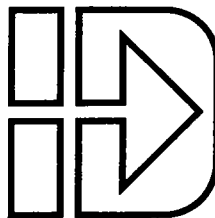**MODEL AC2000 and AC2001
ELECTRIC CYLINDER CONTROLS**

**INSTALLATION AND OPERATING
INSTRUCTIONS**

SPECIFICATIONS AND IDENTIFICATION

TROUBLESHOOTING CHART

PARTS LIST
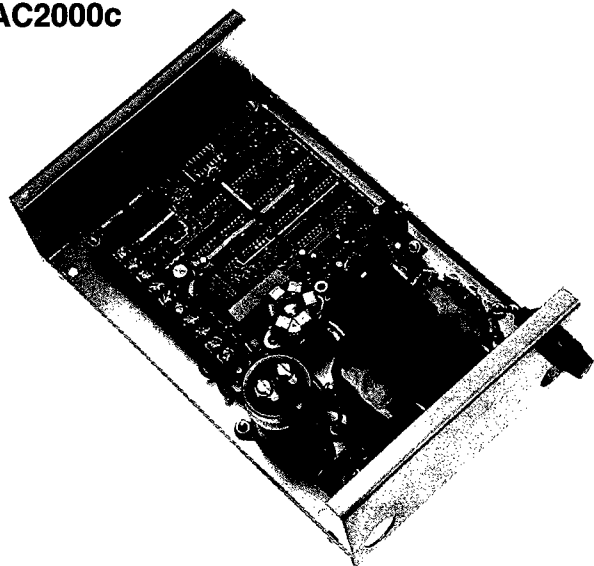
SUFFIX DEFINITIONS

**INDUSTRIAL
DEVICES
CORPORATION**

Novato, CA 94949-6284
(415) 883-3535
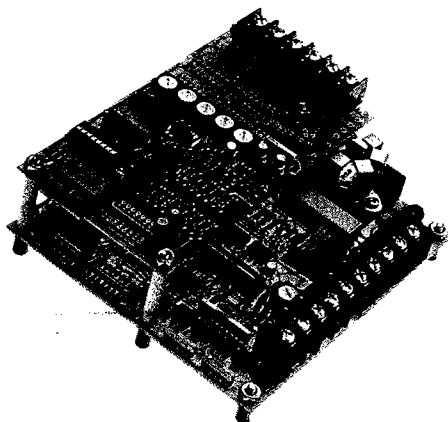
IDENTIFICATION

AC2000c

AC2001c
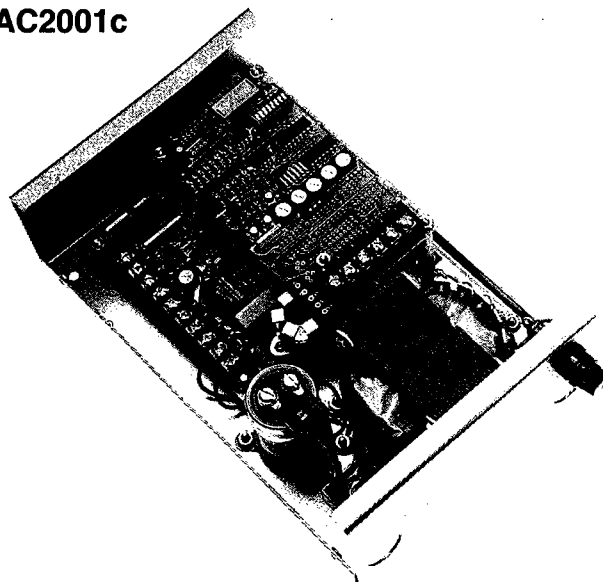
AC2001b

**AC2000eL
AC2001eL**

AC2001pL

SUFFIX DEFINITIONS

b = Board only   c = Chassis, power supply and board   e = Enclosed chassis, power supply and board
L = Line cord   p = Enclosed panel controller with push-button switches

A. C. INPUT - CHASSIS

1. This control is shipped from the factory connected for 115 volt AC input. To use 230 volt AC input, disconnect the jumpers which connect the transformer leads #1 to #3 and #2 to #4. Connect only jumper leads #2 to #3.

