

## OPERATION MANUAL

### DYNAPAR PLANTING MONITOR (DPM-100)



The *Dynapar Planting Monitor* (DPM-100) allows monitoring variables of interest in the process of planting seeds or dispersing inoculants, specially designed to meet the needs of the agricultural sector.

Both the **technical characteristics** (see sections 1 to 4) and the **functions** (see section 5) of the DPM-100 are proof of *Dynapar's* proposal for excellence.

## 1 Environmental Characteristics

### 1.1 Waterproof Rating and Protection

IP53: effective against ingress of dust and sprays of water.

### 1.2 Temperature

Operation: 0 to 65°C (32 to 149°F).

Storage: -25 to 75°C (-13 to 167°F).

## 2 Mechanical Characteristics

### 2.1 Enclosure box and assembly

Black anodized aluminum enclosure, dimensions: 185mm x 123mm x 60mm (7.28" x 4.84" x 2.36").

RAM® double socket arm, ball base and fixing clip.

DPM-100 assembled dimensions: 199 x 149 x 74 mm (7.83" x 5.87" x 2.91"), detailed in Fig. 1 below.

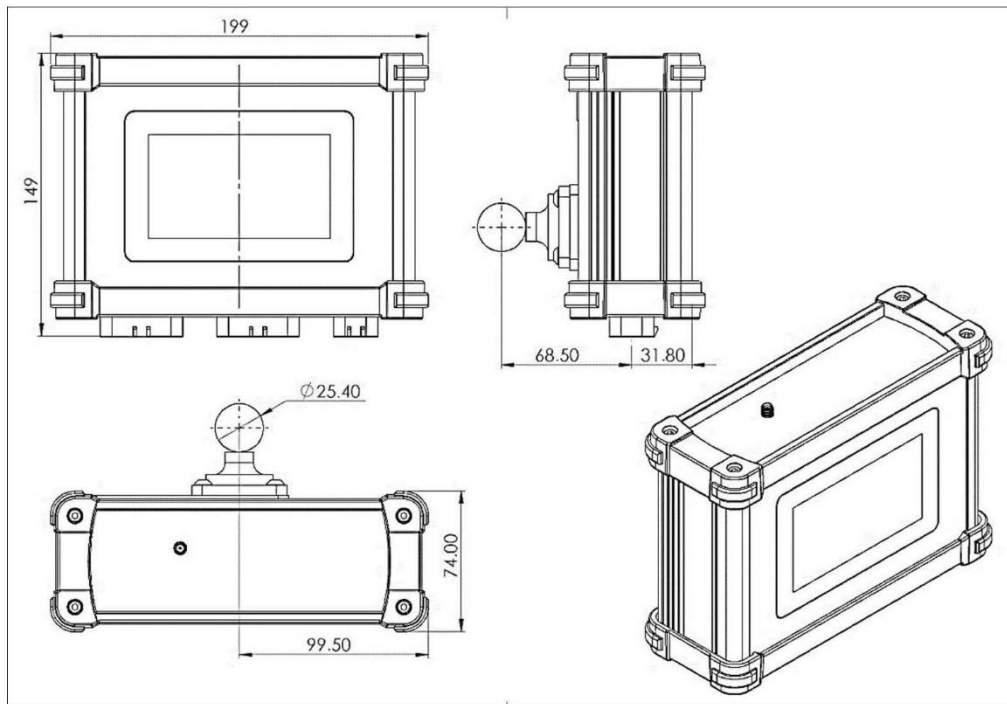


Figure 1 – DPM-100 views and dimensions (millimeters)

## 2.2 Connectors

The DPM-100 is equipped with 8 and 23-pin male AMPSEAL series automotive connectors, sealed type.

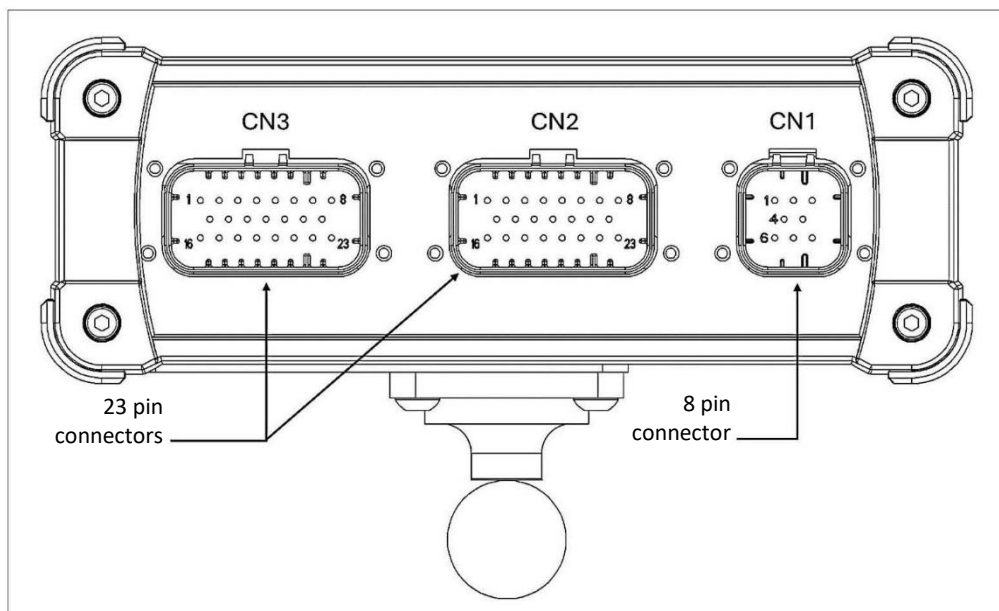


Figure 2 – DPM-100 connectors

Figure 2 above shows three connectors of the DPM-100. The "CN1" connector brings the connections from the tractor battery to the Planting Monitor (general power supply). Through the "CN2" connector we have signal inputs from 1 to 20 and power supply outputs for the seed (or inoculant) sensors. Finally, the "CN3" connector provides signal inputs from 21 to 40 and power supply outputs for the sensors.

