

# **Training Class Syllabus**

**Revision Date: 10/2014**

# MAS-A5/MMC2 Operation Training Class

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# MAS-A5/MMC2 Operation Training Class

## MAKINO Course List

### Scheduled classes taught at a Makino Facility

#### Operations:

[PRO 5 Operations with Fanuc 310i Control – 2.5 Days](#)

[PRO 3 Operations with Fanuc 16i/18i Control – 2.5 Days](#)

[MMC/Systems Control Operations – MAS-A5 Software – 2.5 Days](#)

[High Performance Machining – 4.5 Days](#)

#### Maintenance:

[a51/a61 HMC Maintenance with PRO 3 Control – 4.5 Days](#)

[a71/a81 HMC Maintenance with PRO 3 Control – 4.5 Days](#)

[a51/a61 HMC Maintenance with PRO 5 Control – 4.5 Days](#)

[a71/a81/a82 HMC Maintenance with PRO 5 Control – 4.5 Days](#)

[a51nx/a61nx HMC Maintenance with PRO 5 Control – 4.5 Days](#)

[a51/a61 HMC Advanced Maintenance with PRO 5 Control – 4.5 Days](#)

[a71/a81 HMC Advanced Maintenance with PRO 5 Control – 4.5 Days](#)

[MAG3 Maintenance – 4.5 Days](#)

[S/F Series Preventative Maintenance and Recovery – 2.5 Days](#)

#### Programming

[Manual Part Programming – 4.5 Days](#)

[Macro Programming – 2.5 Days](#)

#### EDM

[Wire EDM Operations \(Hyper-i Control\) – 3 Days](#)

[Wire EDM Operations with MGW-S Control – 4.5 Days](#)

[RAM EDM Operations with MGH Control – 4.5 Days](#)

### Online Training Courses

[a51, a61, a71, a81 Operations with PRO 3 Control](#)

[a51, a61, a71, a81 Operations with PRO 5 Control](#)

[S Series Vertical Machining Center Operations with PRO 5 Control](#)

### [Are You Ready to Enroll in a Class?](#)

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# MAS-A5/MMC2 Operation Training Class

## Makino's Mission Statement

### SUCCESS THROUGH INTEGRITY AND INNOVATION

Our goal is to provide products and services which exceed customer expectations. This is accomplished through INTEGRITY and a commitment to excellence.

Each employee's talent and dedication are the means by which we achieve this goal. Our collective efforts must focus on INNOVATION and continuous improvement to meet the advancing needs of our customers.

We, the employees of Makino, measure success by the satisfaction of those who produce, sell, and use our products. We achieve SUCCESS through INTEGRITY AND INNOVATION.

### Instructors

Makino's course instructors are committed personally and professionally to the quality of the training atmosphere. Our technical instructors are highly experienced in the daily operations of Makino's products, from the 1 Series to the MAG machines. Most importantly, we are committed to improving the understanding and confidence of each student to ensure they are better able to perform their jobs.

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## MAS-A5/MMC2 Operation Training Class

### Pro 5 Operations with Fanuc 310i Control – 2.5 Days

Provide Operators with a working knowledge of the terminology, procedures, codes, formats, and the ability to use all control functions necessary to operate the machine in a safe and efficient manner.

#### Description:

This competency-based course provides an overview of all machine safety features and procedures, operator control stations, and machine components and functions. Detailed instruction is presented on the control, including its functions and screens, setup procedures, and minor recovery operations. The Fanuc 310i control (in Makino Pro 5 configuration) is featured with heavy emphasis on the typical Horizontal Machining Center (HMC) application. Some discussion and/or activity are also directed at the particular models and options of customer machinery for each student where possible. MMC programming and functions are not covered.

#### Contents:

- Explanation of Basic Safety Functions
- Machine Components and their Functions
- Basic Pro 5 Screen Navigation
- Coordinate Systems
- Setting Work Coordinate Offsets
- Tools and Tool Offsets
- Program Management and Editing
- Malfunction Prevention and Program Recovery
- Tool Monitoring

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## MAS-A5/MMC2 Operation Training Class

### Pro 3 Operations with Fanuc 16i/18i Control – 2.5 Days

Provide Operators with a working knowledge of the terminology, procedures, codes, formats, and the ability to use all control functions necessary to operate the machine in a safe and efficient manner.

#### Description:

This competency-based course provides an overview of all machine safety features and procedures, operator control stations, and machine components and functions. Detailed instruction is presented on the control, including its functions and screens, setup procedures, and minor recovery operations. The Fanuc 16i/18i control (in Makino Pro 3 configuration) is featured with heavy emphasis on the typical Horizontal Machining Center (HMC) application. Some discussion and/or activity are also directed at the particular models and options of customer machinery for each student where possible. MMC programming and functions are not covered.

#### Contents:

- Explanation of Basic Safety Functions
- Machine Components and Their Functions
- Introduction to the CNC and PMC Control Functions
- Coordinate System
- Manual and Automatic CNC Functions
- PMC Functions
- Machine Setup
- Minor Alarm Recovery and

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# MAS-A5/MMC2 Operation Training Class

## MAS-A5 Software Operations & MMC2 – 2.5 Days

Provide Cell Management, Operators, and Programmers the ability to effectively define, input, control, and operate the MAS-A5 and MMC System in Automatic System Mode and Manual Mode.

### Description:

This course provides information necessary for performing basic operation and programming techniques for the MAS-A5 System Software. The function, location, and principle of operation for the major components of the MAS-A5 Software are covered. Emphasis is placed on software data entry and system operation. The student will learn through practical experience by setting up an automatic operation using simulators.

### Prerequisites:

- Familiarity with the basic fundamentals of machining and machine tools as related to MMC systems.

