RETIRED

Acromag
LEADER IN SIGNAL CONDITIONING

Instructions: Series 1700
Model 1752 Linear Integrator/Totalizer

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List of Drawings

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.

NEW AREA CODE
248

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4-007.1
8500-049-C09945

INSTRUCTIONS: SERIES 1700
Model 1752 Linear Integrator/Totalizer

INTRODUCTION:

These instructions cover the model types listed in Table 1. Supplementary sheets are attached for units with special options or features.

Table 1

A. Model Number Format: 1752-Input-Output-Power-Calibration
B. Typical Model Number: 1752-W-KO-1

Series/Type	-Input	-Output	-Power	-Cal.*
1752	-W -X -Y -Z -F -G	-KO -K1	-1 -2 -3	(Blank) -C

*Units may be ordered with or without factory calibration. If the unit is factory calibrated to customer specifications the model suffix "-C" will indicate this. The calibration information is specified on a separate calibration label on the unit.

DESCRIPTION:

The Model 1752 Integrator/Totalizer, when used with an electromechanical counter, integrates and totalizes DC input signals representing process variables. This integrator provides a pulse train output at a frequency that is directly proportional to the input signal. The output frequency can be adjusted for full-scale outputs of 25-25,000 counts per hour; higher count rates are available on special request.

These integrator/totalizers feature an adjustable zero drop-out circuit that blocks low rate pulses from the output. Each Model 1752 Linear Integrator/Totalizer has the output capability of driving two Acromag electromechanical counters. In addition, an optional reed relay contact output can be supplied with the unit. Refer to Drawing No. 4500-571 for simplified schematic.

SPECIFICATIONS:

Function: Linear integration of input signal. The full scale count rate is field adjustable from 25-25,000 counts per hour by means of a binary frequency divider on the circuit board and a full scale potentiometer. Higher count rates are available.

Model/Series: 1752-

Input:

-W 1-5V DC, 5 megohms minimum input resistance. By cutting a jumper on the circuit board the input can be converted from 1-5V DC to 0-4V DC.

-X 1-5mA DC, 1000 ohms input resistance.

-Y 4-20mA DC, 250 ohms input resistance.

-Z 10-50mA DC, 100 ohms input resistance.

-F Zero-based voltage input; any customer specified span between 50mV and 4.0V DC. Input resistance is 1 megohm per volt of span. Zero point may be trimmed ±5% of input span.

-G Zero-based voltage input; any customer specified span between 4.0V DC and 100V DC. Input resistance is 10K ohms per volt of span.

Output:

-K0 Pulses for external electromechanical counter, 24V pulses into a minimum load of 75 ohms, 50 ms duration nominal.

-K1 Pulses for external electromechanical counter (similar to "-K0" option above) plus an SPST reed relay. Contact load rating is 15 volt-amps max. at 1 amp max. or 250V AC max. resistive.

Power Requirements:

-1 115V AC, ±10%, 50/60 Hz, 0.10A.

-2 230V AC, ±10%, 50/60 Hz, 0.05A.

-3 24V DC, -10%, to + 50%, 0.25A.

Input Offset: +1.0V DC. By removing a jumper, the offset becomes 0.0V DC. The zero point can be trimmed ±5% of the input span with the zero pot.

Output Count Rate: 25-25,000 counts per hour (CPH). The count rate is continuously adjustable with a 22-turn pot over a 2-to-1 range and is used in conjunction with the frequency divider jumper to allow adjustment over the entire range. The frequecy divider provides for binary division of the voltage to frequency converter output and is selected by means of a field changeable jumper.

Zero Drop-Out (ZDO): 1% of input span nominal. When the input signal is below this value, the pulses will be diverted from the output circuit.

Isolation: The negative input lead is common to the negative output lead. For AC powered units, the power leads are isolated from the signal leads. For DC powered units, the negative input and output leads are common to the negative power lead.

Reference Test Conditions: Input: 1-5V DC; 75 ohm resistive load; 77°F (25°C); nominal power input.

Accuracy: Accurate to within ±0.25% of calibrated span.

Ambient Temperature Range: 32° to 122°F (0° to 50°C).

Ambient Temperature Effect: Less than ±0.01% of output span per °F (±0.018% per °C) over the entire ambient temperature range.

Power Supply Effect: Less than ±0.05% of output span for rated supply variations.

Response Time: Input filtering, 0-98%, settling time is 150 ms, typical, for a step change in input.

Noise Rejection:

Common Mode:

AC Powered Units: 100dB at 60 Hz (between input and power) and 250 ohm unbalance, typical.

DC Powered Units: None, nonisolated (between input, output and power).

Normal Mode: 20dB at 60 Hz and 250 ohm source, typical.

Construction:

Case: General purpose, NEMA 1 type metal enclosure, Class 1.

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

Size: Refer to Enclosures Drawing No. 4500-448.

Connections: Barrier type termainal strip using No. 6 screws and clamp plates. Wire range 12-26 AWG.

Shipping Weight: Four (4) pounds (1.82 kg) packed.

OPTIONAL ENCLOSURES (Separate Model Number):

Refer to Drawing No. 4500-448, for outline dimensions of the enclosure options listed below.

Note: Integrator is installed in enclosure at factory. Conduit mounting holes and fittings in NEMA 4 and 12 Enclosures are customer supplied. Each NEMA 4 or 12 Enclosure can hold up to three (3) Series 1700 units.

