A GPS option for CDS

CDS-012-P

GEODYNAMIK

Contents

CDS with GPS-positioning - CDS-P

General information

The system is based on CDS hardware that has been a tested and proven concept for a long time. It is supplemented with software that processes the position data from a GPS unit, which is connected to the CDS serial port.

The CDS is operated by the roller driver as usual, and the driver receives supplementary information in the form of section data and lateral distances from selected reference lines that are displayed as figures on the bottom border of the screen. All position information is continually updated.

The surface area to be compacted is displayed on the screen as a rectangular surface showing 10 roller-passes side-by-side with a length that can be chosen from between 60 m. and 600 m. The program processes and displays compacting data on the screen in the usual manner and adds position information to enable the compacted surfaces — relative to the construction site's reference lines — to be defined and stored together with the compacting results.
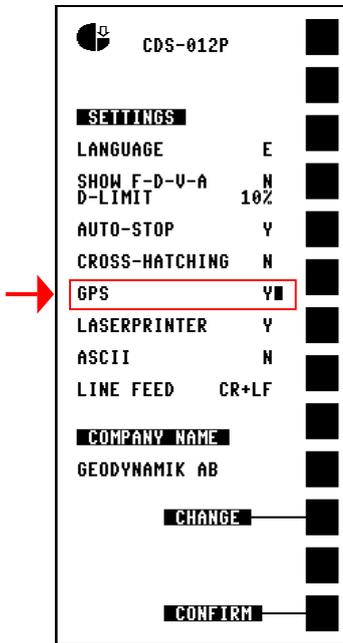
The CDS can, of course, be used with manual start-section input should GPS information be lacking or not required. The information displayed to the driver always consists of section data and lateral distances relative to the chosen reference line already stored in the CDS.

The reference lines are defined by the driver in advance as tables having sections along the reference line and with corresponding coordinates. The tables have to use a coordinate system that the connected GPS unit can generate. The tables are transferred to the CDS via the serial port and stored there until replaced by new reference tables. The PC software program for transferring tables to the CDS is supplied by Geodynamik.

Position data is received as position coordinates from the connected GPS unit. The coordinates are transformed by the CDS into section/lateral-distance/level data relative to the active reference lines. It is assumed that the data is supplied as NMEA signals (GGA) approximately once a second. The CDS-P has, otherwise, no special GPS requirements as regards type or manufacture.

