MACHINEMATE®

SYSTEM

SPECIFICATION

CNC Series

LW

05.04.04

CONTENTS

1 Introduction

Superior Capability in Technology and Productivity

The **MACHINEMATE LW CNC** provides you with innovative high performance technology to handle the ever increasing demands of today's automation industry. The modern and fully open CNC architecture using a single powerful CPU gives you leading edge CNC performance and flexibility.
The **MACHINEMATE LW CNC** fulfills all technical requirements for various applications. A high performance CNC control does not have to be high-priced anymore. The compact and modular **MACHINEMATE LW CNC** provides you with the performance you need at an excellent price / performance ratio.

Modularity

To match the **MACHINEMATE LW CNC** to your requirements a variety of hardware components such as a 9" CRT or 10.4" to 12.1" TFT-display can be added.

PC Technology

The **MACHINEMATE LW CNC** is based on standard PC-technology integrated on an industrial level. Through the standard PC motherboard with the powerful processor running the standard PC operating system plus the **MACHINEMATE Real Time Kernel Extension**, the MACHINEMATE LW is open to the PC components manufactured world wide. This way, e.g., a modern browser based human machine interface was readily incorporated. Moreover, there is the possibility to have 18 GB or more of NC program memory by means of PC hard disk technology.

Application Experience and Know how

Starting from 2 axis turning the **MACHINEMATE LW CNC** fulfills a wide range of motion application requirements. A list of standard functionality i.e. compensations as well as high tech functions like Look Ahead makes it an extremely versatile CNC.

High Speed machining

An important factor in machine tool productivity is the feed rate. New machine concepts and new tooling technologies require accurate and responsive controls with continuously increasing feed rates. Extremely short block cycle times (up to 200 blocks/sec.) and specific control algorithms and communication functions are required for high speed machining. „**Adaptive Look Ahead**“ analyzes up to 50 NC blocks ahead in real-time and calculates the maximum achievable feed rate for machining requirements staying within the programmed parameters and constraints.

Accuracy

The demands for increased productivity, higher accuracy and better surface finish are continuously increasing. The **MACHINEMATE LW CNC** provides a solution to manufactures with high precision requirements.

Human Machine Interface

Using six clearly defined modes of operation and a simple and clean-cut menu driven operation via soft keys, the machine operator will find the operation of the **MACHINEMATE LW** easy to learn and use. By means of the window technology, the information is presented where it is needed on the screen.

2 Characteristics

		MACHINEMATE LW
Blocks / sec. (ISO)		200
Gain (typical) up to		3
Number of axes	basic	4
	max.	8
Numbers of simultaneous axes	max.	4
Dynamic block buffer (NC-blocks)		50
NC-memory (RAM KB /HD GB)		128/18
PLC-memory (KB)		64
Inputs/outputs		48/32
with MMMIO	max.	576/348

MACHINEMATE LW Control Model

The MACHINEMATE LW in its standard configuration is a compact device comprising an operator's station with display and a CNC box.

MACHINEMATE LW CNC

Panel with 10.4 TFT Color-Monitor with 2.5 or 10 meter cable to box.

h = 17 21/64" (440 mm)
w = 11 5/12" (290 mm)
d = 2 ¾" (70 mm)

MACHINEMATE LW CNC box

h = 4 11/12" (125 mm)
w = 13 3/64" (332 mm)
d = 9 27/32" (250 mm)

3 Operator’s Panels

Operator panel with 9” monochrome CRT and 10.4" up to 15" color flat screen. Touch screen optional on some displays.

VGA 800 x 600 (10.4”)

- Membrane switch keyboard with short stroke keys
- Mode selection keys
- Soft keys
- Numeric keypad

3rd party VGA-Panels and standard PC keyboards can be used as well.

