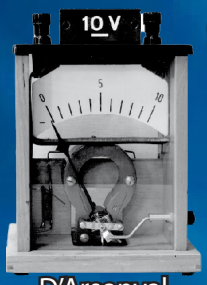
# THE DAWN OF A NEW AGE

Upgrade to Mil-Spec, Class1E, and Industrial Grades and DIGITIZE without changing anything but the old meter, IOW: Plug N Play

## OTEK's CLASS 1E & MIL PNP SERIES




D'Arsonval Movement 1800s


DB40 1900s


GE180 1900s


NTM or PNP-9 2020


NTM or PNP-7


NTM or PNP-N


NTM or PNP-X or -Y

## PLUG & PLAY

Meters & Transmitters 100% Form, Fit, & Function replacements of old analog & digital meters

- 50 Models or Custom
- Over 40 input signals
- Over 12 control outputs

- 7 power inputs
- All plug-in
- Nothing to solder!


Aviation Panel Meter (APM) See pg. 22 1" Diameter

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OTEK™ CORP.
The "DIGITIZERS"
SINCE 1974

A CLASS 1E COMPANY

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

MADE IN USA

# PNP SERIES PLUG & PLAY METERS & TRANSMITTERS

© PATENTED & PENDING 02/01/24

## 100% FORM, FIT & FUNCTION ANALOG & DIGITAL Class1E & MIL REPLACEMENTS

HOW TO REPLACE OBSOLETE ANALOG/DIGITAL METERS WITHOUT CHANGING ANYTHING BUT THE METER!



**CUSTOMS: OVER 50% OF OUR SALES ARE CUSTOM DESIGNS! SEE P.34, P.7, & P.14 OR CONTACT OTEK.**

PNP-7 | PNP-G or -9 | PNP-2

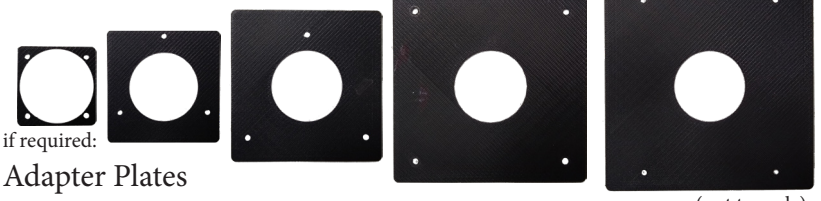
2 Channel
*Bailey 775

*GE180

*VMI9222

PNP-J or -N

*Equivalent *DB40

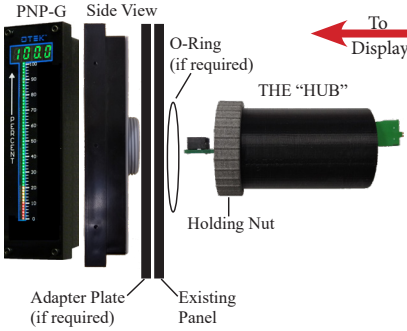


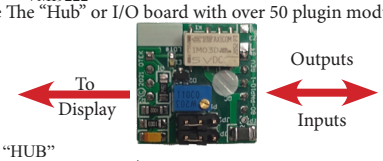
if required:
Adapter Plates
From 1" to ...?

(not to scale)

Inside The "Hub" or I/O board with over 50 plugin modules

(If it fits, stick it on)
READ #'S 4, 5 & 6 ABOVE
ALL HARDWARE, (NO SW) CYBER SAFE

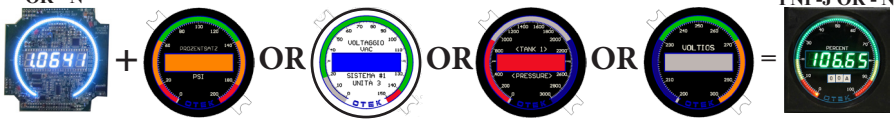



**ANY COLOR, SCALE, & LANGUAGE**

**"ONE FOR ALL" JUST STICK IT ON THE FRONT**
**COLOR-EX™ SCALE PLATE FILTER ON!**

NAKED PNP-J OR - N




PNP-J OR - N

Standard Bar & Digits Colors

## The PNP Transmitters up to 2 miles distance (pg. 24)

### RE: EPRI MTA #3002020578 & 3002020579

Convert any and all signals to current loop at the distribution panel or up to 2 miles (3.2km) away. All you need is one Powerless™ (loop power) input display type, different scale plates, and plug it in.
**Effectively eliminates 99% of spares!**

PNP-U

DIN rail mount

PNP-W

⅛ DIN Panel Mount

PNP-Y

Explosion Proof

NEED SCADA/DAS?
see **pg. 26**

Certified for class I, Div. 1, groups B-G, EX & IECex: 1M2, Exd 1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**OLD I&C ROOM**

**DIGITIZED I&C ROOM**

**My love affair with simplicity and a near-death experience with "stuck" needle.** At 18, learning to fly a 1938 single-engine Cessna, the needle got stuck! Emergency Landing! I switched to engineering college after that experience. In 1973, after 7 years at NASA during the Apollo Program, I noticed an empty barge going upstream in the Mississippi puffing smoke and another full of coal going downstream without smoke (Powerless?). A year later (1974) I introduced the world's 1st 4-20 mA current loop powered LCD D.P.M. (I called it the Powerless™ DPM - Model 516 & 518). Many patents later and many years of perseverance (or stubbornness?) here is the **PNP.**

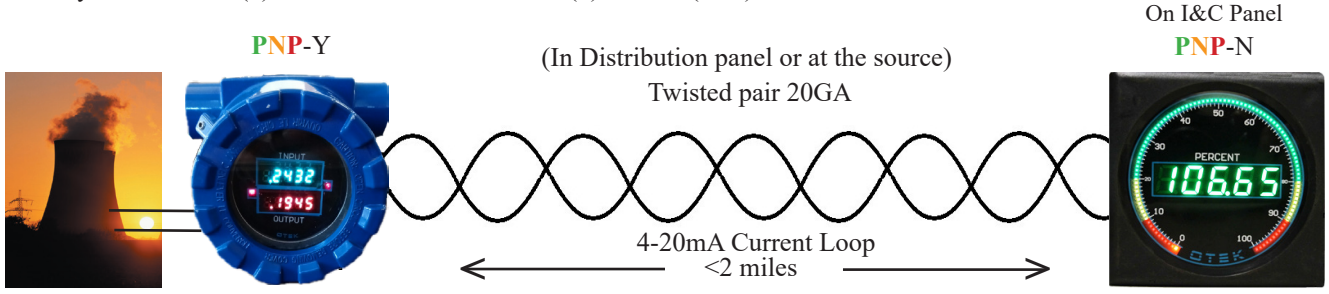
50 years later... After supplying our Armed Forces with MIL-SPEC meters, NASA, Nuclear Power, and many other industries, I have reached my lifelong goal of KIS - Keep It Simple. I present the culmination of my life's work - The **PNP**! This is my farewell and thank you to all our loyal customers and honest competitors. We invite you to be the Judge of the **PNP** and let us know if you think it is worth our time and effort!

**Simplicity! "The most dificult goal to achieve" - My father, August Fest**. (IOW: KIS) He also told me the four (4) "P"'s for a successful life: **passion, purpose, perseverance,** & **planning** ~1945 (I was 8). Why? Why was something so simple made so difficult, complicated, and expensive? The economics: a typical I&C (+ simulator) in an NPP built last century (~350 of them) has ~500 meters of 3 sizes and shapes, ~30 different input signals, 2 different outputs, over 200 different scale plates (Vac/dc, W, Hz, Amps, pressure, temperature, radiation, etc.) this equates to thousands of unique combinations! Spares inventory is estimated to cost over $1M! Yes, One (1) million USD to maintain! Have you tried buying a VMI 9222 or 9223 replacement? What's the cost & delivery of a rebuilt (not new) unit? We copied D'Arsonal's original "one movement" and converted it to the latest solid-state technology and used our several patents on current loop technology to eliminate the waste, inaccuracy, low resolution, and "stuck needle" syndrome responsible for thousands of accidents and deaths (almost mine). Typical NPP replaces 20 analog meters annually at a cost of ~$250,000 mostly because the built-in scale plates (sealed behind the filter) cannot be changed from one meter to another even if it's the same movement, add this to the cost of dead inventory, maintenance personnel, overhead, etc. and you are looking at millions of dollars wasted over the life of the plant.

**The PNP** solution: Replace all meters with one (yes only one) meter of each size, or use the adapter plate for **"one for all"**. Then replace all present input signals (~30) with one 4-20mA current loop input at the meter and power it with our Powerless™ patented technology (loop power) then place our PNP-U, W and/or PNP-Y transmitters at the signal source (or distribution panel) and transmit it to the meter via a simple twisted pair of wires, you may be able to use existing wiring. The results: **a.** one meter **b.** one signal **c.** one power **d.** any one spare "sticky scale plate" of every different display and input signal (at transmitter) conditioner. Estimated change over time: **within one outage**, estimated cost of spares: < $30k (~3% of analogs)!

Want to see a typical example of simplicity? See **pg. 24-25**. - Sincerely, the Otek team.

P.S. Would you invest one (1) million dollars to save two (2) million (ROI)?





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# PNP HOW IT WORKS



02/01/24

The **PNP** is designed to replace 100% Form, Fit, and Function (Plug & Play) obsolete analog and digital meters **without** any changes to existing installations such as signal, power, panel cutout, wiring, or operators. The **PNP** replaces meters ranging from 1½" sqr. to any size limited by your needs with "off the shelf" equivalents. See **pg. 30** for other cases developed for nuclear and military customers. By using a "universal" input assembly ("**HUB**") that accepts any signal or power offered, by just selecting "Plug-In" modules that cover over **40** input signals and 100% signal power. These include analogs such as current loops (4-20 & 10-50mA), Vac/dc to 250V, ac to 4 Amps (for C.T.), Hertz, ac/dc, and Watts. For units requiring external power (such as RTD, TD, S-G, pH, ORP, etc.) or even 4-20mA retransmission & isolated control outputs from dry contacts to SPDT 4 Amp relays, the **PNP** offers built-in plug-in universal power input/output modules (3.5/25-250Vac/dc). The universal **HUB** plugs into the rear of the selected display module (Digit 4 Options E, F, G, & J see **pg. 13**), or our built-in Options B, D, N, R, X, 2, 7, & 9 (stand alone). **See pg. 14**.

**EPRI MTA# 3002020578:**
Since 1974 Otek has been servicing our military and our nuclear industry since 1980. We were asked to help the **NPP** eliminate the excessive & expensive redundant "spares" inventory of obsolete analog and digital meters **without making changes to existing installations!** Read EPRI assessment report. See **pg. 27-28**.

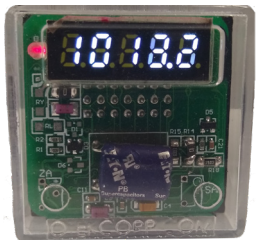
**Our Solution: The PNP!**

1. **"All For One"**: All displays are identical in design "movement" & NEI08-09 Exempt (No CDA). All accept the same signal (±0.5Vdc F.S.) and Power (3.5-5.5Vdc) from the plug-in **HUB** or I/O P.C.B. inside. The front filters accept our **Color-X™ "Sticky"** scales, eliminating the need to void the factory seal.
2. Modules & sockets have gold-plated pins & are shock/vibration proof.
3. The **PNP** can be 100% field configurable, tested, certified, and installed by your maintenance personnel without any special training in minutes. Video tutorial & in situ training available.
4. The **PNP** uses no C.D.A. (per NEI08-09). Just plain CMOS logic proven design with generic components that are military qualified for >40 years, obsolence hardened (availability) and CMTBF! Only the mechanical innovation of "One size fits all" of the adapter plates, the "One for all" (one output for all inputs) of the **HUB**, and the "All for one" (all displays for one input) of displays and the field changeable "Sticky" Color-EX™ scale plate (filter) are **new**! Need A.P.C. (smart) compatible NEI08-09 (cyber security) compliant (meter/controller)? See our NTM & UPM configurators.


**1½" x 1½" Analog**

The red/bright LED on the bar is our solution to the **"stuck needle."** Our patented **"Fail-Safe"** alarm! If you lose power/signal, the LED stays on for hours!

SEE P. 22 FOR 1" Ø AVIATION PANEL METER **APM** NVG3/MIL-SPEC



**PNP-E (1½")**

**PNP-F Our popular "Flat Pack" (2 x 3 x 0.5")**


**DB40**
**(4 x 4 x 6")**


**PNP-J OR -N**
**(4 x 4 x 1")**

**2" Deep**


**PNP-7**
**Replaces Bailey 775**

**1" Deep**


**PNP-9 or -G**

**1.5" Deep**


**PNP-2**
**Replaces VMI9222**

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# PNP DIGIT 11: TYPICAL DISPLAY COLOR, TEXT, "STICKY" SCALE PLATE SHOWN FOR -M OR-N CASE ©

02/01/24

## OTEK'S COLOR-EX™ SYSTEM

**AVAILABLE COLORS USING OTEK'S COLOR-X™ "STICKY" OVERLAY**

**(Select Digits 11 & 12, Option 9 (Custom) and provide the range and color number(s).**

BROWN RED ORANGE YELLOW GREEN BLUE VIOLET GREY WHITE


Note 1: If required, specify the specific colors for the bar and the digits. Example (Digit 11, Option 0): Bar %: **0-10**: red; **11-20**: yellow; **21-80**: green; **81-90**: yellow; **91-100**: red. Digits: All white (standard Option 0)

**"ONE FOR ALL" ... JUST STICK ON THE FRONT FILTER!**
**NO NEED TO OPEN THE CASE AND VOID THE CERTIFICATION!**

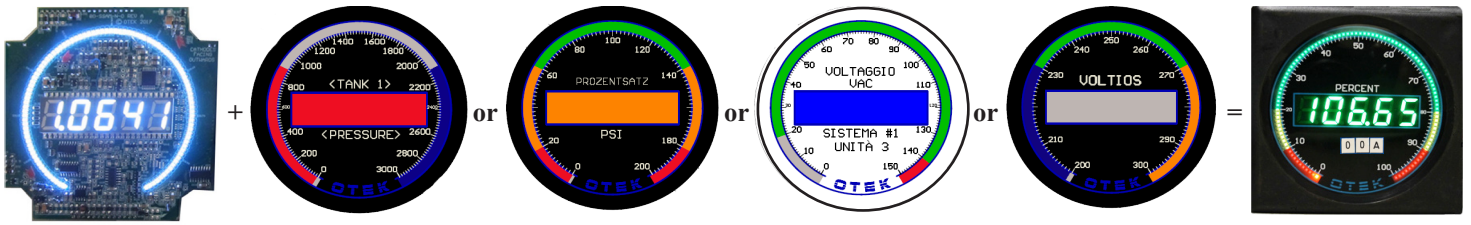
## (MODEL PNP-J OR -N SHOWN)

**COLOR-EX™ SCALE PLATE, ANY COLOR, SCALE, OR LANGUAGE**

**PNP-J OR -N w/o SCALE PLATE**

TYPICAL CUSTOM "**STICKY**" SCALE PLATES

**PNP-J OR -N w/"STICKY" PLATE**




STICKS ON FRONT FILTER (OUTSIDE)

**Standard Bar & Digits Colors**

## WHY WE DEVELOPED THE PNP

The **PNP** uses a proprietary (Pat. Pend.) technology to customize the display **"Onsite"** to your specific needs; such as range, color(s), language, etc. Standard scales are as listed on note 1 above. Standard colors: SAFE (green), WARNING (yellow), and DANGER (red). For customs, use Digit 12 Option 9 and send us your drawing/specs. It is **NOT** necessary to open the **PNP** to change the scale plate and void its factory certificate.

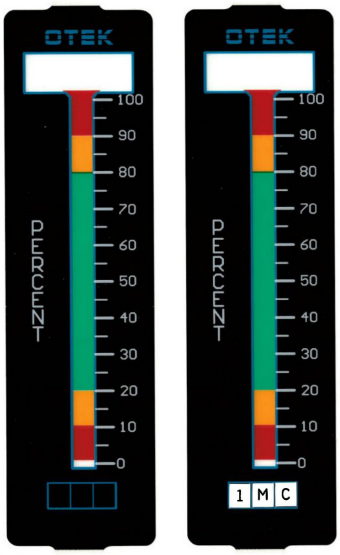
### "STICKY" SCALE PLATE CHANGE INSTRUCTIONS:

1. Clean the filter with alcohol base solution & dry it.
2. Carefully lift top right corner and peel it off.
3. On new scale plate, remove its backing, align it with the bottom of the filter and gently squeeze it up leaving **no** air bubbles.
4. If air bubbles remain, carefully pinch them with an exacto knife and force the air out, that's all!

**NIGHT VISION: AUTOMATIC-MANUAL DISPLAY INTENSITY CONTROL:**
**Automatic:** The **PNP** senses the ambient light on its display facing you and automatically dims in dark ambient and the brighter the ambient, the brighter the display gets. **5-25Vdc Isolated Voltage Controlled Display:** 5Vdc: Minimum intensity, 25V: Maximum intensity current consumption: ~ 10mW. **10-100k not Isolated Resistance Intensity Control**: 10-100k Pot. Range: 20-70% lower resistant = higher intensity.

### NEED NEW METER I.D.?

Note: Just "stick" any three alpha-numeric ID (A-Z & 0-9) stickers on it as shown below with example (1MC).





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# PNP DIGITS 78 INPUT SIGNAL SPECIFICATIONS ©

## SEE MASTER CHART pg. 15. ALSO USED ON TRANSMITTERS pg. 24

YOURS NOT HERE? WE WILL DESIGN IT!

02/01/24

### POWERLESS™ INPUT FUNCTIONS

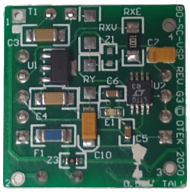
80-PNP78-00A4

**Option 00 (KP78-00): 4-20mA Loop Powered:** Burden: >3V@4mA, ≤5V@ 20mA. Since we invented our Powerless™ **DPM** in 1974, millions are still working! Mounts on **SCA** SOCKET jump JC3, JC4. Only turn on switch 7.

Patent# 10,222,405 & pending

**Option 17 (KP78-17): 10-50mA Loop Powered:** Burden: >3V@10mA, ≤5V@50mA. "If it works, don't fix it!" Use the same module for 4-20mA, only turn on switch 2! Schematic on **pg. 11**.

**Note:** Always check/recalibrate zero & span after changing modules.



80-PNP78-01B3

**Option 01 (KP78-01): Vac Signal Powered:** Burden: <100mW

Range: 25-250Vac/40-400Hz; Must use Isolated Potential transformer PT. Mounts on SCA.

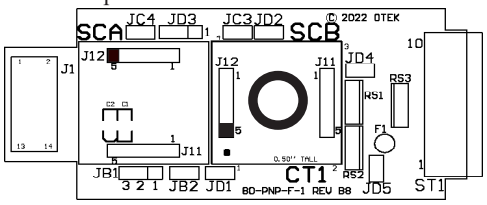
See Master Chart pg.14 Patent# 8,908,569

**Option 02 (KP78-02): 5 Aac Signal Powered:** Burden: <100mW; Best range: 0.3-4A Fused at 5A. Must use >150:5 isolated current transformer (C.T.) **HUB** PCB shown. Must use external 4.5A **slow blow** fuse in series. CT1 is factory soldered & tested on SC-B space & P7801 PCB is plugged on SC-D sockets. RS1, RS2 & F1 are soldered. IMPORTANT: This HUB assy KP7802 is only for Aac Powerless™.

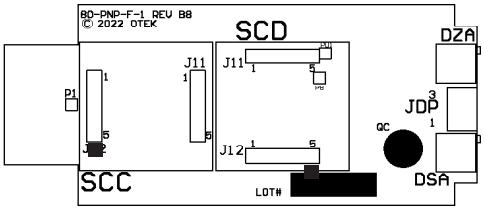
See Master Chart **pg. 15**

The black ring is the CT

Top View




Bottom View



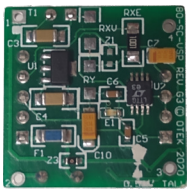

80-PNP-F-1B5

Note: Why subassemblies? Because these options require factory soldering, testing & certification for Class1E (safety).

**Option 03, (KP78-01 + KP78-02 + KP78-03): Watts RMS ac (USE C.T. & P.T.) Signal Powered:** Best range: 100-500W. Uses 3 modules: **P78-01** (V) on SCA, **P78-02** (A) on SCD & CT1 soldered on SC-B including RS1, RS2, F1 & **P78-03** (W) on SCC. Plug jumper JD3-2 & 3. This assembly is only for Powerless™ Wac!

See Master Chart **pg. 15** Patent# 7,626,378

**25-250 Vac To 5Vdc P.S.**

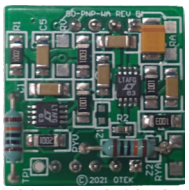


80-PNP78-01A2

**C.T. "A" to "V" Converter**

Mounts on SC-B space

**WATTS RMS Converter**



80-PNP78-03B2

**Option 04, (KP78-04 + KP78-01): Hz Vac Signal Powerless™:** Range: ≥ 25V ≤ 250V and > 30 < 100Hz Range: Uses 2 modules, **P78-01** (Vac) that mounts on SCA & **P78-04** (Hz) Mounts on SCC. Jump JSP1 &2 on Assy/Tag **P78-04** and externally jump ST1-6 to ST1-3 and ST1-5 to ST1-4 (ac Signal).

NOTE: **P78-01** Converts the ac signal to power and P78-04 frequency to Vdc.

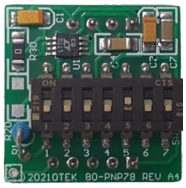
80-PNP78-04B4

**Hz Converter**

**Option 18 (KP78-18): 25-250Vac/dc Signal Powered:** Requires >5<50mW (~3mA-20mA). Use it to monitor/control ac or dc generators, or batteries! **PT78-01** mounts on SCA. Jump JC3 & JC4.

80-PNP78-01A4

### POWERED SIGNAL INPUT FUNCTIONS ALL MOUNT ON SCA



80-PNP78-00A4

**Options 20- 24 (mA RMS) (KP78-20):** Burden: <25Ohm (0.5V F.S.) 4-20mA C.L. close switches 1 & 7

**Option 21 (100mA FS):** 5KΩ close switches 1 & 6

**Option 22:** 500Ω (1mA F.S>) close switches 1 & 5

**Option 23:** 50Ω (10mA F.S) close switches 1 & 4

**Option 24:** 5Ω (100mA F.S.) close switches 1 & 3

**Options 25-28 & 30 (V RMS) (KP78-25):** Zin: 1M Ω Switch: selectable

**IF IT HAS DIP SW. IT IS MULTI-RANGE**

**Option 25:** 100mV RMS F.S. open switch 1 only

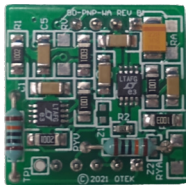
**Option 26:** 1V RMS F.S. open switch 1 close switch 5

**Option 27:** 10V RMS F.S. open switch 1 close switch 4

**Option 28:** 100V RMS F.S. open switch 1 close switch 3

**Option 30:** 250V RMS F.S. open switch 1 close switch 2

**Options 31 & 32: Watts RMS:** Order P/N **KP78-31** for 1V x 1A RMS or **KP78-32** for 1V x 1V RMS mount on SCA socket and Plug JC3 & JC4. But for Options 33 or 34 (High Current [4A]) the 20W shunt resistor (RS3) must be factory soldered, tested & certified!



80-PNP78-03B2

**Option 33: 120V 4A F.S.: KP78-33H** or **KP78-33N** for PNP-N or **KP78-339** for PNP-9.

**Option 34: 4A RMS: KP78-34H** or **KP78-34N** for PNP-N, or **KP78-349** for **PNP-9**, or contact us. Above assemblies (-33 & -34) include RS3 and RMS-dc Multiplier (For Option 33 Watts) P/N: **KP78-33** or **KP78-34** plug it on SC-A socket and plug JC3 & JC4.

See Master Chart on **pg. 15** and "Plug & Play!"

**Option 41-44: Hertz (KP78-41, -42, -43 & -44):** Zin: 1MΩ

**Option 41:** 30-10KHz TTL

**Option 42:** 50-150Vac, 30-100Hz

**Option 43:** 100-250Vac, 30-100Hz

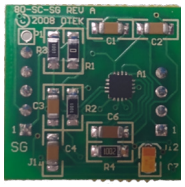
**Option 44:** 50-150Vac, 300-500Hz. Plugs on SC-A socket.

80-PNP78-04B4

**Important Note:** For options 45-56 (transducers) it is best to use our 4-20mA transmitters.

See **pg. 24-25**

**Option 45: STRAIN GAUGE (KP78-45):** Excitation: 4.096V, 50 PPM/°C Range: ±300-4K Ω. Contact us for monolithic S-G. Mounts on SC-A socket.



80-PNP78-45

**NOTES:**

1. **All displays (bar or no bar) accept 3-5.5Vdc on J12-1 (+) & Ground on J11-2. And ±0.5 Vdc F.S. signal on J11-3 (-) and J11-4(+).**
2. **All displays and signal conditioners have a combined accuracy of ±0.5% unless otherwise noted.**
3. **P/N = Tag # (On Module)**
4. **Stuck Needle? All displays have an "INPUT SIGNAL FAIL" alarm (LED) that remains "ON" for hours after failure. Needs ~ 1 hour to fully charge. (PAT. # 10,222,405).**
5. **See Master Chart on pg. 15 for connections & jumpers (plug-in).**

# PNP DIGITS 78 INPUT SIGNAL SPECS SEE MASTER CHART pg. 15 ©

## YOURS NOT HERE? WE WILL DESIGN IT!

02/01/24

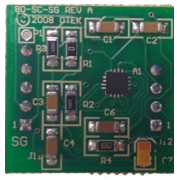
**Option 47 (KP78-47) PT100, Option 48 (KP78-48) PT 1000:** 2, 3 or 4 wire. Range: Same as RTD. Accuracy ±1°C. Max distance of 2 wires: <100ft, 4 wire <400ft if longer. Use 4-20mA transmitter (**pg. 24** for < 2 miles distance). PNP-B, -R, or -Y. Plugs on SC-A.


80-PNP78-47

**Option 55 % RH (KP78-55):** Range: Per sensor's input Type, 2-3% pF/% capacitors used. Send us your sensor specs for matching. Signal Hi: ST1-6, Signal Lo: ST1-5. Plugs on SC-A socket.


80-PNP78-55

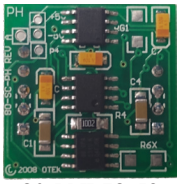
**Options 50-52 TC (KP78-50):** Range: -210 to 760°C Accuracy & Linearity ±2°C. **Option 51:** Range -270 to 1370°C. **Option 52:** Range -270 to 400°C Must install included 1N4148 External T.C. diode. Anode: ST1-3, Cathode: ST1-4, -TC: ST1-5, +TC: ST1-6. On SC-A Other TC input & scales on request. Max distance: 100ft (30m) or see **pg. 24** for <2 miles (3.2Km) transmitters.


80-PNP78-50

**Option 56 10KΩ Resistance (KP78-56):** 0-10K Ω = 0-100%. Ideal for linear transducers. Signal Hi: ST1-6, Signal Lo: ST1-5. Also see transmitters on **pg. 24**. Plugs on SC-A socket.


