

ACSI Motor/Drive/Controller with Allen Bradley RSLogix 5000 EtherNet/IP Setup Guide



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1. System Requirements

HARDWARE	MINIMUM REQUIREMENTS
Processor	Intel Pentium II 450 MHz Min
	Intel Pentium III 733 MHz (or better) recommended
Software Requirements	Windows XP with Service Pack 2 (or above)
RAM	128 MB Minimum
	256 MB Recommended
Disk Space	3 GB Free HDD space
PLC	Allen Bradley ControlLogix L3X or above
RSLogix	5000 version 18
Cables	USB
	CAT 5e

NOTE: Tolomatic's Motion Interface is dependent on .NET 4. Reference the TMI User Guide 3600-4167 for minimum requirements.

2. Cabling

Setup and establish communication between RSLogix and the controller. Connect an Ethernet cable to the PLC controller and to the ACS Drive.

3. Setting up the Tolomatic ACS Drive IP Address

Using the Tolomatic Motion Interface (TMI) program with the ACS, go to Tools -> Ethernet menu selection or press the Configure Ethernet button on the toolstrip. Assign the IP address of the drive (Figure 1). By default the ACS will be set for DHCP mode. A static IP address can be set using the "Ethernet Setup Tool" in TMI or the TCP/IP object (OXF5) in EtherNet/IP. For additional instruction, refer to the "Ethernet Setup Tool" section of the TMI User Guide 3600-4167

ACS Internet Protocol (TCP/IP) Properties 💶 🗖 🔀				
Network Settings Dbtain an IP address automatically				
IP address 192.168. 0 .100				
Subnet Mask 255.255.255.0				
Default Gateway 192.168. 0 . 1				
MAC Address 00:04:A3:33:10:ED				
OK Test Cancel				
StaticIPAddress				

Figure 1: Assigning ACS Drive an IP Address.



4. Using Add-on Profiles & Add-On Instructions

4.1 Overview

These instructions assume that the user is very familiar with Studio 5000 Logix Designer/RSLogix 5000 programming and EtherNet/IP communications. This document references the EtherNet/IP Users Guide 3600-4168 which defines the EtherNet/IP interface to the ACS drive and controller.

4.2 Step 1: Import Add-On Instructions

The first step to using the ACS Add-On Instructions is to import them into your Studio 5000 Logix Designer/RSLogix 5000 program.

- 1. In your Controller Organizer tree view, right click on Add-On Instructions and select Import Add-On Instruction.
- 2. Browse to the directory which contains the ACS Add-On Instructions
- 3. Select the instruction you wish to import
- 4. The default configuration should be ok, click 'OK'
- 5. Repeat for all instructions you wish to use.

NOTE: IF YOU ARE PLANNING ON USING THE MOTION ADD-ON INSTRUCTIONS, YOU WILL NEED THE START MOTION, AND CLEAR START MOTION INSTRUCTIONS.

4.3 Step 2: Add ACS Drives to Project

You will now want to add the ACS Drive(s) to your project.

Tolomatic has created EDS based Add-On Profiles which work hand-in-hand with the Add-On Instructions. The EDS files are included in the Add-On Instructions download. EDS file 36043187 is for ACS servo and stepper drives. EDS file 36043188 is for ACSI integrated motor/drive/controller.

- 1. Click on Tools->EDS Hardware Installation Tool
- 2. Follow the RSLogix EDS wizard to Register an EDS file
- 3. When prompted, browse to the EDS file (36043187_ACS_DRIVE.eds) or (36043188_ACSI_DRIVE.eds)
- 4. Once completed, Right click on the Ethernet Port Controller in your controller organizer window
- 5. Select 'New Module'
- 6. In the Catalog, search 'Tolomatic'
- 7. Assign a Name and Description for each drive
- 8. Assign an IP Address (default Drives ship in DHCP mode)



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4.4 Step 3: Create Enable Rung

Many of the Add-on Instructions reference the same command word on the ACS drive. Because of this, "race conditions" on this command word can exist in programs if proper care is not followed. The program should only send the enable command if the drive is not enabled. See below:

ACS_Drive:LSTAT.0		Enable ACS Drive ACS_ENABLE_DRIVE Enable ACS Drive ACS_ENABLE_DRIVE StepperEnable DriveCMD ACS_Drive.O.CMD
	Only Home if drive is enabled and	not homed Routine based on homing profile defined in drive
CS_Drive:LSTAT.0 ACS_Drive:LST	AT.1	ACS_HOME_MOVE- Initiated Homing Routine based on homi ACS_HOME_MOVE_StepperHome DriveCMDACS_Drive:O.CMD
	We are enabled and homed - signal we	are ready to go
CS Drivet STATA ACS Drivet ST	AT.1 ACS_Drive:LSTAT.2	Stepper_ReadyToRumb

Figure 2 - Create Enable Rung

As soon as the drive is enabled, the enable command is no longer active. If this run was left on, the command word would overwrite other commands such as Home and Start Motion.

A note about faults:

A common implementation for the ACS Drive is to cut motor power when an ESTOP switch is activated, keeping the drive powered by an auxiliary power supply connected to Keep Alive input on the drive. This causes an under voltage fault on the drive. The drive disables the motor in an attempt to protect itself. To clear most faults, the drive must be disabled and enabled by the program. This is true even if the drive has already disabled itself as a result of a fault. The drive uses the cycling of the enable bit from the PLC as an active acknowledgement that the program has detected and processed the fault. Once the drive detects this transition, the fault will clear if the fault condition is no longer present.

