

**NEW**

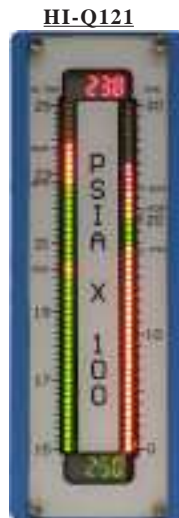
## **AUTO-TRICOLOR BAR-DIGITAL CONTROLLER FOR NUCLEAR, MIL-SPEC AND INDUSTRIAL**

**MODEL  
HI-Q120  
& HI-Q121**

**Replaces Sigma 9270, 9264; VMI: 2000; Dixon: BD, BJ, BS, BL; Weschler: PC, PH; YEW: US1000  
or Any 1/2 DIN 72 x 144mm or 48 x 144mm**

### **FEATURES**

- \*Single or Dual Bar-Digital
- \*Vertical Mount
- \*Class 1E, EPRI & Mil-Spec
- \*Optional Relays (4)
- \*Mathematical Functions
- \*X-Y Tables & Polynomials
- \*AC or DC Power Input
- \*No Rewiring Required
- \*Lifetime Warranted
- \***USB**, RS232, 422 & 485
- \*Field Selectable Ranges
- \*Custom Scales



### **SPECIFICATIONS @ 25°C**

#### **A/D CONVERTER:**

- 16-Bit Plus Sign A/D & DAC
- Display Resolution: 0.01% of F.S.
- Accuracy:  $\pm 0.01\%$  of Full Scale
- Linearity:  $\pm 0.01\%$  of Full Scale
- Drift:  $\pm 50\text{PPM}/^\circ\text{C}$
- Zero: Automatic/Programmable
- SPAN: Programmable
- Sampling Rate: 16/sec.  $\div$  by Channels
- Input Type: Single Ended/Diff.
- Input Bias: 50pA
- C.M.V.:  $\pm 2\text{VDC}$
- CMR:  $>90\text{dB}$
- Averaging (Weighted): None to 255
- Self Diagnostics
- Signal Conditioners For Any Input
- EPRI 102323-R2, TVA 18.14.01 Compliant

### **DESCRIPTION:**

**The Mechanical:** Thanks to "**SONGS**", OTEK introduces its Models **HI-Q120** and **HI-Q121** to replace existing Sigma's 9270 indicators. To make the switchover economical and smooth to the latest technology offered by OTEK's **HI-Q** Series, we redesigned the housing of our **HI-Q119** and display board leaving the mother board and option boards "As Is" as well as the **SV&V** approved firmware. This approach saved **SONGS** thousands of \$\$ and time! As a by product of the **HI-Q120** we created the **HI-Q121** whose Bezel is 1.75" wide vs. 2.84" of the **HI-Q120**. By adding "Trim Plates" we can make the **HI-Q121's** bezel replace any **6"** bargraph as listed above without additional expenses to you! And if we don't have it, we will make it!

**The Electronics:** Thanks to **PVN**, **TVA** (BF) and **FPL** (St. Lucie) and many other **Nuclear Power Plants**, we perfected the original **HI-Q HW & SW** to bring you the best and latest proven technology and features for either stand alone indicator/controller or as part of your **DCS/Scada** System (See Common Features and Specifications Section).

**Self-Diagnostics:** We check for **CPU**, display co-processor, & **ADC** and more. When we detect a failure we visually notify you if it is a component failure, we will repair it for Free, hence our Life Time Warranty!

**HFE/HSI:** Only OTEK's **HI-Q** Series comply to EPRI's and **NUREG's** Human Factor Engineering, Human-System Interface and MMI (Machine-Machine Interface)

### **ON-OFF CONTROL OUTPUTS RELAYS**

- Type: S,P,D.T. (1C) 500VAC Isolation
- Max. Switching Current: 10A Res., Minimum: 1mA
- Max. Switching Voltage: 30VDC/240VAC @ Rated Current
- Contact Protection: Varistors to 250VAC included.