80-PNP78-56

**Option 53, pH (KP78-53):** Range: 0-14.00 Zin: $10^{15}$Ω Temperature compensation: none. Send us your sensor specs for matching. +Signal: ST1-6 -Signal ST1-5. Best if you use C.L. transmitters on **pg. 24**. Plugs on SC-A socket.


80-PNP78-53

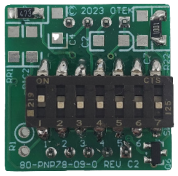
**Option 57 10-50mA Current Loop (KP78-20):** (mA) Flip switches 1 & 2. Plug it on SCA. Plug JC3, JC4 connect + loop to ST1-6, -loop to ST1-5 and turn the power on! Also see Option 17. Plugs on SC-A socket. **IMPORTANT NOTE:** Any PCB with **DIP** switch has six (6) multi-range options field selectable.


80-PNP78-57

**Option 54 ORP (KP78-54):** Range 0-2000mV; Zin: > $10^9$Ω You can use any 0-2Vdc signal conditioner (KP78-25) such as Option 26 in emergency if its Zin is > $10^9$Ω + Signal: ST1-6, -Signal: ST1-5. Plugs-in SC-A socket.


80-PNP78-54

**NIGHT VISION/ INTENSITY CONTROL Digit 12 Option "9"** This is a "**custom**" option to be factory quoted intensity control via external **isolated** 5-24Vdc (min-max) <1mA OR **not isolated** 10-100k Ω potentiometer (0Ω = max, 100k Ω = minimum intensity). Or Automatic "Direct" Ambient Display Control (Dark environment = lowest intensity, brightest = maximum intensity. Or custom for **NVG3** filter, specify it. Customs only. **See pg . 14**


80-PNP9-C

## PNP GENERAL COMMERCIAL GRADE SPECIFICATIONS

Note: Custom models (PNP-C--) are governed by these specs, unless your specs are accepted in writing by Otek.

**DIGITS 7 & 8 POWERLESS™ (SIGNAL POWERED) REQUIREMENTS: Options 00-18**

- 4-20mA or 10-50mA Current Loop
- Volts ac: 25-250Vac, 40-100Hz
- Amps ac: 0.2-4Aac, 40-70Hz
- Hertz: 40-70Hz (25-250Vac)
- Watts ac: 25-250Vac & 0.1-4Aac
- Vdc: 30-300Vdc
- Must be able to supply ≥ 10mW and withstand a 5V drop otherwise use ***EXTERNAL POWER (Digit 9)*** or send your specs. for ***CUSTOMS***.

**NOTICE:**
**OTEK IS A MIL-SPEC QUALIFIED AND NUCLEAR CLASS 1E - APPENDIX B MANUFACTURER. CONTACT US W/ YOUR REQUIREMENTS.**

**SINCE 1972, WE'VE SPECIALIZED IN "CUSTOMS"**

**PNP SPECIFICATIONS (All Models):**

See specific input signal specifications.

- Input signal: Per Digits 7 & 8 option #
- Display: 4½ Digits (-1.8.8.8.8)*
- Colors: Any color, see Digit 11 & **pg. 5**
- Accuracy: ±0.5% of F.S. ±1 LSD
- Temp Coefficient: ±50 PPM/°C from 20°C
- Operating Temp.: -20 to +70°C
- CMRR: >90dB @ 50-60Hz
- Humidity: 5-95% (Non-condensing)
- Front Panel: NEMA 3 or NEMA 4X
- Recalibration: Suggested at every 2 yrs.
- Powerless™ Mode: >10<100mW
- Ext. Power Mode: >50<300mW
- Conversion Rate: 3/second
- CMTBF: >40 years

**NOTE**: Above specs are for Industrial Grade (Digit 5, Options 0, 2, or 3). Grades E & M per agreed specifications if different.
*Due to its high resolution of ±3 µv/1 µA some ranges will have only 3½ digits (1.9.9.9) display.

**ISOLATED EXTERNAL POWER 6-32Vdc & 25-250Vac/dc (Digits 7&8 Options 20-57) ALL FULL SCALE:**

Input Signals (CUSTOMS WELCOME):

- 1-5, 4-20, & 10-50 mA current loop
- Vac: 100mV - 250Vac, 40-450 Hz
- Aac: 0.1mA-4A, 40-450Hz
- Hertz: 30 Hz-10kHz
- Watts ac: 1-1kW RMS
- Vdc: 0.1-250 RMS
- Adc: 0.01-4 RMS (INT'L/EXT. SHUNT)
- Strain Gage: ≥ 300 ≤ 4k Ohm
- RTD: PT100, PT 1000, 2, 3 or 4 Wire
- TC: Type J, K, T, (custom: Type E)
- pH: 0.00-14.00 (specify sensor) NOT temperature compensated
- ORP: 0-2000mVdc
- % RH: Specify Sensor & specifications
- Resistance: 0.0-10k Ohm
- Power Inputs: 3.5-250Vdc/25-250Vac
- 4-20mA C.L. Transmission/retransmission
- Dry SPDT contact <4 Amp
- Opto Isolated 400V MOSFET

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**CAGE CODE 57861**

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The "DIGITIZERS"

A CLASS 1E COMPANY

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TUCSON, AZ 85714 U.S.A.

MADE IN USA

# PNP DIGIT 9: POWER INPUTS ALL MOUNT ON SCD ©

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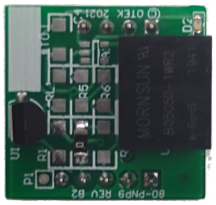
**Option 0 (Only for Digits 7 and 8 Options 00-18)** is Powerless™ powered by the signal it measures, just like analog meters but without "stuck needles", parallax or ambiguity, and its "signal fail" LED remains on for hours after the signal fails so you know the PNP is ok!

**Option 3** For 5-32Vdc **Isolated** (<1000V) Power Input <300mW. Actually works great from 3.5-32Vdc! Custom Option 5: 5-32Vdc with remote display dimming ideal for night vision. Requires External 500Ohm potentiometer. KP9-3



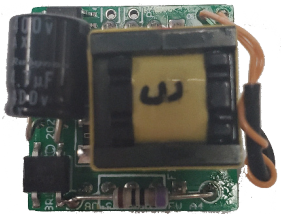
80-PNP9-2 A2

**Option 1** plugs into SC-D, has an input range of ≥ 3.5 ≤ 5.5 Vdc and only needs ~50mW (10mA) power input, it is **not isolated** from the signal. Option 1 uses JD1, JD2, JD3-2 & 1. The "jumper" board function is to extend its inputs at J11 to J12 of any socket. KP9-1


80-SC-SHORT A1

**Option 4** For 25-250Vac/dc Power Input, Isolated 1000V Requires <500mW. Why the wide range? So you can monitor/control your DC generator/battery bank. This options mounts upside down on SC-D. KP9-4

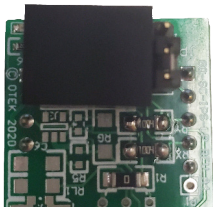
Patent applied for



80-PNP9-4 B4

**Options 2-4** mount on SC-D and inputs are on ST1-1 (+/5V) & ST1-2 (GND).

**Option 2** For 5Vdc **Isolated** (1000V) from the signal power input, the range is from >4.5<5.5Vdc and requires <300mW. KP9-2



80-PNP9-2 B2

**Option 9** For your "**Custom**" needs, send us your specifications!

Need intensity controller? NVG3 compliant? 3 options available. We've customized Option 3 for the U.S. Navy! See **pg.7 & 34** Over 50 modules available! See **pg. 29** Want visual alarm? We developed for nuclear customer so operator can see the display and annunciator "blinking" when limit is exceeded!

## PNP DIGIT 10: ALARM (pg. 10) & 4-20mA C.L. OUT (see pg. 11), ALL MOUNT ON SC-B UNLESS DISPLAY #2 IS INCLUDED (see pg. 20-21)

Patent# 10,222,405 & pending

### Loop or signal power meter with relay outputs?

Yes! Our patented PNP Powerless™ technology will alarm you via its H.V. dry contact, or SSR (MOSFET) up to 4Amps even when powered just by the signal. The same module is used for Hi or Lo alarm, just change the plug-in jumper!

### Fail Safe Output?:

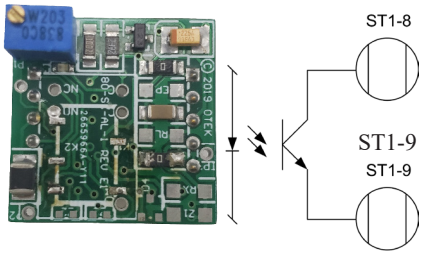
Just set the "Hi" limit to the lowest alarm value (ie: 125°F) and on power up the relay/output will switch on and stay on, unless the **signal fails or power** fails or goes below a safe limit you set, then it resets.

### Hi or Lo Alarm Settings:

**ALL MOUNT ON SCB**

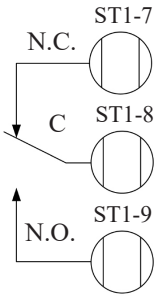
Standard calibrations for "Hi" is 80% and for "Lo" is 20% of full scale. You can "field" change it at will via a built in 12 turn potentiometer and plug-in jumpers for either "Hi" or "Lo" operation. **OPTIONS A-D**: 4-20mA output with or without compliance signal or externally powered or external control and KISPID! See **pg. 11-12**

**Options 1& 2:** Hi Limit: Jump JP1-2&3 & JP2-2&3. Lo Limit: Jump JP1-2&1 & JP2-2&1 Set limit w/ potentiometer on board. (NOTE: All alarms have an LED alarm indicator, so you know when it is on! H.V. contacts are protected with 150V varistors). Isolated **O**pen **C**ollector **T**ransistor (OCT): Vc: >1<30Vdc; IC: >0.1<50mA, Isolation <500V; Response < 1mS.



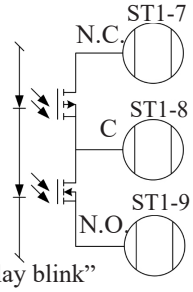

**Options 3 & 4:** SPDT Reed Relay: switching voltage: <150Vac/dc, switching current: Dry to 100mAac/dc. Isolation: <1500V; Response: <1 mS Ideal for H.V.L.C Annunciators.

80-PNP10-3 A4
KP10-3&-4




**Options 5 & 6:** ac/dc SPDT MOSFET (SSR): Switching Voltage: <400 V, ac/dc Switching Current: <100 mA Vac/dc Isolation: 1500V Response <1mS Break Before Make: >500uS Max "ON" Resistance: <50 Ω.

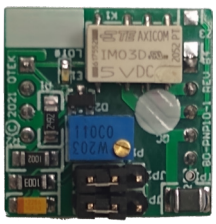
80-PNP10-3 B4
KP10-5&-6



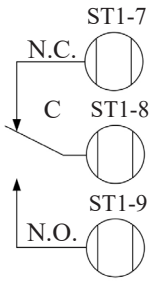

**Option 9 custom:** 80-PNP 10-G PCB is used for "display blink" and external load alarm ~2/sec.

**Options 7 & 8:**

SPDT 4A contact relay: Actually, we use a 4Amp DPDT (connected in paralleled) relay with gold plated bifurcated contacts for dry loads (low current) such as Annunciators. Switching Voltage: <300Vac/dc, Switching Current: <3Aac/dc, Isolation: <1500 V, Response: <5mS, Break before make: > 2mS.



80-PNP10-1 B4
KP10-7&-8



# PNP DIGITS 7 & 8: INPUT SIGNALS (See Chart pg. 15-16) MOUNTS ON SC-A ©
## YOURS NOT HERE? WE WILL DESIGN IT!

02/01/24

**Digits 78 Options 00-18 TAG #KP78-00 through 18:**
**Powerless ™** are 100% input signal powered (like analogs), if your signal can produce ≥5mW of energy and sustain <5V burden, the PNP can display/control it.

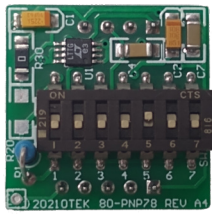
**Digits 78 Options 00 & 17:**
Tag # **KP78-00** is for **Loop Powered** options 00 & 17. See schematic below. For options 01-04 & 18, V&A RMS Powerless™ see **pg. 6.**

**Digits 78 Option 09:** For your **custom signal powered** inputs. Send us your requirements. **www.otekcorp.com**

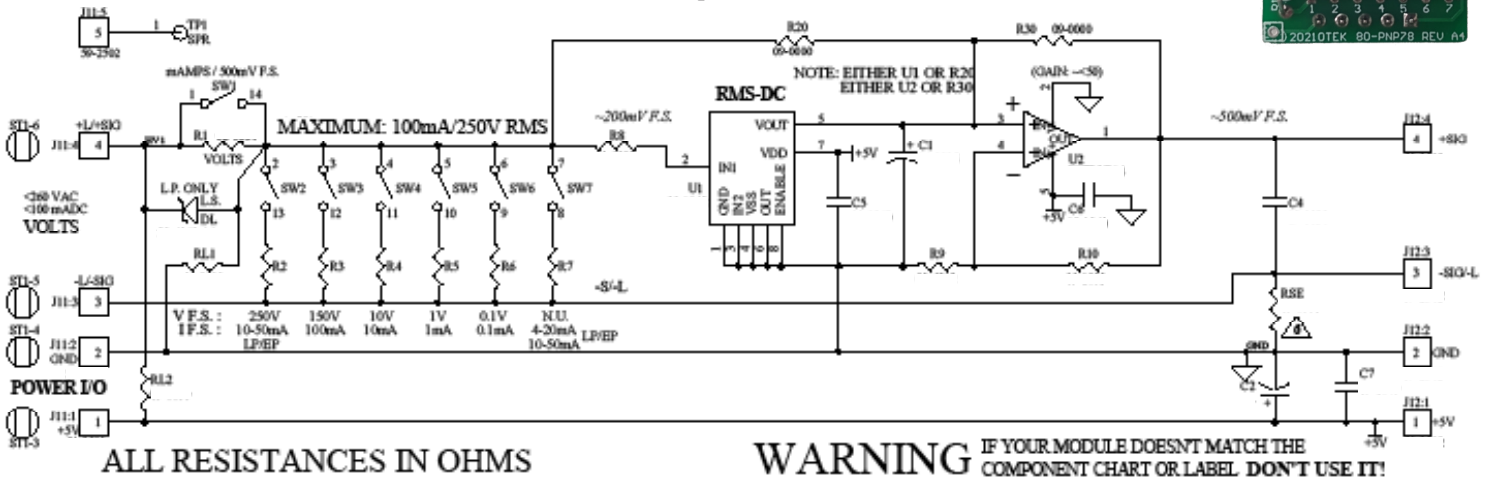
**Digits 78 Options 57**: 10-50mA C.L. 10 Ohm load.

**Digits 78 Options 20-28 & 30 are powered Multi-Range** RMS (ac or dc Input Signals) uses a multi-range signal conditioner for all signals, so all you need to do is "**Flip the Switch**". Tag # KP78-20 is for **RMS current inputs** of 4-20mA, 1mA, 10mA, 100 mA, 10-50mA, or 5A.
Assembly # A81-PNP-78-25 (Tag # KP78-25) is for **Volts RMS Inputs** of 100mV, 1V, 10V, 150V, and 250Vdc or ac. Just **Plug It In** and flip the switch! For custom ranges (Option 29) we include 2 spare switches, if included Tag # would be KP78-29-xx. (Note: K=Kit).

**Digits 78 Input How Powerless™ works? (Pat # 10,222,405 & others):** Tag # KP78-00: +current loop at ST1-6. J11-4 (No R1 & SW1 open) flows through RL2 to J12-1 & J11-1 (Don't connect to 1-3 or -4) to power the display. DL Clamps the voltage to <4V, the current through the load (display) develops the voltage between J12-2 (+) and J12-3 (-) returning to ST1-5 (-Loop) **IF RSE** is **NOT** installed. The voltage across R7 (4-20 mA) or R2 (10-50mA) is displayed. Externally power options (KP78-20 or KP78-25) have **NO** DL, RL1, or RL2. RSE is for single ended. U2 is only used for "custom". **Note**: Since we use an RMS-DC converter, the **PNP** accepts dc or ac signals up to 1KHz.




**(NOTE: THIS MULTIRANGE SC ALWAYS MOUNTS ON SCA & NEEDS PLUGS JC3 & JC4)**
**Used on Options 00, 17, 20-30**




ALL RESISTANCES IN OHMS

**WARNING** IF YOUR MODULE DOESN'T MATCH THE COMPONENT CHART OR LABEL **DON'T USE IT!**

| DIGITS 7&8 OPTION #s/ TAG # P78-XX | F.S. INPUT RANGE | SWITCH SELECTION FOR INPUT | | | | | | | LOOP POWER (P78-00 & 17) Vout: -0.1 to -0.5V | | | | | | CURRENT SHUNT (P78-20 THRU 24 & 57) VOUT: 0-0.5V F.S. | | | | | | VOLTAGE DIVIDER (P78-25 THRU 28 & 30) VOUT: 0-0.5V F.S. (SEE NOTE 11) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | SW1 | SW2 | SW3 | SW4 | SW5 | SW6 | SW7 | RSE | DL | R2 | R7 | R9 | R10 | R2 | R3 | R4 | R5 | R6 | R7 | R2 | R3 | R4 | R5 | R6 | R7 | U1 | R20 | R30 | RL1 | RL2 | R1 |
| 00 (00) | 4-20mA L.P. | OFF | | | | | | ON | N | Y | | 25 | N | N | | | | | | | | | | | | | | | | Y | Y | N |
| 17 (00) | 10-50mA L.P. | OFF | ON | | | | | | N | Y | 10 | | N | N | 10 | | | | | 25 | | | | | | | | | | Y | Y | N |
| 20 (20) | 4-20mA E.P. | ON | | | | | | ON | Y | | | | N | N | | | | | 4.99K | 25 | | | | | | | Y | N | Y | | | N |
| 21 (20) | 0.1mA E.P. | ON | | | | | ON | | Y | | | | N | N | | | | | | | | | | | | | Y | N | Y | | | N |
| 22 (20) | 1mA E.P. | ON | | | | ON | | | Y | | | | N | N | | | | 499 | | | | | | | | | Y | N | Y | | | N |
| 23 (20) | 10mA E.P. | ON | | | ON | | | | Y | | | | N | N | | | 50 | | | | | | | | | | Y | N | Y | | | N |
| 24 (20) | 100mA E.P. | ON | | ON | | | | | Y | | | | N | N | | 5 | | | | | | | | | | | Y | N | Y | | | N |
| 25 (25) | 0.1V E.P. | ON | | | | | | | Y | | | | N | N | | | | | | | | | | | | | Y | N | Y | | | Y |
| 26 (25) | 1V E.P. | OFF | | | | ON | | | Y | | | | N | N | | | | | | | | | | 1M | | | Y | N | Y | | | Y |
| 27 (25) | 10V E.P. | OFF | | | ON | | | | Y | | | | N | N | | | | | | | | | 49.9K | | | | Y | N | Y | | | Y |
| 28 (25) | 150V E.P. | OFF | | ON | | | | | Y | | | | N | N | | | | | | | | 4.99K | | | | | Y | N | Y | | | Y |
| 09 & 29 | CUSTOM | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 30 (25) | 260V E.P. | OFF | ON | | | | | | Y | | | | N | N | | | | | | | 1K | | | | | | Y | N | Y | | | Y |
| 56 & 57 (20) | 10-50mA E.P. | ON | ON | | | | | | | | | | | | | | | | | | 10 | | | | | | N | N | Y | N | N | N |

NOTES:
1. There are THREE (3) assemblies: 78-20 for current inputs, 78-25 for voltage inputs & 78-00 for Loop Powerless™ inputs.
2. After range selected, span must be calibrated on display for digits (DSA) & bar (BSA); zero adjust is optional
3. All ranges are full scale (10000) EXCEPT option -25 (1000).
4. CUSTOM (Option 29) see "Custom Report" - U2, R9, & R10 only for Customs
5. A blank spot = not used, Y = used
6. RMS & Option 25 (0.1V F.S.) only single ended (-signal and ground connected w/RSE) for AC or DC signals
7. **DON'T** close SW1 for Loop Power (Powerless™) OPTION 00 & 17. DON'T connect to J11-1 (ST-1) or J11-2 (ST1-2) when Loop Power (OPTION 00). For 4-20mA L.P. close SW7, for 10-50mA L.P. close SW2.
8. **ABSOLUTE MAXIMUM INPUT: 260V RMS, 100mA RMS.**
9. U1, R9, R10, & C6 are optional for custom ranges only.
10. **ARE YOU SURE?**...Always close a switch before you open another, never OPEN/CLOSE switches with signal on!
11. R1: 1M ohm, ALL switches open: 0.5V Full Scale.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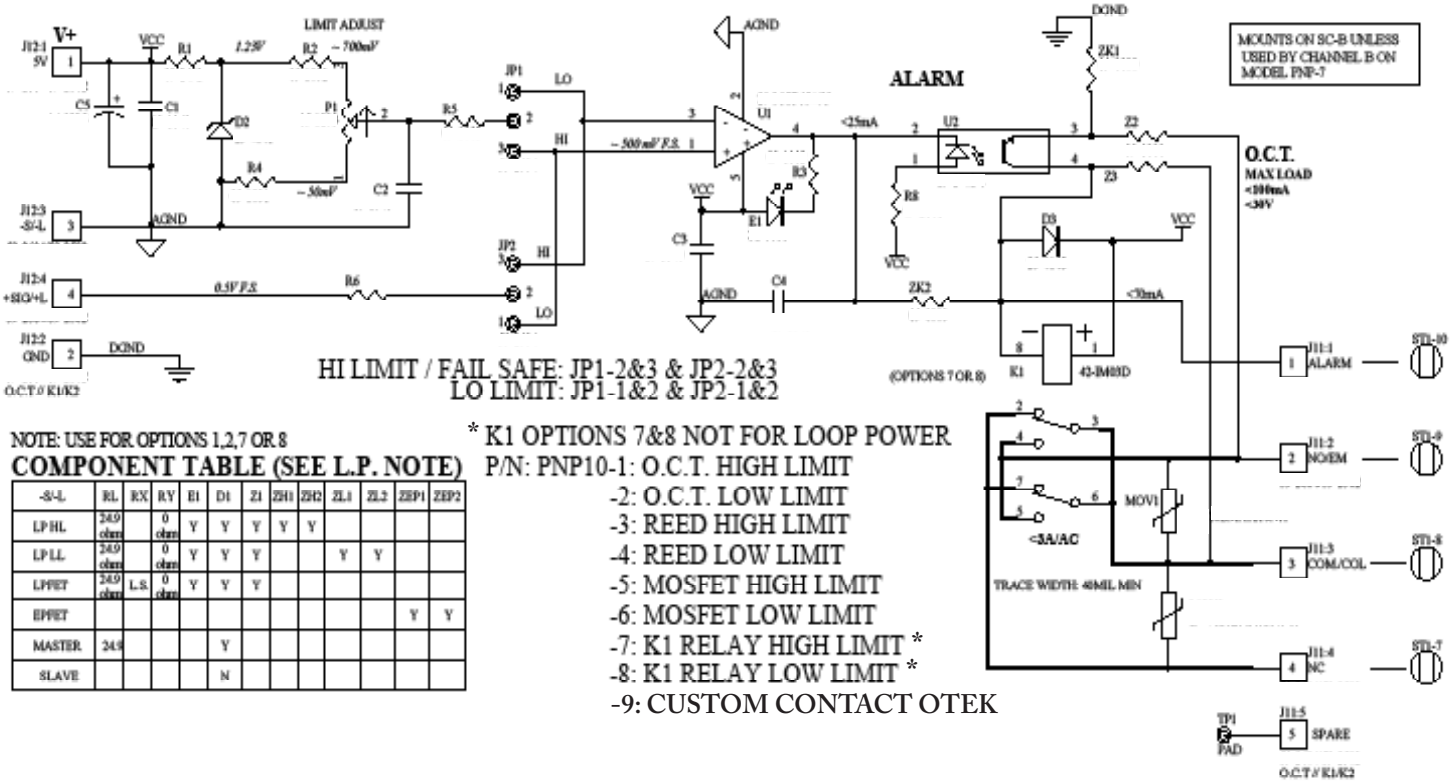
MADE IN USA

# CONTROLLING OUTPUT SECTION- DIGIT 10, OPTION 1-8 ©

## MOUNTS ON SC-B UNLESS USED BY CH. 2 ON MOD. PNP-B, D, R, U, W, X, Y, OR 7

02/01/24

### PNP10-1 OR -2 O.C.T. OR -7 OR -8 RELAY HI OR LOW ALARMS




NOTE: USE FOR OPTIONS 1,2,7 OR 8

**COMPONENT TABLE (SEE L.P. NOTE)**

| -S/-L | RL | RX | RY | EI | DI | ZI | ZH1 | ZH2 | ZL1 | ZL2 | ZEP1 | ZEP2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LP HL | 249 ohm | | 0 ohm | Y | Y | Y | Y | Y | | | | |
| LP LL | 249 ohm | | 0 ohm | Y | Y | Y | | | Y | Y | | |
| LPFET | 249 ohm | L.S. | 0 ohm | Y | Y | Y | | | | | | |
| EPFET | | | | | | | | | | | Y | Y |
| MASTER | 249 | | | | Y | | | | | | | |
| SLAVE | | | | | N | | | | | | | |

* K1 OPTIONS 7&8 NOT FOR LOOP POWER

P/N: PNP10-1: O.C.T. HIGH LIMIT
-2: O.C.T. LOW LIMIT
-3: REED HIGH LIMIT
-4: REED LOW LIMIT
-5: MOSFET HIGH LIMIT
-6: MOSFET LOW LIMIT
-7: K1 RELAY HIGH LIMIT *
-8: K1 RELAY LOW LIMIT *
-9: CUSTOM CONTACT OTEK

**Notes**: Digit 10, Options 1-8 use identical comparator circuit except for their output. See **pg. 18-19** & schematic above. High Alarm: Use JP1-2 & 3 and JP2-2 & 3. Low alarm: Use JP1-1 & 2 and JP2-1 & 2. Adjust P1 for desired tripping (limit) point for either Hi or Lo alarm. For **"Fail Safe"** Use "Low Alarm" (JP1-1 & 2 and JP2-1 & 2) and set tripping point at lowest (CCW) ~ < 5% as required. Results: **1.** If power fails, the relay will reset. **2.** If the signal drops below the limit, the relay will reset (2 alarms in 1). **IOW:** If signal or power fails, the output will switch to its resting position **(Fail Safe)**. **Need automatic blinking (on-off) alarm for annunciators (and PNPdisplay)? See our new inventions on P.34**

**Emergency Replacement Kits and Calibration Notes:** For emergency replacement 24/7 by just matching the required display, scale plate (if required), plug in signal or power conditioners modules & required jumpers per master chart (**pg. 15**) and helpful plug-in modules & jumper notes (**pg. 16**) to just Plug-N-Play after recalibrating for zero & span for digits & bar.

