NX100 OPTIONS
INSTRUCTIONS

FOR ERROR RECOVERY FUNCTION

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

YASKAWA

MANUAL NO.
154413-1CD ◈0

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 NX100 Instructions. To ensure correct and safe operation, carefully read the NX100 Instructions before reading this manual.
- For detailed instructions regarding additional equipment including the HyperStart, NX100 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

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury to personnel.

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

Always be sure to follow explicitly the items listed under this heading.

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

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 NX100 and the programming pendant.
  When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.

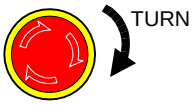
Injury or damage to machinery may result if the emergency stop circuit cannot stop the manipulator during an emergency. The manipulator should not be used if the emergency stop buttons do not function.

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 NX100.
  - 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 NX100 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 NX100 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 NX100 Instructions before operating the manipulator:

Notation for Menus and Buttons

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

Item	Manual Designation
Menu	The menus displayed on screen are denoted with { }. ex. {TOOL}.
Button	The buttons, check boxes, radio buttons displayed on screen are denoted with [ ]. ex. [Close]; [Sync] check box; [Fast] radio button.

Description of the Operation Procedure

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

• To move the cursor to the object item and left-click on it with the mouse.

• To pick out the object item by the tab key and press the Enter key.

(In case of selecting a menu, use arrow keys instead of the tab key to pick out the object item, then press the Enter key.)

Registered Trademark

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

1 Introduction

1.1 Overview

The Motoman Error Recovery function is part of the Motoman 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 Error Recovery function can be used with single robot cells as well as multiple robot cells and systems with external axis positioners. When using the Error Recovery function with multiple robots or cells with external axes, the alarm trigger stops all system motion while the faulted robot travels to the pre-defined service location. The faulted robot uses the collision detect function while following 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 Error Recovery function works with very little input from the user. However, the Error Recovery function makes use of several additional NX100 features and functions. Each of these additional functions must be setup properly for Error Recovery to operate correctly. These additional NX100 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.
- Arm Interference - monitors robot motion to ensure no two robots occupy the same space at the same time. When an arm interference is detected, one robot is paused allowing the other to continue until the path is clear.
- 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 Error Recovery function can be used with all basic arc-welding applications, some applications are better suited than others. When used with Motoman ArcWorld type cells, the 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 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 Error Recovery function. Setup of the Error Recovery function should be performed by personel familiar with arc welding application setup and configuration. Read this chapter thoroughly before beginning setup and configuration of the Error Recovery function.

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.

2.1 Required Functions and Parameters

The following functions and parameters must be installed and operating on the NX100 for the Error Recovery function to work properly. Please contact your Motoman representative for information on purchasing and enabling these functions and parameters.

Interrupt Job Function
Included with purchase of NX100 Recovery function

Macro Job Function
Included with purchase of NX100 Recovery function

S4C129 Parameter
This parameter must be set to equal (1) to report the current step number to the M-register.

2.2 Required Jobs

The following jobs must be installed on the NX100 controller for the Error Recovery function to work properly.

Table 2-1: Required Jobs

Required Jobs	User Modification	Single Robot	Dual Robot	Triple Robot	Description
ERR_MNGR.JBI	No- requires setup in weld job	X	X	X	R* Macro Job: Allows the user to specify what alarm triggers the function and how the robot(s) resume welding.
R1-EXIT.JBI	No- requires setup in weld job	X	X	X	R1 Macro Job: Used in R1 weld jobs to define torch extraction distance, escape route #, and sub-task number.
R1-PATHS.JBI	Yes- user must program escape path	X	X	X	R1 Robot Job: Defines basic structure (template) for programming escape paths. This is the job executed when an error occurs.
R1-RCVRY.JBI	No- requires use in R1-PATHS.JBI	X	X	X	R1 Macro Job: Contains the logic for performing the error recovery and posting robot status messages.
R2-EXIT.JBI	No- requires setup in weld job	N/A	X	X	R2 Macro Job: Used in R2 weld jobs to define torch extraction distance, escape route #, and sub-task number.
R2-PATHS.JBI		N/A	X	X	R2 Robot Job: Defines basic structure (template) for programming escape paths. This is the job executed when an error occurs.
R2-RCVRY.JBI		N/A	X	X	R2 Macro Job: Contains the logic for performing the error recovery and posting robot status messages.
R3-EXIT.JBI		N/A	N/A	X	R3 Macro Job: Used in R3 weld jobs to define torch extraction distance, escape route #, and sub-task number.
R3-PATHS.JBI		N/A	N/A	X	R3 Robot Job: Defines basic structure (template) for programming escape paths. This is the job executed when an error occurs.
R3-RCVRY.JBI		N/A	N/A	X	R3 Macro Job: Contains the logic for performing the error recovery and posting robot status messages.

