MOTOMAN CONTROLLER WITH MILLER AUTO-CONTINUUM MIG WELDING SYSTEM

FOR YRC1000

Only personnel with proper training offered by Yaskawa should carry out the procedures described in this manual.

Upon receipt of the product and prior to initial operation, read these instructions thoroughly, and retain for future reference.

MOTOMAN INSTRUCTIONS
MOTOMAN-MANIPULATOR INSTRUCTIONS
MOTOMAN OPERATORS MANUAL FOR ARC WELDING
MOTOMAN CONCURRENT I/O MANUAL
CONTROLLER MANUAL
MAINTENANCE MANUAL

The operator’s manual above corresponds to specific usage. Be sure to use the appropriate manual. Vendor manuals for system components not manufactured by Yaskawa

Part Number: 182088-1CD
Revision: 0
DANGER

• This manual explains the starting point detecting function of the Controller system. Read this manual carefully and be sure to understand its contents before handling the Controller.

• General items related to safety are listed in Section 1 of the Controller instructions. To ensure correct and safe operation, carefully read the section before reading this manual.

CAUTION

• Some drawings in this manual are shown with the protective covers or shields removed for clarity. Be sure all covers and shields are replaced before operating this product.

• The drawings and photos in this manual are representative examples and differences may exist between them and the delivered product.

• Yaskawa may modify this model without notice when necessary due to product improvements, modifications, or changes in specifications.

• If such modification is made, the manual number will also be revised.

• If your copy of the manual is damaged or lost, contact a Yaskawa representative to order a new copy. The representatives are listed on the back cover. Be sure to tell the representative the manual number listed on the front cover.

• Yaskawa is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids your product's warranty.
We suggest that you obtain and review a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems (ANSI/RIA R15.06-2012). You can obtain this document from the Robotic Industries Association (RIA) at the following address:

Robotic Industries Association  
900 Victors Way  
P.O. Box 3724  
Ann Arbor, Michigan 48106  
TEL: (734) 994-6088  
FAX: (734) 994-3338  
www.roboticsonline.com

Ultimately, well-trained personnel are the best safeguard against accidents and damage that can result from improper operation of the equipment. The customer is responsible for providing adequately trained personnel to operate, program, and maintain the equipment. NEVER ALLOW UNTRAINED PERSONNEL TO OPERATE, PROGRAM, OR REPAIR THE EQUIPMENT!

We recommend approved YASKAWA training courses for all personnel involved with the operation, programming, or repair of the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.
Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the Yaskawa Motoman robot.

In this manual, the Notes for Safe Operation are classified as “DANGER”, “WARNING”, “CAUTION”, or “NOTICE”.

**DANGER**
Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. Safety Signs identified by the signal word DANGER should be used sparingly and only for those situations presenting the most serious hazards.

**WARNING**
Indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury. Hazards identified by the signal word WARNING present a lesser degree of risk of injury or death than those identified by the signal word DANGER.

**CAUTION**
Indicates a hazardous situation, which if not avoided, could result in minor or moderate injury. It may also be used without the safety alert symbol as an alternative to “NOTICE”.

**NOTICE**
NOTICE is the preferred signal word to address practices not related to personal injury. The safety alert symbol should not be used with this signal word. As an alternative to “NOTICE”, the word “CAUTION” without the safety alert symbol may be used to indicate a message not related to personal injury.

Even items described as “CAUTION” may result in a serious accident in some situations.

At any rate, be sure to follow these important items.

**NOTICE**
To ensure safe and efficient operation at all times, be sure to follow all instructions, even if not designated as “DANGER”, “WARNING” or “CAUTION”.
WARNING

• Before operating the Controller, check that servo power is turned OFF by pressing the emergency stop button on the programming pendant. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is OFF.

Injury or damage to machinery may result if the emergency stop circuit cannot stop the Manipulator during an emergency. The Manipulator should not be used if the emergency stop button does not function.

Fig. : Emergency Stop Button

• Once the emergency stop button is released, clear the cell of all items which could interfere with the operation of the Manipulator. Then turn the servo power ON.

Injury may result from unintentional or unexpected Manipulator motion.

Fig. : Release of Emergency Stop

• Observe the following precautions when performing teaching operations within the P-point maximum envelope of the Manipulator:
  – View the Manipulator from the front whenever possible.
  – Always follow the predetermined operating procedure.
  – Ensure that there is a safe place to retreat in case of emergency.

Improper or unintended Manipulator operation may result in injury.

• Confirm that no person is present in the P-point maximum envelope of the Manipulator and that you are in a safe location before:
  – Turning on the power for the Controller.
  – Moving the Manipulator with the programming pendant.
  – Running the system in the check mode.
  – Performing automatic operations.

Injury may result if anyone enters the P-point maximum envelope of the Manipulator during operation. Always press an emergency stop button immediately if there is a problem.

The emergency stop button is located on the programming pendant.
WARNING

- Since detected voltage (200V), welding current, and welding voltage are applied to the starting point detecting unit, install the unit securely so that it does not fall.
- Failure to observe this warning may result in an electric shock or damage to the unit.
- Before connecting the inter-unit cables and the welding cables, be sure to turn OFF the power supply to the Controller and the welder.
- Failure to observe this warning may result in an electric shock.
- Special attention should be paid during starting point detection, since 200 V<sub>DC</sub> is applied across the wire and the workpiece (welding jig).
- Failure to observe this warning may result in an electric shock.
- Do not place any object directly on the cable of the starting point detecting unit.
- Failure to observe this warning may result in an injury or damage caused by the disconnection of the cable.
- Attach the cable of the starting point detecting unit for the wire feeder with the wire stand, to protect it from robot movement. If interference between the cable and the peripheral devices are unavoidable, cover the cable with a rubber plate or spiral tube, etc.
- Failure to observe this warning may result in an electric shock, an injury, or damage to the cable.
- Do not lay the cable of the starting point detecting unit directly on the floor, but install them in a pit or duct or shield the cable with a protective cover.
- Failure to observe this warning may result in an injury or damage to the cable.
- Since a high current flows through the welding cable, separate it from the cables of the control circuit system. If the cables cannot be separated, take preventative measures such as using metallic ducts or tubes on the cables of the control circuit system.
**Definition of Terms Used Often in This Manual**

The Yaskawa Motoman Manipulator is an industrial robot product. The Manipulator usually consists of the Controller, the programming pendant, and supply cables.

In this manual, the equipment is designated as follows:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>YRC1000 Controller</td>
<td>Controller</td>
</tr>
<tr>
<td>YRC1000 programming pendant</td>
<td>Programming pendant</td>
</tr>
<tr>
<td>Cable between the Manipulator and the Controller</td>
<td>Manipulator cable</td>
</tr>
</tbody>
</table>
Descriptions of the programming pendant, buttons, and displays are shown as follows:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programming Pendant</td>
<td></td>
</tr>
<tr>
<td>Character Keys</td>
<td>The keys which have characters printed on them are denoted with [ ]. ex. [ENTER]</td>
</tr>
</tbody>
</table>
| Symbol Keys                | The keys which have a symbol printed on them are not denoted with [ ] but depicted with a small picture. ex. [page key] 
|                            | The cursor key is an exception, and a picture is not shown. |
| Axis Keys & Number Keys    | “Axis Keys” and “Number Keys” are generic names for the keys for axis operation and number input. |
| Keys pressed simultaneously| When two keys are to be pressed simultaneously, the keys are shown with a “+” sign between them, ex. [SHIFT]+[COORD] |
| Displays                   | The menu displayed in the programming pendant is denoted with { }. ex. {JOB} |

**Description of the Operation Procedure**

In the explanation of the operation procedure, the expression “Select • • •” means that the cursor is moved to the object item and the SELECT key is pressed, or that the item is directly selected by touching the screen.

