



**871/872
DIGITAL CONTROLLER**

04982ML-01

OWNERS MANUAL

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1.0 GENERAL INFORMATION

1.1 DESCRIPTION

The Newport Series 870 Digital Controller/Comparators are panel mounted, two or three position controllers designed to interface directly with any Newport Digital Voltmeter, Counter or Pyrometer.

Model 871

The Model 871 compares digital input data with a single switching point selected by the front panel 5-digit thumbwheel switches to provide two position control (Figure 1). A red HI zone LED lamp is illuminated for inputs above the switching point, while a red LO zone LED lamp is illuminated for inputs equal to or below this point. Corresponding to these indicators are two logic outputs. A Form C relay contact is optional. For alarm applications the 871 may be commanded to latch when the input passes into the alarm zone. The alarm zone will be indicated until reset by depressing the front panel pushbutton or by an external digital signal.

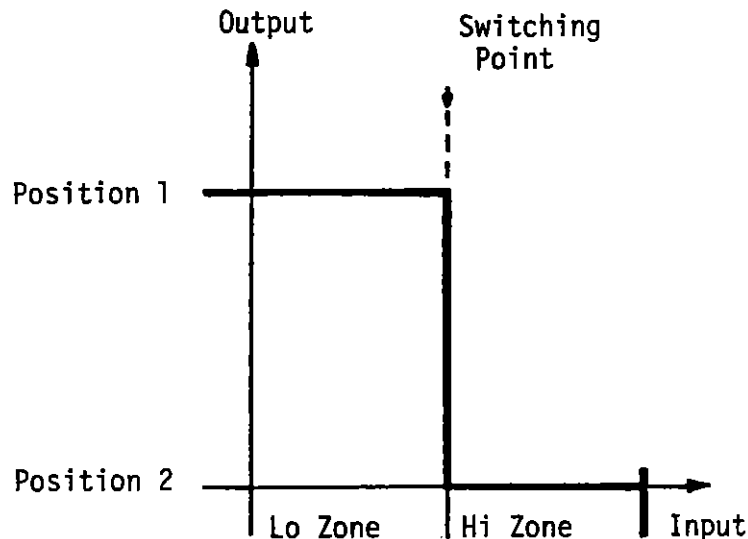


Figure 1. Two Position Control

Model 872

The Model 872 compares digital input data with two switching points selected by two sets of front panel 5-digit thumbwheel switches. Three position control (Figure 2) is standard while two position hysteresis control (Figure 3) is optional. Control signals are derived from LED indicators, digital output lines and contact closures from optional Form C relays. A red HI zone LED lamp is illuminated for inputs above the HI switching point, while another red LO zone LED lamp is illuminated for inputs below the LO switching point. A green GO zone LED lamp is illuminated for inputs equal to or between these switching points. Corresponding to the three front panel zone indicators are three logic

outputs. For alarm applications the 872 may be commanded to latch when either switching point is exceeded. The HI or LO zone will be indicated until reset by depressing the front panel pushbutton or by an external digital signal.

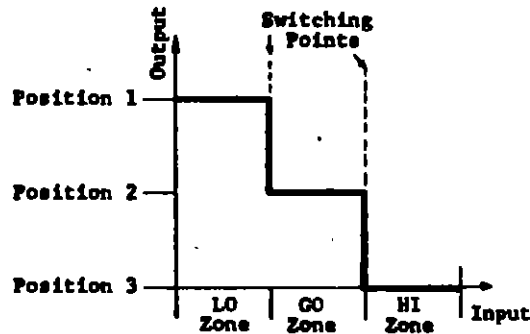


Figure 2. Three Position Control

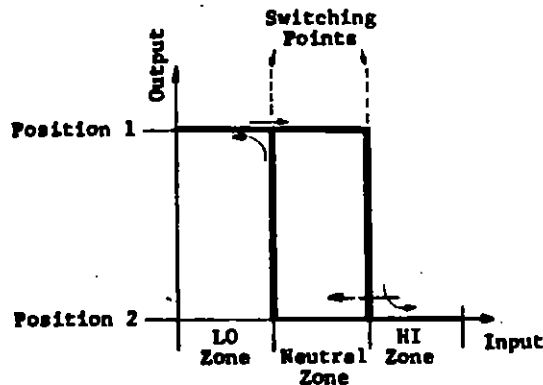


Figure 3. Hysteresis Control

1.1.1 Data Inputs

Series 870 Controller/Comparators can be used with any digital panel meter or other instrument having TTL or DTL compatible positive true outputs in a parallel BCD or Binary (Octal) format.

