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STRIPCHART AGS PERFORMANCE MONITOR

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Collider Accelerator Department

Brookhaven National Laboratory

U.S. Department of Energy

USDOE Office of Science (SC)

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AGS DIVISION TECHNICAL NOTE

No. 138

STRIPCHART AGS PERFORMANCE MONITOR

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August 24, 1977

Purpose: To monitor and record graphically several measures of AGS performance. Functions shown are average linac current for all linac pulses, ICBM (Injection Circulating Beam Monitor) protons circulating immediately after injection, CBM - protons circulating 100 ms after injection, CE010 - extracted beam, A+B+C - sum of extracted beam to A, B and C targets, and the number of experiments running in the experimental areas.

Special interfaces have been built to display these six functions on two Rustrak recorders near the Main Control Room. The linac current is averaged for 5 seconds and a proportional voltage is fed to the recorder (see Appendix A). The ICBM and CBM signals are sampled and held for the recorder. The CE010 and A+B+C target signals are pulse trains (1 c per 10^9) and converted to voltages and held (see Appendix B).

The Dibbuk PDP-11 system routinely polls the experimenter's status. This information is fed via the PDP-10, a Datacon Autodet, and a time-to-voltage converter, to the recorder (see Appendix C).

Figure 1 shows the charts generated while the AGS had a cyclical problem with injection.

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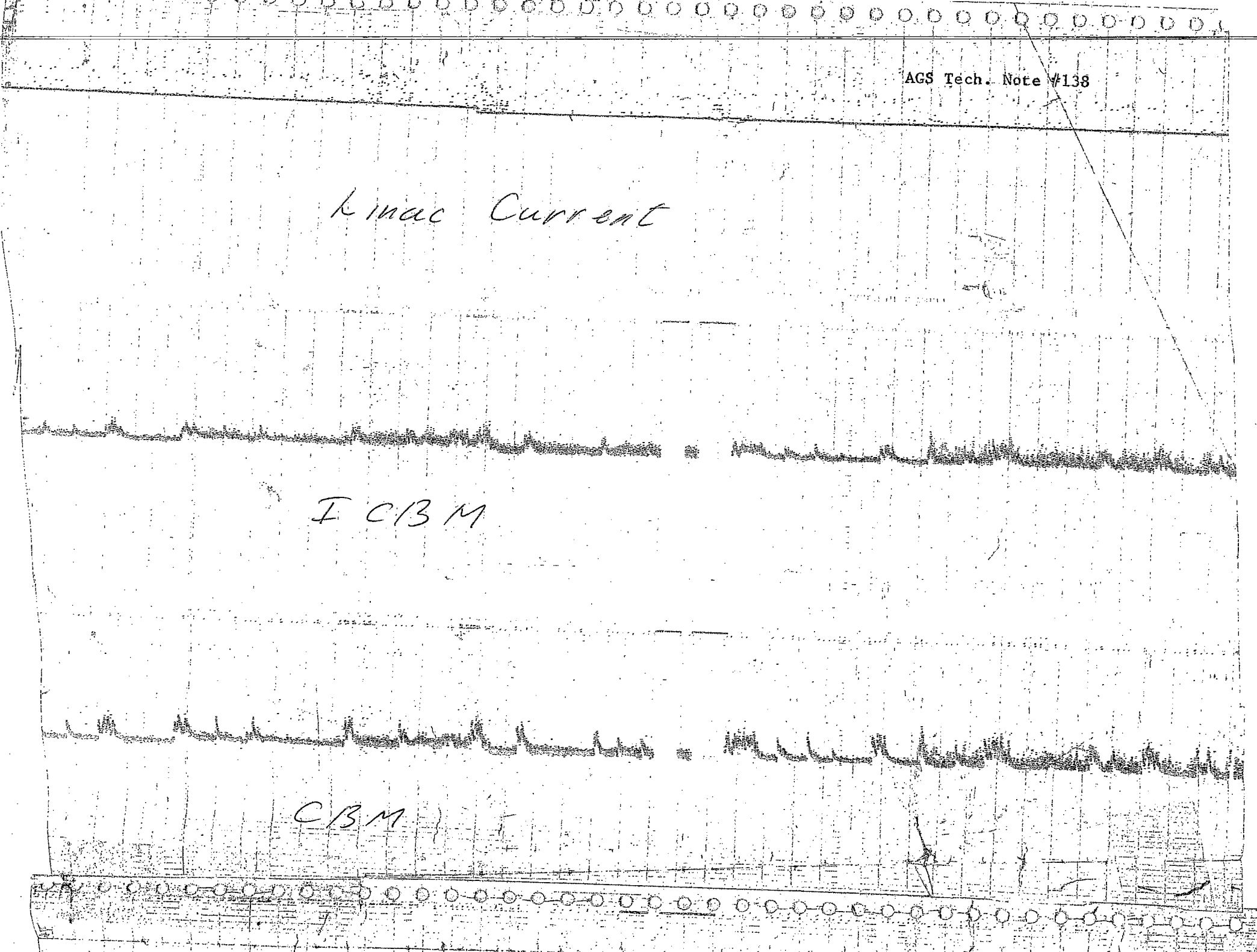
*Presently at Stanford University


