YASKAWA

TRAINING

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

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MotionWorks IEC Hardware Configuration

Basic Concepts

Hands-on Training Tutorial

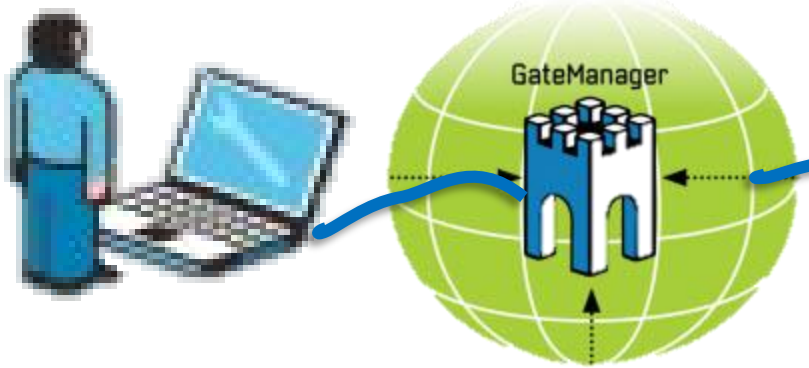
- *Hardware Configuration Data*
- *Offline & Online*
- *Configuration Differences*

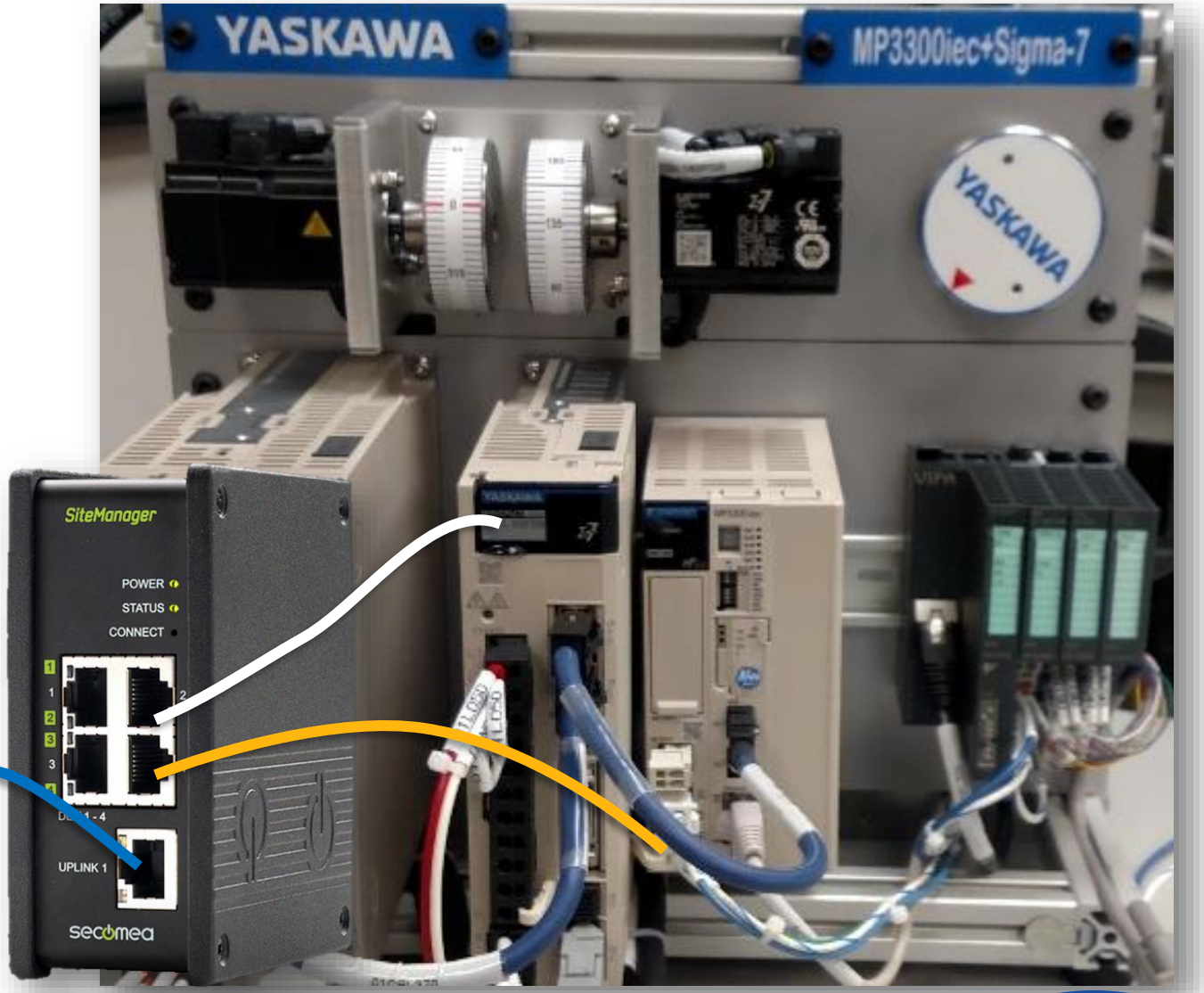
Overview

- *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*
- *Remote Connection Process*
  - *eLV.MPiec.01.PLCopen_RmtCnct*





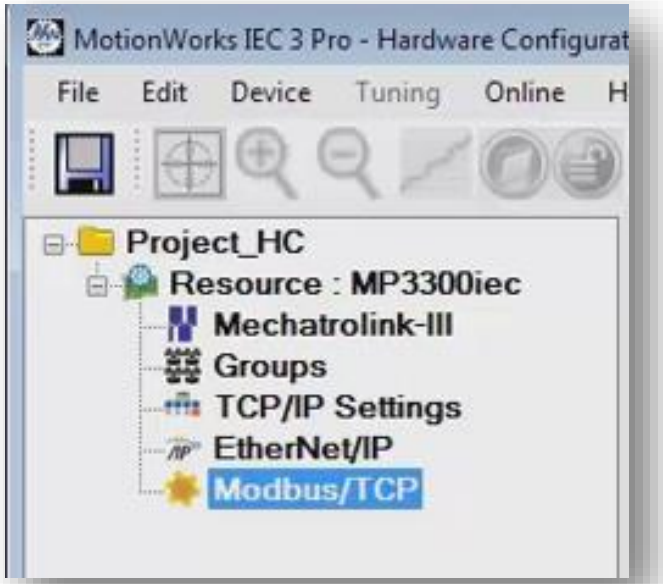
Hardware Configuration Data

- *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

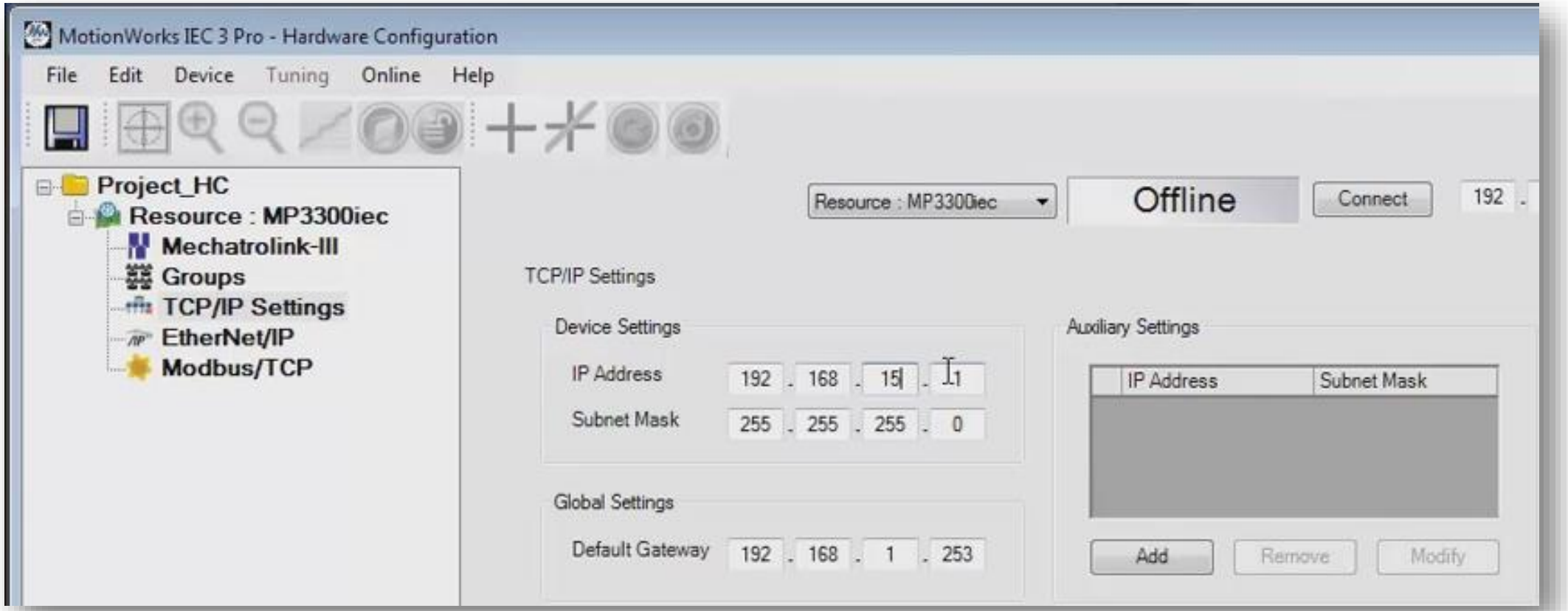
- *Make a new project*
- *Open Hardware Configuration*
- *Hardware Tree*
- *Overview*
  - *Resource: MP3300iec*
  - *Mechatrolink-III*
  - *Groups*
  - *TCP/IP Settings*
  - *Ethernet/IP*
  - *Modbus/TCP*



Hardware Configuration Data

EXERCISE

- *TCP/IP Settings*



Hardware Configuration Data

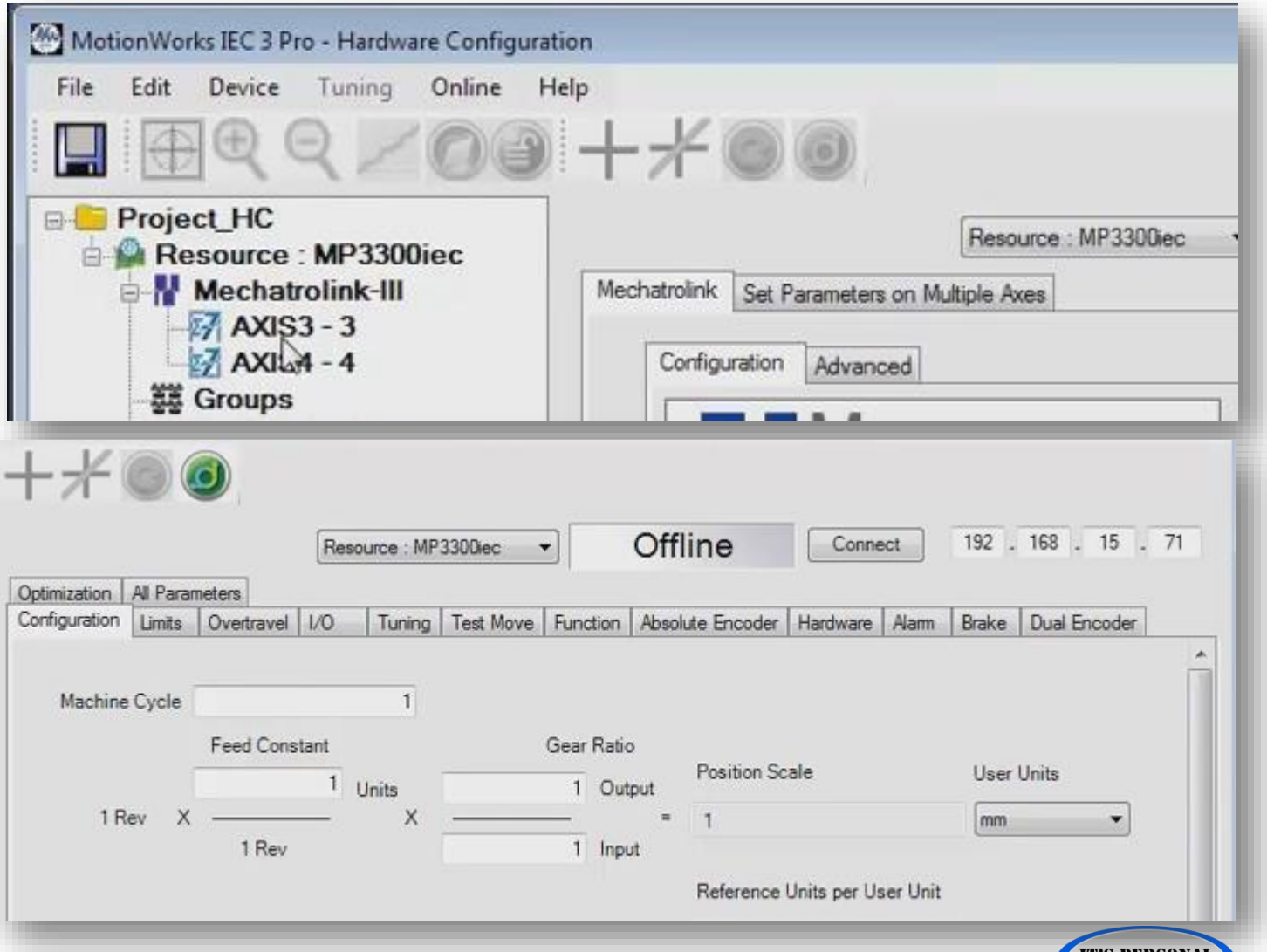
EXERCISE

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

Hardware Configuration Data

EXERCISE

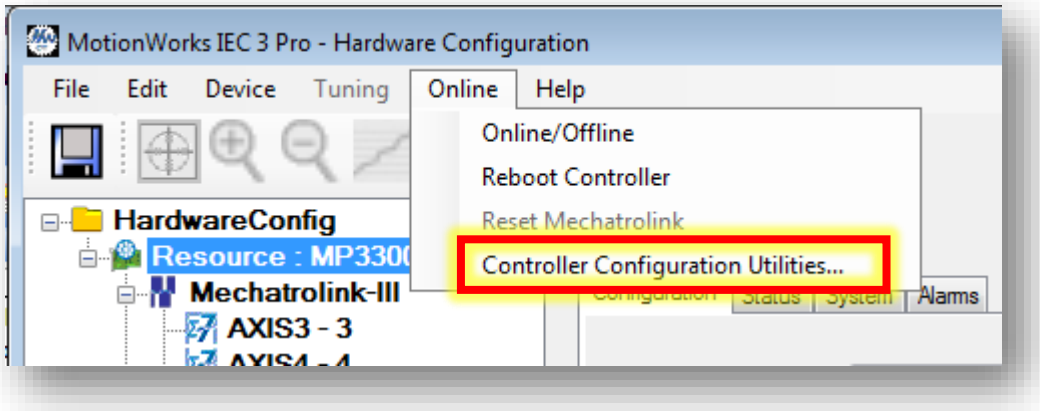
- *Add SGD7W to Mechatrolink-III*
  - *Node 3*
- *Preview each tab*

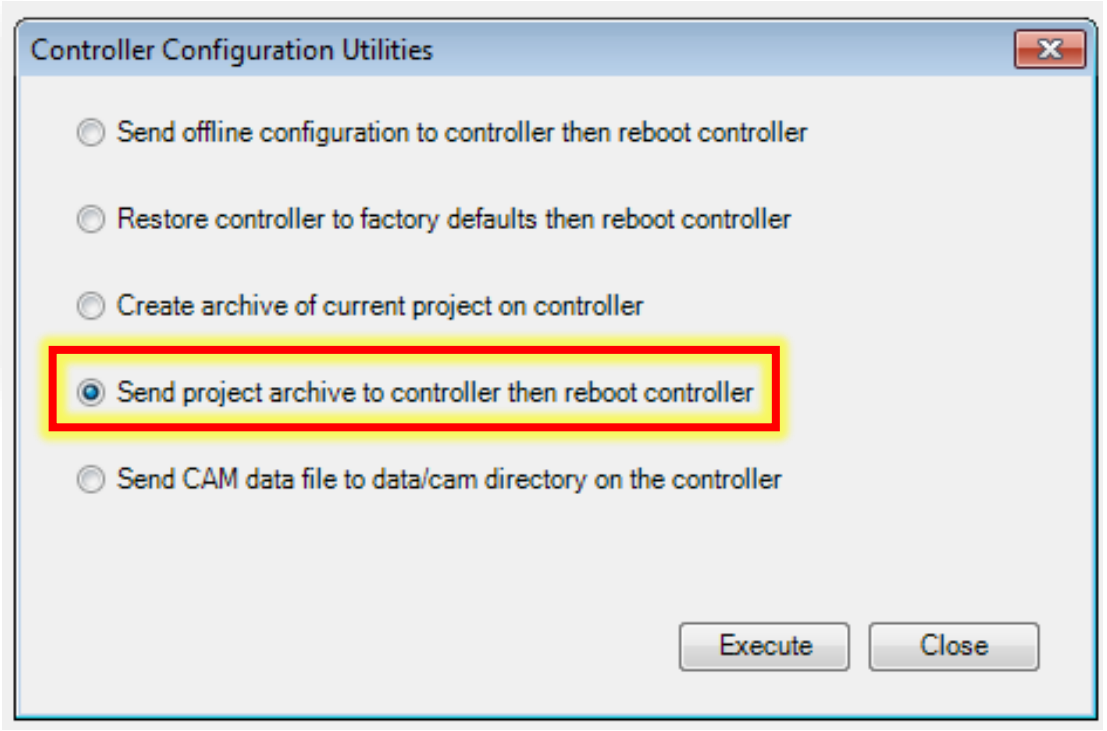


Controller Configuration Utilities

EXERCISE

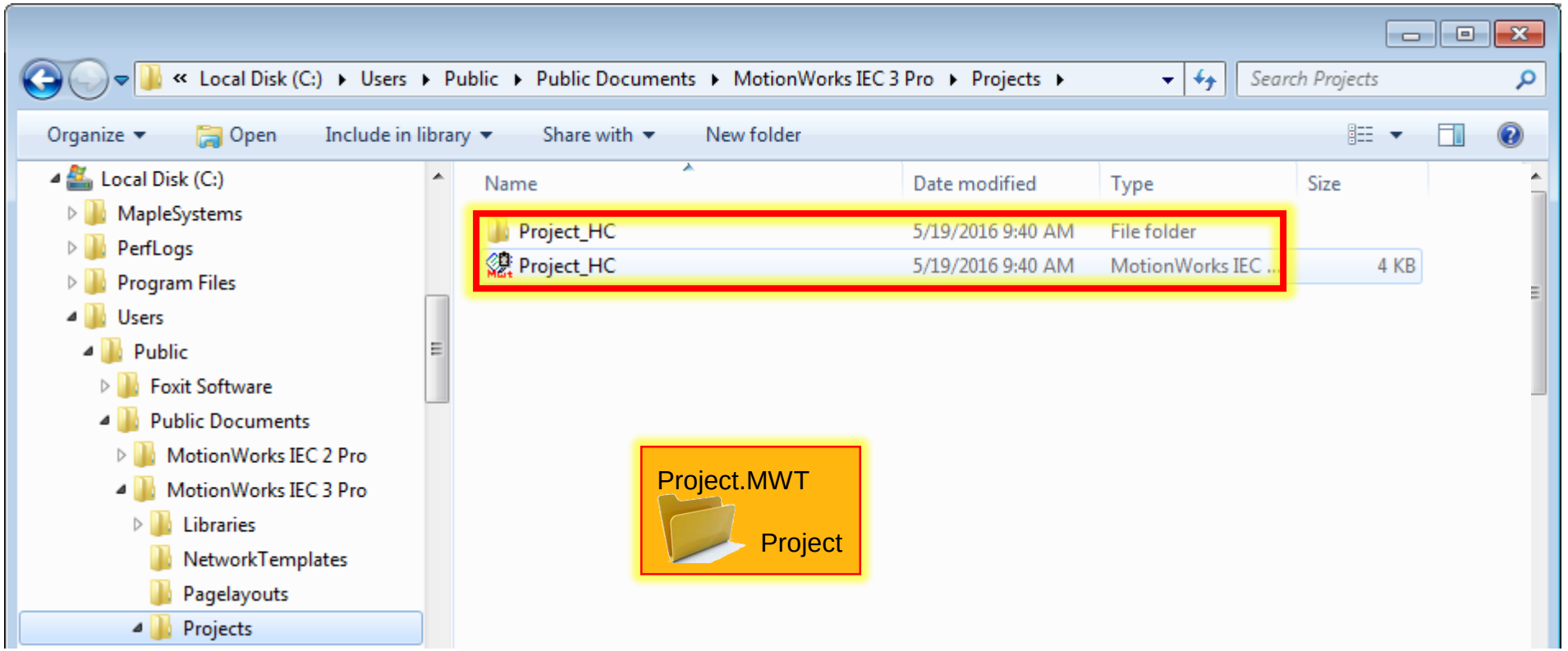
- *Send project archive to controller then reboot controller*





