

NATIONAL RADIO ASTRONOMY OBSERVATORY
Green Bank, West Virginia

Electronics Division Internal Report No. 71

THE FRONTEND BOX TEMPERATURE
CONTROLLER FOR THE 36-FOOT TELESCOPE

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Introduction:

Weight and space limitations at the focus of the 36-foot radio telescope in Tucson, Arizona do not allow the use of the standard NRAO frontend box temperature control system. For this reason a new system was designed. It holds the frontend box temperature to within one degree Centigrade of the set-temperature. Better performance is expected after minor modifications are made. The air temperature cycles over 0.5 °C p-p due to thermal lag in the system, with a period of the order of 10 sec.

Block Diagram:

1. Cooled air from an air condition unit mounted on one of the lower telescope platforms is blown to the frontend box via an air duct along one of the feed support legs. A light-weight reheater is located near the frontend box.

The reheat elements form part of a servo loop which regulates the reheater exhaust air temperature. The reheat unit consists of a number of ceramic cone heater elements with a total power rating of 5 kW. AC power to the reheat element is controlled with TRIAC's.

2. A thermometer measures the frontend box temperature. It consists of a YSI thermistor on an electronic readout circuit. The temperature can be read on a front panel meter.
3. Due to the high electric power involved, a number of safety precautions are taken.
 - a) No AC power is directed to the reheat elements if the AC power to the blower fan is disconnected.

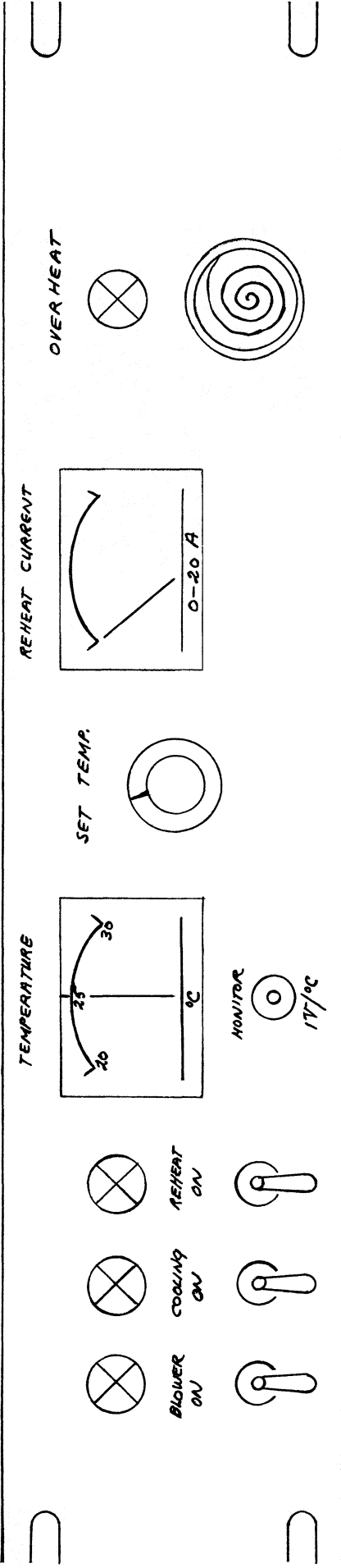
- b) The system does not operate when the AC power to the cooling unit is disconnected.
- c) A thermistor mounted close to the cone heater elements senses an overheat condition when either the heaters become very hot or the cool input air flow is interrupted. It shuts off the 208 V AC power to the reheater and gives an audible and visible warning signal.
- d) When the frontend box temperature is higher than 31 °C, an overheat condition is also created, with the same effects.

Circuit Diagrams:

The circuit diagrams should speak for themselves and do not contain any novelties.

The TRIAC power amplifier circuit was taken from a GE application note. It has three positions: off, half power, or full power. The TRIAC's switch during the zero crossings of the AC voltage cycle. Isolation between the 208 V AC system, which is not grounded, and the rest of the system is obtained with the input control relay. The reed relay contacts switch only 1 mA at 1 V, resistive. A Raytheon Raysistor could have been used also in this function, but was not available.

