MITSUBISHI ELECTRIC

Programmable Controller

MELSEC iQ-F series

MELSEC iQ-F Character String Operation Function Block Library Reference

SAFETY PRECAUTIONS

(Read these precautions before use.)

Before using this product, please read this manual and the relevant manuals introduced in this manual carefully and pay full attention to safety in order to handle the product correctly.

This manual classifies the safety precautions into two categories: [⚠ WARNING] and [⚠ CAUTION].

⚠ **WARNING**	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
⚠ **CAUTION**	Indicates that incorrect handling may cause hazardous conditions, resulting in minor or moderate injury or property damage.

Depending on the circumstances, procedures indicated by [⚠ CAUTION] may also cause severe injury.

It is important to follow all precautions for personal safety.

Store this manual in a safe place so that it can be read whenever necessary. Always forward it to the end user.

INTRODUCTION

Thank you for purchasing the Mitsubishi Electric MELSEC iQ-F series programmable controllers.
This manual describes the module function blocks for the target modules listed below.
It should be read and understood before attempting to install or use the module function blocks.
Always forward it to the end user.

Target module

- FX5S CPU module
- FX5UJ CPU module
- FX5U CPU module
- FX5UC CPU module

Regarding use of this product

- This product has been manufactured as a general-purpose part for general industries, and has not been designed or manufactured to be incorporated in a device or system used in purposes related to human life.
- Before using the product for special purposes such as nuclear power, electric power, aerospace, medicine or passenger movement vehicles, consult Mitsubishi Electric.
- This product has been manufactured under strict quality control. However when installing the product where major accidents or losses could occur if the product fails, install appropriate backup or failsafe functions in the system.

Note

- If in doubt at any stage during the installation of the product, always consult a professional electrical engineer who is qualified and trained in the local and national standards. If in doubt about the operation or use, please consult the nearest Mitsubishi Electric representative.
- Since the examples indicated by this manual, technical bulletin, catalog, etc. are used as a reference, please use it after confirming the function and safety of the equipment and system. Mitsubishi Electric will accept no responsibility for actual use of the product based on these illustrative examples.
- This manual content, specification etc. may be changed, without a notice, for improvement.
- The information in this manual has been carefully checked and is believed to be accurate; however, if you notice a doubtful point, an error, etc., please consult your local Mitsubishi Electric representative. When doing so, please provide the manual number given at the end of this manual.

CONTENTS

RELEVANT MANUALS

Manual name	Description
MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware) <SH-082452ENG>	Hardware of the CPU module, including I/O specifications, wiring, installation, and maintenance
MELSEC iQ-F FX5 User's Manual (Application) <JY997D55401>	Basic knowledge about programming, functions of the CPU module, devices/labels, and parameter settings
MELSEC iQ-F FX5 Programming Manual (Program Design) <JY997D55701>	Program specifications (ladder, ST, FBD/LD, and SFC programs) and labels
MELSEC iQ-F FX5 Programming Manual (Instructions, Standard Functions/Function Blocks) <JY997D55801>	Specifications of the instructions and functions that can be used in programs
GX Works3 Operating Manual <SH-081215ENG>	Explanation of system configuration, parameter settings, and online operations of GX Works3

TERMS

Unless otherwise specified, this manual uses the following terms.

Term	Description
Engineering tool	A tool used for setting up programmable controllers, programming, debugging, and maintenance
JSON string	Data string based on the way JavaScript objects are written
Key string	Value for identifying the Value string in the JSON string
Member	Structure including the type, Key string, Value string, and depth of hierarchy
Value string	Data to be written after the Key string in the JSON string

GENERIC TERMS AND ABBREVIATIONS

Unless otherwise specified, this manual uses the following generic terms and abbreviations.

Generic term/abbreviation	Description
FB	An abbreviation for "Function Block". A function block is created from a ladder block repeatedly used in a sequence program so that it can be used as a component in a sequence program. Using FBs helps to develop programs more efficiently, reduce mistakes, and improve quality of programs.
FX5	A generic term for FX5S, FX5UJ, FX5U, and FX5UC programmable controllers
FX5 CPU module	A generic term for FX5S CPU module, FX5UJ CPU module, FX5U CPU module, and FX5UC CPU module
FX5S CPU module	A generic term for FX5S-30MR/ES, FX5S-40MR/ES, FX5S-60MR/ES, FX5S-80MR/ES, FX5S-30MT/ES, FX5S-40MT/ES, FX5S-60MT/ES, FX5S-80MT/ES, FX5S-30MT/ESS, FX5S-40MT/ESS, FX5S-60MT/ESS, and FX5S-80MT/ESS
FX5U CPU module	A generic term for FX5U-32MR/ES, FX5U-32MT/ES, FX5U-32MT/ESS, FX5U-64MR/ES, FX5U-64MT/ES, FX5U-64MT/ESS, FX5U-80MR/ES, FX5U-80MT/ES, FX5U-80MT/ESS, FX5U-32MR/DS, FX5U-32MT/DS, FX5U-32MT/DSS, FX5U-64MR/DS, FX5U-64MT/DS, FX5U-64MT/DSS, FX5U-80MR/DS, FX5U-80MT/DS, and FX5U-80MT/DSS
FX5UC CPU module	A generic term for FX5UC-32MT/D, FX5UC-32MT/DSS, FX5UC-64MT/D, FX5UC-64MT/DSS, FX5UC-96MT/D, FX5UC-96MT/DSS, FX5UC-32MT/DS-TS, and FX5UC-32MT/DSS-TS
FX5UJ CPU module	A generic term for FX5UJ-24MR/ES, FX5UJ-24MT/ES, FX5UJ-24MT/ESS, FX5UJ-24MR/DS, FX5UJ-24MT/DS, FX5UJ-24MT/DSS, FX5UJ-40MR/ES, FX5UJ-40MT/ES, FX5UJ-40MT/ESS, FX5UJ-40MR/DS, FX5UJ-40MT/DS, FX5UJ-40MT/DSS, FX5UJ-60MR/ES, FX5UJ-60MT/ES, FX5UJ-60MT/ESS, FX5UJ-60MR/DS, FX5UJ-60MT/DS, and FX5UJ-60MT/DSS

1 OVERVIEW

The function blocks in this reference manual mean the FB libraries for character string operation in the MELSEC iQ-F series.

1.1 Features

This section describes the features of this function.

Shortening programming time

Programming time can be shortened because the character string operation program that had to be created by combining instructions for CPU modules is grouped into blocks for each function.

1.2 List of FB Libraries

The following table lists the FB libraries in this reference manual.

○: Required, —: Not required

Name	Description	Parameter setting
M+StrProcessing_JSONDeserialize_F (Acquisition of JSON string)	Acquires the Value string corresponding to the specified Key string from the JSON string.	—
M+StrProcessing_JSONSerialize_F (Construction of JSON string)	Constructs the JSON string by specifying the Key string and Value string.	—

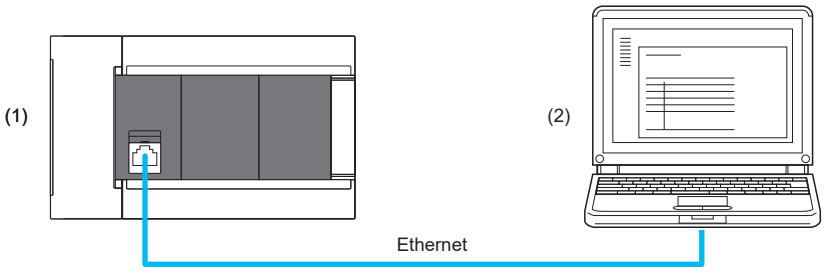
For these FB libraries and software, please consult your local Mitsubishi Electric representative.

