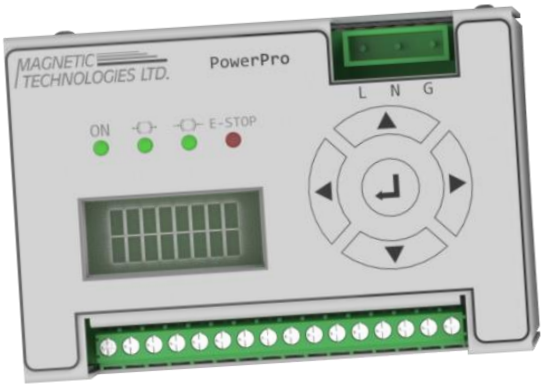
MAGNETIC TECHNOLOGIES LTD

MPP24-XX User Manual



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V3.5

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Introduction

The Magnetic Technologies Power Pro 24 is a 0-60 VDC programmable, constant current power supply. The Power Pro 24 is designed to be used with Magnetic Technologies LTD. Electric Hysteresis Brakes. Control is provided by a Digital Signal Processor (DSP) and a precision 24VDC internal power supply.

Max. Current Output: 2 Amperes
Input Voltage: 90-264 VAC, 47-63 Hz.

There are 4 operating modes:

Constant Current:
- Current is set directly via keypad entry.

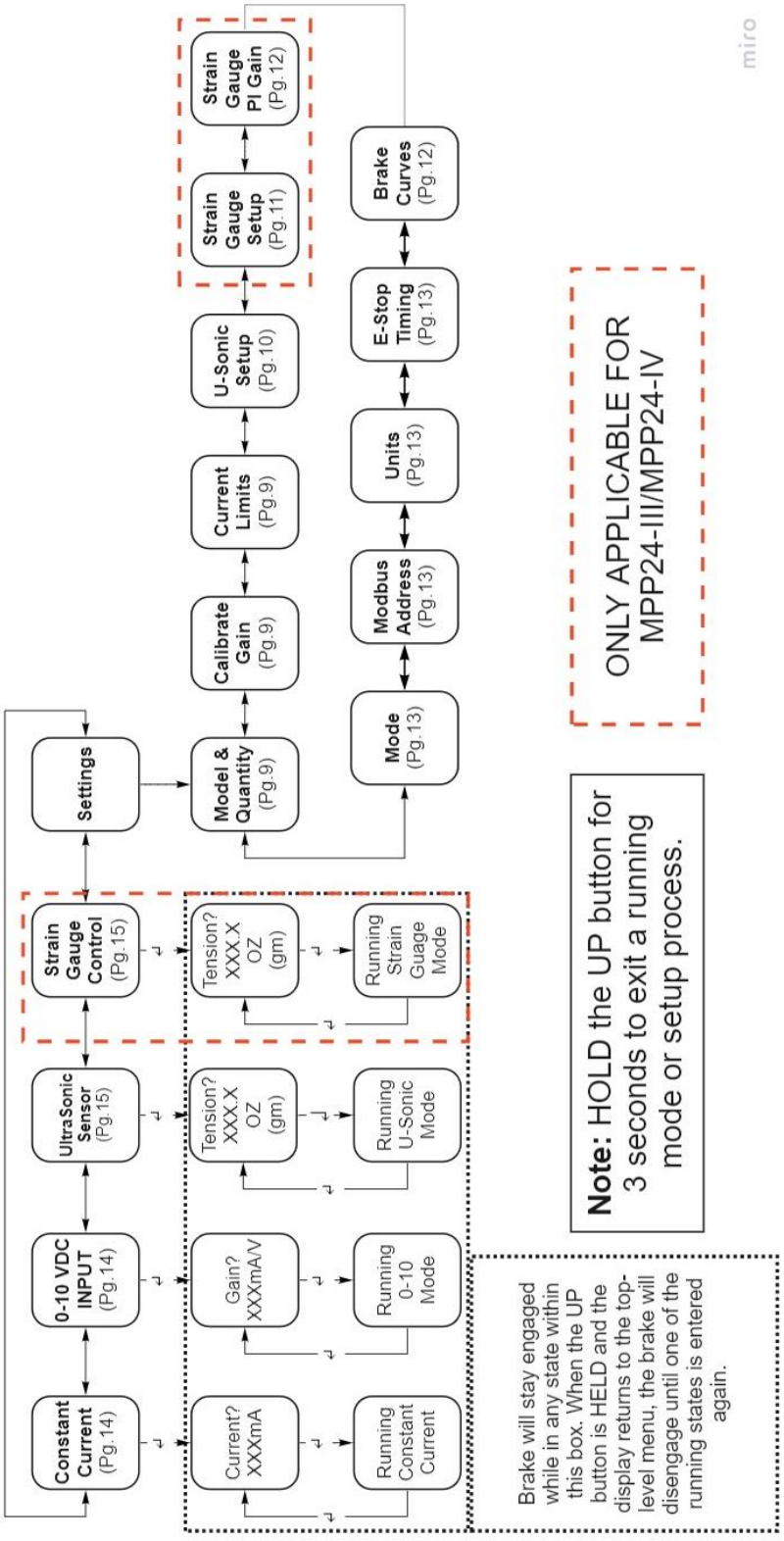
0-10 VDC Follower:
- Current is controlled from either an external 0-10 VDC input, or a voltage divider circuit using the internal 10 VDC supply.

Ultrasonic:
- Current is controlled from 0-10 VDC input from a diameter sensor. Tension is set directly via keypad entry and pre-programmed brake curves are used to achieve constant tension.

Strain Gauge: *(ONLY AVAILABLE WITH MPP24-III & MPP24-IV)*
- Current is controlled from strain gauge input (0-10VDC or mV signal). Tension is set directly via keypad entry and a PID loop is used to achieve constant tension.