### Contents:

#### Course Outline

- |   |  |
|---|--|
| <ul style="list-style-type: none"><li>• Introduction MAS-A5 Operations</li><li>• Safety</li><li>• MMC2 Cell Overview<ul style="list-style-type: none"><li>○ Components of a Cell</li></ul></li><li>• Basic Cell &amp; MAS-A5 Operations<ul style="list-style-type: none"><li>○ How to Start/Stop the Cell Controller/Client</li><li>○ MAS-A5 Navigation</li></ul></li><li>• MAS-A5 Data Entry<ul style="list-style-type: none"><li>○ Steps of Data Entry<ol style="list-style-type: none"><li>1. NC Programs &amp; Work Offset Files</li><li>2. Tooling Data</li><li>3. Part Data Setup</li><li>4. Pallets &amp; Fixtures</li><li>5. Order Entry &amp; Material Input</li></ol></li><li>○ Process to Remove Data</li><li>○ Quick Data Entry*</li><li>○ Automatic Data Entry*</li><li>○ Common Fixtures*</li></ul></li><li>• Operator Work Set Station Interface<ul style="list-style-type: none"><li>○ Clamp/Unclamp Qty's</li><li>○ Clamp/Unclamp Cancel</li><li>○ Normal/Scrap</li><li>○ Re-Machining</li><li>○ CMM/Gage Inspection*</li></ul></li><li>• Diagnostic Tools<ul style="list-style-type: none"><li>○ Pallet Diagnosis</li><li>○ Process Diagnosis</li></ul></li></ul> | <ul style="list-style-type: none"><li>• Diagnostic Tools, cont.<ul style="list-style-type: none"><li>○ Tool Set</li><li>○ Compare Tool Data</li><li>○ Process Assigned to Machine</li></ul></li><li>• Manual Pallet Moves<ul style="list-style-type: none"><li>○ Manual Pallet Transport using MAS-A5</li><li>○ Pallet-IN/Pallet-OUT</li><li>○ Manual moves using the Remote Handy Terminal Controller</li><li>○ MMC Vehicle Fork Moves using the Handy Terminal Controller</li><li>○ Manual moves for Part Program Prove-Out</li></ul></li><li>• MMC2 Cell Recovery<ul style="list-style-type: none"><li>○ Pallet Recovery<ol style="list-style-type: none"><li>1. High Level Maintenance*</li></ol></li><li>○ Machine Recovery</li><li>○ Work Set Station Recovery</li><li>○ Vehicle Recovery</li><li>○ Work Data Reset</li></ul></li><li>• MAS-A5 Reports<ul style="list-style-type: none"><li>○ Export Formats</li></ul></li><li>• Customer Specific Topics<ul style="list-style-type: none"><li>○ Any specific topics that the customer requests additional attention during the training</li></ul></li><li>• Miscellaneous Questions</li></ul> |
|---|--|

**NOTE:** \* -Some of the training topics listed may not be applicable to every MAS-A5 Cell Operations training class, since the parameters may or may not be set for specific functionality within the MAS-A5 software.

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# MAKINO

## Makino CNC Technical Training

### High Performance Machining – 4.5 Days

Provide Operators and Programmers with necessary knowledge and materials to make appropriate decisions related to tooling and programming part geometry which support high-performance machining applications. Provide 1 day basic Pro 5 Control operations. Provide half day of Tool Measure probing operations.

#### Description

Provide Operators and Programmers with necessary knowledge and materials to make appropriate decisions related to tooling and programming part geometry which support high-performance machining applications. Provide 1 day basic Pro 5 Control operations. Provide half day of Tool Measure probing operations.

#### Prerequisites

- Attendees will learn how to determine best approach to completing a job but will not learn how to set it up on the machine.
- Recommended for Operators and Programmers responsible for running the machine.

#### Contents

##### Days -1 through 3 High Speed Milling

- Class Overview, Machine Overview, Tool Holders, and Cutting Tools Suitable for HPM
- Application of These Tools to Real Life Machining
- SGI, Machine Communications, and Transfer
- HPM Feeds and speeds calculations
- Basic CAM Theories and Techniques

##### Days- 4 PRO5 Control Operations

- Basic Pro 5 Screen Navigation
- Coordinate Systems
- Setting Work Coordinate Offsets
- Tools and Tool Offsets
- Program Management and Editing
- Malfunction Prevention and Program Recovery
- Tool Monitoring

##### Day 5 – Half Day Laser ATLM

- Calibration
- Bull Nose/Ball nose checks

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# MAKINO

## Makino CNC Technical Training

### a51/a61 HMC Maintenance with Pro 3 Control – 4.5 Days

Provide Maintenance personnel with the ability to effectively determine a machine fault and its probable causes. Perform basic electrical and mechanical adjustments as well as general and periodic maintenance procedures. Practice machine recovery.

#### Description:

This course provides the information necessary to perform basic machine maintenance. The function, location, and principle of operation for the major machine units are described. Emphasis is placed on troubleshooting a machine fault, by use of the various diagnostic functions available on the machine tool and the Pro 3 control. The course consists of classroom sessions and hands-on training.

#### Prerequisites:

- Identify dimensions from part drawings and work with coordinate systems.
- Ability to read blueprints, hydraulic diagrams, and electrical schematics.
- Understanding of mechanical systems and basic electricity.
- Familiarity with the tools used to check and repair mechanical, hydraulic, and electrical systems.

#### Contents:

##### Day 1

- Introduction to Machine.
- Safety precautions and procedures.
- Basic operations and screen navigation.

##### Days 2

- Data Back-up.
- Troubleshooting via machine side and control side screens and diagnostics.
- Description of the major machine units, their principles of function, specifications, and hands-on checks/adjustments.
  - Spindle

##### Days 3 and 4

- Feed Axes
- Table
- Automatic Tool Changer (ATC)
- Tool Magazine
- Automatic Pallet Changer (APC)
- Auxiliary units
- Periodic Maintenance.

