

DishScan Verification and Alignment Instructions

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Revision History

Revision	ECO No	Description of Change	Date	Approval
C	N/A	Page 5 Sec. 4.0 updated	11/11/05	Nico J
C1	N/A	@ 45° EI Added on Page 5 Sec. 4.0 Step 10.	12/6/05	Nico J
C2	N/A	Corrected page numbers, reduced recommended drive amplitudes	1/30/06	PGB

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1.0 Application

This bulletin outlines the basic tests that can be performed to ensure that all the parameters associated with DishScan tracking are properly set. It also outlines the procedures necessary to make adjustments to the DishScan parameters in the PCU and the ACU if the factory default settings do not produce the desired results.

Adjustment of the PCU parameters is recommended for Sea Tel trained personnel only. The procedures in this bulletin require the DacRemP PC software version 0.16e or later. The PCU software required for xx03 and xx04 pedestals is version 2.21 or greater and for xx96, xx97 or xx00 pedestals is version 1.51 or greater.

2.0 Settings

The settings in the PCU affect the physical DishScan motion which can be monitored with the DishScan XY display of DacRemP. The settings in the ACU affect the tracking response which can be monitored with the DacRemP ADMC display. Although the settings are not super critical, they have a large adjustment range to accommodate a wide combination of antenna sizes and pedestal configurations and so it needs to be verified they are set in the correct range for proper DishScan tracking and satellite signal reception. In most cases the factory default values will produce adequate tracking motion and tracking response so no further adjustment will be necessary.

The parameters in the PCU that affect the physical DishScan motion are: the Servo Gain settings for each axis (3 parameters); the DishScan Amplitude for each axis (3 parameters); and the timing pulse Phase Offset (1 parameter).. The commands for setting and viewing these parameters from the DAC front panel or the serial port are:

n1xxx for setting CL Gain, n1999 for viewing CL Gain
n2xxx for setting LV Gain, n2999 for viewing LV Gain
n3xxx for setting AZ Gain, n3999 for viewing AZ Gain
n7xxx for setting Phase Offset, CL drive, AZ drive, and LV drive
n7999 for viewing the current n7 parameter setting.

The parameters in the ACU that affect the tracking response are the EL STEP SIZE, the AZ STEP SIZE and the STEP INTEGRAL. When the STEP INTEGRAL is set to 0, Conical Scan Tracking (CONSCAN) is enabled and the two Step Size parameters actually become sensitivity settings. Then normal setting for EL STEP SIZE and AZ STEP SIZE when using DishScan tracking is 0. These parameters can be set directly from the DAC front panel or from the serial port with these commands:

Ynnnn* or mGnnn for setting EL STEP SIZE and mG999 for viewing..
Xnnnn* or mHnnn for setting AZ STEP SIZE and mH999 for viewing..
mlnnn for setting STEP INGEGRAL and ml999 for viewing (capitol I).

* The Xnnnn and Ynnnn commands must be sent twice in 2 seconds to take affect. Use the Repeat key in the Comm Diagnostic window to do this easily.

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3.0 DacRemP Operation.

You will need to get the full installation program for DacRemP from the Sea Tel support web site or have a service technician email it to you. Run the installation program and click the Yes or OK buttons when they appear. Connect an ACU serial cable between the system DAC and your PC. Click on the DacRemP icon that the installation places on your desktop to open the program. If the Port Status indicator is yellow or red, select the CommPort toolbar item and then select the Properties menu item from the drop down list. Verify the proper Comm Port is selected for your PC and the proper Baud Rate is selected for your DAC (DAC-97 and DAC-03 are set for 4800 baud and the DAC-2200 is set for 9600 baud). Click on the Port Status indicator to re-open the Comm Port if it is red (Red = port closed, Yellow = no response, Green = good communications).