### **ALARM SET POINTS**

- Programmable with P.O.D. and Hysteresis, On or Off

### **SERIAL COMMUNICATIONS**

- Isolation to 5V or Other Power Inputs: 500VDC
- Baud Rate: to 19.2K Baud
- Protocol: Full ASCII (8N1 Setting)
- Concurrent Use of RS-232C & 422 or RS-232C & RS-485 I/O
- USB front mount behind scale plate

### **POWER INPUTS**

- 5VDC  $\pm 5\%$  Non-Isolated
- Or 10-32VDC Isolated
- Or 100-240VAC Isolated
- Power Consumption: 10 Watts

### **ENVIRONMENTAL (To Specs)**

- Operating Temperature: -10 to 55°C
- Storage Temperature: -20 to 65°C
- Humidity 10-90% RH, N.C.
- MTBF:  $> 100,000$  Hrs. (Calculated)

**OPT'L:** Conformal Coating & EMI/RFI (Mil-Std. 461)

**Housing:** All SS316, Bezel nickel plated, (color coded O.R.)

**Connectors:** Terminal barrier or plug-in screw type.

**IF YOU DON'T SEE IT  
ASK FOR IT!**



**520-748-7900**

FAX: 520-790-2808

E-MAIL: sales@otekcorp.com

http://www.otekcorp.com

**OTTEK** <sup>TM</sup> **CORP.**  
SINCE 1974

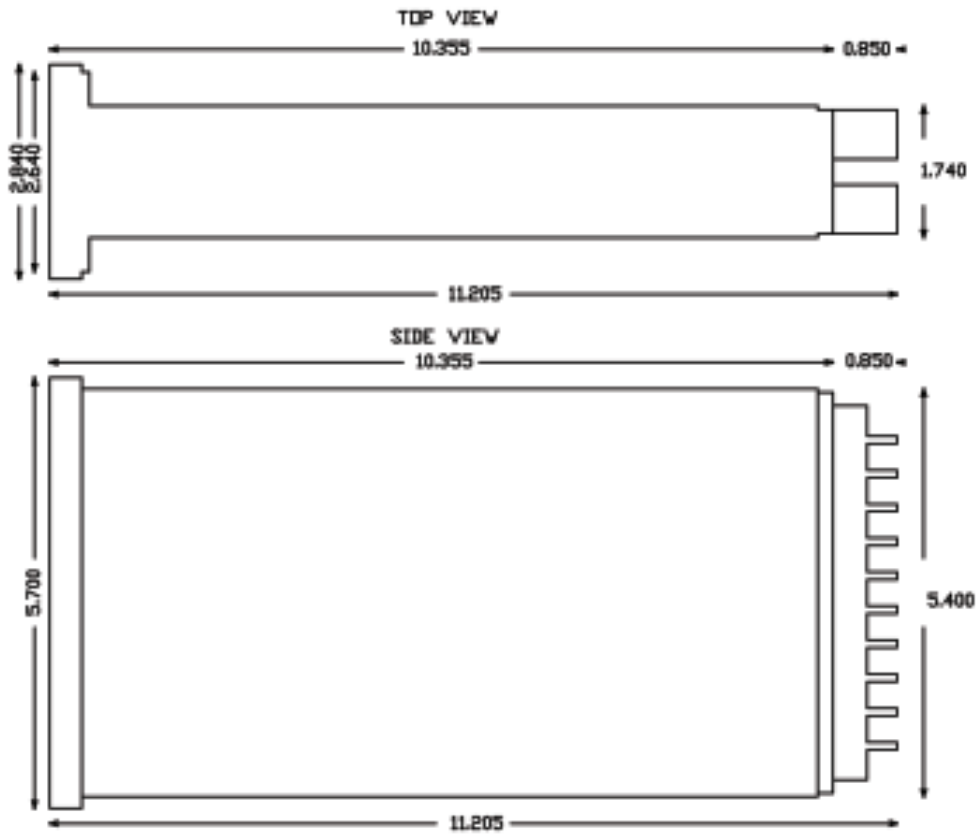
4016 E. TENNESSEE ST.  
TUCSON, AZ. 85714 U.S.A.

MADE  
IN  
USA 

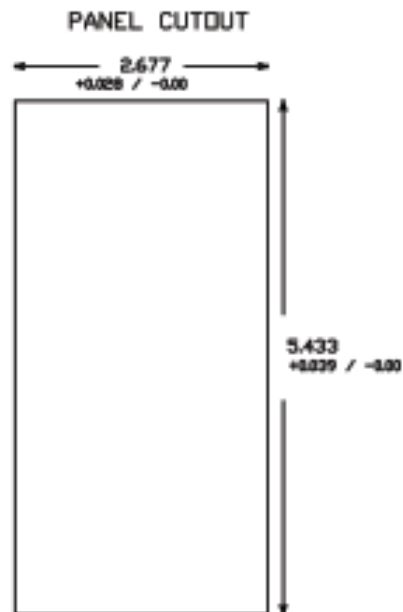


# HI-Q120 MECHANICAL INFORMATION

## HI-Q120 EPRI HOUSING ONLY



## HI-Q120 PANEL CUTOUT (ALL) MODELS



520-748-7900  
FAX: 520-790-2808  
E-MAIL: sales@otekcorp.com  
<http://www.otekcorp.com>

