

Programmable Multi-Axis Controller

Startup Guide for OMRON G5-Series Servo Drive

CK5M-CPU

CK3M-CPU

CK3W-AX

**Startup
Guide**

NOTE

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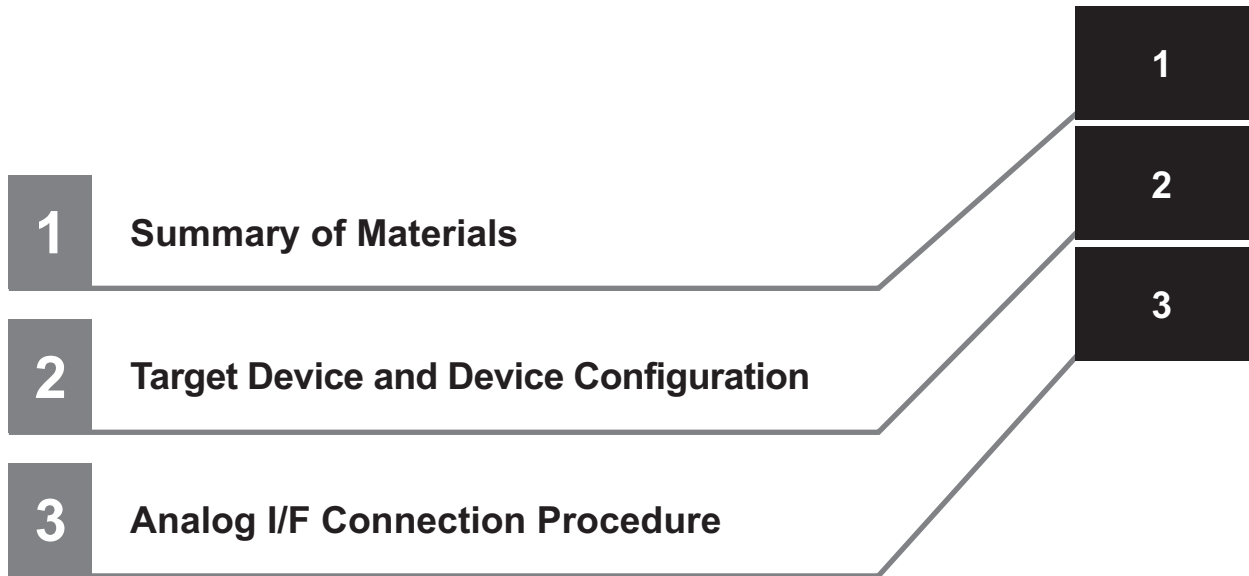
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Precautions

- 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-□ CK3W-□	CK3M/CK5M-series Programmable Multi-Axis Controller User's Manual Hardware
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.

Cat. No.	R193-E1-03
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↑
Revision code

Revision code	Date	Revised content
01	April 2018	Original production
02	July 2018	Corrected mistakes.
03	January 2023	<ul style="list-style-type: none">• Revisions due to the addition of the CK5M-CPU1□1• Correcting mistakes.

1

Summary of Materials

This section lists a summary of these materials.

1-1	Introduction	1-2
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1-1 Introduction

This document describes the procedure and confirmation for operating an OMRON Servo Drive (G5-series Servo Drive, hereinafter called "Servo Drive") with the motion program of the OMRON Programmable Multi-Axis Controller CK□M-□ (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.

2

Target Device and Device Configuration

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

2-1	Target Device	2-2
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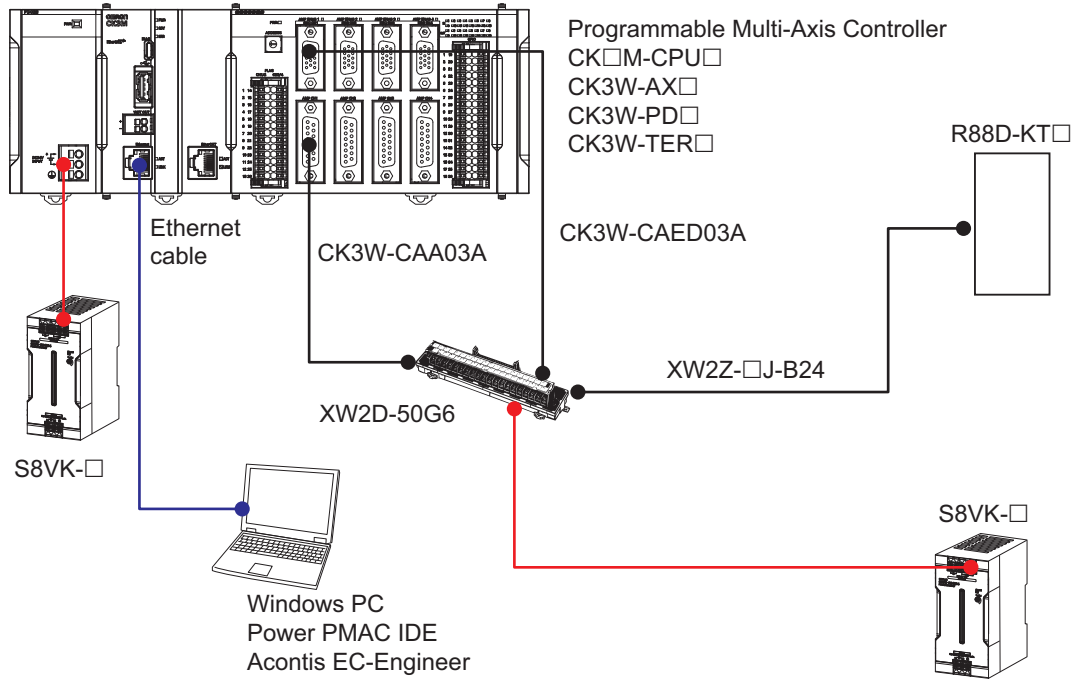
2-1 Target Device

The target equipment for connection is shown below.

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-□
OMRON	AC Servo Drive	R88D-KT□
OMRON	Amplifier Cable	CK3W-CAA03A
OMRON	Encoder Cable	CK3W-CAED03A
OMRON	Connector-Terminal Block Conversion Unit	XW2D-50G6
OMRON	Control Cable	XW2Z-□J-B24

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-□	—
OMRON	AC Servo Drive	R88D-KT□	—
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
OMRON	Servo Drive Setting Tool	CX-Drive	—

3

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 3-5	
▼	
3-3 Various Equipment Wiring on page 3-7	Perform wiring for each piece of equipment.
▼	
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.
▼	
3-7-1 Open Loop Test on page 3-13	
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3-7-5 Creation of Tuning Parameter Project on page 3-18	
▼	
3-8 Absolute Encoder System Home Setting on page 3-19	Perform homing.
▼	
3-8-1 Absolute Encoder Setup on page 3-19	Create a motion program, and perform an operations check.
▼	
3-8-2 Read Absolute Encoder Position on page 3-19	
▼	


