User's Guide

ORiN2 Provider XRCX

For the controller of YAMAHA MOTOR Co.

Version 1.3.0

March 19, 2010

【 Remarks 】

【 Revision History 】

Date	Version	Content
2008/12/17	1.0.0	First edition
2009/06/23	1.1.0	Serial connection parameters were added.
2009/07/18	1.1.1	Supported command was revised and the description of Variable method was added.
2009/07/24	1.1.2	Commands of sub-robot were supported.
2009/09/11	1.2.0	[The Type of XRCX controller](Table1) was modified. The guide for setting up license key (2) was added. The connecting method of serial and Ethernet connection (3.3.1) was modified. [Attention before using controller] (3.2) was added. Special commands for DRCX/SR1-X/SR1-P controller were added. The error code of 0x8010E003(Appendix B) was added. The initial setup for RCX controller(Appendix C) was added. The Trouble-Shooting(Appendix D) was added.
2009/09/25	1.2.1	The writing mistake of company name was corrected.
2010/03/19	1.3.0	License key for evaluation (2) was added. The error code of 0x8010E005(Appendix B) was added.

Contents

1 Introduction

This document describes external specifications of the CAO provider for the YAMAHA robot controller (1 / 2 / multi-axis). In this document, CAO provider (CaoProvXRCX.dll) is called as XRCX provider. The XRCX provider implements all interfaces defined in the CAO provider specification.

This document describes the XRCX provider specifications on connection parameters, system variables, user variables, files and original enhancement.

The dependency of the YAMAHA robot controller's model and version is described in the next table as Sign in this document.

Table1: The Type of XRCX controller

Supported Controller	Type	Description of controller
ERCD / ERCX	YMH01	Single-axis controller
SRCX / SRCP / SRCP30	YMH01	
SR1-P / SR1-X	YMH01	
DRCX	YMH01	2 axes controller
RCX221 / 222	YMH02	2 axes controller
RCX141 / RCX142 RCX240	YMH02	4 axes controller

With the license key which is issued when customer purchases XRCX Provider, it becomes available to communicate to the 2 types of controller YMH01(Single-axis + DRCX) and controller YMH02(4 axes + RCX221/222) . Regarding to how to use the license key, it will be detailed in the next chapter. Furthermore, in this Guide book, we will use the word of "Single-axis" instead of YMH01 and "Multi-axes" instead of YMH02.

1.1. The position of Emergency stop device

Before using the robot controller, make sure that emergency stop device shall be in a position where they can be reached easily to stop the robot immediately.

(1) The emergency stop device shall be red colored.

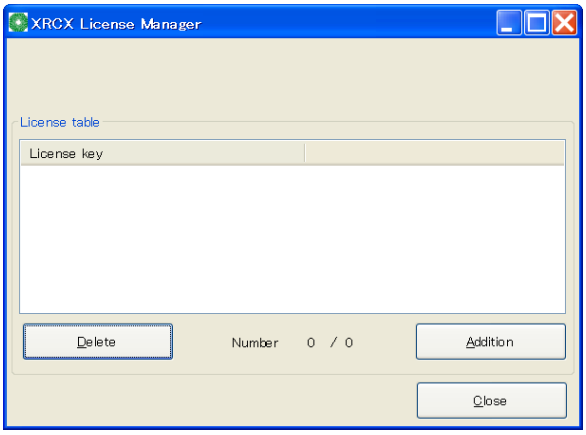
(2) Do not restart the robot controller automatically after emergency stop.
Prevent from improperly restart by other workers

(3) Set up the emergency stop device separate from the power switch.

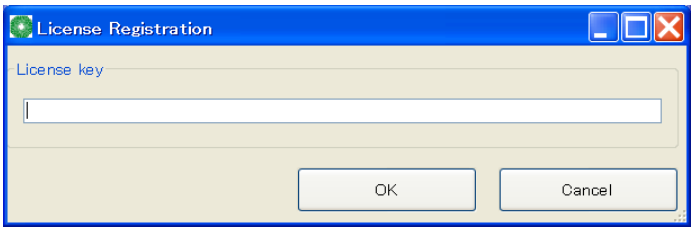
2 Guide for setting up license key

The license key will be issued when customer purchases this Provider. Register it as following procedure.

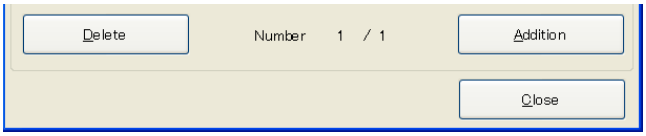
(1) From START menu(Program menu), [XRCX PROV], run [License Manager]



(2) Press [Addition] button, input the license key, then click [OK] .



(3) If the license key is correct, the available number of controller will be displayed in the panel, please make sure of it. Then click [Close] button to close the License Registration window.



The meaning of the Number is 「supported number of Multi-axes controller / supported number of Single-axis controller」.

The following is a license key for evaluation.

- License key (valid for 30 days) for evaluation
  「JQFMBR-8N4JZF-EP3DIU-7IAMYA-FQBWH3-N9TE1L」

3 Outline of provider

3.1. Outline

The XRCX provider is CAO provider that absorbs YAMAHA Single-axis / Multi-axes controller dependant part and offers the functions defined by the CAO provider interface specifications. The file format is DLL (Dynamic Link Library), and it is dynamically loaded from CAO engine when it is used. To use XRCX provider, registry need to be manually registered according to the table below.

Table2: XRCX provider

File name	CaoProvXRCX.dll
ProgID	CaoProv.YAMAHA.XRCX
Registry registration	regsvr32 CaoProvXRCX.dll
Remove registry registration	regsvr32 /u CaoProvXRCX.dll

A license key is required to use the CAO Engine module. Please refer to "License registration" section of "ORiN2 SDK User's Guide."

※ ORiN is a registered trademark of the Japan Industrial Robot Association.
※ ORiN2 SDK is a product of Denso Wave Incorporated.

3.2. Attention before using controller

Before sending online command to Multi-axes controller (RCX), please setup controller in [Auto Mode] or [Manual Mode]. If the online command was sent out during [Program Mode] or [System Mode], the controller would become error state, couldn't perform the correct action.

