Consumers Power Company

General Offices: 212 West Michigan Avenue, Jackson, Michigan 49201 • Area Code 517 788-0550

September 5, 1980

Director, Nuclear Reactor Regulation
Att Mr Dennis M Crutchfield, Chief
Operating Reactors Branch No 5
US Nuclear Regulatory Commission
Washington, DC 20555

DOCKET 50-155 - LICENSE DPR-6 -
BIG ROCK POINT PLANT - CONTAINMENT
PRESSURE AND WATER LEVEL MONITORS:
SUBMITTAL OF DESIGN DESCRIPTION

NRC letter dated September 13, 1979 specified requirements for plant modifications as a result of lessons learned at Three Mile Island. Two modifications required involved upgrading of containment pressure and water level instrumentation for post-accident use. Consumers Power Company letter dated December 27, 1979 (as revised January 18, 1980 and March 14, 1980) detailed actions to be taken at Big Rock Point in response to the NRC requirements. Consumers Power Company agreed to provide upgraded capabilities for post-accident containment monitoring and to supply a design description for NRC information.

Attached are design descriptions of the containment pressure and water level instrumentation modifications to be installed at Big Rock Point. NRC letter dated October 30, 1979 identified these modifications as "implementation review" (ie, to be installed in accordance with 10CFR 50.59 and reviewed by NRC after installation). Accordingly, NRC approval of these design descriptions is not requested at this time; however, prompt identification of NRC concerns, if any, would be appreciated and would minimize potential impact on project schedule.

David P Hoffman (Signed)

David P Hoffman
Nuclear Licensing Administrator

CC JGKeppler, USNRC
NRC Resident Inspector - Big Rock Point

Attachment - 38 pages

CONTAINMENT PRESSURE AND WATER LEVEL MONITORS
DESIGN DESCRIPTIONS

BIG ROCK POINT PLANT

DOCKET 50-155

CONSUMERS POWER COMPANY
Nuclear Plant

FACILITY CHANGE

UFI No. 0 2 2 4 0 (Sys) 5 0 8 0 5 (Eqmt) FC - 4 9 8

0 2 2 4 0 (Sys) 5 0 8 0 4 (Eqmt)

TITLE: UPGRADE CONTAINMENT PRESSURE INSTRUMENTS

Functional Description: REFER TO ATTACHED EA-FC498-FD

REQUIREMENT:

PROVIDE A CONTINUOUS INDICATION OF CONTAINMENT PRESSURE IN THE CONTROL ROOM, WITH MEASUREMENT AND INDICATION OF FOUR TIMES DESIGN PRESSURE AND MINUS FIVE PSIG, TO PROVIDE OPERATORS THIS INFORMATION DURING AND FOLLOWING AN ACCIDENT. INSTRUMENTATION SHALL MEET THE DESIGN AND QUALIFICATION PROVISIONS OF REGULATORY GUIDE 1.97.

ACTION TO BE TAKEN AT BIG ROCK:

INSTRUMENTATION TO MONITOR CONTAINMENT PRESSURE AFTER AN ACCIDENT WILL BE PROVIDED TO COVER THE RANGE OF MINUS FIVE PSIG TO ONE HUNDRED AND TEN PSIG. THE MEASUREMENT AND INDICATION WILL BE BY CONTINUOUS RECORDING. THE NEW INSTRUMENTATION WILL MEET THE DESIGN PROVISIONS OF REGULATORY GUIDE 1.97 INCLUDING QUALIFICATION, REDUNDANCY, AND TESTABILITY.

Processing Sequence	Date	
Prelim Eng Comp — R. Bevhart — Proj Engr	6/10/80	1
Q-List Affected — [X] Y [ ] N — R E Schrader — Tech Supt	6/10/80	2
PRC Action — Mtg.No/Date CNAPS 734-80	6/18/80	3
Detailed Engr Comp — Proj Engr		4
Proj Review Comp — Tech Supt		5
QA Review — QA		6
Authorization to Implement — Plant Supt		7
Operations Notified — Proj Engr		8
Completed, Inspected, Tested — Proj Engr		9
QC Review — QC Supv		10
Operability Authorization — Ops Supt		11
Document Update — Proj Engr		12
Close Out — Tech Supt		13

INFORMATION COPY

(1)

CONSUMERS POWER COMPANY
Nuclear Plant
ENGINEERING ANALYSIS WORKSHEET

Title: FUNCTIONAL DESCRIPTION

Performed by: R. Lambert Date: 6-7-80

References: FACILITY CHANGE FORM FC498

Review Method by: Alternate Calcs ☐
Detailed Review ☑
Qualification Test ☐

R.B. Schrauder 6-10-80
Review by: Date

TWO INDEPENDENT CONTAINMENT PRESSURE MONITORING CHANNELS WILL BE PROVIDED. EACH CHANNEL WILL CONSIST OF LOCA AND SEISMIC QUALIFIED PRESSURE TRANSMITTERS QUALIFIED TO IEEE 323 (1971) AND IEEE 344 (1971) TO LEVELS OF 5×10^6 RADS AND 3g'S SEISMIC WICH ARE WELL ABOVE EXPECTED LEVELS UNDER ACCIDENT CONDITIONS.

EQUIPMENT SELECTED WILL ENCOMPASS THE REQUIRED RANGE OF MINUS FIVE TO ONE HUNDRED AND EIGHT (-5 to 108) PSIG AND WILL FUNCTION WITHIN REQUIRED ACCURACY FOLLOWING A SAFE SHUTDOWN EARTHQUAKE.

THE TRANSMITTERS WILL BE LOCATED IN ROOM 110 (THE OUTSIDE CABLE PENETRATION ROOM) AND WILL BE MOUNTED ADJACENT TO THE EXISTING CONTAINMENT PRESSURE TRANSMITTERS PT-173 AND PT-174 WHICH ARE DIRECTLY INPUTED FROM CONTAINMENT SPHERE PIPE PENETRATIONS H-96 AND H-98 THROUGH ONE HALF INCH STAINLESS STEEL TUBING. THE NEW WIDE RANGE CONTAINMENT PRESSURE TRANSMITTERS WILL BE CONNECTED TO THESE SEPARATE TUBING SENSING LINES BY USE OF APPROPRIATE FITTINGS AND ISOLATION VALVING TO ALLOW ON-LINE TESTABILITY OF EACH CHANNEL. EXISTING NARROW RANGE CONTAINMENT INSTRUMENTATION WILL BE RETAINED TO PROVIDE THE SENSITIVITY NEEDED FOR NORMAL PLANT OPERATION.

THE OUTPUT SIGNALS FROM EACH NEW TRANSMITTER WILL BE ROUTED TO TWO SEPARATE CONTINUOUS RECORDERS LOCATED IN THE MAIN CONTROL ROOM. THESE RECORDERS WILL ALSO BE USED TO DISPLAY TWO CHANNELS OF CONTAINMENT WATER LEVEL FOR ACCIDENT-MONITORING.

CONSUMERS POWER COMPANY
Nuclear Plant
ENGINEERING ANALYSIS WORKSHEET

Title: FUNCTIONAL DESCRIPTION (CONTINUED)

Performed by: R. Bouchart Date: 6-7-80

References: SEE SHEET 1

Review Method by: Alternate Calcs ☐
Detailed Review ☑
Qualification Test ☐

Review by: M A Schrader Date 6-10-80

EACH OF THESE TWO PEN RECORDERS WILL INCORPORATE MULTI SPEED CHART DRIVES AND INDICATING SCALES SO THE OPERATORS CAN READILY DISCERN THE MONITORED PROCESSES. CROSS CHECKING BETWEEN CHANNELS WILL SERVE TO ENSURE AVAILABILITY OF EACH CHANNEL BETWEEN CALIBRATION INTERVALS.

SINGLE FAILURE OBJECTIVES ARE REALIZED BY USING TWO SEPARATE CHANNELS. ELECTRICAL INDEPENDENCE IS ACHIEVED BY USE OF TWO SEPARATE INSTRUMENT AND CONTROL POWER PANEL BREAKERS 34-1 AND 34-11, RELIABILITY OF ELECTRICAL POWER AVAILABILITY IS PROVIDED BECAUSE PANEL 34 IS INTERCONNECTED TO THE EMERGENCY DEISEL GENERATOR THROUGH THE 480 VOLT MOTOR CONTROL CENTER BUS 2B DURING LOSS OF ALL OFF SITE POWER.

CONSUMERS POWER COMPANY
Nuclear Plant
ENGINEERING ANALYSIS WORKSHEET

Title: DESIGN INPUT

Performed by: R Barnhart Date: 5-27-80

References:

Review Method by: Alternate Calcs ☐
Detailed Review ☑
Qualification Test ☐

Review by: M Schrader Date: 6-10-80

1.b. TECHNICAL SPECIFICATIONS

SECTION 3.1 SPECIFIES DESIGN PRESSURE OF 41.7 PSIA INTERNAL FOR THE CONTAINMENT SPHERE.

PSIG = 41.7 PSIA - 14.7 ABSOLUTE PRESSURE

PSIG = 27.0

DESIGN OF NEW INSTRUMENTATION IS TO BE FOUR TIMES DESIGN PRESSURE.

THUS FOUR X 27.0 = 108 PSIG REQUIRED

SECTION 3.1 SPECIFIES DESIGN EXTERNAL PRESSURE OF 0.5 PSIG (NOT LIMITING, SAFE EXTERNAL PRESSURE IS 1.22 PSIG)

DESIGN OF NEW INSTRUMENTATION IS TO BE MINUS FIVE (-5) PSIG.

SECTION 3.4.2(e)

SPECIFIES METHOD OF CLOSURE FOR LINES ENTERING AND LEAVING CONTAINMENT SPHERE.

INSTRUMENT NOZZLE PENETRATIONS SELECTED FOR INSTRUMENT SAMPLE POINTS WILL MEET THE PROVISIONS OF THIS SECTION.

THESE INSTRUMENT LINES LEAVE AND RETURN TO THE CONTAINMENT SPHERE WITHOUT ANY OPENINGS TO THE ATMOSPHERE AND DO NOT REQUIRE ISOLATION VALVES AS THEY ARE NOT IN DANGER OF RUPTURE AS A RESULT OF REACTOR SYSTEM RUPTURE.

CONSUMERS POWER COMPANY
Nuclear Plant
ENGINEERING ANALYSIS WORKSHEET

Title: DESIGN INPUT

Performed by: R. Barnhart Date: 5-27-80

References:

Review Method by: Alternate Calcs [ ] Detailed Review [✓] Qualification Test [ ]

Review by: [signature] Date 6-10-80

1.c. CODES

APPLICABLE SECTIONS OF ANSI B31.1 CODE FOR PRESSURE PIPING WILL BE UTILIZED AS A GUIDE FOR INSTRUMENT TUBING INSTALLATION.

1.d. STANDARDS

NO KNOWN STANDARDS EXCEPT THE PLANT STATION BINDER APPLY.

CONSUMERS POWER COMPANY
Nuclear Plant
ENGINEERING ANALYSIS WORKSHEET

Title: DESIGN INPUT

Performed by: R. Barnhart Date: 5-27-80

References:

Review Method by: Alternate Calcs ☐
Detailed Review ☒
Qualification Test ☐

Reviewed by: [signature] Date: 6-10-80

1.e. REGULATORY REQUIREMENTS

ENCLOSURE 3 OF SEPTEMBER 13, 1979 NRC LETTER TO ALL OPERATING NUCLEAR POWER PLANTS FROM DG EISENHUT. NUREG 0578 ACRS SHORT TERM INSTRUMENTATION REQUIREMENTS.

1.f. REGULATORY GUIDES

REG GUIDE 1.97 REV. 1

1.g. PLANT ENGINEERING SPECIFICATIONS

PLANT PIPING SPECIFICATION 3159-M53 WILL BE FOLLOWED FOR MATERIAL SELECTION FOR INSTRUMENT TUBING.

INTERFACE WITH MAIN CONTROL PANEL WILL BE COMPLETED USING 3159-M201 FOR CONTROL PANEL CONNECTIONS AND INSTRUMENT INSTALLATION.

1.h. EHSR SECTIONS 3.2 SPHERE DESIGN & 3.4 PENETRATIONS ARE REFERENCED.

1.i. FUNCTIONAL DESCRIPTION.

REFER TO FACILITY CHANGE FORM TAB IN THIS FACILITY CHANGE FOLDER FC 498.

1.j. Q-LIST

THIS CHANGE WILL REQUIRE THE INTERFACE WITH THE FOLLOWING Q-LISTED COMPONENTS.

INSTRUMENT NOZZLE PENETRATIONS
EMERGENCY POWER BUS (S)
CONTROL PANEL/CONSOLE.
NEW INSTRUMENTATION WILL BE ADDED TO PLANT Q-LIST.

CONSUMERS POWER COMPANY
Nuclear Plant
ENGINEERING ANALYSIS WORKSHEET

Title: DESIGN INPUT

Performed by: R. Bauhart Date: 5-27-80

References:

Review Method by: Alternate Calcs ☐
Detailed Review ☑
Qualification Test ☐

Review by: [signature] Date 6-10-80

1.k. PLANT DRAWINGS

REFER TO DESIGN DOCUMENT CHECKLIST TAB, THIS FC-498 FOLDER.

2. EXTERNAL-ENVIRONMENTAL CONDITIONS

2.a. PRESSURE

NORMAL AMBIENT ATMOSPHERIC CONDITION WILL BE EXPERIENCED.

2.b. TEMPERATURE

PRESSURE TRANSMITTERS WILL BE LOCATED IN ROOM 110, THE OUTSIDE CABLE PENETRATION ROOM WHERE THE EXPECTED TEMPERATURE RANGE IS 40 to 90 DEGREES FARENHEIT.

OTHER INSTRUMENTS SUCH AS RECORDERS AND POWER SUPPLIES WILL BE LOCATED IN THE MAIN CONTROL ROOM WHERE EXPECTED TEMPERATURES WILL BE 65 TO 90 DEGREES FARENHEIT.

2.d. HUMIDITY

EXPECTED MAXIMUM HUMIDITY FOR CONTROL ROOM MOUNTED EQUIPMENT IS 80 % RELATIVE HUMIDITY.

TRANSMITTERS MOUNTED IN ROOM 110 WILL NEED TO BE QUALIFIED TO 100% RELATIVE HUMIDITY TO ACCOUNT FOR "FPS" SPRINKLERS LOCATED IN THIS AREA.

2.e. RADIATION ROOM 110

LESS THAN 10^5 RADS OVER A 30 DAY PERIOD FOLLOWING A LOCA. REFERENCE RW SINDERMAN LTTR. 1-25-78.
NORMAL RADIATION LEVELS EXPECTED ARE ≈ 1.5mr PER HOUR. REFERENCE DWG. 0740 G 10052
CONTROL ROOM RADIATION LEVELS ARE NEGLIGIBLE.

