SCAN TRONIC
COMBUSTION OPTIMIZING

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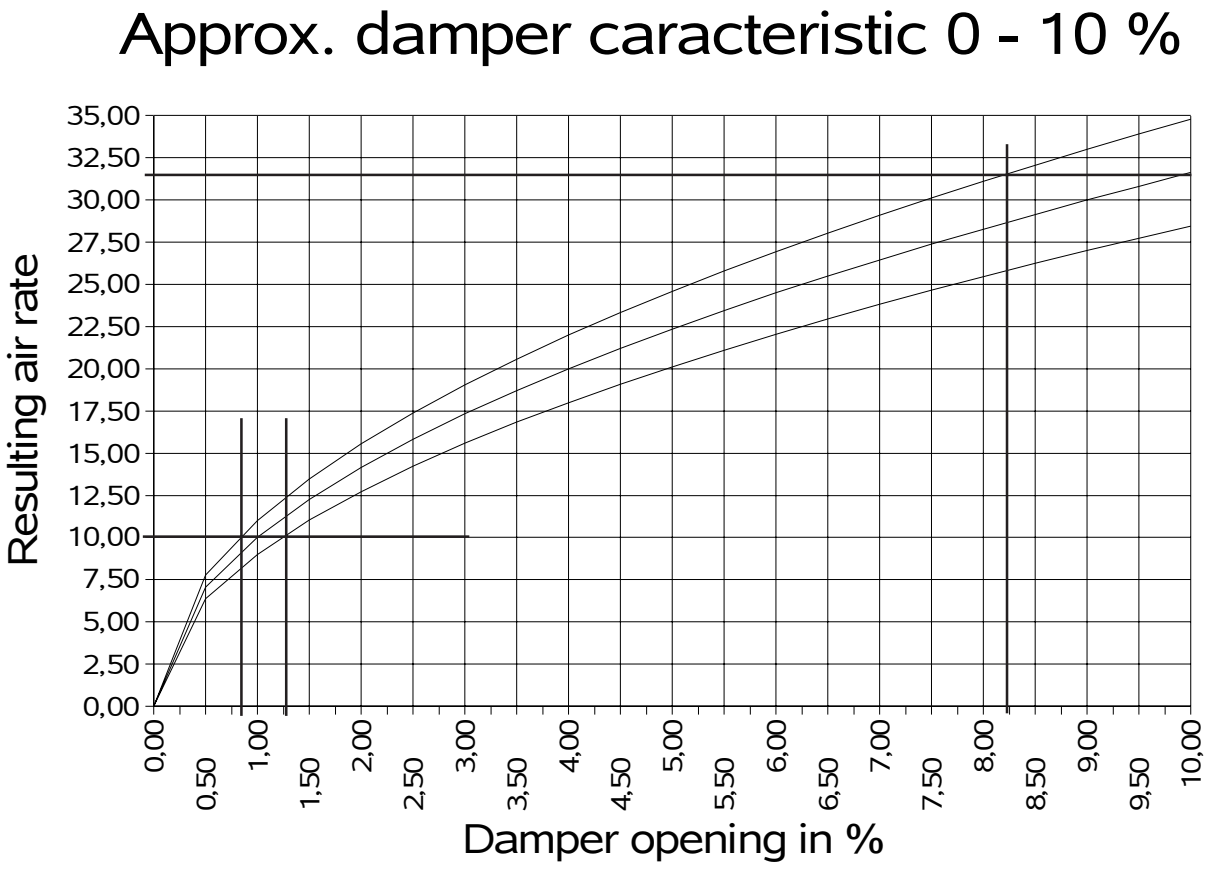
Damper trim actuator design guidelines.

The fans giving the secondary air used in rotational oil burners are regulated using a damper in the air channel as near the burner as possible. The damper are designed using a number of shafts each shaft bearing a metal plate.
When the damper is closed to give minimum air all the plates are sitting side by side enabling them together to close the opening of the channel. Opening this damper gives an air rate that opproximate a second order function to the moving angle of the shafts.
The curves below (please forget the upper and lower ± 10 % curves until later) show the air rate resulting from the first 10 % opening angle.