   Wire the AC input to the terminals on the transformer labeled L1 and L2. Secure a ground line to the grounding screw provided. Consistent with good wiring practice, AC lines should be separate from the low voltage DC wiring in the rest of the system.

2. **POWER SUPPLY WIRING - AC2000** (Disregard if received wired).

   The **red wire** (24VDC) from the Power Capacitor " + " terminal is connected to position #2 on the terminal strip and the **black lead** (ground) from the capacitor "—" terminal to position #1. CAUTION - Reverse polarity will damage this circuit.

3. **MOTOR WIRING - AC2000**

   Connect motor leads to positions #3 and #4. Connect **black lead** to #3, red to #4. 16AWG wire is adequate for runs under 10 feet; if a longer distance between controller and motor is required, use 14AWG wire. NOTE: Units with reverse motor mount or certain gear ratios will require reversing the motor leads (terminals #3 & #4) for proper extend/retract orientation.

4. **LOGIC WIRING - AC2000**

   All logic functions utilize low-level signals and are initiated by normally open momentary contacts. Wire all logic contacts across the "Com" terminal, #5, and appropriate position as follows:

Position	Circuit Board Label	Function
6	"RTR"	RETRACT
7	"EXT"	EXTEND
8	"STOP"	STOP
9	"LS"	LIMIT SWITCH
10	"AUX"	AUXILIARY

5. **ADDITIONAL LOGIC WIRING**

Position	Circuit Board Label	Function
11	"LS2"	Limit Switch 2 - (speed change)
12	"COM-EXT EN"	COMMON - EXTEND ENABLE - See note below
13	"COM-RTR EN"	COMMON - RETRACT ENABLE - See note below

   NOTE: Used with LS2 to provide for **speed change** in the appropriate direction, i.e., if a limit switch is used to change speed when extending, but not when retracting, it should be wired to "COM-EXT EN" & "LS2".

14	"EXT-COMP"	EXTEND COMPLETE OUTPUT
15	"RTR-COMP"	RETRACT COMPLETE OUTPUT
16	"GND"	GROUND - additional ground

6. **ADJUSTMENTS - Speed Potentiometers**

   E_1 INITIAL SPEED EXTEND —
   Turn clockwise to increase speed

   R_1 INITIAL SPEED RETRACT —
   Turn clockwise to increase speed

   E_2 SECOND SPEED EXTEND —
   Turn clockwise to increase speed

   R_2 SECOND SPEED RETRACT —
   Turn clockwise to increase speed

   IR IR COMPENSATION —
   Turn counterclockwise to increase gain

7. **DIP SWITCH POSITIONS**

   1 = LS STOP
   2 = LS AUTO-RETRACT
   3 = LS AUTO-EXTEND
   4 = LS STOP IN RETRACT DIRECTION ONLY
   5 = LS STOP IN EXTEND DIRECTION ONLY
   6 = CURRENT LIMIT: AUTO-RETRACT
   7 = CURRENT LIMIT: AUTO-EXTEND
   8 = SPARE

ELECTRIC CYLINDER CONTROL

The AC2000 series electric cylinder control provides all the power, logic and solid state switching functions required to drive an Industrial Devices Model 15D electric cylinder. The AC2000 is the basic electric cylinder control providing motor direction switching, automatic overload protection and dynamic braking. A second board, part number VS001, can be added to provide additional functions to the control. *An AC2000 used in conjunction with a VS001 is designated as an AC2001.*

AC2000

The AC2000 has five logic function inputs: EXTEND, RETRACT, STOP, LIMIT SWITCH, and AUXILIARY. Each of these inputs, when grounded, activates that function - logic low true. (A common ground post, terminal #5, is provided for this purpose.) The inputs are optically coupled for transient protection and noise immunity. Typical devices used to activate the inputs are: a normally open momentary switch, a relay (form A or C), or an open collector sinking transistor.

MODES OF OPERATION

The AC2000 can be operated in a RUN or JOG mode. A removable jumper is supplied on the circuit board to provide for operation in the jog mode. NOTE: The control is shipped from the factory with this jumper installed on one pin of the JOG position — (not connected, RUN mode). To enable the JOG mode — place the jumper across both pins.

JOG:

In the jog mode the cylinder moves *only* while the extend or retract input is maintained. When the signal is released, the cylinder will stop. During jog movement, it will *also* stop when the "stop" or "limit switch" inputs are activated. To restart, the "extend" or "retract" inputs must be released and reactivated.