For the FB library registration method, refer to the following.

GX Works3 Operating Manual

1.3 System Configuration

The following figures show examples of system configuration for using the FB libraries in this reference manual.



(1) Programmable controller programmed by using the FB libraries
FX5S, FX5UJ, FX5U, or FX5UC CPU module

(2) Personal computer where GX Works3 is installed

MEMO

2 SPECIFICATIONS

This chapter describes the common specifications of the FB libraries in this reference manual.

2.1 FB Library Specifications

The FB libraries in this reference manual are used on a single CPU module of the MELSEC iQ-F series without communicating with external devices.

For the available number of characters and character codes, refer to the following.

☞ Page 10 DETAILS OF FB LIBRARIES

2.2 List of Structures

The following table lists the structure used in the FB libraries in this reference manual.

Name	Description
Member	Refers to member information.

Member

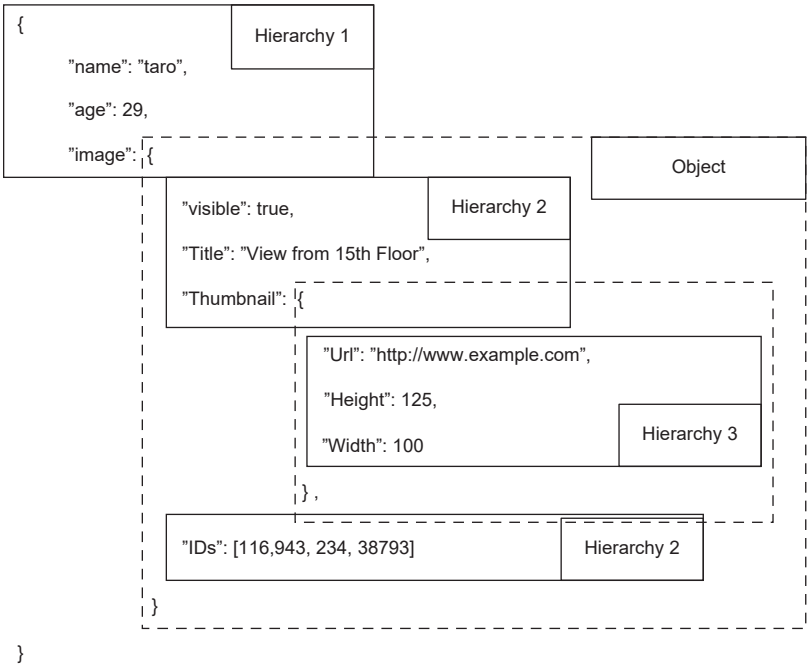
It is the structure used for constructing or acquiring the JSON string.

Label	Label name	Data type	Setting range	Description
uType	Type of Value	Word [unsigned]/bit string [16 bits]	0 to 4	Set the type of Value. 0: Member structure array end 1: Object 2: Array 3: String 4: Numerical value/true/false/null
s32Key	Key string	String (32)	31 characters + a terminator	Set the Key string and terminator.
s64Value	Value string	String (64)	63 characters + a terminator	■When it is used in the JSON string acquisition FB Used to store the acquired Value strings. No setting is required. ■When it is used in the JSON string construction FB Set the Value string and terminator.
uDepth	Depth of hierarchy	Word [unsigned]/bit string [16 bits]	1 to 30	Set the depth of Key hierarchy.

Set uDepth (depth of hierarchy) of pb_st30Member, which is the structure used in the FB libraries, according to the following rules.

- The initial value of hierarchy is 1.
- The Value string parenthesized with {} indicates an object.
- If the Value is an object, one following hierarchy increases.
- When the end of an object is reached, one following hierarchy decreases.

In the JSON string below, hierarchies are surrounded by solid lines and objects are surrounded by dotted lines.



2.3 Precautions

Before using the FB libraries in this reference manual, check the following precautions.

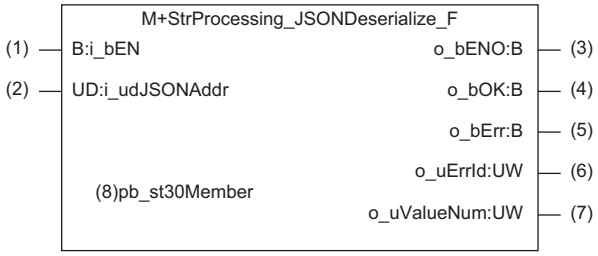
Description
The FBs in this reference manual do not include the error recovery processing. Prepare the error recovery processing separately to suit the user's system and the expected operation.
Do not use the FBs in programs that are executed only once, such as a subroutine program or FOR-NEXT loop, because i_bEN (execution command) cannot be turned off and the normal operation cannot be acquired. Always use the FBs in programs that can turn off the execution command.
The FBs require the configuration of a ladder block for every input label.
The FBs cannot be used in an interrupt program.

3 DETAILS OF FB LIBRARIES

3.1 M+StrProcessing_JSONDeserialize_F (Acquisition of JSON String)

Overview

This FB acquires the Value string corresponding to the specified Key string from the JSON string.



Labels

Input labels

No.	Label	Name	Data type	Import	Setting range	Description
(1)	i_bEN	Execution command	Bit	Always	On, Off	On: FB starts. Off: FB does not start.
(2)	i_udJsonAddr	JSON start address	Double word [unsigned]	At start of FB	Valid device range*1	Specify the start address of the file register where the JSON string is stored.

*1 The setting range differs depending on the "Device/Label Memory Area Setting" in "CPU Parameter".

Output labels

No.	Label	Name	Data type	Default value	Description
(3)	o_bENO	Execution status	Bit	Off	On: The execution command is on. Off: The execution command is off.
(4)	o_bOK	Normal completion	Bit	Off	The on state indicates that the FB has been completed successfully.
(5)	o_bErr	Error completion	Bit	Off	The on state indicates that an error has occurred in the FB.
(6)	o_uErrId	Error code	Word [unsigned]/bit string [16 bits]	0	The error code of an error that occurred in the FB is stored.
(7)	o_uValueNum	Number of Value strings that have been acquired	Word [unsigned]/bit string [16 bits]	0	The number of Value strings that have been acquired is stored.

