PRECISION INSTRUMENT COMPANY

2019

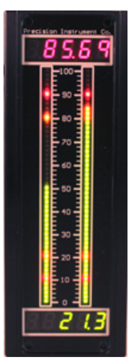
P9000 Series Software Command set, Mechanical and connection diagrams

P9224 & T9224 Series 2 ¼” Square

PB40 Series 4 ½” Square

P350 Series Dual Bargraph

P180 Series 6” Single Bargraph



P180 Series 6” Dual Bargraph

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Version Control

Firmware Version	Release Date	Changes Made
1.0	June 2014	Initial Release
2.0	Dec 2014	Added analog input functionality
2.0.1	Apr 2016	Added analog output and relay control
2.1	July 2016	Added models P180 and PB40 bargraphs
2.2	Feb 2017	Added second A/D input, improved A/D health routine, changed CJC sensor
2.3	Aug 2017	Added functionality for Hz signal conditioner
2.3	Oct 2018	Added MIL-PRF SSR board information
2.5	Mar 2019	Added MODBUS and clarified AC RMS option

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.

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 is a single 5 digit numeric and a single 51 segment bargraph
Type 3 is a single 5 digit numeric and a single 101 segment bargraph
Type 9 is a single 4 digit numeric and a single 51 segment bargraph with LED1 starting at top (P9224 only)

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

GF This command gets floating point readings and transmits the 4 BYTE value, representing the floating point number.

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

BOn, 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 (BCn 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.

ACn, 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 BCn command above except only the portion of the bargraph beyond the alarm value changes color, not the entire bargraph.

BAnn Turn on or off bargraph Alarm (limit) markers BAon, BAoff
(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

ACnx, 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). These limits are used to control mechanical or solid state relays if ordered

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)

ADnnn Analog input enable (Controls input type, adon, adoff, adhz)
(example 123adon<cr><lf>)
This command gives you control over the input type, allowing you to turn the analog input on, off or change it to frequency input (adhz command). Commands are adon, adoff and adhz

AVn Averaging the Input Signal (Reduces unwanted noise)
(example 123av40<cr> <lf>)
Averaging command is AVn 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.
Sending DBa puts the unit into an automatic dead band setting that changes based on the input frequency.

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, 0.00385 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

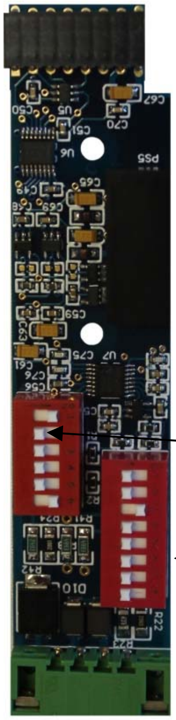
UPx y (User Polynomial Input)

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

PGA Settings

Iout	Register
0	0
0.010	1
0.050	2
0.100	3
0.250	4
0.500	5
1.000	6
1.500	7

Excitation Current
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.

Analog input board for AC True RMS Signals

The AC Volts and Amps True RMS input option uses a high accuracy RMS-DC converter with a purely resistive input attenuator to set the appropriate range. Use the table below to select your input range and the GUI to configure the units scaling.

Input Range	SW1	Xc	Xg
200 mVAC	8	0	0
2 VAC	1 & 8	1	0
20 VAC	2 & 8	2	0
200 VAC	3 & 8	3	0
500 VAC	4 & 8	4	0
1 Amp AC	6	5	0
5 Amp AC	7	6	0

Commands (Specific for Analog Output control)

DCn, n=C / V Selects the analog output you will be using V=Voltage out, C=Current out (example 123dcc<cr> <lf>) sets the unit to use the current output calibration coefficients for maximum accuracy. Note that both outputs are always active and will track each other however only the output selected with this command will have the specified accuracy. The other output can be ignored if desired.

DX (0-9)<##> Selects the calibration slope of the analog output x-y table. You can have a simple linear output with only two break points or create a slope with up to 10 break points. The 0-9 are the break points, the ## is the value being displayed.

DY (0-9)<##> Selects the calibration slope of the analog output x-y table. You can have a simple linear output with only two break points or create a slope with up to 10 break points. The 0-9 are the break points, the ## is the value desired output in either volts or mill-amps based on the DC command above.

Commands (Specific for Relay output control)

AR (1-4)<##> Sets the relay output delay in 100 millisecond increments. The (1-4) is the relay number which is the same as the alarm number

4=Hi-Hi limit

3=Hi limit

2=Low limit

1=Low-Low limit

The <##>, when set to 0 will have no delay, a setting of 1 will have a 100 millisecond delay, a setting of 10 will have a 1 second delay (1000 milliseconds)

AH (1-4)<##> Sets the hysteresis for each relay to avoid relay chatter when the process variable is near or at the alarm set point. The (1-4) is the relay number which is the same as the alarm number

4=Hi-Hi limit

3=Hi limit

2=Low limit

1=Low-Low limit

The <##>, when set to 0 will have no hysteresis and a setting of 5 will have 5 counts of hysteresis above and below the alarm value.

