Working with the EPROM on Porsche 986 (Boxster)/996 (Carrera) Clusters

Introduction

The 986 Boxster three-gauge instrument cluster can be upgraded with the five-gauge cluster from a compatible 996 Carrera. The 996 cluster adds the oil pressure gauge and voltmeter. The basic procedure for the upgrade has been thoroughly documented on several forums including Pelican and Renntech and I will not repeat it here. Read those procedures first so that you are aware of the basics. Most importantly, you need to understand which cluster you are working on. There is an "old-style" cluster that works in Model Year 2000 and earlier Boxsters, and a "new-style" cluster that works on 2001 and later Boxsters. The equipment you will use to program either cluster is the same, but the processes and computer code have significant differences.

Before proceeding further, I must acknowledge my debt to Gavin Yuill who figured most of this out and to Shaun Merriman for serving as a test case with the "new style" cluster. I also provide the following warnings:

1. I am not an electronics expert and you are using these instructions at your own risk. I was able to make them work on a 2000 Boxster using a cluster from a 2000 Carrera. Other combinations of cluster model years may not work. I have also had e-mail exchanges with another board member who successfully worked on a 2001 Boxster, but I don't have hands-on experience with the "new style" clusters.

2. It may be possible to figure out how to reset the mileage on one of these clusters so that it does not reflect the actual mileage on your car. This is odometer fraud and it is illegal in the United States, and probably in most other countries.

3. When working with the clusters, be careful to avoid scratching the plastic that covers the gauge faces. I laid mine on top of soft towels

The upgrade leaves five potential challenges. These are:

1. The 996 gauge cluster you bought for a bargain price on the Internet came with a damaged lcd or dot matrix display. This happened to me and led me to research this topic. Here's a picture of the clock/oil

gauge lcd on the one I bought. This is a fairly common problem and led to warranty replacements or other dealer repairs. I bought my cluster from a former Porsche tech for $155 shipped. This is a rare case when I was not permanently harmed by my inner cheapskate.

2. The mileage on the 996 cluster is incorrect. You can send the cluster to be reprogrammed to at least one shop (Palo Alto Speedometer) but the cost with shipping will be over $200.

3. The Vehicle Identification Number (VIN) stored in the 996 cluster is incorrect for your 986. This may cause a problem with your radio in a later-year car.

4. The top operation warning light does not illuminate if you bought your 996 cluster from a coupe rather than a cabriolet.

5. Your on-board computer isn't activated in the new cluster.

The first three can definitely be conquered by working directly with the programming on an EPROM (erasable programmable memory) chip on the 986/996 circuit boards. The other two challenges may also be solved in this way if someone can work on the programming.

Facts

The circuit boards on an "old style" 996 and "old style" 986 are identical as are the boards on the "new style" 996 and 986 clusters. However, the boards on "old" and "new" clusters are different from each other.

You can remove the gauges from the 996 and plug them into the 986 circuit board and they will work with the exception of the voltmeter. The reason for this is that the programming on the 986 circuit board is different. This may not be important to you if you bought a non-defective 996 gauge cluster and you are willing to pay the price to have your mileage updated or just ignore the discrepancy.

If you have a cluster with a damaged lcd or dot matrix display or want to update the mileage yourself, the fact that you can update the EPROM programming is a plus.

Materials

In order to read and write to the cluster EPROM (Erasable Programmable Memory) on a Porsche Boxster/996 you need the following materials:

- EPROM programmer capable of programming a 93c56 ("old style" cluster) or 93c86 ("new style" cluster) EPROM.

Any EPROM programmer will do, but make sure it will work with your computer – many are not compatible with Windows 7 or use a parallel port for connections.

The most commonly used programmer (and my recommendation) is the Willem GQ-4X

- Interface cable with SOIC Clip (SOIC stands for small outline integrated circuit.)

This links the programmer to the chip.