**Registered Trademark**

In this manual, names of companies, corporations, or products are trademarks, registered trademarks, or bland names for each company or corporation. The indications of (R) and TM are omitted.
# Table of Contents

1 Introduction ..................................................................................................................................... 1-1  
  1.1 About This Document ........................................................................................................ 1-1  
  1.2 System Configuration ..................................................................................................... 1-2  
    1.2.1 Major Components ............................................................................................... 1-3  
  1.3 Reference Documentation ................................................................................................. 1-3  
  1.4 Training for Yaskawa Motoman Products ........................................................................ 1-3  
  1.5 Customer Support Information ........................................................................................... 1-4  

2 Safety........................................................................................................................................... 2-1  
  2.1 Introduction ........................................................................................................................ 2-1  
  2.2 Important Advisory Information .......................................................................................... 2-2  
  2.3 General Safeguarding Tips ................................................................................................ 2-3  
  2.4 Mechanical Safety Devices ................................................................................................ 2-3  
  2.5 Installation Safety ............................................................................................................... 2-4  
  2.6 Programming, Operation, and Maintenance Safety ........................................................... 2-5  

3 Equipment Description .................................................................................................................... 3-1  
  3.1 Robot and Controller ..................................................................................................... 3-1  
  3.2 Miller Auto-Continuum Power Supply ................................................................................ 3-1  
    3.2.1 Software ............................................................................................................... 3-1  
    3.2.2 Miller Auto-Continuum Wire Drive Motor Assembly .............................................. 3-1  
      3.2.2.1 Specifications .......................................................................................... 3-2  
    3.2.3 Miller-Motoman Pendant Interface (HMI) Software .............................................. 3-2  
      3.2.3.1 Starting the HMI Software ....................................................................... 3-2  
    3.2.4 Start Screen ......................................................................................................... 3-3  
    3.2.5 Live Weld Data Screens ....................................................................................... 3-4  
      3.2.5.1 Welder Summary Tab.............................................................................. 3-4  
      3.2.5.2 Welder Detail Tab.................................................................................... 3-5  
    3.2.6 Program Selection Screen ................................................................................... 3-6  
    3.2.7 Config/Monitor Screens .................................................................................. 3-8  
      3.2.7.1 System Configuration Tab ....................................................................... 3-8  
      3.2.7.2 Welder Error Monitoring Tab ................................................................. 3-9
# Table of Contents

4 Theory of Operation ........................................................................................................ 4-1
   4.1 Miller HMI .................................................................................................................. 4-2
   4.2 Pulse Mode ................................................................................................................ 4-2

5 Operation ........................................................................................................................................ 5-1
   5.1 Set-Up Overview ......................................................................................................... 5-1
      5.1.1 Arc Start Files .................................................................................................... 5-2
      5.1.2 Arc End Files ..................................................................................................... 5-2
      5.1.3 Selecting Weld Programs .................................................................................. 5-3
   5.2 Robot Job Programming .............................................................................................. 5-5
      5.2.1 Weld Program Selection ...................................................................................... 5-5
   5.3 Welder Front Panel Display ......................................................................................... 5-5
   5.4 Troubleshooting ........................................................................................................... 5-6

6 Miller Auto-Continuum E Digital ............................................................................................ 6-1
   6.1 Setting Proportional Speed Instruction ......................................................................... 6-1
      6.1.1 The “R*-SET-PROPORTIONAL-SPD.JBI” .......................................................... 6-1
   6.2 MACRO Job Settings .................................................................................................. 6-3
      6.2.1 MILLER-PROG-SEL Macro ................................................................................. 6-3
      6.2.2 MILLER-STRT-PART Macro ................................................................................ 6-4
      6.2.3 MILLER-CHNG-WELD Macro ............................................................................. 6-6
      6.2.4 MILLER-END-PART Macro ................................................................................ 6-7
      6.2.5 Example Weld Job Structure .............................................................................. 6-8
   6.3 Error Reporting .............................................................................................................. 6-9
      6.3.1 Weld Error Reporting ........................................................................................... 6-9
      6.3.2 Part Error Reporting ............................................................................................. 6-10
1 Introduction

1.1 About This Document

This manual provides information about a Yaskawa's robotic arc welding system using the Miller Auto-Continuum power sources. The use of this manual is for welding personnel who have received operator training from Yaskawa, and are familiar with the operation of their Yaskawa robot. For more detailed information, refer to the manuals listed in section 1.3 “Reference Documentation”. This manual contains the following sections:

- CHAPTER 1 - INTRODUCTION
  This chapter provides general information about the Miller Auto-Continuum power source and its components, technical specifications, a list of reference documents, and customer service information.

- CHAPTER 2 - SAFETY
  This chapter describes the conventions used to identify precautionary text throughout this manual. This chapter also contains a list of general cautions and warnings that apply to many of the procedures described in this manual.

- CHAPTER 3 - EQUIPMENT DESCRIPTION
  This chapter provides instructions for basic setup and integration of a Yaskawa welding system with a Miller Auto-Continuum power source. This chapter also provides procedures for start-up and calibration.

- CHAPTER 4 - THEORY OF OPERATION
  This chapter describes general arc welding principles, how the welding system works, and identifies specific welding problems and requirements.

- CHAPTER 5 - OPERATION
  This chapter provides instructions for basic operation of the Auto-Continuum arc welding system. This chapter also provides procedures for start-up. Sample robot programs are also included here.

- CHAPTER 6 - MILLER AUTO-CONTINUUM E DIGITAL
  This chapter provides Miller Auto-Continuum E Digital instructions for macro jobs and error reporting.
1.2 System Configuration

The Miller Auto-Continuum arc welding system is an integrated package of tools and components designed for specific welding requirements. A typical system includes the following components and optional equipment.

Fig. 1-1: Typical Auto-Continuum Welding System

Cable Chart
1 Power Source Control Cable (DeviceNet/Ethernet)
2 Feeder Control Cable
3 Weld Positive
4 Voltage Sense Cable
5 Shock Sensor Cable
6 Gas Hose
7 Weld Negative
1 Introduction

1.3 Reference Documentation

1.2.1 Major Components

A typical system includes the following major components:

- Yaskawa Manipulator and Controller
- Welding equipment, including the following:
  - Miller Auto-Continuum power source
  - Miller Auto-Continuum Wire Drive Motor Assembly
  - Welding torch
- Optional welding equipment:
  - Water circulator
  - Nozzle cleaner
  - Bulk wire delivery package
  - PC/Laptop/HMI for web-page access

1.3 Reference Documentation

For additional information refer to the following:

- Yaskawa Manipulator Manual
- Yaskawa Operator's Manual for Arc Welding
- Yaskawa Concurrent I/O Manual
- Yaskawa Controller Operators Manual
- Yaskawa Controller Maintenance Manual
- Yaskawa Controller Independent/Coordinated Control Manual
- Vendor manuals for system components not manufactured by Yaskawa.