1.1.2 Outputs

Output signals consist of simultaneous front panel lamp illumination, logic-level shift, and optional relay contact closure. For alarm applications these outputs can be commanded to latch until reset by depressing the front panel pushbutton switch or by applying logical "0" to the LATCH input line.

Contact Closures	1 or 2 Form C with 10A/30 V dc or 10A/230 V ac resistive load rating. Relay response is 50 mS max delay.
Sample Complete	2 μ S positive pulse. "0" \leq 0.4 V @ 13 mA "1" \geq 4.0 V @ 0.1 mA
1.2.4 <u>Power</u>	
Standard	5 V dc \pm 5%, 1.5W
Option	100/115/230 V ac \pm 10%, 50/60 Hz, 3W
1.2.5 <u>General</u>	
Operating Temp	0 $^{\circ}$ C to 50 $^{\circ}$ C
Storage Temp	-40 $^{\circ}$ C to 75 $^{\circ}$ C
Humidity	Up to 95% at 0 to 40 $^{\circ}$ C
Weight	485 g (1.06 lbs.)
Case	
Material	Polycarbonate
Bezel (WxHxT)	DIN (96 x 48 x 6) mm or (3.78 x 1.89 x 0.24) in.
Depth Behind Bezel W/Conn.	DIN 134.5 mm or 5.29 in.
Panel Cutout (WxH)	DIN (92 x 45) mm or (3.62 x 1.77) in.
Connector	
Comparator	One 36 pin, key between pins 13 and 14.
Ac Power Supply	One 36-pin, key between pins 12 and 13.
Type	SAE SAC 18D/1-2

1.3 OPTION CODES

871	Basic controller with one \pm 39999 range and 5 V dc powered.
872	Basic controller with two \pm 39999 ranges and 5 V dc powered.
01	One or two 99999 switching point ranges.
02	115 V ac, 50/60 Hz power supply with 2 relays.
03	230 V ac, 50/60 Hz power supply with 2 relays.
04	100 V ac, 50/60 Hz power supply with 2 relays.
05	115 V ac, 50/60 Hz power supply with 1 relay and hysteresis.
06	230 V ac, 50/60 Hz power supply with 1 relay and hysteresis.
07	100 V ac, 50/60 Hz power supply with 1 relay and hysteresis.
D1	One P.C. edge connector with solder terminals.
D2	Two P.C. edge connectors with solder terminals.

Example: 872-01-05-D2 is a two-position hysteresis controller with two 99999 switching point ranges, one control relay, 115 V ac, 50/60 Hz power supply, and two mating connectors.

2.0 RECEIVING AND INSTALLATION

2.1 UNPACKING AND INSPECTION

Your Series 870 Digital Controller/Comparator has been carefully inspected and tested before shipment. Unpack the comparator and perform a visual inspection to assure that no damage has occurred during shipment or handling. These instruments are factory sealed units. Because extensive damage could result from attempts to measure circuit parameters or to trouble-shoot the instrument by non-factory personnel, the warranty is automatically voided if the unit has been removed from its case.

2.2 INSTALLATION-MECHANICAL

Drawing Number 06896, in Section 4, illustrates the detailed method of mounting the controller/comparator. All critical dimensions are shown including those for the panel cutout.

3.0 OPERATING INSTRUCTIONS

3.1 INTRODUCTION

The Series 870 Digital Controller/Comparators are compact panel-mounted instruments that compare positive true BCD data with switching points entered on front panel thumbwheel switches. The basic controller/comparator is incorporated on a printed circuit card located in the upper board location of the case. The optional lower board contains the control relays and ac power supply. All required connections are made to the rear connectors of these two boards including power, data and command inputs, and control outputs.

The standard Series 870 can compare data over the range -39999 counts to +39999 counts. Optionally the range 00000 counts to 99999 counts can be accommodated.

