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# X-Gauge

**For the smart® fortwo (gasoline/petrol), 2001 to 2006**
**For the smart® fortwo cdi (diesel), 2004 to 2006**

# Installation Guide

# Table of contents

# 1 Disclaimer

The information contained in this document is subject to change and does not represent a commitment on the part of the copyright holder. While the information contained herein is assumed to be accurate, Welte Engineering assumes no responsibility for any errors or omissions. In no event shall Welte Engineering be liable for special, direct, indirect, or consequential damage, losses, costs, charges, claims, demands, or expenses of any nature or kind.

# 2 Introduction

Note that the ***X-Gauge*** will only work in the following cars:

- smart® fortwo, 2001 to 2006 with gasoline/petrol engine.
- smart® fortwo cdi, 2004 to 2006 with diesel engine.
- smart® roadster, all models.

These model limitations are due to the fact that the diagnostic interface in earlier models does not deliver the generic engine parameters that the ***X-Gauge*** requests from the ECU, while models after 2006 have a CAN based diagnostic interface implemented that the ***X-Gauge*** is not yet compatible with.

This document is a step-by-step guide on how to change an original smart® cockpit clock into an ***X-Gauge***. Before grabbing your tools and diving right into it, please familiarize yourself with all installation procedures by reading this guide from front to back cover. If you do not feel comfortable with any of the installation steps, please find someone else who is qualified to do the job for you. Be aware that the ***X-Gauge*** module is a delicate electronic device that must be handled with proper care. The warranty will not cover any damage caused by incorrect installation or mishandling. Text and pictures in this document assume a left hand driven smart®, so you will have to do some mirroring if your car is right hand driven.

Changing a cockpit clock into an ***X-Gauge*** is done in 4 distinct phases:

1) Removing the cockpit clock from the car.
2) Disassembling the cockpit clock.
3) Assembling the ***X-Gauge***.
4) Installing the ***X-Gauge*** in the car.

Make sure that you'll keep all remaining parts of the cockpit clock in a safe place so that you will be able to change the ***X-Gauge*** back into the cockpit clock at a later time.

If it makes you feel more at ease you may disconnect the negative battery cable of your car during the removal and installation phases. Be aware, though, that your car's radio may request the entry of a security code after its battery supply was interrupted, so you better have this code ready if you decide to disconnect the battery.

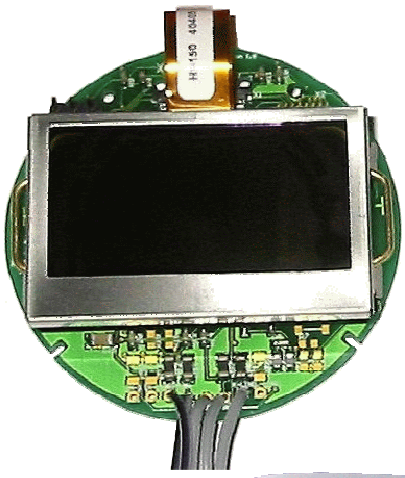
# 3 Kit Contents

Verify that your kit includes all these items:

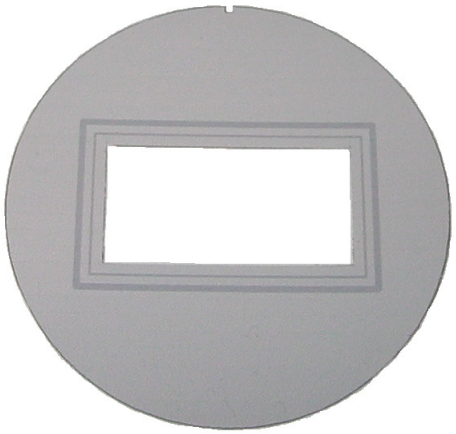
- ***X-Gauge*** module, including display and cables
- Faceplate
- 3-wire PCB connector
- OBD connector shell with 3 pins
- User Manual
- This Installation Guide

Latest versions of User Manual and Installation Guide are available for downloading from our website.

***X-Gauge*** module, including display and cables

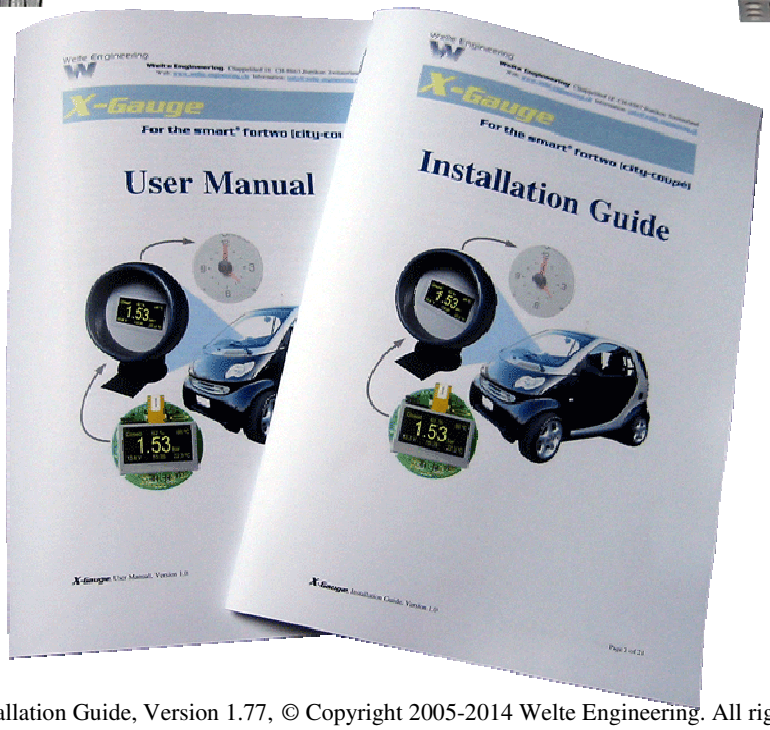


Faceplate



OBD connector shell with 3 pins

3-wire PCB connector



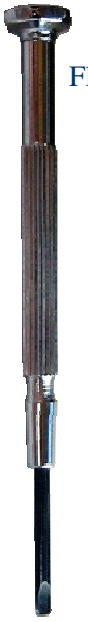
# 4 Required Tools

Examples of required tools are shown below. Instead of a mini clamp which is used for pressing the 3-wire PCB connector together, you might also use a small vise. The side cutter is intended for separating the cable of the original cockpit clock from the clock module but you might also use a pair of scissor or a soldering iron instead.