CONSUMERS POWER COMPANY
Nuclear Plant
ENGINEERING ANALYSIS WORKSHEET

Title: DESIGN INPUT

Performed by: R. Lambert Date: 5-28-80

References:

Review Method by: Alternate Calcs ☐
Detailed Review ☑
Qualification Test ☐

Review by: [signature] Date 6-10-80

3.a. SEISMIC

INSTRUMENTATION SHOULD BE SELECTED WHICH WILL MEET SEISMIC CATAGORY I ANDWILL BE REQUIRED TO FUNCTION FOLLOWING BUTNOT NECESSARILY DURING A SAFE SHUTDOWN EARTHQUAKE.
EQUIPMENT MUST WITHSTAND 1.0g IN EACH ORTHOGONAL DIRECTION SIMULTANEOUSLY WITH NO RESONANCES BELOW 35 Hz.

4. MECHANICAL REQUIREMENTS.

4.b. STRESS
4.d. PRESSURE
4.e. TEMPERATURE
4.h. MATERIAL COMPATIBILITY

MECHANICAL DESIGN REQUIREMENTS ARE THOSE NECESSARY FOR PIPING/TUBING INSTALLATION. ONE HALF INCH STAINLESS STEEL TUBING WITH MINIMUM WALL THICKNESS OF 0.035 INCHES, WHICH ADEQUATELY PROVIDES PRESSURE, STRESS, & TEMPERATURE REQUIREMENTS. CONNECTIONS WILL BE MADE WITH SWAGELOK FITTINGS AND ADAPTERS WHICH MEET BIG ROCK PIPING TUBING SPECIFICATIONS AND ARE COMPATIBLE WITH EXISTING PLANT EQUIPMENT.

(8)

CONSUMERS POWER COMPANY
Nuclear Plant
ENGINEERING ANALYSIS WORKSHEET

Title: SIMPLIFIED BLOCK DIAGRAM_ INSTRUMENTATION. DIC 6.

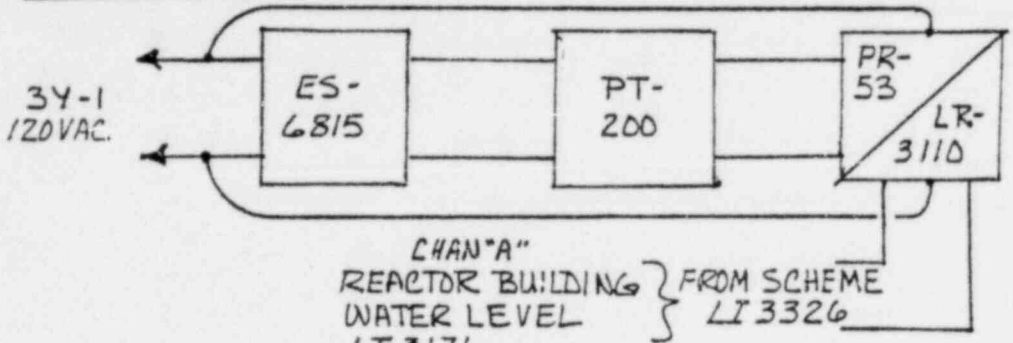
Performed by: R Barnhart Date: 5-28-80

References: ATTACHED PRODUCT INFO & INSTRUMENT NUMBERS FROM I&C SUPERVISOR, SCHEME NUMBERS RESERVED THRU DDC M.J.S.

Review Method by: Alternate Calcs ☐ Detailed Review ☑ Qualification Test ☐

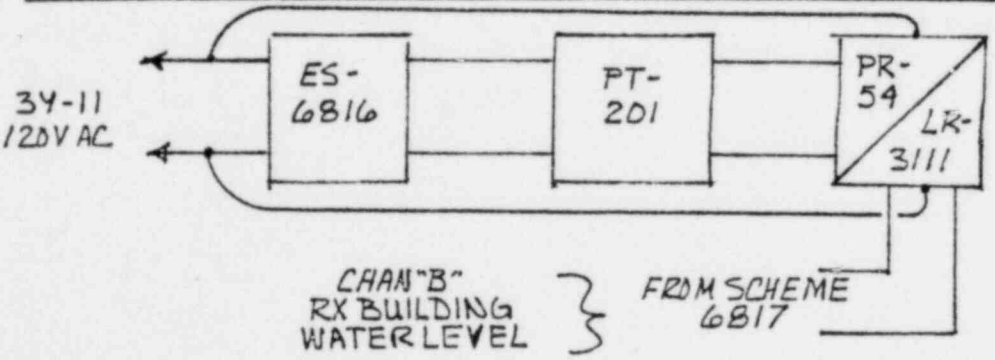
Reviewed by: [signature] Date 6.10.80

6. CHANNEL "A" RX BUILDING PRESSURE SCHEME 6815



CHAN "A"
REACTOR BUILDING
WATER LEVEL
LT-3171
ES-3171
LI-3400
} FROM SCHEME LI 3326
34-1

CHANNEL "B" RX BUILDING PRESSURE SCHEME 6816



CHAN "B"
RX BUILDING
WATER LEVEL
LT-3175
ES-6817
34-11
} FROM SCHEME 6817

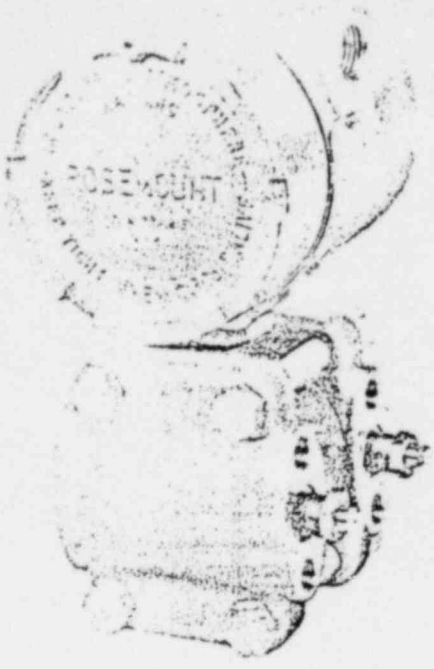
PT-200 & PT-201 ARE ROSEMOUNT 1152 GP 7 A 22 PB MODEL.

ES-6815 & ES-6816 ARE ROSEMOUNT PLUGIN SPS-2102-P MODEL.

PR-53 & PR-54 } ARE TRACOR WESTRONIX D4E MODEL.
LR-3110 & LR-3111 }

REFER TO ATTACHED PRODUCT INFORMATION SHEETS FOR DESCRIPTION OF EQUIPMENT.

MODEL 1152 ALPHALINE PRESSURE TRANSMITTERS



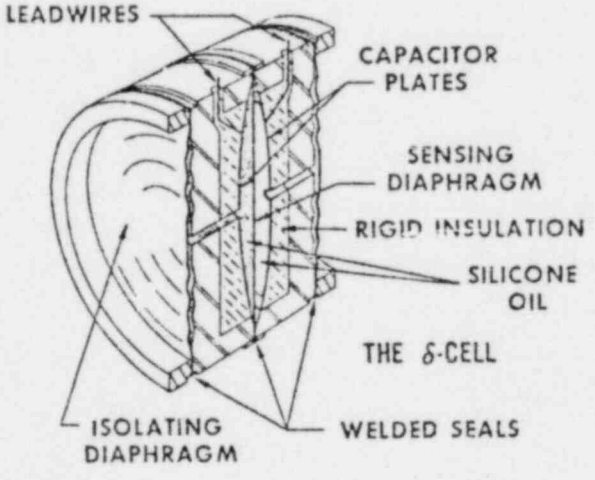
Absolute, gage and differential models
Loss of Coolant Accident (L.O.C.A.) qualified
Traceability of pressure retaining parts
SST housing option
Cleaned for nuclear service
0.25% accuracy

FEATURES

Rosemount's Model 1152 ALPHALINE® Pressure Transmitters* are designed for precision pressure measurements in nuclear applications requiring reliable performance and safety over an extended service life. These transmitters are qualified per IEEE-323, (1971) and IEEE-344, (1971) to levels of 5×10^6 rads TID gamma radiation, seismic levels of 3g's and for steam-pressure/chemical-spray performance. Stringent quality control during the manufacturing process includes traceability of pressure retaining parts, special nuclear cleaning, and hydrostatic testing.

Model 1152 Transmitters are similar in construction and performance to Rosemount's proven Model 1151 Transmitters. Units are available in Absolute (AP), Gage (GP), Differential (DP) and High-Line Differential (HP) configurations, with a variety of pressure range options.

Direct electronic sensing with the completely sealed δ-CELL™ capacitance sensing element eliminates mechanical force transfer and problems associated with shock and vibration. Installation and commissioning are simplified by compact design, 2-wire system compatibility and external span and zero adjustments. Wiring terminals and electronics are in separate compartments, so the electronics remain sealed during installation. Reverse polarity protection keeps wiring mishaps from costing money. Maintenance costs are reduced by the use of solid state plug-in printed circuit boards which are interchangeable among all Rosemount Model 1152 transmitters.



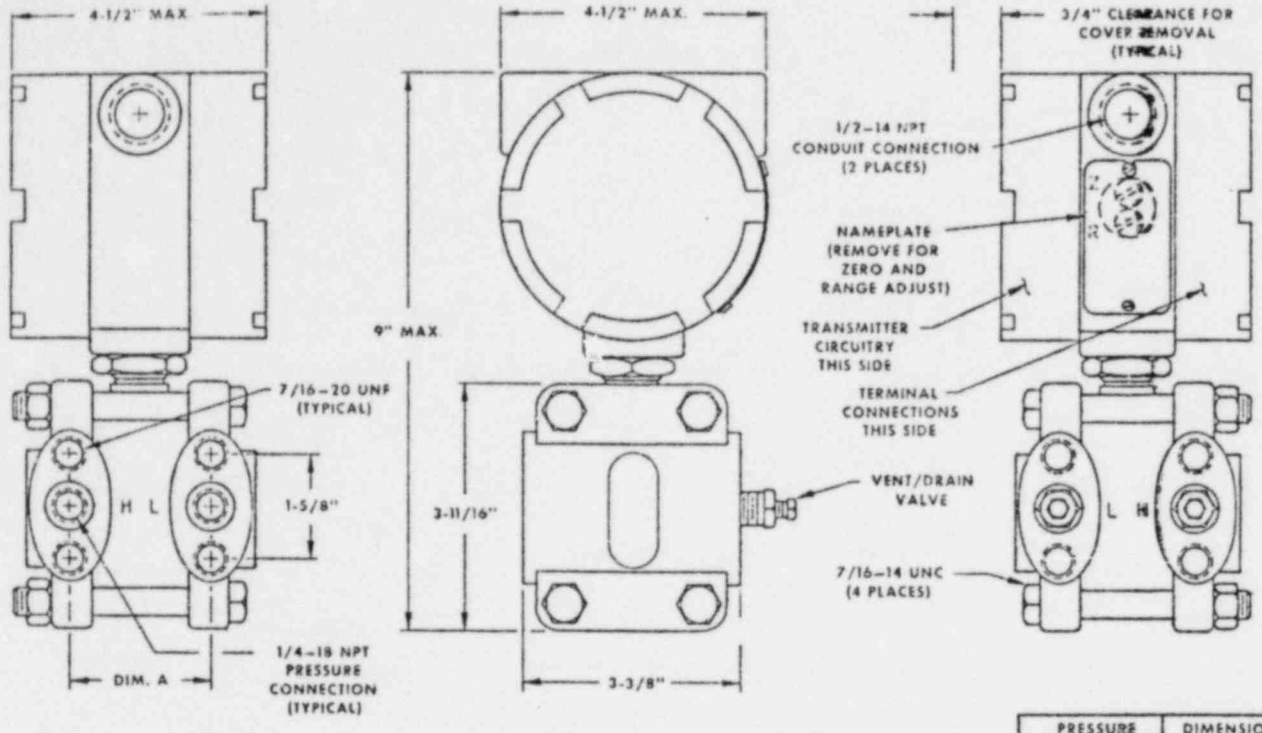
OPERATION

Process pressure is transmitted through an isolating diaphragm and silicone oil fill fluid to a sensing diaphragm in the center of the δ-CELL. The reference pressure is transmitted in like manner to the other side of the sensing diaphragm. The displacement of the sensing diaphragm, a maximum motion of 0.004 inches, is proportional to the pressure differential across it. The position of the sensing diaphragm is detected by capacitor plates on both sides of the sensing diaphragm. The differential capacitance between the sensing diaphragm and the capacitor plates is converted electronically to a 2-wire, 4-20 mADC signal.

Rosemount

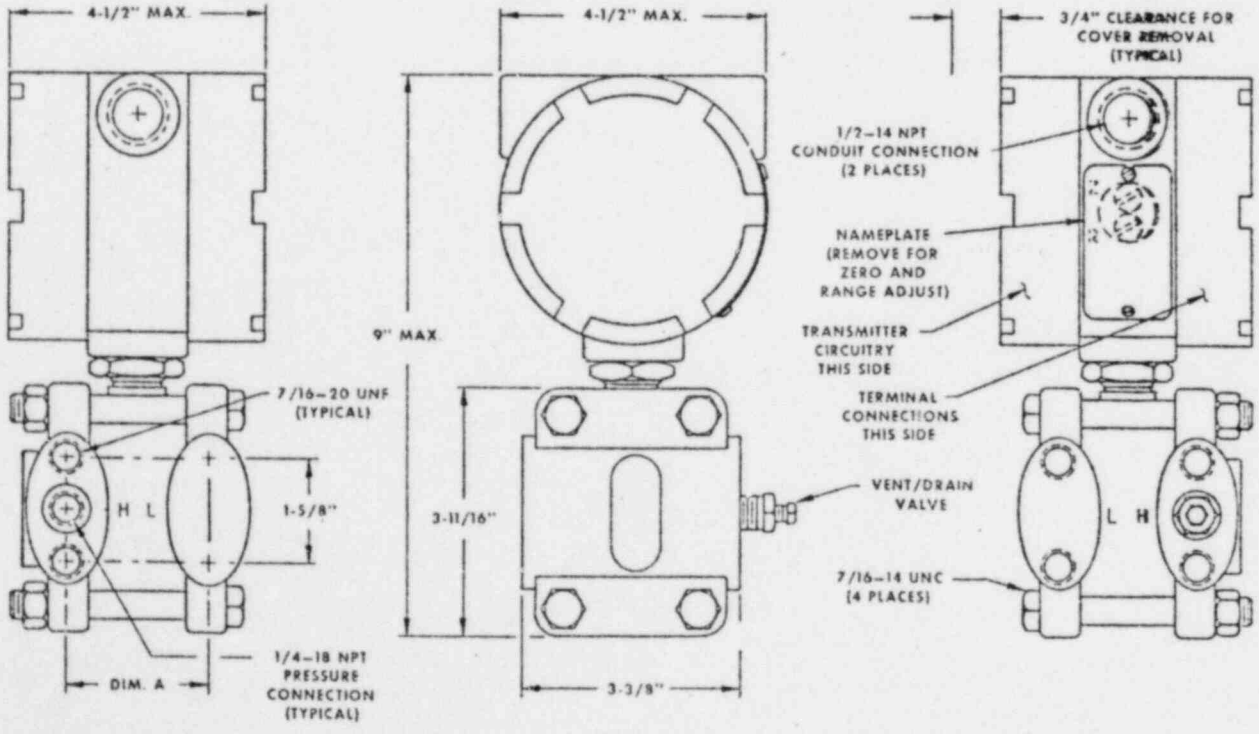
1C

DIMENSIONAL DRAWINGS
MODELS 1152DP AND 1152HP



PRESSURE RANGE CODE	DIMENSION A
3,4,5	2-1/8"
6,7	2-3/16"
8	2-1/4"
9	2-9/32"
0	2-21/64"

DIMENSIONAL DRAWINGS
MODELS 1152AP AND 1152GP



NUCLEAR SPECIFICATIONS ALL MODELS

(Qualified per IEEE-323 - 1971, IEEE-344 - 1971)

Radiation Performance ±2.0% accuracy during and after testing to 5 x 10^8 rads, total integrated dosage gamma radiation; ±0.25% of span after recalibration.