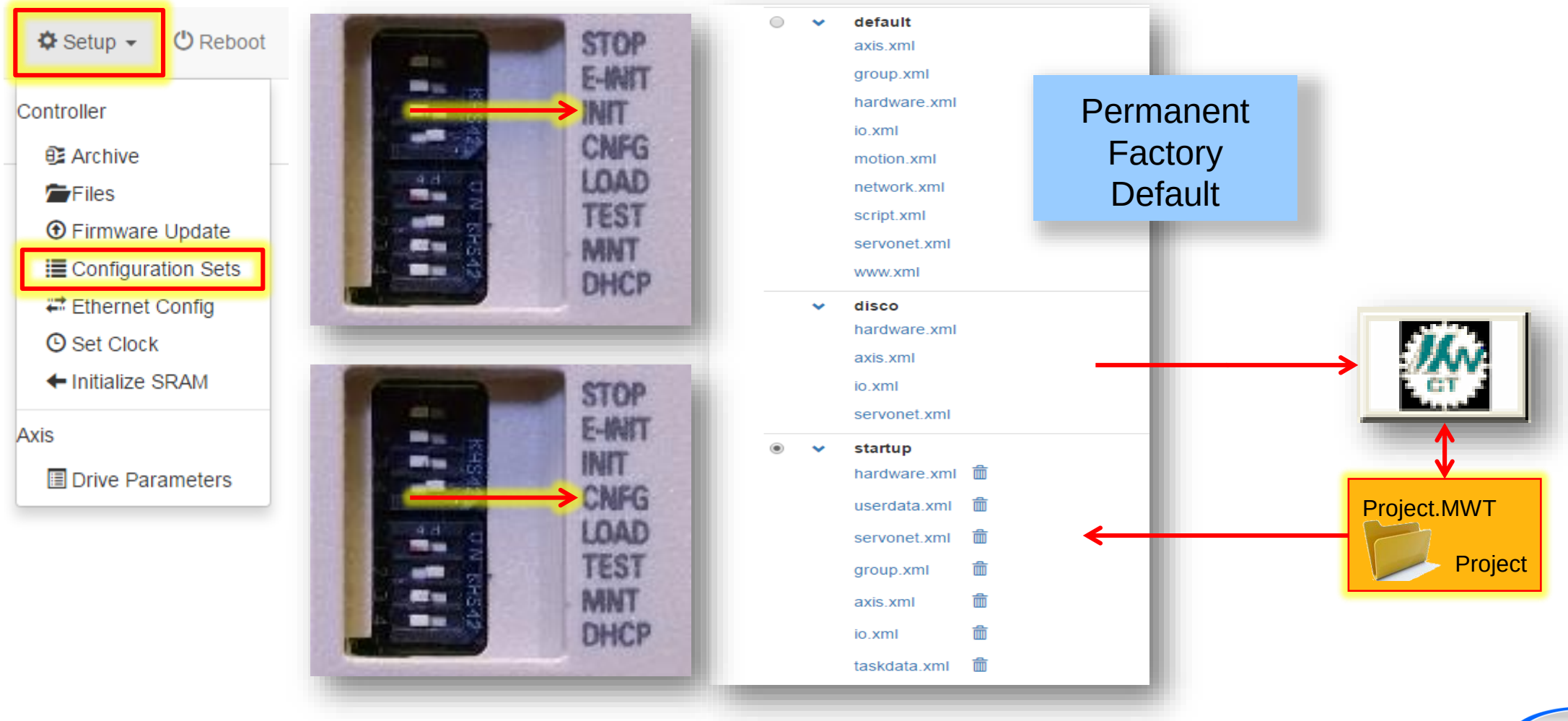
Offline & Online

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



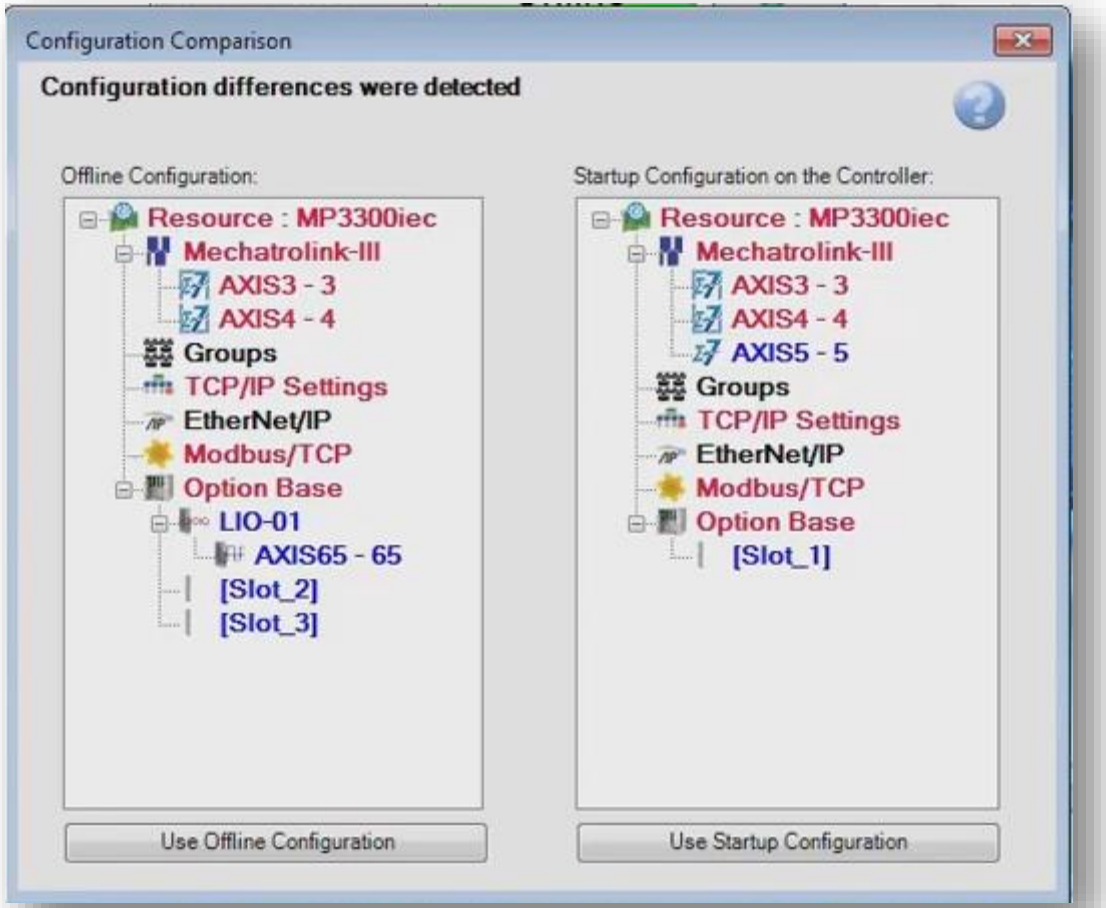
Offline & Online

- *Online Configuration on controller*



Offline & Online

- *Connect*



Project.MWT

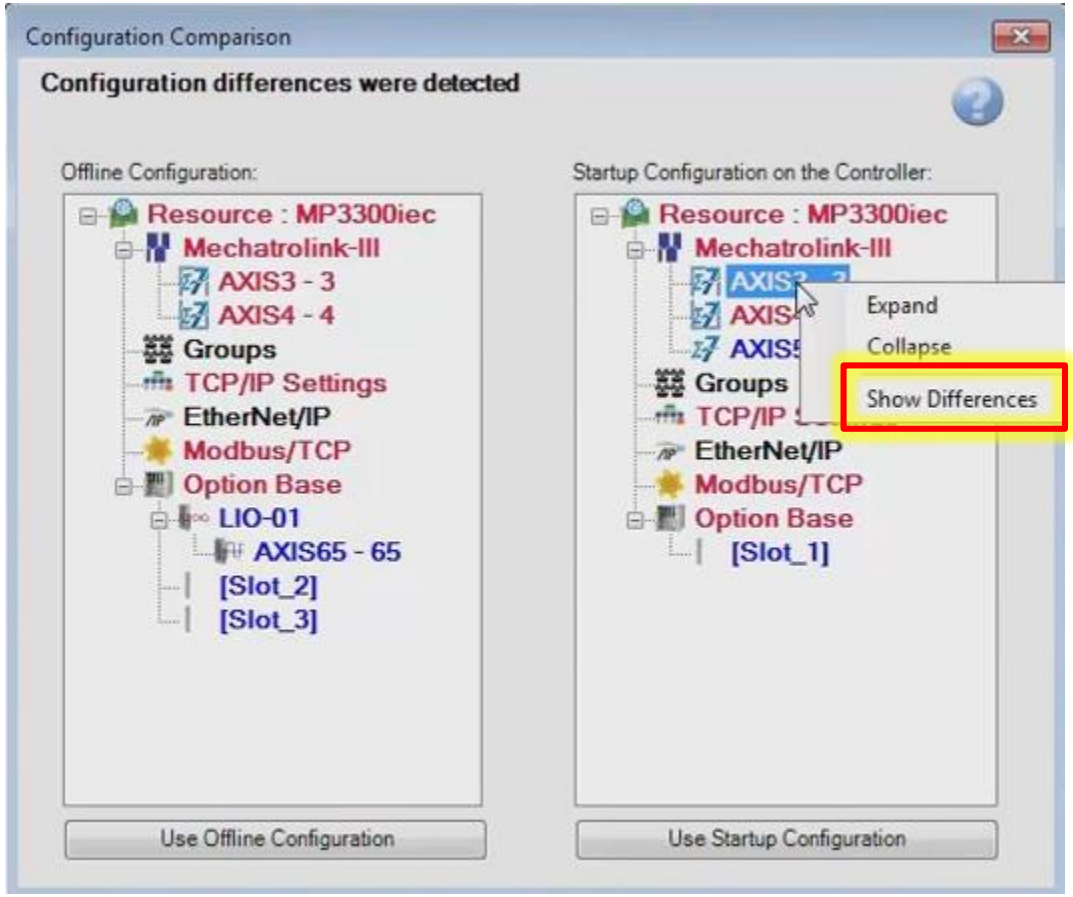
Project

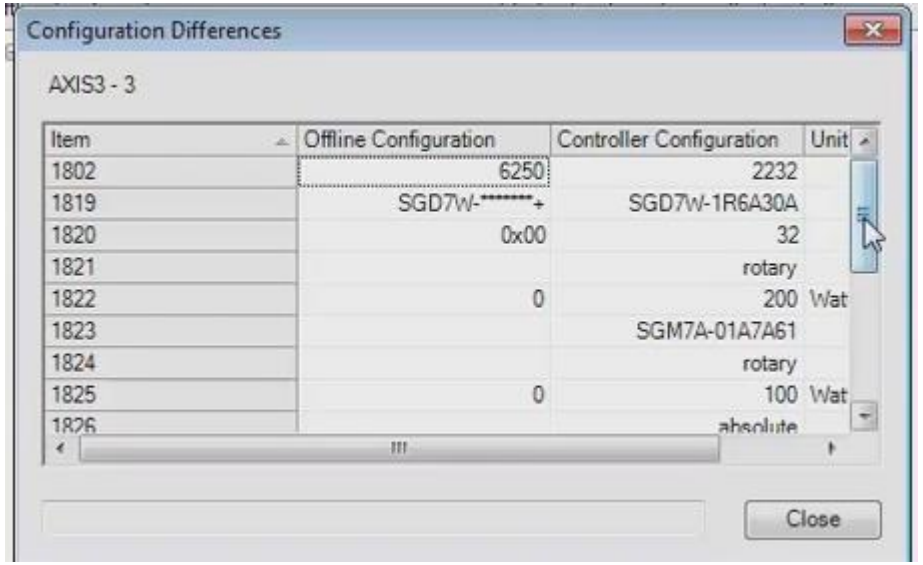
Choose offline to Change the controller and servo configuration

Choose ONLINE to leave all controller and servo settings unchanged

Offline & Online

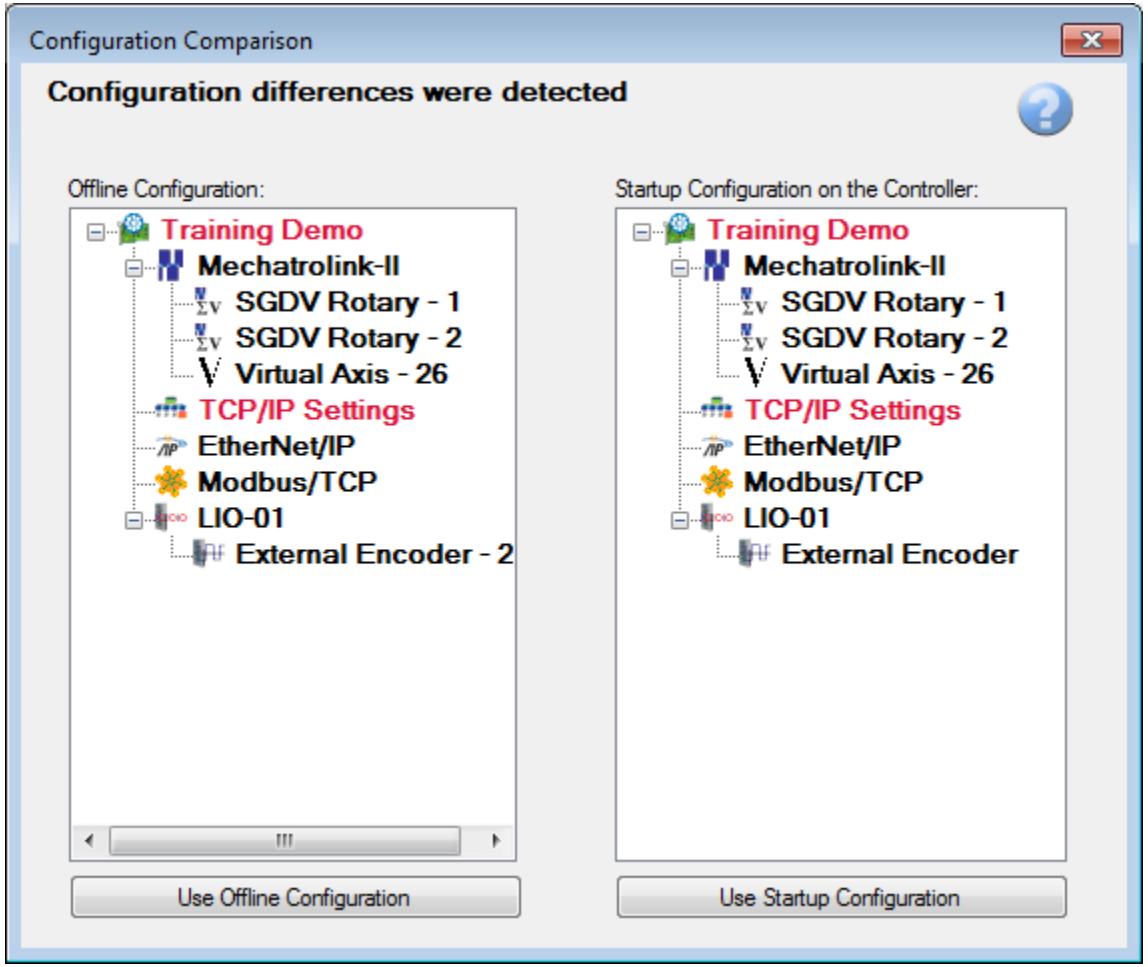
- *Right-click to list Servopack differences*





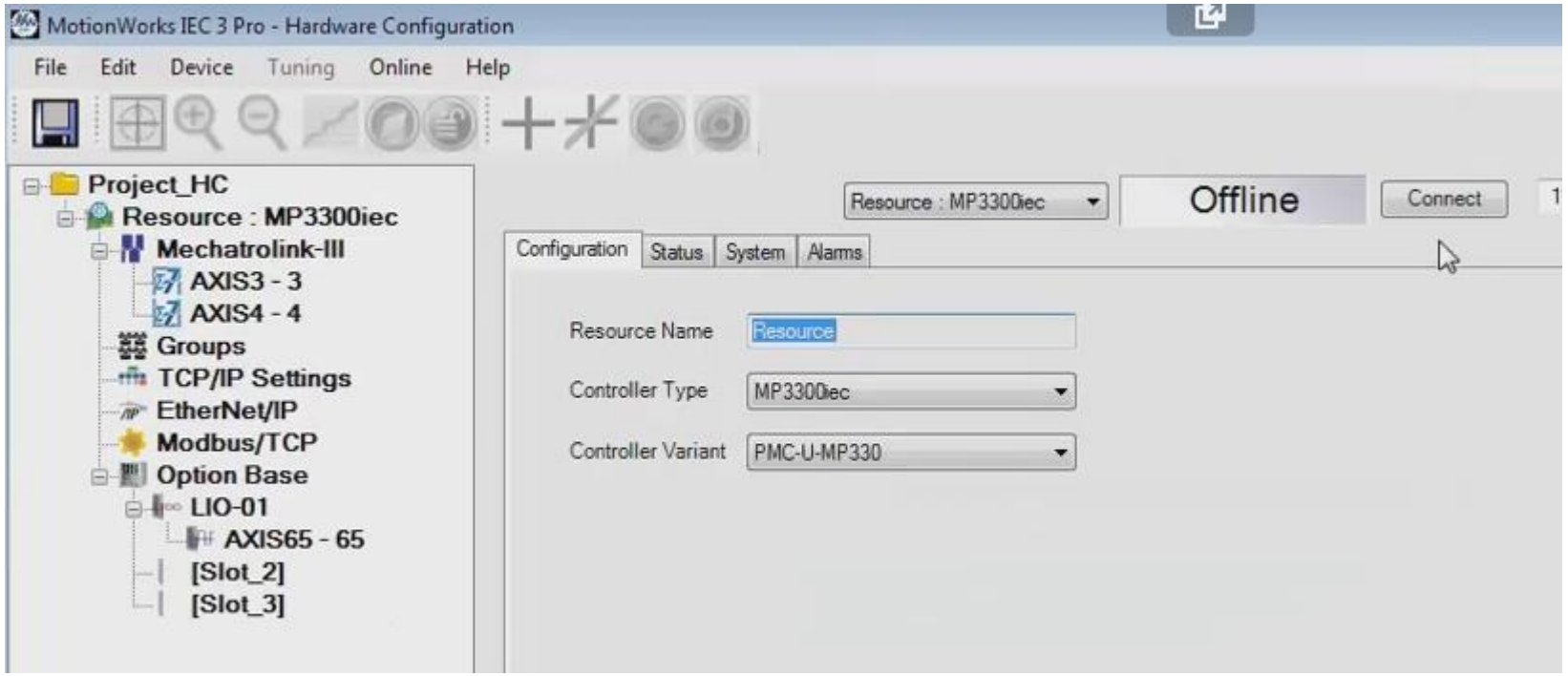
Online Configuration

- *Choose Online*
  - *What happens?*



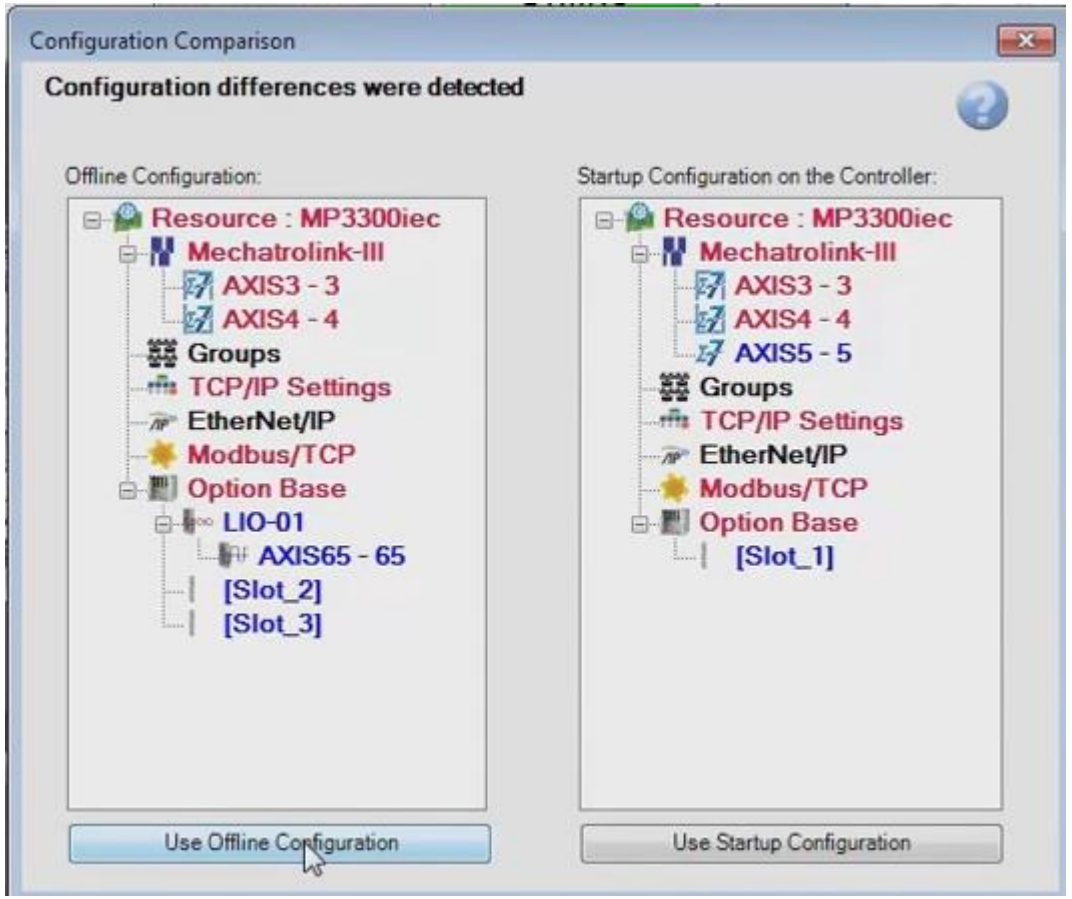
Online Configuration

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



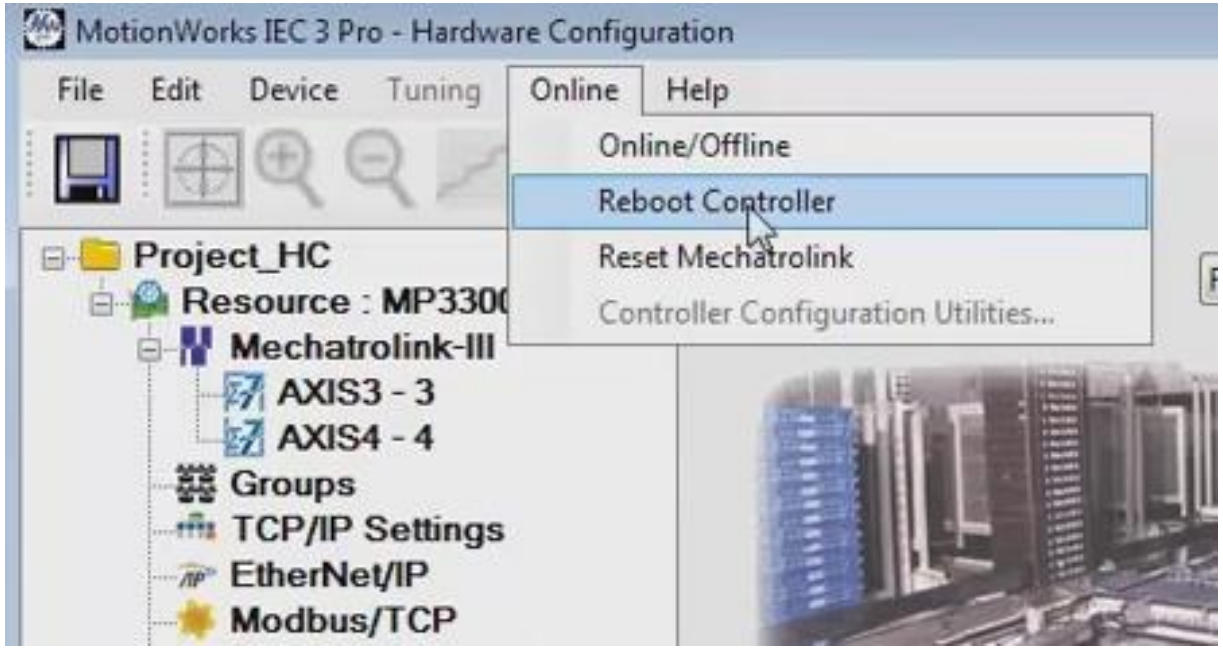
Offline Configuration

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



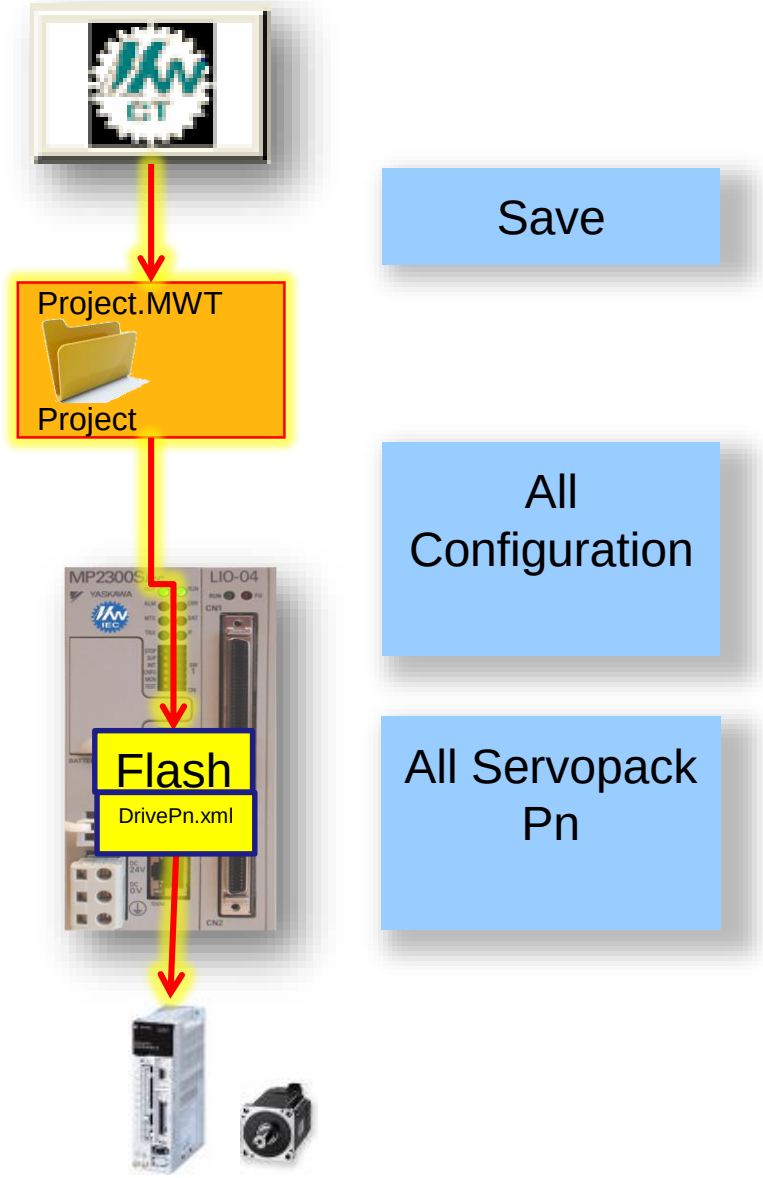
Offline Configuration

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



Online Save

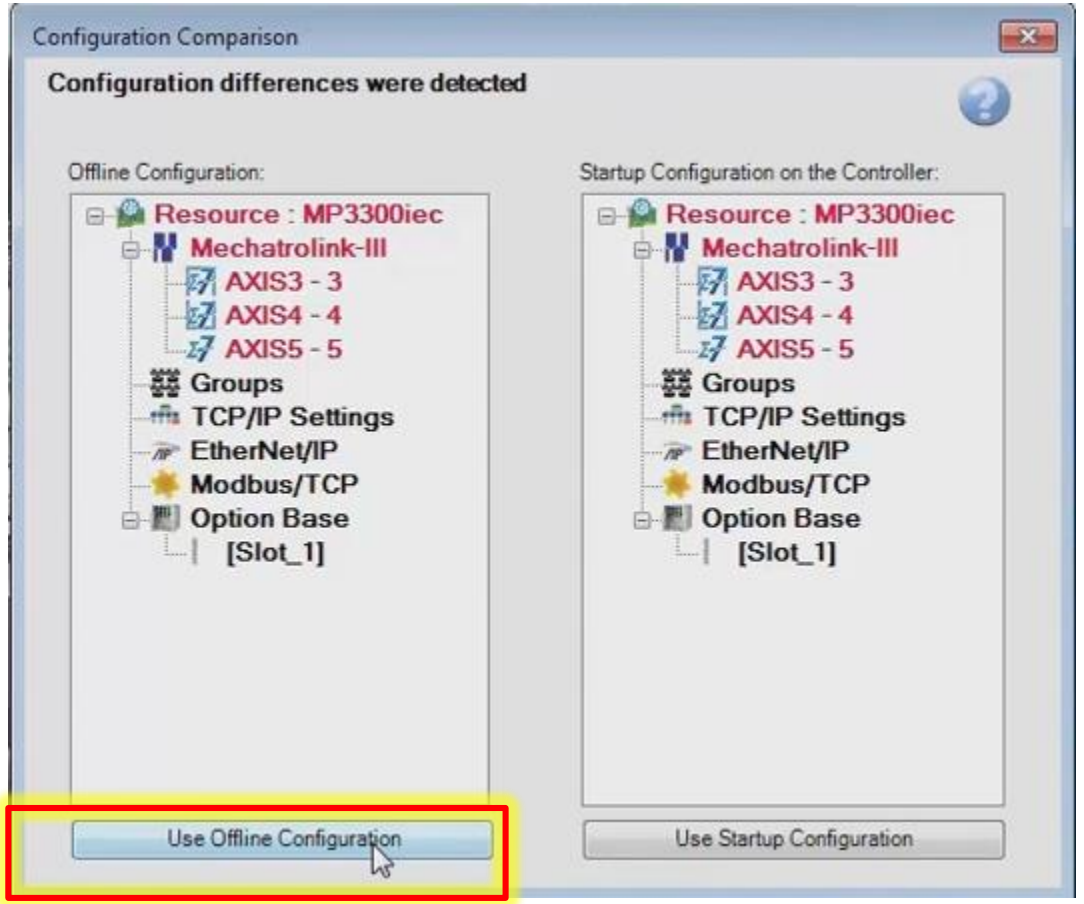
- *Makes permanent changes*
  - *Controller configuration*
  - *Servo parameters*
  - *Variables created / updated*
  - *I/O drivers*
- *Offline and Online configuration match*
- *Changes take effect after reboot*