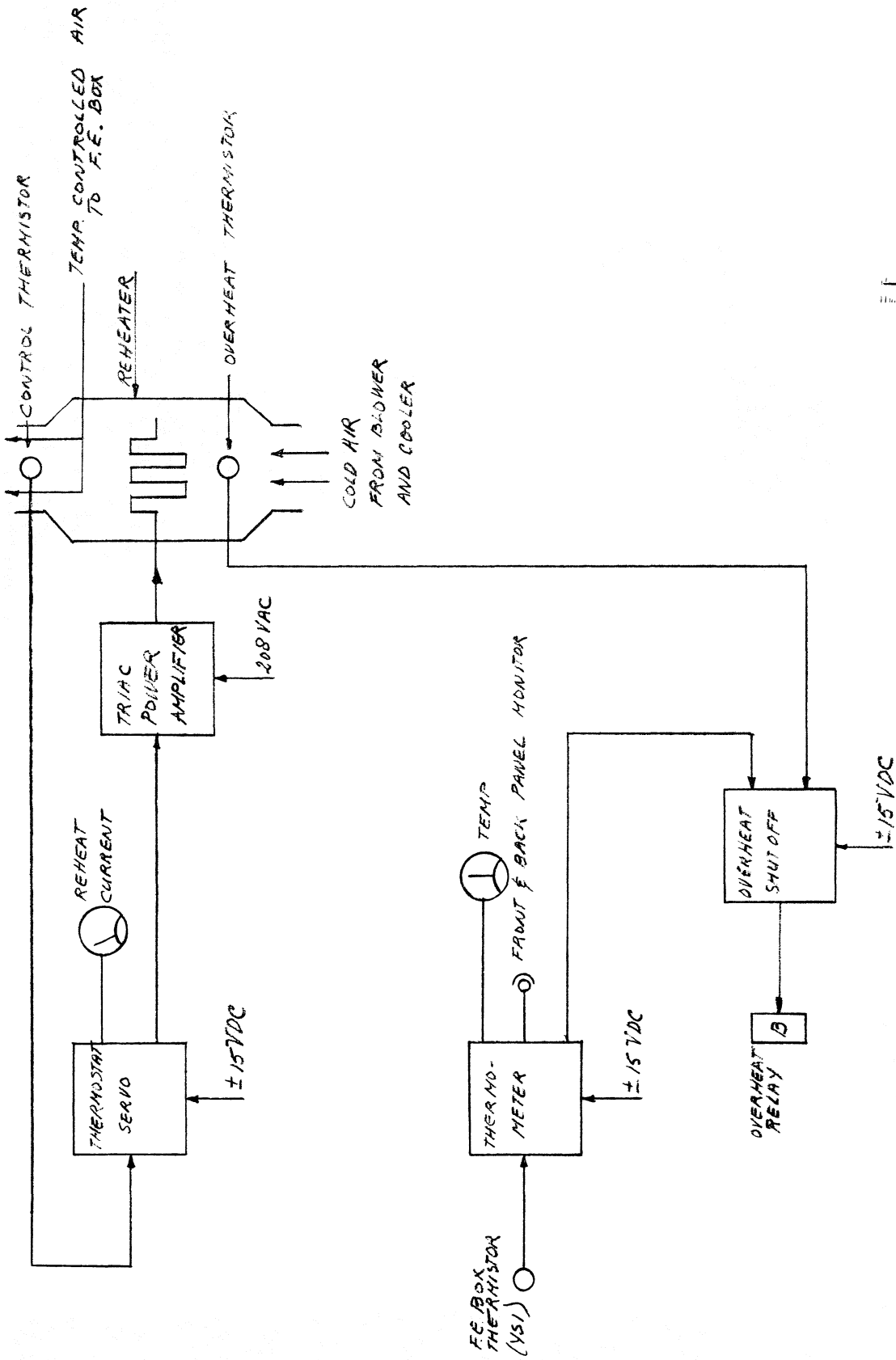
An improvement in the system can be made, by locating the servo thermistor at a point where the reheated air is more thoroughly mixed, and at a point closer to the frontend box.