Seismic Performance ±0.25% accuracy during and after seismic testing to the 3g level over a range of 5-100 Hz in 3 major axes.

Steam Pressure/Chemical Spray Performance ±0.75% accuracy after sequential exposure to steam pressure of 70 psig, 316°F for 1 hour; 55.4 psig, 303°F for 7 hours and 6 psig, 230°F for 42 hours. For SST housing option, ±0.75% accuracy after chemical spray concurrent with above steam pressure cycle.

Quality Assurance Program In accordance with 10CFR50, Appendix B. **Nuclear Cleaning** to 1 ppm chloride content. **Hydrostatic testing** to 150% of rated line pressure for Models 1152DP and 1152HP; to 150% of maximum span (125% of 6000 psig range) or 2000 psi, whichever is greater, for Model 1152GP and 1152AP. **Traceability** in accordance with 10CFR50, Appendix B; chemical and physical material certification of pressure retaining parts.

PERFORMANCE SPECIFICATIONS MODEL 1152AP AND 1152GP

(Zero-based Spans, Reference Conditions)

Accuracy ±0.25% of calibrated span. Includes combined effects of linearity, hysteresis and repeatability.

Deadband None

Stability ±0.25% of upper range limit for 6 months.

Temperature Effect at Maximum Span (e.g. 0-100 psig for 0-17/100 psig range)
Zero Error: ±0.5% of span per 100°F.
Total effect including span and zero errors: ±1.0% of span per 100°F.
NOTE: Double the specified effect for Range Code 3.

Temperature Effect at Minimum Span (e.g. 0-17 psig for 0-17/100 psig range)
Zero Error: ±3.0% of span per 100°F.
Total effect including span and zero errors: ±3.5% of span per 100°F.
NOTE: Double the specified effect for Range Code 3.

Overpressure Effect: 2000 psig overpressure will cause a zero shift of less than ±0.25% of upper range limit for Range Codes 3 & 4 (Only Range 4 for AP); less than ±1.0% of upper range limit for Range Code 5; less than ±3.0% of upper range limit for Range Codes 6 & 7; less than ±6.0% of upper range limit for Range Code 8; less than ±.5% of upper range limit for Range Code 9 up to 4500 psig (For GP only); less than ±1.0% of upper range limit for Range Code 0 up to 7500 psig (For GP only).

Power Supply Effect Less than 0.005% of span per volt.

Load Effect No load effect other than the change in power supplied to the transmitter.

Mounting Position Effect Zero shift of up to 1 inch H_2O which can be calibrated out. No effect in plane of diaphragm. No span effect.

PERFORMANCE SPECIFICATIONS MODEL 1152DP AND 1152HP

(Zero-based Spans, Reference Conditions)

Accuracy including effects of linearity, hysteresis and repeatability

Model 1152DP: ±0.2% of calibrated span for ranges 3, 4, 5; ±0.25% for ranges 6, 7, 8.

Model 1152HP: ±0.25% of calibrated span (all ranges)

Deadband None

Stability ±0.25% of upper range limit for 6 months.

Temperature Effect at Maximum Span (e.g. 0-150 in. for 0-25/150 in. H_2O range)
Zero Error: ±0.5% of span per 100°F.
Total Effect including Span and Zero Errors:
±1.0% of span per 100°F.
(Note: Double the specified effect for Range Code 3).

Temperature Effect at Minimum Span (e.g. 0-25 in. for 0-25/150 in. H_2O range)
Zero Error: ±3.0% of span per 100°F.
Total Effect including Span and Zero Errors:
±3.5% of span per 100°F.
(Note: Double the specified effect for Range Code 3).

Overpressure Effect

Model 1152DP: 2000 psig overpressure will cause a zero shift of less than ±0.25% of upper range limit (Range Codes 3, 4); less than ±1.0% of upper range limit (Range Code 5); less than ±3.0% of upper range limit (Range Codes 6, 7) less than ±6.0% of upper range limit (Range Code 8).

Model 1152HP: 4500 psi overpressure will cause a zero shift of less than ±1.0% of upper range limit (Range Code 4); less than ±2.0% of upper range limit (Range Code 5); less than ±5.0% of upper range limit (Range Codes 6, 7).

Static Pressure Effect

Model 1152DP Zero Error: ±0.25% of upper range limit per 2000 psi (Range Codes 4, 5); ±0.5% of upper range limit per 2000 psi (Range Codes 3, 6, 7, 8).

Span Error: −1.0±0.25% of reading per 1000 psi (Range Codes 4, 5, 6, 7, 8); −1.5±0.25% of reading per 1000 psi (Range Code 3).

Model 1152HP Zero Error: ±2.0% of upper range limit per 4500 psi (all ranges).

Span Error: −1.0±0.25% of upper range limit per 1000 psi (all ranges).

Span error is systematic and can be calibrated out for a particular pressure before installation.

Power Supply Effect Less than 0.005% of span per volt.

Load Effect No load effect other than the change in power supplied to the transmitter.

Mounting Position Effect Zero shift of up to 1 in. H_2O which can be calibrated out. No span effect. No effect in plane of diaphragm.

PHYSICAL SPECIFICATIONS ALL MODELS

Materials of Construction

Isolating Diaphragms and Drain/Vent Valves: 316SS
Process Flanges: 316SS
Wetted O-Rings: Ethylene Propylene
Non-wetted O-Rings: Ethylene Propylene and Buna-N
Fill Fluid: Silicone Oil
Flange Bolts: Plated Alloy Steel, per ASTM A-540
Electronics Housing: Low-copper aluminum with acrylic baked enamel; or austenitic stainless steel.
Process Connections: 1/4-NPT
Electrical Connections: 1/2-inch conduit with slotted and 0.104" diameter jack-type screw terminals.
Weight: 12 lbs. with aluminum housing; 16 lbs. with stainless steel housing.

FUNCTIONAL SPECIFICATIONS MODEL 1152AP AND 1152GP

Ranges
(3) 0-5/30 in. H_2O (GP Units Only)
(4) 0-25/150 in. H_2O; 0-2/11 in. HgA
(5) 0-125/750 in. H_2O; 0-10/55 in. HgA
(6) 0-17/100 psia/psig
(7) 0-50/300 psia/psig
(8) 0-170/1000 psia/psig
(9) 0-500/3000 psig (GP Units Only)
(0) 0-1000/6000 psig (GP Units Only)

Output 4-20 mADC

Power Supply External power supply required, up to 45 VDC. Transmitter operates on 15 VDC with no load.

Span and Zero Continuously adjustable externally.

Elevation and Suppression Zero may be suppressed up to 100% of calibrated span, but upper range limit may not exceed the maximum range. Zero may be elevated for compound ranges down to 0.5 psia (For Model 1152GP).

Temperature Limits
–20 to 200°F Amplifier operating.
–20 to 220°F Sensing Element operating.
–60 to 250°F Storage.

Overpressure Limits
Model 1152GP: 0.5 psia to 2000 psi for ranges to 1000 psig; 4500 psi for the 3000 psig range and 7500 psi for the 6000 psig range for operation within specifications.
Model 1152AP: 2000 psi (all ranges) for operation within specifications.

Humidity Limits 0-100% RH.

Turn-on Time 2 seconds. No warmup required.

Damping
Output Option A: Nominal fixed response times of 0.3 seconds (range 3), 0.2 seconds (ranges 4, 5), and 0.1 seconds (ranges 6-0).
Output Option D: 4-position variable time constant switch for nominal response times of 2.0 seconds, 1.0 seconds, 0.5 seconds, or as above.

FUNCTIONAL SPECIFICATIONS MODEL 1152DP AND 1152HP

Ranges
(3) 0-5 to 0-30 in. H_2O (DP Units Only)
(4) 0-25 to 0-150 in. H_2O
(5) 0-125 to 0-750 in. H_2O
(6) 0-17 to 0-100 psi
(7) 0-50 to 0-300 psi
(8) 0-170 to 0-1000 psi (DP Units Only)

Output 4-20 mADC

Power Supply External power supply required, up to 45 VDC. Transmitter operates on 15 VDC with no load.

Span and Zero Continuously adjustable externally.

Elevation and Suppression Zero suppression or zero elevation up to 150% of calibrated span (ranges 3, 4, 5) or 50% of calibrated span (ranges 6, 7, 8), but upper range limit may not exceed ±100% of maximum range.

Temperature Limits
–20 to 200°F Amplifier operating.
–20 to 220°F Sensing Element operating.
–60 to 250°F Storage.

Static Pressure and Overpressure Limits
Model 1152DP: 0.5 psia to 2000 psig maximum rated static pressure for operation within specifications. 0.5 psia to 3000 psig static pressure without damage to the transmitter. 2000 psig overpressure on either side without damage to the transmitter.
Model 1152HP: 0.5 psia to 4500 psig maximum rated static pressure for operation within specifications. 0.5 psia to 6750 psig static pressure without damage to the transmitter. 4500 psig overpressure on either side without damage to the transmitter.
10,000 psig proof pressure on the flanges.

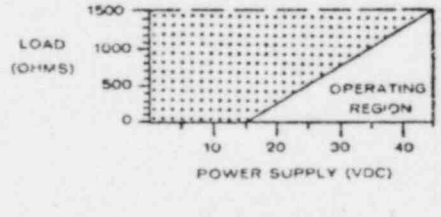
Humidity Limits 0-100% RH.

Volumetric Displacement Less than 0.01 cubic inches.

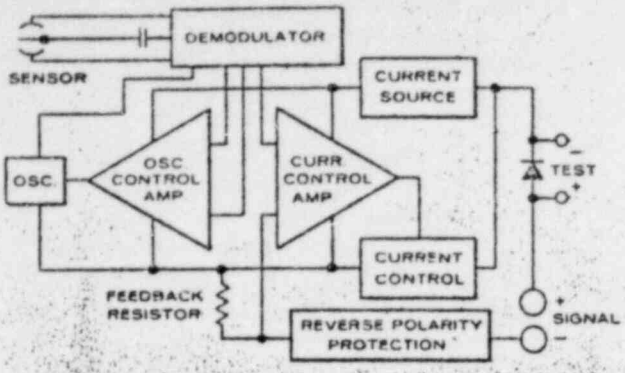
Turn-on Time 2 seconds. No warmup required.

Damping
Output Option A: Nominal fixed response times of 0.3 seconds (range 3), 0.2 seconds (ranges 4, 5), and 0.1 seconds (ranges 6, 7, 8).
Output Option D: 4-position variable time constant switch for nominal response times of 2.0 seconds, 1.0 seconds, 0.5 seconds, or as above.

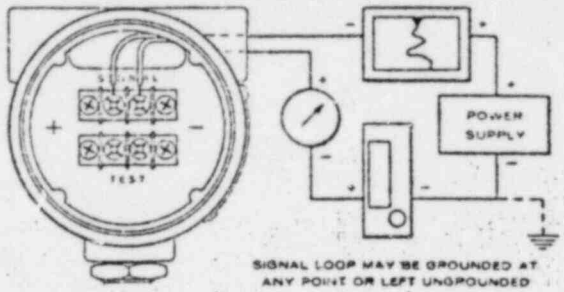
Load Limitations
All Models



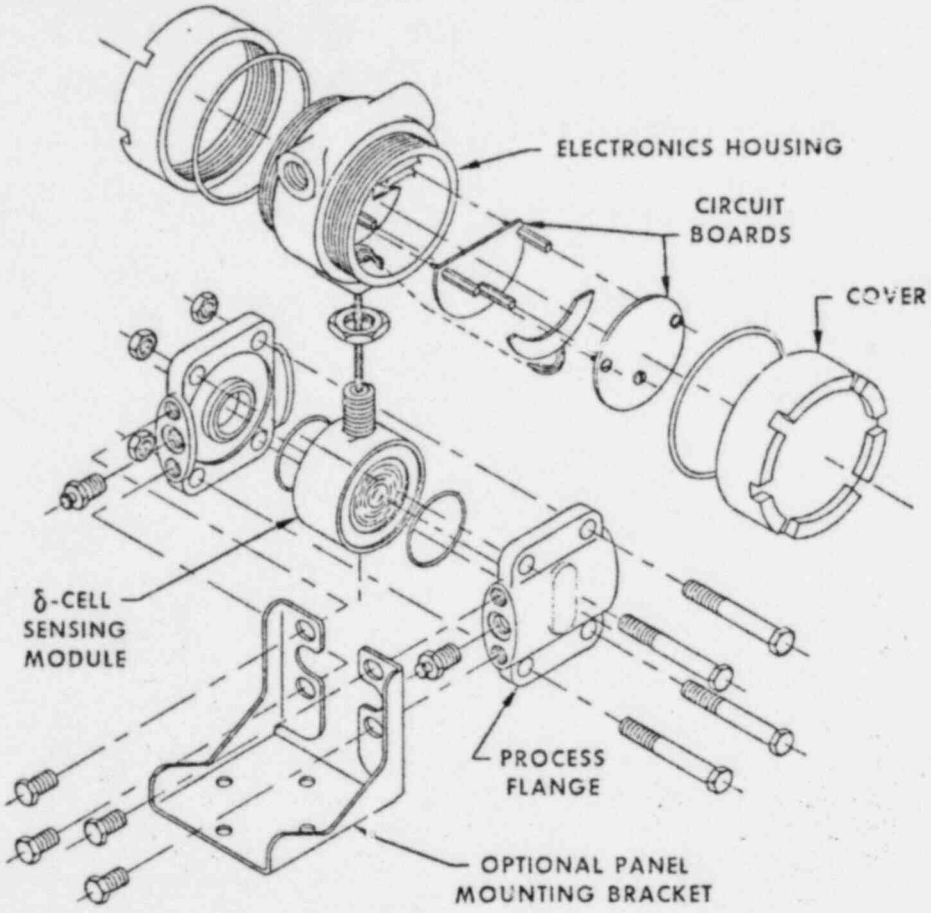
ELECTRICAL BLOCK DIAGRAM

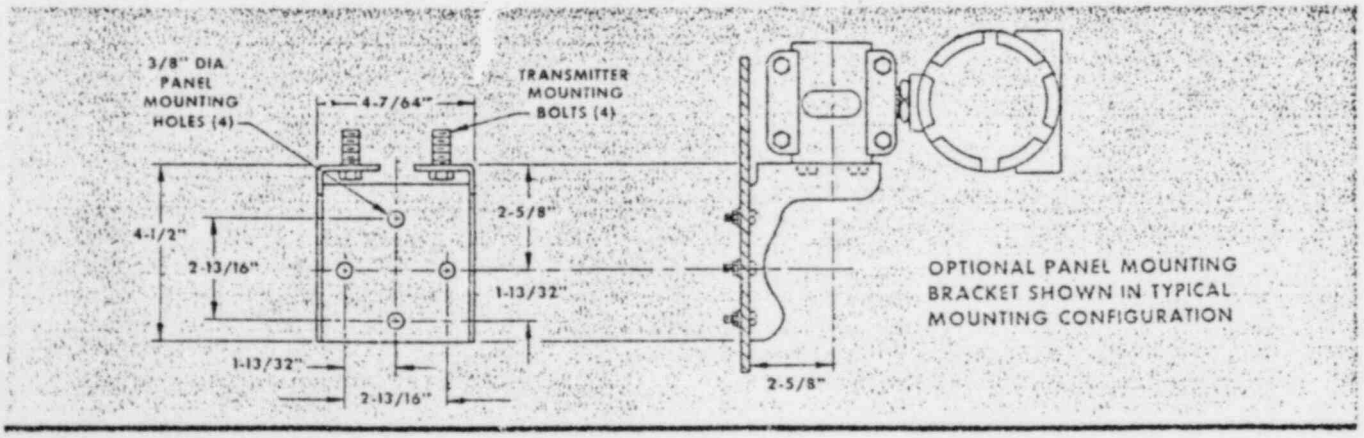


WIRING CONNECTIONS



TYPICAL MODEL 1152 PRESSURE TRANSMITTER ASSEMBLY





Ordering Information

MODEL	ALPHALINE PRESSURE TRANSMITTERS FOR NUCLEAR APPLICATIONS
1152	

CODE	PRESSURE MEASUREMENT
DP	Differential Pressure, 2000 psig Static Pressure Rating
HP	Differential Pressure, 4500 psig Static Pressure Rating
AP	Absolute Pressure
GP	Gage Pressure