4.5 Step 4: Create Start Motion Timer Rungs

According to the EtherNet/IP users guide, in order to continuously make motion, you must strobe the Start Motion bit in the Output Assembly. The drive detects the rising edge of the bit, so if you want to make a move after you have already made a move, you must bring the bit low, before you again assert it to start motion. To accomplish this, you use a timer to force down a Clear Start Motion command after a Start Motion Command has been sent. To enforce this logic, we do the following for each drive:

1. In the Program Tags, add a StartMotionTimerEnable BOOL tag

2. In the Program Tags, add a StartMotionTimer TIMER tag



Now create the following rungs in your program:

Start Motion requires Shared Timer and a Start Timer Enable bit	TON	1
	Timer On Delay Timer StartMotionTimer Preset 0 ← Accum 0 ←	-(EN)
Continuously monitors timer and clears when appropriate		
Clears the	Start Bit	
Cears Start	Motion	
i ime Enao Resets Stati	Motion	
	ART MOTION	
Clears the Start Motion BRClears ACS_CLEAR_START_MOTI DF DriveCND SMITimerEnable SMITimer	Start Motion Timer Enable L RV_CLR_START_MOT_AOI ACS_DRIVE01:0.CMD StartMotionTimerEnable StartMotionTimer	ineR J J

Figure 3 - Start Motion

You may want different logic in your application, so the add-on instructions give you this control. The basic thing to remember is that the drive must detect the start motion bit LOW before the PLC sets it high again. This means that the Start Motion Timer must be longer than the RPI, and you should not command another move before the Clear ACS Start Motion command has a chance to be sent to the drive.

4.6 Motion Example

The following is an example of a Force Move (ACS Servo and ACSI Servo Only), but Absolute and Incremental Moves have the same inputs.

	Move to an Absolu Position using For Move logic	ute ce		
TEST_FORCE_MOVE	ACS_FORCE_MC	DVE	ACS_ST	ART_MOTION-
][Move to an Absolute Position using Force I	Move logic		
	ACS_FORCE_MOVE	DRV_FORCE_MOVE_AOI	ACS_START_MOTION	DRV_START_MOT_AOI (
	Position	25	DriveCMD	ACS_DRIVE01:0.CMD
	Acceleration	69	StartMotionTimer	StartMotionTimer StartMotionTimerEnable
	Deceleration	85		
	Velocity	39		
	Force	100		
	DriveMoveSelect ACS	DRIVE01:0.MOVESELECT		
	DriveTargetPos ACS_D	RIVE01:0.TARGET_0_POS		
	DriveTargetVel ACS_D	RIVE01:0.TARGET_0_VEL		
	DriveTargetAcc ACS_D	RIVE01:0.TARGET_0_ACC		
	DriveTargetForce ACS_DRIV	/E01:O.TARGET_0_FORCE		
	DriveTargetMotionType ACS_DRIVE01:0.	TARGET_0_MOTION_TYPE		

Figure 4 - Force Move Example

In this application, the move is immediately initiated when the TEST_FORCE_MOVE bit is set high. The move is set up and the Drive Target Variables are mapped to the specific variables in the Controller Tags for a given drive.

Once the move is set up, the ACS Start Motion command is sent. We reference the Start Motion Timer program tag, the Start Motion Timer Enable semaphore program tag, and specify the pulse width of the Enable line. For this to be work correctly, the pulse width should be approximately 2x the RPI of the drive. In this instance, it is 20ms.

EXCELLENCE IN MOTION

Add-On Instruction Variable	Controller Tag Reference	Description
DriveCMD	[ACS Drive]:O.CMD	Command Register of Drive ^{1, 2}
DriveMoveSelect	[ACS Drive]:O.MOVESELECT	Index Move to Execute – 0 uses Target_0 settings, otherwise the indexed positions are configured in the Tolomatic Motion Interface
DriveTargetPos	[ACS Drive].O.TARGET_0_POS	Index 0 Target Position ⁴
DriveTargetVel	[ACS Drive].O.TARGET_0_VEL	Index 0 Target Velocity ⁴
DriveTargetAcc	[ACS Drive].O.TARGET_0_ACC	Index 0 Target Acceleration ⁴
DriveTargetDec	[ACS Drive].O.TARGET_0_DEC	Index 0 Target Deceleration ⁴
DriveTargetForce	[ACS Drive].O.TARGET_0_ FORCE	Index 0 Force %
DriveTargetMotionType	[ACS Drive].O.TARGET_0_ MOTION_TYPE	Motion Type Register ³
DriveDigitalOutput	[ACS Drive].O.DIGITAL_OUTPUT	Set Digital Output Pins register mask
[Unused]	[ACS Drive].I.CPOS	Current Position ⁴
[Unused]	[ACS Drive].I.STAT	Drive Status Register⁵
DriveFaults	[ACS Drive].I.FAULTS	Drive Faults Register ⁵
[Unused]	[ACS Drive].I.INPUT_BITS	Read Digital Inputs
[Unused]	[ACS Drive].I.OUTPUT_BITS	Read Digital Outputs
[Unused]	[ACS Drive].I.AIN	Read Analog Input
[Unused]	[ACS Drive].I.AOUT	Read Analog Output

¹The individual bits in this register should not be changed independently of each other. There are some combinations that are invalid, and the drive will not recognize these commands. The following are accepted: 0x0 – Disable Drive; 0x1 – Enable Drive; 0x3 – Start Motion; 0x5 – Home; 0x8 – Software Stop (Estop); 0x11 – Stop Motion

²To clear start motion manually, simply send it another valid command. Typically the Enable Drive Command. If the drive is already enabled, the drive will stay enabled.

