



Document Revision 1.2.1 (Updated 11/22/2021)

© 2021 Vital Systems Inc Atlanta, GA USA For more information, please visit the product web page: www.vitalsystem.com/ec01



Contents

LICENSE AGREEMENT	2
INTRODUCTION Tested EtherCAT Devices	3
EC-LINK GUI	4
EC-LINK STATUS INDICATOR	5
MENU ITEM FUNCTIONS	7
ESI Files	7
PROJECT	8
CONTROLLER	8
MISCELLANEOUS	9
ETHERCAT DEVICE TREE	10
Manually Add EtherCAT Devices	
Add a master EtherCAT controller	10
Add an EtherCAT device	10
Automatically Add EtherCAT Devices	11
PDO TAB	12
For All Users	12
For Advance Users (Most people can ignore this section)	
Edit an existing PDO	
Create a new PDO	13
Copy an existing PDO and add it as new	
Delete a User Created PDO	
Reset a PDO trial exists in the ESI file	13 14
	15
Configuring an SDO object using SDO Editor	
OBJECT MAP TAB Rx-PDO object mapping	17 18
BROWSE NETWORK	20
TROUBLESHOOTING	21
	21



License Agreement

Before using the HICON and accompanying software tools, please take a moment to go thru this License agreement. Any use of this hardware and software indicate your acceptance to this agreement.

It is the nature of all machine tools that they are dangerous devices. In order to be permitted to use HICON on any machine you must agree to the following license:

I agree that no-one other than the owner of this machine, will, under any circumstances be responsible, for the operation, safety, and use of this machine. I agree there is no situation under which I would consider Vital Systems, or any of its distributors to be responsible for any losses, damages, or other misfortunes suffered through the use of the HICON board and its software. I understand that the HICON board is very complex, and though the engineers make every effort to achieve a bug free environment, that I will hold no-one other than myself responsible for mistakes, errors, material loss, personal damages, secondary damages, faults or errors of any kind, caused by any circumstance, any bugs, or any undesired response by the board and its software while running my machine or device.

I fully accept all responsibility for the operation of this machine while under the control of HICON, and for its operation by others who may use the machine. It is my responsibility to warn any others who may operate any device under the control of HICON board of the limitations so imposed.

I fully accept the above statements, and I will comply at all times with standard operating procedures and safety requirements pertinent to my area or country, and will endeavor to ensure the safety of all operators, as well as anyone near or in the area of my machine.

WARNING: Machines in motion can be extremely dangerous! It is the responsibility of the user to design effective error handling and safety protection as part of the system. VITAL Systems shall not be liable or responsible for any incidental or consequential damages. By Using the HiCON motion controller, you agree to the license agreement.



Introduction

IMPORTANT

This document makes the assumption that the reader has thoroughly reviewed the HiCON User Manual, has completed the proper hardware setup, and possesses basic knowledge and understanding of Mach4 CNC Software.

EC-Link is proprietary software created by Vital Systems to configure the HiCON EtherCAT motion controller like EC01. This software uses information provided within the ESI file (XML format) and presents in a user-friendly GUI for easy configuration.

- Please obtain the ESI files for your EtherCAT Device from the respective manufacturer's website before using this software. ESI file import procedure is defined in this <u>section</u>.
- ***** Read the entire manual before attempting to use the software.

Tested EtherCAT Devices

While any EtherCAT drive with CiA402 protocol should work with our controller we test and provide support for the EtherCAT drive of your choice on request. (Drive needs to be shipped to us)

EtherCAT I/O blocks and EtherCAT spindle devices are supported as well.

