of a MACHINEMATE CNC in an 11-axes special machine that processes the logs for log homes. MACHINEMATE INC provided this system that included the 11 SERCOS digital drives, motors and cables with the CNC. The 11-axes are involved in the process of converting logs into the parts of a log home.

The CNC is configured for two stations because it runs two part programs simultaneously. Eight axes are in the first station and three axes are in the second. Several pictures from this machine are shown below. The system is given the specifications for the parts required for a log home (where the specifications define each part program required for each part) and then consecutively runs those programs to produce all the parts so that at the end of the 'run' all the logs are ready to deliver for the construction of the specified home.

The machine is rather large. The total length from infeed deck to outfeed deck is 83 feet. The machine is set up to handle 6"x8" logs. The logs come to this machine pre-profiled in either exterior or interior profile. The exterior profile has one round side and the interior log is flat on both sides. Both styles have a double tongue and groove top and bottom. This profile is cut on another machine. The clamps have pads that correspond to the tongue and groove pattern for reasonably precise handling.



The shortest log that is specified is 30" but the machine can do limited machining on shorter pieces by using only 1 clamp. The longest log is 16 feet.

The list of processes that the machine can do:

1. Notch (2 machine centers = 1 notch)
2. Circular saw station makes precision length cuts and also angled cuts coordinated with clamps.
3. Mortising Chain Saw. The chain saw axis is used to cut the tops and bottoms of windows and doors only. It is oriented along the log and doesn't rotate.
4. Router. The router is used to make electrical boxes and beam pockets.
5. Dado Head. Used to cut a key in the end of logs in windows and doors to resist twisting of the logs. The dado head and the router are actually on the same axis. The router plunges via an air cylinder.
6. Drill. Used to drill holes for electrical wiring and also for structural rods. 1.25" diameter drill is used on a Milwaukee drill press style drill motor.
7. Finger Jointer. Creates the finger joints when necessary. It sits on a 3/16" air cylinder that offsets the lead and trail end finger joints.

Control of an axis via RS232 communications

Wayne Gordon, a MACHINEMATE integrator, recently completed a retrofit integration of a MACHINEMATE CNC with a Brown & Sharpe CMM for an end customer in New England. The MACHINEMATE controls a rotary table for the CMM.

Wayne selected the MACHINEMATE CNC because the rotary axis controller required an analog drive interface (analog velocity control with encoder feedback) and an RS232 serial interface (to the PC-based CMM). Other controls (CNC or GMC) on the market might provide both of these requirements but typically an RS232 interface is an expensive or difficult add-on to one of those systems. As a CNC, the MACHINEMATE has the simple tools for configuring and running the axis (e.g., encoder resolution, D/A resolution for motor RPM, homing configuration (speed/direction), jogging, moving to a programmed position at a programmed feed rate, etc.).

In this application, the CMM sends a serial formatted string to the rotary axis controller (i.e., the MACHINEMATE) for either a status request or a motion command. The response is a formatted string with the position and status (error or success). The soft PLC has the function calls available for the management of the serial port (and the parallel port as well). For the most flexibility in this application, the PLC saves the command details (e.g., end point and feed rate) in several CNC cycle parameters and then a specific part program runs to execute the command from the CMM. This part program enabled other requirements such as bi-directional or unidirectional approach to the end point. No special features in the MACHINEMATE were required for this CNC application and no changes were required in the CMM for the CNC integration.

With two PC-based computers, an interesting serial communications test is possible in this system. Microsoft Windows comes with Hyperterminal software as a standard utility. This utility enables the RS232 wiring to be tested between two different PCs with no special test software. When Hyperterminal on the MACHINEMATE could send and receive strings to the Hyperterminal on the CMM then both ends of the serial connection were verified.

When the system is operational, the CMM operator does not access the MACHINEMATE since its handling of the rotary axis is transparent to the CMM. The CMM requests a move of the rotary table, the table moves into position and then the CMM continues with its inspection program.

III Technical Reviews

Standard cycles

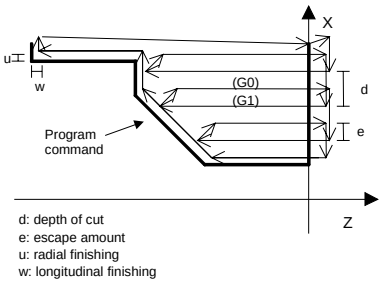
One of the versatile standard features of the MACHINEMATE is its set of cycles – for either drilling or turning (depending on the CNC configuration).

