

Programmable Multi-Axis Controller

Startup Guide for Yaskawa Electric Σ-V Series Servo Drive

CK5M-CPU□ CK3M-CPU□ CK3W-AX□

Startup Guide

NOTE

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Precautions

- For actual system construction, check the specifications for each device and piece of equipment that makes up the system, use a method with sufficient margin for ratings and performance, and adopt safety circuits and other safety measures to minimize risks even if a breakdown occurs.
- To safely utilize the system, obtain a manual or user's guide for each device and piece of equipment that makes up the system, confirm their content, including "Safety Precautions", "Precautions for Safe Use", and other precautions related to safety, and then proceed with use.
- The customer must check all regulations, laws, and rules that are applicable to the system themselves.
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Precautions for Correct Use

Precautions on what to do and what not to do to ensure correct operation and performance.



Additional Information

Additional information to read as required. This information is provided to increase understanding and make operation easier.

Related Manuals

To safely utilize the system, obtain a manual or user's guide for each device and piece of equipment, confirm their content, including "Safety Precautions", "Precautions for Safe Use", and other precautions related to safety, and then proceed with use.

The manuals for OMRON Corporation (hereafter, "OMRON") and Delta Tau Data Systems Inc. (hereafter "DT") are as shown below.

Manufacturer	Cat. No.	Model	Manual Name
OMRON	O036	CK5M-□	CK3M/CK5M-series Programmable Multi-Axis Controller User's Manual
		CK3M-□	Hardware
		CK3W-□	
DT	O014		Power PMAC User's Manual
DT	O015		Power PMAC Software Reference Manual
DT	O016		Power PMAC IDE User's Manual

Terms and Definitions

Terms	Descriptions and Definitions
Power PMAC IDE	Computer software that is used to configure the Controller, create user programs,
	and perform monitoring.
	PMAC is an abbreviation for Programmable Multi-Axis Controller.

Revision History

A manual revision code appears as a suffix to the catalog number on the front and back covers.

Revision code

Revision code	Date	Revised content
01	April 2018	Original production
02	July 2018	Corrected mistakes.
03	January 2023	 Revisions due to the addition of the CK5M-CPU1□1 Corrected mistakes.

1

Summary of Materials

This section lists a summary of these materials.

1-1 Introduction

This document describes the procedure and confirmation for operating a Servo Drive from Yaskawa Electric (Σ -V Series Servo Drive, hereinafter called "Servo Drive") with the OMRON Programmable Multi-Axis Controller CK \square M- \square (hereinafter called "Controller").

In these materials, the general name for the Servo Drive together with the connected Servo Motor is the "motion control device". In addition, the Servo Drive is called the "slave", based on the description content.

By understanding the setting points and setting procedure described in *Section 3 Analog I/F Connection Procedure* on page 3-1, you can operate the motion control device by forming a closed loop with torque control using the Analog I/F. In this document, a motion program is used for operation check.

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Target Device and Device Configuration

This section lists the target equipment and system configurations for connections in these materials.

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2-1 Target Device

Manufacturer	Name	Model
OMRON	Programmable Multi-Axis Controller CPU Unit	CK□M-CPU□
OMRON	Programmable Multi-Axis Controller Axial Interface Unit	CK3W-AX□
OMRON	Programmable Multi-Axis Controller Power Supply Unit	CK3W-PD
OMRON	Programmable Multi-Axis Controller End Cover	CK3W-TER□
OMRON	Switch Mode Power Supply	S8VK-□
Yaskawa Electric	AC Servo Drive	SGDV-□
OMRON	Amplifier Cable	CK3W-CAA03A
OMRON	Encoder Cable	CK3W-CAED03A
OMRON	Connector-Terminal Block Conversion Unit	XW2D-50G6
OMRON	Control Cable	XW2Z-□J-B24

The target equipment for connection is shown below.

2-2 Device Configuration

The configuration devices for recreating the connection procedures in these materials are shown below.



Manufacturer	Name	Model	Version
OMRON	Programmable Multi-Axis Controller CPU Unit	CK□M-CPU□	—
OMRON	Programmable Multi-Axis Controller Axial Interface Unit	CK3W-AX□	_
OMRON	Programmable Multi-Axis Controller Power Supply Unit	CK3W-PD□	_
OMRON	Programmable Multi-Axis Controller End Cover	CK3W-TER□	_
OMRON	Switch Mode Power Supply	S8VK-□	—
Yaskawa Electric	AC Servo Drive	SGDV-□	_
OMRON	Amplifier Cable	CK3W-CAA03A	—
OMRON	Encoder Cable	CK3W-CAED03A	—
OMRON	Connector-Terminal Block Conversion Unit	XW2D-50G6	—
OMRON	Control Cable	XW2Z-□J-B24	—
_	Windows PC		—
DT	Power PMAC Setting Tool	Power PMAC IDE	4.0 or higher
Yaskawa Electric	Servo Drive Setting Tool	SigmaWin+	

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Analog I/F Connection Procedure

This section describes the procedures for connecting the Controller and Servo Drive, and operating the motion control equipment.

