ClearLink Hardware Manual
Includes wiring information for CCIO-8 (I/O Expansion Board)
Rev. 1.04 / March 3, 2020
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Introduction

Welcome

Thank you for purchasing a ClearLink EtherNet/IP Motion and I/O Controller. This document is a hardware reference manual for the ClearLink controller, optional I/O expansion board, and optional encoder input board, PN: CL-ENCDFR-DFIN (available early 2021).

For programming information, please see the ClearLink EtherNet/IP Data Reference.

What's in this Document

- Parts identification
- Wiring diagrams for common I/O and motor devices
- Power supply requirements
- Mating hardware information
- Product specifications
- Mechanical dimensions
- Mounting information
Safety Information

Precautionary Statement

Always follow appropriate safety precautions when installing and using any automated motion control equipment. Motion control systems should be designed and utilized to prevent personnel from coming into contact with moving parts and electrical contacts that could potentially cause injury or death. Read all cautions, warnings, and notes before attempting to install or operate this device. Follow all applicable codes and standards when using this equipment. Failure to use this equipment as described may impair or neutralize protections built into the product.

General Disclaimer

The User is responsible for determining the suitability of this product for his or her application. 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 unintentional 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.

Should Teknic's products be 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 and/or bystanders from injury.
Example ClearLink System
Parts Overview

Parts of a ClearLink

- **Digital Inputs (3x)** or **Differential Encoder Input (3-channel)**
  Teknic Encoder Board PN **CL-ENCDR-DFIN*** required.

- **EtherNet/IP Port**
- **USB Port** (not used)
- **Reset Switch**
- **Mounting Holes (2x)**
- **Motor Connectors** (4x) M0-M3 Control ClearPath motors, step motor drives, or servo motor drives
- **Digital Input, Digital Output*, or Analog Output (4-20mA or 0-20mA)**
- **Digital Inputs or Digital Outputs**
- **Card Slot** (not used for ClearLink)
- **DC Power Input** 24VDC
- **CCIO Port**
  RJ-45 connector, used to connect CCIO-8 I/O expansion module(s)
- **Combined I/O Header**
  Can be used in only one of the two ways listed
  - Connect optional Teknic Differential Encoder Board here (Teknic PN **CL-ENCDR-DFIN***).
  - Connect Encoder Board (Teknic PN **CL-ENCDR-DFIN***).

- **Communication Port**
  RJ-45 connector, compatible with UART, or RS-232 devices

- **Breaks out all 13 I/O points.** (Provides an alternative hookup path to the individual 3-pin I/O connectors.)

---

*Digital outputs I/O-0 through I/O-3 have built-in clamping circuitry and are capable of driving coils of up to 9-watts max. I/O-4, I/O-5 can drive up to 18 watts max.*
Parts of a CCIO-8 (I/O Expansion Board)

- **COM IN (RJ-45 jack)**
  - Serial communication input from ClearLink CCIO-8 port or input from the COM OUT connector of a previous CCIO-8.

- **COM OUT (RJ-45 jack)**
  - Serial communication output. Connect to COM IN of next CCIO-8 if applicable, or leave as "no connect".

- **Combined I/O Header**
  - For alternate hookup of I/O points (for use with custom break-out boards, bulkhead connectors, harness, etc.)

- **Mounting Hole**
- **Mounting Plate**
  - Aluminum, 2mm

- **Digital Inputs or Digital Outputs (8 total)**

- **DC Power Input**
  - 24VDC
Powering ClearLink and CCIO-8

ClearLink and CCIO-8 are 24VDC compatible devices. This section includes ClearLink power supply recommendations and wiring instructions.

**Important:** Do not use your ClearLink power supply to also supply DC bus power to servo or stepper drives attached to ClearLink (this applies to ClearPath motors well). **Always use a separate, dedicated power supply, such as the IPC-5, that is specifically designed to meet the power and regenerated energy requirements of servo or stepper motor drives.**

### Recommended Power Supply

**PWR-IO-24VDC**

The [PWR-IO-24VDC](#) power supply (Mean Well PN LRS-150-24) is an inexpensive, 24VDC, 6.5A (156W) switching supply capable of powering most ClearLink applications. Click [here](#) to view product datasheet.

---

**Why choose a "higher current" power supply?**

A power supply of 6.5A or more is recommended for ClearLink applications to ensure that the ClearLink processor always remains powered, even under adverse operating conditions such as overloads or shorts. Note: **Lower current supplies will work with ClearLink but may experience shutdowns or brown outs if ClearLink is overloaded or shorted due to use or application error.**
Wiring DC Power to ClearLink and CCIO-8

See below for instructions on wiring 24VDC power to ClearLink and CCIO-8.