### 3 Electronic Characteristics

#### 3.1 Display

The display is color, with capacitive touch screen (better response to touch), IPS (In-Plane Switching) technology for the best user experience in terms of color reproduction and viewing angle with high brightness and contrast (for optimal viewing of data even against sunlight).

The display has 4.3" and resolution of 480 x 272.

#### 3.1 Signal Inputs

The DPM-100 has capacity for up to 40 opto-coupled rows (input channels for seed or inoculant sensors, CN2 and CN3): robust against electrical discharges, noise and incorrect assembly.

Signal inputs are compatible with NPN output sensors: *Dynapar*, *Dickey John*, among others.

Table 1 shows the pinout of CN1 connector (monitor power supply).

Table 1 – CN1 Connector Pinout	
Pin – number #	Function
1	+Vbat
2	Not Connected (N.C.)
3	0V
4	+Vbat
5	Not Connected (N.C.)
6	CAN+
7	0V
8	CAN-

Table 2 shows the pinout of CN2 connector (signal inputs from 1 to 20 and power supply outputs for the seed/inoculant sensors).

Table 2 – CN2 Connector Pinout	
Pin – number #	Function
1	+Vsensor
2	0V
3	Not Connected (N.C.)
4	Ex_signal_20
5	Ex_signal_19
6	Ex_signal_18
7	Ex_signal_17
8	Ex_signal_16
9	Ex_signal_15
10	Ex_signal_14
11	Ex_signal_13
12	Ex_signal_12
13	Ex_signal_11
14	Ex_signal_10
15	Ex_signal_09
16	Ex_signal_08
17	Ex_signal_07
18	Ex_signal_06
19	Ex_signal_05
20	Ex_signal_04
21	Ex_signal_03
22	Ex_signal_02
23	Ex_signal_01

Table 3 shows the pinout of CN3 connector (signal inputs from 21 to 40 and power supply outputs for the seed/inoculant sensors).

Table 3 – CN3 Connector Pinout	
Pin – number #	Function
1	+Vsensor
2	0V
3	Not Connected (N.C.)
4	Ex_signal_40
5	Ex_signal_39
6	Ex_signal_38
7	Ex_signal_37
8	Ex_signal_36
9	Ex_signal_35
10	Ex_signal_34
11	Ex_signal_33
12	Ex_signal_32
13	Ex_signal_31
14	Ex_signal_30
15	Ex_signal_29
16	Ex_signal_28
17	Ex_signal_27
18	Ex_signal_26
19	Ex_signal_25
20	Ex_signal_24
21	Ex_signal_23
22	Ex_signal_22
23	Ex_signal_21

### 3.3 Power Supply

#### 3.3.1 Planting Monitor Power Supply (DPM-100)

Voltage: 12Vcc, lead acid battery (automotive)

Consumption current: up to 200 mA (without sensors connected)

#### 3.3.2 Power Supply of Seed or Inoculant Sensors

Maximum current per sensor: 50 mA

Power supply outputs:  $8,2V_{-0,4}^{+0,4}$  .

### 3.4 GNSS

Integrated GNSS (Global Navigation Satellite System) module of standard precision, multi-constellation for all GNSS-L1 systems (*GPS*, *Galileo*, *GLONASS*, *BeiDou*) with external standard SMA antenna (female connector, SubMiniature version A).

## 4 Other information

### 4.1 Languages

The DPM-100 is available in Portuguese, English and Spanish.

Although the default language is Portuguese, the preferred language can be selected in *Settings* (see section 5.8).

### 4.2 Tests performed

The DPM-100 has undergone several testing, and their characteristics are detailed below.

#### 4.2.1 Vibration

The DPM-100 was tested and approved under two types of vibration testing:

- random vibration (IEC60068-2-64 standard, duration of 8h/axis on the 3 axes, with RMS acceleration of 3.45g from 10 to 1,000 Hz), and
- sinusoidal vibration (IEC60068-2-6 standard, duration of 2h/axis on the 3 axes, with frequency from 10 to 500Hz, increasing acceleration from 10 to 60Hz and constant acceleration of 5g from 60 to 500Hz).

#### 4.2.2 Temperature

The DPM-100 is suitable for operation from 0 to 65°C (32 to 149°F), and storage from -25 to 75°C (-13 to 167°F).

#### 4.2.3 ISO14982 Standard Protocol

The DPM-100 was developed to meet the ISO14982 standard protocol (Oct. 2017): Agricultural and forestry machinery — Electromagnetic compatibility — Test methods and acceptance criteria.

