PRECISION PULSER
Model 8210

0785

Instruction Manual

Canberra Industries, Inc., One State Street, Meriden, CT 06450 Tel. (203) 238-2351 TWX: 710-461-0192 Cable: CANBERRA

M192R0 7/85 Printed in U.S.A.

Table of Contents

Section 1. Introduction

1.1 DESCRIPTION

The Model 8210 is a highly accurate source of signal pulses for calibration and performance testing of analog-to-digital converters and multichannel analyzer systems. It can also be used as a reference signal source for a digital stabilizer operating in conjunction with an analog-to-digital converter (ADC).

A binary ladder attenuator provides output resolution of 1 part in 8192 with an accuracy of 0.005%. This feature makes it possible to precisely track the amplitude versus channel characteristic of an ADC by additive switch selection.

Multichannel analyzer users will find the Model 8210 an invaluable aid in maintaining and checking proper operation of their equipment. Performance tests that can be accomplished with the Model 8210 include:

- Zero Intercept Calibration
- Count Rate Shift
- Channel Profile
- Gain and Zero Drift
- Count Rate Scatter
- Linearity Spot-checking
- General Troubleshooting

Section 2. Specifications

2.1 CONTROLS

AMPLITUDE SWITCHES - Thirteen toggle switches 1/2 to 1/8192 in a binary sequence. Control the binary ladder input and provide precise output control.

COARSE AMPLITUDE - Adjusts output of ladder network; range is 10 to 100%.

FINE AMPLITUDE - Adjusts voltage input to binary ladder network.

RISE TIME - Rotary switch to select approximate rise time. Settings are 0.1 μs, 0.5 μs, 2.0 μs, and 5.0 μs. The decay time is $\approx$ 50 μs. The control changes the time constant of the pulse former network.

RELAY
ON - Applies ac power to pulse former relay.
OFF - De-energizes relay and connects the output of the COARSE AMPLITUDE control to the output connector. Output 0 to 17 V dc into 25 kilhoms.

PHASE
0° - Pulse output in approximate coincidence with zero crossing of line frequency.
90° - Pulse output in approximate coincidence with peak of line frequency.

AMP
HI - Output pulse 0 to > 10 V into 2 kilohm load.
LOW - Output pulse 0 to 200 mV into 93 ohm load.

POLARITY
+ Output is positive with respect to ground.
- Output is negative with respect to ground.

2.2 CONNECTORS

SIGNAL OUT - Digital resolution, 1 part in 8192; integral linearity, $\pm$0.005%; temperature coefficient, less than $\pm$50 ppm/°C; line voltage sensitivity, less than 0.005%, 105 to 125 V; pulse output amplitude, high level 0-10 V into 2 kilohm load; low level 0-200 mV into 93 ohm load; direct output voltage, 0 to 17 volts into 25 kilohms; BNC connector.

TRIGGER OUT - Positive 3.5 V pulse at 3 mA in approximate coincidence with the output signal. Can be used to trigger a Stabilizer to prevent storage of reference pulse; BNC connector.

2.3 PHYSICAL

SIZE - Standard double-width NIM module 6.86 × 22.12 cm (2.70 × 8.71 in.) per TID-20893 (rev.)