Tools Required
- Slotted screwdriver with max. 2mm wide blade
- Wire cutter/stripper
- 3-position screw terminal connector, Molex part # 0395105003

Procedure
1. Turn off power supply.
2. Strip DC output wires from power supply. Expose approximately 6.5mm (0.25") of bare wire.
3. Fully insert V+ and V- wires fully into terminal block "+" and ground positions.
4. Tighten terminal screws.
5. Inspect connector for good wire capture. Verify that no wire insulation is captured in the closure, and that no loose wire strands are sticking out of the connector.
6. **Recommended**: Before connecting the terminal block to ClearLink, test for correct voltage polarity between "+" and ground terminals.

Connecting power to ClearLink and CCIO-8

Chassis Connection
Mount ClearLink and CCIO-8 to a machine frame or chassis continuous with Protective Earth. Alternately, connect the chassis terminal on the 3-position power connector to machine frame using conductive hardware.
Wiring I/O to ClearLink

Introduction

This section discusses the function and wiring of ClearLink and CCIO-8 user-configurable I/O points.

ClearLink I/O at a Glance

- (13) configurable I/O points
- Up to (13) digital inputs
- Up to (4) analog inputs
- Up to (6) digital outputs (with PWM)
- Up to (1) 4-20mA (or 0-20mA) output
- Separate ground and power for all I/O points (grounds not isolated)
- A dedicated status LED for every I/O point
- Add up to 64 more digital in/out points with Teknic’s CCIO-8 (I/O expansion modules)

I/O Overview Table

The table below lists all ClearLink and CCIO-8 I/O connectors and their supported I/O types. Refer to the ClearLink programming reference for instructions on how to configure ClearLink and CCIO-8 I/O connectors.

<table>
<thead>
<tr>
<th>Label</th>
<th>Digital Input</th>
<th>Digital Output</th>
<th>0-10V Analog Input</th>
<th>4-20 mA Output</th>
<th>Servos or Steppers</th>
<th>Encoder Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>IO-0</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td>yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IO-1</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IO-2</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IO-3</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IO-4</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IO-5</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DI-6</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td></td>
<td></td>
<td>yes³</td>
</tr>
<tr>
<td>DI-7</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td></td>
<td></td>
<td>yes³</td>
</tr>
<tr>
<td>DI-8</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td></td>
<td></td>
<td>yes³</td>
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<tr>
<td>A-9</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A-10</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A-11</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A-12</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M-0</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td></td>
<td></td>
<td>yes³</td>
</tr>
<tr>
<td>M-1</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td></td>
<td></td>
<td>yes³</td>
</tr>
<tr>
<td>M-2</td>
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<td>yes</td>
<td></td>
<td></td>
<td></td>
<td>yes³</td>
</tr>
<tr>
<td>M-3</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td></td>
<td></td>
<td>yes³</td>
</tr>
<tr>
<td>CCIO-8</td>
<td>yes</td>
<td>yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note 1: All digital outputs are PWM capable (except for those on the CCIO-8 expansion board).
Note 2: This output can also provide 0-20mA, which is less commonly used.
Note 3: Each motor connector has 3 digital outputs (step, dir., enable) and 1 digital input.
Note 4: There are 8 of these I/O points on the CCIO-8 expansion module.
Note 5: Additional encoder board required Teknic PN: CL-ENCODR-DFIN

ClearLink I/O overview table
Wiring I/O to the Outer I/O connectors

This section explains how to wire common I/O devices to a ClearLink controller. Each subsection includes a diagram of the ClearLink internal circuitry and several example hookup diagrams.

ClearLink I/O connectors
I/O-0 through I/O-5 configured as DIGITAL INPUTS

Note: The wiring examples shown below also apply to all CCIO-8 I/O points configured as digital inputs.

Input Equivalent Circuit

<table>
<thead>
<tr>
<th>IN[NN]n</th>
<th>3V3</th>
<th>169k</th>
<th>10k</th>
</tr>
</thead>
<tbody>
<tr>
<td>G</td>
<td>S</td>
<td>Gnd</td>
<td>Gnd</td>
</tr>
</tbody>
</table>

Typical Sensor Hookup Details

Digital “NPN” Sensor:
- Proximity
- Optical
- Hall-Effect, etc.