Online Save

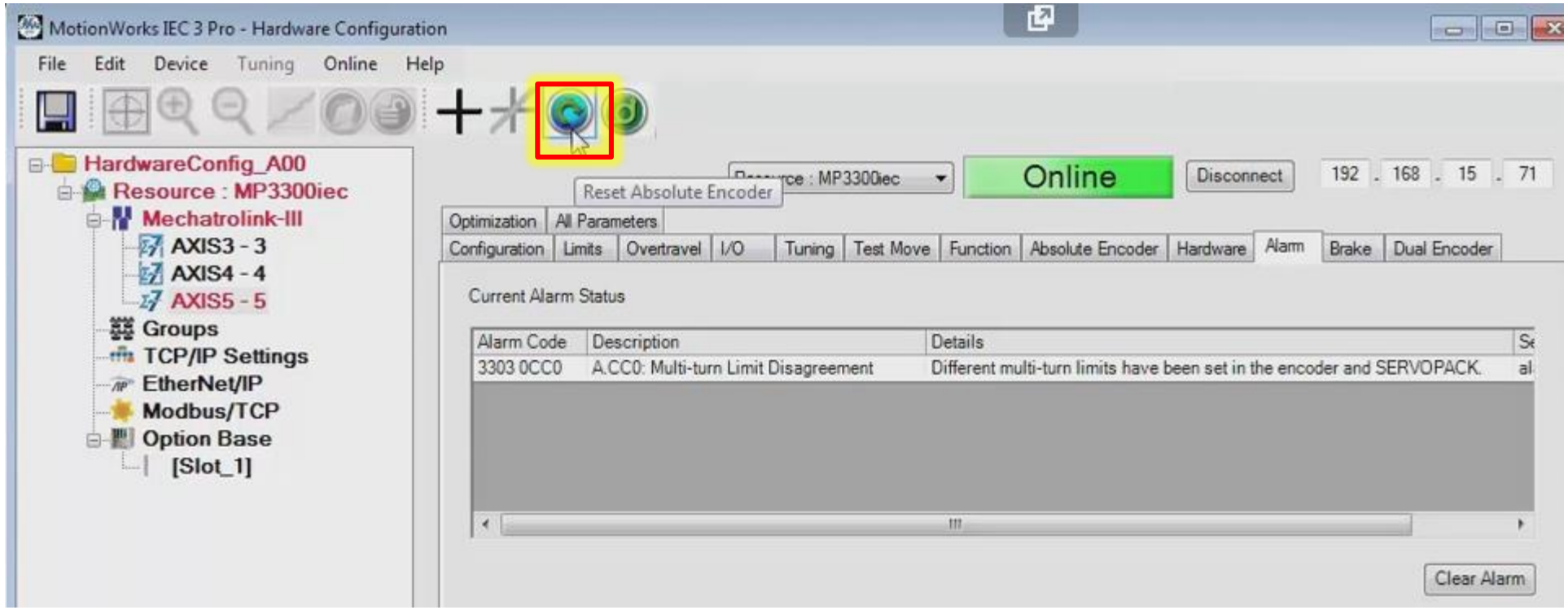
EXERCISE

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



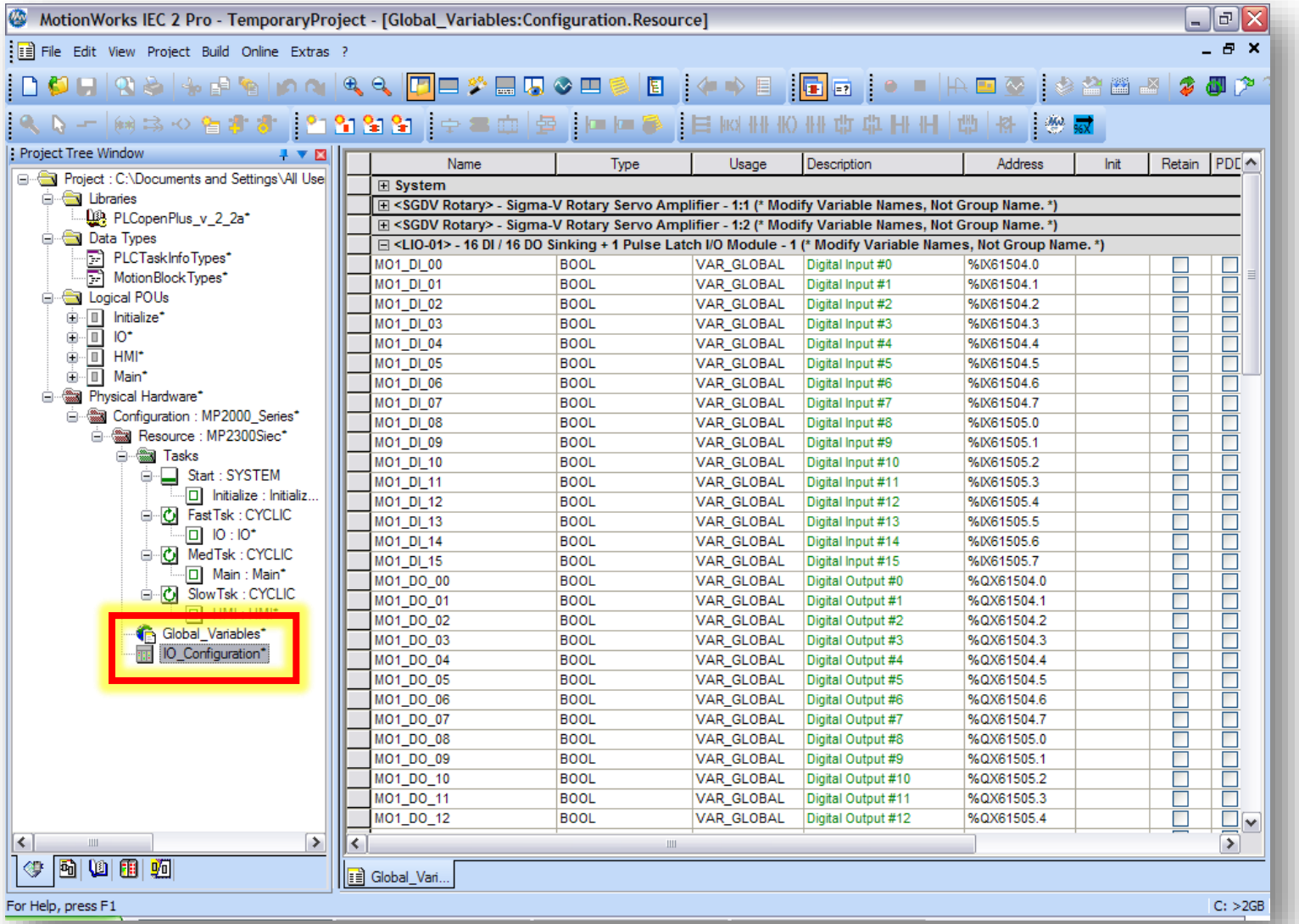
Reset Absolute Encoder

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



Online Save

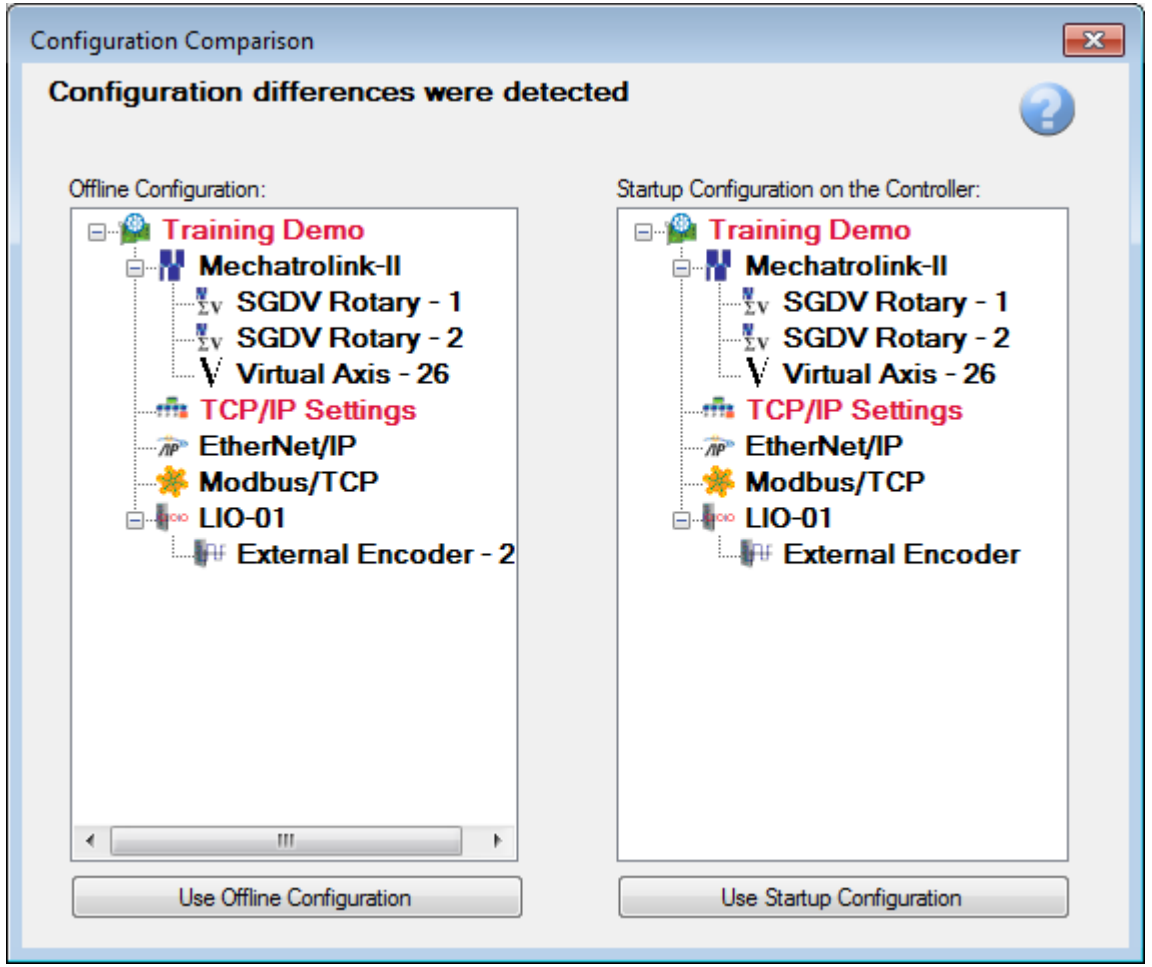
- *Updates the program*
  - *Global Variables*
  - *IO_Configuration*
- *Compile project again*



Differences Detected

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

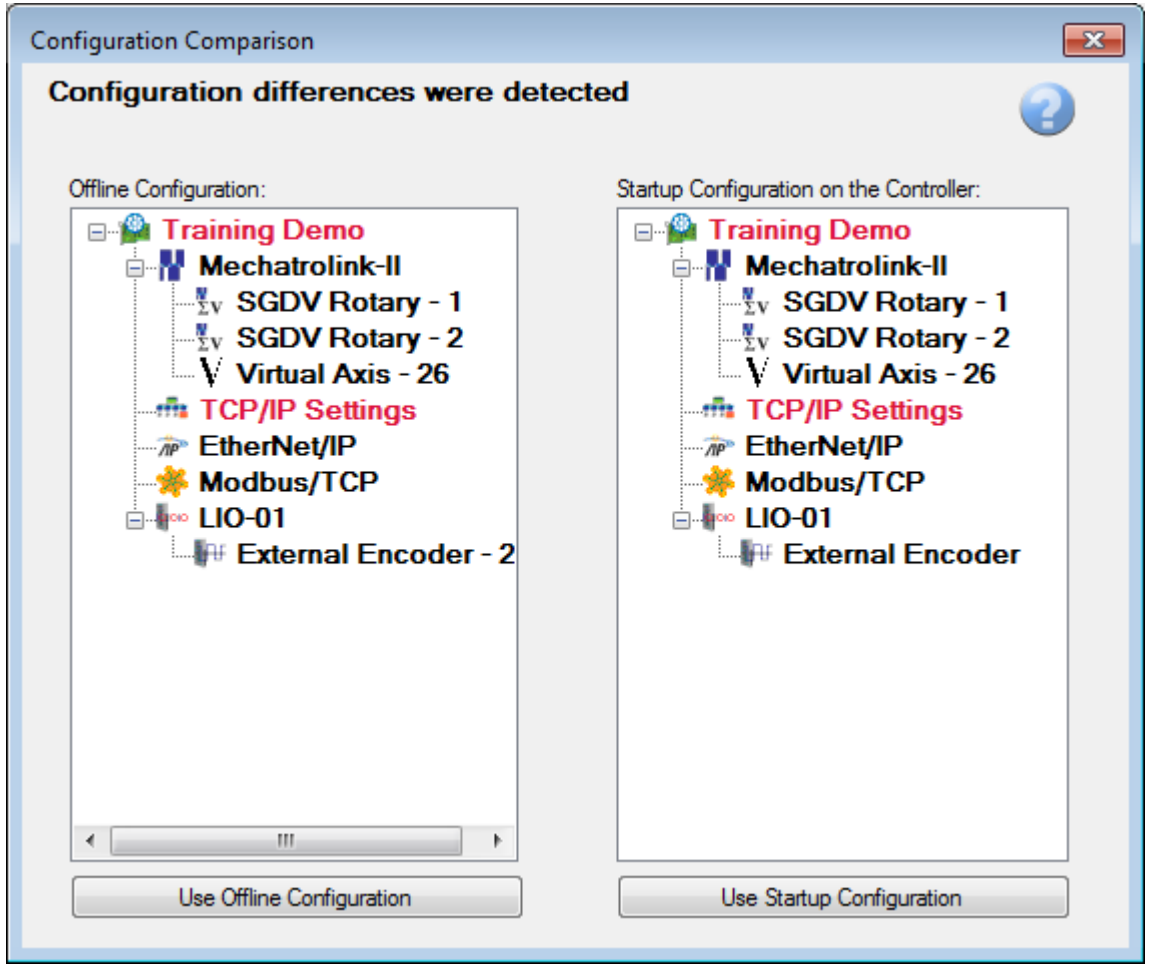
Offline or Online?



Differences Detected

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

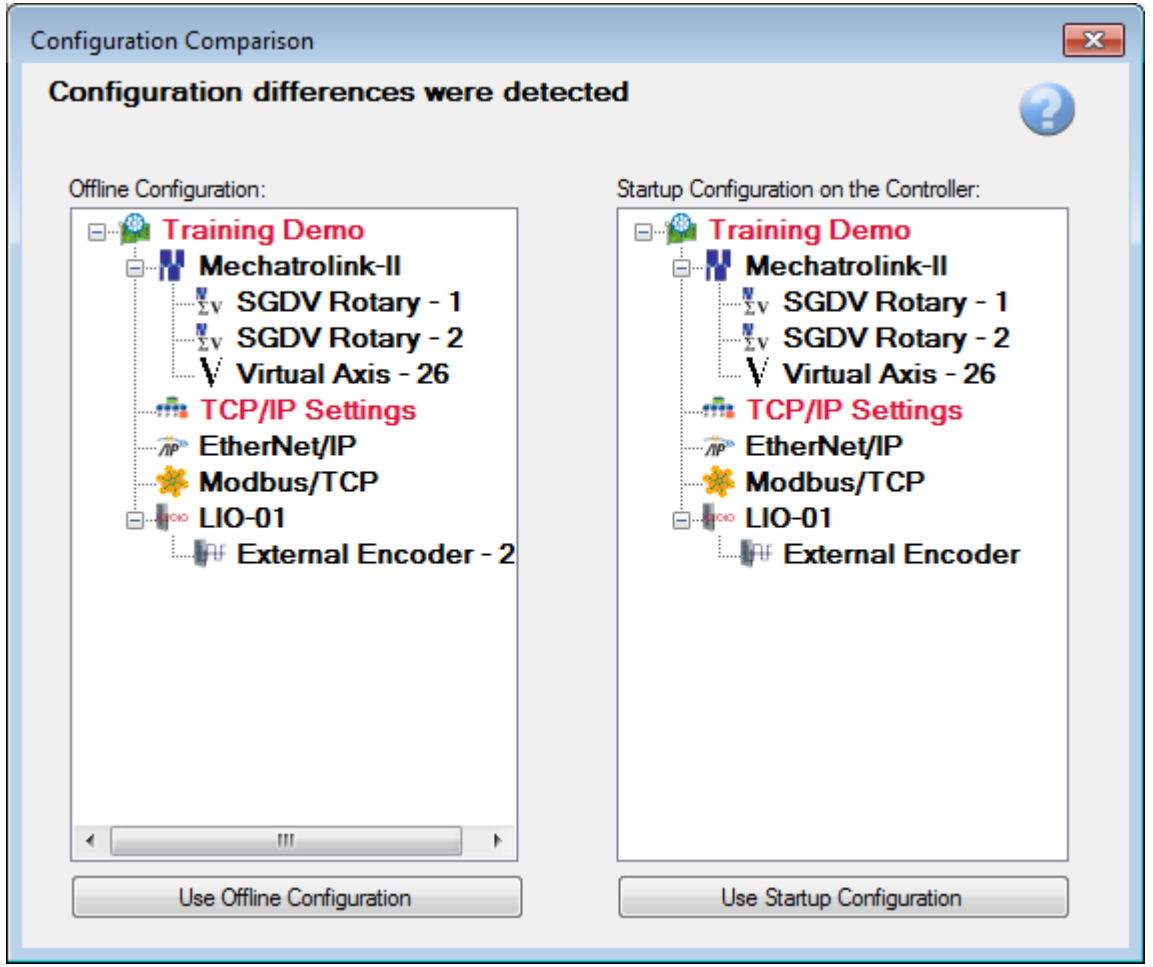
Offline or Online?



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.*

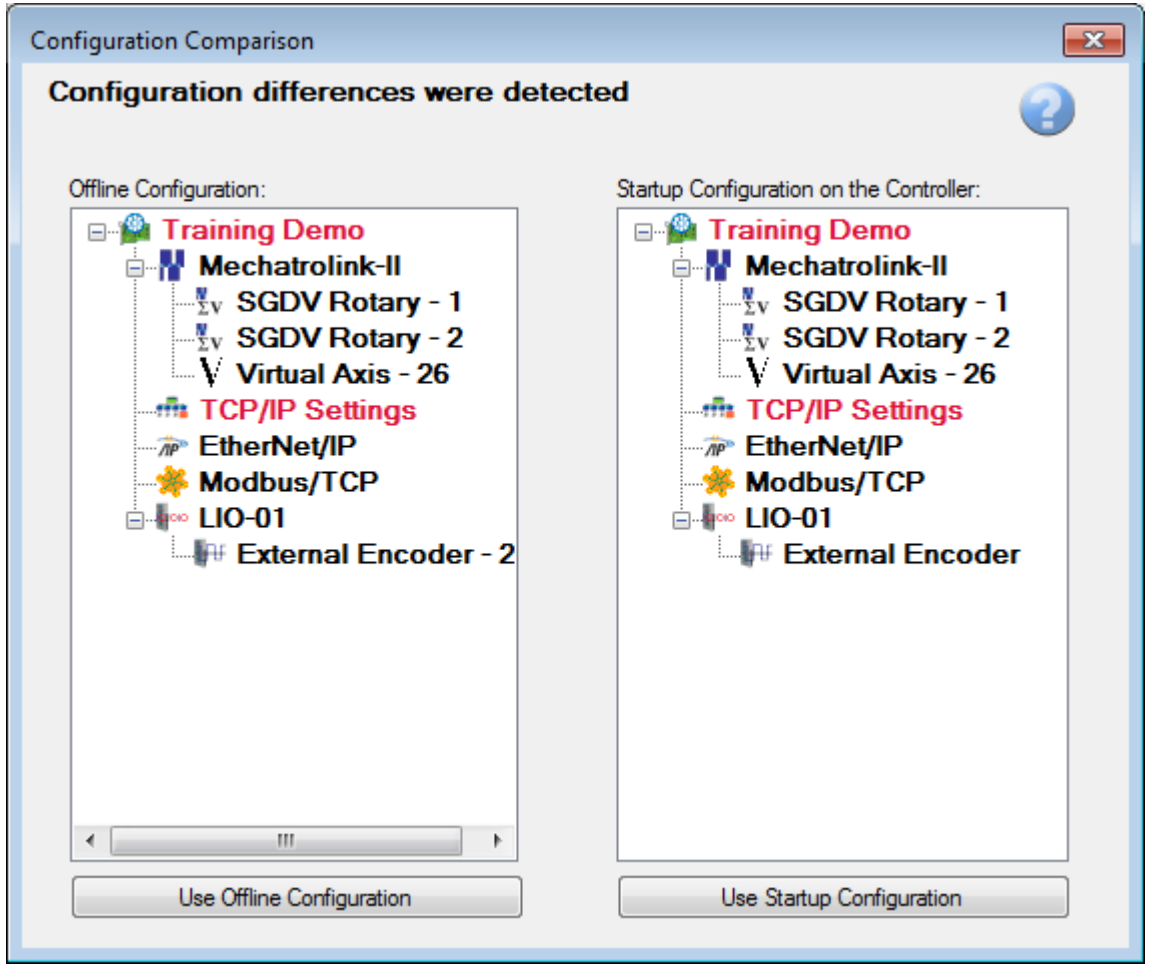
Offline or Online?



Differences Detected

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

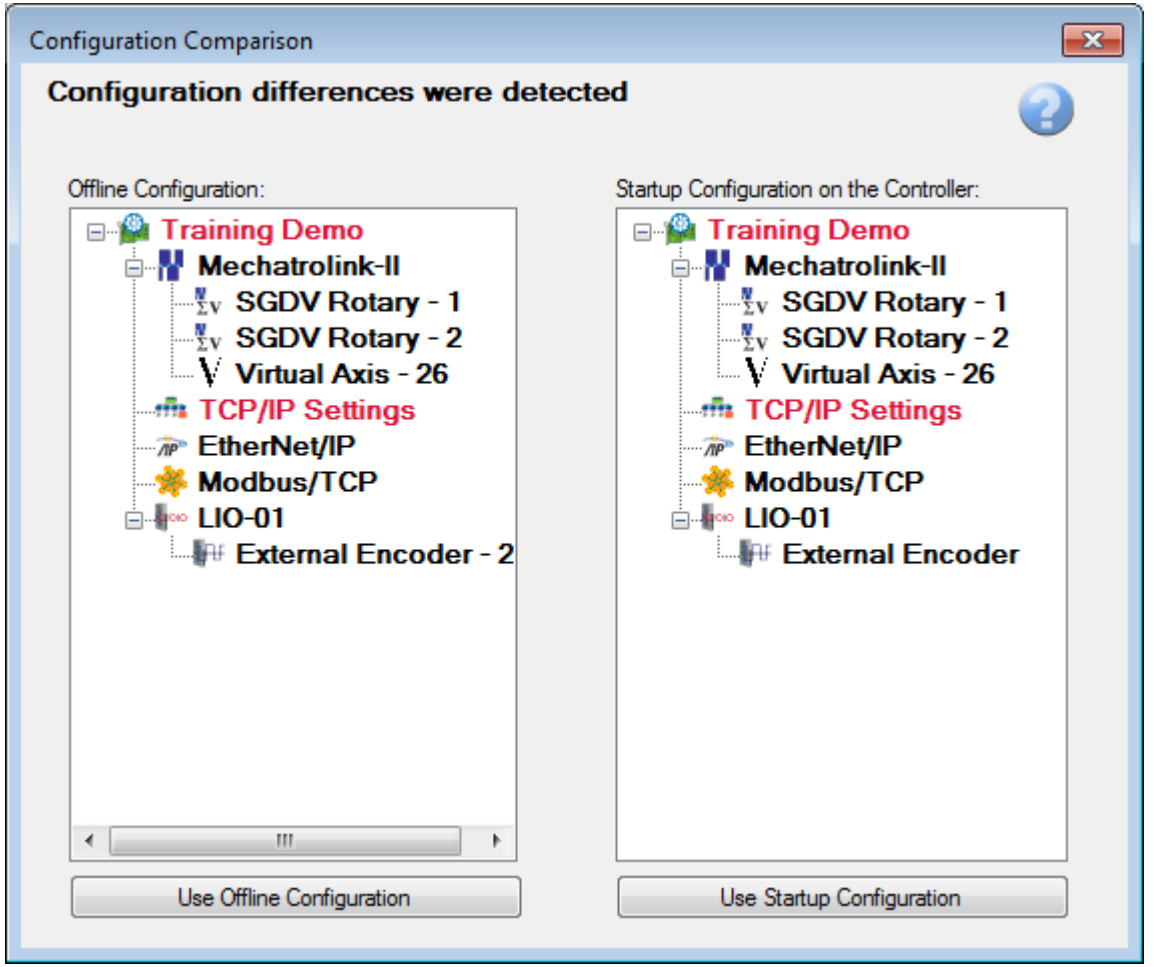
Offline or Online?