2.3 Variables

2.3.1 Byte (B) Variables

Table 2-2: Byte (B) Variables

Variable	Description
B090	R1 currently specified escape route number (set by R1-ERROR.jbi)
B091	R2 currently specified escape route number (set by R2-ERROR.jbi)
B092	R3 currently specified escape route number (set by R3-ERROR.jbi)

2.3.2 Integer (I) Variables

Table 2-3: Integer (I) Variables

Variable	Description
I090	R1 currently specified M-register to get the step # based on sub-task# (set by R1-ERROR.jbi)
I091	First step # of R1 escape route (captured in R1-PATHS.jbi)
I092	Last step # of R1 escape route (captured in R1-PATHS.jbi)
I093	R2 currently specified M-register to get the step # based on sub-task# (set by R2-ERROR.jbi)
I094	First step # of R2 escape route (captured in R2-PATHS.jbi)
I095	Last step # of R2 escape route (captured in R2-PATHS.jbi)
I096	R3 currently specified M-register to get the step # based on sub-task# (set by R3-ERROR.jbi)
I097	First step # of R1 escape route (captured in R3-PATHS.jbi)
I098	Last step # of R1 escape route (captured in R3-PATHS.jbi)

2.3.3 Double (D) Variables

Table 2-4: Double (D) Variables

Variable	Description
D090	R1 User specified Tool X extraction distance * 1000 (set by R1-ERROR.jbi)
D091	R1 User specified Tool Y extraction distance * 1000 (set by R1-ERROR.jbi)
D092	R1 User specified Tool Z extraction distance * 1000 (set by R1-ERROR.jbi)
D093	R2 User specified Tool X extraction distance * 1000 (set by R2-ERROR.jbi)
D094	R2 User specified Tool Y extraction distance * 1000 (set by R2-ERROR.jbi)
D095	R2 User specified Tool Z extraction distance * 1000 (set by R2-ERROR.jbi)
D096	R3 User specified Tool X extraction distance * 1000 (set by R3-ERROR.jbi)
D097	R3 User specified Tool Y extraction distance * 1000 (set by R3-ERROR.jbi)
D098	R3 User specified Tool Z extraction distance * 1000 (set by R3-ERROR.jbi)

2.3.4 Position (P) Variables

Table 2-5: Position (P) Variables

Variable	Description
P090	R1 position at time of error / return position (pulse) (captured in R1-RCVRY.jbi)
P091	R1 calculated extraction location (pulse) (captured in R1-RCVRY.jbi)
P092	R2 position at time of error / return position (pulse) (captured in R2-RCVRY.jbi)
P093	R2 calculated extraction location (pulse) (captured in R2-RCVRY.jbi)
P094	R3 position at time of error / return position (pulse) (captured in R3-RCVRY.jbi)
P095	R3 calculated extraction location (pulse) (captured in R3-RCVRY.jbi)

2.3.5 Register (M) Variables

Table 2-6: Register (M) Variables

Variable	Description
M215	Contains data indicating what errors the function responds to how (lap / no lap) (set by ERR-MNGR.jbi)
M380	Contains the step # of the cursor while executing Master job
M381	Contains the step # of the cursor while executing sub-task #1
M382	Contains the step # of the cursor while executing sub-task #2
M383	Contains the step # of the cursor while executing sub-task #3
M384	Contains the step # of the cursor while executing sub-task #4
M385	Contains the step # of the cursor while executing sub-task #5
M386	Contains the step # of the cursor while executing sub-task #6
M387	Contains the step # of the cursor while executing sub-task #7