If you hold your mouse over any button or selection window without clicking on it, the program will give you information about that item or hints on how to use program features. The Comm Diagnostics window that is floating over the program on the right hand side can be used to send serial commands directly to the ACU or the PCU. This tool is very handy to use for DishScan setup especially as it eliminates the need to manually key in difficult command sequences on the DAC front panel. If your PC screen is large enough (1024 x 768 or larger), drag the window to the right of the main program window so it doesn't get hidden every time you click on the main program screen. If you have a small PC screen (800 x 600) you can bring the tool back to the front by selecting it in the Tools menu item list or by simply typing Ctrl-F (Ctrl and F keys simultaneously).

Click the down arrow in the lower right to expand the strip chart graphing tool. If the Port Status indicator is green, you should see a strip chart display of Level (Elevation), Azimuth, of Click on the Graph Mode Selection window and select DishScan XY. Let the program accumulate data points for a few seconds then click the Center All button. A display similar to Figure 1 below should be seen. Note; the colors of the display samples in this document have been altered slightly from the default values to make viewing and printing on white paper more legible.

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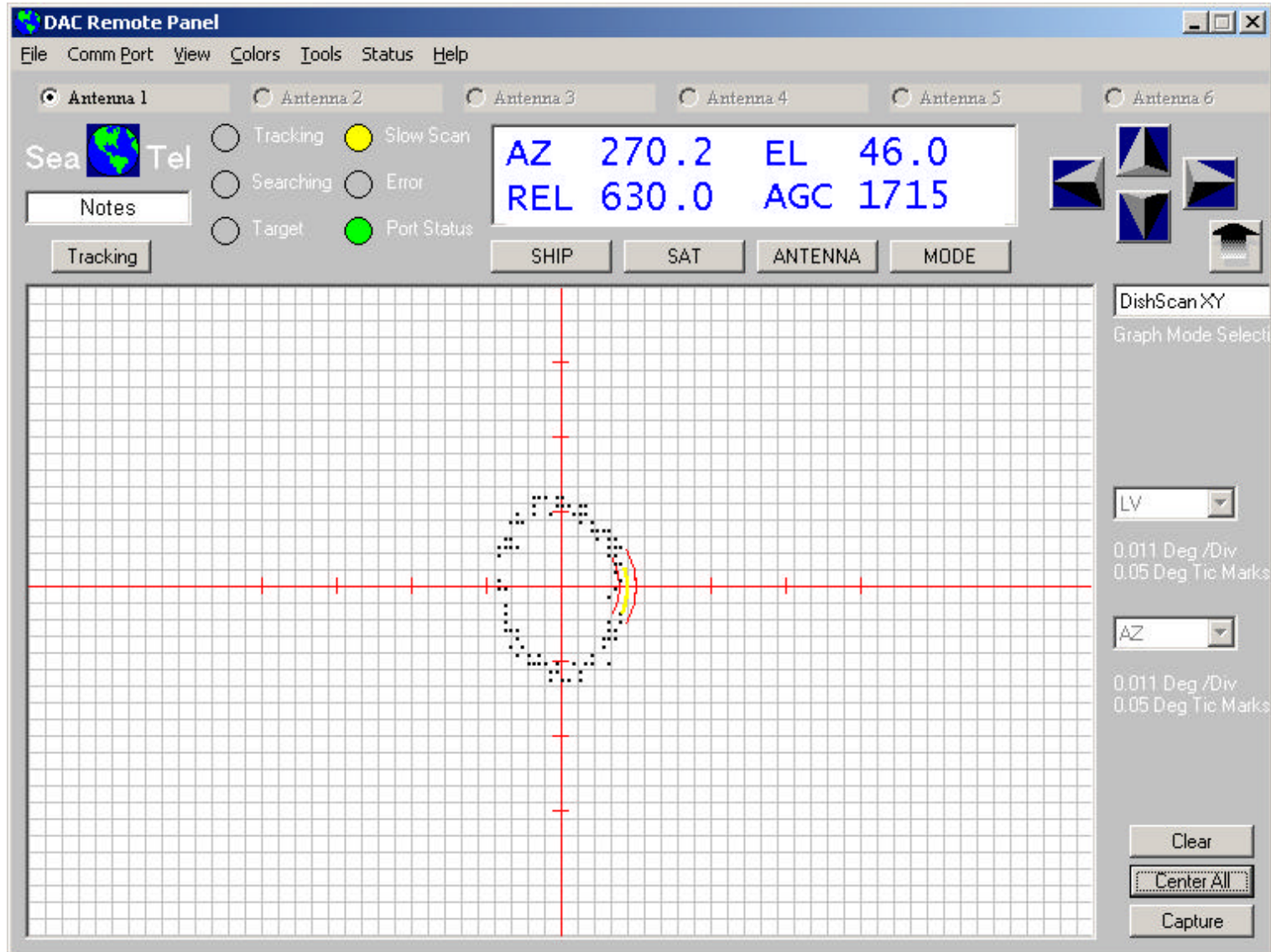