* Wire colors listed are typical of industrial sensors

Switch or Relay Contact

5V/3.3V Logic System

Digital “PNP” Sensor:
- Proximity
- Optical
- Hall-Effect

330 Ω 1/2 Watt
820 Ω 1 Watt

* Wire colors shown are typical of industrial sensors

● Resistors sized for 24VDC supply voltage
● External resistors not included

“Ease of Use” Note: 5V Sensors
Before using 5VDC sensors, consider either
1) sourcing 24V alternatives, or 2) providing a separate 5VDC supply to power your 5V sensors.

IMPORTANT:
Inputs are “negative true”:
On<~1.0V, Off>=~1.0V

* Wire colors shown are typical of industrial sensors
A-9 through A-12 and DI-6 through DI-8 configured as **DIGITAL INPUTS**

### Input Equivalent Circuit

![Diagram of Input Equivalent Circuit]

**IMPORTANT:**
Inputs are “negative true”:
On < ~1.0V, Off ≥ ~1.0V

### Typical Sensor Hookup Details

#### Digital “NPN” Sensor

- **Proximity**
- **Optical**
- **Hall-Effect**, etc.

#### Digital “PNP” Sensor

- **Proximity**
- **Optical**
- **Hall-Effect**

**“Ease of Use” Note: 5V Sensors**

Before using 5VDC sensors, consider either:
1) sourcing 24V alternatives, or 2) providing a separate 5VDC supply to power your 5V sensors.

- Resistors sized for 24VDC supply voltage
- External resistors not included

*Wire colors shown are typical of industrial sensors*
A-9 through A-12 configured as ANALOG INPUTS

ClearLink is compatible with a variety of analog sensors (transducers) including the following:

- Pressure
- Temperature
- Distance
- Mass
- Force
- Angle
- Level
- Velocity
- Torque
- Inclination
- Flow
- Electric current

Input Equivalent Circuit

Typical Sensor Hookup Details

Sensor Notes:

- 0-5V output sensors can be used with ClearLink, but there will be a loss of 1 bit of resolution (provided they are compatible with the ClearLink supply voltage (Vsupply).
- 0-20mA sensors can be used with ClearLink, but there will be some loss of linearity near zero current (this is sensor dependent).
I/O-0 through I/O-5 configured as DIGITAL OUTPUTS

Note: *The wiring shown in this section also applies to all CCIO-8 points configured as digital outputs.*

**Output Equivalent Circuit**

V_supply (24V)

10k 0.375A Max.

OUT[NN]

V_supply (24V)

* protected FET

**IMPORTANT:**

Outputs are "negative true": On state turns on transistor, enabling current in load, pulling output <0.5V

**Typical Actuator Hookup Details**

Relay

Contactor

Vacuum Valve

Pneumatic Valve

Solenoid Guard Lock

Fluid Valve

Solenoid Actuator
(e.g., diverter)

No Shunt Diode Required

Outputs have built-in active clamping

DC Motor, Pump, etc. (single direction)

DC Fan

5V/3.3V Logic System

External clamping diode to logic supply may be required, consult logic IC datasheet.
I/O-0 configured as a 4-20mA (or 0-20mA) OUTPUT

ClearLink connector I/O-0 can be configured to supply a variable 4-20mA analog signal to control a wide variety of analog actuators. A few examples of devices that can be controlled using 4-20mA signaling include:

- Damper control
- Pressure regulator
- Rotary position actuator
- Variable speed display
- Proportional valve
- Linear position actuator
- Process meter (display)

Output Equivalent Circuit

Typical Actuator Hookup Details

### 4-wire Actuator

<table>
<thead>
<tr>
<th>S</th>
<th>G</th>
<th>+</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-20mA</td>
<td>4-20mA RET.</td>
<td>COM</td>
</tr>
<tr>
<td>V+ SUPPLY</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- Connect signal and supply return wires close to output terminal block
- Use twisted pair as shown for best noise immunity

### 3-wire Actuator

<table>
<thead>
<tr>
<th>S</th>
<th>G</th>
<th>+</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-20mA</td>
<td>COM</td>
<td>V+ SUPPLY</td>
</tr>
</tbody>
</table>

### 2-wire Control

May be required depending on device

May be required depending on device

### 3-wire 0-10V Actuator

<table>
<thead>
<tr>
<th>S</th>
<th>G</th>
<th>+</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10V</td>
<td>COM</td>
<td>V+ SUPPLY</td>
</tr>
</tbody>
</table>

Note: Place 499 Ohm shunt resistor close to actuator
ClearLink Combined I/O Header

The ClearLink I/O header (labeled "Combined I/O" on the case) provides an alternative way to connect I/O devices to ClearLink’s I/O points.