- Mitsubishi MR-JET, MR-J5
- Omron 1S series
- Yaskawa Sigma7 SGD7S
- Yaskawa Sigma5 SGDV
- Festo CMMT-AS
- ✤ Advantech AMAX I/O Block

- ✤ Maxine EP3E-EC
- Beijing CTB Technology 3Axis Drives
- Delta ASDA-A2
- ✤ LeadShine EM3E-A882



EC-Link GUI

\mathbf{r}	💥 HiCON Ec-Link - Test.ECL	3	- 🗆 ×
2	State: Disconnected Esi State: Disconnected Esi State: Disconnected Esi Esi Esi Files	PROJECT CONTROLLER New Open Reset Save As Project Project Project Project Project Project Connect Device Network	MISCELLANEOUS
	 HiCON Ec-Master EP3E-EC 	PDO SDO Object Map	•
	VITAL Ethercat I/O Module ECS	Rx-PDO 5 + New PDO	0
	4	Description PDO ID Description Index □ 1st Receive PDO mapping 0x1600 ☑ 2nd Receive PDO mapping 0x1601 □ 3rd Receive PDO mapping 0x1602 □ 4th Receive PDO mapping 0x1603	SubIndex Bits
		Tx-PDO 💠 New PDO	0
		Description PDO ID Description Index 1st Transmit PDO mapping 0x1a00 2nd Transmit PDO mapping 0x1a01 3rd Transmit PDO mapping 0x1a02 4th Transmit PDO mapping 0x1a03	SubIndex Bits
	Visit Vital Systems Inc		

Number	Description
1	EC-Link version number
2	Controller status indicator
3	Toolbar Menu
4	EtherCAT device tree
5	PDO and SDO Views



EC-Link Status Indicator

The Status indicator provides useful information to determine what is the status of the controller and the EtherCAT Network.

Controller States: Indicates the status of the controller EtherCAT States: Indicates the state of the EtherCAT Network

	Controller States
Color	Description
Black	Comms Error
	(The Controller communication has bad data contact support)
Ghost White	Disconnected
\bigcirc	(The Controller is not connected to EC-Link (PC))
Ghost White	E-CAT Unplugged
	(The Controller is not connected to EtherCAT network)
Dark Red	Searching
	(EC-Link has lost connection with the controller)
Orange	None/PDO-Error
	(The controller does not have the project downloaded to it)
Blue	Downloading
	(EC-Link is downloading the configuration to the controller)



	EtherCAT States
Color	Description
Red	Error
	(EtherCAT Error State)
Gold	Boot
	(EtherCAT Boot State)
Yellow	Init
	(EtherCAT Init State)
Green Yellow	Pre-Op
	(EtherCAT Pre-Op State)
Lime Green	Safe-Op
	(EtherCAT Safe-Op State)
Lawn Green	Op
	(EtherCAT Op State)



Menu Item Functions

ESI		PRO	JECT			CONTR	OLLER			MISCELLANEOUS
	4	4	<u> </u>	ــــــــــــــــــــــــــــــــــــــ	2	0			•	
ESI	New	Open	Reset	Save As	Upload	Download	Connect	Browse	Help	
Files	Project	Project	Project	Project	Project	Project	Device	Network		

ESI Files

A ESI file is an **Xml file** that contains the EtherCAT configuration.

The ESI Files opens the ESI File Manager where you import the ESI files into EC-Link

😽 ESI File Manager				\times
File Name	Vendor Name	Vendor ID		
MELSERVO MR_JET_G_N1_B-Modifie	Mitsubishi Electric Corpora	00000A1E	莭	
Omron R88D-1SN01H-ECT.xml	OMRON Corporation	0000083	觉	
Omron R88D-1SN04H-ECT.xml	OMRON Corporation	0000083	觉	
AMAX-4800_v1.8.0.xml	Advantech Co., Ltd.	000013FE	莭	
EM3E_V1.00.xml	Leadshine Technology Co.,	17185	莭	
Import ESI		Delet	e All	

Import the ESI file that comes with your EtherCAT device. Click on the "Import ESI" button and select the ESI file then press "Ok".

This should be the first step before using the application.

Note: You do not need the ESI file to use an already configured ECL project file. You can quickly load the ECL project file and Download it to the controller.



PROJECT

<u>New Project:</u> Create a new ECL Project file.

Open Project: Open a ECL Project file.

<u>Reset Project</u>: Reset the current ECL Project and start over without creating a new one (Permanently clears the project file).

<u>Save As Project</u>: Save the current project into a new project file while continuing to work on the current one.

CONTROLLER

<u>Upload Project</u>: Upload the project file from the controller (If it Exists) and save it on the computer. Opens a dialog to select the location of the save file. The project is saved within a Zip File.

<u>Download Project</u>: Downloads the configured ECL project to the controller.