Features	Operating Modes			
	Constant Current	0-10 VDC Follower	Ultrasonic	Strain Gauge
Maximum brake current determined by selection of MTL Electric Hysteresis Brake or user set current limits.	✓	✓	✓	✓
"On The Fly" current change is allowed	✓	✓	✓	✓
Displays brake current and approx. brake torque based on stored tabular data	✓	✓	✓	
Multiple brakes in parallel accommodated	✓	✓	✓	✓
Displays tension set point & measured tension				✓

Menu Layout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Running Strain Guage Mode
Tension? XXX.X OZ (gm)
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Gain? XXXmA/V
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Running Constant Current
ONLY APPLICABLE FOR MPP24-III/MPP24-IV
Note: HOLD the UP button for 3 seconds to exit a running mode or setup process.
Brake will stay engaged while in any state within this box. When the UP button is HELD and the display returns to the top-level menu, the brake will disengage until one of the running states is entered again.
miro

Hardware Setup

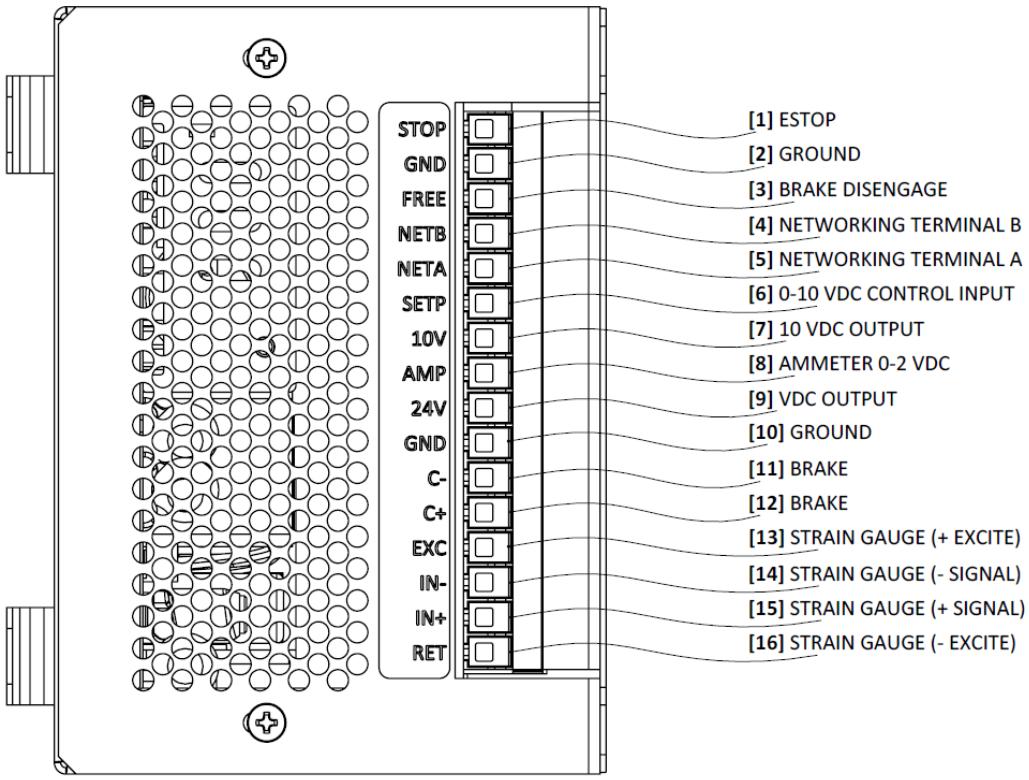
Wiring Specifications

Note: Refer to pg. 5 & 6 for wiring diagram

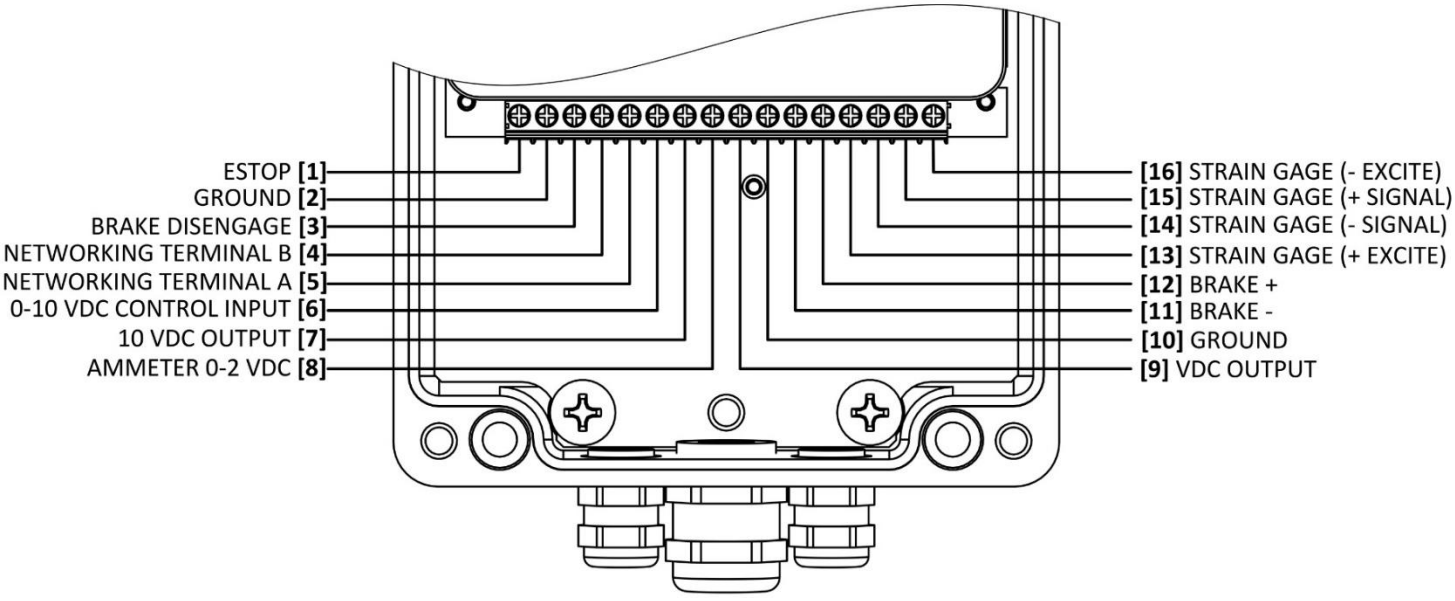
	Description [Pin #]
90-264VAC, 47-63 Hz Power:	Supplied to PL-1. Note: Line, Neutral, Ground connections.
Brake:	Connected to terminals C+ **[12]**, C- **[11].** Polarity does not matter.
Ultrasonic Probe:	Connected to 24VDC supply **[9]** & Ground **[10]**. 0-10VDC output of probe connected to SETP **[6]**.
Laser Sensor:	Connected to 24VDC supply **[9]** & Ground **[10]**. 0-10VDC output of probe connected to SETP **[6]**.
[mV] Strain Gauge:	Excitation wires connected to SGEX **[13]** and SGRET [**16]**. Signal wires connected to internal amplifier SG+**[14]** and SG-[**15]**.
[0-10V] Strain Gauge:	Excitation wires connected to 24VDC supply **[9]** & Ground **[10]**. 0-10VDC output from strain gauge connected to SETP **[6]**.
Follower – Voltage Divider:	Requires 10KΩ minimum resistance. Connect across 10V **[7]** & Ground **[10]** terminals with wiper Connected to SETP **[6]**.
External Ammeter:	0-2VDC is available from AMP **[8]** to GND **[10]** as an analog to 0-2A current output.
E-Stop:	Connection between STOP **[1]** and GND **[2]**.
Free:	Connection between Free **[3]** and GND **[2]**.
Modbus (RS485) Networking:	Daisy-chain network connection using NETA **[5]** and NETB **[4]**.
HMI Touchscreen Display:	Refer to document: “Modbus Wiring Block Diagram”

