Tachometer

Hawk™ HK40 Series
Advanced Digital Panel Meter

- ***Easily Programmed from the Front Panel***
- ***Software Functions Include:***
  Password — *Display Scaling*
  One or Two Set points — *Decimal Point Selection*
  Time Delay & Hysteresis
- ***2-Piece Screw Terminal Connector for Easy Installation***
- ***1/8 DIN Case, Made of High-Impact Noryl®***
- ***Three Tachometer Functions: A (2-30 VRMS), B (8.2VDC/1KΩ), D (On/Off)***
- ***Display Hold***
- ***Optional NEMA 4 Front Panel Cover***
- ***Optional 5-Amp Relays and Analog/Digital Outputs***
- ***4-digit, 0.56" (14.2 mm) High, Bright Red LED Display***

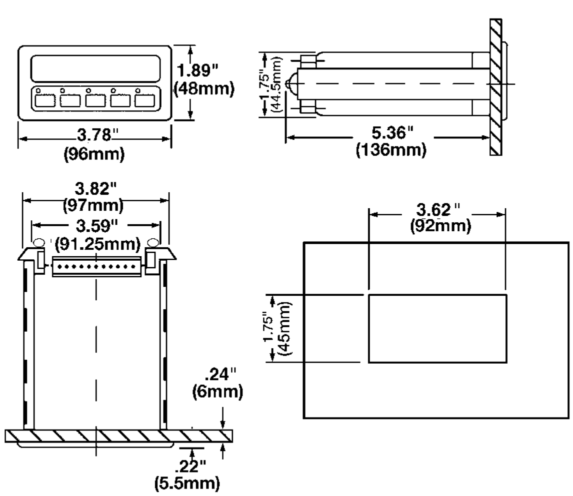
Simpson's Hawk advanced digital panel meters are ideal for measuring and controlling a wide variety of process variables. The display can be easily scaled from the front panel to virtually any engineering unit.

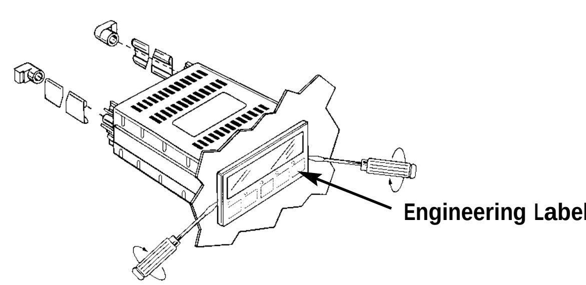
Two optional 5-amp relays include front panel programming features for hysteresis, time delay and relay operation. Optional analog or digital outputs are available for use with chart recorders or computers. Other programmable software features include programmable decimal point and a password lockout feature.

By using the password feature, the meter's programming functions and set points are protected from accidental reprogramming.

Hawk series advanced digital panel meters are compactly designed for applications requiring minimal rear panel depth and feature a standard 1/8 DIN case made of high-impact Noryl®. The Hawk has an optional NEMA 4-rated front panel cover that equips the unit for wash down environments. A two-piece screw terminal is standard for easy installation and removal of the meter.

Installation and Panel Cutout





Mounting Requirements
Insert the instrument into the panel and fasten it with the mounting brackets and side retainers provided.

Engineering Label Placement
To replace the engineering unit label, insert a screwdriver into the lateral slot in the front panel and gently twist the screwdriver. Remove the front panel completely, and replace the engineering unit label with tweezers. Snap the front panel on after label is replaced.

Specifications

DISPLAY
Type: 7-segment, red LED
Height: 0.56" (14.2mm)
Decimal Point: 3-position software programmable from front panel
Overrange: Display (flashing) indicates maximum reading (Hi)
Underrange: Display (flashing) indicates minimum reading (Lo)
Alarm Indicators: 2 LED indicators for alarm conditions on front panel

POWER REQUIREMENTS
AC Voltages: 24, 48, 110, 220VAC, ±15%
Power Consumption: 9VA max.

