



**FR5000/FR6000 REPEATER
IDAS PROGRAMMING GUIDE**
(Includes Trunking)



Icom America Inc.

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What is Covered in this Guide

This guide provides simplified step by step instructions for programming your FR5000/FR6000 repeater. The programming information covers IDAS 6.25kHz digital programming, including IDAS trunking. It covers repeater operation only, though the repeater can be used as a base station.

IDAS (Icom Digital Advanced System) is a digital and analog land mobile radio system, using the NXDN™ 6.25kHz digital modulation and common air interface protocol.

Before You Start Programming

Check that you have the following:

- CS-FR5000 cloning software, latest version
- Latest firmware loaded in the Radios, Repeaters, and Trunking Controllers (if applicable)
- Repeater power supply
- Cloning cable OPC-1122/U
- UC-FR5000 Trunking Controller Boards (for trunking applications)

Applicable Models

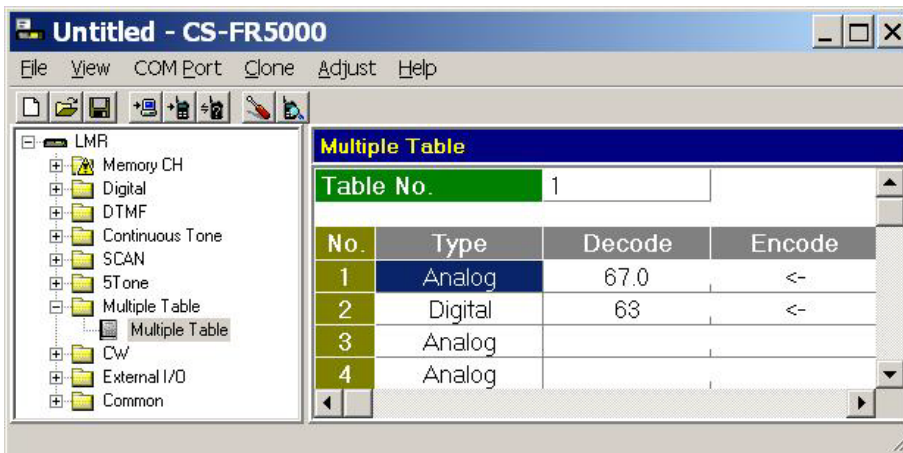
This Guide applies to the FR5000/FR6000 repeaters only.

Programming Tones in Repeater Mode

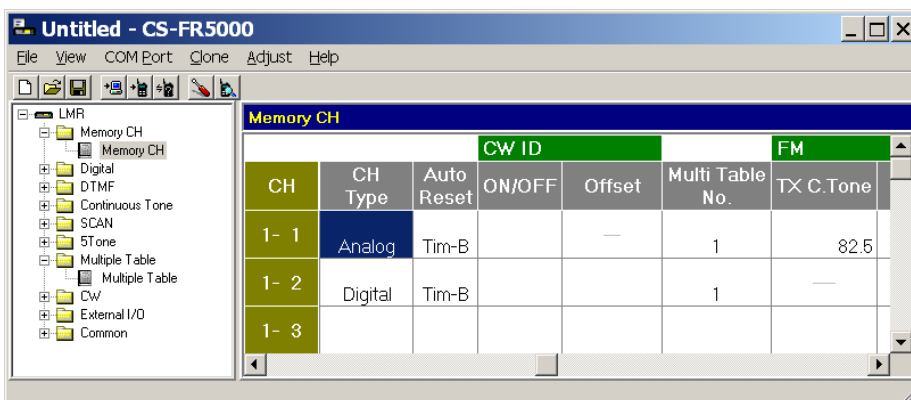
The FR5000/6000 uses standard analog CTCSS tones and DTCS tones. When in digital mode, the repeater uses RAN codes. RAN Codes are digital equivalents to CTCSS tones. The codes are decimal, and range from 0 to 63. If you want squelch open to be able to receive all RANs, enter 0. This code allows all RAN codes to be received and will retransmit using the code that is programmed for transmit in that channel.