##### Day 5

- Reading Maintenance Drawings
- Hands-on Problem solving (alarms, faults, etc.)
- Final Review and wrap-up

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# MAKINO

## Makino CNC Technical Training

### a71/a81 HMC Maintenance with Pro 3 Control – 4.5 Days

Provide Maintenance personnel with the ability to effectively determine a machine fault and its probable causes. Perform basic electrical and mechanical adjustments as well as general and periodic maintenance procedures. Practice machine recovery.

#### Description:

This course provides the information necessary to perform basic machine maintenance. The function, location, and principle of operation for the major machine units are described. Emphasis is placed on troubleshooting a machine fault, by use of the various diagnostic functions available on the machine tool and the Pro 3 control. The course consists of classroom sessions and hands-on training.

#### Prerequisites:

- Identify dimensions from part drawings and work with coordinate systems.
- Ability to read blueprints, hydraulic diagrams, and electrical schematics.
- Understanding of mechanical systems and basic electricity.
- Familiarity with the tools used to check and repair mechanical, hydraulic, and electrical systems.

#### Contents:

##### Day 1

- Introduction to Machine.
- Safety precautions and procedures.
- Basic operations and screen navigation.

##### Days 2

- Data Back-up.
- Troubleshooting via machine side and control side screens and diagnostics.
- Description of the major machine units, their principles of function, specifications, and hands-on checks/adjustments.
  - Spindle

##### Days 3 and 4

- Feed Axes
- Table
- Automatic Tool Changer (ATC)
- Tool Magazine
- Automatic Pallet Changer (APC)
- Auxiliary units
- Periodic Maintenance.

##### Day 5

- Reading Maintenance Drawings
- Hands-on Problem solving (alarms, faults, etc.)
- Final Review and wrap-up

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# MAKINO

## Makino CNC Technical Training

### a51/a61 HMC Maintenance with Pro 5 Control – 4.5 Days

Provide Maintenance personnel with the ability to effectively determine a machine fault and its probable causes. Perform basic electrical and mechanical adjustments as well as general and periodic maintenance procedures.

#### Description:

This course provides the information necessary to perform basic machine maintenance. The function, location, and principle of operation for the major machine units are described. Emphasis is placed on troubleshooting a machine fault, by use of the various diagnostic functions available on the machine tool and the Pro 5 control. The course consists of classroom sessions and hands-on training.

#### Prerequisites:

- Identify dimensions from part drawings and work with coordinate systems.
- Ability to read blueprints, hydraulic diagrams, and electrical schematics.
- Understanding of mechanical systems and basic electricity.
- Familiarity with the tools used to check and repair mechanical, hydraulic, and electrical systems.

#### Contents:

##### Day 1

- Introduction to Machine.
- Safety precautions and procedures.
- Basic operations and screen navigation.

##### Days 2

- Data Back-up.
- Troubleshooting via machine side and control side screens and diagnostics.
- Description of the major machine units, their principles of function, specifications, and hands-on checks/adjustments.
  - Spindle

##### Days 3 and 4

- Feed Axes
- Table
- Automatic Tool Changer (ATC)
- Tool Magazine
- Automatic Pallet Changer (APC)
- Auxiliary units
- Periodic Maintenance.

##### Day 5

- Reading Maintenance Drawings
- Hands-on Problem solving (alarms, faults, etc.)
- Final Review and wrap-up

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# MAKINO

## Makino CNC Technical Training

### a71/a81/a82 HMC Maintenance with Pro 5 Control – 4.5 Days

Provide Maintenance personnel with the ability to effectively determine a machine fault and its probable causes. Perform basic electrical and mechanical adjustments as well as general and periodic maintenance procedures.

#### Description:

This course provides the information necessary to perform basic machine maintenance. The function, location, and principle of operation for the major machine units are described. Emphasis is placed on troubleshooting a machine fault, by use of the various diagnostic functions available on the machine tool and the Pro 5 control. The course consists of classroom sessions and hands-on training.

#### Prerequisites:

- Identify dimensions from part drawings and work with coordinate systems.
- Ability to read blueprints, hydraulic diagrams, and electrical schematics.
- Understanding of mechanical systems and basic electricity.
- Familiarity with the tools used to check and repair mechanical, hydraulic, and electrical systems.

#### Contents:

##### Day 1

- Introduction to Machine.
- Safety precautions and procedures.
- Basic operations and screen navigation.

##### Days 2

- Data Back-up.
- Troubleshooting via machine side and control side screens and diagnostics.
- Description of the major machine units, their principles of function, specifications, and hands-on checks/adjustments.
  - Spindle

##### Days 3 and 4

- Feed Axes
- Table
- Automatic Tool Changer (ATC)
- Tool Magazine
- Automatic Pallet Changer (APC)
- Auxiliary units
- Periodic Maintenance.

##### Day 5

- Reading Maintenance Drawings
- Hands-on Problem solving (alarms, faults, etc.)
- Final Review and wrap-up

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# MAKINO

## Makino CNC Technical Training

### **a51nx/a61nx HMC Maintenance with Pro 5 Control – 4.5 Days**

Provide Maintenance personnel with the ability to effectively determine a machine fault and its probable causes. Perform basic electrical and mechanical adjustments as well as general and periodic maintenance procedures.

#### **Description:**

This course provides the information necessary to perform a51nx/a61nx machine maintenance. The function, location, and maintenance requirements for the major machine units are described. Emphasis is placed on troubleshooting machine faults by use of the diagnostic functions available on the machine and the control. The course includes classroom sessions and hands-on activities in the shop.

#### **Prerequisites:**

- Ability to read mechanical drawings, hydraulic diagrams, and electrical schematics.
- Understanding of mechanical systems and basic electricity.
- Familiarity with the tools used to check and repair mechanical, hydraulic, and electrical systems.
- Familiarity with shop practices and safety requirements.

#### **Contents:**

##### Day 1

- Introduction to Machine.
- Safety precautions and procedures.
- Basic operations and screen navigation.