ACCURACY @ 25º C
HK40: 0.02% of input ±1 digit
ENVIRONMENTAL
Operating Temp.: 0°C to +50°C
Storage Temp.: -10°C to +60°C
Relative Humidity: <90% non-condensing
Ambient Temperature: 25°C
Temperature Coefficient (per °C): ±100PPM/°C
Warmup Time: 15 minutes

NOISE REJECTION
NMRR: 60dB @ 50/60Hz
CMRR: 70dB (1KV unbalanced) @ 50/60Hz

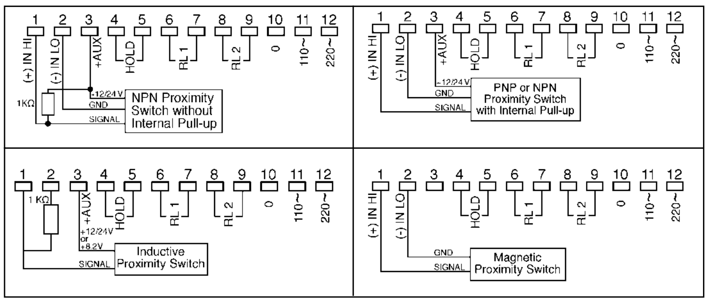
ANALOG TO DIGITAL CONVERSION
Technique: Special dual slope
Time Base: 1 second

INPUT VOLTAGE
Type A: 2-30VRMS
Type B: 8.2VDC / 1KΩ (NAMUR operation)
Type D: < 2V - level 0, > 6V - level 1 (Inductive and capacitive proximity switches and encoder)
MECHANICAL
Bezel: 3.78" x 1.89" x 0.22"
(96mm x 48mm x 5.5mm)
Depth: 5.35" (136mm)
Panel Cutout: 3.6" x 1.8"
(92mm x 45mm) 1/8 DIN
Case Material: 94 V-1 UL rated Noryl®
Weight: 16oz (453.6g)

INPUT: Tachometer

Input Range	Input Frequency Range	Time Base
Type A		
9999 RPM	2Hz - 600Hz	1 second
9999 RPM	15Hz - 150KHz	1 second
Type B		
9999 RPM	2Hz - 600Hz	1 second
9999 RPM	15Hz - 150KHz	1 second
Type D		
9999 RPM	2Hz - 600Hz	1 second
9999 RPM	15Hz - 150KHz	1 second

Wiring Diagram



Input Signal:
Connect the input signal to the terminals specified in the diagrams to the left.

Input Power:
110VAC & 24VAC are connected to terminals #10 and #11
220VAC & 48VAC are connected to terminals #10 and #12
9-32VDC is connected to terminals #10(-) and #11(+)

Display Hold:
This is a standard feature on the Hawk controller. The display value can be held indefinitely by shorting terminals #4 and #5. The comparison of the input variable with the alarm set point remains active. This allow the controller to function normally when the display is held (allowing a reading to be taken). To reactivate the display, remove the short between the two terminals.

Programming

The Programming mode allows the user to define the following instrument parameters:

- Password for access to programming
- Decimal point position
- Minimum and maximum values of the electrical range
- Display scaling
- Alarm set point values

The normal measurement and control functions are not active during programming mode. The input variable is not monitored during the programming sequence. The operator can exit the programming mode at any time by pressing the **S** key. Termination for the programming mode is automatic after the last variable is entered. The Hawk will return to the measurement and control mode after the programming mode is exited or if 45 seconds has passed between pressing keys.

Access to Programming (PAS)
Press the **S** key. The display will show "**PAS**" for about one second. The ▲ and ▼ keys increment the displayed value up or down (0-99). The correct password must be displayed, then press the **ENTER** key. The unit is shipped with a password of "0."

Programming a new password
If the correct password is entered, the "PV," "SP1," and "SP2" LEDs will flash. The display will show "**PAS**" for one second, and then the password will be displayed again. To retain the password, press **ENTER** to continue to the next parameter. To change the password, press the ▲ and ▼ keys until the desired password is displayed (0-99). Then press the **ENTER** key to proceed to the next parameter.

Decimal Point Selection (dP)
The display will show "**dP**" for one second. The display will then show "**1111**" and the "PV" LED will be flashing. The current decimal point position will be displayed. To change the position of the decimal point, press the ▲ and ▼ keys to move it left or right, respectively. Press the **ENTER** key to continue to the next parameter.

Selecting the number of pulses/revolution (COGS)
The display will show "**COGS**" for about one second. Use the ▲ and ▼ keys to change the indicated value of COGS (pulses/revolution) to a different value. Check the Formula section for help in calculating RPM, Frequency, and number of pulses per revolution.

Electrical Input Range (LoE and HiE)
The electrical input range must be specified. The display will indicate "**LoE**" for one second, then the stored value will be displayed. This value is expressed in RPM, and generally this value is 0.

