INSTALLATION & OPERATION
LCI MOTOR LOAD CONTROLS

LCI Motor Load Controls Sense Motor Horsepower—

Use this valuable feedback to:

- Adjust Machines and Processes
- Signal Beginning or End of Process
- Detect Trouble
- Protect Machines and Processes

LOAD CONTROLS INCORPORATED

53 TECHNOLOGY PARK RD.
STURBRIDGE, MA 01566
508-347-2606
FAX 508-347-2064
www.loadcontrols.com

POWER

The POWER to a motor measured in watts or horsepower is essentially linear for all motor loads and is the best indicator of the work being done by a motor. This is more sensitive than just sensing Amps.

These Controls have a built-in fast response Power Sensor

- Voltage is taken from two of the phases
- Current (amperage) is taken from the remaining phase
- Power Factor is calculated from the lag of the current behind the voltage

THREE PHASE POWER = VOLTS X AMPS X POWER FACTOR X 1.73

FEATURES ON ALL CONTROLS

ADJUSTABLE SET POINTS

When power reaches your selected SET POINT a built-in Relay Output is activated (tripped). Relay stays tripped (latched). You choose when to reset.

ANALOG OUTPUT

Hook to the Load Meter for monitoring load, easy setup and adjustment.

EASY SETUP WITH SET READ SWITCHES

Press the SET READ Switch and the SET POINT for that Channel is displayed on the LOAD METER.

- You **know** where the SET POINT is
- Easily verify proper operation

BUILT-IN STARTUP TIMER

Adjustable Timer eliminates false trips while the Motor is starting.

FILTER OUT NUISANCE TRIPS

Adjustable On-Delay Timer. Trip won't activate until the selected delay time is exceeded.

RESET

The Control can be Reset

- Automatically — when the overload is gone
- Remotely — with switch, relay or programmable controller
- Manually

TRIP INHIBIT

The Control can be remotely bypassed during any part of the cycle when not required.

Also Available

Remote Set Point Adjustment for All Models

STANDARD LOAD CONTROLS

The relays trip when a Set Point is reached. Set Points can be:
High Trip — Trips when the power goes above the Set Point
Low Trip — Trips when the power goes below the Set Point

STANDARD LOAD CONTROL MODEL NUMBERS

PFR-1500 Single Set Point
One Set Point — High Trip

PFR-1500L
One Set Point — Low Trip

PFR-1700 Dual Set Points
Two Set Points — Both High Trip

PFR-1700HL High-Low Set Points
Two Set Points — One High Trip, One Low Trip

COMPENSATOR™LOAD CONTROLS

For machine tool applications the IDLE or BASELINE power of a machine tool drifts because of changes in:

- Temperature
- Lubricant Viscosity
- Mechanical Clearance
- Idle Speed

For accurate dull or broken tool detection, grinder gap elimination, this drift should be zeroed out.

- A limit switch or programmable controller signal tells the COMPENSATOR™ each time the machine is in the idle or "BASELINE" position.
- The COMPENSATOR™ samples this power level and retains it as a reference.
- The SET POINTS are related to this BASELINE.

In other words, the COMPENSATOR™ zeros out the BASELINE power for each cycle. The absolute trip point changes as conditions change but always remains a fixed amount away from the BASELINE. This means no constant fine tuning. It adjusts itself.

COMPENSATOR™LOAD CONTROLS MODEL NUMBERS

PCR-1800 COMPENSATOR™
Single Set Point Above the Compensating Baseline

PCR-1810 COMPENSATOR™
Two Set Points: One Compensating, One Standard

PCR-1820 COMPENSATOR™
Two Set Points, Both Compensating

INSTALLATION

MOUNTING

The Load Control should be mounted in a control cabinet or in a protected area. The four Phillips head screws on the Control should be removed and used for attaching the mounting brackets to the Control. High voltage is present on the upper terminal strips. If regular access to the Control is needed in this case, these terminals should be covered.

ELECTRICAL CONNECTIONS

VOLTAGE

120 Volts AC - 35VA minimum is taken from two of the phases. If the machine already has a 120 Volt control transformer with 35 VA of free capacity, this can be used. Otherwise, install a separate transformer. Be sure to note which two phases supply the transformer.

CURRENT

The current signal is taken from the ***REMAINING*** phase. There is a current sensing toroid inside the control and up to 15 Amps can be passed directly through the control. The normal control has full scale capacities of 3.75, 5 and 15 Amps built-in. Above 15 Amps, an external current transformer reduces the signal to 5 Amps which is then passed through the control. For small motors, the control can easily be factory modified. A standard modification is .75, 1.0, 3.0 Amps full scale.