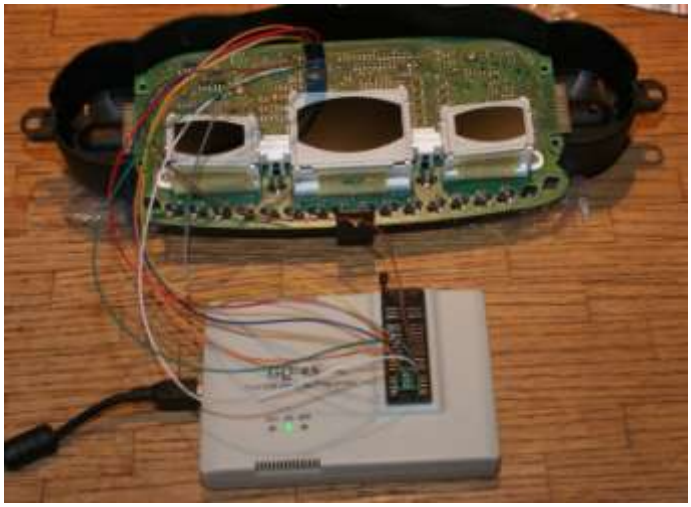
Programming – "Old Style" Cluster

You need to disassemble the cluster to the point where the main circuit board is separated from the cluster. Here's what to do for the "old style" cluster. This is relatively easy. There are two

green sliding connectors on the back. Slide them outward. This takes a little bit of force. There is also a black clip at the bottom of the cluster beneath the tachometer. Carefully pry this up and separate the gauges form the circuit board. This will expose the front of the circuit board. This shows the back of the circuit board with the sliding connectors open on the two sides of the board. The black clip can be seen at the bottom center of the photo.

On the front of the board will be an 8 pin chip. It is marked with the number 93c56 although you will probably need magnification to read that. This is the chip that contains the programming for the cluster. You can see the chip in this picture. It is the small, almost square, black chip that is above the center lcd and slightly to the right of the upper left corner of the lcd.