Pinout Diagrams

MPP24-I / MPP24-III



MPP24-II / MPP24-IV

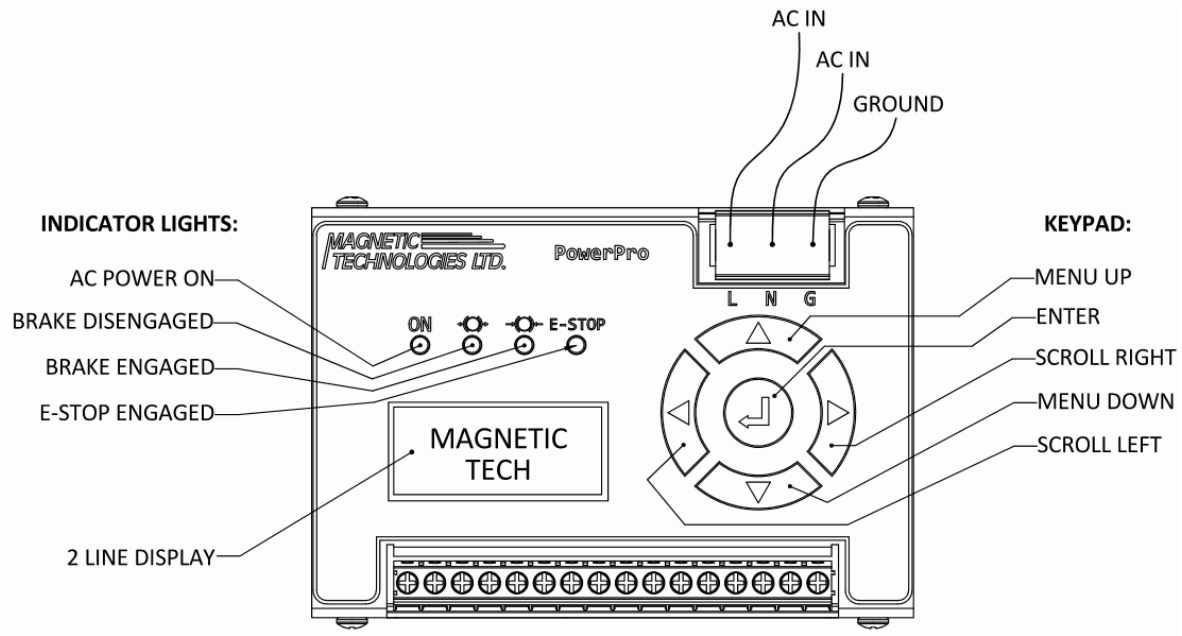


Pinout Details

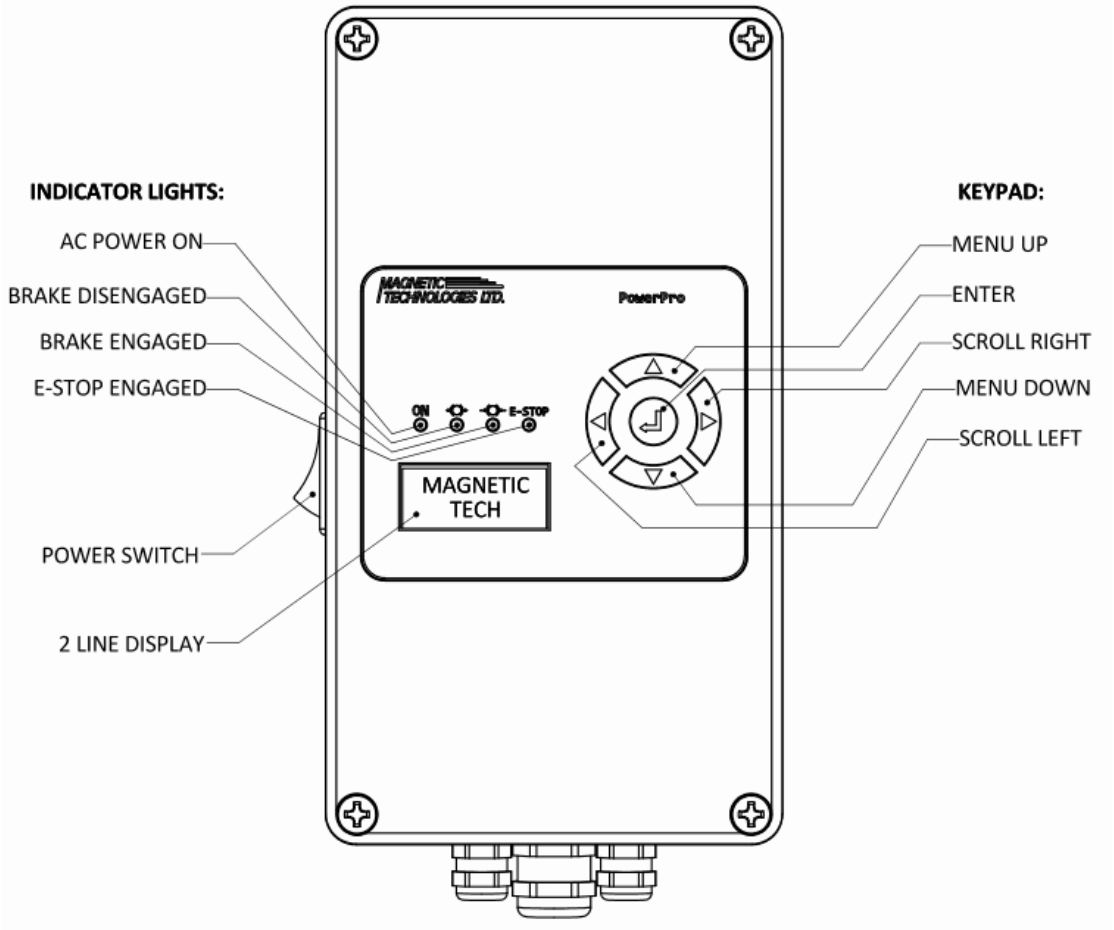
PIN #	Pin Name	Signal Name	Direction	Description
1	STOP	E-Stop	N/A	When connection is made while in a running mode, current output will ramp to the lower of maximum current for brake size selected or maximum value set in current limits. When connection is released, power supply returns to pervious mode and current resumes. Ramp time is controlled from 0-4 seconds via settings menu.
2	GND	Ground	N/A	Ground pin.
3	FREE	Brake Disengage	N/A	When connection is made while in a running mode, current output will drop to zero. When connection is released, power supply returns to previous mode and current resumes.
4	NETB	Networking Terminal B	Output	These terminals are used for Modbus Networking (RS485).
5	NETA	Networking Terminal A	Output	
6	SETP	0-10 VDC Control Input	Input	This input is used for a 0-10VDC control input signal. Some examples include a diameter sensor, external PLC, voltage divider circuit, or amplified strain gauge.
7	10V	10 VDC Output	Output	This output can be used with a potentiometer or voltage divider to create an input to the SETP terminal.
8	AMP	Ammeter 0-2 VDC	Output	Monitoring the voltage output on this pin will allow for external monitoring and recording of output current to the brake.
9	24V	24 VDC Output	Output	This output can be used to power external devices and accessories such as sensors or an HMI screen.
10	GND	Ground	N/A	Ground pin.
11	C-	Brake	Output	These terminals are used to connect an electric hysteresis brake. Polarity does not matter.
12	C+	Brake	Output	
13	EXC	Strain Gauge (+Excite)	Output	These terminals are used to connect a non-amplified strain gauge with mV signals. A programmable gain amplifier is built into the power supply allowing for a variety of SG gain factors to be used.
14	IN-	Strain Gauge (-Signal)	Input	
15	IN+	Strain Gauge (+Signal)	Input	
16	RET	Strain Gauge (-Excite)	Output	

