Wiring and LED Information

Overview

The following diagram shows an overview of all connectors and LEDs.

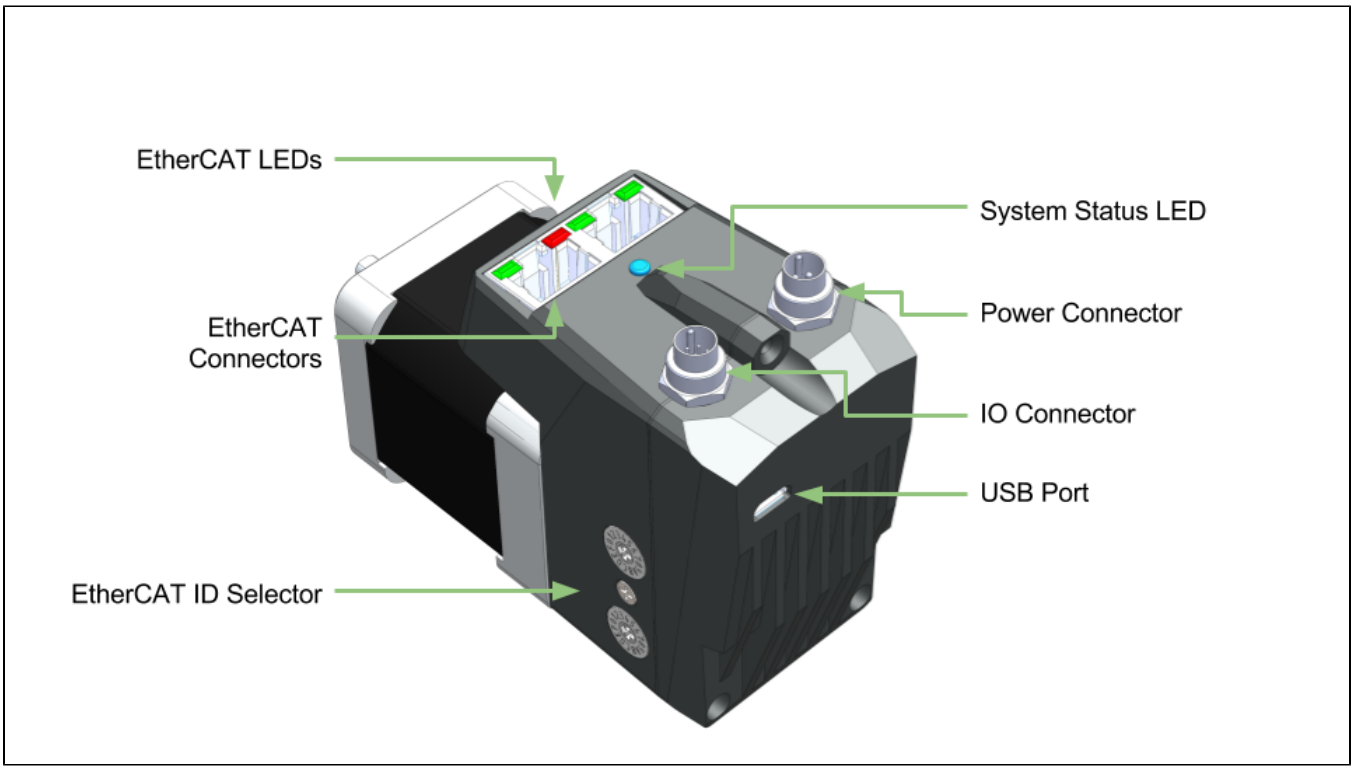
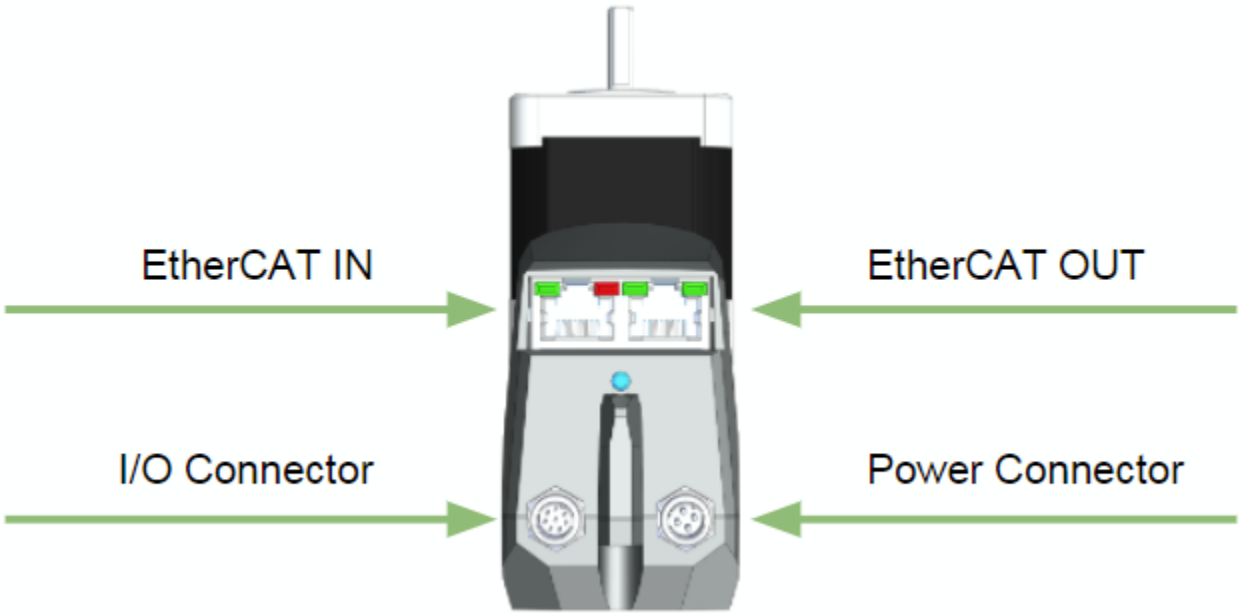


