CEM-AC-E0-A
CEM-AC-E1-A

Description:

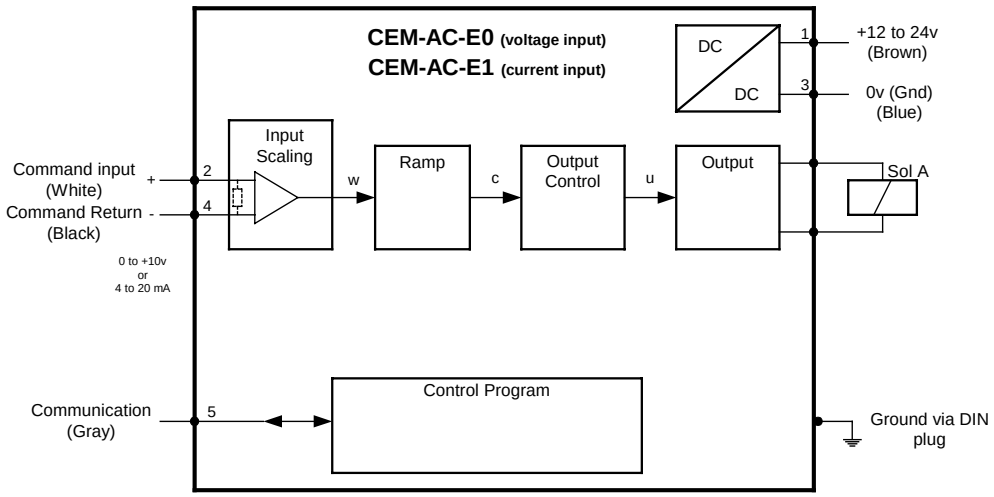
This power amplifier mounts directly to a single solenoid proportional valve coil with a DIN style connector, and will drive up to 2.5A. It is suitable to control current to either a proportional flow or pressure valve coil.
A wide range of analog signals are accepted. There are two product choices for input, one accepts voltage commands, the other accepts current commands. These inputs are easily scaled to match system requirements. Two independent ramps are available for acceleration and deceleration control.
Min and Max output current are adjustable. Output characteristics can be independently customized. The module is disabled if the coil outputs are shorted or open. If command current is outside of the proper range, the module is also disabled. PWM and Dither are user adjustable.
This module is easily adapted to a variety of system requirements. All variables are user adjusted with easy to use software on your Microsoft Windows laptop. Control variables are stored in non-volatile memory internal to the module. All variables can be read by the laptop, and reproduced exactly on other modules.

Technical Data:

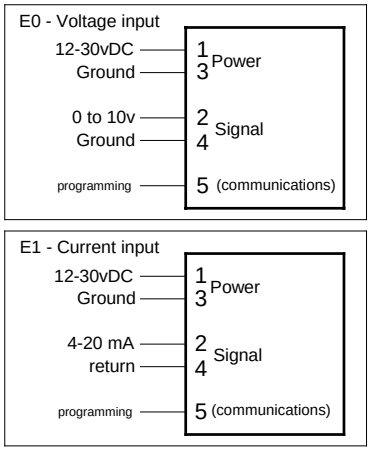
Power Supply		vDC	12 to 30 (including ripple)
	Consumption	mA	<100mA + solenoid
	External Fuse	A	3 (medium action)
Analog Input	Voltage	vDC	0 to +10 (voltage version)
	Impendance	ohm	90k
	Current	mA	4 to 20 (current version)
	Impendance	ohm	390
	Resolution	%	<0.1
	Sample Time	mS	1.0
Solenoid Output		A	1.2 ⊢ Software Selectable
		A	2.5
	PWM Frequency	Hz	60 to 2650
	Dither Frequency	Hz	60 to 400
	Dither Amplitute	%	0 to 30
	Sample Time	mS	0.17

Electrical Connection			
	Power and Signal		M12 5 pin male key style A
	Communication		LIN bus
	Ground		via DIN coil pin
Housing	Housing		Attaches to DIN 43650 coil
	Material		Polyamide PA
	Combustability Class	UL94	V1
	Protection Class	IP	65 (with gasket)
	Working Temperature	C	-20 to +60
	Storage Temperature	C	-20 to +70
	Humidity	%	95 (non condensing)
Electro Magnetic Compatibility			
	Emission		EN 61000-6-2
	Immunity		EN 61000-6-3
	Vibration Resistance		EIC 60068-2-6

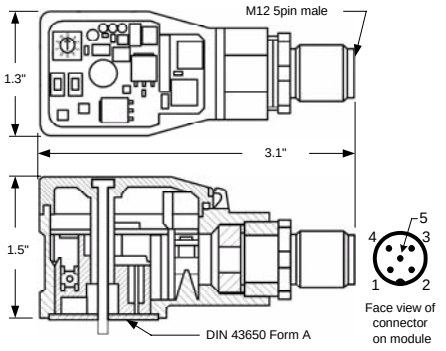
Functional Diagram:



Wiring Example:



Dimensions:



Steps to install and configure a new application:

1. Mount the module on the valve solenoid.
2. Connect the M12 cordset with power supply and command wires
3. Attach VEA-PB5 programming box tool
4. Connect programming tool to computer with VEA-USB programming cable
5. Adjust current range to match valve
6. Adjust PWM/Dither to optimize valve performance
7. Adjust analog input to scale command input
8. Adjust ramping (if desired)
9. Adjust internal monitor functions (if desired)

Module Mounting:

This module is to be mounted on a proportional valve solenoid with a DIN 43650 connector. It has an environmental protection rating of IP65. Additional external protection may be necessary on machinery subjected to extreme wash down conditions.
Do not mount near other items that emit high power electrical interference, such as motor controllers and high power contactors.

Power Supply:

This amplifier module is designed to operate on DC power from a regulated power supply ranging from 12 to 30 volts. Match valve solenoid voltage rating to power supply, typically 12 or 24 volts.

A 3 amp medium action fuse is recommended in the “+” power supply line.

Wiring to Amplifier:

The CEM-AC products have an industry standard M12 5pin male electrical connector. Mating connectors or complete cordsets are available from many sources.

Voltage drop must be considered when selecting connecting cable.

CHI offers the VEA-3P5C, a 5 meter long 22 gauge 5 conductor shielded cable cordset. The voltage drop in this cable should be acceptable with 24v solenoid applications. Allowable voltage drop may limit the cable length in an application where the solenoid requires the full 2.5A.

Adjust MODE to STD or EXP:

The module wakes up in the default mode of STD. Several parameters may be adjusted while in STD mode.

EXP mode allows more complex parameter adjustments to the module.

MODE parameter valid options are STD and EXP.

Adjust module current output to match valve requirements:

Proportional valve manufactures will generally list the following specifications:

Maximum current
Minimum current (cracking current)
Recommended dither for optimum performance

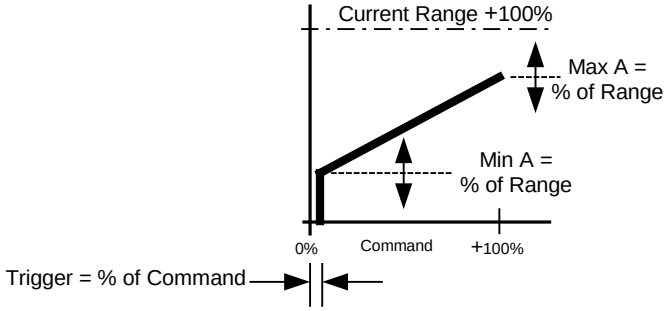
This module must first be adjusted to match the valve solenoid requirements.

The first step is to select the appropriate current range. There are two choices:

CURRENT = 0 solenoid current up to 1.2A
CURRENT = 1 solenoid current up to 2.5A

Maximum current is set with software as a percentage of this range. Max is usually adjusted to the solenoid rating.

Minimum current is adjusted via software for the purpose of deadband elimination.



This module has a software adjustable “dead zone” near zero, termed TRIGGER. With a command in this near zero area, neither solenoid will be energized. Trigger is intended to keep small noise signals on the analog command from causing either solenoid to be energized.

PWM and Dither are set via software.

Output Current:

1. Select Module output range to meet valve requirements:

Example: D03 direction valve with 24v solenoid – Max = 0.86A
CURRENT = 0; output up to 1.2 A
CURRENT = 1; output up to 2.5A

1a *Set Value of software parameter CURRENT = “0”.*

2. Adjust Maximum solenoid current for the solenoid:

Example: 0.86A/1.2A = 71.67%

2a *Set software parameter MAX:A to value of 7167.*
(note: Software parameter has units of 0.01%)

3. Adjust Minimum solenoid current for the solenoid:

Example: Valve will start to flow at about 0.180A.
0.180A/1.2A=15.00%

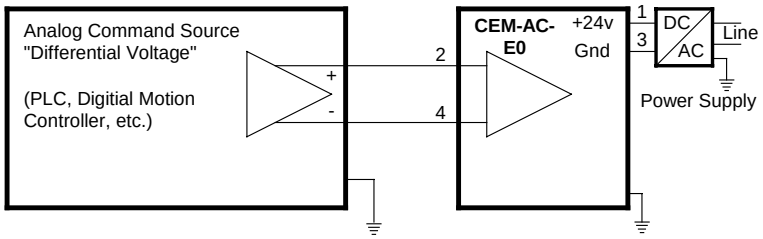
3a *Set software parameter MIN A to value of 1500.*
(note: Software parameter has units of 0.01%)