1.4 Training for Yaskawa Motoman Products

Yaskawa Motoman offers standard, modified and/or customized training courses given at several locations throughout the Americas.

For assistance concerning available training contact the Yaskawa Academy at:

Phone: 937-847-3307

e-mail: training@motoman.com

website: www.motoman.com/support/training/us
1.5 Customer Support Information

If you need assistance with any aspect of your Miller Auto-Continuum system, please contact Yaskawa Customer Support at the following 24-hour telephone number:

(937) 847-3200

For routine technical inquiries, you can also contact Yaskawa Customer Support at the following e-mail address:

techsupport@motoman.com

When using e-mail to contact Yaskawa Customer Support, please provide a detailed description of your issue, along with complete contact information. Please allow approximately 24 to 36 hours for a response to your inquiry.

NOTICE

Please use e-mail for routine inquiries only. If you have an urgent or emergency need for service, replacement parts, or information, you must contact Yaskawa Customer Support at the telephone number shown above.

Please have the following information ready before you call:

- System: Miller Auto-Continuum
- Robots: MA1400/MA1900/MA3100...
- Power Supply: Miller Auto-Continuum
- Primary Application: Welding
- Controller: DX100, DX200, or YRC1000
- Software Version: Access this information on the Programming Pendant’s LCD display screen by selecting {MAIN MENU} - {SYSTEM INFO} - {VERSION}
- Robot Serial Number: Located on the robot data plate
- Robot Sales Order Number: Located on the Controller data plate
2 Safety

2.1 Introduction

The purchaser is responsible for following all local, county, state, and national codes, regulations, rules, or laws relating to safety and safe operating conditions for each installation.

We suggest that you obtain and review a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems (ANSI/RIA R15.06-2012). You can obtain this document from the Robotic Industries Association (RIA) at the following address:

**Robotic Industries Association**

900 Victors Way  
P.O. Box 3724  
Ann Arbor, Michigan 48106  
TEL: (734) 994-6088  
FAX: (734) 994-3338  
www.roboticsonline.com

Ultimately, well-trained personnel are the best safeguard against accidents and damage that can result from improper operation of the robot system. The customer is responsible for providing adequately trained personnel to operate, program, and maintain the robot cell. **NEVER ALLOW UNTRAINED PERSONNEL TO OPERATE, PROGRAM, OR REPAIR THE ROBOT SYSTEM!**

We recommend approved Motoman training courses for all personnel involved with the operation, programming, or repair of the robot system. The training course familiarizes personnel with the safe and correct operation of the robot system.

This safety section addresses the following:

- Standard Conventions (Section 2.2)
- General Safeguarding Tips (Section 2.3)
- Mechanical Safety Devices (Section 2.4)
- Installation Safety (Section 2.5)
- Programming, Operation, and Maintenance Safety (Section 2.6)
2.2 Important Advisory Information

Read this manual carefully before installation, operation, maintenance, or inspection of the Miller Auto-Continuum.

In this manual, the Notes for Safe Operation are classified as “DANGER”, “WARNING”, “CAUTION”, or “NOTICE”.

**DANGER**
Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. Safety Signs identified by the signal word DANGER should be used sparingly and only for those situations presenting the most serious hazards.

**WARNING**
Indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury. Hazards identified by the signal word WARNING present a lesser degree of risk of injury or death than those identified by the signal word DANGER.

**CAUTION**
Indicates a hazardous situation, which if not avoided, could result in minor or moderate injury. It may also be used without the safety alert symbol as an alternative to “NOTICE”.

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NOTICE is the preferred signal word to address practices not related to personal injury. The safety alert symbol should not be used with this signal word. As an alternative to “NOTICE”, the word “CAUTION” without the safety alert symbol may be used to indicate a message not related to personal injury.

Even items described as “CAUTION” may result in a serious accident in some situations.

Make sure to follow these important items.

**NOTICE**
To ensure safe and efficient operation at all times, be sure to follow all instructions, even if not designated as “DANGER”, “WARNING” or “CAUTION”.

2.3 General Safeguarding Tips

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. General safeguarding tips are as follows:

- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation of this robot, the operator's manuals, the system equipment, options, and accessories should operate this robot system.
- Do not enter the robot cell while it is in automatic operation. Programmers must have the Programming Pendant when they enter the robot cell.
- Improper connections can damage the robot. Make sure all connections are within the standard voltage and current ratings of the robot I/O (Inputs and Outputs).
- Place the robot in Emergency Stop (E-Stop) mode when not in use.
- In accordance with ANSI/RIA R15.06-1999, section 4.2.5, Sources of Energy, use lockout/tagout procedures during equipment maintenance. Refer also to Section 1910.147 (29CFR, Part 1910), Occupational Safety and Health Standards for General Industry (OSHA).

2.4 Mechanical Safety Devices

The safe operation of the robot, positioner, auxiliary equipment, and system is ultimately the user's responsibility. The user should review the conditions for safe operations of the equipment. The user must be aware of the various national codes, ANSI/RIA R15.06-2012 safety standards, and other local codes that may pertain to the installation and use of industrial equipment. Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. The following safety equipment is provided as standard:

- Safety fences and barriers
- Light curtains and/or safety mats
- Door interlocks
- Emergency stop palm buttons located on operator station, robot Controller, and programming pendant

Check all safety equipment frequently for proper operation. Repair or replace any non-functioning safety equipment immediately.
2.5 Installation Safety

Safe installation is essential for protection of people and equipment. The following suggestions are intended to supplement, but not replace, existing federal, local, and state laws and regulations. Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. Installation tips are as follows:

• Be sure that only qualified personnel familiar with national codes, local codes, and ANSI/RIA R15.06-2012 safety standards are permitted to install the equipment.

• Identify the work envelope of each robot with floor markings, signs, and barriers.

• Position all Controllers outside the robot work envelope.

• Whenever possible, install safety fences to protect against unauthorized entry into the work envelope.

• Eliminate areas where personnel might get trapped between a moving robot and other equipment (pinch points).

• Provide sufficient room inside the workcell to permit safe teaching and maintenance procedures.
2.6 Programming, Operation, and Maintenance Safety

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this robot should program, operate, and maintain the system. All personnel involved with the operation of the equipment must understand potential dangers of operation.

- Inspect the robot and work envelope to be sure no potentially hazardous conditions exist. Be sure the area is clean and free of water, oil, debris, etc.

- Be sure that all safeguards are in place. Check all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.

- Do not enter the robot cell while it is in automatic operation. Be sure that only the person holding the programming pendant enters the workcell.

- Check the E-Stop button on the programming pendant for proper operation before programming. The robot must be placed in Emergency Stop (E-Stop) mode whenever it is not in use.

- Back up all programs and jobs onto suitable media before program changes are made. To avoid loss of information, programs, or jobs, a backup must always be made before any service procedures are done and before any changes are made to options, accessories, or equipment.