Figure: Overview of Connections and status LEDs

Motor Connections

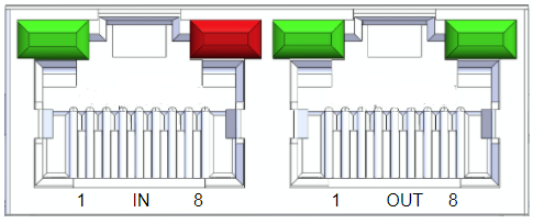


EtherCAT Connectors

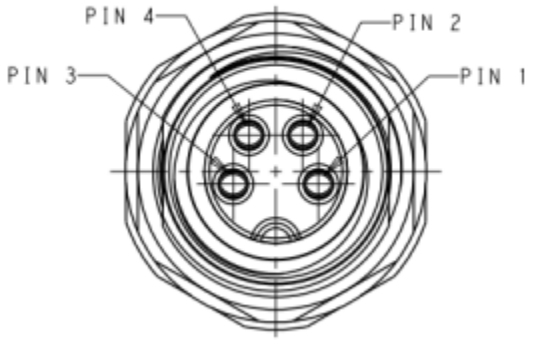
The EtherCAT ports use standard Ethernet RJ45 CAT5e, M8-A or M8-D connectors depending on the motor variant. They are labeled IN and OUT as per the EtherCAT standard.

Connector Options

- RJ45



  - Amphenol - RJHSE538B02
- M8-A Female



  - TE Connectivity - T4041017041-000
- M8-D Female

Pinout

	RJ45[(1)]	M8-A	M8-D
Tx+	1	1	1
Rx+	3	2	2
Rx-	6	3	4
Tx-	2	4	3

(1) Pins 4,5,7 and 8 are connected to GND.

Example Cables

All ethernet cables are standard pinouts and are available from a variety of online suppliers or cable houses. Here are a few example cables from the Phoenix Contact NBC series

Image	Part Number	Description	Digikey Link

	1407353	M8-A male to RJ45 Phoenix Contact - 1407353	Digikey - 1407353
	1407349	M8-A male to M8A male Phoenix Contact - 1407349	Digikey - 1407349
	1227562	RJ45 to RJ45 Phoenix Contact - 1227562	Digikey - 1227562

Power Connector

The power connector supplies 24V to the EtherCAT slave and the motor separately. These two can be tied together so both are off the same power supply.

