
Carousel INS

Delco Carousel IV-A Inertial Navigation System for *Microsoft Flight Simulator*

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Displayed Status Guide

INS unit status is displayed on the CDU Right Data Display when the CDU Data Selector Knob is placed in the DSRTK/STS position. Full understanding of the status, as displayed, is a mandatory requirement for unit operators. This guide has been developed to help the novice user understand how to decode all information provided as an apparently meaningless sequence of numbers.



figure 1 - CDU in DSRTK/STS Mode

The right data display holds 6 digits as shown in the picture, we'll look at each of them starting from the leftmost one:

1st Digit: NAV Mode Indicator (always visible)

This digit can assume two different values:

- 0** Unit is NOT currently in NAV Mode
- 1** Unit is in NAV Mode

If the NAV Mode indicator is 0 then the unit is either in STBY or ALIGN status.

2nd and 3rd Digits: Action/Malfunction Codes (not always visible)

These are the 2 digits where Action/Malfunction codes are displayed. They are blank if there is no Action/Malfunction codes pending. As the display room is so small, the TEST button is used to scroll through all pending codes. Once the end of the sequence of codes have been reached, codes belonging to a warning condition will be automatically cleared by the system, codes related to (persisting or not) error conditions will not be cleared. So when TEST is pressed at the end of the sequence, then the 2 digits will either become blank, if all pending codes were in fact warnings, or the sequence will restart from the beginning (without cleared warning codes).

It is important to notice that it is always possible to understand if a certain value is either an Action or a Malfunction code by looking at the value itself. Action codes are identified by small numbers (1 to 8) while Malfunction Codes have higher values.

It is also important to know that if there are pending codes, the TEST button will assume the "scroll" functionality independently from the position of the Data Selector knob. So if you press it while not in DSRTK/STS mode and then you switch to that mode, you'll not see the first value in the sequence, but the one relative to the number of times TEST has already been pressed (that's why it is important to be able to distinguish between Action and Malfunction codes). If pending codes are relative to a warning condition, they could be cleared without even looking at them, just by pushing TEST few times in any Data Selector knob position currently selected. Clearing a "warning condition" without checking Action and Malfunction codes is not part of any operational procedure. Data Selector should be always switched to the DSRTK/STS position first, and then codes have to be checked before clearing them with the TEST button.

If Action/Malfunction codes are present then the Action code is displayed first (something like 01 for example). To check the associated Malfunction code press the TEST switch. Action code will be substituted with the Malfunction code (something like 38 for example). We then have the complete code (01-38) to be used to understand what is going on (ActionAndMalfunctionCodes.pdf) and to find out which is the right abnormal procedure to be carried out (AbnormalProcedures.pdf). If codes are relative to a warning condition they will disappear if TEST is pressed once again. Otherwise pressing TEST the display will scroll back showing the Action Code.

Warning Condition:

| | | |
|------------|----|---------------------------|
| Number | -> | Action Code |
| Press TEST | | |
| Number | -> | Malfunction Code |
| Press TEST | | |
| Blank | -> | Warning condition cleared |

A very common warning condition example all users have experienced is the 06-41 case. When present position has been entered the unit compares it to its last internally computed position and, if they exceed the tolerated error (of $3+(3*T)$ Nautical Miles, where T is last flight's NAV Time expressed in hours), the 06-41 warning will be generated to signal the unusual condition (which in fact is, in the real world) possibly due to an error in the entered present position. As it is only a warning, it is possible to clear it by scrolling though the whole sequence (06->41) and then clearing the display by pressing TEST one more time.

Error Condition:

Number -> Action Code
Press TEST
Number -> Malfunction Code
Press TEST
Number -> Action Code (again)
Press TEST
Number -> Malfunction Code

If codes are relative to an error then once the sequence of codes has been completely scrolled through, it will restart again from the first Action code as shown in the previous scheme.

These are in fact only the simplest cases. There are more complex cases as, in some circumstances, the unit may produce several Action and Malfunction codes, and/or there could be multiple Malfunction codes associated to the same Action code. In such cases multiple pairs of codes will be listed sequentially as TEST is pressed. Let's make an example: if pending error codes are 02-13, 02-14, 02-15, 03-22, 03-23, 04-57, 06-41 (this is only an example, these codes would never actually be all present at the same time), they would be displayed as follows:

02 <- Start of sequence
Press TEST
13
Press TEST
14
Press TEST
15
Press TEST
03
Press TEST
22
Press TEST
23
Press TEST
04
Press TEST
57
Press TEST
06
Press TEST
41 <- End of sequence
Press TEST
02 <- (re)Start of codes sequence

As they're all non-clearable conditions except the 06-41 case, pressing TEST again will not reset the display to blanks, the whole sequence will be restarted instead, that's why 02 "reappears" and 13 would be next value if TEST is pressed again. Codes 06-41 would no longer be displayed as they have been taken out of the sequence, because relative to a warning, not an error condition.

4th Digit: Always Blank

5th Digit: PI / AI (always visible)

During the alignment phase the fifth digit is called Performance Index (PI) representing the current INS computer alignment submode. It is displayed as a single digit number starting from 9 and decreasing toward 0 as alignment phase progresses. At PI 5 or lower, NAV Mode is allowed.

In NAV Mode the fifth digit becomes the Accuracy Index (AI) providing an indication of the position error the unit should have statistically accumulated at the present stage. It is not a precise value where, for instance, the value 6 corresponds to 0.5 NM of error. In NAV Mode AI grows toward 9 or reduces while DME Updating is in progress.

6th Digit: "Desired PI" or "Requested PI" (always visible)

Rightmost digit is the Desired Performance Index. It stays fixed at 5 during alignment. In NAV Mode it can assume the following values:

- 4** Unit is operating in "aided inertial mode", meaning either TripleMix or DME Updating is currently active.
- 5** Unit is operating independently but all previous corrections are still maintained, if they have not been previously eradicated from the system using the special position eradication procedure.