

# MotionWorks IEC Hardware Configuration

**Class No.** TRM010-MotionWorksIEC-HardwareConfig

**Rev.** A.01

**Date:** 10/27/2016



# Contents

- *Basic Concepts*
- *Basic Axis Configuration*
- *Servo Options*
- *Absolute Encoders*

This is the PDF training guide  
for this series of eLearning  
videos

# Instructor Introduction

*Matt Pelletier*

*Product Training Engineer*

[training@yaskawa.com](mailto:training@yaskawa.com)

**1-800-YASKAWA**





# MotionWorks IEC Hardware Configuration **Basic Concepts**

Hands-on Training Tutorial

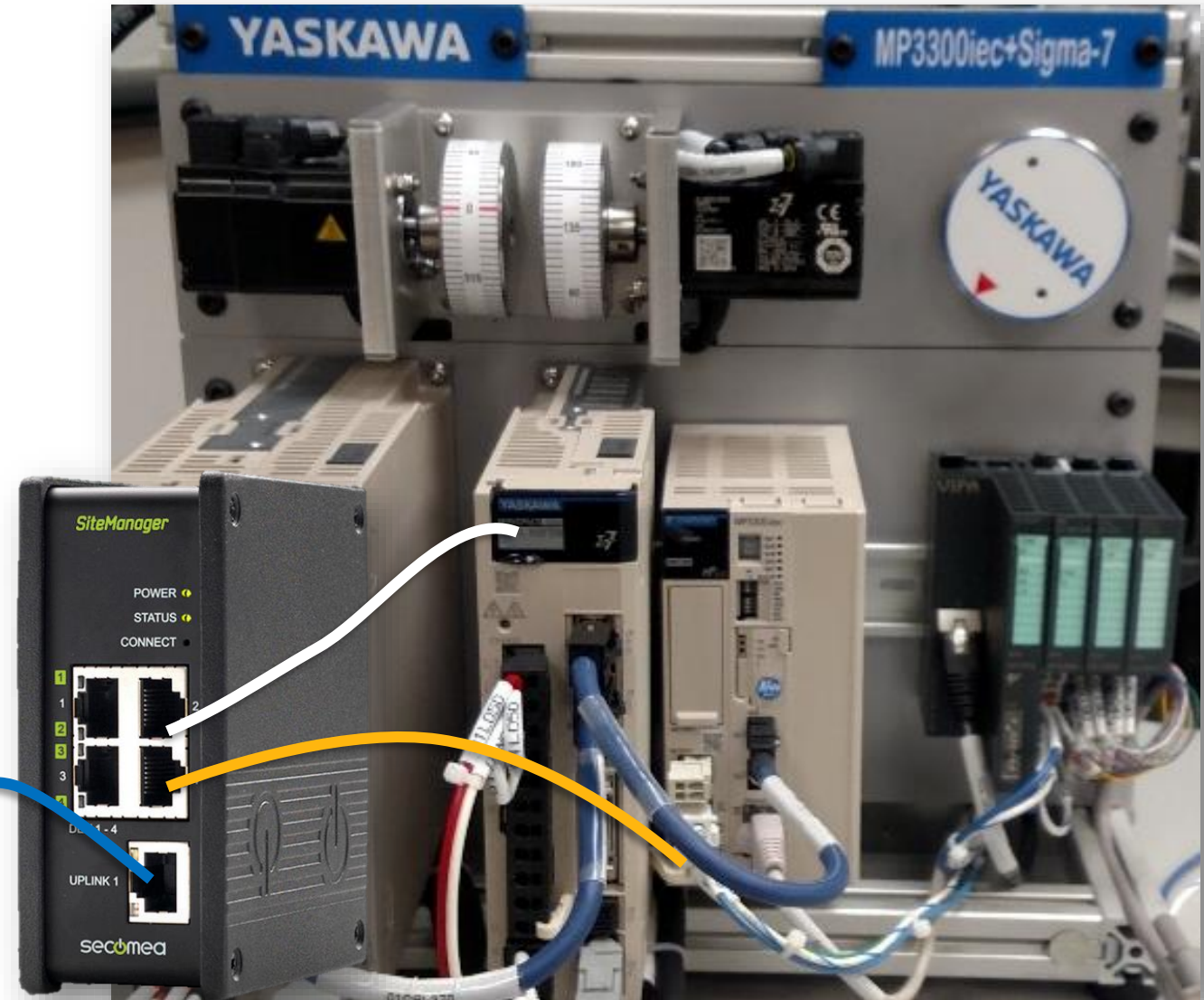
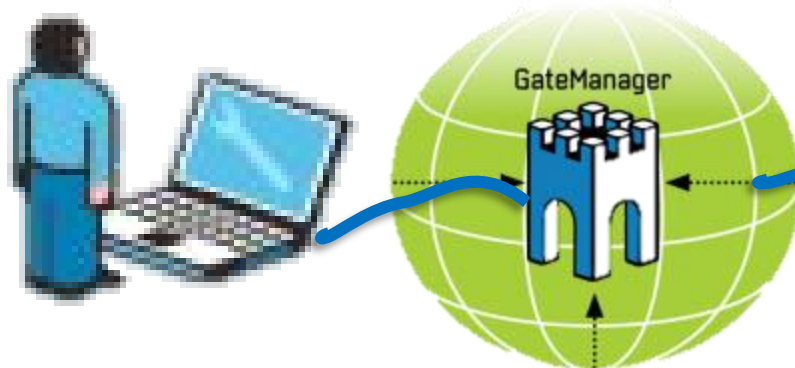
- *Hardware Configuration Data*
- *Offline & Online*
- *Configuration Differences*

# Overview

- *Pre-requisites*
  1. *Servo Basics video*
  2. *Web UI self-guided video tutorial*
    - » *TRM010-MPiec-WebUI*
  3. *Remote Demo System*

# Remote Demo System

- Request access by Email
  - [Training@yaskawa.com](mailto:Training@yaskawa.com)
- Remote Connection Process
  - `eLV.MPIec.01.PLCOpen_RmtCnct`



# Hardware Configuration Data

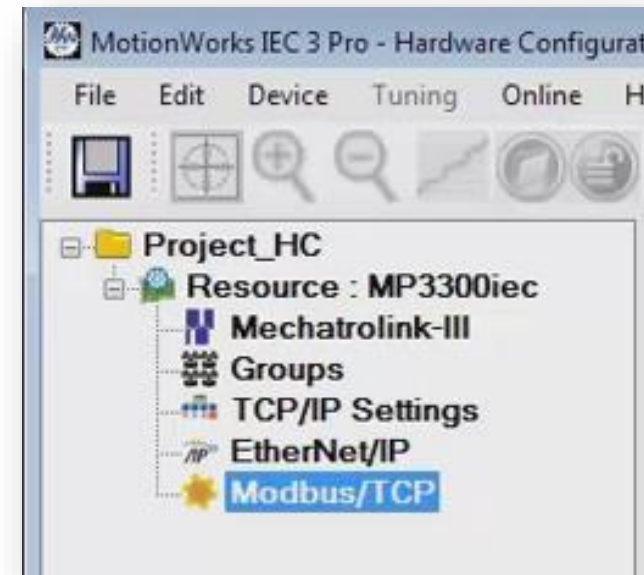
- *Settings of the controller and each connected device*
  - *Controller*
    - » *TCP/IP settings*
    - » *Local I/O cards*
  - *Network devices*
    - » *Mechatrolink-III axes*
    - » *Ethernet/IP*
    - » *Modbus/TCP*



# Hardware Configuration Data

## EXERCISE

- *Make a new project*
- *Open Hardware Configuration*
- *Hardware Tree*
- *Overview*
  - *Resource: MP3300iec*
  - *Mechatrolink-III*
  - *Groups*
  - *TCP/IP Settings*
  - *Ethernet/IP*
  - *Modbus/TCP*





# Hardware Configuration Data

## EXERCISE

- *TCP/IP Settings*

The screenshot displays the MotionWorks IEC 3 Pro - Hardware Configuration interface. The window title is "MotionWorks IEC 3 Pro - Hardware Configuration". The menu bar includes File, Edit, Device, Tuning, Online, and Help. The toolbar contains various icons for file operations and device management. The left sidebar shows a tree view for "Project\_HC" with sub-items: Resource : MP3300iec, Mechatrolink-III, Groups, TCP/IP Settings (selected), EtherNet/IP, and Modbus/TCP. The main area shows the configuration for "Resource : MP3300iec", which is currently "Offline". The "TCP/IP Settings" section is active, showing "Device Settings" with IP Address (192.168.15.1) and Subnet Mask (255.255.255.0). Below this is the "Global Settings" section with Default Gateway (192.168.1.253). The "Auxiliary Settings" section is empty, with buttons for Add, Remove, and Modify.

Resource : MP3300iec Offline Connect 192 .

TCP/IP Settings

Device Settings

IP Address 192 . 168 . 15 . 1

Subnet Mask 255 . 255 . 255 . 0

Global Settings

Default Gateway 192 . 168 . 1 . 253

Auxiliary Settings

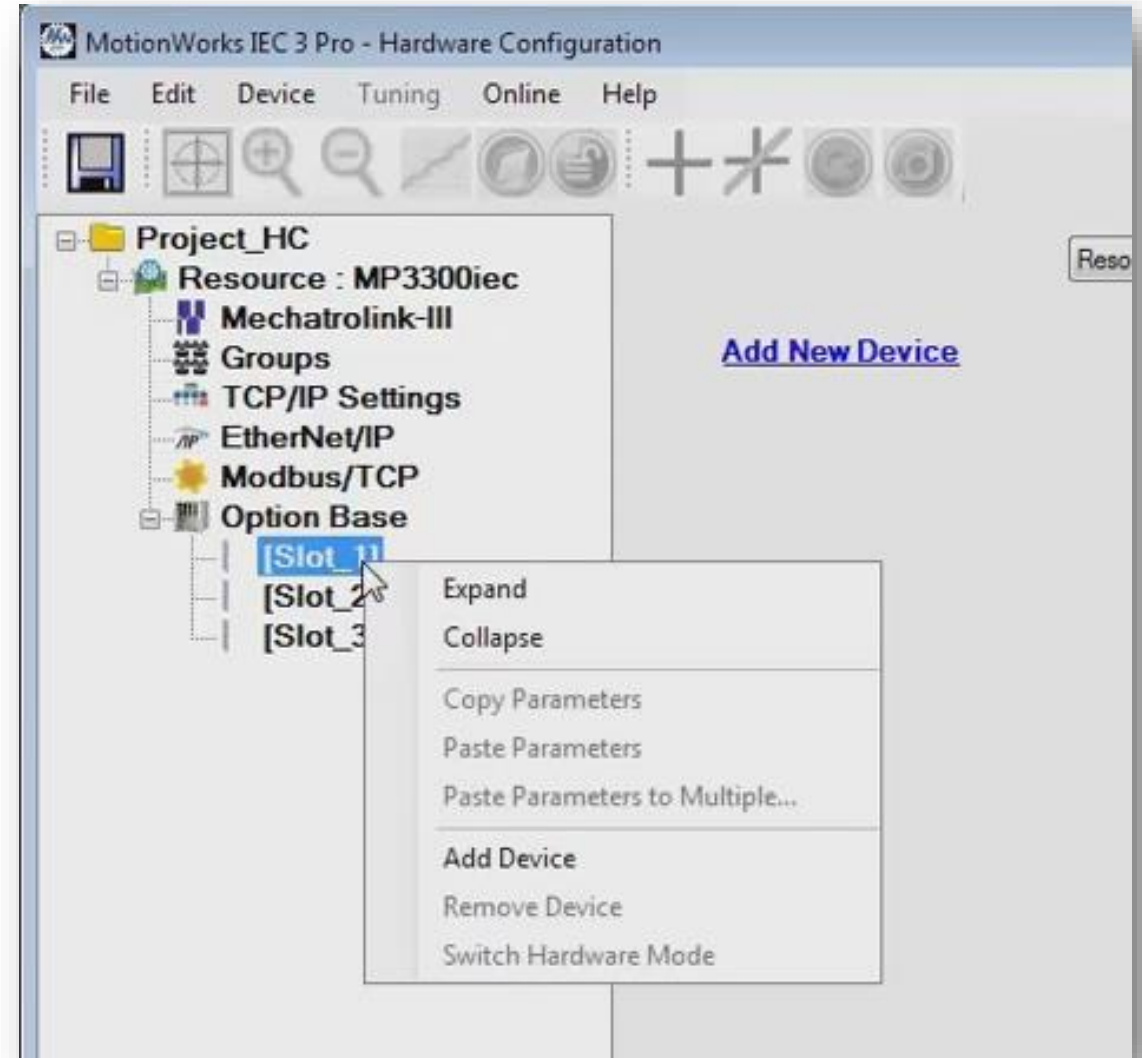
IP Address	Subnet Mask

Add Remove Modify

# Hardware Configuration Data

## EXERCISE

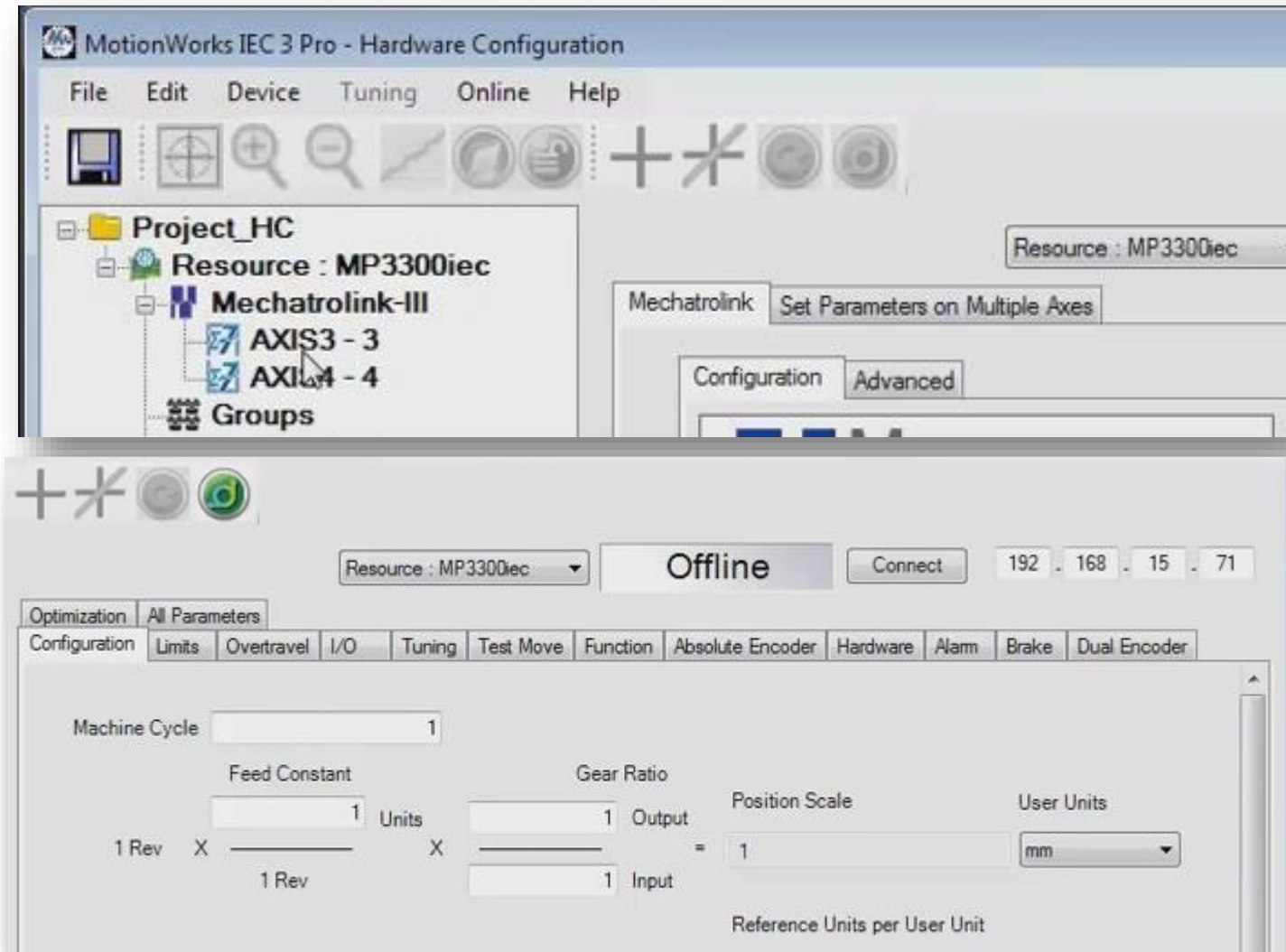
- *Add option base*
- *Add LIO-01*



# Hardware Configuration Data

## EXERCISE

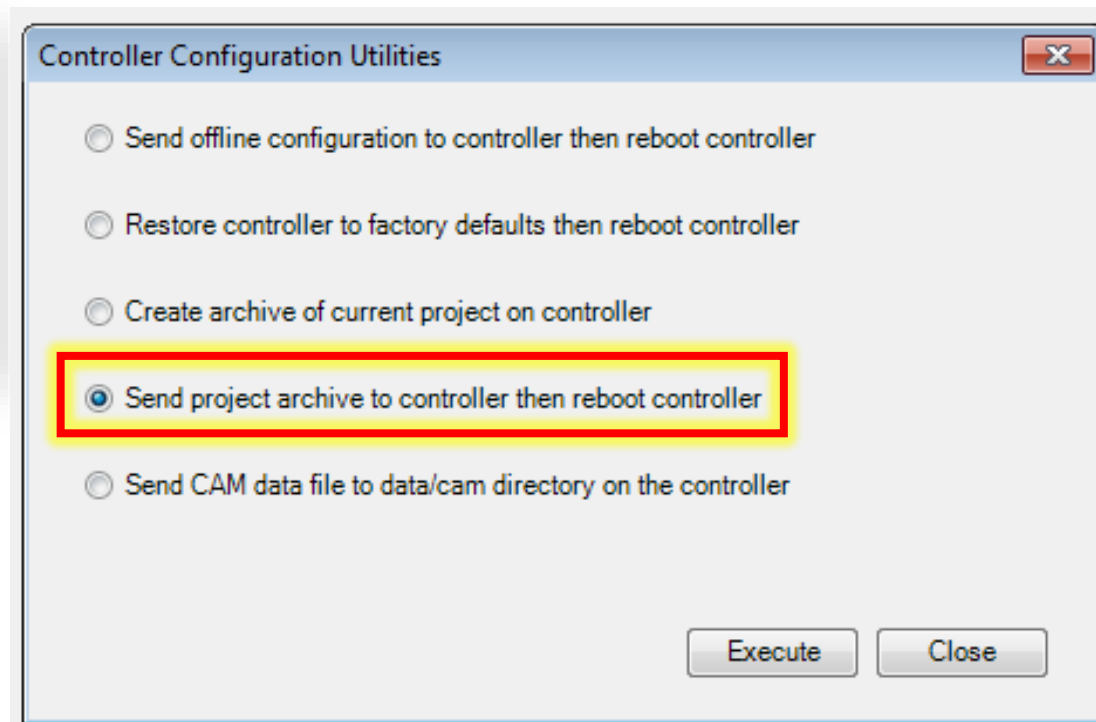
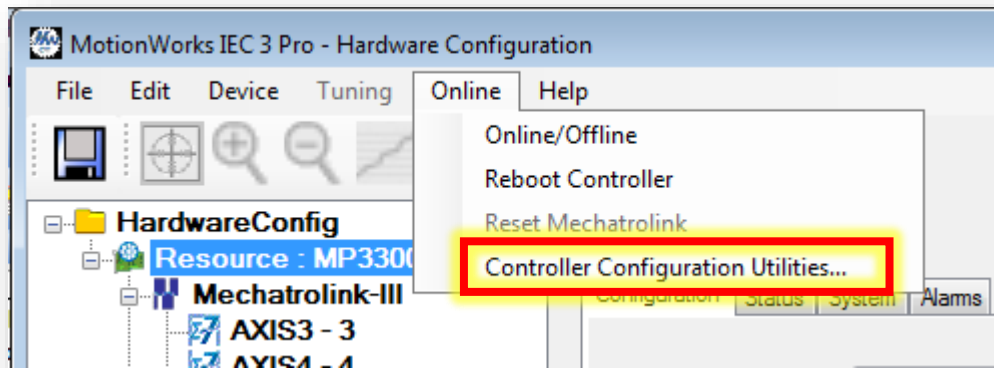
- *Add SGD7W to Mechatrolink-III*
  - *Node 3*
- *Preview each tab*



# Controller Configuration Utilities

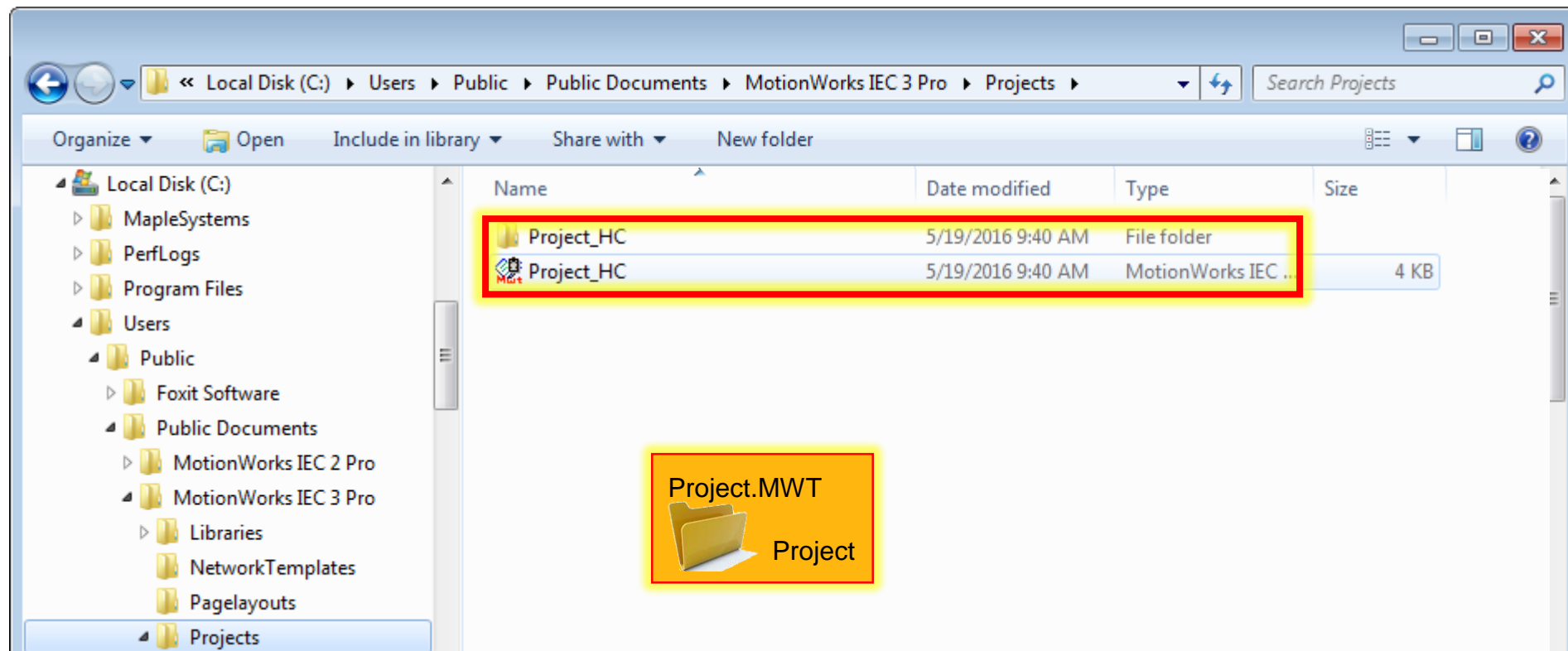
## EXERCISE

- *Send project archive to controller then reboot controller*



# Offline & Online

- *OFFLINE configuration in Project folder*
  - *Project.MWT*
  - *Project [Folder]*
    - » *OFFLINE configuration in this folder*



