Panasonic®

Servo Drives

Quick Start Guide
MINAS A6 Multi

Position control with TRIO host controller over EtherCAT

QS10006_V1.0_EN

2020.11 | https://industry.panasonic.eu

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Table of contents

1 Introduction

1.1 Before you start

Before operating this product, read the safety instructions in the following manuals:

- “SX-DSV03514, MINAS A6 Multi, Technical Reference – Integrated Safety Part”
- “SX-DSV03508, MINAS A6 Multi, Programming Manual – PANATERM for Safety”

This product is for industrial use only.

Electrical connections must be made by qualified electrical personnel.

1.2 About this document

This “Quick Start Guide” is intended to help you set up a MINAS A6 Multi servo drive system. It is based on information from the MINAS A6 Multi series manuals and the practical experience of our engineers.

Step-by-step instructions will guide you through connecting a TRIO MC6N-ECAT host controller to a MINAS A6 Multi servo drive system. You will also learn how to program a simple positioning task in TRIO's Motion Perfect software. Communication is achieved using EtherCAT.

In these instructions we assume that you are using a Windows 10 operating system.

Please refer to the original documentation of our servo drive systems for detailed information. It is available free of charge in our Panasonic Download Center.

1.3 Related documents

Select the following links to download the documents from our Panasonic Download Center.

- Safety specifications:
  “SX-DSV03514, MINAS A6 Multi, Technical Reference – Integrated Safety Part”
- Information on wiring the MINAS A6 Multi servo drive system:
  “SX-DSV03454, MINAS A6 Multi, Reference Specifications – Driver Module”
- Information on wiring the MINAS A6 Multi power supply module:
  “SX-DSV03452, MINAS A6 Multi, Reference Specifications – Power Supply Module”
- Information on EtherCAT communication:
  “SX-DSV03456, MINAS A6 Multi, Technical Reference – EtherCAT Communication Specification”

- Description of the servo driver functions:
  “SX-DSV03455, MINAS A6 Multi, Technical Reference – Functional Specification”
- Information on safety programming:
  “SX-DSV03508, MINAS A6 Multi, Programming Manual – PANATERM for Safety”
- Information on how to reduce electromagnetic interference (EMI):
  “Recommendations for EMC-compliant wiring of servo drivers and motors”
- Related Quick Start Guides:
  “QS10000, MINAS A6 Multi, Position control with Beckhoff host controller over EtherCAT”
  “QS10001, MINAS A6 Multi, Ethernet over EtherCAT with PANATERM”
  “QS10002, MINAS A6 Multi, Safe Torque Off (STO)”
  “QS10003, MINAS A6 Multi, Safe Stop 1 (SS1)”
  “QS10004, MINAS A6 Multi, Safe Speed Monitoring (SSM)”
  “QS10005, MINAS A6 Multi, Position control with Omron host controller over EtherCAT”

1.4 Available software

The following software is available free of charge in our Panasonic Download Center:

- PC configuration software PANATERM for MINAS A6 Multi, 32 bit, or PC configuration software PANATERM for MINAS A6 Multi, 64 bit
- Panasonic ESI file

The following software can be downloaded from TRIO’s Web site (https://www.triomotion.com):

