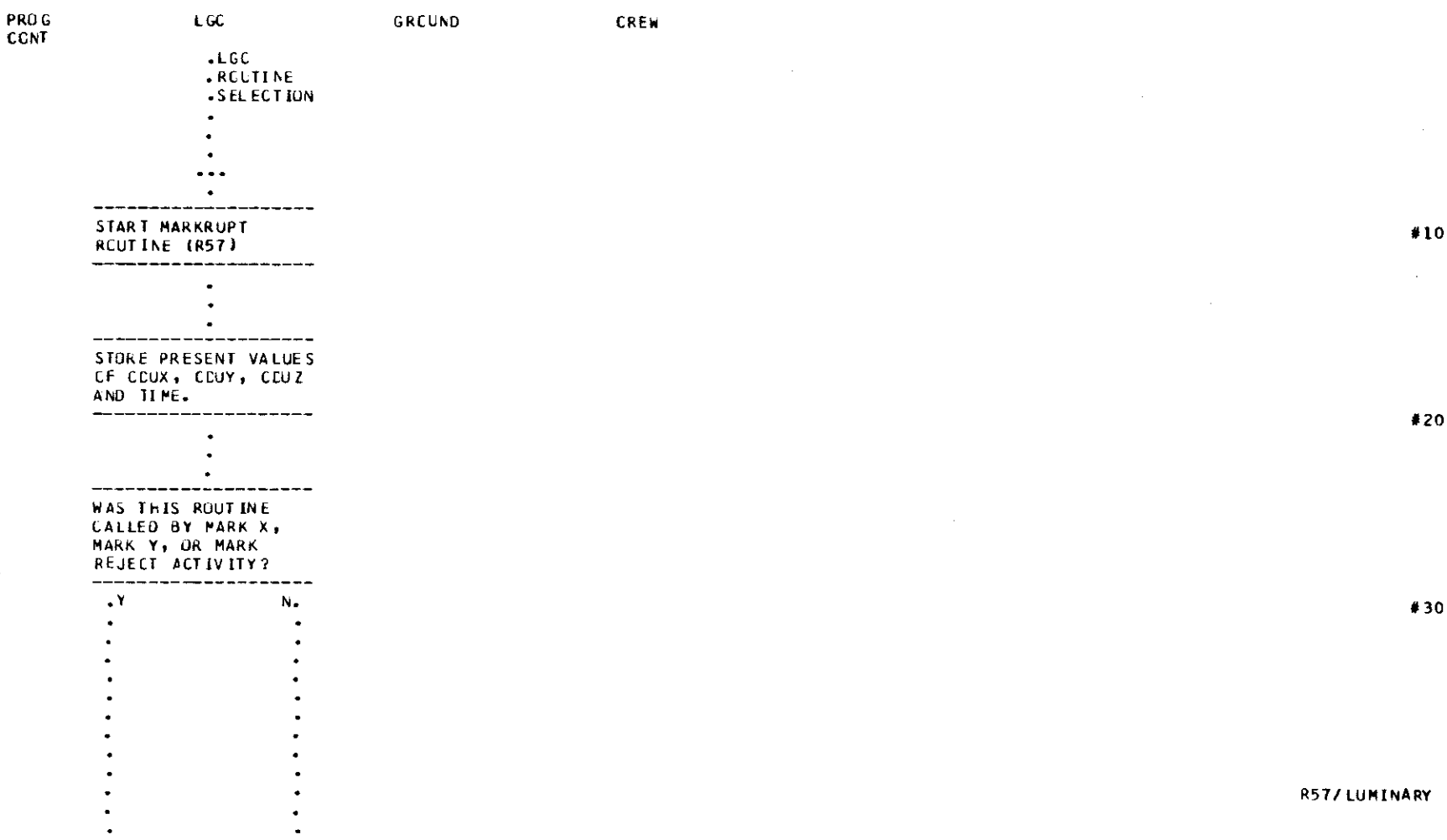
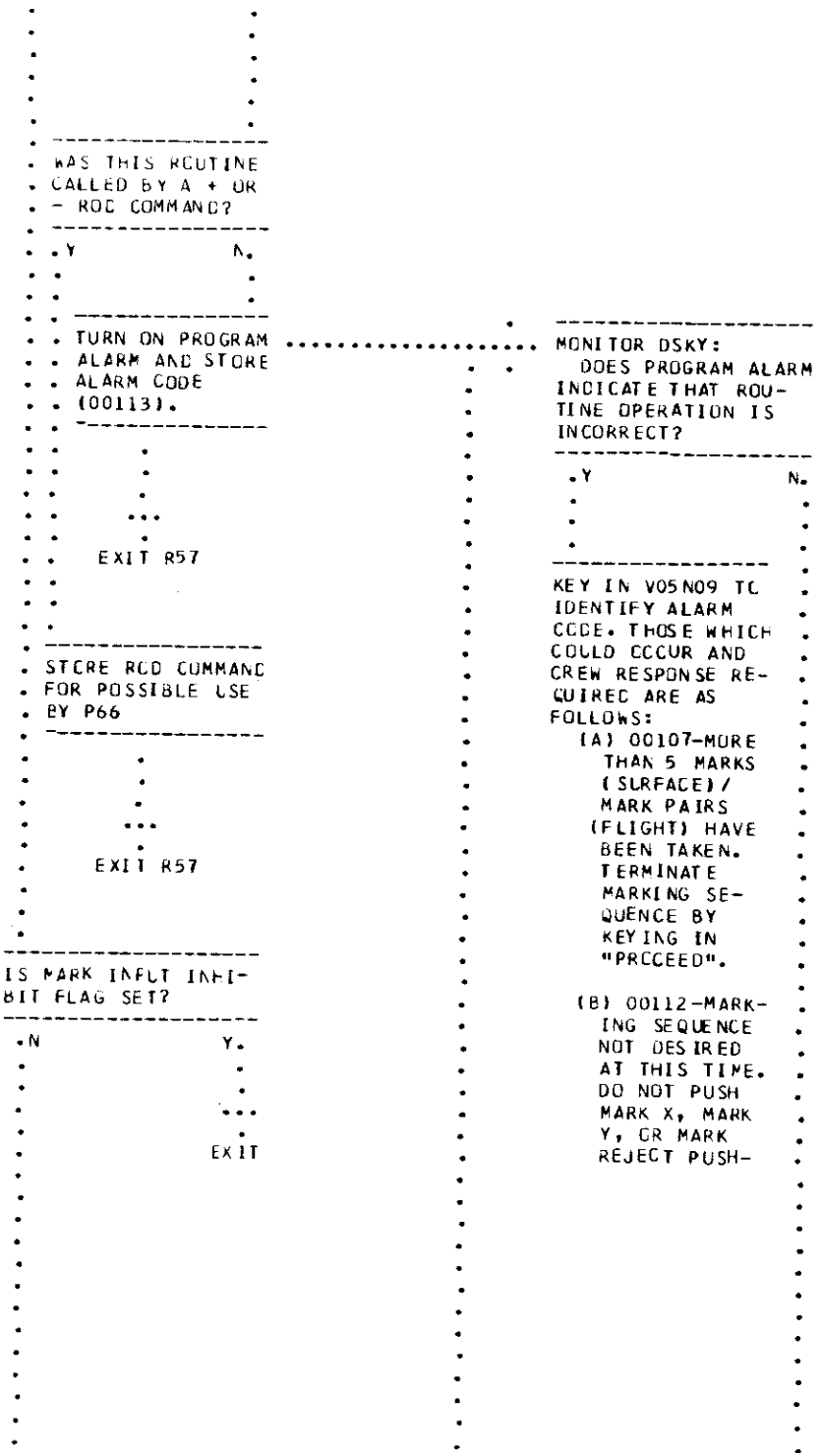
MARKRUPT ROUTINE (R57) REV 03 12/03/69

(1) TO ACCEPT AND PROCESS CREW INPUTS (MARK X, MARK Y, AND MARK REJECT) ASSOCIATED WITH THE ALIGNMENT MARKING PROCESS.

(2) TO ACCEPT AND STORE CREW INPUTS (PLUS AND MINUS ROD COMMANDS) ASSOCIATED WITH THE RATE OF DESCENT PHASE (P66) OF THE LUNAR LANDING.

ASSUMPTIONS: (1) THIS ROUTINE IS AUTOMATICALLY CALLED WHENEVER THE MARK X PUSHBUTTON, MARK Y PUSHBUTTON, MARK REJECT PUSHBUTTON, OR THE DES RATE (+ OR -) SWITCH ARE USED BY THE CREW, EITHER IN FLIGHT OR ON THE LUNAR SURFACE.



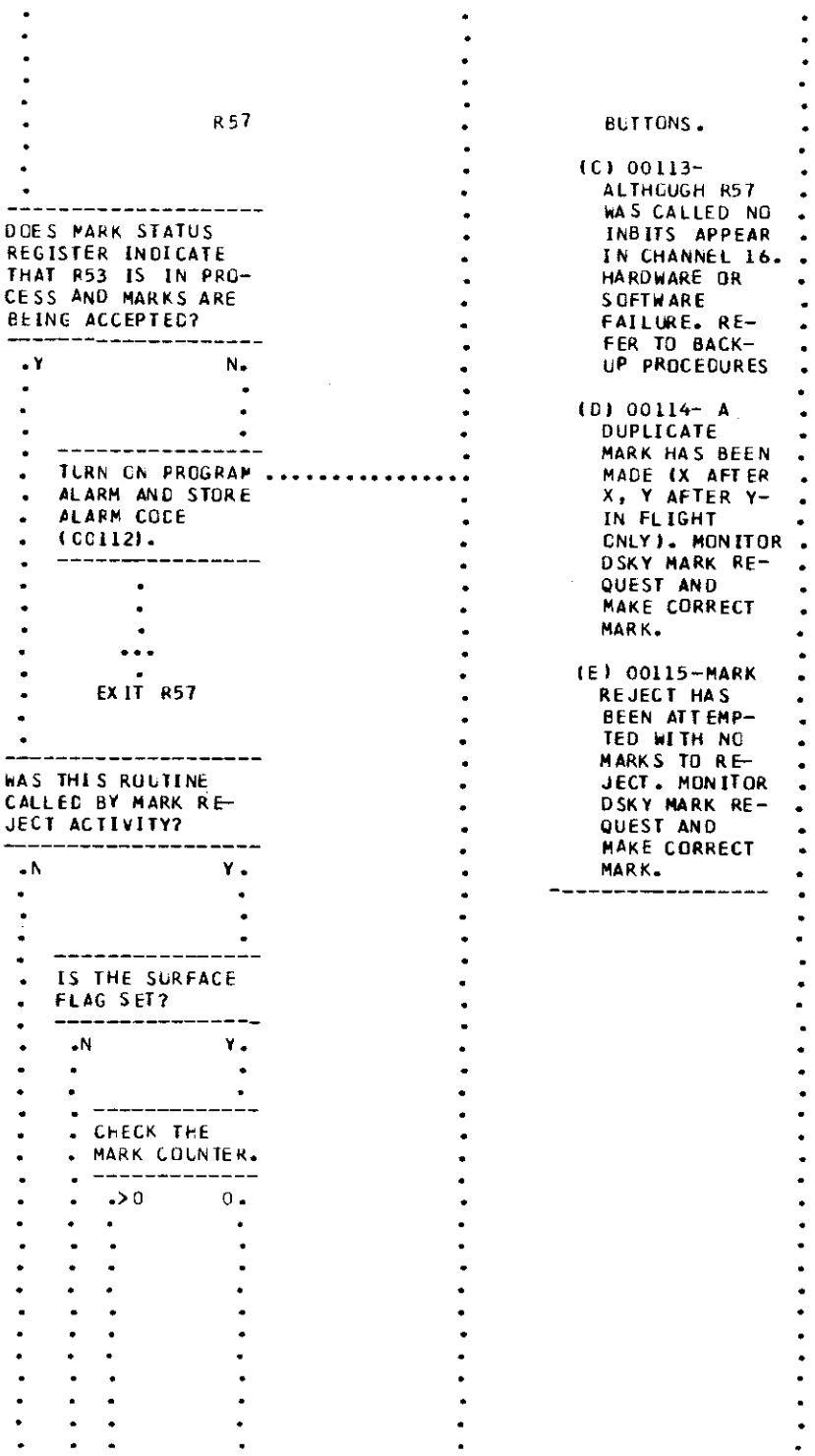

WAS THIS ROUTINE CALLED BY A + OR - ROC COMMAND?
Y
N.
TURN ON PROGRAM ALARM AND STORE ALARM CODE (00113).
EXIT R57
STORE ROD COMMAND FOR POSSIBLE USE BY P66
EXIT R57
IS MARK INPUT INHIBIT FLAG SET?
N
Y.
EXIT
MONITOR DSKY:
DOES PROGRAM ALARM INDICATE THAT ROUTINE OPERATION IS INCORRECT?
Y
N.
KEY IN V05N09 TO IDENTIFY ALARM CODE. THOSE WHICH COULD OCCUR AND CREW RESPONSE REQUIRED ARE AS FOLLOWS:
(A) 00107-MORE THAN 5 MARKS (SURFACE)/MARK PAIRS (FLIGHT) HAVE BEEN TAKEN. TERMINATE MARKING SEQUENCE BY KEYING IN "PROCEED".
(B) 00112-MARKING SEQUENCE NOT DESIRED AT THIS TIME. DO NOT PUSH MARK X, MARK Y, OR MARK REJECT PUSH-

#40

#50

#60

#70



BUTTONS.

(C) 00113- ALTHOUGH R57 WAS CALLED NO INBITS APPEAR IN CHANNEL 16. HARDWARE OR SOFTWARE FAILURE. REFER TO BACK-UP PROCEDURES

(D) 00114- A DUPLICATE MARK HAS BEEN MADE (X AFTER X, Y AFTER Y- IN FLIGHT ONLY). MONITOR DSKY MARK REQUEST AND MAKE CORRECT MARK.

(E) 00115-MARK REJECT HAS BEEN ATTEMPTED WITH NO MARKS TO REJECT. MONITOR DSKY MARK REQUEST AND MAKE CORRECT MARK.

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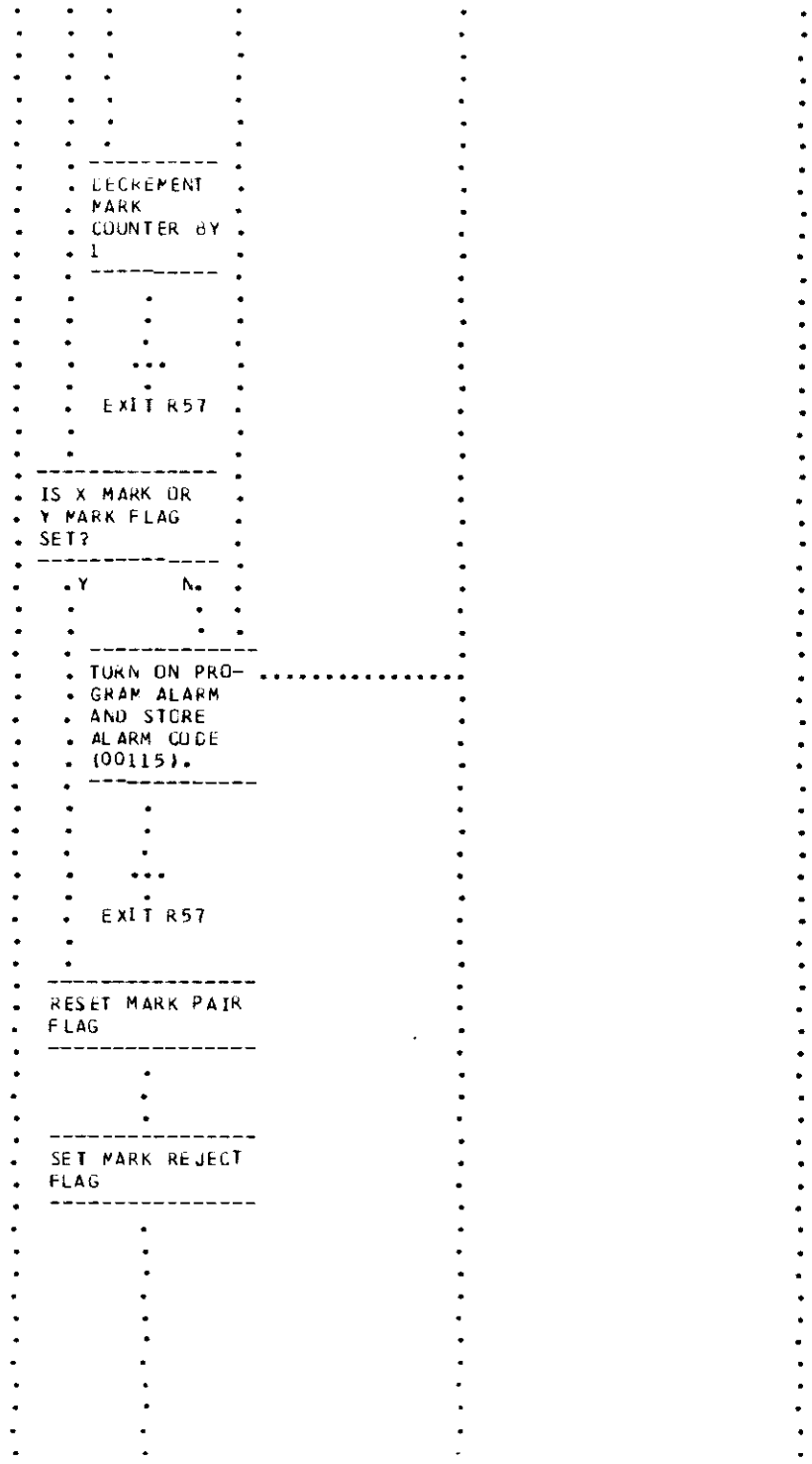

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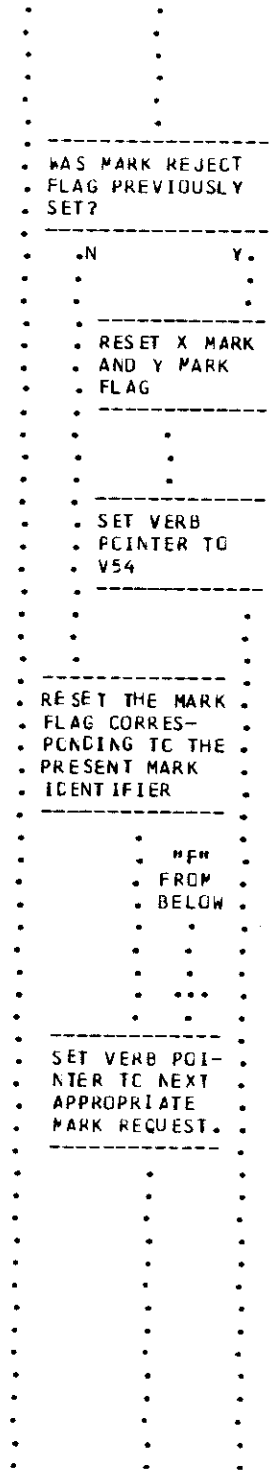

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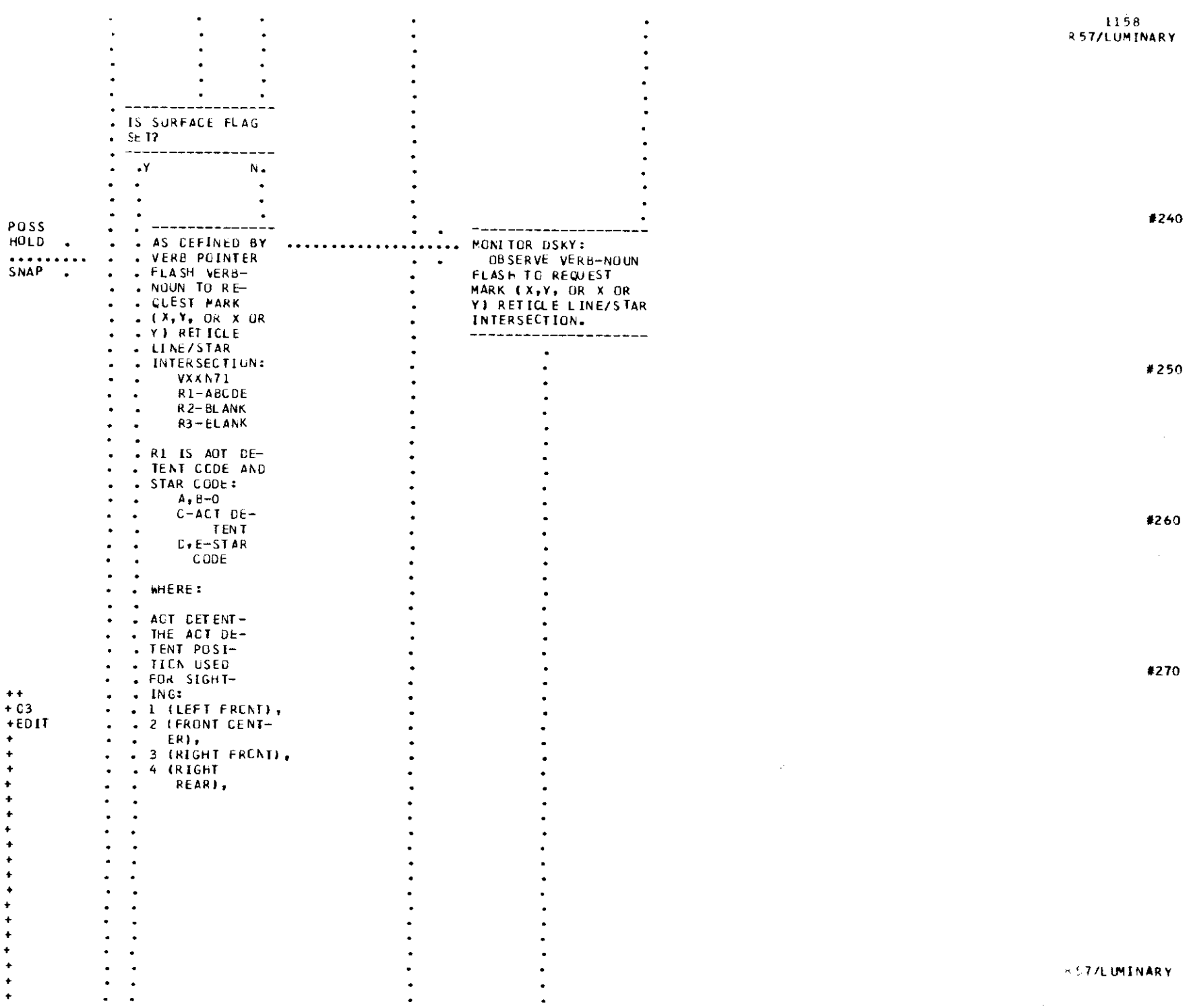

IS SURFACE FLAG SET?
Y
N
AS DEFINED BY VERB POINTER FLASH VERB-NOUN TO REQUEST MARK (X,Y, OR X OR Y) RETICLE LINE/STAR INTERSECTION:
VXXN71
R1-ABCDE
R2-BLANK
R3-BLANK
R1 IS ACT DETENT CODE AND STAR CODE:
A,B-0
C-ACT DETENT
D,E-STAR CODE
WHERE:
ACT DETENT-THE ACT DETENT POSITION USED FOR SIGHTING:
1 (LEFT FRONT),
2 (FRONT CENTER),
3 (RIGHT FRONT),
4 (RIGHT REAR),
MONITOR DSKY:
OBSERVE VERB-NOUN FLASH TO REQUEST MARK (X,Y, OR X OR Y) RETICLE LINE/STAR INTERSECTION.
POSS HOLD
SNAP
#240
#250
#260
#270

967

5 (REAR CENTER),
6 (LEFT REAR),
7 (A BACKUP OPTICAL SYSTEM WILL BE USED).

STAR CODE- THE DESIGNATION OF THE CELESTIAL BODY TO BE USED. ALL DESIGNATIONS IN OCTAL:
00-PLANET
01/45-STAR (FROM STAR CODE LIST)
46-SUN
47-EARTH
50-MOON

WAIT FOR KEYBOARD ENTRY

TERMINATE FLASH UPON RECEIPT OF PROCEED, ENTER, OR TERMINATE

PROCEED

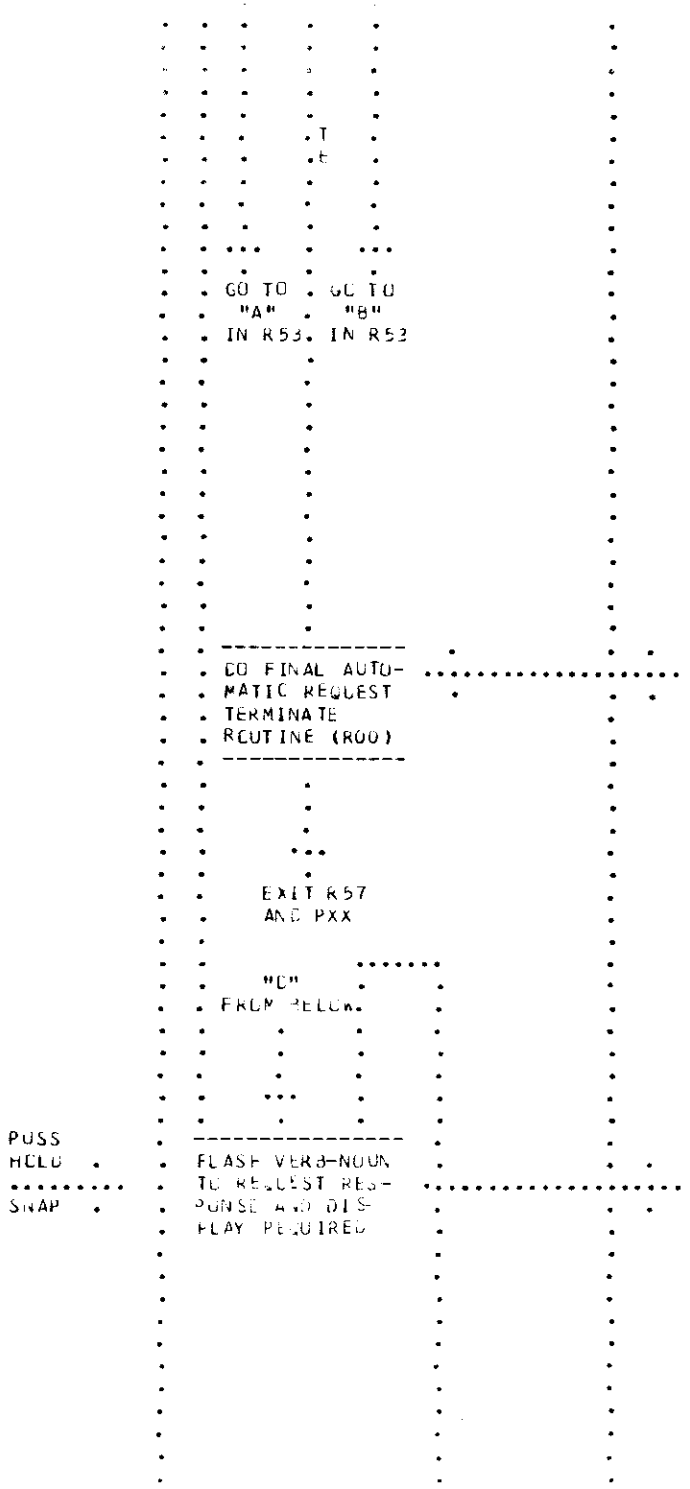
COMPLETE SIGHTING MARK PROCEDURE (REFER AOT MARK ROUTINE (R53) ALSO) ADHERING TO THE FOLLOWING PRINCIPLES:

(A) INFLIGHT

(1) ADJUST AOT RETICLE TO ZERO BEFORE PERFORMING MARKS.

(2) A MARK IS MADE WHEN THE TARGET BODY

#280
#290
#300
#310
#320



CROSSES THE X OR Y RETICLE LINE BY PRESSING THE APPROPRIATE MARK BUTTON.

(3) MARKS MUST BE MADE IN X AND Y PAIRS.

(4) SEQUENCE OF MARKS IN EACH PAIR (X,Y OR Y,X) IS IRRELEVANT.

(5) MARK REJECTS MAY BE MADE TO THE DEPTH OF ONE PAIR OR PARTIAL PAIR.

(6) THE LGC WILL PROCESS UP TO AND INCLUDING 5 MARK PAIRS FOR EACH CELESTIAL BODY. THE LGC WILL AVERAGE ALL OF THE LOS TO DEFINE A FINAL LOS.

(7) AFTER EACH PAIR THE CREW MAY; TERMINATE THE MARKING (KEY IN "PROCEED"): CONTINUE MARKING ON THE SAME CELESTIAL BODY IF LESS THAN 5 PAIRS ARE ALREADY STORED IN THE LGC (USE APPROPRIATE MARK BUTTONS); OR THROW AWAY ALL DATA ON PRESENT CELESTIAL BODY, SELECT A NEW BODY AND CONTINUE MARKING (KEY IN

#330

#340

#350

#360

#370

CURSOR AND SPIRAL ANGLES AND POSITION CODE:
V06N79
R1-CURSOR ANGLE
R2-SPIRAL ANGLE
R3-POSITION CODE

CURSOR ANGLE - THE ANGLE DISPLAYED ON THE ACT READOUT COUNTER WHEN THE TARGET IS BRACKETED BY THE CURSOR. IN DEGREES TO NEAREST .01 DEGREE.

SPIRAL ANGLE - THE ANGLE DISPLAYED ON THE ACT READOUT COUNTER WHEN THE TARGET IS BRACKETED BY THE SPIRAL. IN DEGREES TO NEAREST .01 DEGREE

POSITION CODE - THE AOT POSITION TO BE USED FOR THE SIGHTING. 1, 2, 3 = FORWARD POSITIONS; 4,5 6 = REAR POSITIONS

.
.
.

WAIT FOR KEYBOARD ENTRY

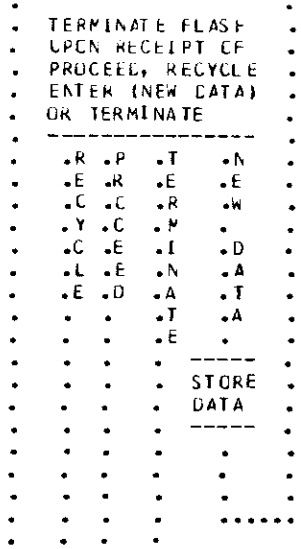
"ENTER", DEFINE NEW BODY AND CONTINUE MARKING)

(8) IN ADDITION TO THOSE PROGRAM ALARMS WHICH MAY OCCUR IN R57 A PROGRAM ALARM MAY OCCUR IN THE FOLLOWING CASE (KEY IN V05N09 TO IDENTIFY): A "PROCEED" WHEN NO COMPLETE PAIR OF MARKS IS STORED IN THE LGC (CODE 00111). #380 #390

(8) SURFACE

(1) MARKS ARE MADE SINGLY BY PUSHING EITHER THE MARK X OR MARK Y PUSHBUTTON AND LOADING THE APPROPRIATE CURSOR AND SPIRAL ANGLES FOR THAT MARK ACTION (THE TARGET BODY SHOULD BE BRACKETED BY THE CURSOR/SPIRAL). #400 #410

THE LGC WILL NOT CONSIDER A MARK TO HAVE BEEN MADE UNTIL BOTH OF THE ABOVE STEPS HAVE BEEN PERFORMED. THEREFORE IT IS NOT NECESSARY TO REJECT A MARK FOR WHICH CURSOR AND SPIRAL ANGLE INFORMATION HAVE NOT BEEN LOADED. ANOTHER MARK AC- #420



TION WILL "WRITE OVER" THE PREVIOUS ONE.

(2) A MARK REJECT WILL REJECT A MARK AND ITS ASSOCIATED CURSOR AND SPIRAL ANGLES TO ANY DEPTH AS LONG AS ANY MARKS REMAIN. (MARK COUNTER >0). #430

(3) OPTIMALLY A MARK SHOULD BE MADE BETWEEN ITS CURSOR AND SPIRAL ANGLE RECORDING WHICH REQUIRES THAT THE FIRST ANGLE BE WRITTEN DOWN OR REMEMBERED. (DSKY WILL NOT REQUEST CURSOR AND SPIRAL INFORMATION UNTIL A MARK PUSHBUTTON ACTION IS MADE.) IN THAT THE SPIRAL READING IS CONSIDERED MORE DIFFICULT, IT SHOULD BE MADE FIRST (THEN THE MARK, THEN CURSOR READING). #440 #450 #460

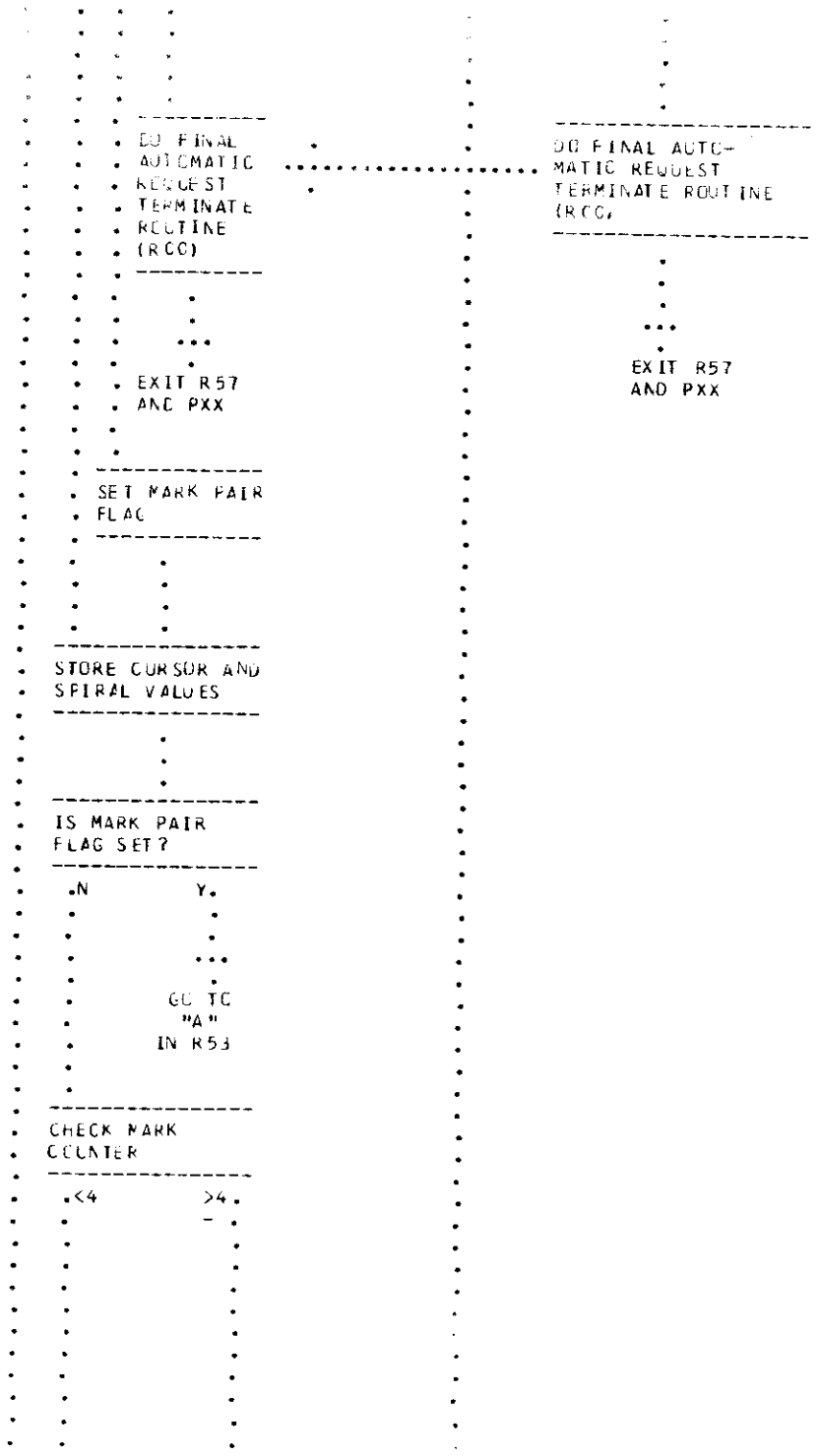
(4) THE LGC WILL PROCESS UP TO AND INCLUDING 5 MARKS FOR EACH CELESTIAL BODY. THE LGC WILL AVERAGE ALL OF THE LOS TO DEFINE A FINAL LOS. #470

(5) AFTER EACH MARK (AS DEFINED IN (B)(1) ABOVE) THE CREW MAY; TERMINATE THE MARKING (KEY IN "PROCEED"); CONTINUE MARKING ON THE SAME CELESTIAL BODY (IF LESS THAN 5 MARKS ARE ALREADY STORED IN THE LGC); OR THROW AWAY ALL DATA ON PRESENT CELESTIAL BODY, SELECT A NEW BODY, AND CONTINUE MARKING (KEY IN "ENTER", DEFINE NEW BODY, AND CONTINUE MARKING). #480 #490

(C) INFLIGHT OR SURFACE

(1) THIS ROUTINE AND THE PRESENT ALIGNMENT PROGRAM MAY BE TERMINATED AT ANY TIME BY KEYING IN TERMINATE (V34E). #500

.TERMINATE #510



#520

#530

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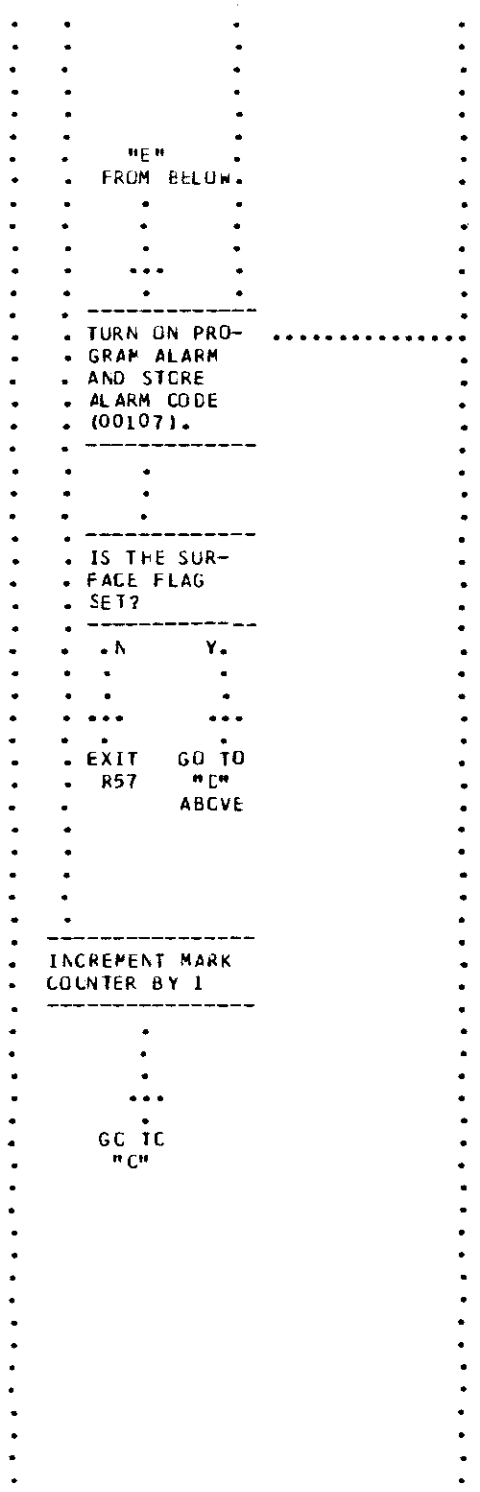
#560

++
+03
+EDIT
++

973



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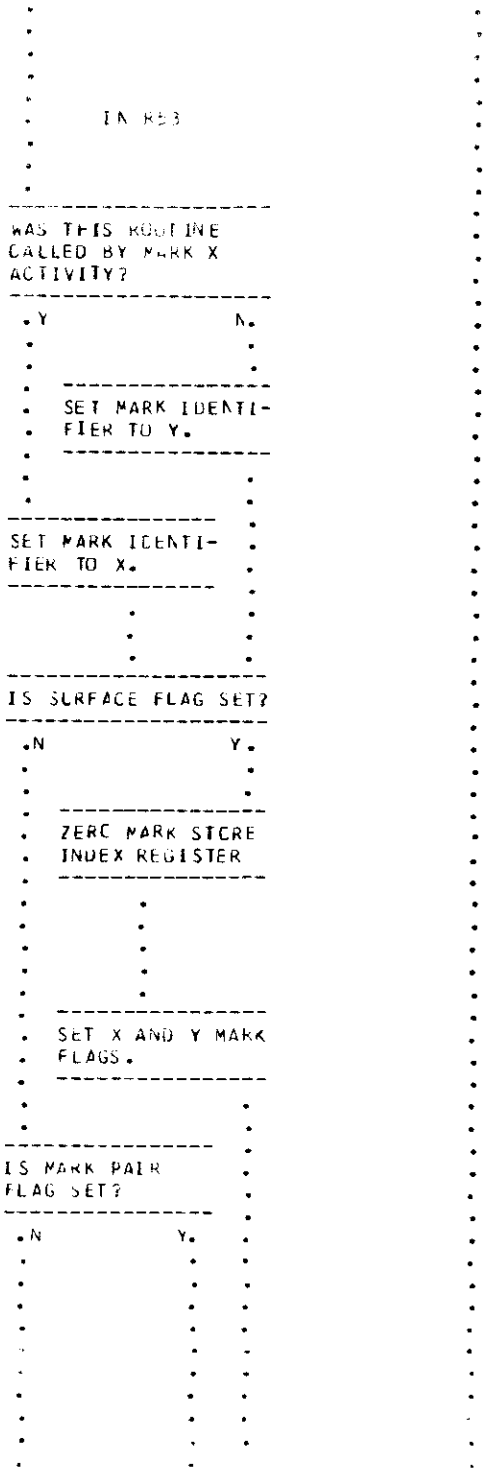

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+EDIT
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#660

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+03
+EDIT
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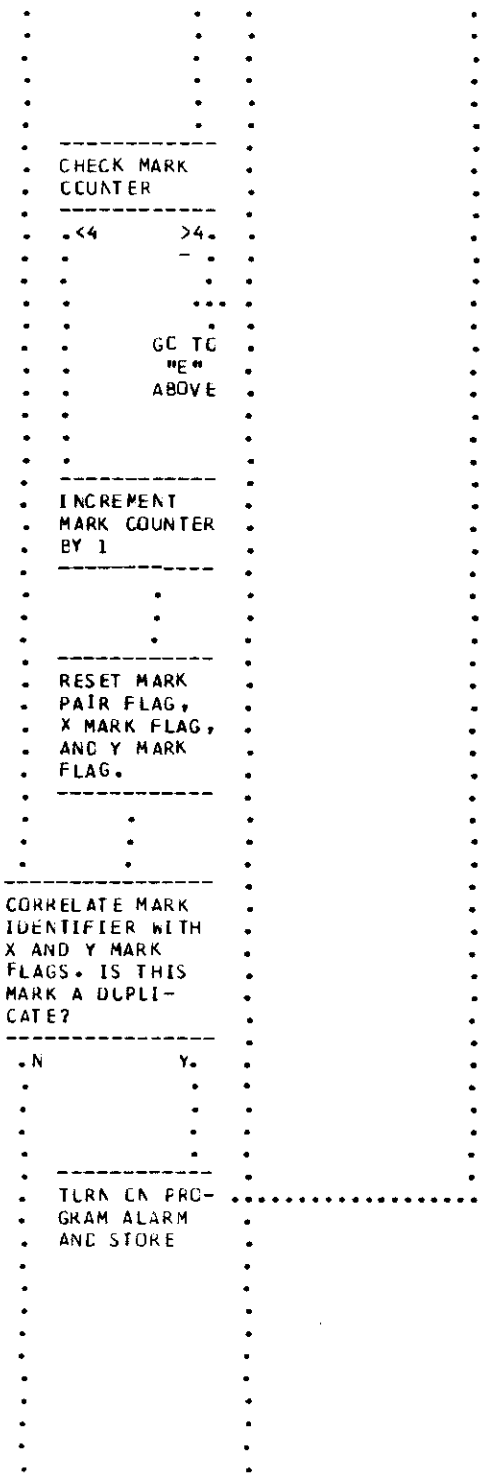

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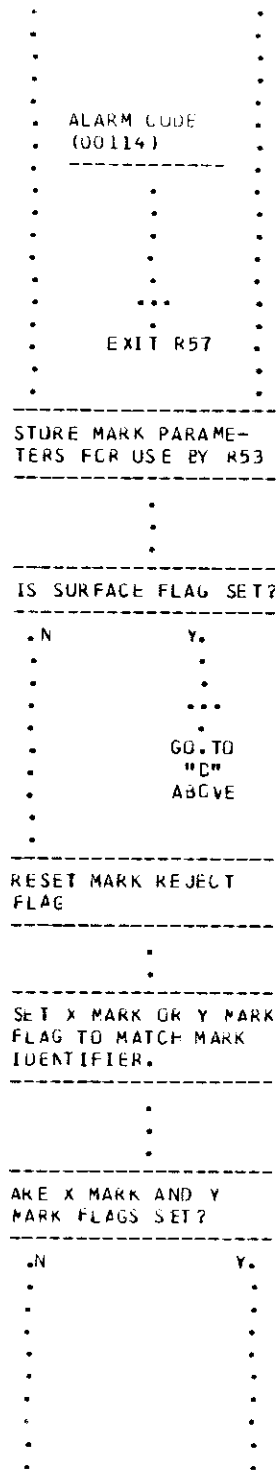

#720

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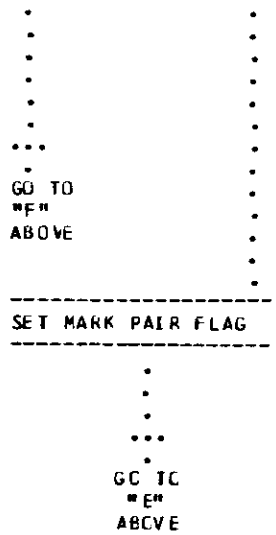

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CHANGE CONTROL NOTES

REV 01 EDITORIAL
REV 02 (LUM 1A) PCR 659, EDITORIAL
REV 03 EDITORIAL

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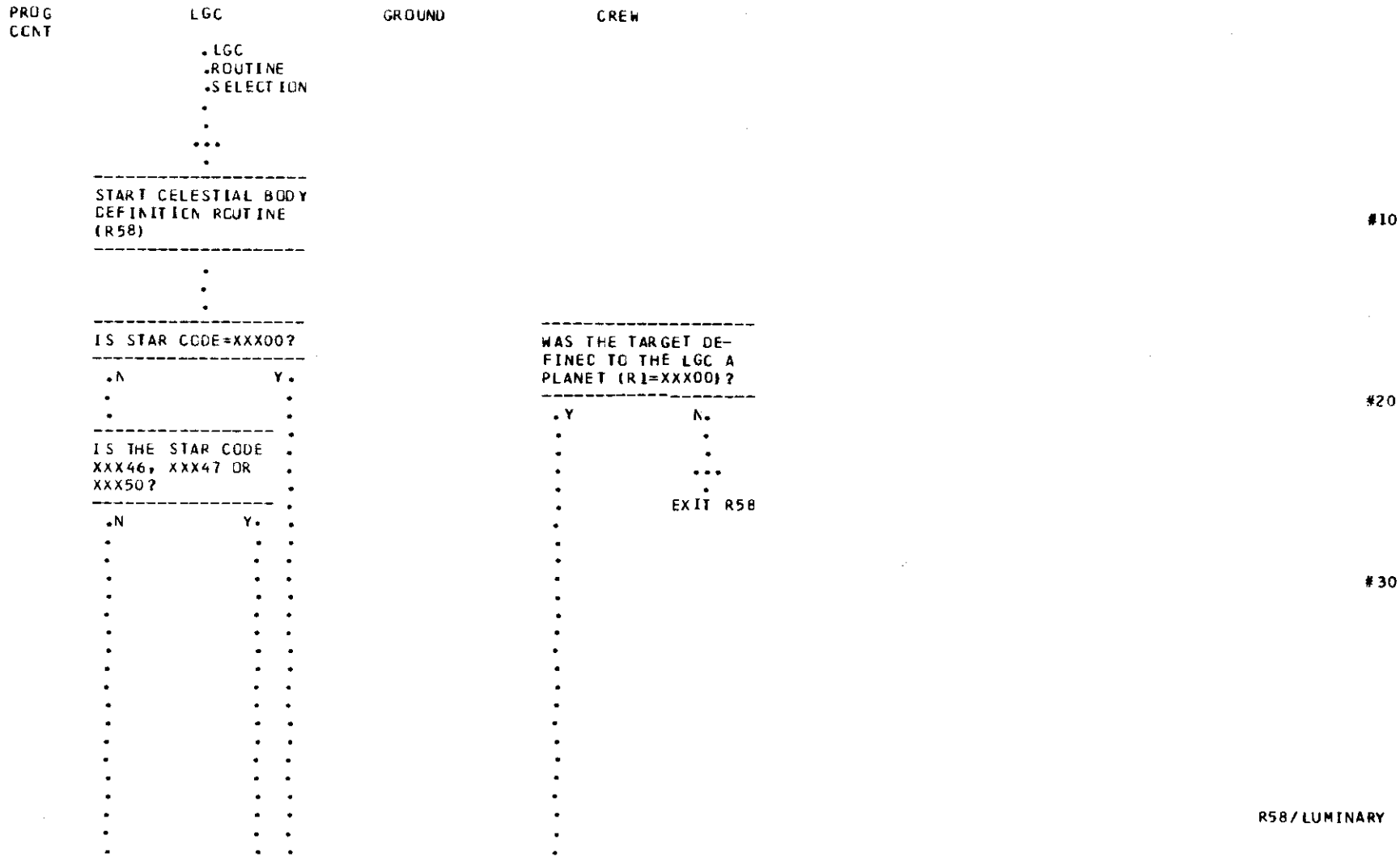
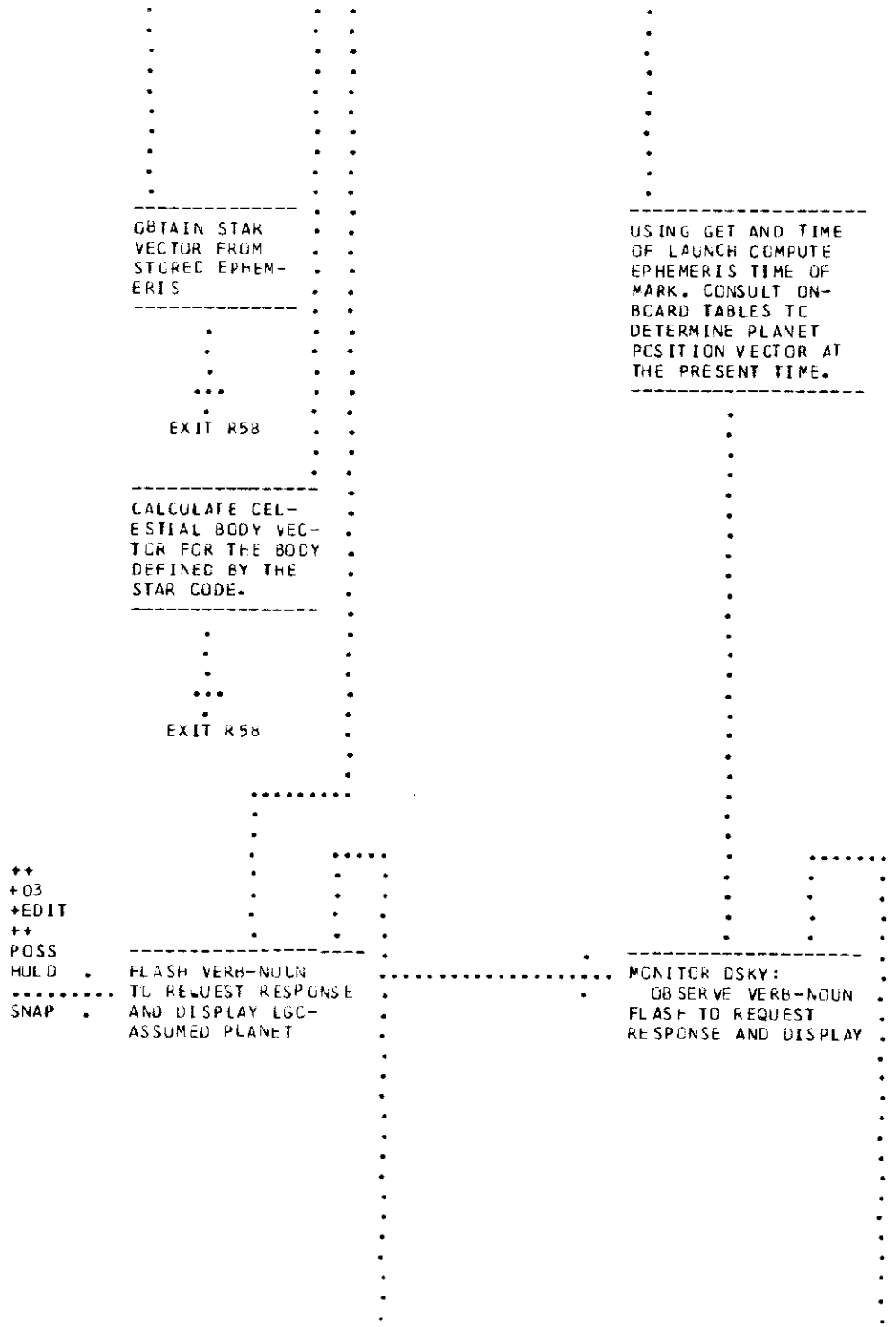
917

CELESTIAL BODY DEFINITION ROUTINE (R58) REV 03 12/03/69

PURPOSE: (1) TO OBTAIN THE CORRECT CELESTIAL BODY VECTOR FROM INFORMATION SPECIFIED BY THE CREW DURING IMU ALIGNMENTS.

ASSUMPTION: (1) THIS ROUTINE IS AUTOMATICALLY CALLED BY P51, P57, R51 AND R52.




OBTAIN STAR VECTOR FROM STORED EPHEM-ERIS
EXIT R58
CALCULATE CEL-ESTIAL BODY VEC-TOR FOR THE BODY DEFINED BY THE STAR CODE.
EXIT R58
++
+03
+EDIT
++
POSS
HOLD
SNAP
FLASH VERB-NOUN TO REQUEST RESPONSE AND DISPLAY LGC-ASSUMED PLANET
USING GET AND TIME OF LAUNCH COMPUTE EPHEMERIS TIME OF MARK. CONSULT ON-BOARD TABLES TO DETERMINE PLANET POSITION VECTOR AT THE PRESENT TIME.
MONITOR DSKY:
OBSERVE VERB-NOUN FLASH TO REQUEST RESPONSE AND DISPLAY

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#60

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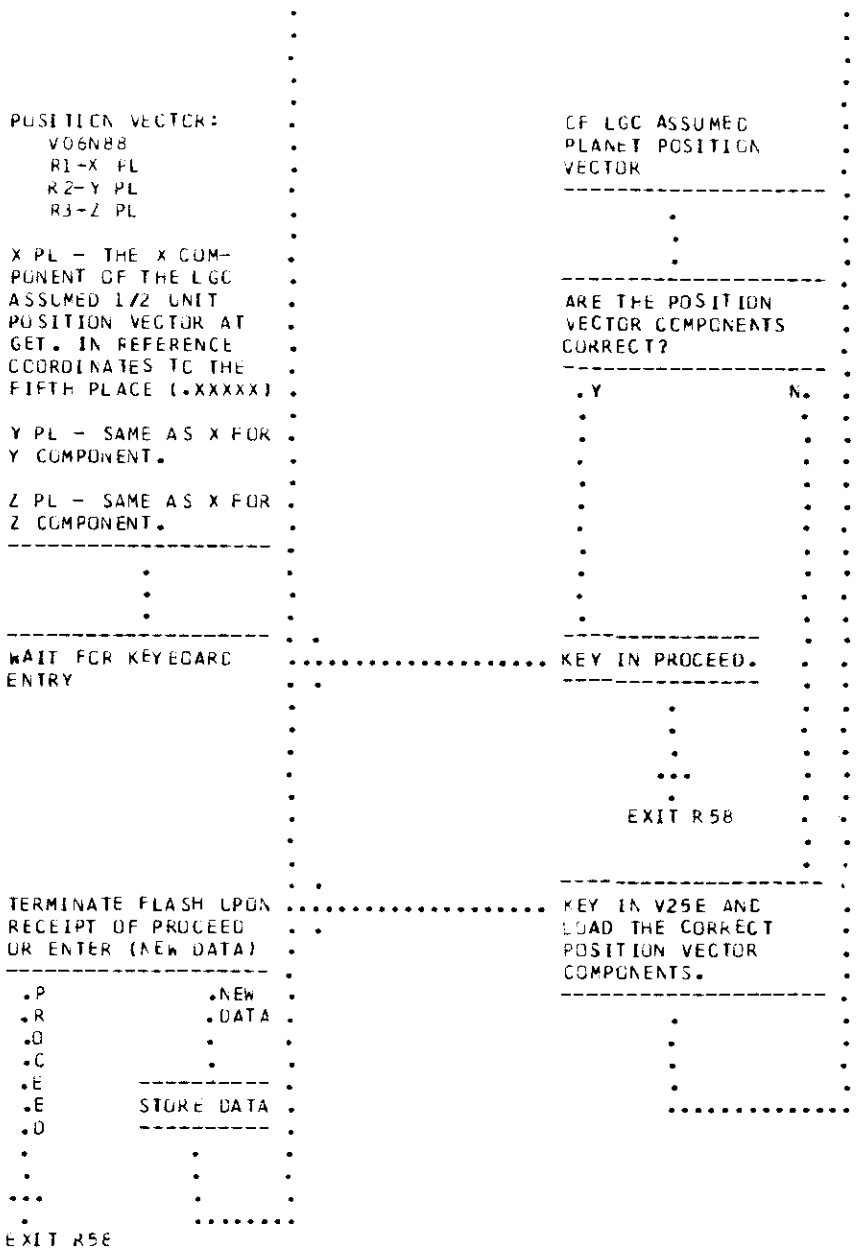

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CHANGE CONTROL NOTES

REV 01 EDITORIAL
REV 02 EDITORIAL
REV 03 EDITORIAL

LUNAR SURFACE SIGHTING MARK ROUTINE (R59) REV 02 12/03/69

PURPOSE: (1) WHILE ON THE LUNAR SURFACE, TO PERFORM AOT SIGHTINGS ON A CELESTIAL BODY (NAVIGATION STAR, PLANET, OR THE SUN) FOR USE BY THE LUNAR SURFACE ALIGN PROGRAM (P57).

ASSUMPTIONS: (1) THIS ROUTINE IS ONLY USED ON THE LUNAR SURFACE.

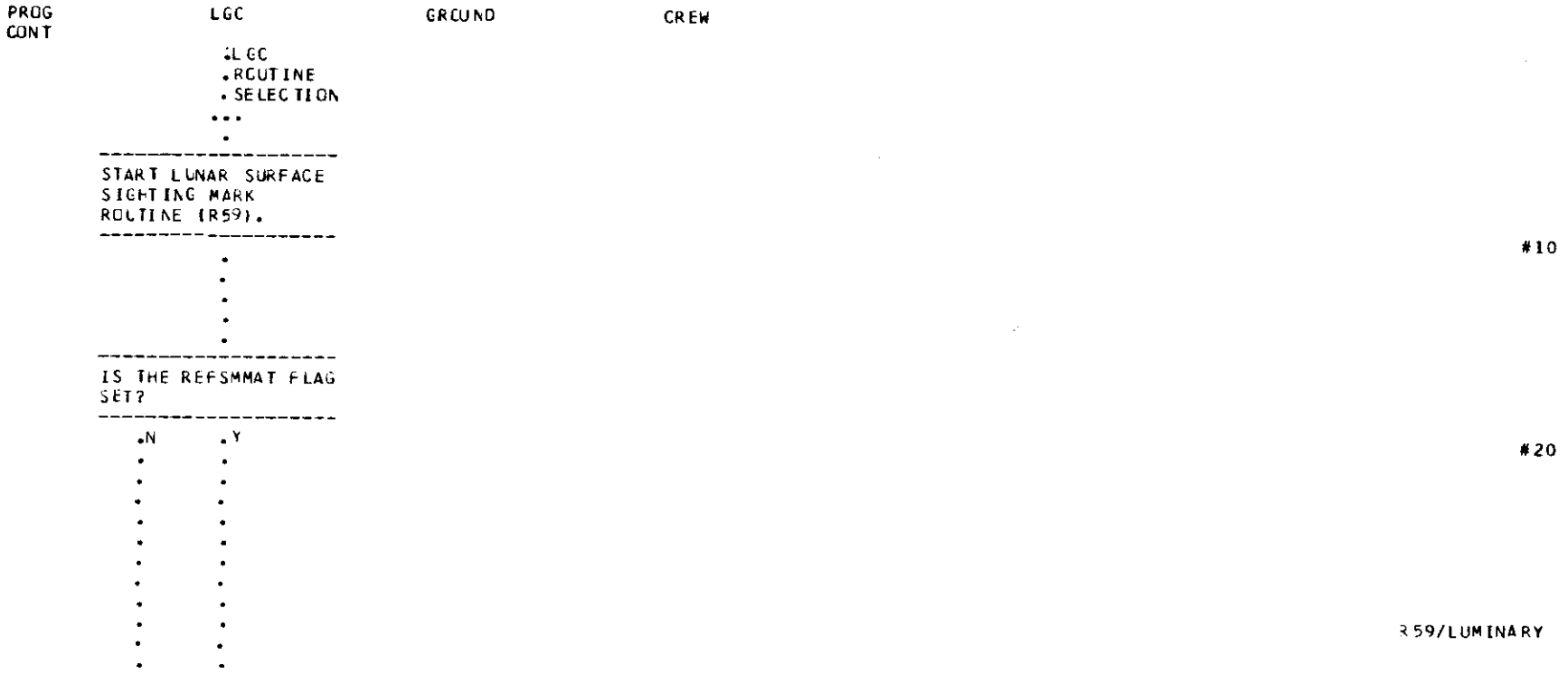
(2) NAVIGATION STARS MAY OR MAY NOT BE VISIBLE. THE SUN OR A PLANET MAY OR MAY NOT BE VISIBLE. ALTHOUGH VISIBLE, THE CELESTIAL BODY MAY BE AT TOO HIGH AN ELEVATION TO BE EFFECTIVE FOR AZIMUTH DETERMINATION DURING THE ALIGNMENT OPTION WHICH REQUIRES A SIGHTING ON ONLY ONE CELESTIAL BODY (OPTION 00003). THE MAXIMUM USABLE ELEVATION IN THIS CASE IS 70 DEGREES ABOVE THE LUNAR HORIZON. FOR ALIGNMENT OPTIONS REQUIRING SIGHTINGS ON TWO CELESTIAL BODIES THE LOS BETWEEN THESE BODIES SHOULD FORM A MINIMUM ANGLE OF 50 DEGREES.

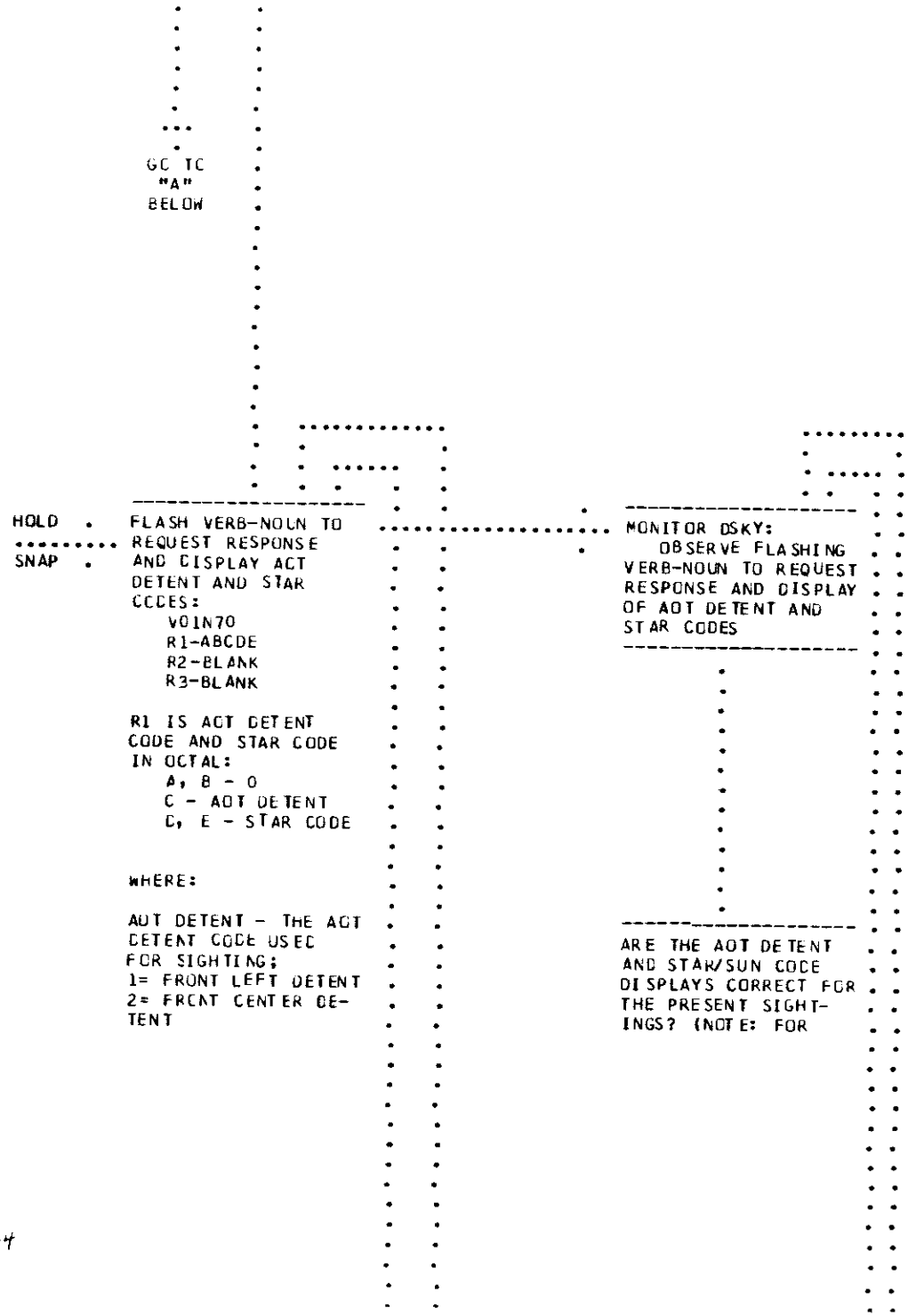
(3) A NEUTRAL DENSITY FILTER FOR THE AOT IS AVAILABLE FOR USE DURING SUN SIGHTINGS.

(4) MULTIPLE PAIRS OF SIGHTINGS MAY BE USED TO DETERMINE THE "AVERAGE" LOS VECTOR TO THE BODY.

(5) THE REAR DETENTS OF THE AOT MAY BE USED IF NECESSARY.

(6) THE ROUTINE IS AUTOMATICALLY CALLED BY THE LUNAR SURFACE ALIGN PROGRAM (P57).





