Displacement Detection System

Model 4200
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1. Introduction & Parts Guide:

This manual provides guidance on the installation of the HMA Geotechnical Displacement Detector System (DDS) Model 4200. The system is designed to provide an audible and visual alarm when displacement is detected on a slope or unstable ground.

**Model 4200 DDS parts guide**

4200-1 Displacement Detector Controller  
4200-2 Sensors  
4200-3 & 4200-4 Surface/Borehole Anchors  
4200-5 Alarm Signal (Audible & Visual)  
4200-6 Power Supply (Battery & Solar Panel)  
4200-7 Borehole Sensor Collar  
4200-8 Cable Clamps  
4200-9 Stainless Steel Wire Rope  
4200-12 Electrical Cable  
4200-13 Anchor Eyebolt Adaptor  
4200-15 Support Stand

**Equipment required to install the system**

Hammer  
Screwdriver (Philips/Star & Flathead)  
2x Adjustable Spanners  
Side Cutters  
Parrot Nosed Cutters  
Pliers

**IMPORTANT NOTE – The two anchor positions are termed as following:**

*Sensor Anchor* – Normally closest to the DDS Control Box and outside of the failure zone.  
*Dead Anchor* – Within the failure zone.
## Specifications:

### Displacement Detector System

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement Range</td>
<td>0-90 mm</td>
</tr>
<tr>
<td>Number of Sensors (Maximum)</td>
<td>6</td>
</tr>
<tr>
<td>Maximum distance between intermediate anchors</td>
<td>5 m</td>
</tr>
<tr>
<td>Maximum distance between Sensor and Controller</td>
<td>300 m</td>
</tr>
<tr>
<td>Maximum distance between Controller and Alarm</td>
<td>500 m</td>
</tr>
<tr>
<td>Controller Power</td>
<td>12V DC Sealed Lead-Acid Battery and 20W Solar Panel</td>
</tr>
<tr>
<td>Alarm Power</td>
<td>12V DC Sealed Lead-Acid Battery and 20W Solar Panel</td>
</tr>
<tr>
<td>Controller Dimensions</td>
<td>600 mm H x 400 mm W x 200 mm D</td>
</tr>
<tr>
<td>Controller Weight</td>
<td>13 kg</td>
</tr>
<tr>
<td>Sensor Dimensions</td>
<td>Ø30 mm x 500 mm L</td>
</tr>
<tr>
<td>Sensor Weight</td>
<td>4 kg</td>
</tr>
<tr>
<td>Alarm Dimensions</td>
<td>600 mm H x 400 mm W x 200 mm D</td>
</tr>
<tr>
<td>Alarm Weight</td>
<td>15 kg</td>
</tr>
</tbody>
</table>
3. **Installation Method – Sensors & Controller**

1. Confirm with site engineers where the sensors are to be located and that the site is safe for installation to proceed.
2. Place every anchor at the expected installation positions and lay out the steel wire rope. Ensure that there is enough rope available for the installation before proceeding.
3. Place the DDS controller and DDS alarm box at their installation positions and confirm that there is enough electrical cable to connect the two. If the boxes are being installed at different locations and there is a significant cable run, cable protection such as PVC pipe should be considered.
4. Drive each surface anchor post (4200-3) into the ground ensuring that the narrow edge is perpendicular to the direction of expected displacement.
5. Prepare to attach the sensor (4200-2-1) to the surface anchor post. Align the sensor so that the graduated end points away from the direction of the dead anchor.

![](Typical_setup_showing_a_dead_anchor,_intermediate_anchor_and_sensor_position.png)

6. Attach the sensor (4200-2-1) to the surface anchor post using the supplied wing nut.
7. Drive the dead anchor post (4200-2-12) into the ground. Again ensure that the narrow edge is perpendicular to the direction of expected displacement.
8. Cut the stainless steel cable (4200-9) to suit the distance between the points allowing enough excess to pass through the brass sensor tube.
9. Fix the stainless steel cable to the brass clamp on the dead surface anchor.
10. Run the steel cable back to the sensor and thread it through the brass tube.
11. Tension the stainless steel cable so that the sensor is tensioned to the predetermined gradation. Fix the stainless steel cable using the cable clamp provided. The tension will alter how much movement can be allowed. For example, six gradations will allow 60mm of movement. The maximum allowable movement is 100mm.
12. If there is excessive sag in the wire then intermediate anchors with eyebolt adaptors (4200-13) may be added.

