



CLEARPATH-EC USER MANUAL

ETHERCAT COMPLIANT CLEARPATH MOTORS

DC INPUT, FRACTIONAL HORSEPOWER

NEMA 17 FRAME SIZE

VERSION 1.12 / SEPTEMBER 29, 2026



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TABLE OF CONTENTS

TABLE OF CONTENTS	3
SAFETY WARNINGS	6
Personal Safety Warnings.....	6
Machine, Shock, and Fire Safety Compliance Warnings	6
General Disclaimer	7
INTRODUCTION	8
What is a ClearPath-EC Motor?	8
Parts of a ClearPath-EC Motor	10
TOP TIPS FOR CLEARPATH-EC USERS.....	11
QUICK START GUIDE.....	12
Read Me: User Warning	12
ClearPath Quick Setup.....	13
Required Items	13
Recommended Items.....	13
Secure Your Motor.....	13
Power Up Your ClearPath-EC Motor.....	14
Power-Up Procedure	16
Setting Up ClearView 3.0 Software	17
ClearView 3.0 Minimum System Requirements.....	17
Download and Install ClearView 3.0.....	17
Connecting a ClearPath-EC Motor to Your PC	18
Open ClearView 3.0 (Motor Setup Program).....	19
Test Spin Your Motors Using Motion Generator	20
If You See Exceptions, Warnings, or Motor Shutdowns.....	21
Auto-Tuning.....	21
Before You Seek Technical Help.....	22
POWERING CLEARPATH-EC.....	24
Introduction.....	24
DC Bus Motor Power Supply (12-75VDC).....	24
Logic Power Supply (12-75VDC)	24
Before Powering a ClearPath.....	24
Power Distribution Boards	25
POWER4-HUB-S.....	25
POWER4-HUB-S System Diagram (Two Power Supplies)	26
POWER4-HUB-S Expanded System Diagram.....	26
POWER4-HUB-S: Things to Know	27
POWER4-STRIP-S (Single Power Supply)	28
POWER4-STRIP-S: Things to Know.....	28
Other Power Supply Topics	30
The "Ideal" DC Bus Power Supply.....	30
Teknic IPC-3 and IPC-5.....	30
Underpowered DC Bus Motor Power Supplies	31
Switching Power Supplies.....	31
Power Supply Compliance Notes.....	31
Power Supply Switching and Fusing	32
FAQ: "How do I size a DC bus power supply?"	32

CONNECTING TO AN ETHERCAT NETWORK	33
ClearPath-EC Connections Overview	33
EtherCAT Master	33
ClearPath-EC / EtherCAT Port Topology.....	34
INPUTS AND OUTPUTS	35
ClearPath-EC I/O Circuits	35
I/O Logic Power	35
ClearPath-EC Inputs.....	36
Input Wiring (Switches, NPN, PNP Logic Devices)	36
Automatic Input Features.....	37
ClearPath-EC Outputs	38
Output Wiring.....	38
SOFTWARE (CLEARVIEW 3.0)	39
Minimum System Requirements.....	39
Installing ClearView 3.0 Software	39
Using the Diagnostic Port.....	40
Terms Used in this Section	40
Connecting to the Motor Diagnostic Port	40
CLEARPATH-EC SOFTWARE REFERENCE	43
APPENDIX A: TROUBLESHOOTING	44
LED Blink Codes.....	44
APPENDIX B: MECHANICAL REFERENCE	45
Dimensioned Drawings (Links).....	45
ClearPath-EC Motor	45
Power Distribution Boards	45
Motor Mounting Considerations	46
Connecting ClearPath to a Mechanical System	46
Motor Connection: General Tips and Guidelines.....	47
Coupling Selection	49
Installing Pulleys and Pinions	50
About End-of-Travel Stops	51
Hard Blocks.....	51
Elastomeric (rubber) Stops.....	51
Pneumatic or Hydraulic Dampers.....	51
End Stops and Hard Stop Homing.....	51
Fan Mounting (Optional)	52
APPENDIX C: CONNECTOR AND CABLE REFERENCE....	53
Mating Connectors.....	53
ClearPath-EC NEMA 17 Motor	53
Power4-Hub-S, Power4-Strip-S, IPC-5.....	54
Cable Drawings (All Links Go To Teknic.com)	55
Power Cables	55
Network Cables	55
I/O Cable.....	55
APPENDIX D: SPECIFICATIONS	56
ClearPath-EC Motor: Common Specifications (NEMA 17)	56
POWER4-HUB-S	58
POWER4-STRIP-S.....	59

APPENDIX E: GROUNDING AND SHIELDING 60

Protective Earth (PE) Connection60

Grounding and Shielding.....60

Power Returns 61

APPENDIX F: CLEARPATH PART KEY..... 62

APPENDIX G: MISCELLANEOUS 63

How to make a Logic Power Supply cable for your POWER4-
HUB-S63

Other Product Notes64

Re: Electrical Fast Transient (EFT) Testing.....64

ClearPath EMC Instructions.....64

SAFETY WARNINGS

IMPORTANT: Please read this safety information before attempting to install, apply power to, or operate a ClearPath motor. Failure to understand and follow the safety information presented in this document could result in property damage, bodily injury or death.

PERSONAL SAFETY WARNINGS

- Read and follow all safety information and warnings.
- Do not wear loose clothing or unconfined long hair when using ClearPath motors. Remove ties, rings, watches and other jewelry before operating an unguarded motor.
- Do not operate a ClearPath motor if your alertness, cognitive function, or motor skills are impaired.
- Always handle, and carry a ClearPath motor by the housing (don't carry it by the shaft or hanging from its cables).
- Be aware that in certain modes of operation ClearPath is designed to spin as soon as DC Bus Motor Power is applied.
- Install and test all emergency stop devices and controls before using ClearPath.
- Before applying DC power, secure the ClearPath motor to a sturdy work surface and install a finger-safe guard or barrier between the user and the motor shaft.
- Provide appropriate space around the ClearPath motor for ventilation and cable clearances.
- Do not allow cables or other loose items to drape over, or rest near the ClearPath motor shaft.
- Never place fingers, hands, or other body parts on or near a powered ClearPath motor.
- Thoroughly test all ClearPath applications at low speed to ensure the motor, controls, and safety equipment operate as expected.

MACHINE, SHOCK, AND FIRE SAFETY COMPLIANCE WARNINGS

- Do not open device enclosure. There are no user serviceable parts inside this product.
- Follow all instructions and use the product only as directed.
- Safety of any system incorporating this equipment is the responsibility of the system designers and builders.
- The machine designers need to recognize and incorporate required warning symbols, guards and shields for ClearPath motors that are used in applications that can result in the external accessible parts of their machine exceeding a temperature of 65 Celsius. This is required as a method to reduce burns. A tool shall be required to remove any guards and/or shields.

- ClearPath motors require that a conductive path exist between the motor chassis and the Protective Earth (PE) connection of the machine to which it is affixed. (Note: The PE connection is often satisfied by simply bolting the motor to the machine; however it is the users responsibility to verify the PE connection.) If an external grounding wire is required, use the same or larger wire gauge as used between the DC power supply and ClearPath Motor.
- Any maintenance or repair guide created by the user shall state that power shall be removed before the Protective Earth ground conductor is disconnected. When reconnecting power, the Protective Earth ground conductor shall be the first wire reconnected. Main power may be reconnected only after the Safety Ground connection is secure.

GENERAL DISCLAIMER

The User is responsible for determining the suitability of products for their different applications. The User must ensure that Teknic's products are installed and utilized in accordance with all local, state, federal and private governing bodies and meet all applicable health and safety standards.

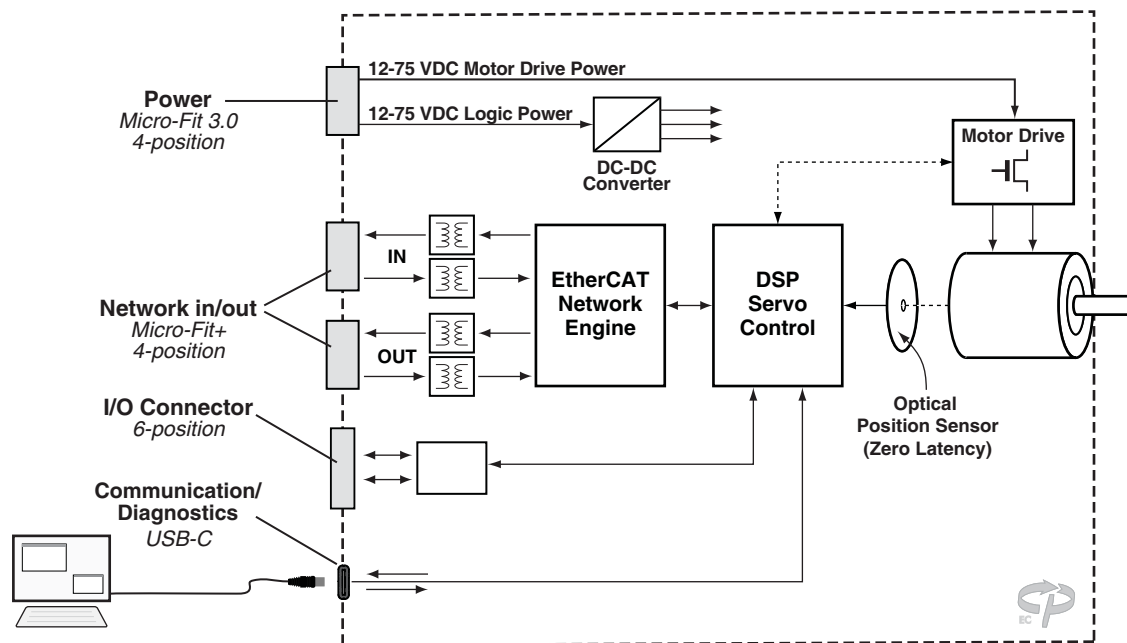
Teknic has made all reasonable efforts to accurately present the information in the published documentation and shall not be responsible for any incorrect information which may result from oversights. Due to continuous product improvements, the product specifications as stated in the documentation are subject to change at any time and without notice. The User is responsible for consulting a representative of Teknic for detailed information and to determine any changes of information in the published documentation.

If Teknic's products are used in an application that is safety critical, the User must provide appropriate safety testing of the products, adequate safety devices, guarding, warning notices and machine-specific training to protect the operator from injury.

INTRODUCTION

WHAT IS A CLEARPATH-EC MOTOR?

ClearPath-EC is an integrated servo system that combines a precision brushless motor with encoder feedback, a high-performance servo drive, an internal motion controller, and an EtherCAT interface into a single compact package. The all-in-one design is comparable in size to a typical non-integrated NEMA 17 servo motor, simplifying installation while reducing panel space, wiring, and system complexity.



NEMA 17 ClearPath-EC Block Diagram

ClearPath-EC is a professional level, industrial grade product.

The NEMA 17 ClearPath-EC motor is designed with oversized bearings, stainless steel shaft, high temperature windings, and powerful rare earth magnets.

The position sensing element is a high-resolution optical encoder with superior accuracy and ultra-low latency for improved servo response as compared to magnetic encoders. The servo drive electronics and motion control firmware employ the same state-of-the-art technology and advanced control algorithms as Teknic's high-end, non-integrated servo control products.

Getting started with ClearPath-EC is easy. Install the included ClearView 3.0 software, connect the motor to your PC via USB, and configure and tune the system. Once setup is complete, disconnect the USB connection and control the motor directly from your EtherCAT master.

ClearPath-EC also includes two configurable I/O points that can be used as general-purpose inputs or outputs, or assigned dedicated functions such as an axis brake or touch probe.

ClearView 3.0 software is written in plain English with plenty of tips and annotations. Use ClearView 3.0 to tune your system, set parameters and options, and troubleshoot axis issues using the included Soft Scope.

Flexibility. ClearPath-EC motors support:

- Cyclic Synchronous Position (CSP)
- Cyclic Synchronous Velocity (CSV)
- Cyclic Synchronous Torque (CST)
- Profile Position (PP)
- Profile Velocity (PV)
- Profile Torque (TQ)
- Homing mode (HM)

ClearPath-EC motors support a wide range of applications, from variable-speed conveyors and multi-axis positioning systems to kinetic sculptures. In addition, ClearPath-EC can be quickly reconfigured and retuned to meet changing application requirements.

Safety and self-protection features are standard. ClearPath will rapidly shut down if it becomes overloaded, overheated, detects a hard stop, or exceeds any of the safety or motion limits you specify.

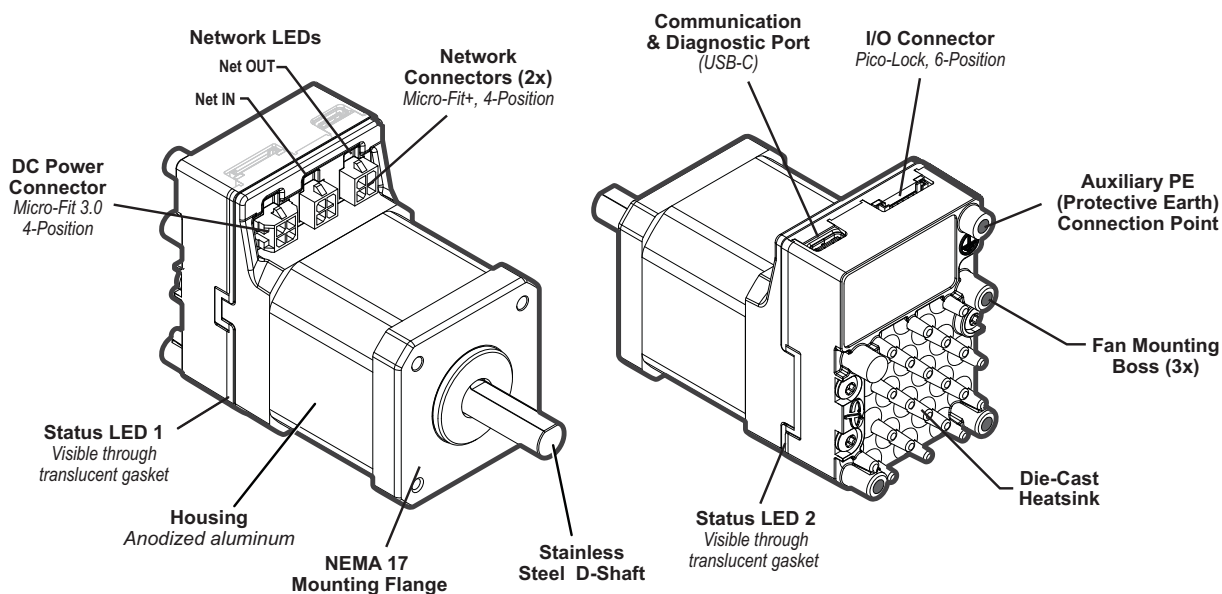
Machine Safety features are standard. You have direct access to the motor drive power, so it's easy to implement Safe Torque Off (STO) by interrupting the ClearPath-EC's motor drive DC power. Only one interrupting circuit at a central point is required to render all ClearPath-EC motors in your machine safe, eliminating significant STO wiring.