The kits were developed for minimum inventory and onsite labor, quick assembly, test & certification, and economical replacement. All you'll need for emergency replacement is:

**A)** 1 or 2 of each different size & shape of display (Digit 4 Options C-9) being used and its grade (Digit 5)
**B)** 1 or 2 of each different adapter plate (if required) being used (Digit 14)
**C)** 1 or 2 of each different signal conditioners being used (Digit 78 Options 00-57)
**D)** 1 or 2 of each power input modules (Digit 9 Options 1-5 or 9)
**E)** 1 or 2 of each control output (Digit 10 Options 1-D) being used
**F)** 1 or 2 (or more) **"Sticky"** scale plates (Digits 11 & 12) and under 5 minutes to plug-in, test and certify it and under 3 minutes to replace the failed unit. Tutorial video and/or personal training are available.

**PNP Notes: STOP! Before making any changes:**

1. Confirm unit works as originially designed for.
2. Remove cover(s) and take photos of assemblies & jumpers as received.
3. Repeat step 1 above (without cover or HUB housing).
4. List changes you will make, make them and take photo.
5. Are you sure? Apply power/signal as required.
6. Test 100% and document here the results. Good Luck! (You make your own).

# PNP DIGIT 10 OPTIONS A-D: 4-20mA C.L. OUT & KIS-PID PLUGS ON SC-B ©

Patent #7,684,768 & pending **NOTE: NOT AVAILABLE W/ DISPLAY #2 (DIGIT 6 OPTION 2)** 02/01/24

**OPTION A (Tag # KP10-A): 4-20mA out, no internal (32V) compliance (mounts on SCB unless used by channel 2 [PNP-7]).**

1. If PNP is LOOP POWER (input signal Options 00 or 17 or power input Option 0 on Digit 9) plug jumpers JE2-2 & 1, JE1-2 & 1 here.
2. If PNP is any other input signal option or externally powered (Digit 9 Options 1-4) plug jumpers JE2-2 & 1, JE1-2 & 1 here.
3. Connect your 5 < 32Vdc per "**Sink**" or "**Source**" diagram below.

**Specifications for all versions: Accuracy & Linearity: ±0.5% of full scale and input signal.**

**OPTION B (Tag # KP10-B): 4-20mA out with internal (32Vdc) compliance:** (Note: Options B-D are not available if Digit 9 is Option 0 Powerless™) and vice versa. Internal compliance is internally limited to **30mA** by D2.

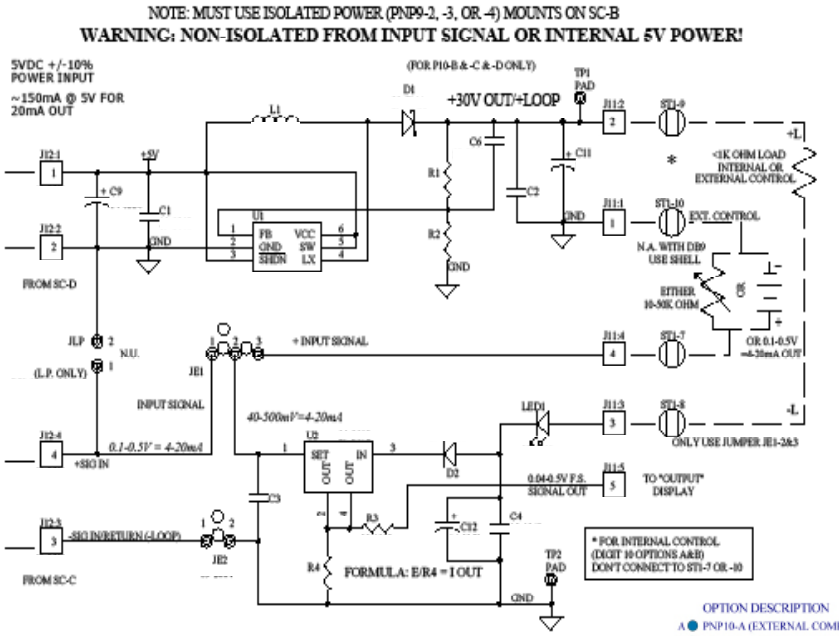
1. Plug-in jumpers JE1-2 & 1 and JE2-2 & 1.
2. Connect your external load (<1kΩ ) "+" to ST1-9 and its "-" to ST1-8 and monitor across it **OR** if the **PNP display** will monitor the C.L. output, just plug **JB2** (see **pg. 16**) and connect external load per schematic & notes. Maximum drop across R4: 0.5V at 20mA.

**OPTION C (Tag # KP10C): External control of 4-20mA output under your external resistance, voltage, or current loop (with 25 Ohm in series with your loop) control:** (NOTE: For manual/auto 4-20mA control use a 10 turn 50kΩ potentiometer, (10k-50k or 0.1-0.5V in = 4-20mA out) or variable resistor, or equivalent controlling signal or 0-0.5Vdc signal, and...

Plug JE1-2 & 3 ONLY and connect per diagram below (& **pg. 12**) for Options **B** or **C** and with or without using the **PNP** display (as Option B) **Controlling the C.L. Output: Formula: I out = E/R4 or R/R4 where "E" is in Vdc and "R" is in KΩ & R4 = 25Ω**, so 0.1-0.5Vdc input = 4-20mA output, or 10K-50K = 4-20mA due to internal reference of U2. Lowest output is ~0.4mA.

**OPTION D (Tag # KP10D) KIS-PID™ (PAT A.F.):** See **pg. 12** for description & applications. If you have problems/suggestions, contact us. **Transmission or retransmission?** Options **C** & **D** can be displayed (see "HUB" schematics on **pg. 13**) **if**: no module is plugged on **SCC** socket, JC3, JC-4, & JB1 **plugs are off** and **JB2 is on**. The input to the display is the same as the "transmitted" output (4-20mA) but in voltage (0.1V = 4mA & 0.5V = 20mA) across R4 through R3 to J11-5 to JB2 to +Sig **C (J1-4 [+Sig])**. "Follow the Signal" on **pg. 25**.

**Note**: If you need to display both **input & output**, buy any **2 channel** PNP. Ie: **PNP-B, D, R, & X** (meters) or **-U,W, & Y** (Xmtrs **pg. 24**).

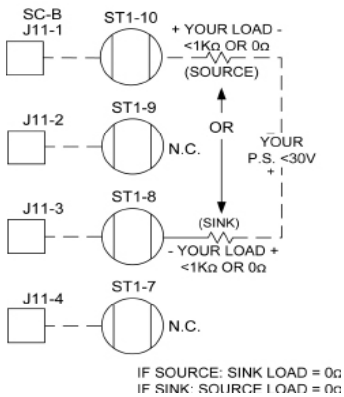



NOTE: FOR EXTERNAL CONTROLS SEE pg. 12

OPTION DESCRIPTION

- A PNP10-A (EXTERNAL COMPLIANCE)
- B PNP10-B (INTERNAL COMPLIANCE)
- C PNP10-C (EXTERNAL CONTROL W/ COMPLIANCE)
- D PNP10-D SAME AS C WITH KIS-PID CONTROL

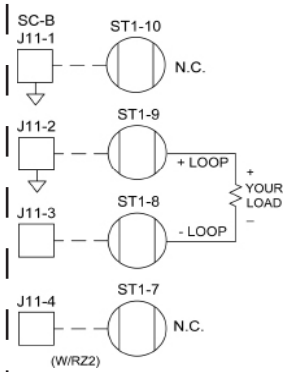
Option #10A KP10A: 4-20mA Out No P.S.




Note: external supply must be limited to 40V/30mA


80-PNP10-A B7

Option #10B KP10B: 4-20mA With Internal Power




**OPTION # JUMPERS TABLE**

| PNP10- | JLP | JE1 | JE2 |
|---|---|---|---|
| A | --- | 1&2 | 1&2 |
| B | --- | 1&2 | 1&2 |
| C | --- | 2&3 | --- |
| D | --- | 2&3 | --- |

**NOTES:**

1. This ASSY Mounts on SC-B & outputs on ST1-7 through 10 & inputs on J12-1 through 4 from internal power/signal.
2. **DANGER/WARNING**: Outputs are **NOT ISOLATED** from input signal or 5V power.
3. Ext. Control: Don't use with Powerless™ (Options 78-01 through 14 & 18) unless isolated. When used with KIS-PID (Option 10-D) R4 here is **not** installed, R3 is zero Ohm and RL on module PNP10-D (KIS-PID) is 25 Ohm to produce 4-20mA (0.1 to 0.5V) output. **See pg. 12**.
4. Tag #KP11-a (4-20mA retransmission without compliance) must use JE2-1 & 2 and JE1-1 & 2 to operate, the 4-20mA output is equal to PNP full scale input signal per digit 89 input option used.
5. Tag #KP11-B (4-20mA retransmission with internal 25Vdc compliance output) must use JE1-1 & 2 and JE2-1 & 2.
6. Tag #KP11-C (4-20mA output) externally controlled by user must use JE1-2 & 3 and NO jumper on JE2 or JLP. Output is governed by equation: Iout = E/R4 (25 Ohm). For 4-20mA out E = 0.1 - 0.5 Vdc at J11-5 (ST1-7). If for resistance input (potentiometer for manual control) use a 50K Ohm 10 turn potentiometer for 0.4-24mA output. You can put a ≤10K resistor in series with it for 4-24mA or 0.1 - 0.5Vdc = 4-20mA out.
7. Tag #KPNP11-D (KIS-PID): Internal (signal input) or external control of the current loop output is displayed on PNP Transmitters (U, W, or Y on display "B" and optional standard PNP displays (instead of input by plugging JB2 on HUB or I/O Board). **See pg. 12** How KIS-PID Works.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MADE IN USA

# NEED A COMPLETE MANUAL/AUTOMATIC (SIMPLE PID) EXTERNALLY CONTROLLED TRANSMITTER? ©

02/01/24

**NOTE: For single channel models only!**

1. Select housing option (Digit 4)
2. Any Grade (Digit 5)
3. Any adapter plate (Digit 14) or custom or none
4. Input Signal Option **00** - Loop Power (Digits 7 & 8)
5. Any Power input Option 1-4 (Digit 9)
6. Control output Option **10D** (Digit 10) - consisting of Options **C&D**
7. Connect per diagram below and **KIS!**

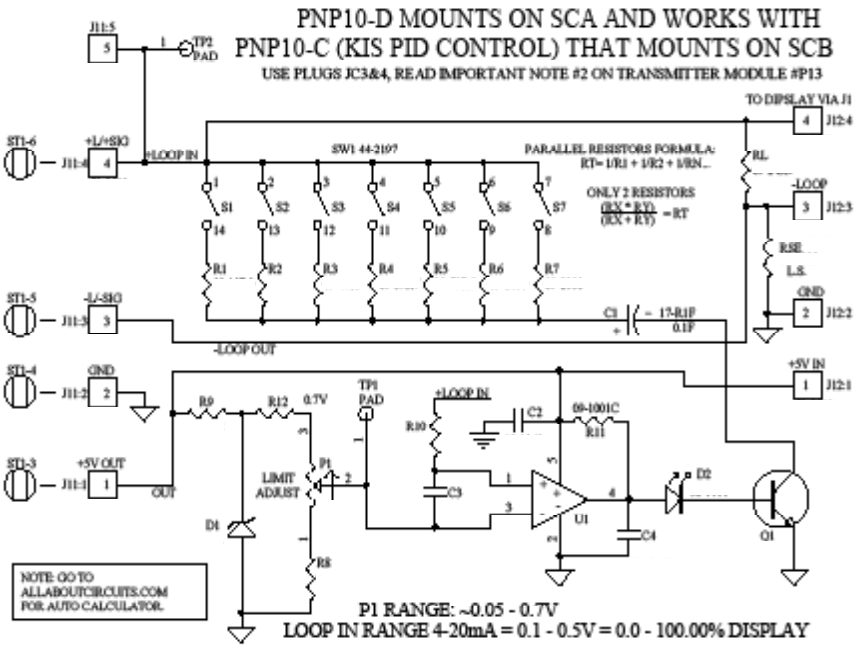
**Note:** Not available with 2 displays Digit 6 Option 2. See **pg. 21-22** for exception.

**NOTES FOR KIS-P.I.D. (USING PNP10-C & -D)**

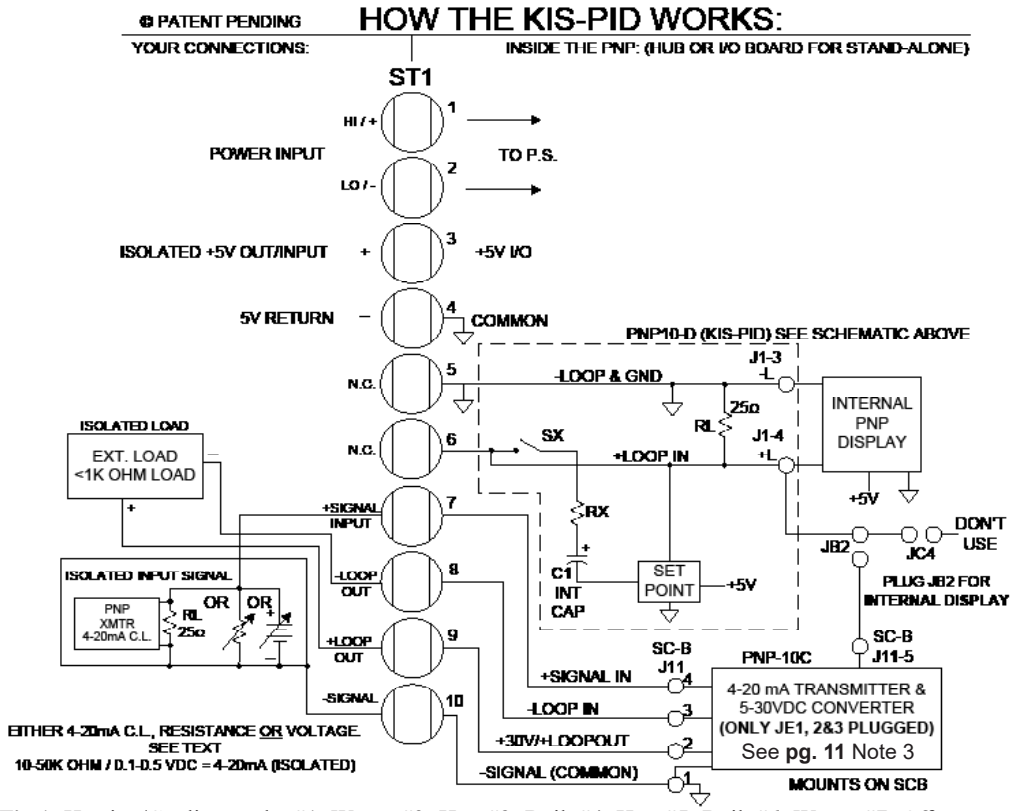
1. PNP10-D mounts on **SCA**, PNP10-C mounts on **SCB**, use JC3 & JC4 jumpers on I/O Board or HUB.
2. Must use isolated power supply PNP9-2, or -3, or -4 THA mounts on SCD and connects to ST1-1 (+/High) and ST1-2 (-/Low).
3. To discharge C1, momentarily short out ST1-6 (+L) and ST1-5 (-L).
4. To charge C1 when used as "integral," close desired S1-S7 or combination (in parallel), in other words: integrate, to prevent over or under shoot of current into users system. Since the output current loop goes through RL & RSE and ends at PIN2 of J11-1 of PNP10-C (Transmitter) on SCB, C1 becomes in parallel with +loop out (ST1-8) and users -loop load at ST1-9 (-L) dampening the loop output based on selected SW1 resistor & C1. Best RC for "Tripping Point" is ~90% of full scale (~0.45V) and since C1 is 0.1 FARAD, R3 would create a ~10 second delay to full scale creating a "parabolic" effect during both charge and discharge of C1.
5. For lower "RC" combinations, use multiple switch/resistors in parallel "ON". *Contact us for CUSTOM COMBINATIONS* see scope photos.

**KIS-PID OPERATIONAL THEORY**

Assume: Your process requires 16mA (at its input) to achieve 100.0°C without overshooting and you want to slow it down at 90.0°C (10% below the optimal value) or 450mV (50mV below F.S.). Set your input "CONTROLLING SIGNAL" at ST1-7(+) to 450mV (or 45k Ohms or 16mA) and wiper of P1 (TP1) at 450mV. Since our "RL" (Loop Resistor) is 25 Ohms it will develop 450mV (10% <F.S.) across it tripping U1 negative connecting C1(-) to -Loop starting to charge itself shunting the loop current away from your load and the PNP display slowing your heating and gradually (but slower) increasing the temperature with a "parabolic" effect to prevent overshooting giving enough time to your load to react and maintain the oven temperature constant until your dinner is ready, try it! The opposite is true for cooling down where C1 will slowly discharge through your load resistor (and our RL [25 Ohms]) in "series" with your load to gradually decrease the temperature (instead of undershoot with sudden on-off) for smooth (parabolic) temperature control. See connection below.




Note: Need dual displays for input & output? See Digit 14 on **pg. 18**




**PNP10-C Mounts on SCB**

**Fig. 1**

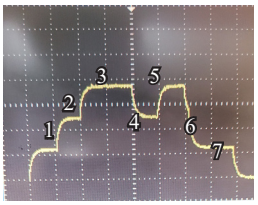



**Fig. 2**

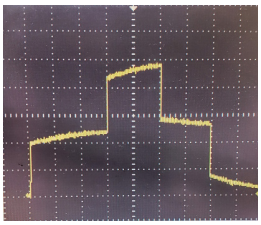


**Fig. 3**

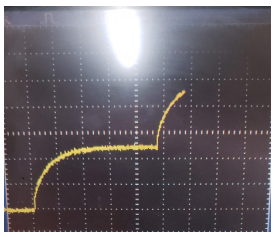


**Fig 1:** Heating/Cooling cycle: **#1:** Warm **#2:** Hot **#3:** Boil **#4:** Hot **#5:** Boil **#6:** Warm **#7:** Off All under your input signal control. **Fig 2:** Typical 2 cycle scaling pressure cycle. **Fig 3:** Parabolic effect. All under your input control!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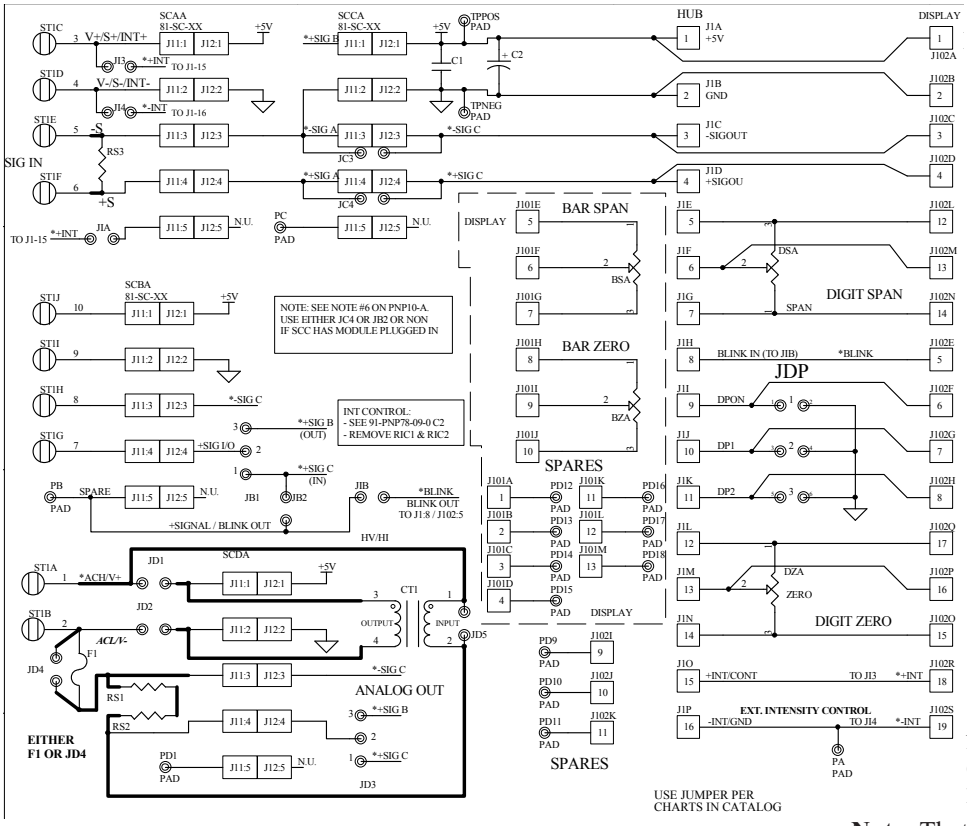
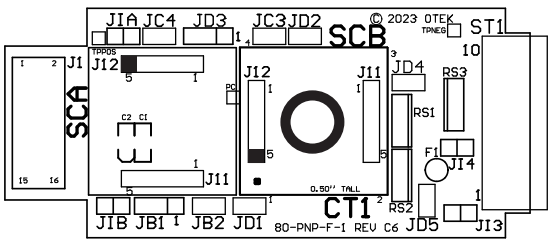
# PNP THE ONE FOR ALL HUB: DIGIT 4 OPTIONS E, F, H, & M ©
# SCHEMATIC/PLD SEE MASTER CHART pg. 15 SEE NOTES pg. 17

02/01/24




## Single channel only

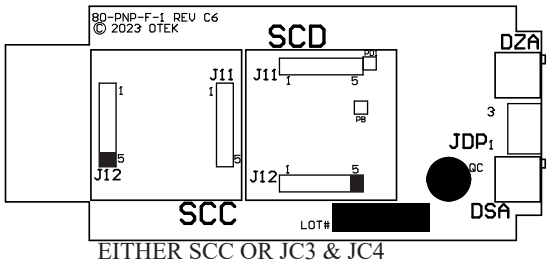
TOP VIEW




SC-B NOT SHOWN (UNDER CT1)
EITHER SCB OR CT1, RS1, RS2 & F1

**NOTE:**
**ALL J12 PIN5 IS BLOCKED FOR "PROPER" PLUG-IN POLARITY.**

BOTTOM VIEW




EITHER SCC OR JC3 & JC4

Note: Except for display's J101 & J102 connectors, the HUB (above) and the "stand alone" schematics are identical. See **pg. 14**

**(JDP) DECIMAL POINT CHART #13**

| D.P. | J1-18 JDP1 | J1-19 JDP2 | J1-20 JDP3 |
|---|---|---|---|
| 1XXXX | Y | N | N |
| 1XXX.X | N | Y | Y |
| 1XX.XX | N | Y | N |
| 1X.XXX | N | N | Y |
| 1.XXXX | N | N | N |

(X = DON'T CARE)

NOTE: THE SAME SCHEMATIC IS ON ALL "STAND ALONE" VERSIONS.

**Note:** That <u>all</u> displays are identical in their:

a) J1 inputs, F.S. signal input range of ±0.5Vdc & power >3<5.5Vdc.

b) Case option Digit 4 E & F have <u>NO</u> bar therefore <u>BSA</u> & <u>BZA</u> are absent.

c) **All** input/outputs are identical at ST1 & J1 regardless of the model number.

## <u>PNP General Troubleshooting Notes</u>

**Remember:** All signal conditioners sockets have V+ (or High) input on J11-1, V- (or Low) on J11-2, + input signal on J11-4 & "-" on J11-3 and all outputs: J12-1:VCC, -2: GND, -3: -signal out & -4: + signal out. **<u>Except Option 78-03</u> (<u>Watts</u>)** J11-1-4 Inputs, J12-1 & 2 Power input & J12-3 (GND) & J12-4 + Output Signal. Socket SCB is for either inputs or outputs (Digit 10) or channel 2 input signal. All PCB are only 0.9" x 0.9".

1. Check that <u>all</u> jumpers are plugged in per the master chart (**pg. 15-16**), and read important notes on **pg. 17**.
2. Power at <u>J1-1</u> is >3<5.5Vdc. J1-2 is power ground.
3. Signal at J1-4 is ±0.5Vdc F.S. with respect to J1-3 (- signal return) but...
4. <u>Loop Powered</u> versions (Options 00 & 17) J1-3 is negative (~<0.5V F.S.) w/respect to power ground (J1-2) and J1-4 (+ signal input) is controlled by "DZ" (**D**igits **Z**ero Adjust) potentiometer on **HUB** or **I/O** board...but for all other input signals J1-2 & J1-3 are shorted (0v) via RSE (single ended) by the input signal conditioner used. See multirange schematic on **pg. 9**.
5. That's all! KIS! If still having problems, read notes 1-4 above or contact us (below) for assistance. Why? Because if you have carefully confirmed that:
   a) All your input/output connections are per Master Chart on **pg. 15-16** and notes on **pg. 17**.
   b) Module(s) is plugged on socket(s) per Master Chart **pg. 15-16**.
   c) All plug in jumpers are "**on**" (or "**off**") per Master Chart **pg. 15-16**.
   d) You have recalibrated (if required) the displays for Zero & Full Scale.
   e) You are sure of A-D above. **<u>IF</u>** we are **<u>WRONG!</u>** Sorry! Send use the name of your CHARITY TO DONATE (in your name) up to $1,000 - (at our discretion) after confirming your comments within 60 days. Thank you!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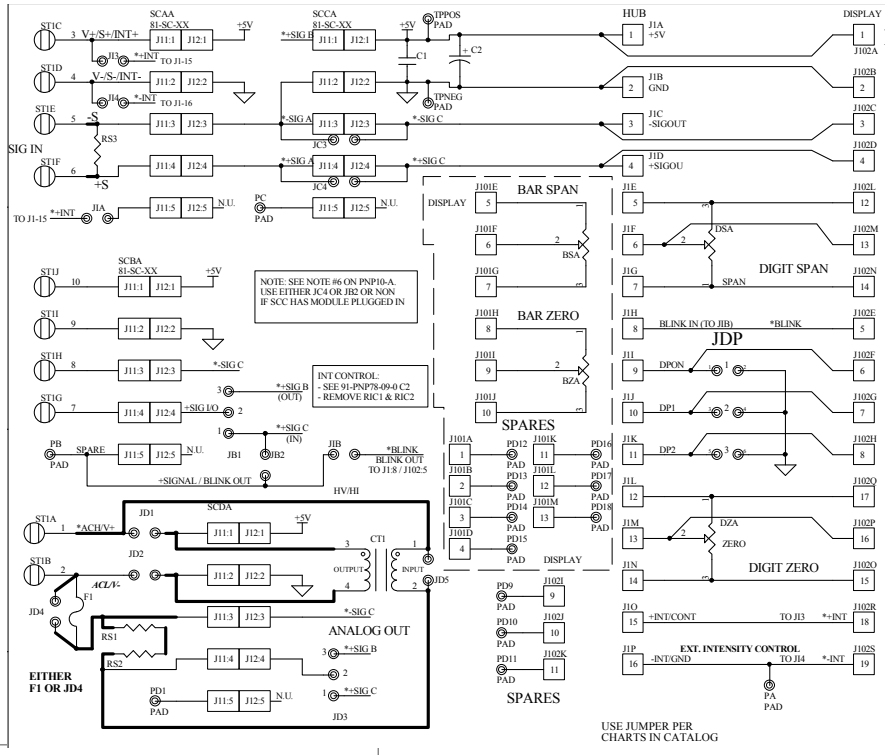
# PNP DIGIT 4 OPTIONS SINGLE CHANNEL (N, 2, & 9 STAND ALONE) SCHEMATIC/PLD SEE MASTER CHART pg. 15-16 ©

02/01/24

Remember: Either HUB (PNP-E, F, G, or J) or **stand alone**, schematics are identical, either J1 (for HUB) or "SC" A-D (for S.A.)




