

Nitrogen Reduction Control Panel

Timer-Based Process Control | 120 VAC · 60 Hz · Single Phase | UL 508A Listed

ENGINEERED & MANUFACTURED FOR AKHA MANUFACTURING, LLC · HYDRO-ACTION® SYSTEMS

DOCUMENT VERSION 4.3 (Full · AKHA Edition)

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MODEL / PANEL REVISION CP-001-1-0001 · Rev v6.1

UL FILE NUMBER E547664

MANUFACTURED BY Legacy Controls · 6200 FL-46, Mims, FL 32754

COMPLIANCE UL 508A · NSF/ANSI 40 & 245 compatible

MANUFACTURED FOR AKHA Manufacturing, LLC · Plymouth, Indiana

SUPPORT & WARRANTY AKHA Manufacturing · 800-370-3749

Engineered and manufactured by Legacy Controls as an automation solution for Hydro-Action wastewater treatment systems, this UL Listed control panel delivers precise process automation, reliable performance, and layered protection to ensure consistent effluent quality and prevent untreated discharge.

IMPORTANT NOTICE — SUPPORT & WARRANTY ADMINISTRATION This control panel is manufactured by Legacy Controls for AKHA Manufacturing, LLC and is intended for use with Hydro-Action wastewater treatment systems. **ALL technical support, warranty claims, service questions, callbacks, and customer communications must be directed to AKHA Manufacturing, LLC. AKHA Manufacturing, LLC · 2055 Pidco Dr. / P.O. Box 640, Plymouth, Indiana 46563 · Toll Free 800-370-3749 · Phone (574) 936-2542 · Fax 574-936-2298 · hydro-action.com.** Legacy Controls provides manufacturing and warranty support to AKHA Manufacturing, LLC and does not accept direct inquiries or claims from end users or installers for this product line.

READ FIRST — ISOLATED CONTROL CIRCUIT

This panel ships from the factory with the control circuit **COMBINED** with main power via a jumper installed between terminals 1 and 2. If a separate (isolated) power feed is required, remove the jumper and provide a dedicated feed — a separate feed remains energized when the main feed is off. **Disconnect ALL power sources and verify with a voltage tester before opening the panel.**

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1. SAFETY INSTRUCTIONS

WARNING Risk of electric shock and serious injury. This control panel operates at 120 VAC and contains both main power circuits and an isolated control circuit. Improper handling can result in serious injury, death, electrical shock, fire, or equipment damage. Only qualified personnel familiar with local electrical codes (NEC) and UL 508A standards should install, operate, or maintain this panel.

ISOLATED CONTROL CIRCUIT From the factory, this circuit is disabled via a jumper installed between terminals 1 and 2. If a separate power feed is required, remove the jumper and provide a dedicated feed — a separate feed remains energized when the main feed is off. Disconnect all power sources before service.

- **Power Off Procedures** — disconnect power at the main panel disconnect switch — and any separate isolated control-circuit feed — and use proper lockout/tagout procedures before opening the panel. Always verify with a voltage tester.
- **Grounding** — ensure proper grounding of the panel and all connected equipment per NEC requirements.
- **Failsafes and Lockouts** — never bypass or disable any safety features, lockouts, or alarms. Doing so may allow untreated wastewater discharge.
- **Overload Protection** — overload protection is integral to the pump motors — this panel contains no overload devices. The alarm circuit is limited to 5 A.
- **PPE** — wear insulated gloves, safety glasses, and appropriate protective clothing when working near electrical components or the treatment plant.
- **Field Wiring** — use copper conductors rated 60 °C minimum, 26–10 AWG, 600 V. Torque all terminal screws to 0.79 N·m (7.0 in-lbs).
- **Unauthorized Modifications** — any alteration, modification, or unauthorized repair will void the UL listing, the manufacturer's warranty, and may create serious safety hazards.

CAUTION A main panel disconnect switch must be supplied and installed in the field. Always verify with a voltage tester before working inside the panel.