Linac Current
I CBM
C BM

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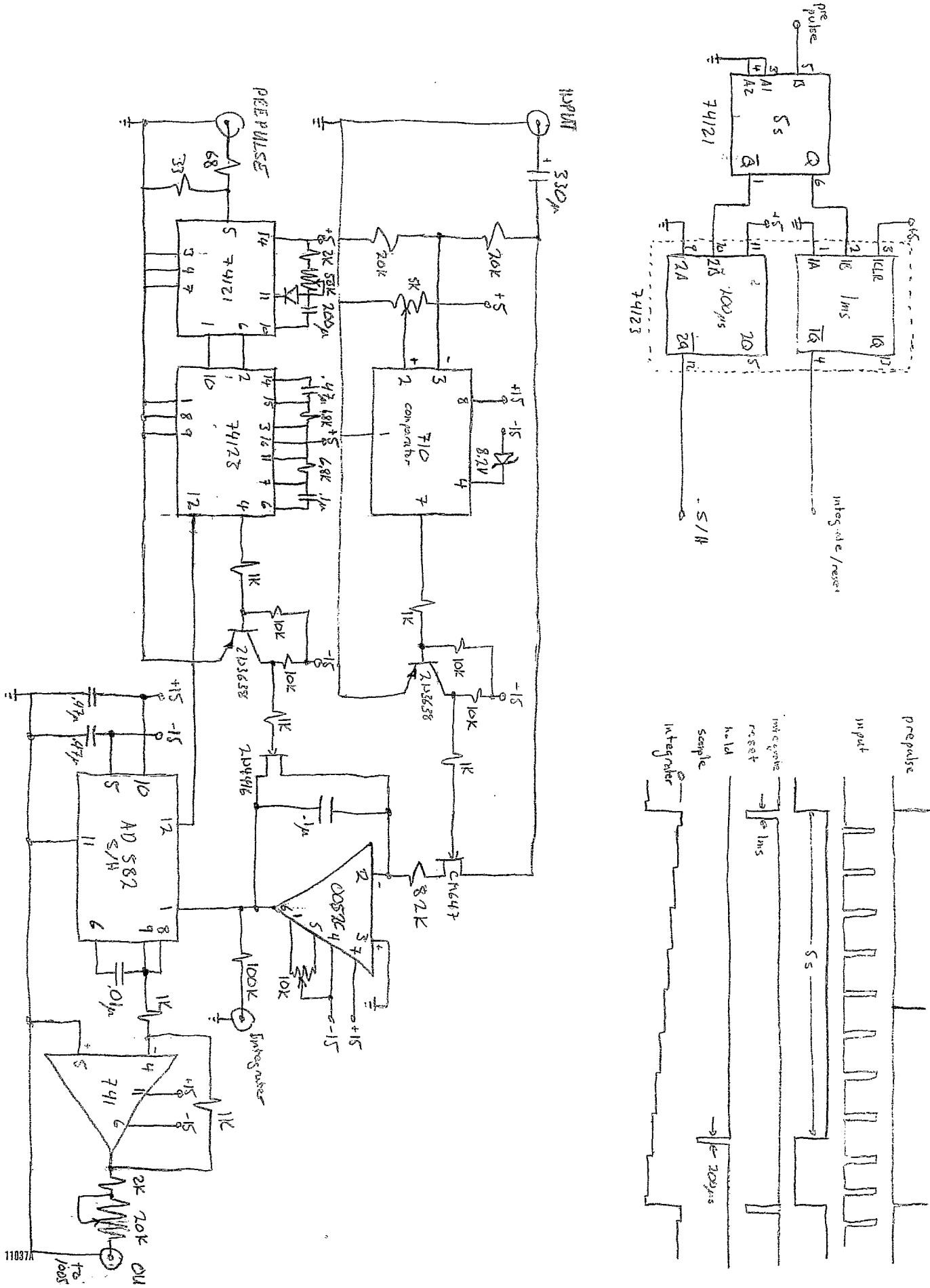
BY K Poulton DATE 8-5-77 SUBJECT Linac Current Pulse Integrator + Ractrak Driver SHEET NO. ____ OF ____