- Motion Perfect software

2 Functional overview

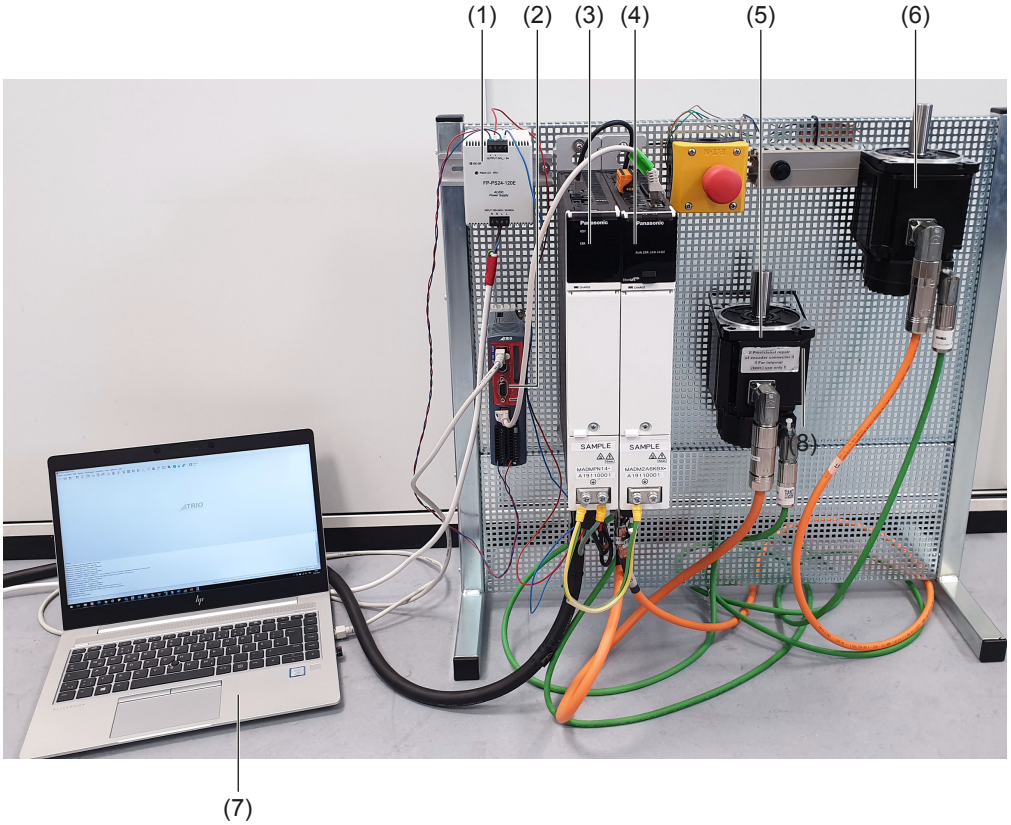
A Panasonic MINAS A6 Multi servo drive system includes a power supply module, one or more 400V driver modules, and one or two motors connected to each driver module. Communication can be achieved through EtherCAT with any host controller that supports the CAN application protocol over EtherCAT (CoE).

Example

A servo drive system, consisting of a 15kW power supply module, an A-size 1.5kW two-axis driver module, and two servo motors with a rated power of 1.0kW and 1.5kW, is connected to a TRIO MC6N-ECAT host controller by an Ethernet cable to communicate via EtherCAT.

Use the following accessories:

- 1 x 400V AC power supply cable
  Connects the MINAS A6 Multi power supply module to the main power supply (400V AC).
- 1 x 24V DC power supply cable
  Connects the power supply unit (24V DC) and the host controller.
- 1 x grounding wire (M4 round terminal)
  Connects the PE terminals of the power supply module and the driver module.
- 2 x Panasonic motor cable
  Connects the motor and the driver module.
- 2 x Panasonic encoder cable
  Connects the encoder and the driver module.
- 1 x Ethernet cable
  Connects the PC and the host controller.
- 1 x Ethernet cable (used for EtherCAT communication)
  Connects the host controller and the driver module.
- 1 x RJ11 communication cable (2 x RJ11 plug)
  Connects the power supply module and the driver module.
- 1 x feed bus bar (50mm) with end cap for the DC link bus (535V DC to 675V DC)
  Connects the power supply module and the driver module.
- 1 x feed bus bar (50mm) with end cap for the control bus (24V DC)
  Connects the power supply module and the driver module.