Figure 1
Typical DishScan XY Display

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4.0 Checking Dish Scan Amplitude

1. Target the antenna to 45 degrees. This allows accurate measurement of the Elevation drive for Up/Down motion.
2. Select the DishScan XY display on DacRemP. Press Center All.
3. Observe the size of the white circular dot pattern. Compare the Left/Right and Up/Down excursions to the values in table 1. Larger antennas will require less motion, smaller antenna will require more motion. To illustrate this measurement, the dot pattern in Figure 1 is +/- 3.5 divisions Left to Right (from center) and 4.5 divisions (from center) Up and Down. See table 1 for acceptable Amplitudes.
4. Make special note of the Up/Down DishScan motion here at 45 degrees of Elevation. This will be used as a reference in the next two measurements.
5. Move the antenna to 5 degrees Elevation. This allows an accurate measurement of the Azimuth drive for Left/Right motion.
6. After the antenna settles, Press Clear and let the data collect for a few seconds. Press Center All to reset the circle of dots to the center of the screen. You may notice a slight reduction of the Up/Down pattern size at this extreme elevation position. This is normal and should not be a problem as long as there is still some Up/Down motion remaining.
7. Now Recheck the Left/Right dot pattern size. It should be nearly the same as the size of the Up/Down pattern measured at 45 degrees. If the Left/Right pattern size is different than the Up/Down pattern size at 45 degrees by more than 2:1 then either the Azimuth Gain or the Azimuth DishScan Drive will need to be adjusted.
8. Move the antenna to 80 degrees Elevation. This allows an accurate measurement of the Cross Level drive for Left/Right motion.
9. After the antenna settles, Press Clear and let the data collect for a few seconds. Press Center All to reset the circle of dots to the center of the screen. Again, you may notice a slight reduction of the Up/Down pattern size at this extreme elevation position.
10. Recheck the Left/Right dot pattern size. If it is different than the Up/Down pattern @ 45° El by more than 2:1 then the Cross Level Gain or the Cross Level DishScan Drive will need to be adjusted.

On the following page is a table of typical DishScan amplitudes for common dish sizes and operating bands. There are also some examples of the DishScan drive and the pedestal gain parameters that are set improperly and the effects you might observe on the DishScan XY display.

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Table 1 DishScan Amplitude

Antenna	Minimum Scan Amplitude	Maximum Scan Amplitude
3.7 Meter C band	+/- 1 divisions	+/- 3 divisions
2.5 Meter C band	+/- 3 divisions	+/- 6 divisions
2 Meter Ku band	+/- 1 divisions	+/- 3 divisions
1 Meter Ku band	+/- 3 divisions	+/- 6 divisions

