

OPERATING INSTRUCTIONS

RESISTOTROL - MODEL 1215
& MODEL 1220

Shell Development Design

PRINCIPLE:

The RESISTOTROL is a general purpose temperature controller for laboratory or industrial use. It is designed to operate as an on-off controller.

A resistance thermometer sensing element is used as the variable arm in an A.C. Wheatstone bridge circuit. The bridge is operated at balance by means of an adjustable ratio arm which selects the temperature setting. A change in thermometer resistance produces an A.C. voltage which is amplified by a resistance coupled amplifier. This amplified A.C. voltage is then applied as a bias voltage to a thyratron tube energizing an enclosed mercury switch which turns a heater on and off.

CONTROLLERS IN GENERAL:

The optimum performance of a controlled system depends upon many factors other than the controller itself. For example, the bath liquid must be well stirred to avoid gradients. In any system it is advisable to supply heat to the point where it is being lost, otherwise a transfer of heat from another location will result in gradients. Time lag is to be avoided in heaters as well as in the temperature sensing elements.

The technique of placing the sensing element close to the heating element to obtain smooth control should also be avoided as this merely reduces the gain and introduces a droop for which the controller cannot compensate.

POWER:

The power required is 115 volt 60 cycle, 40 watts for Model 1215, and 220 volt 60 cycle, 40 watts for Model 1220. The power connections are made by removing the back plate and connecting the leads to the lugs labeled "POWER" on the terminal strip. The letters H, N and G designate Hot, Neutral and Ground legs of the power circuit for 115 volt operation and H₁, H₂, and N designate Hot, Hot and Neutral for 220 volt operation.

LOAD:

The instrument is capable of supplying power to a load of 115 volt 60 cycles up to 30 amperes (non-inductive), and to a load of 220 volt 60 cycles, up to 25 amperes (non-inductive). The load connections are made on the same terminal strip to the lugs marked "LOAD". These connections are polarized the same as those for power H, N and G, and H₁, H₂, and N.

Two lugs labeled "SPARE" are provided for auxiliary use, such as for connecting a stirrer. These lugs are wired to a 115 volt source of power on Model 1215 and 220 volt source of power on Model 1220, and are energized when the main switch is on.

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THERMOMETER:

The thermometer leads are also connected to the terminal strip at the back of the instrument. The lugs are labeled 1, 2, 3 and 4.

Standard Thermometers are listed below. Bulbs having other ranges or specifications than those listed are available on request.

THERMOMETER BULBS - LIQUID

- MODEL 1221 - Nickel wound resistance bulb in stainless steel sheath, thin walled flat sensitive portion, response time 0.8 seconds, length 2-15/32" below thread, with AN connector and 5 feet rubber covered 4-conductor cable, 7/8"-14 NF mounting thread; range -70°C to 200°C.
- MODEL 1080 - Bath type bulb using the same sensitive portion as Model 1221, with flange mounting, 5 feet rubber covered 4-conductor cable, overall length 10-1/4" below flange; range -70°C to 200°C.
- MODEL 1106 - Bath type bulb similar to Model 1080, except with 1/2" NPT connection instead of flange mounting, overall length 10-1/4" below thread; range -70°C to 200°C.

THERMOMETER BULBS - AIR or GAS

- MODEL 1085 - Nickel wound resistance bulb, 4" sensitive bare element with protecting guard, overall length 7-1/4" below flange, with 5 feet rubber covered 4-conductor cable, flange mounting; range -70°C to 300°C.
- MODEL 1107 - Similar to Model 1085 except with 1/2" NPT connection for mounting, overall length below thread 7-1/4"; range -70°C to 300°C.

THERMOMETER BULBS FOR METAL BLOCK

- MODEL 1144 - Flat sensitive element 1-7/16" long by 1/2" wide by .006" thick, mounted in Silicone impregnated Fibreglas block approximately 1-3/4" long by 1" wide by 1/4" thick; range -100°F to 300°F.
- MODEL 1196 - Flat sensitive element molded in Silastic with stainless steel backing (.002" thick) for high temperature use. Sensitive element 1" square by 1/8" thick, mounted in Silicone impregnated Fibreglas block approximately 1-3/4" by 2" by 1/4" thick; range -100°F to 500°F.

The range of the RESISTOTROL is determined by the range of the resistance thermometer bulbs used.

SENSITIVITY:

The sensitivity of the RESISTOTROL expressed as the temperature difference between "on and off" operation (or dead zone) is 0.001°C. When used with a bath, the control accuracy of any temperature controller depends on many factors other than the controller itself; such as, time constants, mass and

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configuration of the thermometer sensing element, heater, bath tank and other components, as well as stirring efficiency, insulation, etc. For this reason, the sensitivity characteristics of the controller are listed rather than how accurately it will control a bath temperature.

OPERATION.

Connect the power, load and thermometer to the instrument terminals. These are located in the back of the instrument and are accessible by removing the back cover.

MAINTENANCE:

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FIGURE 1, the wiring diagram of the RESISTOTROL, has the check voltages recorded. All DC measurements are made with a 20,000 ohm per volt meter. The DC voltages are indicated by a rectangle and the AC voltages by parenthesis. All the test points are easily accessible on the tube sockets.