2.4 I/O

2.4.1 Universal Outputs

Table 2-7: Universal Outputs

Output	Description
OUT#989 (#11244)	R1 error recovery function enabled
OUT#990 (#11245)	R1 error recovery complete, robot back at failure point
OUT#991 (#11246)	R1 at service location, service required
OUT#992 (#11247)	R1 arc failure simulate
OUT#993 (#11250)	R2 error recovery function enabled
OUT#994 (#11251)	R2 error recovery complete, robot back at failure point
OUT#995 (#11252)	R2 at service location, service required
OUT#996 (#11253)	R2 arc failure simulate
OUT#989 (#11254)	R3 error recovery function enabled
OUT#990 (#11255)	R3 R1 error recovery complete, robot back at failure point
OUT#991 (#11256)	R3 at service location, service required
OUT#992 (#11257)	R3 Arc Failure Simulate

2.4.2 Universal Inputs

Table 2-8: Universal Inputs

Output	Description
IN#110 (#00145)	R1 arc fault active, error recovery required (trigger for interrupt job R1-PATHS.jbi)
IN#111 (#00146)	R2 arc fault active, error recovery required (trigger for interrupt job R2-PATHS.jbi)
IN#112 (#00147)	R3 arc fault active, error recovery required (trigger for interrupt job R3-PATHS.jbi)

