PT60
Platinum Resistance Thermometer Conditioner Module

MODEL PT60

SECTION 1

General Description

1.1 Description:

The Model PT60 is a platinum resistance thermometer signal conditioner plug-in module to the Validyne Engineering Corporation's MC1 Series Module Cases. Useing four-wire circuitry, the PT60 will accurately indicate the temperature of a PRT sensor even when the sensor is located thousands of feet away. The units are available for operation with any standard probe resistance from 50 Ω to 1000 Ω.

The PT60 has two outputs. Output "A" may be adjusted, by means of front panel controls, to produce ± 10 volts output for any 200°F span between -100°F and +600°F. This sensitivity may be reduced to ± 10 V for a 1000°F span. Output "B" is essentially fixed at 0 to 10V for 0 to 1000°F. Over this temperature range the inherent nonlinear temperature characteristic of platinum is linearized, on both outputs, to better than ± .1% of span. The PT60 is normally supplied with output "B" calibrated to the "strain free platinum curve", for 0°F to 1000°F.

Front panel controls are: Screwdriver adjusted zero and span controls, which may be used to match output "B" to a specific probe; 10-turn calibrated zero and span controls for output "A"; three position calibration control switch to allow either of two calibration resistors to be connected in place of platinum probe.

1.2 Electrical Specifications

Power Requirements:	± 15V DC from Module Case
Sensitivity:	Output A: 10V/100°F between -100°F and 600°F Output B: 10V/1000°F between 0°F and 1000°F
Output Voltage:	A: ± 10V DC at 5ma B: 0 to 10V DC at 5ma Output impedance less than 10 Ω
Sensor Current:	50 Ω probe 8ma 100 Ω probe 4ma 200 Ω probe 2ma 400 Ω probe 1ma 1000Ω probe 0.4ma
Lead Effect:	100 Ω change in any or all leads will cause less than 0.1% change in output.
Temperature:	Zero Shift: .01%/°F Span Shift: .005%/°F 0°F to 160°F
Controls:	Output A only: Zero: 10-turn 0 to 500°F Span: 10-turn 10V/100°F to 10V/500°F Output B: Zero: 20-turn Span: 20-turn Calibration Switch, 3 Position

1.3 Input and Output Connections

Inputs to the PT60 are by means of the WK4-32S Connector on the back of the MC1 Module Case.

Pin 1	Probe current plus
Pin 2	Probe sense plus
Pin 3	Probe sense minus
Pin 4	Probe current minus

PT60 output A and B come from separate XLR Connectors on the back of the MC1 Module Case. Pin connections are the same on both outputs.

Pin 1	Output
Pin 2	Output Ground (System Ground)
Pin 3	Chassis Ground

1.4 Mechanical Specifications:

Width: 1.6 inches

Height: 3.7 inches

Weight: Less than 7 ounces

Plugs into Validyne's MC1 Module Case. Ten plug-ins fit in a standard 19 inch rack width.