CHKD. BY ____ DATE ____ DEPT. OR PROJECT ____ JOB NO. ____



Beam Spill Intensity Pulse Counter

Function: Several detectors of SEB current produce pulse trains with the number of pulses proportional to SEB current. The pulses trigger standard pulses which are integrated, sampled and held and then divided down to Rustrak input levels. It gives SEB intensity in 10^{12} protons. There are three separate channels.

Inputs: The input signal for Channel 1 is CE010 (R55A40→R62T12→Rustrak #9). The pulses are ~ 200 ns X 3 V. The input for Channel 2 is AE300 (R55A6) + BE473 (R55B64) + CE481 (R55B38). The three signals are pulse trains like CE010, and they are "or"ed together in a diode box. Their sum goes to R62T13→Rustrak #10.

Each channel also gets a "begin count" and "end count" signal. These two signals may be made the same for all three channels by flipping the switches in back to "common". "Being count" comes from autodet CTRON (counter on). #354 on PPB (R56E4→R73AC4→Rustrak #2). "End count" comes from autodet CTROF, #355 on PPB (R56E4→R73AC4→Rustrak #3). CTRON is on page POONA (Area SEB) just below F100N, and should always be set to the same value as FL00N. CTROF is just below F100F on page POOFA area SEB and should be set to the same value as FL00F.

All input impedances are 100 Ω, so no other terminations are needed. It is important that the pulse inputs not be terminated elsewhere, since this may drop the signals below the levels needed to trigger the counter.

Operation: The "being count" pulse triggers 121B, causing it to open the integrator FET and zero the integrator. Some 50 ms later, the pulse train begins. Each incoming pulse produces a 5 V X 4.7 μs pulse at the input of the integrator. When the "end count" pulse comes (after the pulse train finishes), 121C sends a 1 ms "sample" signal to the sample and hold. The output is buffered with a 741 and divided down to Rustrak input levels. This division depends on the 100 Ω input impedance of the Rustrak meter, so if the meter is disconnected, the output must be terminated for the voltage divider to work. Output is inverted.

Calibration: The output is linear to within 1% for up to 10,000 counts at up to 100 KHz. The output may be calibrated by sending in any signal of the proper polarity (dimension is unimportant as long as amplitude is great enough to trigger 121A) with a known number of pulses between "being count" and "end count". Pulses during the rest of the cycle are ignored. The output may then be adjusted to bring the Rustrak meter to the desired level.

Currently, the counters are adjusted to 10,000 counts at mid-scale. They will saturate at 12-15 K, but their levels are consistent with ICBM and CBM. One input pulse corresponds to 10^9 protons.

Special Notes: If more of these units are to be built, the printed circuit layout used in this model can be modified easily to fit the final design. (There were many design changes after the original pc layout was done.) I suggest that the output stage be inverted to produce a non-inverted input. Also remember that the output voltage divider depends on the input impedance of the meter.

