CNC SYSTEM

OSP-P300MA

MA-12500H U-AXIS TOOL SPECIFICATIONS

INSTRUCTION MANUAL

(1st Edition)

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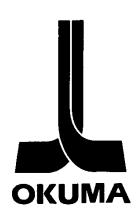
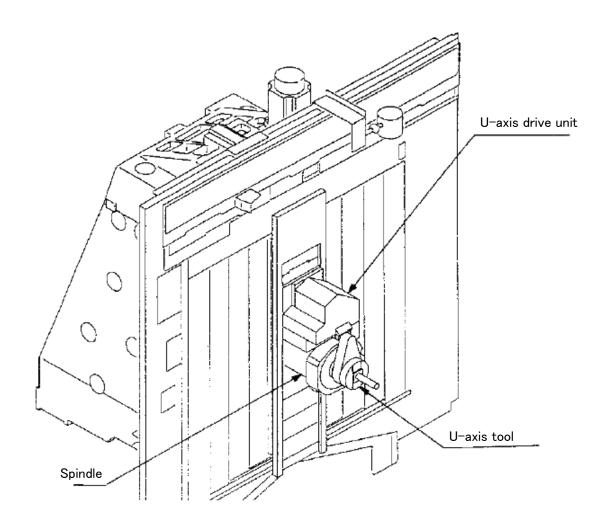


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1. Overview

U-axis tools perform U-axis connection ON/OFF operation in tool mounting to and removal from the spindle by ATC.



2. Setting Method

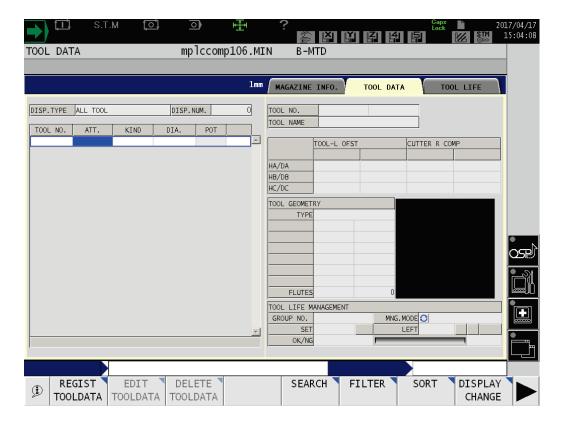
2-1. Setting from the Pot-Tool Correspondence Table

After registering U-axis tool data, set at the pot-tool correspondence table.

Procedure: -

- 1 Press tool data setting key to display the Tool data setting screen.

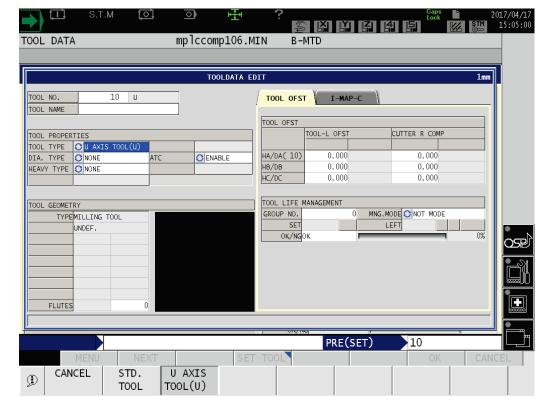
 If the tool data setting screen does not appear, press [F8] (CHANGE DISPLAY) to select the tool data setting screen.
- 2 Select the TOOL DATA sheet and then press [F1] (REGIST TOOLDATA).



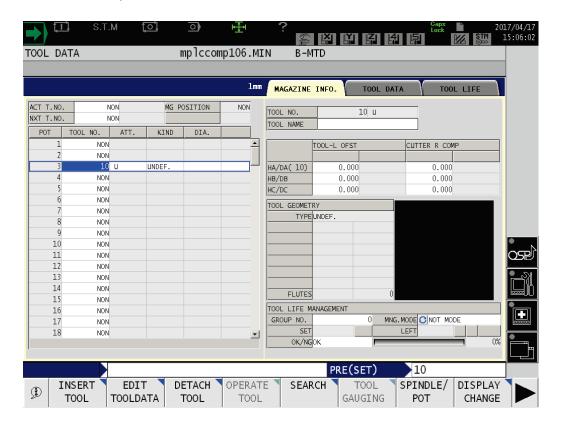
3 A TOOLDATA EDIT screen appears. Enter the tool number for the U-axis tool in TOOL NO.



- **4** Align the cursor with TOOL TYPE, and then set U AXIS TOOL(U) using either of the following methods.
 - ☐ Press [F1] (MENU [*]) and then select U AXIS TOOL(U) from the list of tool types displayed on the function keys.
 - ☐ Press [F2] (NEXT) and set U AXIS TOOL(U).



- **5** Press [F7] (OK) to complete tool data registration.
- 6 Select the MAGAZINE INFO. sheet.
- 7 Align the cursor with the U-axis tool attachment pot from the pot-tool correspondence table (left side of screen).
- 8 Press [F1] (INSERT TOOL), align the cursor with the registered tool data from the displayed tool list, and then press [F7] (OK).

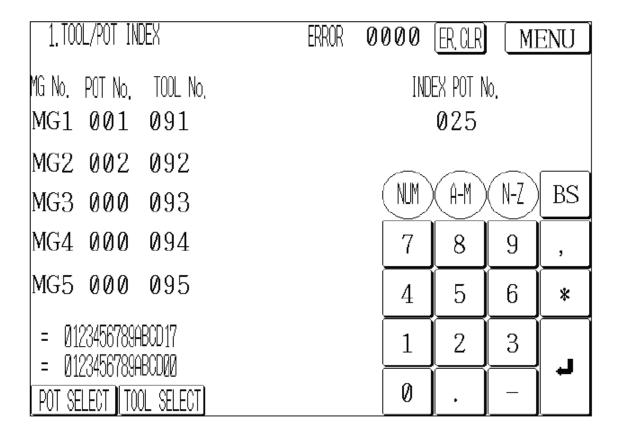


2-2. Setting from the ATC Sub Operation Panel

After registering U-axis tool data at the OSP (machine), set the TOOL No. from the ATC sub operation panel TOOL DATA SET UP-1 screen. (There is no need to set tool properties.)

Procedure:

- 1 Perform steps 1 to 5 in the [2-1. Setting from the Pot-Tool Correspondence Table] to register U-axis tool data.
- 2 Set the tool data registered in the target pot from the ATC sub operation panel TOOL DATA SET UP-1 screen.



For details on how to operate the ATC sub operation panel, refer to SECTION 28 ATC SUB-OPERATION PANEL SPECIFICATIONS in OSP-P300S/P300M SPECIAL FUNCTIONS MANUAL No. 2.

3. U-axis Connection ON Operation

When the next tool is the U-axis tool, U-axis connection ON operation is performed after the next tool is mounted to the spindle with the M6 command.

U-axis connection ON operation is performed during ATC cycle with the M6 command.

The following operations are performed in series for U-axis connection ON operation.

- (1) Positioning to HP16
- (2) Positioning to HP5
- (3) Spindle indexing to U-axis connection position
- (4) U-axis shifter advance, U-axis air blow

4. U-axis connection OFF operation

When the current tool is the U-axis tool, U-axis connection OFF operation is performed when the U-axis tool is removed from the spindle with the M6 command.

U-axis connection OFF operation is performed during ATC cycle with the M6 command.

The following operations are performed in series for U-axis connection OFF operation.

- (1) Positioning to HP15
- (2) Positioning to HP5
- (3) Spindle indexing to U-axis connection position
- (4) U-axis shifter retract, U-axis air blow

5. M Code Command

5-1. U-axis connection ON/OFF

U-axis connection ON/OFF operation is normally performed during ATC cycle with the M6 command. However, U-axis connection ON/OFF can be operated independently by using the M code commands described below.

Use the following M codes when regular M6 command cannot be used due to machine restoration or similar reason.

M code	Content	Axis travel Simultane- ous /after	Machine lock ON	Sequence restart
M315	U-axis connection OFF	After travel	Immediate answer No operation	Immediate answer No operation
M316	U-axis connection ON	After travel	Immediate answer No operation	Immediate answer No operation

The answer is returned when the operation with the M code above is completed.
The M codes above can be specified only when the current tool is the U-axis too
When the current tool is not the U-axis tool, the following alarm occurs.
"2727 ALARM-B Improper M code ***"
315: M315 command was issued with the spindle tool not being U-axis one.
316: M316 command was issued with the spindle tool not being U-axis one.

5-2. U-axis air blow ON/OFF

 $\label{eq:U-axis} \mbox{U-axis air blow ON/OFF can be specified independently by using the following M code commands.}$

M code	Content	Axis travel Simultane- ous /after	Machine lock ON	Sequence restart
M317	U−axis air blow OFF	After travel	Immediate answer No operation	Immediate answer No operation
M318	U-axis air blow ON	After travel	Immediate answer No operation	Immediate answer No operation

		i .		•	•
☐ Wit	th the M cod	des above, the answer is ret	curned immediate	ly after the command	d.
□ U-	axis air blow	is turned off with reset, ala	arm A occurrenc	e, and power save mo	ode ON.

6. Parameter

Set the spindle indexing position at U-axis connection at the following parameter.

Machi	ne user parameter	No. 18	ADDITIONAL AXIS
5	U-AXIS ORIENTATION	POSITION	
	Command	: SET, ADD	
	Initial value : 0		
	Minimum value	: 0	
	Maximum value	: 360000	
	Setting unit : (0.001 degree	

For the parameter above, set the position with the spindle indexing position at 0 degree for ATC.

7	Special	operation	at	restart
Ι.	Special	operation	aι	restart

If the U-axis is stopped halfway during U-axis shifter operation due to alarm A occurrence or power OFF operation may not be restored by regular M315/M316 commands because required conditions such as
travel to HP5 and spindle indexing to the U-axis connection position are not met.
In such a case, specify the M315 command and display the ATC operation screen by pressing the "MACHINE OPERATION" key on the machine panel and pressing the ATC button on the right of the screen. By then pressing [F2] (INT LOCK RELEASE), operation is completed by performing only U-axis shifter retract and air blow discharge without checking the HP5 movement and spindle indexing to the U-axis connection position.
When U-axis connection operation is required while stopping the operation during ATC cycle, specify $M315/M316$ to perform U-axis connection ON/OFF operation.

8. Interlock

8-1. Spindle Rotation Interlock

In this interlock function, spindle rotation is enabled under the following conditions.

☐ When the current tool is not the U-axis tool, the U-axis shifter is retracted.
☐ Positioning to HP5 is complete with U-axis connection OFF.
☐ U-axis connection ON

When the above conditions are not met, a machine diagnosis message is displayed if a spindle rotation command is specified.

For the detail of machine diagnosis message, refer to 9. Machine Diagnosis Message List.

If the above conditions are not met during spindle rotation, the following alarm occurs.

"1707 ALARM-A Spindle rotation interlock *****"

****: alarm code (hexadecimal of diagnosis number)

8-2. U-axis Interlock

U-axis operation is enabled only when U-axis connection is ON.

When the condition is not met, a machine diagnosis message appears.

For the detail of machine diagnosis message, refer to 9. Machine Diagnosis Message List.

If this interlock remains for 5 seconds or more in the automatic operation mode (single block OFF), the following alarm occurs.

"1703 ALARM-A Axis interlock *****"

*****: alarm code (hexadecimal of diagnosis number)

9. Machine Diagnosis Message List

The diagnosis messages displayed in this specification are listed below.

Diagnosis no.	Diagnosis message
15342	U-axis shifter ADVANCE LS is not ON.
15343	U-axis shifter RETRACT LS is not OFF.
15344	U-axis EXIST LS is not ON.
15346	U-axis shifter ADVANCE or RETRACT SOL is not ON
15435	U-axis shifter ADVANCE LS is not ON.
15436	U-axis shifter RETRACT LS is not OFF.
15437	U-axis EXIST LS is not ON.
15438	U-axis shifter RETRACT LS is not ON.
15439	U-axis shifter ADVANCE LS is not OFF.
15440	U-axis EXIST LS is not OFF.
15441	HP 5 is not completed.
15442	U-axis shifter ADVANCE or RETRACT SOL is not ON
15506	U-axis shifter RETRACT LS is not ON.
15507	U-axis shifter ADVANCE LS is not ON.
15508	U-axis EXIST LS is not OFF.
15509	U-axis EXIST LS is not ON.
15510	HP 5 is not completed.
15530	HP15 is not completed.
15531	HP16 is not completed.
16026	U-axis EXIST LS is not ON.
16027	U-axis shifter RETRACT LS is not ON.
16028	U-axis shifter ADVANCE LS is not OFF.
16029	U-axis EXIST LS is not OFF.

10. ATC Logic Data

10-1. Matrix Magazine

MA-1	2500H			1					2		П			3					4					5					6		\Box
	matrix magazine) logic table MAP029A	80 4	0 20	10 0	04 (02 01	80 4	0 20	10 08	04 02	01 8	0 40	20 1	0 08	040	2 01	80 40	20 1		04 02	01 8	30 40	20 1	0 08	04 0:	2 01	80 40	20 1	0 08	04 02 0	.1
Operation sequence No.	Input logic 1/8	Tool	Tool pot unclamp confirmation ON	Tool pot clamp confirmation ON	Change arm tool	I ool pot retraction confirmation ON Tool pot advance confirmation ON	Tool pot tool present				s spindle indexing I	ATC shutter open confirmation normal	close confirmation	ATC shutte	ATC shutter open confi	preser		Movement to pot vertical retract position complete		Movement to pot locking horizontal position complete Vertical movement to tool change position complete	al movement to tool change pos	Spindle tool present clamp confirmation UFF No spindle tool interlock	Not in manual tool chage cycle		du c	clamp outside	APC start positon	MG manual operation command storing	MG manual operation comm	Change arm B gripper tool present Tool breskage inside MG detection in standy position confrastion	Tool breakage inside Mi detection in measurement position confrastion Operation sequence No.
	Writing next tool		ΟĺΟ			<u>o</u>				<u> </u>			₩.	0	4								00	2				4-4		0	1
2	Operation selection				0	0	C				1-12))	++-		1	-		Н,	5		╁┼		0			-		+	0	0	2
	Next tool locking position (horizontal, vertical) Pot advance			┢╌┼╴	0	0	٦	╬┪		 		<u>ي</u> ا -	+		1-10	4		1-15	4	0	╁╌┼		0	+	┢┉┼╌	+		++		0	4
	Tool lock		کار	0	ŏ	0	0	+-+				5	 		 	+-+		† †		-	†-†		0		 			 	+	0	5
	Next tool unlocking position (horizontal)		5	O	O	Ō						5				0			00		П		0					Ħ		Ö	6
7	Tool change standby ready position (vertical))	0	0	0		П	Ţ	П		٥	\prod		\prod			0				T	0			П				0	7
	Tool change standby ready position (horizontal)		2	0	Õ	0	$\sqcup \bot$	44	_	 		일	 		╁┈╁┈	44		\vdash	44		ō	_	000	_	-	44		1-1	-	0	8
	Tool change standby complete position (horizontal, vertical)))	0	0	0	┝╌┝	4-4		├├		일	+		┿	+-		╁┈┼	-	L	0		0		├ ─├-			+-+		<u> </u>	9
	Pot retract Transfer unit on MC side		4	0		0	H	+	+	+))	++	+	++	+	+	+	H	+	\vdash	+	0	+	+	+	+	+	+	0	10 11
	Change arm tool unlock	0		0 0		Ö		┿┿		 		ر اد	+-+	+	+-+-	╅┪		 	+		+-+		0	+	 			++	+	0	12
	AT-axis transfer unit tool grip position (90 mm) (90 mm)	Ö	1	0 0		Õ		11	_	t-t-		5	17	1	T-T-	\top	_	T			11	_	0	1				11	1	Ö	13
14	Change arm tool lock	0		0	0	0						D											0							0	14
	Transport unit tool unlock	0	0		0)			Ш		_	Ш			Ш		0					ш	\perp	0	15
	TI-axis in standby position (170 mm) (0 mm)	0	Ō	 	Q			4-4				기	4-4		4-4-	-					1		O.		 			1-1	-	0	16
	AT-axis in standby position (90 mm) (0 mm)	0	0			0				 		၁ ၁ ဂ		0				-			0		0	_						0	17
	Waiting for MC cycle end Spindle indexed/U-axis connection OFF	0	0			0	+	+	+	\vdash	0	0 0		0		+	+	H	+			-10	00		\vdash	+	0	₩	+	0	18 19
	HP1 (simultaneous movement 1)	0	ő	 		õ	- -	┉┼┈╌┼		 	٢	12	⁴	-19	+			 			 		0	4	╂┈┼╌		0	+-+		0	20
	ATC shutter open (simultaneous movement 1)	o	lŏ		o				+		tt	+	0	+	0	11	+	Ħ	+	C	0		0	2	H	+	Ö	Ħ		ō	21
	TI-axis spindle tool grip position (220 mm) (220 mm)	Ö	ŏ		Õ	Ö		*****		 	†	_	† T	_	Ŏ						† <u>*</u> †		O					†		Ö	22
23	TS-axis A grip spindle tool grip position (270-degree rotation)	Ō	0		0	0									0								0	0						Ō	23
24	Change arm tool unlock	0	0	C		0					П	Ι			0						П		0					Ш		0	24
	AT-axis spindle tool grip position (810 mm) (-810 mm)	0	0	(0					Ш		Ш		0			П			П		0		C			Ш		0	25
	Change arm tool lock/Cylinder unclamp outside spindle	0	O		0			4-4		_ _	1-1-		44	_		44					11		0 0 0		0	0		11	44		26
	Spindle tool unclamp	Ŏ.	Ö		Ŏ										Ŏ							<u> </u>	0		<u>o</u>	0				<u> </u>	27
	TI-axis spindle tool extraction position (170 mm) (390 mm)	0	0		Õ		┝┉┼╌				┿		┿┿		0			┢┉┾╴				0 0	0	- 0	0	0		┿┿		<u> </u>	28
	TS-axis B grip spindle tool grip position (180-degree rotation) TI-axis spindle tool grip position (170 mm) (220 mm)	0	0	┢┿	0	<u>~</u>	┝┼	┿┿	+	- -	++	+-	╁┈┼╴		0	+-+		╆┿	+-	├┼			0	$+^{\circ}$	0	0		++		0	29 30
	Spindle tool clamp	0	10	H	0		Ħ	$\forall \exists$	\top	H	Ħ	+	T	+	0	+	+	H	Ħ	H	Ħ	┪	0	\top	0	l C	+	+	+	0	31
	Change arm tool unlock/Cylinder clamp outside spindle	ŏ.	ŏ			ŏ.	m	+-+	_	 	tt	+-	† †	+	Ö	††		T^{T}	+	-	17		ŏ	+	Č	اح		†	+	Ö	32
	AT-axis in standby position (810 mm) (0 mm)	Ö	Ō	C		0								Τ	0								0							Ŏ	33
34	Change arm tool lock/AT-axis (240 mm (-570 mm)) Simultaneous movement 2 affter movement	0	0		0	0		П	\perp		\prod			L	0	П		Ш				\perp	0	\perp						0	34
	TS-axis A grip transport unit tool grip position (90-degree rotation)/AT-axis simultaneous movement 2	0	0	Щ	0		Щ	Щ		Щ	Щ	Ľ	щ	Ľ	0	Щ		Ц	Щ	Ц"	Ц	1	0	O	Щ	Щ		Щ	Щ	0	35
	TI-axis in standby position (220 mm) (0 mm)	0	0	Ш.	0	0	\vdash	44	_	\vdash	+	_	++	+	0	+		1	_		₩	_	000	+		-	_	++		0	36
	ATC shutter close/U-axis connection ON	0	0	 -	0	<u> </u>	-	+			+	-	+	-	+	+		-	-		┿			-	-	-		+	-	0	37 38
	AT-axis transport unit tool grip position (90 mm)/U-axis connection ON TI-axis transport unit tool grip position (170 mm) (-170 mm)	0	10	\vdash	0	0	$\vdash \vdash$	+-+	+	 	++	+-	+-+	+	+-+-	+-		++	+-	├─┼┈	╁┼	+-	0	+-	++	+-		++		0	38
	Transport unit tool lock	ŏ	٦	0		õ	一十	+-+	+	- -	††	+-	 		 	+-+		 	+	 	††	+	0	+	t	+		††		0	40
	Change arm tool unlock	Ö	$^{+}$	Ö	·	0	H	\forall	\top		Ħ	$^{+}$	TT	$^{+}$	Ħ	Ħ	\top	Ħ	T	\vdash	Ħ	$^{+}$	Ö	\top	H	Ħ	\dashv	11	\forall	ō	41
	AT-axis in standby position (90 mm) (0 mm)	Ŏ.		O C		Õ					TT	1											0							Ö	42
43	Change arm tool lock	Ō	T	0	0	0		П		Ш	\prod			T				П			П	T	0	T	П					0	43
44	Transport unit on MG side)	0		0	LL	11			Į [1 L		11	47		L		ļ	ļГ		0		L			 	4.]	0	44
	TS-axis B grip transport unit tool grip position (0-degree rotation)	_		0		0	Ш	Ш	4	$\sqcup \!\!\! \perp$	\sqcup	_	$\bot\bot$	_	ш	Ш	_	Н	\perp	\perp	Н	4	0	0	ш	Ш	_	$\perp \downarrow$	$\perp \! \! \! \! \! \perp$	0	45
	Pot advance		2	0	0	0	\vdash	44	+	\vdash	+	4	++	+	1	+		Ļ	4		₩	4	0	+	1	4	_	++	-	0	46
	Return tool unlocking ready position (vertical)		2	0	힞	0	-	+-+		├├-	+-+	-	+	-	+	+-		0	+~		┿		0	-	-	-		+	-		47
	Return tool unlocking ready position (horizontal) Return tool unlocked position (vertical)))	0	0	0	\vdash	+-+		- -	++	+-	+-+	+	+-+-			0	0		╁┼		0		-	+		+-+		0	48 49
	Return tool unlocked position (vertical) Return tool locking position (horizontall)		5	ă	ŏ	-10		┿┿		 	++	+-	+-+	+	1 /	4		 	517		†-†		0	+	 	+		+-+			50
- 00			-1	\sim	101		\sim									-			~				\sim			_			-	\sim	

MA-1	2500H	П		1	7						8						9					1	0					1	1			I			12			П
	matrix magazine) logic table MAP029A	80	40	20 1	80 0	04 0	2 01	80	40 2	20 10	80 0	04 0:	2 01	80 4	40 2	0 10	08	04 0	2 01	80	40 2	0 10	08	04 0	2 01	80	40 2	0 10	08	04	02 0	1 80	40 2	20 10	08	04 0	2 01	
Operation sequence No.	Input logic 2/8	aţic	unclamp	Spindle tool clamp LS OFF	7	Spindle tool present clamp confirmation ON	Spindle stop Spindle indexing complete		Next/return tool present	No next/return tool Normal cycle (change arm rotation present)	eration return	No next tool ready operation input	Active tool writing complete	TS-axis 90 degrees	TS-axis 180 degrees	O TS-axis 0 degrees	No recovery NG tool	Recovery NG tool present	Tool change position (HP1)	mplete	Operation door lock confirmation ON	AT-axis Muside AT-axis spindle side	AT-axis in standby position	Change arm rotation complete	Step advance interlock	TS-axis 135 degrees		Not in tool breakage detection cycle	t tool grip	spindle tool extraction	spindle too	returned	ol in next tool ready ST	U-axis connection compleate	action confirma	U-axis shifter retraction confirmation LS OFF	U-axis present Lo Orr TS-axis rotating position	Operation sequence No.
	Writing next tool					0																	0						0									1
	Operation selection	-		-		-		-	0		-					0				-			00		+-	ļ			0		-				-	-	-	2
	Next tool locking position (horizontal, vertical) Pot advance	╂┈┤	-		+			╁┈┤	┝┉┼	-	+	-	┿┥	-+		0		┝╌┼		╁╌┤	-+		0	 -		╢			0			+	┿	-	+	-+		3
	Pot advance Tool lock	+	\dashv	+	+-	+	+	H	+	+	+	+	+	+	+	8		+	+	+	+	+	0	-	+	H	+	+	6		+	+-	+	+	+	+	-	- 4
	Next tool unlocking position (horizontal)	Ħ	T	†	T	Ħ	T		Ħ	T	Ħ		Ħ	7	\top	ŏ		Ħ	T	Ħ	7	T	Ö		T	П	+		o		+	T	П	T	T	T	+	6
7	Tool change standby ready position (vertical)															0)						0						O			1				Τ		7
8	Tool change standby ready position (horizontal)	\Box				П	T	П		Ţ	П	\Box	П		7	0		П	Ţ	П		T	0	Д		П	\perp	\bot	0	П	\perp	\perp	П	1	П	\perp		8
	Tool change standby complete position (horizontal, vertical)	1	_	-	4	-	4	ᆈ	 	4.	4-4		44			Ō		-	-	1-1	_		0	<u> </u>	4	$\downarrow \downarrow$	_	-	0		_	4	1-1	_	4		4	9
	Pot retract	+	\dashv	+	+	H	+	Н	\vdash	+	Н	H	+	4	+	0		H	+	Н	4	+	0	H	+	H	+	+	0		+	╁	Н	+	+	+	₽	10
	Transfer unit on MC side Change arm tool unlock	+		-	-	╁	-		-	-	+	-	-			0		-	-	+		-	00		+	+			0				┿	-	+			11 12
	Change arm tool unlock AT-axis transfer unit tool grip position (90 mm) (90 mm)	1		-	+	\vdash		\vdash	-		+-	-	+-			0		╁╌╁		1-1			10		+-	╁┈┤	-+	+-	0	┰			++	-	+	-+	+-	12
	Change arm tool lock	1			+	 		-			+		+			Ö			+	+		Š	+	-	+	╆┈┤			lõ				† 	+	+			14
	Transport unit tool unlock			_							_		1			Ö				1		ol -	1		_	t			lõ		_		17	_	·			15
	TI-axis in standby position (170 mm) (0 mm)															0)				(O C							Ē		C)						16
	AT-axis in standby position (90 mm) (0 mm)													T		0							Õ			Γ			T		Č)				Τ		17
	Waiting for MC cycle end		0	C		0	\perp	Ш	Щ	C			Ш	_		0			ᆚ	Ш			0		╙					Ш	C)	Ш		Ш		Ш	18
	Spindle indexed/U-axis connection OFF	4	Ō	_ C			O C	1	_	4	4		44			O			4	1		_	Ō		4	 			 	-	_ 9	2	4-4	4	0	00		19
	HP1 (simultaneous movement 1)	1	0			0	_	Н	Н	+	+	\perp	+	_	+	0			+	Н	_	+	0	_	+	Н	_	-	-	Н	- 10	2	Н	+	\vdash	\dashv	+4	20
	ATC shutter open (simultaneous movement 1)		0	_		0							+			<u> </u>	•		C	4-1	0		0						+	-	7	2	┿					21
	TI-axis spindle tool grip position (220 mm) (220 mm) TS-axis A grip spindle tool grip position (270-degree rotation)		0	_ C		0														1-			0		+	ł					<u> </u>		+-+			-+		22 23
	Change arm tool unlock	 	0			ŏ		+			+		+			5	+		+	╁╌			ő			┼┈┤			+		<u> </u>		++		+			24
	AT-axis spindle tool grip position (810 mm) (-810 mm)		ŏ			õ		1					-††			5	+	 -		1-1		C				t			 		ŏ		 -	_	+			25
	Change arm tool lock/Cylinder unclamp outside spindle		Ö	l		Ĭ		П		T	Ħ		Ħ		C		Т		T	Ħ		C			T						o	T		T	П	T	\top	26
27	Spindle tool unclamp			o Ì	О										Ċ		Γ					Ĉ			1				I		Ŏ.	1				Τ		27
28	TI-axis spindle tool extraction position (170 mm) (390 mm)			0	O		I			Ι				1		5			I		\Box	C		\Box			I	I	I	0	Ι	I	П	\perp		Ι		28
	TS-axis B grip spindle tool grip position (180-degree rotation)	1		0	0	L	ļ.,	Щ	L	1	\perp		0		Q	<u> </u>	ļ	L [1		[С			1			1	1	0		ļ	$\perp I$	1				29
	TI-axis spindle tool grip position (170 mm) (220 mm)	\perp		0	0	Н	_	Ш	Ц	4	Н	\perp	\sqcup		0	\perp	┺	Н	1	Н	4	С			1	Ш	_	1	_	_	0	1	Н	4	Н	4	\perp	30
	Spindle tool clamp	1-	0	_				╀┩	 		4-4		4-4		<u>o</u>		╁	-		1-1		Ç	- [↓		+-	+		이		+-+		4		4	31
	Change arm tool unlock/Cylinder clamp outside spindle	+	0	C		0 0		+		-	+	-	+		0	+	+	┿		┿┥		С	4-	-	+	₩		0	4-		<u> </u>		┿		+		0	32
	AT-axis in standby position (810 mm) (0 mm) Change arm tool lock/AT-axis (240 mm (-570 mm)) Simultaneous movement 2 affter movement	+	0	-		0		╁┈┤		-+-	+		┿┥		O O	+	+	┉	+	╁╌┤			+	 - -		╁┈┤			+		0	+	┿		+		12	33 34
	Change arm tool look /A I -axis (240 mm (-b/I/0 mm)) Simultaneous movement 2 after movement TS-axis A grip transport unit tool grip position (90-degree rotation)/AT-axis simultaneous movement 2	+	8	-		õ		+	 	-+-	+	-	+-+	ď	¥ -	+-	+	╁╌┼	-†	1-1			ő	-		t⊸		+-	+		8	+	++		+		-	35
	TI-axis in standby position (220 mm) (0 mm)	Ħ	0			0	\top	H	H	+	Ħ	\vdash	Ħ	Ö	+	+	т	H	+	Ħ	\dashv	†	0	\forall	+	H	\dashv	+	т	Ħ			Ħ	+	Н	\dashv	Ħ	36
	ATC shutter close/U-axis connection ON		ŏ	10		ŏ	+	\Box	\vdash	\top		_		ŏ	_	+	T	T	+	T	_	+	ŏ	_	1	T	_	_	T-	T			TŤ	1		_	-	37
38	AT-axis transport unit tool grip position (90 mm)/U-axis connection ON			1													Γ		Ι			0	T		I				Ι		Č		\prod	C		I		38
39	TI-axis transport unit tool grip position (170 mm) (-170 mm)		\Box	\Box			T	П		T			\prod	I	I	I	\Box		Τ	П					I		T		0	П	Τ	T	\prod		\square	Τ		39
	Transport unit tool lock	\perp	Ц	1	\perp	Щ	1	Ш	Ц	Į.	Щ	Щ	Щ	_[1	1	Ľ	Ц	L.	\Box		0	L	Щ	1	Ш	_["	1			1	Į.	Щ	Ľ	\perp	Ţ	تــــــــــــــــــــــــــــــــــــــ	40
	Change arm tool unlock	1	_	4	4	- -	4	H	-	4	4-1	<u> </u>	44	_	4	+	4-	-	4	1-1			4_	<u> </u>	4	\sqcup		-	Ō			4	1	4	4		\bot	41
	AT-axis in standby position (90 mm) (0 mm)	+	-	-		-	-	-	 	-	4		4-4			+	-	-	-	+			Õ			₩.		-	0				+-+		4		_	42
	Change arm tool lock	+		-	+	⊢	-	\vdash		-	+	-	+-	-+		+-	+	₩	-	+	-+	+	00	-	+-	₩	-	-	0		-		┿		+	-+	-	43 44
	Transport unit on MG side TS-axis B grip transport unit tool grip position (0-degree rotation)	+			+	╁╌┼╴		╁┈┤	┝┉┼		+	┝╼╈┈	╌┼┈┤			0		╫┉╂╸		╂╌╢	+		000	├┼-		╁┈┤			0				┿		+			44 45
	Pot advance		\dashv	+	+	H	+	H	\vdash	+	H	+	H	+	+	0	_	H	+	H	+	+	0	+	+	Н	+	+	0		+	+	$^{+}$	+	+	+	+	46
	Return tool unlocking ready position (vertical)	ť	-	+	+-	\vdash	+-	\vdash	\vdash	+	+	-	+-	_	-	16		\vdash	+	+	-	+	0		+-	\vdash	-	+	6		+	+	+	+	+	+	-	47
	Return tool unlocking ready position (vertical)	•				-			-							0		-		+			n			†			ő				+-+					48
	Return tool unlocked position (vertical)	1		_			1						11	_		ő		m	1	1		1	00		1	m	_	1	ŏ	1	_	1	11			1	-	49
	Return tool locking position (horizontall)	T	_	_	·			Т	[T		1		77			Ō		l	T	П			Õ		1	T			lõ			T	T		7~~		7	50