Note: This connector can alternately be used to take encoder input from Teknic PN CL-ENCDR-DFIN encoder board (available soon).

**Combined I/O**

10x2 Header, 0.10” pitch

<table>
<thead>
<tr>
<th>A-9</th>
<th>A-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-11</td>
<td>GND</td>
</tr>
<tr>
<td>A-12</td>
<td>Vsupply</td>
</tr>
<tr>
<td>DI-6</td>
<td>Vsupply</td>
</tr>
<tr>
<td>DI-7</td>
<td>DI-8</td>
</tr>
<tr>
<td>I/O-0</td>
<td>I/O-1</td>
</tr>
<tr>
<td>I/O-2</td>
<td>I/O-3</td>
</tr>
<tr>
<td>I/O-4+</td>
<td>I/O-5+</td>
</tr>
</tbody>
</table>

**Mating Connector** (for use with ribbon cable)

- Housing: OST/101-206
- Ribbon cable: CnC Tech/304-28-20-MC-0250F

**Mating Connector** (crimp style)

- Housing: AMP/102387-4
- Terminals: AMP/87756-4 (22-26AWG)
Wiring I/O Devices to CCIO-8

The CCIO-8 board connects to ClearLink's CCIO Port via standard Ethernet cable (CAT5e or better). CCIO-8 provides 8 additional I/O points per board. Up to (8) CCIO-8 boards can be connected to a ClearLink.

IMPORTANT NOTES

- All CCIO-8 I/O points are electrically identical to ClearLink I/O points I/O-1, I/O-2, and I/O-3. The only functional difference is that the CCIO-8 points cannot output PWM signals.
- CCIO-8 I/O points can be configured as either digital inputs or digital outputs.
- **Do not** hook up the accessory encoder input board to CCIO-8 (Encoder board available soon).

I/O-0 through I/O-7 configured as DIGITAL INPUTS

The wiring for all 8 of these I/O points (as inputs) is the same as the wiring for ClearLink I/O-0 through I/O-5 configured as DIGITAL INPUTS.

I/O-0 through I/O-7 configured as DIGITAL OUTPUTS

The wiring for all 8 of these I/O points (as outputs) is the same as the wiring for ClearLink I/O-0 through I/O-5 configured as DIGITAL OUTPUTS.

CCIO-8 Combined I/O Header

The CCIO-8 I/O header (labeled "Combined I/O" on the board) provides an alternate, functionally identical way to connect I/O devices to ClearLink's I/O points.
Motor Connectors (M-0, M-1, M-2, M-3)

ClearLink has four multi-function motor connectors that each have three (3) specialized outputs and one (1) specialized input. They are plug and play compatible with Teknic ClearPath motors, but are compatible with many third party servo/stepper drives.

ClearLink can be programmed to send either of the following types of control signals to the motor connectors:

- **Step & Direction** signals to ClearPath-SD series motors or compatible third-party servo or step motor drives.
  
  OR

- **Digital control signals** to ClearPath-MC series (Motion Controller) motors.

**IMPORTANT:** Only one type of motor control method can be used on any given ClearLink Controller: either Step and Direction or Digital Control signals, but not both types on the same ClearLink unit.

**Note:** ClearLink motor connectors are designed to send and receive low-power signals only. The motor connectors are not designed to directly power the phase windings of servo or stepper motors.
How to Wire a ClearPath Motor to ClearLink

ClearPath motors connect to ClearLink with an inexpensive Teknic controller cable. Part numbers are listed below.

ClearPath Controller Cables

Order from Teknic. The quickest way to connect a ClearPath motor to ClearLink is with a ClearPath controller cable available from teknic.com. See links below for information and pricing.

- **CPM-CABLE-CTRL-MU120**  10 ft. ClearPath controller cable
- **CPM-CABLE-CTRL-MM660** 55 ft. ClearPath controller cable

Build your own. ClearPath controller cables can also be built with off-the-shelf components available from electronics distributors like Dig-Key. See Appendix C for a full list of parts and tools required to build ClearPath controller cables.