**OTЕК**™  
CORP.

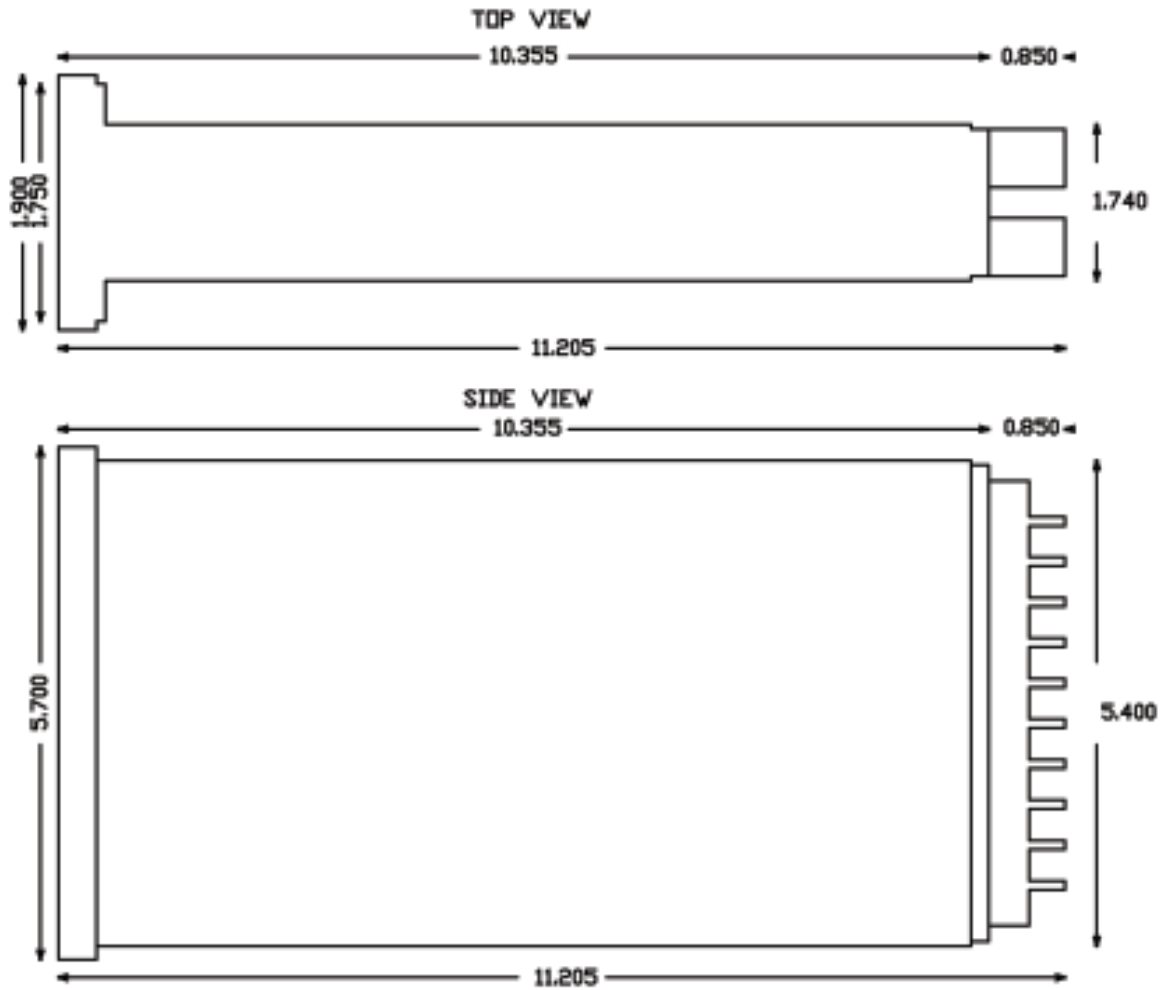
SINCE 1974

4016 E. TENNESSEE ST.  
TUCSON, AZ. 85714 U.S.A.

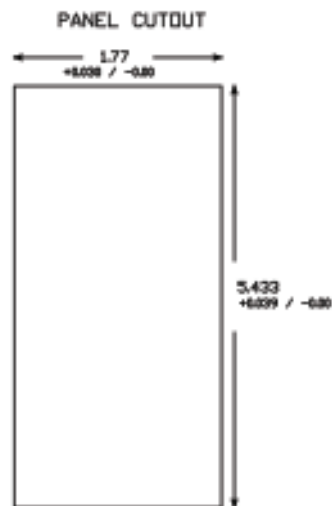
MADE  
IN  
USA



## HI-Q121 EPRI HOUSING ONLY



## HI-Q121 PANEL CUTOUT (ALL) MODELS



# BENEFITS

OF THE

**HI-Q**<sup>TM</sup>  
(High I.Q.)

**DESCRIPTION:** The HI-Q Controllers consist of several products with sub-products. All the products share similar hardware and software with the main difference being their package and display. Once you have familiarized yourself with one, you will know them all! By using common software and hardware, we realize R&D and production savings that we pass on to you.

## INTERFACE

### OPERATOR:

\* **Bargraphs** are used for quick trend indication. The operator can, at a glance, tell where the process is.

\* **Digital Display(s)** are used to give accurate process indication and set point control or calculate values in engineering units. They are also used to display the menu driven prompts.

### PROCESS:

All HI-Q intelligent controllers offer five methods of controlling your process:

- a) Current: 4-20mA, 1-5mA, 0-20mA (including PID), directly or inversely proportional.
- b) Voltage: 0-5VDC & 1-5VDC (or 5-0 & 5-1VDC) or any other ranges in between.
- c) Four (4) or six (6) SPDT 10Amp relays.
- d) Open collector Bi MOS outputs.
- e) The serial port (USB, RS232, 422 & 485)

*Applications: See Technical Brief on Page 27*

## BENEFITS

\* **SV & V:** The HI-Q Series software has been verified & validated as trouble/glitch free per IEEE Std. The Hardware has passed several Mil-Std's, such as 461, 462, 617, EPRI 102323 & others. If we don't have it, we'll make it!

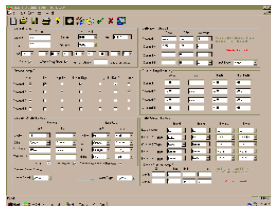
\* **Low Cost-High Performance:** When you buy the HI-Q, you buy a "Computing Controller", not just an instrument. Its performance to price ratio is unsurpassed in the industry. Only the specific functions that you will need are selected and included, no need for unnecessary extras.

