Chapter 20 Single Axis Servo Control

Servo Lab

The Servo Lab gives the student an experience with single axis motion control. Automation uses for single axis motion include indexing machines and grinders. The lab is provided to a point with students expected to expand the base program to include advanced concepts. Developing a useful HMI is a part of this lab. The student is required to provide a motion action with the capability of automatic and manual control.



Servo Motor and Motor Controller Allen-Bradley

While the servo shown is Allen-Bradley, several servos from Siemens are also in the final stages of being purchased. The cost of these servos is approximately \$1000/each. The servo communicates with the PLC via Ethernet. The goal is eight Allen-Bradley stations and four Siemens stations. These units can be stored on a shelf between labs.



From A-B, "The IP address of the Kinetix 350 drive is composed of four sub-octets that are separated by three dots to conform to the Class C Subnet structure. Each sub-octet can be configured with number between 1 and 254. As shipped from the factory, the default IP address of a drive is 192.168.124.200."

The present IP address can be obtained from the drive's display using the up-down keys and reading the address one sub-octet at a time.

A-B states that the drive can be assigned either using DHCP (dynamic IP address) or statically. The drive must be configured statically for our application. You must check that the IP address is already set or ping the address to check if it is operating. There should be an address label on the drive. If checking the drive, use the up-down arrow keys to locate the DHCP parameter and verify that it is set to 0. If not, set to 0 and cycle power.

When using the file given for the course, the controller is configured and ready to run except for the drive's IP address. Configuration of the drive has been accomplished. The next few pages lead one through the process of defining the drive during the configuration process in preparation for the move command programming to follow.

If the controller is not configured, first follow the procedure below:

Бирек	1769-L36ERM CompactLogid336ERM Controller		OK.
Revision:	20 •	_	Cancel
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Notice that the controller must be at revision 20 or higher. Under the controller properties dialog box, click the Date/Time tab and enable Time Synchronization.

Controller Properties - UM_CIP	
General Seriel Part System 7 Date/Time* Advanced SFC Execut	Pretacol User Protocol Major Faults Minor Fault Ion File Reclaridency Non-colaite Manory Memo
The Date and The contained to us a Use these fields to configure Time at per Date. Time and Pa	Controller local true, not vestalishen local true, abstes af the Controller.
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Time Synchronize	
I7 Enable Time Spectrovization ○ In the system line master ○ In 2 services and line data	CANGER. It the spectromation is disabled online, active area in any controller in the chassis, or any other synchronized device. They explore an expected motion. Safety controllers may be the other the spectre and the term.
C) Duplicate CST marter detected	local charges.
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Configure the Kinetix 350 Drive. Right click to create a New Module. Clear the module type filters and check the Drive and Motion categories. Select the appropriate drive.

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Motor .			
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30524/39990	Function 2000, SAL 1252/CMRN, Natur Faller	Alterditation	244
2097-//3/PHINUH	Kinetic 202 Single Asia Ethernet Drive	Alter-Evalley	Drive Makern
2007-1/2019(2	Eineta 300, 44, 125/342V, No.Febr	Alter-Dradby	0 mm
2087-V29992VM	Kinety 200 Single Ava Ethernet Drive	Alter-Bradep	SixaMatan.
2007-0237948	Rowto 300, 24, 247V, Hengeland Felix	dilet-Dadep	line .
2087-V30996LM	Kowto 202 Single Avia Ethamet Drive	Alterbadey	Disa Makin
209/4/1990	Kowto 200, MI, 247V, integrand filter	Alter-Eradep	0.00
2007-V33992-KM	Kowie 350 Single Are Ethener Drive	Alter-Bradley	Distillation
2007-1/33994	Kinetia 300, BA, 247V, Integrated Filler	dilated taday	24e
2007-V33FFi4UM	Kinetis 350 Single-Avia Ethernet Drive	Alter-Evadey	Dan Mater
2087-1/239975	Kinetis 200, 104, 240/Unitegrated Filter	Adapt Exactles	2.44
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2007-020995	Katefie 305, 84, 2474, 9to Filter	Aller-Examp	Date .
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2287-72876-04			

Configure the New Module using the following dialog box. The etnernet address must match the address set for the drive.

Under Change Module Definition, change the following:

Module Definition		×
Bevision:		
Electronic Keying:	Compatible Module	٣
Econnection:	Motion	*
Power Structure:	2097-V33PR5-LM	-
🔽 Verity Power Rating o	n Connection	
		_
DK	Cancel Help	

Under the Associated Axes tab, click 'new axis' and add information:

New Tag		×
Name:	Asit_1	Create 💌
Description	×	Cancel
		Help
	*	
<u>U</u> ≑age:	(normal)	
Type:	Base Connection	
Alias Eor:	v.	
Data <u>T</u> ype:	AVIS_CIP_DRIVE	
Scope:	DUM_Test_2	
Esternal Access:	Read/Wile	
Style:	<u>v</u>	
Constant		
Den AX	IS_CIP_DRIVE Configuration	

Finish by checking 'create'. Next configure the Motion Group. In the Controller Organizer, right click Motion Groups and choose New Motion Group. Assign the axis just created to this motion group.

game.	UM_Rotion	Create
Description:	-	Cancel
		Help
	<u>×</u>	
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Type:	Base 💌 <u>Connetion</u>	
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Coren MD	TION GROUP Configuration	

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Right click on the axis in the Controller Organizer to change properties of the drive. For the motor:

Axis Properties - Axis_	1						
Categories:							
- General	Motor Device Sp	pecification	_				_
- Motor	Data Source:	Nameplate Datasheet	۲		Parameters		
- Motor Feedback	Catalog Number:	(none)		Change Datalog			
- Polarity	Motor Type:	Not Specified					
- Autolune	Units	Rev					
Backlash							
- Position Loop							
- Velocity Loop - Torque/Current Loop							
- Planner							
- Homing							
- Drive Parameters							
- Parameter List							
- Faults & Alarma							
Tag							
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MPLATIOPIN			Web.
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HPL-A320PH			
MPLA220PM			
MPLAZOPS		*	

To Configure the Motor

Use the scaling and loads appropriate for the application:

General	Scaling to Conv	ert Motion fr	on Controller Units to	User Defined Un	Rs .	_
Motor Model Motor Feedback Scaling	Load Type: Transmission	Direct Coup	ied Rotary	Rev	Parameters	
Hookup Teste Polativ	Actuator	·				
Autolune		<none></none>	¥.			
Load Backlash		1.0	Mämetes/Rev			
Compliance		1.0	Milmeter	-		
Position Loop Velocity Loop	Scaling			_		
Acceleration Loop	Units:	Position Uni	ts			
Planner	Scaling	1.0	Position Units	per 1.0	Motor Rev 💌	
Homing	Travel					
Actions	Mode:	Unlimited	*			
Parameter List		1000.0	Position Units			
Status		1.0	Resilier (Inits	per 1.0	Direke	
Faults & Alams Tag	C Soft Trave	el Limits				
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Axis Properties - Axis_	1			
Categories General + Model + Model Moder Scaling Hookup Tests Polanty Autotune + Backlash	Characteristics of Motor Load Load Inertia/Mass Load Couping Use Load Ratio Load Batic Motor Inertia: Load Inertia	Rigid (0.0) 0.000044	Load Ineria/Motor Ineria Kgm12 Kgm2	-
Position Loop Position Loop Velocity Loop Acceleration Loop Torque/Current Loop Pienner Homing Actions	Inertia/Mass Compensation System Inertia: System Acceleration Active Load Compensation	0.0	% Rated/(Rev/s"2) Rev/s"2 @100 % Rated	
— Drive Parametee — Parameter List — Soshus — Faults & Alarns — Tag	Torque Officet:	0.0	% Rated	
Manual Tune			DK Cancel	Apply Help

Actions and Parameters:

Stop Action: Current Decel & Dis	able 💌		
getor Diverload Action: cnoneo niverter Overload Action: cnoneo Exceptions		Eastmeters	lon
Exception Condition	Action	 personnel, machine, and per 	perty.
Motor Comnutation	StopOrive *		hinad
Motor Overspeed Factory Limit	StopOrive *	information	ar tornal
Motor Overtemperature Factory Limit	StopOrive V	promotion	
Motor Thermal Overload Factory Limit	StopOrive •		
Motor Votage Mismatch	StopOrive *		
Overtorque Limit	StopOrive *		
Product Specific	StopOrive V		
Runtime Error	StopOrive •		
Soft Travel Limit - Negative	StopOrive .		
Soft Travel Limit - Positive	StopOrive 💌		
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	Inverter Overload Action: Cricinia Exceptions Exception Condition Motor Commutation Motor Commutation Motor Overtexperiature Factory Linit Motor Overtexperiature Factory Linit Motor Overtexperiature Factory Linit Motor Votespe Mismatch Motor Votespe Mismatch Product Specific Fourtaine Error Soft Travel Linit - Negative Soft Travel Linit - Positive Undertorque Linit	Inverter Overload Action: Crionipo III Seceptions Exception Condition Action Motor Connectation StopOrive III Motor Overseption Eactory Linit StopOrive III Motor Overseption and Pactory Linit StopOrive III Motor Overseption and Pactory Linit StopOrive III Motor Overseption and Pactory Linit StopOrive III Motor Overseption IIII StopOrive IIII Motor Votage Mismatch StopOrive IIII Product Specific StopOrive IIII France Error StopOrive IIII StopOrive IIIII - Positive StopOrive IIII StopOrive IIIIII - Positive StopOrive IIII Underforque Linit - Negative StopOrive IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	Invested Overload Action: Interpretations Exceptions Exception Containin Action Ac

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- Motor		La time		
Model	Marameter <u>La</u> roup:	Actions		Associated Page
Motor Feedback			A deck open	
Scaling	Name		Yalue	Unit
- Hookup Tests	InverterOverloadAc	tion	<none></none>	
- Polaity	MechanicalBrakeCo	ntrol	Autometic	
- Autolune	MechanicalBrokeEn	gageDelay	0.0	\$
Load	MechanicalBrakeRe	leaseDelay	0.0	\$
- Backlash	MotorOverloadActic	n	<none<< td=""><td></td></none<<>	
- Compliance	ProgrammedStopMo	de	Fast Stop	
 Position Loop 	StoppingAction		Current Decel & Disable	
- Velocity Loop	StoppingTimeLinit		1.0	\$
Acceleration Loop	StoppingTorque		0.0	% Motor Rated
 Torque/Current Loop 	VelocityStandstill//	ndow	1.0	Position Units/s
- Planner	VelocityThreshold		0.0	Position Units/s
- Homing				
- Actions				
Drive Parameters				
Parameter List				
- Status				
- Faults & Alams				
- Tag				

Download the application and test and tune the axes.

😳 Axis Properties - Axis_)					_ D ×
Calegories:					
- General	Test Motor and Feedback De	vice Wiring			
Motor Model Motor Faceback Sector Polarity Autoure Code Desking	Motor and Feedback Motor Fe Test Distance: 2.0 Start : Test Skate: Passed	edback Marker	• Position Units	DAVGER: Starting this test may initiate axis motion with the controller in program mode.	
	Test complete.	Current	Test Results		
- Torque/Current Loop - Planner - Homing	Notor Feedback Polarity:	Normal	Normal		
- Actions	Notor Polarity:	Normal	Normal		
- Drive Parameters - Parameter List - Status - Foults & Alarms - Tag	Motion Polarky: Accept Test Results	Normal			
Manual Tune			DK	Cancel Apply	Help

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- Autorune - Backlash - Compliance - Friction - Position Loop	Customize Gain Poston Ini Velocity Ini Velocity Fe	s to Tune egrator Bandwidth egrator Bandwidth edforward	-		Name PostionLoopEendwidth PostionIntegratorEend VelocityLoopEendwidth Advanced Compensat d Parameters Tuned	Current 19.459665 0.0 77.87874 ion	Tuned 19.479559 0.0 77.918236	Units Hz Hz Hz	•
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Auto-tune the Drive