---

**ClearPath Servo Motor**

Pre-fabricated motor control cables available from Teknic.com:
- 10-foot (3.1m): CPM-CABLE-CTRL-MU120
- 55-foot (16.8m): CPM-CABLE-CTRL-MM660

Motor control cable components
- **Housing**: Molex/39-39082 (black)
- **Terminals**: Molex/39-00-0047 (loose); Molex/39-00-0046 (reel)
- **Crimp Tool**: Molex/83819-0900
- **Extractor Tool**: Molex/11-03-0044

---

ClearPath motor connected to ClearLink
Wiring a Stepper Motor Drive to ClearLink

Typical Stepper Motor Drive

Stepper motor drive wired to ClearLink controller
COM-0 (Serial COM Port)

ClearLink includes one multi-function serial port: COM-0. This port is accessed through an RJ-45 connector as shown below. The port is individually configurable for use with UART devices or RS-232 transceivers. The port includes a 5V power pin to power the remote device if needed.
COM-0 with 5V compatible RS-232 transceivers

COM Port Equivalent Circuit

COM-0 For use with 5V compatible RS-232 transceivers

Typical Hookup Details

IMPORTANT: Mating serial ports must be compatible with 0-5V signals or a converter must be used.

DCE/Modem

Male Connector Shown
(e.g. Amphenol/DE09P064TXLF)

DTE/Host

Female Connector Shown
(e.g. Amphenol/DE09S064TLF)

COM-0 configured for RS-232
COM-0 configured for 5V logic UART devices

COM Port Equivalent Circuit

COM-0 For use with 5V logic UART devices (non-inverting)

```
  5V
  2k
  130
  130

COM-0_RX
COM-0_TX
COM-0_CTS
COM-0_RTS

5VOB
```

ClearLink internal

Typical Hookup Details

```
8  Data Out
7
6
5
4
3
2
1

Data In
5V Power In
GND
~Buffer Full
~Stop Data Out

“TTL” UART port device
```

- 5VOB supplies 5V power for any loads connected to COM-0 connector
- Total current available from 5VOB is 450mA

COM-0 configured for 5V UART devices
CL-ENCDR-DFIN Encoder Input Adapter Board

Introduction

The CL-ENCDR-DFIN encoder input adapter board lets you send externally generated encoder data to your ClearCore or ClearLink device. This accessory board is sold separately at Teknic.com.

**Note:** CL-ENCDR-DFIN takes input from one, three-channel differential encoder only. ClearCore and ClearLink devices can receive input from one external encoder per unit.

**IMPORTANT:** When using CL-ENCDR-DFIN, do not connect external I/O devices to connectors DI-6, DI-7 and DI-8 on your ClearCore or ClearLink device. Doing so will likely result in intermittent or nonexistent encoder feedback and may permanently damage your CL-ENCDR-DFIN board.

**Index channel bypass.** If you do not need to use the index channel from your encoder, you may remove jumper P3 from the CL-ENCDR-DFIN board. This will allow you to use DI-8 as a standard input on your ClearCore or ClearLink.

**Supported encoders.** Many third-party encoders with standard, 3-channel, differential output signals will work seamlessly with CL-ENCDR-DFIN. Check the encoder manufacturers specifications to verify compatibility with CL-ENCDR-DFIN before attempting to use.

For information on how to use external encoder data, see the software documentation for your ClearCore or ClearLink device.
Connectors and Pinouts

Pin Signal Name
1 N/C
2 N/C
3 N/C
4 GND
5 N/C
6 N/C
7 Encoder A
8 N/C
9 Encoder B
10 Encoder I
11 N/C
12 N/C
13 N/C
14 V+
15 N/C
16 GND
17 N/C
18 N/C
19 N/C
20 N/C

P1 - To ClearCore or ClearLink

Ribbon Cable Assembly
20 Position Cable Assembly, Rectangular
Socket to Socket, 0.500' (152.40mm, 6.00")
Digi-Key PN: H3CCH-2006G-ND

Mating Connector (for use with ribbon cable)
Housing: OST/101-206
Ribbon cable: CnC Tech/304-28-20-MC-0250F

Mating Connector (crimp style)
Housing: AMP/102387-4
Terminals: AMP/87756-4 (22-26AWG)