SECTION 2

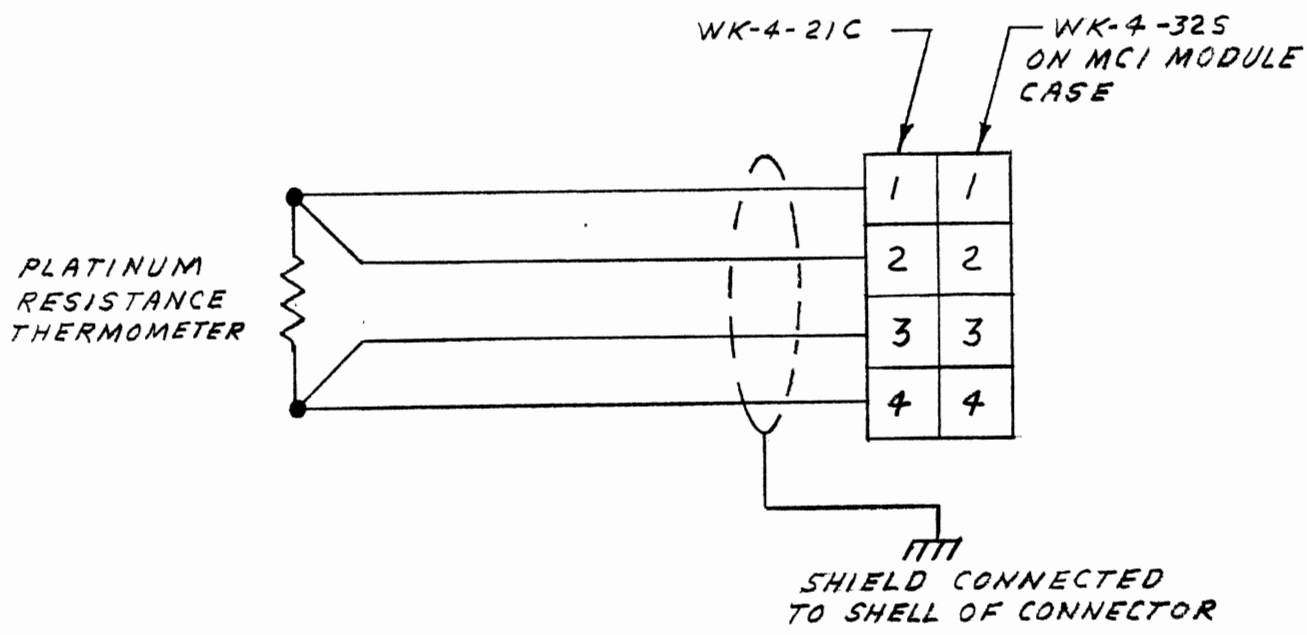
Installation and Operation

2.1 Installation and Operation:

The Model PT60 may be plugged into or out of the MC1 Module Case, while the power is on.

To operate, connect a platinum resistance thermometer, of the correct resistance, to the PT60 as shown in Figure 1. Without further calibration Output "B" will be within the interchangeability tolerance of the probe. To increase the system accuracy, the screw drive adjusted output "B" zero and span controls may be set to exactly match the calibration points of the probe being used. If the probe is furnished with resistance values for various calibration temperatures, it may be convenient to replace the platinum probe with a precision decade resistance box and adjust the zero and span controls to indicate the calibration temperatures at output "B" when the decade box is adjusted to the corresponding calibration resistance. Otherwise the probe should be immersed in an ice bath so the zero control can be adjusted for zero output. The probe should then be immersed in a high temperature calibration bath and the span control set to read the bath temperature at output B (i.e. 2.120V for 212°F). There is very little interaction between the zero and span controls.

Output "A" is best set by replacing the platinum probe with a precision decade box and setting the resistance to the value for which zero output for "A" is desired. Adjust the ten turn front panel zero control for zero output from "A". Then set the decade box to the value for which 10 volts is desired and adjust the ten turn front panel span control for 10 volts output at "A". Output "A" will now read linearity from the zero output temperature to the 10 volt output temperature and will read -10 volts for an equal number of degrees below the zero output temperature.



PT60 FIGURE 1

SECTION 3

3.1 Theory of Operation

Referencing probe wiring diagram, the platinum resistance thermometer is supplied from a constant current source from Pin 1 of the WK4 Connector. Pin 4 is a current sink, designed to keep Pin 3 at ground potential. Operated in this manner the voltage at Pin 2 is only a function of the probe resistance and the value of constant current. The lead resistance does not affect the operation of the current source or sink. Pin 2 and Pin 3 are both very high input impedance sensing circuits, which are not affected by several hundred ohms of lead resistance.

Referring to Schematic 7331, IC1 is a precision 10 volt supply used as a reference for the constant current circuit and as a offset voltage to produce zero output on Output "B" for zero degrees F probe resistance and also the variable offset for Output "A".

IC2 senses the voltage drop across R14, adjusting the gate voltage of Field Effect Transistor Q1 to keep it constant. The current flow in the collector-drain circuit of Q1 and Q2 is the same as in R14 and R22, and independent of the resistance in the collector-drain circuit. This forms the current source for the platinum probe.

IC3 provides the current sink for the platinum probe. Pin 3 of IC3 is connected to ground through R7, and Pin 3 senses the voltage at the lower end of the probe and adjusts the current sink (Pin 6 through R11) until R13 is at ground.

3.1 Theory of Operation (Continued)

The output voltage from the probe is fed into Amplifier IC4 through the active lowpass filter circuit formed by R20, R21, and C4, C5. This filter removes much of the 60Hz noise that might be picked-up on long lines to the probe. The output of IC4 is fed back to the current source through R22 to modify the current through the probe, as the probe resistance changes. This increases the current through the probe as its resistance increases in a manner such that the voltage across the probe is almost perfectly linear with change in probe temperature.

