3 Spins

INTERFACE WITH APL CHARGED PARTICLES EXPERIMENT

This experiment utilizes 46 (each 24 to 10 bit log) compressors and 11 (each 24 to 12 bit log) compressors for a total of 3021 DDP bits in 57 each accumulators

The interface consists of 36 each wires and the transmitted bit rate is 24.32 BPS at the 400 IBPS rate.

SECTORING OF APL PULSES, GENERAL:

32 each 24 to 10 bit log compressors are provided for sectoring. They are broken up into 4 each sets of 8 sectors in a set. See references for drawings that give full details. The contents of all 32 accumulators are transferred to their "X" & "C" registers at the end of each snapshot (i.e., the transfer rate is a function of bit rate). Thus the bit rate in the 400 IBPS rate = 32 x 10/20.48 = 15.63 IBPS and that in the 1600 IPBS rate = 32 x 10/5.12 = 62.50 IBPS.

There are two modes of operation, the normal mode (i.e., OA is OK and ks = 1) and the failure mode (i.e., OA failed and ks = 0).

OA is OK and ks = 1 Mode: This is the primary mode and assumes that the OA computer is working and that the spacecraft is commanded into the "OA SLAVE" (ks = 1) mode. The pulses are accumulated and sectored over 2 spins in IMP-H (or 1 spin in IMP-J) each snapshot independent of bit rate. Thus the scheme is efficient at 1600 IBPS but has much dead time at 400 IBPS. The result is read out once each snapshot. In this mode of operation, the sector that occurs at the first coherent quarter-

spin after the encoder generated a_2 line goes plus (see Figure #2) will start the ~~two~~ three complete spins (1 on J).* Data will be transferred from the 32 accumulators to their respective "X" registers (when a_2 goes plus) in greater than 0.1 ms and less than 5.0 ms. Since the accumulators are "frozen" during the entire transfer time, commutation by the experiment may be performed any time a_2 goes positive as long as the switching is complete in $<$ 0.1 ms.

OA failed and ks = 0 Mode: This is the failure mode and assumes that the satellite has been commanded into the telemetry sync mode (i.e., ks = 0). In this mode, no summing of spins occur and the sectors are TM slaved as follows:

ACCUM #	FOR IMP-H COUNTS DURING	FOR IMP-J COUNTS DURING
$(1)_8$	Fr 0 & 1, Seq 1, All SS	Fr 0 $\Rightarrow$ 3, Seq 2, All SS
$(2)_8$	Fr 2 & 3, " "	Fr 4 $\Rightarrow$ 7, " "
$(3)_8$	Fr 4 & 5, " "	Fr 8 $\Rightarrow$ 11, " "
$(4)_8$	Fr 6 & 7, " "	Fr 12 $\Rightarrow$ 15, " "
$(5)_8$	Fr 8 & 9, " "	Fr 0 $\Rightarrow$ 3, Seq 3, All SS
$(6)_8$	Fr 10&11, " "	Fr 4 $\Rightarrow$ 7, " "
$(7)_8$	Fr 12&13, " "	Fr 8 $\Rightarrow$ 11, " "
$(8)_8$	Fr 14&15, " "	Fr 12 $\Rightarrow$ 15, Seq 3, All SS

Figure #1 illustrates when the accumulators will read in both IMP H & J failure modes. As long as the bit rate is 1600 IBPS, the sectoring time closly resembles a single spin. In the

* SEE DETAILS IN APPENDIX C

400 IBPS mode, however, the sectoring will be over 4 spins and the sectored data will probably not mean much.

SECTOR INPUTS INTERFACE: (Lines ① thru ④)

The 4 each lines are to have the standard accumulator input characteristics described in Appendix C for a Zin of 10 K.

① APL Se-1: Input to 8 each 24 to 10 bit log compressors connected as shown:

Sector #	Accum #
1	APL Se-1 $①_8$
2	" $②_8$
3	" $③_8$
4	" $④_8$
5	" $⑤_8$
6	" $⑥_8$
7	" $⑦_8$
8	APL Se-1 $⑧_8$

RO = Fr 2, Seq 2, All SS
(Se ⑧ SS - 3 Input)
Daughter 163, Type 3

② APL Se-2: Input to 8 each 24 to 10 bit log compressors connected as shown:

Sector #	Accum #
1	APL Se-2 $①_8$
2	" $②_8$
3	" $③_8$
4	" $④_8$
5	" $⑤_8$
6	" $⑥_8$
7	" $⑦_8$
8	APL Se-2 $⑧_8$

RO = Fr 10, Seq 2, All SS
(Se ⑧ SS - 4 Input)
Daughter 163, Type 4

③ APL Se-3: Input to 8 each 24 to 10 bit log compressors connected as shown:

Sector #	Accum #
1	APL Se-3 $①_8$
2	" $②_8$
3	" $③_8$
4	" $④_8$
5	" $⑤_8$
6	" $⑥_8$
7	" $⑦_8$
8	APL Se-3 $⑧_8$

RO = Fr 2, Seq 3, All SS
(Se ⑧ SS - 5 Input)
Daughter 163, Type 5

④ APL Se-4: Input to 8 each 24 to 10 bit log compressors connected as shown:

Sector #	Accum #
1	APL Se-4 $①_8$
2	" $②_8$
3	" $③_8$
4	" $④_8$
5	" $⑤_8$
6	" $⑥_8$
7	" $⑦_8$
8	APL Se-4 $⑧_8$

RO = Fr 10, Seq 3, All SS
(Se ⑧ SS - 6 Input)
Daughter 163, Type 6

APL NON SECTORED RATES, (GENERAL)

25 each 24 bit log compressors are supplied for non sectored rates as follows:

7 each 24 to 12 bit read out every snapshot for 7 x 12/20.48 = 4.10 IBPS@ 400 IBPS. (R_1 thru R_7)

4 each 24 to 12 bit read out every other snapshot for 4 x 12/40.96 = 1.17 IBPS@ 400 IBPS (R_8 thru R_{11})

14 each 24 to 10 bit read out every other snapsnot for 14 x 10/40.96 = 3.42 IBPS@ 400 IBPS (R_{12} thru R_{25})

Thus 8.69 IBPS@ 400 IBPS are supplied for non sectored rates.

Figure #4 enclosed explains where transfer occurs. Please note that a dead time occurs@ transfer of >0.1 ms and <5.0 ms during which the accumulators will not accept pulses.

RATES ACCUMULATORS INTERFACE (Lines (5) thru (29))

All 25 each lines are for pulse inputs to the 24 bit log compressors and have standard input characteristics described in Appendix C for an input Z of 24 K ohms. See Figure 4.

(5)	APL-R_1:	Pulse Input for Accum	#LR12a$_2$- 6
(6)	" -R_2:	"	#LR12a$_2$- 10
(7)	" -R_3:	"	#LR12a$_2$- 14
(8)	" -R_4:	"	#LR12a$_2$- 18
(9)	" -R_5:	"	#LR12a$_2$- 20
(10)	" -R_6:	"	#LR12a$_2$- 22
(11)	APL-R_7:	"	#LR12a$_2$- 26
(12)	APL-R_8:	Pulse Input for Accum	#LR12a$_3$- 61
(13)	" -R_9:	"	#LR12a$_3$- 10
(14)	" -R_{10}:	"	#LR12a$_3$- 14
(15)	APL-R_{11}:	"	#LR12a$_3$- 18

IMP H & J Encoder
APL #6 of 12.

(16)	APL-R_{12}:	Pulse Input for Accum	#LR10a_3- 1
(17)	" -R_{13}:	"	#LR10a_3- 2
(18)	" -R_{14}:	"	#LR10a_3- 5
(19)	" -R_{15}:	"	#LR10a_3- 6
(20)	" -R_{16}:	"	#LR10a_3- 9
(21)	" -R_{17}:	"	#LR10a_3- 10
(22)	" -R_{18}:	"	#LR10a_3- 13
(23)	" -R_{19}:	"	#LR10a_3- 14
(24)	" -R_{20}:	"	#LR10a_3- 17
(25)	" -R_{21}:	"	#LR10a_3- 18
26	" -R_{22}:	"	#LR10a_3- 21
27	" -R_{23}:	"	#LR10a_3- 22
28	" -R_{24}:	"	#LR10a_3- 25
(29)	APL-R_{25}:	Pulse Input for Accum	#LR10a_3- 26

TIMING SPIN SIGNALS INTERFACE (LINES (30) & (31)) GENERAL:

There are two modes of operation for these lines (see sheet 1 & 2 and Figure 5 of this spec.).

OA is ok & ks=1: (OA Computer Slave)

OA failed & ks=0: (TM Slave)

The lines have the standard output of + $\cong$ +7.4 V. @ 56 K & - $\cong$ GRD @ 112 K . They are plus-going at the beginning of the spin in the OA COMPUTER SLAVE MODE and the unbarred functions (i.e. plus going at the beginning of the sequence) are used in the TM slaved MODE where:

E = Frame Rate = 320 ms·(k) + 80 ms · (1-k)
D = 2 Frames Rate = 640 ms·(k) + 160 ms · (1-k)
C = 4 Frames Rate = 1.28 sec·(k) + 320 ms · (1-k)

k = 1 if 400 & 0 if 1600 IBS.
See GE-1281-450 Sh 2 of 2 for more information.