When programming tones, the first step is programming tones in the **Multiple Table**. Here you can enter all tones/codes: CTCSS, DTCS, and digital RAN codes. This table allows you to assign up to 16 tone sets to a channel.

1. Navigate to the **Multiple Table**.
2. Enter the number of the table in the **Table No.** field that applies to that particular channel (frequency set).
3. Enter **Digital** or **Analog**, then set the desired tones.



4. Navigate to the Memory CH window.
5. Enter the number of the **Multiple Table** in the **Multi Table No.** field that you want assigned to your channel.



Important: If no tones are entered in the **Multiple Table** field, the radio will respond as described in the following examples.

Analog Channels

The repeater will receive carrier squelch and will transmit no tones. If there is a tone set in the **TX C Tone** field (in the **Memory CH**), the repeater will transmit this tone.



Digital Channels

The repeater will receive *any* RAN code and retransmit that RX code.



Repeater Programming

Analog Repeating

A repeater set for analog receives and transmits on analog only. Program your radio with the following settings. All frequencies need to be entered and the squelch level must be set before programming the following settings.

Common Window

Field	Setting / Description
Others > Digital Function	Set to Enable , for future use of digital channels. Analog operation is possible with this set to either Enable or Disable . When enabled, the Digital window appears.
Hold Timer	Set to desired Hang Time of the repeater

Memory CH Window

Field	Setting / Description
Operation Mode	Set to Repeat .
Frequency (MHz)	Enter the RX and TX frequencies.
Text	Enter the appropriate text for the channel name.
RF PWR	Set the desired power level. Choices are L1 (5W), L2 (25W), and High (50W).
CH Type	Set to Analog .
CW ID > ON/OFF	Set to ON (the CW window contains the timers and ID).
TX C Tone	Set the CTCSS/DTCS tone here. It is active in repeater mode only If Multiple Table is <i>not</i> enabled, tones apply to TX only; RX is open squelch. The front hand mic uses this TX tone. If RX and TX tones are required, use the Multi Table to set the tones.
Multi Table No.	Set to the desired table number. It points to the tone settings in the Multiple Table screen. The repeater will RX and TX for the assigned channel using all the tone sets referenced in this window. Note: if there is no value entered, the radio will RX on any tone and transmit on the tone entered in the TX C. Tone field.

Multiple Table Window

Field	Setting / Description
Table No.	Set to desired number. Can have as many as 16 tables. If you have created more than 1 table, entering a number in this field will bring up the matching table.
Type	Set to Analog .
Decode/Encode	Set to the desired CTCSS tone set. Repeater will operate on all tone sets entered.

Mixed Analog Repeating

A repeater set for mixed analog is capable of receiving both digital and analog signals, and will re-transmit in the format received. The front hand mic will transmit in Analog.

Program your radio with the following settings. All frequencies need to be entered and the squelch level must be set before programming the following settings.

Common Window

Field	Setting / Description
Others > Digital Function	Set to Enable . When enabled, the Digital window appears.
Hold Timer	Set to desired repeater Hang Time.

Memory CH Window

Field	Setting / Description
Operation Mode	Set to Repeat .
Frequency (MHz)	Enter RX and TX frequencies
Text	Enter appropriate text for the channel name.
RF PWR	Set the desired power level. Choices are L1 (5W), L2 (25W), and High (50W).
CH Type	Set to Mixed-Ana . This allows receiving in analog and digital and transmitting the same format as was received.
CW ID > ON/OFF	Set to ON (the CW window contains the timers and ID).
TX C Tone	If the Multiple Table is <i>not</i> enabled, tones apply to TX only; RX is open squelch. The front hand mic uses this TX tone. If RX and TX tones are required, use the Multi Table to set the tones.
Multi Table No.	Set to the desired number. It points to the tone/RAN settings in the Multiple Table screen. The repeater will RX and TX for the assigned channel using the tone/RAN sets referenced in this window. Note: if there is no value entered, the radio will RX on any tone and transmit on the tone entered in the TX C. Tone field or, if set to Digital , will have no RAN for RX or TX.
TX RAN	No function in Mixed Analog Mode.