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ATC (matrix magazine) logic table MAP029A	80 40 20 10 08 04 02 01 80 40 20 10 08 04 02 01 80 40 20 10 08 04 02 01 80 40 20 10 08 04 02 01 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 20 10 80 40 2	20 10 08 04 02 01
Input logic 3/8	Tool pot spindle side confirmation Tool pot unclamp confirmation Tool pot unclamp confirmation Tool pot clamp confirmation Change arm tool unclock confirmation Tool pot takentoe confirmation Tool pot takentoe confirmation ATO shutter copen confirmation Tool present in transfer pot Novement to pot vertical position Movement to pot vertical cells on collimate Novement to pot tool index collimate Movement to pot looking profession Novement to coll change collimation ATO shutter collimation ATO shutter collimation Childer unclamp outside spindle Childer unclamp outside spindle Childer clamp outside spindle	ΣΣΙΟΙΡΙ
51 Tool unlock		0 5
52 Pot retract		O 5:
53 Tool transfer complete		O 5:
54 TI-axis transport unit tool grip position/U-axis connection ON		O 54
55 Transport unit on MG side		O 5
56 TS-axis B grip transport unit tool grip position (0-degree rotation)		0 5
57 Tool transfer complete		O 5
58 Operation selection		O 5
59 Next tool ready return tool locking position (horizontal, vertical)		
60 Pot advance 61 Tool lock		O 6
		0 6
62 Next tool ready return tool unlocking position (horizontal) 63 Return tool unlocking ready position (vertical)		0 6
64 Return tool unlocking ready position (vertical)		
65 Return tool unlocked position (vertical)		0 6
66 Return tool locking position (horizontal)		0 6
67 Tool unlock		0 6
68 Pot retract		0 6
69 Tool transfer complete		O 69
70 Operation selection		0 70
71 Next tool, input tool locking position (horizontal, vertical)		0 7
72 Pot advance		0 7:
73 Tool lock		0 7;
74 Next tool, input tool unlocking position (horizontal)		0 7
75 Next tool ready input tool unlocking ready position (vertical)		O 7
76 Next tool ready input tool unlocking ready position (horizontal)		0 7
77 Next tool ready input tool unlocked position (vertical)		0 7
78 Next tool ready input tool locking position (horizontal)		0 7
79 Tool unlock		0 79
80 Pot retract		0 80
81 Tool transfer complete 82 Operation selection		0 0 8
82 Operation selection 83 Calling tool locking position (horizontal, vertical)		
84 Pot advance		
85 Tool lock		
86 Calling tool unlocking position (horizontal)		0 8
87 MG manual change unlocking ready position (vertical)		0 8
88 MG manual change unlocking ready position (horizontal)		
89 MG manual change unlocked position (vertical)		O 89
90 MG manual change locking position (horizontal)		O 90
91 Tool unlock		0 9
92 Pot retract		0 9:
93 Tool transfer complete		0 9:
94 Operation selection		
95 MG manual change locking position (horizontal, vertical)		O 9:
96 Pot advance		O 91
97 Tool lock		O 9
98 MG manual change unlocking position (horizontal)		O 98
99 Storing tool unlocking ready position (vertical)		O 9!
100 Storing tool unlocking ready position (horizontal)		O 100

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ATC	matrix magazine) logic table MAP029A	80	40	20 1	80 0	04 (0 20	1 80	40	20 1	0 08	04	02 0	1 80	40	20 1	10 0	8 04	102	01 8	0 40	20	10 0	8 04	02	01 8	0 40	20	10 0	0 80	4 02	01	80 4	10 20	0 10	08 0	04 02	2 01	
Operation sequence No.	Input logic 4/8	tool deterrminatio	Spindle tool unclamp LS OFF	Spindle tool clamp LS OFF	Spindle tool unclamp LS ON	Spindle tool present clamp confirmation ON	Spindle indexing complete	M64 Next tool storage cycle	Next/return tool present		Normal cycle (change arm rotation present) No next tool ready operation return	No next tool ready operation input	Next tool ready operation	TS-axis 90 degrees	TS-axis 180 degrees	TS-axis 270 degrees	TS-axis 0 degrees	Recovery NG tool present		Tool change position (HPI)		AT-axis MG side	AT-axis spinde side	Change arm rotation complete	Step reverse interlock	Step advance interlock	Tool breakage detection cycle complete		etection	transport unit tool grip	TI-axis spiritle tool extraction TI-axis spiritle tool grip position	tandby position	Return tool to be returned to nezt tool ready ST	next tool read	ction compleate	retraction	2	TS-axis rotating position	Operation sequence No.
	Tool unlock																OL.))						0									51
	Pot retract	 		-			4	<u>.</u>	1			1			↓_		0		4		-	4		2		_		 		0	-	1		_		-	-	44	52
	Tool transfer complete	╁┈┤	-+		+	├┼		+	+			╁╌┼		+	-		0		┿┥			+		2	┿	0	-+	1-))		┼	-		_			+-	53
	TI-axis transport unit tool grip position/U-axis connection ON Transport unit on MG side	-	+	+	+	\vdash	+	+	+	\dashv	+	+		С	Ή	-+	+	+-	+	-	+	+	-15	0	₩	+	+-	+			+	+-	-	+	10	\vdash	-	+-	54 55
	Transport unit on MG side TS-axis B grip transport unit tool grip position (0-degree rotation)	H	\dashv	+	+	H	+	+	H	\dashv	+	H	+	+	+	-	0	+	Н	+	+	H		2	H	+	+	Н			+	+	H	+	+	\vdash	+	\forall	56
	Tool transfer complete	****			••••••							****					ŏl-					•		5	-	o				Š		*****						+	57
	Operation selection	1	_	_		17	_		1	_		† †	0	_	1		_		1		_	1		-	o	<u> </u>		1		Ť-	+			_	1		_		58
	Next tool ready return tool locking position (horizontal, vertical)	1		_			-	1	1			177		T	1		_		111		1	1		1	TŤ	_		T		7	_	1		_	1				59
	Pot advance																											1											60
	Tool lock																																					П	61
	Next tool ready return tool unlocking position (horizontal)	1		_								1										1			Ш	_		1		4.								11	62
	Return tool unlocking ready position (vertical)		_	4			_	1	1			11			ļ				4		4	1	_	4		_		<u></u>	_	4		4			4			44	63
	Return tool unlocking ready position (horizontal)	 						4	4		_	44		4	ļ				4	_	4	4		4	11	_		ļ	-	4.	-	4				-			64
	Return tool unlocked position (vertical)		-	+	-	Н	+	╀	\vdash	-	+	Н	+	+	╀	+	+	+	Н	+	+	Н	+	╆	Н	+	+	H	\vdash	+	+	Н	+	+	+	+	+	+	65
	Return tool locking position (horizontal) Tool unlock	-		-		-			+			┿┉┼			+							+			₩				-	-								-	66 67
	Pot retract					-	-		+			+-+		-	+				+			+			1			+	-	-	+	+				-	-	+	68
	Tool transfer complete	tt				 -			+			†=†			+	-			1		+	+			tt	-		+	-	+		+						+	69
	Operation selection	1	_	_	*****		_		1	_		177	0	┺	†				1		_	1	_	-	177	_		1		7		1			1				70
	Next tool, input tool locking position (horizontal, vertical)																																					П	71
72	Pot advance											П		T	Π										П	Ι		Γ		1					Τ			\square	72
	Tool lock		_									11			1				1		_	Ш		1	Ш					_									73
	Next tool, input tool unlocking position (horizontal)	1							1			11		4					4		4	1		_	Ш	_		1		4		1			1				74
	Next tool ready input tool unlocking ready position (vertical)		_	4	1	Н	_	1	\perp	_	_	Н		+	_		4	+	\perp	_	+	\perp	_	1	Ш	4	+		Н	4	4	Ш		_	\perp	\perp	_	ш	75
	Next tool ready input tool unlocking ready position (horizontal)	-		-		-			-			-			-	-			-						├ ─┼	-		-	-	-		-							76
77	Next tool ready input tool unlocked position (vertical)								-			╁╌┼			+				-		-	-			-						-	-					-		77 78
	Next tool ready input tool locking position (horizontal) Tool unlock	├ ──┼				-			+			┿┯┿			-				+			+			╫┉┼			+	-			+							78 79
	Pot retract	╂┈┤	-+	-+-	+	 - 		+-	+			┿┿		+	+	┝┯┼			┿┪			+		+	┼╌┼	-+	-+	+	-	+		┿┉	-		+	-+		+-+	80
	Tool transfer complete		\dashv	+	\dagger	H	+	+	H	\dashv	T	Ħ	Ħ	†	t	\vdash	$^{+}$	$^{+}$	Н	+	+	П	+	+	Н	0	+	П	\vdash	$^{+}$	+	H	H	$^{+}$	Ħ	\vdash	+	\forall	81
	Operation selection	1	-	_		1 1	_	-	1	7		17			†	-			11					+	17	_		1	-	+		1			†	1		17	82
	Calling tool locking position (horizontal, vertical)			I				Ι			Ι			I	Π		Τ	I			Ι			Ι						I	I			Τ	Π		T		83
84	Pot advance			Ι	I			Γ	П		Γ	П		I			Ι			I	1		T	T	П	\perp	I	\Box		T	I			Π		\Box	Γ		84
	Tool lock	Щ	[1	Щ			Щ	_[Ľ	Ш	Щ	Щ.	Ľ	Щ		1	Ш		Ц.	Щ	_[Ľ	Ц		<u> </u>	Щ	Щ	Д"		Ш	Щ		Ľ	Ц		Щ	85
	Calling tool unlocking position (horizontal)		_	4		Щ	_	1	\perp	ļ	_	Ш		\perp	_		_	_	\perp		_	1	4	\perp	Ш	_			Щ	4	_			_	\perp	\sqcup		\perp	86
87	MG manual change unlocking ready position (vertical)	-	-	-		₩	_		+			+		-	+				+		-	+		-		-		+	-	-	-	+		-	-	-		+	87
	MG manual change unlocking ready position (horizontal)	├				┝╌┼		+	+			┿┿			┿	├ ─-├			┿┥			┿┥			┿			+	├┼			┿	├ ── ├		-	┉┼		4	88
89	MG manual change unlocked position (vertical) MG manual change locking position (horizontal)	╂┉┤	-		+	┝╌┼		+-	╬			╁╌┼	₩-		╁	┉┼			┿┥			┿┥		+	┉┤			╂┉┤	┉	+		┿┉	├┼-		+	┝┯┼		┿┥	89 90
	Tool unlock	H	\dashv	+	+	H	+	╫	Н	+	+	H	+	+	+	+	+	╫	+	+	+	Н	+	+	H	+	+	+	\vdash	+	+	+	+	+	+	\vdash	+	\forall	91
	Pot retract	t≕		-	+	 		+	+			+		+	†	-			+			+		+	++			1-	-	-		+			+	-		+	92
	Tool transfer complete	1			•••••	-	+		+	-+		†=†			†	-	17	5	1			+			1	ö		1	-	+		+				-		+	93
	Operation selection	1	7	_		\Box	7	T	\Box	7	1	\Box	<u> </u>	1	1	\top	7	-	17	_	1		_	1	o	1	_	1		1	1	17		1	1		1	\top	94
	MG manual change locking position (horizontal, vertical)	1	7		†	17	7	1	1	_		177		1	1-		_	<u> </u>	777			1		┪~	T	7		1	_	7	1	1	m-t-	_	1	1	<u> </u>	177	95
	Pot advance													I					\Box																			\square	96
97	Tool lock		J	\perp		П	I	I		\Box	I	П	I	I		II	Ι		П	I	I		\perp	I.	П	I			\Box	I	I		I.	\perp	I	\Box	I	П	97
	MG manual change unlocking position (horizontal)			_[_	1	П	1	L	Щ	_Ţ	Ĺ	\Box	LI.	Į.	1	H	Ľ	1	\Box		1		[_	1	П	_[^	1		П	_[_	1	П	ЦĨ	_[_	T.	II	\perp	Ш	98
	Storing tool unlocking ready position (vertical)	1	_	4	4	\sqcup	_	1	1		_	$\downarrow \downarrow$		4	 	-	_	4	44		4	4-4	_	4	\sqcup	4	4	4	 	4		$\downarrow \downarrow$	<u> </u>		1		4	$\downarrow \downarrow$	99
100	Storing tool unlocking ready position (horizontal)	1			1	ıl			1	- 1	- 1	1 1		1	1	1 1	- 1		1 1		- 1	1			1	- 1	-1	1	1 1	- 1	- 1	1	1 1	- 1	1	1 1	- 1	1 1	100