Logic Power Backup The Logic Power input maintains EtherCAT communications, I/O functionality, and position feedback if DC Bus Power is interrupted, allowing critical system status and feedback to remain available during a power outage or machine safety event.

Absolute Position Feedback functionality is standard. Logic Power for a group of ClearPath-EC motors can be supplied by a battery and charger, preserving position information even during a power loss, lockout, or machine safety event.

Made in the USA. Each ClearPath motor is built and tested at our New York manufacturing facility and is backed by a three-year warranty.

PARTS OF A CLEARPATH-EC MOTOR



NEMA 17 ClearPath-EC Motor

DC Power Connector - This Molex Micro-Fit 4-pin connector takes in DC Bus Motor Power (12-75VDC) and Logic Power (12-75 VDC).

Network Connectors - These two 4-pin Molex Micro-Fit+ connectors provide the EtherCAT IN and OUT network connections.

Communication & Diagnostic Port - USB-C port used to connect ClearPath-EC to a Windows PC running ClearView 3.0. A USB connection is required to run Auto-Tune, to configure the motor, and to access ClearView 3.0 diagnostic tools, including the Soft Scope.

Status LEDs - Indicate the operational status of the ClearPath motor. See Appendix A for ClearPath LED codes.

Auxiliary PE (Protective Earth) Connection Point - Provides an alternate Protective Earth connection. This is important if the motor mounting hardware does not provide a reliable PE bond. Connect a wire between this screw boss and a machine frame or chassis point that is bonded to PE.

I/O Connector - This 6-pin Molex Pico-Lock connector supports two configurable I/O points. Each can be configured as a general-purpose input or output, or assigned a dedicated function such as a home sensor, limit switch, brake output, touch probe, or interlock.

TOP TIPS FOR CLEARPATH-EC USERS

These tips apply to the ClearPath-EC, **NEMA 17** motors discussed in this document.

- ✓ **Turn off the DC power supply** before connecting or disconnecting motor power cables. This helps prevent electrical arcing, which can damage the motor pins and mating cable terminals over time.
- ✓ **Hear a brief buzz during power-up?** The motor may produce a brief buzzing sound (less than one second) while it initializes. This is normal and expected.
- ✓ **Motor Killer!** Never reverse DC Bus Power polarity (positive vs. negative) to your ClearPath motor. Doing so will irreparably damage the motor.
- ✓ **USB cables matter.** If you are having USB communication problems, verify that you are using a **USB-IF certified cable** to communicate with your ClearPath-EC motor. [Teknic USB cables](#) are USB-IF certified. Need [more information](#)?
- ✓ **Cover the USB connector when not in use.** This helps prevent dust and debris from entering the connector, which can cause communication problems.
- ✓ **Run Auto-Tune with the full mechanical load attached.** For best performance, run Auto-Tune with the ClearPath-EC motor coupled to the machine exactly as it will operate in service. The factory-default tuning is configured for unloaded operation.

QUICK START GUIDE

This section will help you get your ClearPath-EC motor up and running.

IN THIS SECTION

- How to download and install *ClearView 3.0* (setup and configuration software)
- How to power up your ClearPath-EC motor
- How to connect your ClearPath-EC to a PC and establish communication
- How to spin your unloaded¹ ClearPath motor under ClearView 3.0 software control

READ ME: USER WARNING

Always use caution and common sense when working with motion control equipment. Even the smallest ClearPath motor is powerful enough to damage fingers, grab loose clothing, or make an unfortunate hairstyle permanent in just a few milliseconds. By comparison, a human blink takes around 200 milliseconds. Please read and understand all safety warnings in the ClearPath User Manual before operating a ClearPath motor.

¹ Unloaded means *with nothing attached to the motor shaft*. ClearPath comes factory preconfigured for unloaded operation. **ClearPath must be tuned** whenever it is connected to a new type of mechanical system.

CLEARPATH QUICK SETUP

REQUIRED ITEMS

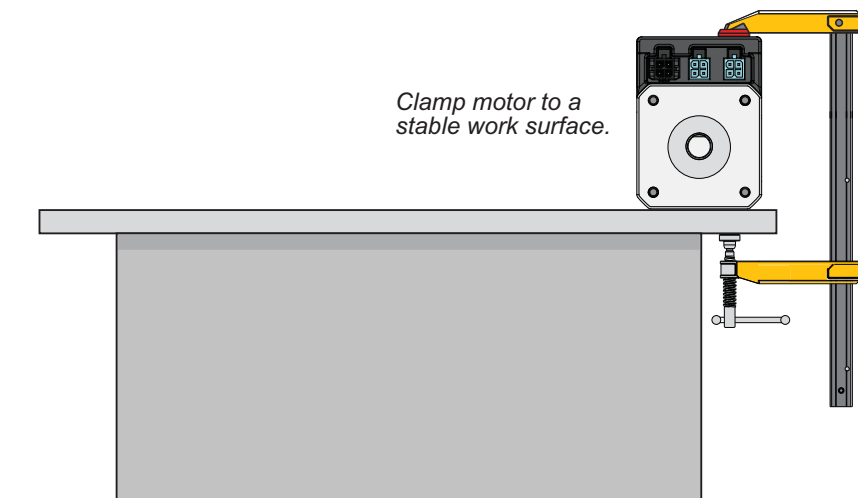
- Windows PC (Win 10, 11) with ClearView 3.0
- ClearPath-EC motor
- DC Bus Motor Power Supply (with cables) 12-75 VDC
- Power distribution board (POWER4-HUB-S or POWER4-STRIP-S)
- Logic Power Supply (12-75VDC). *Required only if using Power4-HUB-S.*
- USB A-C data cable, Teknic PN: CPM-CABLE-USB-118AC

RECOMMENDED ITEMS

- Network & I/O cables

SECURE YOUR MOTOR

Injury Warning: The motor may move suddenly during tuning and operation. To prevent injury or property damage, secure the motor to a stable surface before operation.

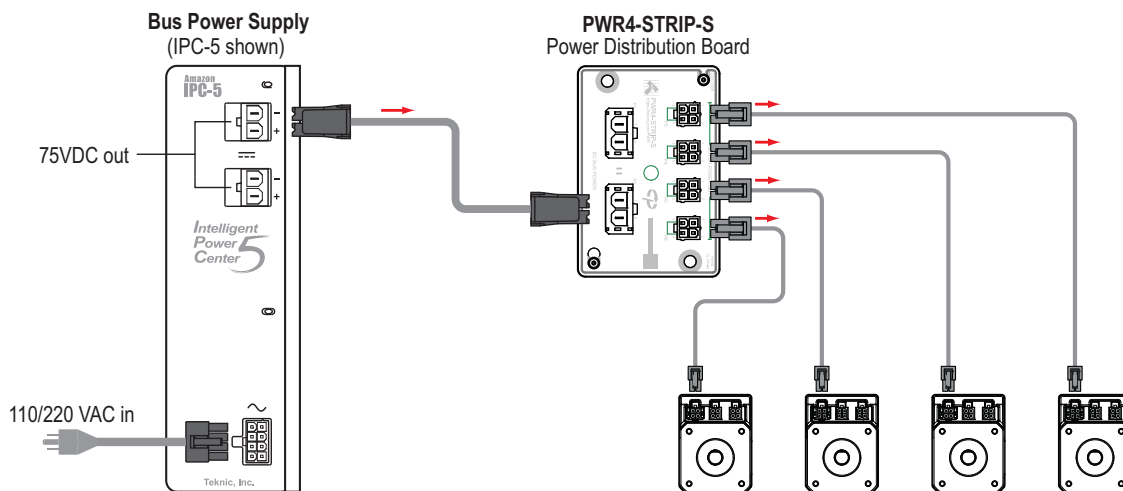
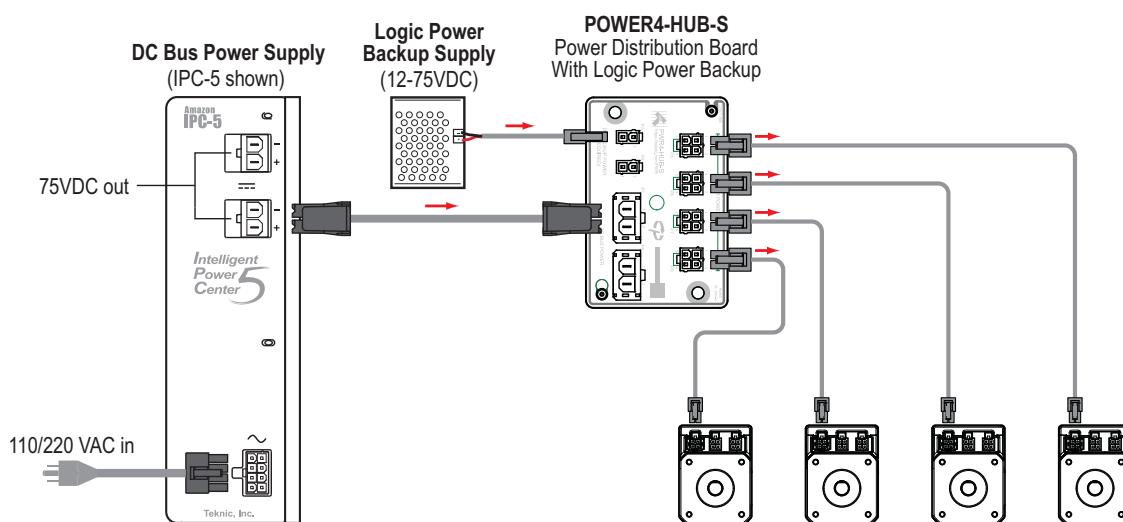


Clamp it!

POWER UP YOUR CLEARPATH-EC MOTOR

THINGS YOU'LL NEED

- DC Bus Motor Power Supply: Teknic/IPC-5, 75VDC Bus Motor Power Supply or equivalent, cables as shown below.
- Power distribution board: POWER4-HUB-S or POWER4-STRIP-S. **Note:** for POWER4-HUB-S users, a separate Logic Supply is required (12-75VDC). A separate Logic Supply *is not* required when using a POWER4-STRIP-S.
- Cables as shown below.



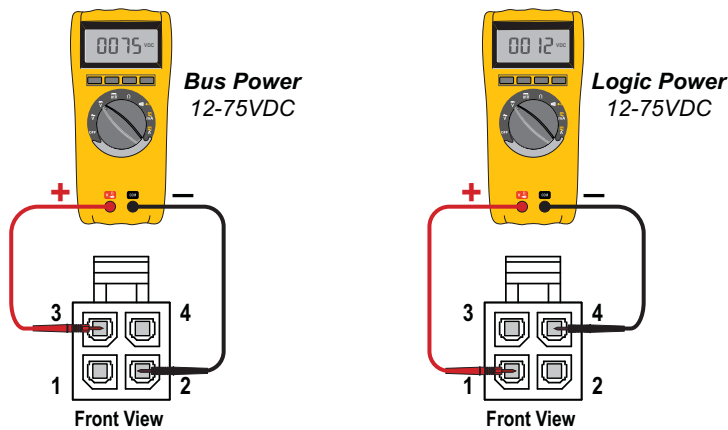
NEMA-17 ClearPath-EC Power Connections using a POWER4-HUB-S or POWER4-STRIP-S

TEST DC POWER POLARITY

IMPORTANT: Reversing DC Bus Power polarity *will* permanently damage your ClearPath motor.

Important Notes

- If you are using unmodified Teknic manufactured cables, you can safely skip this test.
 - **Do not force or jam DMM probes into the connector.** Use smaller probe tips or find a safe alternative way to verify that polarity is correct.
1. Start with the Micro-Fit power connector disconnected from your ClearPath-EC motor and the AC unplugged.
 2. Power-up your DC Bus Motor Power Supply.
 3. **Measure DC Bus Motor Power Supply voltage and polarity.** With a multimeter, measure the DC voltage from Bus Motor Power+ (positive) to Bus Motor Power- (negative).
 4. Power-up your logic power supply.
 5. **Measure Logic Supply voltage and polarity.** With a DMM, measure the Logic Supply voltage between Logic Power+ and Logic Power-.



Terminal Assignment Table			
Position	Wire Size	Color	Signal
1	24 AWG	ORN	Logic Power +
2	18 AWG	BLK	Bus Motor Power -
3	18 AWG	RED	Bus Motor Power +
4	24 AWG	BLU	Logic Power -

Check power polarity with a DMM

Note: See [Appendix C](#) for links to cable drawings and pinouts.

POWER-UP PROCEDURE

1. **IMPORTANT:** Start with power supplies turned off. See note below.
2. Connect cables as shown earlier in this section.
3. Turn on power supplies.

IMPORTANT: Remove AC power to your DC Bus Power Supply whenever connecting or disconnecting a power cable to your motor. Removing power will prevent electrical arcing from damaging the motor and connector terminals.

SETTING UP CLEARVIEW 3.0 SOFTWARE

ClearView 3.0 provides a variety of diagnostic and configuration tools, including:

- **Auto-Tune** - Easily tune your ClearPath-EC motor using this built in utility.
- **Soft Scope** - View multiple system variables on an oscilloscope-like display. such as measured torque, velocity, following error, and many more.
- **Real time alerts, exceptions, and warnings.**
- **Move Generator** - Command motion before an EtherCAT Master or network is up and running. Simple controls let you jog the motor and execute positioning, velocity, and torque moves directly from ClearView 3.0.

CLEARVIEW 3.0 MINIMUM SYSTEM REQUIREMENTS

Operating system:	Windows 10 or later Note: <i>Windows PCs with ARM processors are not supported.</i>
Processor speed:	1.5 GHz or faster
RAM:	2 GB
Free hard drive space:	1 GB
Monitor:	1280 x 1024 pixels or higher

DOWNLOAD AND INSTALL CLEARVIEW 3.0

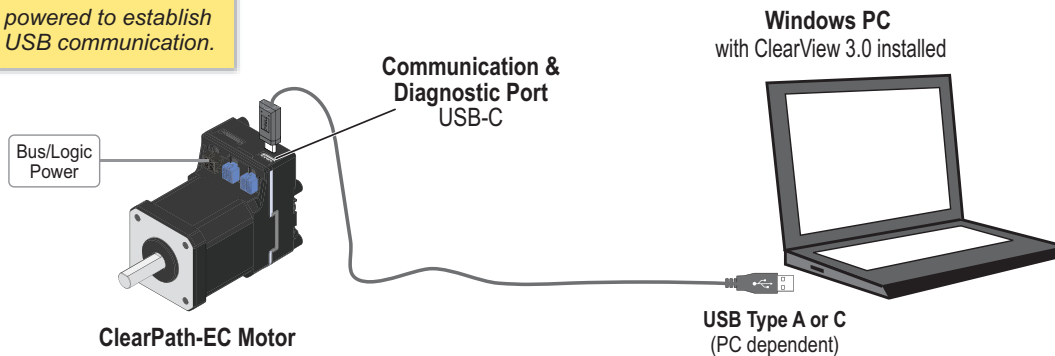
1. Download the ClearView 3.0 installer from:
<https://www.teknic.com/downloads/>.
2. Launch the ClearView 3.0 installer. Follow the on-screen prompts to complete installation.