3.3. Method and Property

3.3.1. CaoWorksSpace::AddController method

Specify parameters to connect YAMAHA controller .

Syntax

AddController(<bstrCtrlName:BSTR>,<bstrProvName:BSTR>,
<bstrPcName:BSTR,<bstrOption:BSTR>)

bstrCtrlName	:[in] Controller name. Unique name like RCX1
bstrProvName	:[in] Provider name. Fixed to "CaoProv.YAMAHA.XRCX"
bstrPcName	:[in] Provider execution machine name. Null character is possible.
bstrOption	:[in] Option character string. Connection parameter, motion setting etc. (Options are divided by comma)

The setting of parameters is listed up as following.

Table 3 Parameters of Connection

Option	Explanation
Conn=<connecting parameter>	Necessary. Specify the communication state and connecti parameters. Refer to 3.3.1.1
userid=<USER ID>	Necessary for Socket connection. Specify the user ID which is registered in controller. It will be ignored during serial connection.
password=<password>	Necessary for Socket connection. Specify the password which is registered in controller. It will be ignored during serial connection.
type=<type>	Specify the type of controller. If it was not specified, default value would be set. 0:Multi-axes controller(Default) 1:Single-axis controller

3.3.1.1. The option of Conn

Connecting parameters of Conn option are listed up as following. Parameters in ("[]") can be omitted. If parameter was not specified, default value would be set.

✧ Socket connection

"eth:<IP Address>[:<Port No>]"

<IP Address> : IP address of controller

<Port No> : Specify the port number of controller.
If it was not specified, the Telnet standard port(23) will be connected as default.
If port(23) was specified, it will execute Telnet negotiation.

Client application sample (Socket connection + VB.NET)

When connecting Multi-axes controller by IP:192.168.0.1、userID:USER、password:PASSWORD

```
connStr    = "Conn=eth:192.168.0.1,userid=USER,password=PASSWORD,type=0"

g_caoEng   = New ORiN2.interop.CAO.CaoEngine
g_caoCtrls = g_caoEng.Workspaces.Item(0).Controllers

g_caoCtrl  = g_caoCtrls.Add("RCX1", "CaoProv.YAMAHA.XRCX", "", connStr)
```

✧ Serial connection

"com:<COM Port>[:<BaudRate>[:<Parity>:<DataBits>:<StopBits>]]"

<COM Port> : The number of COM port

<BaudRate> : Specify the communicating speed.
4800:4800bps
9600:9600bps
19200:19200bps
38400:38400bps (Default)
57600:57600bps

<Parity> : Specify Parity check
N: No Parity
O: Odd Parity(Default)
E: Even Parity

<Databits> : Specify Data bits
7:7bit
8:8bit（Default）
<Stopbits> : Specify Stop bits
1:1 Stop Bit（Default）
1.5:1.5 Stop Bit
2:2 Stop Bit

Client application sample (Serial connection + VB.NET)

When connecting Single-axis controller by COM port 1、Baudrate38400、Odd Parity、Data bits 8bit 、Stop bits 1bit,

```
connStr    = "Conn=com:1:38400:O:8:1,type=1"

g_caoEng   = New ORiN2.interop.CAO.CaoEngine
g_caoCtrls = g_caoEng.Workspaces.Item(0).Controllers

g_caoCtrl  = g_caoCtrls.Add("RCX1", "CaoProv.YAMAHA.XRCX", "", connStr)
```

3.3.2. CaoController::AddRobot method

Create the CaoRobot object which can be controlled by Controller command, name the robot as what you want.

Syntax

AddRobot(<bstrName:BSTR> [,<bstrOption:BSTR>])

bstrName :[in] Robot Name

bstrOption :[in] Option (Unused)

3.3.3. CaoController::AddVariable method

Create variables object which can access status information、and parameters.

Syntax

AddVariable(<bstrName:BSTR> [,<bstrOption:BSTR>])

bstrName :[in] Variable Name

bstrOption :[in] Option (Unused)

3.3.4. CaoController:: VariableNames method

Obtain the name list of variables which can be specified by AddVariable method.

Syntax

VariableNames ()

3.3.5. CaoRobot::Accelerate method

Set the internal acceleration and deceleration ratio of the robot.

This method corresponds to ACCL command and DECEL command of Multi-axes robot.

For Single-axis, it is not functional.

Syntax

Accelerate(<lAxis:LONG>, <fAccel:FLOAT>, <fDecel:FLOAT>)

lAxis	:[in] Axis number	0:All axes, !0:specified axis
fAccel	:[in] Acceleration	1～100, -1:no change
fDecel	:[in] Declaration	1～100, -1: no change

3.3.6. CaoRobot::Halt method

Halt the robot motion (send^C).

Syntax

Halt([<bstrOption:BSTR>])

bstrOption :[in] Option (Unused)

3.3.7. CaoRobot::Move method

Move Robot to the specified coordinates.

This method corresponds to MOVE command of Multi-axes Robot.

And MOVD command of Single-axis Robot.

Syntax

Move(<lComp:LONG>, <vntPose:VARIANT>, [<vntOpt:BSTR>])

lComp	:[in] Specify complementation	1:P, 2:L, 3:C (Multi-axes controller only)
vntPose	:[in] Specify Point	For Single-axis controller, only specify coordinates
vntOpt	:[in] Option	Specifying speed is necessary for Single-axis

controller

3.3.8. CaoRobot::Rotate method

Not implemented

3.3.9. CaoRobot::Speed method

Specify the internal movement speed of robot.

This method corresponds to SPEED command of Multi-axes robot.

For Single-axis, it is not functional.

Syntax

Speed(<lAxis:LONG>, < fSpeed:FLOAT>)

lAxis	[in]: axis number	(unused)
fSpeed	[in]: speed	1～100

3.3.10. CaoRobot::Execute method

Specify the YAMAHA robot command which above methods of CaoRobot class do not support.

Syntax

[<vntRet:VARIANT>=]Execute(<bstrCommand:BSTR>
[, <vntParam:VARIANT>])

bstrCommand	[in]: Command
vntParam	[in]: Parameter
vntRet	[Out]: Return value

Below, we list up all commands which can be supported by provider.