It is ***VERY IMPORTANT*** that the current signal comes from the phase that IS NOT supplying the 120V control transformer. Be extra careful when the machine has reversing starters or multi-speed windings. If a wrong phase is used the control will either:

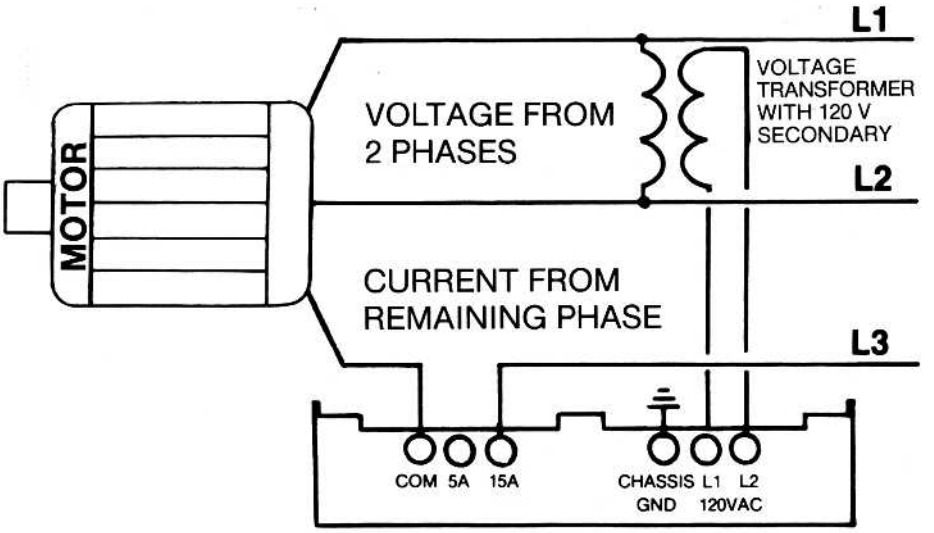
- Work backwards
- Have reduced sensitivity.

CAPACITY	CONNECT CURRENT TO TERMINALS
Below 2 Amps	*MODEL "1.0" Factory Modification
3.75 Amps	5A and 15A
5 Amps	COM and 5A
15 Amps	COM and 15A
Above 15 Amps Use xxx: 5 Current Transformer	COM and 5A

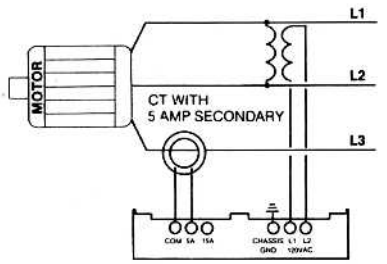
*For Small Motors
Specify Suffix "1.0"
Full Scale .75 Amp, 1 Amp, 3 Amp

ELECTRICAL CONNECTIONS (Continued)

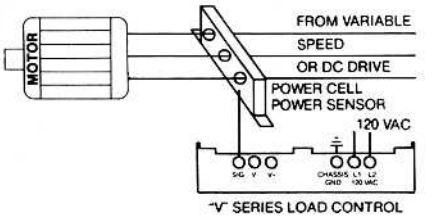
Up to 15 Amps Directly
Through Control



Over 15 Amps Use External
Current Transformer



For Variable Frequency
Or DC Power Use Power
Cell Power Sensor and
"V" Series Load Control

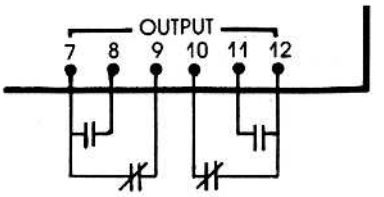


"V" SERIES LOAD CONTROL

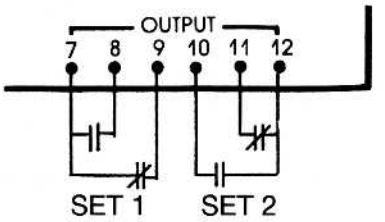
See Page 10 for CT Hookup

OUTPUT CONNECTIONS (Terminals 7-12)

RELAY OUTPUTS —
SINGLE SET POINT CONTROLS
PFR-1500
PFR-1500L
PCR-1800



RELAY OUTPUTS —
TWO SET POINT CONTROLS
PFR-1700
PFR-1700HL
PCR-1810
PCR-1820



- ***Relays Shown Normal Operation***
- ***Power On***
- ***Not Tripped***
- Specifications: .01 Amps to 3 Amps at 120 Volts AC 1/20 HP at 120 Volts AC

(Set 1 is the low set point for model PFR-1700HL)

CONTROL CONNECTIONS (Terminals 1-6)

ANALOG OUTPUT AND SET READ SWITCHES

Always use a Load Meter! It greatly simplifies setup, adjustment and trouble shooting.

