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LEADER IN SIGNAL CONDITIONING

Instructions: Series 160A
Model 160A - V/PC/CAC/VAC Alarms

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IMPORTANT SAFETY CONSIDERATIONS

It is very important for the user to consider the possible adverse effects of power, wiring, component, sensor or software failures in designing any type of control or monitoring system. This is especially important where economic property loss or human life is involved. It is important that the user employ redundancy, and comprehensive failure analysis to insure a safe and satisfactory overall system design. It is agreed between the Buyer and Acromag, that this is the Buyer's responsibility.

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8500-152-H93J016

INSTRUCTIONS: SERIES 160A
DC Volts/Process Current AC Amps/AC Volts Input

INTRODUCTION:

These instructions cover the model types listed in Table 1 below. Supplementary sheets are attached for models with special options or features. Model numbers can be constructed from the information given in Table 1, and as described in steps A and B:

Table 1 (Models on P.C. Board 1018-387)

A. Model Number Format: 160A-Input-Output-Option(s)-Power-Calibration
B. Typical Model Number: 160A-VL-SN-1

Type	-Input	-Output	-Option(s)	-Power	-Cal**
160A	-VL -VM -VH -V5 -05 -20 -50 -CDC* -VDC* -CAC -VAC	-SN -SH -DN -DH	-NP -T -G -L -GT -GL -TL -GTL	-1 -2 -3	(Blank) -C

*This unit must be ordered with factory calibration option. Specify minimum and maximum input values, and setpoints on order. Calibration charge is included with this input option.

**Alarms can be ordered with or without factory calibration. If unit is factory calibrated to a customer specifications, the model number suffix "-C" will indicate this. The calibration information will be indicated on a separate calibration label on the unit.

DESCRIPTION:

The 160A Series Alarms can be configured by model number to:

* Accept DC voltage, process current, AC current, AC voltage inputs.

* Be a single or dual channel.

* Provide standard (not-sealed, general purpose) or hermetically-sealed relay output with DPDT contacts.

* Provide time-delay, latch/reset or graduated setpoint control options.

* Be powered by 115V AC, 230V AC, or 24V DC.

Standard "Setpoint" and "Deadband" controls are "blind", utilizing 15-turn potentiometers. An optional graduated, single-turn, setpoint control can be provided. Deadband (hysteresis), however, is always a blind adjustment, and has a range of 0.5 to 5.0 percent of the input signal span. The optional Time Delay is adjustable (1 to 20 seconds, nominal) with a 15-turn potentiometer. All alarms feature field-selectable "High" or "Low" fail-safe operation (independent operation in dual- channel models). All 160A alarms are RFI/EMI resistant.

SPECIFICATIONS:

Function: Single or dual alarm for a DC voltage, process current, AC current or AC voltage input with blind or graduated dial setpoint adjust, deadband adjust, time-delay option, latch/reset option, standard general purpose or hermetically sealed relay with DPDT contacts, field selectable high or low fail-safe operation.

Model/Series: 160A-

Input:

-VL 0 to 1.0V DC, input impedance 5 megohms, minimum.
-VM 0 to 10.0V DC, input impedance 40K ohms, nominal.
-VH 0 to 100.0V DC, input impedance 400K ohms, nominal.
-V5 1.0 to 5.0V DC, input impedance 5 megohms, minimum.
Note: Two-Wire Transmitter Excitation: This unit provides an excitation supply for one external two-wire transmitter. The excitation supply is 24V DC nominal and 30 mA max.; available at the "L" terminal. Use is optional.

-05 1 to 5.0 mA DC, through 200 ohms.
-20 4 to 20.0 mA DC, through 49.9 ohms.
Note: Two-Wire Transmitter Excitation: This unit provides an excitation supply for one external two-wire transmitter. The excitation supply is 24V DC nominal and 30 mA max.; available at the "L" terminal. Use is optional.
-50 10 to 50.0 mA DC, through 20 ohms.

-CDC DC current input; any customer-specified input span up to 100 mA DC, 1V DC maximum input voltage drop. Maximum input current must be specified when ordered.

-VDC DC voltage input; any customer-specified input span up to 100V DC that cannot be handled with a standard input type. Input impedance; function of span, 40K ohms, minimum. Maximum voltage must be specified when ordered.

-VAC AC voltage, 50/60 Hz, 0 to 150V RMS.

-CAC AC current, 50/60 Hz, 0 to 5 A. RMS.

Output:

-SN Standard Relay: One Double-Pole, Double Throw (DPDT), Form C Relay. Isolated contacts rated at 5A, 120/240V AC; 5A, 30V DC; 0.4A, 110V DC resistive. For inductive loads, contacts rated at 2.5A, 120V AC; 2.0A, 240V AC; 2.5A, 30V DC. Contact material; pure silver. Life; 500,000 operations at rated load.

-DN Same as -SN except that there are two relay channels.

-SH Hermetically-Sealed Relay: One Double-Pole, Double Throw (DPDT), Form C Relay. Isolated contacts rated at 3A, 120V AC or 30V DC, resistive/inductive. Contact material; silvercadmium oxide. Life; 500,000 operations at rated load.

-DH Same as -SH except that there are two relay channels.

Options:

-NP No options

-G Graduated Setpoint Adjust: Screwdriver-adjustable, single-turn graduated metal-film potentiometer. Continuous adjustment, over full input range.

-T Time Delay: Screwdriver-adjustable, 15-turn metal-film potentiometer. Continuous adjustment from 1 to 20 seconds (nominal). Pull-in delay or drop-out delay is DIP switch-selectable. LEDs on main PCB indicates alarm condition versus relay pull-in (drop-out).

-L Relay Latch: When the relay is energized, it will remain energized until remote reset terminals are shorted. Latch function can be disabled if a jumper is installed across latch terminals.

-GT, -GL, -TL, -GTL: More than one option can be added to the alarm by specifying desired combination.

Power:

-1 115V AC $\pm$10%, 50 to 60Hz, 0.10A.
-2 230V AC $\pm$10%, 50 to 60Hz, 0.05A.
-3 24V DC $\pm$25%, -10%, 0.25A. Note: This unit has a DC to DC power converter to maintain input/power circuit isolation. Reverse polarity protected.

Electrical Isolation: Three way isolation; input, contacts, and power are isolated from each other for common mode voltages up to 250V AC or 354V DC off ground (will withstand 1500V AC dielectric strength test for 1 minute without breakdown) on a continuous basis. Complies with test requirements outlined in ANSI C39.5-1974 for the voltage ratings specified.

Setpoint Adjust (Standard): Blind setpoint adjustment(s) use 15-turn metal-film potentiometer(s), screwdriver set-adjustable over full range. Note: A graduated dial (-G option) is also available, see above.

Deadband Adjust: Blind deadband adjustment(s) use 15-turn metal-film potentiometer(s), screwdriver set-adjustable range 0.1% to 5% of the input span.

Relay Operation: Alarms can be converted from "NORMAL" acting (relay energized above trip-point, "fail-safe" for low limit alarming) to "REVERSE" acting (relay energized below trip-point, "fail-safe" for high limit alarming) by cutting a field changeable jumper(s) on the printed circuit board.

Relay LED: Standard all units, the LED(s) indicate when the input is above the setpoint value.

Alarm LED: Included on main P.C. board when the Time-Delay (T) option is specified. This LED(s) will light as soon as the input signal exceeds the setpoint, the "Relay LED" will light after the time delay has expired. When calibrating the alarm, this Alarm LED should be observed to indicate proper setpoint position.

Reference Test Conditions: Dual alarm with 0 to 5V DC input; setpoint at 5.0V DC; 100-ohm source; 0.5% deadband; nominal supply voltage. Accuracies are measured as deviations from these conditions.

Ambient Temperature Range: 32°F to 158°F (0 to 70°C).

Accuracy: Repeats within $\pm$0.1% of input span for constant conditions (25°C), $\pm$0.5% for -CAC and -VAC input types.

Ambient Temperature Effect: Trip-point varies less than $\pm$0.01% of input span per °F (0.018% per °C), over ambient temperature range for reference test conditions.

Response: The relay contacts switch from closed to open within 100m sec for a step input change from 10% of span on one side of the alarm point to 5% of span on the other side of the alarm point for high or low alarms.

Power Supply Effect: Trip-point varies less than $\pm$0.05% of input span for rated supply variations.

Noise Rejection:
Common Mode: 120 dB at 60Hz, 100 ohm unbalance, typical.
Normal Mode: 30 dB at 60 Hz, 100 ohm source, typical.

RFI Resistance: Unit will not trip when input is ±0.5% of input span from setpoint voltage, with RFI field strengths up to 10V/meter at frequencies of 27, 151 and 467 MHz.

