



6-DIGIT FREQUENCY METER, TACHOMETER, RATE METER, TIMER, PULSE TOTALIZER, PROCESS METER & TOTALIZER WITH RS-232

NEWPORT

PENTA™ P6000

OPERATING MODES

1. Frequency/tachometer from 10^{-6} Hz to 7 MHz
2. Frequency ratio FB/FA from 0.02 Hz to 7 MHz
3. Totalizer up or down from -99,999 to 999,999 or accumulating stopwatch
4. Period/period average from 140 ns to 36 days
5. Time interval/time interval average/stopwatch
6. Process meter for 4-20 mA, 0-2 or 0-10 V input
7. Integrating totalizer for 4-20 mA, 0-2 V or 0-10 V input

FAST LOW-FREQUENCY MEASUREMENT

Every 50 ms + 1 signal period
Slower read rates for frequency averaging

PROGRAMMING FEATURES

Scale factor from -99,999 to 999,999
(any decimal point, multiply or divide)
Offset from -99,999 to 999,999
(any decimal point)
HI and LO setpoints for control or alarm
Programming via front-panel or RS-232
Program stored in non-volatile memory
Four levels of program lockout for security
Fixed decimal point or autoranging

SIGNAL CONDITIONER CHOICES

Dual-channel TTL with protection to 25 V
Single-channel, isolated, with excitation
Dual-channel, isolated, with excitation
Single-channel, non-isolated, with excitation
Analog input, isolated, 4-20 mA, 0-2 V, 0-10 V

COMMUNICATIONS & CONTROL

RS-232 or 20 mA serial ASCII output (std)
HI, LO, GO 150 mA open-collectors (std)
Dual 8A Form C relays (opt)
Parallel BCD output, isolated (opt)
Analog output, isolated and scalable,
4-20 mA, 0-20 mA, 0-10 V (opt)

DISPLAY & MECHANICAL

Six 0.56 in (14.2 mm) 7-segment LED characters
Five-key programming front panel (std)
Plain front panel (opt)
Screw-clamp connectors for signal and power
1/8 DIN case



With five-key programming front panel



With plain front panel

DESCRIPTION

In its base configuration, the P6000 is a microprocessor-based, 6-digit, 1/8 DIN counter which can be configured by front-panel keys or by a personal computer as a frequency meter/tachometer, frequency-ratio meter, period/period-average meter, time-interval/time-interval-average meter or totalizer. It combines these five operating modes with ease of setup, wide dynamic range, six-figure crystal-based accuracy, and software scaling.

With the addition of an optional analog-to-frequency signal conditioner, the P6000 can become a software-scalable process meter with two setpoints and exceptionally wide zero offset capability. It can also become a 6-digit analog integrating totalizer.

The P6000 provides a five-key front panel, which can be used to select mode of operation, scale factor, zero offset and two setpoints for ON/OFF control or alarm. Setup parameters can be saved in non-volatile memory with four levels of front-panel lockout for program security. In addition, the P6000 can be programmed via RS-232. It can also report its own setup data and transmit ongoing readings and alarm status via RS-232 or 20 mA ASCII current loop. Modem support is built in for remote operation.

FLEXIBLE SIGNAL CONDITIONING

0. TTL-LEVEL PULSE INPUTS

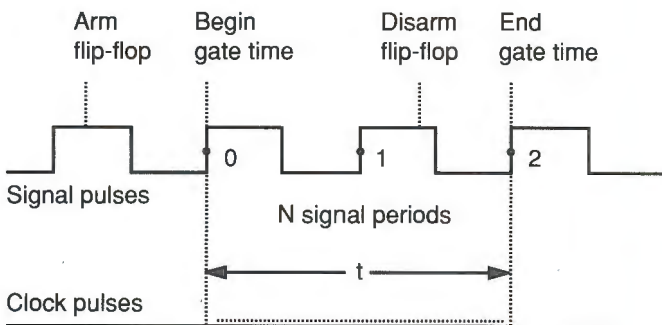
Dual non-isolated TTL/5 V CMOS-level input channels with protection to 25 V dc are standard and can accommodate frequencies up to 7 MHz. The inputs can be tied to contact closures by using a spare flip-flop available at the connector for debounce. They can also be tied to sensors with an open-collector NPN or PNP output if these are powered externally. Contact closures require an external 20 kOhm pull-up resistor. PNP sensors require an external 1 kOhm pull-down resistor.