- Any modifications to PART 1, System Section, of the robot Controller concurrent I/O program can cause severe personal injury or death, as well as damage to the robot! Do not make any modifications to PART 1, System Section. Making any changes without the written permission of Motoman will VOID YOUR WARRANTY!

- Some operations require standard passwords and some require special passwords. Special passwords are for Motoman use only. YOUR WARRANTY WILL BE VOID if you use these special passwords.

- The robot Controller allows modifications of PART 2, User Section, of the concurrent I/O program and modifications to Controller parameters for maximum robot performance. Great care must be taken when making these modifications. All modifications made to the Controller will change the way the robot operates and can cause severe personal injury or death, as well as damage the robot and other parts of the system. Double-check all modifications under every mode of robot operation to ensure that you have not created hazards or dangerous situations.

- Check and test any new or modified program at low speed for at least one full cycle.

- This equipment has multiple sources of electrical supply. Electrical interconnections are made between the Controller and other equipment. Disconnect and lockout/tagout all electrical circuits before making any modifications or connections.
2 Safety
2.6 Programming, Operation, and Maintenance Safety

- Do not perform any maintenance procedures before reading and understanding the proper procedures in the appropriate manual.
- Use proper replacement parts.
- Improper connections can damage the robot. All connections must be made within the standard voltage and current ratings of the robot I/O (Inputs and Outputs).
3 Equipment Description

This chapter contains brief descriptions of The Miller Auto-Continuum welding system components.

3.1 Robot and Controller

The Controller coordinates the operation of the various welding system components. The Controller executes instruction sequences provided in a robot job file. As the Controller steps through the series of instructions, it directs the movement of the torch, and operates the welding power supply. The robot moves the welding torch and supply lines through a series of programmed steps. The Controller sets the speed, direction, and position of the robot as it moves from point to point. It communicates weld signals through a digital interface board mounted in the Controller cabinet. The Controller sends command values for wire feed speed, voltage/arc length, arcon and arcoff. The robot also selects one of eight weld programs by setting three outputs. The Miller Auto-Continuum power source communicates to the Controller when the arc is established, when there is a fault condition, or when the wire is stuck to the puddle. The power source also communicates the fault type back to the Controller.

This enhanced interface also features a pendant application which allows weld data to be assigned to the eight weld programs. It also provides functionality similar to Millers’ File Manager Software.

3.2 Miller Auto-Continuum Power Supply

The Auto-Continuum 350 provides 11,000 watts (350 amps and 31.5 volts at 100 percent duty cycle). The Auto-Continuum 500 provides 19,000 watts (500 amps and 39 volts at 100 percent duty cycle).

Auto-Continuum Power Supplies offer standard MIG and flux-cored welding processes, as well as advanced processes, including Accu-Pulse® and Regulated Metal Deposition (RMD®). In addition, the machines are capable of advanced pulse processes, like Versa-Pulse®, along with high deposition MIG processes.

3.2.1 Software

The Miller Auto-Continuum comes standard with programs for carbon steel, aluminum, and stainless welding, including Accu-Pulse, standard or adaptive pulse, Accu-Speed, Accu-Curce, conventional MIG, and RMD (included free-of-charge on Auto-Continuum E Digital machines.) The standard Yaskawa interface provides an array of functionality including allowing the user to customize the arc starting and ending timing.

3.2.2 Miller Auto-Continuum Wire Drive Motor Assembly

The Miller Auto-Continuum Wire Drive Motor Assembly features a rugged case design, superior wire feeding capabilities, and digital meters to enhance accuracy.
3 Equipment Description

3.2 Miller Auto-Continuum Power Supply

3.2.2.1 Specifications

<table>
<thead>
<tr>
<th>Input Power</th>
<th>Welding Power Source Type</th>
<th>Wire Feed Speed Range</th>
<th>Wire Diameter Range</th>
<th>Welding Circuit Rating</th>
<th>Dimensions</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 V&lt;sub&gt;DC&lt;/sub&gt;</td>
<td>Continuum</td>
<td>Standard: 1.27 - 25.4m/min (50 - 1000ipm)</td>
<td>0.9 - 2mm (0.035 - .078125in.)</td>
<td>75V 500A 100% Duty Cycle</td>
<td>Height: 234mm (9.2in.) Width: 254mm (10.0in.) Length: 269mm (10.6in.)</td>
<td>8.16kg (18lb)</td>
</tr>
</tbody>
</table>

a) See the MILLER CONTINUUM DRIVE ASSEMBLY OWNER’S MANUAL for details concerning wire type, wire size and wire feed speed.

3.2.3 Miller-Motoman Pendant Interface (HMI) Software

This Interface Software connects the Controller to each of the welding units (up to 4) that are part of the system. The HMI software allows the operator to set the Miller Auto-Continuum parameters from the Controller programming pendant.

This software is standard with the Auto-Continuum/Controller system.

3.2.3.1 Starting the HMI Software

To start the HMI program tap the {ARC WELDING} button, then the {Miller_HMI} button (Fig. 3-2).

Fig. 3-2: Starting HMI Software
3.2.4 Start Screen

The Start Screen (Fig. 3-3) will take you to the various applications shown on each button. These screens are described in more detail later.

*Fig. 3-3: Start Screen*

**Program Setup:** This button opens the Program Setup Screen where programs are selectable.

*Notice: Some of the set-up functions cannot be changed in Play Mode.*

**Live Weld Data:** This button displays the Voltage, Amps, Wire Feed Speed (WFS), wire feeder status, gas solenoid status, travel speed, and weld contactor status.

**Config/Monitor:** This button opens a set of tabs for error monitoring, and welder configurations.

*Notice: The permission and monitor settings can only be changed when the Controller is in Management Mode. When the Controller is not in Management Mode this screen can only be viewed.*

**Quit:** This button closes the application and returns the user to the pendant programming menus. During normal system operation, if the program is not needed, it should be closed.
3.2.5 **Live Weld Data Screens**

The Live Weld Data Screen is separated into two sections. The two sections are the “Welder Summary” tab and the “Welder Detail” tab.

### 3.2.5.1 Welder Summary Tab

The Welder Summary Tab (Fig. 3-4) displays all four welders (if available) Volts, Amps, WFS (Wire Feed Speed), and TS (Travel Speed).

*Fig. 3-4: View All Welders*

These windows display:
- Welding Volts
- Welding current in amps
- Wire Feed Speed (WFS) in welder configured units.
- Travel Speed (TS) in welder configured units.
- Wire Feed
- Gas Flow
- Arc Detect
- Program Number (#) - displays the selected weld program

**refresh:**
Asks the welder for the most current information.

**Return:**
Returns to the Start Screen. See section 3.2.4 “Start Screen” for more details.
3.2.5.2 Welder Detail Tab

The Welder Detail Tab (Fig. 3-5) displays the Voltage, Amps, and Wire Feed Speed (WFS). This tab also displays the status of the Wire Feed, Gas Flow, and Arc On.