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	(matrix magazine) logic table MAP029A	80	40	20 1	0 08	04	02 0	1 80	40	20 1	0 08	04 0	2 01	80	40 2	0 10	08	04 0	02 0	1 80	40 2	20 1	0 08	04 (2 01	80	40 2	0 10	08	04	02 0	11 80	0 40	20	10 0	8 04	02 01	1
Operation sequence No.	Input logic 5/8	Tool pot spindle side confirmation ON	Tool pot magazine	Tool pot unclamp confirmation ON	Change arm tool unlock con	0	Tool pot	Tool pot tool pres	No tool pot tool				U-axis spindle indexing position	anual interruption OFF	shutter open confirmation r	shutter close confirmat	shutt	oben	Tool prese	200		Movement to pot vertical retract position complete	Movement to pot unlocking horizontal	orizontal pos	Vertical movement to tool change position complete Horizontal movement to tool change position complete	o confir	No spindle tool interlock	APC pallet cleaning sequence OFF		unclamp	clamp outside spindle	APC start rositon	3	manual	MG manual operation command calling Not MG manual operation command	Change arm B gripper tool	Tool breakage inside MG detection in standby position confirmation Tool breakage inside MG detection in measurement position confirmation	Operation sequence No.
	Storing tool unlocked position (vertical)	<u> </u>	0			00			μŢ		<u> </u>	\prod	\perp	_[<u>_</u>	<u> </u>	L.J.	C)	L_[0	ĻŢ	<u> </u>	니		0	1	ĻΙ	[_	1		L.I		4]	0	101
	Storing tool locking position (horizontal)	4	0		2	Õ						 -					ļ		0	-			2	0		1		2	 	 			4				O.	102
	Tool unlock	-	ō			Õ) C				 -					┿	-						-		-	- 19))	┿┈	₩			-	-			<u>o</u>	103
104	Pot retract Tool transfer complete	-	0			0	$\frac{\circ}{\circ}$	-	0	-	+-	-			-	-	+		-	-	-	-	+		+))	+	₩		-	-	\vdash			0	104
	Tool change standby complete position (horizontal, vertical)	+	0		+	0	0	+	Г	+	+	\vdash		0	+	+	+	+	+	+	H	+	+	H	00	Н	-	_	+	H	+	+		H	+		0	106
	Transport unit on MC side	0		Ö		0	Õ		1	_	+	 		ö		+	1-		_			-	_	1		1))	†	111	_	+	-		_		Ö	107
	TI-axis in standby position (170 mm) (0 mm)	To		Õ		Ŏ	Õ		1	_	1			Ö		_	1	-	_	1		_	1			1	Ċ	Ď.	†	1		1					Õ	108
	TI-axis transport unit tool grip position (170 mm) (-170 mm)	O		Ō		Õ										I	1									Π	() [T					Õ	109
	Transport unit on MG side		0			0			0)		Ш				П			0	110
111		4	0	0	4	0	0	4	0	_	1	ш		_	4	С	0	_	_		_	_	1	Н	_		()	_	Н	_	_		Н	_	_	0	111
112	TS-axis B grip transport unit tool grip position (0-degree rotation) (for SEQ22 return)			-		 			+			 					╁	-			-			-		-			 	₩			-				Q.	112
113	TS-axis A grip spindle tool grip position (270-degree rotation) (for SEQ28 return)			-		╁╌╁			╂┉┼			╫╌╫┈		+			╁							₩		 			┿┈	┿				┝╌┼			0	113
115	TS-axis B grip spindle tool grip position (180-degree rotation) (for SEQ34 return) TS-axis A grip transport unit tool grip position (90-degree rotation) (for SEQ44 return)	-	-	+		-		_	+	-	+	-	-		_	-	+		-	-	-	-	-	-	-		-		+-	\vdash	-	-	-	\vdash			0	115
116		t	Н	\dashv	+	H	+	+	Ħ	$^{+}$	T	H	+	_	+	+	t	\pm	+	+	\dashv	+	+	H	+	H	+	+	+	H	$^{+}$	+	T	H	+		0	116
	TI-axis transport unit tool grip position (170 mm) (-170 mm) (for SEQ107 return)		_	_		tt			1	_	1	1-1-				+	1	_	_	_		_	_		+	1	_	-	_	1	_	+	-				Õ	117
118		1		7		177			1	_	1					_	1	-	_	1		_	1			1		_	†	1		1					Õ	118
119	AT-axis instandby position (90 mm) (0 mm)/TI-axis in standby position (170 mm) (0 mm) (for SEQ37 return)																																				0	119
120		0		ol.	C		Q											0										2									0	120
121	Change arm tool lock/AT-axis (240 mm (-570 mm)) Simultaneous movement 3 affter movement	-0		O		O			11	-	4	 						O	-	4			4	1		!		2	 	1		4	4				Q	121
122	TS-axis A grip tool breakage inside MG measurement position (135-degree rotation)/AT-axis simultaneous movement 3	0		<u>o</u>	_	0		+	Н	_	+	Н	+	_	4	+		0	+	_	_	_	+	Н	+	Н)	0	Н	_	+	_	Н	+		0	122
	TI-axis in standby position (220 mm) (0 mm)	10		0		0	Ω.		╁┈┼			┼┼-					┿	0						-		-		2	┿┈	┿			-	┝╌┼			0	123
125	ATC shutter close/U-axis connection ON AT-axis transport unit tool grip position (170 mm) (-170 mm)/U-axis connection ON	10		ŏ			o O		╁┈┼			┉					+							-				2		┿				-			0	125
	Measurement unit preparation (down)	7		ŏ			Õ		1		+	 					+							1	+	-))	+	1			-				Ö	
	Tool breakage detection cycle	Ő		ŏ		ŏ			†**	_	+	tt-				+	1	_		1		_	+		_	1	ď	5	†**	1	_	+		1-1	_	+	Ö	
	Measurement unit retract (up)	O		Õ		0	O				T						T									1	C))									Õ	128
	TI-axis in standby position (170 mm) (0 mm)	0		o		0	O)									0	129
	TS-axis A grip transport unit tool grip position (90-degree rotation)	0		0		0	0		\perp		_	_				4	ļ		_		1	_			_	1)	0	11	_	4					0	130
	TI-axis in standby position (170 mm) (0 mm) (for SEQ124 return)	-	 	-		╢			+			 					ـ				-			 -					┿	↓			-	-			 	131
	TS-axis A grip tool breakage inside MG measurement position (135-degree rotation) (for SEQ129 return)	+			+		_	+	Н	+	+	\vdash	+		+	+	-	+	+	+	+	+	+	H.		Н	-	_	+	Н	+	+	+	Н	+	+	 	132
	Tool change standby complete position (horizontal, vertical) Transport unit on MC side	+	0	0		000	2		╂┉┤	-+-		╫╌		0			+	├		+	┉┼	-	+	 	2 0	+))	┿┈	┿			+	┝╼┼	-		0	133
	Transport unit on MC side Transport unit on MG side	٧	Ö			띩	ă		ō	-	+	+		ᅬ		-	+			+			+	┿		+		ر 2	+	┿			-				o o	135
	Tool transfer complete	t	Ö		+		0	t	ŏ	$^{+}$	t	Ħ	T		1		0	\top	$^{+}$	Ħ	\top	T	t	Ħ	$^{+}$	Н		5	$^{+}$	Ħ	$^{+}$	T	t	Ħ	\top		0	136
	TI-axis in standby position (for SEQ130 return)	1	Ĭ			Ĭ		1	Ĭ		1		\Box				ĭ		丁			Ť				П		1	I	L		J	1		\top	П	\Box	137
138	Transport unit on MC side (for SEQ54 return)	T						T		T																	T				T	T					П	138
139				[ļД			↓ J		ļ						ļ							 	J.				ļ	Ш				Ш		4		139
	Transport unit on MG side (for SEQ106, 133 return)	+	Н	4	4	Н	4	+	Н	4	4	\vdash	Н	_	4	_	┺	\perp	4	\perp	\dashv	4	1	Н	+	Н	_	+	+	Н	4	+	1	Н	+	+	⊢	140
141	AT-axis transfer unit tool grip position (90 mm) (90 mm) (for SEQ16 return)	+-	┝┥	-		╁╌┼			1	-		┼-┼-					+	-		-	┉┼	+		┝		╂			┼┈	╁┼			+	┝╌┥	-		2	141
142	AT-axis in standby position/TI-axis in standby position/U-axis connection OFF (for SEQ37 return) TI-axis transport unit tool grip position (for SEQ128 return)	+	\vdash	+	-	\vdash	-	+	+	+	+	\vdash	+	-	-	+	+	-	+	-	\vdash	-	+-	\vdash	+	\vdash	+	-	+-	H	-	+	+-	\vdash	-	+	0	142
143	11-axis transport unit tool grip position (for SEQ128 return)	+	Н	+	+	Н	+	+	+	+	+	+	+		+	+	_	+	+	+	+	+	+	Н	+	Н	+	+	+	Н	+	+	+-	Н	+	ᅱ	-	143
B tes	t data			0	20	О	0	2	\Box	\pm	†	\vdash	\top	\neg	\pm	+	$^{+}$	\vdash	\pm	\top	\vdash	\pm	+	\vdash	+	Н	\pm	+	+	\vdash	\pm	\top	+	\vdash	\pm	\forall	00	,
ر روي دوي	C 0000		اب			اب		_	1	_	1	_	┰	7	+	+	1	+	_	_	\dashv	+	+	\vdash	+	Н	_	+	1	_	_	1	+	Т	+	Н	212	†
AB m	ode	I						I			1	П								I		1						1	L			1			I	I	仜	仜
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MA-1	2500H	1			7			-			ρ						7 (9						10					1	11			1		7	12	_	_	<u> </u>
	matrix magazine) logic table MAP029A	80	40	20 1	0 08	04	02 0	1 8	0 40	20	10 0	8 0	4 02	01	80	40 20	10	08	04 0	02 0	1 80	40 2	20 10	0 08	04	02 01	80	40	20 10	080	04	02 0	1 80	40 2	20 1	0 08	04 0	02 01	
Operation sequence No.	Input logic 6/8	Return tool deterrmination commplete	tool	Spindle tool clamp LS OFF	tool	Spindle tool present clamp confirmation ON		Spindle Indexing complete M64 Next tool storage ovels	return to	No next/return tool	(char	No next tool ready operation return	rati	Active tool writing complete	TS-axis 90 degrees	TS-axis 180 degrees	ъ р 0	No recovery NG tool	Recovery NG tool present	Tool change position (HP1)	sk search complete	Operation door lock confirmation ON	AT-axis MG side	AT-axis in standby position	Change arm rotation complete	Step reverse interlock Step advance interlock	TS-axis 135 degrees	Tool breakage detection cycle complete	Tool breakage detection cycle Not in tool breakage detection cycle	TI-axis transport unit tool grip position	spindle	TI-axis spindle tool grip position	Return tool to be returned to nezt tool ready ST	tool ready ST	-avic connection compleate	shifter retraction confirmation LS	shifter retraction confirmation	U-axis present LS OFF TS-axis rotating position	Operation sequence No.
101	Storing tool unlocked position (vertical)	╅	0,	7	, 0,	0,	0, 0	_	T				Ť		Т	Ť	Ť		_	Ť	Ħ	Ĭ)	Τ	Ĭ	,,,,,	Ħ	Ħ		Ť	П	Τ	T		T	+	ſΤ	1	101
	Storing tool locking position (horizontal)				<u> </u>	\sqcap			1	17	7	1	†	m	7	_	1	1	_	1	1		_	1-	1	1	1	1		1	П		1	17	_	1	ΠŤ		102
	Fool unlock					17		T	T	1777		7	┪	177	7		†	1		7	1			┪~	1	7	177			1-	1		1	†	7	7	ΠŤ	1	103
	Pot retract		_	7	<u> </u>			_	T-	177		_	1	17	7		1	1		7	17		_	+	1	7	1			T	r		1	177	7	777	ΠŤ	7	104
105	Tool transfer complete													П												C													105
	Tool change standby complete position (horizontal, vertical)	T	П	T		П	I	I			T	T		П	I	T	0		I	T	П	I	Ţ	0		Ι	П	\Box	Ţ		П	T	I	П	T		П		106
	Fransport unit on MC side		LL	_[4	ĻĴ		_L	1	$\perp \perp$	[ĻĹ	[4	0				1]		_L	0		Ļ	$\bot \bot$	<u> </u> [<u> </u>	1[4	ļ Ĺ		Ш	 		107
	Π-axis in standby position (170 mm) (0 mm)			_		Ш				11			1	Ш			0				1			O		C				<u> </u>		_ (2	11	_	44	↓		108
	Π-axis transport unit tool grip position (170 mm) (-170 mm)			4					4	$\downarrow \downarrow$			4				0			_	11			0			1			0		_		11	_	44	↓		109
	Transport unit on MG side		Ш	4		Ш		4	1	Н	_	_	1	Ш	_		0	_	_	_	\perp	_	_	0	Ш	_	\perp			0	Ш	4	_	Ш	_	$\perp \!\!\! \perp$	\vdash	+	110
	Tool transfer complete	_	Н	+	_	Н	_	+	+	Н	_	_	+	Н	_	_	0		_	_	+	_	_	0	Н	С	1	\perp	-	0	Н	4	_	Н	_	+	\vdash	+	111
	FS-axis B grip transport unit tool grip position (0-degree rotation) (for SEQ22 return)					╢				╫┈┼		-	┿┈	₩			┿┈	├ ─┤			- 				╂┉┼		+				₩			┿			├ ── 		112
	FS-axis A grip spindle tool grip position (270-degree rotation) (for SEQ28 return)			-		╢				₩				₩			+	╂╼┥							₩		++				-			┿	-		├ ──├		113
	IS-axis B grip spindle tool grip position (180-degree rotation) (for SEQ34 return) IS-axis A grip transport unit tool grip position (90-degree rotation) (for SEQ44 return)		-	+		Н			-	₩				-			-	-		-	+		-		-	-	-			+				₩					114 115
	IS-axis A grip transport unit tool grip position (90-degree rotation) (for SEQ55 return)	+	Н	+	+	H		+	+	Н	+	+	╁	H	\dashv	+	+	Н	\dashv	+	+	\dashv	+	╁	H	+	+	+	+	+	H	+	+	\vdash	+	+	\vdash	+	116
	FI-axis transport unit tool grip position (170 mm) (-170 mm) (for SEQ107 return)					1-1			+	1			+	1			+	1-1		-	1-1			-	╅┈┤		1			+					_	++	r-t-	-	117
118	Operation selection (for SEQ110 return)			-		tt			+	†**†			┪~	t=t	~		+	11		~	1-1		_		⇈		1			+	1			†	_	+	r - †	_	118
	NT-axis instandby position (90 mm) (0 mm)/TI-axis in standby position (170 mm) (0 mm) (for SEQ37 return)		_	+		m	-	_	_	1		_	_	m	_	_	+			_	1	_	_	_	1	_	1	_		+	_	_		1	_	++	ſΤ		119
120	AT-axis in MG position (900 mm) (0 mm)		0	()	0		T						П		0					T		T								П	0				\Box	ΠŤ	0	120
121	Change arm tool lock/AT-axis (240 mm (-570 mm)) Simultaneous movement 3 affter movement		O		5	Ō				1			1			Õ	-				1				1		_			_		0		1			/ T	-	121
	S-axis A grip tool breakage inside MG measurement position (135-degree rotation)/AT-axis simultaneous movement 3		O			Ō			T	m			1	m			1	1			1	7	o		1		0			1		O		T			i T		122
	TI-axis in standby position (220 mm) (0 mm)		0)	0			T	П			T	П	T		T	П		T	П		0	T			0				П)	П	T	\Box	П	T	123
124	ATC shutter close/U-axis connection ON		0			O							L	Ш									0				0			I		C)			IJ	П		124
125	AT-axis transport unit tool grip position (170 mm) (-170 mm)/U-axis connection ON			I										Ш									0				0			0					C)			125
	Measurement unit preparation (down)			_		Ш				11			<u> </u>	Ш			1				1		이	ļ	1		0			Q	1		۰	11	_	44	↓		126
	Tool breakage detection cycle		<u> </u>	4					4	$\downarrow \downarrow$			4				 	1			1-1				 		0	0		Q		_		11	_	44	↓		127
	Measurement unit retract (up)		Н	4	-	Н		_	+	Ш	_	_	-	ш	_	_	+			_	+		<u> </u>	_	-	_	0	_		0	_	_		-	_		-		128
	ΓI-axis in standby position (170 mm) (0 mm)			-		-				₩					_			-			-		<u> </u>		-	-	0						2						129
	TS-axis A grip transport unit tool grip position (90-degree rotation)					╁╌┼			+-	╢			+		이		+	╁					<u> </u>		╂┈┼	C	4						2	┿					130
131	IT-axis in standby position (170 mm) (0 mm) (for SEQ124 return) IS-axis A grip tool breakage inside MG measurement position (135-degree rotation) (for SEQ129 return)			-		╢				₩				₩	┉┼		+	╂╼┥			╁╌┼				₩		┿				-			┿			┝┉┿╴		131
		+	Н	+	+	Н	+	+	+	Н	-	+	+	Н	\dashv	+	0	Н	+	+	+	\dashv	+	0	Н	+	+	+	+	+	Н	+	+	H	+	+	+	+	132
	Tool change standby complete position (horizontal, vertical)			-		┼╌┼			+	┿┥				┉			0	╁┈┼			+			10	┿┽	ī					┉			++	-		-		134
	Fransport unit on MC side Fransport unit on MG side		 -	+		╁			+	┿┽		+	+	┉			10	1			+			10	┿		+			+	┉			┿	-+-	+	一十		135
	Fool transfer complete	+	H	\top	$^{+}$	Ħ	\pm	+	+	H	\dashv	+	T	H	7	$^{+}$	0	П	1	$^{+}$	Ħ	\dashv	\top	0	П		,	\forall		$^{+}$	Ħ	\dashv	+	Ħ	$^{+}$	+	亣	+	136
	II-axis in standby position (for SEQ130 return)	1	П	1	T	П	_	+	T	П	7	+	T	П	7	T	Ť	П	\top	T	П	7	T	Ť	П	Ť	П	\sqcap	\top	T	П	1	T	П	+	\forall	ιt	\top	137
	Fransport unit on MC side (for SEQ54 return)			_	T	\Box		_	1	177			1	17	_		1	1						1	1					T	\Box		1	17	_	7	ΠŤ		138
	Operation selection (for SEQ56 return)			I							J		1							Ι													1	П		IJ	П		139
140	Transport unit on MG side (for SEQ106, 133 return)																																				Ш		140
	AT-axis transfer unit tool grip position (90 mm) (90 mm) (for SEQ16 return)		LI		<u> </u>	Ш			1_	$\downarrow \downarrow$			↓_	L I	_[4	<u> </u>	μŢ		_L_	\prod	[↓_	ĮI		$\downarrow \downarrow$	L.I		↓_	ĻΙ		<u> </u>	ĻΙ		$\perp J$	μŢ		141
	AT-axis in standby position/TI-axis in standby position/U-axis connection OFF (for SEQ37 return)		Ш	4	1	Ш	_		1	Ш		_	1	Ш	4		1	Ш	4	_	Ш	_		1	Ш		Ш	Ш		1	Ш	4	_	Ш	4	$\perp \downarrow$	Ш	_	142
143	Π-axis transport unit tool grip position (for SEQ128 return)		Ц	_	_	ш		1	┸	Ш	_		_	ш	4	_	_	\sqcup	_	┸	Ш	_ļ	_	_	ш	┸	ш	Ц	_	┸	ш	_	_	ш	_	ш	Щ	4	143
ш		_	Н	\perp	\perp	Н	_	4	+	ш	_	_	\perp	Н	_	+	+	Н	4	_	\vdash	_	4	\perp	Н	_	Н	Н	-	_	Н	_	_	Н	\perp	+	\vdash	+	igspace
B tes	data	_	Ц	4	+	щ	4	4	4	щ	_	4	+	Ц	4	4	4	ш	4	_	щ	4	4	+	щ	4	\vdash	щ	4	_	щ	4	+	щ	4	$oldsymbol{\sqcup}$	4	4	\vdash
45		_		+			-	+	-		-	3	-	Н	-	-				-	+	1				-	-		,			-	+		+	₩	+	+	\vdash
AB m	ode		H	÷	_		+	+	1	Н	+	3	-	Н	+	+	1		+	-	4	-	+	_		-	Н	Н	÷	1		+	+	H	÷	+	\dashv	+	\vdash

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	(matrix magazine) logic table MAP029A		80 40	20	10 0	3 04	02 0	1 80	40	20 10	08 04	4 02	01 8	0 40	20	10 0	8 04	02 0	1 80	40	20 1		04	02 0	1 8	0 40	20	10 0	8 04	02	01 8	80 4	0 20			04 02	01	
Operation sequence No.	Input logic 7/8		Tool pot spindle side confirmation ON Tool pot magazine side confirmation ON	Tool pot unclamp confirmation ON	Tool pot clamp confirmation ON Change arm tool unlock confirmation ON	151	Tool pot retraction confirmation ON	Tool pot advance confirmation ON Tool pot tool present					U-axis spindle indexing position	en o	shutter close	ATC shutter close confirmation ATC shutter onen confirmation OFF	shutter	Tool present in transfer pot	TO TOO TOO TOO TOO TOO TOO TOO TOO TOO		Movement to pot vertical retract position complete	Movement to pot unlocking horizontal position complete	Movement to pot locking horizontal position complete	Vertical movement to tool change position complete	Horizontal movement to tool change position complete Spindle tool present clamp confirmation OFF	No spindle tool interlock	Not in manual tool chage cycle	APC pallet cleaning sequence OFF	Cylinder unclamp outside spindle	clamp outside spindle	Oylinder clamp outside spindle OFF	APC start positon	MG manual operation command storing	MG manual operation command calling	Not MG manual operation command	Uhange arm B gripper tool present Tool breakage inside MG detection in standby position confirmation	To d breakage inside MG detection in measurement position confirmation	Operation sequence No.
Auto	branch data																					F		Ŧ								\perp		Н	-			
	Operation selection (M63 command (no next tool))	⇒106	0	О	\vdash	О	0	\top	0	т	\vdash	т		1	П	\neg	\top	т	\top	т	\top	$^{+}$	П	$^{+}$	\top	$^{+}$	О	\top	$^{+}$	т	П	+	$^{+}$	\vdash	0	0	\vdash	- 2
	Operation selection (Chage arm B gripper tool present)	⇒133		Ö	H	ŏ	0		Ö		Ħ	H			Ħ	_		Ħ	+	Ħ	+	t		+	1	+	ŏ	1	t		H	+	t			00		2
	Operation selection (operatio ready for next tool)	⇒58		Ö		ŏ			ŏ		\pm	+			H	_		Ħ	+	Ħ	+	+		+	+	+	Ö	1	+		H	+	+		0	0		- 2
	Operation selection (MG manual calling)	⇒82		Ö	П	Õ		T	Ö			T	-	_	П	_		Ħ	T	Ħ	1	T	П	1	T	T	C	1	T		Ħ	\pm	T	0	Ť	Õ		-2
	Operation selection (MG manual storing)	⇒94		ŏ	т	Ŏ		T	Ŏ		\top	T		\top	П	_		Ħ	T	Ħ	T	T	П	1	T	T	ŏ	1	T		Ħ	\pm	0	~	十	Õ		2
_	Next tool unlocking position (horizontal) (Next tool in ready ST for next tool)	⇒9	Ō		0	O	-	0	Ĭ	П	\top	T	(5	П	_			5	Ħ		olo		T	Ť	T	O	1	T		Ħ	\top	Ť	П	十	O		- 6
	Waiting for MC cycle end (next tool present in M64 operation)	⇒38	0	0		O	0		П				C	00		C)	Ħ	1	П	T	Τ		olo	0	0	Ō	0	T		Ħ	\top	T	П	\top	O	П	18
	Waiting for MC cycle end (no next tool in M64 operation)	⇒109	O	Ō		O			П	П		T	(00	П	C		П	T	Ħ	T	T		Ō	o c	Ō	Ō	Ō	T		П	\top	T	П	T	0	П	18
18	Waiting for MC cycle end (during MG manual interruption call operation)	⇒135	0	0		0			П					0	П	C)	П		П	Т	Т	П	0	0	0	0	0	Т		П		Т	0		0	П	18
18	Waiting for MC cycle end (during MG manual interruption storage operation)	⇒135	0	0		0								0		C								0	0	0	0	0					0		\Box	0		18
37	ATC shutter close/U-axis connection ON (no return tool operation)	⇒54	0	0		0																					0							Ш		0		37
	Pot advance (return tool in next tool ready ST)	⇒49	0		0	0	(2										Ш		Ш					┸		0				Ш	\perp		Ш		0		46
	Tool transfer complete	⇒1		0		0		\perp	0	Ш		\perp		\perp		00		Щ	┸	Ц	_	┸			1	┸	0		┸	_	Ц	4	┸	Ш	ユ	0		53
	Tool transfer complete	⇒1		0		0			0							00)	ш		Ш		\perp			╙	\perp	0		\perp		Ш		┸	Ш	_	0		57
	Operation selection (no next tool ready return)	⇒70		0		0	0	4	0						Ш	_		ш	4	Ш	4	1		4	4	_	0	_	1		Ш	4	1	Ш	4	0		58
	Tool transfer complete (no next tool ready input)	⇒1		0		0	0		0					_	Ш			ш	4	ш	_	_	Ш	_	4	_	0	_	_		Ш	4	_	Ш	4	0		69
	Tool transfer complete	⇒1		0	ш	0	0	_	0			\perp	_	_	Ш	_	_	ш	4	Ш	_	+		4	4	+	0	_	+		Н	+	+	Н	4	0		81
_	Tool transfer complete	⇒1		0	\vdash	0		+	0		\vdash	+	_	+	Н	_	+	\vdash	+	Н	+	+	Н	4	+	+	0	_	+	+	\vdash	+	+	\vdash	+	0		93
	Tool transfer complete	⇒2		0	\vdash	0		+	0		\vdash	+	4	+	Н	_	+	\vdash	+	Н	+	+	Н	4	+	+	0	_	+	+	\vdash	+	+	\dashv	+	0		93
	Tool transfer complete	⇒1		0	H	0		+	0	\vdash	\vdash	+	-	+	Н	+	+	Н	+	Н	+	+	Н	+	+	+	0	+	+	+	Н	+	+	\vdash	+	0		105
	AT-axis in standby position (810 mm) (0 mm)	⇒34	0	0	С		0	+	+	\vdash	\vdash	+	Η.	\perp	Н	+	0	Н	+	Н	+	+	Н	+	+	+	0	+	+	+	Н	+	+	\vdash	+	0		33
	TI-axis in standby position (170 mm) (0 mm)	⇒18	0	0	\vdash	0		+	L	\vdash	\vdash	+	(4	Н	_	+	Н	+	Н	+	+	Н	+	+	+	0	+	+	+	Н	+	+	+	_	0		108
	Tool transfer complete	⇒1		0	\vdash	00		+	0	-	\vdash	+	+	+	-	00	_	\vdash	+	Н	+	+	Н	+	+	+	0	+	+	+	Н	+	+	-	0	0		111
	Tool transfer complete	⇒82 ⇒94		0	H	0		+	0		-	+	+	+		00		\vdash	+	H	+	+	Н	+	+	+	0	+	+	+	H	+	0	0	+	0		111
	Tool transfer complete		C	0	-		0	+	10	\vdash	\vdash	+	+	+	H	OIC	7	H	+	Н	+	+	Н	+	+	+	C	+	+	0	H	+	10	+	+	0		32
	Change arm tool unlock/Cylinder clamp outside spindle (during tool breakage inside MG)	⇒120 ⇒39	0	C	1	0		+	+	\vdash	\vdash	+	+	+	H	+	10	+	+	H	+	+	H	+	+	+	C	+	+	10	H	+	+	++	+	0		130
	TS-axis A grip transport unit tool grip position (90-degree rotation)		0	C			0	+	+	H	\vdash	+	+	+	H	+	0	+	+	\vdash	+	+	Н	+	+	+	C	+	+	+	\vdash	+	+	+	+	0		
	AT-axis in MG position (900 mm) (0 mm)	⇒121)	0				+	+	H	\vdash	+	+	+	Н	+	10	\vdash	+	H	+	+	H	+	+	+		+	+	+	${}+$	+	+	\forall	+	0		120
134	Transport unit on MC side	⇒18	0	O	$\sqcup \! \! \! \! \! \perp$	0	O			ىب		للل	(بال	ш			ட		ш		ㅗ	ш	_		┸	0		ㅗ		ш	ㅗ	┸	ш	ᆚ	_0	لــــــــــــــــــــــــــــــــــــــ	134