INTENSITY CONTROL NOTES:
1) IF USED WITH PNP78-09-0 C2 ON SCA OR SCB REMOVE D10, RS1 & ADD RI, RI1, RI2 ON DISPLAY

**NOTES: SEE CHART# 78 & 9 FOR:**

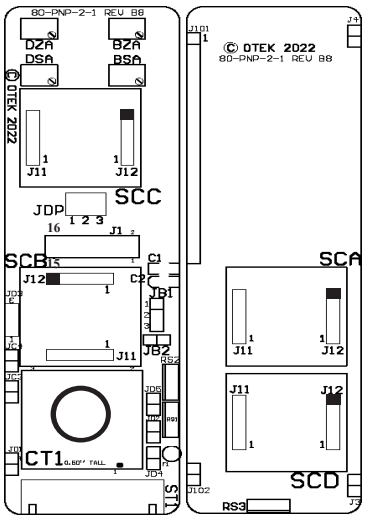
CONNECTIONS, PLUG-IN MODULE LOCATION, JUMPERS VS FUNCTION, DECIMAL POINT SELECTION. J1 FOR HUB, J101&J102 FOR DISPLAY.

**(JDP) DECIMAL POINT CHART #13**

| D.P. | DP1 | DP2 | DP3 |
|---|---|---|---|
| 1XXXX | YES | X | X |
| 1.XXXX | NO | NO | NO |
| 1X.XXX | NO | NO | YES |
| 1XX.XX | NO | YES | NO |
| 1XXX.X | NO | YES | YES |

**(X = DON'T CARE)**

PNP-2-1 or -9-1 = 80-PNP-9-1




BACK SIDE FRONT SIDE

Either J1 (for -G & HUB) or SCA-D & ST1 for "Stand Alone (PNP-2 or -9)

ALL J12-5 Sockets are blocked to prevent you from plugging "SC" backwards.

J101 ☐ PNP-G, -2, -7 OR -9

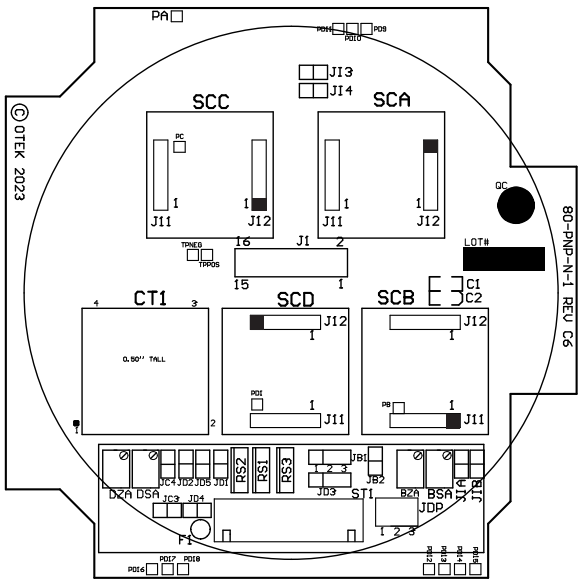
J102 ◯ PNP-J OR -N

Note: J101 on **PNP-1** not connected. Only used for support

**NOTES FOR Digit 4 (case Option D):** As of 3-1-22 only models -E, -F, -G, & -J use the HUB. All others are **"stand-alone"**

1. If for HUB, PCB only has J1, pots & C1 & C2.
2. If for **"stand alone"**, PCB has all parts except J1
3. RS3 (P/N 03-R040) for 4AAC Option 34 along with Kit # KP78-34.
4. **ALWAYS** adjust **ZERO** (TWICE) before **SPAN.**
5. **ALWAYS** confirm proper **"PLUG"** placement (per Master Chart **pg. 15-16**) before applying signal or power or sealing the cover.

PNP-N-1




80-PNP-N-1

**DISPLAY: AUTOMATIC OR EXTERNAL INTENSITY CONTROL & BLINKING ALARM**

This option converts your isolated or non-isolated control signal either 5-24Vdc or 0-1OOK Ω variable resistance. 5Vdc/100k Ω = minimum intensity and 24Vdc/0Ω = maximum intensity. This option uses ST1-3 & -4 and is **ONLY** available for Digits 78 Options 00, 04-17, 20-30, 34-44, 53-57 or custom designs. It is available in **"stand alone"** housings & **HUB** models. Use Digit **78** Options 00, 04-17, 20-30, 34-44, & 53-57 or Custom Option 09.

**NVG3?** Use Digit 12 Option 9 (custom) and specify **NVG3** filter or as part of Option C for NVG3 displays must be **GREEN Digit 11 Option 5.**

**Flashing displays**, if this custom option is included, upon the set point tripping. (See digit 12 option on pg. 18) The diplay will flash ~ 2/sec.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# MASTER CONNECTION CHART ©

## PNP SINGLE CHANNEL CONNECTIONS SEE pg. 21 FOR 2 CH.

02/01/24

NOTES: **1.** All PNP models have IDENTICAL connections (unless custom P/N). ***IC** = **I**ntensity **C**ontrol

**2.** Connections only depend on Digits 78, 9 & 10. Option number. **See important calibration notes on pg. 17.**

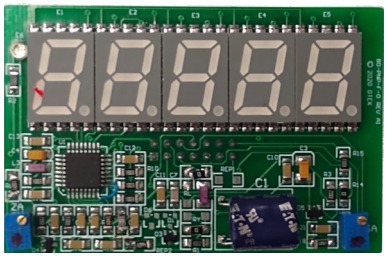
| DIGIT # OPTION # | NAME See pg. 18 for Ord. Info | CONNECT TO ST1-TERM# | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 ch. 1 | 4 ch. 1 | 5 ch. 1 | 6 ch. 1 | 7 | 8 | 9 | 10 |
| 78-00 | 4-20 mA Loop Power | | | +IC | -IC | -L | +L | | | | |
| 78-01 | VAC SIG POWER | | | VH | VL | | | | | | |
| 78-02 | AAC SIG POWER | AH | AL | +IC | -IC | | | | | | |
| 78-03 | WAC SIG POWER | AH | AL | VH | VL | | | | | | |
| 78-04 | Hz VAC SIG PWR | VH | VL | +IC | -IC | | | | | | |
| 78-17 | 10-50mA Loop Power | | | +IC | -IC | -L | +L | | | | |
| 78-18 | VDC SIG POWER | | | VH | VL | | | | | | |
| 78-20 | 4-20mA C.L. Ext Pwr | | | +IC | -IC | -L | +L | | | | |
| 78-21 | 100 uA F.S. | | | +IC | -IC | -S | +S | | | | |
| 78-22 | 1mA RMS | | | +IC | -IC | -S | +S | | | | |
| 78-23 | 10mA RMS | | | +IC | -IC | -S | +S | | | | |
| 78-24 | 100mA RMS | | | +IC | -IC | -S | +S | | | | |
| 78-25 | 100mV RMS | | | +IC | -IC | -S | +S | | | | |
| 78-26 | 1V RMS | | | +IC | -IC | -S | +S | | | | |
| 78-27 | 10V RMS | | | +IC | -IC | -S | +S | | | | |
| 78-28 | 100V RMS | | | +IC | -IC | -S | +S | | | | |
| 78-30 | 250V RMS | | | +IC | -IC | -S | +S | | | | |
| 78-31 | W: 1V x 1A RMS | | | VH | VL | AL | AH | | | | |
| 78-32 | W: 1V x 1V RMS | | | V1H | V1L | V2L | V2H | | | | |
| 78-33 | W: 120V x 4A RMS | | | VH | VL | AL | AH | | | | |
| 78-34 | 4A RMS | | | +IC | -IC | AL | AH | | | | |
| 78-41 | 10K Hz, TTL | | | +IC | -IC | SL | SH | | | | |
| 78-42 | 100 Hz @ 120V | | | +IC | -IC | SL | SH | | | | |
| 78-43 | 100 Hz @ 240V | | | +IC | -IC | SL | SH | | | | |
| 78-44 | 500Hz @ 120V | | | +IC | -IC | SL | SH | | | | |
| 78-45 | Strain-Gauge <4k Ω | | | +E | -E | -S | +S | | | | |
| 78-47 | PT100 RTD | | | -E | +E | -S | +S | | | | |
| 78-48 | PT1000 RTD | | | -E | +E | -S | +S | | | | |
| 78-50 | TYPE J TC | | | K | A | -S | +S | | | | |
| 78-51 | TYPE K TC | | | K | A | -S | +S | | | | |
| 78-52 | TYPE T TC | | | K | A | -S | +S | | | | |
| 78-53 | pH (Acidity) | | | +IC | -IC | -S | +S | | | | |
| 78-54 | ORP | | | +IC | -IC | -S | +S | | | | |
| 78-55 | RH % | | | +IC | -IC | L | H | | | | |
| 78-56 | 10K Ω RESISTANCE | | | +IC | -IC | L | H | | | | |
| 78-57 | 10-50mA C.L. | | | +IC | -IC | -L | +L | | | | |
| 9-0 | NONE | SIGNAL POWERED | | | | | | | | | |
| 9-1 | NON-ISOL 5VDC | V+ | V- | | | | | | | | |
| 9-2 | ISOL 5VDC | V+ | V- | | | | | | | | |
| 9-3 | ISOL. 4-32VDC | V+ | V- | | | | | | | | |
| 9-4 | ISOL VAC/VDC | VH | VL | | | | | | | | |
| 10-0 | NONE | | | POWERLESS™ | | | SEE NOTE 10 BELOW | | | | |
| 10- 1& 2 | ISOL. O.C.T. N.O. | | | | | | | | C | E | |
| 10- 3&4 | REED RELAY SPDT | | | | | | | NC | C | NO | |
| 10- 5&6 | MOSFET/SSR SPDT | | | | | | | NC | C | NO | |
| 10- 7&8 | 4A RELAY SPDT | | | | | | | NC | C | NO | |
| 10-A | 4-20mA OUT ONLY No Compliance | SEE SCHEMATIC pg. 10-11 | | | | | | NC | -L | NC | GND |
| 10-B | 4-20mA & 30V OUT | SEE SCHEMATIC pg. 10-11 | | | | | | | -L | +L | |
| 10-C | Output Ext. Control | SEE SCHEMATIC pg. 10-11 | | | | | | +S | -L | +L | -S |
| 10-D | KIS-PID w/ Ext. Cont. | SEE pg. 14-15 | | | | | | +S | -L | +L | -S |
| 10-F | BUFF. AN. OUT | | | | | | | +V | -V | | |

PNP-E

80-PNP-E-0

ZERO SPAN

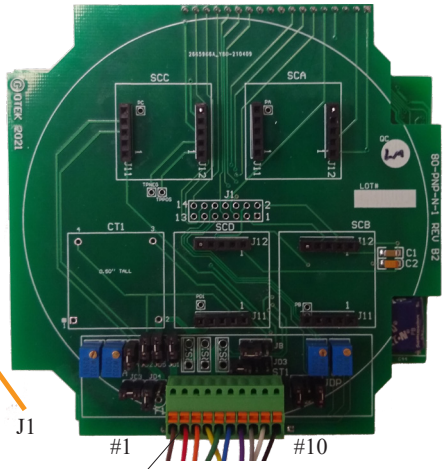
PNP-F



ZERO 80-PNP-F-0 SPAN

PNP-9 SHOWN FOR **HUB** (-G)

PNP-J & -N BACK BOARD SHOWN FOR "**STAND ALONE**" (-N)



J1

#1 #10

ST1 I/O CONNECTOR

80-PNP-N-1

80-PNP-9-1, PNP-2 & 7 are very similar

**Either** "J1" for **HUB only OR** sockets SCA-SCD with signal conditioners & ST1 I/O connector for "**Stand Alone**". DSA: Digits Span, DZA: Digits Zero, BSA: Bar Span, BZA: Bar Zero Adjustments.

**POWER INPUT (See Page 7)**

9-1: input > 3.5 < 5.5vdc < 20mA
9-2: input > 4.5 < 5.5vdc < 100mA
9-3: input > 4.5 < 32vdc < 200mA
9-4: Vac or dc > 25 < 250V ~50mA

The "One For All" **HUB** (One output for all inputs)

#10

#1

shown with Option 78-00 and Option 10-7 or 8 (4A SPDT)

IMPORTANT NOTE: Read Calibration & Troubleshooting and Notes on **pg. 17**. You can replace 4 with 1: ~for Hi or Lo Limit Jumper Selectable, see **pg. 10**. **No** alarms on models with **two (2)** channels (**Digit 10** must have **Option 0**) unless **custom**, contact OTEK (below).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**CAGE CODE 57861**

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The "DIGITIZERS"

A CLASS 1E COMPANY

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TUCSON, AZ 85714 U.S.A.

MADE IN USA

# PNP KITS FOR SPARE INVENTORY, MOUNTING & CONNECTION CHART ©

## SEE NOTES ON pg. 17, 20-21 FOR CHANNEL 2

02/01/24

SEE **pg. 13** FOR HUB PLD, **pg. 14** FOR -M, -N, -H, -2, & -9. **pg. 21** FOR 2 CH.

| | DIGIT # OPTION # | TAG # KP78-XX | NAME | MOUNT ON SC-SOCKET | Plug Jumper * | CONNECT TO ST1-TERM# 1 | 2 | 3 ch. 1 | 4 ch. 1 | 5 ch. 1 | 6 ch. 1 | 7 | 8 | 9 | 10 | NOTES ON pg. 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 78-00 A1 | KP78-00 | 4-20 mA Loop Power | A | JC3 & JC4 | | | | | -L | +L | | | | | 78-00 |
| | 78-01 B2 | KP78-01 | VAC SIG POWER | A | JC3 & JC4 | | | VH | VL | | | | | | | |
| | 78-02 | KP78-02 | AAC SIG POWER | D | JD3:2&1 | AH | AL | | | | | | | | | 78-02 |
| | 78-03 | KP78-03 C/O 3 ASSEMBLIES | WAC SIG POWER | 01 @ A<br>02 @ D<br>03 @ C | JD3:2&3 | AH | AL | VH | VL | | | | | | | 78-03 |
| | 78-04 | KP78-04 C/O 2 ASSEMBLIES | Hz VAC SIGNAL POWER & HZ-DC | 01-04 @ D<br>04 @ C | JD1, 2, JD3, 2&3, JSP 2 & 3(on 78-04) | VH | VL | | | | | | | | | 78-04 |
| | 78-09 | ---------- | CUSTOM | -- | -- | | | | | | | | | | | |
| | 78-17 | KP78-00 | 10-50mA Loop Power | A | JC3 & 4 | | | | | -L | +L | | | | | 78-17 |
| | 78-18 | KP78-18 | VDC SIG POWER | A | JC3 & 4 | | | VH | VL | | | | | | | 78-18 |
| | 78-20 | KP78-20 | 4-20mA C.L. Ext Pwr | A | JC3 & 4 | | | | | -L | +L | | | | | 78-20 |
| | 78-21 | KP78-20 | 100 uA F.S. | A | JC3 & 4 | | | | | -S | +S | | | | | 78-20 |
| | 78-22 | KP78-20 | 1mA RMS | A | JC3 & 4 | | | | | -S | +S | | | | | 78-20 |
| | 78-23 | KP78-20 | 10mA RMS | A | JC3 & 4 | | | | | -S | +S | | | | | 78-20 |
| | 78-24 | KP78-20 | 100mA RMS | A | JC3 & 4 | | | | | -S | +S | | | | | 78-20 |
| | 78-25 | KP78-25 | 100mV RMS | A | JC3 & 4 | | | | | -S | +S | | | | | 78-25 |
| | 78-26 | KP78-25 | 1V RMS | A | JC3 & 4 | | | | | -S | +S | | | | | 78-25 |
| | 78-27 | KP78-25 | 10V RMS | A | JC3 & 4 | | | | | -S | +S | | | | | 78-25 |
| | 78-28 | KP78-25 | 100V RMS | A | JC3 & 4 | | | | | -S | +S | | | | | 78-25 |
| | 78-29 | ---------- | CUSTOM | -- | -- | | | | | | | | | | | 78-25 |
| | 78-30 | KP78-25 | 250V RMS | A | JC3 & 4 | | | | | -S | +S | | | | | 78-25 |
| | 78-31 | KP78-31 | W: 1V x 1A RMS | A | JC3 & 4 | | | VH | VL | AL | AH | | | | | 78-31 |
| | 78-32 | KP78-32 | W: 1V x 1V RMS | A | JC3 & 4 | | | V1H | V1L | V2L | V2H | | | | | 78-32 |
| | 78-33 | KP78-33 | W: 120V x 4A RMS | A | JC3 & 4 | | | VH | VL | AL | AH | | | | | 78-33 |
| | 78-34 | KP78-34 | 4A RMS | A | JC3 & 4 | | | | | AL | AH | | | | | 78-34 |
| | 78-41 | KP78-41 | 10K Hz, V5 TTL | A | JC3 & 4 | | | | | SL | SH | | | | | 78-41 |
| | 78-42 | KP78-42 | 100 Hz @ 120V | A | JC3 & 4 | | | | | SL | SH | | | | | 78-41 |
| | 78-43 | KP78-43 | 100 Hz @ 240V | A | JC3 & 4 | | | | | SL | SH | | | | | 78-41 |
| | 78-44 | KP78-44 | 500Hz @ 120V | A | JC3 & 4 | | | | | SL | SH | | | | | 78-41 |
| | 78-45 | KP78-45 | Strain-Gauge | A | JC3 & 4 | | | +E | -E | -S | +S | | | | | 78-45 |
| | 78-47 | KP78-47 | PT100 RTD | A | JC3 & 4 | | | -E | +E | -S | +S | | | | | 78-47 |
| | 78-48 | KP78-48 | PT1000 RTD | A | JC3 & 4 | | | -E | +E | -S | +S | | | | | 78-48 |
| | 78-50 | KP78-50 | TYPE J TC | A | JC3 & 4 | | | K | A | -S | +S | | | | | 78-50 |
| | 78-51 | KP78-51 | TYPE K TC | A | JC3 & 4 | | | K | A | -S | +S | | | | | 78-50 |
| | 78-52 | KP78-52 | TYPE T TC | A | JC3 & 4 | | | K | A | -S | +S | | | | | 78-50 |
| | 78-53 | KP78-53 | pH (Acidity) | A | JC3 & 4 | | | | | -S | +S | | | | | 78-53 |
| | 78-54 | KP78-54 | ORP | A | JC3 & 4 | | | | | -S | +S | | | | | 78-54 |
| | 78-55 | KP78-55 | RH % | A | JC3 & 4 | | | | | L | H | | | | | 78-55 |
| | 78-56 | KP78-56 | 10K Ω RESISTANCE | A | JC3 & 4 | | | | | L | H | | | | | |
| NOTES: Kits have same # as digit & option # | 78-57 | KP78-20 | 10-50mA C.L. | A | JC3 & 4 | | | | | -L | +L | | | | | |
| POWER INPUT | 9-0 | KP9-0 | NONE | - | **POWERLESS ™** | | | | | | | | | | | |
| | 9-1 | KP9-1 | NON-ISOL 5VDC | D | JD1&2 | V+ | V- | | | | | | | | | 9-1 |
| | 9-2 | KP9-2 | ISOL 5VDC | D | JD1&2 | V+ | V- | | | | | | | | | 9-2 |
| | 9-3 | KP9-3 | ISOL. 4-32VDC | D | JD1&2 | V+ | V- | | | | | | | | | 9-3 |
| | 9-4 | KP9-4 | ISOL VAC/VDC | D | JD1&2 | VH | VL | | | | | | | | | 9-4 |
| | 9-9 | ---------- | CUSTOM | -- | -- | | | | | | | | | | | |
| CONTROL OUTPUTS ONE CHANNEL ONLY | 10-0 | NONE | NONE | -- | -- **SEE pg. 10-11 AND NOTE 10 BELOW** | | | | | | | | | | | |
| | 10- 1& 2 | KP10-1 & 2 | ISOL. O.C.T. | B | JB1&2 | **READ NOTE 10-1 ON pg. 17** | | | | | | | C | E | | 10-1 |
| | 10- 3&4 | KP10-3 & 4 | REED RELAY | B | JB1&2 | **READ NOTE 10-3 ON pg. 17** | | | | | | NC | C | NO | | 10-3 |
| | 10- 5&6 | KP10-5 & 6 | MOSFET/SSR | B | JB1&2 | **READ NOTE 10-5 ON pg. 17** | | | | | | NC | C | NO | | 10-5 |
| | 10- 7&8 | KP10-7 & 8 | 4A RELAY | B | JB1&2 | **READ NOTE 10-7 ON pg. 17** | | | | | | NC | C | NO | | 10-7 |
| | 10-9 | ---------- | CUSTOM | -- | -- | | | | | | | | | | | |
| | 10-A | KP10-A | 4-20mA OUT ONLY | B | JB1, 2&1 JE1, 1&2 JE2 | | | **SEE pg. 10** | | | | | -L | +L | GND | 10-A |
| | 10-B | KP10-B | 4-20mA & 30V OUT | B | JB1, JB3, JE1:1&2, JE2 | | | **SEE pg. 10** | | | | | -L | +L | +L | 10-B |
| | 10-C | KP10-C | Ext. C.L. Control | B | JE1-2 & 3 | | **SEE pg. 10-11** | | | | | +S | -L | +L | -S | 10-C |
| | 10-D | KP10-D | KIS-PID | A | | | **SEE pg. 10-11** | | | | | +S | -L | +L | -S | 10-D |

*JB, JC, JD, & JDP jumpers are on **HUB** or I/O board. All other jumpers are on plug in boards.

10. **No** alarms or transmission on models with **two (2)** channels (**Digit 10** must have **Option 0**) unless **custom**, contact OTEK (below).


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# CALIBRATION NOTES FOR SPARE KITS CHART ON pg. 16 ©

02/01/24

**Important Connection & Calibration Notes for your technicians:**

1. I/O Connector ST1: Just Plug It In! Use 18-24 GA solid or stranded wire. Strip its end ⅜ - ½", identify the terminal # & press it in while inserting the wire. Pull the wire to confirm a good connection. That's all!
2. Always read calibration notes when making changes to the **PNP.**
3. Always only use certified calibrated calibrators & technicians.
4. Always confirm 3 times when changing zero & span adjustments: zero, then span, confirm/display zero, then span, zero & span.

**Notes for Master Chart (pg. 15-16) Digits 78: (Note: Tag # is same as option # on master chart)**

78-00: Same assembly, different switch setting for Options 00 & 17. See Tag #KP78-00 on **pg. 8** for switch settings & schematic.
78-01: The same tag is used for Option 18 but different zero & span calibration. 01 is for Vac, 18 is for Vdc.
78-02: Aac Powerless™ input Option 02 CANNOT have any outputs (Digit 10), contact Otek for customs. Why? CT1 mounts on SC-B sockets).
78-03: Wac Powerless™ uses 3 Sig. Cond. (AxV=W) (P78-01-V; P78-02-A & P78-03-W).
78-04: **Hz ac** Powerless™ uses Option 04, (Freq to Voltage) & Option 01 (P78-01) (Vac signal Power) **must plug JC3 & JC4** on **HUB or I/O board & JSP 2 & 3 on P78-04.** JD1, JD2, JD3-2 & 3, and JD5 on PNP-F-1 (**HUB**), or on -N-1 or -9-1 or -2-1 **I/O** board.
78-17: [10-50mA] Uses tag P78-00 [4-20mA] same as Option 00 see **pg. 8** and **only close switch 2**.
78-18: Uses the same tag as Option 01 but is calibrated for Vdc instead of Vac. You can use for either **ac** or **dc** but must be calibrated.
78-20 thru 78-24: mA RMS multirange for Options 20-24, just close switch #1 and range desired. See **pg. 8**.
78-25 thru 78-30: Volts RMS multirange for Options 25-28 & 30, just flip the switch per input range, but **never close SW1!** See **pg. 8.**
78-31: Watts RMS for 1V & 1A F.S. input. You can use for ac or dc inputs, has RMS-dc converter but must be recalibrated for dc inputs.
78-32: Same as above 78-31 but for Volts inputs. Has RMS-dc converter but must be recalibrated for ac input (Vdc STD.)
78-33: Watts Converter for 120Vac line requires externally isolated (>100:5A) current and potential transformers or **don't use it!**
78-34: 5A RMS input, has internal 5A input 0.04 Ω, 20W shunt (RS1 & RS2, 0.02Ω in series), resistors included & factory calibrated.
78-41 thru 78-45: Converts frequency (per range) to voltage (0-0.5Vdc F.S.). **Must Plug JSP 1& 2,** mounts on SCA & Plug JC3 & JC4.
78-45: Strain-Gage accepts bridges >300<4000 Ω. Use shielded wire for best noise rejection/protection.
78-47: For 100Ω RTD 2,3, or 4 wire, use shielded wire. Calibrated for °C. For °F set "zero" for both bar (**BZA**) & Digits (**DZA**) to 32.0 and span (**BSA** & **DSA**) to desired full scale (typically 800°F) and repeat zero and span twice. Use calibrated resistance source & chart.
78-48: Same as 78-47 but for **1000 Ohm RTD.**
78-50: For type "J" thermocouple, (78-51 for "K" & 78-52 for "T") make sure included ambient temperature compensation diode with module (1N4148) is mounted on ST1 of terminals 3 (anode) & 4 (cathode) as close to the connector as possible. Connect red wire (-) of TC cable to ST1-5 other color (depends on TC type) to ST1-6 (+). Use TC calibrator, adjust zero & span 2 or 3 times. See **pg. 15**.
78-53: pH (Acidity) Note: Does NOT have temperature compensation! Use mV calibrator and pH chart, do not touch the sensor tip, and confirm zero and span 2 or 3 times for accuracy.
78-54: ORP: Oxygen Reduction Potential. Has high output impedance and requires a higher (100x+) input impedance receiver with non-inverting amplifier such as our P/N (tag) KP78-20 or KP78-29 that we customize for ORP and tag it as KP78-54. Just calibrate the PNP for 0-100.00% with 0.00 to 2.00V input signal.
78-55: Relative Humidity (RH) scale is 0.0-100.0% and uses standard 2-3 PF capacity humidity transducers. If our range doesn't match your XDCR, send us your specs and use Option 09 on Digits 78.
78-56: Ohms: Standard range is 0-10kΩ = 0-100.00% after your zero & span calibration. If different range is required contact our sales & engineering department. Widely used with position transducers.
78-57: 10-50mA current loop. See P78-20 (part of mA multirange module) or P78-00 (loop power) and **pg. 8** for multirange schematic.

**Power Input Digit 9: All mount on SCD, (unless custom) use JD1 & JD2 Jumpers on all 9-1 thru 9-5 options**

9-1: Non-isolated 5Vdc, PNP input power range is >3.5<5.5Vdc at < 20mA (~100mW) & input power is on ST1-1 (H/+) and ST2-2 (L/-).
9-2: Isolated 5Vdc, input range is >4.5<5.5Vdc at <200mAdc. Mounts on SC-D.
9-3: Isolated 6-24Vdc input range and can supply <200mA. Mounts on SC-D.
9-4: Universal power input. Finally all you need is ONE! "One for All!" Power inputs from 24-250Vac/Vdc! Out: 5Vdc < 200mA out.