EMI Resistance: Unit will not trip when input is ±0.25% of input span from setpoint voltage with switching solenoids or commutator motors.

Surge Withstand Capability (SWC): Input/Output terminations rated per ANSI/IEEE C37.90-1978. Unit is tested to a standardized test waveform that is representative of surges (high frequency transient electrical interference), observed in actual installations.

Construction:

Case: General purpose, NEMA 1 type metal enclosure, Class 1. Chassis-aluminum; cover-self-extinguishing polypropylene UL94 V-0, color blue.

Printed Circuit Board: Military grade FR-4 epoxy glass circuit board.

Size: Refer to mechanical outline Drawing 4500-325.

Mounting: Designed for panel mounting or for mounting in optional enclosures, described below.

Connections: Modular terminal blocks with screw clamps for external connections. Wire range 14 to 26 AWG, CSA approved.

Shipping Weight: 3 pounds (1.35 kg.) packed.

OPTIONAL ENCLOSURES (Separate Model Number):

See Drawing 4500-325 for outline dimensions for enclosure options below. Note: Alarms will be installed in enclosure, conduit mounting holes and fittings in NEMA 4/12 enclosures are customer-supplied. Each optional enclosure comes with the necessary special hardware to mount the 1600 Series unit.

Model 1600-N4: NEMA 4 enclosure, water-tight. Enclosure material and finish: 0.075 and 0.060 inch thick steel with gray hammertone enamel finish inside and out. Shipping weight; 10 pounds (4.5 kg.) packed.

Model 1600-N12: NEMA 12 enclosure, oil-tight. Enclosure material and finish: 0.075 and 0.060 inch thick steel with gray hammertone enamel finish inside and out. Shipping weight; 10 pounds (4.5 kg.) packed.

Model 1600-EXP: NEMA type 7, NEC Class 1 Group D; NEMA type 9, NEC Class II Groups E, F & G and NEMA 4 (water-tight). Manufacturer: Adalet type XJWH9 with O-ring, modified with internal mounting holes and two conduit holes. Material: aluminum alloy. O-ring material: nitrile rubber. Shipping weight: 25 pounds (11.25 kg.) packed.

INSTALLATION:

The alarm is packaged in a general purpose type of enclosure. Use an auxiliary enclosure to protect against unfavorable environments and locations. Maximum operating ambient temperatures should be within 32 to 158°F (0 to 70°C) for satisfactory performance. If the unit has been factory calibrated, it is ready for installation. Connect as shown in connection diagram (Drawing No. 4500-343). If the unit has not been factory calibrated, refer to the "CALIBRATION" section of these instructions.

Mounting: See Drawing 4500-325 for mounting and clearance dimensions.

Electrical Connections: The wire size used to connect the unit to the control system is not critical. All terminal strips can accommodate wire from 14-26 AWG. Input wiring should be either twisted pairs or shielded. Since common mode voltages can exist on signal wiring, adequate wire insulation should be used and proper wiring practices should be followed. It is recommended that contact/power wiring be separated from signal wiring for safety as well as for low noise pick-up.

To bring the wiring to the terminal blocks, pierce the special grommets, pull wires through and attach to terminals.

For connection information see Drawing 4500-342.

1. Power: Connect the AC or DC to the alarm per connection diagram. Label on unit specifies the power required for the particular unit being installed. On DC units, inadvertant reverse connection will not damage unit.

2. Grounding: Connect the terminal marked "G" to an earth ground. Note: The ground wire must be installed for safe use of the instrument.

3. Input: Connect input per connection diagram, observe polarity, see label for input type. If unit is factory calibrated, the calibration label will indicate range of input.

   Danger: 160A-CAC AC Current Transformer (C.T.) Connections: Disconnect power to C.T. or short output of C.T. before removing input connections to alarm. If this is not done an open circuited C.T. will generate high voltages and possible C.T. damage.

4. Output Contacts: Wire contacts as shown in connection diagram, see label on unit for relay type and contact rating.

CALIBRATION:

First determine which trip mode is required in your application, "NORMAL" or "REVERSE" acting.

1. Normal acting (standard-as shipped): Refers to relay energized when input signal is above setpoint (low fail-safe).

2. Reverse acting: Refers to relay energized when input signal is below the setpoint (high fail-safe). For "REVERSE ACTION" cut Jumper J1 for Relay 1 and Jumper J2 for Relay 2, see Drawing 4500-476, page 1 of 4, for jumper location.

Connect alarm as shown in the connection diagram. The input source must be adjustable over the entire range of the unit and settable to an accuracy of 0.1% or better. The LED(s) mounted on the alarm can be used to indicate relay action; the LED's are ON when relay coil is energized.

The calibration example below is for a DC voltage input. Calibration is essentially the same for units with other input/output configurations.

Adjustment Procedure:
Calibration Example:

Model: 160A-VL-SN-T-1

Input (-VL): 0 to 1.0V DC.
Setpoint: 0.50V DC.
Output (-SN): Single Alarm with standard relay (DPDT).
Relay Action: Normal Acting (Jumper J1 - IN).
Option (-T): Time Delay, 5 seconds.
Power (-1): 115V AC.

1. If the unit has the time delay option (T) set the delay to minimum during the setpoint/deadband calibration (both channels on dual "D" units).
   NOTE: Refer to Specifications Section concerning the function of the Relay LED and the Alarm LED.
2. If the unit has the latch option (L), disable the latch function during the setpoint/deadband calibration (both channels on dual "D" units). Attach a jumper between CH1 and COM terminal on the option P.C. board, also connect a jumper between CH2 and COM if unit is a dual "D" alarm. Remove jumpers after calibration procedure.
3. Set the deadband adjustment potentiometer, DB1, fully counterclockwise for minimum deadband (approximately 0.5% for a pure DC signal).
4. Adjust input source for 0.50V DC (value desired for alarm setting in this example).
5. Adjust the setpoint potentiometer (SP1) fully clockwise (maximum trip) first, then rotate it counterclockwise slowly until the relay operates. The associated LED will come ON when setpoint goes below input signal for "NORMAL" acting, or when setpoint goes above input signal for "REVERSE" acting.
   NOTE: On low-level input models (mV, TC, RTC, P), if the setpoint cannot be set properly, cut Jumper J3 to reduce the gain of the input stage, then repeat step 3.

6. Verify setpoint by decreasing input source below trip point and then increasing the input slowly until the relay operates. Adjust setpoint potentiometer, as required, to attain calibration.
7. If increased deadband is required, turn DB1 control clockwise. Vary input signal and determine input values for pull-in and drop-out of relay. The difference of these values is the amount of deadband. Adjust deadband control and vary input until desired deadband is obtained. Note, if the deadband potentiometer is readjusted, it may be necessary to readjust the setpoint setting.
8. If unit is a dual (D) alarm, repeat steps 3 to 7 for second channel using SP-2 and DB-2 adjustments.
9. Time Delay Adjustment Procedure:

A. Select mode of operation from Table 4.

Table 4. Mode select by DIP switch positions.

Time Delay Mode	Dip Switch Positions
Delay relay pickup	Depressed towards C2 and C4
Delay relay dropout	Depressed towards C1 and C3
No delay	Depressed towards C2 and C4 and potentiometer fully CCW.

B. Set approximate time delay:
   1. Turn time delay potentiometer fully CCW.
   2. Select number of CW turns from Table 5.

Table 5. Potentiometer turns vs nominal time delay (seconds).