1 & 2. ISOLATED SIGNAL CONDITIONER WITH EXCITATION OUTPUT

This almost universal signal conditioner is available in single- or dual-channel versions. It provides sensor excitation output plus AC or DC coupling, signal isolation to 350 Vp, and jumper-selectable low-pass filtering, debounce time and hysteresis. It allows the P6000 to be tied directly to passive magnetic pickups with output down to ± 10 mV, to AC line voltages up to 240 V rms, and to NPN, PNP, NAMUR or contact-closure sensors — all with a high degree of input protection.

3. NON-ISOLATED SIGNAL CONDITIONER WITH EXCITATION OUTPUT

This is an economical single-channel non-isolated signal conditioner which supplies power up to 16 V at 25 mA for direct 3-wire connection to NPN sensors, or 2-wire connection to NAMUR sensors (<1 mA ON, >3 mA OFF) and contact closures. It can also be used with magnetic pickups and other active voltage sources from 0 to 200 mV up to 60 V rms.



The P6000 measures frequency or period by counting the number of 11.059 MHz clock pulses during an actual gate time t , which corresponds to an integral number of signal periods N . This technique allows high-accuracy low-frequency measurements. Frequency is calculated from N/t , period from t/N .

4. ISOLATED ANALOG-TO-FREQUENCY SIGNAL CONDITIONER

This signal conditioner accepts 4-20 mA, 0-5 V or 0-10 V analog signals and turns the P6000 into a process meter with isolated input, 6-digit scale and offset capability, two setpoints and RS-232. It also allows the P6000 to serve as an analog integrating totalizer, for instance to display volume based on the 4-20 mA signal from a flowmeter.

SEVEN OPERATING MODES

1. FREQUENCY, TACHOMETER, RATE MODE

In the frequency mode, the P6000 provides a 14-decade measurement range with 6-digit resolution from below 1 μ Hz (36-day period) to 7 MHz. Exceptional flexibility of operation is made possible by 6-digit software multiply or divide, software averaging, and software-selectable number of digits to the right of the decimal point. This allows the P6000 to display frequency in Hz, kHz or MHz, to be used as a tachometer with display of RPM, or to be used as a rate meter for display of flow or speed. Programmable zero offset allows the P6000 to be used with transducers with frequency output.

A major feature of the P6000 is its ability to measure very low frequencies with 6-digit resolution in times as low as 50 ms + 1 signal period. This is achieved with a gate time setting of 0.00 sec and communications at 9600 baud. Slower read rates may be programmed and will provide a mathematical average over multiple signal periods.

The ability to combine low-frequency measurement with high read rate makes the P6000 ideal for monitoring power line frequency and low rates of speed or flow. For instance, the P6000 can display 60 Hz line frequency at 15 readings/sec. It can display accurate flow rate in units of flow even if there are several seconds between pulses from a positive displacement flowmeter.

To measure frequency, the P6000 counts the number of signal periods during a preprogrammed gate time and then extends this gate time dynamically to eliminate any partial signal periods. It also counts the number of 11.059 MHz crystal-clock periods during the same measurement time. The ratio of signal periods to clock periods provides signal frequency; the ratio of clock periods to signal periods provides signal period. In case of periods over 2 sec, which may indicate very low frequency or a complete stoppage of the signal source, the P6000 may be programmed to wait for the next end-of-period pulse or to automatically reset frequency to zero.

2. FB/FA FREQUENCY-RATIO MODE

The P6000 can be used as an FB/FA frequency-ratio meter with FB and FA up to 7 MHz. In case of low frequencies, the P6000 achieves exceptional accuracy in minimum time by correcting for partial signal periods in FB during the actual gate time. The frequency ratio capability is ideal for monitoring the relative speed of shafts, conveyor belts and other moving machinery. In combination with display offset, it can also be used to display draw.

3. PULSE TOTALIZER MODE

The P6000 can be used as an up-counting totalizer (with positive scale factor) or a down-counting totalizer (with negative scale factor) for rates up to 7 MHz. The display capacity is -99,999 to 999,999 counts. In case of over-range, the display automatically converts to exponential format with correct readings up to 9.99×10^9 , which is displayed as 9.99 E9. An external signal can repetitively gate input pulses without error in gated counts. In the event of AC power loss, the latest reading is automatically saved in non-volatile RAM and is restored upon return of power.