**Control Outputs Digit 10: Options 1, 3, 5 & 7 are *Hi Limit*, Options 2, 4, 6 & 8 *Lo Limit*. You can change it with jumpers JP1 & JP2.**

**1.** "**Hi**" or "**Lo**" alarms are selectable, JP1 & JP2: 2 & 3 for **Hi**; JP1 & JP2: 2 & 1 for **Lo**, limit is via 10 turn 50 ppm/°C pot. Read notes on **pg. 10**.
**2.** Need "**Fail-Safe**"? Just set **Low limit** to "Lowest" (ccw) range, turn signal & power on, output will switch. Turn off power or signal and its output will reset.
10-1: Ideal for loop/signal power! Please don't exceed specs <30mA, <30Vdc. Opto Isolated **O.C.T**.
10-3: SPDT reed relay perfect for "Dry Contact" annunciators <100mA, <150V. Also See 10-7, **SPDT** 4A Relay.
10-5: Ideal for annunciators & loop/signal power (Powerless™) Load: "Dry" to <400Vac/dc, <80mA. Opto Isolated SPDT **MOSFET** (SSR).
10-7: Gold Plated SPDT bifurcated contacts <4 Amps, <150V. We use DPDT contacts in parallel for higher reliability.
10-A: **4-20mA Retransmission With Loop Power?** (Digit 9, Option 0). For external power 4-20mA current loop transmission of signal input (78-00 or -17), use the same jumpers listed on **pg. 15 chart**. 4-20mA output w/o internal compliance; range of your external compliance: 7-32Vdc. See **pg. 15-16** for connections. **Must plug jumpers per table**. **See schematics on pg. 11-12.**
10-B: Includes **non-isolated** (from input signal) 30V Loop compliance. See **pg. 11** for connections. **Must plug jumpers per table**.
10-C: Externally control the 4-20mA output with your isolated input signal, see **pg. 11-12. Must plug jumpers JE1, 2 & 3 only.**
10-D: KIS-PID (no Ph.D. req'd) You control the derivative via your input signal into the 4-mA transmitter (KP10-C) module plugged on **SCB** socket. The KP10-D (selectable time constant capacitor charge/discharge module) plugged on **SCA** controls the over-under shoot of the current loop output to give time for your load to react to the input signal. IOW: **KIS-PID** under your local, remote manual, or automatic control, see **pg. 11**.

# PNP FINISHED PRODUCT ORDERING INFORMATION ©

**FOR TWO (2) CHANNEL ORDERING INSTRUCTIONS SEE pg. 20-21**

02/01/24

P N P - 4 5 6 - 78 9 - 10 11 12 - 13 14 ( 6 2 - 78 9 - 10 11 12 - 13 14 )

(For channel 2 only)

## CASE STYLE/ MODEL # (4)

- B.....1 or 2 ch. ANSI 3½" SQR. Stand Alone
- C.....Custom (Contact Otek)
- D.....1 or 2 ch. ANSI 3½ SQR. Barrel Stand Alone
- E.....(for HUB only) 1½" x 1½" x ½"
- F.....(for HUB only) 2" x 3" x ½"
- G.....6"H x 1.74" Wide (= Option 9) (For HUBOnly)
- J.....ANSI 4"sqr. (SWBD) (DB40) (For HUB Only)
- N.....ANSI 4" sqr. (SWBD) (DB40) For Stand Alone
- R.....1 or 2 ch. DIN Rail Mount (⅛ DIN) Stand Alone
- U*.....DIN Rail Mount **Transmitter Only**
- W*.....⅛ DIN Panel Mount **Transmitter Only**
- X.....1 or 2 ch. 4" x 4" Explosion Proof Metal Only Stand Alone
- Y*.....Explosion Proof **Transmitter Only**
- 1.....1 or 2 ch Metal Only 5.7x1.9"(VMI2000) Stand Alone
- 2.....Metal Only 5.7" x 2.84" (VMI9222) Stand Alone
- 7.....1 or 2 ch. Metal Only (Bailey 775) Stand Alone
- 9.....6" x 1.74" (GE180) Stand Alone

## GRADE (5)

- E....To EPRI-Nuclear & Metal (contact OTEK)
- M.....To Mil-Spec & Metal (contact OTEK)
- 0.....Industrial & Plastic NEMA 3
- 2.....Industrial & Plastic NEMA 4X
- 3.....Industrial & Metal NEMA 4X
- 9.....Custom (contact OTEK)

**Important 2nd Ch. Note: See pg. 20-21 for restrictions**

## NUMBER OF CHANNELS (6)

- 0*.....Xmtr Only Input & Output
- 1.....1 Channel
- 2.....2 Channel
- 9.....Custom (Contact Otek)

**CUSTOM DISPLAY? IMPORTANT DIGIT 12 NOTES:**

**1. Standard display option 0 is per P.5.**
**2. Option 9 is for any and all custom changes including display intensity, colors, language, text, spare scale plates, identification labels, etc. Send us your drawings & specifications.**
**3. I.D. kits consists of: 10 ea numeric (0-9) & 10 ea. alpha (A-Z).**
**Kit P/N: KIT-PNP-12-9-ID**
**4. Display Intensity Control: Three (3) options are avaible: a) Automatic (ambient responsive) b) Vdc controlled c) resistance controlled)**

## INPUT SIGNAL POWERED (POWERLESS™) (78)

NOT FOR TRANSMITTERS

- 00.....4-20mAdc, Loop Power
- 01.....25-250 Vac, RMS Signal Power
- 02.....0.5-4 Aac, RMS Signal Power
- 03.....50-1K Wac, RMS Signal Power
- 04.....40-70 Hz/25-250Vac Signal Power
- 09.....Custom (contact OTEK)
- 17.....10-50mAdc Loop Power
- 18.....25-250Vdc Signal Power

## EXTERNAL POWER ALL FULL SCALE (78)

FOR METERS OR TRANSMITTERS

- 20.....4-20mA Current Loop
- 21.....100uAdc/RMS
- 22..... 1mAdc/RMS
- 23.....10mAdc/RMS
- 24..... 1.00mAdc/RMS
- 25..... 10.0mVdc/RMS
- 26.....1Vdc/RMS
- 27.....10Vdc/RMS
- 28.....150Vdc/RMS
- 29.....Custom (Contact OTEK)
- 30.....250Vdc/RMS
- 31.....Wdc/RMS 1V x 1A
- 32.....Wdc/RMS 1V x 1V
- 33.....Wdc/RMS 120V x 4A
- 34.....4A RMS
- 41.....Hertz (10KHz/5V Logic) F.S.
- 42.....Hertz (120Vac/40-100 Hz) F.S.
- 43.....Hertz (240Vac/30-100 Hz) F.S.
- 44.....Hertz (120Vac/500 Hz) F.S.
- 45.....Strain-Gage (≥300<4K Ohm)
- 47.....RTD (PT100) 2, 3, or 4 wires
- 48.....RTD (PT1000) 2, 3, or 4 wires
- 50.....TC (Type J)
- 51.....TC (Type K)

## EXTERNAL POWER (78) (Cont.)

- TC (Type T) .....52
- pH (0-14.00)..... 53
- ORP (0-2000mVdc).....54
- % RH (Specify Sensor).....55
- Resistance (0-10KΩ).....56
- 10-50mA Current Loop F.S.....57

**OVER 40 PLUG IN INPUT SIGNALS**

## POWER INPUT (9)

- Powerless™ (Signal Powered).....0
- Non-Isolated 5Vdc (3.5-5.5V).....1 **DON'T USE OPTION 0 FOR TRANSMITTERS**
- Isolated 5Vdc.....2 **6 PLUG IN**
- Isolated 6-32Vdc.....3 **POWER INPUTS**
- Isolated 25-250Vac/dc.....4
- Isolated 5-32Vdc w/Dimming.....5
- Custom (Contact OTEK).....9

## CONTROL OUTPUTS (10) (6)

NOT FOR TRANSMITTERS

- None.....0
- "HI" O.C.T. N.O. (30V/30mA).....1
- "LO" O.C.T. N.O. (30V/30mA).....2
- "HI" H.V. SPDT Reed Relay.....3
- "LO" H.V.. SPDT Reed Relay.....4
- "HI" H.V. SPDT S.S.R. (MOSFET).....5
- "LO" H.V. SPDT S.S.R. (MOSFET).....6
- "HI" H.V. SPDT 5A Relay.....7
- "LO" H.V. S.P.D.T. 5A Relay.....8
- Custom (Contact OTEK).....9

MUST SELECT ONE FOR XMTRS

- 4-20mA Retransmission No Compliance.....A
- 4-20mA Retransmission With Compliance.....B
- 4-20mA Out, External Control w/ Compliance....C
- 4-20mA Out, External Control w/ KIS-PID.....D

SEE **NTM TRANSMITTER** FOR CONTROLLING OUTPUTS & SERIAL I/O

## DIGITS/ONLY COLOR (ON SCALE PLATE) (11)

- White (Standard).....0
- Red.....2
- Orange.....3
- Yellow.....4
- Green.....5
- Blue.....6
- Violet.....7
- Grey.....8
- Custom (Contact OTEK).....9

**NOTE: Case style E&F use no scale plates unless custom (#9)**

## CALIBRATION, TEXT, SCALE, COLOR (12)

- Standard: 0-FS = 0.00-100.00%.....0
- Custom (Contact OTEK).....9

*For custom display intensity control and/or automatic display flashing on set point (digit 10 option 1-8) tripping use custom option 9.

***NIGHT VISION:**

## DECIMAL POINT (13)

- None (1XXXX).....0
- 1XXX.X.....1
- 1XX.XX (Standard).....2
- 1X.XXX.....3
- 1.XXXX.....4
- Custom (Contact OTEK)...9

Note: For transmitters use option 9 and specify for Ch. A (input) and Ch. B (output).

## DISPLAY "B" (OUTPUT) (14) FOR XMTRS ONLY

- Displays output in 4-20.00mA (4.00-20.00).....A
- Displays ouput in % 0.03-100.00%.....B
- Custom (Contact Otek).....C

## ADAPTER MTG. PLATE* FOR HUB ONLY(14)

- None ( Digit 5 Options E, M or None)....0
- For 1½" SQR Replacement.....1 (Digit 4 Option E & F)
- For 2½" SQR Replacement.....2
- For 3½" SQR Replacement.....3
- 4" SQR For Digit 4 Option J.....4
- For 4½" SQR Replacement.....5
- For Digit 4 Option G.....9
- Custom (Contact OTEK).....C

**NOTES FOR DIGIT #:** SEE EPRI **MTA** REPORT #3002020578

**4.** Contact Otek for custom case, see **pg. 32** Digit 14 for adapter plates and **pg. 32-34** for other housings available.
**5.** EPRI (E) & Mil-Spec (M) to your specs and Otek App. B., NEMA 4X Grade must have span and zero adjustments on the rear (behind your panel).
**6.** Only case styles **B, D, R, X, & 7** (and transmitters **U, W, & Y**) offers 1 or 2 channels unless custom (Option 9), see **pg. 20-21**.
**78.** "One for All" there are 3 multirange (dip switch selectable) assemblies. Read **Digit 7 & 8 Input Signal Description & Specifications** on **pg. 5-11** for schematic/PLD and instructions before ordering. For example: If you order Option 00 or 17 (L.P.) you get both, if you order any Option between 20-24 or between 25-30 you get them all listed above. We ship it with the specified switch closed per P/N but you can change it if required. **Note:** Option 25 (100mV F.S.) only uses 3½ digits (100.0 mV Full Scale).
**9. Powerless™** or Powered: Option 0 is for Powerless™ (signal powered like analog meters). See **pg. 6** for specifications. For Digit 78 Options 00-18, Options 1-4 for powered.
**10. Control & Current Loop Outputs:** Hi & Lo Alarms use the same assembly. Hi, Lo, or F.S. are plug-in jumper selectable. Option A-D transmitter's output 4-20mA C.L even as Powerless™.
**11. One Size Fits All** (1SFA) this is where you customize the "looks" of your PNP without paying a fortune! See **pg. 5** and see samples of 1SFA of our Sticky Scale Plates.
**12. Custom Calibration (Option 9) And/Or Intensity Control (Option C). See Pg. 7 & 14. Automatic/manual display intensity control for nigh vision. Contact OTEK.**
**13. Decimal Point** is selectable via Plug-In jumpers. Standard (Option 2) is 100.00. See decimal point chart on **pg. 12-13 & 20**.
**14.** If your "Adapter Plate" is not listed, use Option C (Custom) and send us your requirements. You can order adapter plates alone, see Digit 14. Options N, 2, 7, or 9 use **no** adapter plate. Only Digit 4 options **E, F, G, & J** or **custom** use adapter plates (Digit 14). See **pg. 30-31**.

# PNP MASTER B.O.M. FOR RE-ORDERING SPARES (KITS) ©

## FOR YOUR INVENTORY (SEE NOTES pg. 16-17)

02/01/24

**ORDER BY P/N:**

P N P - 4 5 6 - 78 9 - 10 11 12 - 13 14 ( 6 2 - 78 9 - 10 11 12 - 13 14 )

(For channel 2 only) **P/N:**

**CASE STYLE/MODEL # NOTE (4)**

- B.....1 or 2 ch. ⅛ DIN Vertical Panel Mount S.A.
- CE...C.....Custom (contact OTEK)
- D..... 1 or 2 ch. ANSI 3½" SQR. Stand Alone
- E.....1½" x 1½" x ½" for HUB
- F.....2" x 3" x ½" for HUB
- G.....6" x 1.74" (GEI80) for HUB
- J.....ANSI 4" SQR (DB40) for HUB
- N.....ANSI 4" SWBD (DB40) Stand Alone
- R..... 1 or 2 ch. ⅛ DIN Rail Mount, Stand Alone
- U.....DIN Rail Mount **Transmitter Only**
- W.....⅛ DIN Panel Mount **Transmitter Only**
- X.....1 or 2 ch. Explosion Proof Metal Only, S.A.
- Y.....Explosion Proof **Transmitter Only**
- 1..... Metal Only 5.7x1.9" Stand Alone
- 2.....5.7" x 2.84" (VMI9222) Stand Alone
- 7.....1 or 2 ch. (Bailey 775) Stand Alone
- 9.....6" x 1.74" (GE180) Stand Alone

**DISPLAY KIT (C/O Digits 4 & 5)**

- KPB0: PLA. 3.....(SA)
- KPB2: PLA. 4X.....(SA)
- KPD0: PLA. 3.....(SA)
- KPD2: PLA. 4X.....(SA)
- KPE0: PLA. 3.....(SA)
- KPE2: PLA. 4X....(HUB)
- KPF0: PLA. 3.....(HUB)
- KPF2: PLA. 4X....(HUB)
- KPG0: PLA. 3.....(HUB)
- KPG2: PLA. 4X...(HUB)
- KPG3: MET. 4X...(HUB)
- KPJ0: PLA. 3.....(HUB)
- KPJ2: PLA. 4X...(HUB)
- KPJ3: MET. 4X..(HUB)
- KPN0: PLA. 3.....(HUB)
- KPN2: PLA. 4X.....(SA)
- KPN3: MET. 4X.....(SA)
- KPR0: PLA. 3.....(SA)
- KPX3: MET. 4X.....(SA)
- KP13: MET. 4X.....(SA)
- KP23: MET. 4X.....(SA)
- KP73: MET. 4X.....(SA)
- KP90: PLA. 3.....(SA)
- KP92: PLA. 4X.....(SA)
- KP93: MET. 4X.....(SA)

Transmitter (U, W, & Y) must be ordered complete P/N. See **pg. 18**

Use above P/N to order spare displays. **All displays** accept the same input signal (±0.5Vdc F.S.) & power (3-5.5Vdc) from either **HUB** or **SA** I/O board for all channels. For ch. 2 displays, use "Z" on Digits 6-13 and 1 or 2 on Digit 14.
RED = Digit 4 Option #
GREEN = Digit 5

KEY:
K = KIT
P = PNP
# = OPTION #
IND = INDUSTRIAL GRADE
EPRI = CLASS1E GRADE
MIL = MIL-SPEC GRADE
PLA = PLASTIC
MET = METAL
4X = NEMA 4X
3 = NEMA 3
HUB = FOR USE W/HUB
SA = FOR "STAND ALONE"
? = CONTACT US!

**GRADE (5)**

- CE...E.....To EPRI-Nuclear & Metal (Contact OTEK)
- CE...M.....To Mil-Spec & Metal (Contact OTEK)
- 0.....Industrial & Plastic NEMA 3
- 2.....Industrial & Plastic NEMA 4X
- 3.....Industrial & Metal NEMA 4X
- CE...9.....Custom (Contact OTEK)

**NUMBER OF CHANNELS (6)**

See Note 6

- 1.....1 Channel
- 2.....2 Channel
- CE...9....Custom (Contact OTEK)

**Note: 2 ch. only PNP-B, D, R, X, & 7**

**Important 2nd Ch. Note: See pg. 20-21 for restrictions**

**INPUT SIGNAL (Powered) POWERLESS™ (78)**

- KP78-00...00.....4-20mAdc, Loop Power
- Read Note KP78-01...01.....25-250Vac, RMS Signal Power
- Read Note KP78-02...02.....0.5-4 Aac, RMS Signal Power
- Read Note KP78-03...03.....50-1K Wac, RMS Signal Power
- KP78-04...04.....40-70Hz 25-250Vac Signal Power
- CE...09.....Custom (Contact OTEK)
- KP78-00...17.....10-50mAdc, Loop Power
- KP78-01...18.....25-250Vdc Signal Power

**EXTERNAL POWER ALL FULL SCALE (78)**

- KP78-20...20.....4-20mA Current Loop
- KP78-20...21.....100uAdc/RMS
- KP78-20...22..... 1mAdc/RMS
- KP78-20...23.....10mAdc/RMS
- KP78-20...24..... 100mAdc/RMS
- KP78-25...25..... 100mVdc/RMS
- KP78-25...26.....1Vdc/RMS
- KP78-25...27.....10Vdc/RMS
- KP78-25...28.....150Vdc/RMS
- CE...29.....Custom (contact OTEK)
- KP78-25...30.....250Vdc/RMS
- KP78-31...31.....Wdc/RMS 1V x 1A
- KP78-32...32.....Wdc/RMS 1V x 1V
- KP78-33...33.....Wdc/RMS 120V x 4A
- KP78-34...34.....4A RMS
- KP78-41...41.....Hertz (10KHz/5V Logic) F.S.
- KP78-42...42.....Hertz (120Vac/40-100 Hz) F.S.
- KP78-43...43.....Hertz (240Vac/30-100 Hz) F.S.
- KP78-44...44.....Hertz (120Vac/500 Hz) F.S.
- KP78-45...45.....Strain-Gage (≥300<4K Ohm)
- KP78-47...47.....RTD (PT100) 2, 3, or 4 wires
- KP78-48...48.....RTD (PT1000) 2, 3, or 4 wires

**ADAPTER (MTG.) PLATE* (14)**

- (Digit 5 Options E & M).....0...CE
- For 1½" SQR Replacement.....1...50-KP14-1
- For 2½" SQR Replacement.....2...50-KP14-2
- For 3½" SQR Replacement.....3...50-KP14-3
- For Digit 4 Option J.....4...50-KP14-4
- For 4½" SQR Replacement.....5...50-KP14-5
- For Digit 4 Option G.....9...50-KP14-9
- Custom (Contact Otek).....C...CE

**DISPLAY "B" (OUTPUT) (14) FOR XMTRS ONLY**

- Displays output in 4-20.00mA (4.00-20.00).....0
- Displays output in % 0.03-100.00%.....A
- Custom (Contact Otek).....C

**DECIMAL POINT (13)**

- None (1XXXX).....0
- 1XXX.X.....1
- 1XX.XX.....2
- 1X.XXX.....3
- 1.XXXX.....4
- Custom (Contact Otek)...9...CE

**PLUGS P/N: KP13-10**

**CALIBRATION, TEXT SCALE, LANGUAGE (12)**

- Standard: 0-FS = 0.00-100.00%...0
- Custom (contact OTEK).....9...CE

**DIGITS/ONLY COLOR (11) (BAR PER pg. 4)**

- White (Standard) .....0...KP11-0
- Red.....2...KP11-2
- Orange.....3...KP11-3
- Yellow.....4...KP11-4
- Green.....5...KP11-5
- Blue.....6...KP11-6
- Violet.....7...KP11-7
- Grey.....8...KP11-8
- Custom (Contact OTEK)...9...CE

**CONTROL OUTPUTS (10)**

- None.....0...NONE
- "HI" O.C.T. N.O. (30V/30mA).....1...KP10-1
- "LO" O.C.T. N.O. (30V/30mA).....2...KP10-1
- "HI" H.V. SPDT Reed Relay.....3...KP10-3
- "LO" H.V. SPDT Reed Relay.....4...KP10-3
- "HI" H.V. SPDT S.S.R. (MOSFET).....5...KP10-5
- "LO" H.V. SPDT S.S.R. (MOSFET).....6...KP10-5
- "HI" H.V. SPDT 4A Relay.....7...KP10-7
- "LO" H.V. SPDT 4A Relay.....8...KP10-7
- Custom (Contact OTEK).....9...CE
- 4-20mA RT, No Compliance.....A...KP10-A
- 4-20mA RT, With Compliance.....B...KP10-B
- 4-20mA Out External Control.....C...KP10-C
- 4-20mA External Control w/KIS-PID.....D...KP10-D

**POWER INPUT (9)**

- Powerless™ (Signal Powered).....0...NONE
- Non-Isolated 5Vdc (3.5-5.5V).....1...KP9-1
- Isolated 5Vdc.....2...KP9-2
- Isolated 6-32Vdc.....3...KP9-3
- Isolated 25-250Vac/dc.....4...KP9-4
- Custom (Contact OTEK).....9...CE

**EXTERNAL POWER (78) (Cont.)**

- TC (Type J).....50...KP78-50
- TC (Type K).....51...KP78-51
- TC (Type T) .....52...KP78-52
- pH (0-14.00).....53...KP78-53
- ORP (0-2000mVdc).....54...KP78-54
- % RH (Specify Sensor).....55...KP78-55
- Resistance (0-10KΩ).....56...KP78-56
- 10-50mA Current Loop F.S.....57...KP78-20

## IMPORTANT CALIBRATION NOTE:

1. You **MUST** calibrate **displays** with certified calibrator and personnel for zero & span before sealing & installing any **PNP!**
2. You **MUST** confirm/select proper placement of plug-in jumpers per chart on **pg. 16** and notes on **pg. 17**.
3. You **MUST** calibrate & confirm any & all plug-in modules that have potentiometer - jumpers as required!
4. You **MUST** have another tech-manager confirm & sign your paperwork or Otek warranty will be void.

---

**4. HUB or SA?** Digit 4 Options E, F, G & J are for use with **HUB** and Adapter Plate (Digit 14) on **pg. 32-33**. Options B, D, N, R, X, 2, 7, & 9 are for **Stand Alone.**
**Digits 78, Options 02:** Amps ac signal powered and Digits 78 Option 03 Watts ac signal powered are specifically built, tested & certified for a specific input signal. If for models **PNP-E, F, G, or J** (for **HUB** usage) order P/N KPF1-7802 for **Digit 78 Option 02** (5Aac Powerless™). If for **Digit 4 Option N** ("Stand Alone" 4" Switchboard) order **P/N KPN1-7802.** For **Digit 4 Option 9** ("Stand Alone" 6" Edgewise) order **P/N KP91-7802**.
For Watts ac Powerless™ **Digit 78 Option 03** for case **Digit 4 models E, F,G, or J** (for HUB usage) order **P/N KPF1-7803**. For **Digit 4 Option N** (4" Switchboard "Stand Alone") order **P/N KPN1-7803**. For **Digit 4 Option 9** ("Stand Alone 6" Edgewise Case) order **P/N KP91-7803**.
**KP78-04:** Hertz kit c/o 2 plug in modules. Tag # **KP78-01** VAC and **KP78-04** (F-V) plug into sockets per chart on **pg. 15**.
It is best to read the complete P/N of PNP in use, and extract the replacement (spare) P/N from it by Digit & Option #.
**6**. 1 or 2 channels? Only models **B, D, R, X,** and **7** offer 1 or 2 channels. See note 6 on **pg. 18**.

# PNP 2 CHANNEL RESTRICTIONS & ORDERING INFORMATION©

**CH. 2 IS 100% ISOLATED & CAN DISPLAY INTERNAL (VIA JB2) OR EXTERNAL SIGNALS (JB1, 2 & 1)** 02/01/24


PNP-B & -W ⅛ DIN Panel Mount


PNP-R & -U ⅛ DIN for Rail Mount

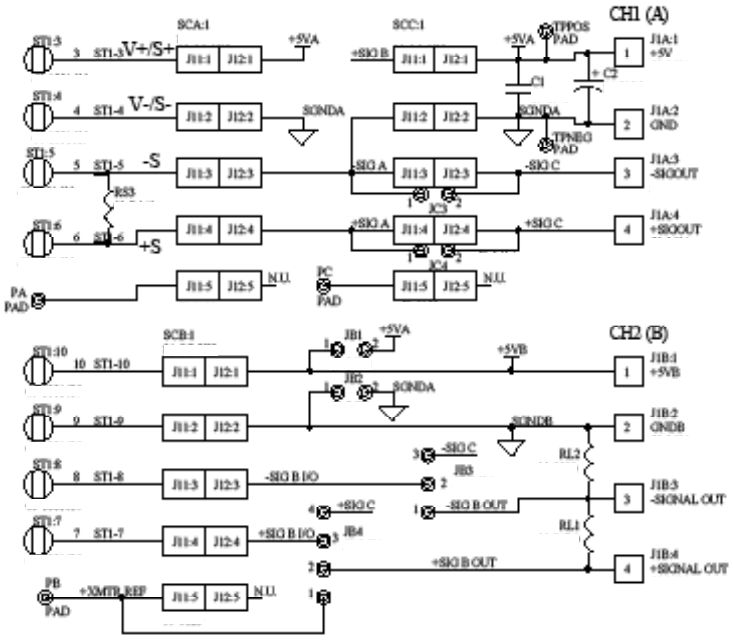

PNP-D NEMA/ANSI 3½" Panel Mount


PNP-X & -Y Explosion Proof ¾" NPT Mounting


PNP-7 has 2 isolated channels, Replaces Bailey 775, 776, Foxboro 25T same size as Otek NTM-7 & HiQ 117

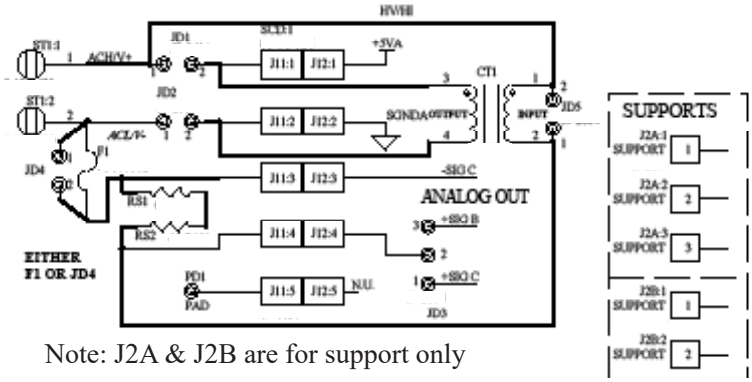
Due to the hardware only design of the **PNP** (no CDA or NEI08-09) there are **mechanical limitations**. For channel 2 (B): signal converter plugs into SCB (see ch. 2 below) that is also used by the **PNP** controlling outputs Digit 10 Options 1-9, and Options A-D (if used). Transmitters' output can be displayed on display B (Ch. 2) by just plugging jumper **JB2**. See schematic of I/O board below. Have any questions or need a custom design? Please contact us!
See connections and P/N/ selection on **pg. 21**.