Public variable (input)

No.	Label	Name	Data type	Setting range	Description
(8)	pb_st30Member	Member list	Member (0..29)	—	Specify the member information related to acquisition. For details on the structure, refer to the following. ☞ Page 8 List of Structures

Function details

Applicable hardware and software

Module	Firmware version	Engineering tool
FX5S CPU module	1.000 or later	GX Works3 Version 1.087R or later
FX5UJ CPU module	1.032 or later	GX Works3 Version 1.087R or later
FX5U/FX5UC CPU module	1.271 or later	GX Works3 Version 1.087R or later

Basic specifications

Item	Description
Language to use	Ladder
Number of steps	3232 steps The number of steps of the FB embedded in a program depends on the CPU module used, the input/output definitions, and the option setting of GX Works3. For the option setting of GX Works3, refer to the following. 📖GX Works3 Operating Manual
Points of labels used	• Label: 8824 (Word) • Latch Label: 0 (Word) The points of labels embedded in a program depend on the CPU module used, the devices specified for arguments, and the option setting of GX Works3. For the option setting of GX Works3, refer to the following. 📖GX Works3 Operating Manual
Points of index register used	• Index register: 1 point, Number of the device used (Z9) • Long index register: 0 points When using an interrupt program, do not use this index register in the interrupt program.
Points of file register used	0 points
FB dependency	No dependency
FB compilation method	Subroutine type
FB operation	Pulse execution type (multiple scan execution type)

Function description

- Turning i_bEN (execution command) on searches for s32Key (Key string) of pb_st30Member (member list) in the JSON string and acquires the corresponding Value string. Refer to the following for the procedure to acquire the Value string from the JSON string.

☞ Page 12 Usage procedure

- In the FB, the JSON string is converted to the same format as pb_st30Member (member list) and analyzed. More than 30 members result in error completion, causing an error (202H) to occur. (☞ Page 12 Usage procedure)
- After all Value strings corresponding to s32Key (Key string) specified in pb_st30Member (member list) have been acquired, o_bOK (normal completion) turns on.
- If an error occurs during acquisition of the Value string, o_bErr (error completion) turns on and processing of the FB is interrupted. In addition, an error code is stored in o_uErrId (error code). (☞ Page 15 Error code)

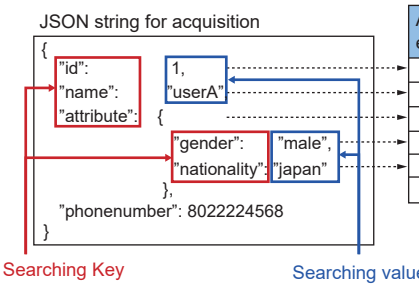
Usage procedure

The following shows the procedure to acquire the Value string from the JSON string.

1. Regarding the JSON string for acquisition, set uType (type of Value), s32Key (Key string), and uDepth (depth of hierarchy) for items to acquire the Value string in pb_st30Member (member list).

- Configure settings other than s64Value (Value string) in pb_st30Member (member list).
- If the number of members is less than 30, set "0" to uType (type of Value) in pb_st30Member (member list) that is acquired last.

Ex.



pb_st30Member (member list)

Array element No.	uType	s32Key	s64Value	uDepth
0	4 (numerical value)	id		1
1	3 (string)	name		1
2	1 (object)	attribute		1
3	3 (string)	gender		2
4	3 (string)	nationality		2
5	0 (member structure array end)	Not specified	Not specified	Not specified

Do not specify the values of s64Value.

2. After i_bEN (execution command) is turned on, the Value string whose uType (type of Value), s32Key (Key string), and uDepth (depth of hierarchy) completely match those specified in pb_st30Member (member list) is acquired.

Ex.

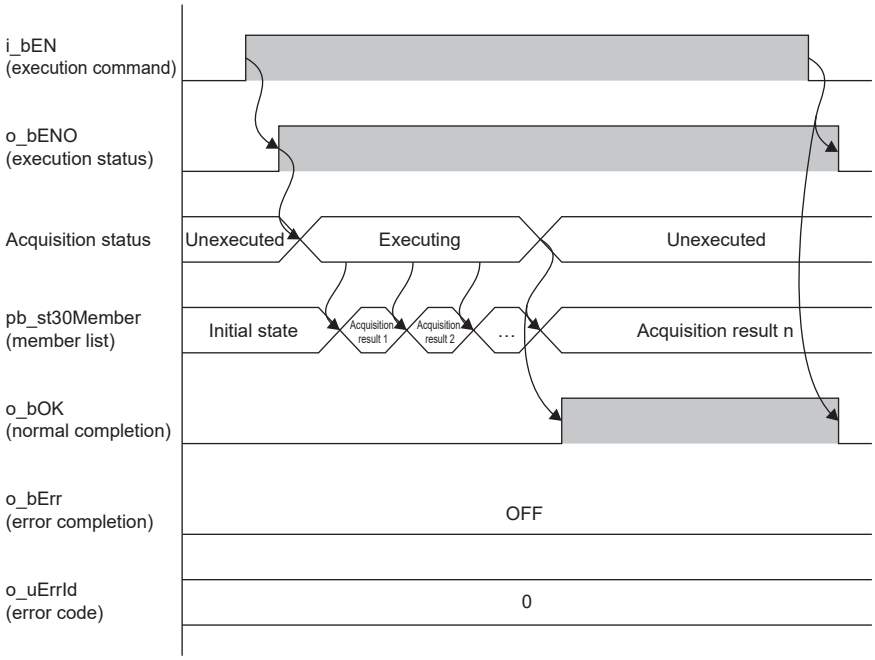
pb_st30Member (member list)

Array element No.	uType	s32Key	s64Value	uDepth
0	4 (numerical value)	id	1	1
1	3 (string)	name	userA	1
2	1 (object)	attribute	NULL	1
3	3 (string)	gender	male	2
4	3 (string)	nationality	japan	2
5	0 (member structure array end)	Not specified	Not specified	Not specified

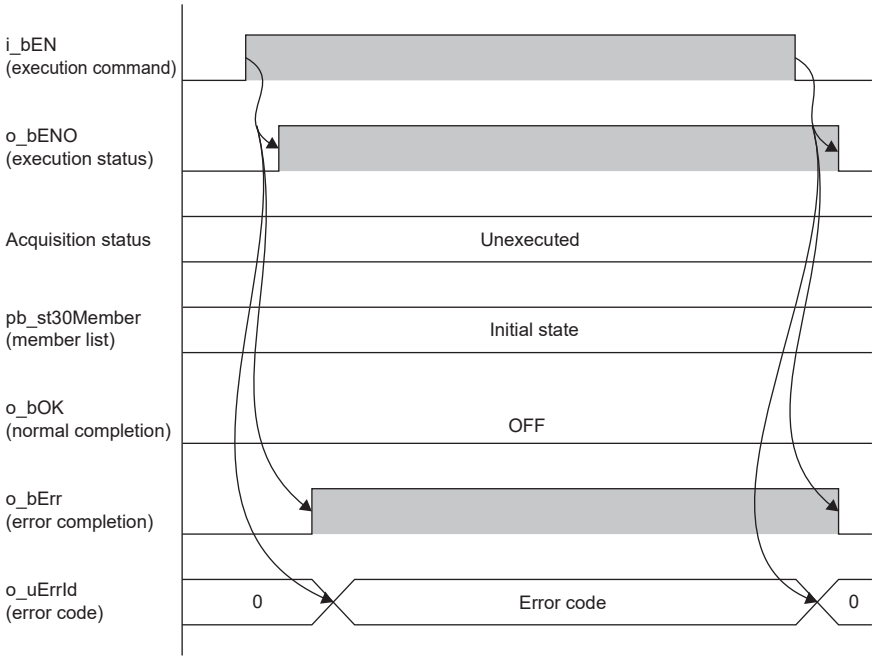
The searched values are stored in s64Value.