RUN:

In the run mode the "extend", "retract", and "auxiliary" inputs need only to be activated momentarily to latch their operation. The cylinder will then run continuously until another input is activated or until the unit is stopped. Minimum duration of signal is 5 milliseconds.

LOGIC COMMANDS

All logic functions are initiated by grounding the input terminals as described above. These are low-level signals, 8 volts at 11 milliamperes; light wire and low contact ratings may be used. The control circuitry is designed to ignore contact bounce and transient signals. All logic contacts connect across the "Com" terminal, #5, and the appropriate function as follows:

EXTEND:

Contact causes cylinder to extend until it receives a new signal or is stopped due to a current overload such as a mechanical stop (e.g., end of stroke). See "Current/Overload Sensing" below.

RETRACT:

Same as above but opposite direction. NOTE: Applying a "retract" signal while the cylinder is extending, or an "extend" signal while retracting, will cause the unit to stop and immediately start in the opposite direction. If both "extend" and "retract" signals are given simultaneously, the electric cylinder will stop and will not restart until both signals are released and one is reinitiated.

STOP:

An emergency stop control function, this causes an immediate stop. The control will not accept another signal while this condition is maintained.

LIMIT SWITCH:

A one-shot function; immediately stops the cylinder yet permits other inputs to operate.

AUXILIARY:

Used to resume operation. If the cylinder has been stopped, this input will restart in the same direction as it was previously traveling.

CURRENT/OVERLOAD SENSING

The single potentiometer in the lower middle of the circuit board sets the current sense threshold. Clockwise rotation of this pot increases the thrust level at which the control will automatically cause the unit to stop. Too low a setting will cause the unit to stop immediately after it starts; too high a setting may break the machine linkage or cause the fuse to blow.

If the cylinder is stopped due to current overload, the input to that direction is disabled, e.g., if the cylinder is extending and reaches the end of stroke and stops due to current overload, any further activations to the extend input are ignored.

If functional considerations require continued motion after current sense stop, this feature can be disabled—consult factory.

AC2001 (AC2000 with VS001)

The VS001 circuit board adds the following functions to the AC2000: 1) variable speed: two independent speed adjustments for each direction, and 2) additional automatic logic functions, including limit switch direction mask, limit switch input to auto-retract or auto-extend, and auto-extend/auto-retract due to current overload.

VARIABLE SPEED

Four speed potentiometers provide four independent speed adjustments, two in each direction. The speed adjustments allow for a 15:1 reduction from the base speed (maximum rated no-load speed for cylinder). Full clockwise rotation is maximum speed.

E1: Sets the first speed used in the extend direction.

R1: Sets the first speed used in the retract direction.

E2: Allows for a second speed in the extend direction only. The logic is activated by grounding the LS2 input (terminal #11) while extending. The LS2 input is located on the VS001 terminal strip. See "Common-Extend Enable" below.

R2: Same as above but in the retract direction only. See "Common-Retract Enable" below.

IR: This fifth pot is provided to smooth the motor action at low speeds. It is normally set in the full clockwise position. If significant changes in load during the cycle cause excessive speed fluctuation, turn counterclockwise to increase the control's sensitivity to speed change. Adjustment is also needed when the current sense feature is used while running at very slow speeds. In this case, the IR pot should be slowly rotated counterclockwise until the current sense circuit operates.

DIRECTION CONDITIONAL LOGIC

COMMON-EXTEND ENABLE:

It is used in conjunction with the LS2 input to initiate a speed change in the extend direction only. Additionally, this directional "common" can be used to enable a limit switch in only the *extend* direction, or to signal other controls that the actuator is running in the extend direction. This is accomplished via a sinking transistor output which is grounded only when the control is in the extend direction.

COMMON-RETRACT ENABLE:

Same as "Common-Extend Enable" but in the *retract* direction.