The power connector is an M9 circular connector from Binder. The relevant parts numbers are

Connector	Part Number	Supplier
Motor connector	09 0081 20 04	Binder
Female cable side mating connector	99 0080 102 04	Binder
4m power cable	CM1M9-4F-4000	Myostat

- The CM1M9-4F-4000 is 24AWG with conductor resistance of 97.5/km
    - The HF version with EXT-3D cable has a resistance of 91.1/km

Pin #	Description	Voltage	Current
1 - yellow	EtherCAT + Motor Control Power	24V ±10%	125mA max
2 - white	0V	-	
3 - grey	0V	-	
4 - orange	Motor Drive Power	24V ±10%	See individual motor ratings

*Colors indicated are for the standard **CM1M9-4F-4000** power cable.*

- NOTE: There is no reverse polarity protection. Ensure the 24V power is connected correctly before powering the unit.
- Maintaining EtherCAT power and switching off motor drive power will
    - retain motor position
    - remove any ability for the motor to be driven (as power to the motor drive has been removed).

I/O Connector

- Connecting a digital input to GND will produce a logical high on the device.
- All digital inputs can be monitored by the EtherCAT master.
- Inputs 2 and 3 are also connected to the motor controller. This allows them to function as inputs for embedded home routines as well as any standard CML programming when in CML mode
- The analog input is referenced by the motor and available in CML mode
- Output 1 is controller by the EtherCAT slave controller. It is switched on and off by the EtherCAT master
- Output 2 can be programmed as a standard motor output and cannot be controller directly by the EtherCAT master.

Connector	Part Number	Supplier
Motor connector	09 0481 22 08	Binder
Female cable side mating connector	99 0480 102 08	Binder
4m I/O cable	CM1M9-8F-4000	Myostat

Pin #	Name	EtherCAT Function	Motor Function	Specifications			
Digital Inputs - Sourcing (supply 0V to trigger)				**Parameter**	**Min**	**Max**	**Unit**
1 - orange	IN1	Digital input 1	-	Voltage Range	0	36	V
2 - brown	IN2	Digital input 2	Digital input 2	Input ON level	0	1.4	V
3 - green	IN3	Digital input 3	Digital input 3	Input OFF level	1.4	36	V
4 - yellow	IN4	Digital input 4	-	Continuous Current	-	30	mA
				Peak Current	-	0.5	A
				Pulse Width	-	1	ms
Analog Input (0-5V)				**Parameter**	**Min**	**Max**	**Unit**
5 - purple	A-IN5	-	Analog input 4	Voltage Range	0	5	V
				Resolution	10 bit		
Digital Outputs - Sinking (output supplies 0V when asserted)				**Parameter**	**Min**	**Max**	**Unit**
6 - blue	OUT1	Digital output 1	-	Voltage Range	0	-	V
7 - black	OUT2	-	Output 2	Continuous Current	-	1	A
				Inductive Load Peak Rev Current	-	0.2	A
				Inductive Load Peak Rev Voltage	-	70	V
Signal Ground (0V)				**Parameter**	**Min**	**Max**	**Unit**
8 - red	0V	0V	0V	Voltage Range	0	0	V

- *Colors indicated are for the standard **CM1M9-8F-4000** I/O cable.*
- *For custom cable length pin-out and colors see CM1M9-8F.PDF*