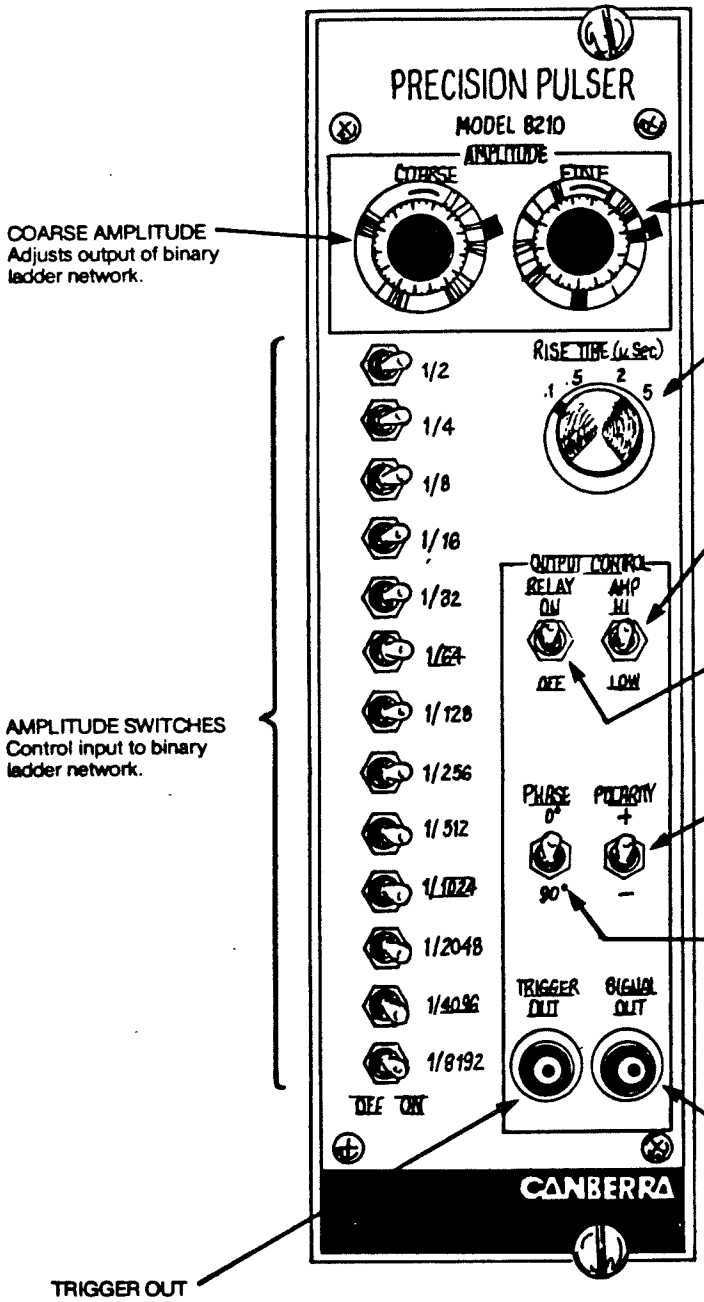
NET WEIGHT - 2 kg (4.5 lb)

SHIPPING WEIGHT - 4.3 kg (9.5 lb)

POWER - 115 V ac; 50-60 Hz; $\approx$ 65 mA

Section 3.
Controls and Connectors

3.1 FRONT PANEL CONTROLS



COARSE AMPLITUDE
Adjusts output of binary ladder network.

FINE AMPLITUDE
Adjusts voltage input to binary ladder network.

RISE TIME
Selects Rise Time of the output pulse.

AMP
HI selects high level output.
LOW selects mV level output.

RELAY
ON selects pulse output.
OFF selects dc level output.

AMPLITUDE SWITCHES
Control input to binary ladder network.

POLARITY
+ selects positive output.
− selects negative output.

PHASE
0° Output relative to zero crossing of line frequency.
90° Output relative to peak of line frequency.

SIGNAL OUT
Provides output signal to ADC.

TRIGGER OUT
Output pulse in approximate coincidence with SIGNAL OUT.

Figure 3.1
Front Panel

Section 4.
Operating Procedure

NOTE

The 8210 must always be operated in a vertical position.

