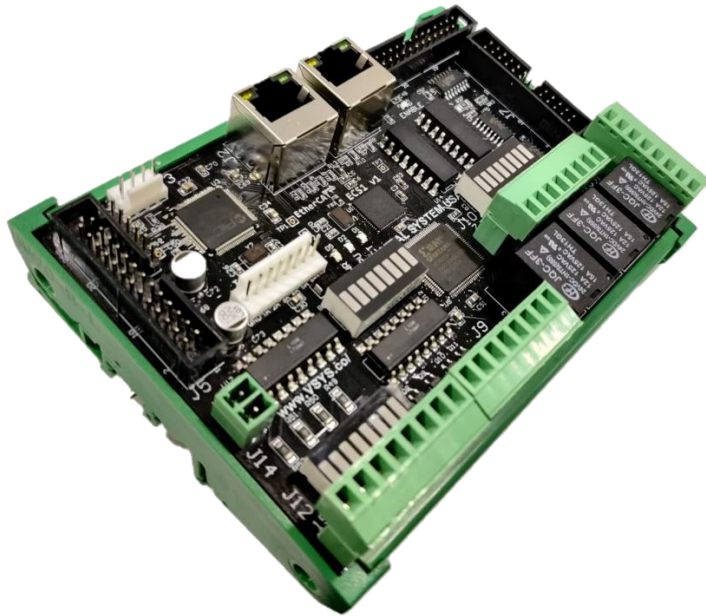


ECS1 EtherCAT Slave IO Device



User Guide

Document Draft

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Atlanta, Georgia USA

For more information please visit the product web page:
<http://www.vitalsystem.com/ethercat>

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License Agreement

Before using the HiCON and accompanying software tools, please take a moment to go through 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:

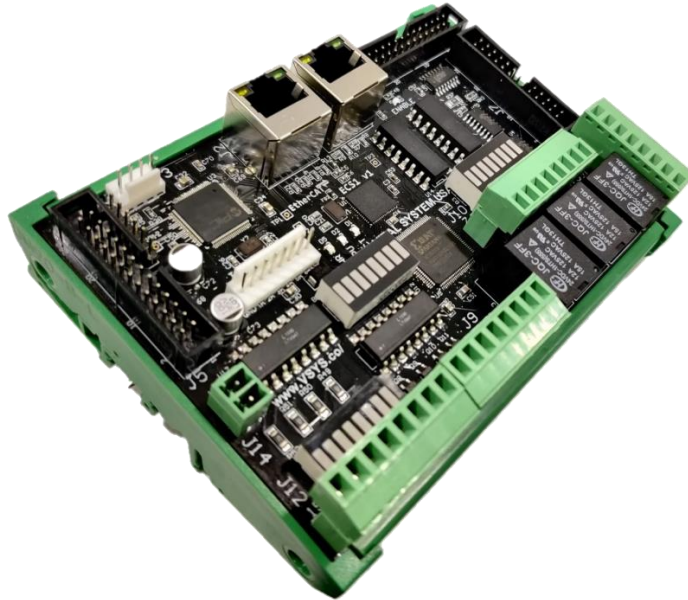
I agree that no-one other than the owner of this machine, will, under any circumstances be responsible, for the operation, safety, and use of this machine. I agree there is no situation under which I would consider Vital Systems, or any of its distributors to be responsible for any losses, damages, or 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.

