

Sample ladder program for *i*Pendant

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1 Overview

To operate a machine tool from *iPendant*, you need to make sequence program for the *iPendant* operation. For your reference, a sample ladder program for *iPendant* with FANUC standard key sheet is provided in source file format of function block that can be used in your sequence program using FANUC LADDER-III. This document describes the specification of the sample function block (hereafter “sample FB”), and how to use it in your ladder program.

2 Requirements for *iPendant*

The following versions of software are required to use *iPendant*.

PMC System software

Software	Drawing No.	Series	Edition
Series 30i/31i/32i -B Series 35i -B Power Motion <i>i</i> -A PMC System software	A02B-0323-H580#40A5 A02B-0333-H580#40A5 A02B-0334-H580#40A5	40A5	07 or later

CNC System software

Software	Drawing No.	Series	Edition
Series 30i -B CNC System software	A02B-0323-H501#G301 G311 G321	G301 G311 G321	18 or later
Series 31i -B5 CNC System software	A02B-0326-H501#G421 G431	G421 G431	
Series 31i -B CNC System software	A02B-0327-H501#G401 G411	G401 G411	
Series 32i -B CNC System software	A02B-0328-H501#G501	G501	
Series 35i -B CNC System software	A02B-0333-H501#G601 G611	G601 G611	
Power Motion <i>i</i> - MODEL A CNC System software	A02B-0334-H501#88H0	88H0	03 or later

Ethernet display software

Software	Drawing No.	Series	Edition
Ethernet display software	A02B-0333-J573#658N	658N	01 or later

* Required when you operate Boot or IPL menu from *iPendant*.

Embedded Ethernet software

Software	Drawing No.	Series	Edition
Embedded Ethernet software	A02B-0333-J571#658M	658M	05 or later

BOOT software

Software	Drawing No.	Series	Edition
BOOT software	-	60W4	04 or later

* Required when you operate Boot menu from *iPendant*.

The “Function block function (A02B-0xxx-R852)” option is required to run the sample FB.

3

Sample FB for *i*Pendant

There are two operation modes in *i*Pendant.

- MDI unit operation mode
The mode for using key board of *i*Pendant as MDI unit
- M-OPE (Machine-Operation) mode
The mode for using key board of *i*Pendant as machine operator's panel

This sample FB enables the following operations in M-OPE mode when using *i*Pendant with FANUC standard key sheet.

- Mode selection (MDI, MEM, EDIT, REF, JOG, T-JOG)
- Cycle start
- Feed hold
- Jog feed /incremental feed
- Dry run
- Single block
- Optional block skip
- Spindle stop when manual operation

Note

- 1 For detailed specification of *i*Pendant, see the "*i*Pendant (for CNC) Connection and Maintenance Manual (A-77247)".
- 2 To make the "RESET" key effective, you need to make additional ladder circuit. See "3.5 Additional Ladder circuit" for details.



CAUTION

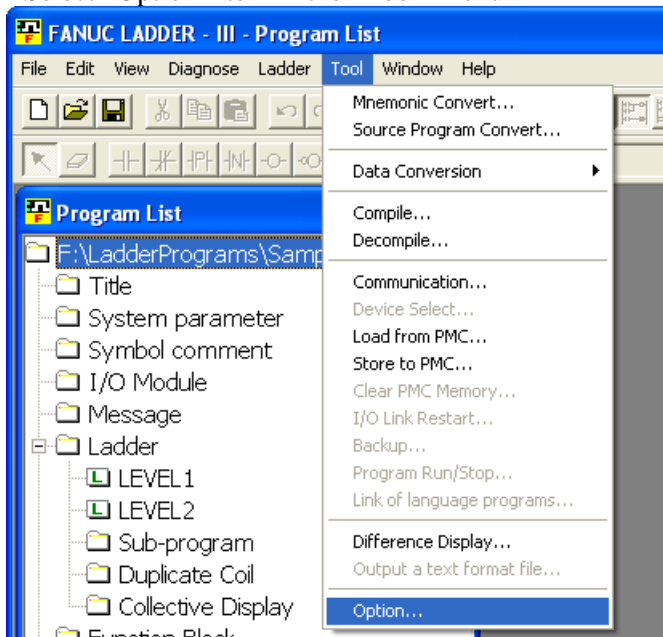
- 1 This sample FB does not contain a circuit of emergency stop button of *i*Pendant. To make the emergency stop button of *i*Pendant effective, you should include the emergency stop signal of *i*Pendant in the emergency stop circuit of the machine tool and finally connect to the emergency stop input of CNC and servo amplifier.
- 2 If the operator, who uses the *i*Pendant to operate the machine, may possibly face a dangerous situation, the ladder circuit should be designed to cut off the power of machine tool by releasing the enabling switch of *i*Pendant.

