

# LRMate Education Training Cart MH1

*EET 4144*

**FANUC**  
Robotics



**OVERVIEW**

**FANUC**  
Robotics

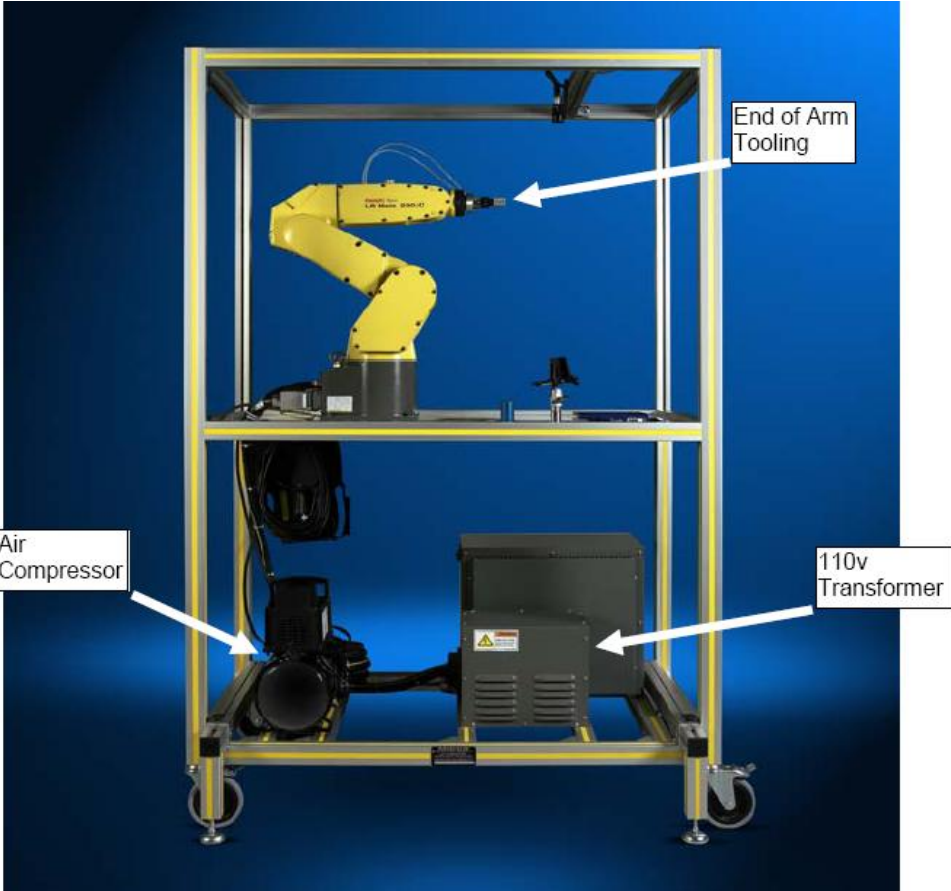


**CERTIFIED  
EDUCATION  
ROBOT TRAINING**

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The FANUC Robotics LRMate Education Training Cart MH1 consists of the following components:

- A wheeled cart with an open lower compartment and an upper compartment having clear sides with an access door
- LRMate 200iC robot arm mounted on a table top on the cart.
- Pneumatic end of arm tool mounted on the robot.
- Camera for use with FANUC Robotics iR Vision mounted at the top of the cart.
- R30iA Mate controller mounted on the cart frame
- 110v transformer mounted on the cart frame
- 110v air compressor mounted on the cart frame.



# Safeguards

The FANUC Robotics LRMate Education Training Cart MH1 is equipped with various hardware and software measures intended to safeguard personnel who may operate, program, repair, or otherwise use it. These include:

- Perimeter guarding with a dual channel interlock gate switch to prevent automatic operation with the door open and prevent observers from accessing the work envelope during automatic operation.
- A three position enabling switch on the Teach Pendant that disconnects power to the robot servomotors when it is released.
- A lockout to prevent unauthorized access to the controller power as part of school/plant Lock Out Tag Out procedures
- A lock on the access door to prevent unauthorized access to the work envelope.
- Restricting the work envelope using Dual Check Safety (DCS) position check parameter software settings to prevent the robot from striking the perimeter guarding. These settings are password protected to prevent unauthorized editing.
- Limiting automatic speed to <250 mm/s using DCS speed check parameters. These settings are password protected to prevent unauthorized editing.

## Turning On and Off the Controller

Turning on the robot provides power to the robot and controller and performs the following actions:

- Initializes changes to system variables
- Initializes changes to I/O setup
- Displays the utilities hints screen (during Cold start only)
- Initializes changes to cell I/O



### **WARNING**

Lethal voltage is present in the controller **WHENEVER IT IS CONNECTED** to a power source. Be extremely careful to avoid electrical shock.