Front Button and Indicator Layouts

MPP24-I / MPP24-III

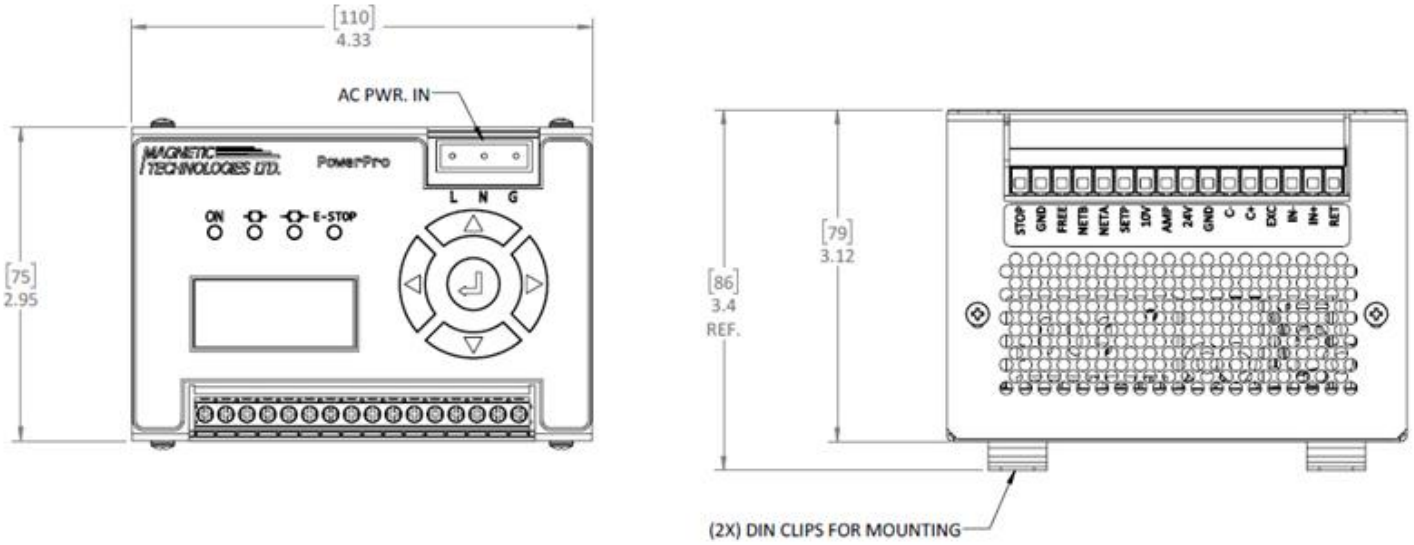


MPP24-III / MPP24-IV

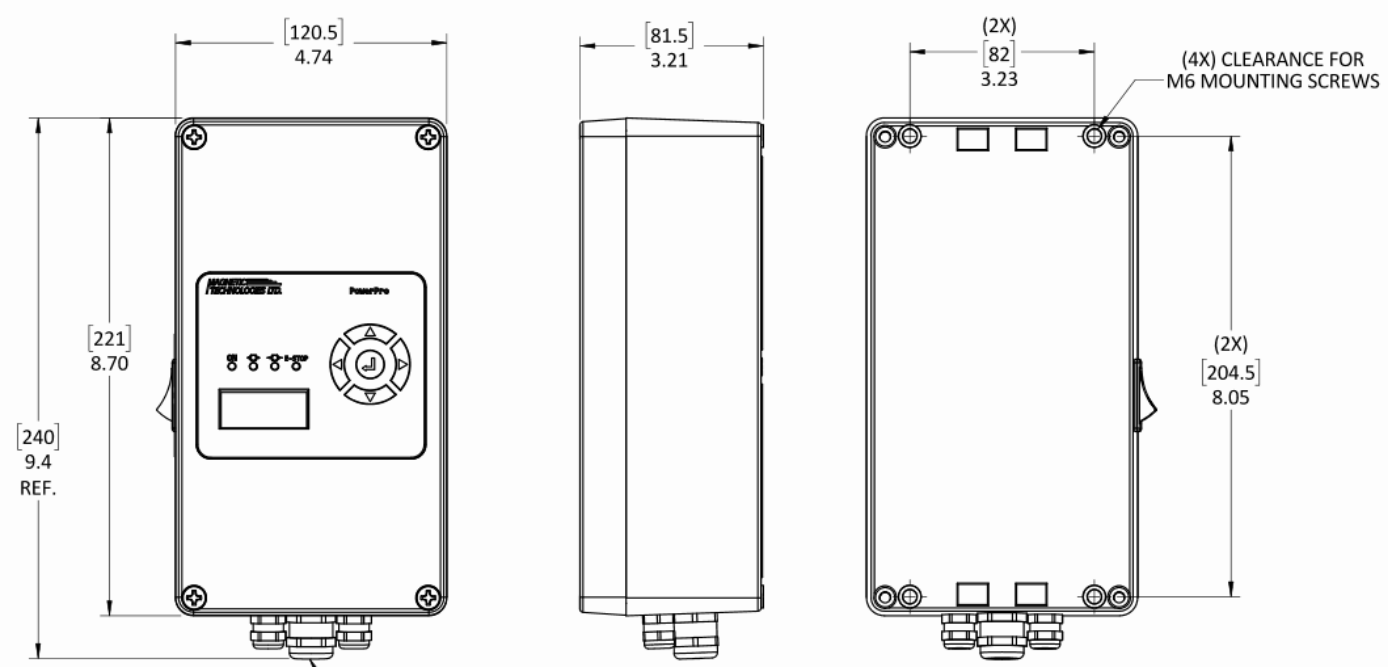


Overall Dimensions

