

# 58<sup>A</sup> GDS Helpsheet



*World Leaders in Computer Controlled Testing  
Systems for Geotechnical Engineers and Geologists*

## Hardware

### Advanced Controller 1000cc

### Removal and Reassembly of piston and ball screw

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## 1. Removal

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1. Make sure the instrument is powered off and that the mains power lead is removed from the rear socket. Also make sure that the folding rear feet of the instrument are retracted.
2. Undo the screws fixing the annular plate to the output shaft end of the gearbox. This will allow you to push back the bellows covering the ballscrew and hence expose the connection between the ballscrew and the output shaft of the gearbox.
3. With a small punch and a light engineers hammer, drive out the hardened dowel pin connecting the two shafts together. Be careful not to hit the gearbox and damage the paintwork. If the angle is wrong and the pin is not aligned nearly vertically, you may briefly power on the controller and operate the FILL or EMPTY functions to achieve the best alignment. Do not forget to power off and disconnect the power lead before resuming the procedure.
4. With the heel of your hand, bump the gearbox along so that the two shafts disengage. The bellows may now be removed. Attach a small self-adhesive label to the end of the screw identifying the top of the dowel pin hole and the serial number of the controller. This is so your ball screw will match up again with the output shaft of the gearbox after GDS have fitted a new piston.
5. Using an Allen key/hexagonal drive, remove the 8 stainless steel cap-headed Allen screws securing the light coloured top plate to the darker coloured lower case.
6. With the help of a colleague, gently raise the front edge of the top plate while making sure it does not slide backwards. Be careful - the pressure cylinder is very heavy!
7. Rotate the top plate until you can see inside the case. Make sure that the internal cables are not tensioned, particularly the shortest one which is transparent and connects the key pad to the printed circuit board (PCB).
8. While your colleague holds the top plate in position, reach your hand inside the case and gently pull up from the PCB the connector of the transparent ribbon cable.
9. Now disconnect the other cables linking the top plate to the PCB. The grey ribbon cable to the display is connected to the PCB via a keyed clipped connector which is released by moving the hinged clips up and outwards. On the right hand edge of the PCB, the pressure transducer, limit switches and motor cables may be pulled off the board by moving them to your right. Note that the limit switch and transducer connectors have raised "horns" which are uppermost. Note also that the motor and transducer connections have the individual wire colours printed on the PCB.

10. The top plate may now be moved and rested on the bench top to the rear of the case. You will find it helpful to have a small solid object about 60mm or 2.5" high to prop under the pressure cylinder end block so that the plate is vertical and resting on edge. You may also find it helpful to remove the earth cable (coloured yellow and green stripe) from the top plate to totally free the top plate from the case.
11. The large countersunk screws and alignment pins securing the pressure cylinder end blocks can now be seen. The screws may now be removed using a 3/16" Allen key/hexagonal drive. Now rest the pressure cylinder lengthwise on the edge of your bench so that the top plate is vertical and over the edge and nearest you.
12. Making sure that a colleague has a firm grip of the top plate, lightly tap the plate off the alignment pins using a soft nylon faced mallet. The pressure cylinder and ball screw is now free of the top plate. You may need to feed the pressure transducer lead through the top plate hole. To do this you may need to first cut the tie around the transducer lead loop.
13. Remove the stainless steel cap-headed Allen screws fixing the pressure cylinder flange to the end block from which the ballscrew protrudes.
14. Make sure the pressure outlet is vented to atmosphere. The piston may now be removed from the cylinder.
15. Now fit the keeper rod (which is to be supplied under separate cover) to the end of the ballscrew. Undo the captive ballnut from the pressure cylinder end block and wind it onto the keeper rod. In this way, the ballnut is removed from the screw with the ball bearings retained.
16. The ballscrew may now be removed from the end block. Fit the keeper rod back onto the ball screw and wind the nut onto the screw again.
17. Send the piston and ball screw to GDS.

