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Digital Dev. Memo #294

To: Distribution
From: Donald Bowler
Date: 21 January 1966
Subj: Hand Controller Multiple Use Proposal

There are several changes being proposed for Channel 31. The best way to describe this is to rewrite page 8 of D.D. Memo #254 Rev. 1 by Albert Hopkins.

Channel 31 - Inbits, Translation and Rotation

IMPORTANT - All of the input signals in Channels 30-33 are inverted.

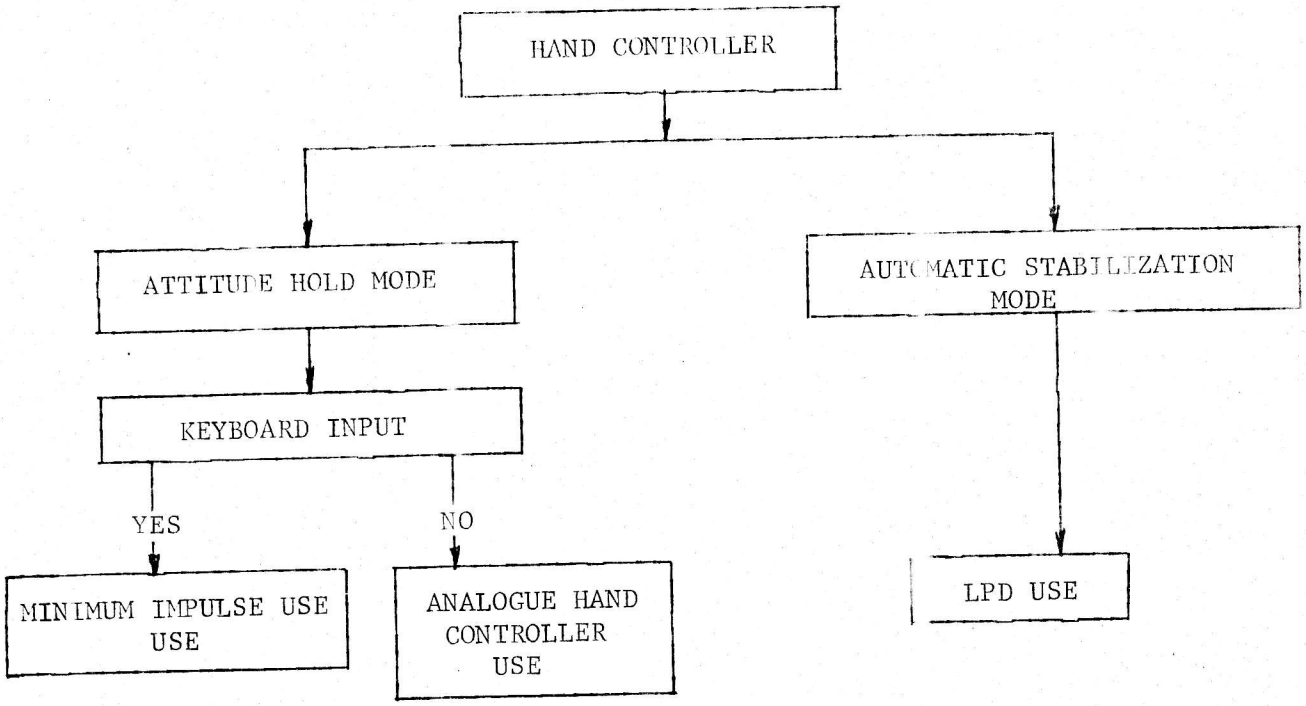
BIT	C/M	LEM	TRAP	RUPT
1	+ PITCH MAN ROT	+ EL (LPD), + PMI	31A	10
2	- PITCH MAN ROT	- EL (LPD), - PMI	31A	10
3	+ YAW MAN ROT	- , + YMI	31A	10
4	- YAW MAN ROT	- , - YMI	31A	10
5	+ ROLL MAN ROT	+ AZ (LPD), + RMI	31A	10
6	- ROLL MAN ROT	- AZ (LPD), - RMI	31A	10
7	+ X TRANS	* (same as C/M)	31B	10
8	- X TRANS	*	31B	10
9	+ Y TRANS	*	31B	10
10	- Y TRANS	*	31B	10
11	+ Z TRANS	*	31B	10
12	- Z TRANS	*	31B	10
13	HOLD FUNCTION	ATTITUDE HOLD		
14	FREE FUNCTION	AUTO STABILIZATION		
15/16	G/C AUTO PILOT CONTROL	ATTITUDE CONTROL OUT OF DETENT		

(LPD) Stands for Landing Point Designator;

PMI Stands for Minimum Impulse about the Pitch Axis.

Auto throttle will be moved to Channel 30 Bit 5 and G/N control of spacecraft will be put in Channel 30 Bit 10 LEM only.

It is being proposed that the hand controller in the LEM have three functions. A flow diagram best describes this.



Physically on each axis of the hand controller there are two sets of switches and a resolver (analogue input). The first set of switches are "ORed" to give the attitude control out of detent signal (proposed Channel 31 bit 15). This input used to cause an interrupt but will now be detected by sampling if the input angle is large enough to close the second set of contacts one will still get an interrupt).

The second set of contacts will go into one of the corresponding bit positions 1-6 of Channel 30 and these will cause interrupt 10.

These contacts will be used in the LPD mode and the minimum impulse mode. Trap 31A is reset by outbit Channel 31 bit 12.

There are 5-12 millisecond delays between contact closures and openings appearing at the inbits due to the filtering on the "D" networks and this plus the astronauts ability to move the stick make for an interesting programming problem.

It is hoped that anyone getting this note and seeing possible problems in making these changes will get their inputs into D. Hoag, E.C. Hall or P. Felleman.

Physically these changes will be accomplished by modifying the cable harnesses.

Dist.

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