Both signals are approximate square waves.

(30) APL - 8∿: 8 cycles / spin if in OA SLAVE (i.e. ks = 1).

If TM SLAVE (i.e. ks = 0)

D if IMP H

C if IMP J

(31) APL - 16∿: 16 cycles/spin if in OA SLAVE (i.e. ks = 1).

If TM SLAVE (i.e. ks = 0)

E if IMP H

D if IMP J

TIMING TM SIGNALS INTERFACE: (Lines (32) thru (36)) See Figure #2

These 5 each lines are very nearly square waves that are positive going at the beginning of the function (i.e., at the start of Ch 0, Fr 0, etc.). The + level ≅ 7.5v@ 56 K and the - level ≅ gnd@ 112 K. The period of these functions are a function of bit rate. See Figure #2 for lines (32) thru (36) timing.

(32) APL-a_3: 1 cycle/2 snapshots

(33) APL-a_4: 1 cycle/page

(34) APL-a_5: 1 cycle/2 pages (= 8 snapshots)

(35) APL-a_6: 1 cycle/4 pages = 1 album (= 16 snapshots)

(36) APL-a_7: 1 cycle/2 albums (= 32 snapshots)

REFERENCES:

GE-1281-507: Telemetry Format (IMP-H)

GE-1281-163: "Daughter #D for individual bit structures.

(OTHERS TO BE ADDED LATRR)