Remark:

1) 0,5 % opening already gives 7 % of the air rate
2) 10 % opening gives 31,5 % of the air rate



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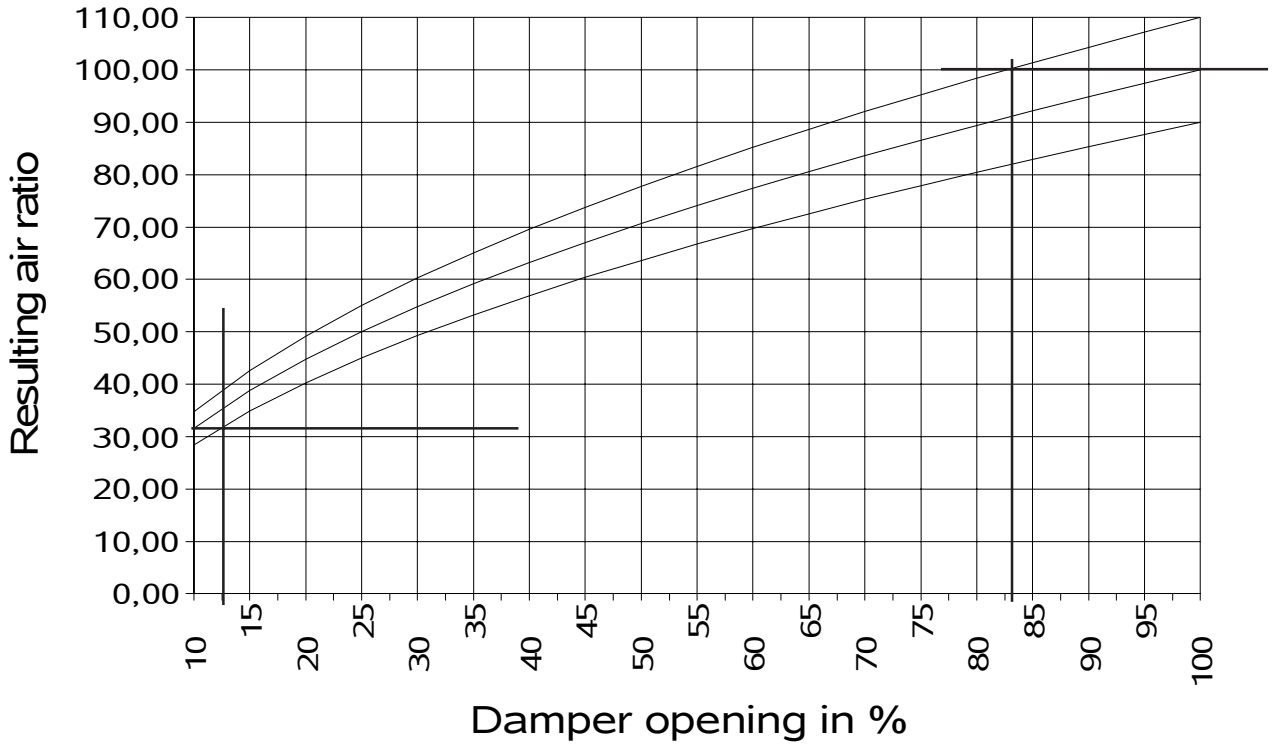
Appox. damper caracteristic



Examining the rest of the opening cuve above show much better liniarity.

I you want to apply an Oxygen Trim System on such a boiler a rule of thumb says that your trim system must not be able to change the original mechanical fuel/air ratio control more than ± 10-15 % - measured on the air volume. Else the flame stability of the burne may be influenced. This result in some severe design considerations:

On the same two curve sheets a set of ± 10 % air rate lines plus some help lines are drawn. From this some figures for a ± 10 damper correction can be derivated:

1) at 10 % air rate only a position change from 0,8 % to 1,26 % (0,46 %) is needed.
2) at 32 % air rate a position change from 8,2 % to 12,5 % (4,3 %) is needed.
3) at 100 % air rate a position change from 83 % to 124 %(41 %) is needed.