Timing chart of I/O signals

■Completed successfully



■Completed with an error



Precautions

- Only the Value string whose uType (type of Value), s32Key (Key string), and uDepth (depth of hierarchy) completely match those specified in pb_st30Member (member list) is acquired. Partially matched strings are not acquired.
- Special characters including escape sequences are not supported. A Value string including any special character may not be acquired correctly. The JSON string supports 0x00 and 0x20 to 0x7E.
- "true", "false", and "null" are identified only by their first character. For numerical values, e, +, -, and the position and number of periods are not checked.
- When the target Value string has 64 characters or more, 63 characters from the beginning are stored.
- If the target Value string is not found or is an object (pb_st30Member.uType (type of Value in member list) is K1), NULL is stored in s64Value (Value string) of pb_st30Member (member list).
- Even if uType (type of Value) of pb_st30Member (member list) is K1 (Object), configure the settings for s32Key (Key string) and uDepth (depth of hierarchy) of pb_st30Member (member list) because of influence on search results of this FB.
- Set pb_st30Member (member list) according to the JSON string sequence. Otherwise, the Value string may not be acquired correctly.
- Store a NULL-terminated ASCII string in the Key string.
- Any string with the multidimensional array or nested array is not acquired.
- Any independent JSON string (array, string, numerical value, true, false, null) constructed only with the following strings is not supported.

Input type	Example
Array alone	[1, "a"]
String alone	"ab"
Numerical value alone	2
Boolean value alone	true
Null alone	null

Parameter settings

Parameter settings are not required for this FB.

Performance values

Module	Measurement condition		Processing time	Maximum scan time	Number of scans
	Number of members	Number of characters in JSON string			
FX5S CPU module	1	100	837.000ms	21.800ms	37 scans
	15	1000	1670.000ms	24.500ms	97 scans
	30	16383	64100.000ms	70.500ms	1123 scans
FX5UJ CPU module	1	100	708.000ms	18.400ms	37 scans
	15	1000	1440.000ms	21.200ms	97 scans
	30	16383	59900.000ms	64.500ms	1123 scans
FX5U/FX5UC CPU module*1*2	1	100	586.000ms	15.200ms	37 scans
	15	1000	1190.000ms	17.900ms	97 scans
	30	16383	50800.000ms	55.400ms	1123 scans

*1 When the program capacity is set to 128K steps, the processing speed may become slow.

*2 The standard area is used for labels.

Error code

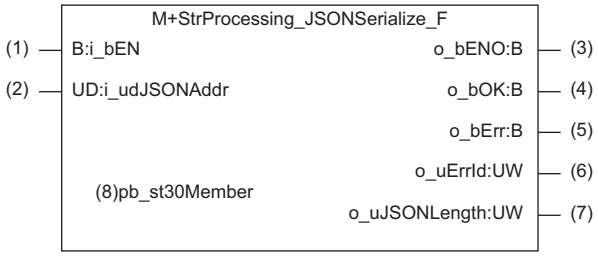
Error code	Description	Action
100H	The setting value of i_udJsonAddr (JSON start address) exceeds the maximum value of file register.	Check and correct the setting, then execute the FB again.
101H	The setting value of uType (type of Value) of pb_st30Member (member list) is out of range. A value other than 0 to 4 is set for the type of Value.	Check and correct the setting, then execute the FB again.
102H	The setting value of uDepth (depth of hierarchy) of pb_st30Member (member list) is out of range. A value other than 1 to 30 is set for the depth of hierarchy.	Check and correct the setting, then execute the FB again.
103H	The number of characters in s32Key (Key string) of pb_st30Member (member list) is out of range. Unintended memory in the CPU may be accessed.	Set s32Key (Key string) using 31 characters or less.
200H	i_bEN (execution command) is turned off during processing.	i_bEN (execution command) must be on until normal completion or error completion turns on.*1
201H	A JSON string that is not available in this FB is stored.	Correct the target JSON string, then execute the FB again.
202H	The number of members of JSON string exceeds 30.	Correct the target JSON string, then execute the FB again.

*1 Output only for one scan.

3.2 M+StrProcessing_JSONSerialize_F (Construction of JSON String)

Overview

This FB constructs the JSON string by specifying the Key string and Value string.



Labels

Input labels

No.	Label	Name	Data type	Import	Setting range	Description
(1)	i_bEN	Execution command	Bit	Always	On, Off	On: FB starts. Off: FB does not start.
(2)	i_udJSONAddr	Start address of JSON string storage location	Double word [unsigned]	At start of FB	Valid device range*1	Specify the start address of the file register where the constructed JSON string is stored.

*1 The setting range differs depending on the "Device/Label Memory Area Setting" in "CPU Parameter".

Output labels

No.	Label	Name	Data type	Default value	Description
(3)	o_bENO	Execution status	Bit	Off	On: The execution command is on. Off: The execution command is off.
(4)	o_bOK	Normal completion	Bit	Off	The on state indicates that the FB has been completed successfully.
(5)	o_bErr	Error completion	Bit	Off	The on state indicates that an error has occurred in the FB.
(6)	o_uErrId	Error code	Word [unsigned]/bit string [16 bits]	0	The error code of an error that occurred in the FB is stored.
(7)	o_uJSONLength	Number of characters in JSON string	Word [unsigned]/bit string [16 bits]	0	The number of characters (bytes) in the constructed JSON string is stored.

Public variable (input)

No.	Label	Name	Data type	Setting range	Description
(8)	pb_st30Member	Member list	Member (0..29)	—	Specify the member information about the Key to be constructed. For details on the structure, refer to the following. ☞ Page 8 List of Structures

Function details

Applicable hardware and software

Module	Firmware version	Engineering tool
FX5S CPU module	1.000 or later	GX Works3 Version 1.087R or later
FX5UJ CPU module	1.032 or later	GX Works3 Version 1.087R or later
FX5U/FX5UC CPU module	1.271 or later	GX Works3 Version 1.087R or later

Basic specifications

Item	Description
Language to use	Ladder
Number of steps	2681 steps The number of steps of the FB embedded in a program depends on the CPU module used, the input/output definitions, and the option setting of GX Works3. For the option setting of GX Works3, refer to the following. 📖GX Works3 Operating Manual
Points of labels used	• Label: 10472 (Word) • Latch Label: 0 (Word) The points of labels embedded in a program depend on the CPU module used, the devices specified for arguments, and the option setting of GX Works3. For the option setting of GX Works3, refer to the following. 📖GX Works3 Operating Manual
Points of index register used	• Index register: 1 point, Number of the device used (Z9) • Long index register: 0 points When using an interrupt program, do not use this index register in the interrupt program.
Points of file register used	0 points
FB dependency	No dependency
FB compilation method	Subroutine type
FB operation	Pulse execution type (multiple scan execution type)

Function description

- A JSON string is written using the format of {"Key string (item)": Value string (value)}.
- Turning i_bEN (execution command) on constructs the JSON string by using the Key string (item) and Value string (value), and stores the JSON string in the file register. Refer to the following to construct the JSON string.