**Fig. 3-5: Welder Summary Tab**

<table>
<thead>
<tr>
<th>1</th>
<th>Welder Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Current Program</td>
</tr>
<tr>
<td>3</td>
<td>Volts</td>
</tr>
<tr>
<td>4</td>
<td>Amps</td>
</tr>
<tr>
<td>5</td>
<td>WFS</td>
</tr>
<tr>
<td>6</td>
<td>Wire Feed</td>
</tr>
<tr>
<td>7</td>
<td>Gas Flow</td>
</tr>
<tr>
<td>8</td>
<td>Arc On</td>
</tr>
</tbody>
</table>

- **Welder Selection:** If more than one welder is connected to the system, select the desired welder number to view its data.
- **Current Program:** Displays the weld program (1 - 8) selected on the Miller Auto-Continuum.
- **Volts:** Actual welding voltage.
- **Amps:** Actual welding Current, in Amps.
- **WFS:** Actual welding Wire Feed Speed, in inches/minute.
- **Wire Feed:** If Indicator is:
  - Grey = Wire Feeder is Off
  - Green = Running in either forward (welding) or reverse (retracting wire)
- **Gas Flow:** If Indicator is:
  - Grey = Gas solenoid off
  - Green = Gas solenoid in on
- **Arc On:** If indicator is:
  - Grey = Welder is in standby
  - Green = Gun Switch is on
- **Refresh:** Asks the welder for the most current information.
- **Return:** Returns to the Start Screen. See section 3.2.4 "Start Screen" for more details.
3.2.6 Program Selection Screen

The Miller Auto-Continuum can have eight user definable weld programs (Fig. 3-6 “Program Selection Screen”). Each program can be configured for the process, wire size and type, and shielding gas.

Fig. 3-6: Program Selection Screen

**Welder Selection:** If more than one welder is connected to the system, select the welder you wish to view.

**Return:** Returns to the Start Screen. See section 3.2.4 “Start Screen” for more details.

**Tabs 1-8:** The tabs labeled 1-8 correspond to the eight program slots available on the Miller Auto-Continuum welder.

- Selecting a tab will switch the welder to the selected program and display the associated selections of that program.
- Using the drop-down boxes, the user can make selections to customize the selected program.
- After making selections pressing the {Load} button loads the correct weld program into the selected program slot.

**Notice:**
- Use a stylus to ensure selection of information needing to program.
- The tab panel is only enabled if you are in Manager Mode or if a manager has granted the user the right to save program changes. (See section 3.2.7 “Config/Monitor Screens” description)

**Wire Type:** Allows the operator to choose the wire type.

**TP#:** Shows the unique Teach Program number that is comprised of the selected parameters.

**Wire Alloy:** Allows the operator to choose the wire alloy based on the wire type selection.

**Wire Size** Allows the operator to select the wire size.
3.2 Miller Auto-Continuum Power Supply

<table>
<thead>
<tr>
<th>Button</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gas</strong></td>
<td>Allows the operator to select the gas or gas combinations</td>
</tr>
<tr>
<td><strong>Process</strong></td>
<td>Allows the operator to select the process based on all the previous selections.</td>
</tr>
<tr>
<td><strong>Refresh:</strong></td>
<td>Asks the welder for the current data.</td>
</tr>
<tr>
<td><strong>Load:</strong></td>
<td>After selecting all the weld parameters the {Load} button becomes active. Pressing it will load the appropriate program.</td>
</tr>
</tbody>
</table>
3.2.7 Config/Monitor Screens

3.2.7.1 System Configuration Tab

Fig. 3-7: System Configuration Tab

- **Welder**
  - **Quantity:** Allows the user to choose the quantity of welders, 1 to 4.
  - **Units:** This setting allows the user to choose the units display for the system. The choices are “English”, and “Metric”. These choices will affect the wire size selections in the “Program Setup” screen. See section 3.2.6 “Program Selection Screen” for more details.

Notice: The welder settings can only be changed when the Controller is in Management Mode. When the Controller is not in Management Mode this screen is disabled.

- **Permission Settings**
  - **Lock welder front panel:** This check box locks out the front panel of the welder.
  - **Allow Operator to edit program setup:** Marking this check box gives the operator permission to edit the program setup.
  - **Allow operator to edit error configuration:** Marking this check box gives the operator permission to change the error monitoring setup.

Notice: The permission settings can only be changed when the Controller is in Management Mode. When the Controller is not in Management Mode this screen is disabled.

- **Return:** Returns to the Start Screen. See section 3.2.4 “Start Screen” for more details.
3.2.7.2 Welder Error Monitoring Tab

The Miller Auto-Continuum has several errors that can be enabled or disabled depending on user preferences. Sometimes these errors will give “nuisance” trips, causing excessive downtime.

The Yaskawa/Miller interface includes a mapping of Miller error codes into the Controller. Welder errors will generate a user alarm on the robot with the error message displayed. Welder alarm history can be viewed under user alarms (see section 5.4 “Troubleshooting” on page 5-6). The error code is recorded along with the date, time, program, and step number of the error.

**Fig. 3-8: Error Preference Screen**

- **Welder Selection:** Select the welder (if more than one is connected to the system).
  - Only that welder is affected.
- **Voltage Sense Error**
  - Monitors the arc voltage between the electrode and the workpiece if box is checked.
- **Wire Stuck Error**
  - Sets an alarm if the weld wire sticks to the workpiece with box checked.
- **Wire Feed Speed Error**
  - When checked the system sets an alarm when the wire feed speed does not match command.
- **Arc Runtime Error**
  - Allows the monitoring for an error if Arc voltage goes below setting for a desired amount of time in seconds when checking the box.
- **Motor Over Current Error**
  - This check box notifies if the primary power source is to high.
- **Coolant Flow Error**
  - Gives an error if no coolant flow is in the water system when box is checked.
- **Gas Flow Error**
  - Sets an alarm if there is no gas flow to gun with box checked.
3.2 Miller Auto-Continuum Power Supply

**Arc Start Error**

Allows the monitoring for an Arc Start Error to occur by checking the box. With checking the box set time in seconds before the Miller Auto-Continuum sets an alarm if there is no arc.

**Return:**

Returns to the Start Screen. See section 3.2.4 “Start Screen” for more details.

**Notice:**

- These errors are global within the Miller Auto-Continuum and affect all eight weld programs.
- Any changes to these error settings are saved immediately.
4 Theory of Operation

The Auto-Continuum is a Gas Metal Arc Welding (GMAW) power supply capable of non-pulsed, or MIG, and pulsed (GMAW-P) modes of operation.

The Controller utilizes EtherNet IP to interface with the Auto-Continuum. This interface provides two basic levels of controls:

• Real time display of weld data.
• Programming of welder set-up data from the Programming Pendant.

Auto-Continuum interfaces function with the INFORM weld instructions utilized on the Controller. The interface uses an application created by Motoman called the Miller HMI. This provides pendant screens with dialog boxes to allow Managers or Operators (if allowed by Managers) to make changes to programs in the welder.

These commands and signals are set and sequenced through the Controller’s concurrent I/O (CIO) program. This program has a system section which can not be edited by Users because of Safety functionality. The User section is provided for users to add fixture and cell control logic. INFORM functions such as RETRY and ANTI-STICK use signals in the ladder to operate. Motoman developed the HyperStart function to allow users to set values used in the system section to optimize cycle time and arc alarm conditions to suit the application.

