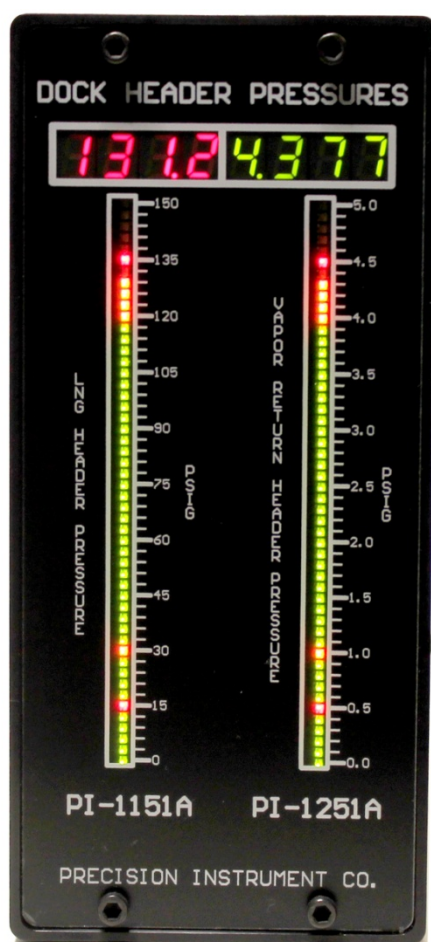


2014

P9000 Series Software Command set



P9224 Series



P350 Series

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Precision Instrument Co.

Version Control

<i>Software Version</i>	<i>Release Date</i>	<i>Changes Made</i>
<i>1.0</i>	<i>June 2014</i>	<i>Initial Release</i>
<i>2.0</i>	<i>Dec 2014</i>	<i>Added analog input functionality</i>

Command set for P9000 Software

Power on

Perform lamp test (all segments on) and read eeprom data/checksum, compare. If good then use stored settings. If not good, retry read up to 3 times to insure corruption

After 4 unsuccessful reads force unit to default mode CA=001, CB=9600, CI=100, mode PI bus, CR=OFF, CT=0 then display Err1 on numeric LED's. For the Bargraph settings, DT=1, DP=3, BM=E, BS=0, BE=0.1, BC=A, BC=N, BA=OFF, BO=D, AC=N, ACn=A for all four alarms and A1-A4 values are all set to 0.

If checksum match is successful, turn on all DP's to indicate a power on state. Note this will be affected by the CT command below if no data is received within the timeout period

Commands (General for device)

Commands are not case sensitive and are always terminated by <cr> <lf> pair (enter key)

CA change address (example 001ca123<cr> <lf>) new address is now 123

The address shall be 3 alpha-numeric characters in length

In addition to the units set address, the unit shall respond to an address of 000

CB change baud rate (example 123cb9600<cr> <lf>) new baud rate is now 9600 baud

The baud rates supported are 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200

Use standard 8N1 (8 data bit, no parity, 1 stop bit)

CD display string (example 123cd23.45<cr> <lf>) unit will display 23.45 on the LED's. The displayed range is -19999 to 99999 and is always right justified. All decimal points are able to be turned on. For the minus sign, use segment G of the digit to the left of the numbers being displayed.

CI change intensity (example 123ci100<cr> <lf>) sets intensity to maximum brightness

The intensity range is 0 to 100 percent brightness 0=display off, 25=1/4 brightness, 50=1/2 brightness, 100=max brightness. Intensity is controlled through PWM from the micro-controller or from an external TTL level, 10 KHz PWM input.

If ordered with the DC voltage input intensity control option, you can change between external or serial input control with the commands CIA and CIS. CIA sets external voltage control input and CIS sets serial input control. The DC Voltage input accepts levels up to 30VDC (minimum VDC input span is 4VDC) and can be calibrated to your specific range. Calibration is simple by following these 3 steps.

Send the CIA command (example 123cia<cr> <lf>) This places the unit in analog intensity control.

To calibrate minimum intensity level, apply your minimum voltage level and send the command CIL (example 123cil<cr> <lf>)

To calibrate the maximum intensity level, apply your maximum input voltage (do not exceed 30VDC) and send the command CIH (example 123cih<cr> <lf>)

Your display intensity level will now be calibrated to your voltage input. Remember to send the SC command to save your changes.