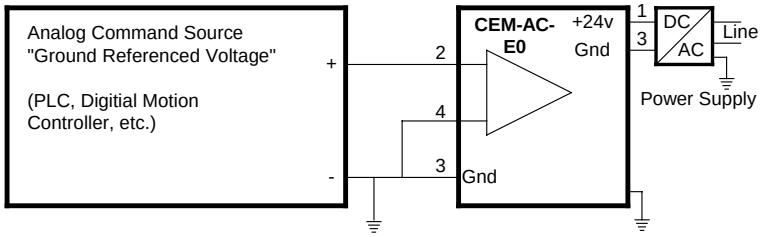
Note: Minimum values (cracking current) will need to be adjusted for each and every valve, as each valve has a unique flow gain characteristic.

Command input with Voltage:

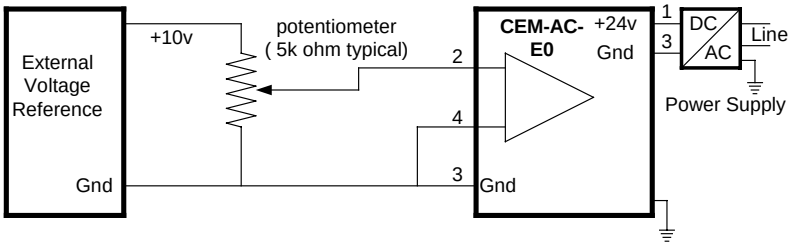
The CEM-AC-E0 can accept voltage signals for commanding valve performance.

An analog command source voltage may be either “differential” or “ground referenced”.





All ground based reference voltages must have a connection to Pin 3.

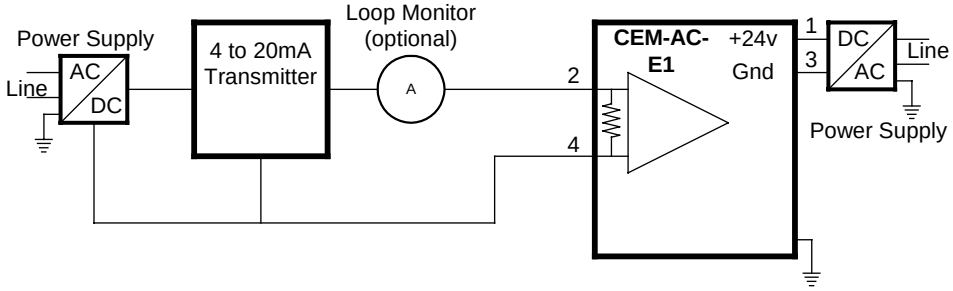


Command input with current:

The CEM-AC-E1 can accept current signals for commanding valve performance.

The CEM-AC-E1 has a 390 ohm resistor inserted across terminals 2 and 4. This resistor converts the current to a voltage. This voltage is measured by the differential amplifier to become the module command.

Input current range is 0 to +/- 20 mA, and is typically used at 4 to 20mA. This current is converted to voltage, and software scale and offset parameters are applied to meet system requirements.



All analog input signal cables must be shielded!

Good analog system design requires that all analog signals in an electrically noisy environment be shielded. Long wires act like antenna's that pick up analog noise. The wire connecting the analog command source to command this module must be shielded! An unshielded cable can allow electrical noise to be added to the desired command signal, and can make the system response erratic.

Good design principals require a noise sensitive wire be wrapped in a noise blocking shielded cable. That shield must be grounded at only one end, usually the end that sends the signal. Short signal wires in electrically quiet environments may not need to be shielded.

Swapping polarity with the POL parameter:

The input command polarity may be swapped with the POL command. Valid parameter values are "+" and "-". (Default = +).
Setting POL to "-" will change the 0% to 100% valve operation to 100% to 0%.

Adjustment of SENS internal monitoring function:

SENS parameter has two options: ON (default) and OFF

The CEM-AC-E0 is able to monitor the solenoid electrical connection. If the module senses a short circuit or open circuit on the output to the valve solenoids, the module is disabled.

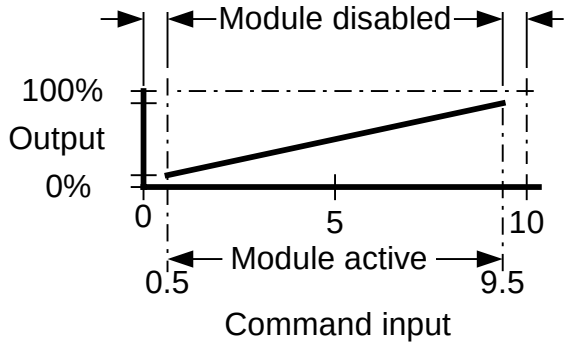
The CEM-AC-E1 adds the ability to monitor the analog input current range to the solenoid monitoring listed above. If SENS is "ON", and the command current falls outside of the 4 to 20mA range, the module is disabled.