# Offline & Online

- *Online Configuration on controller*

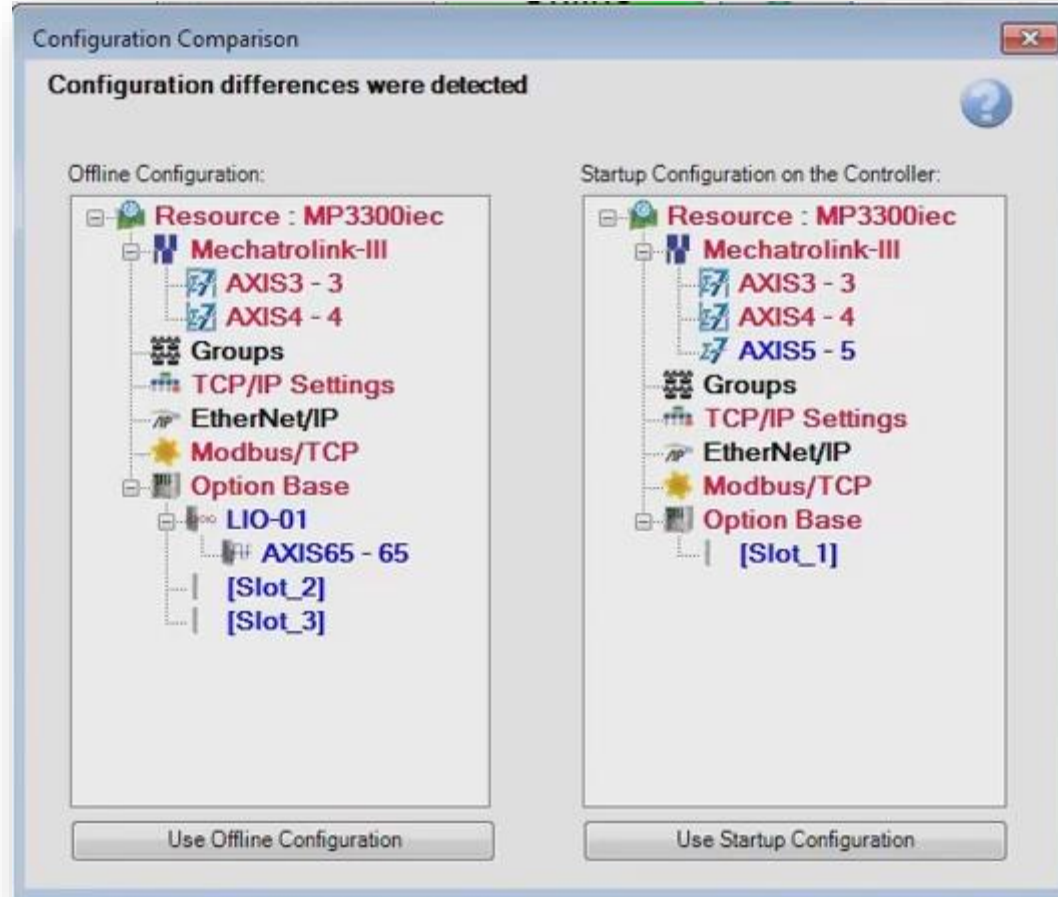


# Offline & Online

- *Connect*



Choose offline to  
Change the  
controller and  
servo  
configuration

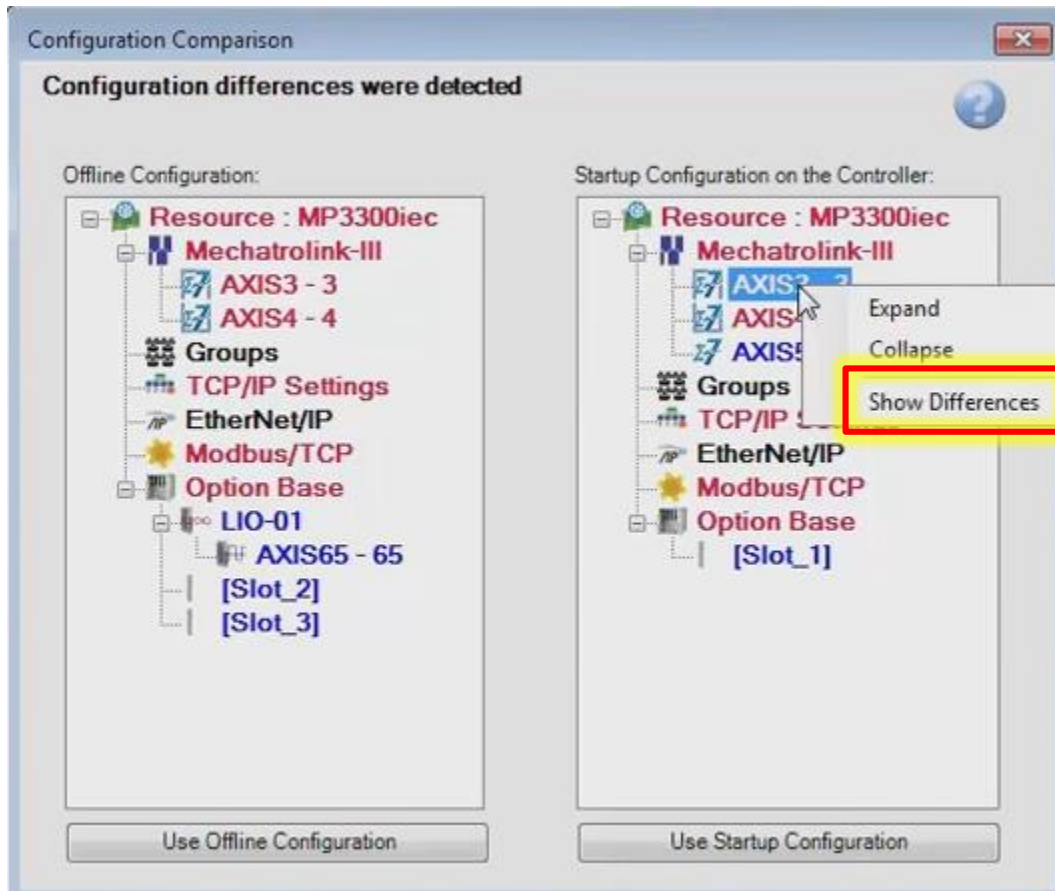


Choose ONLINE to  
leave all controller  
and servo settings  
unchanged



# Offline & Online

- *Right-click to list Servopack differences*



Configuration Differences

AXIS3 - 3

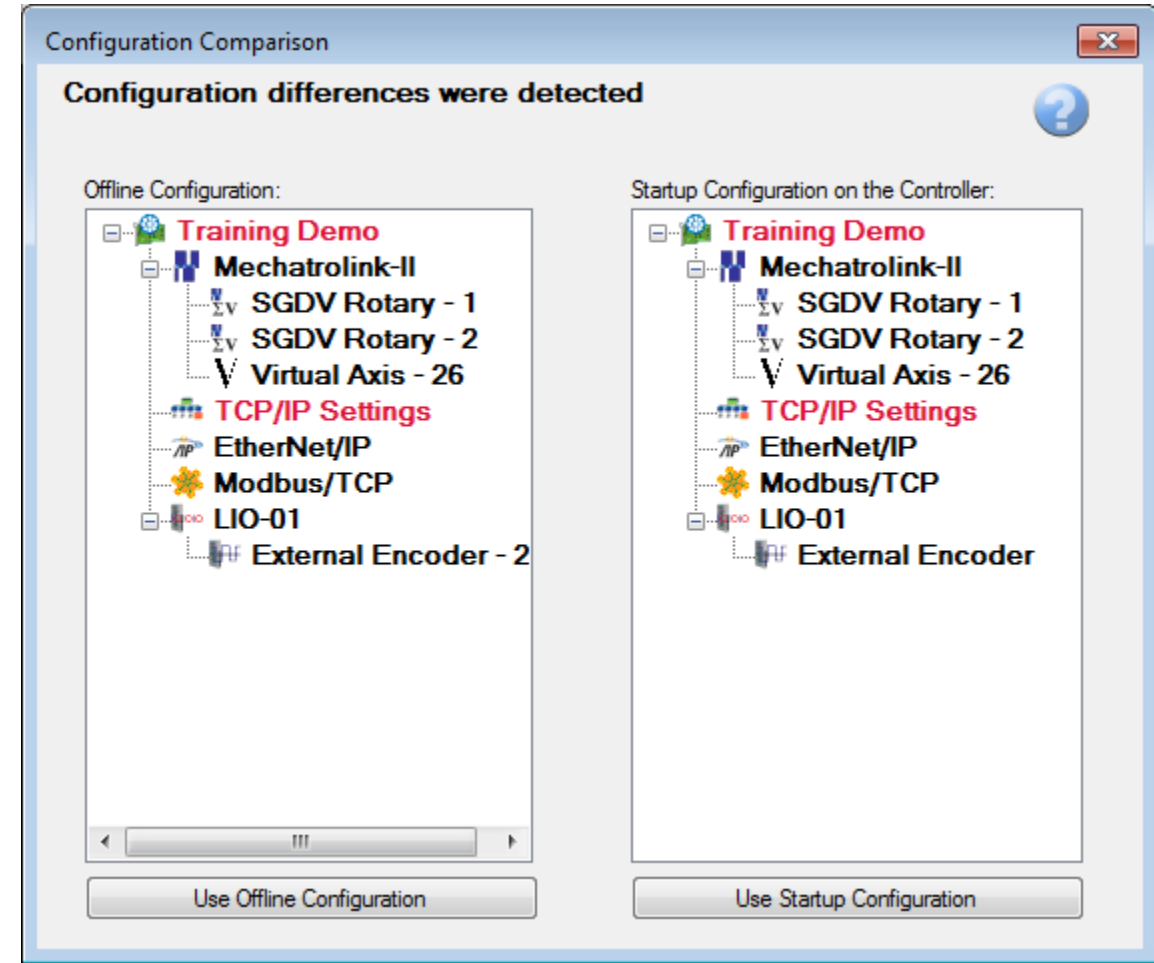
Item	Offline Configuration	Controller Configuration	Unit
1802	6250	2232	
1819	SGD7W-*****+	SGD7W-1R6A30A	
1820	0x00		32
1821			rotary
1822	0		200 Wat
1823		SGM7A-01A7A61	
1824			rotary
1825	0		100 Wat
1826			absolute

Close



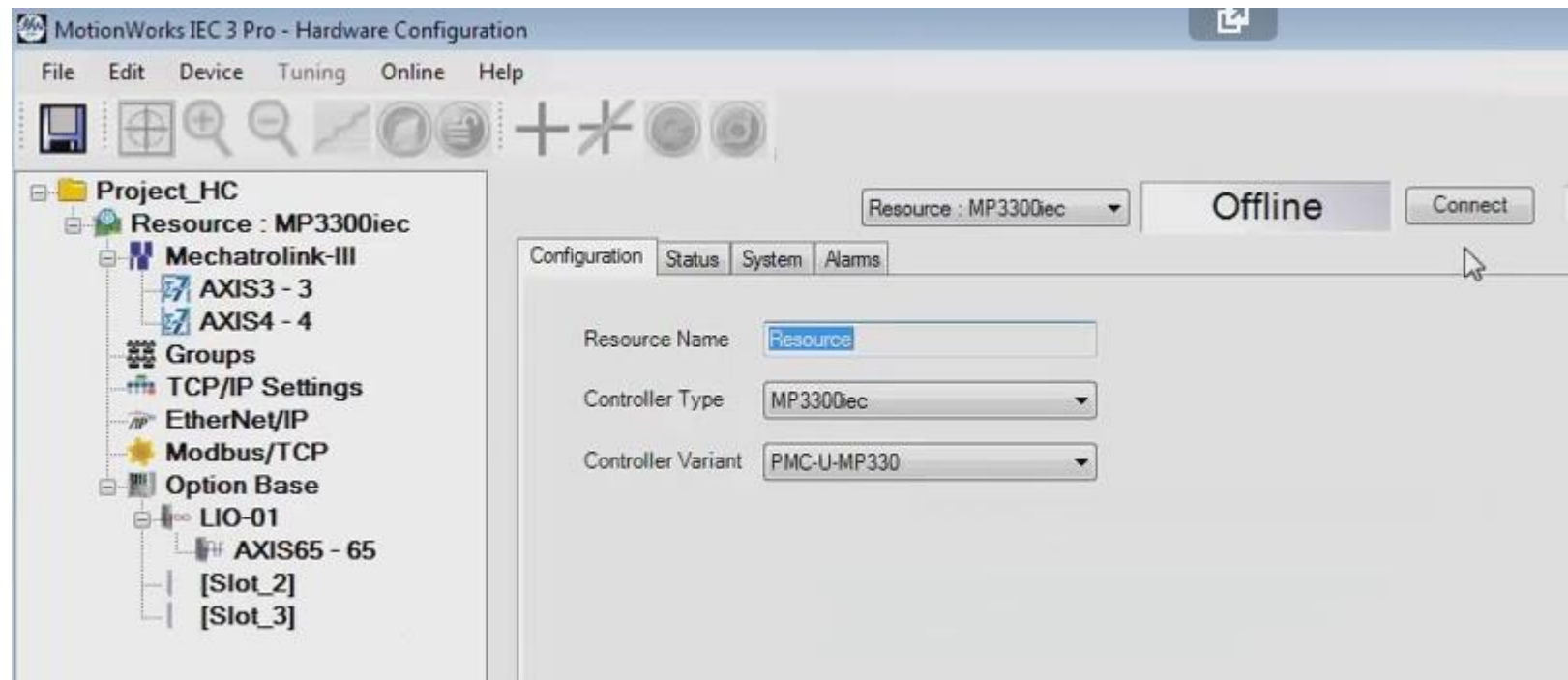
# Online Configuration

- *Choose Online*
  - *What happens?*



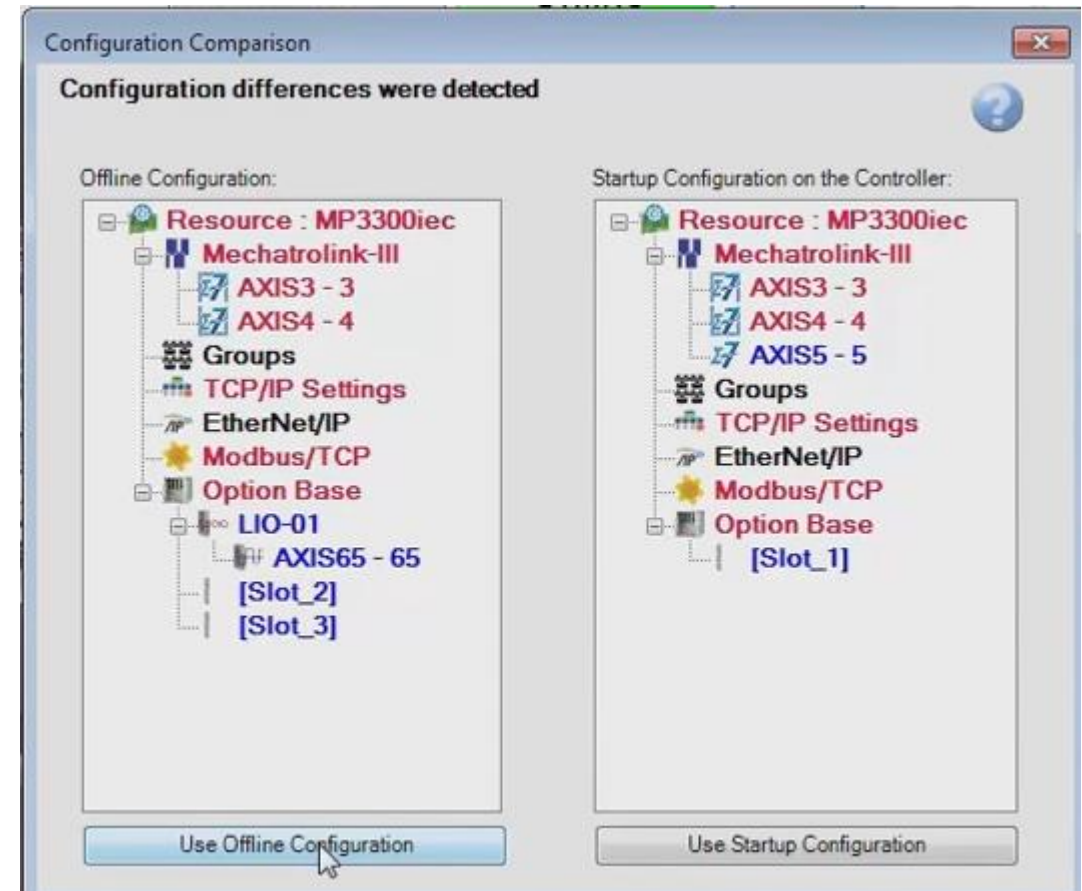
# Online Configuration

- *Choice is NOT permanent until ONLINE SAVE*
- *Process to “Undo”*
  - *Disconnect back to offline without saving.*
  - *Close / Re-open Hardware configuration.*



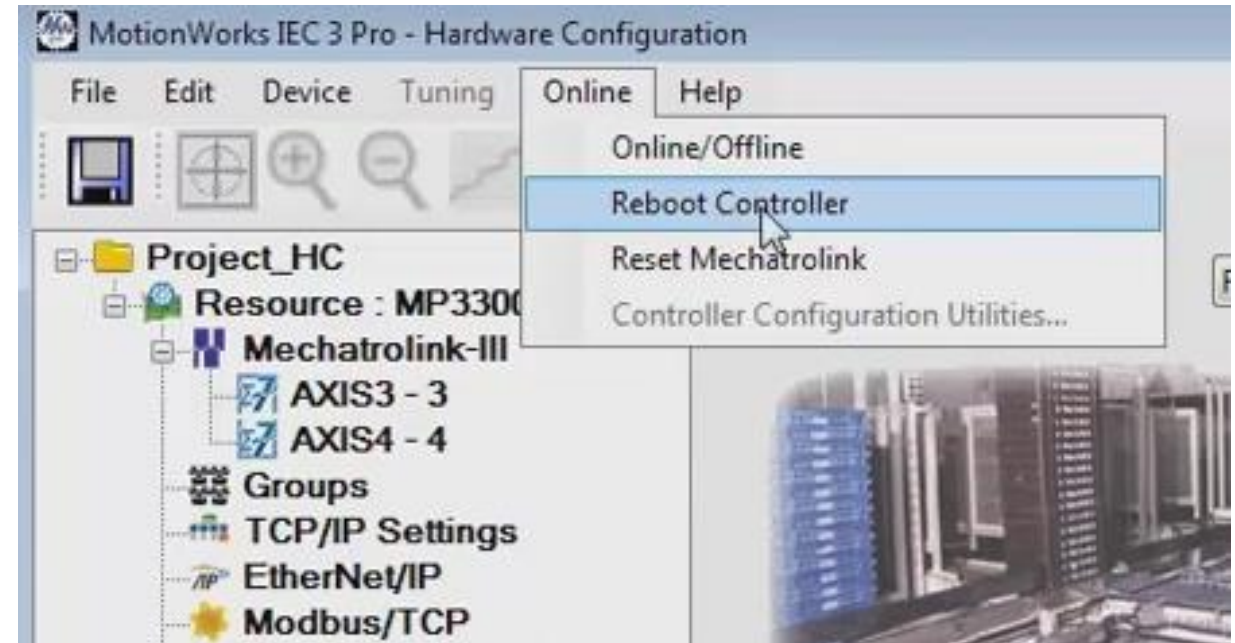
# Offline Configuration

- *Connect (again)*
- *Choose Offline*
  - *What happens?*
  - *“Writing Drive Pns” message*



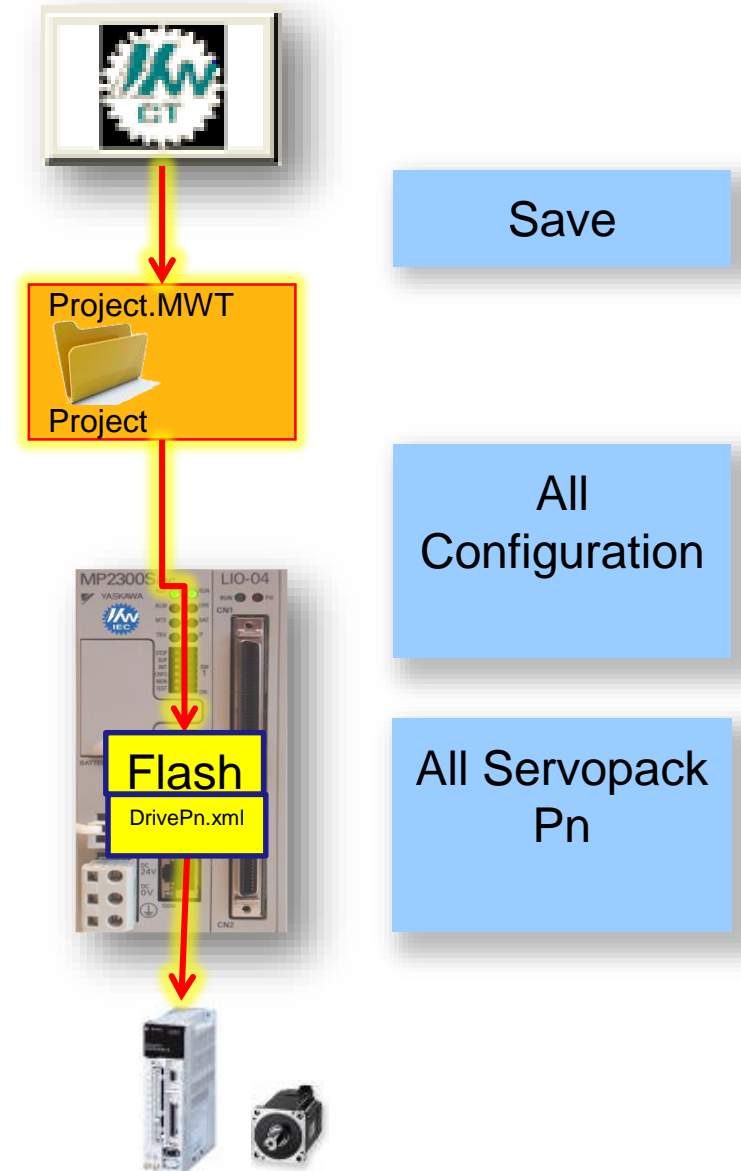
# Offline Configuration

- *Choice is NOT permanent until ONLINE SAVE*
- *Process to “Undo” :*
  - *Reboot*
  - *Reopen Hardware Configuration*



# Online Save

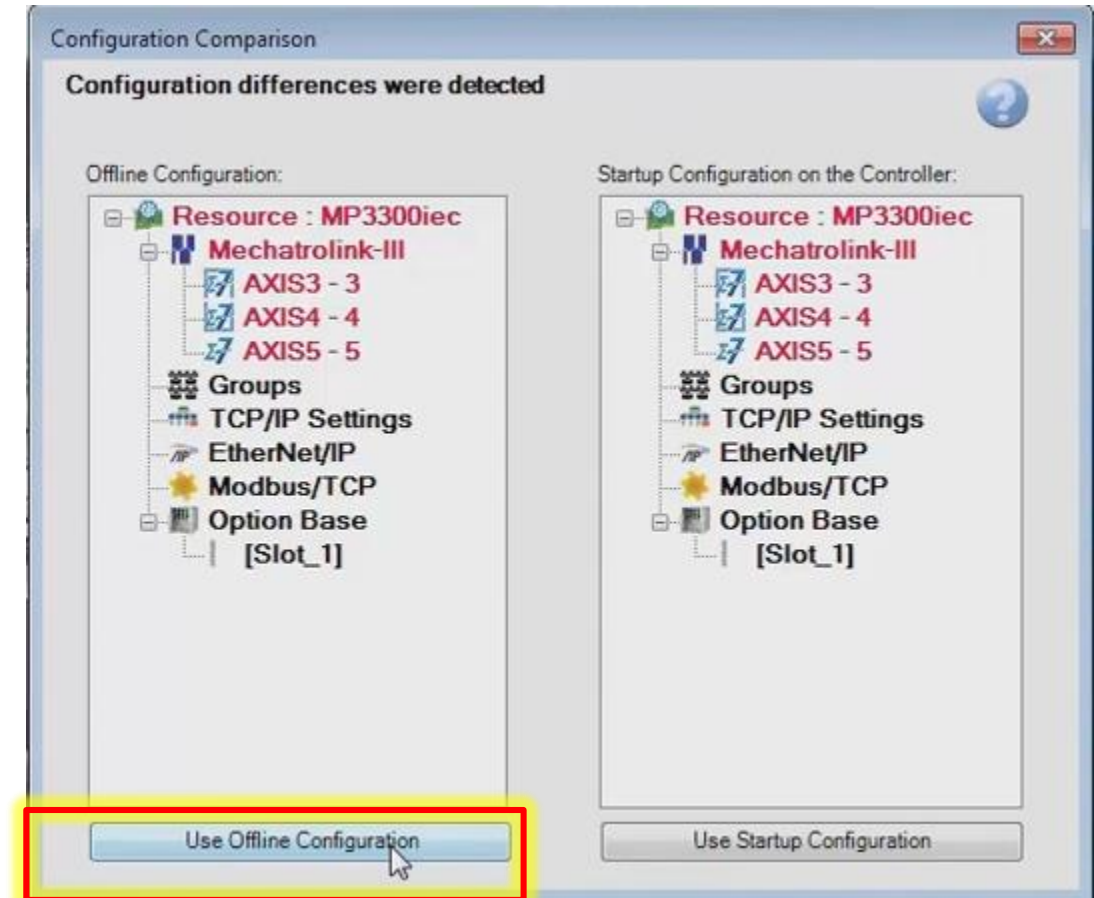
- *Makes permanent changes*
  - *Controller configuration*
  - *Servo parameters*
  - *Variables created / updated*
  - *I/O drivers*
- *Offline and Online configuration match*
- *Changes take effect after reboot*



# Online Save

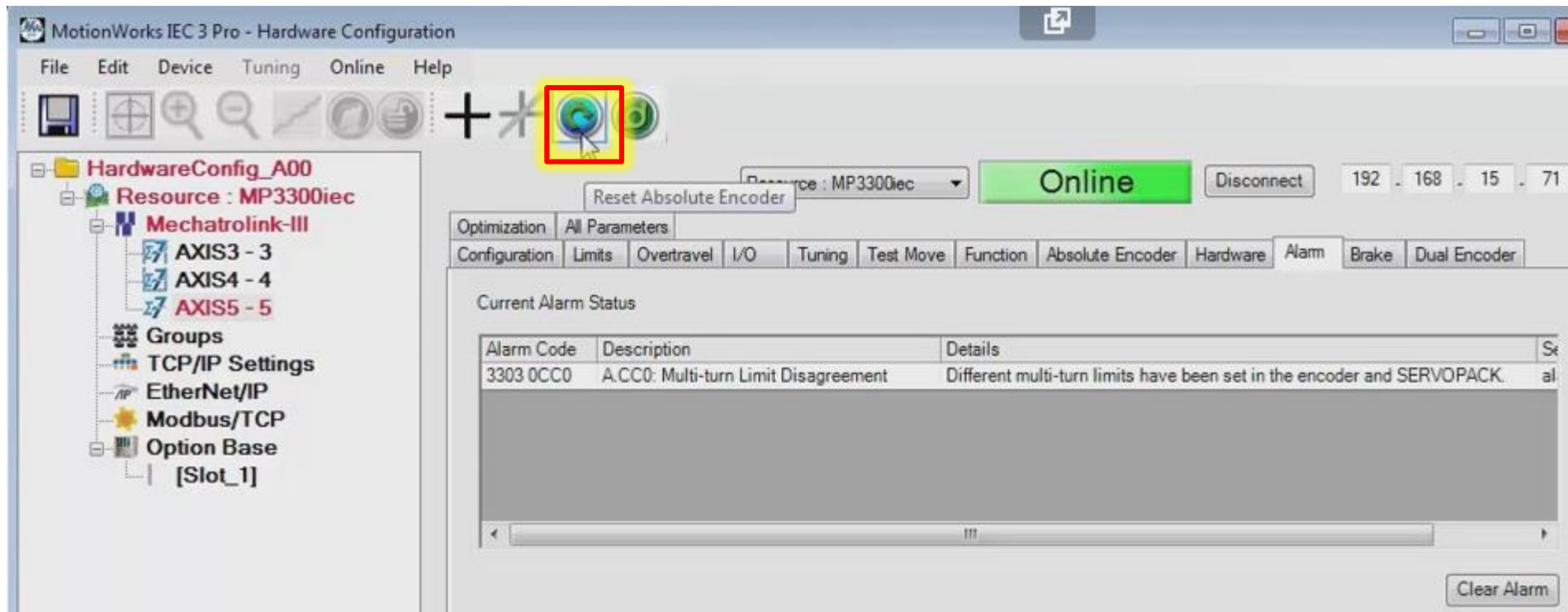
## EXERCISE

1. Open “HardwareConfig.zwt” project
2. Connect online with Offline configuration
3. Online Save
4. Reboot (to use configuration)
5. Connect



# Reset Absolute Encoder

- *Clear alarm A.CC0*
  1. *Connect online*
  2. *Select axis in tree*
  3. *“Reset Absolute Encoder” button*
  4. *Reboot (to reboot drive)*



# Online Save

- *Updates the program*
  - *Global Variables*
  - *IO\_Configuration*
- *Compile project again*

The screenshot shows the MotionWorks IEC 2 Pro software interface. The Project Tree Window on the left displays a project structure with 'Global\_Variables\*' and 'IO\_Configuration\*' highlighted in a red box. The main window displays a table of I/O configurations.