CODE	PRESSURE RANGES MODEL 1152DP (DIFFERENTIAL)	MODEL 1152HP (DIFFERENTIAL)	MODEL 1152AP (ABSOLUTE)	MODEL 1152GP (GAGE)
3	0-5 to 0-30 in. H_2O (0-127 to 0-762 mm H_2O)	N/A	N/A	0-5 to 0-30 in. H_2O (0-127 to 0-762 mm H_2O)
4	0-25 to 0-150 in. H_2O (0-635 to 0-3810 mm H_2O)	0-25 to 0-150 in. H_2O (0-635 to 0-3810 mm H_2O)	0-2 to 0-11 in. HgA (0-69 to 0-380 g/cm²)	0-25 to 0-150 in. H_2O (0-635 to 0-3810 mm H_2O)
5	0-125 to 0-750 in. H_2O (0-3175 to 0-19050 mm H_2O)	0-125 to 0-750 in. H_2O (0-3175 to 0-19050 mm H_2O)	0-10 to 0-55 in. HgA (0-0.345 to 0-1.889 kg/cm²)	0-125 to 0-750 in. H_2O (0-3175 to 0-19050 mm H_2O)
6	0-17 to 0-100 psid (0-1.2 to 0-7.0 kg/cm²)	0-17 to 0-100 psid (0-1.2 to 0-7.0 kg/cm²)	0-17 to 0-100 psia (0-1.2 to 0-7.0 kg/cm²)	0-17 to 0-100 psig (0-1.2 to 0-7.0 kg/cm²)
7	0-50 to 0-300 psid (0-3.5 to 0-21 kg/cm²)	0-50 to 0-300 psid (0-3.5 to 0-21 kg/cm²)	0-50 to 0-300 psia (3.5 to 21 kg/cm²)	0-50 to 0-300 psig (3.5 to 21 kg/cm²)
8	0-170 to 0-1000 psid (0-12 to 0-70 kg/cm²)	N/A	0-170 to 0-1000 psia (0-12 to 0-70 kg/cm²)	0-170 to 0-1000 psig (0-12 to 0-70 kg/cm²)
9	N/A	N/A	N/A	0-500 to 0-3000 psig (0-35 to 0-210 kg/cm²)
0	N/A	N/A	N/A	0-1000 to 0-6000 psig (0-70 to 0-420 kg/cm²)

CODE	OUTPUT
A	4-20 mADC
D	4-20 mADC with Adjustable Damping

CODE	MATERIALS OF CONSTRUCTION FLANGES	DRAIN/VENT VALVES	ISOLATING DIAPHRAGMS	ELECTRONICS HOUSING/ COVERS
22	316SS	316SS	316SS	Aluminum
92	316SS	316SS	316SS	Austenitic SS

CODE	OPTIONS
PB	Panel Mounting Bracket

1152	DP	4	A	22	PB	← TYPICAL MODEL NUMBER

STANDARD ACCESSORIES All Models are shipped with vent/drain valves and one instruction manual per shipment.

CALIBRATION Transmitters are factory calibrated to customer's specified range. If calibration is not specified, transmitters are calibrated at maximum range. Calibration is at ambient temperature and pressure.

TAGGING ALPHALINE Pressure Transmitters will be supplied with SST tagging in accordance with customer requirements.

DOCUMENTATION Certification of compliance will be provided for each 1152 transmitter for nuclear qualification, accuracy, special cleaning, hydrostatic testing, and traceability. Chemical and physical reports and identification of pressure boundary materials will be on file at Rosemount.

Rosemount Inc.

POST OFFICE BOX 35129 MINNEAPOLIS, MINNESOTA 55435

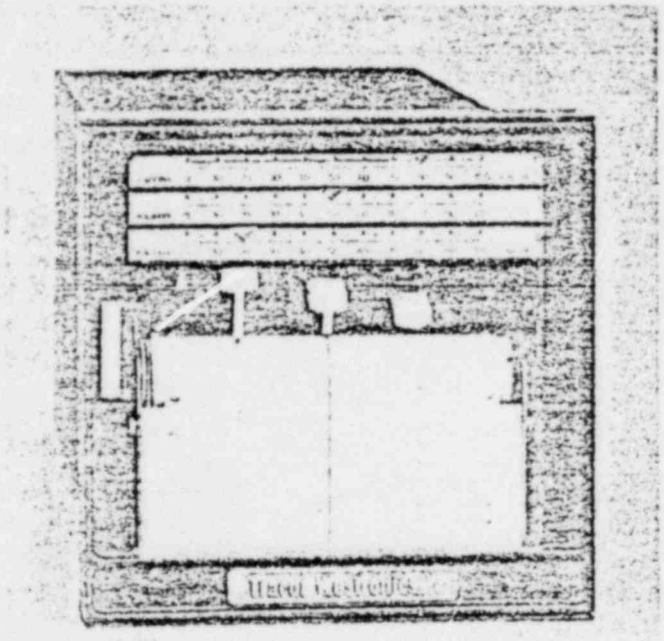
PHONE: (612) 941-5560 TWX: 910-576-3103 TELEX: 29-0183 CABLE: ROSEMOUNT

Revised 9/79

Tracor Westronics

S4E, D4E and T4E MINIATURE RECORDERS

Product Description & Technical Information



PRODUCT DESCRIPTION

Tracor Westronics' E Series Miniature Recorders include the S4E single pen recorder, the D4E dual pen recorder, and the T4E three pen recorder. All E Series Miniature Recorders fit the industry standard 6" x 6" panel cutout. All recorder versions feature a 15" case depth, making these recorders among the most compact in their performance category.

Like all E Series Recorders, the S4E, D4E, and T4E are designed and manufactured to set new standards of performance and reliability. These instruments utilize the same component and material quality standards, finishes, plating methods and exhaustive Q.C. procedures as are utilized on Tracor Westronics' multipoint and "large case" continuous writing recorders. Only dimensions have been reduced.

FEATURES

- FIBERTIP PEN CARTRIDGES – inexpensive fibertip pen cartridges write over 2,000 ft. Cartridges can be easily changed-out without the mess and inconvenience of capillary inking.

- SELF-CLEANING SLIDEWIRE CONTACTS – multi-fingered slidewire wiper contacts keep the slidewire clean and eliminate erratic operation due to dirt.

- PROTECTED SERVOMOTOR – the servomotor and servomechanics are protected electronically from damage due to overrange inputs.

- UNIVERSAL RANGE/AMPLIFIER CARDS – switch selectable gain programming allows all high level ranges to be set-up on a high level range/amplifier card, all low level ranges to be set-up on a low level range/amplifier card, and all thermocouple ranges (including cold junction compensation) to be set-up on a thermocouple range/amplifier card. All RTD ranges can be accommodated with an RTD range/amplifier card plus several plug-in range modules.

- EVENT MARKER OPTION – each recorder pen can be equipped with an electronic event marker which places a right angle mark on the trace at the beginning and ending of the event.

- INTERCHANGEABLE CHART DRIVE MAGAZINES – conversion from English to Metric chart speeds (or Metric to English) is as simple as interchanging chart drive magazines. The removable chart drive magazine also simplifies paper loading.

- MULTISPEED CHART DRIVE – a switch selectable 14 speed chart drive is standard equipment on all E Series Miniature Recorders.

VERTICAL AND HORIZONTAL CONFIGURATIONS - all E Series miniature recorders can be configured for vertical running or horizontal running charts and scales.

ALARM SWITCHES - up to 2 fully adjustable alarm switches can be installed on each pen.

MODULAR CONSTRUCTION - all major subassemblies are modular and can be removed and replaced without unsoldering. The frame assembly can be disconnected and removed from the case without disturbing field wiring.

ISOTHERMAL INPUT TERMINALS - prevents thermal EMF errors from being added to input signals within the recorder.

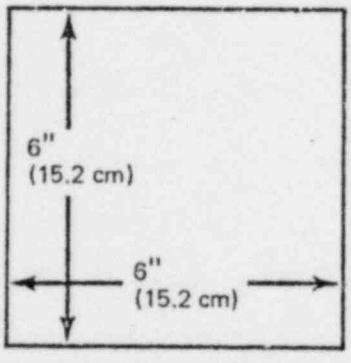
STANDARD ACCESSORIES - standard accessories include power on/off switch, chart on/off and manual chart advance.

STANDARD OPTIONS

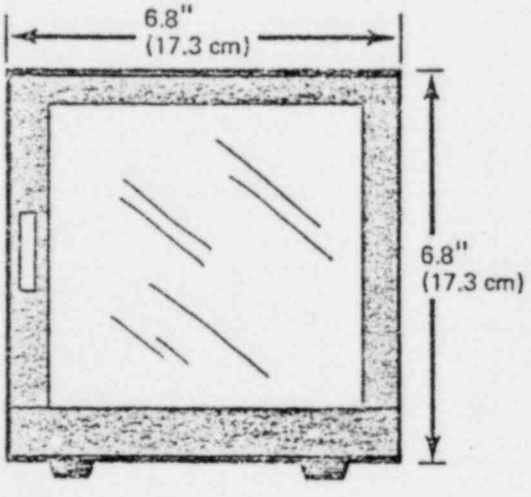
- Alarm Switches - up to 2 per pen, adjustable over 100% of span.
- Event Marker - available on each pen. Momentary trace pertubation to display event. Left movement at event start; right movement at event end. External contact closure required.
- Range/Amplifier Cards - for low level, thermocouple*, or RTD. (High level standard.)
- Shunts for current inputs
- Special Charts and Scales
- Door Lock
- Air Purge Case
- Power Cord
- Carrying Handle

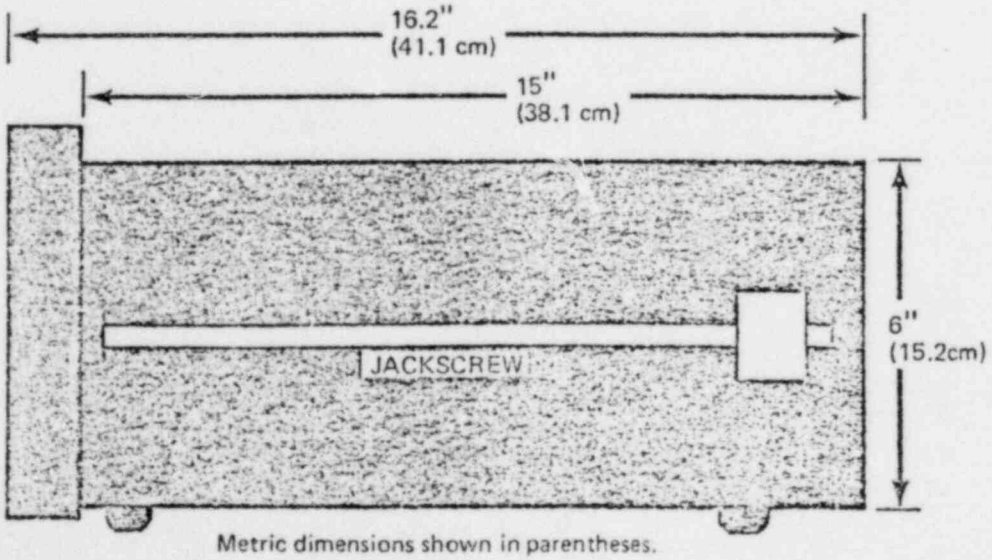
*Specify upscale, downscale or no thermocouple burn-out indication.

INSTALLATION DIMENSIONS



PANEL CUTOUT





Metric dimensions shown in parentheses.

SPECIFICATIONS

Input:	Isolated	
Range/Amplifier Cards:	High Level	Low Level, Thermocouple and RTD
Spans*:	100mV to 10V	1mV to 100mV Thermocouple spans include cold junction compensation and burnout indication. RTD spans include current source
Zero Adjust:	±100% of span	±100% of span
Zero Elevation/Suppression:	±600% of span	±600% of span
Accuracy:	±0.5% span	±0.5% span or 10μV, whichever is greater (at calibrated ambient)
Drift:	—	1μV/°C from calibrated ambient
Step Response:	0.5 second	0.5 second
Overshoot:	1% of span	1% of span
Input Impedance:	5 megohm on spans to 14V 1 megohm on spans >14V	5 megohm
Source Resistance:	25K ohm	5K ohm for spans greater than 10mV 500 ohm for spans 1mV to 10mV
Deadband:	0.25% span	0.25% span
Common Mode Rejection:	120db@ 50/60 Hz	120db@ 50/60 Hz
Normal Mode Rejection:	60db@ 50/60 Hz	60db@ 50/60 Hz

Scale: 100mm (nominal 4") calibrated in engineering units. Black lettering on white background.

Chart: 100mm calibrated width; 82 feet (25 meters) long.

Chart Speeds: 0.25 0.5, 1, 2, 4, 8, 16 in/min and in/hr (English). 0.5, 1, 2, 4, 8, 16, 32 cm/min and cm/hr (Metric).