³Valid motion types for network controlled ACS Drives: 0x0 – Absolute; 0x1 – Increment Position; 0x2 – Decrement Position; 0x9 – Force Move (Servo Only) 0xB – Increment Position (Rotary); 0xC – Decrement Position (Rotary); 0xD – Velocity Forward (Rotary); 0xE – Velocity Reverse (Rotary)

⁴All distance is in drive default millimeters; Speed is in mm/s; Acceleration is mm/s² this can be changed in TMI for rotary actuators to Revs or Degrees.

⁵Drive Status and Fault Register Masks are defined in the ACS Drive Ethernet/IP Programmers Guide, Section 3.2 Input Assembly (3600-4168).



5. Setting Up the Allen Bradley PLC Using the RSLogix 5000 Software Using Generic Module (no EDS file)

This instruction will walk through how to add an Ethernet module to a PLC controller, create data types, and download configurations and instructions to the controller.

5.1 Adding an Ethernet Module

ť	5.1 Adding an Ethe	AT IVIOQUIE
(Open RS Logix and select a 'N	Project.'
(Controller Projects	
	Recent Projects	
	Open Project	
	New Project	
	Open Sample Project	
	Recent Projects Open Project New Project Open Sample Project	

Figure 5: Select New Project

In the 'New Controller' window, select controller, give project a name, and choose a directory to save the project.

New Controller				
Vendor:	Allen-Bradley			
<u>Т</u> уре:	1769-L23E-QB1 CompactLogix5323E-QB1 Controller 🗸	ОК		
Re <u>v</u> ision:	18 🗸	Cancel		
	Redundancy Enabled	Help		
Na <u>m</u> e:	ExampleProject			
Description:				
<u>C</u> hassis Type:	<none></none>			
Sl <u>o</u> t:	0 💲 Safety Partner Slot: <none></none>			
Cr <u>e</u> ate In:	C:\RSLogix 5000\Projects	Browse		

Figure 6: RSLogix New Project Window



Next, add a generic EtherNet/IP module; right click on 'Ethernet' and select 'New Module'.



Figure 7: Adding a Generic EtherNet/IP Module

The 'Select Module' window will open. Choose the 'Generic Ethernet Module' and click 'OK". For details on how to use an Add on Profile & Instructions see section 6 "Using Add-On Instructions".

Select Module	
Module	Description
- 2097-V34PR5	Kinetix 300, 4A, 480V, No Filter 🔥
2097-V34PR6	Kinetix 300, 6A, 480V, No Filter
2364F RGU-EN1	Regen Bus Supply via 1203-EN1
- Drivelogix5730 Ethernet	10/100 Mbps Ethernet Port on DriveLogix5730
ETHERNET-BRIDGE	Generic EtherNet/IP CIP Bridge
ETHERNET-MODULE	Generic Ethernet Module
ETHERNET-PANELVIEW	EtherNet/IP Panelview
EtherNet/IP	SoftLogix5800 EtherNet/IP
PowerFlex 4 Class Multi	Multi Drive via 22-COMM-E
PowerFlex 4-E	AC Drive via 22-COMM-E
PowerFlex 4M-E	AC Drive via 22-COMM-E
PowerFlex 40-E	AC Drive via 22-COMM-E
PowerFlex 40P-E	AC Drive via 22-COMM-E
	<u>></u>
	<u> </u>
By Category By Vendor	Favorites
	OK Cancel <u>H</u> elp

Figure 8: Selecting a Generic Ethernet Module

NOTE: An IP address can be obtained via DHCP by configuring the PLC. For more information on this procedure, please reference the software/hardware manual for the PLC in use.



The new module properties window should have opened. Enter a name for the module, an IP address for the drive, and the assembly object parameters and click 'OK'. Set up Assembly Instances for the ACS drive as shown in Figure 6. The IP address must match the address configured in the Tolomatic Motion Interface Software (see section 3 of the TMI User Guide 3600-4167.

New Module						×	
Type: Vendor: Parent:	ETHERNET-MODULE Generic Ethernet Allen-Bradley LocalENB	Module	ameters				
Na <u>m</u> e. Description:	Tolomatic_ACS_Drive		Assembly Instance:	Size:			
		<u>I</u> nput:	100	7	(32-bit)		
		0 <u>u</u> tput:	113	8 🛟	(32-bit)		
Comm <u>F</u> ormat:	Data - DINT	Configuration:	1	0 🛟	(8-bit)		
• Address / H	ss: 192 . 168 . 0 . 100	<u>S</u> tatus input:					
<u>○ H</u> ost Nar	ne:	S <u>t</u> atus Output:					
🗹 Open Modu	le Properties	ОК	Can		Help]	

Figure 9: New Module Properties Window

In the connection tab, select these settings or other Requested Packet Interval (RPI). This value determines the interval the controller will use to send/receive data. To conserve bandwidth, use higher values. Click 'OK' when finished. **NOTE:** Setting the packet interval to low may result in erratic motion. Recommended RPI is 12.0 ms. Fastest RPI is 10.0 ms.

Module Properties: LocalENB (ETHERNET-MODULE 1.1)
General Connection* Module Info
Requested Packet Interval (RPI): 50.0 ms (1.0 - 3200.0 ms)
Major Fault On Controller If Connection Fails While in Run Mode
Use Unicast Connection over EtherNet/IP Module Fault
Status: Offline OK Cancel Apply Help

Figure 10: Module Properties Connection Tab



Now the module should have been automatically added in the organizer window.