#### 4.2.4 Protection Rating: IP53

The DPM-100 was tested and approved against ingress of dust and sprays of water, with the IP53 protection rating. The 1st cardinal number (IP5#) means that it is dust protected (under a negative pressure of 200mm water column and air suction up to 80 times the DPM-100 enclosure volume). The 2nd cardinal number (IP#3) means that it is protected against sprays of water under an angular variation of  $\pm 60^\circ$ .

### 4.3 Option for the Climate FieldView™

The DPM-100 leaves the factory (native from *Dynapar*) with the electronics already suitable for the *Climate FieldView™* feature, by *Agro Bayer*. However, this function requires:

- a *Dynapar* kit (for fixing to the DPM-100 enclosure) including some parts: specific cabling and connectors, tether support and screws for external assembly. This kit can be purchased separately, after purchasing the DPM-100.
- *Climate FieldView™* hardware and software, which must be purchased by the customer directly from the manufacturer.

## 5 DPM-100 Functions

The *Dynapar Planting Monitor* (DPM-100) can display several variables of interest in the process of seed planting or inoculant dispersion. For better user experience, a main screen (summarizing the main information) and other specific screens (to be used according to interest) were provided. The next sections show the specificity of each screen.

### 5.1 Startup screen

The DPM-100 starts (acc. to Fig. 3) by pressing the "power" physical button (rear of the enclosure) for more than 2 seconds. For turning off the monitor, simply press the same button for 5 seconds.

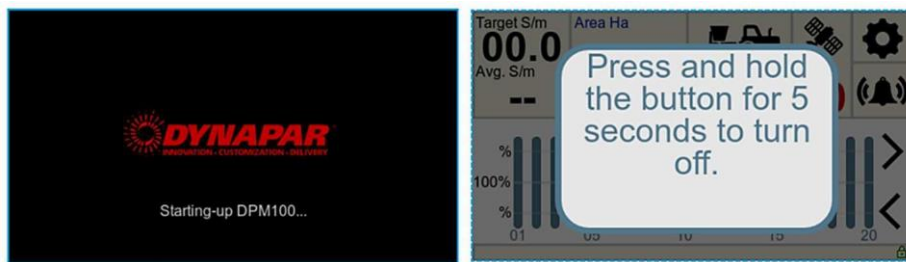


Figure 3 – DPM-100 startup (left) and shutdown (right) screens

### 5.2 Main Screen

On Fig. 4 it is possible to view different information (or fields).

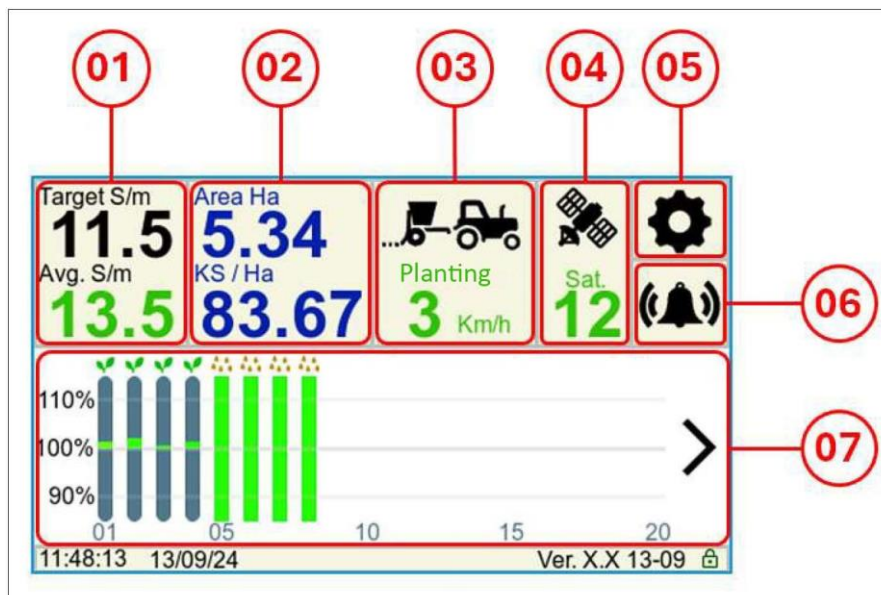


Figure 4 – Main screen and fields

Table 4 contains information for each field within the DPM-100 main screen.

Table 4 – Information of fields on the DPM-100 main screen		
Field # (acc. to Fig. 4)	Function	Description
01	Target S/m; Avg. S/m	Expected <i>seeds/meter</i> target; averaged <i>seeds/meter</i> occurred
02	Area Ha; KS/Ha	Total planted area, in Hectares; quantity of kilo-seeds/hectare scattered
03	Tractor status: Planting; Km/h	The statuses are Planting, Maneuvering, Stopped, and Testing. Instantaneous average speed of the tractor.
04	Sat.	Number of satellites obtained in real time through the GNSS module
05	Settings symbol	Different settings are arranged on specific screens
06	Alarms symbol	Multiple visual/audible alarms can be configured
07	Overall status of the rows: sensors	Displays number of rows (seed or inoculant sensors), variation/condition of each row relative to target (in %). There are 2 screens, each with 20 rows.

### 5.3 Navigating the main screen

From Fig. 5 it is possible to view several screens that are available from the main screen. For each of them, you can return to the main screen by clicking on the "home" button (🏠).