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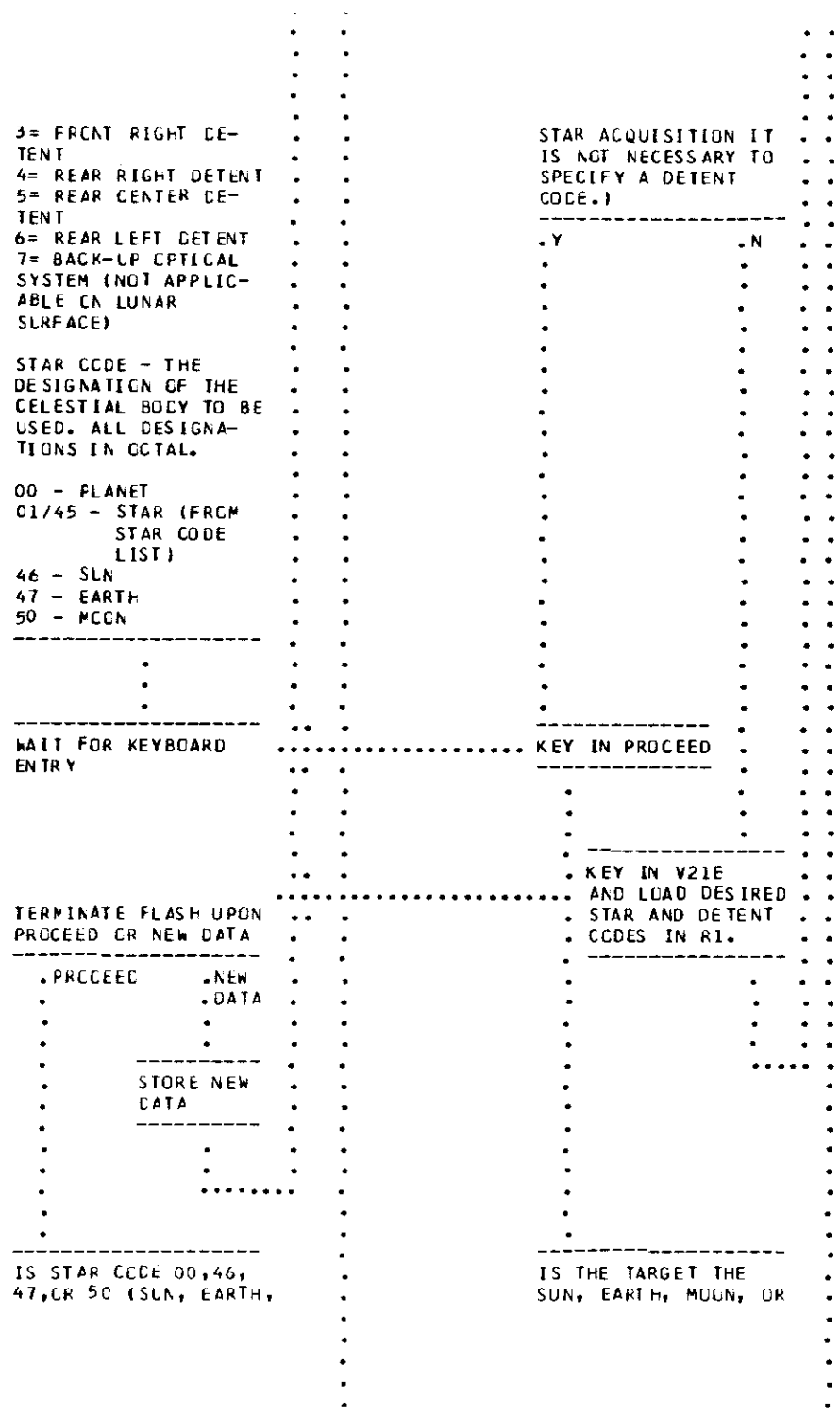

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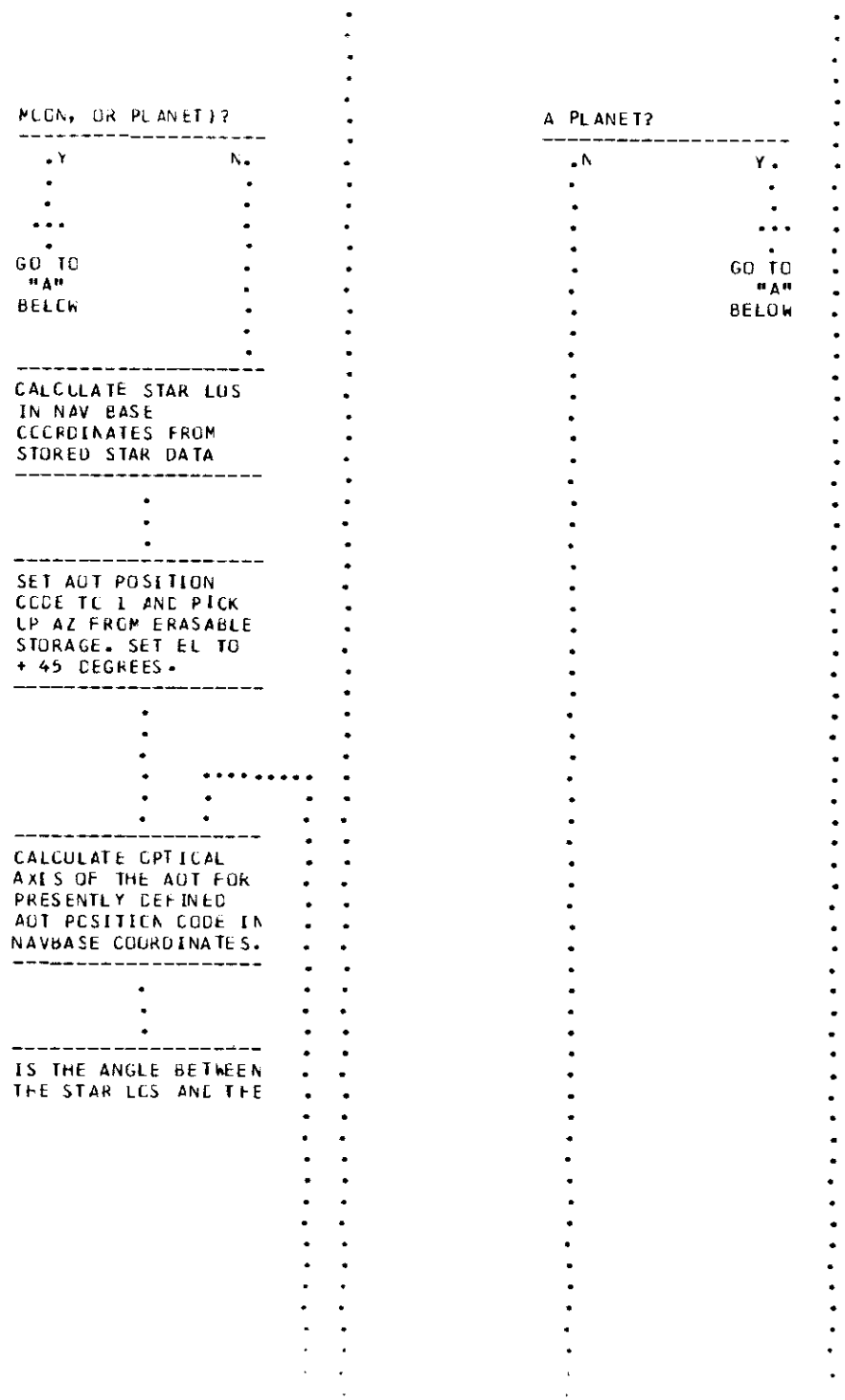

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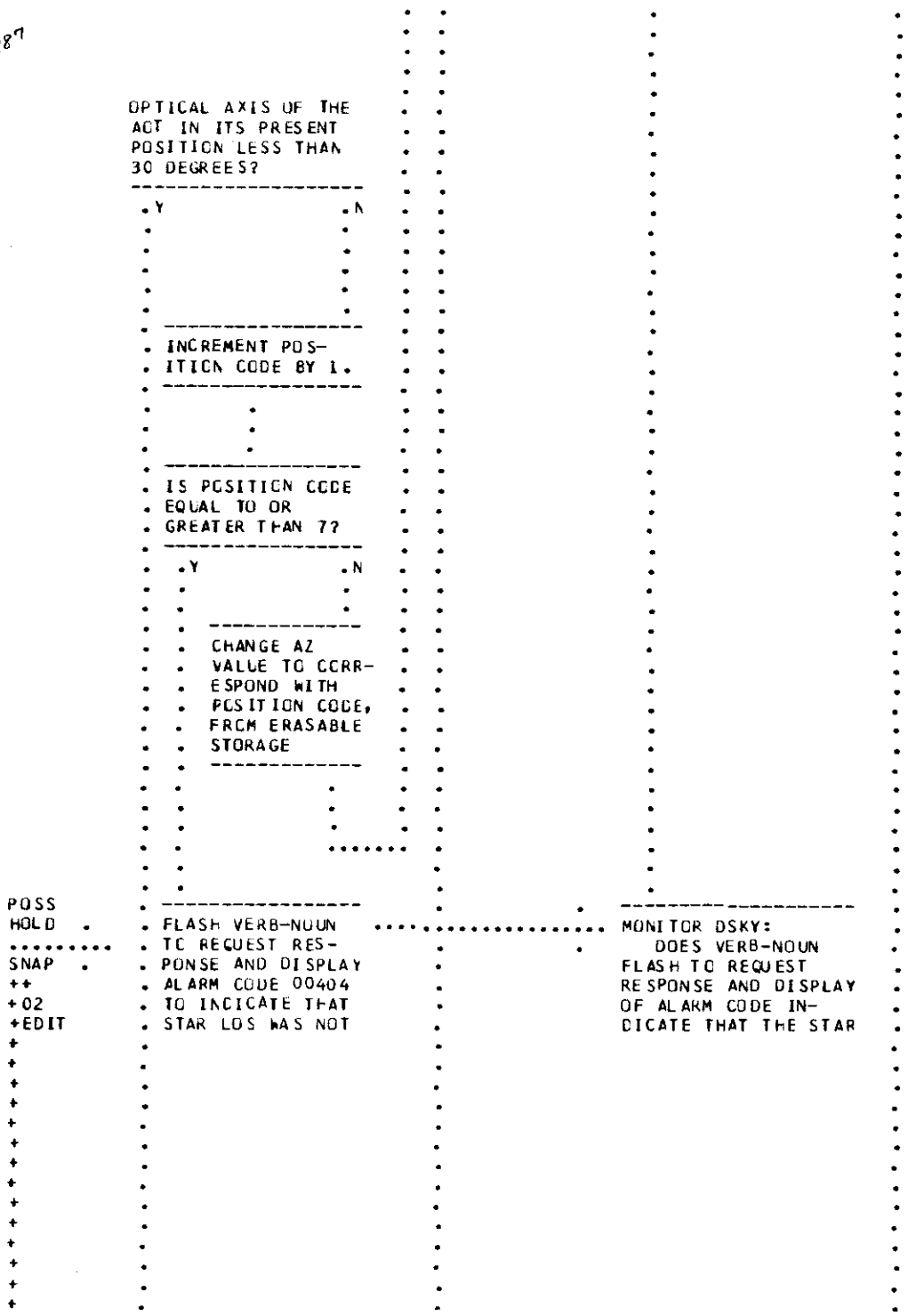

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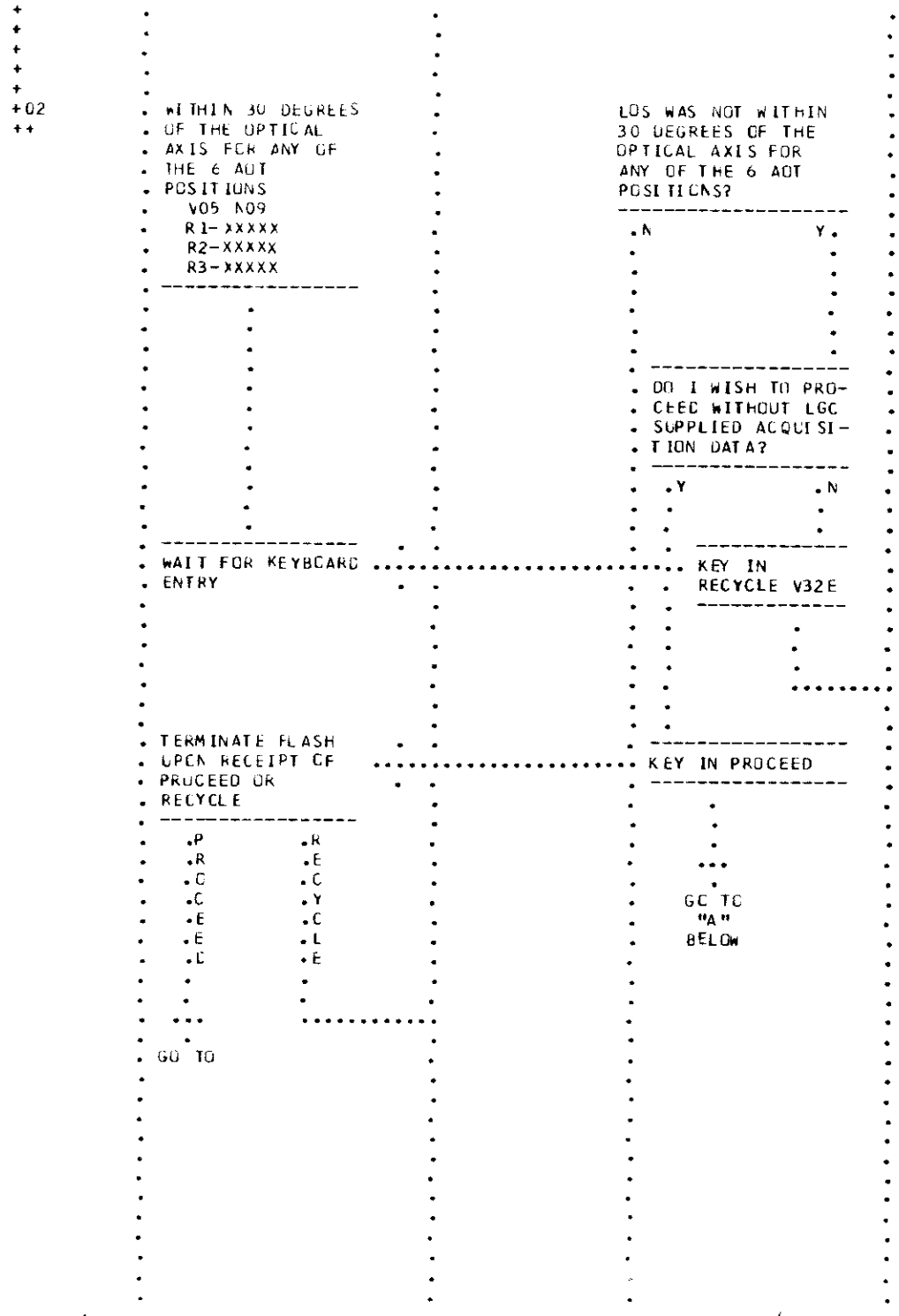
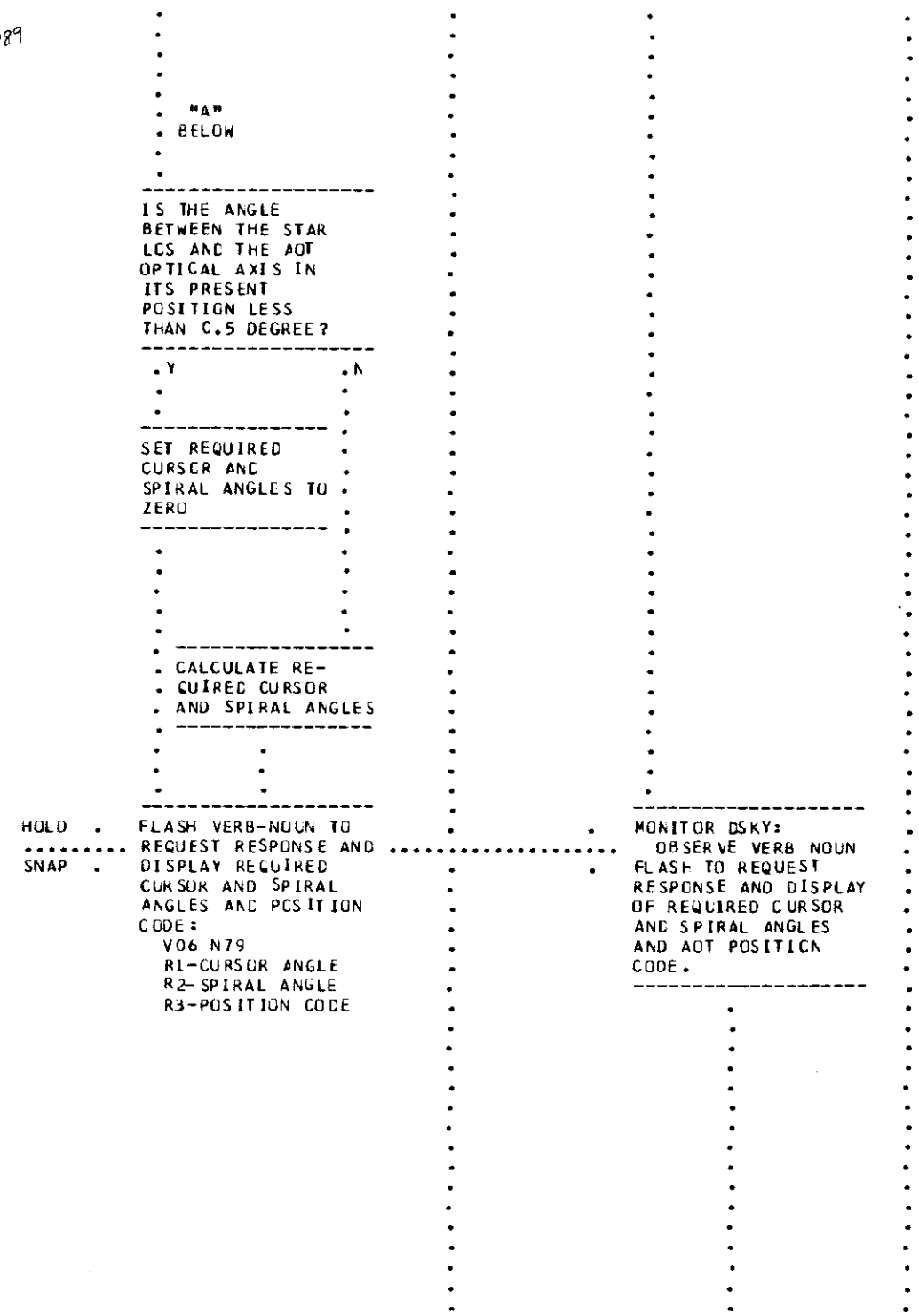

+02
++
WITHIN 30 DEGREES OF THE OPTICAL AXIS FOR ANY OF THE 6 AOT POSITIONS
V05 N09
R1-XXXXX
R2-XXXXX
R3-XXXXX
LOS WAS NOT WITHIN 30 DEGREES OF THE OPTICAL AXIS FOR ANY OF THE 6 AOT POSITIONS?
N
Y
#220
#230
DO I WISH TO PROCEED WITHOUT LGC SUPPLIED ACQUISITION DATA?
Y
N
#240
WAIT FOR KEYBOARD ENTRY
KEY IN RECYCLE V32E
#250
TERMINATE FLASH UPON RECEIPT OF PROCEED OR RECYCLE
KEY IN PROCEED
P
R
E
C
Y
C
L
E
GO TO
GO TO "A" BELOW
#260



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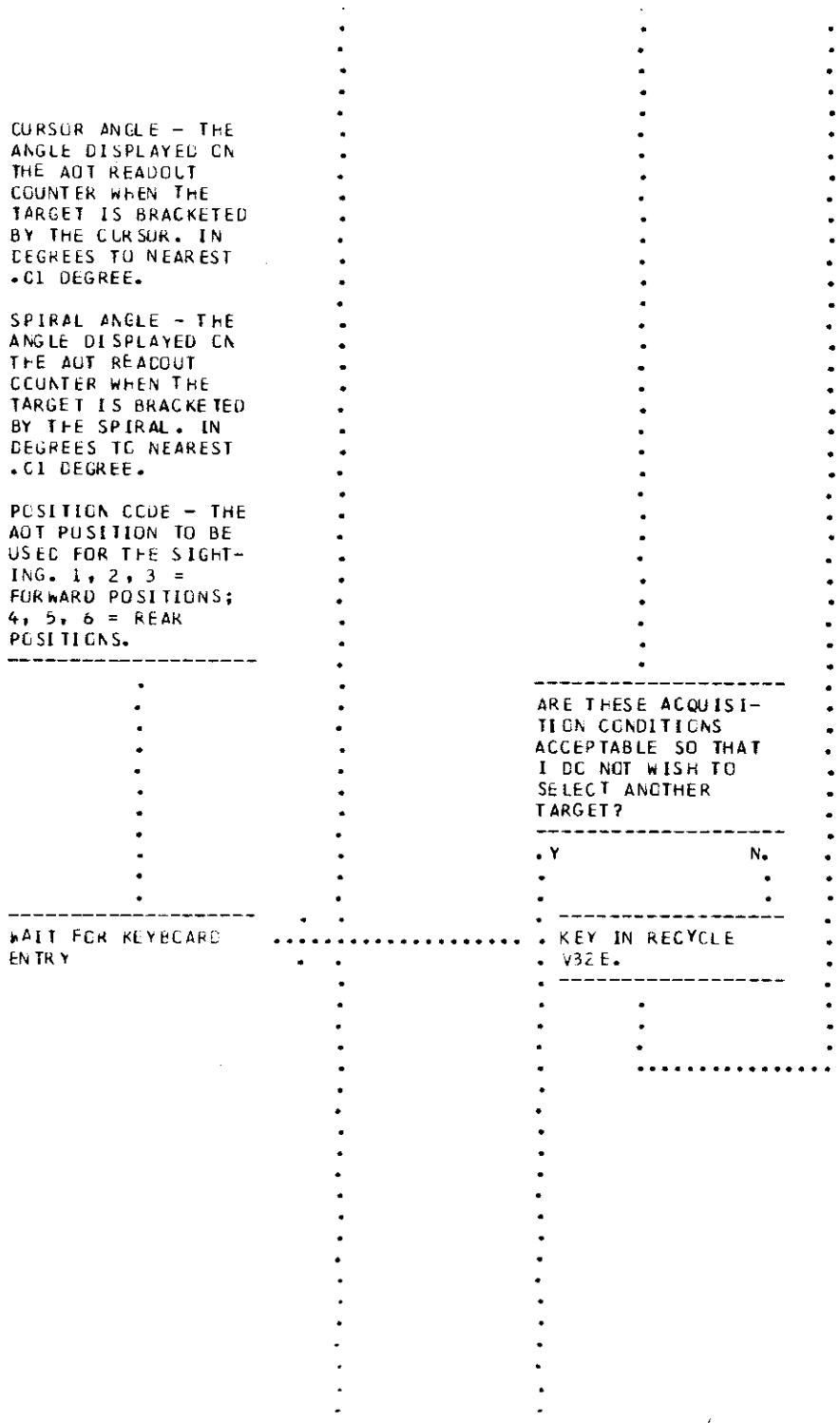

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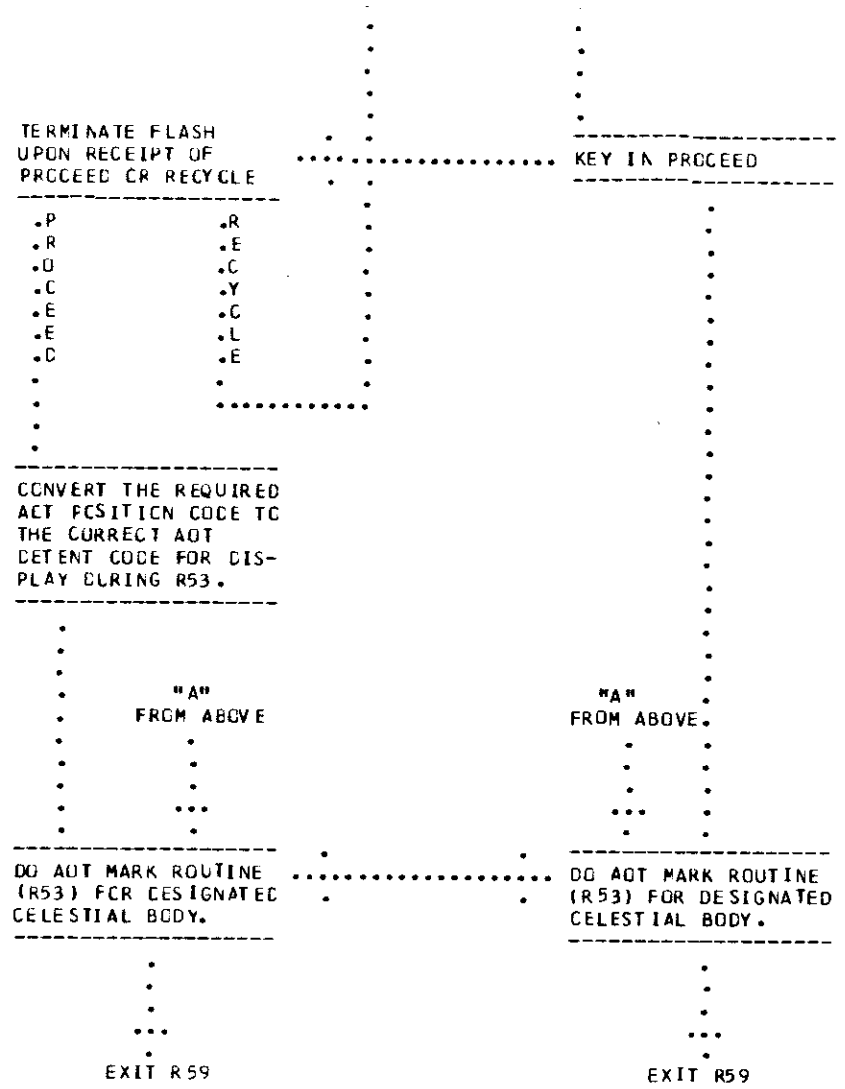

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+02
+EDIT
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CHANGE CONTROL NOTES

REV 01 EDITORIAL
REV 00(LUM 1A) PCR 699
REV 01(LUM 1B) EDITORIAL
REV 02 EDITORIAL

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993

ATTITUDE MANEUVER ROUTINE (R60) REV 03 12/03/69

PURPOSE: (1) TO MANEUVER THE LM TO AN ATTITUDE SPECIFIED BY THE PROGRAM IN PROCESS.

ASSUMPTIONS: (1) THE FINAL ATTITUDE DESIRED, DEFINED AS FOLLOWS, HAS BEEN STORED BY THE CALLING PROGRAM:

(A) A SPECIFIC BODY FIXED VECTOR AND A DIRECTION IN SPACE TO WHICH THIS VECTOR IS TO BE ALIGNED (THE 3-AXIS FLAG IS RESET).

(B) A THREE AXIS (ORTHOGONAL) INERTIAL ORIENTATION TO WHICH THE THREE BODY AXES ARE TO BE ALIGNED (THE 3-AXIS FLAG IS SET).

(2) THE MANEUVER MAY BE PERFORMED AUTOMATICALLY BY THE PGNCS OR PERFORMED MANUALLY WITH AN OPTIONAL FINAL AUTOMATIC PGNCS-CONTROLLED TRIM MANEUVER. THIS OPTIONAL TRIM MANEUVER SHOULD BE CONSIDERED ESSENTIAL FOR MANEUVERS TO THRUSTING ATTITUDES.

(3) THE DOCKED CONFIGURATION OF THE VEHICLES HAS BEEN CORRECTLY DEFINED TO THE LGC VIA R03.

(4) THE PGNCS CAN GENERATE TWO TYPES OF ATTITUDE ERRORS FOR DISPLAY ON THE FDAI:
MODE I - SELECTED BY EXTENDED VERB 61. AUTOPILOT FOLLOWING ERRORS USED AS A MONITOR OF THE DAP'S ABILITY TO TRACK AUTOMATIC STEERING COMMANDS.
MODE II- SELECTED BY EXTENDED VERB 62. TOTAL ATTITUDE ERRORS USED TO ASSIST CREW IN MANUALLY MANEUVERING THE VEHICLE.

++ PGNCS-DERIVED VEHICLE ATTITUDE RATES MAY ALSO BE DISPLAYED VIA SELECTION BY EXTENDED VERB 60.
+03 MODE II ATTITUDE ERROR DISPLAYS ARE AUTOMATICALLY SELECTED AT THE BEGINNING OF R60. (SEE ASSUMPTION (12) BELOW).
+EDIT DISPLAY SELECTION IS ALWAYS BASED UPON THE LAST ENTRY MADE IN THE DSKY. FOR A MORE DETAILED DESCRIPTION OF THESE
++ DISPLAYS, REFER TO SECTION 3 OF R567, PARA. 3.2.6.

(5) THE DAP DATA LOAD ROUTINE (R03) HAS BEEN PERFORMED PRIOR TO THIS ROUTINE.

(6) THE ATTITUDE DEADBAND USED BY THIS ROUTINE WILL BE THAT MOST RECENTLY SELECTED BY THE ASTRONAUT VIA R03, UNLESS THAT DEADBAND HAS BEEN OVERRIDDEN BY THE PROGRAM IN PROCESS IN WHICH CASE THE PROGRAM-SPECIFIED DEADBAND WILL BE USED.

(7) THE ATTITUDE MANEUVER RATE FOR AN AUTOMATIC MANEUVER WILL BE THAT WHICH WAS LAST SPECIFIED BY THE ASTRONAUT VIA R03.

(8) THE X-AXIS OVERRIDE OPTION IS NOT INHIBITED DURING THIS ROUTINE, BUT IT SHOULD NOT BE EXERCISED WHEN THE LGC IS SPECIFYING A DESIRED YAW ATTITUDE, I.E.: DURING AN AUTOMATIC LGC-CONTROLLED MANEUVER.

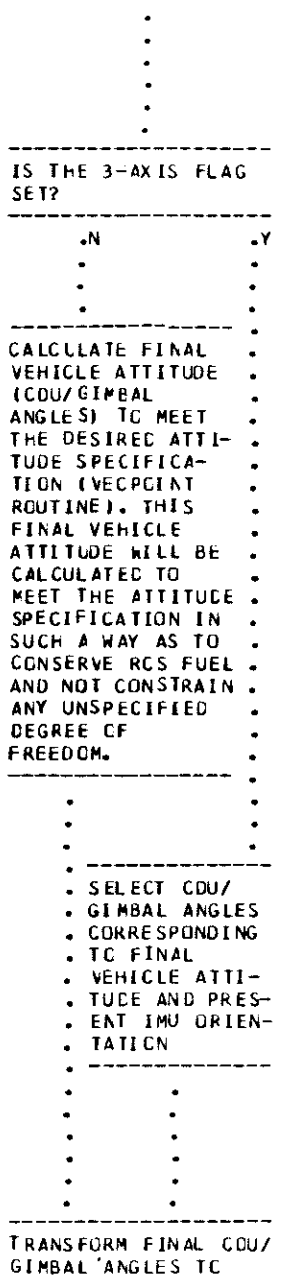
(9) THE ROUTINE IS AUTOMATICALLY SELECTED BY THE PROGRAM OR ROUTINE REQUIRING THE ATTITUDE MANEUVER.

(10) IF THIS ROUTINE WAS SELECTED BY THE PREFERRED TRACKING ATTITUDE ROUTINE (R61) OR THE FINE PREFERRED TRACKING ATTITUDE ROUTINE (R65), THE V50N18 AND THE V06N18 IN THIS ROUTINE ARE PRIORITY DISPLAYS. THE V50N18 DISPLAY WILL REMAIN UP A MINIMUM OF 2 SECONDS. RESPONSE AFTER 2 SECONDS WILL CAUSE THE PROGRAM TO CONTINUE AS DESCRIBED.

(11) WHEN THIS ROUTINE IS SELECTED BY A PROGRAM OTHER THAN P20 OR P25, ALL DISPLAYS ARE NORMAL.

(12) WHEN THIS ROUTINE IS SELECTED, THE ATTITUDE ERROR NEEDLE DRIVE IS AUTOMATICALLY SET TO MODE 2 ATTITUDE ERRORS, AND IS NOT SUBSEQUENTLY RESET BY THIS ROUTINE.

PROG CONT	LGC	GROUND	CREW	
	.LGC .ROUTINE .SELECTION • • ••• •			
	START ATTITUDE MANEUVER ROUTINE (R60)			#10
	• • •			
	SPECIFY MODE 2 ATTITUDE ERROR DISPLAY TO DAP			#20
	• • •			
	SET NEEDLE FLAG			#30
	• • • •			
	OBTAIN DESIRED ATTITUDE SPECIFICATION FROM THE CALLING PROGRAM			#40
	• • • • • • • • • • • • • • • • • • • •			


IS THE 3-AXIS FLAG SET?
N
Y
CALCULATE FINAL VEHICLE ATTITUDE (CDU/GIMBAL ANGLES) TO MEET THE DESIRED ATTITUDE SPECIFICATION (VECPOINT ROUTINE). THIS FINAL VEHICLE ATTITUDE WILL BE CALCULATED TO MEET THE ATTITUDE SPECIFICATION IN SUCH A WAY AS TO CONSERVE RCS FUEL AND NOT CONSTRAIN ANY UNSPECIFIED DEGREE OF FREEDOM.
SELECT CDU/GIMBAL ANGLES CORRESPONDING TO FINAL VEHICLE ATTITUDE AND PRESENT IMU ORIENTATION
TRANSFORM FINAL CDU/GIMBAL ANGLES TO

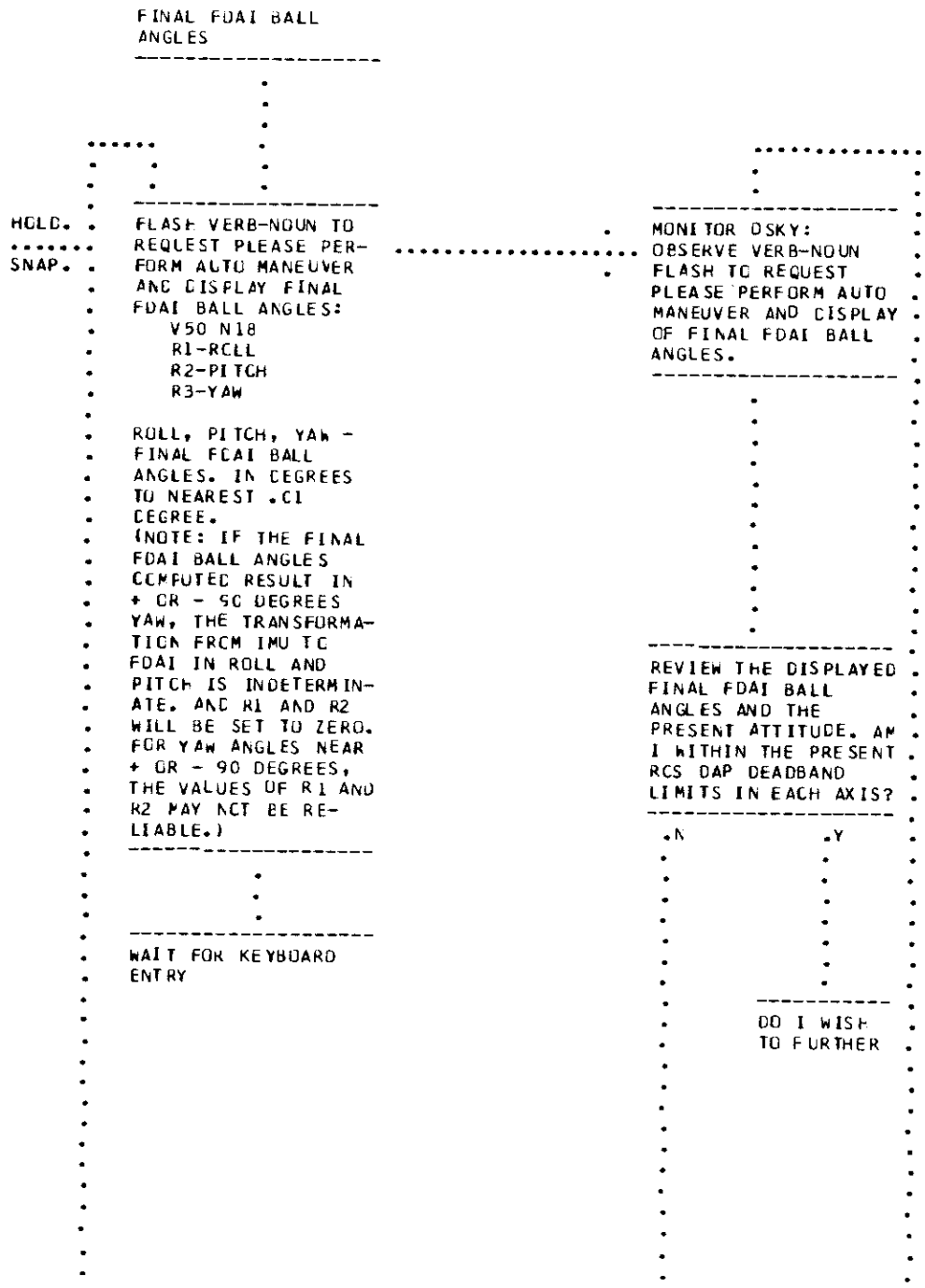
#50

#60

#70

#80

#90



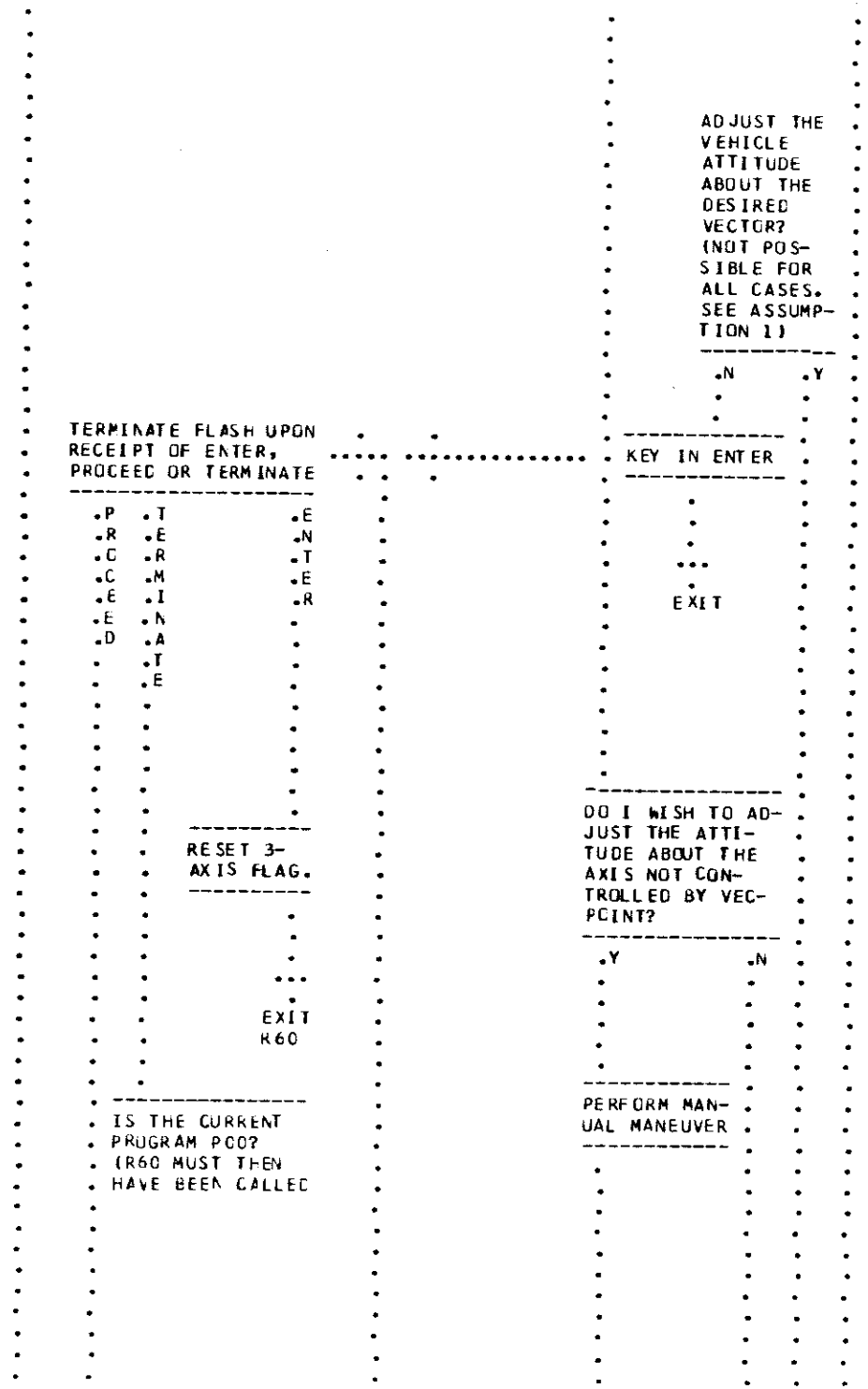
#100

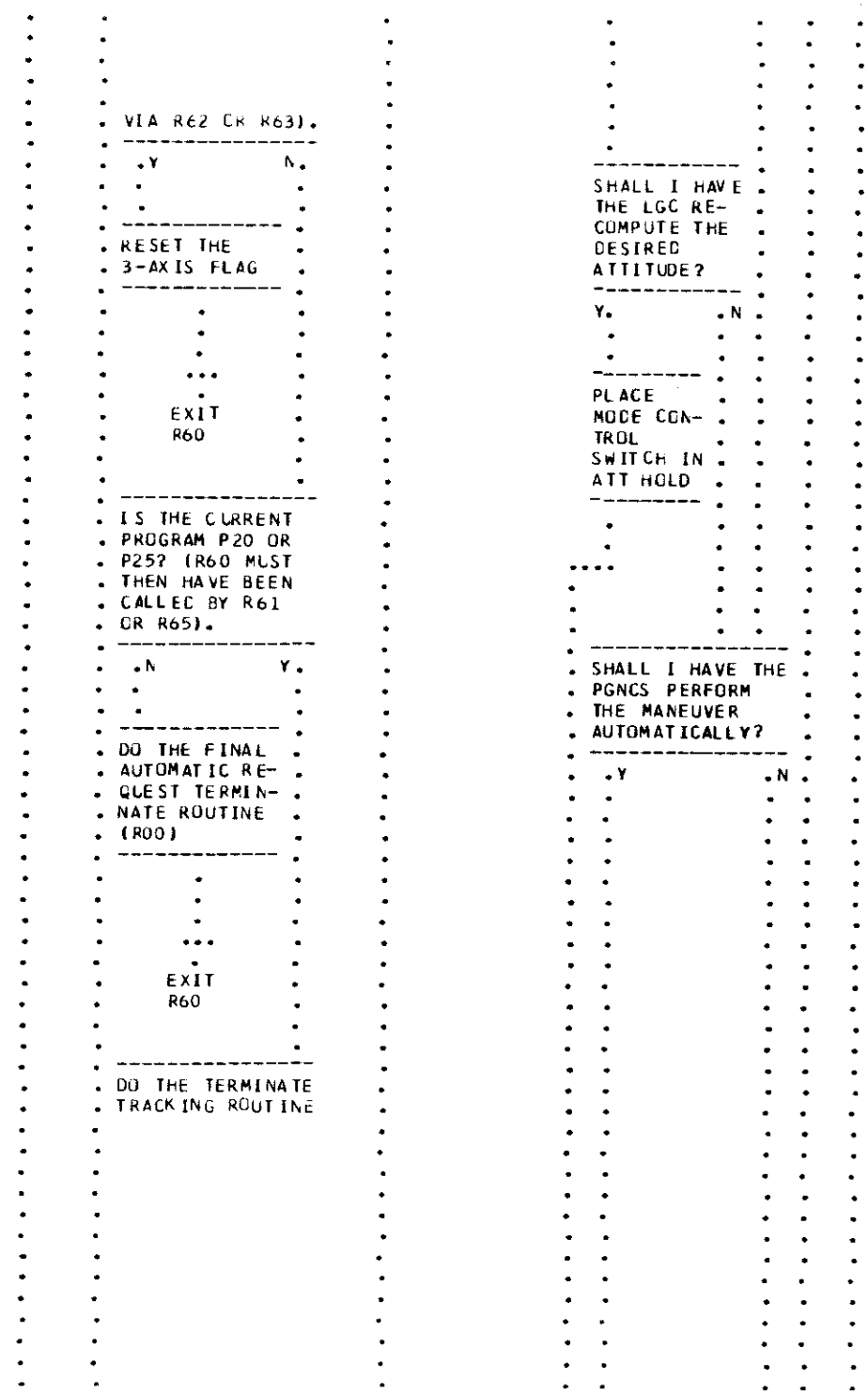
#110

#120

#130

#140


ADJUST THE VEHICLE ATTITUDE ABOUT THE DESIRED VECTOR? (NOT POSSIBLE FOR ALL CASES. SEE ASSUMPTION 1)
.N
.Y
#150
#160
TERMINATE FLASH UPON RECEIPT OF ENTER, PROCEED OR TERMINATE
KEY IN ENTER
EXIT
#170
.P .R .C .C .E .E .D
.T .E .R .M .I .N .A .T .E
.E .N .T .E .R
RESET 3-AXIS FLAG.
EXIT R60
#180
DO I WISH TO ADJUST THE ATTITUDE ABOUT THE AXIS NOT CONTROLLED BY VECPOINT?
.Y
.N
#190
IS THE CURRENT PROGRAM P00? (R60 MUST THEN HAVE BEEN CALLED
PERFORM MANUAL MANEUVER



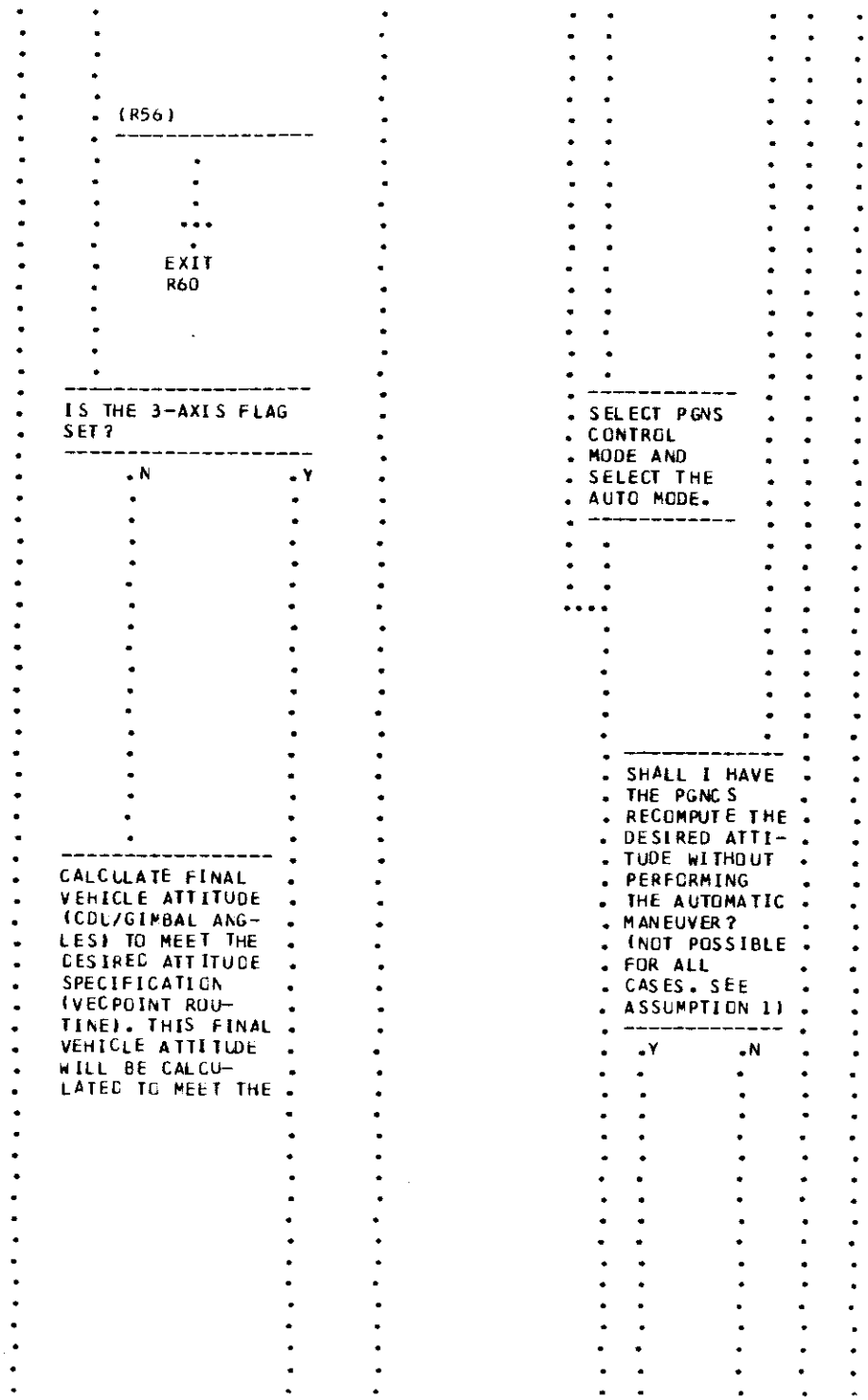
#200

#210

#220

#230

#240



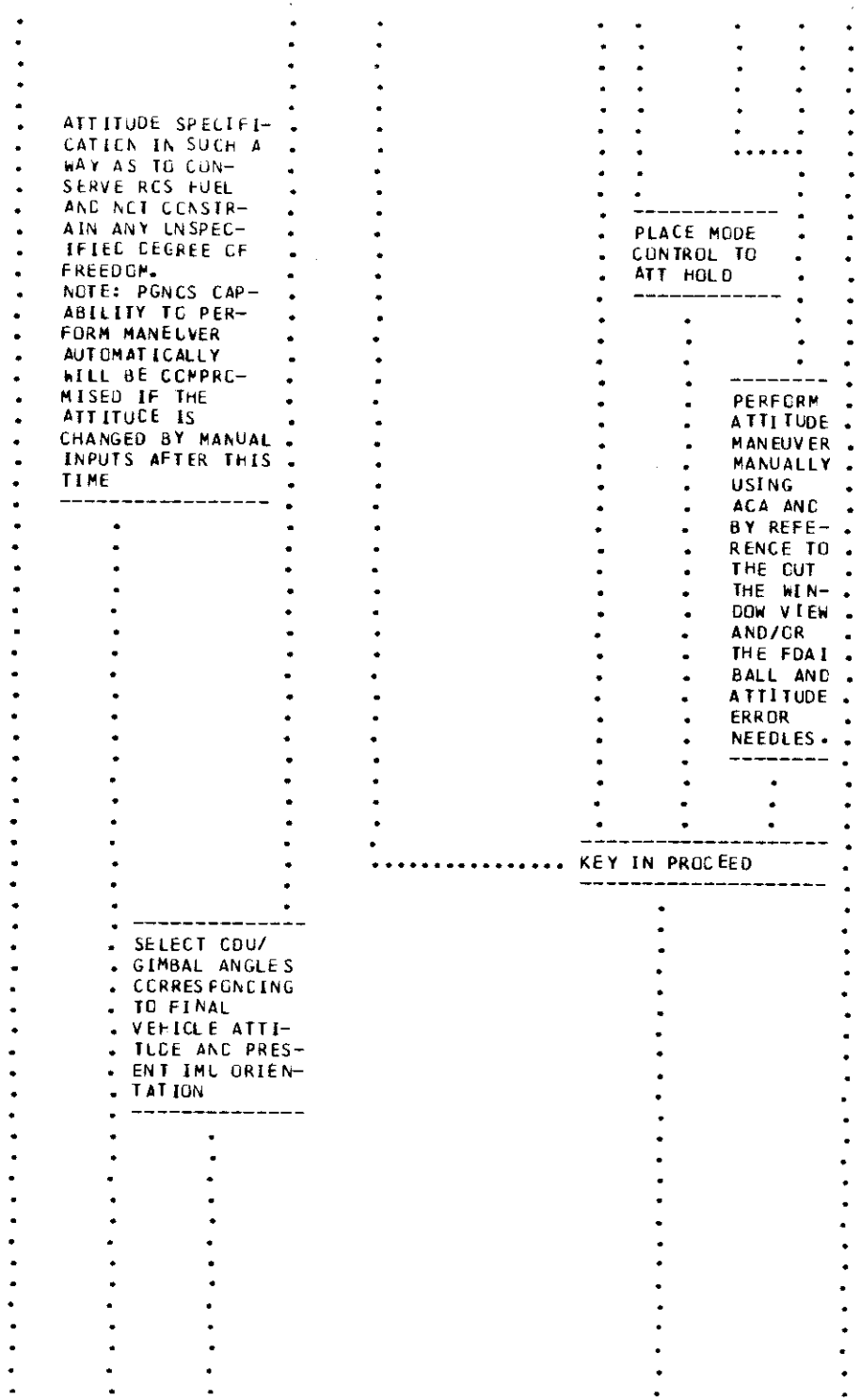
#250

#260

#270

#280

#290


ATTITUDE SPECIFICATION IN SUCH A WAY AS TO CONSERVE RCS FUEL AND NOT CONSTRAIN ANY UNSPECIFIED DEGREE OF FREEDOM.
NOTE: PGNCS CAPABILITY TO PERFORM MANEUVER AUTOMATICALLY WILL BE COMPROMISED IF THE ATTITUDE IS CHANGED BY MANUAL INPUTS AFTER THIS TIME
SELECT CDU/ GIMBAL ANGLES CORRESPONDING TO FINAL VEHICLE ATTITUDE AND PRESENT IMU ORIENTATION
PLACE MODE CONTROL TO ATT HOLD
PERFORM ATTITUDE MANEUVER MANUALLY USING ACA AND BY REFERENCE TO THE CUT THE WINDOW VIEW AND/OR THE FDAI BALL AND ATTITUDE ERROR NEEDLES.
KEY IN PROCEED
#300
#310
#320
#330
#340

1001

TRANSFORM FINAL CDU/ GIMBAL ANGLES TO FINAL FDAI BALL ANGLES

#350

HAS PGNS CONTROL MODE BEEN SELECTED?

.N .Y

DID I DIRECT THE LM TO PERFORM THE MANEUVER AUTOMATICALLY?

.Y .N

#360

HAS THE AUTO ATTITUDE CONTROL MODE BEEN SELECTED?

.N .Y

#370

TEMP HOLD.

SNAP.

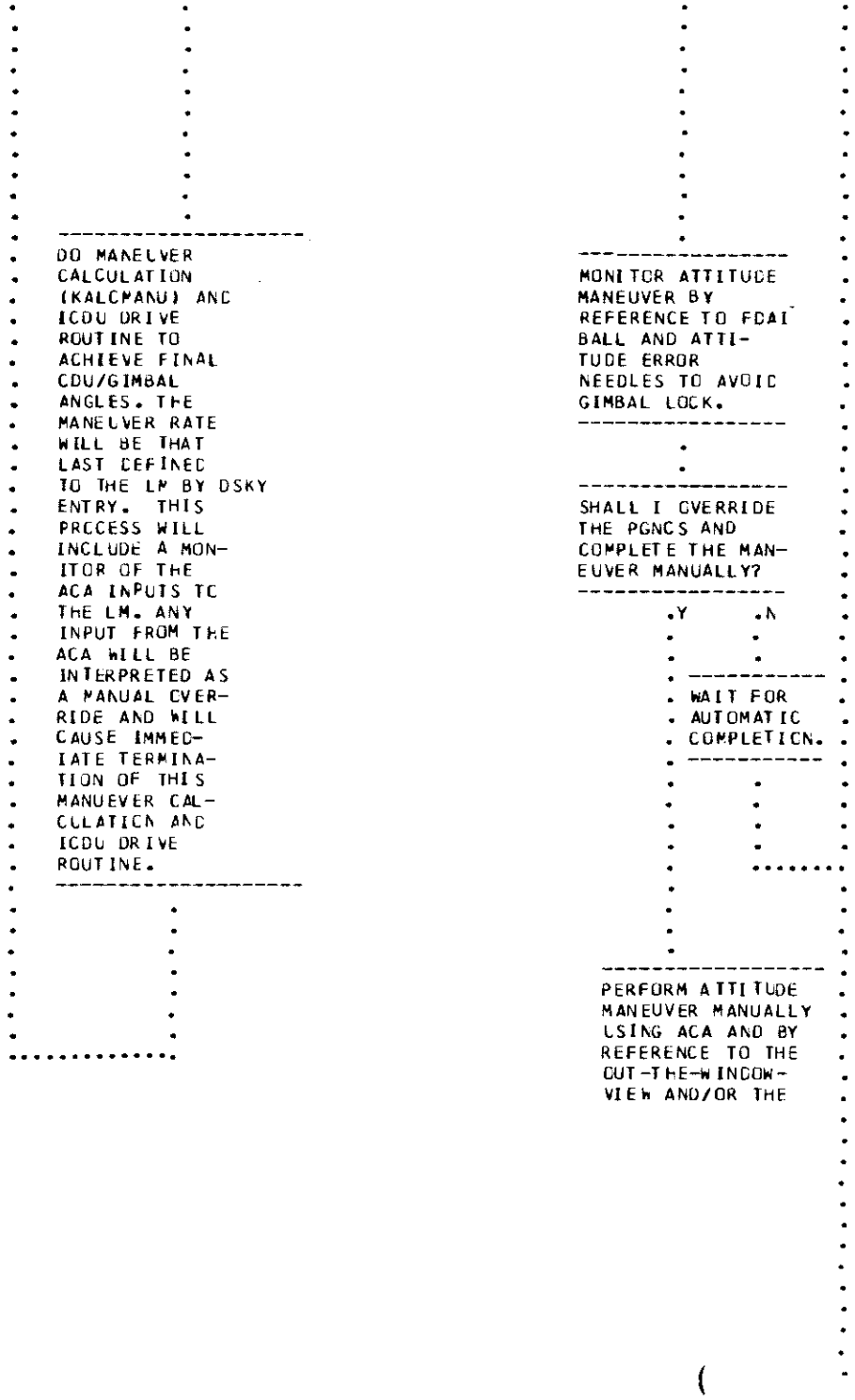
DISPLAY FINAL FDAI BALL ANGLES
V06N18
R1-ROLL
R2-PITCH
R3-YAW

ALL ANGLES IN DEGREES TO THE NEAREST .01 DEGREE

MONITOR DSKY:
OBSERVE NON-FLASHING VERB-NOUN DISPLAY OF FINAL FDAI BALL ANGLES UNTIL COMPLETION OF THE AUTOMATIC MANEUVER.

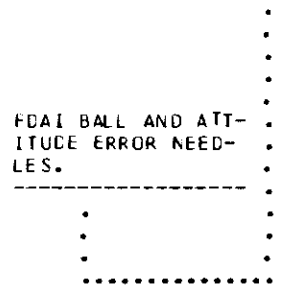
#380

#390


DO MANEUVER CALCULATION (KALCMANU) AND ICDU DRIVE ROUTINE TO ACHIEVE FINAL CDU/GIMBAL ANGLES. THE MANEUVER RATE WILL BE THAT LAST DEFINED TO THE LM BY DSKY ENTRY. THIS PROCESS WILL INCLUDE A MONITOR OF THE ACA INPUTS TO THE LM. ANY INPUT FROM THE ACA WILL BE INTERPRETED AS A MANUAL OVERRIDE AND WILL CAUSE IMMEDIATE TERMINATION OF THIS MANUEVER CALCULATION AND ICDU DRIVE ROUTINE.
MONITOR ATTITUDE MANEUVER BY REFERENCE TO FDAI BALL AND ATTITUDE ERROR NEEDLES TO AVOID GIMBAL LOCK.
#400
#410
SHALL I OVERRIDE THE PGNCS AND COMPLETE THE MANEUVER MANUALLY?
Y
N
WAIT FOR AUTOMATIC COMPLETION.
#420
#430
PERFORM ATTITUDE MANEUVER MANUALLY USING ACA AND BY REFERENCE TO THE OUT-THE-WINDOW-VIEW AND/OR THE
#440

1002

1003



#450

CHANGE CONTROL NOTES

LOGIC REV 01 PCR 9,86,164,226,234,433,446,637
REV 02 (LUM 18) PCR 841, EDITORIAL
REV 03 EDITORIAL

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PREFERRED TRACKING ATTITUDE ROUTINE (R61) REV 03 12/03/69

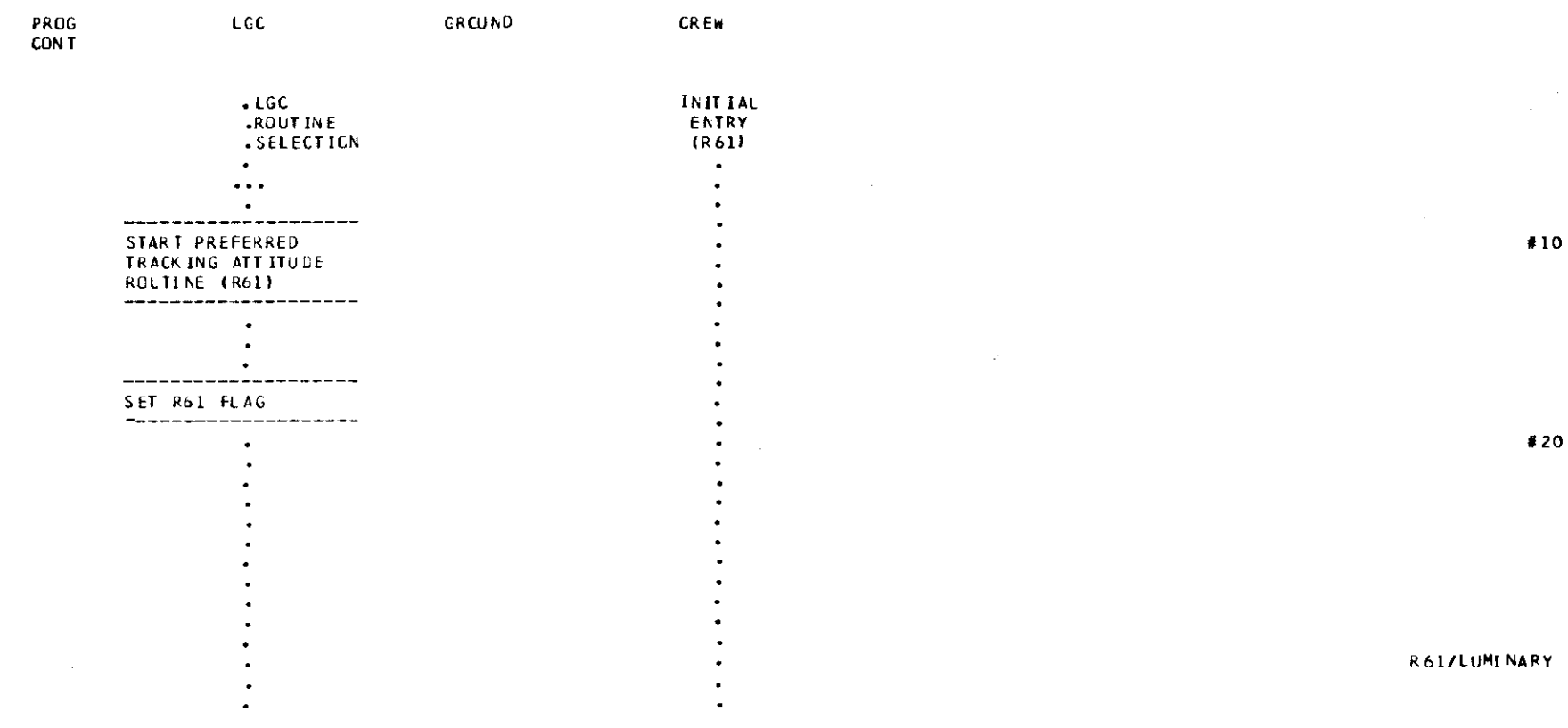
PURPOSE: (1) TO PERFORM A SINGLE AUTOMATIC TRIM MANEUVER TO THE PREFERRED TRACKING ATTITUDE IF MANEUVER REQUIRED IS LESS THAN A SPECIFIED FUNCTION OR, IF NOT, TO NOTIFY THE CREW THAT AN ATTITUDE MANEUVER TO THE PREFERRED TRACKING ATTITUDE IS REQUIRED VIA R60.

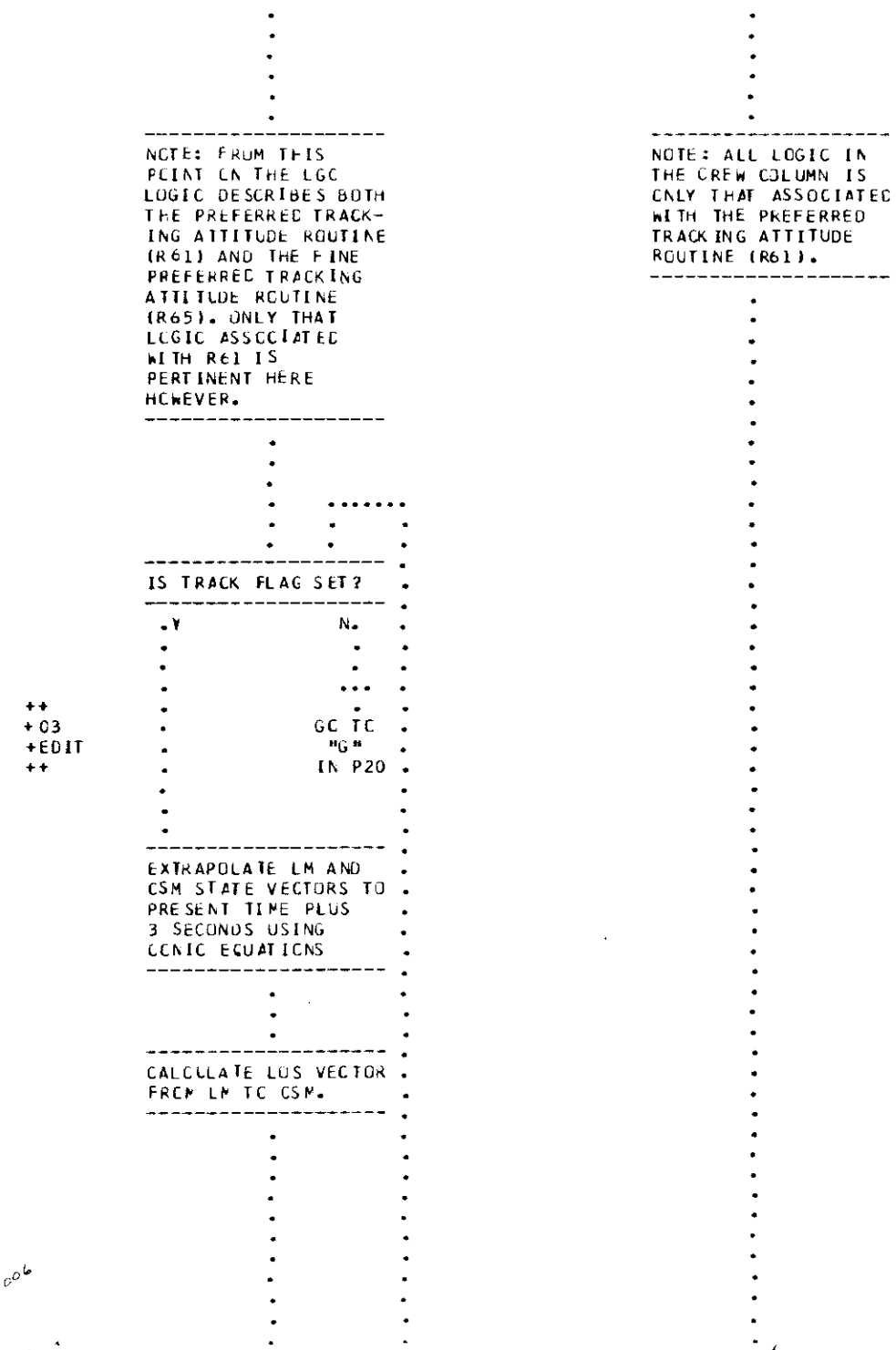
(2) TO COMPUTE THE PREFERRED TRACKING ATTITUDE OF THE LM WHICH ENABLES RR TRACKING OF THE CSM, AND CSM TRACKING OF THE LM BEACON.

ASSUMPTIONS: (1) THE PREFERRED TRACKING ATTITUDE IS DEFINED AS FOLLOWS:

(A) THE LM +Z AXIS IS ALIGNED ALONG THE LOS TO THE CSM.

++ (B) THE ROLL ATTITUDE (ABOUT LM +Z AXIS) IS UNDEFINED, BUT MAINTAINED AT THE ORIENTATION RESULTING FROM
+03 THE R60 MANEUVER, OR FROM MANUAL CREW ADJUSTMENT.
+EDIT
++ (2) THE ROUTINE IS AUTOMATICALLY CALLED BY THE RENDEZVOUS NAVIGATION PROGRAM (P20), THE RR MANUAL ACQUISITION ROUTINE (R23), AND THE RR SEARCH ROUTINE (R24).





