Mech-Mind User's Manual

Mech-Mind

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This section introduces the master-control program for FANUC robots and the procedure of setting up the communication with a robot through the program.

CHAPTER

FANUC SETUP INSTRUCTIONS

This section introduces the process of loading the robot master-control program onto a FANUC robot. The process consists of the following steps:

- Check Controller and Software Compatibility
- Setup the Network Connection
- Load the Program Files
- Test Robot Connection

Please have a flash drive ready at hand.

1.1 Check Controller and Software Compatibility

- Controller: no requirement
- Controller system software version: V7.5, V7.7, V8.*, and V9.*
- Additional controller software packages:
 - R651 or R632 (karel) used to enable karel function
 - R648 (User Socket Msg)
- Mech-Mind Software Suite: latest version recommended

1.2 Setup the Network Connection

1.2.1 Hardware Connection

Plug the Ethernet cable of the IPC into the Ethernet port of robot controller as shown in the figure. You can plug the cable into either CD38A port or CD38B port. CD38A corresponds to **Port#1** in the robot IP setting, while CD38B corresponds to **Port#2**.



1.2.2 IP Configuration

1. Press on *MENU*→ *SETUP*, select **Host Comm** in the context menu, and then press **ENTER** to open the **SETUP Protocols** window.



2. Select TCP/IP and press on DETAIL to open the SETUP Host Comm window.



3. Enter the robot IP in the **IP address** line with the keyboard of the teach pendant. The robot IP should be in the same subnet as the IPC.





4. If the Ethernet cable is connected to port 2, please press *Port* to switch the port. Then you can enter the robot IP in the **IP address** line.



1.3 Load the Program Files

1.3.1 Backup

- 1. Connect the flash drive to the robot controller or the teach pendant.
- 2. Press on the MENU button, and select $FILE \rightarrow File$ on the screen, and then press on ENTER to open the FILE window.

Busy Step Hold Fault	T2 JOINT 100
Select	€ ≡ 🕀
MENU 1	FILE 1 ee 1/47
1 UTILITIES	1 File 3 Comment
2 TEST CYCLE	2 File Memory
3 MANUAL FCTNS	3 Auto Backup []
4 ALARM	ETUP VR []
5 I/O 🕨	RAM VR []
6 SETUP	ET PC []
7 FILE	2 MR [Get PC Data]
8 iRVision	FPOS PC []
9 USER	HOME PC [Get Home Pos]
0 NEXT	
Menu Favorites (press and	hold to set)
_×	
	MENU EDIT DATA FCTN SHIFT NEXT
RESE	

3. Select $UTIL \rightarrow Set Device$, and press on ENTER to open the USB folder.

Busy Sto	ep Hold Fault O Prod TCyc	T2 JOINT 100
FILE		€. 🖽
	MC:*.*	1/32
	1 *	<pre>* (all files)</pre>
	2 *	KL (all KAREL source)
	3 *	CF (all command files)
	4 *	TX (all text files)
	5 *	LS (all KAREL listings)
	6 *	DT (all KAREL data files)
	7 *	PC (all KAREL p-code)
	8 *	TP (all TP programs)
	9 *	MN (all MN progr UTIL 1
	10 *	VR (all variable 1 Set Device 2
	11 *	SV (all system 2 Format
	Press DIR to	generate directo
		4 Make DIR
		4 Hake Dik
	[TYPE] [DI	IR] LOAD [BACKUP] UTIL

4. If your flash drive is connected to the **controller**, please select **USB Disk (UD1:)**; if your USB flash drive is connected to the **teach pendant**, please select **USB on TP (UT1:)**.

Busy Step Hold Fault Run I/O Prod TCyc	T2 JOINT	100
FILE		A
MC:*.*	1/32	
121I USB on TP (UT1:)1 FROM Disk (FR 22 Backup (FRA:)33 RAM Disk (RD:444 Mem Card (MC 55 Mem Device (I)666 Console (CON 77 USB Disk (UD: 8next page IR to gene	<pre>(all files) (all KAREL source) (all command files) (all text files) (all KAREL listings) (all KAREL data files) (all KAREL p-code) (all TP programs) (all TP programs) (all MN programs) (all variable files) (all system files) erate directory</pre>	
[TYPE] [DIR]	LOAD [BACKUP] [VTIL]	>
PREV SHIFT MENU SELE	EDIT DATA FCTN SHIFT NEXT STEP (1) (1) HOLD (1) (1) M ENTER FWD (1) (1)	

