F. KYE

MIT/IL PROGRAM CHANGE ROUTING SLIP

PCR/PCN # ____________
ANOMALY # L-1B-10

- [ ] COLOSSUS 2C
- [ ] COLOSSUS 2D
- [ ] COLOSSUS 2E
- [ ] COLOSSUS 2F
- [ ] LUMINARY 1B
- [x] LUMINARY 1C
- [ ] LUMINARY 1D
- [ ] LUMINARY 1E

- [ ] MIT Approved PCN
- [ ] NASA Approved PCR
- [ ] NASA Approved PCN
- [x] NASA Approved Software Anomaly
- [ ] MIT Approved Software Anomaly

A. Coding

(✓) Begin coding immediately — G. Kalan

ACTION: ____________

Program Supervisor's Approval: Margaret Hamilton

( ) Do not code until new GSOP material has been approved by the MIT Mission Design Review Board (MDRB) and distributed.

B. GSOP Preparation

( ) Prepare GSOP revisions for MDRB consideration ____________

ACTION: ____________

- [ ] Technical Committee Meeting not required.
- [ ] Technical Committee Meeting(s) held on ____________
  Attendees:

C. KSC Testing and Checkout

( ) Review for possible impact on KSC testing and checkout ACTION: ____________

D. Other Programs Affected

( ) Review for corresponding changes in ____________

ACTION: ____________

Special Instructions

Project Manager: Bruce McCoy for R. Larson
Date: 10/29/69

(Rev 10/69)

MIT/IL SOFTWARE ANOMALY REPORT

MSC REPORT NO. L-1B-10

1.1 ORIGINATOR:	1.2 ORGANIZATION	1.3 DATE:	1.4 ORIGINATOR CONTROL NO.	PROGRAM	PROGRAM REVISION
G.R. Kalan	MIT/IL	10/23/69		LUMINARY 1B	116

1.5 DESCRIPTION OF ANOMALY:

When the ACA is returned to the detent position after being recycled in and out of detent in the manual rate command mode, the DAP may enter the attitude hold mode immediately, rather than first damping the spacecraft rates as desired.

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1.6 DESCRIPTION OF RUN:

See Data Amplification Sheet

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- MIT ANALYSIS -

2.1 CAUSE:

See Data Amplification Sheet

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2.2 RECOGNITION:

Rate and attitude overshoot will be observed after ACA is returned to detent.

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2.3 MISSION EFFECT:

Slight RCS fuel penalty due to overshoot.

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2.4 AVOIDANCE PROCEDURE:

Pause in detent for a short time before moving ACA out of detent the second time.

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2.5 RECOVERY PROCEDURE:

None necessary

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2.6 PROGRAM CORRECTION:

Set JUSTIN to 1 each time the ACA is found out of detent in Fig. 3.4-16.

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2.7 RECOMMENDED DISPOSITION (Fix, Work-around, etc):

No action required for LUMINARY 1B.
Fix coding for LUMINARY 1C.

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2.8 RECOMMENDED RE-TESTING:

None for LUMINARY 1B. Repeat run in 2.1 for LUMINARY 1C.

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2.9 MIT/IL SIGNATURE: B McCoy for R. Larson

2.10 DATE: 10/29/69

3.1 NASA DIRECTION:

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4.1 CLOSING ACTION TAKEN:

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3.2 NASA/MSC SIGNATURE:	3.3 ORGANIZATION	3.4 DATE:	4.2 SIGNATURE:	4.3 ORGANIZATION:	4.4 DATE:

1.6 Description of Run:

The anomaly was discovered by Grumman engineers while attempting to execute the following manual rate command sequence on the FMES/FCI simulator:

1. start in detent
2. move ACA out of detent to soft stop
3. remain on the soft stops until the pseudo-automatic mode is entered
4. return ACA to detent
5. quickly return ACA back to soft stops (before pseudo-automatic mode can be established in detent position)
6. remain on the soft stops until the pseudo-automatic mode is entered
7. return ACA to detent

When the ACA was returned to detent for the final time, rate and attitude overshooting was observed.

2.1 Cause:

MIT agrees with the following analysis presented by H. Berman, C. Tillman, and J. Glassman in GAEC simulator discrepancy report LM-LUM-67:

" The effect is related to the handling of RCSFLAGS B09, JUSTIN. What happens can be seen by following the history of RCSFLAGS and DAPBOOLS B12, OURRCFLG, thru the above sequence, with the aid of Figure 3.4-16 and -17 of Section 3 of the GSOP (attached). When the stick is just moved out of detent OURRCFLG is tested and since it is 0 an initialization pass is made in P-Axis. It is at this point that OURRCFLG and JUSTIN are set (made equal 1).

When the stick is returned to detent as detected in P axis (Fig. 3.4-16), OURRCFLG is tested and since it is 1, JUSTIN is tested. Since JUSTIN is also 1, the routine would continue on to Q, R -Axis (Fig. 3.4-17). Here the condition of the stick (as determined by a check of CH31 in P-Axis and buffered in CH31TEMP) is checked.

