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

• This manual explains the error recovery function. Read this manual carefully and be sure to understand its contents before operation.

• General items related to safety are listed in Section 1: Safety, in the DX100 Instructions. To ensure correct and safe operation, carefully read the DX100 Instructions before reading this manual.

• For detailed instructions regarding additional equipment including the HyperStart, DX100 controller, manipulator, or other components, refer to the specific equipment manuals included with your documentation package.

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.

• Software described in this manual is supplied against licensee only, with permission to use or copy under the conditions stated in the license. No part of this manual may be copied or reproduced in any form without written consent of YASKAWA.
Notes for Safe Operation

Before using this product, read this manual and all the other related documents carefully to ensure knowledge about the product and safety, including all the cautions.

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

![WARNING](warning-icon) **WARNING**
Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury to personnel.

![CAUTION](caution-icon) **CAUTION**
Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury to personnel and damage to equipment. It may also be used to alert against unsafe practices.

![MANDATORY](mandatory-icon) **MANDATORY**
Always be sure to follow explicitly the items listed under this heading.

![PROHIBITED](prohibited-icon) **PROHIBITED**
Must never be performed.

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

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

![NOTE](note-icon) **NOTE**
To ensure safe and efficient operation at all times, be sure to follow all instructions, even if not designated as "CAUTION" and "WARNING".
WARNING

• Before operating the manipulator, check that servo power is turned OFF pressing the emergency stop buttons on the front door of the DX100 and the programming pendant. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned 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 buttons do 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 you have 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 DX100.
  – 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 buttons are located on the right of front door of the DX100 and the programming pendant.
CAUTION

- Perform the following inspection procedures prior to conducting manipulator teaching. If problems are found, repair them immediately, and be sure that all other necessary processing has been performed.
  - Check for problems in manipulator movement.
  - Check for damage to insulation and sheathing of external wires.
- Always return the programming pendant to the hook on the cabinet of the DX100 after use.
- The programming pendant can be damaged if it is left in the manipulator's work area, on the floor, or near fixtures.
- Read and understand the Explanation of Warning Labels in the DX100 Instructions before operating the manipulator:

Notation for Menus and Buttons

Descriptions of the programming pendant, buttons, and displays are shown as follows:

<table>
<thead>
<tr>
<th>Item</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Menu</td>
<td>The menus displayed on screen are denoted with { } ex. {TOOL}.</td>
</tr>
<tr>
<td>Button</td>
<td>The buttons, check boxes, radio buttons displayed on screen are denoted with [ ]. ex. [Close], [Sync] check box; [Fast] radio button.</td>
</tr>
</tbody>
</table>

Description of the Operation Procedure

In the explanation of the operation procedure, the expression "Select • • • " means 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

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1 Introduction

1.1 Overview

The YASKAWA Motoman DX100 Error Recovery function is part of the YASKAWA family of standardized solutions. The function is designed to automatically remove the weld torch from the part after an alarm condition. The robot moves the torch to a pre-defined service location, ideally outside the robot work envelope, for inspection and repair by maintenance personnel. Moving the torch outside the work envelope, eliminates the need for maintenance personnel to enter the work cell, and enables cell operators to safely perform simple tip replacement and repair. Once the repair has been made and all alarms cleared, pressing the [Start] button moves the robot back to the fault location at the part and restarts the welding process. Optional lap welding can also be performed at this time if configured.

The DX100 Error Recovery function can be used with single and double robot cells with or without external axis positioners. When using the DX100 Error Recovery function with multiple robots, the alarm trigger can be configured to stop the non-faulted robot immediately or the faulted robot can be paused while the non-faulted robot completes its current weld. The faulted robot follows one of 255 user programmed paths to move safely to the service location.

The robot moves the torch to the service location and the alarm occurrence is recorded in the alarm history. Once all repairs have been made and all alarms cleared, the operator presses the [Start] button and the robot moves back to the fault location following the same user programmed path, and restarts the welding process. Optional lap welding can be performed at this time if configured.