To retain the stored value, press **ENTER**. To increase or decrease the "LoE," press the ▲ and ▼ keys until the desired value is displayed. Press **ENTER** to lock in the "LoE" value.

"**HiE**" will appear for one second, then the stored value will be displayed. In the Hawk Tachometers this value is expressed in RPMs, and is set with a default of 9999 RPMs. To retain this value, press **ENTER**. To modify the "HiE" value, use the ▲ and ▼ keys. Press **ENTER** to lock in the new value.

Display Scaling (Lo/Hi)
The display can be scaled to any engineering unit. This allows the unit to easily display different values.
For example:

Electrical Input Range : 0 to 9999 RPM (LoE to HiE)

Programmed Display Scaling: 0 to 1000 feet (Lo to Hi)

Programming (Cont'd)

The link between the input value and the displayed value is completely adjustable. Thus, it is possible to correlate a minimum input value to a maximum displayed value. This is called "scale inversion."

The display will show "**Lo**" for one second. This is the minimum displayed value corresponding to the input range (LoE). The stored value will be displayed. To retain the stored value, press **ENTER**. to modify the value, use the ▲ and ▼ keys to increase or decrease the value. Press **ENTER** to lock in this new value and continue to the next parameter.

The display will show "**Hi**" for one second, then the stored value will be displayed. This value can be changed up or down by using the ▲ and ▼ keys. By changing the high value, the input is scaled to display a new range. Our example above has a "Hi" of 1000 (feet). Press **ENTER** to continue to the next parameter.

Programming the Set Points

The Hawk is shipped with two programmable set points for the alarm LEDs on the front panel. Optional relays can be added to the unit, and will work based on the parameters programmed to the set points. These relays can be used to turn on a light or process. The set point is relative to the span (defined by "Lo" and "Hi"), not the electrical input range. The set points can be displayed during normal operation by pressing the ▲ and ▼ keys. The "SP1" LED will turn on, and the display will show set point #1. Press the ▲ key again, "SP1" will turn off, "SP2" will turn on, and set point #2 will be displayed. The display will stay on for ten seconds, then revert to normal operation.

Alarm Set Point #1 (SP)

The display will show "SP" for one second. The "SP1" LED will flash while you are programming the "SP1" values, and the "PV" LED will stop flashing. The stored set point value is displayed, and can be changed up or down by using the ▲ and ▼ keys. Press **ENTER** to lock in the value and to continue to the next parameter.

High and Low Alarm Level (uP/do)

The display will indicate "**uP**" or "**do**," signifying high or low alarm level. Use the ▲ and ▼ keys to change the state. Press the **ENTER** key to continue to the next parameter.

Hysteresis (HYS)

"**HYS**" will be displayed for one second. Hysteresis is the difference between the set point value (at which the alarm is enabled) and the value at which you want to disable the alarm. Hysteresis is selectable from 0.0% to 100.0% of the maximum display span. Use the ▲ and ▼ keys to affect the value displayed, and press **ENTER** to lock in the new Hysteresis value.

Time Delay (dEL)

The Time Delay is programmable for 0 to 99 seconds. Time delay differs from Hysteresis, because this value indicates how long the Hawk will wait after reaching an alarm state before turning on the "AL1" LED (and triggering the relays, if installed).

The Hawk will display "**dEL**" for one second, and then display the stored value. To change the value, use the ▲ and ▼ keys to increase or decrease the value. Press **ENTER** to store the new value in memory.

Relay Status (nd/nE)

This is the relay status in the absence of an alarm condition. The instrument will display the stored value, which can be changed by pressing the ▲ and ▼ keys. ▲ will make the status Normally Energized ("nE"), while the ▼ key will make the status Normally De-energized ("nd").

Set Point #2

If the unit is equipped with two relays, the programming sequence will continue. The "SP1" LED will turn off, and the "SP2" LED will turn on, and the Hawk will proceed through the programming sequence for the second set point.

Exiting Programming mode

After programming the relay(s), the Hawk automatically exits the programming mode. The "SP1" LED (or "SP2" if you have two relays) is turned off, and the "PV" LED will start flashing. The display will show "**run**" for about one second, then the unit will function normally. The programming mode can be exited at any time by pressing the **S** key.

Relays

Up to two relays are available for the Hawk controller. The relays are 5-amp, 250 VAC, DPST models. The functions of the relays are defined in the programming mode. The functions include the set point, the alarm level, hysteresis, time delay and status of each relay.