If ordered with PWM intensity control input, send the command CIP<cr><lf>. Input level is TTL (5V) and frequency response range is 200Hz to 20KHz. PWM cutoff is 0-5% and 95-100% so a PWM input of 5-95% represents display turned off to full brightness.

CM (future possibility) change communication mode (example 123cm1<cr> <lf>) set unit for mode 1.

Mode 1= PI comm., mode 2=Modbus/ASCII comm., mode 3=Modbus/RTU comm., mode 4=Fieldbus comm

CR turn on/off retransmit of incoming data (example 123cr0<cr> <lf>) turns off retransmit

Modes are 0 (off) and 1 (on). When turned on, the device will echo all incoming characters to the uart output

CT changes timeout value (example 123ct0<cr> <lf>) sets timeout to off

The timeout range is 5, 10, 15, 20 seconds. Set to 0 to turn off this function

This timeout is used for loss of communications. If host device does not update this device with new data within the set timeout duration then print err2 on display until new data is received.

DT Display type configuration. We currently support two different display types.

Type 0 is a single 4 digit numeric and a single 51 segment bargraph with LED1 starting at bottom

Type 1 is a single 4 digit numeric and a single 101 segment bargraph

Type 2 (possible future addition) is a dual 4 digit numeric and dual 51 segment bargraph

Type 9 is a single 4 digit numeric and a single 51 segment bargraph with LED1 starting at top

(example 123dt0<cr> <lf>) sets device to display type 0 per above

SC saves changes and new checksum to eeprom (example 123sc<cr> <lf>)

STAnnn Serial Transmission of Analog. Sends “n” number of readings out the serial port. Useful for logging data digitally and calibration of unit during initial set up. Values are 1-255

(example 123sta5<cr> <lf>) after receiving this command, the unit will send you 5 consecutive input readings

Commands (Specific for display control)

Numeric (digital) Display

DPn Displayed precision (decimal point) n=0-4, 0=xxxxx., 1=xxxx.x, 2=xxx.xx, 3=xx.xxx, 4=x.xxxx

On the P9224 and P350, the MSD is not used so only 0-3 would apply

(example 123dp2 <cr> <lf>) sets the numeric display decimal point to xx.xx

Bargraph settings

BMn n=E or C Bargraph mode, BME=End start, BMC=Center start. Commands bargraph to start at end (LED1) or at center (LED51) and fill accordingly.

(example 123bmc<cr> <lf>) sets bargraph mode to center

BSnnnnn (nnnnn=numeric number) Bargraph start value, number at which bargraph will begin to illuminate at (example 123bs50<cr> <lf>) sets bargraph to begin filling at a value of 50. Values below 50 will only have the very first bar illuminated and values between 50 and BE number (see below) will illuminate the bar accordingly.

BEnnnnn (nnnnn=numeric number) Bargraph end (full scale value), number at which bargraph will top off at (example 123be150<cr> <lf>) sets the bargraph end value to 150. Value above 150 will force the entire bar to be turned on. Setting BS to 50 and BE to 150, the bar will be 50% turned on with a value of 100

BCn, n=(r,g,a) Bargraph normal color, BCR (red), BCG (green), BCA (amber)

(example 123bcg<cr> <lf>) sets bargraph color to green during normal operation

BCn, n=(n,y) Bargraph color changing. BCN=no color change, BCY=yes color change to limit color

(example 123bcy<cr> <lf>) sets bargraph to change color when the limit has been reached. The entire illuminated portion of the bargraph will change to the programmed limit color per the command set A1-A4 detailed below

BO_n, n=(r,g,a,d) Sets the color of the off segments of the bargraph so the value being measured can be displayed as one color and the rest (background) in a separate color. Useful for displaying water/steam in boilers or pressure vessels.

(example 123bor<cr> <lf>) Once set, if the bargraph normal color (BC_n above) is set to Green, the displayed value will turn on in green color, the remainder of the bargraph in red color. To turn off this feature, set BO to d.

AC_n, n=(n,y) Alarm color changing. ACN=no color change, ACY=yes color change.

(example 123acy<cr> <lf>) sets bargraph to change color at the preprogrammed alarm values. Similar to BC_n command above except only the portion of the bargraph beyond the alarm value changes color, not the entire bargraph.