3.1 Integrating Sample FB

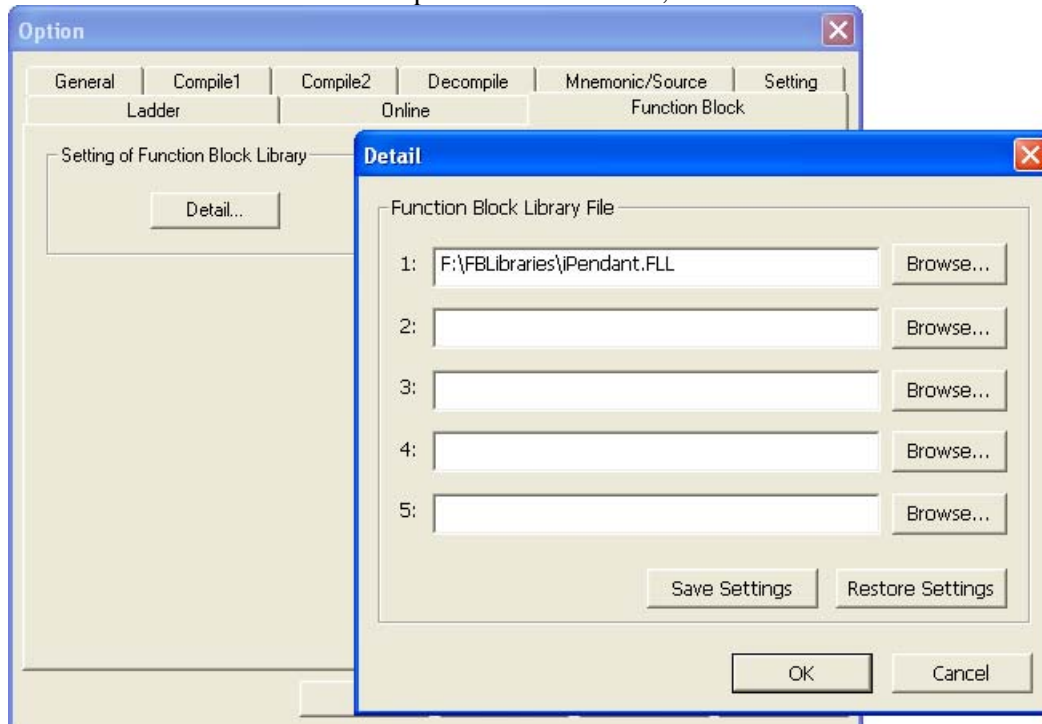
The sample ladder program for iPendant is provided in source file format of function block.

This sample FB whose name is “iPendantControl” is included in the function block library file “iPendant.FLL” attached in the installation CD of FANUC LADDER-III. To use the sample FB, 1) register “iPendant.FLL” as a function block library to refer, 2) drag and drop the sample FB, which appears in “Program List” window, onto the ladder diagram editor window, 3) program proper signals or circuits at the input and output sections of the FB.

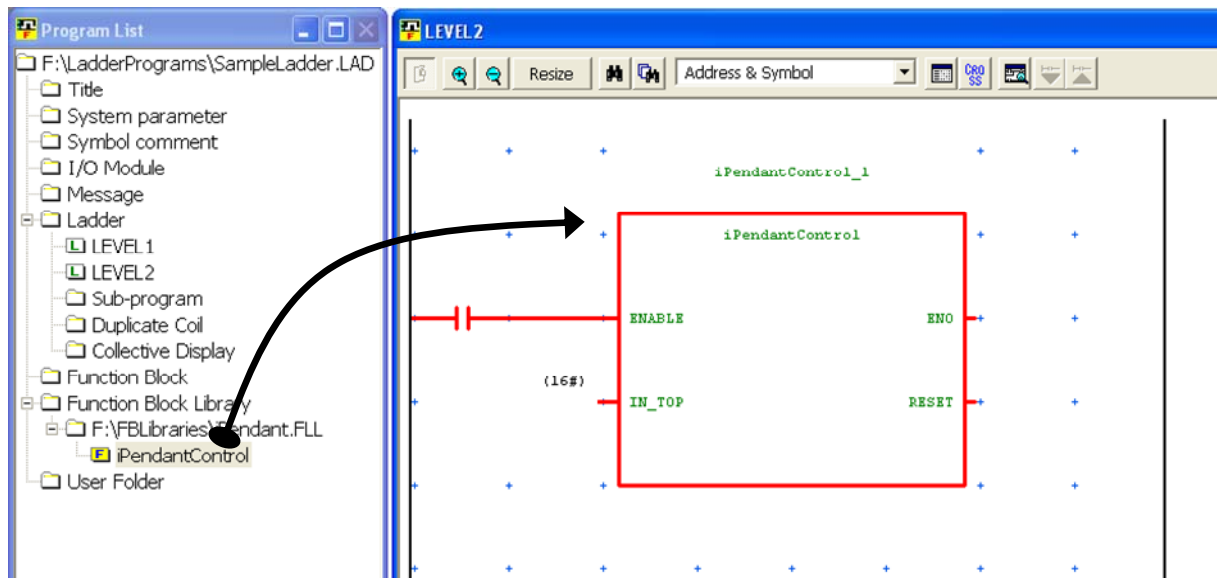
- 1) Register “iPendant.FLL” file as a function block library
 - Select “Option” item in the “Tool” menu