Figure 11: Ethernet Module Added to Organizer Window

A new node named Tolomatic_ACS_Drive now exists under I/O Configuration. Module-defined data types have also been created. These tags allow access to the Input and Output data of the ACS drive using the controller's ladder logic.

5.2 Download Configuration to Controller

Download the previous configurations to the controller and save the project.

5.3 Controller Tags

In the organizer window, expand 'Module-Defined' under 'Data Types'. Make sure Ethernet module data types are: AB:ETHERNET_MODULE_DINT_28Bytes:I:0

AB:ETHERNET_MODULE_DINT_32Bytes:0:0



Figure 12: Verify Ethernet Module Data Types in Organizer Window



Next, double-click on 'Controller Tags' in the organizer window.



Figure 13: Controller Tags in Organizer Window

A window opens showing all of the existing controller tags. With the new Ethernet module, the controller tags were also created.

Ø	🖉 Controller Tags - ExampleProject(controller)									
S	cope: 🛐 ExampleProject 🔽 Show: All Tags	y, Enhachlam	e Filles 🗸 🗸	~						
	Name <u>IB</u> A	Data Type	Description 📥 📷	<u>-</u>						
	⊞-Local:1:C	AB:Embedded_IQ16F:C:0		σ						
	⊞-Local:1:I	AB:Embedded_IQ16F:I:0		rone						
	±-Local:2:C	AB:Embedded_0B16:C:0	artie	ntie.						
	⊞-Local:2:I	AB:Embedded_0B16:1:0		29						
	⊞-Local:2:0	AB:Embedded_0B16:0:0		-						
	I → Tolomatic_ACS_Drive:C	AB:ETHERNET_MODULE:C:0								
	⊞-Tolomatic_ACS_Drive:I	AB:ETHERNET_MODULE_DINT_28Bytes:1:0								
	⊞-Tolomatic_ACS_Drive:0	AB:ETHERNET_MODULE_DINT_32Bytes:0:0								
┫	Monitor Tags / Edit Tags /		×							

Figure 14: Controller Tags Window

This example uses the new Ethernet module: Tolomatic_ACS_Drive:C, Tolomatic_ACS_Drive:I, and Tolomatic_ACS_Drive:O.

Click the '+' next to each tag to expand the bytes. The data tags are listed numerically.

Name <u>=8</u> V	Value 🔦	Force Mask 🛛 🔦	Style
Tolomatic_ACS_Drive:0	{}	{}	
-Tolomatic_ACS_Drive:I	{}	{}	
Tolomatic_ACS_Drive:I.Data	{}	{}	Decimal
Tolomatic_ACS_Drive:I.Data[0]	0		Decimal
Tolomatic_ACS_Drive:I.Data[1]	0		Decimal
-Tolomatic_ACS_Drive:I.Data[1].0	0		Decimal
-Tolomatic_ACS_Drive:I.Data[1].1	0		Decimal
-Tolomatic_ACS_Drive:I.Data[1].2	0		Decimal
-Tolomatic_ACS_Drive:I.Data[1].3	0		Decimal
-Tolomatic_ACS_Drive:I.Data[1].4	0		Decimal
-Tolomatic_ACS_Drive:I.Data[1].5	0		Decimal
-Tolomatic_ACS_Drive:I.Data[1].6	0		Decimal

Figure 15: Expanded Controller Tags

Create user defined data types that reflect better naming conventions.



5.4 Creating Program Tags

Create two user defined data types called Tolo_Inputs, and Tolo_Outputs. To do this, Right click on 'User Defined' and select 'New Data Type'. Use the assembly object table as a reference to map the new program tags to each controller tag. Use naming conventions that will be easy to understand in the ladder logic. The following figures show each data type created.

Each bit in the 'Drive_Faults' register (bytes 8-11 of instance 100) represents a particular fault. The 'Drive_Faults' data type is created so each fault can be easily referenced by name instead of by bit number when a ladder logic program is defined.

193 D)ata Type: Drive	e_Faults								
Na	Name: Drive Faulte									
	ino.	Dirite_r daits								
De	escription:		Dri	ve Fault						
			pa	rameters						
Me	embers:			Da	ata Type Size	e: 4 byte(s)				
	Name	Da	ita Type		Style	Description		External Acce	ess	~
	Positive_Limit	BO	IOL		Decimal			Read/Write		
	Negative_Limit	BO	IOL	I	Decimal			Read/Write		
	eStop	BO	IOL		Decimal			Read/Write		
	Position_Error	BO	IOL	1	Decimal			Read/Write		
	Feedback_Erro	or BO	IOL	[Decimal			Read/Write		≡
	Over_Temp	BO	IOL	[Decimal			Read/Write		
	Motor_Overten	np BO	IOL	[Decimal			Read/Write		
	Drive_Overtemp BOOL		[Decimal			Read/Write			
	Drive_Overvolt	age BO	IOL	[Decimal			Read/Write		
	Drive_Undervo	oltage BO	IOL	[Decimal			Read/Write		
	Flash_Error	BO	IOL	[Decimal			Read/Write		~
				_						
N	love Up Mov	e Down			OK	Cancel		Apply	Help	

Give each member a name, data type, and style to display a formatted number.

Figure 16: Creating a Drive Faults Data Type

Follow the same procedure for the drive 'Drive_Status' register. Some bits of the Drive_Status data type are not used in the ACS drive. Those are marked as reserved.