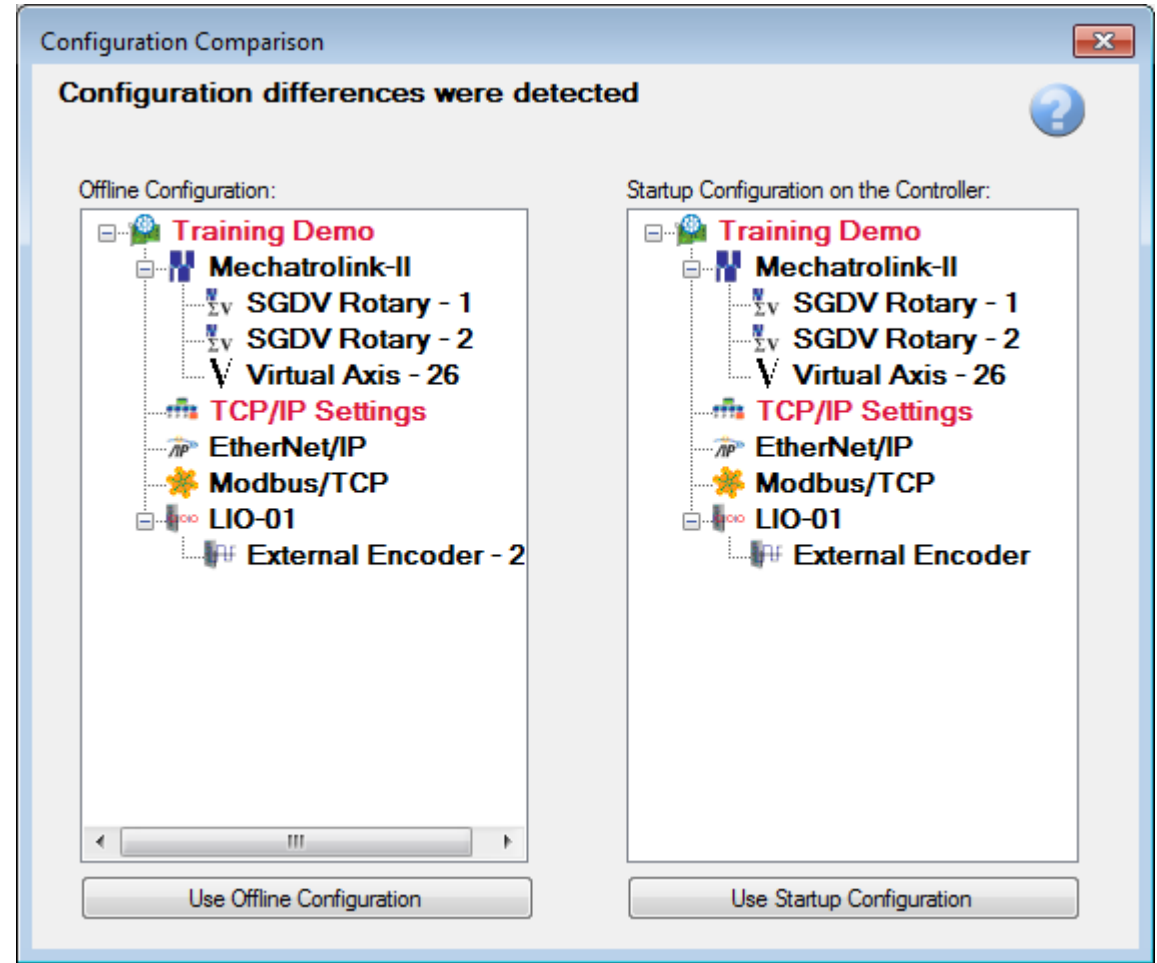
Name	Type	Usage	Description	Address	Init	Retain	PDC
System							
<SGDV Rotary> - Sigma-V Rotary Servo Amplifier - 1:1 (* Modify Variable Names, Not Group Name.*)							
<SGDV Rotary> - Sigma-V Rotary Servo Amplifier - 1:2 (* Modify Variable Names, Not Group Name.*)							
<LIO-01> - 16 DI / 16 DO Sinking + 1 Pulse Latch I/O Module - 1 (* Modify Variable Names, Not Group Name.*)							
MO1_DI_00	BOOL	VAR_GLOBAL	Digital Input #0	%IX61504.0		<input type="checkbox"/>	<input type="checkbox"/>
MO1_DI_01	BOOL	VAR_GLOBAL	Digital Input #1	%IX61504.1		<input type="checkbox"/>	<input type="checkbox"/>
MO1_DI_02	BOOL	VAR_GLOBAL	Digital Input #2	%IX61504.2		<input type="checkbox"/>	<input type="checkbox"/>
MO1_DI_03	BOOL	VAR_GLOBAL	Digital Input #3	%IX61504.3		<input type="checkbox"/>	<input type="checkbox"/>
MO1_DI_04	BOOL	VAR_GLOBAL	Digital Input #4	%IX61504.4		<input type="checkbox"/>	<input type="checkbox"/>
MO1_DI_05	BOOL	VAR_GLOBAL	Digital Input #5	%IX61504.5		<input type="checkbox"/>	<input type="checkbox"/>
MO1_DI_06	BOOL	VAR_GLOBAL	Digital Input #6	%IX61504.6		<input type="checkbox"/>	<input type="checkbox"/>
MO1_DI_07	BOOL	VAR_GLOBAL	Digital Input #7	%IX61504.7		<input type="checkbox"/>	<input type="checkbox"/>
MO1_DI_08	BOOL	VAR_GLOBAL	Digital Input #8	%IX61505.0		<input type="checkbox"/>	<input type="checkbox"/>
MO1_DI_09	BOOL	VAR_GLOBAL	Digital Input #9	%IX61505.1		<input type="checkbox"/>	<input type="checkbox"/>
MO1_DI_10	BOOL	VAR_GLOBAL	Digital Input #10	%IX61505.2		<input type="checkbox"/>	<input type="checkbox"/>
MO1_DI_11	BOOL	VAR_GLOBAL	Digital Input #11	%IX61505.3		<input type="checkbox"/>	<input type="checkbox"/>
MO1_DI_12	BOOL	VAR_GLOBAL	Digital Input #12	%IX61505.4		<input type="checkbox"/>	<input type="checkbox"/>
MO1_DI_13	BOOL	VAR_GLOBAL	Digital Input #13	%IX61505.5		<input type="checkbox"/>	<input type="checkbox"/>
MO1_DI_14	BOOL	VAR_GLOBAL	Digital Input #14	%IX61505.6		<input type="checkbox"/>	<input type="checkbox"/>
MO1_DI_15	BOOL	VAR_GLOBAL	Digital Input #15	%IX61505.7		<input type="checkbox"/>	<input type="checkbox"/>
MO1_DO_00	BOOL	VAR_GLOBAL	Digital Output #0	%QX61504.0		<input type="checkbox"/>	<input type="checkbox"/>
MO1_DO_01	BOOL	VAR_GLOBAL	Digital Output #1	%QX61504.1		<input type="checkbox"/>	<input type="checkbox"/>
MO1_DO_02	BOOL	VAR_GLOBAL	Digital Output #2	%QX61504.2		<input type="checkbox"/>	<input type="checkbox"/>
MO1_DO_03	BOOL	VAR_GLOBAL	Digital Output #3	%QX61504.3		<input type="checkbox"/>	<input type="checkbox"/>
MO1_DO_04	BOOL	VAR_GLOBAL	Digital Output #4	%QX61504.4		<input type="checkbox"/>	<input type="checkbox"/>
MO1_DO_05	BOOL	VAR_GLOBAL	Digital Output #5	%QX61504.5		<input type="checkbox"/>	<input type="checkbox"/>
MO1_DO_06	BOOL	VAR_GLOBAL	Digital Output #6	%QX61504.6		<input type="checkbox"/>	<input type="checkbox"/>
MO1_DO_07	BOOL	VAR_GLOBAL	Digital Output #7	%QX61504.7		<input type="checkbox"/>	<input type="checkbox"/>
MO1_DO_08	BOOL	VAR_GLOBAL	Digital Output #8	%QX61505.0		<input type="checkbox"/>	<input type="checkbox"/>
MO1_DO_09	BOOL	VAR_GLOBAL	Digital Output #9	%QX61505.1		<input type="checkbox"/>	<input type="checkbox"/>
MO1_DO_10	BOOL	VAR_GLOBAL	Digital Output #10	%QX61505.2		<input type="checkbox"/>	<input type="checkbox"/>
MO1_DO_11	BOOL	VAR_GLOBAL	Digital Output #11	%QX61505.3		<input type="checkbox"/>	<input type="checkbox"/>
MO1_DO_12	BOOL	VAR_GLOBAL	Digital Output #12	%QX61505.4		<input type="checkbox"/>	<input type="checkbox"/>



# Differences Detected

- *Scenario 1:*
  - *You started a blank project and are connecting to a machine in production*

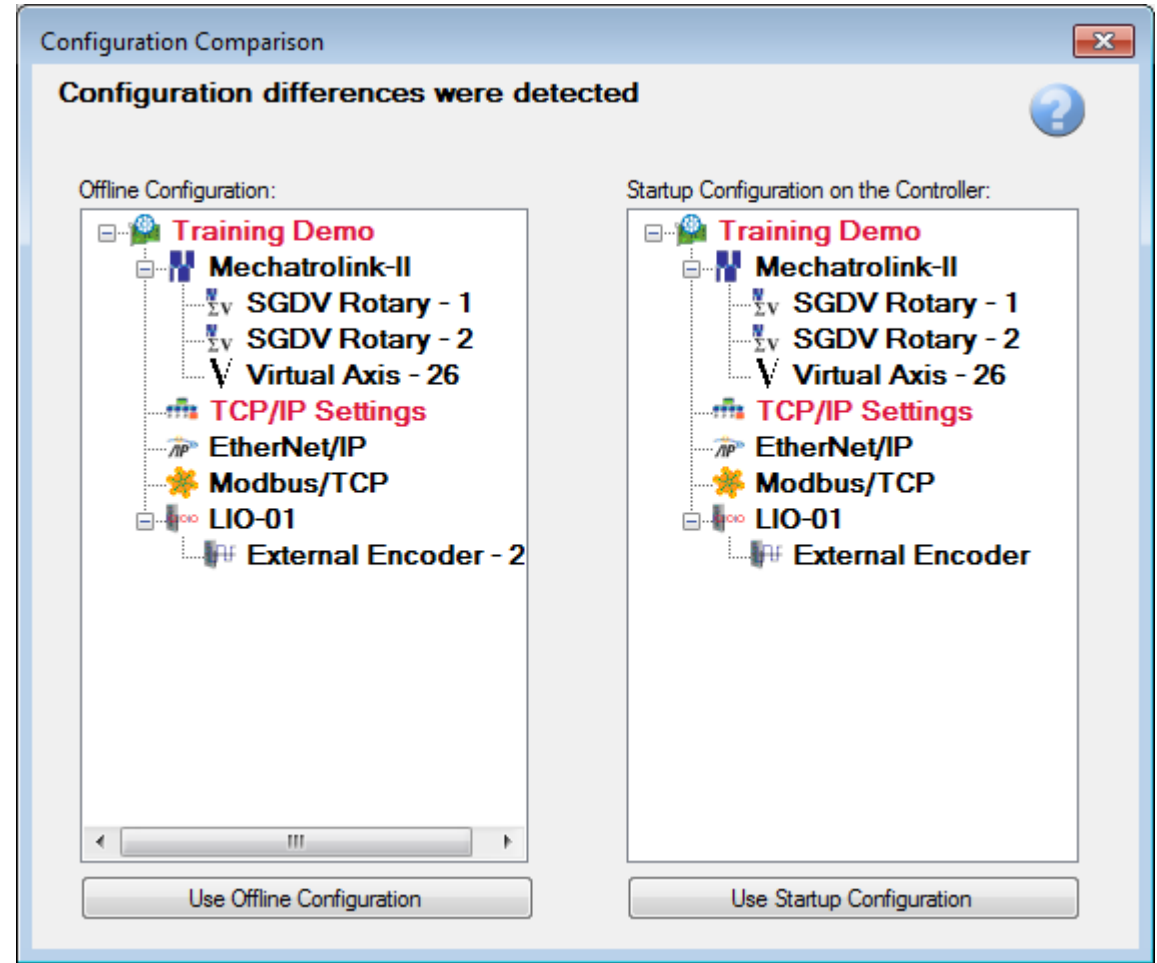
Offline  
or  
Online?



# Differences Detected

- *Scenario 2:*
  - *You are deploying a new controller which is at factory default settings.*

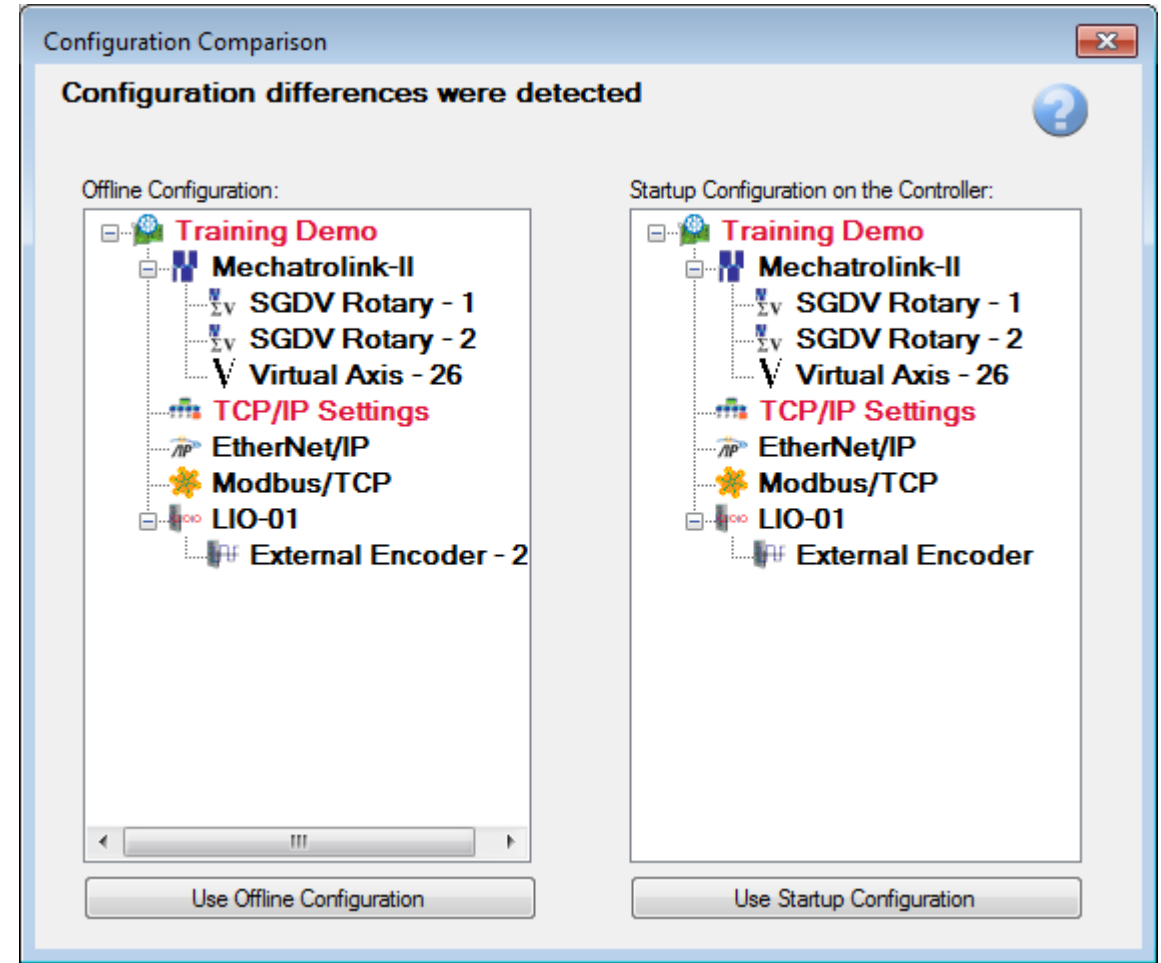
Offline  
or  
Online?



# Differences Detected

- *Scenario 3:*
  - *Customer wants to add axes. You opened the project and configured the new axes at the office. Now you're at the customer site.*

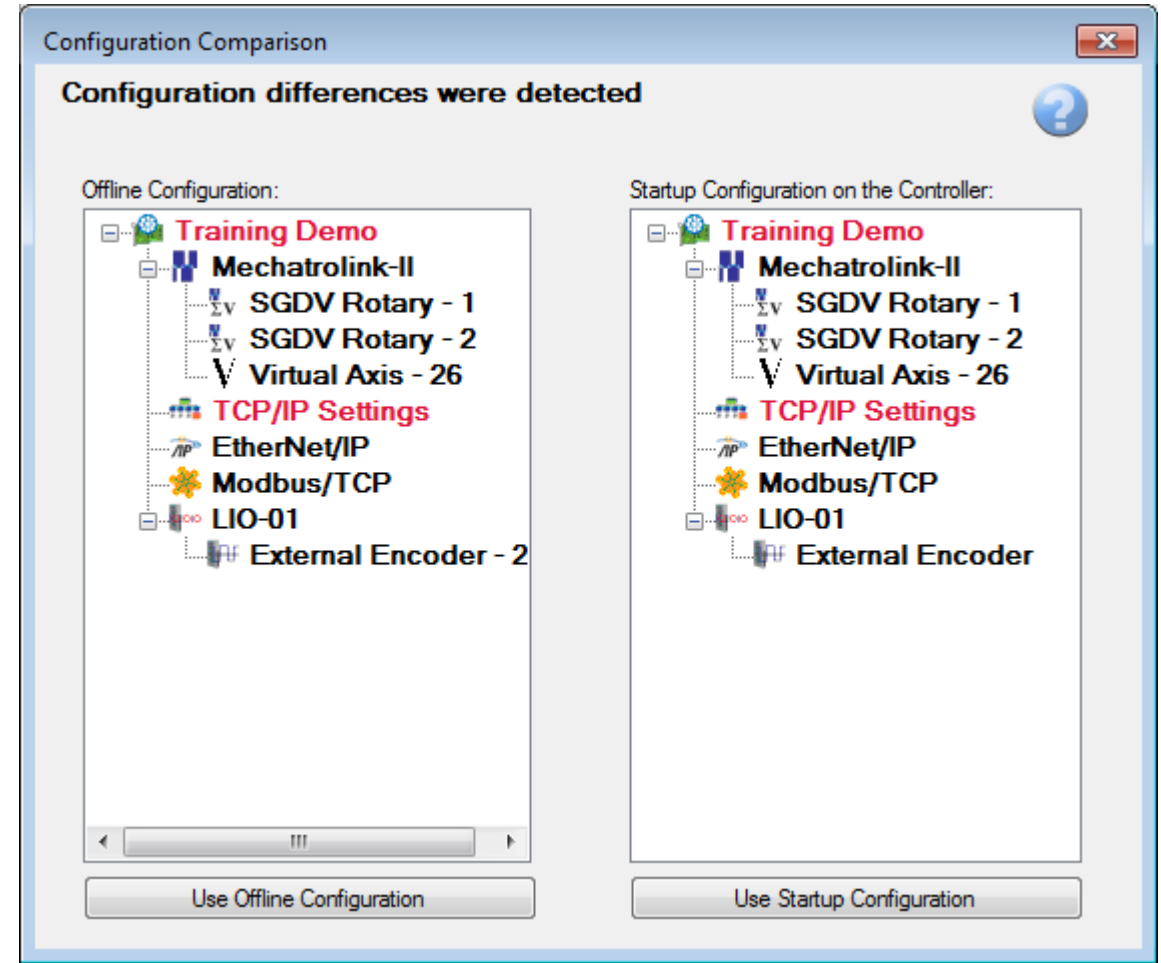
Offline  
or  
Online?



# Differences Detected

- *Scenario 4:*
  - *You're not sure if your project is the right version of what's on the machine.*

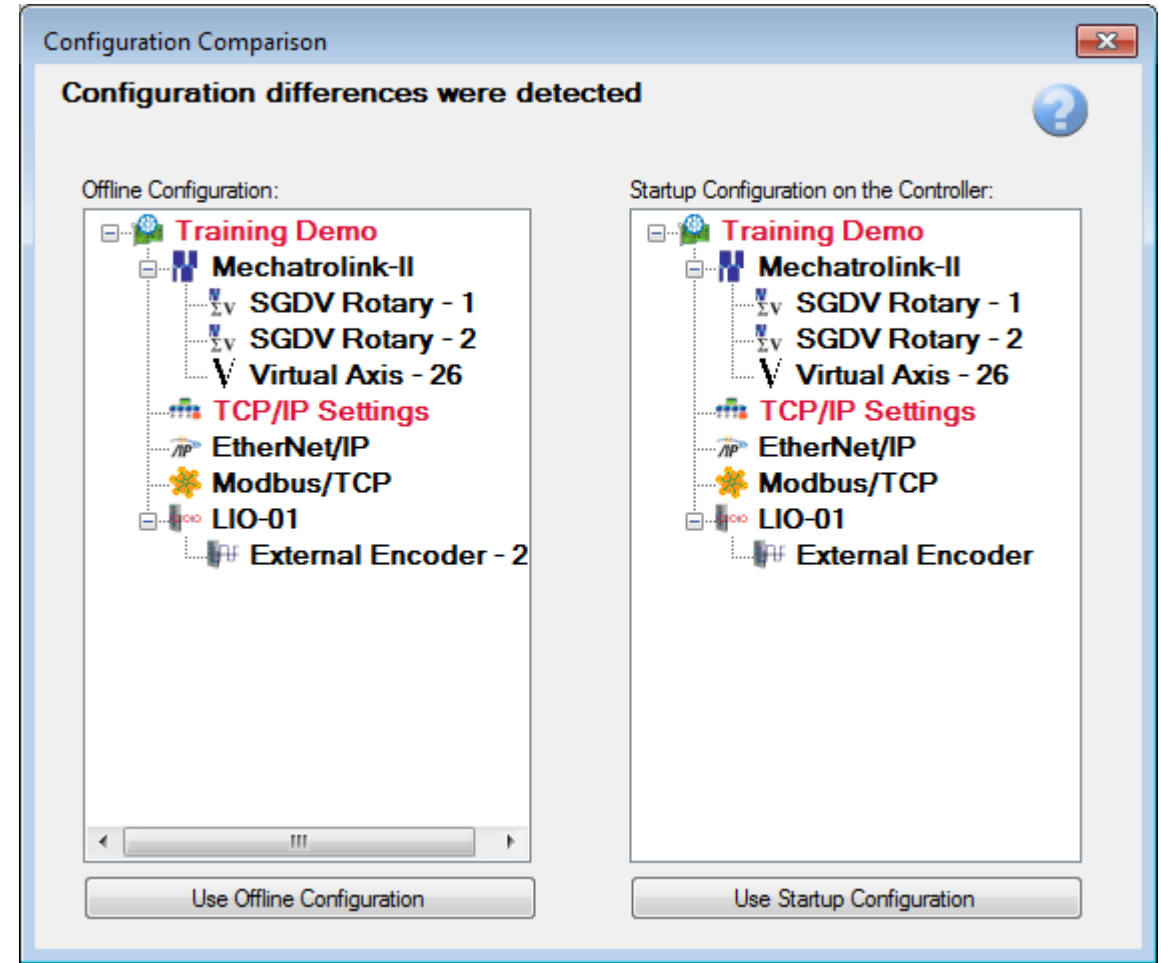
Offline  
or  
Online?



# Differences Detected

- *Scenario 5:*
  - *You just finished tuning the servos with SigmaWin+ (through the USB port) and many servopack parameters have been changed as a result.*

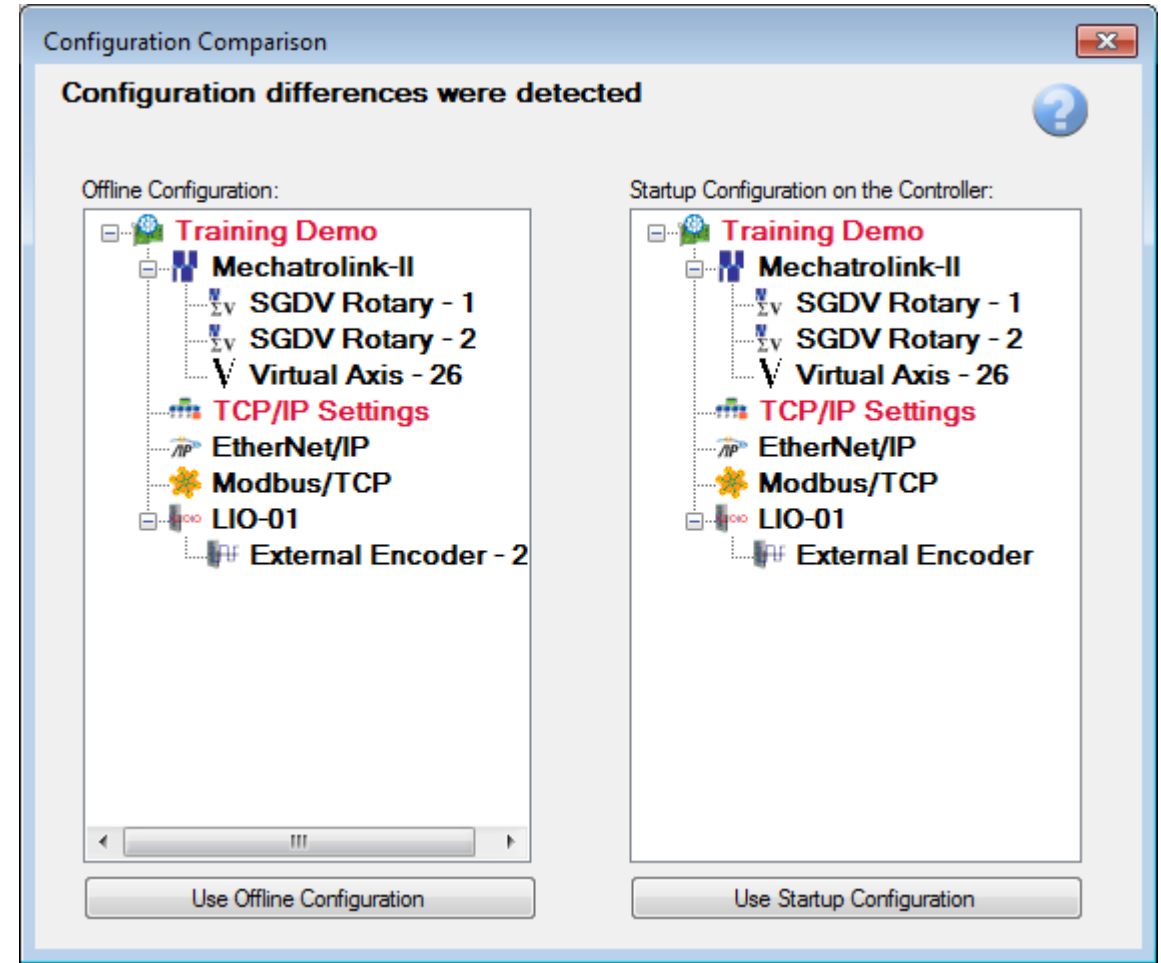
Offline  
or  
Online?