- Select “Function Block” tab and press “Detail” button, enter “iPendant.FLL” as a function block library



- 2) Drag & drop the “iPendantControl” into your ladder program in the ladder diagram window



3) Program proper signals or circuits at the input and output section of the FB

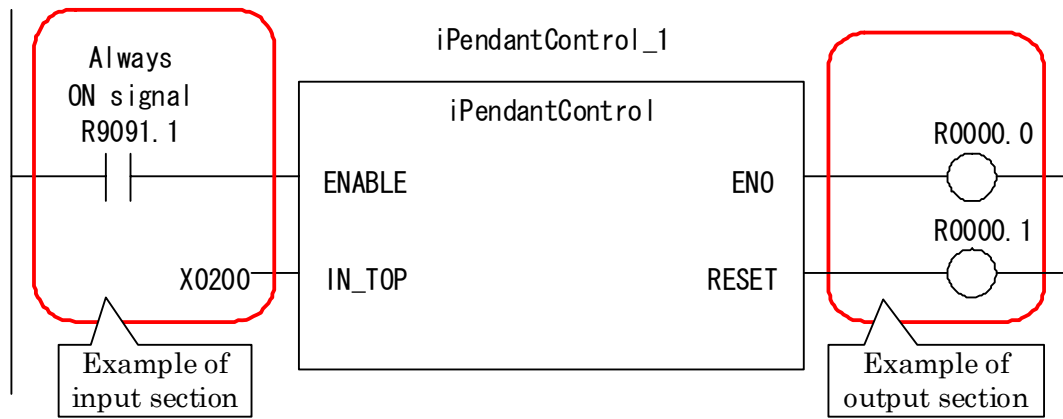


Fig. 3.1 (a) Sample FB

3.2 Specification of Sample FB

The detailed specifications of each parameter of the sample FB are listed below.

Table 3.2 (a) Parameters of the function block

Symbol	kind of parameter	Data type	number	Explanation
ENABLE	Input parameter	BOOL	-	When using <i>i</i> Pendant, set this parameter always to ON regardless of connection status of <i>i</i> Pendant. If this parameter is OFF, any key operation of <i>i</i> Pendant in the M-OPE mode is not effective and the both output parameter 'ENO' and 'RESET' turn OFF.
X_TOP	Input parameter	BYTE	10	Set the top address of key signal data area specified in CNC parameter No.11542 and No.11543.
ENO	Output parameter	BOOL	-	This parameter becomes ON, when operating CNC by <i>i</i> Pendant (i.e. connecting <i>i</i> Pendant and setting the operation ON/OFF switch to ON). In case that the input parameter ENABLE is OFF, this parameter always becomes OFF. This parameter can be used for switching the operation from <i>i</i> Pendant and other machine operator's panel.
RESET	Output parameter	BOOL	-	When connecting <i>i</i> Pendant, this parameter means the press status of the [RESET] key regardless of the status of the operation ON/OFF switch and [M-OPE/MDI] key. This output becomes ON when pressing [RESET] key. In case that the input parameter ENABLE is OFF, this output always becomes OFF. To make the output effective, you should program the output in ladder circuit for external reset.

In this sample FB, the following signals are written when CNC is operated by *i*Pendant (i.e. *i*Pendant is connected and the operation ON/OFF switch is turned ON).

Table 3.2 (b) Signals used in the function block

Signal	Symbol	Signal name
G0007.2	ST	Cycle start signal
G0008.5	*SP	Feed hold signal
G0029.6	*SSTP	Spindle stop signal
G0043.0 ~ G0043.2	MD1, MD2, MD4	Mode selection signals
G0043.5	DNCI	DNC operation selection signal
G0043.7	ZRN	Signal for selecting manual reference position return
G0044.0	BDT1	Optional block skip signal
G0046.1	SBK	Single block signal
G0046.7	DRN	Dry run signal
G0100.0 ~ G100.5	+J1 ~ +J6	Feed Axis and Direction Selection Signals
G0102.0 ~ G102.5	-J1 ~ -J6	



CAUTION

If the machine tool has a machine operator's panel other than *iPendant*, and can be operated from these devices at the same time, it may lead to dangerous situations. Therefore, you have to design your ladder program to operate the machine tool exclusively with the sample FB. In other words, your ladder program should not write the above-mentioned signals while the sample FB is active and operating the machine.