SKETCH ONLY

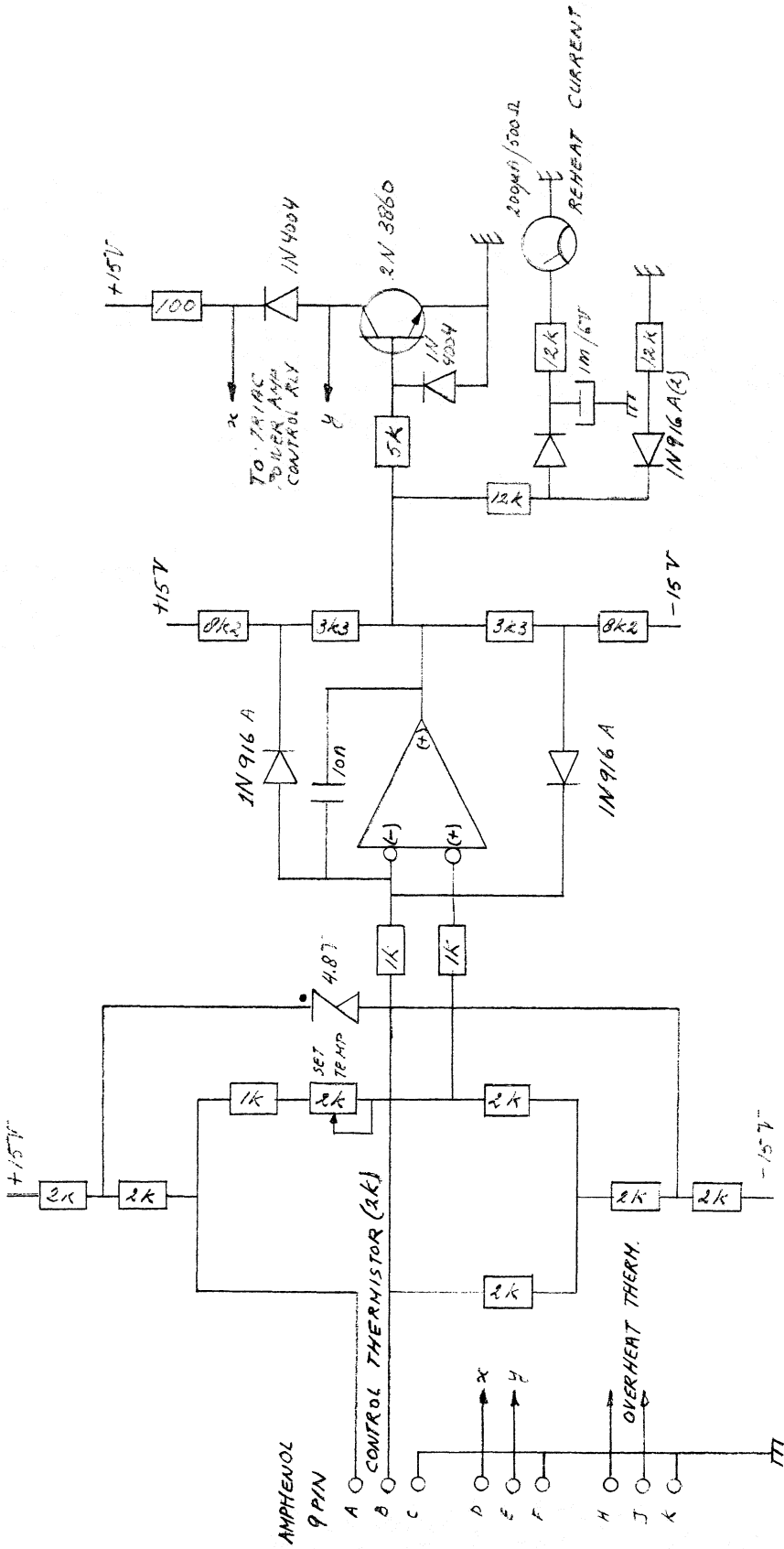
36 FT ELECTRONICS

F.E. BOX TEMP CONTROLLER
FRONT PANEL