Case Dimensions: Overall dimension 6.8"w x 6.8"h x 16.2"d (17.3cm x 17.3cm x 41.1cm).
Panel cutout 6" x 6" (15.2cm x 15.2cm).
Panel mounting depth 15" from bezel to backplate (38.1cm from bezel to backplate).

Weight: 3 pen: 18 lbs. (8.2 Kg.)

Inking: Replaceable fibertip ink cartridges – red, blue or green.

Operating Temperature: 10°C–40°C

Operating Humidity: 10% – 90% relative humidity.

Models: S4E Single Pen, D4E Dual Pen, T4E Three Pen.

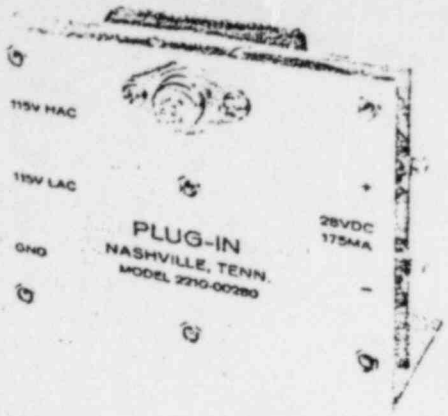
Configurations: Vertical or horizontal scales.

Power: 120 VAC ±10% 50/60 Hz.

*Shunts available for current inputs

Specifications Subject to Change Without Notice.

PLUG-IN™ REGULATED DC POWER SUPPLIES

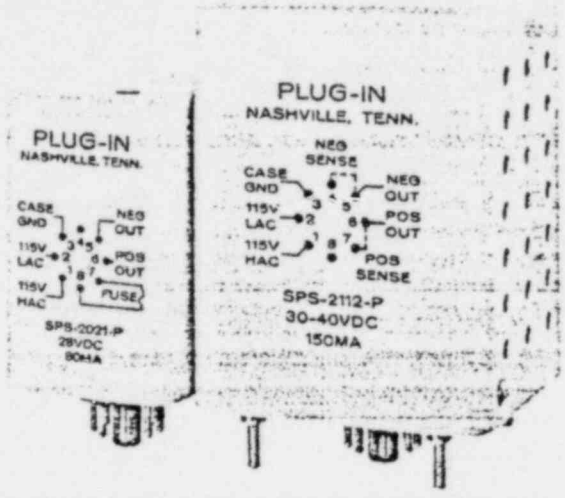


1 to 40 volt outputs

Adjustable voltage

Overcurrent protection

(Automatic or external fuse)



GENERAL

Rosemount regulated Plug-In DC power supplies provide highly stable and isolated DC voltage for various industrial, medical, laboratory, ground support and other applications. These models are ideally suited for industrial transducer excitation, current transmitter applications as well as for laboratory use.

The Plug-In types are transistorized and compact, but are repairable. A mating 8-pin octal receptacle for conventional chassis mounting is shipped with each unit. However, the optional screw-down socket with molded barrier strips offers extra convenience and fast installation.

The open construction 2210 series is equally convenient in use and installation. This economical unit is of solid state design, and offers automatic momentary short circuit protection. The line and load regulation and the ripple specifications are less stringent (see ordering table) than for the enclosed models. However, these units are especially designed for low-cost applications where a large number of isolated voltages are required and where electrical specifications are not critical.

Power supplies are available with narrow slot range and with wide range voltage adjustments. Any voltage between 1 and 40 volts is available from at least one Rosemount standard power supply. The table below shows the model numbers for the most popular voltage ranges between 1 and 40 volts. After determining applicable models, refer to the "Style" table on page 2 for electrical specifications. Duplications exist in some voltage ranges for your selection based on economy, current ratings or electrical specifications.

VOLTAGE/MODEL TABLE

	VOLTAGE									
STYLE	1–6.5	5–9	10	12	15	18	20	24	28	30–40
2210				2210	2210	2210		2210	2210	
A			SPS–2077	SPS–2077	SPS–2078					
B			SPS–2014	SPS–2010	SPS–2018			SPS–2011	SPS–2021	
D	SPS–2055	SPS–2056	SPS–2057 SPS–2052	SPS–2057 SPS–2052 SPS–2073–D	SPS–2058 SPS–2074–D	SPS–2054	SPS–2054 SPS–2101	SPS–2060 SPS–2101	SPS–2101	SPS–2102
F	SPS–2062	SPS–2063	SPS–2110	SPS–2110 SPS–2120–D	SPS–2110 SPS–2121–D	SPS–2110	SPS–2111	SPS–2111	SPS–2111	SPS–2112

Rosemount

ORDERING INFORMATION

2210

OPEN CIRCUIT CONSTRUCTION

MODEL	DC OUTPUT RATING		REGULATION (mV DC)		RIPPLE (mV RMS)	OUTPUT ADJUST
	VOLTS	CURRENT (mA)	LINE	LOAD		
2210-00280	28	175	±10	20	10	±5%
2210-00240	24	225	±10	20	10	±5%
2210-00180	18	250	±10	20	10	±5%
2210-00150	15	300	±10	20	10	±5%
2210-00120	12	400	±10	20	10	±5%

STYLE "A"

ULTRA COMPACT 0.6 WATT PLUG-IN

MODEL	DC OUTPUT RATING		REGULATION (mV DC)		RIPPLE (mV RMS)	TEMP. COEFF. (%/°F)
	VOLTS	CURRENT (mA)	LINE	LOAD		
SPS-2077-P	9-12.5	0-50	3	6	1.5	0.02
SPS-2078-P	13-16	0-40	3	6	1.5	0.02

STYLE "B"

ECONOMICAL 2 WATT PLUG-IN

MODEL	DC OUTPUT RATING		REGULATION (mV DC)		RIPPLE (mV RMS)	TEMP. COEFF. (%/°F)
	VOLTS	CURRENT (mA)	LINE	LOAD		
SPS-2014-P	10	0-175	±4.5	± 9	1	0.03
SPS-2010-P	12	0-175	±6	±12	1	0.03
SPS-2018-P	15	0-125	±6	±12	1	0.03
SPS-2011-P	24	0-90	±5	±12	1	0.025
SPS-2021-P	28	0-80	±6	±14	1	0.025

STYLE "D"

3 WATT PLUG-IN OR SOLDER-HEADER MOUNTING

	MODEL	DC OUTPUT RATING		REGULATION (mV DC)		RIPPLE (mV RMS)	TEMP. COEFF. (%/°F)	MOUNTING STYLE
		VOLTS	CURRENT (mA)	LINE	LOAD			
NARROW ADJUSTMENT RANGE	SPS-2055-P SPS-2055-S	1-6.5	0-300	15	5	1.5	0.03	Plug-In Solder-Header
	SPS-2056-P	5-9	0-250	15	5	1.5	0.03	Plug-In
	SPS-2057-P	9-13	0-200	2	5	0.5	0.02	Plug-In
	SPS-2058-P	13-17	0-175	2	5	0.5	0.02	Plug-In
	SPS-2052-P SPS-2052-S	9-13	0-200	2	5	0.5	0.01	Plug-In Solder-Header
	SPS-2054-P	17-21	0-150	2	5	0.5	0.01	Plug-In
WIDE ADJUSTMENT RANGE	SPS-2101-P	20-30	0-100	10	15	1	0.02	Plug-In
	SPS-2102-P	30-40	0-75	10	15	1	0.02	Plug-In
DUAL VOLTAGE OUTPUT	SPS-2073D-P SPS-2073D-S	±12	0-75	3	6	1	0.02	Plug-In Solder-Header
	SPS-2074D-P SPS-2074D-S	±15	0-65	3	6	1	0.02	Plug-In Solder-Header

STYLE "F"

4.5 WATT PLUG-IN OR SOLDER-HEADER MOUNTING

	MODEL	DC OUTPUT RATING		REGULATION (mV DC)		RIPPLE (mV RMS)	TEMP. COEFF. (%/°F)	MOUNTING STYLE
		VOLTS	CURRENT (mA)	LINE	LOAD			
NARROW ADJUSTMENT RANGE	SPS-2062-P SPS-2062-S	1-6.5	0-600 0-800	15	10	1.5	0.03	Plug-In Solder-Header
	SPS-2063-P SPS-2063-S	5-9	0-450 0-600	15	10	1.5	0.03	Plug-In Solder-Header
WIDE ADJUSTMENT RANGE	SPS-2110-P	10-20	0-200	15	15	1	0.02	Plug-In
	SPS-2111-P	20-30	0-175	15	15	1	0.02	Plug-In
	SPS-2112-P	30-40	0-150	15	15	1	0.02	Plug-In
DUAL VOLTAGE OUTPUT	SPS-2120-P SPS-2120-S	±12	0-175	5	10	1.5	0.02	Plug-In Solder-Header
	SPS-2121-P SPS-2121-S	±15	0-150	5	10	1.5	0.02	Plug-In Solder-Header

GENERAL SPECIFICATIONS

Input Voltage
105 to 125 VAC at 50–400 Hz.

Adjustable Output
Voltage adjust potentiometer at the top of all power supplies. (If range is not specified, adjustment is ±5%.)

Floating Output
Positive or negative, output can be grounded, isolated from case and AC line.

DC Isolation
Greater than 100 megohm with 200 VDC applied between output and case.

AC Isolation
Typically 20 picofarad – shield between primary and secondary transformer.

Line Regulation (output voltage variation as input line voltage changes from 105 to 125 VAC)
See ordering table on opposite page.

Load Regulation (output voltage variation due to a change from no load to full rated load current)
See ordering table on opposite page.

Output Impedance
Less than 0.1 ohms (DC to 1KC).

Reverse Current
Fully protected against an application of reverse current.

Remote Sensing
Styles "D" and "F" models have provisions for remoting the point of regulation to the load.

Short Circuit Protection
Electronic protection against accidental short-circuit and temporary overloads. (The style "B" has provision for external fusing.)

Transient Response
250 mV peak to peak, for a step load change of 10 to 100% for less than 50 millisecond duration. (Not specified for 2210.)

Temperature Range
The temperature effect over the usable range of 20°F to 125°F is less than .03%/°F. Do not exceed 150°F maximum temperature on base of solder-header styles or permanent damage may result. (Not specified for 2210.)

Stability
Long term stability is better than ±0.1% of rated voltage at fixed conditions. Stability is ±0.2% for Style "B" and other models when operating below 9 volts.

PRICING AND DISCOUNTS

The applicable price list is P50000. All models listed on the current price list are stocked at our Nashville plant. Most styles delivered from stock in quantities to 25 pieces F.O.B., Nashville, Tennessee. Prices and specifications on all models are subject to change without notice. When ordering, specify model number and quantity of each item.

Quantity discount schedule follows:

DISCOUNT	QUANTITY
1–9	Base Price
10–24	Base Price Times 0.96
25–49	Base Price Times 0.92
50–99	Base Price Times 0.88
100–199	Base Price Times 0.84

WARRANTY

Rosemount Nashville, Inc. warrants its power supplies to be free from defects in workmanship and/or material and to function satisfactorily when properly installed, operated and maintained in accordance with instructions and specifications for a period of 6 months. The warranty becomes effective on the date of shipment.

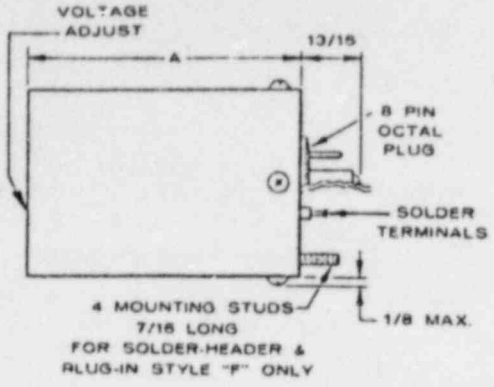
This warranty does not extend to any of our products which have been subject to misuse, neglect, accident, or improper installation or application; nor shall it extend to units which have been repaired or substantially altered by persons other than authorized personnel.

Rosemount Nashville, Inc. will, in no way, be liable for damage to other equipment caused by failure or malfunction of equipment built by Rosemount Nashville, Inc.

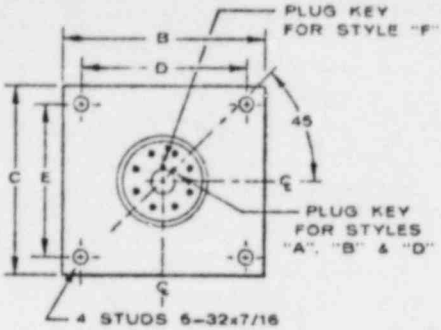
REPAIR POLICY

The warranty obligation is limited to repairing or adjusting of the power supply or parts thereof upon authorized return to the factory, transportation prepaid. Repair or replacement of such equipment, which upon examination proves to be defective due to materials or workmanship, will be completed at no charge and reshipped F.O.B. Nashville. Any power supply returned beyond the time limit warranty, or due to misuse, etc., will be repaired (repair price is approximately half price) or if not repairable, can be replaced at the current price.

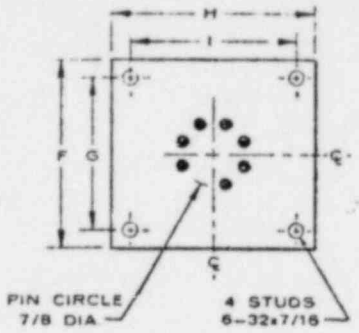
OUTLINE DRAWINGS



ALL STYLES - SIDE VIEW



PLUG-IN STYLES
"A", "B", "D" & "F"
BOTTOM VIEW



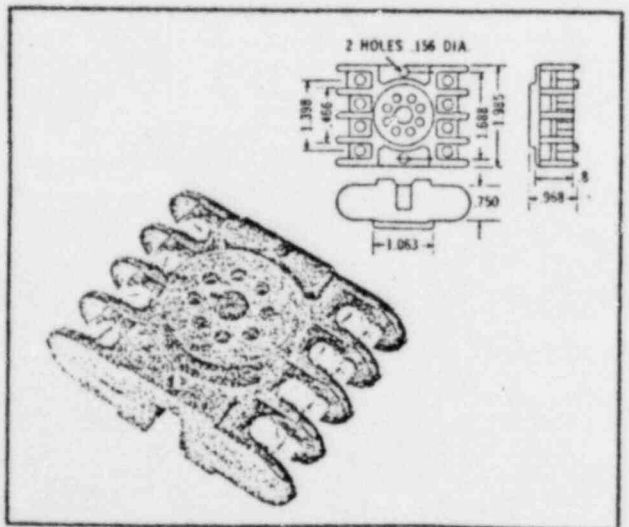
SOLDER-HEADER STYLE "D"
BOTTOM VIEW

STYLE	DIMENSIONS, PLUG-IN MODELS									WEIGHT
	A	B	C	D	E	F	G	H	I	LBS.
"A"	2-1/2	1-7/16	1-7/16							3/8
"B"	3	2	2							1/2
"D"	3-1/8	2-1/4	2-1/8			2-1/8	1-1/2	2-1/4	1-1/2	1
"F"	3-15/16	3-1/16	2-15/16	1-7/8	2-9/32					2

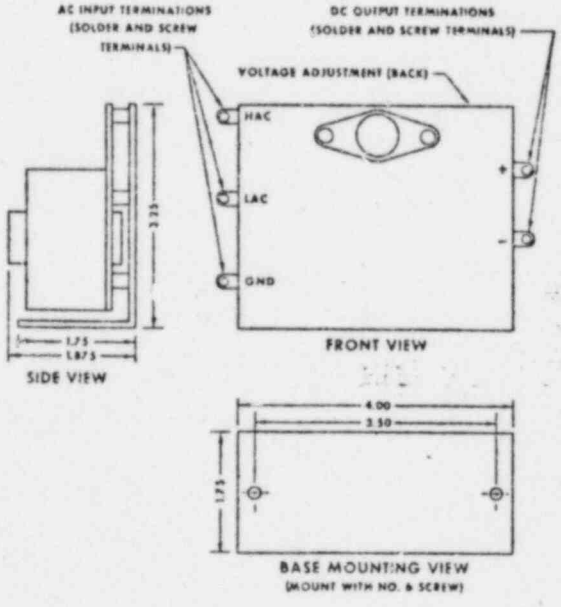
SCREW-DOWN SOCKET WITH MOLDED BARRIER STRIPS

Rosemount Part Number: N0012-00170

This Amphenol Model 146-104 socket can be used to connect plug-in power supplies into a circuit without soldering. Both mounting and terminal connection problems are quickly solved by using this socket. The socket can be mounted above or below the chassis. Voltage rating is 1250 volts RMS at 5 amp. Mounting screws are not supplied.