Encoder Output (P1)
To ClearCore or ClearLink I/O Header

Encoder Input (P2)
From external encoder

P2 - Encoder Input

Pin Signal Name
1 GND
2 +
3 B+
4 A+
5 5V
6 -
7 B-
8 A-
9 GND

Mating Connector
Standard D-sub 9 shell, female contacts
## Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Temperature</td>
<td>-20</td>
<td>50</td>
<td></td>
<td>°C</td>
</tr>
<tr>
<td>Count Rate</td>
<td></td>
<td>2</td>
<td></td>
<td>MHz</td>
</tr>
<tr>
<td>5V Output Current</td>
<td></td>
<td>300</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>A, B, I Signal Termination Impedance</td>
<td>470</td>
<td></td>
<td></td>
<td>Ω</td>
</tr>
<tr>
<td>Index Capture Delay</td>
<td>2</td>
<td></td>
<td></td>
<td>µS</td>
</tr>
<tr>
<td>Common Mode Input Voltage</td>
<td>-7</td>
<td>7</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Input Differential Hysteresis</td>
<td>60</td>
<td></td>
<td></td>
<td>mV</td>
</tr>
</tbody>
</table>
# Appendix A: Specifications

## ClearLink Specifications

### Mechanical

<table>
<thead>
<tr>
<th>Dimension</th>
<th>5.0&quot; x 3.5&quot; x 1.0&quot; (127mm x 88.9mm x 25.4mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (with cover)</td>
<td>0.40 lbs (453.6 g)</td>
</tr>
<tr>
<td>Material</td>
<td>3mm thick polycarbonate cover, aluminum mount frame</td>
</tr>
</tbody>
</table>

### Electrical

<table>
<thead>
<tr>
<th>Voltage Input</th>
<th>20-28 VDC (24VDC nominal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Current Capability</td>
<td>I/O 0,1,2,3 - 375mA RMS, (750mA peak)</td>
</tr>
<tr>
<td></td>
<td>I/O 4,5 - 750mA RMS, (1000mA peak)</td>
</tr>
<tr>
<td>Indicator LEDs for each input</td>
<td>yes</td>
</tr>
<tr>
<td>IP rating</td>
<td>IP20</td>
</tr>
<tr>
<td>Operating Temperature/Humidity</td>
<td>-20C to 50C, 0-90% non-condensing</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-40C to 85C</td>
</tr>
<tr>
<td>Power Consumption</td>
<td>300mA @ 24VDC</td>
</tr>
<tr>
<td>Protection features</td>
<td>Overcurrent protection on all outputs</td>
</tr>
<tr>
<td></td>
<td>Inductive clamping on all outputs</td>
</tr>
<tr>
<td></td>
<td>Board master overvoltage and overcurrent protection</td>
</tr>
<tr>
<td></td>
<td>ESD protection features on all I/O circuits</td>
</tr>
<tr>
<td>Capacitive load (max.)</td>
<td>Capacitance on I/O-0 through I/O-5 (and expansion port power pins) collectively may not exceed 250uF.</td>
</tr>
</tbody>
</table>

### Processing/Communication

<table>
<thead>
<tr>
<th>Total I/O</th>
</tr>
</thead>
<tbody>
<tr>
<td>13 built-in I/O points, configurable as any combination of up to 13 digital inputs, 4 analog inputs, 6 digital outputs, and 1 analog output (4-20mA or 0-20mA). See I/O table below.</td>
</tr>
<tr>
<td>Another 64 digital I/O can be added by using optional 8-point I/O expansion modules (p/n CCIO-8).</td>
</tr>
</tbody>
</table>

| Serial communication | 1 multi-functional serial port that can be used as a UART or RS-232 at up to 115.2kBaud. Port hardware includes a 5V power pin. |
|                      | Rates up to 2MBaud are achievable depending on cable length, slave transceiver circuit and grounding. |

| Ethernet | 10Base-T/100Base-TX Ethernet. Accessed via standard RJ-45 jack. Use standard CAT5e cable or better. |

| Processor type and speed | 32 bit floating point ARM M4F processor  |
|                         | 120 MHz (p/n SAME53N19A) |

| Maximum Step Frequency   | 500kHz @ 50% duty cycle |
| Step Pulse Time          | 1uS | **Note:** 3rd party Step & Dir drives must be able to accept 1uS pulses. |
# ClearLink I/O Function Table

