
Carousel INS

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

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'Quick & Dirty' Reference Guide

This pseudo-checklist includes all major programming/control steps an INS unit requires during a flight. This is a VERY "quick&dirty" guide but it still can be useful to learn basic usage of the system. Experience will then come by practice. It is strongly suggested to read "Operations Manual" and "Gauge User Manual" documents before using this guide.

NOTE: Within the INS system heading/track values are always relative to the TRUE NORTH

1) POWER ON / WARMUP (repeat for EACH installed unit)

- **Make sure the aircraft is NOT moving**
Make sure Parking Brakes are SET
- **Make sure the INS, once turned on, will NOT rely on its own battery**
If engines are shut down and/or their associated generators are not on, use simulated auxiliary power unit by making sure the plane is not moving forward.
- **Rotate MSU Mode Selector Knob from OFF to STBY position**
Switches the unit ON and the warmup cycle begins. Warmup duration depends on the outside temperature, lower temperature causes longer warmup time. It normally takes about 3 minutes if the initial temperature is 68°F (20°C). During warmup it is possible to perform preliminary INS checks (refer to the "INS Operations Manual") and load the present position.
- **Check for Action/Malfunction codes moving the Data selector to DSRTK/STS position**
- **Rotate CDU Data Selector to the POS position**
- **Enter present position**

Using either a parking chart or pressing Shift+Z and looking at the upper left screen corner, enter the ramp position as the Present Inertial Position. Leading zeros could be omitted.
- **Move MSU selector from STBY to ALIGN**

As soon as warmup is over, alignment will start automatically.

2) ALIGNMENT *(repeat for EACH installed unit)*

- **Rotate CDU Data Selector to DSRTK/STS and monitor the API (Actual Performance Index) decreasing from 9 to 0**

INS unit is aligning. The aircraft must absolutely not be moved (at least) until the MSU GREEN light "READY NAV" illuminates (at API 5) and the MSU selector has been switched to NAV position. Take advantage of the alignment time to load all (or the first nine if they're more than nine) flight plan waypoints.

NOTE: It is possible to use the hidden MSU "Immediate Alignment" button to minimize alignment times after all "setup" phases have been completed. Refer to the "Gauge User Manual" for MSU "Immediate Alignment" button usage.

3) WAYPOINTS DEFINITION *(repeat for EACH installed unit or use 'REMOTE' mode)*

This operation is normally performed while the unit is aligning on ground and in flight when further waypoints have to be inserted.

- **Rotate CDU Data Selector Knob to WAYPT position**
- **Push all unit REMOTE switches/Lights**

Check REMOTE light is illuminated on all CDUs. This is to copy ("broadcast") waypoint definitions to all units. Otherwise they will have to be defined separately for each unit.

Using the keypad of any installed and active CDU:

- **For EACH waypoint**
 - Move the Waypoint/DME Selector in the required position
 - Check the FromTo Display is showing the correct Waypoint ID
 - Check the FromTo Display is NOT blinking
 - **WARNING: blinking means selected Waypoint is part of the leg being flown**
 - Insert/Check Latitude
 - Insert/Check Longitude

4) PRE PUSHBACK / PRE TAXI *(repeat for EACH installed unit)*

- **Check READY NAV Light of all installed MSUs are illuminated.**

All "NAV Ready" lights should be illuminated. If not then either alignment is still in progress or the WARN light is illuminated meaning there were problems. If any of them is NOT illuminated DO NOT MOVE the aircraft. You should delay pushback/taxi. Check the STS Display to understand what is going on (what actually went wrong).
- **Move MSU Mode Selector Knob in NAV position.**

Now the INS unit is in NAVIGATION mode and the aircraft can be moved, it's fully operational.

5) AFTER TAKE OFF

When on track:

- **Decide which INS unit will be used to control the Autopilot**
(Only when multiple INS units are installed)

- **Check/Set Autopilot ON**
- **Check/Set Autopilot HDG mode ACTIVE**
- **Set INS' NAV Mode Switch ON**
From this moment the INS will send navigation commands to the Autopilot

6) NAVIGATION / CRUISE

Basically, during navigation, you need to:

- **Program it, when needed, to navigate to the destination waypoint**

This unit is able to memorize only up to 9 waypoints. If the flight requires more than 9 waypoints (remember the INS wraps back to waypoint 1 after the 9th is reached, so from leg 89 it jumps to 91) then you' ll need to load new ones during flight (see WAYPOINTS DEFINITION)

- **Keep it aligned as much as possible**

In order to reduce INS calculated position error during cruise it is possible to perform "Manual Updating" or "DME Updating" procedures to minimize it. In addition it is recommended, in Triple INS configuration, to maintain all the INS units in Triple Mixing mode, when no DME Updating is in progress. Refer to the Operations Manual for all details on how to carry out the mentioned procedures.

In addition it is possible to:

- **Use it as a valuable source of informations**
 - Wind, WON and Windshear
 - Distance between waypoints and between current position and TO waypoint
 - Time to reach between waypoints and between current position and TO waypoint
 - Current and Desired Tracks
 - Ground Speed
 - Instant Acceleration
 - Current Inertial and Displayed Positions

7) APPROACH

During Approach phase, when radar vectors the approach or a STAR should be flown, the INS NAV MODE SEL may be switched OFF and the autopilot controlled manually:

- **Set Active INS' NAV Mode Switch to OFF**
The autopilot will be left in HDG mode (as it was), and selected heading remains the last one set by the active INS. INS is no longer in control of autopilot HDG mode.

8) LANDING

Use the INS to detect Wind shear selecting WIND + HOLD

9) POST FLIGHT CHECKS *(repeat for EACH installed unit)*

The post flight procedure should be performed at arrival ramp with the plane stopped, engines shut down and parking brakes set.

- ERADICATE any existing update from the unit (DSRTK/STS->1->INSERT)
- Load arrival ramp position as a Waypoint X (ID N°) using charts or FS' Shift+Z
- Rotate CDU Data Selector Knob to DIS/TIME position
- Set new 0-X leg (WAYPTCHG->0X->INSERT)
- Check the DIS on left Data Display (Distance), it represents the error that the unit has accumulated from last alignment. Maximum drift should be less than 3nm/hour.
- Rotate CDU Data Selector Knob to TK/GS position to check residual GS, should stand within max allowed limit (15 KTS)

10) SHUTDOWN *(repeat for EACH installed unit)*

- **Rotate MSU Mode Selector Knob to the OFF position**
The unit is OFF, alignment and waypoints are lost, DME stations and their elevation are kept in memory.