Mechanical and Solid State relay outputs

Quad 5-amp rated relay board

Dual MIL-PRF-28750 SSR board

The quad relay board has each relay, 1-4, permanently connected to each alarm setting A1-A4.

On the dual SSR relay board, you can connect SSR1 and SSR2 to any of the four alarms by means of a mini-link jumper installed at JP1 and JP2. The board has white silkscreen next to each pair of pins, designating the alarm which will trip the relay (A1-A4).

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<xx>	Hz, on or off	Analog input selection
AR(n)<#>	N=1-4, # = 0-120,000	Alarm Relay delay in 100 millisecond increments
AH(n)<#>	N=1-4, # = -1,000,000 to 1,000,000	Alarm Relay Hysteresis in Counts
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 or A	Dead Band for running average, set in engineering units or automatic for Hz inputs
DC<n>	n=c, v	Selects current or voltage output calibration coefficients
DX<n><#>	n=0-9, # =	Analog output X point table
DP<n>	n = 0 - 4	Decimal location
DT<n>	n = 0, 1, 2, 9, P	Display type
DY<n><#>	N=0-9, # =	Analog output Y point table
GF <cr>	Float	Get floating point and transmit the value
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. *Note: This will erase all of your current settings if you follow with an SC command*. 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
VR	None	Returns the firmware version of the units code
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

Commands (For ModBus versions)

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

AE<#>, this command sets the end address for Master Mode

AS<#>, this command sets the start address for Master Mode

AU<#>, this command sets the unit (slave) address

CA<address>, this command is the same as the main processor, “change address” this is not the modbus address

CB<baud>, this command is the same as the main processor, “change baud”

CM<1,2,3,4>, communications mode 1 = normal ascii proprietary command set, 2 = slave, 3 = sniffer, 4 = master

CCR<0,1>, turns echo for modbus processor on or off. This is for debugging, leave it off for modbus applications as it isn’t part of the modbus protocol to echo characters.

CRD<cr>, defaults the modbus processor

CVR<cr>, modbus processor code version

IF<0,1>, int or float as the incoming or outgoing data type. 0 = integer, 1 = float

MR<#>, modbus register to be written to in sniffer and master mode. Register 23 is reserved and cannot be used.

RO<0,1>, register order 1,2,3,4 or 2,1,4,3. 0 = 1,2,3,4 ; 1 = 2,1,4,3.

RS<cr>, reset both processors

SC<cr>, write both processors

TT<#>, transmit or receive poll timer

UA<0,1>, get analog value from main processor

MODBUS code and command Summary.

Register Mapping

For simplicity the memory mapping is repeated for the 4 different MODBUS memory spaces. The memory map is shown below.

Register Number	Register Address (Hex)	Variable function
1	0x00	32 bit Floating Point Value to be displayed in Slave and Sniffer Mode
3	0x02	32 bit Floating Point Value of channel 1 A/D reading updated in Slave and Master Mode
5	0x04	32 bit Floating Point Value of channel 2 A/D reading updated in Slave and Master Mode
7	0x06	16 bit Signed Integer value to be displayed in Slave and Sniffer Mode
8	0x07	16 bit Signed Integer Value of channel 1 A/D reading updated in Slave and Master Mode
9	0x08	16 bit Signed Integer Value of channel 2 A/D reading updated in Slave and Master Mode
10	0x09	Relays Status, future unimplemented
11	0x0A	MODBUS register to be updated/read in Master/Sniffer Mode
13	0x0C	Unit’s Slave Address
14	0x0D	Start of Master Address range
15	0x0E	End of Master Address range
16	0x0F	Polling rate for Master Mode set in 100ms increments
17	0x10	Communications mode, 0 = normal, 1 = slave, 2 = sniffer, 3 = master
18	0x11	Baudrate, 0 = 1200, 1 = 2400, 2 = 4800, 3 = 9600, 4 = 19200, 5 = 38400, 6 = 57600, 7 = 115200
19	0x12	Normal mode unit address, default 001
21	0x14	Flag Register, <xxxxxxxxxxx><data type><get analog reading><byte order><response>. ‘x’ = don’t care (11 bits).
22	0x15	Write register, if set to a value other than 0 EEPROM is written.
23	0x16	Pause register, pauses polling in Master Mode.

Slave Mode

In this mode the unit will act as a slave device. If the A/D converter is set to on and the “get analog reading” bit is set the unit will update the holding registers 3 & 4, 5 & 6, 8 and 9 with A/D data. If the “get analog bit” is not set the display will be updated with the values written to holding registers 1 & 2 and 7. If desired the main processor can be setup to timeout and display an error if the reading is not updated.

Sniffer Mode

In this mode the unit will only update its reading with values written to the MODBUS register. The sniffer will not generate a response. If desired the main processor can be setup to timeout and display an error if the reading is not updated. The data type of float or integer can be selected.