Table 4: Executable command for Single-axis controller

Command	Parameter	Remarks
SRVO	<SRVO status|0|1|> [,<axis>]	<axis> is only for DRCX
X+/X-	None	
Y+/Y-	None	only for DRCX
XINC/XDEC	None	
YINC/YDEC	None	only for DRCX
ORG, ORGN	[<axis >]	<axis> is only for DRCX
MOVA	< Point Number >, < Maximum speed >	
MOVF	< Point Number >, <DI Number >, <DI status >	
MOVI	< Point Number >, < Maximum speed >	
MOVL	< Point Number >, < Maximum speed >	only for DRCX
MOVC	< Point Number >, < Maximum speed >, < specified Startup>	only for DRCX
DRVD	< axis >, < position (mm)>, < Maximum speed >	only for DRCX
DRVA	< axis >, < Point Number >, < Maximum speed >	only for DRCX
DRVI	< axis >, < Point Number >, < Maximum speed >	only for DRCX
ACHA	< axis >, <specified position>	only for DRCX
ACHI	< axis >, < specified position >	only for DRCX
P	< Point Number >	
P+	None	
P-	None	
MOVM	< Pallet work position >, < maximum speed >	

MAT	< line number >, < row number >, < Pallet number >	
MSEL	< Pallet number >	
SHFT	< Point Number >	
ALMRST	None	only for SR1-P / SR1-X
?STP	< Program number >	
?ALM	< History number >[, < display number>]	
?PRM	< parameter number >[, < parameter number>]	
?P	< Point Number >[, < Point Number>]	
?ERR	< History number >[, < display number>]	
?MAT	< Pallet number >	
Pnnn	<X> <X>,<Y> (※only for DRCX controller)	Point variable nnn = 0～999 Parameters are Divided by ","

The Parameter in "[ ]" can be omitted.

Table 5: Executable command for Multi-axes controller

Command	Parameter	Remarks
EMGRST	None	
ABSRST	None	
DRIVE	(<axis>, <point expression>) [, (<axis>, <point expression>)...] [, option]	
DRIVE2	(<axis>, <point expression>) [, (<axis>, <point expression>)...] [, option]	
DRIVEI	(<axis>, <point expression>) [, (<axis>, < point expression >)...] [, option]	
DRIVEI2	(<axis>, <point expression>) [, (<axis>, <point expression>)...] [, option]	
MOVE2	PTP|P|L|C , <specified point>[, option [, option]...]	
MOVEI	PTP|P, <specified point>[, option [, option]...]	
MOVEI2	PTP|P, <specified point>[, option [, option]...]	
ORIGIN	None	

PMOVE	(<pallet definition number >, < pallet definition number >)[, option [, option]...]	Need positioning
PMOVE2	(<pallet definition number >, < pallet definition number >)[, option [, option]...]	Need positioning
SERVO	ON|OFF|FREE|PWR [(<expression >)]	
SERVO2	ON|OFF|FREE|PWR [(<expression >)]	
CHANGE	H< hand number >	
CHANGE2	H< hand number >	
HAND	H< hand number >=<1st parameter > <2nd parameter > <3rd parameter >	Parameters are Divided by space
HAND2	H< hand number >=<1st parameter > <2nd parameter > <3rd parameter >	Parameters are Divided by space
RIGHTY	None	
LEFTY	None	
RIGHTY2	None	
LEFTY2	None	
SHIFT	< shift variable >	
SHIFT2	< shift variable >	
ACCEL2	< expression > (<expression1>)=< expression2>	
ARCH	< expression > (<expression1>)=< expression2>	
ARCH2	< expression > (<expression1>)=< expression2>	
ASPEED	< expression >	
ASPEED2	< expression >	
AXWGHT	(<expression1>)=< expression2>	
AXWGHT2	(<expression1>)=< expression2>	
DECEL	< expression > (<expression1>)=< expression2>	
DECEL2	< expression > (<expression1>)=< expression2>	
ORGORD	< expression >	
ORGORD2	< expression >	
OUTPOS	< expression >	

	(<expression1>)=< expression2>	
OUTPOS2	< expression > (<expression1>)=< expression2>	
PDEF	(<pallet definition number>)=<nx>, <ny>[, <nz>]	
SPEED2	< expression >	
TOLE	< expression > (<expression1>)=< expression2>	
TOLE2	< expression > (<expression1>)=< expression2>	
WEIGHT	< expression >	
WEIGHT2	< expression >	
TORQUE	(<expression1>)=< expression2>	
TORQUE2	(<expression1>)=< expression2>	
TRQTIME	(<expression1>)=< expression2>	
TRQTIME2	(<expression1>)=< expression2>	
?MSG	<Start Number>, <Last Number>	
?Pnnnn	None	Obtain point data nnnn = 0～9999
?Sn	None	Obtain shift data n = 0～9
Pnnnn	<X> <Y> <Z> <R> [<A> <B>]	Point variable nnnn = 0～9999 The value range of x, y, z, r, a, b depends on the type of point data. Parameters are Divided by space
Sn	<X> <Y> <Z> <R>	Shift variable n = 0～9 x, y, z, r = -99999.99～99999.99 Parameters are Divided by space

The Parameter in "[ ]" can be omitted.

command	parameter	note
LAST_ERROR	None	Acquire the character string of the last error from the controller.

3.3.11. CaoVariable::putValue method

Write information into variable. Please refer to table6, 7, 8 for details

3.3.12. CaoVariable::getValue method

Obtain variable's information. Please refer to table6, 7, 8 for details

Table 6 Single-axis Controller Variable

Variables	Description	Comment	put	get
POS	Obtain the current position	When axis is specified, please use CaoRobot::Execute method	—	○
XPOS	Obtain the current position of X axis	Only for DRCX	—	○
YPOS	Obtain the current position of Y axis	Only for DRCX	—	○
NO	Obtain the current program number		—	○
SNO	Obtain the current step number		—	○
PNO	Obtain the current selected point number		—	○
STP	Obtain total steps of selected program	Supported by CaoRobot::Execute method	—	○
MEM	Obtain the remaining steps for addition		—	○
VER	Obtain the controller system version		—	○
ROBOT	Obtain the type of selected robot		—	○
CLOCK	Obtain the total time of using controller		—	○
ALM	Obtain the alarm history	Supported by CaoRobot::Execute method		○
EMG	Obtain the EMG status		—	○
SRVO	Obtain the SRVO status	When axis is specified, please use CaoRobot::Execute method	—	○