BA_{nn} Turn on or off bargraph Alarm (limit) markers BA_{on}, BA_{off}

(example 123baon<cr> <lf>) turns on the alarm markers for the bargraph. When enabled, the appropriate bargraph segment will be turned on to indicate the alarm value location relative to the bargraph

Alarm (limit) Color for bar

Sets color of limit markers on bargraph display

AC_{nx}, n=1, 2, 3, 4, x=R, G, A, D. Change limit 1-4 color to Red, Green, Amber or off (D)

(example 123ac4r<cr> <lf>) sets bargraph alarm color for limit A4 (hi-hi limit) to red

Limits (color changing)

Limit commands are A1, A2, A3, A4 (Alarms). Will eventually be tied to relay outputs in next phase

Anyyyy A= limit command, n=limit number (1-4), yyyy=value of limit

A4=Hi-Hi limit

A3=Hi limit

A2=Low limit

A1=Low-Low limit

(example 123a4140<cr> <lf>) sets alarm 4 limit to a value of 140. If displayed value is equal or greater than 140 then bargraph may change color if bc command is set to y. If relay outputs are installed, A4 relay will change state as well (+/-hysteresis value). Note order of operation for alarms; A4>A3, A3>A2, A2>A1. Unit will not allow an A1 value greater than an A2 value

Commands (Specific for Analog Input control)

AD_{nnn} Analog input enable (Turns on or off the A/D converter)

(example 123adon<cr><lf>)

This command gives you control over the A/D converter allowing you to turn it on or off. Commands are adon and adoff

AV_n Averaging the Input Signal (Reduces unwanted noise)

(example 123av40<cr> <lf>)

Averaging command is AV_n where n=0 to 255. The averaging method is a running average where the oldest reading of the group “n” is discarded and the newest reading is integrated into the group. Under normal conditions, a value of 40 for “n” is sufficient however for faster response times this may be reduced. If the signal has a large amount of fluctuations that you wish to suppress you may increase this up to a maximum of 255.

DBn Dead Band (Interacts with the Averaging command above)

(example 123db10<cr><lf>)

This command is very similar to the Dead Band implemented into contact closure outputs years ago. It interacts with the A/D converters averaging command in order to provide a quick step response to a real change in the signal input as opposed to system noise. The Dead Band will reset the averaging to zero if a value is received that exceeds its threshold and then return the averaging back to the original setting so you have an adjustable smart filtering system. The value for “n” is in direct displayed units. If your unit is scaled from 0-500 for example and you’re not concerned with a small change of 5, you can set DB to 5 and if you suddenly get a change in signal that exceeds 5, it will track the signal quickly and once stabilized will re-enable the averaging

LN<0-15> (Linearization and Math Functions)

(example 123ln5<cr><lf>)

This command gives you the ability to linearize your input signal. You have a selection of 18 different types of linearization features as follows

0 = No linearization is enabled, display reads 1:1 with the interpretation of the X-Y calibration table

1 = user polynomial as you sent to this device, uses a polynomial you created up to 9th order for linearization

2 = square root extraction, extracts the square root of the original displayed value on the display

3 = log (Base10), computes the log10 values of the original displayed reading

4 = anti-log (Base 10), computes the anti-log Base10 value of the original displayed reading

5 = RTD PT100, 0.00385 Curve per ITS-90 Standard, compensates for non-linearity’s of the sensor

6 = RTD PT100, 0.00392 Curve per ITS-90 Standard, compensates for non-linearity’s of the sensor

7 = RTD PT1000, 0.00285 Curve per ITS-90 Standard, compensates for non-linearity’s of the sensor

8 = RTD NI120, 0.00672 Curve per ITS-90 Standard, compensates for non-linearity’s of the sensor

9 = RTD CU10, 0.00427 Curve per ITS-90 Standard, compensates for non-linearity’s of the sensor

10 = Type J Thermocouple Curve per ITS-90 Standard, compensates for non-linearity’s of the sensor

11 = Type K Thermocouple Curve per ITS-90 Standard, compensates for non-linearity’s of the sensor

12 = Type N Thermocouple Curve per ITS-90 Standard, compensates for non-linearity’s of the sensor

13 = Type E Thermocouple Curve per ITS-90 Standard, compensates for non-linearity’s of the sensor

14 = Type R Thermocouple Curve per ITS-90 Standard, compensates for non-linearity’s of the sensor

15 = Type S Thermocouple Curve per ITS-90 Standard, compensates for non-linearity’s of the sensor

16 = Type T Thermocouple Curve per ITS-90 Standard, compensates for non-linearity’s of the sensor

17 = Type B Thermocouple Curve per ITS-90 Standard, compensates for non-linearity’s of the sensor

TCx (Temperature Units)

(example 123tc0<cr><lf>) Sets temperature conversion to degrees C

valid “x” values are 0, 1 and 2

This command is for Temperature Conversion to direct units in degrees Centigrade, Fahrenheit or Kelvin.