Multiple Table Window

Field	Setting / Description
Table No.	Set to desired number. Can have as many as 16 tables. If you have created more than 1 table, entering a number in this field will bring up the matching table.
Type	Set to Analog or Digital .
Decode/Encode	Set to the desired CTCSS tone or RAN code set. Note: RAN codes are decimal.

Mixed Digital Repeating

A repeater set for mixed digital is capable of receiving both digital and analog signals, and will transmit in the format received. The front hand mic transmissions will be digital.

Program your radio with the following settings. All frequencies need to be entered and the squelch level must be set before programming the following settings.

Common Window

Field	Setting / Description
Others > Digital Function	Set to Enable . When enabled, the Digital window appears.

Memory CH Window

Field	Setting / Description
Operation Mode	Set to Repeat .
Frequency (MHz)	Enter RX and TX frequencies.
Text	Enter appropriate text for the channel name.
RF PWR	Set the desired power level. Choices are L1 (5W), L2 (25W), and High (50W).
CH Type	Set to Mixed-Digi . This allows receiving in analog and digital and transmitting the same format as was received.
CW ID > ON/OFF	Set to ON (the CW window contains the timers and ID).
TX C Tone	If the Multiple Table is <i>not</i> enabled, tones apply to TX only; RX is open squelch. The front hand mic uses this TX tone. If RX and TX tones are required, use the Multi Table to set the tones.
Multi Table No.	Set to the desired number. It points to the tone/RAN settings in the Multiple Table screen. The repeater will RX and TX for the assigned channel using the tones/RAN's referenced in this window. Note: if there is no value entered, the radio will RX on any tone and transmit on the tone entered in the TX C Tone or, if set to Digital , will have no RAN for TX and RX.
TX RAN	Front mic functionality only. Repeater will TX this RAN from the front mic.

Multiple Table Window

Field	Setting / Description
Table No.	Set to desired number. Can have as many as 16 tables. If you have created more than 1 table, entering a number in this field will bring up the matching table.
Type	Set to Analog or Digital .
Decode/Encode	Set to the desired CTCSS tone or RAN code set. Note: RAN codes are decimal.

Digital Repeating

A repeater set for digital receives and transmits in digital only. Program your radio with the following settings. All frequencies need to be entered and the squelch level must be set before programming the following settings.

Common Window

<i>Field</i>	<i>Setting / Description</i>
Others > Digital Function	Set to Enable . When enabled, the Digital window appears.
Hold Timer	Set to desired Hang Time of the repeater

Memory CH Window

<i>Field</i>	<i>Setting / Description</i>
Operation Mode	Set to Repeat .
Frequency (MHz)	Enter RX and TX frequencies
Text	Enter appropriate text for the channel name.
RF PWR	Set the desired power level. Choices are L1 (5W), L2 (25W), and High (50W).
CH Type	Set to Digital . This allows transmitting in digital and receiving in digital.
CW ID > ON/OFF	Set to ON (the CW window contains the timers and ID).
Multi Table No.	Set to the desired number. It points to the RAN settings in the Multiple Table screen. The repeater will RX and TX for the assigned channel using the RAN codes referenced in this window. Note: if OFF is selected, the repeater will RX and TX any matching digital frequency regardless of the RAN codes.
TX RAN	Front hand mic uses this RAN for transmission.

Multiple Table Window

<i>Field</i>	<i>Setting / Description</i>
Table No.	Set to desired number. Can have as many as 16 tables. If you have created more than 1 table, entering a number in this field will bring up the matching table.
Type	Set to Analog or Digital .
Decode/Encode	Set to the desired RAN code set. Note: RAN codes are decimal.

Trunking Repeater Programming

The following procedure assumes that the squelch has been set.

1. Go to **Memory CH** and enter your frequencies if you have not already done so.
2. In the **Operation Mode** field select **Full-Duplex**.