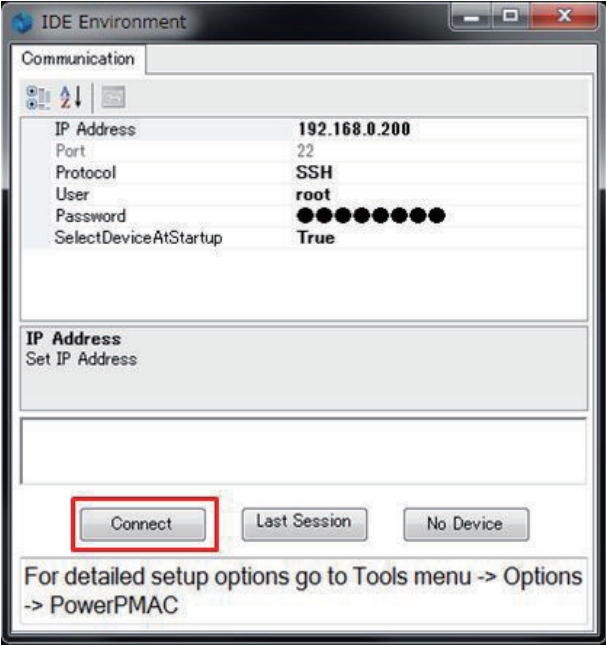
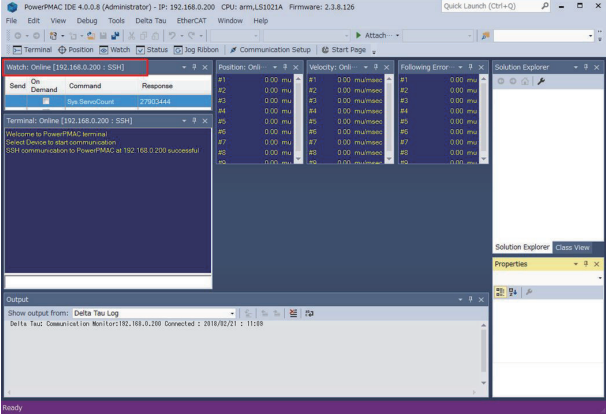
3-8-3 <i>Execute Homing</i> on page 3-22	
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3-2 Controller Setting Preparations.

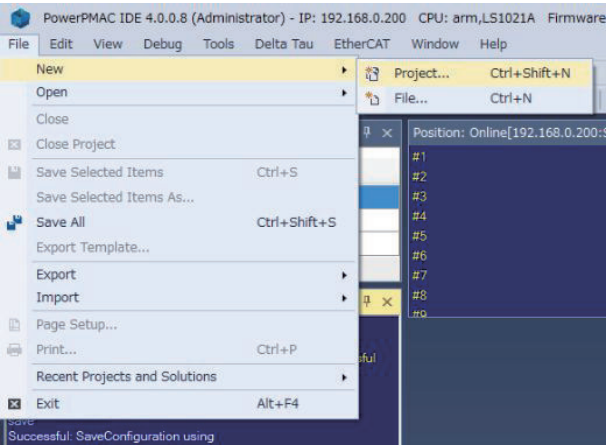
Perform the Controller setting preparations.

Install the Power PMAC IDE on the PC beforehand.

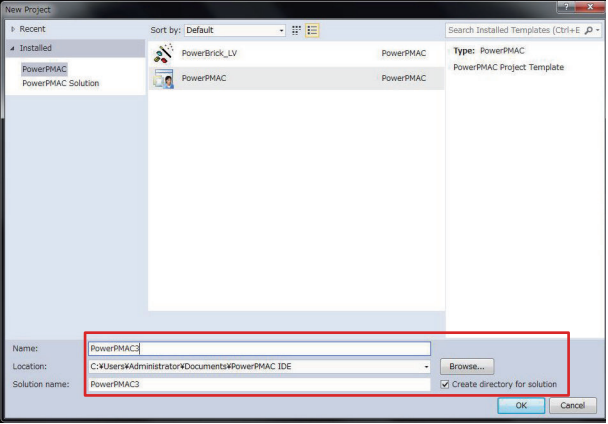
3-2-1 Creation of a New Project

1	Connect the Controller and computer with an Ethernet cable.	
2	Turn ON the power supply to the Controller.	
3	<p>Start up Power PMAC IDE.</p> <ul style="list-style-type: none"> If a dialog for checking access rights is displayed at the time of startup, select the option for starting up. 	
4	<p>The Communication screen is displayed, so specify the IP address of the Controller to be connected to, and click Connect.</p> <ul style="list-style-type: none"> The default IP address for the Controller is 192.168.0.200. If necessary, change the Windows IP address to 192.168.0.X. 	
5	Power PMAC IDE starts up, and the Controller will come online.	

6 From the **File** menu, select **New, Project**.



7 Input the desired project name and the save destination, and select **OK**.



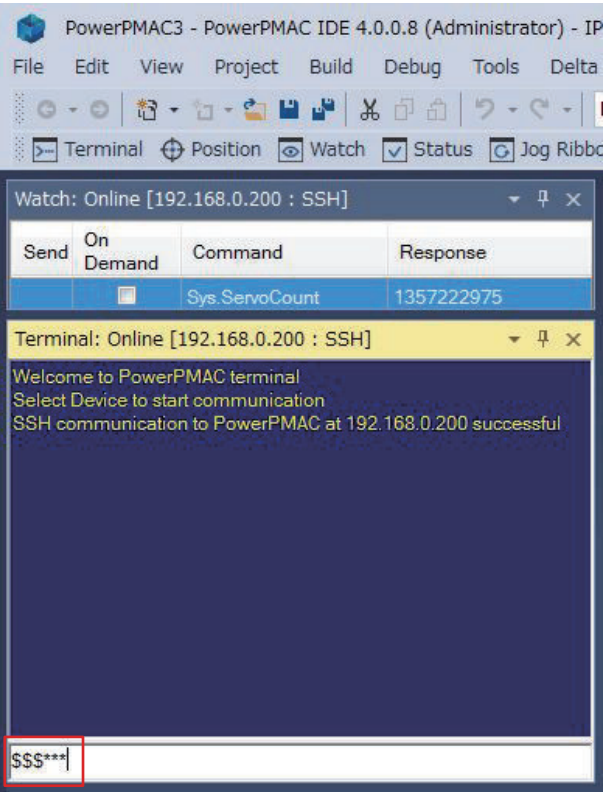
3-2-2 Controller Initial Setting

Perform the initial settings for the Controller.

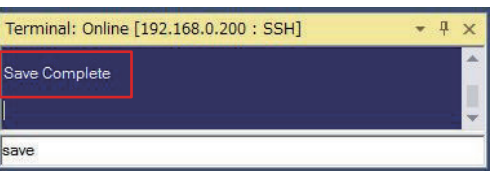
 **Precautions for Correct Use**

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

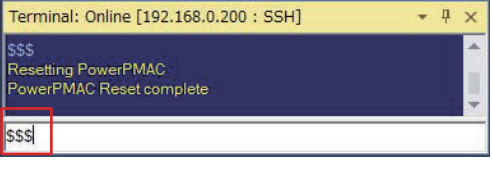
- 1** Type the **\$\$\$**** command from the Terminal, and set the Controller to the factory default state.



The screenshot shows the PowerPMAC IDE interface. A 'Watch' window displays a table with columns 'Send', 'On Demand', 'Command', and 'Response'. The 'Command' column contains 'Sys.ServoCount' and the 'Response' column contains '1357222975'. Below the 'Watch' window is a 'Terminal' window titled 'Terminal: Online [192.168.0.200 : SSH]'. The terminal text reads: 'Welcome to PowerPMAC terminal', 'Select Device to start communication', and 'SSH communication to PowerPMAC at 192.168.0.200 successful'. At the bottom of the terminal window, the command '\$\$\$**' is entered and highlighted with a red box.
- 2** Type the **save** command in the Power PMAC IDE Terminal.
When the save is completed, "Save Complete" is displayed in the Terminal.



The screenshot shows the terminal window with the text 'Save Complete' displayed. Below it, the command 'save' is entered in the terminal input field. A red box highlights the 'Save Complete' text.
- 3** Type the **\$\$\$** command in the Power PMAC IDE Terminal.