4. PERIOD/PERIOD-AVERAGE MODE

The P6000 can be used as a period or period-average meter by counting the number of clock pulses during a pre-programmed gate time, which is extended to eliminate any partial period. The nominal gate time is programmable from 10 ms to 99.99 s and can be extended dynamically by the signal period to 36 days. If the preprogrammed gate time is longer than one period, the P6000 automatically calculates the average period, thereby compensating for any jitter in the individual periods.

5. A-TO-B TIME INTERVAL/ TIME-INTERVAL AVERAGE MODE

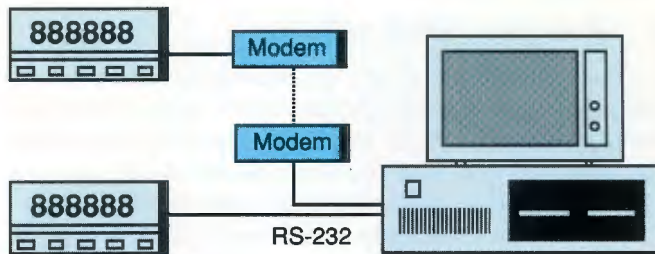
The P6000 can be used to measure the time interval or average time interval between the rising or falling edges of two signals. The meter counts the number of clock pulses in time intervals during a preprogrammed gate time. If the pre-programmed gate time is so long as to contain multiple time intervals, the P6000 automatically calculates the average interval, thereby compensating for any jitter in individual intervals. The time-interval-average capability allows extremely accurate phase measurement at a known frequency. A special configuration is available which converts the P6000 to a phase meter.

6. PROCESS METER MODE

With the addition of an optional analog-to-frequency signal conditioner board, the P6000 can become a process meter with 99.9% accuracy for 4-20 mA, 0-5 V or 0-10 V analog signals. Benefits of the P6000 as a process meter include the two setpoints, RS-232 communications, programmable zero and span, and programmable time for signal averaging.

7. INTEGRATING TOTALIZER MODE

With the analog-to-frequency signal conditioner board, the P6000 can also be used as a 6-digit totalizer for 4-20 mA, 0-5 V or 0-10 V signals. For example, it can totalize the 4-20 mA signal from a flowmeter to display total volume in liters or gallons. It can totalize the 0-10 V signal from a power meter to display kilowatt-hours. In either example, the P6000 can easily be scaled to read out directly in dollars.



RS-232 communications and modem support are built into the P6000 for remote programming, remote diagnostics and data transmission.

LOCAL OR REMOTE PROGRAMMING

1. FRONT-PANEL PROGRAMMING

The P6000 can be programmed manually at the front panel, which provides five programming keys and alphanumeric prompting through the LED display. If desired, all setup parameters can be stored in non-volatile memory. To prevent unauthorized or inadvertent program changes, the P6000 provides four levels of front-panel lockout using push-on jumpers. The front panel can be locked out completely, be locked out except for setpoints, or be fully usable except for fine-calibration of the crystal clock. Saving program changes in non-volatile memory can also be locked out, so that previously stored setup parameters can always be recalled.

Once the program is stored in non-volatile memory, an optional front panel without keys can be substituted for the standard front panel with keys.

2. REMOTE PROGRAMMING

The P6000 can also be programmed remotely by downloading setup parameters from a host computer via RS-232 using direct wiring or a modem. It is well suited for ATE and other computer-controlled applications, since the host computer or programmable controller can dynamically change all setup parameters, including setpoints, and receive data via RS-232. To aid in programming, an IBM PC compatible 5 1/4 inch floppy disk with a menu-driven setup program is available as a low-cost option.

3. PREPROGRAMMED VERSIONS

The P6000 can be ordered fully configured and programmed from Newport or its authorized distributors, with the program stored in non-volatile memory. Such preprogrammed units can later be modified by the user through the front panel or via RS-232.