The data input is compared with switching points entered on front panel thumbwheel switches. The output from the comparison circuitry is transferred into the output memory on a continuous or sampling basis. The memory then simultaneously drives front panel lamps and digital output lines that indicate in which zone the input data falls. Optional form C contacts are also controlled by the output memory, and can be used to switch 30 V dc, or 230 V ac control voltage.

All input and output lines are TTL, DTL compatible. BCD and Polarity inputs are positive true. All logic outputs are buffered, being implemented with passive pull-up, "open-collector" integrated circuits. Two auxiliary inverters are provided to invert input signals where necessary.

3.2 POWER

The standard controller/comparator operates from a 5 V +5% power source. It dissipates approximately 1.5W. The optional Ac power supply allows the comparator to be operated on 100 V ac, 115 V ac, or 230 V ac +10%, 50/60 Hertz power source. Typically 3 watts are dissipated in ac operation.

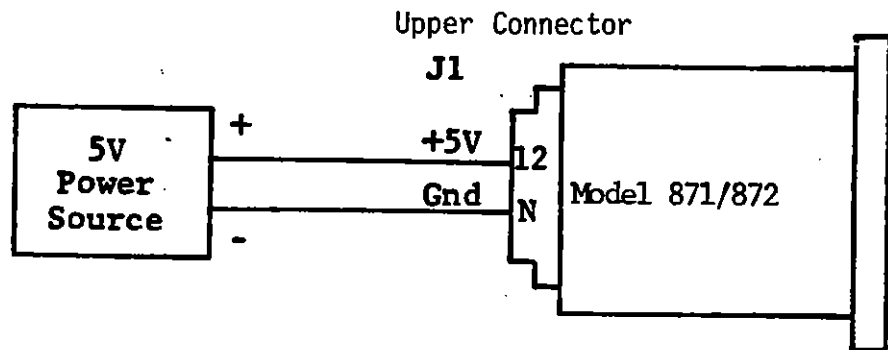
NOTE: That if the optional AC operation is used, Pin 12 (+5V) is an output.

3.2.1 Dc Operation

In Dc operation the controller/comparator should be connected to a +5 V power source capable of supplying a steady state current of 300 mA or more. Care must be taken when connecting the input, output, and power supply ground lines to insure that a ground loop is not formed. It is suggested that all ground connection be made at the same node, preferably at the ground terminal of the controller/comparator.

The power cable is connected as follows to the upper (main) board at J1.

- A. Connect the positive lead of the 5 V power source to pin 12.
- B. Connect the negative lead (ground reference) of the 5 V power source to Pin N.



Wiring Detail, 5 V dc Operation

Recommended Power Source Specifications

Input Voltage at J1 (Static or Instantaneous)	4.75 V min. 5.25 V max.
Ripple (50 Hz to 120 Hz)	20 mV rms
Noise (above 230 Hz)	10 mV rms
Output Impedance (Including Interconnect Wiring)	0.5 ohm max.

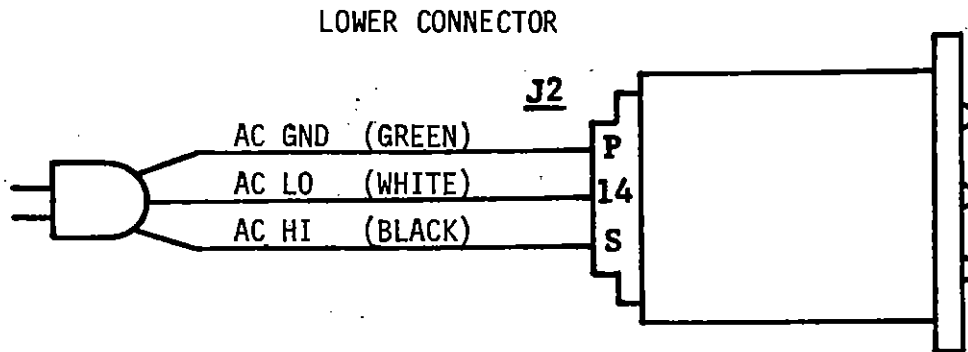
3.2.2 Ac Operation

Series 870 Controller/Comparators can be ordered with an optional power supply board wired for either 100 V ac, 115 V ac, or 230 V ac 50/60 Hz power source. The power connector is connected per wiring diagram to the printed circuit edge connector J2 (lower connector) of the instrument. No attempt should be made to connect ac power to a Series 870 Controller/Comparator containing only one board. Before connection to 230 V ac confirm that the instrument is wired for 230 V ac power, as over-voltage could cause electrical damage.