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.*

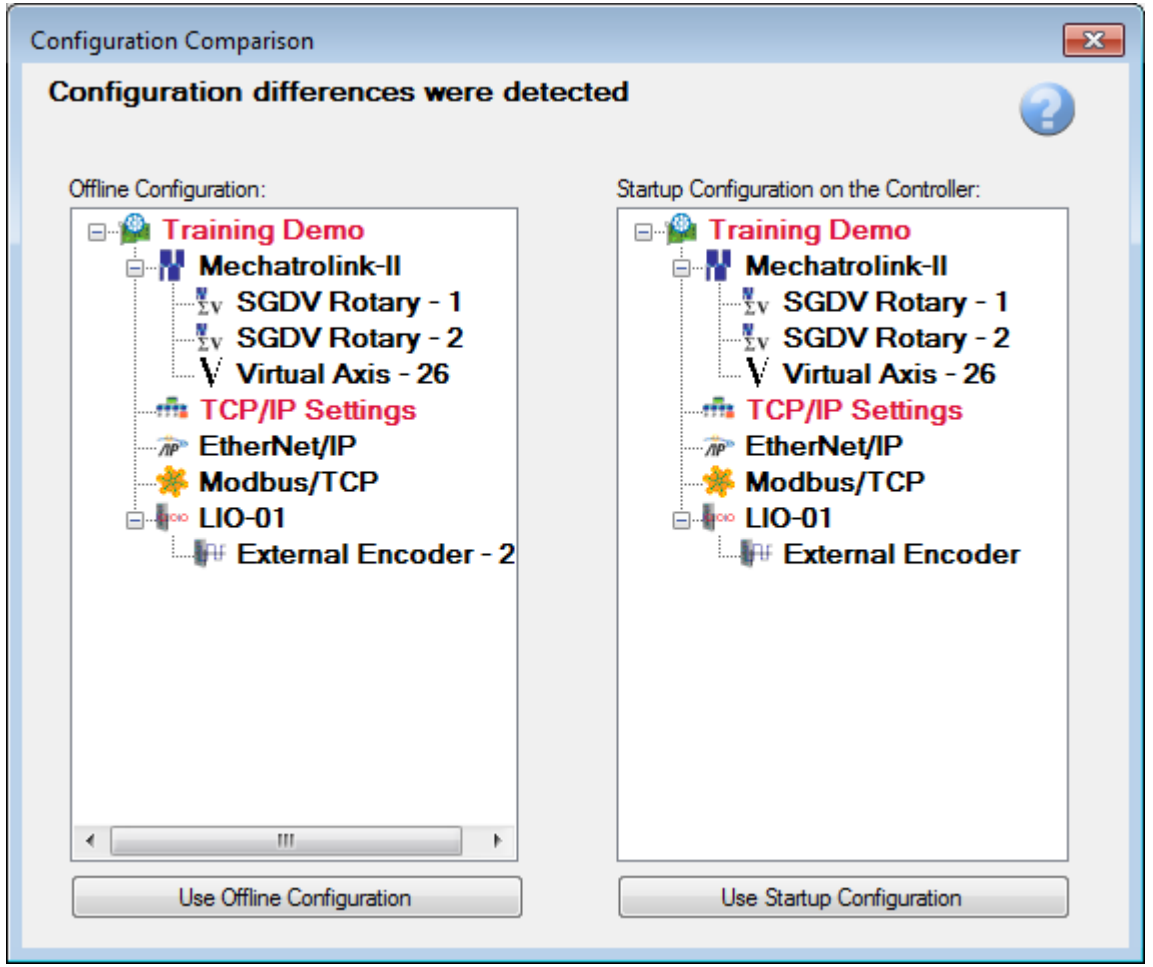
Offline or Online?



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.*

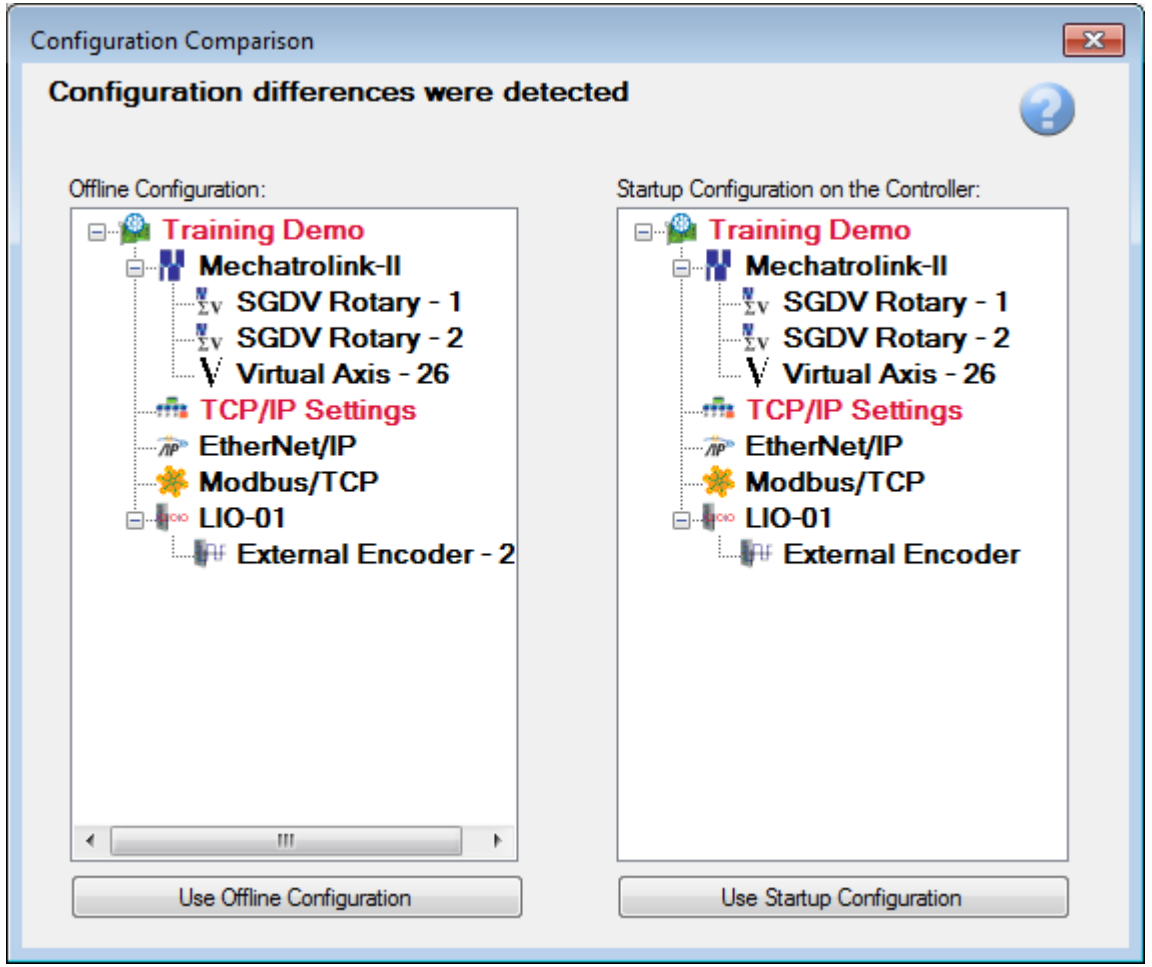
Offline or Online?



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

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*

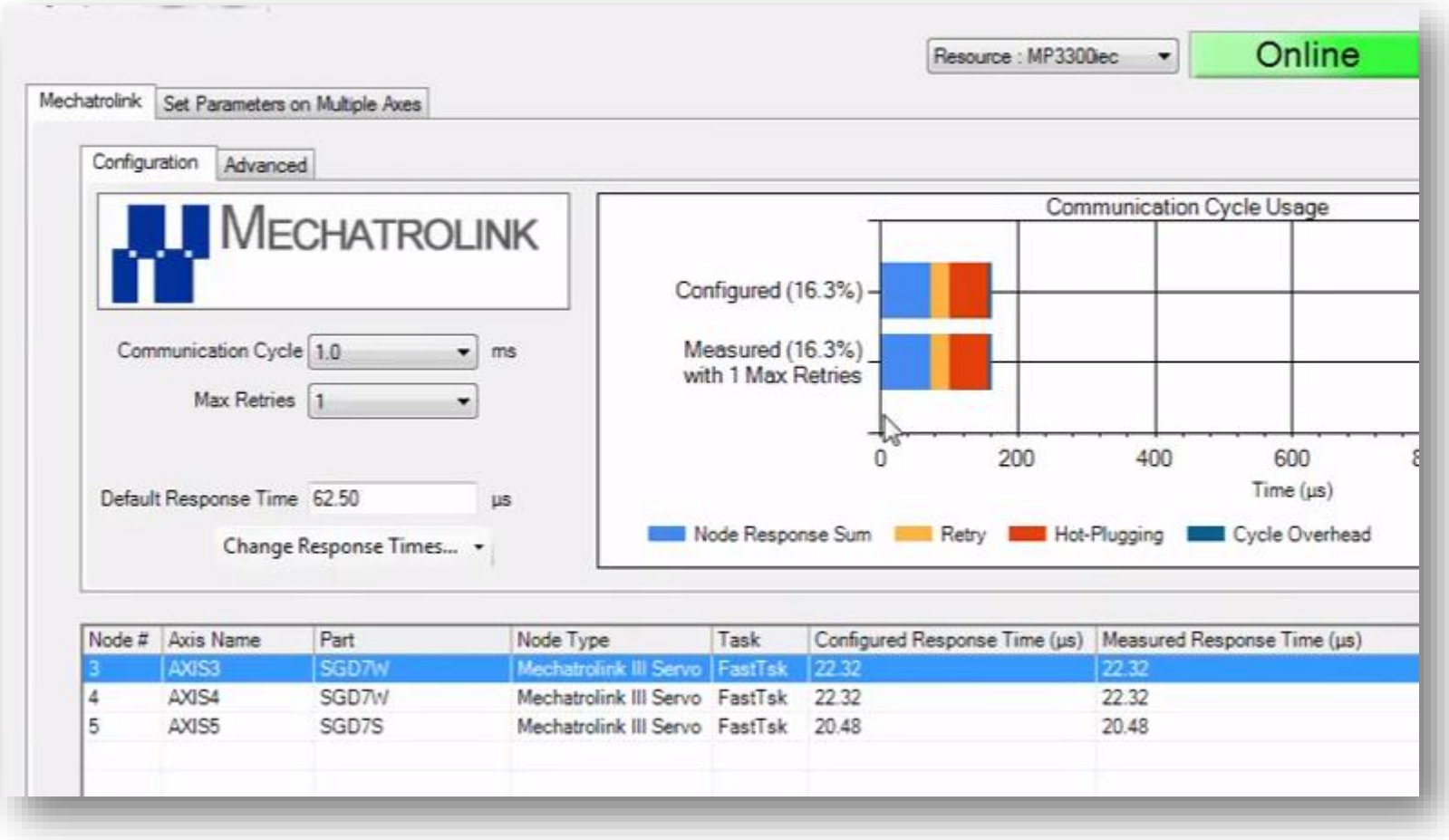
Online with Default Configuration

- 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*



Application Example

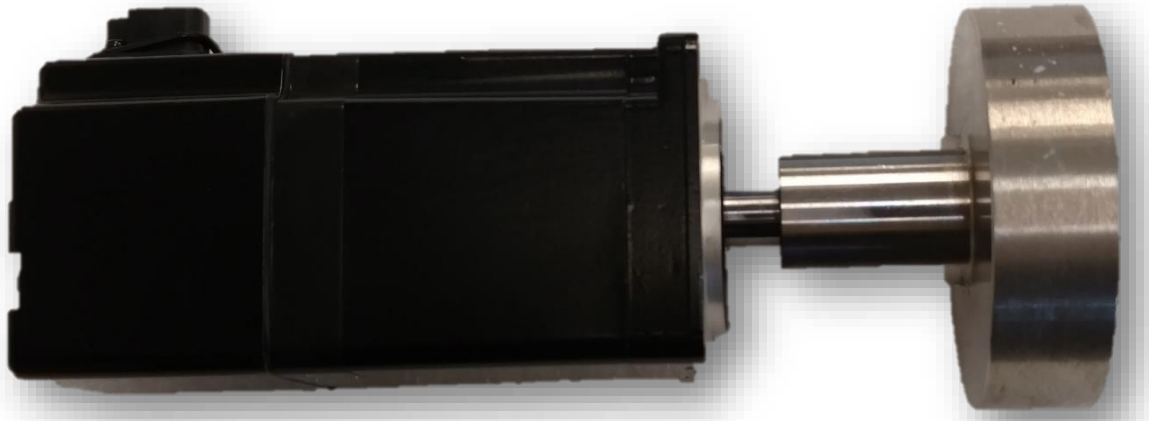
- *X Axis Actuator*
  - *Timing Belt*
  - *5 [mm] pitch*
  - *Drive pulley 72 teeth*
  - *Result: 5x72 = 360 [mm/rev]*
- *Y Axis Actuator*
  - *Same as X*

Application Example

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

Application Example

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

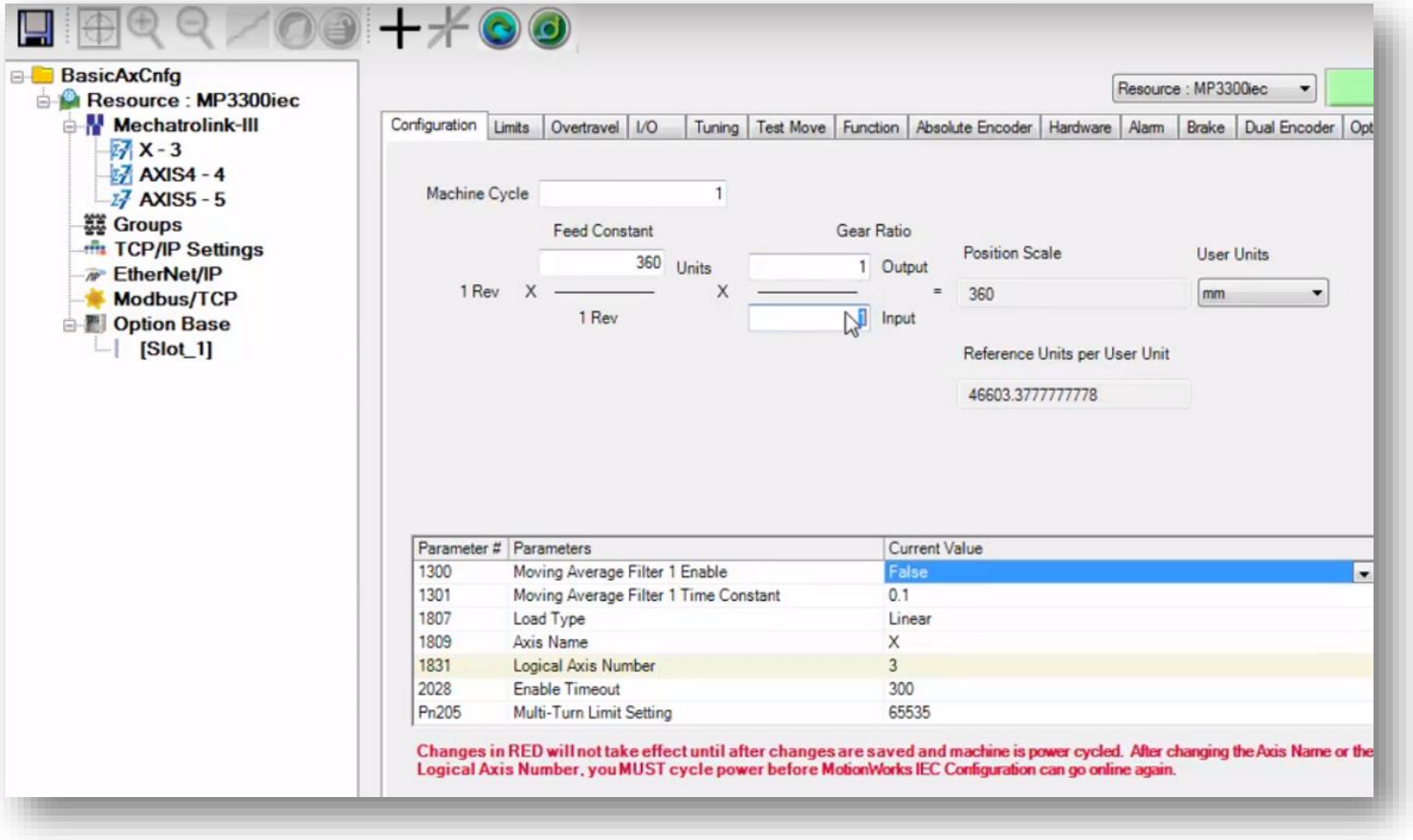


Application Example

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

X-Axis Belt Mechanical Configuration

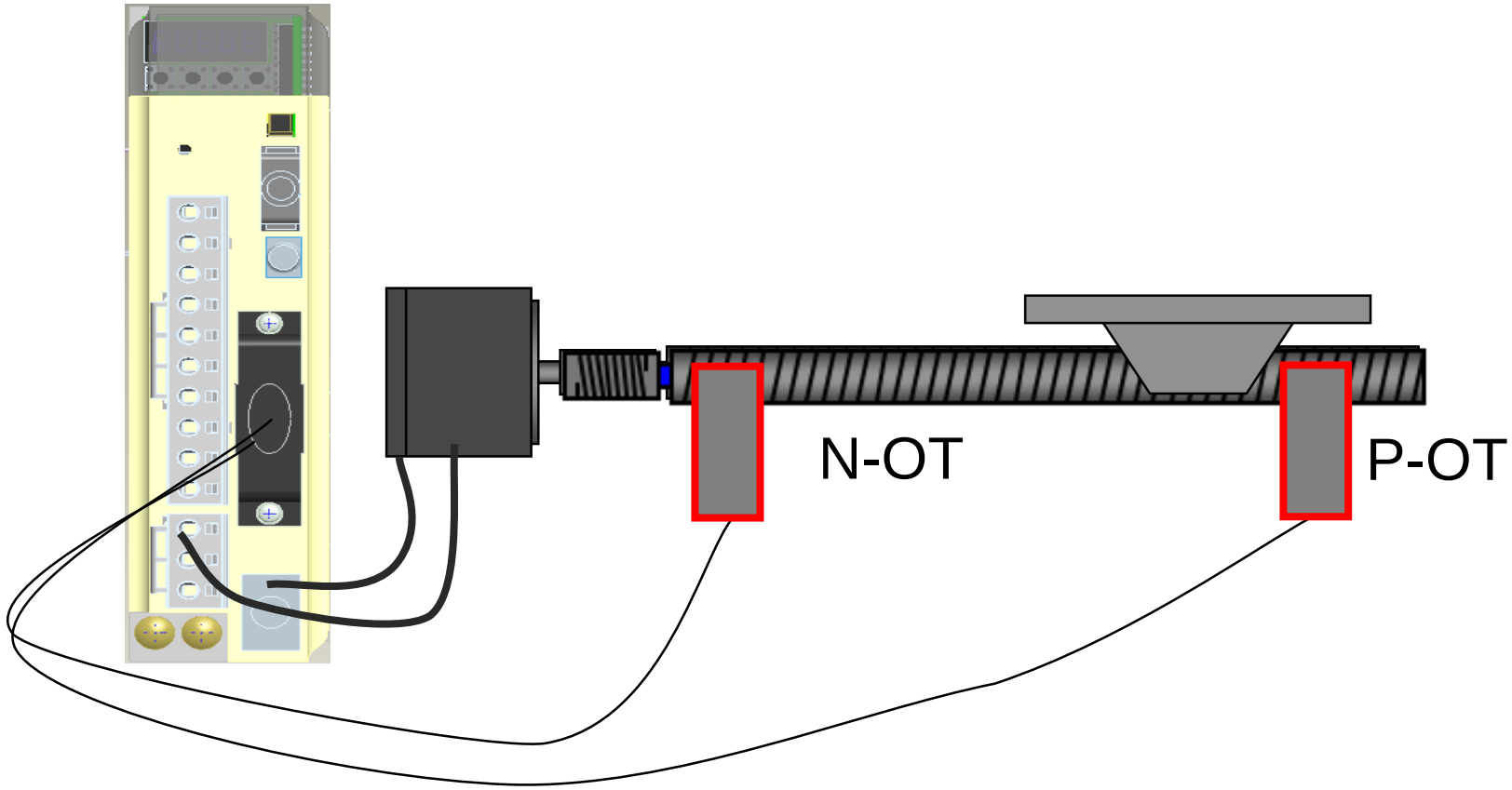
- *Name: X*
- *Load Type : Linear*
- *User Unit: mm*
- *Feed Constant: 360*
- *Machine Cycle*
  - *Not Used with Linear load type*
  - *Used with Rotary load type*
  - *Distance moved to complete a cycle*
  - *Stations on a Rotary Table*
  - *Flighted Conveyor*



X-Axis Belt Servo Parameters

Overtravel Tab

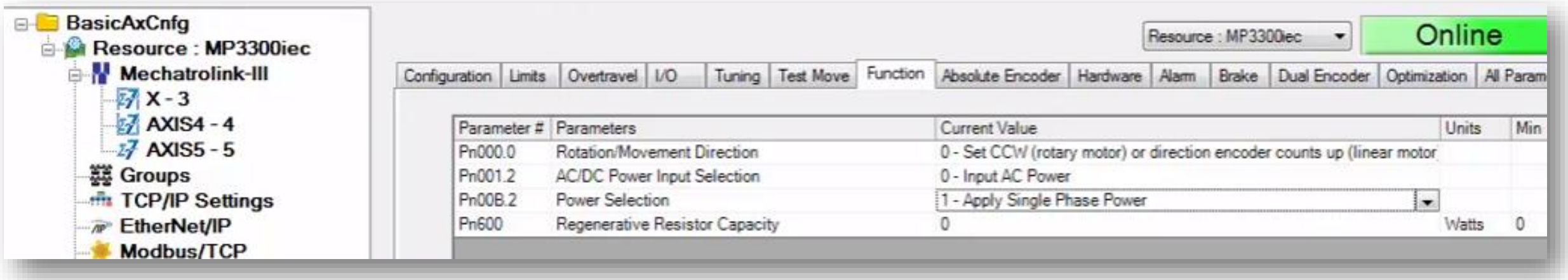
- *Pn50A.3*
  - *8 = disable*



X-Axis Belt Servo Parameters

Function Tab

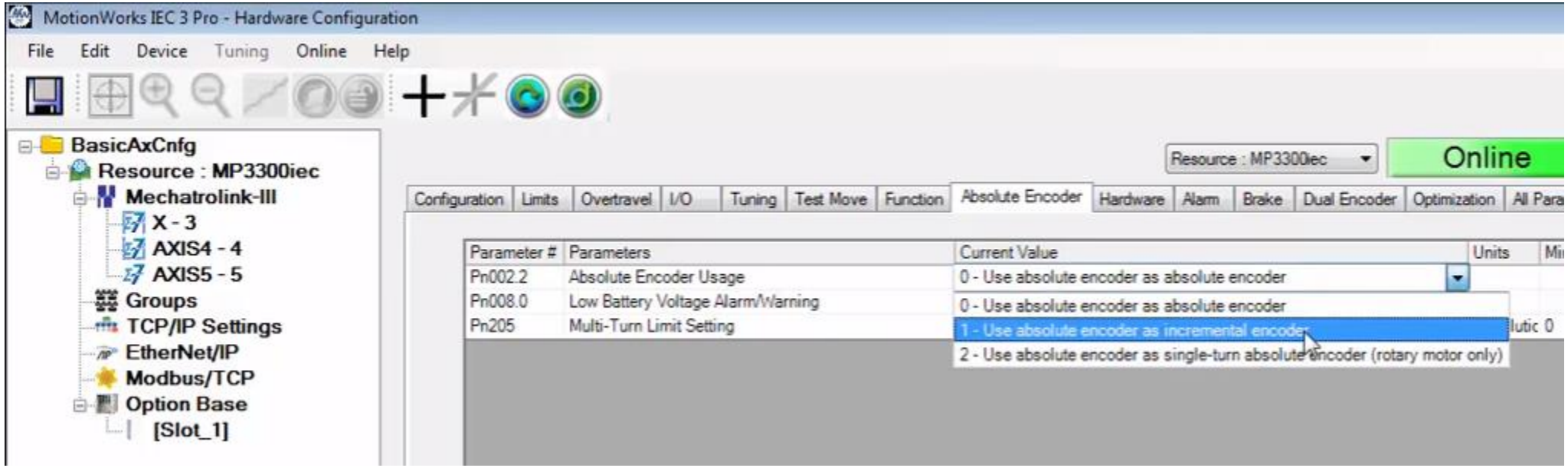
- *Pn000.0*
  - *Direction*
  - *CCW forward*
- *Pn00B.3*
  - *200V Power*
  - *1-phase*