Turns	Delay	Turns	Delay	Turns	Delay
0	0	9	9	18	19.5
1	0	10	10	19	21
2	.5	11	11	20	22
3	2	12	12.5	21	23
4	3	13	14	22	24
5	4	14	15	23	25
6	5	15	16	24	26
7	6	16	17	25	27
8	7.5	17	18.5		

C. Adjust input signal (or setpoint) to operate relay.

D. Measure time delay and readjust potentiometer as necessary.

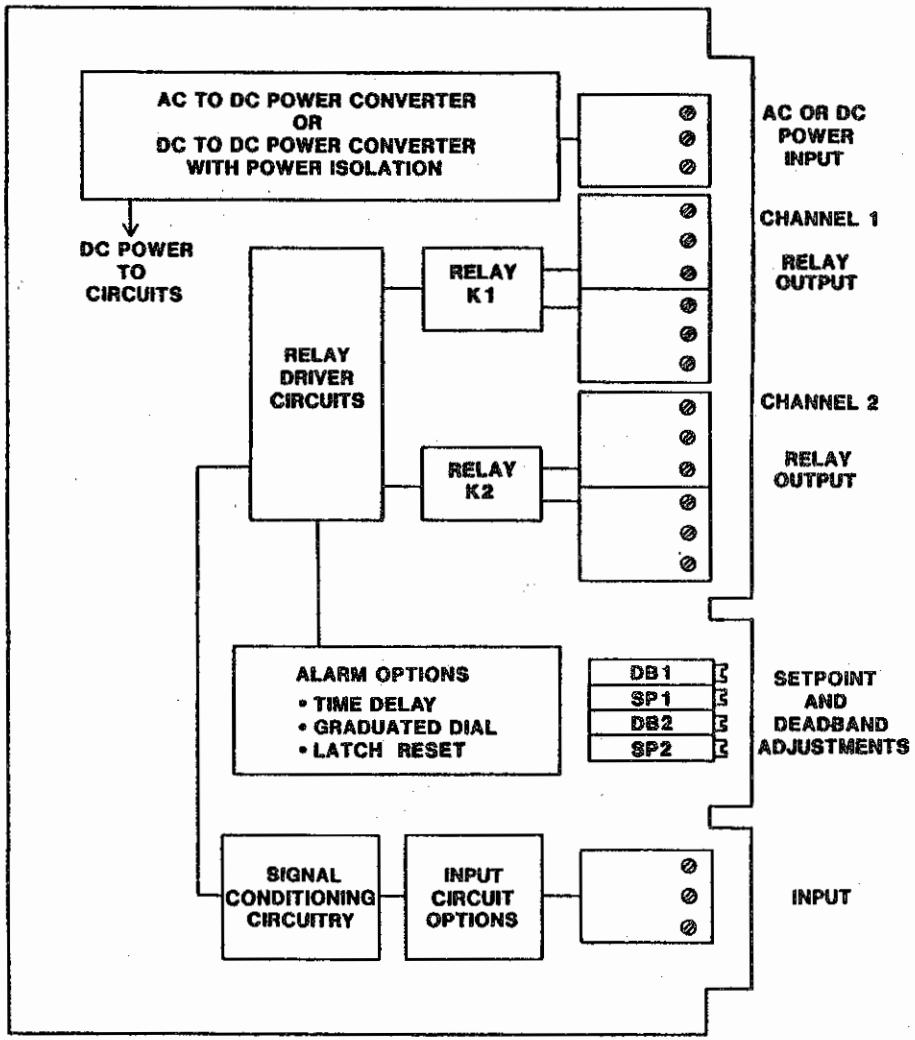
GENERAL MAINTENANCE:

The alarm contains solid-state components and requires no maintenance except for periodic cleaning and calibration verification. If an alarm is not operating properly, it should be removed and given a full bench checkout. Past experience indicates that most problems are in the field wiring and associated circuits rather than in the alarm itself. If the problem is tracked to the unit itself, conventional electronic troubleshooting methods may be used.

In the event of a suspected failure, check for the presence of power; exchanging the unit with a known good unit is a convenient method for identifying faulty units. Fault isolation at the component level requires proper test equipment and qualified technicians familiar with solid-state circuitry. If these facilities are not available, the unit should be returned to the factory for repair and recalibration.

If replacement parts must be ordered, the following information should be included:

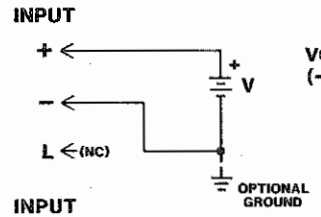
A. Instrument model number
B. Instrument serial number
C. Component designation and value (e.g., R20, 499 ohms, 1/8W, 1%).



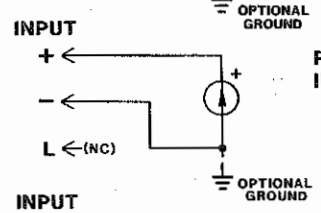
SERIES 160A ALARMS • SIMPLIFIED SCHEMATIC

Acromag WIXOM, MICH.	15 SEP 88	B	8458	TW		
	22AUG 84	A	6882	TW	DS	
	23MAY 84	---	----------	TW	DS	---
	DATE	REV	CO	DR	ENG	CLP
TITLE: SIMPLIFIED SCHEMATIC						
SIZE C	SERIES 1600	SHEET 1 of 1	DRAWING 4500-653	REV B		

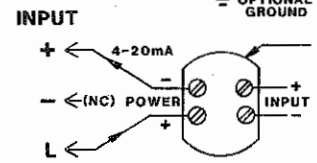
DATE	SYM	REVISION RECORD	CLR	DR	CK
6-84	A	6859	RP	TV	DS
9-84	B	8457	RP	TV	DS
3-85	C	9296	RP	TV	DS



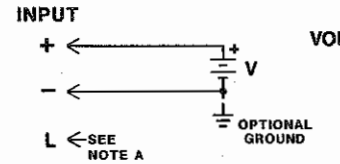
VOLTAGE INPUT
(-VL, -VM, -VH, -VDC)



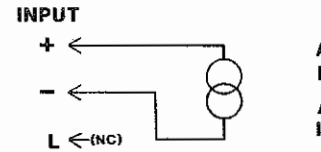
PROCESS CURRENT INPUT
(-05, -20, -50, -CDC)



TWO-WIRE TRANSMITTER INPUT (-20)



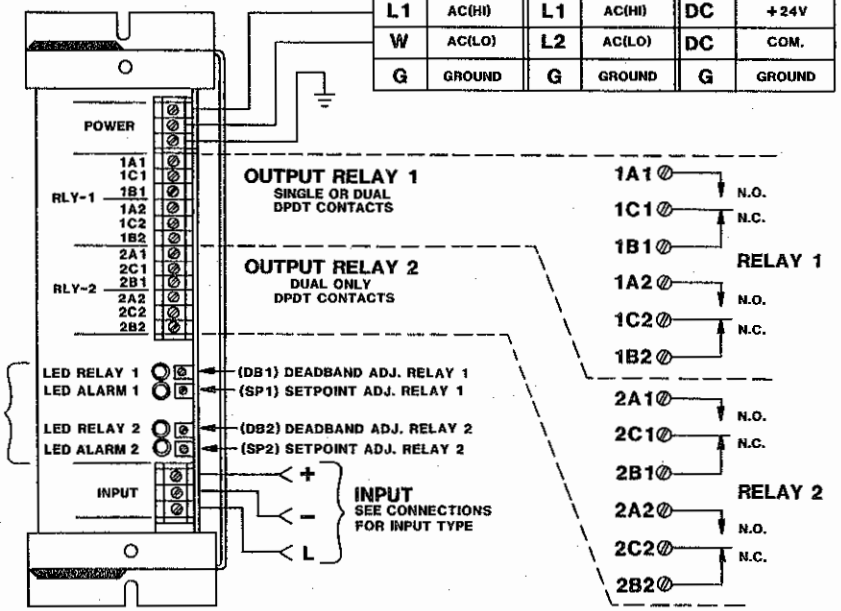
VOLTAGE INPUT
(-V5)



AC VOLTAGE INPUT (-VAC)

AC CURRENT INPUT(-CAC)

−1		−2		−3	
115V AC		230V AC		24V DC	
L1	AC(HI)	L1	AC(HI)	DC	+24V
W	AC(LO)	L2	AC(LO)	DC	COM.
G	GROUND	G	GROUND	G	GROUND



NOTES:
1. LED ALARM 1 AND LED ALARM 2 (DUAL) ARE INSTALLED ON UNITS WITH THE "-T", TIME DELAY OPTION.
2. THE "ALARM" LED WILL LIGHT AS SOON AS THE INPUT EXCEEDS THE SETPOINT . THE "RELAY" LED INDICATES RELAY PULL-IN (DROP-OUT) AFTER THE TIME DELAY.