### SYSTEM:

\* **Use the Isolated RS Translator** to interface with other industry standard USB, RS-232C/RS-422 or RS-485 devices with open or proprietary protocols. If they are "RS" and "ASCII" compatible, the HI-Q can communicate with them.

\* **Stand Alone: as Single or Multi Loop Controller** Whether under the protection of a factory environment or in the open field, the HI-Q will meet and exceed your expectations.

**CONFIGURATION:** Just Upload OTEK's **FREE Windows Navigator<sup>TM</sup>** and configure or re-configure your HI-Q without an Instruction Manual, in minutes!



## COMMON FEATURES

\* **Ready to Use:** Just apply power, select the commands, set your limits and start controlling.

\* **Automatic Tricolor:** Changes colors (Red, Blue, Purple, Green, Amber) upon reaching a limit. **Flashing & dimming** of the displays are under your control. (Some Models)

\* **Password Security:** You can enable or disable the front panel keypad (Optional Keypad) on some models.

\* **Emergency Shut Down:** Any three keys held down simultaneously will shut down the controller sending all outputs to a "Fail Safe" (Off) state.

\* **Power on Test (POT):** Will test every major section of its hardware, software and firmware and flag any malfunctions.

\* **C.O.P. (Computer Operating Properly):** Checks the operation of its internal algorithms. You can disable it.

\* **R.T.C (Real-time Clock):** Indispensable for time keeping functions, such as time, event alarms, etc... (only on some models).

\* **Mathematical Functions:** Insert the math function. Transmit and/or control with the result.

\* **Polynomials and Look Up Tables:** Make your own or use the preprogrammed polynomials to 9<sup>th</sup> order.

\* **Self Diagnostics:** The HI-Q will detect major software/hardware failure & warn you via its display/serial port.

\* **Modular Design For Long Life Expectancy**

\* **Lifetime Warranted**

### Some Commands You Can Enter Via the Keypad (More Via the Serial Port) or GUI



Security Code-Restricted Access



Zero Offset-Tare



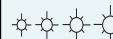
Full Scale-Range



Colors (LED or LCD backlight)



Intensity-None to Max.