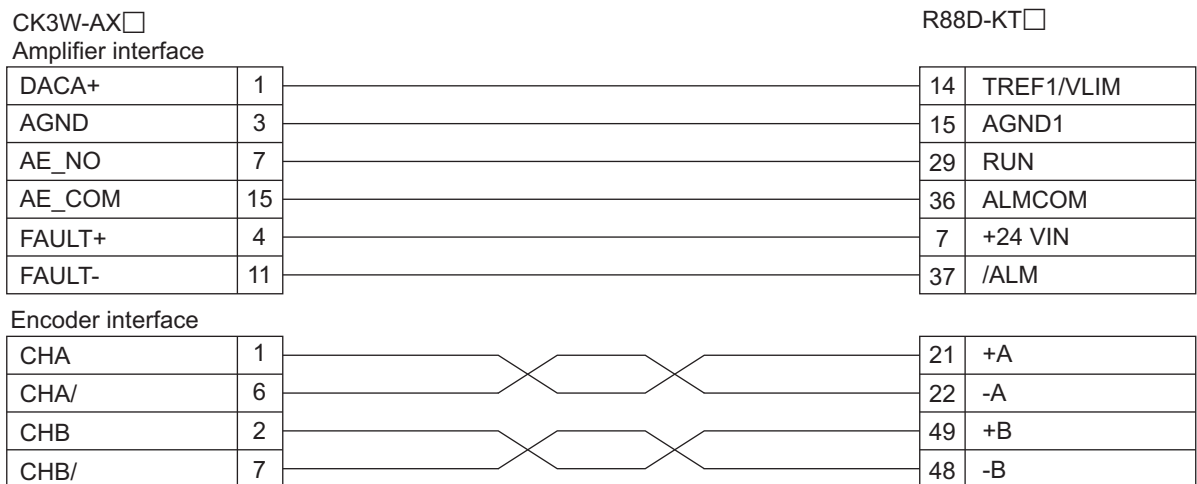
The screenshot shows the terminal window with the text 'Resetting PowerPMAC' and 'PowerPMAC Reset complete' displayed. Below it, the command '\$\$\$' is entered in the terminal input field. A red box highlights the '\$\$\$' text.

3-3 Various Equipment Wiring

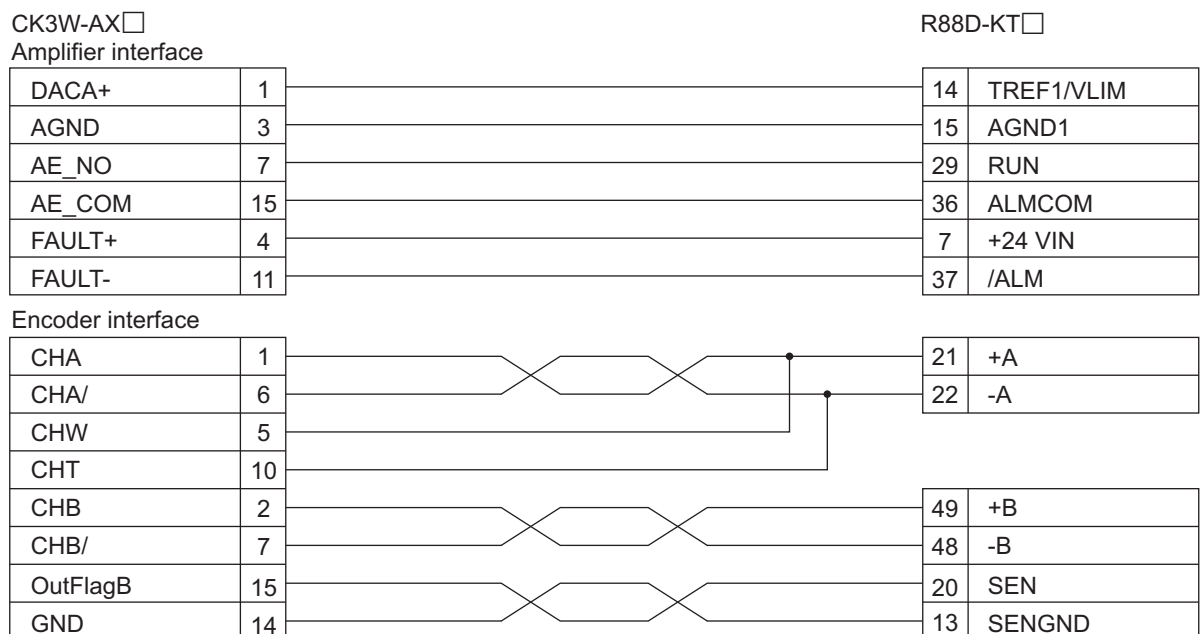
3-3-1 Axial Interface Unit and Driver Wiring

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

If Using an Incremental Encoder



If Using an Absolute Encoder



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

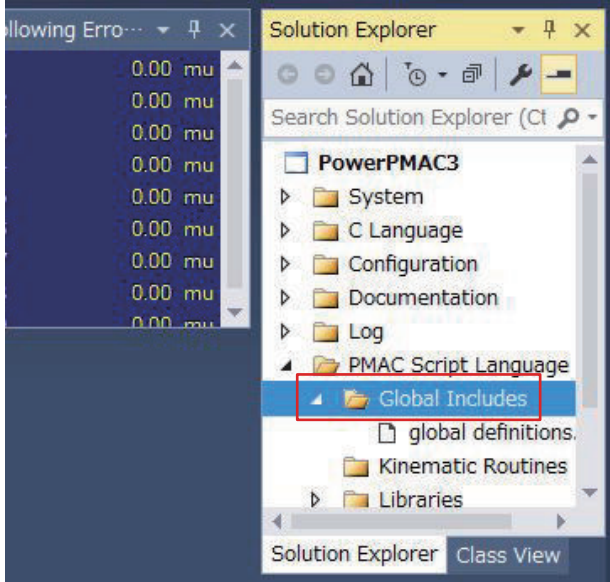
3-3-2 Wiring for Switch Mode Power Supply and Driver

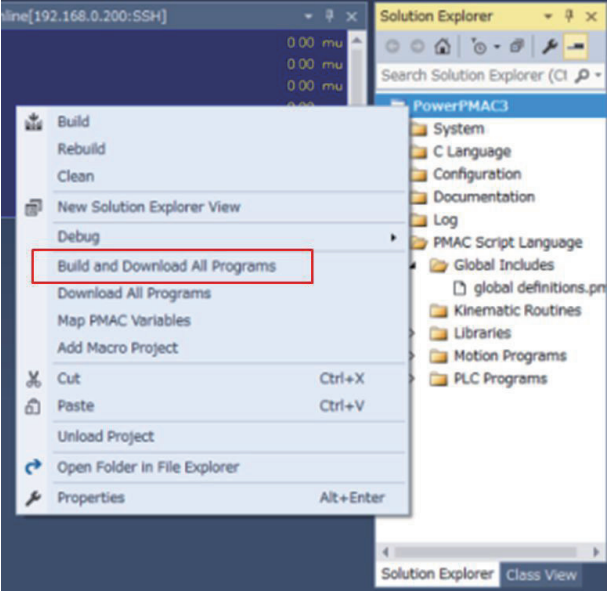
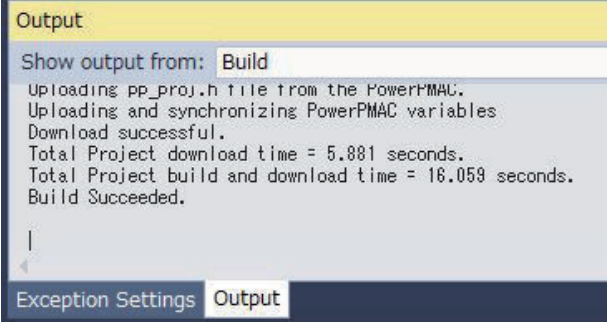
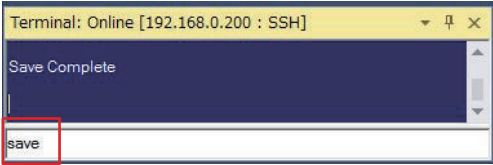
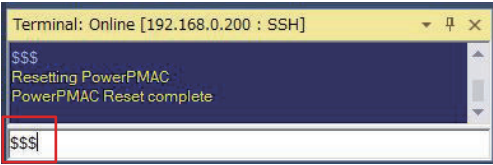
Perform the wiring for the switch mode power supply and the Servo Drive as shown below.