4 Operation

The **MACHINEMATE LW CNC** has 6 different operating modes, which are selected by means of soft keys. Alternatively they may be selected through a pointing device, i.e. a cursor, mouse or alternative means:

MANUAL

- Continuous jog
- Machine zero (Referencing)
- Auxiliary functions
- Play-Back
- Incremental jog
- Teach-in
- Hand wheel function

AUTOMATIC

- Program selection
- Program test
- Program process 1 (continuous, single, MDI)
- Program process 2 (M01, block delete)
- Path graphics

DATA

- Select
- Load
- Save
- Device select
- Edit
- Modify
- Manage
- Load/save application data

INFORMATION

- Version
- Diagnostics
- Active PLC program
- Status treatment
- System commands

SYS

- Display functions
- Station (Channel) selection
- Operation
- Settings

SETUP

- PLC
- Machine parameters
- Logic analyzer
- I/O configuration
- Drive configuration

5 Display / diagnostics

Display Languages

- English
- Other languages on request
- German

NC Axis Information

- Position
- Direction
- Output voltage
- Distance to go
- Active offsets
- Velocity
- Lag (following error)
- Position loop gain
- End position
- Offset values

Stored data information

- NC programs
- Radius compensation
- File attributes
- Windows programs
- PLC programs
- Tool length offsets
- Zero offsets

Status Information

- Auxiliary functions
- Active block
- Active G codes
- PLC interface
- Active NC program status
- Active subprogram
- Program repetition
- Active PLC program

System Memory

- Memory size for both
- CNC and PC system Memory space available
- Number of part programs
- Program size

Logic Analyzer

- Digital Logic Analyzer Function
- Recording function
- Analog Logic Analyzer Function
- Print function

Interfaces / Data Ports

- CNC ←→PLC interface
- Serial interfaces
- External device definition
- PLC ←→ machine interface
- Serial interface setup

User information box

- Error messages in legible text
- Time and date display
- Help messages in legible text

Machine Parameters

- Legible machine parameters
- Edit machine parameters
- Input/output of machine parameters

6 . Axis functions

4 axes simultaneous; analog interface (velocity command)

Measurement input frequency	20 MHz (after quadrupling)
Measurement resolution	freely selectable
Output Signal	± 10 V DC 16 Bit

Maximum feedrate

- Resolution of 10.0 µm: 12,000 m / min
- Resolution of 1.0 µm: 1,200 m / min
- Resolution of 0.1 µm: 120 m / min

7 . CNC FUNCTIONS - optional

Axis Control

- Adaptive Look Ahead 2½D

Automatic Drift Compensation

Spindle Control

- Analog:
  with / without feedback

Tangential Control

- 2D tangential control of rotary axis

Measurement Functions

- Probe Logic

8 Memory

- NC memory (buffered CMOS-RAM) 128 KB
- NC programs up to 200 / unlimited on HDD
- Program number 6 digits
- NC memory on hard disk 18 GB
- Dynamic NC block buffer 50
- PLC program memory 64 KB (max. 128kB)
- Cycle parameters 1000
- Setup data 8 KB

9 Compensations

- Tool compensation
  - Tool length compensation 128 sets
  - Tool radius compensation 128 sets

- Zero offsets
- External compensation via PLC
- Access to compensations via cycle programming

10 Programming

- Subprograms (up to 4 levels)
- Automatic syntax checking
- Decimal point programming
- Compensation programming
- Programming simultaneous during program execution
- Teach-In function