2210 OUTLINE



Rosemount
Nashville Inc.

100 HEIL-QUAKER BOULEVARD LAVERGNE, TENNESSEE 37086

PHONE: (615) 793-7561 TWX: 810-380-4370

Revised 8/75

CONSUMERS POWER COMPANY
Nuclear Plant
ENGINEERING ANALYSIS WORKSHEET

Title: DESIGN INPUT

Performed by: R. Courtot Date: 6-9-80

References: BIG ROCK POINT DRAWING 0740A 30009 SH. 29 ATTACHED

Review Method by: Alternate Calcs ☐ Detailed Review ☑ Qualification Test ☐

Review by: [signature] Date 6-10-80

6 a. POWER SUPPLY LOADING

TWO SEPARATE BREAKERS ON PANEL 3Y WILL BE AFFECTED BY THIS CHANGE.

(1.) BREAKER 3Y-1 PHASE A (Y13)
(2.) BREAKER 3Y-11 PHASE C (Y13)

6.a.(1.) EXISTING LOAD ON BREAKER 3Y-1 IS 90 VOLT-AMPS
REFER TO BIG ROCK POINT DRAWING 0740A 30009 SHEET 29.

AVAILABLE TOTAL LOAD IN VOLT-AMPS =
VOLTAGE X CURRENT X POWER FACTOR =
120 VAC X 15 AMP X 100% (ASSUMED) =
3Y-1 TOTAL LOAD AVAILABLE = 1800 VOLT-AMPS

ADDITIONAL LOAD TO BE ADDED TO 3Y-1

POWER REQUIREMENTS OF D4E TWO PEN RECORDER PR-53
120 VOLTS AC FUSED AT 3/8 AMP
RECORDER LOAD MAXIMUM =
120 VAC X 3/8 AMP =
RECORDER LOAD = 45 VOLTAMPS

POWER REQUIREMENTS OF SPS-2102-P POWER SUPPLY ES-6815
120 VOLTS AC 3 WATT WHICH SUPPLIES PT-200.
PLUG-IN POWER SUPPLY LOAD =
120 VAC X CURRENT IN AMPS =
$120\ \text{VAC} \times \left(\frac{3\ \text{WATTS}}{120\ \text{VAC}} \right) =$
120 VAC X 0.025 AMP =
POWER SUPPLY LOAD = 3 VOLT-AMPS

THUS TOTAL ADDITIONAL LOAD = 45 + 3
= 48 VOLT-AMPS

REFER TO 7.b. FOR ADDITIONAL VOLTAGE CURRENT INFORMATION.

A	9/19/75	ADDED POWER FOR CARD READERS	RL	RC	C	10/5/76	Revised For Record DCN 35-75 & 42-76 & Added Req'ts. For Job #7664 (SWC 3409S)	RAB	KFA
B	9/11/7x	ISSUED FOR RECORD GWO-7108	LP	RE	D	10-12-77	REVISED PER DCN 37-77.	GHRP	ERL

PNL MFR-ITE MFR TYPE-P4L1Z

AC FEED 1A OR 2B — PANEL 3Y 120/208YV (STA PWR ROOM - NORTH WALL)

	VOLT-AMPS			BREAKER		CIRCUIT NUMBER		BREAKER		VOLT-AMPS			
	A	B	C	TRIP	POLE			TRIP	POLE	A	B	C	
REACT BLDG WATER LEVEL LT-3171	40			15	1	1	2	15	1	50			CORE SPRAY LINE PRESS PT 184, PI-412. REACTOR PRESS. PT 1A 07C
PRIMARY CORE & ENCL SPRAY FLOW FT-2162, FT-2164		80		15	1	3	4	15	1		50		PIPE TUNNEL DAMPER POSITION INDICATION
BACK UP CORE & ENCL SPRAY FLOW FT-2161, FT-2163			80	15	1	5	6	30	1			1500	ACCESS CONTROL SYSTEM
SPARE	X			15	1	7	8	15	1	X			SPARE
"		X		15	1	9	10	15	1		600		FIRE DETECTION CIRCUIT
"			X	15	1	11	12	15	1			600	FIRE TROUBLE CIRCUIT

NOTE: FOR PIPE TUNNEL SCHEMATIC REFER TO CPC-0740G31040

TOTAL VOLT-AMPS	A 80	B 730	C 2180	FEEDER AMPS	A	B	C

DR. R.O. GOTTSCHALDT 4-3-75

CK. T.A. HICKS 4-3-75

APP. GWT 4-7-75

PANEL SCHEDULE No. 3Y

BIG ROCK POINT

CONSUMERS POWER CO.
ELEC. ENGINEERING DEPT.
JACKSON, MICHIGAN

8520-3019-6

No. 740-A-30009 SHEET 29

Rev. D

O.K. TO FILE

AP	4-24-75	A	6/19/75 RCL	C		E		G		I		K	
		C	10-14-76	D	10-13-77	F		H		J		L	

OK MS 11-12-77

BIG ROCK POINT PLANT DRAWING CHANGE

Dwg No. 0740 A 30009 Sh 29 Rev D

DCN No. 08 - 80 : Add RI-8322,3 to Circuit 9 per FC-493 DLS

REVISION ENG

Part 1 of 1

INFORMATION COPY

A	9/19/75	ADDED POWER FOR CARD READERS	RL	RC	C	9/3/76	REVISED FOR RECORD-DCN 35-75 (42-76) ADDED REQ'TS. FOR JOB #7625 (GWO 3009?)	D L O	RAB	RFA
B	9/11/75	ISSUED FOR RECORD GWO-7108	LP	RE	D	10-12-77	REVISED PER DCN 37-77.	GIRP	L	ERL	RAB

PNL MFR-ITE MFR TYPE-P4LIC

AC FEED 1A OR 2B — PANEL 3Y 120/208YV (STA PWR ROOM - NORTH WALL)

	VOLT-AMPS A	VOLT-AMPS B	VOLT-AMPS C	BREAKER TRIP	BREAKER POLE	CIRCUIT NUMBER	CIRCUIT NUMBER	BREAKER TRIP	BREAKER POLE	VOLT-AMPS A	VOLT-AMPS B	VOLT-AMPS C	
REACT BLDG WATER LEVEL LT-3171	40			15	1	1	2	15	1	50			CORE SPRAY LINE PRESS PI-412. REACTOR PRESS. P
PRIMARY CORE & ENCL SPRAY FLOW FT-2162, FT-2164		80		15	1	3	4	15	1		50		PIPE TUNNEL DAM POSITION INDICAT
BACK UP CORE & ENCL SPRAY FLOW FT-2161, FT-2163			80	15	1	5	6	30	1			1500	ACCESS CONTROL SYSTEM
SPARE	X			15	1	7	8	15	1	X			SPARE
RI-8322, RI-8323 High Range Monitors		10		15	1	9	10	15	1		600		FIRE DETECTION CIRCUIT
SPARE			X	15	1	11	12	15	1			600	FIRE TROUBLE CIRCUIT

NOTE: FOR PIPE TUNNEL SCHEMATIC REFER TO CPC-0740G31040

TOTAL VOLT-AMPS A 80 B 740 C 2180 FEEDER AMPS A B C

PANEL SCHEDULE No. 3Y

APP. GWT 4-7-75
APP.
APP.

DR. R.O. GOTTSCHALDT 4-3-75 CH. TA HICKS 4-3-75

CONSUMERS POWER CO.
ELEC. ENGINEERING DEPT.
JACKSON, MICHIGAN
8520-3019-6

BIG ROCK POINT

NO 740-A-30009 SHEET 29

REV. D

O.K. TO FILE

AP	4-23-75	A	6/19/75 ECC	C		E		I	K
		B	11-1-76	D	10-12-77	F		J	L

OK MJS 11-12-77

BIG ROCK POINT
DOCUMENT CONTROL CENTER
OFFICIAL FILE COPY

25

INFORMATION COPY

Rev	Date	Description	By	Chk	Rev	Date	Description			
A	9/19/75	ADDED POWER FOR CARD READERS	BL	RE	C	4/5/76	REVISED FOR RECORD-DCN 35-75 & 42-76 / ADDED REQ'TS. FOR JOB #7668 (SNC3009S)	OLD	RHS	1.1.A
B	7/11/76	ISSUED FOR RECORD GWO-7108	LP	RE	D	10-12-77	REVISED PER DCN 37-77.	GHC	L	ERL

PNL MFR-ITE MFR TYPE-P4L12

AC FEED 1A OR 2B — PANEL 3Y 120/208YV (STA PWR ROOM - NORTH WALL)

	VOLT-AMPS			BREAKER		CIRCUIT NUMBER		BREAKER		VOLT-AMPS			
	A	B	C	TRIP	POLE			TRIP	POLE	A	B	C	
REACT BLDG WATER LEVEL LT: 3171	40			15	1	1	2	15	1	50			CORE SPRAY LINE PRESS PT 1861 PI-412. REACTOR PRESS. PT 1A 07C
PRIMARY CORE & ENCL SPRAY FLOW FT-2162, FT-2164		80		15	1	3	4	15	1		50		PIPE TUNNEL DAMPER POSITION INDICATION
BACK-UP CORE & ENCL SPRAY FLOW FT-2161, FT-2165			80	15	1	5	6	30	1			1500	ACCESS CONTROL SYSTEM
RELIEF VALVE MONITORING SYSTEM.	50			15	1	7	8	15	1	X			SPARE
SPARE		X		15	1	9	10	15	1		600		FIRE DETECTION CIRCUIT
"			X	15	1	11	12	15	1			600	FIRE TROUBLE CIRCUIT

NOTE:
FOR PIPE TUNNEL SCHEMATIC REFER TO CPC-0740G31040

PANEL SCHEDULE No. 3Y

TOTAL VOLT-AMPS	A 140	B 730	C 2180	FEEDER AMPS	A	B	C

BIG ROCK POINT PLANT DRAWING CHANGE

Dwg No. 740A 30009 Sh 29 Rev D

DCN No. 11 - 80 :

FC-489 STEAM DRUM R/V MONITORING POWER

REVISION — ENG RGB

Part 1 of 1

APP. GWT 4-7-75
APP.
APP.

R.O. GOTTSCHALDT 4-3-75
T.A. HICKS 4-3-75

CONSUMERS POWER CO.
ELEC. ENGINEERING DEPT.
JACKSON, MICHIGAN
8520-3019-6

BIG ROCK POINT
740-A-30009 SHEET 29

REV. D

OK. TO FILE

AP	6-24-75	A	6/19/75 ECL	C		E		G		I		K	
		B	10-1-17/76	D	10-12-77	F		H		J		L	

OK RHS 11-12-77

CONSUMERS POWER COMPANY
Nuclear Plant
ENGINEERING ANALYSIS WORKSHEET

Title: DESIGN INPUT

Performed by: R Bernhart Date: 6-9-80

References:

Review Method by: Alternate Calcs ☐
Detailed Review ☑
Qualification Test ☐

Review by: [signature] Date 6.10.80

6.a.(3) (CONTINUED)

ADDING EXISTING LOAD ON 3Y-1 OF 40 VOLT-AMPS PLUS TOTAL ADDITIONAL LOAD IMPOSED OF 43 VOLT-AMPS GIVES A TOTAL OF 83 VOLT AMPS WHICH IS INSIGNIFICANT WHEN COMPARED TO THE TOTAL LOAD AVAILABLE OF 1800 VOLT AMPS ON BREAKER 3Y-1 THUS THE BREAKER LOAD ≈ 5% OF FULL LOAD CAPACITY.

6.a.(2) LOAD FOR BREAKER 3Y-11

3Y-11 IS A SPARE 15 AMP 120 VOLT AC BREAKER LOCATED IN PANEL Y13.

LOAD IMPOSED ON THIS BREAKER WILL APPROXIMATE THE LOAD ON BREAKER 3Y-1 AS THE DEVICES THAT DRAW CURRENT FROM IT WILL BE EQUAL TO THE DEVICES ON 3Y-1. (REFERENCE SHEET 6 OF THIS EA.)

6.b. TESTABILITY

EQUIPMENT INSTALLED WILL BE CAPABLE OF BEING TESTED ON-LINE AND AVAILABLE CALIBRATION EQUIPMENT IS ON HAND TO SUPPORT TESTING REQUIREMENTS. THIS TEST EQUIPMENT MEETS OR EXCEEDS ACCURACY STANDARDS REQUIRED.

6.c. RANGE/SPAN/DEADBAND

REFER TO PRODUCT INFORMATION SHEETS ATTACHED TO SHEET 6 of THIS EA.

6.d. PIPING/TUBING/LAYOUT

A SKETCH DEPICTING INSTRUMENT SENSING LINE CONNECTIONS WILL BE DEVELOPED AND INCORPORATED WITH THE INSTALLATION PROCEDURE, REFERENCE DIC ITEM 13. REFER TO SHEET 9 OF THIS EA FOR LAYOUT AND MATERIAL LISTING.