++
+03
+EDIT
++

#30

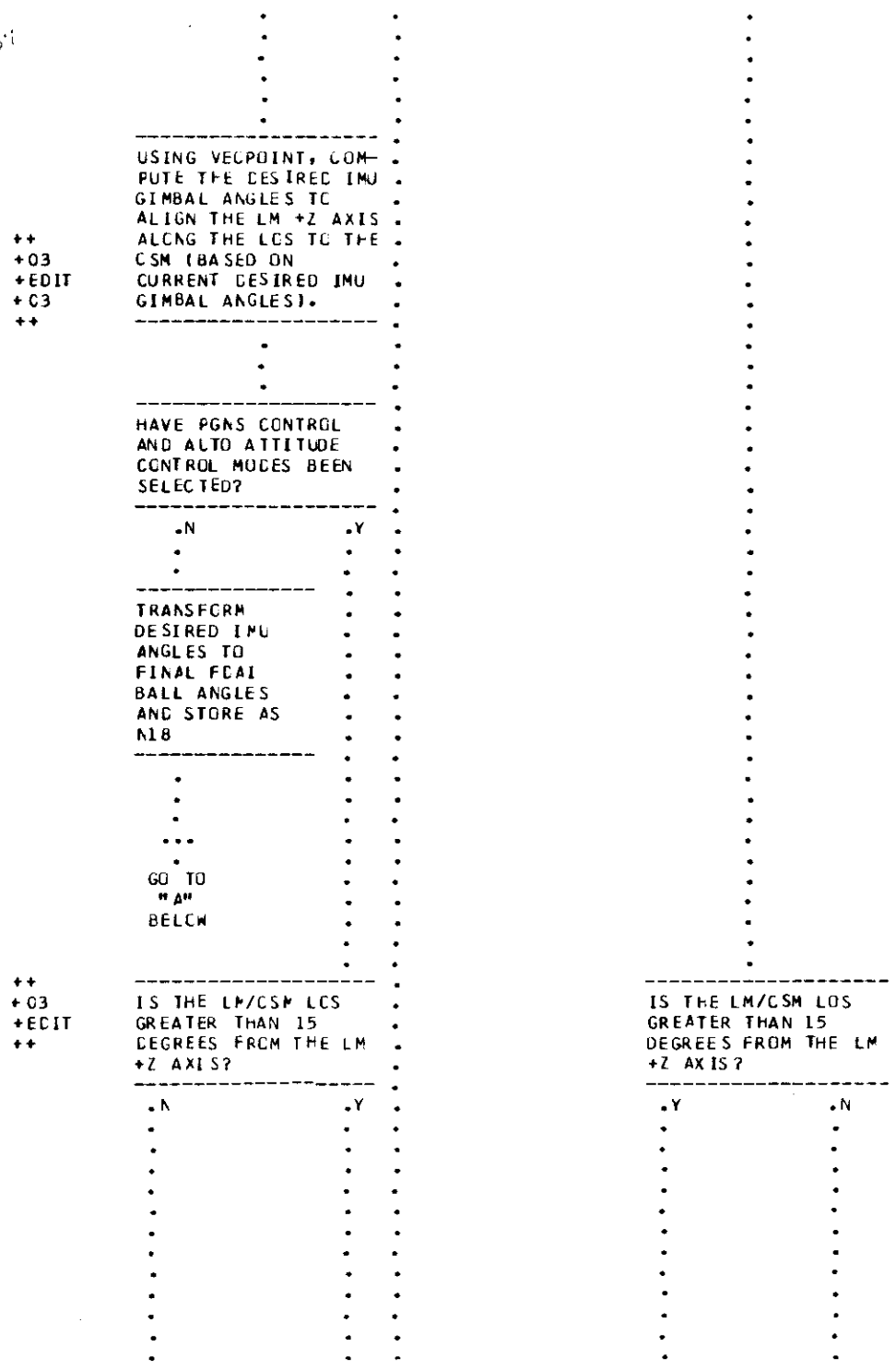
#40

#50

#60

#70

1006



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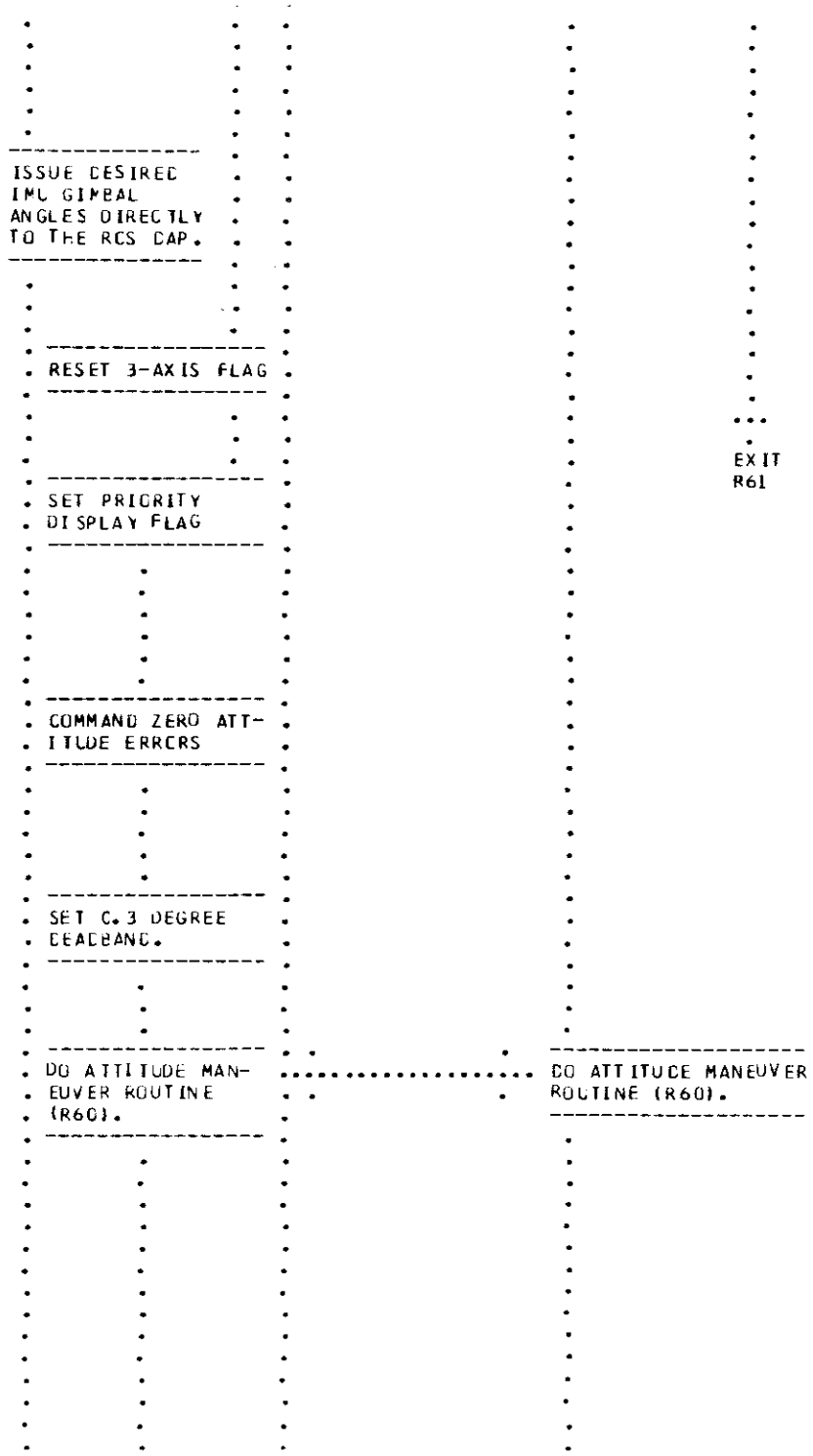
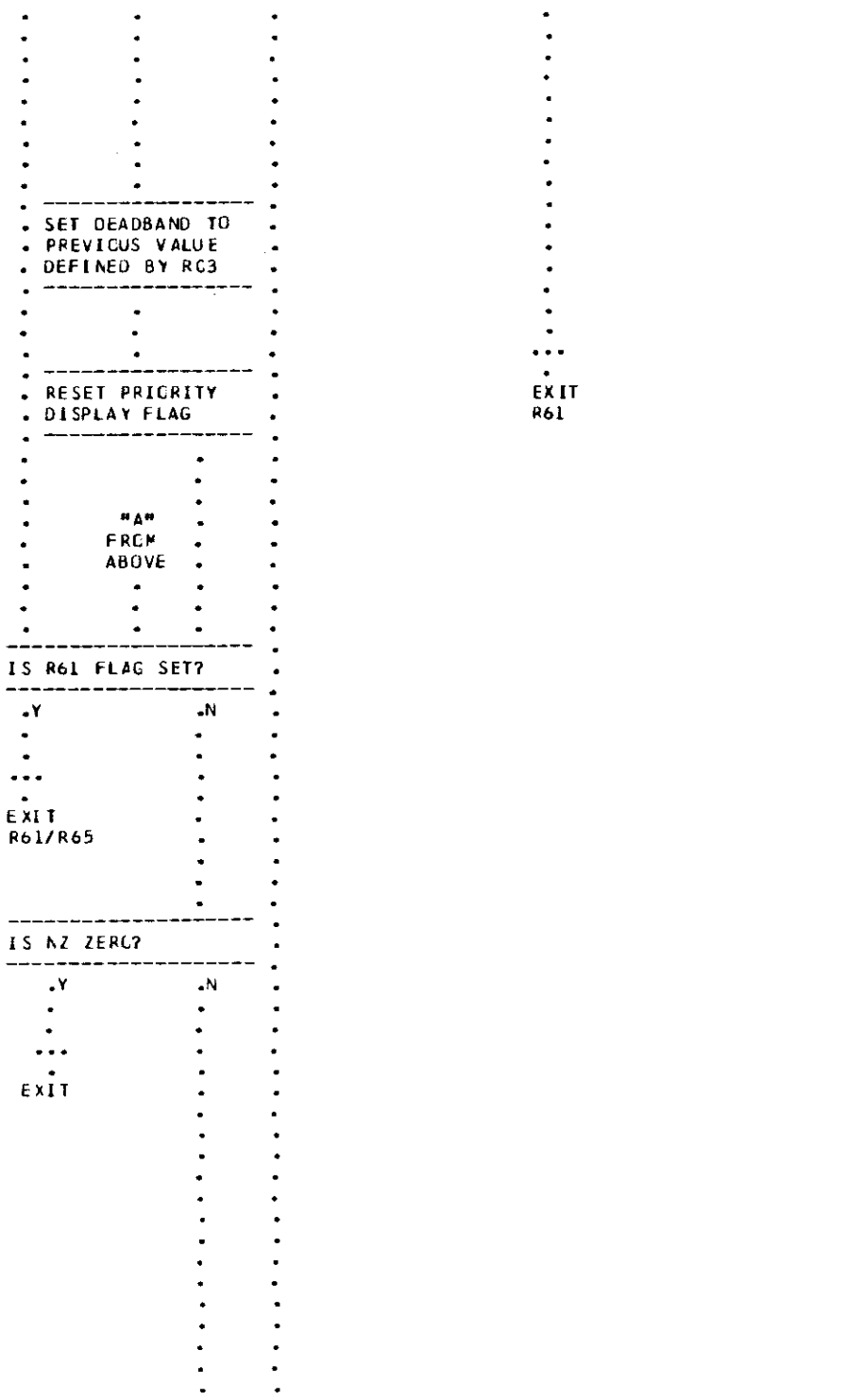
#110

#120


ISSUE DESIRED IMU GIMBAL ANGLES DIRECTLY TO THE RCS DAP.
RESET 3-AXIS FLAG
SET PRIORITY DISPLAY FLAG
COMMAND ZERO ATTITUDE ERRORS
SET 0.3 DEGREE DEADBAND.
DO ATTITUDE MANEUVER ROUTINE (R60).
DO ATTITUDE MANEUVER ROUTINE (R60).
EXIT R61
#130
#140
#150
#160
#170

1009



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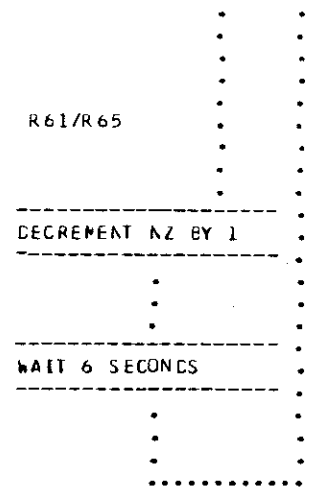
#190

#200

#210



#220

#230

CHANGE CONTROL NOTES

REV 01 PCR 39,634
REV 02 (LUM 1A) PCR 642,716, EDITORIAL
REV 03 EDITORIAL

1010

1011

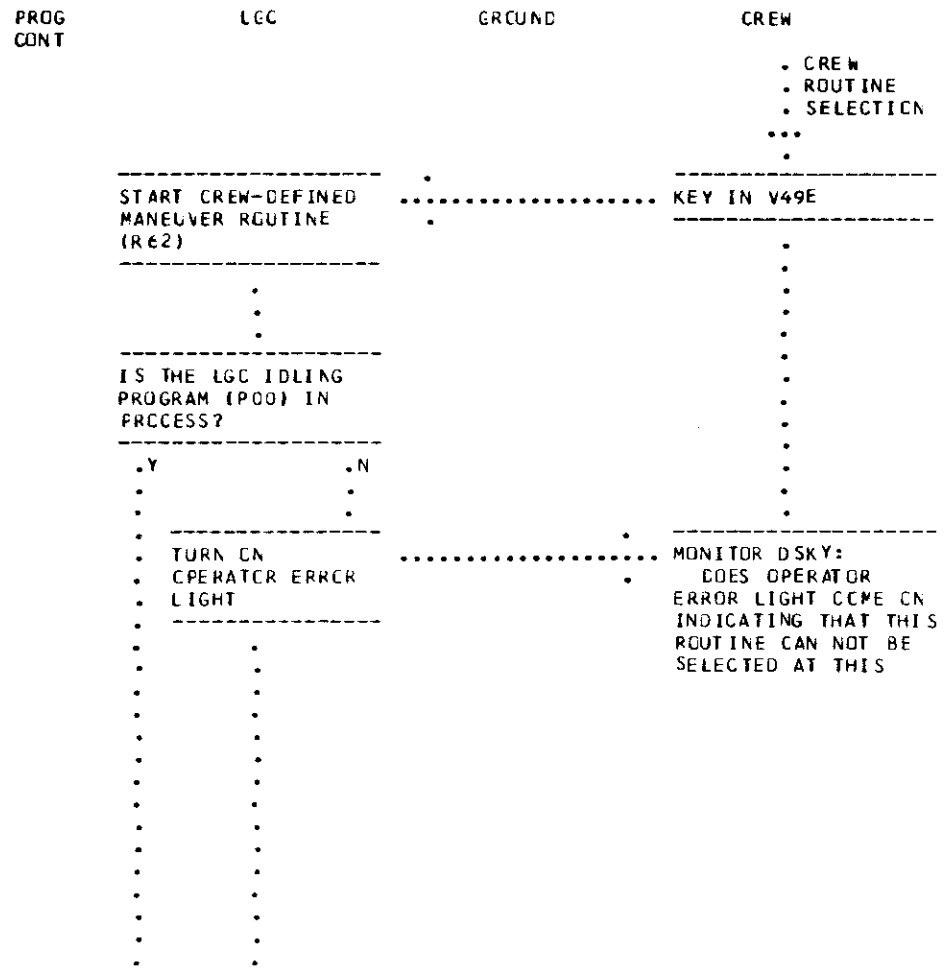
CREW-DEFINED MANEUVER ROUTINE (R62) REV 03 12/03/69

PURPOSE: (1) TO PROVIDE THE CREW WITH THE ABILITY TO SPECIFY A FINAL VEHICLE ATTITUDE FOR USE BY AN LGC-CONTROLLED ATTITUDE MANEUVER.

ASSUMPTIONS: (1) THE ROUTINE IS MANUALLY SELECTED BY THE ASTRONAUT BY DSKY ENTRY.

(2) THE DAP DEADBAND DURING THIS ROUTINE IS AS DEFINED BY THE DAP DATA LOAD ROUTINE (R03).

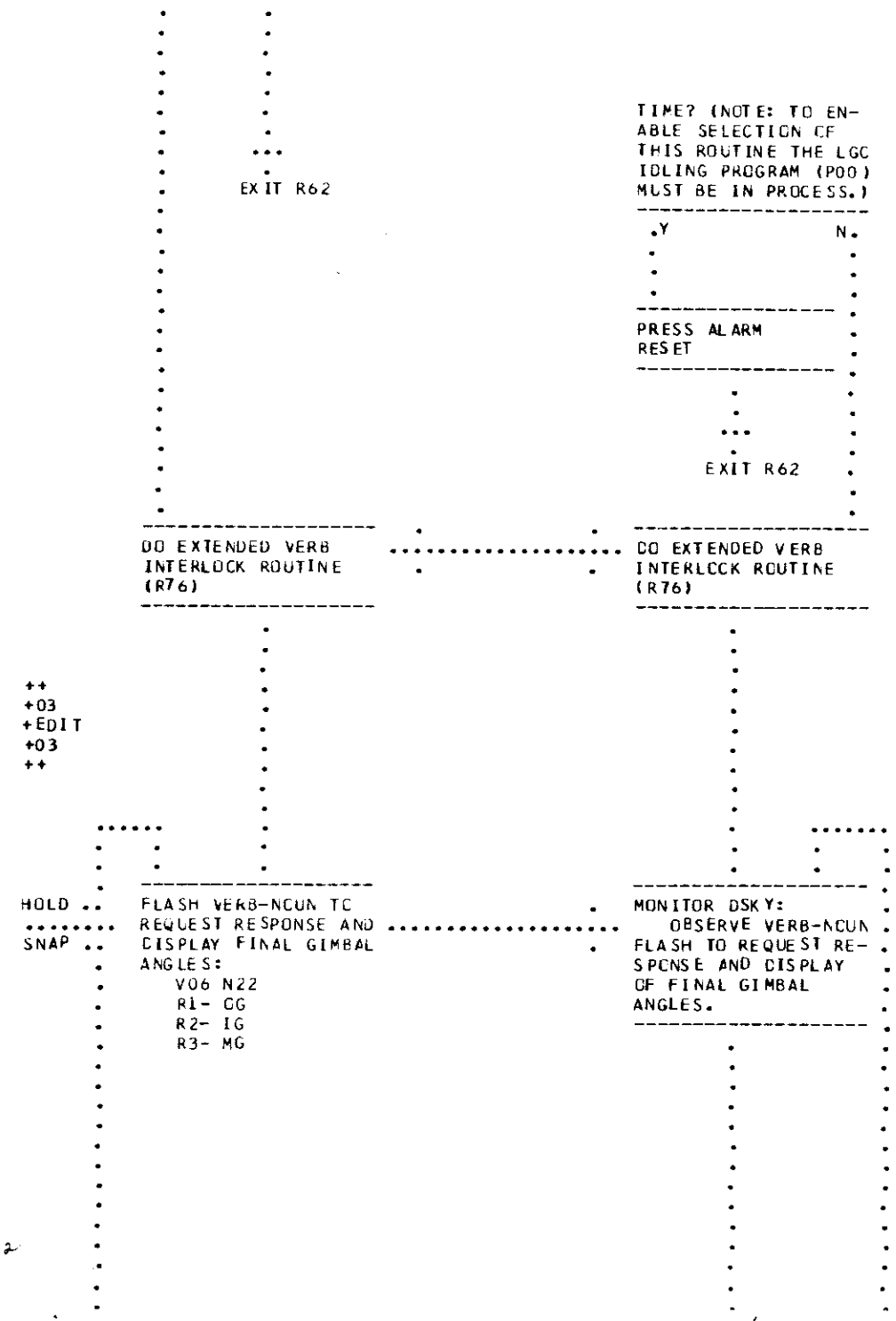
(3) THIS ROUTINE CAN ONLY BE ENTERED FROM THE LGC IDLING PROGRAM (P00).



#10

#20

R62/LUMINARY
R62/COLOSSUS
R62/SUNDANCE



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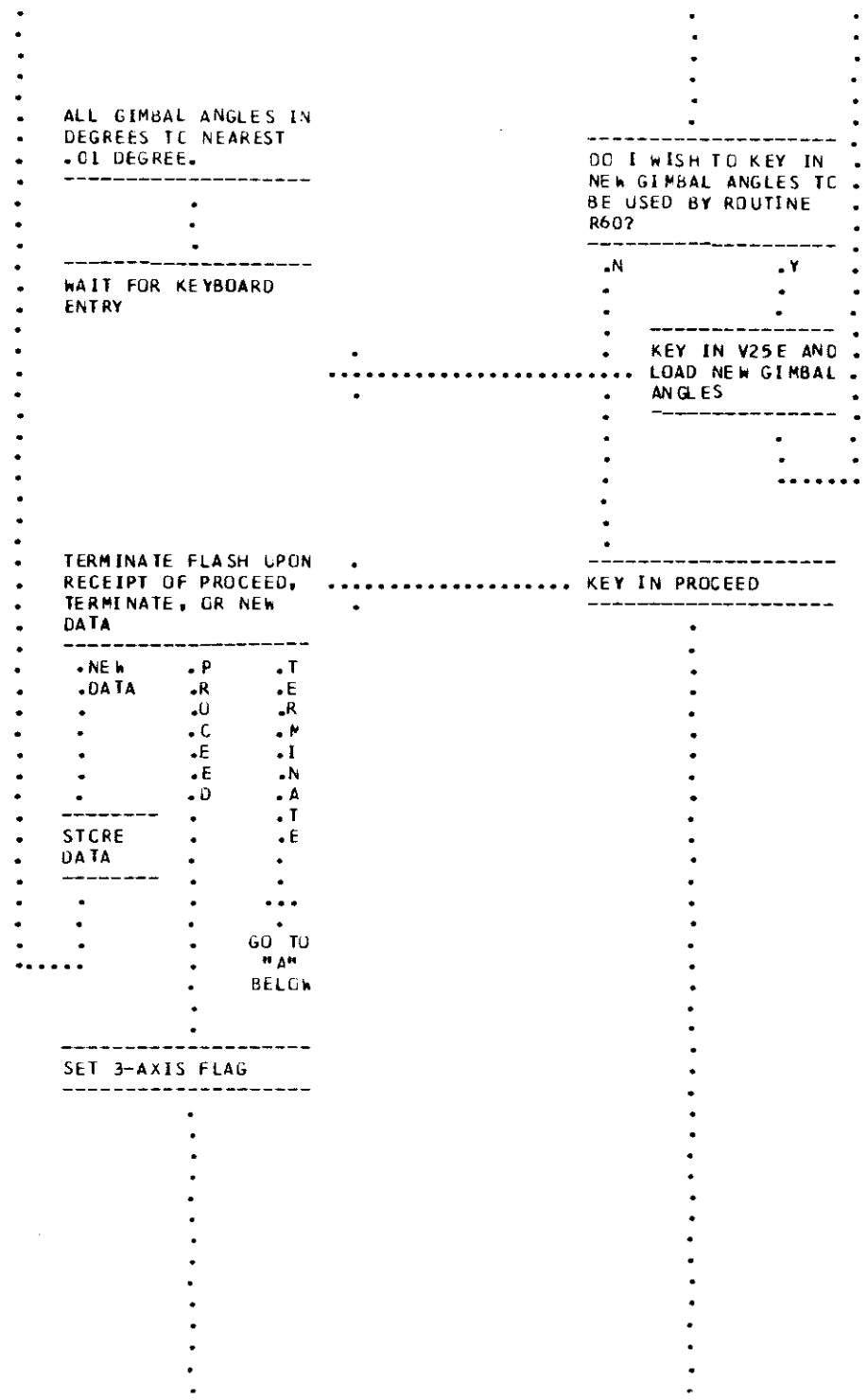
1012



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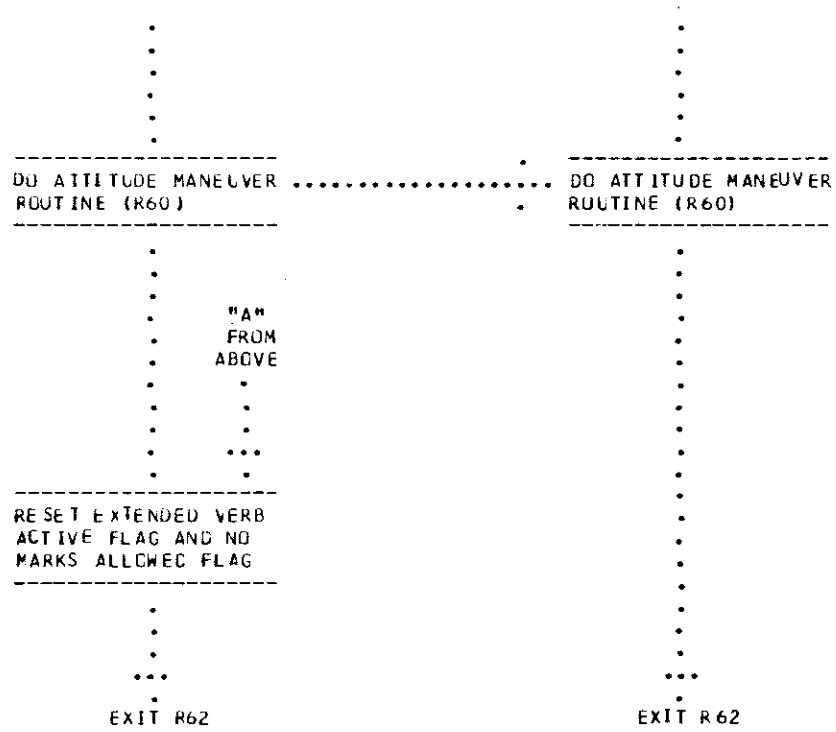
#120



#130

#140

#150

CHANGE CONTROL NOTES

REV 01 EDITORIAL
REV 02 EDITORIAL
REV 03 EDITORIAL

1014

1015

RENDEZVOUS FINAL ATTITUDE ROUTINE (R63) REV 03 12/03/69

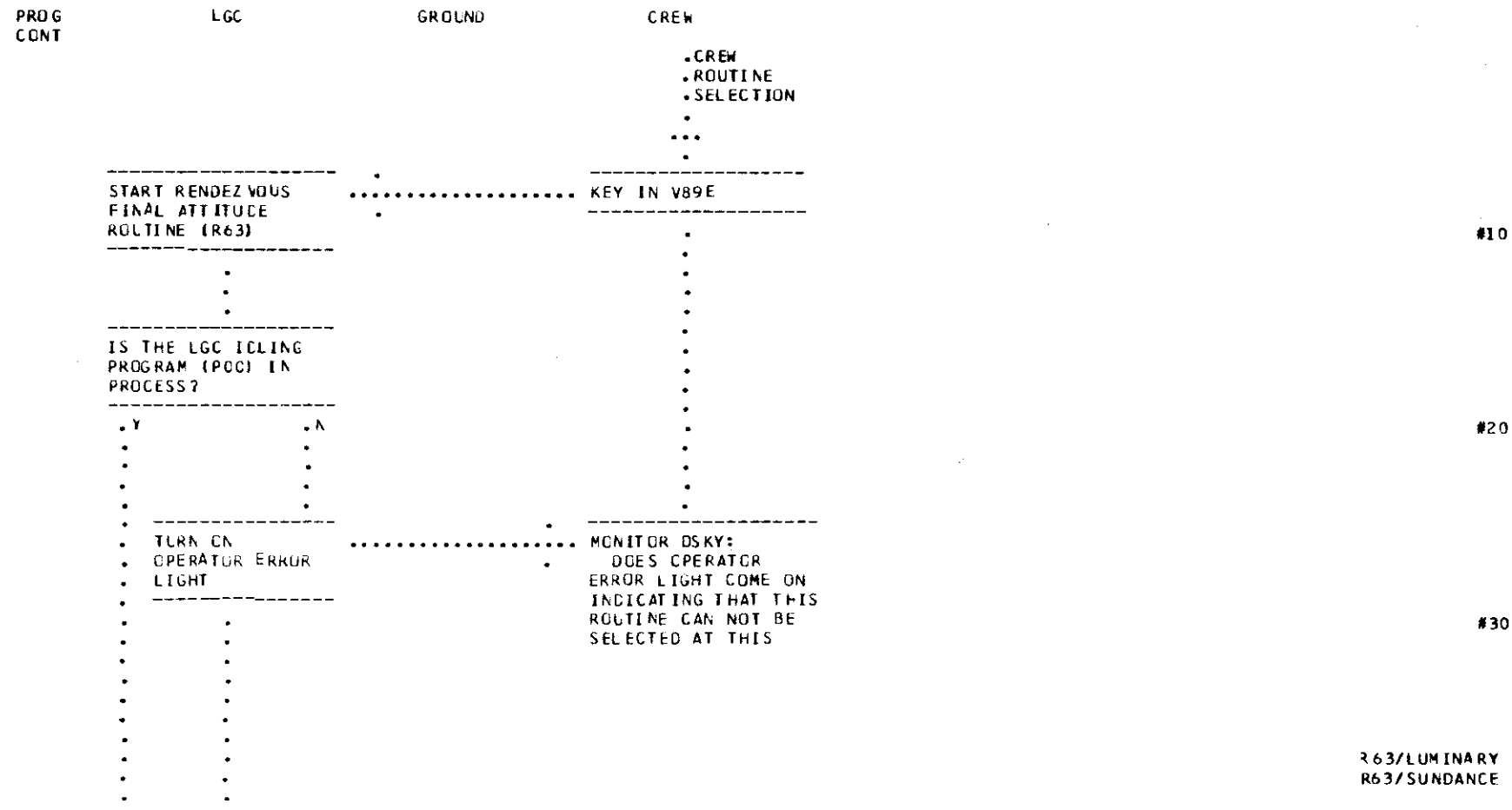
PURPOSE: (1) TO CALCULATE AND DISPLAY THE FINAL FDAI BALL ANGLES REQUIRED TO POINT THE LM +Z OR +X AXIS AT THE CSM.

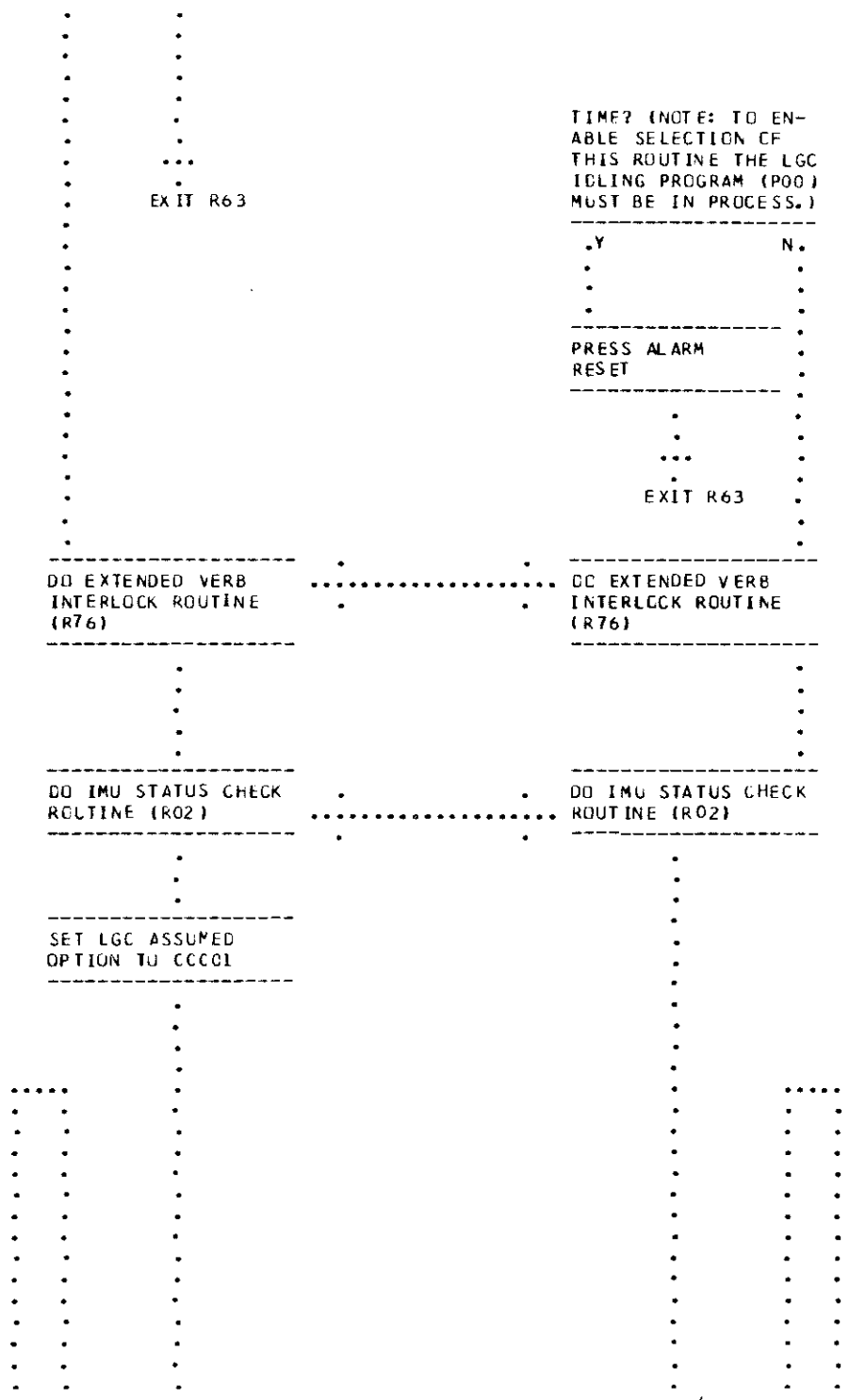
(2) TO CALL THE ATTITUDE MANEUVER ROUTINE (R60) FOR AUTOMATIC MANEUVER CAPABILITY.

ASSUMPTIONS: (1) TO SAVE TIME THE LM ATTITUDE CONTROL MODE SHOULD BE PRESELECTED (FOR AUTOMATIC MANEUVERS, R03 SHOULD HAVE BEEN DONE AND THE AUTO MODE SELECTED).

(2) THIS ROUTINE CAN ONLY BE SELECTED DURING THE LGC IDLING PROGRAM (P00).

(3) THIS ROUTINE IS SELECTED BY THE ASTRONAUT BY DSKY ENTRY.




EXIT R63
TIME? (NOTE: TO ENABLE SELECTION OF THIS ROUTINE THE LGC IDLING PROGRAM (P00) MUST BE IN PROCESS.)
Y
N
PRESS ALARM RESET
EXIT R63
DO EXTENDED VERB INTERLOCK ROUTINE (R76)
DO EXTENDED VERB INTERLOCK ROUTINE (R76)
DO IMU STATUS CHECK ROUTINE (R02)
DO IMU STATUS CHECK ROUTINE (R02)
SET LGC ASSUMED OPTION TO 00001

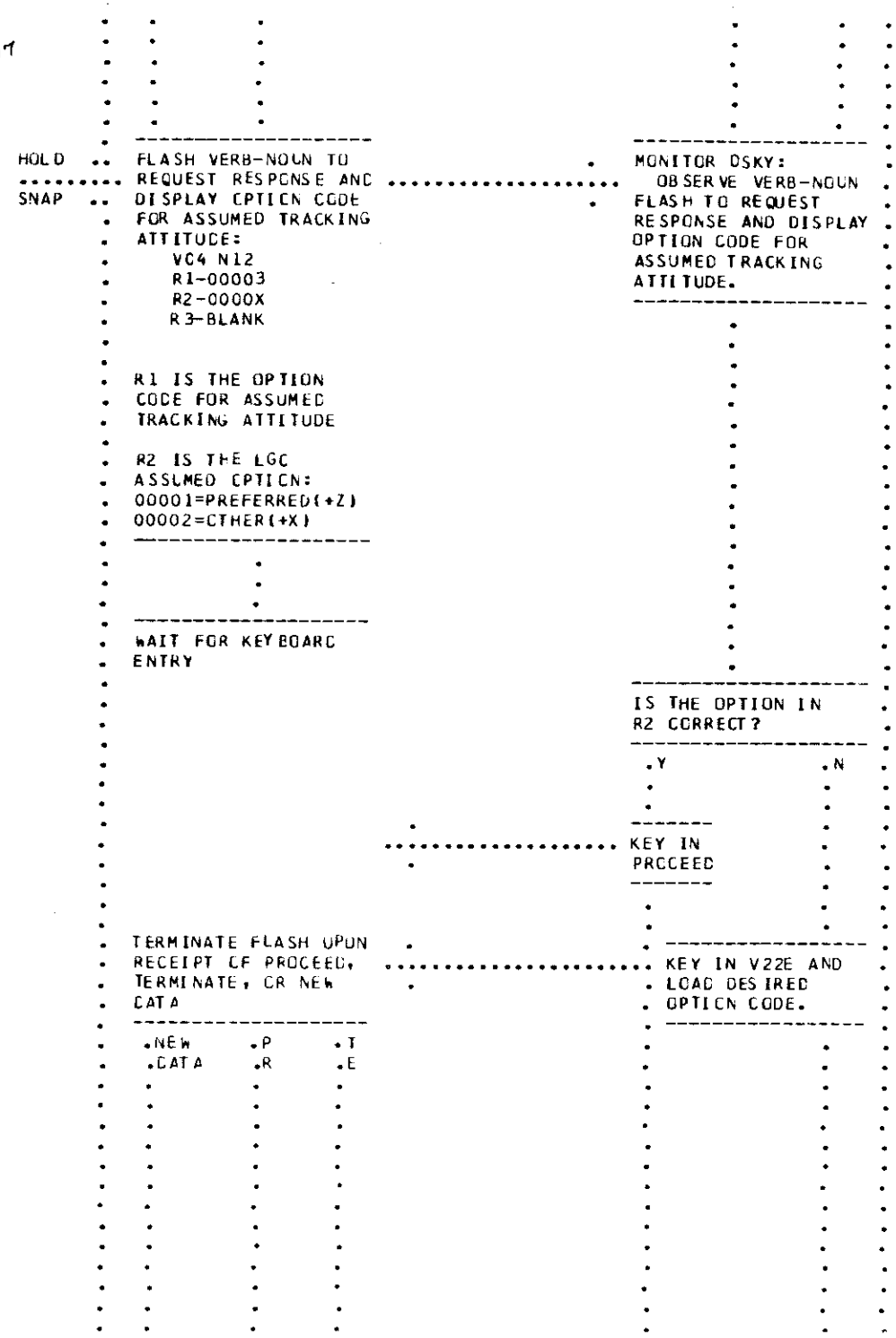
#40

#50

#60

#70

#80



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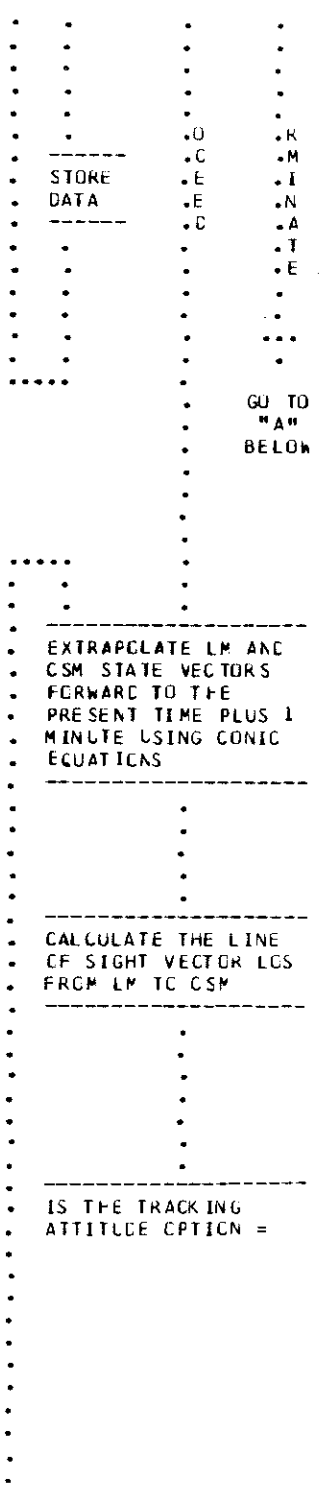
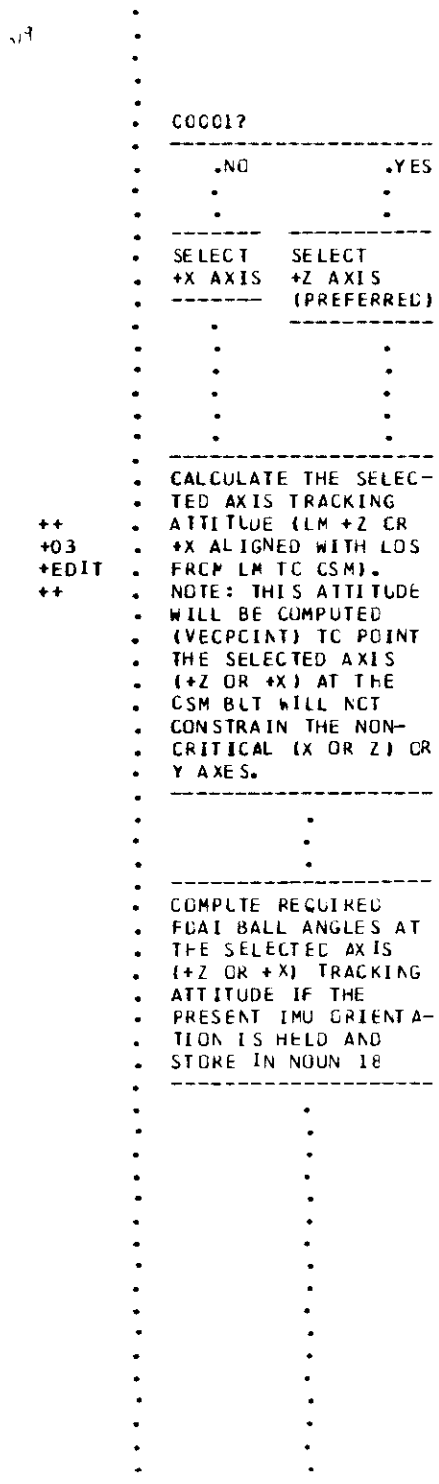




++
+03
+EDIT
++

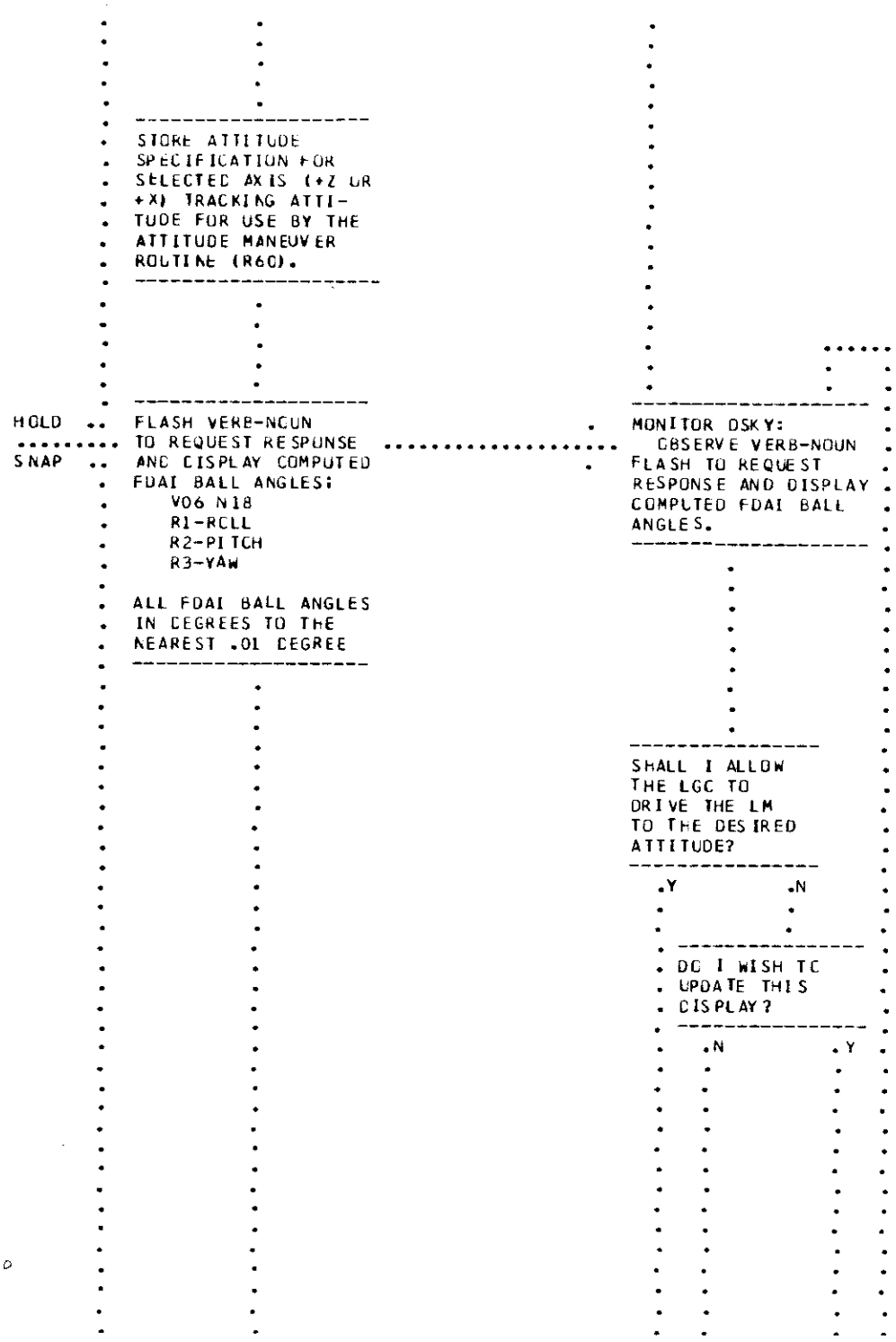
#180

#190

#200

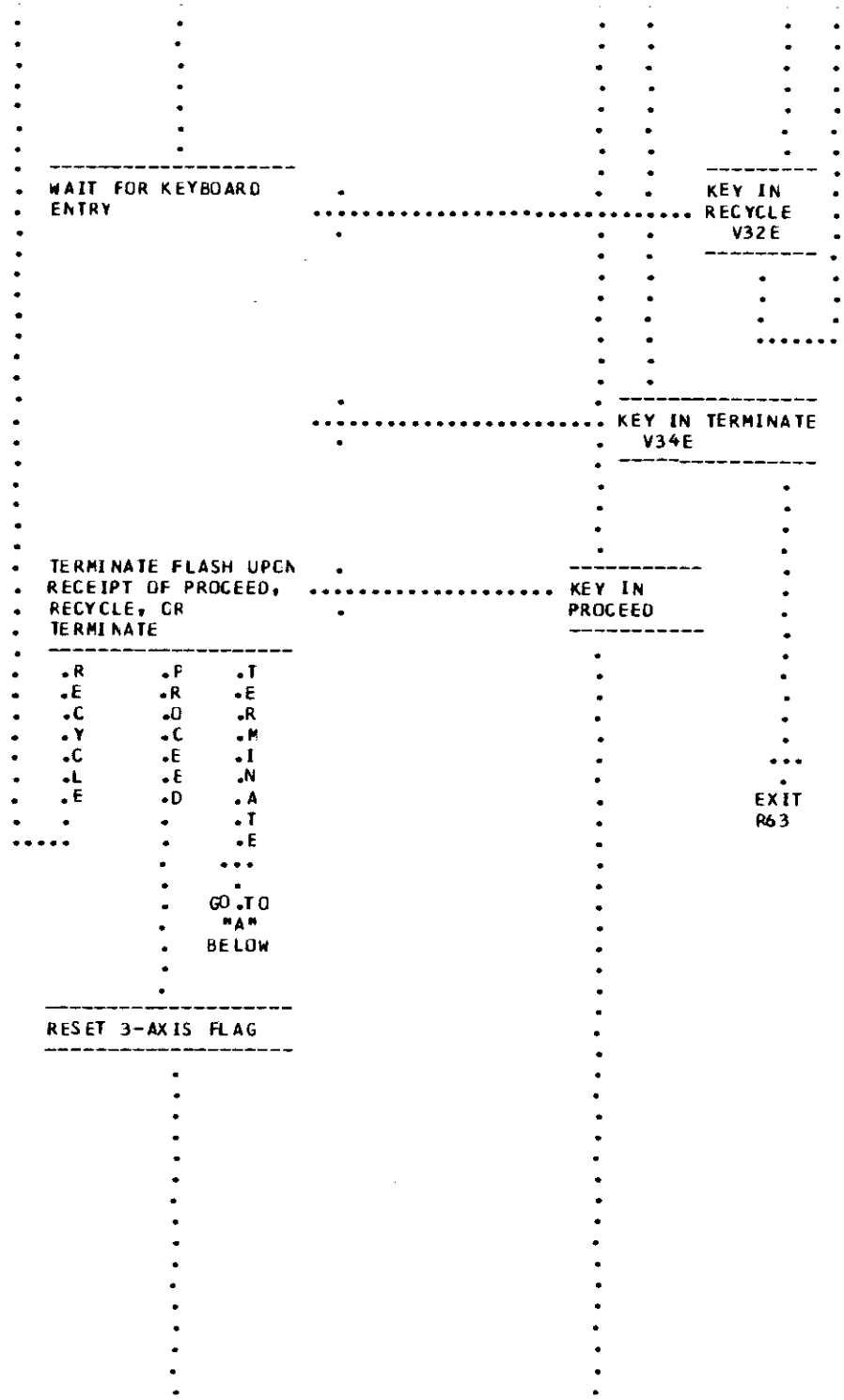
#210

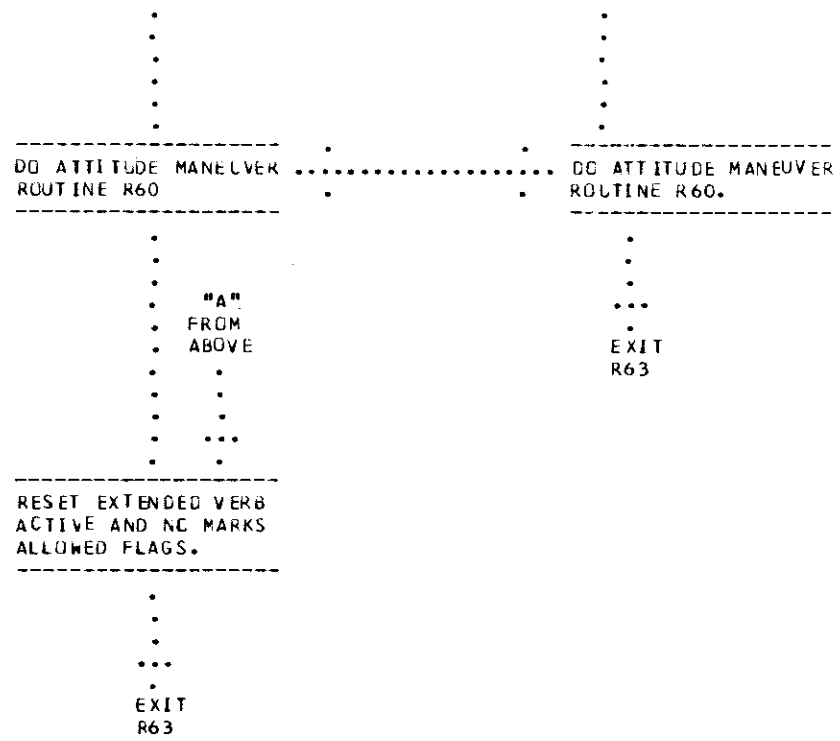
#220


STORE ATTITUDE SPECIFICATION FOR SELECTED AXIS (+Z OR +X) TRACKING ATTITUDE FOR USE BY THE ATTITUDE MANEUVER ROUTINE (R60).
#230
HOLD
SNAP
FLASH VERB-NOUN TO REQUEST RESPONSE AND DISPLAY COMPUTED FDAI BALL ANGLES:
V06 N18
R1-ROLL
R2-PITCH
R3-YAW
ALL FDAI BALL ANGLES IN DEGREES TO THE NEAREST .01 DEGREE
MONITOR DSKY:
OBSERVE VERB-NOUN FLASH TO REQUEST RESPONSE AND DISPLAY COMPUTED FDAI BALL ANGLES.
#240
#250
SHALL I ALLOW THE LGC TO DRIVE THE LM TO THE DESIRED ATTITUDE?
#260
Y
N
DO I WISH TO UPDATE THIS DISPLAY?
#270
N
Y

1020

1021


WAIT FOR KEYBOARD ENTRY
KEY IN RECYCLE V32E
#280
KEY IN TERMINATE V34E
#290
TERMINATE FLASH UPON RECEIPT OF PROCEED, RECYCLE, OR TERMINATE
KEY IN PROCEED
#300
.R .E .C .Y .C .L .E
.P .R .O .C .E .E .D
.T .E .R .M .I .N .A .T .E
GO TO "A" BELOW
EXIT R63
#310
RESET 3-AXIS FLAG
#320



#330

#340

#350

CHANGE CONTROL NOTES

REV 01 PCR 496,498,531
REV 02 EDITORIAL
REV 03 EDITORIAL

1222

FINE PREFERRED TRACKING ATTITUDE ROUTINE (R65) REV 02 12/03/69

PURPOSE: (1) TO PERFORM A CONTINUOUS SERIES OF AUTOMATIC TRIM MANEUVERS TO THE PREFERRED TRACKING ATTITUDE IF EACH MANEUVER REQUIRED IS LESS THAN A SPECIFIED FUNCTION OR, IF NOT, TO NOTIFY THE CREW THAT AN ATTITUDE MANEUVER TO THE PREFERRED TRACKING ATTITUDE IS REQUIRED VIA R60.

(2) TO COMPUTE THE PREFERRED TRACKING ATTITUDE OF THE LM WHICH ENABLES RR TRACKING OF THE CSM AND CSM TRACKING OF THE LM BEACON.

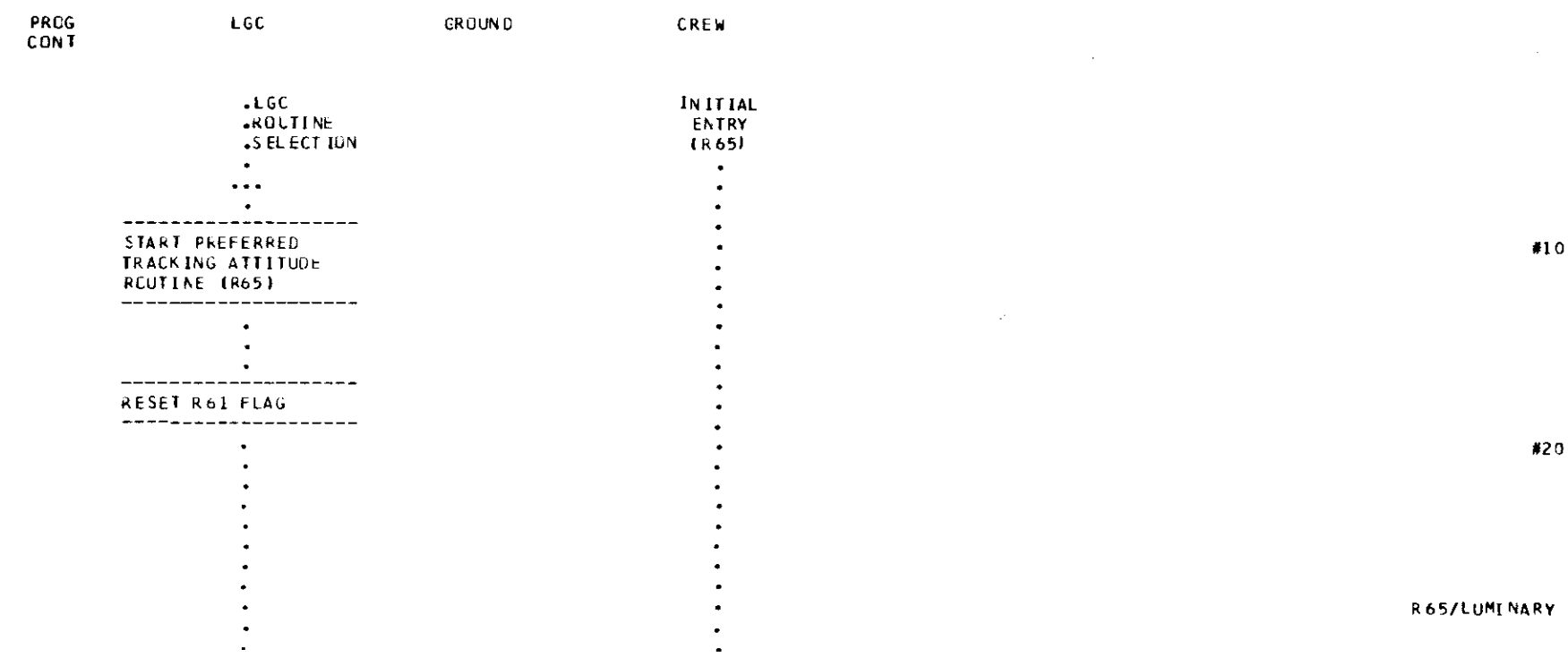
ASSUMPTIONS: (1) THE PREFERRED TRACKING ATTITUDE IS DEFINED AS FOLLOWS:

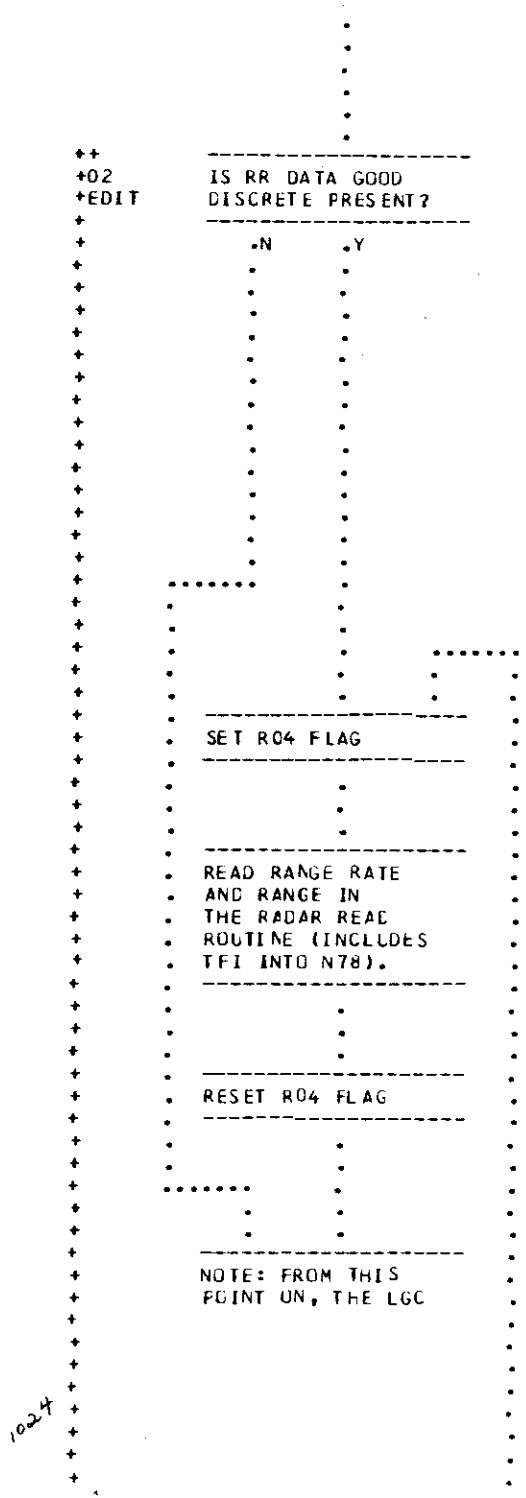
(A) THE LM +Z AXIS IS ALIGNED ALONG THE LOS TO THE CSM.

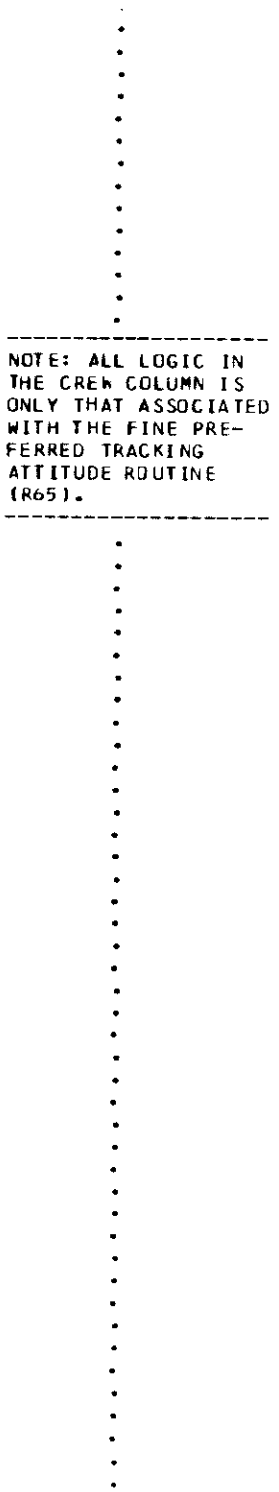
++
+02 (B) THE ROLL ATTITUDE (ABOUT LM +Z AXIS) IS UNDEFINED, BUT MAINTAINED AT THE ORIENTATION RESULTING FROM THE R60 MANEUVER, OR FROM MANUAL CREW ADJUSTMENT.
++

(2) THIS ROUTINE WILL ITERATE NZ TIMES, WHERE NZ IS DEFINED BY THE CALLING PROGRAM/ROUTINE.

(3) THE ROUTINE IS AUTOMATICALLY CALLED BY THE PREFERRED TRACKING ATTITUDE PROGRAM (P25), AND THE RR DATA READ ROUTINE (R22).







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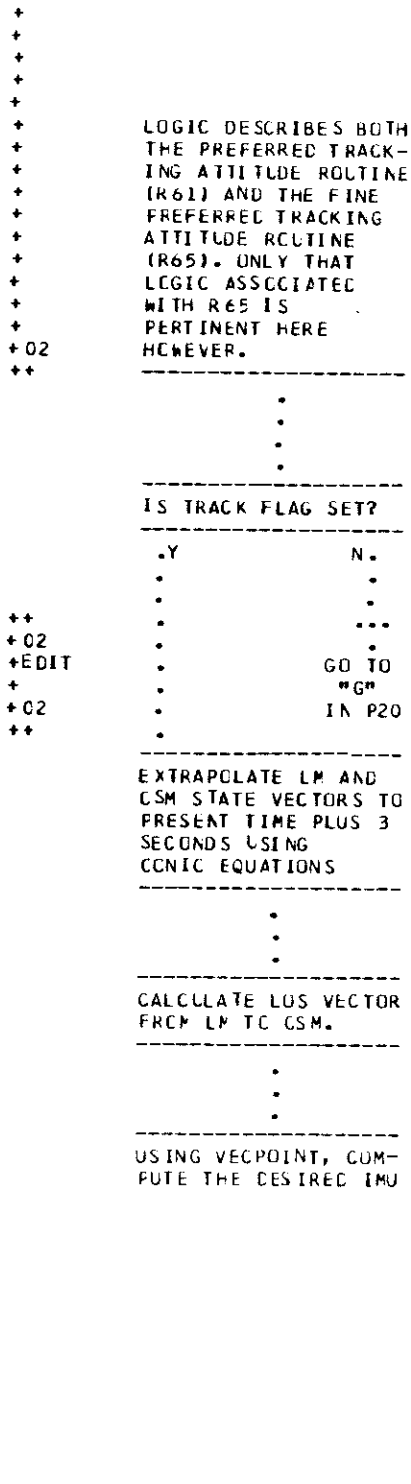
1024

1025



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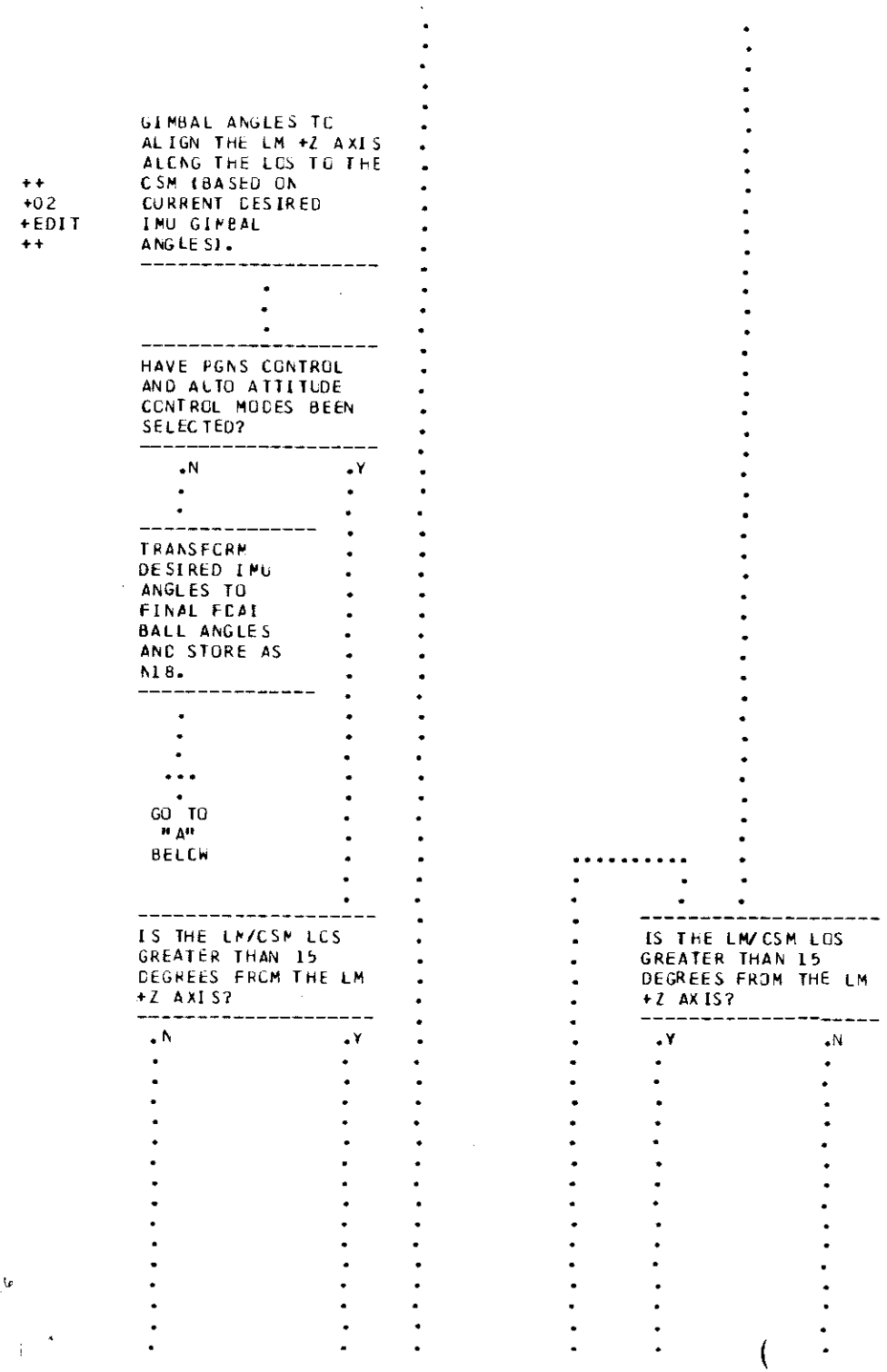

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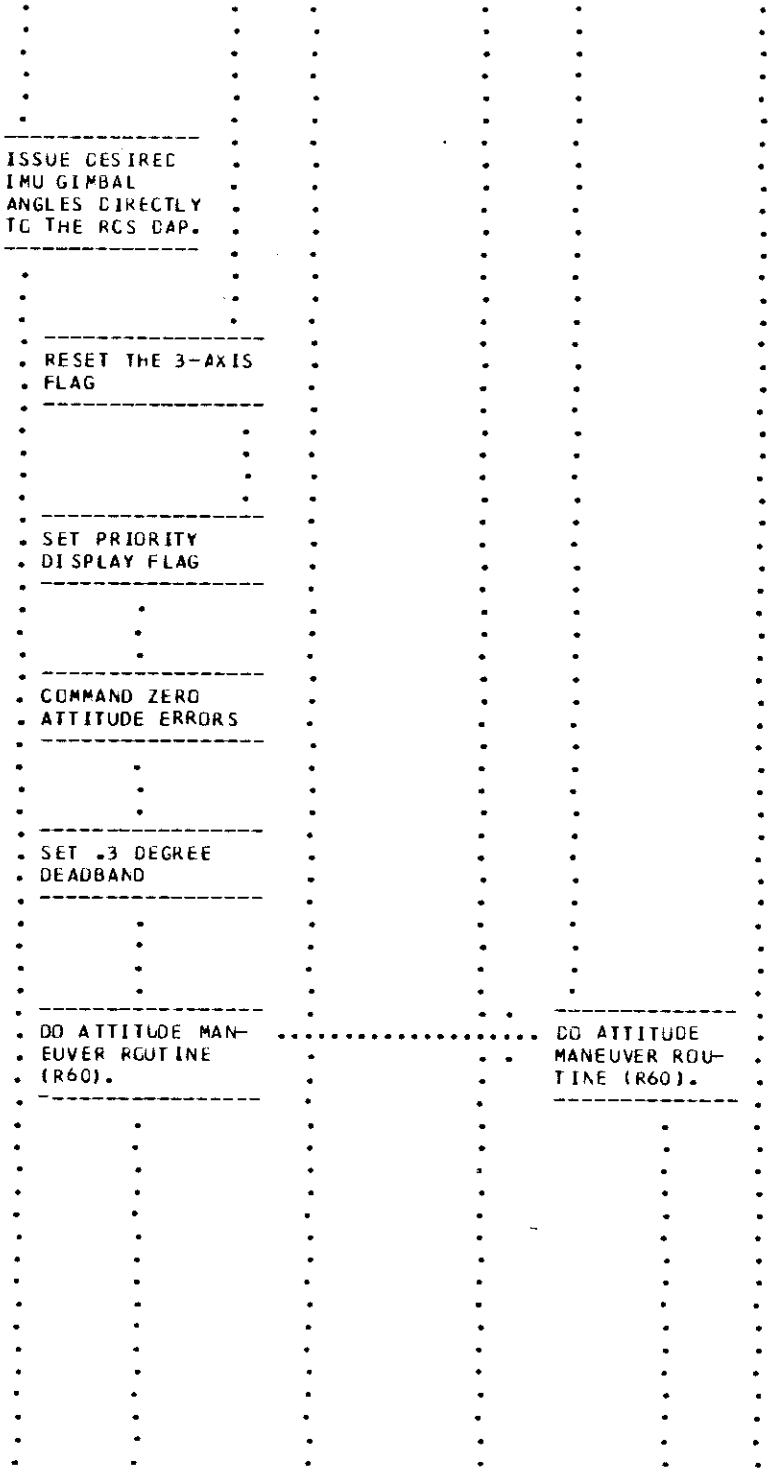

++
+02
+EDIT
++

#220

#230

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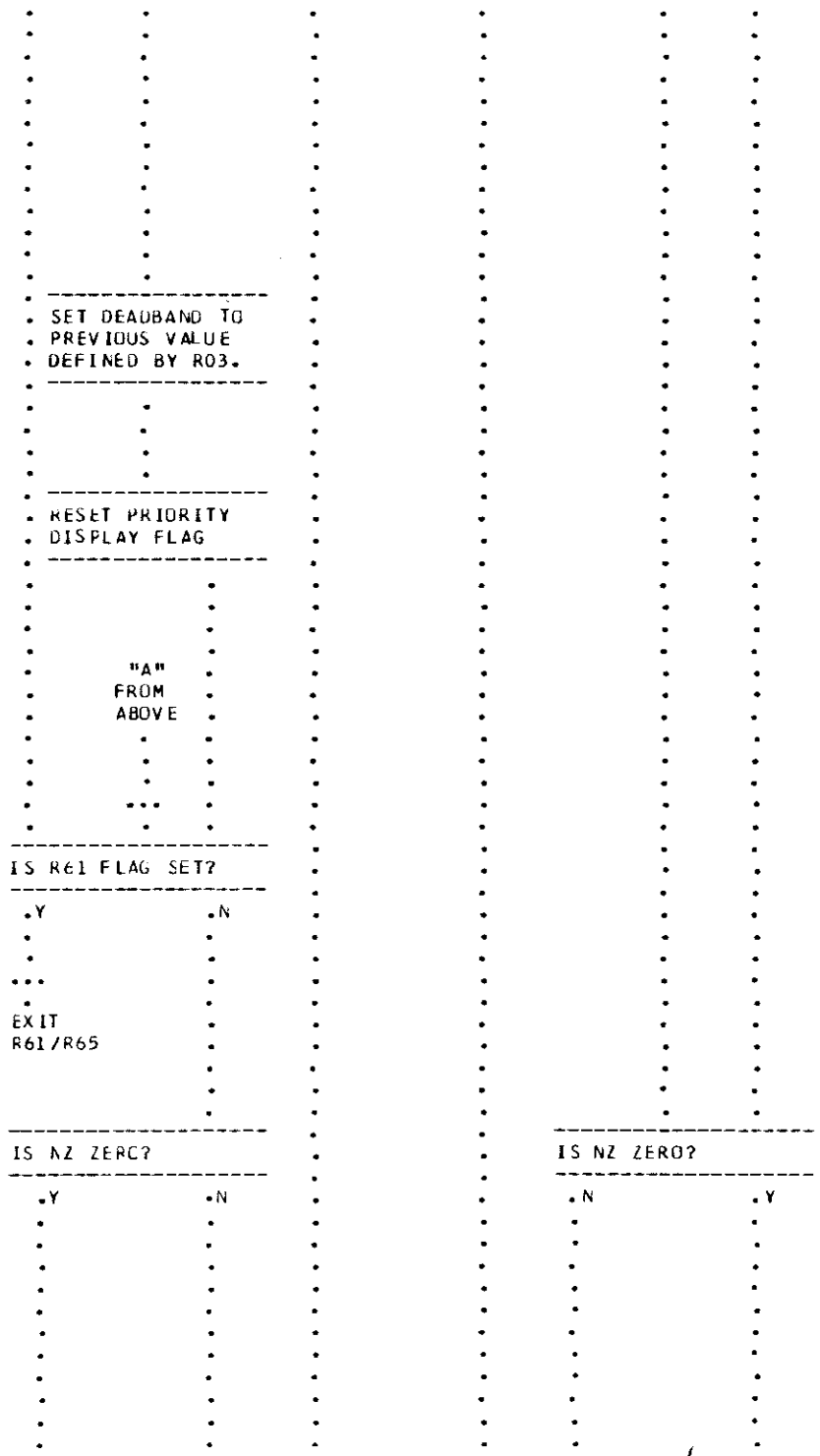
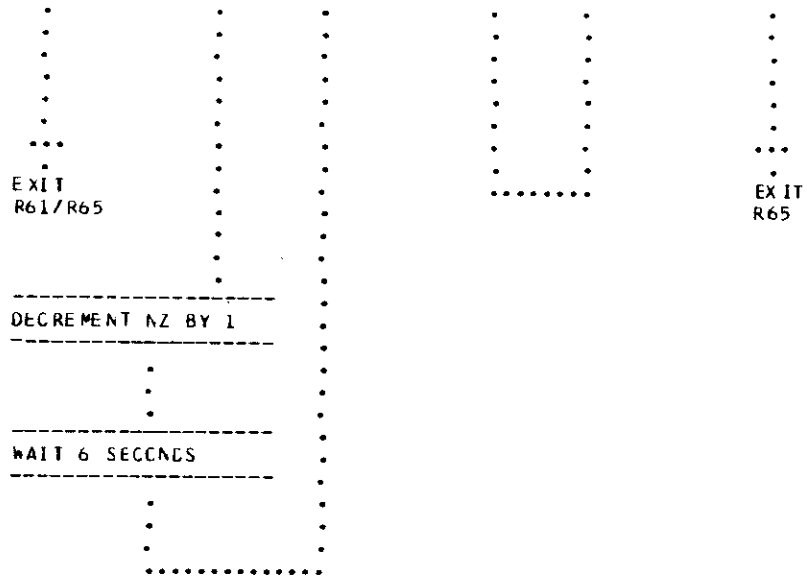


1029



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CHANGE CONTROL NOTES

LOGIC REV 01 PCR 39,634
LOGIC REV 02(LUM 1A) PCR 642,716
LOGIC REV 01(LUM 1B) PCR 780
REV 02 EDITORIAL

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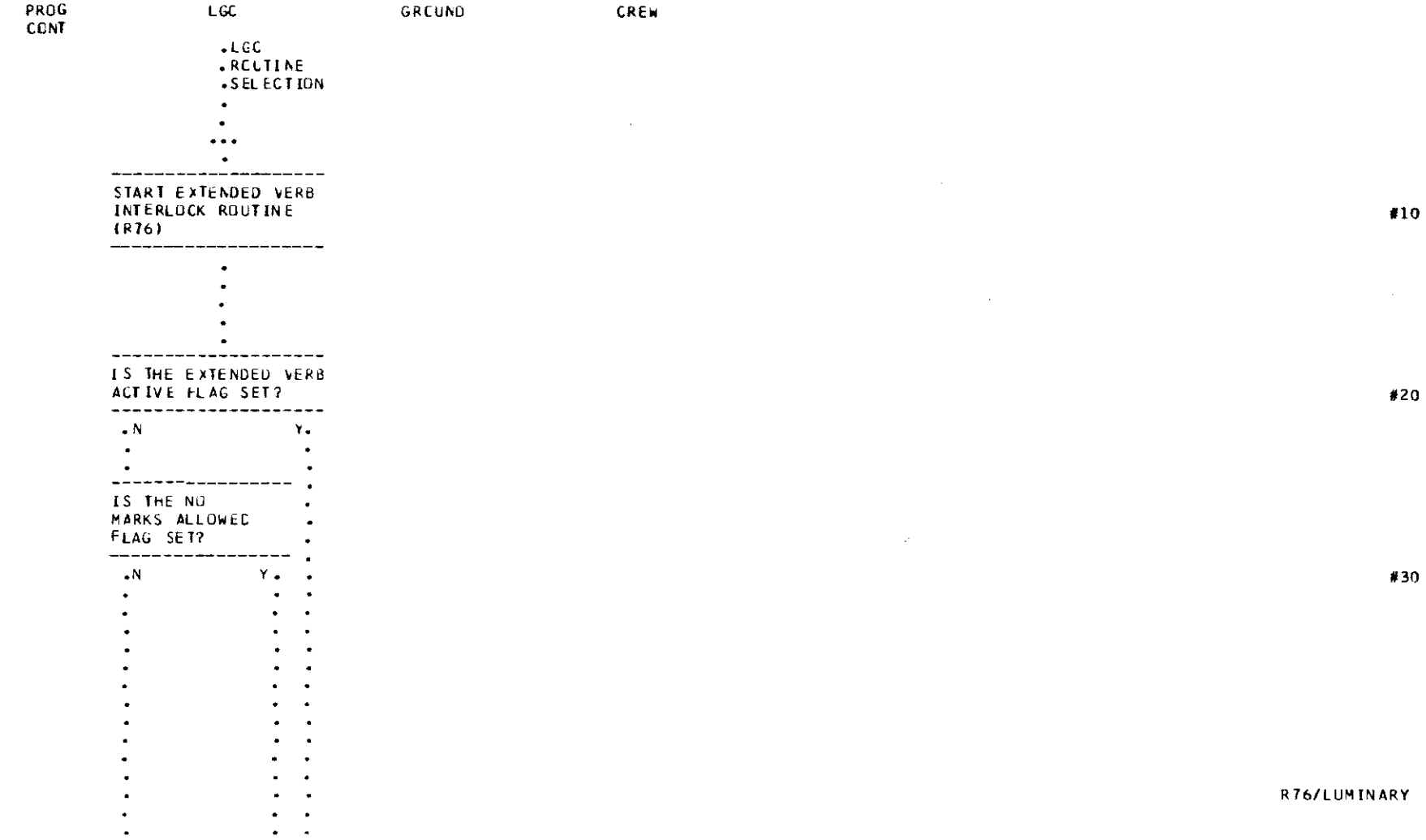
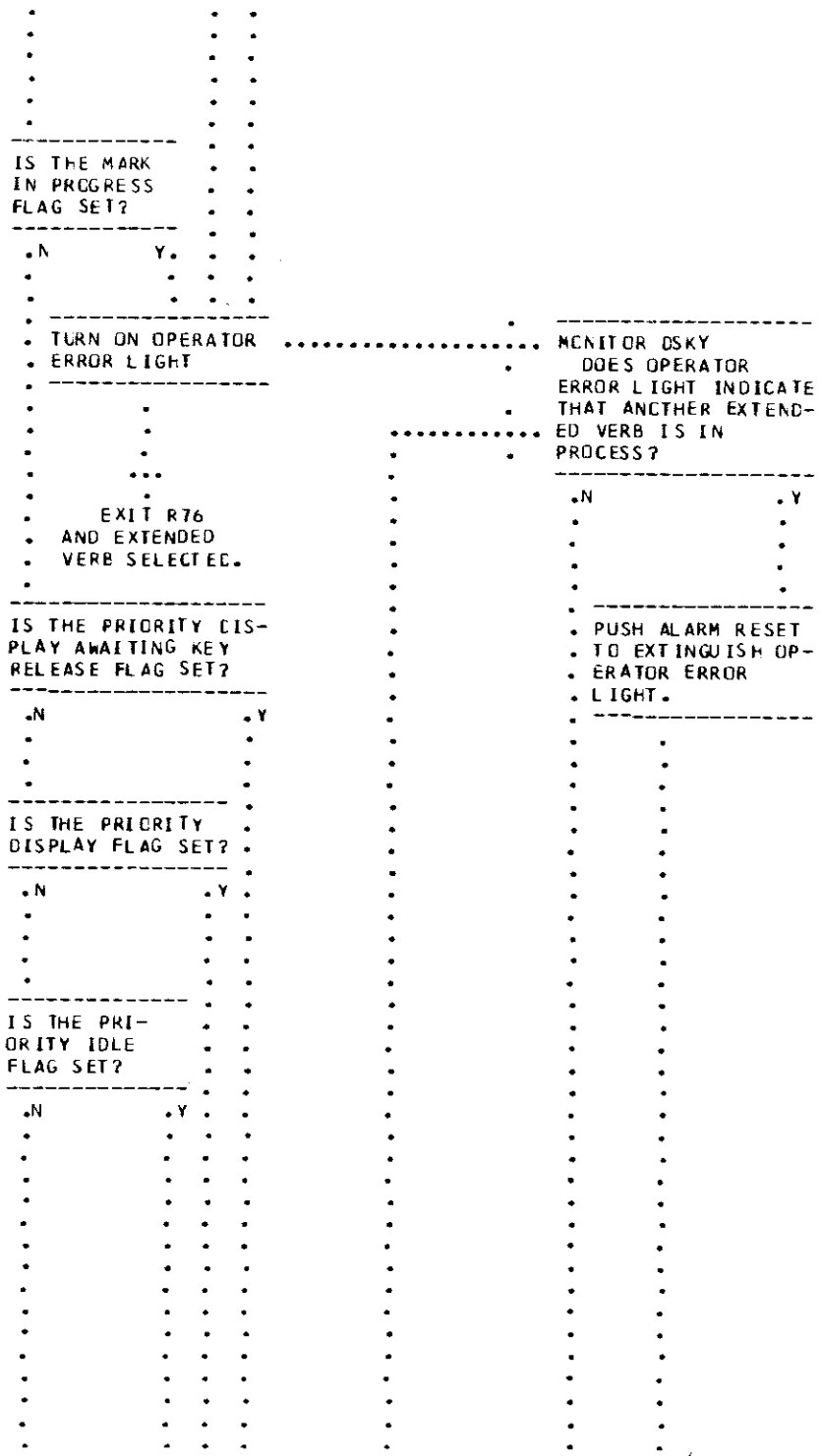
1031

EXTENDED VERB INTERLOCK ROUTINE (R76) REV 02 12/03/69

PURPOSE: (1) TO INHIBIT SELECTION OF EXTENDED VERBS UNDER CERTAIN CIRCUMSTANCES.