The ANALOG OUTPUT (0-1 milliamp) proportional to motor power is on Terminal 6 (Positive) and Terminal 5 (Common). The Percent Load Meter is connected to this output.

- The Meter shows the Motor Load.
- When the Set Read switches are pressed, the Set Point is displayed.

The ANALOG OUTPUT can also be used to drive a chart recorder or as an input to a computer or controller.

The output can be factory modified for a 0-10V or 4-20 milliamp output. To convert the 0-1 milliamp output in the field to 0-10 volts, use a 10K ohm 1% resistor across Terminals 5 and 6.

HOOKUP

Terminal 6 Positive **Terminal 5 Common**

Use #18 AWG or larger. For lengths of 10-100 feet, use shielded cable with the shield grounded at the Control, but not at the Meter.

HOOKING UP RESET, INHIBIT AND BASELINE

The terminals for BASELINE, RESET and INHIBIT generate a small amount of current (8-12 milliamps). To activate one of these functions you just need to connect the terminal to the circuit common (Terminal 5).

The switches or relays that you use must be suitable for low current. (Gold flashed contacts, Reed Relays, Mercury Switches, Open Collectors).

Don't use 10 Amp switches. They won't be reliable.

A voltage signal from a programmable controller can also be used but it must be a sink or source/sink (30 Volt max., 12 Volt min). When in doubt, use a reed relay.

Don't put 120V on Terminals 1-6. It will destroy the control.

RESET

Control can be reset 3 ways:

- Manually with the Reset button on the Control.
- Remotely with a remotely located Reset button.
- Automatically by jumpering the Reset Terminal. The Control will then automatically reset itself when the trip condition goes away.

HOOKUP

Remote Reset —

Momentarily Connect Terminal 2 to Terminal 5 for Set 1
Momentarily Connect Terminal 4 to Terminal 5 for Set 2

Automatic Reset —

Jumper Terminal 2 to Terminal 5 for Set 1
Jumper Terminal 4 to Terminal 5 for Set 2

INHIBIT

The Control can be inhibited or bypassed with the INHIBIT. This lets you ignore the Control during certain parts of the machine cycle, if you desire.

HOOKUP

Terminal 1 to Terminal 5

HOOKING UP RESET, INHIBIT AND BASELINE (Continued)

BASELINE
(For COMPENSATOR™ Models PCR-1800, PCR-1810, PCR-1820)

A COMPENSATED Set Point needs a zero reference. This is done 2 ways: The first way is with a limit switch or programmable controller on the machine. Usually, an existing switch or controller is used as long as it is electrically compatible. The BASELINE signal should last at least 250 milliseconds but can be as long as you want. The COMPENSATOR™ remembers the last value before the BASELINE contact opens.

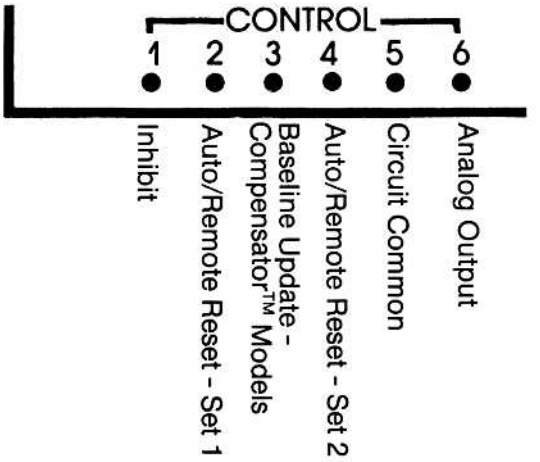
You need a BASELINE update for each machine cycle. The green Baseline LED is on DURING the update.

The control also automatically establishes a Baseline when the Startup timer goes off. If each machine cycle includes starting the motor, an external BASELINE is not needed.

HOOKUP
Momentarily connect Terminal 3 to Terminal 5.