When the Auto-Continuum is in a pulse mode, then the voltage value is 3/4 of the arc adjust setting (i.e. arc voltage setting of 22.5 provides an arc adjust setting of 45 on the welder). The arc adjust setting on the Auto-Continuum has a setting of 0-100 with a nominal setting of 50. The welder is synergic which means an arc adjust value of 50 will provide good welding conditions through the whole range of wire feed settings. Users may want to reduce the arc adjust setting to get a shorter arc length to suit a given application.

The Auto-Continuum has eight program locations for different process settings. The process can be changed between welds or even during welding by setting I/O commands in the robot program to select a different program.
4.1 Miller HMI

The key feature of the Miller HMI pendant application is the ability to perform set-up functions from the Programming Pendant. The pendant application takes over the pendant display. The application provides much of the functionality of the Miller File Manager software used with a Palm PDA. The Auto-Continuum retains the User Interface display. This allows users to change processes from the welder or confirm weld settings on the LED meter display.

Most of the pendant application is used for set-up functions. Most of the functionality is only available in TEACH mode to ensure signals are not passed while the power source is welding. There is Management password protection to allow administrators to determine if they want to allow operators access to change program information in the power source. They can initiate edit lock on the welder to keep operators from being able to make program changes from the welders.

The Auto-Continuum digital interface utilizes a total of nine bytes and are addressed by Motoman for the exact cell configuration. Users should make back up copies of their I/O settings including the concurrent I/O (CIO.LST). It is recommended that Users invest in the File Manager software from Miller to support maintenance functions.

With the Auto-Continuum, Motoman is able to log error messages from the welder. These can be viewed on the message display when the alarm occurs. The error messages are logged in the robot’s alarm history in the User Alarm section. The alarm is saved with date, time, job name, and step number when the alarm occurred.

4.2 Pulse Mode

Pulse Mode behaves identically to non-pulsed (MIG) mode except that spray current, (low/no-spatter) can be achieved for virtually the entire range of wire feed speeds. Spray transfer is accomplished by elevating the current above that required for globular transfer, holding the current while a droplet(s) is formed and detached from the electrode, and then dropping the current to a low background level. The amount of time at this background level is often based (inversely proportional) on the wire feed speed - higher wire feed speeds require more droplets per second and so shorter background times (higher frequencies) are often used. Pulse mode is recommended for welding conditions (wire feed speeds) where in a globular transfer is achieved in non-pulsed mode. Pulse mode is typically used for all wire feeds speeds for aluminum GMA welding.
5 Operation

5.1 Set-Up Overview

This chapter covers set-up information that is unique to the Controller/Miller Auto-Continuum system. It covers:

- Arc Start Files and Arc End Files
- Selecting weld programs
5.1 Set-Up Overview

5.1.1 Arc Start Files

**VOLTAGE:** In the welding modes that require an Arc Length value (Pulse, Accupulse, . . .) the Voltage parameter is set to 1/2 the required setting. That is:

\[ \text{Arc Length} = 2 \times \text{Voltage Setting} \]

**Example:**

Arc Length value required is 50
In the Arc Start File (ASF) and/or Arc End File (AEF) set
Voltage to 25.0

**Example:**

Arc Length value required is 47
In the Arc Start File (ASF) and/or Arc End File (AEF) set
Voltage to 23.5

In MIG mode, the voltage value is the actual reference value desired.

**Example:**

Voltage required is 21.8 volts
In the Arc Start File (ASF) and/or Arc End File (AEF) set
Voltage to 21.8

**CURRENT:** The Current setting is actually Wire Feed Speed in inches per minute. A setting of 300 will give 300 ipm of wire.

**BURN BACK:** The Miller Auto-Continuum DI has a Sharp Start routine to reduce wire ball size. Do not set high voltage or low wire feed speed setting in the Arc End files, this can create adverse results.

**RETRY:** If RETRY is used (ON), set the Voltage and Current in the Arc Auxiliary Condition File to the same values as in the Arc Start Files.

5.1.2 Arc End Files

**CURRENT and VOLTAGE:** Arc End Files are used if a crater fill is required at the end of the weld sequence. If no crater fill is required, a simple ARCOF command can be used. If it is desired to use the Arc End files, but no crater fill is needed, set the CURRENT and VOLTAGE to the same values as used in the corresponding Arc Start File, and set the ROBOT PAUSE TIME to 0.0 sec.

**BURN BACK:** The Miller Auto-Continuum DI has a Sharp Start routine to reduce wire ball size. Do not set high voltage or low wire feed speed settings in the Arc End files, this can create adverse results.

**ANTI-STICK:** The Miller Auto-Continuum DI has a built-in anti-stick feature, so in general this function is not needed and should be set to OFF.
5.1.3 Selecting Weld Programs

Eight separate weld programs can be defined for the Miller Auto-Continuum DI. Each program can be configured for weld mode (MIG, Pulse, AccuPulse, Accu-Speed, Accu-Curve, RMD), wire type (Steel, Aluminum, etc.), diameter, and shield gas type. The programs can be selected by the robot using three outputs, as shown in section 5.2.1 Weld Program Selection. These outputs are assigned by Yaskawa, and cannot be changed. Check the Yaskawa system prints to verify which outputs are used, since they can vary depending on the Controller configuration.

**Fig. 5-9: Universal Output Screen**

The output status can be viewed by pressing the IN/OUT buttons then selecting Universal Outputs (see Fig. 5-9). The page key will index between different groups (8 bits). In this example, the Miller schedule select bits are labeled:

- OUT#0045 #10064 R1 PROGRAM 0
- OUT#0046 #10065 R1 PROGRAM 1
- OUT#0047 #10066 R1 PROGRAM 2
5 Operation
5.1 Set-Up Overview

Table 5-1 “Universal Outputs” shows the values necessary to select weld programs 1-8 using Universal Outputs 45, 46, and 47 which are OGH#(12). The outputs may change depending on the system configuration.

Table 5-1: Universal Outputs

<table>
<thead>
<tr>
<th>Auto Axxess Program#</th>
<th>Universal Outputs</th>
<th>OGH#(12)</th>
<th>OUT#0045</th>
<th>OUT#0046</th>
<th>OUT#0047</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>0</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>1</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>2</td>
<td>Off</td>
<td>On</td>
<td>Off</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>3</td>
<td>On</td>
<td>On</td>
<td>Off</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>4</td>
<td>Off</td>
<td>Off</td>
<td>On</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>5</td>
<td>On</td>
<td>Off</td>
<td>On</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>6</td>
<td>Off</td>
<td>On</td>
<td>On</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>7</td>
<td>On</td>
<td>On</td>
<td>On</td>
</tr>
</tbody>
</table>
5.2 Robot Job Programming

5.2.1 Weld Program Selection

The robot selects one of the eight weld programs by setting three outputs. Typically a binary value (0-7), referenced by a DOUT instruction, is programmed into the robot job. This binary value of 0-7 correspond to programs 1-8 in the Miller Auto-Continuum DI.

In this example, the schedule select bits have been connected to Universal Outputs 45, 46, and 47. These three bits comprise the first three bits of Output Group Half (OGH) #12.