3.3 Example ladder for *iPendant* as only machine operator's panel

When the operation ON/OFF switch is turned ON, machine operation from the *iPendant* becomes effective with this sample FB. When *iPendant* is the only machine operator's panel, machine operation from *iPendant* is enabled by simply calling this sample FB in your ladder program.

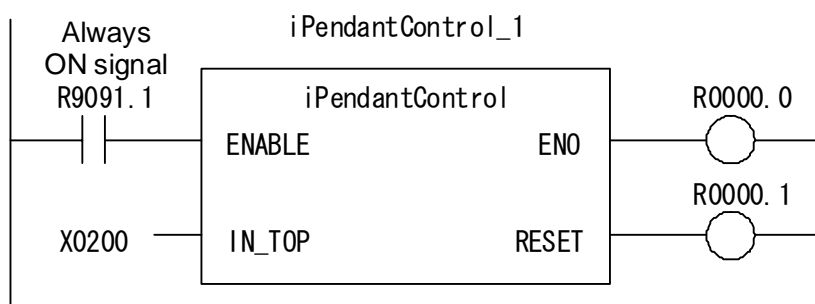


Fig. 3.3 (a) Programming example for *iPendant*

3.4 Example ladder for *iPendant* with another machine operator's panel

To use both of *iPendant* and another machine operator's panel, you have to design ladder program not to operate the machine tool from both of them at the same time. In the case that you switch the machine operation by operation ON/OFF switch on *iPendant*, your ladder program can use ENO output to know the status of operation ON/OFF switch on *iPendant*, and can switch the effective operator's panel between *iPendant* and the other machine operator's panel accordingly.

Example.1) In the case that the other machine operator's panel is controlled by another function block
Your ladder program should activate the function block for other machine operator's panel only while the ENO of sample FB is ON.

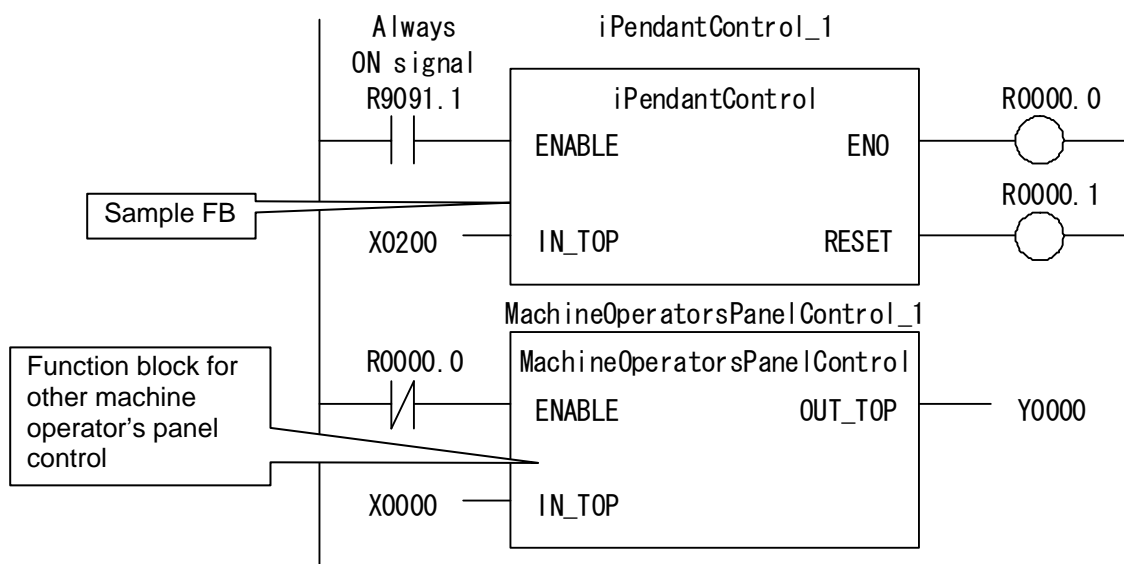


Fig.3.4 (a) Example 1 of switching the operation between *i*Pendant and other machine operator's panel

Example.2) In the case that function block is not used to control the other machine operator's panel
 Your ladder program should not write the signals described in table 3.2(b) while the ENO of the sample FB is ON.