# Differences Detected

- *Scenario 6:*
  - *The machine is not working the same as it was before. You are sure you have open the correct project and configuration.*

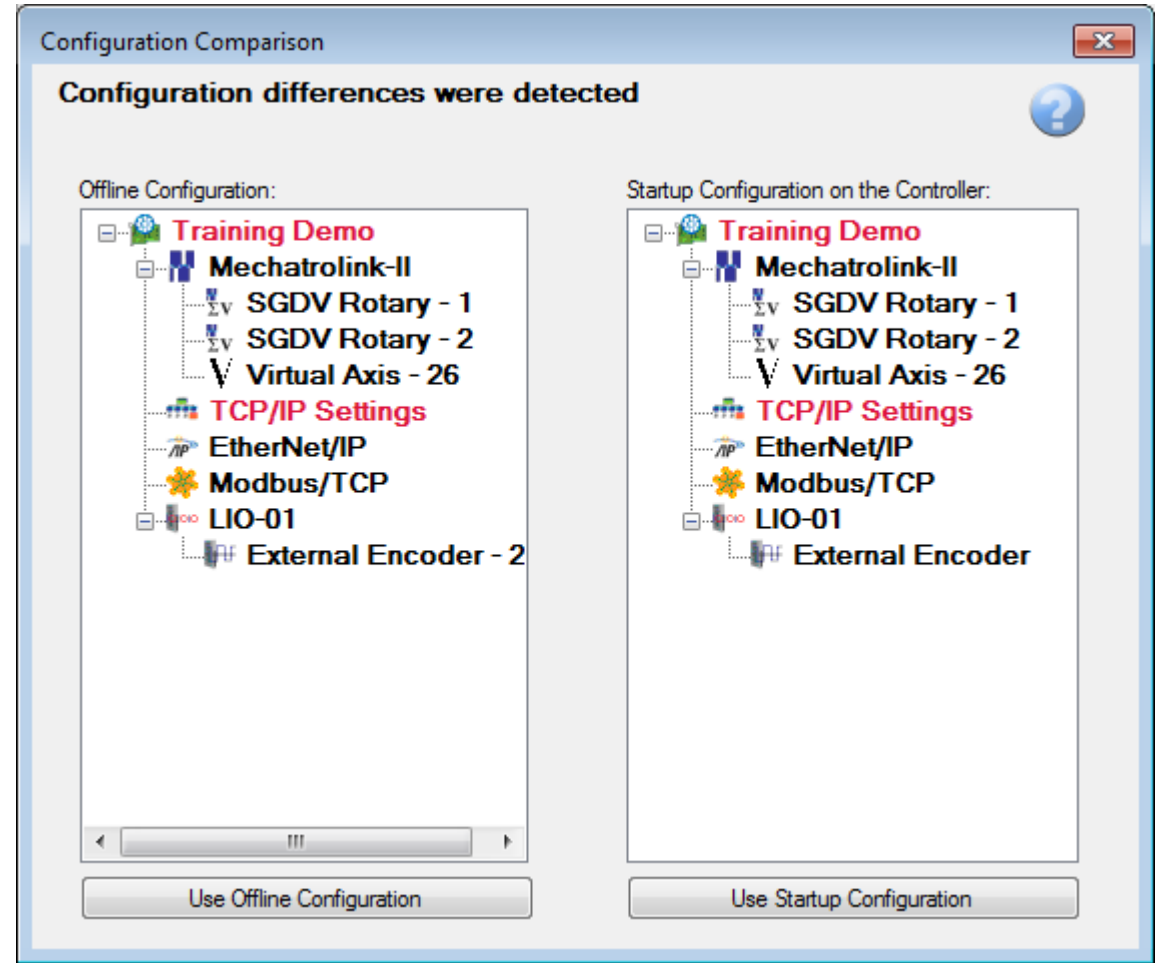
Offline  
or  
Online?



# Differences Detected

- *Scenario 7:*
  - *You started a blank project and will set the controller to factory default.*

Offline  
or  
Online?



# Factory Default

- eLV.Mpiec.01.ResetController
- eLV.Mpiec.01.ResetServo

## 2.6 Reset the MPiec controller back to factory settings

### KEY INFORMATION:

Required only when starting a new application with a controller that is not new. The controller, servopack and servomotor are reset individually in MotionWorks IEC



Reset MPiec Controller to Default in MotionWorks IEC

Yaskawa America

### Up Next

Autoplay



Reset Servos to Default in MotionWorks IEC

Yaskawa America  
189 views



MPiec Project Archive Startup

Yaskawa America  
226 views



MP2600iec Hardware Setup

Yaskawa America  
346 views



MPiec Firmware Update

Yaskawa America  
269 views



MP2300iec Hardware Setup

Yaskawa America  
668 views





# MotionWorks IEC Hardware Configuration

## Basic Axis Configuration

Hands-on Training Tutorial

- *Application Example*
- *Mechatrolink III*
- *Mechanical Configuration*
- *Servo Parameters*
- *Axis data copy/paste*
- *Rotary table*

# Online with Default Configuration

- Option1: Factory Default
  - eLV.Mpiec.01.ResetController
  - eLV.Mpiec.01.ResetServo
  
- *Option2: Demo Project with Defaults Saved*
  - *Open project HardwareConfig*
  - *Save as "BasicAxCnfg"*
  - *WebUI - Delete project archive (to delete any project running)*
  - *Go online in Hardware configuration*


# Mechatrolink-III

- *Communication Cycle*
  - *Set 1.0 [ms]*
  - *Advanced tab “max number of nodes”*
  - *Optimize for application*
- *Retries*
- *Response Time*
  - *Measured*

Resource : MP3300ec Online

Mechatrolink Set Parameters on Multiple Axes

Configuration **Advanced**

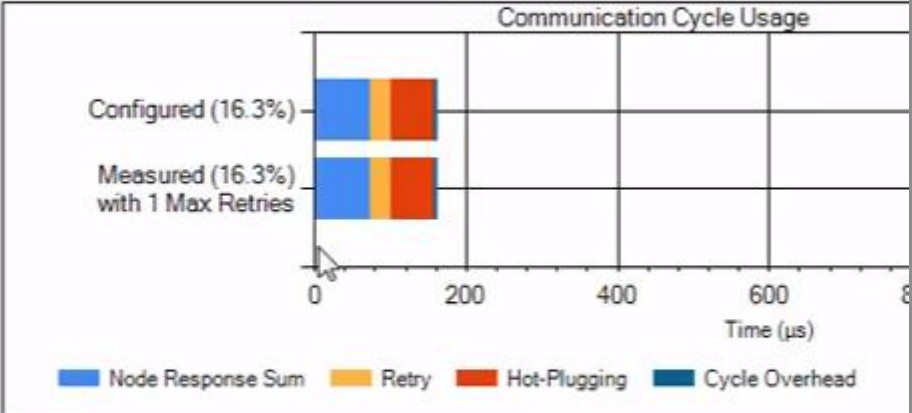


Communication Cycle  ms

Max Retries

Default Response Time   $\mu$ s

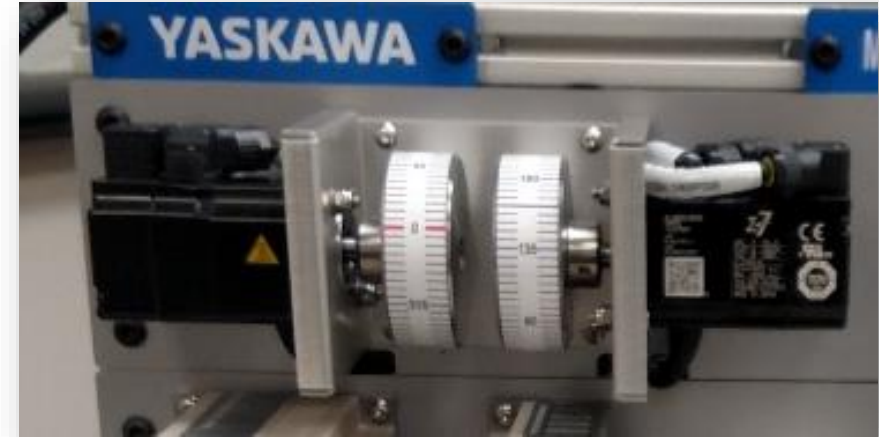
**Communication Cycle Usage**



Node #	Axis Name	Part	Node Type	Task	Configured Response Time ( $\mu$ s)	Measured Response Time ( $\mu$ s)
3	AXIS3	SGD7W	Mechatrolink III Servo	FastTsk	22.32	22.32
4	AXIS4	SGD7W	Mechatrolink III Servo	FastTsk	22.32	22.32
5	AXIS5	SGD7S	Mechatrolink III Servo	FastTsk	20.48	20.48

# Application Example

- *X Axis Actuator*
  - *Timing Belt*
  - *5 [mm] pitch*
  - *Drive pulley 72 teeth*
  - *Result:  $5 \times 72 = 360$  [mm/rev]*
- *Y Axis Actuator*
  - *Same as X*



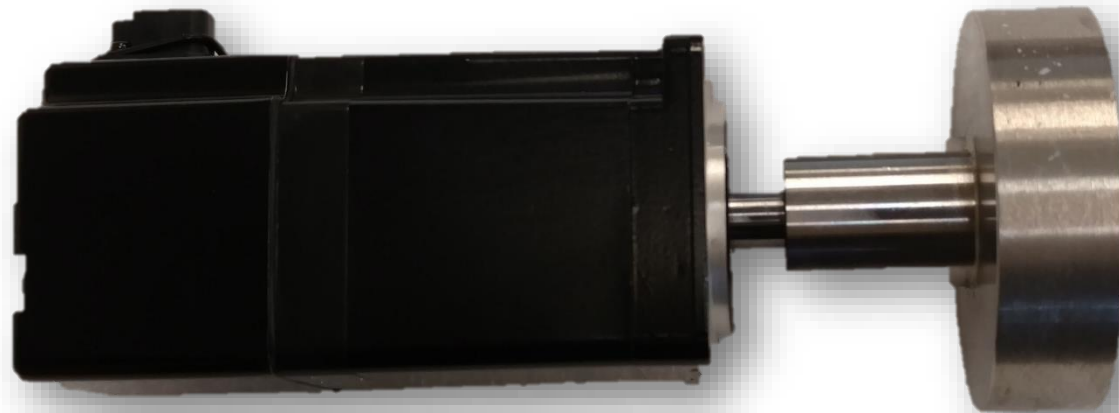
# Application Example

- *X and Y Axis Amplifier*
  - *SGD7W*
  - *200V*
  - *Wired for 1-phase*



# Application Example

- *Z Axis Actuator*
  - *Rotary Table*
  - *360 [degrees/rev]*



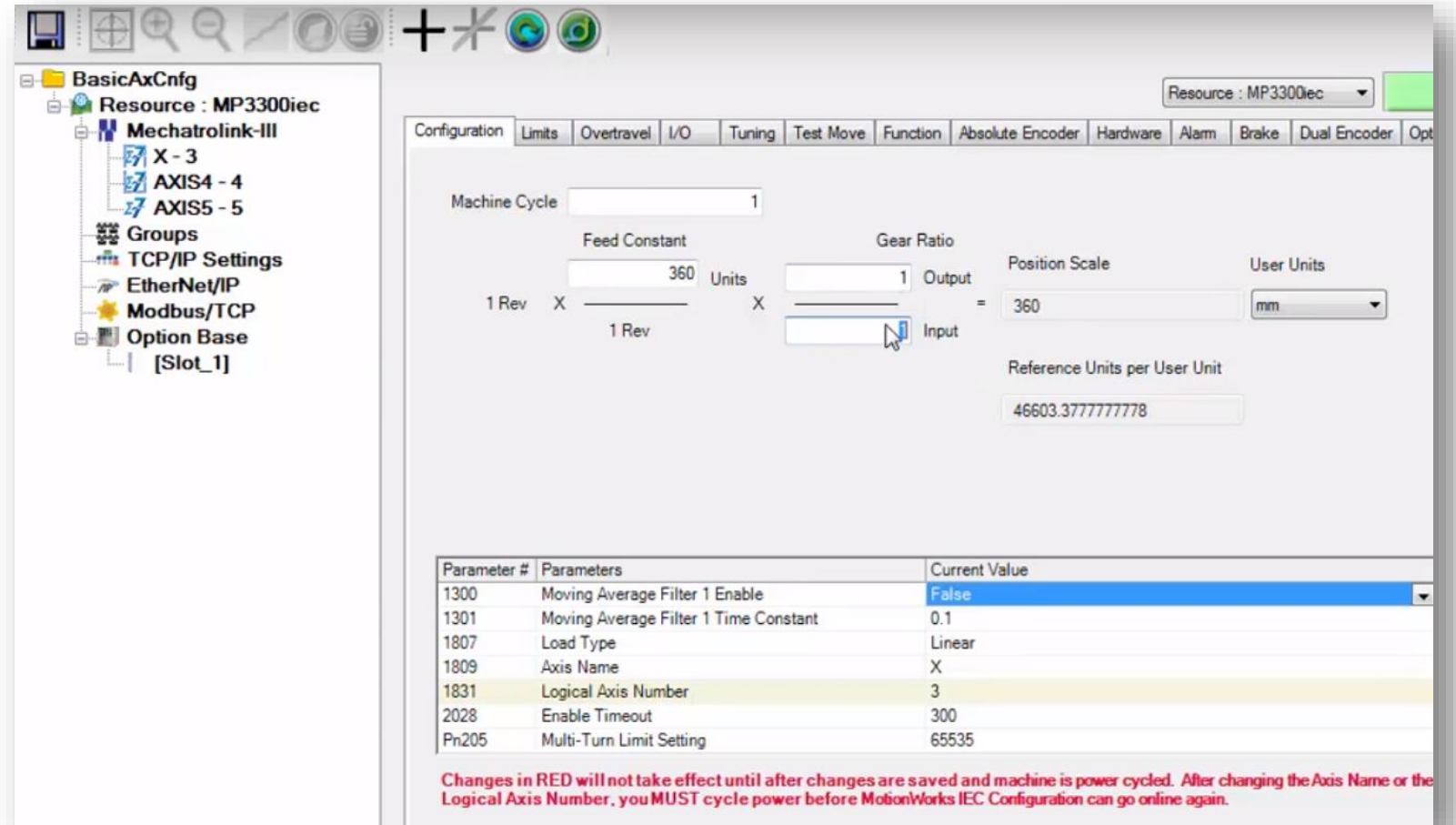
# Application Example

- *Z Axis Amplifier*
  - *SGD7S*
  - *100V*
  - *1-phase*



# X-Axis Belt Mechanical Configuration

- *Name: X*
- *Load Type : Linear*
- *User Unit: mm*
- *Feed Constant: 360*
- *Machine Cycle*
  - *Not Used with Linear load type*
  - *Used with Rotary load type*
  - *Distance moved to complete a cycle*
  - *Stations on a Rotary Table*
  - *Flighted Conveyor*



Resource : MP3300iec

Configuration Limits Overtravel I/O Tuning Test Move Function Absolute Encoder Hardware Alarm Brake Dual Encoder Opt

Machine Cycle

Feed Constant  Units  Output =  User Units

1 Rev X  1 Rev X  Input

Reference Units per User Unit

Parameter #	Parameters	Current Value
1300	Moving Average Filter 1 Enable	False
1301	Moving Average Filter 1 Time Constant	0.1
1807	Load Type	Linear
1809	Axis Name	X
1831	Logical Axis Number	3
2028	Enable Timeout	300
Pn205	Multi-Turn Limit Setting	65535

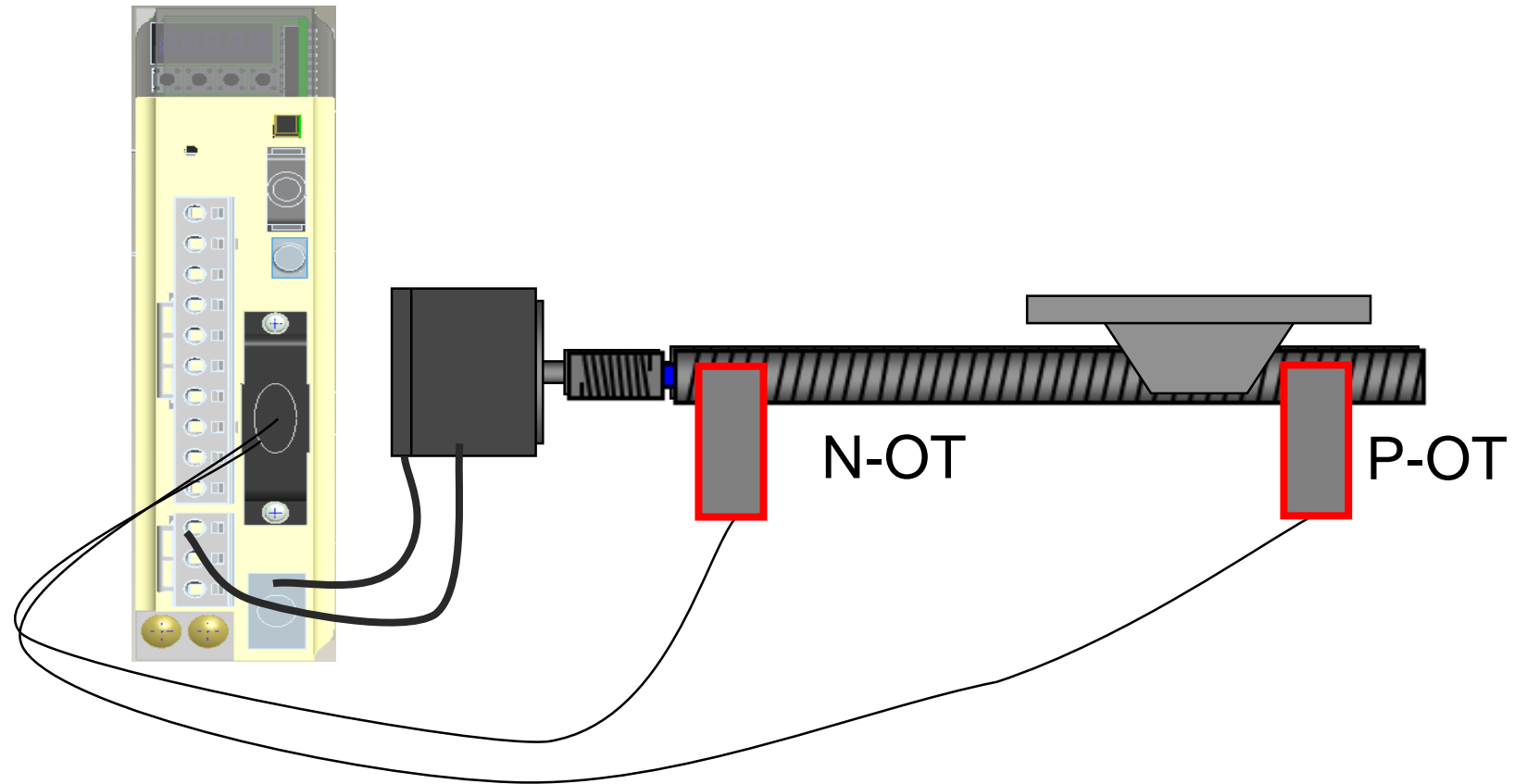
Changes in RED will not take effect until after changes are saved and machine is power cycled. After changing the Axis Name or the Logical Axis Number, you MUST cycle power before MotionWorks IEC Configuration can go online again.



# X-Axis Belt Servo Parameters

## Overtravel Tab

- *Pn50A.3*
  - *8 = disable*



# X-Axis Belt Servo Parameters

## Function Tab

- *Pn000.0*
  - *Direction*
  - *CCW forward*
- *Pn00B.3*
  - *200V Power*
  - *1-phase*

The screenshot displays the Yaskawa Servo Configuration software interface. On the left, a tree view shows the configuration structure: BasicAxCnfg > Resource : MP3300iec > Mechatrolink-III > X - 3 > AXIS4 - 4 > AXIS5 - 5 > Groups > TCP/IP Settings > EtherNet/IP > Modbus/TCP. The main window shows the 'Function' tab selected, with a table of parameters. The 'Resource' is set to 'MP3300iec' and the status is 'Online'. The table lists parameters Pn000.0, Pn001.2, Pn00B.2, and Pn600. The 'Current Value' for Pn00B.2 is set to '1 - Apply Single Phase Power'.

Parameter #	Parameters	Current Value	Units	Min
Pn000.0	Rotation/Movement Direction	0 - Set CCW (rotary motor) or direction encoder counts up (linear motor)		
Pn001.2	AC/DC Power Input Selection	0 - Input AC Power		
Pn00B.2	Power Selection	1 - Apply Single Phase Power		
Pn600	Regenerative Resistor Capacity	0	Watts	0

# X-Axis Belt Servo Parameters

## *Absolute Encoder Tab*

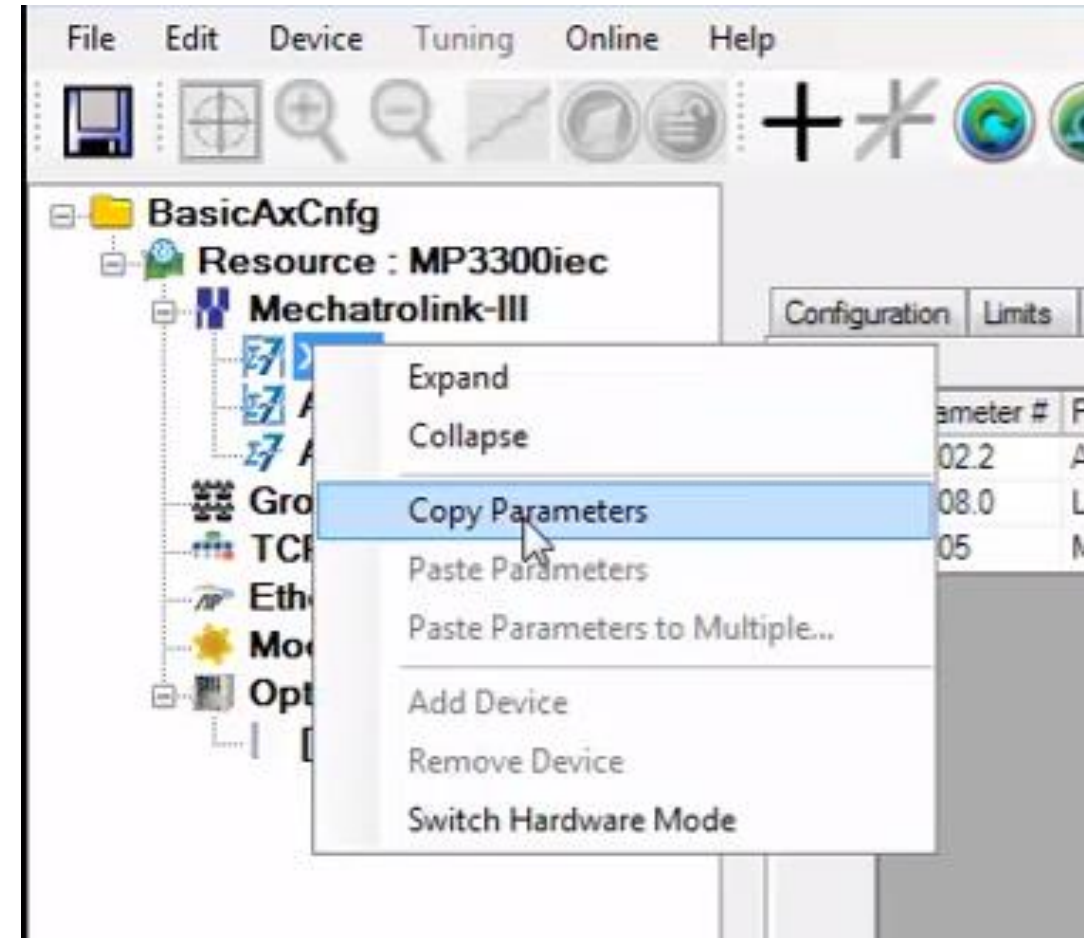
- *Pn002.0*
  - *Encoder*
  - *Incremental*

The screenshot shows the MotionWorks IEC 3 Pro - Hardware Configuration software interface. The left sidebar displays a tree view of the configuration structure, including 'BasicAxCnfg', 'Resource : MP3300iec', 'Mechatrolink-III', 'X - 3', 'AXIS4 - 4', 'AXIS5 - 5', 'Groups', 'TCP/IP Settings', 'EtherNet/IP', 'Modbus/TCP', and 'Option Base [Slot\_1]'. The main window is titled 'MotionWorks IEC 3 Pro - Hardware Configuration' and has a menu bar (File, Edit, Device, Tuning, Online, Help) and a toolbar. The 'Absolute Encoder' tab is selected, showing a table of parameters. The 'Current Value' column for parameter Pn002.2 is set to '0 - Use absolute encoder as absolute encoder', and a dropdown menu is open showing the option '1 - Use absolute encoder as incremental encoder' selected. Other parameters shown include Pn008.0 (Low Battery Voltage Alarm/Warning) and Pn205 (Multi-Turn Limit Setting). The 'Online' button is visible in the top right corner.