MPP24-I / MPP24-III



MPP24-II / MPP24-IV



Wiring Procedure: (MPP24-II / MPP24-IV)

a.) Loosen (4) Phillips head screws.

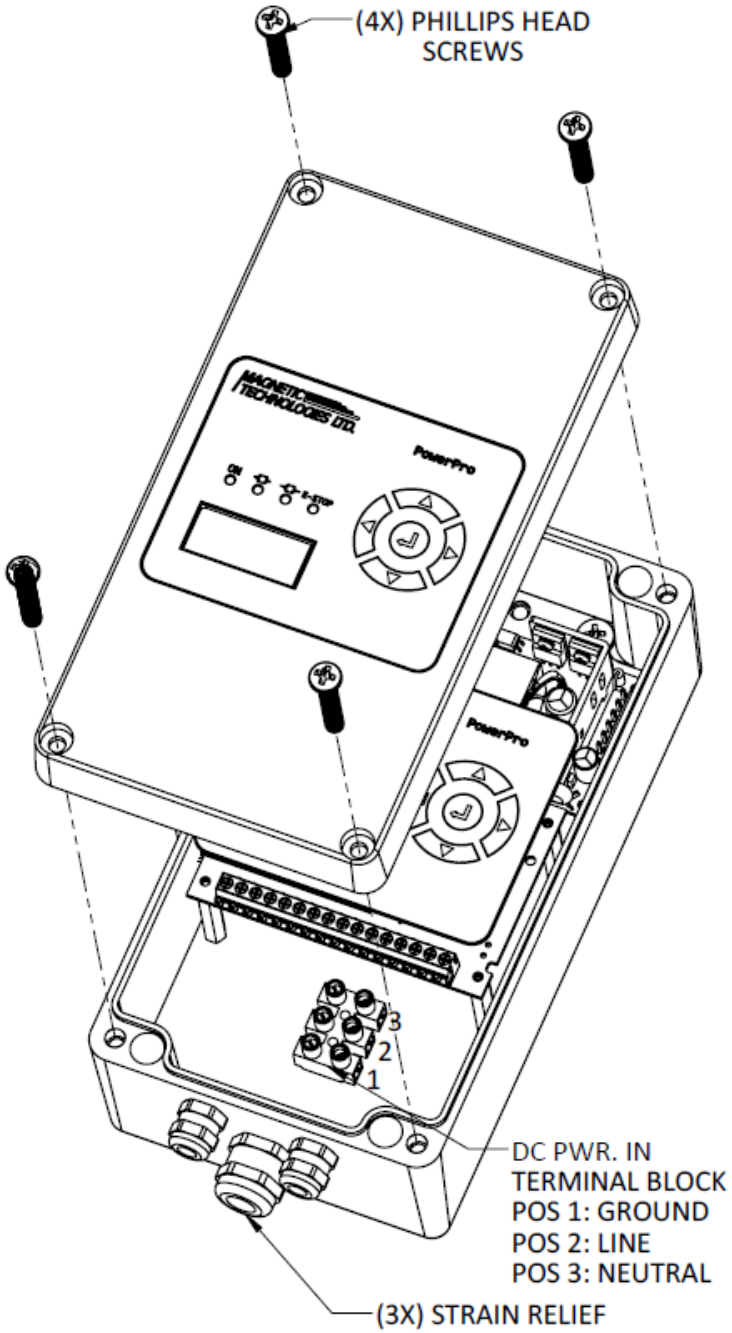
b.) Carefully remove control box lid.