## 2. Reassembly

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1. Fit the keeper rod with the ballnut to the end of the ball screw. Wind the ballnut back onto the keeper rod. Pass your returned ballscrew through the pressure cylinder end block such that the new piston is on the side with the flange securing holes.
2. Lightly smear the piston and o-ring with silicone grease. Offer up the piston to the open end of the pressure cylinder and gently press the piston into the cylinder. Line up the end block with the pressure cylinder flange and fix the cylinder to the block with the cap-headed Allen screws.
3. Fit the keeper rod with the ballnut to the end of the ball screw. Wind the ballnut back onto the screw. Screw the ballnut back into the end block. The pressure cylinder, piston and ballscrew should now be reassembled.
4. Now fix the cylinder back onto the top plate. This is done by positioning the cylinder lengthwise on the edge of the bench with the end block alignment pins pointing towards you. With the help of a colleague, offer up the top plate to the cylinder so that the appropriate hole line up with the alignment pins. With a soft nylon-faced mallet, tap the top plate onto the alignment pins. Now insert the large countersunk screws and tighten them home with a 3/16" Allen key/hex drive.
5. Position the top plate and the case alongside each other lengthwise on the bench with the plate to the rear. Reconnect the earth lead (yellow and green stripe) if disconnected. Reconnect the motor lead to the PCB (note the colours and that the connector should have a plain upper surface). Reconnect the display lead to the PCB. The connector is keyed and will only go in the right way. Make sure the grey ribbon cable is not twisted.

6. The new piston you have fitted is longer than the old one because it now houses an updated thrust bearing assembly. Accordingly, the limits to the stroke of the piston need to be reset. This is done as follows.
7. Remove the rear limit switch after you have carefully noted its position. Attach the slotted metal plate provided to the limit switch using the screw in the countersunk hole. The assembly should be in line.
8. Fix the assembly in position with the rear limit switch screw passing through the slotted hole such that the limit switch is now some 40mm nearer the pressure cylinder than before.
9. Reposition the forward limit switch with the fixing screw in the next hole so that the forward limit switch is nearer the pressure cylinder. Turn the forward limit switch so that it is at about 45 degrees to the line of the ballscrew and fix it in position.
10. The top plate may now be fixed back onto the case of the instrument. With the help of a colleague, lift the top plate onto the case such that the rearmost edge of the top plate is resting on the rearmost edge of the case. Be careful because the motor and gearbox are still free to move on the ballslide.
11. While your colleague holds the front edge up, reach under the top plate and into the case. (Don't forget that the instrument should be powered off and the power lead disconnected at this time!) Reconnect the limit switches and the transducer cables (note the "horns" on the connectors should be uppermost). Push the display connector back onto the PCB making sure it is not twisted. Gently lower the top plate down being careful to tuck in any cabling that may get trapped.
12. Fix the top plate to the case using the cap-headed Allen screws. Do not overtighten.
13. Now the ballscrew and gearbox can be reconnected. First, fit the bellows over the ball screw making sure to get it the right way round with the keeper-ring end towards the end of the ballscrew. Now push the gearbox up to the ballscrew. By hand, turn the ballscrew so that the top of the dowel pin hole corresponds to the position of the hole in the gearbox output shaft. Push the two shafts together and line the holes up. You may need to separate the shafts and try again if they do not line up first time. Drive in the hardened dowel pin. Some versions of the controller were fitted with 3/32" spring pins and so the new pin will not fit. In these cases, drill a 3mm hole through the existing hole and ream out with 1/8" ream to obtain a light tap fit with the dowel pin provided.
14. Fit the bellows keeper-ring to the face of the gear box.
15. Power on the controller and using the TEST function key, invoke the diagnostic procedures and check out all the main hardware functions. In particular, use the FILL and EMPTY functions to check that the repositioned limits are correct. Re-adjust if necessary. Note that the forward limit switch position can be checked by observing both the piston position through the pressure outlet hole and the ballslide position with respect to the forward end stop. Note also that the rear limit switch position can be checked by both listening for the stepper motor slipping (indicating the piston has reached the end of the cylinder-immediately press RESET and EMPTY if this occurs-don't worry, the system is failsafe and you cannot hurt it!) and observing the ball slide position with respect to the rear end stop.
16. Using the FILL and EMPTY functions, fill the cylinder with deaerated water.
17. If there are any problems, call GDS.