Flat screwdriver approx. $^1/_4$″

Torx screwdriver T10

Flat screwdriver approx. $^1/_{10}$”



Mini clamp or small vise

Side cutter or scissors

Pliers

# 5 Removing the Cockpit Clock from the Car

5.1) Insert the 1/4″ flat screwdriver into the gap between frame and top cover of the center console. Pushing the screwdriver down into the gap may suffice for unlocking the cover. If not, carefully bend the screwdriver towards the windshield to unlock the cover.


5.2) Remove the 3-wire PCB-connector of the cockpit clock from the top cover. The connector can be pulled straight out after the black locking clip is pushed slightly upwards.

5.3) Using the T10 torx screwdriver just loosen (do not remove) the 2 screws that attach the frame of the center console to the dash, so that the frame can be lifted high enough for the 3-wire PCB-connector to fit between frame and dash.

Completely remove the 3 screws that hold the cockpit clock to the dash and remove the cockpit clock from the car. Keep the screws in a safe place for later re-installation.

# 6 Disassembling the Cockpit Clock

6.1) Separate the decorative frame from the cockpit clock housing. This frame is only pushed onto the housing so it can be simply pulled off with your fingers.

6.2) Remove the decorative frame and keep it for later re-assembly.

6.3) The next step of separating the lens frame from the cockpit housing is a little trickier because this frame is snapped into the housing and needs to be unlocked. Carefully insert a $^{1}/_{10}$" flat screwdriver between the housing and the lens frame at either the 3 or 9 o-clock position. Even more carefully, bend the screwdriver slightly outwards in order to unlock the lens frame.

Continued at next picture …

6.4) **Warning:** Do not put too much strain onto the housing while bending the screwdriver outwards, otherwise the plastic of the housing will get discolored or it might even break!

Remove the lens frame and keep it for later re-assembly.

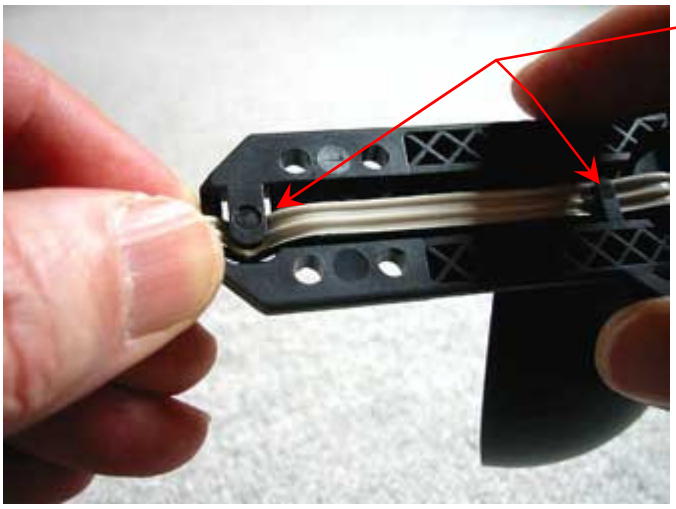

6.5) Pry the minute hand from the cockpit clock with your finger nails as show in the picture. If the black cover comes off in the process just clip it back onto the minute hand.


6.6) Pry the hour hand from the cockpit clock with your finger nails as show in the picture.

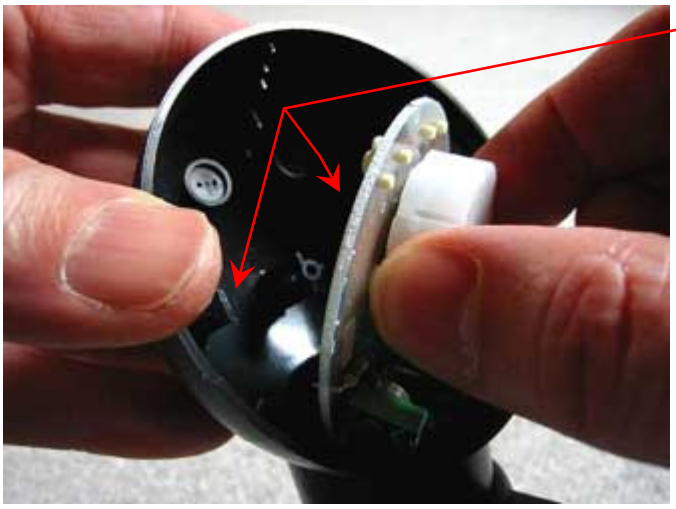
Store minute and hour hands in a safe place so that you will be able to re-assemble the cockpit clock at a later time.

6.7) Shake the faceplate with attached light guide out of the cockpit clock housing. It will easily fall out.

Store it in a safe place so that you will be able to re-assemble the cockpit clock at a later time.