Once properly setup, the DX100 Error Recovery function works with very little input from the user. However, the DX100 Error Recovery function makes use of several additional DX100 features and functions. Each of these additional functions must be setup properly for the DX100 Error Recovery to operate correctly. These additional DX100 Error Recovery functions include:

- Ladder Logic - monitors welder and robot status for generated alarms.
- Interrupt Job Function - pauses the currently running job and starts the correct error recovery job.
- Collision Detect Function - monitors servo motor feedback for indications of a collision during movement into and out of the robot work area.
- Macro Jobs - allow ease of setup for determining which alarm triggers the function and which user programmed escape path is to be used.
1.2 Applications

While the DX100 Error Recovery function can be used with all basic arc-welding applications, some applications are better suited than others. When used with YASKAWA Motoman ArcWorld type cells, the DX100 Error Recovery function provides a high degree of functionality as there is typically more space available for programming escape routes. Also, the robot can more easily reach a service window located in the safety fencing. While it may not be possible to reach a service window in a very large system, the DX100 Error Recovery function can still speed up recovery time, by safely extracting the torch from the work area. The torch can be automatically removed from the work area and positioned for easy inspection and repair by maintenance personnel.
2 Setup and Configuration

This chapter provides detailed setup procedures for the DX100 Error Recovery function. Setup of the DX100 Error Recovery function should be performed by personal familiar with arc welding application setup and configuration. Read this chapter thoroughly before beginning setup and configuration of the DX100 Error Recovery function.

2.1 Required Functions and Parameters

The following functions and parameters must be installed and operating on the DX100 for the Error Recovery function to work properly. Please contact your YASKAWA Motoman representative for information on purchasing and enabling these functions and parameters.

**Interrupt Job Function**
The interrupt job function is included with purchase of DX100 Error Recovery function.

This function monitors a specified input. When the input actuates, the currently executing job is stopped and the specified "interrupt job" begins.

**Macro Job Function**
The Macro Job function is included with purchase of DX100 Error Recovery function.

Provides a customizable user interface screens with user defined parameters and text. This acts as the interface for the "Error Recovery" function.

**System Job Function:**
Used to clear and reset I/O status in the event that error recovery is aborted mid-process.

---

**CAUTION**

- The customer is responsible for providing trained operators to run the equipment. The customer is also responsible for making sure that the equipment is operated in accordance with the ANSI/RIA R15.06-1999 Robot Safety standard, as well as any other local or state standards.
S4C242 Parameter = Step Number to Register
This parameter must be set to equal (255) to report the current step number to the M-register.

The DX100 Error Recovery function reports the location of the cursor for each of the various operating sub-tasks:

- Sub#0 = M690
- Sub#1 = M691
- Sub#2 = M692
- Sub#3 = M693
- Sub#4 = M694
- Sub#5 = M695
- Sub#6 = M696
- Sub#7 = M697
- Sub#8 = M698

S2C446 Parameter = MOVC Motion Following Error Recovery
- 0 = Executes a linear path to the next programmed point following error recovery during a circular motion.
- 1 = (DEFAULT) Continue to execute a circular move (if specified) following error recovery.
## 2.2 Required Jobs

The following jobs must be installed on the DX100 controller for the Error Recovery function to work properly.