OUTPUT SIGNALS

EXTEND COMPLETE:

An output used to signal other electric cylinders or other devices that the unit has stopped. This is a sinking transistor output that will go low once stopped and stay low until the unit is restarted in *either* direction.
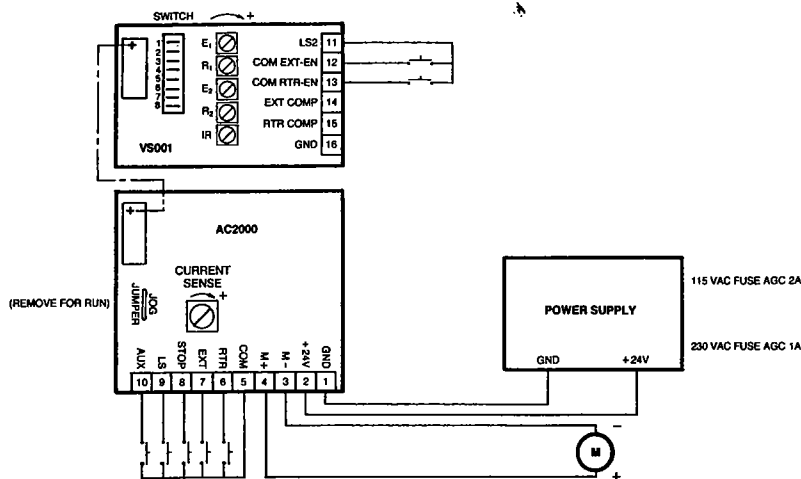
RETRACT COMPLETE:

Same as "Extend Complete" but in the *retract* direction.
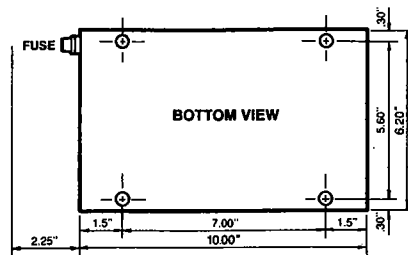
PROGRAMMABLE FUNCTIONS

A variety of complex motions can be obtained by the use of selected stopping and auto-return functions. An eight-position dip switch is provided to select these actions when they are required. The normal state for the dip switch is in the open position. Closing the appropriate switch enables that function. Each dip switch position is defined as follows:

Position	Function
1	Sets the normal *stop function* to the limit switch circuitry on the AC2000 board.
2	Sets the limit switch circuitry to *auto-retract* instead of stop (DO NOT enable position 4 when using this input).
3	Sets the limit switch circuitry to *auto-extend* instead of stop (DO NOT enable position 5 when using this input).
4	Sets the limit switch circuitry to operate *only in retract direction* (to be used with position 1).
5	Sets the limit switch circuitry to operate *only in extend direction* (to be used with position 1).
6	Enables *auto-retract* when a *current overload* exists in the extend direction.
7	Enables *auto-extend* when a *current overload* exists in the retract direction.
8	Spare.

BOTTOM VIEW

NOTE:
FUSE REQUIRES CLEARANCE
FOR REMOVAL.

115 VAC

208, 230 VAC
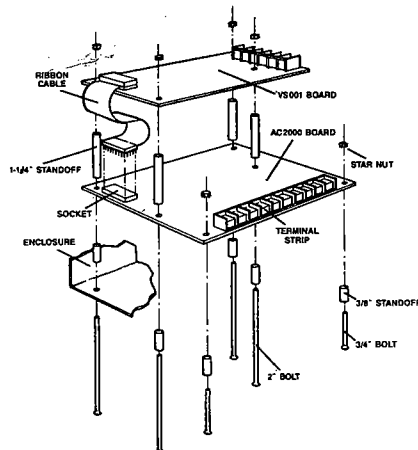
(Connection of an VS001b to an AC2000c, disregard if received assembled)

VS001b Parts List

Qty.	Part #	Description
1	VS001b	Variable Speed circuit board
4	AC-2014-13	#6-32x2" Flat head machine screw
4	AC-2014-12	1¼" Nylon Standoff for a #6 screw

ASSEMBLY INSTRUCTIONS

1. Check that all of the parts are accounted for.
2. Remove the four back mounting screws on the AC2000 board; two are along the far back edge (side opposite terminal strip) and two are in the middle.
3. Install the four 2-inch long screws through these positions making sure to go through the ⅜ inch standoffs located between the chassis and AC2000 board.
4. Place the 1¼ inch standoffs over these screws; position the VS001 board and install nuts to secure.
5. Connect the ribbon cable from the VS001 board into the AC2000 socket so that the cable makes an "S" turn and protrudes under the VS001. Align position number 1 on the cable with position number 1 on the socket.