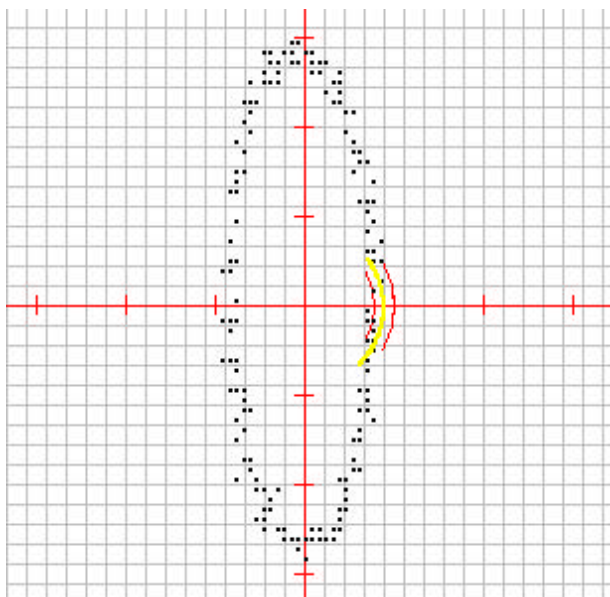


Figure 2

Up / Down drive too high or
Left / Right gain too high

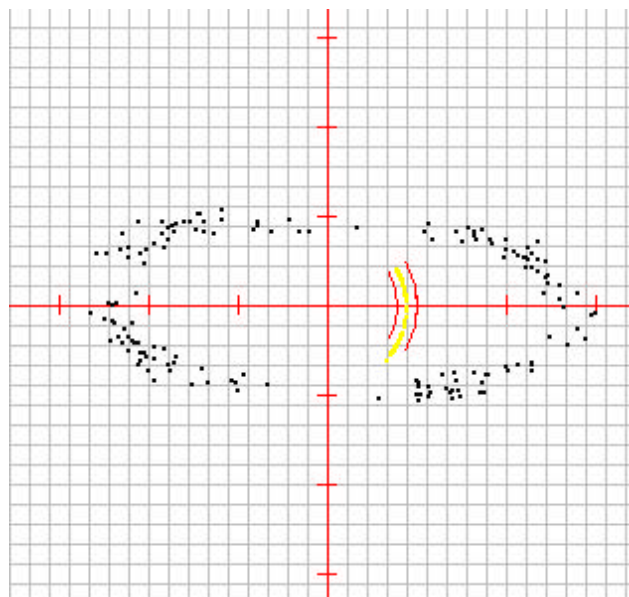


Figure 3

Left / Right drive too high or
Up / Down gain too high

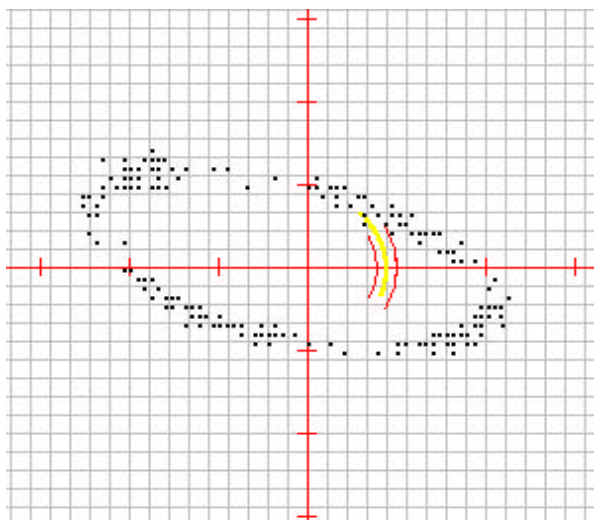


Figure 4

Left/Right gain too low

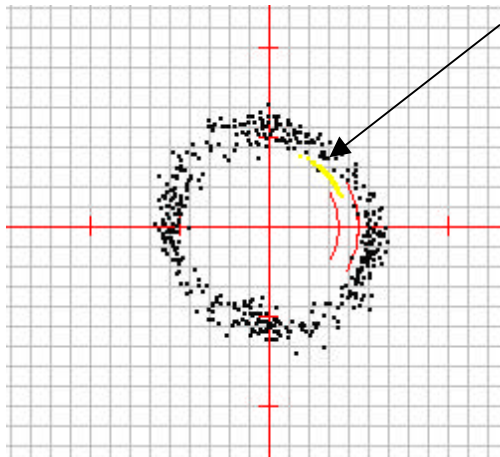
Notice the circle is squashed into an ellipse along a 45 degree line. This shape is caused by a difference in the servo response time between the Up / Down axis and the Left / Right axis. This can only be caused by an improper gain setting in one of the axes.