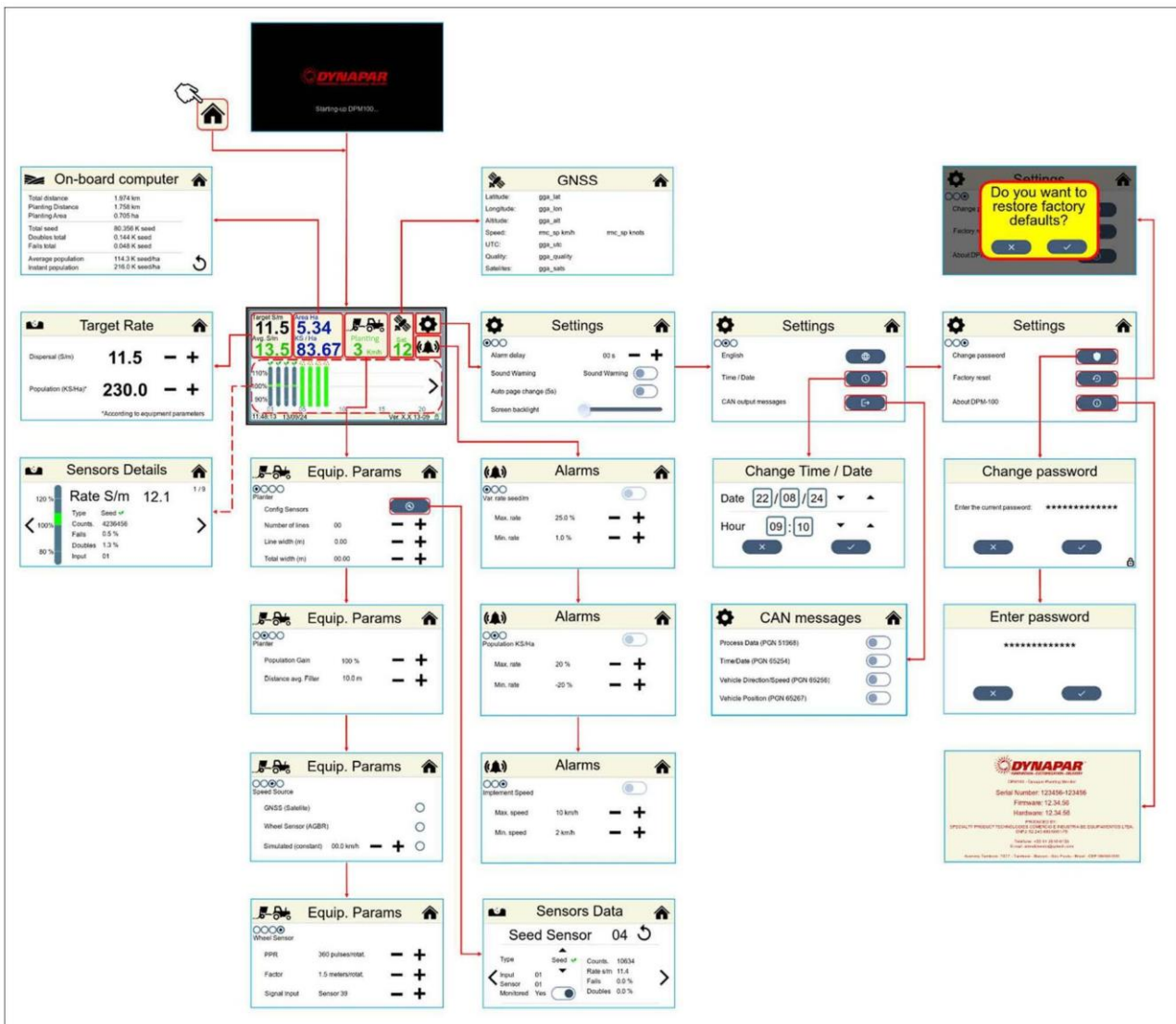


Figure 5 – Screens from the DPM-100 main screen

In any case, for the safety of the planting manager, the DPM-100 operates with a password for the most important settings, as shown in Fig. 6.

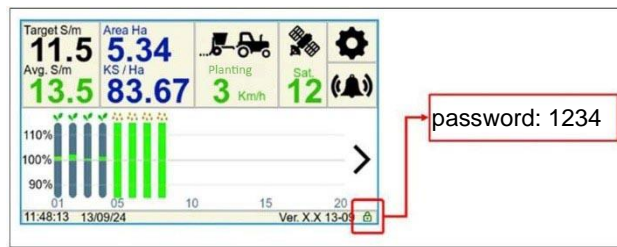


Figure 6 – Default (factory) password

The default password (1234) can also be changed as shown in Fig. 7 below.