0=C, 1=F, 2=K

Use this to set the desired displayed temperature after setting up the linearization

UPx y (User Polynomial Input)

(example 123up1 0.099073e-12<cr><lf>) Sets your polynomial coefficient #1 to 0.099073 e-12. Coefficients are processed in the following order $Y = X_9Y^9 + X_8Y^8 + X_7Y^7 + X_6Y^6 + X_5Y^5 + X_4Y^4 + X_3Y^3 + X_2Y^2 + X_1Y + X_0$

25 Point X-Y table input, Ux and Uy commands

(example 123ux0 0<cr><lf>)

This is a user table input feature allowing you to input up to 25 X and Y coordinates to create your own 25 point linearization. This is also used to calibrate the device to your engineering units. For example, if your input signal is 4-20mADC and you wanted to display 0-300 on the numeric display you would send the following four command strings. **The space is required between the command and your value.**

123ux0 0.004<cr><lf>

123uy0 0<cr><lf>

123ux1 0.020<cr><lf>

123uy1 300<cr><lf>

Both Ux and Uy have a range of 0-24 entries. The values for “x” are in direct input of volts or amps units. If setting for milli-volt input then your value would be 0.050 for “x” as an example for 50mV from a shunt. For mA it would be 0.004 for 4mA and 0.020 for 20mA. If you are sending a 1-5V or 0-10V signal it would be 5 and 10 respectively for the full scale value

Analog input board for DC signals



Excitation	SW2
5VDC	3&5
10VDC	2&3
12VDC	3&6
24VDC	1&6
mADC	3&4



Caution!

Disconnect both power and signal before changing switch settings.

Excitation control by SW2

Range selection using SW1
Close only the switches as shown in the two tables

Input Type	SW1	Xc	Xg	Xi	Xt	LN
50mVDC	4&5	0	3	0	Off	
200mVDC	4&5	0	1	0	Off	
5VDC	3	1	5	0	Off	
10VDC	3	1	4	0	Off	
20VDC	3	1	3	0	Off	
200VDC	3	1	1	0	Off	
20mADC	4, 5 & 6	2	0	0	Off	
50mADC	4, 5 & 7	3	0	0	Off	
3ADC	4, 5 & 8	4	2	0	Off	
RTD PT100, SW2 #3&4 Closed	4&5	5	1	2	Off	5-6
RTD PT1000, SW2 #3&4 Closed	4&5	6	1	1	Off	7
RTD 120 ohm NI, SW2 #3&4 Closed	4&5	5	1	2	Off	8
RTD 10 ohm CU, SW2 #3&4 Closed	4&5	7	3	3	Off	9
Thermocouple (J, K, N, E)	1, 4&5	8	2	0	On	10-13
Thermocouple (R, S, T)	1, 4&5	8	4	0	On	14-16
Thermocouple (Type B)	1, 4&5	8	4	0	On	17
Strain Gage (1mV/V) Based on 10V Ex	4&5	9	5	0	Off	
Strain Gage (3mV/V) Based on 10V Ex	4&5	9	3	0	Off	
Strain Gage (5mV/V) Based on 10V Ex	4&5	9	3	0	Off	
Strain Gage (10mV/V) Based on 10V Ex	4&5	9	2	0	Off	

Xc=Factory cal select, Xg=recommended gain setting, Xi=Constant Current for resistance input, Xt=cold junction compensation, LN=Linearization

XCn, n=(0-16) Load factory calibration values to be used for different inputs per table above

(example 123xc0<cr><lf>) Loads the calibration coefficients for the 50mVDC input range

XGn, n=(0-7) Sets up the programmable gain amplifier

(example 123xg5<cr><lf>) sets the input gain to 32

XIn, n=(0-3) Sets up the programmable current source

used for resistance measurements. You have a selection of 0mA, 0.25mA, 0.50mA and 1.50mA

(example 123xi2<cr><lf>) sets the current source 0.50mA

Gain	Register
1	0
2	1
4	2
8	3
16	4
32	5
64	6
128	7

Iout	Register
0	0
0.25	1
0.50	2
1.50	3

Iout in milli-amps

XTnn, n=(on / off) Changes the temperature cold junction compensation effect.