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5.0 Checking the Dish Scan Phase.

The Dish Scan phase is affected by antenna weight and size. The larger the antenna, the slower it moves and the more phase lag there is between the drive signal and the resulting physical motion of the dish. The Conscan tracking demodulator in the DAC needs to know fairly accurately what position the antenna is in to properly determine what direction to move the antenna to correct any pointing errors that the scanning motion picks up. The timing of the DishScan reference pulses relative to the actual position of the dish is adjusted with the Phase Offset parameter and can very easily be checked with the DishScan XY phase display.

1. Select the DishScan XY display in DacRemP.
2. Target the antenna to 45 degrees elevation. Wait for the antenna to settle for a few seconds.
3. Press Clear to start a new data collection. Let the data collect for 15 to 20 seconds and press Center All to center the circle of position dots on the graph. This will also bring up the phase display reference arcs and a series of yellow phase dots.
4. Verify the majority of the phase dots are contained within the two red phase reference arcs and that the center of yellow phase dot collection is also within the center of the reference arcs.
5. If the average position of the phase dots is outside the reference arcs as shown in the figure below, then the phase parameter will need to be adjusted.



Average position of yellow phase dots is outside the phase reference arcs.

Figure 5

Small dish with Phase offset set too high

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6.0 Making DishScan Parameter Adjustments.

This procedure is recommended ONLY for Sea Tel trained personnel familiar with making PCU parameter adjustments. Improperly set PCU parameters will cause improper system operation and may result in damage to the antenna system.

There are three factors to observe when making DishScan adjustments. The first is that the servo gain settings will affect both the amplitude and phase displays on DacRemP. Second, DishScan drive will only affect the amplitude display and third, DishScan phase will only affect the phase display. It is therefore very important to follow this sequence when making any adjustments to the DishScan n7 parameter.

1. Verify that all 3 servo gain settings are correct.
2. Set the DishScan drive to obtain the desired motion amplitude.
3. Set the DishScan phase offset to show the correct pulse timing.

6.1. Servo Gain settings

To verify the servo gain settings, first recall the current settings using the Comm Diagnostics window in DacRemP. Type in **n1999 [Enter]**, **n2999 [Enter]** and **n3999 [Enter]** in the Command text box. The Response text box will show 4 digits and a * for each entry in the Command text box. Record the settings below.

n1999 _____ **n2999** _____ **n3999** _____

Increase the gain settings of each channel, one at a time by 100 percent. Example: if the response to n1999 was 0020* i.e. channel 1 gain is set to 20, then set the channel 1 gain to 40 by sending an **n1040 [Enter]** command. Verify that the servo loop is stable and not oscillating. If you cannot observe the antenna physically, turn DishScan off by pressing the DishScan Tg button on the Comm Diagnostics window and observe the resulting dot pattern on the DishScan XY display. The dish is stable if the dots remain within a 1 to 2 division square block. Oscillation will show up as several divisions of motion. Increase the gain setting by another 50 percent and verify that oscillation occurs. Reduce the gain slowly until the oscillation dies away on its own. This is the maximum stable gain setting and should be close to double the original gain setting. Record the maximum stable gains for each axis

n1999 _____ **n2999** _____ **n3999** _____

The correct servo gain setting is 50 percent or 1/2 of the maximum stable gain value recorded above. If the original or default gain setting was close to this value, then leave the gain setting unchanged. If a change is required to the gain setting, be sure to save the parameters in the PCU NVRAM or they will be lost when the antenna is power cycled. You may use the Save Remote key on the Comm Diagnostics window to easily update the PCU NVRAM. Be sure to verify the PCU responds with ||> in the Response window to verify it received the command. Repeat the key press if necessary.