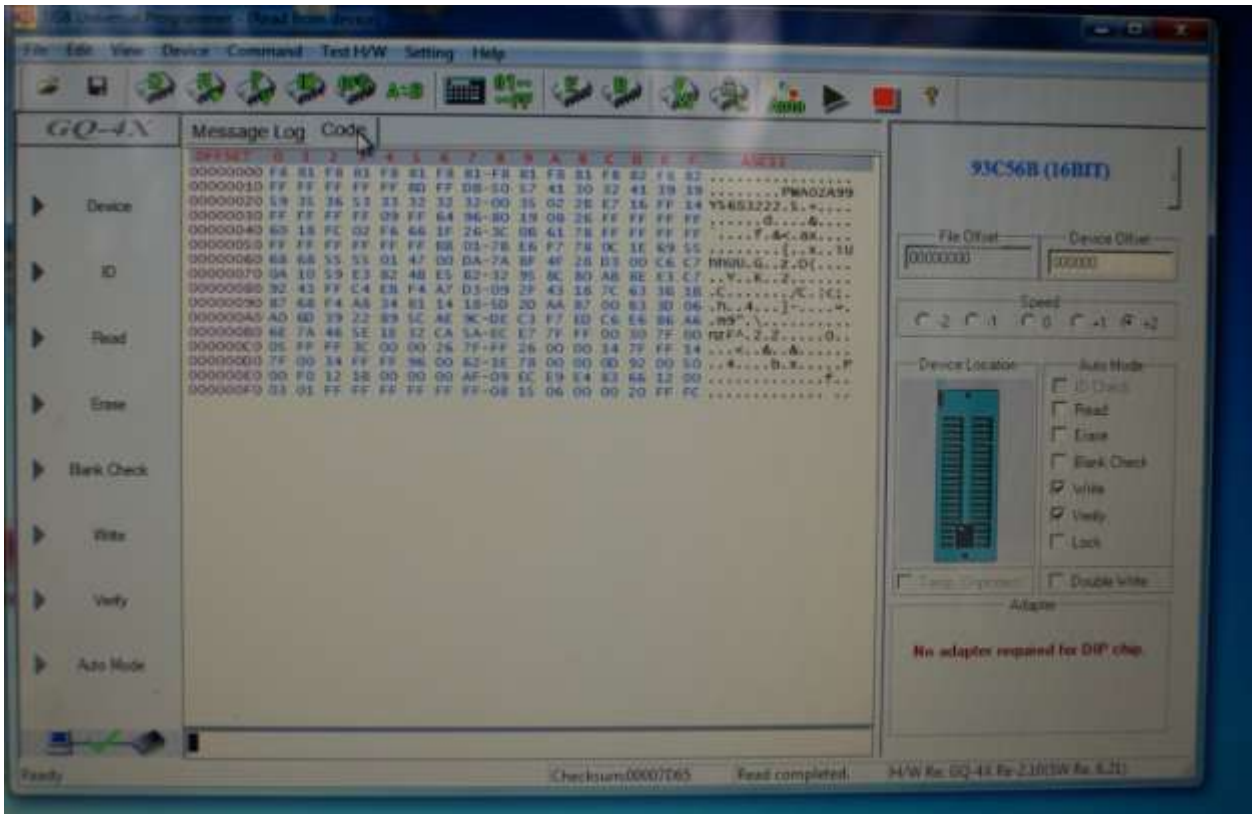
Pin 1 of the chip is the pin that is on the top right of the chip. Once the SOIC clip is clipped on to this, it should correspond to the top left pin connected to the programmer. The programmer software will tell you where to plug the cable in to the programmer. Here's a view of the programmer hooked up to the circuit board using the SOIC clip. Note that if you rotated the circuit board 90 degrees counter clockwise, the chip on the circuit board would be oriented the same way as the connector that goes into the programmer.



Here's a view of the SOIC clip attached to the circuit board. Once the clip is on the chip and the cable plugged in to the programmer you should select the chip type in the programmer software as a 93c56. Note that there are several choices for 93c56 chips in the

EPROM programmer software. The one that worked for my car is the one designated 93C56B (16 BIT) in the device menu. It is under the “ALL” sub menu.

You should then use the software to read off the current programming on the chip. Save this to a file in case anything goes wrong. Here’s a picture of the data on the programmer screen



Note that when you read off the data, the bits will be swapped. To correct this, simply click on the icon at the top of the screen showing A-B. You will know that you have it right when you can read the VIN in the column headed ASCII. The VIN starts in the middle of the second line and ends in the first half of the third line. You may want to read your Boxster chip first so you will know the VIN you are looking for.

Once the data is read off the chip, it can be changed to suit. The top line of the file should contain several values which are all the same or very similar. This is the mileage for the vehicle, however it is encrypted.

The second and third line is the VIN of the car. This is important if you have a 2001 or later car, as the audio system will not work if this does not match the ECU.

If you wish to copy the data from one cluster to another, i.e. you have a damaged cluster in your car and want to copy across, simply read the data from one cluster and save it to a file, then program it back to the new cluster.

Here’s the sequence I followed:

1. Connect the programmer to the Carrera circuit board. (In my case, this had a damaged lcd)
2. Download the programming from the Carrera cluster “swap the bits” and save it to a file.
3. Disconnect from the Carrera circuit board and connect to the Boxster circuit board. (This had good lcd’s, but won’t operate the voltmeter without a programming modification.)
4. Download the programming from the Boxster chip. Swap the bits and save it to a file.
5. Copy the first line of the Boxster programming and use it to overwrite the first line of code in the file containing the Carrera coding. (This contains the mileage.)
6. Copy the second half of the second line of the Boxster code and overwrite the second half of the second line of the Carrera Code. Copy the first half of the third line of the Boxster code and use it to overwrite the first half of the third line of the Carrera code. Take the first character from the second half of the third line of Boxster code and use it to overwrite the corresponding character on the Carrera code. (This updates the VIN)
7. Save the modified code to a new file.
8. Write the modified Carrera code file to the Boxster chip
9. Reassemble everything. I used my Boxster circuit board with my Carrera gauges because my Carrera circuit board was damaged. If you want to use your Carrera circuit board, simply update the programming on that board instead of your Boxster circuit board.