Parameter #	Parameters	Current Value	Units	Min
Pn002.2	Absolute Encoder Usage	0 - Use absolute encoder as absolute encoder		
Pn008.0	Low Battery Voltage Alarm/Warning	0 - Use absolute encoder as absolute encoder		
Pn205	Multi-Turn Limit Setting	1 - Use absolute encoder as incremental encoder		Limit 0
		2 - Use absolute encoder as single-turn absolute encoder (rotary motor only)		

# Copy/Paste Parameters

- *Right-click on axis in tree*
- *Paste X to Y*
- *Option: Paste Parameters to Multiple Axes*
  - *Matching hardware required*



# Y-Axis Belt Configuration & Parameters

- *Configuration*
  - *Axis Name: Y*
- *Parameters*
  - *Direction: CW*

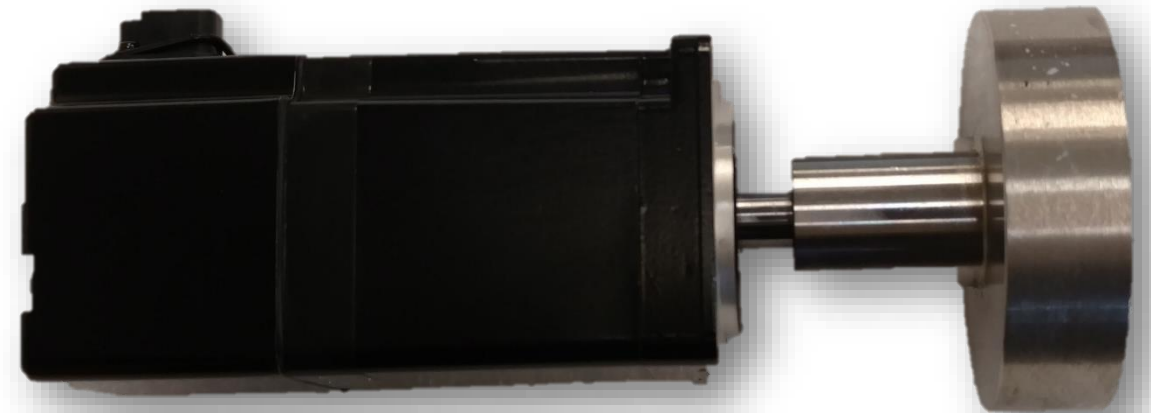
The screenshot displays the Yaskawa configuration software interface. On the left, a tree view shows the configuration structure under 'BasicAxCnfg' for 'Resource : MP3300iec'. The 'Mechatrolink-III' section is expanded, showing 'X - 3', 'Y - 4', and 'AXIS5 - 5'. Below this are 'Groups', 'TCP/IP Settings', 'EtherNet/IP', 'Modbus/TCP', and 'Option Base'. The main window shows the 'Function' tab selected, with a table of parameters. The 'Current Value' for Pn000.0 is set to 1, indicating CW rotation. The 'Units' column shows 'Watt' for Pn600.

Parameter #	Parameters	Current Value	Units
Pn000.0	Rotation/Movement Direction	1 - Set CW (rotary motor) or direction encoder counts down (linear n <sub>r</sub> )	
Pn001.2	AC/DC Power Input Selection	0 - Input AC Power	
Pn00B.2	Power Selection	1 - Apply Single Phase Power	
Pn600	Regenerative Resistor Capacity	0	Watt

# Z-Axis Rotary Table

## EXERCISE

- *Configure as direct drive rotary table*
  - *Name: Z*
  - *Units: degrees\**
  - *Over Travel: Used*
  - *Encoder: Incremental*
  - *Power: 100V*



*\*Hint: Set machine cycle*

# Z-Axis Rotary Table

## Solution

### ■ Configure the rotary table

- Name "Z"
- Load type Rotary
- Machine Cycle 360
- User Unit – deg
- Feed constant 360
- Gear: 1 to 1
- IO: Over Travel enable default
- Pn000.0=0
- Pn002.2= incremental
- Pn00B.3 = N/A

elp

Resource : MP3300ec

Configuration Limits Overtravel I/O Tuning Test Move Function Absolute Encoder Hardware Alarm Brake Dual Encoder Op

Machine Cycle 360

Feed Constant 360 Units

1 Rev X 1 Rev X

Gear Ratio 1 Output = 360 Input

Position Scale 360 User Units Degrees

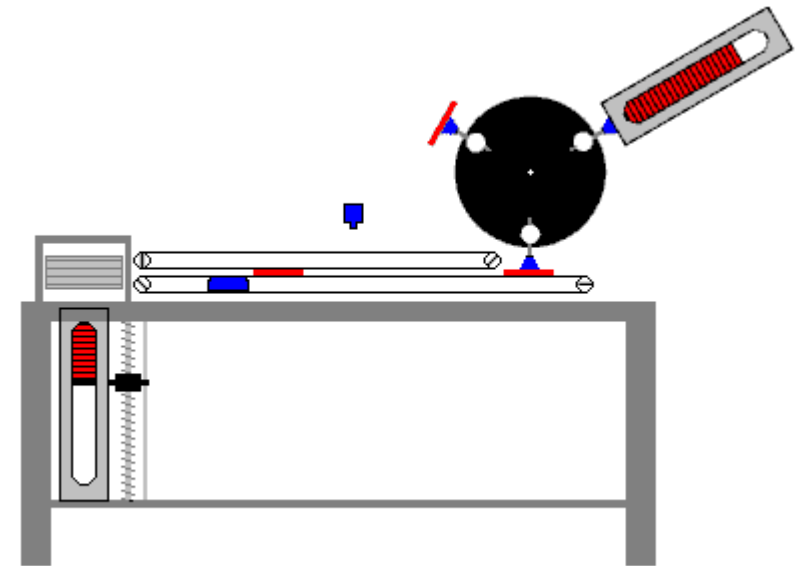
Reference Units per User Unit 46603.3777777778

Parameter #	Parameters	Current Value
1300	Moving Average Filter 1 Enable	False
1301	Moving Average Filter 1 Time Constant	0.1
1807	Load Type	Rotary
1809	Axis Name	Z
1831	Logical Axis Number	5
2028	Enable Timeout	300
Pn205	Multi-Turn Limit Setting	65535

# Rotary Table

## Extra Credit

- *If the Z axis was a rotary placer with a tool every 90 [deg], how might the configuration change?*
  - *Machine cycle 90 to simplify programming*





# Test Run

- *Online Save*
- *Reboot*
- *Test Move*
  - *See next video for details*
  - *Use Remote IO to see what happens if one or more Overtravel is not connected.*
- *Save project as ZWT*
  - *BasicAxCnfg*



# MotionWorks IEC Hardware Configuration **Servo Options**

Hands-on Training Tutorial

- *Overview*
- *Sigma-7 Product Manual*
- *Rules for Parameters*
- *Parameter Introduction*

# Overview

- *Requirements*
  - *Sigma-7 Product Manual*
  - *MotionWorks IEC*
    - » *BasicAxCnfg Project*
    - » *Optional Implementation*

# Sigma-7 Product Manual

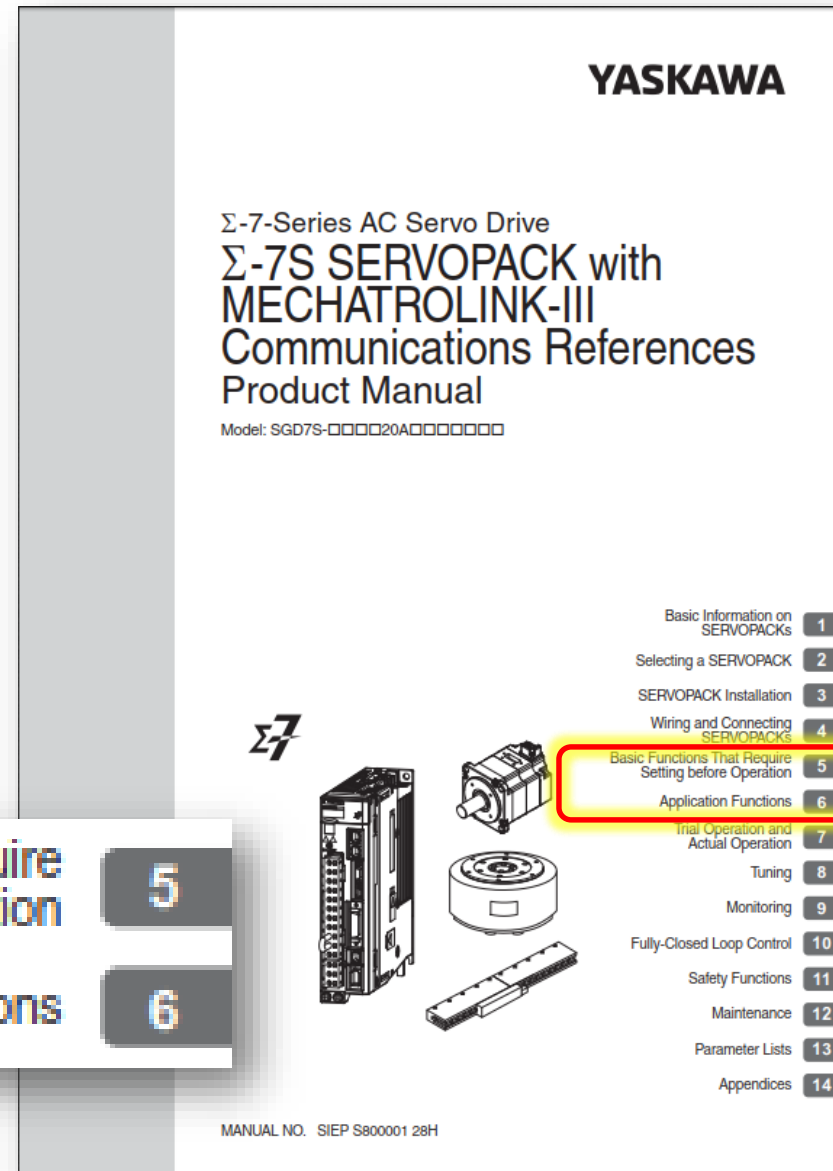
- *Yaskawa.com*
- *Document Number*
  - *SIEP S800001 28*
- *Version*
  - *H*
- *Chapter 5*
- *Chapter 6*

Basic Functions That Require  
Setting before Operation

5

Application Functions

6



# Rules for Parameters

- *Immediate effect?*
  - *Table in manual “when enabled”*
  - *Red text in Hardware Configuration*
- *Hardware Configuration Online Save for permanent change*
- *Reboot Controller also reboots Sigma-7*

## 5.1.1 Parameter Classification

There are the following two types of SERVOPACK parameters.

Classification	Meaning
Setup Parameters	Parameters for the basic settings that are required for operation.
Tuning Parameters	Parameters that are used to adjust servo performance.

**Information** The tuning parameters are not displayed by default when you use the Digital Operator. To display and set the tuning parameters, set Pn00B to n.□□□1 (Display all parameters).

Parameter	Meaning	When Enabled	Classification
Pn00B n.□□□0 (default setting)	Display only setup parameters.	After restart	Setup
n.□□□1	Display all parameters.		

# Parameter Introduction

1. *Input Power*
2. *Linear Motor*
3. *Holding Brake*
4. *Over Travel*
5. *Force Stop*
6. *Servo Off Stop*
7. *Alarm Stop*
8. *Safety Stop*
9. *Overload Detection*
10. *Electronic Gear*
11. *Absolute Encoder*
12. *Regen Resistor*
13. *Max Motor Speed*
14. *Encoder Pulse Output*
15. *Software Limits*
16. *Torque Limits*
17. *Vibration Detection*
18. *Motor Current Detection*

# 1. Input Power

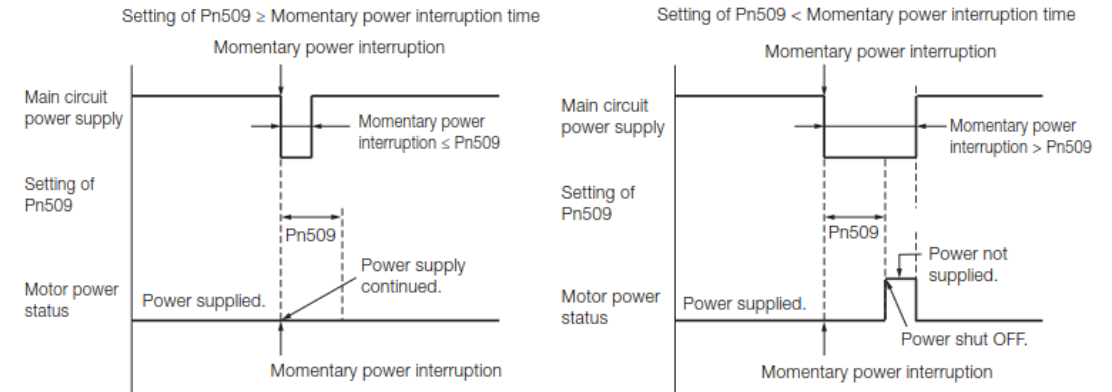
- *AC or DC Power (5.3)*
  - *Pn001*
- *1 phase 200V (5.3)*
  - *Pn00B*
- *Power Interruptions (6.2)*
  - *Pn509*
- *Low Voltage brownouts (6.3)*
  - *Semi F47*
  - *Pn008, Pn424, Pn425*

## 6.2 Operation for Momentary Power Interruptions

Even if the main power supply to the SERVOPACK is interrupted momentarily, power supply to the motor (servo ON status) will be maintained for the time set in Pn509 (Momentary Power Interruption Hold Time).

Pn509	Momentary Power Interruption Hold Time			Speed	Position	Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	20 to 50,000	1 ms	20	Immediately	Setup	

If the momentary power interruption time is equal to or less than the setting of Pn509, power supply to the motor will be continued. If it is longer than the setting, power supply to the motor will be stopped. Power will be supplied to the motor again when the main circuit power supply recovers.



## 2. Linear Motor

- *Encoder Pitch (5.6)*
  - *Pn282*
- *Phase, Polarity (5.9, 5.10)*
  - *Pn080*

### 5.6 Setting the Linear Encoder Pitch

If you connect a linear encoder to the SERVOPACK through a Serial Converter Unit, you must set the scale pitch of the linear encoder in Pn282.

If a Serial Converter Unit is not connected, you do not need to set Pn282.



Term

#### Serial Converter Unit

The Serial Converter Unit converts the signal from the linear encoder into a form that can be read by the SERVOPACK.

#### Scale Pitch

A linear encoder has a scale for measuring lengths (positions). The length of one division on this scale is the scale pitch.

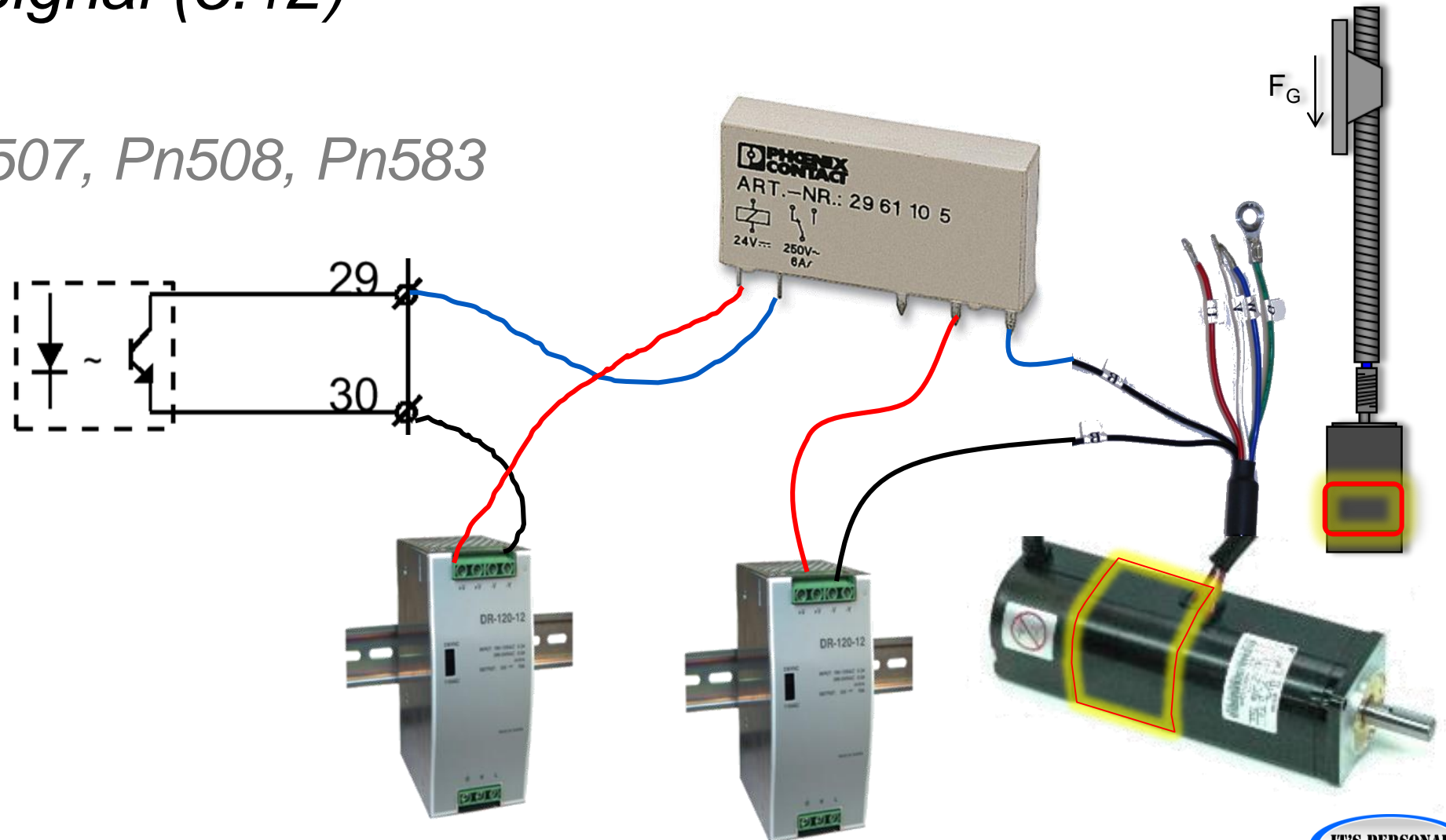
Pn282	Linear Encoder Scale Pitch				
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	0 to 6,553,600	0.01 $\mu\text{m}$	0	After restart	Setup



## 3. Holding Brake

### ■ /BK Output Signal (5.12)

- Pn50F
- Pn506, Pn507, Pn508, Pn583



## Quick Review (1 of 3)

- 1. What parameter allows the amplifier to be powered by wiring to a DC power supply?*
- 2. If the amplifier is connected to a linear motor, what parameter sets the linear encoder scale pitch?*
- 3. Which parameters control timing of the holding brake output?*

# Parameter Introduction

1. *Input Power*
2. *Linear Motor*
3. *Holding Brake*
4. *Over Travel*
5. *Force Stop*
6. *Servo Off Stop*
7. *Alarm Stop*
8. *Safety Stop*
9. *Overload Detection*
10. *Electronic Gear*
11. *Absolute Encoder*
12. *Regen Resistor*
13. *Max Motor Speed*
14. *Encoder Pulse Output*
15. *Software Limits*
16. *Torque Limits*
17. *Vibration Detection*
18. *Motor Current Detection*

## 4. Over-travel

- *Enable or Disable (5.11)*

- *Pn50A, Pn50B*

- *Stopping Method (5.11)*

- *Pn001*
- *Pn406*
- *Pn30A*

- *Warning A.090 (5.11)*

- *Pn00D*      New feature for Sigma-7  
Try it!

### 5.11.3 Motor Stopping Method for Overtravel

You can set the stopping method of the Servomotor when overtravel occurs in Pn001 = n.□□XX (Motor Stopping Method for Servo OFF and Group 1 Alarms and Overtravel Stopping Method).

	Parameter	Motor Stopping Method*	Status after Stopping	When Enabled	Classification
Pn001	n.□□00 (default setting)	Dynamic brake	Coasting	After restart	Setup
	n.□□01	Coasting			
	n.□□02		Coasting		
	n.□□1□	Deceleration according to setting of Pn406	Zero clamp		
	n.□□2□	Deceleration according to setting of Pn406	Coasting		
	n.□□3□	Deceleration according to setting of Pn30A	Zero clamp		
	n.□□4□	Deceleration according to setting of Pn30A	Coasting		

# 5. Force Stop

- *FSTP Input (6.13)*
  - *Pn516*
- *Stopping Method*
  - *Pn00A*
  - *Pn406*
  - *Pn30A*


New feature for Sigma-7

!!! Not SAFETY stop !!!

## 6.13.1 FSTP (Forced Stop Input) Signal

Classification	Signal	Connector Pin No.	Signal Status	Description
Input	FSTP	Must be allocated.	ON (closed)	Drive is enabled (normal operation).
			OFF (open)	The motor is stopped.

Note: You must allocate the FSTP signal to use it. Use Pn516 = n.□□□X (FSTP (Forced Stop Input) Signal Allocation) to allocate the FSTP signal to a connector pin. Refer to the following section for details.

 6.1.1 Input Signal Allocations on page 6-4

## 6.13.2 Stopping Method Selection for Forced Stops

Use Pn00A = n.□□X□ (Stopping Method for Forced Stops) to set the stopping method for forced stops.

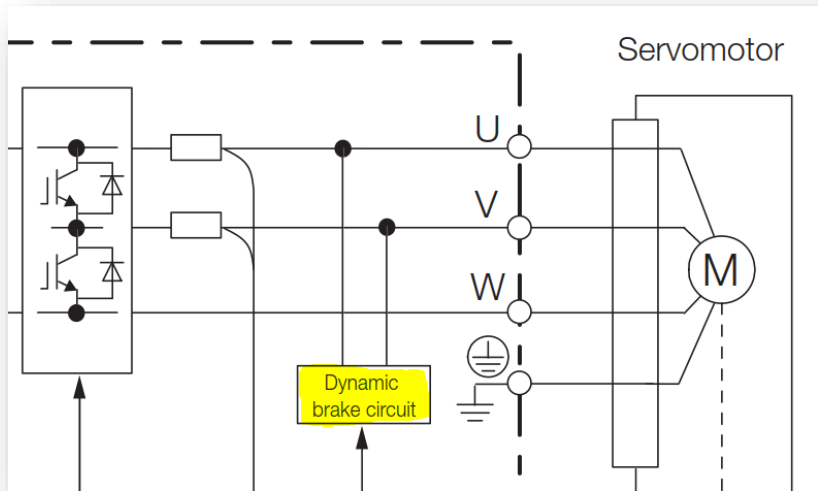
Parameter	Description	When Enabled	Classification
Pn00A	n.□□0□	After restart	Setup
	n.□□1□ (default setting)		
	n.□□2□		
	n.□□3□		
	n.□□4□		

Note: You cannot decelerate a Servomotor to a stop during torque control. For torque control, the Servomotor will be stopped with the dynamic braking or coast to a stop according to the setting of Pn001 = n.□□□X (Motor Stopping Method for Servo OFF and Group 1 Alarms).

# 6. Servo Off Stop

- *Stopping Method (5.13)*
  - *Pn001*

What is the Dynamic Brake?  
See section 2.2 Block Diagrams



## 5.13.1 Stopping Method for Servo OFF

Set the stopping method for when the servo is turned OFF in Pn001 = n.□□□X (Motor Stopping Method for Servo OFF and Group 1 Alarms).

Parameter	Servomotor Stopping Method	Status after Servomotor Stops	When Enabled	Classification
Pn001	n.□□□0 (default setting)	Dynamic brake	After restart	Setup
	n.□□□1			
	n.□□□2	Coasting		

Note: If Pn001 is set to n.□□□0 (Stop the motor by applying the dynamic brake) and the Servomotor is stopped or operates at a low speed, braking force may not be generated, just like it is not generated for coasting to a stop.

## 5.13.2 Servomotor Stopping Method for Alarms

There are two types of alarms, group 1 (Gr. 1) alarms and group 2 (Gr. 2) alarms. A different parameter is used to set the stopping method for alarms for each alarm type.

Refer to the following section to see which alarms are in group 1 and which are in group 2.

📖 12.2.1 List of Alarms on page 12-5

### Motor Stopping Method for Group 1 Alarms

When a group 1 alarm occurs, the Servomotor will stop according to the setting of Pn001 = n.□□□X. The default setting is to stop by applying the dynamic brake.

Refer to the following section for details.