NAMUR input

Connection	2-wire
Sensor excitation output	8.2 V
Internal load/source impedance	1 k Ω
Activated	< 1 mA
Deactivated	> 3 mA

Contact-closure input

Connection	2-wire
Debounce time: 15 μ s, 10 ms or 80 ms (jumper-selectable)	

4. ANALOG INPUT (OPT)

Number of channels	1
Isolation, SIG GND to DIG GND	350 Vp
Signal range	0-1 mA, 4-20 mA, 0-5 V, 1-5 V, 0-10 V dc (jumper-selectable)
Output to main meter	1 Hz to 10 kHz
Low-level shutoff	Jumper selection to disable output below 10 Hz, 50 Hz or 260 Hz
Zero offset adjustment	\pm 5% of full scale via potentiometer
Non-linearity, max	\pm 0.02% of full scale
Accuracy at 25°C	99.95% of reading
Tempco of span	\pm 0.005% of reading/ $^{\circ}$ C (50 ppm/ $^{\circ}$ C) in 4-20 mA range
Tempco offset	0.1 count/ $^{\circ}$ C

OPERATION MODES

1. FREQUENCY/TACHOMETER MODE

Frequency range	10 ⁻⁶ Hz to 7 MHz
Accuracy at 25°C (square wave)	\pm 0.0002% (\pm 2 ppm)
Gate time, actual	Programmable from 10 ms to 99.99 s plus adder to complete last period
Calculation time	20-50 ms
Measurement time for 6-digit resolution:	
Below 10 Hz	0.05 sec + 1 period
Above 10 Hz	0.15 s

2. FREQUENCY RATIO MODE (FB/FA)

B and A frequencies, max	7 MHz
B and A frequencies, min	0.2 Hz
Accuracy, FB > 5 kHz	\pm 1/(measurement time x FB)
Accuracy, FB < 5 kHz	\pm 1/(measurement time x 5 kHz)

3. PULSE TOTALIZER MODE

Frequency range	0 to 7 MHz
Counting direction	Up or down (determined by sign of scale factor)
Display capacity, normal	-99,999 to 999,999
Display capacity, overflow	-9.9 E9 to 9.99 E9
Display offset (preset)	-99,999 to 999,999
Internal count capacity	6 x 10 ¹⁰ counts

4. PERIOD/PERIOD-AVERAGE MODE

Period range	140 ns to 36 days
Display capacity	999,999 units of time
Unit of time	Programmable from 10 ns to 0.1 hr
Accuracy at 25°C (square wave)	\pm 0.0002% (\pm 2 ppm)

5. TIME-INTERVAL/TIME-INTERVAL-AVERAGE MODE

Interval range, A to B	500 ns to 36 days
Display capacity	999,999 units of time
Unit of time	Programmable from 10 ns to 0.1 hr
Trigger error (square wave, 7 MHz)	+100 ns / -50 ns

6. PROCESS METER MODE

Signal range	0-1 mA, 4-20 mA, 0-5 V, 1-5 V, 0-10 V dc (jumper-selectable)
Output to main meter	1 Hz to 10 kHz
Meter scaling	Frequency/rate meter mode with software scale and offset
Low-level cutoff	Jumper selection to disable output below 10 Hz, 50 Hz or 260 Hz

7. INTEGRATING TOTALIZER MODE

Signal range	0-1 mA, 4-20 mA, 0-5 V, 1-5 V, 0-10 V dc (jumper-selectable)
Output to main meter	Totalizer mode with software scale and offset
Zero offset adjustment	\pm 5% of full scale via potentiometer
Low-level cutoff	Jumper selection to disable output below 10 Hz, 50 Hz or 260 Hz

DISPLAY

Type	7-segment, red LED
Height	0.56 in (14.2 mm)
Symbols	8.8.8.8.8. and -8.8.8.8.8.
Decimal points	Six positions, program-selectable
Leading zeros	Shown or blanked, program-selectable
Over-range indication	Exponential to 9.99 E9
Dimming	Three levels, program-selectable
Display update time	Actual gate time + (10 to 50 ms)
Indicator lights	Gate LED indicator; LO, HI LED indicators for control/alarm outputs

POWER

AC voltage	115 or 230 V ac \pm 10%
AC frequency	49-440 Hz
DC voltage	9.5-32 V dc, isolated to 300 Vp
Power consumption, typical	5 W
Provision for external battery (not compatible with isolated signal conditioners or excitation output):	
6-12 V dc, 400 mA	full meter operation with display
6-12 V dc, 60 mA	meter operation without display
Provision for power failure (totalize on integrate mode):	
	Last total saved in non-volatile RAM and restored with power.