4.1 ZERO INTERCEPT CALIBRATION:

1. Connect SIGNAL OUT to the ADC's input.
2. Select output polarity: + or -.
3. Select HI or LOW level output
3. Select HI or LOW level output
   (HI: 0 to 10 V)
   (LOW: 0 to 200 mV)
4. Set the Rise Time to the desired setting.
5. Turn the RELAY on.
6. Set the ADC's GAIN control as desired.
7. Set all Amplitude Switches on the Model 8210 to the ON (right hand) position, turn the RELAY on, and adjust the COARSE and FINE AMPLITUDE controls for maximum conversion. That is, so that counts are collected in the highest channel of memory.
8. If the memory size is smaller than the ADC GAIN selected, the appropriate ADC OFFSET will have to be switched in. For instance, if the memory is 4096 channels and the ADC GAIN is set for 8192, an ADC OFFSET of 4096 must be added so that conversion can take place in the highest channel of the memory.
9. Turn all Amplitude Switches on the Model 8210 OFF, except the 1/64 switch, which should be left ON.
10. Set the ADC's OFFSET to zero.
11. Adjust the ADC's ZERO control so that counts are being collected in the proper channel, as follows:

Gain	Channel
8192	128
4096	64
2048	32
1024	16
512	8
256	4

12. Repeat steps 7 through 11 until no further adjustments are necessary.
13. Each of the Amplitude Switches will now be equivalent in channels to the switch's value times the ADC's Gain; for example, when calibrating an 8192 channel ADC, the 1/2 switch corresponds to 1/2 × 8192 or 4096 channels, and the 1/8 switch corresponds to 1/8 × 8192, or 1024 channels.

4.2 USE AS REFERENCE PULSER

1. Select the output polarity.
2. Select HI or LOW output.
3. Turn the RELAY on.
4. Set the Rise Time to the desired setting.
5. Set the Amplitude Switches and the COARSE and FINE AMPLITUDE controls for the desired channel.
6. Connect TRIGGER OUT to the Model 8200 Digital Stabilizer to prevent storage of the reference pulse in memory.

   NOTE: The pulse shape from the 8210 is optimized for use with an ADC input. It is not well suited for use as a test input for preamps and amplifiers.

4.3 LEVEL OUTPUT

1. Select polarity.
2. Set the Amplitude Switches and the COARSE and FINE AMPLITUDE controls for the desired value.
3. Note that the HI-LOW switch has no effect.

Section 5.
Theory of Operation

The Model 8210 consists of a precision voltage regulator, binary ladder, relay and driver circuits, and a pulse former network. All the circuitry has been designed for low temperature drift and precise integral linearity. The reference for the voltage regulator is a low temperature coefficient Zener diode. The regulator uses an integrated circuit operational amplifier as the error amplifier; this amplifier provides high gain and excellent temperature stability. The output of the power supply is used as the voltage input to the ladder network. The output of the ladder is attenuated by the Coarse Amplitude control and is used by the pulse former network. A mercury relay is used to generate the pulse because of its long life and bounce-free characteristic.

WARRANTY

This warranty covers Canberra hardware and software shipped to customers within the United States. For hardware and software shipped outside the United States, a similar warranty is provided by Canberra's local representative.

DOMESTIC WARRANTY

Equipment manufactured by Canberra's Instruments Division, Detector Products Division, and Nuclear Systems Division is warranted against defects in materials and workmanship for one year from the date of shipment.

Canberra warrants proper operation of its software only when used with software and hardware supplied by Canberra and warrants software media to be free from defects for 90 days from the date of shipment.

If defects are discovered within 30 days of the time you receive your order, Canberra will pay transportation costs both ways. After the first 30 days, you will have to pay the transportation costs.

This is the only warranty provided by Canberra; there are no other warranties, expressed or implied. All warranties of merchantability and fitness for an intended purpose are excluded. Canberra shall have no liability for any special, indirect or consequential damages caused by failure of any equipment manufactured by Canberra.

EXCLUSIONS

This warranty does not cover equipment which has been modified without Canberra's written permission or which has been subjected to unusual physical or electrical stress as determined by Canberra's Service Personnel.

Canberra is under no obligation to provide warranty service if adjustment or repair is required because of damage caused by other than ordinary use or if the equipment is serviced or repaired, or if an attempt is made to service or repair the equipment, by other than Canberra personnel without the prior approval of Canberra.