Note: ClearPath-EC motors are compatible with ClearView 3.0 or later.

CONNECTING A CLEARPATH-EC MOTOR TO YOUR PC

1. Power up your ClearPath-EC motor.
2. Connect a high-quality USB cable (A to C or C to C) to the motor's USB-C communication port. See figure below.
3. If this is a first-time connection, wait for ClearPath to automatically install its driver software before proceeding. This should only take a few seconds.

Note: Motor must be powered to establish USB communication.



Connect ClearPath to your PC

Important Communication Notes

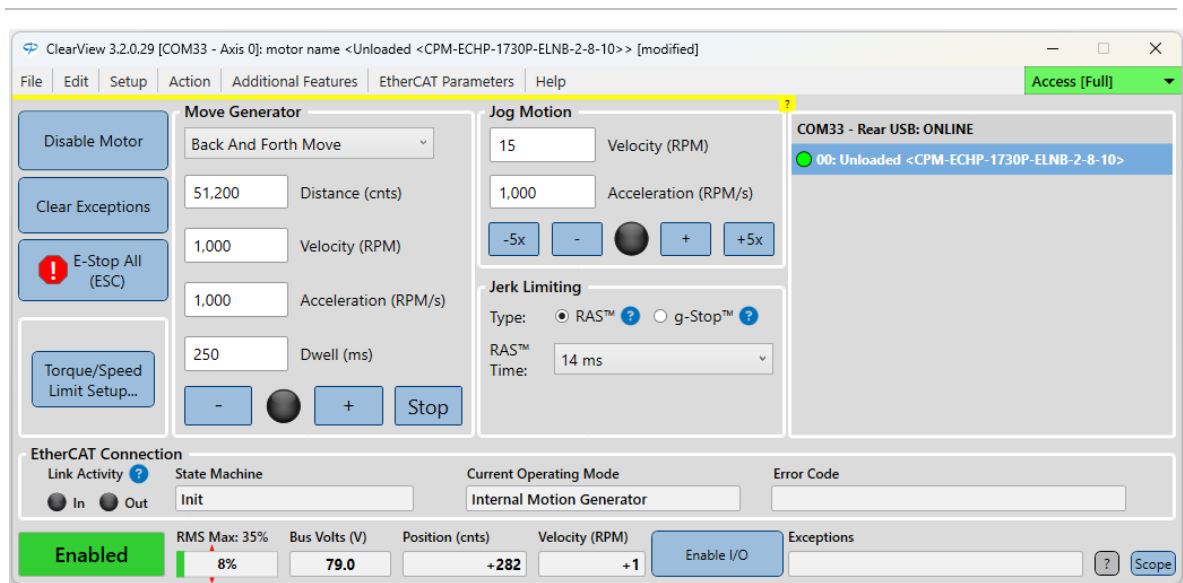
- For best performance use USB-IF certified cables such as Teknic's [CPM-CABLE-USB-118AC](#). Avoid using USB cables of unknown origin (i.e. one found in a junk drawer). Cables designed for *charging only* will not work with this product.
- You may connect your ClearPath to a PC at any time to use ClearView 3.0 configuration and diagnostic software tools.
- ClearPath does not require a USB to PC connection during normal machine operation.

OPEN CLEARVIEW 3.0 (MOTOR SETUP PROGRAM)

After you open ClearView 3.0, your ClearPath-EC motor will attempt to establish communication with your PC. When successfully connected, the ClearView 3.0 UI will look similar to that of the figure shown below.

MAIN UI FEATURES

- Enable/Disable button
- Clear Exceptions button
- E-Stop button (or Esc key on keyboard)
- Torque Limit Setup
- Move Generator (allows you to command several different move types).
- Jog Motion Controls allow you to manually jog the motor.
- EtherCAT Connection Status
- Motor Status



ClearView 3.0 motor setup and configuration software

TEST SPIN YOUR MOTORS USING MOTION GENERATOR

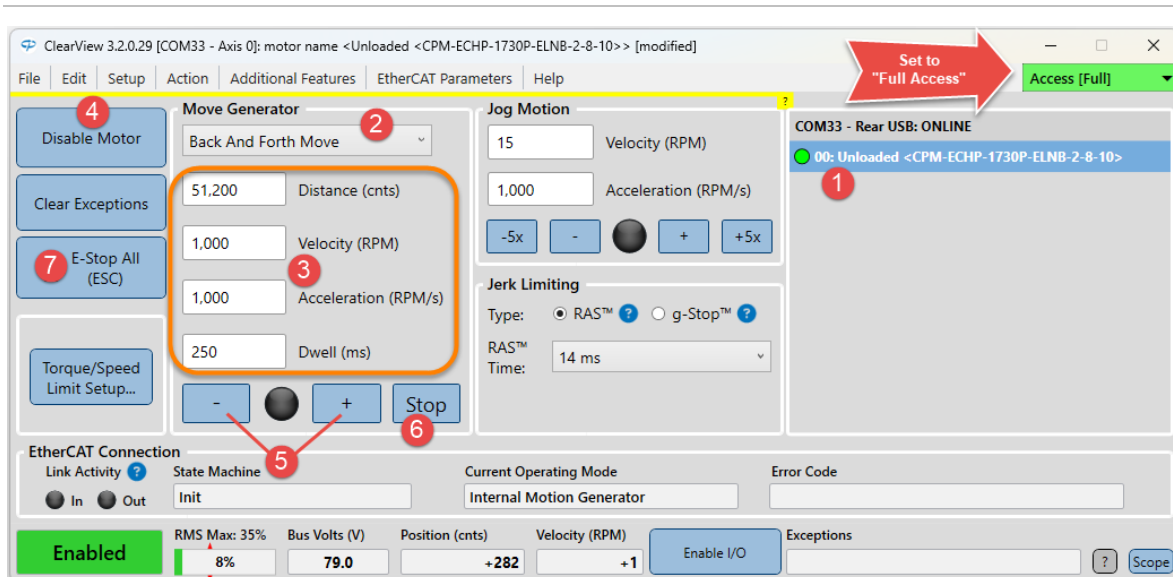
Note: This section describes how to operate an unloaded motor (i.e., a motor with nothing attached to the shaft).

Important: ClearPath-EC motors are preconfigured for unloaded operation. Run Auto-Tune whenever the motor is connected to a new or different mechanical load.

Click and spin—no Master required! Once your system is powered up and communicating, you can take your motors for a test spin using ClearView's Move Generator or Jog Motion controls. Refer to instructions below.

Important: To change settings and run moves you must set ClearView to **Full Access mode** using the "Access" dropdown menu.

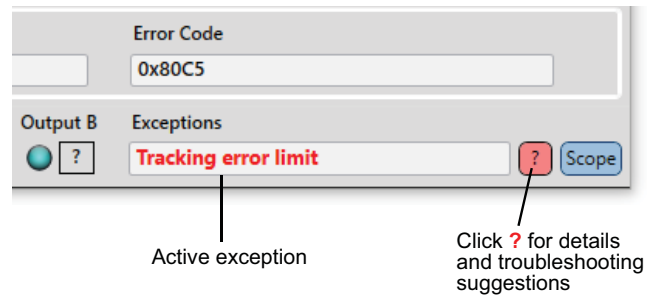
1. Select the motor you'd like to spin from the Motor List.
2. Set the Move Type: Back and Forth, Single, Repeating, or Constant Velocity.
3. Enter the Move Parameters: Distance, Velocity, Acceleration, and Dwell (Dwell is just the pause time between repeating moves).
4. Click Enable/Disable button to enable the motor.
5. Click "+" to start in the CCW direction. Click "-" to start in the CW direction.
6. Single click the "Stop" button to end motion cycling. Double click the Stop button to stop motion immediately.
7. Click "E-Stop All" or hit your Esc key to stop motion immediately.



ClearView 3.0 UI

IF YOU SEE EXCEPTIONS, WARNINGS, OR MOTOR SHUTDOWNS

If your motor shuts down while running unloaded, check the Exceptions field in ClearView 3.0 for information and troubleshooting suggestions.



Exception information displayed in ClearView 3.0 UI

- Many shutdowns are caused by non-motor issues such as an undersized power supply, mechanical problems, and/or inappropriate move settings. A shutdown does not automatically mean that the motor is broken.
- If you get Torque Sat, Volt Sat, or Over Speed exceptions, try reducing move acceleration, velocity, or both to see if the exception clears.
- Clear most exceptions by clicking the Clear Exceptions button, but be aware that if the underlying problem isn't fixed, shutdowns may continue to occur.
- IF THE MOTOR'S STATUS LED FLASHES **RED**, your ClearPath motor has identified an internal hardware problem and may need to be returned for repair or replacement. Please contact Teknic if this happens.

AUTO-TUNING

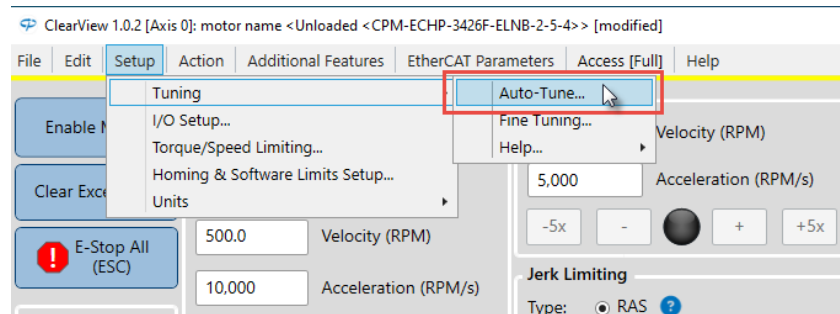
Tuning is required whenever you bolt a ClearPath motor to a new or different mechanical system. The Auto-Tune feature speeds up and simplifies the tuning process in most cases.

BEFORE YOU BEGIN THE AUTO-TUNE PROCESS:

- Disable your motor.
- Recommended: Turn off your PC's sleep mode. If your PC goes into standby, sleep, or hibernation mode during Auto-Tune, the process will fail.
- Tighten all couplings, fasteners, pinions, and belts to the manufacturer's specifications.
- Make sure the axis and machine frame is fully intact.
- Don't try to tune a system on casters or on a flimsy table.
- Use a power supply designed for use with motor drives such as Teknic's IPC-3 or IPC-5.
- Don't use a low power switching power supply.

STARTING THE AUTO-TUNER

In ClearView 3.0, click **Setup>Tuning>Auto-Tune**.



Start the Auto-Tuner

Important: The Auto-Tune application was designed to walk the user through the tuning process in a safe, step-by-step manner. Anyone engaged in Auto-Tuning must be able to read and follow all instructions presented.

DURING THE AUTO-TUNE PROCESS

- **Be careful.** Immobilize your motor with a clamp or vise. Keep your hands, hair and clothing away from the motor shaft and mechanical system.
- **Be patient.** Auto-Tune will take several minutes (5-15 minutes is typical).
- **Noises happen.** Expect to hear humming, buzzing, clicks and clacks. Loud squeals and buzzes are perfectly normal while ClearPath explores the limits of your mechanical system.

BEFORE YOU SEEK TECHNICAL HELP

Issue: The status LED on the motor is not lit, and my ClearPath apparently has no power.

- Connect power cable to ClearPath.
- Plug in and turn on power supply.
- Verify wall outlet is powered and no circuit breakers are tripped.
- If you accidentally reversed DC power to your ClearPath motor, it may be damaged and in need of repair.

Issue: The status LED is working, but my ClearPath and PC are not communicating.

- Disconnect the USB cable from ClearPath and your PC, close ClearView 3.0, restart, and reconnect the USB cable.

Issue: Auto-Tune failed to complete.

- Verify that the motor is sized appropriately for the application. Don't expect a NEMA 17 motor with no gearing to spin a manhole cover.
- If your power supply is underpowered and/or cannot tolerate regenerated energy, you may have problems running Auto-Tune. ClearPath motors can operate between 12-75 VDC, but they require adequate input power to complete an Auto-Tune.

Issue: My ClearPath is getting shutdowns.

- A shutdown does not automatically mean that the motor is broken or defective.
- Shutdowns with yellow blink codes usually mean that ClearPath is reporting a problem but is unlikely to be the source of the problem. Connect ClearPath to your PC running ClearView 3.0 and look in the “Exceptions” field to see what is being reported.
- Check the ClearPath User Manual (Appendix A) for blink code details and suggested fixes.
- If you see a shutdown accompanied by a red flashing LED, you'll probably have to return your ClearPath for repair or replacement. Check the Teknic website for repair/return information.

How do I restore my ClearPath to its factory default settings?

If you need to return ClearPath to its original state (i.e., configured exactly as it was when we shipped it to you), use File>Reset Config File To Factory Defaults. All parameters and settings will be over-written and ClearPath will be returned to its default factory configuration.

POWERING CLEARPATH-EC

INTRODUCTION

ClearPath-EC has separate inputs for **Bus Power** and **Logic Power**. Both inputs accept 12–75 VDC and may be powered from the same DC supply or from separate supplies depending on application requirements.

Bus Power provides power for motor operation. **Logic Power** powers the motor's control electronics and also establishes the operating voltage for any connected I/O devices.

A single power supply is sufficient for many applications. Separate supplies are required when a higher Bus Power voltage is desired for motor performance and lower voltage (e.g. 12VDC, 24VDC) is required for I/O devices. For example, the motor can use 75 VDC Bus Power and 24 VDC Logic Power to accommodate 24 VDC sensors or a brake.

DC BUS MOTOR POWER SUPPLY (12-75VDC)

The DC Bus Power Supply provides power to the ClearPath-EC motor drive. The Teknic IPC-5 (75 VDC) is a compatible bus power supply.

LOGIC POWER SUPPLY (12-75VDC)

Users can opt to use a dedicated Logic Power Supply for applications that require uninterrupted power to the motor's processor, communication, and I/O circuits.