RS-232 / 20 mA ASCII COMMUNICATIONS (STD)

Baud rate	1200 or 9600
RS-232 voltage levels	+5 V, -6 V
RS-232 connections	Data out, data in, RTS, GND
20 mA ASCII connections	Data out, GND
Receive capability	Complete program setup
Transmit capability	Readings with decimal point, sign, alarm status, unit of measurement, setup data

CONTROL, ALARM & DATA OUTPUTS

1. MAIN BOARD (STD)

Setpoint output Three open-collector transistors
 Power rating 150 mA sink, 30 V

2. DUAL-RELAY UPPER BOARD (OPT)

Output type Two form-C relays
 Power rating 8 A, 30 V dc or 240 V ac, resistive load

3. ISOLATED PARALLEL BCD UPPER BOARD (OPT)

BCD type Isolated, buffered, gated tri-state
 Digit addressing 3 or 6 digits at a time
 Output level TTL/CMOS, 10 LSTTL loads
 Power External 5 V dc for isolated BCD,
 internal 5 V dc for non-isolated BCD

4. ISOLATED ANALOG OUTPUT UPPER BOARD (OPT)

Output level (source) 4-20 mA, 0-20 mA, 0-10 V
 (jumper-selectable)
 Compliance for 20 mA source 12 V
 Compliance for 10 V source 20 mA
 Isolation, SIG GND to ANA GND 500 Vp
 Resolution 1/4096 of output span (12 bits)
 Accuracy, 10 - 40°C ±0.1% of theoretical value
 Step response, 10% to 90% of full-scale 50 ms
 Zero and span adjust Via screwdriver from rear of case
 Turndown ratio (max zero offset + by min span) 20:1



Models P6000 and P6000 with optional NEMA-4 splash-proof lens cover

ENVIRONMENTAL

Operating temperature 0 to 60°C
 Storage temperature -40 to +85°C
 Relative humidity 95% at 40°C (non-condensing)

MECHANICAL

Environmental protection: Splash-resistant front panel (std)
 NEMA-4 lens cover (opt)
 Dimensions Newport DIN 4896-150 (1/8 DIN) case,
 150 mm behind panel
 Weight, nominal 21 oz (590 g)
 Case material 94V-0 UL-rated polycarbonate

ELECTRICAL CONNECTIONS

Signal, power, and dual-relay upper-board option:
 Push-in cable connectors with screw clamping
 RS232/20 mA ASCII:
 10-pin dual-row male header on meter (standard),
 10-pin dual-row female cable connector (D10D option)
 Control I/O functions:
 20-pin dual-row male header on meter (standard),
 20-pin dual-row female cable connector (D20D option)
 Parallel BCD upper-board option:
 50-pin dual-row male header on meter plus
 50-pin dual-row female cable connector (both standard)

Note: The male dual-row headers and female cable connectors are per DIN 41612 and provide .100" x .100" (2.54 x 2.54 mm) pin spacing. The cable connectors allow mass termination or individual wire connections without soldering by using needle-nose pliers or a hand-insertion tool like 3M 3430-01000.

MOST POPULAR MODELS		
MODEL	INPUT	
P6100	TTL	
P6121	ISOLATED PULSE	
P6130	TTL	
P6131	AC	
P6134	ANALOG	
P6101 SPC4	ISOLATED PULSE	
P6134 SPC4	ANALOG	

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ORDERING GUIDE

Make a maximum of one entry per box to create a model number.

Example: P6011, D10D, SB02

This is a model P6000 with parallel BCD output, isolated signal conditioner board, connectors and setup program.

P6 6-DIGIT PROGRAMMABLE FREQUENCY METER, TACHOMETER, RATE METER, TIMER, PULSE TOTALIZER, ANALOG PROCESS METER OR ANALOG TOTALIZER

Standard features include front panel with programming keys, protected TTL-level inputs, three open-collector control outputs, RS-232/20 mA communications, screw-clamp connectors for power and signal, 10-pin male header for RS-232/20 mA, 20-pin male header for control I/O, and 150 mm deep 1/8 DIN case (92 x 45 mm panel cutout).