10.1 NC Programming

G-codes

G 000	Rapid traverse
G 001	Linear interpolation with feed rate
G 002	Circular interpolation (cw)
G 003	Circular interpolation (ccw)
G 012	Circular interpolation (cw) with radius
G 013	Circular interpolation (ccw) with radius
G 004	Dwell time in msec
G 007	Tangential circular interpolation
G 008	Ramping function at block transition , Look Ahead “off”
G 009	No ramping function at block transition , Look Ahead “on”
G 010	Stop dynamic block preprocessing
G 011	Stop interpolation during block preprocessing
G 017	Selection of the X, Y - plane
G 018	Selection of the Z, X - plane
G 019	Selection of the Y, Z - plane
G 020	Selection of a freely definable plane
G 024	Safe zone programming; lower limit values
G 025	Safe zone programming; upper limit values
G 026	Safe zone programming “off“
G 027	Safe zone programming “on“
G 033	Thread cutting with constant pitch
G 034	Thread cutting with dynamical pitch
G 036	Programmable feed limitation “active“
G 037	Programmable feed limitation “off“
G 038	Mirror imaging “on“
G 039	Mirror imaging “off“
G 040	Path compensations “off“
G 041	Path compensation left of the work piece contour;
G 042	Path compensation right of the work piece contour;
G 043	Path compensation left of the work piece contour with altered approach
G 044	Path compensation right of the work piece contour with altered approach
G 050	Scaling
G 051	Part rotation; programming in degrees
G 052	Part rotation; programming in radiants
G 053	Zero offset off
G 054	Zero offset #1
G 055	Zero offset #2
G 056	Zero offset #3

G 057	Zero offset #4
G 058	Zero offset #5
G 059	Zero offset #6
G 063	Feed / spindle override not active
G 066	Feed / spindle override active
G 070	Inch format active
G 071	Metric format active
G 072	Interpolation with precision stop “off“
G 073	Interpolation with precision stop “on“
G 074	Home position
G 080	Drilling cycle “off“
G 081	Drilling to final depth
G 082	Spot facing with dwell time
G 083	Deep hole drilling
G 084	Thread cutting with balanced chuck
G 085	Reaming
G 086	Boring
G 087	Reaming with measuring stop
G 088	Boring with spindle stop
G 089	Boring with intermediate stop
G 090	Absolute programming
G 091	Incremental programming
G 092	Position register preset
G 093	Constant tool circumference velocity “on“ (grinding wheel)
G 094	Feed in inches/min (mm /min)
G 095	Feed per revolution inches/rev (mm/rev)
G 096	Constant cutting speed “on“
G 097	Constant cutting speed “off“
G 133	Zero lag thread cutting “on“
G 134	Zero lag thread cutting “off“
G 170	Digital measuring signals; block transfer with hard stop
G 171	Digital measuring signals; block transfer without hard stop
G 172	Digital measuring signals; block transfer with smooth stop
G 190	Diameter programming deactivation
G 191	Diameter programming „on“ and display of the contact point
G 192	Diameter programming; only display contact point diameter
G 193	Diameter programming; only display contact point actual axes center point
G 200	Corner smoothing “off“
G 201	Corner smoothing “on“ with defined radius
G 202	Corner smoothing “on“ with defined corner tolerance
G 203	Corner smoothing with defined radius up to max. tolerance

G 270	Turning finishing cycle
G 271	Stock removal in turning
G 272	Stock removal in facing
G274	End phase peck drilling cycle
G275	Outer diameter/internal diameter drilling cycle
G276	Multiple thread cutting cycle
	Programmable acceleration

10.2 Cycle Programming

- Programming tool with 1000 parameters
- Allocation of parameters values with NC addresses
- Execution control of the NC program
- Output signal programming
- Verification of input signals
- Arithmetic and trigonometric functions
- Boolean programming functions
- Jump commands
- Repeat commands

11 Integrated SOFT PLC - IEC 1131-3

Languages	• Ladder Diagram • Structured Text
Inputs	• 48
Outputs	• 32
PLC-memory	• 64 KB
Data memory	• 64 KB, non-retentive, Real, Integer, Timer, Boolean variables
Data memory	• 4KB, retentive
I/O definition	• Bit/Byte, WORD, DWORD

12 Integrated IPC

- Processor Intel Celeron min. 1.2 GHz
- System hard drive min. 20 GB
- Windows 2000®
- MM Real time Kernel Extension
- Data transfer with Memory Stick (64 MB)
- 1 PCI Slot for Superbus
- 1 PCI Slot for Fieldbus (CAN Open or DeviceNet)