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Operation sequence No.	Input logic 8/8		Return tool determination commplete Spindle tool unclamp IS OFF	tool clamp LS OFF	Spindle tool clamp LS ON	p confirmation ON	Spindle stop Spindle indexing complete	cle	Next/return tool present No next/return tool	ge arm rotation present)		dy operation	Active tool writing complete TS-axis 90 degrees	s 180 degrees		No recovery NG tool Recovery NG tool present		Tool change position (HPI)	ock confirmation ON		AT-axis spinde side AT-axis in standby position	omplete	Step reverse interlock Step advance interlock		complete	Not in tool breakage detection cycle	transport unit tool grip position		in standby position	o nezt tool ready ST			U-axis shifter retraction confirmation LS U-axis shifter retraction confirmation LS OFF		c	Operation seguence No.
lu+a	branch data					Н		\blacksquare		Н		Н								П	-						П								H	_
	Operation selection (M63 command (no next tool))	⇒106		$^{+}$	т	т	$\overline{}$	$\overline{}$	C	1	_	$\overline{}$	_	т	О	$\overline{}$	т	$\overline{}$	-	П	0	П	_	П	\neg	_	$\overline{}$	\neg	_	\vdash	_	$\boldsymbol{\top}$	-	$\overline{}$	\vdash	-
	Operation selection (Chage arm B gripper tool present)	⇒133		+	H	+	_	+		Ή	_	\vdash		H	ŏ		+			H	0		+	H	+	+	+		+	+	+		+		Ħ	_
	Operation selection (chage arm B gripper tool present) Operation selection (operatio ready for next tool)	⇒58	\vdash	+	H	+	+	+	+	+	+		+	H	0	\vdash	+	+	+	H	0		+	H	+	+	+	_	╁	+	+	++	+	+	\vdash	_
	Operation selection (Operatio ready for next (661)	⇒82	H	+	H	+	+	+	+	+	+	М	+	H	0	+	+	+	+	H	0		+	H	+	+	+	\dashv	+	+	+	+	+	+	\vdash	-
	Operation selection (MG manual storing)	⇒94	+	+	H	+	+	+	+	+	+	+	+	H	ŏ	+	+	+	+	H	0		+	H	+	+	+	\dashv	+	+	+	+	+	+	\vdash	_
	Next tool unlocking position (horizontal) (Next tool in ready ST for next tool)		H	+	H	+	+	+	+	+	+	\vdash	+	H	Ö	+	+	+	+	H	0		+	H	+	+	0	_	+	Η,	2	+	+	+	\vdash	-
	Waiting for MC cycle end (next tool present in M64 operation)	⇒38	(1	0	0	_	0	_	+	+	\vdash	+	H	ő		+		+	H	0		+	H	+	+	1		0	-	~		+		Ħ	1
	Waiting for MC cycle end (next tool present in M64 operation) Waiting for MC cycle end (no next tool in M64 operation)	⇒109			C	0	+	C		1	+	+	+	H	0		+	+	+	H	0		+	H	+	+	+	_	0	+	+	+	+	+	\vdash	1
	Waiting for MC cycle end (no next tool in M64 operation) Waiting for MC cycle end (during MG manual interruption call operation)	⇒135			C	0	+	1	_	1	+	+	+	H	0		+	+	+	H	0		+	H	+	+	+	\dashv	10	+	+	+	+	+	\vdash	1
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	ATC shutter close/U-axis connection ON (no return tool operation)				0	ŏ	+	+	-		+	\vdash	0	H	-	+	+	+	+	H	0		+	H	+	+	+	_	0	+	+	+	+	+	\vdash	3
	Pot advance (return tool in next tool ready ST)	⇒49	0	+	М	М	+	+	+	Ή	_	Н		H	0		+	-	+	H	ŏ		_	H	+	+	0	$^{+}$	۲	С	_	H	+	+	H	4
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	AT-axis in standby position (810 mm) (0 mm)	⇒34		T		П	T	П	T	\Box		П		0	П				T	П	0	П	T	П	T	T	П			П	T		T	П		3
	TI-axis in standby position (170 mm) (0 mm)	⇒18		T	П	\Box	T	T	T	\Box	T	П	-	1	Ю		П	T	Τ	П	Ŏ		T	П	T	T			0	П	T		T	П		10
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	Tool transfer complete	⇒94				\Box		T							O						0			П			П							П		11
32	Change arm tool unlock/Cylinder clamp outside spindle (during tool breakage inside MG)	⇒120	C		0	0								0							0					0	\Box	(1			3
	TS-axis A grip transport unit tool grip position (90-degree rotation)	⇒39		L		口	Ι		1		I	П	0						L	0	I	П	I		T	Ι	П	I	0	П	I		I	П		13
100	AT-axis in MG position (900 mm) (0 mm)	⇒121			0	0								0						0				П												12
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2 Operation selection	ig ig	Ti-axis spindle tool grip position Ti-axis in standby position TIS-axis 90 degrees	Ę.	0	tool grip	tool grip	apuds	spindle c	Ovliner unclamp outside	-	Retractable	Retract	- track	- track	- track	Retract	- track	Retract	Retract	Retract	Retract	Retract	Retract	Retract	Retract	Retract	Retract	Retract	Retract	Retract	Retract	Retract	Retract	Retract	Rotract	Rotract	Rotract	Dottood	4000	4000	4000	4000	Dottood	Dottood	Dottood	Dottood	Dottood	Dottood	Dottood	Dottood	Dottood	Dottood	Dottood	Dottood	Dottood	Dottood	Dottood	Dottood	Dottood	Dottood	Dottood	Do Amond					Return	Return	Return	Return cycle inhibited	Return cycle inhibited	Return cycle inhibited	Return cycle inhibited	Return cycle inhibited	Return cycle inhibited	Return cycle inhibited	Return cycle inhibited	Return cycle inhibited	Detum over a history	Dating along the hited	Dating along the hited	Dethit along matter	Dethit along matter	Dethit along matter	Dating along the hited	Dating along the hited	Dating 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19 Spindle indexed/U-axis connection OFF			44			L	_																																																																								L.	ļ.	ļ.	ļ.,	ļ.,	ļ.,	ļ.	ļ.	ļ.	ļ.	ļ.	ļ.	ļ.	ļ.	ļ.	ļ.	ļ.	ļ.	4
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21 ATC shutter open (simultaneous movement 1)	 		╁╌┼			L	-																																																																																										
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26 Change arm tool lock/Oylinder unclamp outside spindle	 	-+-+-	╁╌┪				+		-	╬	~																																																																																						
27 Spindle tool unclamp		++	H	\dashv	+	H	5	0	C	-																																																																																							
28 Traxis spinde tool extraction position (170 mm) (390 mm)			+	-			źΤ	ŏ	č	1																																																																																							
30 Tracis spindle tool grip position (170 mm) (220 mm)			,†**	ō	7		ŜΤ	ō	Ĉ	7																																																																																							
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32 Change arm tool unlock/ Cylinder clamp outside spindle		0	0	П			5	Ö	C	7		Г	Г	Г	Г	Г	Г	Г	Г	Г	Г	Г	Г	Г	Г	Г	Г	Г	Г	Г	-	-	-	Г	Г	Г	Г	Т	Т	Т	Т	Т	Т	Т	Т	Т	Т	Т	Т	Т	Т	Т	Т	Т	Т	Т	Т	Т	Т	Т	Т	Г	Τ	T	T	7													Γ	-	-	1	1	1	-	-	-	-	1	1	1	1	1	1	1	1	5
33 AT-axis in standby position (310 mm) (0 mm) (0 mm) 34 AT-axis in standby position (310 mm) (0 mm) 0			П	П		L		0	C	(Ι.	Ι.	Ι.	L	Ι.	L	Ι.									I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I		I	Ι	I																																										
34 Obarge arm tool lock/AT-axis (240 mm <-570 mm) Smultaneous movement 2 affixer movement 2 O O O O O O O O O O O O O O O O O O		$\Box \Box$	П		ľ		Ι		Ĺ	Ι		Ľ	Ĺ	Ĺ	Ĺ	Ĺ	Ĺ	Ĺ	Ĺ	Ĺ	Ĺ	Ĺ	Ĺ	Ĺ	Ĺ	Ĺ	Ĺ	Ĺ	Ĺ	Ľ	Ĺ	Ĺ	Ĺ	Ľ	Ĺ	Ĺ	Ĺ	Ĺ	ľ	ľ	ľ	ľ	Ĺ	Ĺ	Ĺ	Ĺ	Ĺ	Ĺ	Ĺ	Ĺ	Ĺ	Ĺ	Ĺ	Ĺ	Ĺ	Ĺ	Ĺ	Ĺ	Ĺ	Ĺ	Ĺ	Ĺ	Ĺ	I	1	_					_	_	_	_	_	_	_																				
35 Transis in standby position (220 mm) (0 mm) 0 mm] 0	$\sqcup \sqcup \sqcup \sqcup \sqcup$	\bot	\perp	[L	Ţ	[L	1		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	Ţ	Ţ	Ţ	Ţ	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	Ţ	Ţ	1	_[_	_		_	_	_	_																				
38 T1- axis in standby position (220 mm) (0 mm)			\perp	_	_		1		L	1		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	_	_	_	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	ļ	1	1	_	_	_																													
37 ATC shutter closes/U-axis connection ON			Н	4	4	L	1	_	L	4	_	L	1	1	1	L	1	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	1	1	1	1	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	1	1	4	4																															
38 AT -axis transport unit tool grip position (90 mm)/U-axis connection ON		니이	4-4		4	L	4		ļ	4	_	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	Ļ	1	4	4													ļ	ļ.,	ļ.,	ļ.,	4	4	4	ļ.,	ļ.,	ļ.,	ļ.,	4	4	4	4	4	4	4	4	4
39 Traxis transport unit tool grip position (170 mm) (-170 mm) O O O O O O O O O			╁┼		-	ــــا	4	_																																																																						۴.	١	ļ.,	ļ.,	↓.	↓.	↓.	ļ.,	ļ.,	ļ.,	ļ.,	╁.	╁.	╁.	╁.	╁.	4	4	4	4
40 Transport unit tool lock		++	₩	-	+	<u>_</u>	+																																																																		-					L.	١.	╁-	╁-	+	+	+	╁-	╁-	╁-	╁-	╀	╀	╀	╀	╀	+	+	+	+
41 Change arm tool unlock	 	++-	+	-	4	ıΩ	-49																																																																			~~	~~	~~	~~	-	-	╁	╁	+	+	+	╁	╁	╁	╁	╀	╀	╀	╀	╀	╀	╀	╀	+
42 AT-axis in standby position (90 mm) (0 mm) O	 	$+\!+$	+	+	+	H	+	\dashv																																																													-									H	H	H	H	+	+	+	H	H	H	H	+	+	+	+	+	+	+	+	+
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44 Transport unit on MG side 6 0 00 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	┍┈┋┈┋	-+-+-	┿		-	٠	+																																																																								h	┿	┿	┿	┿	┿	┿	┿	┿	┿	┿	┿	┿	┿	┿	╁	╁	╁	┿
45 TS-axis B grip transport unit tool grip position (0-degree rotation)	 	-+-+-	┿	+	+	├	+																																																																							۳-	۱	╆╌	╆╌	╁	╁	╁	╆╌	╆╌	╆╌	╆╌	╆	╆	╆	╆	╆	╁	╁	╁	┿
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47 Return tool unlocking ready position (vertical)		+	Ħ	\dashv	+	H	Ť	7																																																																						H	H	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	†
49 Return tool unlocking ready position (horizontal)		+	T	\forall	T	<u> </u>	Ť	7																																																															_	_	-	-	-	-	-	_	T	T	T	t	t	t	T	T	T	T	t	t	t	t	t	t	t	t	Ť
49 Return tool unlocked position (vertical)			1	7	_		"†	_																																																																-		•	•	•	•		r	T	T	1	1	1	T	T	T	T	1	1	1	1	1	t	t	t	†
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Operation sequence No.	Output logic 2/6	Spindle rotation inhibited	RS air blow	Spindle air blow		Manual tool change	Next tool cancelled		At-axis in standby position	removal con	Next tool installation and active tool storage command Active tool writeng	2	A, B mode invalid Change arm rotation command	continue	Ste	Auto branch	Step timer No.2			C-axis travel inhibited	trave	Z-axis travel inhibited	T-axis travel inhibited X-axis travel inhibited		Same T command valid U-axis connection OFF command	0	CIV		Determining return tool	MG manual operation storing cycle MG manual operation calling cycle	ready return cycle	Tool ready input cycle		Tool change position command (HP7) Tool change position command (HP1)	Operation sequence No.
	Writing next tool														0			0			L				0	\Box		0		\Box	\Box		П		1
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	Next tool unlocking position (horizontal)	┝╌┝╌	+-+		+		+	┢┿		┿		┿		┿┿		40	╫┽	+	╁┉┼		+	╟┼		╂╌┤		4-4	┿	0		-	-	╆┉┼╌	-++		+ 6
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	Tool change standby ready position (norizontal) Tool change standby complete position (horizontal, vertical)		+		+-+					++		┿		╁╌┼			╁╌┼		+-+		+	-		-		+	┉				-	₩	+		
	Pot retract		++	+	+	+	+-	+	-	+	+	+	+-	+	-	+-	+	+	+	+	+	\vdash	+	+		+-	+	+	+	-	+-	++	+-	-	10
	Transfer unit on MC side	H	+	+	+	+	+	H	+	H	+	+	+	+	+	+	+	+	H	+	+	H	+	H	-	+	H	+	H	+	+	+	+	+	11
	Change arm tool unlock		┿		┿			-		┿┈┿		┉╁		┿┉			╂╍┼		┿		+	┉┼		┿			┉	0	-		+	╆┉┾╌			12
	AT-axis transfer unit tool grip position (90 mm) (90 mm)		┿		┿			0		┼┈┼		┉╁		╁╌┤		+	┿		╂┉╂		+	-		╁┈┼		+	 -	0			-	╆┉┼╌		_	13
	Change arm tool lock		╌┼		++			-		┿┈┿		┿		┿			╂┈┼		++		+	 -		┿		-		0			-	╆┉┾╌	++		14
	Transport unit tool unlock		+		+-+					+		++		++			 		+-+		+	-		+			-	ŏ			-	+			15
	TI-axis in standby position (170 mm) (0 mm)	+	О	+	+	+	+	H	+	+	+	+	+	+	+	+	+	+	+	+	+	H	+	H	_	+		ŏ		+	+	+	+	+	16
	AT-axis in standby position (90 mm) (0 mm)		╁		+-+				Õ	-		-		┿			 		++					+				Ö		******			-		17
	Waiting for MC cycle end		++		++		5			+				┰		10	1		++		+	-		1			 	lö			+	 	+		18
	Spindle indexed/U-axis connection OFF	т	\top	\top	Ħ	Ċ)	Ħ	\top	Ħ	1	Ħ	T	Ħ	+	Ť	Н	+	П	+	T	Ħ	+	Ħ	С			Ö		o	o	\vdash	\forall	o	19
	HP1 (simultaneous movement 1)	h	1		†**†	T c	5	1		 -		†		11		┪~	1		†**†		┪	m		1		+	 	Ŏ		_	+	1	777	Ĉ	20
	ATC shutter open (simultaneous movement 1)	00		T	Ħ	Т	Т	П					T	П	_	T	П		П		0	0	0 0)		\top		Ť	П	\top	\top	П	\Box	C	21
	TI-axis spindle tool grip position (220 mm) (220 mm)	00			1	_						TT				_	17				0	0	o o)											22
	TS-axis A grip spindle tool grip position (270-degree rotation)	00			11	_		П		1		T		177		1	17		11		0	0	0 0)			m	1	1						23
	Change arm tool unlock	00		_	1	_		1		1		17		1		_	17		177		Ö	Ö	o c	,		1	177		1		1		77		24
	AT-axis spindle tool grip position (810 mm) (-810 mm)	O C			TT			1	o ·	1		1		7		7	1		TT	To	οĨÖ	0	ÖÖ	,		1	1	7	m		7				25
26	Change arm tool lock/Cylinder unclamp outside spindle	00			П	T								П		Т	П		П	(0	0	0 0)				Т	П	Т	П	П	П	П	26
27	Spindle tool unclamp	00	ol T	T	П			П		П	1	П	T-	П		T	П		П	C	0	0	0 0)			П	T	П	T		П	Т		27
28	TI-axis spindle tool extraction position (170 mm) (390 mm)	0		О						0		Ш					П		П		0	0	0 0)											28
	TS-axis B grip spindle tool grip position (180-degree rotation)	0		О							0		C				Ш		$\perp \perp$				0 0						\perp			$\perp \perp$			29
	TI-axis spindle tool grip position (170 mm) (220 mm)	00		О						- (0	Ш				T	Ш			C	0	0	0 0)						\perp		П			30
	Spindle tool clamp	00		_	11			Ш		11.		$\perp \perp$		11		_	11		\perp	(0	0	0 0	4		'	1		Ш						31
	Change arm tool unlock/Cylinder clamp outside spindle	00		_	44									4		0			1		0	0	0 0)			<u> </u>					1			32
	AT-axis in standby position (810 mm) (0 mm)	00		_	4-4				0	4	_	₩.		1		0	4-4		\perp		0	0	0 0)			<u> </u>				4	₩.			33
	Change arm tool lock/AT-axis (240 mm (-570 mm)) Simultaneous movement 2 affter movement	00		_	1	_		-	0	1		₩	-	\perp	_	_	1		\vdash		0	0	0)		'	Щ.	_	_		╨	₩			34
	TS-axis A grip transport unit tool grip position (90-degree rotation)/AT-axis simultaneous movement 2	00		_	\vdash	_	4	Ш	0	1		ш	_	\sqcup	_	+	\vdash	_	ш				0 0			#	ш	\bot	Ш	+	╨	\vdash	+	+	35
	TI-axis in standby position (220 mm) (0 mm)	00	4-4	-	44	4	+	├	-	+		₩.		4-4	-	+-	1-4	-	╁┼	-49	ΝĮΟ	익	0	4-4		+_!		+-	┿	-	4	╁╌┼╴	44		36
	ATC shutter close/U-axis connection ON	┝╌┝╌	4-4	-	44	-	┿	나		₊		₩.		╁┼		20	4-4		╁╌┼		+	 		1		0	₩.	0			4	₩	4-4		37
	AT-axis transport unit tool grip position (90 mm)/U-axis connection ON	├ ─┼	1	+	++	-	+	0		+-+		₩		+-+		2	╁┼		₩	-	+	⊢∔	-	+-		+!	-	0			+	₩			38
	TI-axis transport unit tool grip position (170 mm) (-170 mm)		0	-	++	-	+	+		+		╁╌╂		+		잌	╁╌┼		+	-	+-	⊢⊦		+-		+!	┼-┼-	0			+	₩			39 40
	Transport unit tool lock Change arm tool unlock	\vdash	+	+	₩	+	+	H	+	+	+	++	+	\dashv			+	-	+	+	+	\vdash	+	H	+	₩	+	0		+	+	+	+	+	41
	Change arm tool unlock AT-axis in standby position (90 mm) (0 mm)		+-+		+-+	+		+	ō			┯		+	- 6	ϥ	┿		+-+	-	+	\vdash		+-+		-		0			+	+-+-		-	41
	A I - axis in standby position (90 mm) (0 mm) Change arm tool lock	┢┉┼┉	┿		┿	-	+	┿	-12	++		┿		┿┿		5	┿		┿		+	┝╌┼		┿		+	┿	٦	┿		-	╆┉┼╌	+-+		43
	Transport unit on MG side	┝┈┼┈	┿		┿	-	+	╆┿		┿		┿		┿┿			╅╌┼		+-+		+	┝╌┼		┿		+-	┿		┿			╆┉┼╸	+		43
	Transport unit on MG side TS-axis B grip transport unit tool grip position (0-degree rotation)	├├-	++	-	++	-	-	+		+-+		╁┼	-	+			╁╌┼		++		+	⊢┼		+-		+	╁		+		-	+-+	+-+		45
	Pot advance	\vdash	+	+	+	+	+	\vdash	+	+	+	+	+	\forall		30	+	+	H	+	+	\vdash	+	H	+	+	+	+		+	+	+	+	+	45
	Return tool unlocking ready position (vertical)	\vdash	++	+	++	+	+	+	+-	+		++	+	+		5	1-1	+-	+	+	+	\vdash	+	+		+	++	0	М	+	+	++	+	+	47
	Return tool unlocking ready position (vertical)		+	-	+	+	+	+		+		+		+-+	-1		┿		+	+	+	\vdash	+-	1-1		-	+	- 0			+	+	+-	_	48
	Return tool unlocked position (vertical)		┿		++	-		++		+-+		 		┿┥		5	†-†		††	-	+			1-		+	+-+-	0		-	-	 	+-+		49
	Return tool unlocked position (vertical)	├ ─┼~	╅┉╅		+	-	+	╆┿		┿		 		┿┥	-+>	š †	┿		++		+	┢╌┼		1-		+	 - 	0		-	+	 	++		50
- 50	Total Total Total position (Horizontall)				<u> </u>	_	_											_		_	_	_	_			_			_				_		

		_	_	_	_	_	_	_	_		_2					_	_ ;	3	_	ш		_	4	Щ	_					5	_		_	_			6	_	_		
ATC(matrix magazine) logic table MAP029A		80	40 2	0 10	08	04	02 0	1 8	0 40	20	10 (08 0	14 02	01	80 4	10 2	0 10	08 0	04 02	01 8	30 4	0 20	10	08)4 ()	2 01	80	40	20 1	0 0	8 04	02	01	80 4	10 2	0 1	0 08	B 04	02	01	₩.
Output logic 3/6		pot on	5	ž ž	Change arm tool unlock	Change arm tool lock	by.	Lool pot advance	rool breakage inside MG detection cycle start	ion in standby po	Tool breakage inside MG detection in measurement position	TS-axis 135 degrees	Mo command innibited Tool breakage detection start	t pot brake relea	int OFF command	Magazine manual interruption available	Chage arm check	ATC door open inhibited		ok for po	Tool change position command	Magazine pot vertical complete command Magazine pot horizontal complete command		pot unlo		Next tool command	al return ATC		com	Determining chage arm B gripper tool present M64 command libilitied	Return cycle inhibited	Retractable	amp outside spinc	-axis transport unit tool grip	II-axis spindle tool extraction position	-axis spindle tool	TS-axis 90 degrees		270		Operation sequence No.
51 Tool unlock		Ħ	olo	<u> </u>	-	0	-	9	Τ	Ō	-	٦	+	Ħ	Ť.	Ť	Ť	Ì	_	Ĭ	٣	Ť	ñ	Ť	Ť	Ť	r	_		-	Ť	0		Τ,	Ť	Ť	Ť	۳	Ť	Ť	5
52 Pot retract		1	Õ	5	1	Õ	0	7	1	Õ			1	177		_	1			Ō	_		m			T	m				1	0			_	7	1	7	1	1	5
53 Tool transfer complete		1	00	5	1	0	0	_		O				1									m									0			_	1	_	1	1	1	5
54 TI-axis transport unit tool grip position/U-axis connec	tion ON	0			Г	0	0	Т	T	0				П				П		П			П									0		0	Т	Т	Т	1	T		5
55 Transport unit on MG side		\Box	⊚ (Ľ	0	Ô	1	Ι	O			Т	O			\mathbf{I}^{-}	Ш	I	П		I	\Box		T	Ι	\Box			I	T	O			Τ	T	Ι	Ι	Γ	Ľ	5
56 TS-axis B grip transport unit tool grip position (0-degre	ee rotation)	\Box	0 0			0	0	J	Г	0	J	J	Ι	П	IJ	Ι		LT	\mathbf{I}	IJ	J	Ι	П	IJ	I	Γ	П	J		Ι		0		J	Ι	Ι	Ι	П	\prod	0	5
57 Tool transfer complete			Õ (j .		0	Õ	Ι	Ι	0		Ι	I	\prod		Ι		Ш	Ι		Ι	Ι			Ι	Ι		I	I	Ι	Ι	0			Ι	Τ	Ι	Ι	I		5
58 Operation selection			Õ ()		0	Õ	I	Ι	Ö		Ι	I					\square	I		T	Ι			Ι	Ι			T	T	I	0		T	T	Τ	I	Ι	Γ	Γ	5
59 Next tool ready return tool locking position (horizontal,	vertical)		00			0	0	Ι	Ι	O						I			\perp			ÖÖ			Ö	0					I	0			T	Τ	Ι	I	Γ	Γ	5
60 Pot advance			00			Ö	(9	Τ	0										0	Т	Ι	\Box		Τ	I			T	I		0			T	Τ	Τ	Τ			6
61 Tool lock		П	0	0	П	0		0		0	П			П			Т	П		П	T		П		T	Т	П	П				0		T	T	Т	Т	Т	Т	Т	6
62 Next tool ready return tool unlocking position (horizont	tal)	TT	Õ	Τõ	1	Õ	(ΣĪ	T	Õ				1		_	1	1		1-1	7	To	1	O		lö	m				Πö	0			_	7	7	7	1	1	6
63 Return tool unlocking ready position (vertical)		11	õ	Τō	1	Õ	-	آر اد		Õ				177			+	T		1-1		t	ΙõΙ	Õ	To	ol 🖺	1777		_			Ö				_		┪~	1-	†~~	6
64 Return tool unlocking ready position (horizontal)		TT	Õ	Τõ	m	Õ	(ΣĪ	T	Õ				1		_	1	1		1-1		To	T	O	C	5	m				7	O			7	7	7	7	1	1	6
65 Return tool unlocked position (vertical)		_	Õ	Tô	1	Õ		آرَّ		Ô										1	7	o To		Ö	C	5						Õ			_	_	_		1	1-	6
66 Return tool locking position (horizontal)		П	0	0	П	0		5	1	0			T	П			T	П	\top	Ħ	T	0	П		00	5	П			T		0		T	T	T	T	T	T	T	6
67 Tool unlock		1	٥l٥	51		Ö	(ā		O						****	_	-		1			177		_		1				-	O				_	_	****	1-	*	6
68 Pot retract			O C	5	†	Ö	0	_		Ö				1		_				0			1		_	_	1				_	Õ			-	_	-	┪~	†	†─	6
69 Tool transfer complete		11	٥l٥	5	1	Ö	ŏ			Õ				11			+	· · · · · ·	_	†≚†	_		11	_	+		1				+	Ö			_	+	+-	+	†~	†─	6
70 Operation selection			Õld		1		Õ			Õ				1-1		_	+		_	1	_		†**†		_		1				_	Ö		_	-	+	+	ヤ~	†~	†─	7
71 Next tool, input tool locking position (horizontal, vertical	a))	Ħ	Ŏ C	5		Ŏ	0	+	+	Õ		_	+	П	$^{+}$	+	\top	H	+	tt		00			0	С	H	\forall	_	+	+	Ö		_	+	+	+	T	t	t	7
72 Pot advance			o c		1	Ö	_	a		Ö		-		1		_	-	1		0	-		T	_	_	Ť					_	Ö		_	_	_	+	+	1	1	7.
73 Tool lock		11	o l	10	†	Ö	-	<u></u>		Ö				1		_		1		Ť	_		††		_		1				-	Ö			_	_	+	+	+	┿┈	7
74 Next tool, input tool unlocking position (horizontal)		1	Ö	Tö	-	Ö		<u>-</u>		Ö								-		1-1			1	0			1				_	Ö					+-	+	┪~	┪	7
75 Next tool ready input tool unlocking ready position (ver	tical)	+-+	ă	Τŏ	1	Ö		ŠT.		ő				tt				····		tt		~†~	ñ	ö	1	5l≚	1					Ö			-	+	+-	+	†~	┿~	7
76 Next tool ready input tool unlocking ready position (hor	rizontal)	Н	o l	ō	Н	Ö		Š	+	Õ		_	+	Н		\top	+	H	_	Ħ	+	О		Ö		5	H	\neg	_	+	Ť	Ö		\neg	$^{+}$	+	+	+	t	t	7
77 Next tool ready input tool unlocked position (vertical)	12011041/	+	ŏt-	Tŏ	-	ő		ŠŤ-		ő				_		-			_	1				Ö		<u> </u>					_	Ö			-	_	+		+-	+	7
78 Next tool ready input tool locking position (horizontal)		_	ŏ	Tŏ	†	ö		ŠŤ-	+	Ö				177	_	_		-	_	1-1	-+	Ĭ			ölö	śt	-				+	Ö		_	+	_	+	+	+-	+	7
79 Tool unlock		+	ŏla		т	ŏ	1	0	+	ŏ		_	_	Ħ	\vdash	\top		ΙT	+	T^{\dagger}	$^{+}$	┱	††	ΤŤ	1	+-	1	-	-	+	+-	Ö		-		-†-	+	+	1-	1	7
80 Pot retract		1	O C		-	Ö	0	<u> </u>		Ö				_				-		10			1		-		1					Ö					+-	+	┪~	┪	8
81 Tool transfer complete		Ħ	olo	-	Н	ŏ	Õ	$^{+}$	1	O		_	+	П	$^{+}$	+	\top	H		ĭ	+	_	Ħ	\vdash	$^{+}$	+	Ħ	\dashv	_	$^{+}$	+	O		\dashv	$^{+}$	+	$^{+}$	$^{+}$	t	t	8
82 Operation selection		+-+	ŏΙά		┪	ö	õ		+	ő			_	†**†		-		o		tt			†**†	-	_	+	1				+	Ö					+-	ヤ~	†~	┿┈	8
83 Calling tool locking position (horizontal, vertical)			ŏlc		m	ő	6	+	+	Ö		-		17	一十	+	+	ŏ	+-	††	7	ölö	††	1	ö†	To		_	_	_	+-	Ö		_	+	+	+	+	1-	1-	8
84 Pot advance			ŏlc		m	ö		<u></u>	+	ő	-	-	_	17	1	_		ŏ	+	tot	†`	Ť	††	ΤŤ	_	Ť		_	-	_	+-	Ö		_	+	+	+	+	1-	1-	8
85 Tool lock		T^{\dagger}	ŏ	10	П	ŏ		ŠŤ-	T	Ö		_		П	\top	T		ŏ	1	TŤ	T	T	П	\top	T	T	П			+	\top	ŏ		_	\top	T	\top	T	1	1	8
86 Calling tool unlocking position (horizontal)		П	Ó	ō	П	Ö		5	T	Ö		T	T	П	\sqcap	\top		Ö	T	Ħ	1	0	П	0	T	0	П	\dashv	T	T	0	Ö		7	\top	T	\top	T	T	T	8
87 MG manual change unlocking ready position (vertical)		1	öΓ	Τŏ	1	Ö		Š		Õ				† **†		_		ō	+-	† †		T-		ŏ	7	51~	1					Ö			_	_	+-	+	†~	†~	8
88 MG manual change unlocking ready position (horizontal	1)	T-+	ŏ	ŏ	m	Ö		ŠŤ.	†	Õ			7	177	_	_	1	ŏ		1t		lo		ŏ	Ċ	51	1			7	7-	Õ		_	7	7	+	⁺	1-	1	8
89 MG manual change unlocked position (vertical)		T +	Ö	ō	m	ŏ		ŠŤ-		Ö				17	7	_		ŏ		11	7	ō†‴		ŏ		51		_			1	Ö		_	_	+	+	T	1	1	8
90 MG manual change locking position (horizontal)		T^{\dagger}	Ö	ŏ	П	ŏ		ŠŤ-	1	Ö				17	7	_	1	ŏ	1	11	T	To			Ö	~~~	П			_	1	Ö		_	_	_	\top	†	1	1	9
91 Tool unlock		П	ŏlo	٦Ĺ	П	Ŏ	-	9	T	Õ		T	T	П	\vdash	T	П	ŏ	T	Ħ	\top	Ť	П	\sqcap	Ť	T	П	T	T	1	T	Ŏ		7	\top	\top	\top	T	T	T	9
92 Pot retract		17	Ö	5	1	Ö	0	_	+	Ö				17	_	_		Ö		o			Ħ	_	_	+-	1				-	Ö			_		+	+	1-	1-	9
93 Tool transfer complete		1	Ö	5		Ö	õ	7	1	Ö			_	T 7	_	_		Ö		†		┪	17	_	_		1	_	_		-	Ō		_	_	7	+	7	1-	†	9
94 Operation selection		17	Õ			Ō	õ	7	1	Õ			1	T 1		_		Õ	7	TT		1	177		+	1	1				7-	Ō		_	7	7	1	7	1	1	9
95 MG manual change locking position (horizontal, vertical)	17	Ŏ C			Õ	0	1	1	Ö				П	\Box	_		Ö	1	TŤ	7	οÖ	1	1	Ö	To		\neg		_	1	Ö		_	_	1	T	1	1	1	9
96 Pot advance			00		П	Ö	-	9	T	Õ		1	T	П	Ħ	T	T	0	T	0	T	Ť	П	T	T	T	П	Ħ	1	\top	T	Ö		\neg	\top	\top	Т	Т	Т	Т	9
97 Tool lock		\top	ol	10	П	ŏ		ŠT-	T	Ö		_		П	\sqcap	T		ŏ	1	TŤ	T	T	П	\top	T	T	П			+	\top	ŏ		_	\top	T	\top	T	1	1	9
98 MG manual change unlocking position (horizontal)		1	Ö	Ö	1	Ö		5	+	Ö				17	_	_		Ö		17		70	1	Ö	_	To	1	-			Ö	Ö			_		+	+	1-	1-	9
		+	⇒t~	٦ŏ	t	Ö		~ ~		ő				++				ŏ		++		t		ŏ	-12	₹†~	1					Ö						+	+	┿~	9
99 Storing tool unlocking ready position (vertical)																															10										