CONSUMERS POWER COMPANY
Nuclear Plant
ENGINEERING ANALYSIS WORKSHEET

Title: DESIGN INPUT

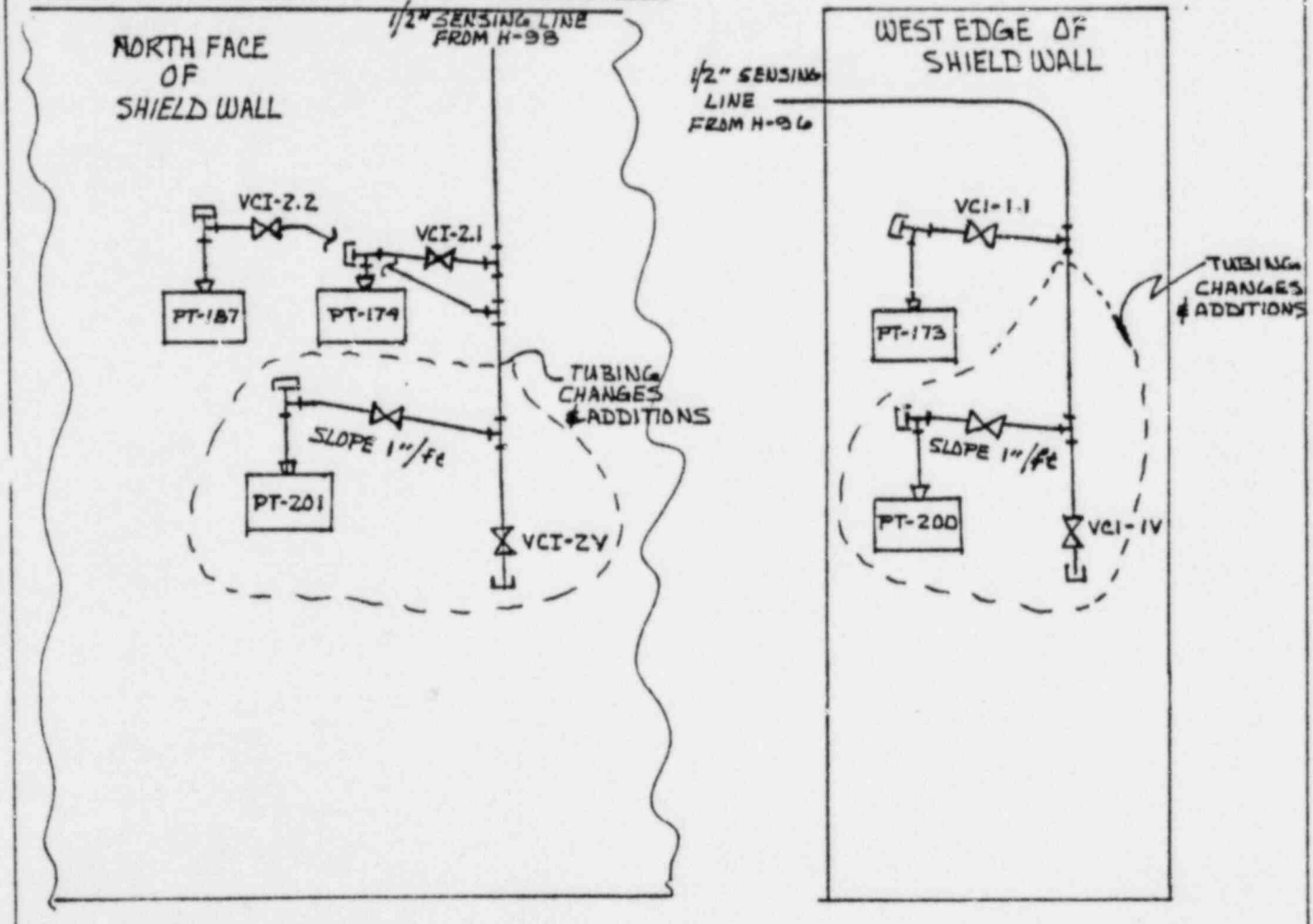
Performed by: R Bernhart Date: 6-9-80

References: BIG ROCK POINT DRAWING 0740A40408 ATTACHED.

Review Method by: Alternate Calcs ☐
Detailed Review ☑
Qualification Test ☐

Review by: [signature] Date: 6.10.80

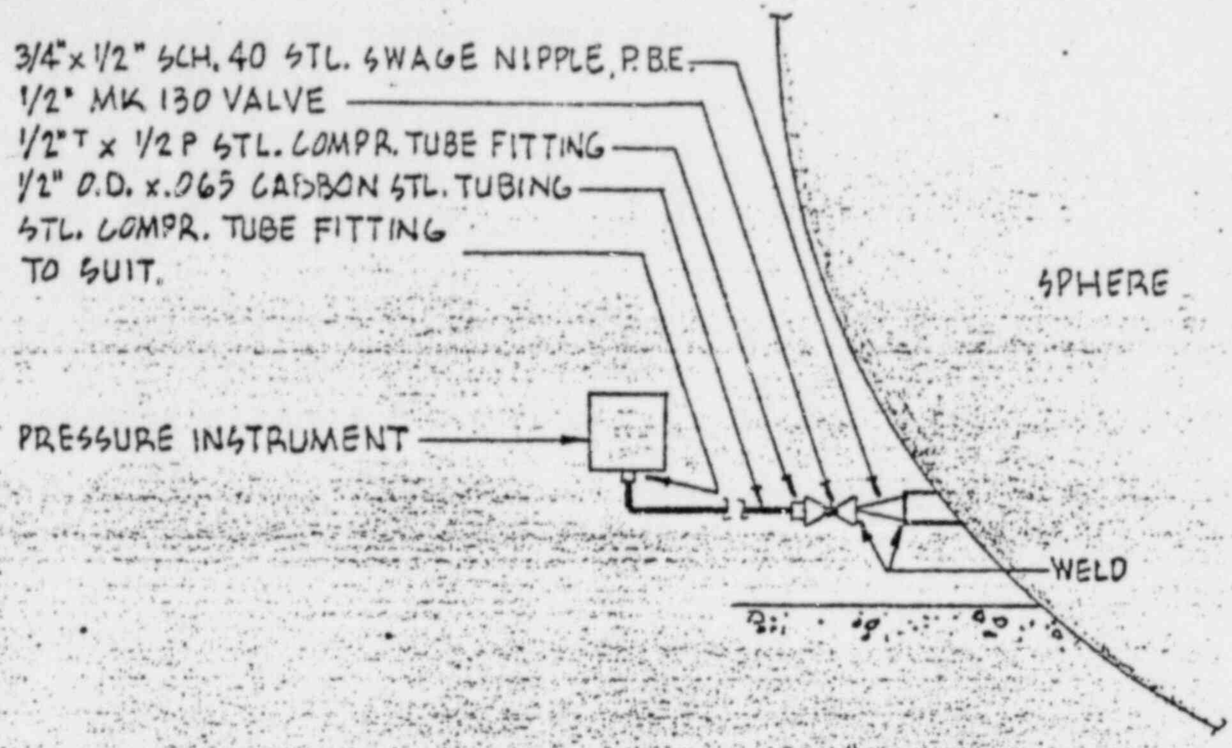
ROOM 110 TRANSMITTER LOCATION LAYOUT



MATERIAL LISTING

PT-200 & PT-201 - ROSEMOUNT 1152GP
TUBING - 1/2" STAINLESS STEEL 0.065 WALL
FITTINGS - 1/2" STAINLESS STEEL SWAGELOK TUBE FITTINGS, ADAPTERS, AND UNION TEES.
VALVES - WHITEY SS-8VF8

THE ABOVE EQUIPMENT IS EQUAL TO AND COMPATIBLE WITH THE EXISTING EQUIPMENT & MEETS OR EXCEEDS PLANT PIPING SPECS.



NOTES:

1. MOUNT INSTRUMENTS IN SHED OUTSIDE SPHERE ABOUT 4'-9" OFF FLOOR, FOR LOCATIONS SEE DWG. E-29
2. FOR PRIMARY CONNECTIONS USE PENETRATIONS H-88 THRU H-99 AS REQUIRED.

REV.	DESCRIPTION	ENG	DR	CHK	SUPV	MATL	APPROVALS	DATE
A	CHANGED DWG. NO.							1-5-66
1	REVISED CARB. STL. TUBING (WAS 1/2 O.D. x .049)	J.W.	R.P.	P.L.				7-26-61
0	ISSUED FOR CONSTRUCTION	J.W.	R.P.					4-2-61

BECHTEL CORPORATION
POWER AND INDUSTRIAL DIVISION

INSTRUMENT PIPING PRESS. INSTR.
REACTOR BLDG. SAFETY SYSTEM
BIG ROCK POINT PLANT
CONSUMERS POWER COMPANY
CHARLEVOIX MICHIGAN

JOB No 3159
FORMER DWG. NO. M-408
NEW 0740A40408
REV. A

G-231-E 4-14-58

CONSUMERS POWER COMPANY
Nuclear Plant
ENGINEERING ANALYSIS WORKSHEET

Title: DESIGN INPUT

Performed by: R. Bamford Date: 6-9-80

References:

Review Method by: Alternate Calcs ☐
Detailed Review ☑
Qualification Test ☐

Review by: [signature] Date 6-10-80

7.a. POWER SUPPLY LOADING

REFER TO 6.a. ABOVE.

7.b. VOLTAGE/CURRENT

120 VAC VOLTAGE LOAD STUDY AND ANALYSIS WAS ADDRESSED IN 6.a. ABOVE, THAT ANALYSIS INCLUDED THE AC VOLTAGE INPUT TO ES-6815 & ES-6816 WHICH ARE PLUG-IN TYPE ADJUSTABLE 30 TO 40 VOLT DC OUTPUT RATED TO PROVIDE THE TRANSMITTER 4 to 20 m AMP CURRENT LOOP, WHICH IS ALSO THE INPUT TO THE PRESSURE RECORDERS PR-53 & PR-54.

THE TRANSMITTER NO LOAD VOLTAGE REQUIREMENT IS 15VDC, AND THE RECORDER INPUT OF 4 to 20 m AMP IS SHUNTED TO PROVIDE A VOLTAGE INPUT.

THE 30 TO 40 VOLT DC POWER SUPPLY WAS SELECTED TO PROVIDE EXCESS VOLTAGE/CURRENT CAPACITY IN THE EVENT FUTURE REQUIREMENTS DICTATE ADDITIONAL LOAD. PRECISION DROPPING RESISTORS WILL BE SELECTED TO PROVIDE OPTIMUM POWER SUPPLY LOAD IN THE OPERATING REGION.

7.c. INSULATION WIRE/CABLE

600 VOLT INSULATION RATING WILL BE SPECIFIED FOR ALL WIRE & CABLE. SIZE 14 A.W.G. WIRE WILL BE USED WITH 120 V[illegible] POWER FROM 15 AMP BREAKERS 3Y-1 & [illegible]. OTHER WIRING WILL BE 16 A.W.G.

7.e. RACEWAY (SEPARABILITY, REDUNDANCY)

EACH CHANNEL WILL BE ROUTED SEPARATELY WHERE POSSIBLE. PHYSICAL SEPARATION BY USE OF CONDUIT WILL BE USED WHEN REQUIRED.

CONSUMERS POWER COMPANY
Nuclear Plant
ENGINEERING ANALYSIS WORKSHEET

Title: DESIGN INPUT

Performed by: R. Barnhart Date: 6-10-80

References:

Review Method by: Alternate Calcs ☐
Detailed Review ☑
Qualification Test ☐

Review by: [signature] Date 6-10-80

8. a. MATERIALS

NO FLAMABLE MATERIALS ARE ASSOCIATED WITH THIS DESIGN EXCEPT THE WIRE AND CABLE WHICH WILL BE SELECTED TO MEET IEEE 383 FLAME TEST.

8. b. SEPARABILITY

SEE 7. e. ABOVE.

8. c. FIRE BARRIERS

FIRE BARRIER PENETRATION WILL BE COVERED BY EXISTING PLANT PROCEDURES, NO NEW FIRE BARRIERS ARE REQUIRED, ONLY REPAIR OF EXISTING BARRIERS AFTER ROUTING WIRE, CABLE, OR CONDUIT.

11. PHYSICAL INTERFACES

11. a. OTHER STRUCTURES.

INTERFACE WITH OTHER STRUCTURES IS REQUIRED FOR THE ATTACHMENT OF TRANSMITTER MOUNTING BRACKETS. THIS ATTACHMENT WILL BE ACCOMPLISHED USING A PRC REVIEWED PROCEDURE. AND PLANT APPROVED CEMENT ANCHORS.

11. b. OTHER COMPONENTS

INTERFACE WITH OTHER COMPONENTS IS REQUIRED FOR INSTRUMENT SENSING LINES, POWER SUPPLY CONNECTION TO Y13 PANEL, AND CONTROL ROOM INSTRUMENT LOCATION AND INSTALLATION. THESE INTERFACES WILL BE ACCOMPLISHED USING PRC APPROVED INSTALLATION PROCEDURE(S). LEVEL RECORDERS LR-3110 & LR3111 ARE ONE CHANNEL OF DUAL CHANNEL RECORDERS WHICH ARE USED FOR PR-53 & PR-54 RESPECTIVELY. INPUTS TO THESE RECORDERS ARE ELECTRICALLY ISOLATED. REFER TO SHEET 6 BLOCK DIAGRAM

CONSUMERS POWER COMPANY
Nuclear Plant
ENGINEERING ANALYSIS WORKSHEET

Title: DESIGN INPUT

Performed by: L Bamhart Date: 6-10-80

References:

Review Method by: Alternate Calcs ☐
Detailed Review ☒
Qualification Test ☐

Review by: [signature] Date: 6·10·80

12. FUNCTIONAL INTERFACES

12.a. OTHER SYSTEMS

THIS MODIFICATION WILL INTERFACE WITH THE 480 VOLT MOTOR CONTROL CENTER BUS 2B THROUGH INSTRUMENT AND CONTROL POWER PANEL 34. IN ADDITION TO BEING PROTECTED BY BREAKERS 34-1 & 34-11, BUS 2B IS FURTHER PROTECTED BY BREAKER 52-2B29. INTERFACE WITH BUS 1A DURING AUTOMATIC SWITCH OVER IS PROTECTED BY 34-1 & 34-11 AND BREAKER 52-2B29 ALSO.

THE SENSING LINE CONNECTIONS FOR EACH CHANNEL WILL NOT FUNCTIONALLY INTERFACE WITH OTHER SYSTEMS CONNECTED TO THESE LINES, THIS IS A PHYSICAL INTERFACE ONLY.

12.b. OTHER COMPONENTS

NO FUNCTIONAL INTERFACES WITH OTHER COMPONENTS EXIST OTHER THAN WITH THE DUAL CHANNEL RECORDERS AS OUTLINED IN 11.b. ABOVE.

12.c. OPERATIONAL REQUIREMENTS UNDER VARIOUS PLANT MODES

ONE OF THE TWO CHANNELS WILL BE REQUIRED TO BE OPERATIONAL DURING ALL POWER OPERATIONS. THIS REQUIREMENT WILL BE ADDRESSED IN VOLUME 3, OPERATIONS MANUAL.