### Table 2-1: Required Jobs

<table>
<thead>
<tr>
<th>Required Jobs</th>
<th>User Modification</th>
<th>Single Robot</th>
<th>Dual Robot</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERR_MNGR.JBI</td>
<td>No requires setup in weld job</td>
<td>X</td>
<td>X</td>
<td>R* Macro Job: Allows the user to specify what alarm triggers the function and how the robot(s) resume welding.</td>
</tr>
<tr>
<td>CANCERR1</td>
<td>No</td>
<td>X</td>
<td></td>
<td>R1 Robot Job: Used to acknowledge an arc failure.</td>
</tr>
<tr>
<td>R1-EXIT.JBI</td>
<td>No requires setup in weld job</td>
<td>X</td>
<td>X</td>
<td>R1 Macro Job: Used in R1 weld jobs to define torch extraction distance, escape route #, and sub-task number.</td>
</tr>
<tr>
<td>R1-PATHS.JBI</td>
<td>Yes - user must program escape path</td>
<td>X</td>
<td>X</td>
<td>R1 Robot Job: Defines basic structure (template) for programming escape paths. This is the job executed when an error occurs.</td>
</tr>
<tr>
<td>R1-RCVRY.JBI</td>
<td>No requires use in R1-PATHS.JBI</td>
<td>X</td>
<td>X</td>
<td>R1 Macro Job: Contains the logic for performing the error recovery and posting robot status messages.</td>
</tr>
<tr>
<td>RECOVERY-RESET.JBI</td>
<td>No</td>
<td>X</td>
<td></td>
<td>System Job: Clears and resets I/O based on signals generated by ladder.</td>
</tr>
<tr>
<td>CANCERR2</td>
<td>No</td>
<td>X</td>
<td></td>
<td>R2 Robot Job: Used to acknowledge an arc failure.</td>
</tr>
<tr>
<td>R2-EXIT.JBI</td>
<td>No requires setup in weld job</td>
<td>N/A</td>
<td>X</td>
<td>R2 Macro Job: Used in R2 weld jobs to define torch extraction distance, escape route #, and sub-task number.</td>
</tr>
<tr>
<td>R2-PATHS.JBI</td>
<td>N/A</td>
<td>X</td>
<td></td>
<td>R2 Robot Job: Defines basic structure (template) for programming escape paths. This is the job executed when an error occurs.</td>
</tr>
<tr>
<td>R2-RCVRY.JBI</td>
<td>N/A</td>
<td>X</td>
<td></td>
<td>R2 Macro Job: Contains the logic for performing the error recovery and posting robot status messages.</td>
</tr>
<tr>
<td>R3-EXIT.JBI</td>
<td>No requires setup in weld job</td>
<td>N/A</td>
<td>X</td>
<td>R3 Macro Job: Used in R3 weld jobs to define torch extraction distance, escape route #, and sub-task number.</td>
</tr>
<tr>
<td>R3-PATHS.JBI</td>
<td>N/A</td>
<td>X</td>
<td></td>
<td>R3 Robot Job: Defines basic structure (template) for programming escape paths. This is the job executed when an error occurs.</td>
</tr>
<tr>
<td>R3-RCVRY.JBI</td>
<td>N/A</td>
<td>X</td>
<td></td>
<td>R3 Macro Job: Contains the logic for performing the error recovery and posting robot status messages.</td>
</tr>
</tbody>
</table>
2.3 System Job Configuration

The Error Recovery function utilizes a system job called "Recovery-Reset.jbi" which constantly operates in the background monitoring I/O status. Modification of the system job is not required and setup should be performed prior to shipment. However, verification of operation can be made from management mode. Press the "Job" button, then select "Cntrl System Job". From within the system job screen, the "Recovery-Reset.jbi" should be selected, set for "Auto" startup, and when executing, the line number field should be changing rapidly.

*Fig. 2-1: System Job Screen*
## 2.4 Variables

### 2.4.1 Byte (B) Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B090</td>
<td>R1 currently specified escape route number (set by R1-ERROR.jbi)</td>
</tr>
<tr>
<td>B091</td>
<td>R2 currently specified escape route number (set by R2-ERROR.jbi)</td>
</tr>
<tr>
<td>B093</td>
<td>R1 extract point calculated</td>
</tr>
<tr>
<td>B094</td>
<td>R1 extracted</td>
</tr>
<tr>
<td>B095</td>
<td>R2 extract point calculated</td>
</tr>
<tr>
<td>B096</td>
<td>R2 extracted</td>
</tr>
</tbody>
</table>