ASSUMPTIONS: (1) THIS ROUTINE IS CALLED BY THE FOLLOWING EXTENDED VERBS: V41N20, V41N72, V42, V43, V47(R47), V48(R03), V49(R62),
++ V55, V57, V63(R04), V64(R05), V67, V70(P27), V71(P27), V72(P27), V73(P27), V82(R30), V83(R31), V85, V89(R63),
+02 V90(R36), V91, V92
+EDIT
++





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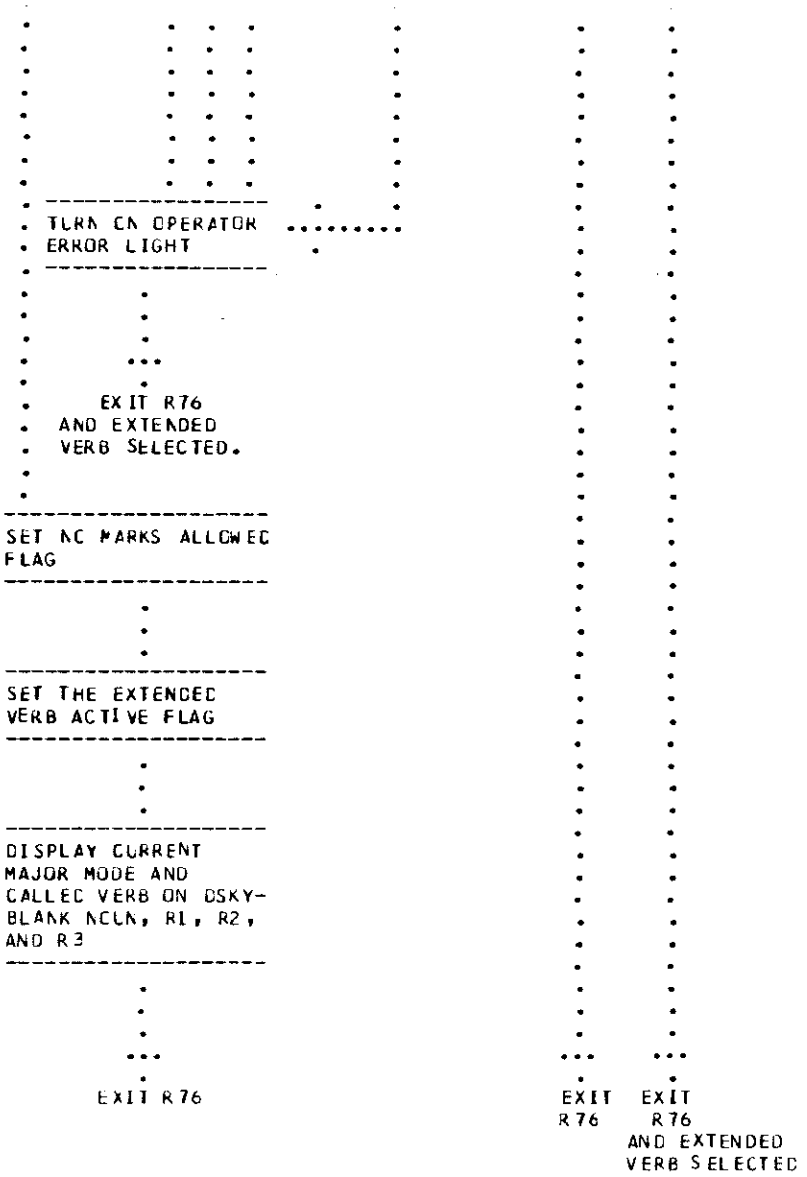

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CHANGE CONTROL NOTES

REV 01 (NO PCRS)
REV 02 EDITORIAL

1034

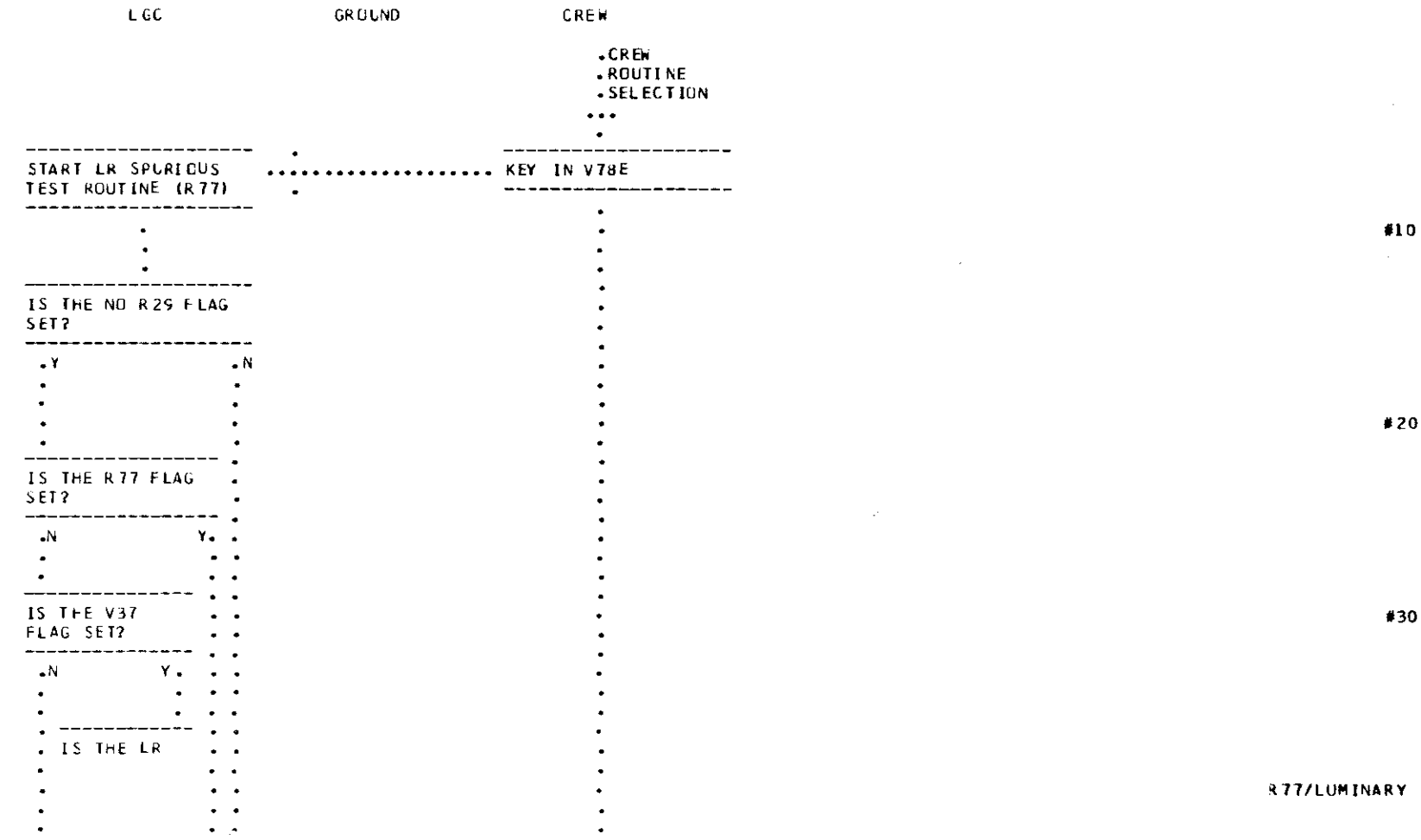
1035

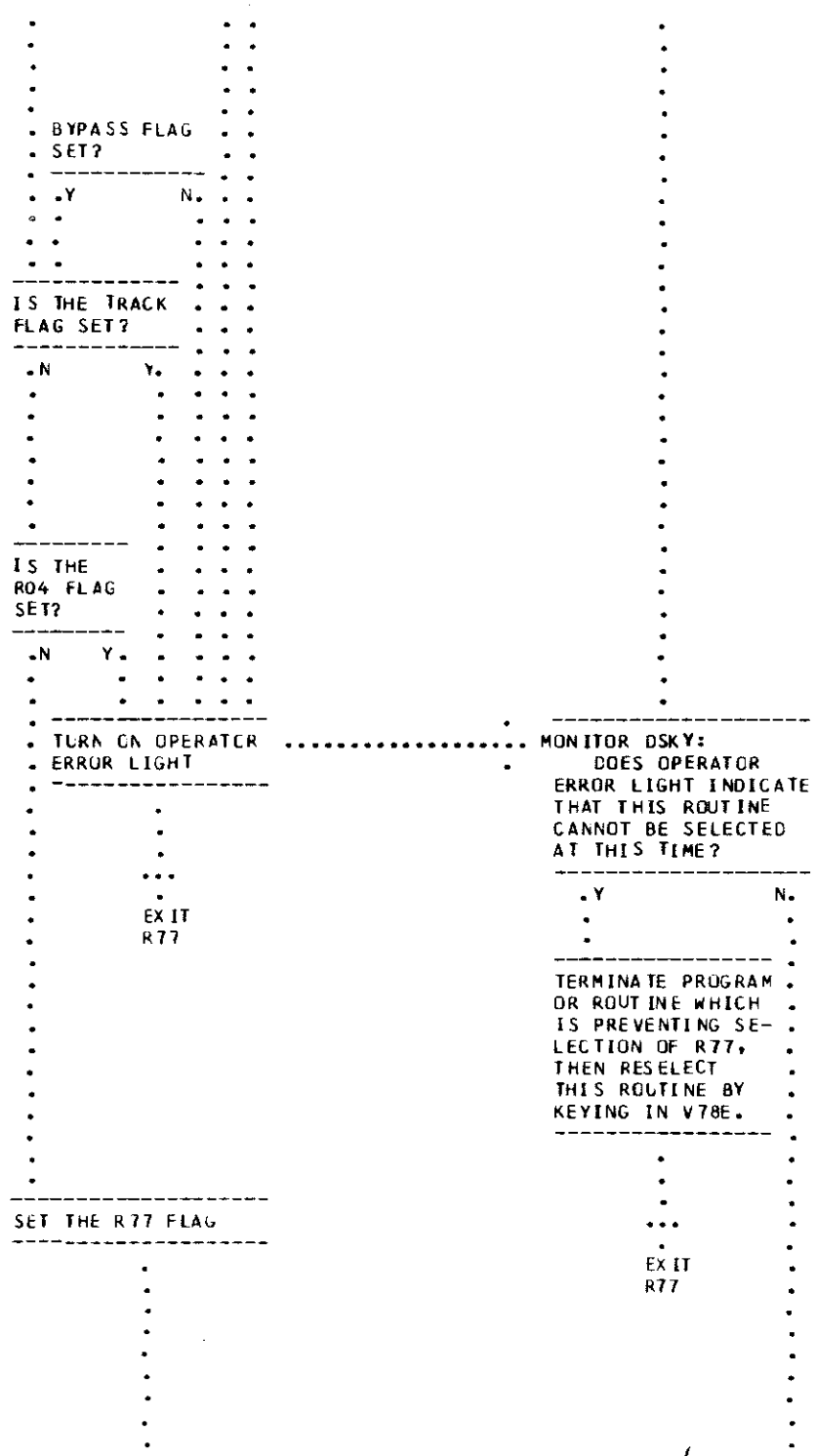
LR SPURIOUS TEST ROUTINE (R77) REV 03 12/03/69

PURPOSE: (1) TO READ OUT THE RANGE AND VELOCITY DATA FROM THE LANDING RADAR (LR) AND PUT IT ON THE LGC DOWNLINK DURING LR SPURIOUS RETURN TESTS.

ASSUMPTIONS: (1) THE LR DATA IS PLACED ON THE DOWNLINK REGARDLESS OF THE STATUS OF THE LR RANGE DATA GOOD AND VELOCITY DATA GOOD DISCRETES.

++
+03
+EDIT (2) THIS ROUTINE IS MANUALLY SELECTED BY DSKY ENTRY (V78E) AND MAY BE CALLED ONLY WHEN NO OTHER PROGRAM OR ROUTINE IS USING EITHER RADAR. THE ROUTINE MUST BE TERMINATED BY MANUAL DSKY ENTRY (V79E).
+03
++





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+03
+EDIT
+03
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+03
+EDIT
+
+03
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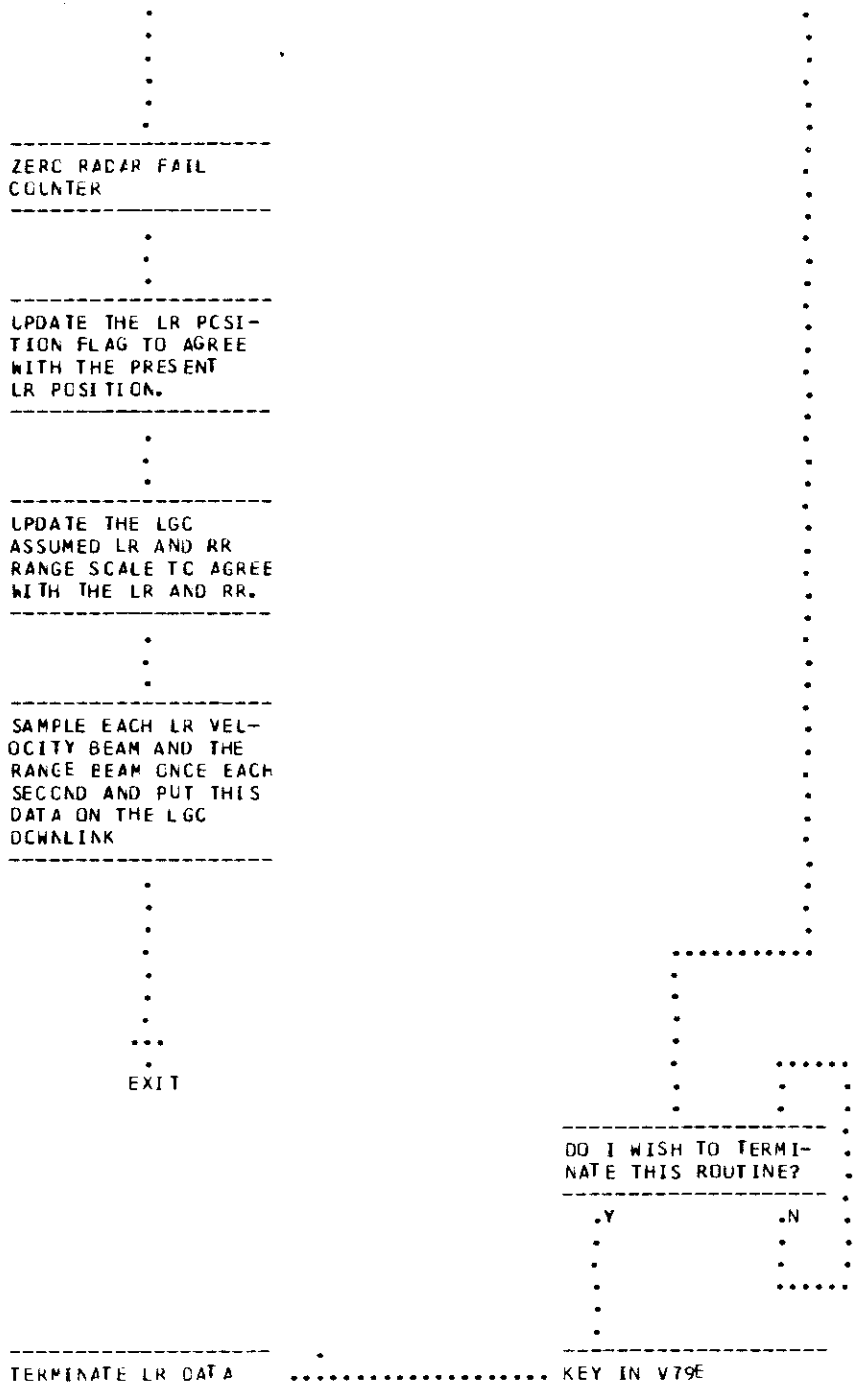
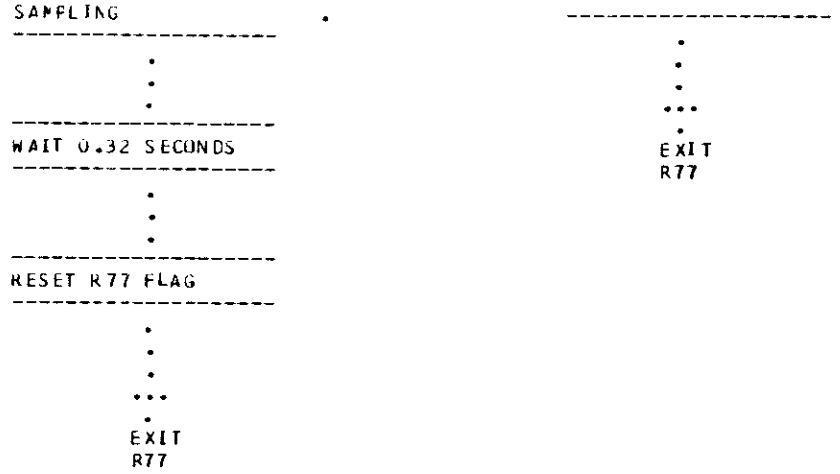
1036

1037


ZERO RADAR FAIL COUNTER
#100
UPDATE THE LR POSITION FLAG TO AGREE WITH THE PRESENT LR POSITION.
#110
UPDATE THE LGC ASSUMED LR AND RR RANGE SCALE TO AGREE WITH THE LR AND RR.
#120
SAMPLE EACH LR VELOCITY BEAM AND THE RANGE BEAM ONCE EACH SECOND AND PUT THIS DATA ON THE LGC DOWNLINK
#130
EXIT
DO I WISH TO TERMINATE THIS ROUTINE?
#140
Y
N
TERMINATE LR DATA
KEY IN V79E



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CHANGE CONTROL NOTES

LOGIC REV 01 PCR 229
REV 02 EDITORIAL
REV 03 EDITORIAL

1038

4.4.11 EXTENDED VERBS(AND V36)

REV 01 08/07/69

	TITLE
V36	REQUEST FRESH START
V40N20	ZERO IMU CDUS
V40N72	ZERO RR CDUS
V41N20	COARSE ALIGN IMU CDUS
V41N72	COARSE ALIGN RR CDUS
V42	FINE ALIGN IMU
V43	LOAD FDAI ERROR NEEDLES
V44	TERMINATE RR CONTINUOUS DESIGNATE
V47	INITIALIZE AGS, R47
V48	START CAP DATA LOAD, R03
V49	START CREW-DEFINED MANEUVER, R62
V50	PLEASE PERFORM
V52	MARK X-RETICLE
V53	MARK Y-RETICLE
V54	MARK X-OR Y-RETICLE
V55	INCREMENT LGC TIME (DECIMAL)
V56	REQUEST TERMINATE TRACKING ROUTINE
V57	PERMIT LANDING RADAR UPDATE
V58	INHIBIT LANDING RADAR UPDATE
V59	COMMAND LR TO POSITION 2
V60	DISPLAY VEHICLE RATES
V61	DISPLAY CAP ATTITUDE ERROR
V62	DISPLAY TOTAL ATTITUDE ERROR

V63	START RR/LR SELF TEST ROUTINE, R04
V64	START S-BAND ANTENNA ROUTINE, R05
V65	DISABLE U,V JETS DURING DPS BURNS
V66	VEHICLES ATTACHED, MOVE THIS VEHICLE STATE VECTOR TO OTHER VEHICLE STATE VECTOR
V67	W MATRIX RMS ERROR DISPLAY
V69	RESTART
V70	START LGC UPDATE: LIFTOFF TIME
V71	START LGC UPDATE: BLOCK ADDRESS
V72	START LGC UPDATE: SINGLE ADDRESS
V73	START LGC UPDATE: LGC TIME (OCTAL)
V74	INITIALIZE ERASABLE DUMP VIA DOWNLINK
V75	ENABLE L,V JETS DURING DPS BURNS
V76	MINIMUM IMPULSE COMMAND MODE
V77	RATE COMMAND AND ATTITUDE HOLD MODE
V78	START LR SPURIOUS TEST, R77
V79	STOP LR SPURIOUS TEST, R77
V80	ENABLE LM STATE VECTOR UPDATE
V81	ENABLE CSM STATE VECTOR UPDATE
V82	REQUEST ORBIT PARAMETER DISPLAY, R30
V83	REQUEST RENDEZVOUS PARAMETER DISPLAY, R31
V85	DISPLAY RR LOS AZIMUTH AND ELEVATION
V89	START RENDEZVOUS FINAL ATTITUDE MANEUVER, R63
V90	REQUEST RENDEZVOUS OUT-OF-PLANE DISPLAY, R36
V91	DISPLAY BANKSUM
V92	START IMU PERFORMANCE TESTS (GROUND USE)
V93	ENABLE W MATRIX INITIALIZATION
V95	NO UPDATE OF EITHER STATE VECTOR

1040

V96 INTERRUPT INTEGRATION AND GO TO P00

V97 PERFORM ENGINE FAIL PROCEDURE

V99 ENABLE ENGINE IGNITION

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V36, REQUEST FRESH START REV 03 12/03/69

PURPOSE: (1) TO INITIATE A COMPUTER FRESH START.

ASSUMPTION: (1) THIS PROCESS MAY BE SELECTED AT ANY TIME.

(2) FRESH START CAN BE INITIATED IN ANY OF THE FOLLOWING WAYS:

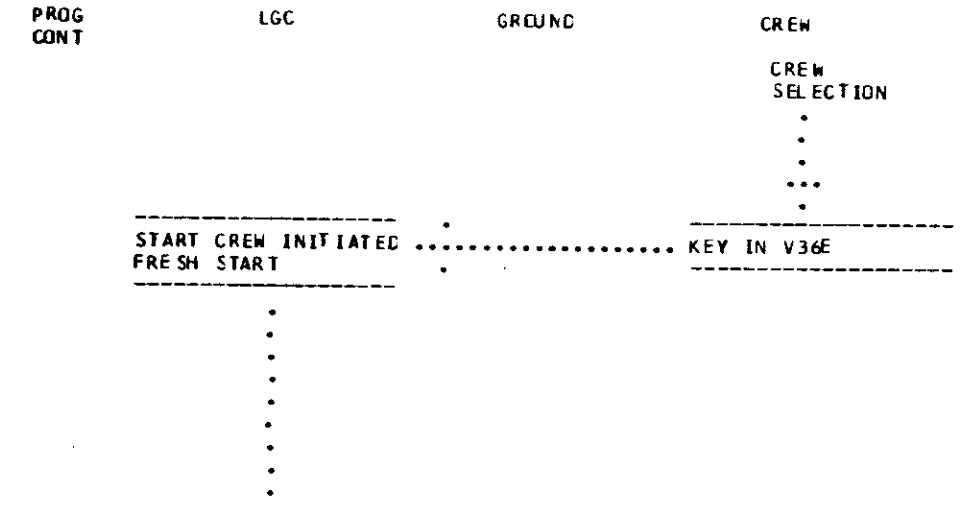
(A) VIA PROGRAM IF PHASE TABLE DISAGREEMENT IS DETECTED FOLLOWING A RESTART (ALARM CODE 01107).
(B) VIA PROGRAM IF SELF CHECK IS INTERRUPTED BY A RESTART DURING ITS ERASABLE MEMORY CHECK AND ERASABLE MEMORY IS SUSPECT.
(C) BY SIMULTANEOUS DEPRESSING OF THE MARK REJECT AND ERROR RESET BUTTONS DURING A RESTART.
(D) DSKY ENTRY OF V36E.

NOTE: A COMMANDED FRESH START (V36) WILL TURN OFF THE ENGINE, AS WILL PRESSING "MARK REJECT" AND "ERROR RESET" DURING A RESTART.
THUS: "A" AND "B" DO NOT SHUT OFF THE DPS OR APS, "C" AND "D" WILL SHUT OFF THE DPS OR APS.

(3) IF FRESH START INTERRUPTS STATE VECTOR INTEGRATION, THE STATE VECTOR MAY BE INVALIDATED.

NOTE: LGC FRESH START INITIALIZES ALL FLAGWORDS (SEE EXCEPTIONS BELOW), CLEARS ALL JOB CORE SET AND VAC AREAS, SETS WAITLIST TASKS TO ENDTASK, INITIALIZES ALL OUTPUT CHANNELS, INITIALIZES DAP IDLING PROGRAM, INITIALIZES DOWNLINK TO COAST-AND-ALIGN DOWNLIST, BLANKS THE DSKY , AND EXITS TO AN IDLING STATE (DUMMY JOB).

LGC FRESH START DOES NOT ALTER THE STATE OF THE FOLLOWING FLAG BITS:
(1) APSFLAG, WHICH INDICATES IF THE DESCENT STAGE IS ATTACHED.
(2) SURFACE FLAG, WHICH INDICATES IF THE LM STATE IS ON THE LUNAR SURFACE.
(3) LMOONFLG, WHICH INDICATES IF THE LM STATE IS EARTH OR LUNAR CENTERED.
(4) CMOONFLG, WHICH INDICATES IF THE CSM STATE IS EARTH OR LUNAR CENTERED.
(5) REFSMMAT FLAG, WHICH INDICATES IF REFSMMAT IS VALID.



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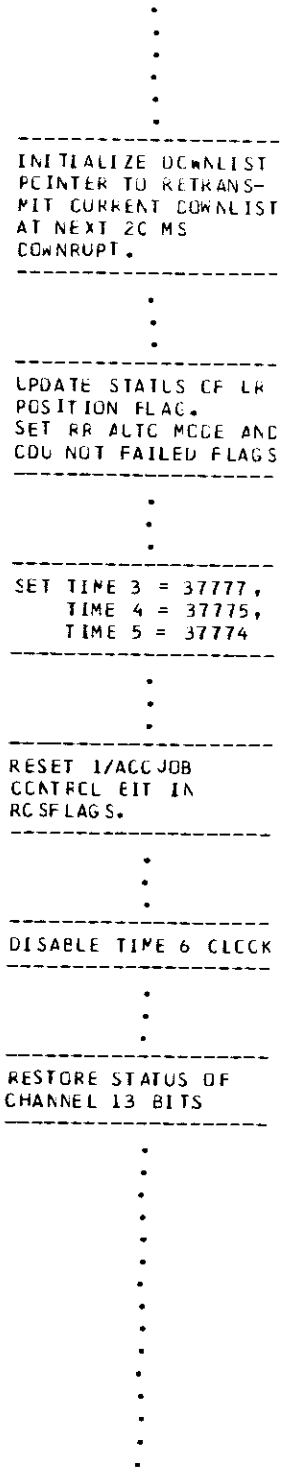

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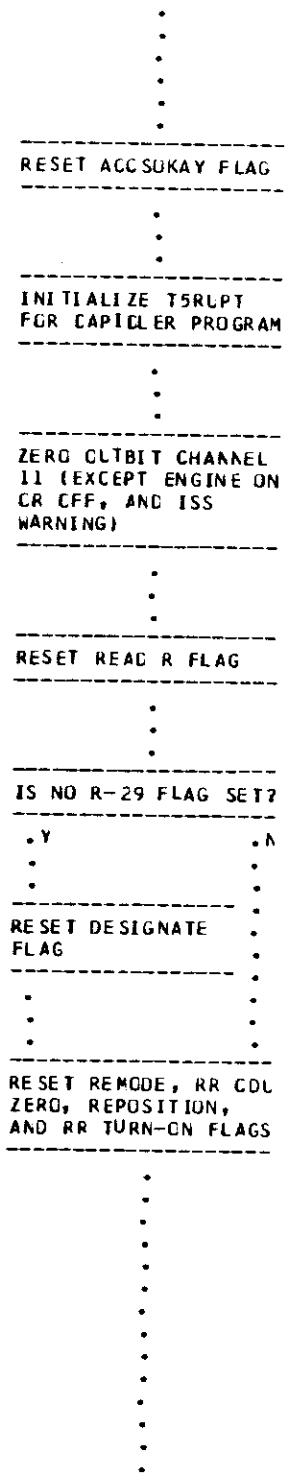


#70

#80

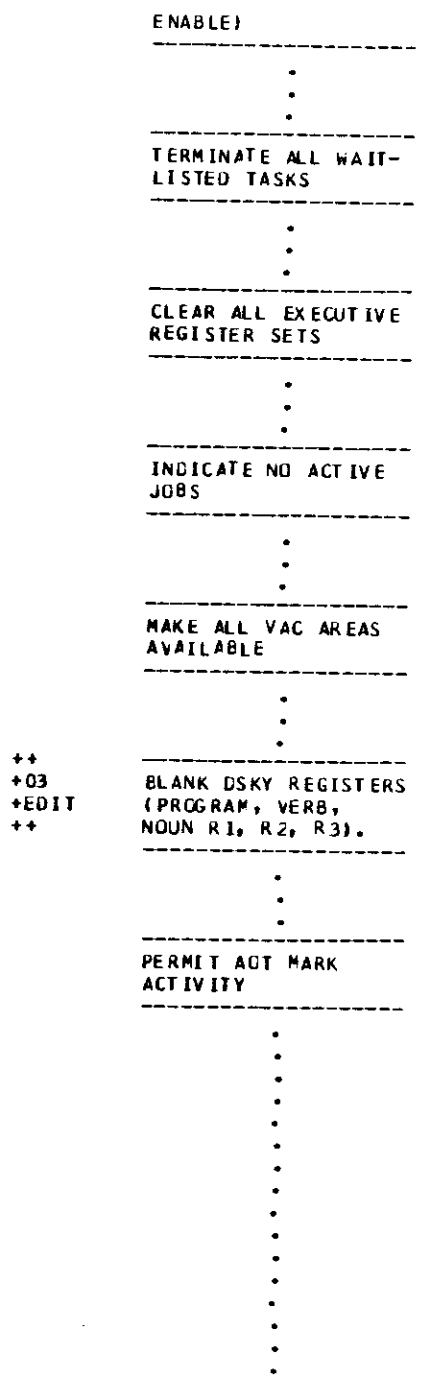
#90

#100

#110

```
                    .
                    .
                    .
                    .
                    .
                    .
          ----------------------
          ZERO OUTBIT CHANNEL
          12 (EXCEPT RR LOCK-
          ON ENABLE, GIMBAL
          TRIM DRIVES, ENABLE
          IMU ERROR COUNTERS,
          ZERO IMU CDUS, AND
          COARSE ALIGN
          ENABLE).                                          #120
          ----------------------
                    .
                    .
                    .
          ----------------------
          RESET NC RR MONITOR
          FLAG (R25)
          ----------------------
                    .
                    .
                    .                                       #130
                    .
++        ----------------------
+03       RESET R77 FLAG
+EDIT     ----------------------
++                  .
                    .
                    .
          ----------------------
          ZERO OUTBIT CHANNEL
          13 (EXCEPT TELEMETRY
          BITS, RESET TRAP                                  #140
          BITS, AND T6RUPT
          BIT).
          ----------------------
                    .
                    .
                    .
          ----------------------
          SET HAND CONTROL
          RUPT BIT IN CHANNEL                               #150
          13.
          ----------------------
                    .
                    .
                    .
          ----------------------
          ZERO OUTBIT CHANNEL
          14 (EXCEPT GYRO
```

1046



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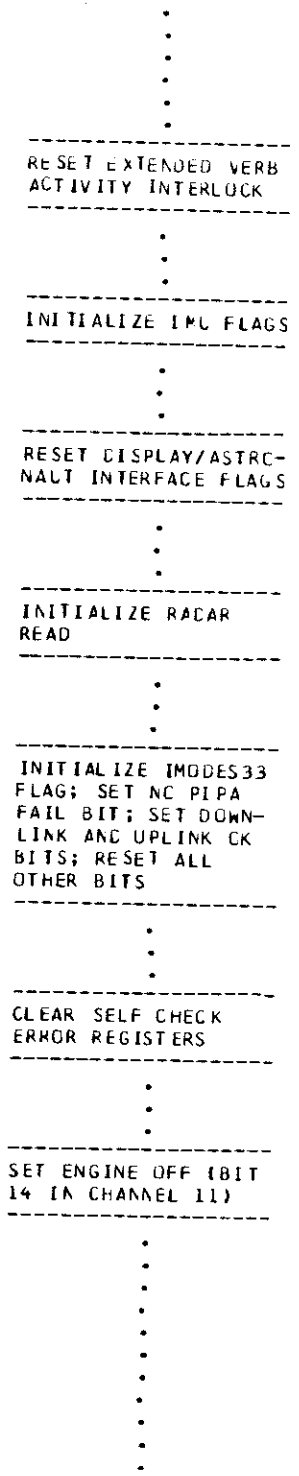


#210

#220

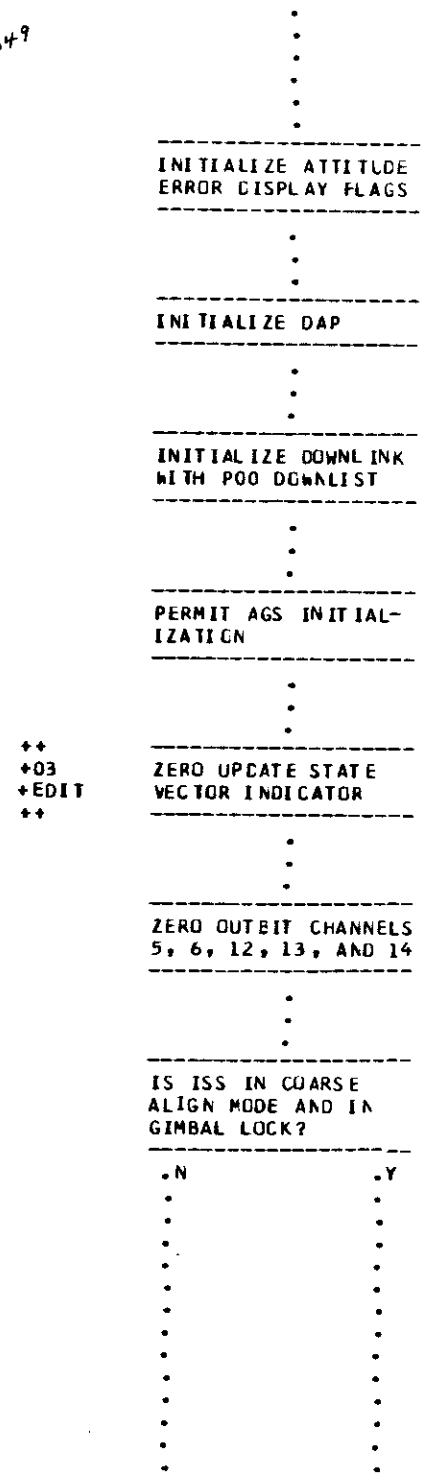
#230

++
+03
+EDIT
++

#240

#250

1048



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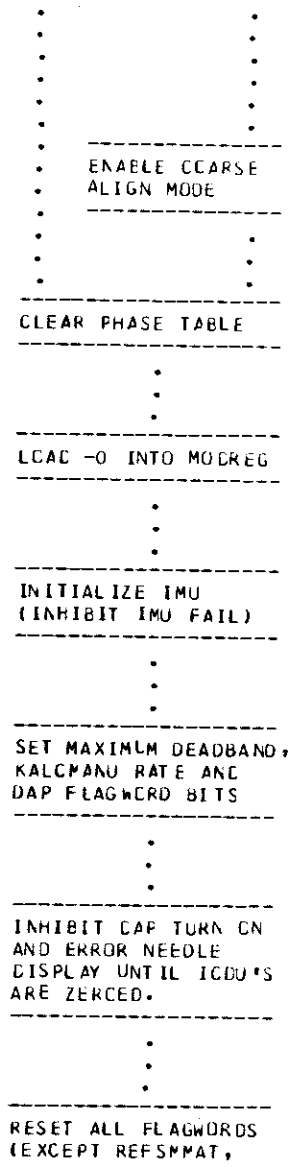

#310

#320

#330

#340

#350

1050

SURFACE, CMOONFLG,
LMOONFLG, AND APS
FLAGS). SET THE
NO R2S, IDLE, AND
LR BYPASS FLAGS.

.
.
.
...
.
EXIT

#360

CHANGE CONTROL NOTES

LOGIC REV 00 PCR 496
REV 01 EDITORIAL
REV 02 EDITGRIAL
REV 03 EDITORIAL

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1053

V40N20, ZERO IMU CDUS REV 03 12/03/69

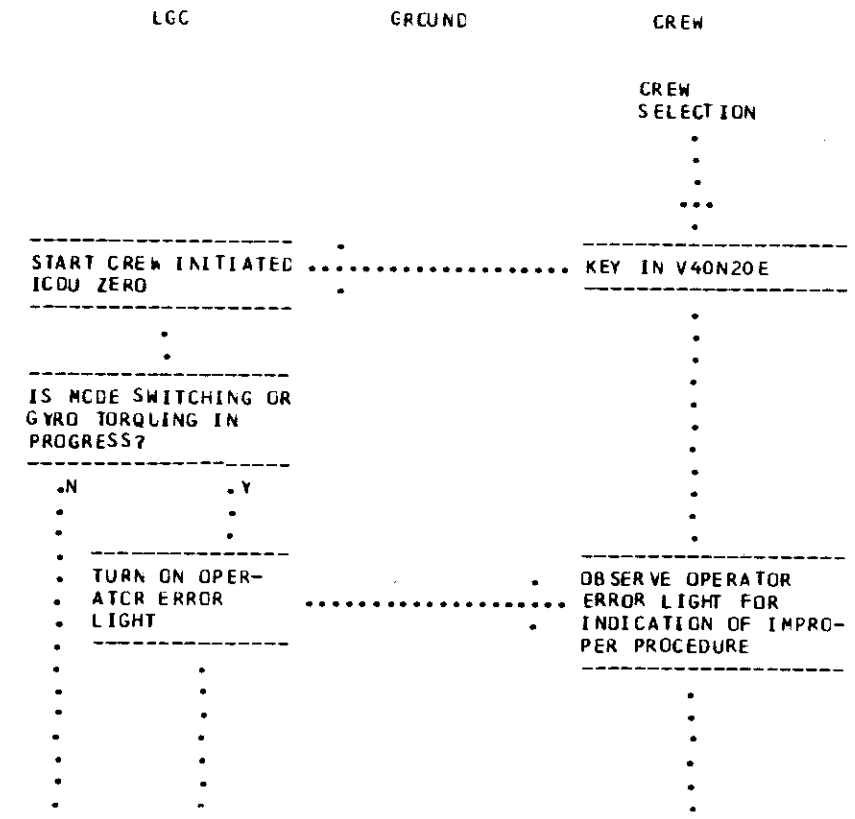
PURPOSE: (1) TO INSURE SYNCHRONIZATION OF THE IMU CDU COUNTERS AND THE ICDU COUNTERS IN THE LGC.

(2) TO TERMINATE THE IMU COARSE ALIGN MODE AND ENTER THE INERTIAL MODE.

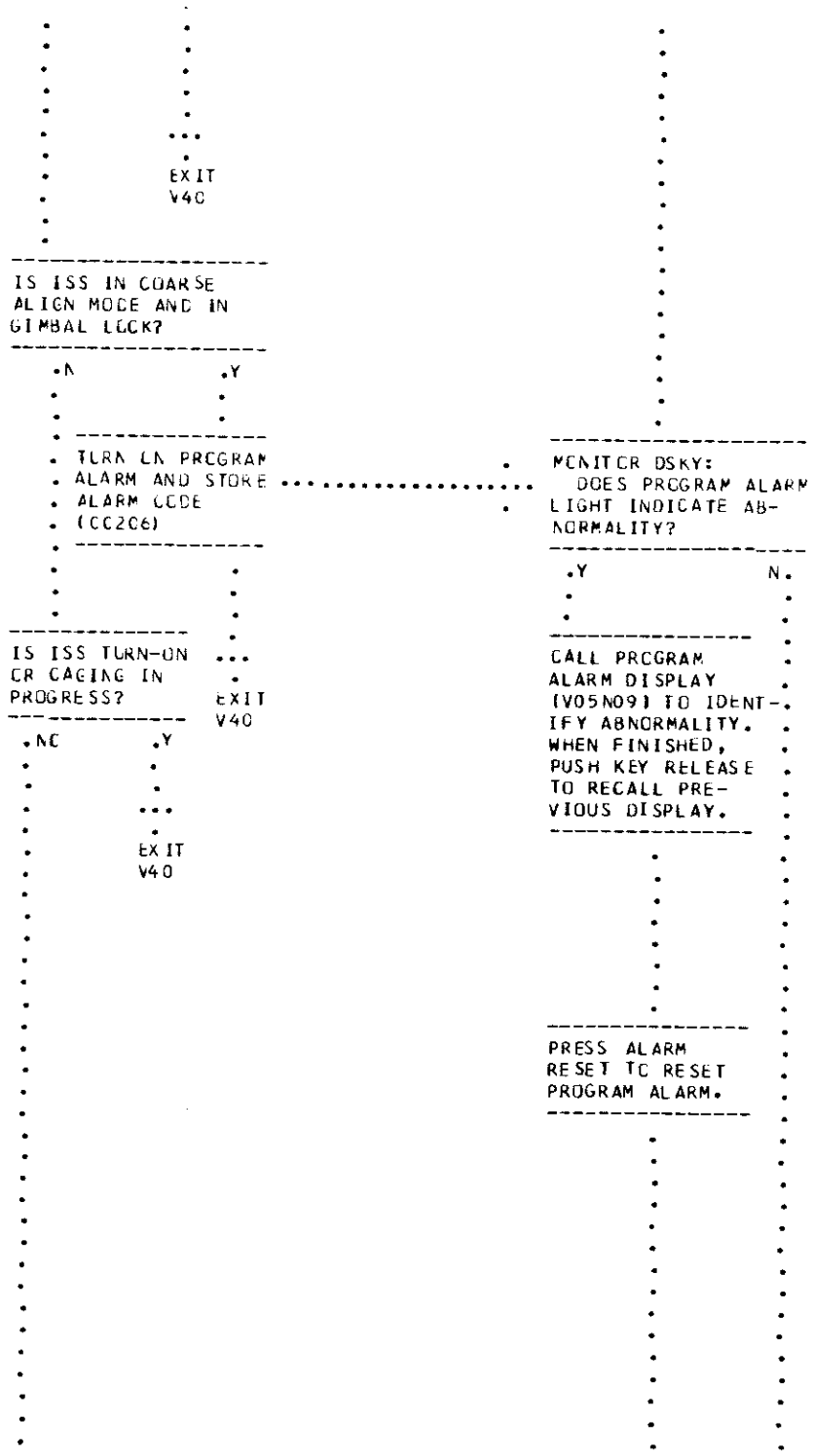
ASSUMPTIONS: (1) THIS EXTENDED VERB (V40N20) MAY BE CREW-SELECTED BY DSKY ENTRY. A VALID IMU ZERO (SYNCHRONIZATION OF CDU COUNTERS) CAN BE ACHIEVED ONLY IF THE ISS IS ENERGIZED (NO ALARM 00210). THIS PROCESS MAY BE SELECTED EVEN IF ANOTHER EXTENDED VERB IS BEING PROCESSED. ASIDE FROM THE ICDU ZERO PROCEDURE WHICH FORMS A NORMAL PART OF THE ISS TURN-ON, THE ASTRONAUT CAN COMMAND ICDU ZERO PROCEDURES ONLY BY CALLING V40N20 OR BY CALLING R47 (VIA V47).

(2) V40 MAY NOT BE SELECTED IF IMU MODE SWITCHING IS IN PROGRESS, NOR IF GYRO TORQUING IS IN PROGRESS, NOR IF THE IMU IS IN THE COARSE ALIGN MODE AND IN GIMBAL LOCK.

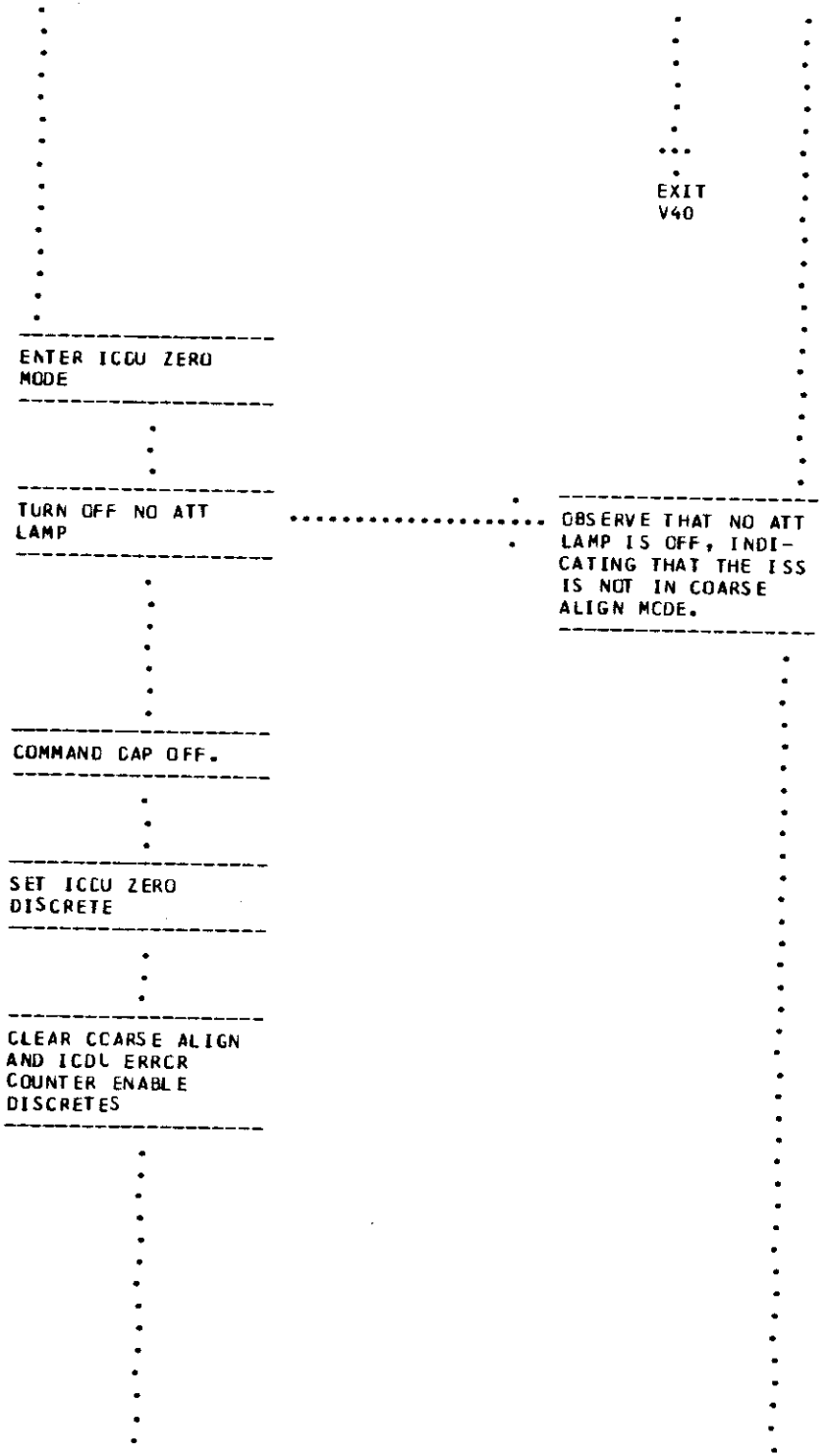
(3) THIS VERB DISABLES THE DAP FOR APPROXIMATELY 10 SECONDS.



V40N20/LUM


EXIT
V40
IS ISS IN COARSE ALIGN MODE AND IN GIMBAL LOCK?
N
Y
TURN ON PROGRAM ALARM AND STORE ALARM CODE (CC206)
IS ISS TURN-ON OR CAGING IN PROGRESS?
NO
Y
EXIT
V40
MONITOR DSKY: DOES PROGRAM ALARM LIGHT INDICATE ABNORMALITY?
Y
N
CALL PROGRAM ALARM DISPLAY (V05N09) TO IDENTIFY ABNORMALITY. WHEN FINISHED, PUSH KEY RELEASE TO RECALL PREVIOUS DISPLAY.
PRESS ALARM RESET TO RESET PROGRAM ALARM.
#40
#50
#60
#70

1054



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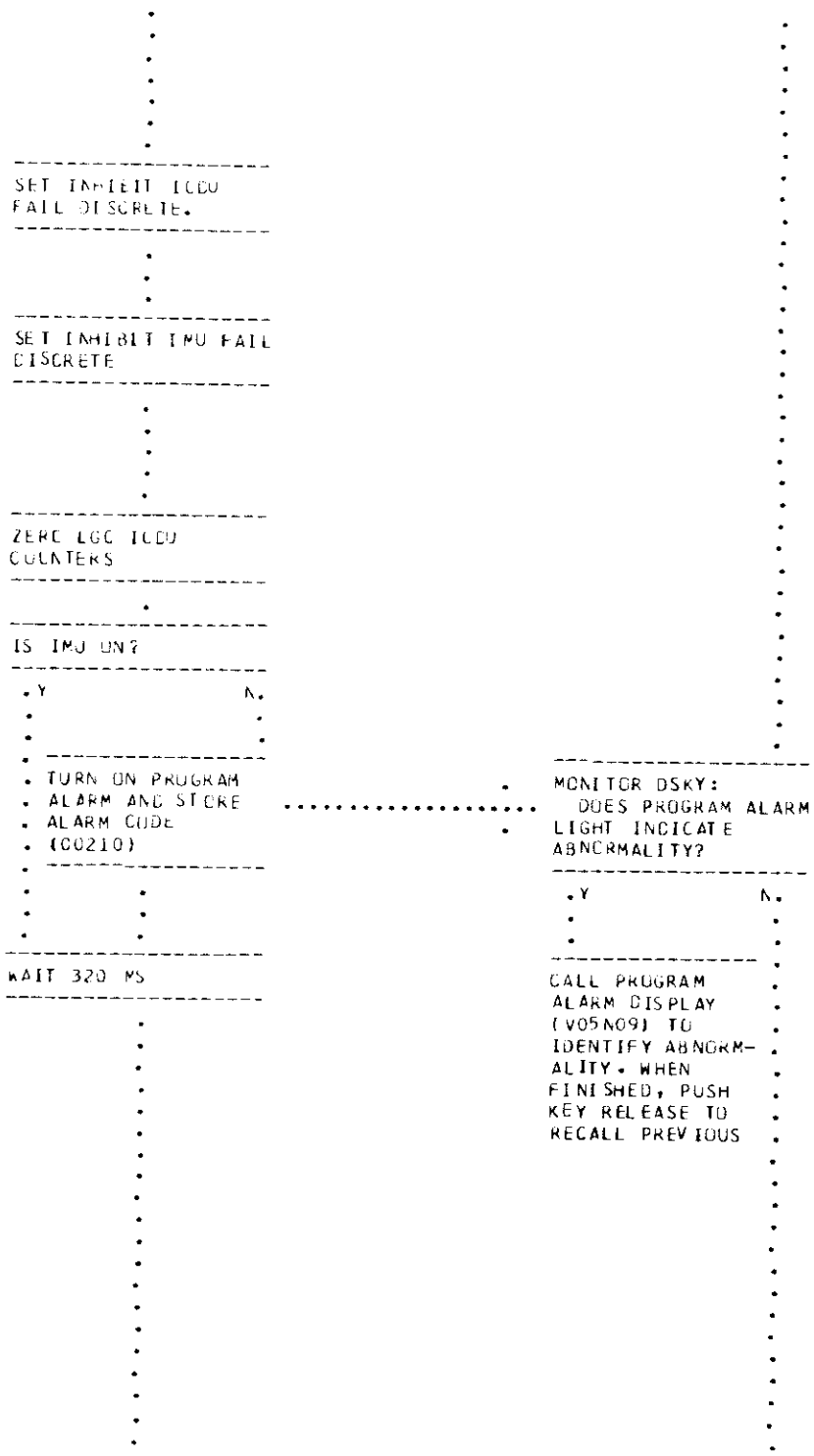
#90

#100

#110

#120



#130

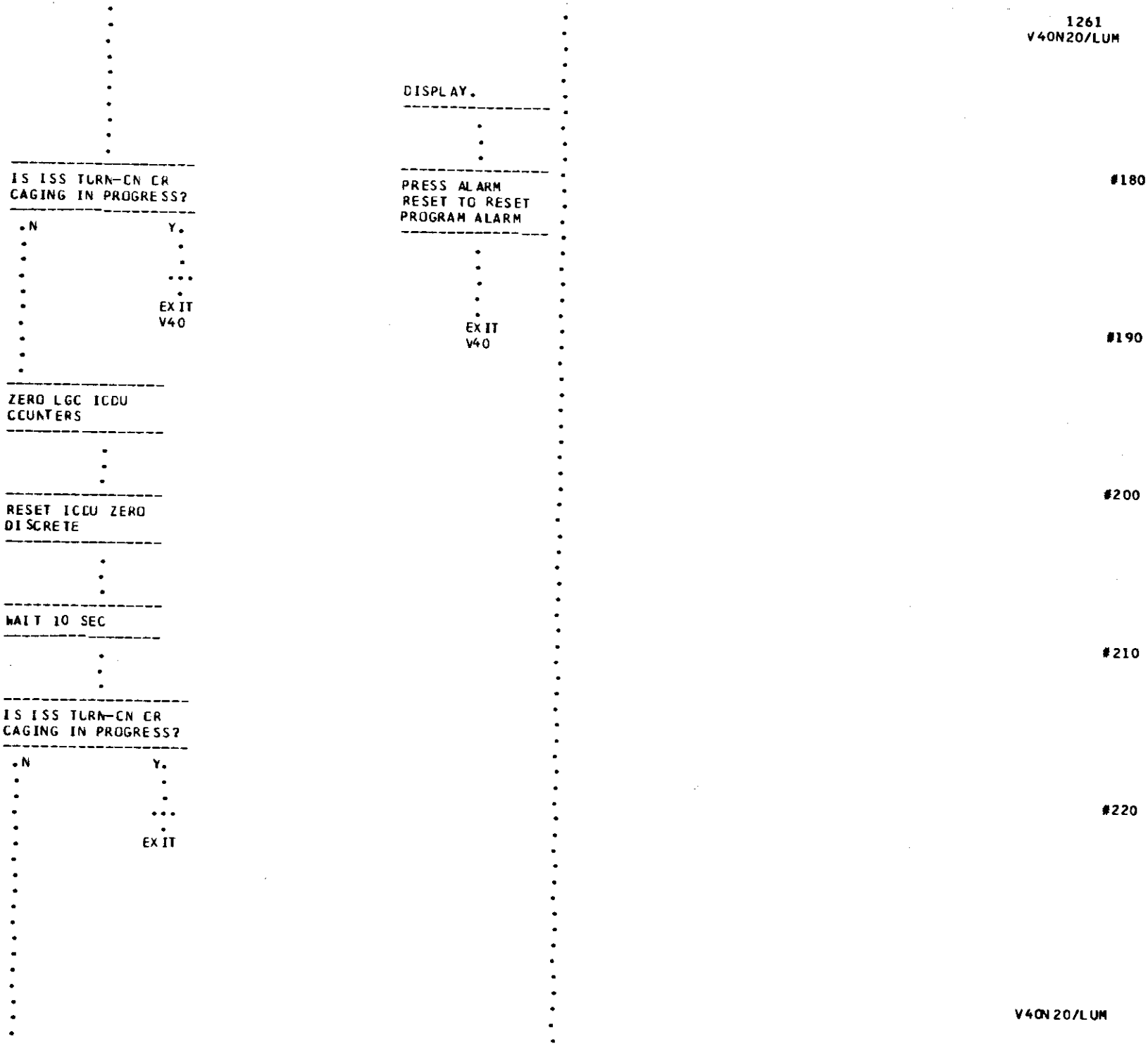
#140

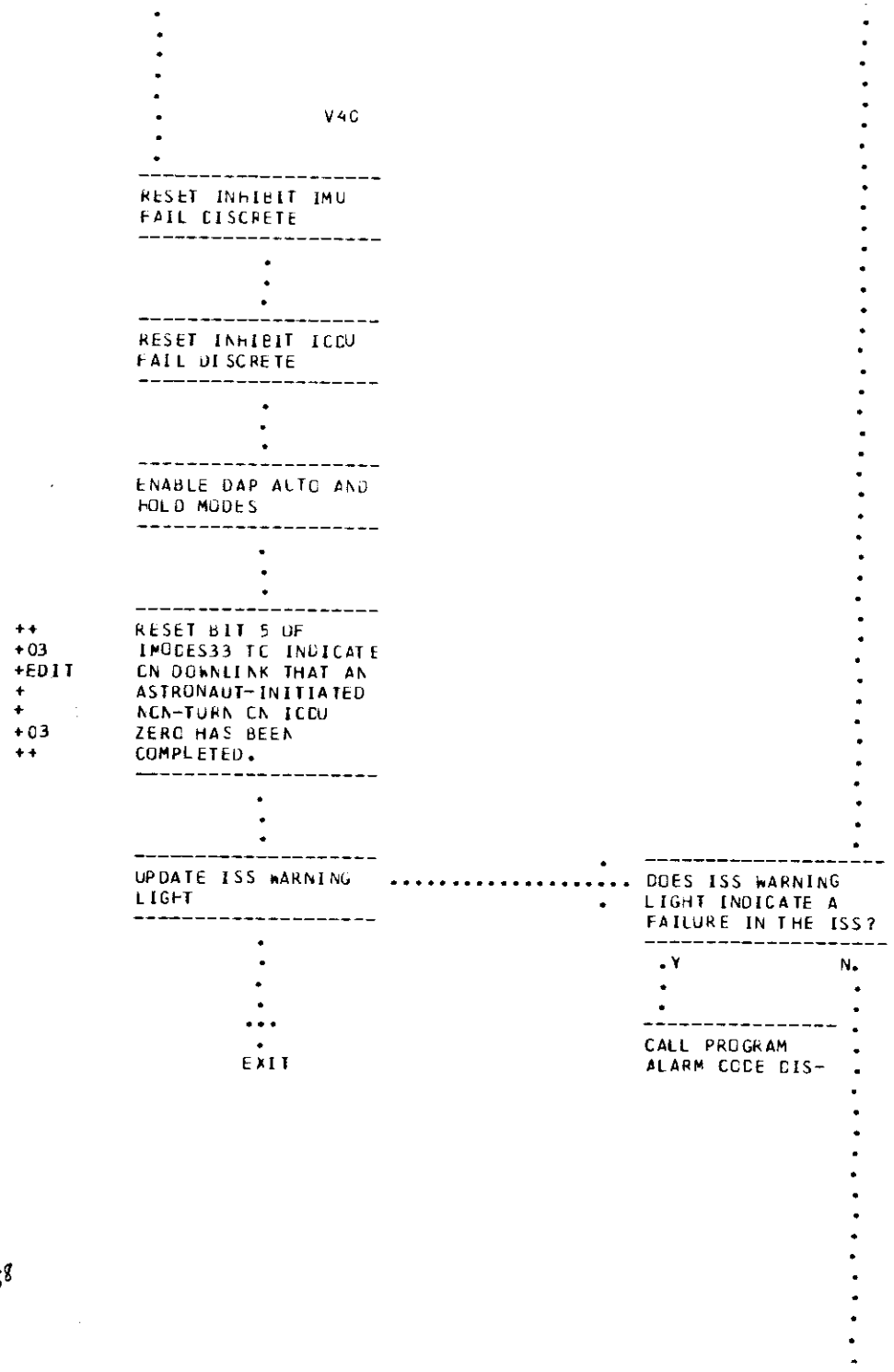
#150

#160

#170

1056


IS ISS TURN-ON OR CAGING IN PROGRESS?
.N
Y.
EXIT V40
ZERO LGC ICDU COUNTERS
RESET ICDU ZERO DISCRETE
WAIT 10 SEC
IS ISS TURN-ON OR CAGING IN PROGRESS?
.N
Y.
EXIT
DISPLAY.
PRESS ALARM RESET TO RESET PROGRAM ALARM
EXIT V40
#180
#190
#200
#210
#220


V40
RESET INHIBIT IMU FAIL DISCRETE
RESET INHIBIT ICDU FAIL DISCRETE
ENABLE DAP AUTO AND HOLD MODES
++ +03 +EDIT + + +03 ++
RESET BIT 5 OF IMODES33 TO INDICATE ON DOWNLINK THAT AN ASTRONAUT-INITIATED NON-TURN ON ICDU ZERO HAS BEEN COMPLETED.
UPDATE ISS WARNING LIGHT
EXIT
DOES ISS WARNING LIGHT INDICATE A FAILURE IN THE ISS?
Y
N
CALL PROGRAM ALARM CODE DIS-
#230
#240
#250
#260
#270

1058

V40

PLAY (V05N09) TO IDENTIFY THE FAILURE. THERE ARE SIX POSSIBLE CAUSES FOR ISS WARNING. (SEE SEC. 4.4.7 OF THIS DOCUMENT FOR DEFINITION OF ALARM CODES). WHEN FINISHED, PUSH KEY RELEASE TO RECALL PRE-VIOUS DISPLAY.

#280

PRESS ALARM RESET TO RESET PROGRAM ALARM

#290

EXIT V40

EXIT V40

#300

CHANGE CONTROL NOTES

LOGIC REV 00 PCR 496
REV 01 EDITORIAL
REV 02 EDITORIAL
REV 03 EDITORIAL

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1060

1061

V40N72, ZERO RR CDUS

REV 03 12/03/69

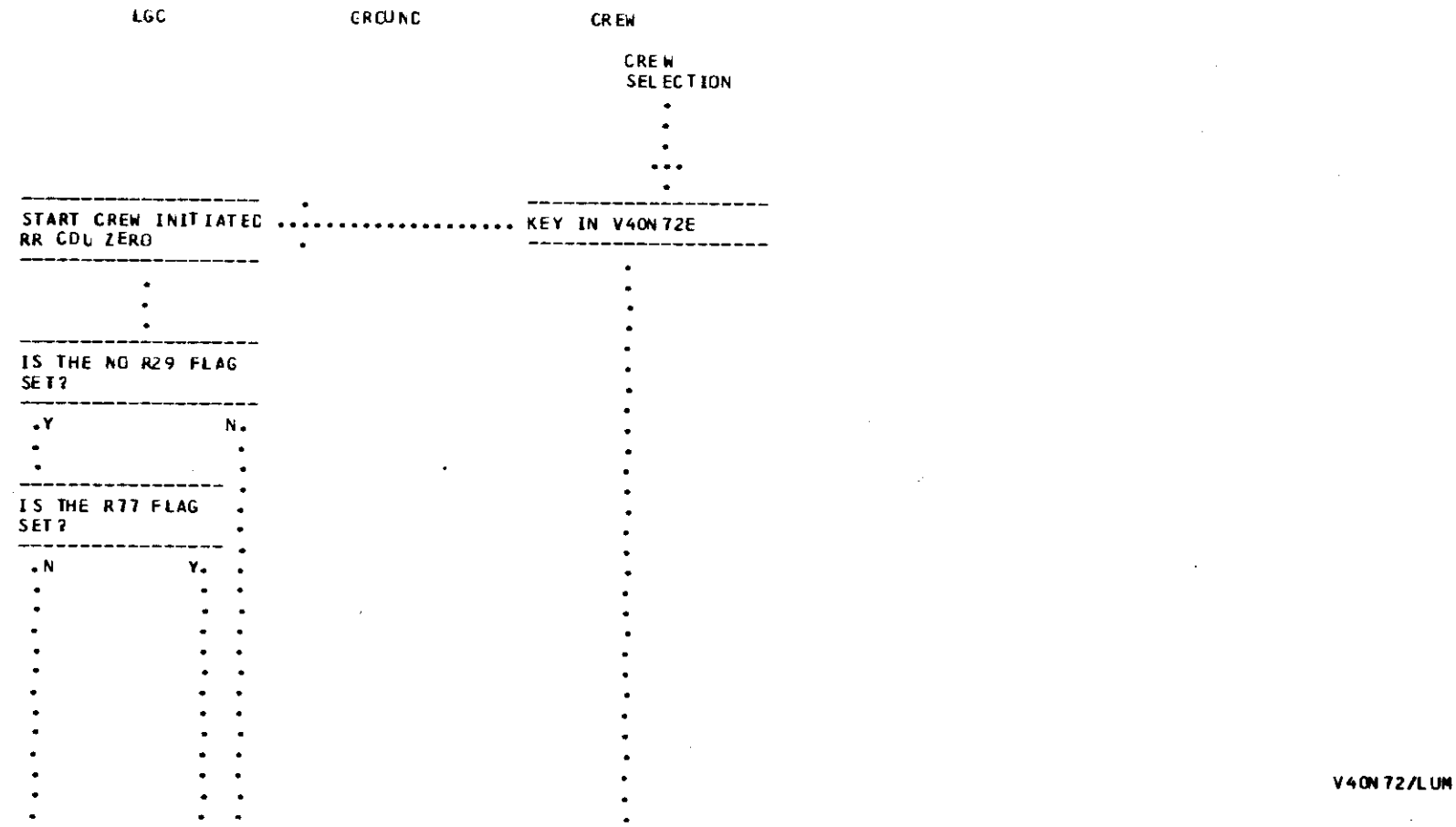
PURPOSE: (1) TO ZERO THE RR CDUS.

(2) TO DETERMINE THE RR ANTENNA MODE.

ASSUMPTIONS: (1) THE PROCESS IS CREW SELECTED BY DSKY ENTRY.

(2) THIS PROCESS MAY BE SELECTED AT ANY TIME EXCEPT WHEN A READ SEQUENCE OF EITHER RADAR OR A RR DESIGNATE IS IN PROGRESS.

(3) EXCEPT FOR THE RESTRICTIONS NOTED IN (2) ABOVE, THIS PROCESS CAN BE SELECTED AT ANY TIME IN COMBINATION WITH ANY OTHER EXTENDED VERB.