Master Mode

In this mode the unit can act as a Master and send data to multiple slave devices. The “get analog reading” bit must be set. The Address start and end range can be defined as well as what register is being written (MODBUS register). The data type of float or integer can be selected.
If the “get analog reading” bit is not set the unit will request data from the address start address and display the response.

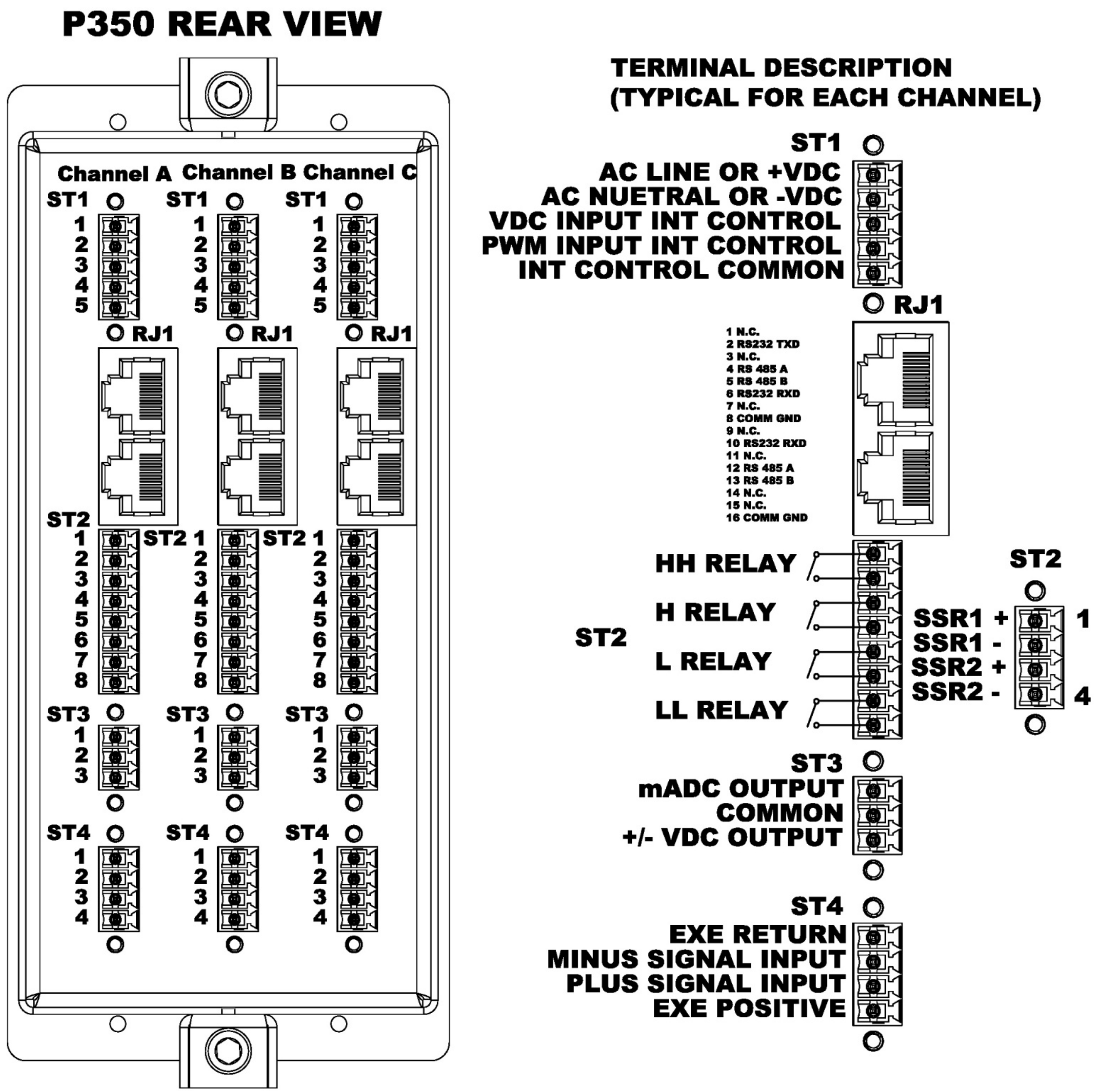
GUI

The GUI can be used to configure all MODBUS modes. Depending upon the mode not all options are available. The GUI is intelligent and will only enable available options for the different MODBUS modes.

Variable	Description
Unit Address	The units 8 bit slave address. The default is the broadcast address of 0.
Modbus Register Order	The order of bytes can be selected as 1,2,3,4 or 2,1,4,3 for compatibility, default is 2,1,4,3
Data type	Integer or Floating Point data to be sent or received
Update Analog	The “get analog reading bit” this decides if the Modbus processor is requesting a/d readings from the main processor.
Transmit Start Address	In master mode this is the starting address for requests to send or receive data. If requesting data this address controls which address the request goes to. If in sniffer mode this is the address it is listening for
Transmit Address Finish	In master mode this is the last address for requests to send or receive data. If requesting data this address is ignored.
Register Address	The register to be read or written to in master mode. In sniffer mode this is the register that it listens to, to be updated.
Transmission Rate	The rate at which the Master polls (sends readings or requests readings) to other units.