MA-1	2500H			7					8	3		Т			9					7	10					11					12			$\overline{}$	٦
	matrix magazine) logic table MAP029A	80 40	0 20	10 08	04 0	2 01	80 4	0 20	10	08 0	4 02	01 8	0 40	20	100	8 04	02	01 80	40			04	02 01	80	40 20			02 0	1 80	40 2	0 10 0	08 04	02 0	1	
Operation sequence No.	Output logic 4/6	Spindle rotation inhibited Manual axis advance inhibited	RS air blow	Spindle air blow		Manual tool change	Next tool cancelled	AT – axis mu side	standby p	removal cor	Active tool writeng	A B mode investig	Change arm rotation command	continuous step command	Step reverse inhibited	NO answer back Auto branch	Step timer No.2	Step timer No.1 ATC start position		C-axis travel inhibited	A-axis travel inhibited	Z-axis travel inhibited	Y-axis travel inhibited X-axis travel inhibited		Same T command valid U-axis connection OFF command	U-axis connection ON command	Determining NG tool	TS-axis braking command Determining return fool	MG manual operation storing cycle	operation calling	ready		Tool change position command (HP7)	change position command Operation sequence No	
51	Tool unlock))												0			Ш			51	1
	Pot retract		0																		I							0						52	
	Tool transfer complete		11		<u> </u>		0		1					1		0 0)		1									0	1				1	53	
	TI-axis transport unit tool grip position/U-axis connection ON	<u> </u>	44		1				-					-		2	1		11			1		-					1		44		1	54	4
	Transport unit on MG side	\vdash	+	+	H	+	\vdash	+	H	+	+	+	+	+		S S	+	+	Н	+	+	\vdash	+	H	+	\vdash	+	+	+	\vdash	+	+	\vdash	55	
	TS-axis B grip transport unit tool grip position (0-degree rotation)	╌	+-+		┿		٦		+-+		+	-+		+			+-1		╁╌┼	-		╁╌┼		╁┈┼		├┼-		_	+-+		+-+		╁╌┼╴	56	
	Tool transfer complete	-	++		╀┈┼┈		0		++					+	Olc	~+~	4		┿┽			╁┈┼		++				힞	┿		+-+		╁╌╁╴	57	
	Operation selection Next tool ready return tool locking position (horizontal, vertical)	╌┼╌	+-+		╌┼	+	-		+-+		+		+	┿┥		40	4-4		₩	-+-	+-	╁┼		+-				0	+		1		+-+	58 59	
	Pot advance		10			+	-		+-+				-	+		+	₩		+	-	+	-		₩				 	+		1		+	60	
	Tool lock	H	19	+	H	+	+	+	+	-	+	+	+	+	+	+	Н	+	Н	+	+	H	+	Н	_	+		0	+		3	+	+	61	
	Next tool ready return tool unlocking position (horizontal)	-	┿		╂┈┼╴				++					+			┿┥		┿		+	╁┈┼		┿				<u></u>	++		<u>5</u> 1-1		╂┷┼╸	62	
	Return tool unlocking ready position (nonzontal)	 	┿		╂┷┼				++					+		+	┿┥		╁┯╁		+	╫		╁┈┼				ŏ	╂┈╂		<u> </u>		╁╌┼╴	63	
	Return tool unlocking ready position (horizontal)	 	++		tt-		-		++		+			+		+	┉		†~†	-	+	 -		† †				ŏ	++		át t		 	64	
	Return tool unlocked position (vertical)		+				-		+-+					+		-	+		†**			-		-				ŏ	++		át t		+	65	
	Return tool locking position (horizontal)	H	+	+	Ħ	+	\vdash	+	T	_	\pm	_	\top	Н	\vdash	$^{+}$	Н	_	Ħ	\top	t	H	+	H	_	\vdash		ŏ	+			+	\vdash	66	
	Tool unlock		++		tt-				-			*****	-	+		-	1		†**			-		***				Ö	+	7	51 1		 	67	
	Pot retract		10		tt-		-		1					+			1		 		+	-		1				ō	+		át t		tt-	68	
	Tool transfer complete	!	† <u>*</u> †		tt-		õ		1		_		_	1		To	1		†**†	-	+	177		1			-	ŏ	11		51 1		tt-	69	
	Operation selection	!	177	_	T		-		1		_		_	1		To	,		177	_	1	177		1			_	Ō	1	-	1			70	
	Next tool, input tool locking position (horizontal, vertical)	Ħ	TT	T	Ħ			1					1	\Box		Ť	П		П	7	т	П		П		П		Ō	Ħ		0		П	71	ī
72	Pot advance		0														П		m		1			П				0			0		П	72	2
	Tool lock		111						1								П		1	1	1	11		T				0			0			73	3
74	Next tool, input tool unlocking position (horizontal)	1	1		1		-		1					1			П		T	1	T	П		П				O			0		П	74	4
75	Next tool ready input tool unlocking ready position (vertical)		Ш		Ш											Т	П		П		Т							0			0		Ш	75	
76	Next tool ready input tool unlocking ready position (horizontal)			\perp																								0			0		П	76	
77	Next tool ready input tool unlocked position (vertical)		\perp		Ш														Ш			Ш						0	\perp		0		Ш	77	
	Next tool ready input tool locking position (horizontal)		\perp		Ш												Ш		Ш			Ш						0			0			78	
	Tool unlock	L.,	11		<u> </u>				1					1			Ш		1		1			1				0			0		11	79	
	Pot retract	Ш	0	_	ш		ш						_	ш		_	Ш	_	Ш	4	_	Ш		Ш				0	\perp		0	4	ш	80	
	Tool transfer complete	├ ─├	4-4	4	1-4-	4	O_	4	44		44	4		44	 	- 0		_	╁┤	4	4	₩		1	_			<u>o</u>	44	 -	이		╁╌╁╴	81	
	Operation selection		+	-	┵	-	-		+		+			+		0	4-4	_	₩	-	+	₩		1				0	+	<u>_</u>	++		+	82	
	Calling tool locking position (horizontal, vertical)	₩.	1,1	-	₩	+-	-		+-+		+	-	+-	+	-	+-	₩		₩	-	+	₩		₩	_			0	+	0	+-+		+-+	83	
	Pot advance	\vdash	0	+	\vdash	+	\vdash	-	+		+	+	+	+	-	+	+	-	\vdash	+	+	\vdash	-	\vdash	_	-		0	+	00	+	-	+	84	
	Tool lock Calling tool unlocking position (horizontal)	\vdash	+	+	+	+	H	+	+	-	+	+	+	Н	+	+	Н	+	Н	+	+	H	+	Н	+	+		0	+	0	+	+	+	85 86	
	Calling tool unlocking position (horizontal) MG manual change unlocking ready position (vertical)	┿	+-+		╁╌┼	-	┝╌┼		+-+		+	-+		+	├┼-	+-	┿┥		╁╌┼	-	+-	┿		┿		├┼-		8		0	+-+		┿	86	
	MG manual change unlocking ready position (vertical) MG manual change unlocking ready position (horizontal)	╆┿	+-+		╆╌┼╴	+	┝╌┼		++		+	-+		╫╢	├┼-	+	┿┥	-+-	┿	-+	+-	╁╌┼		┿				8		ő.	++		 -	88	
	MG manual change unlocking ready position (horizontal) MG manual change unlocked position (vertical)		++	+	++	+-	⊢┼		+-+		+		+	+	-	+-	+		+	-+-	+-	₩		+				8	+	8	++		+-+-	89	
	MG manual change locking position (horizontal)	 	++	+	\vdash	+-	-		+-		+-		+-	+	-	+-	+		+	+	+-	╁		+				 	+-	8	++		++	90	
	Tool unlock	\vdash	+	+	H	+	H	+	H	+	+	+	+	Н	+	+	Н	1	H	+	+	H	+	H	-	+		ŏ		0	+	+	+	91	
	Pot retract	t	10		tt-	_	-		+-+		+		+-	+-	-	+-	+		+	-+-	+-	+		1-				ŏ	+-+	Ö	+-+		1-1-	92	
	Tool transfer complete	t	╅╅		t	+	õ		+-+		+		+	+		To	1		$^{++}$		+	††		1				ŏ		ő	+-+		t	93	
	Operation selection	t	+-+	+	t†-	+-	řŤ		+-+		+			+	 	-10			†††	-+	+	† †		1-			- -	0	+-+	 	+++		1-1-	94	
	MG manual change locking position (horizontal, vertical)	tt	11	_	t	+-	-		1		+		+	+-	_	╁	+		††	-	+	Ħ		1				ŏ	o	-	+++		1-1-	95	
	Pot advance	Ħ	0	\top	Ħ	T	Ħ	$^{+}$	П	_	П	T	\top	П	\top	\top	П	1	П	\top	T	Ħ	1	П		Ħ		ŏ	Ö		\top	1	Ħ	96	
	Tool lock	m	17	_	ΠŤ	1	ΙT	_	\Box			T	+	П		\top	П		П	T	T	П	1	П				ŏ	Ö	\top	11	1		97	
	MG manual change unlocking position (horizontal)	1 1	11	_	TT	1	m					_	_		_	+	17		T	_	†	17		1			_	ŏ	Ö		17		17	98	
	Storing tool unlocking ready position (vertical)	1	77		ΓŤ	1-	mt		1		1		_			7	Ш		TT	_	†	17		1			-	Ō	Ō		+++	_		99	9
	Storing tool unlocking ready position (horizontal)	П	77		T 1		r		T		1			7-1		7	T'''		T	7	1	ΤŤ		T				ol	0		77			100	ã

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	matrix magazine) logic table MAP029A	80 4	0 20	100	8 04	02	01 8	0 40	20 1	0 08	04 0	2 01	80 4	10 20	10	08 0	4 02	01	80 4	0 20	10	08	04 02	2 01	80	40 2	20 10	0 08	04 0	2 01	80 4	10 21	0 10	080	4 02 0	01	\exists
Operation sequence No.	Output logic 5/6	Tool pot on MC side	Tool pot unclamp	Tool pot clamp	Change arm tool unlock	retract	Tool pot advance	Tool breakage inside MG detection cycle start	e inside MG detection in standby position	axis 135 degrees	I inhibited	brake release)FF command	Magazine manual interruption available ATC air blow check	e arm check	ATC door open inhibited		k for pot presence	position command	ete command rolete command	t vertical retract command	Magazine pot unlock command	Magazine pot lock command Return tool command		al return ATC shutter close	an command	Oylinder unclamp inside spindle command Determining chage arm B primer tool present	hibited	ole inhibited	Netractable Oyliner unclamp outside spindle command	transport unit tool grip position	II-axis spindle tool extraction position II-axis spindle tool grip position	by position	TS-axis 90 degrees	270 degrees		Operation sequence No.
101	Storing tool unlocked position (vertical)	C		0	О		0		0							0			(0	C))					П		101
102	Storing tool locking position (horizontal)	C		0	О		0	I	0							0			Ι	С			0 0							2	П	\perp		\perp	\square		102
	Tool unlock			 	Q		Q.	1	0		 				4-4	0	٠,	Ш	_		1	Ш	1	4	1		_	44			$\bot \bot$		11	_	44		103
	Pot retract		0	- -	- 0	0	-	+	0	4-4	-	-	-	-	+	0	-	0	-+		4-	$\vdash \vdash$	-	4	1		-	4-4		2	₩	-	44	_	+-+		104
	Tool transfer complete		0	Н		0		+	0	+	H	+	+	+	+	0	+	Н	1	1	+	\vdash	+	+	H	4	+	+		2	\vdash	+	+	+	+		105
	Tool change standby complete position (horizontal, vertical)	@		⊢⊦		Ö	-	+-	0	-		+		-	+		-	-	0	SIC	4	⊢	-	+-	-		-	+		2	₩	+	+-		+-+		106 107
	Transport unit on MC side	<u>◎</u>	0	╁╌┼	. 0		⊢⊹	+-	0			0		-	+-+			₩	-		+	⊢	-	+-	+		-	+		2	₩	-	0	-	+		107 108
	TI-axis in standby position (170 mm) (0 mm) TI-axis transport unit tool grip position (170 mm) (-170 mm)	<u> </u>	0	┝╌┼╴		0			0		-				┿┉┪			┿			+	-			-			+))	Ы		191		┿		109
	Transport unit tool grip position (170 mm) (=170 mm)	9	10	┝╌┼╴		lõ		+-	0		-	-			╫┉╂			┿	-+		┿┈	┢┉┼		+	+			++		5	М		+		┿		110
	Transport unit on MG side Tool transfer complete			H		0	\vdash	+	0	+	H	0	+	+	+	+	+	Н	+	+	+	H	+	+	H	\dashv	+	+			H	+	+	+	₩		111
	TS-axis B grip transport unit tool grip position (0-degree rotation) (for SEQ22 return)		0	 -		ő		+-	Ö		ō				╁┈╅			╁╌╁	-+		+	-		+	++	0			ō c		╁┈┼	+	+		+-+		112
	TS-axis A grip spindle tool grip position (270-degree rotation) (for SEQ28 return)	0	ŏ		10	0			ŏ		ŏ		0		+			-			+	-				0		70	ŏ		+-+	+	+-1		101		113
	TS-axis B grip spindle tool grip position (180-degree rotation) (for SEQ34 return)	Ö	0	1		lŏ		_	Õ	-	Ö		Ô	_	1		_	1	_		+		-			ő	_	ő			†	_	1	7	TT		114
	TS-axis A grip transport unit tool grip position (90-degree rotation) (for SEQ44 return)	(0	0		0			0					_					_	_	1	П		_						5		\top		O	\Box		115
	TS-axis A grip transport unit tool grip position (90-degree rotation) (for SEQ55 return)	(0	т		0			O						\Box			П	T	T	T	П		T		T				5	Ħ	\top	П	Ō	П		116
117	TI-axis transport unit tool grip position (170 mm) (-170 mm) (for SEQ107 return)	0	Ю		O	O		Ι.	O								Ι	П	Ι	Ι	Ι		Ι	Ι					C		0	П			Π		117
118	Operation selection (for SEQ110 return)	C	0			0		I	0						П			П	Ι	I	Ι			I					C		П	Т		\perp	\prod		118
119	AT-axis instandby position (90 mm) (0 mm)/TI-axis in standby position (170 mm) (0 mm) (for SEQ37 return)	0	0	Ш	О	0	Ш	_	0			0			\perp					_		Ш		_			4		()	Ш	4	0	_	ш		119
	AT-axis in MG position (900 mm) (0 mm)	0	0		2	Q	L		0		0		0	_	0		-	-	_		4	_				0		0			↓	_		_	4-4		120
121	Change arm tool lock/AT-axis (240 mm (-570 mm)) Simultaneous movement 3 affter movement	0	0	╙		0		_	0		0		0	_	4-4		_	-	_		4	_				0	_	0			┷	-		_	4-4		121
122	TS-axis A grip tool breakage inside MG measurement position (135-degree rotation)/AT-axis simultaneous movement 3	0	0	Н		0		+	0	0	0	-	0	+	+	_	_	Н	+	+	╀	Н	+	+	-	0	_	0	_	+	Н	+	-	0	₩		122
	TI-axis in standby position (220 mm) (0 mm)	0	10	┝		0			0		0		0	-	+		-	-	-		+	\vdash			+_	0	-	0		_	₩	-	0		+		123
124	ATC shutter close/U-axis connection ON	<u>o</u>	0	-		Q			O.				0		+			-		-	+	-	-		O			-		2	╁┵		┿┥		+-+		124
125	AT-axis transport unit tool grip position (170 mm) (-170 mm)/U-axis connection ON	0	0	┝╼┼		0	ļ		0	_	-				╬┉╂			┿			+	-))	0						125 126
	Measurement unit preparation (down) Tool breakage detection cycle	0	0	┝╌┼╴		ő	├ ── ├	0	9		 -				┿┪			╆┯╂		┉┼┈	┿┈	╌┼		+	┰			++			╂┉┼	-	╌┼╌┤		+-+		120
	Measurement unit retract (up)	0	ő	 		ő		-12	0	e	 				++			╁┷╅	-+		+	-			+			++		ő	╀┈┼		+		+-+		128
	TI-axis in standby position (170 mm) (0 mm)	Ö	lŏ	 		ŏ			ő				_		+		_	+	-		+	1			-		_	-			++	-	10		†††		129
	TS-axis A grip transport unit tool grip position (90-degree rotation)	Ö	lo			10			Ö	_	 			_	++		_	171	-		+	1		-	1		_	+		Š	†	-	1	0	†**		130
	TI-axis in standby position (170 mm) (0 mm) (for SEQ124 return)	Õ	lo			0			0					_	1				_		_							_		2	1	_	0		1		131
132	TS-axis A grip tool breakage inside MG measurement position (135-degree rotation) (for SEQ129 return)	O	Ō			lo			Ō	0											1																132
	Tool change standby complete position (horizontal, vertical)	(0			0					Ι	\prod		\perp	\prod	0	olc			Ι	Ι			\perp	\prod	00		П	Ι		I	\Box		133
134	Transport unit on MC side	0	0		Q	Q	П	I	0			Q		I	П		T	П	I	Τ	Ι		T	Ι	П		I	П	00		П	I		I			134
	Transport unit on MG side	(Ц		0	Ц	1	0	ш	Щ	Ö	Ц	1	Ш	Щ		Щ	_[1	1	Ц		1	Ц	\Box	_	ЦŢ		2	Ц	1	Ш	₩	ЦŢ		135
	Tool transfer complete		0	\sqcup		0		4	0	4	1		1	_	\perp	1	4	\perp	4	4	4_	Ш	_	4	1	_	_	44		2	Ш	_	44	_	44		136
	TI-axis in standby position (for SEQ130 return)	Ω	Ω	├ -├		Ω	╙┼		Ω	44	 	4_	 -		+			Ω	-		4	┝		4	 			4-4		2	₩	-		_	44		137
	Transport unit on MC side (for SEQ54 return)	<u>Q</u>	Ō	⊢⊦		0	⊢⊹	+	Ō.		-	Ω	-	-	+	-	+-	+-	+		4-	\vdash	+	+	+-	-	-	+		2	₩	-	+		+-+		138
	Operation selection (for SEQ56 return)			⊢⊹		0	⊢⊹	+	0	+-	┢	_		+	+	-	+-	₩	+		+	\vdash	+	+-	+-	-	-40	4		2	₩	+	+	-	┿		139
	Transport unit on MG side (for SEQ106, 133 return)		0	+		0	+	+		+	+	0	+	+	+	+	+	Н	+	+	╀	\vdash	+	+	H	+	+	+))	Н	+	+	+	₩		140
	AT—axis transfer unit tool grip position (90 mm) (90 mm) (for SEQ16 return) AT—axis in standby position/TI—axis in standby position/U-axis connection OFF (for SEQ37 return)	0	0	╁		0	╁	+-	0	-		_	-	C	4-1			₩	-		+	⊢	-	+-	+			+-))	₩	+	0	-	+		141 142
	Al-axis in standby position/II-axis in standby position/U-axis connection OFF (for SEU37 return) TI-axis transport unit tool grip position (for SEQ128 return)	7	12	\vdash	-12	12	\vdash	+-	0	-	-	-12		-	+		+	┿		+	+		-	-	+			+-+		╣-	t	-	الال		+-+		143
143	11 axis dansport unit tool 200 bostuon (101 SEQ 120 16tum)			Н			Н	+	· ~	+	\vdash	\top	\vdash	+	Н	\vdash		Н	1	+	1	Н	1	+	Н	_	1	Н		_	0	+	Н	+	o	十	70
ABT	_k		Т	П	1	Т	т	1			П		П	1	П			П	1	Т		П	┰	Т	П	П				1	П	\pm	П	\neg	\Box	T	╛
					1	1								-					7	_			_	1								\neg		\neg	\Box	\neg	\neg

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ATC	matrix magazine) logic table MAP029A	80 4	0 20	08	04 0:	2 01	80 41	0 20	10 0	08 04	02 (01 80	40	20 1	0 08	04	02 0	1 80	40	20 10	08	04 (12 01	80	40 2	0 10	08 04	4 02	018	30 40	20	10 0	B 04	02 01	
Operation sequence No.	Output logic 6/6	Spindle rotation inhibited	RS air blow	Spindle air blow			Next tool cancelled	AT-axis spindle side	standby p	Active tool removal command Next tool installation and active tool storage command	writ	A. B mode invalid	Change arm rotation command	continuous step command	Step reverse inhibited NC answer back	Auto branch	Step timer No.2	Step timer No.1 ATC start position	1 1	C-axis travel inhibited R-axis travel inhibited	trave	Z-axis travel inhibited	T-axis travel inhibited X-axis travel inhibited		Same T command valid	connection ON c	Determining NG tool	TS-axis braking command	Determining return tool	MG manual operation storing cycle MG manual operation calling cycle	Tool ready return cycle	Tool ready input cycle		Tool change position command (HP7) Tool change position command (HP1)	Operation sequence No
	Storing tool unlocked position (vertical)														\perp						L							O		<u>ی</u> [د	П				101
	Storing tool locking position (horizontal)		44								1						<u> </u>				_	Ш						0		2	1		4-4		102
	Tool unlock	↓	4-4			4-4	_		<u> </u>		 -		4-4	 -		-	ļļ.		₩	-	↓	⊢∔		4-4				O		<u> </u>	╁┷╁				103
	Pot retract	₩	0		-	4-4	_		₩		₩		+-	┝	+	+-	⊢⊦		₩	-	+	\vdash		+-				0		2	₩	-	4		104
	Tool transfer complete	\vdash	+	+	+	+	0	+	\vdash	+	\vdash	+	+	Н	+	10	Н	+	Н	+	+	${}$	+	+	+	+	+	0	-10	2	Н	+	+	+	105 106
	Tool change standby complete position (horizontal, vertical) Transport unit on MC side	╆┉┼╌	++								++	+	+		-+	+			╁╌┼		+			+				0	-+		╁╌┼		+-1		106
	Transport unit on MC side TI-axis in standby position (170 mm) (0 mm)	+	++	-		+	-	+-	-		++	+	+	+-+	+-		╁	+	₩	-+-	+	\vdash	+-	1-		+-		0		+-	┰	-+-	+	-	107
	TI-axis in standay position (170 mm) (0 mm) TI-axis transport unit tool grip position (170 mm) (-170 mm)	 	+-+		-	+-+	-	+	+-+		++	+	+	++	0	الا	++	+-	┿		+	\vdash		1-		+-+		0			++		+	_	109
	Transport unit on MG side	t	++			++					 		+	╫┈┼╴	0	4	h		╆┯╂	-	+	1		+				0			┿		++		110
	Tool transfer complete	Ħ	\top	\top	+	Ħ	C	\top	Ħ	\top	\vdash	十	т			0	H	\top	Н	\top	T	Ħ	\top	Ħ	_	T	_	0	\dashv	+	Н	\dashv	\top	\pm	111
	TS-axis B grip transport unit tool grip position (0-degree rotation) (for SEQ22 return)	t	1	_		11	~		 - -		† **†		1	11-	~+~	1×.	tt-		177	-	┪	m		1					-		177	_	*****		112
	TS-axis A grip spindle tool grip position (270-degree rotation) (for SEQ28 return)	T	177			1	_			_	0		0			1	1-1-		m			1									***	_	++		113
	TS-axis B grip spindle tool grip position (180-degree rotation) (for SEQ34 return)		11			177					1					_			m		_								_		1	_	1		114
	TS-axis A grip transport unit tool grip position (90-degree rotation) (for SEQ44 return)	П	11			TT									0)			П				T						T		T				115
	TS-axis A grip transport unit tool grip position (90-degree rotation) (for SEQ55 return)	Ħ	TT			11					П		П	П	Ō)	П	T	П	T	T	Ħ	T						T		П		П		116
	TI-axis transport unit tool grip position (170 mm) (-170 mm) (for SEQ107 return)		777			77									Õ)			П		1							О			T				117
118	Operation selection (for SEQ110 return)		\prod			\prod					Ш	Ι	\Box			O		Ι.	П	Ι	Ι		Ι		0			0	Ι		Π			\Box	118
119	AT-axis instandby position (90 mm) (0 mm)/TI-axis in standby position (170 mm) (0 mm) (for SEQ37 return)		TT						0																			0							119
120	AT-axis in MG position (900 mm) (0 mm)	00					C									0					0	0	\circ											\perp	120
121	Change arm tool lock/AT-axis (240 mm (-570 mm)) Simultaneous movement 3 affter movement	00				\perp															0	0	\circ)											121
	TS-axis A grip tool breakage inside MG measurement position (135-degree rotation)/AT-axis simultaneous movement 3	00				\perp	C				ш		Ш	ш			ш		Ш			0							_		Ш	_	\perp	4	122
	TI-axis in standby position (220 mm) (0 mm)	00	4								1										0	0	2 C)					_						123
124	ATC shutter close/U-axis connection ON	\sqcup	11			1					1								1		_	_		4		O					1		44		124
	AT-axis transport unit tool grip position (170 mm) (-170 mm)/U-axis connection ON	L	4-4	_		4-4					4-4		4	 	Q		 		1		+	<u> </u>	_	-					_		1				125
	Measurement unit preparation (down)	!	4-4			4-4			L		11		4	 	Q		 -		11	4	╀	\sqcup		4		4-4		4	_		4-4		4-4		126
	Tool breakage detection cycle	↓	4-4			4-4	_		<u> </u>		 -		4-4	 -	Q		ļļ.		₩	-	↓			4-4					-		╁┷╁				127
	Measurement unit retract (up)	₩	+-+								++			┝╌┼╴	0		-		₩		-	₩		-							++				128
	TI-axis in standby position (170 mm) (0 mm)		+			+					┿		+	┝┈┼╴	Q		 -		┿		+	┝╌┼		+							┿┿		╌┼┈┼		129
	TS-axis A grip transport unit tool grip position (90-degree rotation)	┼┼-	++								++		+	┝╼┾╴	-40	0	╌┼╴		₩		+	₩		-							┿┿				130
	TI-axis in standby position (170 mm) (0 mm) (for SEQ124 return) IS-axis A grip tool breakage inside MG measurement position (135-degree rotation) (for SEQ129 return)		++			+	-				++	-	+			+	-		╁	-	+-	-	-	+					-+		╁╌┼		+		131
		+	+-+			+	-				++		+			+			╁╌┼		+	-		++				0	-+		+	+	+		132 133
	Tool change standby complete position (horizontal vertical) Transport unit on MC side	+	+-+			+	-				++								++				-	+				0	-+		++		+		134
	Transport unit on MC side Transport unit on MG side		┿								++		+	┝┈┾╴		14	┝╌┼╴		╁╌┼	-	+	-		+				0			┿		╌┼╌┼		135
	Transport unit on wid side Tool transfer complete	Ħ	+	+	+	+	\top	H	Ħ	+	Ħ	+	Н	1	2	0	Ħ	+	H	$^{+}$	T	H	+	Ħ	+	+	\top	0	\dashv	+	Н	\top	+	\pm	136
	TI-axis in standby position (for SEQ130 return)	t -t-	10	_	-	$\dagger \dagger$	_	-	_	+-	$^{++}$		1	1-1	×	✝˘	H	_	Ħ	+	+	\vdash	-	+	_	+	_	12	-	+-	$^{++}$	_	+		137
	Transport unit on MC side (for SEQ54 return)	T	1 ~1	_		177	T	1		_	17		177			1		1	177	_	†		1	1		1			t	7	177		77		138
	Operation selection (for SEQ56 return)		\Box			\Box										То					I		1		0		\perp				\Box^{\dagger}			\Box	139
	Transport unit on MG side (for SEQ106, 133 return)	Ш			\square	\Box	\Box			\Box		\mathbf{I}		Ш	O			I		\Box	L	Ш	I				\Box	0		\perp				\Box	140
	AT-axis transfer unit tool grip position (90 mm) (90 mm) (for SEQ16 return)		П	П		П	C	2				I			0)		Ι		\perp			I	П				0	I		П			\perp	141
142	AT-axis in standby position/TI-axis in standby position/U-axis connection OFF (for SEQ37 return)	П				П	I		0		П	I			Τ		П	Τ	\prod	Ι	Γ		Ι	\prod			\perp	0	Ι	I	П	I	П	I	142
143	TI-axis transport unit tool grip position (for SEQ128 return)	Щ	П		ΙÏ	П	Т	Ш	Щ	T	Щ	T	Ш	Щ	lô		Щ	T	لتنا	T		Щ	Т.	آثا		Ш	T	Ш		T	آثا	Ţ	\Box	Т.	143
\vdash		\vdash	$\downarrow \downarrow$	4	Ļ	Ш	Ļ	Ļ	ĻĻ	Ļ		_	Ļ	ĻĻ	_		Ļ	_	Ļļ	Ļ	Ļ	Щ	_	щ	_	,	_	Щ	\perp	4	Щ	_	Ш	4	ш
ABŦ	-K	\vdash	44	4	4	\perp	4		\sqcup	-	Н	_	\perp	\vdash	-		Н	_	Н	-	-	Н	-	+	\perp	\perp	-	\perp	Н	\perp	Н	_	\perp	4	\sqcup
\blacksquare					\perp	1	-			1	<u> </u>									1	1				\perp		1		\Box					L	