The accuracy of available GPS units varies. A simple GPS, having no correction data supplied by a base station, has an accuracy of about 5 m, which is insufficient. With DGPS systems, this accuracy is down to 0.5 m most of the time, which is good enough to determine the position of the roller passes during compaction. Height accuracy is at least twice as unreliable and, therefore, cannot be used for level control or to document what level is being compacted. With an RTK system, accuracy can be down to centimeters, but, then, both cost and complexity increase dramatically.
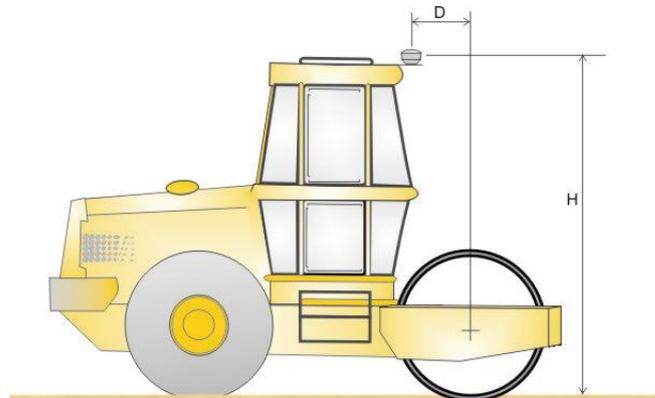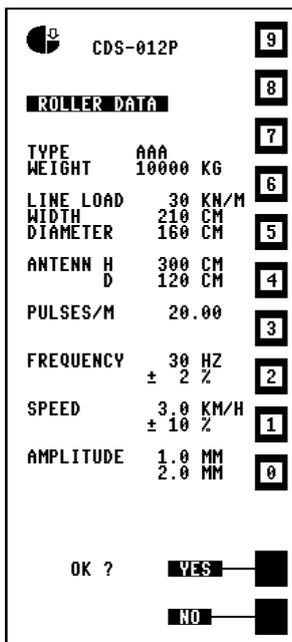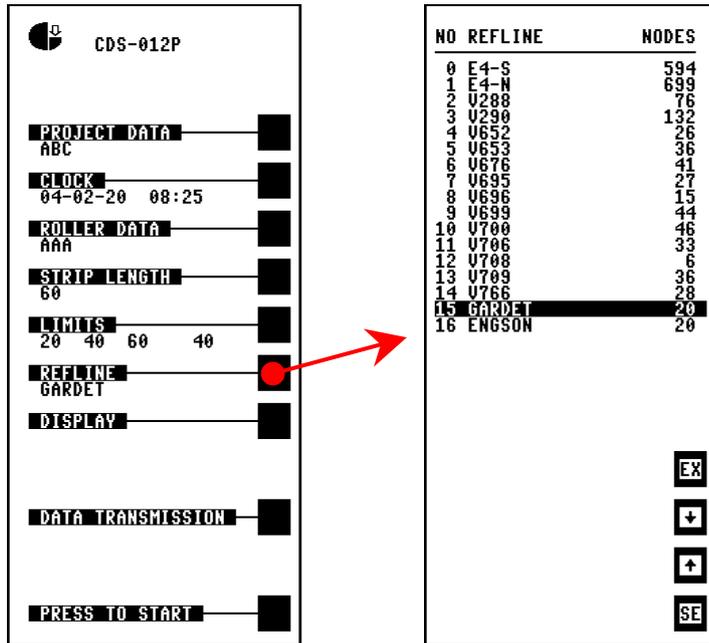
Settings

```
      CDS-012P

   SETTINGS
   LANGUAGE        E
   SHOW F-D-V-A    N
   D-LIMIT        10%
   AUTO-STOP       Y
   CROSS-HATCHING  N
→  GPS             Y
   LASERPRINTER    Y
   ASCII           N
   LINE FEED    CR+LF

   COMPANY NAME
   GEODYNAMIK AB

        CHANGE

        CONFIRM
```

The only setting in the **SETTINGS** menu that differs from a normal CDS is that for **GPS**. Select **Y**(es) or **N**(o) depending on whether or not a functioning GPS system is connected.

Roller data

Position data from the GPS unit relates to the position of the antenna. In order that the position can be converted into roller position and/or ground level, the system must be given dimensions **D** and **H** (see figure). These values are to be in centimeters and entered using the menu **ROLLER DATA**.

```
      CDS-012P          9

   ROLLER DATA         8

   TYPE      AAA       7
   WEIGHT  10000 KG
                       6
   LINE LOAD   30 KN/M
   WIDTH      210 CM   5
   DIAMETER   160 CM
                       4
   ANTENN H   300 CM
         D    120 CM
                       3
   PULSES/M   20.00
                       2
   FREQUENCY   30 HZ
             ±  2 %    1
   SPEED      3.0 KM/H
             ± 10 %    0
   AMPLITUDE  1.0 MM
              2.0 MM

   OK ?      YES

             NO
```
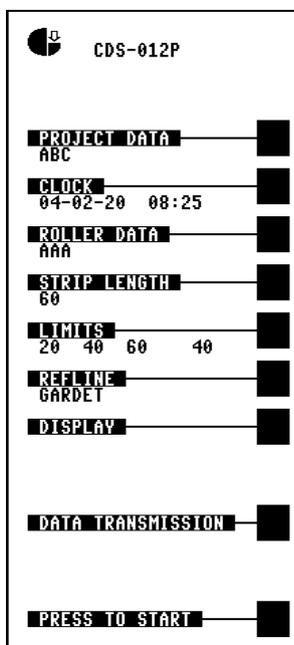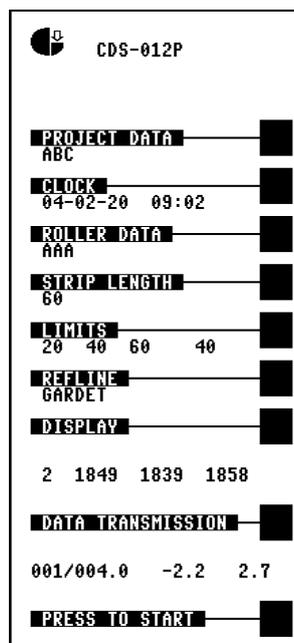
Reference lines

A list of the reference lines stored at the moment in the CDS is displayed if **REFLINE** is selected in the main menu.