📖 5.13.1 Stopping Method for Servo OFF on page 5-37

# 7. Alarm Stop

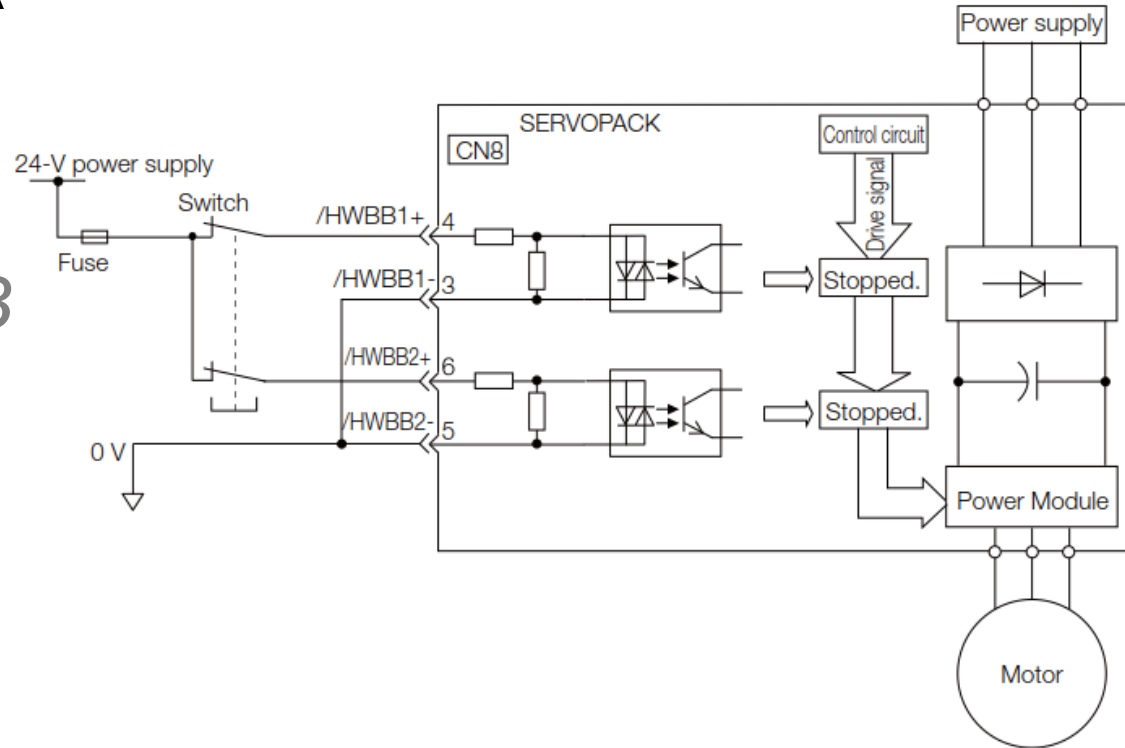
- *Group 1 – most severe (5.13)*
  - *Pn001*
- *Group 2 – less severe*
  - *Pn001*
  - *Pn00A*
  - *Pn00B*

Parameter			Servomotor Stopping Method	Status after Servomotor Stops	When Enabled	Classification	
Pn00B	Pn00A	Pn001					
n.□□□□ (default setting)	-	n.□□□0 (default setting)	Zero-speed stopping	Dynamic brake	After restart	Setup	
		n.□□□1		Coasting			
		n.□□□2		Coasting			
n.□□□□	-	n.□□□0 (default setting)	Dynamic brake	Dynamic brake			
		n.□□□1	Coasting	Coasting			
		n.□□□2	Coasting	Coasting			
n.□□□□	n.□□□□ (default setting)	n.□□□0 (default setting)	Dynamic brake	Dynamic brake			
		n.□□□1		Coasting			
		n.□□□2		Coasting			
	n.□□□□	n.□□□1	n.□□□0 (default setting)	Motor is decelerated using the torque set in Pn406 as the maximum torque.			Dynamic brake
			n.□□□1				Coasting
			n.□□□2				Coasting
	n.□□□□	n.□□□2	n.□□□0 (default setting)	Motor is decelerated according to setting of Pn30A.	Coasting		
			n.□□□1		Coasting		
			n.□□□2		Coasting		
	n.□□□□	n.□□□3	n.□□□0 (default setting)	Motor is decelerated according to setting of Pn30A.	Dynamic brake		
			n.□□□1		Coasting		
			n.□□□2		Coasting		
n.□□□□	n.□□□4	n.□□□0 (default setting)	Motor is decelerated according to setting of Pn30A.	Coasting			
		n.□□□1		Coasting			
		n.□□□2		Coasting			

# 8. Safety Stop

## Hard Wire Base Block (11.2)

- *Pn001*
- *Global Variable \_HBB*
- *CN-8*



X_HBB	BOOL	VAR_GLOBAL	HBB, Stop Signal Input
-------	------	------------	------------------------



## Quick Review (2 of 3)

1. *What parameter selects the stopping method for stopping at over-travel sensors?*
2. *What parameter selects the stopping method for Forced Stop input?*
3. *What parameter selects the stopping method for Servo Off stop?*
4. *What parameter selects the stopping method for Alarm Stop?*
5. *What parameter selects the stopping method for Safety Stop?*

# Parameter Introduction

1. *Input Power*
2. *Linear Motor*
3. *Holding Brake*
4. *Over Travel*
5. *Force Stop*
6. *Servo Off Stop*
7. *Alarm Stop*
8. *Safety Stop*
9. *Overload Detection*
10. *Electronic Gear*
11. *Absolute Encoder*
12. *Regen Resistor*
13. *Max Motor Speed*
14. *Encoder Pulse Output*
15. *Software Limits*
16. *Torque Limits*
17. *Vibration Detection*
18. *Motor Current Detection*

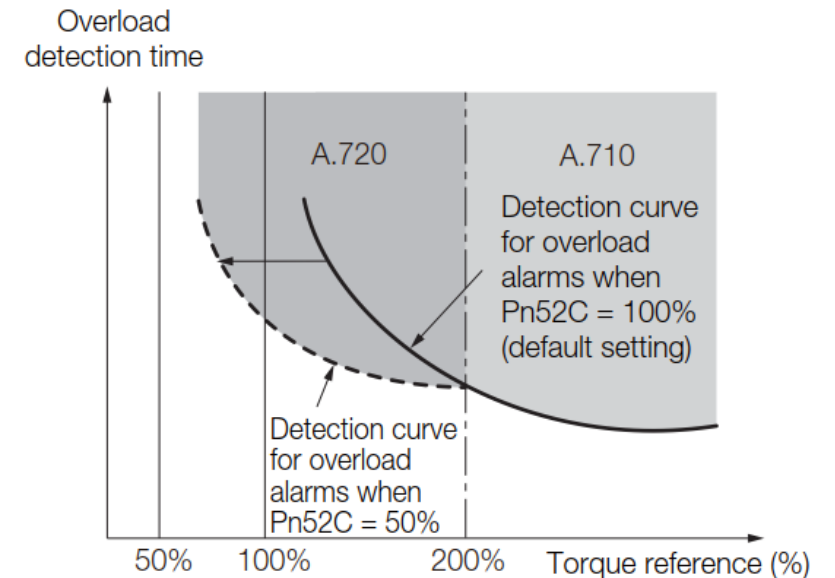
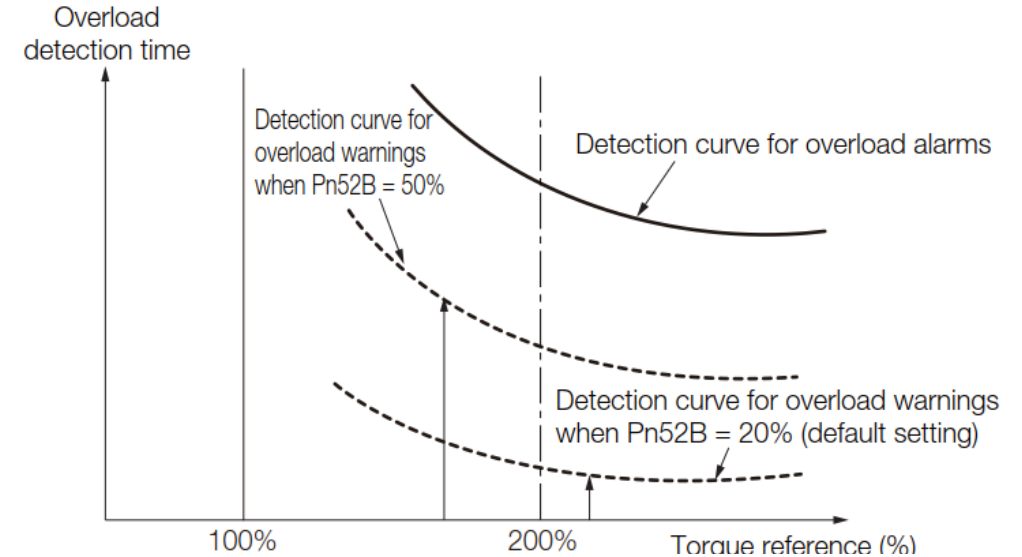
## 9. Overload Detection

### ■ *Overload Warning Level (5.14)*

- *Pn52B*
- *Time before A.910 displayed*

### ■ *Overload Alarm*

- *Pn52C*
- *De-rate motor to prevent overheat*



## 10. Electronic Gear

- *Encoder pulses per motor rotation*
  - *Pn20E*
  - *Hardware Configuration automatically sets Pn20E=1*
- *Command pulses per motor rotation*
  - *Pn210*
  - *Hardware Configuration automatically sets Pn210=1*

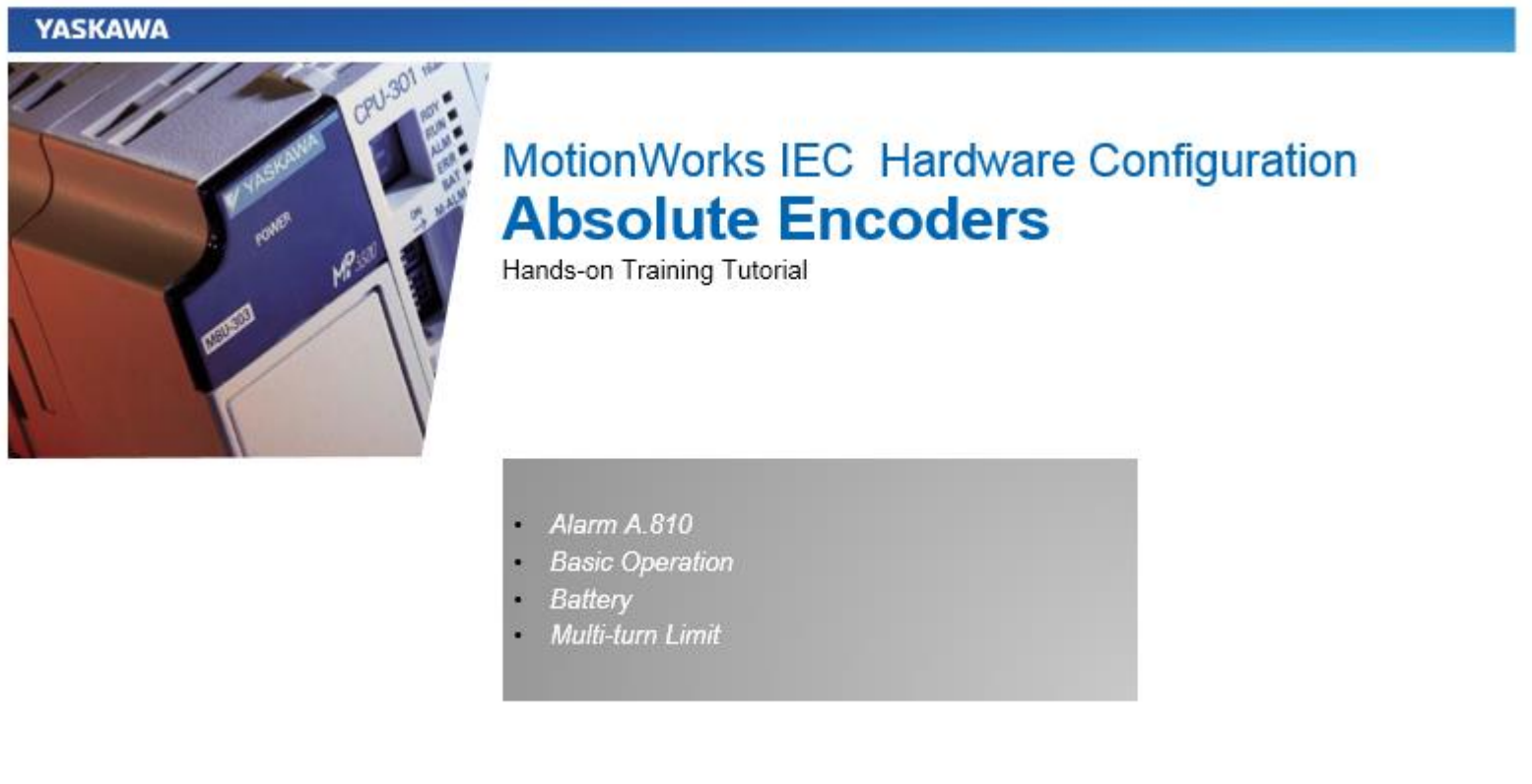
Essentially, this feature is not used by the MPiec controller because it calculates the units internally.

Still these parameters are important because they define the “reference unit” used by other parameters. The reference unit is 1 encoder pulse for an MPiec system.

Pn20E	Electronic Gear Ratio (Numerator)				Position
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 1,073,741,824	1	16	After restart	Setup
Pn210	Electronic Gear Ratio (Denominator)				Position
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification
	1 to 1,073,741,824	1	1	After restart	Setup

# 11. Absolute Encoder

- *Reset the Absolute Encoder*
  - *A.810, A.820*
- *Set the Multi-Turn Limit*
  - *Pn205*
  - *A.CC0*



The image shows a slide from a training tutorial. On the left is a photograph of a YASKAWA servo motor with a blue absolute encoder. The encoder has labels for 'YASKAWA', 'POWER', 'MP', and 'CPU-301'. To the right of the photo is the title 'MotionWorks IEC Hardware Configuration Absolute Encoders' and the subtitle 'Hands-on Training Tutorial'. Below this is a grey box containing a list of topics: Alarm A.810, Basic Operation, Battery, and Multi-turn Limit.

**MotionWorks IEC Hardware Configuration**  
**Absolute Encoders**  
Hands-on Training Tutorial

- Alarm A.810
- Basic Operation
- Battery
- Multi-turn Limit

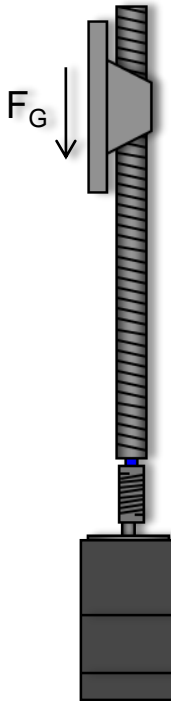
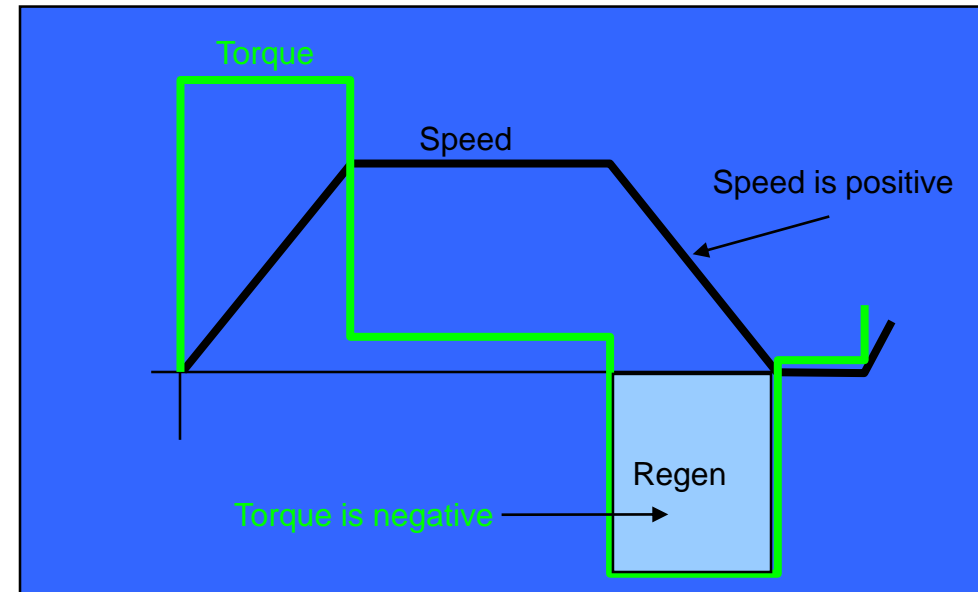
The next section is devoted to Absolute Encoders

## 12. Regenerative Resistor

- *Regen Power (5.18)*
  - *Pn600*
- *Regen Resistance*
  - *Pn603*
- *Sigma Select software sizes the resistor*

### Factors that Increase Regen

- High Speed
- High Inertia
- High Deceleration Rate
- Vertical Applications
- Low Friction



“Regeneration” means that the motor is generating energy rather than using energy. This happens during deceleration because the load forces the motor to move in the direction opposite to that in which torque is being applied.

# 13. Motor Maximum Speed

- *Motor Maximum Speed (6.4)*
  - *Pn316*
  - *Pn385 (linear motor)*
  - *A.510 Overspeed*

## 6.4 Setting the Motor Maximum Speed

You can set the maximum speed of the Servomotor with the following parameter.

- Rotary Servomotors

Pn316	Maximum Motor Speed			Speed	Position	Torque
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 65,535	1 min <sup>-1</sup>	10,000	After restart	Setup	

- Linear Servomotors

Pn385	Maximum Motor Speed			Speed	Position	Force
	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	1 to 100	100 mm/s	50	After restart	Setup	

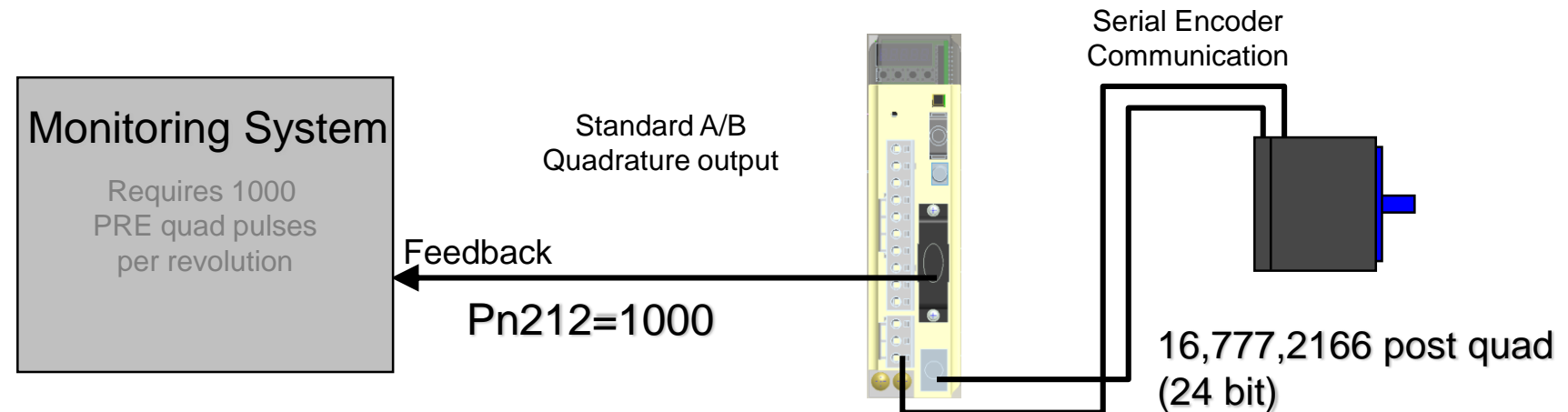
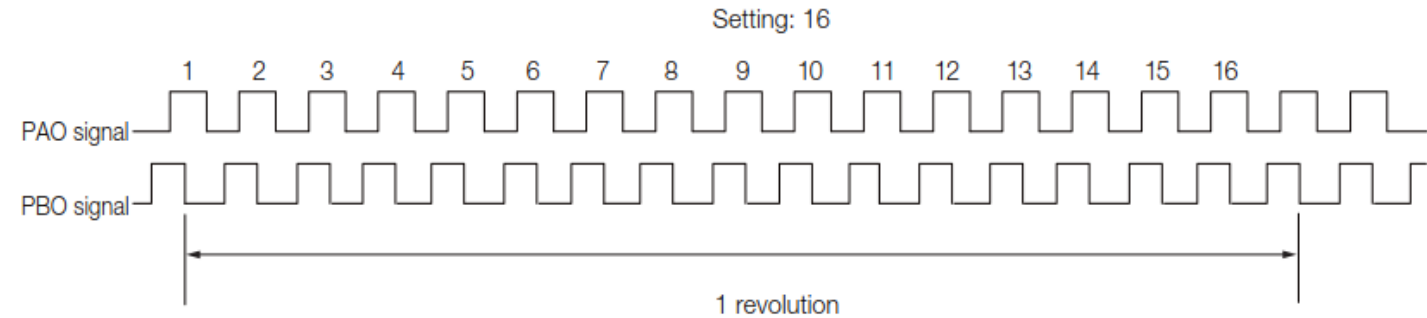
You can achieve the following by lowering the maximum speed of the Servomotor.

- If the motor speed exceeds the setting, an A.510 alarm (Overspeed) will occur.

# 14. Encoder Pulse Output

## Position Feedback Resolution to another device (6.5)

- *Pn212, Pn081*
- *Phase A: CN1-17,18*
- *Phase B: CN1-19,20*
- *Phase C: CN1-21,22*





# 15. Software Limits

- *Servo Software Limits NOT USED by MPiec (6.6)*

- *Pn804, Pn806, Pn801*

Software limit defines the maximum absolute position possible.

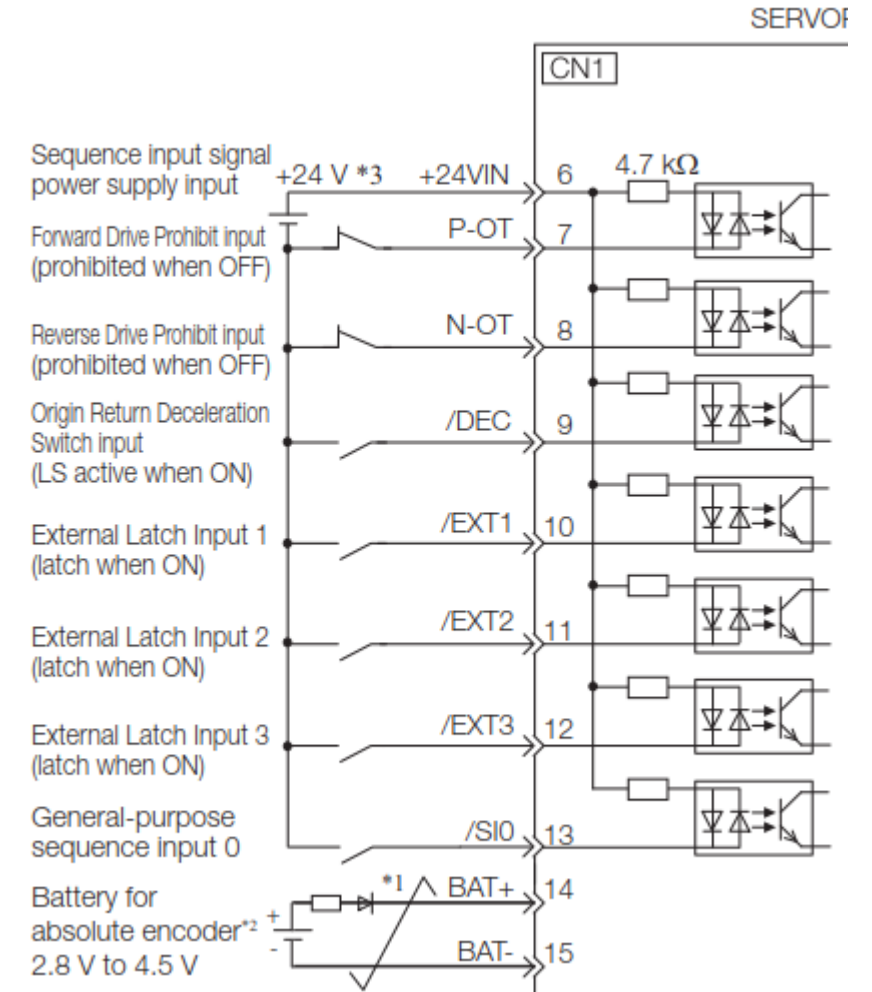
- *MPiec controller handles software limits*

Parameter #	Parameters	Current Value	Units	Min	Max	Default Value
1200	Limit Position Negative	-1.797693E+308	mm	-1.797693E+308	1.797693E+308	-1.797693E+308
1201	Limit Position Positive	1.797693E+308	mm	-1.797693E+308	1.797693E+308	1.797693E+308
1202	Limit Position Enable	True				True
Pn402	Positive Torque Limit	800	% Motor Rated Torque	0	800	800
Pn403	Negative Torque Limit	800	% Motor Rated Torque	0	800	800
Pn407	Speed Limit during Torque Control	10000	per minute	0	10000	10000
Pn408.1	Speed Limit	0 - Use Smaller of Motor M				0 - Use Smaller of Motor M
Pn520	Excessive Position Error Alarm Level	5242880	ref units	1	1073741823	5242880

1.79E+308 [mm] is approximately 1.0E+290 light years!

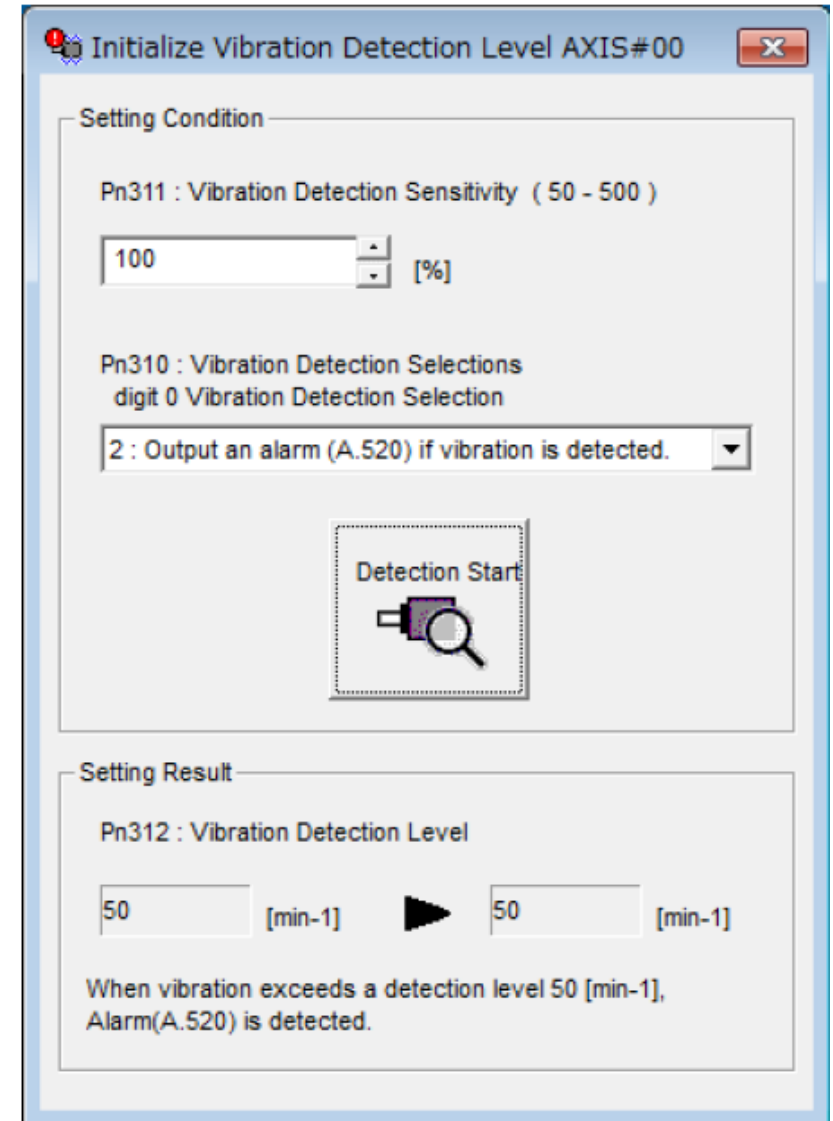
# 16. Torque Limits

- *Internal Torque Limits (6.7)*
  - *Pn402, Pn403*
  - *Pn483, Pn484 (linear motor)*
  - *Parameters can be changed by MPiEc during code execution*
- *External Torque Limits*
  - *Pn50B input allocation*
    - » *Turn on/off torque limit via servo input*
  - *Pn404, Pn405*