Turning the disconnect or circuit breaker to the **OFF** position removes power from the output side of the device only. High voltage is always present at the input side whenever the controller is connected to a power source.

## Turning On the Robot

- Condition**
- All personnel and unnecessary equipment are out of the enclosure.
  - The access door is closed and latched.
  - The robot and air compressor are plugged in.
  - The wheels have been locked.

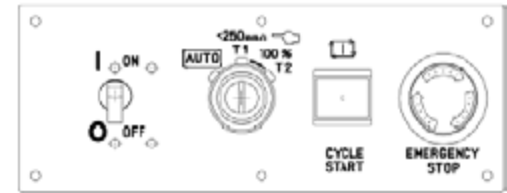
- Step**
- 1 Visually inspect the robot, controller, enclosure, and the surrounding area. During the inspection make sure all safeguards are in place and the enclosure is clear of personnel.
  - 2 Move the ON/OFF button on the transformer case to the ON position.



### **WARNING**

**DO NOT** turn on the robot if you discover any problems or potential hazards. Report them immediately. Turning on a robot that does not pass inspection could result in serious injury.

## Turning On the Robot



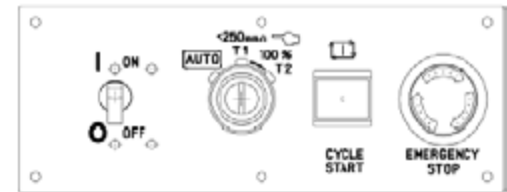
- 3 Move the ON/OFF button on the operator panel to the ON position. On the teach pendant display, you will see a screen similar to the following.



- 4 Move the ON/OFF button on the air compressor to the ON position. The air compressor will automatically shut-off when it reaches maximum pressure.

## Turning Off the Robot

### Step



- 1 If a program is running or if the robot is moving, press the HOLD key on the teach pendant.
- 2 Move the ON/OFF button on the operator panel to the OFF position.
- 3 Move the ON/OFF button on the transformer case to the OFF position and unplug the controller when performing maintenance on the robot or controller.

### **⚠ WARNING**

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Turning the disconnect or circuit breaker to the **OFF** position removes power from the output side of the device only. High voltage is always present at the input side whenever the controller is connected to a power source.

# Dual Check Safety Settings

Dual Check Safety (DCS) is a software option that checks speed and position data of motors with two independent CPUs in the robot controller. This function can detect position and speed errors immediately and shut down the motor power by two independent channels. Safety data and processes are cross-checked by the two CPUs. Self-diagnosis of safety hardware and software is executed periodically to prevent potential failure accumulation.

The DCS functions are collectively called Position/Speed Check. To use Position/Speed Check, the DCS Position/Speed Check software option is needed.



## Dual Check Safety Settings

The DCS menu is displayed by the following operation.

MENU → 0 -- NEXT -- → 6 SYSTEM → F1 , [TYPE] → DCS

The following Teach Pendant screens show the DCS setting values for the FANUC Robotics LRMate Education Training Cart MH1:

### *DCS Top Menu*

```
SRVO-342 DCS Cartesian position(G1) 1,1
                                     AUTO
DCS JOINT 100 %
                                     1/10
 1 Position/speed process:  ENABLE
   (Speed check (<250mm/sec) in T1)
 2 TCP:
 3 User frame:
 4 Joint position check:    DISABLE
 5 Joint speed check:      DISABLE
 6 Cartesian position check: ENABLE
 7 Cartesian speed check:  ENABLE
 8 Robot setup:            OK
 9 Mastering parameter:   OK
DCS params are loaded, please verify.
[ TYPE ] VERIFY DETAIL [CHOICE]
```

# Dual Check Safety Settings

## Items in the DCS TCP menu

```
SRVO-342 DCS Cartesian position(G1) 1,1
                                         AUTO
DCS                                     JOINT 100 %
TCP                                     Group:1 1/3
  1 X:                                0.000 mm
  2 Y:                                0.000 mm
  3 Z:                                -15.000 mm

Press PREV key to exit
[ TYPE ] GROUP COPY
```

## Items in DCS user frame menu

```
SRVO-342 DCS Cartesian position(G1) 1,1
                                         AUTO
DCS                                     JOINT 100 %
User frame                             Group:1 1/6
  1 X:                                0.000 mm
  2 Y:                                0.000 mm
  3 Z:                                0.000 mm
  4 W:                                0.000 deg
  5 P:                                0.000 deg
  6 R:                                0.000 deg

Press PREV key to exit
[ TYPE ] GROUP COPY
```