Switch Mode Power Supply	Servo Drive
+24 V	7 : +24 VIN
GND	36 : ALMCOM

3-4 Various Controller Settings

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

1	<p>Open Global Definitions.pmh located under PMAC Script Language-Global Includes in the Solution Explorer.</p>	
2	<p>Write the text on the right to Global Definitions.pmh.</p>	<ul style="list-style-type: none"> • For CK3W-AX1414□ <pre>Sys.WpKey = \$AAAAAAAA Gate3[0].PhaseFreq = 64000 Gate3[0].ServoClockDiv = 3 Gate3[0].Chan[0].PwmFreqMult = 5 Sys.ServoPeriod= 1/16 Sys.PhaseOverServoPeriod = 1/4 Motor[1].ServoCtrl = 1 Gate3[0].Chan[0].OutputMode = 0 Gate3[0].Chan[0].PackOutData = 0 Motor[1].pDac = Gate3[0].Chan[0].Pwm[0].a Motor[1].pLimits = 0 Motor[1].AmpFaultLevel = 1</pre> • For CK3W-AX1515□ <pre>Sys.WpKey = \$AAAAAAAA Gate3[0].PhaseFreq = 64000 Gate3[0].ServoClockDiv = 3 Gate3[0].Chan[0].PwmFreqMult = 5 Sys.ServoPeriod = 1/16 Sys.PhaseOverServoPeriod = 1/4 Motor[1].ServoCtrl = 1 Gate3[0].Chan[0].OutputMode = 7 Gate3[0].Chan[0].PackOutData = 0 Motor[1].pDac = Gate3[0].Chan[0].Dac[0].a Motor[1].pLimits = 0 Motor[1].AmpFaultLevel = 1</pre>

<p>3</p>	<p>If using an absolute encoder, add the settings on the right to the bottom of the Global Definitions.pmh file.</p>	<pre>Gate3[0].EncClockDiv = 3 Gate3[0].SerialEncCtrl = \$82230005 Gate3[0].Chan[0].SerialEncCmd = \$13000 Gate3[0].Chan[0].SerialEncEna = 1 Gate3[0].Chan[0].OutFlagD = 0</pre>
<p>4</p>	<p>Downloading the project</p> <p>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.</p>	
<p>5</p>	<p>Make sure that there are no errors in the Output Window.</p> <ul style="list-style-type: none"> If the transfer failed, check the content of the error in the Output Window. If there is a program error, re-view the program. 	
<p>6</p>	<p>On the Power PMAC IDE Terminal, type the save command. When saving is complete, "Save Complete" is displayed in the Terminal.</p>	
<p>7</p>	<p>On the Power PMAC IDE Terminal, type the \$\$\$ command.</p>	

 **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

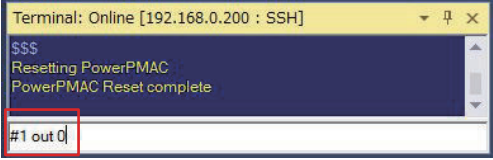
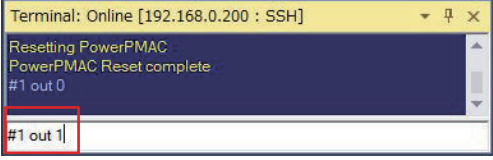
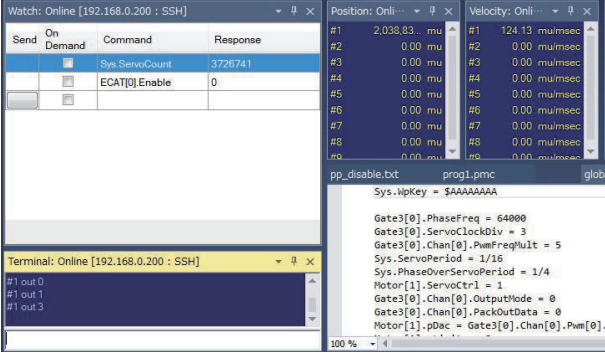
3-5 Various Servo Drive Settings

Use the CX-Drive to perform the R88D-KT□ 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 R88D-KT□ operations method, refer to the attached manual.

No.	Name	After change
Pn001	Control mode selection	2: Torque control (analog command)
Pn319	Torque command scale	10
Pn321	Speed limit value setting	6000

3-6 Checking Operation

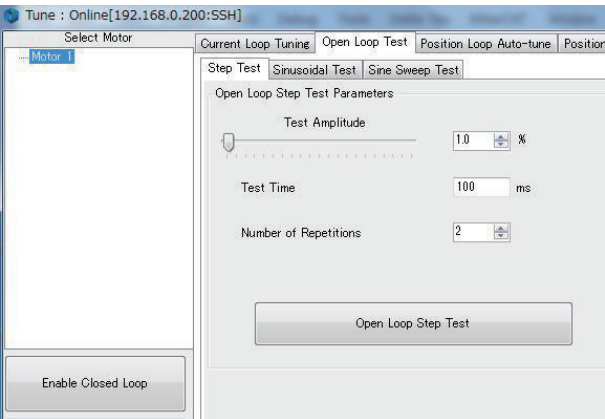
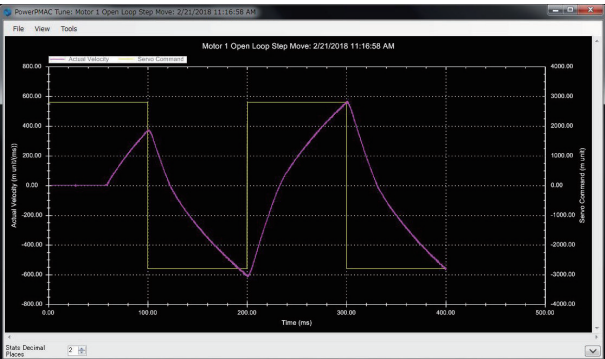
Check whether the settings up to here are correct.

<p>1</p>	<p>Type the #1 out0 command from the Terminal. At this time, check that the motor has the servo ON.</p> <ul style="list-style-type: none"> When using the absolute encoder, type Gate3[0].Chan[0].OutFlagB=1 from the Terminal beforehand. 																																	
<p>2</p>	<p>Type the #1 out1 command from the Terminal.</p>																																	
<p>3</p>	<p>Make sure that the motor is rotating. In addition, check that the Watch window Position value is increasing in the positive direction.</p> <ul style="list-style-type: none"> If the motor does not rotate even after typing the #1 out1 command, input #1 out2, #1 out3, or another large value. 	 <table border="1" data-bbox="786 835 1106 1070"> <thead> <tr> <th>Send</th> <th>On Demand</th> <th>Command</th> <th>Response</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td>Sys.ServoCount</td> <td>3726741</td> </tr> <tr> <td></td> <td></td> <td>ECAT[0].Enable</td> <td>0</td> </tr> </tbody> </table> <table border="1" data-bbox="1114 835 1393 992"> <thead> <tr> <th>Position: Onli...</th> <th>Velocity: Onli...</th> </tr> </thead> <tbody> <tr><td>#1 2,038.83... mu</td><td>#1 124.13 mu/msec</td></tr> <tr><td>#2 0.00 mu</td><td>#2 0.00 mu/msec</td></tr> <tr><td>#3 0.00 mu</td><td>#3 0.00 mu/msec</td></tr> <tr><td>#4 0.00 mu</td><td>#4 0.00 mu/msec</td></tr> <tr><td>#5 0.00 mu</td><td>#5 0.00 mu/msec</td></tr> <tr><td>#6 0.00 mu</td><td>#6 0.00 mu/msec</td></tr> <tr><td>#7 0.00 mu</td><td>#7 0.00 mu/msec</td></tr> <tr><td>#8 0.00 mu</td><td>#8 0.00 mu/msec</td></tr> <tr><td>#9 0.00 mu</td><td>#9 0.00 mu/msec</td></tr> </tbody> </table> <pre data-bbox="786 1081 1106 1178"> Terminal: Online [192.168.0.200 : SSH] #1 out 0 #1 out 1 #1 out 3 </pre>	Send	On Demand	Command	Response			Sys.ServoCount	3726741			ECAT[0].Enable	0	Position: Onli...	Velocity: Onli...	#1 2,038.83... mu	#1 124.13 mu/msec	#2 0.00 mu	#2 0.00 mu/msec	#3 0.00 mu	#3 0.00 mu/msec	#4 0.00 mu	#4 0.00 mu/msec	#5 0.00 mu	#5 0.00 mu/msec	#6 0.00 mu	#6 0.00 mu/msec	#7 0.00 mu	#7 0.00 mu/msec	#8 0.00 mu	#8 0.00 mu/msec	#9 0.00 mu	#9 0.00 mu/msec
Send	On Demand	Command	Response																															
		Sys.ServoCount	3726741																															
		ECAT[0].Enable	0																															
Position: Onli...	Velocity: Onli...																																	
#1 2,038.83... mu	#1 124.13 mu/msec																																	
#2 0.00 mu	#2 0.00 mu/msec																																	
#3 0.00 mu	#3 0.00 mu/msec																																	
#4 0.00 mu	#4 0.00 mu/msec																																	
#5 0.00 mu	#5 0.00 mu/msec																																	
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3-7 Motor Tuning