This warranty does not cover detector damage caused by abuse, neutrons, or heavy charged particles.

SHIPPING DAMAGE

Examine shipments carefully when you receive them for evidence of damage caused in transit. If damage is found, notify Canberra and the carrier immediately. Keep all packages, materials and documents, including your freight bill, invoice and packing list. Although Canberra is not responsible for damage sustained in transit, we will be glad to help you in processing your claim.

OUT OF WARRANTY REPAIRS

Any Canberra equipment which is no longer covered by warranty may be returned to Canberra freight prepaid for repair. After the equipment is repaired, it will pass through our normal pre-shipment checkout procedure.

RETURNING EQUIPMENT

Before returning equipment for repair you must contact your Regional Service Center or one of our factories for instructions. For detector repair, contact the Canberra Detector Division in our Meriden, Connecticut, factory for instructions. If you are going to return the equipment to the factory, you must call first to get an Authorized Return Number (ARN).

When you call us, we will be glad to suggest the best way for you to ship the equipment and will expedite the shipment in case it is delayed or lost in transit. Giving you shipping advice does not make us responsible for the equipment while it is in transit.

SOFTWARE LICENSE

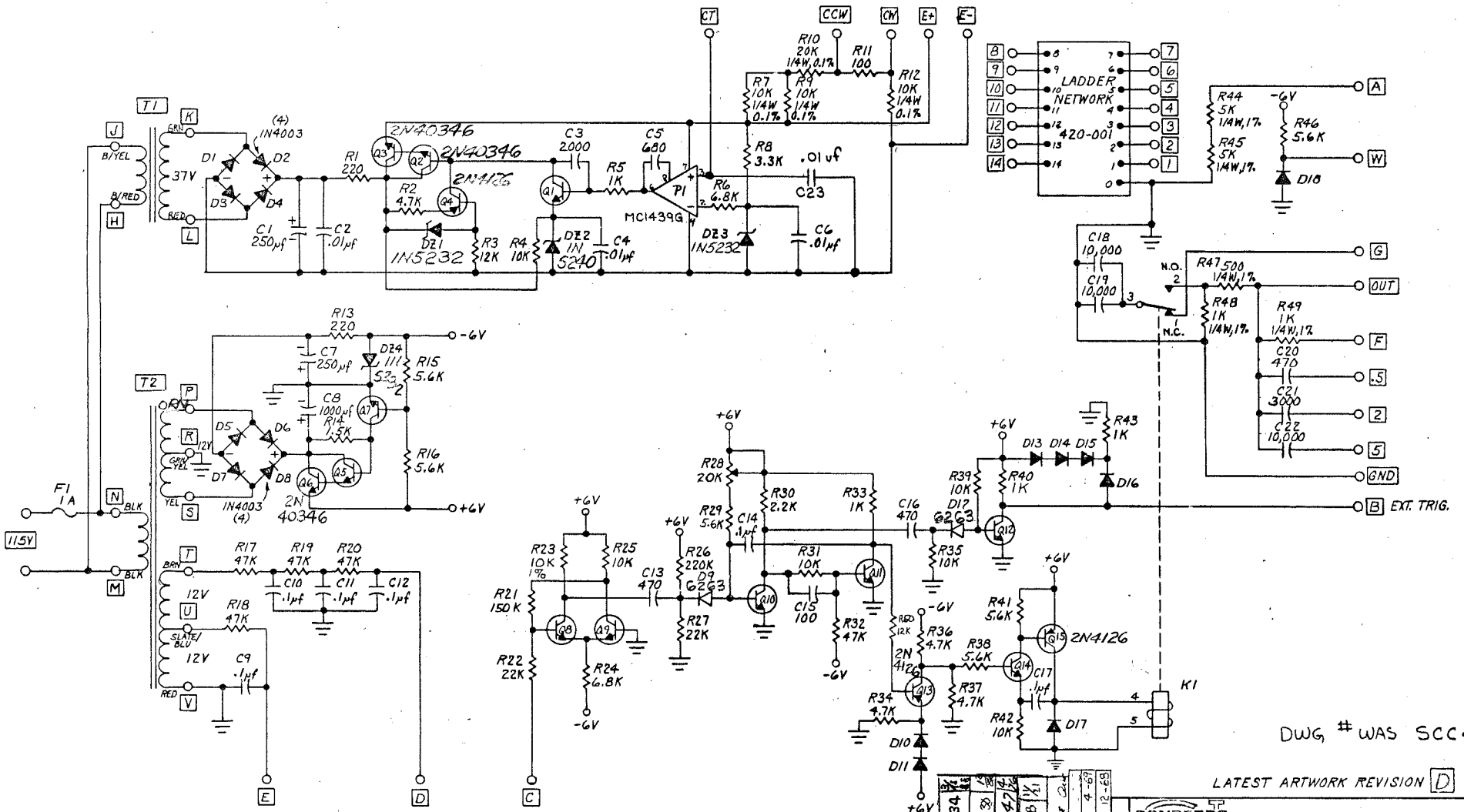
You have purchased the license to use Canberra software, not the software itself. Since title to this software remains with Canberra, you may not sell or transfer this software. This license allows you to use this software on only one compatible computer at a time. You must get Canberra's written permission for any exception to this license.