Blinking None, Slow, Fast



Filtering (averaging)



Danger Alarms (Warning-Stop)

Relays (4 or 6) Bi Mos (8) On-Off

Current Loops 4-20mA(0-5V out)

\* Timer, Real-time Clock Alarm(s)

Calendar: \* Date, Month, Year, Stamp

1 → 3 Assign any Channel to any Display & Relays to Channels or External Commands

A/M \* Auto/Manual Process Control

K Assign any Constant to any Channel

Δt Assign any Delay to any Output

P Proportional

I Integral

D Derivative

Your Own Custom Commands

oops! Reset to Default Parameters

Poly Ours or Your Polynomials/Tables

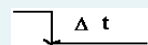
...!! \* Process Predictability

(Signal(s) vs Time

\* **Some Models**

+,-,x,÷,√,Σ

Fixed or Variables



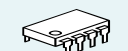
Alarm w/or w/out Delay



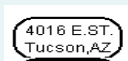
Watchdog Timer



COP-Computer Operating Properly



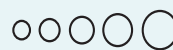
Store any Fix Value or Command in Memory



Any Address Alphanumeric or Either



Any speed 1.2 to 19.2 KBPs



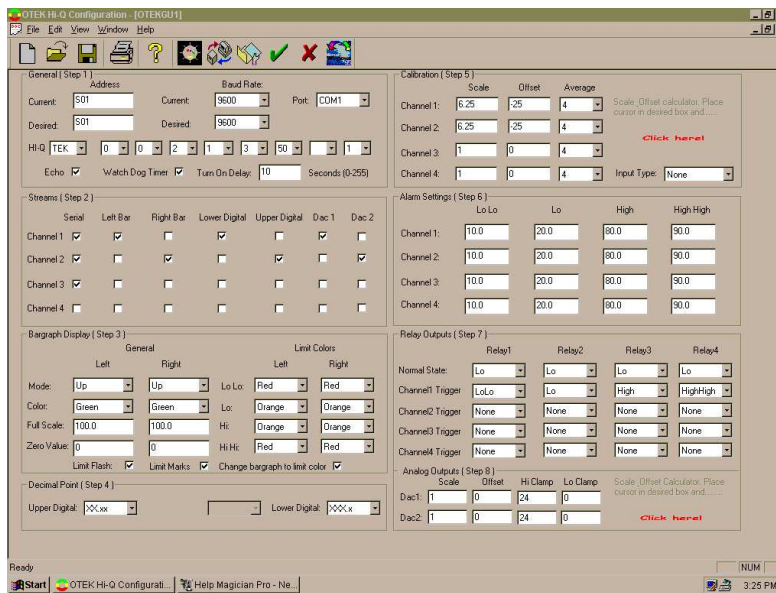
Any Resolution (1 to 50,000)

# THE BENEFITS OF THE "HI-Q"

Now you can monitor and control your process from the comfort of your control room or at the site with an inexpensive PC & OTEK's complete line of **Programmable Intelligent Controllers**. Use them either as Stand-Alone or as part of your DCS or SCADA system.

**CONFIGURATION** with OTEK's New **Windows Navigator™** (PC G.U.I.) is so fast & easy that no instruction manual (other than connections) is required! Just Plug in your PC Terminal, upload our **FREE** Program and start selecting your configuration. Within minutes you will be done and you can even email it to remote locations!

For a **FREE** copy of the Windows Navigator™ visit our website at [www.otekcorp.com](http://www.otekcorp.com) then click on Windows Navigator™



OTEK's "HI-Q" line of **Programmable Intelligent Controllers** with their built-in and isolated signal conditioners will connect directly to your sensor and/or transducer and it will even power it. All you have to do is to connect & power up. We will even preprogram the "HI-Q" for you if so desired for **"Plug-N-Play"**.