☞ Page 18 Usage procedure

- After the JSON string has been output, o_bOK (normal completion) turns on.
- If an error occurs during construction of the JSON string, o_bErr (error completion) turns on and processing of the FB is interrupted. In addition, an error code is stored in o_uErrId (error code). (☞ Page 21 Error code)

Usage procedure

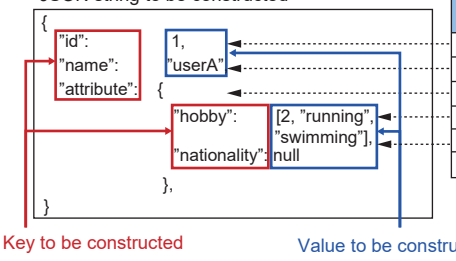
The following shows the procedure to construct the JSON string by using the Value string (value).

1. Set a numerical value corresponding to the type of Value string (value) for the JSON string to be constructed in uType (type of Value) of pb_st30Member (member list). The type of Value string is as follows. 4: Numerical value/true/false/null, 3: String, 2: Array, 1: Object, or 0: Member structure array end.
2. Set the Key string (item) for the JSON string to be constructed to the s32Key (Key string) of pb_st30Member (member list).
3. Set the Value string (string, numerical value, array, boolean value, null) that pairs with the Key string (item) for the JSON string to be constructed to s64Value (Value string) of pb_st30Member (member list) as a string. If uType (type of Value) of pb_st30Member (member list) is an object, s64Value (Value string) of pb_st30Member (member list) does not need to be set.
4. Set uDepth (depth of hierarchy) of pb_st30Member (member list) according to the rules described in the following.

☞ Page 8 List of Structures

5. If the number of members of pb_st30Member (member list) is less than 30, set "0" in uType of the last array element number.
6. Set the start address of the file register where the constructed JSON string is stored in i_udJSONAddr (start address of JSON string storage location).

Ex.



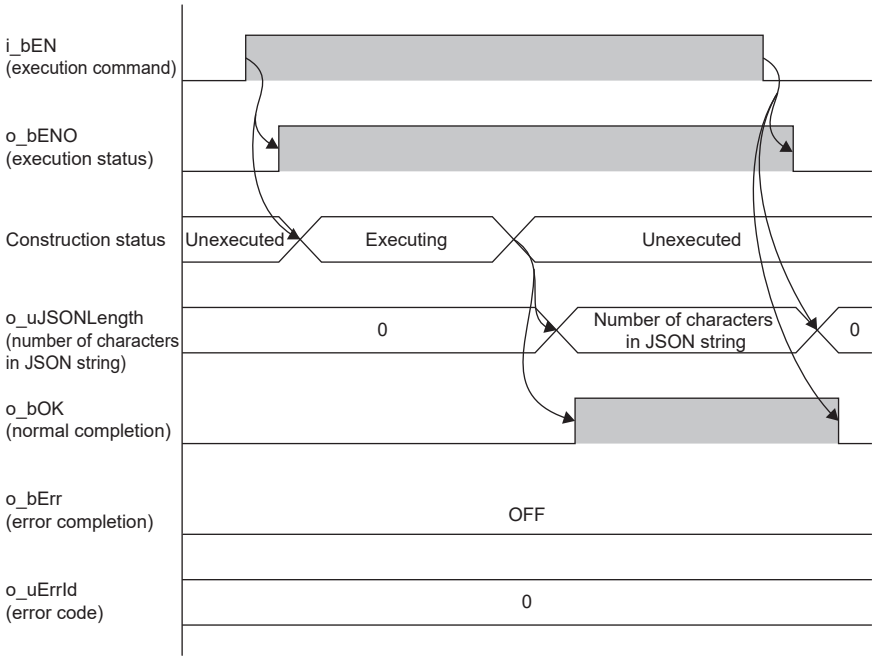
pb_st30Member (member list)

Array element No.	uType	s32Key	s64Value*1	uDepth
0	4 (numerical value)	id	1	1
1	3 (string)	name	userA	1
2	1 (object)	attribute	NULL	1
3	2 (array)	hobby	2, "running", "swimming"	2
4	4(null)	nationality	null	2
5	0 (member structure array end)	Not specified	Not specified	Not specified

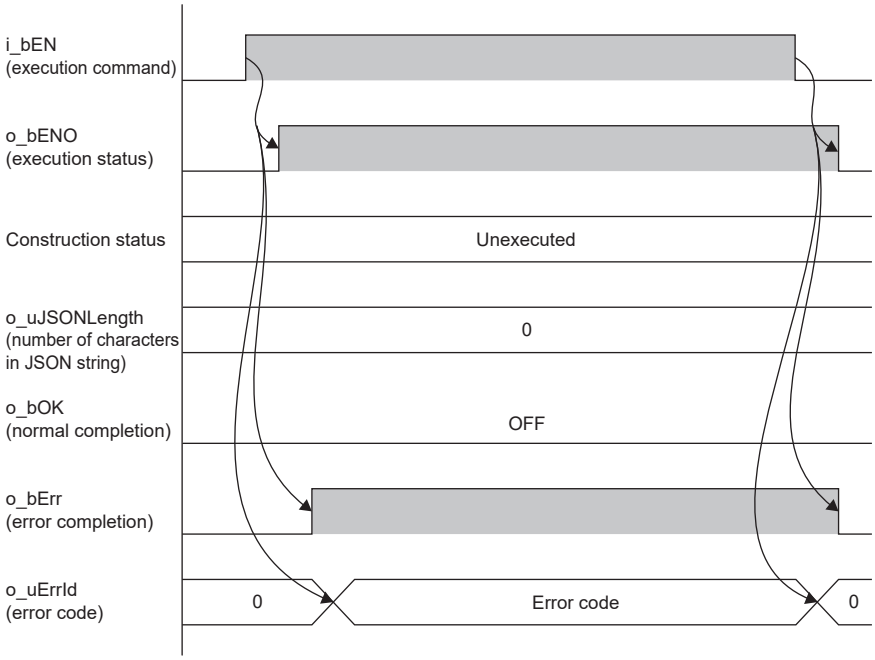
*1 If uType is an object, the values of s64Value do not need to be set.

Timing chart of I/O signals

■Completed successfully



■Completed with an error



Precautions

- A JSON string is constructed without line break codes and spaces.
- The number of characters in the constructed JSON string is output to the output label o_uJSONLength (Number of characters in JSON string). The JSON string with the terminator is stored in the file register.
- If the type of Value of the JSON string to be constructed is an object and the difference in change of uDepth is less than 2, errors due to difference in the set value are not output.
- Allocate the file register area in advance, and set the string to be stored in i_udJSONAddr (start address of JSON string storage location) so that the number of characters in the JSON string to be constructed is 16383 or less.
- Do not change the values in pb_st30Member (member list) while FB is being executed.
- Multidimensional arrays or nested arrays may not be constructed.
- Any independent JSON string (array, string, numerical value, true, false, null) constructed only with the following strings is not supported.

Input type	Example
Array alone	[1, "a"]
String alone	"ab"
Numerical value alone	2
Boolean value alone	true
Null alone	null

Parameter settings

Parameter settings are not required for this FB.