ORG	Obtain the ORG status	When axis is specified, please use CaoRobot::Execute method	—	○
MODE	Obtain the MODE status		—	○
PVA	Obtain status of point variables P			○
PRM	Obtain the data of selected parameter	Supported by CaoRobot::Execute method	—	○
P	Obtain the data of selected point	Supported by CaoRobot::Execute method	—	○
ERR	Obtain error history	Supported by CaoRobot::Execute method	—	○
MAT	Obtain the information of defined matrix	Supported by CaoRobot::Execute method	—	○
MSEL	Obtain the pallet number of selected matrix		—	○
SHFT	Obtain the current SHIFT data		—	○

Table 7 Multi-axes Controller Variable

Variables	Description	comment	put	Get
ARM	Obtain arm status		—	○
CONFIG	Obtain the information of configuration		—	○
EXELVL	Obtain execution level		—	○
MOD	Obtain mode status		—	○
MSG	Obtain the current message	For message history, please use CaoRobot::Execute method	—	○
ORIGIN	Obtain ORGIN status		—	○
ABSRST	Obtain ABSRST status		—	○
SERVO	Obtain SERVO status		—	○

SPEED	Obtain SPEED status		—	○
UNIT	Obtain the coordinates of point/ unit		—	○
VER	Obtain version information		—	○
WHERE	Obtain current position of pulse coordinates		—	○
WHERE2	Obtain current position of pulse coordinates (for sub robot)		—	○
WHRXY	Obtain current position of XY coordinates		—	○
WHRXY2	Obtain current position of XY coordinates (for sub robot)		—	○
SHIFT	Obtain the status of task executing		—	○
HAND	Obtain HAND status		—	○
MEM	Obtain valid memory status		—	○
EMG	Obtain EMG status		—	○
SELFCHK	Obtain self-check error status		—	○
OPSLOT	Obtain option slot status		—	○

Table 8 General Variables of XRCX provider

Variables	Description	comment	put	Get
@MAKER_NAME	"YAMAHA/TKCC MAV"		—	○
@TYPE	"xRCX Controller"		—	○
@VERSION	Version of XRCX provider		—	○

AppendixA Robot Language list

A-1. Supported command list for Single-axis

Group	SEQ.	Command	Object	Method	Corresp.	Remarks
Robot action						
	1	ORG[N]	CaoRobot	Execute	○	
	2	RESET			×	
	3	RUN			×	
	4	SRUN			×	
	5	SRVO	CaoRobot	Execute	○	
	6	X+/X-			○	
	7	Y+/Y-			○	Only for DRCX
	8	XINC/XDEC			○	
	9	YINC/YDEC			○	Only for DRCX
	10	MOVD		Move	○	
	11	MOVA		Execute	○	
	12	MOVI			○	
	13	MOVF			○	
	14	MOVL			○	Only for DRCX
	15	MOVC			○	Only for DRCX
	16	DRVD			○	Only for DRCX
	17	DRVA			○	Only for DRCX
	18	DRVI			○	Only for DRCX
	19	ACHA			○	Only for DRCX
	20	ACHI			○	Only for DRCX
	21	DO			×	
	22	WAIT			×	
	23	TIMR			×	
	24	P	CaoRobot	Execute	○	
	25	P+			○	
	26	P-			○	
	27	MOVM			○	
	28	MAT			○	
	29	MSEL			○	

	30	CSEL			×	
	31	C			×	
	32	C+			×	
	33	C-			×	
	34	D			×	
	35	D+			×	
	36	D-			×	
	37	SHFT	CaoRobot	Execute	○	
	38	ALMRST			○	Only for SR1-P / SR1-X
Data						
	1	?POS	CaoVariable	getValue	○	
	2	?XPOS			○	Only for DRCX
	3	?YPOS			○	Only for DRCX
	4	?NO			○	
	5	?SNO			○	
	6	?TNO			○	
	7	?PNO			○	
	8	?STP	CaoRobot	Execute	○	Inform the Return data without change
	9	?MEM	CaoVariable	getValue	○	
	10	?VER			○	
	11	?ROBOT			○	
	12	?CLOCK			○	
	13	?ALM	CaoRobot	Execute	○	Can not specify the display number
	14	?EMG	CaoVariable	getValue	○	
	15	?SRVO			○	
	16	?ORG			○	
	17	?MODE			○	
	18	?PVA			○	
	19	?DI			×	Output port 0~15
	20	?DO			×	Output port 0~12
	21	?PRM	CaoRobot	Execute	○	
	22	?P			○	

	23	READ			×	
	24	WRITE			△	Only for point variable (substituted command) P1 = 100.0 (write 100.0 to P1)
	25	?ERR	CaoRobot	Execute	○	Can not specify the display number
	26	?MAT			○	
	27	?MSEL	CaoVariable	getValue	○	
	28	?CSEL			×	
	29	?C			×	
	30	?D			×	
	31	?SHFT	CaoVariable	getValue	○	
Utility						
	1	INIT			×	
	2	SWI			×	
	3	SWITSK			×	
	4	SINS			×	
	5	SDEL			×	
	6	SMOD			×	
	7	COPY			×	
	8	DEL			×	
	9	PDEL			×	
Special Code						
	1	^C(=03h)	CaoRobot	Halt	○	
	2	^Z(=1Ah)			△	Same as WRITE

※The command which is gray marked is not supported.