FIGURE #1
SECTORING FAILURE MODES

IMP H & J ENCODER
APL #8 OF 12

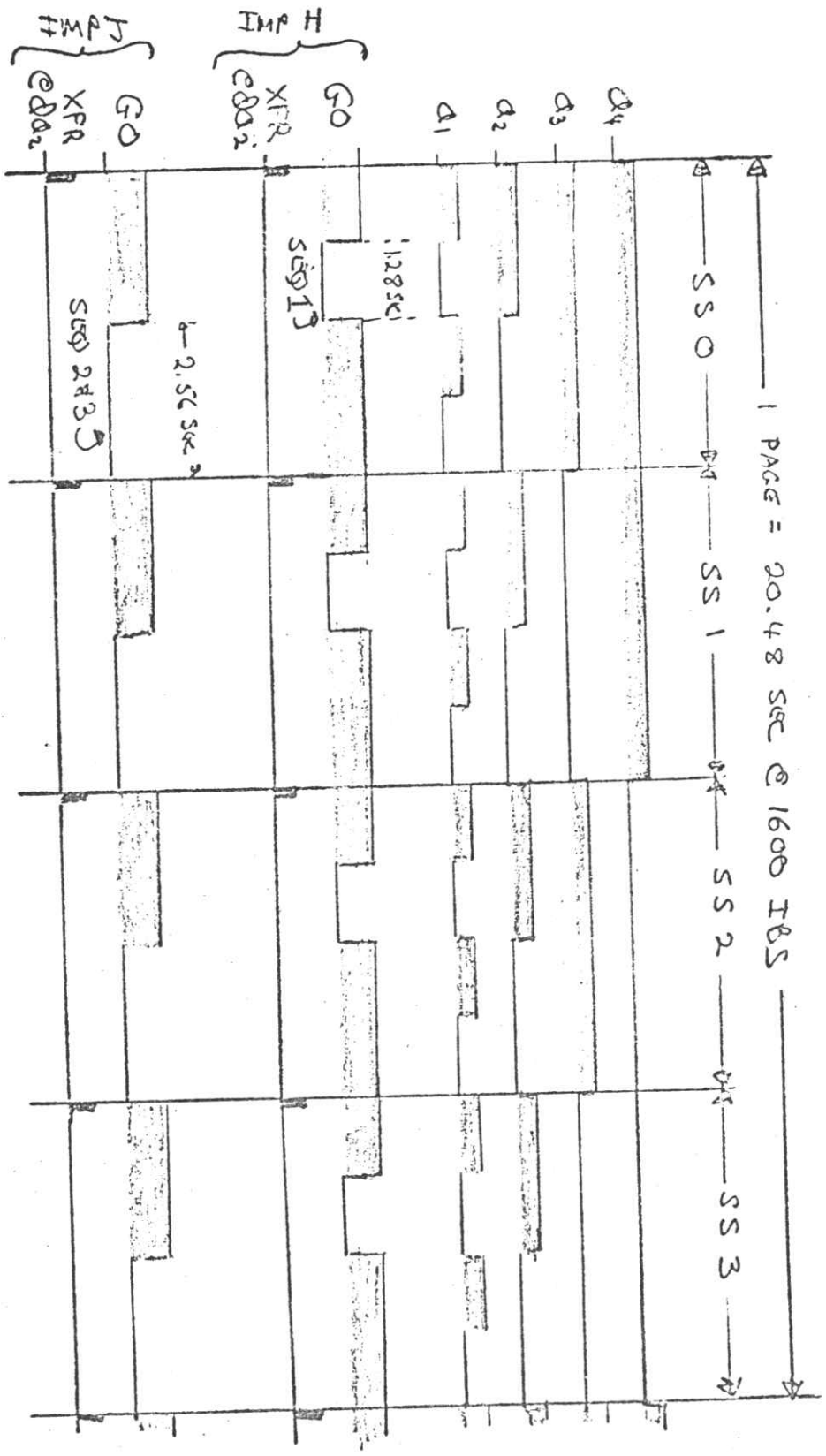


FIGURE #2
Q1 → Q7 WF'S

IMP H&J ENCODER
APL #9 OF 12

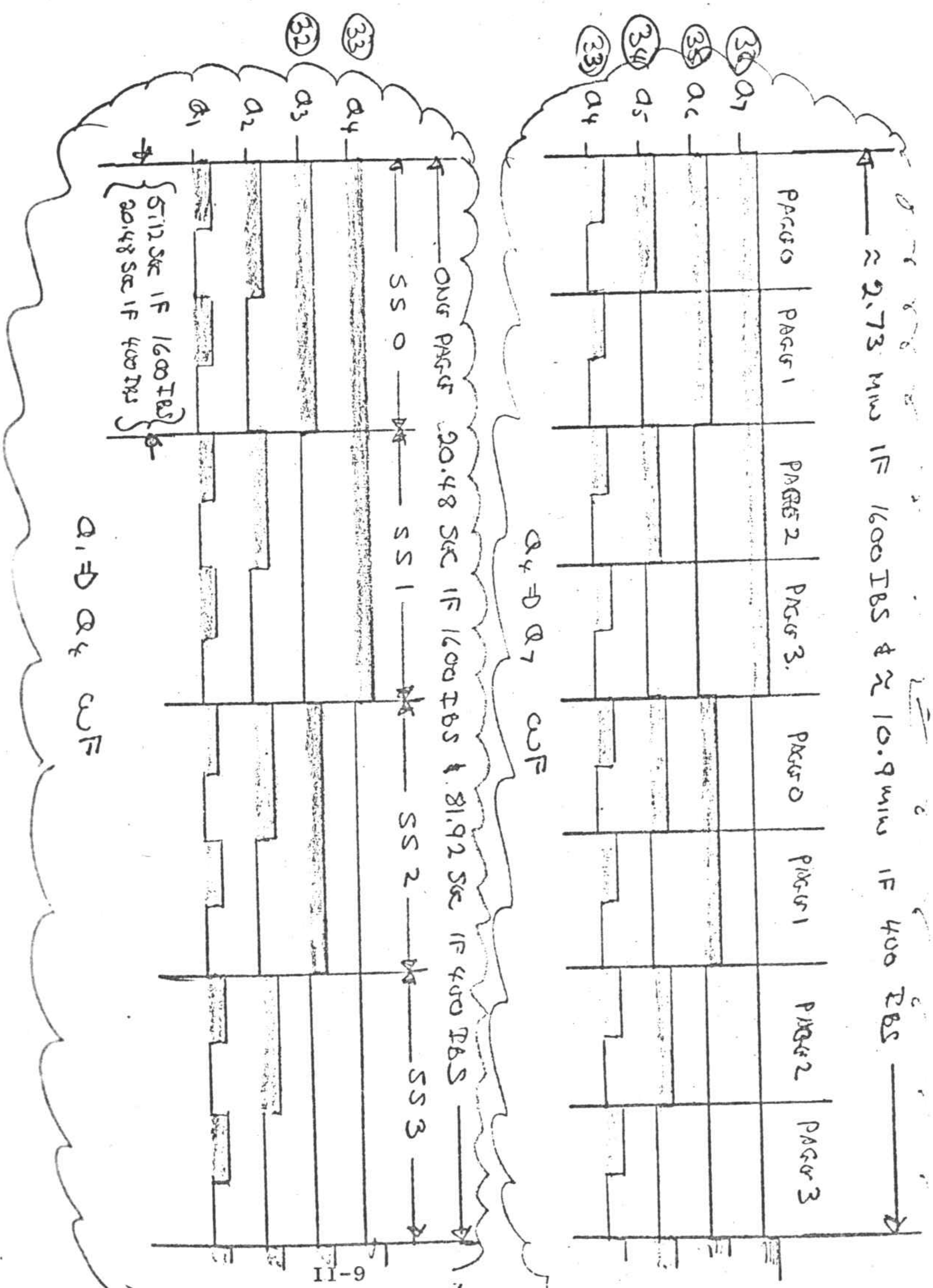
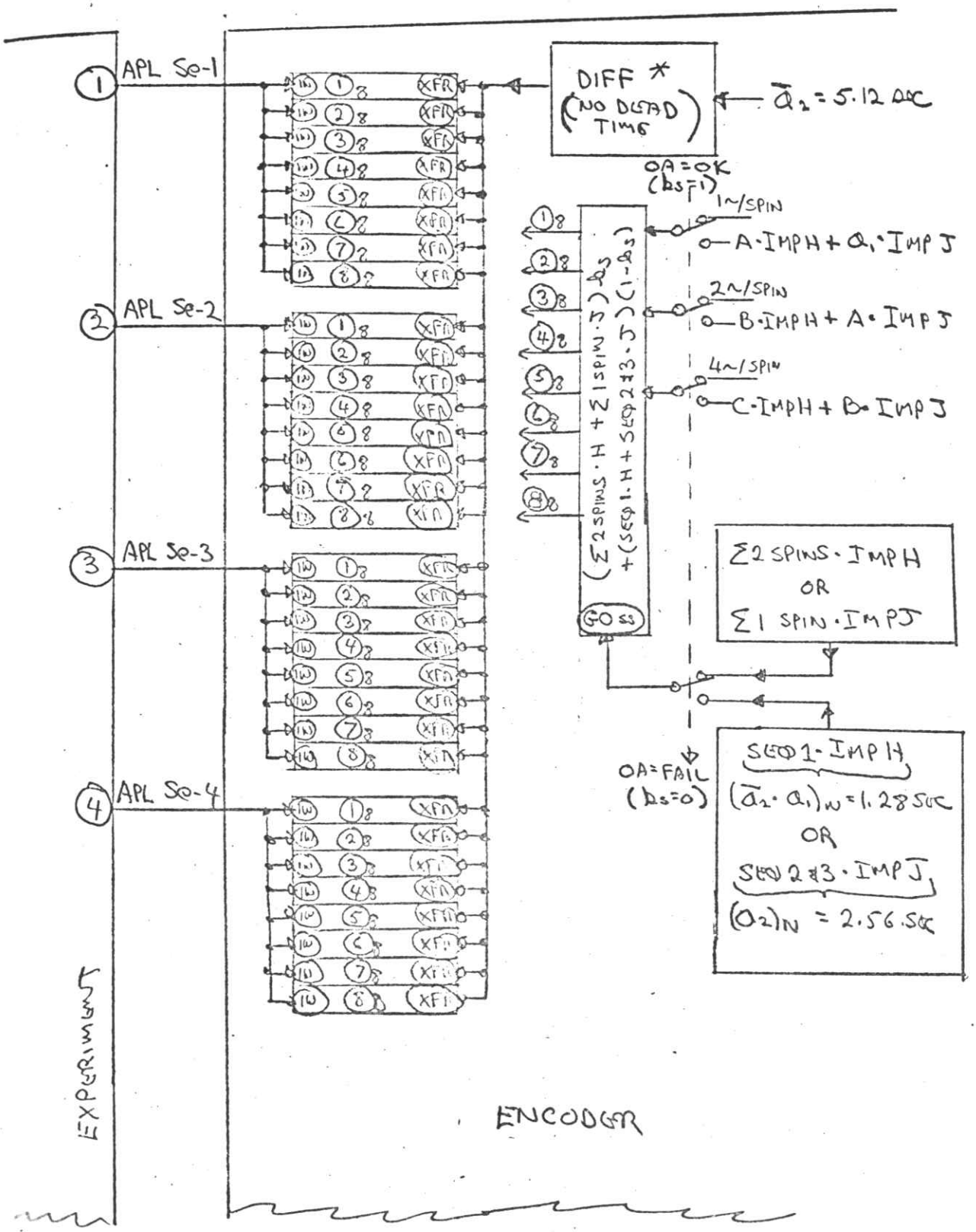


FIGURE #3

INTERFACE WIRES (SH 1 OF 3)

IMP H & J ENCODER

APL # 10 OF 12

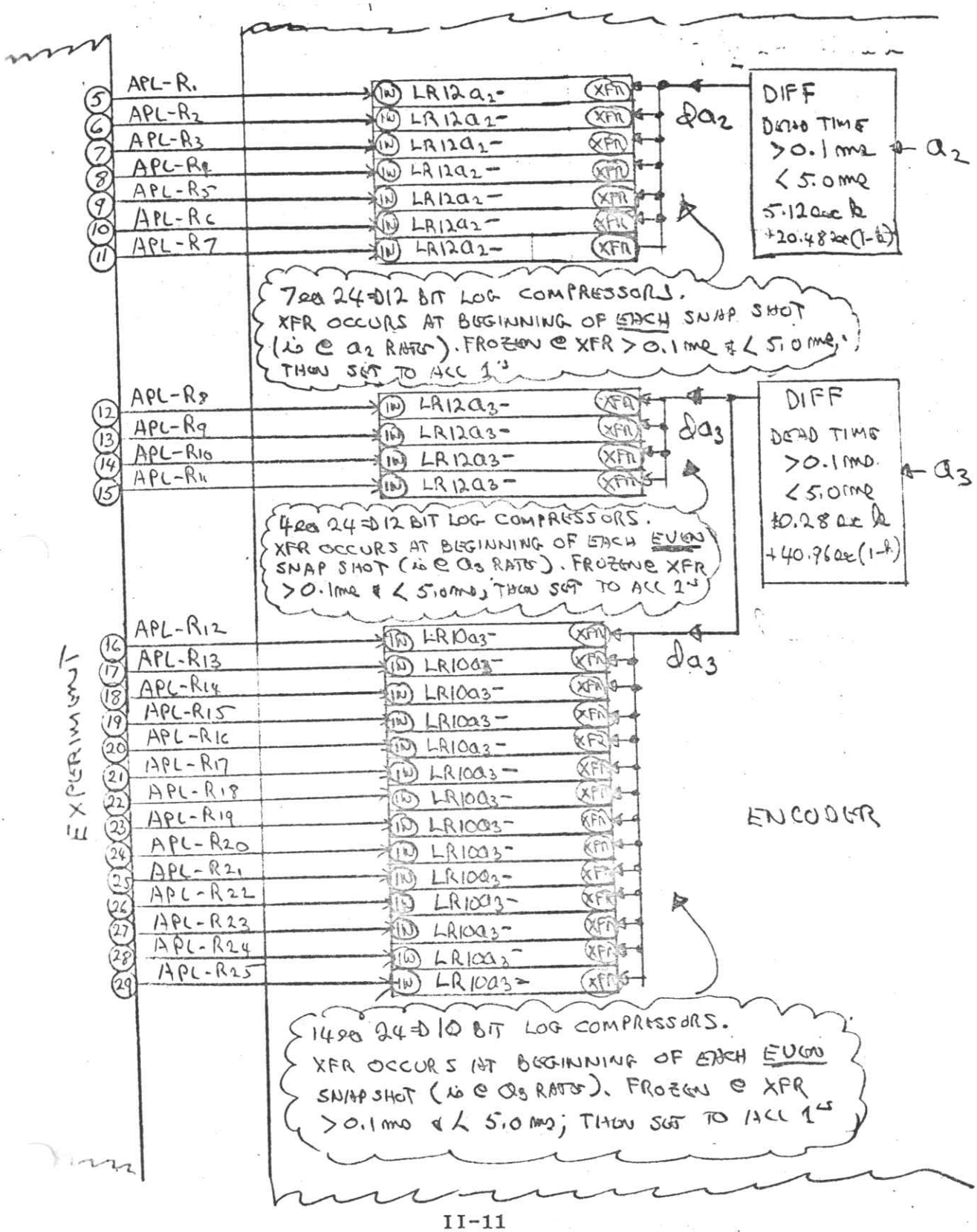


* SEE DETAILS IN APPENDIX C

FIGURE # 4

INTERFACE WIRES (SH 2 OF 3)