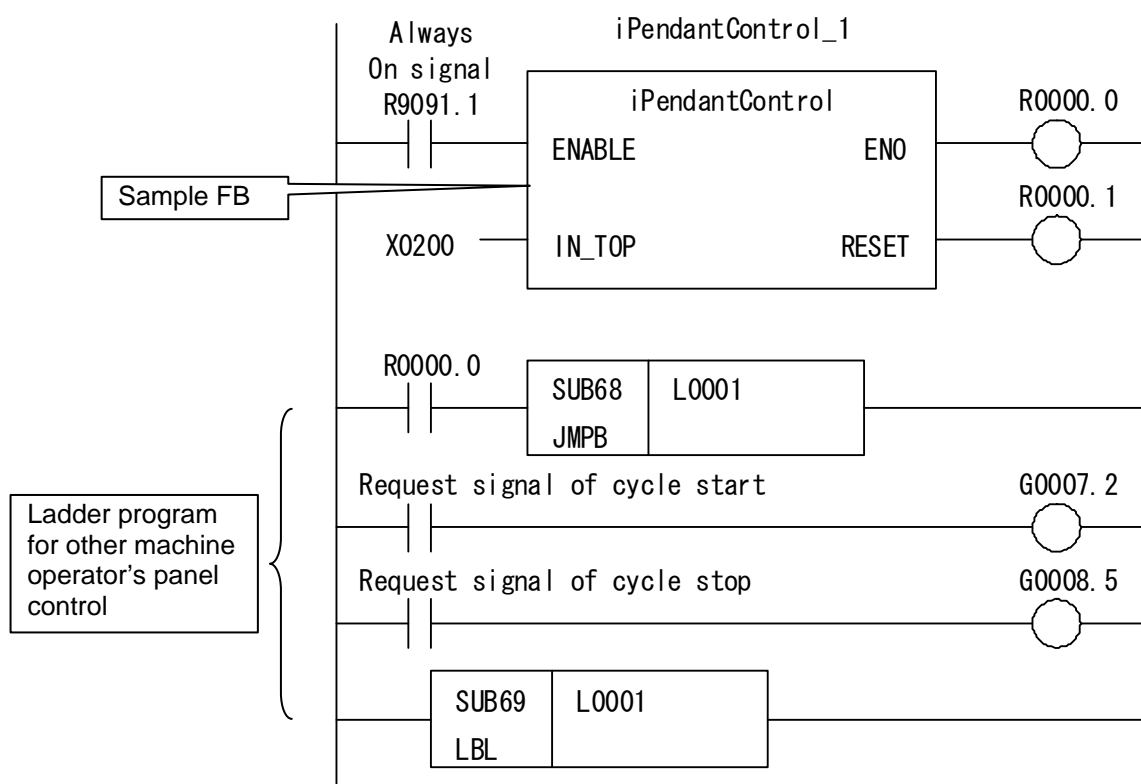


Fig.3.4 (b) Example 2 of switching the operation between *i*Pendant and other machine operator's panel

3.5 Additional Ladder circuit

The following functions are not provided by the sample FB, because their related signals have to be inserted in the emergency stop circuit or the reset circuit of the machine tool. Please integrate the signals in your ladder program to support these functions.

- Emergency stop button
- Enabling switch
- RESET key
- Selecting display unit for MDI operation

Emergency stop button, Enabling switch

Signals for emergency stop button and enabling switch on *iPendant* are provided to PMC through I/O Link. To make emergency stop button on *iPendant* effective, the emergency stop signal of *iPendant* should be inserted to the emergency stop circuit of the machine and finally connect to the emergency stop input of CNC and servo amplifier. If the operator, who uses the *iPendant* to operate the machine, may possibly face a dangerous situation, the ladder circuit should be designed to cut off the power of machine tool by releasing the enabling switch of *iPendant*.

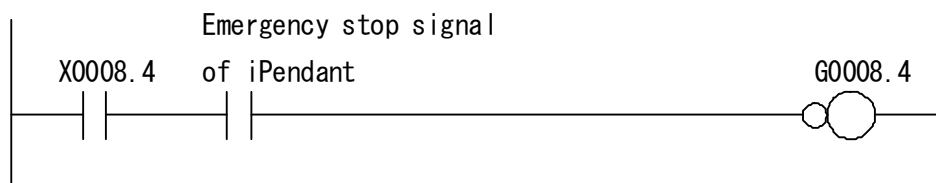


Fig.3.5 (a) Example of emergency stop circuit

Reset

To reset CNC by RESET key on *iPendant*, the output signal “RESET” of the sample FB should be inserted to the external reset circuit in your ladder program. See the “3.2 Specification of Sample FB” for details of the output parameter “RESET”.