Master connection diagram for P350, P216 and P180. Number of channels dependant on part number ordered

REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED
	B	ADDED SSR OUTPUTS	10/18/18	OHF



SCALE 1 : 1

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

THIRD ANGLE PROJECTION

PRECISION INSTRUMENT CO

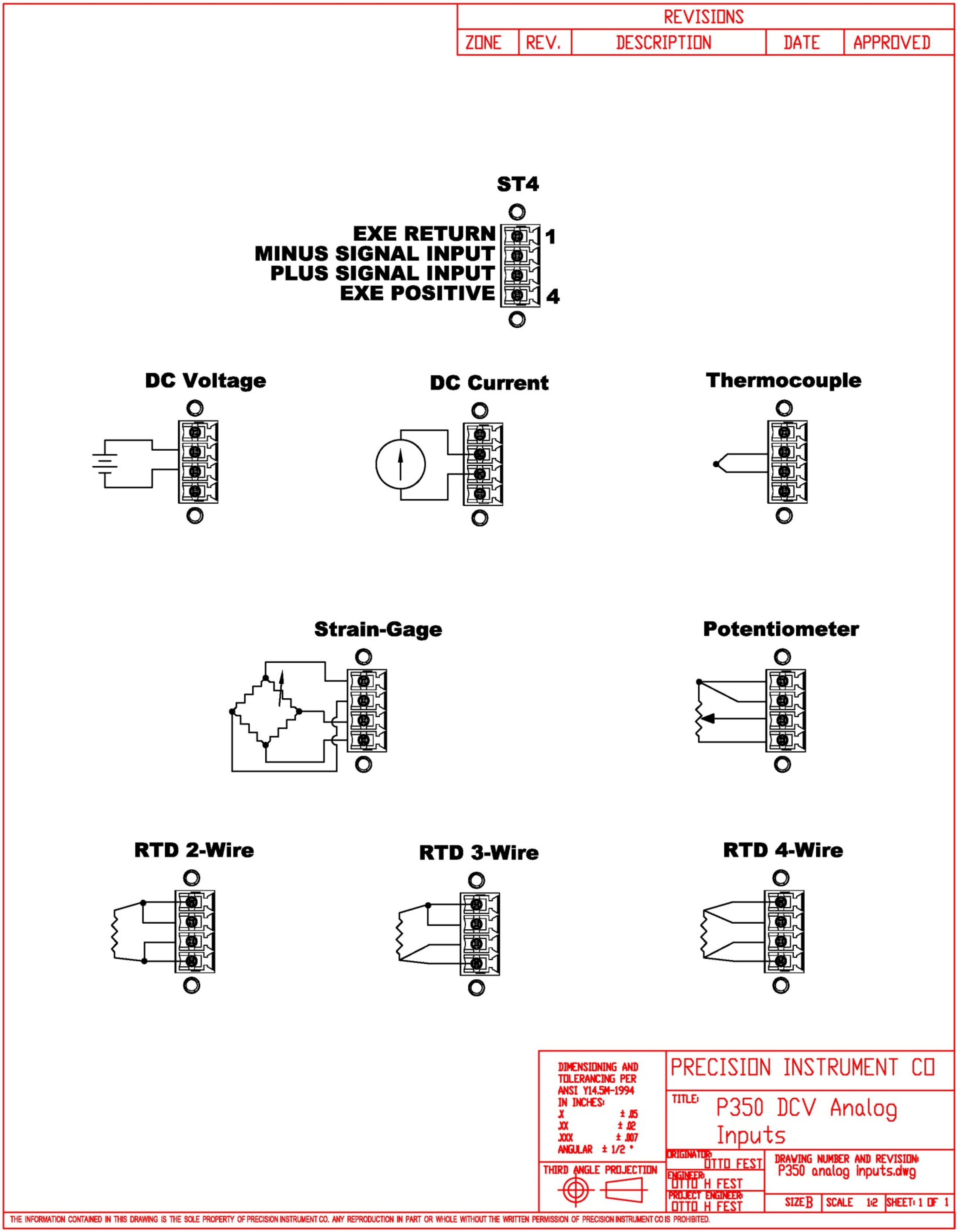
TITLE: P350 Master Connection Diagram

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

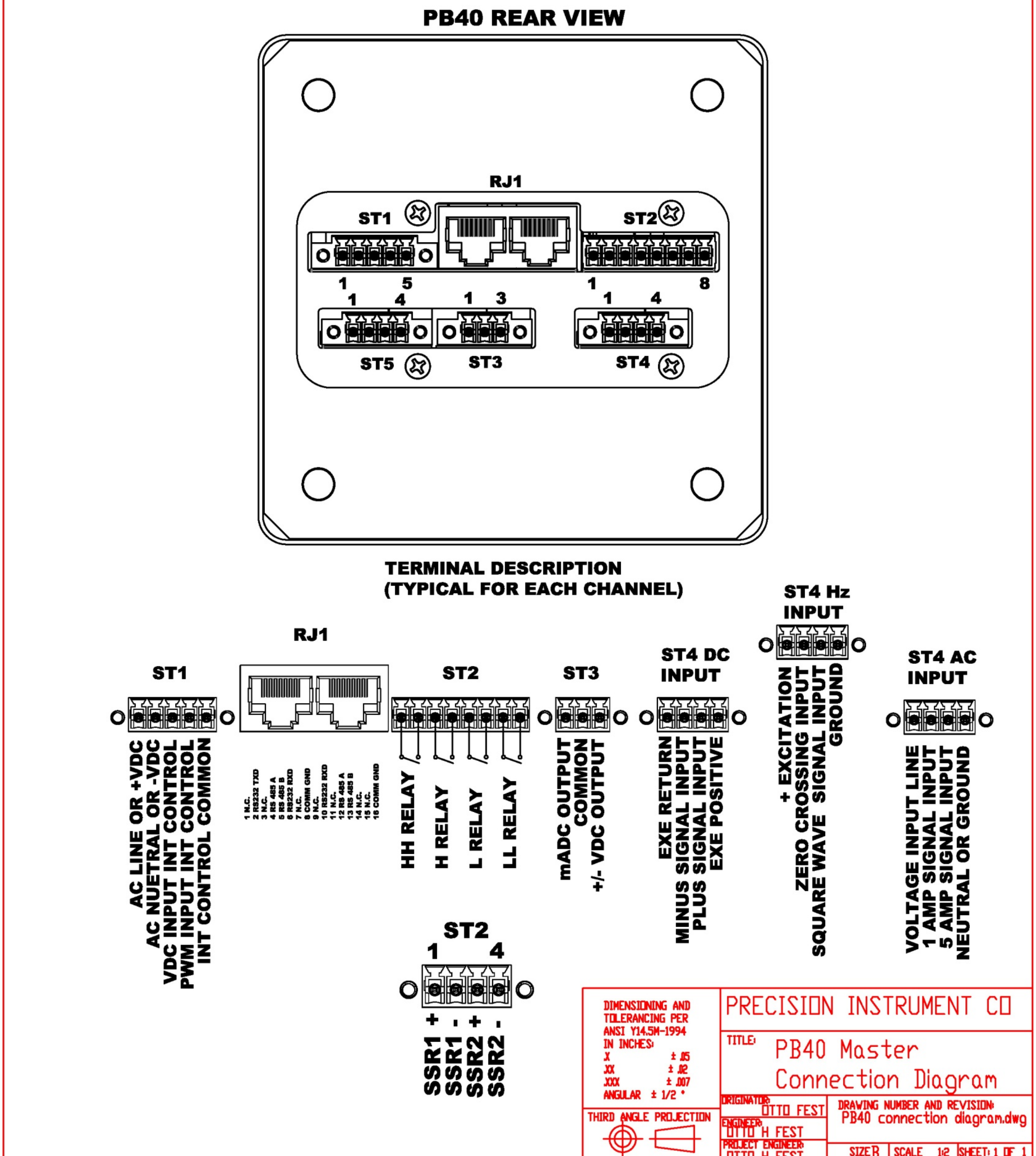
DC input type connection diagram for P350, P216 and P180 series