Programming Notes – “Old Style” Cluster:

For some reason the programmer reads and writes with the bytes swapped. This is fine, as long as you program it back correctly. The file that you write to the cluster should have the bytes swapped back. That is, you will press the A-B icon and you will the VIN will change back to the code that you read from the car. This is what the chip will expect from the programmer, so it should just be a matter of loading it up and hitting program. The way you will be able to tell you are doing it correctly is:

1. When you first read the chip, the VIN will look different than the one in your car. When you swap the bits, you will be able to read the VIN.

2. When you are through programming and ready to write the file to the car, “un-swap” the bits. The VIN will look like it did when you originally read it form the car. This is the programming from the 996.

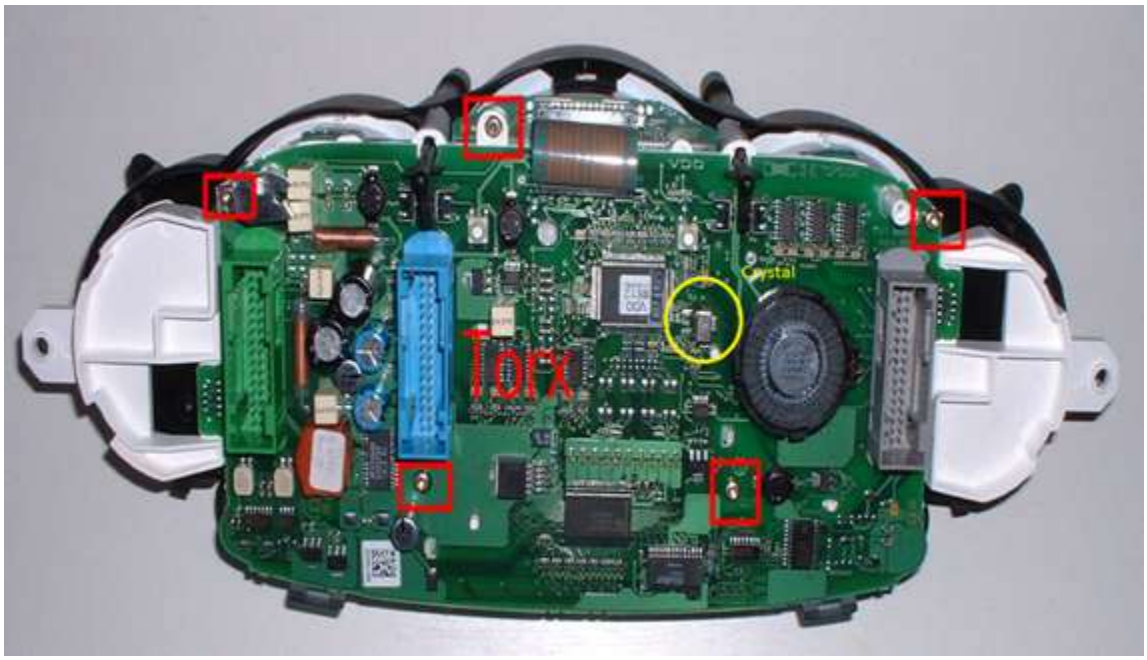
The bits have been “swapped” so that you can read the VIN. This code would need to be “un-swapped” before writing it to the cluster. Note that the mileage on the first line is encrypted, so you cannot read what it is.