Memory CH				
				Frequency
CH	Atr	Inh	Operation Mode	RX
1- 1	AB		Full-Duplex	454.000000
1- 2				

3. Go to the **Common** folder and click **Common**. Set **Digital Function** to **Enable**.

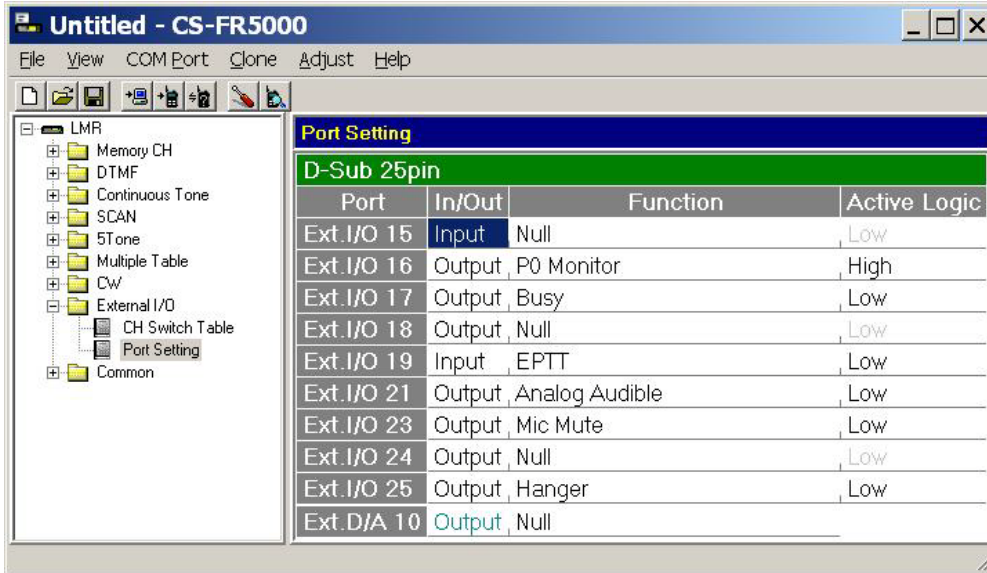
Others	
Beat Cancel	Auto
Wide Band Width	Wide
Front Speaker	ON
Digital Function	Enable

4. Click **Clone** and write the file into the repeater.

Clone	Model	He
Read <- TR		
Write -> TR		
Information		

Using the External I/O Settings

The FR5000/6000 cloning software has an interface that allows you to configure ports on the DB-25 connector for external devices. These settings are in the **External I/O** window. The **Port Settings** window shows the ports; each port represents a pin on the connector. The **CH Switch Table** window allows you to change the pin assignment.



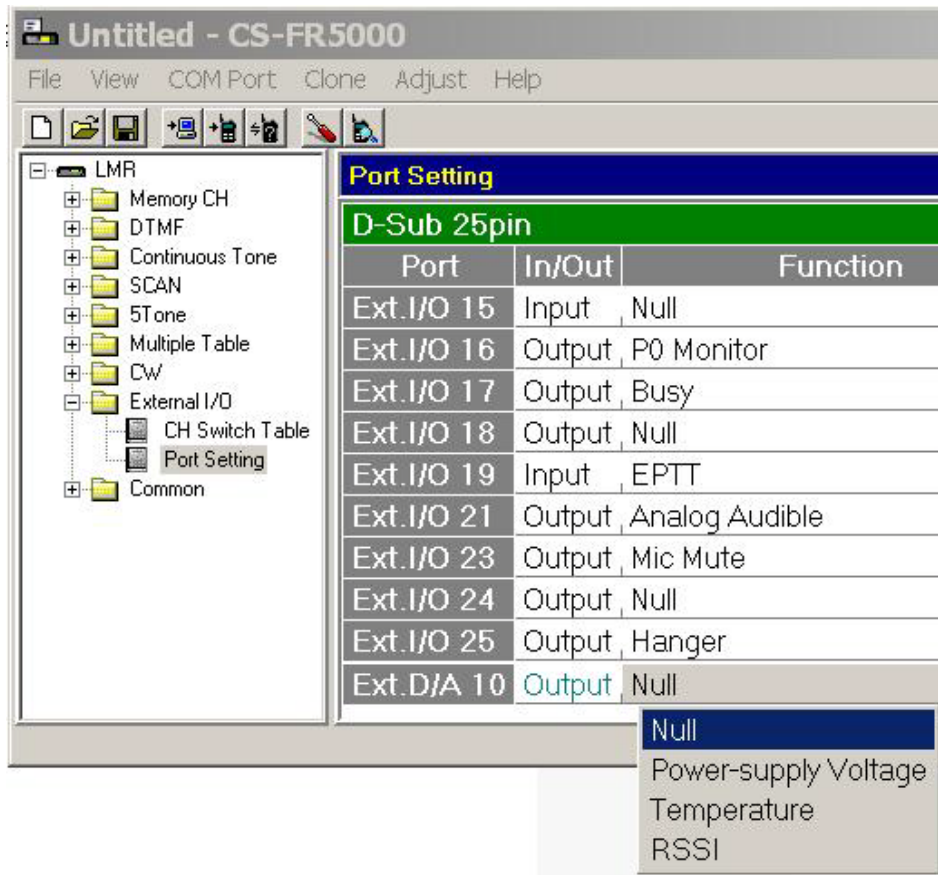
Ports 15 through 25 can be set as input or output; each has its own set of options. Ports 1 through 14 (excluding port 10) are fixed. You also have the option to set the output to be active low or active high.