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3-1 Work Flow

The procedures for connecting the Controller and Servo Drive, and operating the motion control equipment, are shown below.

3-2 Controller Setting Preparations on page 3-4	Perform the Controller setting preparations.
▼	
3-2-1 Creation of a New Project on page 3-4	
▼	
3-2-2 Controller Initial Setting on page 3-6	
$\overline{\nabla}$	
3-3 Various Equipment Wiring on page 3-7	Perform wiring for each piece of equip- ment.
▼	
3-3-1 Axial Interface Unit and Driver Wiring on page 3-7	
▼	
3-3-2 Wiring for Switch Mode Power Supply and Driver on page 3-8	
∇	
3-4 Various Controller Settings on page 3-9	Perform the Controller settings.
⊽	
3-5 Various Servo Drive Settings on page 3-11	Perform the Servo Drive settings.
⊽	
3-6 Checking Operation on page 3-12	Check that the settings up to here are correct.
∇	
3-7 Motor Tuning on page 3-13	Perform motor tuning.
▼	1
3-7-1 Open Loop Test on page 3-13	
▼	1
3-7-2 Bandwidth Automatic Setting on page 3-13	
▼	1
3-7-3 Manual Correction of Bandwidth on page 3-14	
▼	1
3-7-4 Feed-Forward Value Setting on page 3-16	
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3-7-5 Creation of Tuning Parameter Project on page 3-18	
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3-8 Absolute Encoder System Home Setting on page 3-19	Perform homing.
▼	
3-9 Operations Check Based on Motion Pro- gram on page 3-23	Create a motion program, and perform an operations check.
▼	
3-9-1 Creation of Operations Check Program on page 3-23	
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3-9-2 Transferring Project Data and Checking the Operation on	
page 3-25	

3-2 Controller Setting Preparations

Perform the Controller setting preparations. Install the Power PMAC IDE on the PC beforehand.

3-2-1 Creation of a New Project

1	Connect the Controller and computer with an Ethernet cable.	
2	Turn ON the power supply to the Con- troller.	
3	 Start up Power PMAC IDE. If a dialog for checking access rights is displayed at the time of startup, se- lect the option for starting up. 	PowerPMAC IDE
4	 The Communication screen is displayed, so specify the IP address of the Controller to be connected to, and click Connect. The default IP address for the Controller is 192.168.0.200. If necessary, change the Windows IP address to 192.168.0.X. 	IDE Environment Communication IP Address Port 22 Protocol SSH User root Password SelectDeviceAtStartup IP Address Set IP Address Set IP Address For detailed setup options go to Tools menu -> Options -> PowerPMAC
5	Power PMAC IDE starts up, and the Controller will come online.	Provertified, 1024 40.0.02 (Additionality Market) - 19: 102.1166.2020 (PPU) emul.(5312)/A Firmmarke: 2.3.8.126 Provertified, 1024 40.0.02 (Control of the Control of the C

3-2 Controller Setting Preparations

3

3-2-1 Creation of a New Project

6	From the File menu, select New,	0	PowerPMAC	IDE 4.0.0.8 (Adm	inistrator) - IP:	192.1	58. <mark>0.2</mark> 00) CPU: ar	m,LS1021A Firmware
	Project.	File	Edit Viev	v Debug Too	ls Delta Tau	Eth	erCAT	Window	Help
			New				摺 P	roject	Ctrl+Shift+N
			Close				້ນ F	le	Ctri+N
		63	Close Project				₽×	Position:	Online[192.168.0.200:
		1.1	Save Selecter	d Items	Ctrl+S			#1	
			Save Selecter	d Items As					
		-	Save All		Ctrl+Shift	+S		#4	
			Export Templ	ate				#5	
			Export					#7	
			Import			•	Ψ×	#8	
			Page Setup						
		-	Print		Ctrl+P		ful		
			Recent Project	ts and Solutions		•			
		E3	Exit		Alt+F4				
		Suc	e ccessful: SaveCo	nfiguration using					
_									
1	Input the desired project name and the	New P	Project	Cathy Defait		1			
	save destination, and select OK .	4 In	istalled	PowerBrick	•) #* (#		Powe	PMAC Typ	e: PowerPMAC
	,	P	owerPMAC	PowerPMAC			Powe	POV	verPMAC Project Template
		P	owerPMAC Solution						
		Nerr	ne: Dover?						
		Nam Lock	ne: Power stion: C:VLBs	MACS	WPowerPMAC IDE			- Brow	rs

3-2-2 Controller Initial Setting

Perform the initial settings for the Controller.