Sample Robot Job:

```
0000  NOP
0001  MOVJ VJ=33.0  (Welding start position)
0002  DOUT OGH##(12)5  (Selection of Schedule #6)
0003  ARCON AC=285 AV=22.0  (ArcOn request)
0004  MOVL
0005  ARCOF
0006  MOVJ VJ=33.0
```

The above job selects Program #6 with the DOUT instruction. It also sets wire feed speed to 285 in./min and sets either voltage to 22.0V (MIG mode) or trim to 44% (Pulse or AccuPulse) depending on the mode selected in Program #6.

5.3 Welder Front Panel Display

When the welder is powered on, "MOTO" will appear on the welder display. During normal operation, the welder display shows the following:

- Power Supply Idle (not welding): Displays the set Wire Feed Speed and Voltage or Arc Length values.
- Power Supply Welding: Displays the actual average Amperage (or the wire feed speed) and actual average Voltage.
- Immediately after Welding: Displays the actual average Amperage and actual average Voltage for five seconds.
5.4 Troubleshooting

The Miller Auto-Continuum generates several error messages that are displayed on the front panel (see the Miller Auto-Continuum Manual for a complete list). Some of the more common errors are displayed and logged as User Alarms on the Controller programming pendant. The less common errors are logged on the pendant as an Unknown Error, and the Miller Auto-Continuum must be checked to determine the exact error. For other service related problems, call Yaskawa Customer Service (937) 847-3200.

The following is a list of User Alarms and messages displayed for welder #1 on the programming pendant. These messages will repeat for welders #2, #3, #4.

**Table 5-2: User Alarms**

<table>
<thead>
<tr>
<th>User Alarm</th>
<th>Message Displayed</th>
<th>Auto-Continuum Display</th>
<th>Troubleshooting</th>
</tr>
</thead>
<tbody>
<tr>
<td>9122 WELDER 1: ARC FAILED TO START</td>
<td>TOGGLE GAS TO CLEAR WELDER 1 ERR</td>
<td>ERR STRT</td>
<td>Arc did not start. Check/replace the tip and torch liner. Check the wire supply. Look for restrictions in the wire feeding system.</td>
</tr>
<tr>
<td>9123 WELDER 1: ROBOT COMMUNICATION</td>
<td>TOGGLE GAS TO CLEAR WELDER 1 ERR</td>
<td>ROBT COMM</td>
<td>1. Welder was turned on before the Controller. Toggle gas to clear error. 2. If this message only displays on the welder, check the EtherNet connection between the power source and the Controller.</td>
</tr>
<tr>
<td>9124 WELDER 1: E-STOP</td>
<td></td>
<td>E STOP</td>
<td>Check the E-Stop connection on the Miller Auto-Continuum. It must be cleared before the unit will operate.</td>
</tr>
<tr>
<td>9125 WELDER 1: TACH ERROR</td>
<td>TOGGLE GAS TO CLEAR WELDER 1 ERR</td>
<td>ERR TACH</td>
<td>The welder did not receive a tach signal from the wire feeder. Check the cable and connection between the wire feeder and welder.</td>
</tr>
<tr>
<td>9126 WELDER 1: UNKNOWN ERROR</td>
<td></td>
<td></td>
<td>Varies, depending on error</td>
</tr>
</tbody>
</table>
6 Miller Auto-Continuum E Digital

The Miller Auto-Continuum welder combines the Miller Auto-Continuum welder with a powerful and feature packed process monitoring tool called “CenterPoint”. “CenterPoint” is a PC application which is used to set-up weld processes and limits. These welding sequences and limits are then transferred to the welder where they reside during production (PC application can be disconnected/removed). During production the sequence and limits are monitored on a weld-to-weld and part-to-part basis to ensure that production parts stay within the predefined limits and sequence.

6.1 Setting Proportional Speed Instruction

With the Auto-Continuum E Digital (EtherNetIP interface) the robot needs to transmit its TCP travel speed to the Auto-Continuum so that the power source can calculate the heat-input of the weld. This is accomplished by issuing a command contained in a pre-existing job. The “R*-SET-PROPORTIONAL-SPD” instruction sets an analog channel with a value pertaining the robot's actual speed while executing a linear, circular, or spline move. The scaling for the value is set by issuing a “ARATION” instruction. Each robot's job sets a predefined analog output register which is then rescaled in robot's CIO ladder program before being transmitted to the welder. Below are the jobs and the instructions that set the proper scaling.

6.1.1 The “R*-SET-PROPORTIONAL-SPD.JBI”

Only needs to be set once and should be called either in the start-up portion of the “Master” job or within the main weld job. It does not need to be shut-off of adjusted once it has been set.

<table>
<thead>
<tr>
<th>Job Name</th>
<th>ARATION A0#(Register) BV</th>
<th>V(0)</th>
<th>OTHER</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>R1-SET-PROPORTIONAL-SPD.JBI</td>
<td>A0#(36)</td>
<td>V=50</td>
<td>OF V=0.00</td>
<td></td>
</tr>
<tr>
<td>R2-SET-PROPORTIONAL-SPD.JBI</td>
<td>A0#(37)</td>
<td>V=50</td>
<td>OF V=0.00</td>
<td></td>
</tr>
<tr>
<td>R3-SET-PROPORTIONAL-SPD.JBI</td>
<td>A0#(38)</td>
<td>V=50</td>
<td>OF V=0.00</td>
<td></td>
</tr>
<tr>
<td>R4-SET-PROPORTIONAL-SPD.JBI</td>
<td>A0#(39)</td>
<td>V=50</td>
<td>OF V=0.00</td>
<td></td>
</tr>
</tbody>
</table>

**NOTICE**

The “V=50” is setting the velocity to voltage ratio. The value of 50 is in cm/min. If another unit of travel speed is selected under the “SETUP” menu then the units may need to be entered so that they correlate/equal 50cm/min.
6.1 Setting Proportional Speed Instruction

Fig. 6-1: Setting Proportional-Speed
6.2 MACRO Job Settings

The Auto-Continuum EtherNetIP interface allows the robot to communicate the welder letting it know where the robot physically is within the welding sequence. The robot can also instruct the welder what the “Part ID” and “Weld ID” is for each weld. The robot is also able to indicate the start and end of a part which then calculates the complete part processing time. To do this, the following macro jobs are used and described detail.

The macro job instructions can be located by pressing the [Inform List] button on the pendant and pressing the {Macro} button.

Fig. 6-2: Macro Button Location

6.2.1 MILLER-PROG-SEL Macro

Use this macro routine to specify the weld program at the start of a weld or change the weld program mid-weld. It also allows adjustment of the arc characteristics for the specified program. These characteristics can be changed either at the beginning or mid-weld if desired

- **Welder Number**: Allows specification of the desired welder. Allowable values are 1 to 4.