Check the Load Meter as the Baseline LED goes out. This is the value that the COMPENSATOR™ remembers. It should be the idle load of the machine.

MANUAL BASELINE UPDATE
During machine setup it is sometimes helpful to manually update the BASELINE. Do this by momentarily jumpering Terminal 3 to Terminal 5.



Don't put 120 volts on Terminals 1-6! It will destroy the control.

ADJUSTMENTS

TRIP SET AND SET READ SWITCHES

The TRIP SET knobs set the power level at which the Load Control will trip.

The SET READ switches show the trip point on the Percent Load Meter. Press the SET READ switch to read the set point. Holding the switch down while moving the TRIP SET knob makes set up easy.

For COMPENSATING Set Points, the set point is the level ***ABOVE THE BASELINE*** at which the Load Control will trip. With the power on but motor not running, the SET READ switch will show the ***INCREASE*** in load needed to trip. With the motor running, the SET READ switch shows the combined Baseline and Setting.

This means that the total Set Point for the COMPENSATING Controls will change as the Baseline or idle power changes during the day. But, the ***INCREASE*** always stays the same. This zeroes out the effect of machine drift.

STARTUP TIMER

The STARTUP TIMER bypasses the control during motor startup to avoid false trips because of current inrush. For convenience, ***THE TIMING BEGINS WHEN THE MOTOR STARTS.*** The STARTUP LED stays lit until the Startup period is over.

Adjust the STARTUP time with the locking pot on the Load Control. Clockwise for more time. The Startup time should be:

- Long enough so that the load has stabilized. The Percent Load Meter should stabilize before the STARTUP LED goes out.
- Short enough so that the machine does not start a work cycle before the LED goes out.

ON-DELAY TIMERS

To avoid nuisance trips from short overloads, ON-DELAY TIMERS bypass the Control for the selected time. The relays won't trip until the time is exceeded. If the trip condition goes away before the time is up, the timer resets to zero.

- Always start with minimum ON-DELAY (full counterclockwise). If you are getting trips where you don't want them (as the tool is entering the workpiece for example) increase the ON-DELAY time.

ANALOG OUTPUT AND FULL SCALE

The Analog Output is proportional to the power that is being sensed. This output is usually 0-1 milliamp but can also be 0-10 Volts or 4-20 milliamps. The output is hooked to a Percent Load Meter and the value of this signal can be calculated:

Full Scale Watts = (E) (I) (1.73)
E = Primary Voltage (Typically 460 Volts)
I = Current Value being used (External Current Transformer rating or Terminals being used)

Example
Full Scale: 230 Volt Primary, current going directly through the 15 Amp terminal.
Watts = (230) (15) (1.73) = 5968 Watts
Horsepower = 8 (5968 Watts/746)
100% on load meter = 8 Horsepower
50% on load meter = 4 Horsepower

Example
Full Scale: 460 Volt Primary, 50:5 External CT connected to the 5A terminal.
Watts = (460) (50) (1.73) = 39790 Watts
Horsepower = 53
100% on load meter = 53 Horsepower
10% on load meter = 5.3 Horsepower

FULL SCALE HORSEPOWER

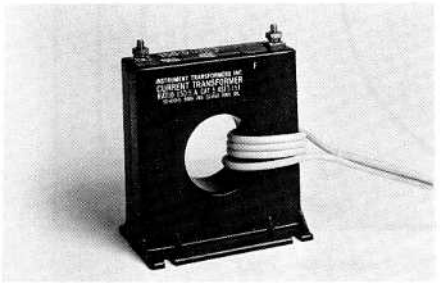
Show below are some selected capacities in Horsepower.

Current Hookup	230 Volt Supply	460 Volt Supply
Direct 5 Amp	3 HP	5 HP
Direct 15 Amp	8 HP	16 HP
CT 25:5	13 HP	27 HP
CT 30:5	16 HP	32 HP
CT 50:5	27 HP	53 HP
CT 75:5	40 HP	80 HP
CT 100:5	53 HP	107 HP
CT 150:5	80 HP	160 HP
CT 200:5	107 HP	213 HP

CONNECTING EXTERNAL CURRENT TRANSFORMER

For loads over 15 Amps, a Current Transformer is used to reduce the primary current to 5 Amps. Each time the primary wire goes through the center of the Current Transformer is a "Turn". Passing through the first time is 1 Turn. The proper number of Turns must be used to reach the desired rating. For most loads the CT 150:5 is used and the capacity is changed by changing the number of turns.

Connect the secondary leads to the COM and 5A Terminals on the Load Control.