(1) Power supply unit (24V DC)
(2) TRIO MC6N-ECAT host controller
(3) MINAS A6 Multi power supply module (400V AC, 15kW)
(4) Two-axis MINAS A6 Multi driver module (1.5kW)
(5) MINAS A6 servo motor B (1.5kW)
(6) MINAS A6 servo motor A (1kW)
(7) PC with Motion Perfect

Set-up of a MINAS A6 Multi servo drive system - Position control with TRIO MC6N-ECAT host controller and EtherCAT

3 Wiring

3.1 Recommendations for wiring

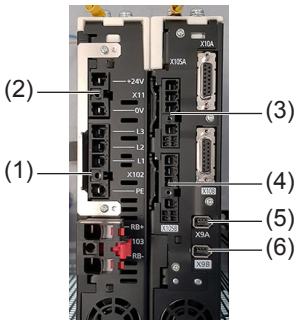
It is the customer's responsibility to apply the countermeasures that they consider necessary to comply with current regulations on wiring, safety and reducing EMI.

Do not forget to meet the specifications indicated in the hardware manual for each of the devices being wired. If any specifications in the manual conflict with the information in this document, the manufacturer's manual takes preference.

For detailed information on reducing EMI, please refer to “Recommendations for EMC-compliant wiring of servo drivers and motors”.

3.2 Bottom side connectors of the servo drive system

The image shows the most important connectors of a power supply module (left) and a driver module (right). Please refer to the technical documentation for details about other connectors.

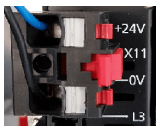


(1) X102: Main power supply (400V AC)
(2) X11: Control power supply (24V DC)
(3) X105A: Motor A
(4) X105B: Motor B
(5) X9A: Encoder A
(6) X9B: Encoder B

Bottom view of power supply module (left) and driver module (right)

X11 connector (control power supply)

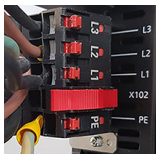
Connect the 24V DC control power supply to X11.



Wiring of the X11 connector

X102 connector (main power supply)

Connect the 400V AC main power supply cable to X102.



Wiring of the X102 connector

X105A and X105B connectors (motor connectors)

Connect the motor cable for servo motor A to X105A and the motor cable for servo motor B to X105B.

Wiring of the X105A and X105B connectors

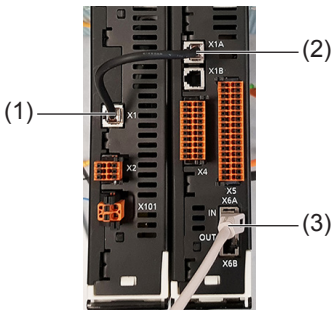
X9A and X9B connectors (encoder connectors)

Connect the cable of encoder A to X9A and the cable of encoder B to X9B.

Wiring of the X9A and X9B connectors

3.3 Top side connectors of the servo drive system

The image shows the most important connectors of a power supply module (left) and a driver module (right). Please refer to the technical documentation for details about other connectors.



(1) X1: Internal communication connector on power supply module
(2) X1A: Internal communication connector on driver module
(3) X6A: EtherCAT communication connector on driver module

Top view of power supply module (left) and driver module (right)

X1, X1A connectors (internal communication connectors)

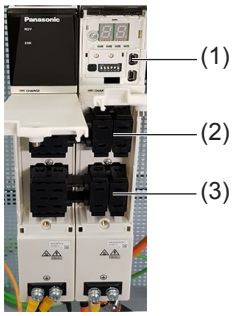
Connect X1 and X1A with the RJ11 communication cable.

X6A connector (EtherCAT connector)

Connect an Ethernet cable between the EtherCAT connector of the host controller and X6A of the driver module.

3.4 Front side connectors of the servo drive system

The image shows the most important connectors of a power supply module (left) and a driver module (right). Please refer to the technical documentation for details about other connectors.

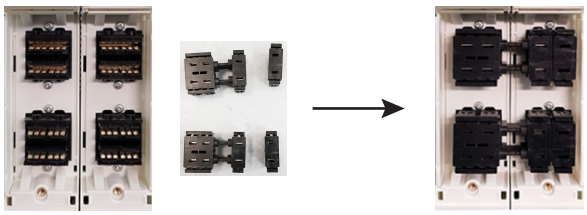


(1) X7: USB connector (for driver configuration) on driver module
(2) X104: DC link bus connectors on power supply module and driver module (535V DC to 675V DC)
(3) X12: Control bus (24V DC) connectors on power supply module and driver module

Front view of power supply module (left) and driver module (right) with bus bars

X104 and X12 connectors (DC bus)

Attach the bus bars to X104 and X12 to connect the DC circuits of the power supply module and the driver module.