<u>Connect Device</u>: Connect the EtherCAT motion controller to EC-Link.

Opens a dialog where the user can scan for HiCON EtherCAT Motion Controllers connected to the $\ensuremath{\mathsf{PC}}$

K EC-Link Connect D		_		×				
IP Address	Firmware	Serial Number	FPGA	Boot Loader	Hardware	Ad	apter IP	
192.168.0.95	5.25	631588	A050	1.60	EC01	169.254	.243.239	
192.168.0.95	5.25	631588	A050	1.60	EC01	192.168	.0.12	
Scan	Connect	Master						

Select the device from the list and press Connect Master. If successful the Status Led will start blinking.

© 2021 Vital Systems, Inc.



<u>Browse Network:</u> Opens a new window where you can see EtherCAT devices connected to the controller. Here you can Read/Write SDO and get all the connected devices into the project file.

MISCELLANEOUS

Help: Opens the EC-Link User Manual in a browser.



EtherCAT Device Tree

- This is an offline view where EtherCAT Devices can be added to the configuration.
- The devices must be added in sequence of the EtherCAT devices connected to the controller.
- The EtherCAT devices can be deleted and shifted up/down by right clicking on a device.

Manually Add EtherCAT Devices

Add a master EtherCAT controller

1. Right click on empty space and select "Add Master Device"

Add an EtherCAT device

- 1. Right click on the "HiCON Ec-Master" to open the Device list.
- 2. Choose a Vendor from the dropdown.
- 3. Select a device form the list and click on Add Slave. The device should be added to the selected master.

Note: You must first <i>import ESI file for the EtherCAT devices to be listed.



Automatically Add EtherCAT Devices

Coming soon.



PDO Tab

Rx-PDO	Copy PDO					8
Description	PDO ID	Description	Index	SubIndex	Bits	
✓ 1st receive PDO Mapping	0x1600	Controlword	0x6040	0	16	
258th receive PDO Mapping	0x1701	Target position	0x607a	0	32	
259th receive PDO Mapping	0x1702	Touch probe function	0x60b8	0	16	
260th receive PDO Mapping	0x1703					
261th receive PDO Mapping	0x1704					
262th receive PDO Mapping	0x1705					
273th receive PDO Mapping	0x1710					
Tx-PDO	New PDO					3
Tx-PDO Description	New PDO	Description	Index	SubIndex	Bits	3
Tx-PDO Description Ist transmit PDO Mapping	New PDO PDO ID 0x1a00	Description	Index	SubIndex	Bits	3
Description Ist transmit PDO Mapping 258th transmit PDO Mapping	New PDO PDO ID 0x1a00 0x1b01	Description	Index	SubIndex	Bits	8
Tx-PDO Description Image: Second colspan="2">Ist transmit PDO Mapping 258th transmit PDO Mapping 259th transmit PDO Mapping	 New PDO PDO ID 0x1a00 0x1b01 0x1b02 	Description	Index	SubIndex	Bits	0
Tx-PDO Description Ist transmit PDO Mapping 258th transmit PDO Mapping 259th transmit PDO Mapping 260th transmit PDO Mapping	New PDO PDO ID 0x1a00 0x1b01 0x1b02 0x1b03	Description	Index	SubIndex	Bits	9
Description Description Ist transmit PDO Mapping 258th transmit PDO Mapping 259th transmit PDO Mapping 260th transmit PDO Mapping 260th transmit PDO Mapping 261th transmit PDO Mapping	New PDO PDO ID 0x1a00 0x1b01 0x1b02 0x1b02 0x1b03 0x1b04	Description	Index	SubIndex	Bits	Ð
Tx-PDO Description Ist transmit PDO Mapping 258th transmit PDO Mapping 259th transmit PDO Mapping 260th transmit PDO Mapping 261th transmit PDO Mapping 273th transmit PDO Mapping	New PDO PDO ID 0x1a00 0x1b01 0x1b02 0x1b02 0x1b03 0x1b04 0x1b10	Description	Index	SubIndex	Bits	8

For All Users

In this tab you can configure the device PDOs. Select on a slave to populate the values.