Performance values

Module	Measurement condition		Processing time	Maximum scan time	Number of scans
	Number of members	Number of characters in JSON string			
FX5S CPU module	1	100	54.000ms	53.300ms	2 scans
	15	1000	586.000ms	38.100ms	30 scans
	30	16383	1730.000ms	53.100ms	59 scans
FX5UJ CPU module	1	100	45.000ms	43.600ms	2 scans
	15	1000	481.000ms	31.200ms	30 scans
	30	16383	1440.000ms	43.500ms	59 scans
FX5U/FX5UC CPU module*1*2	1	100	39.000ms	38.800ms	2 scans
	15	1000	424.000ms	27.700ms	30 scans
	30	16383	1250.000ms	38.800ms	59 scans

*1 When the program capacity is set to 128K steps, the processing speed may become slow.
*2 The standard area is used for labels.

Error code

Error code	Description	Action
100H	The setting value of i_udJsonAddr (start address of JSON string storage location) exceeds the maximum value of file register.	Check and correct the setting, then execute the FB again.
101H	The setting value of uType (type of Value) of pb_st30Member (member list) is out of range. A value other than 0 to 4 is set for the type of Value.	Check and correct the setting, then execute the FB again.
102H	The setting value of uDepth (depth of hierarchy) of pb_st30Member (member list) is out of range. A value other than 1 to 30 is set for the depth of hierarchy.	Check and correct the setting, then execute the FB again.
103H	The number of characters in s32Key (Key string) of pb_st30Member (member list) is out of range. Unintended memory in the CPU may be accessed.	Set s32Key (Key string) using 31 characters or less.
104H	The number of characters in s64Value (Value string) of pb_st30Member (member list) is out of range. Unintended memory in the CPU may be accessed.	Set 63 characters or less.
105H	The number of characters in JSON string (o_uJSONLength) exceeds 16383 when the JSON string is constructed by using pb_st30Member (member list).	Correct the setting so that the number of characters in JSON string (o_uJSONLength) is 16383 or less, then execute the FB again.
106H	The JSON string storage area exceeds the range of the file register.	Correct the value of i_udJSONAddr (start address of JSON string storage location), then execute the FB again.
107H	A JSON string format error occurred.	Correct the value of uDepth (depth of hierarchy) of the structure array, then execute the FB again.
200H	i_bEN (execution command) is turned off during processing.	i_bEN (execution command) must be on until normal completion or error completion turns on.*1

*1 Output only for one scan.

4 APPLICATION EXAMPLE

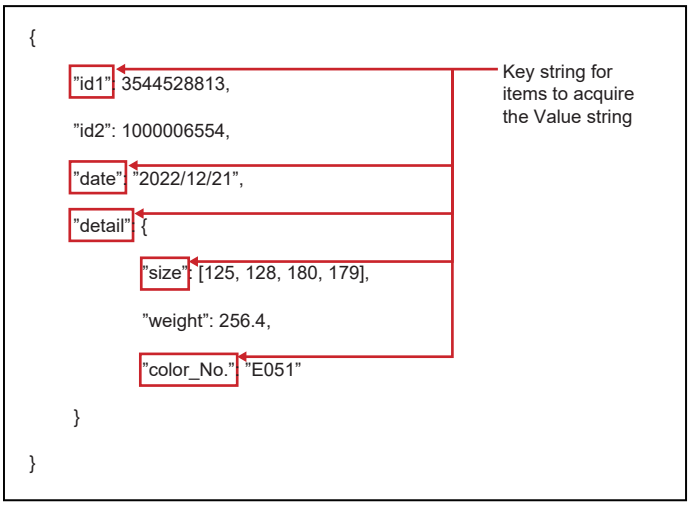
4.1 Acquiring Value String from JSON String

This chapter describes the procedure to acquire the Value string from the JSON string.
In the following example, M+StrProcessing_JSONDeserialize_F (Acquisition of JSON string) is used.

Overview

The Value string corresponding to the specified Key string is acquired from the JSON string.

Ex.



Key string	Type of Value	Depth of hierarchy
id1	Numerical value	1
date	String	1
detail	Object	1
size	Array	2
color_No.	String	2

Process flow

The following shows the process flow to acquire the Value string from the JSON string.

1. FB library registration

Register the FB library.

For the operating procedure, refer to the following.

GX Works3 Operating Manual

2. Programming

Create programs. (☞ Page 25 Programming)

3. Presetting

Before executing the FB, store the JSON string in the device by using GX Works3. (☞ Page 23 Presetting)

Presetting

Before executing the FB, store the JSON string in R0 to R95 by using GX Works3.

Device Name	+0	+1	+2	+3	+4	+5	+6	+7	String
R0	0A7B	2020	2020	6922	3164	3A22	3533	3434	{. "id1":3544
R8	3235	3838	3331	0A2C	2020	2020	6922	3264	528813,. "id2
R16	3A22	3031	3030	3030	3536	3435	0A2C	2020	":1000006554,.
R24	2020	6422	7461	2265	223A	3032	3232	312F	"date":"2022/1
R32	2F32	3132	2C22	200A	2020	2220	6564	6174	2/21",. "deta
R40	6C69	3A22	0A7B	2020	2020	2020	2020	2020	il":{.
R48	2020	7322	7A69	2265	5B3A	3231	2C35	3231	"size":[125,12
R56	2C38	3831	2C30	3731	5D39	0A2C	2020	2020	8,180,179],.
R64	2020	2020	2020	2020	7722	6965	6867	2274	"weight"
R72	323A	3635	342E	0A2C	2020	2020	2020	2020	:256.4,.
R80	2020	2020	6322	6C6F	726F	4E5F	2E6F	3A22	"color_No.":
R88	4522	3530	2231	200A	2020	7D20	7D0A	0000	"E051". }}.

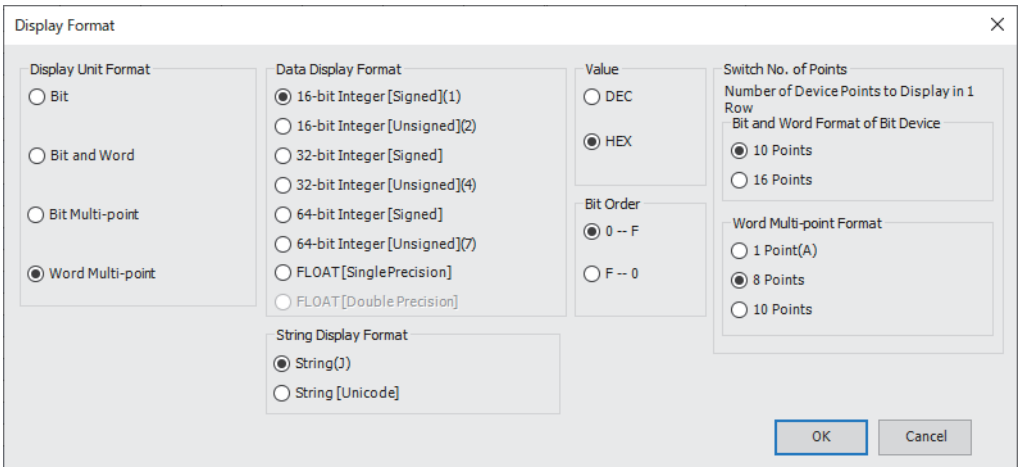
1. Write a sample program to the programmable controller to have the program ready to run.