c.) Place lid to the side of the control box. Be sure ribbon cable is not pulled taught or twisted.

d.) Run wires thru strain reliefs, insert wires into appropriate terminals, tighten terminal screws.

e.) Tighten strain relief nuts with an open-end wrench.

f.) Re-install cover, tighten (4) screws.



Software Setup

Follow these steps for initial set-up of your MPP24-II Power Supply:
Default Settings: (Brake: EB-140, Quantity: 1, Units: Imperial)

Note: Refer to flow chart (Pg. 3) for assistance.

Model & Quantity: Allows for user to set brake model and brake quantity being operated with single power supply. Proper selection of brake model and quantity limits current output to prevent damage to brake as well as selecting appropriate adjustment curve for Ultrasonic Mode. Also, allows for the operation of multiple brakes from a single power supply assuming identical operating conditions.

a. From Settings menu, navigate to "MODEL & QUANTITY". Press ↵
b. "MDL TYP?" will display. Use ◀ **or** ▶ to select model (ex. EB-3, EB-10) Press ↵
c. "MDL QTY?" will display. Use ▲ **or** ▼ to select number of brakes in parallel. Press ↵

Calibrate Gain

Gain calibration is performed at the factory. If recalibration is required, please contact Magnetic Technologies.

Current Limits: Allows for user to set the maximum and minimum output current. System will still abide by maximum current for brake selected if the maximum output current is set higher than the brake maximum.

a. From Settings menu, navigate to "CURRENT LIMITS" Press ↵
b. "MAX CUR?" will appear. This will set the maximum output current. Significant figure to be adjusted will be blinking. Use ◀ **and** ▶ to change significant figure, and ▲ **and** ▼ to adjust maximum current value. Press ↵
c. "MIN CUR?" will appear. This will set the minimum output current. Significant figure to be adjusted will be blinking. Use ◀ **and** ▶ to change significant figure, and ▲ **and** ▼ to adjust minimum current value. Press ↵

U-Sonic Setup: Setup and entry of parameters for usage of an ultrasonic/laser spool diameter sensor. Necessary for proper function of system in Ultrasonic mode. First the probe will be calibrated independent of the MPP24 unit, after the probe has been set to output 10V at maximum diameter and 0V at minimum diameter, the user will run through this procedure to teach the system the measurement setup. If any component positions are moved after calibration, the calibration will no longer be accurate and must be carried out again.

Note: Distance probe (ultrasonic, laser, etc.) must be calibrated **prior** to running through these settings. Refer to instruction manual provided with sensor. Sensor output must be 10V (nominal) at full spool and 0V (nominal) at empty spool

a. From Settings menu, navigate to "U-SONIC SETUP" Press ↵
b. "MAX DIA?" will appear. Here you will enter the diameter being used to teach full spool, this must correspond to the diameter used to set 10V on the probe calibration. Significant figure to be adjusted will be blinking. Use ◀ **and** ▶ to change significant figure, and ▲ **and** ▼ to adjust maximum spool diameter. Press ↵
c. "MIN DIA?" will appear. Here you will enter the diameter being used to teach empty spool, this must correspond to the diameter used to set 0V on the probe calibration. Significant figure to be adjusted will be blinking. Use ◀ **and** ▶ to change significant figure, and ▲ **and** ▼ to adjust minimum spool diameter. Press ↵
d. "GEARING?" will appear. Use ◀ **and** ▶ to change significant figure, and ▲ **and** ▼ to adjust to the gear ratio of the gearbox or pulleys being used. If the brake is being driven directly, keep value at 1.00:1. Press ↵
e. "MAX?" will appear. This will teach the system the actual output voltage of the sensor at a full spool. Use ▲ **and** ▼ to select between "SET NOW" and "SYS MAX".
    i. "SET NOW" is preferred as this will record a voltage value from the probe when it is sensing a full spool. With the ultrasonic probe measuring the same maximum diameter as previously entered, Press ↵ to measure and record a voltage value.
    ii. "SYS MAX" will set the value to 10V. This may be less accurate in operation as some nominal 0-10VDC sensors do not truly reach 10V output. If you would like to use this option, simply Press ↵ to proceed.
f. "ZERO SET" will appear. This will teach the system the output voltage of the sensor at an empty spool. Use ▲ **and** ▼ to select between "SET NOW" and "SYS MIN".
    i. "SET NOW" is preferred as this will record a voltage value from the probe when it is sensing an empty spool. With the ultrasonic probe measuring the same minimum diameter as previously entered, Press ↵ to measure and record a voltage value.
    ii. "SYS MIN" will set the value to 0V. This may be less accurate in operation as some nominal 0-10VDC sensors do not truly reach 0V output. If you would like to use this option, simply Press ↵ to proceed.
g. "SET 3K" will appear. Toggle On/Off with ▶ (Toggle on if ultrasonic probe requires 3KΩ minimum impedance). Press ↵ . For probes provided by Magnetic Technologies, this setting will be set to off.
h. "SETUP COMPLETE" will display.

