DIAGNOSTIC ROUTINES FOR THE YAMAHA DX7

IT'S ALWAYS EXCITING when a radical new instrument is introduced, and the DX series digital synthesizers from Yamaha are no exception. One interesting aspect of these instruments, which owners may not know about since it is not documented in the owner's manual, is a built-in test program which allows the technician to trouble-shoot the instrument before even opening it up. This test routine is part of the system program contained in the instrument's software, and is accessed and operated with switches and controls on the front panel.

To enter the test routine on the DX7, push and hold the function switch. While keeping it depressed, push the green #16 voice switch and keep it down. While holding these two switches, push the green #32 voice switch and then release all three. At this time the LCD display will say "TEST MODE ENTRY — ARE YOU SURE?" Push the +1/yes switch, and the program will advance to the first test. During this test, the DX7 will output a fairly accurate 440Hz sine wave. This test is mainly used to check for failures in the circuits following the envelope generators and operators. The volume control and footpedal volume should operate smoothly, and with volumes wide open the output level should be -10dB.

Pressing the +1/yes switch again will advance the program to test 2. In test 2, all LED and LCD display segments flash on and off at one-second intervals so that each segment can be checked visually. The segments flash so that we can see not only that they go on but that they go off when told to.

Pressing the +1/yes switch again will advance the program to test 3. Test 3 checks all the switches on the front panel. At the beginning of this test the LED will show "1." Press the green #1 voice switch. If the switch and its associated circuitry are okay, the LED will change to "2." Press the green #2 voice switch, and if it is okay the LED will change to "3." Continue this way through all the green voice switches. If a switch is depressed out of order or is bad, the LCD will read "ERROR SEE LED." The number displayed by the LED is the switch that was missed or is faulty. If the switch number displayed by the LED is pressed and the LCD still says error, the switch or its associated circuitry is bad. When you reach switch #32, continue with switch #33, which is the orange "store" switch, and so on through the two rows of control switches. The +1/yes and -1/no switches are the only two left at this point. Obviously, the +1/yes switch is working, or we wouldn't have gotten this far. The -1/no switch is used to back up in the test routine to a previous test, so press it at this time. If it is okay, you will be back in test 2, with the flashing displays. Note that if any of the switches

is defective, you won't be able to continue through the remainder of test 3 until it has been repaired.

To enter test 4, press +1/yes until the LCD readout says "TEST 4 KBD." As the title implies, this test is for the key contacts and associated circuitry. As you play one note at a time from the lowest to the highest key, the LED and LCD will display the key number and note name of the key to be struck next. Once again, as with the switch test, if a key is played out of order or there is a problem, the LCD will show "KBD ERROR," and the name of the faulty note, while the LED will display the note number.

Test 5 is an analog/digital conversion test for the analog controls and controllers. These are the data entry slider, pitch-bend and modulation wheels, after-touch, modulation foot controller, and breath controller. These controls can be checked in any order desired. As soon as one is moved slightly, the LCD will display the name of what you have moved and the LED will begin showing appropriate numbers relating to the position of the control. All of these controls and controllers should range from 1 or 2 to 99. The center position of the pitch wheel should be 50.

Test 6 is a ROM cartridge test. This involves the use of a special test ROM cartridge, which has not been available and may never be. If in normal operation the instrument reads the voice ROMs supplied with the unit, then we know there's no problem.

Test 7 is a RAM cartridge write test. This particular test is a little redundant, in that we can do the same thing with the next two tests. The advantage of this test is that it will not remove any voices that are in the RAM cartridge. There are two EEPROMs (Electrically Erasable Programmable Read-Only Memory) in the cartridge. This test writes and reads one byte in each EEPROM in an area of the EEPROM that is not used for voice storage. To perform this test, insert a RAM cartridge with its memory protect off. Since the test is initiated as soon as you enter test 7, if you have entered test 7 without a RAM cartridge in place the LED will read "WRITE ERROR." In this case, simply insert the cartridge, hit -1/no to back up to test 6, then hit +1/yes again to advance to test 7. The LCD should now read "WRITE OK."

Test 8 is a RAM cartridge read/write test. This test writes data into the entire cartridge, then reads it back, making a comparison with the original data. This test can only be made with the memory protect switch on the cartridge off, and it erases any voices that are in the cartridge. As a safety precaution to prevent accidental erasure of the cartridge, when you enter test 8, the test will not begin. The top of the LCD will read

"TEST 8 CRT RW," and the bottom will be blank. To initiate the test, push the green #1 voice switch. The bottom of the LCD should then read "JUST CHECK." If the memory protect switch on the cartridge is on, or if there is a problem with either the cartridge or the internal circuitry, the LCD will show "EEPROM ERROR" or "WRITE ERROR" after a few seconds. If everything is okay, it will take about a minute to completely load and read the cartridge. The LCD will then read "EEPROM OK." Remember that this test wipes out anything stored in the cartridge, but only if you push the green #1 voice switch. You can cycle through to test 9 without affecting the cartridge.