2. SPECIFICATIONS

Panel Identification & Electrical Ratings

PARAMETER	SPECIFICATION
Model / Revision	CP-001-1-0001 · Rev v6.1
UL File Number	E547664
Electrical	120 VAC, 60 Hz, single phase · Total FLA 26 A · largest motor FLA 7.0 A · SCCR 5 kA
Supply Circuit	Minimum supply circuit ampacity 30 A · field-supplied main disconnect required
Terminal Torque	0.79 N·m (7.0 in-lbs)
Field Wiring	Copper conductors, 60 °C minimum, 26–10 AWG, 600 V
Compliance	UL 508A · designed for NSF/ANSI 40 & 245 compatible Hydro-Action systems

Key Components

PARAMETER	SPECIFICATION
Timers	T1 — Elko CRM-2H asymmetric flasher · T2 — Elko CRM-183J/UNI off-delay
Current Sensing Relay (CS)	Elko EP PRI-32 — monitors recirculation pump load for failure detection
Pressure Switch	Monitors air pressure; triggers demand dose lockout on low pressure
Motor Contactors	M1 (Recirculation pump — float-protected) · M2 (Mixing pump — float-protected) · M3 (Demand dose pump — the only lockout-protected output)
Isolated Control Circuit	Factory disabled with jumper between terminals 1 and 2; removable for separate feed

3. INSTALLATION INSTRUCTIONS

WARNING Installation must be carried out by qualified personnel only. Follow local electrical codes (NEC) and consult the panel schematic and connection diagram.

1. **Mounting** — secure the Type 1 enclosure to a stable vertical surface in a weatherproof location (outdoor) or well-ventilated indoor area.
2. **Power Supply** — provide 120 VAC single-phase power on a dedicated circuit with a minimum supply circuit ampacity of 30 A. Install a main panel disconnect switch upstream (field supplied).
3. **Isolated Control Circuit** — factory default has the jumper between terminals 1 and 2 (disabled). If a separate feed is required, remove the jumper and run a dedicated conductor. Neutrals from both feeds must land on the same neutral bus in the feeder panel.
4. **Field Wiring** — use copper conductors rated 60 °C minimum. Torque all terminal screws to 0.79 N·m (7.0 in-lbs). Connect pumps, floats, pressure switch, and alarm devices exactly as shown on the schematic and connection diagram.
5. **Float Installation** — position floats for proper Pump Down operation: recirculation enable float lowest, high-water float highest.
6. **Initial Testing** — confirm all timers are set per Section 6. Apply power, verify the isolated control circuit is energized, and use the Pump Test button to synchronize T1 and T2 once the enable float activates.

4. WIRING AND CONNECTIONS

Refer to the included schematic (CP-001-1-0001 Line Drawing v6.1) and Connection Diagram v6.2 (reproduced on the following pages for reference) for complete wiring details.

Isolated Control Circuit

This panel features an isolated control circuit. From the factory it is disabled with a jumper between terminals 1 and 2. Remove this jumper and provide a separate power feed when the isolated control circuit is required — a separate feed remains energized when the main feed is off.

WARNING Verify all connections match the schematic before energizing. Incorrect wiring can cause faults or safety hazards.

5. OPERATION

System Initialization and Power-Up Behavior

Prior to applying power, confirm that Timers T1 and T2 have been properly set according to the system size and the recommended timer settings found in Section 6. If T1 and T2 are correctly configured before power is applied, the panel will only generate an alarm condition until the recirculation enable float becomes active. The recirculation enable float must rise to trigger Timer T1 before the recirculation cycle can begin — until the enable float activates, T1 has not started its timing sequence.

Using the Pump Test Button: the Pump Test button can be used after power-up to manually cycle the system. This allows verification of pump operation and helps bring the control logic into the proper operating sequence.

Float Switch System

The CP-001-1-0001 uses a two-float level detection system for reliable control and protection of the Hydro-Action wastewater treatment process. Position the recirculation enable float lowest and the high-water float highest.