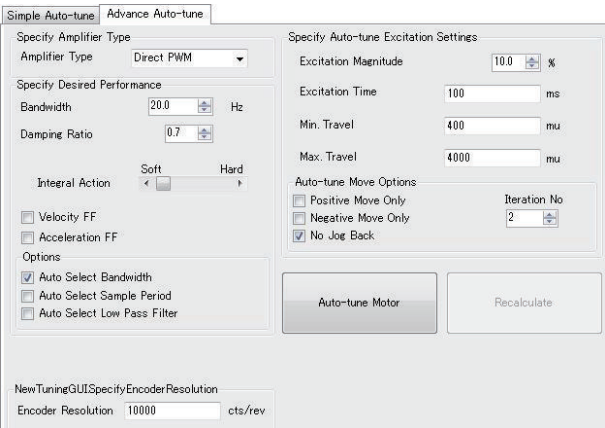
3-7-1 Open Loop Test

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

1	<p>Open the Tune screen on the right from the Delta Tau → Tools menu, and select Open Loop Test → Step Test.</p> <ul style="list-style-type: none"> When using the absolute encoder, input Gate3[0].Chan[0].OutFlagB=1 from the Terminal before implementing tuning. 	
2	<p>Set the tuning parameters on the right.</p>	<p>Test Amplitude: 1.0% (If the motor is not rotating, set a large value.) Test Time: 100ms Number Of Repetition: 2</p>
3	<p>Click Open Loop Step Test, and check that the motor is performing reciprocating operation.</p>	

3-7-2 Bandwidth Automatic Setting

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

1	<p>Select Position Loop Auto Tune → Advance Auto-tune.</p>	
----------	--	--


2	<p>Set the tuning parameters on the right.</p> <ul style="list-style-type: none"> Encoder Resolution is determined by the resolution of the servomotor encoder being used, and by the electronic gear ratio of the Servo Drive. Set the value for the output pulse number per one motor rotation. 	<p>Amplifier Type: Torque Mode Auto Select Bandwidth: Check Encoder Resolution: 10000 Excitation Magnitude: 1% (Select the value rotated in the open loop.) Iteration No.: 2</p>																																
3	<p>Click Auto-tune Motor.</p>																																	
4	<p>If the message on the right appears, click Yes.</p>																																	
5	<p>If the screen on the right appears, click Implement.</p>	<table border="1"> <thead> <tr> <th></th> <th>Current Gains</th> <th>Previous Gains</th> <th>Recommended Gains</th> </tr> </thead> <tbody> <tr> <td>Proportional (Kp)</td> <td>4</td> <td>4</td> <td>0.56379949970272</td> </tr> <tr> <td>Derivative (Kvfb)</td> <td>40</td> <td>40</td> <td>291.301670468814</td> </tr> <tr> <td>Integral (Ki)</td> <td>9.9999997e-05</td> <td>9.9999997e-05</td> <td>0</td> </tr> <tr> <td>Velocity feedforward (Kvff)</td> <td>40</td> <td>40</td> <td>0</td> </tr> <tr> <td>Acceleration feedforward (Kaff)</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Derivative Gain 2 (Kvfb2)</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Velocity feedforward into integrator (Kviff)</td> <td>0</td> <td>0</td> <td>0</td> </tr> </tbody> </table>		Current Gains	Previous Gains	Recommended Gains	Proportional (Kp)	4	4	0.56379949970272	Derivative (Kvfb)	40	40	291.301670468814	Integral (Ki)	9.9999997e-05	9.9999997e-05	0	Velocity feedforward (Kvff)	40	40	0	Acceleration feedforward (Kaff)	0	0	0	Derivative Gain 2 (Kvfb2)	0	0	0	Velocity feedforward into integrator (Kviff)	0	0	0
	Current Gains	Previous Gains	Recommended Gains																															
Proportional (Kp)	4	4	0.56379949970272																															
Derivative (Kvfb)	40	40	291.301670468814																															
Integral (Ki)	9.9999997e-05	9.9999997e-05	0																															
Velocity feedforward (Kvff)	40	40	0																															
Acceleration feedforward (Kaff)	0	0	0																															
Derivative Gain 2 (Kvfb2)	0	0	0																															
Velocity feedforward into integrator (Kviff)	0	0	0																															

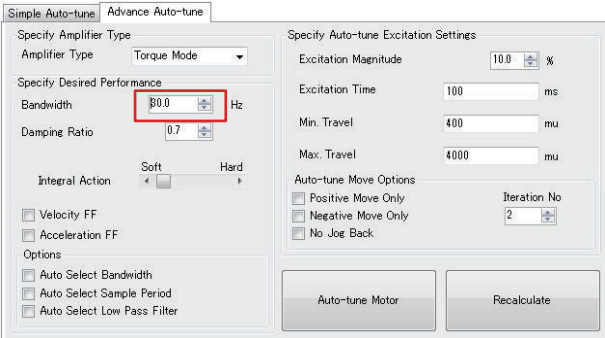
3-7-3 Manual Correction of Bandwidth

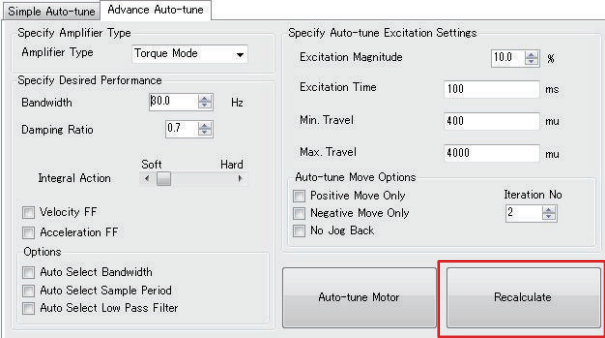
While monitoring the stepwise response, select the most suitable bandwidth.

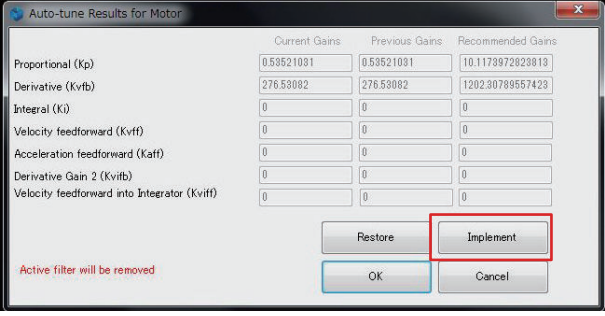
1	<p>Select Position Loop Interactive Tuning.</p>	
----------	--	--

- 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.


- 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.