2. Write the project to the programmable controller and open the "MAIN (Device Memory)" window.

Navigation window ⇨ [Device] ⇨ [Device Memory] ⇨ [MAIN]

3. Set the display format as follows.

[Display] ⇨ [Display Format Detailed Setting]



- Display Unit Format: Word Multi-point
- Data Display Format: 16-bit Integer [Signed]
- String Display Format: String
- Value: HEX
- Bit Order: 0-F
- Switch No. of Points (Word Multi-point Format): 8 Points

4. Enter R0 in the device name and press the Enter key.

5. Copy the following values of binary data for pasting to GX Works3, select R0(+0) from the table in the "MAIN (Device Memory)" window, and paste the values.

0A7B	2020	2020	6922	3164	3A22	3533	3434
3235	3838	3331	0A2C	2020	2020	6922	3264
3A22	3031	3030	3030	3536	3435	0A2C	2020
2020	6422	7461	2265	223A	3032	3232	312F
2F32	3132	2C22	200A	2020	2220	6564	6174
6C69	3A22	0A7B	2020	2020	2020	2020	2020
2020	7322	7A69	2265	5B3A	3231	2C35	3231
2C38	3831	2C30	3731	5D39	0A2C	2020	2020
2020	2020	2020	2020	7722	6965	6867	2274
323A	3635	342E	0A2C	2020	2020	2020	2020
2020	2020	6322	6C6F	726F	4E5F	2E6F	3A22
4522	3530	2231	200A	2020	7D20	7D0A	0000

6. Select and right-click R0(R0(+0)) to R95(R88(+7)), select [Online] from the pull-down menu, and click [Write Selected Range] to open the "Write Selected Range" window. While "Common File Register in All Programs" is selected, click the [OK] button.

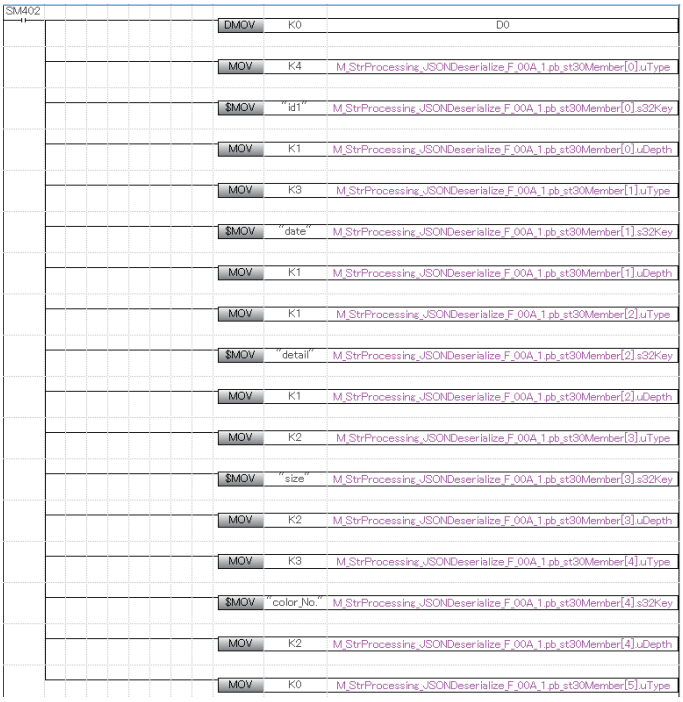
Programming

This section describes programs used in the application example.

Program example

■Setting the member information

Set the member information in pb_st30Member (member list) of the FB public variable to acquire the Value string.



Set the JSON start address to K0.

[Element No.0 in member list]
- Set K4 (numerical value) in the type of Value.
- Set "id1" in the Key string.
- Set K1 in the depth of hierarchy.

[Element No.1 in member list]
- Set K3 (string) in the type of Value.
- Set "date" in the Key string.
- Set K1 in the depth of hierarchy.

[Element No.2 in member list]
- Set K1 (object) in the type of Value.
- Set "detail" in the Key string.
- Set K1 in the depth of hierarchy.

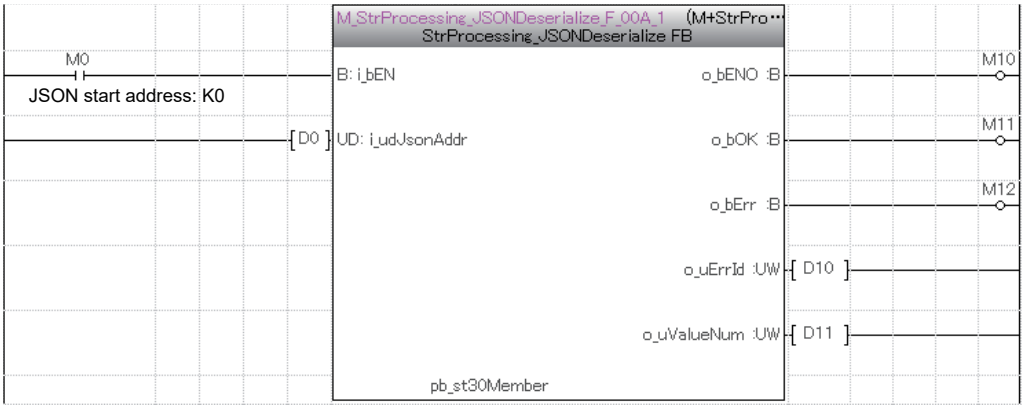
[Element No.3 in member list]
- Set K2 (array) in the type of Value.
- Set "size" in the Key string.
- Set K2 in the depth of hierarchy.

[Element No.4 in member list]
- Set K3 (string) in the type of Value.
- Set "color_No." in the Key string.
- Set K2 in the depth of hierarchy.

[Element No.5 in member list]
- Set K0 (member list array end) in the type of Value.

■Acquiring the Value string

Turning M0 (execution command) on acquires the Value string whose uType (type of Value), s32Key (Key string), and uDepth (depth of hierarchy) are the same as those specified in pb_st30Member (member list) from the JSON string that is stored in the file register having the address specified in i_udJsonAddr (JSON start address), and stores the Value string in s64Value (Value string) of pb_st30Member (member list).



The following table lists the values in pb_st30Member (member list) after the FB completed successfully.

Array element No.	uType	s32Key	s64Value	uDepth
1	4	id1	3544528813	1
2	3	date	2022/12/21	1
3	1	detail	NULL	1
4	2	size	125, 128, 180, 179	2
5	3	color_No.	E051	2
6	0	NULL	NULL	0

4.2 Constructing the JSON String

This section describes the procedure to construct the JSON string.

In the following example, M+StrProcessing_JSONSerialize_F (Construction of JSON string) is used.

Overview

Construct the JSON string as follows.

Ex.

```
{
    "id1": 3544528813,
    "id2": 1000006554,
    "date": "2022/12/21",
    "detail": {
        "size": [125, 128, 180, 179],
        "weight": 256. 4,
        "color_No.": "E051"
    }
}
```

Point

The JSON string constructed by executing the FB includes no line break or space.

Process flow

The following shows the procedure to construct the JSON string.

1. FB library registration

Register the FB library.

For the operating procedure, refer to the following.