Precautions for Correct Use

Since all memory is cleared by the initial settings, be sure to save any data remaining in the Controller that you may need.



3-3 Various Equipment Wiring

3-3-1 Axial Interface Unit and Driver Wiring

Perform wiring for the Axial Interface Unit and Servo Drive in accordance with the wiring diagram below.

If Using an Incremental Encoder

CK3W-AX Amplifier interface		SGE	DV-□
DACA+	1	9	TREF
AGND	3	10	SG
AE_NO	7	40	/S-ON
AE_COM	15	32	ALM-
FAULT+	4	47	+24 VIN
FAULT-	11	31	ALM+
Encoder interface			

CHA	1		33	PAO
CHA/	6		34	/PAO
СНВ	2		35	PBO
CHB/	7]	36	/PBO

If Using an Absolute Encoder

CK3W-AX Amplifier interface		SGE	DV-
DACA+	1	9	TREF
AGND	3	10	SG
AE_NO	7	40	/S-ON
AE_COM	15	32	ALM-
FAULT+	4	47	+24 VIN
FAULT-	11	31	ALM+

Encoder interface

CHA	1	- 33	PAO
CHA/	6	- 34	/PAO
CHW	5		
CHT	10		
СНВ	2	35	PBO
CHB/	7	- 36	/PBO
OutFlagB	15	4	SEN
GND	14	2	SG

The cables and units used are shown in the table below.

Manufacturer	Name	Model
OMRON	Amplifier cable	CK3W-CAA03A

Manufacturer	Name	Model
OMRON	Encoder cable	CK3W-CAED03A
OMRON	Connector-Terminal Block Conversion Unit	XW2D-50G6

3-3-2 Wiring for Switch Mode Power Supply and Driver

Perform the wiring for the switch mode power supply and the Servo Drive as shown below.

Switch Mode Power Supply	Servo Drive
+24 V	47 : +24 VIN
GND	32 : ALM-

3-4 Various Controller Settings

Perform the settings for connecting the Controller to the Servo Drive.



3

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-						
3	If using an absolute encoder, add the	<pre>Gate3[0].EncClockDiv = 3</pre>				
	settings on the right to the bottom of the	Gate3[0].SerialEncCtrl = \$82230005				
	Global Definitions.pmh file.	Gate3[0].Chan[0].SerialEncCmd = \$13000				
		Gate3[0].Chan[0].SerialEncEna = 1				
		Gate3[0].Chan[0].OutFlagD = 0				
4	Downloading the project Right-click the project name in the Solution Explorer in the upper-right corner of the IDE window, select Build and Download All Programs , and then perform the build and download.	Solution Explorer				
5	 Make sure that there are no errors in the Output Window. If the transfer failed, check the content of the error in the Output Window. If there is a program error, review the program. 	Output Show output from: Build Uploading pp_proj.h file from the PowerPMAC. Uploading and synchronizing PowerPMAC variables Download successful. Total Project download time = 5.881 seconds. Total Project build and download time = 16.059 seconds. Build Succeeded. Exception Settings Output				
6	On the Power PMAC IDE Terminal, type the save command. When saving is complete, "Save Complete" is displayed in the Terminal.	Terminal: Online [192.168.0.200 : SSH]				
7	On the Power PMAC IDE Terminal, type the \$\$\$ command.	Terminal: Online [192.168.0.200 : SSH] - I × \$\$\$ Resetting PowerPMAC PowerPMAC Reset complete - \$\$\$\$ -				

Precautions for Correct Use

Do not specify the servo cycle Sys.ServoPeriod setting as a decimal but rather in fraction form, as shown below. If this is not correctly set, there is a possibility that you may not be able to obtain synchronization with the Controller and EtherCAT driver. (Example) At servo clock 12 kHz Correct: Sys.ServoPeriod = 1/12 Incorrect: Sys.ServoPeriod = 0.083333

rh1

3-5 Various Servo Drive Settings

Use SigmaWin+ to perform the SGDV- \Box setting. Change the drive parameters as shown in the table below. (Set parameters other than those shown in the table below to the factory settings.) For the SGDV- \Box operation method, refer to the attached manual.

No.	Name	After change	
Pn000.1	Control method selection	2: Torque control (analog reference)	
Pn002.2	Absolute encoder usage	If Using an Incremental Encoder	
		1: Uses absolute encoder as an incremental encoder.	
		If Using an Absolute Value Encoder	
		0: Uses absolute encoder as an absolute value encoder.	
Pn200.0	Reference pulse form	4: Phase A + Phase B (x4), positive logic	
Pn50A.3	P-OT signal mapping	8: Forward run allowed	
Pn50B.0	N-OT signal mapping	8: Reverse run allowed	

3-6 Checking Operation

Check whether the settings up to here are correct.