##### Days 2

- Data Back-up.
- Troubleshooting via machine side and control side screens and diagnostics.
- Description of the major machine units, their principles of function, specifications, and hands-on checks/adjustments.
  - Spindle

##### Days 3 and 4

- Feed Axes
- Table
- Automatic Tool Changer (ATC)
- Tool Magazine
- Automatic Pallet Changer (APC)
- Auxiliary units
- Periodic Maintenance.

##### Day 5

- Reading Maintenance Drawings
- Hands-on Problem solving (alarms, faults, etc.)
- Final Review and wrap-up

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# MAKINO

## *Makino CNC Technical Training*

### **a51/a61 HMC Advanced Maintenance w/Pro 5 Control – 4.5 Days**

Provide Maintenance personnel with the ability to effectively determine a machine fault and its probable causes. Perform basic electrical and mechanical adjustments as well as general and periodic maintenance procedures.

#### **Description:**

This course provides the information necessary to perform advanced a51/a61 machine maintenance. The function, location, and principle of operation for the major machine units are described. Emphasis is placed on tear-down and rebuild of the major machine units. The course consists of classroom sessions and hands-on training.

#### **Prerequisites:**

- Minimum 3 years working on a51/a61 in a maintenance capacity OR attendance in a51/a61 Maintenance training.
- Ability to use indicator and other precision-measuring equipment.
- Identify dimensions from part drawings; work with coordinate systems.
- Read blueprints, hydraulic diagrams, and electric schematics.
- Understand mechanical systems/basic electricity.
- Familiarity with machining/machine tools required.

#### **Contents:**

- Safety Precautions and Procedures
- Mechanisms and Adjustment/Replacement Procedures
- Machine Controller
- Special Tools/Jigs

#### **[Are You Ready to Enroll in a Class?](#)**

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# MAKINO

## *Makino CNC Technical Training*

### **a71/a81 HMC Advanced Maintenance w/Pro 5 Control – 4.5 Days**

Provide Maintenance personnel with the ability to effectively determine a machine fault and its probable causes. Perform basic electrical and mechanical adjustments as well as general and periodic maintenance procedures.

#### **Description:**

This course provides the information necessary to perform advanced a71/a81 machine maintenance. The function, location, and principle of operation for the major machine units are described. Emphasis is placed on tear-down and rebuild of the major machine units. The course consists of classroom sessions and hands-on training.

#### **Prerequisites:**

- Minimum 3 years working on a71/a81 in a maintenance capacity OR attendance in a71/a81 Maintenance training.
- Ability to use indicator and other precision-measuring equipment.
- Identify dimensions from part drawings; work with coordinate systems.
- Read blueprints, hydraulic diagrams, and electric schematics.
- Understand mechanical systems/basic electricity.
- Familiarity with machining/machine tools required.

#### **Contents:**

- Safety Precautions and Procedures
- Mechanisms and Adjustment/Replacement Procedures
- Machine Controller
- Special Tools/Jigs

### **[Are You Ready to Enroll in a Class?](#)**

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# MAKINO

## Makino CNC Technical Training

### MAG3 Maintenance – 4.5 Days

Provide Maintenance personnel with the ability to effectively determine a machine fault and its probable causes. Perform basic electrical and mechanical adjustments as well as general and periodic maintenance procedures.

#### Description:

This course provides the information necessary to perform basic machine maintenance. The function, location, and principle of operation for the major machine units are described. Emphasis is placed on troubleshooting a machine fault, by use of the various diagnostic functions available on the machine tool and the CNC control. The course consists of classroom sessions and hands-on training.

#### Prerequisites:

- Identify dimensions from part drawings and work with coordinate systems.
- Ability to read blueprints, hydraulic diagrams, and electrical schematics.
- Understanding of mechanical systems and basic electricity.
- Familiarity with the tools used to check and repair mechanical, hydraulic, and electrical systems.

#### Contents:

##### Day 1

- Introduction to Machine.
- Safety precautions and procedures.
- Basic operations and screen navigation.

##### Days 2

- Data Back-up.
- Troubleshooting via machine side and control side screens and diagnostics.
- Description of the major machine units, their principles of function, specifications, and hands-on checks/adjustments.
  - Spindle

##### Days 3 and 4

- Feed Axes
- Table
- Automatic Tool Changer (ATC)
- Tool Magazine
- Automatic Pallet Changer (APC)
- Auxiliary units
- Periodic Maintenance.

##### Day 5

- Reading Maintenance Drawings
- Hands-on Problem solving (alarms, faults, etc.)
- Final Review and wrap-up

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# MAKINO

## *Makino Technical Training*

### **S/F Series Preventive Maintenance and Recovery – 2.5 Days**

Provide Operators and Programmers with necessary knowledge and materials to make appropriate decisions related to tooling and programming part geometry which support high-performance machining applications.

#### **Description:**

This course provides the information necessary to perform basic machine maintenance. The function, location, and principle of operation for the major machine units are described. Emphasis is placed on troubleshooting a machine default, by use of the various diagnostic functions available on the machine tool and the CNC control. The course consists of classroom sessions and hands-on training.

#### **Prerequisites:**

- Identify dimensions from part drawings and work with coordinate systems.
- Ability to read blueprints, hydraulic diagrams, and electrical schematics.
- Understanding of mechanical systems and basic electricity.
- Familiarity with the tools used to check and repair mechanical, hydraulic, and electrical systems.

#### **Contents:**

- Introduction to Machine
- Safety Precautions and Features
- Troubleshooting Via Machine Side and Control Side Diagnostics
- Description of the Major Units and Their Principles of Operations and Specifications
  - Spindle Head
  - Feed Axis Unit
  - ATC

#### **[Are You Ready to Enroll in a Class?](#)**

***Please indicate if you would like this class presented onsite for large groups!***

TO REGISTER: call 1-888-Makino4 and ask for the Training Department or please complete the Enrollment Form located at [www.makino.com/customer-support/training/public-training/](http://www.makino.com/customer-support/training/public-training/).