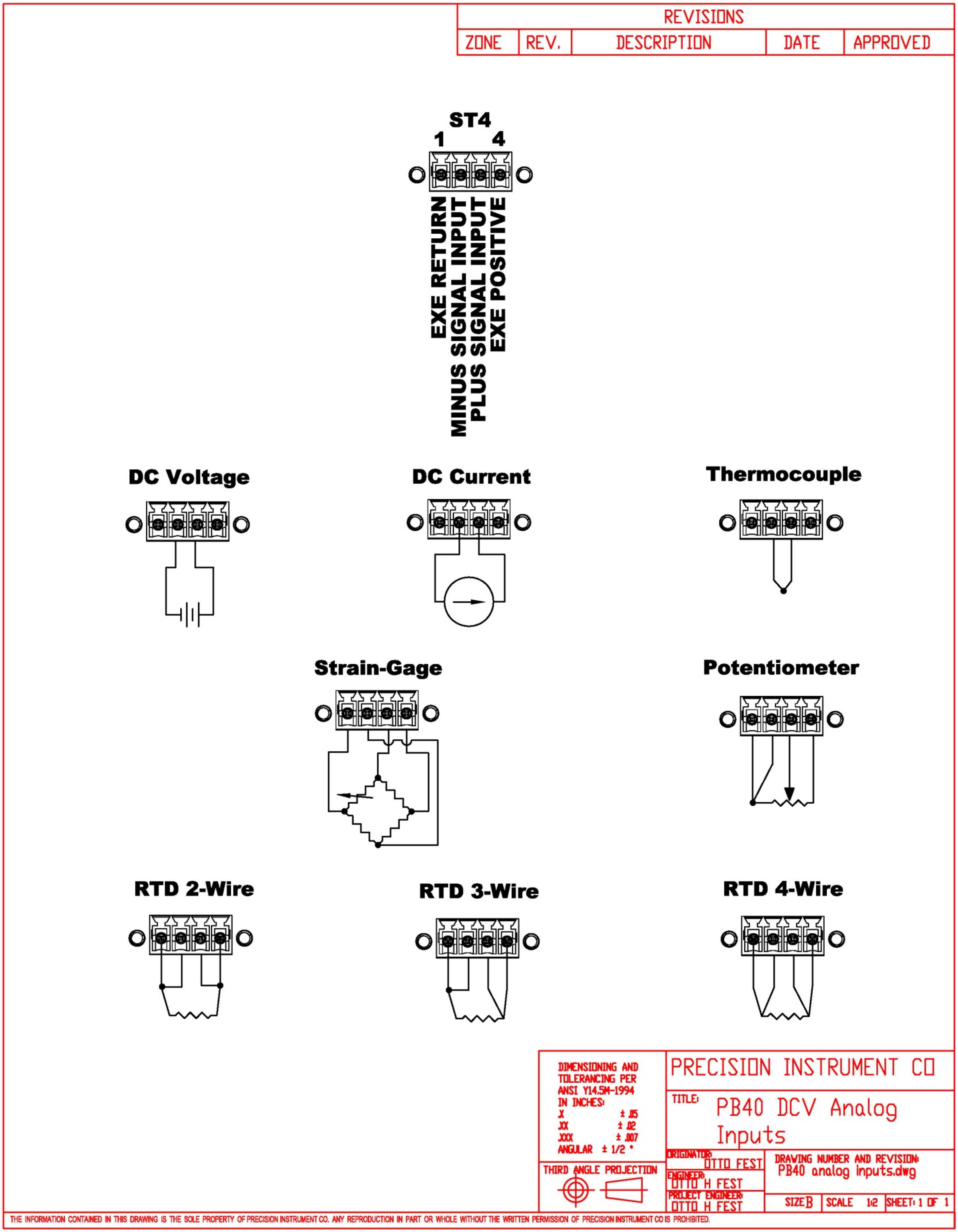
PB40 Master Connection Diagram

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
A	INITIAL RELEASE	7/27/16	OHF
B	ADDED Hz INPUT OPTION	9/10/17	OHF
C	ADDED SSR OUTPUT	10/18/18	OHF

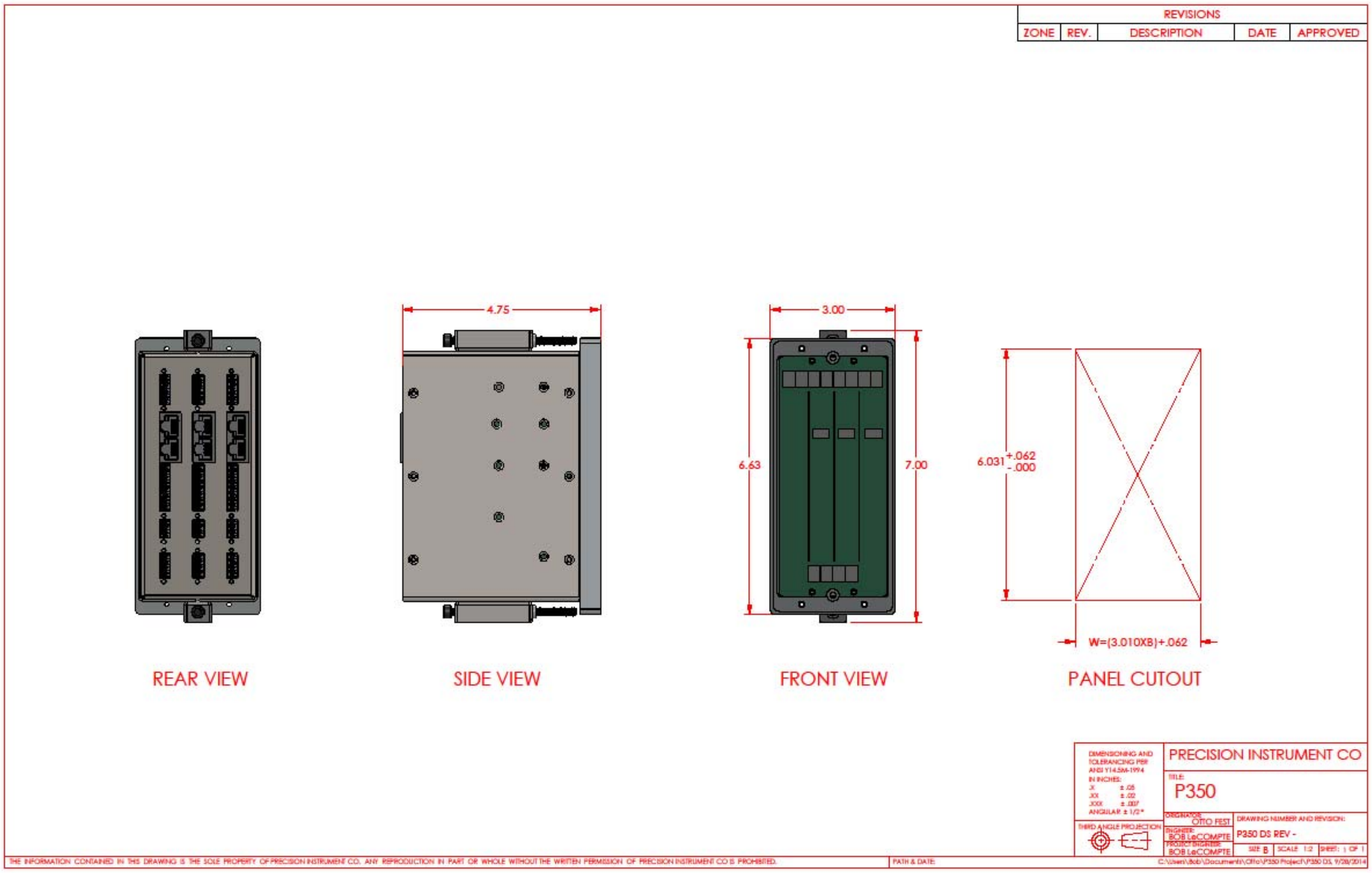
REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
D	ADDED AC INPUT	3/24/19	OHF