Wiring Detail, Ac Operation

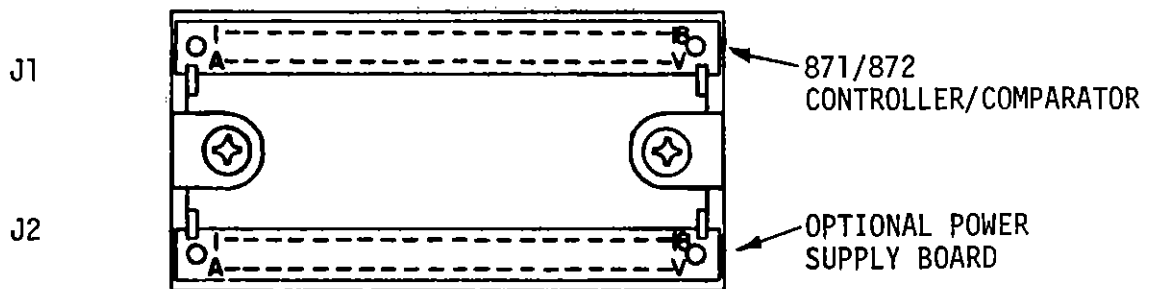
The power cable is connected as follows to the bottom (power supply) board at J2.

- A. Connect Ac HI to Pin S.
- B. Connect Ac LO to Pin 14.
- C. Connect Ac Gnd to Pin P.



CAUTION

1. The optional power supply board is internally connected for 100, 115, or 230 V ac. Check table for proper supply voltage.
2. Proper insulation of power line connections is mandatory to insure safety against shock hazard.



REAR VIEW OF UNIT

3.3 DATA INPUTS

Series 870 Comparator/Controllers are compact panel mounted instruments that compare positive true BCD or Octal data with single or dual switching points selected by front panel 5-digit thumbwheel switches. Comparison is algebraic, and inputs more positive than the high switching points are indicated by HI zone outputs, and in the Model 872 inputs more negative than the low switching point are indicated by LO zone outputs. Refer to examples 1-9.

When entering dual switching points, care must be taken to always enter the lesser (or more negative) number as the LO switching point and the greater (or more positive) number as the HI switching point. Reversing the switching points will cause mid zone data to be indicated simultaneously as higher than the HI switching point and lower than the LO switching point. Although this is algebraically correct it obviously is not desirable. Refer to examples 10-12.

It should also be noted that comparisons between two negative numbers are based on algebraic value, not absolute value, and will not be indicated the same as their positive counterparts. Refer to examples 13-15.

EXAMPLE	DATA IN	SWITCHING POINT(S)		OUTPUT	COMMENT
		(LO)	(HI)		
1	99		100	LO	
2	100		100	LO	
3	101		100	HI	
4	-100		-100	LO	
5	-99		-100	HI	
6	99	100	101	LO	
7	100	100	101	GO	
8	101	100	101	GO	
9	102	100	101	HI	
10	200	100	300	GO	
11	200	300	100	LO & HI	Switching Points Reversed
12	-200	-100	-300	LO & HI	Switching Points Reversed
13	200		100	HI	
14	-200		-100	LO	
15	-200	-300	-100	GO	

The data inputs must be TTL compatible positive true BCD or Octal code. If Octal, the "8" bit inputs of each digit are connected to ground and the thumbwheels are not advanced past "7". There are no other electrical changes to the controller/comparator.

All data inputs are applied to the J1 connector (upper board position) according to the pin assignment list shown in Table 1. Unused data inputs must be grounded if a false state is desired. If the data input is assumed to be always positive, POLARITY (J1-11) should be pulled up to +5 V on bipolar meters.

The POLARITY input accepts a positive true "+" input (i.e. "high" for positive numbers). Negative polarity signals must be inverted before connection to the POLARITY input using one of the auxiliary inverters provided.

3.4 COMMAND INPUTS

The command inputs are applied to connector J1 (upper board position) according to the pin assignment list shown in Table 1. The command inputs are labeled TRACK/SAMPLE, SAMPLE TIME, LATCH, and ALARM ZONE. Auxiliary inverters are provided to allow inversion of command input signals where necessary.