# MAKINO

## *Makino Technical Training*

### **Manual Part Programming – 4.5 Days**

Provide a working knowledge of the codes, format, and process necessary to write part programs in CNC language for Makino machines.

#### **Description:**

This course provides training to help develop part programs for use on Makino Machining Centers. The main focus of this course is Part Boundary Programming (using print dimensions). This includes explanation of the formats and codes used to produce a program on a Makino machine.

#### **Prerequisites:**

- Ability to read part prints and use algebra, geometry, and right angle trigonometry.
- A working knowledge of machine ability, tool selection, and applications needed to calculate speeds and feeds.
- Familiarity with proper setup procedures including the correct application of work-holding devices.
- Knowledge of chucks, vises, and fixturing is also helpful.

#### **Contents:**

- Introduction to Programming
- Outline of Machine
- Control Specifications and Options
- Tooling
- Preparation for Part Programming
- Composition of a Program
- Canned Cycles
- M Codes, G Codes
- Speed, Feed, Tool, and Indexing Table Codes
- Tool Radius/Diameter and Length Compensation
- Work Coordinate Systems
- Linear & Circular Interpolation
- Rotary Axis Programming
- Subroutines
- Examples
- Tool Monitoring Functions
- Mathematical Functions

### **[Are You Ready to Enroll in a Class?](#)**

***Please indicate if you would like this class presented onsite for large groups!***

TO REGISTER: call 1-888-Makino4 and ask for the Training Department or please complete the Enrollment Form located at [www.makino.com/customer-support/training/public-training/](http://www.makino.com/customer-support/training/public-training/).



# MAKINO

## *Makino Technical Training*

### **Macro Programming – 2.5 Days**

Provide an understanding and working knowledge of macro programming techniques and capabilities and allow the student to become a more efficient and proficient programmer, reducing their part programming time.

#### **Description:**

This course is designed to enable the Programmer to use the control's powerful macro programming feature on milling machines with Fanuc controls. Students will learn to write repetitive machining cycles (i.e., variably decreasing peck drilling, special pocket milling, tool/workpiece/fixture inter-ference checks). Students will understand the components of the macro body and the meaning of the macro call command variables. Past students have programmed entire families of parts with one master program utilizing macros.

#### **Prerequisites:**

- Previous attendance of Makino's Manual Part Programming course or at least 3 months programming experience on a Fanuc control.
- Ability to read part prints and use algebra, geometry, and right angle trigonometry.
- A working knowledge of machine ability, tool selection, and applications needed to calculate speeds and feeds.
- Familiarity with proper setup procedures including the correct application of work-holding devices.

#### **Contents:**

- User Macro Introduction
- Composition of Macro Command
- Local, Common and System Variables
- Arithmetic Commands
- Control Commands
- Registration of Macro Body
- Call of Macro
- Words Used in Macro
- Writing Alarms
- Shifting Program Zero Points

### **[Are You Ready to Enroll in a Class?](#)**

***Please indicate if you would like this class presented onsite for large groups!***

TO REGISTER: call 1-888-Makino4 and ask for the Training Department or please complete the Enrollment Form located at [www.makino.com/customer-support/training/public-training/](http://www.makino.com/customer-support/training/public-training/).



# MAKINO

## *Makino Technical Training*

### **Wire EDM Standard Operations (Hyper-i Control) – 3 Days**

#### **Standard Operator Training (3 Days at Makino):**

This training provides information about operation and maintenance of the machine. Machine parts, movements, controls, and maintenance are discussed. The process of loading, selecting, and running a program is covered. Programming basics and variations are covered before a sample part will be processed. Selection and modification of electrical cutting conditions are covered. Helpful tools such as consumable life and cost estimation are also discussed. Navigation of EDM Assist (onboard manuals) will be explained.

#### **Description:**

The Hyper-i Control training is applicable to the U3, U6, Uj, U86, U1310, and UPV WEDM machines. **Standard Operator Training** begins at 8:30 on Tuesday. It is recommended for all new users of Makino WEDM machines and operators needing a refresher course on the control and maintenance procedures. The course consists of a combination of classroom lecture and hands-on training to facilitate quick learning of the machine.

#### **Prerequisites:**

##### **Standard Operator Training**

- Familiarity with G/M-code programming.

#### **Contents:**

Standard Operator Training:

- Machine parts, movements, and controls
- Maintenance
- Loading and modifying programs
- Part setup, detailed pick-up cycles, and setting work coordinates
- Selection and modification of cutting conditions
- Explanation of miscellaneous functions
- Select and run sample programs.
- Location and navigation of onboard manuals

### **[Are You Ready to Enroll in a Class?](#)**

***Please indicate if you would like this class presented onsite for large groups!***

TO REGISTER: call 1-888-Makino4 and ask for the Training Department or please complete the Enrollment Form located at [www.makino.com/customer-support/training/public-training/](http://www.makino.com/customer-support/training/public-training/).



# MAKINO

## Makino Technical Training

### Wire EDM Operations with MGW-S Control – 4.5 Days

**Session A:** Provide an introductory survey of the wire EDM machine tool, the control and its features, maintenance and upkeep procedures, part programming, and processing of an actual EDM application.

**Session B:** Review of maintenance procedures, detailed discussion on control features, taper and 4-axis programming requirements, Makino EDM cutting parameters and their effect on the process and result, discussion of typical real life applications.

#### Description:

This 2-part course provides full training on the operation, programming, and in-depth maintenance of wire EDM machines using the MGW-S control, applicable to the DUO, SP,U86, U..i, and U..j series wire EDM machines.

**Session A** begins at 8:30 on Monday and is recommended for all new users of Makino WEDM machines and operators needing a refresher course on the control and especially maintenance procedures.