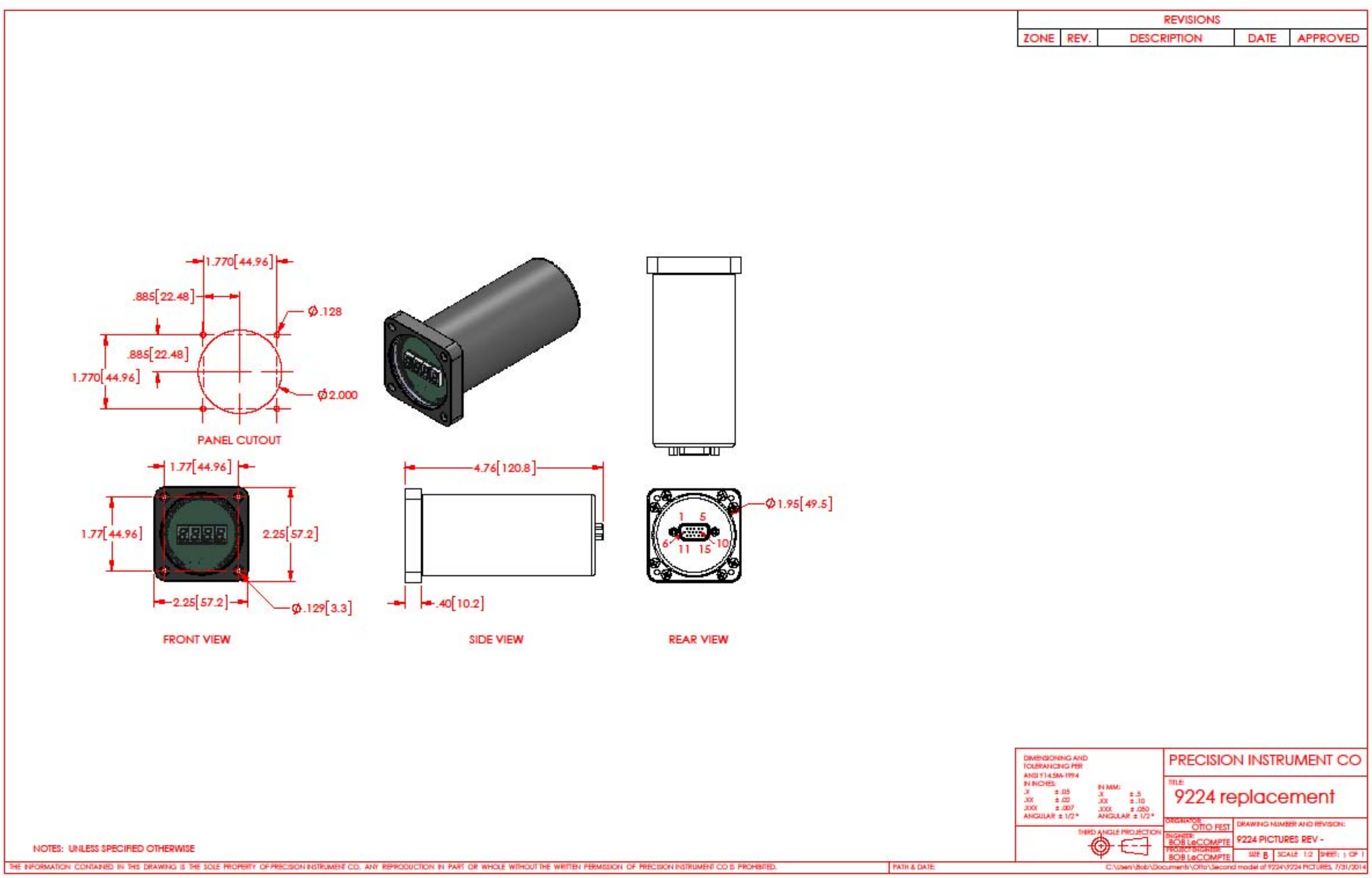
DC input type connection diagram for PB40 Series