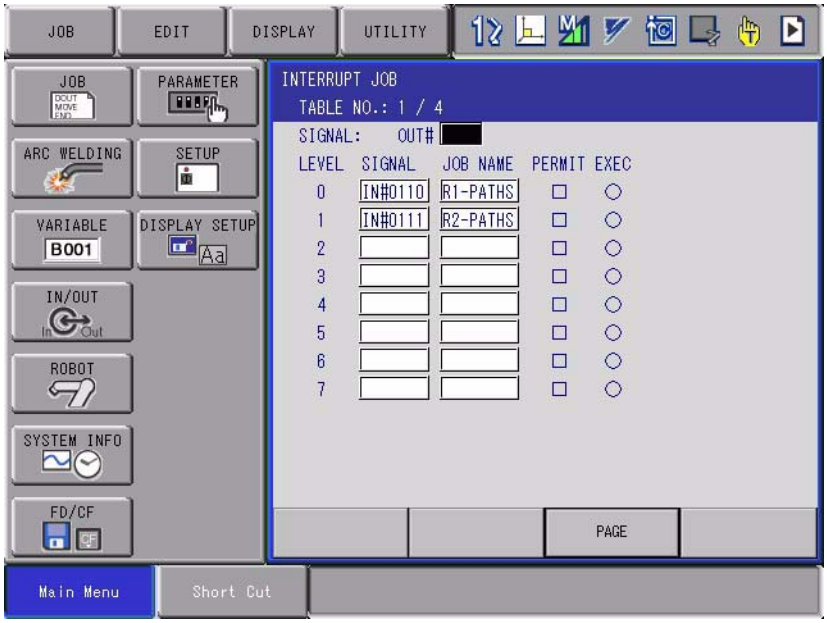
2.5 Interrupt Job Setup

The 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. 2-1: Interrupt Job



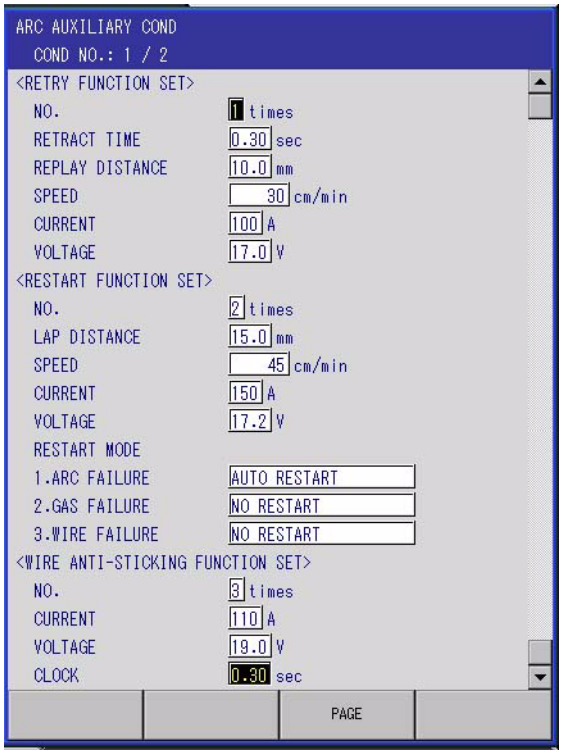
2.6 Arc Auxiliary Condition File Setup

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 Auxilliary Condition file is critical for proper operation of the Error Recovery Function. The settings contained in the "Arc Aux" file influence the operation by allowing the overlap distance to be specified and executed as desired. Other settings not related to the Error Recovery function are detailed in the "Operators Manual for Arc Welding" (149235-1). Below, the setting requirements for proper operation of the Error Recovery function are highlighted.

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

Fig. 2-2: Arc Auxiliary Condition File



2.6.1 Restart Function Set

- NO. must be set to 1 or more times.
- 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: Need to verify operation
- VOLTAGE: Need to verify operation

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" to return the robot the arc failure position where the user would be required to press the "Start" button again before the robot executes the lap distance and continues welding.
2. GAS FAILURE
   - Not used with the Error Recovery function.
3. WIRE FAILURE
   - Not used with the Error Recovery function.

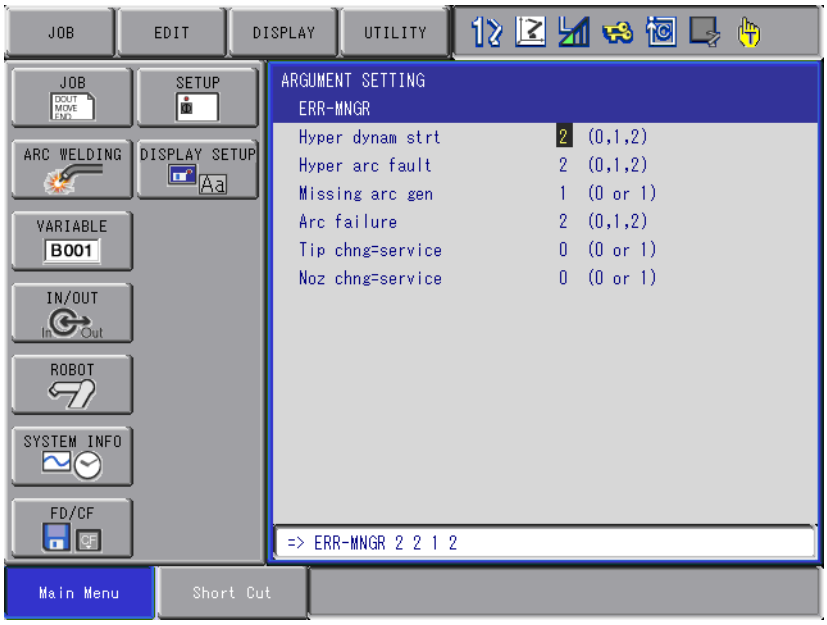
2.7 Weld Job Setup

The 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 Error Recovery function. Below are the needed commands that are required to properly setup and execute the Error Recovery function from within a weld job.

2.7.1 ERR-MNGR Macro Job

The ERR-MNGR macro job allows the user to specify which welding related alarms trigger the 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 can not be individually tailored for a specific robot. Settings specified affect operation of all available robots.

Fig. 2-3: 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" occurance 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 then specified or more times 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 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) where welding resumes.

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 a Arc Established signal after 3 seconds, 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 resuming 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 so 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 resuming welding without executing a 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) where welding resumes.

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 989, R2 = out 993, R3 = 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.