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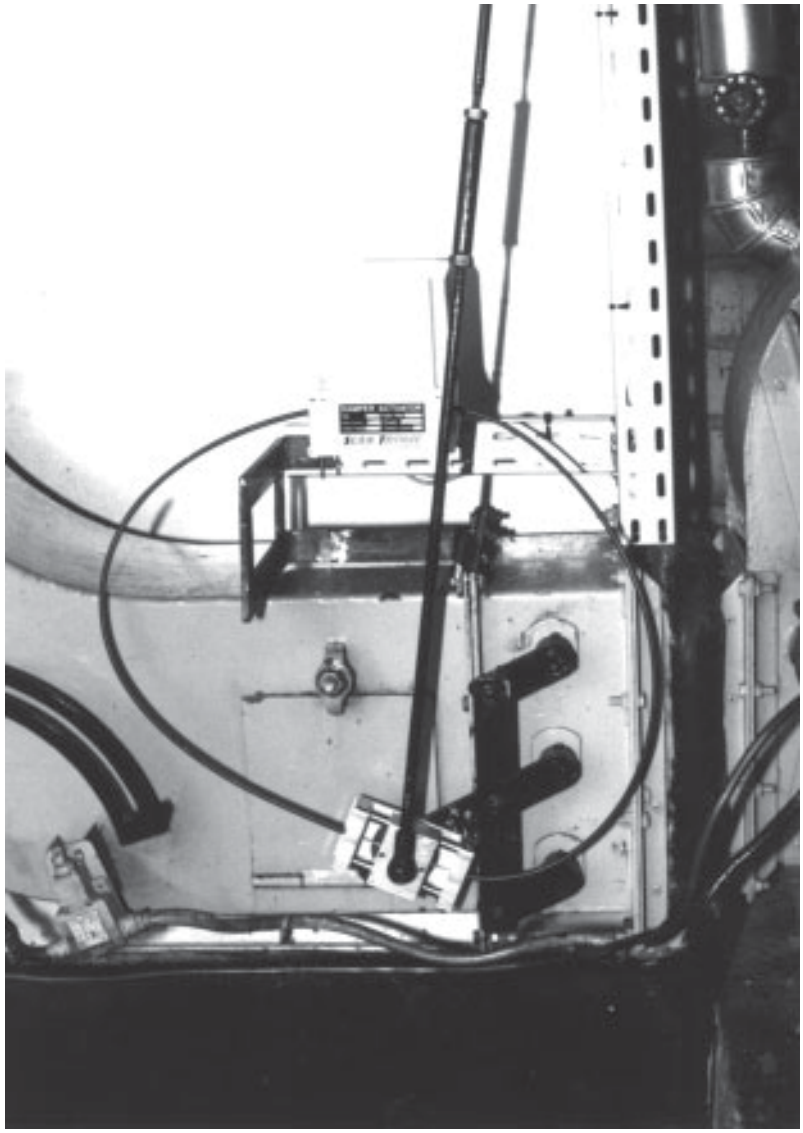
Conclusion:

A device that can change the link to the air damper i a way that increase by a factor one hundred from closed to fully open damper.

ScanTronicssolution are shown right.



The link rod is comming from high above and the damper is shown (with the shafts of 3 plates) and the assoiated extra arms and lingage.

The strange alumina device sitting where the rod ended before the change is the device evoking the trim. The linkage rod is now connected (the ball joint are repositioned) to a sledge that can move ± 25 mm for- and backwards and this in an changing angle to the linkage rod. The sledge is gliding on two 10 mm rods fixed in the assy fixed to the damper arm.

The fotograph show a position near to minimum air position (she sledge is near to a 90 ° angle to the linking rood and when this and the arm is moved upwards the the angle gets smaller and smaller until the sledge is moving in exact in the same rirection as the linking rod adding a trim action of ± 25 mm to the origianal air/fuel ration.