Model 1700-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: 25 pounds (11.5 kg) packed.

Model 1700-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: 25 pounds (11.5 kg) packed.

Model 1700-EXP: NEMA 7, NEC Class I, Group D; NEMA 9, NEC Class II, Groups E, F and G. Manufacturer: Adalet type XJWH9 modified with internal mounting holes and two conduit holes. Material: Aluminum alloy. Shipping weight: 25 pounds (11.5 kg) packed.

OPTIONAL COUNTERS (Separate Model Number):

Refer to Drawing No. 4500-710, for outline dimensions of electromechanical counter options listed below.

Model 1035-011: Six-digit electromechanical counter with manual reset. Maximum count rate: 36,000 counts per hour. Screw terminals are provided for connection. Shipping weight: 1 pound (0.45 kg) packed.

Model 1035-012: Six-digit electromechanical counter. Maximum count rate: 36,000 counts per (CPH). Screw terminals are provided for connection. Shipping weight: 1 pound (0.45 kg) packed.

Model 1035-015: Six-digit predetermining mechanical counter with manual reset. Output is a SPDT contact which closes at counter setting and remains actuated until counter is reset. Counting continues after the switch is actuated. Shipping weight: 1 pound (0.45 kg) packed.

INSTALLATION:

The Model 1752 is packaged in a general purpose type of enclosure. Use an auxiliary enclosure to protect against unfavorable environments and locations. Maximum operating ambients should not exceed 32° to 122°F (0° to 50°C) for satisfactory performance. If the unit has been factory calibrated, it is ready for installation. Connect as shown in connection diagram (Drawing No. 4500-453). If the unit has not been factory calibrated, refer to the "CALIBRATION" section of these instructions.

Mounting: Refer to Enclosures Drawing No. 4500-448 for mounting and clearance dimensions.

Electrical Connections: The wire size used to connect the integrator to the control system is not critical. All terminal strips can accommodate wire from 12-26 AWG. Input wiring should be either twisted pairs or shielded, output wires should be twisted pairs. 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 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 refer to Drawing No. 4500-453.

1. Power: Connect the AC or DC power to the integrator as shown in the connection diagram. The label on the unit specifies the power required for the unit. On DC units, inadvertent reverse connection will not damage unit.

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

3. Input: Connect inputs as shown in the connection diagram. For units specified to accept process current inputs the required dropping resistors are installed on the printed circuit board at the factory. If field conversion to a different input signal is required, refer to Table 1 on Parts Location Drawing No. 4500-145, page 1 of 2.

   The negative input terminal is common to the output. AC powered units provide power isolation; if DC power is specified, the input, output and power circuit all have a common negative terminal.

4. Output: The output connections are made to the instrument as shown in the connection diagram.

   The "-K0" output option provides a 24V (nominal) pulse, with a duration of approximately 50 ms. This pulse is capable of driving an external electromechanical counter with a coil resistance of 75 ohms or more. Loads less than 75 ohms are not recommended.

   Note: The minus output terminal is common to the minus input terminal.

   The "-K1" output option provides two outputs, an SPST Reed relay contact and a pulse output for an electromechanical counter (similar to the "-K0" option). When driving a load referenced to a different potential, the Reed relay contact will provide electrical isolation. Contact load rating is 15 volt-amps max. at 1 amp max. or 250V AC max. resistive.

CALIBRATION:

If the unit has been factory calibrated, refer to the following "Adjustment Procedure" to verify or change calibration. On factory calibrated units, a label describing calibration appears on the enclosure. If the unit has not been factory calibrated, select the output range from Table 2 of Parts Location Drawing No. 4500-145, page 1 of 2, before advancing to the "Adjustment Procedure".

Select either zero-base or live-zero input mode (refer to Parts Location Drawing No. 4500-145, page 1 of 2).

1. Zero-Base: Remove Jumper J1.

2. Live-Zero: Jumper J1 must be connected.

The following procedure makes reference to 1-5V input signals. Calibration is essentially the same for process current inputs; 1V represents 1mA, 4mA, or 10mA, and 5V represents 5mA, 20mA, or 50mA.

Locate the proper output range containing the Full Scale (F.S.) count rate from the following "Table 2, Divider Jumper Table", and read the corresponding divider jumper position to the left. Insert the flexible divider jumper into this location on the PC board. Refer to Drawing No. 4500-145, page 1 of 2, for divider jumper location.

Table 2

DIVIDER JUMPER TABLE

Divider Jumper Position	Divider Ratio	Output Range Counts per Hour (CPH)
A	1	100,000 to 200,000
B	2	50,000 to 100,000
C	4	25,000 to 50,000
D	8	12,000 to 25,000
E	16	6,000 to 12,000
F	32	3,000 to 6,000
H	64	1,500 to 3,000
J	128	750 to 1,500
K	256	375 to 750
L	512	187 to 375
M	1024	93 to 187
N	2048	47 to 93
P	4096	25 to 47

Connect the integrator as illustrated in the connection diagram. The input source must be adjustable to an accuracy of 0.1% or better. Connect and electromechanical counter (75 ohms or greater) across the output terminals. Connect an electronic counter-timer (such as, Fluke Model 1952B) to Test Point TP+ and Test Point TP-. Refer to Drawing No. 4500-145, page 1 of 2, for test point location. Set the counter-timers to measure period rather than frequency to reduce calibration time. With the counter-timer connected to these test points, the output of the voltage to frequency converter is being monitored. This period measurement will differ from the period measured at the output terminals by the divider ratio.