MA-1	2500H					ľ	1					2						3						4					5						6		П		
ATC	(matrix magazine) logic table MAP029A			80	40 2	0 10	08	04 02	2 01	80 4	0 20	10 08	04	02 (1 80	40	20 1	0 08	04	02 0	1 80	40 2	20 10	08			80	40 20	100	08 04	02	01 8	0 40	20	10 08	04	02 0)1	_
Operation sequence No.	Manual interlock 1/8	Step reverse	Return cycle	t spindle side co	Tool pot magazine side confirmation ON	pot clamp confirmation Of	arm tool unlock confirmatio	Change arm tool lock confirmation ON Tool not retraction confirmation ON	pot advance confirm	Tool pot tool present	No tool pot tool				U-axis spindle indexing position MG manual interruption OFF	shutter open conf	shutter close	ATC shutter close confirmation ATC shutter open confirmation OFF	shutter open	Tool present in transfer pot			Movement to not vertical retract position complete Movement to not vertical position complete	o pot unlocking horizontal	Movement to pot locking horizontal position complete	tool	ndle tool present clamp confin	No spindle tool interlock Not in manual tool chage cycle	2 pallet cleaning	LS axis servo UN contirmation Cylinder unclamp outside spindle	clamp outside spir	Cylinder clamp outside spindle OFF APC start nositon		manual operation command	MG manual operation command calling Not MG manual operation command	arm B gripper tool	age inside MG detection in		Operation sequence No.
1	Writing next tool	1	1		0 0			00		(2							Q C											O								П	I	1
2	Operation selection	53			(2	Ш						\perp	_	C				_		1	Ш				_	Ш		0		11			Ш	C		Ш		2
	Next tool locking position (horizontal, vertical)	52	53	44		1	III.		4.]		2	<u> </u>	44	4	<u> </u>	Ш	L.L	4	Ψ.	0	4	Щ	C	4	O	4	Ш		0	_L_	1[<u></u>	ĻГ			Цľ		3
	Pot advance	51			-	+-	\sqcup	_		0	+-	├ -	+4	4	+	┯	1	4	+	\vdash	+-	\sqcup	4	4	_	4	H		힞	-	₩	-	+	₩		+	\vdash	_	4
	Tool lock	50			+	0	\vdash	+	+	0	+	\vdash	+	+	+	Н	\vdash	+	+	H.		\vdash	+	0	-	+	Н		0	+	Н	+	+	\vdash	+	Н	\vdash	+	5
	Next tool unlocking position (horizontal)	49 48				-	-	-	+				++	-+	-				+		4	Н.	_	10		+	₩		의		++		-	₩			┿		6
	Tool change standby ready position (vertical) Tool change standby ready position (horizontal)	48				-	-		-				-	-		+			+		-	+	۷	+		ō	╁		0		+-			₩		+			/ 8
	Tool change standby ready position (nonzontal) Tool change standby complete position (horizontal, vertical)	46				-								-					-			+-+		-		0	-		ŏ					-			-		
10	Pot retract	44					-		+				+-+			+			+		+	+		-		12	+		ŏ		++			₩		-	 		10
	Transfer unit on MC side	43		О	+	+	H	+	+	+	+	H	+	+	+	Н	+	+	+	H	+	+	+	+	_	+	H		ŏ	+	H	-	+	H	+	+	H		11
	Change arm tool unlock	42				_	o	-	-							+		_	+	-	+-	+	-	+		+-	m		ŏ		++		+	m	_	+	m		12
	AT-axis transfer unit tool grip position (90 mm) (90 mm)	41				_	Ť		+				++			1	_	_	+		+	1	_	1-			t		ő		†**†			17	_	+	 		13
	Change arm tool lock	40						ol -	_				1			1		_	1	<u> </u>	_	17		1		_	m		o					m			m		14
	Transport unit tool unlock	39			(5	m	****	1					7		m		7	1		1			1		1	M		o		T			П		1			15
16	TI-axis in standby position (170 mm) (0 mm)	141																				П							0								П		16
	AT-axis in standby position (90 mm) (0 mm)	37				1			Ι		I		\prod	\perp					I		I	П					П		0		П	\perp		П			\Box		17
	Waiting for MC cycle end	119						C						T	С	0		C)									0	0								П		18
	Spindle indexed/U-axis connection OFF	37												_	0	0		C											0				2						19
	HP1 (simultaneous movement 1)	37				_	Ш	_	\perp	4	_	╙	+	4	4	0	_	С			+	\sqcup	_	\perp		+	Ш		0	4	Н			Ш	4	ш	\vdash		20
	ATC shutter open (simultaneous movement 1)	36					-						+	-		-	0		0		+-	₩				-	₩		0					₩	-	-	⊢⊹		21
	TI-axis spindle tool grip position (220 mm) (220 mm)	112		4	-	-	-	-	+		-		+	-		-	-	-	+	-	-	₩	-	+-		+-	-		0		+	-		₩	-	-	⊢		22
	TS-axis A grip spindle tool grip position (270-degree rotation)	34					0		+				++	-+		+			+	├┼-		╁╌┼		-					0		┿┵			┼┈┼		+	₩		23 24
	Change arm tool unlock AT-axis spindle tool grip position (810 mm) (-810 mm)	33 32					14		+				┿┿			┿┥		-	+	┝╌┼╌	+	╁╌┼		+			╁╌╁		8		┿┿			╫		+	┢┉╁╴		25
	Change arm tool lock/Cylinder unclamp outside spindle	31			+	+	H.	0	+	+	+	\vdash	+	+	+	+	+	+	╫	H	+	+	+	+	_	+	H		Ö	С	+	+	+-	H	+	+	\vdash		26
	Spindle tool unclamp	30					 	×+	+			 	++			+			+	 -		╁╌╁		+			┉		ŏ		4+			†~+		+	 		27
	TI-axis spindle tool extraction position (170 mm) (390 mm)	113				+	t t		+			 	++	~†		⇈			+		+	1-1		+		+	177		ŏ		†**†		+	†"†		+	十十		28
	TS-axis B grip spindle tool grip position (180-degree rotation)	28				_	1		_					_		1			+	_	_	†	_	_		_	m		ŏ		1		_	m		1	一十		29
30	TI-axis spindle tool grip position (170 mm) (220 mm)	27			_	1			1	_				_†		1		_	T	\Box^{\dagger}	1	\Box	_	1		1-	17	ŏ	ŏ		17		1		_		口上	_	30
	Spindle tool clamp	26	31										П			П					L	П					П	0	0		П	Ι			Ι		П		31
32	Change arm tool unlock/Cylinder clamp outside spindle	25	32			I	0				T			I			I	I	\Box		I	П					П	0	0		0		I	П			II		32
33	AT-axis in standby position (810 mm) (0 mm)	24			Ţ	1	П	_[_			1	LΙ	\Box	_[\perp	П	LŢ	\Box	L	Щ	F	П	_[_			1	П		0	£	\Box	\perp	ļ	П	\perp		μŢ		33
	Change arm tool lock/AT-axis (240 mm (-570 mm)) Simultaneous movement 2 affter movement	114			_	+		0	\perp	_	-	\vdash	\sqcup	4	\perp	\perp	\sqcup	_	+	\vdash	+	\sqcup	_	\perp	_	+	\sqcup		0	+	\sqcup	_	+	\sqcup	\perp	\perp	\sqcup		34
	TS-axis A grip transport unit tool grip position (90-degree rotation)/AT-axis simultaneous movement 2	22			4	+	Н	+	+	4	+	\vdash	+	4	+	Н	\vdash	_	+	\vdash	+	\vdash	+	+	+	+	Н		0	+	Н	+	+	Н	+	+	\vdash		35
	TI-axis in standby position (220 mm) (0 mm)	21					₩		4-4			┝┉┝┉	+-+	+		┿┥		_	+-	₩		╁╌┼		4-4	-		₩		Q.		+-+	-		₩	-	+	┝┷┼	-	36
	ATC shutter close/U-axis connection ON	142			+	-	₩		+	-+		┝┉┼┈	┿┿	-+		┿┥		Ω	+-	┝┿		┿		+		-	╁╌┤		잋		┿┽	-	-	╁╌┼		+	┝╼┾		37
	AT-axis transport unit tool grip position (90 mm)/U-axis connection ON	16			-+		┢┉┼	-+-	+			┢┉┼┉	┿┽	-+		┿┥	┝╾╋		+-	┝┿		╁╌┼		+		+	╁╌┤	-15	0	-+-	┿┽	-+-		┼┈┼	-+-	+	┝┯┼		38
	TI-axis transport unit tool grip position (170 mm) (-170 mm) Transport unit tool lock	15 14			-+	0	┿	-+-	+-		+	┿	┿┿	+	+-	┿┥	 +		+	┿	+	┿		+		+	╁╌┤		8		┿┽	-+-	+	╁┯┼	-+-	+	+-+		39 40
	Change arm tool unlock	13			+	۳	0	+	H	\dashv	+	\vdash	+	+	+	H	H	+	+	H	+	H	+	H	+	+	H		0	+	H	+	+	H	+	Н	\vdash		41
	AT-axis in standby position (90 mm) (0 mm)	12			-+	+	14		+		+	 	+-+	-+		ヤᢇᡰ	-+	+-	+	+	+-	┿	+	+-		+	╅		ŏ		†*†	-+-	+	†*†		+	十十		42
	Change arm tool lock	11			-	+-	1		+				+-+	+	_	1	_	+	+	_	+	+	+	+-		-	H		ŏ		†		+	H	_	1	\vdash		43
	Transport unit on MG side	115			o	-	-	**********	-				-	1				-	-		-	****	-	-		_	1		ŏ		_		-	m		-	m		44
	TS-axis B grip transport unit tool grip position (0-degree rotation)	10				T	П	T		1		I	\top	1	T	П	T	1	T	П	T	Ħ	1	1	_	T	П		ŏ	+	П	T	1	ΠŤ	T	П	广		45
	Pot advance	9	46			Т	П	T	Ю	T	Т	\sqcap	\sqcap	T	1	П	Ħ	T	T	ΠŤ	T	П	1	П	T	T	П		ŏ	T	П	T	Τ	П	T	П	П		46
	Return tool unlocking ready position (vertical)	8	47		I	1		I							I						I		0						o	I		I	I				口		47
	Return tool unlocking ready position (horizontal)	7	48		I	Ι		Τ		I	Ι		\prod	I	Ι	П		I	I		Ι	П	I	Q			\prod		o	I	П	I	Ι	П	Ι		\Box	I	48
49	Return tool unlocked position (vertical)	6	49		I	Γ	Ш	\perp			T		\prod	_[I	П		T	Γ	Ш	L]ç	0		I	П	O	Q	T	П	T		П	\perp		Ш		49
50	Return tool locking position (horizontall)	5	50		- [1	ΙÏ	1 "	1]	oľ	1 "	I I	1 T	ſ	1	1 1	l f	1	1	lol"	1	Ιľ	- 1	17	O	1	ıΊ	lö	О	- 1 "	1 T	1	1	ιĪ	1	1]	ıſ	1	50

MA-1	2500H			L			7		_1			8			L			9		LΙ			10						11			L		12	2			
ATC	matrix magazine) logic table MAP029A			80	40 2	0 10	08 0	4 02	018	0 40	20 1	10 08	04	02 0	1 80	40 2	20 10	0 08	04 02	01	80 4	0 20	100	8 04	02	01 80	40 2	20 1	80 0	04 0	02 01	80	40 20	0 10	08 0	14 02	01	
Operation sequence No.	Manual interlock 2/8	Step reverse	Raturo cocla	tool de terrminatio	Spindle tool unclamp LS OFF	clamp LS	tool	Spindle stop	Spindle indexing complete	Not read tool storage cycle	t/return tool	Normal cycle (change arm rotation present) No next tool ready operation return	ool ready	Next tool ready operation	rS-axis 90 degrees	IS-axis 180 degrees	S-axis 2 /0 degrees	No recovery NG tool	Recovery NG tool present	Fool change position (HP1)	Fool rack search complete	Operation door look commission on AT-axis MG side	AT-axis spindle side		Step reverse interlock	Step advance interlock TS-axis 135 degrees	breakage	lool breakage detection cycle Not in tool breakage detection cycle	- 4	spindle tool	II-axis spindle tool grip position II-axis in standby position	ol to be	Next tool in next tool ready ST	connection compl	shifter retraction	confirmation	sition	Operation sequence No.
1	Writing next tool	1	۳	ī	0) 0	, 0,	0, 0	5	0, 2	-	۲		Ť	-	_	ſΤ	C) -	۲	Г	0	_		5	0,	" [П	7	0	-	T	1	-	Ħ	_	#1	ĒΤ	1
	Operation selection	53			I	I								Ι													Π	I						\Box			П	2
3	Next tool locking position (horizontal, vertical)	52	5	3	Ι				Τ	Ι.				Ι						Π	Τ	I			П	Ι	Π		Ι		Τ	Π		\prod				3
4	Pot advance	51	5	2	I						П		П	I							I	I	П	Ι	П			Ι	Ι			П				\square	П	4
	Tool lock	50			\perp	1	Щ	П	T	1-"	П	_	П	T	П	П	\Box	Щ	\Box	П	T	L	Ц	ľ	П	Г	П	ľ	_	LŢ	\Box	Щ	Γ	П		₽	Щ	5
	Next tool unlocking position (horizontal)	49											1																								4	6
	Tool change standby ready position (vertical)	48				4					Ш		11	_	1	\sqcup	_	1	<u> </u>	-	4	_	Щ	_	1	_	1	_	_	Щ.	_	1	_	44	_	╜	4	7
	Tool change standby ready position (horizontal)	47																																				8
	Tool change standby complete position (horizontal, vertical)	46									1		11	_		11			Щ.	\bot	_	_		_	1		1		_			1		-	_	44	₩	9
	Pot retract	44			_	4	Ш	\perp	_	4	ш	_	ш	_		ш	_	\perp	ш	ш	_	4	Ш	4	ш	4	ш	4	_		_	ш	_	ш	_	╜	Н	10
	Transfer unit on MC side	43			_	-	-	-			₩	-	+	_	-	-			-	+	_	+		-	-	-	+-+	_	-			-		+	-		⊢⊢	11
	Change arm tool unlock	42					-		-		₩		+			╌┼			ļļ	44		-	-				+-+		┿┈			₩		+-+			┝╌┡╴	12
	AT-axis transfer unit tool grip position (90 mm) (90 mm)	41			-		-			-	₩		┿			╌┼			├ ─├-	++	-	Q	-	-	 -		++	-	┿			₩		4		4-4	┝╌┞╴	13
	Change arm tool lock	40					-				╀┈┼		┿			╁┷┼				-			├ ──┼		┼┼		++		┿┈	├ ──┼		₩		++			┉	14
	Transport unit tool unlock	39			+	+	H	+	+	+	Н	+	+	+	+	Н	+	+	H	+	+	+	H	+	\vdash	+	₩	+	+	\vdash	٠,	+	+	+	+	#	+	15
	TI-axis in standby position (170 mm) (0 mm)	141			-	-					╁┈┼		┿	-		╌				+	-	-		+			+		+		-10	-		+-+			⊢⊢	16
	AT-axis in standby position (90 mm) (0 mm) Waiting for MC cycle end	37 119									 		╫┉╂			╁┷┼		+	├├-	┉			ļļ	4	┿		┿		+			╁┉┼		++			┝╌┝╴	17 18
	Spindle indexed/U-axis connection OFF	37			+	+	H	0	$\overline{}$	+	H	0	+	+	-	Н	+	+	H	+	+	+	H	+	+	+	+	+	+	H	+	++	+	+	00	00	+	19
	Spindle indexed/U-axis connection OFF HP1 (simultaneous movement 1)	37						8					++			-			-	ō	-			-	+											20	-	20
	ATC shutter open (simultaneous movement 1)	36			+	+	H		0	+	H	+	+	+	+	H	+	+	H	0	+	+	\vdash	+	H	+	+	+	+	\vdash	+	H	+	+	9	44		21
	TI-axis spindle tool grip position (220 mm) (220 mm)	112						10	9		++		+-+			+-+				19	-	-		-	++		++		+		_	++			-	-	-	22
23	TS-axis A grip spindle tool grip position (270-degree rotation)	34			-	-		-	-+		+	-	+	-	-	Н,	$\overline{}$		-	+	+	+-	-	+-	+-+	+-	+-+	-	+		4	+-+		-	_	+	\vdash	23
	Change arm tool unlock	33				+		+			†~†		+-+			 `		+		++	-	-	-	-	 -		†**		+			++		++		+	-	24
	AT-axis spindle tool grip position (810 mm) (-810 mm)	32									tt-		+-+			tt-			t	++			<u> </u>		 		1		+			++		++		-		25
	Change arm tool lock/Cylinder unclamp outside spindle	31			\top	+	H	\top	十	+	Ħ	+	Ħ	\top	+	Н	+	+	H	Н	\top	+		$^{+}$	\vdash	+	Ħ	\top	T	H	+	Ħ	+	\top	\top	+	广	26
	Spindle tool unclamp	30			_	_	0	_	_		177		177	_	1	tt-	_	1	h	1	_		1	_	tt-	_	† †	_	┪~			†		177	_	-		27
	TI-axis spindle tool extraction position (170 mm) (390 mm)	113				+	l***	777			T * †		7	_	1	一十	_	177	<u> </u>	77	7	1	T-†	+	T		1	_	†	0		1		777	_	7	mt	28
29		28				1					\sqcap	_	\top		T	o	T			1	_	T	\Box	1	\Box	T	T^{\dagger}	_	1		1	T		11	1		ΠŤ	29
	TI-axis spindle tool grip position (170 mm) (220 mm)	27	31		I	T	Ш			Ι.	П		\Box^{\dagger}	T	Т	Ш	T		Ш		\Box	Ι.	Ш	T		T		T	\mathbf{L}		o i	\prod		\mathbb{T}^{\dagger}	\Box		Ш	30
31	Spindle tool clamp	26			I	0		Ш	I		П		\Box	I		LΤ					I		J		LΙ							LΙ				ユブ	I	31
	Change arm tool unlock/Cylinder clamp outside spindle	25			Ţ		L		I		П		$\perp I$	I	L	П	\Box		LI		I		П		ĻΪ		П	C		LI		ĻΪ		\perp	Ţ		L	32
	AT-axis in standby position (810 mm) (0 mm)	24			1	1	Щ	\perp			Щ		$\perp I$			Цſ	Ļ	Щ	\Box	Щ	_[1)	Ш	1	ĻΙ	1	1	Щſ		μŢ		41		47	щ	33
	Change arm tool lock/AT-axis (240 mm (-570 mm)) Simultaneous movement 2 affter movement	114			4	1	Ш	44	_	1	Ш	_	$\perp \downarrow$	4	\perp	Ш	4	Ш	\vdash	Ш	4	4	(Ш	4	\perp	4	1	Щ	_	Ш	4	11	_	4	\vdash	34
	TS-axis A grip transport unit tool grip position (90-degree rotation)/AT-axis simultaneous movement 2	22			_	_	ш	\perp	4	1	Ц	\perp	\perp	4	0	Ц	4	ш	\vdash	ш	4	4	Ц		Ш	_	\perp	_	_	Ц	_	ш	_	\perp	4	\bot	Н	35
	TI-axis in standby position (220 mm) (0 mm)	21			4	4-	1	44	4	4	₩		+	-	1	$\perp \downarrow$	4	44	├ ├-	11	-	4-	↓	4-	11	4	44	4	4	↓ ↓	-10	44	-	44	_	4!	┵	36
	ATC shutter close/U-axis connection ON	142			-	4	├ ─┼	4-4	-		╁┈┼		+-+	-	4	╁		4-4	├	+-4		4-	├ ─-	+-	₩.		4-4	-	-	├ ─-├		+-+		44			┷	37
	AT-axis transport unit tool grip position (90 mm)/U-axis connection ON	16			-+-		-	4-4	+		₩		┿	-	+	╁╌┼	- -	4-4	┝╌┝╌	┿		ΙΩ	├ ─┼		┼-┼	-	+-+	-	+	┝┉┼		₩		10	-	-41	⊢∔	38
	TI-axis transport unit tool grip position (170 mm) (-170 mm)	15					-	4-4			╁┈┼		┿┿	-	+	⊬		4-4	┝╌├╌	+			├ ├		┿		+-+		10	┝┉┼		╁┉┼		4-4			⊢⊢	39
	Transport unit tool lock	14			+	+	H	+	+	+	Н	-	+	+	+	\vdash	+	+	\vdash	+	+	+	\vdash	+	+	+	+	+	+	H	+	+		+	+	+-	+	40
	Change arm tool unlock	13			-+-	+	-				╁╌┼		┿┿	-+	-	╁╌┼		+-	┝╌┝╌	┿┿			┾┼	+-	┿┿		+-+	-	+	┝┉┼		┿	-+-	+-+			┝	41
	AT-axis in standby position (90 mm) (0 mm)	12			-	-	-	-			₩		+-+		-	╁	-	+	\vdash		-	-		4			+-+		-		-	-		-		+-	-	42
	Change arm tool lock	11 115			-	-	-	-			-		+-+		-	┿		+	-	-	+	-	-	-			+	-	-		-			-	-	-	-	43
	Transport unit on MG side TS-axis B grip transport unit tool grip position (0-degree rotation)	115			+	+	\vdash	+	+	+-	\vdash	+	++	+	+	\vdash	-	+	\vdash	+	+	+	\vdash	+-	+	+	+	+	+	\vdash	+	+	+	+	+	+	H	44 45
	Pot advance	10	4:		+	+	H	+	+	+	H	+	+	+	+	+		4	\vdash	+	+	+	\vdash	+	+	+	+	+	+	\vdash	+	+	+	+	+	+	+	46
	Pot advance Return tool unlocking ready position (vertical)	- 3	4		+	+	+	+	+	+	+	-	++	+	+	+	+	+	\vdash	+	+	+	\vdash	+	+	+-	+	+	+	+	+	+	+	+	+	+	\vdash	46
	Return tool unlocking ready position (vertical) Return tool unlocking ready position (horizontal)	۳,	4		-+-	+		+	-	+	┿		++	-+	+	+	+	+	 -	+-+	-+	+-	 	+-	+-+		++	-	+	+-+		++		+-+	+	+	rt	48
	Return tool unlocking ready position (horizontal) Return tool unlocked position (vertical)		4		-+-	+-	-	+	+	+	†*†		+-+	-+	+	†-†		+	 -	+	-+-	+	 	+-	 		1-+	-	+	 	-+-	++		+-+		+	rt	48
			5		-+-	+	 	+	-+		†-†		┿┿	-+	+	++	+	┿┥	 -	+-+	-+-	+	├	+-	++	-	1-	-+-	+	+-+		††	-+-	++		+	rt	50
50	Return tool locking position (horizontall)		1 0	,																					1						- 1			1				JU

	2500H			Ц		1			1			2		Ţ			3						4	Ţ		1			5			1			6		T	П	\Box
ATC	matrix magazine) logic table MAP029A			80	10 20	10	08 04	102	018	0 40	20	10 08	04 0:	2 01	80 4	0 20	10	08 0	4 02	018	30 40	20	100	8 04		01 8	0 40	20 1	10 0	8 04	02	01 80	0 40	20	10 0	8 04	102	01	_
Operation sequence No.	Manual interlock 3/8	Step reverse	Return cycle	t spindle side confirmation Of	Lool pot magazine side confirmation UN Tool pot unclamp confirmation ON	pot clamp confirmation ON	Change arm tool unlock confirmation ON Change arm tool lock confirmation ON	retraction confirmation ON	Tool pot advance confirmation ON	ool pot t				U-axis spindle indexing position	MG manual interruption OFF ATC shutter onen confirmation normal	close conf	shutter close	shutter open	present in tra	No tool pot tool			Movement to pot vertical position complete	oct locking horizontal po	change positio	Horizontal movement to tool change position complete Spindle tool present clamp confirmation OFF	dle too	Not in manual tool chage cycle	APC pallet cleaning sequence OFF TS axis serve ON confirmation	inder unclamp	der clamp	Cylinder clamp outside spindle OFF APC start nositon		manual operation		nd manual operation of	ge inside MG detection in	Tool breakage inside MG detection inmeasurement position confirmation	Operation sequence No.
51	Tool unlock	4	51		C)		Ħ	Ť	┰	П		T	T	П	1	Ť	1	Τ	П	T	T	7	Τ			Τ	0		Ť		Т		⇈	7	Ť	Ħ	Ħ	51
	Pot retract	2	52					0		O												1		Ι.				0	Ō	<u> </u>				Π					52
53	Tool transfer complete	1	53	П	o c		I	0	I	0			I				O	Ō		\prod	T		I	I	П	I		0		Ι		T	I		T	Ι		\Box	53
	Π-axis transport unit tool grip position/U-axis connection ON	138	54		Ц.	$\bot \rbrack$		4.]	1	<u> </u>	ļI			L		1	Щ	1	1	Ц	1	4	1	4	Щ		\perp	0		1	Ш	Į.	<u> </u>	$\perp \downarrow$	_	ļ	IJ	Ц	54
	Transport unit on MG side	116			0	+	4	+	4	+	H	Щ	+	+	\vdash	+	Н	+	+	\vdash	4	+	+	+	Н	+	+	0		+	\vdash	+	+	\sqcup	4	+	₽	\vdash	55
	TS-axis B grip transport unit tool grip position (0-degree rotation)	139		-		+-		+_+						+	-	-	_		-		-	-		-				0		-	-			+				-	56
	Tool transfer complete Operation selection	69	57 69		0 0			0		0				+	-	-	10	0	-	-	-	+-		-				00		-	-			+-		-	-		57 58
	Operation selection Next tool ready return tool locking position (horizontal, vertical)	68				-								-					-				$\overline{}$	10				0						+			-		58 59
	Pot advance	67				+		+	0		++			+-			-		10	+-+	+	+	9	1				0		+	-			+		-	+-	++	60
	Tool lock	66			+	0	_	+		-	H		+	+	H	+	Н	$^{+}$	+	Н	+	H	+	+	H	+		0	_	+	H	+	+	H	+	+	+	Ħ	61
	Next tool ready return tool unlocking position (horizontal)	65			-	ťΤ		+		<u></u>	1		_	+	1	+	-	_	+-	0	+	1	-	5	_		-	0		+	_			$^{+}$	_	_	+	m	62
	Return tool unlocking ready position (vertical)	64				17		1			177			+	!	+		_	+	~	_	ō		1-	_		_	0		+	177			11	_	+	+		63
	Return tool unlocking ready position (horizontal)	63	64			17		1			177			1		_			1		_	-	7	51	_			Ö		1				11	_		1		64
65	Return tool unlocked position (vertical)	62	65		T						Ш								T		T	П	Õ					0	o					П	Т			П	65
	Return tool locking position (horizontal)	61				Ш		1	(2	Ш			_					0	Ш	_			0				0						Ш			LJ.	Ш	66
	Tool unlock	60			C	4		41			11			1		_	\perp		_	\perp	_	1		4				0						Ш	_	4	لسلب	Ш	67
	Pot retract	59				1		10		0	1			+			-		-	-	_	-	-	_				0		_	-			₩	_	_		1	68
	Tool transfer complete	58			0 0			0		0				-							-	-		-				0									-		69
	Operation selection	81 80			C	1	-	+	-	0	Н	-	-	+	Н	+	Н	_	0	H	+	+	0	0	Н	+		0		+	H	+	+	Н	+	+	+-1	H	70 71
	Next tool, input tool locking position (horizontal, vertical) Pot advance	79				╁╌┼		+	00	_	-			+-					10	╁┼	+	+-	9	-10				00		+				╁╌┤			+-	H	72
	Fool lock	78			-	0		+			+		-	+	\vdash	+	-	-	+	+	+	+	-	+	-	_		0		+-	-	-	-	+	+	-	+	H	73
	Next tool, input tool unlocking position (horizontal)	77				tΥ		++		d	†**†			+-	 	+	1	-	+	ō	+	+		51				0		+	-			$^{++}$	-		+	1	74
75	Next tool ready input tool unlocking ready position (vertical)	76				1-1		1-1			†"†			+	! !	+	1		+	\sim	+	0		4-	-			Ö		+	 			††	-	+-	+	1	75
	Next tool ready input tool unlocking ready position (horizontal)	75			T	П		\Box	7	T	П			Т		т	П		T	П	T	Ť		5	П	1		0		T	П	T	T	П	7	T	\vdash	П	76
	Next tool ready input tool unlocked position (vertical)	74				T		777			177			1		1	1		1		_	1	õ	1				0		1				П		7			77
	Next tool ready input tool locking position (horizontal)	73		П		\square			ζ)	П			Ι					0			Π		O				0	o	I		Ι			I	T	\square	П	78
	Tool unlock	72	79	Ш	C	4.1		1.I	C		Ļ.I			Į.		Ļ			1	Цľ		\Box	[<u> </u>	L.J			0	QL.	1	Ш	1	<u> </u>	$\perp 1$	_[ــــــــــــــــــــــــــــــــــــــ	IJ	Lſ	79
	Pot retract	71			_	\sqcup	_	0	4	0		Ш	_	╀	ш	┺	Н	4	1	Н	4	\perp	4	1	Ш	4		0		\bot	Ц	4	1	\sqcup	4	4	₽	Ц	80
	Tool transfer complete	70			0 0			0		0				-	-		-		+-	-	_	+	-	-	-			0		-	-			+-	_	-	4	-	81
	Operation selection	93				4		+	-	0	+		-	+	-	+	+-	-	-	-	-	+	=	+	-		-	0		+	\vdash	-	-	\vdash	0	-	+	H	82
	Calling tool locking position (horizontal, vertical) Pot advance	92 91			+	+		+	00	+	₩		-	+-	╌	+-	+	-+	0	╁┼	+	+	0	0	-	-	+-	00		+	+	+	+	+	-+	+-	+	H	83 84
	Fool lock	90			+	0	-	+			+	-	+	+	\vdash	+	+	+	+	+	+	+	+	+	\vdash	+	+	0		+	+	+	+	+	+	+	+	H	85
	Calling tool unlocking position (horizontal)	89			+	悄	+	Ħ	\pm	+	Н	+	$^{+}$	t	Ħ	+	Н	+	+	0	+	Ħ	-	1	H	+		0		+	H	+	+	H	+	+	Н	H	86
	MG manual change unlocking ready position (vertical)	88				77		77		+	177			+	!	+	1	_	+	۲Ť		ō		-	1	_	1	Ö	ő	+	177		+	17	_	+	1	广十	87
	MG manual change unlocking ready position (horizontal)	87			I	\Box		\Box	I	I	\Box^{\dagger}		Ι	Ι		Ι	Γ	I	T		1	ľ		ΣĪ			\mathbf{I}	Ö	õ	Ι.		I	<u> </u>	\Box	1	I	Γ	\Box^{\dagger}	88
	MG manual change unlocked position (vertical)	86	89	П	Ι		I		Ι	I			Ι	Γ		Ι		Ι	Ι		Τ		Q.	Ι		I		0	Q.	Ι		Τ	Ι		Ι	Ι	\prod		89
	MG manual change locking position (horizontal)	85			T	П		\Box	C)			T	Ľ	Ш	Γ	П		O		T		T	Ö	П			0			П	T		П	Ï	Т	Д	П	90
	Tool unlock	84			C	4		4.4	_	1	11			1		_	\perp		1	$\perp \downarrow$	_	1		1	Ш	_	\perp	0		1	Ш		4	$\perp \downarrow$	_	1	L	Ш	91
	Pot retract	83			_	$\downarrow \downarrow$		0		0			4		⊢-		1		-	1	4	1	_	_	_		-	0		+	1			\sqcup	_		4	ш	92
	Tool transfer complete	82	93		2			0	-	Q	4		-	_	-	+	-	-	+	-	_	+	-	-			-	0	斘	+	1	-		اے	-	-	4	H	93
	Operation selection	105	105			4-1	-	+	+	0	1		+	+	\vdash	+	+	+	-	\vdash	+	+		_	\vdash	-		0		+-	\vdash	+	+-	0	+	+	+-	\vdash	94
	MG manual change locking position (horizontal, vertical)	104	105		+	\dashv	+	+	1	+	Н	+	+	+	\vdash	+	Н	+	10	\vdash	+	+	0	10	H	+		0		+	H	+	+	\vdash	+	+	┯	\vdash	95
	Pot advance	103	104	\vdash	+	o	-	+	0 0		+	-	+	+	\vdash	+	+	+	+	\vdash	+	+	+	+	\vdash	-		00		+	\vdash	+	+-	+	+	+	+	\vdash	96 97
	Tool lock	102	103	₩	+-	ᄤ		+-+	45	4	╆┿		-+-	+-	╌┼╴	+-	+	-+	+-	0	+	+		-	┯			0		+	┯	-+-	+	┿	-+	+-	+-	H	98
	MG manual change unlocking position (horizontal) Storing tool unlocking ready position (vertical)	100			-+-	┿┪		+-+	-+	+	╆╌╅			+-	 	+-	+	-+	+	٧.		1		4-	 	-	+-	0		+	 	-+-	+	+-+	-+	+	+-	十十	98
	Storing tool unlocking ready position (vertical) Storing tool unlocking ready position (horizontal)	99			+	†*†		†"†	-+		†"†			+-	 	+-	T	-	+-	 		12	-17	51	 	-	+-	0		+	 	-+-	+	††		+	+-	tt	100