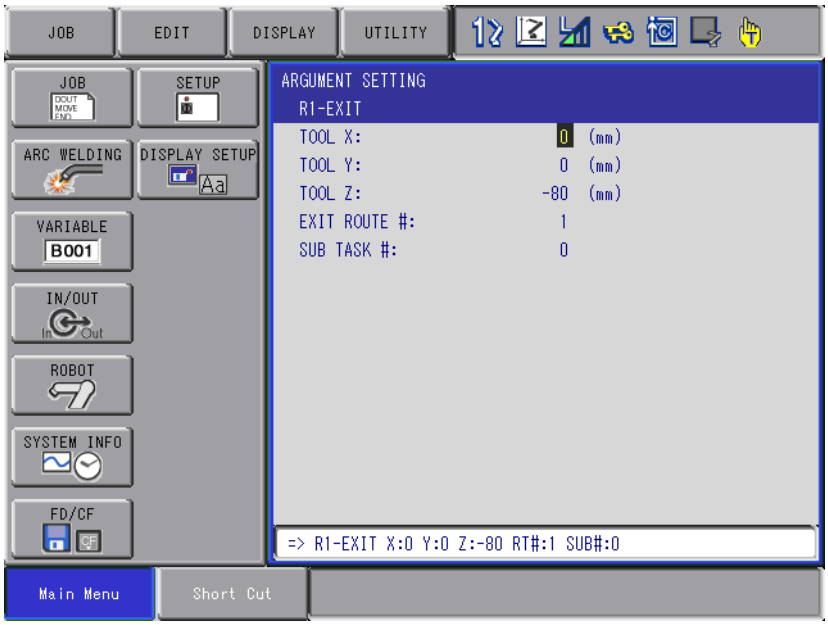
Noz chng=service
Specifies if the robot travels to its service location when the Nozzle change time specified in the Arc Diag file has been exceeded. This is checked both at the beginning and end of every weld while the R* ERROR RCVY ON output (R1 = out 989, R2 = out 993, R3 = 997) is ON.

- 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.

2.7.2 R*-EXIT Macro Job

The R*-EXIT macro enables and configures the 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 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 989, R2 = out 993, R3 = 997) from the inform job.

Fig. 2-4: R-EXIT*



Tool X
Specifies the distance (valid settings: +1000mm to -1000mm) in tool coordinate system's 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 system's 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 system's 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 bone. 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.

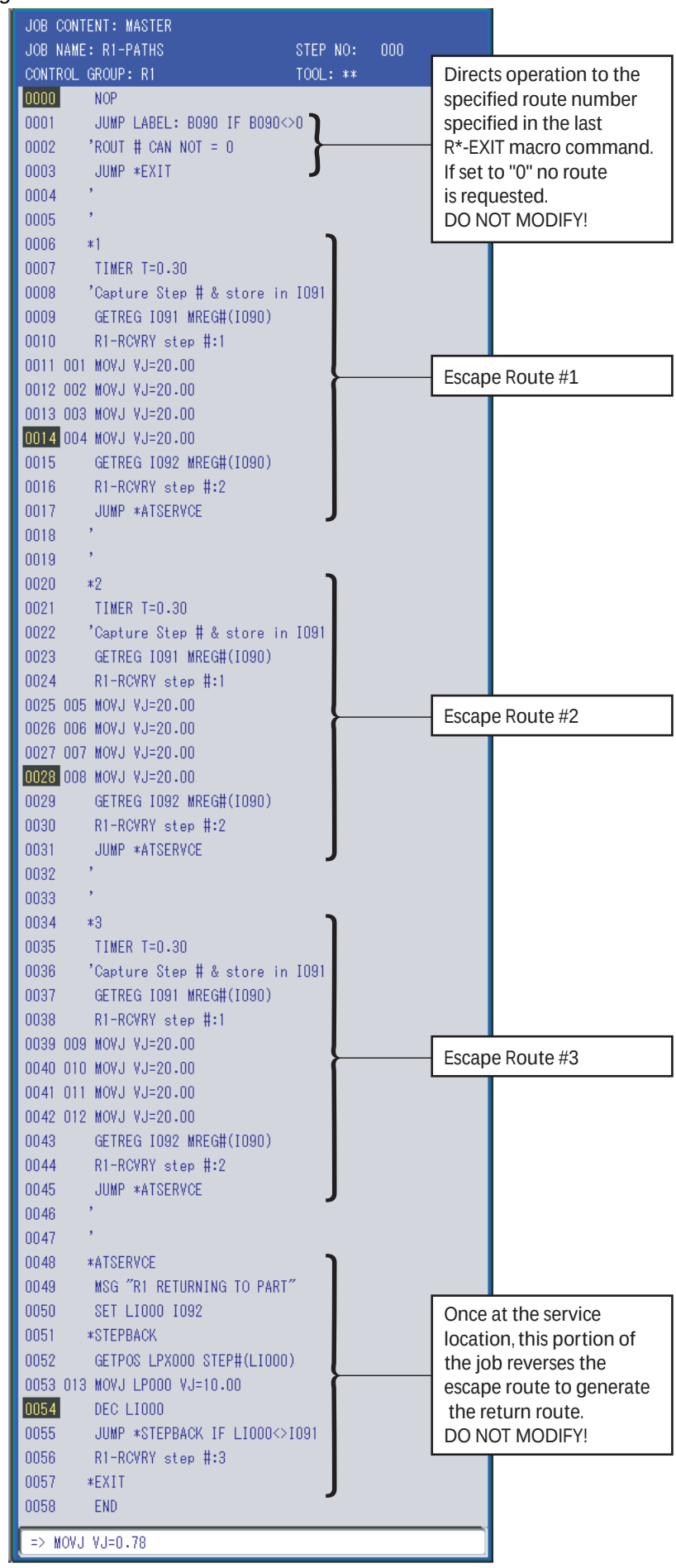
Sub Task #
This setting specifies what sub-task number (valid settings: 0 to 7) the current job is being run as. This setting is critical to for proper operation of the function. If a sub-task is changed in a upper-level job, the sub-task number also needs to be updated in all child jobs where a R*-EXIT command exists. A setting of 0 (zero) indicates that no independent or coordinated task is being executed (true for most single robot systems).