### 2.4.2 Integer (I) Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I080</td>
<td>R1 Tool X Extract Distance (mm)</td>
</tr>
<tr>
<td>I081</td>
<td>R1 Tool Y Extract Distance (mm)</td>
</tr>
<tr>
<td>I082</td>
<td>R1 Tool Z Extract Distance (mm)</td>
</tr>
<tr>
<td>I083</td>
<td>R2 Tool X Extract Distance (mm)</td>
</tr>
<tr>
<td>I084</td>
<td>R2 Tool Y Extract Distance (mm)</td>
</tr>
<tr>
<td>I085</td>
<td>R2 Tool Z Extract Distance (mm)</td>
</tr>
<tr>
<td>I090</td>
<td>R1 currently specified M-register to get the step # based on sub-task# (set by R1-ERROR.jbi)</td>
</tr>
<tr>
<td>I091</td>
<td>First step # of R1 escape route (captured in R1-PATHS.jbi)</td>
</tr>
<tr>
<td>I092</td>
<td>Last step # of R1 escape route (captured in R1-PATHS.jbi)</td>
</tr>
<tr>
<td>I093</td>
<td>R2 currently specified M-register to get the step # based on sub-task# (set by R2-ERROR.jbi)</td>
</tr>
<tr>
<td>I094</td>
<td>First step # of R2 escape route (captured in R2-PATHS.jbi)</td>
</tr>
<tr>
<td>I095</td>
<td>Last step # of R2 escape route (captured in R2-PATHS.jbi)</td>
</tr>
</tbody>
</table>
2.4.3 Double (D) Variables

Table 2-4: Double (D) Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>D090</td>
<td>R1 User specified Tool X extraction distance * 1000 (set by R1-ERROR.jbi)</td>
</tr>
<tr>
<td>D091</td>
<td>R1 User specified Tool Y extraction distance * 1000 (set by R1-ERROR.jbi)</td>
</tr>
<tr>
<td>D092</td>
<td>R1 User specified Tool Z extraction distance * 1000 (set by R1-ERROR.jbi)</td>
</tr>
<tr>
<td>D093</td>
<td>R2 User specified Tool X extraction distance * 1000 (set by R2-ERROR.jbi)</td>
</tr>
<tr>
<td>D094</td>
<td>R2 User specified Tool Y extraction distance * 1000 (set by R2-ERROR.jbi)</td>
</tr>
<tr>
<td>D095</td>
<td>R2 User specified Tool Z extraction distance * 1000 (set by R2-ERROR.jbi)</td>
</tr>
</tbody>
</table>

2.4.4 Position (P) Variables

Table 2-5: Position (P) Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P090</td>
<td>R1 position at time of error / return position (pulse) (captured in R1-RCVRY.jbi)</td>
</tr>
<tr>
<td>P091</td>
<td>R1 calculated extraction location (pulse) (captured in R1-RCVRY.jbi)</td>
</tr>
<tr>
<td>P092</td>
<td>R2 position at time of error / return position (pulse) (captured in R2-RCVRY.jbi)</td>
</tr>
<tr>
<td>P093</td>
<td>R2 calculated extraction location (pulse) (captured in R2-RCVRY.jbi)</td>
</tr>
</tbody>
</table>

2.4.5 Register (M) Variables

Table 2-6: Register (M) Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M215</td>
<td>Contains data indicating what errors the function responds to how (lap / no lap) (set by ERR-MNGR.jbi)</td>
</tr>
<tr>
<td>M690</td>
<td>Contains the step # of the cursor while executing Master job</td>
</tr>
<tr>
<td>M691</td>
<td>Contains the step # of the cursor while executing sub-task #1</td>
</tr>
<tr>
<td>M692</td>
<td>Contains the step # of the cursor while executing sub-task #2</td>
</tr>
<tr>
<td>M693</td>
<td>Contains the step # of the cursor while executing sub-task #3</td>
</tr>
<tr>
<td>M694</td>
<td>Contains the step # of the cursor while executing sub-task #4</td>
</tr>
<tr>
<td>M695</td>
<td>Contains the step # of the cursor while executing sub-task #5</td>
</tr>
<tr>
<td>M696</td>
<td>Contains the step # of the cursor while executing sub-task #6</td>
</tr>
<tr>
<td>M697</td>
<td>Contains the step # of the cursor while executing sub-task #7</td>
</tr>
</tbody>
</table>
2.5 I/O