Since it is in detent OURRCFLG is checked and being found set, JUSTIN is reset. Assuming rate command changes and prime axes rate errors greater than the break out level and the rate deadbands respectively, Direct Rate Control will be established by setting RCSFLAGS B11, QRBIT. On the next P-Axis pass with the stick still in detent OURRCFLG is still set but though JUSTIN is reset, transfer is made to Q, R - Axes without resetting OURRCFLG (see Fig. 3.4-16) because QRBIT is set.

Now if the stick is deflected out of detent before Q, R - axes established Auto - as indicated by QRBIT being reset - the program will be left with a deflected stick and JUSTIN equal 0. Note that up to now and in fact until the stick is next returned to detent there is no visible anomalous effect on the control of the vehicle.

However, if the stick is returned to detent after Pseudo - Auto has been established (QRBIT reset) then after the test of OURRCFLG (refer to Fig. 3.4-16) the tests on JUSTIN and QRBIT will find them both reset so OURRCFLG will be reset. Now in Q, R - axes, when OURRCFLG is tested and found to be reset, the program flow will be transferred to Automatic Control.

So much for how it happens - here is a summary of the operational considerations:

A. The length of time the stick is originally deflected is not important except as it affects the rate established before return into detent, see B below. Pseudo - Auto mode does not have to be established, as a logical requirement.

B. The time of redeflection of the stick after coming back to detent is the controlling factor. It must be moved out before Auto is established. This is dependent primarily on the amount and duration of the original deflection. For example, we noted that for the SS deflection, 20°/sec, return to Auto was controlled by the Q R Timer - 4 secs, however, this was close to the point at which transfer would have occurred on a rate error basis.

C. Pseudo - Auto mode must be established before final return to detent. Magnitude of rate commanded (over the break out level) is not important to get the effect although of course it determines the magnitude of the overshoot.