Secondary to Com & 5A Term.

	CT Size	Primary Turns	Capacity
CT 150:5 With 4 Turns	CT 150:5	6	25 AMPS
		5	30 AMPS
		4	37.5 AMPS
		3	50 AMPS
		2	75 AMPS
		1	150 AMPS
Larger CT's also available.	CT 100:5	1	100 AMPS
	CT 200:5	1	200 AMPS
	CT 250:5	1	250 AMPS
	CT 300:5	1	300 AMPS

The Full Scale Capacity (Sensitivity) of the Load Control can be fine tuned by adding or taking away Turns. More Turns = More Sensitivity. Fewer Turns = Less Sensitivity.

The Load Control is ***NOT DAMAGED*** by an overload. Don't be afraid to increase the sensitivity. More deflection means easier setting.

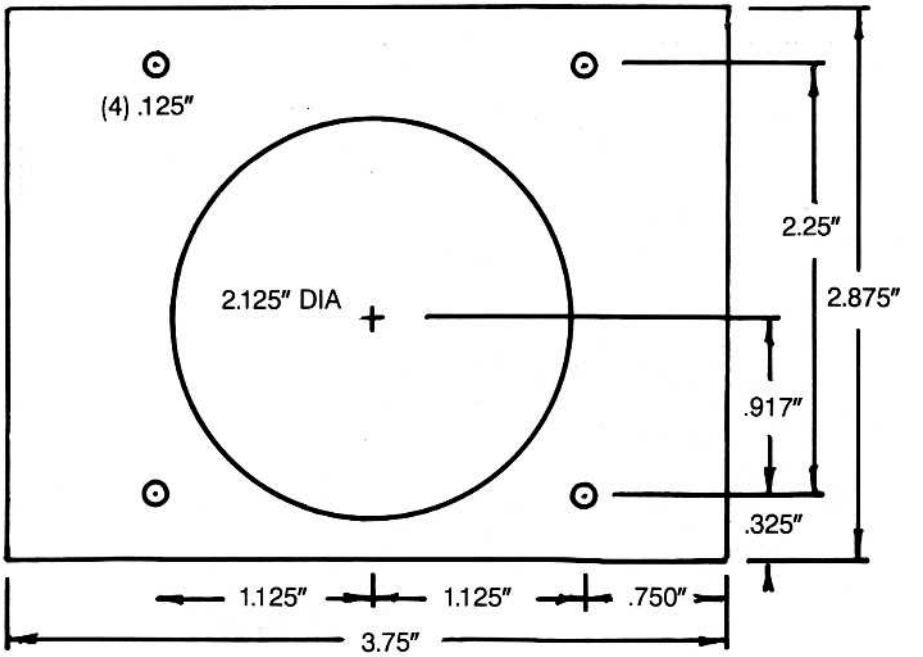
CAUTION

When current is flowing through the primary, always have the secondary wires either:

- Connected to the Load Control
- If the Load Control is removed, connected to each other.

If they are left open, dangerous and destructive voltages can develop.

PLM LOAD METER MOUNTING TEMPLATE

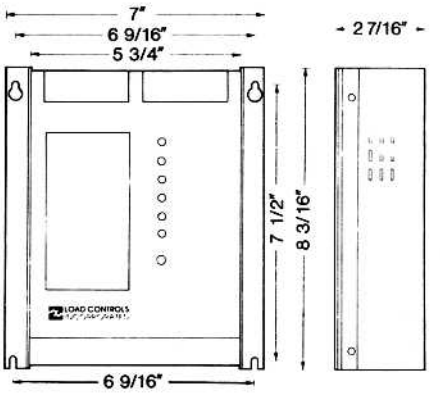


.5" FRONT CLEARANCE REQUIRED

2" REAR CLEARANCE REQUIRED

SPECIFICATIONS FOR MOTOR LOAD CONTROLS

CAPACITY — to 1000 Horsepower
POWER CONSUMPTION — 35 VA, 120 Volts
OUTPUTS: RELAY — .01 Amp to 3 Amp at 120 Volts AC, 1/20 HP
ANALOG — 0-1 milliamp (0-10 Volt or 4-20 milliamp optional)
RESPONSE TIME — 25 milliseconds
TEMPERATURE — 0° C-55° C
TIMERS: STARTUP — 1-12 seconds: Bypasses control during startup.
ON-DELAY — .04-2 seconds: Relay output will not operate until delay time is exceeded.



10/06