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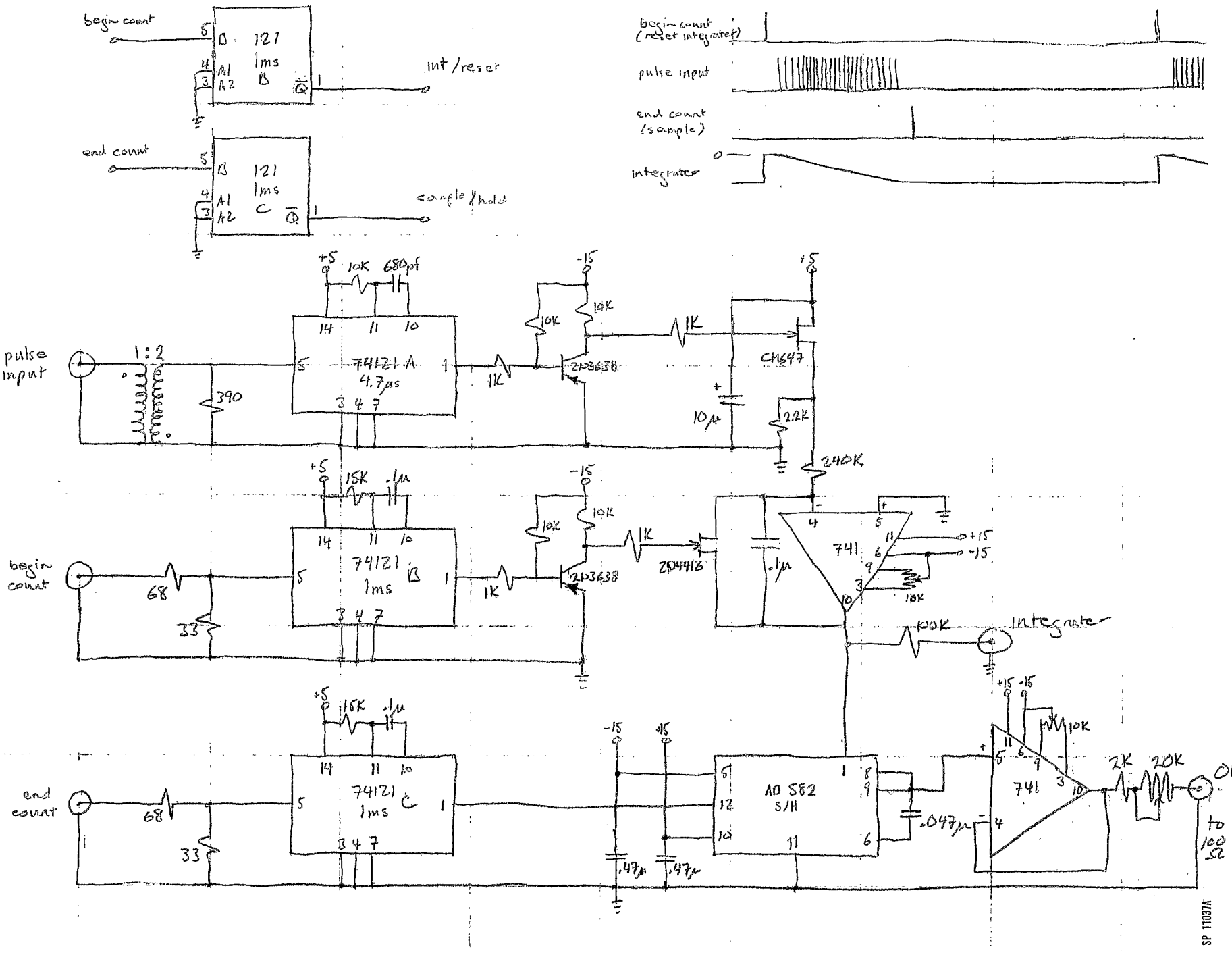
AGS Tech. Note #138
BY K. Poulton DATE 8-18-77
CHKD. BY _____ DATE _____
SUBJECT Beam Intensity Pulse Counter
r/Pustnik Driver
DEPT. OR PROJECT _____
SHEET NO. _____ OF _____
JOB NO. _____



Number of Experiments Running Monitor

Function: The monitor consists of a program, EXPS, and a receiver and Rustrak driver. The program determines how many experiments are running in the experimental areas and sets an autodet pulse. A time-to-voltage converter output is held and divided to Rustrak levels.

Software - EXPS:

Operation: Every ten or twenty seconds the two PDP11's on the experimental floor send nine data words to the main PDP-10 system. (See "Dibbuk to PDP10" attached). The ninth is a status word, telling which experiments are running. Currently, each experimenter must flip a switch to tell the 11's whether they are on or off.