36 FT ELECTRONICS

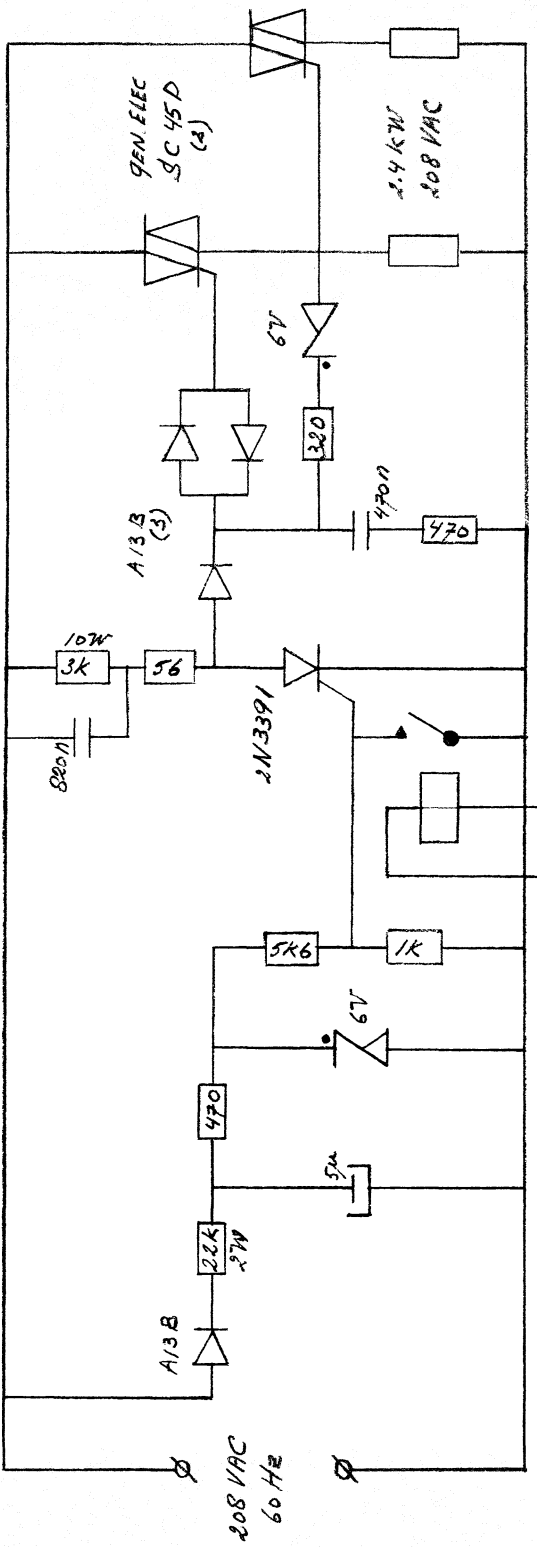
FE BOX TEMP CONTROL
ELECTRONICS BLOCK DIAG.