🔅 Axis Properties - Axis2					
Categories:					
; General	General				
Motor	Axis Configuration:	Position Loop	· · · · · · · · · · · · · · · · · · ·		
Scaling	Feedback Configuration:	Motor Feedback			
Hookup Tests	Application Type:	Tracking			
Polarity	Loop Response:	High	-		
Autotune	Motion Group:	Group		New Group	
Backlash	Accessized Medule				
Position Loop	Associated Hodule	r			
Velocity Loop	Module:	K350_2			
Torque/Current Loop	Module Type:	2097-V31PR0-LM			
Planner	Power Structure:	2097-V31PR0-LM			
Actions	Axis Number:	1			
Drive Parameters					
Parameter List					
Status					
- Faults & Alarms					
i Tag					
Manual Tune			OK	Cancel	Apply Help

Axis Properties for our application:

General	Motor Device Sp	ecification				
Motor	Data Source:	Catalog Number	Ŧ		Parameters	
Motor Feedback	Catalog Number:	TLY-A110P-Bxx	2	Change Catalog		
Scaling Hookup Tests	Motor Type:	Bolary Permane	nt Magnet			
Polarity	Linite:	Peu	-			
Autotune	onna.	1164	· · ·			
- Backlash	Nameplate / Dat	asheet - Phase	to Phase paramete	rs		
Compliance	Rated Power:	0.041	kW	Pole Count:	8	
Position Loop	Rated Voltage:	230.0	Volts (RMS)			
Torque/Current Loop	Rated Speed:	5000.0	RPM	Max Speed:	5000.0	RPM
Planner	Rated Current:	0.39	Amps (RMS)	Peak Current:	0.92	Amps (RMS)
Homing	Rated Torque:	0.1	N-m	Motor Overload Limit:	100.0	% Rated
Drive Parameters						
Parameter List						
Status						
Tag						



gones.					
General	Motor Model Phase to Pha	se Parameters			
Motor	Torque Constant (Kt):	0.327	N-m/Amps(RMS)		
Motor Feedback	Voltage Constant (Ke):	19.745378	Volts(RMS)/KRPM		
Scaling Hookup Tests	Resistance (Rs):	92.0	Ohms		
···· Polarity	Inductance (Ls):	0.093	Henries		
Autotune] Load	Flux Saturation Profile				
Backlash	Flux Saturation @ 12.5%:	100.0	% Nominal Inductance		
····· Compliance ···· Position Loop	Flux Saturation @ 25.0%:	100.0	% Nominal Inductance		
Velocity Loop	Flux Saturation @ 37.5%:	100.0	% Nominal Inductance		
Torque/Current Loop	Flux Saturation @ 50.0%:	100.0	% Nominal Inductance		
Homina	Flux Saturation @ 62.5%:	100.0	% Nominal Inductance		
Actions	Flux Saturation @ 75.0%:	100.0	% Nominal Inductance		
Drive Parameters Parameter List	Flux Saturation @ 87.5%:	100.0	% Nominal Inductance		
Status Faults & Alarms Tag	Flux Saturation @ 100%:	100.0	% Nominal Inductance		

Motor Model Phase to Phase Properties

gories:									
General	Motor Feedback D	evice Spec	cification						
- Motor	Device Function:		Motor Mounted Feedb	ack		Param	state		
- Motor Feedback	Feedback Channel		Feedback 1			1 dram	01010		
Scaling	Type:		Tamanawa Serial	-					
- Hookup Tests	Units:		Paul						
- Polanty - Autotune	Tamagawa Serial		nev	· ·					
- Load	Cuele Resettion		121072	Free Arrest	C				
- Backlash	Cycle Hesolution	ι.	131072	Feedback	Cycles/Hev				
Compliance	Lycle Interpolatio	om:	1	Feedback	Counts per l	.ycle			
- Velocity Loop	Effective Resolu	tion:	131072	Feedback	Counts per l	lev			
- Torque/Current Loop	Startup Method:		Absolute ~						
- Planner	Turns:		65536						
- Homing									
 Drive Parameters 									
- Parameter List									
- Status	Commutation								
- Faults & Alarms	commutation								
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	Uffset:		0.0	Degrees					
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egories: General	Scaling to Conve	rt Motion fr	om Controller Units	to User D	OK	Cancel	Apply	H	elp
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wis Properties - Axis2 egories: - Motor - Motor - Model - Motor Feedback - Scaling - Hookup Tests - Polarity - Autotune - Load - Backlash - Compliance - Position Loop - Velocity Loop - Torque/Current Loop - Planner - Homing	Scaling to Conve Load Type: Transmission Ratio [:0: Actuator Type: Lgad: Diameter: Scaling Linits: Scaling:	rt Motion fr Direct Coup 1 (none> 1.0 1.0 1.0 Degrees 360.0	om Controller Units led Rotary : 1 Millimeter Millimeter Degrees	to User D	efined Un Rev	Cancel its Param	Apply neters		elp .
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nual Tune xis Properties - Axis2 egories: General Model Motor Model Motor Feedback Scaling Hookup Tests Polarity Autotune Load Backlash Compliance Position Loop Velocity Loop Torque/Current Loop Planner Homing Actions Drive Parameters Parameter List Status Faults & Alarms Tag	Scaling to Conve Load Type: Transmission Ratio [:0: Actuator Type: Lgad: Diameter: Scaling Units: Scaling Units: Scaling: Travel Mgde: Range: Unwind: Soft Travel	rt Motion fr Direct Coup 1 (\none> 1.0 1.0 1.0 1.0 360.0 360.0 360.0 360.0 360.0	om Controller Units led Rotary	to User D	OK efined Un Rev per 1.0	Cancel	Apply Apply Cycle		
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Scaling Parameters

gones.	Test Motor and Feedback Device Wiring		
- Motor - Model - Motor Feedback - Scaling - <mark>Hookup Tests</mark>	Motor and Feedback Motor Feedback Marker Test Distance: 360.0	Degrees	DANGEP - Startion test with controller in
- Polarity - Autotune - Load - Backlash - Compliance - Position Loop - Velocity Loop	Start Stop Test State: Ready Pressing Start initiates motion. Watch motion direction during test.	A	Program or Run Mode initiates axis motion.
- Planner - Homing - Actions - Drive Parameters - Parameter List - Status	Current	Test Results	
- Faults & Alarms - Tag	Motion Polarity: Normal Accept Test Results		