EXPS accesses this data word (given with its age) and sends a message to the ALARM program if the data is more than 30 seconds old. This message is sent every 30 minutes until the data is refreshed. EXPS then determines how many experiments are running and then sets autodet EXPS in area SEB to 100* (no. of experiments running). The program then snoozes for 10 seconds, starts over, and if the number of experiments is the same as before, it skips the setting routine and sleeps for one minute. Every five minutes the program goes through the autodet setting routine at least once.

Special Notes: The source is EXPS.F4, the debug version (with many helpful messages to the teletype running it) is EXPSD.

Hardware - Delay Counter:

Inputs: The "autodet"input" comes from autodet EXPS, currently #316 on PPB, accessible via AGAST in area SEB, page TEST. The signal currently runs from R56E6→R73AC6→Rustrak #4. This autodet must always be run on 1000 Hz. The electronics also needs T_o. Both inputs are 100 Ω.

Operation: The T_o pulse turns off the integrator hold FET and turns the input FET (CM647 on to start the integrator. It increases steadily at about 10 V/s until the autodet pulse turns the input FET off and sends a "sample" pulse to the sample and hold chip. After 2 ms, the sample and hold goes back to hold mode and the integrator hold FET is turned on to clear the integrator. The output is buffered with a 741 and then divided down to Rustrak input levels. The voltage divider depends on using the Rustrak's 100 Ω input impedance.

Number of Experiments Running Monitor (cont'd)

Calibration: Calibration is simple. Either set autodet EXPS to a particular value using AGAST or DATACON (remember the program EXPS resets the autodet EXPS every five minutes) or use a predet input. Adjust the output by watching the Rustrak meter.

The circuit is linear within 1% up to 100 ms. It will saturate at about 1.2 sec.

Distr:

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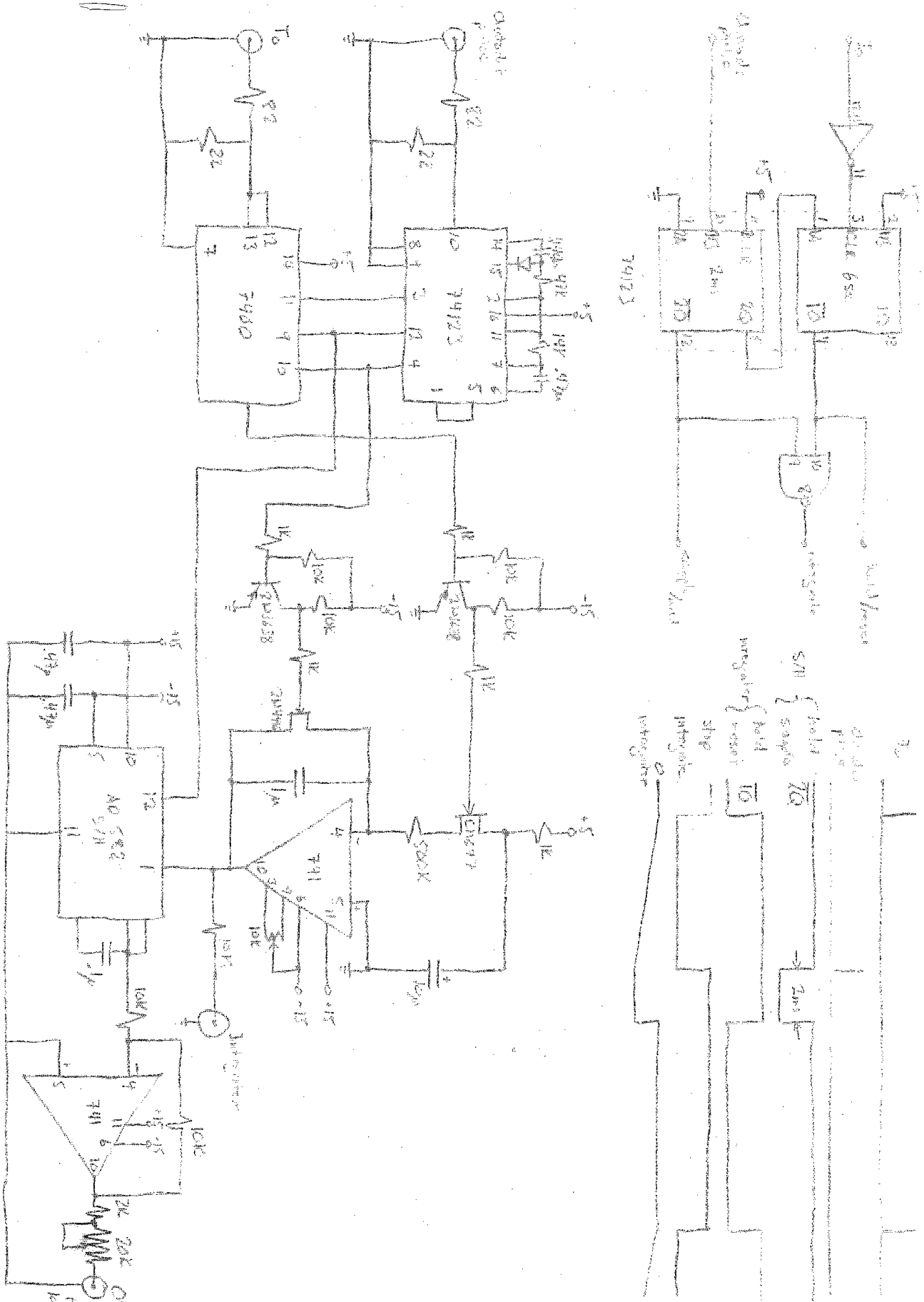
BY L Coulter DATE 8-5-77 SUBJECT delay counter SHEET No. OF