GX Works3 Operating Manual

2. Programming

Create programs. (☞ Page 27 Programming)

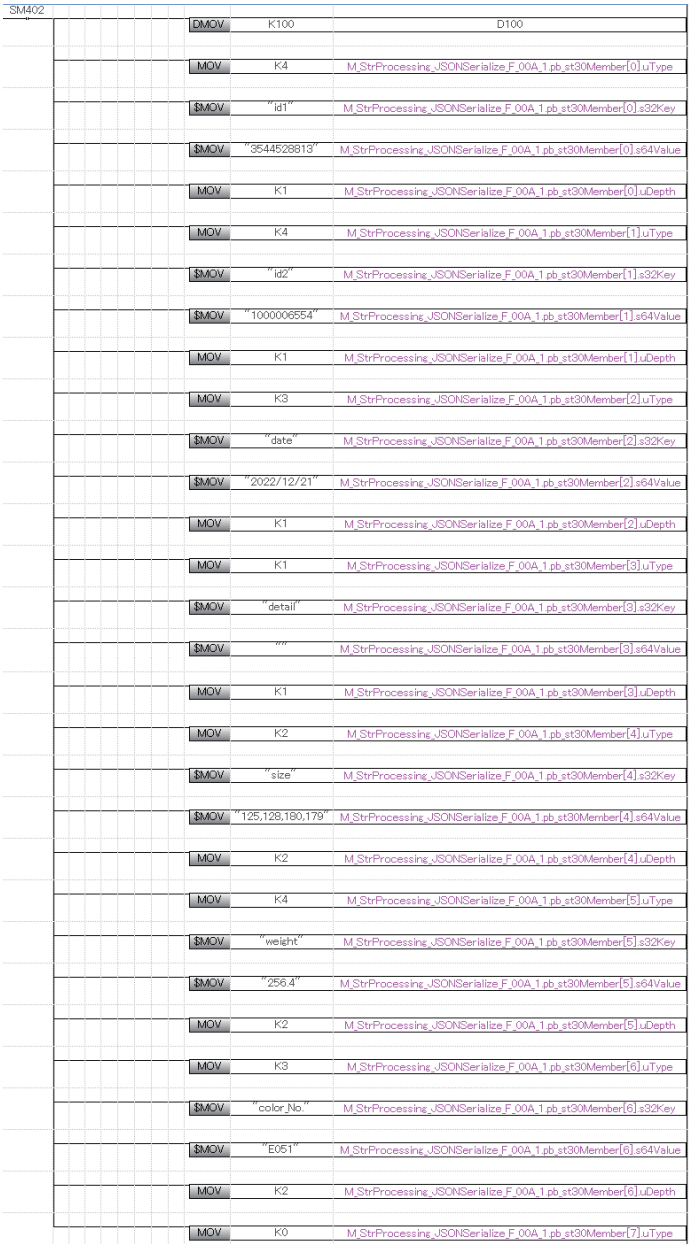
Programming

This section describes programs used in the application example.

Program example

■Setting the member information

Set the member information in pb_st30Member (member list) of the FB public variable to construct the JSON string.



Set the JSON start address to K100.

[Element No.0 in member list]
· Set K4 (numerical value) in the type of Value.
· Set "id1" in the Key string.
· Set "3544528813" in the Value string.
· Set K1 in the depth of hierarchy.

[Element No.1 in member list]
· Set K4 (numerical value) in the type of Value.
· Set "id2" in the Key string.
· Set "1000006554" in the Value string.
· Set K1 in the depth of hierarchy.

[Element No.2 in member list]
· Set K3 (string) in the type of Value.
· Set "date" in the Key string.
· Set "2022/12/21" in the Value string.
· Set K1 in the depth of hierarchy.

[Element No.3 in member list]
· Set K1 (object) in the type of Value.
· Set "detail" in the Key string.
· Set "" in the Value string.
· Set K1 in the depth of hierarchy.

[Element No.4 in member list]
· Set K2 (array) in the type of Value.
· Set "size" in the Key string.
· Set "125,128,180,179" in the Value string.
· Set K2 in the depth of hierarchy.

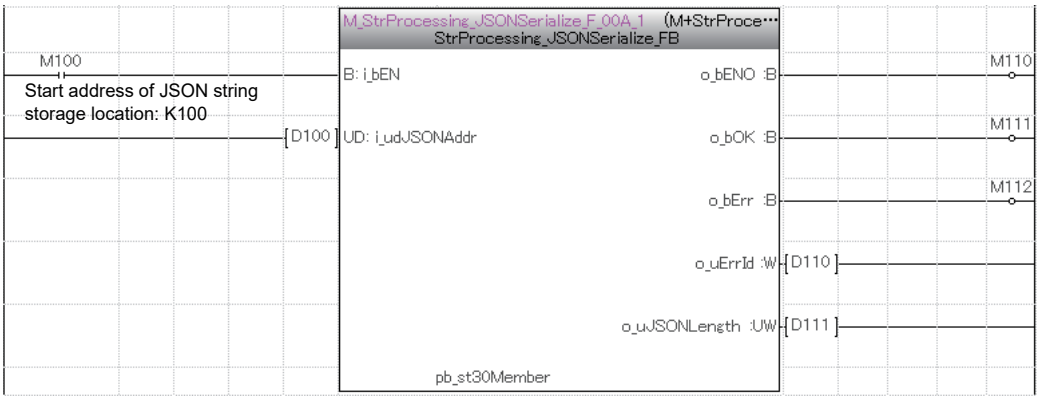
[Element No.5 in member list]
· Set K4 (numerical value) in the type of Value.
· Set "weight" in the Key string.
· Set "256.4" in the Value string.
· Set K2 in the depth of hierarchy.

[Element No.6 in member list]
· Set K3 (string) in the type of Value.
· Set "color_No." in the Key string.
· Set "E051" in the Value string.
· Set K2 in the depth of hierarchy.

[Element No.7 in member list]
· Set K0 (member list array end) in the type of Value.

■Constructing the JSON string

Turning on M100 (execution command) constructs the JSON string according to the information of uType (type of Value), s32Key (Key string), s64Value (Value string), and uDepth (depth of hierarchy) specified in pb_st30Member (member list), and outputs the JSON string to the file register having the address specified in i_udJsonAddr (start address of JSON string storage location).



Once the FB completes successfully, the following values are stored in the file register areas R100 to R163.

Device Name	+0	+1	+2	+3	+4	+5	+6	+7	String
R100	227B	6469	2231	333A	3435	3534	3832	3138	{"id1":354452881
R108	2C33	6922	3264	3A22	3031	3030	3030	3536	3,"id2":10000065
R116	3435	222C	6164	6574	3A22	3222	3230	2F32	54,"date":"2022/
R124	3231	322F	2231	222C	6564	6174	6C69	3A22	12/21","detail":
R132	227B	6973	657A	3A22	315B	3532	312C	3832	{"size":[125,128
R140	312C	3038	312C	3937	2C5D	7722	6965	6867	,180,179],"weigh
R148	2274	323A	3635	342E	222C	6F63	6F6C	5F72	t":256.4,"color_
R156	6F4E	222E	223A	3045	3135	7D22	007D	0000	No.":"E051"}]...

INSTRUCTION INDEX

M

MEMO

REVISIONS

*The manual number is given on the bottom left of the back cover.

Revision date	*Manual number	Description
April 2023	SH(NA)-082619ENG-A	First edition
July 2023	SH(NA)-082619ENG-B	■Added or modified part GENERIC TERMS AND ABBREVIATIONS

Japanese manual number: SH-082618-B

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