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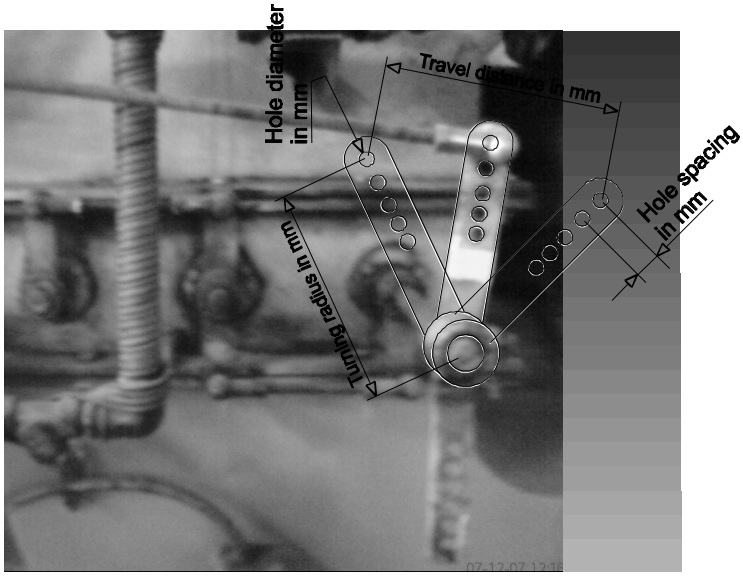
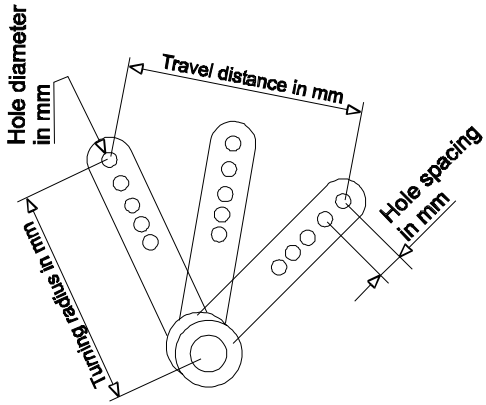
Selecting the correct actuator (the above sliding device and the servomotor (shown fitted just above the middle of the foto) and carefully adapt it to the damper can give a god working and safe trimmed system - that within 5 minutes can be rolled back.

What information is needed and how is the fitting procedure done?

Right a part of a photo from our distributor in Tyrkey is shown.
The linkage from the air/fuel-ratio system is comming from the upper left corner and the





trim sledge can be fitted removing the the ball joint and refitting it on the sledge.

Left the possible positions of the damper arm are sketched and the 4 needed data are listed.
Having these data Scantronic can select the right sledge size.

This examble is strait forward and the long rood for the linkage and plenty of space around the damper arm makes fitting easy.
The actuator can be placed to the right side fixing it on a console on top or front side of the air channel.

On the next page yet another photo examble from Tyrkey is shown.

On this burner the air/fuel linkage is done electronic using one servo motor for each function.