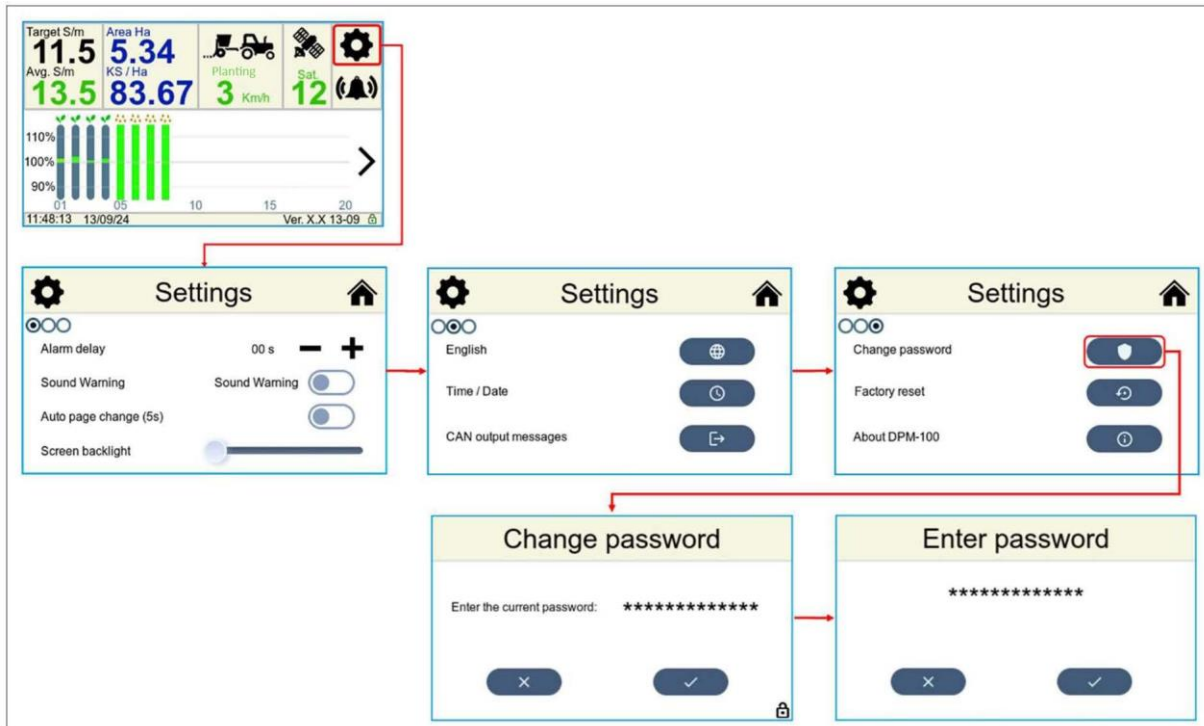


Figure 7 – Password change

The following sections show specific information for each field on the main screen.

#### 5.4 Target Rate

The target rate screen (Fig. 8) allows two planting variables to enter: seeds per meter (S/m) and population in kilo-seeds/hectare (KS/Ha).



Figure 8 – Target rates for dispersal and population

These two variables appear on the main screen as a reference for monitoring.

### 5.5 On-board computer

The on-board computer screen (Fig. 9) preserves various information about the tractor's path, seeds dispensed (as well as the count of failures and double seeds), average and instantaneous population.

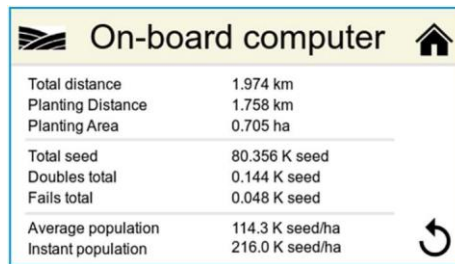


Figure 9 – On-board computer screen (computed data)

In addition to the total seed count, the DPM-100 also provides seed count information for each planting row (see next section).

### 5.6 Planting and Implement Parameters and Conditions

The DPM-100 performs the line-by-line monitoring of sensors. As an example, see Fig. 10. It shows the overall planting status. Specifically in the region underlined in red it is possible to check the condition of each enabled row/sensor. In the 20 possible rows that can be seen on the first screen<sup>1</sup>, only 8 sensors were configured.



Figure 10 – Detail on the main screen: status of each line/sensor

In Fig. 10, rows 1 to 4 were set for seed dispersal and rows 5 to 8 for inoculant dispersal. The first row shows a status above the target, and the rows 2 to 4 are in a normal condition. Rows 5 to 7 are in normal condition and row 8 has a problem (in relation to the configured target and tolerances).

Fig. 11 shows how to access and edit planting and implement parameters and conditions, from the main screen (Fig. 11, top left screen). The relevant variables of the agricultural implement are configurable in Fig. 11, intermediate screens (there are 4 different configurations when sliding each screen). The sensor setup is configured as shown in Fig. 11, right screen (in this case, specific to 'sensor 04').

<sup>1</sup> The DPM-100 supports 40 rows or sensors. Fig. 10 shows rows 1 to 20. Rows 21 to 40 can be accessed by the "next" button (>), on the far right of Fig. 10, region underlined in red.