CAUTION-DANGER

AC CURRENT TRANSFORMER CONNECTIONS

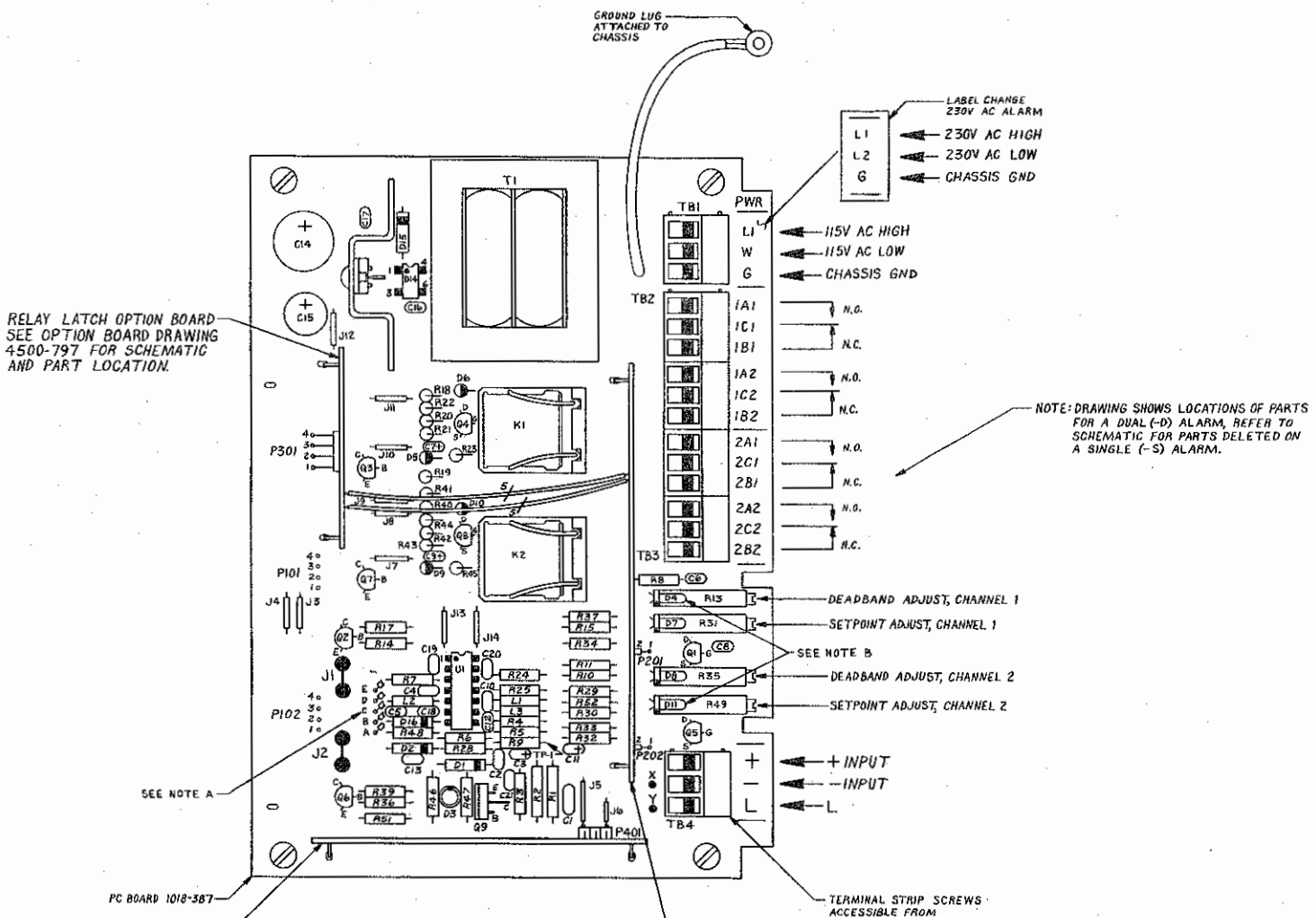
IMPORTANT: IF INPUT WIRING IS TO BE REMOVED FROM TERMINALS, DISCONNECT POWER TO C.T. OR SHORT OUTPUT OF C.T. BEFORE REMOVING INPUT CONNECTIONS TO TRANSMITTER.

NOTE A: INPUT OPTION -V5; L TERMINAL PLUS EXCITATION WITH RESPECT TO THE (-) TERMINAL.

160A ALARM CONNECTIONS

TOLERANCES (EXCEPT AS NOTED): DECIMAL ± FRACTIONAL ± ANGULAR ±	ACROMAG, INC.-WIXOM, MICH.	SCALE
	DRAWN BY TV	APPROVED BY DS
	TITLE 160A ALARM CONNECTIONS	
C	DATE 1-3-83	DRAWING NUMBER 4500-342C

BRUNING 44 231 52959



160A-V/PC ALARMS
POWER: -1, -2 (115V AC, 230V AC)

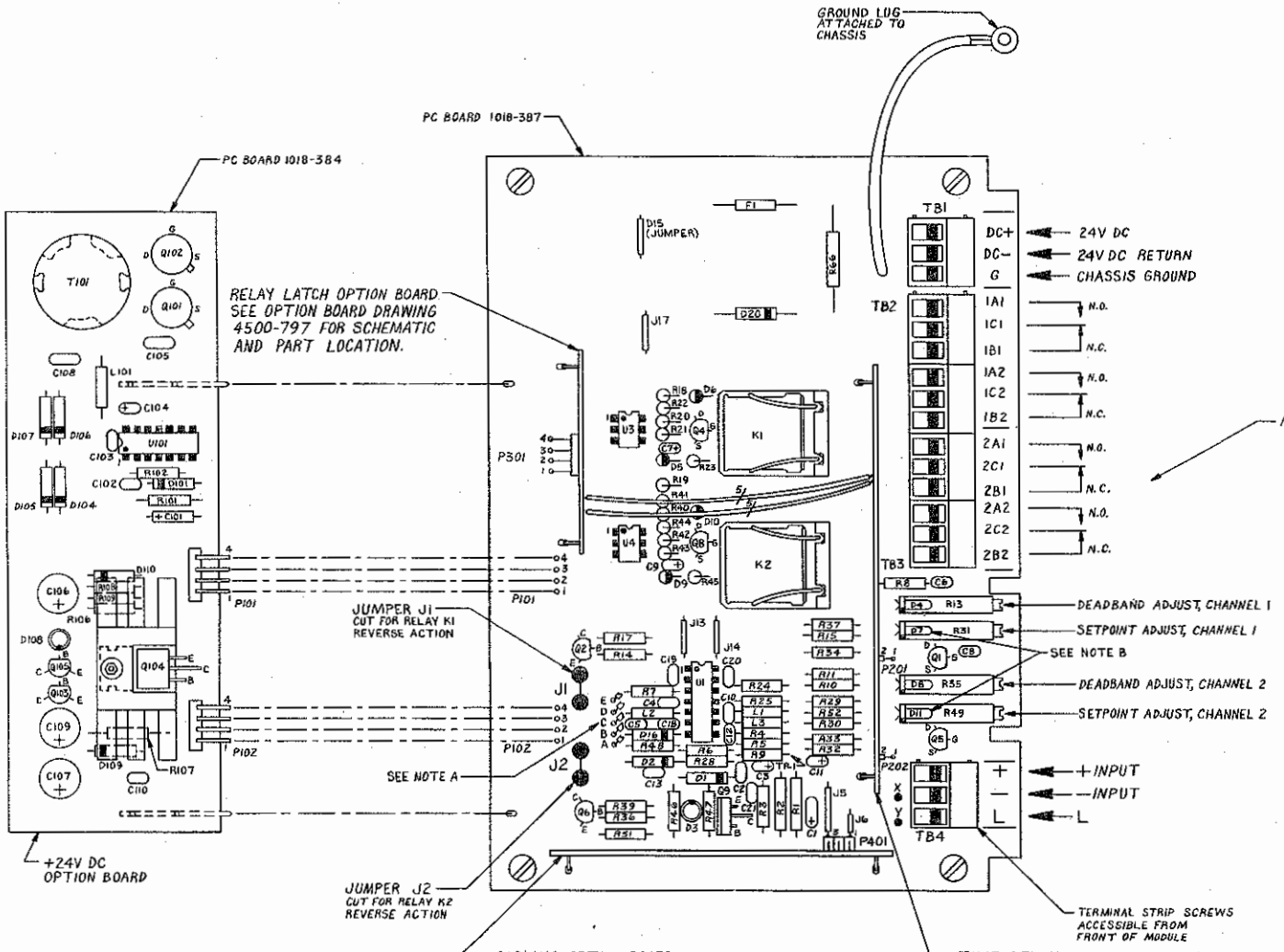
NOTE:
A. IF THE TIME DELAY OPTION "T" IS PART OF UNIT, WIRES A, B, C, D AND E FROM THE "T" OPTION BOARD CONNECT TO THESE POINTS.
B. LEDS D7 AND D11 ONLY ON UNITS WITH THE "T" TIME DELAY OPTION.

26 APR 93	F	93D017	PV	WJ	TH
17 MAY 89	E	9365	PV	WJ	RD
1 MAR 89	D	9296	PV	WJ	RD
18 SEP 86	C	8466	PV	WJ	RD
30 APR 85	B	7623	PV	—	—
4 SEP 84	A	4916	PV	—	—
9 AUG 83	–	—	PV	—	—
DATE	REV	CO	DR	ENG	CHK

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TITLE: 160A-V/PC ALARMS

SIZE D DWG | SERIES: 160A SERIES | SHEET: 1 OF 4 | DRAWING: 4500-476 | REV: F



NOTE:
A. IF THE TIME DELAY OPTION "T" IS PART OF UNIT, WIRES A,B,C,D AND E FROM THE "T" OPTION BOARD CONNECT TO THESE POINTS.