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ATC	matrix magazine) logic table MAP029A			80	0 2	10	08 0	4 02	018	0 40	20	10 0	8 04	02 0)1 8	0 40	20	10 0	8 04	02	018	0 40	20	10 0	04	02 (1 80	40 2	0 10	08	04 (02 01	80	40 20	0 10	08 0	4 02	01	
Operation sequence No.	Manual interlock 4/8	Step reverse	Return cycle	tool	tool clamp I.S. Of	clamp LS ON	Spindle tool unclamp LS ON		Spindle indexing complete			Normal cycle (change arm rotation present) No next tool ready operation return	ool ready operation i	Next tool ready operation	Active tool writing complete TS-avis 90 degrees	TS-axis 180 degrees	TS-axis 270 degrees	TS-axis 0 degrees	Recovery NG tool present		Tool change position (HP1)	Operation door lock confirmation ON	AT-axis MG side	AT-axis spindle side AT-axis in standby position	Change arm rotation complete	Step reverse interlock	Step advance interlock TS-axis 135 degrees	Tool breakage detection cycle complete	Not in tool breakage detection cycle	Traxis transport unit tool grip position	spindle tool	TI-axis spindle tool grip position TI-axis in standby position	ol to be retu	Next tool in next tool ready ST	U-axis connection compleate	shifter retraction confirmation	U-axis snitter retraction confirmation LS OFF U-axis present LS OFF	TS-axis rotating position	Operation sequence No.
51	Tool unlock	4	51																																		\perp	П	51
52	Pot retract	2	52	П												1			I.			L					1		1	L			\prod					П	52
	Tool transfer complete	1	53	₩	4	44	4	44	4		44	_	\perp		4	4	┰	_	4	니	4		Щ	4	1		2	1		4_	 	4	44	_	4_	ĻĻ	4	H	53
	TI-axis transport unit tool grip position/U-axis connection ON	138	54 55		+	+	-	+-	-	+	+-	-	+		_	+-	⊢	-	+	\vdash	-	+	\vdash	+	+	0	-	\vdash	-	0	1	+	+	_	0			₩	54
	Transport unit on MG side TS-axis B grip transport unit tool grip position (0-degree rotation)	116	56		+	Н	+	+	+	+	Н	+	Н	+	+	+	Н	0	+	H	+	+	H	+	Н	\vdash	+	H	+	+	\vdash	+	H	+	+	H	+	H	55 56
	Tool transfer complete	133	57		+	+				-							H	<u> </u>		-		+	-	+	+-		5	+-+		+			+			-		++	57
	Operation selection	69			-	+	_	+		+	1	_	+	_		+	Ħ	_	+	m	-	+-	1	_	1	o i	_	1	+	†	_	_	1		-	m		m	58
59	Next tool ready return tool locking position (horizontal, vertical)	68	69	П													П		I										I	1								П	59
60	Pot advance	67																																			\perp	П	60
	Tool lock	66				1											Ш			Ш	_	1		_						1								Ш	61
	Next tool ready return tool unlocking position (horizontal)	65			4	4-4		4-4			4-4		4		_			_		<u> </u>	4	4	1		1		4			↓			1		4			₩	62
	Return tool unlocking ready position (vertical)	64			-	+	-				+		-	-	_		₩		-	-	-	-	-	-	-	-	_	├		+-			+-			-		₩	63
	Return tool unlocking ready position (horizontal)	63 62	64 65		-+-	┿┥					+						╌┼			-	-		-		┼	-		╁┈┼		┿┈			┿			-		╁╌┼	64 65
	Return tool unlocked position (vertical) Return tool locking position (horizontal)	61			+	Н	+	+	+	+	Н	-	+	+	+	+	H	+	+	H	+	+	H	+	+	+	+	H	+	+	H	+	H	+	+	+	+	H	66
	Tool unlock	60			-	+		+		-							H	_	-	-		_	_	-	1	-	-	$^{+}$		+			+			-		tt	67
	Pot retract	59			_	1			_	_	+				_	1	tt	_	+	m	_	+		+	1	_	_	1		†	_		†**		_			tt	68
	Tool transfer complete	58															П									0	5						П					П	69
	Operation selection	81															П									0											\perp	П	70
	Next tool, input tool locking position (horizontal, vertical)	80				1					-	_					Ш			Ш		4	Щ.		_			1		4			1					ш	71
	Pot advance	79		\vdash	-	+-	-		_	-	-		-	_	_	-	Н	-	-	Н	+	+	Н	-	-	-	-	\vdash	-	+	_	-	\vdash	-	-	-	-	₩	72
	Tool lock	78 77				┿┥					+						╌┼			-		+	-	-	-	-	-	╁╌┼		+-					+			₩	73
	Next tool, input tool unlocking position (horizontal) Next tool ready input tool unlocking ready position (vertical)	76			-+-	┿┥					+		+				╌┼		+	╌	-	+	┢┷		+	-		╁╌┼		+			╁╌		+			╁╌┼	74 75
	Next tool ready input tool unlocking ready position (vertical) Next tool ready input tool unlocking ready position (horizontal)	75			+	Н	+	+	+	+	+	_	+	$^{+}$	+	+	Н	+	+	Н	+	+	H	+	Н	+	+	\vdash	+	+	H	+	+	_	+	+	+	H	76
	Next tool ready input tool unlocked position (vertical)	74				1					+		+		_		177		+	1	_	+	1	-	1	-		† * †		†~	_		†**		+	-		$t^{-}t$	77
	Next tool ready input tool locking position (horizontal)	73			_	17		777		_						1	m	_	1		_	1		_	1	_	_	11		1			T		1			m	78
	Tool unlock	72	79	Ш		П	I	П	I	I	П				I				I		I	I					I	П	I		П	I			П		Ι	П	79
80	Pot retract	71	80		_[^	П	_[~	Щ	T	ľ	Щ	Т	Щ	T	\Box	ľ	Ц		1	Ц	1	1	Ц		П	ЦĨ	Ţ.	Ц		1	П	_[_	Щ	\perp	Щ	Щ	#	Щ	80
	Tool transfer complete	70			_	\perp	4	4		4	4	_	-	_	_	+	Н	_	+	\vdash	4	+-	\vdash	4			2	-	4	+-	1	_	+	_	-	1		₩	81
	Operation selection	93 92			+	+-	-	-	-	-	+		-		_	+-	⊢⊦	-	-	-	-	+	-	+	+	0	_	-	-	+-		-	+-		-	-		-	82 83
	Calling tool locking position (horizontal, vertical) Pot advance	92			+	+	+	+	-+	+	+	-	+	-+		+-	₩		+-	\vdash		+-	₩	+	+	\vdash	+-	+	+-	+	++	+	+	-	+	\vdash	+-	₩	83
	Pot advance Tool lock	90			+	+	+	+	+	+	+	+	+	+	+	+	H	+	+	H	+	+	H	+	+	\vdash	+	\vdash	+	+-	+	+	H	-	+	\vdash	+	+	85
	Calling tool unlocking position (horizontal)	89			$^{+}$	Н	\top	+	1	+	Ħ	$^{+}$	Ħ	+	+	\top	Ħ	+	+	H	T	+	H	T	П	H	+	Ħ	$^{+}$	t	H	$^{+}$	Ħ	+	Н	H	+	Ħ	86
	MG manual change unlocking ready position (vertical)	88			I		T			T					1				T			1					1		1	1		1	\mathbf{I}^{\dagger}	T			T	\Box^{\dagger}	87
	MG manual change unlocking ready position (horizontal)	87	88	П	I		I	П	I	I		I			T			T	Ι		I		П				I		I	Γ	П	I	П	T			I	П	88
89	MG manual change unlocked position (vertical)	86			1	Ш		4.]	[L.	$\downarrow \downarrow$		44		1		Щ	_	1	Ш	_[1	Щ	1		ļļ.	4	μſ	1	1	Ш	1	4]		Щ	LL	Щ.	Цľ	89
	MG manual change locking position (horizontal)	85			+	Н	+	+	4	+	+	+	+	+	+	+	Н	+	+	Н	+	+	Н	+	Н	\vdash	+	\vdash	+	+	H	+	H	+	+	\vdash	+	H	90
	Tool unlock	84			+	┿┥		-			4-4		+		-	-	╁╌┼		+	┢┉┼			┢┷		+	├ }-		+-+		+	┝┉┼		┿	-+-	+	 -	+	₩	91
	Pot retract Tool transfer complete	83 82			-	+-		-		-						-	₩	-	-	₩		+-	-	-	+-	0	5	+	-	+			+-			-			92 93
	Operation selection	105				+											-			-				-	-	00	_	-		+			+				***************************************		93
	MG manual change locking position (horizontal, vertical)	104	105		+	†	$^{+}$	+	_	+	††	+	\top	$^{+}$	+		Ħ	+	+	H	$^{+}$	+	\vdash	+	П	1	+	\Box	+	†	\vdash	+	Ħ	+	\top	ΙŤ	+	\sqcap	95
	Pot advance	103	104		I	П	1	\perp		I	П	I	П		1	I	ธ	_	T		I	T		I	П	◩	İ	D	I	T	◨	1		士	П	П	I	口	96
	Tool lock	102	103	П	I		I			I	П		П	I	I		П	I	I		I		П	I			I		I		П	I		I			I	П	97
98	MG manual change unlocking position (horizontal)	101	102	П	Ţ	П	T	П	\perp	L	П	I	П	\perp	T		П	Ţ	Γ	П	T		П	T		П	T		I		П	T	\Box	T	П	II	T	П	98
	Storing tool unlocking ready position (vertical)	100		Ш	4	Ш		44	4	_	\perp	_	\perp	_	4	4	Ш	_	1	Щ	_	4	Щ	4	1	<u> </u>	4	$\downarrow \downarrow$	4	1	Ш	_	1		44	LL	4	₩	99
100	Storing tool unlocking ready position (horizontal)	99	100	ш										_1			Ш			ш			ш		Ш	Ш				1	Ш							ш	100

MA-1	2500H					1			ı			2					3	3					4						5			1			6		\top	П	\neg
	matrix magazine) logic table MAP029A			80 4	0 20	10	08 04	1 02	018	0 40	20	10 08	04 02	01	80 4	0 20	10	08	04 0:	2 01	80 4	0 20	10	08 0	4 02	01	80 41	20	10	08 04	02	01 8	0 40	20	10	080	4 02	01	
Operation sequence No.	Manual interlock 5/8	Step reverse	Return cycle	Tool pot spindle side confirmation ON	pot unclamp confirmation ON	np confirmation ON	Change arm tool unlock confirmation ON Change arm tool lock confirmation ON	retraction confirmation ON	Tool pot advance confirmation ON	ol pot t				U-axis spindle indexing position	nterruption	ATC shutter close confirmation OFF	shutter close confirmation	shutter open	ATC shutter open confirmation	oot tool		vement to pot vertical retr	pot vertical position o	Movement to pot unlocking horizontal position complete	ovement to tool change position	tool change p	Spindle tool present clamp confirmation OFF No spindle tool interlock		APC pallet cleaning	US axis servo UN contirmation Cylinder unclamp outside spindle	amp outside spi	Cylinder clamp outside spindle OFF	APC start position	MG manual operation command storing	MG manual operation command calling	Not MG manual operation command	arm in gripper tool ge inside MG detection in	Tool breakage inside MG detection inmeasurement position confirmation	Operation sequence No.
	Storing tool unlocked position (vertical)	98	101		4	11		4-4			Ш			1	_	_		_	_	-			0	4		Ш		0			Ш			1	Ш	_		Ш	101
	Storing tool locking position (horizontal)	97	102		1	\perp		\perp	C		Ш					_				2			Ш		2	Ш		0			Ш			1	Ш			Ш	102
	Tool unlock		103		0	1		\perp			Ш			L									Ш			Ш		0			\perp			_	Ш			Ш	103
	Pot retract	95	104		1	\perp		0		0						_			_	44			Ш	_		Ш		0			Ш			1	Ш			Ш	104
105	Tool transfer complete	94	105		0 0			0		0																		0	0						Ш	ш	ш		105
106	Tool change standby complete position (horizontal, vertical)	140	111		1	Ш		\perp			Ш			L								1	Ш		0	0		0			Ш			1	L			Ш	106
107	Transport unit on MC side		110	0	Т.	Ш		$\perp \perp$		Т.	LL			Ш		L		Ш					Ш			Ш		0			Ш			Т.	Ш			Ш	107
108	TI-axis in standby position (170 mm) (0 mm)		109					TI			Ш																	0	0									П	108
109	TI-axis transport unit tool grip position (170 mm) (-170 mm)	107	109		Ι	LI		\prod	Ι.	Ι	П																	0	0		\prod			Ι		\Box	Ι	Ш	109
110	Transport unit on MG side	118	110								Ш																	0	0									Ш	110
111	Tool transfer complete		111		0	1		0		0				L			0	0		\perp			Ш			Ш		0	0									Ш	111
112	TS-axis B grip transport unit tool grip position (0-degree rotation) (for SEQ22 return)		112						\perp							L												0	0							\perp			112
113	TS-axis A grip spindle tool grip position (270-degree rotation) (for SEQ28 return)	113	113			\prod		\prod			П					L							П					0	0		\Box					\perp		П	113
114	TS-axis B grip spindle tool grip position (180-degree rotation) (for SEQ34 return)		114			Ш			\perp																			0	0							\perp		П	114
115	TS-axis A grip transport unit tool grip position (90-degree rotation) (for SEQ44 return)		115			Ш					ш																	0	0							ш			115
116	TS-axis A grip transport unit tool grip position (90-degree rotation) (for SEQ55 return)		116																									0								I	I		116
117	TI-axis transport unit tool grip position (170 mm) (-170 mm) (for SEQ107 return)	117	117					\prod			\prod					\perp												0	0										117
118	Operation selection (for SEQ110 return)		118		0			\prod	Ι.	0	Π				0	\perp												0	0		\prod						Ι.		118
119	AT-axis instandby position (90 mm) (0 mm)/TI-axis in standby position (170 mm) (0 mm) (for SEQ37 return)	119	119	0		Ш																						0	0		Γ	T							119
120	AT-axis in MG position (900 mm) (0 mm)	24	120					\prod						П		L								Ι.				0	0		П					\Box	\perp	П	120
121	Change arm tool lock/AT-axis (240 mm (-570 mm)) Simultaneous movement 3 affter movement	114	121		Ι][C		Ι.											Π					I	\coprod		0	0	Ι.	LI	I					Ι		121
122	TS-axis A grip tool breakage inside MG measurement position (135-degree rotation)/AT-axis simultaneous movement 3	22	122								Ш																	0	0							\perp	L		122
123	TI-axis in standby position (220 mm) (0 mm)	21	123		Ι	\prod		\prod	\perp																			0	0			\perp				Π.	\mathbf{I}		123
124	ATC shutter close/U-axis connection ON	131	124			Π		TI			Ш						0											0	0							\perp		П	124
125	AT-axis transport unit tool grip position (170 mm) (-170 mm)/U-axis connection ON	128	125		Ι	\prod		\Box	Τ					П		Ι			Ι		Ι			I				O	0	I			Ι			T	I	П	125
126	Measurement unit preparation (down)		126	\prod	I	\prod		\Box	Τ		\Box			Γ	\Box	Τ			Ι		Ι	I		Τ	I		Τ	O	Õ	I	\Box		I	I		T		Õ	126
	Tool breakage detection cycle	126	127		I	\prod		\Box	Ι		П			П		Ι			Ι		Ι		П	I			I	Ö		I	\Box		Ι	Ι		I		П	127
	Measurement unit retract (up)		128		I	\prod		\Box	Ι		П					Ι			Ι		I		П	I			I	O		I			Ι	I		I	0	\prod	128
129	TI-axis in standby position (170 mm) (0 mm)		129		I	\prod		\prod	Ι		П			П		Τ	П		Ι		I		П	I			I		0	I	П		Ι	Ι		I		П	129
	TS-axis A grip transport unit tool grip position (90-degree rotation)	137			I	П		\prod	I		П					Ι			Ι		I		П	T		П	I		0	I			Ι	I		I		П	130
131	TI-axis in standby position (170 mm) (0 mm) (for SEQ124 return)		131		Γ	П		\prod	I		П			0		Τ	П		Ι		I		П	T		П		Ö	0	I	П		Ι	Γ		I		П	131
132	TS-axis A grip tool breakage inside MG measurement position (135-degree rotation) (for SEQ129 return)		132		\perp	П	I	\Box	Ι		П		Ш			Γ			Ι	\Box	I		П	Ι		П	I	0		I			Ι		Ш	I		\prod	132
133	Tool change standby complete position (horizontal, vertical)	140	133		I				T							Ι									0	0		0	0	I	\Box		I					П	133
134	Transport unit on MC side	37	134	0	I				Ι					П		Ι			Ι					I				O	0	I	\Box		I						134
	Transport unit on MG side	118	135			\Box^{\dagger}			Ι	\Box	\Box			Γ	Ш	Ι			\Box					\Box				0	0	I			I			I	\perp	П	135
136	Tool transfer complete	1	136		0		1	0	I	0	П	I	П	П		Ι	0	0	Ι	П			П	Ι		П	Ι	0	0	I	П		I			I	I	П	136
	TI-axis in standby position (for SEQ130 return) Transport unit on MC side (for SEQ54 return)	137 138	138	Õ	$oxed{\mathbb{F}}$	\prod	-	\Box	-		H		$oxed{\Box}$			F	\Box	\Box	Ŧ	\Box	$oldsymbol{\mathbb{F}}$		\Box	\exists		H	$oldsymbol{\mathbb{I}}$	0	0 0	Ι		\exists	I	F	H	-	$\overline{\mathbf{F}}$	H	137 138
139	Operation selection (for SEQ56 return)	139	139	I	Ö	1			T	1					Ö	Т			T			-T	177	T		m	-T	O	Õ	T	\Box		T		П	o	-	[]	139
	Transport unit on MG side (for SEQ106, 133 return)	140	140	(ΤŢ		T	_	1	TŤ					1	m		7	777	_	1		7	1	m	1	Ō	õ		77	_	1	T-	\Box		1	m	140
141	AT-axis transfer unit tool grip position (90 mm) (90 mm) (for SEQ16 return) AT-axis in standby position/TI-axis in standby position/UI-axis connection OFF (for SEQ37 return)	141 142		Ö	-	+-		+		-			_	Ö		-	\vdash				-	-	-	-	-		_	0			-	-		-		_	Ŧ	П	141 142
143	TI-axis transport unit tool grip position (for SEQ128 return)	143	143	Ш	Τ.	П		П			П		\Box	Д	Т		П		1	П	7	_	П	7		П		Ö	O		П	7		T	П	工	工	П	143