Port	In/Out	Function	Active
Ext. I/O 15	Input	Null	Low
Ext. I/O 16	Output	Null	
Ext. I/O 17	Output	MCH Select : 1	
Ext. I/O 18	Output	MCH Select : 2	
Ext. I/O 19	Input	MCH Select : 3	
Ext. I/O 21	Output	MCH Select : 4	
Ext. I/O 23	Output	MCH Select : 5	
Ext. I/O 24	Output	EPTT	
Ext. I/O 25	Output	Repeat Disable	
Ext. D/A 10	Output	TX Disable	
		Mic Mute	
		Ext. Key	: Select Key Function

Port	In/Out	Function
Ext. I/O 15	Output	Null
Ext. I/O 16	Output	Null
Ext. I/O 17	Output	Busy
Ext. I/O 18	Output	Analog Audible
Ext. I/O 19	Input	Digital Audible
Ext. I/O 21	Output	Mic Mute
Ext. I/O 23	Output	Hanger
Ext. I/O 24	Output	PTT
Ext. I/O 25	Output	TX
Ext. D/A 10	Output	Low Voltage 1
		Low Voltage 2
		Over Voltage
		Final Protect
		Fan State
		TX Unlock
		RX Unlock
		P0 Monitor
		P1 Monitor
		P2 Monitor
		P3 Monitor
		P4 Monitor

Port 10 allows you to set power output options for pin 10 of the connector. **Power Supply Voltage** simply means that the output pin will reflect the voltage on the power supply. The **Temperature** setting creates an output that varies according to the temperature inside the repeater. Appendix A on page 12 lists the range of temperatures and the corresponding voltages. When using the **RSSI** setting, the repeater varies the output based on the RSSI (Receive Signal Strength Indicator) of the radios in the system.

Note: When a port is set to **Analog Audible** output, be sure to set the **AF Min Level (Set Mode window)** to 1 or more. If this is set to 0, there will be no audible output from the assigned pin.



Program Settings

This section defines all of the enhanced feature settings for your radio. In most cases, the default settings will work best.

