

**MACHINEMATE®**

**SERIES CNC**

**STANDARD FEATURES**

**INCLUDED IN THE BASIC OEM PACKAGE**

# **MACHINEMATE BASIC CONFIGURATION**

## 1. OPERATION

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

### **MANUAL**

- Move Continuously
- Traverse to Reference Point
- Auxiliary Functions
- Move Incrementally
- Retreat
- Hand Wheel Function
- Playback

### **AUTOMATIC**

- Program Selection
- Program Test
- Path Graphics
- Backward
- Program Process 1 (Continuous, Single Block, Manual NC)
- Program Process 2 (Block Read Over, Optional Halt, Parallel Edit, Initial State)

### **DATA**

- Selection
- Load
- Save
- Edit
- Modify
- Manage

### **INFORMATION**

- Interface Display
- Version
- Status Treatment

### **SYSTEM**

- Display Functions
- Station (Channel) Selection
- Exit
- Operation
- Settings
- Minimize

## **SETUP**

- PLC
- Machine Parameters
- SERCOS Monitor
- I/O Configuration
- Drive Configuration
- Pitch Error Comp
- Gantry Initialize
- Logic Analyzer

## **2. DISPLAY/DIAGNOSTICS**

### **Display Languages**

Two display languages are selectable:

- English
- German
- Other Languages on Request

### **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
- NT/DOS Programs
- Radius Compensation
- File Attributes
- 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

### System Memory

- Memory Size for Both CNC and Windows NT System
- Memory Space Available
- Number of Part Programs
- Program Size

### Interfaces/Data Ports

- CNC  $\leftrightarrow$  PLC Interface
- Serial Interfaces\*
- External Device Definition
- PLC  $\leftrightarrow$  Machine Interface
- Serial Interface Setup\*

\*May require additional software.

### 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

## 3. AXES/AXIS FUNCTIONS

4 Axes Simultaneous

### Choice of Analog Interface or Digital Interface (SERCOS)

	Analog 4x	SERCOS 8x
<b>Measurement Input frequency</b>	1 MHz (Internal 4 MHz)	Depends on Drive
<b>Measurement Resolution</b>	Freely Selectable	Freely Selectable
<b>Maximum Feedrate</b>		Depends on Drive
Resolution of 10 $\mu\text{m}$ : 2,400 m/min		
Resolution of 1 $\mu\text{m}$ : 240 m/min		
Resolution of 0.1 $\mu\text{m}$ : 24 m/min		
<b>Output Signal</b>	$\pm 10\text{V DC}$ , 5 mA	Digital via Optical Fiber Cable

#### 4. COMPENSATIONS

Tool Compensation

- 128 Radius Compensations
- 128 Length Compensations

Backlash Compensation

Zero Offsets

External Compensation via PLC

Access to Compensations via Cycle Programming

#### 5. SPINDLE CONTROL

Through SERCOS or Analog CNC engine

Analog Spindle Control via PLC is also possible (option - analog module)

#### 6. COMMUNICATION

Interfaces

COM 1 Port  
COM 2 Port  
LPT 1 Port  
VGA/SVGA external Display Port  
Keyboard Port  
CD ROM (IDE) Connector  
Mouse Port

Data Transfer Monitoring

RTS/CTS hardware handshake,  
XON, XOFF, PA checksum

NC Format

ISO (DIN 66025)

Data I/O Simultaneously with Program Execution

Continuous Download (Drip-Feed)

File Load

Main- and Subprograms Executable From Hard Disk

## 7. MEMORY

### Hard Disk

- Number of NC Programs unlimited (to disk capacity)
- Program Number 6 digits

### NC Program Memory

128 KB CMOS RAM

- Number of NC Programs 200
- Program Number 6 digits

(option – increases to 224KB, 400KB or 872KB)

### Dynamic Block Buffer

50 blocks

(option – increases to 200 or 1000 blocks)

### PLC Program Memory

64 KB

(option – increases to 128KB or 256KB)

### Cycle Parameter Memory

1000 parameters

(option – increases in increments of 1000)