Test Polarity Screen

edoties:									
Canada	Tune Control	lloon bu Mea	suring Load Charac	teristics					
Motor		- 200p by 1400							
Model	Application	Tracking	-	Pe	rform Tun	e	A DA	NGER: Sta	rting tuning
Motor Feedback	Type:				Start	Stop	ך 🤼 pro	ocedure with	n Controller in Mode cau
Scaling	Loop	High	-		- Chart		axi	is motion.	
Hookup Tests	Response:			Tu	ne Status:	Ready			
Polarity	Load Coupling:	Rigid	-	Lo	op Paramete	ers Tuned			
Autotune	couping.				Name		Current	Tuned	Units
- Load	Customize G	Gains to Tune			PositionLo	opBandwidth	22.868168		Hz
Backlash	Position	n Integrator Ban	dwidth		PositionInt	tegratorBan	0.0	<u> </u>	Hz
Compliance	Velociti	u Integrator Ban	dwidth		VelocityLo	opBandwidth	58.542515		Hz
Position Loop			2110301	Ŧ	Advanced I	Compensation			
····· Velocity Loop	Velocity	y Feedforward			ad Paramete	ars Tuned			
Torque/Current Loop	🗸 Acceler	ration Feedforwa	ard		Nama	ne ranca	Current	Tuned	Unite
Planner	Torque	Low Pass Filter			Marrie	A I 4'	current 4000440.0	Tuned	Units
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Drive Parameters	in medsare in	increa daing rand			Joystemine	siua	0.030433070		/0
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Motor Load Characteristics

Axis Properties - Axis2							- • ×
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Compliance Compensation

regories:					
General	Position Loop				
Motor	Gains			Parameters	
Motor Feedback	Bandwidth:	22.868168	Hertz		
Scaling	Integrator Bandwidth:	0.0	Hertz		
Hookup Tests		0.0			
Polarity	Integrator Hold:	Disabled •			
Autotune	Velocity Feedforward:	100.0	%		
Backlash					
Compliance	Limits				
- Position Loop	Error Tolerance:	354.94327	Degrees		
Velocity Loop	Look Toleranoo:	26	Degrees		
Torque/Current Loop	LUCK TOIEIANCE.	3.0	Degrees		
Hanner					
Actions					
- Drive Parameters					
Parameter List					
Status					
– Faults & Alarms					
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Axis Properties - Axis2		_	_		
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Axis Properties - Axis2 regories: 	Velocity Loop Gains Bandwidth:	58.542515	Hertz	Parameters	
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Velocity Loop Properties

tegories:	T			
General The Motor	Torque/Current Loop			
Model	Gains			Parameters
Motor Feedback	Bandwidth:	1000.0	Hertz	
Scaling				
Hookup Lests				
Autotune	Limits			-
Load	Peak Torque Limit Positive:	235 89745	% Bated	
Backlash	Peak Torque Limit Negative:	-225 09745	% Pated	
Lompliance	r eak roique Linic Negauve.	-200.00740	76 Hated	
Velocity Loop				
Planner				
Homing Actions				
- Drive Parameters				
- Parameter List				
Status				
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anual Tune			ПК	Cancel Apply Help
			- OIN	Concer Tripply Trop
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Axis Properties - Axis2	_	-		
Axis Properties - Axis2 tegories:	Characteristics of Motion Pl	anner		
Axis Properties - Axis2 tegories: General Motor	Characteristics of Motion Pl	anner	_	
Axis Properties - Axis2 tegories: General Motor	Characteristics of Motion PI Maximum Speed:	anner 25500.0	Degrees/s	Parameters
Axis Properties - Axis2 tegories: General Motor Motor Model Motor Feedback	Characteristics of Motion Pl Maximum Speed: Maximum Acceleration:	anner 25500.0	Degrees/s	Parameters
Axis Properties - Axis2 tegories: General Motor Modor Modor Motor Feedback Scaling	Characteristics of Motion Pl Maximum Speed: Maximum Acceleration:	anner 25500.0 1809140.3	Degrees/s Degrees/s^2	Parameters
Axis Properties - Axis2 tegories: 	Characteristics of Motion PI Maximum Speed: Maximum Acceleration: Maximum Deceleration:	anner 25500.0 1809140.3 2086079.5	Degrees/s Degrees/s^2 Degrees/s^2	Parameters
Axis Properties - Axis2 tegories: General Motor Motor Motor Feedback Scaling Hookup Tests Polarity Autotune	Characteristics of Motion PI Maximum Speed: Maximum Acceleration: Maximum Deceleration: Maximum Acceleration.lerk:	anner 25500.0 1809140.3 2086079.5	Degrees/s Degrees/s^2 Degrees/s^2	Parameters
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Axis Properties - Axis2 tegories: 	Characteristics of Motion PI Maximum Speed: Maximum Acceleration: Maximum Deceleration Jerk: Maximum Deceleration Jerk:	25500.0 1809140.3 2086079.5 128352488.0 170655984.0	Degrees/s Degrees/s ² Degrees/s ² Degrees/s ³ Degrees/s ³	Parameters = 100% of Max Accel Time Calculate = 100% of Max Decel Time Calculate
Axis Properties - Axis2 tegories: 	Characteristics of Motion PI Maximum Speed: Maximum Acceleration: Maximum Deceleration Jerk: Maximum Deceleration Jerk:	25500.0 1809140.3 2086079.5 128352488.0 170655984.0	Degrees/s Degrees/s^2 Degrees/s^2 Degrees/s^3 Degrees/s^3	Parameters = 100% of Max Accel Time Calculate = 100% of Max Decel Time Calculate
Axis Properties - Axis2 tegories: - General - Motor - Model - Model - Model - Mokup Tests - Polarity - Autoture - Load - Backlash - Compliance - Position Loop - Velocity Loop	Characteristics of Motion PI Maximum Speed: Maximum Acceleration: Maximum Deceleration : Maximum Acceleration Jerk: Maximum Deceleration Jerk:	anner 25500.0 1809140.3 2086079.5 128352488.0 170655984.0	Degrees/s ² Degrees/s ² Degrees/s ² Degrees/s ³ Degrees/s ³	Parameters = 100% of Max Accel Time Calculate = 100% of Max Decel Time Calculate
Axis Properties - Axis2 tegories: - General - Motor - Model - Motor Feedback - Scaling - Hookup Tests - Polarity - Autotune - Load - Backlash - Compliance - Position Loop - Velocity Loop - Torque/Current Loop	Characteristics of Motion PI Maximum Speed: Maximum Acceleration: Maximum Deceleration Jerk: Maximum Acceleration Jerk:	anner 25500.0 1809140.3 2086079.5 128352488.0 170655984.0	Degrees/s Degrees/s ² Degrees/s ² Degrees/s ³ Degrees/s ³	Parameters = 100% of Max Accel Time Calculate = 100% of Max Decel Time Calculate
Axis Properties - Axis2 tegories: 	Characteristics of Motion PI Maximum Speed: Maximum Acceleration: Maximum Deceleration Maximum Acceleration Jerk: Maximum Deceleration Jerk:	anner 25500.0 1809140.3 2086079.5 128352488.0 170655984.0	Degrees/s Degrees/s ² Degrees/s ² Degrees/s ³ Degrees/s ³	Parameters = 100% of Max Accel Time Calculate = 100% of Max Decel Time Calculate
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Axis Properties - Axis2 tegories: General Motor Motor Feedback Scaling Hookup Tests Polarity Autotune Load Backlash Compliance Position Loop Velocity Loop Torque/Current Loop Plannet Homing Actions Drive Parameters Parameter List Status Faults & Alarms Tag	Characteristics of Motion PI Maximum Speed: Maximum Acceleration: Maximum Deceleration Jerk: Maximum Deceleration Jerk:	25500.0 1809140.3 2086079.5 128352488.0 170655984.0	Degrees/s ² Degrees/s ² Degrees/s ³ Degrees/s ³	Parameters = 100% of Max Accel Time Calculate = 100% of Max Decel Time Calculate
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Axis Properties - Axis2 tegories: - General - Motor - Model - Motor Feedback - Scaling - Hookup Tests - Polarity - Autoture - Load - Backlash - Compliance - Position Loop - Velocity Loop - Torque/Current Loop - Plannel - Homing - Actions - Drive Parameters - Parameter List - Status - Faults & Alarms - Tag	Characteristics of Motion PI Maximum Speed: Maximum Acceleration: Maximum Deceleration Jerk: Maximum Deceleration Jerk:	25500.0 1809140.3 2086079.5 128352488.0 170655984.0	Degrees/s ² Degrees/s ² Degrees/s ³ Degrees/s ³	Parameters = 100% of Max Accel Time Calculate = 100% of Max Decel Time Calculate
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Motion Planner