Strain Gauge Setup (MPP24-III & IV ONLY)**:** Setup of operating conditions for usage of a strain gauge. Necessary for proper function of system in Strain Gauge operation setting. This calibration uses a known weight to apply a known tension to the system. This will teach the system a correlation between sensor voltage and tension necessary for accurate control. PID parameters must be set for this mode to function.

a. From Settings menu, navigate to "SG SETUP" Press ↵

b. "SG INPUT" will appear. ◀ **and** ▶ to select between *0-10VDC* or *mV Signal*. Select the option that corresponds with the sensor you are using.

c. "MAX LOAD?" will appear. This value sets the maximum input value that the operator can select. Typically, this would be the rating of the load cell. Significant figure to be adjusted will be blinking. Use ◀ **and** ▶ to change significant figure, and ▲ **and** ▼ to adjust maximum input load. Press ↵

d. **For Mv Signal Load Cells only**, "SG Gain?" will appear. Select amplifier gain based on SG Sensitivity. Refer to table below. Significant figure to be adjusted will be blinking. Use ▲ **and** ▼ to select a gain. Press ↵

SG Sensitivity (mV/V)		SG Gain
Greater Than	Less Than or Equal To	
0	0.5	**256**
0.5	1	**128**
1	2	**64**
2	4	**32**
4	8	**16**
8	16	**8**
16	32	**4**

e. "SG Zero" will appear. Ensure the load cell is mounted in place and has no load on it. Press ↵ to store a voltage value with the strain gauge experiencing only the force of gravity. Nothing should be touching the roller during this step.

f. "SG CAL" will appear. Using a calibration weight or known mass, run a wire or string through the **complete** pulley system and hang the weight on the end of the material. The material must run through the entire payoff process from the spool through the exit idler pulley on the load cell. Ensure the weight hangs freely and still. Press ↵ to store a voltage value with the strain gauge experiencing the tension of the hanging weight.

g. "WEIGHT?" will appear. Enter the mass of the calibration weight used in the previous step. Use ◀ **and** ▶ to change significant figure, and ▲ **and** ▼ to adjust the value. Press ↵

h. Navigate to the PI Gain Menu and adjust PI parameters as needed as well as current limits if desired. If current limits are not set, the current output will run the range of the brake model selected.

Strain Gauge PI Gain(MPP24-III & IV ONLY)**:** Allows user to modify the proportional gain, integral gain, and time constant used to determine response to changes in the strain gauge signal. To tune the system, start with all 3 parameters at their lowest values. Begin testing by slowly increasing proportional gain until desired response is achieved. Generally, slower system response is preferred as it will produce a stable output and any changes will be gradual. A fast system will tend to hunt for tension and will be thrown out of equilibrium by small disturbances. After proportional gain is set to the desired sensitivity, some integral gain can be added to smooth the response if there is some level of oscillation. The time constant should be left at the minimum value to allow for the maximum sampling speed.

a. From Settings menu, navigate to "SG PI GAIN" Press ↵
b. "P GAIN?" will display. Use ◀ **and** ▶ to change significant figure, and ▲ **and** ▼ to adjust the proportional gain value. Press ↵
c. "I GAIN?" will display. Use ◀ **and** ▶ to change significant figure, and ▲ **and** ▼ to adjust the integral gain value. Press ↵
d. "PID dT?" will display. Use ◀ **and** ▶ to change significant figure, and ▲ **and** ▼ to adjust the integral gain value. Press ↵

Brake Curves: Generates custom 3rd order polynomial fit calibration curve from collated brake data and user input. Brake torque vs. current curves can vary somewhat from brake to brake. It may be useful to adjust the brake adjustment curve to match the exact serialized brake being used. This brake curve is crucial for output current calculations in ultrasonic mode and is responsible for the approximate torque values displayed in various running modes. The brake curves have no effect on the strain-gauge mode as that is a closed-loop system and does not rely on any pre-programmed brake data.

a. From Settings menu, navigate to "BRAKE CURVES" Press ↵
b. "MODEL?" will display. Use ▲ **and** ▼ to change to the brake model number matching the unit being used with the power supply. Press ↵
c. "C0?" will display. Use ◀ **and** ▶ to change significant figure, and ▲ **and** ▼ to adjust the C_0 constant value. Press ↵
d. "E0?" will display. Use ◀ **and** ▶ to change significant figure, and ▲ **and** ▼ to adjust the E_0 constant value. Press ↵
e. "C1?" will display. Use ◀ **and** ▶ to change significant figure, and ▲ **and** ▼ to adjust the C_1 constant value. Press ↵
f. "E1?" will display. Use ◀ **and** ▶ to change significant figure, and ▲ **and** ▼ to adjust the E_1 constant value. Press ↵
g. "C2?" will display. Use ◀ **and** ▶ to change significant figure, and ▲ **and** ▼ to adjust the C_2 constant value. Press ↵
h. "E2?" will display. Use ◀ **and** ▶ to change significant figure, and ▲ **and** ▼ to adjust the E_2 constant value. Press ↵
i. "C3?" will display. Use ◀ **and** ▶ to change significant figure, and ▲ **and** ▼ to adjust the C_3 constant value. Press ↵
j. "E3?" will display. Use ◀ **and** ▶ to change significant figure, and ▲ **and** ▼ to adjust the E_3 constant value. Press ↵
k. "CALC IN PROGRESS" will display. Once "BRAKE CURVES" displays again the unit has generated and stored the input brake curve.

E-Stop Timing: Allows user to modify ramp time of emergency stop.

a. From Settings menu, navigate to "E-STOP TIMING" Press ↵

Note: Factory default is set to 0.5

b. Use ▲ **and** ▼ to adjust ramp time up to 4 seconds. Press ↵

Units: Allows user to select units of measure.

a. From Settings menu, navigate to "UNITS?". Use ▲ to toggle between "IMPERIAL" and "METRIC" unit systems. Press ↵

b. If unit system is changed parameters that are unit dependent (ex. spool diameters, brake curve modifiers, etc.) will be converted automatically.