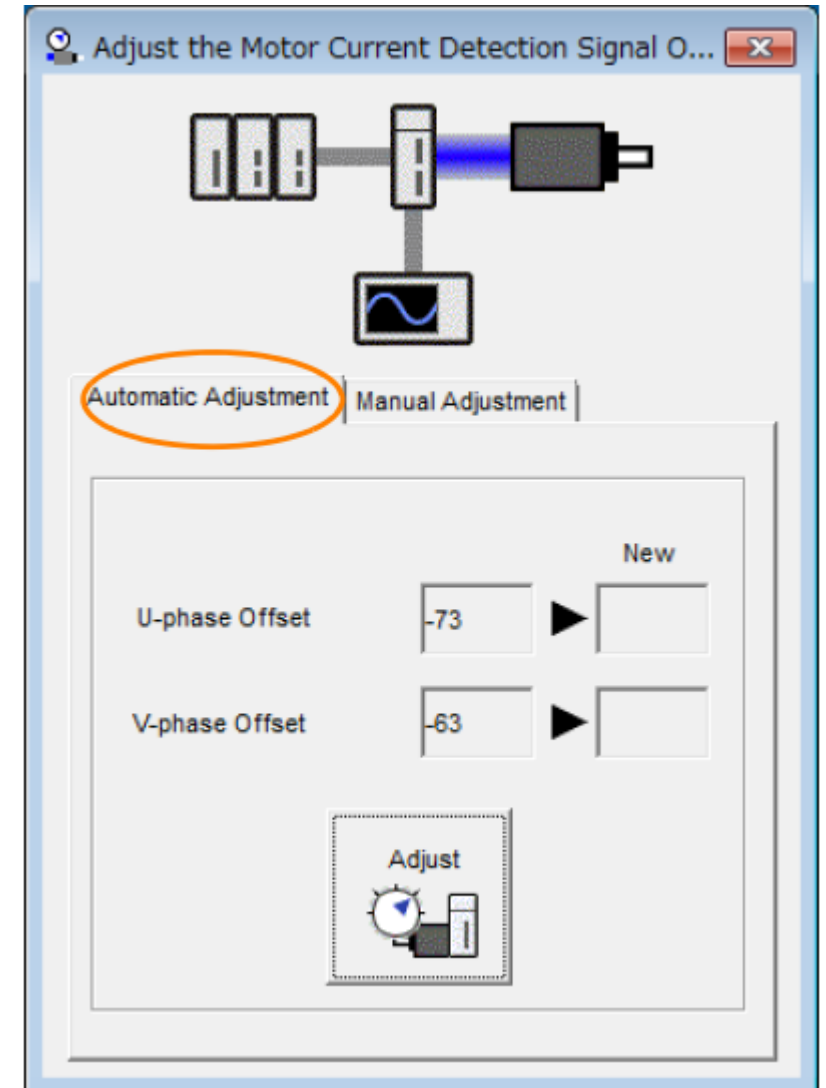
# 17. Vibration Detection

- *Detect Vibration (6.11)*
  - *Pn310*
- *Alarm or Warning*
  - *A.911*
  - *A.510*
- *Sensitivity*
  - *Pn311*
- *Detection Level*
  - *Pn312*
- *Use SigmaWin+ to set after tuning is complete*



# 18. Motor Current Detection

- *Reduces torque ripple*
- *Not normally required*
- *No parameters*
- *Use SigmaWin+ to calibrate*



## Quick Review (3 of 3)

- 1. What parameter can be used to de-rate the motor's torque below 100%?*
- 2. What parameters configure the amplifier for the connected regeneration resistor?*
- 3. What parameters can limit the motor maximum speed?*
- 4. What parameters can limit the motor maximum torque?*

# Conclusion

- *Many Sigma-7 parameters!*
- *Use the product manual*
- *Implement parameter of interest*

Parameter #	Parameters	Current Value	Units	Min	Max	Default Value
Pn308	Speed Feedback Filter Time Constant	0				0
Pn30A	Deceleration Time for Servo OFF and Forced Stops	0	ms from	0	10000	0
Pn30B	Reserved (Do not change.)	0				0
Pn30C	Speed Feedforward Average Movement Time	0.0	ms	0.0	510.0	0.0
Pn310.0	Vibration Detection Switch	0 - No detection				0 - No detection
Pn310.1	Reserved (Do not change.)	0 - Reserved (Do not change.)				
Pn310.2	Reserved (Do not change.)	0 - Reserved (Do not change.)				
Pn310.3	Reserved (Do not change.)	0 - Reserved (Do not change.)				
Pn311	Vibration Detection Sensibility	100	%	50	500	100
Pn312	Vibration Detection Level	50	per minut	0	5000	50
Pn316	Maximum Motor Speed	10000	RPM	0	65535	10000
Pn324	Moment of Inertia Calculating Start Level	300	%	0	20000	300
Pn401	Torque/Force Reference Filter Time Constant	1.00	ms	0.00	655.3	1.00
Pn402	Positive Torque Limit	800	% Motor	0	800	800
Pn403	Negative Torque Limit	800	% Motor	0	800	800
Pn404	Positive External Torque/Force Limit	100	% Motor	0	800	100
Pn405	Negative External Torque/Force Limit	100	% Motor	0	800	100
Pn406	Emergency Stop Torque/Force	800	% Motor	0	800	800
Pn407	Speed Limit during Torque Control	10000	per minut	0	10000	10000
Pn408.0	1st Step Notch Filter	0 - Disabled				0 - Disabled
Pn408.1	Speed Limit	0 - Use Smaller of Motor Maximum Speed or Speed Limit during Torque				0 - Use Smaller of Motor Maximum
Pn408.2	2nd Step Notch Filter	0 - Disabled				0 - Disabled
Pn408.3	Friction Compensation Function	0 - Disabled				0 - Disabled
Pn409	1st Notch Filter Frequency	5000	Hz	50	5000	5000
Pn40A	1st Notch Filter Q Value	0.70		0.50	10.00	0.70
Pn40R	1st Notch Filter Depth	0.000		0.000	1.000	0.000



**EASY TO WORK  
WITH**

**ENGINEERING  
EXPERTISE**

**YASKAWA**



**QUALITY  
PRODUCT**

**TECHNOLOGICAL  
INNOVATION**



# MotionWorks IEC Hardware Configuration

## Absolute Encoders

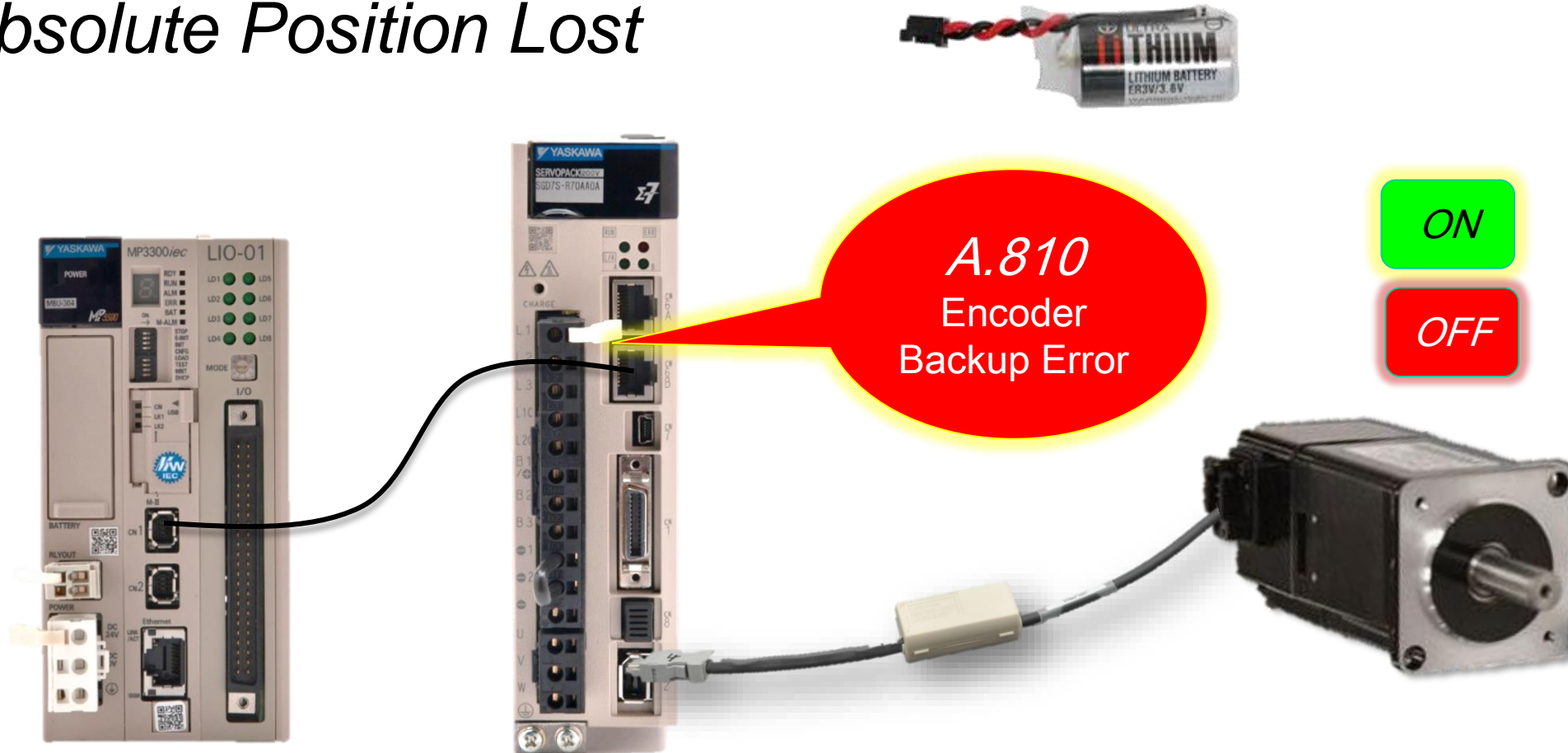
Hands-on Training Tutorial

- *Alarm A.810*
- *Basic Operation*
- *Battery*
- *Multi-Turn Limit*

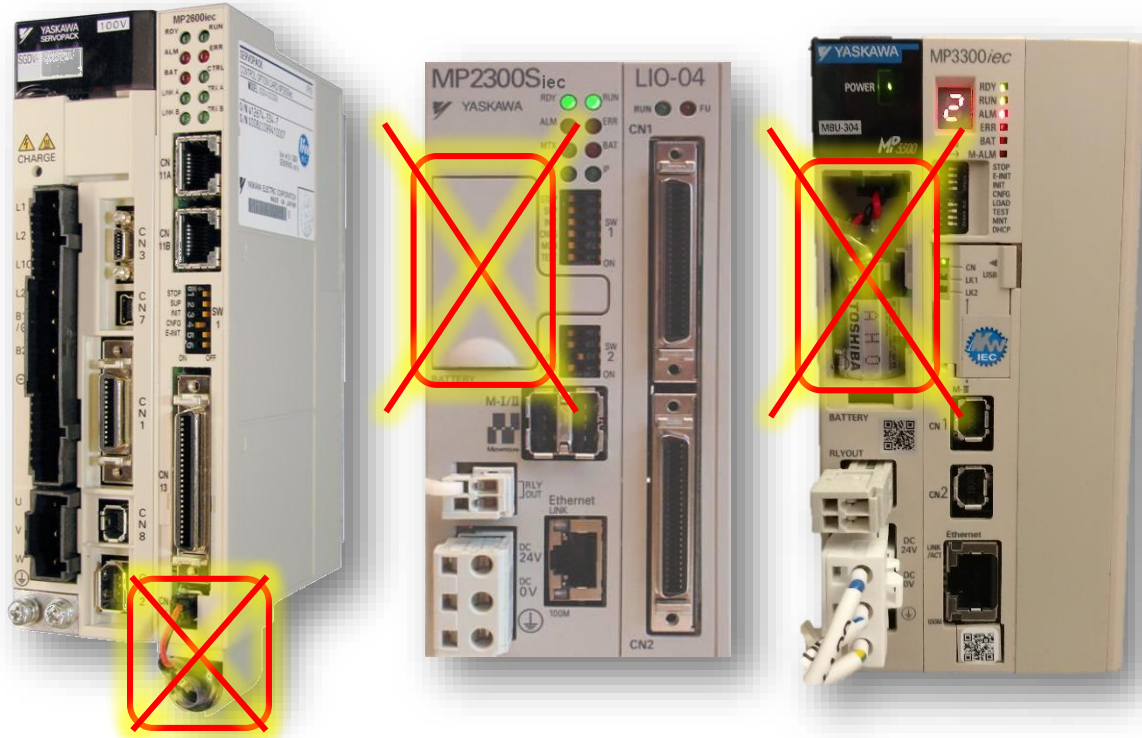


# Alarm A.810

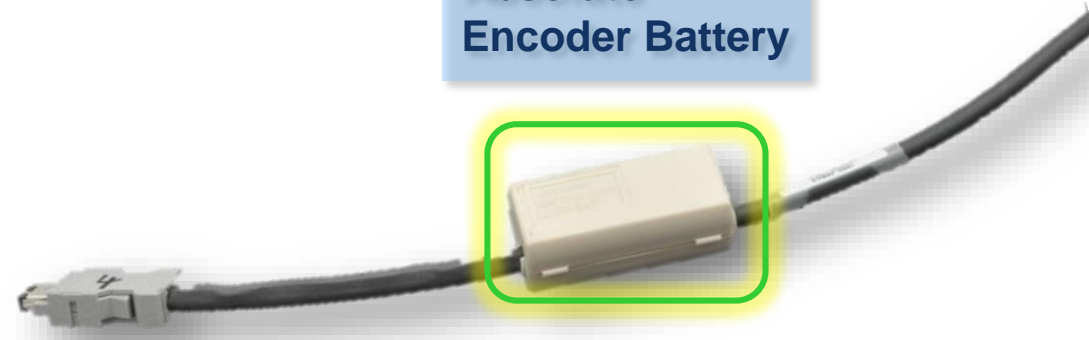
- *Encoder Battery Backup Lost*
- *Absolute Position Lost*



# Alarm A.810



Absolute Encoder Battery



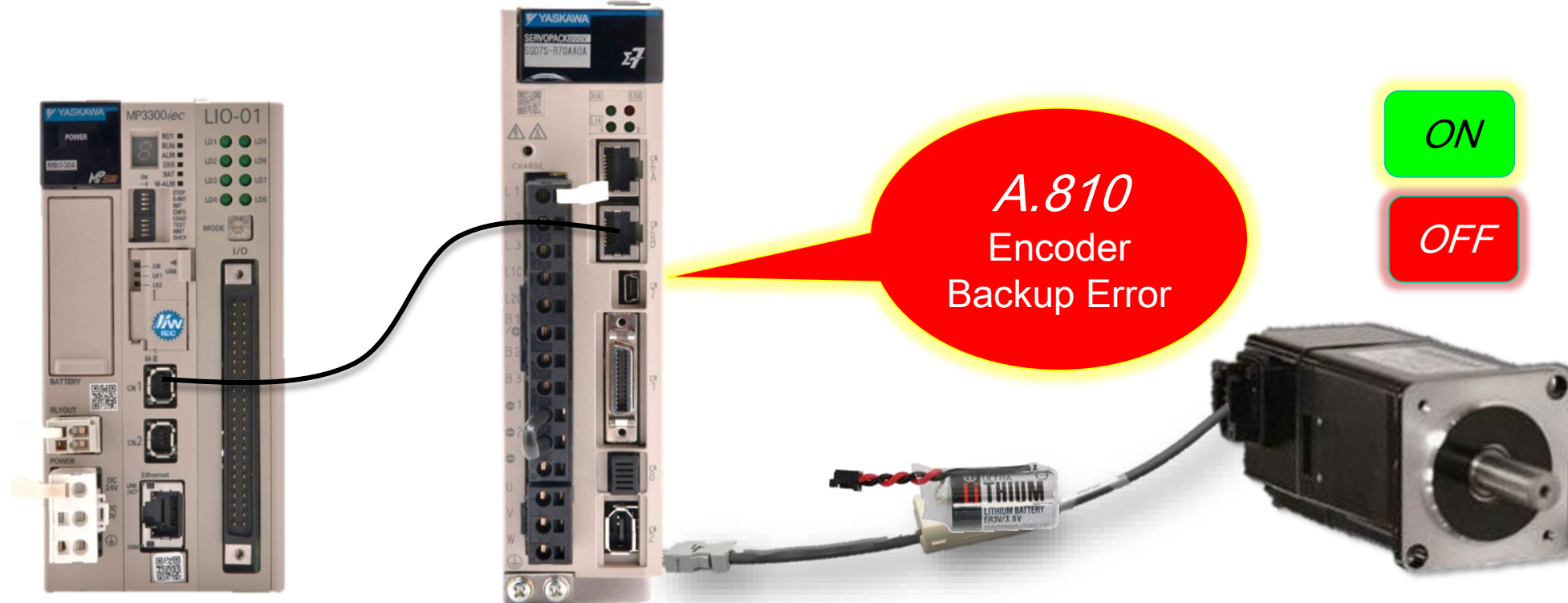
## Alarm A.810

- *No battery voltage while servo control power is off*
- *Under what circumstances will this alarm appear?*



# Alarm A.810

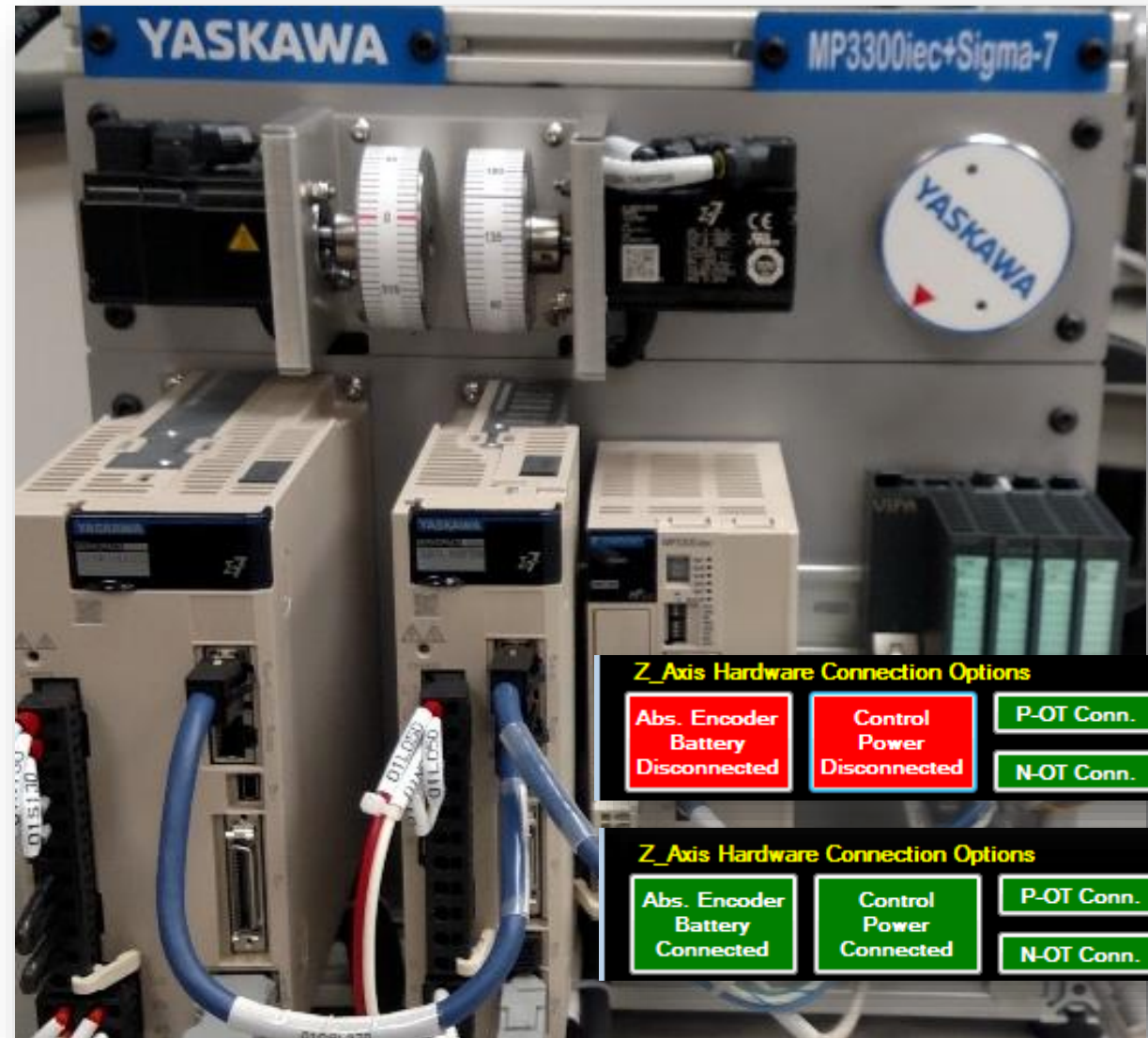
- *Encoder cable disconnected from motor*
- *During power off...*
  - *Battery dead*
  - *Battery disconnected / replaced / missing*



# Alarm A.810

- Save project as *AbsEnc.mwt*
- Create alarm A.810 on the *MP3300iec + Sigma-7 Demo*
  1. Set z-axis\* to absolute encoder mode
    - » Pn002
    - » Online save
  2. Remote I/O: Disconnect battery & control power
  3. Remote I/O: Connect battery & control power
  4. Reboot controller
  5. Online connect, look at alarms
  6. Can the alarm be cleared?
    - » ALARM CLEAR DOES NOT CLEAR A.810.
    - » ABSOLUTE ENCODER RESET is required

\* Only with remote demo. Use the X or Y axis with local connection to the demo. You will have to physically remove the encoder cable from the motor.



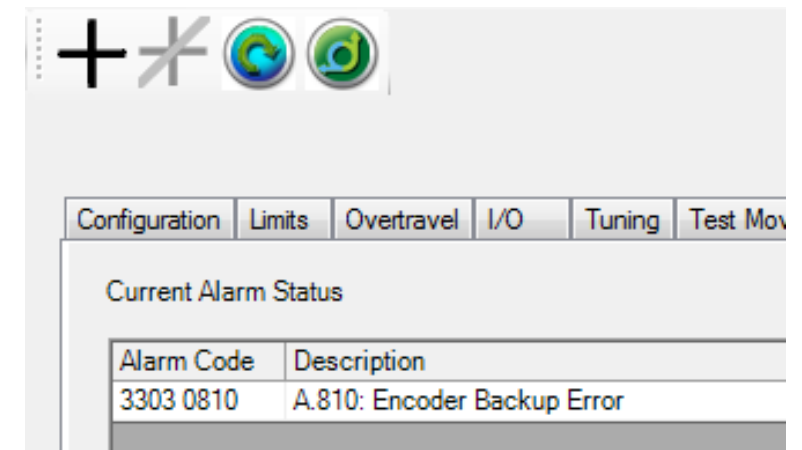
# Alarm A.810

## ■ *Clear Alarm A.810 in Hardware Configuration*

- » *Reset with dedicated button*
  - *Alarm does not immediately clear*
- » *Reboot, reconnect.*

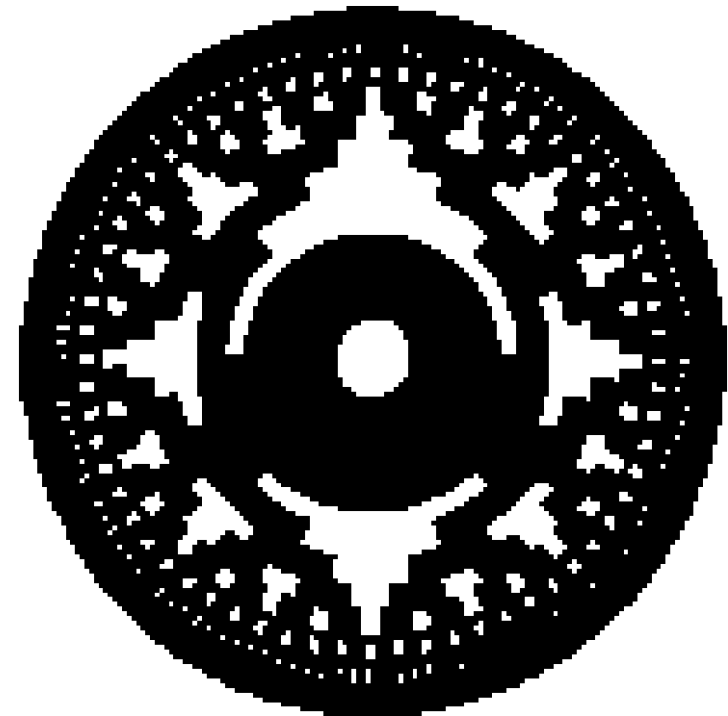
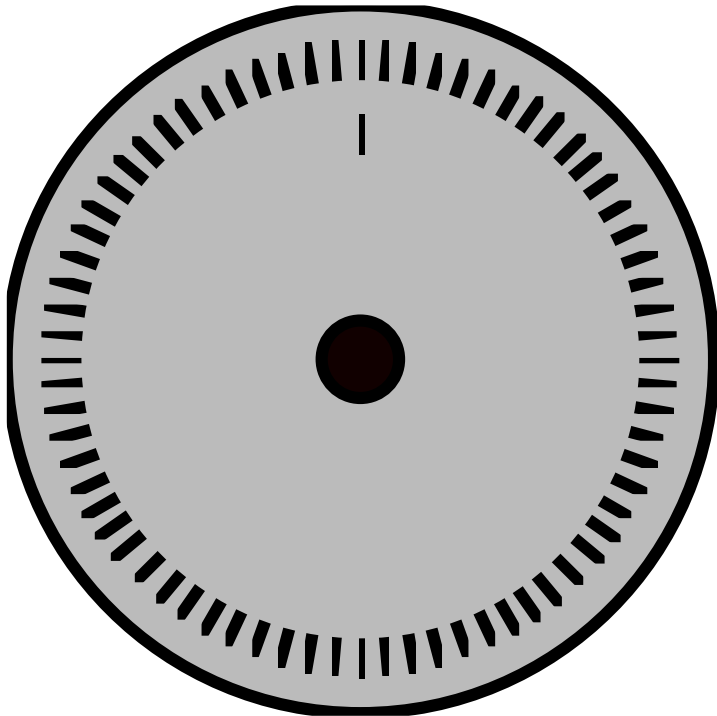


- ## ■ *Repeat the procedure until confident*
- *How the alarm is produced*
  - *How to clear it in hardware configuration*



# Basic Operation

- *Incremental*
  - *Loses position at power loss*
  - *Controller requires homing routine every time power is turned on*
- *Absolute*
  - *Battery-backed position tracked during power loss*
  - *Controller requires zero-set procedure when motor installed*
  - *Can run as incremental*