## Common Features of the "HI-Q™" Series:

- Math Functions: +, -, x, ÷, √ and More
- Isolated 18-bit A/D w/Signal Conditioners
- Isolated Analog Outputs (4-20mA & 0-5VDC)
- (4 or 6 each) 10A SPDT Relays for On-Off Control
- O.C.T. (250mADC) for Fast On-Off Control
- Isolated 10-32VDC (24VAC Also) Power Input
- Isolated 100-240VAC or (100-350VDC on Request) Power Input
- 5 VDC Power for Low Voltage Applications
- Look Up Tables for Thermocouples/RTDs
- Polynomials to the 9th Order
- Customer's X-Y (25X25) Tables
- ZERO • TARE • SPAN • AVERAGE
- All ASCII Characters for Open Protocol
- Programmable Baud Rate & Address
- Isolated RS-232C/422/485 Translator & USB
- Automatic Tricolor LED Displays with Dimming, Blinking & Pointers
- P.I.D. or Just Plain Proportional Control
- SV & V, Mil-Stds with Self-Diagnostic Capabilities
- Modular Design for Long Life Expectancy
- Lifetime Warranted

### What Can the "HI-Q" Series Do for You?

It can accurately and reliably monitor and/or control your process as stand alone or as part of a DCS/SCADA for complete factory automation.

From the most basic form as a serial input **remote display** to the most complex as stand alone **Programmable Intelligent Controller**, the "HI-Q" Series will perform to specifications in the oceans, on earth or in outer space, in the Alaskan tundras or in the Tucson deserts.

**MILITARY, NUCLEAR, SEISMIC & EPRI TR-102323R3** Models Are (Or Being) Approved. Contact OTEK™

### Where Are the "HI-Qs" Being Used?

Only OTEK's HI-Q Series are in Outerspace (**Mir & I.S.S.**), Military Aircraft (**Night Vision**), Naval Warships (**Mil-Spec**), Nuclear Power Plants, Offshore Exploration/Drilling, Mass Transit (**Metro**), Biomedical (Non-Life Support), Pharmaceutical, Agricultural, Waste & Water Treatment, etc.

### IS YOUR APPLICATION MORE CRITICAL?

**IF YOU DON'T SEE IT, ASK FOR IT!**

Our customers **THINK** of the products, we just design them!

**B**

# HI-Q SERIES COMMON SPECIFICATIONS *for:*

**For: •DIN-BAR •TEK •TBS •114 •116 •117**

**•118 •119 •120 •121 •123 •124 •126 •127 •2K and 2000**

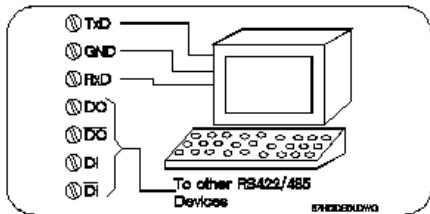
*(All at 25°C) Also See Individual Specifications*

FF

## SERIAL COMMUNICATIONS

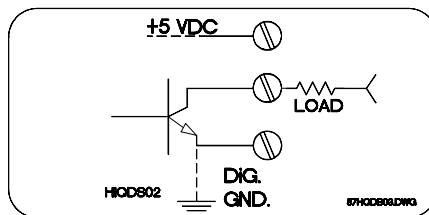
- Isolation to 5V or Other Power Inputs: 500VDC
- Baud Rate: to 19.2K Baud
- Protocol: Full ASCII
- Concurrent Use (Translator) of USB or RS-232C & 422 or RS-232C & RS-485 I/O & USB

*NOTE: As a translator, you can use the com. port to translate from one protocol to another, so long as you only "talk" on anyone and listen on the others, ie talk on USB, listen on 485, or 422, talk on 232, listen on 485. Can NOT have 232&USB.*



## BiMOS OPEN COLLECTOR

- Type: Sink Driver (Transistor)
- Isolation to 5V Power: None
- Max. Current Sink: 250mA
- Vsat @250mA: .8V
- Standard VC: 5VDC
- External VC: <35VDC
- Switching Speed: 1µS

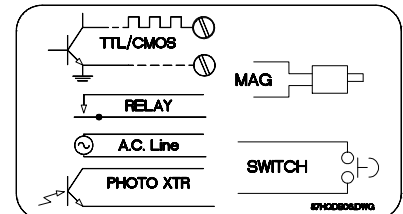


## Multilevel (Option 01): (Low Speed)

- Dry Contact to 24VDC
- Isolation to 5V Power: None
- Response: DC to 100Hz
- Input Impedance: 1MΩ/27pF

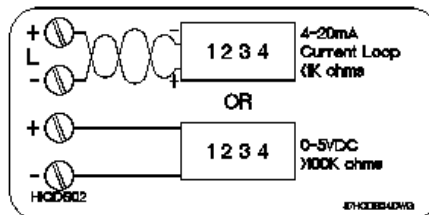
## TTL Level (Option 02): (High Speed)