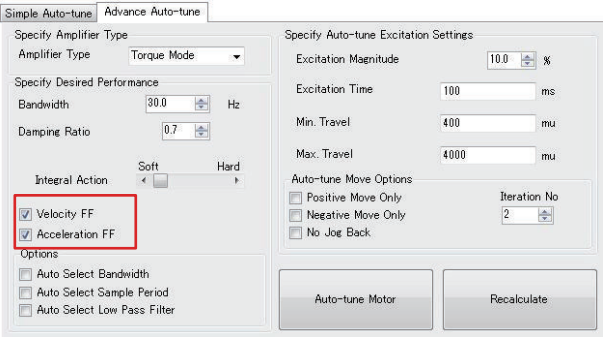

- 5** Click **Recalculate**.

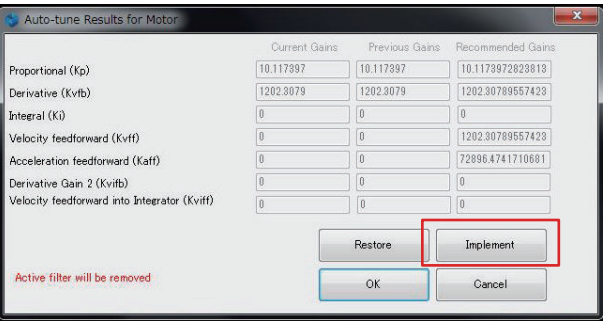

- 6** If the screen on the right appears, click **Implement**.

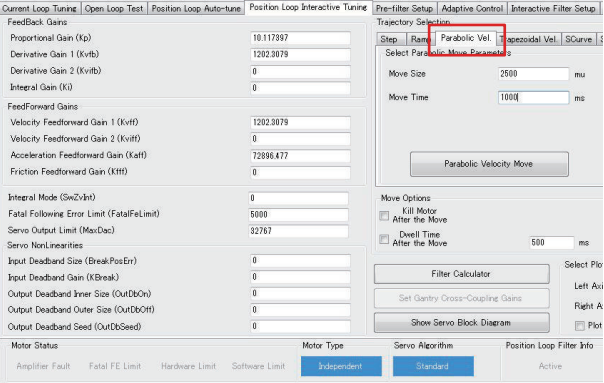

- 7** Return to Step 1. Repeat until the desired responsiveness is obtained.

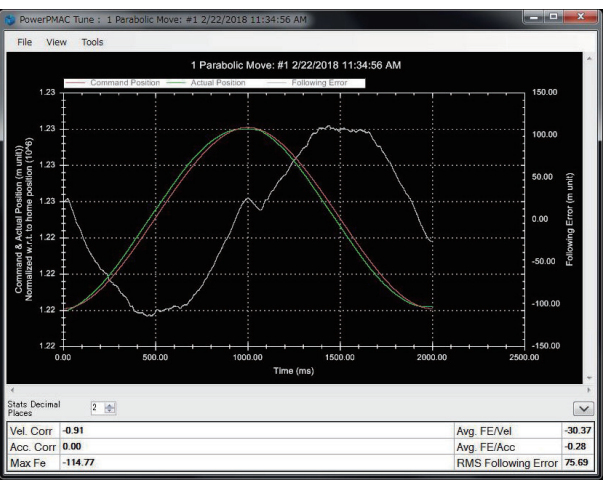
3-7-4 Feed-Forward Value Setting

- 1** Select **Position Loop Auto Tune** → **Advance Auto-tune**, and insert checks into **Velocity FF** and **Acceleration FF**.

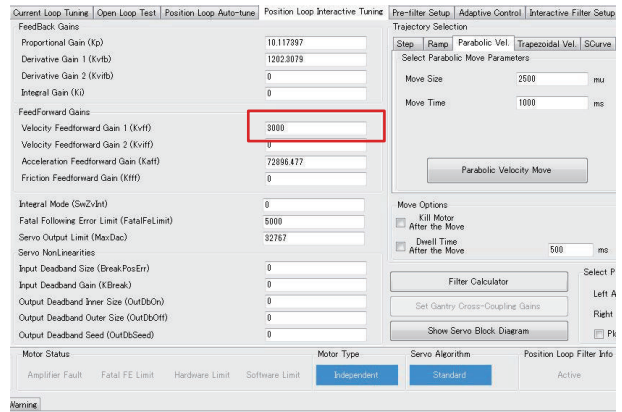

- 2** Click **Recalculate**, and click **Implement** in the pop-up window.


- 3** Select **Parabolic Vel..** Use the same value for Move Size and Move Time.

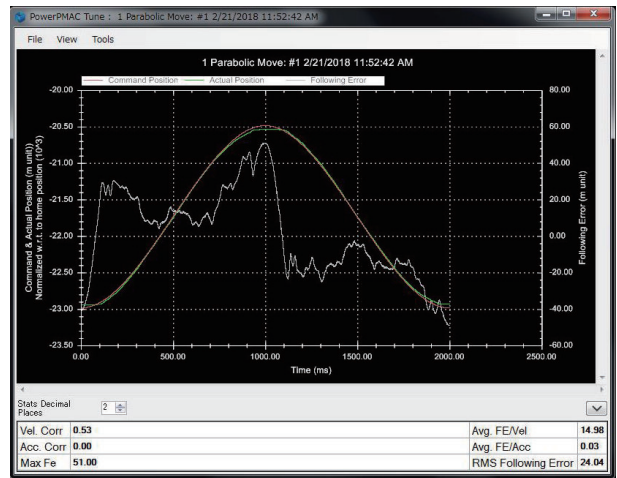

- 4** Click **Parabolic Velocity Move**.



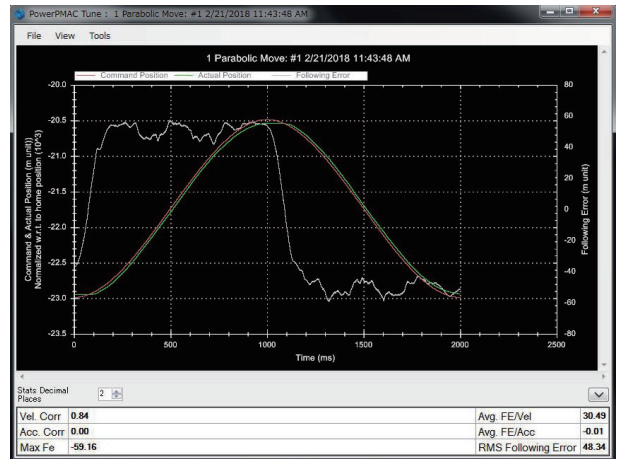
5 If the Following Error has a positive correlation to the speed, make Kvff larger. If it has a reverse correlation, make Kvff smaller.



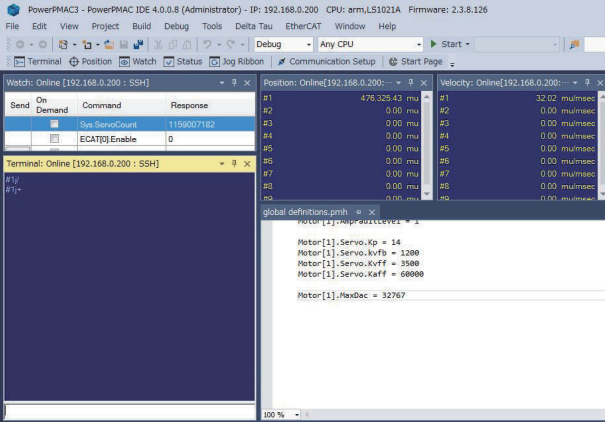
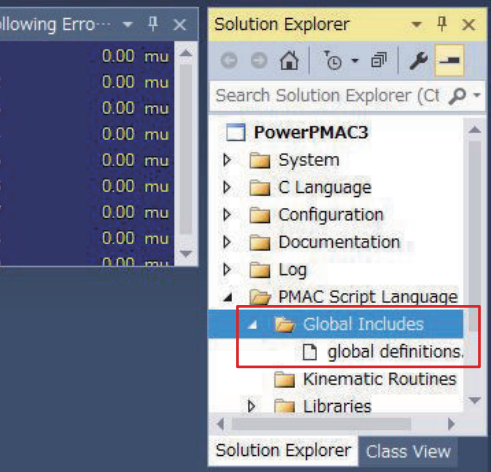
6 Click **Parabolic Velocity Move** again. Repeat this until the correlation of Following Error to the speed disappears.