Memory CH Window

Field	Description	Suggested Setting
RX RAN	The receive digital code that must match the TX radio RAN before squelch will open. The range is 0 to 63, with 0 representing open squelch.	User preference
TX RAN	The transmit digital code that must match the RX radio RAN before squelch will open. The range is 0 to 63, with 0 allowing a match to any RAN code.	User preference
Unit ID	The unique identification for an individual radio.	User preference
Talkgroup ID	The unique identification for a talkgroup.	User preference
Squelch Type	If set to OFF , there is only carrier squelch. If set to RAN , the digital RAN code must match before a squelch will open. If set to Sel , the RAN and the Unit ID or Talkgroup ID must match before squelch will open.	User preference

Digital/Option Window

Field	Description	Suggested Setting
Talkgroup Display on Mode Change	Enables the Talkgroup ID or Zone to display on the radio when changing the channel or zone.	User preference
Talkgroup Display on Receive	Allows the receiving radio to display the talkgroup of the transmitting radio.	User preference
Unit ID Display on Receive	Allows the receiving radio to display the Unit ID of the transmitting radio.	User preference
Talkgroup Display on PTT	When you select a talkgroup and press PTT, the selected talkgroup ID will show on your radio's display.	User preference

Expert Window

Note: Settings in the Synchronization field are for digital operation only. Use the default settings in these fields.

Field	Description	Suggested Setting
TX All Call	Allows you to transmit an all call if set to Enable . You will also need to set a talkgroup ID of 65535.	
RX All Call	Allows you to receive an all call if set to Enable .	

Appendix A: Temperature/Voltage Output Chart

This table applies when the I/O output of pin 10 is set to **Temperature**. The following temperatures and voltages are based on a maximum output of 5V, and they vary as the internal temperatures of the repeater changes.

Programmed Temperature (in celcius)	Voltage	Programmed Temperature (in celcius)	Voltage
-30	0.464106	37.5	3.924844
-27.5	0.539563	40	4.009059
-25	0.623751	42.5	4.086995
-22.5	0.716946	45	4.158974
-20	0.819274	47.5	4.225337
-17.5	0.930689	50	4.286434
-15	1.050951	52.5	4.342615
-12.5	1.179616	55	4.394226
-10	1.316033	57.5	4.441604
-7.5	1.459351	60	4.485072
-5	1.608537	62.5	4.524937
-2.5	1.76241	65	4.561488
0	1.919673	67.5	4.594997
2.5	2.078965	70	4.625718
5	2.238903	72.5	4.653885
7.5	2.398132	75	4.679716
10	2.555366	77.5	4.703412
12.5	2.70943	80	4.725157
15	2.859282	82.5	4.745119
17.5	3.004038	85	4.763453
20	3.142978	87.5	4.780301
22.5	3.275549	90	4.795792
25	3.40136	92.5	4.810043
27.5	3.520169	95	4.823162
30	3.631867	97.5	4.835246
32.5	3.736462	100	4.846384
35	3.83406		

Appendix B: Checking RSSI Levels

1. Set a DMM to Vdc RMS.
2. Check the level at pin 10 on the repeater after assigning pin 10 to RSSI, as shown in the following.

The screenshot shows a software interface with a tree view on the left and a 'Port Setting' table on the right. The tree view includes folders like 'Memory CH', 'DTMF', 'SCAN', '5Tone', 'Multiple Table', 'CW', 'External I/O', 'CH Switch Table', 'Port Setting', 'Uption', and 'Common'. The 'Port Setting' table is titled 'D-Sub 25pin' and has columns for 'Port', 'In/Out', 'Function', and 'Active Logic'. The 'Ext.D/A 10' port is highlighted in blue and labeled 'RSSI'. A red callout bubble points to this port with the text 'Select RSSI.'

Port	In/Out	Function	Active Logic
Ext.I/O 15	Input	Null	Low
Ext.I/O 16	Output	P0 Monitor	Low
Ext.I/O 17	Output	Busy	Low
Ext.I/O 18	Output	Null	Low
Ext.I/O 19	Input	EPTT	Low
Ext.I/O 21	Output	Analog Audible	Low
Ext.I/O 23	Output	Mic Mute	Low
Ext.I/O 24	Output	Null	Low
Ext.I/O 25	Output	Hanger	Low
Ext.D/A 10	Output	RSSI	Low

Signal Strength uV	Voltage Vdc RMS @ Pin
10	1.544
5	1.416
1	1.089
0.9	1.069
0.8	1.049
0.7	1.009
0.6	0.973
0.5	0.93
0.4	0.891
0.3	0.829
0.2	0.756
0.1	0.679
0.05	0.635