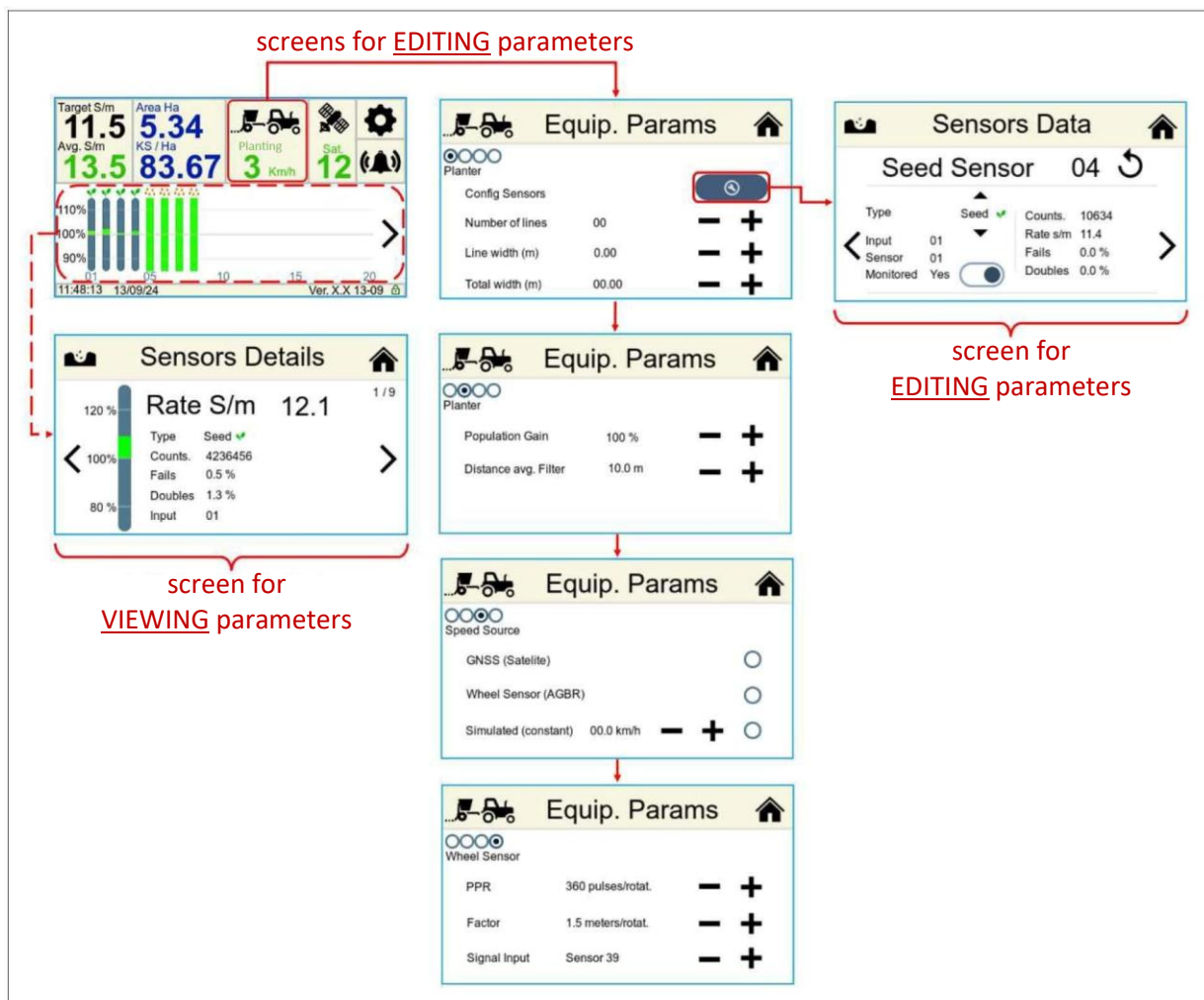


Figure 11 – Planting status screens, equipment parameters and sensor setup

By clicking on the full planting status area (see Fig. 10, red outlined area), it is only possible to view the data from each sensor in operation (acc. to Fig. 11, bottom left screen).

A breakdown from Fig. 11 is shown below for the setting/viewing screens of both, each sensor/row (acc. to Fig. 12) as well as the agricultural implement (acc. to Fig. 13).

### 5.6.1 Planting Parameters and Conditions

In addition to viewing the entire planting monitoring (see Fig. 10), the DPM-100 allows viewing the data from each sensor individually, as shown in Fig. 12, right screen. From this screen it is possible to see the seed count, the seeds per meter rate, count of failures and double seeds, as well as the specific setup for this sensor (planting seeds or dispersing inoculants, whether you want to monitor it, or not, etc.)

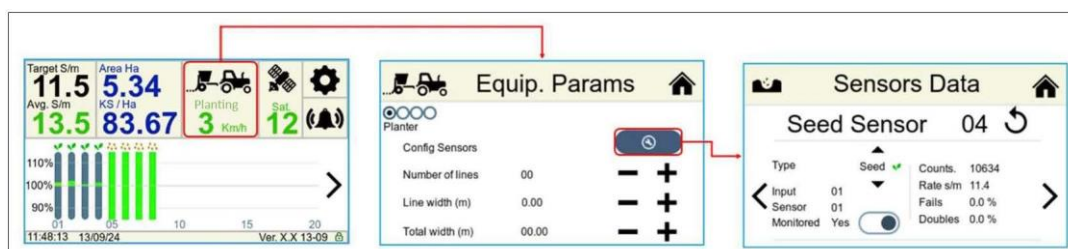


Figure 12 – Setup and information for a specific planting row (sensor)

For viewing the rows on the main screen, when accessing the right screen in Fig. 12, press the sensor "search" button (🔍). This will automatically search for connected rows and detect seed (or inoculant) sensors.

### 5.6.2 Implement Parameters and Conditions

Tractor and implement parameters and conditions are accessed through the main screen, as shown in Fig. 13, left screen: tractor image outlined in red. There are 4 screens for setting/viewing implement data. Each screen must be swiped to access the others.