- **Recirculation Enable Float (lowest)** — the primary control float — when activated, enables Timer T1 and starts the recirculation cycle. Both the recirculation pump (M1) and the mixing pump (M2) are float-protected and operate only when this float is up.
- **High Water Float (highest)** — alarm only — by design. Triggers the alarm globe and buzzer but never locks anything out. A high-water event means the demand dose pump is not keeping up — the last thing you want is to shut it off. Test both floats at commissioning and each service.

Normal Operation

The panel manages four integrated functions: ATU aeration control; timed recirculation (M1 · T1, float-protected); intermittent mixing (M2, float-protected — short bursts throughout the day); and demand dosing (M3 — the only lockout-protected output). The recirculation pump draws effluent from the mixing and aeration chamber and doses it slowly back into the pretreatment tank throughout the day, creating an anoxic zone where nitrogen production is reduced.

Recirculation Supervision — How T1 and T2 Interact

Timer T1 has four potentiometers: the top two set the ON duration and the bottom two set the OFF duration. The OFF time divides the daily recirculation volume evenly across 24 hours (see Section 6). Timer T2 is an off-delay countdown set longer than T1's OFF time. While M1 runs, the current sensing relay (CS) sends a continuous signal that holds T2 reset. When T1 switches to its OFF period, T2 begins counting down — and if the next M1 run does not arrive before T2 expires, the panel declares a recirculation failure.

Recirculation Supervision — PRI-32 Current Monitoring (CS)

The recirculation pump is supervised by an Elko EP PRI-32 current monitoring relay — the CS relay on the schematic. The pump's supply conductor passes through the PRI-32's built-in current transformer. If the recirculation pump fails, runs dry, or draws abnormal current, the PRI-32 drops its output and the panel responds exactly as it does to an air-pressure failure: failsafe lockout with alarm.

Setup and calibration: the trip threshold is set at commissioning to the pump's normal running draw — 6–8 A per the maintenance schedule — and adjusted only after pump or relay replacement, never during routine service. Verify operation by observing the CS signal while the pump runs, per the maintenance procedure in Section 7.

CURRENT MONITORING ASSISTANCE Need more detail on the Elko EP PRI-32 current monitoring relay? Scan the QR code to open the manufacturer's official datasheet — specifications, wiring, ranges, and adjustment. Threshold changes only after pump or relay replacement. — CS · ELKO EP PRI-32



Alarm vs. Lockout — Multi-Tier Protection

Only two conditions create a lockout, and the only output ever locked out is the demand dose pump (M3). The high-water float deliberately triggers the alarm only — high water means M3 is not keeping up, and shutting it off is the last thing the system needs.

CONDITION	ALARM (GLOBE + BUZZER)	DEMAND DOSE (M3) LOCKOUT
Low air pressure	Yes	Yes
Recirculation failure (CS / T2 timeout)	Yes	Yes
High water float	Yes	No — M3 keeps running by design

6. TIMER SETTING CALCULATIONS

Recirculation timer settings (T1 and T2) must be calculated based on daily plant capacity. Use the tables below for recommended settings, based on the standard Zoeller N264 pump at 21.25 GPM.

Quick-Reference Cheat Sheet (Field Use)

GPD	T1 ON RANGE	T1 ON POT	T1 OFF RANGE	T1 OFF POT	T2 RANGE	T2 ON POT
450	1 min	0.50	10 min	0.95	30 min	1.00
550	1 min	0.65	10 min	1.00	30 min	1.00
660	1 min	0.75	10 min	0.95	30 min	1.00
800	1 min	1.00	10 min	1.00	30 min	1.00
1,100	1 min	0.70	10 min	0.50	30 min	1.00

How to set: select the rotary switch to the specified range, turn the potentiometer to the exact Pot value shown, then use the Pump Test button to verify synchronization.