CHKD. BY DATE thumbwheel JOB No.

DEPT. OR PROJECT



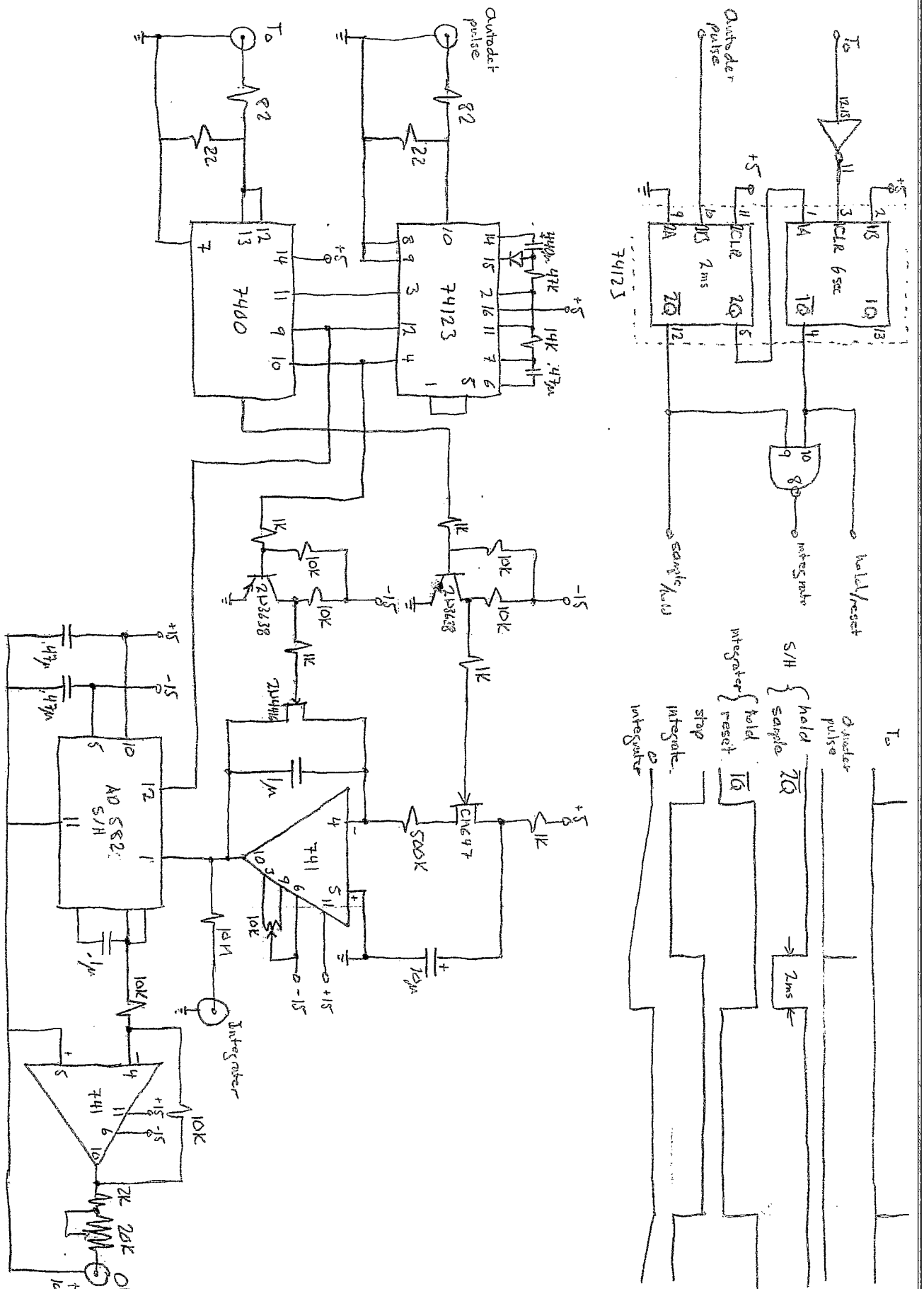
SP 11037A

BROOKHAVEN NATIONAL LABORATORY

BY K Poulton DATE 8-5-77 SUBJECT delay counter SHEET NO. OF

CHKD. BY DATE + Kustrak driver JOB NO.

DEPT. OR PROJECT



SP 11037A

```
C             *****EXPS*****  (SOURCE EXPS.F4,DEBUG EXPSD)
C             KEN POULTON 8-20-77
C             PROGRAM TO FIND NUMBER OF EXPERIMENTS RUNNING
C             AND SET AUTODET EXPS ACCORDINGLY
C
      IMPLICIT INTEGER (A-Z)
      INTEGER PDP(2),DATA(9),WRD(2),ERR(2),LALARM(2),REQ(5),MESSG(9)
      DATA(PDP(A),A=1,2)/'PPH','PPI'/
      DATA ALARM6/"41 54 41 62 55 00/
      DATA MESSG/0,'EXPS:LAST DATA FROM ',4*0/
      FLAG="000 000 200 000
      PEXPS=-1
C             READ PDP11 DATA WORDS
10    DO 100 A=1,2
      CALL DATA11 (PDP(A),DATA,ERR(A))
      WRD(A)=DATA(9)
D     TYPE 20, PDP(A), WRD(A)
D20   FORMAT (1X,A3,' STATUS:',O12)
      IF (ERR(A).EQ.0) LALARM(A)=-1
      IF (ERR(A).EQ.0) GOTO 100
C             ERROR: PRINT/SEND ALARM WITH AGE OF DATA
      HR=-ERR(A)/10800
      MIN=-ERR(A)/180-HR*60
      SEC=MOD(-ERR(A)/3,60)
      IF (HR.GE.1) WRD(A)=0
C             SEND ALARM EVERY 30 MINUTES (5400=30*60*3)