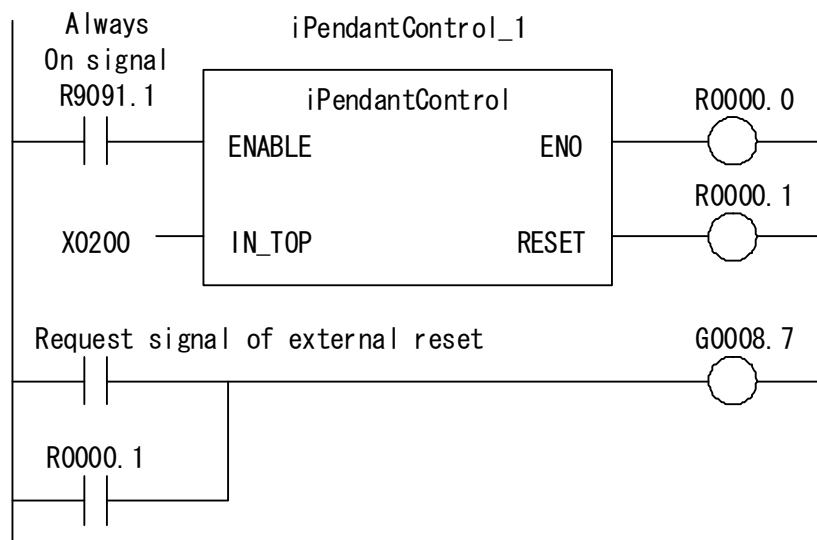


Fig.3.5 (b) Example of external reset circuit

Switching MDI operation

If the machine tool has both of the standard CNC display and the *iPendant*, and one of the following options is applied, your ladder program should support switching MDI operation between them.

- CNC screen dual display function
- Twin display function with Ethernet

When switching the MDI operation by operation ON/OFF switch on *iPendant*, your ladder program can use ENO output to know the status of the operation ON/OFF switch on *iPendant*, and switch the MDI operation between *iPendant* and the other display unit accordingly.

In the following condition, use the selection signal CNCKY for switching MDI operation.

- “CNC screen dual display function” is effective, or
- “Twin display function with Ethernet “ is effective and the CNC parameter No.11539#2 is set to 0

Key control selection signal CNCKY <G295.7>

[Classification] Input signal

[Function] Selects which key control, on *iPendant*, or on CNC, is to be enabled in case of the following conditions.

- The CNC screen dual display function is effective
- The “Twin display function with Ethernet” is invalid or the bit 2 (D3K) of parameter No.11539 is 0

[Operation] In case of “0”, Key control on *iPendant* is enabled.

In case of “1”, Key control on CNC is enabled.

Example)

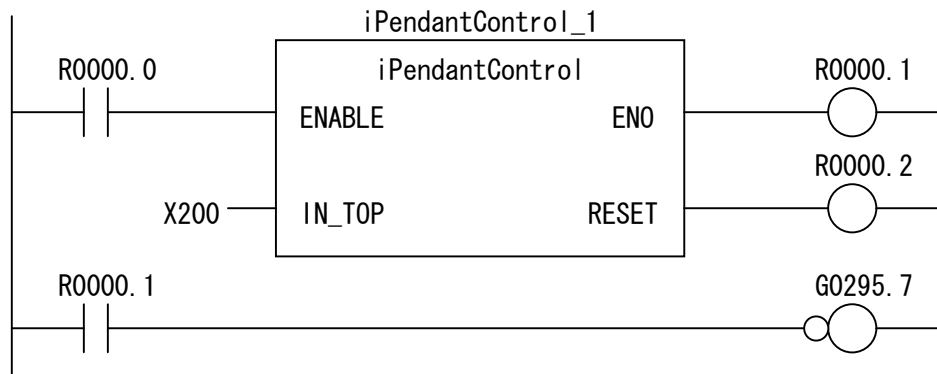


Fig.3.5 (a) Example 1 of switching MDI operation between other CNC display and *iPendant*

When following condition, selection signal CTRL0 and CTRL1 can be used for switching.

- “Twin display function with Ethernet “ is effective and the CNC parameter No.11539#2 is set to 1

Key input selection signals CTRL0, CTRL1 <G0514.1>,< G0514.2>

[Classification] Input signal

[Function] When the secondary display unit for Ethernet connection is effective and the bit 2 (D3K) of parameter No.11539 is 1, these signals select the screen unit whose MDI operation and touch panel operation are enabled according to the following table.