OPAMP: PHILBRICK P2

36 FT ELECTRONICS

THERMOSTAT SERVO
AMPLIFIER

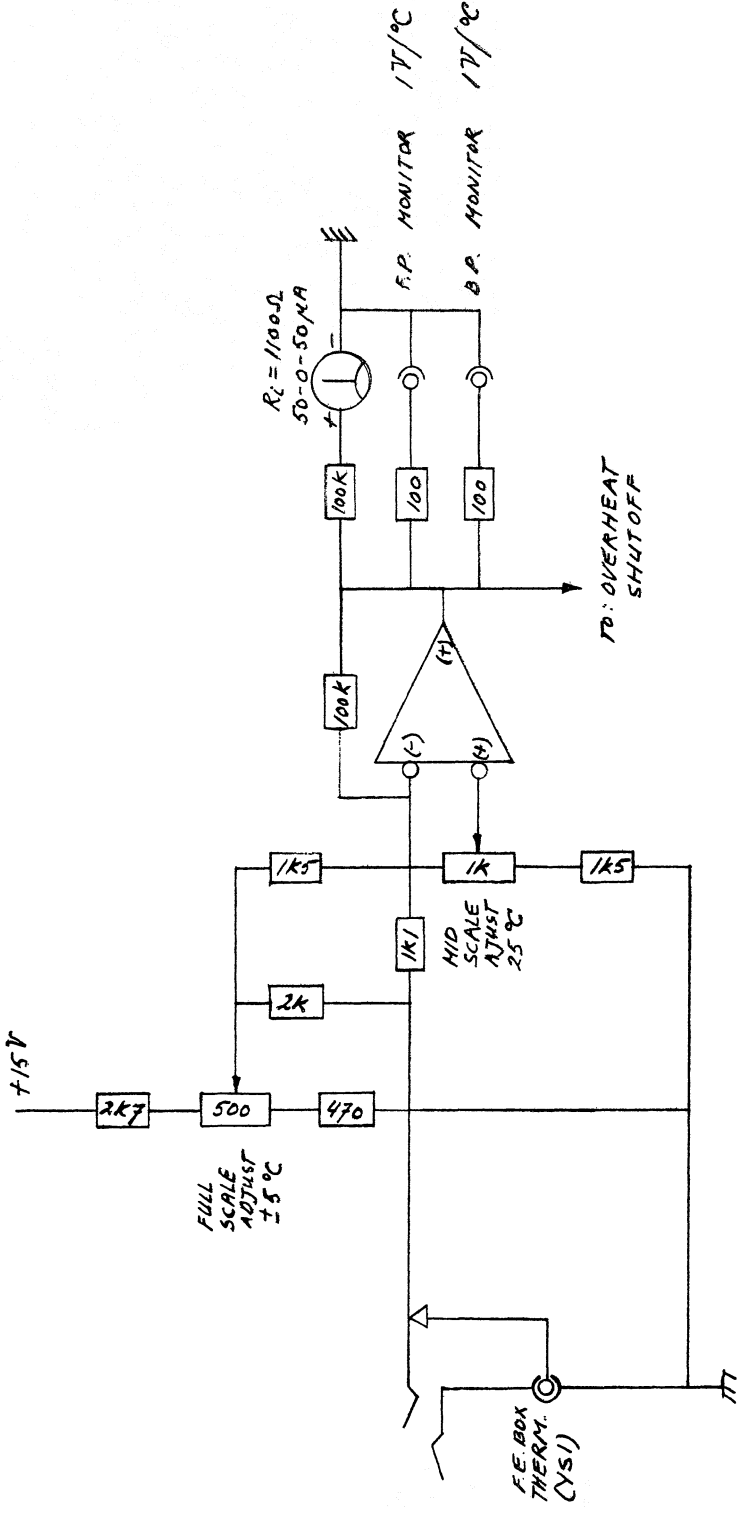


44 K 9 PIN AMPHENDL
H J K
CONTROL
SIGNAL
FROM
THERMOSTAT
SERVO

RELAY: MAGNECRAFT REED