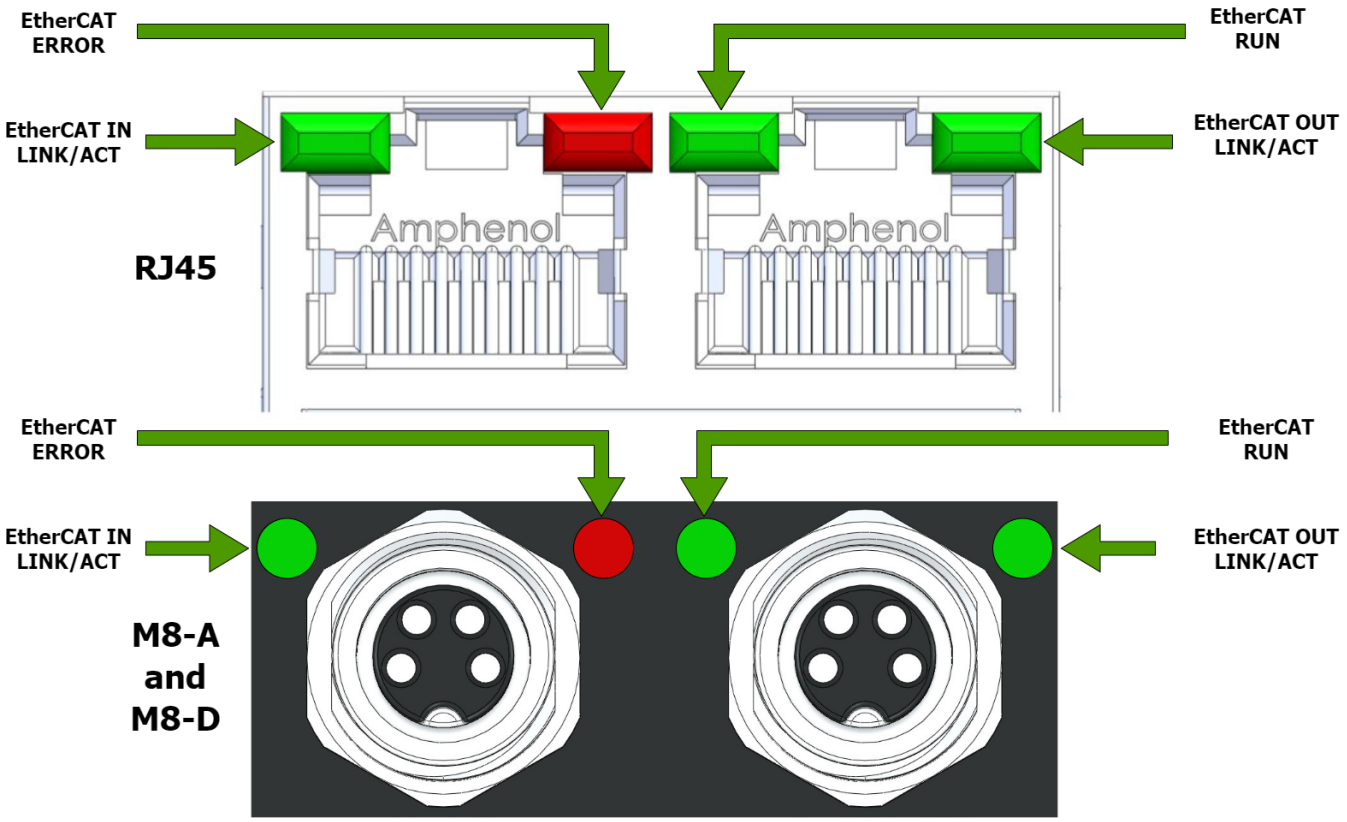
USB Connection

The USB connector is a standard micro USB and is used to update the EtherCAT firmware. When it is plugged into a computer it will create a virtual serial port.

LEDs

EtherCAT Status LEDs

An EtherCAT slave device is required to have LEDs indicating different states.



Link/Activity Indicator

There is a Link/Activity LED for both the IN and OUT EtherCAT ports. The table below describes the indicator conditions and their associated states

Link	Activity	Condition	Link/Activity Code
Yes	No	Port Open	On
Yes	Yes	Port Open	Flickering
No	N/A	Port Closed	Off

Run Indicator

The Run indicator shows the state of the EtherCAT State Machine. The indicator states are described in the table below.

Indicator State	Slave State	Description
Off	Initialisation	The device is in state "Init"
Blinking	Pre-Operational	The device is in state "Pre-Operational"
Single Flash	Safe-Operational	The device is in state "Safe-Operational"
On	Operational	The device is in state "Operational"
Flickering	Init or Bootstrap	The device is booting and has not yet entered the "Init" state or, the device is in state "Bootstrap. Firmware download is in progress.

Error Indicator

The Error indicator shall show device and EtherCAT errors. Errors are as defined in the table below.

Error State	Error Name	Description	Example
On	Application controller failure	A critial communication or application error has occured	• Over torque error • Motor communication error
Double flash	Process Data Watchdog timeout/ EtherCAT watchdog timeout	An application watchdog timeout has occured	Sync Manager watchdog timeout
Single flash	Local Error	Slave device application has changed the EtherCAT state autonomously, due to local error.	Device has changed from Op to safe-op due to EtherCAT error
Blinking	Invalid Configuration	General Configuration error	
Flickering	Booting Error	Init state reached but boot error detected	Application boot error
Off	No Error	Device is in working condition	

System and Motor Status LED

The system status LED provides feedback to the user on overall system status. The following states exist

LED Colour	Description
Red	Motor Error Solid: • 24V motor drive power not present Blinking • Motor communication error Flashing: • 1 - Position error • 2 - Over speed error • 4 - Over torque error
Green	Solid - CiA402 Mode