X-Axis Belt Servo Parameters

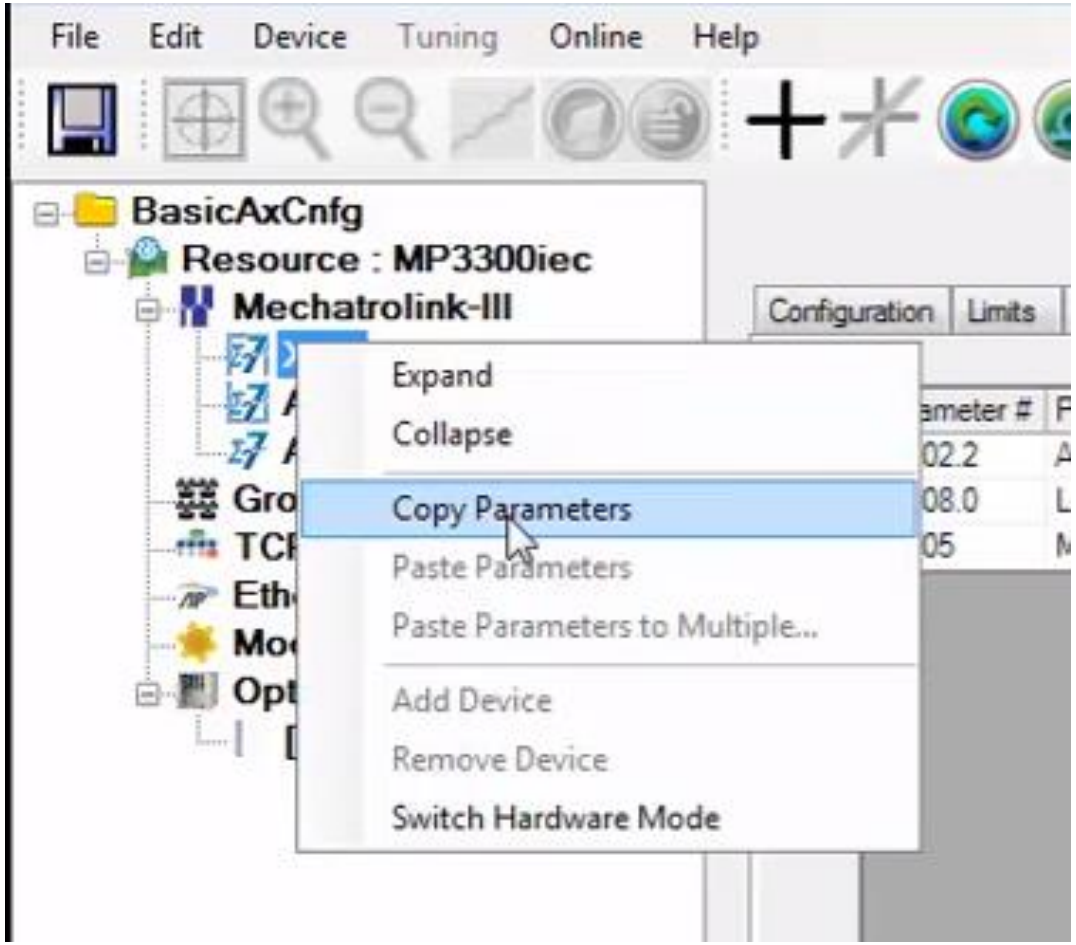
Absolute Encoder Tab

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



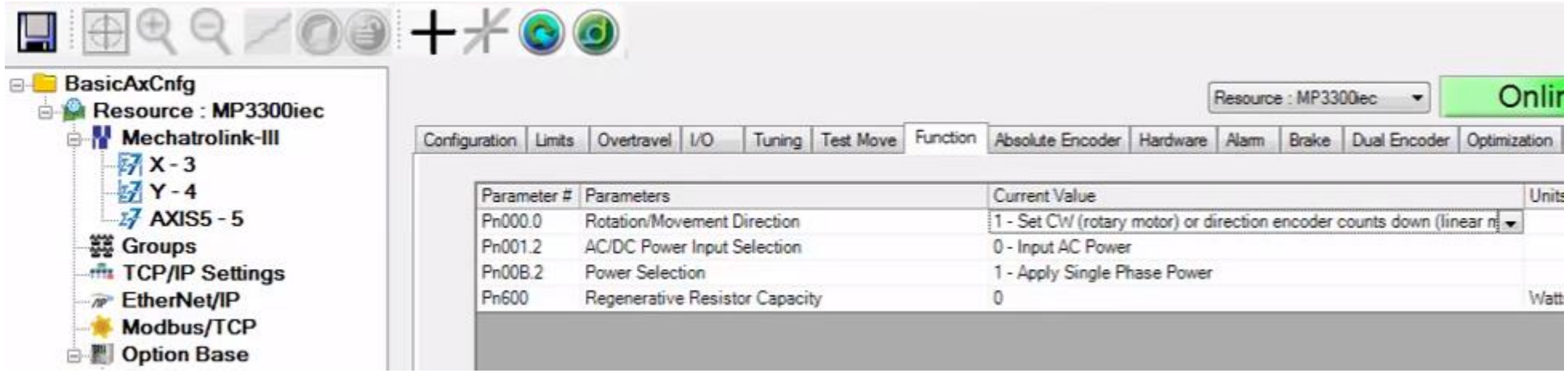
Copy/Paste Parameters

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



Y-Axis Belt Configuration & Parameters

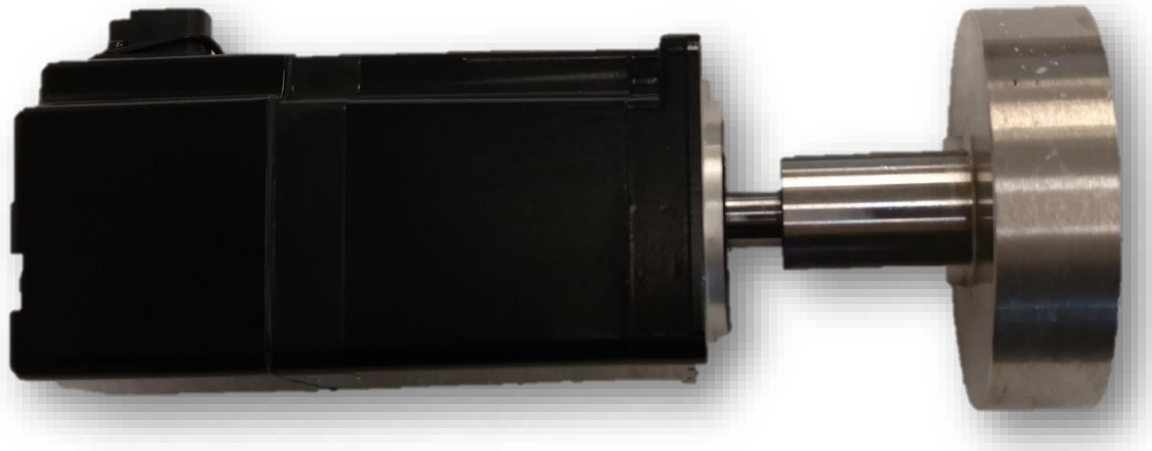
- *Configuration*
  - *Axis Name: Y*
- *Parameters*
  - *Direction: CW*



Z-Axis Rotary Table

EXERCISE

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

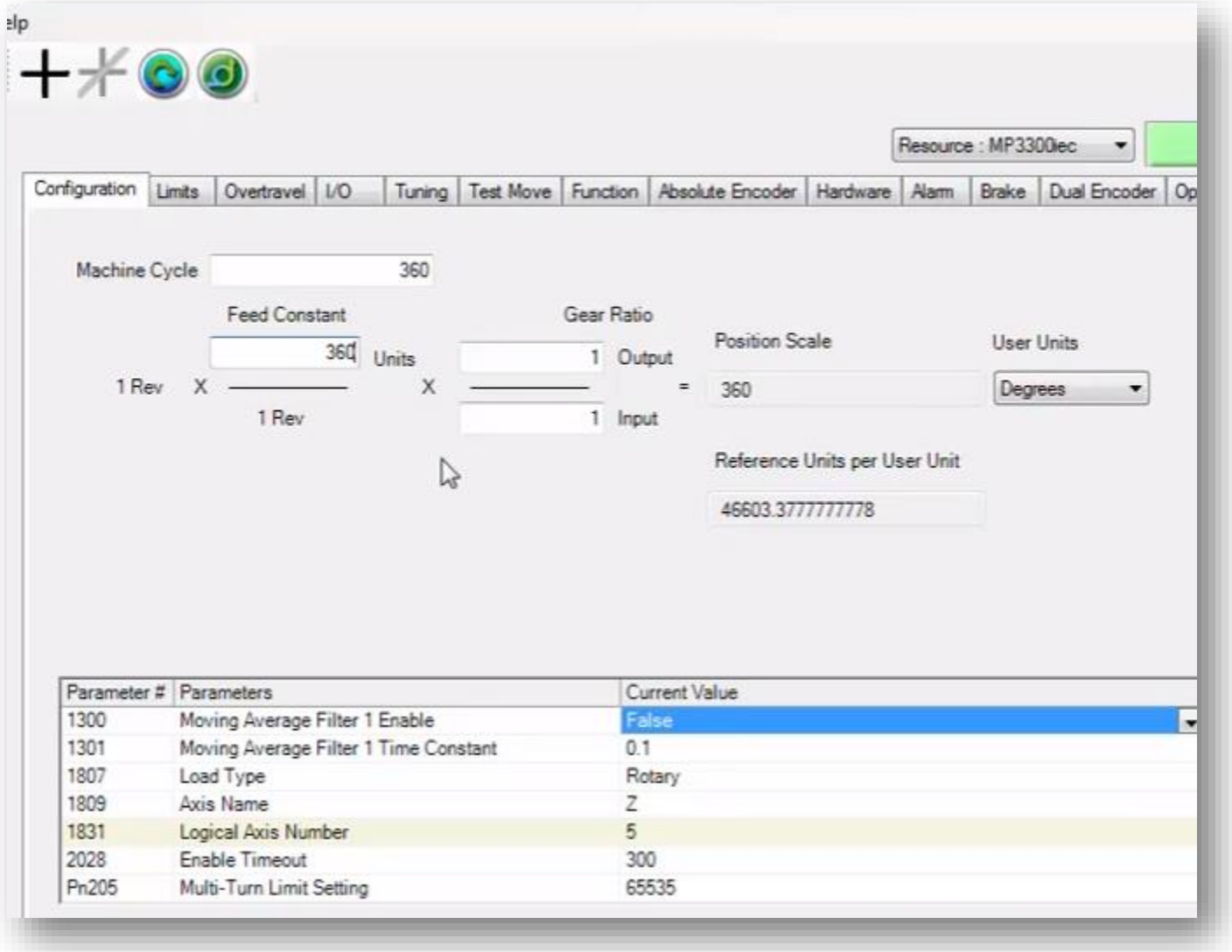


**Hint: Set machine cycle*

Z-Axis Rotary Table

Solution

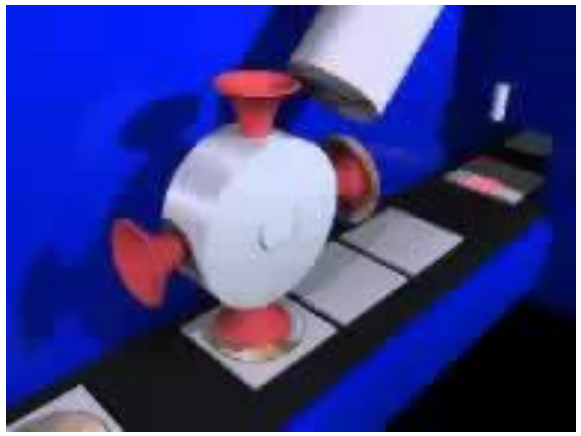
- *Configure the rotary table*
  - *Name “Z”*
  - *Load type Rotary*
  - *Machine Cycle 360*
  - *User Unit – deg*
  - *Feed constant 360*
  - *Gear: 1 to 1*
  - *IO: Over Travel enable default*
  - *Pn000.0=0*
  - *Pn002.2= incremental*
  - *Pn00B.3 = N/A*

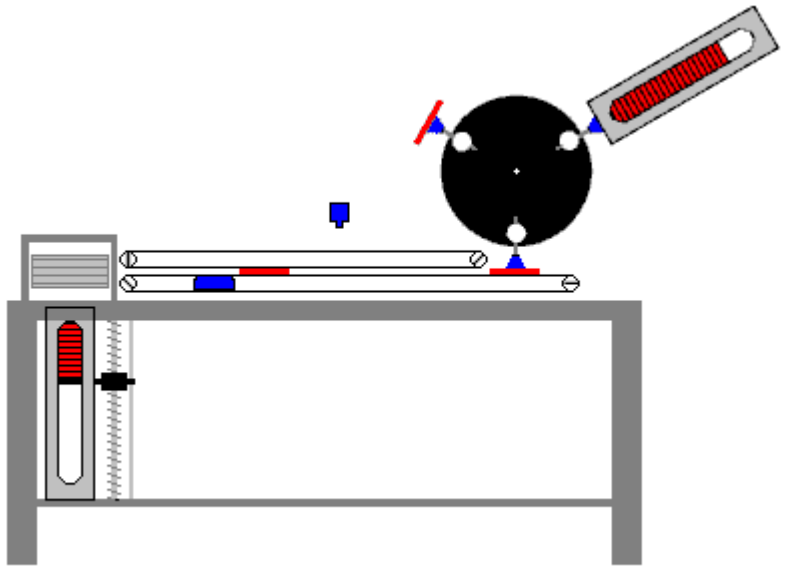


Rotary Table

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

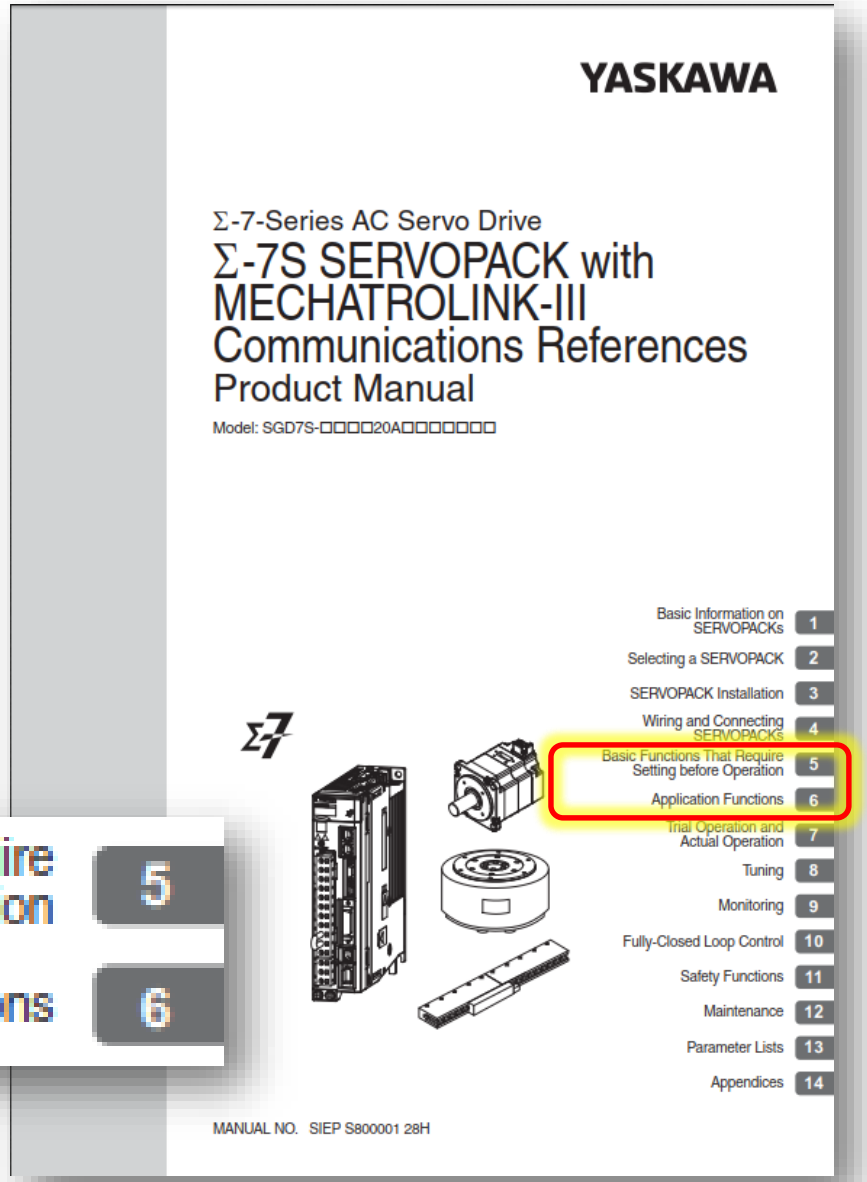
- *Overview*
- *Sigma-7 Product Manual*
- *Rules for Parameters*
- *Parameter Introduction*

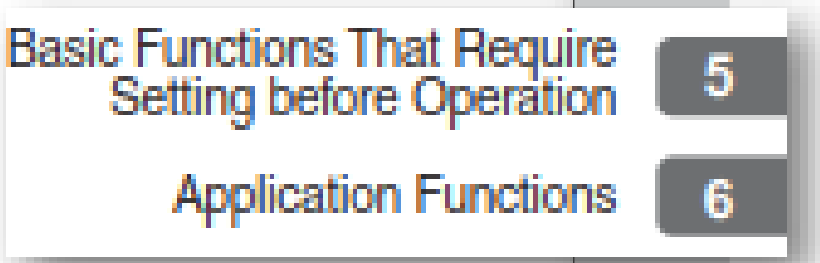
Overview

- *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*





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

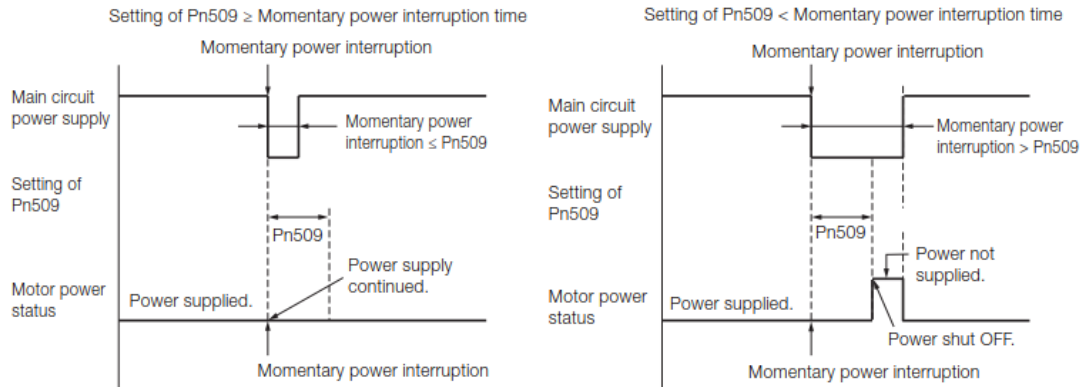
- *AC or DC Power (5.3)*
  - *Pn001*
- *1 phase 200V (5.3)*
  - *Pn00B*
- *Power Interruptions (6.2)*
  - *Pn509*
- *Low Voltage brownouts (6.3)*
  - *Semi F47*
  - *Pn008, Pn424, Pn425*

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

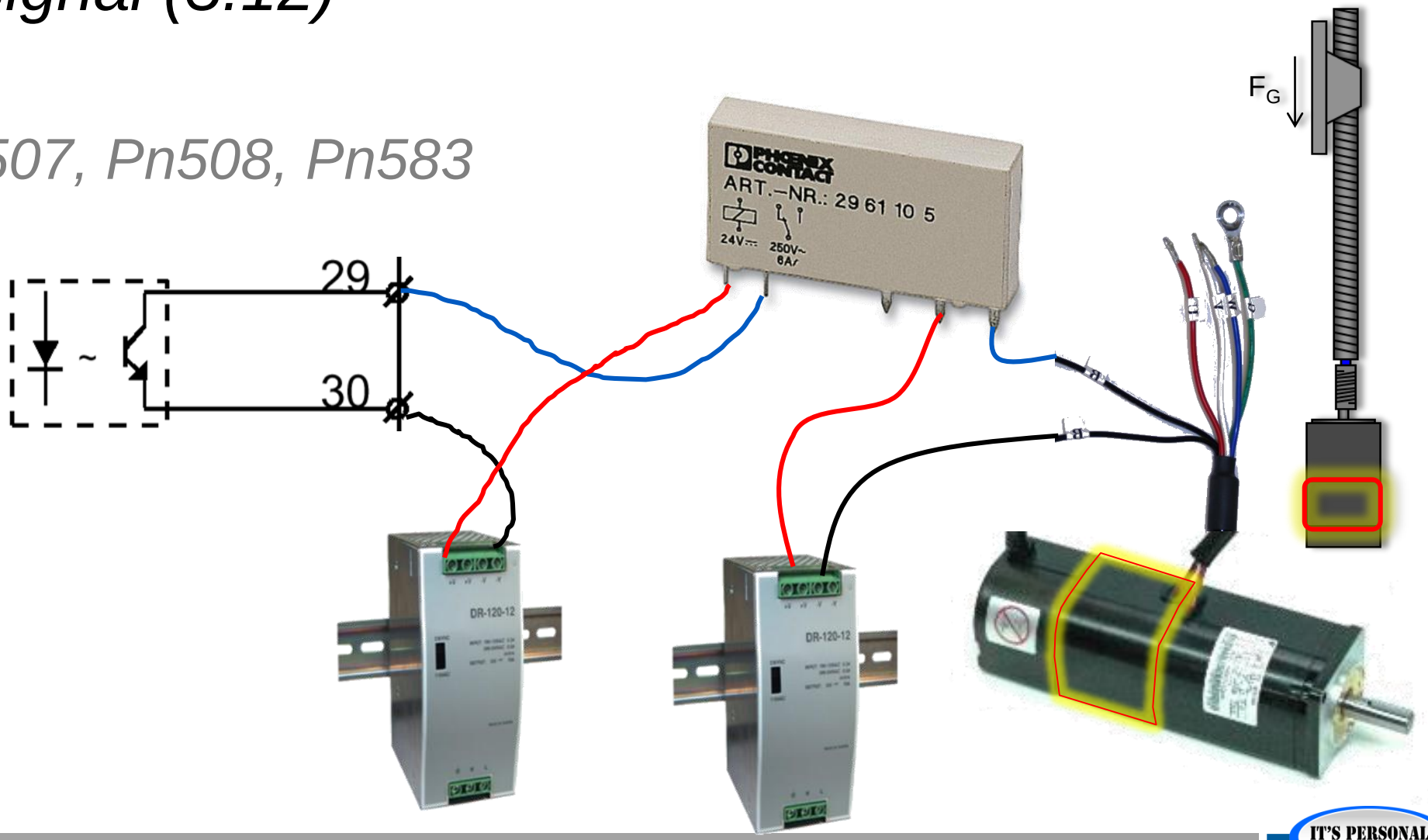
Serial Converter Unit
The Serial Converter Unit converts the signal from the linear encoder into a form that can be read by the SERVOPACK.

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

	Linear Encoder Scale Pitch			Speed	Position	Force
Pn282	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 6,553,600	0.01 µm	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				
	n.□□02	Coasting			
	n.□□1□	Deceleration according to setting of Pn406	Zero clamp		
	n.□□2□		Coasting		
	n.□□3□	Deceleration according to setting of Pn30A	Zero clamp		
	n.□□4□		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.

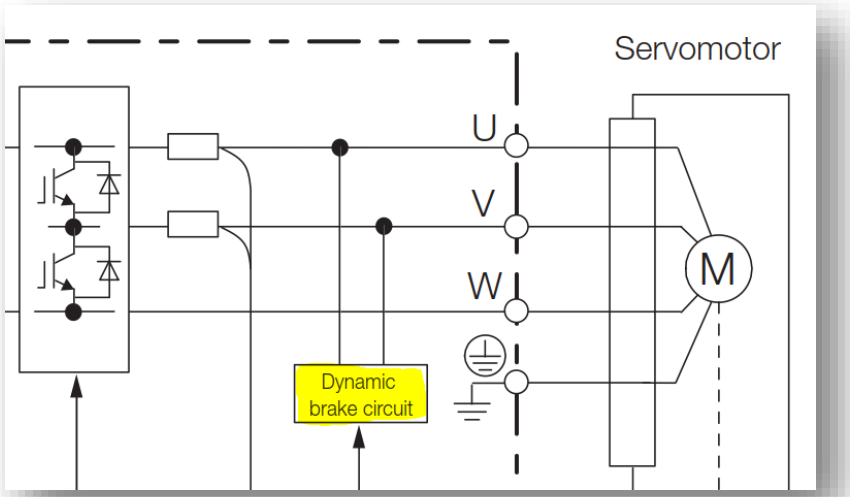
Parameter		Description	When Enabled	Classification
Pn00A	n.□□0□	Apply the dynamic brake or coast the motor to a stop (use the stopping method set in Pn001 = n.□□□X).	After restart	Setup
	n.□□1□ (default setting)	Decelerate the motor to a stop using the torque set in Pn406 as the maximum torque. Use the setting of Pn001 = n.□□□X for the status after stopping.		
	n.□□2□	Decelerate the motor to a stop using the torque set in Pn406 as the maximum torque and then let the motor coast.		
	n.□□3□	Decelerate the motor to a stop using the deceleration time set in Pn30A. Use the setting of Pn001 = n.□□□X for the status after stopping.		
	n.□□4□	Decelerate the motor to a stop using the deceleration time set in Pn30A and then let the motor coast.		