W/01 PCX-6
SPST-NO-1R/100

36 FT ELECTRONICS

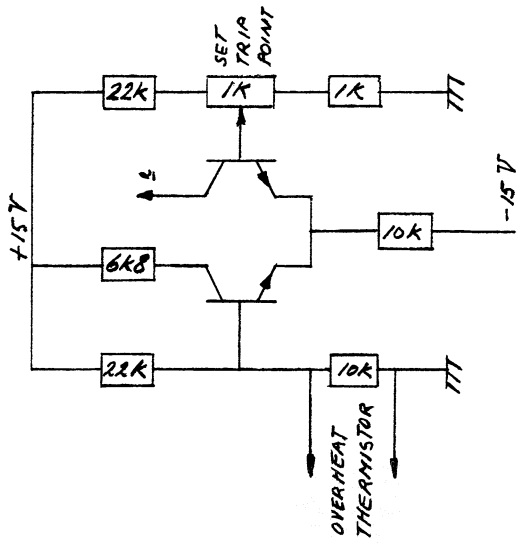
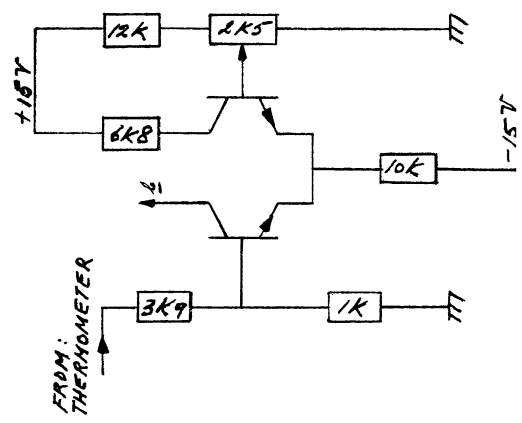
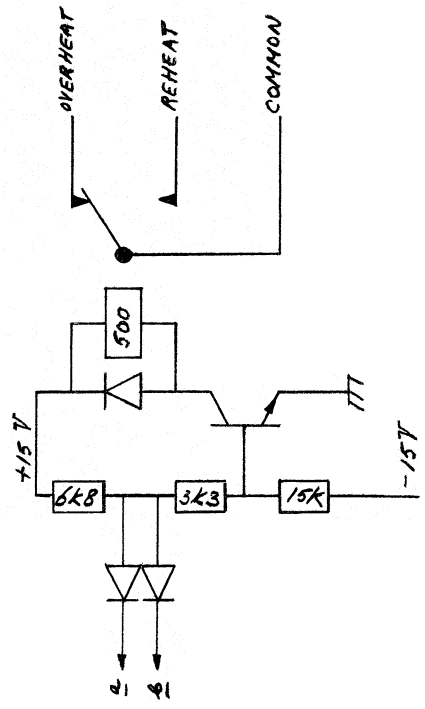
TRIAC POWER AMPLIFIER