A-2. Supported command list for Multi-axes

Group	SEQ.	Command	Object	Method	Corresp.	Remarks
Key Operation						
	1	AUTO			×	
	2	PROGRAM			×	
	3	MANUAL			×	
	4	SYSTEM			×	
	5	RESET			×	
	6	RUN			×	
	7	STEP			×	
	8	SKIP			×	
	9	NEXT			×	
	10	STOP			×	
	11	BREAK			×	
	12	CHGTSK			×	
	13	MSPEED			×	
	14	MSPEED2			×	
	15	ABSADJ			×	
	16	ABSADJ2			×	
	17	ABSRESET			×	
	18	ABSRESET2			×	
	19	ORGRTN			×	
	20	ORGRTN2			×	
	21	INCH			×	
	22	INCH2			×	
	23	JOG			×	
	24	JOG2			×	
	25	TEACH			×	
	26	TEACH2			×	
Utility						
	1	PADDR			×	
	2	COPY			×	
	3	BRA			×	
	4	REN			×	
	5	ATTR			×	

	6	INT			×	
	7	LANGUAGE			×	
	8	UNIT			×	
	9	MSGCLR			×	
	10	ACCES			×	
	11	EXELVL			×	
	12	SEQUENCE			×	
	13	ARMTYP			×	
	14	ARMTYP2			×	
	15	EMGRST	CaoRobot	Execute	○	
	16	DATE			×	
	17	TIME			×	
Data						
	1	?LANGUAGE			×	
	2	?ACCESS			×	
	3	?ARM	CaoVariable	getVariable	○	
	4	?BREAK			×	
	5	?CONFIG	CaoVariable	getVariable	○	
	6	?EXELVL			○	
	7	?MOD			○	
	8	?MSG			○	Inform the Return data without change
	9	?ORIGIN			○	
	10	?ABSRST			○	
	11	?SERVO			○	
	12	?SEQUENCE			×	
	13	?SPEED	CaoVariable	getVariable	○	
	14	?UNIT			○	
	15	?VER			○	
	16	?WHERE			○	
	17	?WHERE2			○	
	18	?WHRXY			○	
	19	?WHRXY2			○	
	20	?TASKS			×	

	21	?TSKMON			×	
	22	?SHIFT	CaoVariable	getValue	○	
	23	?HAND			○	
	24	?MEM			○	
	25	?EMG			○	Command format 2 is not supported
	26	?SELFCHK			○	
	27	?OPSLOT			○	Inform the Return data without change
	28	?[Numeric expression]			○	
	29	?[Character expression]			○	Only the variable which is defined in program of controller can be specified
	30	?[Point expression]			○	
	31	?[Shift expression]			○	
	32	READ			×	
	33	WRITE			×	
Robot Language						
	1	SWI	CaoRobot		×	
	2	LET			×	
	3	ABSRST		Execute	○	
	4	DRIVE			○	
	5	DRIVE2			○	
	6	DRIVEI			○	
	7	DRIVEI2			○	
	8	MOVE		Move	○	
	9	MOVE2		Execute	○	
	10	MOVEI			○	
	11	MOVEI2			○	

	12	ORIGIN			○	
	13	PMOVE			○	
	14	PMOVE2			○	
	15	SERVO			○	
	16	SERVO2			○	
	17	DELAY			×	
	18	DO			×	
	19	LO			×	
	20	MO			×	
	21	OUT			×	
	22	RESET			×	
	23	SET			×	
	24	SO			×	
	25	TO			×	
	26	WAIT			×	
	27	CHANGE	CaoRobot	Execute	○	
	28	CHANGE2			○	
	29	HAND			○	
	30	HAND2			○	
	31	RIGHTY/LEFTY			○	
	32	RIGHTY2/LEFTY2			○	
	33	SHIFT			○	
	34	SHIFT2			○	
	35	ACCEL		Accelerate	○	
	36	ACCEL2		Execute	○	
	37	ARCH			○	
	38	ARCH2			○	
	39	ASPEED			○	
	40	ASPEED2			○	
	41	AXWGHT			○	
	42	AXWGHT2			○	
	43	DECEL		Accelerate	○	
	44	DECEL2		Execute	○	
	45	ORGORD			○	
	46	ORGORD2			○	

	47	OUTPOS			○	
	48	OUTPOS2			○	
	49	PDEF			○	
	50	SPEED		Speed	○	
	51	SPEED2			○	
	52	TOLE			○	
	53	TOLE2			○	
	54	WEIGHT			○	
	55	WEIGHT2		Execute	○	
	56	TORQUE			○	
	57	TORQUE2			○	
	58	TRQTIME			○	
	59	TRQTIME2			○	
Operation						
	60	Pnnnn	CaoRobot	Execute	○	
	61	Sn			○	
Robot Language						
	62	^C(=03h)	CaoRobot	Halt	○	

※The command which is gray marked is not supported.

AppendixB Error code of XRCX provider

The error code of XRCX provider is HRESULT type. About HRESULT type , please refer to the following URL for more detail.

<http://msdn2.microsoft.com/en-us/library/bb401631.aspx>

In XRCX provider, we use the following format as error code.

"0x8010xxxx"

The lower 4 bytes "xxxx" is detailed in Error Code list of the user's manual of YAMAHA Robot Controller.

Table8: Error code of XRCX provider

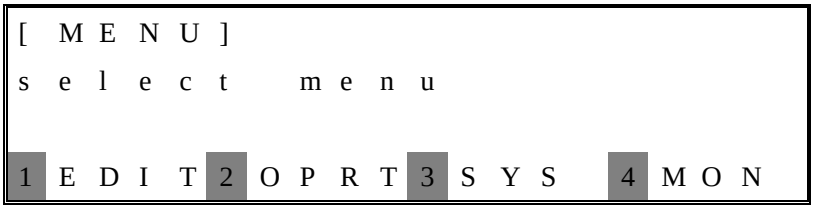
Number	Macro name	Description
0x00000000	S_OK	No error occurred
0x8010xxxx	E_RC_RESULT	An error occurred. "xxxx" represents the error code defined in YAMAHA robot controller user's manual.
0x8010E001	E_NO_LICENSE	Is not registered for a license key, can not start.
0x8010E002	E_AXIS_LIMIT	Because it had reached the number of upper bounds that was able to be controlled, it was not possible to start.
0x8010E003	E_NO_CONNECT	Because the communication fault with the controller had occurred, it failed in the connection.
0x8010E004	E_COMMUNICATION	Abnormality occurred in the communication with the controller.
0x8010E005	E_LAPSE_LICENSE	The use period of the license passed, you need to obtain a license.

AppendixC Controller Setup

C-1. Single-axis Controller

A robot controller needs to be setup before it is going to be controlled by XRCX provider. For this initial setup, Teaching Box is required. As following, we will introduce how to use HPB to setup the controller.