B. LEDS D7 AND D11 ONLY ON UNITS WITH THE "T" TIME DELAY OPTION.

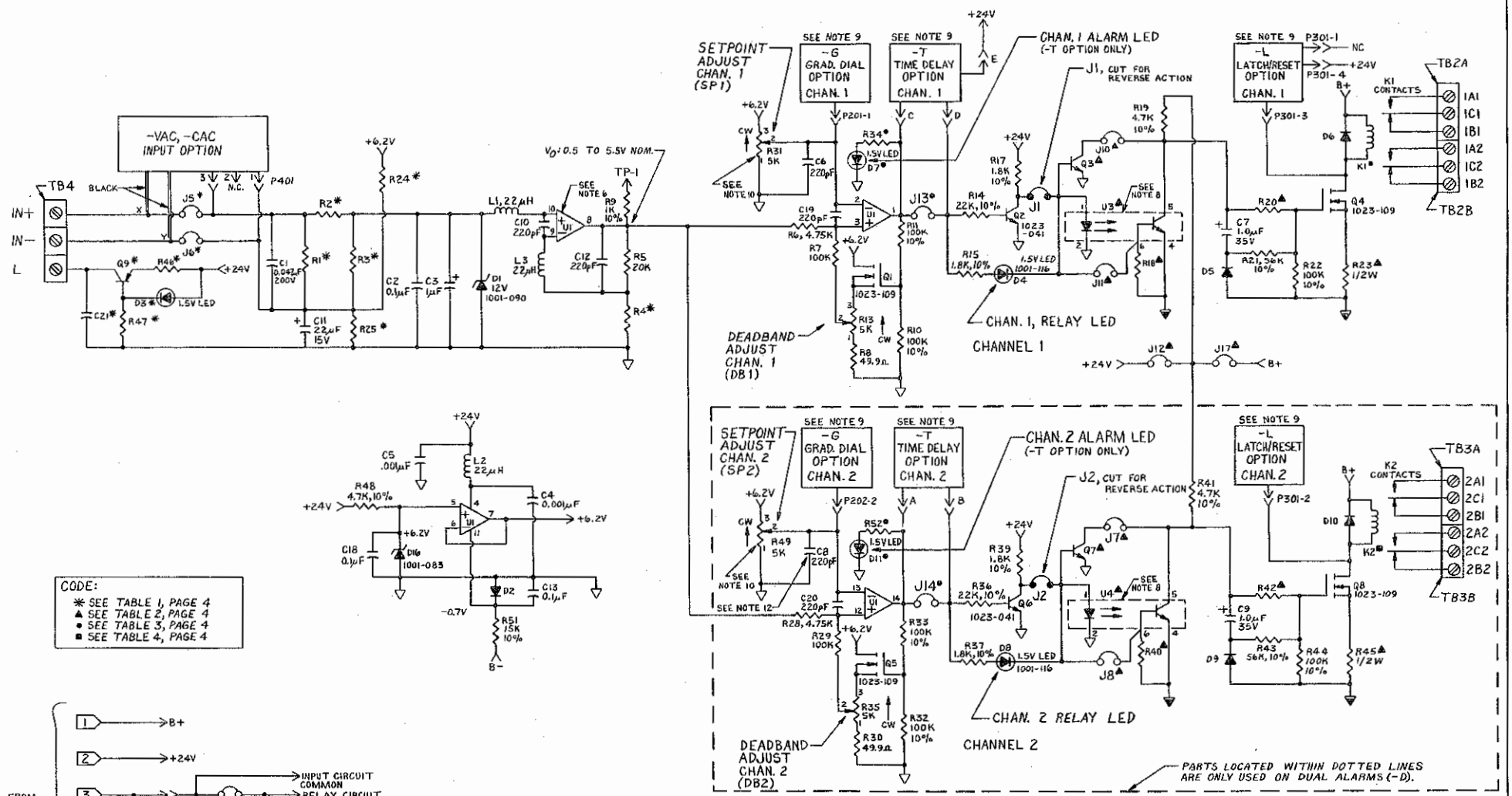
160A-V/PC ALARMS
POWER: 24V DC(-3)

26 APR 93	F	930017	TAV	10	7/4
17 MAY 89	E	9365	TAV	10	8/2
1 MAR 89	D	9296	TAV	10	4
18 SEP 86	C	8466	TAV	10	10
30 APR 85	B	7623	TAV		—
4 SEP 84	A	6916	TAV		—
9 AUG 83	—	—	TAV		—
DATE		REV	CO	DR	ENG	CLP

Acromag WIXOM, MICH.

TITLE: 160A-V/PC ALARMS

SIZE D | SERIES 160A SERIES | SHEET 2 OF 4 | DRAWING 4500-476 | REV F



NOTES:

1. ALL RESISTORS ARE 1/8W, 1% UNLESS OTHERWISE SPECIFIED.
2. ALL RESISTORS ARE T2 TYPE UNLESS OTHERWISE NOTED.
3. CAPACITOR VOLTAGE RATINGS ARE 50WVDC (MINIMUM) UNLESS OTHERWISE SPECIFIED.
4. ALL SEVEN DIGIT NUMBERS ARE ACROMAG PART NUMBERS.
5. ALL DIODES ARE ACROMAG 1001-113 UNLESS OTHERWISE NOTED.
6. U1 IS ACROMAG 1033-154 (QUAD OP-AMP).
7. SYMBOLS U2 & U5 NOT USED.
8. U3, U4 ARE ACROMAG 1033-530 (OPTO-ISOLATOR).
9. SEE OPTION BOARD DRAWING 4500-797 FOR SCHEMATIC, PARTS LOCATION, MOUNTING AND CONNECTION INTERFACE INFORMATION.
10. IF UNIT HAS THE "G" OPTION R31 (R49) ARE REMOVED FROM MAIN PC BOARD.
11. U6 IS ACROMAG 1033-224 (VOLTAGE REGULATOR, 24V).
12. FOR A SINGLE ALARM (-S) C8 IS A JUMPER.

DATE	REV	CO	DR	ENG	CLK
26 APR 98	F	93007	PV	MF	TH
17 MAY 89	E	9365	PV	—	RD
1 MAR 89	D	9296	PV	MF	JJ
18 SEP 86	C	8466	PV	MF	RD
30 APR 85	B	7623	PV	—	—
4 SEP 84	A1	6916	PV	—	—
9 AUG 83	—	—	PV	—	—

Acromag WIXOM, MICH.

TITLE: 160A-V/PC ALARMS

SIZE D | SERIES 160A SERIES | SHEET 3 OF 4 | DRAWING 4500-476 | REV F

TABLE 1(✱): INPUT CONDITIONING: (NOTE: ALL RESISTORS 1%, 1/8W, T2 UNLESS OTHERWISE STATED).

PART	INPUT TYPE										
	-05	-20	-50	-VL	-VM	-VH	-V5	-CAC	-VAC	-CDC	-VDC
R1(1/2W)	200Ω	499Ω	20Ω	N.U.	N.U.	N.U.	N.U.	N.U.	N.U.	SEL	N.U.
R2(1/2W)	20K	20K	20K	20K	20K	374K	20K	20K	20K	20K	SEL
R3	N.U.	N.U.	N.U.	N.U.	20K	20K	N.U.	N.U.	N.U.	N.U.	SEL
R4	4.99K	4.99K	4.99K	4.99K	N.U.	N.U.	N.U.	4.99K	4.99K	4.99K	4.99K
R24	6.04K	6.04K	6.04K	6.04K	6.04K	6.04K	6.04K	6.04K	6.04K	6.04K	6.04K
R25	0Ω	0Ω	0Ω	100Ω	523Ω	523Ω	0Ω	100Ω	100Ω	100Ω	100Ω
R46	N.U.	33.2Ω	N.U.	N.U.	N.U.	N.U.	33.2Ω	N.U.	N.U.	N.U.	N.U.
R47	N.U.	10K,10%	N.U.	N.U.	N.U.	N.U.	10K,10%	N.U.	N.U.	N.U.	N.U.
C21	N.U.	.1μF,100V	N.U.	N.U.	N.U.	N.U.	.1μF,100V	N.U.	N.U.	N.U.	N.U.
Q9	N.U.	1023-094	N.U.	N.U.	N.U.	N.U.	1023-094	N.U.	N.U.	N.U.	N.U.
D3	N.U.	1001-116	N.U.	N.U.	N.U.	N.U.	1001-116	N.U.	N.U.	N.U.	N.U.
J5	IN	IN	IN	IN	IN	IN	IN	OUT	OUT	IN	IN
J6	IN	IN	IN	IN	IN	IN	IN	OUT	OUT	IN	IN