Locate the proper output range containing the Full Scale (F.S.) count rate from Table 2, Divider Jumper Table, and read the corresponding divider ratio to the left. Determine the F.S. period that will be observed at TP+ and TP- by using the following formula:

$$\text{F.S Period (sec)} = \frac{3600}{\text{F.S. Count Rate (CPH) X Divider Ratio}}$$

NOTE: The calculated F.S. period at TP+ and TP- will always be between 0.018 second and 0.0375 second.

Calibration Example: 1752-W-KO-1
Input: 1-5V DC (0-4V DC with jumper J1 cut).
Output Count Rate: 0-1000 CPH.
Output: KO, pulse to activate 24V DC counter, 75 ohms minimum load.

Adjustment Procedure:

1. Determine divider jumper position for required count rate from Table 2, Divider Jumper Table and place jumper as indicated in the preceding example. The jumper should be placed in the "J" position, having a divider ratio of 128.

   Divider Ratio = 128 (from Table 2, Divider Jumper Table)

   $$\text{F.S Period (sec) at TP+} = \frac{3600}{1000 \times 128} = 0.028 \text{ sec.}$$

2. Apply one of the following input signals and adjust the zero potentiometer to give a period of exactly 16 times the calculated full-scale period (refer to the following step 3).

   A. Live-Zero Units (1-5V Input): Apply 1.250V Input
   B. Zero-Based Units (0-4V Input): Apply 0.250V Input

   NOTE: Do not use a 0% input signal for calibration, this will cause the zero drop-out circuit to operate and block the output pulses.

3. Apply one of the following input signals and adjust the full-scale (F.S.) potentiometer to give the calculated full-scale period (refer to the preceding step 1).

   A. Live-Zero Units (1-5V Input): Apply 5.000V Input
   B. Zero-Based Units (0-4V Input): Apply 4.000V Input

4. Repeat Steps 2 and 3 above until the unit is calibrated.

5. Connect the counter-timer to the output terminals in parallel with the counter. The output period will be the full-scale period at TP+ multiplied by the divider ratio (8, 16, 32...4096).

   CAUTION: Be sure the counter-timer minus (-) terminal is attached to the minus (-) output terminal.

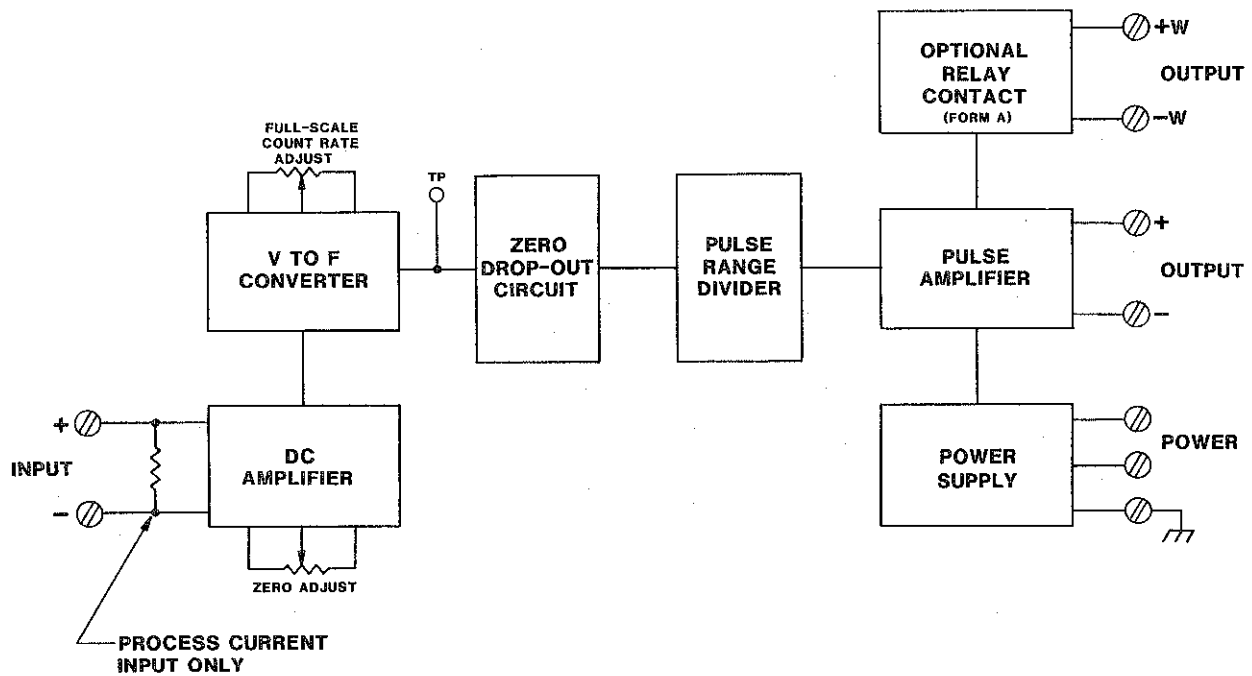
GENERAL MAINTENANCE:

These instruments contain solid-state components and require no maintenance except for periodic cleaning and calibration verification. If the Integrator is not operating properly, it should be removed and given a full bench check-out. Past experience indicates that most problems are in the field wiring and associated circuits rather than in the Integrator itself. If the problem is traced to the unit itself, conventional electronic troubleshooting methods may be used.