Connectors for DC circuits with and without bus bars

X7 connector (for driver configuration)

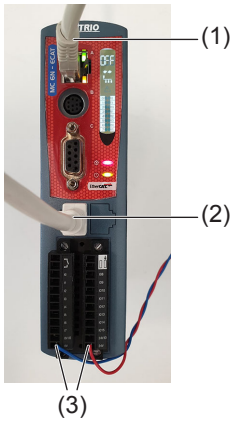
The driver module is configured using the PC configuration software PANATERM. Use a commercially available USB A to mini-B cable to connect the PC to the driver module.

(1) X7: USB connector on driver module

Connector X7 for PC connection

3.5 Connectors of the TRIO MC6N-ECAT host controller

The image shows the front view of the host controller.



(1) Programming port
(2) EtherCAT port
(3) 24V power supply

Front view of TRIO MC6N-ECAT host controller

Programming port

Connect an Ethernet cable between this connector and the Ethernet port of your PC.

EtherCAT port

Connect an Ethernet cable between this connector and the X6A connector of the MINAS A6 Multi driver module.

24V power supply

Connect this connector to 24V DC.

4 Create a Motion Perfect project

4.1 Install Motion Perfect on your PC

The servo drive system is controlled with TRIO's Motion Perfect software. Install this software and the Panasonic ESI file on your PC.

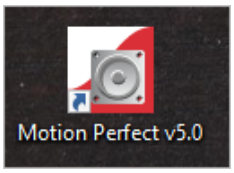
1. Download the Motion Perfect software from TRIO’s website and execute the installation file.
2. Download the Panasonic ESI file (`Panasonic_MINAS_A6Multi_V*.xml`).
3. Start Motion Perfect.

The download links can be found under Available software (page 5).

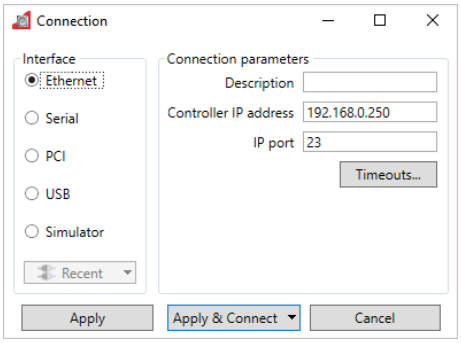
4.2 Create a new project in Motion Perfect

You must set the IP address for the Ethernet connection between your PC and the host controller. The default IP address of the host controller is 192.168.0.250. The IP address of your PC must be in the same IP range. In this example we use the IP address 192.168.0.10.

1. Set the IP address in your PC.
   In Windows, go to “Network Connections” > “Change adapter options”. Select “Ethernet” > “Properties”. On the “Network” tab, select “Internet protocol, Version 4 (TCP/IPv4)” > “Properties”. Select “Use the following IP address” and set the IP address.
   Example:
   IP address: 192.168.0.10
   Subnet mask: 255.255.255.0
   (settings for default gateway and preferred DNS server not required)
2. Select the Motion Perfect icon on your desktop to start the software.

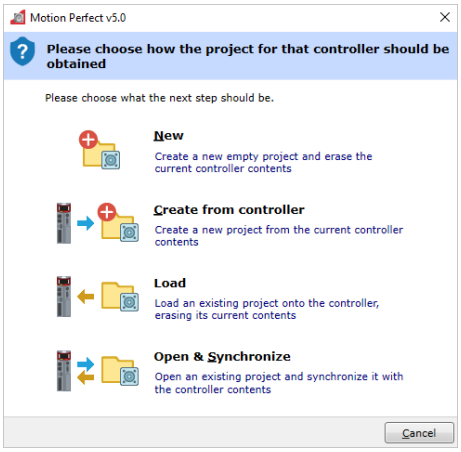


3. On the “Connection” dialog, select “Ethernet” and enter the IP address of the host controller. Do not change the default value in “IP port”.