This code came from a car with the top operation warning light and the on-board computer operational. If someone can figure out which line of code and which sequence of programming works to switch these functions on, they should share it with the rest of the community.

The programming was done using a program called HxD hex editor, which is a free editing tool. It was done on the byte swapped files, then swapped them back before saving as the programmer will want them in that format.

Programming – “New Style” Cluster

Here’s a picture of the back of the circuit board from the “new style” cluster. Note the green, blue and gray connectors:



You will need to unfasten the torx fasteners highlighted with the red rectangles to access the EPROM. The issue with the newer clusters is that they run on much lower power and the programmer will provide enough juice to make the processor start up and confuse everything. In order to prevent this, you need to short out the crystal that provides the clock for the processor. This won’t hurt anything. It will just stop the board from running and allow us to read the EPROM. The area circled in yellow shows the location of the crystal. Just use a wire (or paperclip) to short out the two legs.

Here's what that the other side of the board which holds the EPROM looks like. The chip you need to clip into is above the dot-matrix display and slightly to the left of center. It is black and has 8 "legs":

Set up your programmer in the same way that as shown for the "old-style" programmer. You will be reading a 93c86 chip, so select that from your device menu.

Programming Notes – “New Style” Cluster:

The code for the “new style” clusters is much larger in order to support additional functions in the on-board computer. The picture below shows what the first part of that code looks like. (The entire code is so long that it won’t fit on one page.) Note that the VIN is stored in the first line. The model is stored on line 2 or 3. It is in plain text and reads 09 96 or 09 86. Changing it is not critical unless you hook it up to a PIWIS, when you won't be able to access the instrument commands unless you change the model type in the PIWIS menu system. The mileage is stored on lines 300 & 310 and again on 500 & 510. (You cannot see lines 500 & 510 in the picture, but you will when you read them with the programmer.) Both need to be changed. The mileage is encrypted.

Unlike the “old-style” clusters, the code here is not read bit swapped. After you have edited the code with a program such as HxD hex editor, write it to the chip using your programmer. Then, read the chip to be sure the code was written correctly. Reassemble the cluster and install it in your car.

