

F3400 Series: Low-Level and Limited DES Encryption

Introduction

The following procedures describe how to program 15-bit NXDN or limited DES (four keys maximum) encryption built into the F3400/F5400 Series digital radios as a standard option. While the F3400/5400 series radios offer DES (more than four keys) or AES encryption using additional accessories, this document describes how to program 15-bit or limited DES encryption only.

Note: High and Low Level encryption are for digital operation only.

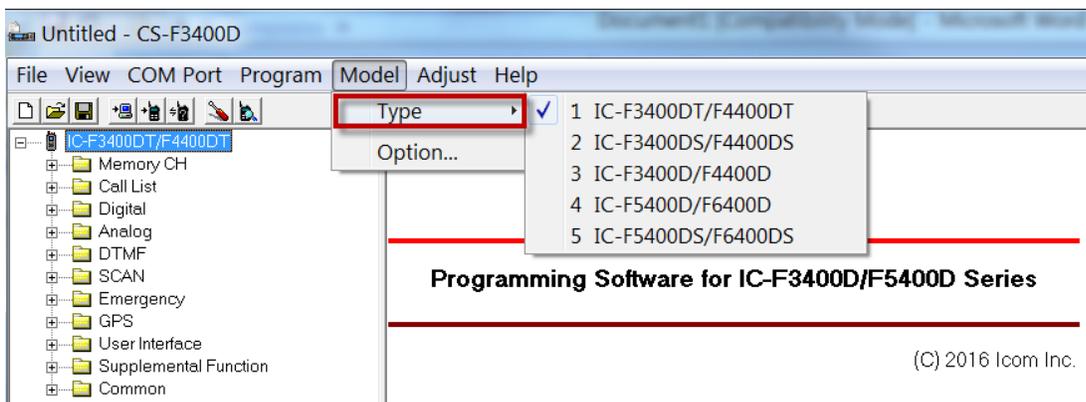
Prerequisites

- Radio connected to the computer with a cloning cable. USB A to micro B type, with matching driver or OPC-1862 (portables) or OPC- 2363 (Mobiles) with matching drivers
- For NXDN 15-bit programming:
 - All F3400/F5400 series fleets: Use CAI 1.3
 - Mixed fleets of F3400/F5400 and others: Use CAI 1.2
- Firmware and Software are updated to the latest version
- Windows® 7, 8.1, or 10 (32/64bit) operating system

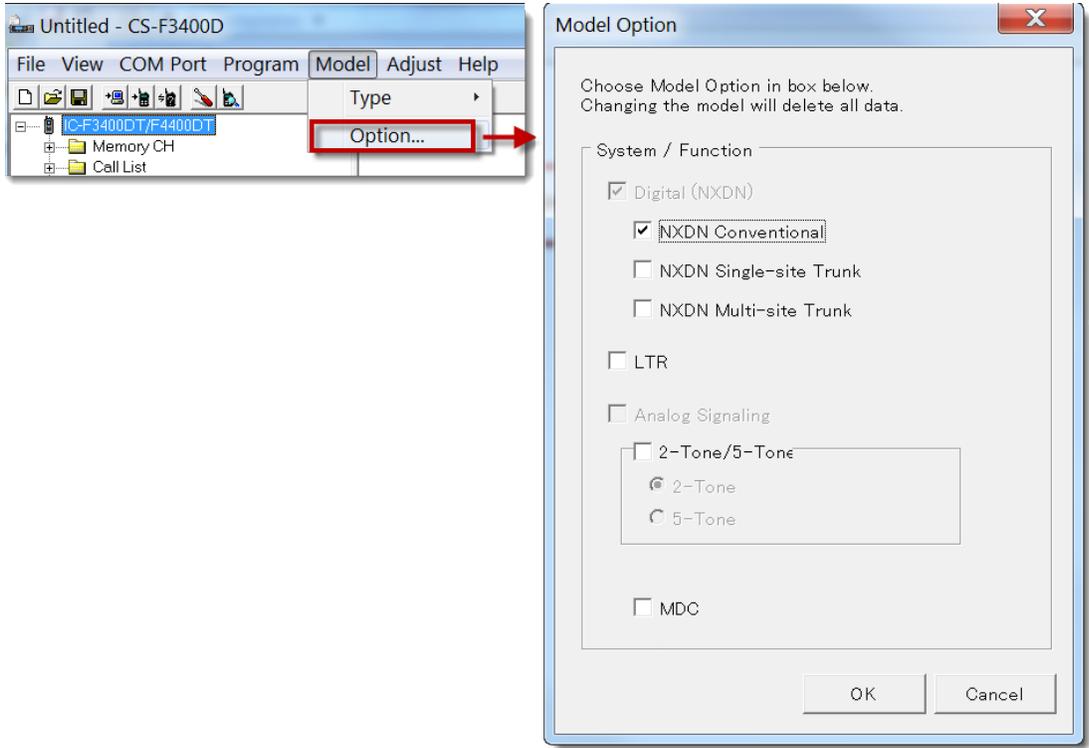
Programming

The following procedures describe programming for both low level (15-bit) and limited high level (4-key DES) encryption.