(example 123xton<cr> <lf>) Turns on the cold junction compensation in order to cancel out errors from the thermocouple wire to terminal block connection. This command should only be used if the unit is going to be measuring temperature from a thermocouple probe.

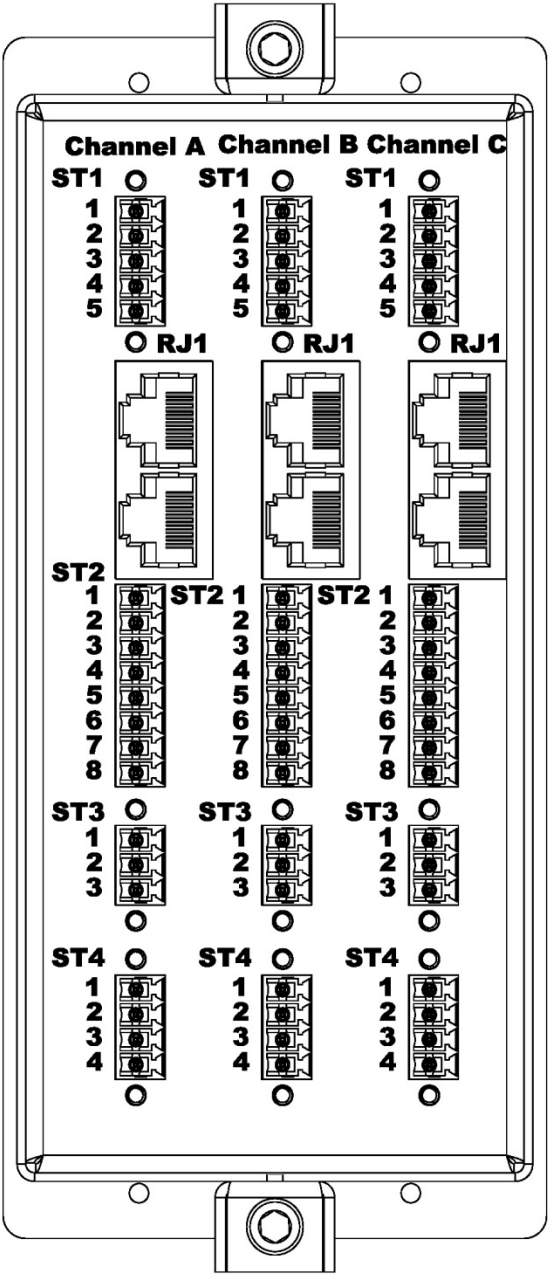
Table of commands

Command	Arguments	Description
A<n><m>	n = 1-4, m = floating point value	Sets Alarm 1 through Alarm 4 value
AC<n><c>	n = 1-4, c = r, g, a, d	Sets Alarm limit color to red, green, amber or none
AC<y/n>	yes or no	Alarm limit color changing
AD<on/off>	on or off	Analog input enable
AV<n>	n=0-255	Running average samples
BA<on/off>	on or off	Alarm limit markers on or off
BB<m>	m = floating point value	Sets value at which bar will go up or down when in BMC (center) mode. <m> must be between BS and BE value
BC<c>	c = r, g, a, d	Changes the bargraph color
BC<y/n>	Y or N	Bargraph change to limit color on or off
BE<m>	m = floating point value	Bargraph end value
BM<n>	n = e, c, t	Bargraph mode of bottom to top, top to bottom or bidirectional
BO<c>	c = r, g, a, d	The color of the unlit segments of the bargraph
BS<m>	m = floating point value	Bargraph start value
CA<s>	S = 3 byte ASCII string	Changes the address
CB<n>	N = 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200	Changes the baud rate
CD<m>	m = floating point value or ASCII string	Changes displayed value
CI<n>	n = 0 - 100	Display Intensity
CM<n>	n = 1	1 = PI communications mode
CR<n>	n = 0, 1	0 = unit does not echo, 1 = unit will echo incoming characters
CT<n>	n = 0 – 250	Timeout value in seconds before display error occurs
DB<n>	n=0-99999	Dead Band for running average, set in engineering units
DP<n>	n = 0 - 4	Decimal location
DT<n>	n = 0, 1, 2, 9, P	Display type
LN<n>	n=0-15	Enables linearization for different sensor types
RS	none	Resets unit to last SC command saved state
RD	none	Resets unit to Default mode as if eeprom read was bad and lights up all the decimal points only, no ERR1 on the numeric display. <i>Note: This will erase all of your current settings if you follow with an SC command.</i> To undo, cycle power to the unit.
SC	none	Saves user parameters to EEPROM
STA<n>	n=1-255	Transmits analog input readings out the serial port
TC<n>	n=0-2	Changes temperature units to degrees C, F or K
UX<n><m>	n=0-24, m= -999999 to +999999	Sets user table “X” value
UY<n><m>	n=0-24, m= -999999 to +999999	Sets user table “Y” value
XC<n>	n=0-16	Changes calibration coefficients to be used, see table
XG<n>	n=0-7	Changes gain in the programmable gain amplifier, see table
XI<n>	n=0-3	Changes constant current source for resistance input, see table
XT<on/off>	On or off	Enable or disable cold junction compensation