For a milling application, nine canned drilling cycles are provided. Each cycle is implemented as a subprogram so if the customer's application requires a new/different drilling cycle, that change is done within the associated subprogram. The following is a brief summary of these drilling cycles:

- G81 drilling to a final depth (drill to depth with no dwell)
- G82 spot facing with a dwell (drill to depth with dwell before retract at rapid)
- G83 deep hole drilling (incremental depths with retract each time)
- G84 simple tapping (feed to depth, reverse spindle, feed out)
- G85 reaming (drill to depth with dwell before retract at feed)
- G86 bore out (bore to depth, orient and move in X and Y, then retract)
- G87 reaming with measuring stop (includes retract and operator stop within the cycle)
- G88 bore out with spindle halt (spindle stops before the retract from depth at rapid)
- G89 bore out with intermediate step (drill to first depth, rapid deeper, drill to second depth, dwell, retract)

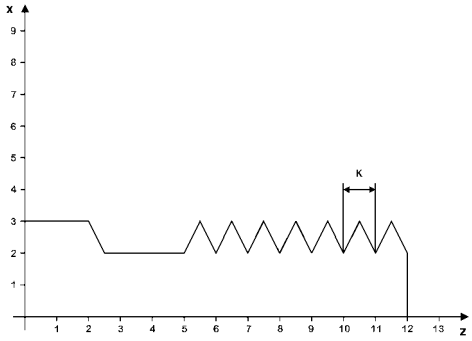
For a turning application, several turning cycles are provided. The first three below are supported with a subprogram (via NC blocks within the main program), allowing a customer's particular variation to be easily implemented. The other three below are cycles defined by part program parameters associated with the G-code statement.

- G270 finishing cycle
- G271 stock removal in turning (illustrated at right)
- G272 stock removal in facing
- G274 peck finishing cycle
- G275 outer diameter / inner diameter turning cycle
- G276 multiple pass threading cycle



For a milling or turning configuration, either rigid tapping or thread cutting cycles are also available. These two cycles are defined by part program parameters associated with the G-code statement.

- G33 thread cutting with uniform pitch
  - Plain thread
  - Cylindrical thread (illustrated at right)
  - Conical thread
  - Cylindrical thread with controlled run out
  - Conical thread with controlled run out
- G34 thread cutting with dynamic pitch
  - Cylindrical thread
  - Conical thread



Work cycles

The MACHINEMATE CNC has the capability for the customer to add a set of work cycles. This set of eight consecutive G-codes (the G-code assignment is configurable) will invoke eight predefined subprograms (each program number assignment is configurable). Each subprogram can access all the NC statement parameters (i.e., all the A-Z fields on the line with the G-code are saved in a set of cycle parameters) to perform the desired operation. The work cycles are not drilling cycles that have a modal behavior (i.e., active until a G80). Each work cycle is run only once, when invoked by its G-code in an NC statement. This capability of work cycles is a standard feature of the control and allows the customer to provide support for special operations using just G-code statements and the associated subprogram(s).

CNC Is Extensible for Special Applications

The MACHINEMATE CNC has built-in 'hooks' for an engineer to develop a sophisticated application that interacts with the CNC at a very low level. By following the MACHINEMATE defined rules for the development of a DLL (dynamic linked library) for this CNC, the customer's code (developed using Microsoft C++ compiler) can be called for specified events (i.e., the 'hooks') within the CNC interpreter or interpolator. For example, events for the completion of an NC block's parsing or the start of an NC block's interpolation can result in the execution of the customer's DLL code for a specific CNC application.

The documentation for these DLL 'hooks' (with their associated data structures) is not part of the standard product but can be purchased as an option. The customer-written DLL feature and its documentation are called 'compile cycles' and are intended for those applications where the CNC must be modified to support a special application. The MACHINEMATE CNC (with its set of features and options) and/or the integrated soft PLC (with its associated libraries of functions) can address most machine or control requirements without this compile cycle option. However, for those other special applications that are not covered, this CNC feature allows the development and integration of unique algorithms to solve those special problems.

Conclusion

If you do not want to receive this newsletter, please tell us with a phone call or just respond with an e-mail with 'unsubscribe' in the subject line. If you received a printed issue and you wish to receive it via e-mail, please tell us that by an e-mail to us at info@machinemate.com or call us at 920-907-0001.

Our web site www.machinemate.com has lots of information about our products and applications; a link can be provided to our customers for the complete manual set. A number of MACHINEMATE control retrofit articles are also available. Please periodically check the site for news.

Thank you,

The staff of MACHINEMATE, INC.
phone: 920-907-0001
fax: 920-907-0181
e-mail: info@machinemate.com
web: http://www.machinemate.com

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