Recommended Timer Settings — Full Calculation Table

GPD	T1 ON RNG	T1 ON POT	T1 ON (S)	T1 OFF RNG	T1 OFF POT	T1 OFF (S)	N CYCLES	T2 RNG	T2 POT	T2 (S)	ACTUAL GPD	% ERR
450	1 min	0.50	30	10 min	0.95	570	144	30 min	1.0	1800	1,530	0.00
550	1 min	0.65	39	10 min	1.00	600	135	30 min	1.0	1800	1,865	-0.28
660	1 min	0.75	45	10 min	0.95	570	140	30 min	1.0	1800	2,231	-0.57
800	1 min	1.00	60	10 min	1.00	600	130	30 min	1.0	1800	2,763	+1.56
1,100	1 min	0.70	42	10 min	0.50	300	252	30 min	1.0	1800	3,749	+0.23

TIMER PROGRAMMING ASSISTANCE Need help setting or understanding the Elko timers? Scan the QR code to open the manufacturer's instruction sheet — time-range selection, potentiometer fine adjustment, and wiring. — T1 · ELKO CRM-2H



TIMER PROGRAMMING ASSISTANCE T2 off-delay countdown — official manufacturer data sheet with time-range selection and adjustment detail. — T2 · ELKO CRM-183J



7. MAINTENANCE

Recommended service interval: every six months (biannual), or immediately upon any alarm condition. Record all readings and adjustments on the maintenance log.

TASK	PROCEDURE	REFERENCE
Visual Inspection	Check for corrosion, loose wires, burnt components, water intrusion. Inspect terminal blocks, relays, contactors, and CS relay.	Schematic
Terminal Torque	Tighten all terminal screws to 0.79 N·m (7.0 in-lbs).	Connection Diagram
Timer Verification	Confirm settings match Section 6. Use the Pump Test button to verify synchronization after the enable float activates T1.	Section 6
CS Relay Calibration	Test recirculation pump current. Calibrate to trip at ~6–8 A. Verify hysteresis.	Schematic
Float Switches	Manually actuate both floats. Verify correct triggering and check cables for damage.	Schematic
Pressure Switch	Test the low-air-pressure lockout. Confirm it disables only the demand dose pump.	Schematic
Pump Test & Lockouts	Press the Pump Test button to cycle pumps and verify all lockouts function correctly.	Operation
Alarm Functions	Test alarm globe and buzzer. Confirm high water and lockout conditions activate the alarm.	Schematic
Final Functional Test	Restore power and run a full cycle. Confirm no false alarms and all failsafes operate correctly.	Full System

8. TROUBLESHOOTING

Preliminary checks: verify power and the isolated control circuit, then use the Pump Test button to check basic operation.

ISSUE	POSSIBLE CAUSE	RESOLUTION
Alarm triggers	Enable float not activating, CS trip, low air pressure	Check float, recalibrate CS, inspect air system. Reset with Pump Test.
Demand dose failure	M3 wiring or lockout active	Verify lockout status and test the pressure switch.
Low air pressure alarm	Air pump failure or leak	Inspect air pump and lines. Reset after repair.
System not starting	Power off, enable float down, or isolated control circuit not powered	Verify power feeds, float level, and the isolated control circuit.
Timer sync failure	T1/T2 out of sync or float not triggering T1	Press the Pump Test button once the enable float activates T1.
Float failure	Obstruction, wear, or damaged cable	Inspect and replace float or cable as needed.

A complete device-classified troubleshooting reference — the CP-001-1-0001 Troubleshooting Guide — is supplied with this panel.

IF ISSUES PERSIST Contact AKHA Manufacturing, LLC with the model and serial number — Toll Free 800-370-3749 · Phone (574) 936-2542 · hydro-action.com

9. WARRANTY

CLAIMS ADMINISTRATION All warranty claims, support requests, and service issues for this control panel must be submitted through AKHA Manufacturing, LLC, using the contact information in the Important Notice at the beginning of this manual. Legacy Controls provides warranty support to AKHA Manufacturing as the authorized supplier.