## 8. PROGRAMMING

### NC Programming as per ISO (DIN 66025)

- G00 Rapid traverse
- G01 Linear interpolation
- G02/G03 Circular interpolation
- G04 Dwell
- G07 Tangential circle interpolation
- G08/G09 Path control mode (ramp at block transitions)  
"Adaptive Look ahead" function
- G10/G11 Block pre-processing control
- G12/G13 Circular interpolation with radius input
- G17-G20 Plane selection
- G33 Thread cutting/rigid tapping
- G38/G39 Mirror image
- G40-G44 Tool radius compensation
- G50 Scaling
- G51/G52 Part rotation
- G53-G59 Zero offsets
- G63/G66 Programmable feed rate/spindle speed override
- G70/G71 Inch/metric switching
- G72/G73 Interpolation with in position stop
- G74 Home position
- G80-G89 Canned cycles
- G86 or G186 Programmable tolerance band

- G90/G91 Absolute/incremental programming
- G92 Position register preset
- G94/G95 Feedrate programming
- M00 Program stop
- M01 Optional stop
- M02/M30 End of program
- M03/M04/M05 Spindle control
- M06 Tool change
- M19 Spindle orientation
- M101-M118 Fast M functions

(programming options: see Product Guide section 2 for complete G-code list)

#### Cycle Programming

- Programming tool with 1000 parameters
- Use of parameter values within NC addresses
- Execution control of the NC program
- Programmable man-machine interface
- Input/output signal programming
- Monitoring of input signals
- Arithmetic and trigonometric functions
- Boolean operators
- Jump commands
- Repeat commands

#### Subroutines (4 Levels)

#### Automatic Syntax Check

#### Decimal Point Programming

#### Compensation Programming

#### Programming Parallel to Program Execution

#### Probing function - Automatic Position Value Acquisition

### 9. INTEGRATED SOFT PLC AS PER IEC 1131-3

Languages:	Structured Text (Standard) Ladder Diagram (Standard)
PLC Memory	64 KB (expandable to 256KB, equiv. to 40,000 instr.)
Internal Flags	256 (expandable to 1000) non retentive 256 (expandable to 1000) retentive

Timers	256 (expandable to 1000) non retentive 256 (expandable to 1000) retentive
I/O Definition	bit/byte, word, double word
C Routines	Custom routines written in C can be integrated via an external object library

## 10. INTEGRATED PERSONAL COMPUTER

### Integrated Personal Computer Board

- Intel Pentium processor (varies with CNC model) & motherboard
- 1.44 MB, 3½"-system floppy drive
- TFT display graphics board
- System hard disk
- MS Windows NT operating system
- **MACHINEMATE** real time kernel

## 11. SAFETY FUNCTIONS

Following checks are integrated:

- |   |  |
|---|--|
| - CNC voltage monitoring                        | - Processor activity                         |
| - Battery voltage monitoring for CMOS backup    | - Electrical noise monitoring                |
| - Processor watchdog timer monitoring           | - CMOS Memory                                |
| - Feedback supervision<br>(incremental encoder) | - Feedback signal<br>(broken wire detection) |
| - RAM memory                                    | - Hard disk / floppy drive                   |
| - Bus systems                                   | - Temperature monitoring                     |

Operator Guidance Through Soft Keys

Syntax Check During NC Program Input

Checksum Test

Software Limit Switches

CNC Status and Machine Status Display via PLC

Read, Write, Delete and Execution Protection for NC Programs

Protected Programs

Password Protection (up to 10 levels)



The **MACHINEMATE** Milling or Turning application software must be specified at the time of purchase.

Abbreviations in the following list are as follows:

Package:		item:
M	Milling package	i included
T	Turning package	o optional

When an item is indicated as included for a major group, there is usually at least one option for that category.

## **CNC STANDARD FEATURES**

<b><i>DESCRIPTION</i></b>	<b><i>M</i></b>	<b><i>T</i></b>	<b><i>COMMENTS</i></b>
---------------------------	-----------------	-----------------	------------------------

### 1. OPERATION

Handwheel Interface	i	i	
250 pulses per rev.; maximum of 3 handwheels			
(options include operator hardware)			

### 2. DISPLAY / DIAGNOSTICS

The color displays available are selected through the choice of the basic control type. The 10.4" color flat panel display with VGA (640x480) is standard, whereas the expanded version features a 12.1" SVGA (800x600) color flat panel display. In either case, an additional VGA and SVGA interface is provided for an external display.

Flat TFT touch screens are available as an option in 10.4", 12.1", 15", 18" and 20.1" sizes.

### 3. AXES / AXIS FUNCTIONS

The basic control comes with 8-axes SERCOS or 4-axes analog (not both). Please specify which drive control interface is desired.