The following procedure should be used to determine that the RESISTOTROL is operating properly:

- 1) Check all plate voltages. The voltages should be between 70 to 90 volts on stage 1, 18 to 25 on stage 2, 40 to 60 on stage 3 and 150 to 175 on stage 4.
- 2) Connect two 100 ohm wire wound resistors between terminals 1 - 2 and 2 - 3.
- 3) Connect oscilloscope leads to Test Point and chassis. The reading on a calibrated oscilloscope should be less than 1.0 volts when Coarse and Fine controls are adjusted to bridge balance. If a higher reading is obtained, insert another 12AX7 tube in the first stage.
- 4) Remove the 2D21 thyratron tube from socket.
- 5) A DC meter connected between the test point and the chassis should indicate minus 1.8 - 2.2 volts.
- 6) Replace the thyratron tube.

* Model 1215 - FIGURE 1
Model 1220 - FIGURE 2

PARTS LIST

RESISTOTROL - MODELS 1215 & 1220

(* Used only on Model 1215)

(** Used only on Model 1220)

ITEM	DESCRIPTION	PART NO.	NO. REQ'D
C1A	Capacitor, 0.001 mfd, 600 volt	DT 422	1
C1	" , 10 mfd, 50 volt	DT 414	1
C2	" , 10, 10, 10 mfd, 450 volt	DT 415	1
C3	" , 0.03 mfd, 400 volt	DT 416	1
C4	" , 0.05 mfd, 200 volt	DT 417	1
C6	" , 0.007 mfd, Mica	DT 418	1
C9	" , 8 mfd, 450 volt	DT 421	1
D1	Rectifier, Selenium, 20 ma	DJ 404	1
E1	Resistance thermometer (See pg. 2 of oper. instr.)	-	1
K1	Relay, Mercury, 30 Amp. 115 volt 25 Amp. 220 volt	EV 413	1
P1	Pilot light holder, Red Jewel	CN 414	1
*	Lamp, 6 watt, 115 volt	DX 401	1
**	Lamp, 10 watt, 220 volt	DX 410	1
R1	Resistor, Special, Manganin	DY 498	1
R2	Potentiometer, 10 ohm, wire wound	DZ 423	1
R3	Potentiometer, 50 ohm, wire wound	DZ 418	1
R4	Resistor, special; part of Item E1	-	-
R14	Resistor 1K ohm, 1/2 watt, 5%	DY5EB1K5-1/2	1
R15	" 10K ohm, " 5%	DY5EB10K5-1/2	1
R16	" 100K ohm, " 10%	DY5EB100K10-1/2	1
R17	" 150K ohm, " 10%	DY5EB150K10-1/2	1
R18	" 1M ohm, " 5%	DY5EB1M5-1/2	1
R19	" 680K ohm, " 10%	DY5EB680K10-1/2	1
R20	" 1M ohm, " 5%	DY5EB1M5-1/2	1
R21	" 150K ohm, " 10%	DY5EB150K10-1/2	1
R22	" 680K ohm, " 5%	DY5EB680K5-1/2	1
R23	" 220K ohm, " 5%	DY5EB220K5-1/2	1
R24	" 470K ohm, " 10%	DY5EB470K10-1/2	1
R36	" 4.7K ohm, " 5%	DY5EB4.7K5-1/2	1
R37	" 220K ohm, " 5%	DY5EB220K5-1/2	1
R38	" 4.7K ohm, " 5%	DY5EB2.2M5-1/2	1
*S1	Switch, Toggle, SPST, 6 Amp. 125 volt	EH 427	1
**S1B	Switch, Toggle, DPST, 20 Amp. 250 Volt	EH 435	1
*T2	Transformer, Input, Special	EE 416	1
**T2B	Transformer, Input, Special	EE 418	1
V1	Vacuum Tube, 12AX7, selected	JF 401	1
V2	Vacuum Tube, 12AX7, selected	JF401-2	1
V3	Thyratron, 2D21	JF 404	1
XV1	Tube Socket, 9-pin miniature	DC 407	1
XV2	Tube Socket, 9-pin miniature	DC 407	1
XV3	Tube Socket, 7-pin miniature	DC 408	1

PARTS LIST

ITEM	DESCRIPTION	PART NO.	NO. REQ'd
XV4	Pin Tip Jack, Red	DP 403	1
YV1	Socket Shield Base for 9 Pin Socket	EG 405	2
YV3	" " " " 7 Pin Socket	EG 404	1
100	Dial, Multiturn, Coarse Control	BM 402	1
101	Housing	CX 411	1
102	Panel	CU 437	1
103	Chassis	DL 410	1
105	Terminal Strip Back Insulator	GN 412	1
107	Relay Mounting Bracket	BQ 416	1
108	Knob, Fine Control	BK 415	1
109	Washer, Fibre, (Rectifier D1)	KS 15	2
110	Vacuum Tube Shield	EG 406	2
111	Thyratron Tube Shield	EG 407	1
112	Fuse Holder	DV 408	1
113	Mounting Plate, Capacitor C2	CZ 435	1
114	Grommet, Chassis	BR 406	1
115	Grommet, Back Cover Plate	BR 407	3
F1	Fuse, 1/2 Amp.	DV 409	1
116	Terminal Strip	DK 427	1
117	Tie Post	DK 426	1