**Session B** begins at 8:30 on Wednesday and is recommended for Session 1 students and operators with prior experience using the MGW-S control.

The course consists of a combination of classroom lecture and hands-on use of the machine. Student active participation is encouraged.

#### Prerequisites:

- Ability to read part drawings.

##### Session A

- No prior Makino wire EDM experience.

##### Session B

- Prior experience on Makino wire EDM. Familiarity with G/M-code programming.

#### Contents:

##### Session A:

- Overview of the machine control
- Detailed machine maintenance procedures
- Work coordinate systems and usage
- How to write incremental programs
- How to write absolute part programs
- How to get programs in and out of the machine
- Job setup and cutting an actual job

##### Session B:

- Details of the machine control
- Review of common operator maintenance items
- Job pre-checks and time estimation
- Part pickup and location setting techniques
- Taper and 4-axis program requirements
- Setting up the machine in preparation for a cut
- Cutting technology & effects of various elements
- What can go wrong and why
- Discussion of CAM software packages

***Please indicate if you would like this class presented onsite for large groups!***

TO REGISTER: call 1-888-Makino4 and ask for the Training Department or please complete the Enrollment Form located at [www.makino.com/customer-support/training/public-training/](http://www.makino.com/customer-support/training/public-training/).



# MAKINO

## *Makino Technical Training*

### **RAM EDM Operations with MGH Control – 4.5 Days**

Enable the Operator/Programmer to develop a program, choose the proper cutting (burning) conditions, and use the control functions to obtain unattended and/or semi-unattended operations.

#### **Description:**

This course provides a thorough understanding of EDM RAM techniques and technologies, along with the CNC capabilities and MODEL PLAN conversational programming of the MGH control.

#### **Prerequisites:**

- Background in tool and die and/or parts manufacturing.
- Minimum of 2 weeks hands-on experience with machine and a basic understanding of its functions.

#### **Contents:**

- Introduction to CNC EDM
- Main Machine Components
- Basic Functions for Getting Started
- Modes of Operation
- Introduction to Programming
- Manual and Automatic Workpiece Pickups
- Machine Cutting Parameters
- Stored E-Codes and Model Data
- G and M Codes
- CNC Functions
- Machining Methods Selection
- Pattern Machining Orbit Selection
- Graphics Functions
- Options Functions
- Basic Maintenance

### **[Are You Ready to Enroll in a Class?](#)**

***Please indicate if you would like this class presented onsite for large groups!***

TO REGISTER: call 1-888-Makino4 and ask for the Training Department or please complete the Enrollment Form located at [www.makino.com/customer-support/training/public-training/](http://www.makino.com/customer-support/training/public-training/).



# MAKINO

## *Makino Technical Training*

### **a51, a61, a71, a81 Operations with Pro 3 Control – Online**

Provide Operators with a working knowledge of the terminology, procedures, codes, formats, and the ability to use all control functions necessary to operate the machine in a safe and efficient manner.

#### **Description:**

In addition to outstanding performance and reliability, 1 Series customers can enjoy added benefits:

- Begin training prior to delivery of machine.
- Train in the convenience of own facility or even at home.
- Eliminate cost associated with traditional training.
- Work at own pace.

Achieve a greater understanding of the machine and featured capabilities!

The web-based training course features animated simulations of the machines and provides a virtual operating experience for an effective understanding. In addition, the course provides an evaluation by a series of multiple-choice questions to ensure a successful completion of the training program.

#### **Prerequisites:**

- Pentium III (or higher) and at least 128MB RAM
- Macromedia Shockwave Player
- Windows Media Player 7 or later
- High-speed Internet connection
- Internet Explorer 5 or later
- Screen Resolution: 1024x768 with 24 bit colors

#### **Contents:**

- Module 1: Orientation of the Machine
- Module 2: Operation Panels and Modes of Operation
- Module 3: Part Process (Applications) Considerations
- Module 4: Programming
- Module 5: Job Setup
- Module 6: Run Job
- Module 7: Basic Recovery
- Module 8: Productivity Enhancements

***Please indicate if you would like this class presented onsite for large groups!***

TO REGISTER: call 1-888-Makino4 and ask for the Training Department or please complete the Enrollment Form located at [www.makino.com/customer-support/training/public-training/](http://www.makino.com/customer-support/training/public-training/).





# MAKINO

## *Makino Technical Training*

### **a51, a61, a71, a81 Operations with Pro 5 Control – Online**

Provide Operators with a working knowledge of the terminology, procedures, codes, formats, and the ability to use all control functions necessary to operate the machine in a safe and efficient manner.

#### **Description:**

In addition to outstanding performance and reliability, 1 Series customers can enjoy added benefits:

- Begin training prior to delivery of machine.
- Train in the convenience of own facility or even at home.
- Eliminate cost associated with traditional training.
- Work at own pace.

Achieve a greater understanding of the machine and featured capabilities!

The web-based training course features animated simulations of the machines and provides a virtual operating experience for an effective understanding. In addition, the course provides an evaluation by a series of multiple-choice questions to ensure a successful completion of the training program.

#### **Prerequisites:**

- Pentium III (or higher) and at least 128MB RAM
- Macromedia Shockwave Player
- Windows Media Player 7 or later
- High-speed Internet connection
- Internet Explorer 5 or later
- Screen Resolution: 1024x768 with 24 bit colors

#### **Contents:**

- Module 1: Orientation of the Machine
- Module 2: Operation Panels and Modes of Operation
- Module 3: Part Process (Applications) Considerations
- Module 4: Programming
- Module 5: Job Setup
- Module 6: Run Job
- Module 7: Basic Recovery
- Module 8: Productivity Enhancements

***Please indicate if you would like this class presented onsite for large groups!***

TO REGISTER: call 1-888-Makino4 and ask for the Training Department or please complete the Enrollment Form located at [www.makino.com/customer-support/training/public-training/](http://www.makino.com/customer-support/training/public-training/).



