How to Program the PMDG 737 NGX FMC

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How to Program the
PMDG 737-800 NGX FMC

The Flight Management Computer

The NGX has two flight management computers (FMCs) located in the avionics bay beneath the cockpit floor. The Control Display Units (CDUs) are the pilot interfaces to the FMCs.

The CDU has a screen and keypad that can be used to enter and display information into the FMC. The bottom line of the screen is known as the **scratchpad** where various information and error messages can be displayed, and where information that you enter using the CDU keypad is shown. You can clear any messages in the scratchpad by pressing the CLR key in the lower-right corner of the keypad.

The six keys along each side of the CDU screen are called **Line Select Keys (LSKs).** It is common to see them referred to as, for example, LSK 2L. This stands for the 2nd line select key from the top on the left side of the CDU.

Pre-flight Preparations

Press Shift-3 to load a 2D popup of the CDU. The CDU will display as shown opposite (Figure 1).

Fuel
Press LSK 5R [FS ACTIONS>]. The screen will change as shown in Figure 2.

Press LSK 1L [<FUEL] to select the FUEL page (Figure 2).
The prompts on the right side of the fuel page allow you to load preset fuel levels, and the prompts on the left side allow you to type the total fuel level, a percentage, or the individual tank weights and then line select them into place.

In this case we will select a preset amount to full. Press LSK 3R. Note that the total fuel changes to approximately 46,000 lbs at LSK L1 (See Figure 3).

Payload (passengers & cargo)
Press LSK 6L [<RETURN] to return to the root FS ACTIONS page (Figure 4).

Press LSK 2L to select the PAYLOAD page. The PAYLOAD page is like the FUEL page but for passengers and cargo weight. The prompts on the right side are quick-load presets and on the left side you can type and line select in the exact number of passengers and the weight of cargo in the forward and aft compartments under the passenger cabin (Figure 5).

For this example, press SET FULL > [LSK 4R] prompt at LSK 4R. We shall also enter 1500 lbs of cargo into both the forward and aft cargo compartments located under the passenger cabin. To do this click into the scratchpad and type 1500, then press LSK 5L to load the aft cargo compartment weight. Repeat this action to load forward cargo weight, only this time press LSK 4L (Figure 6). Make note of the zero fuel weight (ZFW) and the centre of gravity (CG) figures. We will need these numbers later.
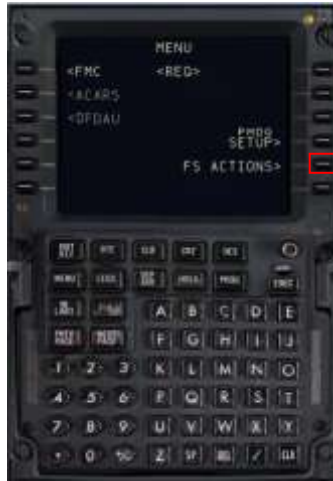

Figure 1

Figure 2

Figure 3

Figure 4

Figure 5

Figure 6

Note the real-time weight and balance readouts at the upper right of the screen on the FUEL and PAYLOAD pages for gross weight (GW) and maximum taxi weight (MTW). These will turn yellow if they are in excess of limits.

Route Setup

Next we need to set up the flight plan's lateral route and program it into the FMC. The basic sequence we will follow to accomplish is:

1. Position Initialisation
2. Airport Entry
3. Departure Entry (SID)

4. Enroute and SID Entry
5. STAR and Approach Entry
6. Route Activation.

Press MENU, which will take us back to the root menu.
Select the **IDENT page** by pressing the <FMC prompt [LSK 1L] (Figure 7). The IDENT page doesn't contain any fields for entry, but it does provide some valuable information such as aircraft type, engine thrust rating (in this case 26,000lbs of thrust per engine), the FMC software version, known as the Op Program (currently the latest on NGs, U10.8A) and the currently installed navigation database and its valid dates. In the real world this aeronautical information is published on a 28-day cycle. Each 28-day period is known as an Aeronautical Information Regulation and Control (AIRAC) cycle. So the first cycle of the year 201EWM1 is AIRAC-1101, the second AIRAC-1102, and so on. AIRAC updating would be the responsibility of maintenance staff and pilots just need to verify that the current cycle is installed. AIRAC 1108 will work fine with this tutorial.
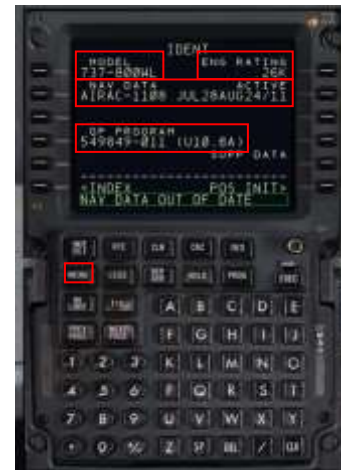
Figure 7

1. Position Initialisation
Press LSK 6R to select the **POS INIT page**.
The POS INIT page is used during a cold and dark start for aligning the inertial reference system (IRS) gyros. When loading from Free Flight, the IRS is already aligned, so this page would not have any real function. For the purposes of this tutorial, however, we will load the relevant airport.

Enter the origin airport into the scratch pad and line select REF AIRPORT [LSK 2L]. In this case it is KIAH (Houston's George Bush Intercontinental Airport). Note how the airport's latitude and longitude is automatically displayed. See Figure 8.
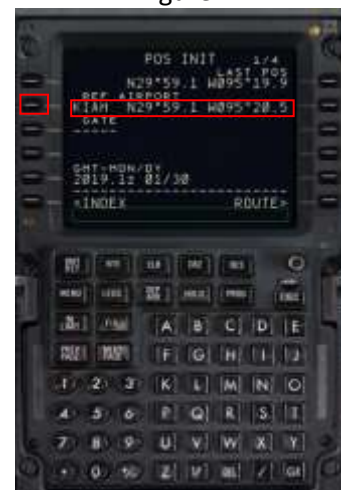
Figure 8

2. Airport Entry
Next we enter the destination airport.
Press LSK 6R to select the **RTE page**. The RTE page is the primary location for entering the enroute portion of your flight plan. You'll notice that KIAH is already placed in the scratchpad as a result of having previously entered it on the POS INT page (Figure 9).

Line select the KIAH text into LSK 1L, the ORIGIN field (Figure 10).

Figure 9   Figure 10

Type the destination airport code into the scratchpad and line select it up to LSK 1R, the DEST field. In this case it will be KLAX, Los Angeles International Airport (Figure 11).

Type PMDG738 into the scratchpad and line select it with LSK 2R, the FLIGHT NO. field. You could enter the runway now on the RTE page, but we're going to do that on the DEP ARR page instead to demonstrate another feature.

The completed RTE page should look like that shown in Figure 12.

Figure 11

Figure 12

3. Departure Entry (SID)

Press the DEP ARR button to get to the DEP ARR INDEX page. The DEP ARR INDEX page contains a series of prompts that take you to the departure and arrival procedure selection pages for the two airports you have entered into the RTE page ORIGIN and DEST fields earlier on the RTE page. The reason you have both departure and arrival prompts for the origin airport is to enable a return to the airport after takeoff in the case of an emergency. At LSK 6L and 6R, you have two prompts that allow you access to any airport's departure or arrival page. You can type the ICAO airport identifier of the airport in question into the scratchpad and then line select it to the DEP or ARR field. This can be useful in the event of an enroute diversion.

Figure 13

Press LSK 1L to get back to the KIAH DEPARTURES page. The KIAH DEPARTURES page contains all of the runways and Standard Instrument Departures (SIDs) for Houston's George Bush Intercontinental Airport that exists in the FMC's navigation database.

Select LSK 3R to select runway 09. Notice the list of SIDs on the left side is filtered so that only the SIDs for runway 09 are displayed. This is the reason for not entering the runway on the RTE page 1 earlier - when you enter it there, it does not filter the SIDs unless you reselect the runway on the KIAH DEPARTURES page.

We want to select the JCT7 SID but it does not appear on the current display. Note the 1/4 at the top right of the display. This means we are on page 1 of 4 pages for KIAH DEPARTURES. Press the NEXT PAGE button to go to the next list of SIDs for runway 09 (Figure 14).