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00000000: 57 50 30 43 41 32 39 39 36 33 53 36 35 30 31 32  WP0CA29963S65012
00000010: 37 00 00 00 00 00 00 00 00 00 00 00 00 09 96 64  7..............-d
00000020: 19 81 63 1B 00 00 00 00 00 00 00 00 00 00 00 00  .c..............
00000030: FF FF DE 27 1F 31 BF 0F 00 00 11 11 00 00 11 01  ÿÿÞ'1¿.........
00000040: 00 00 18 FF 16 7F 00 0B FF FF FF FF FF FF FF FF  ...ÿ.ÌÌ..ÿÿÿÿÿÿÿÿ
00000050: 3C 78 FC 5D 78 64 E6 FF FF FF FF FF FF FF FF FF  <xü]xdæÿÿÿÿÿÿÿÿÿ
00000060: FF FF 73 09 3C FF E5 05 78 82 20 C8 A0 6E 50 50  ÿÿs.<ÿå.x, È nPP
00000070: 64 5F F0 00 90 03 79 03 00 08 FF 00 90 01 03 00  d_ð..y...ÿ.....
00000080: 96 00 1E 00 00 46 77 8C 04 78 3C 25 04 1E 88 00  -....FwŒ.x<%.ˆ.
00000090: 90 00 1E 01 00 0F 5B 05 23 01 CC 4C 20 00 00 02  ....[.#.ÌL ....
000000A0: F4 01 06 27 C8 00 03 00 F0 03 3C A7 28 5C 17 05  ô..'È...ð.<§(\..
000000B0: FF FF 80 20 FF A2 5B 00 00 ED FF FF FF FF FF FF  ÿÿ€ ÿ¢[..íÿÿÿÿÿÿ
000000C0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF  ÿÿÿÿÿÿÿÿÿÿÿÿÿÿÿÿ
000000D0: FF FF FF FF 10 07 02 05 31 21 12 07 02 06 17 48  ÿÿÿÿ....1!.....H
000000E0: 98 72 00 00 00 20 11 02 FF FF 09 92 70 14 64 29  ˜r... ..ÿÿ.'p.d)
000000F0: 04 07 02 04 12 25 00 7F 7F 7F 7F 7F 7F FF 7F FF  .....%.▯▯▯ÿ▯ÿ
00000100: 7A 01 81 01 67 02 00 00 35 00 27 07 FF FF FF FF  z..g...5.'.ÿÿÿÿ
00000110: FF FF FF FF 18 00 AF 00 E0 00 35 00 60 04 27 07  ÿÿÿÿ..¯.à.5.`.'.
00000120: 00 00 4B 00 7D 00 FF FF FF FF FF FF FF FF FF FF  ..K.}.ÿÿÿÿÿÿÿÿÿÿ
00000130: FF FF FF FF FF FF FF FF 00 00 40 1F 35 00 67 0E  ÿÿÿÿÿÿÿÿ..@5.g.
00000140: FF FF FF FF FF FF FF FF 6C 00 75 00 90 00 A8 00  ÿÿÿÿÿÿÿÿl.u..¨.
00000150: CF 00 DD 00 E3 00 E5 00 00 00 35 00 CC 00 1E 02  Ï.Ý.ã.å...5.Ì..
00000160: 17 03 7A 03 87 05 09 06 42 00 6C 00 9B 00 DA 00  ..z.‡...B.l.›.Ú.
00000170: 30 01 A1 01 26 02 B1 02 39 03 9B 03 C2 03 E3 03  0.¡.&.±.9.›.Â.ã.
00000180: FF FF FF FF 00 00 D5 04 82 2D 70 7B 35 99 FF FF  ÿÿÿÿ..Õ.‚-p{5™ÿÿ
00000190: FF FF 00 00 78 05 63 2E 82 7B 26 99 35 00 C9 00  ÿÿ..x.c.‚{&™5.É.
000001A0: 8B 04 C4 0B 88 17 FF FF FF FF FF FF FF FF 00 00  ‹.Ä.ˆ.ÿÿÿÿÿÿÿÿ..
000001B0: 40 00 E3 01 07 05 3C 06 FF FF FF FF 00 00 28 00  @.ã...<.ÿÿÿÿ..(.
000001C0: 2C 01 20 03 E0 03 FF FF FF FF 80 0C E6 05 FF FF  ,. .à.ÿÿÿÿ€.æ.ÿÿ
000001D0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF  ÿÿÿÿÿÿÿÿÿÿÿÿÿÿÿÿ
000001E0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF  ÿÿÿÿÿÿÿÿÿÿÿÿÿÿÿÿ
000001F0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF  ÿÿÿÿÿÿÿÿÿÿÿÿÿÿÿÿ
00000200: FF FF A1 03 66 03 23 03 85 02 AF 01 68 00 00 00  ÿÿ¡.f.#.….¯.h...