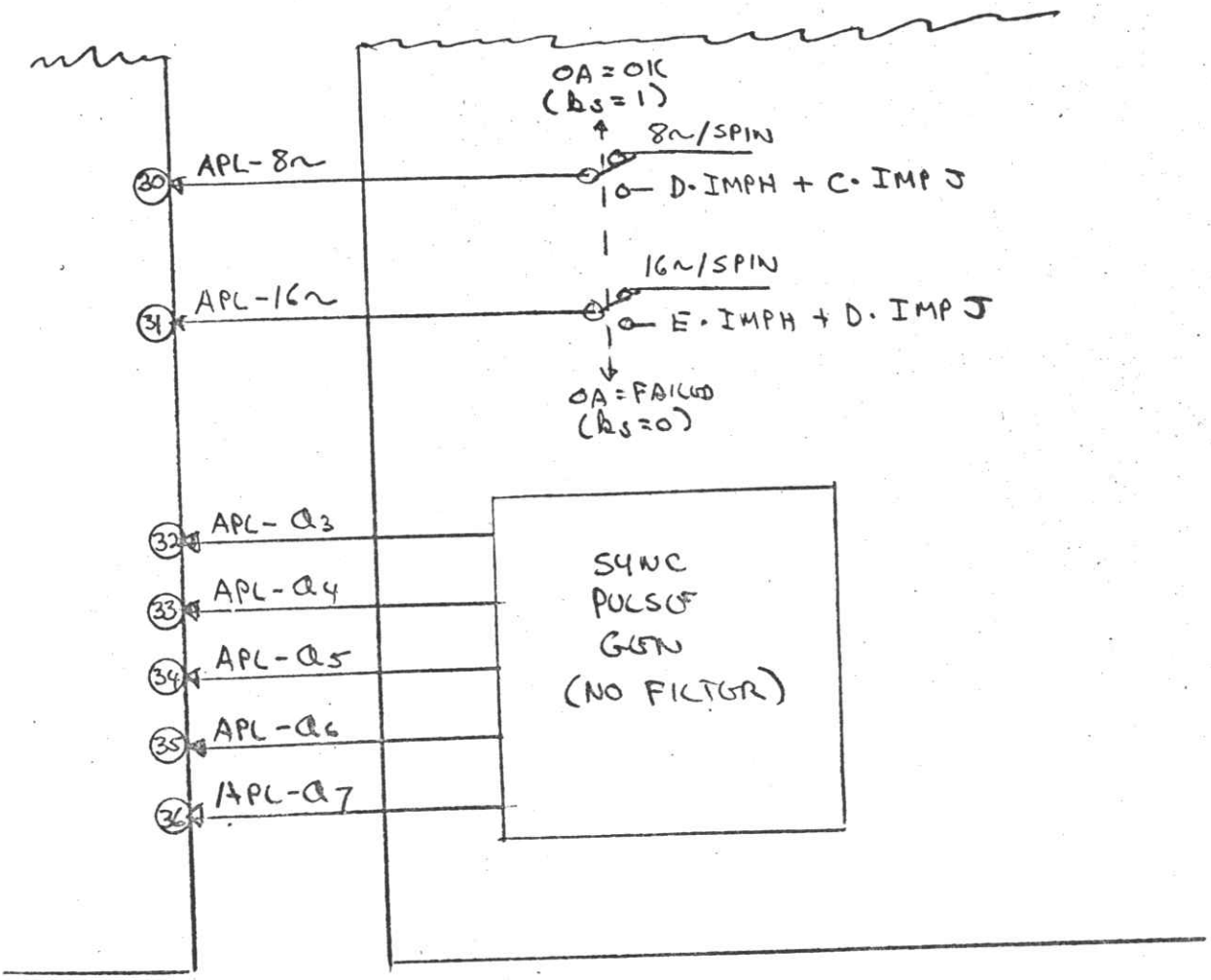
IMP H & J ENCODER
APL # 11 OF 12



IMP H & J ENCODER
APL # 12 OF 12

FIGURE # 5

INTERFACE WIRES (SH 3 OF 3)



The filter effectively filters out switching spikes at f_x' but noise spikes may still be present on the line due to pick up. It is therefore advisable for the experimenter to take advantage of the large voltage swing between the two states to perform his switching. If differentiation of leading or trailing edges of sync pulses is required, it must be done in the experimenter's package by the experimenter taking into account the noise problem mentioned above. Coincidence of one sync pulse to another will be within 50 microseconds of each other when filtered.

L. ANALOG INPUTS

0 to +5v DC at Z_{IN} = 100 K $\pm$1%

See Appendix D for full details

II. FLOATING POINT COMPRESSION

A. GENERAL

The development of AMI's MOS Thick Oxide Process has been so rapid that it now takes only one chip to do 24 to 12 bit floating point compression. Two basic types of compression will be done as follows:

1. 24 bits compressed to 12 bits telemetered as $X_1X_2X_3X_4X_5X_6X_7C_1C_2C_3C_4C_5$ where the 5 each C bits are the number of shifts to the right required to find the first "1" and the 7 each X bits are the value of the seven bits preceding the first "1."

   Thus the first 255 counts will be telemetered with no error and the maximum counting error will be $1/2^7$ = 1/128 or +1/256 or less than $\pm$1/2%.

2. 24 bits compressed to 10 bits telemetered as $X_3X_4X_5X_6X_7C_1C_2C_3C_4C_5$. It will be noted that this is the same as the 12 bit compression except that the X_1 and X_2 bits are not read out.

Thus the first 63 counts will be telemetered with no error and the maximum error will be $1/2^5 = 1/32$ or $\pm 1/64$ or less than $\pm 1.6\%$. The compressed answer will be held in temporary storage and nondestructively read out at the telemetry rate.

B. EQUATIONS FOR 24 TO 12 BIT COMPRESSION:

The bit compressor formats the word:

$X_1X_2X_3X_4X_5X_6X_7C_1C_2C_3C_4C_5$.

For 12 bit compression all 12 of the bits are telemetered while for the 10 bit compression the X_1 and X_2 bits are not telemetered. The compression of the 24 bit accumulator word, "Ac", will be expressed by:

$$Ac = X_1 2^{(16-N)} + X_2 2^{(17-N)} + X_3 2^{(18-N)} + X_4 2^{(19-N)} + X_5 2^{(20-N)} + X_6 2^{(21-N)} + X_7 2^{(22-N)} + 2^{(23-N)} + \triangle$$

where $\triangle = 1/2\left(2^{(16-N)} - 1\right)$ for 12 bit compression

or $\triangle = 1/2\left(2^{(18-N)} - 1\right)$ for 10 bit compression

and $N = C_1 2^0 + C_2 2^1 + C_3 2^2 + C_4 2^3 + C_5 2^4$

SOME SPECIAL CASES:

1. If N = 31, the contents of the accumulator was zero which means the accumulator received 1 pulse.
2. If N = 0 and all the X's = 1 then the accumulator reads all 1's which means it received no pulses since the last time it was reset to "1's".
3. Anytime $N > 16$ (For the 24 bit accumulators) negative exponents will result. Disregard only the negative exponents because less than 256 counts were received for the 12 bits, or less than 64 counts were received for the 10 bit accumulator so "Ac" will accurately represent the contents of the accumulator.

4. Since the accumulator is set to all 1's instead of reset to all 0's, the contents of the accumulator will be one less than the number of pulses counted, therefore, Ac + 1 = number of pulses counted.

The accumulator is set instead of reset for checkout purposes and to avoid any race problems.

C. BRIEF DESCRIPTION OF OPERATION OF 24 TO 12 BIT COMPRESSOR:

The 24 bit accumulator counts at a maximum rate of > 640 KC. Upon a transfer command, the 24 bit accumulator is frozen (will accept no more pulses) and the accumulator is changed into a 24 bit shift register.

If the last bit in the shift register is not "1" the shift register is shifted right one place and the C register receives a count. The shift register is shifted right one place and the C register receives a count. The shift register will shift until the last bit is a "1" advancing the C register by 1 on each count or will shift until the C register reads 31.

Thus the C register gives the number of shifts to find the first one. The last bit of the shift register will be a "1" (therefore, is not telemetered) and the next 7 leftmost bits X_1 thru X_7 are telemetered for a 12 bit compression. The 7 each X bits and 5 each C bits are held in temporary storage and are nondestructively read out synchronously with the telemetry. When the next transfer pulse occurs the compression process repeats.

The entire process takes less than 5 milliseconds and more than 100 microseconds during which the accumulator will not accept pulses. Thus the experiment may switch at this time.

At the end of the compression, the accumulator is set to all "1's" and is ready to again count pulses.

D. SOME EXAMPLES (See Chart #1)

Assuming 12 bit compression

1. For example #1, N = 12 and the 12 telemetered bits

will be: $X_1X_2X_3X_4X_5X_6X_7C_1C_2C_3C_4C_5$

0 0 0 0 0 0 0 0 0 1 1 0

and Ac = $0+0+0+0+0+0+0+2^{11} + 1/2\ (2^4 - 1) = 2048 +$

$1/2\ (15) = 2055.5 \pm 7.5$

2. For example #2, N = 0 and the 12 telemetered bits

will be: $X_1X_2X_3X_4X_5X_6X_7C_1C_2C_3C_4C_5$

1 1 1 1 1 1 1 0 0 0 0 0

and Ac = "All 1's" = no pulses in.

3. For example #3, N = 31 and the 12 telemetered bits

will be $X_1X_2X_3X_4X_5X_6X_7C_1C_2C_3C_4C_5$

0 0 0 0 0 0 0 1 1 1 1 1

and Ac = "All 0's" = 1 pulse in.

4. For example #4, N = 20 and the 12 telemetered bits

will be: $X_1X_2X_3X_4X_5X_6X_7C_1C_2C_3C_4C_5$

0 0 0 0 1 1 0 0 0 1 0 1

and Ac = $X_1 2^{-4} + X_2 2^{-3} + X_3 2^{-2} + X_4 2^{-1} + 1X2^0 + 1X2^1$
$+ 0X2^2 + 2^3 + 1/2\left(2^{-4} - 1\right)$

Disregarding all negative exponents we get

Ac = $2^0 + 2^1 + 2^3 = 1 + 2 + 8 = 11$

(e.g., 12 pulses in) and there is no error.