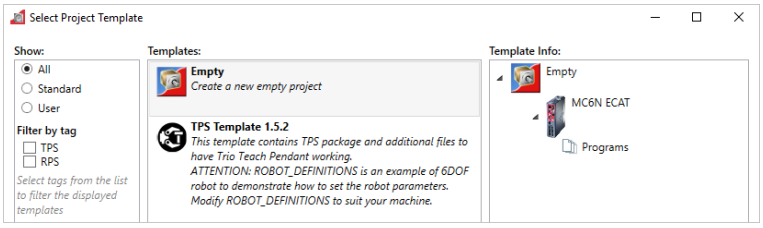


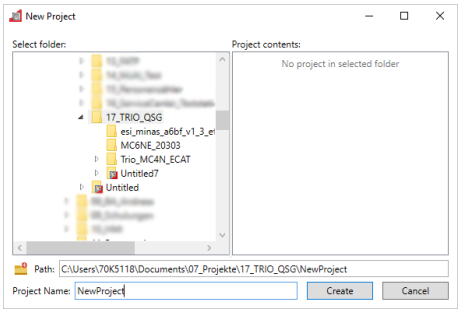
4. Select “Apply & Connect”.

5. Select “New” to create a new project.



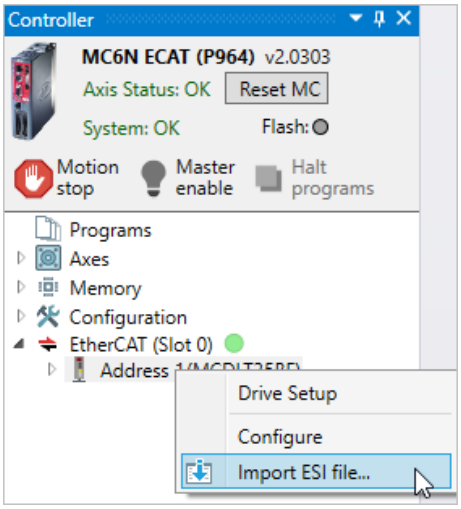
6. Select “Empty” to create an empty project and click on “Select”. Then choose a folder and file name for your project.
   If a warning appears that all controller content will be erased, make sure you have a backup of your projects on the PC.





The axis status and the system status "OK" are now displayed in green color in the upper left corner of the screen. The EtherCAT slave is connected and ready.