7 In the same way, if Following Error has a correlation to acceleration, friction, etc., increase or decrease the Kaff and Kfff values. The figure on the right is an example of a correlation to friction.



3-7-5 Creation of Tuning Parameter Project

<p>1</p>	<p>Type the #1 j+ command from the Terminal.</p>	
<p>2</p>	<p>Make sure that the motor is rotating. In addition, confirm that the Watch window Velocity value is around +32.</p>	
<p>3</p>	<p>Open Global Definitions.pmh under PMAC Script Language — Global Includes in the Solution Explorer.</p>	
<p>4</p>	<p>Add the values obtained from tuning to the Global Definitions.pmh.</p>	<pre> Motor[1].Servo.Kaff = *** Motor[1].Servo.Kvff = *** Motor[1].Servo.Kp = *** Motor[1].Servo.Kvfb = *** Motor[1].MaxDac = 32767 </pre>

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

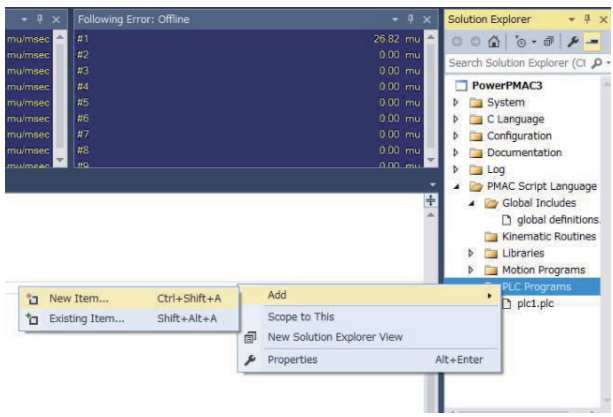
When using the absolute encoder for the first time, when wanting to initialize the rotation amount data to 0, or when the absolute encoder has been left standing for a long period without connecting to a battery, etc., the absolute encoder setup is necessary. For details of the setup method, refer to the manual attached to the OMRON G5-series Servo Drive.

3-8-2 Read Absolute Encoder Position

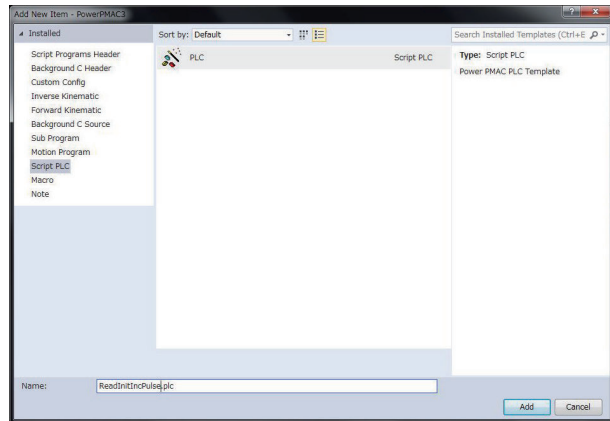
Read the absolute encoder position from the Servo Drive.

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.

1	List the program on the right in the Solution Explorer in PMAC Script Language — Libraries subprog1.pmc.	<pre>open subprog timer(delay_time) local EndTime; endtime = Sys.Time + delay_time; while (endtime > Sys.Time){}; close</pre>
2	Add the code to the right to Global Definitions.pmh.	<pre>Sys.Wpkey = \$AAAAAAAA Gate3[0].SerialEncCtrl = \$82230005 Gate3[0].Chan[0].SerialEncEna = 1</pre>
3	Right click on the Solution Explorer PMAC Script Language — PLC Programs , and select Add → New Item...	

4 Select **Script PLC**, set Name to **ReadInitIncPulse.plc**, and then select **Add**.



5 List the program on the right in the Solution Explorer **PMAC Script Language** — **PLC Programs** **ReadInitIncPulse.plc**.

- The value shown below is determined by the resolution of the servo-motor encoder being used, and by the electronic gear ratio of the Servo Drive. Set the value for the output pulse number per one motor rotation.

Global EncoderResolution = **

```
Global MultiTurnCount, InitIncPulse;
Global EncoderResolution = 10000;

open plc 1

callsub sub.motorInitialize;
call timer(0.2);
callsub sub.requestMultiTurnData;
call timer(0.25);
callsub sub.readMultiTurnCount;
call timer(1.0);
callsub sub.readInitIncPulse;
Motor[1].HomePos = -Motor[1].HomeOffset

disable plc 1;
return;

////////////////////////////////////
sub: motorInitialize

homez 1;
kill 1;
Gate3[0].Chan[0].OutFlagB = 0;
Gate3[0].Chan[0].CountReset = 1;

return;
////////////////////////////////////
sub: requestMultiTurnData

Gate3[0].Chan[0].SerialEncCmd=$13000
Gate3[0].Chan[0].OutFlagB = 1

return;
```

```

////////////////////////////////////
sub: readMultiTurnCount

    local tmpSerialEncDataA, tmpSerialEncDataB;
    local cAsciiOffset = 48;
    tmpSerialEncDataA = Gate3[0].Chan[0].SerialEncDataA;
    tmpSerialEncDataB = Gate3[0].Chan[0].SerialEncDataB;

    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

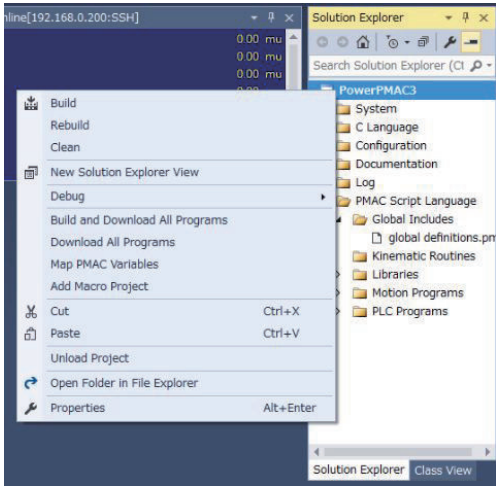
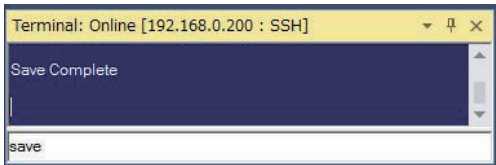
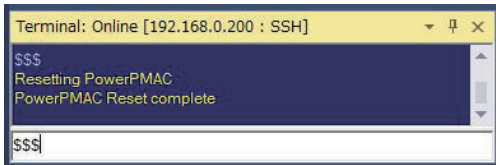
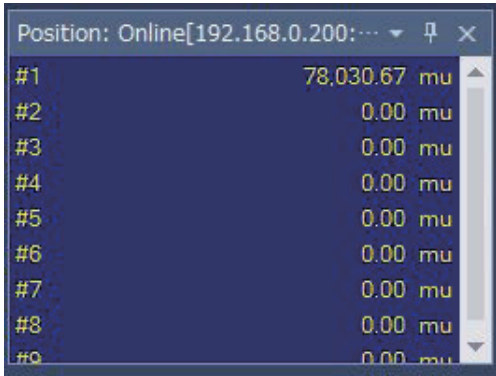
    local tmpInitIncPulse;
    tmpInitIncPulse = (Gate3[0].Chan[0].ServoCap
t) >> 8;
    InitIncPulse = tmpInitIncPulse;
    Motor[1].Pos = MultiTurnCount * EncoderResol
ution + tmpInitIncPulse;

return;
////////////////////////////////////

close;
enable plc 1

```

- 6** List the program on the right in the Solution Explorer **Configuration** pp_start-up.txt.