3.4.1 TRACK/SAMPLE

The comparator circuit makes a continuous comparison between the input data and the comparison value generated by the thumbwheels. When the TRACK/SAMPLE input (J1-P) is held low the output of the comparator circuit is continuously transferred into the output memory and the output is a real-time comparison of input data. When the TRACK/SAMPLE input goes high the last comparison value before the transition is held in memory indefinitely. Data may be transferred into memory by applying a low pulse to the TRACK/SAMPLE input.

3.4.2 SAMPLE TIME

When the TRACK/SAMPLE input is left high the sampling mode is enabled. In the sampling mode the output of the comparator circuit may be transferred into the output memory at any sample time, and the stored comparison is held in memory until the next sample time. This transfer occurs on the positive transition (from low to high logic level) of the SAMPLE TIME input (J1-18). Prior to the transition the logic level should have remained low for a minimum of 10 us, with a maximum transition rise time of 1 us. The high level should be maintained a minimum of 5 us. By inverting the sample time signal with one of the auxiliary inverters provided, the transfer to memory will occur on the negative transition of that signal.

3.4.3 LATCH

For alarm applications, Series 870 Controller/Comparators may be commanded to latch and display an alarm condition. When LATCH (J1-13) is high the latching mode is enabled and the outputs will latch when the input passes into the alarm zone. In the Model 871 either the HI or LO zone can be selected to be the alarm zone. In the Model 872 both the HI and LO zones are considered to be alarm zones and the output will latch if the input passes into either of these zones. To reset, the front panel reset pushbutton must be depressed while non-alarm data is entered either by a positive transition on SAMPLE TIME (J1-18) or a low level on TRACK/SAMPLE (J1-P). Alternately the output may be reset by applying a low level on LATCH (J1-13).

3.4.4 ALARM ZONE

The ALARM ZONE input (J1-1) is used with the 871 Controller/Comparator only. To select the HI or LO zone as the alarm zone for latching applications, ALARM ZONE (J1-1) should be connected to HI (J1-V) if the output is to latch in the HI zone and should be connected to LO (J1-17) if the output is to latch in the LO zone.

3.4.5 Auxilliary Inverters

An auxilliary inverter and NAND gate are provided to increase interface flexibility. The input of the inverter is J1-14, its output is J1-15. The NAND gate's inputs are J1-R and J1-S, its output is J1-T. Connect the two inputs of the NAND gate together when it is to be used as an inverter.

Interconnect Wiring Example Between 2000AS & 872
(Continuous or Stored Input Data)