13 Communication

Interfaces

- 1 x RS 232 C/ COM1
- Keyboard
- VGA (256 colors)
- USB (Mouse, Memory Stick, FD, CD-ROM)
- 1 x Centronics / LPT1 (Printer)
- EtherNet

Data I/O simultaneously with program execution

Continuous downloading of part programs

Field-bus interfaces
(optional)

- CAN Open
- DeviceNet

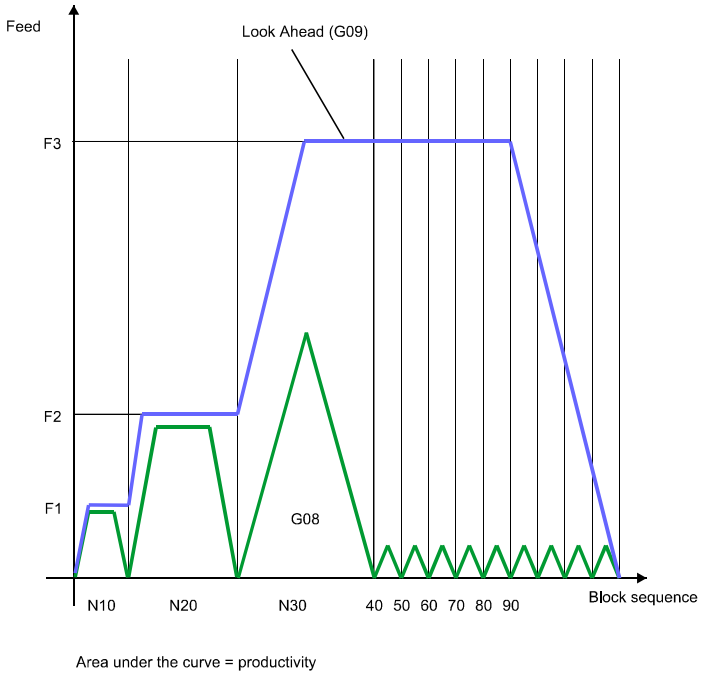
14 Safety Functions

- **Integrated Diagnostic Functions:**
  - Internal CNC voltage monitoring
  - Processor activity
  - Battery voltage monitoring for CMOS backup
  - Electric noise monitoring
  - Processor watchdog timer monitoring
  - CMOS memory
  - RAM memory
  - Hard disk
  - Bus systems
  - Temperature monitoring

- **Operator Guidance through soft keys**
- **Syntax check during NC program inputs**
- **Checksum test**
- **Software limit switches**
- **Comprehensive CNC and machine status display via PLC**
- **Read , write-, and clear protection for NC-programs**
- **Protected programs**
- **Password protection (up to 10 levels)**