Me	embers:		Data Ty	vpe Size: 4 byte(s)	
	Name	Data Type	Style	Description	External Access
	Drive_Enable	BOOL	Decimal	Drive Enable Input	Read/Write
	Drive_Homed	BOOL	Decimal	Drive Home Input	Read/Write
	Drive_InMotion	BOOL	Decimal	Drive In Motion Input	Read/Write
	Drive_EStop	BOOL	Decimal	Drive E-Stop Input	Read/Write
	rsved_bit00	BOOL	Decimal		Read/Write
	rsved_bit01	BOOL	Decimal		Read/Write
	rsved_bit02	BOOL	Decimal		Read/Write
	rsved_bit03	BOOL	Decimal		Read/Write
	rsved_bit04	BOOL	Decimal		Read/Write
	rsved_bit05	BOOL	Decimal		Read/Write
	rsved_bit06	BOOL	Decimal		Read/Write
	rsved_bit07	BOOL	Decimal		Read/Write
	rsved_bit08	BOOL	Decimal		Read/Write
	Drive_EthAvail	BOOL	Decimal	Drive Ethernet Online	Read/Write
	rsved_bit09	BOOL	Decimal		Read/Write
	rsved_bit10	BOOL	Decimal		Read/Write
	rsved_bit11	BOOL	Decimal		Read/Write
	rsved_bit12	BOOL	Decimal		Read/Write
	rsved_bit13	BOOL	Decimal		Read/Write
	rsved_bit14	BOOL	Decimal		Read/Write
	Drive_BrakeOff	BOOL	Decimal	Brake Not Active	Read/Write
	rsved_bit15	BOOL	Decimal		Read/Write
	rsved_bit16	BOOL	Decimal		Read/Write

Figure 17: Drive Status Data Type

The previously created data types 'Drive_Faults' and 'Drive_Status' will now be used within our next data type. Create a data type called 'Tolo_Inputs'. Add these faults and status members using user defined data types. The other members can be created using the statndard data types DINT and REAL.

888 D	ata Type: Tolo_Inputs										
Na	Name: Tolo Inputs										
De	Description:										
Ме	mbers:	 Data Tune	Data Type Size	e: 28 byte(s)	Eutemal Access						
	Current Position	BEAL	Eloat	Description	Bead/W/rite						
	Drive Status	Drive Status			Read/Write						
	Drive Faults	Drive Faults			Read/Write						
	Digital Input	DINT	Binary	8 bits used of 32	Read/Write						
	Digital_Output	DINT	Binary	4 bits used of 32	Read/Write						
	Analog_Input	REAL	Float		Read/Write						
	Analog_Output	REAL	Float		Read/Write						
10f ⁰ 010											
M	Move Up Move Down OK Cancel Apply Help										

Figure 18: Creating a Tolo_Input Data Type



Next, create another data type called 'Network_Outputs' that will be used as a data type within the 'Tolo_Outputs' data type.

101 010 D	ata Type: Netw	vork_Outputs				
Na	me:	Network Outputs				
140	inc.					
Description: Tolomatic ACS Outputs			ACS Drive puts			
Members: Data Type Size: 4 byte(s)						
	Name	Data Type	Style	Description	External Access	~
	Enable	BOOL	Decimal		Read/Write	
	Start_Motion	BOOL	Decimal		Read/Write	
	Home	BOOL	Decimal		Read/Write	
	eStop	BOOL	Decimal		Read/Write	Ξ
	res4	BOOL	Decimal		Read/Write	
	res5	BOOL	Decimal		Read/Write	
	res6	BOOL	Decimal		Read/Write	
	res7	BOOL	Decimal		Read/Write	
	Move_Select	SINT	Decimal		Read/Write	
10f ⁰ 010						×
M	love Up Mov	e Down	ОК	Cancel	Apply Hel	P

Figure 19: Creating a Network_Output Data Type

Next, create the 'Tolo_Outputs' data type as shown.



888 D	ata Type: Tolo_	_Output	S					
Na	me:	Tolo_Out	puts					
De	scription:		Tolomatic ACS Outputs) Drive				
					3			
	l							
Me	mbers:		ſ	Data Type Size	e: 32 byte(s)			
	Name		Data Type	Style	Description	External Access		
	🗄 Drive_Control		Network_Outputs		4 bits used of 8	Read/Write		
	Target_Position	ı	REAL	Float		Read/Write		
	Target_Velocity	,	REAL	Float		Read/Write		
	Target_Acceler	ration	REAL	Float		Read/Write		
	Target_Deceler	ration	REAL	Float		Read/Write		
	Target_Force		REAL	Float		Read/Write		
	Target_Motion_	Туре	SINT	Decimal	Absolute or Incremental	Read/Write		
	Digital_Output		DINT	Decimal	4 bits used of 32	Read/Write		
10f ⁴ 010								
M	fove Up Move	e Down		ОК	Cancel	Apply He	lp 🛛	

Figure 20: Create a Tolo_Outputs Data Type

Open the controller tags and click on the 'Edit' tab. Add Tolo_Inputs and Tolo_Outputs as the new data types just created.

