

INFOMATE

Introduction

Welcome to the 15th issue of our newsletter. The newsletter is used to send product and information updates to our customers on a regular basis.

New LW CNC Model

MACHINEMATE, INC has announced a new CNC model, called the LW. This provides a new 'lowest cost' model for analog servo applications.

This **MACHINEMATE**® LW picture shows the built-in 24VDC inputs and outputs (48 inputs, 32 outputs) on the top right and the built-in analog servo connections (4 encoders in, 4 D/A out) on the top left. The standard PC connections (keyboard, VGA display, COM1, LPT, USB, Ethernet network) are visible on the lower left of the unit's side. The single spare PCI slot is visible on the lower right of the side, above the CNC PCI card.



The LW complements the L2 product offering. Both run the Microsoft® Windows 2000 operating system. Both connect to the same operator front panels. Both the LW and the analog L2 have the same quantity of built-in IO (48 in, 32 out) and the same built-in analog servo interface (4 encoders, 4 D/A). Both can be expanded with more IO and more servos using external IO modules. The L2 is a larger CE-rated IPC (industrial personal computer) tower with 3 spare PCI slots and a built-in floppy disk drive. The LW is a smaller IPC with only 1 spare PCI slot and no built-in floppy disk drive. However the LW ships with a USB pen disk which has a much larger capacity than a 3.5" floppy. The LW includes an integrated Ethernet network connection while the L2 will accept an optional PCI Ethernet card. The L2 is available in models for either digital SERCOS servos (up to 8) or analog servos (up to 12; up to 12 servos total) while the LW supports only analog servos (up to 8).

The L2 package is shown at the right for reference. The LW package is essentially the same as the L2 (i.e., IP65 front panel, IPC, cables, complete CNC software). The difference in their respective packages is the CE-rated industrial PC (with the LW IPC shown above and the L2 tower visible at the left in this picture). The picture at the right also shows one of the IO modules available for expansion to either system, as well as the documentation set (provided on CD with every unit; a printed set is also available for purchase).



The approximate dimensions for the LW IPC (reference the picture above top right for WLH) are width of 13.1" (332mm) to the outside edges of mounting flanges (11.9" or 302mm for width of box with no flange), length of 9.8" (250mm) and height of 4.9" (125mm). The approximate dimensions for the L2 IPC (reference the picture above for WLH) are width of 6.44" (163.5mm), length of 11.625" (295.3mm) and height of 19" (482.6mm) to the top of the mounting flange (17.8" or 452.4mm for height of box with no flange).

The LW becomes the third Windows 2000 based CNC package. The L2 (with its larger tower configuration enabling more PC expansion via PCI slots) is mentioned above. The other Windows 2000 package is the eCNC. This is for the high-performance CNC applications. This IPC has a Pentium 4 to support the highest NC block performance and/or the best PC performance (e.g., for a CAM solid model package that must run at the same time as the CNC). Certain high-end CNC features are available only on the eCNC, such as 5-axes transformation (where the part coordinate system for the linear axes can be changed by a rotary axis motion, enabling the capability of 'drilling at an angle' where only the Z is programmed but during its motion both X and Y automatically move to maintain the correct tool path within the rotated part coordinate system). The eCNC IPC is shown at the right (CE-rated stainless steel case, with double flange for mounting on a panel).



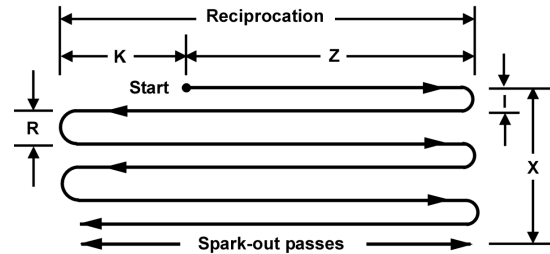
CNC System Hardware Specification

When proposing MACHINEMATE CNC solution, sometimes the hardware details like dimensions or weights are needed long before the unit is received. These respective hardware details have been collected (they are a small subset of the wealth of information available for the eCNC, L2, LW in our Hardware Manual) for such queries that are common in the proposal process. The link to the 21-page pdf document is http://www.machinemate.com/MM_HardwareSpec.pdf. The file is about 700KB.

Cylindrical Grinding Cycles

A new CNC configuration is now available for our CNC models. To complement the existing mill and lathe CNC configurations, there is now a cylindrical grinding CNC package. This configuration includes the common grinding cycles for cylindrical parts:

- G701 Reciprocation without plunge
- G702 Incremental Face Grinding (Axis 1)
- G703 Incremental Plunge Grinding (Axis 2)
- G704 Multi-pass Face Grinding (Axis 1)
- G705 Multi-pass Diameter Grinding (Axis 2)
- G706 Shoulder Grinding
- G707 Shoulder Grinding With Face Plunge
- G708 Shoulder Grinding With Diameter Plunge



The illustration at the right shows the major parameters for the G703 cycle. Just as with our canned G8x drilling cycles for the mill configuration, these cycles are provided as subprograms that can be easily customized by the integrator, as needed, for any unusual grinding applications.



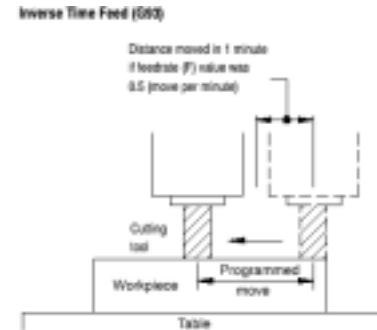
Grinding applications sometimes also request the optional oscillation feature which provides the programmer with two additional G-codes:

- G35 sinusoidal oscillation
- G36 linear oscillation

Reciprocation is the oscillation-type motion that is programmed within a cycle with specific axis commands (like in G701 above). The two oscillation G-codes above allow the oscillation to be programmed as a separate 'background' process. While this oscillation continues, other axes can be moved manually or in the part program. Oscillation is an optional feature. The reciprocation aspect of the standard grinding cycles does not use the oscillation feature.