The POWER4-HUB-S power distribution board requires a Logic Power Backup Supply in addition to the main DC Bus Motor Power Supply.

Note: When using ClearPath's I/O circuits, the Logic Power voltage supplied to the motor should match the operating voltage of the connected I/O devices. For example, when connecting 24 VDC sensors, use 24 VDC Logic Power.

Important: Logic Power alone cannot power the motor windings for motion.

BEFORE POWERING A CLEARPATH

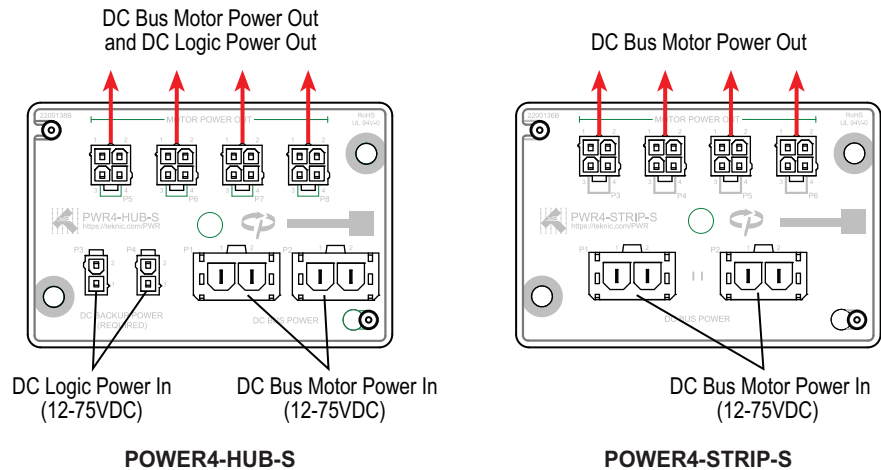
- Check for proper DC power polarity before connecting power to a ClearPath motor. Reversing DC power polarity will permanently damage the motor. Follow this [link](#) for more information.
- Before connecting a power cable to a ClearPath-EC motor, verify that the supply is turned off and discharged to prevent electrical arcing from damaging the connectors.
- **Note:** When a ClearPath motor is powered up, a startup routine energizes the motor for a few milliseconds. During this startup routine a small amount of motion may occur at the motor shaft (<1° typical).

POWER DISTRIBUTION BOARDS

ClearPath motors in this family require both DC Bus Power and Logic Power. Teknic offers two power distribution boards—the **POWER4-HUB-S** and **POWER4-STRIP-S**—to simplify power connections and distribution to multiple motors.

POWER4-HUB-S - Distributes DC Bus Power and Logic Power from a separate Logic Power backup supply to as many as four ClearPath motors. Both power inputs support 12–75 VDC. Logic Power is typically 12 VDC or 24 VDC, particularly when supplied by a backup battery or when using the motor's built-in I/O.

POWER4-STRIP-S - Distributes 12-75VDC to the DC motor drive and the logic power circuits. Up to four ClearPath motors can be connected per board. The POWER4-STRIP-S does not support a separate Logic Power Supply. It will send the same voltage to bus and logic pins.



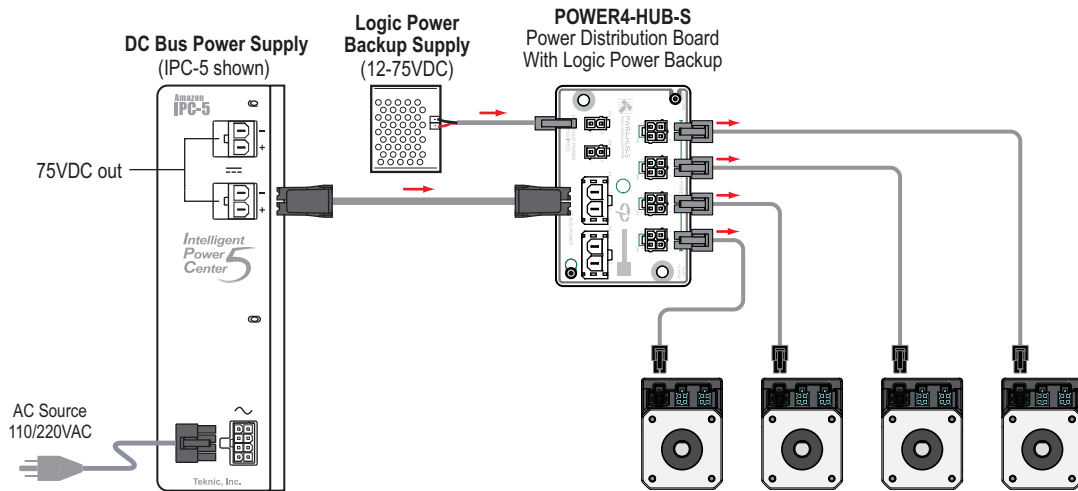
POWER4-HUB-S

The **POWER4-HUB-S**:

1. Distributes DC Bus Motor Power to up to four ClearPath motors.
2. Distributes Logic Power to the ClearPath motor via a separate supply. Logic Power will keep the motor's processor, encoder position, and associated electronics alive in the event that DC Bus Power drops out.

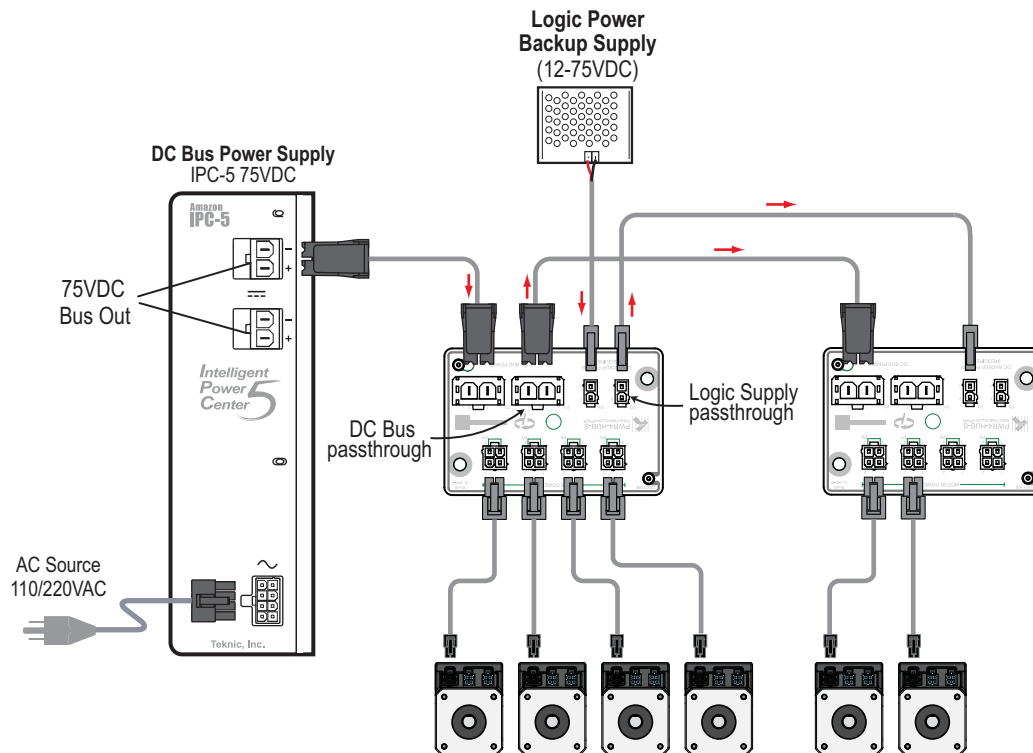
Note: Logic Power does not power the motor windings. Bus Power must be present to produce torque at the motor.

POWER4-HUB-S SYSTEM DIAGRAM (TWO POWER SUPPLIES)



A POWER4-HUB-S in a ClearPath system

POWER4-HUB-S EXPANDED SYSTEM DIAGRAM



NOTE: The actual number of motors that can be powered by a single DC bus power supply is application and power supply dependent.

Two POWER4-HUB-S boards powering several ClearPath motors

POWER4-HUB-S: THINGS TO KNOW

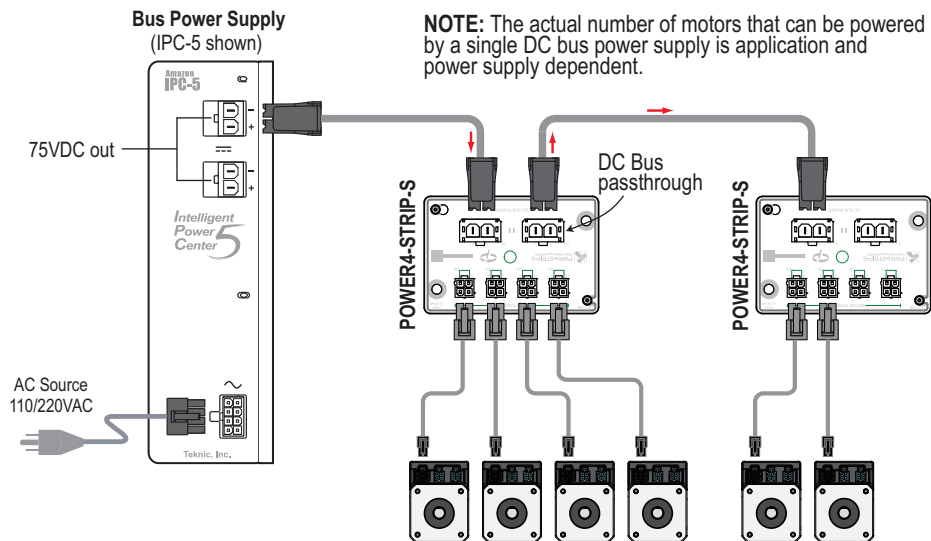
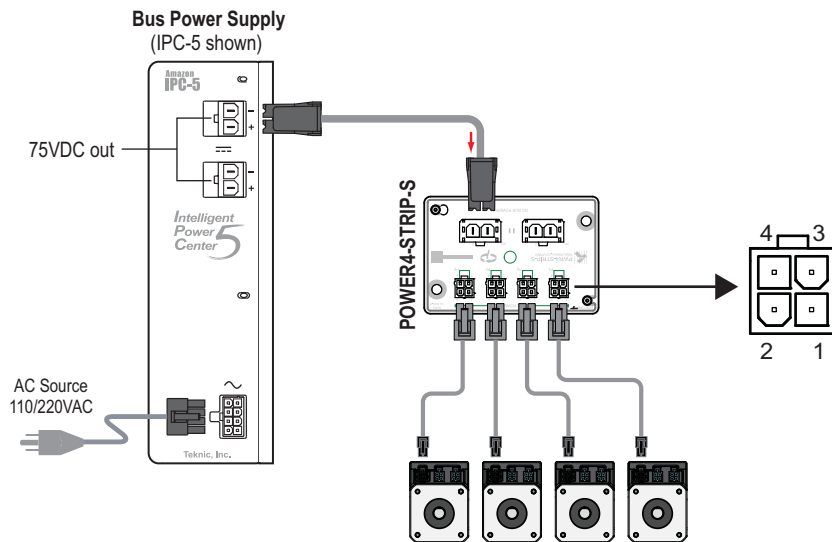
- **IMPORTANT:** Do not connect two IPC-3 / IPC-5 power supplies to a single POWER4-HUB-S. These power supplies do not operate in parallel or series configurations.
- **Logic Power alone will not spin a motor.** However, Logic Power *will* keep the motor's processor, communication and internal sensor circuits powered.
- **Do not "hot swap" DC power connectors.** Turn off the DC Bus Power Supply before connecting a motor to the POWER4-HUB-S. *Connecting and disconnecting the motor from a live power supply will cause electrical arcing that will damage the connectors over time.*

IMPORTANT: The Power4-HUB-S board is not considered a shock hazard when the Logic Power Backup Supply is 42VDC or lower (12VDC or 24VDC is the most commonly used voltages for Logic Power). Traces on the exposed (connector side) of the PCBA carrying Logic Power can inadvertently come in contact with a user. **Therefore, if Logic Power is above 42VDC the Power4-HUB-S board must be installed behind a protective cover.**

POWER4-STRIP-S (SINGLE POWER SUPPLY)

The **POWER4-STRIP-S** Distributes DC Bus Motor Power to up to four ClearPath motors. This board serves as a basic plug strip for your ClearPath motors.

Note: The POWER4-STRIP-S board does not take a separate Logic Power Backup Supply.



NOTE: The actual number of motors that can be powered by a single DC bus power supply is application and power supply dependent.

POWER4-STRIP-S boards powering ClearPath motors

POWER4-STRIP-S: THINGS TO KNOW

- **IMPORTANT:** Never connect two IPC-3 or IPC-5 power supplies to a single POWER4-HUB-S. The IPC power supplies are not designed to operate in parallel or series configurations.

- **Do not "hot swap" DC power connectors.** Turn off DC Bus Motor Power Supply (disconnect AC power) before connecting a motor to the POWER4-STRIP-S. Connecting and disconnecting the motor from a live power supply will cause electrical arcing that will damage the connectors over time.

OTHER POWER SUPPLY TOPICS

THE "IDEAL" DC BUS POWER SUPPLY...

...can deliver high peak current (for short periods) and effectively manage regenerated energy (reverse voltage that returns to the power supply and can overload it). Teknic's IPC-3 and IPC-5 are designed with these requirements in mind.

"Bulk" linear power supplies—basically a transformer, rectifier, and large capacitor—can also work well with servo systems

Small switching-mode power supplies are generally not the best choice.

Important: Always test your ClearPath application with the intended power supply under worst case load conditions. This may include low AC line, high AC line, heaviest load, highest acceleration/velocity, most aggressive duty-cycle, highest ambient temperature, etc. This will help ensure sufficient power capacity and adequate operating margin.

TEKNIC IPC-3 AND IPC-5

Teknic manufactures the IPC-3 and IPC-5, 75VDC power supplies designed specifically for powering motor drives. These supplies effectively manage peak current demand, regenerated energy, and include many built-in protective features.



Teknic IPC-3



Teknic IPC-5

Teknic 75VDC IPC family power supplies

TEKNIC IPC-3

The IPC-3 open-frame power supply can typically power one to four ClearPath motors. The actual number of motors depends on the application.

TEKNIC IPC-5

The IPC-5 fully enclosed power supply can typically power two to six ClearPath motors. The actual number of motors depends on the torque, speed, and duty cycle required.

UNDERPOWERED DC BUS MOTOR POWER SUPPLIES

ClearPath motors can and do work with power supplies as low as 12 volts DC, provided that the power supply has sufficient voltage, current, and capacitance to meet your application's motor torque and speed requirements.