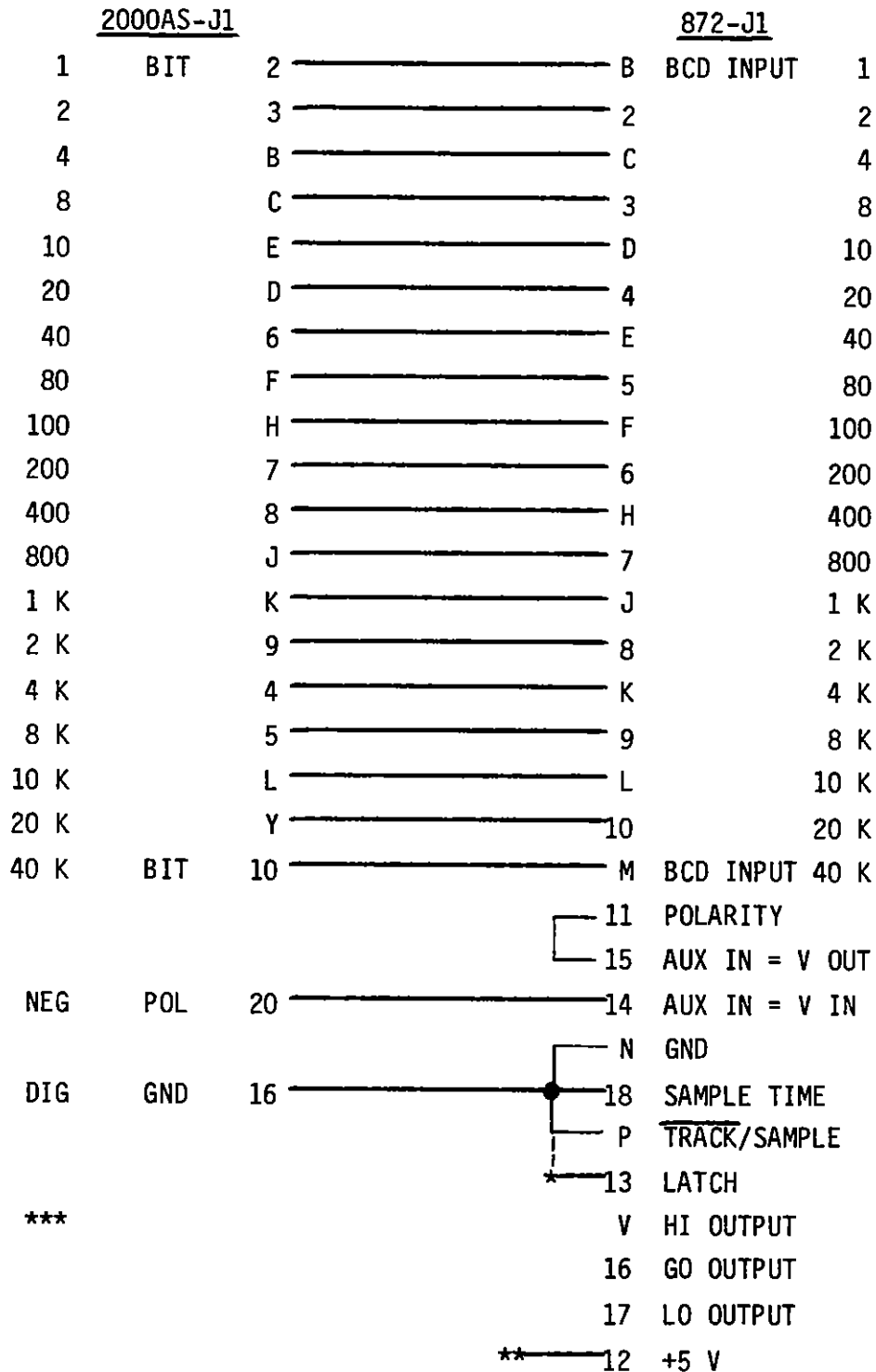


Figure 4

- * If latched outputs are not desired, tie pin 13 to pin N on the 872.
- ** Apply +5 V to pin 12 with respect to GND on pin N (of the 872).
- *** Input and power connection to the 2000AS are not shown.