Relays can be used to "turn on" or "turn off" power to a process that the Hawk is monitoring. A light can be "turned on" when a set point is exceeded, alerting the operator to a change in condition in the process. Also, the excitation or analog output of the Hawk can be controlled with the relays by wiring them together, "turning on" or "turning off" the output when a set point is reached or exceeded.

The set points for the relays are the same as the alarm set points, which are specified when you program the controller. The front panel has two LEDs which are used to indicate when an alarm condition is met, and the appropriate relay is activated.

The unit is delivered with normally closed contacts (NC) for the alarm relays. If you would prefer the contacts to be normally open during operation, they can be modified in the programming sequence. By changing the values of the alarm status and the relay status, the controller will act as though the contacts had been changed, without soldering or unsoldering them.

The bottom chart shows the alarm and relay conditions when the configuration is changed.

RELAY SPECIFICATIONS

Breakdown Voltage: 750VRMS (60Hz) across contact gap,
4,000VRMS (60Hz) between coil and contacts

EXPECTED LIFE

Mechanical: 20 million operations minimum
Electrical: 100,000 operations minimum
Temperature range: -40ºC to 70ºC

TIME VALUES

Pull in time: 8mS maximum
Drop out time: 4mS maximum

CONTACTS

Ratings: 5A @ 250VAC
Material: Ag - Cdo
Arrangements: 1 Form C

Programmed Values		**When Above Set Point**		**When Below Set point**	
Alarm	Relay	Alarm	Relay	Alarm	Relay
UP	NE	On	Closed	Off	Open
UP	ND	On	Open	Off	Closed
DOWN	NE	Off	Open	On	Closed
DOWN	ND	Off	Closed	On	Open

For example, a customer wants to turn on a process and alarm light #1 when the RPMs are below 70, and turn on alarm light #2 when the RPMs are above 95.

Set point #1 should be set at 70, alarm #1 set at "DOWN" and the relay set at "NE" for normally energized.

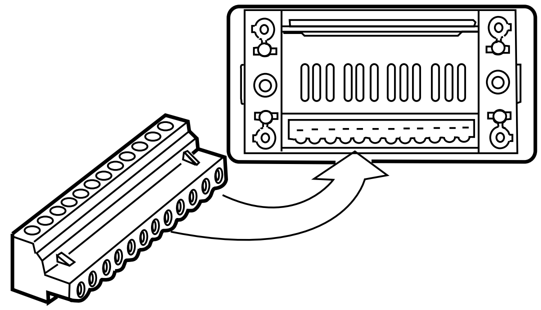
Set point #2 should be set at 95, alarm #2 set at "UP" and the relay set at "NE" for normally energized.

Removable Connector

A special two-piece removable connector is standard on the Hawk controller. This allows the unit to be removed from the wiring connections easily without the need to disconnect the signal input wires.

Attach the input signal and power supply to the screw terminal connector provided with the unit.

The screw terminal connector is attached to the mating connector on the back of the Hawk unit (see the diagram). Extra connectors are available at your Hawk authorized distributor.



Digital Outputs

There are four digital outputs available for the Hawk:

1) RS422 (serial)
2) BCD Open Collector (parallel)
3) BCD Open Collector w/ selection lines (parallel)
4) BCD Tri-State output (parallel)

Serial Outputs
The RS422 is a serial interface suitable for connecting the Hawk to personal computers, host computers or printers. The communications mode is asynchronous and mono-directional. This means that it is not possible to change the programming parameters of the Hawk directly from the computer. The data exchanged between the Hawk and the computer complies with ASCII standards. The RS422 connection must use a nine-wire shielded cable. Maximum length is 3937ft (1200m).

These connections are made to the upper connector on the rear of the Hawk. See the charts below for the pin connection call-outs, and the diagram after the charts for the terminal locations on the rear of the Hawk.