IMPORTANT: An underpowered supply can result in ClearPath performance limitations and problems including the following:

- **ClearPath is unable to complete the auto-tuning process.** The ClearPath auto-tuning feature uses aggressive moves to test the limits of each mechanical system. A weak power supply (i.e. one that can't handle the peak current demands required by ClearPath) may "droop" the supply below ClearPath's minimum operating voltage, about 21.5VDC. This can cause loss of communication and shutdowns.
- **ClearPath completes the auto-tuning process but experiences warnings or shutdowns during programmed motion.** If Auto-Tune runs to completion, but you experience torque saturation, voltage saturation, or both during regular machine operation, you may be exceeding the supply's voltage and/or current capability.

Possible remedies for underpowered DC Bus Motor Supply

- **Lower the commanded acceleration and/or velocity.** Sometimes lowering commanded acceleration and/or velocity can reduce the burden on a weaker power supply enough to eliminate shutdowns caused by "power starvation".
- **Upgrade to a more powerful supply.** Look for a supply with higher voltage, higher peak and continuous current ratings, and a large capacitor bank.

SWITCHING POWER SUPPLIES

Switching power supplies will work with ClearPath motors but **switchers are often not well-suited to high power servo applications** because they generally have the same peak and continuous current ratings. This can lead the user to purchase a large but ultimately under-worked power supply just to meet peak current requirements.

In addition, most switching supplies are not designed to manage the regenerated energy (back-EMF) that a heavily loaded decelerating motor returns to the power supply, especially when gravitationally loaded. Without special provisions, regenerated energy can cause a switching supply to reset, power cycle, shut down, or even fail.

POWER SUPPLY COMPLIANCE NOTES

- Any 3rd party (non-Teknic) power supply used with the POWER4-HUB-S or PWR-STRIP-S, should be current limited or fused to 25A or less using a 25A, >100VDC fuse.
- If UL compliance is a consideration, select a UL Listed DC fuse.

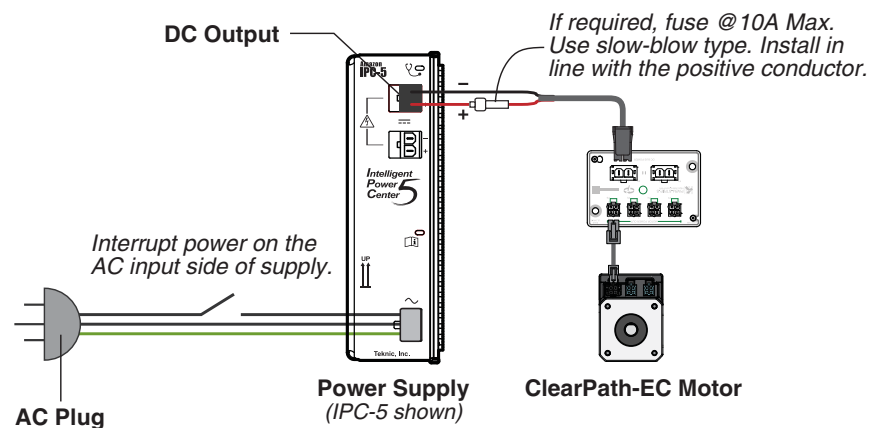
POWER SUPPLY SWITCHING AND FUSING

POWER SUPPLY ON/OFF SWITCHING

When power switching is required, switch the AC input power to the supply rather than its DC output. Switching the DC output, particularly with electromechanical relays, can cause contact pitting, corrosion, or welding, potentially resulting in intermittent power and unreliable operation.

POWER SUPPLY FUSING

If you require an external fuse on your power supply's DC output (to meet compliance standards for example) it should be installed in line with the positive leg of the DC output wiring. Use a maximum 10A time delay fuse.



FAQ: "HOW DO I SIZE A DC BUS POWER SUPPLY?"

Determining the DC bus power requirements for a complex machine can be challenging. The exact requirements depend on many interrelated factors, including the number and type of motors and drives connected to the supply, the torque, speed, and acceleration requirements for each motor, environmental factors, and more.

At the systems level, factors such as axis duty cycle, effects of synchronous motion, and regenerated energy management also come into play.

Because of these variables, power supply selection often involves making an initial estimate and then verifying it through testing on the actual machine. For applications with several motors operating at high speeds and torques, consider starting with a Teknic IPC-5 75 VDC power supply. If additional power is required, another supply can be added. A single-axis machine moving a relatively light load at low speed will require considerably less power.

Whenever practical, verify the selected power supply under actual machine operating/loading conditions.

CONNECTING TO AN ETHERCAT NETWORK

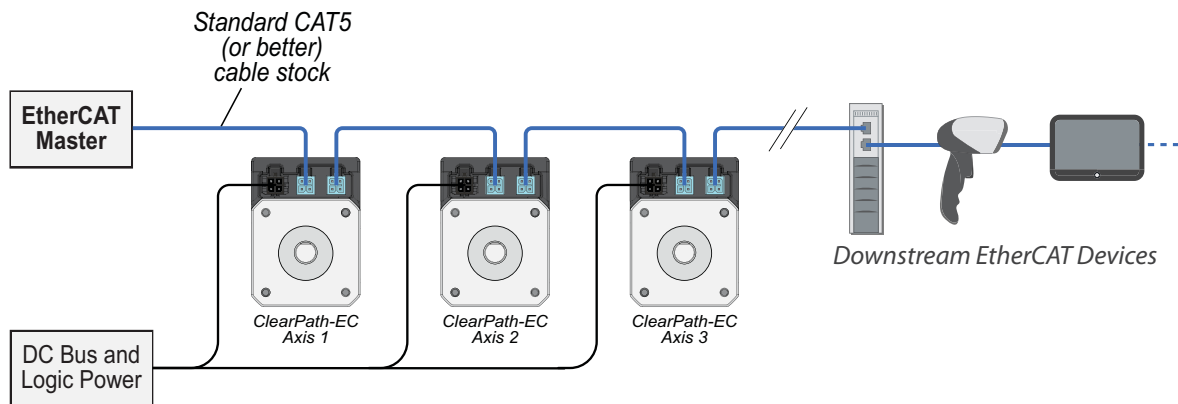
This section discusses how ClearPath-EC motors can be integrated into your EtherCAT machine topology.

The ClearPath-EC system:

- Uses a low-cost, motor-to-RJ45 cable available from Teknic (PN: CPMT-CABLE-NET-YR120), to connect ClearPath to your EtherCAT master or to third party EtherCAT devices.
- Use a motor-to-motor EtherCAT network cable to daisy chain communications between ClearPath-EC motors. available from Teknic (PN: CPMT-CABLE-NET-YY072 or CPMT-CABLE-NET-YY240),.

CLEARPATH-EC CONNECTIONS OVERVIEW

ClearPath-EC components easily connect to EtherCAT compliant systems.



ClearPath-EC EtherCAT system overview

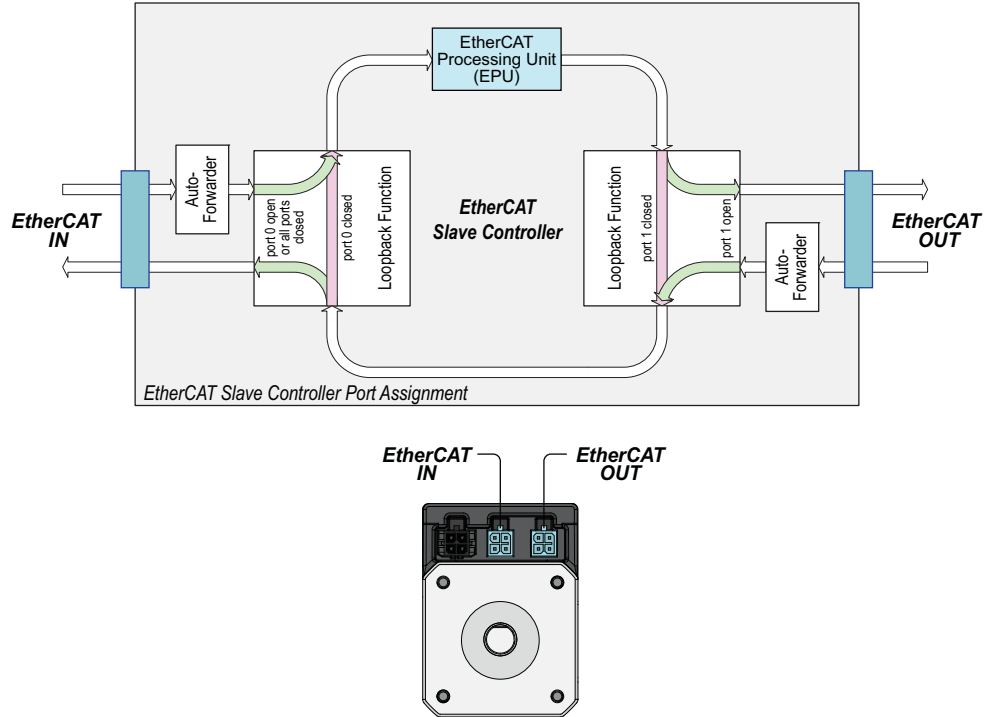
ETHERCAT MASTER

All EtherCAT Masters that support the CiA® 402 device profiles should be compatible with ClearPath-EC motors.

IMPORTANT: It is the user's responsibility to verify that the Network Interface Card (NIC) in the EtherCAT Master uses an EtherCAT-compatible chipset.

CLEARPATH-EC / ETHERCAT PORT TOPOLOGY

ClearPath-EC motors include two 4-position Micro-Fit+ connectors for EtherCAT network connectivity, enabling multiple motors and other EtherCAT devices to be connected in a daisy-chain configuration.

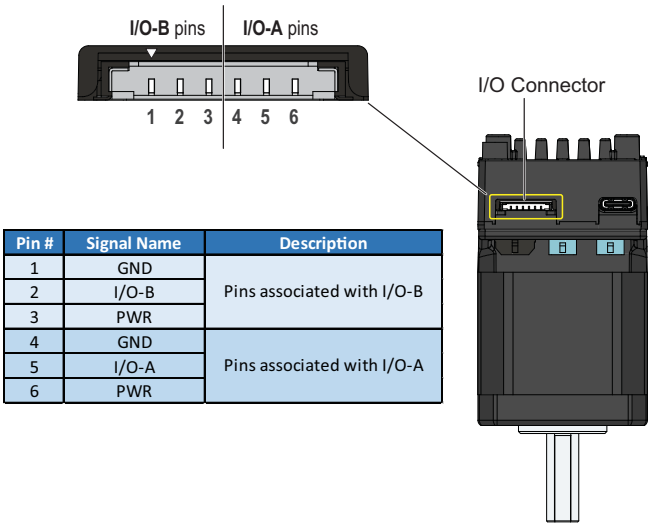


NEMA 17 ClearPath-EC: EtherCAT Port Topology

INPUTS AND OUTPUTS

CLEARPATH-EC I/O CIRCUITS

ClearPath-EC motors include two high-speed digital I/O circuits for connecting sensors, actuators, logic level devices, brakes. These circuits are referred to as **I/O-A** and **I/O-B** in this document.



I/O LOGIC POWER

The ClearPath-EC I/O connector provides PWR and GND for powering external I/O devices such as NPN and PNP sensors, as well as brakes, fans and other devices. The voltage at the PWR pins is the same as the Logic Power voltage supplied to the motor up to ~ 35 VDC (see note* below). For example, supplying the motor with 24 VDC Logic Power provides 24 VDC at the I/O connector PWR pins.

Most I/O devices used with ClearPath-EC operate at 12 VDC or 24 VDC. When using powered I/O devices, select a Logic Power voltage that is compatible with your I/O devices.

*I/O Connector Voltage and Current Notes

The I/O connector is automatically disabled if the Logic Power voltage exceeds approximately 35 VDC. Logic Power up to 75 VDC may still be used when external I/O is not required. This does not otherwise affect motor operation.

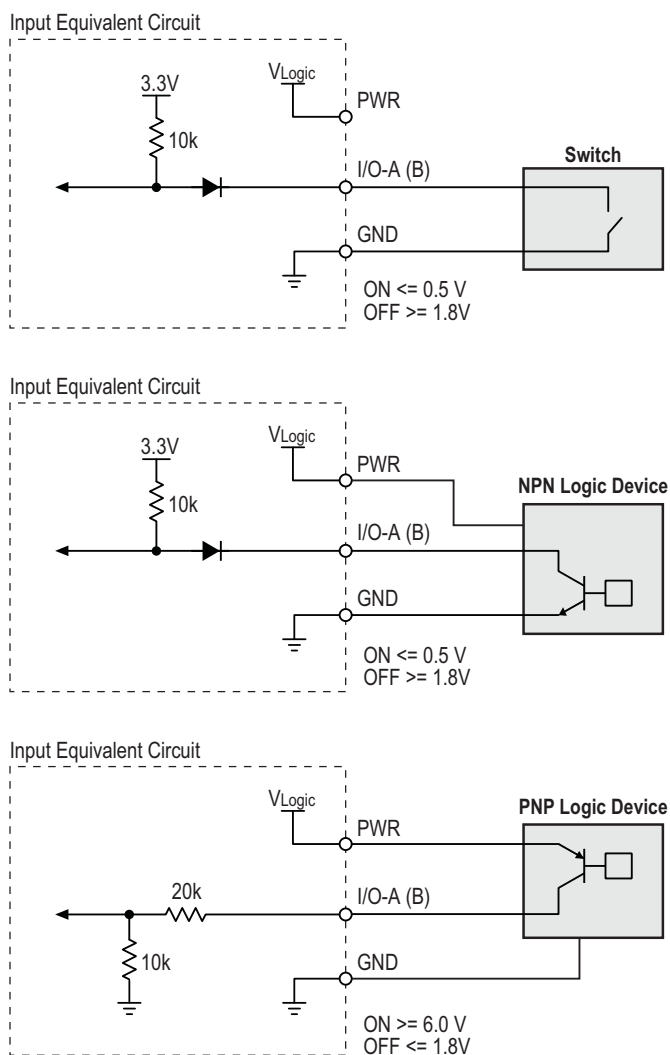
The I/O connector is limited to 300 mA of sourced current per I/O point. This limit includes current supplied through the PWR pins and current sourced by I/O-A or I/O-B. Current sunk by an I/O point does not count toward the 300 mA limit.

CLEARPATH-EC INPUTS

When configured as inputs, I/O-A and I/O-B can accept signals from switches, limit and home sensors, relays, and other digital devices. The EtherCAT Master can read the state of each input and use it for application-level control and monitoring.

INPUT WIRING (SWITCHES, NPN, PNP LOGIC DEVICES)

Input A, and *Input B*, are designed for use with 12-32 VDC logic levels and pulses from a variety of signal sources and devices including sensors and mechanical switches. 12 VDC and 24VDC devices are commonly used.