Preliminary Programming



1. Click **Model** -> **Type** and select your model radio.
2. Click **Model** -> **Option** and select your digital features in the **Model Option** window.



Zone Operation Window

Zone Operation (3984 Remaining)					
Zone	Text	Zone Type	Unit ID Type	Unit ID	Squelch Type
1	Zone 1	Conventional	Own	1	RAN

3. Select a **Zone Type** (Conventional in this example).
4. Select a **Squelch Type** of RAN or SEL as per application requirements.

Zone 1

Zone 1: Zone 1 (3984 Remaining)											
					Frequency (MHz)			C.Tone		RAN	
CH	Atr	Inh	Text	CH Type	RX	TX	TX Inh	RX	TX	RX	TX
1- 1	AB			Digital	454.000000	<-		--	--	1	<-
1- 2											

5. Go to **CH Type** and select **Digital**.
6. Enter an applicable **Frequency**.
7. Enter an applicable **RAN** number.

Low Level Encryption Programming (15-bit NXDN scrambling)

Zone 1 (continued)

Scrambler/Encryption				
Message Linking	Auto Reset	ON/OFF	Encryption Mode	Encryption Key List No.
OFF	Tim-B	ON	Low Level	1
		OFF		
		ON		
		Inh : Inhibit		

1. Go to **ON/OFF** and set to **ON**. Encryption will be active by default. You can turn it off with a **Scrambler/Encryption** key. If set to **OFF**, encryption will be off by default. A **Scrambler/Encryption** key will be required to activate it on a channel by channel basis.
2. Set **Encryption Mode** to **Low Level** (NXDN 15-bit).
3. Set **Encryption Key List No.** to **1**. This number points to line No 1 in **Low Level Encryption Key List** in the following steps. Note: Ignore the yellow warning icon if present.
4. Go to **Digital > Encryption > Low Level Encryption**.

Low Level Encryption Key List		
No.	Key ID (Dec)	Encryption Key (Dec)
1	5,25542	
2		
3		
4		
5		
6		
7		
8		

5. At **Key ID (Dec)**, enter the Key ID (1-63). All radios must have the same Key ID if they are all using this encryption code on Line 1.
6. At **Encryption Key (Dec)**, enter the Encryption Key. It can be any number from 0 to 32767, as long as all radios match.
7. Write the file into your radio.

Operation

- If all radios are set to the same encryption code they will decode each other correctly.
- If you want to turn encryption on or off for each channel, a Scrambler/Encryption key needs to be programmed into the radio (**Menu > Channel Scan > Scrambler > Encryption**).
- If one radio is operating with encryption, other NON-encrypted radios will hear no audio when receiving that signal.

NXDN 15-Bit Encryption Compatibility with older Icom radios

The F3400/F5400 series radios use the **CAI v1.3** protocol for encryption. Older Icom radios use CAI v1.2. As a result, the F3400/F5400 Series will not be compatible with encryption when used with older series of radios such as the F4261 and F4161 unless this setting is changed to v1.2.

1. Go to **Digital > Expert**.

Digital/Expert Window

The screenshot shows two windows from the Icom software. The left window is titled "Digital - Expert" and displays various settings for the IC-F3400DT/F4400DT radio. The right window is titled "Low Level Encryption Key List" and shows a table of encryption keys.

Digital - Expert	
Delayed Header	
Delayed Header	0
Delayed Header Off Timer (Sec)	0.000
Send along with Voice Communication	Disable
Timer & Counter	
Ack TX Delay (Sec)	0.100
Ack RX Wait (Sec)	0.800
Attempt No.	5
Power Down (Sec)	0.320
Detect Lag Timer (Sec)	0.200
RAN Decode Compare	1
RAN Decode Delay Count	2
Handshake Timer (Sec)	0.600
Wait Timer for Network Delay (Sec)	1.800
Random Registration Slot	16
Compatibility Mode	
Stationary Detection	CAI v1.3
Motion Detection	CAI v1.3
Lone Worker	CAI v1.3
Low Level Encryption	CAI v1.2

Low Level Encryption Key List		
No.	Key ID (Dec)	Encryption Key (Dec)
1	---	---
2	---	---
3	---	---
4	---	---
5	---	---
6	---	---
7	---	---
8	---	---

2. At **Low Level Encryption**, change the setting to **CAI v1.2**.

Note that the key ID setting is now grayed out in the software (following window) and is not required for encryption between new and older radio models.