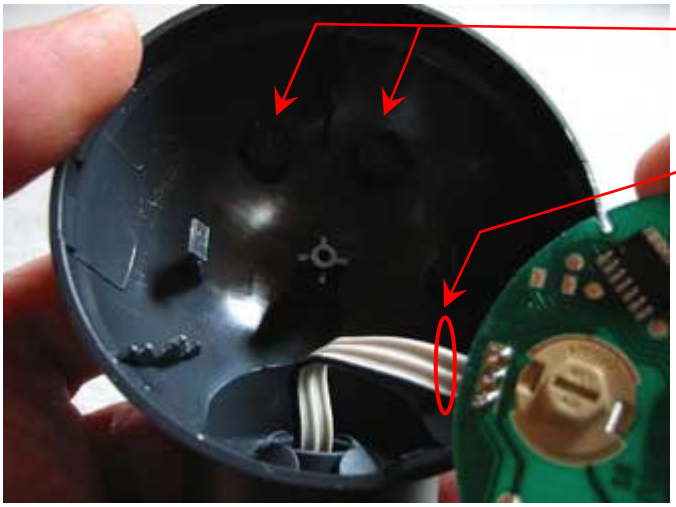


6.8) Free the 3-wire cable from the two wire guides as shown in the picture.



6.9) Remove the clock module from the housing while bending the two locking clips slightly outwards.

**Warning:** Do not bend the locking clips too much because they could break off!



6.10) Remove the two plastic buttons and keep them for later re-assembly. They will easily fall out.

Because the 3-wire cable with attached PCB-connector can not be pulled through the opening at the bottom of the housing, the cable needs to be cut or de-soldered from the module. If you cannot de-solder it, cut the cable close to the module.

Pull the cable through the opening and store it together with the clock module in a safe place so that you will be able to re-assemble the cockpit clock at a later time.

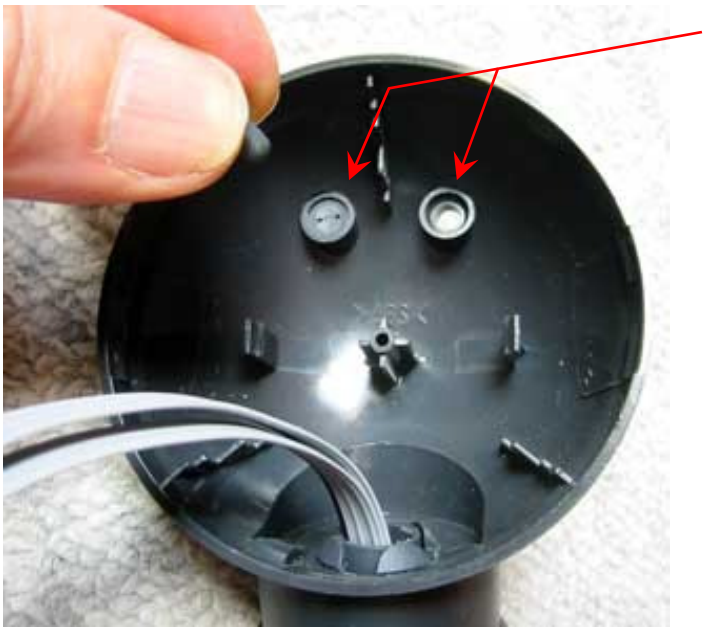
# 7 Assembling the *X-Gauge*

7.1) Before handling the ***X-Gauge*** module, discharge your body by touching some solid metallic structure in order to prevent damage due to electrostatic discharge.

Guide the two 3-wire cables of the module through the opening at the bottom of the housing.

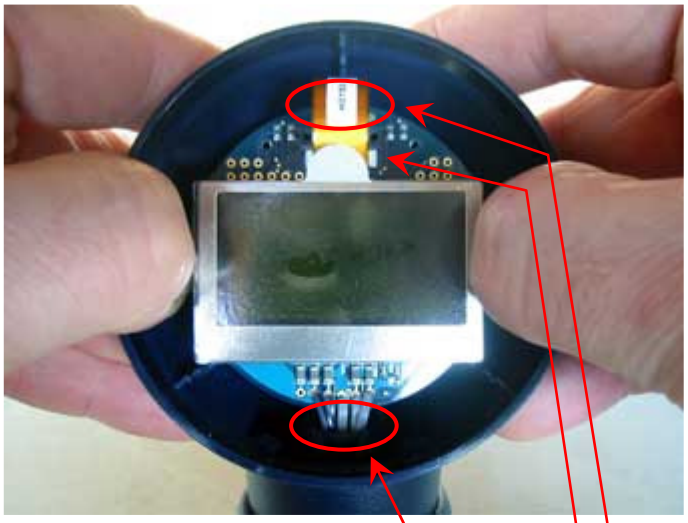
Note: If the opening is not wide enough for passing the two OBD pins, use a small file or a drill to make it bigger.

**Warning:** Be very careful that you do not bend the cables too many times back and forth at the ***X-Gauge*** module. Otherwise they will break off!



7.2) Put the two plastic buttons from the cockpit clock back into their openings at the rear of the housing.
Make sure that they won't fall out until the module is clipped into place.

Note: You can coat the sides of the two buttons with a thin layer of silicon grease. This will prevent any possibility that they might rattle.



**Very Important:**
DO NOT put any pressure on the display for snapping the module into the housing! This may bend the display's mounting bracket, or even worse, will break the backing glass of the display. Welte Engineering will not replace any display with a cracked backing glass under Warranty.

7.3) Place the module inside the housing by aligning the cutouts at its 12, 4 and 8 o-clock positions with the corresponding guides of the housing. By placing your thumbs on the PCB, as shown in the picture, push the module evenly down over the two locking clips until you hear them both snap. Do not push down on the display (see note on the left)!