- There are two types of PDO's Rx-PDO and Tx-PDO
- Rx-PDO are received by the EtherCAT device E.g., Target Position, Digital Inputs
- Tx-PDO are transmitted by the EtherCAT device E.g., Actual Position, Digital Outputs
- Selecting a PDO will list the objects contained with it on the right section
- Tick a PDO to add it to the configuration and Save Changes.

© 2021 Vital Systems, Inc.



For Advance Users (Most people can ignore this section)

Edit an existing PDO

1. Right Click on a PDO and select Edit to open the PDO Editor

Note: Some PDO's obtained from the ESI file can be edited

Create a new PDO

- 1. Click on an empty space in the PDO list section to unselect a PDO.
- 2. Click on the "New PDO" Button to open the PDO Editor

Copy an existing PDO and add it as new

- 1. Click on the PDO you want to copy
- 2. Click on the "Copy PDO" Button to open the PDO Editor with all the values populated

Delete a User Created PDO

1. Right Click on a PDO and select Delete

Reset a PDO that exists in the ESI file

1. Right Click on a PDO and select Reset

Note: Some PDO's obtained from the ESI file can be edited and reset. User created PDO's cannot be reset.



Using the PDO Editor

₩ Ed	lit Pdo									×
	Device ID: Ec_ Confi Name: 1st receive F	Ed	itor Avai	lable Objec	ts					
	PDO ID: 0x1600	Fixed:	5			Description Controlword	Index 0x6040	SubIndex 0	Bits 16	^
	Description Controlword Target position Touch probe function	Index 0x6040 0x607a 0x60b8	SubIndex Bit 0 16 0 32 0 16	Bits 16 32 16		larget position Touch probe function Physical outputs Target velocity Target torque Modes of operation Max profile velocity	0x607A 0x6088 0x60FE 0x60FF 0x6071 0x6060 0x607F	0 1 0 0 0	32 16 32 32 16 8 32	~
						Add Us	ser Objects	? SubIndex	+ N Bits	lew
	SAVE		Ø	CANCEL						

- The PDO Editor has two sections.
- The "Configured Object" section displays values that will be saved into the configuration.
- The "Available Objects" section display the values that can be used to configure the object.
 - ESI Objects All the objects within the ESI file are listed here. Please refer the respective EtherCAT device manual if the PDO can use those objects. Refer <u>Reset PDO</u> to reset the object back to ESI defaults.
 - User Objects The User can create their own custom PDO objects. Custom PDO objects are saved within the ECL project file and can be used with other devices easily.
- To remove a configured object right click on it and select "Remove".
- To add an object to the configured list, select one object from the right and click on "Add".
- Save the PDO by clicking on "SAVE"



SDO Tab

_	PDO SDO						•
			ESI (Objects			
	obj	ects l	oad	ed fro	om ESI fi	le	
	Name	Index	Bits	Туре	SDO Access	PDO Mapping	<u>^</u>
	Device Type	0x1000	32	UDINT	CompleteAccess	Т	
	Error Register	0x1001	8	USINT	CompleteAccess	т	
	Manufacturer Device Name	0x1008	160	STRING(2	CompleteAccess	Т	
	Manufacturer Hardware Version	0x1009	160	STRING(2	CompleteAccess	т	
	Manufacturer Software Version	0x100A	160	STRING(2	CompleteAccess	Т	
	Store Parameters	0x1010	48	DT1010	SubIndexAccess	т	
	Restore Default Parameters	0x1011	112	DT1011	SubIndexAccess	т	
	Identity Object	0x1018	144	DT1018	SubIndexAccess	т	
	Node Address Reload	0x10E0	48	DT10E0	SubIndexAccess	Т	
	Diagnosis History	0x10F3	4864	DT10F3	SubIndexAccess	т	
	Present Time for Event Log	0x10F9	80	DT10F9	SubIndexAccess	т	
			↓ S	DO Editor			
	Name	Index	Bits	Туре	PDO Mapping	Value	SubNam
	Modes of operation	0x6060	8	SINT	R	8	
	conf	igure	d ob	ojects			

In the SDO tab the top section lists all the SDO objects from the ESI file. The bottom section lists all the configured objects that will be downloaded to the controller in Pre-Op State.