1	 Type the #1 out0 command from the Terminal. At this time, check that the motor has the servo ON. When using the absolute encoder, type Gate3[0].Chan[0].OutFlagB=1 from the Terminal beforehand. 	Terminal: Online [192.168.0.200 : SSH]
2	Type the #1 out1 command from the Terminal.	Terminal: Online [192.168.0.200 : SSH]
3	 Make sure that the motor is rotating. In addition, check that the Watch window Position value is increasing in the positive direction. If the motor does not rotate even after typing the #1 out1 command, input #1 out2, #1 out3, or another large value. 	Watch: Online [192.168.0.200 : SSH] • # × Send On Demand Command Response #1 2.038.83mu #2 0.00 mu #3 0.00 mu #3 0.00 mu #3 0.00 mu #3 0.00 mu #3 0.00 mu #3 0.00 mu #4 0.00 mu #4 0.00 mu #4 0.00 mu #4 0.00 mu #4 0.00 mu #5 0.00 mu #5

3-7 Motor Tuning

3-7-1 Open Loop Test

Operate the motor in an open loop, and check that each type of setting is correct.

1	 Open the Tune screen on the right from the Delta Tau → Tools menu, and select Open Loop Test → Step Test. When using the absolute encoder, input Gate3[0].Chan[0].OutFlagB=1 from the Terminal before implementing tuning. 	Tune : Online[192.168.0.2 Select Motor	200:SSH] Current Loop Tuning Open Loop Test Position Loop Auto-tune Position Step Test Sinusoidal Test Sine Sweep Test Open Loop Step Test Parameters Test Amplitude Test Amplitude Test Time Number of Repetitions 2
		Enable Closed Loop	Open Loop Step Test
2	Set the tuning parameters on the right.	Test Amplitude: (If the motor is no Test Time: 100ms Number Of Repe	1.0% t rotating, set a large value.) s s tition : 2
3	Click Open Loop Step Test , and check that the motor is performing reciprocat- ing operation.	 Preventinket: Tables: Markas: 1 Count Loop Each Markas: 2 (2000 11 11 11 15 12 12 12 Motor 1 Open Loop Skep Move: 2/21/2018 11 16 50 AM

3-7-2 Bandwidth Automatic Setting

Use the Power PMAC IDE auto-tuning function to automatically set the servo loop bandwidth.

	Specify Amplifier Type	Specify Auto-tune Excitation	Settings	
Advance Auto-tune.	Amplifier Type Direct PWM -	Excitation Magnitude	10.0 🔶 🗴	
	Specify Desired Performance	Excitation Time	100 ms	
	Bandwidth 20.0 🚔 Hz	Min Travel		
	Damping Ratio 0.7 🛬	min. Iravei	400 mu	
	Coff Hard	Max. Travel	4000 mu	
	Integral Action	Auto-tune Move Options		
		Positive Move Only	Iteration No	
	Velocity FF Acceleration FE	Negative Move Only	2 🚖	
		V NO DOS DACK		
	Auto Select Bandwidth			
	Auto Select Sample Period	Auto-tune Motor	Recalculate	
	Auto Select Low Pass Filter			
			·	
	NewTuningGUISpecifyEncoderResolution			
	Encoder Resolution 10000 cts/rev	e la		

2	Set the tuning parameters on the right.	Amplifier Type: Torque Mode				
_	Encoder Resolution is determined	Auto Select Bandwidth	i: Check			
	by the resolution of the servomotor	Encoder Resolution: 8192				
	by the resolution of the servorholo	Excitation Magnitude: 1%				
	encoder being used, and by the elec-					
	tronic gear ratio of the Servo Drive.	(Select the value rotated in the open loop.)				
	Set the value for the output pulse	Iteration No.: 2				
	number per one motor rotation.					
3	Click Auto-tune Motor.	Simple Auto-tune Advance Auto-tune Specify Amplifier Type	Specify Auto-tune Excitation Settings			
		Amplifier Type Torque Mode 👻	Excitation Magnitude			
		Specify Desired Performance	Excitation Time 100 ms			
		Bandwidth 20.0 🖶 Hz	Min. Travel 400 mu			
			Max. Travel 4000 mu			
		Soft Hard Integral Action	Auto-tune Move Options			
		Velocity FF	Positive Move Only Iteration No			
		Acceleration FF	No Jog Back			
		Vortions V Auto Select Bandwidth				
		Auto Select Sample Period Auto Select Low Pass Filter	Auto-tune Motor Recalculate			
		NewTuningGUISpecifyEncoderResolution				
			24			
4	If the message on the right appears	Position AutoTune Message	X			
-	click Vas					
	CIER TES.	We have chosen a safe and conservative band	width of 13.6 Hz.You may choose a			
		wish to go back and change this bandwidth (if	if you choose No the auto-tuning			
		process will continuely				
			Yes No			
5	If the person on the right encourse slight					
Э	If the screen on the right appears, click	S Auto-tune Results for Motor				
	Implement.	Proportional (Kp)	4 4 0.56379849970272			
		Derivative (Kvfb)	40 40 291.301670468814			
		Integral (Ki)	9.9999997e-05 0			
		Velocity feedforward (Kvff)				
		Derivative Gain 2 (Kvifb)				
		Velocity feedforward into Integrator (Kviff)	0 0			
			Restore Implement			
		Active filter will be removed	OK Cancel			