gones:					
	Homing				
General Motor	noming				
- Model	Mode:	Active 👻			
- Motor Feedback	Position:	0.0	Degrees		
Scaling		0.0		l est Marker	
- Hookup Tests	Uffset:	0.0	Degrees		
Polarity	Sequence:	Immediate 👻 🔻			
Autotune	Limit Switch - No	rmallu: (i) Open 🛛 Close	d		
- Load		, <u>O -</u>	-		
Backlash Comelionee					
Compliance	Active Home S	equence Group			
- Velocity Loop	Direction:	Forward Bi-directional	-		
- Torque/Current Loop	Canada	0.0			
- Planner	opeed:	0.0	Degrees/s		
Homing	Return Spee	d: 0.0	Degrees/s		
- Actions					
- Drive Parameters					
Parameter List					
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is Properties - Axis2					
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Actions to Take Upon Conditions

gories:									
General	Drive	Parameters to Controller Ma	pping						
Motor	Para	meters to be read each cycle	2:			Para	ameters to be written each cy	/cle:	
Motor Feedback		Name	Value		*		Name	Value	14
Scaling		PositionFineCommand		0.0			PositionTrim	0.0	
- Hookup Lests		PositionReference		0.0			VelocityTrim	0.0	1
Autohino		PositionFeedback1		0			TorqueTrim	0.0	1
Autotune		PositionError		0.0			VelocityFeedforwardGain	100.0	1
- LUdu Backlash		PositionIntegratorOutput		0.0			AccelerationFeedforwardGain	100.0	1
Compliance		PositionLoopOutput		0.0			PositionLoopBandwidth	22.868168	1
Desition Loop		VelocityFineCommand		0.0			PositionIntegratorBandwidth	0.0	1
Velecity Loop		VelocityFeedforwardCommand		0.0			VelocityLoopBandwidth	58.542515	1
Terque /Current Loop		VelocityReference		0.0			VelocityIntegratorBandwidth	22.86817	1
Planner		VelocityFeedback		0.0			TorqueLimitPositive	235.89745	1
Homing		VelocityError		0.0			TorqueLimitNegative	-235.89745	1.
Actions		VelocityIntegratorOutput		0.0			VelocityLowPassFilterBandwidth	0.0	1
Actions		VelocityLoopOutput		0.0			TorqueLowPassFilterBandwidth	292.7126	1
Drive Parameters									
Drive Parameters Parameter List Status Faults & Alarms Tag		AccelerationFineCommand		0.0	•		SystemInertia	0.030499676	1.
: Drive Parameters - Parameter List - Status - Faults & Alarms - Tag - Tag		AccelerationFineCommand		0.0	•	OK	SystemInertia	0.030499676	lelp
Drive Parameters - Parameter List - Status - Faults & Alarms - Tag - Tag - Tag - Tag - Tag - Tag - Tag - Tag - Tag - Tag		AccelerationFineCommand		0.0	•	OK	SystemInertia	0.030499676	
Drive Parameters - Parameter List - Status - Faults & Alarms - Tag - Tag - Tag - Jag - Jag		AccelerationFineCommand		0.0	•	OK	SystemInertia	0.030499676	lelp
Drive Parameters - Parameter List - Status - Faults & Alarms - Tag - Tag - Tag - Une - Sproperties - Axis2 - General	Motio	AccelerationFineCommand		0.0	•	OK	SystemInertia	0.030499676	lelp
Drive Parameters - Parameter List - Status - Faults & Alarms - Tag - Tag - Tag - Une - Sproperties - Axis2 - General - Motor	Motio	n Axis Parameters		0.0	•	OK	SystemInertia	0.030499676	lelp
Drive Parameters - Parameter List - Status - Faults & Alarms - Tag - Tag - Tag - Une - Some set of the set of	Motio	n Axis Parameters neter Group: Motor Fe	redback	0.0	•	OK	SystemInertia Cancel Ap Associated Page	0.030499676	elp
Drive Parameters Parameter List Status Faults & Alarms Tag ual Tune is Properties - Axis2 gories: General Motor Motor Motor Feedback	Motio	n Axis Parameters neter Group: Motor Fe	redback	0.0	•	OK	SystemInertia Cancel Ap Associated Page	0.030499676	ielp
Drive Parameters - Parameter List - Status - Faults & Alarms - Tag - Tag - Unal Tune - General - Motor - Motor - Motor Feedback - Scaling	Motio	AccelerationFineCommand In Axis Parameters neter Group: Motor Fe Name	redback	0.0	•	OK	SystemInertia Cancel Ap Associated Page Unit	0.030499676	
Drive Parameters Parameter List Status Faults & Alarms Tag Ual Tune is Properties - Axis2 gories: General Motor Motor Motor Motor Scaling Hookup Tests	Motio Paran	AccelerationFineCommand	redback	0.0	•	OK	SystemInertia Cancel Ap Associated Page Unit 0.0 Degrees	0.030499676	