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	Dynamic brake	After restart	Setup
	n.□□□1		Coasting		
	n.□□□2	Coasting	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

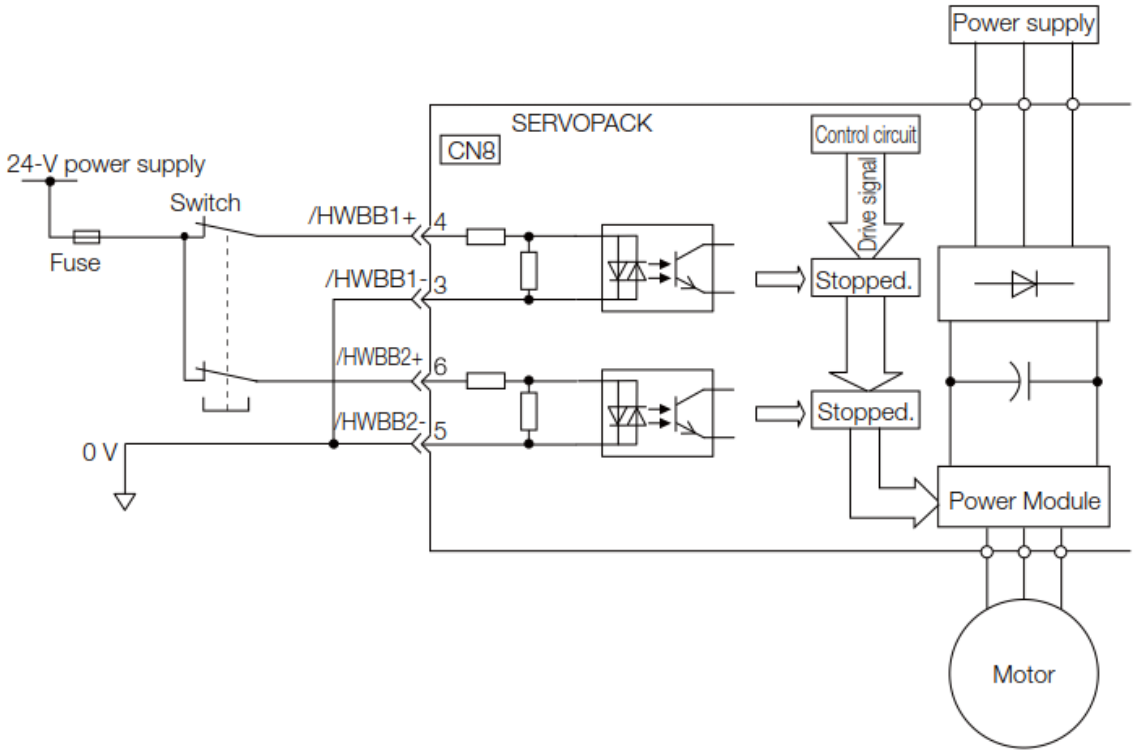
7. Alarm Stop

- *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.□□0□ (default setting)	–	n.□□□0 (default setting)	Zero-speed stopping	Dynamic brake	After restart	Setup
		n.□□□1		Coasting		
		n.□□□2				
n.□□1□	–	n.□□□0 (default setting)	Dynamic brake	Dynamic brake		
		n.□□□1		Coasting		
		n.□□□2	Coasting			
n.□□2□	n.□□□0 (default setting)	n.□□□0 (default setting)	Dynamic brake	Dynamic brake		
		n.□□□1		Coasting		
		n.□□□2	Coasting			
	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				
	n.□□□2	n.□□□0 (default setting)		Coasting		
		n.□□□1				
		n.□□□2				
	n.□□□3	n.□□□0 (default setting)	Motor is decelerated according to setting of Pn30A.	Dynamic brake		
		n.□□□1		Coasting		
		n.□□□2				
	n.□□□4	n.□□□0 (default setting)		Coasting		
		n.□□□1				
		n.□□□2				

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?*

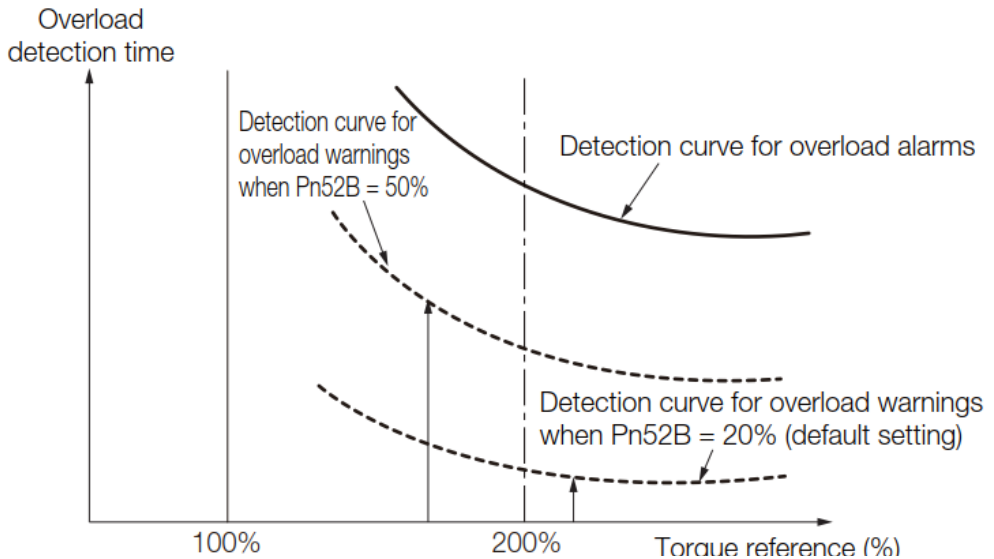
5. *What parameter selects the stopping method for Safety Stop?*

Parameter Introduction

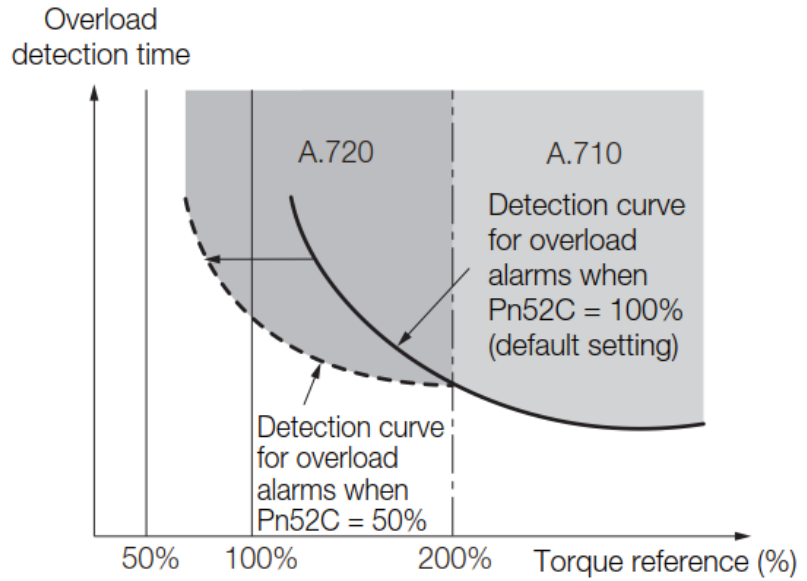
1. Input Power
2. Linear Motor
3. Holding Brake
4. Over Travel
5. Force Stop
6. Servo Off Stop
7. Alarm Stop
8. Safety Stop
9. Overload Detection
10. Electronic Gear
11. Absolute Encoder
12. Regen Resistor
13. Max Motor Speed
14. Encoder Pulse Output
15. Software Limits
16. Torque Limits
17. Vibration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

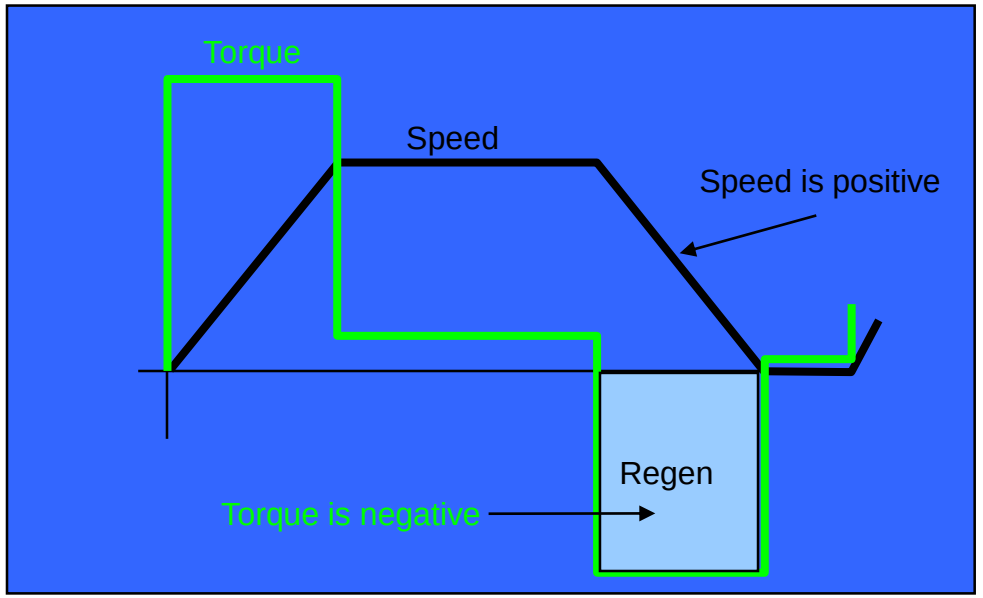
11. Absolute Encoder

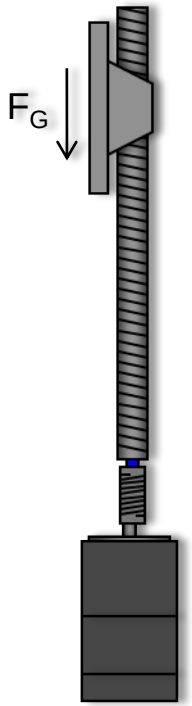
- *Reset the Absolute Encoder*
  - *A.810, A.820*
- *Set the Multi-Turn Limit*
  - *Pn205*
  - *A.CC0*

The next section is devoted to Absolute Encoders

12. Regenerative Resistor

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





"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

Factors that Increase Regen

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

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

	Maximum Motor Speed			Speed	Position	Torque
Pn316	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	0 to 65,535	1 min^{-1}	10,000	After restart	Setup	

- Linear Servomotors

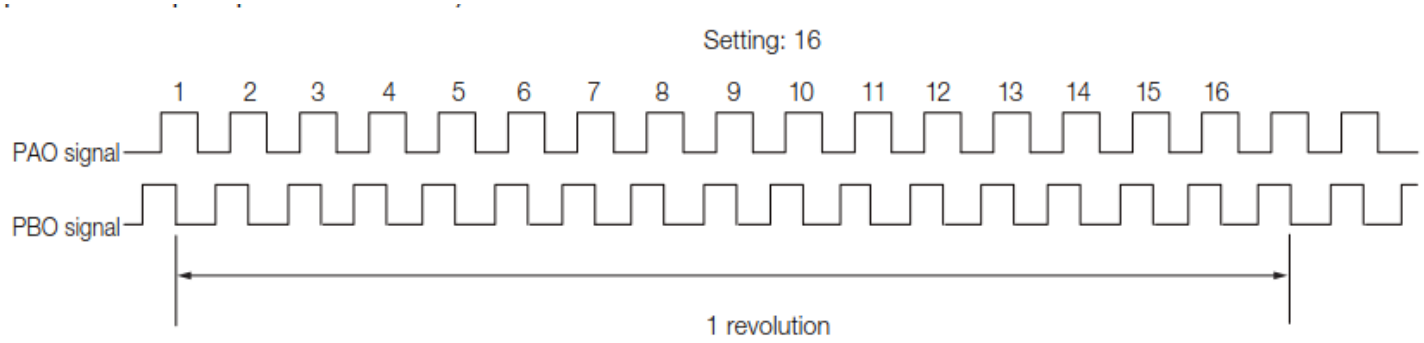
	Maximum Motor Speed			Speed	Position	Force
Pn385	Setting Range	Setting Unit	Default Setting	When Enabled	Classification	
	1 to 100	100 mm/s	50	After restart	Setup	

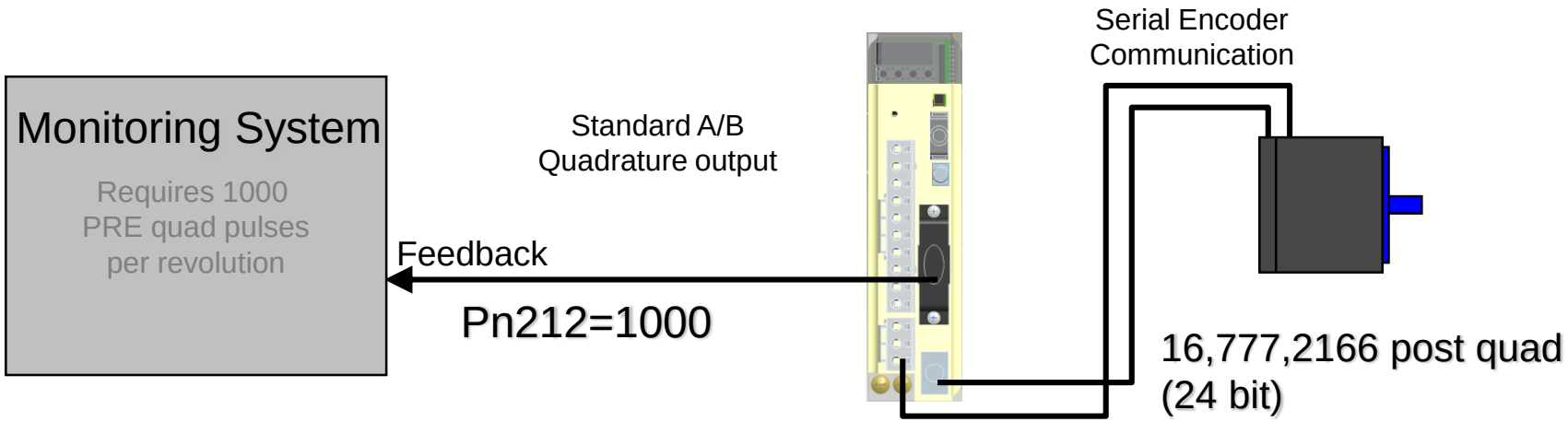
You can achieve the following by lowering the maximum speed of the Servomotor.

- 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*

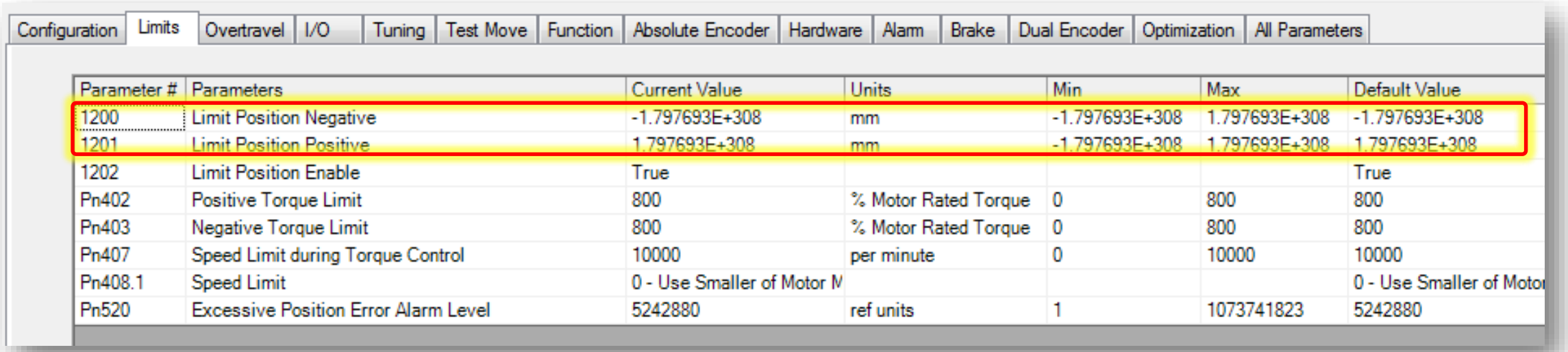




15. Software Limits

- *Servo Software Limits NOT USED by MPiec (6.6)*
  - *Pn804, Pn806, Pn801*
- *MPiec controller handles software limits*

Software limit defines the maximum absolute position possible.

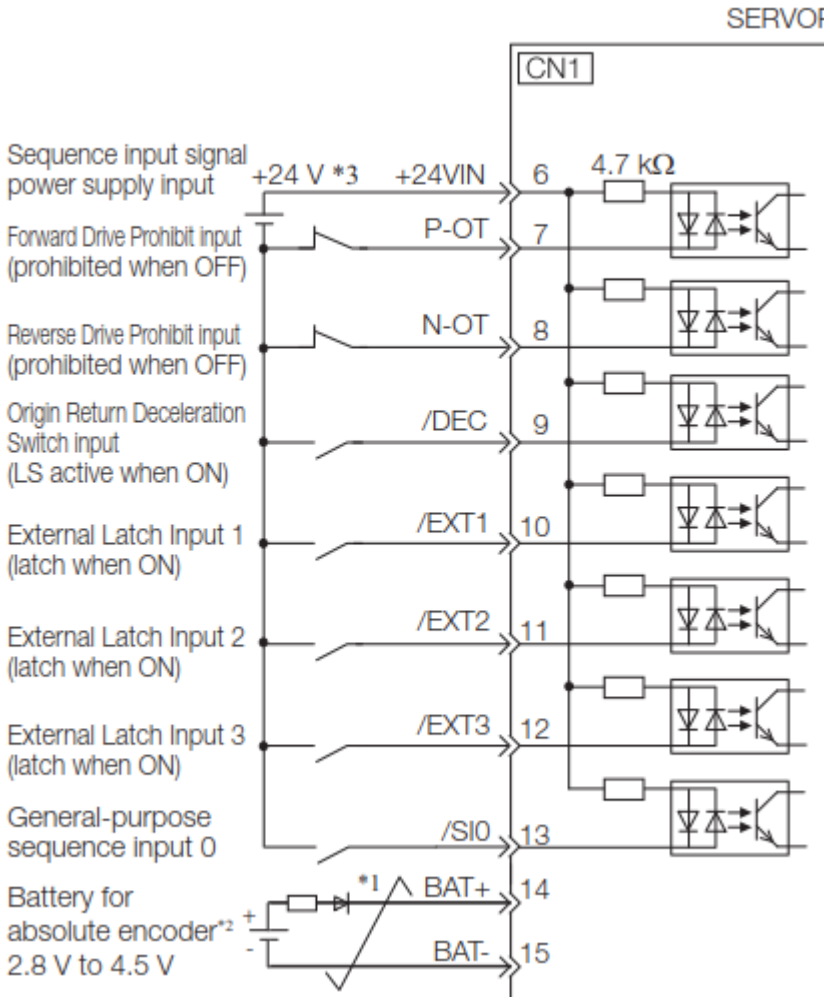


Parameter #	Parameters	Current Value	Units	Min	Max	Default Value
1200	Limit Position Negative	-1.797693E+308	mm	-1.797693E+308	1.797693E+308	-1.797693E+308
1201	Limit Position Positive	1.797693E+308	mm	-1.797693E+308	1.797693E+308	1.797693E+308
1202	Limit Position Enable	True				True
Pn402	Positive Torque 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
Pn520	Excessive Position Error Alarm Level	5242880	ref units	1	1073741823	5242880

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

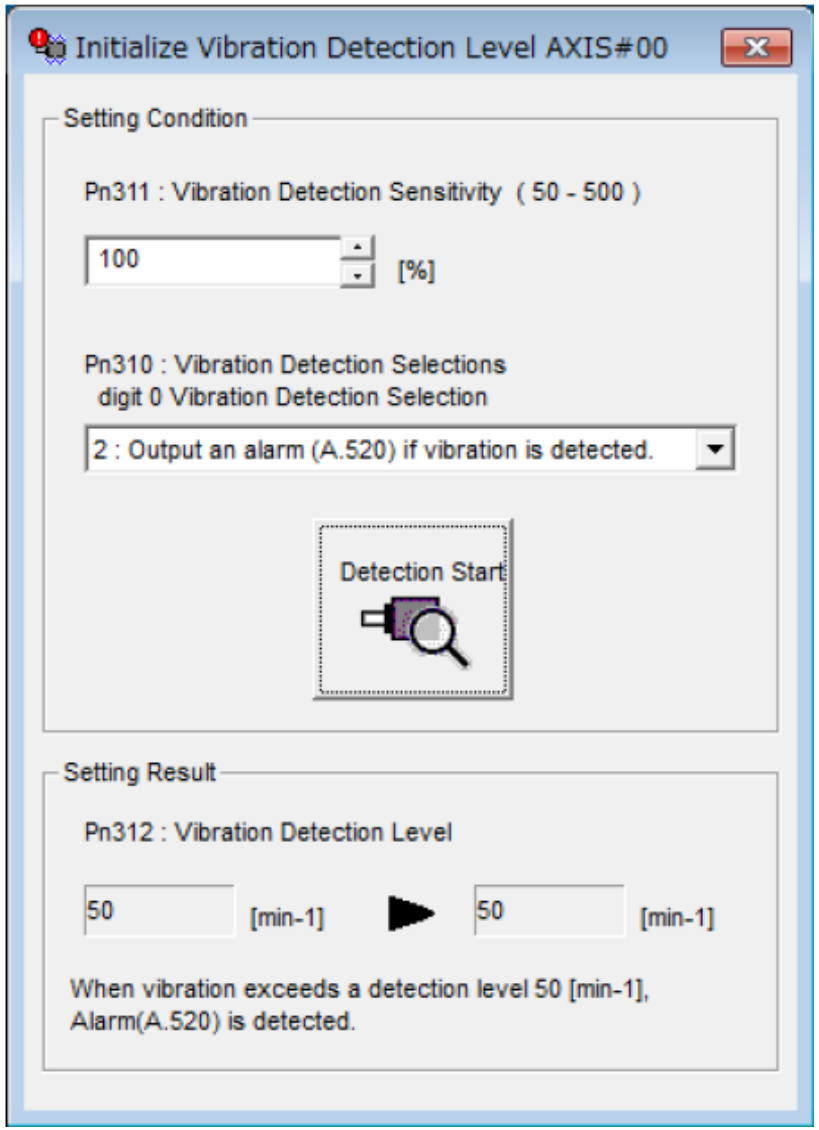
16. Torque Limits

- *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*



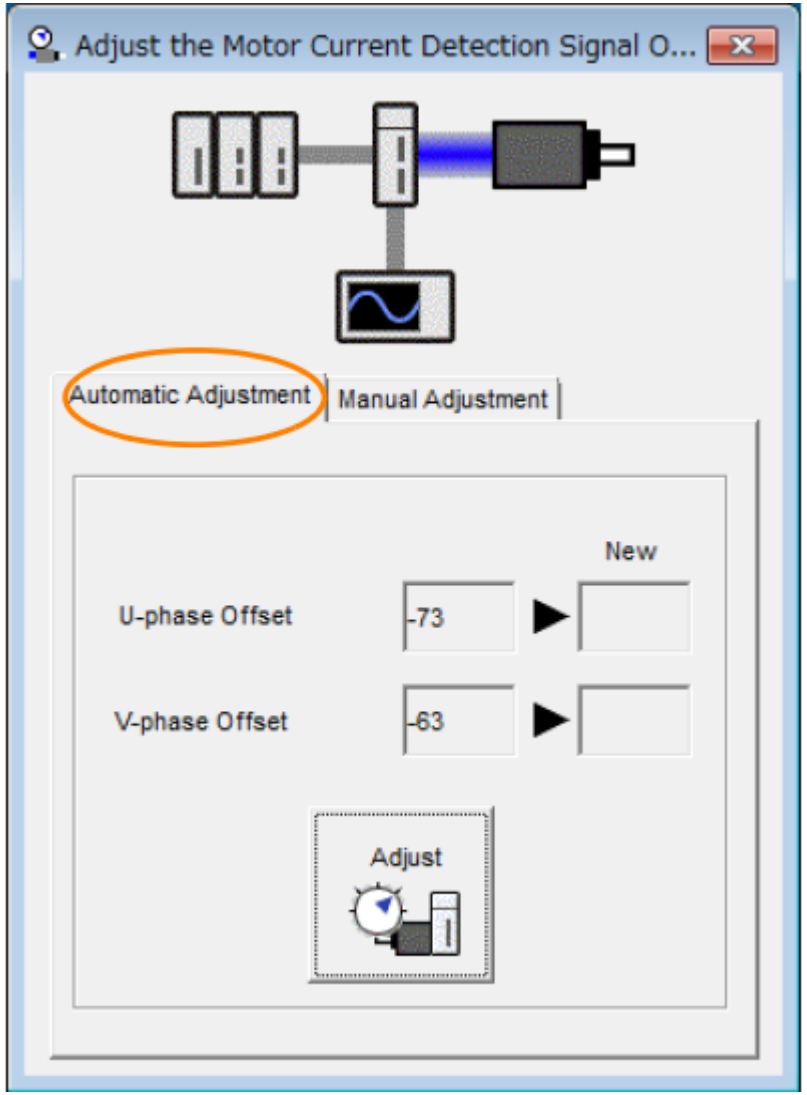
17. Vibration Detection

- *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?*

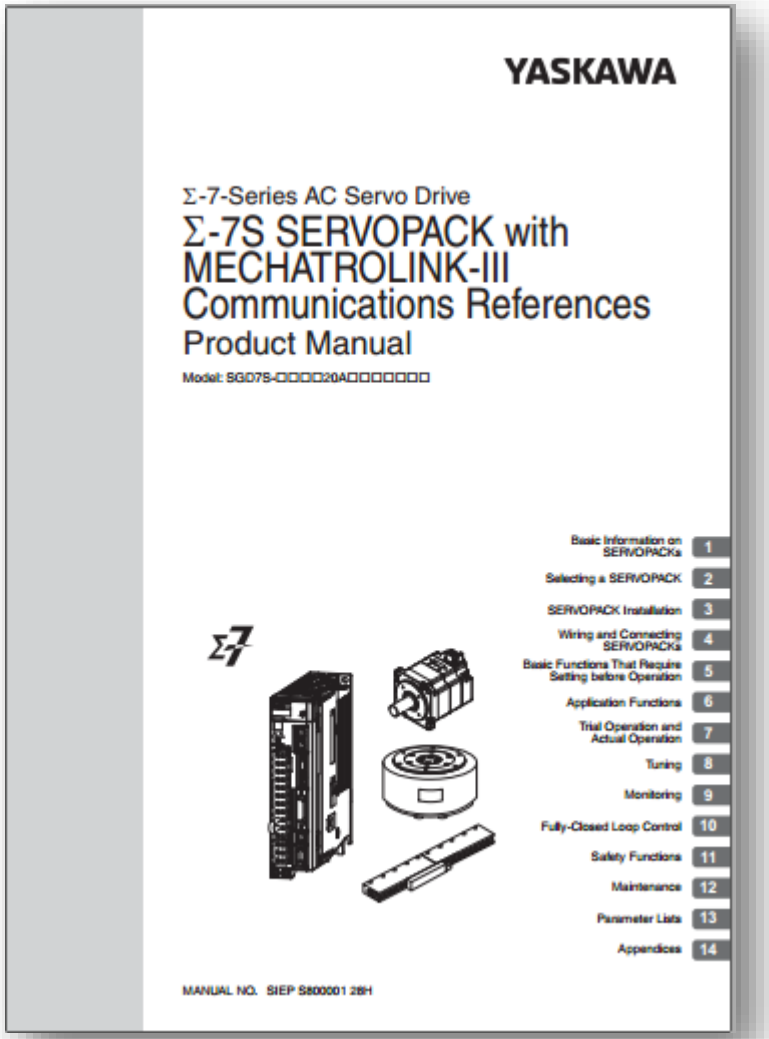
4. *What parameters can limit the motor maximum torque?*

Conclusion

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

Configuration | Limits | Overtravel | I/O | Tuning | Test Move | Function | Absolute Encoder | Hardware | Alarm | Brake | Dual Encoder | Optimization | All Parameters

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 r	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 Torqu				0 - Use Smaller of Motor Maximur
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
Pn40B	1st Notch Filter Depth	0.000		0.000	1.000	0.000



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MotionWorks IEC Hardware Configuration