Definitions

“Product” refers to the UL Listed industrial control panel manufactured by Legacy Controls, including all components, assemblies, and associated hardware as originally supplied. “Defect” means a failure of the Product to conform to Legacy Controls’ published specifications due to faults in materials or workmanship under normal use and service. “Authorized Service Provider” means Legacy Controls or its designated dealers, distributors, or repair facilities authorized in writing by Legacy Controls. “Original Purchaser” means the end-user who first purchases the Product from Legacy Controls or an authorized dealer/distributor for use, not resale. “Warranty Period” means the period of two (2) years commencing from the date of original purchase as evidenced by valid proof of purchase.

Warranty Statement

Legacy Controls warrants to the Original Purchaser that the Product will be free from Defects in materials and workmanship for the Warranty Period when used in accordance with the instructions provided in this operation manual, the accompanying panel schematic, and applicable UL standards (including UL 508A for industrial control panels). This Limited Warranty is non-transferable and applies only to the Original Purchaser.

Coverage

If a Defect occurs during the Warranty Period, Legacy Controls or an Authorized Service Provider will, at its sole discretion, repair or replace the defective Product or component. Repaired or replaced Products or components are warranted for the remainder of the original Warranty Period or ninety (90) days from the date of repair or replacement, whichever is longer.

Exclusions & Limitations

This Limited Warranty does not cover damage or failure resulting from misuse, abuse, negligence, improper installation or maintenance, alterations by unauthorized parties, normal wear and tear, cosmetic damage, environmental deterioration, external factors, or products purchased from unauthorized sellers. Liability is limited to the original purchase price. TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, LEGACY CONTROLS SHALL NOT BE LIABLE FOR ANY CONSEQUENTIAL, INCIDENTAL, INDIRECT, SPECIAL, PUNITIVE, OR EXEMPLARY DAMAGES.

Governing Law

This Limited Warranty shall be governed by the laws of the State of Florida. Any disputes shall be resolved exclusively in the state or federal courts located in Brevard County, Florida.