# Basic Operation

- *Absolute partial motor turn*
- *Multi-turn counter*



Mechatrolink III

Absolute Position

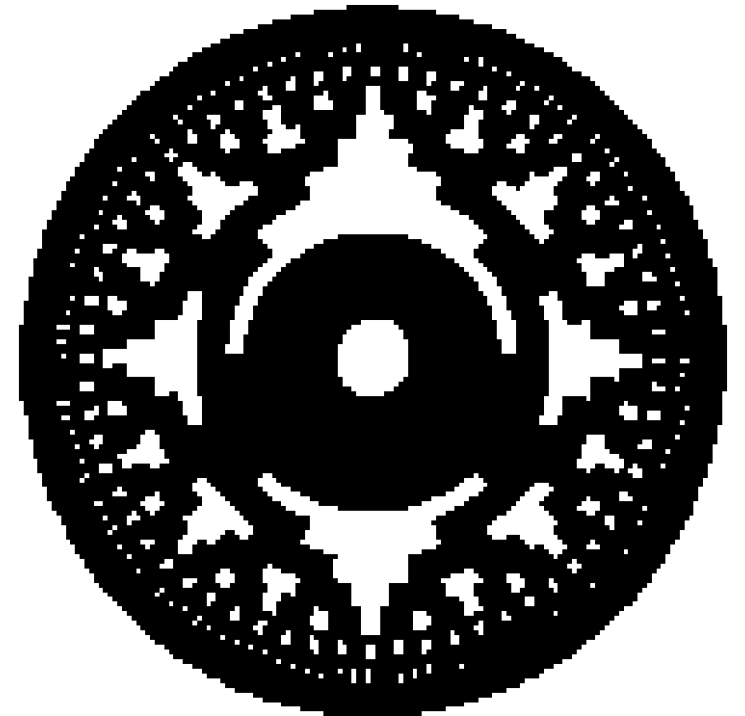


Serial Encoder

Absolute Position



Number of Turns



Partial Turn

Apply Offset  
Convert to user units



# Basic Operation

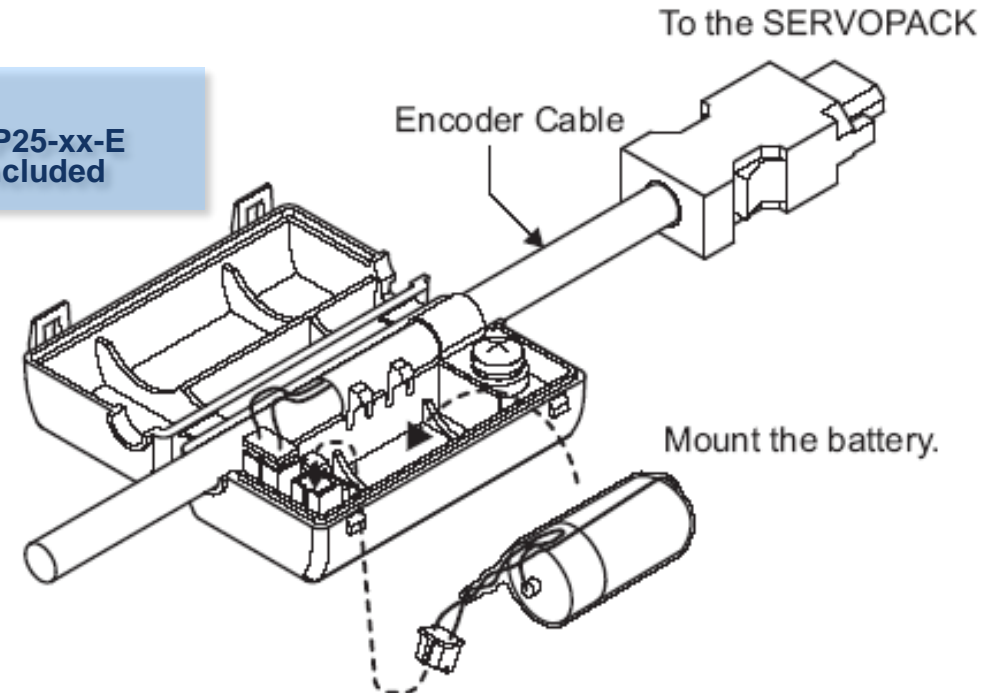
- *What is the position of the absolute encoder after*
  1. *ABSOLUTE ENCODER RESET and REBOOT*
  2. *REBOOT ONLY?*



# Battery

- *Service Life: 5 years*
- *Replace with power on*
- *Position not lost during amplifier disconnection*

**Cable:**  
JZSP-CSP25-xx-E  
Battery included



**Battery:**  
JZSP-BA01  
3.6V, 1200mAh  
Service Life: 5 years



# Battery

- *Connection option at CN-1*
  - *Encoder cable without battery*
  - *Axes can share external battery*
  - *Absolute Position Lost*
    - » *Amplifier Disconnect*
    - » *CN-1 Disconnect*



# Battery

## ■ Alarm A.830

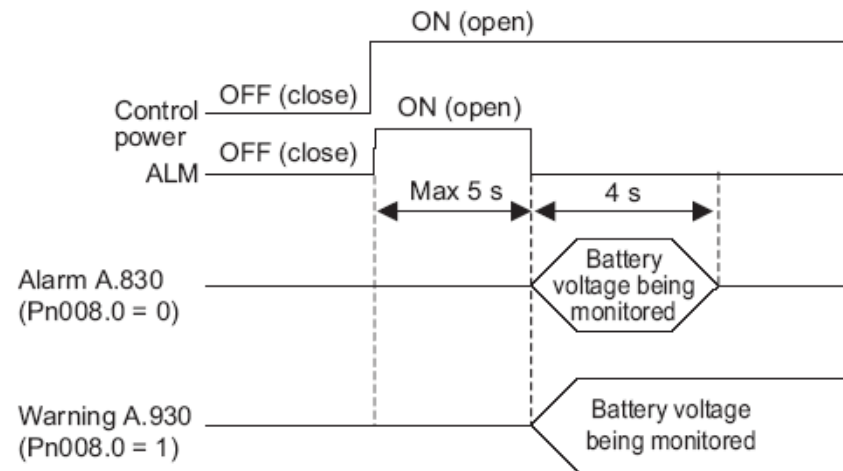
- Servo OFF
- Stop
- Alarm code

## ■ Warning A.930

- Servo ON
- Warning code

Parameter #	Parameters	Current Value
Pn002.2	Absolute Encoder Usage	0 - Use absolute encoder
Pn008.0	Low Battery Voltage Alarm/Warning	1 - Display Warning for low
Pn205	Multi-Turn Limit Setting	89935

- If Pn008.0 is set to 0, alarm detection will be enabled for 4 seconds after the ALM signal turns ON when the power is turned ON.  
Note: No alarm will be displayed even if the battery is disconnected after 4 seconds.
- The battery voltage will be always monitored if Pn008.0 is set to 1.



2.7 V DC = Low Battery

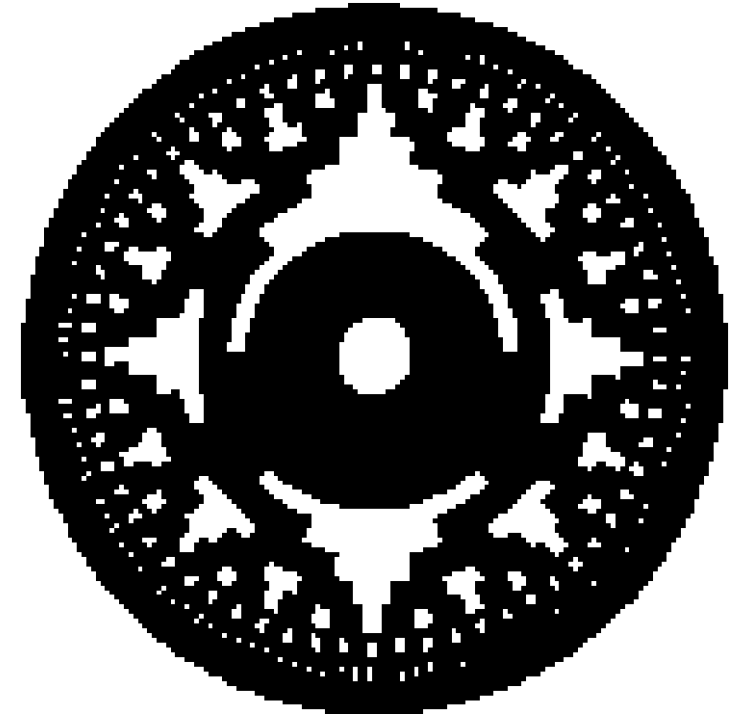
# Battery

- *Exercise – Battery Warning A.930*
  1. *Remote I/O Interface*
    - » *Control power connected*
    - » *Absolute encoder battery disconnect/connect*
    - » *What happens?*
  2. *Hardware Configuration*
    - » *Pn008.0 = 1*
    - » *Online save, reboot*
  3. *Remote I/O Interface*
    - » *Control power connected*
    - » *Absolute encoder battery disconnect/connect*
    - » *What happens?*
  4. *Hardware Configuration*
    - » *Clear Alarm*



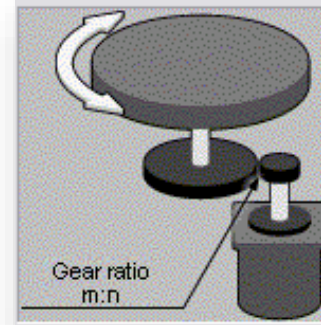
# Battery

- *Scheduled Replacement every 5 years*
  - *Why wait for alarm/warning?*
- *Purchase fresh Lithium batteries*
  - *Capacity lost in storage*



# Multi-Turn Limit

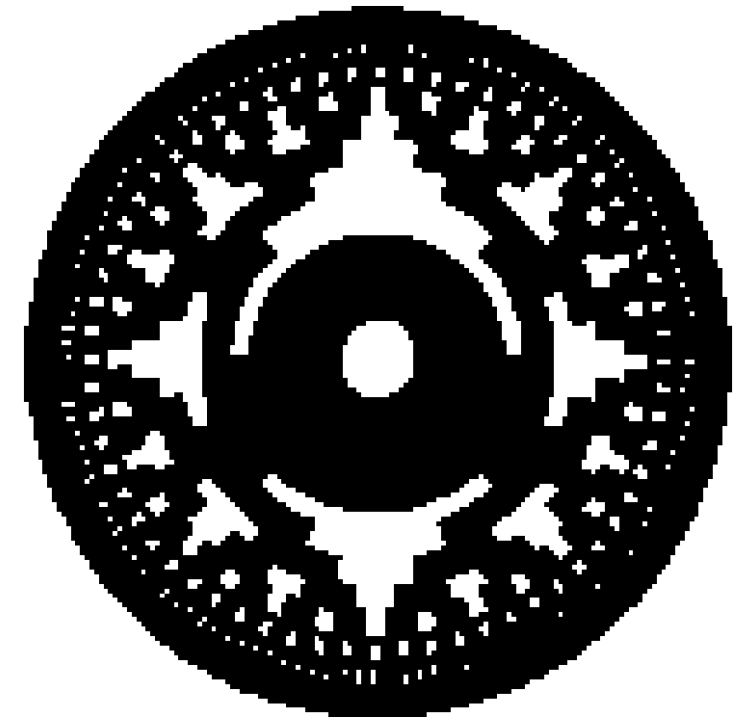
- For axes with infinite motion possible
- Motor turns  $\neq$  machine rotations
- Position incorrect at power up
- Set Pn205 to a number of motor turns that corresponds to an integer number of machine rotations



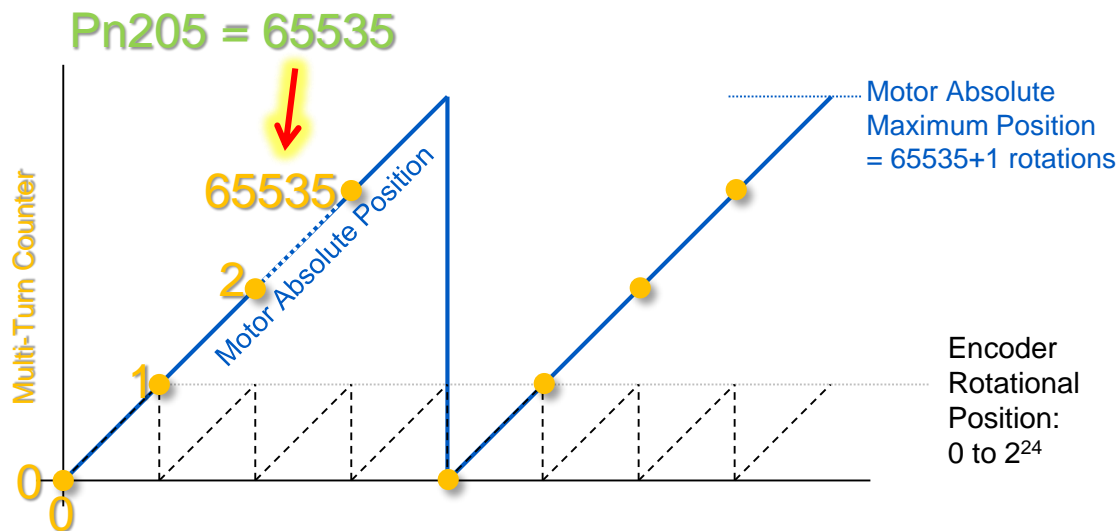
Maximum  
65,535  
Turns



Number of Turns

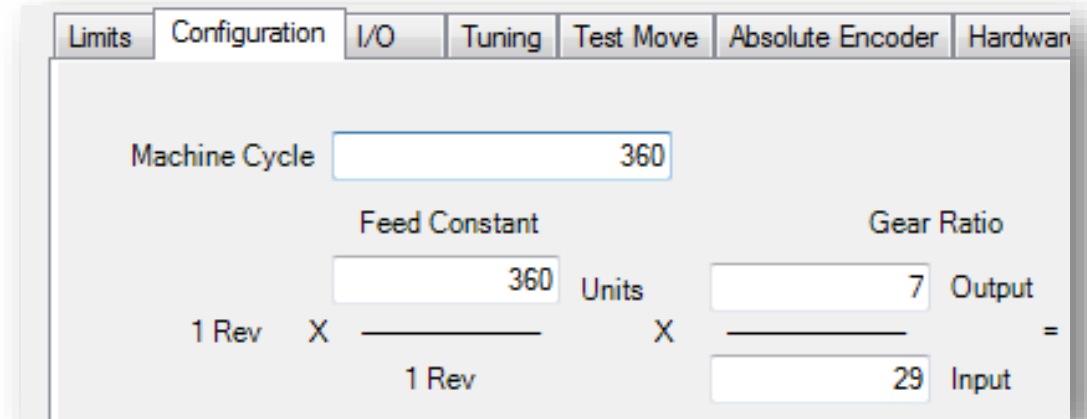


Partial Turn

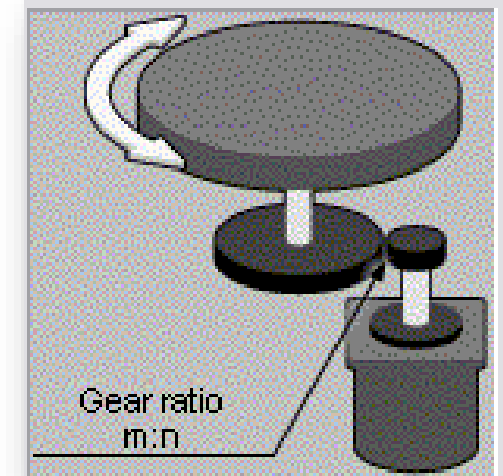
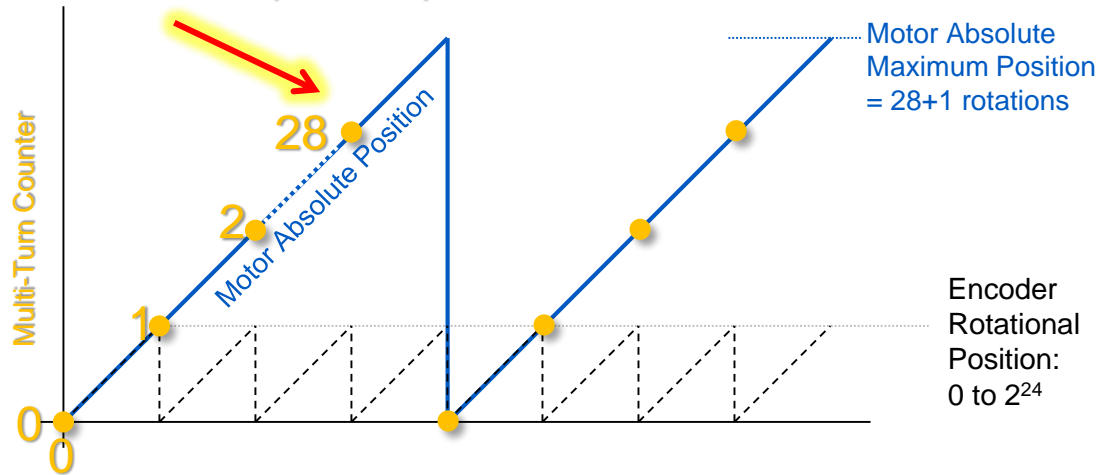


# Multi-Turn Limit

- *Example 1: Rotary Table*
  - Gear Ratio: 29:7
  - Machine Cycle: 1 [rotation] = 360 [deg]



$Pn205 = (29 \cdot n - 1) = 28, 57, 86, \text{ etc}$





# Multi-Turn Limit

## EXERCISE

- *Implement the Example on Axis Z*
  - *Rotary Table*
  - *Gear Reduction: 29:7*
  - *Machine Cycle: 1 [rotation] = 360 [deg]*



# Multi-Turn Limit

- *Example Solution*
  - *Online Save*
  - *Reboot*

Machine Cycle

Feed Constant  Units

1 Rev X  $\frac{\quad}{1 \text{ Rev}}$

Gear Ratio  Output =  Input

Position Scale  User Units

Reference Units per User Unit

Parameter #	Parameters	Current Value	Units	Min	Max
1301	Moving Average Filter 1 Time Constant	0.1	s	0	5
1807	Load Type	Rotary		0	1
1809	Axis Name	Z_Axis			
1831	Logical Axis Number	5		1	512
2028	Enable Timeout	300	ms	5	10000
Pn205	Multi-Turn Limit Setting	28	Revolutions	0	65535

Because Rotary Load Type and Absolute Encoder are selected, set Pn205 (multiturn limit setting) such that the machine cycle and absolute encoder's multiturn reset are synchronized to avoid invalid position values after power cycle. For example: In a machine with a 10:1 gear set Pn205 to any value where the absolute encoder will reset on the same revolution when the machine crosses zero, such as 9, 19, 29, 39, 49, 59, 69, 79, 89, 99, 109, 119, 129, 139, 149, 159, 169, 179, 189, 199, 209, 219, 229, 239, 249, 259, 269, 279, 289, 299, 309, 319, 329, 339, 349, 359, 369, 379, 389, 399, 409, 419, 429, 439, 449, 459, 469, 479, 489, 499, 509, 519, 529, 539, 549, 559, 569, 579, 589, 599, 609, 619, 629, 639, 649, 659, 669, 679, 689, 699, 709, 719, 729, 739, 749, 759, 769, 779, 789, 799, 809, 819, 829, 839, 849, 859, 869, 879, 889, 899, 909, 919, 929, 939, 949, 959, 969, 979, 989, 999. Please refer to the Sigma-5 Servopack Manual (SIEP S800000 46) section 4.7.6.

# Multi-Turn Limit

- *Alarm A.CC0*
  - *Amplifier and motor have different multi-turn limits*
  - *Send the multi-turn limit to the encoder*
  - *Reboot*
- *Verify*
  1. *Test run >29 turns*
  2. *Note position*
  3. *Power cycle*
  4. *Verify position*



Configuration Limits Overtravel I/O Tuning **Test Move** Function Absolute Encoder Hardware Alarm Brake Dual Encoder

Direction:  +  -  +/-

Distance:  Degrees

Speed:  Degrees/s

Acceleration/Deceleration:  Degrees/s<sup>2</sup>

Cycles:

Delay Time:  ms

**Start**

Feedback Parameter	Current Value	Units
Feedback Position	25.00003707	Degrees
Feedback Velocity	-0.031076628	Degrees/s
Feedback Torque/Force	1.08	% Motor Rated Torque/Force
Position Error	-3.6256E-05	Degrees

# Multi-Turn Limit

- *Incorrect Multi-Turn Limit*
  1. *Test run >29 turns*
  2. *Note position*
  3. *Power cycle*
  4. *Incorrect position*

Parameter #	Parameters	Current Value	Units	Min	Max	Default Value
1300	Moving Average Filter 1 Enable	False				False
1301	Moving Average Filter 1 Time Constant	0.1	s	0	5	0.1
1807	Load Type	Rotary		0	1	Linear
1809	Axis Name	Z				
1831	Logical Axis Number	5		1	512	1
2028	Enable Timeout	300	ms from	5	10000	300
Pn205	Multi-Turn Limit Setting	29	Revolutic	0	65535	65535

# Multi-Turn Limit

## EXERCISE

- *Restore original Z-axis configuration*
  1. *Absolute Encoder as Absolute*
  2. *Gear Ratio 1:1*
  3. *Multi-Turn Limit Setting 65535*
  4. *Clear resulting alarm A.CC0*
- *Save project as ZWT*

Parameter #	Parameters	Current Value	Units	Min	Max	Default Value
1300	Moving Average Filter 1 Enable	False				False
1301	Moving Average Filter 1 Time Constant	0.1	s	0	5	0.1
1807	Load Type	Rotary		0	1	Linear
1809	Axis Name	Z				
1831	Logical Axis Number	5		1	512	1
2028	Enable Timeout	300	ms from	5	10000	300
Pn205	Multi-Turn Limit Setting	65535	Revoluti	0	6553	65535

# Multi-Turn Limit

- Example 2: Conveyor**
  - Gear Reduction: 35:1
  - Machine Cycle: 3186
  - Feed Constant 45

Configuration	Limits	Overtravel	I/O	Tuning	Test Move	Function	Absolute Encoder	Hardware	Alarm	Brake	Dual Encoder
Machine Cycle	3186										
Feed Constant	45										
1 Rev	X	Units		X	Gear Ratio		Position Scale		User Units		
		1 Rev			1		= 1.28571428571429		mm		
					35		Reference Units per User Unit		13048945.7777777		

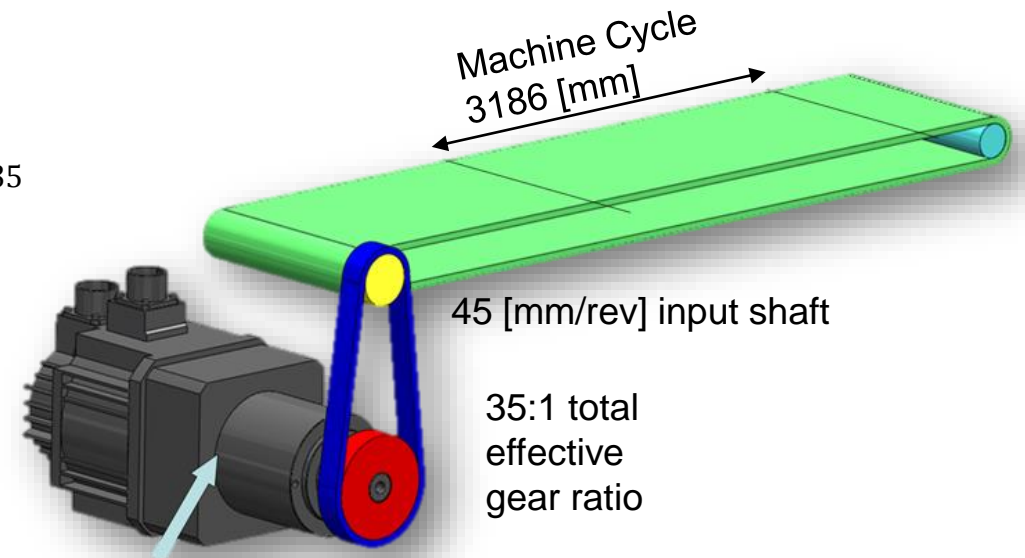
$$(Pn205 + 1) * \frac{GR\_OutputRevs * FeedConstant}{GR\_InputRevs} = MachineCycle * n$$

where  $n = \text{any integer such that } Pn205 \leq 65535$

$$(Pn205 + 1) * \frac{1 * 45}{35} = 3186 * 1$$

$$Pn205 = 3186 * 1 * \frac{35}{1 * 45} - 1 = 2477$$

$$Pn205 = 2477$$

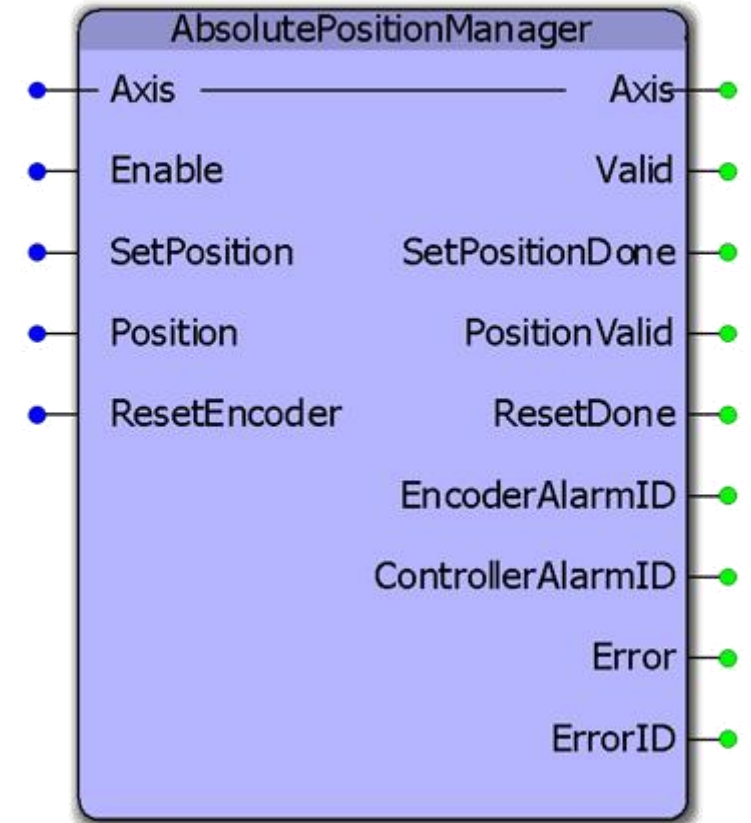


# Multi-Turn Limit

## ■ *Absolute Position Manager*

- *Part of “PLCopen\_Toolbox” User Library*
- *Monitor and Clear Absolute Encoder Alarms*
  - » *A.CC0*
  - » *A.810, 820, 830, 840*
  - » *Controller SRAM Alarms*
- *Sends multi-turn limit Pn205 to Encoder*
- *PositionValid to prevent motion if encoder alarm occurs*
- *Set Position*

## AbsolutePositionManager



**EASY TO WORK  
WITH**

**ENGINEERING  
EXPERTISE**

**YASKAWA**



**QUALITY  
PRODUCT**

**TECHNOLOGICAL  
INNOVATION**