Configuring an SDO object using SDO Editor

- 1. Select an object from the list
- 2. Click on "SDO Editor" to open the SDO Editor window

2 r 1-	💥 SDO Editor	X	
- - X	Device ID: 1	Configured Object 💿 SDO Editor Available SubItems	
l	Sub Name:	Load ESI Objects 3	l
	Sub Index:	1 Name SubIndex BitSize Offset Type	
	Sub Type:	O Store Parameters 1 32 UDIN UDINT	
	Sub BitSize:	0	
l	Sub BitOffset:	0	
	Name:	Store Parameters	
	Index 0x	0x1010	
	Туре:	DT1010 Load User Objects (2) + New	
	BitSize:	48 Name SubIndex BitSize Type	2
		SDO Value	
	📇 SAVE		

The SDO Editor has two sections.

- The "Configured Object" section displays values that will be saved into the configuration.
- The Available Subitems display the values that can be used to configure the object.
 - ESI Objects Some SDO's will have "SubIndex Access" and this section will list them. For "Complete Access" SDO this will be empty.



- User Objects The User can create their own SDO objects. Custom SDO objects are saved within the ECL project file and can be used on other devices easily.
- 3. You can load the ESI Object/User Object values by clicking on the Load button. For "Complete Access" SDO this step is not required.
- 4. Enter a value for the SDO object in **decimal** and click "SAVE"

	Rx-	PDO			Auto Selec
Description	Index	SubIndex	Bits	Object Type	_
Controlword	0x6040	0	16	Default ~	
Target Position	0x607A	0	32	Default ~	
	Tv-	PDO			
Description	Tx-	PDO Subladex	Bits	Object Type	
Description Statusword	Tx- Index 0x6041	PDO SubIndex	Bits 16	Object Type Default V	_
Description Statusword Position Actual Value	Tx- Index 0x6041 0x6064	PDO SubIndex 0	Bits 16 32	Object Type Default v Default v	

Object Map Tab

© 2021 Vital Systems, Inc.



The "Object Map" Tab is for mapping the PDO objects to a certain function. For example, Input PDO object must be mapped to Inputs in Object Type drop down.

This is a mandatory configuration and cannot be skipped. Correct mapping is required for Mach4 plugin to function.

- <u>Auto Select:</u> This button will auto map the required objects to their corresponding functions.
- On ECS1 this button will automatically map all the I/O and Analog functions. Stepper and Encoder functions must be mapped manually if the drive has the necessary software activations.

Rx-PDO object mapping

Default	The object will just show up in EtherCAT status and will have no other function
Digital Output	The object is mapped as Digital Output. Each bit is an On/Off switch
Analog Output	The object is mapped as Analog Output. Must be 16-bit
Controlword	The object is mapped as Controlword for Cia402 drives
Target Position	The object is mapped as Target Position for Cia402 drives
DRO Output	The object shows up as a Mach4 Register. A total of 5 objects can be mapped to this type (Available on EC01-6 and up)



Tx-PDO object mapping

Default	The object will just show up in EtherCAT status and will have no other function
Digital Input	The object is mapped as Digital Input. Each bit is an On/Off switch
Analog Input	The object is mapped as Analog Input. Must be 16-bit.
Encoder	The object is mapped as an Encoder read out. Must be 16-bit
DRO Input	The object shows up as a Mach4 Register. A total of 5 objects can be mapped to this type (Available on EC01-6 and up)
Statusword	The object is mapped as Statusword for Cia402 drives
Actual Position	The object is mapped as Actual Position for Cia402 drives





Browse Network

Live view of the EtherCAT Network.



- Scan to list the devices available on the EtherCAT Network
- The EtherCAT mode can be locked to a desired mode. Setting it to "Auto" will make the controller go into operational mode using the PDO and SDO values configured using EC-Link.



Troubleshooting

This section refers to troubleshooting the EC-Link application itself and not the operation of the controller or the EtherCAT network.

If the application crashes a log file is saved on the Desktop with the name 'EcLink-ERROR-LOG'. Please send this file along with a brief description on where this crash occurred to our support email. <u>Contact Us</u>

Additional References

- EC01 Hardware Manual
- Mach4 Software Integration Manual
- Quick Start YouTube Video
- EC01 Product Page