ClearPath Input Wiring

AUTOMATIC INPUT FEATURES

In addition to providing general-purpose inputs for the EtherCAT Master, the inputs can be assigned to dedicated functions that are handled directly by the motor.

1. **Limit Sensor.** Stops motion in a specified direction when the limit input is triggered. A linear axis can use one, two, or no limit inputs.
2. **Home Sensor.** Monitors a sensor used to establish a reference position during a homing operation. Home sensor functionality can be combined with limit sensors on a linear axis.
3. **Touch Probe.** Input A can be configured for high-speed position capture using a touch probe or other trigger sensor. When triggered, the motor captures its internal encoder position and stores the value for retrieval by the EtherCAT Master. This can be used for calibration, on-the-fly registration, and similar applications.
4. **Interlock Switch.** Disables the servo when the input is triggered. This function is not safety rated.

CLEARPATH-EC OUTPUTS

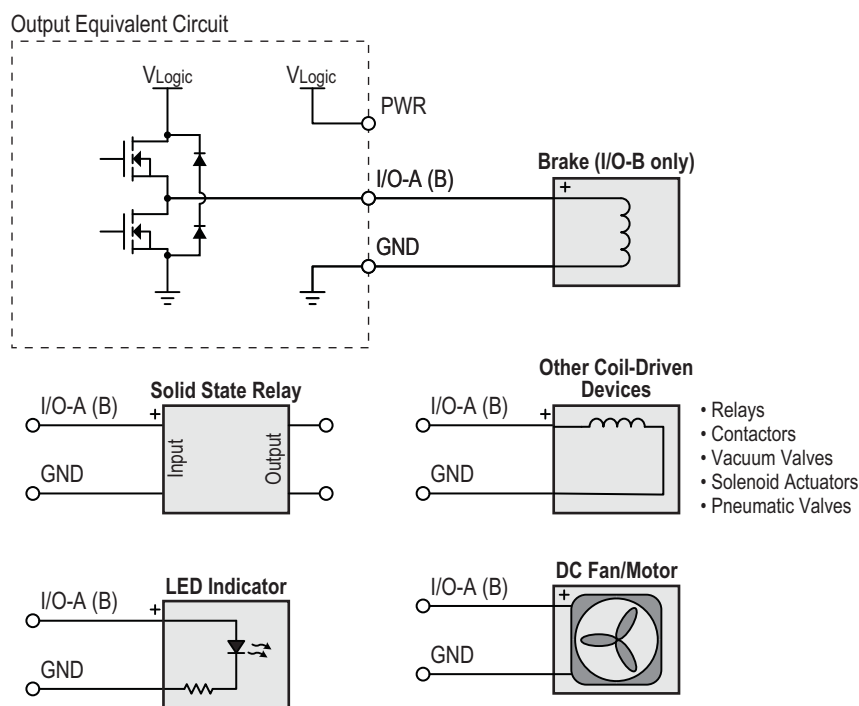
I/O-A or I/O-B can be configured as outputs, supporting devices such as power-off brakes (I/O-B only), cooling fans, small DC motors, and more.

OUTPUT WIRING

Any external circuit or device connected to the ClearPath output should conform to the guidelines below. Proper circuit design/selection greatly reduces the probability of electrically damaging the output, particularly in the event of a common production mistake such as an accidental short or reversed wiring.

PUSH-PULL DIGITAL OUTPUT

When configured as a Push-Pull Digital Output, ClearPath-EC's I/O can be used to control a variety of 12/24 V devices, including solid-state relays, LEDs, coil-driven devices, pneumatic valves, solenoid actuators, DC fans, and small DC motors. **Note:** Only I/O-B supports automatic brake functionality.



Push-Pull Output Wiring

SOFTWARE (CLEARVIEW 3.0)

ClearView 3.0 software provides a suite of powerful configuration, analysis, and diagnostic tools to speed machine and software development. These tools—the Soft Scope in particular—make it easy to capture and share key motion performance data.

MINIMUM SYSTEM REQUIREMENTS

Operating System:	Windows 10 or later; ARM-based systems are not supported.
Processor:	1.5 GHz or faster
Memory:	2 GB RAM
HD Free Space:	1 GB
Monitor:	1280 x 1024 pixels or higher
Other:	Sound card with speakers (optional)

INSTALLING CLEARVIEW 3.0 SOFTWARE

- Download the ClearView 3.0 installer from <https://www.teknic.com/downloads/>.
- Launch the ClearView 3.0 installer.

USING THE DIAGNOSTIC PORT

EtherCAT Port vs. Diagnostic Port

ClearPath-EC motors communicate with the EtherCAT Master over the **EtherCAT Port**.

The Diagnostic Port is used for temporary tasks such as motor configuration and diagnostic work. It requires a separate PC running ClearView 3.0. Communication occurs through the motor's USB-C Port.

A key benefit of the Diagnostic Port is that it allows the user to run their machine software on the "main" channel (aka, the EtherCAT Port) while simultaneously monitoring performance on the Diagnostic Port.

TERMS USED IN THIS SECTION

Master. This is the EtherCAT Master device that controls the machine application.

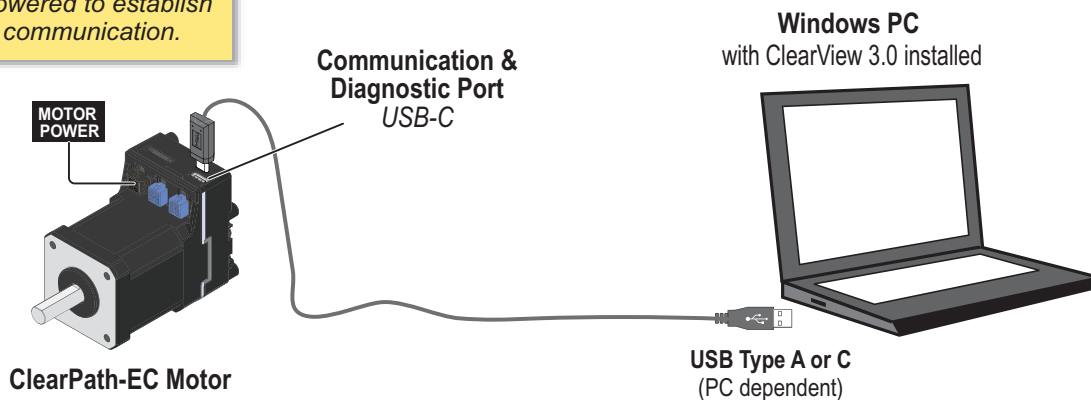
EtherCAT Port. This is the communication channel between the Master and the ClearPath-EC motors.

Communication and Diagnostic Port. This is a secondary data channel that sends data between the ClearPath-EC and a separate PC running ClearView 3.0. The Diagnostic Port is accessed via the **USB-C Port** on the top of the motor.

CONNECTING TO THE MOTOR DIAGNOSTIC PORT

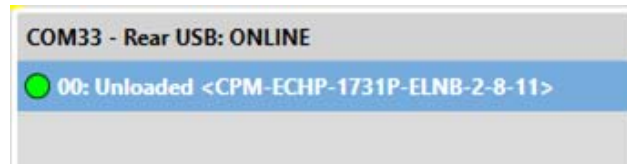
1. Connect a USB cable (Type A-C) to the motor's USB-C Port. Then plug the other side into your PC.

Note: The motor must be powered to establish USB communication.



2. ClearView 3.0 should automatically identify your motors as shown below.

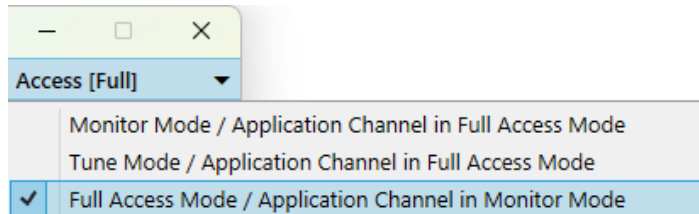
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CHANGING DIAGNOSTIC PORT ACCESS MODES

Set the access level using the drop down located in the upper right-hand corner of the Main ClearView 3.0 window.

#



DIAGNOSTIC ACCESS MODES

Monitor Mode

In Monitor Mode, ClearView 3.0 can access the Soft Scope through the Diagnostic Port, while most other settings and parameters are unavailable. Restricted UI items are grayed out. The EtherCAT Master retains Full Access in this mode.

Tune Mode

In Tune Mode, ClearView 3.0 has access to the Soft Scope and most of the tuning gains, RAS settings, following error limit, and fine tuning controls. The EtherCAT Master retains Full Access in this mode.

Full Access Mode

In Full Access Mode, ClearView 3.0 has full control of the motor, including access to all normally available settings and parameters. The EtherCAT Master is placed in Monitor Mode, and any commands it sends are ignored.

TROUBLESHOOTING DIAGNOSTIC PORT CONNECTIONS

If your motors stop communicating with ClearView 3.0, or if you get baud rate errors when connecting or reconnecting to the USB Port, follow these steps:

1. Check that DC Bus Power and Logic Power (if applicable) are present at the motor.
2. Verify that the USB cable is securely attached to the motor's USB-C Port.

3. Check that the motor's USB-C port is free of dirt and debris.
4. Restart ClearView 3.0

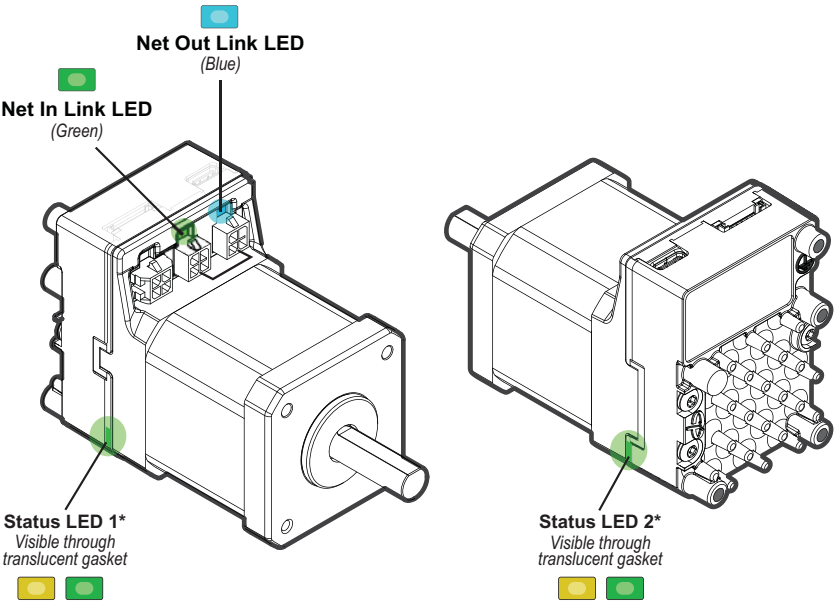
CLEARPATH-EC SOFTWARE REFERENCE

The ClearPath-EC Software Reference Manual is available on the Teknic Downloads page. See link below:

https://teknic.com/files/downloads/ClearPath-EC_Software_Reference.pdf

APPENDIX A: TROUBLESHOOTING

LED BLINK CODES



Link Activity and Status LEDs

Status LEDS	Motor Status
Green flicker	Motor Enabled
Green solid	Motor Disabled
Yellow blink	Motor in Shutdown
Red blink	Hardware Error

Green Link LED	Blue Link LED	Link Activity Description
On	x	IN Link connected. No activity present.
Flickering	x	IN Link connected. Activity present.
Off	x	IN Link not connected.
X	On	OUT Link connected. No activity present.
X	Flickering	OUT Link connected. Activity present.
X	Off	OUT Link not connected.

APPENDIX B: MECHANICAL REFERENCE

DIMENSIONED DRAWINGS (LINKS)

CLEARPATH-EC MOTOR

[NEMA 17 Frame ClearPath-EC Motor](#)

POWER DISTRIBUTION BOARDS

[POWER4-HUB-S](#)

[POWER4-STRIP-S](#)

MOTOR MOUNTING CONSIDERATIONS

Tip: Teknic recommends mounting the motor such that the USB-C communication port and status LEDs are visible and accessible whenever practical.

- **Do not** mount ClearPath motors over a heat source such as a deep fryer, heater, or hot exhaust pipe. ClearPath will automatically shut down if its internal temperature exceeds its maximum setting.
- **Do not** mount ClearPath motors in an unventilated enclosure.
- **Do** allow for at least 1" of space around each motor.
- ClearPath can be fitted with an external accessory fan if desired. See **Fan Mounting and Cooling** later in this section for details.

CONNECTING CLEARPATH TO A MECHANICAL SYSTEM

ClearPath must be properly connected to the mechanical system to achieve reliable motion and optimal servo performance. The appropriate shaft interface depends on the application and may include a coupling, pulley, pinion, or other mechanical connection.

Poor mechanical connections can cause slippage, excessive backlash, or problems associated with shaft misalignment. The selected interface should be appropriate for the application, whether driving a precision positioning stage, a low-speed conveyor, or another type of mechanism.

The shaft interface must be securely clamped to the motor shaft with minimal backlash (ideally none). A rigid, secure mechanical connection is essential for achieving and maintaining optimal servo system performance.

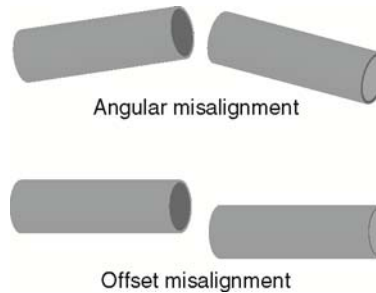
MOTOR CONNECTION: GENERAL TIPS AND GUIDELINES

This section contains information and tips on how to safely and securely couple a motor to a mechanical system.

For more information on this topic, visit the Teknic website:

<https://teknic.com/securing-mechanics-motor-shafts/>

- **Align with care.** When connecting two shafts—such as a motor shaft to a screw shaft—the rotating centers must be carefully aligned in both the angular and offset sense (including offsets/adjustments for thermal growth) to achieve the best possible motion quality and longest motor/bearing life.



Some couplings are more forgiving of misalignment than others, but in general, misalignment will cause undesired vibration/noise, shortened bearing life, or even broken motor shafts in extreme cases.