Digital SERCOS Drive Interface (8 axes)	i	i	Select SERCOS
Analog Axis Interface (4 axes)	i	i	<b>or</b> Analog

(options include more axes and/or more stations – or program paths;  
also for Analog: axis connection box; for SERCOS: IO expansion box)

<b><u>DESCRIPTION</u></b>		<b><u>M T COMMENTS</u></b>	
	Axis Types		
	Parallel Axes Logic	i	i
	(options include gantry axes and other axis variations)		
	Adaptive Look Ahead; 2½ D	i	i
	Adaptive ART II including Command Filter 2½ D	i	i
	Automatic Drift Compensation (analog)	i	i
	(options include other transformations, such as full 5-axis, polar or barrel cam)		
4.	COMPENSATIONS		
	Lead Screw Error Compensation 1,000 Internal Points	i	i
	(options include more points, up to 16000)		
5.	SPINDLE CONTROL		
	Spindle Control	i	i
	Spindle with Feedback	i	i
	Automatic Gear Step Selection (analog)	i	i
	(options include more spindles)		
6.	COMMUNICATION		
	Floppy Disk Drive (A:), Front Access	i	i
	(options include external floppy drive or network card)		
7.	MEMORY EXTENSION		
	NC Memory Extension (buffered CMOS RAM)	i	i
	(options include more memory)		

<b><u>DESCRIPTION</u></b>	<b><u>M</u></b>	<b><u>T</u></b>	<b><u>COMMENTS</u></b>
---------------------------	-----------------	-----------------	------------------------

8.	PROGRAMMING		
----	-------------	--	--

	Cycle Programming		
--	-------------------	--	--

	Extension to 1000 Parameters	i	i
--	------------------------------	---	---

	(options: more available in increments of 1000)		
--	---	--	--

	NC programming		
--	----------------	--	--

	Helical Interpolation	i	o
--	-----------------------	---	---

	Spline Interpolation	i	o
--	----------------------	---	---

	Feedrate Interpolation	i	o
--	------------------------	---	---

	Diameter Programming	o	i
--	----------------------	---	---

	Thread Cutting G33/G34	o	i
--	------------------------	---	---

	Rigid Tapping	i	o
--	---------------	---	---

	Constant Surface Speed	o	i
--	------------------------	---	---

	Feed Per Revolution	i	i
--	---------------------	---	---

	Polar Coordinate Programming	i	o
--	------------------------------	---	---

	Programmable Acceleration	i	o
--	---------------------------	---	---

	Safe Zone Programming	i	i
--	-----------------------	---	---

	Corner Rounding	i	i
--	-----------------	---	---

	Tool Management	i	i
--	-----------------	---	---

	Extended PLC Interface	i	i
--	------------------------	---	---

	(options in most cases above: the optional item is usually associated with either a Milling or Turning application so it does not apply to the other application – making it optional for that type)		
--	--	--	--

<b><u>DESCRIPTION</u></b>		<b><u>M</u></b>		<b><u>T</u></b>	<b><u>COMMENTS</u></b>
9.	PROBING FUNCTIONS				
	Probing Logic (Probing routine is an option.)	i		i	
10.	<b>MACHINE</b> MATE MODULAR I/O*				
	Module Box (for two I/O Modules)	i		i	
	I/O Module 24-Input/16-Output (1A) 24 VDC	i		i	(qty: see below)
	(for the MM1 and MM3 models, only 1 module is provided; for the MM5 and MM7 models, 2 modules are provided; more modules (and boxes) are available for any model)				
	(SERCOS model comes with additional 24i/16o connector)				
	(options: Analog Module: 4 input channels/4 output channels; Axis Encoder Module: 4 analog axis channels)				
	READY-TO-USE CABLES FOR MODULAR I/O				
	Interconnect Cable - 6.6 ft. (2 m)	i		i	
	*Omron I/O can be furnished as an option in place of Modular IO.				
11.	PLC DEVELOPMENT ENVIRONMENT				
	PLC IEC1131 Language (Ladder Diagram and Structured Text)	i		i	
	PLC Development System on CNC	i		i	
	(options: the other IEC-1131 standard languages: Instruction List (IL), Function Block (FB), and Sequential Flow Chart (SFC), individually)				
12.	DOCUMENTATION				
	Installation Kit	i		i	
	(includes <b>MACHINE</b> MATE Manuals on CD)				
	(options: the printed manuals are available individually or as a set)				