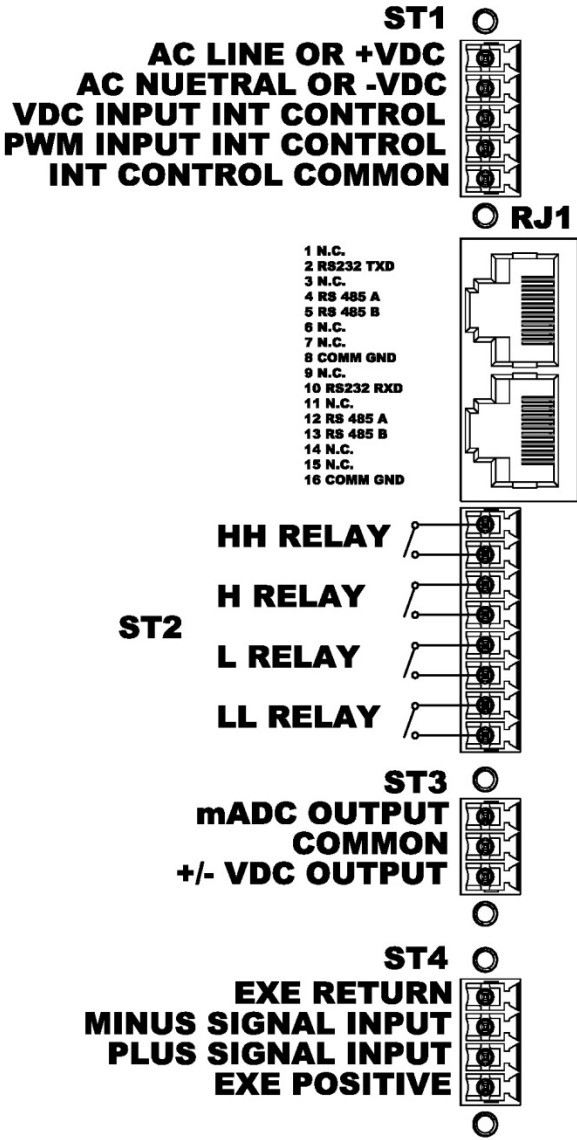
Master connection diagram for P350 series

REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED

P350 REAR VIEW



TERMINAL DESCRIPTION
(TYPICAL FOR EACH CHANNEL)