- General	Motion Axis Parameters			
- Motor				
····· Model	Parameter Group:	Motor Feedback	•	Associated Page
- Motor Feedback				
-Scaling	Name	Δ	Value	Unit
- Hookup Tests	CommutationOffset		0.0	Degrees
- Polarity	Feedback1AccelFilter	Bandwidth	0.0) Hz
- Autotune	Feedback1BatteryAbs	olute	1	lo
- Load	Feedback1CycleInterp	olation	1	1 Feedback Counts/Feedback Cycle
Backlash	Feedback1CycleReso	ution	131072	2 Feedback Cycles/Rev
i Compliance	Feedback1StartupMet	nod	Absolu	te
- Position Loop	Feedback1Turns		65536	8 Rev
 Velocity Loop 	Feedback1Type		Tamagawa Seri	al
- Torque/Current Loop	Feedback1Unit		Re	ev .
- Planner	Feedback1VelocityFilt	erBandwidth	2546.478	3 Hz
-Homing				
- Actions				
 Drive Parameters 				
- Parameter List				
- Status				
- Faults & Alarms				
- Tag				
	,			

More Drive Parameters

General Motion Status				
Motor Axis State: Model Command Position: Scaling Actual Position: Hookup Tests Balaxin	Stopped 47.278 47.278	Command Velocity: Actual Velocity:	0.0 0.0	
Autotune Axis Status Axis Status Axis Status Axis Status Axis Status Polarity DC Bus Up Tracking Compliance Standstill Position Loop Velocity Loop Torque/Current Loop Torque Current Loop Torque Polarity Polarit	○ Torque Limit ommand ○ Current Limit ○ Thermal Limit	⊖ Position L ⊖ Velocity L	ock ock	
Planner Homing Actions Drive Parameters Parameter List Status Faults & Alarms Tag	 Registration 1 Registration 2 	 Positive 0 Negative 1 	vertravel Overtravel	
I Tune		OK	Cancel	Apply