TABLE 2(▲): POWER COMPONENTS

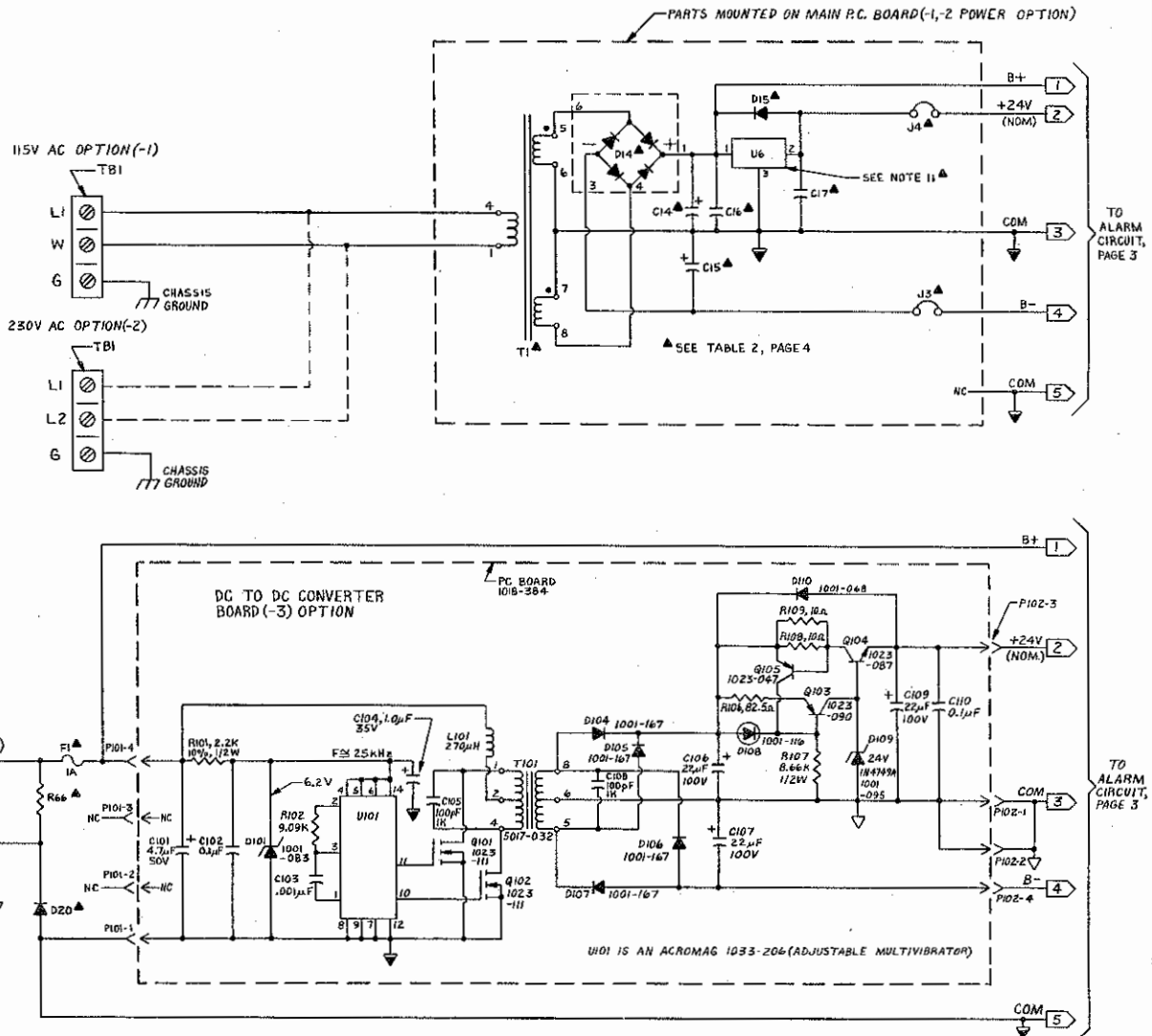
PART	POWER OPTION		
	-1(115V AC)	-2(230V AC)	-3(24V DC)
T1	1014-082	1014-083	NONE
J3	IN	IN	OUT
J4	IN	IN	OUT
J7	IN	IN	OUT
J8	IN	IN	OUT
J9	IN	IN	OUT
J10	IN	IN	OUT
J11	IN	IN	OUT
J12	IN	IN	OUT
J17	OUT	OUT	IN
Q3	1023-041	1023-041	N.U.
Q7	1023-041	1023-041	N.U.
U3	N.U.	N.U.	1033-530
U4	N.U.	N.U.	1033-530
R20	390K, 10%	390K, 10%	220K, 10%
R42	390K, 10%	390K, 10%	220K, 10%
F1	N.U.	N.U.	1030-455
R66	N.U.	N.U.	10K, 10%, 1/2W
D20	N.U.	N.U.	1001-068
D14	1001-133	1001-133	N.U.
D15	1001-068	1001-068	JUMPER
C14	1000μF, 50V	1000μF, 50V	N.U.
C15	100μF, 50V	100μF, 50V	N.U.
C16	0.001μF, 50V	0.001μF, 50V	N.U.
C17	0.1μF, 50V	0.1μF, 50V	N.U.
U6	1033-224	1033-224	N.U.
R18	10K, 10%	10K, 10%	220K, 10%
R23	82.5, 1%	82.5, 1%	0Ω
R40	10K, 10%	10K, 10%	220K, 10%
R45	82.5, 1%	82.5, 1%	0Ω

TABLE 3(●): TIME DELAY COMPONENTS

PART	TIME DELAY OPTION	
	YES	NO
J13	OUT	IN
R34	3.9K, 10%	OPEN
D7	1001-116	OPEN
J14	OUT	IN
R52	3.9K, 10%	OPEN
D11	1001-116	OPEN

TABLE 4(■): RELAY COMPONENTS

PART	115V AC & 230V AC (-1 & -2)		24V DC (-3)	
	-N(STD.)	-H(HERM.)	-N(STD.)	-H(HERM.)
K1	1022-017	1022-015	1022-017	1022-015
K2	1022-017	1022-015	1022-017	1022-015

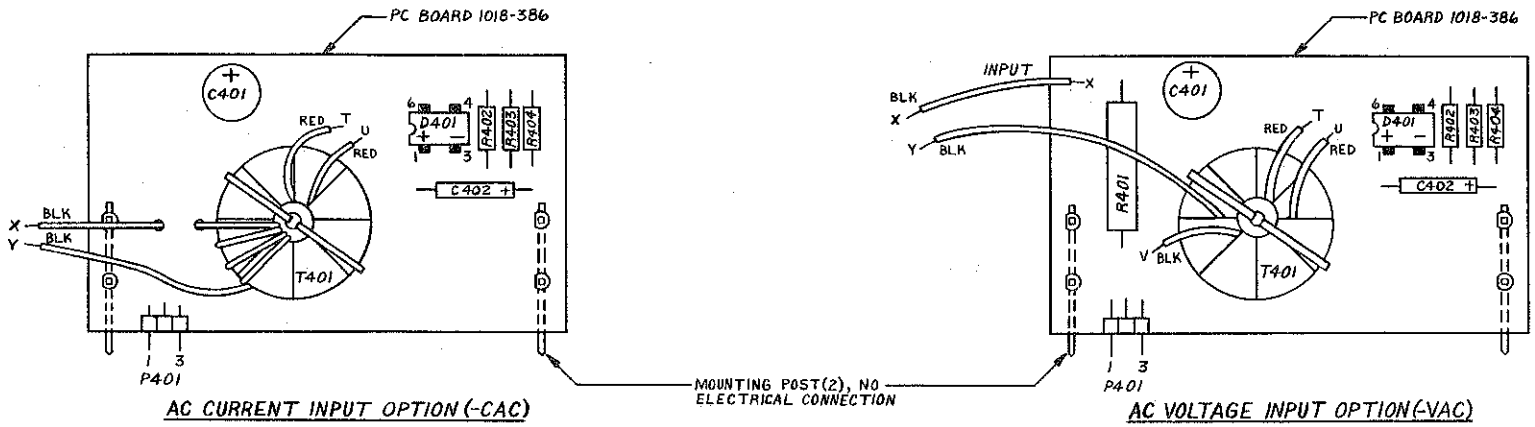


DATE	REV	CO	DR	ENG	CLP
26 APR 93	A	93007	TAV	LK	TH
17 MAY 89	E	9365	TAV	LK	TH
1 MAR 89	D	9296	TAV	LK	TH
18 SEP 86	C	8466	TAV	LK	RLS
30 APR 85	B	7623	TAV	LK	—
4 SEP 84	A	6919	TAV	LK	—
9 AUG 83	—	———	TAV	LK	—

Acromag® WIXOM, MICH.