Specifications:
Baud Rate: 1200, 4800, 9600, 19200.
Format:
Data Bits: 7 or 8
Parity: Even, odd or none
Stop Bits: 1 or 2

RS422

Hawk I/O	Hawk-Computer connections	Computer I/O
Pin 1A CTS+	←	*
Pin 2A RTS+	→	*
Pin 3A TX+	→	RX+
Pin 4A RX+	←	TX+
Pin 1B CTS-	←	*
Pin 2B RTS-	→	*
Pin 3B TX-	→	RX-
Pin 4B RX-	←	TX-
Pin 5B SG	↔	SG

Inputs

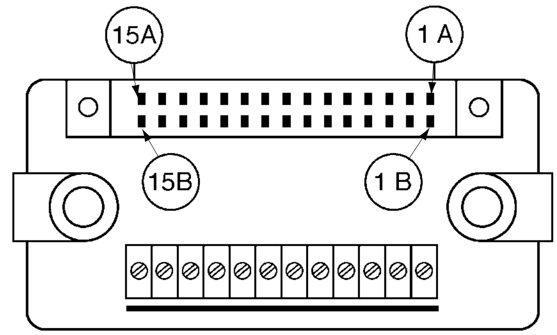
Min. Logic Levels	Max. Logic Levels
0 ≥ + 0.2V (diff)	0 ≤ + 12V (diff)
1 ≤ - 0.2V (diff)	1 ≥ - 12V (diff)

Termination Resistances : 100Ω ±10%

Outputs

Min. Logic Levels	Max. Logic Levels
0 ≥ + 1.5V (diff)	0 ≤ + 5V (diff)
1 ≤ - 1.5V (diff)	1 ≥ - 5V (diff)

* Control lines managed by the software, to enable the correct reception of the data transmitted from the Hawk.



CTS = Clear to send (computer ready to receive data)
RTS = Request to send (Hawk ready to transmit data)
TX = Transmit data (data transmission from Hawk)
RX = Receive data (data reception from computer)
SG = Signal ground

Note: The inactive lines are in the high logical status. All inputs/outputs are protected from short circuits. The serial output is isolated from the input variable signal (500VRMS) by means of optocouplers.

Digital Outputs (Cont'd)

BCD Outputs

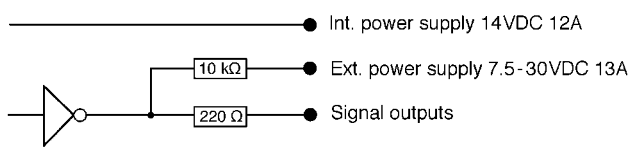
There are three kinds of BCD outputs available for the Hawk. On the three variants, the signal outputs are protected from short circuits and isolated from the input variable signal (500VRMS) by means of opto-couplers.

BCD Open Collector output signal

The connections for this output signal are to rows A and B of the upper-rear edge connector on the Hawk. All outputs are open collector types and the voltage level relating to 0 is ≤ 1.2 volts. The power supply for open collector outputs is applied to pin 13A. It can vary from 7.5VDC to 30VDC. With this function, it is possible to use the internal supply voltage (14VDC) by placing a jumper across pin 12A with pin 13A. This voltage will not be stabilized and it can drop to 7.5VDC. See the chart below for the appropriate pin call-outs, and the diagram below the chart for the resistance values of the external power supply and signal outputs.

Auxiliary Signals

Function	Pin	
Burn-Out	6A	
Overrange	7A	
Sign*	8A	*Negative = logical status 1
Underrange	9A	Positive = logical status 0
Ground	10A	
Internal Power supply V+	12A	
Ext. Open Coll. Pow. Supply V+	13A	



IOFF(Max) = 250µA @45°C
ION (Max) = 10mA

Digital Signal Outputs

Ist digit(lsd) Value	Pin	2nd digit Value	Pin	3rd digit Value	Pin	4th digit Value	Pin	5th digit(msd) Value	Pin
1	1B	10	1A	100	5B	1,000	9B	*10,000	5A
2	2B	20	2A	200	6B	*2,000	10B		
4	3B	40	3A	400	7B	*4,000	11B		
8	4B	80	4A	800	8B	*8,000	12B		

*These signals are present only in the HK45.

BCD Open Collector w/ Selection lines

This output is very similar to the other BCD Open Collector output except for the Enable commands. The digital signal output chart does not change, but the auxiliary signals chart changes as follows:

Auxiliary Signals

Function	Pin	
Burn-Out	6A	
Overrange	7A	
Sign*	8A	*Negative = logical status 1
Underrange	9A	Positive = logical status 0
Ground	10A	
Internal Power supply V+	12A	
Ext. Open Coll. Pow. Supply	13A	
Enable 1	13B	
Enable 2	14B	
Enable 3	15B	

The power supply is connected the same way with the same features. In addition, the digital signal outputs chart is exactly the same as the first BCD option. The only real changes are the addition of Enable commands.