In the event of a suspected failure, check for the presence of AC 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 analog 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%

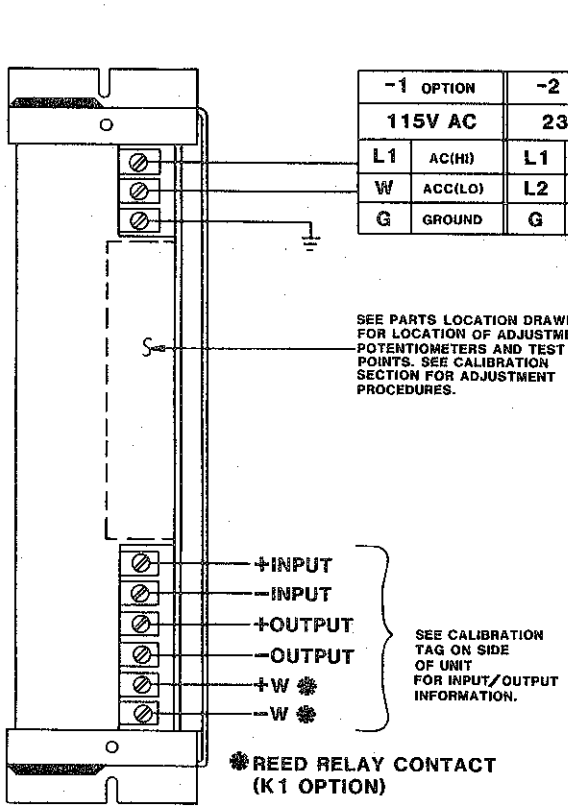


SERIES 1752 • LINEAR INTEGRATOR/TOTALIZER
SIMPLIFIED SCHEMATIC

TOLERANCES (EXCEPT AS NOTED)	ACROMAG, INC.-WIXOM, MICH.		
DECIMAL ±	SERIES 1752	SCALE	DRAWN BY TV / APPROVED BY
FRACTIONAL ±	TITLE SIMPLIFIED SCHEMATIC		
ANGULAR ±	DATE 12-6-83	DRAWING NUMBER 4500-571	
C			

BRUNING 44-231-02959

DATE	BY/M	REVISION RECORD	DR	CH



1752 - ELECTRICAL CONNECTIONS

TOLERANCES (EXCEPT AS NOTED)	ACROMAG, INC.-WIXOM, MICH.		
DECIMAL ±	SERIES 1752	SCALE	DRAWN BY TAV / APPROVED BY KG
FRACTIONAL ±	TITLE: ELECTRICAL CONNECTIONS		
ANGULAR ± '	DATE: 8-3-83	DRAWING NUMBER: 4500-453	