**Two Channel I/O Board (PNP-X-1 Shown)**




| 2 CHANNEL JUMPER TABLE (ALSO SEE CHART ON pg. 21) NOTES ON pg. 17 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FUNCTION / OPTION | JB1 | JB2 | JB3 | JB4 | JC3 | JC4 | JD1 | JD2 | JD3 | JD4 | JD5 | NOTE |
| ISOLATED CH1 & 2 / CUSTOM | --- | --- | 1 & 2 | 2 & 3 | A.R. | A.R. | --- | --- | --- | --- | --- | 9-9 |
| NON-ISOLATED CH1 & 2 | 1 & 2 | 1 & 2 | 1 & 2 | 2 & 3 | A.R. | A.R. | --- | --- | --- | --- | --- | 9-1 |
| DIGIT 9 OPTION 0 POWERLESS | | | 1 & 2 | 2 & 3 | A.R. | A.R. | --- | --- | --- | --- | --- | 9-0 |
| DIGIT 9 OPTION 1 NON-ISOL 5VDC | 1 & 2 | 1 & 2 | 1 & 2 | 2 & 3 | A.R. | A.R. | --- | --- | --- | --- | --- | 9-1 |
| DIGIT 9 OPTION 2 ISOL. 5VDC | | | 1 & 2 | 2 & 3 | A.R. | A.R. | --- | --- | --- | --- | --- | 9-2 |
| DIGIT 9 OPTION 3 ISOL. 6-32VDC | 1 & 2 | 1 & 2 | 1 & 2 | 2 & 3 | A.R. | A.R. | 1 & 2 | 1 & 2 | SEE MASTER CHART | | | 9-3 |
| DIGIT 9 OPTION 4 25-240 VAC/DC | 1 & 2 | 1 & 2 | 1 & 2 | 2 & 3 | A.R. | A.R. | 1 & 2 | 1 & 2 | SEE MASTER CHART | | | 9-4 |
| DIGIT 10 OPTION 0 NO CONTROL OUT | NO CONTROL OUT. SCB SOCKET USED BY CH2 INPUT SIGNAL | | | | | | | | | | | 10-0 |
| DIGIT 10 OPTION B 4-20mA C.L. OUT | 1 & 2 | 1 & 2 | 2 & 3 | | A.R. | A.R. | SEE MASTER CHART **pg. 15** | | | | | 10-B |
| DIGIT 10 OPTION C 4-20 C.L. EXT. CONT. | 1 & 2 | 1 & 2 | 2 & 3 | | A.R. | A.R. | --- | --- | --- | --- | --- | 10-B |
| DIGIT 10 OPTION D KIS PID | 1 & 2 | 1 & 2 | 2 & 3 | | A.R. | A.R. | --- | --- | --- | --- | --- | 10-B |
| DIGIT 10 OPTION 9 CUSTOM | ? | ? | ? | ? | ? | ? | ? | ? | ? | ? | ? | |

A.R.: As required. See chart on **pg. 15-16**




Note: J2A & J2B are for support only

**(JDP) DECIMAL POINT CHART #13**

| D.P. | DPA | DP1A | DP2A |
|---|---|---|---|
| 1XXXX | YES | X | X |
| 1.XXXX | NO | NO | NO |
| 1X.XXX | NO | NO | YES |
| 1XX.XX | NO | YES | NO |
| 1XXX.X | NO | YES | YES |

**(X = DON'T CARE)**

**(JDP) DECIMAL POINT CHART #13**

| D.P. | DPB | DP1B | DP2B |
|---|---|---|---|
| 1XXXX | YES | X | X |
| 1.XXXX | NO | NO | NO |
| 1X.XXX | NO | NO | YES |
| 1XX.XX | NO | YES | NO |
| 1XXX.X | NO | YES | YES |

**(X = DON'T CARE)**

**520-748-7900**
FAX: 520-790-2808
E-MAIL: sales@otekcorp.com
https://www.otekcorp.com

**CAGE CODE 57861**

OTEK™ CORP. *SINCE 1974*
The "DIGITIZERS"

A CLASS 1E COMPANY

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

MADE IN USA

# PNP TWO CHANNEL RESTRICTIONS, P/N SELECTION & CONNECTIONS ©
## (DIGIT 6 OPTION 2) MOUNTS ON SC-B SEE pg. 15-16 FOR ONE CHANNEL

02/01/24

| DIGIT # OPTION # | NAME See pg. 18 for Ord. Info | CONNECT TO ST1-TERM# | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 ch. 1 | 4 ch. 1 | 5 ch. 1 | 6 ch. 1 | 7 ch. 2 | 8 ch. 2 | 9 ch. 2 | 10 ch. 2 |
| 78-00 | 4-20 mA Loop Power | | | | | -L | +L | +L | -L | | |
| 78-01 | VAC SIG POWER | | | VH | VL | | | | | VL | VH |
| 78-02 | AAC SIG POWER | AH | AL | | | | | - | - | - | - |
| 78-03 | WAC SIG POWER | AH | AL | VH | VL | | | - | - | - | - |
| 78-04 | Hz VAC SIG PWR | VH | VL | | | | | | | | |
| 78-17 | 10-50mA Loop Power | | | | | -L | +L | +L | -L | | |
| 78-18 | VDC SIG POWER | | | V+ | V- | | | | | V- | V+ |
| 78-20 | 4-20mA C.L. Ext Pwr | | | | | -L | +L | +L | -L | | |
| 78-21 | 100 uA F.S. | | | | | -S | +S | +S | -S | | |
| 78-22 | 1mA RMS | | | | | -S | +S | +S | -S | | |
| 78-23 | 10mA RMS | | | | | -S | +S | +S | -S | | |
| 78-24 | 100mA RMS | | | | | -S | +S | +S | -S | | |
| 78-25 | 100mV RMS | | | | | -S | +S | +S | -S | | |
| 78-26 | 1V RMS | | | | | -S | +S | +S | -S | | |
| 78-27 | 10V RMS | | | | | -S | +S | +S | -S | | |
| 78-28 | 100V RMS | | | | | -S | +S | +S | -S | | |
| 78-30 | 250V RMS | | | | | -S | +S | +S | -S | | |
| 78-31 | W: 1V x 1A RMS | | | VH | VL | AL | AH | AH | AL | VL | VH |
| 78-32 | W: 1V x 1V RMS | | | V1H | V1L | V2L | V2H | V2H | V2L | V1L | V1H |
| 78-33 | W: 120V x 4A RMS | | | VH | VL | AL | AH | - | - | - | - |
| 78-34 | 4A RMS | | | | | AL | AH | - | - | - | - |
| 78-41 | 10K Hz, TTL | | | | | SL | SH | SH | SL | | |
| 78-42 | 100 Hz @ 120V | | | | | SL | SH | SH | SL | | |
| 78-43 | 100 Hz @ 240V | | | | | SL | SH | SH | SL | | |
| 78-44 | 500Hz @ 120V | | | | | SL | SH | SH | SL | | |
| 78-45 | Strain-Gauge <4k Ω | | | +E | -E | -S | +S | +S | -S | -E | +E |
| 78-47 | PT100 RTD | | | -E | +E | -S | +S | +S | -S | +E | -E |
| 78-48 | PT1000 RTD | | | -E | +E | -S | +S | +S | -S | +E | -E |
| 78-50 | TYPE J TC | | | K | A | -S | +S | +S | -S | A | K |
| 78-51 | TYPE K TC | | | K | A | -S | +S | +S | -S | A | K |
| 78-52 | TYPE T TC | | | K | A | -S | +S | +S | -S | A | K |
| 78-53 | pH (Acidity) | | | | | -S | +S | +S | -S | | |
| 78-54 | ORP | | | | | -S | +S | +S | -S | | |
| 78-55 | RH % | | | | | L | H | H | L | | |
| 78-56 | 10K Ω RESISTANCE | | | | | L | H | H | L | | |
| 78-57 | 10-50mA C.L. | | | | | -L | +L | +L | -L | | |

**IMPORTANT NOTES:**

1. Ch. 2 input signal module only mounts on socket **SC-B** unless custom. See ch. 1, power inputs (Digit 9), and control outputs (Digit 10) on **pg. 15-16**. **No** ch. 2 if ch. 1 Digit 78 Options 02, 03, 33, or 34 are selected.
2. See **pg. 20** for plug-in jumpers required. If in doubt, **don't** power it & contact Otek.
3. **Only exception:** If you want display #2 to display the output of ch. 1 if Digit 10 is Option **B, C, D** (transmitter), then ch. 2 is not allowed. Use Option 1 on Digit 6.

YOUR NOTES: _____

**CHANNEL #2 (B) ORDERING GUIDE:**

1. Select all options desired for Ch.1 on **pg. 18** except **use #2 on Digit 6.**
2. Select Option 0 on Digit 10 (no outputs available). **Note**: If you need current loop output, see **pg. 24-25** for transmitters. If you need multichannel and control outputs see our **NTM & UPM** series or custom.
3. Your P/N should look like this:

**CH. 1:** P N P - (4 5 6) B 0 2 - (78 9) ? ? ? - (10 11 12) 0 ? ? - (13 14) ? ?

(?: option selected)

4. Select the desired input signal for **Ch. 2 Digits 78** and **add** it to the end of above P/N in parantheses ie: PNP-B02-203-030-10 (170-050-20).
   What is it? A PNP-B ⅛ DIN Panel Mount dual display.
   a. **Channel #1**: 4-20mA C.L. input (Option 20), 6-32Vdc power input (Digit 9, Option 3), no control outputs (Digit 10 Option 0), ch. 1 orange digits (Digit 11 Option 3), standard calibration (0.00-100.00%) (Digit 12 Option 0), decimal point: 1XXX.X (Digit 13 Option 1), no adapter plate (Digit 14, Option 0).
   b. **Channel #2 (B)**: 10-50mA current loop power (Digit 78 Option 17), no power (Digit 9 Option 0), no control output (Digit 10 Option 0), display #2 color: green (Digit 11 Option 5), standard 0.00-100% calibration (Digit 12, Option 0), 1XX.XX decimal point (Digit 13 Option 2), no adapter plate.

Your final P/N would be:

**CH. 1:** P N P - (4 5 6) B 0 2 - (78 9) 2 0 3 - (10 11 12) 0 3 0 - (13 14) 1 0
**(CH. 2):** ( (6) 2 - (78 9) 17 0 - (10 11 12) 0 5 0 - (13 14) 2 0 )

5. Complete P/N description: Dual channel ⅛ DIN (vertical mount) panel meter, plastic housing, **ch. 1** 4-20mA current loop input, **ch. 2** 10-50mA loop powered input, 6-32Vdc power, ch. 1 display color: orange & display #2: green, STD. calibration on both channels, decimal point for display #1 (top): 1XXX.X for display #1 and 1XX.XX for #2. Color of display #1: orange and for display #2 (bottom) green.

**Practice here:**

**CH. 1:** P N P - (4 5 6) _ _ _ - (78 9) _ _ - (10 11 12) _ _ _ - (13 14) _ _
**(CH. 2):** ( (6) _ - (78 9) _ _ - (10 11 12) _ _ _ - (13 14) _ _ )

6. Use the chart on the left for your connections (same as on **pg. 14**). See **pg. 16** for emergency spares P/N and **pg. 25** for current loop transmitters.
7. In conclusion: options within the parantheses are for **ch. 2 only!** For ch. 3 (if available) will be [ ] and for ch. 4: { }.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MADE IN USA

# PNP AVIONICS DPM FOR MILITARY & COMMERCIAL APPLICATIONS ©
# REPLACES FORM, FIT, & FUNCTION 8DJ103LAH1

02/01/24

**CAGE #57861**


**FEATURES:**

- 4-20mA Loop or External Powered
- STD. 1" Diameter Barrel, 2" long
- Night Vision Compliant (NVG3)
- Replaces HI-LO Needle Type
- (4) 0.25" Full LED Digits (9.9.9.9)
- Color Options: Green, Red or Blue
- To Published Mil-Spec
- Industrial or Mil-Spec Grades
- Automatic Lost Signal Detection
- Replaces FF&F P/N 8DJ103LA H1 & EAK-4A/A3J-2 RTCA-160F Qualified
- Internal/External Intensity Control
- Night vision NVG3 available
- Customs: welcome

MODEL **APM**


## DESCRIPTION

OTEK's Model **APM** is a four digit green, red, or blue LED indicator that accepts standard avionics power of 5-32Vdc (Green, Red, or Blue digits) and intensity control voltage of 1.5-5V 50-440Hz (or dc/Resistance). OTEK's exclusive powerless technique allows the **APM** to be loop powered causing a maximum of 4Vdc burden to the loop. The Powerless™ **APM** only requires 2 wires & <50mW to operate.

The heart of the **APM** is our patented (#10,222,405) Powerless™ that accepts Vdc or mAdc and can be scaled (internally) to any value. The unit mounts in a standard avionics 1" diameter hole with four mounting screws and connects to Power and signal via a "Twist Lock" circular connector (DBC53H-10-6P, Mating Cable End: MS347640 (L or M) -6S).

The **APM** is fully sealed and it is not affected by differential pressure, liquid spray (NEMA4X), or humidity (see specs).

## APPLICABLE MIL-SPECS:

MIL-STD-461D, 462D, 704F, 130K, 810F, 889B2 & 1472F; MIL-HDBK-217F & 454A, RTCA-160F, & **NVG3.**

## SPECIFICATIONS @ 25°C & 5Vdc +10%

**Powered Models**

- Loop Powered: 4-20mA, <4V burden (50mW)
- Power Input Voltage: 5-32Vdc, 200mW
- Power Consumption: 0.5W max
- Intensity Control Input: 1.5-5Vdc/ac or resistance
- Input Signal: V/mAdc (Specify)
- Display: 4 each ¼" (6.5mm) LED Green, Red, or Blue
- Night Vision Display: green digits only (NVG3 on request)
- Accuracy & Linearity: ±0.05% of reading
- Sampling Rate: 3/second
- Input Impedance: 1M Ohms (V)/50 Ohms (mA)
- Operating Temperature: -20 to +60°C
- Storage Temperature: -30 to +70°C
- Altitude Operating: 50,000 feet max
- Altitude Storage: 60,000 feet max
- Weight: 1.5oz. (42g)
- Finish: Electroless Nickel Plating or Black Powder Coat

**Loop Powered Models Powerless™**

- Burden: 50mW (4V max)
- Min-Max Signal: 3.6-36mA
- Specify Input Signal F.S. vs. Display F.S. & Decimal Point


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MADE IN USA

# APM™ ORDERING & MECHANICAL INFORMATION ©

02/01/24

**NOTE: Please READ BEFORE building part number**

**APM - 1 2 3 4 5 6**

CAGE # 57861

**INPUT SIGNAL (1)**
- 0.....4-20mA Loop Powered
- 1.....1 Vdc F.S.
- 2.....10Vdc F.S.
- 3.....100Vdc F.S.
- 4.....1mAdc F.S.
- 5.....10mAdc F.S.
- 6.....100mAdc F.S.
- 7.....100mV (Shunt)
- 8.....Powered 4-20mA
- 9.....Custom (Contact OTEK)

**POWER INPUT (1, 4)**
- 0.....Loop Powered
- 1.....5Vdc Non-Isolated
- 2.....5Vdc Isolated
- 3.....7-32Vdc Non-Isolated
- 4.....7-32Vdc Isolated
- 9.....Custom (Contact OTEK)

**HOUSING**
- 0.....Electroless Nickel Plated
- 1.....Black Powder Coat over E. Nickel Plated
- 9.....Custom (Contact OTEK)

**CALIBRATION (6)**
- 0.....4-20mA = 0-100.0%
- 1.....0-F.S. = 0-100.0%
- 9.....Custom (Contact OTEK)

**DISPLAY TYPE (3)(7)**
- 0.....Red Digits
- 1.....(**NVG3**) Green Digits
- 2.....Blue Digits
- 9.....Custom (Contact OTEK)

**GRADE (5)**
- I.....Industrial
- M.....Mil-Spec (Contact OTEK)
- 9.....Custom (Contact OTEK)

Note: NVG3 (custom) on request

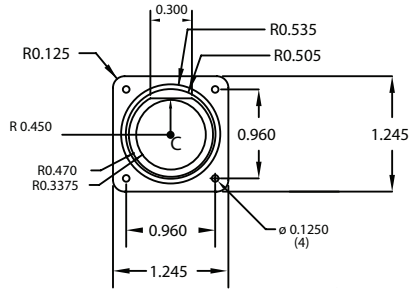
***DOWNLOADS:***
***For manuals, user-software or drivers:***
***www.otekcorp.com***

## NOTES:

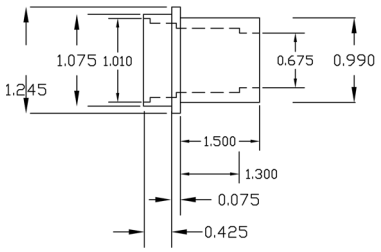
1. If Digit 1 is Option 0, then Digit 2 must be Option 0 (and conversely).
2. The APM has 4 full digits and negative sign. Maximum display is -9999 to 9999.
3. Loop powered display intensity is minimum 4mA and maximum 20mA.
4. OTEK will build to certain nuclear or MIL-Standards but testing and confirmation of compliance, if required, will need to be done by third party and at customer's expense.
5. Calibration and decimal point position are set before unit is sealed. Customizations must be specified & accepted before ordering.
6. For NVG-3 (Night Vision) compliant use Option 9 on Digit 4 & specify: Green Digits & NVG-3 compliant & use intensity control terminals.

## APM MECHANICALS

FRONT VIEW




SIDE VIEW




## TYPICAL CONNECTIONS

**FIG. APM-0** **LOOP POWERED**


A: +LOOP INPUT
B: -LOOP INPUT
C: INTENSITY CTRL
F: INTENSITY CTRL RTN

IF REQ 100KΩ

P/N DBC53H-10-6PN

MATTING: MS3476L10-6S OR EQUIV.(NOT SUPPLIED)
SHELL CHASSIS IS GND

**FIG. APM-1** **VDC POWERED**


SEE 90-AMP-0

A: V+ SUPPLY IN
B: V- SUPPLY IN
C: +INTENSITY CTRL (OPTN)
D: +INPUT SIGNAL
E: -INPUT SIGNAL
F: INTENSITY CTRL RTN (OPTN)

**NOTE:** INTENSITY CTRL IS CUSTOM SET FOR (VAC/VDC) OR RESISTANCE.

FOR VAC/VDC CONFIGURATION THERE IS NO INTERNAL ISOLATION.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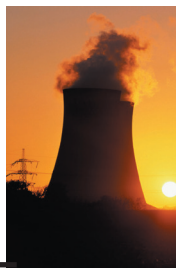
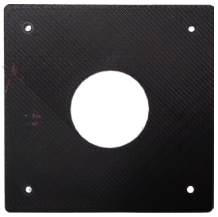
# PLUG AND PLAY (PNP) CURRENT LOOP TRANSMITTERS©

02/01/24

OPTIONAL ADAPTER PLATES (**pg. 33**)



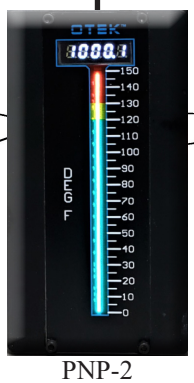


"ONE SIZE FITS ALL"

YOURS ?

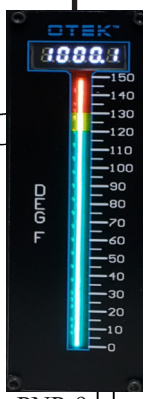
## Control or Alarm Annunciator Panel


PNP-N or -J




PNP-2


PNP-7




PNP-9 or -G

PNP-Y Transmitter
(Explosion Proof)


SIGNAL

Don't change your panel, wiring, signal, or operators!
**Just change the meters!**

**"Simplicity is very difficult to achieve" (IOW: KIS)**

The **PNP** transmitters are identical to the **PNP** meters except for their function. See ordering information on **pg. 18** for technical info, see index on front cover. The only difference is the transmitters' function to convert any input signal to 4-20mA current loop output with a 24V compliance limited to 30mAdc so it can reliably transmit up to 2 miles (3.2km). The **PNP** meter converts the 4-20mA to power itself, the optional alarms (see Digit 10), and display the data with ultra-efficient white LEDs. That way you can customize the "Sticky" scale plate to any color, text, language, or scale without opening the meter. Use one and only one type of meter (Powerless™) for **all** display and control applications; all without changing anything on your present panel except the meters!

**Imagine:**

1. All transmitters in the distribution panel or origin of the signal.
2. The ouput via a twisted pair (two >18GA wires) to any place within 2 miles to a control room, bridge, engineering room, treatment plant, or drilling rig.
3. All meters are identical with or without adapter plates and optional control outputs.
4. All scale plates are "sticky" field interchangeable with any meter that has the same front filter dimensions.
5. SCADA or DAS? Just connect it in series with the **PNP** current loop output or contact Otek for USB output.

**Result: "One for All and All for One"**

**Emergency** replacement inventory: one of each size (or adapter plate) meter, transmitter, plug-in module, and one "sticky" of every different design (text, language, scale, color, and calibration). That's all!

**Remember:** The **PNP** is hardware only (no CDA), all generic components (obsolescence hardened), CMTBF: >40 years, lifetime warranted (since 1974), and USA made! See **NPP** case studies on **pg. 26**.

**Specifications**: Same as all **PNP**:

- 14 GA twisted pair
- ~24V compliance
- <1k Ohm total resistance up to 2 miles

or PNP-W


PANEL MOUNT

or PNP-U


DIN RAIL MOUNT

OR CUSTOM

+L IN

+L OUT

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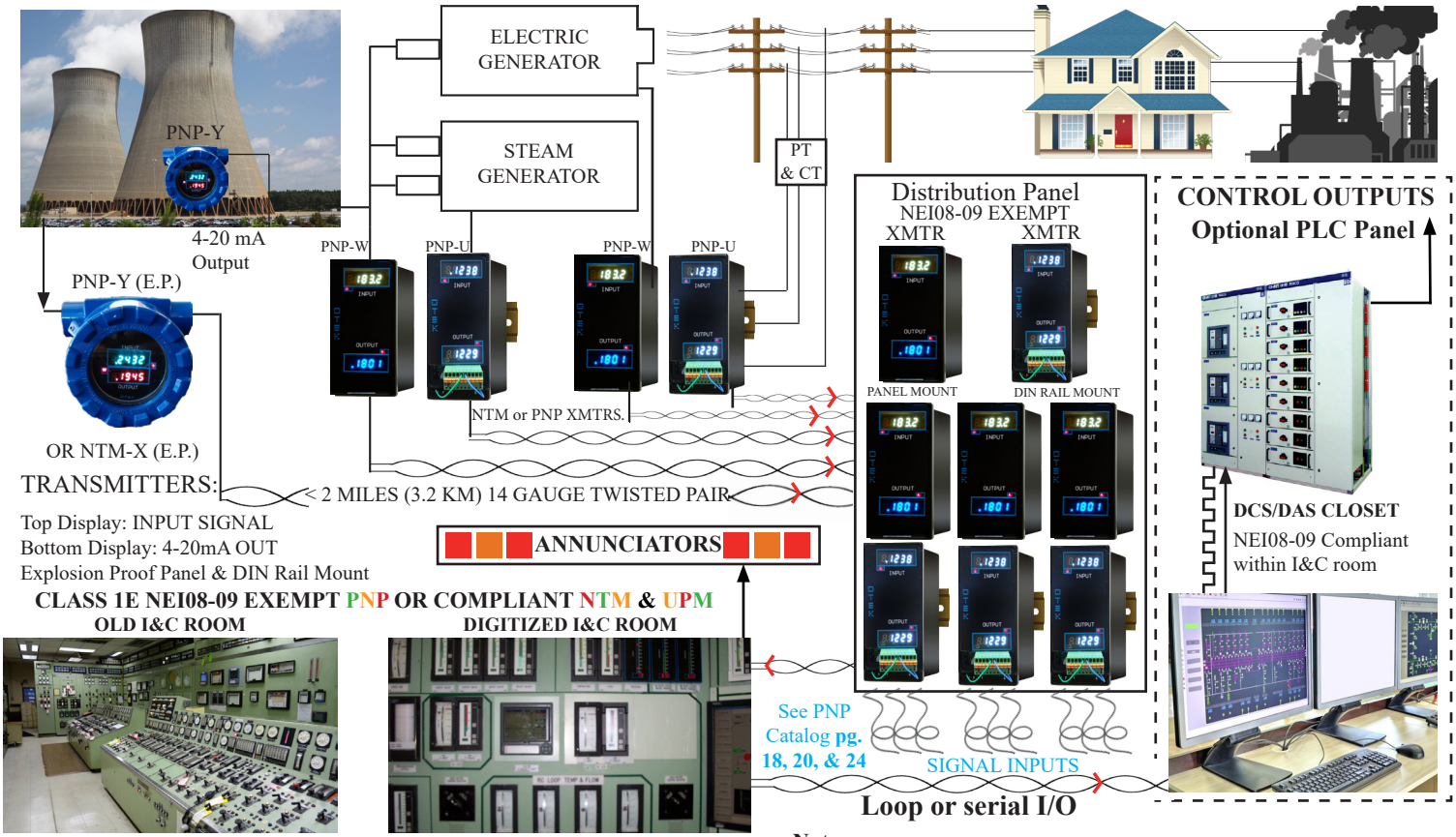
# Follow the Signal & Digitize Your I&C in One Outage ©

Cyber Security Exempt (**PNP**) or Compliant to NEI08-09 (**NTM & UPM**) 02/01/24




**PNP, NTM & UPM**

**Follow the Signal:**

1. Install **PNP** Transmitters at the signal source or up to 2 miles away or in existing distribution panel. See note on right. **PNP XMTRS** convert >50 signals to 4-20mA current loop (C.L.) including PID. All PNP meters are loop power (Powerless™) and have optional isolated SPDT HV dry contacts to drive existing annunciators.
2. All 4-20mA C.L. outputs go from distribution panel room to existing control panels to the **PNP** or **NTM**. They then display **HMI** data via tricolor bar-digital displays and terminate at the new cybersecurity safe computer room.
3. The **SCADA**/touch screen converts the 4-20mA C.L. to programmed commands for the **PLC** to control your process. See master **PNP** or **NTM** catalogs with over 30 models to choose from. You can also use one model for all replacements using our **panel adapter plates.**

**Economical Reasons:**

See **EPRI MTA** #3002020578 & **Tech Brief** #3002020579

The Tech Brief details benefits of digitization such as over $5M annual increase in efficiency, $1M reduction in maintenance, and $1M elimination of 99% spares inventory. Digitizing also solves parallax, inaccuracy, and "Stuck Needle" accidents. The savings/efficiency is estimated to be over $10M annually. Covering the cost of digitizing the I&C and simulator with our PNP or NTM in one outage. Subsequent years of NPP profits will increase by $10M x 25 years of NPP life expectancy or $250M from $10M invested in **One Outage!**

**Note:**
Above shown with **PNP** meters/controllers, use **NTM** for serial I/O. Replace the C.L. from present control panel with new serial wiring to adjacent SCADA room.