# MAKINO

## *Makino Technical Training*

### **S Series Vertical Machining Center Operations with Pro 5 Control – Online**

Provide Operators with a working knowledge of the terminology, procedures, codes, formats, and the ability to use all control functions necessary to operate the machine in a safe and efficient manner.

#### **Description:**

In addition to outstanding performance and reliability, S Series customers can enjoy added benefits:

- Begin training prior to delivery of machine.
- Train in the convenience of own facility or even at home.
- Eliminate cost associated with traditional training.
- Work at own pace.

Achieve a greater understanding of the machine and featured capabilities!

The web-based training course features animated simulations of the machines and provides a virtual operating experience for an effective understanding. In addition, the course provides an evaluation by a series of multiple-choice questions to ensure a successful completion of the training program.

#### **Prerequisites:**

- Pentium III (or higher) and at least 128MB RAM
- Macromedia Shockwave Player
- Windows Media Player 7 or later
- High-speed Internet connection
- Internet Explorer 5 or later
- Screen Resolution: 1024x768 with 24 bit colors

#### **Contents:**

- Webinar: Built for Die Mold
- Introduction: Getting Started
- Module 1: Orientation of the Machine
- Module 2: Operation Panels and Modes of Operation
- Module 3: Part Process (Applications) Considerations
- Module 4: Programming
- Module 5: Job Setup
- Module 6: Run Job
- Module 7: Basic Recovery
- Module 8: Productivity Enhancements

***Please indicate if you would like this class presented onsite for large groups!***

TO REGISTER: call 1-888-Makino4 and ask for the Training Department or please complete the Enrollment Form located at [www.makino.com/customer-support/training/public-training/](http://www.makino.com/customer-support/training/public-training/).



## *Makino Technical Training*

### **Makino Terms and Conditions for Training**

The following terms and conditions apply to all training sessions conducted by Makino. Any additional terms/conditions shall be submitted in writing; such additions shall not be effective until agreed to by Makino. Any attempt to substitute or add terms/conditions are rejected and shall be of no effect.

Makino offers our customers a number of formal training opportunities on selected topics and products. Content is based on specific skill sets and objectives and is designed to transfer a working knowledge and understanding of the machine tool system and related processes.

Makino Training Credits may be provided with the machine purchase based on machine type and machine purchase agreements. These credits must be used during the first year after purchase. Training for additional personnel or after the standard first year period is on a pay basis only.

Training credits on EDM and Milling Machines are determined by the terms of the purchase proposal. Customers wishing to enroll in Makino Technical Training should refer to their purchase proposal for Training Credit details. Additional training is on a pay basis only.

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TO REGISTER: call 1-888-Makino4 and ask for the Training Department or please complete the Enrollment Form located at [www.makino.com/customer-support/training/public-training/](http://www.makino.com/customer-support/training/public-training/).



# MAKINO

## Makino Technical Training

### Pricing and Terms of Payment

Payment for training classes is due prior to attending the training session. Makino reserves the right to refuse attendance in a class if payment has not been received.

Rescheduling of a class registration is done at no charge if Makino is notified within 15 working days of the class date. Rescheduling is subject to a fee of 20% of the course tuition if notice is received less than 15 working days of the class date. The full tuition fee will be charged for those students who fail to attend the class or fail to notify of a cancellation.

For those students with training credits, one training credit will be used if attendee's company fails to notify Makino of cancellation or if student fails to attend class.

### Training Charges

<b>COURSE COSTS</b>	<b>Technical Training</b>	<b>Advanced Maintenance Training</b>
<b>Mason/SST//Regional Locations (Elgin, IL; Waukesha, WI; Auburns Hills, MI)</b>	\$395.00 per person, per day	\$470.00 per person, per day
<b>Onsite Training Requested</b> <i>Note: Minimum of 4 students required to hold on site training</i>	\$395.00 per person, per day plus instructor expenses	Advanced Maintenance Training is not taught at customer facility.

- Onsite training is on a pay basis only and is subject to instructor availability.
- Pricing is based on class sizes between 2 and 6 students. Please contact us to discuss options and possible additional charges if you plan a larger class size.
- Four day courses begin on Monday and end on Thursday.
- All classes are on first shift only. Classes other than first shift will be charged a differential, as shown:
  - Second shift - \$1,000.00
  - Third shift - \$2,000.00

***Please indicate if you would like this class presented onsite for large groups!***

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# MAKINO

## *Makino Technical Training*

### **Class Time Schedule**

Course length and meeting times vary by subject and training type. Typically, courses begin at 8:30 a.m. and end at 4:30 p.m. You will be notified should this time vary. All training classes share the following rules unless otherwise noted.

- Breaks are provided during the day, based upon the instructor's discretion.
- Lunch is available in the Makino Café from 11:30 am until 1:30 pm Monday through Friday, for classes conducted at the Makino Mason, Ohio facility..

### **Facility Rules**

- Makino is a non-smoking facility.
- Students are required to wear a security badge at all times when attending courses held at Makino.
- Safety glasses with side shields and steel-toed safety shoes that meet ANSI standards are required during class time spent in the shop; we recommend for your own comfort that you bring your own safety glasses to class.
- Business casual attire is requested. Neatly pressed jeans, casual pants, and clean gym shoes are acceptable. **Please, NO shorts, sweat pants, T-shirts with writing, or sandals.**

### **Drug Free Workplace**

It is the policy of Makino that the use, sale, transfer, or possession of alcohol and/or drugs on premises, vehicles, work sites, or in any private vehicles parked on Makino's property is prohibited. Additionally, Makino prohibits individuals from attending any training class under the influence of alcohol and/or drugs. If a Makino instructor determines that an individual attending a training class is under the influence of alcohol and/or drugs, the individual will be asked to leave the premises.