C

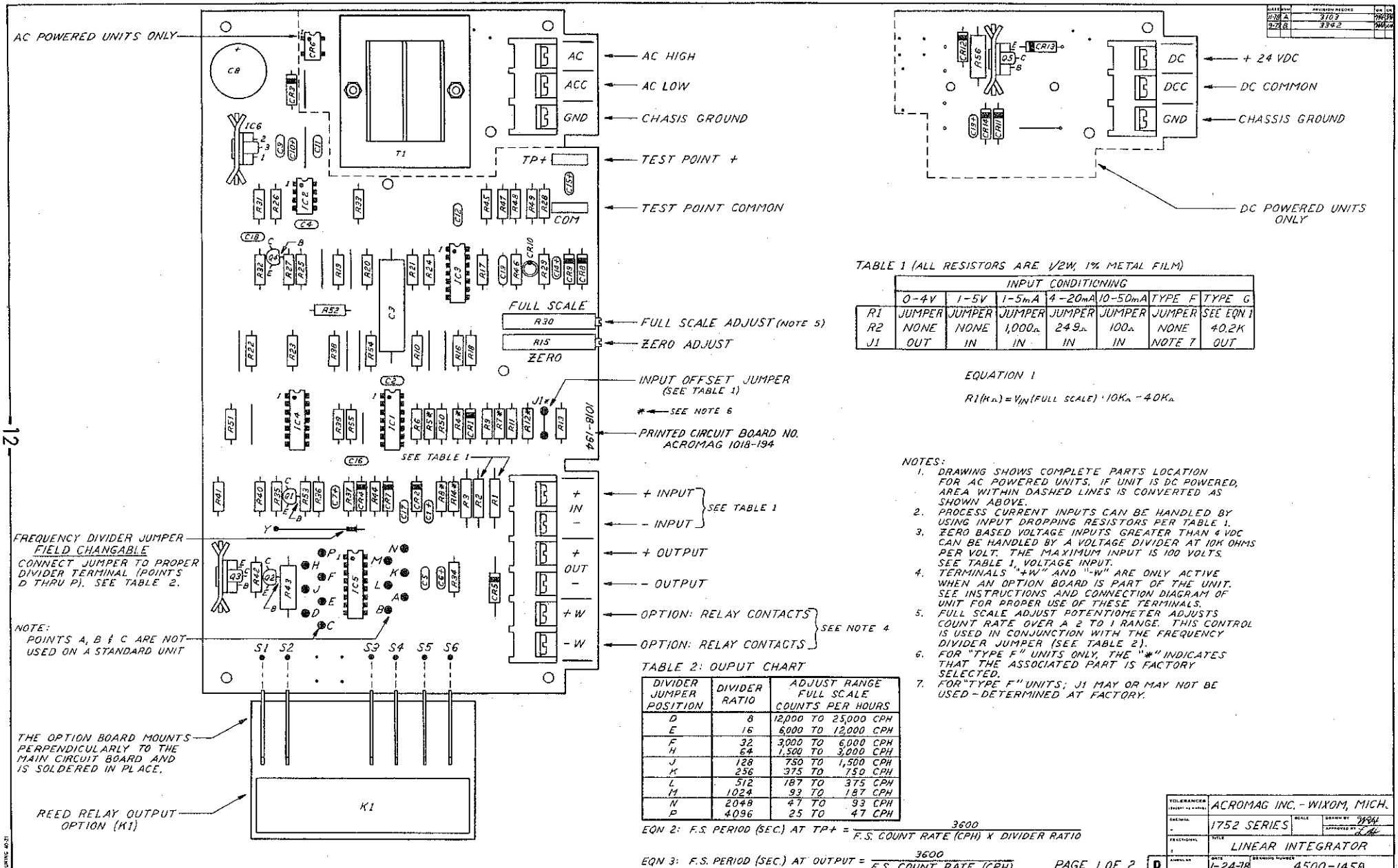


TABLE 1 (ALL RESISTORS ARE 1/2W, 1% METAL FILM)

	INPUT CONDITIONING						
	0-4V	1-5V	1-5mA	4-20mA	10-50mA	TYPE F	TYPE G
R1	JUMPER	JUMPER	JUMPER	JUMPER	JUMPER	JUMPER	SEE EQN 1
R2	NONE	NONE	1,000Ω	249Ω	100Ω	NONE	40.2K
J1	OUT	IN	IN	IN	IN	NOTE 7	OUT

EQUATION 1

$R1(K\Omega) = V_{IN}(\text{FULL SCALE}) \cdot 10K\Omega - 40K\Omega$

NOTES:
1. DRAWING SHOWS COMPLETE PARTS LOCATION FOR AC POWERED UNITS. IF UNIT IS DC POWERED, AREA WITHIN DASHED LINES IS CONVERTED AS SHOWN ABOVE.
2. PROCESS CURRENT INPUTS CAN BE HANDLED BY USING INPUT DROPPING RESISTORS PER TABLE 1.
3. ZERO BASED VOLTAGE INPUTS GREATER THAN 4 VDC CAN BE HANDLED BY A VOLTAGE DIVIDER AT 10K OHMS PER VOLT. THE MAXIMUM INPUT IS 100 VOLTS. SEE TABLE 1, VOLTAGE INPUT.
4. TERMINALS "+W" AND "-W" ARE ONLY ACTIVE WHEN AN OPTION BOARD IS PART OF THE UNIT. SEE INSTRUCTIONS AND CONNECTION DIAGRAM OF UNIT FOR PROPER USE OF THESE TERMINALS.
5. FULL SCALE ADJUST POTENTIOMETER ADJUSTS COUNT RATE OVER A 2 TO 1 RANGE. THIS CONTROL IS USED IN CONJUNCTION WITH THE FREQUENCY DIVIDER JUMPER (SEE TABLE 2).
6. FOR "TYPE F" UNITS ONLY, THE "*" INDICATES THAT THE ASSOCIATED PART IS FACTORY SELECTED.
7. FOR "TYPE F" UNITS; J1 MAY OR MAY NOT BE USED - DETERMINED AT FACTORY.