G93 Inverse Time Programming

The most common G-codes for feedrate part programming are G94 (linear feedrate, with its units in either inches/minute or mm/minute) and G95 (spindle-directed feedrate, in either inches/revolution or mm/revolution). For handling a mix of linear and rotary axis motion, some controls have used G93, often called inverse time programming. With this G-code, the accompanying F-value provides the CNC with the time for the move rather than the path feedrate. This is most commonly used when the part programmer knows the actual position of the cutter relative to the diameter of the part during this rotary motion. Therefore the part programmer provides the CNC with the time for the move as well as the respective axis motions. The part programmer can calculate the effective path feedrate with that actual part diameter information (for the rotary motion). The CNC will interpolate the axis motions with the time required and the resulting path feedrate will match that calculated by the part programmer.



The G93 G-code for inverse time programming is not standard on the MACHINEMATE CNC control. However, this G93 interpretation is available as an option. This G93 syntax is handled by a compile cycle DLL package. The CNC architecture allows the development and integration of DLLs to alter the standard CNC kernel operations. Since these DLLs are developed using software written in the C programming language that is compiled into a DLL (dynamic link library) being called by the CNC kernel, the CNC feature is called a compile cycle.

If the G93 inverse time programming option (M158) is required, just request it with the CNC order and the DLL package will be included. Alternately, the compile cycle package is easily integrated into an existing CNC application. After this integration, the G93 feature is enabled or disabled just by a change to a machine parameter value.

Part Program Conversions

Among the services provided by MACHINEMATE, INC is a part program conversion utility. It is actually free and available from our web site. While our RS274 M/G-code programming syntax is similar to most other contemporary CNC models, differences can become more of an issue with retrofits. Sometimes the customer will have a number of part programs written for the old control being replaced. In such scenarios, a utility like this will expedite the transition from the obsolete control to the new MACHINEMATE control when the old programs are still important.

There have been several notable applications of this utility in recent retrofits. One customer replaced a Fanuc0. The existing part programs were very long, roughly 5000 lines, of many short lines and arcs for the complex profiles. The old program used G2/G3 with R for its arcs while the MACHINEMATE syntax is G2/G3 with IJK but G12/G13 with K for the radius. The other compatibility problem is the old syntax did not always put a G1 on a non-circular line after a G2/G3 series. The utility took care of these conversions. The old control had run these part programs in about 15 minutes. The MACHINEMATE L2 CNC runs them in about 8 minutes – making the customer very happy with the much improved part cycle time.

Another customer recently replaced an Allen Bradley 7300 control on a 3-axes milling machine. The 7300 could not execute arcs of more than 90-degrees so its G2/G3 IJK syntax was always positive IJK values to the arc center and the control would determine the correct quadrant for the particular arc. Since the MACHINEMATE can cut any arc from 0 to the full 360-degrees, its IJK syntax requires the appropriate sign for the correct arc/circle. In this particular application, the old control had managed axes named X-V-W, where V would normally be named Y and W would be Z. The utility handles the

correct sign for the IJK based on the particular arc start/end points. The utility handles two 7300 conversions – the ‘usual 7300’ (including this IJK sign problem) where X-Y-Z are the three linear axes and a ‘7300XVW’ where the X-V-W are treated as X-Y-Z for the correct IJK analysis (normally a V or W would be considered an auxiliary axis not involved in the G2/G3 path but rather as a third-axis departure motion also called a helical interpolation; in this case X-V-W define the arc in the modal G17/G18/G19 plane). This 7300XVW was developed just to help our integrator on this particular application. The customer is happy that existing part programs can be run on this machine after the conversion without manual edits.

The part program conversion utility has a set of rules for these control types: Allen Bradley 7300, 8200, 8400, AMCB, Acramatic, Anilam, Bendix series 5, Boss, Dynapath series 5, Fadal, Fagor, Fanuc, GE1050, Giddings & Lewis 8000, Haas, Hurco, Mazak, Meldas, Osp, Prototrak, Siemens7T, Teammate 2, Yasnac. Since we do not have complete NC programming specifications for some of these control types and so we have relied on examples with partial information from our integrators, we can never guarantee that a conversion will not require manual edits. Some applications used unique or special G-codes or M-codes that must require editing. The goal of the utility is to avoid the simple repetitive edits (like adding an N-number, changing G2R to G12K or changing G20 to G70). This ‘free’ utility does not perform sophisticated tool path analysis nor does it handle complex features like work zone limits or ‘out of the ordinary’ G-codes or M-codes. However since most part programs use a control’s basic G0/G1/G2/G3 syntax for all lines and arcs or profiles, and perhaps with the usual G80 to G89 canned drilling cycles on mill applications, the converted part program often achieves success without edits. The prevalence of CAM packages also tends toward the simpler set of G-codes in the part programs since the CAM package handles any complex profile paths.

Moved

As a reminder, **MACHINEMATE**, INC moved to a new facility in January 2004. Our correct address is 100 West Larsen Drive, Fond du Lac, WI 54937 (in an industrial park here in Fond du Lac). The new office is much bigger with more room for training and will enable better manufacturing service to our customers. We have maintained the same telephone and email contacts.



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 available. Please periodically check the site for news.

Thank you,

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