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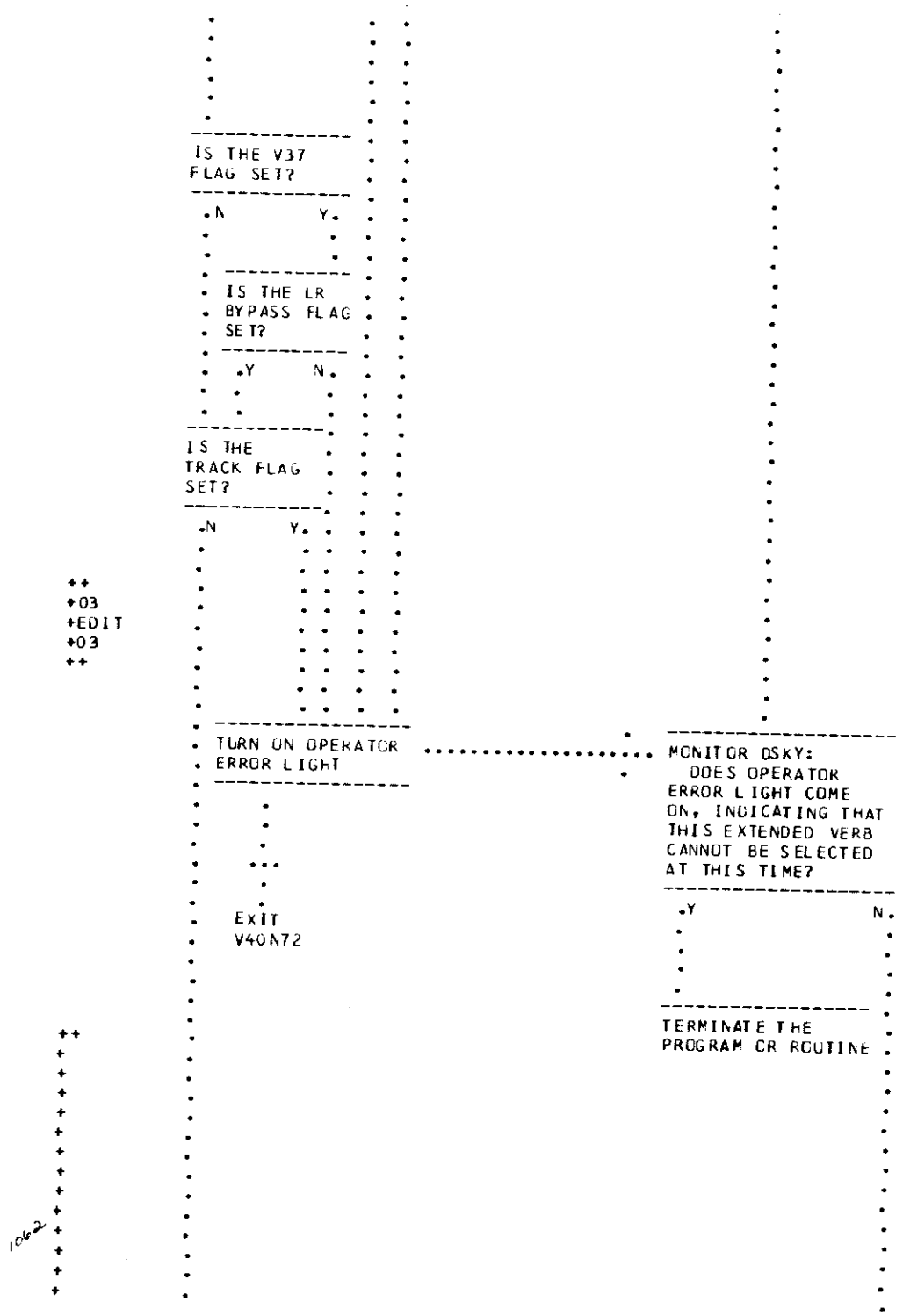
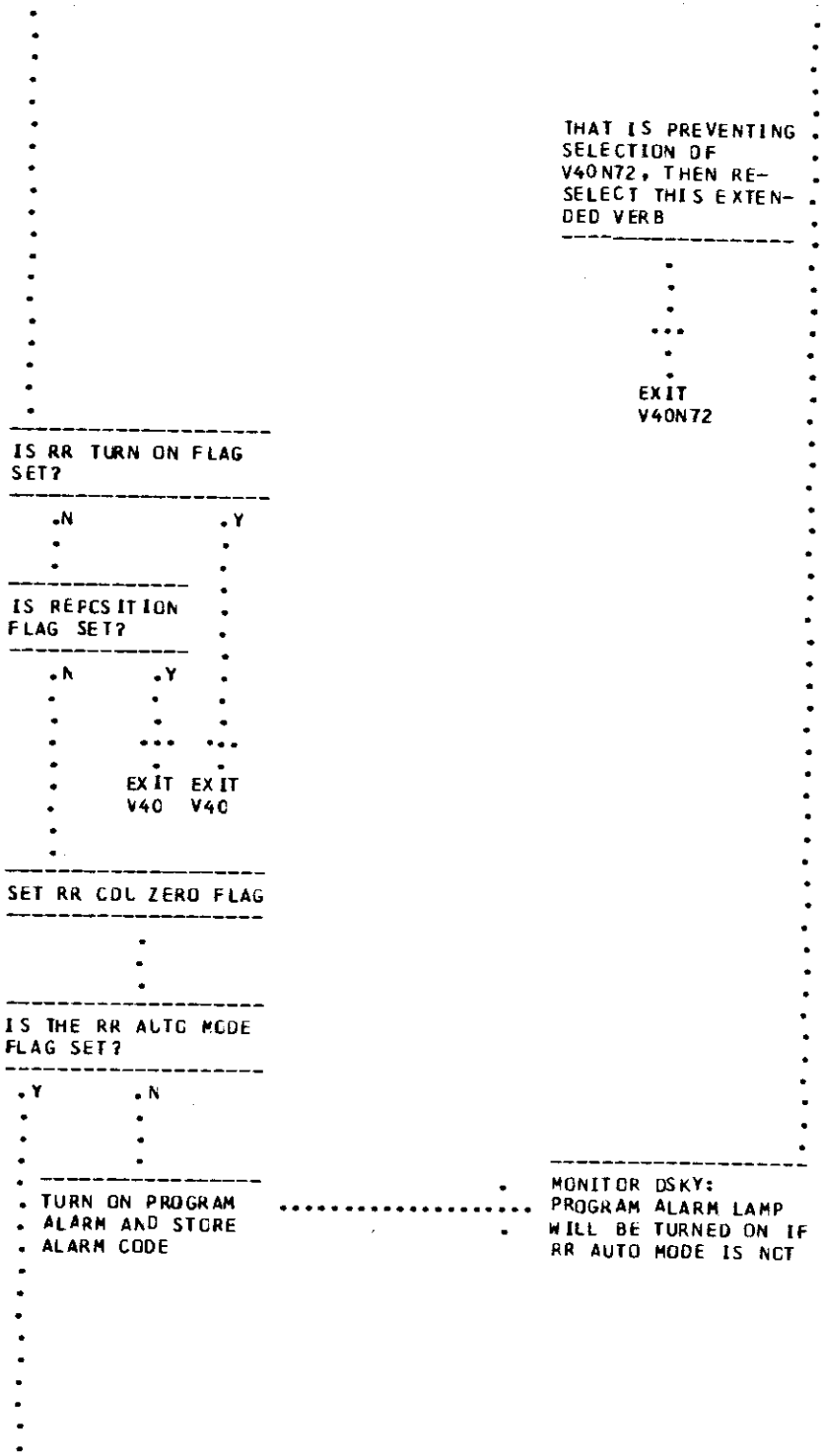


++
+03
+EDIT
+03
++

++

1062

1063
+
+
+
+03
+EDIT
+03
++



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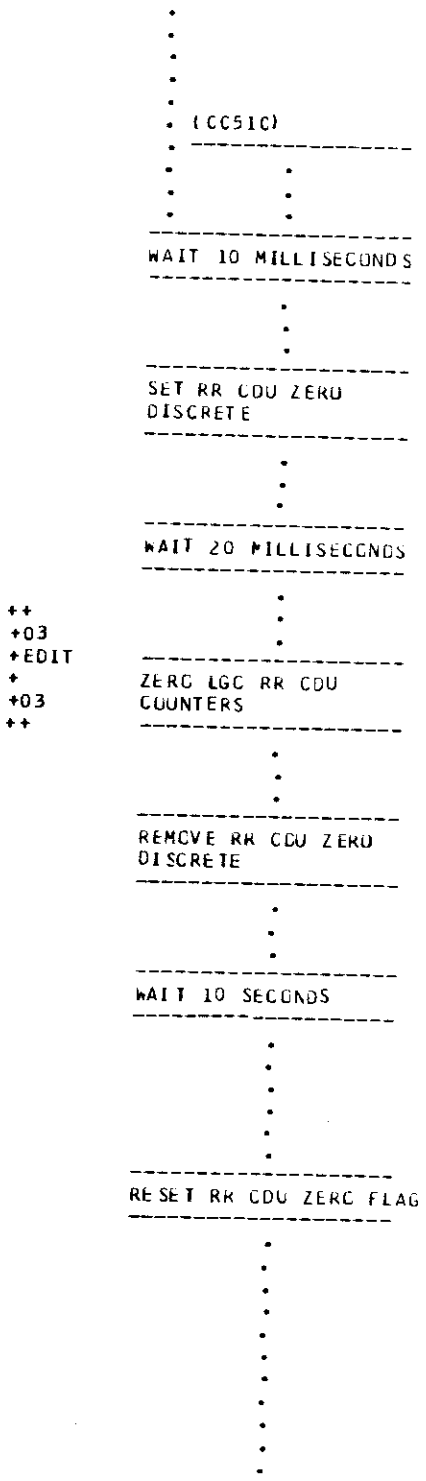

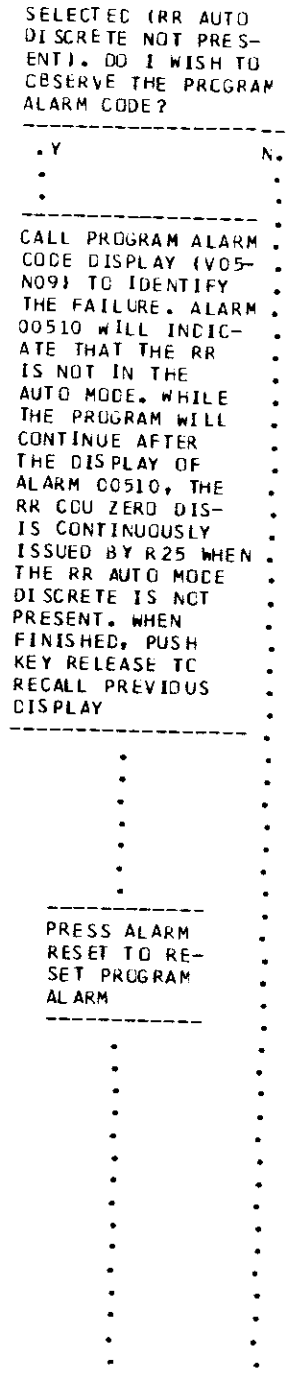

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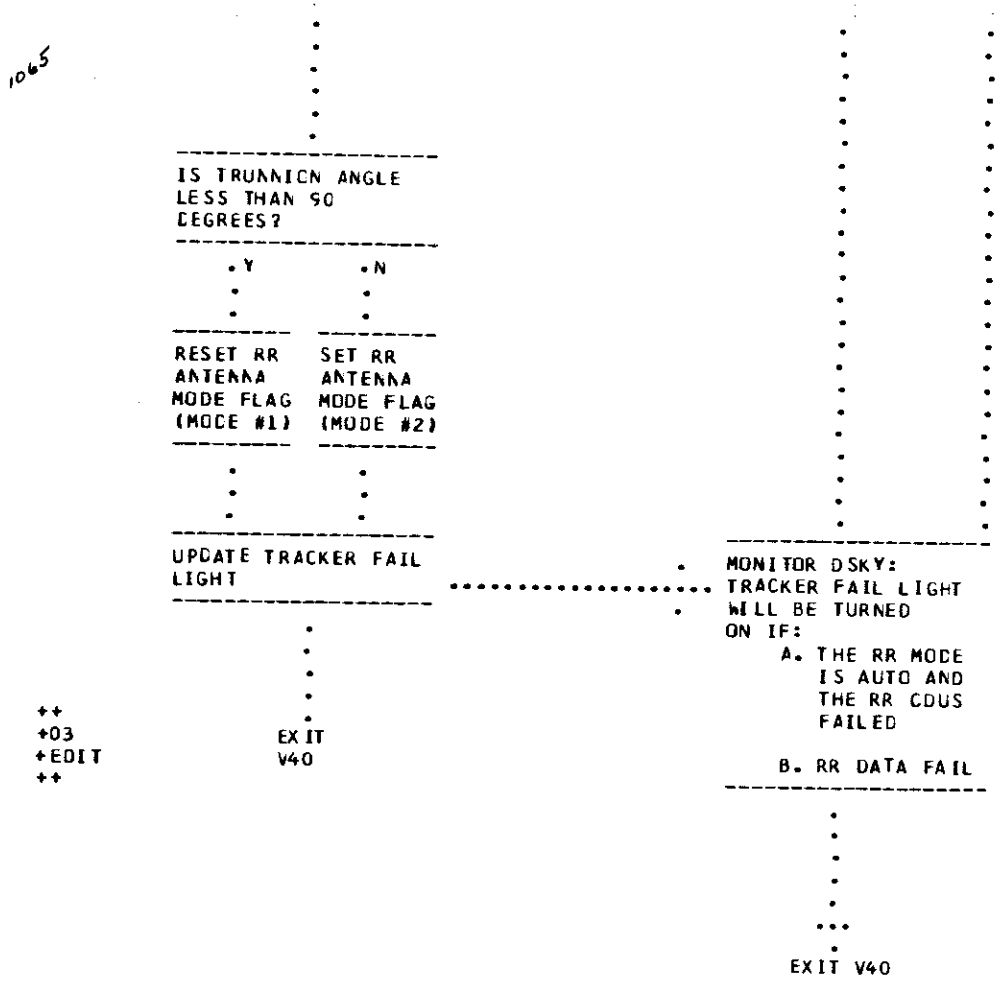
1064



#180

#190

#200

#210

++
+03
+EDIT
++

CHANGE CONTROL NOTES

LOGIC REV 00 PCR 496
LOGIC REV 01 EDITORIAL
REV 02(LUM 18) PCR 848,EDITORIAL
REV 03 EDITORIAL

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V41N20, COARSE ALIGN IMU CDUS

REV 03 12/03/69

PURPOSE: (1) TO COARSE ALIGN THE IMU TO GIMBAL ANGLES SPECIFIED BY THE ASTRONAUT.

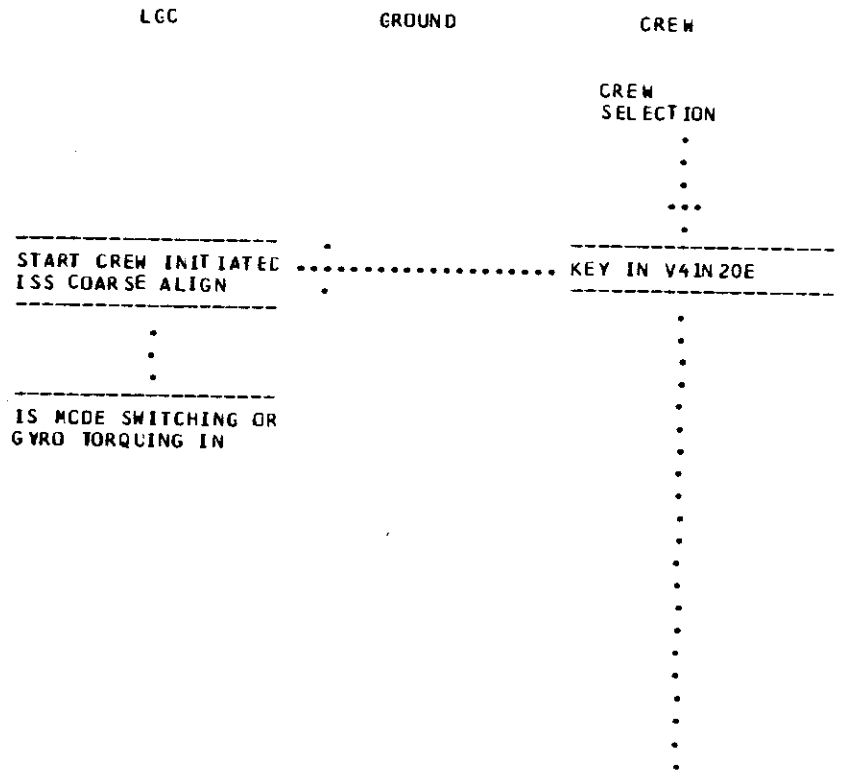
ASSUMPTIONS: (1) EXTENDED VERB V41 MAY BE CREW SELECTED ONLY WHEN NO OTHER EXTENDED VERB WHICH HAS SET THE EXTENDED VERB INTERLOCK IS ACTIVE. IT MAY NOT BE SELECTED WHEN AN ICDU ZERO IS IN PROCESS, NOR WHEN GYRO TORQUING IS IN PROCESS, NOR WHEN A PREVIOUSLY SELECTED COARSE ALIGNMENT IS IN PROGRESS. V41N20 IS INHIBITED WHILE THE GIMBALS ARE BEING TORQUED TO A DESIRED COARSE ALIGN ATTITUDE, BUT IS NOT INHIBITED WHEN IN THE COARSE ALIGN MODE IF THE GIMBALS ARE NOT BEING TORQUED.

(2) V41 MAY ONLY BE USED WITH N20(ICDU ANGLES) OR WITH N72(RR CDU ANGLES).

(3) THE ACCURACY OF THE ALIGNMENT IS TESTED TO A TOLERANCE OF +2 DEGREES. IF THIS TOLERANCE IS EXCEEDED, THE ASTRONAUT IS NOTIFIED VIA A PROGRAM ALARM (00211).

(4) THIS PROCESS RESETS THE TRACK FLAG AND THE REFSMMAT FLAG AND DISABLES IMU COMPENSATION AND THE DAP.

(5) AFTER ACCOMPLISHING COARSE ALIGNMENT, THE COARSE ALIGN MODE MAY BE TERMINATED BY KEYING IN V40N20E.



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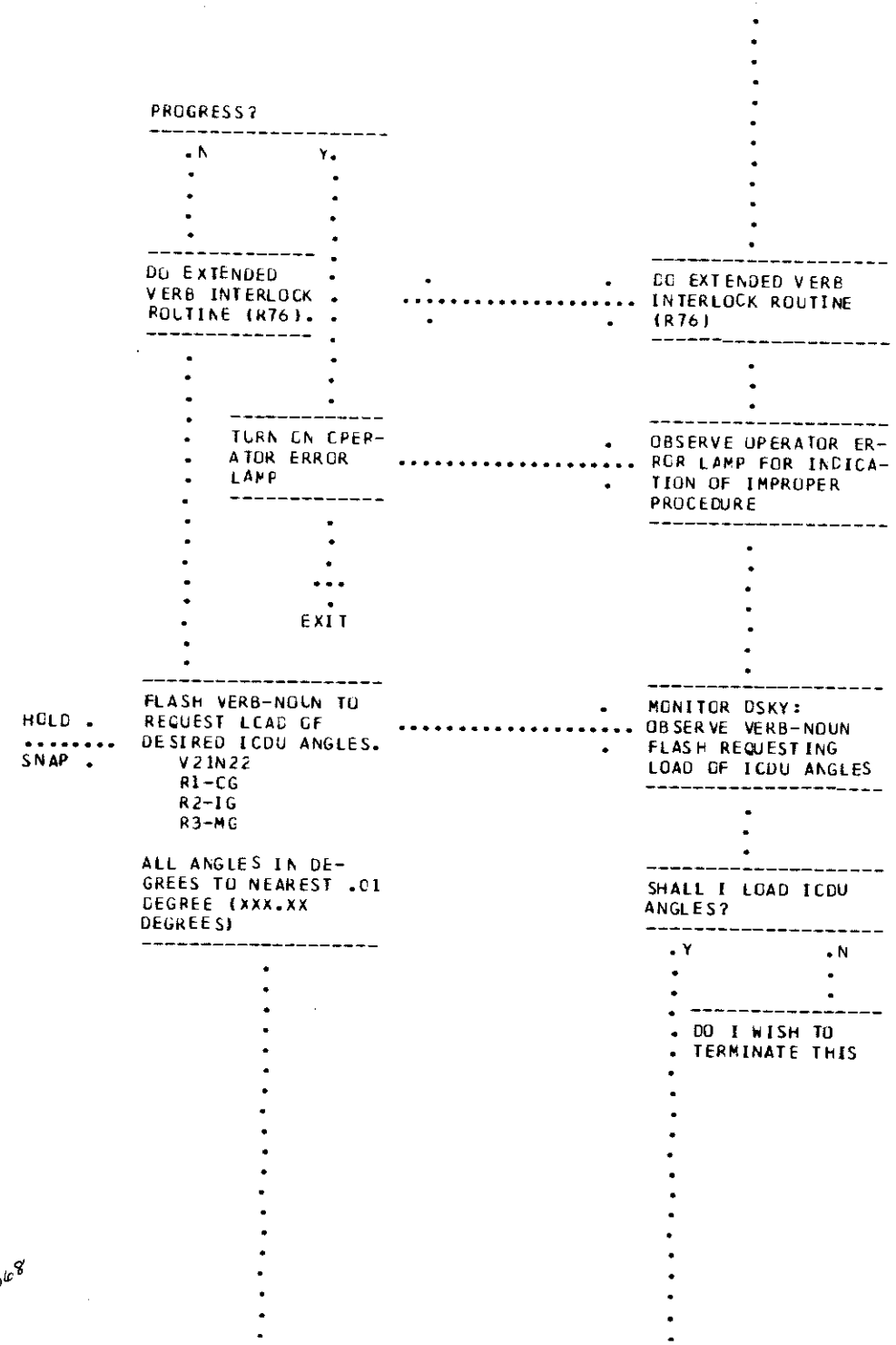
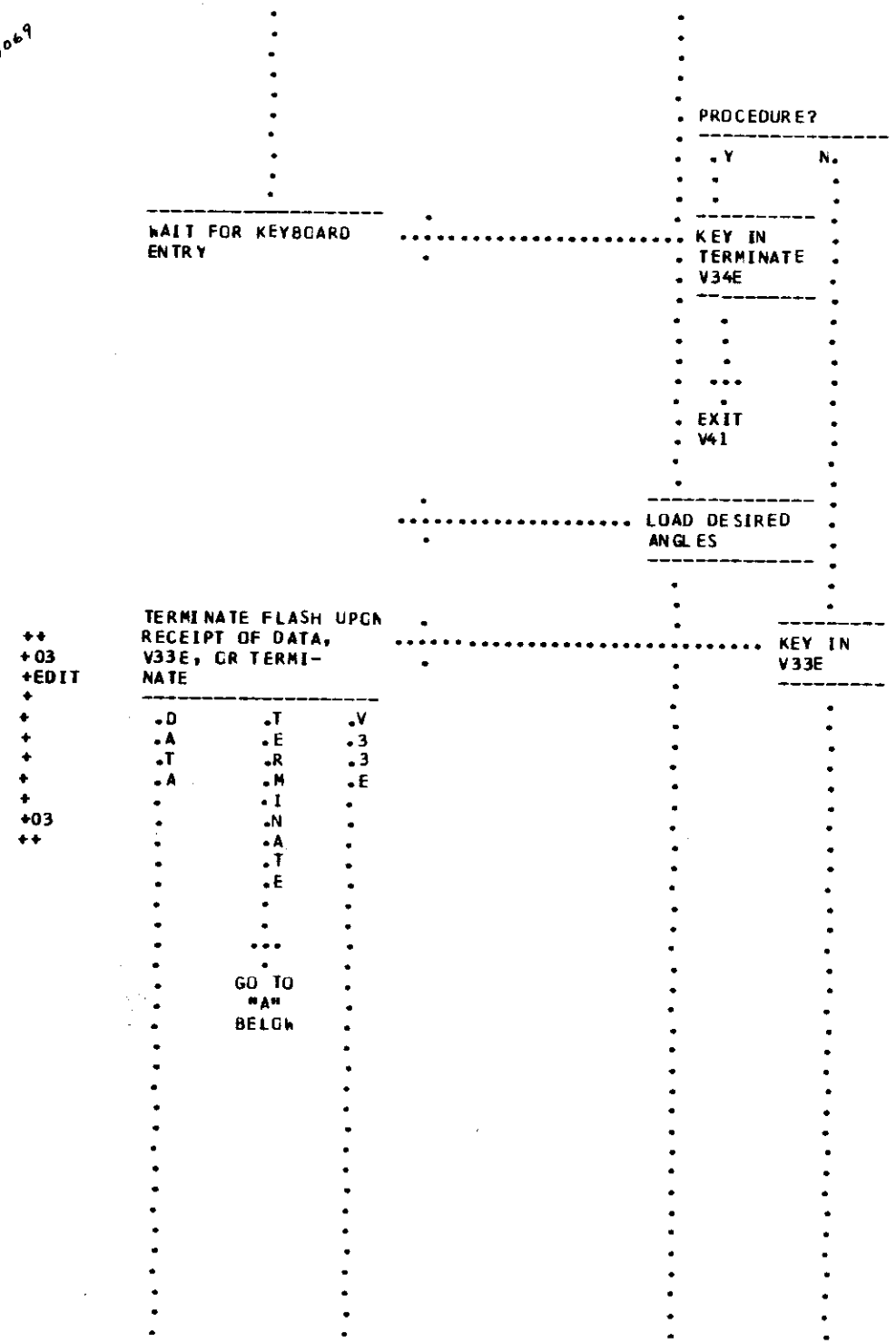

PROGRESS?
N
Y
DO EXTENDED VERB INTERLOCK ROUTINE (R76).
TURN ON OPERATOR ERROR LAMP
EXIT
FLASH VERB-NOUN TO REQUEST LOAD OF DESIRED ICDU ANGLES.
V21N22
R1-CG
R2-IG
R3-MG
ALL ANGLES IN DEGREES TO NEAREST .01 DEGREE (XXX.XX DEGREES)
HOLD
SNAP
DO EXTENDED VERB INTERLOCK ROUTINE (R76)
OBSERVE OPERATOR ERROR LAMP FOR INDICATION OF IMPROPER PROCEDURE
MONITOR DSKY: OBSERVE VERB-NOUN FLASH REQUESTING LOAD OF ICDU ANGLES
SHALL I LOAD ICDU ANGLES?
Y
N
DO I WISH TO TERMINATE THIS
#20
#30
#40
#50
#60

1068

1069



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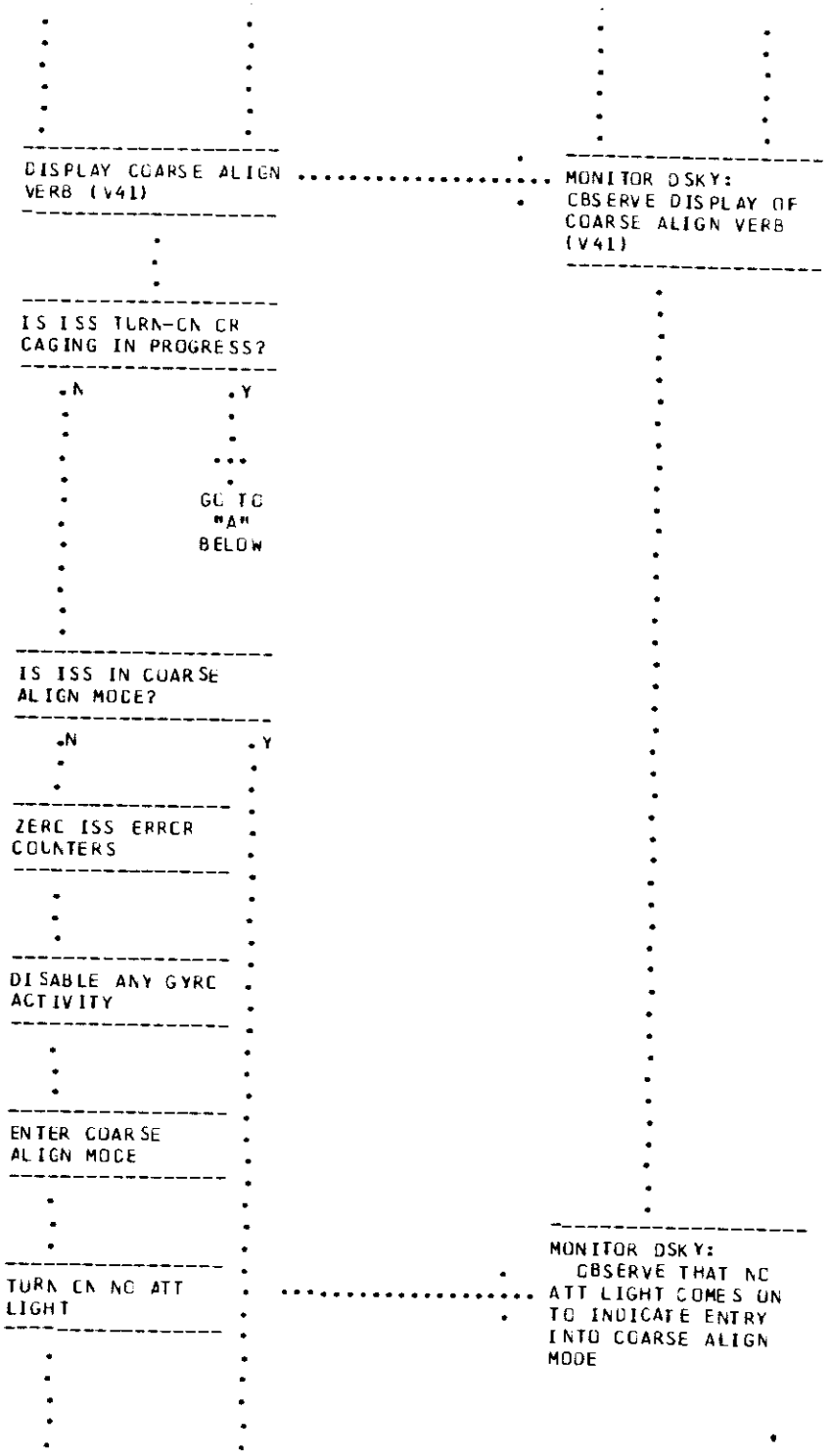

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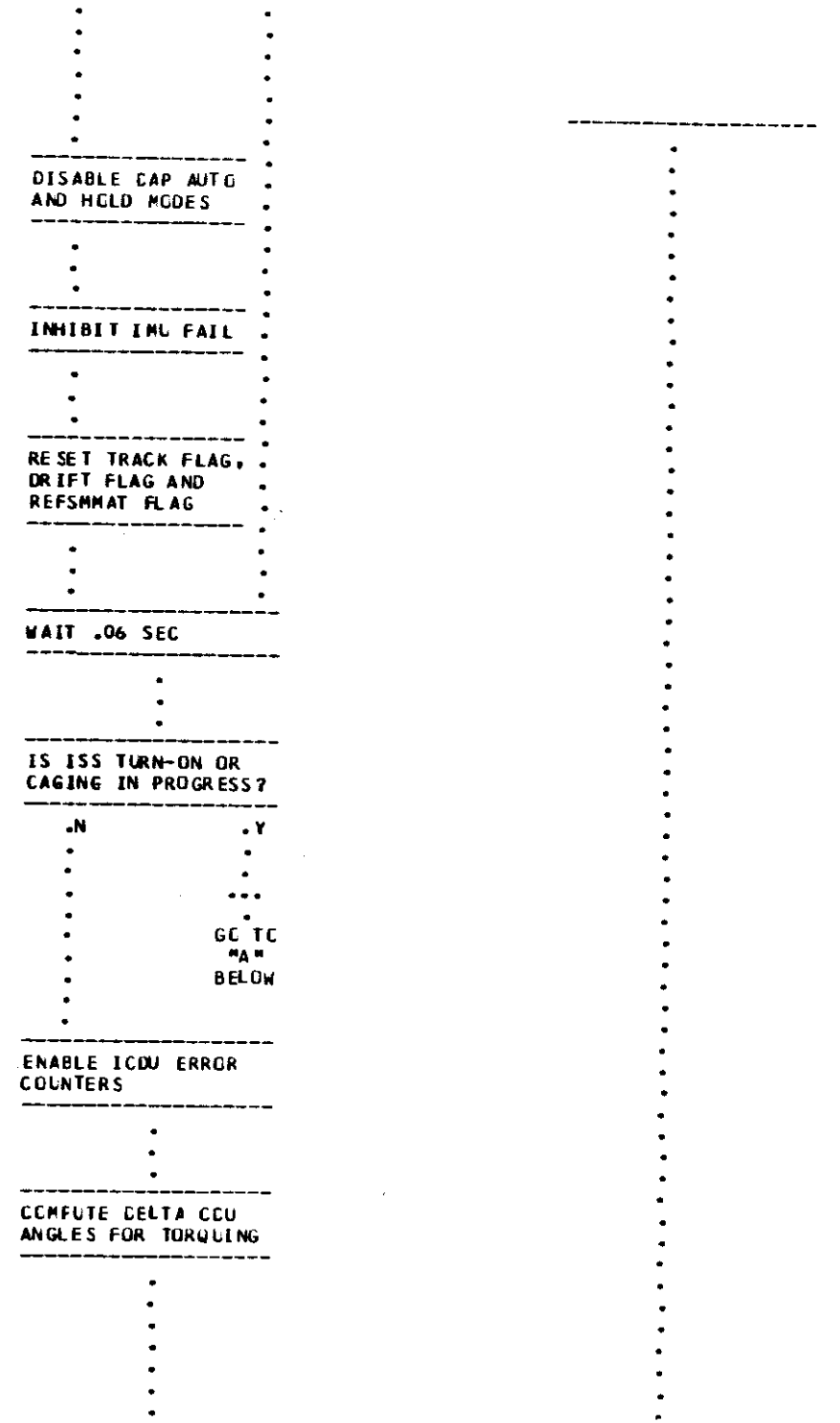

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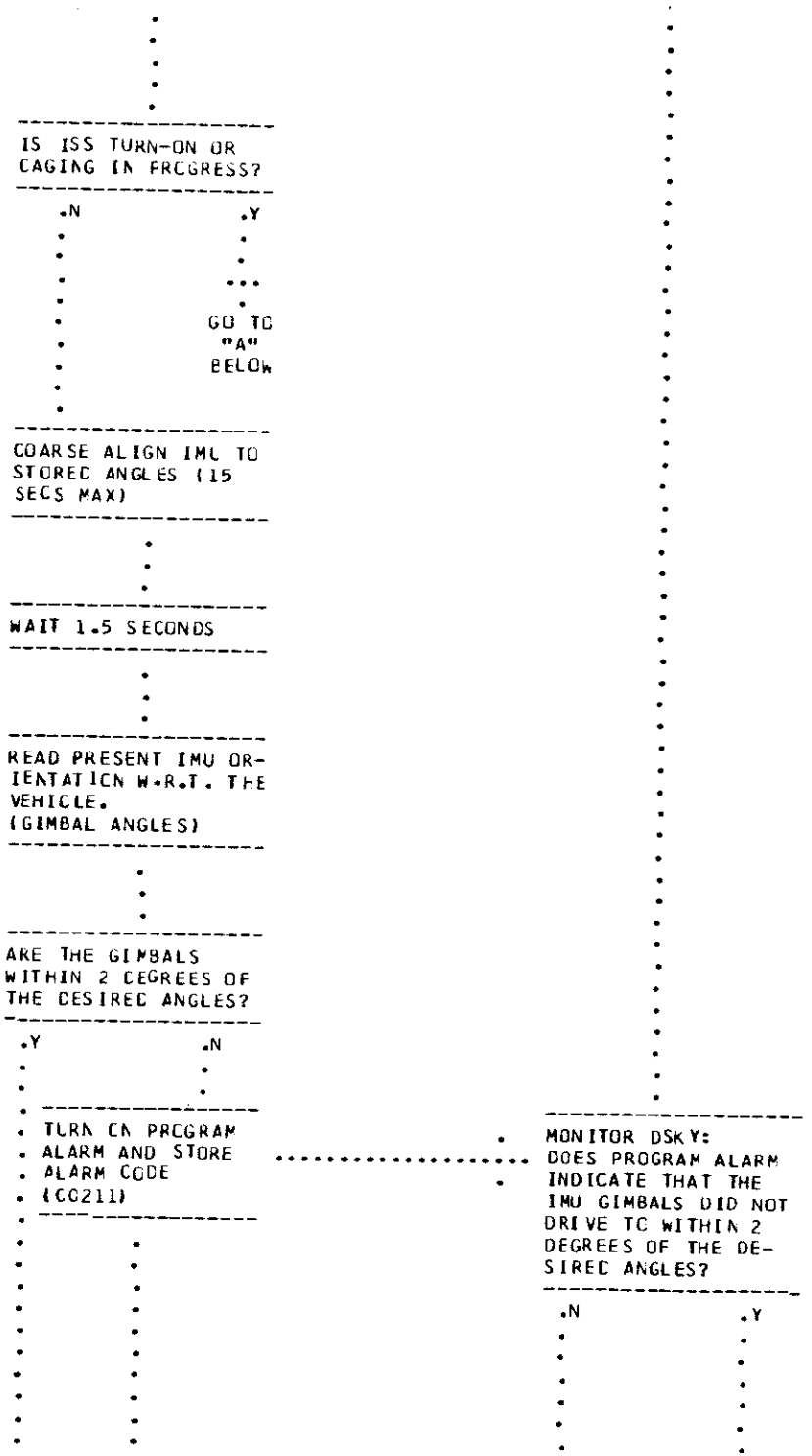
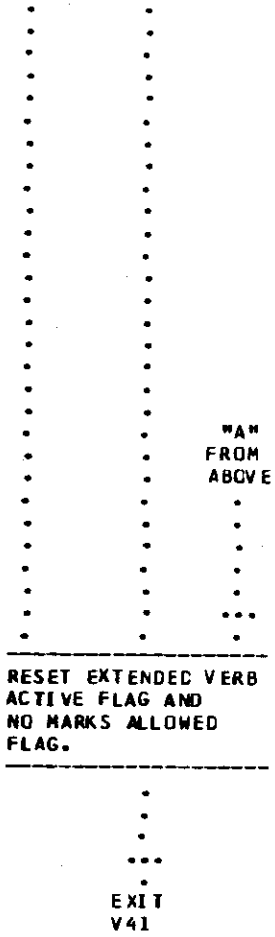
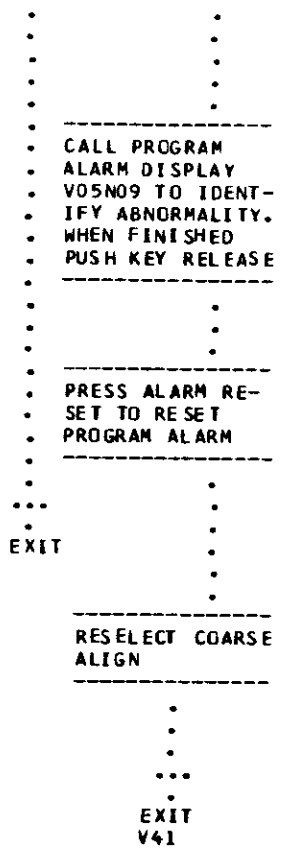

IS ISS TURN-ON OR CAGING IN PROGRESS?
.N
.Y
GO TO "A" BELOW
#230
COARSE ALIGN IMU TO STORED ANGLES (15 SECS MAX)
#240
WAIT 1.5 SECONDS
#250
READ PRESENT IMU ORIENTATION W.R.T. THE VEHICLE. (GIMBAL ANGLES)
#260
ARE THE GIMBALS WITHIN 2 DEGREES OF THE DESIRED ANGLES?
.Y
.N
TURN ON PROGRAM ALARM AND STORE ALARM CODE (00211)
#270
MONITOR DSKY: DOES PROGRAM ALARM INDICATE THAT THE IMU GIMBALS DID NOT DRIVE TO WITHIN 2 DEGREES OF THE DESIRED ANGLES?
.N
.Y
#280

1072

1073





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CHANGE CONTROL NOTES

LOGIC REV 00 PCR 185
REV 01 EDITORIAL
REV 02 EDITORIAL
REV 03 EDITORIAL

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V41N72, COARSE ALIGN RR CDUS REV 03 12/03/69

PURPOSE: (1) TO DRIVE THE RENDEZVOUS RADAR SHAFT AND TRUNNION TO ANGLES SPECIFIED BY THE ASTRONAUT.

ASSUMPTIONS: (1) THE PROCESS IS CREW SELECTED BY DSKY ENTRY.

(2) THE PROCESS MAY NOT BE SELECTED WHEN ANOTHER EXTENDED VERB WHICH ALSO SETS THE EXTENDED VERB INTERLOCK IS ACTIVE.

(3) THE PROCESS MAY NOT BE SELECTED IF P20 OR P22 IS RUNNING.

(4) THE CONTINUOUS DESIGNATE MODE MUST BE TERMINATED BY DSKY ENTRY OF V44.

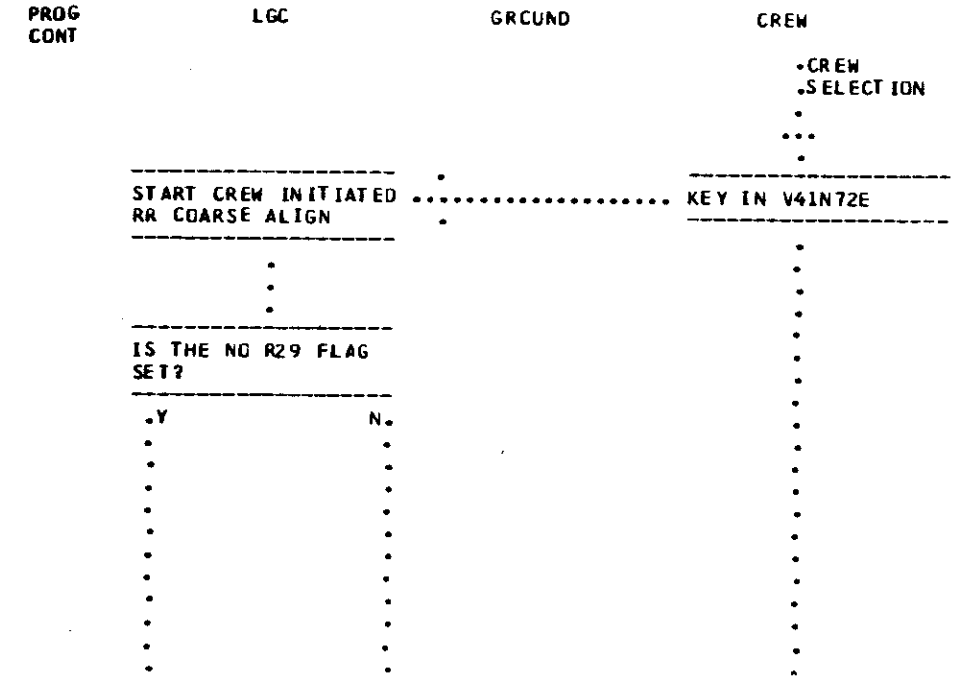
(5) THE CONTINUOUS DESIGNATE MODE INHIBITS RR GIMBAL MONITOR ROUTINE (R25).

(6) THE RR SHAFT AND TRUNNION LIMITS ARE:

(A) MODE 1: SHAFT -70 DEG TO +59 DEG, TRUNNION -55 DEG TO +55 DEG.

(B) MODE 2: SHAFT -25 DEG TO -139 DEG, TRUNNION -125 DEG TO -235 DEG.

(C) MODE 1, CONTINUOUS DESIGNATE ONLY: SHAFT -85 DEG., TO +59 DEG., TRUNNION -55 DEG. TO +55 DEG.



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V41N72/LUM

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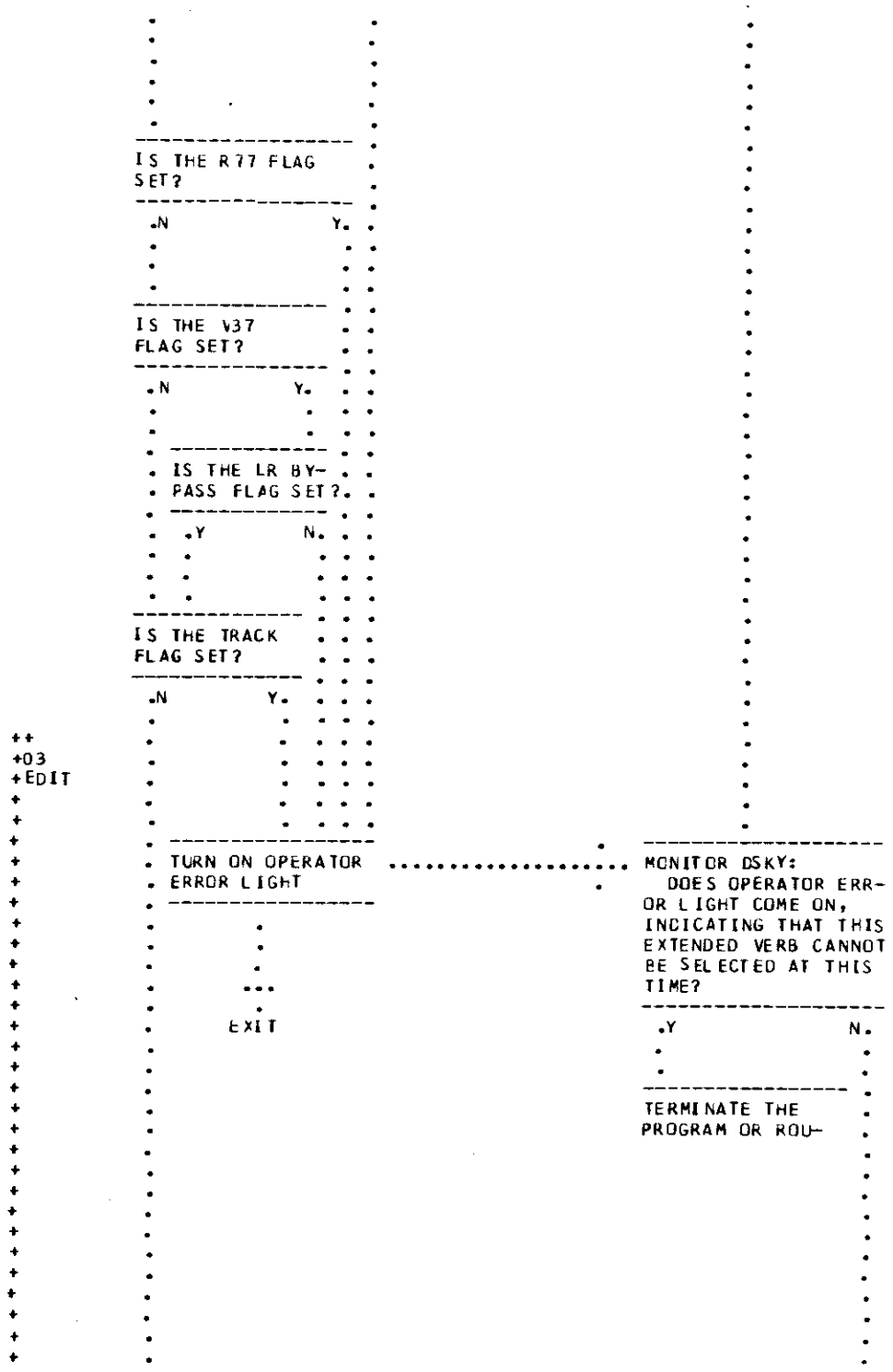
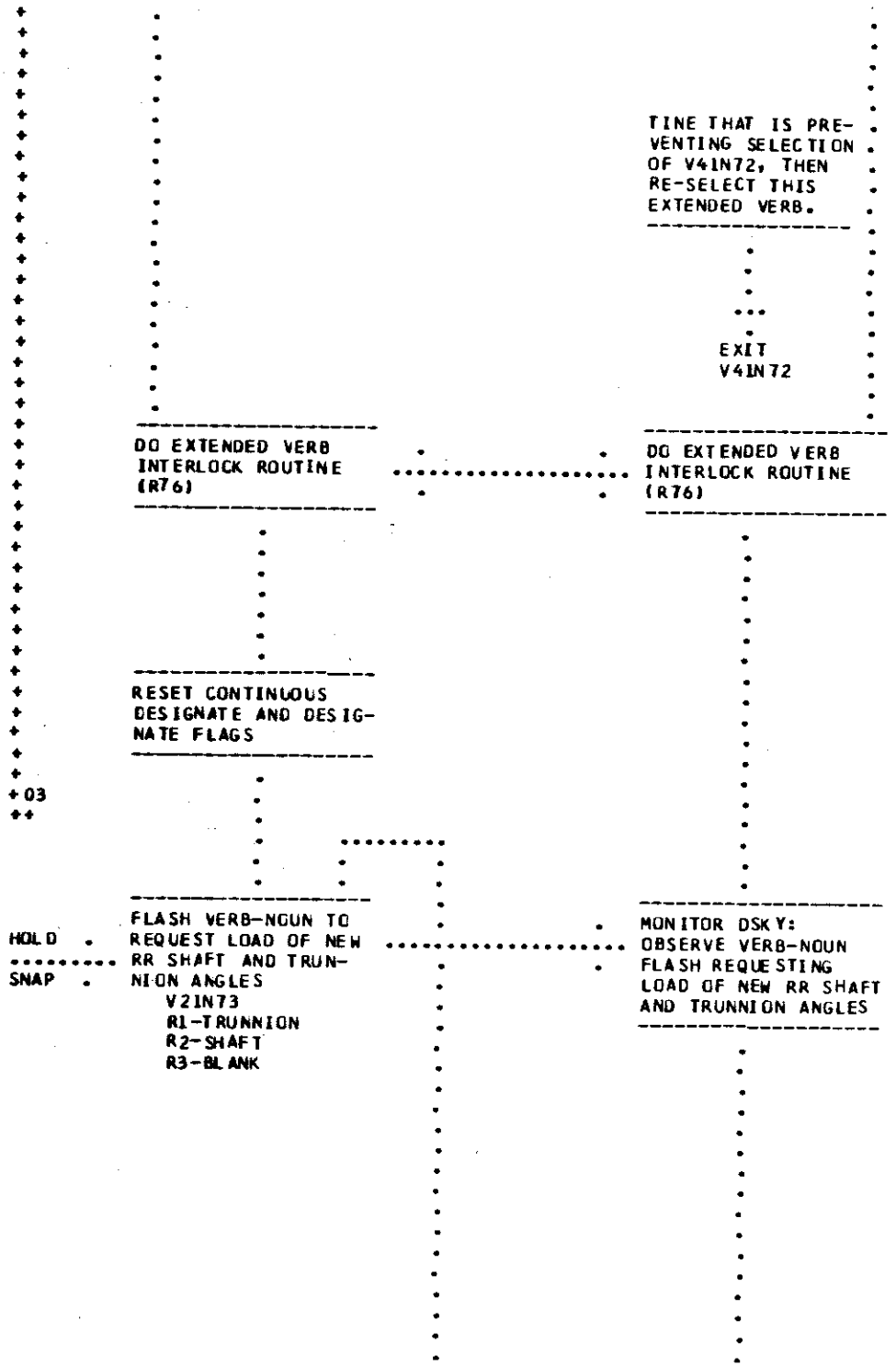


++
+03
+EDIT

1076



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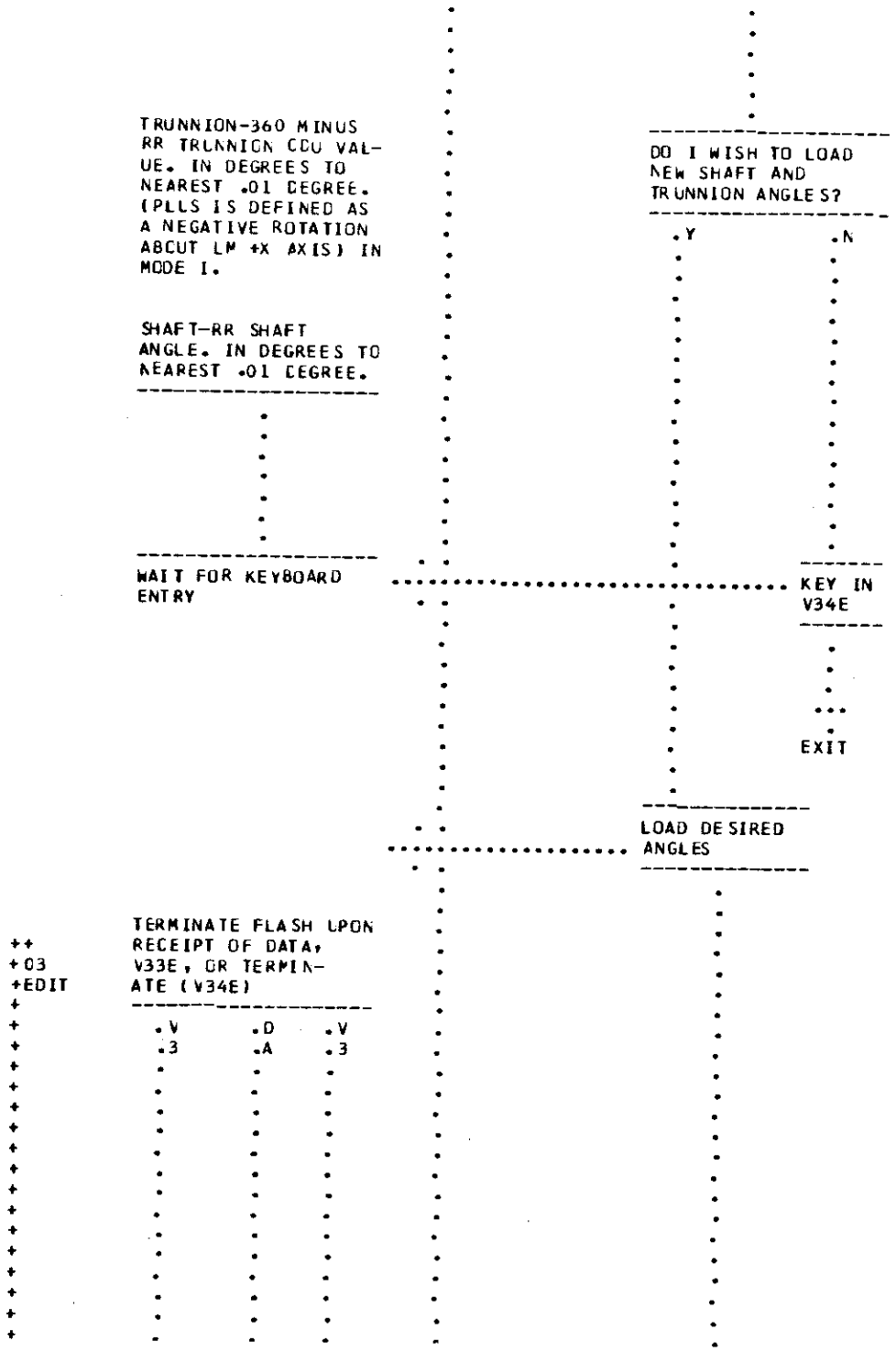

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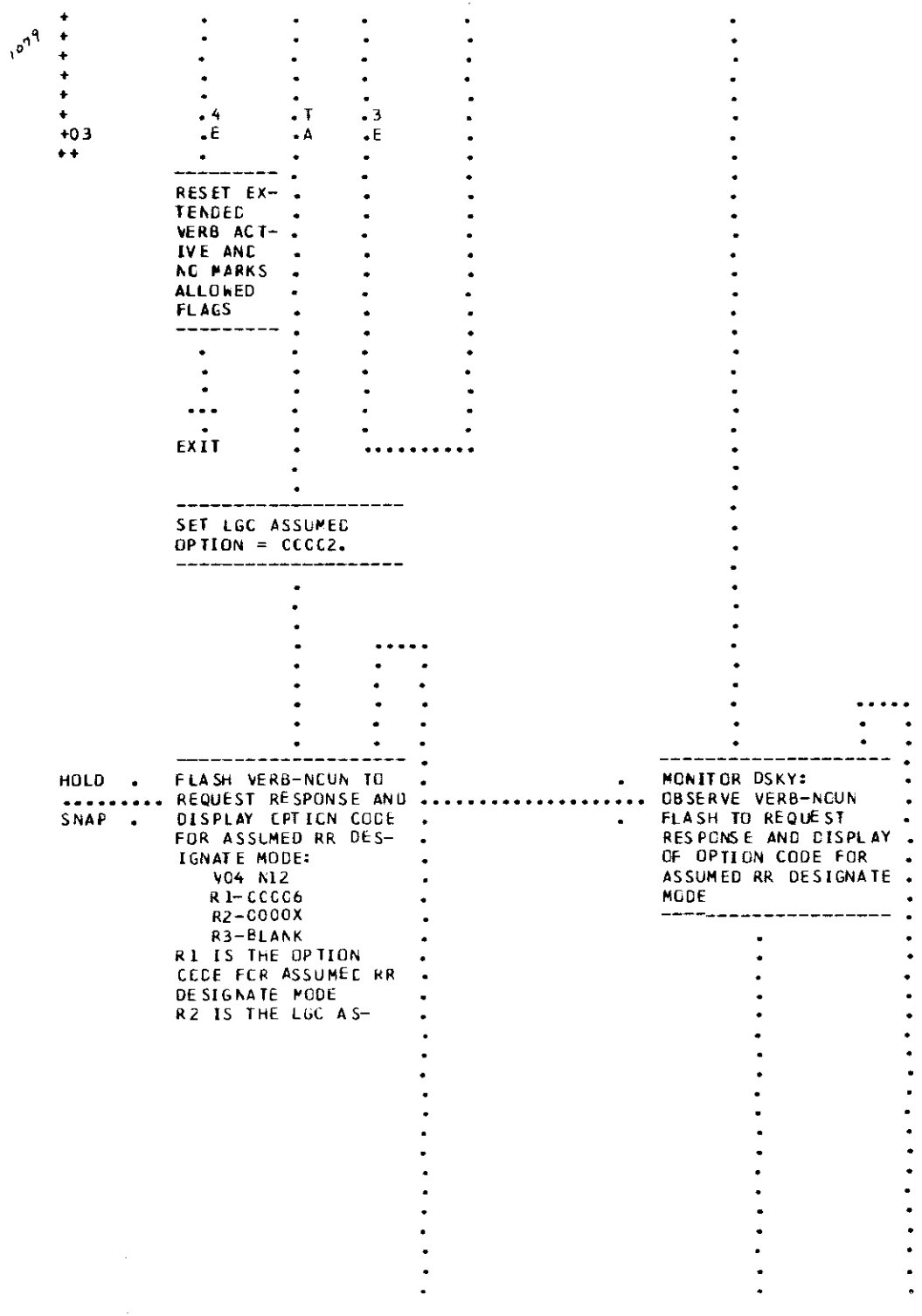

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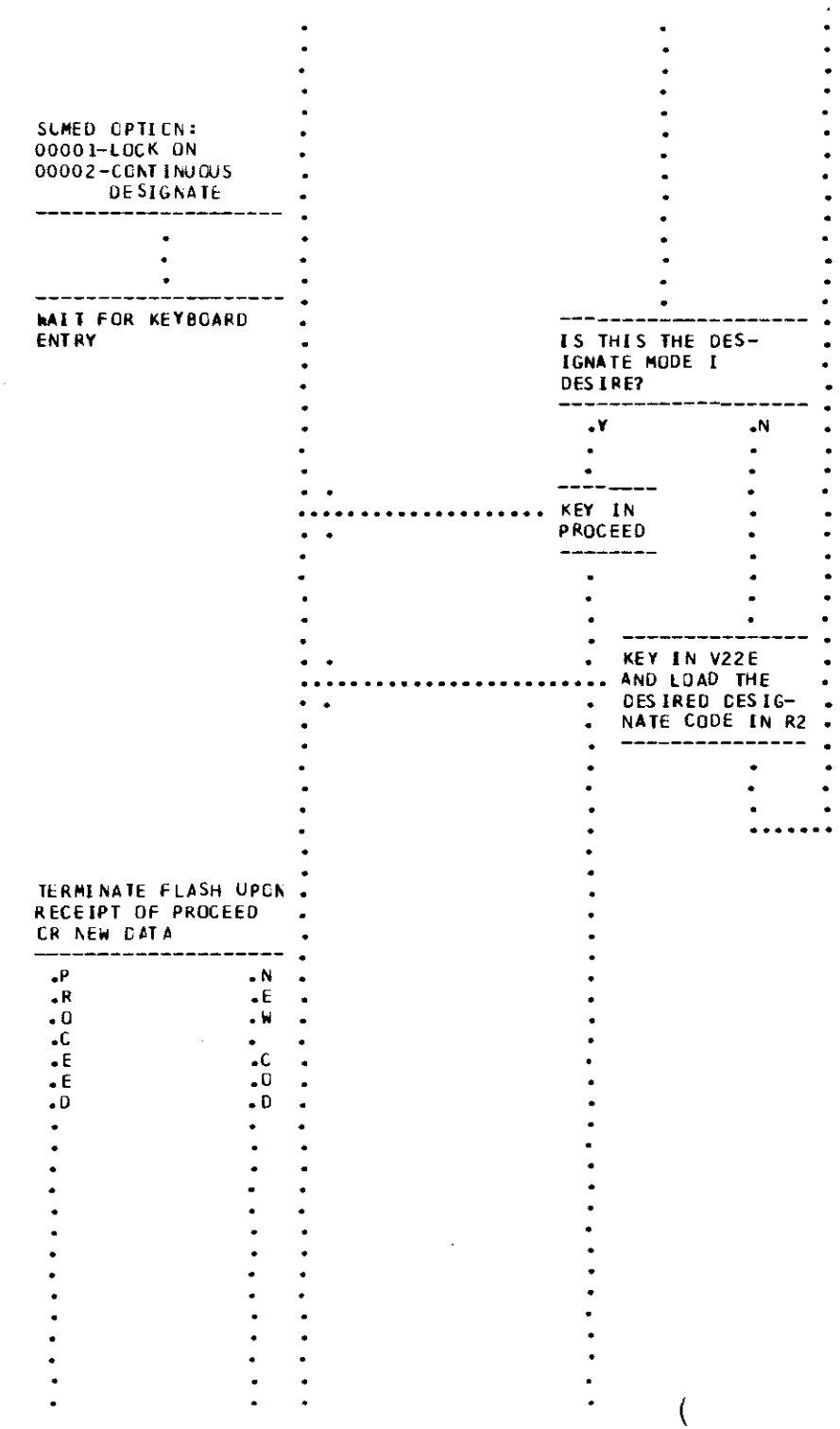

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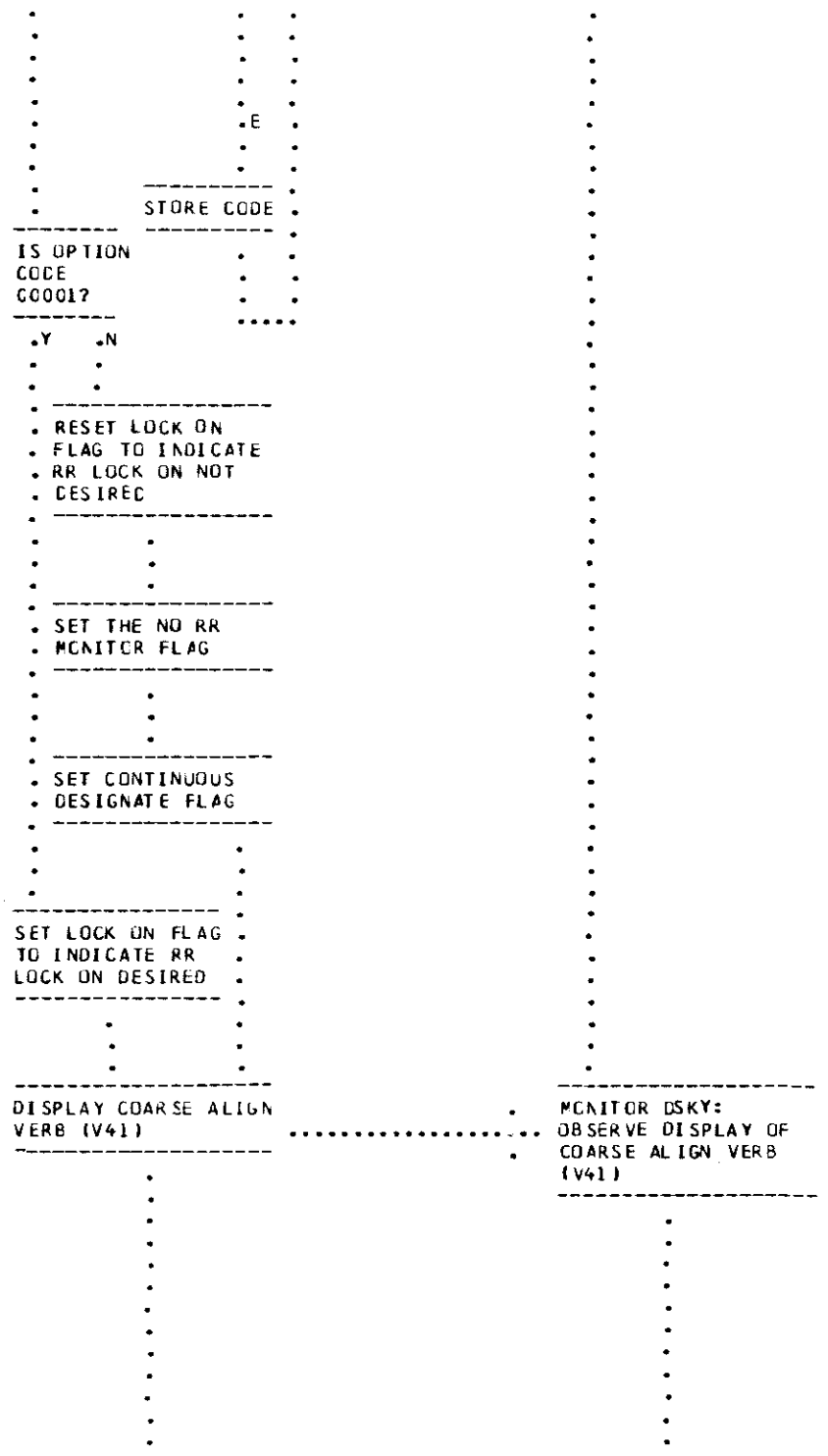

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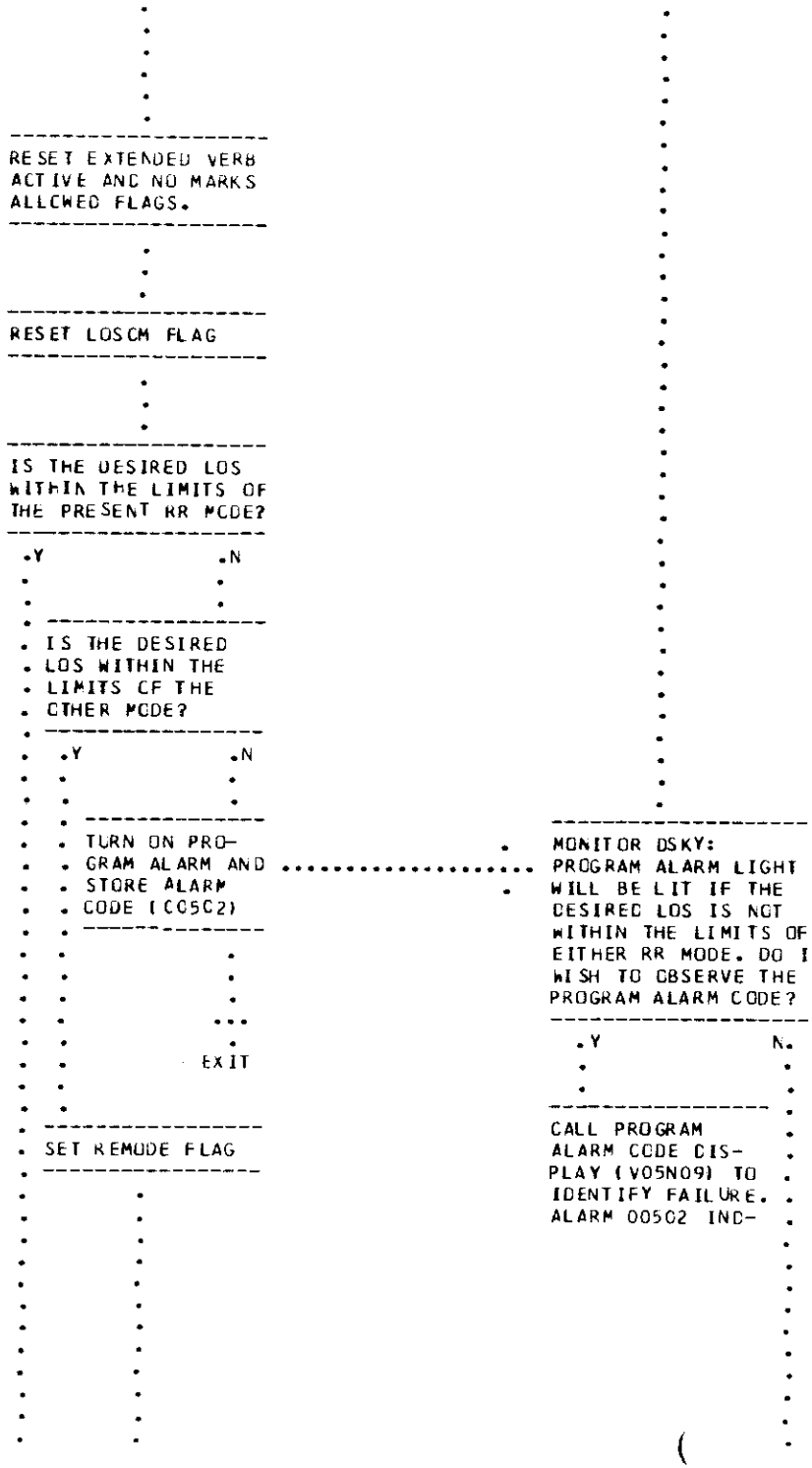

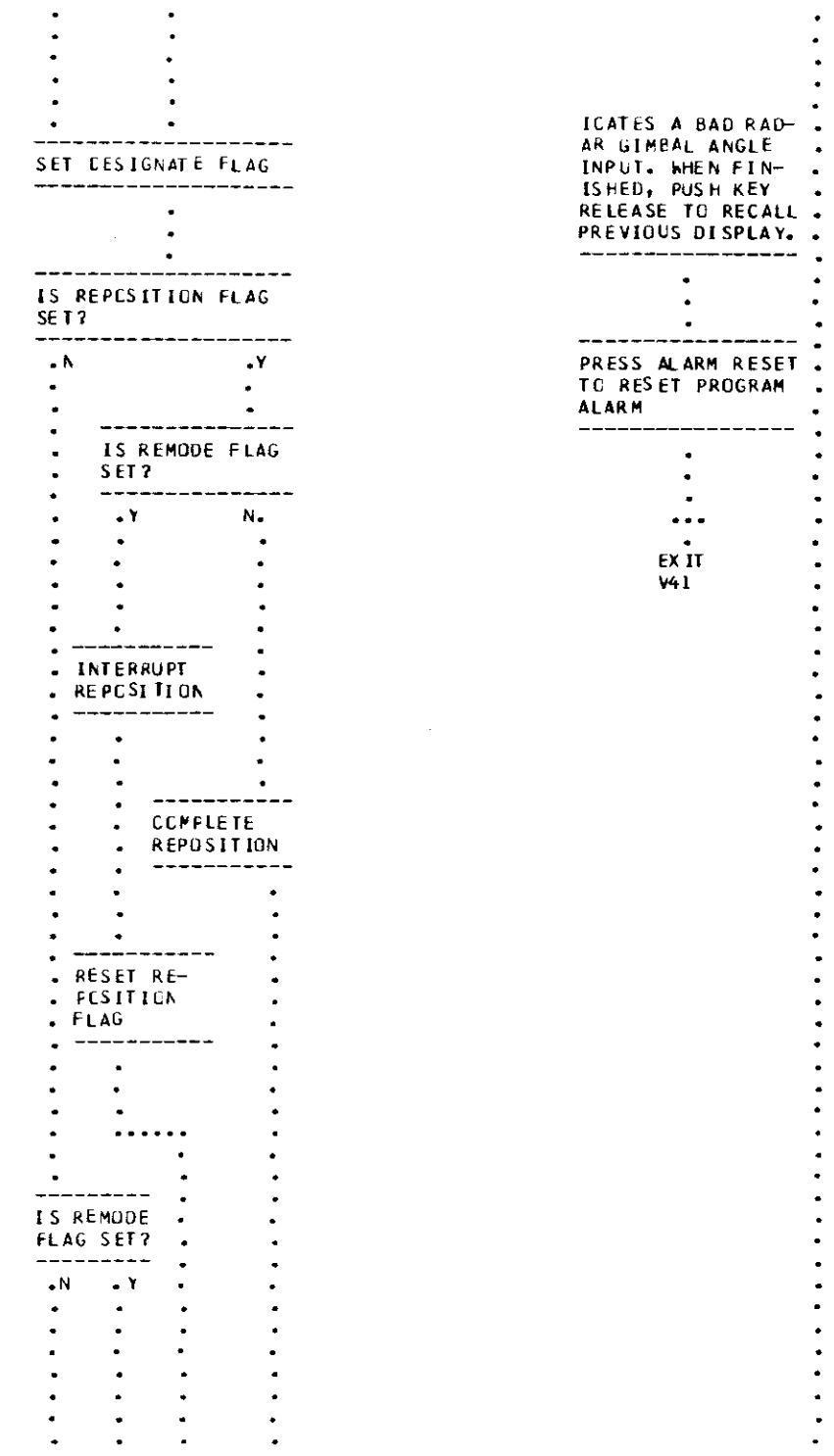

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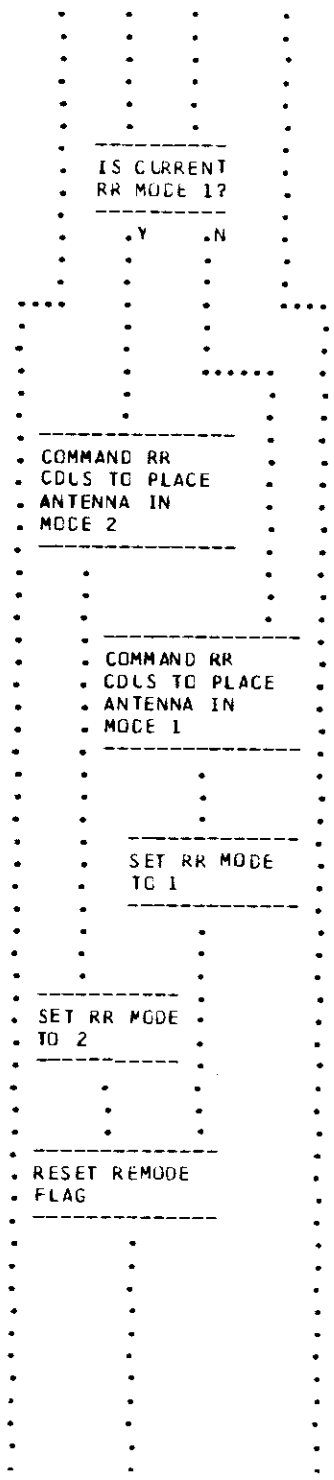