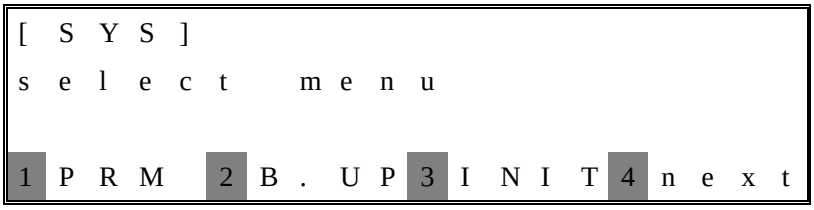
1. The display after Power ON



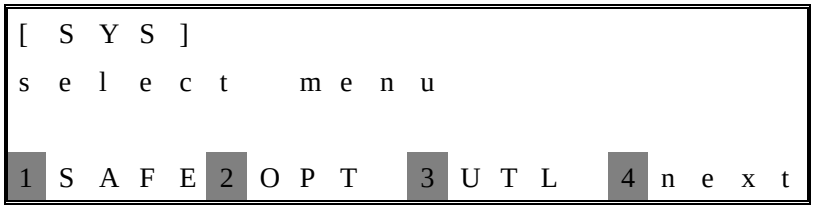
The item number in the screen, corresponds to function keys (F1 ～ F4), you can select an item by pressing a function key.

2. Setup for Ethernet I/F

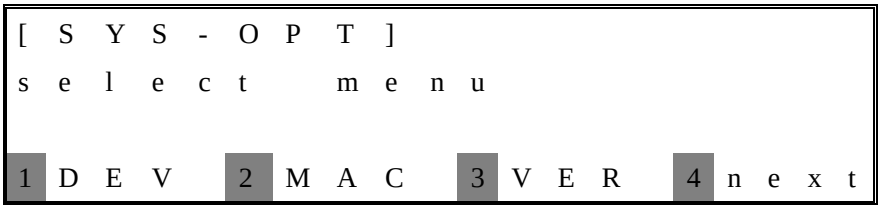
(1) Press F3 key (3.SYS) to system menu



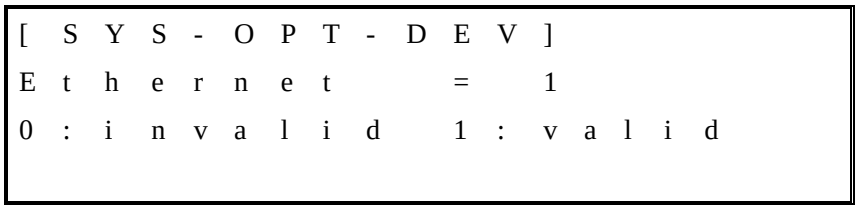
(2) Press F4 key (4.next) to next menu.



(3) Press F2 key (2.OPT) to option menu.



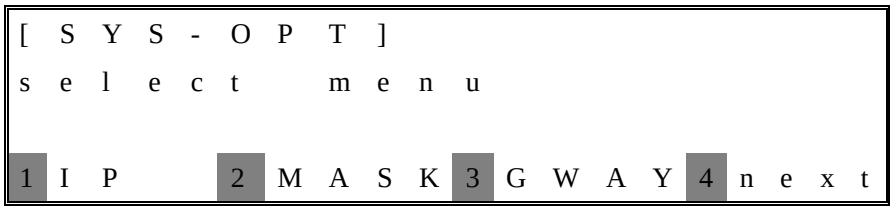
(4) Press F1 key (1.DEV) to Device Setup menu.



IF the Ethernet device is valid, "Ethernet = 1" would appear on the screen, you can press ESC key back to the system option menu.

IF not, you can press the number 1 key, then Enter key, to change the setting to be valid. After that, press ESC key back to the system option menu.

(5) Press F4 key (4.next) to the next menu.



⑹ Press F1 key (1.IP) to IP Setup menu.

```
[ S Y S - O P T - I P ]
I P   a d d r e s s
   =   1 9 2 . 1 6 8 .     0 .     2
```

In this menu, we can setup the host address (IP).

Input the network address by pressing the number key, but do not change the position of "." , if it was changed, controller system would not accept your setup. (Use cursor key to pass over ".") After completing input, press ESC key to go back to the previous menu.

⑺ Press F2 key (2.MASK) to Subnet Mask setup menu.

```
[ S Y S - O P T - M A S K ]
s u b n e t   m a s k
   =   2 5 5 . 2 5 5 . 2 5 5 .     0
```

The default value is 255.255.255.0. Input the proper network address. The input method is same as the IP setup. After completing input, press ESC key to go back to the previous menu.

⑻ Press F3 key (3.GWAY) to Gateway address setup menu.

```
[ S Y S - O P T - G W A Y ]
g a t e w a y
   =   1 9 2 . 1 6 8 .     0 .     1
```

The default value is 192.168.0.1. Input the proper gateway address.
The input method is same as the IP setup. This setup is not needed if no other network address is connected. After the input is completed, press ESC key to display the previous menu.

(9) Press F4 key (4.next) to the next menu.

```
[ S Y S - O P T ]
s e l e c t   m e n u

1 P O R T 2 E C H O 3 T O U T 4 n e x t
```

(10) Press F1 key (1.PORT) to PORT setup menu.

```
[ S Y S - O P T - P O R T ]
p o r t   n o
  =   2 3
r a n g e   0 ~ 6 5 5 3 5
```

The default value is 23. Make sure the value is 23, and do not change the value. If the value is changed, it is not able to communicate by TELNET protocol. After the input is completed, press ESC key to display the previous menu.

(11) Press F2 key (2.ECHO) to ECHO BACK setup menu.

```
[ S Y S - O P T - E C H O ]
e c h o   b a c k
  =   1
0 : i n v a l i d   1 : v a l i D
```

The default value is 1. Set "1(valid)" because ECHO BACK is needed for the communication of YAMAHA ORiN provider. After the input is completed, press ESC key to display the previous menu.

(12) Press F3 key (3.TOUT) to TIMEOUT setup menu.

```
[ S Y S - O P T - T C U T ]
t i m e o u t
   =      5    [ m i n ]
r a n g e    0 ~ 2 5 5
```

Set the timer interval of the check for client existence.

If the communication with client did not work, after timeout, TELNET would be cut off. "0" means that the timeout check is invalid, therefore it would be advised that set the value to "0" .After the input is completed, Press ESC key to display the previous menu.