Modbus Address: Allows user to assign a Modbus address to each individual MPP24 in a networked configuration.

a. From Settings menu, navigate to "MB ADDR".

b. Use ▲ **and** ▼ to change the unit's Modbus Address. Press ↵

Mode: Allows user to use a series of MPP24 units in an RS485 Modbus network. Entering HMI Mode will only allow the system to be controlled via a remote networked device.

a. From Settings menu, navigate to "MODE".

b. Use ▲ **and** ▼ to toggle LCD/HMI. Press ↵

Note: *If power is interrupted at any time, all data is stored. Power supply program will return to last location when power is restored.*

Operation

⚠ Hold▲ to exit any screen or running mode.

Constant Current: User selects a fixed current value (mA) via keypad entry to achieve a constant torque from the brake. Voltage is varied in Realtime to maintain the setpoint current and thus the slip torque of the brake. Current can be adjusted at any time while the system is running. It may be useful to refer to a torque vs. current chart for the brake being used to determine approximate current value required for a desired slip torque.

a. From Main Menu, navigate to "CONSTANT CURRENT" Press ↵
b. Set desired current. Significant figure to be adjusted will be blinking. Use ◀ **and** ▶ to change significant figure, and ▲ **and** ▼ to adjust current. Press ↵
c. "Brake Engaged" (→◯←) green LED will be activated.
d. Display will scroll thru: Model, Radius, Output Current (total), Output Current (per brake), & Calculated Torque.

Note: *To increase/decrease current while running:*

a.) Press ↵
b.) Significant figure to be adjusted will be blinking. Current will adjust in real-time.
c.) Use ◀ **and** ▶ to change significant figure, and ▲ **and** ▼ to adjust current
d.) Press ↵ when complete.

0-10 VDC: Allows operator to set current output using external 0-10 VDC input or voltage divider with internal 10 VDC. This can be useful for running the brake through a programmed adjustment cycle or for manual adjustment via a remote device. Output current will be equal to the input voltage multiplied by the gain factor (e.g., with 100mA/V gain factor, 5V input would correspond to 500mA output).

a. From Main Menu, navigate to "0-10 VDC" Press ↵
b. Use ▲ **and** ▼ to set gain factor (200mA/V, 100mA/V, 50mA/V, 40mA/V, 25 mA/V, 20mA/V) Press ↵ when complete.
c. "Brake Engaged" green LED will be activated.
d. Display will scroll thru: Model, Radius, Output Current (total), Output Current (per brake), & Calculated Torque.

Note: *To adjust gain while running*

a.) Press ↵
b.) Use ▲ **and** ▼ to adjust the gain value
c.) Press ↵ when complete

Ultrasonic Mode: This mode automates payoff applications and provides constant tension. Utilizing either a laser or ultrasonic sensor to measure spool diameter, the system uses pre-programmed brake curves to calculate a current output for a given tension and measured diameter. This allows for tension to remain constant through a large diameter change and allows for easy operation by directly inputting a target tension value in ounces or grams. Spool diameter will be continuously measured in real-time and braking torque will be constantly adjusted to achieve the target tension.

Note: Ultrasonic Probe must be installed and setup prior to use. (See wiring specifications and setup instructions on *Page 4 & Page 8)*

a. From main menu, navigate to "USONIC" Press ↵
b. Set desired tension. Significant figure to be adjusted will be blinking. Use ◀ **and** ▶ to change significant figure, and ▲ **and** ▼ to adjust tension. Press ↵
c. "Brake Engaged" green LED will be activated.
d. Display will scroll thru: Model, Radius, Output Current (total), Output Current (per brake), & Calculated Torque.

Note: *To increase/decrease tension while running*

a.) Press ↵
b.) Use ◀ **and** ▶ to change significant figure
c.) Use ▲ **and** ▼ to adjust current
d.) Press ↵ when complete

Strain Gauge(MPP24-III & IV ONLY)**:** Utilizes a strain gauge and built in PID controls to vary brake torque output to maintain constant tension. This mode directly measures the tension of the material using an in-line roller load cell and automatically adjusts torque to the brake to achieve the target tension.

Note: Strain Gauge must be installed and setup prior to use. (See wiring specifications and setup instructions on *Page 4 & Page 12)*

a. From main menu, navigate to "SGAUGE" Press ↵
b. Set desired tension. Significant figure to be adjusted will be blinking. Use ◀ **and** ▶ to change significant figure, and ▲ **and** ▼ to adjust tension. Press ↵
c. "Brake Engaged" green LED will be activated.

Note: *To increase/decrease tension while running*

a.) Press ↵
b.) Use ◀ **and** ▶ to change significant figure
c.) Use ▲ **and** ▼ to adjust current
d.) Press ↵ when complete

Free Contact: Current drops to zero, displayed torque is minimum drag torque from internal table. "Free" green LED will be activated. When contact is opened, power supply returns to previous mode.

E-Stop: Current increases to maximum allowable for brake. "E-Stop" red LED will be activated.
(Ramp time can be adjusted 0-4 seconds from Settings Menu *See page 10)*
When contact is opened, power supply returns to previous mode.

Quick Reference Technical Data	
Input	90 – 264 VAC, 47 – 63 Hz
Output Voltage	0-60 VDC
Output Power	80W Max.
Output Current	0-2A, 0-1A, 0-500 mA, 0-400 mA, 0-250 mA, 0-200 mA
Overload Protection	Short circuit or overload: unit switches off, attempts to switch on within a short period of time.
Current Ramp	Adjustable 0-Full load from 0-5 seconds
Operating Temperature	-15C - +40C
Control Voltage	0 – 10 VDC
Additional Fixed Voltage	24 VDC Output (To power external devices such as diameter probe)
Display	2-line x 8 character backlit LCD
Unit Display	Imperial (or) Metric
Temperature Control	Unit will switch off during thermal overload and switch back on again after cool down.
Power Failure Reset	Control settings are retained in non-volatile memory. When power is restored, unit returns to previous operating state.
Safety	EN 60950-1
Emission	EN61000-3-2 class A, EN55022B Class B, FCC part 15 Class B
Directives	Low voltage directive 2006/95/EC ROHS Directive 2011/65/EU
Ripple & Noise	1%
Full Load Efficiency	90%