1. Overview



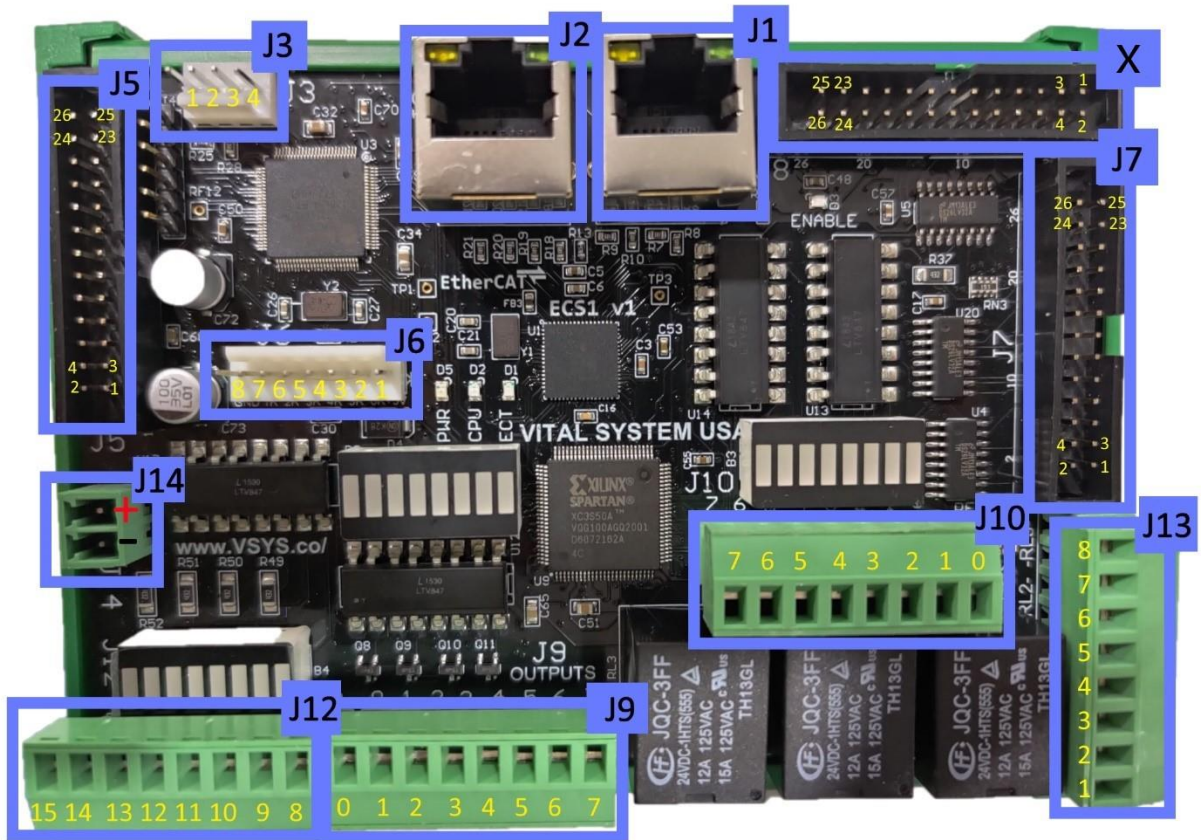
ECS1 is the latest in our line of HiCON EtherCAT Devices. It is an EtherCAT slave device with a wide range of functionality such as its large amount of digital IO and Encoder capabilities, multiple relays, and an analog input and output. The ECS1 can be paired with any EtherCAT master using the ESI configuration file. ECS1 can be used with Vital Systems EC01 EtherCAT Master controller to create a powerful and flexible Mach4-based CNC control system.

Key Features

- Multifunction EtherCAT Slave
- 24 Optically Isolated Digital IO (8 NPN In, 8 PNP In (24v), 8 PNP Out (24v))
- 24 Additional Digital IO via expansion plug.
- 3 Onboard Relays
- Expansion header for 6 relay board
- 4 Differential Encoder Channels
- 2 Analog Inputs (0-5V) and 1 Analog Output (0-10V)
- ESI File Available

2. ECS1 Hardware Interface

The ECS1 has several interface ports and indicator LEDs. The figure below shows a top view of the ECS1 board with interface ports and other components:



J1	EtherCAT Ethernet Interface IN
J2	EtherCAT Ethernet Interface OUT
J3	2 Analog Inputs (0-5V)
J5	Digital IO Expansion Plug (16 IN, 8 OUT)
J6	Relay Expansion Header (Up to 6 extra relays using expansion board)
J7	Differential Encoder Expansion Port (4 Encoder Inputs)
J9	8 PNP Outputs (300mA max per output)
J10	8 Optically Isolated 24V PNP Inputs
J12	8 Optically Isolated NPN Inputs
J13	3 Relays N.O. Contacts, Analog Out (0-10V)
J14	Power Input, +24VDC

2.1. Power Supply (J14)

J14 Pin#	Function
+	+12 - 28VDC (Polarity Protected)
-	Ground

- Unit requires at least 5W power input.
- If more devices are connected to the unit, a bigger power supply may be required.