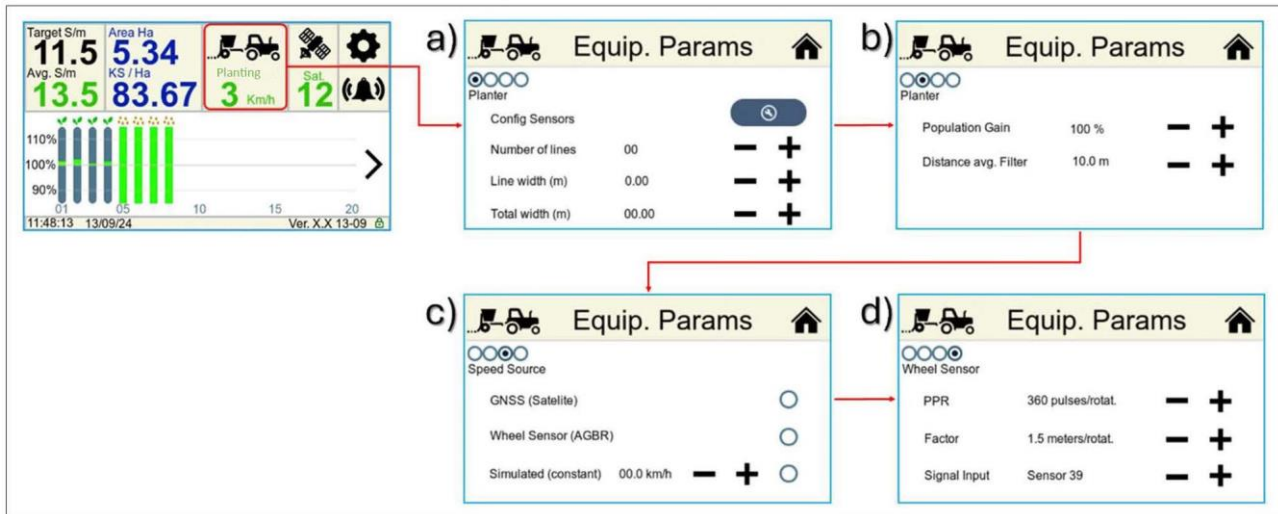


Figure 13 – Implement settings

The planter data (number of rows, distance between rows and total width) are entered through the screen in Fig. 13, a). The screen in Fig. 13, b) can be used for setting the proper population gain, mainly. On the screen in Fig. 13, c), we can choose which data source will be used to compute the velocity data (from the GNSS module of DPM-100, or via the wheel/encoder sensor on the machine's shaft), and there is also the option of performing a test using a simulated constant velocity. On the screen in Fig. 13, d), it is possible to characterize the counting method for the data from the wheel sensor.

### 5.7 Visual and Audible Alarm Settings

Visual and audible alarms can be enabled/configured as shown in Fig. 14 below.

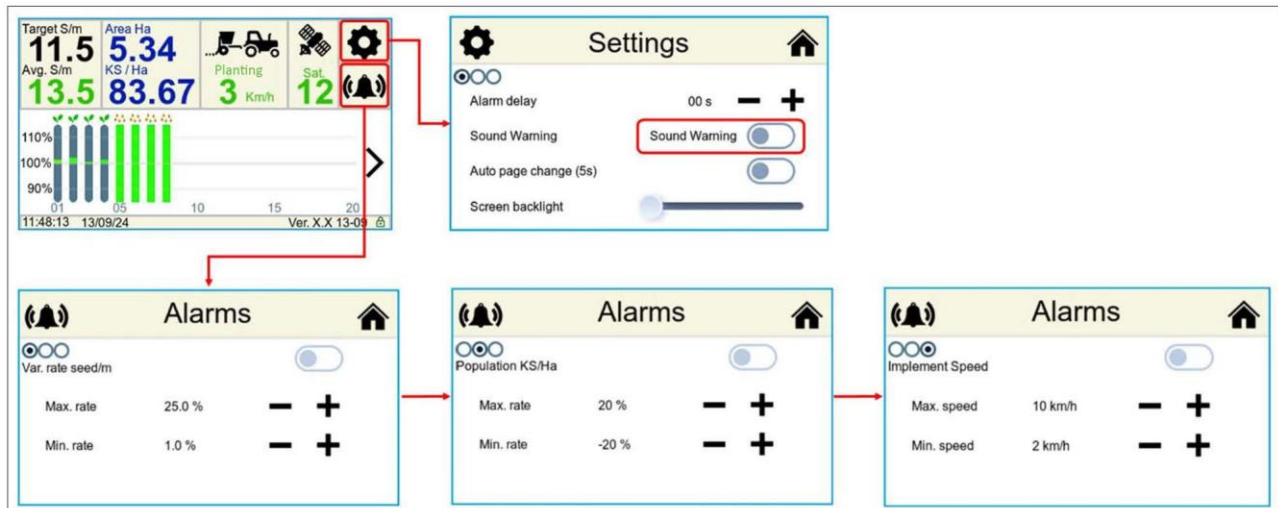


Figure 14 – Alarm settings

Three alarm types can be set, for:

- seeds per meter rate: higher and lower limits (%), with row failure
- population: minimum and maximum limits (%)
- tractor velocity: minimum and maximum values (km/h)

Once the alarms are set, depending on the operating and sensing conditions, warnings will occur with specific information, as shown on Fig. 15 below.