🍄 Axis Properties - Axis2

	its and Alahiis Luy				
	Date/Time 🛆	Source	Condition	Action	End State
A	12/31/1969 19:00:07.9	Start Inhibit	Feedback Not Configured	Alarm Off	
$\overline{\mathbf{n}}$	12/31/1969 19:00:07.91	Faults Cleared	Module Reset	No Action	No Action
Ā	12/31/1969 19:00:50.91	Start Inhibit	Feedback Not Configured	Alarm Off	
5	12/31/1969 19:00:50.91	Faults Cleared	Module Reset	No Action	No Action
5	1/7/1998 21:49:24.532	Faults Cleared	Fault Log Reset	No Action	No Action
5	1/7/1998 21:49:24.556	No Alarms	Alarm Log Reset	Alarm Off	
Ā	1/7/1998 21:49:24.912	Start Inhibit	Feedback Not Configured	Alarm Off	
Ā	1/7/1998 21:51:31.750	Axis Fault	Excessive Velocity Error	Immediate Stop (Co	Disabled
2	1/7/1998 21:51:36.384	Faults Cleared	Fault Reset	No Action	No Action
Ā	1/7/1998 21:51:45.13	Axis Fault	Excessive Velocity Error	Immediate Stop (Co	Disabled
5	1/7/1998 21:51:53.312	Faults Cleared	Fault Reset	No Action	No Action
Ā	1/7/1998 21:52:34.112	Axis Fault	Excessive Velocity Error	Immediate Stop (Co	Disabled
5	1/7/1998 21:52:39.744	Faults Cleared	Fault Reset	No Action	No Action
Ā.	1/7/1998 21:52:51.770	Axis Fault	Excessive Velocity Error	Immediate Stop (Co	Disabled
5	1/7/1998 21:52:56.656	Faults Cleared	Fault Reset	No Action	No Action
T.	1/8/1998 0:28:48.237	Axis Fault	Excessive Position Error	Immediate Stop (Co	Disabled
5	1/8/1998 0:29:17.799	Faults Cleared	Fault Reset	No Action	No Action
T.	1/8/1998 0:32:35.799	Axis Fault	Excessive Velocity Error	Immediate Stop (Co	Disabled
5	1/8/1998 0:32:41.325	Faults Cleared	Fault Reset	No Action	No Action
T.	1/8/1998 0:32:51.303	Axis Fault	Excessive Velocity Error	Immediate Stop (Co	Disabled
5	1/8/1998 0:33:06.429	Faults Cleared	Fault Reset	No Action	No Action
	48488844848484848484848484848	Date/Time Z ↓ 12/31/1969 19:00:07.9 ↓ 12/31/1969 19:00:07.91 ↓ 12/31/1969 19:00:50.91 ↓ 12/31/1969 19:00:50.91 ↓ 12/31/1969 19:00:50.91 ↓ 1/7/1998 21:49:24.532 ↓ 1/7/1998 21:49:24.532 ↓ 1/7/1998 21:49:24.532 ↓ 1/7/1998 21:49:24.532 ↓ 1/7/1998 21:51:33.31 ↓ 1/7/1998 21:52:53.312 ↓ 1/7/1998 21:52:53.312 ↓ 1/7/1998 21:52:52:51.770 ↓ 1/7/1998 21:52:52:51.770 ↓ 1/7/1998 21:52:55.656 ↓ 1/8/1998 0:32:35.799 ↓ 1/8/1998 0:32:35.799 ↓ 1/8/1998 0:32:35.1.303 ↓ 1/8/1998 0:32:35.1.303 ↓ 1/8/1998 0:32:35.06.429	Date Finne ∠ Source ↓ 12/31/1969 19:00:07.9 Start Inhibit ↓ 12/31/1969 19:00:50.91 Faults Cleared ↓ 17/1998 21:49:24.532 Faults Cleared ↓ 1/7/1998 21:49:24.912 Start Inhibit ↓ 1/7/1998 21:51:31.750 Axis Fault ↓ 1/7/1998 21:51:53.312 Faults Cleared ↓ 1/7/1998 21:51:53.312 Faults Cleared ↓ 1/7/1998 21:52:34.112 Axis Fault ↓ 1/7/1998 21:52:39.744 Faults Cleared ↓ 1/7/1998 21:52:51.770 Axis Fault ↓ 1/7/1998 21:52:55.7770 Axis Fault ↓ 1/7/1998 0:28:48.237 Axis Fault ↓ 1/8/1998 0:32:51.779 Faults Cleared ↓ 1/8/1998 0:32:51.799 Axis Fault ↓ 1/8/1998 0:32:51.303 Axis Fault ↓ 1/8/1998 0:32:51.303 Axis Fault ↓ <td>Date Fine 2 Source Condition Image: Date Fine 22 Source Condition Image: Date Fine 12/31/1969 19:00:07.91 Faults Cleared Module Reset Image: Date Fine 12/31/1969 19:00:07.91 Faults Cleared Module Reset Image: Date Fine 12/31/1969 19:00:50.91 Start Inhibit Feedback Not Configured Image: Date Fine 12/31/1969 19:00:50.91 Faults Cleared Module Reset Image: Date Fine Module Reset Faults Cleared Fault Log Reset Image: Date Fine Alarm Society Alarm Log Reset Image: Date Fine Alarm Society Start Inhibit Feedback Not Configured Image: Date Fine Alarm Society Start Inhibit Feedback Not Configured Image: Date Fine Alarm Society Start Inhibit Feedback Not Configured Image: Date Fine Alarm Society Start Inhibit Feedback Not Configured Image: Date Fine Alarm Society Start Inhibit Feedback Not Configured Image: Date Fine Alarm Society Start Inhibit Feedback Not Configured Image: Date Fine Start Inhibit</td> <td>Date TimeA SourceConditionActionA 12/31/1969 19:00:07.9Start InhibitFeedback Not ConfiguredAlarm OffA 12/31/1969 19:00:07.91Faults ClearedModule ResetNo ActionA 12/31/1969 19:00:50.91Start InhibitFeedback Not ConfiguredAlarm OffA 12/31/1969 19:00:50.91Faults ClearedModule ResetNo ActionA 12/31/1969 19:00:50.91Faults ClearedModule ResetNo ActionA 17/1998 21:49:24.532Faults ClearedFault Log ResetNo ActionA 17/1998 21:49:24.556No AlarmsAlarm Log ResetAlarm OffA 17/1998 21:49:24.912Start InhibitFeedback Not ConfiguredAlarm OffA 17/1998 21:51:31.750Axis FaultExcessive Velocity ErrorImmediate Stop (CoA 17/1998 21:51:32.6384Faults ClearedFault ResetNo ActionA 17/1998 21:51:33.312Faults ClearedFault ResetNo ActionA 17/1998 21:52:34.112Axis FaultExcessive Velocity ErrorImmediate Stop (CoA 17/1998 21:52:39.744Faults ClearedFault ResetNo ActionA 17/1998 21:52:51.770Axis FaultExcessive Velocity ErrorImmediate Stop (CoA 17/1998 21:52:56.656Faults ClearedFault ResetNo ActionA 17/1998 21:52:56.656<t< td=""></t<></td>	Date Fine 2 Source Condition Image: Date Fine 22 Source Condition Image: Date Fine 12/31/1969 19:00:07.91 Faults Cleared Module Reset Image: Date Fine 12/31/1969 19:00:07.91 Faults Cleared Module Reset Image: Date Fine 12/31/1969 19:00:50.91 Start Inhibit Feedback Not Configured Image: Date Fine 12/31/1969 19:00:50.91 Faults Cleared Module Reset Image: Date Fine Module Reset Faults Cleared Fault Log Reset Image: Date Fine Alarm Society Alarm Log Reset Image: Date Fine Alarm Society Start Inhibit Feedback Not Configured Image: Date Fine Alarm Society Start Inhibit Feedback Not Configured Image: Date Fine Alarm Society Start Inhibit Feedback Not Configured Image: Date Fine Alarm Society Start Inhibit Feedback Not Configured Image: Date Fine Alarm Society Start Inhibit Feedback Not Configured Image: Date Fine Alarm Society Start Inhibit Feedback Not Configured Image: Date Fine Start Inhibit	Date TimeA SourceConditionActionA 12/31/1969 19:00:07.9Start InhibitFeedback Not ConfiguredAlarm OffA 12/31/1969 19:00:07.91Faults ClearedModule ResetNo ActionA 12/31/1969 19:00:50.91Start InhibitFeedback Not ConfiguredAlarm OffA 12/31/1969 19:00:50.91Faults ClearedModule ResetNo ActionA 12/31/1969 19:00:50.91Faults ClearedModule ResetNo ActionA 17/1998 21:49:24.532Faults ClearedFault Log ResetNo ActionA 17/1998 21:49:24.556No AlarmsAlarm Log ResetAlarm OffA 17/1998 21:49:24.912Start InhibitFeedback Not ConfiguredAlarm OffA 17/1998 21:51:31.750Axis FaultExcessive Velocity ErrorImmediate Stop (CoA 17/1998 21:51:32.6384Faults ClearedFault ResetNo ActionA 17/1998 21:51:33.312Faults ClearedFault ResetNo ActionA 17/1998 21:52:34.112Axis FaultExcessive Velocity ErrorImmediate Stop (CoA 17/1998 21:52:39.744Faults ClearedFault ResetNo ActionA 17/1998 21:52:51.770Axis FaultExcessive Velocity ErrorImmediate Stop (CoA 17/1998 21:52:56.656Faults ClearedFault ResetNo ActionA 17/1998 21:52:56.656 <t< td=""></t<>