Test 9 is an internal/cartridge RAM test. At first glance, this test seems to be yet another RAM cartridge test, with internal RAM added. It does in fact do this, but in a different and useful way. Like test 8, this test erases voices, so once again the test won't start until you push the green #1 voice switch. Remember that since we are testing internal RAM as well as the cartridge, internal voices will be erased along with cartridge voices. Test 9 can be performed in three different ways, with three different results: (1) without a RAM cartridge inserted; (2) with a RAM cartridge inserted and the memory protect switch in the off position; (3) with the cartridge inserted and the memory protect switch on. If a RAM cartridge is not inserted and the green #1 voice switch is pushed, the LCD will read "WRITE ERROR" for a fraction of a second, showing that the cartridge was not inserted, and then "RAM OK" for a fraction of a second, followed by "COMPLETED." If there is anything wrong with internal RAM, the display will read "RAM ERROR," and will also list the IC number of the defective RAM. This test wipes all voices from internal RAM.

The second way we can run this test is with a RAM cartridge inserted with its memory protect switch off. This is the way Yamaha intended for the test to be performed. When the green #1 voice switch is pressed, the LCD will read "UNDERWRITING" for about a half a minute, then "RAM OK" for a fraction of a second, then "COMPLETED." Once again, if there is a problem, the display will show "WRITE ERROR" or "RAM ERROR." The interesting thing about performing the test this way is that whatever voices are in internal RAM will be loaded into the cartridge.

If test 9 is performed with the cartridge memory protect switch on, the voices contained in the cartridge will be loaded into internal RAM. This third method can prove very useful. When Yamaha first designed the DX7, it was decided that it would be nice to allow the user to ID his or her RAM cartridges. This meant

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that you could load an ID number into the cartridge, and the only way anyone could use the cartridge would be by calling up the correct ID number. This idea was later discarded, and the software was changed so that all cartridges have the same ID number, and the instrument automatically enters this number when a cartridge is inserted and called up. This seems to be well and good, but I have already run into two RAM cartridges whose ID numbers have somehow changed. One was brand new, and the other had been in use for a while and had the owner's special voices in it. In both cases, if I tried to call up a cartridge voice, the LCD read "READ PROTECTED," and if I tried to store into the cartridge, it read "ID CONFLICT." If this happens to you, never fear. Help is just a test routine away. If the cartridge doesn't have any voices you want to save, call up the test routine and hit +1/yes until you get to test 8. Turn the memory protect switch on the cartridge off and insert it. Hit the green #1 voice switch; the LCD should read "JUST CHECK" for about a minute and then read "EEPROM OK." I have discovered that this test reloads the correct ID number into the cartridge, after which it will work fine.

But what if you have some great voices in the RAM cartridge and it suddenly comes up "READ PROTECTED"? Now we use the third method of test 9. Call up the test routine and hit +1/yes until you get to test 9. Switch the memory protect switch on the cartridge to on, and insert. When you push the green #1 voice switch, the voices in the cartridge will be loaded into the internal memory of the instrument. Exit the test routine, call up the internal memory, and make sure that they are in fact there. Now all you have to do is go to test 8, turn the memory protect switch on the cartridge off, hit the green #1 voice switch, wait a minute, exit the test routine, reload your voices from internal memory back into the cartridge, and you're in business again. Since I've had only two RAM cartridges change this way, I can't guarantee 100% success with this method, so I highly recommend that you back up your voices on a voice data list as shown in the back of the owner's manual. It's not hard, takes just a few minutes, and could save a lot of heartache down the road. One other thing before I leave test 9. If you have one of my memory expanders, you can perform the internal RAM test in each position of the memory bank switch. Just remember that you'll erase whatever is there.

Test 10 is an internal ROM test. The internal ROM contains all the software for operation of the instrument. As soon as test 10 is selected, the test is automatically started. All data in ROM are added and compared to previously computed data. If the two sums are the same, the LCD will read "SUM CHECK OK." If there is a problem, it will respond with "SUM CHECK ERROR."

Test 11 is an automatic audio keying test. This is a general-purpose test that can be used to automatically key the unit when tracing an audio signal or intermittent problem. In this test the instrument automatically plays a chromatic scale over and over again from the lowest key to the highest key. This is the last test, and when you hit +1/yes again, the DX7 exits the test program and goes back into normal operation.

I understand that at some point this test routine may be changed slightly, but it probably won't be for a while. If and when it does get changed, I'll let you know. Next month we'll go through the test routine on the DX9 and also get into some other goodies, so don't miss it! ■