Figure 14

Select JCT7 SID [LSK 3L]. The KIAH DEPARTURES page should look as it appears in Figure 15.

4. Route Entry
Press LSK 6R to get back to the RTE page. We are going back to it because the RTE page is where enroute airways are entered.

Press the NEXT PAGE button to go to RTE page 2. The RTE page 2 and further are where you actually enter route information. Note the VIA and TO columns on the left and right sides of the screen. The TO column is where you're going and the VIA column is how you are going to get there (Figure 16).

Figure 15

Figure 16

You can see that we have one line already filled in automatically by our SID selection - we're going to JCT VIA the JCT7 SID procedure. If you were to just enter a single waypoint into the TO column, you'd see DIRECT automatically appear in the VIA column, letting you know that there is no VIA routing, just a direct line from the previous TO column waypoint. The PMDG NGX RTE page functionality almost exactly mirrors the real life one. You can actually enter just about anything into the VIA column including typing in the names of SIDs, STARs, waypoint intersections and approaches as well as airways and it will take them. So let's enter the waypoints and STAR for this flight.

As outlined earlier, the flight plan for this tutorial is: JCT7.EWM.BXK.TNP.BASET3. Removing the SID and STAR we have remaining intermediate waypoints: EWM.BXK.TNP.

Enter waypoints beyond JCT (EWM, BXK, TNP) into the scratchpad line selecting them separately into LSK 2R (Figure 17).

Next we enter our SID (JCT7). Begin by pressing the DEP/ARR button. Next press the <DEP at LSK 1L. There four CDU pages of KIAH DEPARTURES to choose from. Begin by pressing LSK 3R to select the departure runway, then press NEXT PAGE to select the JCT7 departure at LSK 3L (Figure 18).

Figure 17

Figure 18

5. STAR and Approach Entry

Now press the DEP/ARR key again and select LSK 2R to display the first of seven KLAX arrivals. Our planned STAR (BASET3) happens to be the first on the list. Press LSK 1L. This will display the BASET3 STAR on the KLAX ARRIVALS page (Figure 19). In the left column below the BASET3 arrival are listed a number of transition points. If you look at the BASET3 ARRIVAL chart, you will see the TWENTYNINE PALMS VOR (TNP) as the transition point for the BASET3 ARRIVAL. Select TNP using LSK 4L (Figure 19).

We will not be selecting an approach into KLAX until we get closer to our destination.

Figure 19

6. Route Activation

Press the RTE key on the CDU keypad (Figure 19) to return to the RTE pages, followed by NEXT PAGE to display the second of three RTE pages currently in the FMC.

At this point we would normally activate the route in the FMC by pressing LSK 6R next to the ACTIVATE> prompt, followed by the EXEC button (Figure 20).

However, you will notice that a ROUTE DISCONTINUITY message has appeared on the screen. This is a common error when programming departures and arrivals; but it is quick and easy to fix, as shown below.

Figure 20

How to fix a ROUTE DISCONTINUITY error

1. Press the LEGS button on the CDU keypad.

2. Press the NEXT PAGE button until you locate the blank section in the route. In this case it is located on page 2 at LSK 2L (Figure 21).

3. Type the code for the following waypoint (in this case EWM) into the scratchpad.

4. Line select EWM to LSK 2L. You will see the error message disappear and the route becomes complete.

Now you can activate the route by selecting ACTIVATE> at LSK 6R, then press the EXEC key on the CDU keypad (Figure 20).
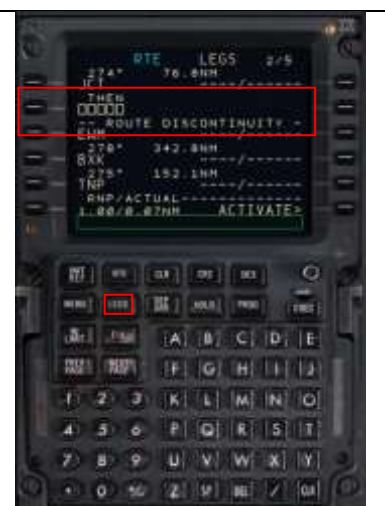

Figure 21

Performance Data and Vertical Path Initialisation

We now begin programming the FMC for the pre-flight procedure. If the CDU is not currently displayed, press Shift-3 again. Press MENU on the CDU keypad then <FMC at LSK 1L. Display the PERF REF page by pressing INIT REF button on the keypad. The CDU should now look like Figure 22.