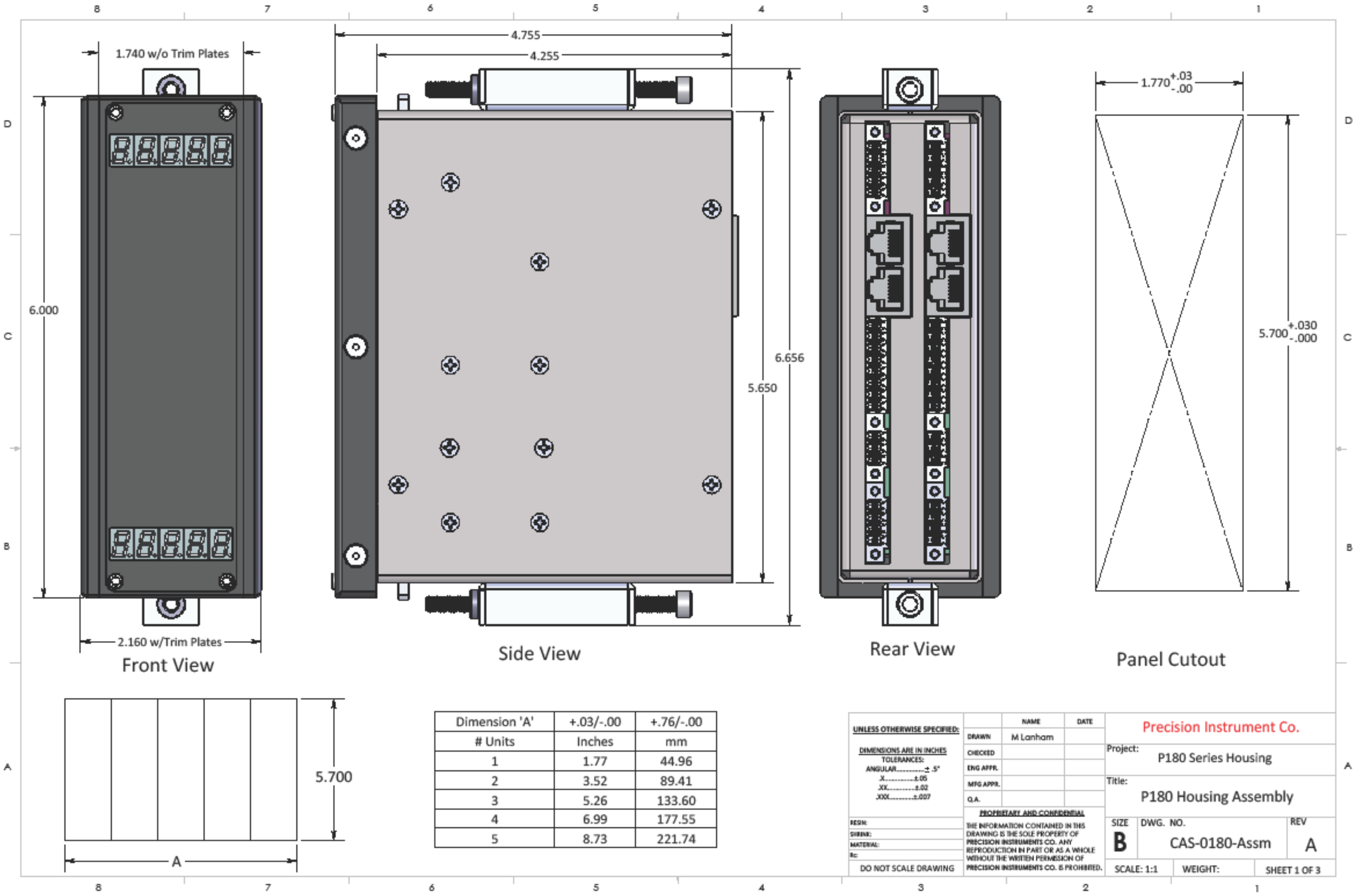
P350 Mechanical Information



P9224 Mechanical Information



P180 Mechanical Information



Dimension 'A'	+.03/-.00	+.76/-.00
# Units	Inches	mm
1	1.77	44.96
2	3.52	89.41
3	5.26	133.60
4	6.99	177.55
5	8.73	221.74

PB40 Mechanical Information