3-7-3 Manual Correction of Bandwidth

While monitoring the stepwise response, select the most suitable bandwidth.

1 Select Position Loop Interactive	Current Loop Tuning Open Loop Test Position Loop Auto-tune FeedBack Gains	Position Loop Interactive Tuning	Pre-filter Setup Ada Trajectory Selection	aptive Control Interactive	e Filter Se
Tuning	Proportional Gain (Kp)	0.56428814	Step Bamp Par	abolic Vel. Trapezoidal V	/el. SOur
runing.	Derivative Gain 1 (Kvfb)	Derivative Gain 1 (Kvtb) 29155466		Select Step Move Parameters	
	Derivative Gain 2 (Kvifb)	0	Stee Size	2500	
	Integral Gain (Ki)	0	Step Size	2000	
	FeedForward Gains		Step Time	5000	
	Velocity Feedforward Gain 1 (Kvff)	0			
	Velocity Feedforward Gain 2 (Kviff)	0			
	Acceleration Feedforward Gain (Kaff)	0		Chan Maur	
	Friction Feedforward Gain (Kfff)	0	Step Move		
	Integral Mode (SwZvint)		Move Options		
	Fatal Following Error Limit (FatalFeLimit)	5000	Kill Motor		
	Servo Output Limit (MaxDac)	32767	Duroll Time		
	Servo NonLinearities		After the Move	500	
	Input Deadband Size (BreakPosErr)	0			Sel
	Input Deadband Gain (KBreak)	0	Filter	Calculator	
	Output Deadband Inner Size (OutDbOn)	0	Set Gantry Cro	ss-Coupling Gains	
	Output Deadband Outer Size (OutDbOff)	0	· · · · · ·		F
	Output Deadband Seed (OutDbSeed)	0	Show Servo	Block Diagram	
	Motor Status	Motor Type	Servo Algorithm	Position Loo	op Filter
	Amplifier Fault Fatal FE Limit Hardware Limit So	ftware Limit Independent	Standard	Act	tive
	Namine	16			

2	Set the tuning parameters on the right.	Step Size: 2500 Fatal Following Error: 5000 Servo Output Limit: 32767
3	Click Step Move , and check the step- wise response.	ProvertPMAC Tune: 1 Step Move: +1 12/21/2018 11:32:31 AM File View Tools 1 Step Move: F1 12/21/2018 11:32:31 AM 0 0
4	If the target position has not been reached, return to the Advance Auto- tune screen, and set an even larger value for the Bandwidth.	Simple Auto-tune Advance Auto-tune Specify Amplifier Type Torque Mode Amplifier Type Torque Mode Specify Desired Performance Excitation Magnitude Bandwidth 0.7 Integral Action 0.7 Soft Hard Integral Action Soft Velocity FF Soft Options No. Joe Back. Options Auto-Select Bandwidth Auto Select Low Pass Filter Auto-tune Motor
5	Click Recalculate .	Simple Auto-tune Advance Auto-tune Specify Amplifier Type Specify Auto-tune Excitation Settings Amplifier Type Torque Mode Specify Desired Performance Excitation Magnitude Bandwidth 80.0 Dampine Ratio 0.7 Soft Hard Integral Action Soft Velocity FF Nestive Move Only Auto Select Bandwidth No. Joe Back Options Auto Select Bandwidth Auto Select Low Pass Filter Auto-tune Motor
6	If the screen on the right appears, click Implement .	Auto-tune Results for Motor Proportional (Kp) 0.58521031 0.58521031 0.1173972829013 Derivative (Krtb) 276.53082 226.53082 1001.307282591423 Integral (Ki) 0 0 0 0 Velocity feedforward (Krtf) 0 0 0 0 Derivative Gain 2 (Kvitb) 0 0 0 0 Velocity feedforward in Integrator (Kvitf) 0 0 0 0 Velocity feedforward in Integrator (Kvitf) 0 0 0 0 Velocity feedforward in Integrator (Kvitf) 0 0 0 0 Velocity feedforward in Integrator (Kvitf) 0 0 0 0
7	Return to Step 1. Repeat until the de- sired responsiveness is obtained.	