The Enable commands (active low) allow you to select the group of data outputs indicated in the digital signal output table below.

Command	Data Group
Enable 1	Digit 1 and 2
Enable 2	Digit 3 and 4
Enable 3	Burn-Out, Under/Overrange, Sign, 5th digit*
	*Only for the HK 45

It is possible to reduce the number of lines of the parallel bus from 19 (for HK35) or 23 (for HK45) to 13. This is done by connecting (in parallel) the outputs of Digit 1 and 2 with the outputs of Digit 3 and 4, and with the outputs of Burn-Out, Underrange, Overrange and Sign (and the 5th digit if you are using a HK45). Each data group can be selected by means of three Enable lines and the ground line. It is possible to use all output lines (without data group selection) by connecting the three Enable commands to ground.

It is also possible to connect more than one instrument to an acquisition unit by means of a common bus. The connection between instrument and acquisition logic must be carried out by means of a shielded cable. Maximum length is 16ft (5m), maximum capacity is 100pF/m.

BCD Tri-State Output signal

Like the other BCD options, the output signals are connected to the upper rear connector on the Hawk. The main difference is that these outputs are CMOS type outputs. The voltage level relating to 0 is ≤ 1V; relating to 1 ≥ 3.5V. The digital signal outputs are connected to the same terminals as the other two types of BCD outputs (see the chart to the left).

Auxiliary Signals

Function	Pin	
Burn-Out	6A	
Overrange	7A	
Sign*	8A	*Negative = logical status 1
Underrange	9A	Positive = logical status 0
Ground	10A	
Enable 1	13B	
Enable 2	14B	
Enable 3	15B	

The Enable commands (active low) allow you to select the group of data outputs indicated in the digital signal output table below. It is possible to reduce the number of lines of the parallel bus for the BCD Tri-State outputs. This is done in the same manner as the BCD Open Collector w/ Selection Lines signal output.

Command	Data Group
Enable 1	Digit 1 and 2
Enable 2	Digit 3 and 4
Enable 3	Burn-Out, Under/Overrange, Sign, 5th digit*
	*Only for the HK 45

It is also possible to connect more than one instrument to an acquisition unit by means of a common bus. The connection between instrument and acquisition logic must be carried out by means of a shielded cable. Maximum length is 16ft (5m), maximum capacity is 100pF/m.

For information on connecting the Hawk to a printer or host computer, please call the factory. We have additional information we can fax or mail to you upon request.

Analog Outputs

There are five different analog output signals available in the Hawk:

1) 4-20mADC
2) 0-1VDC
3) 0-10VDC
4) 1mVDC / digit (HK35, HK40 & HK45 TC/RTD)
5) 0.1mVDC / digit (HK45 except TC/RTD)

The analog outputs are protected from short circuits (except the 4-20 mA). All of the connections referenced on the following chart are for the upper edge connector on the rear of the Hawk controller. Please note that pin 1A is on the extreme right, and 15A is on the extreme left. Also, when a Burn-Out, Overrange, or Underrange condition occurs (on the outputs relating to 6A, 7A, or 9A), a signal of 5 VDC is available. If none of these conditions occur, the signal is 0 VDC (typical values).

The following table shows the logic outputs for all the analog output variations.

Pin #	Logic Output
6A	Burn-Out (only for TC/RTD)
7A	Overrange
8A	Sign (steady at 0)
9A	Underrange
10A	Ground

The following table indicates the terminal points where the output signal emanates from.

Analog Output	Out +	Out -
4-20mADC	Pin 13A	Pin 14A
0-1VDC	Pin 12A	Pin 11A
0-10VDC	Pin 12A	Pin 11A
1mVDC/digit	Pin 12A	Pin 11A
0.1mVDC/digit	Pin 12A	Pin 11A

The diagram to the right shows the upper and lower terminals for connections.

The following tables show the relationship between the output signal and the displayed value.