# Dual Check Safety Settings

## Items in DCS Cartesian Position Check menu

```
SRVO-342 DCS Cartesian position(G1) 1,1
AUTO
DCS JOINT 100 %
Cartesian position check Group:1 1/6
Mode: INSIDE
OPSFTY: 0
Stop type: Emergency stop
Current Upper Lower
X 249.915 625.000 250.000 mm
Y 0.939 185.000 -190.000 mm
Z 115.921 380.000 -210.000 mm

Press PREV key to exit
[ TYPE ] GROUP [CHOICE]
```

## Items in DCS Cartesian Speed Check menu

```
SRVO-342 DCS Cartesian position(G1) 1,1
AUTO
DCS JOINT 100 %
Cartesian speed check Group:1 1/5
Mode: ENABLE
OPSFTY: 0
Stop type: Controlled stop
Speed limit(mm/sec): 250.000
Permissible distance(mm): 0.000

Press PREV key to exit
[ TYPE ] GROUP [CHOICE]
```

# Dual Check Safety Settings

## Items in DCS robot setup menu

```
SRVO-342 DCS Cartesian position(G1) 1,1
                                           AUTO
DCS JOINT 100 %
Robot setup 1/11
                                           Status
1 Number of groups: 1 OK
2 Scan time: 8 msec OK
3 ----- Group 1 -----
4 Robot: LR Mate 200iC OK
5 Number of axes: 6 OK
6 J1: Servo card - Axis 1 OK
7 J2: Servo card - Axis 2 OK
8 J3: Servo card - Axis 3 OK
9 J4: Servo card - Axis 4 OK
Press PREV key to exit
[ TYPE ] APPLY
```

## Items in DCS Mastering parameter menu

```
SYST-179 SHIFT-RESET Released
ZERO LINE 0 T2 ABORTED
DCS JOINT 5 %
Mastering parameter 1/7
Axis Position Master count Status
1 ----- Group 1 -----
2 J1 0.000 deg 0 OK
3 J2 0.000 deg 0 OK
4 J3 0.000 deg 0 OK
5 J4 0.000 deg 0 OK
6 J5 -90.000 deg 0 OK
7 J6 0.000 deg 0 OK
Press PREV key to exit
[ TYPE ] APPLY
```

# Software Settings

## Tool Frame

A frame is a set of three planes at right angles to each other. The point where all three planes intersect is the origin of the frame. This set of planes is called a Cartesian coordinate system. In the robot system, the intersecting edges of the planes are the x, y, and z axes of the frame.

The default Tool Frame is a Cartesian coordinate system that has the position of the tool center point (TCP) at its origin. When you set up a Tool Frame, you move the default Tool Frame from the robot faceplate to the point on the tool at which the work is to be done.

MENU → 6, SETUP → F1, [TYPE] → Frames

Tool Frame 1 has been set up for the FANUC Robotics LRMate Education Training Cart MH1. The following Teach Pendant screen shows the Tool Frame values that have been set:

```
ZERO          LINE 0      AUTO  ABORTED
SETUP Frames  JOINT 100 %
Tool Frame Setup/ Direct Entry  1/7
Frame Number: 1
1  Comment:      Eoat1
2  X:            0.000
3  Y:            0.000
4  Z:            96.000
5  W:            0.000
6  P:            0.000
7  R:            0.000
   Configuration:  N D B, 0, 0, 0
Active TOOL $MNUTOOLNUM[1] = 1
[ TYPE ][METHOD] FRAME
```

## Collision Guard

The Collision Guard option provides a highly sensitive method to detect that a robot has collided with an object. Collision guard then stops the robot, and allows the axes to sag away from the collision point for 200 msec. This helps minimize potential damage to the end-of-arm tooling and the robot.

When Collision Guard is enabled, it is in effect during jogging and programmed motion. It also helps prevent damage during the process of teaching a program.

You can adjust the level of sensitivity for Collision Guard to eliminate false alarms and to provide fast response when a collision is detected.

## Collision Guard

The COLLISION GUARD menu is displayed by the following operation.

MENU → 6, SETUP → F1, [TYPE] → Coll Guard

The following Teach Pendant screen shows the Collision Guard setting values for the FANUC Robotics LRMate Education Training Cart MH1:

```
ZERO                LINE 0      AUTO  ABORTED
COL GUARD SETUP    JOINT 100 %
                                     4/4
  Group:           1
  Collision Guard status:      ENABLED
  1 Sensitivity:              180%
  2 Sensitivity Def. Reg.:    R[  0]
  3 Collision Guard Error:    DO[  0]
  4 Col. Guard enabled:      DO[  0]

[ TYPE ] HELP      GROUP
```

## **Payload**

Robot payload is the weight, or mass, of the robot end-of-arm tooling and workpiece. You can define up to ten different payload schedules.