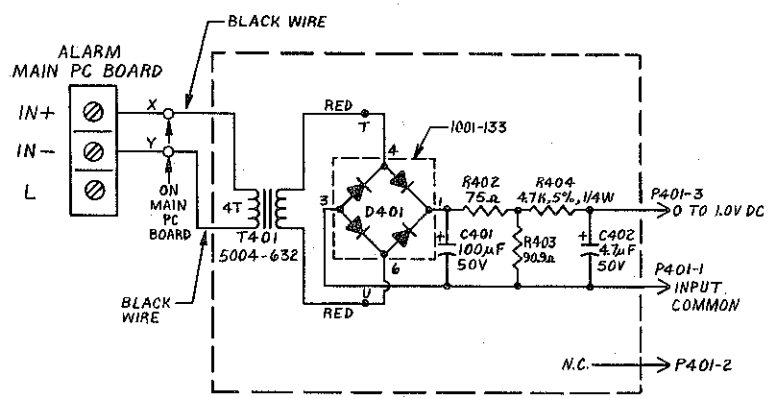
TITLE: 160A-VOLTAGE/CURRENT ALARMS

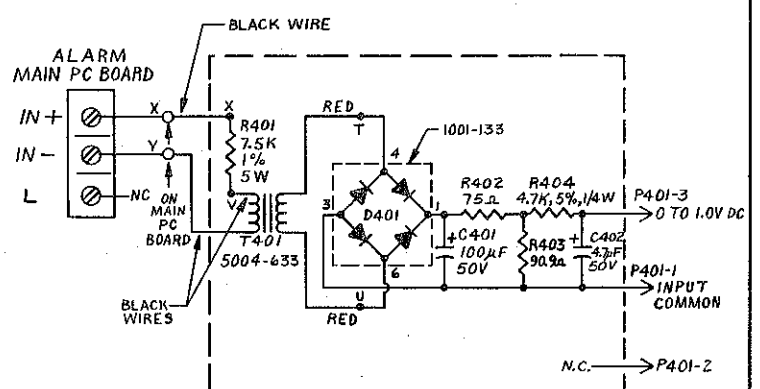
SIZE D | SERIES 160A SERIES | SHEET 4 OF 4 | DRAWING 4500-476 | REV F



AC CURRENT INPUT OPTION (-CAC)

AC VOLTAGE INPUT OPTION (-VAC)





NOTES:
1. ALL RESISTORS ARE 1/8W, 1% UNLESS OTHERWISE SPECIFIED.
2. ALL RESISTORS ARE T2 TYPE UNLESS OTHERWISE NOTED.
3. CAPACITOR VOLTAGE RATINGS ARE 50WV DC (MINIMUM) UNLESS OTHERWISE NOTED.
4. ALL SEVEN DIGIT NUMBERS ARE ACROMAG PART NUMBERS.

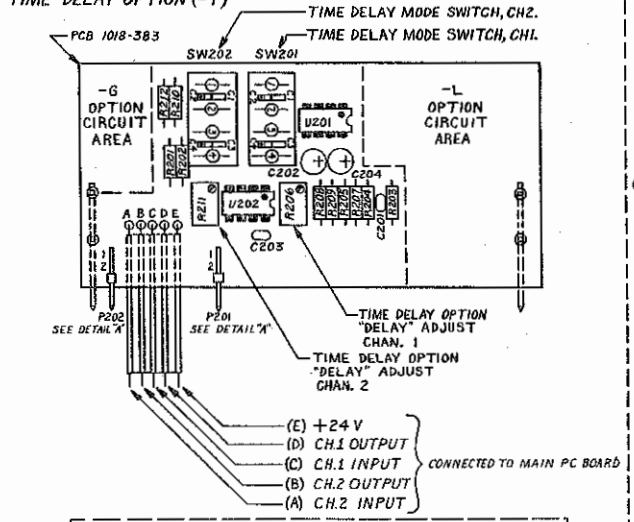
Acromag® WIXOM, MICH.							
	25 AUG 86	—	—	DV	GLS	—	
	DATE	REV	CO	DR	ENG	CLP	

TITLE: -CAC/-VAC INPUT OPTION BOARD

SIZE	SERIES	SHEET	DRAWING	REV
C	160A-ALARMS	1 OF 1	4-500-801	

3600-025

TIME DELAY OPTION (-T)



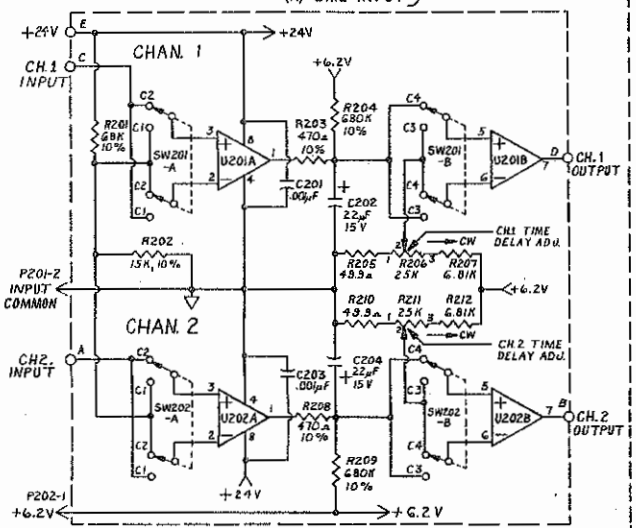


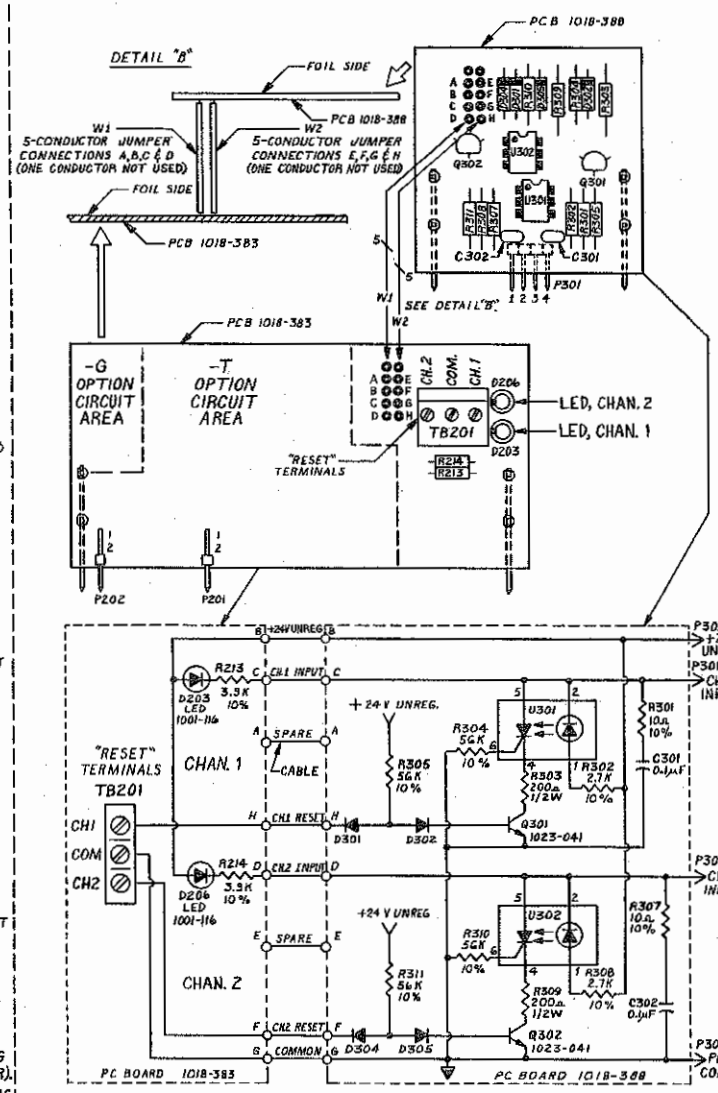
TABLE 1: TIME DELAY DIP SWITCH POSITIONS

TIME DELAY MODE	CHANNEL 1		CHANNEL 2	
	SW201 -A	SW201 -B	SW202 -A	SW202 -B
DELAY OF RELAY PICK-UP	C2	C4	C2	C4
DELAY OF RELAY DROP-OUT	C1	C3	C1	C3
NO DELAY(R206,R211 FCCW)	C2	C4	C2	C4
NO DELAY(R206,R211 FCCW)	C1	C3	C1	C3
NOT VALID	C2	C3	C2	C3
NOT VALID	C1	C4	C1	C4

-T OPTION NOTES:

1. U201 & U202 ARE ACROMAG 1033-531(OP AMP/COMPARATOR).
2. SW201 & SW202 ARE ACROMAG 1037-027 (DUAL 2-POLE, FORM "C" DIP SWITCHES).
3. TURN R206, R211 FCW FOR MAXIMUM TIME DELAY.