(13) Press F4 key (4.next) to the next menu.

```
[ S Y S - O P T ]
s e l e c t    m e n u

1 L I N   2 L O U T 3 I D L E 4 n e x t
```

(14) Press F1 key (1.LIN) to Login Setup menu.

```
[ S Y S - O P T - L I N ]
s e l e c t    m e n u

1 C H E K 2 U S E R 3 P A S S
```

(15) Press F1 key (1.CHEK) to the Login Check Setup menu.

```
[ S Y S - O P T - L I N - C H E K ]
l o g i n    c h e c k
   =    1
0 : i n v a l i d   1 : v a l i d
```

The default value is 1(valid). Make sure the value is 1, and do not change the value. Because YAMAHA ORiN provider will execute login check, do not change the setting. After the input is completed, press ESC key to display the previous menu.

(16) Press F2 key (2.USER) to User ID setup menu.

```
[ S Y S - O P T - L I N - U S E R ]
l o g i n   u s e r
  =   U S E R
A B C D E F G H I J K L M N O P Q R S T
```

The default setting is "USER", change it to the proper ID for security reason. If you change the ID, also be sure to change the ID which is in YAMAHA ORiN provider application. After the input is completed, press ESC key to display the previous menu.

【Character Input Procedure】

The bottom of the display is the character area. Move the cursor to the character which you want to input, and press Enter key to input. Only the characters of A to T are displayed, but you can find other candidate characters by moving the cursor to the end of the character line.

After the input is completed, press ESC key. "data set ok?" appears, press F1 (1.yes) to save, or F2 (2.no) to cancel to keep the last ID.

(17) Press F3 key (3.PASS) to password setup menu.

```
[ S Y S - O P T - L I N - P A S S ]
l o g i n   p a s s w o r d
  =   P A S S W O R D
A B C D E F G H I J K L M N O P Q R S T
```

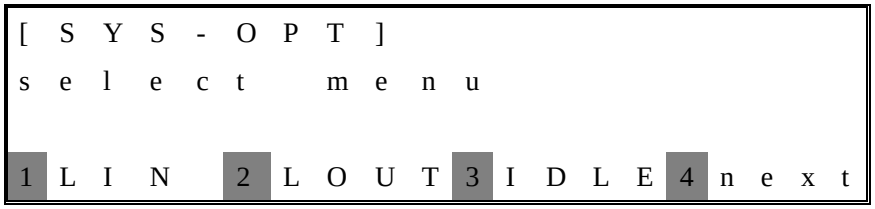
The default setting is "PASSWORD", you can change it to the proper password for security reason. If you change the password, also be sure to change the password in YAMAHA ORiN provider application. After the input is completed, press ESC key to display the previous menu.

【Character Input Procedure】

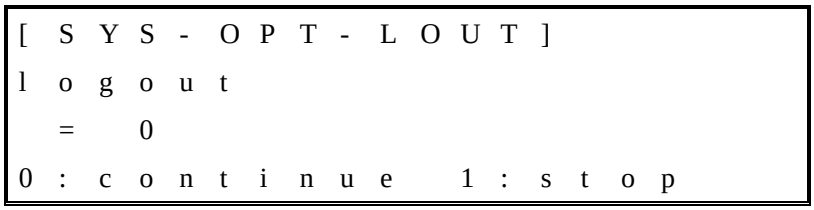
The bottom of the display is the character area. Move the cursor to the character which you want to input, and press Enter key to input. Only the characters of A to T are displayed, but you can find other candidate characters by moving the cursor to the end of the character line.

After the input is completed, press ESC key. "data set ok?" appears, press F1 (1.yes) to save, or F2 (2.no) to cancel to keep the last password.

(18) Login setup menu. Press ESC key to Option menu.



(19) Press F2 (2.LOUT) key to Logout Setup menu.



The default value is 0 (continue). Make sure the value is 0, and do not change the value. If the value is 1 (stop), when disconnected YAMAHA ORiN provider application from the controller, robot would stop even during action. In case of this situation, it does not cause a big trouble, but buzzer would keep sounding. After the input is completed, press ESC key to display the previous menu.

3. Setup for RS232C I/F

Communication Parameters depend on the controller, they might be different for different controller. Please refer to the guide manual of controller.

C-2. Multi-axes Controller

For initial setup, Teaching Box is required. As following, we will introduce how to use MPB to setup the controller.

1. The display after Power ON

```
MANUAL                                    50%[MG][S0H2X]
  Current Position
* Mx=      0.00 * My=      0.00 * Mz=      0.00
  Mr=      0.00

AUTO    PROGRAM  MANUAL  SYSTEM
```

Items in the screen corresponds to the function keys (F1, F2, F3, F4, F5), you can select an item by pressing function key.

2. Setup for Ethernet I/F

(1) Press 「SYSTEM」(F4) key to System menu.

```
SYSTEM                                          V*.**
Robot      =*******
Axes       =*******
Standard   =*******
Opt_i/f    =*******

PARAM   CMU     OPTION  INIT    DIAGNO
```

(2) Press 「PARAM」(F1) key to the next menu.

```
SYSTEM> PARAM                                   V*.**
Robot      =******
      M1=********              M5=no  axis
      M2=********              M6=no  axis
      M3=********
      M4=********
ROBOT   AXIS    OTHERS          OP.BRD
```

(3) Press 「OP.BRD」(F5) key to the next menu.

```
SYSTEM>PARAM>OP.BRD                    V*.**
  1.E_Net                              VALID
  2.
  3.
  4.

SELECT
```

(4) Use cursor key to select E_Net, press「SELECT」(F1) to setup network menu.

```
SYSTEM>PARAM>OP.BRD>SELECT             V*.**
  1.board condition  VALID
  2.IP address       192.168.  0.  2
  3.subnet mask      255.255.255.  0
  4.gateway          192.168.  0.  1
  5.port No          23
EDIT    JUMP
```

(5) Move cursor to item, press 「EDIT」(F1) to edit the item.

① Board condition

Set up Ethernet board to valid or invalid.

② IP address

Set up the host address(IP).

③ Subnet mask

Set up subnet mask.

④ Gateway

Set up network gateway.