BACKUP COPIES

Canberra's software is protected by United States Copyright Law and by International Copyright Treaties. You have Canberra's express permission to make one archival copy of this software for back-up protection. You may not copy Canberra software or any part of it for any other purpose.

NOTES:
1. UNLESS OTHERWISE SPECIFIED;
   ALL RESISTANCES ARE IN OHMS, 1/4 WATT, ± 10 %
   ALL CAPACITANCES ARE IN pf
   ALL TRANSISTORS ARE 2N4124
   ALL DIODES ARE IN914
2. —o INDICATES COMMON TIE POINT OR VOLTAGE BUS.
3. —o□ INDICATES CONNECTION POINTS IN PC BOARD.
4. □ INDICATES EQUIPMENT MARKING.
5. LAST COMPONENT REF. NO.:

TRANSISTOR	Q15	RESISTOR	R50
CAPACITOR	C23	DIODE	D18
ZENER DIODE	DZ4	RELAY	K1
INTEG. CKT.	IC1	FUSE	F1
TRANSFORMER	T2		



DWG # WAS SCC47

LATEST ARTWORK REVISION D

REVISION			
D	ECN 5034	ADDED R50	2-4-69
C	ECN 4638	REV 05 9	4-1-69
B	ECN 1347	REV 020	12-29
A	ADDED R43-D16	INITIAL RELEASE	5-1-70