OPAMP: PHILBRICK P2

36 FT. ELECTRONICS

THERMOMETER



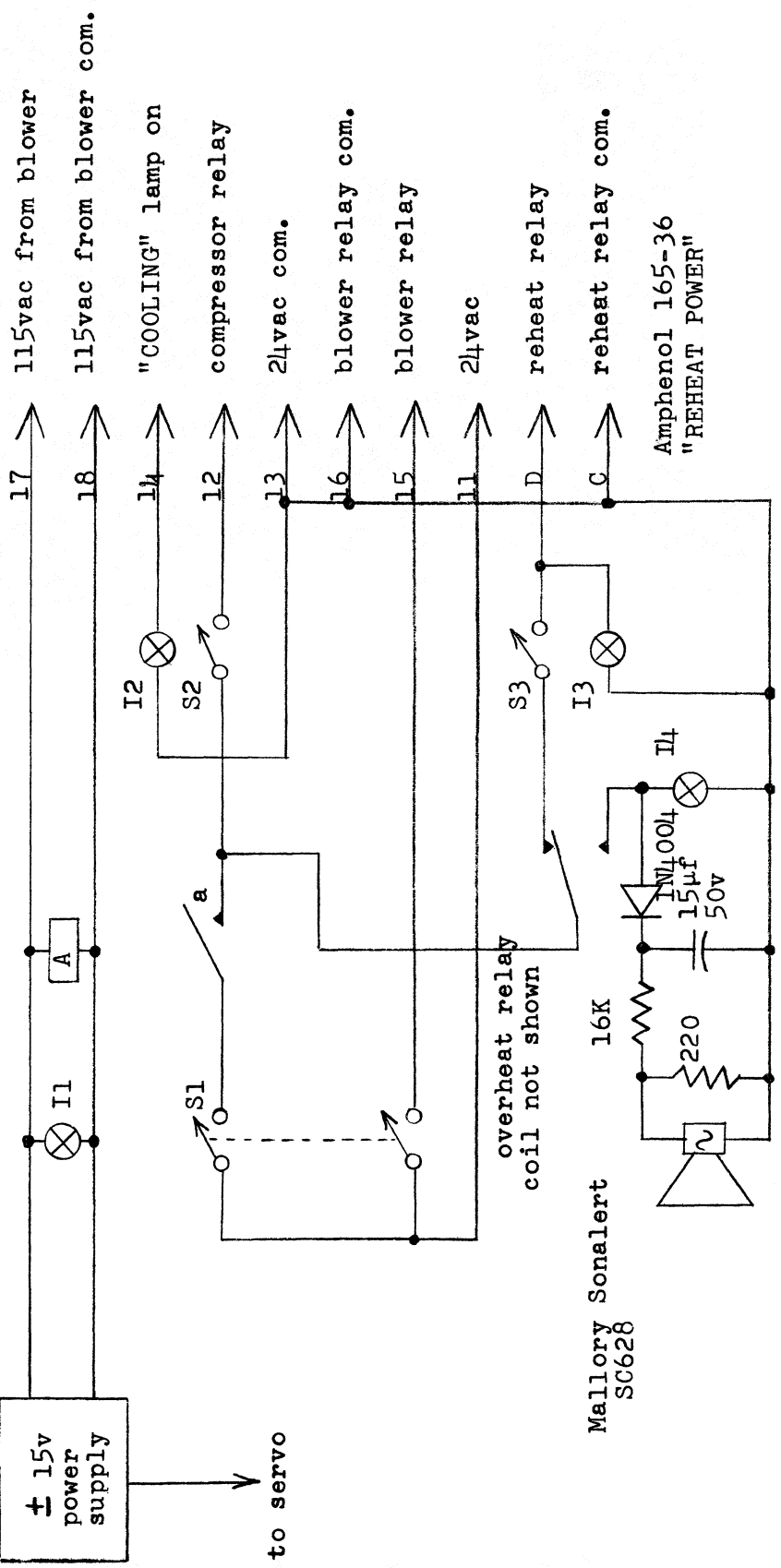
DIODE : 1N916 A
 TRANSISTORS : 2N3860

36 FT ELECTRONICS

OVERHEAT SHUTOFF

Deutsch 6810 750-19-0PN
" AC POWER"