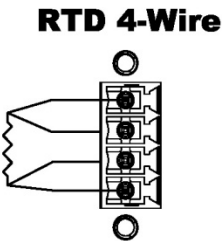
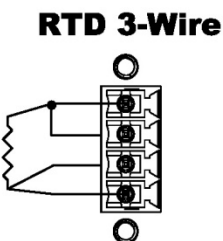
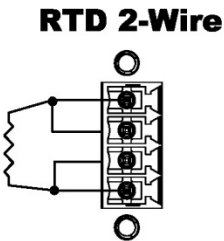
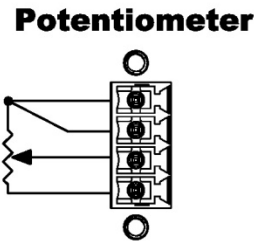
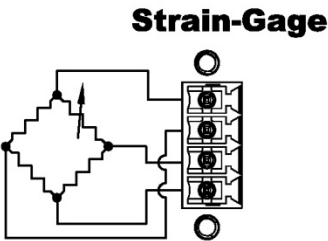
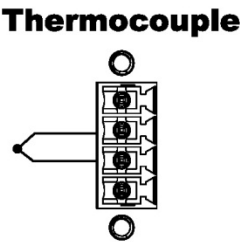
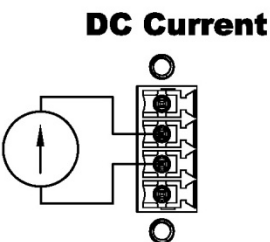
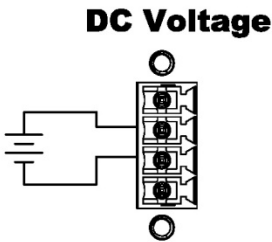


SCALE 1 : 1

DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1994 IN INCHES: X ± .05 XX ± .02 XXX ± .007 ANGULAR ± 1/2 °		PRECISION INSTRUMENT CO	
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ORIGINATOR: OTTO FEST ENGINEER: OTTO H FEST PROJECT ENGINEER: OTTO H FEST		DRAWING NUMBER AND REVISION: P350 connection diagram.dwg	
SIZE B		SCALE 1:2	SHEET 1 OF 1

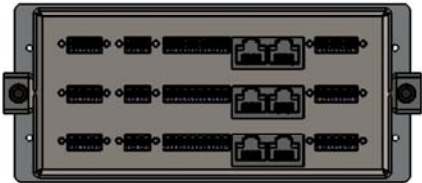
DC input type connection diagram for P350 series

REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED

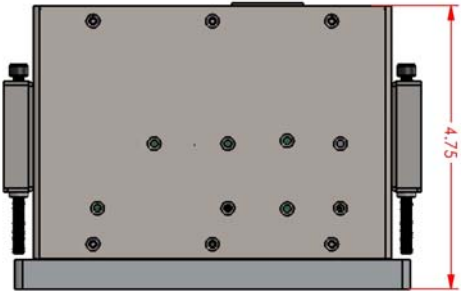


DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1994 IN INCHES: X ± .05 XX ± .02 XXX ± .007 ANGULAR ± 1/2 °		PRECISION INSTRUMENT CO	
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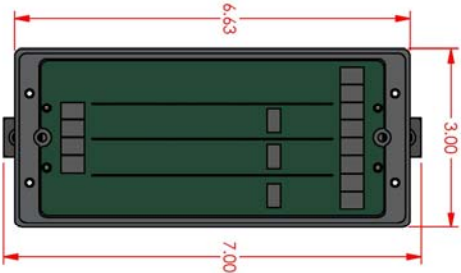
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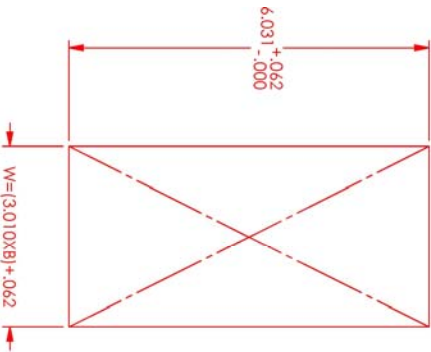
REAR VIEW



SIDE VIEW



FRONT VIEW



PANEL CUTOUT

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DATE & DATE

DIMENSIONS AND TOLERANCES PER ANSI Y14.5M-1994 FINISHES: X ±.05 XX ±.02 XXX ±.01 ANGULAR ±.12°		THIRD ANGLE PROJECTION 	
TITLE P350		PRECISION INSTRUMENT CO	
DRAWING NUMBER AND REVISION: P350 DS REV. 1.0		SHEET 1 OF 1	

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REVISIONS			
ZONE	REV.	DESCRIPTION	DATE



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PATH & DATE:

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THIRD ANGLE PROJECTION		3RD ANGLE X .005 XX .003 XXX .010 ANGLE/IN $\pm 1/2^\circ$	
			
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BOB L INCOMPTE SEE B1	SCALE 1/2 SHEET 1 OF		