5. In the USB FILE window, select $UTIL \rightarrow Make DIR$ to create a new folder.

Busy S	tep Hold Fai	ılt yc		T2	JOINT	100
FILE						e, 🖽
	UT1:*.*				1/32	
	1 *	*	(all fi	les)		
	2 *	KL	(all KA	REL sourc	e)	
	3 *	CF	(all co	mmand fil	.es)	
	4 *	TX	(all te	xt files)		
	5 *	LS	(all KA	REL listi	ngs)	
	6 *	DT	(all KA	REL data	files)	
	7 *	PC	(all KA	REL p-cod	le)	
	8 *	TP	(all TP	programs	;)	
	9 *	MN	(all MN	progi UTI	L 1	
	10 *	VR	(all va	riabl(1 Se	t Device	
	11 *	SV	(all sy	stem 2 Fo	rmat	1
	Press DI	R to gene	erate di	rector	mat EAT32	1
				510		
				4 Ma	KE DIK	
	_	_				
	[TYPE]	[DIR]	LOAD	[BACKUP]	VTIL	1>

6. Select Words, Upper Case, Lower Case, or Options/Keybd to name the folder, and then press on ENTER to confirm and enter the new folder.



Busy Step Hold Run I/O Prod	Fault TCyc		T2 JOINT	100
FILE				🕀 🕀
UT1:	\AOA*.*		1/33	
1	(U	p one lev	el) <dir></dir>	
2	*	* (all	files)	
3	*	KL (all	KAREL source)	
4	+	CF (all	command files)	
5	*	IN (all	KAREL listings)	
7	*	DT (all	KAREL data files)
8	*	PC (all	KAREL p-code)	,
9	*	TP (all	TP programs)	
10	*	MN (all	MN programs)	
11	*	VR (all	variable files)	
[ТУРЕ	[] [D]	IR] LOA	D [BACKUP] [VTIL	

Hint:

• In this example, Upper Case is selected, and the folder name is AOA.

7. Select $BACKUP \rightarrow All \text{ of above} \rightarrow ENTER$ to backup the files.

Busy Step Run I/O	Hold Fa	ult Cyc		1	T2 JOINT	100
FILE						۵ 🕀
	UT1:\AOA	A*.*			1/33	
	1	(Up on	e level)	<dt< th=""><th>R</th><th>2</th></dt<>	R	2
	2 *	*	(all BAC	KUP 1	II pr	ograms
	3 *	KL	(all1Sys	tem files		ogramo
	4 *	CF	(all ₂ TP	programs		
	5 *	TX	(all 3 App	olication		
	0 ×	LS	(all 4 Apr	olicTP		
	2 *	DT	(all frm	or log		
	9 *	ים קיף		anostic		
	10 *	MN	(all - ve	griosuc		
	11 *	VR	(all	on data		
			. 8 All (of above		
			9 Mai	ntenance (data FXT -	
			0 N	IEXT		
	[TYPE]	[DIR]	LOAD	BACKUP	1 ли ј	>
	PREV			TA FCTN	SHIFT NEXT	
\frown					+X	
$\langle \ \rangle$				(J2)	(J2)	
\searrow	R	SET BACK IT	EM ENTER	J - Z (J3)	+Z (J3)	

8. A message asking whether to delete the new folder before backup files will display on the screen. Select Yes.

Busy	Step	Hold	Fault					100
Run	I/O	Prod	TCyc				12 JOINT	100
FILE								🕀 🖽
		UT1:\	AOA	*.*			1/33	
		1		(Up one	e leve	el) <di< th=""><th>:R></th><th></th></di<>	:R>	
		2	*	*	(all	files)		
		3	*	KL	(all	KAREL sou	irce)	
		4	*	CF	(all	command f	iles)	
		5	*	TX	(all	text file	es)	
		6	*	LS	(all	KAREL lis	stings)	
		7	*	DT	(all	KAREL dat	a files)	
		8	*	PC	(all	KAREL p-c	:ode)	
		9	*	TP	(all	TP progra	ums)	
		10	*	MN	(all	MN progra	ums)	
			*		(all	Variable	files)	
		Detet	e UT	AOA/:	beio	re backup	files?	
	_							
						YES	NO	
								a eet e name

9. Then a message asking whether to delete the new folder and backup all files will display on the screen. Select Yes to start backuping.

Busy Step	Hold	Fault					-	2 10	INIT		100
Run I/O	Prod	TCyc						2 10			%
FILE											🔍 🖽
	UT1:	AOA/	* • *					1/	33		
	1		(Up one	e leve	el)	<	DIR	>			
	2	*	*	(all	fil	les)					
	3	*	KL	(all	KAF	REL S	sour	ce)			
	4	*	CF	(all	con	mand	l fi	les)			
	5	*	TX	(all	tex	t fi	lles)			
	6	*	LS	(all	KAF	REL]	list	ings)		
	7	*	DT	(all	KAF	REL C	lata	fil	es)		
	8	*	PC	(all	KAF	KET L	o-co	de)			
	9	*	TP	(all	TP	prog	gram	s)			
	10	*	MN	(all	MN	proc	gram	s)			
	11	*	VR	(all	var	labl	le f	iles)		
	Delet	te UTI	1:\AOA\	and k	back	cup a	11	file	s?		
		_	_		ſ				_	_	_
						Y	ES		NO		