2.5.1 Universal Outputs

Table 2-7: Universal Outputs

<table>
<thead>
<tr>
<th>Output</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUT#993 (#11250)</td>
<td>R1 error recovery function enabled</td>
</tr>
<tr>
<td>OUT#994 (#11251)</td>
<td>R1 error recovery in-process (interrupt job executing)</td>
</tr>
<tr>
<td>OUT#995 (#11252)</td>
<td>R1 at service location, service required</td>
</tr>
<tr>
<td>OUT#996 (#11253)</td>
<td>R1 arc failure simulate, (Can be triggered from IF-Panel while in play mode)</td>
</tr>
<tr>
<td>OUT#997 (#11254)</td>
<td>R2 error recovery function enabled</td>
</tr>
<tr>
<td>OUT#998 (#11255)</td>
<td>R2 error recovery in-process (interrupt job executing)</td>
</tr>
<tr>
<td>OUT#999 (#11256)</td>
<td>R2 at service location, service required</td>
</tr>
<tr>
<td>OUT#1000 (#11257)</td>
<td>R2 arc failure simulate, (Can be triggered from IF-Panel while in play mode)</td>
</tr>
<tr>
<td>OUT#1004 (#11263)</td>
<td>R1 satisfy work start via I/O</td>
</tr>
<tr>
<td>OUT#1005 (#11264)</td>
<td>R2 satisfy work start via I/O</td>
</tr>
</tbody>
</table>

2.5.2 Universal Inputs

Table 2-8: Universal Inputs

<table>
<thead>
<tr>
<th>Output</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN#993 (#01250)</td>
<td>R1 arc fault active, error recovery required (trigger for interrupt job R1-PATHS.jbi)</td>
</tr>
<tr>
<td>IN#994 (#01251)</td>
<td>R1 Restarting (latched until complete or abort)</td>
</tr>
<tr>
<td>IN#995 (#01252)</td>
<td>R1 Error in-process but aborted via job change</td>
</tr>
<tr>
<td>IN#996 (#01253)</td>
<td>R1 Simulate Arc Failure (generated from IF-Panel)</td>
</tr>
<tr>
<td>IN#997 (#01254)</td>
<td>R2 error recovery required (trigger for interrupt job R2-PATHS.jbi)</td>
</tr>
<tr>
<td>IN#998 (#01255)</td>
<td>R2 Restarting (latched until complete or abort)</td>
</tr>
<tr>
<td>IN#999 (#01256)</td>
<td>R2 error recovery in process but aborted via job change</td>
</tr>
<tr>
<td>IN#1000 (#01257)</td>
<td>R1 Simulate Arc Failure (generated from IF-Panel)</td>
</tr>
</tbody>
</table>
2.6 Interrupt Job Setup

The YASKAWA Motoman Interrupt Job Function is shipped pre-configured for operation with the Error Recovery function. However, in the event of a re-initialization of the controller, the function must be reconfigured as follows:

1. Select {JOB} under the main menu. The sub menu appears.

2. Select {INTERRUPT JOB} from the sub menu.

Depending on the system configuration, there can be up to 8 tables depending on if "Independent Coordinated Control" is required for the system. For each of the possible interrupt tables, the following settings should be made:

Fig. 2-2: Interrupt Job
2.7 Arc Auxiliary Condition File Setup

The Arc Auxiliary Condition File contains important settings effecting many arc-related functions including; Arc Retry, Arc Restart, and Automatic Wire-stick Release. These condition files are referred to by the ARCON/ARCOF instructions or in arc start/end condition files. For more information, refer to the Operator's Manual for Arc Welding.

Configuration of the Arc Auxiliary Condition file is critical for proper operation of the DX100 Error Recovery Function. The settings contained in the "Arc Aux" file influences the operation by allowing the overlap distance to be specified and executed as desired. Other settings not related to the DX100 Error Recovery function are detailed in the "Operators Manual for Arc Welding" (155490-1CD). Below, the setting requirements for proper operation of the DX100 function are highlighted.

1. Select {ARC WELDING} from the main menu.
2. Select {ARC AUX COND}. The setting window appears.

Fig. 2-3(a): Arc Auxiliary Condition File

Fig. 2-3(b): Arc Auxiliary Condition File
2.7.1 Restart Function Set

- **NO.** Set to a value of 1 or more if before going to service an automatic restart attempt is desired. Setting to a value of zero will result in the robot traveling to service at the time of the arc failure.

- **LAP DISTANCE:** Specifies the distance the robot reverses from the point where the arc fault occurs.

- **SPEED:** Determines the speed at which the manipulator reverses for the above specified distance.

- **CURRENT:** Specifies the welding current/WFS which is applied while the robot executes its lap. At completion of the specified lap distance, the robot re-applies its main weld condition settings.