Adjustment of LIM internal monitoring function:

LIM is an optional analog input voltage monitor. LIM can be used to monitor a possible cable break or open circuit from command input sources.

LIM can be set from 0 to 20% of total input range.

Example: The module has been configured for a joystick with total input range of 0 to 10v. Setting LIM to 500 (5.00%) will allow module operation with input command between 0.5v and 9.5v. A command below 0.5v, or over 9.5v will cause the module to disable.



Scaling of analog input:

The CEM-AC-E0 module has a native analog voltage input range of 0 to +10v. This input can be scaled and offset with software to allow a wide variety of input voltages. A few examples are:
0 to +10v, 0 to +5v, 1 to 5v, 0.5 to 4.5v

The CEM-AC-E1 module has a native analog current input range of 0 to 20mA. This input can be scaled and offset with software to allow a wide variety of input currents. A few examples are:
0 to 20mA, 4 to 20mA, 0 to 10 mA

The AIN:W is the Parameter used to adjust the analog input.

Analog voltages or currents are scaled with the following linear equation:

$$\text{Output} = A/B * (\text{Input} - C)$$

"Output" of this scaling equation must always be equal to the module native input range, 0 to +/- 10v. "Input" can be any voltage within this 20v range.

A/B allows for a decimal scaling factor. These two numbers are chosen to provide a "gain" to the input signal. A and B are positive or negative whole numbers up to 10000. (Default; A = 1000, B = 1000)

C is an offset, measured as a percentage of range. C has the units of 0.01%, and has the allowable range of –10000 to 10000. (Default; C = 0)

Scaling voltage inputs:

Example: Typical AIN:W parameter settings for popular command voltages:

Command	A	B	C	description	valve centered
0 to +10v	1000	1000	0	100% scale, 0% offset	0v
0 to +10v	1	1	0	100% scale, 0% offset	0v
0 to +5v	10	5	0	200% scale, 0% offset	0v
+1 to +9v	10	8	1000	125% scale, 10% offset	1.0v
+0.5 to +4.5v	10	4	500	250% scale, 5% offset	0.5v
0 to 8v	10	8	0	125% scale, 0% offset	0v

Scaling current inputs:

Example: Typical AIN:W parameter settings for popular command currents:

Command	A	B	C	description	valve centered
4 to 20mA	20	16	2000	125% scale, 20% offset	4mA
4 to 20mA	1250	1000	2000	125% scale, 20% offset	4mA
0 to 20mA	20	20	0	100% scale, 0% offset	0mA
0 to 10mA	20	10	0	200% scale, 0% offset	0mA

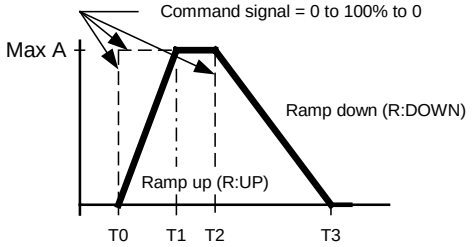
PWM and Dither:

PWM and Dither are parameters that are recommended by the valve manufacturer. For Continental Hydraulics recommendations for PWM and Dither, look for the latest updated reference chart at:

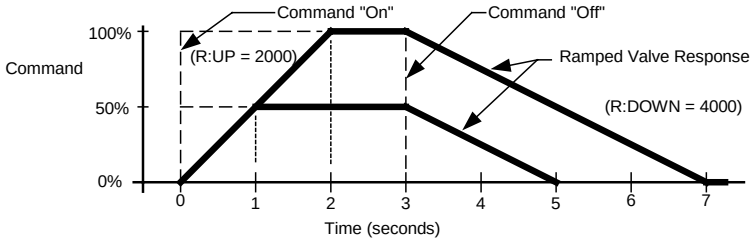
www.continentalhydraulics.com

Ramping:

Command input signals may be ramped.
There are two independently adjustable ramps, R:UP for ramp up, and R:DOWN for ramp down.



All ramp rates are set via software. All ramps are specified in milliseconds, and are actually "time to ramp for a 0 to 100% signal change." For example, a value of 2000 will give a ramp time of 2 seconds for a 0 to 100% step command. The ramp time will be 1 second for a step command of 0 to 50%.



LED function:

Yellow	Steady on	System OK
	Blinking	SENS is turned on, and 4 to 20mA current input is out of range
	Blinking	LIM is turned on, and input voltage is out of range
	Blinking	Connection to solenoid is open or shorted

Parameter monitoring using software:

The following parameters may be monitored in real time using Windows configuration software:

Parameter	Description	Unit
W	Command after scaling	0.01%
C	Command after ramping	0.01%
U	Output to power stage	0.01%
IA	Solenoid Current	mA