- POWER**
- 0** 115 V ac, 50/60 Hz
 - 1** 230 V ac, 50/60 Hz
 - 4** 9.5-32 V dc, isolated

- UPPER-BOARD OUTPUT OPTION**
- 0** None
 - 1** Isolated, tri-state, parallel BCD output, addressable 3 or 6 digits at a time. Includes 50-pin cable connector, female, for mass termination or no-solder single-wire connection.
 - 2** Dual 8 A Form C relays. Includes screw-clamp cable connector.
 - 3** Analog output, 0-10 V, 0-20 mA or 4-20 mA, isolated and scalable. Includes screw-clamp cable connector. Shipped calibrated for 1 mV/count (left four digits) on 0-10 V range.

- SIGNAL CONDITIONER**
Includes screw-clamp cable connector.
- 0** Standard input, dual-channel, non-isolated TTL/5 V CMOS-level, for up to 7 MHz. Shipped jumpered for 100 kHz frequency response and protection to 25 V dc.
 - 1** Isolated signal conditioner board, single-channel, with sensor excitation output. Shipped jumpered for zero debounce time, no low-pass filter, 70 mV hysteresis. Allows one isolated and one non-isolated channel.

SIGNAL CONDITIONER continued

- 2** Isolated signal conditioner board, dual-channel. Can be wired for one isolated and one non-isolated channel.
- 3** Non-isolated signal conditioner board, single-channel with excitation output.
- 4** Isolated analog-to-frequency converter, single-channel, for 4-20 mA, 0-2 V or 0-10 V dc linear input. For process indicator or integrating totalizer applications.

ADDITIONAL OPTIONS

- FP1** Plain front panel without programming keys, shipped in addition to normal front panel with keys.
- D10D** Cable connector, female, 10-pin mass termination or single-wire insulation displacement type, for RS-232 or 20 mA ASCII.
- D20D** Cable connector, female, 20-pin mass termination or single-wire insulation displacement type for control I/O functions.
- RP18** 19" rack panel for one 1/8 DIN instrument (92 x 45 mm panel cutout)
- RP28** 19" rack panel for two 1/8 DIN instruments (92 x 45 mm panel cutout)
- RP38** 19" rack panel for three 1/8 DIN instruments (92 x 45 mm panel cutout)
- TP1** Trimplate panel adapter. 4.3" x 2.5" (109 x 64 mm). Adapts DIN1A/DIN2A cases to larger panel cutouts.
- SPC4** NEMA-4 splash-proof lens cover (includes gasketed bezel and clear cover)
- SB02** IBM PC compatible floppy disk with menu-driven setup program. Requires D10D for connection to IBM PC.

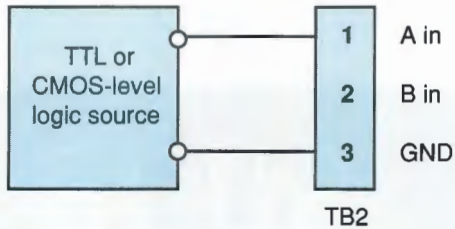


Model P6000

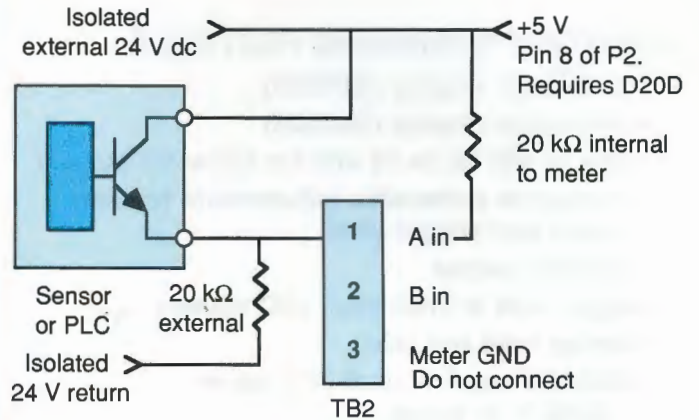
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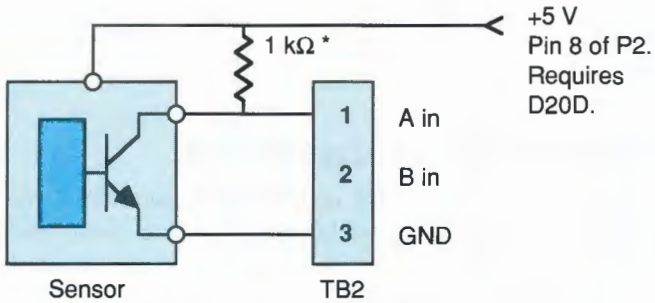
CONNECTION OF NON-ISOLATED P6000 (or P6000F, P6000T) TO DIFFERENT SIGNAL SOURCES