**Interconnect Wiring Example Between 204, 267B & 872
(Data Sampled Each New Reading)**

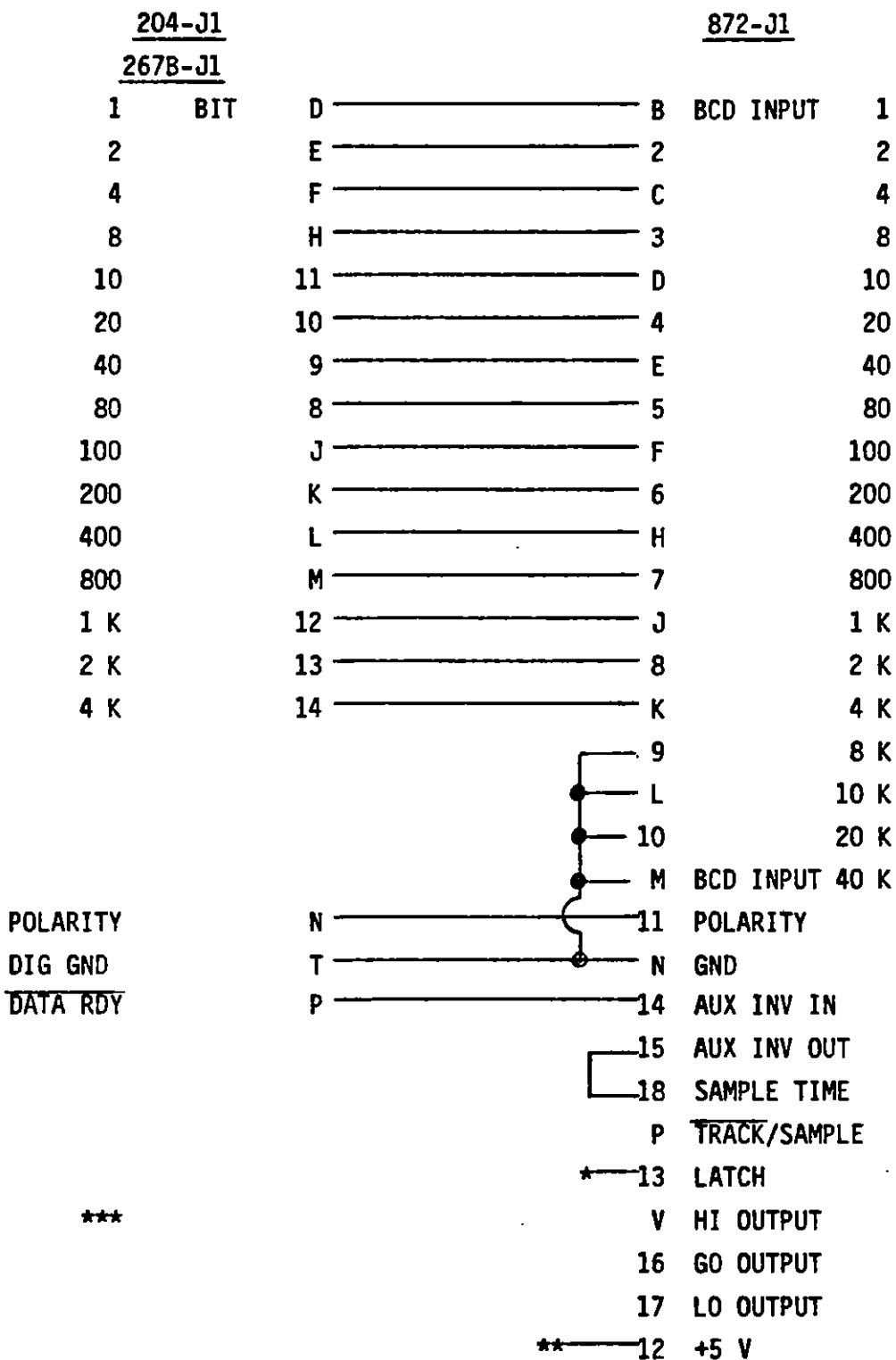


Figure 5

- * If latched outputs are not desired, tie pin 13 to pin N on the 872.
- ** Apply +5 V to pin 12 with respect to GND on pin N (of the 872).
- *** Input and power connection to the 267B are not shown.

3.5 CONTROL OUTPUTS

Output signals consist of simultaneous front panel lamp illumination, "open-collector" logic level shift, and optional relay closure. A SAMPLE COMPLETE output is provided to signal the completion of the sampling process when the controller/comparator is used in the sampling mode.

3.5.1 Sample Complete

When the controller is used in the sampling mode a 2 us positive pulse appears at the SAMPLE COMPLETE output (J1-U) approximately 2 us after the initiating sample time transition. The output of the comparator circuit is continuously transferred into the output memory during this pulse, therefore input data must be held stable for its duration. The negative transition of the SAMPLE COMPLETE pulse signals the completion of the sampling process and indicates that the logic output has settled and is ready for use by an external device.

3.5.2 Lamp Display

The Series 870 Controller/Comparators incorporate front panel high brightness, wide angle LED lamps for maximum dependability and visibility. Unlike incandescent lamps, LED's will normally last the life of the equipment without failure and need for replacement. The HI and LO lamps are red to indicate alarm zone conditions. In the Model 872 the green GO lamp is included to insure the reliable indication of the output state, illuminating only when input data falls between both switching points.

HI (Red) Lamp

The HI lamp is illuminated for data inputs more positive than the upper switching point.

GO (Green) Lamp (872 Only)

The GO lamp is illuminated for data inputs that include or fall between the two switching points.

LO (Red) Lamp

The LO lamp is illuminated whenever the data is more negative than the LO switching point in the Model 872. In the Model 871 the LO lamp is illuminated for data inputs more negative than, or equal to the switching point.

3.5.3 Logic Outputs

The logic outputs are TTL compatible, "open-collector", high-true signals that correspond to the front panel lamp display. The "open-collector" type output drivers have a 10 k pullup resistor to +5 V and are suitable for "wired or" and transistor base drive applications.