The output of IC4 also goes to IC5, which is an additional low pass active filter with unity gain to further reduce any 60Hz in the output signal.

IC7 is a unity gain buffer amplifier to prevent any load or short circuit on Output "B" from affecting Output "A".

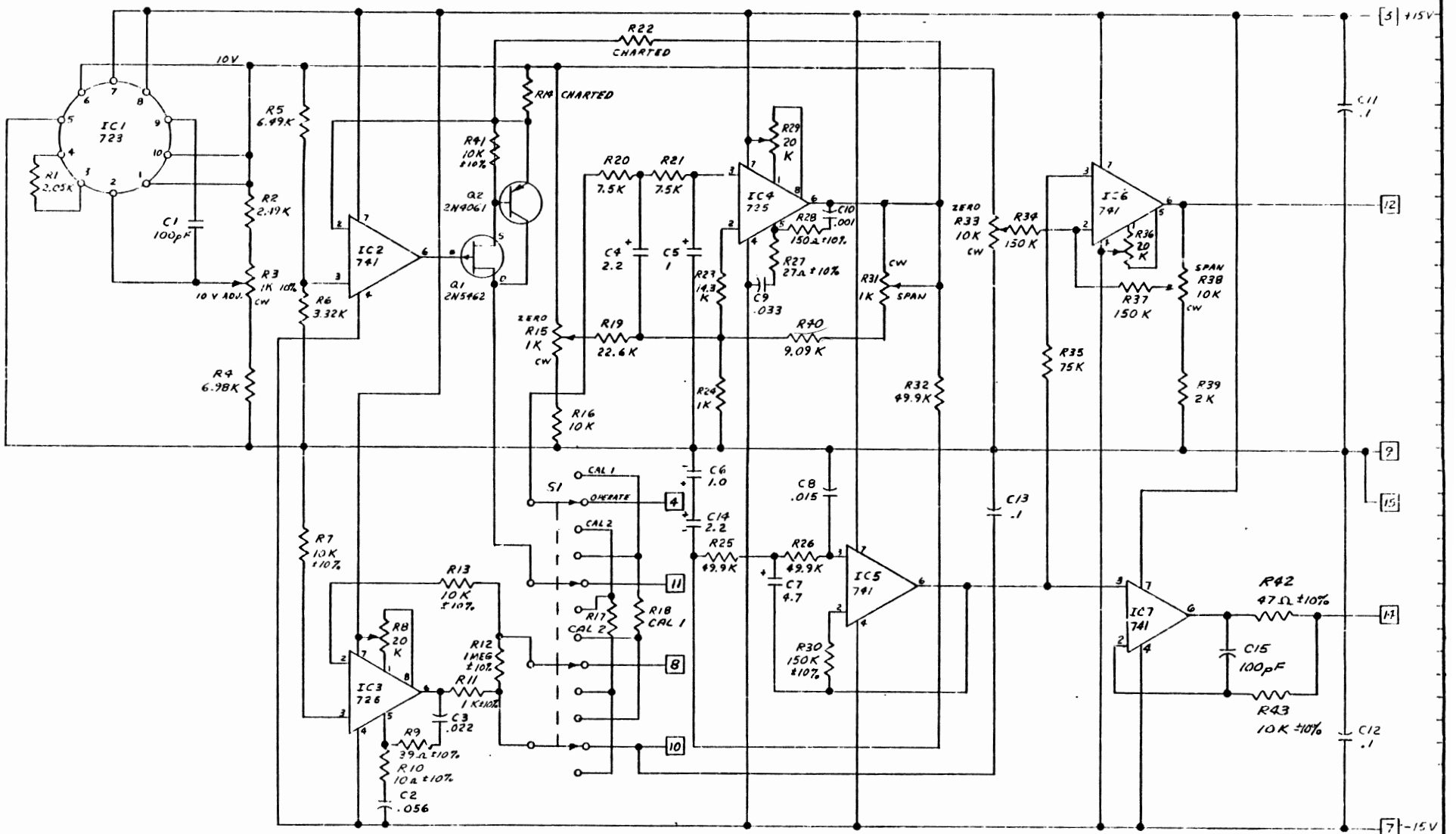
IC6 is a variable gain, variable offset amplifier looking at the output of IC5. R33 adjusts the offset and R38 the gain. Both are ten-turn wire wound potentiometers. Any load or short circuit on IC6, Output "A", will not affect Output "B".