The PERF INIT page is where the FMC is told what the aircraft's weights are and where parameters that affect the performance and vertical path are established. This is also where the flight's cruise altitude is set.

A short cut on the PERF INIT page that doesn't exist in the real FMC to assist in entering weights has been built into this system.

Figure 22

Fuel Weights
Click LSK 3L next to the empty Zero Fuel Weight (ZFW) field. Something close to 122.7 should appear in the scratchpad. Click LSK3L again to enter it into the ZFW field. Notice that the gross weight (GW) is automatically calculated and entered at LSK 1L.

Enter a reserve fuel figure of 2.6 (2600lbs) in the scratchpad and line select it to RESERVES at LSK 4L. If the aircraft starts using this fuel a message will appear on the scratchpad saying USING RSV FUEL. If the destination fuel is predicted to be below 2000lbs, regardless of reserves, an INSUFFICINT FUEL message appears.

Cost Index
Cost Index is a measure of how much the FMC values fuel economy vs the overall speed of the flight. The valid range is 0 to 500. 25 is a common real worl value. For this tutorial we will set it at 20. Type 20 into the scratchpad and line select it to LSK 5L.

Figure 23

Cruise level
Next enter the cruise altitude for the flight (FL360) by typing 360 into the scratchpad and line selecting it to LSK 1R.

The CDU should now appear as in Figure 23.

Press the EXEC button to execute the performance data initialisation.

N1 Limit and Takeoff Reference Data Setup

Next set the engine thrust rating for takeoff and climb.

Press the N1 LIMIT button to go to the N1 LIMIT page.
Press LSK 4L to select the TO-2 fixed derate mode.
Type 40 (°C) into the scratchpad and line select it to LSK 1L.

The completed N1 REF Page should now look like as shown in Figure 24.

The TAKEOFF REF page contains several required entries for calculating the aircraft's performance during takeoff. Press LSK 6R to go to the TAKEOFF REF page.

Enter 5 and line select it into the LSK 1L FLAPS field.
Click LSK 3L. It will place the current CG value into the scratch pad. Line select that back into LSK 3L. This will provide the calculated trim takeoff setting (6.35).

Figure 24

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For flight simulation use only

Programming the PMDG 737 NGX FMC
Quick Start Guide

Procedure	Actions required	LSK & Keypad Presses
Load CDU	Load a 2D popup of the CDU……………………………..	Shift-3

Fuel and Payload		
Fuel Entry	Select FS ACTIONS page……………………………………	FS ACTIONS> [LSK 5R]
	Select FUEL page………………………………………………	<FUEL [LSK 1L]
	SET FULL>, or……………………………………………………..	LSK 3R, or
	SET 2/3>, or………………………………………………………	LSK 4R, or
	SET 1/3>, or………………………………………………………	LSK 5R
	Or	**Or**
	Set by scratchpad entry……………………………………	LSK L2 TANK 1
		LSK 3L TANK 2
		LSK L4 CENTRE TANK
Payload – Passengers Entry	Return to root FS ACTIONS page………………………	<RETURN [LSK 6L]
	Select PAYLOAD page……………………………………….	<PAYLOAD [LSK 2L]
	Enter passenger payload…………………………………	SET FULL> [LSK 4R], or
		SET EMPTY> LSK 5R], or
		SET RANDOM> [LSK 6R]
	Or	**Or**
	Set by scratchpad entry……………………………………	FIRST CLASS> {LSK 1L]
		COACH> [LSK 2L]
Payload – Cargo Entry	Return to root FS ACTIONS page………………………	<RETURN [LSK 6L]
	Open PAYLOAD page…………………………………………	<PAYLOAD [LSK 2L]
	Enter cargo weight……………………………………………	SET FULL> [LSK 4R]
		SET EMPTY> [LSK 5R]
		SET RANDOM> [LSK 6R]
	Or	**Or**
	Set by scratchpad entry……………………………………	AFT CARGO[LSK 5L]
		FWD CARGO [LSK 4L]