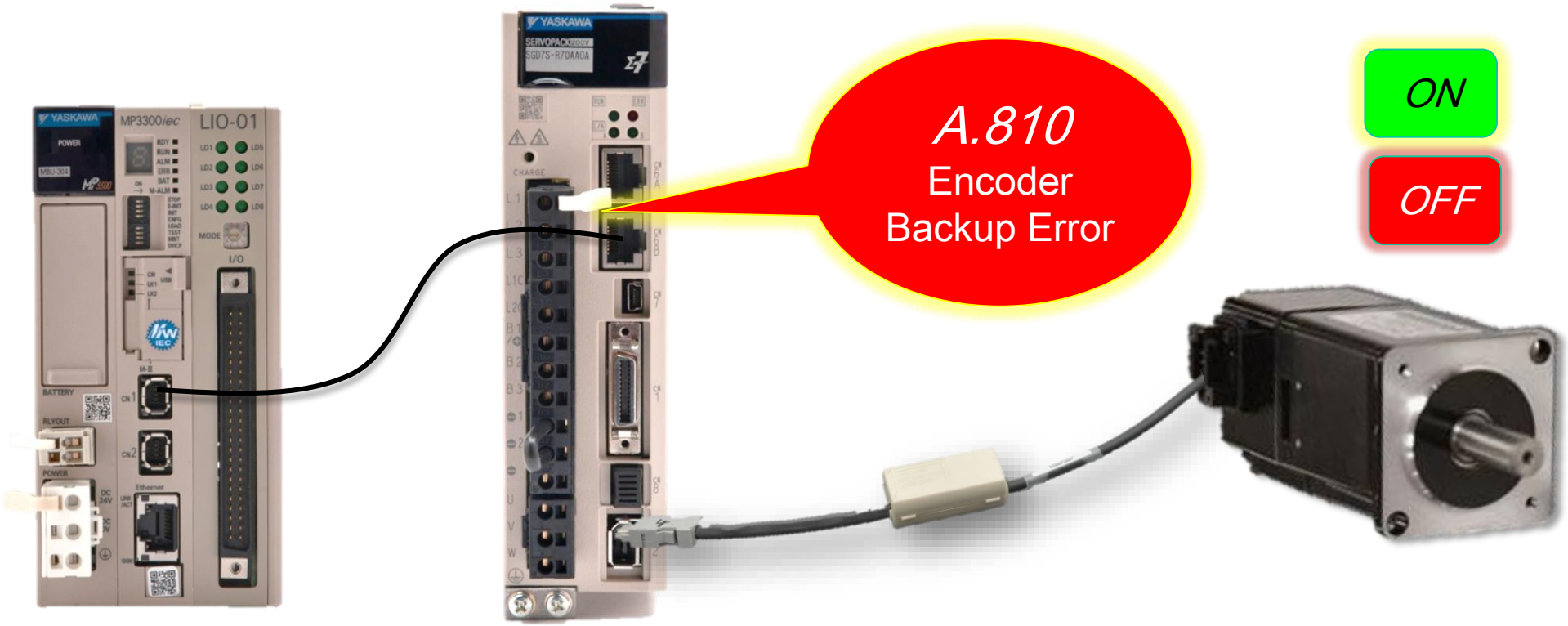
Absolute Encoders

Hands-on Training Tutorial

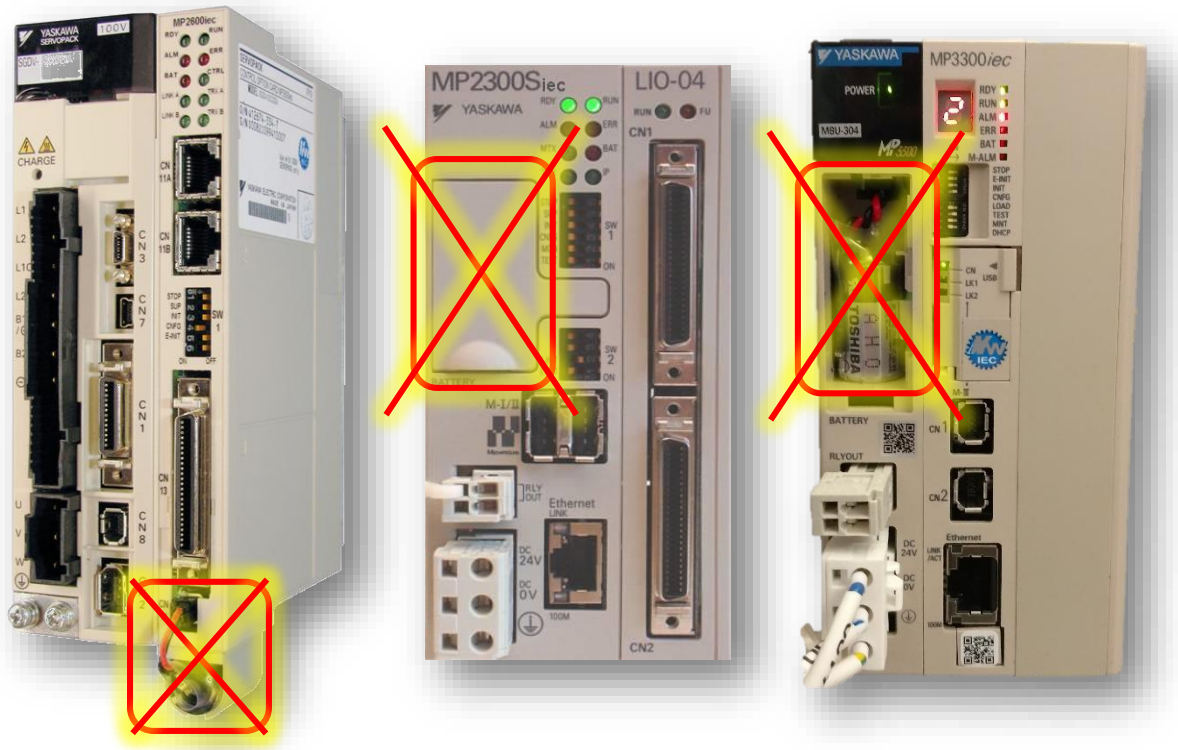
- *Alarm A.810*
- *Basic Operation*
- *Battery*
- *Multi-Turn Limit*

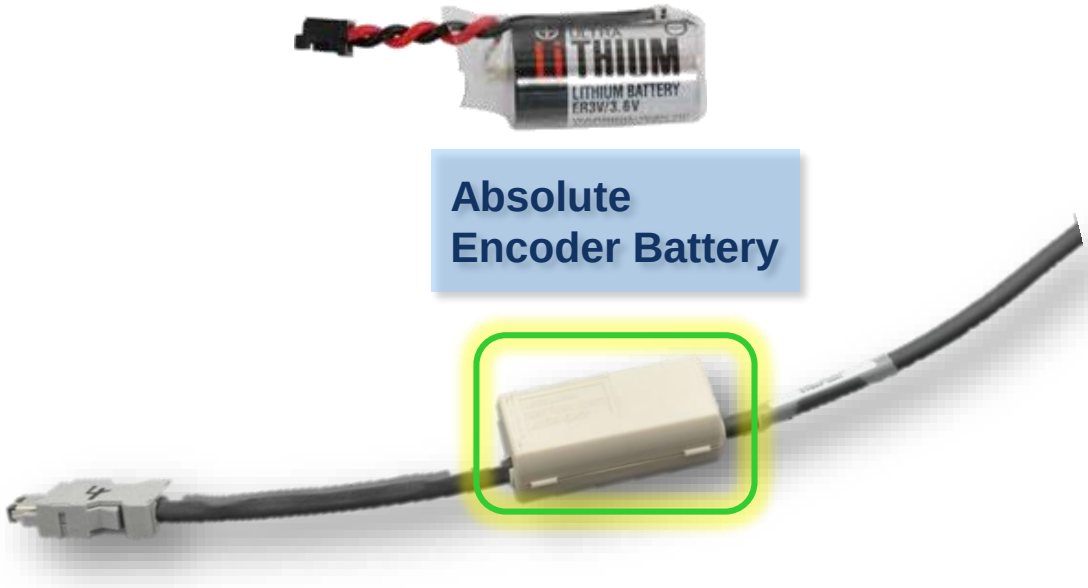
Alarm A.810

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



Alarm A.810


MP2600iec
MP2300Siec
LIO-04
MP3300iec


LITHIUM BATTERY
ER3V/3.6V
Absolute
Encoder Battery

Alarm A.810

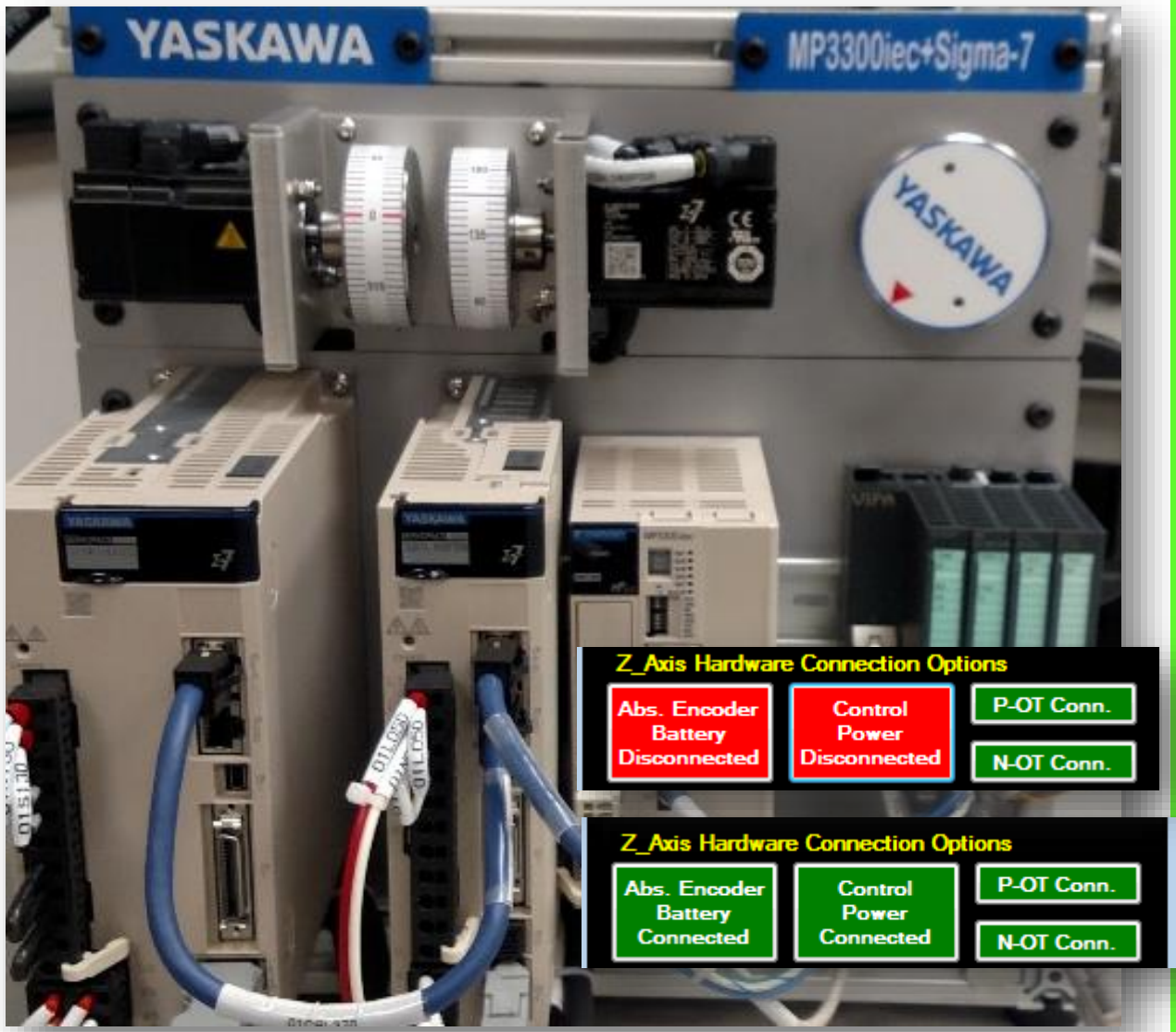
- *No battery voltage while servo control power is off*
- *Under what circumstances will this alarm appear?*

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*

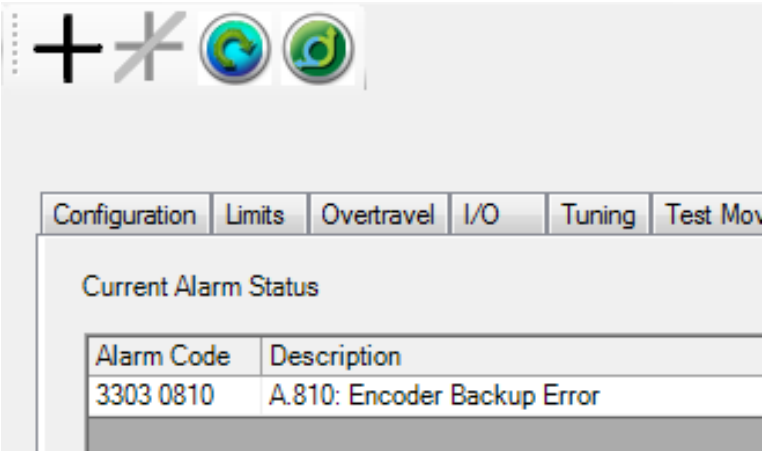


* Only with remote demo. Use the X or Y axis with local connection to the demo. You will have to physically remove the encoder cable from the motor.

Alarm A.810

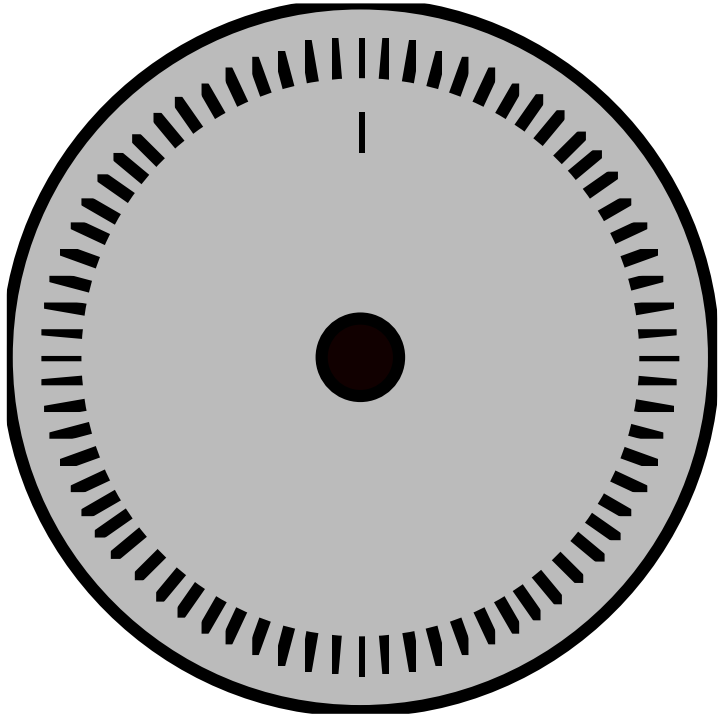
- *Clear Alarm A.810 in Hardware Configuration*
  - » *Reset with dedicated button*
    - – *Alarm does not immediately clear*
  - » *Reboot, reconnect.*

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

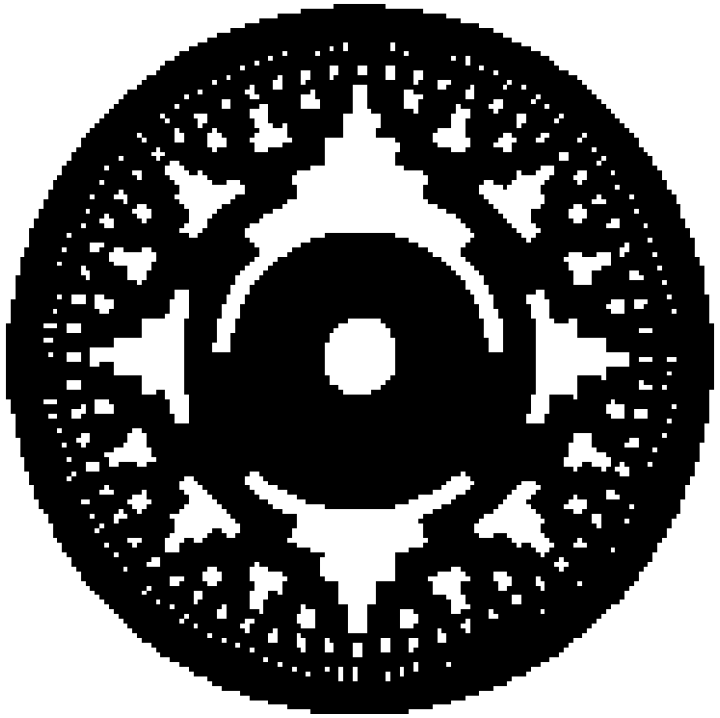


Basic Operation

- *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*



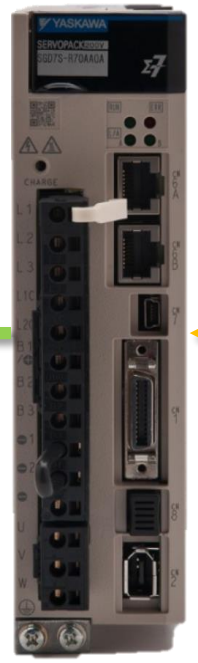
Basic Operation

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

Apply Offset
Convert to user units

Mechatrolink III

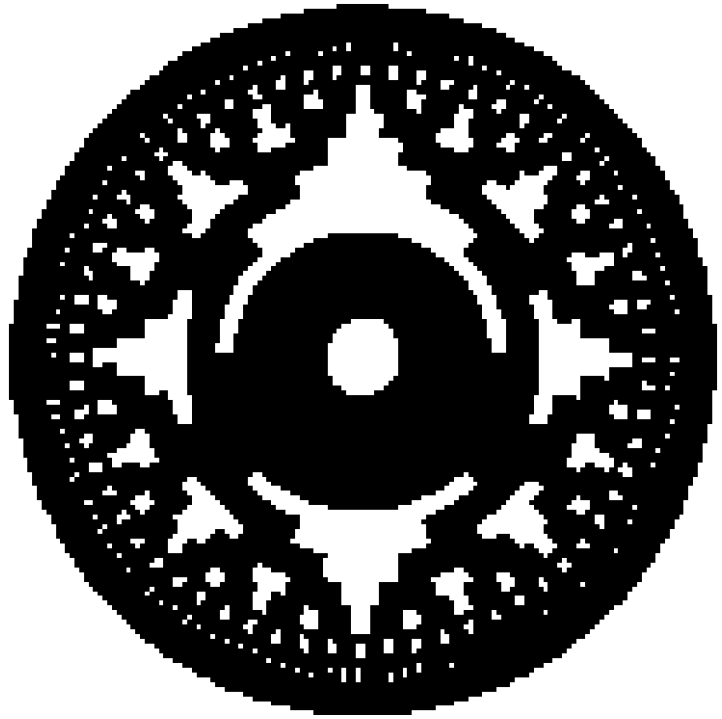
Absolute
Position



Serial
Encoder

Absolute
Position

Number of Turns



Partial Turn

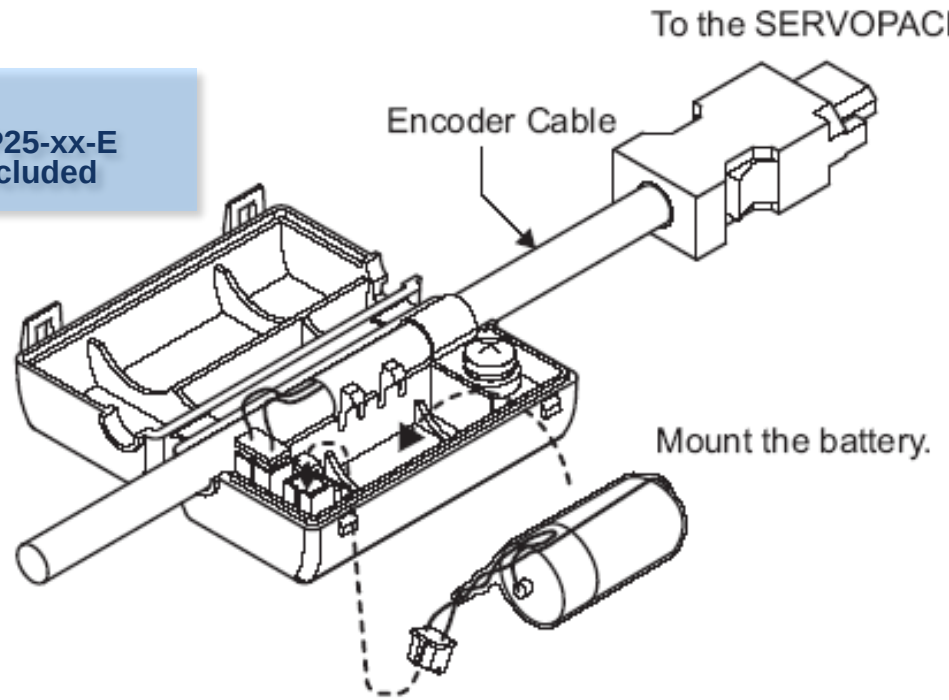
Basic Operation

- *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



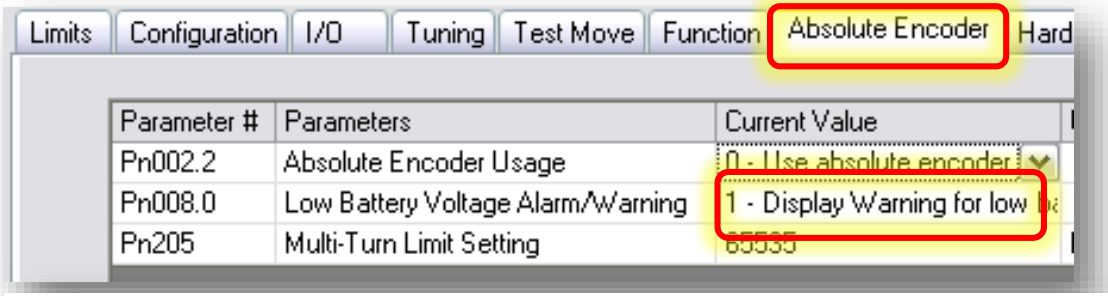
Battery:
JZSP-BA01
3.6V, 1200mAh
Service Life: 5 years

Battery

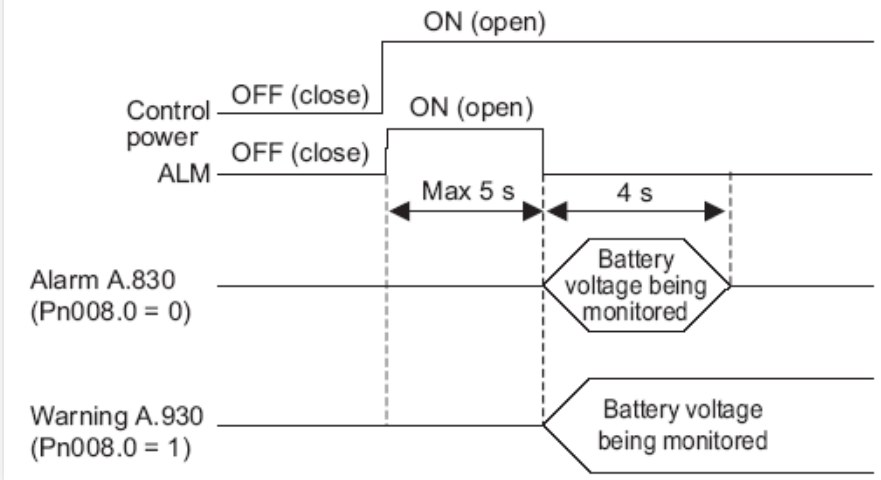
- *Connection option at CN-1*
  - *Encoder cable without battery*
  - *Axes can share external battery*
  - *Absolute Position Lost*
    - » *Amplifier Disconnect*
    - » *CN-1 Disconnect*

Battery

- *Alarm A.830*
  - *Servo OFF*
  - *Stop*
  - *Alarm code*
- *Warning A.930*
  - *Servo ON*
  - *Warning code*



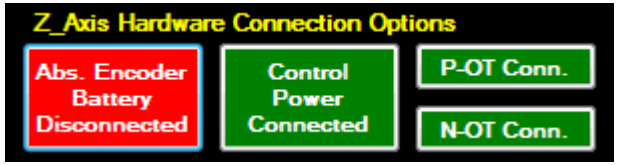
- If Pn008.0 is set to 0, alarm detection will be enabled for 4 seconds after the ALM signal turns ON when the power is turned ON.
  Note: No alarm will be displayed even if the battery is disconnected after 4 seconds.
- The battery voltage will be always monitored if Pn008.0 is set to 1.