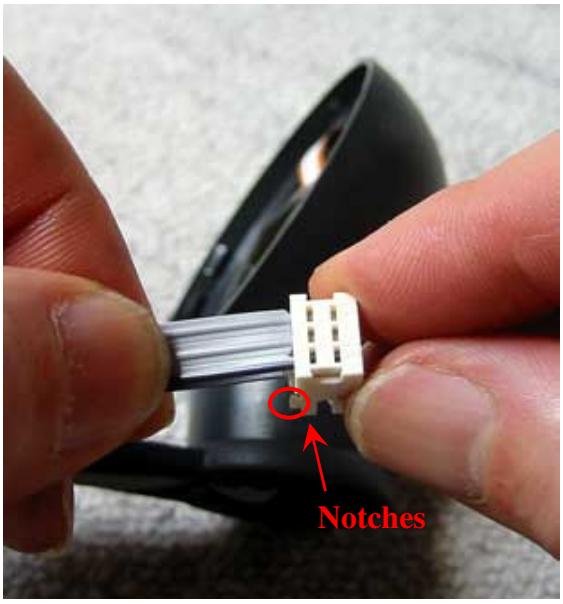
Verify correct placement of the module by pushing both buttons. They should move freely and give a distinctive tactile feedback when they make contact.

If the flat cable of the display protrudes over the display bezel bend it down with your fingers so that the cable won't interfere with the face plate later on.

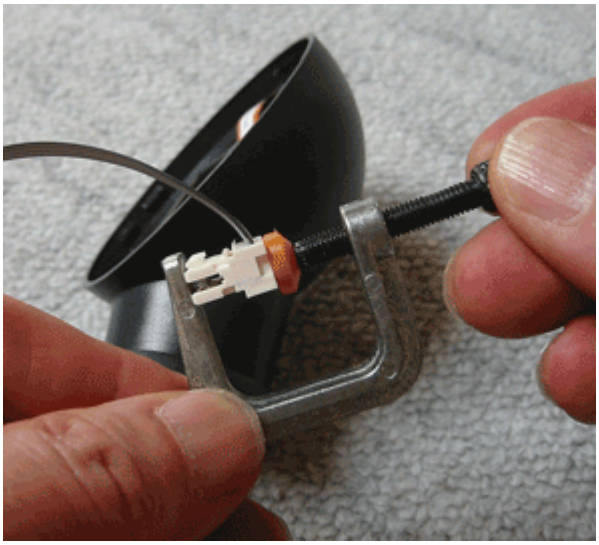
Verify that the flat cable of the display is still securely seated in its connector on the module.

Verify that none of the wires have broken off the module during installation.

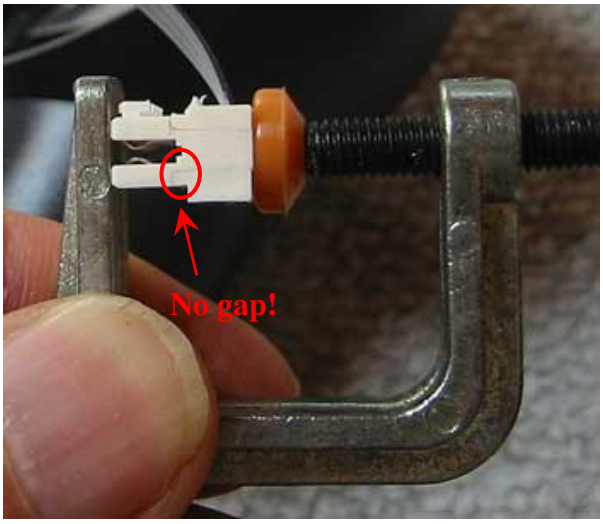
7.4) Tug the cables under the two wire guides as shown in the picture.



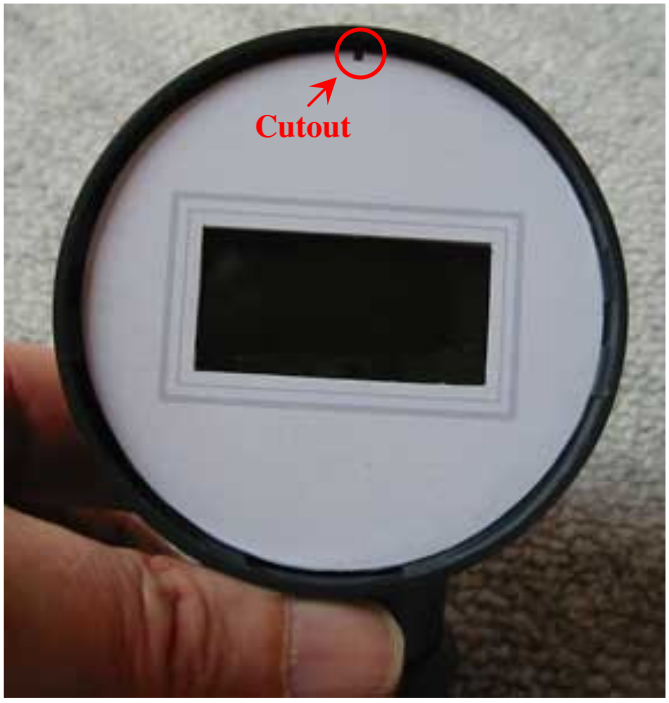

7.5) Insert the ends of the short 3-wire cable into the openings of the PCB connector. Make absolutely sure that the black marked wire is inserted at the position as shown in the picture (see also next two pictures).



7.6) The two connector halves must be pressed together in order for the wires to connect and to be held in place. Unless you have enough strength in your fingers, a mini clamp is the perfect tool for doing this job. You may also use a small vice or some suitable pliers. Whatever you use, make sure that the wires won't fall out until the connector halves are fully pressed together.




7.7) Make sure that the connector halves are pressed fully together, without a gap, as shown in the picture.