- 0<.8V; 1=>2.4V
- Response: DC-50KHz
- Isolation to 5V Power: None



## ANALOG CONTROL OUTPUTS

- Accuracy & Linearity: ± 0.01% F.S.
- Resolution: 16 Bits
- Outputs: 0-5VDC (>100KΩ)  
4-20mA (<1KΩ)
- Custom Output: 0-20mADC
- Compliance Output: 30VDC
- Isolation: 500VDC



## ANALOG INPUT SIGNALS

*(All Isolated to 500VDC & After 30min, Warm Up)  
Note: Worst case accuracy & linearity are the sum of A/D and selected signal conditioner errors.*

## A/D CONVERTER

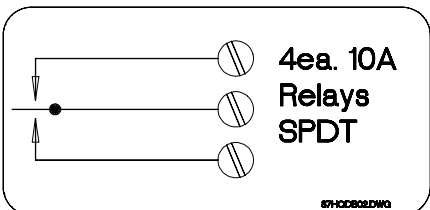
- 16-Bit Plus Sign A/D(50K Counts)\*
- Display Resolution:±0.002% of F.S.\*
- Accuracy: ±0.01% of Full Scale
- Linearity: ±0.01% of Full Scale
- Drift: ±50PPM/°C
- Zero: Automatic/Programmable
- SPAN: Programmable
- F.S.Input Voltage Range: ±0.5VDC
- Max.Current Range: ±1/2 AmpDC
- Sampling Rate:16/sec. ÷ by Channels
- Input Type: Single Ended/Diff.
- Input Bias: 50pA
- C.M.V.: ±2VDC
- CMR: >90dB
- Averaging (Weighted): None to 40
- Input Impedance: See Ord. Info.
- \* Note: Limited by display of model

## POWER INPUTS

- 5VDC±5% Non-Isolated
- Or 10-32VDC (24VAC) Isolated
- Or 100-240VAC or (100-300VDC on Request) Isolated
- Power Consumption varies from model to model and number of options selected. See Specific Models

## ON-OFF CONTROL OUTPUTS RELAYS

- Type: S.P.D.T. (1C)
- Max. Switching Current: 10A Res.
- Max. Switching Voltage: 30VDC/240VAC@Rated Current
- Contact Protection:Included
- Life Expectancy: 10,000,000 Cycles
- Contact Isolation: 1000VRMS
- Initial Contact Resistance: 0.1Ω



## MEASURING INPUTS

### DIGITAL DISCRETE INPUTS

*Functions Selectable:*

Event, Timer, Period, Frequency, RPM and SPH

# HI-Q SERIES COMMON SPECIFICATIONS (Cont'd)

For: •DINBAR •TEK •TBS •114 •116 •117  
•118 •119 •120 •121 •123 •124 •126 •127 •2K and 2000

selected (# of digits) • Stability of Excitation:  $\pm 0.05\%/^{\circ}\text{C}$

**NOTE:** All V/mA Input Models (Options 10, 11, 14, 15, 30, 31, 33, 34, 35, 36, 50, 51, 53 & 54) Have Internal Jumper Selected Input Ranges of .5, 5, 50 & 500V and .5, 5, 50, 500mA.

**OPTIONS:** (See Ord. Information)  
10, 11, 12, 30, 31, 32, 50, 51 & 52

\* Same Specifications As A/D

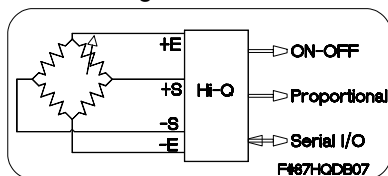
## ANALOG SIGNAL CONDITIONERS

(All outputs set for  $\pm 500\text{mVDC F.S.}$ )

### STRAIN-GAGE:

(Options 17, 18, 37 & 38)

- Accuracy and Lin.:  $\pm 0.1\%$  of F.S.
- V Excitation(1):  $\pm 2.5\text{VDC} \pm 0.5\%$
- I Excitation(2):  $1\text{mADC} \pm 0.5\%$
- Stability of Excitation:  $\pm 0.05\%/^{\circ}\text{C}$
- Maximum Current of VE:  $30\text{mA}$
- Maximum Voltage of IE:  $5\text{VDC}$
- (1) Typical for S-G of 200-400 $\Omega$
- (2) Typical for Monolithic S-G to 5K $\Omega$
- (3) Tare, Range, Zero Span Are User Programmable