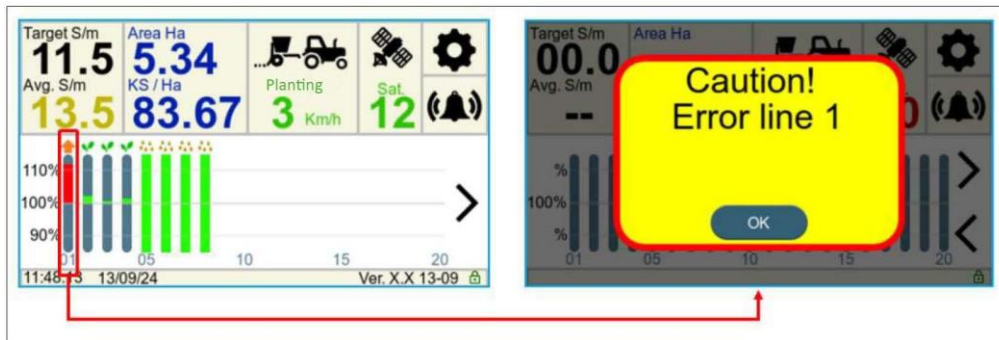


Figure 15 – Alarm occurring due to conditions on row #1

### 5.8 Information of latitude, longitude, number of satellites and UTC

The DPM-100 is integrated with a GNSS module (see section 3.4) able for indicating latitude, longitude, number of satellites and UTC (Coordinated Universal Time), as shown (implicitly) in Fig. 16.

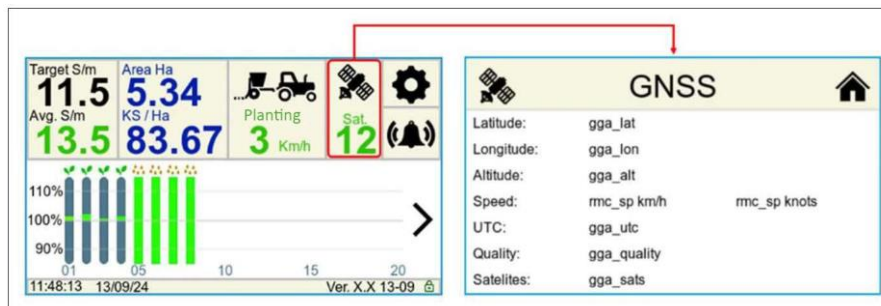


Figure 16 – Data from the DPM-100 GNSS module

The greater the number of satellites incorporated (as shown in Fig. 16, left screen, satellite image outlined in red), the greater the confidence of data (tractor positioning and velocity).

### 5.9 Languages

The DPM-100 leaves the factory set to the Portuguese language, although it can be configured to English or Spanish using the proper button (see Fig. 17).

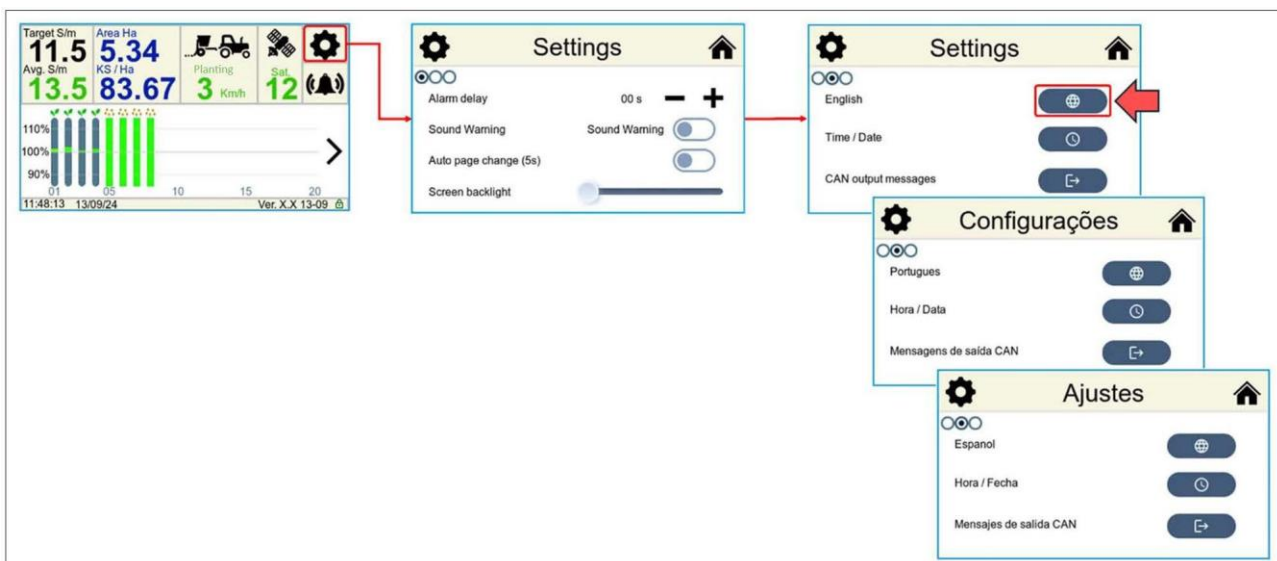


Figure 17 – Language settings