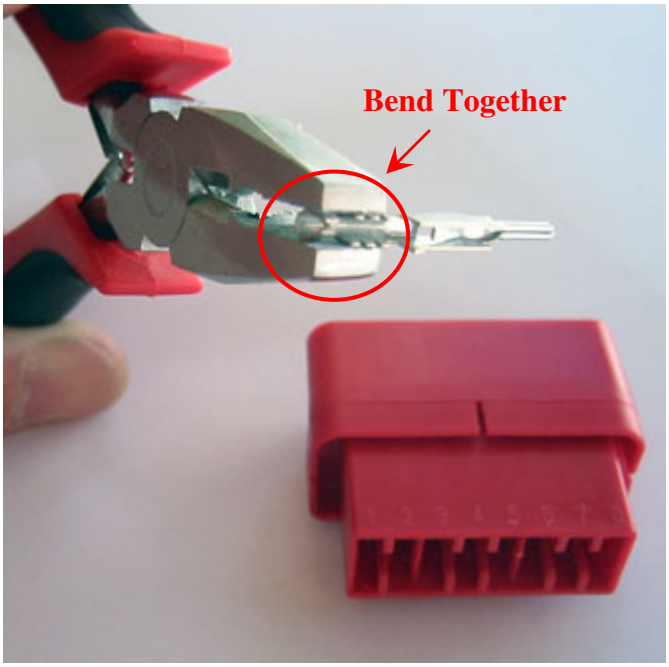

7.8) Place the faceplate into the housing by aligning its cutout with the guide of the housing.

Make sure that you'll have removed the clear protective foil from the display before this step!


7.9) Position the lens frame before snapping it back into the housing, so that its 12 o'clock notch aligns as shown in the picture.

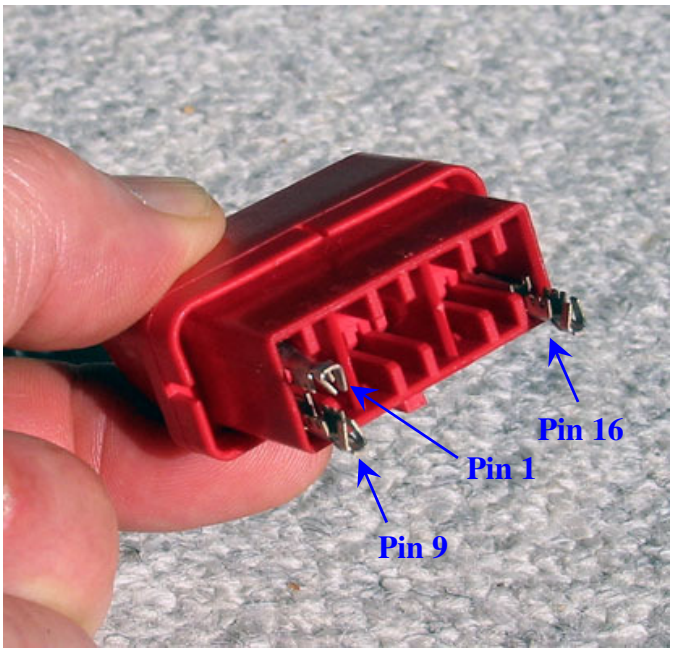
7.10) Snap the lens frame back into the housing by pushing evenly at its 3 and 9 o'clock positions.


7.11) The decorative frame can now be pushed back over the lens frame. It will fit in one position only. Align the decorative frame's smallest tongue with the corresponding notch of the lens frame and push it in (it won't snap).




7.12) Three dummy pins get inserted at the corners of the OBD connector shell so that it will be retained more securely in the car's socket without easily falling out.

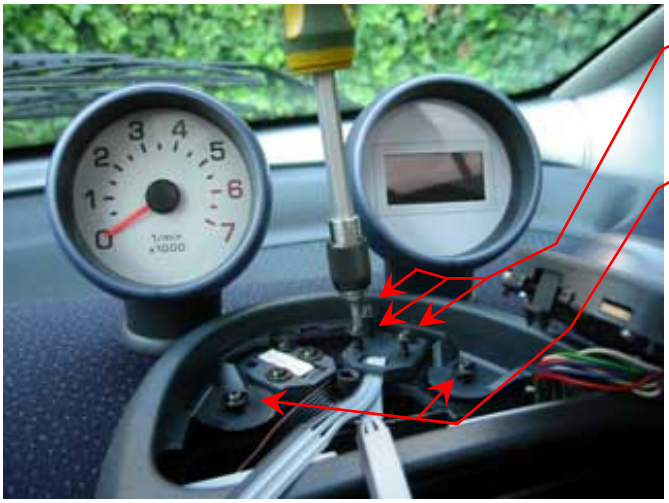
First, bend the cable ends of these pins to some degree with pliers so that they will fit into the openings of the connector shell.




7.13) Insert the three dummy pins into the OBD connector shell as shown in the picture. The corner pin positions to use are numbered on the shell with 1, 9 and 16. Push the pins into place until they are seated with a hearable click.

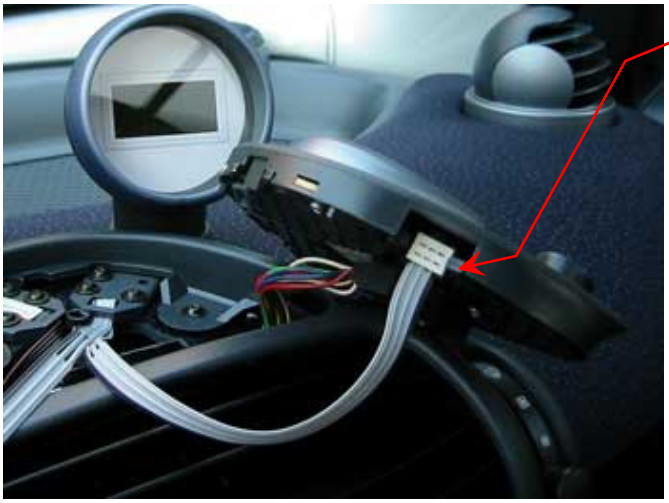
Note: See chapter 9.1 if a pin got accidentally inserted at a wrong position.

# 8 Installing the *X-Gauge* in the Car



8.1) Mount the ***X-Gauge*** to the dash by tightening the 3 torx screws.

Do NOT yet tighten the 2 screws that attach the frame of the center console to the dash.