- **VOLTAGE:** Specifies the welding voltage/trim which is applied while the robot executes its lap. At completion of the specified lap distance, the robot re-applies its main weld condition settings.

**Restart Mode**

1. **ARC FAILURE**
   - Must be set to "Auto Restart" to prevent the stoppage at the failure point.
   - Can be set to "Semi-Automatic." This causes a pause in system operation at the time of the arc failure. The user would be required to press the "Start" button again before the robot travels to the service location.

2. **GAS FAILURE**
   - Not used with the DX100 Error Recovery function.

3. **WIRE FAILURE**
   - Not used with the DX100 Error Recovery function.

2.8 Weld Job Setup

The DX100 Error Recovery function is intended to have a minimal impact on the programming experience of the user. Commands and instructions operate the same with the recovery function as they do without. There are, however, several commands that must be added to the weld job to set-up, enable, and execute the DX100 Error Recovery function. Below are the needed commands that are required to properly setup and execute the DX100 Error Recovery function from within a weld job.
2.8.1 ERR-MNGR Macro Job

The ERR-MNGR macro job allows the user to specify which welding related alarms trigger the DX100 Error Recovery function and how the robot resumes welding. The macro can be added to any non-group job (ie. master job) or R* weld job as it is not associated with any specific control group. The settings specified in ERR-MNGR macro job affect all robots and cannot be individually tailored for a specific robot. Settings specified affect operation of all available robots.

Fig. 2-4: ERR-MNGR Macro

Hyper dynam strt
Specifies how the robot responds to the "R* DYNAMIC ARC START FAULT". The "Dynamic Arc Start" function is enabled and disabled with the "R*-Hyper" command. When enabled, an "R* DYNAMIC ARC START FAULT" occurrence causes the settings specified in the first parameter of the ERR-MNGR macro setting to take affect.

- 0 = Alarm at Fault Location: A setting of 0 (zero) results in the robot faulting at the end of the dynamic time. No error recovery takes place.
- 1 = Go to service, return without overlap: The faulted robot executes its error recovery path by exiting the part, proceeding to the specified service location, alarming at the service location, and then returning to the fault location and resuming welding without executing a overlap distance.
- 2 = Go to service, return with overlap: The faulted robot executes its error recovery path by exiting the part, proceeding to the specified service location, alarming at the service location, and then returning to the fault location, backing-up the distance specified in the Arc Aux file (or to the start point of the weld) and resumes welding.
Hyper arc fault
Specifies how the robot responds to a "R* HYPER ARC FAULT (CNT or TMR)". If while welding, the Arc Established input from the welder goes out for longer than specified or more than specified in the R*-HYPER command, the following will occur.

• 0 = Alarm at Fault Location: A setting of 0 (zero) results in the robot faulting at the location of the HyperStart related arc fault. No error recovery takes place.

• 1 = Go to service, return without overlap: The faulted robot executes its error recovery path by exiting the part, proceeding to the specified service location, alarming at the service location, and then returning to the fault location and resumes welding without executing an overlap distance.

• 2 = Go to service, return with overlap: The faulted robot executes its error recovery path by exiting the part, proceeding to the specified service location, alarming at the service location, and then returning to the fault location, backing-up the distance specified in the Arc Aux file (or to the start point of the weld) and resumes welding.

Missing arc gen
Specifies how the robot responds to a "MISSING ARC START CONFIRM" or "MISSING ARC GENERATION" alarm. If the robot does not receive an Arc Established signal after one second, the robot will respond per the following setting:

• 0 = Alarm at Fault Location: A setting of 0 (zero) results in the robot faulting at the start location. No error recovery takes place.

• 1 = Go to service, return without overlap: The robot which failed to start executes its error recovery path by exiting the part, proceeding to the specified service location, alarming at the service location, and then returning to the fault location and resumes welding without executing a overlap distance.

Arc Failure
Specifies how the robot responds to an Arc Failure signal generated either internally or generated by the welding power supply. Various power supplies generate the Arc Failure signal based on various conditions. Consult the power supply documentation to ensure that error recovery function is desired. The power supply fault may not require torch maintenance so it may not be desirable to enable arc recovery for this alarm input.