**Reference: EPRI MTA #3002020578 Report**

A condensed overview of the benefits of our PNP meters:

By adding 4-20mA current loop transmitters in the distribution panel/room, it eliminates the need for different meters in the I&C room as well as spares inventory. In other words, one meter for all signals since the transmitters can convert any and all signals to 4-20mA from the source up to 2 miles away. That same current loop is routed to the **SCADA/DCS** room for **APC** via **PLC**. This is a fully automatic process control (or **DAS**) since the **PNP** (and **NTM**) offer isolated on/off control outputs and **PID**. The externally mounted "Sticky" scale plate replaces the need for identical meters in inventory. If the adapter plates are selected, the different mechanical meter housings in spares inventory and the I&C room also becomes obsolete.

This means that the new technology described here not only digitizes the I&C room in one outage, but it can bypass all cyber security compliance to **NEI08-09.**

**PNP:** NEI08-09 Exempt (no CDA)
**NTM:** NEI08-09 Compliant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# PNP CASE STUDIES AND CONCLUSIONS ©

02/01/24

**DIGITALIZATION ASSESSMENT CASE STUDIES. REF. EPRI MTA #3002020578**

**Customer A:** Two reactors, operating since 1976, 2500 MW, $4 Billion+ in annual revenue, and 701 total meters. Has a present order for **PNP-7** to replace Bailey's 775 in I&C and simulator. The average cost of Bailey's 775 is $20,000, and delivery is 20+ weeks. The average cost of the **PNP-7** is $5K. Total meters in operation are: 100 units of Bailey 775, 400 units of GE180, 30 units of Otek's Hi-Q117, and other brands; making the total meters (including spares) around 701.

**Option 1**: Do nothing and continue as-is for as long as possible. Is that a smart option?

**Option 2**: Wait 3+ years for Limerick's experiment results, and spend $150 million+ for a new building, I&C room, cyber security, & NRC approvals.

**Option 3**: Similar to Option 2, but no new building. Use existing facility operators, control room, panels, and replace existing meters with Otek's **NTM** series of smart meters/controllers. The **NTM** is 100% APC compatible (serial I/O, math functions, etc.), just add the serial I/O wiring to the computer room for either:

**3.A**: **NTM** displays, controls, and reports to computer. Use existing wiring from meters to the process, just add serial I/O from NTM to central computer.

**3.B**: APC controls and **NTM** executes & displays: (the reverse of 3A), replace all obsolete meters with equivalent **NTM** series. Use them as an interface between the process and the APC computer via the serial (Ethernet, RS485, or USB) of the **NTM**. Use all existing panels, wiring, etc., and add serial I/O wiring; all in one outage using proper planning. SONGS did it in one outage! The estimated cost of options **3.A** or **3.B** (meters only): ~7% of Limerick's estimated cost with the **NTM**.

**Option 4**: The Plug & Play (**PNP**) option. Since the Bailey's 775 and 730 are larger than the GE180, switch all meters to the **PNP-9** (GE180 equivalent) and use adapter plates to convert the Bailey's and other meters' space to **PNP-9**.

**Result:** No changes to existing panels, wiring, signals, or operators; just the meter! Invest $1 million to save $2 million. How?

1. Change all 701 meters to **PNP** Powerless™ (4-20mA loop power). Yes with controlling outputs!
2. Install our **PNP** 4-20mA transmitters (see **pg. 20**) in the distribution panel or at signal source (up to 2 miles [3.2km] away), use existing (or new) twisted pair of wires, and Plug & Play!

All displays are identical, the only difference is the "sticky" scale plate. The estimated cost of 701 meters and transmitters: ~5% of Limerick's cost with the **PNP**, and obtainable in one outage. The cost of "spares" for emergency of one of each spare display, transmitter, plug-in signal/power conditioner, and "sticky" scale plate is around $30,000, extremely low compared to present spares cost of ~$1M? See PS note.

**Customer B:** Two reactors, operating since 1974, 1800 MW, $4 Billion+ in annual revenue, and 638 total meters. There are 445 units of VMI9222 (**PNP-2**), 176 units of VMI9223 (**PNP-V**), and 17 units of Otek's smart **NTM-V**. Otek's **NTM-V** has 25 different input signals, ~120 different calibrations, 400 different scale plates, ~22 meters replaced annually, and the annual cost of which is approximately a quarter of a million (USD).

Spares inventory cost: ~$1M and going up! The plant has partial D.A.S. of critical signals, quoted **PNP-2** & **-V** replacement in consideration.

**Option 1**: Wait 3+ years for Limerick's experiment results, and spend $150 million+ for a new building, I&C room, cyber security, & NRC approvals.

**Option 2**: Replace with **NTM-7** & **-V** (Class1E and CG meters/controllers). The **NTM** can control the process under computer command or convert data to display/control it as commanded by the central computer. The estimated cost of **NTM** meters is only 6% of Limerick's cost, installation, and wiring. The spares would consist of one of each meter and scale plate for the **NTM-7** & **-V**, signal/power converter and control output module.

**Option 3**: Replace with 445 units of **PNP-2**, 193 units of **PNP-V**, and 500 transmitters for Powerless™ I&C displays/controllers. The **PNP** meters are 4-20mA Powerless™ with 24Vdc power/0-10Vdc signal for the simulator. Buy one of each plug-in, 35 different signal and power converters, and one of each different "sticky" scale plate. Estimated cost of meters & transmitters is 5% of Limerick's cost.

**Result:** Option 2 is about 6% of Option 1's cost (Limerick), $50,000 compared to $1M in spares alone, respectively. Option 3 is about 5% of Option 1's cost, $30,000 compared to $1M in spares alone, respectively. With proper planning both Option 2 & 3 can be done in one outage and will save Customer B millions in their digitization, spare meters, time, and efficiency.

**Overall Conclusions:**

**1.** If digitalization increases the thruput of **A** or **B** by 1%, ROI would be within **2** months for **PNP** or **NTM** compared to 3-5 years with touch screens.

**2.** For an owner of 20 NPP, investing in **PNP/NTM** would be **$120M** vs **$3 billion** (touch screens) + interest on borrowed funds for 3-5 years before ROI.

**3.** Decision: **Heart transplant** or **pacemaker**?

Do you want an estimated cost of digitizing your plant, ship, or control room? Contact **sales@otekcorp.com**.

PS: Add a 3 alphanumeric character code (A0Z, 0A9, Z9Z, etc; ~275 million unique codes) on the "sticky" scale plate so your operator won't be confused!

YOUR OWN CONCLUSIONS/NOTES: _____

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| EPRI MTA #: | 3002020578 |
|---|---|

**Title**

Reduce maintenance costs and human performance errors with Class 1E Control Board Meter Replacement

**Description**

Failed analog or digital meters in nuclear control rooms require replacement by seismically qualified, safety related equivalents. The cost of replacement equipment rises higher the farther past the obsolescence date of the device. Modern Class 1E LED meters like the PNP (Plug N Play) and NTM (New Technology Meters) allow for better Human System Interfaces (HSI) while providing easier replacement methods. New meters are modular that separate I/O, display, mounting, and signal conditioning. Using a "true white LED" display allows for in situ printed overlays to be installed on front scale plate of the "one movement" display. These can accommodate any color, scale or text with defined color transitions based on the application. Standard mounting adapter plates (if necessary) fit the present mounting holes and space of the old meter in the control board. A generic hub secures to the back of the display unit. A universal I/O board fits within the hub, which can be configured to accept the field signal and power (if required). As an alternative, the I/O board could be installed in the housing of the meter. The replacement uses standard housing and an I/O board that can be configured for the input signal. The remaining parameters to be selected are the display, face plate and adapter plate (if needed) Form, fit, and function (FF&F) will be the same as the replaced meter. Developing a general installation specification allows replacement as old devices fail or as dedicated replacement campaign. The additional benefit of these FF&F replacements is that they are available for the following applications: 1) display only, 2) displays powered by the signals they measure (like analogs) with controlling outputs such as relays, 3) solid state relays (SSR) with fail safe contacts,4) 4-20 mA current loop transmission, 5) retransmission and 6) PID options. Replacements with only solid state components like the PNP will avoid lengthy cyber security evaluations, while NTM allows more customization and external serial communications and control.

The signal conversion can be moved to distribution panel/cabinet with a 4-20 mA Current Loop transmitter that uses the identical circuit in the PNP HUB is available in three packages: DIN rail, panel mount and explosion proof. The transmitter includes two displays that monitor the input and output signals simultaneously, accepts same input signals, and power plug in modules than the PNP. The transmitters allow signals to be standardized to 4-20 mA and use loop powered meters. This makes the meters on the control board a simple replacement with correct faceplates. If existing signal wiring from distribution panel/cabinet to individual meters qualifies it can be use to carry the current loop signal/power to existing meters eliminating the need for rewiring. The benefit of using the transmitter would be having on standard display type for meter replacement for all applications.

**Benefits**

| | |
|---|---|
| Benefits Estimate | Level 1 based on a "replace as fail" basis (Savings are less than $1 million per year.)<br>Level 2 based on a large replacement of analog meters. (Savings are between $1 million and $5 million per year).<br>Greater savings are possible with an aggressive reduction of parts in inventory. |
| Benefits Description | Ease of Installation: the NTM and PNP meters are made to be plug compatible with existing analog and digital meters. Little extra training is required for implementation of these meters.<br>Better HSI: replacing analog with digital meters improves accuracy of operators reading of values. Instrument displays a mimic of the original meter,101 segment bar and 4-1/2 digit numeric value. These features eliminate the parallax, uncertainty, dyslexia and the stuck needle syndrome of the analog meters. This avoids re-training for operators.<br>Using a signal powered meter to replace an obsolete signal powered meter allows no change to the fit, wiring signal, and power.<br>Using signal or powered meters with controlling outputs (fail safe or standard) require no changes on existing installations. |

This MTA can be accessed from http://www.epri.com/nuclearplantmod. For more on MTA's please see EPRI product 3002020578

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

# Plant Modernization Business Case: Digital Safety-Related Instrumentation and Control (I&C) System Modernizations

## Cost-Benefit Analysis of Implementing Digital Upgrades to Analog Safety-Related I&C Components to Reduce Operating and Material Purchase Costs

Technical Brief — *Plant Modernization (P41.13.01)* **MTA#3002020579**

This EPRI tech brief summarizes the results of a Light Water Reactor Sustainability (LWRS) financial feasibility study of modernizing safety-related I&C systems [1]. Specifically, the labor and materials costs associated with legacy safety-related I&C systems were quantified to determine whether transitioning these systems to modern digital platforms would yield sufficient benefits. Cost avoidance was also quantified, where applicable, in addition to direct costs associated with the modernization project.

This analysis concluded that there are approximately $4.5M US dollars (USD) of direct annual benefits as well as potential avoided material escalation benefits over the remaining plant operating license. The direct benefit cash flows were loaded to EPRI's Business Case Analysis Model (BCAM) and resulted in a net present value (NPV) of $7.2M over the current operating license. When the timeline of the business case is extended to include an additional 20 years that the license renewal will be in effect, the NPV increases to $50M–$80M. The additional material escalation benefits had a present value of approximately $50M–$200M, which would be added to the NPV of direct benefit cash flows if avoided material escalations are included. Key factors influencing the results include how labor efficiencies are converted to operations and maintenance (O&M) savings as well as historic replacement rates and cost escalations of analog components. All costs and savings are shown in USD.

## Nuclear Power Plant I&C Systems

Nuclear power plants employ a variety of I&C systems to support safety and non-safety-related functions under normal and abnormal conditions. These systems employ sensing instrumentation to monitor processes throughout the plant in order to provide control and/or indicating functions for the supported system. Control functions may include protective features, such as isolation of main steam lines in response to high flow or circuit breaker trip due to high current sensed in motor windings.

Due to the reliance on analog electronics and electromechanical components, legacy I&C systems are more likely to suffer from obsolescence when compared to systems consisting of primarily mechanical components. This obsolescence has introduced technical and economic challenges as plants continue to age and replacement parts become increasingly difficult and expensive to procure or reverse engineer. Obsolescence may also introduce personnel challenges associated with knowledge transfer as younger generations of engineers and technicians are not well-versed in the O&M of legacy I&C systems (e.g., analog electronics).

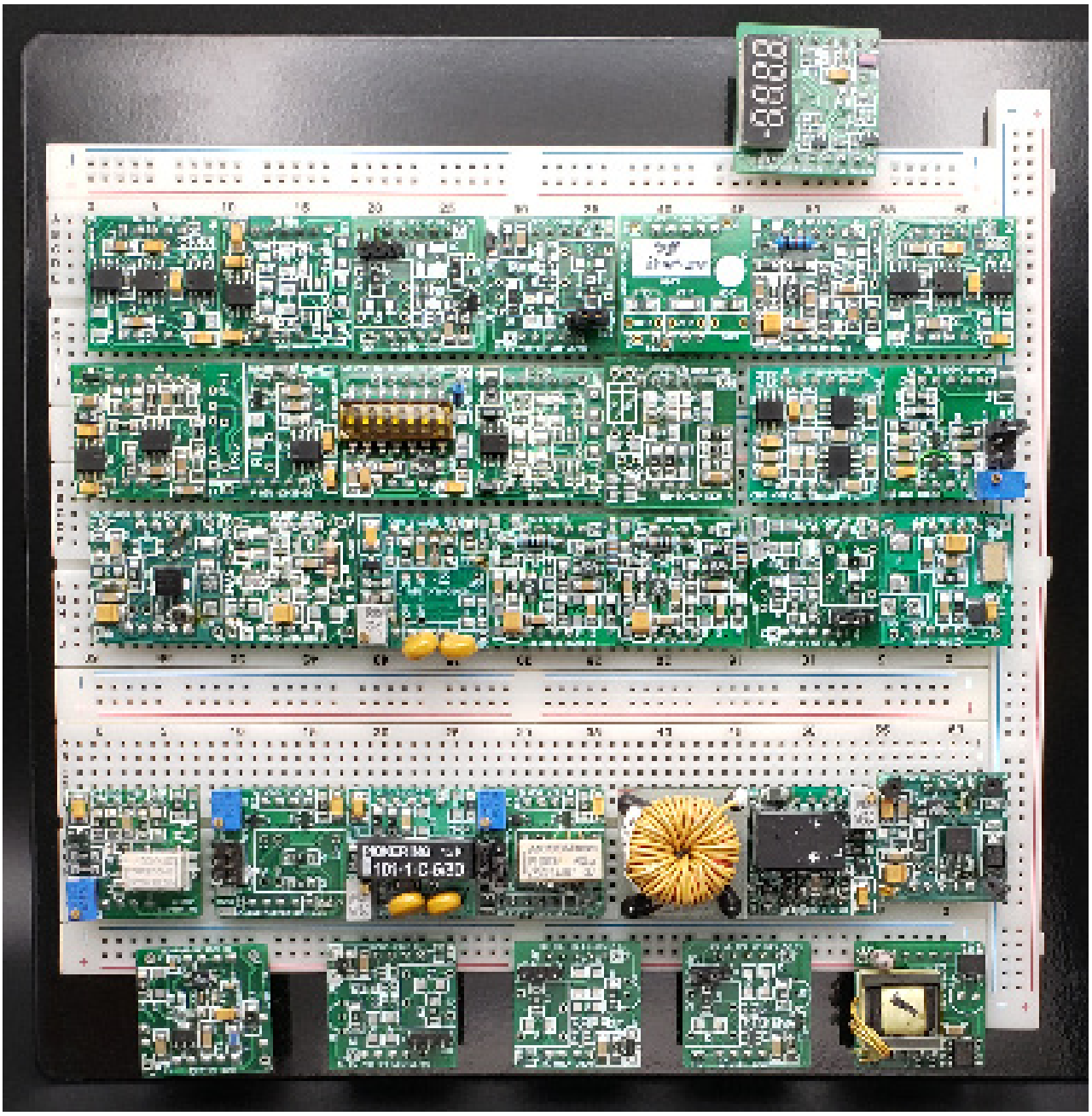
Nuclear power plant operators have pursued replacement of non-safety-related I&C systems (e.g., main turbine controls) with state-of-the-industry digital platforms to mitigate the challenges associated with obsolescence and reduced reliability. Conversely, these plant operators have been reluctant to pursue major modifications to safety-related I&C systems. This reluctance is driven by several factors, including the costs associated with modernizing the safety-related I&C infrastructure and the regulatory uncertainty associated with changes to the plant licensing basis to support these systems. As an industry example, one utility recently implemented a safety-related I&C system upgrade to a plant's Reactor Protection System (RPS) and Engineered Safeguard Protection System (ESPS). The upgrade took more than 10 years to complete and cost more than $200M, which was much greater than the expected duration and cost for the project. Since this project, no other U.S. utility has completed an implementation of a similar safety-related I&C modernization effort.

The current digital modernization project was undertaken with the objective of breaking the impasse associated with safety-related I&C system modernization. Modernizing these systems will assist in reducing overall O&M expenditures and subsequently help increase the cost-competitiveness of operating commercial nuclear power plants. Multiple legacy safety-related I&C systems at a currently operating boiling water reactor (BWR) nuclear power plant were selected as candidates for modernization. These systems include several analog I&C systems made up primarily of obsolete analog trip units and relays along with one microprocessor-based I&C system reliant on fixed transistor-transistor logic (TTL) architecture. The project scope also included the elimination of several digital steam leak detection units that interface with the station's primary containment isolation system, which is otherwise comprised of analog components. Appendix B provides a detailed overview of the candidate systems and the strategy developed to modernize these systems as part of the conceptual design activities.

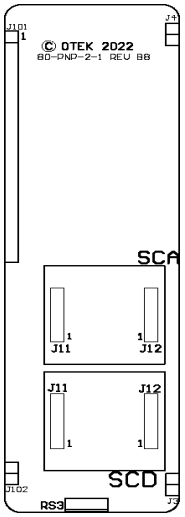
**Note by Otek: This is only page 1 of the economic report. Contact EPRI for full report.**

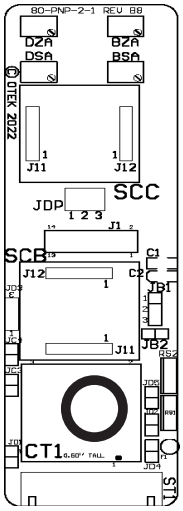
# OVER 50 PLUG-IN 1”X1” MODULES TO CHOOSE FROM (OR CUSTOM) FOR METER OR TRANSMITTER ©

02/01/24



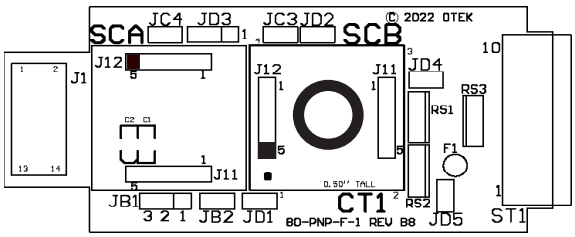
Front side



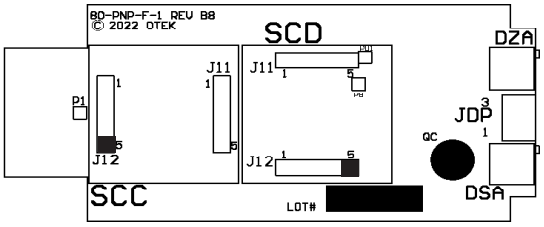




Rear side

## TOP VIEW




## BOTTOM VIEW




Just plug them on the **HUB** or I/O board & play!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# PNP SERIES: PLUG & PLAY "STAND ALONE" MECHANICAL DATA



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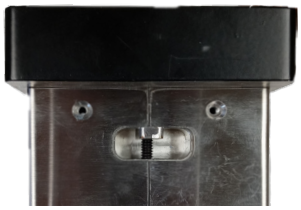
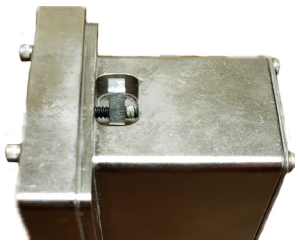
**Mounting Notes:**

The mounting tabs: models **PNP-2, 7, & 9** (and others on **pg. 34**) require no mounting screws or holes. See below photos: just remove the front filter, install the **PNP** on the panel, screw the two "Allen" screws until the **tab** secures the **PNP** against your panel, replace the filter and Plug & Play!



Mounting Tab



Mounting Tab side view

**PNP-2** can be mounted on existing panel cut out of 1.67" x 5.42" (same as **VMI9221**) or 2.66" x 5.42" (**VMI 9222**) because its bezel width is extended to accommodate either/or. Also see model NTM 1 on **pg. 34**.

**PNP-7** depth can be 1" behind panel on custom request. Replaces Bailey's 775 & 776.

**PNP-9** offers bezel side plates (2) on request (P/N 50-NTM-9-5P [plastic] or 50-NTM-9-5M [metal]). Replaces GEI80 and Yokogawa 180.

**PNP-M&N Notes:**

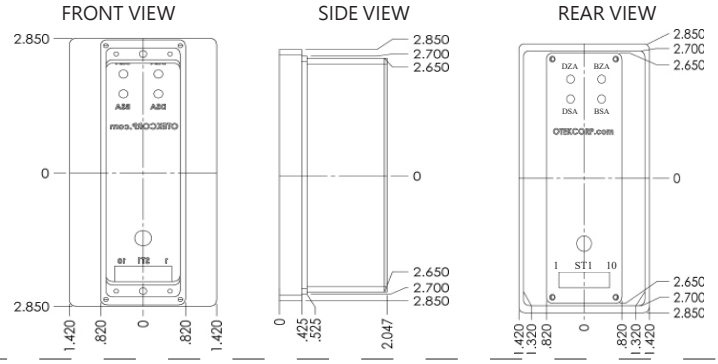
They use NEMA 4 and NEMA 4X ANSI 4" STD. case but only 1" deep. It can mount on existing 4" diameter hole or on new panel with only one ¾" x 3" cut out for access to the connector and calibration ports (4).

YOUR NOTES: _____

**"STAND ALONE" MODELS**

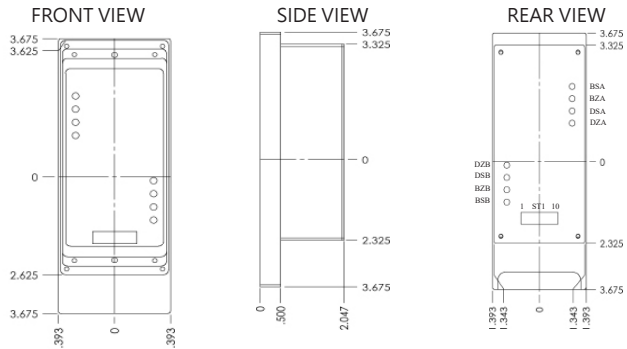
**PNP-2 STAND ALONE (REPLACES VMI9221 or VMI9222 MECHANICALLY)**

Panel cut out: 1.67" x 5.42" **or** 2.66" x 5.42 "



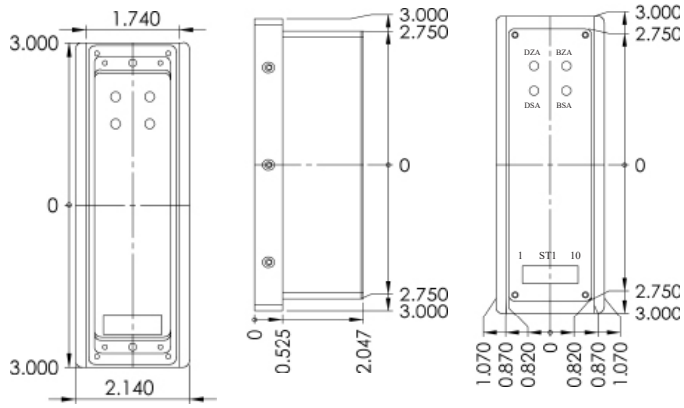

**PNP-7 STAND ALONE (REPLACES BAILEY775 MECHANICALLY)**

Panel cut out: 2.57" x 6.22" Bezel: 2.80" x 7.25"



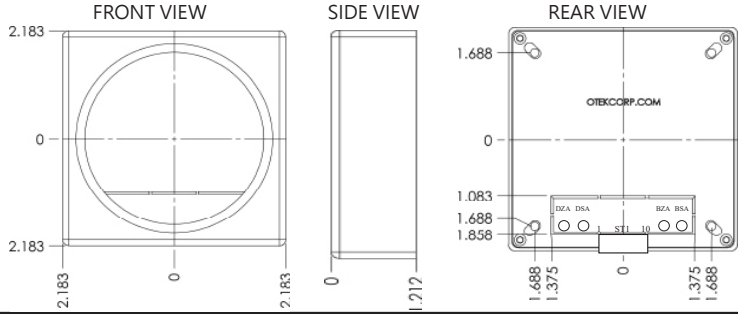

**PNP-9 STAND ALONE (REPLACES GE180 MECHANICALLY)**

Panel cut out: 1.66" x 5.52" Bezel: 1.74" x 6.0" or 2.15" x 6" see note




**PNP-N STAND ALONE ANSI 4" (REPLACES DB40 MECHANICALLY)**

Panel cut out: Either 4" diameter or 0.75" x 3" slot. Bezel: 4.35"Sqr.
4 ea. 8-32 x ½" long mounting studs on 3.375" centers included

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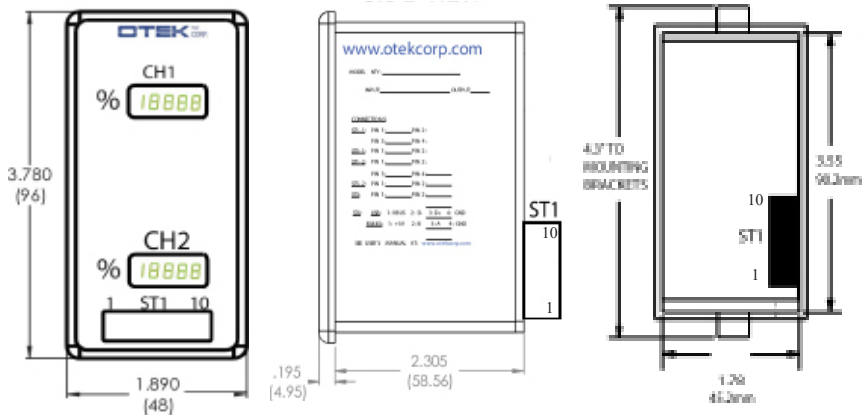
YOUR NOTES:

## OPTIONS -B, R ARE METERS, U, & W ARE TRANSMITTERS ⅛ DIN VERTICAL

Panel cut out: 46 x 92mm (1.81" x 3.62") Bezel: "1.9 x 3.8"

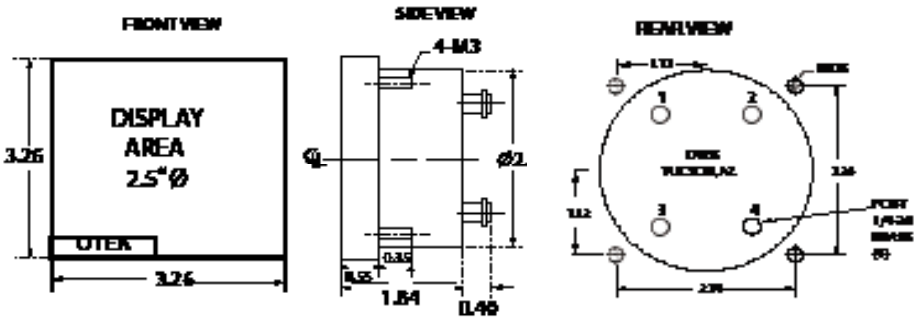
Front View | Side View | Rear View




**Note:** B & W are panel mount, U & R DIN Rail mount
Panel Mount: ST1 on rear, DIN Rail Mount: ST1 on front

## OPTION -D 3 1/2" Analog Meter Case

Panel cut out & Bezel: See drawings

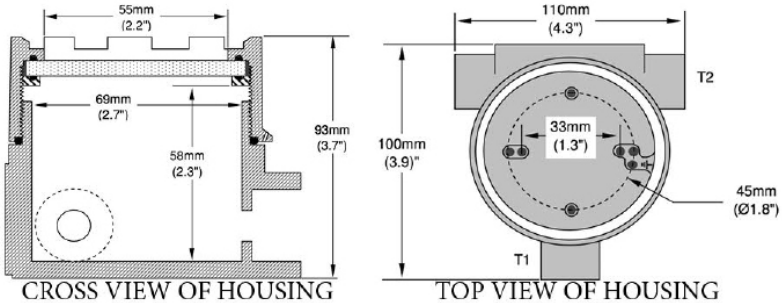



**Note:** Meets NEMA 3½" dimensions
**Note**: Only 4 terminals for signal and power (if required)

## OPTIONS -X OR -Y

### 4 x 4" Explosion Proof Mechanical

**CLASSIFICATIONS:** Certified for Class I, Div. 1, Groups B-G, EX & IECex: IM2, Exd1
Can be pipe mounted horizontal or vertical via ¾" NPT




CROSS VIEW OF HOUSING | TOP VIEW OF HOUSING

Contact OTEK for wall mount bracket

**Note**: ST1 Plug-in connector inside

# PNP DIGITS 4 & 14: CASES FOR HUB & ADAPTER PLATE ©

## "ONE SIZE FITS ALL"MECHANICAL

02/01/24

Complete P/N per ordering info (**pg. 18**). They are ready to mount, connect and play! Models **E, F, J, & G** include the **HUB** with selected options (Digits 5-14). Models **B, D, P, N, R, X, 2, 7, & 9** are 100% self-contained with options selected (Digits 5-14), and are mostly used for **MIL-SPEC** & **Class1E** grade (Digit 5).