15 System Access

Adaptive Look Ahead

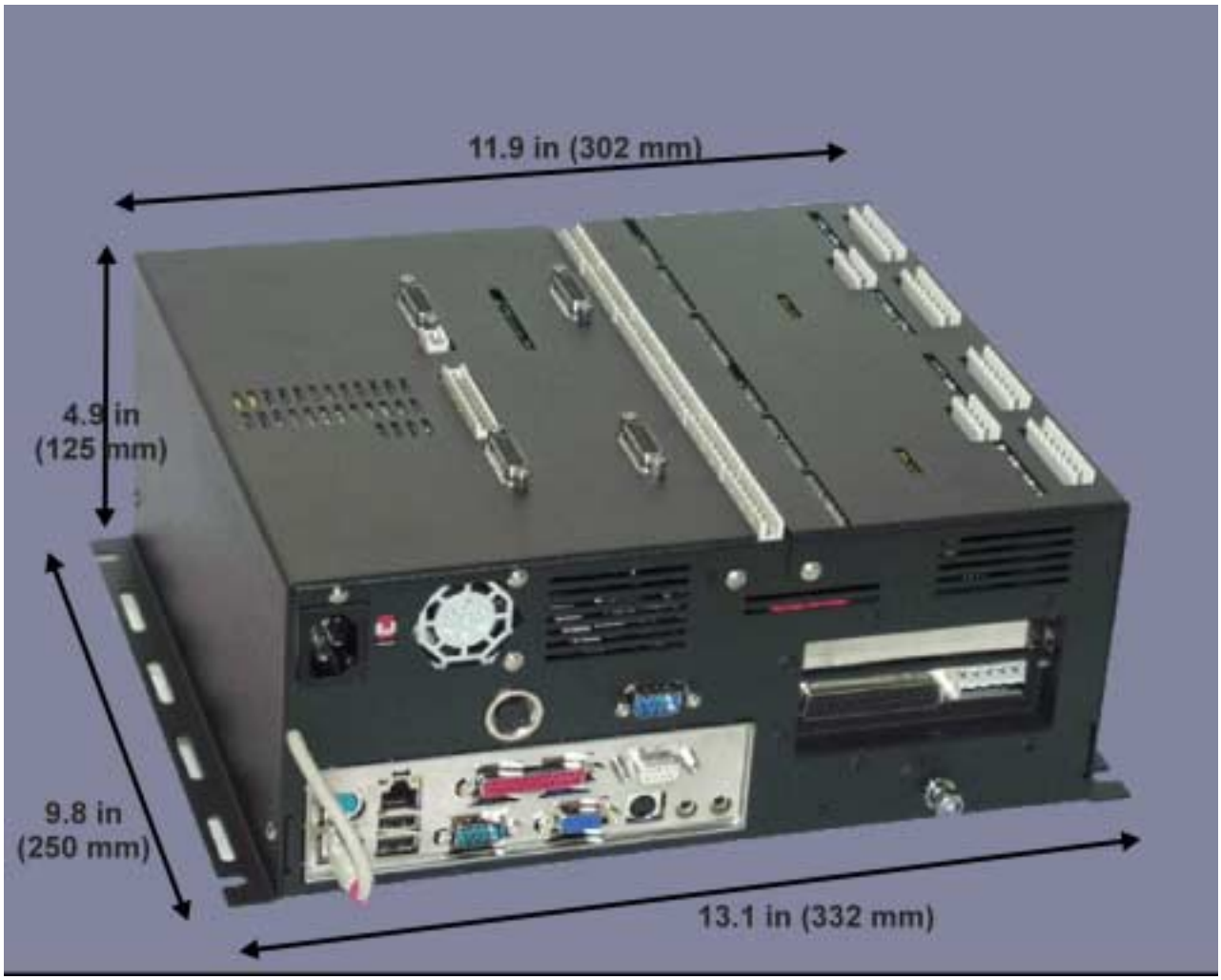


- Adaptive Look Ahead results: Error free block transitions;
- Adaptive Look Ahead analyzes up to several 100 subsequent NC blocks;
- Adaptive Look Ahead monitors the acceleration and deceleration values set for each axis;
- Adaptive Look Ahead assures that the dynamic limits of the machine will never be exceeded;
- Adaptive Look Ahead recognizes peaks in the velocity profile caused by geometry and F word changes. Acceleration and deceleration over multiple NC blocks;
- Adaptive Look Ahead recognizes peaks in the velocity profile caused by geometry and F word changes. Acceleration and deceleration over multiple NC blocks;
- Continuous axis movement;
- Adaptive Look Ahead calculates the max. path velocity with consideration of the programmed F word, the programmed accuracy and the dynamic machine limits;

16 Mechanical outline

CNC Box

16.1 Dimensions



17 Operating conditions

Space Requirements

- For installation - a free space of 4” (100 mm) on front, top and back.

Power requirement

- 115 - 240 V AC / 50-60 Hz

Maximum power required

- 200 VA

Temperature

- Storage temperature -68° F – 140° F (- 20°C to +60° C)
- Environment temperature 50° F – 113° F (10°C to 45°C)

Test conditions

- All controllers are subject to a run-in test of 48 hours in cycles 50° - 113°F.

Protection

- Operator’s panel IP 65