[Operation]

Selected screen unit	CTRL1	CTRL0
Main CNC screen unit	0	0
Secondary CNC screen unit	1	0
<i>iPendant</i>	1	1

Example)

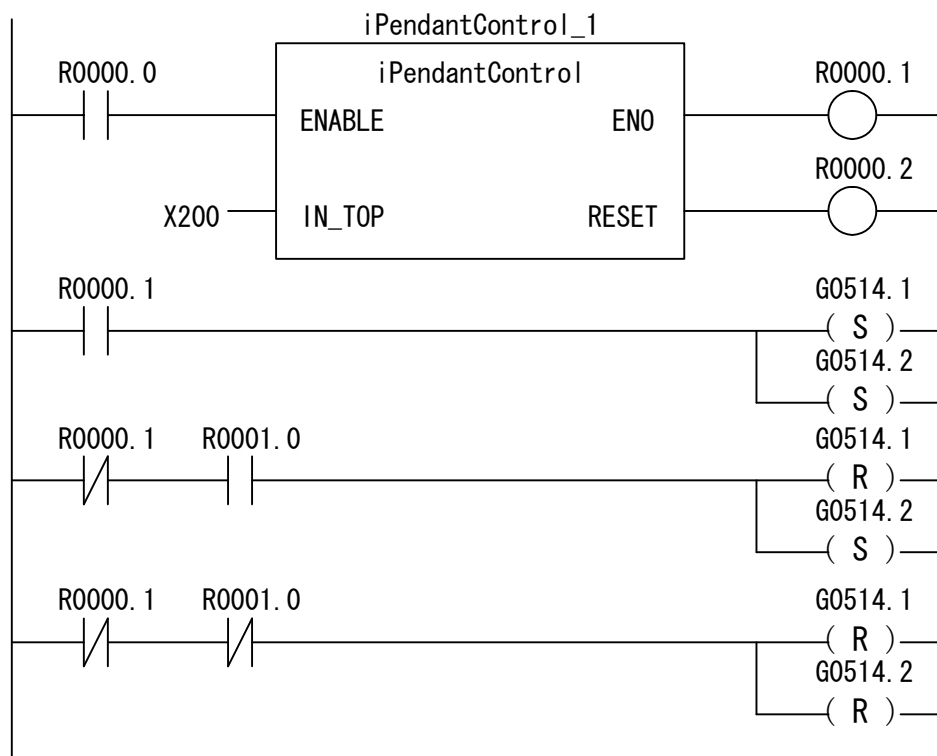


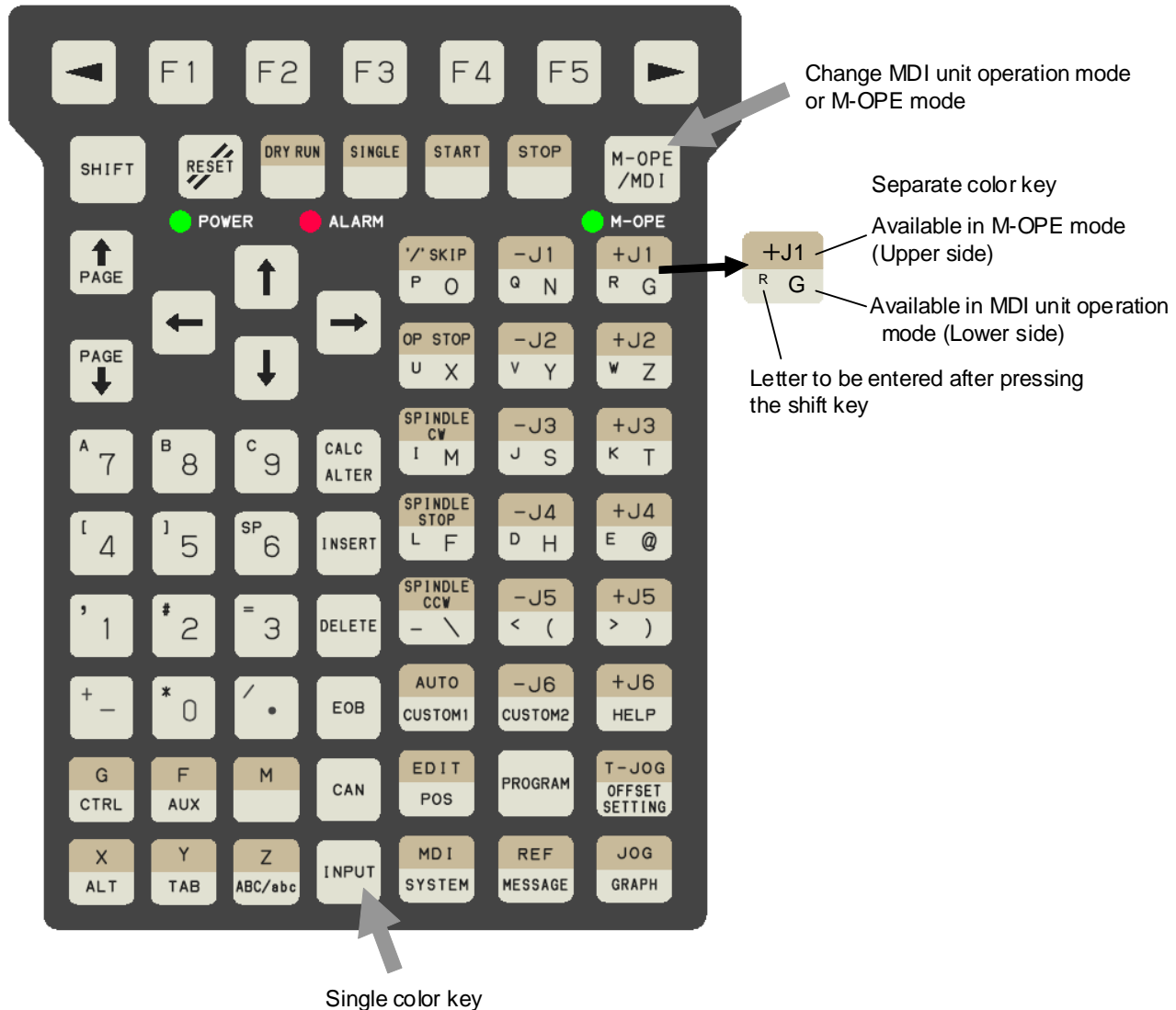
Fig.3.5 (b) Example 2 of switching MDI operation between other CNC display and *iPendant*