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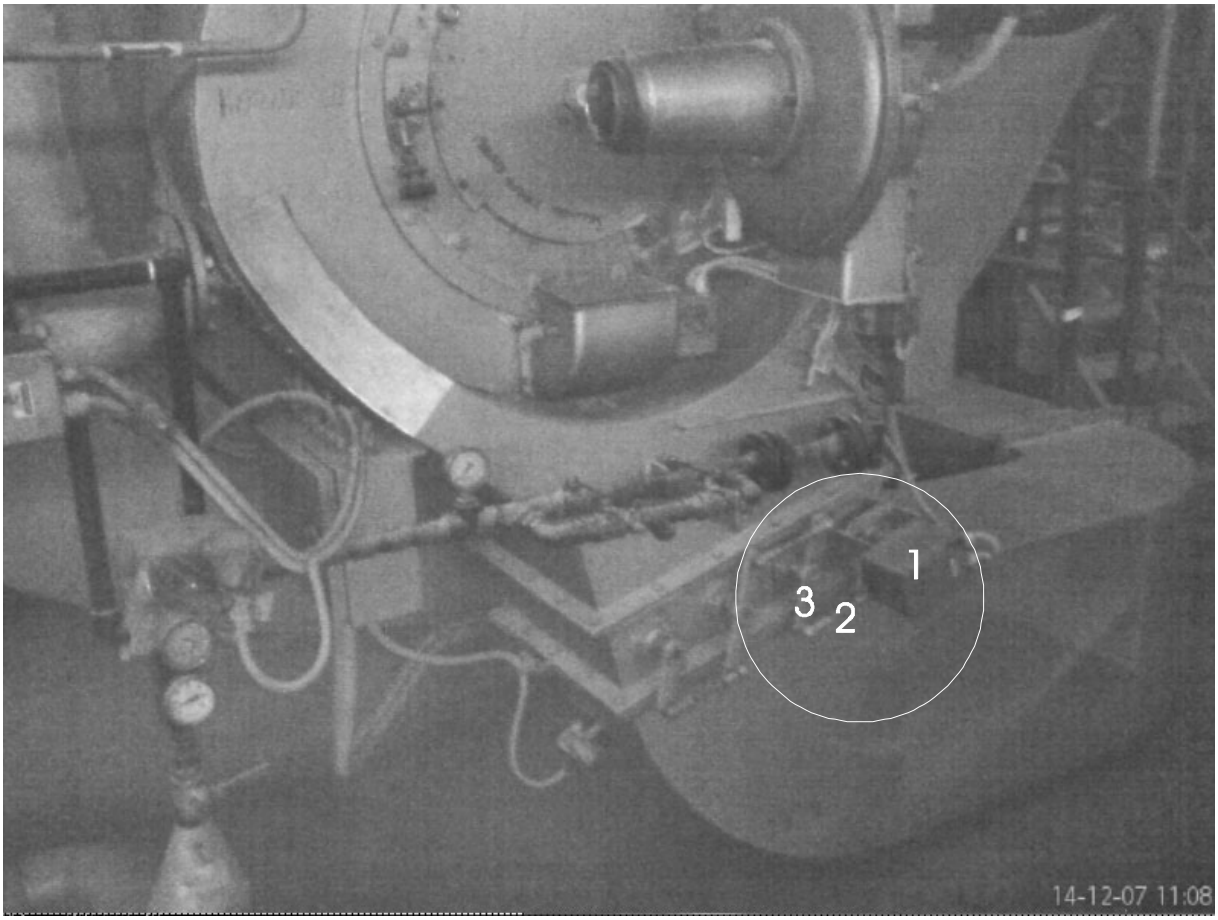
The "1" is the servomotor of the air damper. The servomotor is fitted direct to the end of first shaft of a 4 shaft damper. "2" and "3" are the linkage from shaft 1 to shaft 2.



The ideal solution where to remove the servomotor and refit it on a console on top of the air channel say 50 cm rigtht of the first shaft.
The actuator should then turn the first shaft over a new link connection with two new arms. The new arm on the first shaft should then include the sledge part of the trim actuator and the electrical part on a console - again on console on top of the flue channel.

A less abitious solution are to attach the left end of the linking rod "2" and fit the sledge part of the trim system on the arm of shaft two "3".