A. MECHANICAL

Dimensions	AC2000b	VS001b	AC2001b	DC2000* CHASSIS	DC2000* MOUNTING
Length	5.5"	5.5"	5.5"	11.0"	7.0"
Width	5.0"	3.0"	5.0"	6.5"	5.6"
Height	1.2"	0.9"	2.2"	2.9"	—

Ambient Temperature Range

Operating	0°C to 50°C	(32°F to 122°F)
Storage	-40°C to 85°C	(-40°F to 185°F)

B. ELECTRICAL

Power Requirements: DC2000: 105 - 120VAC 50/60 Hz FUSE AGC 2A
208 - 240VAC 50/60 Hz FUSE AGC 1A
AC2000b: +22 to 30VDC @ 10A Max.

Input Signals: EXTEND, RETRACT, STOP, LS, AUXILIARY
High level, open circuited +8.25VDC Max.
Low level, current sinking 0 to .8VDC @11ma Max.

Input Signal: LS2
High level, open circuited +8.25VDC Max.
Low level, current sinking 0 to .8VDC @1.0ma Max.

Output Signal: COM EXT-EN, COM RTR-EN, EXT COMP, RTR COMP
High level, open circuited +8.25VDC Max.; .400ma Max.
Low level, current sinking .5VDC Max.; 150ma Max.

Output Signal: M+, M-
High level Input Voltage - 2VDC Min., 10A Max.
Low level .5VDC @ 10A Max.

C. INPUT SWITCHING

Input Signal: EXTEND, RETRACT, STOP, LS, AUXILIARY
Low level, pulse width 5ms Min.
(latched input)
Delay between inputs 5ms Min.
(time to go from extend to retract or vice versa)

*A DC2000 is the chassis power supply only

SYMPTOM	CAUSE	REMEDY
ACTUATOR DOES NOT MOVE	Power not on	Check AC voltage
	Fuse blown	Replace Fuse 115VAC: AGC 2A 230VAC: AGC 1A
	No DC power at AC2000	Check DC voltage at Terminals #1 and #2. Power supply bad unless #1 = GND, #2 = 22-30VDC
	Speed setting too low (AC2001 Only)	Increase Speed Pots
	Inputs continuously grounded	Check for ground on Terminals #6, 7, 8, and 10 - remove ground
	No motor power	Be sure that a Run signal has been given, then check for voltage between motor terminals #3 & #4. No voltage - contact factory
	Open circuit between AC2000 & motor	Check wiring to motor leads
ACTUATOR LUNGES FORWARD AND STOPS	Current sense pot too low	Increase current sense pot setting
	Jog plug installed	Remove jog plug for Run applications
MOTOR MOMENTARILY HUMS WITHOUT ACTUATOR MOVING*	Mechanical bind or jamming causing overload	Check for side load binding; Max. 10 lbs. at Output Bearing
	Thrust tube is over torqued deforming Drive nut	Loosen thrust tube and tighten hand tight
	Drive nut jammed against thrust bearing due to thrust tube not being seated against drive nut flange	Contact factory

*NOTES: 1. If Control turns motor on and then off due to current sense overload, the control is working properly and the problem is mechanical.

2. To check for overload — Install a 0-10 AMP Ammeter in series with the motor and read current while running. Maximum dynamic current should be less than 4.5 AMP with no load applied to the actuator and 8 AMP at full load.

Description	Part #	Description	Part #
1. AC2000b	AC2000b	9. Jog Plug	AC-2010-26
2. VS001b (includes mounting hardware)	VS001b	10. Capacitor Holder (Nylon)	999-529
3. Transformer	999-528	11. Fuse Holder	999-509
4. Capacitor 40V 11000uF	999-509	12. On-off Switch (pL version only)	999-548
5. Bridge Rectifier	999-510	13. Neon Light (pL version only)	999-549
6. Fuse AGC 2A (115V operation)	999-532	14. 3/8" Nylon Spacer	999-527
7. Fuse AGC 1A (230V operation)	999-547	15. 1 1/4" Nylon Spacer	AC-2014-12
8. Line Cord	999-534		