🖉 Controller Tags - ExampleProject(controller)									
s	Scope: 🗊 ExampleProject 🔽 Show: All Tags 🛛 👻 🏹 Enter Name Filter								
	Name 28 4	Alias For	Base Tag	Data Type	Description	Exte	^		
				AB:Embedded_IQ		Rea	P		
	I Local1:I			AB:Embedded_IQ		Rea	rope		
	I +-Local:2:C			AB:Embedded_0		Rea	artie		
	⊞-Local:2:I			AB:Embedded_0		Rea	0		
	+-Local:2:0			AB:Embedded_0		Rea			
				Tolo_Outputs	Tolomatic ACS Dri	Rea			
	+-Tolol_Inputs			Tolo_Inputs	Tolomatic ACS Dri	Rea			
	Tolomatic_ACS_Drive:C			AB:ETHERNET		Rea			
	Tolomatic_ACS_Drive:			AB:ETHERNET		Rea			
	Tolomatic_ACS_Drive:			AB:ETHERNET		Rea			
ø									
L							~		
4	Monitor Tags AEdit Tags /		<			>			

Figure 21: Add Tolo_Inputs and Tolo_Outputs as New Data Types

This completes setup of program tags with recognizable naming conventions.

5.5 Ladder Logic Instructions

Double-click on 'Main Routine' to enter the ladder logic program window.





Figure 22: Main Routine in the Organizer Window



Insert 'Synchronous Copy File' instructions to copy the program tags to the controller tags.

Figure 23: Inserting the Synchronous Copy File Instructions

Download the instructions to the controller and run the program. Turn the key on the PLC to RUN and the program should be online and running.

6. Make Motion

When the PLC is in RUN mode and RSLogix is online, manipulate the data tags in the controller tags window. If the proper bits are written, the drive will react as instructed.



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😑 😑 Motion	n Groups	Tolo_Outputs.Drive_Control.Home 0 Decimal 800L	
Ur	ngrouped Axes	-Tolo_Outputs.Drive_Control.eStop 0 Decimal 800L	
Add-C	On Instructions	Tolo_Outputs.Drive_Control.res4 0 Decimal BOOL	
	ser-Defined	Tolo_Dutputs.Drive_Control.res5 0 Decimal BOOL	
	Drive_Faults	Tolo_Outputs.Drive_Control res6 0 Decimal BOOL	
10	Drive_Status	-Tolo_Outputs.Drive_Control.res7 0 Decimal 800L	
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	dd-On-Defined	Tolo_Outputs.Target_Acceleration 0.0 Float REAL	
🗊 🛄 Pr	edefined	Tolo_Outputs.Target_Deceleration 0.0 Float REAL	
🛓 🛄 M	odule-Defined	Tolo_Outputs_Target_Force 0.0 Float REAL	
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Figure 24: Manipulating Data Tags in Controller Tags Window

6.1 Home Move

The first step when bringing a drive online from power-up, is usually to have it find the actuator's home location. To do this, write a '1' to Enable and Home bits (send command 0x5) of Tolo_Outputs.Drive_Control. The drive should immediate begin the homing motion profile that was setup previously using TMI. When homing has successfully completed the tag Tolo_Inputs.Drive_Status.Drive_Home will turn to '1'.

-Tolo_Outputs	{}
Tolo_Outputs.Drive_Control	{}
-Tolo_Outputs.Drive_Control.Enable	1
-Tolo_Outputs.Drive_Control.Start_Motion	0
-Tolo_Outputs.Drive_Control.Home	1
Tolo_Outputs.Drive_Control.eStop	0

Figure 25: Finding the Home Postion

6.2 Absolute Move

To do an absolute move, set the Position, Velocity, Acceleration, and Force parameters of Tolo_Outputs.Drive_Control to desired values. Set Move_Select to '0' and Motion_Type to '0'. Then raise Start_Motion from '0' to '1'. Start_



Motion begins the move only when its value cycles from '0' to '1' and Enable is also '1' (send command 0x3). If the position has not changed since the last move there will be no motion because the actuator is already at the desired position.

─ Tolo_Outputs	{}
Tolo_Outputs.Drive_Control	{}
-Tolo_Outputs.Drive_Control.Enable	1
Tolo_Outputs.Drive_Control.Start_Motion	1
-Tolo_Outputs.Drive_Control.Home	0
-Tolo_Outputs.Drive_Control.eStop	0
-Tolo_Outputs.Drive_Control.res4	0
-Tolo_Outputs.Drive_Control.res5	0
Tolo_Outputs.Drive_Control.res6	0
-Tolo_Outputs.Drive_Control.res7	0
Tolo_Outputs.Drive_Control.Move_Select	0
-Tolo_Outputs.Target_Position	55.2
-Tolo_Outputs.Target_Velocity	25.0
-Tolo_Outputs.Target_Acceleration	200.0
-Tolo_Outputs.Target_Deceleration	200.0
-Tolo_Outputs.Target_Force	100.0
Tolo_Outputs.Target_Motion_Type	0
Tolo_Outputs.Digital_Output	0

Figure 26: Making an Absolute Move

6.3 Increment Move

Set the same motion profile parameters as in the Absolute Move example in section 5.2. Change Target_Motion_Type to '1' and keep Move_Select at '0'. Set the position to the desired increment distance; in this example it is 10mm. Make sure Enable is '1' (command 0x1). Now toggle Start_Motion from '0' to '1' to initiate the move (command 0x3).

To perform an Incremental Negative Move, repeat the same procedure using a '2' for Target_Motion_Type.