4

FANUC standard key sheet

The following figure shows the FANUC standard key sheet.

In the MDI unit operation mode, the single color keys and the lower side of separate color keys are effective. In the M-OPE mode, the single color keys and upper side of separate color keys are effective.





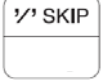





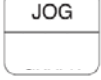




.4 (a) FANUC standard key sheet

Fig

Using the sample FB, the following keys are effective.

Table 4 (a) Key table

Appearance	Explanation
	Dry run: Pressing this key changes ON and OFF of the dry run function.
	Single block: Pressing this key changes ON and OFF of single block execution.

Appearance	Explanation
	Cycle start: Pressing this key starts automatic operation.
	Cycle stop: Pressing this key stops automatic operation.
	Optional block skip: Pressing this key changes ON and OFF of the optional block skip function. Head code of the block that is skipped by this operation is as follows. / or /1
	Spindle stop: Pressing this key stops and resumes the spindle revolution in the manual operation.
	AUTO mode selection: Pressing this key switches to the automatic execution (memory execution) mode.
	EDIT mode selection: Pressing this key switches to the memory edit mode.
	MDI mode selection: Pressing this key switches to the automatic execution (MDI execution) mode.
	REF mode selection: Pressing this key switches to the manual reference point return mode.
	JOG mode selection: Pressing this key switches to the jog feed mode.
	T-JOG mode selection: Pressing this key switches to the teaching jog mode.
	Manual feed: Pressing this key moves 1st to 6th axis to “+” direction in the jog feed mode.
	Manual feed: Pressing this key makes 1st to 6th axis to “-” direction in the jog feed mode.
	For the release of alarms, this key resets CNC. * To use this key, the external reset circuit has to be modified. For details, refer to “3.5 Additional Ladder circuit”.

5 Related CNC parameter

The following CNC parameters have to be set properly to use the sample FB.

CNC parameter	Setting value	Explanation
3206#5 (Note1)	0	The key control will be switched by DI signal (G0295#7) when the CNC screen dual display function is effective.
11539#1 (Note2)	0	When <i>i</i> Pendant is in the MDI unit operation mode and the operation ON/OFF switch is ON, the status of keys on <i>i</i> Pendant will not be informed.
11540 (Note2) 11541 (Note2)	0	Do not use <i>i</i> Pendant operation mode control signal <MOPEC>.
11542 (Note2)	1-3, 11-12, 21-22, 31-32, 41-42	The top address of key signal data information area (X_TOP) of <i>i</i> Pendant (Note3)
11543 (Note2)	0-	
11937#0~ 11939#7 (Note2)	0, 1	If the key signal data information area is allocated in "X" address, set "1" to the bit corresponding to the allocated address.

NOTE

- 1 For details, refer to "FS30i-B parameter manual (B-64490EN/03)".
- 2 For details, refer to "*i*Pendant (for CNC) connection and mountainous manual" (A-77247).
- 3 The key signal data information area needs to be allocated the I/O address block which is not used by either I/O Link or I/O Link *i*. The I/O address blocks mean the area of X0-127, X200-327, X400-527 and X600-727. For example, if X6-9 are used by I/O Link or I/O Link *i*, any address in the address block X0-127 cannot be used for key signal data information area of *i*Pendant.