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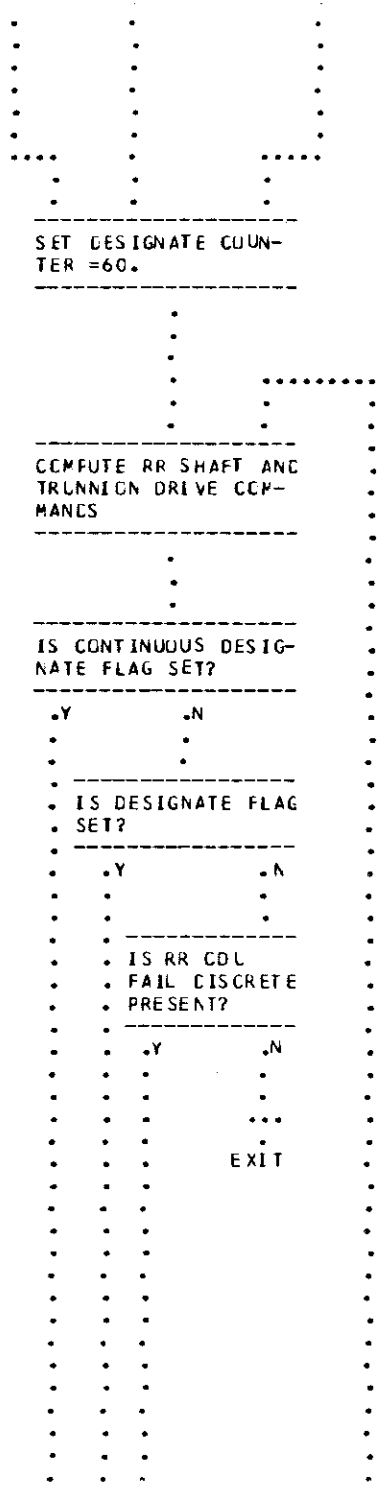

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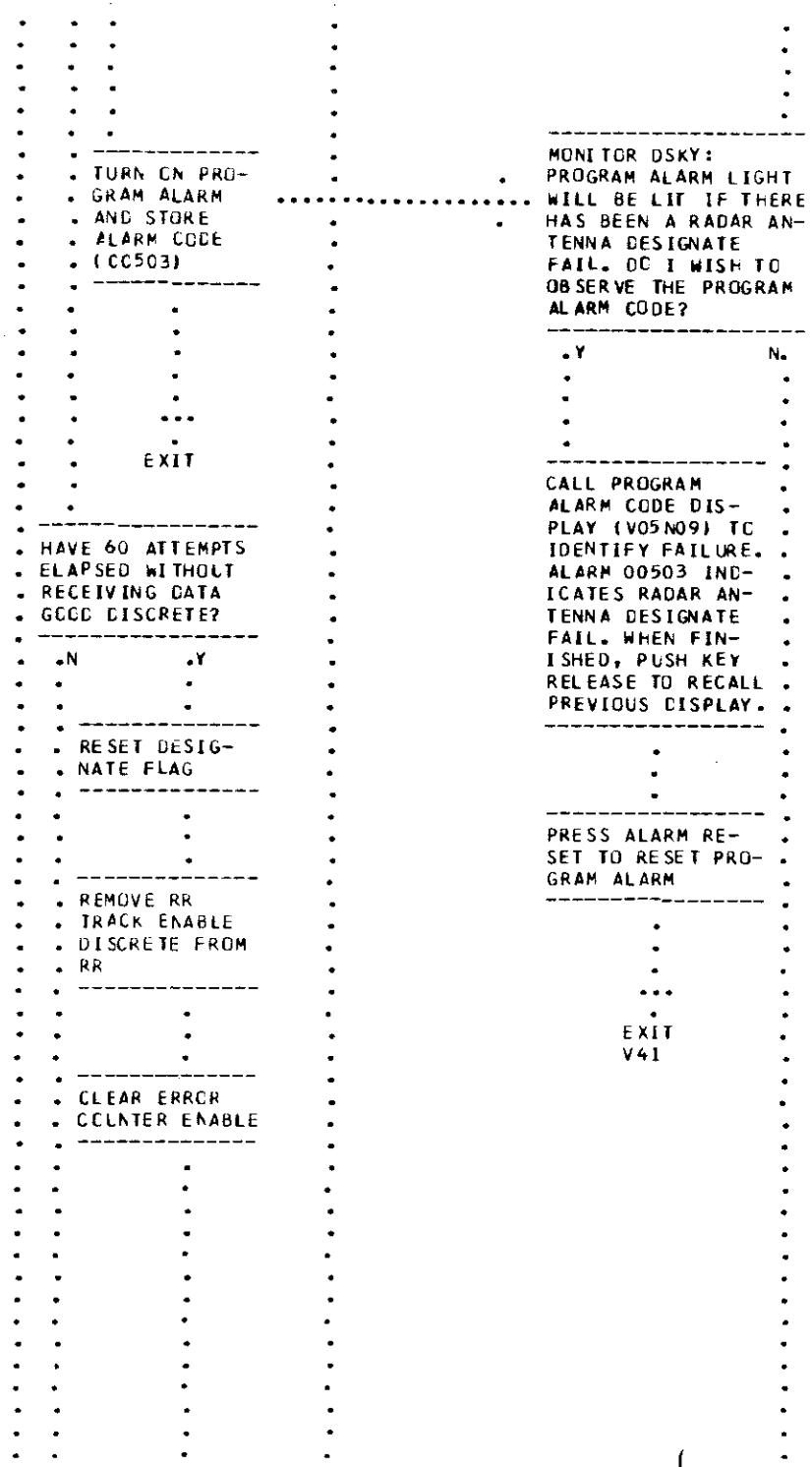

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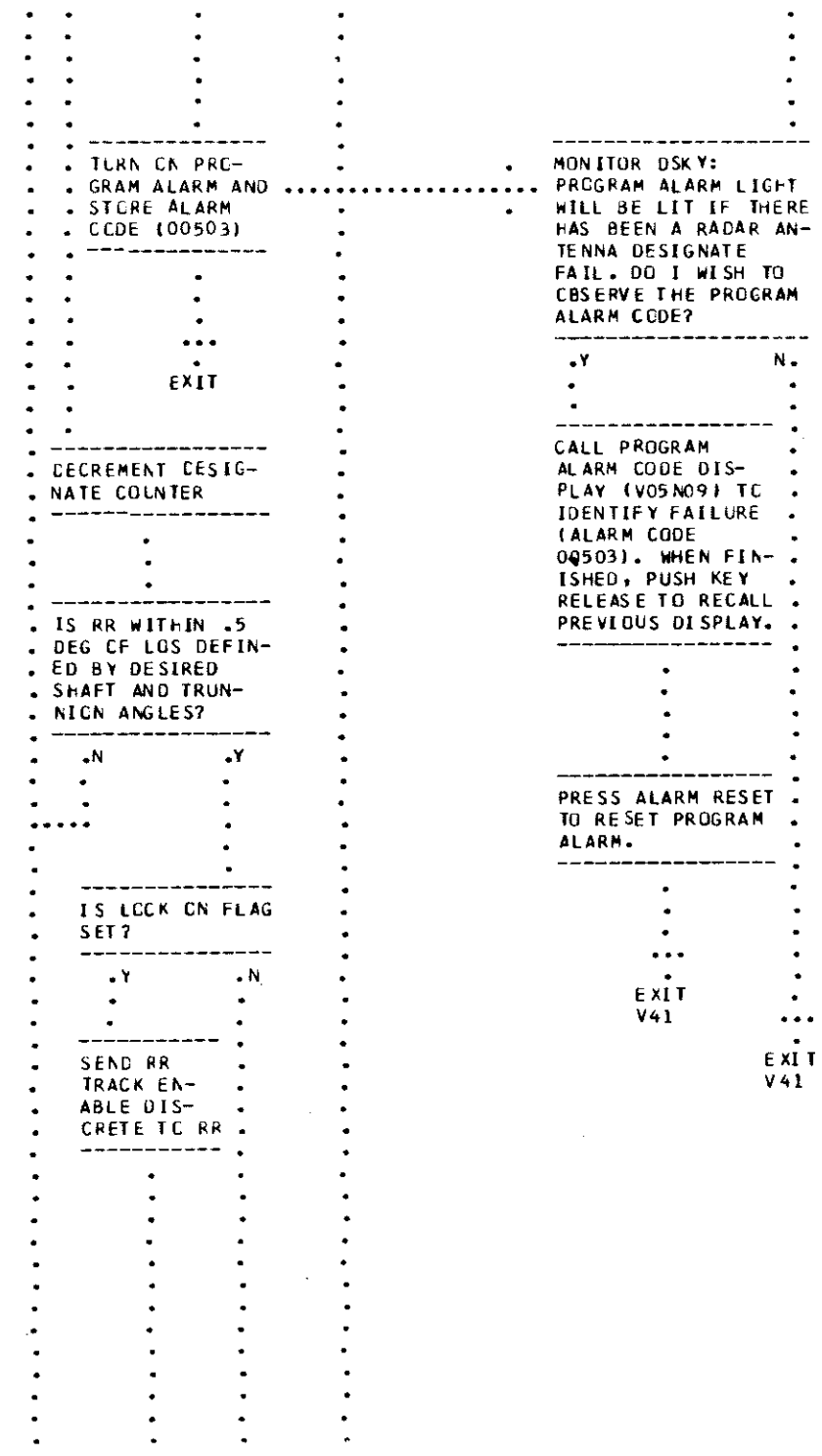

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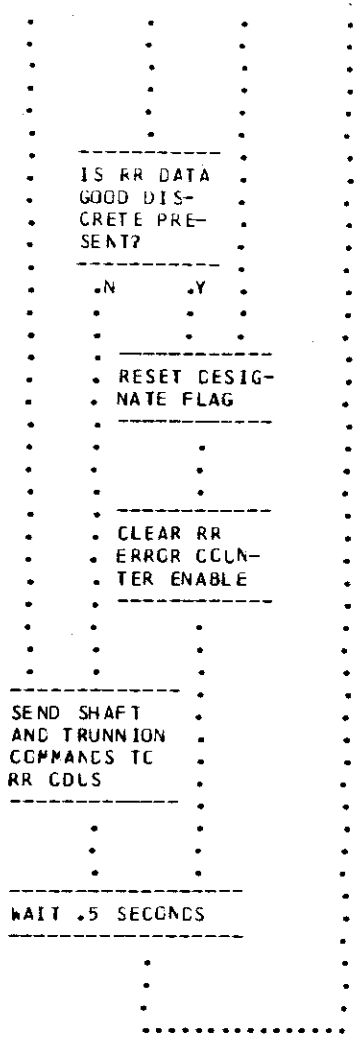

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CHANGE CONTROL NOTES

LOGIC REV 00 PCR 96,185,490
REV 01 EDITORIAL
REV 02 EDITORIAL
REV 03 EDITORIAL

1088

1089

V42, FINE ALIGN IMU REV 01 08/07/69

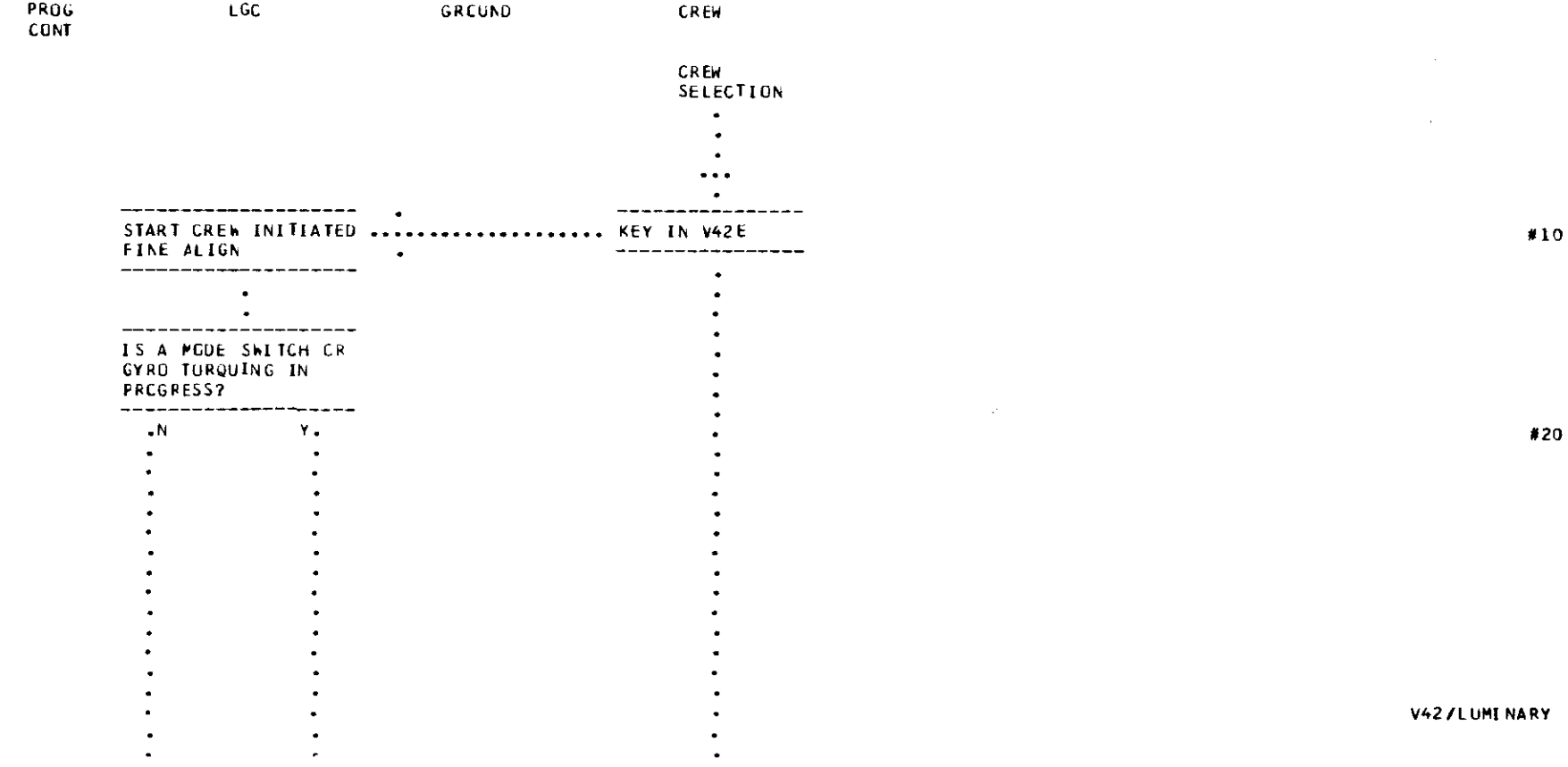
PURPOSE: (1) TO FINE ALIGN THE STABLE MEMBER BY TORQUING THE GYROS.

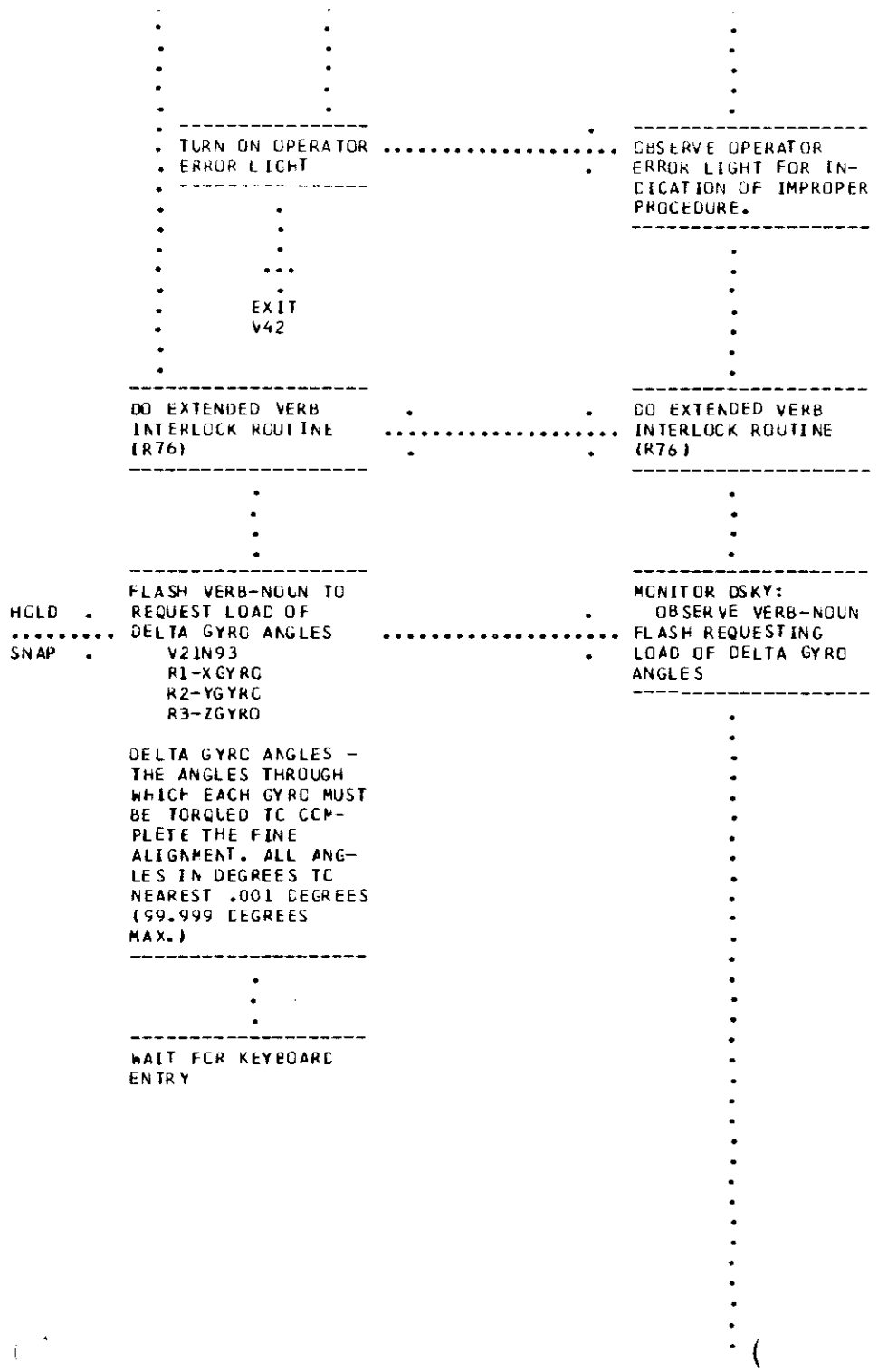
ASSUMPTIONS: (1) THE PROCESS IS CREW SELECTED BY DSKY ENTRY.

(2) VERB 42 MAY NOT BE SELECTED WHEN ANOTHER EXTENDED VERB WHICH ALSO SETS THE EXTENDED VERB INTERLOCK IS ACTIVE, OR WHEN ANOTHER PROGRAM IS TORQUING THE GYROS, ZEROING THE ISS CDUS, OR COARSE ALIGNING THE IMU.

(3) THIS VERB IS NOT PROGRAMMED TO ACCEPT DELTA GYRO ANGLES LARGER THAN 99.999 DEGREES. A SPECIAL PROCEDURE, FOR GROUND USE ONLY, MAKES USE OF A DOUBLE PRECISION LOAD COMBINED WITH V42 WHEN LARGE ANGLE GYRO TORQUING IS REQUIRED.

WARNING: THE DELTA GYRO ANGLES COMMANDED MUST BE LIMITED TO SUCH A SIZE AS NOT TO DRIVE THE MIDDLE GIMBAL INTO GIMBAL LOCK. IN PRACTICE, THIS MEANS THAT THE MIDDLE GIMBAL ANGLE SHOULD NEVER EXCEED 70 DEGREES (POINT AT WHICH GIMBAL LOCK WARNING LAMP IS LIT).




TURN ON OPERATOR ERROR LIGHT
EXIT V42
OBSERVE OPERATOR ERROR LIGHT FOR INDICATION OF IMPROPER PROCEDURE.
DO EXTENDED VERB INTERLOCK ROUTINE (R76)
DO EXTENDED VERB INTERLOCK ROUTINE (R76)
HOLD
SNAP
FLASH VERB-NOUN TO REQUEST LOAD OF DELTA GYRO ANGLES
V21N93
R1-XGYRO
R2-YGYRO
R3-ZGYRO
DELTA GYRO ANGLES - THE ANGLES THROUGH WHICH EACH GYRO MUST BE TORQUED TO COMPLETE THE FINE ALIGNMENT. ALL ANGLES IN DEGREES TO NEAREST .001 DEGREES (99.999 DEGREES MAX.)
MONITOR DSKY:
OBSERVE VERB-NOUN FLASH REQUESTING LOAD OF DELTA GYRO ANGLES
WAIT FOR KEYBOARD ENTRY

#30

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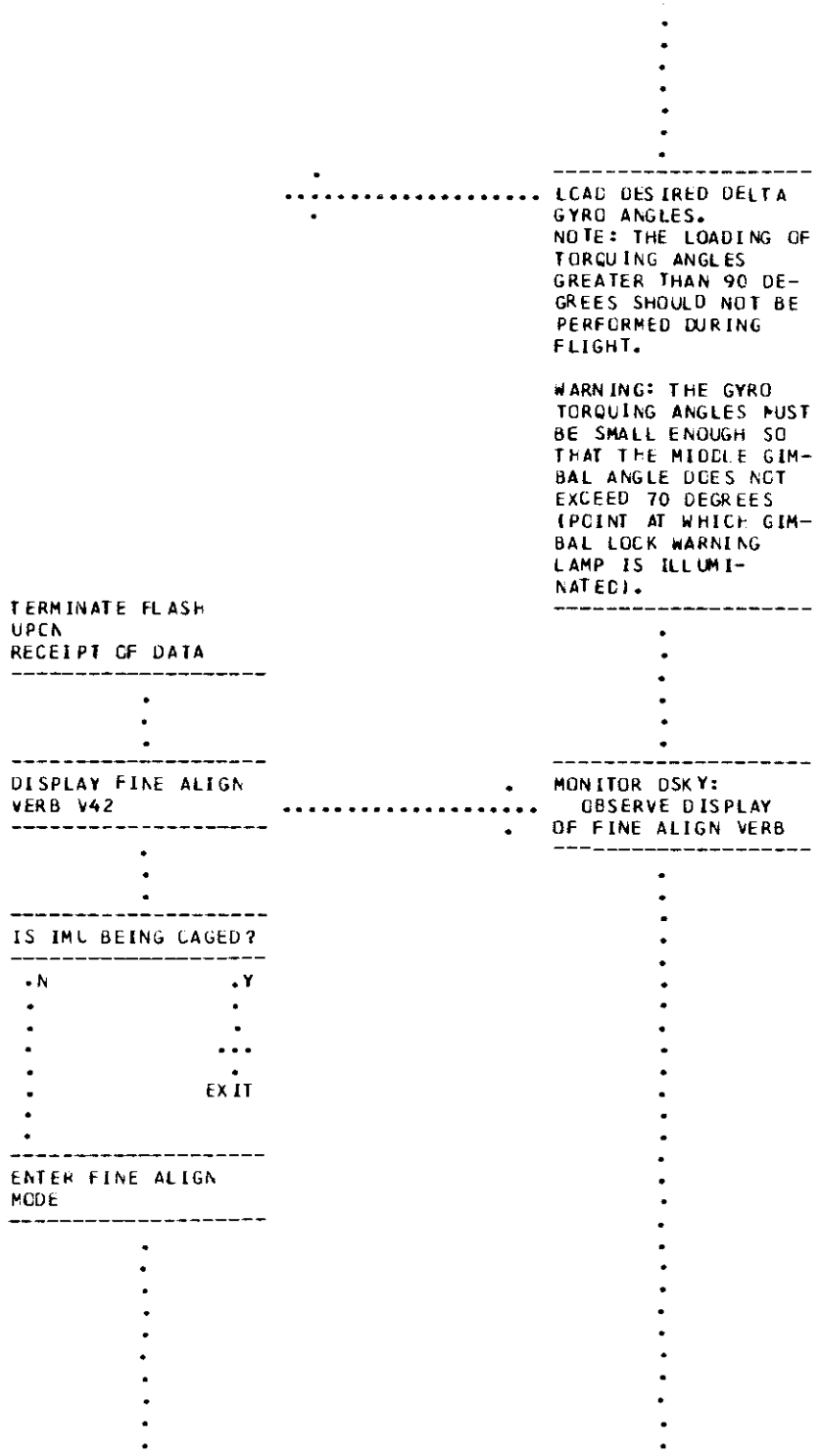
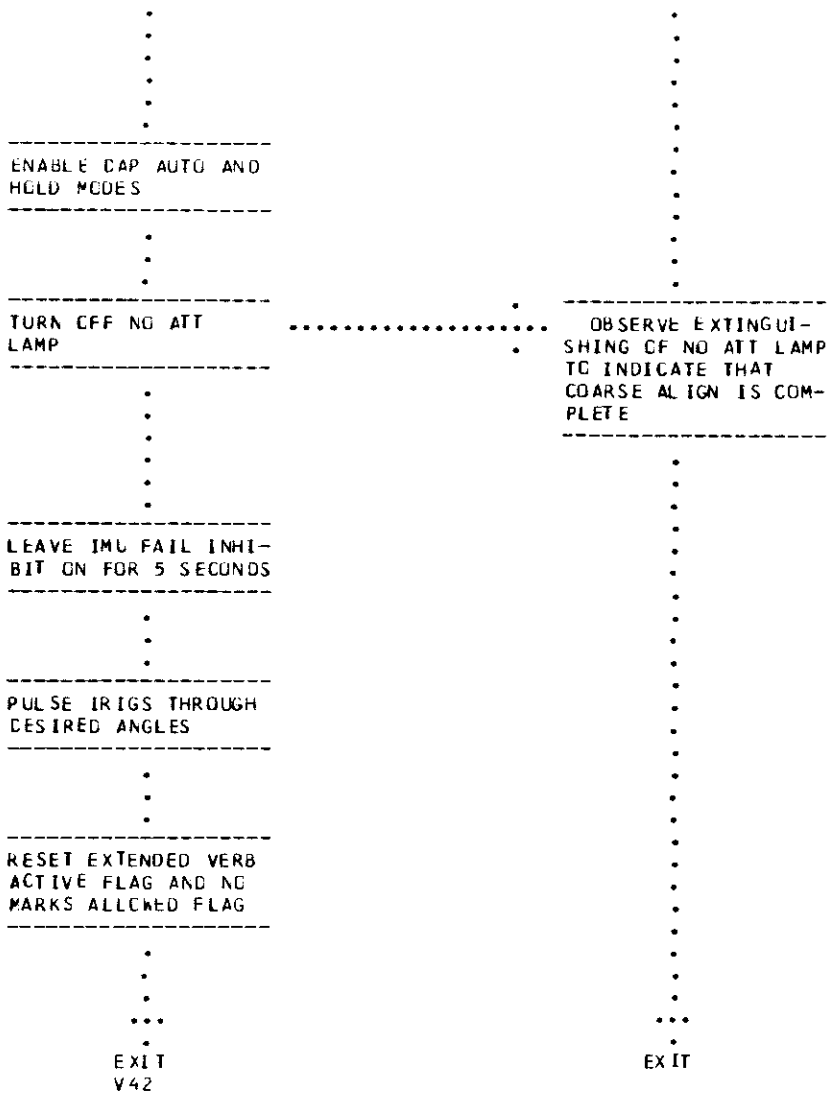

LOAD DESIRED DELTA GYRO ANGLES.
NOTE: THE LOADING OF TORQUING ANGLES GREATER THAN 90 DEGREES SHOULD NOT BE PERFORMED DURING FLIGHT.
WARNING: THE GYRO TORQUING ANGLES MUST BE SMALL ENOUGH SO THAT THE MIDDLE GIMBAL ANGLE DOES NOT EXCEED 70 DEGREES (POINT AT WHICH GIMBAL LOCK WARNING LAMP IS ILLUMINATED).
#80
#90
TERMINATE FLASH UPON RECEIPT OF DATA
DISPLAY FINE ALIGN VERB V42
MONITOR DSKY: OBSERVE DISPLAY OF FINE ALIGN VERB
#100
IS IMU BEING CAGED?
N
Y
EXIT
#110
ENTER FINE ALIGN MODE
#120



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CHANGE CONTROL NOTES

LOGIC REV 00 PCR 496
REV 01 EDITORIAL

1092

V43, LOAD FDAI ERROR NEEDLES REV 03 12/03/69

PURPOSE: (1) TO DISPLAY ASTRONAUT-SPECIFIED ANGLES ON THE FDAI ERROR NEEDLES.

ASSUMPTIONS: (1) THE PROCESS IS CREW SELECTED BY DSKY ENTRY.

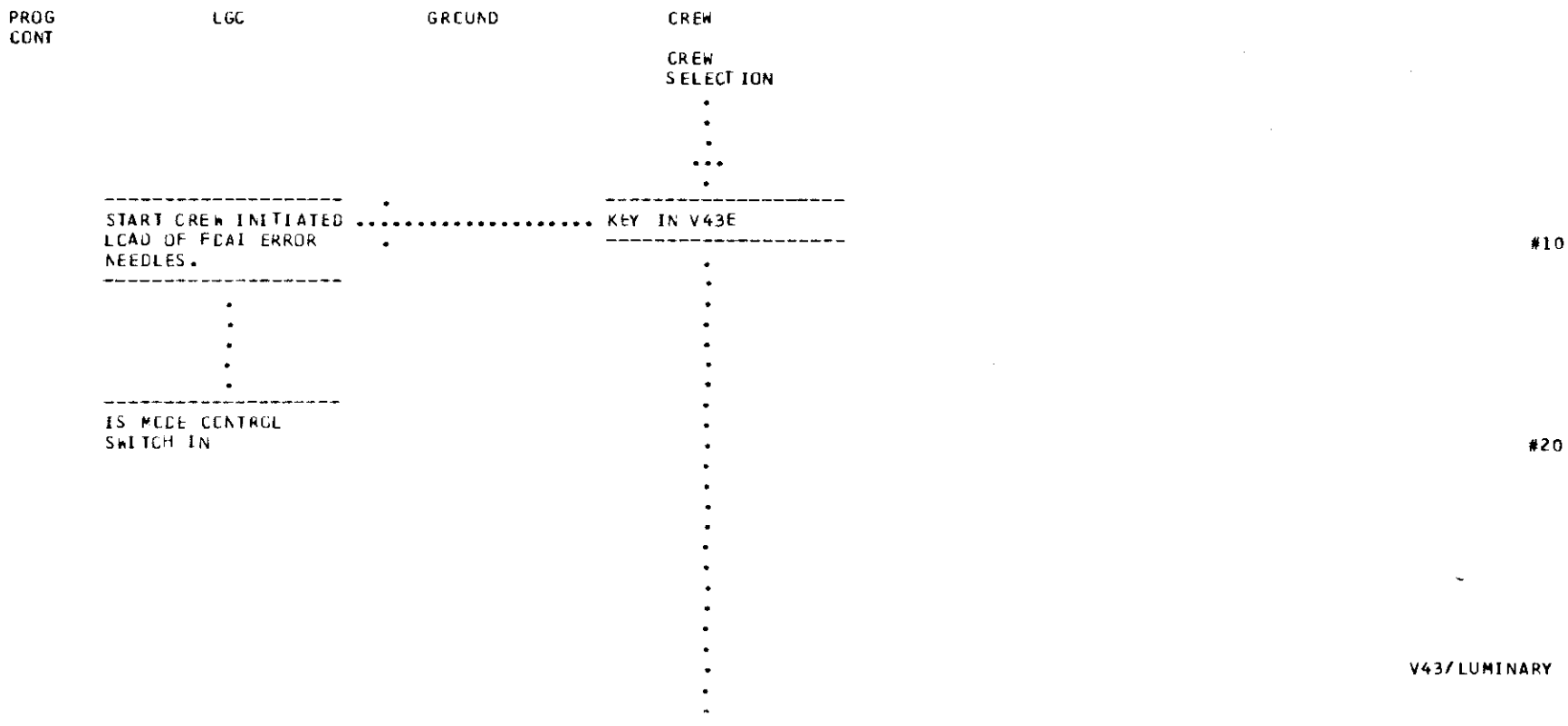
(2) VERB 43 MAY NOT BE SELECTED IF THE IMU IS IN THE COARSE ALIGN OR ZERO ICDU MODE.

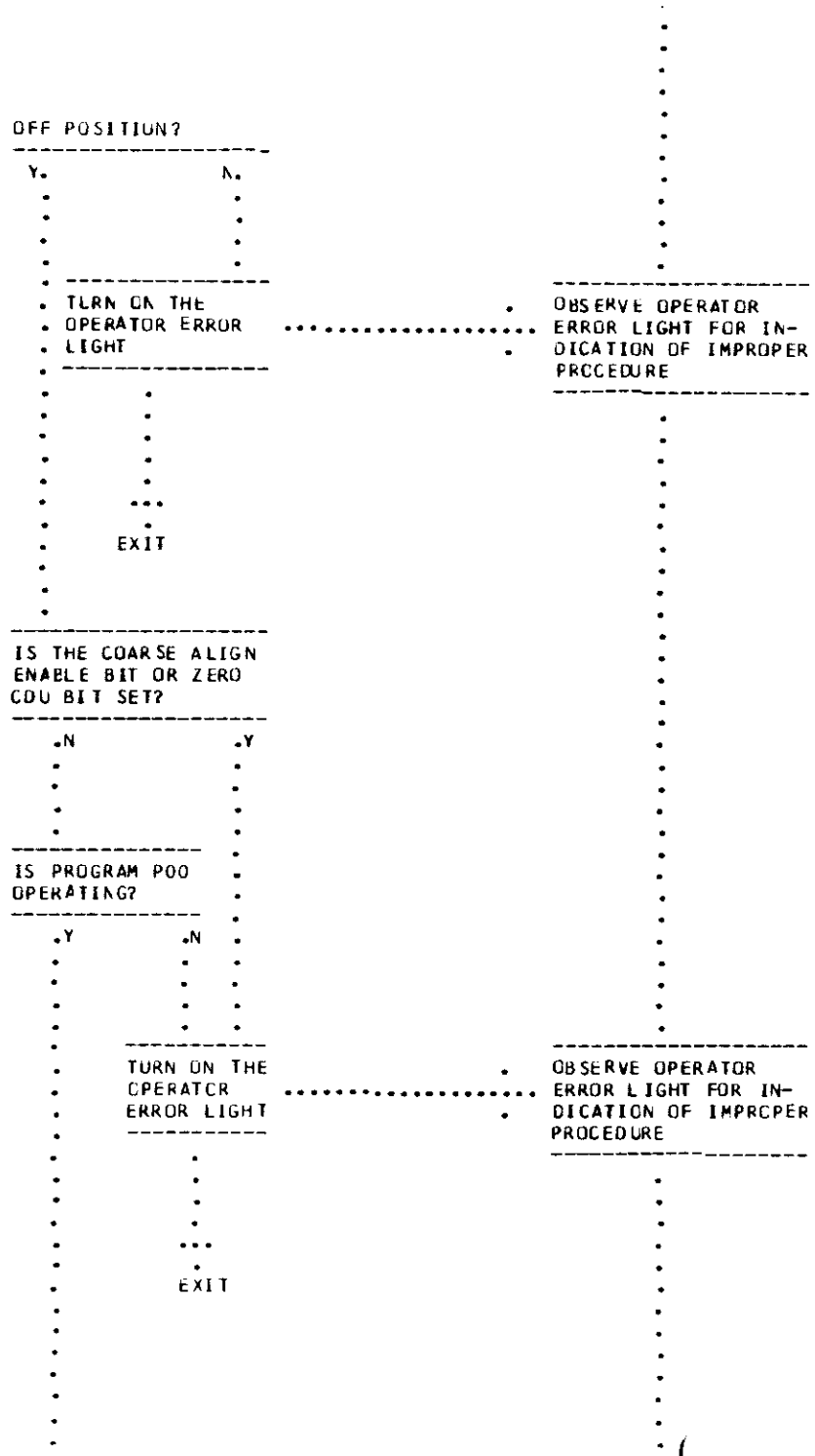
(3) THE MAXIMUM ERROR ANGLE THAT CAN BE DISPLAYED BY THE FDAI IS PLUS OR MINUS 5 DEGREES, LIMITED BY THE NEEDLE STOPS.

(4) THIS PROCESS MAY BE SELECTED ONLY IN P00.

(5) THIS PROCESS MAY BE SELECTED ONLY IF THE MODE CONTROL SWITCH IS OFF.

(6) THIS EXTENDED VERB CANNOT BE SELECTED CONCURRENTLY WITH ANY OTHER EXTENDED VERB WHICH ALSO SETS THE EXTENDED VERB INTERLOCK.





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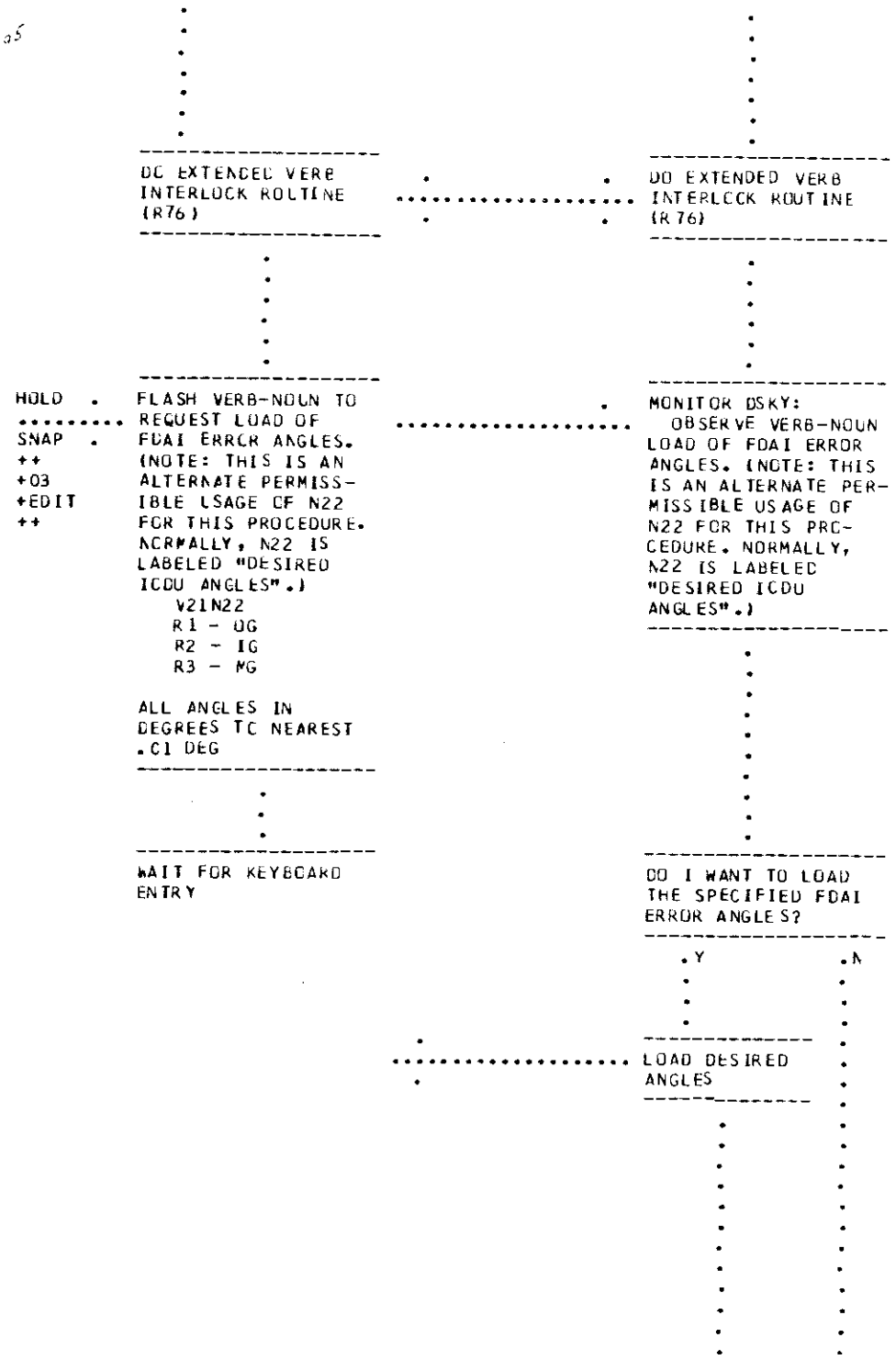
1005



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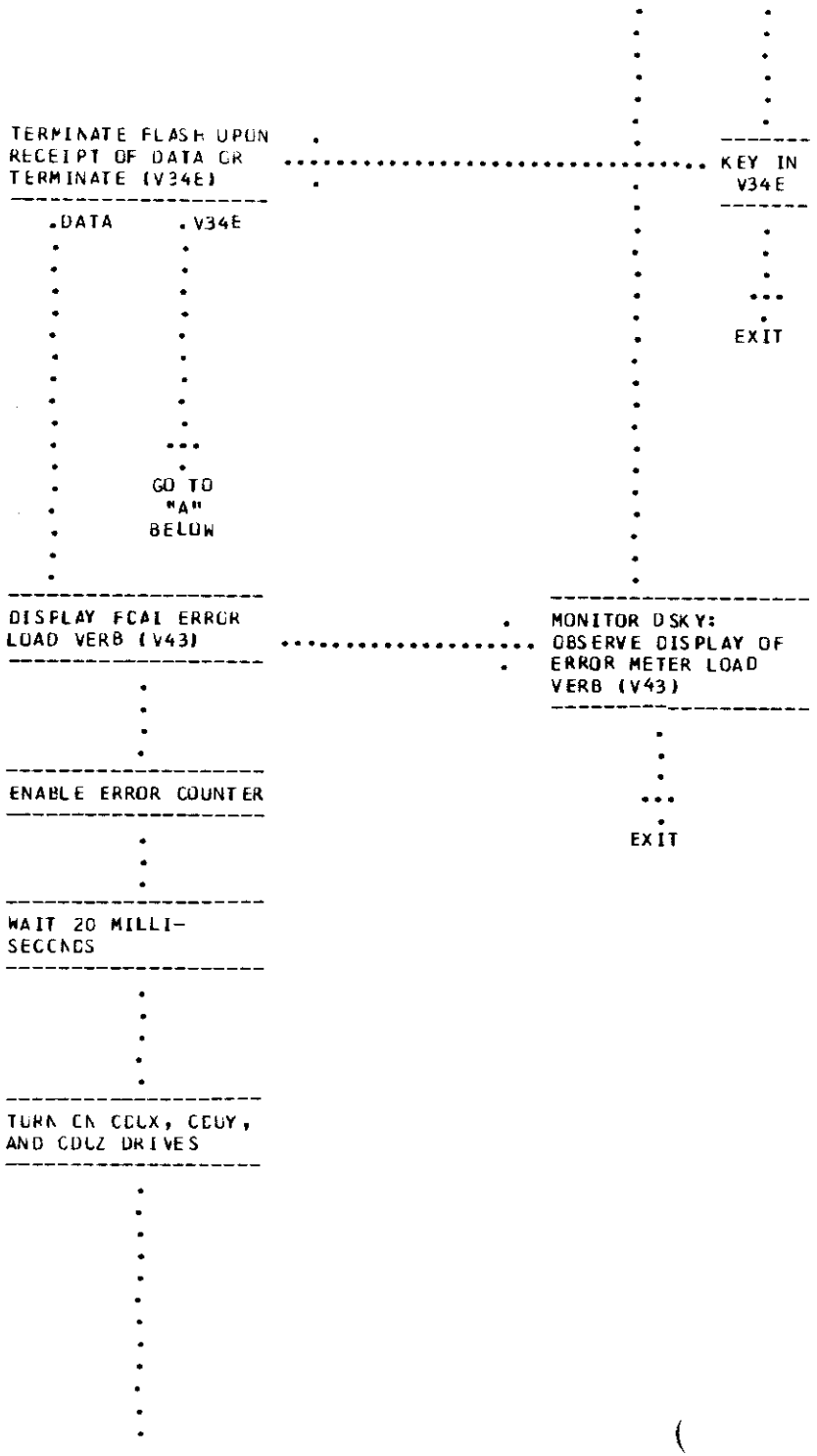

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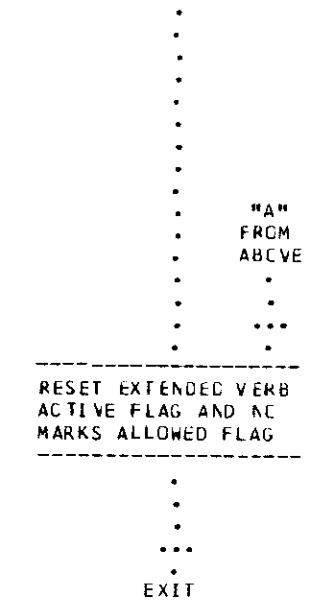

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CHANGE CONTROL NOTES

LOGIC REV 00 PCR 496
      REV 01   EDITORIAL
      REV 02   EDITORIAL
      REV 03   EDITORIAL

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1099

V44, TERMINATE RR CONTINUOUS DESIGNATE REV 01 08/09/69

PURPOSE: (1) TO TERMINATE THE CONTINUOUS DESIGNATE OPTION OF V41N72.

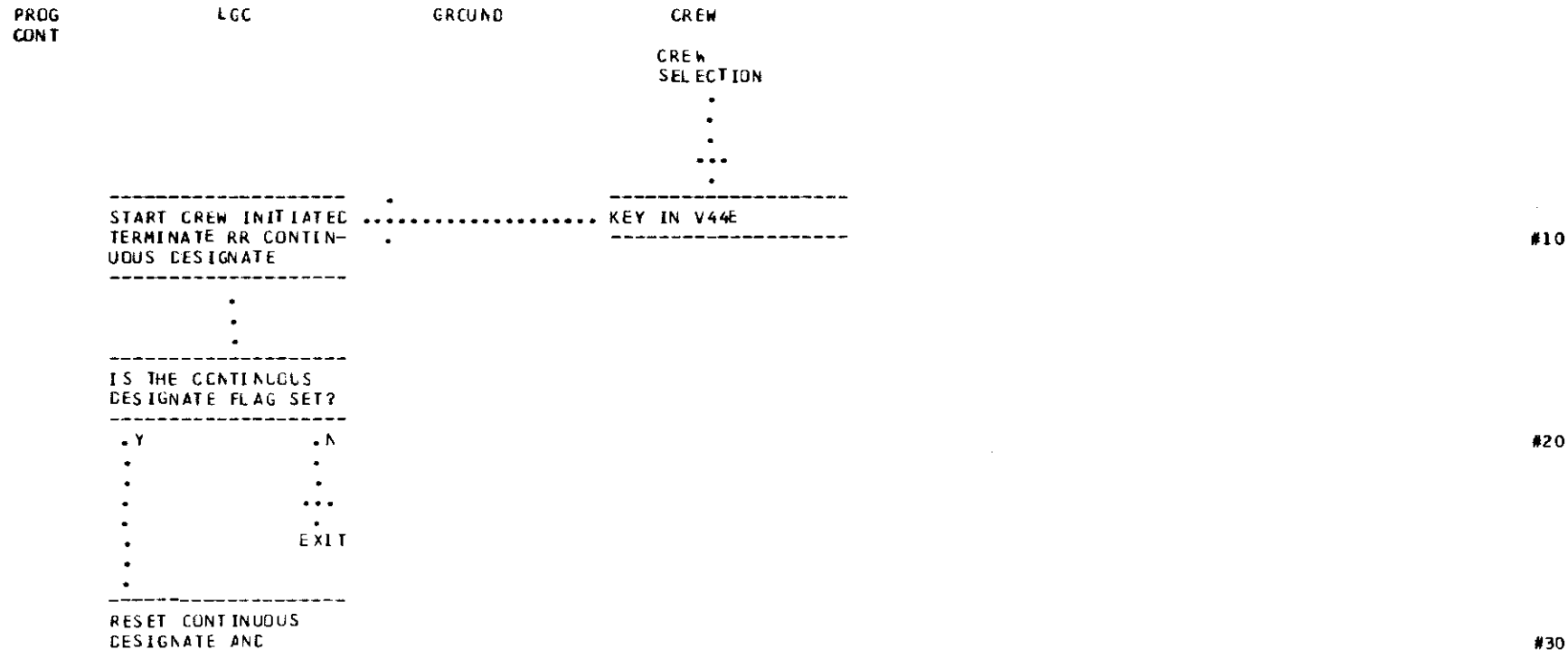
(2) TO DISABLE THE RR CDU ERROR COUNTERS.

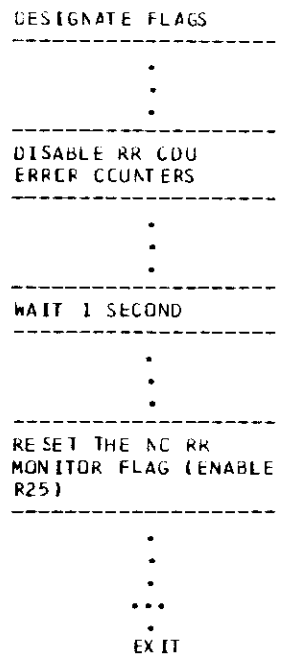
(3) TO ENABLE R25.

ASSUMPTIONS: (1) THE PROCESS IS CREW SELECTED BY DSKY ENTRY.

(2) V44E IS EFFECTIVE ONLY IF RR CONTINUOUS DESIGNATION (V41N72, COARSE ALIGN RR CDUS, OPTION 2) IS IN PROGRESS.

(3) THE PROCESS MAY BE SELECTED AT ANY TIME.





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CHANGE CONTROL NOTES

LOGIC REV 00A PCR 456

1100

1101

V47, INITIALIZE AGS, R47 REV 01 08/09/69

NOTE: THIS EXTENDED VERB IS USED TO CALL ROUTINE 47. SEE R47 FOR THE LOGIC SPECIFICATION FLOW FOR AGS INITIALIZATION.

CHANGE CONTROL NOTES

LOGIC REV CC PCR 184

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1103

V48, START DAP DATA LOAD, R03 REV 01 08/09/69

NOTE: THIS EXTENDED VERB IS USED TO CALL ROUTINE 03. SEE R03 FOR THE LOGIC SPECIFICATION FLOW FOR THE DAP DATA LOAD.

CHANGE CONTROL NOTES

LOGIC REV 00 PCR 184

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V49, START CREW-DEFINED MANEUVER, R62 REV 01 08/09/69

NOTE: THIS EXTENDED VERB IS USED TO CALL ROUTINE 62. SEE R62 FOR THE LOGIC SPECIFICATION FLOW FOR THE CREW-DEFINED MANEUVER.

CHANGE CONTROL NOTES

LOGIC REV CC PCR 496

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1107

V50, PLEASE PERFORM

REV 01 08/09/69

PURPOSE: (1) TO INTERRUPT A PROGRAM OR ROUTINE AND REQUEST ASTRONAUT RESPONSE TO THE ACTION DEFINED BY THE CHECKLIST CODE DISPLAYED ON THE DSKY.

ASSUMPTIONS: (1) THIS VERB IS ALWAYS INTERNALLY INITIATED BY THE PROGRAM IN PROCESS, AND SHOULD NOT BE SELECTED BY THE CREW.

(2) THE VERB ALWAYS APPEARS WITH N25 AS A FLASHING DISPLAY ON THE DSKY

(3) RESPONSES TO THE DSKY DISPLAY OF THIS VERB ARE DESCRIBED IN SECTION 4.2.2.7 OF THIS DOCUMENT.

CHANGE CONTROL NOTES

LOGIC REV 00 PCR 496

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1109

V52, MARK X-RETICLE REV 01 08/09/69

NOTE: THIS EXTENDED VERB IS USED IN R57. REFER TO THIS ROUTINE FOR LOGIC DESCRIPTION OF PERFORMING SIGHTING MARKS ON CELESTIAL BODIES.

CHANGE CONTROL NOTES

LOGIC REV 0C PCR 496

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V53, MARK Y-RETICLE REV 01 08/09/69

NOTE: THIS EXTENDED VERB IS USED IN R57. REFER TO THAT ROUTINE FOR LOGIC DESCRIPTION OF PERFORMING SIGHTING MARKS ON CELESTIAL BODIES.

CHANGE CONTROL NOTES

LOGIC REV 00 PCR 496

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1113

V54, MARK X- OR Y- RETICLE REV 01 08/09/69

NOTE: THIS EXTENDED VERB IS USED IN R53 AND R57. REFER TO THESE ROUTINES FOR LOGIC DESCRIPTION OF PERFORMING SIGHTING MARKS ON CELESTIAL BODIES.

CHANGE CONTROL NOTES

LOGIC REV CC PCR [illegible]

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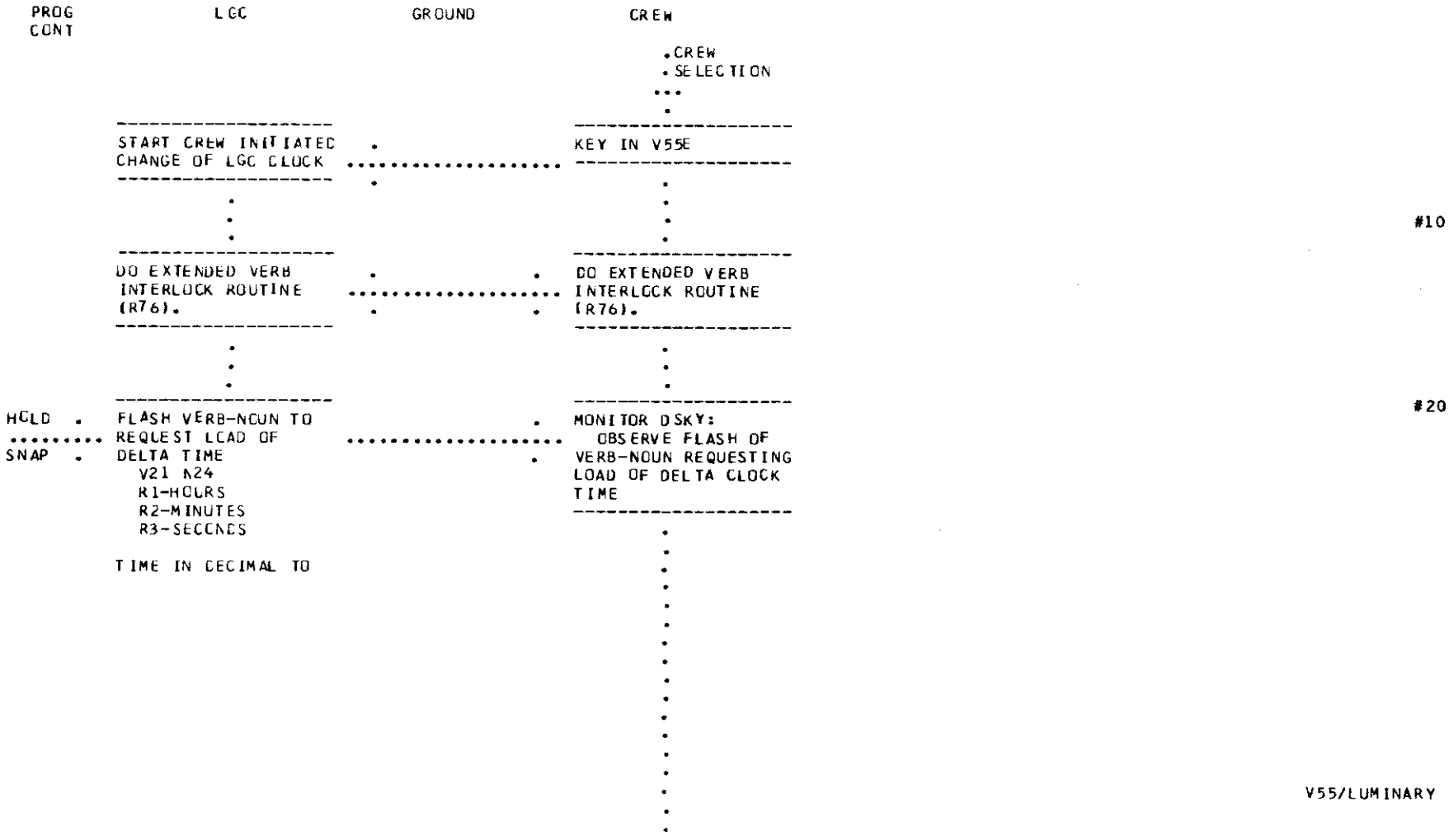
1115

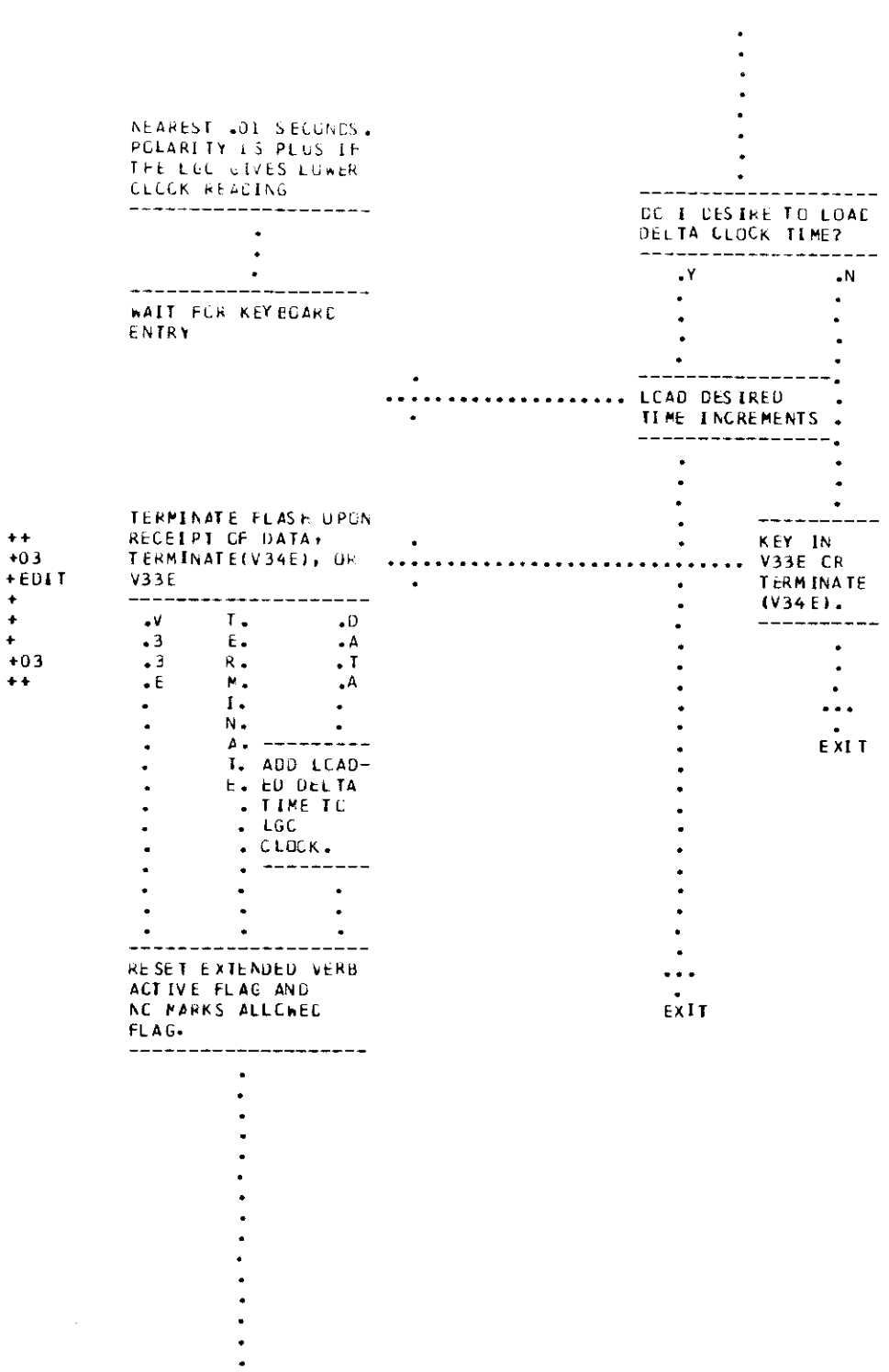
V55, INCREMENT LGC TIME (DECIMAL) REV 03 12/03/69

PURPOSE: (1) TO CHANGE THE LGC CLOCK TIME USING INCREMENTS (OR DECREMENTS) LOADED BY THE ASTRONAUT.

ASSUMPTIONS: (1) THE PROCESS IS CREW SELECTED BY DSKY ENTRY.

(2) THE PROCESS MAY NOT BE SELECTED WHEN ANOTHER EXTENDED VERB WHICH ALSO SETS THE EXTENDED VERB INTERLOCK IS ACTIVE.





++
+03
+EDIT
+
+
+03
++

#30
#40
#50
#60
#70

#80

```
                    .
                    .
                    .
                    .
                    .
                    .
                   ...
                    .
                  EXIT
                  V55
```

CHANGE CONTROL NOTES

```
LOGIC REV 00   PCR 496
      REV 01    EDITORIAL
      REV 02    EDITORIAL
      REV 03    EDITORIAL
```

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1119

V56, REQUEST TERMINATE TRACKING ROUTINE REV 01 08/09/69

NOTE: THIS EXTENDED VERB IS USED TO CALL ROUTINE 56. REFER TO R56 FOR THE LOGIC SPECIFICATION FLOW FOR TERMINATING TRACKING.

CHANGE CONTROL NOTES

LOGIC REV CC PCR 456

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1120

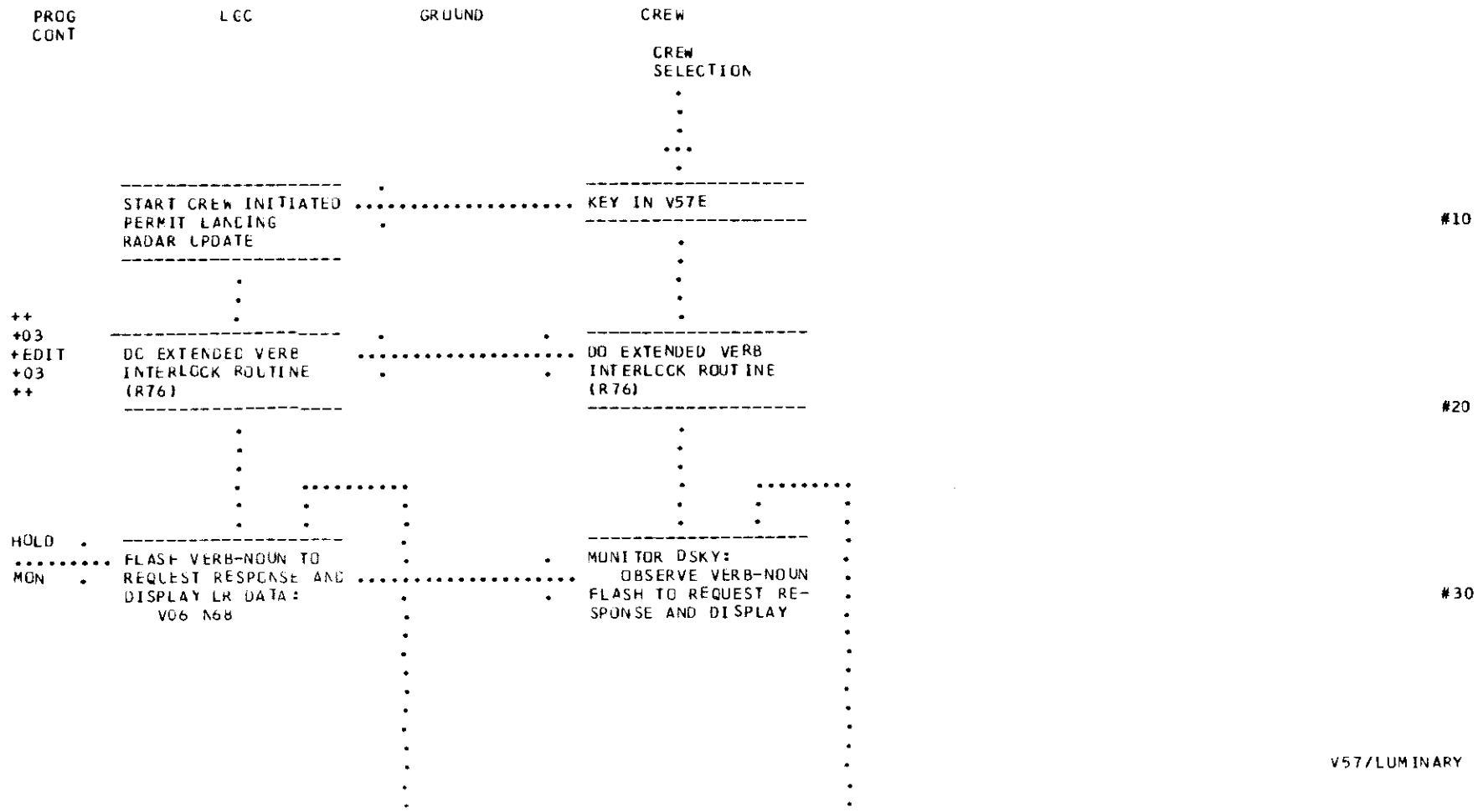
1121

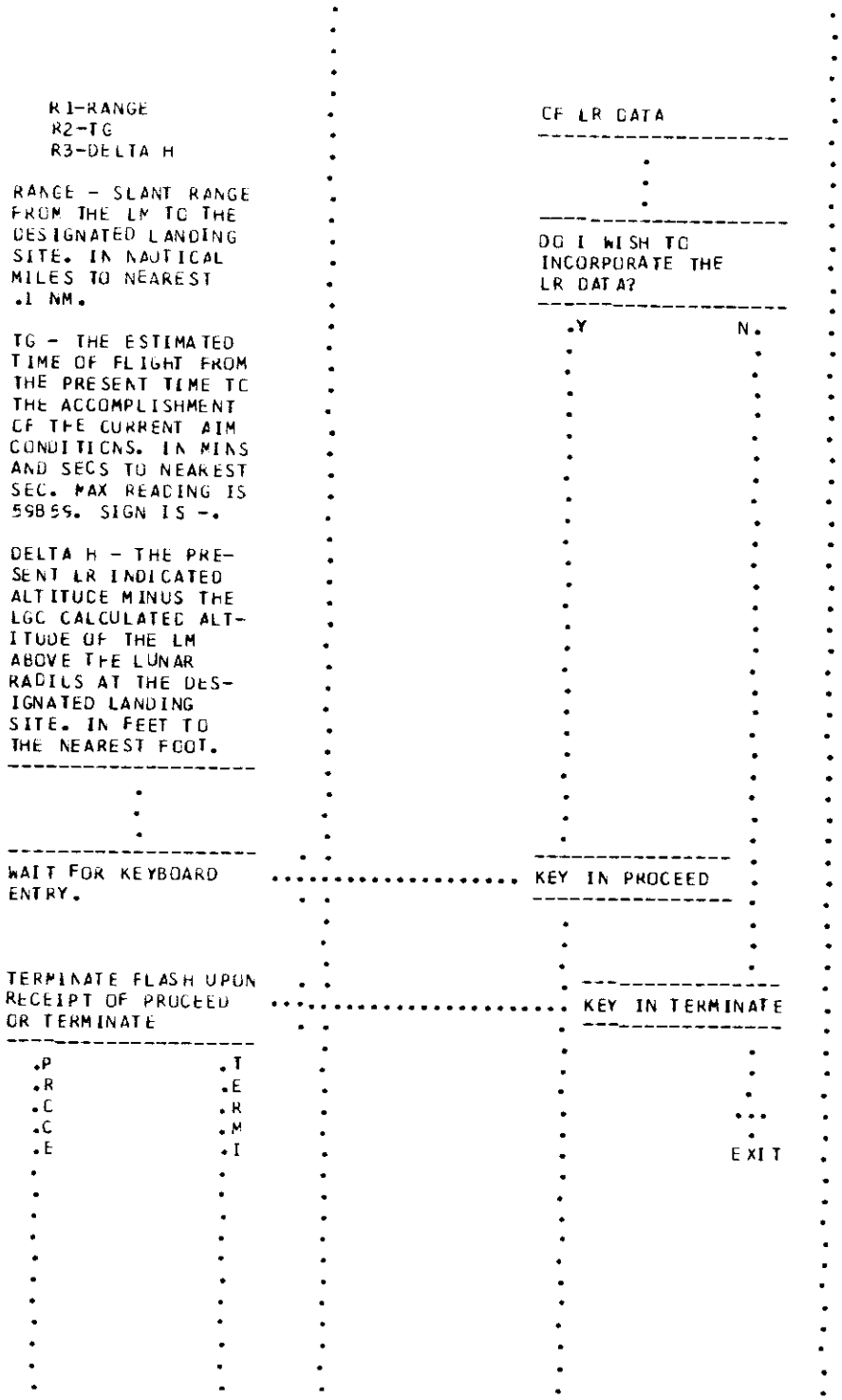
V57, PERMIT LANDING RADAR UPDATE REV 03 12/03/69

PURPOSE: (1) TO PERMIT THE ASTRONAUT TO MONITOR THE LM DELTA ALTITUDE (PRESENT LR INDICATED ALTITUDE MINUS LGC-CALCULATED ALTITUDE) AND TO ALLOW THE INCORPORATION OF LR DATA DURING STATE VECTOR UPDATING BY SETTING THE LR PERMIT FLAG (SEE LOGIC DESCRIPTION BELOW).

ASSUMPTIONS: (1) THE PROCESS IS CREW SELECTED BY DSKY ENTRY.