10. After the backup is complete, select all files and press on ENTER to view all backuped files.

Busy	Step	Hold	Fault					100
Run	I/O	Prod	ТСус					<u>«</u> п
FILE		TTTT1 • \	AOA*	*			2/33	~~ 🗆
		1	AOA ((Up on	e level) <dti< th=""><th>2755</th><th></th></dti<>	2755	
		2	*	*	(all f	iles)		
		3	*	KL	(all K	AREL sour	rce)	•
		4	*	CF	(all c	ommand f:	iles)	
		5	*	TX	(all t	ext files	5)	
		6	*	LS	(all K	AREL list	tings)	
		7	*	DT	(all K	AREL data	a files)	
		8	*	PC	(all K	AREL p-co	ode)	
		9	*	TP	(all T	P program	ns)	
		10	*	MN	(all M	N program	ns)	
		11	*	VR	(all v	ariable :	files)	
		[TYPE	1	[DIR]	LOAD	[BACKUP]	[VTIL]	>
	~	PREV	SHIFT	MENU	LECT	DATA FCTN	SHIFT NEXT	
>								
	\geq		i			STEP (J1)	(J1)	
>			DISP			HOLD	+Y	
\leq	\geq	OFF ON		BACK			+7	
			RESET	SPACE	EM		(J3)	

Busy Step Run I/O	Hold Fault Prod TCyc	T2 JO	INT 100 %
FILE			۵ 🕀
	UT1:\AOA*.*	1/1	69
	1 (Up one l	level) <dir></dir>	
	2 -BCKED8-	TP	74
	3 -BCKED9-	TP	74
	4 -BCKEDT-	TP	74
	5 AAVMMAIN	VR	1523
	6 AMBERLED	GIF	1046
	7 ATERRJOB	VR	64
	8 BACKDATE	DT	342
	9 BICSETUP	VR	71
	10 CAM	VD	57
	11 CBPARAM	VR	338
	[TYPE] [DIR]	LOAD [BACKUP] [VI	

1.3.2 Prepare the Files

The program file is stored in the installation directory of Mech-Mind Software Suite.

Navigate to xxx\Mech-Mind Software Suite-x.x.x\Mech-Center\Robot_Server\Robot_FullControl\fanuc, and copy all the contents of this folder to your flash drive:

Note:

- Please save all the contents in the root directory of the USB flash drive. Do not rename them.
- Please copy all the contents in the folder instead of copying the whole folder directly.

1.3.3 Load the Files to the Robot

1. After connecting the USB flash drive, press MENU and select $FILE \rightarrow File$, and then press ENTER to open the FILE window.



2. Press *UTIL* and select **Set Device** in the context menu.



3. Select the USB flash drive. If your flash drive is connected to the **controller**, please select **USB Disk** (UD1:); if your USB flash drive is connected to the **teach pendant**, please select **USB on TP (UT1:)**.

Busy	Step	Hold	Fault	TPIF-149) Must con	nplete	operation fin	st	A.	100
Run	I/O	Prod	ТСус						<u> </u>	%
FILE										🔍 田
		UT1:\	\ * -*					1/32		
		2			(all	file	es)			
1			D TD (171.)	(all	KARE	L sourc	e)		
1 FROM	Disk (F	R:)		011.)		com	and Ill	es)		
2 Backu	p (FRA:)	_		(all	KARF	Z. listi	nas)		
	vick (PD	, .)	-		(all	KARE	EL data	files)		
5 KAM D		•)	_		(all	KARE	L p-cod	e)		
4 Mem C	Card (M	C:)			(all	TP p	programs)		
5 Mem D)evice ((MD:)			(all	MN F	programs)		
6 Conso	le (CON	IS:)			(all	vari	able fi	les)		
7 USB D	isk (UD:	1:)	-		erate	dire	ctory	S)		
8next	t page-	-	t page							
<u> </u>										
	_	_	_	_		_	_			
		[TYPE	1	[DIR]	LOAD	b	[BACKUP]	[UTIL]		>
		-	-							·
·			_							
	-	PR	EV SHIF	MENU S	ELECT EDIT	DATA	FCTN SHIFT	NEXT		
					<u></u>	STEP	-X +X			
					⇒		(J1) (J1)		\geq	\leq
						HOLD	(J2) (J2)			
\rightarrow			RESE	BACK SPACE	TEM ENTER	FWD	-Z +Z			
			7		9 TOOL	BWD	\overline{X} $\overline{+X}$			/

4. Select the first line (all files) and press ENTER to enter the root directory of the USB flash drive.



Hint: For the next step:

- If the USB flash drive is connected to the robot controller, please select INSTALL_UD.cm.
- If the USB flash drive is connected to the **robot teach pendant**, please select **IN-STALL_UT.cm**.
- 1. Select the corresponding CM file and press ENTER key on the teach pendant. Choose YES to start loading the programs.