Faults and Alarm Log Screen

🔅 Axis Properties - Axis2							×
Categories:							
General	Axis Tag Pro	operties					
Model Motor Feedback	Name:	Axis2					
Scaling Hookup Tests	Description:		^				
- Polarity - Autotune							
Backlash Compliance Position Loop Velocity Loop Torque/Current Loop Planner Homing Actions Drive Respondere	Type: Data Type: Scope: External Access:	Base AXIS_CIP_DRIVE @ Motion_AB Read/Write					
Manual Tune			ОК	Cancel	Apply	He	lp

Note:

Under Drive Parameters, Feedback1BatteryAbsolute, set to 'No' or 0. Otherwise, the hardware will generate a fault and you will not be able to run the axis.

Sample Commands for the A-B Application

Controller Organizer 🗸 🗸 🗙	s	icope: 🕞 MainProg	ram 👻 Show:	All Tags			▼ T. Enter No.	ame Filte
⊡		Name == △	Value 🗧	Force Mask 🛛 🗲	Style	Data Type	Description	C
Controller Lags		+ Action 000	{}	{}		SFC_ACTION	· · ·	
Controller Fault Handler		+ Action 001	{}	{}		SFC ACTION		
- Power-Op Handler		+-Cam	{}	{}		CAM		
		+-Cam Profile	{}	{}		CAM PROFILE		
		+-MCTags_1	{}	{}		MOTION_INSTR		
Program Tags		+-MCTags_2	{}	{}		MOTION_INSTR		
- MainRoutine		+-MCTags_3	{}	{}		MOTION_INSTR		
EQ SEQ		+-MCTags_4	{}	{}		MOTION_INSTR		
🗎 Sequential		 	2		Decimal	DINT		
Unscheduled Programs / Phases		+-Start	{}	{}		SFC_STEP		
🚊 🔲 Motion Groups		+-Step_000	{}	{}		SFC_STEP		
🖨 🖓 🛱 Group		+-Step_001	{}	{}		SFC_STEP		
Axis2		+-Step_002	{}	{}		SFC_STEP		
Ungrouped Axes		+-Step_003	{}	{}		SFC_STEP		
Add-On Instructions		+-Stop	{}	{}		SFC_STOP		
🚊 🗠 🔄 Data Types		+ Time	{}	{}		TIMER		
User-Defined		Tran_000	0		Decimal	BOOL		
		Tran_001	0		Decimal	BOOL		
Add-On-Defined								
H Madula Defined								
1769 Bus								
The Internet And I								
2097-V31PR0-LM K350_2								

Setting Up a Sequence



More Examples of Sequences

Kinetix 350 Drive Ethernet Port Configuration

The IP address of the Kinetix 350 drive is composed of four sub-octets that are separated by three dots to conform to the Class C Subnet structure. Each sub-octet can be configured with number between 1 and 254. As shipped from the factory the default IP address of a drive is 192.168.124.200.

There are two methods of changing the current IP address. An address can be assigned to the drive automatically (dynamic IP address) when the drive is connected to a DHCP (Dynamic Host Configuration Protocol) enabled server, or you can manually assign an IP address to the drive (static IP address). Both methods of configuring the drive's IP address are shown here.

Obtain the Kinetix 350 Drives' Current Ethernet Settings

The current Ethernet setting and IP address of the Kinetix 350 drive can be obtained from the drive display and keypad. Press 🕘 on the display and use

to access parameters IP_1, IP_2, IP_3, and IP_4. Each of these parameters contain one sub-octet of the full IP address, for example in the case of the drive default (factory set) address parameters:

 $IP_1 = 192$ $IP_2 = 168$ $IP_3 = 124$ $IP_4 = 200$

By accessing these four parameters the full IP address on the drive can be obtained.

If parameters IP_1, IP_2, IP_3, and IP_4 all contain '----' rather than a numerical values it means that the drive has DHCP enabled and the DHCP server is yet to assign the drive its dynamic IP address. As soon as an IP address is assigned by the server the address assigned is displayed by the drive in the above parameters. See Configure the IP Address Automatically (dynamic address) on <u>page 83</u>.

Configure the IP Address Manually (static address)

When connecting directly from the Kinetix 350 drive to the personal computer without a server or when connecting to a private network, where all devices have static IP addresses, assign the IP address of the Kinetix 350 drive manually.

To assign the address manually, disable the DHCP mode. Do this by using the drive keypad and following these steps.

1. Press 🔁 .

- 2. Use **O** to access parameter DHCP.
- 3. Check this parameter is set to a value of 0.
- 4. If the DHCP parameter is set to 1 then use 🔁 and 🕥 to set to 0.
- 5. Cycle power to the drive.

The change takes effect.

Do not forget step 5 - Cycle Power!











The following manual describes the setup of the drive:

https://literature.rockwellautomation.com/idc/groups/literature/documents/um/2097-um002_-en-p.pdf

Chapter 6 describes the Drive Safe Torque-off set-up. On pg. 107 the jumpers are shown that bypass the feature. In another chapter, the safety of a system is discussed. This chapter discusses the safe use of this drive and controller.



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