8.2) Insert the 3-wire PCB-connector at the top cover of the center console. You will hear a click when the connector is properly seated. As can be seen in the picture, the black marked wire is to the right. If it is not, then the connector was mounted the wrong way in step 7.5.

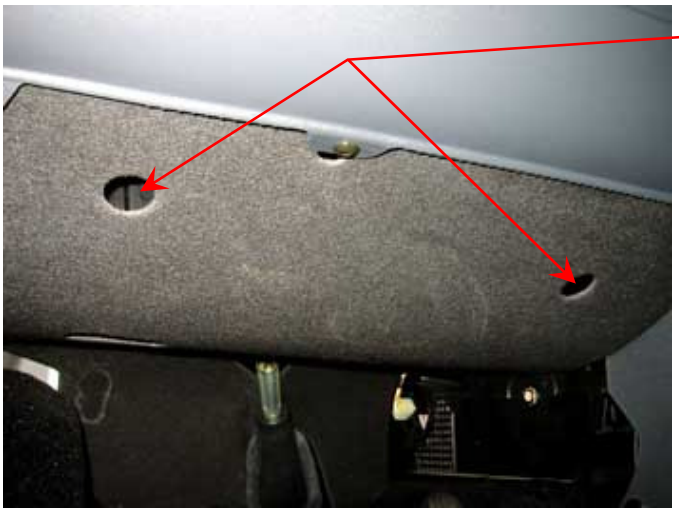
If the car's battery is connected you can tip now either one of the two ***X-Gauge*** buttons to see if it is working (the display will go dark again after 30 seconds as stated in the User Manual on page 11).

**- For 1st generation smart® cars (2002 and before) continue with step 8.3.**

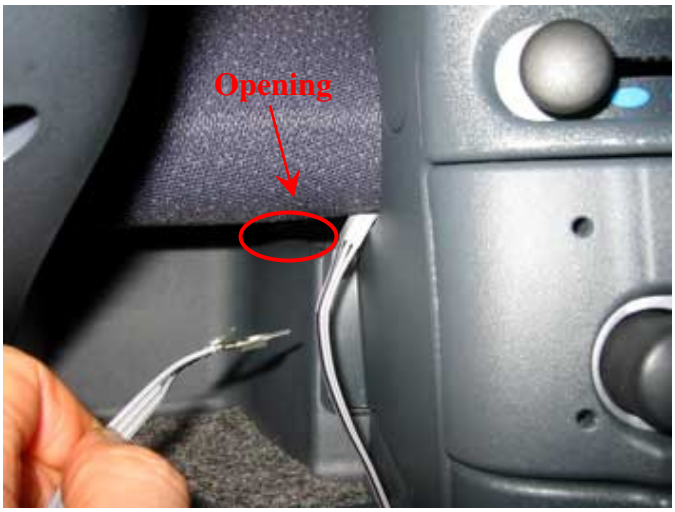
**- For 2nd generation smart® cars (2003 and up) continue with step 8.11.**

**The following steps apply to 1st generation smart® cars (2002 and before):**

8.3) Feed the wire with the 2 pins between dash and frame of the center console and slide it all the way down the left side of the console as shown in step 8.5.

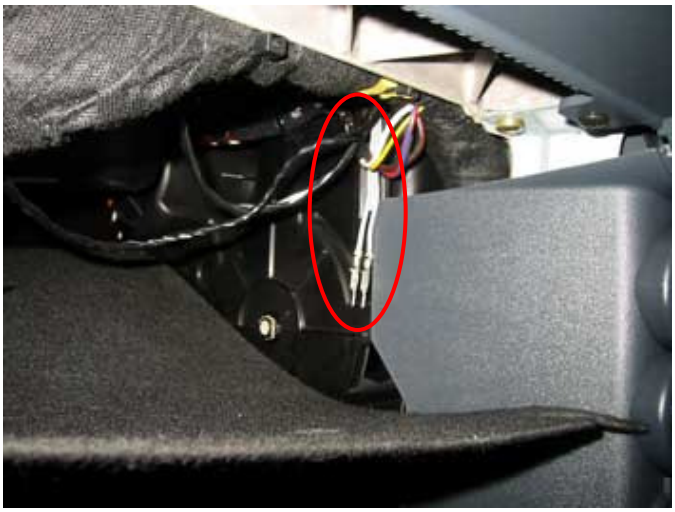


8.4) Unlatch the cover underneath the dash by pulling it down with your fingers in the cutouts as is marked in the picture. Once unlatched, just let it hang.

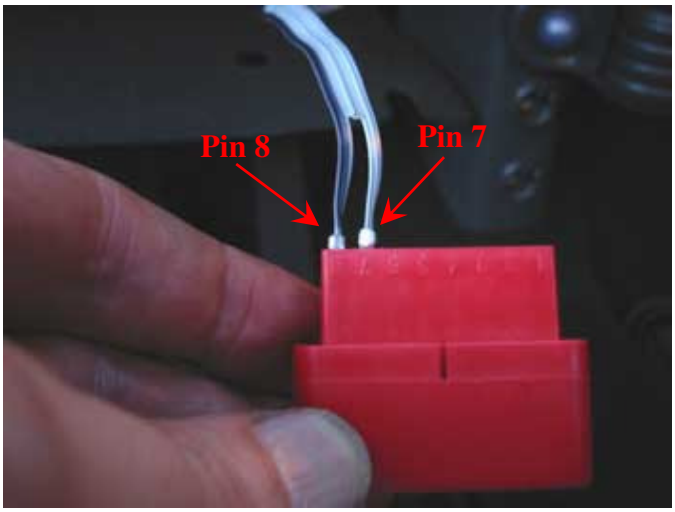



8.5) Now comes the tricky part. The wire must be passed through the opening as marked in the picture and pushed straight down. You can feel the opening with your fingers. Holding the pins with your left hand straighten the wire first by pulling it back at the top of the center console with your right hand. Straightening the wire makes it easier for pushing pins and wire down the opening.