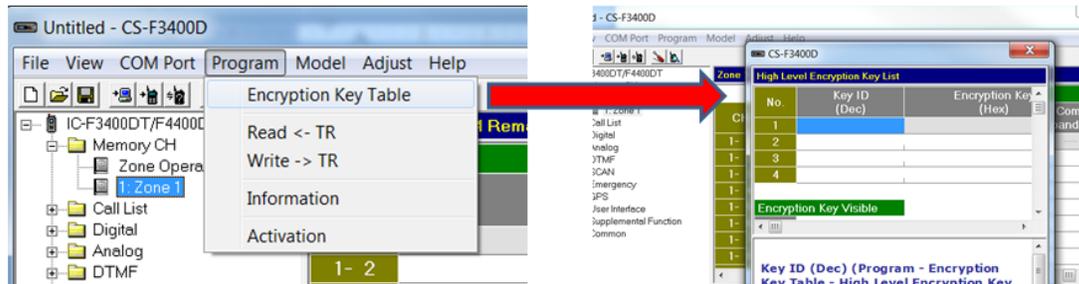
Limited DES Encryption: DES Programming (using CS-F3400 software – 4 DES Keys Only)

Note: Not available in legacy radios.

- Go to **Zone 1 > ON/OFF** and set to **ON** (encryption will be active by default. Can turn off with key). If set to **OFF**, encryption will be off by default. A scrambler Encryption key will be required to activate it on a channel by channel basis.

Scrambler/Encryption				
Message Linking	Auto Reset	ON/OFF	Encryption Mode	Encryption Key List No.
OFF	Tim-B	ON	High Level	1
		OFF		
		ON		
		Inh : Inhibit		

- Set **Encryption Mode** to **High Level** for DES.
- Set **Encryption Key List No.** to **1**. This number points to line No 1 in **High Level Encryption Key List** (found at **Program > Encryption Key Table**).



- Go to **High Level Encryption Key List**.

High Level Encryption Key List		
No.	Key ID (Dec)	Encryption Key (Hex)
1	50120406180838586	
2		
3		
4		

Encryption Key Visible
Visible Disable

01 02 04 07 08 0B 0D 0E 10 13 15 16 19 1A 1C 1F
20 23 25 26 29 2A 2C 2F 31 32 34 37 38 3B 3D 3E
40 43 45 46 49 4A 4C 4F 51 52 54 57 58 5B 5D 5E
61 62 64 67 68 6B 6D 6E 70 73 75 76 79 7A 7C 7F
80 83 85 86 89 8A 8C 8F 91 92 94 97 97 9B 9D 9E
A1 A2 A4 A7 A8 AB AD AE B0 B3 B5 B6 B9 BA BC BF
C1 C2 C4 C7 C8 CB CD CE D0 D3 D5 D6 D9 DA DC DF
E0 E3 E5 E6 E9 EA EC EF F1 F2 F4 F7 F8 FB FD FE

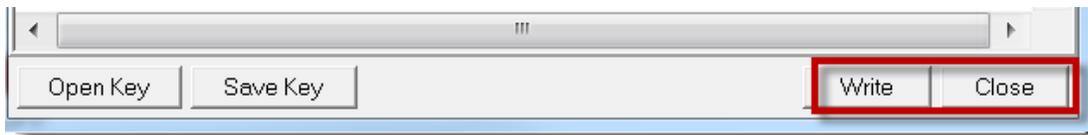
- At **Key ID (Dec)**, enter a key ID (1-63).

6. **At Encryption Key (Hex)**, enter an encryption key. The key must 8 ASCII or 16 hexadecimal characters (useable characters listed in the preceding table). An alternative method for creating a key is to select the **Encryption Key** field, right-click, and select **Auto Create**. This will create a random DES key.

Other Settings:

- To make the encryption key visible, set **Visible** to **Enable**. This makes the key visible in the software.
- To save a Key or a list of keys to your PC, click **Save Key**.
- To open a key that was saved previously, click **Open Key**.

7. Once the key has been entered, click **Write** then **Close**.



8. Write the file into your radio.

Operation

- If all radios are set to the same encryption code they will decode each other correctly.
- If it is desired to turn on or off encryption on each channel, a Scrambler/Encryption key needs to be programmed into the radio (Menu -> Channel Scan -> Scrambler -> Encryption).
- If one radio is operating with encryption, other NON-encrypted radios will hear no audio when receiving that signal.