***Please indicate if you would like this class presented onsite for large groups!***

TO REGISTER: call 1-888-Makino4 and ask for the Training Department or please complete the Enrollment Form located at [www.makino.com/customer-support/training/public-training/](http://www.makino.com/customer-support/training/public-training/).



# MAKINO

## *Makino Technical Training*

### Course Registration

**Note:** Enrollment to attend any Makino public training must be done through our website!

#### Are You Ready to Enroll in a Class?

Makino provides classroom space on a first-come first-served basis. If a requested class is filled, applicants are notified and placed on a waiting list or rescheduled for a later class date. Additional classes are scheduled when possible, if the number of people on the waiting list fills a class to minimum capacity. If the waiting list does not warrant scheduling additional classes within a 6 month period, an attempt will be made to accommodate individual training needs on a "special" basis.

To provide the best possible training environment, Makino reserves the right to limit class size.

#### Registration

All students are required to fill out an enrollment form to register for classes. Due to the demand for classes, enrolling as early as possible is recommended. Students are not considered enrolled for a class until they have received confirmation that their application for class has been accepted. It is recommended that enrollment forms be received by Makino at least 15 working days prior to the class date.

To prevent missing vital information, we request that students do not conduct other business during class hours.

#### Ready to enroll for class?

[Click here](#)

Simply fill out the [electronic enrollment form](#) and hit submit.

**Proper photo identification (i.e., driver's license or alternative photo ID) must be provided by all attendees to the instructor on the first day of training. Foreign national attendees must provide passport identification prior to attending class. Makino reserves the right to refuse training or technology transfer to anyone who does not provide sufficient documentation.**

Safety glasses with side shields and steel-toed safety shoes that meet ANSI standards are required for all training classes held on the shop floor per OSHA and ANSI requirements. Students without these items must reschedule their attendance.

***Please indicate if you would like this class presented onsite for large groups!***

TO REGISTER: call 1-888-Makino4 and ask for the Training Department or please complete the Enrollment Form located at [www.makino.com/customer-support/training/public-training/](http://www.makino.com/customer-support/training/public-training/).



# MAKINO

*Makino Technical Training*

## **Course Registration - Cont.**

### **Cancellation Notice:**

Makino reserves the right to cancel a class at any time. Please do not make non-refundable travel arrangements for class. Makino is not responsible for travel arrangements made for classes.

If you have any difficulty, questions or concerns with the registration process do not hesitate to contact our Training Project Leader for assistance with registration.

Assistance: 1-888-Makino4 and ask to speak with our Phone Coordinator or Training Project Leader.

### **Class Cancellation**

Makino reserves the right to cancel a class at any time. If a class should be cancelled, registrants will be notified prior to the scheduled class date. Students registered for a cancelled class will be given priority for rescheduling in future classes or placed on a waiting list, if no other class is available.

Due to possible class cancellation, it is recommended that only refundable tickets be purchased for transportation to training classes. Makino is not responsible for travel arrangements made for classes.

***Please indicate if you would like this class presented onsite for large groups!***

TO REGISTER: call 1-888-Makino4 and ask for the Training Department or please complete the Enrollment Form located at [www.makino.com/customer-support/training/public-training/](http://www.makino.com/customer-support/training/public-training/).



# MAKINO

## Makino Technical Training

### Travel Arrangement Suggestions

**Disclaimer:** Makino has no interest and does not receive any compensation for any travel arrangements with any of these facilities. These travel accommodations are provided as a convenience for making your travel arrangements. Makino cannot guarantee the accommodations provided by these external services. For additional travel information, please contact Makino's Travel Coordinator. (513) 573-7200 and ask for Makino's Travel Coordinator.

#### Airports

For flight arrangements you can fly into either 'CVG' – Greater Cincinnati International Airport or 'DAY' – Dayton International Airport. Sometimes the Dayton [DAY] International Airport offers less expensive rates and may have less congested highway traffic upon your departure.

#### Cincinnati-N. Kentucky Int'l Airport (CVG)

2939 Terminal Drive  
Hebron, KY 41048  
(859) 767-3151  
(37.3 miles to Makino)

#### Dayton International Airport (DAY)

3600 Terminal Road # 300  
Vandalia, OH 45377  
(937) 454-8200  
(50.4 miles to Makino)

#### Hotels

Below is a short, quick list of local hotels, near the Makino – Mason facility. Customers have stayed at the Holiday Inn Express and the Hilton Garden Inn recently and have had positive comments.

#### Holiday Inn Express - Mason

5100 Natorp Blvd.  
Mason, OH 45040  
(513) 387-6000  
(888) 465-4329 Reservations  
Makino rates available  
(3.3 miles to Makino)

#### Hilton Garden Inn – Cincinnati/Mason

5200 Natorp Blvd  
Mason, OH 45040  
(513) 204-6000  
(800) HILTONS Reservations  
(3.3 miles to Makino)

#### Marriott – Cincinnati Northeast

9664 South Mason-Montgomery Road  
Mason, OH 45040  
(513) 459-9800  
(888) 236-7299 Reservations  
(3.3 miles to Makino)

#### \*Hampton Inn – Cincinnati Kings Island

5323 Beach Blvd  
Mason, OH 45040  
(513) 459-8900  
(855) 238-1591 Reservations  
Makino rates available  
(4.4 miles to Makino)

**NOTE:** \* - Do Not use I-71 South to get to the Makino Mason Facility from the Hampton Inn hotel. There is no exit for Western Row Road from I-71 South bound. Take Kings Mills Road East to Kings Island Blvd. South; then turn Right onto Western Row Road; take Western Row Road West to Left on Innovation Way.

***Please indicate if you would like this class presented onsite for large groups!***

TO REGISTER: call 1-888-Makino4 and ask for the Training Department or please complete the Enrollment Form located at [www.makino.com/customer-support/training/public-training/](http://www.makino.com/customer-support/training/public-training/).