3-7 Motor Tuning

3

3-7-3 Manual Correction of Bandwidth





3

1 Type the #1 j+ command from the Terminal. 2 Make sure that the motor is rotating. PowerPMAC3 - PowerPMAC IDE 4.0.0.8 (Administrator) - IP: 192.168.0.200 CPU: arm,LS1021A Firmware: 2.3.8.126 Delta Tau Ethe Tools In addition, confirm that the Watch win-- O | 🕄 - 뉩 - 🖆 🔛 🔐 | Ferminal 🕀 Position 💿 Watch Any CPU Start p. h 🔽 Sta us G Jog Rit on 🖉 Cor etup | 😂 Start Page dow Velocity value is around +32. and Command 0... ECAT[0].Enable 0 cor[1].MaxDac = 32767 3 Open Global Definitions.pmh under llowing Erro… 🝷 🖡 🗙 Solution Explorer - 4 × PMAC Script Language — Global 0 0 🟠 🔞 - 🗗 🗡 💻 Includes in the Solution Explorer. Search Solution Explorer (Ct 🔎 -PowerPMAC3 System C Language Þ Configuration Documentation D 0.00 mu 🕨 🚞 Log PMAC Script Language 🔺 🐚 Global Inclu global definitions. Kinematic Routines Libraries Solution Explorer Class View 4 Add the values obtained from tuning to Motor[1].Servo.Kaff = *** the Global Definitions.pmh. Motor[1].Servo.Kvff = *** Motor[1].Servo.Kp = *** Motor[1].Servo.Kvfb = *** Motor[1].MaxDac = 32767

3-7-5 Creation of Tuning Parameter Project

3-8 Absolute Encoder System Home Setting

This section describes only the homing for the absolute encoder system. For the incremental encoder and homing commands (home and homez commands), refer to the attached DT manual.

Perform the home setting following the procedure below.

3-8-1 Absolute Encoder Setup

When using the absolute encoder for the first time, when wanting to initialize the rotation amount data to 0, or when the absolute encoder has been left standing for a long period without connecting to a battery, etc., the absolute encoder setup is necessary. For details of the setup method, refer to the manual attached to the Yaskawa Electric Σ -V Series Servo Drive.

3-8-2 Read Absolute Encoder Position

Read the absolute encoder position from the Servo Drive.

Carry out the absolute encoder wiring in 3-3-1 Axial Interface Unit and Driver Wiring on page 3-7, then create a program to read multi-rotation data and initial incremental pulse in absolute encoder, and execute the program.

The procedure for creating a program is described below.





```
sub: readMultiTurnCount
                                   local tmpSerialEncDataA, tmpSerialEncDataB;
                                   local cAsciiOffset = 48;
                                   tmpSerialEncDataA = Gate3[0].Chan[0].SerialE
                                  ncDataA;
                                   tmpSerialEncDataB = Gate3[0].Chan[0].SerialE
                                  ncDataB;
                                  local calcMotorPos = 0;
                                   calcMotorPos = ( tmpSerialEncDataA & $FF) -
                                  cAsciiOffset
                                   calcMotorPos += (( tmpSerialEncDataA & $FF00
                                  )>>8-cAsciiOffset)*10
                                   calcMotorPos += (( tmpSerialEncDataA & $FF00
                                  00)>>16-cAsciiOffset)*100
                                  calcMotorPos += (( tmpSerialEncDataA & $FF00
                                  0000)>>24-cAsciiOffset)*1000
                                   calcMotorPos += (( tmpSerialEncDataB & $FF) -
                                  cAsciiOffset) *10000
                                  MultiTurnCount = calcMotorPos;
                                   if(((tmpSerialEncDataB & $FF00) >> 8) == 45)
                                  MultiTurnCount *= -1
                                  return;
                                  sub: readInitIncPulse
                                  local tmpInitIncPulse;
                                   tmpInitIncPulse = (Gate3[0].Chan[0].ServoCap
                                  t) >> 8;
                                   InitIncPulse = tmpInitIncPulse;
                                  Motor[1].Pos = MultiTurnCount * EncoderResol
                                  ution + tmpInitIncPulse;
                                  return;
                                  close;
6
    List the program on the right in the Sol-
                                  enable plc 1
    ution Explorer Configuration pp_start-
    up.txt.
```