	2^0	2^1	2^2	2^3	2^4	2^5	2^6	2^7	2^8	2^9	2^{10}	2^{11}	2^{12}	2^{13}	2^{14}	2^{15}	2^{16}	2^{17}	2^{18}	2^{19}	2^{20}	2^{21}	2^{22}	2^{23}
Ex.	#A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	A_{11}	A_{12}	A_{13}	A_{14}	A_{15}	A_{16}	A_{17}	A_{18}	A_{19}	A_{20}	A_{21}	A_{22}	A_{23}	A_{24}
1.	?	?	?	?	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

CHART #1

SOME NOTES ON SECTORING:

THE IMP H&J ENCODING SYSTEM HANDLES 26 eq SECTORED RATES IN 208 eq 24 TO 10 BIT LOG COMPRESSORS ARRANGED AS FOLLOWS:

4 eq INPUTS SECTORED BY 16 (OVER 3 SPINS IN H & 1 SPIN IN J) AND READ OUT EACH SNAP SHOT (SEE FIG # 2)

6 eq INPUTS SECTORED BY 8 (OVER 3 SPINS IN H & 1 SPIN IN J) AND READ OUT EACH SNAP SHOT (SEE FIG # 2)

8 eq INPUTS SECTORED BY 8 (OVER 14 SPINS IN H & 7 SPINS IN J) AND READ OUT EACH PAGE (SEE FIG # 1)

8 eq INPUTS SECTORED BY 4 (OVER 14 SPINS IN H & 7 SPINS IN J) AND READ OUT EACH PAGE

THE SYSTEM IS TAILOR MADE FOR 1600 IBPS AND SPIN RATES OF 48 RPM ON IMP H & 24 RPM ON IMP J. FIGURE # 6 ILLUSTRATES THAT THE RPM CAN SLOW DOWN BY 5.7 RPM ON IMP H AND BY 2.4 RPM ON IMP J BEFORE ANY INFORMATION IS LOST.

FIGURE # 3 ILLUSTRATES HOW SPIN & TELEMETRY ARE SYNC. THE MINIMUM TIME BETWEEN A TM GENERATED PULSE (a_2 or a_4) AND THE START OF

SECTORING IS 1/8 OF A SPIN, THUS THERE IS PLENTY OF TIME FOR EXPERIMENT COMMUTATIONS

FIGURE #4 ILLUSTRATES HOW SPIN IS SYNC TO THE SNAPSHOT RATE (Q_2) WHILE FIGURE #5 ILLUSTRATES HOW THE SPIN IS SYNC TO THE PAGE (Q_4) RATES

IT SHOULD BE NOTED THAT SECTORING CAN START ON ANY QUARTER SPIN, SO THAT SECTOR #1 (@ ①m) IS NOT ALWAYS ACCUMULATED FIRST.

THE FAILURE MODES ARE DISCUSSED IN SECTION II WHERE APPLICABLE

IMP H&J ENCODER
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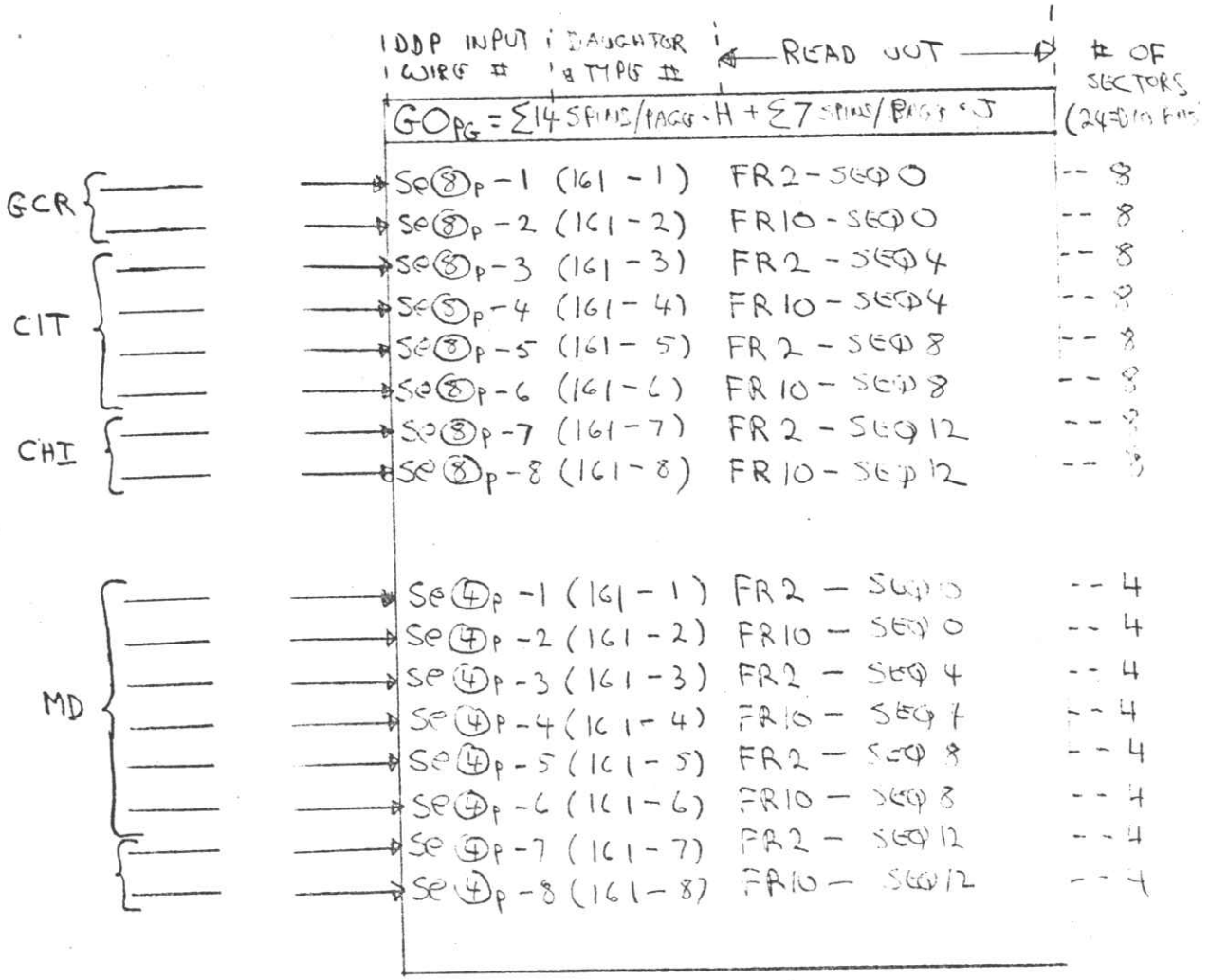
FIGURE # 1
SECTORING & PAGE RATES