- **Use lightweight components.** Aluminum couplings, pinions, and pulleys add significantly less inertia to the motion system than steel parts of the same size. In most applications, lower inertia is preferable because it allows the motor (and attached mechanics) to accelerate harder and move and settle faster.
- **Avoid set screws whenever possible.** Coupling devices with set screws are prone to failure and often become the weak link when joining a motor to a load. Set screws deform the metal around the screw's point of contact, often resulting in a raised bur on the shaft that can make it hard to remove and replace the coupling element. Set screws also tend to slip and score the shaft.
- **Tip:** Couplings, pulleys and pinions with circumferential clamping mechanisms tend not to damage motor shaft, hold better, and are easier to replace than those that use set screws.
- **Clamp close to the motor.** For maximum performance, secure pulleys and pinions as close to the motor face as is practical. This effectively reduces the lever arm (and associated bearing load) for applications with a side load.
- **Don't over-tension belts.** Always read the belt manufacturer's guidelines for proper belt tension, but never exceed the ClearPath specification for maximum side load. Overly tight belts put undue stress on the motor shaft and bearing systems that can result in premature bearing and shaft failure.

- **Avoid using shaft keys when possible.** Although some ClearPath motors include a keyway feature on the shaft, Teknic does not generally recommend the use of keys. Keys tend to cause run-out and backlash errors, particularly in reciprocating, precision positioning motion applications.

However, keys *should be considered* for use in applications where coupling slip could result in a dangerous or hazardous condition. Also, key use may be appropriate for unidirectional applications (where the motor always spins in the same direction) as these applications are less prone to key-related lash problems.

- **Avoid direct loads.** In general, ClearPath motors are not designed for connection to direct loads (e.g. direct connection to a grinding wheel). However, direct connection may make sense if the load is of low-mass and balanced, as with small mirrors for laser applications.

COUPLING SELECTION

Selecting the appropriate coupling is important to servo system performance and reliability. Because coupling requirements vary considerably by application, a complete discussion of coupling selection is beyond the scope of this manual.

For additional information, see *Securing Mechanics to Motor Shafts* on the Teknic website: <https://teknich.com/securing-mechanics-motor-shafts/>

General Guidelines for Coupling Selection

The following guidelines apply to many servo applications but should be considered general rules of thumb:

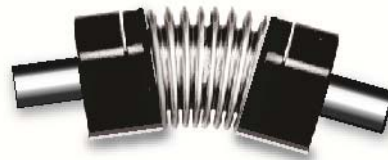
- **Size the coupling appropriately.** Determine the application's torque requirements and select a coupling that operates within the manufacturer's specifications, with reasonable engineering margin.
- **Avoid set-screw couplings.** Set screws can damage the motor shaft and generally provide a less reliable connection than clamp-style couplings.
- **Use clamp-style couplings.** These provide a secure connection by clamping around the circumference of the shaft without damaging or permanently deforming it.
- **Avoid rigid couplings.** Rigid couplings have little tolerance for shaft misalignment and can transmit undesirable loads to the motor bearings.
- Use caution with beam (helical) couplings. Their relatively low torsional stiffness can make them unsuitable for applications requiring high stiffness or vibration damping, and they may resonate at higher speeds.

Coupling Recommendation

Teknic often recommends **zero-backlash curved jaw couplings** (commonly referred to as “spider couplings”) as a good choice for many servo applications. These couplings are moderately priced and widely available from well established manufacturers such as Ruland.



Curved Jaw (Spider) Coupling



Bellows Coupling

Couplings for servo applications

Teknic often recommends zero-backlash **curved-jaw couplings**, sometimes called spider couplings, for general-purpose servo applications. They provide good positioning performance and vibration damping, and are widely available from established manufacturers.

For high-precision positioning applications, **bellows couplings** are another excellent choice. They provide high torsional stiffness and can accommodate greater misalignment than curved-jaw couplings, although they are generally more expensive.

Coupling Information on the Web

Ruland provides a useful collection of technical information covering coupling types, selection, and application. See the links below.

<https://www.ruland.com/technical-resources/technical-articles>

<https://www.ruland.com/technical-resources/technical-articles/5-reasons-to-consider-using-jaw-couplings>

INSTALLING PULLEYS AND PINIONS

PULLEY AND PINION MOUNTING

- Always follow the manufacturers mounting guidelines.
- Mount pulleys and pinions as close to the motor face as possible while still following the manufacturer’s installation guidelines.
- Never drill through, “pin”, or deform the motor shaft when mounting a pulley or pinion.

Application Tip: To prevent loose or slipping pulleys and pinions, some customers use Loctite 638 to bond components to the motor shaft. **Note:** **Loctite 638 is a very strong adhesive.** When fully cured, Loctite 638 can only be removed by applying heat to the bonded parts.

ABOUT END-OF-TRAVEL STOPS

End-of-travel stops are used to prevent the moving element of a linear axis from traveling beyond its intended range in the event of a control or user error. Several types of end stops are commonly used; the appropriate choice depends on the mechanical system and application requirements.

HARD BLOCKS

Hard blocks are typically made from steel, aluminum, or hard plastic and are installed at one or both ends of travel. They should be positioned to provide consistent, repeatable contact with the moving element. Hard blocks are effective at stopping motion but may cause mechanical damage if struck at high speed.

ELASTOMERIC (RUBBER) STOPS

High-durometer elastomeric stops can provide greater shock absorption and axis protection than hard blocks and may also be used with Hard Stop Homing. Very soft, low-durometer stops are generally not recommended because they provide limited benefit during a high-energy axis impact and may reduce homing repeatability.

PNEUMATIC OR HYDRAULIC DAMPERS

Pneumatic or hydraulic dampers can provide excellent shock absorption and reduce mechanical impact loads, but they are generally more expensive than simple hard stops. Common examples include industrial dashpots and shock absorbers designed for machine applications.

END STOPS AND HARD STOP HOMING

A range of end-stop materials, from medium-durometer elastomers to rigid metal stops, can be used successfully with Hard Stop Homing. When selecting an end stop, consider the following:

- Low-friction axes that are easily back-driven can often use softer elastomeric stops while maintaining good homing performance.
- Higher-friction axes, or axes that are difficult to back-drive, will generally require a harder end stop to achieve consistent homing performance.
- Testing may be required to determine the end-stop material that provides the best combination of repeatability, durability, and mechanical protection for the application.

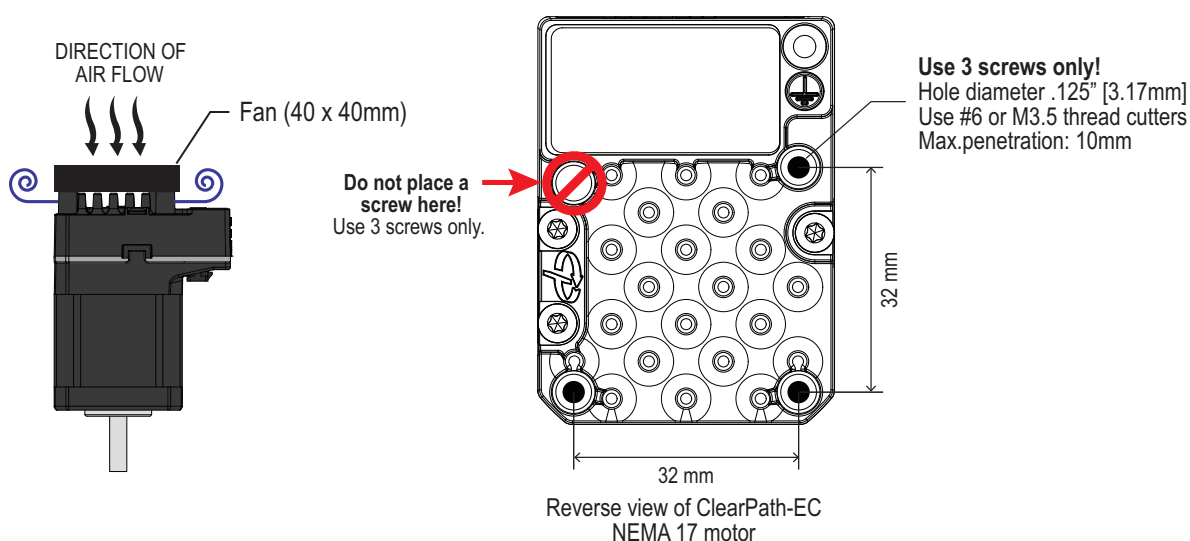
FAN MOUNTING (OPTIONAL)

ClearPath-EC motors include unthreaded mounting bosses on the rear housing for attaching a standard 40 mm cooling fan. Secure the fan using #6 or M3.5 thread-cutting screws

Note: Accessory fans are optional and available from electronics suppliers such as DigiKey and Mouser. Fans require an external power source, typically 12 VDC or 24 VDC.

Note: As with most electronic products, *cooler is better*. So, even though ClearPath can reliably operate at elevated temperatures, keep motor thermal considerations in mind when designing a ClearPath system.

Note: ClearPath will shut down to self-protect when the rear cover temperature reaches approximately 80 degrees C.



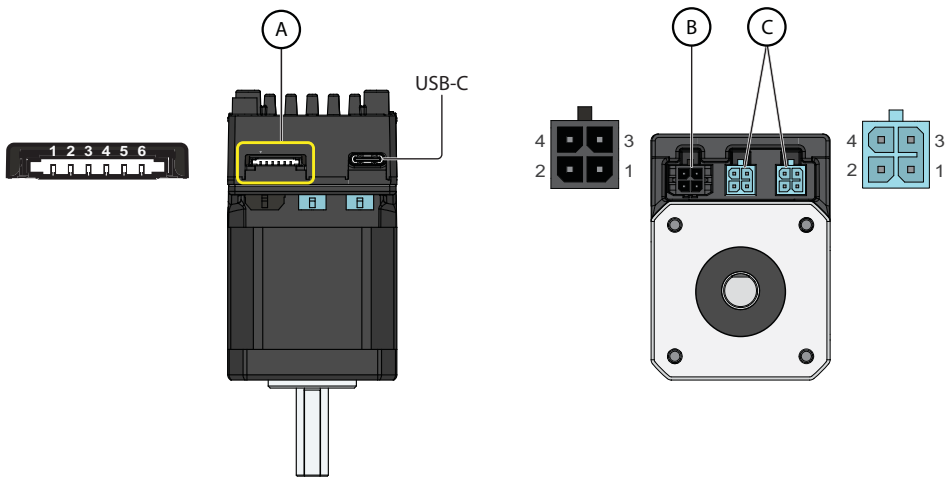
Side and rear view of ClearPath-EC NEMA 17 motor

APPENDIX C: CONNECTOR AND CABLE REFERENCE

This section contains part numbers for ClearPath-EC mating connectors, terminals, and tools.

MATING CONNECTORS

CLEARPATH-EC NEMA 17 MOTOR

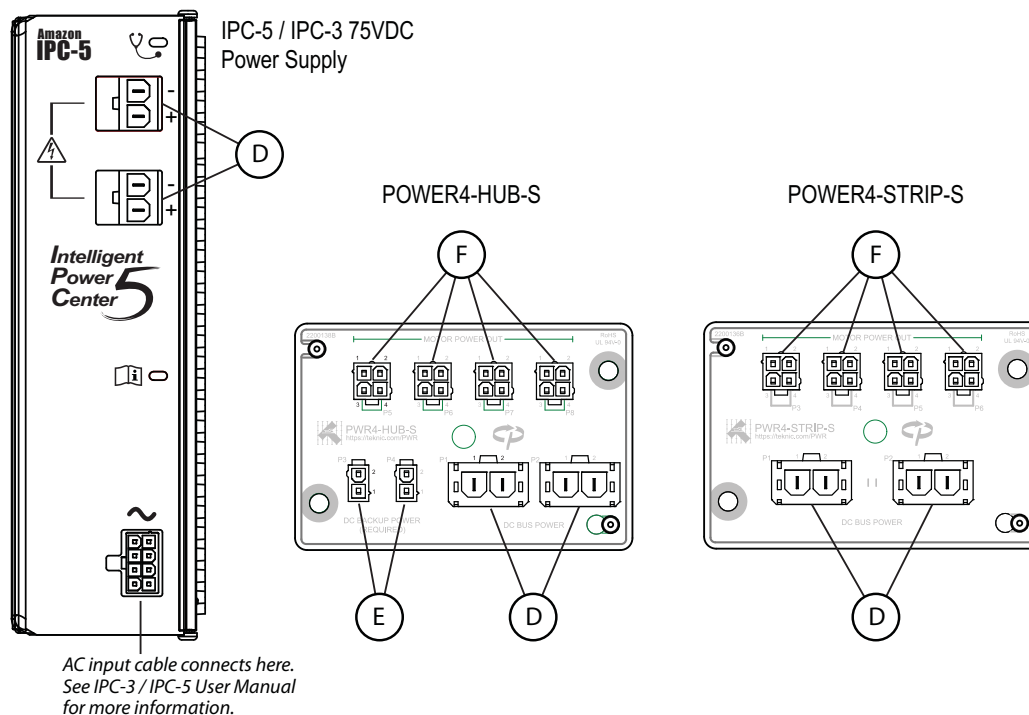


For complete specifications and application information, visit www.molex.com

Mating Connector							
Ref.	Desc.	PN	Terminal PN	Terminal Desc.	Crimp Tool	Extraction Tool	Wire Gauge ¹
A	Molex Pico-Lock, Receptacle, 6 circuits	Molex/ 5040510601	Molex/ 5040520098	Female crimp terminal, 24-28 AWG	Molex/ 638270800 (24-28 AWG)	Molex/ 638132700 or sharp tool	24 AWG
B	Molex Micro-Fit 3.0, Receptacle, 4 circuits	Molex/ 0430250408	Molex/ 0430300001	Female crimp terminal, tin plate, 20-24 AWG	Molex/ 0638190000 (20-30 AWG)	Molex/ 11030043	2x24 AWG (Pins 1,4)
			Molex/ 0430300038	Female crimp terminal, tin plate, (18 AWG)	Molex/ 0638280200 (18 AWG)		2x18 AWG (Pins 2,3)
C	Molex Micro-Fit+ Versa Receptacle, 4 circuits	Molex/ 2064610403	Molex/ 2064600021	Female crimp terminal, tin plate, 20-24 AWG	Molex/ 2133094700 (24 AWG)	Molex/ 11030043	24 AWG

¹AWG values listed are the actual wire gauges used in Teknic-manufactured cables.