2.2. Ethernet Ports (J1, J2)

J1 & J2 EtherCAT Interface Ethernet Ports:

The ECS1 controller has Ethernet Ports for connecting to either other Slaves or an EtherCAT Master using EtherCAT protocol. The ECS1 supports both 10 MBit and 100 Mbit network speeds. J1 should be connected to the master side.

4.3. I/O Ports (J3, J5, J6, J9, J10, J12, J13)

J3 Analog Inputs (0-5V) Pin Assignments:

Pin#	Function
1	+5V
2	0-5V Analog In 1
3	0-5V Analog In 2
4	GND

J5 Digital IO Port:

This plug provide expansion for I/O. The pins are 3.3v TTL, so care must be taken to avoid static shock. The [Opto-isolated 7535P](#) board can be used to covert the pins to 24V standard.

J5 Pin#	Function	J5 Pin#	Function
1	Ground	2	Digital Output 0
3	Digital Output 1	4	Digital Output 2
5	Digital Output 3	6	Digital Output 4
7	Digital Output 5	8	Digital Output 6
9	Digital Output 7	10	Digital Input 0
11	Digital Input 1	12	Digital Input 2
13	Digital Input 3	14	Digital Input 4
15	Digital Input 5	16	Digital Input 6
17	Digital Input 7	18	Digital Input 8
19	Digital Input 9	20	Digital Input 10
21	Digital Input 11	22	Digital Input 12
23	Digital Input 13	24	Digital Input 14
25	Digital Input 15	26	+5V

J6 Relay Expansion Header Pin Assignments:

Pin#	Function
1	+5V
2	Relay N.O. 4
3	Relay N.O. 5
4	Relay N.O. 6
5	Relay N.O. 7
6	Relay N.O. 8
7	Relay N.O. 9
8	GND



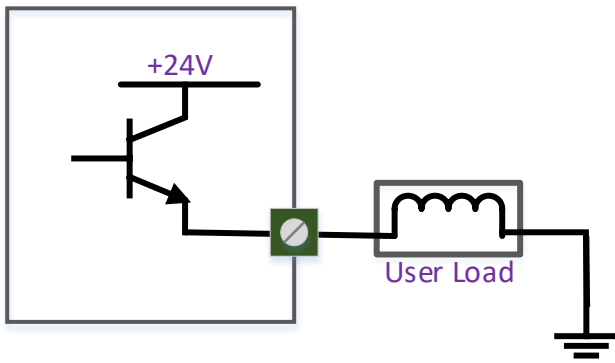
J9 (24V) Digital OUTPUTS Pin Assignments:

J9 Pin#	Function
1	Digital Output 0
2	Digital Output 1
3	Digital Output 2
4	Digital Output 3
5	Digital Output 4
6	Digital Output 5
7	Digital Output 6
8	Digital Output 7

NOTE: Max O/P current: 300mA.

These output pins provide 24V power on the terminals when activated by the software.

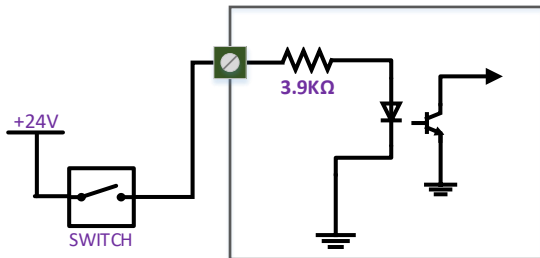
J9 PNP Output Connection Method



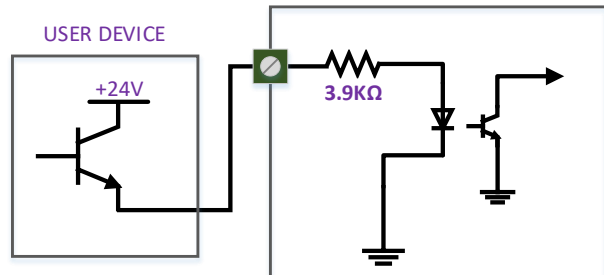
J10 (24V) PNP Optically Isolated Digital INPUTS Pin Assignments:

J10 Pin#	Function
1	Digital Input 0
2	Digital Input 1
3	Digital Input 2
4	Digital Input 3
5	Digital Input 4
6	Digital Input 5
7	Digital Input 6
8	Digital Input 7