2.7 V DC = Low Battery

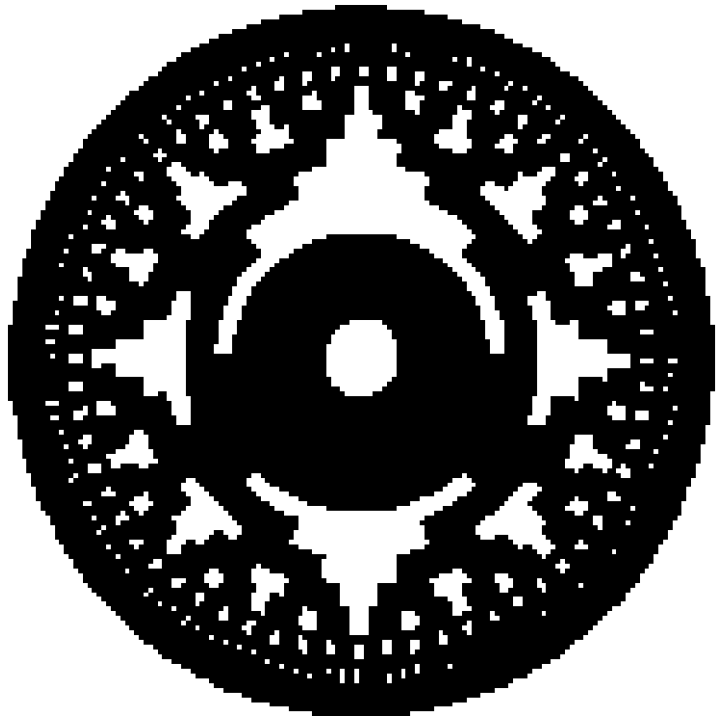
Battery

- *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*



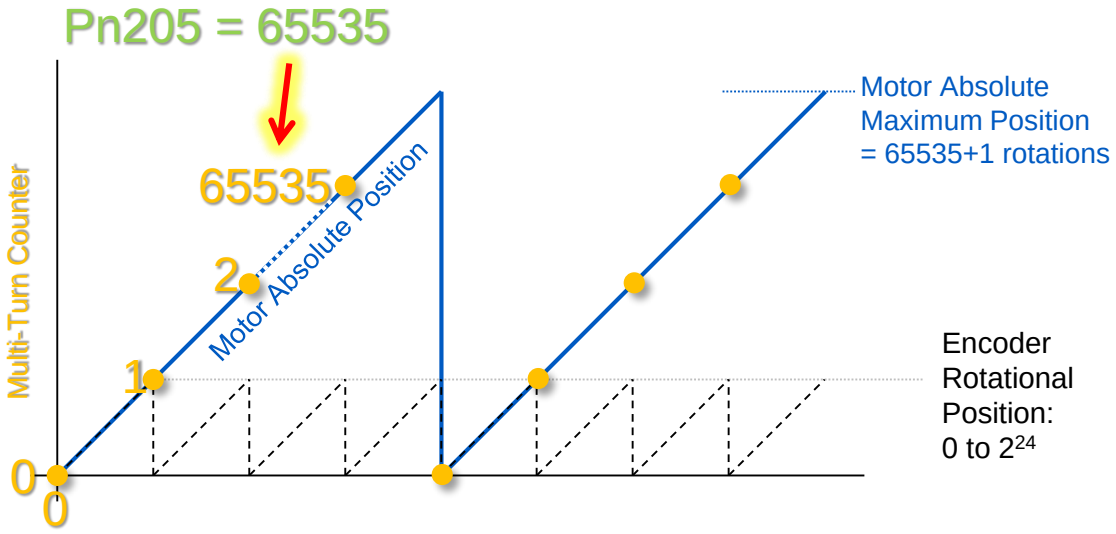
Battery

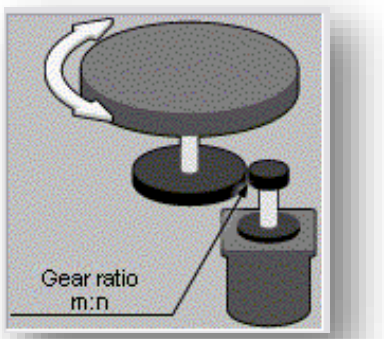
- *Scheduled Replacement every 5 years*
  - *Why wait for alarm/warning?*
- *Purchase fresh Lithium batteries*
  - *Capacity lost in storage*



Multi-Turn Limit

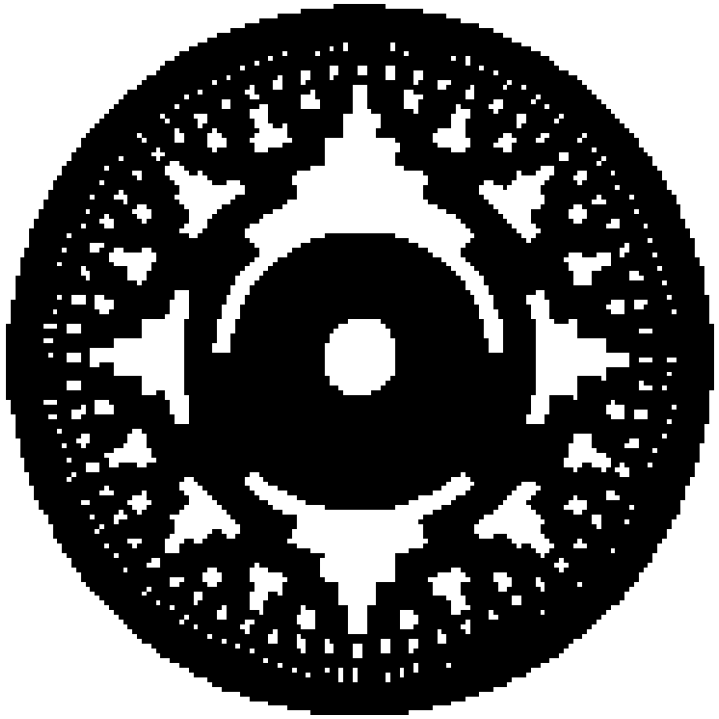
- *For axes with infinite motion possible*
- *Motor turns ≠ machine rotations*
- *Position incorrect at power up*
- *Set Pn205 to a number of motor turns that corresponds to an integer number of machine rotations*





Maximum 65,535 Turns

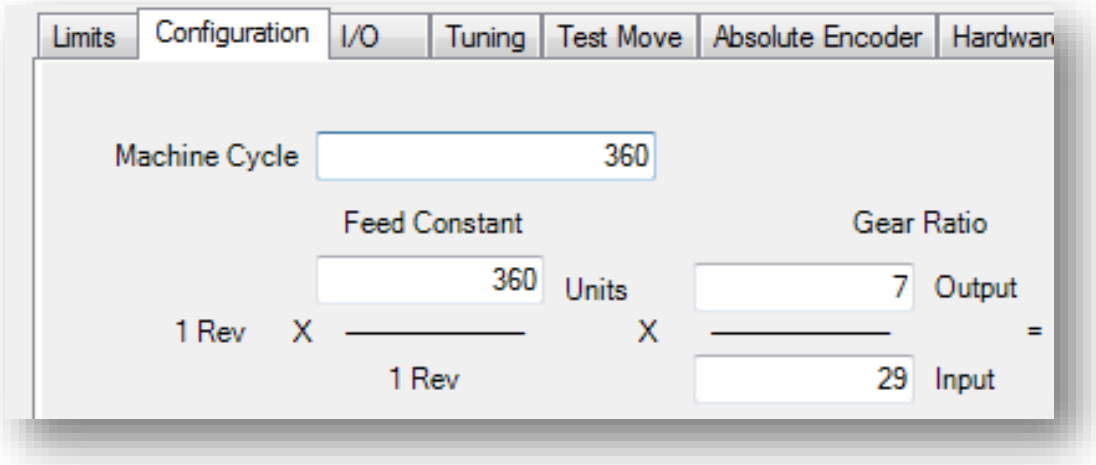
Number of Turns

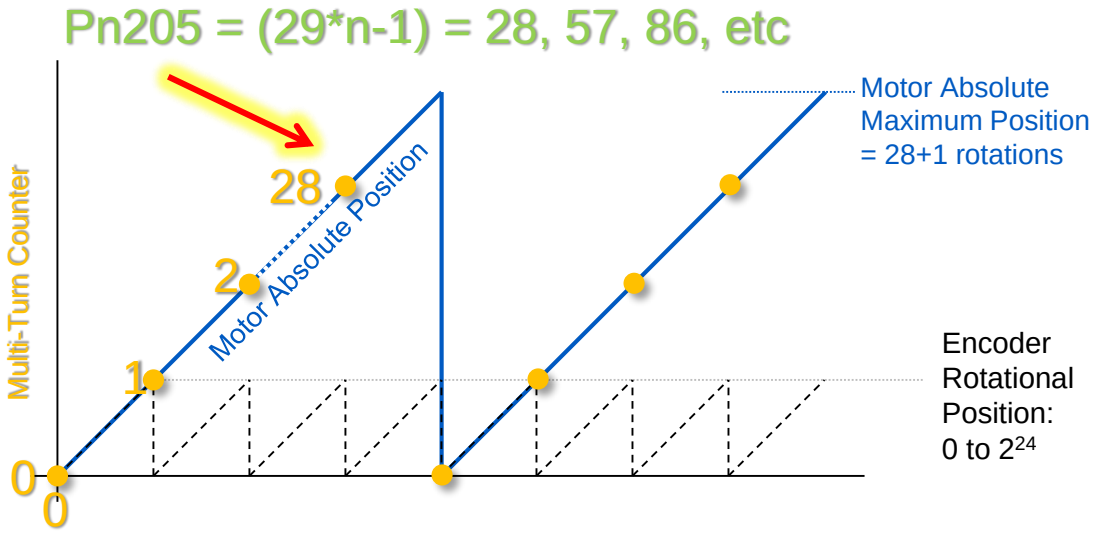


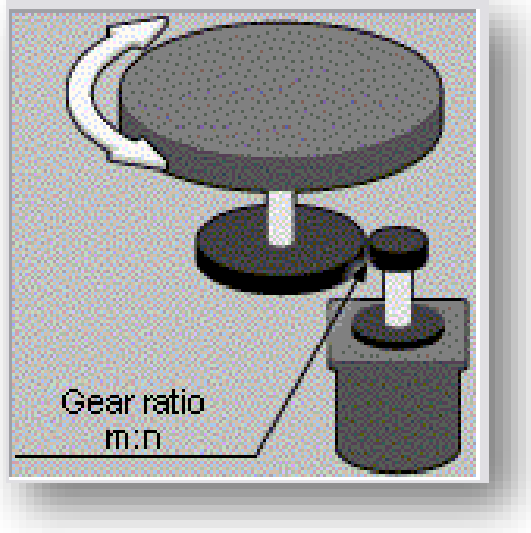
Partial Turn

Multi-Turn Limit

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







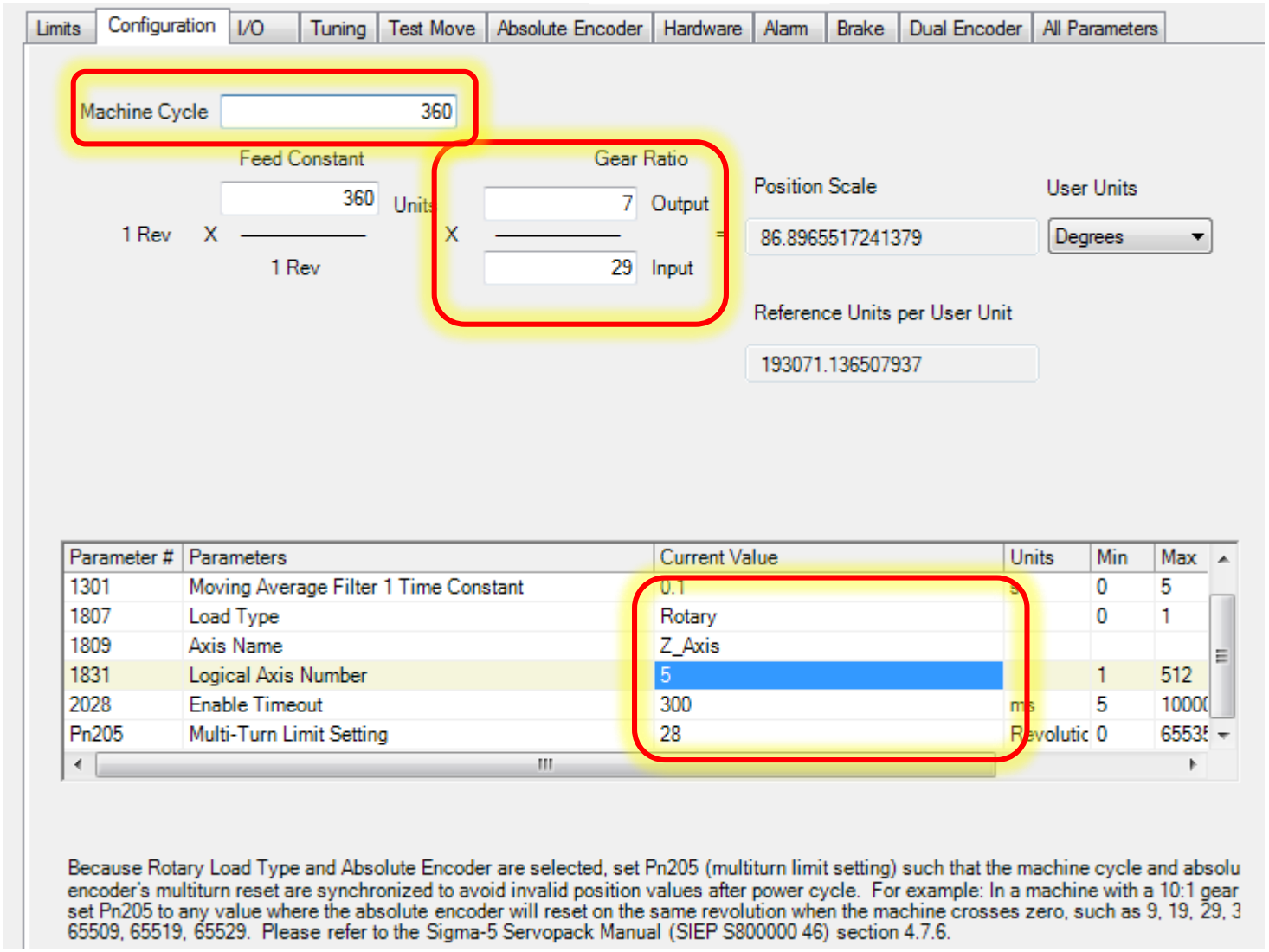
Multi-Turn Limit

EXERCISE

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

Multi-Turn Limit

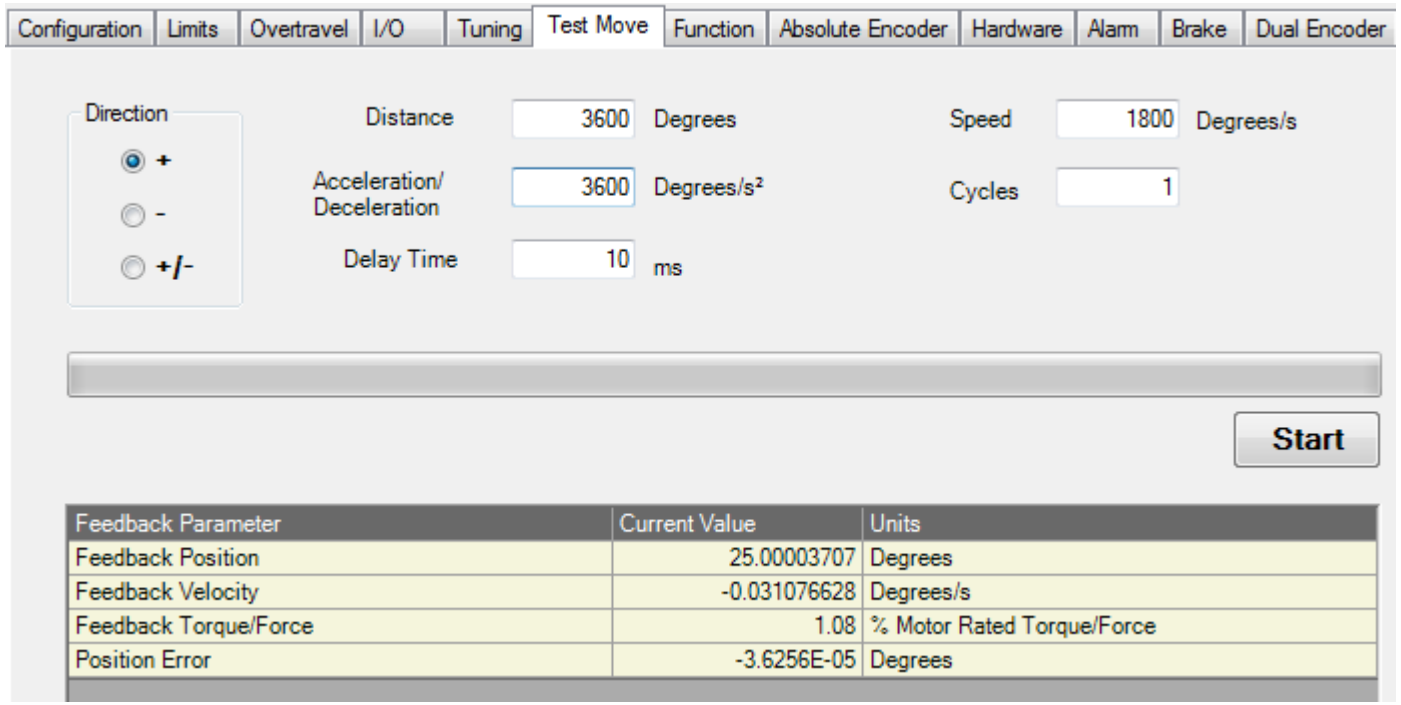
- *Example Solution*
  - *Online Save*
  - *Reboot*



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*



Multi-Turn Limit

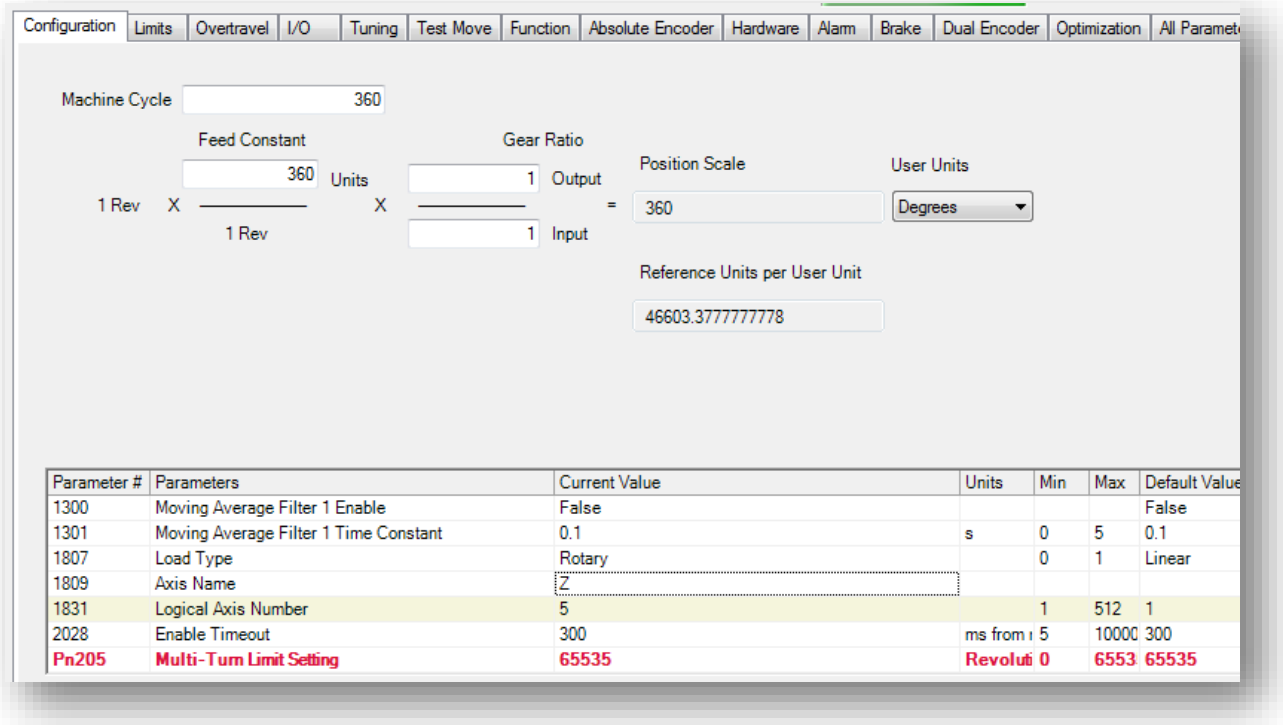
- *Incorrect Multi-Turn Limit*
  1. *Test run >29 turns*
  2. *Note position*
  3. *Power cycle*
  4. *Incorrect position*

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 r	5	10000	300
Pn205	Multi-Turn Limit Setting	29	Revolutic	0	65535	65535

Multi-Turn Limit

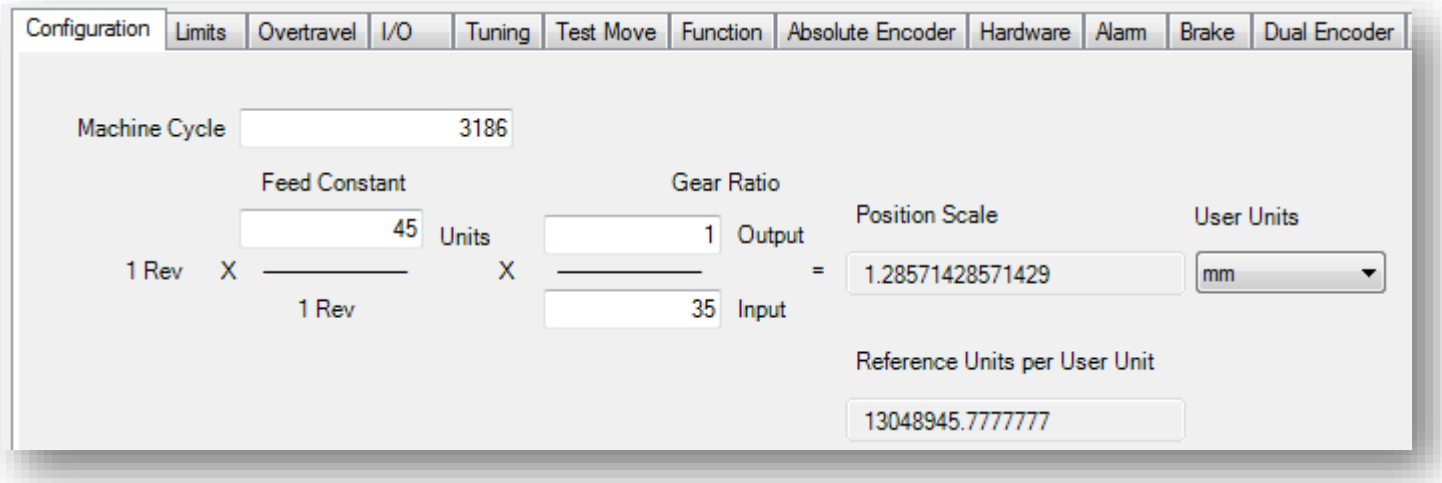
EXERCISE

- *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*



Multi-Turn Limit

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



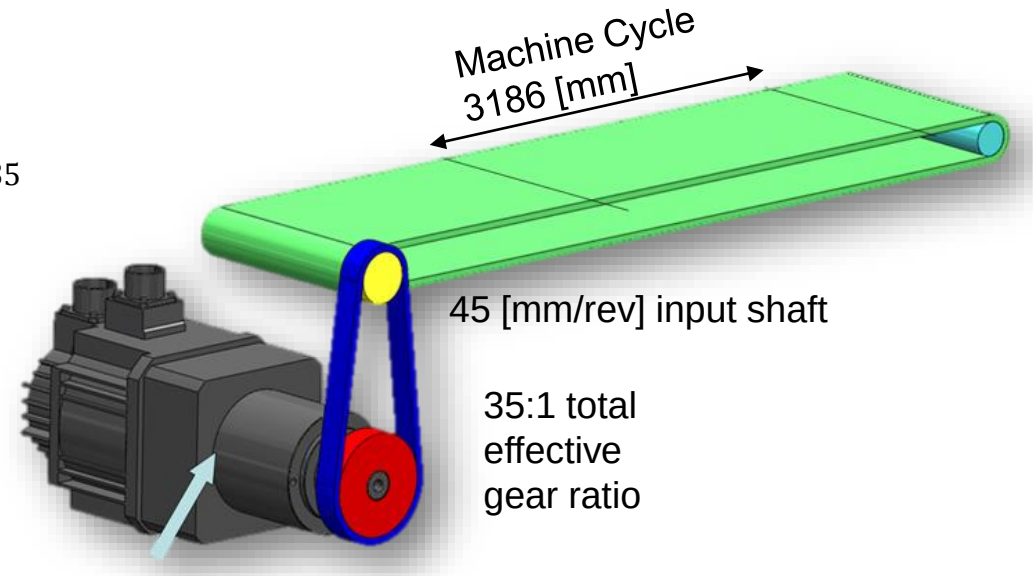
$$(\mathrm{Pn205}+1)*\frac{\mathrm{GR\_OutputRevs}*\mathrm{FeedConstant}}{\mathrm{GR\_InputRevs}}=\mathrm{MachineCycle}*\mathrm{n}$$

where n = *any integer such that* $Pn205 \le 65535$

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

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

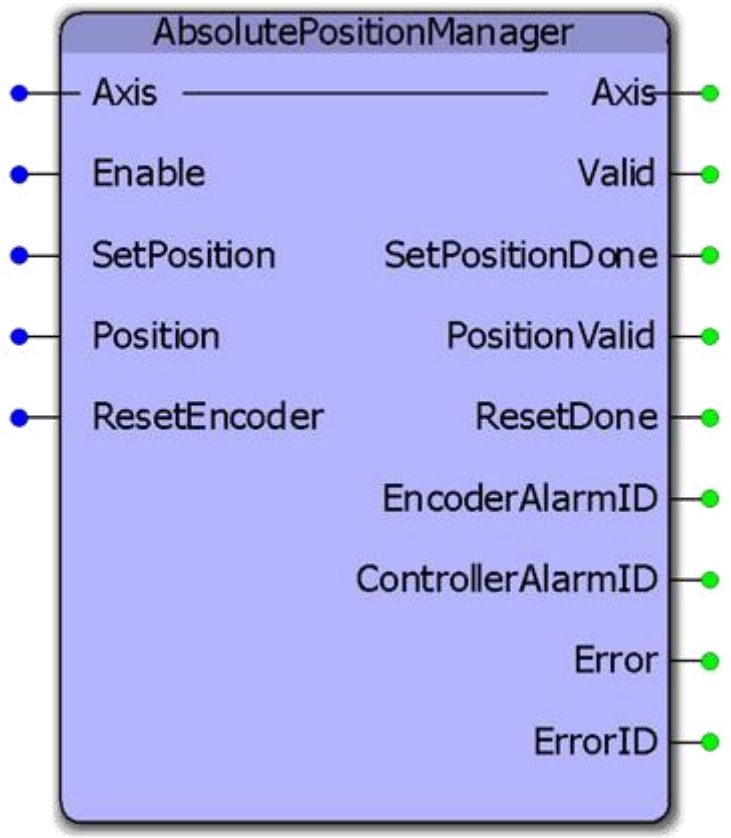
$$Pn205=2477$$



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



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