Move the cursor up or down using the arrow keys and choose the selected reference line with **SE**. There is storage space for up to 32 reference lines.

Registration

When the CDS is switched on, the **MAIN MENU** is displayed first (see figure).

Within a couple of minutes, the GPS system becomes functional and displays position data. The menu is then supplemented with two text lines that show GPS function and the actual position as section, lateral distance, and height.

When the first of the four integers is equal to 2, it means that the GPS system is receiving base-station data and providing fully accurate positioning.

The bottom row of figures shows section, lateral dimensions, and height for the antenna's position.

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Values are calculated by the CDS based on the selected reference line and updated once a second.

The system is now ready for registering compacting data.

Registration starts as usual by first choosing **PRESS TO START** in the main menu and then **NEW AREA**. Then choose **AREA PART, LAYER TYPE**, and **LAYER NO** in the next menu list. An empty registration surface will then be displayed (see figure).
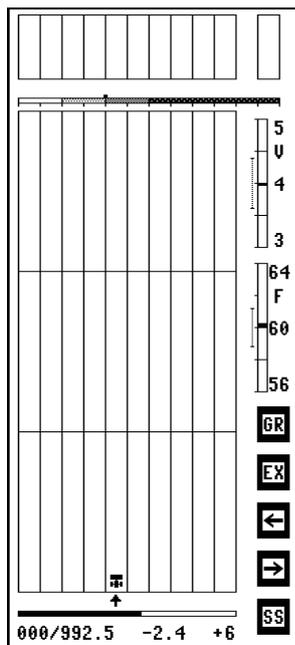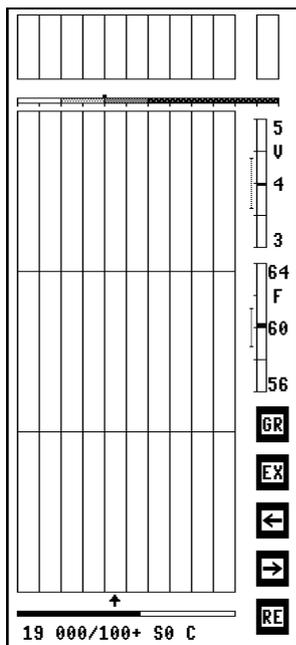
The actual position is continuously displayed at the bottom of the screen.

The first pass on a new surface is carried out exactly the same way as when registering without GPS.

When **RE** is pressed, a roller symbol is displayed above the starting line and the **RE**-key changes to **SS**.

The next time this **SS** key is pressed, registration is activated.
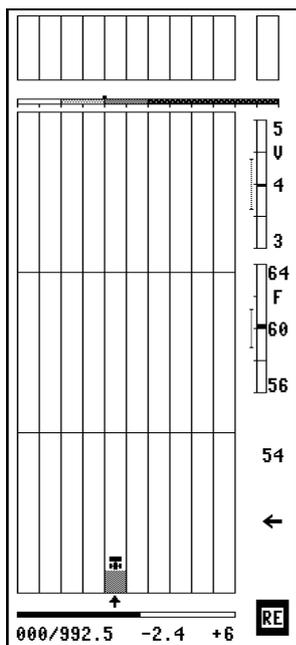
During registration, position is displayed in the bottom row. CMV, as a number, is also displayed on the right-hand side of the screen.

If the roller's path should deviate too much from a line parallel to the reference line, an arrow is shown — either to the left (see figure) or to the right — to indicate which direction the driver must turn to correct.

Registration is automatically terminated when the edge of the compacting surface has been passed, or if the pass is manually terminated by pressing **RE**.

Compacting of the surface, pass by pass, is then automatically carried out with the preselected overlap.

Registration takes place only during forward passes, and the CDS-P automatically chooses the pass for which the data is to be stored based on the lateral distance from the reference line calculated from the GPS data.