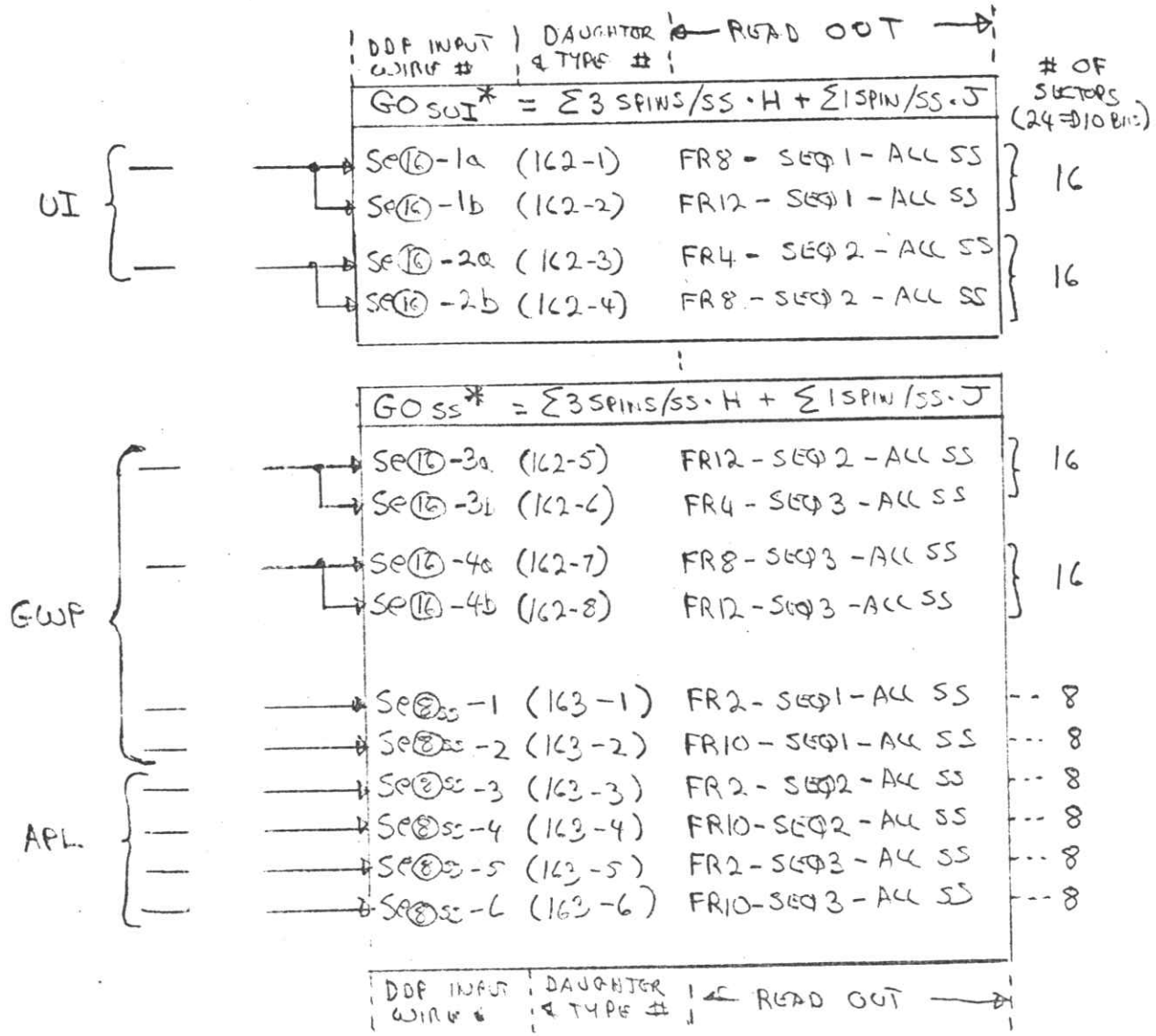


∴ 96 TOTAL SECTORS (24=D10 BIT ACCUMS)

FOR $\frac{96 \times 10}{\text{PAGE}} = \frac{960}{20.48} = 46.875$ IBPS @ 1.5 IBPS

FIGURE #2

SECTORING @ SNAP SHOT RATE



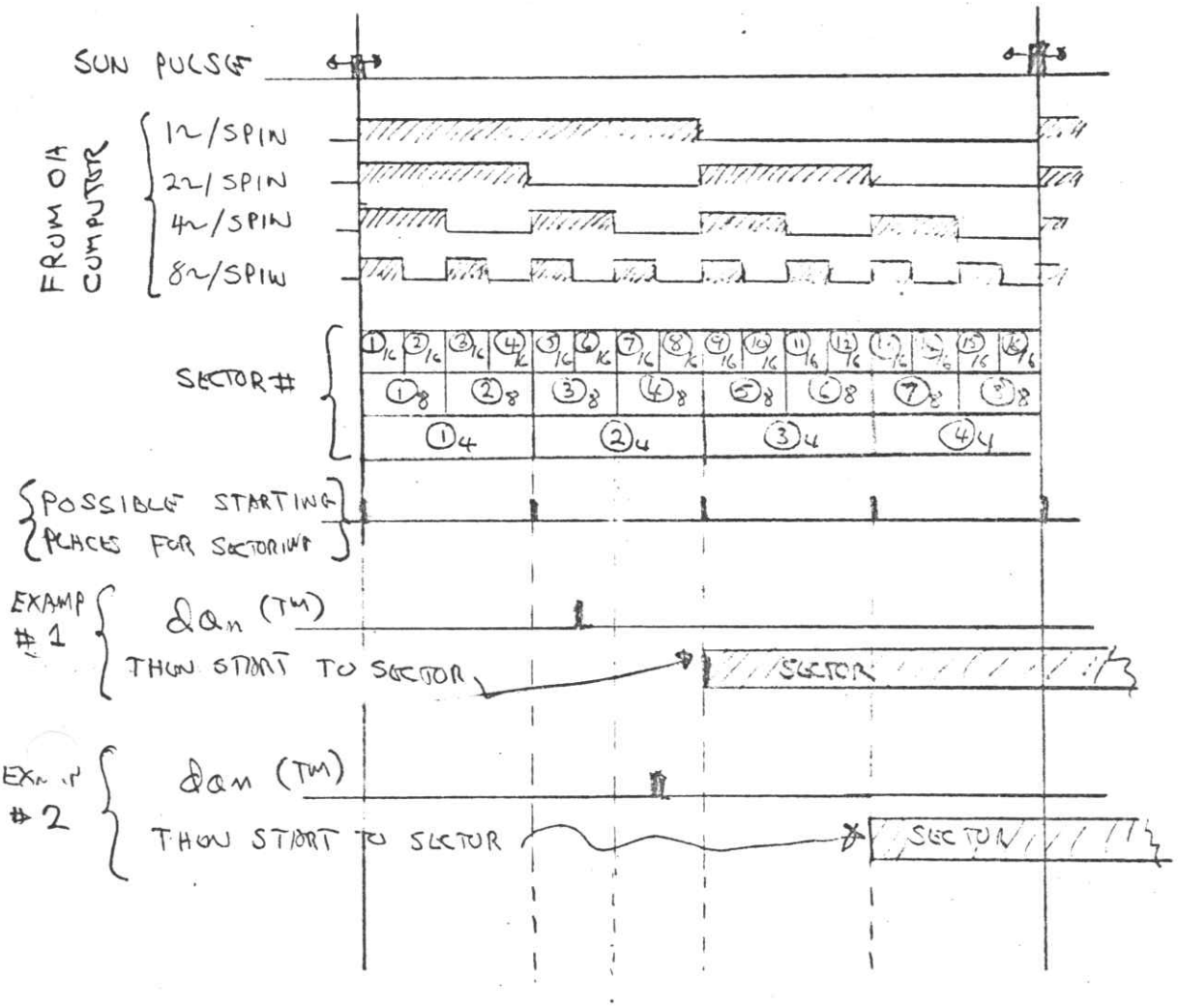
∴ 112 TOTAL SECTORS (24 ⇒ 10 BIT ACCUMS)

FOR $\frac{112 \times 10 \text{ BITS}}{\text{SNAP SHOT}} = \frac{1120}{5.12} = 218.75$ IOPS @ 1600 IOPS

* GO SUI = GO SS IN IMP H & J

FIGURE # 3.

TM & SPIN SYNCHRONIZATION



FOR EX # 1:

dam OCCURED IN AN ODD 8TH SECTOR ∴ SECTORING STARTED IN NEXT QUARTER SPIN

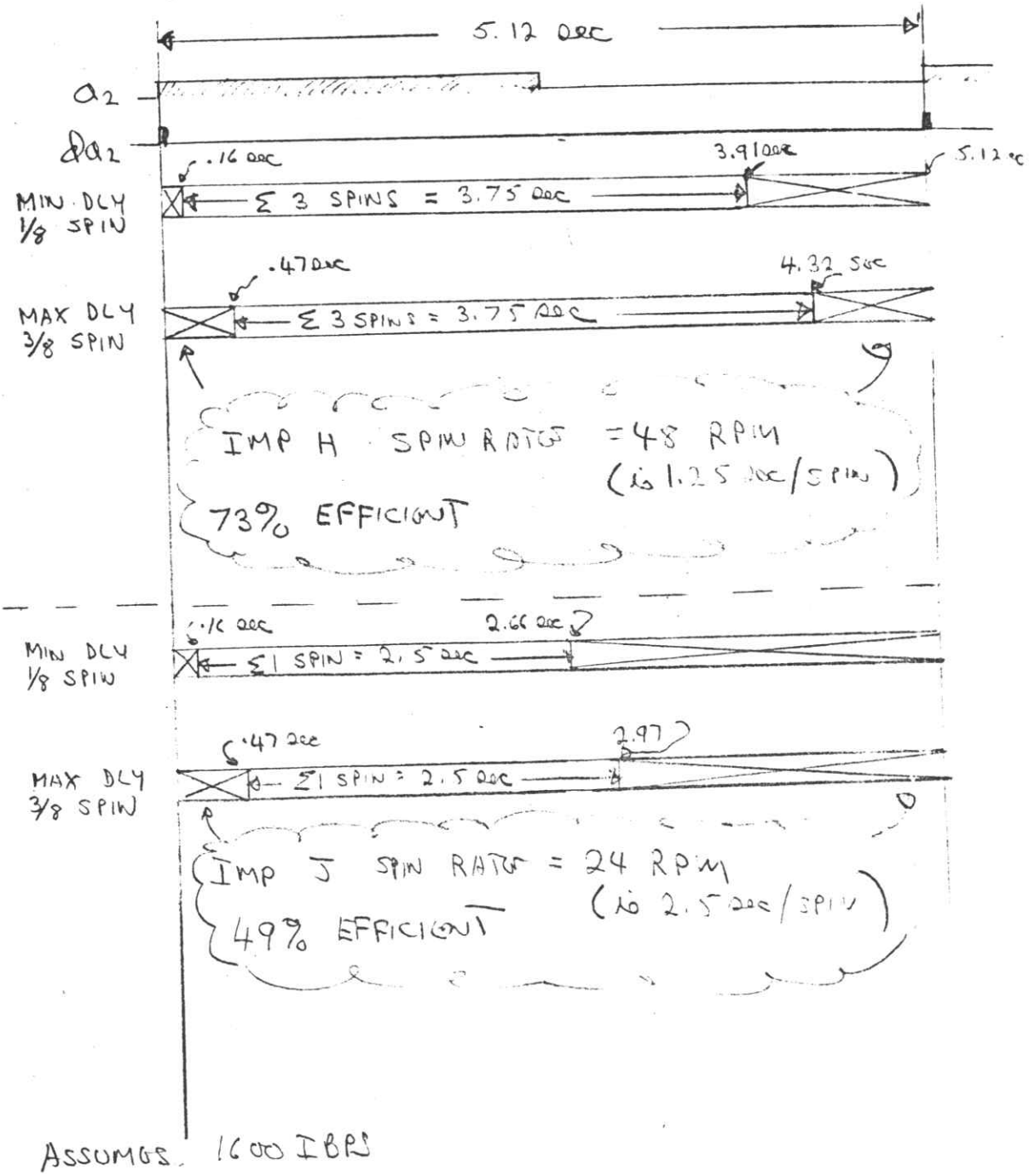
FOR EX # 2:

dam OCCURED IN AN EVEN 8TH SECTOR ∴ SECTORING DID NOT START IN NEXT QUARTER SPIN, BUT IN 2ND QUARTER SPIN AFTER THAT.