TABLE 2: OUPUT CHART

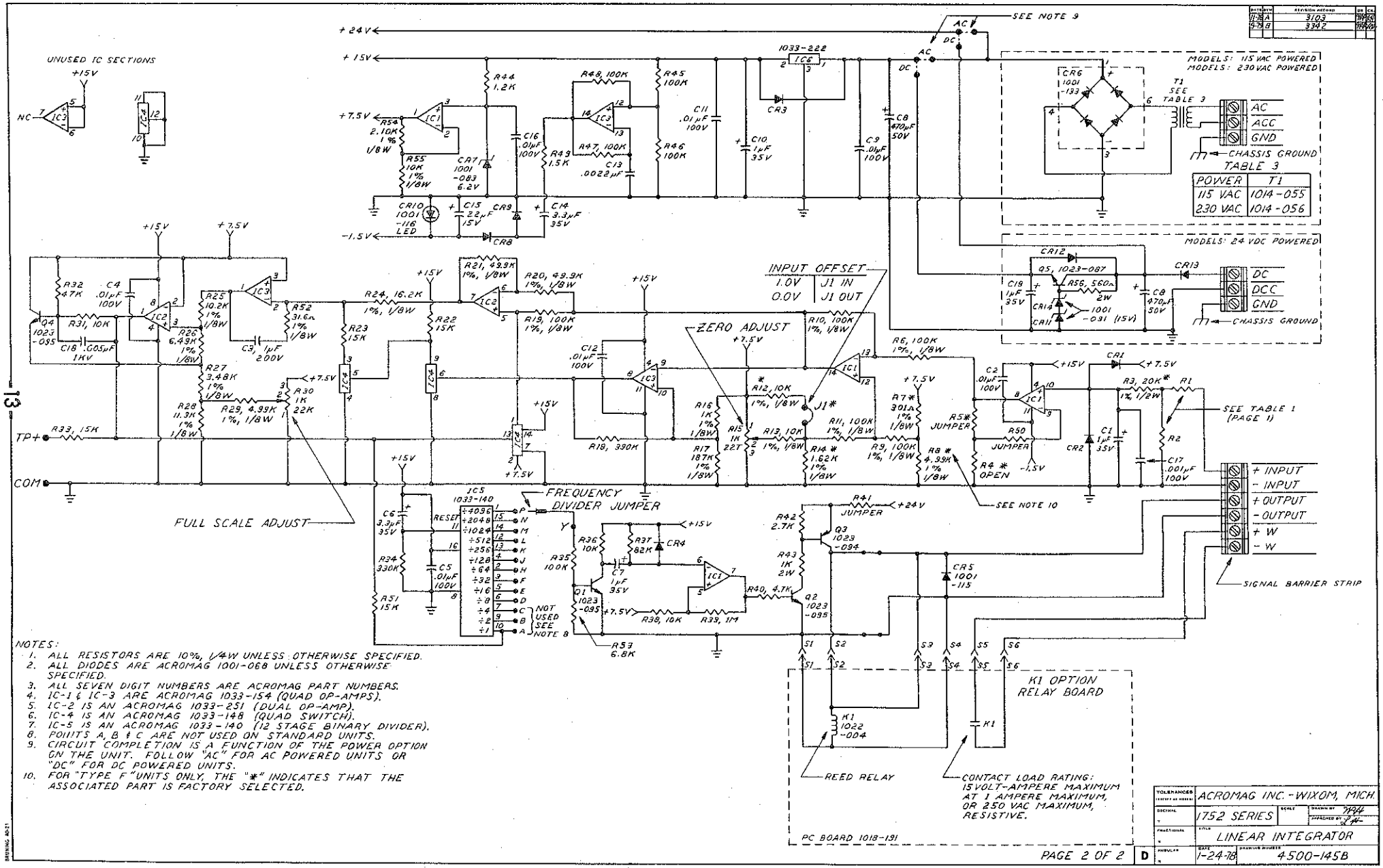
DIVIDER JUMPER POSITION	DIVIDER RATIO	ADJUST RANGE FULL SCALE COUNTS PER HOURS
D	8	12,000 TO 25,000 CPH
E	16	6,000 TO 12,000 CPH
F	32	3,000 TO 6,000 CPH
H	64	1,500 TO 3,000 CPH
J	128	750 TO 1,500 CPH
K	256	375 TO 750 CPH
L	512	187 TO 375 CPH
M	1024	93 TO 187 CPH
N	2048	47 TO 93 CPH
P	4096	25 TO 47 CPH

EQN 2: F.S. PERIOD (SEC.) AT TP+ = $\frac{3600}{\text{F.S. COUNT RATE (CPH)} \times \text{DIVIDER RATIO}}$

EQN 3: F.S. PERIOD (SEC.) AT OUTPUT = $\frac{3600}{\text{F.S. COUNT RATE (CPH)}}$

DATE	REVISION RECORD	BY	CK
11-78	A	3103	MM/PW
9-79	B	3342	MM/PW

ACROMAG INC. - WIXOM, MICH.
1752 SERIES
LINEAR INTEGRATOR
DRAWN BY PWH
APPROVED BY
DATE 1-24-78
DRAWING NUMBER 4500-145B
SIZE D

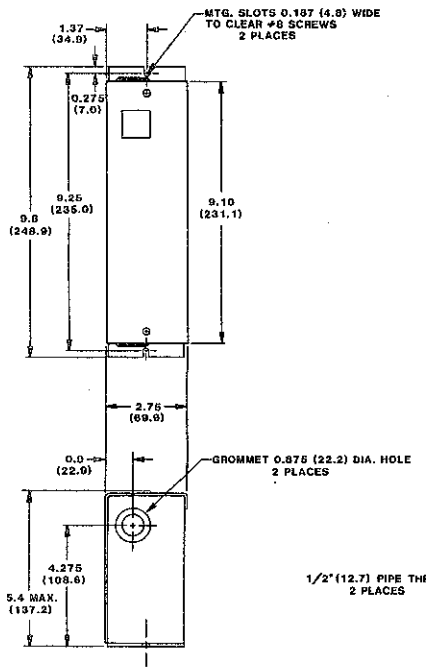


NOTES:

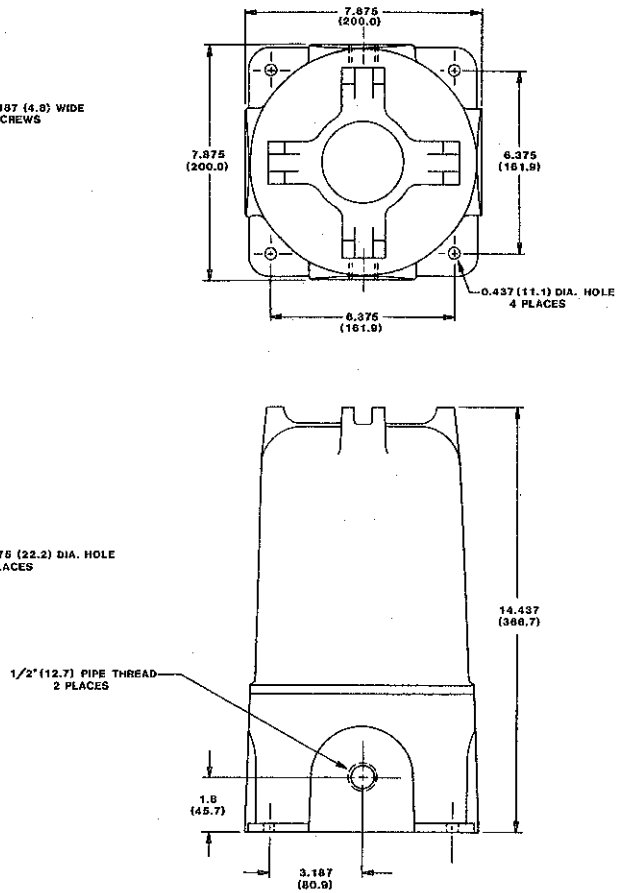
1. ALL RESISTORS ARE 10%, 1/4W UNLESS OTHERWISE SPECIFIED.
2. ALL DIODES ARE ACROMAG 1001-068 UNLESS OTHERWISE SPECIFIED.
3. ALL SEVEN DIGIT NUMBERS ARE ACROMAG PART NUMBERS.
4. IC-1 & IC-3 ARE ACROMAG 1033-154 (QUAD OP-AMPS).
5. IC-2 IS AN ACROMAG 1033-251 (DUAL OP-AMP).
6. IC-4 IS AN ACROMAG 1033-148 (QUAD SWITCH).
7. IC-5 IS AN ACROMAG 1033-140 (12 STAGE BINARY DIVIDER).
8. POINTS A, B & C ARE NOT USED ON STANDARD UNITS.
9. CIRCUIT COMPLETION IS A FUNCTION OF THE POWER OPTION ON THE UNIT. FOLLOW "AC" FOR AC POWERED UNITS OR "DC" FOR DC POWERED UNITS.
10. FOR "TYPE F" UNITS ONLY, THE "*" INDICATES THAT THE ASSOCIATED PART IS FACTORY SELECTED.

DATE/BY	REVISION RECORD	ECR
11-78 A	3103	
4-79 B	3342	

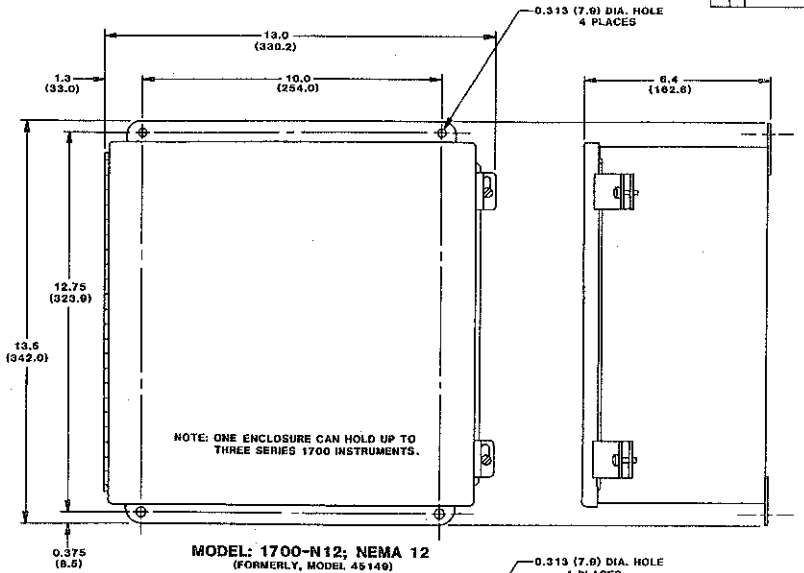
ACROMAG INC. - WIXOM, MICH.
1752 SERIES
LINEAR INTEGRATOR
DRAWING NUMBER 4500-145B
DATE 1-24-78
SIZE D



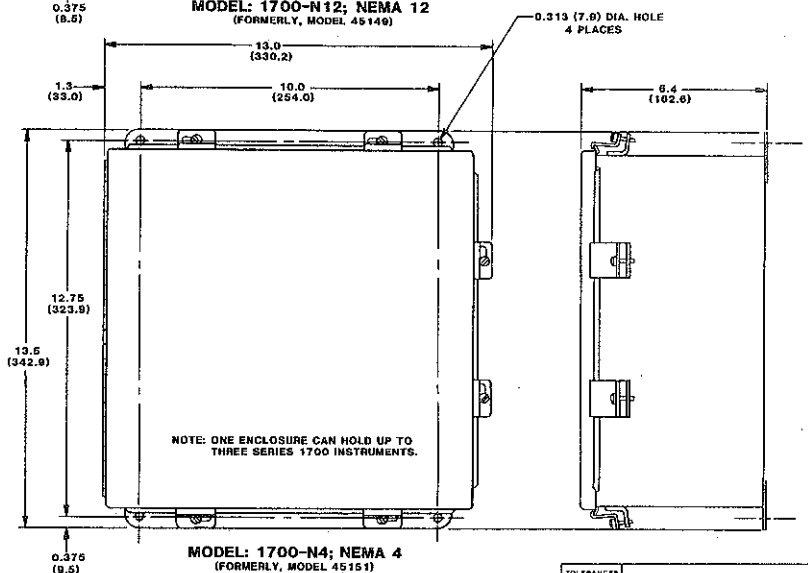
STANDARD ENCLOSURE; NEMA 1



MODEL: 1700-EXP; NEMA 7, 9
(FORMERLY, MODEL 45155)



MODEL: 1700-N12; NEMA 12
(FORMERLY, MODEL 45149)



MODEL: 1700-N4; NEMA 4
(FORMERLY, MODEL 45151)

NOTE: DIMENSIONS ARE IN INCHES (MILLIMETERS).