4-20mADC:

$$I = (16/Hi-Lo) \times (RDG-Lo) + 4$$

I = Output current (mA)
Hi = Max. display value of the whole measuring range
Lo = Min. display value of the whole measuring range
RDG = Displayed value
Accuracy: ±0.25% of input ±0.01mA @25ºC
Temperature Drift: ±120PPM/ºC
Max. Load Resistance: 400Ω
Max. Output Current @5V: ≤0.7mA (Output ≥3.9V) Outputs 6A, 7A, 9A.
Max. Output Current @0V: ≤0.7mA (Output ≤0.8V) Outputs 6A, 7A, 9A.
Type of Isolation: By means of optocouplers
Isolation Voltage: 500Vrms (between input and output)

0-1VDC and 0-10VDC:

$$V = (RDG - Lo)/(Hi - Lo)$$

V = Output voltage (V)
Hi = Max. display value of the whole measuring range
Lo = Min. display value of the whole measuring range
RDG = Displayed value
Accuracy: ±0.20% of input ±0.01V @25ºC
Temperature Drift: ±80PPM/ºC
Min. Load Resistance: 10KΩ Output Resistance: ≤3Ω
Max. Output Current @5V: ≤0.7mA (Output ≥3.9V) Outputs 6A, 7A, 9A.
Max. Output Current @0V: ≤0.7mA (Output ≤0.8V) Outputs 6A, 7A, 9A.
Type of Isolation: By means of optocouplers
Isolation Voltage: 500V rms (between INPUT and OUTPUT)

1 mVDC / digit:

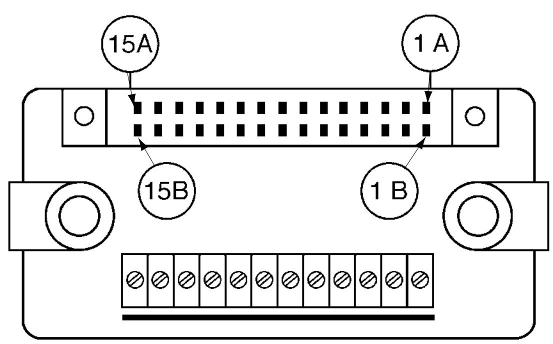
$$mV = RDG \times (\text{number of digits})$$

mV = Output voltage (mV)
RDG = Displayed value
For example, if the displayed value corresponds to 100.0%, the output voltage is 1000mV (1V).
Accuracy: ±0.20% of input ±0.01V @25ºC
Temperature Drift: ±80PPM/ºC(HK 35), ±120PPM/ºC (HK40 & HK45 TC/RTD)
Min. Load Resistance: 10KΩ
Max. Output Current @5V: ≤0.7mA (Output ≥3.9V) Outputs 6A, 7A, 9A.
Max. Output Current @0V: ≤0.7mA (Output ≤0.8V) Outputs 6A, 7A, 9A.
Type of Isolation: By means of optocouplers
Isolation Voltage: 500Vrms (between input and output)

0.1 mVDC / digit:

$$mV = (RDG / 10) \times (\text{number of digits})$$

mV = Output voltage (mV)
RDG = Displayed value
Accuracy: ±0.20% of input ±0.001V @25ºC
Temperature Drift: ±80PPM/ºC
Min. Load Resistance: 10 KΩ Isolation Voltage: 500V rms
Max. Output Current @5V: ≤0.7mA (Output ≥3.9V) Outputs 6A, 7A, 9A.
Max. Output Current @0V: ≤0.7mA (Output ≤0.8V) Outputs 6A, 7A, 9A.
Type of Isolation: By means of optocouplers
Resolution: 12 Bit Output Resistance ≤3Ω
Isolation Voltage: 500Vrms (between input and output)
The signal outputs are protected from short circuits.



Formula

Relationship between rotational speed, frequency, and number of pulses/revolution
This relationship uses the following formula:
RPM = (F*60)/N

Relationship between linear speed, frequency, and number of pulses/revolution.
This relationship uses the following formula:
V = (RPM * S)/60

Where:
RPM = revolutions per minute (rotational speed)
F = input frequency of the instrument in Hz
N = pulses per revolution generated by the proximity switch, corresponding to COGS.
V = linear speed in mm/s, cm/s, or m/s, corresponding to the displayed value.
S = Linear development of capstan circumference per revolution

Formula (Cont'd)

Note that the following formulas can be derived:
F = (RPM*N)/60 N = (F*60)/RPM

It is advisable to check that the minimum and maximum frequency generated by the transducer be within the frequency range of the Hawk controller. This range is 15Hz to 150KHz, or 2Hz to 200Hz depending on the range selected when ordering the controller.

To have the highest resolution, the following relationship has to be maintained: {(Hi-Lo) / (HiE-LoE)} $\leq$N.