Tolo_Outputs	{}
Tolo_Outputs.Drive_Control	{}
-Tolo_Outputs.Drive_Control.Enable	1
-Tolo_Outputs.Drive_Control.Start_Motion	1
-Tolo_Outputs.Drive_Control.Home	0
-Tolo_Outputs.Drive_Control.eStop	0
-Tolo_Outputs.Drive_Control.res4	0
-Tolo_Outputs.Drive_Control.res5	0
-Tolo_Outputs.Drive_Control.res6	0
-Tolo_Outputs.Drive_Control.res7	0
+ Tolo_Outputs.Drive_Control.Move_Select	0
-Tolo_Outputs.Target_Position	10.0
-Tolo_Outputs.Target_Velocity	25.0
-Tolo_Outputs.Target_Acceleration	200.0
-Tolo_Outputs.Target_Deceleration	200.0
-Tolo_Outputs.Target_Force	100.0
Tolo_Outputs.Target_Motion_Type	1
	0
Tol_Outputs.Target_Acceleration Tolo_Outputs.Target_Acceleration Tolo_Outputs.Target_Deceleration Tolo_Outputs.Target_Force Tolo_Outputs.Target_Motion_Type Tolo_Outputs.Target_Motion_Type	200.0 200.0 200.0 100.0 100.0

Figure 27: Increment Positive Move

6.4 Index Move

An Index Move uses the setting from the move definitions table put into the drive at setup. These move definitions can only be changed using TMI. It is not necessary to set any of the motion parameters in Drive_Control. These



parameters are ignored the the drive uses the parameters from the move definition table. Set Enable to '1', (command 0x4) and set Move_Select to any value between '1' and 16'. In this example index '4' is selected. Now toggle Start_Motion from '0' to '1' (command 0x3) to initiate the move.

⊟-Tolo_Outputs	{}
Tolo_Outputs.Drive_Control	{}
-Tolo_Outputs.Drive_Control.Enable	1
-Tolo_Outputs.Drive_Control.Start_Motion	1
-Tolo_Outputs.Drive_Control.Home	0
-Tolo_Outputs.Drive_Control.eStop	0
-Tolo_Outputs.Drive_Control.res4	0
-Tolo_Outputs.Drive_Control.res5	0
-Tolo_Outputs.Drive_Control.res6	0
-Tolo_Outputs.Drive_Control.res7	0
	4
-Tolo_Outputs.Target_Position	0.0
-Tolo_Outputs.Target_Velocity	0.0
-Tolo_Outputs.Target_Acceleration	0.0
-Tolo_Outputs.Target_Deceleration	0.0
-Tolo_Outputs.Target_Force	0.0
∃ Tolo_Outputs.Target_Motion_Type	0
	0

Figure 28: Index Move

6.5 Other Supported Moves

Force_Move:	Motion Type = '9'
Increment Move Positive Rotary:	Motion Type = '11'
Increment Move Negative Rotary:	Motion Type = '12'
Velocity Forward Rotary:	Motion Type = '13'
Velocity Reverse Rotary:	Motion Type = '14'



7. Setting ACS drive IP address automatically with Rockwell BOOTP/DHCP Server

7.0 System Requirements

Tolomatic's ACS Drive uses the Tolomatic Motion Interface (TMI) software which is dependent on .NET4. Please reference the TMI User Guide 3600-4164 for minimum requirements.

Hardware

Tolomatic ACS Stepper Drive: P/N 36049666 Tolomatic ACS Servo Drive: P/N 36049662

Tolomatic ACSI - EIP motors

Software

Tolomatic Motion Interface (TMI), version 2.4 or higher. BOOTP/DHCP Server v2.3 by Rockwell

Cabling

Tolomatic ACS Stepper Drive: USB Type B cable Tolomatic ACS Servo Drive: USB Type B cable Network connection Tolomatic ACSI Motor/Drive/Controller: USB Type Micro B



7.1 Overview

This section describes how to use the Rockwell BOOTP/DHCP server application included with the RSLogix5000 software with the Tolomatic ACS drive. This application is used to assign IP addresses to EtherNet/IP[™] devices via DHCP. Many IP addresses can be assigned to a network of ACS drives that are uniquely identified by their MAC address.



NOTE: Windows Firewall may interfere with the procedure. It is recommended to turn the Windows Firewall OFF before proceeding with the procedure.



NOTE: ACSI should be set to Infrastructure Mode and configured for DHCP to use this mode.

7.2 ACS / TMI Setup

Run Tolomatic Motion Interface and connect to the ACS drive. Configure the actuator and motor, set the ACS Drive for EtherNet/IP on the Mode Setup tab.



Figure 29; Tolomatic Motion Interface Dialog

Open the 'ACS Internet Protocol Properties' window (menu option Tools- > EtherNet/IP setup). In this window you will see the default values for IP address, Subnet Mask, and Default Gateway parameters.

Check the box for 'Obtain an IP Address automatically'. Set the Subnet Mask and Default Gateway to match your network.



For ACSI Motor/Drive/Controllers Infrastructure Mode automatically has DHCP enabled. The ACSI can also be configured using the TCP/IP EtherNet/IP Object (0xF5).

ACS Internet Proto	col (TCP/IP) Prop	
Network Settings		
✓ Obtain an IP A	ddress automatically	
IP Address	192 . 168 . 0 . 240	
Subnet Mask	255 . 255 . 255 . 0	
Default Gateway	192.168.0.1	
MAC Addre	ss 00:04:A3:92:F4:1B	
ОК	Test Default	Cancel
DHCPAddressCo	nfigured	:

Figure 30; IP Address Display

Click 'OK' and write settings to Flash: File->Write Current Settings to Drive Flash

Obtain MAC Address (00:04:A3:92:F4:1B in this example) from the Drive Info area on the Drive tab, or from a label on the cover of the ACS drive.



Figure 31; MAC Address Window

Disconnect TMI saving settings to flash.



Cycle Power on the ACS drive, it will now boot with DHCP enabled.