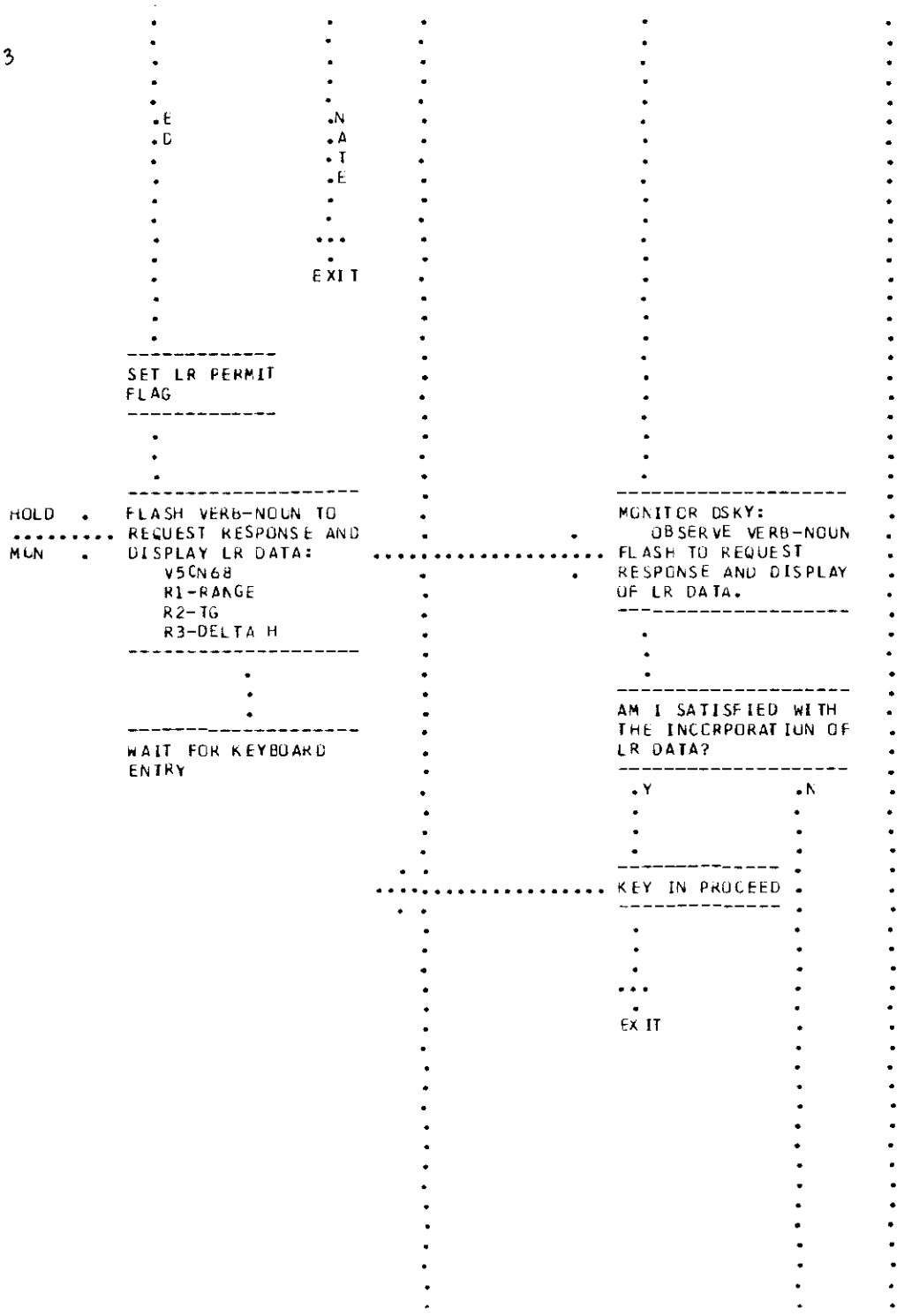
(2) THE PROCESS IS ONLY EFFECTIVE IN R12, DESCENT STATE VECTOR UPDATE ROUTINE.




R1-RANGE
R2-TG
R3-DELTA H
RANGE - SLANT RANGE FROM THE LM TO THE DESIGNATED LANDING SITE. IN NAUTICAL MILES TO NEAREST .1 NM.
TG - THE ESTIMATED TIME OF FLIGHT FROM THE PRESENT TIME TO THE ACCOMPLISHMENT OF THE CURRENT AIM CONDITIONS. IN MINS AND SECS TO NEAREST SEC. MAX READING IS 59B59. SIGN IS -.
DELTA H - THE PRESENT LR INDICATED ALTITUDE MINUS THE LGC CALCULATED ALTITUDE OF THE LM ABOVE THE LUNAR RADIUS AT THE DESIGNATED LANDING SITE. IN FEET TO THE NEAREST FOOT.
WAIT FOR KEYBOARD ENTRY.
TERMINATE FLASH UPON RECEIPT OF PROCEED OR TERMINATE
.P
.R
.C
.C
.E
.T
.E
.R
.M
.I
CF LR DATA
DO I WISH TO INCORPORATE THE LR DATA?
.Y
N.
KEY IN PROCEED
KEY IN TERMINATE
EXIT
#40
#50
#60
#70
#80

1122

1123



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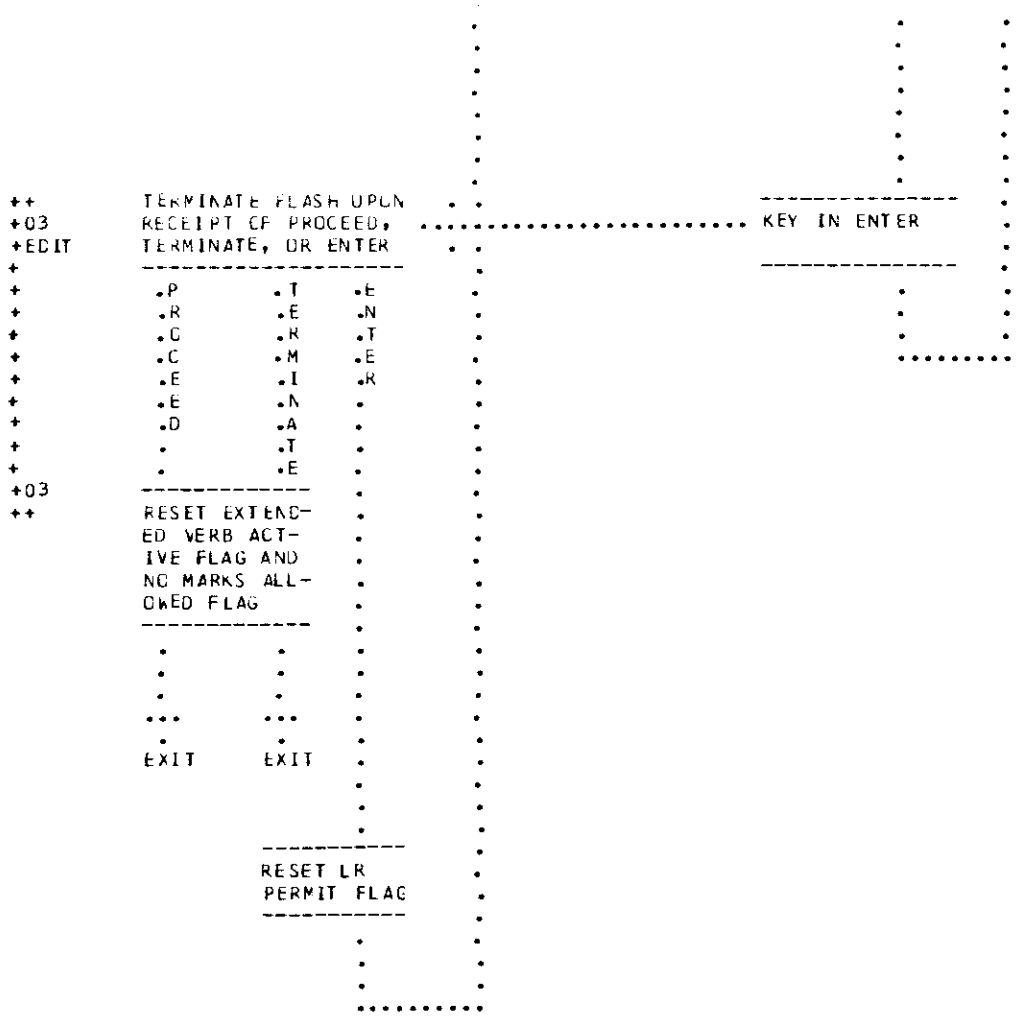

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#160

#170

CHANGE CONTROL NOTES

LOGIC REV 00 PCR 118
REV 01 EDITORIAL
REV 02(LUM 1B) PCR 614
REV 03 EDITORIAL

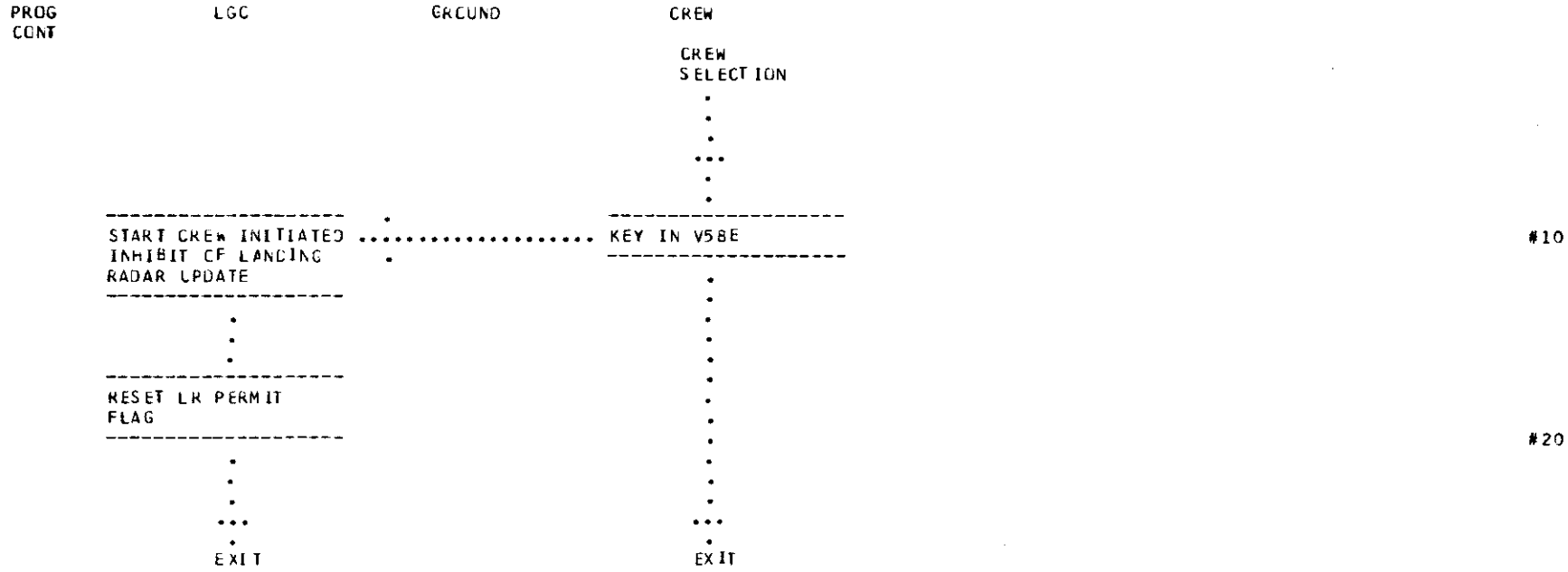
1125

V58, INHIBIT LANDING RADAR UPDATE REV 01 08/09/69

PURPOSE: (1) TO INHIBIT THE INCORPORATION OF LANDING RADAR DATA DURING DESCENT STATE VECTOR UPDATE.

ASSUMPTIONS: (1) THE PROCESS IS CREW SELECTED BY DSKY ENTRY.

(2) THE PROCESS IS ONLY EFFECTIVE IN R12, DESCENT STATE VECTOR UPDATE ROUTINE.



1126

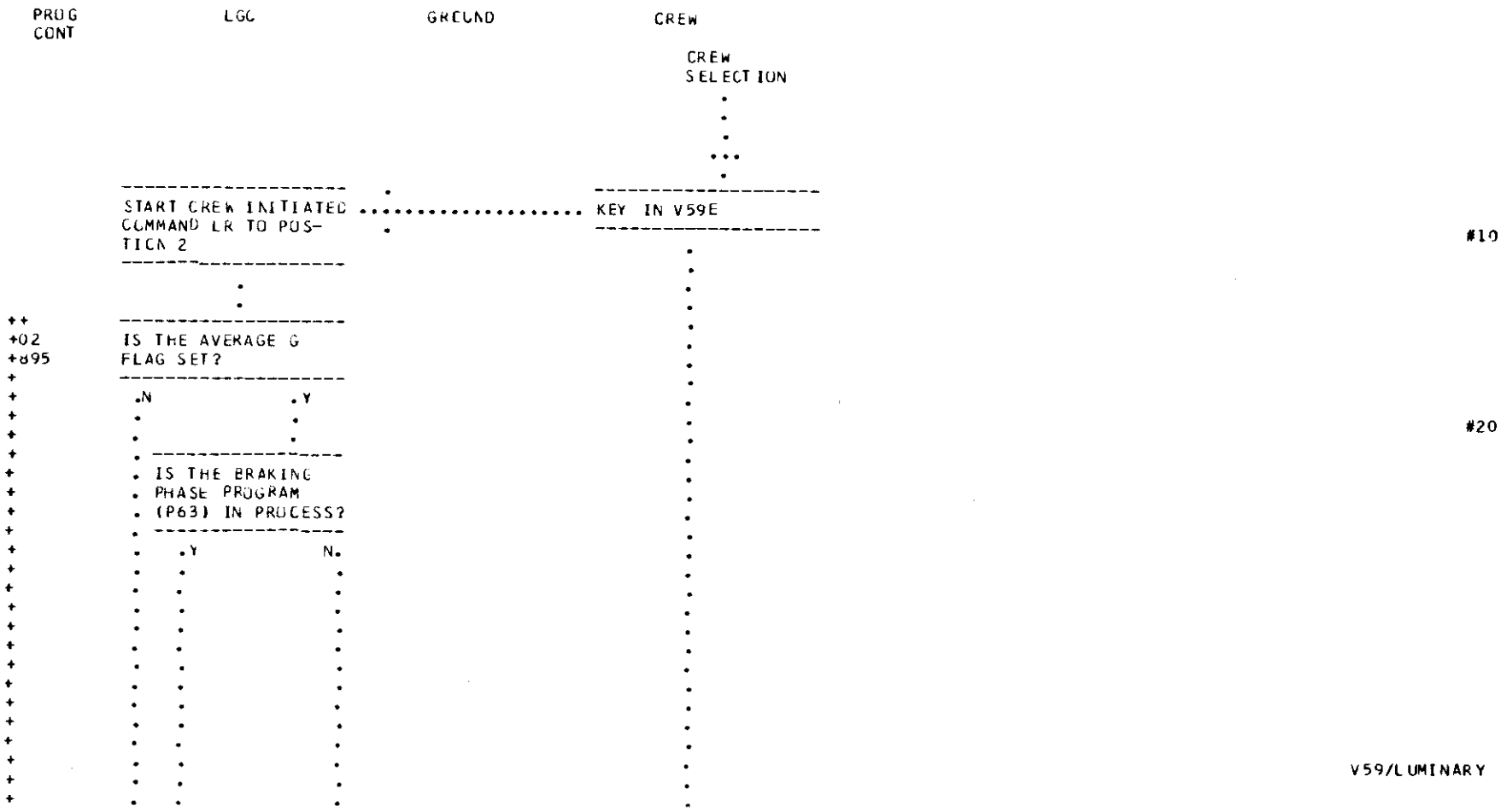
CHANGE CONTROL NOTES

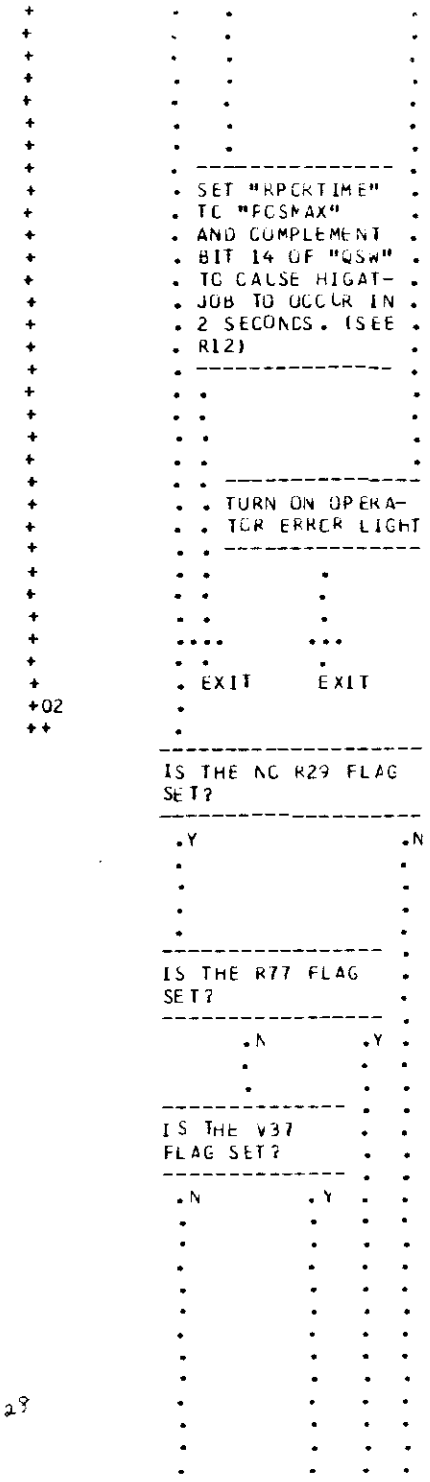
LOGIC REV CO PCR 118

V59, COMMAND LR TO POSITION 2 REV 02 12/03/69

PURPOSE: (1) TO DRIVE THE LANDING RADAR TO POSITION 2 (FINAL APPROACH).
++
+02 (2) TO CAUSE HIGATJOB (HI-GATE) TO OCCUR WITHIN 2 SECONDS IF THE LR IS STUCK IN POSITION #2 DURING P63 POWERED
+895 FLIGHT.
+
ASSUMPTIONS: (1) THE PROCESS MAY BE SELECTED ANY TIME ANOTHER PROGRAM IS NOT USING EITHER LR OR RR; WITH AVERAGE G ON, HOWEVER,
+02 IT IS SELECTABLE IN P63 ONLY.
++

(2) THE PROCESS IS CREW SELECTED BY DSKY ENTRY.





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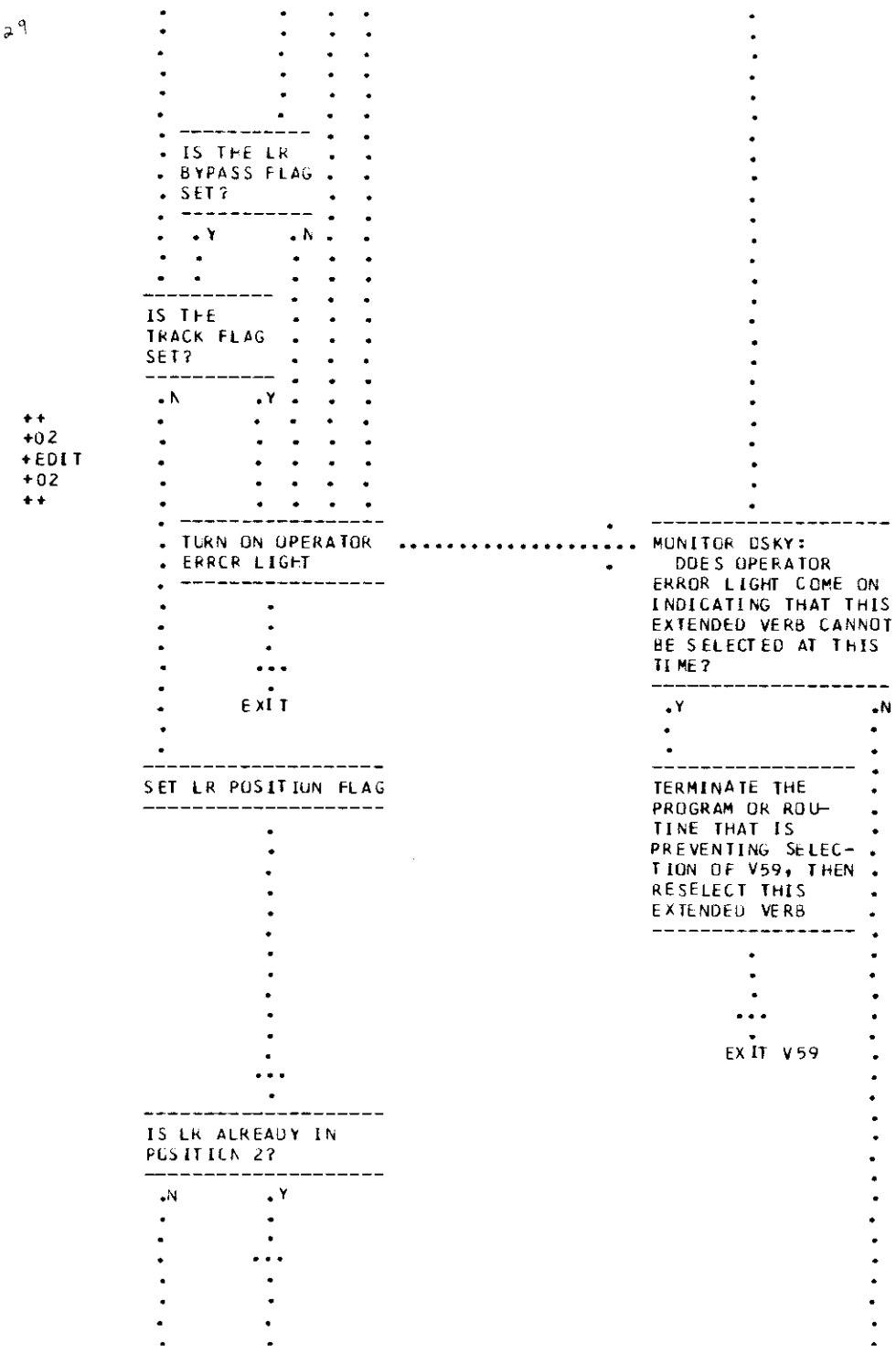
R29

1129



++
+02
+EDIT
+02
++

#80

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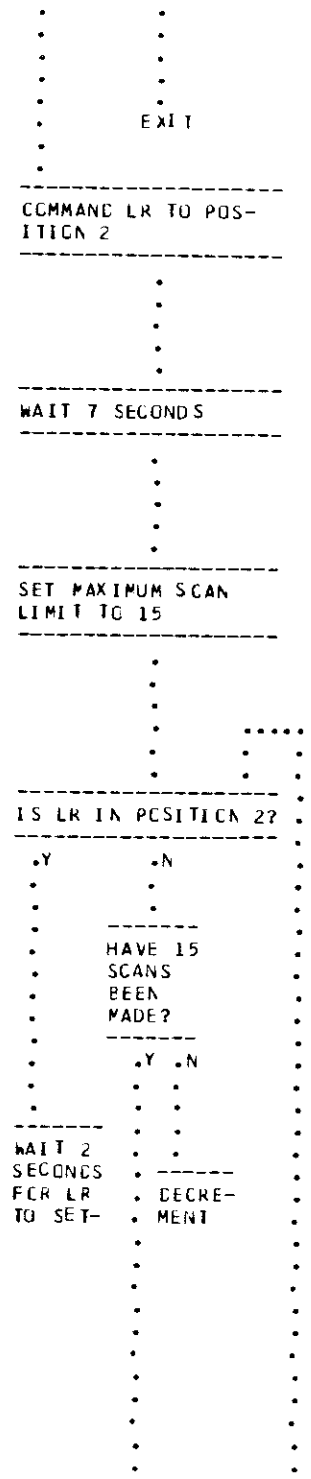
#110

#120

#130



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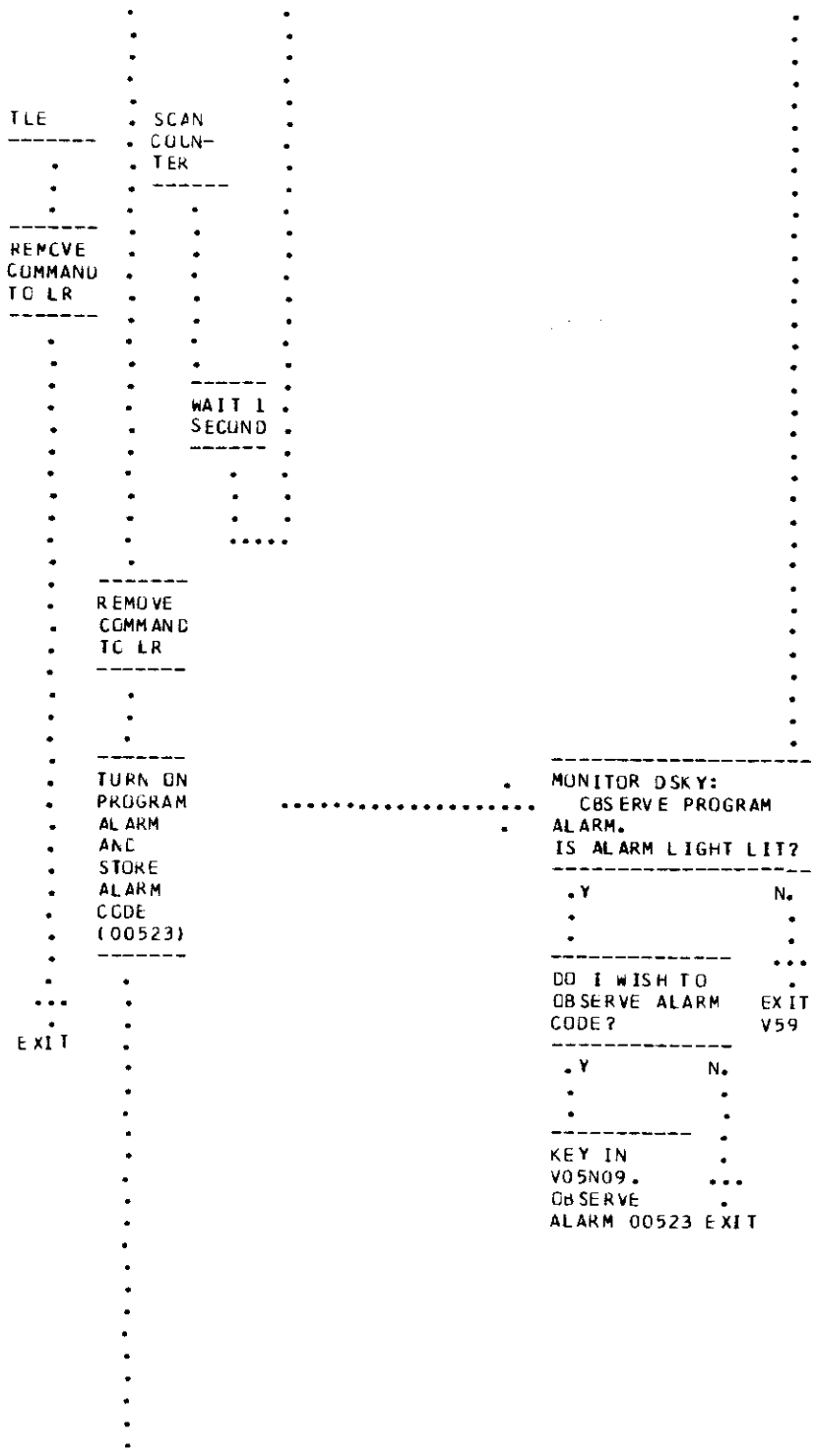
#180

1130



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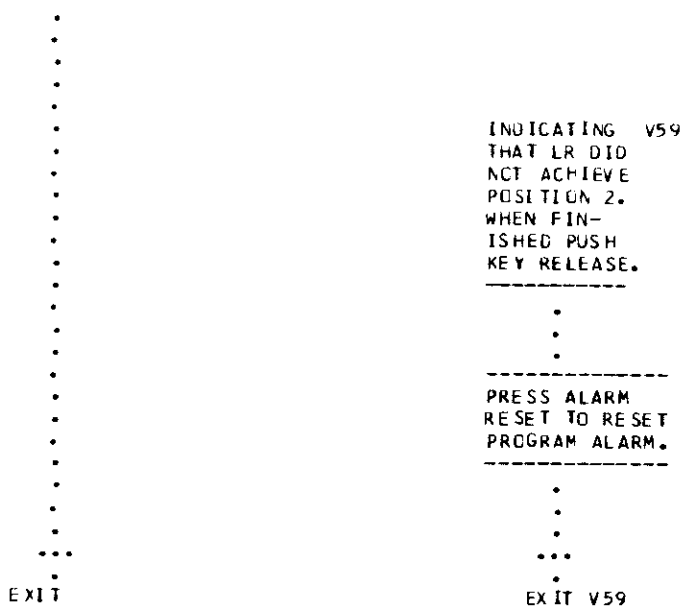
#210

#220

#230



#240

#250

#260

CHANGE CONTROL NOTES

```
LOGIC REV 00  PCR 420
LOGIC REV 01   EDITORIAL
LOGIC REV 00(LUM 1B)   PCR 841,EDITORIAL
      REV 02(LUM 1C)   PCR 895,EDITORIAL
```

1132

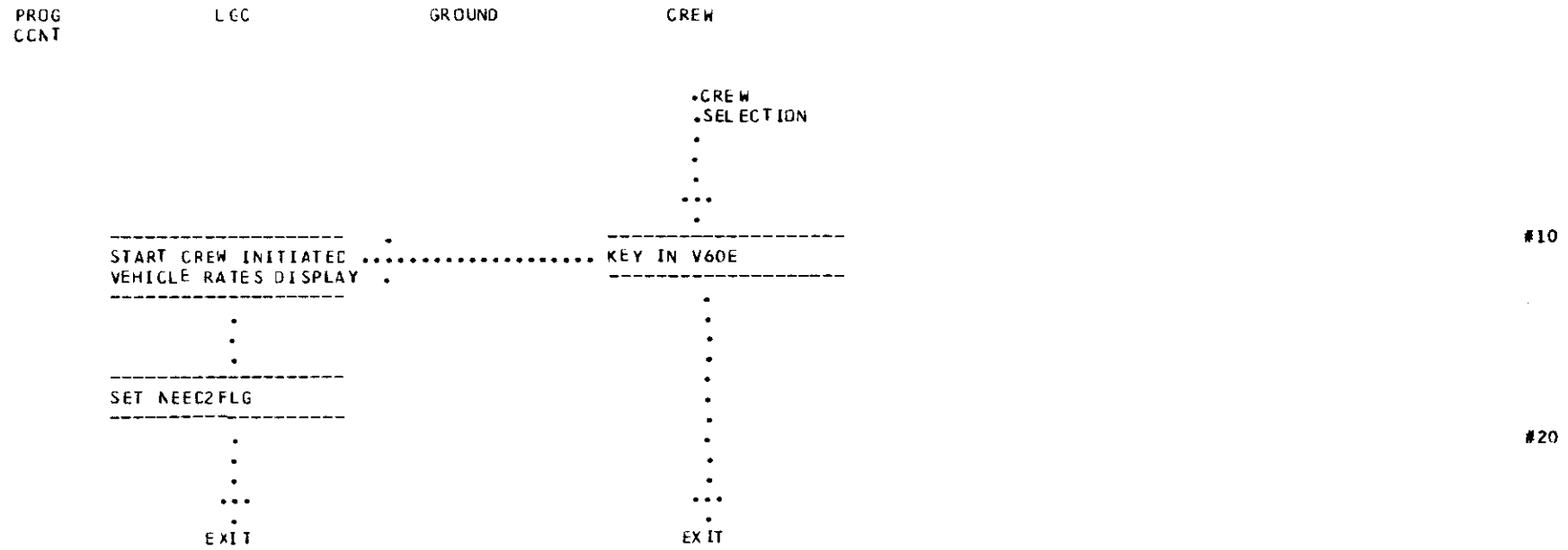
1133

V60, DISPLAY VEHICLE RATES REV 01 08/04/69

PURPOSE: (1) TO DISPLAY ON THE FDAI ERROR NEEDLES THE PGNCS DERIVED VEHICLE ATTITUDE RATES.

ASSUMPTIONS: (1) THE PROCESS IS CREW SELECTED BY DSKY ENTRY.

(2) THIS PROCESS MAY BE SELECTED AT ANY TIME. IT SHOULD BE NOTED, HOWEVER, THAT VEHICLE RATES ARE AVAILABLE ONLY WHEN THE DAP IS TURNED ON, I. E., GUID CONT IN PGNS AND PGNS MODE CONT NOT OFF.



CHANGE CONTROL NOTES

REV 01 PCR 841(ORIGINATED)

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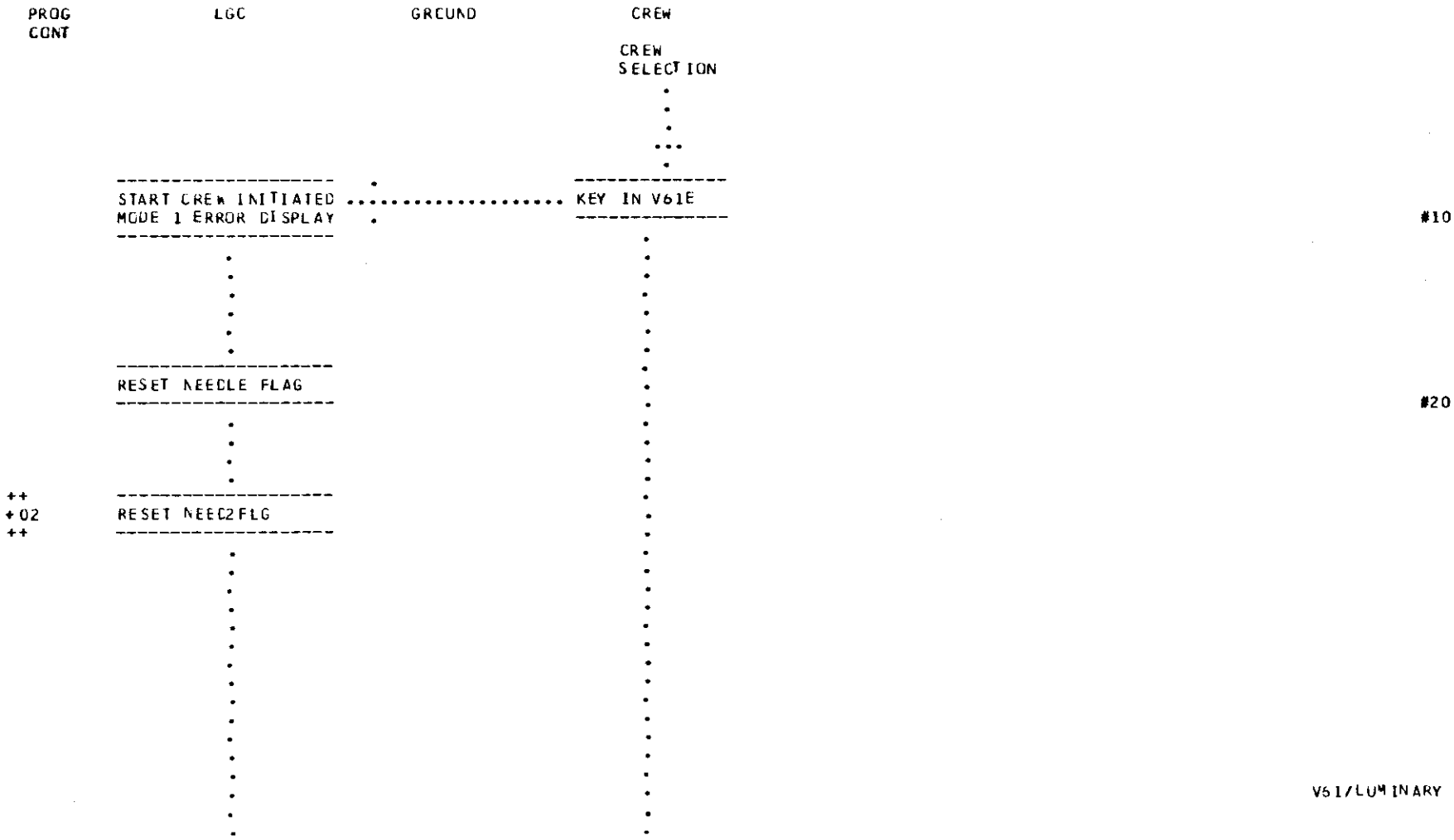
1135

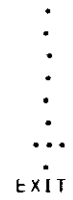
V61, DISPLAY DAP ATTITUDE ERROR REV 02 08/05/69

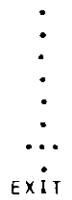
PURPOSE: (1) TO DISPLAY ON THE FDAI ERROR NEEDLES THE DIFFERENCE BETWEEN THE CURRENT CDU ANGLES AND THE DAP COMMANDED ANGLES.

ASSUMPTIONS: (1) THE PROCESS IS CREW SELECTED BY DSKY ENTRY.

(2) THIS PROCESS MAY BE SELECTED AT ANY TIME.







CHANGE CONTROL NOTES

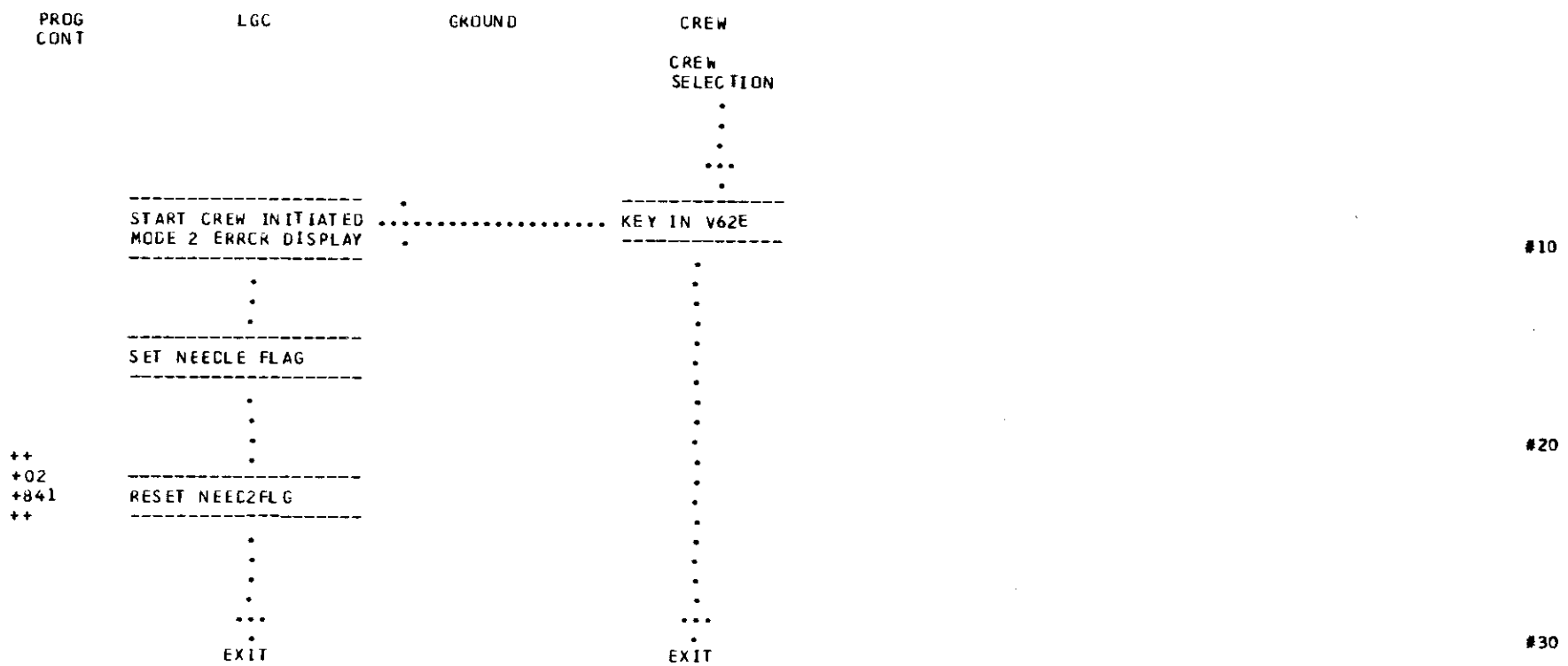
REV 00 PCR 420
REV 01 EDITORIAL
REV 02(LUM 1B) PCR 841

V62, DISPLAY TOTAL ATTITUDE ERROR REV 02 08/05/69

PURPOSE: (1) TO DISPLAY THE TOTAL ATTITUDE ERROR (N22(DESIRED ICDU ANGLES) MINUS N20(PRESENT ICDU ANGLES)) ON THE FDAI ERROR NEEDLES.

ASSUMPTIONS: (1) THE PROCESS IS CREW SELECTED BY DSKY ENTRY.

(2) THIS PROCESS MAY BE SELECTED AT ANY TIME.



CHANGE CONTROL NOTES

LOGIC REV 00 PCR 164, 420
REV 01 EDITORIAL
REV 02 (LUM 1B) PCR 841

1138

1139

V63, START RR/LR SELF TEST ROUTINE, R04 REV 01 08/09/69

NOTE: THIS EXTENDED VERB IS USED TO CALL ROUTINE 04. SEE R04 FOR THE LOGIC SPECIFICATION FLOW FOR THE RR/LR SELF TEST.

CHANGE CONTROL NOTES

LOGIC REV 00 PCR 420

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1141

V64, START S-BAND ANTENNA ROUTINE, R05 REV 01 08/09/69

NOTE: THIS EXTENDED VERB IS USED TO CALL ROUTINE 05. SEE R05 FOR THE LOGIC SPECIFICATION FLOW FOR THE S-BAND ANTENNA CALCULATIONS.

CHANGE CONTROL NOTES

LOGIC REV CC PCR 496

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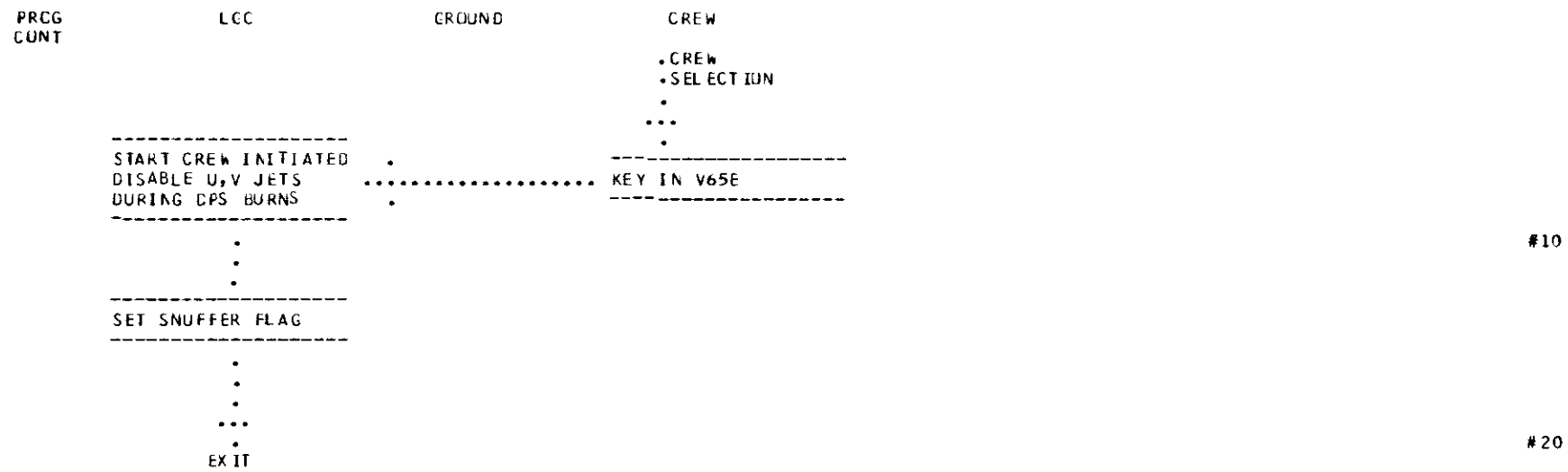
1143

V65, DISABLE U,V JETS DURING DPS BURNS REV 01 08/09/69

PURPOSE: (1) TO INHIBIT U AND V RCS JET FIRINGS DURING DPS POWERED FLIGHT.

ASSUMPTIONS: (1) THE PROCESS IS CREW SELECTED BY DSKY ENTRY.

(2) THE PROCESS MAY BE SELECTED AT ANY TIME.



CHANGE CONTROL NOTES

LOGIC REV C1 PCR 539

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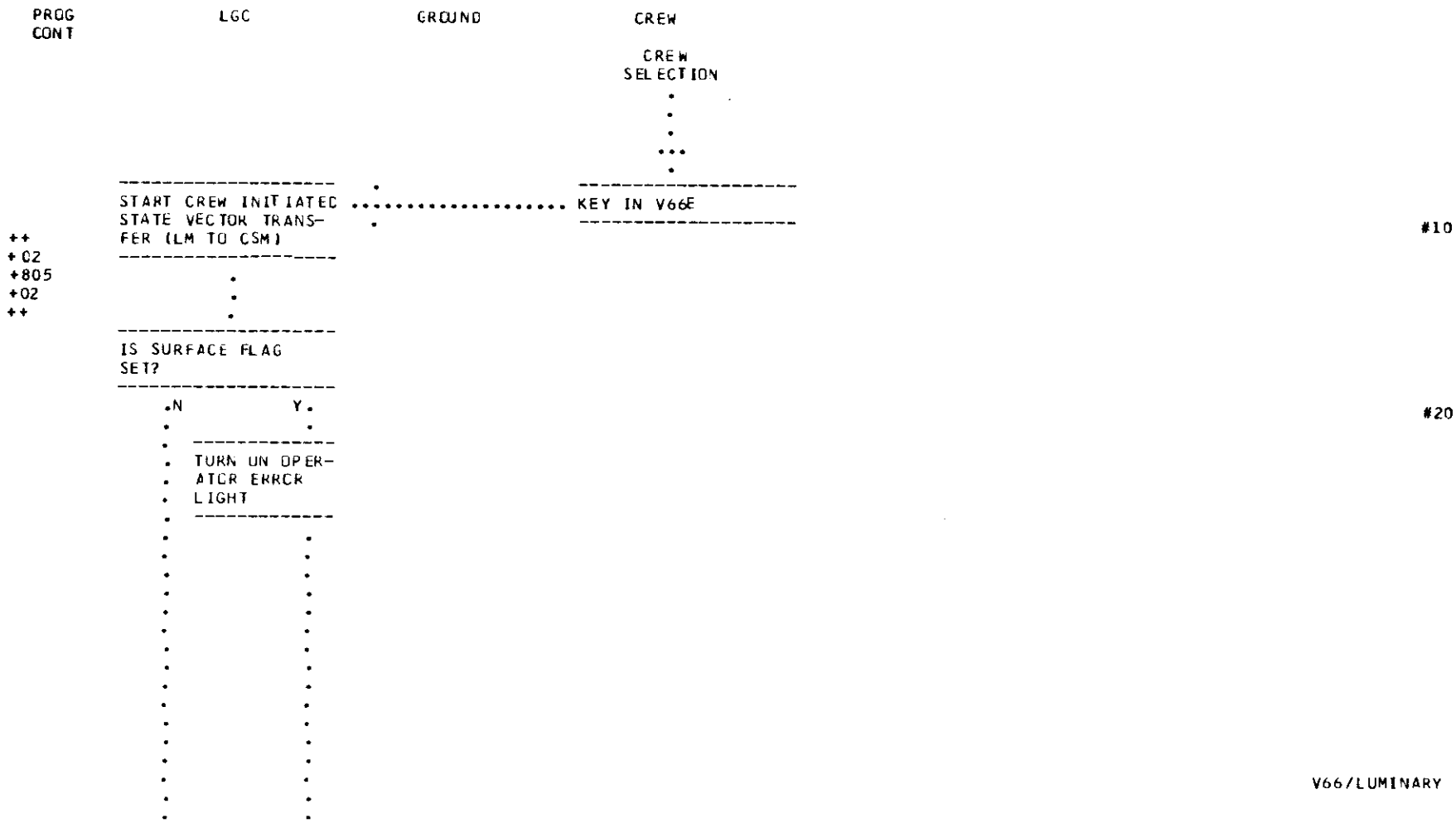
1145

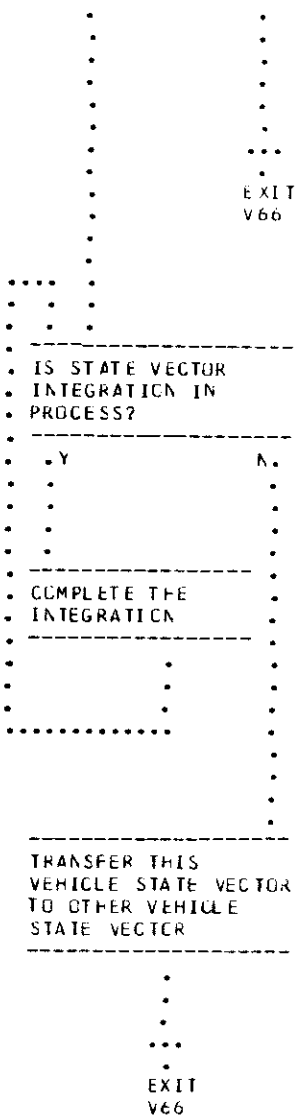
V66, VEHICLES ATTACHED, MOVE THIS VEHICLE STATE VECTOR TO OTHER VEHICLE STATE VECTOR

REV 02 08/07/69

PURPOSE: (1) TO TRANSFER THE LM STATE VECTOR INFORMATION TO THE CSM STATE VECTOR.

ASSUMPTIONS: (1) THE PROCESS IS CREW SELECTED BY DSKY ENTRY.
++
+02 (2) THE TRANSFER OF THE STATE VECTOR INFORMATION MAY BE ACCOMPLISHED AT ANY TIME EXCEPT WHEN AVERAGE G IS IN PROCESS
*EDIT OR WHEN THE SURFACE FLAG IS SET.
++




EXIT
V66
IS STATE VECTOR INTEGRATION IN PROCESS?
Y
N
COMPLETE THE INTEGRATION
TRANSFER THIS VEHICLE STATE VECTOR TO OTHER VEHICLE STATE VECTOR
EXIT
V66

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1147

CHANGE CONTROL NOTES

LOGIC REV C0 PCR 496
      REV C1 EDITORIAL
      REV 02(LUM 18) PCR 805,EDITORIAL

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1149

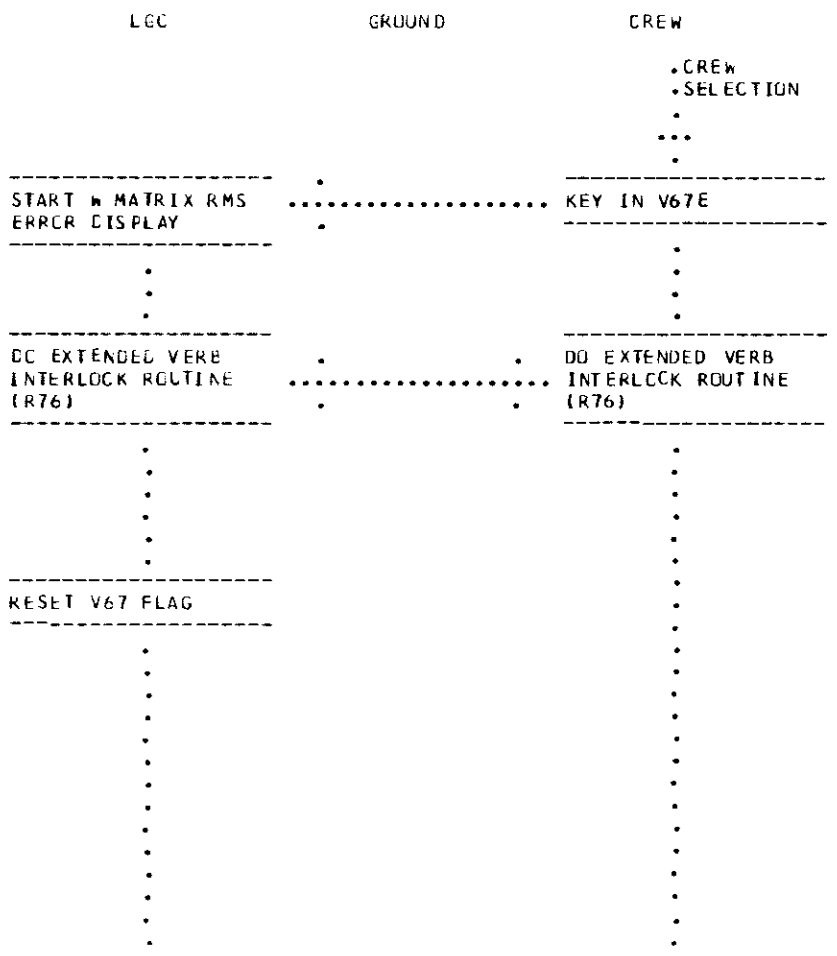
V67, W MATRIX RMS ERROR DISPLAY REV 02 12/03/69

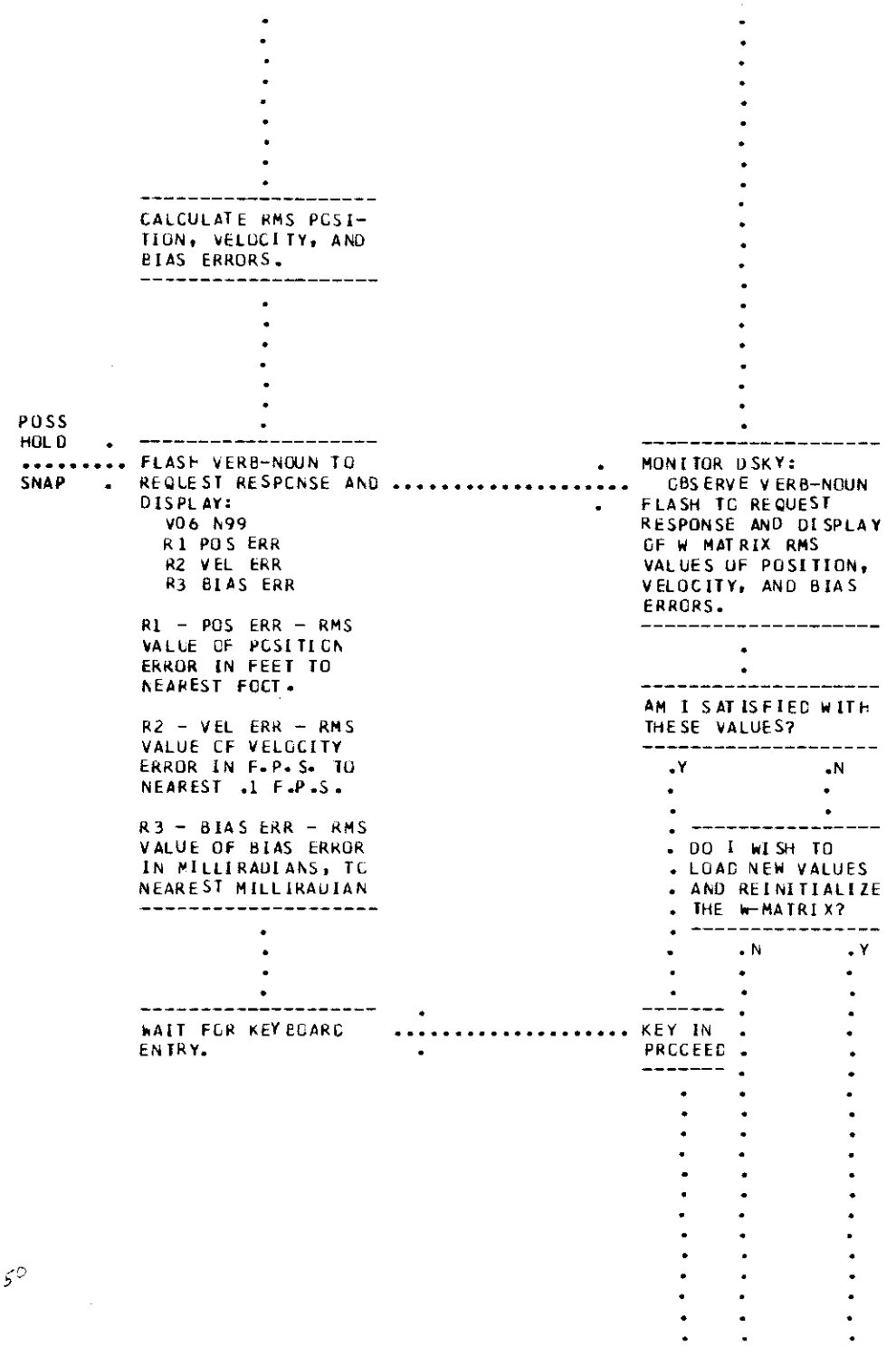
PURPOSE: (1) TO PROVIDE A MEANS OF DISPLAYING W MATRIX INFORMATION AND REINITIALIZING THE W MATRIX IF DESIRED.

ASSUMPTIONS: (1) NO OTHER EXTENDED VERB WHICH SETS THE EXTENDED VERB INTERLOCK IS ACTIVE.

(2) THIS PROCESS IS CREW SELECTED BY DSKY ENTRY.

(3) IF NEW VALUES OF RMS POSITION, VELOCITY, AND BIAS ERRORS ARE LOADED IN THIS ROUTINE, W MATRIX INITIALIZATION OCCURS THE NEXT TIME A NAVIGATION MEASUREMENT IS MADE.





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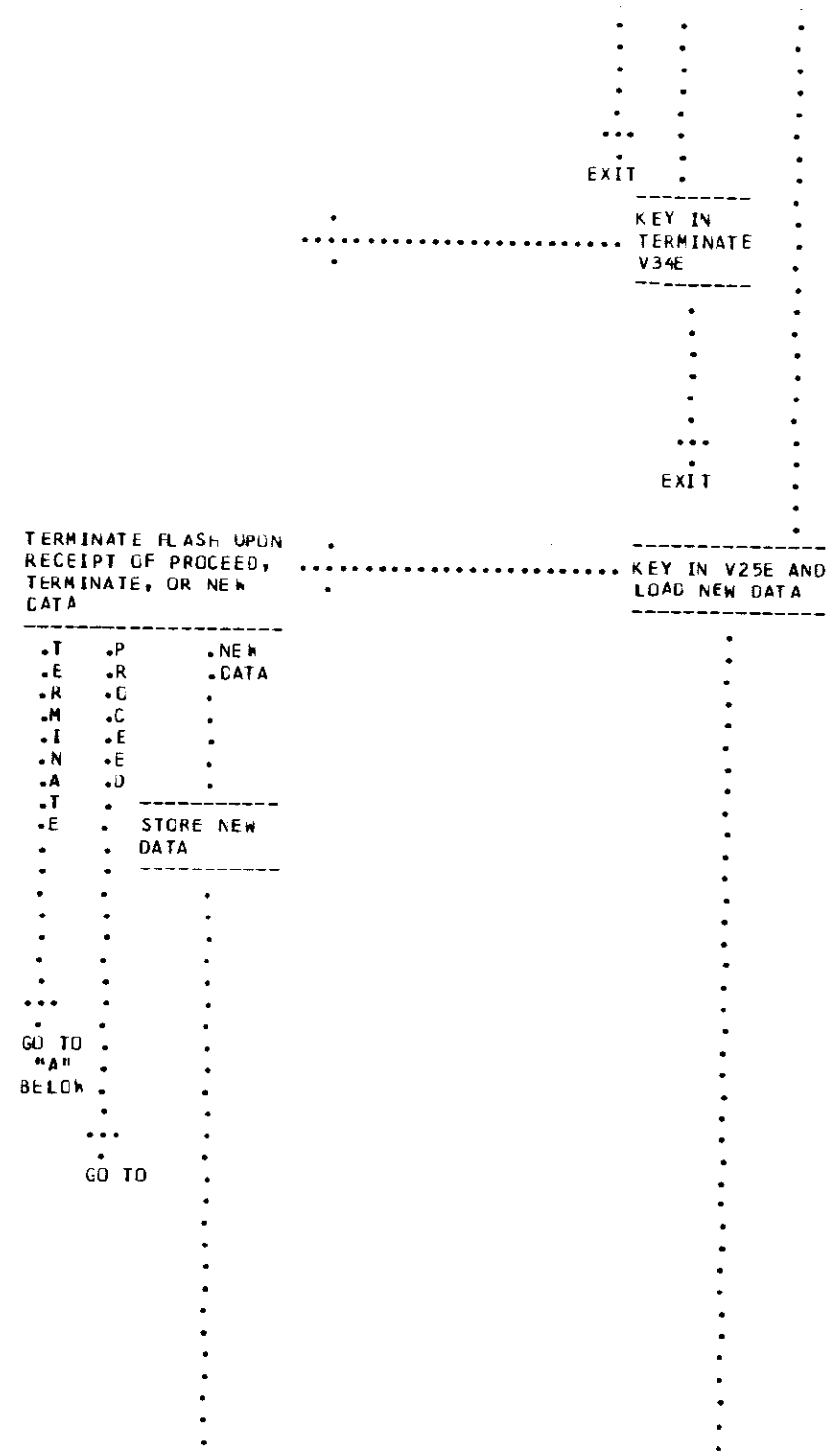

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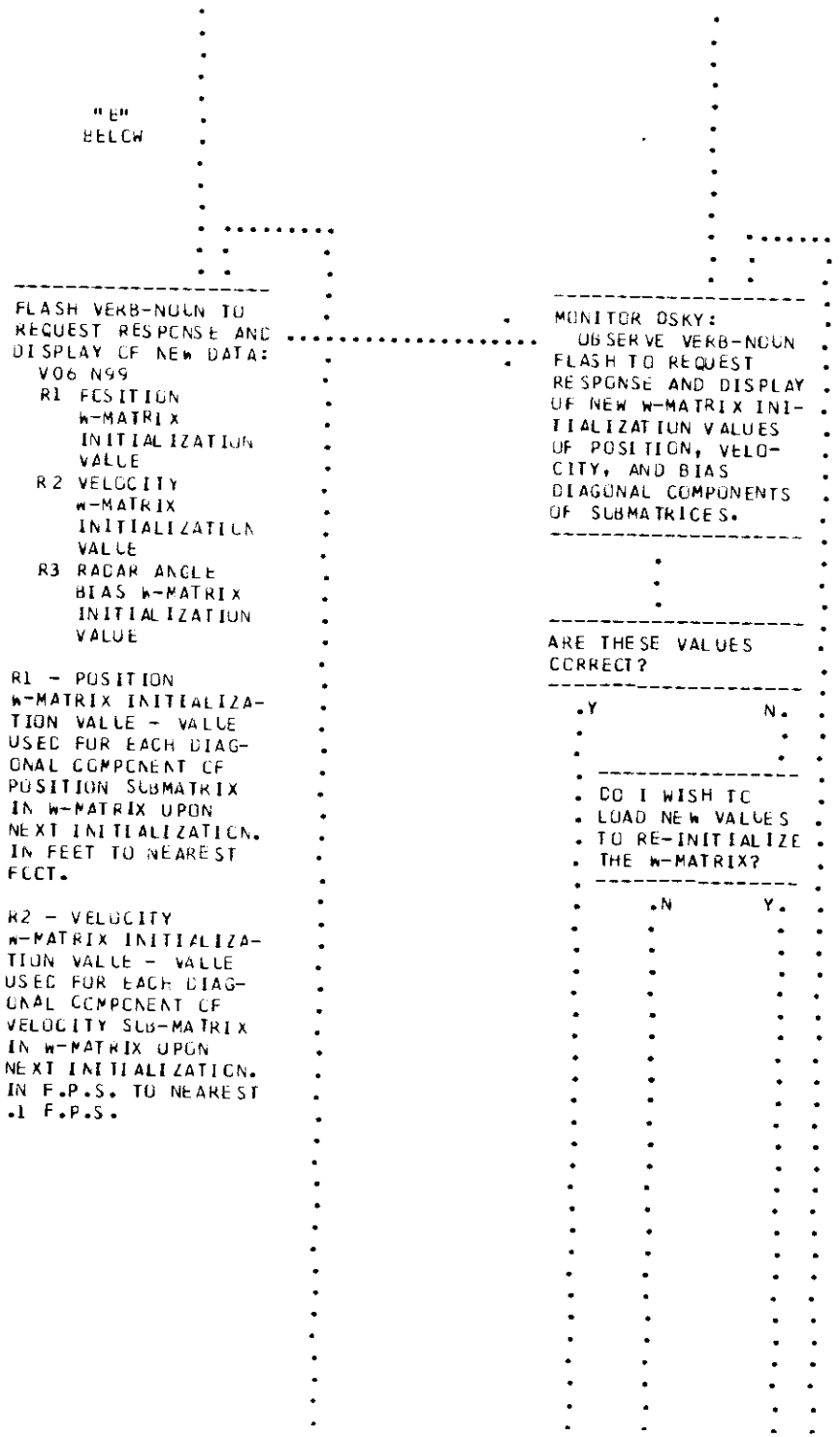

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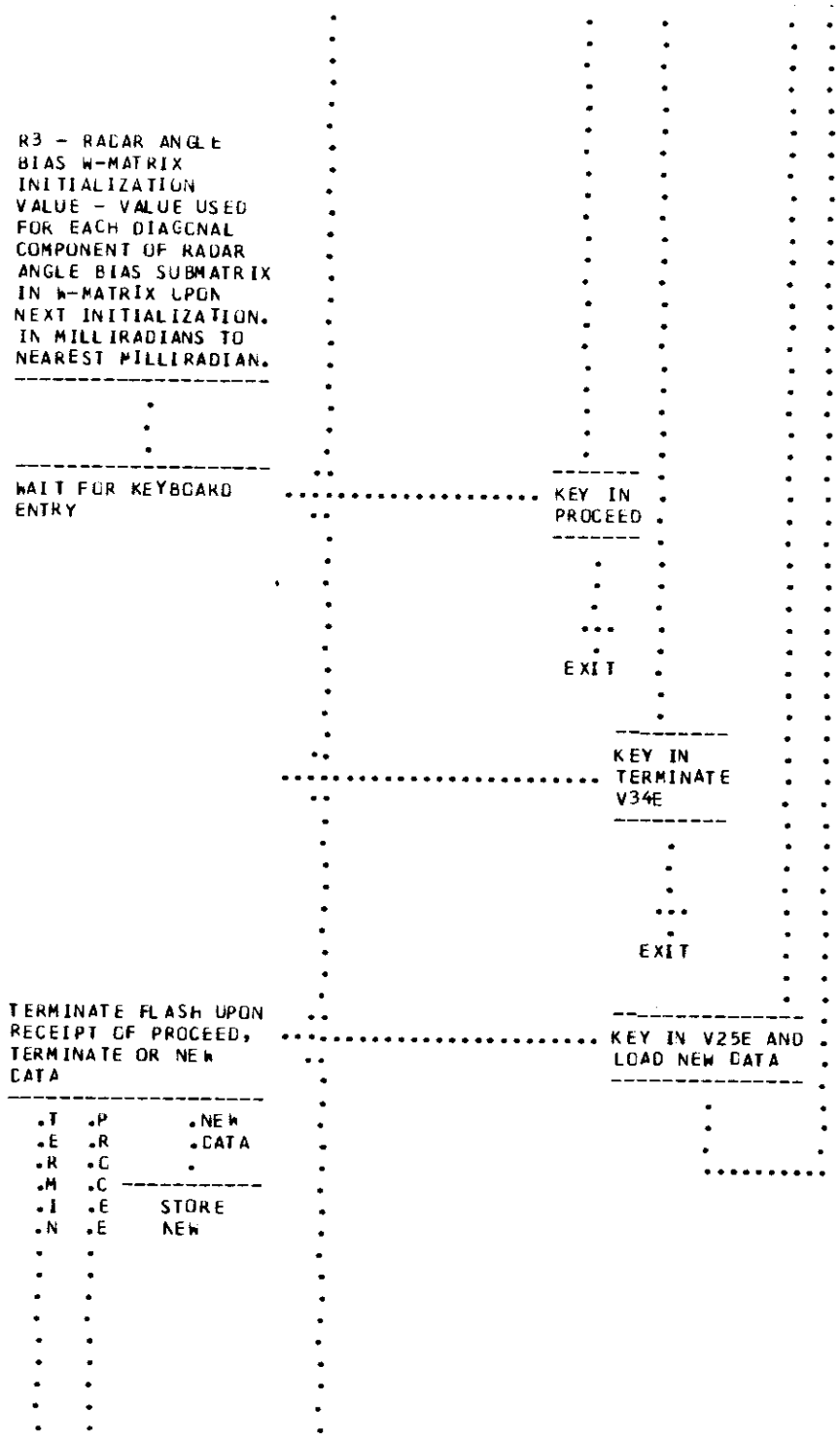

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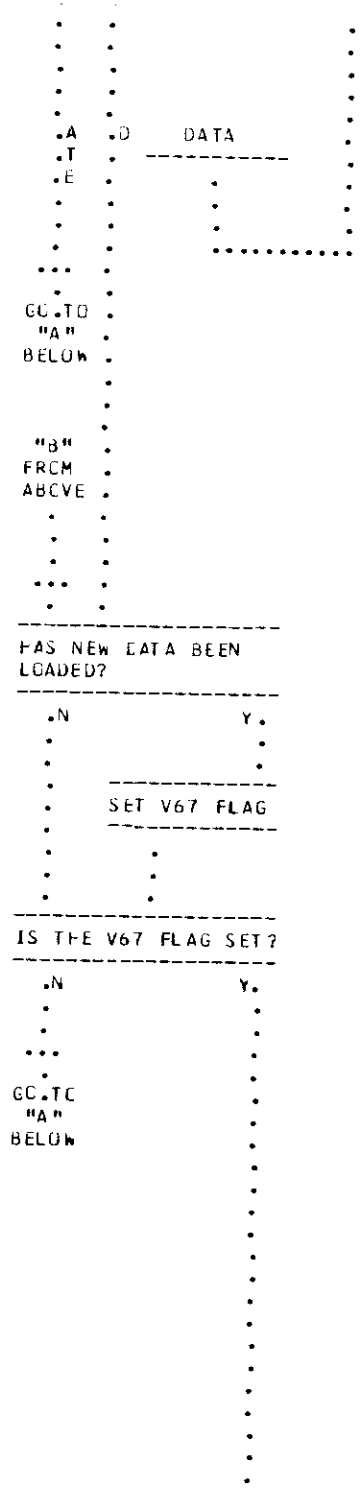
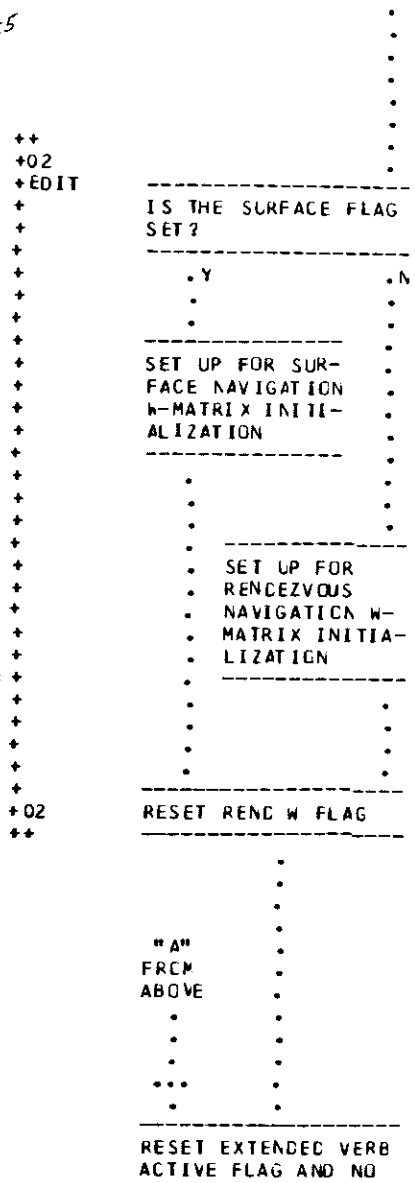


1154



#280

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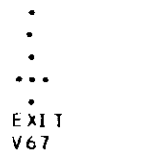
#320

MARKS ALLOWED FLAG



EXIT
V67

#330

CHANGE CONTROL NOTES

REV CC PCR 173,420
REV 01 EDITORIAL
REV 00(LUM 1A) PCR 732
REV C1(LUM 1B) EDITORIAL
REV 02 EDITORIAL

1156

1159

V69, RESTART

REV 03 12/03/69

PURPOSE: (1) TO CAUSE A COMPUTER RESTART.