7	Downloading the project Right click on the Solution Explorer project name at the upper right of the IDE screen, select Build and Download All Programs , and execute Build & Download.	Ime[192.168.0.200:SSH] • # × 0:00 mu 0:00 mu 0:00 mu 0:00 mu 0:00 mu 0:00 mu • # × 0:00 mu 0:00 mu 0:00 mu • # × 0:00 mu • # * 0:00 mu • # * </th
		Paste Ctrl+V Unload Project Open Folder in File Explorer Properties Alt+Enter Solution Explorer Class View
8	Type the save command in the Power PMAC IDE Terminal. When the save is completed, "Save Complete" is displayed in the Terminal.	Terminal: Online [192.168.0.200 : SSH]
9	Type the \$\$\$ command in the Power PMAC IDE Terminal.	Terminal: Online [192.168.0.200 : SSH] # × \$\$\$\$ Resetting PowerPMAC PowerPMAC Reset complete \$\$\$\$\$ \$\$\$\$\$ \$\$\$\$\$ \$\$\$\$\$ \$\$\$\$\$ \$\$\$\$ \$\$\$ \$\$\$
10	Check that the current position is re- flected in the Power PMAC IDE Watch window.	Position: Online[192.168.0.200:… ▼ 井 × #1 78,030.67 mu #2 0.00 mu #3 0.00 mu #4 0.00 mu #5 0.00 mu #6 0.00 mu #7 0.00 mu #8 0.00 mu #9 0.00 mu

3-8-3 Execute Homing

Execute homing. For the homing method, refer to the attached DT manual.

3-9 Operations Check Based on Motion Program

3-9-1 Creation of Operations Check Program

Create a program for the operations check.

The operations check program uses the specific language. For details, refer to *Power PMAC User's Manual (Cat. No. 0014)* and *Power PMAC Software Reference Manual (Cat. No. 0015)*.

1	Creating the Motion Program In the Solution Explorer window, open Project Name — PMAC Script Language — Motion Programs — prog1.pmc.	Position: Online → # × Velocity: Online → # × #1 0.00 mu #1 0.00 mu/mace #2 0.00 mu #3 0.00 mu #3 0.00 mu #3 0.00 mu #4 0.00 mu/mace #4 0.00 mu #5 0.00 mu/mace #5 0.00 mu #6 0.00 mu/mace #7 0.00 mu #7 0.00 mu/mace #7 0.00 mu #8 0.00 mu/mace #7 0.00 mu #7 0.00 mu/mace #6 0.00 mu/mace #8 0.00 mu/mace #7 0.00 mu #8 0.00 mu/mace #6 0.00 mu/mace #8 0.00 mu/mace #6 0.00 mu/mace #9 0.00 mu/mace #7 0.00 mu #9 0.00 mu/mace #6 0.00 mu/mace #9 0.00 mu/mace #7 0.00 mu #10 0.00 mu/mace #6 0.00 mu/mace #0 0.00 mu/mace #6 0.00 mu/mace #10 0.00 mu/mace #6 0.00 mu/mace
2	 In the prog1.pmc tab programming area, write in the program listed on the right. This program example repeatedly rotates the motor in the clockwise direction and stops, and then rotates in the counterclockwise direction and stops. 	<pre>&1; #1->131072X; OPEN PROG 1 INC; TA800; TS300; LINEAR; While (1 < 2) { TA800; TS300; TM3000; X20; DWELL2000; X-20; DWELL2000; }</pre>
3	Creating the PLC Program In the Solution Explorer window, open Project Name — PMAC Script Language — PLC Programs — plc1.plc.	Position: Online Velocity: Online

3

4	In the plc1.plc tab programming area, write in the program listed on the right.	open plc 1
	This program example switches ON	P1000=Svs.Time+1;
	the servo and starts up the motor	while(P1000>Svs.Time){}:
	user program 1 and then ends the	
	execution of the PLC user program	<pre>cmd"&lenable";</pre>
		P1000=Svs.Time+5:
		while $(P1000 > Svs Time)$
		willie (11000/3y3.11me) (),
		<pre>cmd"&lb1r";</pre>
		disable plc 1;
		close
5	User Program Startup Settings	Position: Onli⊷ + # x Velocity: Onli⊷ + # x Following Error⊷ + # x Solution Explorer - # x
		#1 0.00 mu +#1 0.00 mu/msec ##1 0.00 mu G O O O O O F # ▶ #2 0.00 mu #2 0.00 mu Search Solution Explorer (Cl ♪ -
	In the Solution Explorer window, open	#3 0.00 mu #4 0.00 mu/msec #4 0.00 mu ▶ CLAnguage ▲ #4 0.00 mu #4 0.00 mu/msec #4 0.00 mu ▶ CLAnguage ▲
	Project Name — Configuration —	#6 0.00 mu #6 0.00 mu/msco #6 0.00 mu #7 0.00 mu #7 0.00 mu/msco #7 0.00 mu #7 0.00 mu #7 0.00 mu/msco #7
	pp_disable.txt.	#3 Cool mail #5 Cool mail D _ costom savetog #8 0.00 mu #8 0.00 mu
		pp_disable.txt >> x prog1.pmc plc1.plc >> x = = pp_disable.txt == // (//11 = 1) threader //
		8 [™] A //Abra All Programs disable plc 0.31 //Disable all Script PLCs
		clear all buffers
		Solution Exolorer Class View
		Properties - 7 ×
6	In the nn_disable txt tab programming	enable nlc 1.
U	area add in the program listed on the	enable pic 1,
	right	
	• The nn disable tyt is automatically	
	executed when the Controller starts	
	up.	
	In the listed example, execute the	
1	Parameter Settings for Motor Control	illowing Erro… 🔻 🕂 🗙 Solution Explorer 🛛 🔫 🐥 🔍
		0.00 mu 📤 💿 🕤 🍈 - 🗃 🗡 💻
	In the Solution Explorer window, open	0.00 mu Search Solution Explorer (Ct P -
	Project Name — PMAC Script	
	Language — Global Includes —	0.00 mu 🕨 🣴 System
	global definitions.pmh.	0.00 mu 🕨 🎦 C Language
		0.00 mu 👂 🛅 Configuration
		Documentation
		A Cog
		🖌 🕼 Global Includes
		global definitions.
		Carl Kinematic Routines
		Solution Explorer Class View