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6.2. DishScan Phase and Drive settings

There are 4 phase settings for the system phase timing and 4 drive levels available for each of the three pedestal axes. Each of these individual choices are combined into one parameter setting referred to as the n7 parameter. To make all possible combinations of drive levels and phase settings possible, the parameter choices are “packed” using a binary coding method similar to that used for many other PCU and DAC parameters. To determine the n7 parameter value, you must refer to a table of options that gives you a code value associated with each option selection. After making the parameter selections and looking up the associated codes, you simply add up the individual codes to determine the final “code” value used to program the PCU.

Table 2 shows all 4 DishScan PCU parameters and the 4 option choices for each of those parameters. The best way to show the parameter setting process is by example.

The first Example is a small antenna with size 23 motors in Elevation and Cross level and a double stack size 23 motor in azimuth (4003 for example). Small antennas will follow the DishScan drive signal with little to no lag and in most cases will actually lead the drive signal. This means the phase correction will either be set to 0 (for no lag compensation) or to –45 degrees (to correct for a slight lead). The antenna is very light so the minimum DishScan drive will be required. Since the Azimuth motor is twice as powerful as the Elevation and Cross Level motors, the DishScan drives for these two motors will need to be increased to keep the physical motion of the dish balanced. Using the table below, a phase setting of –45 degrees gives a selection value of 0. A minimum Azimuth drive setting gives a selection value of 12. Increasing the CL and EL drives by 2 gives code values of 32 and 2 respectively.

This would give an n7 parameter setting of $0 + 0 + 12 + 32 + 2 = 46$.

The second Example is a large antenna with size 34 motors and –1 servo amplifiers in all 3 axes. A large antenna (9797 or larger) will always lag behind the drive signal by 90 degrees. The large inertia of these antennas causes the servo loops to respond much slower relative to the short time period of the DishScan motion. The large inertial of these antennas also means that the maximum drive available will be required to produce adequate DishScan motion. Using the table below, a phase setting of +90 degrees to compensate for the 90 degree lag of the large antenna give a selection value of 192. The codes for maximum available drive in all 3 axes is 0 so the n7 parameter setting is $192 + 0 + 0 + 0 = 192$. If the pedestal has a –2 servo amplifier (2x the output drive) in the azimuth axis only, which many dual band or dual redundant Tx/Rx systems were equipped with, then the DishScan drive for Azimuth will need to be decreased by a factor of 2 to keep the DishScan motion balanced and produce a nice circular pattern on the DishScan XY display in DacRemP. Using the table below, the code for a 2x reduction in azimuth drive from the maximum available is 4.

This would give an n7 parameter setting of $192 + 0 + 4 + 0 = 196$.

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Table 2 DishScan Phase and Drive Settings

Phase	Value	Cl Drive	Value	Az Drive	Value	El Drive	Value	Total
-45 deg	0	8 x	0	8 x	0	8 x	0	
+0 deg	64	4 x	16	4 x	4	4 x	1	
+45 deg	128	2 x	32	2 x	8	2 x	2	
+90 deg	192	Min	48	Min	12	Min	3	
Selection	N		N		N		N	= NN

Example 1

Selection	0	+ 32	+ 12	+ 2	= 46
Total	↑				

Example 2

Selection	192	+ 0	+ 0	+ 0	= 192
Total	↑				

DacRemP version 0.17 will include a helpful tool to automatically encode and decode n7 parameter values. The tool will allow you to enter an existing code and show you what the 4 parameter setting are. It will then let you change any parameter and show you the new n7 code. The tool is laid out just like the table above so no further instructions should be required. Just pick the setting you want to change, move the option selection up or down and see the resulting change. Here is what this tool will look like.

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7.0 Checking the Tracking Response