00000210: 00 05 A6 08 A6 10 91 17 19 1F F2 03 FD 03 A4 03  ..¦.¦.'..ò.ý.¤.
00000220: 2B 03 2E 02 68 00 00 00 00 05 80 0A 00 0F 80 16  +...h.....€...€.
00000230: B3 1C 12 00 03 01 9B 01 12 03 99 04 44 06 0A 00  ³.....›...™.D...
00000240: 53 00 A0 00 0A 00 00 02 FF 03 0A 00 80 01 FF 03  S. .....ÿ...€.ÿ.
00000250: 0A 00 00 02 FF 03 0A 00 80 01 FF 03 00 40 00 A0  ....ÿ...€.ÿ..@.
00000260: FF FF 00 50 00 A0 00 D0 4F 0D 92 38 FF FF 3D 0A  ÿÿ.P. .ÐO.'8ÿÿ=.
00000270: F0 24 D6 63 50 10 5C 5B FF FF 00 40 00 60 FF FF  ð$ÖcP.\[ÿÿ.@.`ÿÿ
00000280: FF FF FF FF FF FF FF FF FF FF FF FF B5 02 39 03  ÿÿÿÿÿÿÿÿÿÿÿÿµ.9.
00000290: 80 87 F0 55 FF FF C8 C8 AA AA AA AA AA FF FF FF  €‡ðUÿÿÈÈªªªªªÿÿÿ
000002A0: 55 AA FF FF FF FF FF FF 4D 2C B5 FF FF B3 70 CC  UªÿÿÿÿÿÿM,µÿÿ³pÌ
000002B0: FF FF 25 00 3A 00 69 00 37 01 B9 01 8B 02 20 03  ÿÿ%.:.i.7.¹.‹. .
000002C0: 36 03 31 1D 1A 20 21 20 16 0B 00 00 C4 09 88 13  6.1.. ! ....Ä.ˆ.
000002D0: 40 1F 00 32 64 FF 00 32 64 FF 00 00 E8 03 B8 0B  @.2dÿ.2dÿ..è.¸.
000002E0: 58 1B 00 64 96 FF 00 64 96 FF 00 55 AA FF DC E6  X..d-ÿ.d-ÿ.Uªÿ܃æ
000002F0: F5 FF 08 FF 07 0B 04 0B 07 FF 09 0D 06 09 09 FF  õÿ.ÿ.....ÿ.....ÿ
00000300: 8A F4 15 E9 2B D2 57 A4 AF 48 5E 91 FD 22 FA 45  Šô.é+ÒW¤¯H^'ý"úE
00000310: F4 8B E9 17 D2 2F A4 5F 48 BF 91 7E 22 FD 45 FA  ô‹é.Ò/¤_H¿'~"ýEú
00000320: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF  ÿÿÿÿÿÿÿÿÿÿÿÿÿÿÿÿ
00000330: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF  ÿÿÿÿÿÿÿÿÿÿÿÿÿÿÿÿ
00000340: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF  ÿÿÿÿÿÿÿÿÿÿÿÿÿÿÿÿ
00000350: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF  ÿÿÿÿÿÿÿÿÿÿÿÿÿÿÿÿ
00000360: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF  ÿÿÿÿÿÿÿÿÿÿÿÿÿÿÿÿ
00000370: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF  ÿÿÿÿÿÿÿÿÿÿÿÿÿÿÿÿ
00000380: 3E 01 6A 01 97 01 C4 01 F0 01 08 00 16 00 23 00  >.j.—.Ä.ð.....#.
00000390: 31 00 3E 00 27 31 35 35 12 55 5F 64 65 48 84 8C  1.>.'155.U_deH„Œ
000003A0: 93 94 7D B3 BB C2 C4 B3 E2 E8 F1 F3 E8 FF FF FF  ""}³»ÂÄ³âèñóèÿÿÿ
000003B0: FF FF FF FF FF FF 1C 38 77 3C 05 14 00 20 08 06 B1  ÿÿÿÿÿÿ.8w<... ..±
000003C0: A4 5A 3B 05 3B 3B 05 A4 32 0A 05 89 C1 0F 3C 00  ¤Z;.;;.¤2..‰Á.<.
000003D0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF  ÿÿÿÿÿÿÿÿÿÿÿÿÿÿÿÿ
000003E0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF  ÿÿÿÿÿÿÿÿÿÿÿÿÿÿÿÿ
000003F0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF  ÿÿÿÿÿÿÿÿÿÿÿÿÿÿÿÿ
00000400: 00 00 00 00 1A 16 03 32 FF FF 20 16 01 32 48 26  .......2ÿÿ ..2H&
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