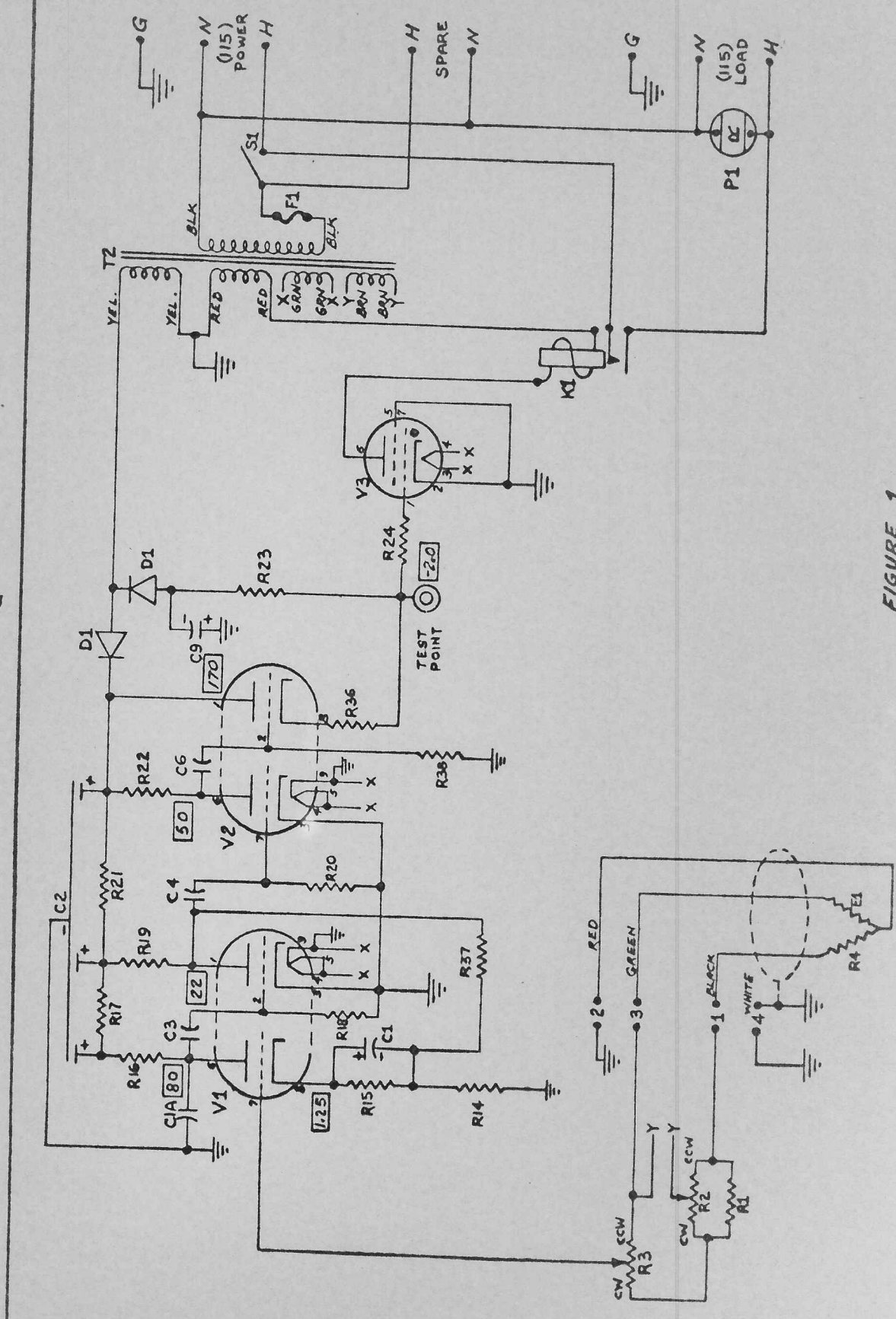


FIGURE 1
 WIRING DIAGRAM- RESISTOTROL
 MODEL 1215A

□ INDICATES D.C. VOLTAGES
 () INDICATES A.C. VOLTAGES

HALLIKAINEN INSTRUMENTS
Berkeley, California

CORRECTION TO PARTS LIST
FOR RESISTOTROLS
MODEL 1215A AFTER SER. #3725
MODEL 1220A AFTER SER. #3367

DELETE:

<u>Rem</u>	<u>Description</u>	<u>Part No.</u>	<u>No. Req'd.</u>
*	Pilot Light Lamp (115V)	DX-401	1
**	Pilot Light Lamp (220V)	DX-410	1
Pl	Pilot Light Holder Assembly	CN-414	1

ADD:

Pl*	Pilot Light with Neon Lamp	CN-425	1
Pl**	Pilot Light with Neon Lamp	CN-426	1