∴ MAX TIME BETWEEN TM GENERATED PULSE (dam) AND SECTORING IS 3/8 OF A SPIN AND MINIMUM TIME IS 1/8 OF A SPIN (FOR EXPERIMENT SWITCHING)

FIGURE #4.

SNAP SHOT SPIN SYNC (GOSS)



ASSUMES 1600 IBPS

IMP H & J ENCODER
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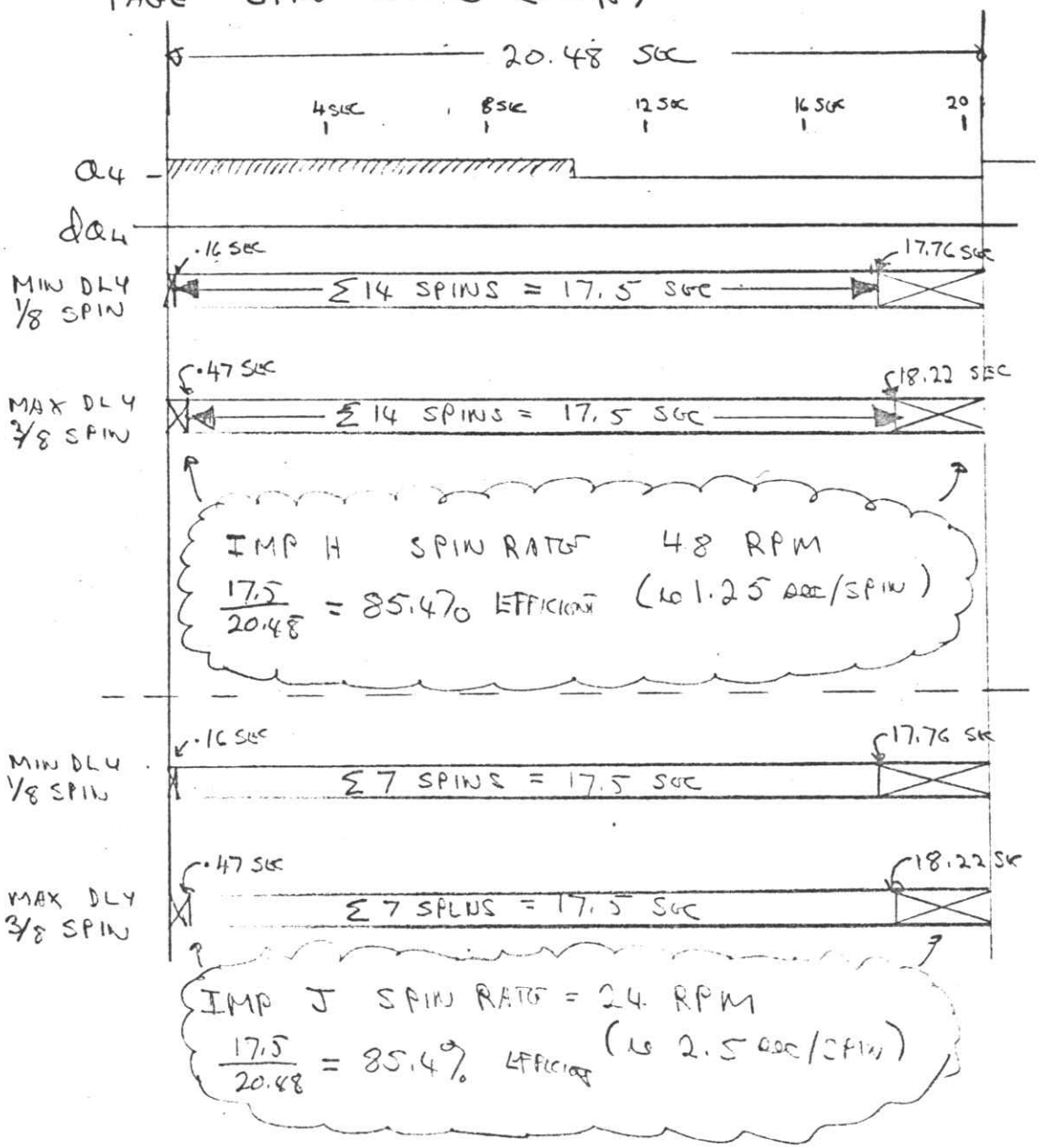
FIGURE #5

PAGE SPIN SYNC (GOAY)



ASSUME 1600 IBPS

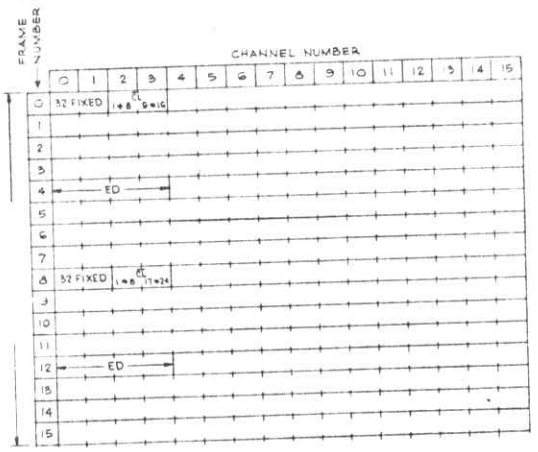
FIGURE # 6

SUMMARY OF RPM PARAMETERS

	NOMINAL RPM	MIN RPM FOR SS & PAGE FUNCTIONS OK	Δ RPM FOR SS & PAGE FUNCTIONS OK	MIN RPM FOR SS FUNCTIONS OK	MIN RPM FOR PAGE FUNCTIONS OK
IMP H	48	42.3	-5.7	39.5 (Σ 3 SPINS)	42.3 (Σ 14 SPINS)
IMP J	84	21.6	-2.4	16.1 (Σ 1 SPIN)	21.6 (Σ 7 SPINS)