TTL or CMOS logic output

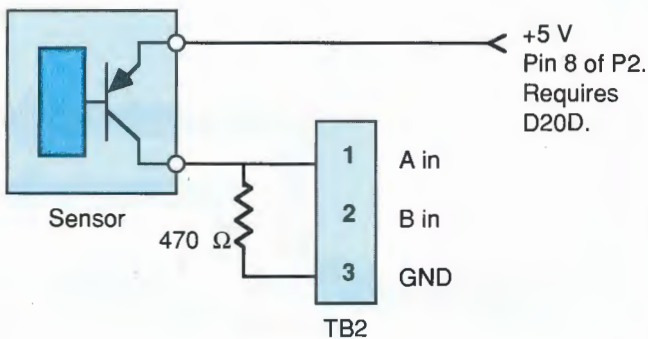


2-wire NPN or PNP open collector output for $V_{sat} \Rightarrow 0.8$ V dc (e.g., Darlington transistor, optical coupler powered by external 6 to 24 V dc)

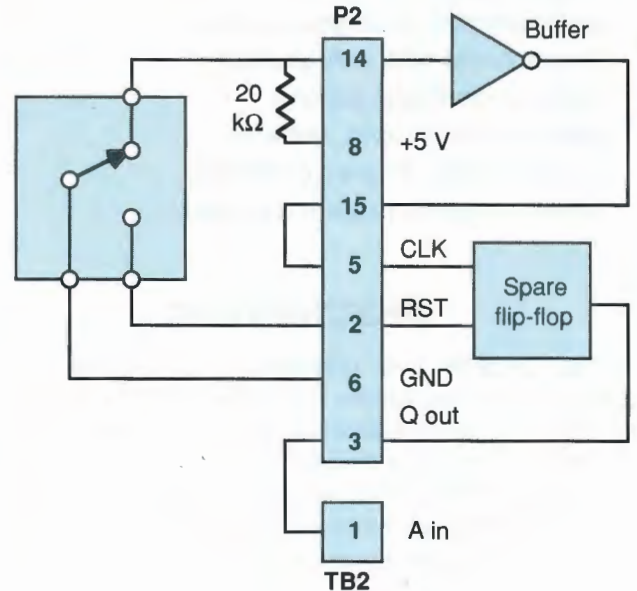


2-wire NPN open collector output for $V_{sat} \leq 0.8$ V dc

*Use external 1kΩ resistor in case of long lines and noisy environments.



2-wire PNP open collector output



Contact closure output from switch or Form C relay contacts, with debounce provided by the spare flip-flop of the P6000.

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• Flow and Level

Air Velocity Indicators, Doppler Flowmeters, Level Measurement, Magnetic Flowmeters, Mass Flowmeters, Pitot Tubes, Pumps, Rotameters, Turbine and Paddle Wheel Flowmeters, Ultrasonic Flowmeters, Valves, Variable Area Flowmeters, Vortex Shedding Flowmeters

• pH and Conductivity

Conductivity Instrumentation, Dissolved Oxygen Instrumentation, Environmental Instrumentation, pH Electrodes and Instruments, Water and Soil Analysis Instrumentation

• Data Acquisition

Communication Products and Converters, Data Acquisition and Analysis Software, Data Loggers Plug-in Cards, Signal Conditioners, USB, RS232, RS485, Ethernet and Parallel Port Data Acquisition Systems, Wireless Transmitters and Receivers

• Pressure, Strain and Force

Displacement Transducers, Dynamic Measurement Force Sensors, Instrumentation for Pressure and Strain Measurements, Load Cells, Pressure Gauges, Pressure Reference Section, Pressure Switches, Pressure Transducers, Proximity Transducers, Regulators, Pressure Transmitters, Strain Gauges, Torque Transducers, Valves

• Heaters

Band Heaters, Cartridge Heaters, Circulation Heaters, Comfort Heaters, Controllers, Meters and Switching Devices, Flexible Heaters, General Test and Measurement Instruments, Heater Hook-up Wire, Heating Cable Systems, Immersion Heaters, Process Air and Duct, Heaters, Radiant Heaters, Strip Heaters, Tubular Heaters