2.7.3 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. If programmed using any other coordinate system, the robot will reverse its path using joint motion which could result in collosions. Programming escape routes using joint motion ensures that the same path is followed when returning to the fault location.

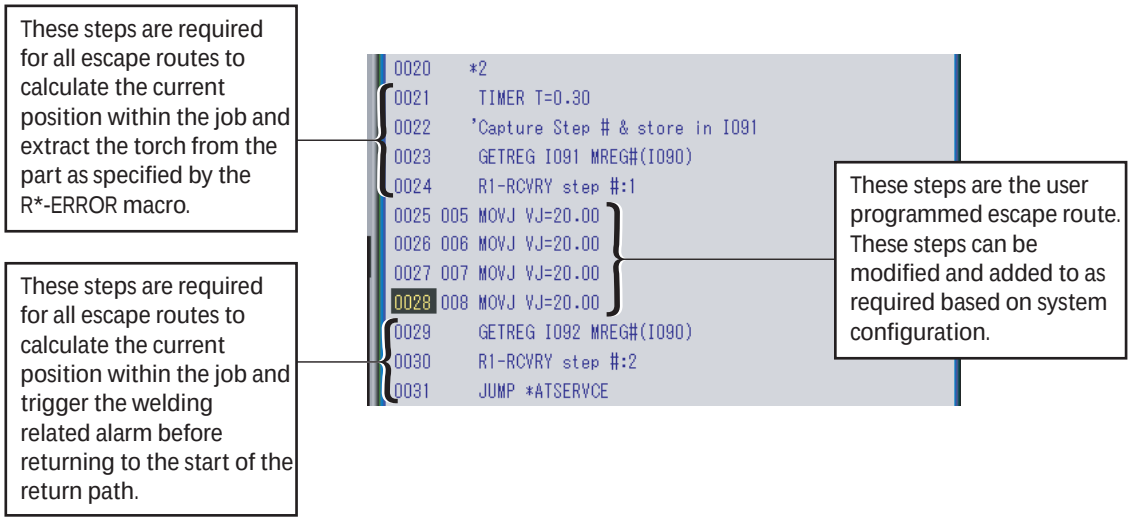
Fig. 2-5: R-PATHS*



2.7.4 Escape Route Programming Requirements

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

Fig. 2-6: Route Programming Requirements



Error Recovery
OPERATION MANUAL

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