7. Go to “EtherCAT (Slot 0)”, right-click “Address 1”, select “Import ESI file”, and browse to the ESI file on your PC.

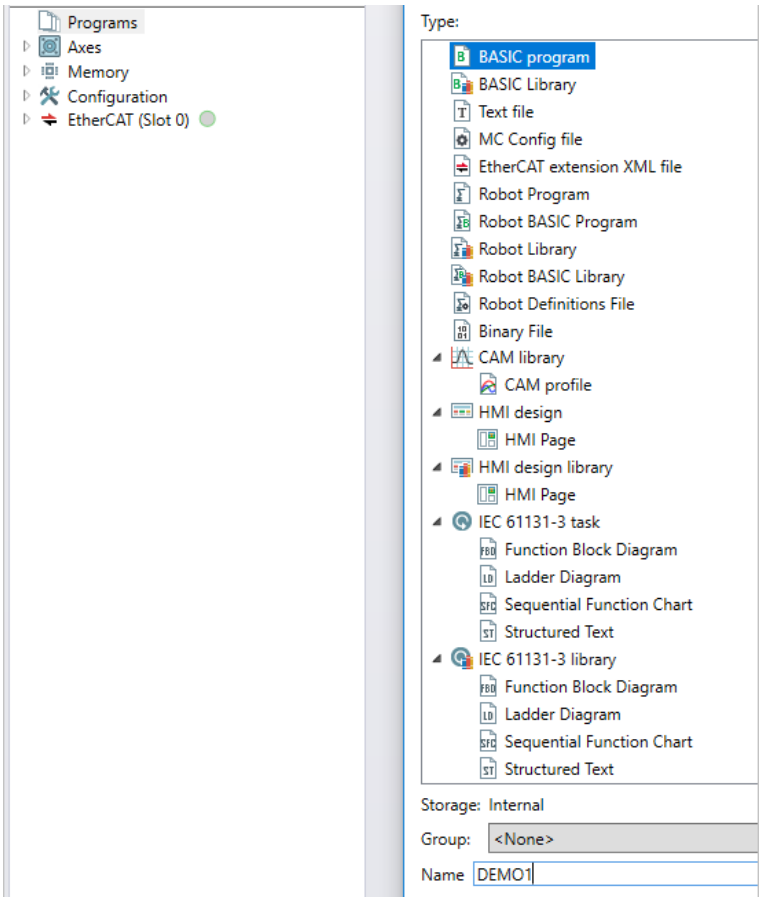


8. Select “Next” in the “Create EtherCAT profile...” dialog which shows details of the ESI file.
9. Select “Save” in the next dialog.
   A message informs you of the successful installation of the ESI file.

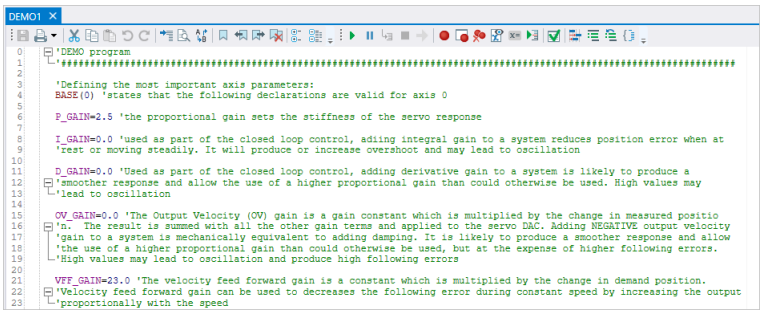
4.3 Program a simple positioning task

This small demo program will show you how to start the positioning of the axis.

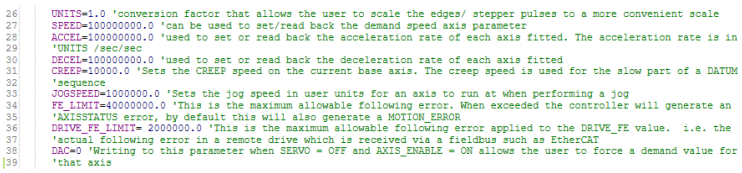
1. Go to “Programs” > “BASIC program”, enter a name for your program and select “OK”.



2. To program the motion routine, perform the following steps.
   The code enables servo control, prints "Machine Active" in the “Terminal” window, turns the motor shaft by 1 revolution, waits 1 second (1000ms), and disables servo control again while displaying "Inactive" in the “Terminal” window.
   - Define the most important variables (gain values) using the BASE(0) instruction.



   - Define units, speeds, limits, etc.



   - Define inputs and other parameters.

```
SERVO=1 'switches closed loop servo control on or off
REP_DIST=10000.0 'contains the allowable range of movement for an axis before the position count overflows or underflows
FWD_IN=-1 'holds the input number to be used as a forward limit input (-1: Input disabled)
REV_IN=-1 'holds the input number to be used as a reverse limit input (-1: Input disabled)
DATUM_IN=-1 'holds a digital input channel to be used as a datum input (-1: Input disabled)
FHOLD_IN=-1 'holds the input number to be used as a feedhold input (-1: Input disabled)
FS_LIMIT=2000000000000000.0 'holds the absolute position of the forward travel limit in user units
RS_LIMIT=-200000000000000.0 'holds the absolute position of the reverse travel limit in user units
```