      IF ((-ERR(A))/5400.LE.LALARM(A)) GOTO 80
      LALARM(A)=-ERR(A)/5400
      CALL JOBNUM(ALARM6,JN)
      IF (.NOT.JN) GOTO 40
D     TYPE 30
D30   FORMAT (' ALARM PROGRAM NOT RUNNING')
      GOTO 80
40    ENCODE (20,50,MESSG(6)) PDP(A),HR,MIN
50    FORMAT (A3,' IS ',I3,':',I2,' HR OLD')
      CALL SREQU(MESSG,9,FLAG,ERR2,JN)
D     IF (ERR2) TYPE 60,ERR2
D60   FORMAT (' SREQU ERR:',O12)
D     TYPE 70,(MESSG(J),J=2,9)
D70   FORMAT (' ALARM MESSAGE:  ',8A5)
80    CONTINUE
D     TYPE 90, PDP(A), HR,MIN,SEC
D90   FORMAT(' LAST DATA WORD FROM ',A3,' RECEIVED ',I3,
D    *     ':',I2,':',I2,' AGO.')
100   CONTINUE
C             FIND NUMBER OF EXPERIMENTS (EXPS) RUNNING
C             (SEE RUSTRAK INFO FOR DATA FORMAT)
      C="000 003 000 000
      EXPS=0
      DO 110 B=1,2
      WRD1=WRD(B)
      DO 110 B1=1,8
      IF ((WRD1.AND.C).EQ.C) EXPS=EXPS+1
110   WRD1=ISHIFT(WRD1,2)
D     TYPE 120, EXPS
D120  FORMAT (1X,I2,' EXPERIMENTS RUNNING')
C             SNOOZE ONE MINUTE IF SAME AS LAST TIME
C             UP TO FIVE MINUTES
      IF (EXPS.NE.PEXPS.OR.SN.GE.5) GOTO 130
      CALL SNOOZE(60)
      SN=SN+1
      GOTO 10
C             REQUEST THAT AUTODET EXPS IN AREA SEB BE SET
130   PEXPS=EXPS
```