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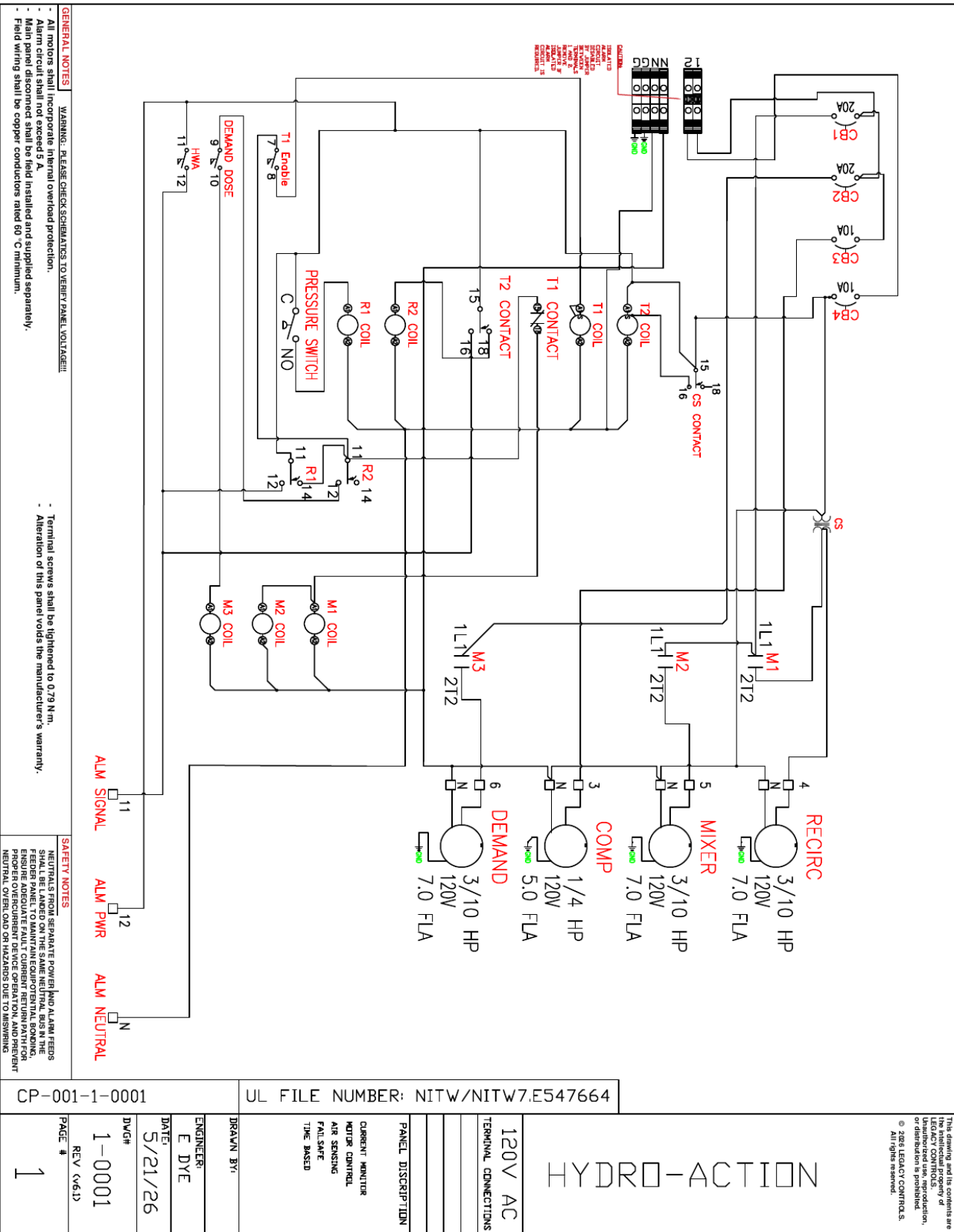
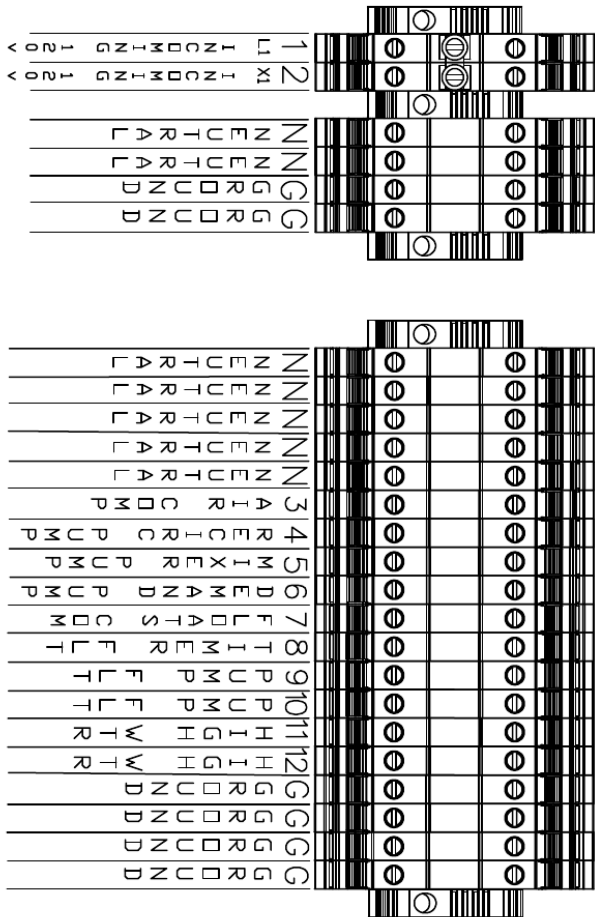


FIGURE 1 — LINE DRAWING V6.1 (REFERENCE)

TIGHTENING TORQUE FOR TERMINAL BLOCKS IS 4.425 in-lbs.

PANEL MODEL #
CP-001-1-0001
v6.2



TERMINAL CONNECTION DIAGRAM

TERMINAL BLOCKS
PINOUT DIAGRAM
26-10 AWG, 600V, 60C

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FIGURE 2 — CONNECTION DIAGRAM V6.2 (REFERENCE)