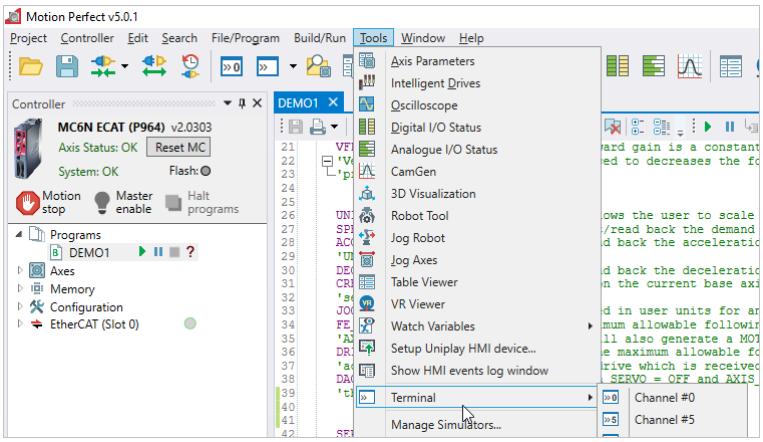
- Program the axis movement.

```
SERVO AXIS(0) = ON 'adresses servo axis 0 to be switched on
WDOG = ON 'Controls the WDOG relay contact used for enabling external drives
PRINT #0, "Machine Active" 'prints "Machine Active" in the terminal channel #0

MOVE(8388608) AXIS(0) 'lets the motor rotate exactly 1 rpm (23bit encoder--> 8388608 pulses per revolution)
WAIT IDLE AXIS(0) 'waits until the axis movement is finished

WA(1000) 'waits 1000ms and proceeds with the rest of code
SERVO AXIS(0) = OFF 'adresses servo axis 0 to be switched off
WDOG = OFF 'switches Off the WDOG and hence the external drive
PRINT #0, "Machine Inactive" 'prints "Machine Inactive" in the terminal channel #0
```

Most comments in these examples were copied from the Motion Perfect help file.

To copy the program code into your project, follow the link in the related topics.

3. To monitor the current status of the axis, open the “Terminal” window: Go to “Tools” > “Terminal” > “Channel#0”.



Related topics

Demo program code (page 17)