8.6) If the wire does not go down properly the first time you try pull it back and try again. It might help pushing it down with your right hand and at the same time trying to grab it with your left hand from underneath the dash as is shown in the next picture.



8.7) This picture shows how the wire is supposed to appear underneath the dash. Pull it all the way down.




8.8) Insert the two pins into the OBD connector shell at pin positions 7 and 8 as is marked on the connector. Make absolutely sure that the black marked wire is at the corner in position 8. Push the pins all the way in until they are seated with a hearable click.

Note: See chapter 9.1 if a pin got accidentally inserted at a wrong position.

8.9) Now you can plug the OBD connector shell into the car's OBD socket. This socket is located in the fuse panel as shown in the picture.

If your battery is connected, you can now verify that the ***X-Gauge*** comes to live when the car's ignition is switched on.

8.10) Put the cover underneath the dash back into place. Make sure that it will be seated properly.

**- Continue with step 8.18.**

## The following steps apply to 2nd generation smart® cars (2003 and up):

8.11) Feed the wire with the 2 pins between dash and frame of the center console.

8.12) Now comes the tricky part. Push the wire through the gap between dash and speedometer housing. Keep the wire flat against the dashboard while pushing it. Push until the wire appears through one of the gaps on the other side of the speedometer housing as is shown in the next two pictures.

Note: Feeding the wire underneath the speedometer can be made easier if the speedometer housing is raised by removing its four T10 torx mounting screws.

8.13) One location where the wire might appear when being pushed as explained in step 8.12.

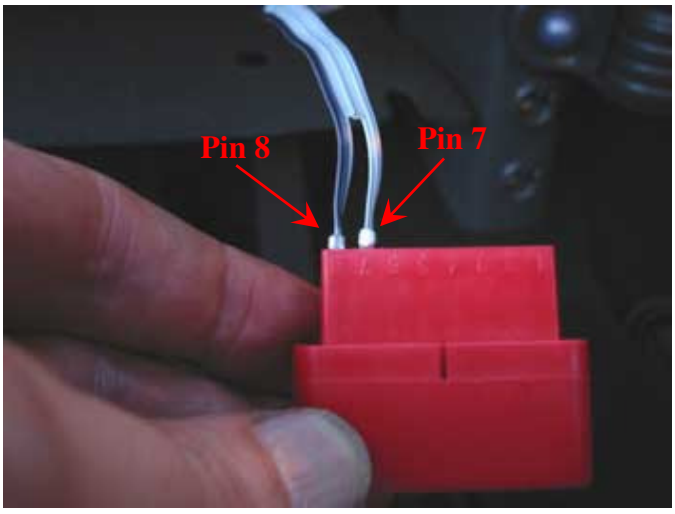
Note: This picture was taken in a 2002 car. So it does not show the OBD socket as in picture 8.15.

8.14) Another location where the wire might appear when being pushed as explained in step 8.12.

Note: This picture was taken in a 2002 car. So it does not show the OBD socket as in picture 8.15.

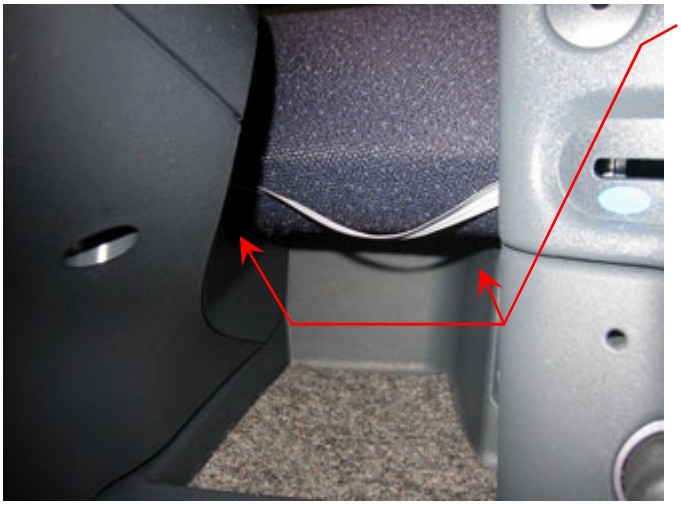
8.15) This picture shows the actual location of the OBD socket in a 2003 or later car. The socket is protected by a cover that must be flipped down.

Note: The cover might rattle when it stays open while the OBD connector of the ***X-Gauge*** is plugged in. You can stop this noise by either pulling the cover off or by lining the bottom of the storage area with foam or carpet.




8.16) Insert the two pins into the OBD connector shell at pin positions 7 and 8 as is marked on the connector. Make absolutely sure that the black marked wire is at the corner in position 8. Push the pins all the way in until they are seated with a hearable click.
Now you can plug the OBD connector shell into the socket.

Note: See chapter 9.1 if a pin got accidentally inserted at a wrong position.



8.17) Push the wire back in the gaps of speedometer and center console as far as possible so it will stay out of sight.

If your battery is connected, you can now verify that the ***X-Gauge*** comes to live when the car's ignition is switched on.

8.18) Now that all wires are connected, you can tighten the 2 torx screws that attach the frame of the center console to the dash.

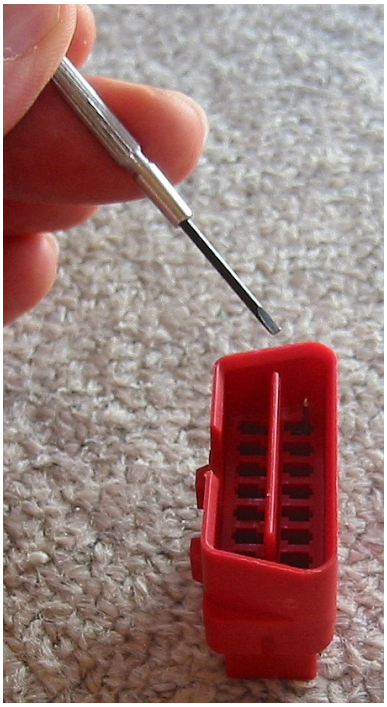
8.19) By holding the top cover of the center console close to the frame make sure that no wires underneath will interfere when the cover will be snapped back into place. Bend the wires appropriately if it looks as if they will get in the way.