<table>
<thead>
<tr>
<th>Label</th>
<th>Digital Input</th>
<th>Digital Output&lt;sup&gt;1&lt;/sup&gt;</th>
<th>0-10V Analog Input</th>
<th>4-20 mA Output&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Servos or Steppers</th>
<th>Encoder Input&lt;sup&gt;3&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>IO-0</td>
<td>yes</td>
<td>yes</td>
<td>#</td>
<td>yes</td>
<td>#</td>
<td>#</td>
</tr>
<tr>
<td>IO-1</td>
<td>yes</td>
<td>yes</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
</tr>
<tr>
<td>IO-2</td>
<td>yes</td>
<td>yes</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
</tr>
<tr>
<td>IO-3</td>
<td>yes</td>
<td>yes</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
</tr>
<tr>
<td>IO-4</td>
<td>yes</td>
<td>yes</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
</tr>
<tr>
<td>IO-5</td>
<td>yes</td>
<td>yes</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
</tr>
<tr>
<td>DI-6</td>
<td>yes</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>yes</td>
</tr>
<tr>
<td>DI-7</td>
<td>yes</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>yes</td>
</tr>
<tr>
<td>DI-8</td>
<td>yes</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>yes</td>
</tr>
<tr>
<td>A-9</td>
<td>yes</td>
<td>#</td>
<td>yes</td>
<td>#</td>
<td>#</td>
<td>#</td>
</tr>
<tr>
<td>A-10</td>
<td>yes</td>
<td>#</td>
<td>yes</td>
<td>#</td>
<td>#</td>
<td>#</td>
</tr>
<tr>
<td>A-11</td>
<td>yes</td>
<td>#</td>
<td>yes</td>
<td>#</td>
<td>#</td>
<td>#</td>
</tr>
<tr>
<td>A-12</td>
<td>yes</td>
<td>#</td>
<td>yes</td>
<td>#</td>
<td>#</td>
<td>#</td>
</tr>
<tr>
<td>M-0</td>
<td>#</td>
<td>□</td>
<td>#</td>
<td>yes&lt;sup&gt;3&lt;/sup&gt;</td>
<td>#</td>
<td>#</td>
</tr>
<tr>
<td>M-1</td>
<td>#</td>
<td>□</td>
<td>#</td>
<td>yes&lt;sup&gt;3&lt;/sup&gt;</td>
<td>#</td>
<td>#</td>
</tr>
<tr>
<td>M-2</td>
<td>#</td>
<td>□</td>
<td>#</td>
<td>yes&lt;sup&gt;3&lt;/sup&gt;</td>
<td>#</td>
<td>#</td>
</tr>
<tr>
<td>M-3</td>
<td>#</td>
<td>□</td>
<td>#</td>
<td>yes&lt;sup&gt;3&lt;/sup&gt;</td>
<td>#</td>
<td>#</td>
</tr>
<tr>
<td>CCIO-8&lt;sup&gt;4&lt;/sup&gt;</td>
<td>yes</td>
<td>yes</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
</tr>
</tbody>
</table>

Note 1: All digital outputs are PWM capable (except for those on the CCIO-8 expansion board).

Note 2: This output can also provide 0-20mA, which is less commonly used.

Note 3: Each motor connector has 3 digital outputs (step, dir., enable) and 1 digital input.

Note 4: There are 8 of these I/O points on the CCIO-8 expansion module.

Note 5: Additional encoder board required, Teknic PN: CL-ENCODR-DFIN.( AVAILABLE SOON)
## CCIO-8 Specifications

<table>
<thead>
<tr>
<th>Mechanical</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td>3.6” x 3.28” x 1.0” (91.5mm x 83.3mm x 25.4mm)</td>
</tr>
<tr>
<td>Weight</td>
<td>3.18 oz. (90 g)</td>
</tr>
<tr>
<td>Material</td>
<td>Assembled circuit board with aluminum mount frame</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Electrical</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage Input</td>
<td>20-28 VDC</td>
</tr>
<tr>
<td>Output Current Capability</td>
<td>All I/O points 375mA RMS (750mA peak)</td>
</tr>
<tr>
<td>Indicator LEDs for each input</td>
<td>Yes</td>
</tr>
<tr>
<td>IP Rating</td>
<td>IP20</td>
</tr>
<tr>
<td>Operating Temperature/Humidity</td>
<td>-20C to 50C, 0-90% non-condensing</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-40C to 85C</td>
</tr>
<tr>
<td>Power Consumption</td>
<td>100mA@24V or 150mA@12V</td>
</tr>
<tr>
<td>Protection Features</td>
<td>Overcurrent protection on all outputs Inductive clamping on all outputs ESD protection features on all I/O circuits</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Processing / Communication</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total I/O</td>
<td>8 built-in I/O points, configurable as any combination of up to 8 digital inputs and 8 digital outputs. A total of 8 CCIO-8 boards can be connected to one ClearLink, for a total of 64 additional digital I/O points. All I/O hardware is configured via software, i.e., there are no jumpers, DIP switches, trim-pots, etc.</td>
</tr>
<tr>
<td>I/O Update Rate</td>
<td>0.2mS (1-2 boards), 0.4mS (3-4 boards), 0.6mS (5-6 boards), 0.8mS (7-8 boards)</td>
</tr>
<tr>
<td>Connectivity</td>
<td>ClearLink connects to CCIO-8 from its CCIO Port to the COM IN port of the first CCIO-8. Additional CCIO-8 boards must connect from COM OUT to COM IN. Use CAT5e cable (non-crossover) or better. Max cable length = 100 feet.</td>
</tr>
</tbody>
</table>