**Important Note**: Custom scale plate, Digit 11 & 12 **Option 0** is per typical samples on **pg. 4** and Digit 11 Option 9 selected. Custom **Option 9** is per your instructions and will be "stuck" onto the front filter, but it can be easily removed and replaced onsite.

**Option "A" (no scale plate)** is **HIGHLY** recommended for more flexibility on **"spares inventory"** units, please read **pg. 4**. Regardless of case style (Digit 4) **ALL** models have identical input/output! The only difference is their size & shape to meet your existing (or new) panel requirements.

In other words, models **B, D, N, R, X, 2, 7, & 9** (for "**Stand Alone**") have identical circuitry in their case as models **E, F, J, & G** have in the plug-in **HUB**. See **pg. 13 & 17**.

**Option C (Custom):** Send us specs, your model P/N used, and manufacturer P/N. See Digit 5 (Grade) and **pg. 30** for existing cases.

**Option E:** 1½ x 1½ x ½" *no bar (smallest case). Plastic only unless custom. For **HUB** use only.

**Option F:** 2 x 3 x ½" *"Flat Pack" is our most popular case (since 1974) and has no bar. Plastic only, for **HUB** use only, unless custom.

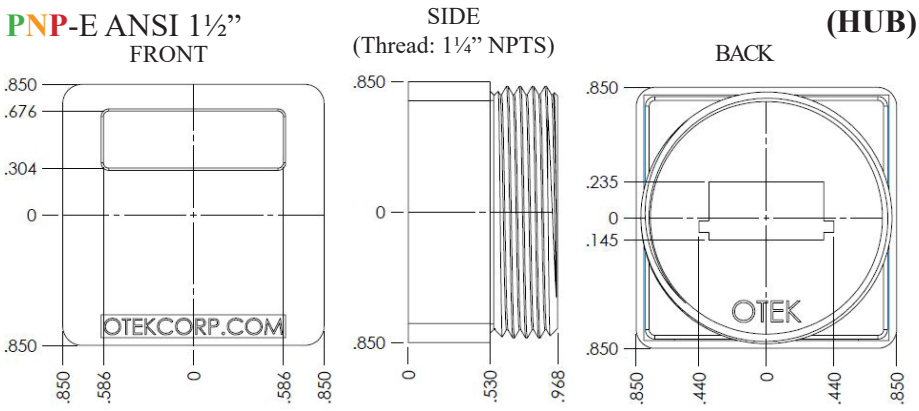
**Option G:** 6" x 1.74" x 1" *deep edgewise, replaces "GE 180" meters 100% FF&F! Plastic or metal. For **HUB** use (same size as Option 9). Offers side adapter plates, see **pg. 33**.

**Option J**: (ANSI 4") "Switchboard" 4" x 4" x 1" *deep, plastic or metal. Replaces "DB40" 100% FF&F! For use with **HUB**. (Same size as **Option N**).

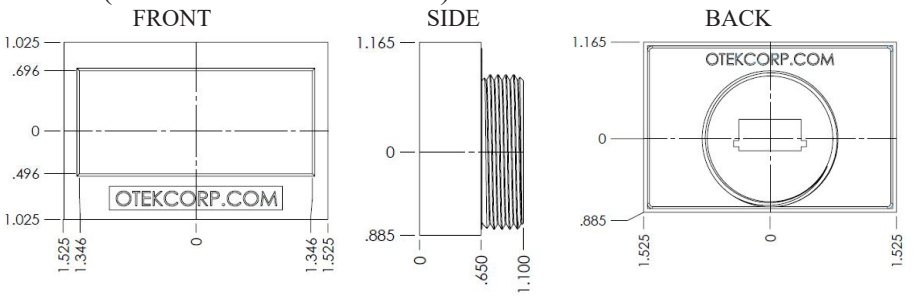
See **pg. 31** for "stand alone", **pg. 33** for adapter plates & HUB, and **pg. 34** for other housings.

*Dimensions = Height x Width x Depth*

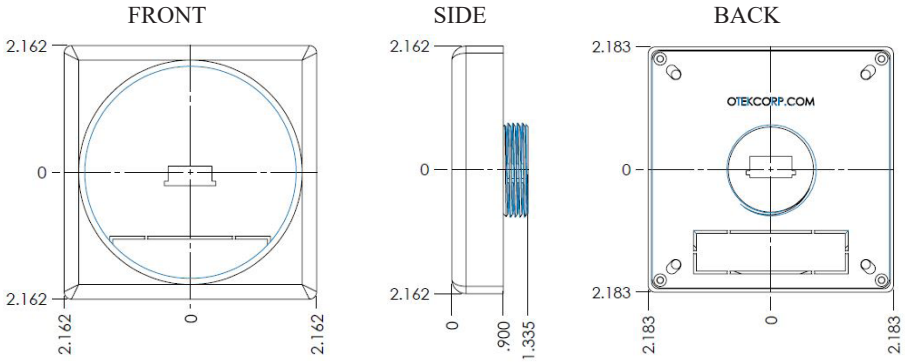
### PNP-E ANSI 1½" (HUB)



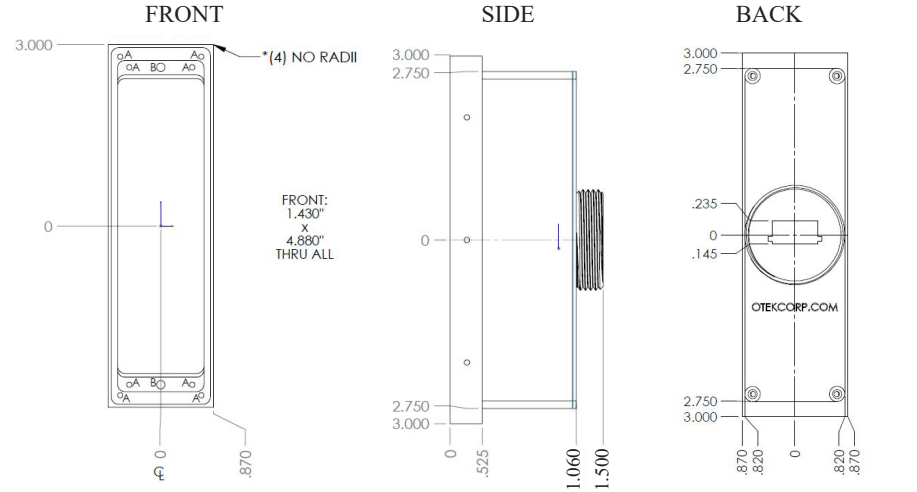

### PNP-F (SAME AS FLAT PACKS)




### PNP-J (SAME AS -N BUT FOR **HUB**)




### PNP-G (SAME AS -9 **BUT FOR HUB**)





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# PNP DIGIT 5: GRADE & DIGIT 14: ADAPTER PLATES FOR HUB ©

02/01/24

## GRADE DIGIT 5:

**Option E:**
To **EPRI** 102323 Rev 4 must be selected for Class1E and "Commercial Grades" to 10CFR50 standard. It must be a metal case that complies with Class1E and Mil-Spec standards. Include your specifications.

**Option M**: **Mil-Std.**
The housing must be metal. Please include the military standards to be met. ie: 461, 462.

**Universal HUB or Identical Case?** Case Style E, F, H, & M are for **HUB.** Cases **B, D, N, R, U, W, X, Y, 2, 7, & 9** are for "**Stand Alone**". See **pg. 34** for other Class1E & Mil-Spec cases with provisions for EMI/RFI ("PI" Filter) & filtered connectors. DB9, DB15, or MS3113 (Avionics) will be used. Contact us (below).

**Purchase Orders:**
Otek's published specifications governs the P.O. **unless** superseded by the customer's specifications & **accepted** by Otek. Read our terms and conditions online.

**Industrial Grade Options 0, 2 & 3:**
Comply with standard industry practice and definitions and meet NEMA and ANSI standards for environmental and dimensional requirements. All metal housings are made of hardened nickel-plated aluminum (#6061) and/or SS316 steel, black powder-coated (bezel only) to applicable Mil-Standards. Contact us for **Navy** gray.

## ADAPTER PLATE DIGIT 14:

An adapter plate is **not** required for new **PNP** installations or replacing existing meters with **identical** panel and mounting dimensions (**stand-alone**) such as models **-B, -D, -N, -R, -U, -W, -X, -Y, -2, -7, & -9** (Option 0). Confirm the panel space is the same or larger than the case size selected.

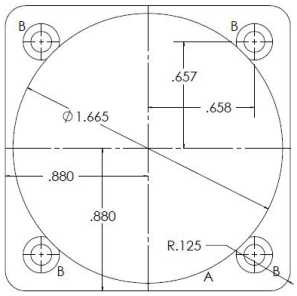
**PNP/1SFA HUB Cases Mounting Instructions:**

1. Select the option that matches your present meter to replace or larger.
2. Mount adapter plate to your panel using #4-40 flat head screws (not included), cut the included double-sided tape (P/N 50-1004) to ~½", and attach it in two places to the back of **PNP.**
3. Align & mount the **PNP** display on the front of the adapter plate.
4. Plug the "**HUB**" on the **PNP** and use the included "O" ring for panel thickness compensation or waterproof if required.
5. Slide the shell & "nut" over the "**HUB**" and screw it hand-tight. The thread is standard **1¼" NPTS.**
6. Make your connections to the "**HUB**" plug-in connector, which accepts solid or stranded (~¼" peeled) 26-18GA wire. **PLUG IT IN**, and turn your signal/power **ON**.

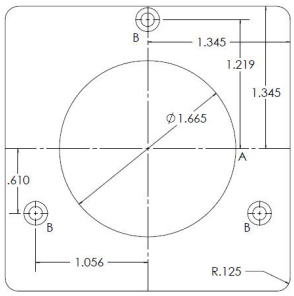
All: Mat'l: 0.0625" SS304, black powder coated. Counter sink for #4-40 screw. Screws not supplied unless it is a custom order. All dimensions are per ANSI standards.

# "ONE SIZE FITS ALL" (1SFA)
# Adapter Plates from 1½" to ?"

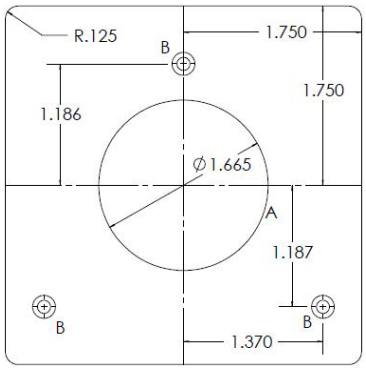
### OPTION 1: 1½" SQR



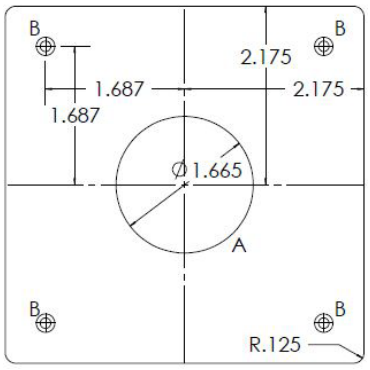

### OPTION 2: 2½" SQR



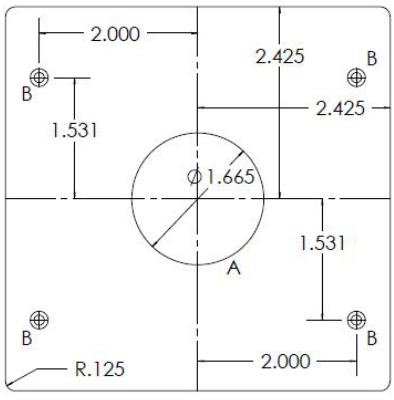

### OPTION 3: 3½" SQR




### OPTION 4: 4" SQR

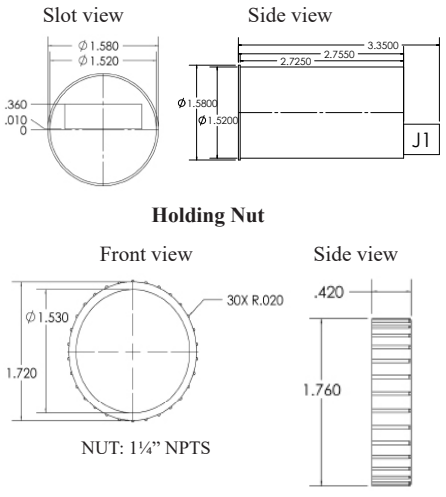



### OPTION 5: 4½" SQR ANSI 4.5"




**Note**: "B" holes are for existing mounting holes on your panel

### THE HUB ANSI 4"




## CUSTOMS WELCOME!


**520-748-7900**
FAX: 520-790-2808
E-MAIL: sales@otekcorp.com
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**CAGE CODE 57861**

OTEK™ CORP. SINCE 1974
The "DIGITIZERS"

A CLASS 1E COMPANY

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

MADE IN USA

# NOT FOUND HERE? OTEK SPECIALIZES IN CUSTOMIZING ITS TECHNOLOGIES! ©

02/01/24

**SOME CUSTOM PROJECTS:**

US Air Force: NVG3 1" **A**viation **P**anel **M**eter (**APM**). US Navy/Coast Guard: **TLD/PNP/NTM**. Nuclear: **HIQ, NTM, PNP, RPM, TRC**, ETC. NASA: **LSS.**

**Latest Innovations:**

1. **U.S. Coast Guard & Navy**: "We need display dimming for night viewing". OTEK developed three (Patent Pending) versions: **Automatic**: display/intenstive emulates ambient's luminance **OR** 5-24vdc isolated input **OR** 0-100kΩ input. See "**Night Vision**". **P. 7 & P. 14**
2. **Nuclear customer**: "Need the display to blink when a limit is tripped". OTEK developed its plug-in alarm module with relay, MOSFET, or reed relay to include a display blinker (on/off) driver. See "**Display Alarm**".
3. **NOA:** "Need to eliminate excessive C.M.V. in our system w/o changing present signal". OTEK Developed a plug-in signal conditioner with over 200V C.M.R.
4. **Vogtle NPP**: "Need a **R**adiation **P**anel **M**eter 100% equivalent to General Atomics/GE model RD2A and RM230. OTEK developed its **RPM** series that accepts **TTY** signals and has an alphanumeric display with exponential for log/anti-log.
5. **NPP**: Need a **T**riple **R**edundancy **C**ontroller to control our reactor". OTEK developed its **TRC series** (variation of **NTM-A**) 100% SCADA compliant.
6. Yours? Many more to list.

**NOTE: All custom designs are NOT listed on ordering information. The P/N shall be built with standard options except for the custom(s) specifications to be assigned by OTEK. Always use option "C" or "9" on digit(s) affected and describe the function in detail. Engineering will contact you.**

**LATEST INNOVATIONS (AS OF 8-1-23) (ALL CUSTOM BUILD): USE DIGIT 12 OPTION 9 OR C AND SPECIFY OR CONTACT US.**

**A. VISUAL LIMIT ALARM. (DISPLAY BLINKS CONTINOUSLY IF SIGNAL IS > OR < LIMIT SET.** Uses the plug-in alarm module # **A81-PNP-10-G**. That also has the optional SPDT MOSFET S.S.R. of digit 10 option 5 or G. If you want **Hi** or **Low** alarm with standard limits (Lo-Lo @ 10%, Lo @ 20%, Hi @ 80% or Hi-Hi @ 90% of F.S.). **Example**: Digit 10 Option 9 (custom) with display blink and SPDT MOSFET high limit at 95.00%. See video via QR code below. **Above can be customized for any NTM or PNP model**.

**B. NIGHT VISIONCOMPLIANT TO NVG3:** There are three (3) methods presently available: 1. Automatic Intenstiy Adjust: Reacts to your room's ambient light and adjusts the display intensity to match the rooms lighting eliminating the need for manual (voltage, current, or resistance) display brightness. 2. Externally isolated 5-24vdc via your variable and isolated D.C. voltage source. Brightest at > 20vdc, dimmest at <5vdc. Current: 1mAdc. 3. Externally non-isolated (isolated on request) 0-1 MΩ potentiometer. Brightest: >90% / 900kΩ Dimmest: < 10kΩ

**SEE IT ALL ON OUR NEW WEBSITE**

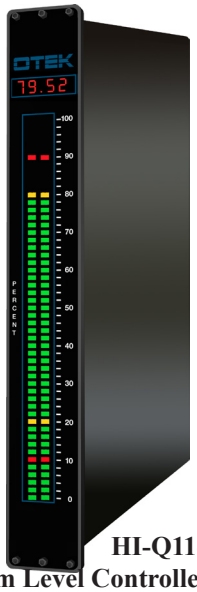
**REPLACES DPMS & TIMER-COUNTERS**


**UPM -L**
**U**niversal **P**anel **M**eter


**APM**
**A**viation **P**anel **M**eter
**REPLACES 8DJ102LAH1**

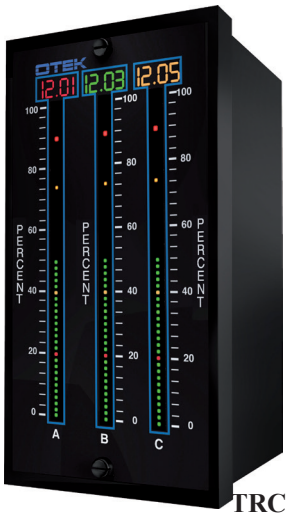

**RPM**
**R**adiation **P**anel **M**eter
**Replaces RM-2300**

**REPLACES CHESSELL'S 700**




**HI-Q114**
**Drum Level Controller**

**3 INDEPEDENT CONTROLLERS IN ONE!**




**TRC**
**T**riple **R**edundant **C**ontroller

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# Bar-Digital Replacement Guide

Existing Meter (OTEK Meter - Direct or Closest Replacement or Custom)
Note: any PNP can replace any meter as long as the panel space is equal or larger.
Many manufacturers use the same mounting dimensions
to denote identical case. See mechanical on pages 30-33.

| |
|---|
| NSN 8DJ103LAH1 (AVIATION PANEL METER APM) |
| A&M/Weston 49 Series (HI-Q119, NTM-9, HiQ-TEK, PNP-9) |
| Bowmar 6" (HI-Q119, NTM-9, HiQ-TEK, PNP-9) |
| Chessel 700 Series (HI-Q114, NTM-4) |
| Crompton 077/078 (HI-QTBS, NTM-3, NTM-M, NTM-N, PNP-N) |
| Crompton 128 (HI-Q119, NTM-9, PNP-9, HiQ-TEK) |
| Dixson BB1101/202PV (HI-Q119, NTM-9, HiQ-TEK, PNP-9) |
| Dixson BD, BJ, BS and BL (HI-Q121, NTM-1) |
| Dixson BE 051/BE101 (HI-Q101, NTM-P) |
| Dixson BEW51,BW051/P (HI-QTBS, NTM-3, NTM-M, NTM-N, PNP-N) |
| Dixson BG101/BG202P (HI-Q116, NTM-6) |
| Dixson BJ101 (DIN-BAR, NTM-0, NTM-B, PNP-B) |
| Foxboro 257 Series (HI-Q118, NTM-8) |
| GE 180 (HI-Q119, NTM-9, PNP-9) |
| GE AB/DB30 or DB40 (HI-QTBS, NTM-3, NTM-M, NTM-N, PNP-N) |
| International Instruments 9262/9263 (DIN-BAR, NTM-0, NTM-B, PNP-B) |
| Modutec 4SB (HI-QTBS, NTM-3, NTM-M, NTM-N, PNP-N) |
| NES 6" (HI-Q119, NTM-9, PNP-9) |
| Sigma 1151/1251 (HI-Q119, NTM-9, PNP-9) |
| Sigma 9200/9220 (NTM-V) |
| Sigma 9262/9263 (NTM-0, NTM-B, NTM-V) |
| Sigma 9264 (HI-Q121, NTM-1, PNP-1) |
| Sigma 9270 (HI-Q120, NTM-2, PNP-2) |
| T.A. Bailey "RY" Series (HI-Q116, NTM-6) |
| T. A. Bailey 775 Series (HI-Q117, NTM-7, PNP-7) |
| Takemoto 6" (HI-Q119; NTM-9, PNP-9) |
| Triplett 6" (HI-Q119, NTM-9, PNP-9) |
| Versatile VMI 2000 (HI-Q120, NTM-2, PNP-2) |
| Weschler PC and PH (HI-Q121, NTM-1) |
| Weschler/Westinghouse K231/241 (HI-QTBS, NTM-3, NTM-M, NTM-N, PNP-N) |
| Weschler/Westinghouse VX252/251 (HI-Q119, NTM-9, PNP-9) |
| Yokogawa Series (HI-Q121, NTM-1) |
| Yokogawa 180 (HI-Q119, NTM-9) |
| Yokogawa AB/DB30 or 40 (HI-QTBS, NTM-3, NTM-M, NTM-N, PNP-N) |

# CONCLUSION: DIGITIZE I&C IN ONE OUTAGE

1. **"EVOLVE OR PERISH"** You can slow down progress, but you can't stop it! Analog and digital meters and operators are being replaced by APC and touch screens on new plants. But what about your 25+ years old equipment?
2. Manufactures of obsolete meters have abandoned you and only popular rebuilt meters at exorbitant prices and deliveries are many months away.
3. Modern computerized control rooms are like doing a "Heart Transplant" to a 90 year old! i.e. Oconee's & Vogtle NPP $1B+ experiment or Limerick's pending >$200M?
4. Only the PNP or NTM offer you an alternative: "A Pace Maker" to help you until the end! **No** cyber security, re-paneling, re-wiring, or new operators needed!
5. Only the PNP will reduce/eliminate "DEAD" "spares" inventory without any changes/expenses to your present installation! **JUST PLUG AND PLAY!**

**Conclusion: "Follow the Signal" on pg. 25 and EPRI MTA on pg. 27-28**
**18 models available + customs.**


*PNP-N*


*PNP-X*

## WHY THE PNP CURRENT LOOP TRANSMITTERS? (pg. 24-25)

Because you asked us to help you eliminate waste, inaccuracy, unreliability, high failure rate, short life expectancy, waste of $ in spares inventory, operator error, and increase throughput (profits) at the power lines! Remember my "Invest a million to save two million" statement? Well, the PNP transmitters which use 100% of the same plug-in architecture, design, & parts as the PNP meters do just that! It will convert all your present signals to a high-reliability 4-20mA current loop (see Digit 10 Options B-D) and all you will need is one Powerless™ meter type and no power to it! Our (1974 and other) patented Powerless™ technology, "Fail-Safe" alarm, and control outputs will reliably control your process for many years! All we did was use the identical design of the PNP meters and repackaged it in Explosion-Proof, DIN rail mount, and Panel mount industry-standard housings! The rest is up to you!

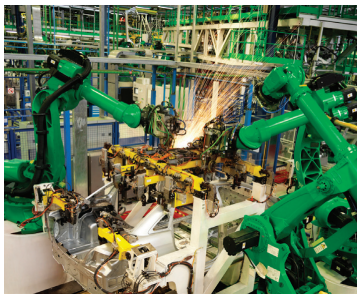
PNP-W


⅛ DIN
panel mount

PNP-R

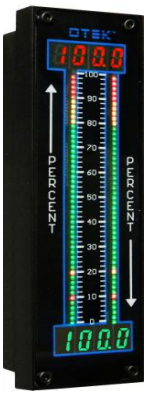

DIN rail mount

# OTHER PATENTED AWARD WINNING PRODUCTS:



**New Technology Meters/Controllers, (smart meters)**
**Cyber Security Compliant to NEI08-09**

The NTM Series includes many features such as: math functions, X-Y tables, polynomials, log-anti-log functions, automatic (programmable) tricolor bargraph, automatic signal fail detect (open or short), indication and serial transmission with run time stamp and unit's ID, isolated retransmission (4-20mA), and universal power input (5-32Vdc and 90-265Vac) or Powerless™ (loop powered). >50 input signals, 20 control outputs, and 5 serial I/O.
**22 models available + customs.**
**The award winning NTM is the "smart" version of the PNP.**




*NTM -9*

**Universal Panel Meters/Controllers (smart meters)**
**(Analog & Digital Inputs/Outputs)**

It's a DPM, counter, timer, clock, log-antilog, PID, Hz, rate, ratio, etc.
The UPM is an NTM (see above) with a different display that accepts over 100 analog & digital input signals and performs over 20 counter/timer/calendar functions and over 30 control output options. The alphanumeric six character automatic tri-color display is HMI and its serial I/O is MMI. Its isolated control outputs (SSR/DRY-CONTACT TO 5A) converts it into a low cost high versatility PLC. NEI08-09 Compliant.
**12 models available + customs.**


*UPM -5*

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