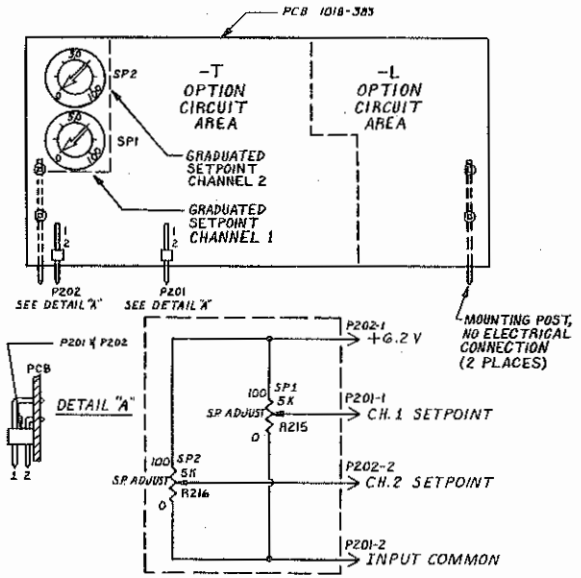
LATCH/RESET OPTION (-L)



-L OPTION NOTES:

1. U301 & U302 ON LATCH/RESET OPTION ARE ACROMAG 1033-648. (OPTO-SCR's).
2. "RESET" TERMINAL BLOCK IS ACCESSIBLE AT FRONT OF ALARM MODULE.
3. LATCHED RELAYS ARE UNLATCHED WHEN "RESET" TERMINALS ARE MOMENTARILY CONNECTED TO "COMMON."

GRADUATED SETPOINT OPTION (-G)



-G OPTION NOTES:

1. GRADUATED SETPOINT POTS ARE ACROMAG 1100-482. (SINGLE-TURN, CERMET).
2. SETPOINT POTS ARE ACCESSIBLE AT FRONT OF ALARM MODULE.

GENERAL NOTES:

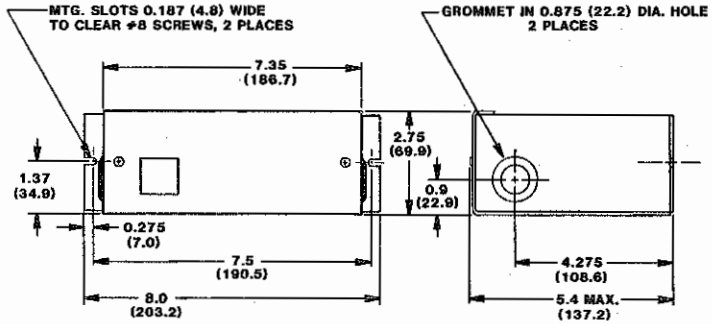
1. ALL RESISTORS ARE 1/8W, 1% UNLESS OTHERWISE SPECIFIED.
2. ALL RESISTORS ARE T2 TYPE UNLESS OTHERWISE NOTED.
3. CAPACITOR VOLTAGE RATINGS ARE 50WV DC(MIN.) UNLESS OTHERWISE NOTED.
4. ALL SEVEN DIGIT NUMBERS ARE ACROMAG PART NUMBERS.
5. ALL DIODES ARE ACROMAG 1001-113 UNLESS OTHERWISE NOTED.
6. IF TIME DELAY OPTION AND LATCH/RESET OPTION ARE USED ON THE SAME ALARM MODULE (-GT, -TL OR -GTL), ONLY THE "DELAY OF RELAY PICK-UP" MODE SHOULD BE USED FOR THE TIME DELAY.
7. "REVERSE-ACTING" MODE CAN NOT BE USED FOR ALARM MODULES WITH LATCH/RESET OPTION (-L, -GL, -TL AND -GTL).

Acromag WIXOM, MICH.	9 AUG 90	A	9687	JW	GT	TH
	22 MAY 86	—	—	KM	12	—
	DATE	REV	CO	DR	ENG	CLP

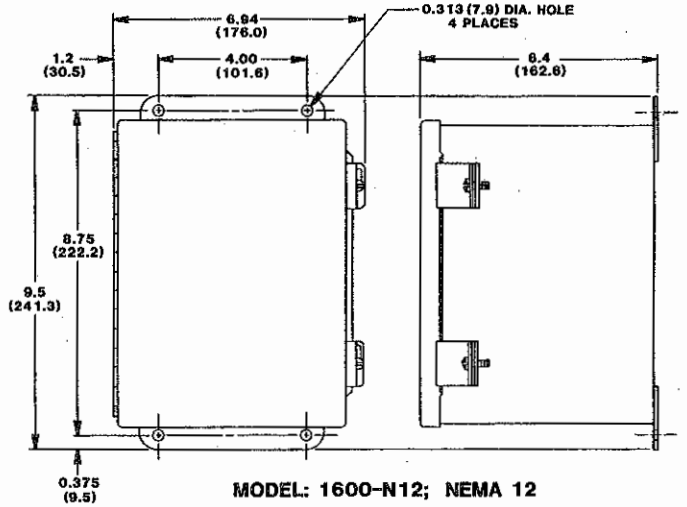
TITLE: -T, -G, & -L OPTION BOARDS

SIZE D DWG | SERIES 1600A-ALARMS | SHEET 1 of 1 | DRAWING 4500-797 | REV A

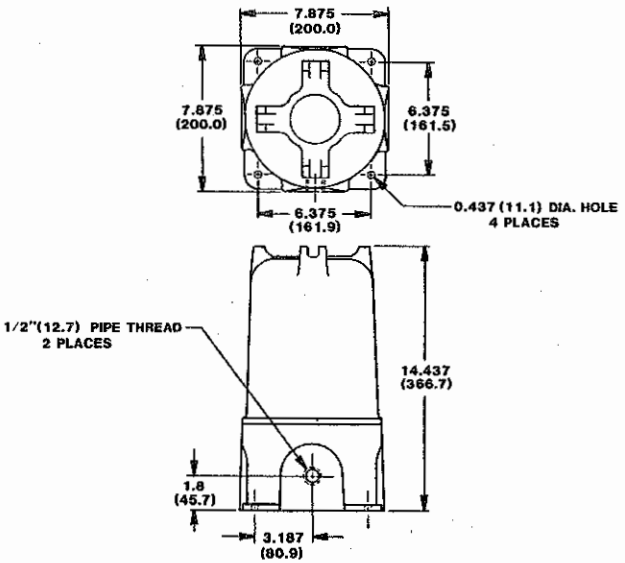
DATE	BY	REVISION RECORD	DR	CK



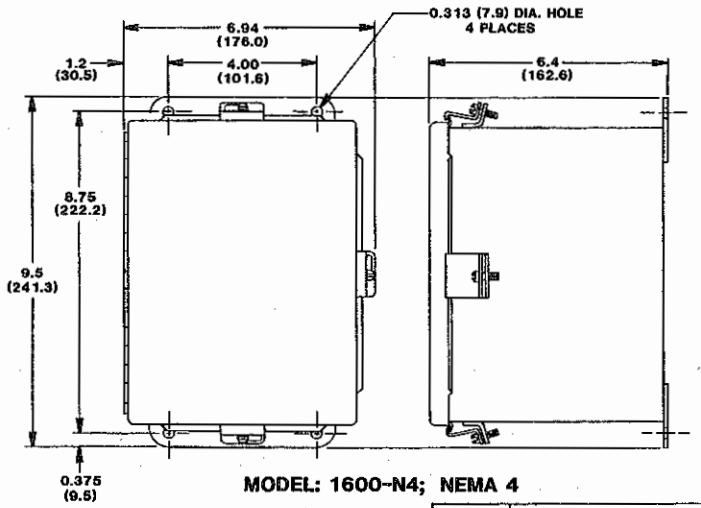
STANDARD ENCLOSURE; NEMA 1



MODEL: 1600-N12; NEMA 12



MODEL: 1600-EXP; NEMA 7, 9



MODEL: 1600-N4; NEMA 4

NOTE : DIMENSIONS ARE IN INCHES (MILLIMETERS).

TOLERANCES (EXCEPT AS NOTED)	ACROMAG, INC.-WIXOM, MICH.		
DECIMAL ±		SCALE	DRAWN BY TAV
FRACTIONAL ±	TITLE 1600 SERIES ENCLOSURES		APPROVED BY
ANGULAR ±	DATE 12-1-82	DRAWING NUMBER 4500-325	
C			

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