Where:
HiE and LoE = the input range
Hi and Lo = the display span

Application Example

An operator wants to indicate the speed of a conveyor belt in feet/min. Underspeed and overspeed alarms are required if the speed of the conveyor falls below 175ft/min or exceeds 325ft/min. A proximity switch is used to sense a gear, with 30 cogs, coupled to a conveyor drive. The shaft speed rating is 500-1500 rpm and the circumference of the capstan is measured to be 15 feet.

The minimum and maximum input frequency can be determined as follows:

$$F = \frac{RPM * N}{60}$$

Fmin = (500 * 30)/60 = 250Hz
Fmax = (1500 * 30)/60 = 750Hz

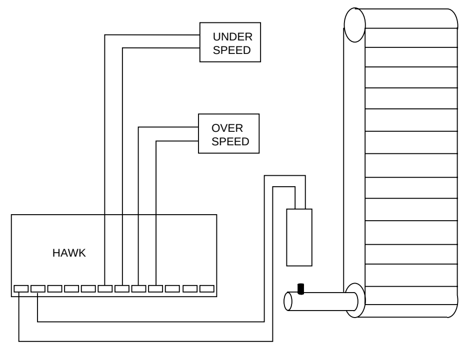
Also, the minimum and maximum linear speed of the conveyor can be determined:

$$V = \frac{RPM * S}{60}$$

Min. linear speed = (500 * 15) / 60 = 125 fps
Max linear speed = (1500 * 15) / 60 = 375 fps

A Simpson Hawk Tachometer controller (Type D, 15Hz to 150 KHz) with dual relays will fit the application requirements. The 15Hz - 150KHz version is needed because the Fmax exceeds the 2 Hz- 600 Hz range of the other version.

The controller is wired per the diagram, and programming is accomplished as follows:



Basic Programming Steps

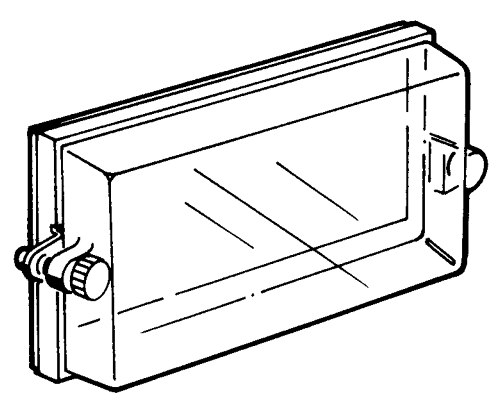
dp	1111
COGs	30
Loe	500
Hie	1500
Lo	125
Hi	375
SP1	175
up/dn	dn
hys	0
del	0
nD/nE	nE
SP2	325
up/dn	up
hys	0
del	0
nD/nE	nE

NEMA 4 Cover

An optional NEMA 4 cover is available for use with all Hawk series controllers. This cover will help protect the controller in wash-down environments where water and dust are present. The cover has two gaskets and is mounted on the panel where the meter will be mounted.

This cover can be removed from the panel, exposing the meter front, by using the two screws on the left and right of the cover. When the bezel of the Hawk is exposed, the programming buttons can be accessed. This allows quick display scaling and decimal point selection without having to remove the meter from the panel.

Catalog # 45003



Ordering Information

Basic Unit — **Power Supply** — **Range** — **Output Signal** — **Relays** — **Excitation**

Basic Unit

HK 40	4 digit

Power Supply

1	110/220VAC
2	24/48VAC

Range

Tachometer A 2-30 VRMS

1110	2-600 Hz
1120	15-150 KHz

Tachometer B 8.2 VDC / 1 KΩ

1210	2-600 Hz
1220	15-150 KHz

Tachometer D On/Off

1310	2-600 Hz
1320	15-150 KHz

Output Signal

0	None
1	4-20mA
2	0-1V
3	1mV/digit
6	RS 422
7	BCD Open Col.
8	BCD TRI-STATE
9	BCD O.C. W/ SEL. LINES
A	0-10V

Relays

0	None
1	One
2	Two

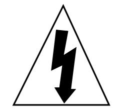
Excitation

0	Standard:

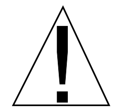
Type A	24V
Type B	8.2V
Type D	24V

NEMA 4 Cover : Catalog # 45003

Safety Symbols



The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury.



The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly adhered to, could result in damage to or destruction of part or all of the instrument.

Engineer's Notes

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