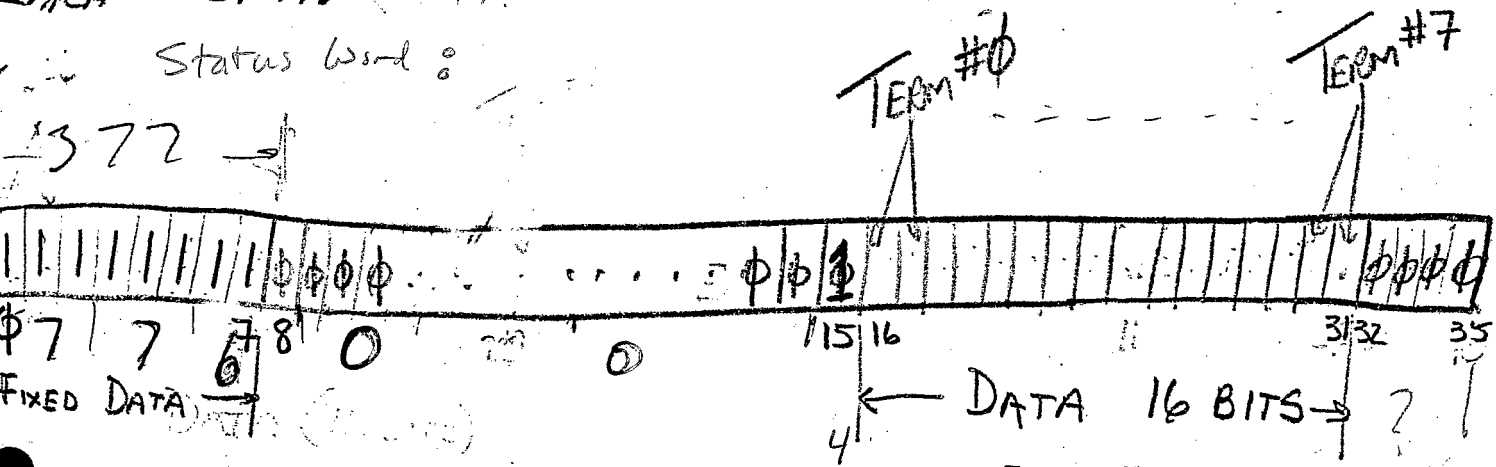
```
      DA[illegible] REQ(D),D=1,4)/'SET','SEB','EXPS','ON'/
      REQ(5)=100*EXPS
C               NOTE: MULTIPLIER=(CLOCK RATE-USUALLY 1000 HZ)/
C               (MAX NO. OF EXPERIMENTS-USUALLY 10)
      CALL SREQU (REQ,5,FLAG,ERR1)
D     TYPE 140, REQ(5)
D140  FORMAT (' AUTODET EXPS SET TO ',I3)
      SN=0
D     IF (ERR1) TYPE 150,ERR1
D150  FORMAT (' ERROR IN SREQU; ERR1= ',O12)
170   CALL SNOOZE(10)
      GOTO 10
      END
```

...DIBBUK TO PDP10

DATA FORMAT

One 36 BIT WORDS EVERY 20 SECONDS FROM Line EACH PDP11.

Status Word:



a. 2 BITS / TERMINAL

b. TERM #0 = BITS 16,17
: #7 = BITS 30,31

000003000000

c. EXPER. ON = 11

OFF (EXPER. PROBLEMS) = 01

OFF (OTHER PROBLEMS) = 10

NOT CONNECTED, READ ERRORS, ETC. = 00

* d. INITIALIZE 11-10 LINK WITH A PDP10 READ.