<p>7</p>	<p>Downloading the project</p> <p>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.</p>	
<p>8</p>	<p>Type the save command in the Power PMAC IDE Terminal.</p> <p>When the save is completed, "Save Complete" is displayed in the Terminal.</p>	
<p>9</p>	<p>Type the \$\$\$ command in the Power PMAC IDE Terminal.</p>	
<p>10</p>	<p>Check that the current position is reflected in the Power PMAC IDE Watch window.</p>	

3-8-3 Execute Homing

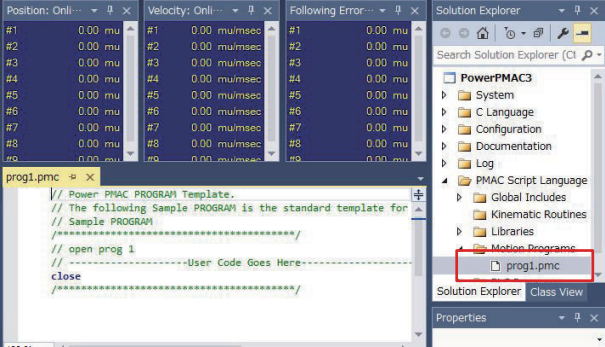
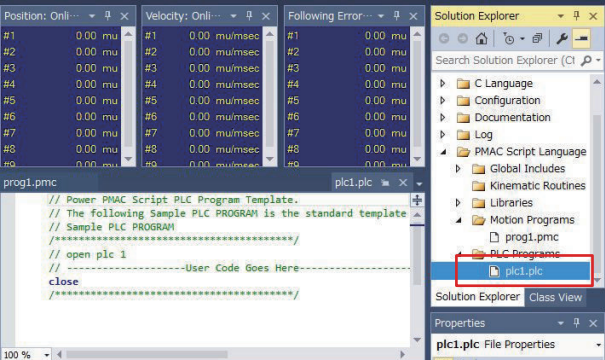
Execute homing. For the homing method, refer to the attached DT manual.

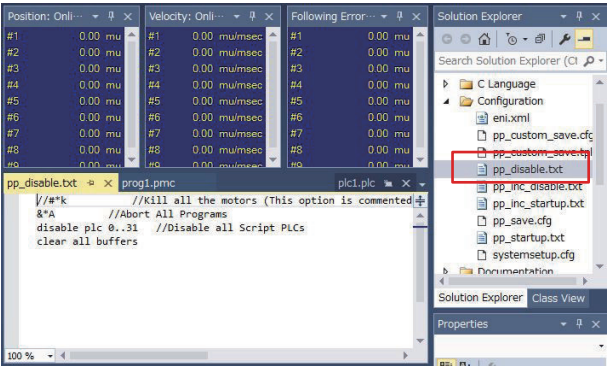
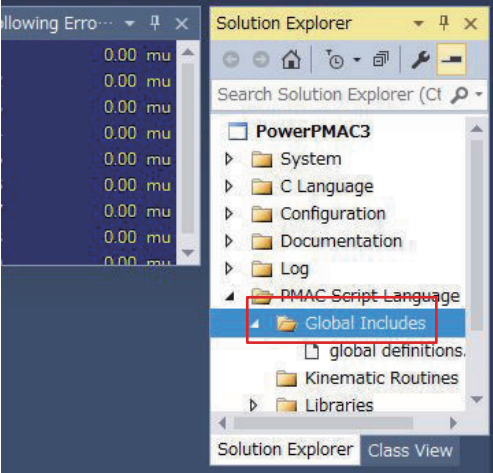
3-9 Operations Check Based on Motion Program

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. O014)* and *Power PMAC Software Reference Manual (Cat. No. O015)*.

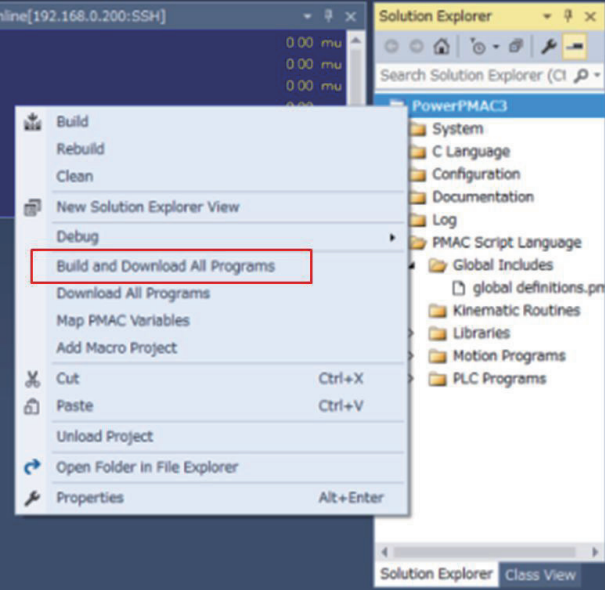
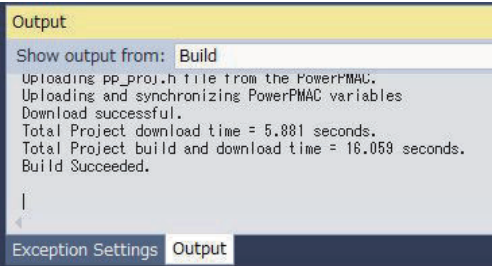
<p>1 Creating the Motion Program</p> <p>In the Solution Explorer window, open Project Name — PMAC Script Language — Motion Programs — prog1.pmc.</p>	
<p>2 In the prog1.pmc tab programming area, write in the program listed on the right.</p> <ul style="list-style-type: none"> This program example repeatedly 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; } CLOSE</pre>
<p>3 Creating the PLC Program</p> <p>In the Solution Explorer window, open Project Name — PMAC Script Language — PLC Programs — plc1.plc.</p>	

<p>4</p>	<p>In the plc1.plc tab programming area, write in the program listed on the right.</p> <ul style="list-style-type: none"> This program example switches ON the servo, and starts up the motor user program 1, and then ends the execution of the PLC user program cycle. 	<pre>open plc 1 P1000=Sys.Time+1; while (P1000>Sys.Time) {}; cmd"&lenable"; P1000=Sys.Time+5; while (P1000>Sys.Time) {}; cmd"&lblr"; disable plc 1; close</pre>
<p>5</p>	<p>User Program Startup Settings</p> <p>In the Solution Explorer window, open Project Name — Configuration — pp_disable.txt.</p>	
<p>6</p>	<p>In the pp_disable.txt tab programming area, add in the program listed on the right.</p> <ul style="list-style-type: none"> The pp_disable.txt is automatically executed when the Controller starts up. In the listed example, execute the PLC1 script. 	<pre>enable plc 1;</pre>
<p>7</p>	<p>Parameter Settings for Motor Control</p> <p>In the Solution Explorer window, open Project Name — PMAC Script Language — Global Includes — global definitions.pmh.</p>	

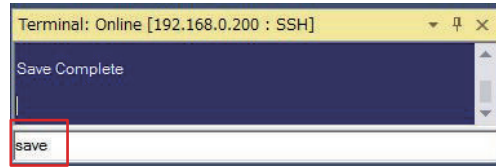
8	<p>In the global definitions.pmh tab programming area, input the setting values to be set by automatic execution when the power is switched ON.</p> <ul style="list-style-type: none"> An example of the settings is shown on the right. 	<pre> Motor[1].FatalFeLimit=0; Motor[1].AbortTa= -0.1; Motor[1].AbortTs= 0; Motor[1].MaxSpeed= 5000; Motor[1].JogTa= -0.1; Motor[1].JogTs= -1; Motor[1].JogSpeed= 1000; 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; </pre>
---	--	--

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	<p>Downloading the project</p> <p>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.</p>	
2	<p>Make sure that there are no errors in the Output Window.</p> <ul style="list-style-type: none"> If the transfer failed, check the content of the error in the Output Window. If there is a program error, review the program. 	
3	<p>When download is successful, the program executes.</p>	

- 4** Confirm that it is operating correctly, and then save the project to the Controller.
- Execute the "save" command from 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.



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