D. The overshoot phenomenon can be avoided by making an adequate pause in detent before going out the second time."

L-1B-10
Pg 4

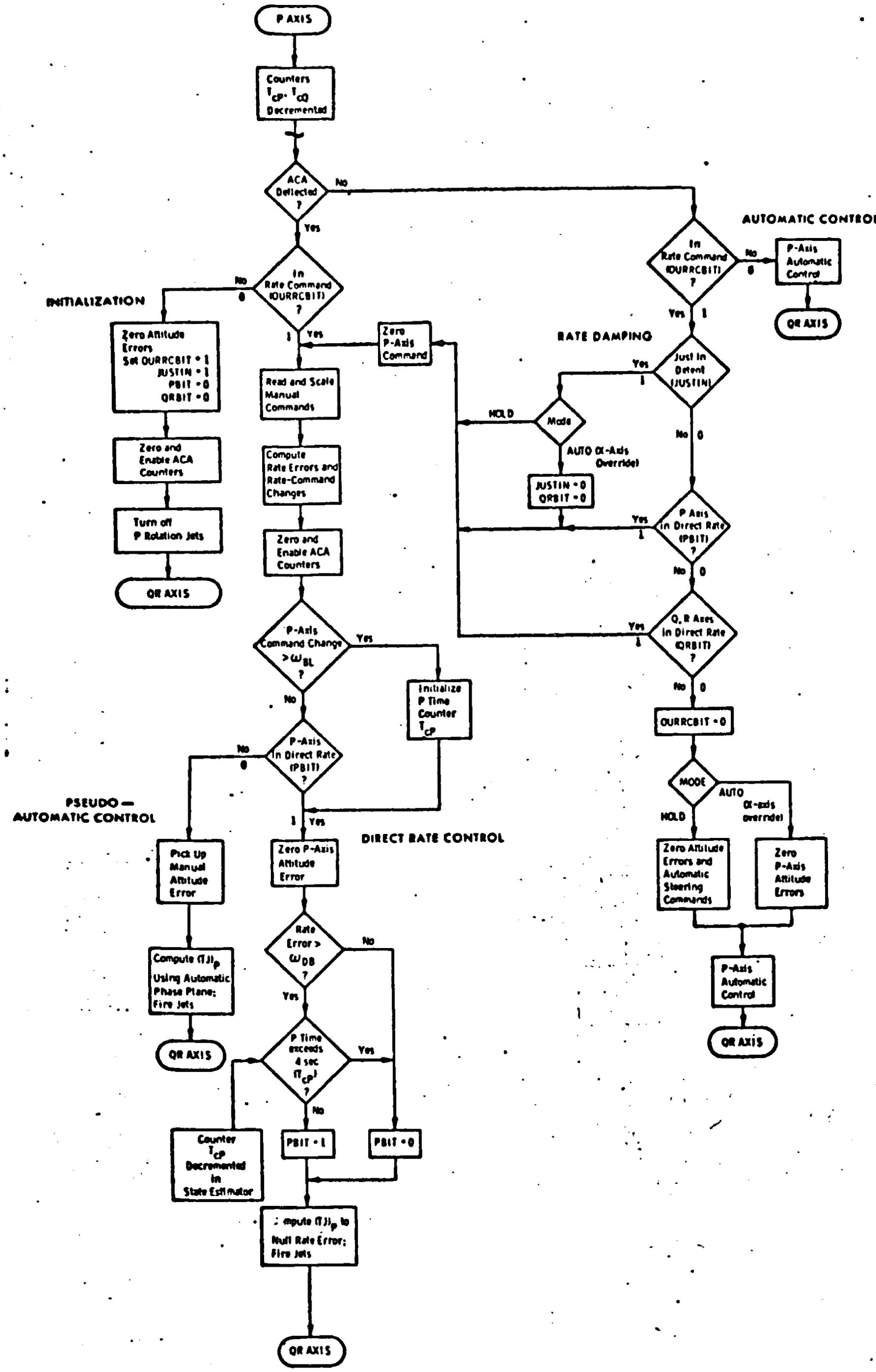

Fig. 3.4-16. Manual rate control logic for the P axis.

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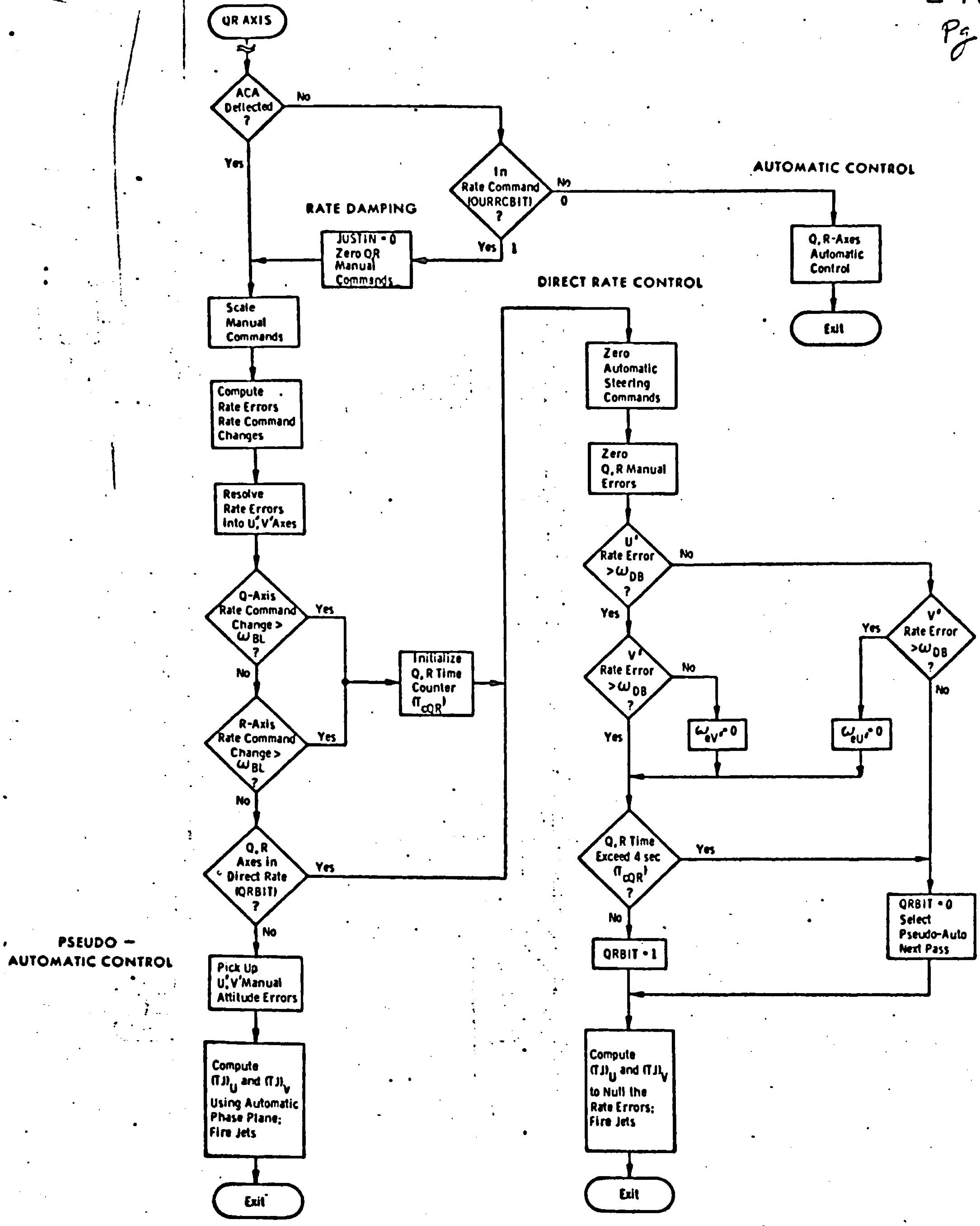

Fig. 3.4-17. Manual rate control logic for the Q,R axes.