Switch S1 disconnects all four leads from the platinum probe, and connects them to either of two calibration resistors, R17 and R18.

R8, R29, and R36 adjust the input offset voltage of their respective amplifiers. R15 adjusts the zero temperature output, and R31 the span for Output "B". R3 allows the reference supply to be adjusted to precisely 10 volts.

DASH NO.	PLATINUM PROBE RESISTANCE	R14 VALUE	R22 VALUE
-1	50Ω	825Ω	14K
-2	100Ω	1.65K	28K
-3	200Ω	3.32K	56.2K
-4	400Ω	6.65K	113K
-5	1000Ω	16.5K	280K

REVISIONS			7331
SYM	DESCRIPTION	DATE	APPROVED
A	ADDED C15, R42, R43		
B	REVISE LETTER FROM IC DWG OUT		
C	SEE DCN	1-14-81	ED
D	MARKED 2-13-81 RHC		



1. ⚠ STANDARD CATALOG ITEM: -3.
3. [ ] INDICATES CIRCUIT BOARD CONNECTOR PIN NUMBERS
2. CAPACITOR VALUES ARE IN MICROFARADS
1. RESISTOR VALUES ARE IN OHMS ±1% 1/8 WATT.

NOTES UNLESS OTHERWISE SPECIFIED

TOL. UNLESS NOTED
DEC. XXX
FRAC. & DEC. XX
ANGLES ±½°
DIAMETERS WITH SAME ℄ SHALL BE CONCENTRIC WITHIN .005 TIR.
SURFACES MUST BE FLAT WITHIN .002 PER IN.
MAX FILLET .015 UNLESS NOTED
DEBURR EDGES .005 MAX UNLESS NOTED.
SURFACE FINISH 125 UNLESS NOTED.
DRILLED HOLE TOL PER ANSI 0.38.2.

SCALE

Validyne ENGINEERING CORPORATION
NORTHRIDGE CALIFORNIA 91324

DWN 10-11 MODEL PT60
CK'D MAT'L
APP'D FINISH
TITLE SCHEMATIC DIAGRAM

WARRANTY

VALIDYNE ENGINEERING CORPORATION warrants equipment of its own manufacture to be free from defects in material and workmanship under normal conditions of use and service.

VALIDYNE will repair or replace any component found to be defective on its return to VALIDYNE within the time specified below:

1. Pressure Transducers and Pressure Transmitters (including transducers supplied as part of Digital Manometer Systems) within three (3) years of its original purchase.
2. Electronic products (Transducer indicator, carrier demodulators, plug-in signal conditioners, module cases, etc.) within one (1) year of its original purchase.

Buyer is requested to secure authorization of VALIDYNE, and to describe defect prior to return of equipment under warranty. Shipment to VALIDYNE shall be at Buyer's expense, with return at VALIDYNE's expense. NON-VERIFIED problems or malfunctions whether warranty or not are subject to a $80.00 evaluation charge.

The warranty carries no liability, either expressed or implied, beyond our obligation to repair or replace, at VALIDYNE's option the unit which carries the warranty to the original purchaser. Prices, specifications and designs subject to change without notice. This warranty is void if the product is subjected to misuse, accident, neglect or improper application, installation or operation.

REPAIR POLICY

Units returned to VALIDYNE for repair which are not under warranty will be subject to the following conditions.

1. A description of the problem or malfunction shall accompany the unit returned for repair, or be communicated to VALIDYNE prior to shipment. Otherwise there will be a minimum evaluation and/or calibration charge of $80.00.
2. Unit will be repaired automatically if charge is less than 65% of current list price unless other specific instructions are received. Above 65%, VALIDYNE will request authorization by buyer.
3. If quotation is required before proceeding with repairs, unit should be accompanied by paper so stating, or information communicated to VALIDYNE prior to shipment.
4. Buyer is to secure authorization and shipping method from VALIDYNE prior to return of equipment or shipment will be rejected. (Applies to Canada only)

REPAIR WARRANTY

Warranty coverage on repairs is 90 days on work done, or to the end of the original warranty period, whichever is longest.

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