2. When the following screen is displayed, the loading and relavent configuration are completed. Press F4 to exit the program.



Attention: Please restart the robot after exiting the program.

1.3.4 Run the Program

1. Press SELECT key on the teach pendant to open the program selection window, and then select $TYPE \rightarrow TP$ Programs, as shown below.

Busy Run	/ Step I/O	Hold Prod	Fault TCvc	TPIF-149) Must co	omplet	e operatio	n first T2	JOINT	1	DÖ
Sele	oct									• =	*° - □ - □ - □
	.00	All	6953	888 b y 1	tes fr	ee		21	/32		
		No.	Prog	gram na	ame		Commer	nt	-		
		17	IRVTY	PE	VR	[]		
		18	MM_MC	VEID	PC	[mm_	moveid	1]		
		19	MM_MC	VESM		[r2	_]		
		20	MM RE	LAY	PC	[mm_	relay		1		
	ТҮРЕ	1		או איז די איז	PC	[13	state		1		
	1 Recent		MM ST	RUCT I	I VR	[1		
	2 41		MTPAF	AM	VR	i i			i		
	2 All		REQME	NU	MR	[Rec	quest H	C Me	enu]		
	3 Collecti	ons	SENDI	ATA	MR	[Ser	nd PC I	Data]		
	4 TP Prog	Irams	3								
	5 KAREL Progs										
	6 Macro										
	7 Cond										
:		TYPE		CREATE	DELE	TE	MONITO	R	[ATTR]	>	
		PR	EV SHIF	MENU S		DAT STE HOL R FW	A FCTN 9 (11) P (11) P (12) C (13) P (13) P (13)	SHIFT +(J1) +(J2) +(J3) +(X3) +(X3)	NEXT	\times	

2. Select **MM_RUN** and press **ENTER** to open the program. Then press the green button on the controller to auto-run the program.



3. If the following screen is displayed, you can proceed to the next section.



1.4 Test Robot Connection

1.4.1 Configure Robot in Mech-Viz

- 1. Open Mech-Viz, click New project to create a new project.
- 2. Select the robot model in use in the next page.
- 3. Save the project by pressing Ctrl + S.
- 4. In the toolbar, change the Vel. (velocity) and Acc. (acceleration) parameters to 5%.
- 5. Right-click the project name in **Resources** and select **Autoload Project**.

1.4.2 Configure Settings in Mech-Center

- 1. Open Mech-Center and click on Deployment Settings.
- 2. Go to **Robot Server**, and make sure **Use robot server** is checked.
- 3. Check if the robot model displayed next to Robot type in Mech-Viz project matches the one in use.
- 4. Set the Robot IP address, and click Save.

1.4.3 Connect to Robot in Mech-Center

- 1. Click Connect Robot in the Toolbar.
- 2. The robot is successfully connected if:
 - A message saying Robot: server connected to the robot shows up in the Log panel, and
 - A robot icon with the robot model shows up in the Service Status panel.

1.4.4 Move the Robot

- 1. In Mech-Viz, click *Sync Robot* in the toolbar to synchronize the pose of the real robot to the simulated robot. Then, click *Sync Robot* again to disable the synchronization.
- 2. Click the **Robot** tab in the lower right, and change the joint position of J1 slightly (for example, from 0° to 3°). The simulated robot will move accordingly.
- 3. Click Move real robot, the real robot should move accordingly.

Attention: When moving the robot, please pay attention to safety hazards. In the case of an emergency, press the emergency stop button on the teach pendant!

CHAPTER

FANUC PROGRAM DESCRIPTION

2.1 Program Module

Program Mod-	Description			
ules				
mm_relay	background program used to receive Robserver data			
mm_state	background program used to send data of robot pose, signal, and status			
mm_movesm	foreground program used to guide the robot to move			
mm_moveid	background program used to write the data received by mm_relay to the register			
mm_run	automatically run the foreground and background program after running this mod-			
	ule			
mm_struct_h	defined struct data			

2.2 Occupied Registers

Register		Description		
MOVE_SPD_REG	180	integer register: motion velocity (in %)		
MOVE_CNT_REG	181	integer register: motion termination (in %)		
MOVE_TYP_REG	182	indicate the move type J or L		
MOVL_RG_SPD	183	move L velocity		
RI_C_BRANCH	184	mm control branch		

Position Regis	ter	Description
MOVE_PREG 80		position register for current point

2.3 Occupied FLAGs

	Description
180	ready signal flag
181	data ready signal flag
182	takes control flag
183	trajectory lock flag
190	stop move flag
191	clear data flag
	180 181 182 183 190 191