It is important that the payload data used by the robot be as accurate as possible. The more accurate the values, the more effective features such as Collision Guard will be. Accurate values will also improve positional accuracy, cycle time, and general motion performance that are critical for today's processing.

If you have not set up the proper robot payload during software installation, or if you need to change the robot payload because you have changed end-of-arm tooling or the workpiece, you must set robot payload.



## Payload

The MOTION menu is displayed by the following operation.

MENU → 0, NEXT → 6, SYSTEM → F1, [TYPE] → Motion

Payload schedule 1 has been set for the FANUC Robotics LR Mate Education Training Cart MH1. The following Teach Pendant screen shows the Payload values that have been set:

ZERO	LINE 0	AUTO	ABORTED
MOTION/PAYLOAD SET		JOINT 100 %	
		1/8	
Group 1			
1	Schedule No[ 1 ] :	[*****]	
2	PAYLOAD	[kg]	0.35
3	PAYLOAD CENTER X	[cm]	0.00
4	PAYLOAD CENTER Y	[cm]	0.00
5	PAYLOAD CENTER Z	[cm]	4.00
6	PAYLOAD INERTIA X	[kg f cms^2]	0.00
7	PAYLOAD INERTIA Y	[kg f cms^2]	0.00
8	PAYLOAD INERTIA Z	[kg f cms^2]	0.00
[ TYPE ]	GROUP	NUMBER	DEFAULT HELP

## Default Motion Instructions for Programming

Programmed motion instructions tell the robot to move to an area in the workcell in a specific way. When you create a program you can define, in advance, the way you want the robot to move when you add a motion instruction. You do this by defining default motion instruction information.

The EDIT DEFAULT screen is displayed by the following operation.

EDIT → F1, POINT → F1, ED DEF

Default motion instruction values have been defined for the FANUC Robotics LR Mate Education Training Cart MH1 to avoid generating DCS Cartesian Speed Check alarms. The following Teach Pendant screen shows the default motion instruction values that have been set:

```
Default Motion JOINT 10 %
1 J P[] 6% FINE
2 J P[] 6% CNT100
3 L P[] 225mm/sec FINE
4 L P[] 225mm/sec CNT100
ZERO
1/2
1:J @P[1] 100% FINE
[End]
ED_DEF TOUCHUP>
```

# Tooling

The FANUC Robotics LRMate Education Training Cart MH1 is equipped with a pneumatically operated gripper. Pressurized air is supplied by a 110v. air compressor mounted on the cart frame. The ON/OFF switch on the air compressor must be in the ON position for the compressor to operate. The gripper may be opened and closed using Robot Output signals.

## Opening and Closing the Gripper

The gripper is opened and closed using Robot Output signals.

Robot Output 3 closes the gripper

Robot Output 4 opens the gripper

For the gripper to work properly, the I/O Robot Out/Port Detail screen for Robot Output 3 must be set to

Complementary: TRUE

## Opening and Closing the Gripper

The I/O Robot Out screen is displayed by the following operation.

I/O → F1, [TYPE] → Robot

The following screens show the I/O settings for the FANUC Robotics LRMate Education Training Cart MH1.

ZERO	LINE 0	AUTO	ABORTED
I/O Robot Out		JOINT 100 %	
#	SIM	STATUS	3/8
RO[ 1 ]	U	OFF	[ ]
RO[ 2 ]	U	OFF	[ ]
RO[ 3 ]	U	OFF	[ GRIPPER CLOSED ]
RO[ 4 ]	U	OFF	[ GRIPPER OPEN ]
RO[ 5 ]	U	OFF	[ ]
RO[ 6 ]	U	OFF	[ ]
RO[ 7 ]	U	OFF	[ ]
RO[ 8 ]	U	OFF	[ ]
[ TYPE ]	IN/OUT	ON	OFF >

ZERO	LINE 0	AUTO	ABORTED
I/O Robot Out		JOINT 100 %	
Port Detail		1/3	
Robot Dig. Output		[ 3 ]	
1 Comment: [ GRIPPER CLOSED ]			
2 Polarity: NORMAL			
3 Complementary: TRUE [ 3 - 4 ]			
[ TYPE ]	PRV-PT	NXT-PT	

## Setting the Air Pressure

The air compressor installed on the FANUC Robotics LRMate Education Training Cart MH1 is equipped with a pressure regulator to control the air pressure supplied to the robot mounted gripper. Refer to the owner's manual furnished with the compressor for the proper procedure to adjust the regulator and for all safety measures applicable to the compressor. The recommended pressure setting is 60 PSI.



**Air Compressor Pressure Regulator**