Unacceptable Sag

13. Once the sensors are in place, mount the controller (4200-1) and the alarm signal (4200-5) in the positions required.

14. With the controller door open, run the electrical cable from the sensors and alarm into the controller cabinet through the hole in the bottom of the cabinet.

15. Unscrew the face panel and hinge it open. Check that the circuit breaker is turned off.

16. On the back of the face panel connect the battery, sensor cables and alarm cable to the terminal strip. Make sure that the polarity of the battery and alarm are correct. The battery lead may be connected to the terminal strip already. In this instance simply connect the other end to the battery ensuring correct polarity.
17. Attach the solar panel (4200-6-1) and support stand (4200-15) to the top of the controller and run its cable into the box through the gland in the top of the box. Note that when you are installing the solar panel, if the panel is exposed to sunlight the power cable will be live. Ensure the red and black wires do not make contact with themselves or the enclosure.

18. Connect the solar panel cable to the S+ and S- terminals.
4. **Installation Method – Alarm Unit**

![Supplied Materials (Alarm System)](image)

1. 3 x Cable glands
   1 x 8mm bolt with spring washers & nuts
   2 x 6mm bolt with spring washers
2. 2 x long & 1 x short solar panel brackets
3. Mounting post
4. Alarm box
5. Flashing light
6. Solar panel
**STEP 1. Mounting Alarm Enclosure**

Open Alarm Box with key provided. Insert 4 x 8mm bolts through rear of box attaching to stand as per figure 3.

**STEP 2. Mounting Solar Panel Brackets**

Unscrew the small bolt located on the mounting post just above the siren. Attach the short Solar panel bracket with the spring washer and bolt which has just been removed (see Figure 4). Now attach the two longer solar panel brackets with 2 x 8mm bolts to the top of the mounting post (see Figure 5). Fasten each 8mm bolt with a spring washer and nut at the back of the mounting post (See Figure 6).
**STEP 3. Mounting Solar Panel**

Obtain the solar panel & 5 x 8mm bolts. The solar panel has a grove at each end on the reverse side (See figure 7.). In one groove place 1 x 8mm bolt in the middle of the groove and 1 x 8mm bolt each side. In the other groove, place 1 bolt each side. Each of these bolts have now been roughly lined up in relation to the 5 holes in total available on the mounting brackets (See figure 8.) Flip the solar panel and feed the bolts attached to the solar panel through the holes on the solar panel brackets (See figure 9.). Fasten the 5 x 8mm bolts each with a spring washer and nut.
STEP 4.  Mounting Flashing Light

Free the hook-up wire coming out of the top of the mounting post (See figure 11). Acquire the Flashing light. Securely attach the end of the Flashing light cable to the hook-up wire within rubber grommet (See Figure 12 & 13). Below the Alarm box on the mounting post, will be the other end of the hook-up wire within the rubber grommet (See figure 14). While feeding the flashing cable into the mounting post, pull the hook-up wire through, and the flashing light cable will follow (See figure 15). Attach flashing light with 2 x 6mm bolts with spring washers (See figure 16).

Note: In some cases, it is easier to remove the rubber grommet on the mounting post to pull the cable through easier.
STEP 5.  Solar Panel Cable

Un-tape the hook-up wire beneath solar panel, located on the mounting post. Securely tape the solar panel cable to hook-up wire (See figure 17.). Pull out rubber grommet from mounting post and slide up close to solar panel to make pulling through cable easier (See figure 18.). Beneath the Alarm enclosure, the other end of the hook-up wire is located. Pull through solar panel cable (See figure 19.). Push rubber grommet back into mounting post.

![Figure 17](image17.png)

![Figure 18](image18.png)

![Figure 19](image19.png)
STEP 6: Wiring Connections

Remove hook-up wires. Attach cable glands to enclosure, with the rubber washer on the outside of the enclosure (See figure 20). Feed through solar panel cable and Flashing light cable through the cable glands (See figure 21). Connect the solar panel wires to the terminals labelled “Solar Panel” (Note the polarity, see Figure 22). Connect Flashing light wires to the terminals labelled “Warning Light” (Note: The brown wire is +VE). The Switch (See Figure 23) controls the Audible Siren only, it has no effect on the operation of the rest of the system.