Route Setup		
Position Initialisation Entry	Go to the root menu……………………………………………..	MENU button
	Select POS INIT page………………………………………………	<FMC [LSK 1L]
	Select POS IDENT page……………………………………………	POS INT> [LSK 6R]
	Type origin <airport> into scratchpad and line select to………………………………………………………………..	REF AIRPORT [LSK 2L]
Airport Entry	Select RTE page……………………………………………….	RTE button
	Line select the departure <airport> already in the scratchpad to………………………………………………..	ORIGIN [LSK 1L]
	Type destination <airport> into scratchpad and line select to………………………………………………	DEST [LSK 1R]
	Type <flight number> into scratchpad and line select to………………………………………………………………..	FLT NO. [LSK 2R]
Departure Entry	Select DEP ARR INDEX page…………………………………	DEP ARR button
	Go back to <airport> DEPARTURES page…………	<DEP [LSK 1L]
	Select departure <runway>……………………………	Right LSKs
	Select required <SID>………………………………………	Left LSKs
	(Use NEXT PAGE if required)	
Route Entry	Select the RTE page……………………………………………	ROUTE> [LSK 6R]
	Press NEXT PAGE button	
	Enter intermediate <waypoints>……………………..	Right LSKs
	Enter the <SID>……………………………………………..	DEP/ARR button
	Press <DEP………………………………………………………	<DEP [LSK 1L]
	Select departure runway…………………………………	<runway> [LSK 3R]
	Select <SID Departure>…………………………………..	NEXT PAGE button
STAR and Approach Entry	Display ARRIVAL STARs……………………………………..	DEP/ARR button
		ARR> [LSK 2R]
	Select planned STAR……………………………………..	A LSK
	Select planned transition <waypoint>……………	A LSK (below STAR)
Route Activation	Select RTE page…………………………………………………	ROUTE button
	Select RTE page 2…………………………………………….	NEXT PAGE
	Activate route………………………………………………….	ACTIVATE> [LSK 6R]
	Execute……………………………………………………………	EXEC key
Route Discontinuity Fix (if required)	Press LEGS button.	
	Press NEXT PAGE to search error line.	
	Enter next waypoint via scratchpad.	
	Line select to error line.	
	Activate route……………………………………………………	ACTIVATE> [LSK 6R]
		EXEC key

Performance Data and Vertical Path Initialisation		
Open CDU and display PERF REF page	Open CDU………………………………………….	Keyboard Shift-3 MENU button
	Display PERF REF page……………………………………	<FMC [LSK 1L] INIT REF button
Fuel Weight Entry	Determine ZFW……………………………………… (A figure will appear in the scratchpad)	>ZFW
	Enter ZFW by line selection to…………………………	>ZFW [LSK 3L]
	Enter RESERVE by line selecting <2.6> to………	>RESERVES [LSK 4L]
Cost Index Entry (usually 25)	Enter COST INDEX by line selection to……………	>COST INDEX [LSK 5L]
Cruise Altitude Entry	Enter <cruise altitude> by line selection to……	CRZ ALT [LSK 1R]
Execute	Execute PERF INT data……………………………………..	EXEC button

N1 Limit & Takeoff Data Setup		
Set N1 limit	Open N1 LIMIT page……………………………………..	LSK 4L
	Set TO-2 fixed derate mode……………………………	LSK 4L
	Type 40 (temperature) into scratchpad, line select to…………………………………………………………….	LSK 1L
Set Takeoff reference	Open TAKEOFF REF page……………………………………	LSK 6R
	Enter 5 (flaps 5) into scratchpad and line select to…………………………………………………………….	LSK 1L
	Obtain current CG……………………………………	LSK 3L
	Enter CG value in scratchpad and line select to…………………………………………………………….	LSK 3L
	This will provide takeoff trim setting.	