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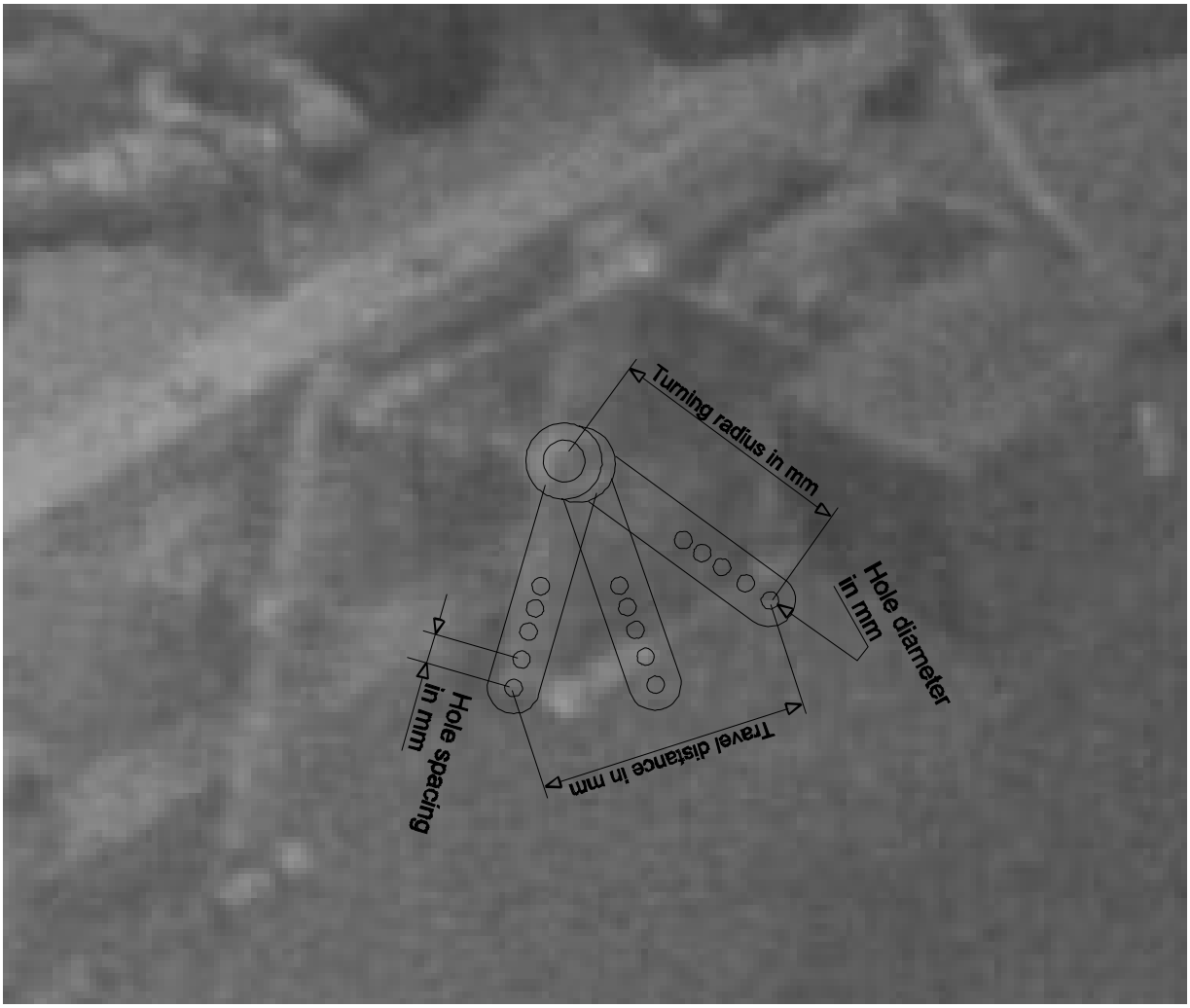

Once agin we need the properties conserning this arm (soory the photo resolution is to poor to give a good enlangement).

Other connection to the original system

1) From the original electrical panel the OTC 2000 need 3 isolated contact sinals:

   a) Start of boiler
   b) Modulation servo motor in maximum (or (if used) preventilation position).
   c) Burner going into modulation

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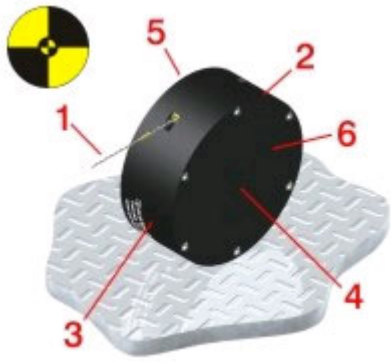
2) From the modulation servo motor the OTC 2000 need a load signal:

   a) The simple solution - if the old system has load signal for i.e. a SCADA system a isolated 4-20 mA signal can be connected direct to OTC 2000.

   b) A potentiometer can be fitted in the servomotor of the load servo motor. This is a economic solution but it can be difficult to get these extra parts for older servo motors. And the gearing must have a close match.

   c) A potentiometer can be connected to the arm of the load servomotor.
   A cood solution could be:
   http://www.prodynamics.com/pdf/174t_de.pdf.
   Over time we have used numerous potentiometers of the "bycycle air pump type" but most brands have problems around the sealing gasket where the rod is moving in and out the house and the wire type is both cheaper and the sealing is rotational and therefore do not have to scrape dust away from the shaft.
   A good precausion when fitting the potentiometer is to fit a "weak" link where the movements is picked up - to protect the internal end stop mechanichs inside the potentiometer.



3) Oxygen sensor and meter fitting is out of the scope of this cocument and we ask you to read the manual on OC 2010 on http://www.scan-tronic.dk/OC2000_OC2010/Manuals/english_manual.pdf and our guide tubes on http://www.scan-tronic.dk/Guidetubes.html

Further Information can at all times be found at the http://www.scan-tronic.dk/ homepage or you can contact info@scan-tronic.dk.
A fax to +45 8691 4577 will also (as an oldfasion snail-mail letter to the address in the top) be answered.