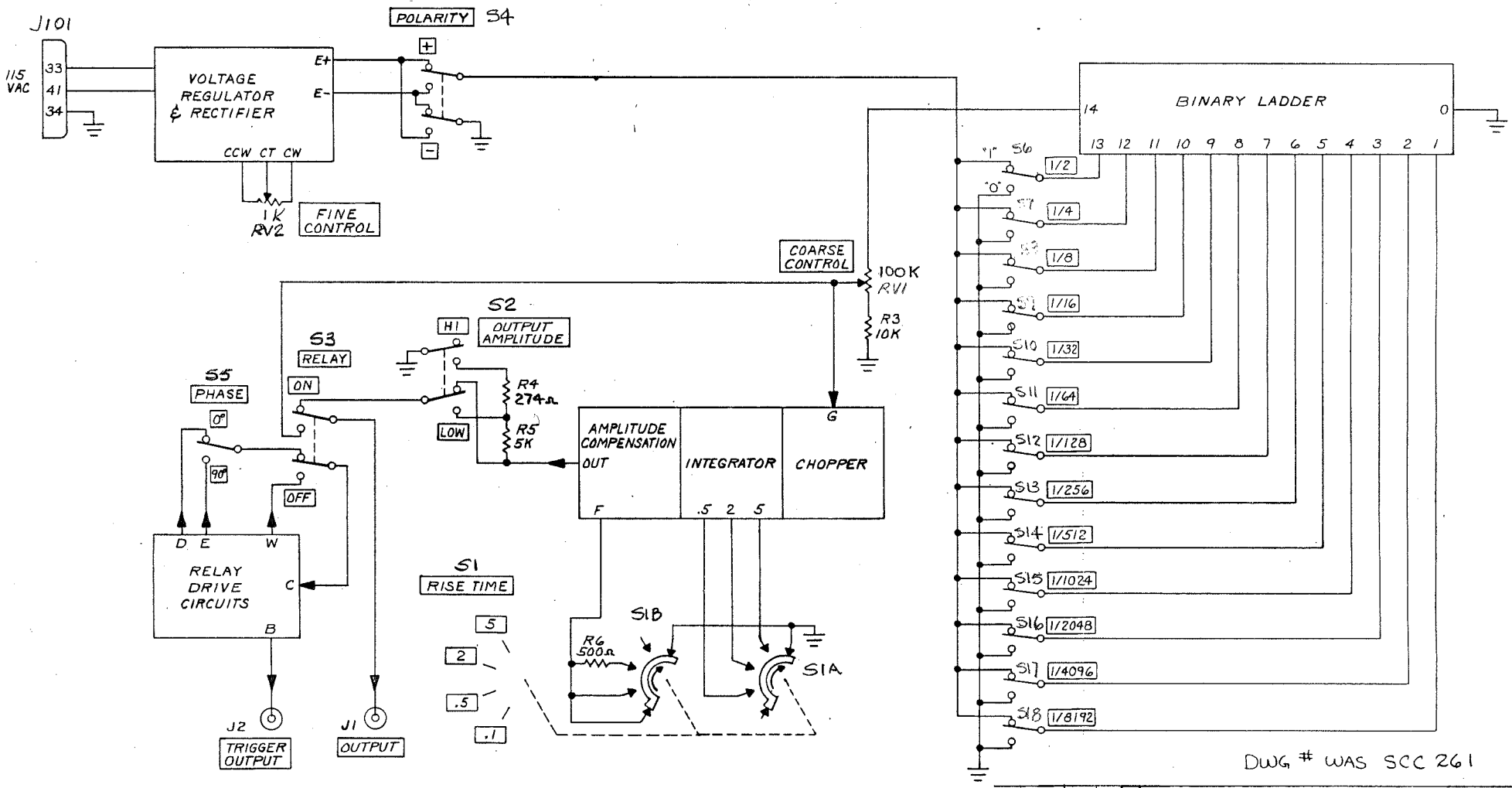
CANBERRA NUCLEAR ELECTRONICS MERIDEN CONN.

MODEL	P.C. NO.	TITLE
2010 8210		PRECISION PULSER

DRAWN LANGE | CHK'D. | APPD. | DWG NO. A-12702-1

BRUNING 40-21 10309

NOTES:
1. UNLESS OTHERWISE SPECIFIED ALL RESISTANCES ARE IN OHMS, 1/4WATT, ±10%.
2. [ ] INDICATES EQUIPMENT MARKING.
3. ROTARY SWITCH IS SHOWN IN EXTREME COUNTERCLOCKWISE POSITION AND IS VIEWED FROM KNOB END. ARROW INDICATES CLOCKWISE ROTATION.



DWG # WAS SCC 261

REVISION			
REV B SEE ECN S 840 BNG 4-71	REV A PER AR 1010 12-27-78 JH	ECN 755 3/4/71 INITIAL RELEASE	

CANBERRA NUCLEAR ELECTRONICS MERIDEN CONN.

MODEL	P.C. NO.	TITLE			
2010 8210		PULSER BLOCK DIAGRAM			
		DRAWN LANGE	CHK'D.	APPD.	DWG. NO. A-12707B

DRAWING 40-21 11-69