• 0 = Alarm at Fault Location: A setting of 0 (zero) results in the robot faulting at the location of the arc fault. No error recovery takes place.

• 1 = Go to service, return without overlap: The robot which faulted executes its error recovery path by exiting the part, proceeding to the specified service location, alarming at the service location, and then returning to the fault location and resumes welding without executing an overlap distance.

• 2 = Go to service, return with overlap: The robot which faulted executes its error recovery path by exiting the part, proceeding to the specified service location, alarming at the service location, and then returning to the fault location, backing-up the distance specified in the Arc Aux file (or to the start point of the weld) and resumes welding.
Tip chng=service
Specifies if the robot travels to its service location when the tip change
time specified in the Arc Diag file has been exceeded. This is checked
both at the beginning and end of every weld while the R* ERROR RCVY
ON output (R1 = out 993, and R2 = out 997) is ON.

- 0 = Disabled: A setting of 0 (zero) results in the robot continuing to
  weld independent of the tip change time setting. No error recovery
  takes place.
- 1 = Go to service when time exceeded: At the start and end of every
  weld while R* ERROR RCVY ON is on, the system checks to see if
  the tip change time has been exceed. If the time has been
  exceeded, the robot travels to the service location, alarms, and
  returns to the start or end location before continuing on the
  programmed path.

Noz chng=service
Specifies if the robot travels to its service location when the Nozzle
change time specified in the Arc Diag file has been exceeded. This is
checked both at the beginning and end of every weld while the R* ERROR
RCVY ON output (R1 = out 993 and R2 = out 997) is ON.

- 0 = Disabled: A setting of 0 (zero) results in the robot continuing to
  weld independent of the nozzle change time setting. No error
  recovery takes place.
- 1 = Go to service when time exceeded: At the start and end of every
  weld while R* ERROR RCVY ON is on, the system checks to see if
  the tip change time has been exceed. If the time has been
  exceeded, the robot travels to the service location, alarms, and
  returns to start or end location before continuing on the programmed
  path.

Alarm after wlds:
Only has an effect in multi-robot systems (no effect on single robot
system). In the case of a multi-robot system, this setting specifies how the
non-faulted robot responds to a fault condition on the other robot(s)

- * 0 = When an alarm occurs on any robot in the system the faulted robot
  executes it's recovery path and generates the appropriate alarm
  independant of what the other robots in the system are in-process of
doing. In the case of a multi-robot system, if both robots are welding and
one robot faults, the faulted robot will extract itself and travel to service.
  Once at service it will alarm causing the other robot to stop welding
  mid-weld.
- * 1= When an alarm occurs, the faulted robot enters a "Sequence Wait"
  state until the other robots completes their current weld. At the completion
  of the non-faulted robot's weld, the non-faulted robot enters a "Sequence
  Wait"s state while the faulted robot travels to the specified service location
  and alarms. This ensures that non-faulted robots can complete their welds
  without mid-weld interruptions caused by other robots in the system. (A
  setting of 1 should not be used if coordinated motion between the two
  robots are required)
2.8.2 R*-EXIT Macro Job

The R*-EXIT macro enables and configures the DX100 Error Recovery function for the specified robot. In application, it can be used to change the exiting parameters mid-weld to change exit routes or extraction distances based on close proximity obstructions. This is the enabling function call that allows error signals to be handled as specified by the ERR-MNGR command. Once this command is issued, the DX100 Error Recovery function is enabled and active. Any subsequent R*-EXIT commands change how the robot responds to alarms. To disable the function once a R*-EXIT command is issued, the user must disable the output (R1 = out 993, and R2 = out 997) from the inform job.

Fig. 2-5: R*-EXIT

**Tool X**
Specifies the distance (valid settings: +1000mm to -1000mm) in tool coordinate systems X direction that the robot moves when an error occurs and the robot is directed to travel to its service location.

**Tool Y**
Specifies the distance (valid settings: +1000mm to -1000mm) in tool coordinate systems Y direction that the robot moves when an error occurs and the robot is directed to travel to its service location.

**Tool Z**
Specifies the distance (valid settings: +1000mm to -1000mm) in tool coordinate systems Z direction that the robot moves when an error occurs and the robot is directed to travel to its service location.