HI (J1-V)

HI is high for data inputs more positive than the upper switching point.

GO (J1-16) 872 Only

GO is high for data inputs that do not exceed either switching point.

LO (J1-17)

LO is high for data inputs more negative than the lower switching point in the Model 872. In the Model 871 the LO output is always the inverse of the HI output.

Hysteresis Output (P2-C) 872 Hysteresis Only

The Model 872 Hysteresis Controller/Comparator incorporates an internal bi-stable circuit whose output is set high when the input data passes into the HI zone, and set low when the input data passes into the LO zone. This circuit drives the internal relay and the logical hysteresis output.

3.5.4 Relay Output

As an option, Three Position Controller/Comparators may be obtained with two high current-rated relays, Two Position Controller/Comparators may be obtained with one relay. In the Three Position Controller/Comparators neither of the relays are energized as long as the input data remains in the NEUTRAL zone. If the input data passes into either the HI or LO zones, the respective relay is energized. In Two Position Controller/Comparators the relay is energized when the data passes into the HI zone.

There is one Form C contact per relay and all three terminals are brought to the rear connector. The contacts are rated for 10A @ 30 V dc, 10A @ 230 V ac. resistive load. Refer to Table 1 for pin assignments.

When wiring a Two Position Controller with relay outputs it is necessary to externally connect the relay control signals. This is accomplished by connecting LO COMMAND IN (J2-2) to LO OUTPUT (J1-17, and HI COMMAND IN (J2-A) to HI OUTPUT (J1-V). No relay control is possible without these connections.

3.6 THUMBWHEELS

The standard Controller/Comparator incorporates thumbwheel switches that may be set to any number between -39999 and +39999. It is important to set the LO bank of thumbwheels to the lower (or more negative) switching point, and the HI bank to the higher (or more positive) switching point. Doing the opposite will cause GO zone data to illuminate both the HI and LO lamps, indicating that the input is simultaneously higher than the high setpoint, and lower than the low setpoint.

The legend on the most significant thumbwheel in each bank differs from the legend on the other four. Instead of being imprinted with 0-9 as are the other thumbwheels the most significant thumbwheel has the following legend:

Most Significant
Thumbwheel Legend

Definition

+	Positive
1	Positive 10,000
2	Positive 20,000
3	Positive 30,000
-	Negative
$\bar{1}$	Negative 10,000
$\bar{2}$	Negative 20,000
$\bar{3}$	Negative 30,000
X	Invalid Setting

Series 870 Controller/Comparators may be ordered with the unipolar option. In this case all thumbwheels are marked with the standard 0-9 legend. These thumbwheels can be set over the range 00000 to 99999. Polarity is assumed to the positive.

Series 870 Pin Assignments

<u>FUNCTION</u>		<u>J1 PIN</u>	<u>FUNCTION</u>		<u>J2 PIN</u>
BCD INPUT	1	B	AC POWER	HI	S
	2	2		LO	14
	4	C		GND	P
	8	3			
	10	D	HI RELAY	N.C.	H
	20	4		C.	J
	40	E		N.O.	F
	80	5			
	100	F		872	
	200	6	<u>3 POSITION CONTROLLER ONLY</u>		
	400	H	LO RELAY	N.C.	E
	800	7		C.	K
1 K		J		N.O.	D
2 K		8			
4 K		K		871	
8 K		9	<u>2 POSITION CONTROLLER ONLY</u>		
10 K		L	LO COMMAND IN		2
20 K		10	HI COMMAND IN		A
40 K		M	HYSTERESIS OUTPUT		C
*POLARITY (80 K)		11			
SAMPLE TIME		18			
SAMPLE COMPLETE		U			
<u>TRACK/SAMPLE</u>		P			
ALARM ZONE					
(Model 871 Only)		1			
LATCH		13			
HI LOGIC OUTPUT		V			
GO LOGIC OUTPUT					
(Model 872 Only)		16			
LO LOGIC OUTPUT		17			
+5 V		12			
GROUND		N			
SPARE INVERTER IN		14			
OUT		15			
SPARE NAND IN 1		R			
IN 2		S			
OUT		T			

* NOTE: POLARITY (PIN 11)
BECOMES BCD 80 K ON
99999 COUNT
INSTRUMENTS.

Table 1