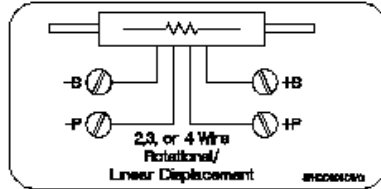


### mVDC (Options 25 & 47)

- Accuracy & Lin.:  $\pm 0.1\%$  of F.S.
- Full Scale Input:  $\pm 10\text{mVDC}$
- Typical Gain: 50(see A/D Sec.)
- Common Mode Voltage:  $\pm 2\text{VDC}$

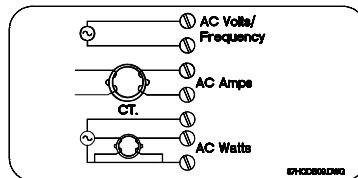
### RESISTANCE (Options 20 & 40)

- Accuracy & Lin.:  $\pm 0.1\%$  of F.S.
- Full Scale Input:  $50\text{K}\Omega$
- Excitation Current:  $0.01\text{mA}$



### TRUE RMS VOLTS, AMPS & WATTS (Options 14, 15, 34, 35, 36, 53, 54, 55, 60 & 61)

- Accy. & Lin.:  $\pm 1.0\%$  of F.S. DC-50KHz Sine Wave
- Accy. & Lin.:  $\pm 0.5\%$  of F.S. DC-10KHz Sine Wave
- Accy. & Lin.:  $\pm 2.0\%$  of F.S. 10KHz-50KHz Sine Wave
- Resolution:  $\pm 0.01\%$  of F.S.
- Common Mode Voltage:  $2\text{Vrms}$
- Overvoltage Protection:  $500\text{VAC}$
- Overcurrent Protection: 200%
- Input Impedance: See Ord. Info.
- Drift vs Temperature:  $\pm 50\text{PPM}/^{\circ}\text{C}$
- Input Bias Current:  $10\text{pA}$



### RTD (Options 21 & 41)

- Din ( $\alpha=0.00385$ ):  $-200^{\circ}\text{ to }+800^{\circ}\text{C}$
- ANSI ( $\alpha=0.003923$ ):  $-200\text{ to }+600^{\circ}\text{C}$
- Accuracy:  $\pm 0.1^{\circ}\text{C}$
- Resolution:  $\pm 0.1^{\circ}\text{C}$
- Scale: User Selectable  $^{\circ}\text{F}$ ,  $^{\circ}\text{C}$  or  $^{\circ}\text{K}$
- Linearization: Polynomial to 9th
- Open Sensor: +Overrange/Flash
- Connections: 2 Wire (3 or 4 Wire On Request)
- Excitation:  $0.1\text{mA}$  or  $1\text{mA}$  (Cu)
- Open RTD: Burn-up

### THERMOCOUPLE (Opt. 22, 42 & 56)

- Thermocouple Type: User Selectable but Specify When

- Ordering (J, K, T, R, S, B, C, E,)
- Accuracy of HI-Q:  $\pm 0.1\%$  of F.S.
- Resolution:  $0.1^{\circ}$
- Full Scale: Same as Thermocouple
- Open TC: (Burn Up)
- Input Impedance:  $>100\text{M}\Omega$
- Scale: User Selectable  $^{\circ}\text{F}$ ,  $^{\circ}\text{C}$  or  $^{\circ}\text{K}$
- Lead Resistance Effect:  $<0.001^{\circ}/100\Omega$
- Linearization: Polynomial to 9th

### Notes:

1. No isolation exists between channels.
2. Do not use grounded thermocouple.

### ENVIRONMENTAL (To Specs) INDUSTRIAL & NUCLEAR:

- Operating Temperature:  $-10\text{ to }55^{\circ}\text{C}$
- Storage Temperature:  $-20\text{ to }65^{\circ}\text{C}$
- Humidity: 10-90%RH, N.C.
- MTBF:  $>100,000\text{HRS}$  (Calculated)
- NEMA4X(IP65)

### MILITARY: TO SPECIFIC MIL-STD (I.E. 461, 462, 901, 167, ETC.)

CUSTOMS: OTEK CUSTOMIZES ANY OF ITS PRODUCTS TO YOUR EXACT SPECIFICATIONS.

### POWER CONSUMPTION (WORST CASE)

DIN-BAR	5W
HI-QTBS:	10W
HI-QTEK:	15W
HI-Q114:	10W
HI-Q116:	10W
HI-Q117:	15W
HI-Q118:	15W
HI-Q119:	15W
HI-Q120:	15W
HI-Q121:	15W
HI-Q123:	5W
HI-Q124:	5W
HI-Q126:	10W
HI-Q127:	5W
HI-Q2000:	15W
HI-Q2K:	15W