ASSUMES 1600 IPS

STANDARD FUNCTION	PLUG #	PIN #	WIRE GOES TO	FUNCTION NAME	IMP H WIRE GOES TO	IMP H FUNCTION NAME	IMP J WIRE GOES TO	IMP J FUNCTION NAME
CMD $\bar{A}_a$	1	K2	SC (BIT RATE)	CMD $\bar{A}_a$		CMD $\bar{A}_a$		CMD $\bar{A}_a$
CMD $\bar{A}_b$	1	H2	SC (CA-TM SLAVE)	CMD $\bar{A}_b$		CMD $\bar{A}_b$		CMD $\bar{A}_b$
CMD $\bar{A}_p$	1	G3	SC (PARITY TYPE)	CMD $\bar{A}_p$		CMD $\bar{A}_p$		CMD $\bar{A}_p$
PP $\bar{A}_p$	2	N3	RATES SLAB	PP $\bar{A}_p$		PP $\bar{A}_p$		PP $\bar{A}_p$
PP $\bar{A}_5$	1	F1	RATES SLAB	PP $\bar{A}_5$		PP $\bar{A}_5$		PP $\bar{A}_5$
CVL PARITY	1	L1	SC (CVL PARITY GEN)	CVL PARITY	IT8	CVL PARITY	IT8	CVL PARITY
CVL DATA	2	P5	SC "	CVL DATA	IT8	CVL DATA	IT8	CVL DATA
CVL DUMP	1	N1	SC "	CVL DUMP	IT8	CVL DUMP	IT8	CVL DUMP
CVL CLOCK	1	M2	SC "	CVL CLOCK	IT8	CVL CLOCK	IT8	CVL CLOCK
CVL 25	1	J1	SC "	CVL 25	IT8	CVL 25	IT8	CVL 25
GSE 32 $\bar{5}$	1	K1	NO CONNECTION	GSE 32 $\bar{5}$	NO CONN	GSE 32 $\bar{5}$	NO CONN	GSE 32 $\bar{5}$
GSE $\bar{A}$	1	G1	NO CONNECTION	GSE $\bar{A}$	NO CONN	GSE $\bar{A}$	NO CONN	GSE $\bar{A}$
GSE $\bar{A}_4$	1	D1	NO CONNECTION	GSE $\bar{A}_4$	NO CONN	GSE $\bar{A}_4$	NO CONN	GSE $\bar{A}_4$
GSE VIDEO	1	N2	NO CONNECTION	GSE VIDEO	NO CONN	GSE VIDEO	NO CONN	GSE VIDEO
XMTR VIDEO1	1	P1	SC (XMTR)	XMTR VIDEO1	IT2	XMTR VIDEO1	IT2	XMTR VIDEO1
XMTR VIDEO2	1	P2	SC (XMTR)	XMTR VIDEO2	IT2	XMTR VIDEO2	IP2	XMTR VIDEO2
+7.75a	2	P1	ENCODER CONVERTER	+7.75a	IP7	+7.75a	IP7	+7.75a
+7.75b	2	P2	"	+7.75b	IP7	+7.75b	IP7	+7.75b
-2a	2	N5	"	-2a	IP7	-2a	IP7	-2a
-2b	2	P4	"	-2b	IP7	-2b	IP7	-2b
-10a	1	A1	"	-10a	IP7	-10a	IP7	-10a
-10b	1	B1	"	-10b	IP7	-10b	IP7	-10b
GRDa	1	L2	"	GRDa	IP7	GRD a	IP7	GRD a
GRDb	1	M1	"	GRD b	IP7	GRD b	IP7	GRD b
CLB-MIC	1	L5	EXP MRA	MIC CAL	MAE	MD-CLB		
CLB-GRA	1	L8	EXP GMD	GRA CAL	GWP	GWCLB GRA		
CLB-MIN	1	C4	EXP MINN	MIN CAL				
CLB-GEF	1	F4	EXP GEF	GEF CAL				
CLB-CHI	2	P8	EXP CHI	CHI CAL 1	CHE	CHI CAL 1		
CLB-LAS	1	E1	EXP LAS	LAS CAL	LAP	LAS CAL		
$S_{1,5}$ $\bar{A}$	1	C2	SC (CA COMP)	CA-$\bar{A}$	IE2	CA-$\bar{A}$		
$S_{2,5}$ $\bar{A}$	2	N2	EXP LAS	LAS-$\bar{A}$	GNF	MAG-$\bar{A}$		
$S_{3,5}$ $\bar{A}$	1	A2	EXP UI	UI-$\bar{A}$				
$S_{4,5}$ $\bar{A}$	1	D2	EXP GEF	GEF-$\bar{A}$	LAP	LAS $\bar{A}$		
$S_{5,5}$ $\bar{A}$	1	A3	EXP IEF	IEF-$\bar{A}$				
$S_{1,1}$ 25	2	J4	EXP GEF	GBF 25				
$S_{1,1}$ 5	2	E2	EXP MAG	MAG-5				
$S_{1,1}$ B	2	D3	EXP MAG	MAG-B				
$S_{1,1}$ E	2	J2	EXP CAL	CAL-D				
$S_{1,1}$ BD	1	H3	EXP GMD	GRA-D				
$S_{2,1}$ BD	1	K2	EXP MINN	MINN-D				
$S_{3,1}$ BD	2	F8	EXP MINN	MINN-C	GNF	MAG-C		
$S_{1,1}$ C	2	E4	EXP UI	UI-B				
$S_{1,1}$ 2B	2	D5	EXP GMD	MD-B	IOE	UI-B		
$S_{2,1}$ 2B	2	A4	EXP GCR	LED-A	GCR,GME	LED-A		
$S_{1,1}$ GA	2	B5	EXP GCR	MED-A	IOE	UI-A		
$S_{2,1}$ GA	2	A3	EXP MAG	MAG-A	GNF	MAG-A		
$S_{3,1}$ GA	2	A2	EXP UI	UI-A	MAP	MIT-A		
$S_{4,1}$ GA	2	A5	EXP GMD	MD-A				
$S_{5,1}$ GA	2	B4	EXP GMD	GRA-A	GCR,GME	MED-A		
$S_{6,1}$ GA	2	L2	EXP GCR	MED-a_1	TRF	TRW-a_1		
$S_{1,4}$ a_1	2	J1	EXP GCR	LED-a_1	GCR,GME	LED-a_1		
$S_{2,4}$ a_1	2	K2	EXP MINN	MINN-a_1	IOE	UI-a_1		
$S_{3,4}$ a_1	2	J3	EXP UI	UI-a_1	GCR,GME	MED-a_1		
$S_{4,4}$ a_1	2	F4	EXP GMD	GRA-a_2	CHE	CHI-a_2		
$S_{1,2}$ a_2	2	E5	EXP IEF	IEF-a_2	IOE	UI-a_2		
$S_{2,2}$ a_2	1	K5	EXP APL	APL-a_2	GCR,GME	VLED-a_2		
$S_{1,10}$ a_3	1	J4	EXP CAL	CAL-a_3				
$S_{2,10}$ a_3	1	K4	EXP GCR	LED-a_3	GCE	RE a_3		
$S_{3,10}$ a_3	1	H5	EXP GCR	VLED-a_3	IE12	GTE-a_3		
$S_{4,10}$ a_3	1	F5	EXP GCR	MED-a_3				
$S_{5,10}$ a_3	1	H4	EXP RE	RE-a_3				
$S_{6,10}$ a_3	1	E5	EXP GEF	GEF-a_3	GWP	GWP-a_3		
$S_{7,10}$ a_3	1	G4	EXP GMD	GRA-a_3	IOE	UI a_3		
$S_{8,10}$ a_3	1	G5	EXP MINN	MINN-a_3	IF10	SOL-a_3		
$S_{9,10}$ a_3	1	E4	EXP UI	UI-a_3				
$S_{10,10}$ a_3	1	K4	EXP GCR	LED-a_4	APP	APL a_4		
$S_{1,7}$ a_4	2	K4	EXP GCR	VLED-a_4				
$S_{2,7}$ a_4	2	J5	EXP GCR	RE-a_4	IE12	GTE-a_4		
$S_{3,7}$ a_4	2	L5	EXP RE	GBF-a_4	GCE	RE-a_4		
$S_{4,7}$ a_4	2	L4	EXP GEF	GRA-a_4	GWP	GWP-a_4		
$S_{5,7}$ a_4	2	G5	EXP GMD	APL-a_4	ICE	UI-a_4		
$S_{6,7}$ a_4	2	H5	EXP APL	UI-a_4	IE2	OA-a_4		
$S_{7,7}$ a_4	2	H4	EXP UI	APL-a_5	APP	APL-a_5		
$S_{1,9}$ a_5	1	D4	EXP APL	CAL-a_5	IE12	GTE-a_5		
$S_{2,9}$ a_5	1	B5	EXP CAL	GHI-a_5	GWP	GWP-a_5		
$S_{3,9}$ a_5	1	C5	EXP CHI	LED-a_5	GCR,GME	VLED-a_5		
$S_{4,9}$ a_5	2	D4	EXP GCR	VLED-a_5	GCE	RE-a_5		
$S_{5,9}$ a_5	2	W4	EXP GCR	LAS-a_5	CAI	CI-a_5		
$S_{6,9}$ a_5	2	E5	EXP LAS	RE-a_5	GCR,GME	LED-a_5		
$S_{7,9}$ a_5	2	N4	EXP RE	UI-a_5	IOE	UI-a_5		
$S_{8,9}$ a_5	2	K5	EXP UI	CHE-a_5	CHE	CHI-a_5		



SATELLITE CLOCK

BIT *	FUNCTION *	READ OUT
1 - $\bar{A}$	"1" = 400 BPS, "0" = 1600 BPS	CH 2 - FRO & B
2 - $\bar{A}$	SEQ RATE	
3 - $\bar{a}_1$	2 SEQ RATE	
4 - $\bar{a}_{2.5}$	SNAP SHOT RATE	
5 - $\bar{a}_{5}$	2 SNAP SHOT RATE	
6 - $\bar{a}_{4}$	PAGE RATE	
7 - $\bar{a}_{8}$	2 PAGE RATE	
8 - $\bar{a}_{6}$	ALBUM RATE	
9 - $\bar{c}_{25}$	2.73 MIN	CH 3 - FRO
10 - $\bar{c}_{26}$	5.46 MIN	
11 - $\bar{c}_{27}$	10.9 MIN	
12 - $\bar{c}_{28}$	21.8 MIN	
13 - $\bar{c}_{29}$	43.7 MIN	
14 - $\bar{c}_{30}$	1.47 HR	
15 - $\bar{c}_{31}$	2.91 HR	
16 - $\bar{c}_{32}$	5.83 HR	
17 - $\bar{c}_{33}$	11.7 HR	CH 3 - FR 8
18 - $\bar{c}_{34}$	23.3 HR	
19 - $\bar{c}_{35}$	46.6 HR	
20 - $\bar{c}_{36}$	93.2 HR	
21 - $\bar{c}_{37}$	7.77 DAY	
22 - $\bar{c}_{38}$	15.5 DAY	
23 - $\bar{c}_{39}$	31.1 DAY	
24 - $\bar{c}_{40}$	62.2 DAY	

* NOTE: DUE TO TYPE LOGIC USED $\bar{A}$ THRU $\bar{c}_{40}$ IS TELEMETERED, THUS THE CLOCK WILL APPEAR TO COUNT BACKWARDS UNLESS THE INDIVIDUAL BITS ARE COMPLIMENTED IN THE DECOM PROGRAM. ($\bar{A}$ IS NOT INVERTED)