8	In the global definitions.pmh tab pro-	<pre>Motor[1].FatalFeLimit=0;</pre>
	gramming area, input the setting values	<pre>Motor[1].AbortTa= -0.1;</pre>
	to be set by automatic execution when	<pre>Motor[1].AbortTs= 0;</pre>
	the power is switched ON.	<pre>Motor[1].MaxSpeed= 5000;</pre>
	An example of the settings is shown	<pre>Motor[1].JogTa= -0.1;</pre>
	on the right.	<pre>Motor[1].JogTs= -1;</pre>
		<pre>Motor[1].JogSpeed= 1000;</pre>
		Motor[1].HomeVel= 1000;
		Coord[1].Tm=100;
		Coord[1].FeedTime=60000;
		Coord[1].MaxFeedRate=5000;
		Coord[1].Td=-0.1;
		Coord[1].Ta=-0.1;
		Coord[1].Ts=-1;

3-9-2 Transferring Project Data and Checking the Operation

Transfer the created project data to the Controller.

When you transfer the project, the program automatically starts up, and the motor rotates.

1	Downloading the project Right click on the Solution Explorer project name at the upper right of the IDE screen, select Build and Download All Programs , and execute Build & Download.	sine(192 ක් ලි ි ි ි ි	Euild Rebuild Clean New Solution Explorer View Debug Build and Download All Programs Download All Programs Map PMAC Variables Add Macro Project Cut Paste Unload Project	Ctrl+X Ctrl+V	Solution Explorer
		e 4	Open Folder in File Explorer Properties	Alt+Ent	er
					Solution Explorer Class View
2	 Make sure that there are no errors in the Output Window. If the transfer failed, check the content of the error in the Output Window. If there is a program error, review the program. 	Outpu Show Up Io Up Io Down Tota Tota Bui I I Excep	ut voutput from: Build mading pp_proj.h file from th pading and synchronizing Powe load successful. I Project download time = 5. I Project build and download d Succeeded.	e PowerPMAC rPMAC varia 881 seconds 1 time = 16.	bles 059 seconds.
3	When download is successful, the pro- gram executes.				

4 Confirm that it is operating correctly, Terminal: Online [192.168.0.200 : SSH] • 4 × and then save the project to the Con-* Save Complete troller. • Execute the "save" command from save the Terminal. • Transfer alone will not save the project to the Controller. If the power to the Controller is switched OFF without executing the "save" command, the transferred project is destroyed.

OMRON Corporation Industrial Automation Company

Kyoto, JAPAN

Regional Headquarters

OMRON EUROPE B.V.

Wegalaan 67-69, 2132 JD Hoofddorp The Netherlands Tel: (31) 2356-81-300 Fax: (31) 2356-81-388

OMRON ASIA PACIFIC PTE. LTD. 438B Alexandra Road, #08-01/02 Alexandra Technopark, Singapore 119968 Tel: (65) 6835-3011 Fax: (65) 6835-2711

OMRON ELECTRONICS LLC 2895 Greenspoint Parkway, Suite 200 Hoffman Estates, IL 60169 U.S.A. Tel: (1) 847-843-7900 Fax: (1) 847-843-7787

Contact : www.ia.omron.com

OMRON (CHINA) CO., LTD. Room 2211, Bank of China Tower, 200 Yin Cheng Zhong Road, PuDong New Area, Shanghai, 200120, China Tel: (86) 21-5037-2222 Fax: (86) 21-5037-2200 Authorized Distributor:

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