- **Program Number**: Allows specification of program number. The number entered specifies which of the eight programs in the welder to execute. Allowable values are 1 to 8 (a value of 0 will allow weld settings to be specified from the front-panel of the welder)

- **Inductance/Ctrl**: Depending on the welding process selected this control has different meanings and acceptable ranges:
  - **MIG**: In MIG processes this controls the welder’s “Inductance” setting where the range is 0-99. The default inductance is a value of 30.
  - **Synergic (pulse)**: In synergic mode this controls the welder’s “Arc Control” setting. The range is 1-50 with a default value of 25.
6.2 MACRO Job Settings

- **Slope**:
  - **MIG**: In MIG processes this control's the welder's “Slope” setting where the range is 1-99. The default slope setting is a value of 50.
  - **Synergic (pulse)**: In synergic mode this control has no impact.

**Fig. 6-3: Miller-PROG-SEL Screen**

6.2.2 MILLER-STRT-PART Macro

Use this macro to signal the start of a new part. It starts the cycle timers within the welder and allows identification of the “Part ID” that's going to be welded. It also allows specification “Weld ID” which tells the welder what weld is being made next allowing out of sequence part processing. The last two settings allow the enabling or disabling of various weld errors.

- **Welder Number**: Allows specification of the desired welder. Allowable values are 1 to 4.
- **Part ID**: Identifies the “Part ID” of the upcoming part. The “Part ID” specified must be configured within the CenterPoint application with the appropriate number of welds and limits before being able to process the part and receive valid data regarding the result of the part following processing.
- **Weld ID**: The “Weld ID” settings allow specification of the upcoming weld. It allows a user to identify the weld before making it. An “Automatic Increment” function allows setting the “Weld ID” equal to “0” which will cause the welder to start at “Weld ID” number 1 and automatically increment the count without further intervention.
• **Enable Weld Errs**: This setting controls how the robot responds to individual welds which are outside of the predetermined acceptable window of operation.
  
  – **Enable Weld Errs = 1**: will cause the robot to alarm following every weld that is outside of the acceptable limits. This occurs at the end of the weld and will cause an interruption in welding of other robots if they happen to welding at the same time.
  
  – **Enable Weld Errs = 0**: will cause the robot to continue on its programmed path following the completion of a “bad” weld. There will be no interruption in the processing of the part.

• **Enable Part Errs**: This setting controls how the robot responds to a “Part” which is determined to be outside of the predetermined acceptable limits. A part error will be generated if any of the individual welds were outside of their specified limits, if the number of welds did not match the predetermined
  
  – **Enable Part Errs = 1**: will cause the robot to alarm following the completion of the part during which any of the individual welds or the number of welds did not match the predetermined number of welds specified within initial setup
  
  – **Enable Part Errs = 0**: will allow the robot to continue without alarming even if the part is flagged with an error.

*Fig. 6-4: MILLER-STRT-PART Screen*
6.2.3 MILLER-CHNG-WELD Macro

The “Miller-Chng-Weld” macro is used to ensure 100% synchronization between the robot’s motion and the current welds identifier or can be used to allow out-of-sequence welding. This may be needed when processing parts that are affected by heat-input and could warp because of heat-input.

- **Welder Number**: Allows specification of the desired welder. Allowable values are 1 to 4.

- **Weld ID**: Specifies the upcoming welds ID# which correlates to the ID and limits specified within the “CenterPoint” application.

Fig. 6-5: MILLER-CHNG-WELD Macro Screen
6.2.4 MILLER-END-PART Macro

The “Miller-End-Part” macro is used to signal the completion of a part. This causes the robot to stop accumulating cycle time and display any “Part Errs” if they occurred during the course of the part.

- **Welder Number**: Allows specification of the desired welder. Allowable values are 1 to 4.

**Fig. 6-6: MILLER-END-PART Macro Screen**

![MILLER-END-PART Macro Screen](image-url)
6.2.5 Example Weld Job Structure

See Fig. 6-7 “Example Weld Job Structure” for an example of a weld job structure. To get to the “JOB CONTENT: MASTER” press {JOB} and {JOB} again on the pendant screen.

Fig. 6-7: Example Weld Job Structure

1. Starts the cycle timers and specifies Part ID: 5 and Starting Weld ID: 13 (Weld and Prt errors are set within the “Detail Edit” screen).
2. Specifies the program number that the next weld is to be made using (arc control parameters are set within the “Detail Edit” screen).
3. Sets the next Weld ID to 14.
4. Once the robot is back in the “Home” position, the “Miller-End-Part” command is issued stopping the accumulation of cycle time and reports part alarms (if “Enable Part Errs” = 1).
6.3 Error Reporting

6.3.1 Weld Error Reporting

Weld Error Reporting: Based on the “Enable Weld Errs” made in the “MILLER-PART-START” macro. The power source can alarm at the completion of a weld and trigger a robot-based user alarm notifying the user of the weld fault. This “ALARM” screen is available by pressing the {SYSTEM INO} button then the {ALARM} button on the pendant. The robot will present the user with a detailed explanation of what welding parameter was outside of limits. The robot's system job builds a “Dynamic” alarm based on what parameters the welder detects being out of limit. The system job build-up this alarm and presents it to the operator and logs the alarm in the alarm history. Below are the possible contents of the “dynamic” alarm:

• ALARM 8999: Wld Err:*”
  - V+ Welding voltage over limit
  - V- Welding voltage below limit
  - A+ Welding current over limit
  - A- Welding current below limit
  - G+ Gas flow over limit (requires gas flow sensor and sensor board within welder)
  - G- Gas flow below limit (requires gas flow sensor and sensor board within welder)
  - W+ Wirefeed speed over limit
  - W- Wirefeed speed below limit
  - D+ Weld duration (time) over limit
  - D- Weld duration (time) below limit

![Fig. 6-8: Over & below voltage, over current, below duration Weld Error Example](image)
6.3.2 Part Error Reporting

Based on the "Enable Part Errs" setting made in the "MILLER-PART-START" macro, the robot can stop production with an user alarm if one of the welds or the part processing characteristics is outside of the predefined limits. Part errors are presented at the completion of a part which is specified with the "MILLER-END-PART" instruction being issues in the job. Once the "MILLER-END-PART" instruction is executed for the particular welder, the robot's system job builds a "dynamic" alarm based on what parameters the welder detects as being out of limit. The system job build-up this alarm and presents it to the operator and logs the alarm in the alarm history. Below are the possible contents of the "dynamic" alarm:

- ALARM 8*98: Part Err:* 
  - Missed Wld(s): Indicates that the part just completed had one or more missing welds 
  - Proc Flt(s): Indicates that one or more of the welds in the just completed part had one or more welds outside of the predetermined limits 
  - Time Flt(s): Indicates that one or more of the time characteristics being monitored by the welder was outside of its acceptable range 
  - Wld Cnt Flt(s): Indicates that the number of welds completed on the last part did not match the number of expected welds for the part type specified. 
  - Clamp Time Flt: The amount of part processing time was longer or shorter than the acceptable limit specified within the "CenterPoint" application. 
  - Arc Time Flt: The amount of actual arc welding time monitored during the duration of the last part exceeds or is below the allowable limit set within the "CenterPoint" application.
Fig. 6-10: Example of a Part Error Process Fault
MOTOMAN CONTROLLER WITH MILLER AUTO-CONTINUUM MIG WELDING SYSTEM
FOR YRC1000

Specifications are subject to change without notice for ongoing product modifications and improvements.