POWER4-HUB-S, POWER4-STRIP-S, IPC-5



For complete specifications and application information, visit www.molex.com

Ref.	Desc.	Mating Connector PN	Terminal PN	Terminal Description	Crimp Tool	Extraction Tool	Wire Gauge ¹
D	Molex Sabre, Receptacle, 2 circuits	Molex/ 44441-1002 (natural, UL 94V-2) 44441-2002 (black, UL 94V-0)	Molex/ 43375-0001	Female crimp terminal, tin plate, 14-16 AWG	Molex/ 638117200 (14-16 AWG)	63813-2700	16 AWG
E	Molex MiniFit-Jr, Receptacle, 2 circuits	Molex/ 39-01-2020 (natural, UL 94V-2) 39-01-3025 (black, UL 94V-2) 39-01-3028 (natural, UL 94V-0) 39-03-9022 (black, UL 94V-0)	Molex/ 39-00-0059 (reel) 39-00-0060 (loose)	Female crimp terminal, tin plate, 18-24 AWG	Molex/ 638190901 (18-24 AWG)	11-03-0044	20 AWG
F	Molex MiniFit-Jr, Receptacle, 4 circuits	Molex/ 39-01-2040 (natural, UL 94V-2) 39-01-3045 (black, UL 94V-2) 39-01-2045 (natural, UL 94V-0) 39-03-9042 (black, UL 94V-0)	Molex/ 39-00-0059 (reel) 39-00-0060 (loose)	Female crimp terminal, tin plate, 18-24 AWG	Molex/ 638190901 (18-24 AWG)	11-03-0044	18 AWG (Pins 2,3) 24 AWG (Pins 1,4)

¹AWG values listed are the actual wire gauges used in Teknic-manufactured cables.

CABLE DRAWINGS (ALL LINKS GO TO TEKNIC.COM)

POWER CABLES

[CPMT-CABLE-PWR-YM120](#)

ClearPath NEMA 17 Motor Power Cable. Molex Mini-Fit Jr. 4-position to Molex Micro-Fit 3.0 4-position, 10ft [3.05m]

[CPMT-CABLE-PWR-YY660](#)

ClearPath NEMA 17 Motor Power Cable. Molex Micro-Fit 3.0 4-position to Molex Micro-Fit 3.0 4-position, 55ft [16.8m]

[PC-SBR-72](#)

DC Bus Power Cable. IPC-3 or IPC-5 to Power4 products, 6ft [1.8m]

[CPM-CABLE-M2P2P-120](#)

2-Position Low Voltage Power Cable. Molex Mini-Fit Jr. 2 to Molex Mini-Fit Jr. 2, 10ft [3.05m]

NETWORK CABLES

[CPMT-CABLE-NET-YR120](#)

ClearPath EC NEMA 17 Motor Network Cable. Molex Micro-Fit+ Versa Color (blue) 4-position to RJ45, 10ft [3.05m]

[CPMT-CABLE-NET-YY072](#)

ClearPath EC NEMA 17 Motor Network Cable. Molex Micro-Fit+ Versa Color (blue) 4-position to Molex Micro-Fit+ Versa Color (blue) 4-position, 6ft [1.83m]

[CPMT-CABLE-NET-YY240](#)

ClearPath EC NEMA 17 Motor Network Cable. Molex Micro-Fit+ Versa Color (blue) 4-position to Molex Micro-Fit+ Versa Color (blue) 4-position, 20ft [6.1m]

I/O CABLE

[CPMT-CABLE-IO-PP203](#)

ClearPath EC NEMA 17 Motor I/O Cable. 6-Position Molex Pico-Lock to 6-position Molex Pico-Lock. 23.6in [60mm]

APPENDIX D: SPECIFICATIONS

CLEARPATH-EC MOTOR: COMMON SPECIFICATIONS (NEMA 17)

Functional Specifications:	
EtherCAT Drive Profile	CiA402 conforms to IEC 61800-7-201; CoE, FoE
EtherCAT Vendor ID	0x0C96
Supported Operating Modes	Cyclic Synchronous Position (CSP), Cyclic Synchronous Velocity (CSV), Cyclic Synchronous Torque (CST), Profile Position (PP), Profile Velocity (PV), Profile Torque (TQ). Homing (HM)
Distributed Clocks	Included
Homing Modes Supported	Homing to the motor's current position, home to a hard stop, home to a sensor, home to a limit switch
Position Limit Modes Supported	Software Limits (after homing), up to two limit switches
Maximum Shaft Rotational Speed	Model dependent
Position Sensor Resolution (Encoder)	High Res ("E"): 51,200 counts per revolution Low Res ("R"): 12,800 counts per revolution
Absolute Position Sensor Function	Implemented by battery backup of the Logic Supply. (A single battery and charger can provide absolute position function for all motors in a machine.)
Digital I/O Complement	Two (2), independently configurable as an input or output
Brake Control	Included
Safe Torque Off (STO) Functionality	Via DC bus removal by external device, resettable via network command
Safe Stop (SS2-t) Functionality	Via DC bus clamp by external device, resettable via network command
Protection Modes	Following error shutdown, Bus over-voltage, Bus undervoltage, Bus RMS current limit, Drive instantaneous current limit, Motor RMS current limit (slow + fast), Drive overtemperature, Position sensor fault
Configuration Port:	
Physical Layer:	USB-C
IP Protection:	IP53 protection
Configuration Software Functions:	Motion monitoring with real-time scope and numerous trigger modes, servo compensator tuning (automatic and manual), fault log display, configuration file load/save, EtherCAT parameter browser/watch window, remote support tools.
Configuration Software Compatibility:	Microsoft Windows 10 or later
Electrical Power Requirements, Motor Bus Supply:	
Bus Supply Voltage, Typical:	12VDC to 75VDC
Bus Supply Voltage, Absolute Min:	7VDC
Bus Supply Voltage, Absolute Max:	90VDC
Disabled Power, Maximum	0.025W

Enabled Power @ 75V (zero shaft torque)	0.95W
Electrical Power Requirements, Logic Supply:	
Logic Supply Voltage, Typical:	12VDC to 75VDC
Logic Supply Voltage, Absolute Min:	7VDC
Logic Supply Voltage, Absolute Max:	90VDC
Continuous Logic Power:	1.83W@24V, 1.91W@75V
Continuous Logic Power, Maximum:	2.1W
I/O Circuits (A or B) Specifications, When Used as Inputs:	
Logic Input Voltage Range:	0V - Vlogic (assuming Vlogic is <35V, otherwise IO is shut down)
Input Current @ 5V:	300uA max
Input Current @ 24V:	800uA max
Recognition Time, Maximum:	NPN: 20ns on, 250ns off PNP: 20ns on (24V), 100ns on (12V), 600ns off
Inductive Clamp Voltage:	Vlogic + 1V
I/O Circuits (A or B) Specifications, When Used as Outputs:	
Output Absolute Maximum Voltage	Vlogic (up to 35V)
Output Current, Maximum:	300mA
Output Voltage Drop @ 10mA:	360mV
Output Voltage Drop @ 300mA:	620mV
Inductive Clamp Voltage:	Vlogic + 1V
Motor Bearing:	
Maximum Radial Load:	25 lbs
Maximum Thrust Load:	6 lbs
Environmental:	
Operational Ambient Temperature:	-40 to +70 degrees C
Storage Temperature:	-40 to +70 degrees C
Maximum Body Temp:	125° C
Maximum Rear Cover Temp:	125° C
Humidity	0-85%; non-condensing
Environmental Sealing:	
IP Rating:	Meets IP50 (IP40 when I/O port is in use). For use in dry environments.
Compliance (CE, UL):	
Status:	Pending
Country of Origin:	
Country:	USA
Warranty:	
Warranty Expiration	3 years

POWER4-HUB-S

DC Bus Motor Power (Input from DC Bus Motor Supply)	
Nominal voltage range	12VDC to 75VDC
Max. input voltage	100VDC
Max. continuous current	20A
Peak current (3 seconds)	50A
Connectors	2-pin Molex Sabre (P1, P2)
Logic Power (Input from Logic Power Backup Supply)	
Nominal voltage range (touch-safe)	12VDC to 42VDC
Max. input voltage	100 VDC
Max. continuous current	10A
Max. peak current	10A
Connectors	2-pin Molex MiniFit Jr. (P3, P4)
DC Bus Motor Power (Output to ClearPath motors)	
Max. motors	4
Connectors	4-pin Molex MiniFit Jr. (P1, P2, P3, P4)
Dielectric Withstand Voltage	
Between DC Bus and Backup Power	1,600 VDC
Between DC Bus and chassis plate	1,600 VDC
Between Backup Power and chassis plate	1,600 VDC
Environmental	
Operating temperature**	-40°C to +70°C
Long term storage temperature	-40°C to +50°C
Pollution Degree	2
Dimensions	
L x W x H (w/o baseplate)	3.37" x 2.23" x 0.67"
L x W x H (with baseplate)	3.62" x 2.35" x 1.03"
Country of Origin	USA
Warranty	1 year

***For operation over 40°C refer to power derating data*

POWER4-STRIP-S

DC Bus Motor Power (Input from DC Bus Motor Supply)

Nominal voltage range	12VDC to 75VDC
Max. input voltage	100VDC
Max. continuous current	20A
Peak current (3 seconds)	50A
Connectors	2-pin Molex Sabre (P1, P2)

DC Bus Motor Power (Output to ClearPath motors)

Max. motors	4
Max. continuous current	10A
Peak current (3 seconds)	20A
Connectors	4-pin Molex MiniFit Jr. (P1, P2, P3, P4)

Environmental

Operating temperature**	-40°C to +70°C
Long term storage temperature	-40°C to +50°C
Pollution Degree	2

Dielectric Withstand Voltage

Between DC Bus and chassis plate	1,600 VDC
----------------------------------	-----------

Dimensions

L x W x H (w/o baseplate)	3.37" x 2.23" x 0.67"
L x W x H (with baseplate)	3.62" x 2.35" x 1.03"

Country of Origin

USA

Warranty

1 year

***For operation over 40°C refer to power derating curves in this manual*

APPENDIX E: GROUNDING AND SHIELDING

PROTECTIVE EARTH (PE) CONNECTION

Compliance Note: ClearPath must be properly connected to the machine's Protective Earth terminal to meet EMC emissions/immunity specification EN-61800-3, as well as electrical safety specification EN-61010 (for CE/UL compliance).

Connect ClearPath to your machine's Protective Earth terminal (PE) using one of the following methods.

- **If the motor mounting plate is bonded to machine PE (typical),** most of the work is already done. Simply secure ClearPath to the mounting plate with conductive fasteners (don't use anodized or coated hardware). Ensure direct, bare metal-to-metal contact between the ClearPath motor face and mounting surface.
- **If the motor mounting plate is *not* bonded to machine PE** it's still easy to make a good PE connection. Just install a grounding wire from ClearPath's Auxiliary PE Connection Point (located on the motor's rear casting) to a point on the machine that is bonded to machine PE. **Use #6-32, thread forming screw, 5/16" length** (McMaster-Carr PN 93878A145). Use grounding wire with same AWG number (or heavier) as the ClearPath DC power input wiring.

Note: In scenarios where ClearPath *is not* connected to a PE (Protective Earth) return path—such as during bench testing or maintenance—temporary grounding measures may be necessary to comply with safety requirements.

GROUNDING AND SHIELDING

- Always maintain separation between isolated control ground and power ground.
- Shielded cable is not required for ClearPath control cables.
- If you choose to use shielded control cable, connect the cable's isolated ground at one point (at the controller only). Do not hook isolated control ground to the machine frame or chassis at any other location.
- Do not ground ClearPath I/O circuits to the machine frame or chassis.

Note: All ClearPath I/O signals are electrically isolated from ClearPath's DC bus power input and motor output circuits, as well as from the motor case. This design feature helps to ensure that control signals aren't compromised by induced currents from the motor, power supply, or internal PWM.

POWER RETURNS

- Never use the machine frame or chassis as a power return. Use discrete cable or wires for all power wiring.
- Use only recommended wire gauge for all ClearPath power wiring.

APPENDIX F: CLEARPATH PART KEY

Example
Part Number

C P M - E C H P - 1 7 3 1 P - E L N B

1 2 3 4 5 6 7 8 9 10

1	Product ID	CPM	ClearPath® Motor
2	Family/Model	ECSK	EtherCAT Compatible / Stepper Killer
		ECHP	EtherCAT Compatible / High Power
3	Motor Frame Size	17	NEMA 17 frame
4	Body Length <i>Approx. excludes shaft length</i>	3	74.5 mm
5	Winding/Magnetic Structure	0	Indicates specific winding design. See your motor's torque-speed curve for more information.
		1	
6	Winding Type	P	Parallel-Wye
7	Enhanced Options	R	Regular Positioning Resolution = 12,800 counts per revolution
		E	Enhanced Positioning Resolution = 51,200 counts per revolution
8	Shaft Diameter	L	8 mm
		F	5 mm
9	Shaft Seal	N	Standard dust sealing
10	Feature Set	B	Standard features

APPENDIX G: MISCELLANEOUS

HOW TO MAKE A LOGIC POWER SUPPLY CABLE FOR YOUR POWER4-HUB-S

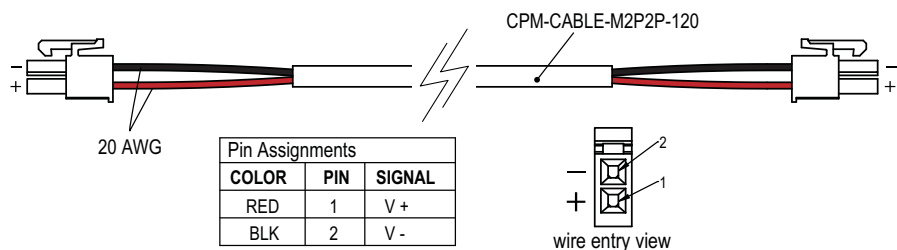
This section describes how to make an inexpensive, no-crimps-required cable to connect your Logic Power Supply to a POWER4-HUB-S.

Notes:

- Most users choose a Logic Power Supply of 12VDC or 24VDC, *but the ClearPath-EC motor will work with any Logic Supply between 12-75VDC.*
- The minimum power requirements of a logic power supply depends on application requirements.

Instructions

1. Select a Logic Power Backup Supply. Typically 12V or 24V, but can be any voltage from 12V-75V.
2. Order a Teknic [CPM-CABLE-M2P2P-120](#). This is a 120" (10-ft.), 2-pin Molex to 2-pin Molex cable as shown below.



CPM-CABLE-M2P2P-120

3. Cut the cable to the desired length. If you cut it exactly in half, you can make two five foot cables.
4. Strip the outer jacket and conductors on the unterminated end of the cable to create flying leads.
5. Connect the flying leads to your Logic Power backup supply. Insulate any exposed conductors with heat shrinkable tubing, electrical tape or similar.

Test DC output polarity before connecting. Use a DMM to verify proper polarity at the DC output connector. Use the above diagram as a reference.

OTHER PRODUCT NOTES

RE: ELECTRICAL FAST TRANSIENT (EFT) TESTING

Electrical fast transient (EFT) testing might induce a motor communication error. In such an event, the motor will come to a controlled stop. The communication error can be cleared by a node reset, after which motion can be resumed on command.

CLEARPATH EMC INSTRUCTIONS

<https://teknich.com/files/downloads/ClearPath EMC Instructions.pdf>

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