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 | 08 0 | 4 02 | 01 8 | 40 | 20 | 10 08 | 04 | 02 01 | 80 4 | 0 20 | 10 | 08 04 | 02 | 01 80
 | 40 2 | 20 10 | 08 | 4 02 | 01 8
 | 0 40 | 20 1 | 0 08 | 04 02 | 01
 | 30 40 | 20 10 | 08 | 04 02 | 01
 | |
| Manual interlock 6/8 | Step reverse | Return cycle | deterrmination commplete | clamp LS OFF | 7
 | tool unclamp LS ON | stop | ete | ant | m tool | ycle (change arm rotation present)
tool ready operation return | ool ready operation input | ready operation | egrees | degrees
degrees | grees | l
esent | |
 | nation ON | Aaxis Mid side AT-axis spindle side | in standby position | erse interlock | Step advance interlock
 | detection cycle complete | age detection cycle | Isport unit tool grip position | spindle tool extraction position | in standby position
 | nezt tool ready ST | connection compleate | shifter retraction confirmation LS | retraction confirmation LS OFF
t LS OFF | TS-axis rotating position
 | Operation sequence No. |
| toring tool unlocked position (vertical) | | | | _ | Ш
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 | 101 |
| oring tool locking position (horizontal) | | | | | П
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 | 102 |
| ool unlock | 96 | 103 | Ш | I | П
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 | 103 |
| ot retract | 95 | 104 | | Ι. | \prod
 | | | | | | | | | | | | | Ш |
 | П | | П | |
 | Ι. | | | | LI
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 | 104 |
| pol transfer complete | 94 | 105 | | | \prod
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 | 105 |
ool change standby complete position (horizontal, vertical)	140	111		\perp								
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 | Ι. | | | | \prod
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 | 106 |
ransport unit on MC side	117	110		Ι.								
 | | | Ξ. | | | | | | | | | | |
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 | 1 | | | | III
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 | 107 |
| -axis in standby position (170 mm) (0 mm) | 37 | 109 | | | П
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 | I | | | | 0
 | | | | | П
 | 108 |
| -axis transport unit tool grip position (170 mm) (-170 mm) | 107 | 109 | | | П
 | | | | T | П | | П | | П | | П | | П |
 | П | | П | 0 |
 | T | | 0 | | П
 | | | | | П
 | 109 |
| ansport unit on MG side | 118 | 110 | | | П
 | | | | | П | | | | | | П | | П |
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 | 1 | | | | Ш
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 | 110 |
| pol transfer complete | - 1 | 111 | | |
 | | | | | | | | | | | П | | |
 | | | | | 0
 | | | | | П
 | | | | |
 | 111 |
| S-axis B grip transport unit tool grip position (0-degree rotation) (for SEQ22 return) | 112 | 112 | | | П
 | | | | | | | | | П | | 0 | | П |
 | П | | П | |
 | | | | | П
 | | | | | П
 | 112 |
| S-axis A grip spindle tool grip position (270-degree rotation) (for SEQ28 return) | 113 | 113 | | | П
 | | | | | | | | | П | 0 | | | |
 | | | П | |
 | | | | | П
 | | | | | П
 | 113 |
| 3-axis B grip spindle tool grip position (180-degree rotation) (for SEQ34 return) | 114 | 114 | | | \square
 | | | | | | | | | | 0 | | | |
 | | | П | |
 | | | | | П
 | | | | | П
 | 114 |
S-axis A grip transport unit tool grip position (90-degree rotation) (for SEQ44 return)	115	115										
 | | | | | | | | | 0 | | | | |
 | П | | | |
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 | 115 |
S-axis A grip transport unit tool grip position (90-degree rotation) (for SEQ55 return)	116	116										
 | | | | | | | | | 0 | | | | |
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 | 116 |
| -axis transport unit tool grip position (170 mm) (-170 mm) (for SEQ107 return) | 117 | 117 | | | П
 | | | | Т | П | | П | Т | П | T | П | Т | П |
 | П | | П | |
 | Т | П | 0 | | П
 | | | | | П
 | 117 |
| peration selection (for SEQ110 return) | 118 | 118 | | 7 | П
 | | | | 1 | П | | П | T | П | T | П | T | П |
 | П | T | П | |
 | 1 | П | T | | П
 | | | T | T- | П
 | 118 |
| -axis instandby position (90 mm) (0 mm)/TI-axis in standby position (170 mm) (0 mm) (for SEQ37 return) | 119 | 119 | | 7 | Ш
 | | | T | 1 | П | | П | T- | П | | П | T | П |
 | Т | 1 | Õ | |
 | 1 | | T | | 0
 | | | TT | | П
 | 119 |
| T-axis in MG position (900 mm) (0 mm) | 24 | 120 | | | П
 | | | T | | П | | П | | П | 1 | П | 1 | |
 | - | 0 | П | 0 |
 | | П | П | | П
 | | | П | |
 | 120 |
| nange arm tool lock/AT-axis (240 mm (-570 mm)) Simultaneous movement 3 affter movement | 114 | 121 | | 7 | Ш
 | | | T | 1 | П | | П | T- | П | | П | T- | П |
 | 1 | Ö | П | |
 | 1 | | T | | ПТ
 | | | TT | TT- | П
 | 121 |
| -axis A grip tool breakage inside MG measurement position (135-degree rotation)/AT-axis simultaneous movement 3 | 22 | 122 | | 1 | П
 | | 1 | | 1 | П | | П | | П | T | т | T- | П |
 | 1 | Ö | П | | (
 | 5 | П | T | | Т
 | | T- | T | | П
 | 122 |
| -axis in standby position (220 mm) (0 mm) | 21 | 123 | | | П
 | | | | П | П | | П | | | | П | | |
 | П | | П | |
 | | | | | 0
 | | | | |
 | 123 |
| TC shutter close/U-axis connection ON | 131 | 124 | | 1 | П
 | | 1 | | T | П | | П | | П | T | т | T- | П |
 | П | | П | |
 | 1 | П | T | | Т
 | | | T | | П
 | 124 |
| -axis transport unit tool grip position (170 mm) (-170 mm)/U-axis connection ON | 128 | 125 | | | m
 | | | | 1 | П | | П | | | | | | |
 | | | | |
 | | | 0 | | T
 | | C |) | | T
 | 125 |
| | 127 | 126 | | | 77
 | | _ | | 1 | 1 | | | | | | 1 | | | -
 | 1 | | | |
 | | T | 7 | | T
 | | | 1 | | T
 | 126 |
| | 126 | 127 | | | m
 | | | | | П | | П | | | _ | | | |
 | | | | |
 | 0 | | 0 | |
 | | | | |
 | 127 |
| easurement unit retract (up) | 143 | 128 | | | T
 | | | | | | | П | | | | | | |
 | T | | | |
 | | | | |
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 | 128 |
-axis in standby position (170 mm) (0 mm)	132	129										
 | | _ | | _ | | | | | | | | | |
 | | | | |
 | | | | | 0
 | | | | | П
 | 129 |
| S-axis A grip transport unit tool grip position (90-degree rotation) | 137 | 130 | | |
 | | _ | | | | | | | 0 | | | | |
 | | | | | 0
 | | | | |
 | | | | |
 | 130 |
| -axis in standby position (170 mm) (0 mm) (for SEQ124 return) | 131 | 131 | | | \Box
 | | _ | | _ | | | | | | | | | |
 | | | | |
 | | | | | 0
 | | | 0 | 00 |
 | 131 |
| -axis A grip tool breakage inside MG measurement position (135-degree rotation) (for SEQ129 return) | 132 | 132 | | | \Box
 | | | | | | | | 1 | | | | | |
 | П | | | |
 | 5 | | | | \Box †
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 | 132 |
| pol change standby complete position (horizontal, vertical) | 140 | 133 | | | \Box
 | | | | | | | | Ι | П | | | \perp | |
 | П | | | 0 |
 | I | | | |
 | | | | |
 | 133 |
| ansport unit on MC side | 37 | 134 | | I |
 | | \mathbf{I} | I | | | | | Ι | | Ι | | 1 | |
 | П | | | | 0
 | I | | | |
 | | | | \perp | П
 | 134 |
| ansport unit on MG side | | | | \mathbb{T} | \Box
 | | Γ | Τ | \square | | | | Ι | Ш | I | | \perp | |
 | \Box | | | |
 | Ι | | | |
 | | \perp | | \perp |
 | 135 |
| pol transfer complete | 1 | 136 | | I | П
 | | Π | Ι | П | П | I | П | Ι | П | I | П | I | П | 1
 | П | I | П | \perp | 0
 | I | | \Box | I |
 | $oldsymbol{oldsymbol{\square}}$ | \perp | П | I | П
 | 136 |
| -axis in standby position (for SEQ130 return) ransport unit on MC side (for SEQ54 return) | | | | | \Box
 | _ | - | _ | - | | | H | T | | - | - | | |
 | Н | | Н | |
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 | 137
138 |
| peration selection (for SEQ56 return) | | | r | 7 | ΤŢ
 | | 1 | _ | 1 | | | mt | | T | 1 | T-1 | 1- | T |
 | T-1 | 7 | 1 | _ |
 | 1 | | 7 | | TT
 | | | 7-1 | | T^{\dagger}
 | 139 |
| ransport unit on MG side (for SEQ106, 133 return) | | | | + | 77
 | | 1 | | 1 | 177 | | 1 | _ | T | + | 17 | | 1 |
 | 1 | | m | - | _
 | _ | T† | 1 | | 177
 | | | 7 | | T †
 | 140 |
T-axis transfer unit tool grip position (90 mm) (90 mm) (for SEQ16 return) -axis in standby position/TI-axis in standby position/U-axis connection OFF (for SEQ37 return)		141										
 | | | - | - | | | | | | - | | _ | |
 | | 0 | 0 | - |
 | | | | | 0
 | | _ | O | 00 | ,
 | 141 |
| | | 143 | | - | +
 | | - | | | | | | | - | | + | - | + |
 | + | | + | _ |
 | | | - | | ++
 | | | + | -+- | +
 | 143 |
| | oring tool unlocked position (vertical) oring tool locking position (horizontal) old unlock it retract tool transfer complete old transfer complete old change standby complete position (horizontal, vertical) ansport unit on MG side - axis in standby position (170 mm) (0 mm) - axis transport unit tool grip position (170 mm) (-170 mm) ansport unit on MG side old transfer complete - axis B grip transport unit tool grip position (170 mm) (-170 mm) - axis A grip spindle tool grip position (170 mm) (-170 mm) - axis B grip transport unit tool grip position (170 mm) - axis B grip transport unit tool grip position (180 degree rotation) (for SEQ32 return) - axis B grip transport unit tool grip position (190 mm) - axis A grip transport unit tool grip position (190 mm) - axis A grip transport unit tool grip position (190 mm) - axis A grip transport unit tool grip position (170 mm) (170 mm) (for SEQ31 return) - axis A grip transport unit tool grip position (170 mm) (170 mm) (for SEQ107 return) - axis transport unit tool grip position (170 mm) (170 mm) (for SEQ107 return) - axis in standby position (190 mm) (0 mm) - axis in standby position (170 mm) (0 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 mm) (170 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MA-1	2500H				ľ	1		1			2					3			1			4		T	1		1	5			П			6	\top	_	\Box
	matrix magazine) logic table MAP029A		80	40 2	20 10	08 0	4 02	01 8	0 40	20 1	10 08	04 02	2 01	80 40	0 20	10 0	04	4 02	01 8	0 40	20				1 80	40 2	0 10	08	04 0	2 01	80	40 2	0 10	08	J4 0	2 01	
Operation sequence No.	Manual interlock 7/8	Step reverse	Return cycle Tool pot spindle side confirmation ON	Tool pot magazine side confirmation ON	Tool pot unclamp confirmation ON Tool pot clamp confirmation ON	ck confirmatio	firmation	Tool pot advance confirmation ON	No tool pot tool				U-axis spindle indexing position	MG manual interruption OFF ATC shutter open confirmation normal	shutter close	shutter	shutter open confirmation	present in tra	No tool pot tool		to pot vertical retract p	Movement to not unlocking horizontal position complete	Movement to pot locking horizontal position complete	change position	Spindle tool present clamp confirmation OFF	No spindle tool interlock	Not in manual tool chage cycle APC pallet cleaning sequence OFF	TS axis servo ON confirmation	unclamp outsi	Cylinder clamp outside spindle Cylinder clamp outside spindle OFF	. uo	MG manual oneration command etoring	MG manual operation command calling	manual opera	gripper tool p	Tool breakage inside MG detection in standby position confirmation Tool breakage inside MG detection inmeasurement position confirmation	Operation sequence No.
				П		П				П								П					П								П				I	T	
	al step branch		_	Н.	_	-	-	_	_	Н		_	_	-	_	-	_		_	_		_		_	-	Н.	2 0		_	-	-	-	+		+	+	₩.
	Operation selection (next tool present)	⇒3 ⇒106	+		<u>)</u>	-	+	+	+	Н	+	+	┿	\vdash	+	H	+	+	+	+	Н	+	Н	+	+				+	+	₩	+	+	0	+	+	2
	Operation selection (M63 command (no next tool)) Operation selection (Chage arm B gripper tool present)	⇒106 ⇒133	-			-	+	+	+	Н	+	+	+	H	+	H	+	+	+	+	Н	+	Н	+	+				+	+	++	+	+	0	+	+	2
	Operation selection (Chage arm 6 gripper tool present)	⇒58	-		5	-	+	+	+	Н	+	+	╁	C	+	+	+	+	+	+	Н	+	Н	+	+				+	+	++	+	+	C	4	+	- 4
	Operation selection (MG manual calling)	⇒82	-		5	-	+	+	+-	Н	+	+	╁	9	+	+	+	+	\dashv	+	Н	+	Н	+	+				+	+	++	+	0	U	+	+	- 4
	Operation selection (MG manual storing)	⇒94	-		5	H	+	-	+	H	\pm	+	╁	H	+	H	+	+	-	+	H	+	H	+	+				+	+	++			H	+	+	2
	Waiting for MC cycle end (next tool present in M64 operation)	⇒38	-	H	4	H		-	+	H	\pm	+	╁	o c	-	-	0	+	-	+	H	+	H	+	+				+	+	++	+	+	H	+	+	13
	Waiting for MC cycle end (next tool in M64 operation)	⇒109	1	Ħ	+	Ħ	ŏ	1	+	H	$\dashv \dashv$	\top	t	00			ŏ	\top	1	+	H	$^{+}$	H	$^{+}$	t		5 6		1	+	Ħ	+	t		+	+	13
	Waiting for MC cycle end (during MG manual interruption call operation)	⇒135	T	H	\top	П	Õ	T	+	Ħ	$\exists \exists$	\top	т				ŏ	Ħ	T	+	П	T	П	\top	T				1	\top	Ħ	\top	10	П	十	十	13
	Waiting for MC cycle end (during MG manual interruption storage operation)	⇒135		Ħ	T	Ħ	Ŏ	T	1	П	\top	十	T	C	5		ŏ	T	T	T	П	T	П	\top	Ť		5 C		T	T	11		5	П	T	T	13
	ATC shutter close (no return tool operation)	⇒54		H	T	m	Ť	T	\top	П	\top	T	T	т	Τ	0		П	T	Т	П	T	П	\top	T		olc		1	T	П	T	Τ	П	T	T	17
53	Tool transfer complete	⇒1		0	0		0		0							0	0				П	Т	П			() C						Т		I	I	34
57	Tool transfer complete	⇒1		0			0		0							0	0				П	Т	П) C						Т		I	I	39
	Operation selection	⇒70			0				0																										I	\perp	40
	Tool transfer complete	⇒1		0			0		0					Ш							Ш) C			\perp		\perp					51
	Tool transfer complete	⇒1		0			0		0					Ш							Ш) C			\perp		\perp					63
	Tool transfer complete	⇒1		0			0		0					Ш							Ш) C			┸		\perp	╙			_	75
	Tool transfer complete	⇒1		0)	ш	0		0	Ш		_		Щ	_	Щ	_	ш			Ш	_		_) C			_	ш	_	┸		4	_	87
	TI-axis in standby position (170 mm) (0 mm)	⇒18	_	ш	_	ш	\perp	_	4	ш	\perp	_	1	Ш	_		_	ш	_	_	Ш	_	Ш	_) C		_	_	Ш	4	1	Ш	4	4	108
	Tool transfer complete	⇒1	_	0		Ш	0	_	0	ш	\perp	_	1	Ш	_	0	0	Ш	_	_	Ш	_	Ш	_) C		_	_	Ш	_	1	Ш	4	4	111
		⇒120	_	ш	+	0	\perp	4	_	Ш	\perp	_	+	Ш	_		_	\perp	4	_	Ш	_	ш	_	-) C		(ш	_	+		4	4	32
	TS-axis A grip transport unit tool grip position (90-degree rotation)	⇒39	_	Н	_	ш	+	_	4	Н	\bot	_	4	4	+		_	\perp	_	+	Ш	_	ш	_	+		2 0		_	_	ш	_	+		+	+	130
	Transport unit on MC side	⇒18	С	1_	_	ш	+-	-	+_	Н	\perp	+	╀	Ш	+	_	_	\perp	-	+	Н	+	Н	+	+) C		_	+	++	+	╀	Н	+	+	134
136	Tool transfer complete	⇒1	+	0		\vdash	10	_	О	щ	+	_	+	Н	_	0	0	+	_	_	ш	_	ш	_	_) C		_	_	-	_	+	ш	_	+	136
	diana badi			\vdash	+			-		Н		+	+		+		+	\Box				+	Н		+			\Box		+	\vdash		+		+	+	-
	al step back Operation selection	⇒1	_	0	-	-		+	+	Н	-	+	+	+	+	+	+	+	+	+	Н	+	Н	+	+	١,	olc		+	+	+	+	+		+	+	+
	Operation selection Waiting for MC cycle end	⇒1 ⇒108	С		4	++	-14	+	+	Н	+	+	+	\vdash	+	\vdash	+	+	+	+	Н	+	Н	+	+				+	+	+	+	+	Н	+	+	37
	AT-axis transport unit tool grip position (90 mm)	⇒18	+	\vdash	+	+	+	+	+	H	+	+	+	H	+	H	+	+	+	+	H	+	H	+	+				+	+	H	+	+	Н	+	+	38
	TI-axis transport unit tool grip position (90 mm) TI-axis transport unit tool grip position (170 mm) (-170 mm)	⇒37	-	+	+	+	+	+	+	H	+	+	+	H	+	H	+	+	+	+	H	+	H	+	+				+	+	H	+	+	Н	+	+	54
	Operation selection	⇒1		0	. 	$^{+}$	0	+	0	H	+	+	+	H	+	H	+	+	+	+	H	+	H	+	+		5 0		+	+	Ħ	+	+	H	+	+	58
	Operation selection	⇒1	_	0		Ħ	ŏ	+	ŏ		\forall	\top	t	Ħ	t	Ħ	$^{+}$	H	+	$^{+}$	H	$^{+}$	Ħ	$^{+}$	+		5 6		\top	$^{+}$	Ħ	$^{+}$	T	Н	+	+	70
	Operation selection	⇒1	T	Ŏ (Ħ	ŏ	7	ŏ		\dashv	1	T	Ħ	Т	Ħ	+	T	7	т	П	+	П	\top	T		5 0		_	\top	Ħ	\top	T	П	\top	T	82
	Operation selection	⇒1	T	Ŏ (Ħ	ŏ	7	ō		\dashv	1	T	Ħ	Т	Ħ	1	T	7	т	П	1	П	\top	T		5 0		_	T	Ħ	\top	T	П	\top	T	94
	Tool change standby complete position (horizontal, vertical)	⇒2		O	Т	П	11	T	T	П	\sqcap	T	T		Т	П	T	\Box	T	T	П	T	П	T			olc		1	T	П	T	T	П	T	Т	106
	TI-axis transport unit tool grip position (170 mm) (-170 mm)	⇒18	С	T	Т		T	T	T	П		T	T		Т	П	Т		T	Т	П	Т	П	T	T		olc		T	Т	П	T	T	П	T	Т	109
	AT-axis in MG position (900 mm) (0 mm)	⇒32			I	0	\Box			П																() C				П				T	T	120
	Tool change standby complete position (horizontal, vertical)	⇒2		0	1	П	Ш	_	L	П	Ш	1	L	Ш	L	Ш	1	\Box	_	L	Ш	1	Ш	┚	L) C		┚	1		1	L		I	1	133
135	Transport unit on MG side	⇒18	Т		0	П	П	Т	0	П	П	Т		0			Т		П	Т	П	Т	П	Т	Т	() C	П	Т	Т		Т	Г		Т		135

	2500Н		Ţ			7		Ţ			8		Ţ	Į,			9				Ţ	10			1	Ţ		11			Ţ			12				٦
ATC	matrix magazine) logic table MAP029A		8	0 40	20 10	08 0	4 02 (01 80	0 40	20 1	08	04 0	2 01	80 4	40 21	0 10	08	04 02	2 01	80 4	0 20	10	8 04	02	01 8	0 40	20	100	8 04	02 0)1 81	40	20 1	0 08	104	02 0	Л.	4
Operation sequence No.	Manual interlock 8/8	Step reverse	Return cycle	unclamp L	Spindle tool clamp LS OFF Spindle tool clamp LS ON	Spindle tool unclamp LS ON	stop	Spindle indexing complete M64 Next tool storage cycle	986	rn tool	Normal cycle (change arm rotation present) No next tool ready operation return	operation	Active tool writing complete	TS-axis 90 degrees	TS-axis 180 degrees	TS-axis 0 degrees	No recovery NG tool	Recovery NG tool present	Tool change position (HP1)	Tool rack search complete	AT-axis MG side	AT-axis spindle side	All-axis in standby position Change arm rotation complete	Step reverse interlock	Step advance interlock	Tool breakage detection cycle complete	Tool breakage detection cycle	Not in tool breakage detection cycle Travis transport unit tool grin position		spindle tool	II-axis in standby position Return tool to be returned to next tool ready ST	ol in next tool ready ST		U-axis connection compleate U-axis shifter retraction confirmation LS	U-axis shifter retraction confirmation LS OFF	U-axis present LS OFF	I S-axis rotating position Operation sequence No.	
			_	-	_		-	4		_			\perp		4		Ш	4		4	+		+		4	\perp		4		Н	4		4	+	Ш	_	_	_
	al step branch	-	_	-	_		-	_		_		_	+	\vdash	-		Н	_	-	-	_		+		_	-	-	_	+	_	+	+	-	+	-	\rightarrow	+	_
	Operation selection (next tool present)	⇒3	-	+	-	Н	+	+	0	_	_	+	+	₩	+	+	Н	_	+	+	+	Н	+	Н	+	+	+	+	+	Н	+	+	+	+	+	+	+	2
	Operation selection (M63 command (no next tool))	⇒106		+	+	\vdash	+	+	+	0	+	+	+	+	+	+	H	+	+	+	+	Н	+	Н	+	+	+	+	+	H	+	+	+	+	+	+	+	2
	Operation selection (Chage arm B gripper tool present)	⇒133	_	+	+	Н	+	+	+	+	_	Η.	╀	Н	+	+	Н	_	+	+	+	Н	+	+	-	+	+	+	+	Н	+	+	+	+	+	+	+	2
	Operation selection	⇒58	_	+	+	Н	+	+	+	+	_	- (7	Н	+	+	Н	_	+	+	+	Н	+	+	-	+	+	+	+	Н	+	+	+	+	+	+	+	2
	Operation selection (MG manual calling)	⇒82		+	+	\vdash	++	+	+	+	+	+	+	H	+	+	H	+	+	+	+	Н	+	+	_	+	+	+	+	Н	+	+	+	+	+	+	+	2
	Operation selection (MG manual storing)	⇒94		+	+	\vdash	++	+	اجل	+	+	+	+	H	+	+	H	+	+	+	+	Н	+	+	_	+	+	+	+	Н	+	+	+	+	+	+	+	2
	Waiting for MC cycle end (next tool present in M64 operation)	⇒38		+	+	H	+		00	_	+	+	+	₩	+	+	H	+	+	+	+	Н	+	Н	+	+	+	+	+	Н	+	++	+	+	+	+		13
	Waiting for MC cycle end (no next tool in M64 operation)	⇒109		+	+	\vdash	++	_(4	0	-	+	+	H	+	+	H	+	+	+	+	Н	+	+	_	+	+	+	+	Н	+	+	+	+	+	+		13
	Waiting for MC cycle end (during MG manual interruption call operation)	⇒135		+	+	\vdash	++	+	+	+	-	+	+	++	+	+	Н	+	+	+	+	Н	+	+	_	+	+	+	+	Н	+	+	+	+	+	+		13
	Waiting for MC cycle end (during MG manual interruption storage operation)	⇒135	-	+	+	\vdash	++	+	+	0	-	+	+	++	+	+	Н	+	+	+	+	Н	+	+	_	+	+	+	+	Н	+	+	+	+	+	+		13
	ATC shutter close (no return tool operation) Tool transfer complete	⇒54 ⇒1		+	+	\vdash	++	+	+	0	-	+	+	++	+	+	Н	+	+	+	+	Н	+	+	_	+	+	+	+	Н	+	+	+	+	+	+		17 34
	Tool transfer complete Tool transfer complete	⇒1	-	+	+	\vdash	+	+	+	+	+	+	+	H	+	+	\vdash	+	+	+	+	Н	+	+	_	+	+	+	+	Н	+	+	+	+	+	+		39
	Operation selection	⇒70	-+	+	+	\vdash	+	+	+	+	0	-	+	H	+	+	\vdash	+	+	+	+	Н	+	+	_	+	+	+	+	Н	+	+	+	+	+	+		39 40
	Tool transfer complete	⇒1	-	+	+	H	+	+	+	+	-0		4	H	+	+	\vdash	+	+	+	+	Н	+	+	_	+	+	+	+	Н	+	+	+	+	+	+		51
	Tool transfer complete Tool transfer complete	⇒1	-	+	+	H	+	+	+	+	+	9	+	H	+	+	H	+	+	+	+	Н	+	+	_	+	+	+	+	Н	+	+	+	+	₩	+		63
	Tool transfer complete Tool transfer complete	⇒1	-+	+	+	H	+	+	+	+	+	+	+	H	+	+	H	+	+	+	+	Н	+	+	_	+	+	+	+	Н	+	+	+	+	₩	+		75
	Tool transfer complete Tool transfer complete	⇒ı ⇒1	-	+	+	\vdash	++	+	+	+	_	+	+	++	+	+	H	+	+	+	+	Н	+	+	_	+	+	+	+	Н	+	+	+	+	+	+		/5 87
	TI-axis in standby position (170 mm) (0 mm)	⇒18	-+	+	+	H	+	+	+	+	+	+	+	H	+	+	H	+	+	+	+	Н	+	+	_	+	+	+	+	Η,	_	+	+	+	₩	+	10	
		⇒18	-+	+	+	\vdash	+	+	+	+	+	+	+	H	+	+	\vdash	+	+	+	+	Н	+	+	+	+	+	+	+	H	4	+	+	+	+	+	11	
	Tool transfer complete Change arm tool unlock/Cylinder clamp outside spindle (during tool breakage inside MG)	⇒1 ⇒120	-+	+	+	\vdash	+	+	+	+	+	+	+	H	+	+	\vdash	+	+	+	+	Н	+	+	+	+		+	+	Н	+	+	+	+	+	+		32
		⇒120	-+	+	+	\vdash	+	+	+	+	+	+	+		+	+	\vdash	+	+	+	+	Н	+	+	+	+	0	+	+	Н	+	+	+	+	+	+	13	
	TS-axis A grip transport unit tool grip position (90-degree rotation) Transport unit on MC side	⇒39	-	+	+	\vdash	++	+	+	+	+	+	+	0	+	+	Н	+	+	+	╁	Н	+	Н	\dashv	+	+	+	+	Н	+	+	+	+	++	+	13	
	Transport unit on MC side Tool transfer complete	→10		+	+		++	+	+	+	+	+	+	H	+	+	\vdash	-	+	+	+	H	+	+	+	+	+	+	+	H	+	+	+	+	+	+	13	
130	Tool transfer complete	71	_	-	+	ш	++	+	+	_	_	_	+	Н	+	+-	Н	_	-	+	+	Н	+	Н	+	+	+	+	+-	Н	+	-	+	+-	+	-	13	30
	al step back			-	-			+		-			+		+			-			+		+		-	+		+			+		+			+		-
	Operation selection	⇒1	\rightarrow	+	+	\vdash	++	+	+	\rightarrow	+	+	+	1	+	+	\vdash	+	1	+	+	Н	+	Н	\rightarrow	+	+	+	+		+	+	$^{+}$	+	\rightarrow	+	+	-
	Operation selection Waiting for MC cycle end	⇒ı ⇒108	\dashv	+	+	+	+	+	+	0	+	+	+	H	+	+	H	+	+	+	+	Н	╅	Н	+	+	+	+	+	Н,		+	+	+	+	+	+	37
	AT-axis transport unit tool grip position (90 mm)	⇒18	\dashv	+	+	+	+			~	+	+	+	+	+	+	\vdash	+	+	+	+	Н	+	Н	+	+	+	+	+	-	<u></u>	+	+	+	+	+		38
	TI-axis transport unit tool grip position (90 mm) TI-axis transport unit tool grip position (170 mm) (-170 mm)	⇒37	\dashv	+	+	+	+	+	┧	+	+	+	+	+	+	+	\vdash	+	+	+	+	Н	+	Н	+	+	+	+	+	Н,	4	+	+	+	+	+		30 54
	Operation selection	⇒1	\dashv	+	+	+	+	+	+	+	+	+	+	+	+	+	H	+	+	+	+	Н	+	Н	+	+	+	+	+	H	+	+	+	+	+	+		58
	Operation selection	⇒1		+	+	\vdash	+	+	+	$^{+}$	+	+	+	\vdash	+	+	H	+	+	+	+	H	+	Н	\dashv	+	+	+	+	H	+	+	$^{+}$	+	\forall	+		70
	Operation selection	⇒1	-+	+	\top		+	+	+	_	+	H	+	\vdash	+	т	H	+	†	$^{+}$	+	H	+	H	\dashv	+	+	+	+	H	+	+	+	+	\forall	+		82
	Operation selection	⇒1		+	\top	\vdash	+	Ŧ	\forall	+	+	\vdash	+	\vdash	$^{+}$	т	H	+	\vdash	$^{+}$	+	H	+	Н	\dashv	+	\forall	$^{+}$	+	H	\top	+	$^{+}$	+	\forall	\dashv		94
	Tool change standby complete position (horizontal, vertical)	⇒2	-1	Ħ	\top	Ιt	11	$^{+}$	11	+	\top	\vdash	T	Ħ	$^{+}$	+	Ħ	1	Ħ	$^{+}$	†	Ħ	$^{+}$	H	1	T	11	+	1	Ħ	+	$\dagger \dagger$	\dashv	+	+	\neg	10	
	TI-axis transport unit tool grip position (170 mm) (-170 mm)	⇒18	-+	+	\top	\vdash	+	Ť	+	\dashv	+	H	t	H	$^{+}$	Н	H	+	+	$^{+}$	t	H	+	Н	+	$^{+}$	+	$^{+}$	+	H	$^{+}$	+	$^{+}$	+	+	\pm	10	
	AT-axis in MG position (900 mm) (0 mm)	⇒32	-t	+	\top	\vdash	+	T	+	\pm	\pm	$^{+}$	+	H	+	Н	H	+	\vdash	+	+	H	+	Н	\dashv	+	+	$^{+}$	+	H	+	+	$^{+}$	+	\forall	\pm	12	
	Tool change standby complete position (horizontal, vertical)	⇒2	-t	+	\top	\vdash	+	$^{+}$	+	\dashv	+	$^{+}$	+	H	+	$^{+}$	H	+	+	$^{+}$	+	H	+	Н	\dashv	+	+	$^{+}$	+	H	+	+	$^{+}$	+	\forall	+	13	
	Transport unit on MG side	⇒18	-1	+	+	Ħ	+	T	+	7	\top	Ħ	T	\vdash	$^{+}$	T	H	_	\top	$^{+}$	1	Ħ	+	Н	1	T	+	1	+	H	T	\top	+	+	+	$^{+}$	13	
700	compete and an over see							_		_					_		_	_	_	_	_	-	_	_	_			_	-				_		_	_		