8.20) Put the top cover back in its place by first inserting it towards the air outlet and then pushing the opposite side down until it snaps in.

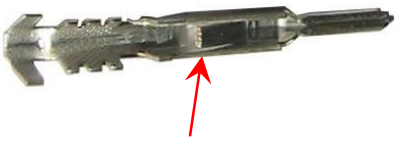
# 9 Appendices

## 9.1 Removing the *X-Gauge* from the Car

If the *X-Gauge* needs to be removed from the car for any reason (e.g. repair, moving it to another car, converting it back to the original cockpit clock) then the steps as outlined before must be done in reversed order. Initially, however, the pins must be extracted from the OBD connector shell as outlined below.



The pins are held in the connector shell by a clip that must be bent down for the pin to dislodge.




In order to extract a pin use a small (1.4 to 1.8 mm) flat screwdriver that fits into the pin openings as shown in the pictures and push the screwdriver down. This will bend the pin's holding clip down and will push it out of the shell.

Important: Before a removed pin can be re-inserted into the connector shell, its clip may have to be bent back into its original position. Otherwise the pin will not lock securely when it gets pushed into the shell.

Perform the following steps if the ***X-Gauge*** module needs to be removed from the cockpit clock housing.

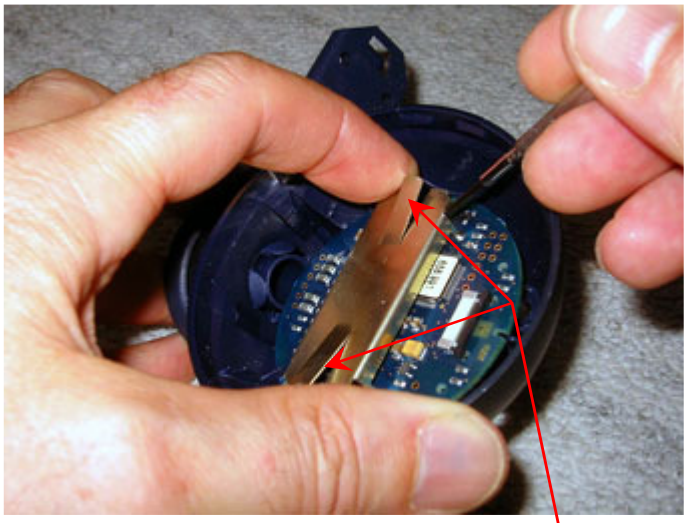
It's best to remove the display assembly from the ***X-Gauge*** module first before the module itself is removed from the cockpit clock housing.

Open the black latch of the ZIF (Zero Insertion Force) connector, that holds the flat cable of the display assembly, by pushing it horizontally outwards on both sides. This is best done with a small screwdriver, but be very careful not to scratch the printed circuit board in the process.

Once the black latch is open, the cable is freed and can be pulled out of the connector as is shown in the picture.

The display assembly can now be detached from its mounting bracket.

Push it horizontally on one side until the other side unlocks and can be lifted from the bracket. Next move the display assembly back so that it can be lifted completely from the bracket.



**Warning:** This next step is very delicate and if not done right the ***X-Gauge*** module as well as the cockpit clock housing can be irreversibly damaged!

In order to unlock the module from the housing, angle a small screwdriver between one of the two plastic locking clips of the housing and the corresponding edge of the display mounting bracket. Apply just enough bending force to the screw driver so that the locking clip of the housing is bend outwards enough for lifting the ***X-Gauge*** module from the housing. Repeat on the other side with the second locking clip.

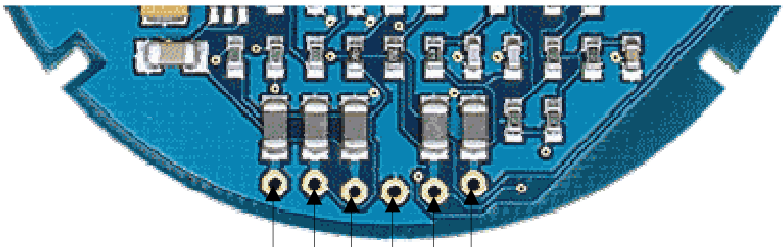
**Warnings:**
**-** Be careful not do scratch any copper traces of the printed circuit board with the screwdriver!
- The two plastic locking clips of the housing can break off if too much bending force is applied!

Bend the two flaps of the mounting bracket slightly upwards before the display assembly is getting re-attached to the mounting bracket. This will make sure that the display will be held tightly in the bracket.

## 9.2 Wire Connections

The details regarding the hookup wires of the ***X-Gauge*** do not have to be known if it gets installed into a smart® fortwo, as long as all installation steps are followed as outlined in the above instructions. For any other installations (e.g. into a smart® roadster), the wiring must be done as is shown below. Note that with the exception of signal 'Light', that is used for dimming the display of the ***X-Gauge***, all required signals are available at the OBD connector (pin numbers as noted below are marked on the OBD connector shell). Keep in mind, however, if 'VBatt' should be taken from the OBD connector, all user programmed settings (including time and date) will be lost whenever the OBD connector gets unplugged.

Outline of ***X-Gauge*** module



**K-Line:** - to OBD connector pin 7.

**Light:** - to car's driving light signal.

**Ground:** - to car's ground or
- to OBD connector pin 5.

**VBatt:** - to car's uninterruptible +12 Volt supply or
- to OBD connector pin 16.

**Ignition:** - to OBD connector pin 8.

not used.