CONSUMERS POWER COMPANY
Nuclear Plant
ENGINEERING ANALYSIS WORKSHEET

Title: DESIGN INPUT

Performed by: K. Bankert Date: 6-10-80

References:

Review Method by: Alternate Calcs ☐
Detailed Review ☒
Qualification Test ☐

Review by: [signature] Date 6.10.80

13.a. SKETCHES
13.b. INSTRUCTIONS
13.c. PROCEDURES
} WILL BECOME PART OF THIS FACILITY CHANGE OR BE ATTACHED TO THE MAINTENANCE ORDERS GENERATED TO PERFORM THE WORK.

14.a. ACCEPTANCE
14.c. PRE-SERVICE
} TESTING WILL BE A PART OF THE INSTALLATION PROCEDURE.

14.b. SURVEILLANCE
14.d. IN-SERVICE
} TESTING WILL BE ADMINISTRATIVELY CONTROLLED BY WRITTEN PROCEDURE IF REQUIRED.

CONSUMERS POWER COMPANY
Nuclear Plant

FACILITY CHANGE

UFI No. 0 2 2 4 0 (Sys) 5 0 6 0 5 (Eqmt) FC - 4 9 9

0 2 2 1 1 (Sys) 5 0 6 0 4 (Eqmt)

TITLE: UPGRADE CONTAINMENT WATER LEVEL INSTRUMENTS

Functional Description: SEE ATTACHED EA-FC499-FD

REQUIREMENT

PROVIDE A CONTINUOUS INDICATION OF CONTAINMENT WATER LEVEL IN THE CONTROL ROOM WITH INSTRUMENT RANGES WHICH INCLUDE ACCIDENT FLOODING LEVELS. WIDE RANGE INSTRUMENT LEVEL RANGE FROM THE BOTTOM TO FIVE FEET ABOVE NORMAL WATER LEVEL. MEASUREMENT SHALL MEET THE DESIGN AND QUALIFICATION PROVISIONS OF REGULATORY GUIDE 1.97.

ACTION TO BE TAKEN AT BIG ROCK

INSTRUMENTATION TO MONITOR CONTAINMENT WATER LEVEL AFTER AN ACCIDENT WILL BE PROVIDED. MEASUREMENT AND INDICATION WILL BE CONTINUOUS RECORDING TO COVER THE RANGE OF ELEVATION 574 FEET, WHICH IS THE LEVEL OF THE SUCTION STRAINERS FOR THE CORE SPRAY RECIRCULATION PUMPS, TO APPROXIMATELY ELEVATION 596 FEET WHICH IS SIX TO NINE FEET ABOVE MAXIMUM WATER LEVEL AFTER AN ACCIDENT. A NEW CONTAINMENT WATER LEVEL INSTRUMENTATION CHANNEL TO COVER THIS RANGE WILL BE PROVIDED. NEW INSTRUMENTS WILL MEET THE DESIGN REQUIREMENTS OF REGULATORY GUIDE 1.97 INCLUDING THE QUALIFICATION AND TESTABILITY, REDUNDANCY WILL BE PROVIDED BY ONE EXISTING INSTALLED INSTRUMENTATION CHANNEL WHICH WILL BE DISPLAYED ON A SEPARATE CONTINUOUS RECORDER.

Processing Sequence	Date	
Prelim Eng Comp Proj Engr		1
Q-List Affected ☒ Y ☐ N R R Schrauder Tech Supt	6/18/80	2
PRC Action Mtg. No/Date _____		3
Detailed Engr Comp Proj Engr		4
Proj Review Comp Tech Supt		5
QA Review QA		6
Authorization to Implement Plant Supt		7
Operations Notified Proj Engr		8
Completed, Inspected, Tested Proj Engr		9
QC Review QC Supv		10
Operability Authorization Ops Supt		11
Document Update Proj Engr		12
Close Out Tech Supt		13

INFORMATION COPY

Form 2953

EA - FC 499-FD
Sheet 1 of 3

CONSUMERS POWER COMPANY
Nuclear Plant
ENGINEERING ANALYSIS WORKSHEET

Title: FUNCTIONAL DESCRIPTION

Performed by: R Barnhart Date: 6-18-80

References: FACILITY CHANGE FORM FC-499

ATTACHED BLOCK DIAGRAM EA-FC499-SK1

Review Method by: Alternate Calcs ☐ Detailed Review ☑ Qualification Test ☐

Review by: M Schneider Date: 6-18-80

ONE NEW CONTAINMENT WATER LEVEL MONITORING CHANNEL WILL BE PROVIDED, THIS CHANNEL WILL CONSIST OF A QUALIFIED LEVEL TRANSMITTER LT-3175 WHICH WILL BE QUALIFIED TO IEEE 323 (1974) FOR LOCA CONDITIONS AND SEISMIC EVENTS.

NOTE: QUALIFICATION IS BASED ON THE USE OF ITT BARTON MODEL 764 LEVEL SYSTEM COMPONENTS WHICH ARE SCHEDULED TO BE QUALIFIED BY 1 JANUARY, 1981.

THE RANGE OF THE TRANSMITTER WILL BE SELECTED TO DUPLICATE THE EXISTING QUALIFIED LEVEL TRANSMITTER LT-3171, WHICH IS AN ITT BARTON MODEL 386/351 SYSTEM WITH A SPAN OF 22 FEET, WHICH COVERS THE CONTAINMENT SPHERE WATER LEVEL RANGE FROM 574 FEET TO 596 FEET ELEVATION. THIS RANGE REPRESENTS THE REGION OF THE LEVEL OF THE CORE SPRAY RECIRCULATING PUMP SUCTION STRAINERS TO A LEVEL SIX TO NINE FEET ABOVE THE LEVEL AT WHICH SWITCHOVER TO RECIRCULATION MODE IS TO OCCUR. THIS SIX TO NINE FEET OF MARGIN MEETS OR EXCEEDS NUREG 0578 SUGGESTED REQUIREMENTS FOR UPPER LEVEL RANGE, AND CAN BE REFERENCED TO THE LOWEST LEVEL IN CONTAINMENT OF 570 FEET 9 INCHES, WHICH REPRESENTS THE SUMP PITS FLOOR ELEVATION.

NEW TRANSMITTER LT-3175 WILL BE INSTALLED IN ROOM 407 (CONTROL ROD DRIVE ACCESS) WHICH IS ALSO THE LOCATION OF EXISTING TRANSMITTER LT-3171. THE TRANSMITTERS WILL BE SEPARATED BY DISTANCE AND WILL BE ELECTRICALLY INDEPENDENT. LOCATION OF BOTH TRANSMITTERS IN THE SAME ROOM IS NECESSITATED BY THE REQUIREMENT TO DISPLAY THE FULL SPAN AND TO ALLOW THE SENSOR TO

CONSUMERS POWER COMPANY
Nuclear Plant
ENGINEERING ANALYSIS WORKSHEET

Title: UNCTIONAL DESCRIPTION (CONTINUED)

Performed by: R. Barnhart Date: 6-18-80

References: SEE SHEET 1

Review Method by: Alternate Calcs ☐
Detailed Review ☐
Qualification Test ☐

M Schrader 6-18-80
Review by: Date

BE DIRECTLY ACTED ON BY THE WATER LEVEL.

LT-3171 AND LT-3175 OUTPUTS OF 4 TO 20 ma WILL EACH BE ROUTED TO TWO NEW TRACOR WESTRONICS MODEL D4E DUAL PEN RECORDERS LR-3110 AND LR-3111 WHICH WILL BE MOUNTED ON THE MAIN CONTROL PANEL C02-2 SECTION. THESE CONTINUOUS RECORDERS WHICH ARE QUALIFIED TO IEEE-344 (1975) WILL EACH BE UTILIZED TO RECORD AND INDICATE ONE CHANNEL OF CONTAINMENT WATER LEVEL AND ONE CHANNEL OF CONTAINMENT PRESSURE. THE RECORDERS INCORPORATE MULTISPEED CHART DRIVE AND INDICATING SCALES SO THE OPERATORS CAN READILY DISCERN THE MONITORED PROCESS. CROSS CHECKING BETWEEN CHANNELS WILL SERVE TO ENSURE AVAILABILITY OF EACH CHANNEL BETWEEN CALIBRATION INTERVALS.

SINGLE FAILURE OBJECTIVES ARE REALIZED BY USE OF TWO REDUNDANT CHANNELS. ELECTRICAL INDEPENDENCE IS ACHIEVED BY USING SEPARATE INSTRUMENT AND CONTROL POWER PANEL BREAKERS 3Y-I AND 3Y-II. THE ELECTRICAL POWER RELIABILITY AND AVAILABILITY IS ENSURED BECAUSE PANEL 3Y IS FED BY THE 480 VOLT MOTOR CONTROL CENTER BUS 2B DURING LOSS OF ALL OFF-SITE POWER, BUS 2B RECEIVES POWER FROM THE EMERGENCY DIESEL GENERATOR DURING THESE EVENTS.

LT-3171 LEVEL CHANNEL HAS AN EXISTING INDICATOR LI-3400 MOUNTED ON THE MAIN CONTROL CONSOLE C01-A SECTION WHICH WILL BE RETAINED.

AN ADDITIONAL LEVEL INDICATION SYSTEM IS PROVIDED BY FOUR JO-BELL FLAT TYPE SWITCHES LOCATED AT

CONSUMERS POWER COMPANY
Nuclear Plant
ENGINEERING ANALYSIS WORKSHEET

Title: FUNCTIONAL DESCRIPTION (CONTINUED)

Performed by: R Barnhart Date: 6-18-80

References: SEE SHEET 1

Review Method by: Alternate Calcs ☐
Detailed Review ☐
Qualification Test ☐

Review by: [signature] Date: 6-18-80

ELEVATIONS 574', 579', 587', AND 595' REPRESENTED BY CONSOLE MOUNTED INDICATOR LIGHTS ADJACENT TO LI-3400. THIS SYSTEM WILL BE RETAINED FOR BACK-UP LEVEL INDICATION.

Form 2953

EA - FC499-SK1
Sheet 1 of 1

CONSUMERS POWER COMPANY
Nuclear Plant
ENGINEERING ANALYSIS WORKSHEET

Title: SIMPLIFIED BLOCK DIAGRAM

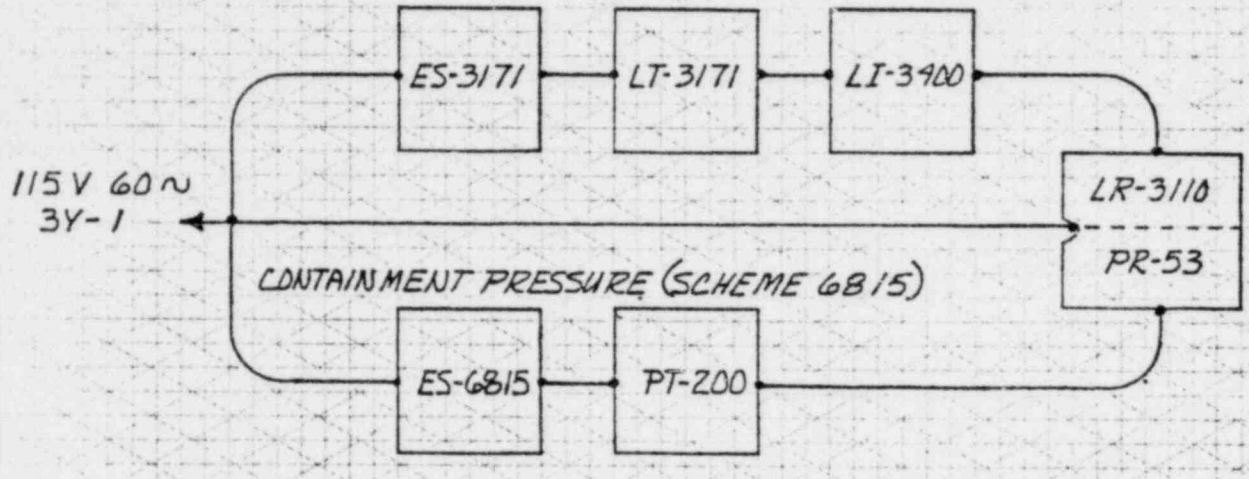
Performed by: R. Barnhart Date: 6-18-80

References: BIGROCK POINT
FACILITY CHANGE FC 498 & FC 499
PROJECT No. 295

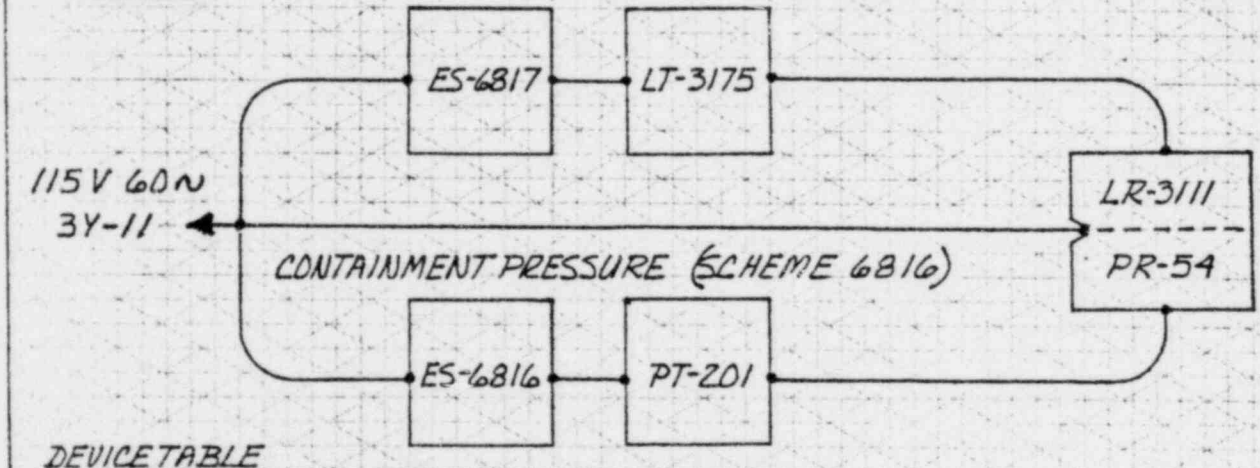
Review Method by: Alternate Calcs ☐
Detailed Review ☐
Qualification Test ☐

Review by: J.M. Schrader Date: 6-18-80

CHANNEL 1: CONTAINMENT WATER LEVEL (SCHEME LI 3326)



CHANNEL 2: CONTAINMENT WATER LEVEL (SCHEME 6817)



DEVICE TABLE

LT-3171 IS AN ITT BARTON MODEL 386/351 LEVEL TRANSMITTER.
LT-3175 IS AN ITT BARTON MODEL 764 LEVEL TRANSMITTER.
ES-3171 & ES-6817 ARE ITT BARTON MODEL 297 POWER SUPPLIES.
ES-6815 & ES-6816 ARE ROSEMOUNT PLUG-IN SPS-2182-P POWER SUPPLIES.
LI-3400 IS A BAILEY METER PM-1, S-3F INDICATOR.
LR-3110/PR-53, LR-3111/PR-54 ARE DUAL PEN TRACOR WESTRONICS MODEL D4S.
PT-200 & PT-201 ARE ROSEMOUNT 1152 GP 7A 22 PB SERIES E TRANSMITTERS.

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