7.3 Rockwell BOOTP/DHCP SERVER Setup

Open BOOTP/DHCP Software

BOOTP/DHCP Server	2.3				
ile <u>T</u> ools <u>H</u> elp					
Request History					
Clear History Add to	Relation List				
(hr:min:sec) Type	Ethernet Address (MAC)	IP Address	Hostname		
Belation List					
Relation List		able BOOTP/DHCP		2	
Relation List	BOOTP Enable DHCP Dis	able BOOTP/DHCP			
Relation List (New) Delete Enable Ethernet Address (MAC)	BOOTP Enable DHCP Dis	able BOOTP/DHCP	Description		
Relation List New Delete Enable Ethernet Address (MAC)	BOOTP Enable DHCP Dis	able BOOTP/DHCP	Description		
Relation List [New] Delete Enable Ethernet Address (MAC)	BOOTP Enable DHCP Dis	able BOOTP/DHCP	Description		
Relation List New Delete Enable Ethernet Address (MAC)	BOOTP Enable DHCP Dis	able BOOTP/DHCP	Description		
Relation List New Delete Enable Ethernet Address (MAC)	BOGTP Enable DHCP Dis	able BOOTP/DHCP	Description		
Relation List New Delete Enable Ethernet Address (MAC)	800TP Enable DHCP Dis	able BOOTP/DHCP	Description		
Relation List New Delete Enable Ethernet Address (MAC) Status Status	BOOTP Enable DHCP Dis	able BOOTP/DHCP	Description	Entries	

Figure 32; BOOTP/DHCP Server Configuration

Under the Relations list click 'NEW'

Enter the MAC address and IP address desired. Then click OK.

New Entry	
Ethernet Address (MAC):	00:04:A3:92:F4:1B
IP Address:	192.168.0.140
Hostname:	
Description:	
	OK Cancel

Figure 33; IP Address Entry Dialog



Confirm that the Relation List includes the newly added MAC address with desired IP address.

BOOTP/DHCP Server 2.3		
<u>File I</u> ools <u>H</u> elp		
Request History		
Clear History Add to Relation List		
(hr:min:sec) Type Ethernet Address (MAC) IP Address	Hostname	
	•	
	VDHCP	
Ethernet Address (MAC) Type IP Address Host 00:04:A3:92:F4:18 192.168.0.140	tname Description	
Status	Entries	
[Disable DHCP] Command successful	1 of 256	

Figure 34; BOOTP/DHCP Server Configuration

Once the server software sends the IP address to the drive, a 'Request History' message should appear displaying the new IP address for the ACS drive.

5	BOOTP/DHC	P Server	2.3				
File	<u>T</u> ools <u>H</u> elp						
ΓR	equest History-						
	Clear History	Add to	o Relation List				
	(hr:min:sec)	Туре	Ethernet Addr	ess (MAC)	IP Address	Hostname	
	15:30:34	DHCP	00:04:A3:92:F	4:1B	192.168.0.140		
	10.00.01	51101	00.01.10.02.1				
∟ ⊢B	elation List						
	New Delete	e Enabl	e BOOTP En	able DHCP	Disable BOOTP/DHCP		
	Ethernet Addre	ess (MAC)	Туре	IP Address	Hostname	Description	
	00:04:A3:92:F4	1:1B	DHCP	192.168.0.1	40		
	tatus						 Entries
S	ent 192.168.0.1	40 to Ethe	rnet address 00:	04:A3:92:F4:1	IB		1 of 256

Figure 35; BOOTP/DHCP Server Configuration



7.4 Confirm IP Address

To verify that the IP address assignment was successful, connect the ACS drive with TMI and validate the updated IP address.

ACS Internet Proto	col (TCP/IP) Prop	_ 0 X
Network Settings		
Obtain an IP A	ddress automatically	
IP Address	192 . 168 . 0 . 140	
Subnet Mask	255 . 255 . 255 . 0	
Default Gateway	192.168.0.1	
MAC Addre	ss 00:04:A3:92:F4:1B	
ОК	Test Default	Cancel
DHCPAddressCo	nfigured	.4



Figure 36; IP Address Dialog

On the DHCP Server software select the ACS drive MAC address and click Disable BOOTP/DHCP.

BOOTP/DHCP Server 2.3	
<u>File Iools Help</u>	
Request History	
Clear History Add to Relation List	
(hr:min:sec) Type Ethernet Address (MAC) IP Address Hostname	
Relation List	
New Delete Enable BOOTP Enable DHCP Disable BOOTP/DHCP	
Ethernet Address (MAC) Type IP Address Hostname Description	
00:04:A3:92:F4:1B 192.168.0.140	
Status	Entries
[Disable DHCP] Command successful	1 of 256

Figure 37; BOOTP/DHCP Server Configuration



Confirm the 'Obtain an IP Address automatically' check box is unchecked. This will require the window to be reopened.

ACS Internet Proto	icol (TCP/IP) Prop	
Network Settings		
Obtain an IP A	ddress automatically	
IP Address	192 . 168 . 0 . 140	
Subnet Mask	255 . 255 . 255 . 0	
Default Gateway	192.168.0.1	
MAC Addre	ss 00:04:A3:92:F4:1B	
ОК	Test Default	Cancel
DHCPAddressCo	nfigured	

Figure 38; IP Address Dialog

The process is now complete.

7.5 Conclusion

This tutorial went through the process of using Rockwell's BOOTP/DHCP Server to automatically assign IP addresses to Tolomatic ACS drives. The second ACS drive connection to TMI was only to show the ACS drive's behavior using DHCP. Normally only the initial TMI connection and configuration is necessary. Using DHCP, many IP addresses can be assigned to a network of ACS drives that are uniquely identified by their MAC addresses.