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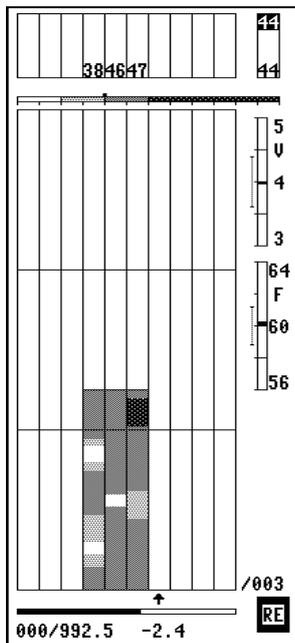
When the roller is backed up a few meters behind the defined starting line, the screen looks something like the one in the figure here. The arrow pointing upward underneath the compacting surface moves step by step between the various passes depending on the position of the roller.

When the roller begins to move forward, the selected pass is locked and a roller symbol is displayed.

Then, when the roller passes over the defined starting line, registration automatically starts for that selected pass.

Result presentation

Two lowest values for control surface
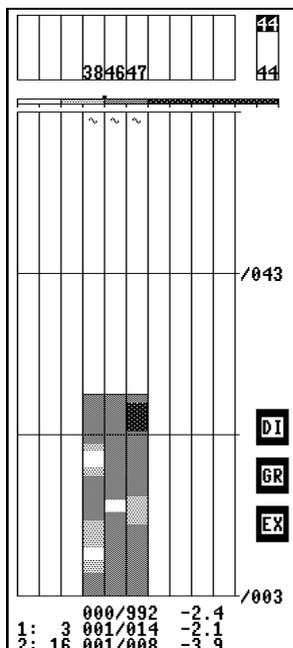
According to some compaction specifications, static plate-loading tests are to be carried out at two points on a control surface. These points are to be chosen within those sections of the control surface that have had the two lowest CMV.

The CDS-P continually calculates the values and the positions for the two lowest CMV across a surface. The calculations are made for the last run on each pass.

Should two values for a pass lie closer to one another than 2 m, they are to be considered to be the same "low-area" and another low point has to be found.

In order to check out the points for plate-load-tests while in the roller cab, select first **DISPLAY** from the main menu and then choose the desired control surface from the list. The screen will display something like that shown in the figure.

The two rows at the bottom show value and position for the two lowest CMV.

The rows above continually show the actual position. The CDS-P can be used, because of this information, to mark out the two points by moving the roller to each section and lateral distance, respectively, in accordance with the two bottom rows.

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CCC-report

The CDS and its PC software can generate reports as A-4 pages for each control surface, i.e. a so-called CCC-report.

For the GPS version of CDS software, the CCC-report is supplemented by

- corner data for the control area given as section/lateral distance,

- section/lateral distance for the two areas having the lowest CMV.

```
CDS-012J   GEODYNAMIK AB                          GEODYNAMIK
Compaction Documentation System          04-02-19  21:30


                                    PROJECT :   ABCDEF
                                                GARDET 1
                                    ROLLER DATA
                                     Model      :    ABC
              384647                 Weight     :   10000 kg
                                     Width      : 210/180 cm
                                     Amplitude  : 1.0/2.0 mm

                                    CALIBRATION VALUES
                                     Layer :  0 C  SUBGRADE
                                     f: 60 Hz  v: 3.0 km/h  A: low

                                    STRIP MARKINGS for
                                     f-deviation   >  2% (58.8-61.2)
                                     Double jump   > 20%
                                     v-deviation   > 10% ( 2.7- 3.3)

                               /043 RESULTS - LAST PASS
                                     Max striplength :  25.0 m
                                     Compacted area  :   135 m2
                                     One value :   0.9 m2

                                    COMPACTION METER VALUES
                                    Number    Mean     SD     CV
                                      150     44.0    11.3    26%

                                    < 40:    27 m2 ( 20%)

                               /023 Limit     20     40      60
                                    Area       7     27     129 m2
                                               5     20      96 %

                                    FREQUENCY/SPEED
                                          Min    Mean    Max
                                    f    60.1   60.3    60.5 Hz
                                    v     2.9    2.9     3.0 km/h

                                    COORDINATES
                                    001/035  -5.0   001/029  +0.8
                                    001/004  -4.8   001/004  +0.0
                               /003
ABCDEF                              MINVALUES
01 001/003+ 031211 18:01           1:   3  001/015  -2.1
                                   2:  16  001/009  -3.9
```