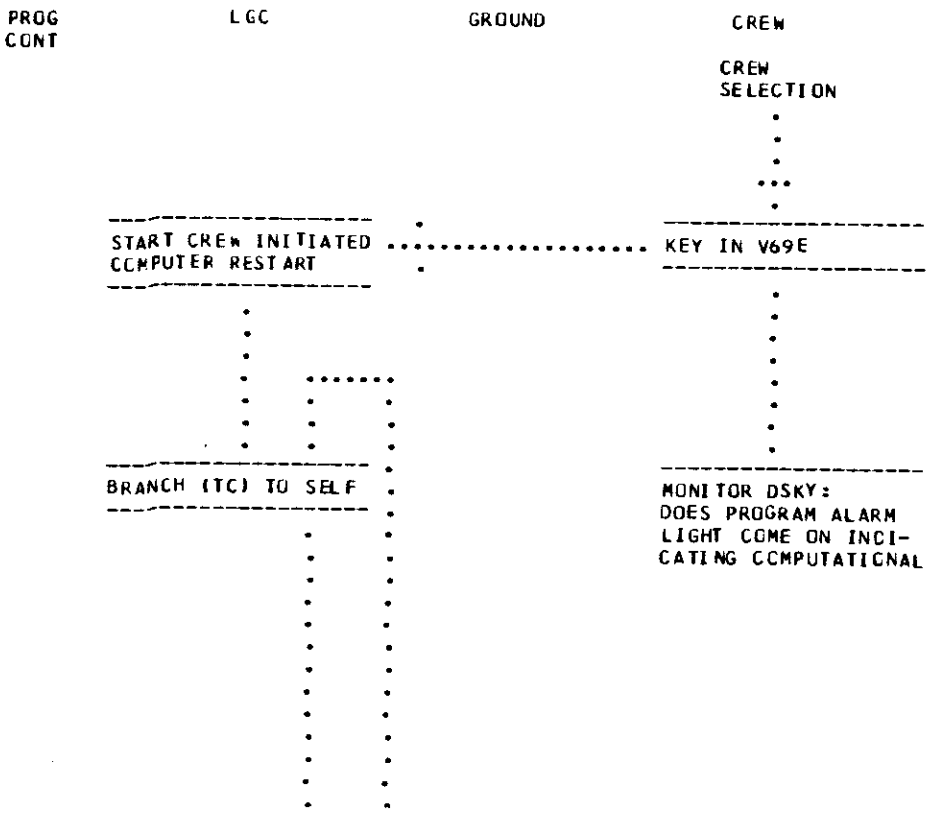
ASSUMPTIONS: (1) THE RESTART IS CREW INITIATED BY DSKY ENTRY.

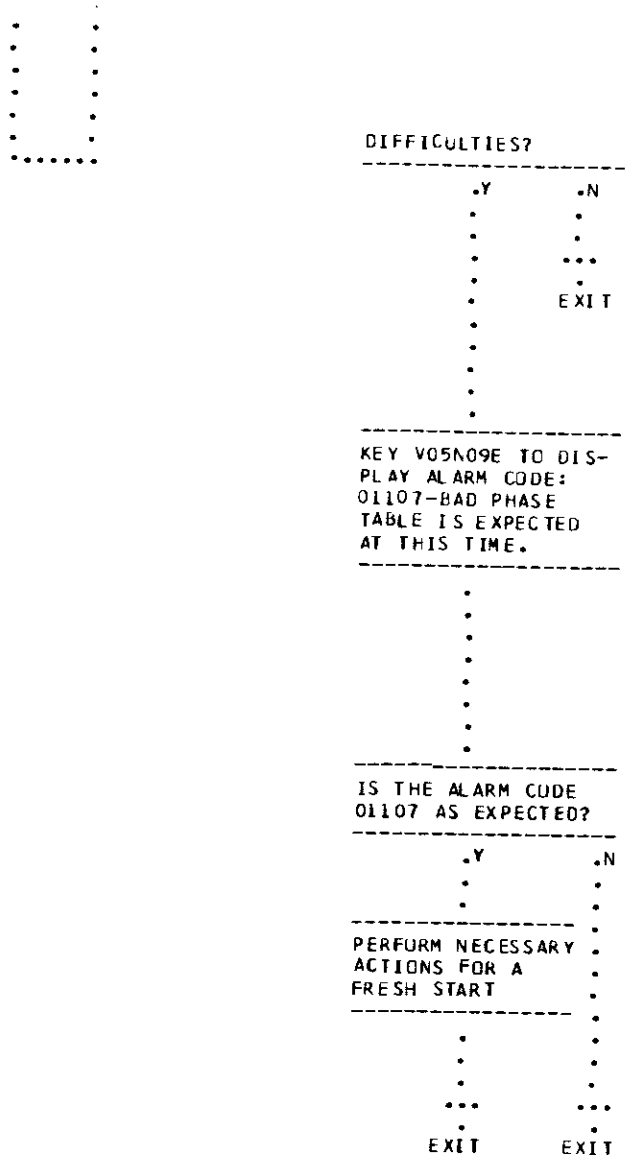
(2) V69E DOES NOT DIRECTLY SELECT RESTART PROCESSING. IT CAUSES A SITUATION WHICH SATISFIES ONE OF THE CONDITIONS FOR AN AUTOMATIC RESTART, I.E.: TOO MANY CONSECUTIVE TC INSTRUCTIONS.

(3) LGC RESTART LOGIC WILL CLEAR ALL JOB CORE SETS AND VAC AREAS, AND SET THE WAITLIST TO CALL ENDTASK.

(4) ALL EXTENDED VERB AND DISPLAY ACTIVITY WILL BE STOPPED. RESTARTABLE TASKS AND JOBS WILL THEN BE RESTARTED BY REFERENCE TO INFORMATION CONTAINED IN THE PHASE TABLE.

(5) A V69E MAY BE SELECTED AT ANY TIME.





#30

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++
+03
+EDIT
++

1158

CHANGE CONTROL NOTES

LOGIC REV 00 PCR 496
      REV 01 EDITORIAL
      REV 02 EDITORIAL
      REV 03 EDITORIAL

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V70, START LGC UPDATE; LIFTOFF TIME REV 01 08/09/69

NOTE: THIS EXTENDED VERB IS USED BY UPDATE PROGRAM P27 ONLY. SEE P27 FOR THE LOGIC SPECIFICATION FLOW FOR UPDATING THE LIFT OFF TIME.

CHANGE CONTROL NOTES

LOGIC REV 00 PCR 496

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1163

V71, START LGC UPDATE; BLOCK ADDRESS REV 01 08/09/69

NOTE: THIS EXTENDED VERB IS USED BY UPDATE PROGRAM P27 ONLY. SEE P27 FOR THE LOGIC SPECIFICATION FLOW FOR A BLOCK ADDRESS UNIVERSAL UPDATE.

CHANGE CONTROL NOTES

LOGIC REV 00A PCR 496

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V72, START LGC UPDATE; SINGLE ADDRESS REV 01 08/09/69

NOTE: THIS EXTENDED VERB IS USED WITH UPDATE PROGRAM P27 ONLY. SEE P27 FOR THE LOGIC SPECIFICATION FLOW FOR A SINGLE ADDRESS UNIVERSAL UPDATE.

CHANGE CONTROL NOTES

LOGIC REV 00 PCR 496

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1166

V73, START LGC UPDATE; LGC TIME (OCTAL)

REV 01 08/09/69

NOTE: THIS EXTENDED VERB IS USED BY THE UPDATE PROGRAM P27 ONLY. SEE P27 FOR THE LOGIC SPECIFICATION FLOW FOR THE OCTAL UPDATE OF LGC TIME.

CHANGE CONTROL NOTES

LOGIC REV 00 PCR 496

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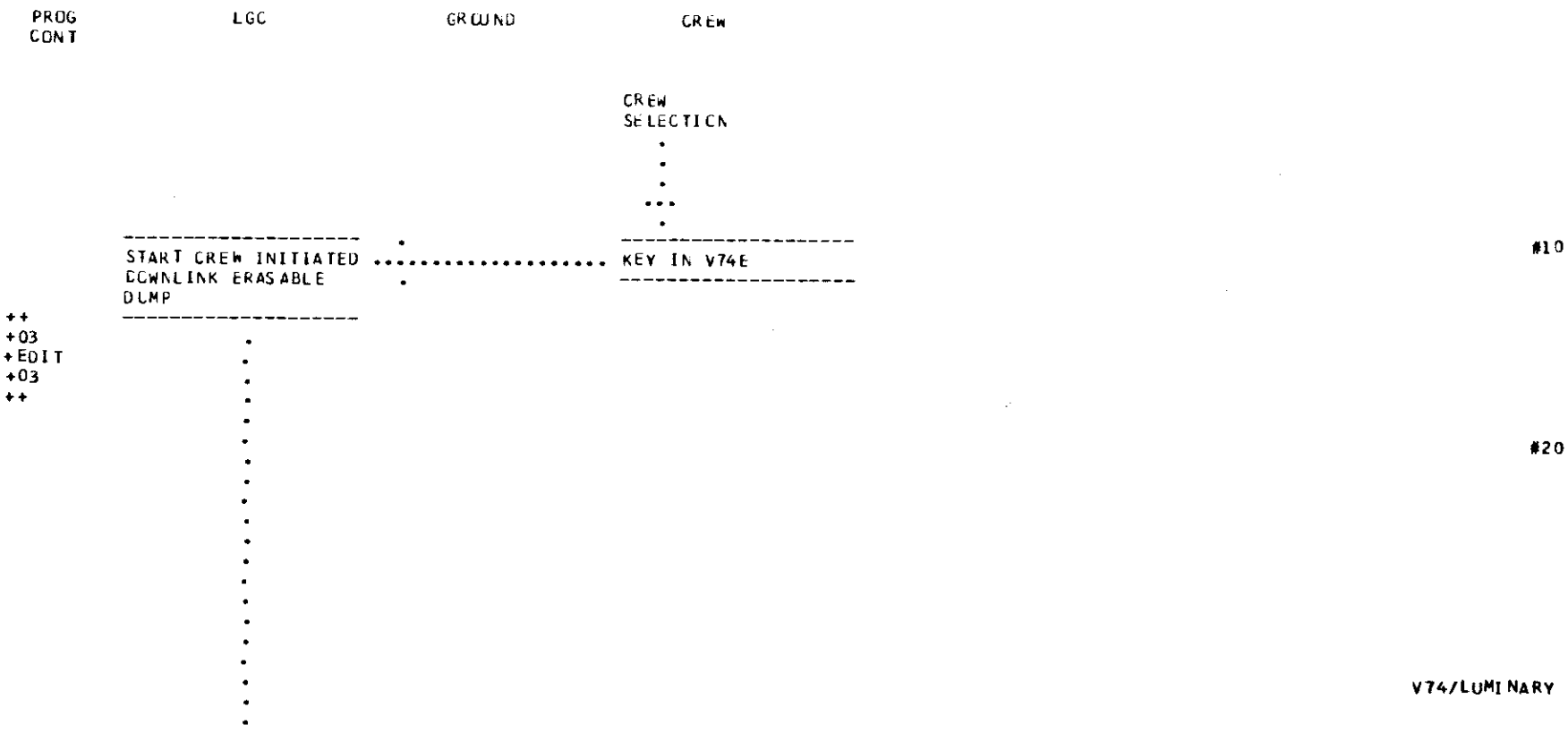
V74, INITIALIZE ERASABLE DUMP VIA DOWNLINK REV 03 12/03/69

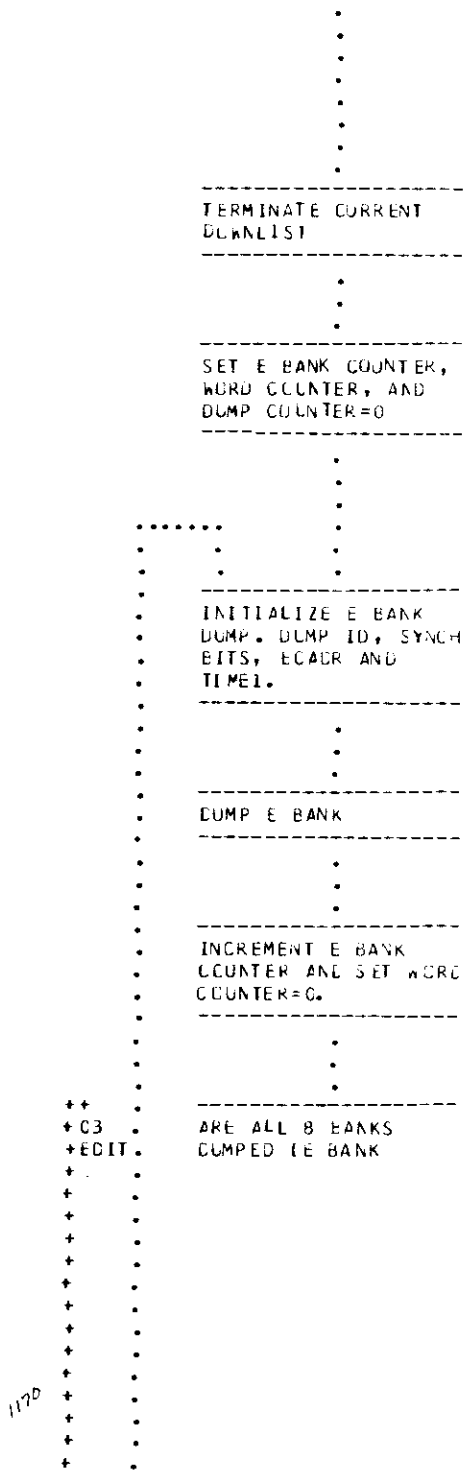
PURPOSE: (1) TO DUMP ALL EIGHT BANKS OF ERASABLE MEMORY VIA DOWNLINK.

ASSUMPTIONS: (1) THE PROCESS IS CREW SELECTED BY DSKY ENTRY.

++ (2) THE DUMP OF EACH BANK IS PRECEDED BY AN ID WORD, SYNCH BITS, ECADR, AND TIME.
+03
+EDIT (3) THE E BANKS ARE DUMPED IN ORDER, STARTING WITH E BANK ZERO.
+
+ (4) DUMPING OF ALL EIGHT BANKS IS REPEATED ONCE (2 COMPLETE DUMPS) TO FACILITATE SUCCESSFUL GROUND RECORDING.
+03
++ (5) THE TIME REQUIRED FOR 4 COMPLETE DUMPS IS 83.2 SECONDS.

(6) THIS PROCESS CAN BE SELECTED CONCURRENTLY WITH ANY OTHER EXTENDED VERB, BUT SHOULD NOT BE SELECTED WITH V47 (R47, AGS INITIALIZATION ROUTINE).




TERMINATE CURRENT DOWNLIST
SET E BANK COUNTER, WORD COUNTER, AND DUMP COUNTER=0
INITIALIZE E BANK DUMP. DUMP ID, SYNCH BITS, ECADR AND TIME1.
DUMP E BANK
INCREMENT E BANK COUNTER AND SET WORD COUNTER=0.
ARE ALL 8 BANKS DUMPED (E BANK
+C3
+EDIT

#30

#40

#50

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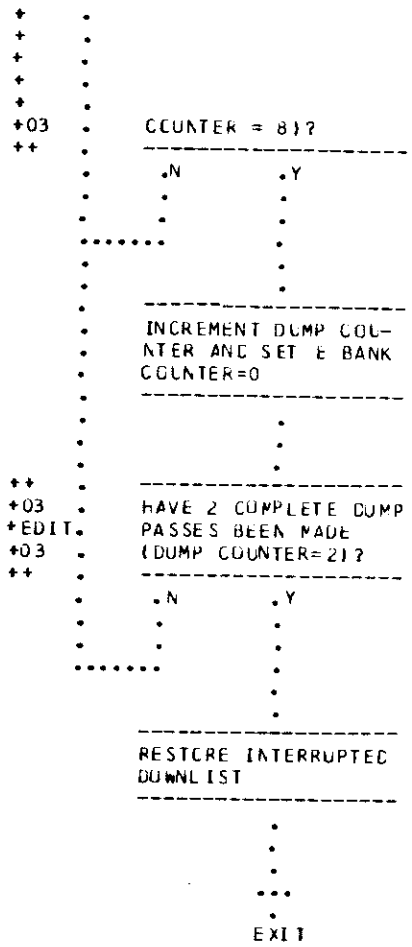

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CHANGE CONTROL NOTES

LOGIC REV 00 PCR 496
LOGIC REV 01 EDITORIAL
      REV 02(LUM 1B) PCR 277,EDITORIAL
      REV 03 EDITORIAL

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1172

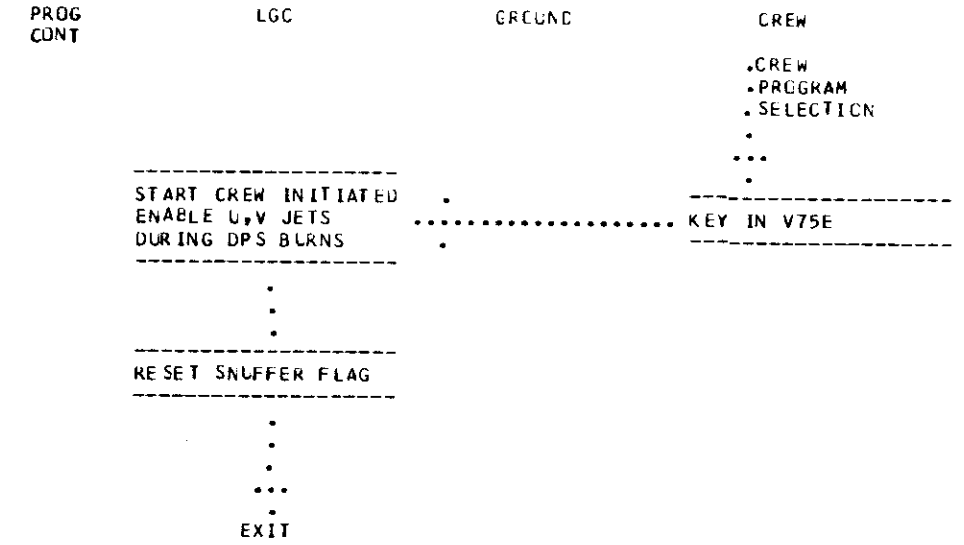
1173

V75, ENABLE U,V JETS DURING DPS BURNS REV 01 08/09/69

PURPOSE: (1) TO ENABLE U AND V RCS JET FIRINGS DURING DPS POWERED FLIGHT.

ASSUMPTIONS: (1) THE PROCESS IS CREW SELECTED BY DSKY ENTRY.

(2) THE PROCESS MAY BE SELECTED AT ANY TIME.



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CHANGE CONTROL NOTES

LOGIC REV 01 PCR 539

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1174

1175

V76, MINIMUM IMPULSE COMMAND MODE REV 03 12/03/69

PURPOSE: (1) TO ENABLE THE MINIMUM IMPULSE MODE OF THE DAP.

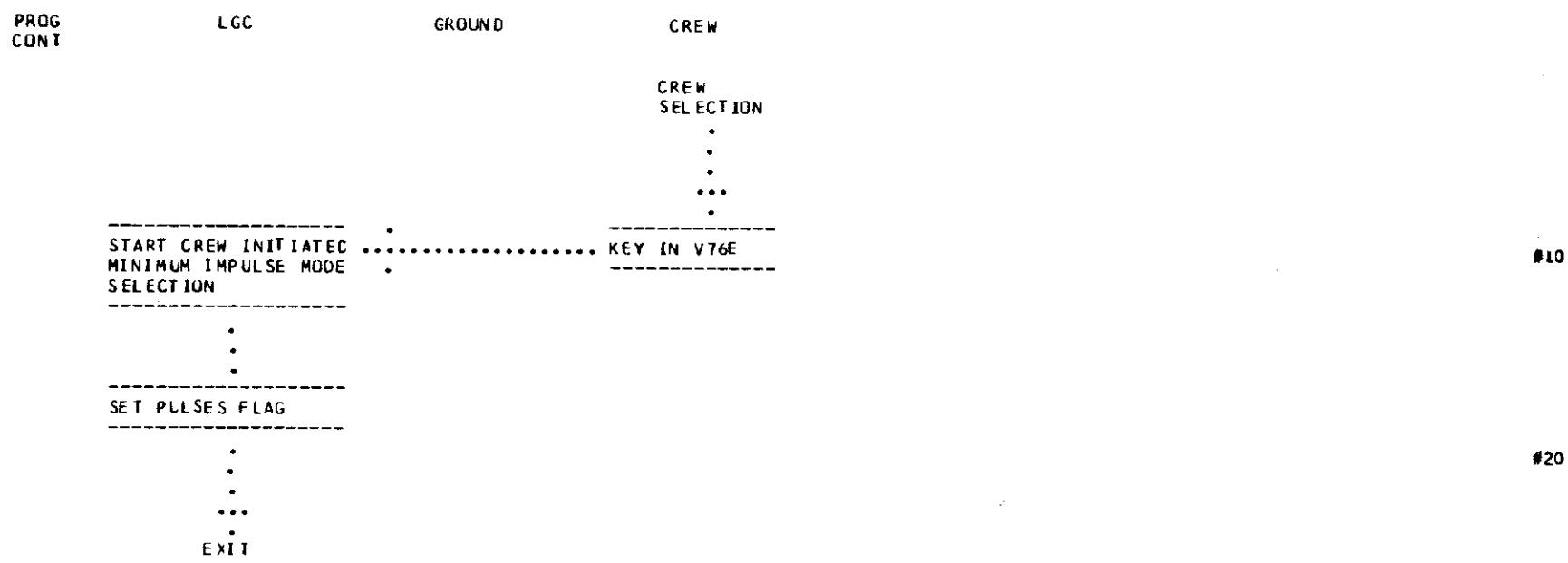
ASSUMPTIONS: (1) THE PROCESS IS CREW SELECTED BY DSKY ENTRY.

(2) TO OBTAIN THE MINIMUM IMPULSE MODE, THE GUID CONT SWITCH MUST BE AT PGNS AND THE MODE CONTROL SWITCH AT ATT HOLD.

++
+03
+EDIT
++

(3) THE MINIMUM IMPULSE MODE WILL REMAIN ENABLED UNTIL CANCELLED BY RATE MODE SELECTION (SEE V77); OR BY FRESH START; OR BY P12,P40,P41,P42,P63,P70 OR P71.

(4) THE PROCESS MAY BE SELECTED AT ANY TIME.



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CHANGE CONTROL NOTES

LOGIC REV 00 PCR 498
LOGIC REV 01 EDITORIAL
LOGIC REV 02 EDITORIAL
REV 03 EDITORIAL

1176

V77, RATE COMMAND AND ATTITUDE HOLD MODE REV 02 12/03/69

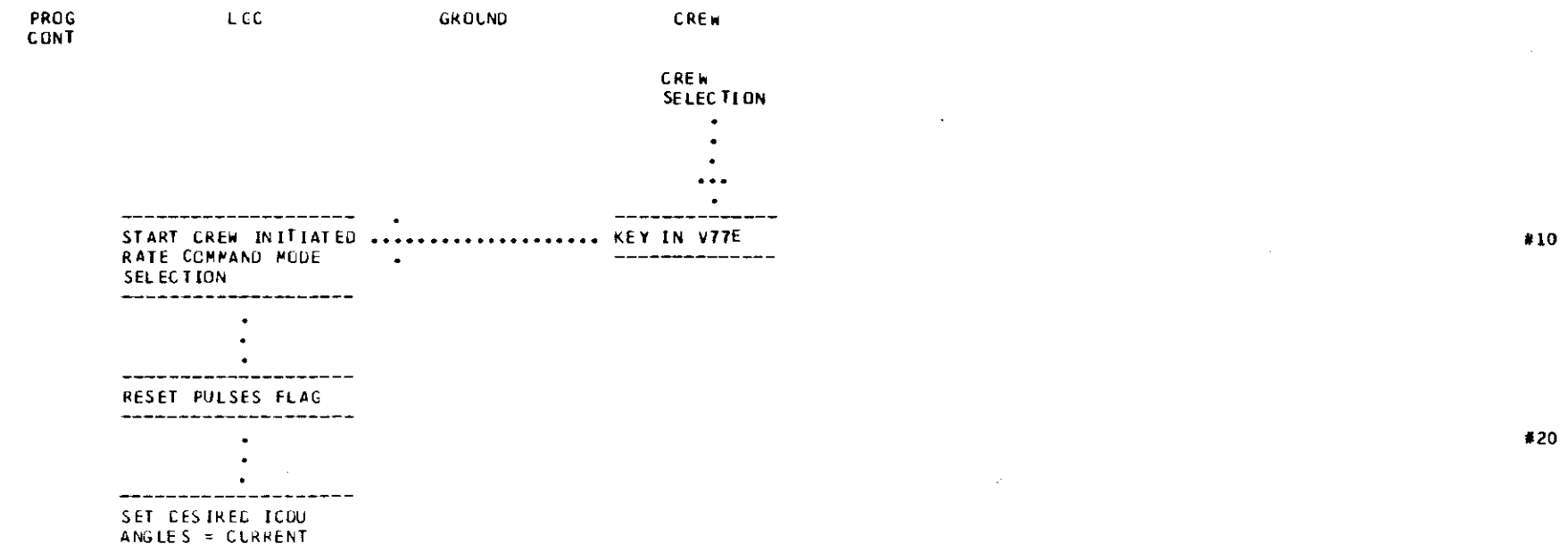
PURPOSE: (1) TO ENABLE THE RATE COMMAND MODE OF THE DAP.

(2) TO SET DESIRED ICDU ANGLES EQUAL TO ACTUAL ICDU ANGLES.

ASSUMPTIONS: (1) THE PROCESS IS CREW SELECTED BY DSKY ENTRY.

(2) TO OBTAIN THE RATE COMMAND MODE, THE GUID CONT SWITCH MUST BE AT PGNS AND THE MODE CONTROL SWITCH AT ATT HOLD.

++
+02 (3) THE RATE COMMAND MODE WILL REMAIN ENABLED UNTIL CANCELLED BY MINIMUM IMPULSE MODE SELECTION (SEE V76), OR BY P68.
+EDIT
++ (4) THE PROCESS MAY BE SELECTED AT ANY TIME.



ICDU ANGLES

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...
.
EXIT

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CHANGE CONTROL NOTES

LOGIC REV CC PCR 496
REV 01 EDITORIAL
REV 02 EDITORIAL

1178

1179

V78, START LR SPURIOUS TEST, R77 REV 01 08/09/69

NOTE: THIS EXTENDED VERB IS USED TO CALL ROUTINE 77. SEE R77 FOR THE LOGIC SPECIFICATION FLOW FOR THE LR SPURIOUS TEST.

CHANGE CONTROL NOTES

LOGIC REV 00 PCR 229

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1180

V79, STOP LR SPURIOUS TEST, R77 REV 01 08/09/69

NOTE: THIS EXTENDED VERB IS USED TO TERMINATE ROUTINE 77. SEE R77 FOR THE LOGIC SPECIFICATION FLOW FOR THE LR SPURIOUS TEST.

CHANGE CONTROL NOTES

LOGIC REV 00 PCR 229

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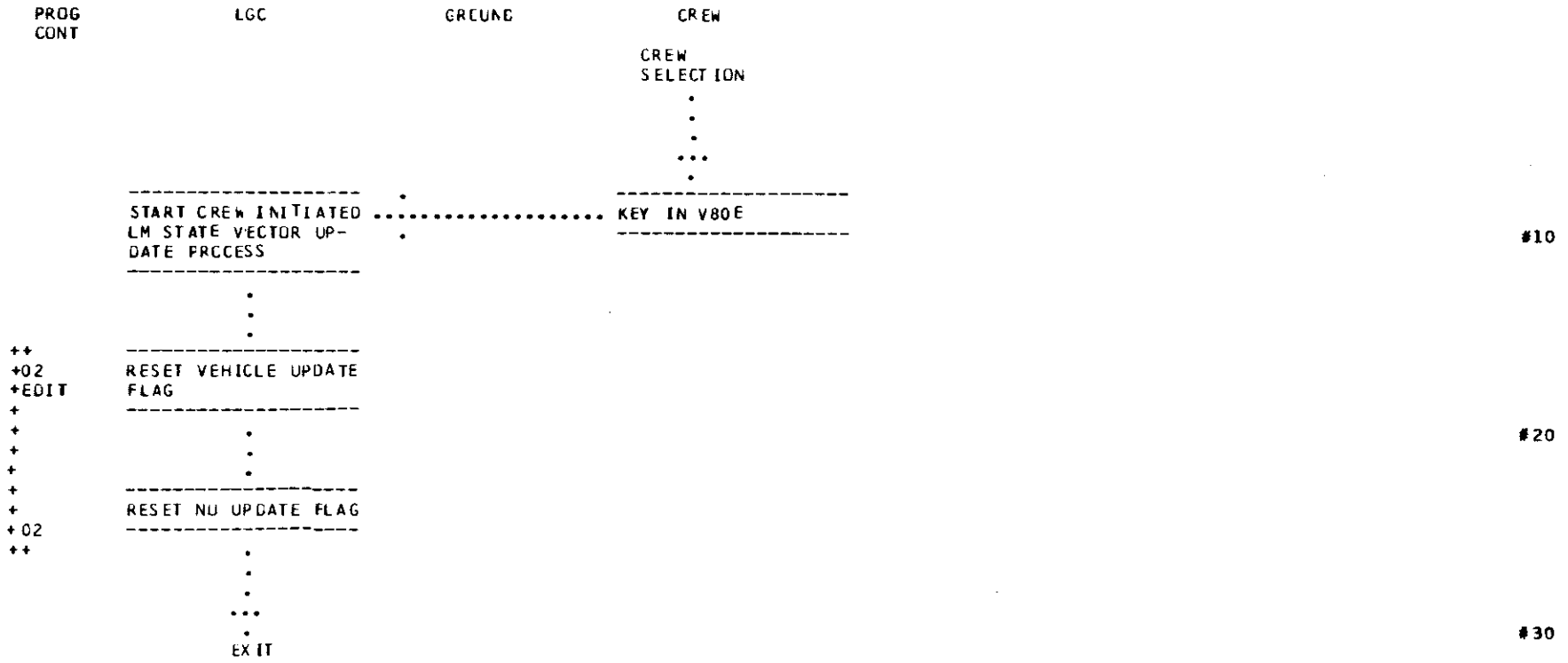
1182

V80, ENABLE LM STATE VECTOR UPDATE REV 02 08/07/69

PURPOSE: (1) TO CAUSE THE RENDEZVOUS DATA PROCESSING RESULTS TO UPDATE THE LM STATE VECTOR.

ASSUMPTIONS: (1) THE PROCESS IS CREW SELECTED BY DSKY ENTRY.

(2) THE PROCESS MAY BE SELECTED AT ANY TIME.



CHANGE CONTROL NOTES

REV 00 PCR 496
REV C1 EDITORIAL
REV C2 EDITORIAL

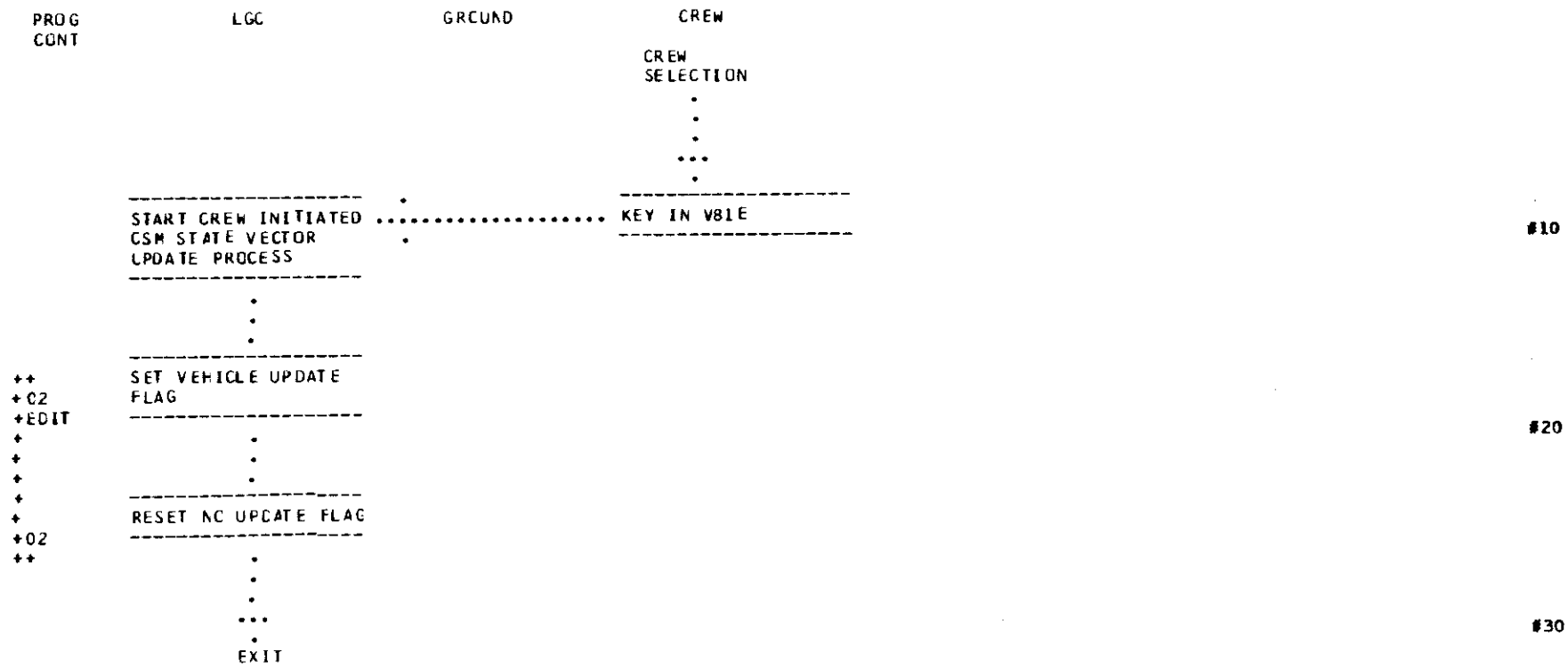
1185

V81, ENABLE CSM STATE VECTOR UPDATE REV 02 08/07/69

PURPOSE: (1) TO CAUSE THE RENDEZVOUS DATA PROCESSING RESULTS TO UPDATE THE CSM STATE VECTOR.

ASSUMPTIONS: (1) THE PROCESS IS CREW SELECTED BY DSKY ENTRY.

(2) THE PROCESS MAY BE SELECTED AT ANY TIME.



CHANGE CONTROL NOTES

LOGIC REV 00 PCR 496
REV 01 EDITORIAL
REV 02 EDITORIAL

1186

V82, REQUEST ORBIT PARAMETER DISPLAY, R30 REV 01 08/09/69

NOTE: THIS EXTENDED VERB IS USED TO CALL ROUTINE 30. SEE R30 FOR THE LOGIC SPECIFICATION FLOW FOR REQUESTING THE ORBIT PARAMETER DISPLAY.

CHANGE CONTROL NOTES

LOGIC REV 00 PCR 496

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1189

V83, REQUEST RENDEZVOUS PARAMETER DISPLAY, R31 REV 01 08/09/69

NOTE: THIS EXTENDED VERB IS USED TO CALL ROUTINE 31. SEE R31 FOR THE LOGIC SPECIFICATION FLOW FOR REQUESTING THE RENDEZVOUS PARAMETER DISPLAY.

CHANGE CONTROL NOTES

LOGIC REV 00 PCR 496

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1190

1191

V85, DISPLAY RR LOS AZIMUTH AND ELEVATION REV 02 12/03/69

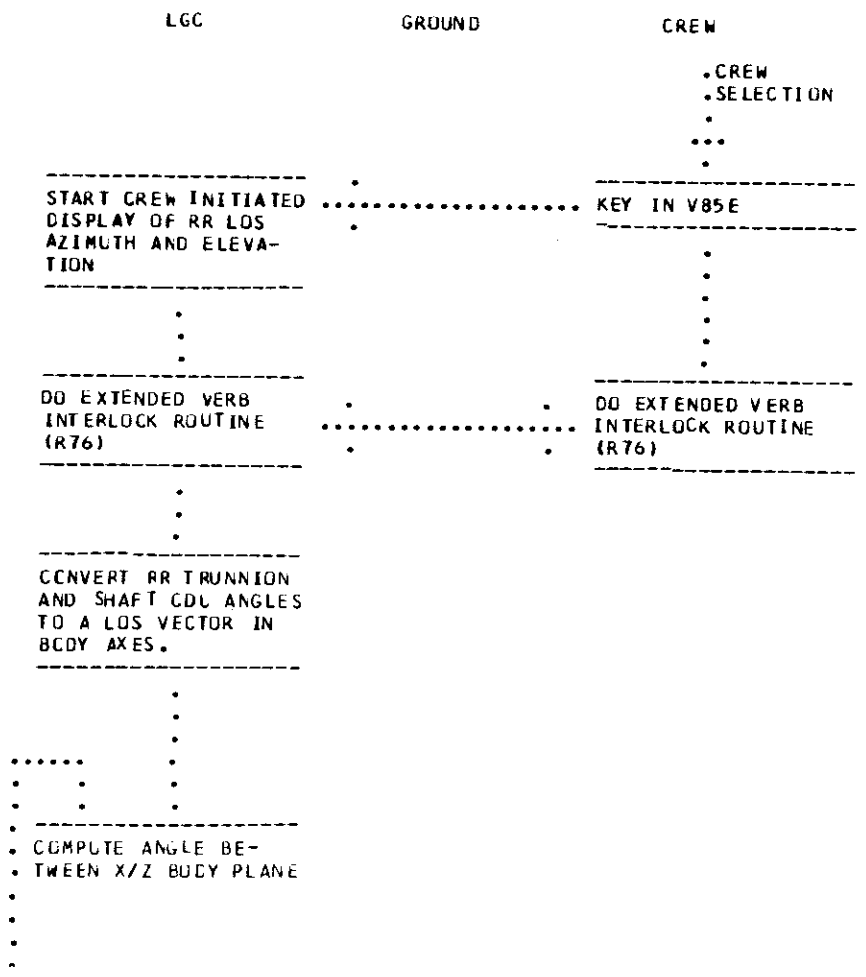
PURPOSE: (1) TO DISPLAY RR ANTENNA AZIMUTH AND ELEVATION.

ASSUMPTIONS: (1) THE PROCESS IS CREW SELECTED BY DSKY ENTRY.

(2) THIS PROCESS CAN BE SELECTED ANY TIME ANOTHER EXTENDED VERB OR ROUTINE (SEE R53) WHICH ALSO SETS THE EXTENDED VERB INTERLOCK IS NOT ACTIVE.

++
+02
+EDIT
++

(3) IF THE RR IS NOT IN THE AUTO MODE THE ANGLES DISPLAYED BY THIS PROCESS MAY BE INCORRECT BECAUSE THE RR CDU ZERO DISCRETE WILL BE PRESENT AS LONG AS THE RR MODE IS NOT IN AUTO.



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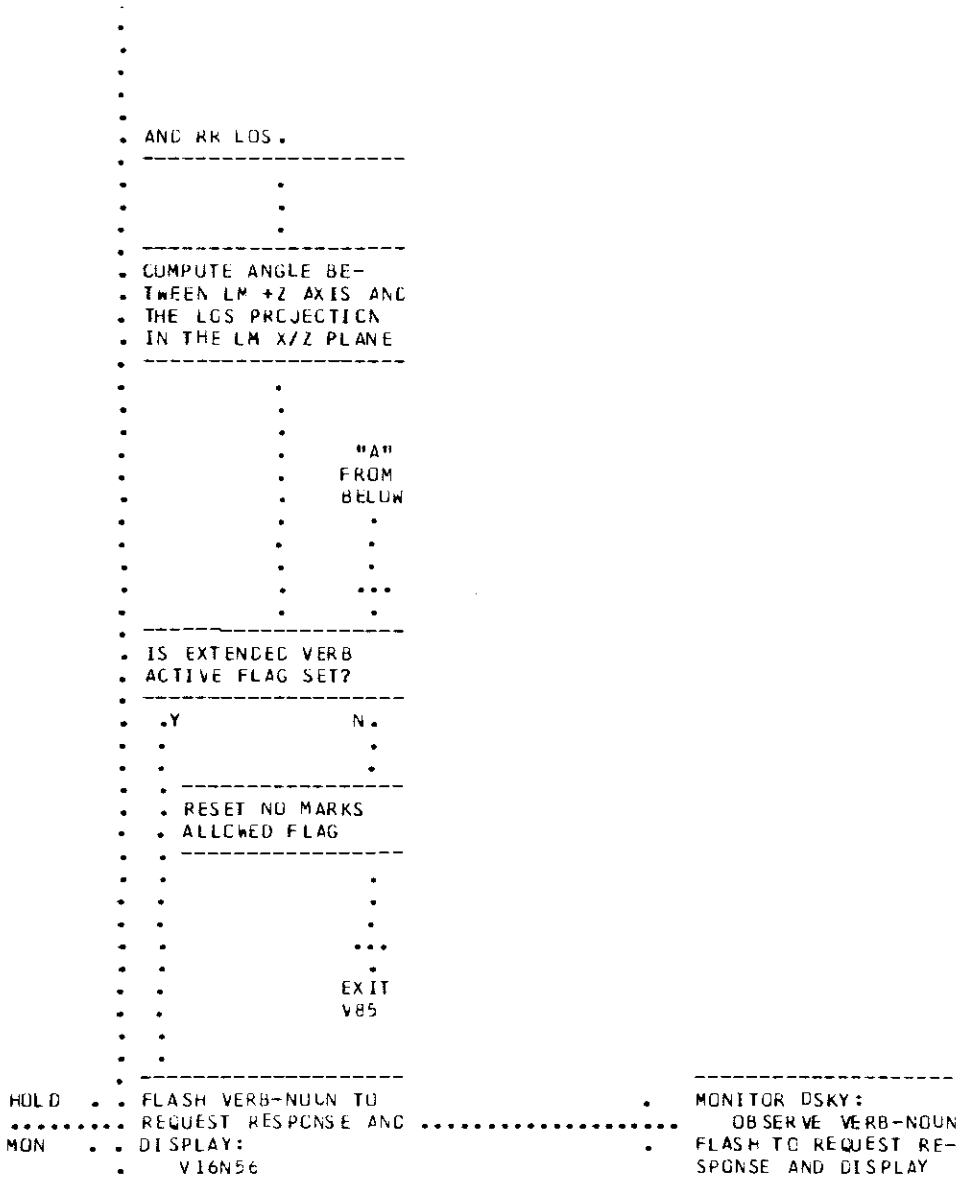
AND RR LOS.
COMPUTE ANGLE BE-
TWEEN LM +Z AXIS AND
THE LOS PROJECTION
IN THE LM X/Z PLANE
"A"
FROM
BELOW
IS EXTENDED VERB
ACTIVE FLAG SET?
Y
N.
RESET NO MARKS
ALLOWED FLAG
EXIT
V85
HOLD
MON
FLASH VERB-NOUN TO
REQUEST RESPONSE AND
DISPLAY:
V16N56
MONITOR DSKY:
OBSERVE VERB-NOUN
FLASH TO REQUEST RE-
SPONSE AND DISPLAY

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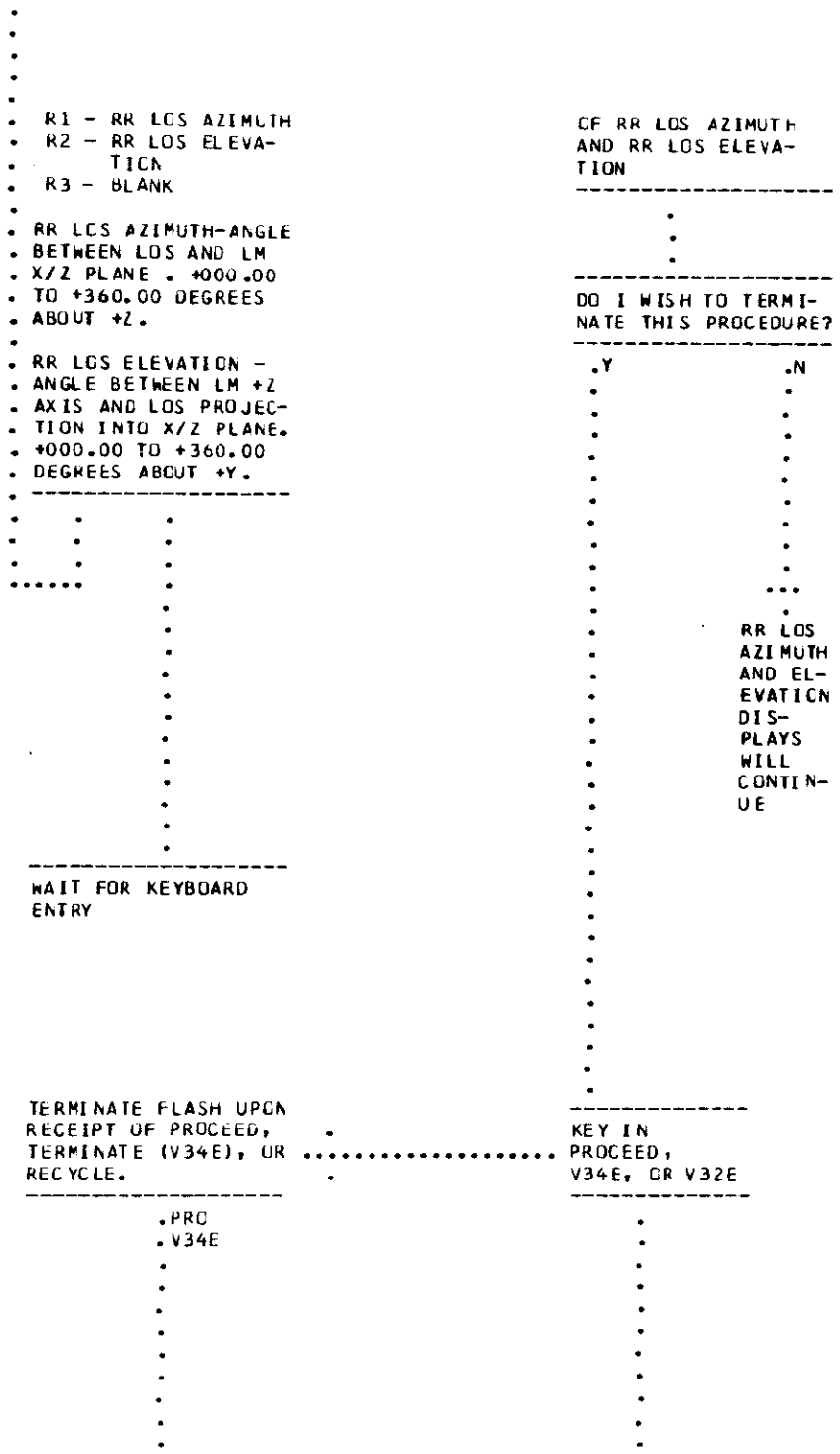

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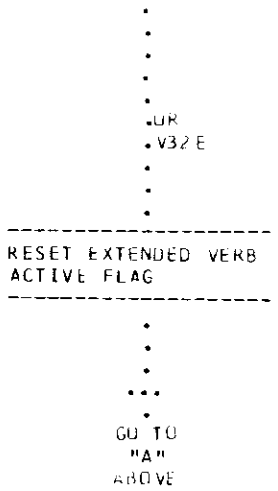

#140

#150

CHANGE CONTROL NOTES

LOGIC REV 01 PCR 623
REV 02 EDITORIAL

1195

V89, START RENDEZVOUS FINAL ATTITUDE MANEUVER, R63 REV 01 08/09/69

NOTE: THIS EXTENDED VERB IS USED TO CALL ROUTINE 63. SEE R63 FOR THE LOGIC SPECIFICATION FLOW TO START RENDEZVOUS FINAL ATTITUDE MANEUVER ROUTINE (R63).

CHANGE CONTROL NOTES

LOGIC REV 00 PCR 496

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1197

V90, REQUEST RENDEZVOUS OUT-OF-PLANE DISPLAY, R36 REV 01 08/09/69

NOTE: THIS EXTENDED VERB IS USED TO CALL ROUTINE 36. SEE R36 FOR THE LOGIC SPECIFICATION FLOW FOR REQUESTING THE RENDEZVOUS OUT-OF-PLANE DISPLAY.

CHANGE CONTROL NOTES

LOGIC REV 00 PCR 496

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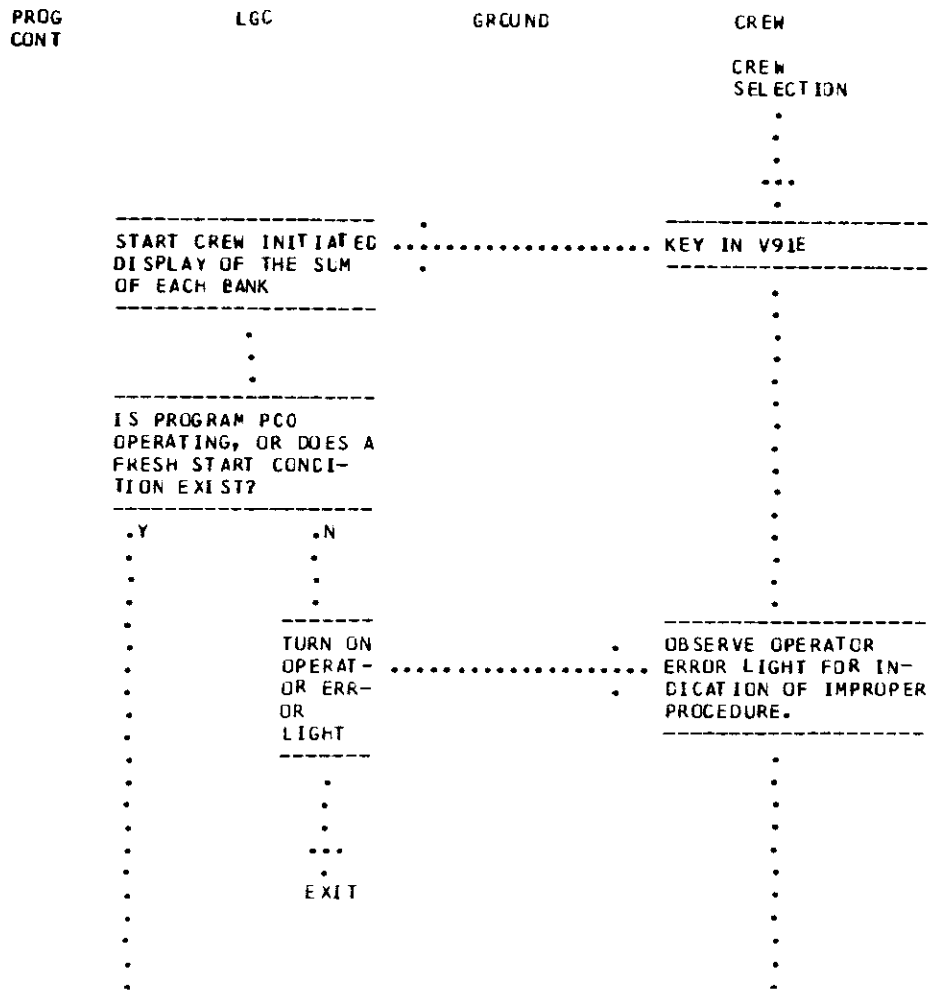
V91, DISPLAY BANKSUM REV 01 08/09/69

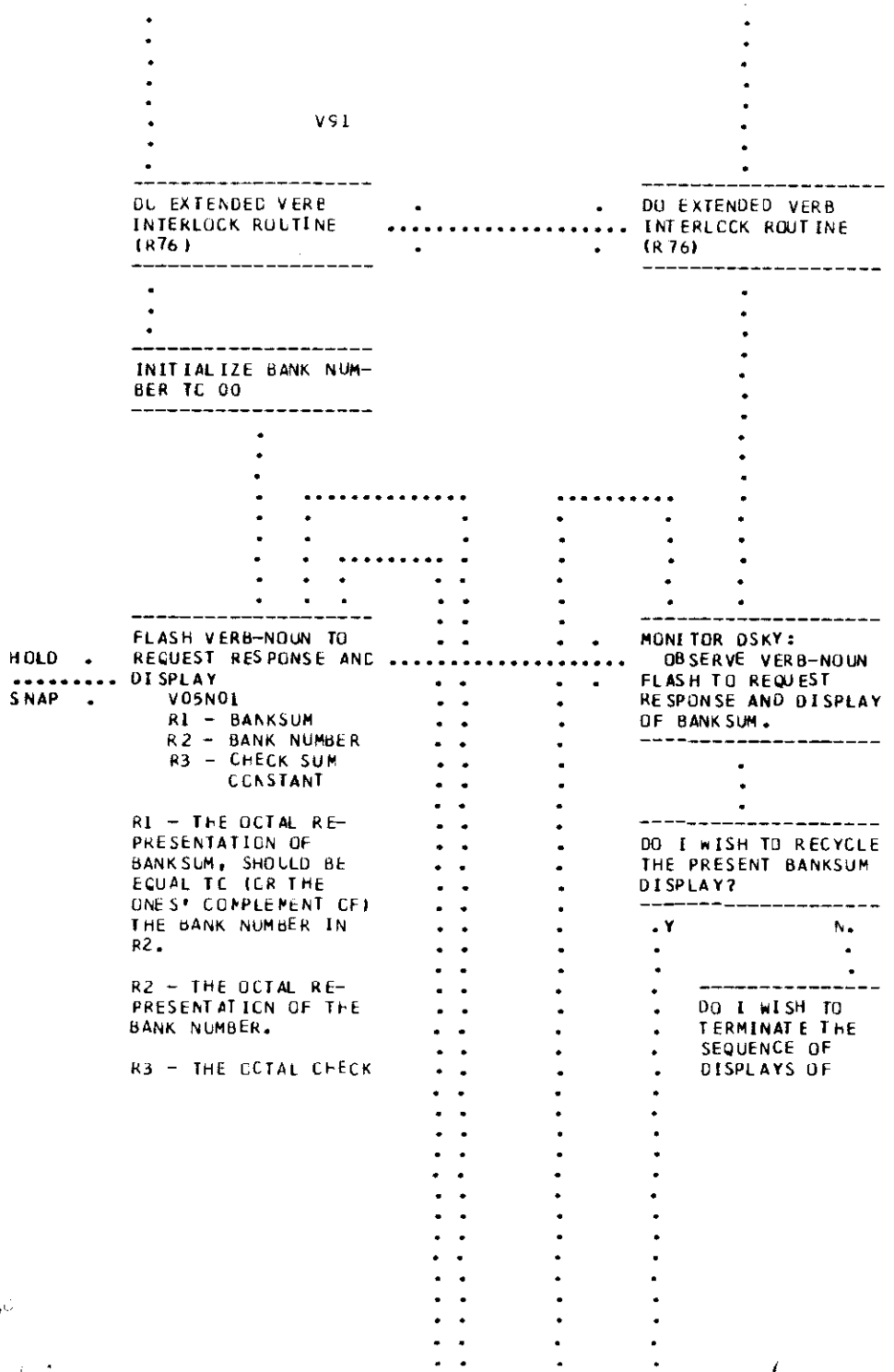
PURPOSE: (1) DISPLAY THE SUM OF EACH BANK FOR COMPARISON.

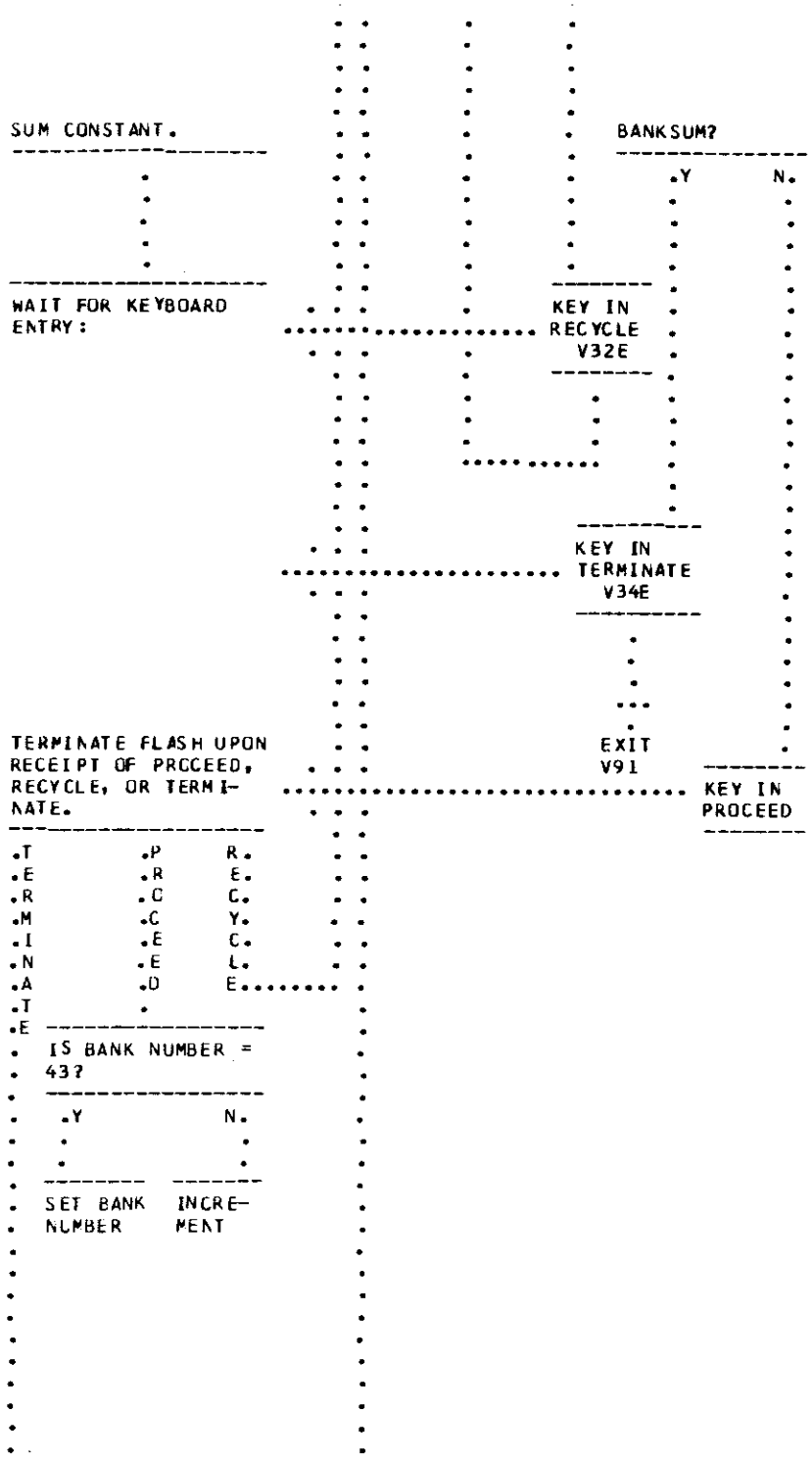
ASSUMPTIONS: (1) THE PROCESS IS CREW SELECTED BY DSKY ENTRY.

(2) P00 IS OPERATING, OR A FRESH START CONDITION EXISTS.

(3) NO OTHER EXTENDED VERB WHICH SETS THE EXTENDED VERB INTERLOCK IS ACTIVE.




V51
DO EXTENDED VERB INTERLOCK ROUTINE (R76)
INITIALIZE BANK NUMBER TO 00
FLASH VERB-NOUN TO REQUEST RESPONSE AND DISPLAY
V05N01
R1 - BANKSUM
R2 - BANK NUMBER
R3 - CHECK SUM CONSTANT
R1 - THE OCTAL REPRESENTATION OF BANKSUM, SHOULD BE EQUAL TO (OR THE ONES' COMPLEMENT OF) THE BANK NUMBER IN R2.
R2 - THE OCTAL REPRESENTATION OF THE BANK NUMBER.
R3 - THE OCTAL CHECK
HOLD
SNAP
DO EXTENDED VERB INTERLOCK ROUTINE (R76)
MONITOR DSKY: OBSERVE VERB-NOUN FLASH TO REQUEST RESPONSE AND DISPLAY OF BANKSUM.
DO I WISH TO RECYCLE THE PRESENT BANKSUM DISPLAY?
Y
N
DO I WISH TO TERMINATE THE SEQUENCE OF DISPLAYS OF
#40
#50
#60
#70
#80



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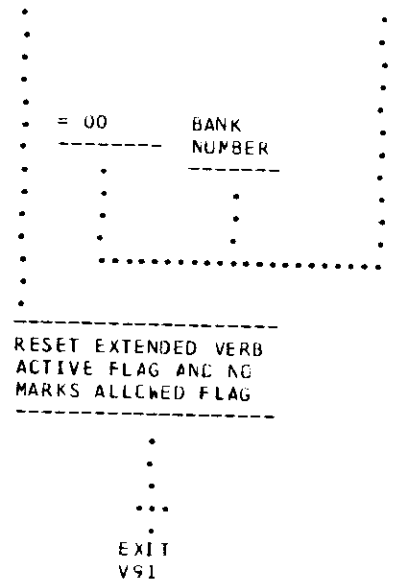

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CHANGE CONTROL NOTES

LOGIC REV 00 PCR 496

1202

1203

V92, START IMU PERFORMANCE TESTS (GROUND USE) REV 01 08/09/69

NOTE: THIS EXTENDED VERB IS USED TO OPERATE THE IMU PERFORMANCE TEST (P07). A DESCRIPTION OF THIS PROGRAM IS CONTAINED IN SECTION 1 OF R557(PRELAUNCH TEST PROGRAMS FOR SUNDANCE AND LUMINARY, FIGURE 1.4.1-1)

CHANGE CONTROL NOTES

LOGIC REV 00 PCR 496

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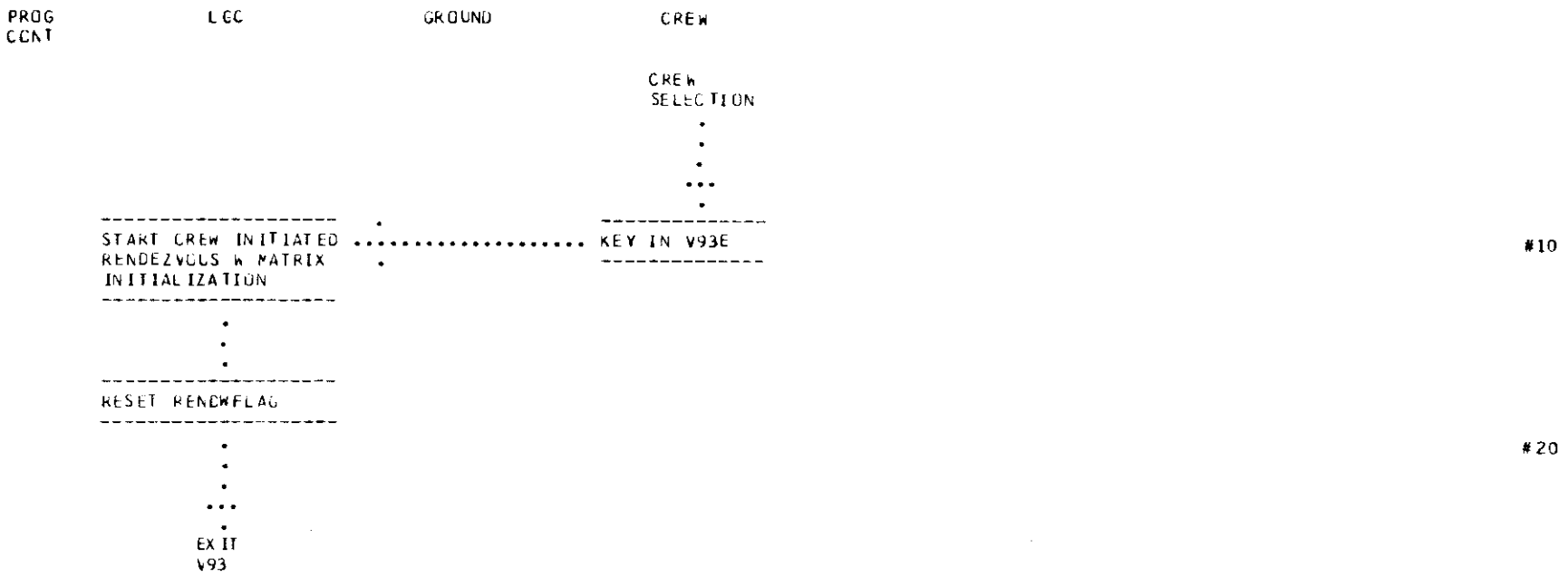
V93, ENABLE W MATRIX INITIALIZATION REV 01 08/09/69

PURPOSE: (1) TO REQUEST REINITIALIZATION OF THE RENDEZVOUS W MATRIX.

ASSUMPTIONS: (1) THIS PROCESS RESETS THE RENDWFLAG INDICATING THAT THE RENDEZVOUS W MATRIX IS NOT VALID AND MUST BE REINITIALIZED BEFORE BEING USED. THE RENDWFLAG IS AUTOMATICALLY SET FOLLOWING W MATRIX INITIALIZATION OR REINITIALIZATION.

(2) THE PROCESS IS CREW SELECTED BY DSKY ENTRY.

(3) THIS PROCESS MAY BE SELECTED AT ANY TIME.



CHANGE CONTROL NOTES

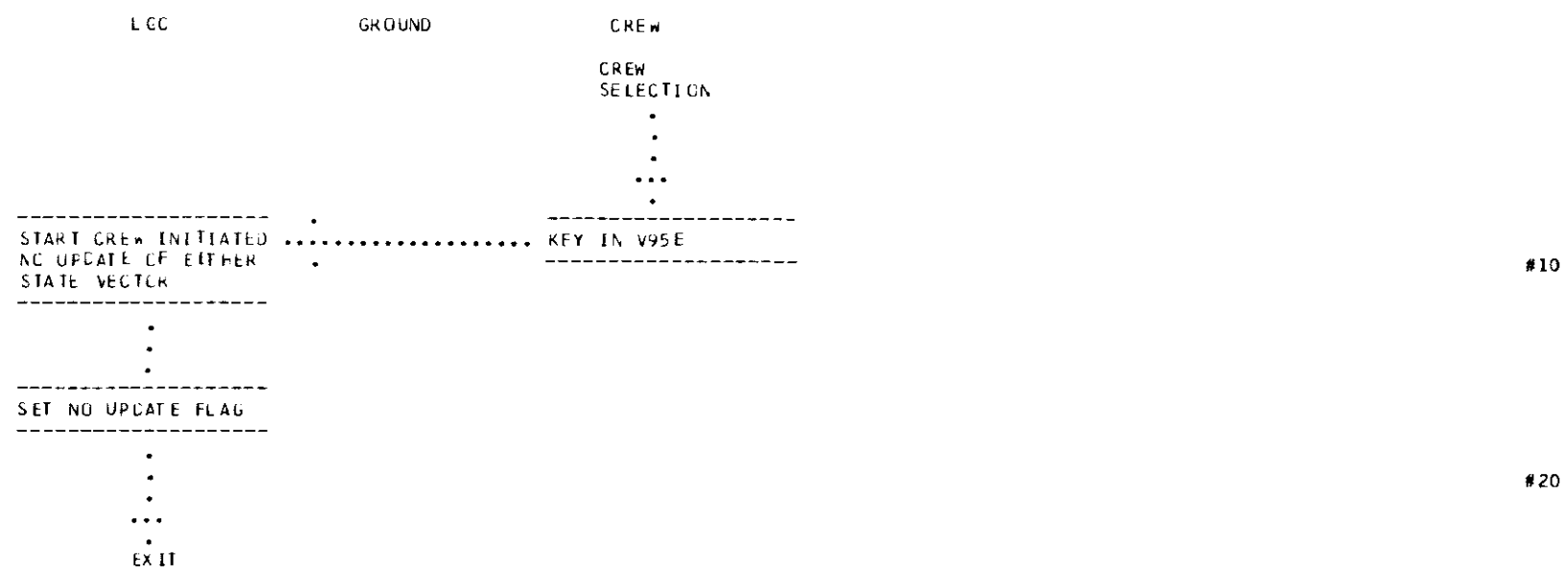
LOGIC REV 00 PCR 496

1206

V95, NC UPDATE OF EITHER STATE VECTOR REV 01 08/09/69

PURPOSE: (1) TO PREVENT LM OR CSM STATE VECTOR UPDATING BY P20 OR P22.

ASSUMPTION: (1) THE PROCESS IS CREW SELECTED BY DSKY ENTRY.



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CHANGE CONTROL NOTES

LOGIC REV CO PCR 496

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1209

V96, INTERRUPT INTEGRATION AND GO TO P00 REV 02 08/07/69

PURPOSE: (1) TO PROVIDE A MEANS OF SUSPENDING STATE VECTOR INTEGRATION.

ASSUMPTIONS: (1) IF THE COASTING INTEGRATION ROUTINE IS IN OPERATION, IT IS TERMINATED AT THE END OF THE CURRENT TIME STEP.

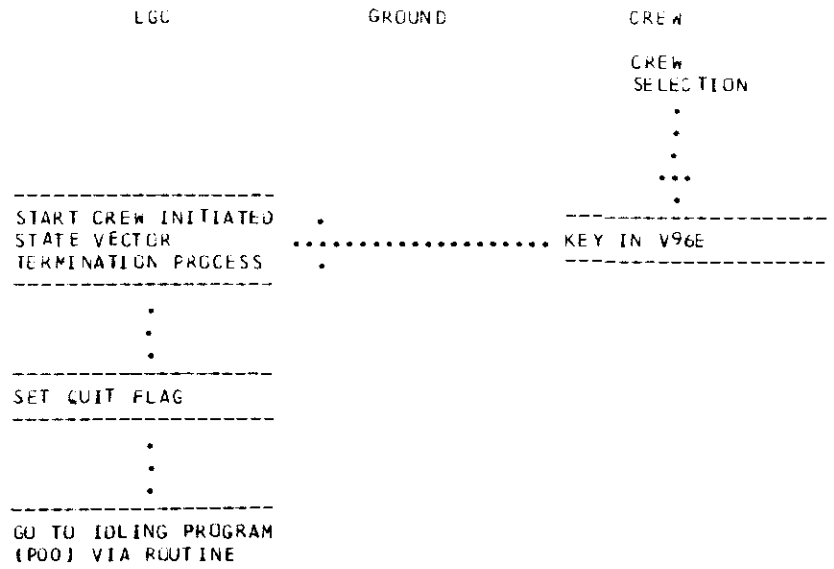
(2) THE CURRENT PROGRAM IS TERMINATED.

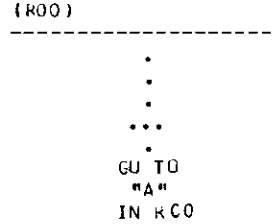
(3) THE LGC IDLING PROGRAM (P00) IS ACTIVATED.

(4) P00 STATE VECTOR INTEGRATION IS BYPASSED UNTIL A NEW PROGRAM SELECTION IS MADE.

(5) THIS PROCESS DOES NOT MAINTAIN STATE VECTOR SYNCHRONIZATION, THEREFORE INCORRECT W MATRIX EXTRAPOLATION MAY RESULT.

(6) THE PROCESS IS CREW SELECTED BY DSKY ENTRY.





#30

CHANGE CONTROL NOTES

LOGIC REV 00 PCR 146
      REV 01 PCR 507
      REV 02 EDITORIAL

1210

1211

V97, PERFORM ENGINE FAIL PROCEDURE REV 01 08/09/69

NOTE: EXTENDED VERB 97 IS USED IN THE DPS/APS THRUST FAIL ROUTINE R40. SEE R40 FOR THE LOGIC SPECIFICATION FLOW FOR DISPLAY OF DPS/APS THRUST FAIL.

CHANGE CONTROL NOTES

LOGIC REV 00 PCR 456

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12/2

V99, ENABLE ENGINE IGNITION REV 02 08/07/69

NOTE: EXTENDED VERB 99 IS USED IN PROGRAMS P12, P40, P42, P63 AND ROUTINE R40. SEE P12, P40, P42, P63, AND R40 FOR THE LOGIC SPECIFICATION FLOWS RELATING TO ENGINE IGNITION.

CHANGE CONTROL NOTES

REV 00 PCR 496
REV 01 EDITORIAL
REV 02 EDITORIAL

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