PNP Input Setup Method 1



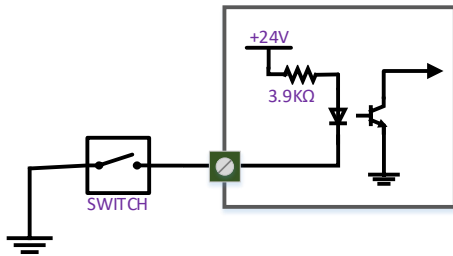
PNP Input Setup Method 2



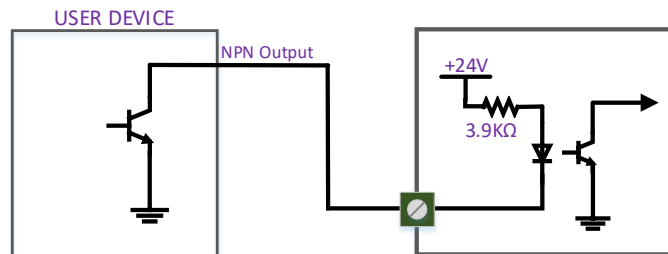
J12 (24V) NPN Optically Isolated Digital Inputs Pin Assignments:

J12 Pin#	Function
8	Digital Input 8
9	Digital Input 9
10	Digital Input 10
11	Digital Input 11
12	Digital Input 12
13	Digital Input 13
14	Digital Input 14
15	Digital Input 15

J12 NPN Input Setup Method 1



J12 NPN Input Setup Method 2

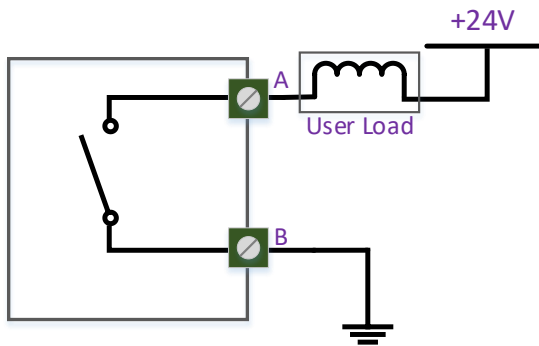


J13 (24V) Relays and Analog Output Pin Assignments:

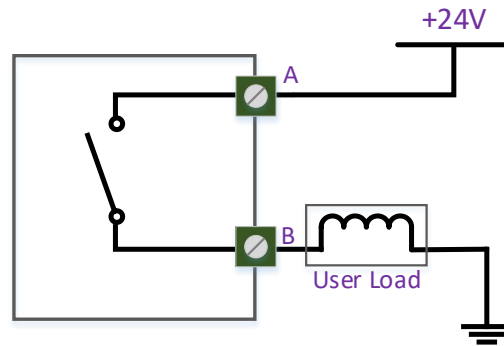
Physical Pin#	Function
1	GND
2	Analog Output (0-10V) Spindle DAC
3	Relay N.O. 1 A
4	Relay N.O. 1 B
5	Relay N.O. 2 A
6	Relay N.O. 2 B
7	Relay N.O. 3 A
8	Relay N.O. 3 B

WARNING
Do not put more than 30V through the relay contacts.

J13 Relay Setup Method 1



J13 Relay Setup Method 2



4.5 Encoders (J7)

J7 Differential Encoder Pin Assignments:

The ECS1 provides four 5V differential Encoder channels.

Pin#	Function	Pin#	Function
1	GND	2	A+ Encoder Channel0
3	A- Encoder Channel0	4	B+ Encoder Channel0
5	B- Encoder Channel0	6	Z+ Encoder Channel0
7	Z- Encoder Channel0	8	A+ Encoder Channel1
9	A- Encoder Channel1	10	B+ Encoder Channel1
11	B- Encoder Channel1	12	Z+ Encoder Channel1
13	Z- Encoder Channel1	14	A+ Encoder Channel2
15	A- Encoder Channel2	16	B+ Encoder Channel2
17	B- Encoder Channel2	18	Z+ Encoder Channel2
19	Z- Encoder Channel2	20	A+ Encoder Channel3
21	A- Encoder Channel3	22	B+ Encoder Channel3
23	B- Encoder Channel3	24	Z+ Encoder Channel3
25	Z- Encoder Channel3	26	+5V