**Exit Route #**
This setting specifies which of the possible 255 exit routes (valid settings: 0 to 255) the robot follows once torch extraction has occurred. The exit routes are programmed in the R*-Paths job where a label within the job corresponds to the route number specified above. For more information regarding the job structure of the R*-Paths job, refer to bottom. If it is desirable to have the robot simply extract the torch from the part and not travel to a service location, this setting can be set to 0 (zero). This setting results in a torch extraction followed by the appropriate alarm.
2.8.3 R*-PATHS Macro Job

Contained within the R*-PATHS job are all of the possible escape paths that the robot can follow when traveling to the service location. These paths consist of only the programmed points required to get the robot to the service location following arc fault as specified in the ERR-MNGR macro job. The path required to get the robot back to the part and reinserted into the part is calculated using the same path that was traveled to get to the service location. Therefore, the user only needs to program the escape path. There are however some restrictions that must be adhered to for proper operation of the function. Those restrictions include the following:

- No CALL or JUMP instructions can be issued from within an escape path
- Inform instructions other than motion are only executed on the escape path not on the return path.
- All escape paths must be programmed using joint motion ONLY. Robot will reverse its path using the coordinate system that was chosen for the escape path. Verify moves to assure collisions will not occur. Programming escape routes using joint motion ensures that the same path is followed when returning to the fault location.
2 Setup and Configuration

2.8 Weld Job Setup

Fig. 2-6: R*-PATHS

Directs operation to the specified route number specified in the last R*-EXIT macro command. If set to "0" no route is requested. DO NOT MODIFY!

Escape Route #1

Escape Route #2

Escape Route #3

Once at the service location, this portion of the job reverses the escape route to generate the return route. DO NOT MODIFY!
2.8.4 Escape Route Programming Requirements

The following requirements for individual route programming are critical to proper operation of the DX100 Error Recovery function.

Fig. 2-7: Route Programming Requirements

These steps are required for all escape routes to calculate the current position within the job and extract the torch from the part as specified by the R*-ERROR macro.

These steps are required for all escape routes to calculate the current position within the job and trigger the welding related alarm before returning to the start of the return path.

These steps are the user programmed escape route. These steps can be modified and added to as required based on system configuration.
3 Monitoring Status:

Fig. 3-8: I/F Panel

- **R* ARCON COMMAND:** Indicates the state of the welder as directed from the robot. When on, the welder is commanded on and should be welding. When off, the welder is in an idle state.

- **R* ARC ESTABLISHED:** Indicates the status of the welder's arc established signal. When on, the welder is welding and the robot free to move. When off, the welder is idle.

- **WLDER#* FAULT:** Indicates the status of the input generated by the welder indicating if a fault is active. When on, the welder is generating a fault condition. When off, the welder is not in a fault state.

- **R* ERROR REVRY ON:** Indicates that status of the error recovery function for the particular robot. When on, the robot will respond to alarms as indicated by "Err-Mngr". When off, the robot will fault at the fault location. Enabled with "R*-EXIT" macro call.

- **R* EXTRACT TOOL X:** Indicates the extraction distance (in mm) that the robot will extract in tool coordinate system, X direction. Specified in "R*-EXIT" macro.

- **R* EXTRACT TOOL Y:** Indicates the extraction distance (in mm) that the robot will extract in tool coordinate system, Y direction. Specified in "R*-EXIT" macro.

- **R* EXTRACT TOOL Z:** Indicates the extraction distance (in mm) that the robot will extract in tool coordinate system, Z direction. Specified in "R*-EXIT" macro.
3 Monitoring Status:

- **R* ERROR ROUTE#:**
  Shows the currently specified escape route to be used in the event of an alarm. Specified in "R*-EXIT" macro.

- **R* SIMULATE ARC FAULT:**
  Button acts as a momentary push button allowing simulation of an power source generated arc fault. When pressed the specified escape path is executed. (Requires "Operation" switch be located in the "permit" location)

- **R* WIRE INCH:**
  Button acts as a momentary push button causing wire to inch forward from the feeder. (Requires "Operation" switch be located in the "permit" location)
Specifications are subject to change without notice for ongoing product modifications and improvements.