Note: All I/O points on CCIO-8 are electrically identical to I/O-1, I/O-2, and I/O-3 on ClearLink.
## CCIO-8 I/O Function Table

<table>
<thead>
<tr>
<th>Label</th>
<th>Digital Input</th>
<th>Digital Output</th>
<th>0-10V Analog Input</th>
<th>4-20 mA Output</th>
<th>Servos or Steppers</th>
<th>Encoder Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>I/O-0</td>
<td>yes</td>
<td>yes</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
</tr>
<tr>
<td>I/O-1</td>
<td>yes</td>
<td>yes</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
</tr>
<tr>
<td>I/O-2</td>
<td>yes</td>
<td>yes</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
</tr>
<tr>
<td>I/O-3</td>
<td>yes</td>
<td>yes</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
</tr>
<tr>
<td>I/O-4</td>
<td>yes</td>
<td>yes</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
</tr>
<tr>
<td>I/O-5</td>
<td>yes</td>
<td>yes</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
</tr>
<tr>
<td>I/O-6</td>
<td>yes</td>
<td>yes</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
</tr>
<tr>
<td>I/O-7</td>
<td>yes</td>
<td>yes</td>
<td>#</td>
<td>#</td>
<td>#</td>
<td>#</td>
</tr>
</tbody>
</table>

Note 1: Digital outputs on CCIO-8 are not PWM capable.
Appendix B: Mechanical Reference

ClearLink Mounting and Clearance Dimensions

ClearLink Mounting Dimensions

ClearLink Mounting and Clearance Notes
- Leave a minimum of 1.5” (38.1mm) clearance around all ClearLink surfaces (except the mounting plate) for appropriate ventilation.
- Provide appropriate clearance for top and side-mounted cables. Note: some Ethernet and USB cables may require up to 2” clearance.
CCIO-8 Mounting and Clearance Dimensions

CCIO-8 Mounting and Clearance Notes

- Leave a minimum of 1.5" (38.1mm) clearance around all CCIO-8 surfaces (except the mounting plate) for appropriate ventilation.
- Provide clearance for top and side-mounted cables. Note: some Ethernet and USB cables may require up to 2" clearance.
## Appendix C: Mating Connectors and Terminals

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Mating Connector Description</th>
<th>Mating Connector or Cable PN</th>
<th>Terminal Description</th>
<th>Terminal PN</th>
<th>Tooling</th>
<th>Wire Gauge (AWG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Screw terminal block, 3- position, 3.81mm pitch</td>
<td>Molex/0395105003</td>
<td>OPTIONAL Wire ferrule, 20-24 AWG, white</td>
<td>OPTIONAL American Electrical 1181050</td>
<td>OPTIONAL Crimp Tool American Electrical TRAP 22-10</td>
<td>20-24</td>
</tr>
<tr>
<td>B</td>
<td>Molex MiniFit-Jr, receptacle, 8-position</td>
<td>Molex part numbers: 39-01-2080 (natural, UL 94V-2) 39-01-3085 (black, UL 94V-2) 39-03-2082 (natural, UL 94V-0)</td>
<td>Female crimp terminal, tin plate, 22-28 AWG</td>
<td>Molex/39-00-0046 (reel) Molex/39-00-0047 (loose)</td>
<td>Crimp tool Molex/63819-1000 Extraction tool Molex/11-03-0044</td>
<td>22</td>
</tr>
<tr>
<td>C</td>
<td>Crimp style connector, 20 position, free hanging, panel mount, 0.10” (2.54mm) pitch</td>
<td>TE/102387-4</td>
<td>Socket contact, gold plate, 22-26 AWG crimp</td>
<td>TE/87756-4</td>
<td>Crimp tool TE/169481-1</td>
<td>22-26</td>
</tr>
<tr>
<td></td>
<td>Ribbon cable connector, 20-position, IDC, gold finish</td>
<td>Connector OST/101-206 Ribbon cable stock GnC Tech/304-28-20-MC-0250F</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

*Use CAT5e cable or better (non-crossover)*

---

![Diagram of ClearLink hardware](image-url)