⑤ Port No

Default setting is 23. Do not change the setting. If the setting was changed, the communication by TELNET protocol was not going to work.

⑥ ECHO BACK

Default setting is valid. Keeping it valid is necessary for YAMAHA ORiN Provider communication.

⑦ Time out [min]

Set the timer interval of the check for client existence.

If the communication with client did not work, after timeout, TELNET would be cut off. "0" means that the timeout check is invalid, therefore it is

advised that set the value to "0".

⑧ Login Check

Default setting is valid. Because YAMAHA ORiN provider will execute login check, please do not change the setting.

⑨ Login user

Default setting is "USER", change it to the proper ID for security reason. If you change the ID, also be sure to change the ID which is in YAMAHA ORiN provider application.

⑩ Login password

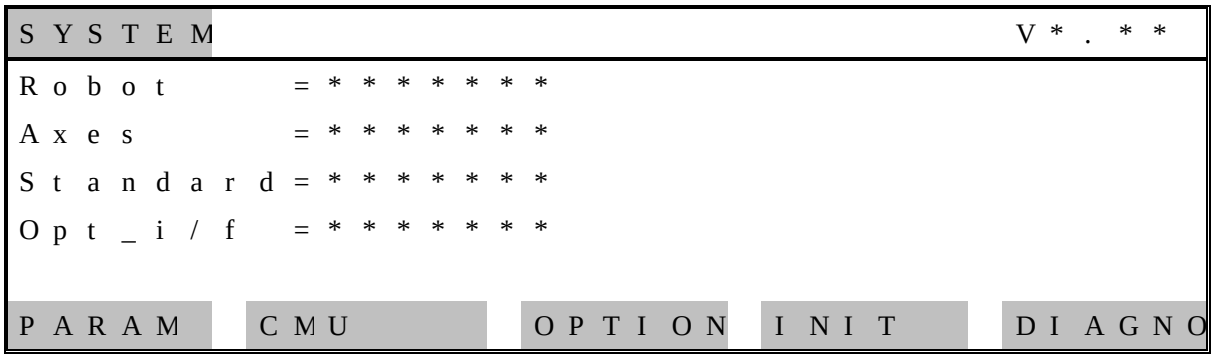
Default setting is "PASSWORD", you can change it to the proper password for security reason. If you change the password, also be sure to change the password in YAMAHA ORiN provider application.

⑪ Logout

Default setting is "continue". If the value is "stop", when disconnected YAMAHA ORiN provider application from the controller, robot would stop even during action.

3. Setup for RS232C I/F

(1) Press「SYSTEM」(F4) key to system menu.



(2) Press「CMU」(F2) key to communication menu.

(3) Move cursor to item, press 「EDIT」(F1) to edit the item.

① Communication Mode

Set up the mode of communication with computer.

② Data bits

Set up the length of data bit.

③ Baud rate

Set up communication speed.

④ Stop bit

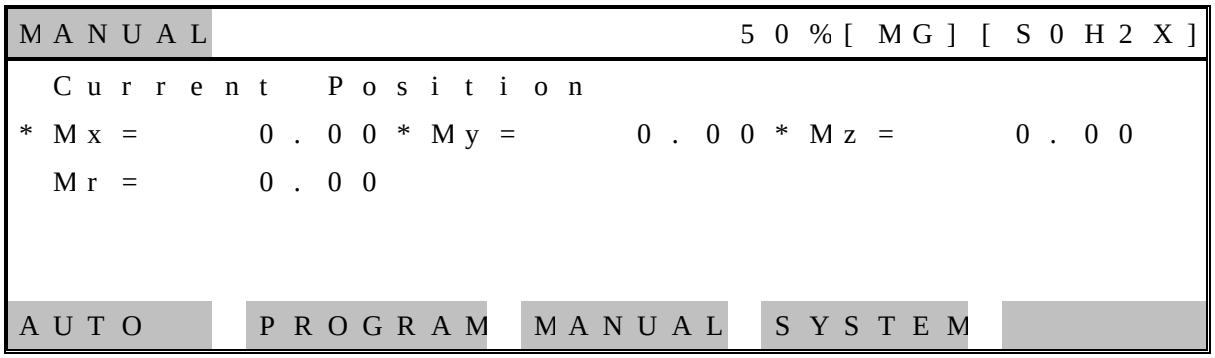
Set up the length of stop bit.

⑤ Parity

Set up the parity check.

4. Others

Before sending online command to Multi-axes controller (RCX), please set up controller in [Auto Mode](F1) or [Manual Mode](F3). If the online command was sent out during [Program Mode] or [System Mode], the controller would become error state, couldn't perform the correct action.



AppendixD Trouble-Shooting

D-1. I can not connect with a robot controller...

Check	Action
■Robot controller side	
□ Is the cable, RS232C or Ethernet cable connected properly?	Ensure that the cable is not loose on the connector. (Refer to the Manual of Controller)
□ Is the type of cable such as Straight and Cross correct?	Check the cable. (Refer to the Manual of Controller)
□ In case of Ethernet, is the address correctly set?	Check the address settings. (Refer to Appendix C)
□ In case of Ethernet, does it keep the status of no communication for long time?	Check the timeout settings. (Refer to Appendix C)
□ In case of RS232c, is the communication parameter correctly set?	Check the parameters of RS232c. (Refer to Appendix C)
■PC side	
□ Is there other application program connecting with controller ?	Terminate the application program.
□ Are the parameters of the AddController() function correctly set?	Check the parameters of the AddController() function. (Refer to 3.3.1)

D-2. I can not access variables of a robot controller...

Check	Action
■Robot controller side	
□ Is any edit dialogue displayed in the Teaching Box?	Close the dialogue.
□ Is it the EMG status ?	Release the EMG status.
■PC side	
□ Is the variable name correctly set?	Check the variable name.

D-3. I can not move a robot...

Check	Action
■Robot controller side	
□ Is any edit dialogue displayed in the Teaching Box?	Close the dialogue.

□ Is the robot in the executable state?	Check the MODE setting、Robot type、motor ON、EMG OFF　etc.
■PC side	
□ Are the command names and parameters correctly specified?	Check the command specification, pay attention to the method of using parameters.

User's Guide

ORiN2 Provider XRCX

March 2010
Version 1.3.0

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