4.4 Demo program code

This is the program code of the application example in this section. To get started, copy the lines of the program code into your project.

```
'DEMO program

'#############################################################################


'Defining the most important axis parameters:

BASE(0) 'states that the following declarations are valid for axis 0


P_GAIN=2.5 'the proportional gain sets the stiffness of the servo response
```

```
I_GAIN=0.0 'used as part of the closed loop control, adding integral gain to a system reduces position error when at

'rest or moving steadily. It will produce or increase overshoot and may lead to oscillation


D_GAIN=0.0 'Used as part of the closed loop control, adding derivative gain to a system is likely to produce a

'smoother response and allow the use of a higher proportional gain than could otherwise be used. High values may

'lead to oscillation


OV_GAIN=0.0 'The Output Velocity (OV) gain is a gain constant which is multiplied by the change in measured positio

'n. The result is summed with all the other gain terms and applied to the servo DAC. Adding NEGATIVE output velocity

'gain to a system is mechanically equivalent to adding damping. It is likely to produce a smoother response and allow

'the use of a higher proportional gain than could otherwise be used, but at the expense of higher following errors.

'High values may lead to oscillation and produce high following errors


VFF_GAIN=23.0 'The velocity feed forward gain is a constant which is multiplied by the change in demand position.

'Velocity feed forward gain can be used to decreases the following error during constant speed by increasing the output

'proportionally with the speed


UNITS=1.0 'conversion factor that allows the user to scale the edges/ stepper pulses to a more convenient scale

SPEED=10000000.0 'can be used to set/read back the demand speed axis parameter

ACCEL=100000000.0 'used to set or read back the acceleration rate of each axis fitted. The acceleration rate is in

'UNITS /sec/sec

DECEL=100000000.0 'used to set or read back the deceleration rate of each axis fitted
```

```
CREEP=10000.0 'Sets the CREEP speed on the current base axis. The creep
speed is used for the slow part of a DATUM

'sequence

JOGSPEED=1000000.0 'Sets the jog speed in user units for an axis to run at
when performing a jog

FE_LIMIT=40000000.0 'This is the maximum allowable following error. When
exceeded the controller will generate an

'AXISSTATUS error, by default this will also generate a MOTION_ERROR

DRIVE_FE_LIMIT= 2000000.0 'This is the maximum allowable following error
applied to the DRIVE_FE value. i.e. the

'actual following error in a remote drive which is received via a fieldbus
such as EtherCAT

DAC=0 'Writing to this parameter when SERVO = OFF and AXIS_ENABLE = ON
allows the user to force a demand value for

'that axis


SERVO=1 'switches closed loop servo control on or off

REP_DIST=10000.0 'contains the allowable range of movement for an axis
before the position count overflows or underflows

FWD_IN=-1 'holds the input number to be used as a forward limit input (-1:
Input disabled)

REV_IN=-1 'holds the input number to be used as a reverse limit input (-1:
Input disabled)

DATUM_IN=-1 'holds a digital input channel to be used as a datum input (-1:
Input disabled)

FHOLD_IN=-1 'holds the input number to be used as a feedhold input (-1:
Input disabled)

FS_LIMIT=2000000000000000.0 'holds the absolute position of the forward
travel limit in user units

RS_LIMIT=-200000000000000.0 'holds the absolute position of the reverse
travel limit in user units


SERVO AXIS(0) = ON 'addresses servo axis 0 to be switched on

WDOG = ON 'Controls the WDOG relay contact used for enabling external drives

PRINT #0, "Machine Active" 'prints "Machine Active" in the terminal channel
#0
```

```
MOVE(83886080) AXIS(0) 'lets the motor rotate exactly 1 rpm (23bit encoder--
> 8388608 pulses per revolution)

WAIT IDLE AXIS(0) 'waits until the axis movement is finished


WA(1000) 'waits 1000ms and proceeds with the rest of code

SERVO AXIS(0) = OFF 'addresses servo axis 0 to be switched off

WDOG = OFF 'switches Off the WDOG and hence the external drive

PRINT #0, "Machine Inactive" 'prints "Machine Inactive" in the terminal
channel #0
```

Related topics

Program a simple positioning task (page 15)

5 Update the firmware

The firmware of the TRIO MC6N-ECAT controller can be updated with the Motion Perfect software. Download the firmware files from TRIO's website. The download links can be found under Available software (page 5).

To update the firmware, go to "Controller" > "Load Firmware..." and follow the instructions in the software.

6 Help us improve

Please feel free to contact us if you have any questions, or if you have any suggestions for improvement. In that case, we ask you to include the Quick Start Guide number in the email subject line. You can find the number starting with "QS" on the cover page.

servo.peweu@eu.panasonic.com

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7 Record of changes

QS10006_V1.0_EN, 2020.11

First edition

8 Panasonic hotline

If you have questions that cannot be clarified by the manuals or online help, please contact your sales office.

Europe

Austria:	02236 / 2 68 46, info.pewat@eu.panasonic.com
Benelux:	0499 / 37 27 27, info.pewswe@eu.panasonic.com
France:	01 / 60 13 57 57, info.pewswef@eu.panasonic.com
Germany:	089 / 45 354 2750, servo.peweu@eu.panasonic.com
Ireland:	01 / 4 60 09 69, info.pewuk@eu.panasonic.com
Italy:	045 / 67 52 711, info.pewit@eu.panasonic.com
Scandinavia:	46 / 8 59 47 66 80, info.pewns@eu.panasonic.com
Spain:	91 / 3 29 38 75, info.pewes@eu.panasonic.com
Switzerland:	041 / 799 70 50, info.pewch@eu.panasonic.com
United Kingdom:	01908 / 23 15 55, info.pewuk@eu.panasonic.com

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