Technipower
M-15.8-0.100A

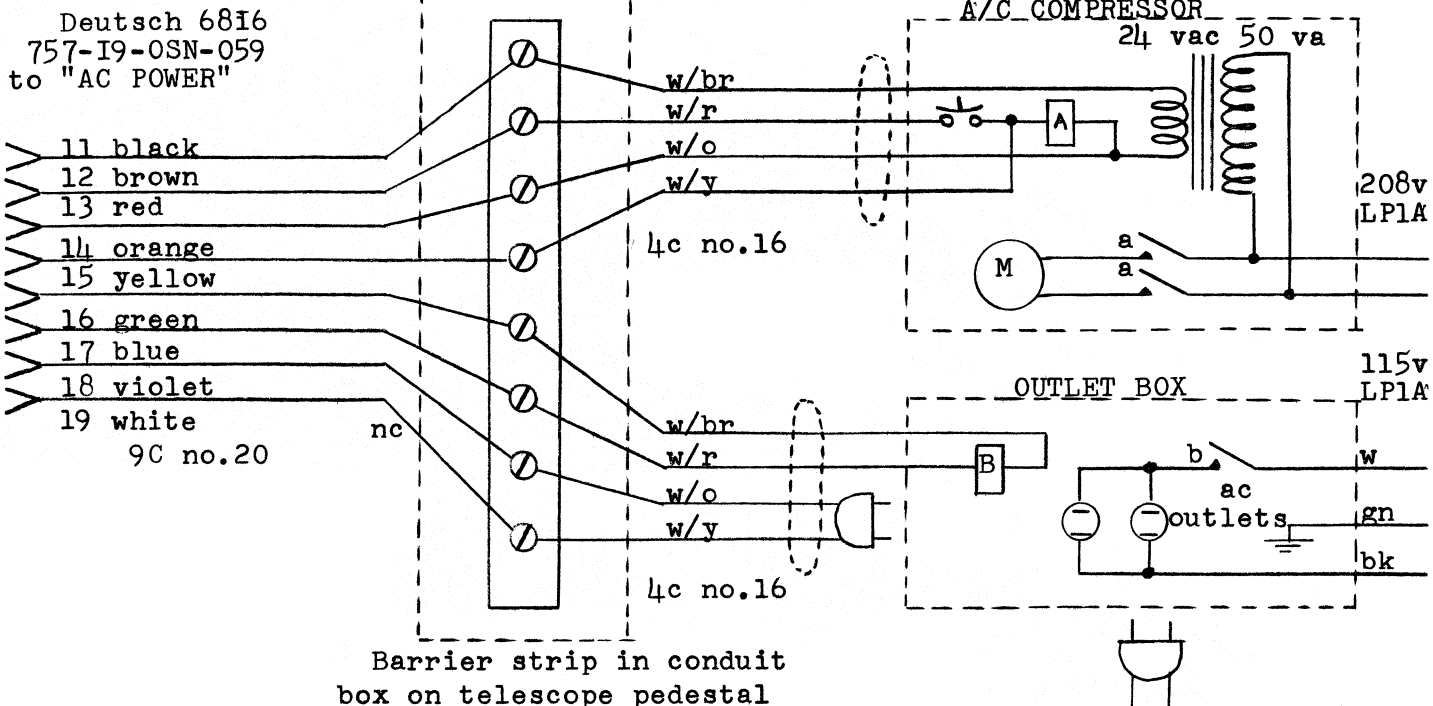


I1= NE-51 "ON"
I2= 1820 "COOLING"
I3= 1820 "REHEAT"
I4= 1820 "OVERHEAT WARNI
FRONT END BOX TEMPERATURE
CONTROLLER

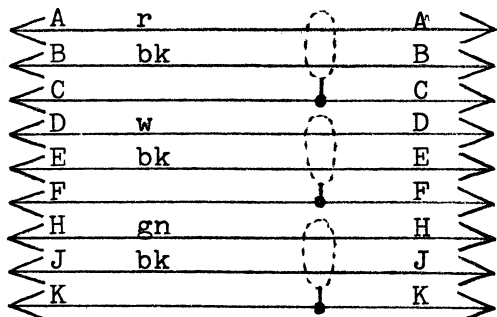
SWITCHING CIRCUIT

N.P.A.

1 May, 1968

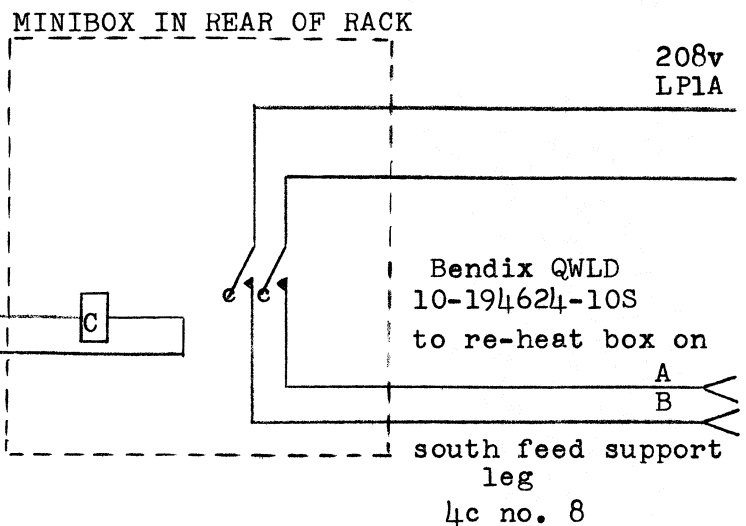


Amphenol 165-13 to "
Amphenol 165-13 to re-heat box on south feed support leg



6 shielded twisted pair no. 22

Amphenol 165-33 to "REHEAT POWER"



N.P.A.

1 May, 1968

FRONT-END BOX TEMPERATURE CONTROLLER
INTERCONNECTING CABLING
NRAO 36' TELESCOPE