TOLERANCES (EXCEPT AS NOTED)	ACROMAG, INC.-WIXOM, MICH.		
DECIMAL .X		SCALE	DRAWN BY TAV
.XX			APPROVED BY KG
FRACTIONAL .X	TITLE 1700 SERIES ENCLOSURES		
ANGULAR	DATE 8-2-83	DRAWING NUMBER 4500-448	
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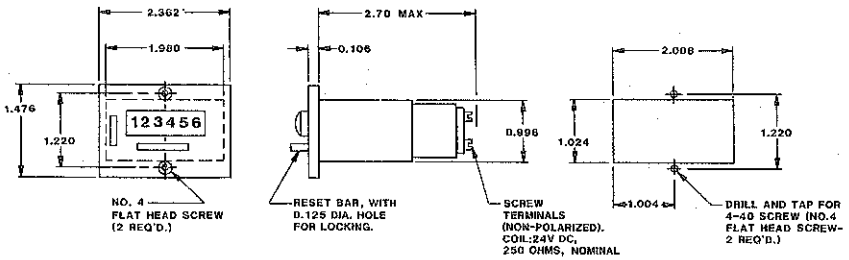
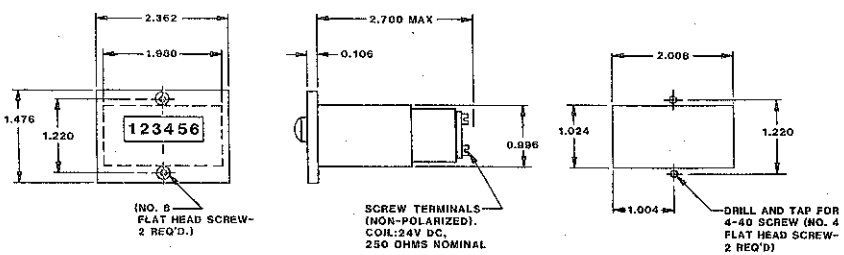


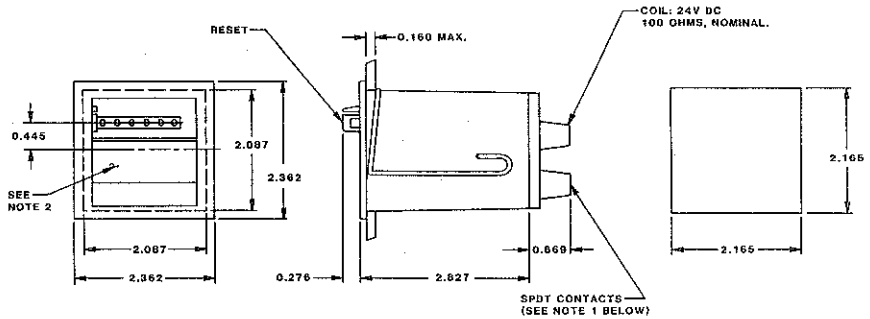
OUTLINE DIMENSIONS PANEL CUTOUT

MODEL 1035-011
SIX DIGIT MECHANICAL RESET COUNTER



OUTLINE DIMENSIONS PANEL CUTOUT

MODEL 1035-012
SIX DIGIT MECHANICAL NON-RESET COUNTER



OUTLINE DIMENSIONS PANEL CUTOUT

MODEL 1035-020
SIX DIGIT PREDETERMINING
MECHANICAL RESET COUNTER

NOTES:

1. THE BUILT-IN SNAP ACTION SPDT SWITCH IS ACTUATED WHEN THE PRESET NUMBER IS REACHED AND REMAINS IN THIS POSITION UNTIL THE COUNTER IS RESET. THE COUNTER WILL CONTINUE TO ACCEPT COUNTS AFTER THE SWITCH HAS TRIPPED UNLESS THE OUTPUT SIGNAL IS INTERLOCKED. THE SWITCH IS RESTORED TO ITS' ORIGINAL POSITION WHEN COUNTER IS RESET MANUALLY.

   CONTACT RATING
   AC: 250 VOLTS, 5 AMP MAX., NON-INDUCTIVE.
   DC: 48 VOLTS, 0.6 AMP MAX., 125 VOLTS, 0.1 AMP MAX.

2. PUSH BUTTON TO OPEN COVER; CLOSE COVER TO RUN.

ELECTROMECHANICAL COUNTERS

Acromag WIXOM, MICH.	DATE	REV	CO	DR	ENG	CAP
	29 APR 91	B	9857	TW		
	17 JAN 89	A	9266	TW		
	21 DEC 84	—	—	TW		—

TITLE: ELECTROMECHANICAL COUNTERS

SIZE	SERIES	SHEET	DRAWING	REV
D		1 OF 1	4500-710	B