

**ROJ**

**CE**



**PCS 200**

Installation  
Operation  
Maintenance

ORIGINAL INSTRUCTIONS

**PCS 200 – Rev. 3.0 – October 2019**

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This manual is meant for the **PCS 200 Kit** users.

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Thank you for your trust and we wish you all the best in your work.

**The PCS 200 is a patented equipment which employs exclusive and high-tech solutions.**

# PCS 200

## INSTALLATION, OPERATION AND MAINTENANCE MANUAL

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**TABLE OF CONTENTS**

**PREFACE** ..... **iii**

Safety ..... iv

CE Marking identification ..... iv

Compliance with the European Directives and Regulations ..... v

Warranty and Responsibility of the Manufacturer ..... vi

Other Warranty terms ..... vi

**1. GENERAL INFORMATION** ..... **1.1**

1.1 INTRODUCTION ..... 1.1

1.1.1 The ideal solution to control and optimize the seeding process ..... 1.1

1.1.2 Purposes of this manual ..... 1.1

1.1.3 How to use this Manual ..... 1.1

1.1.4 Symbols used in this Manual ..... 1.2

1.1.5 Environment protection ..... 1.2

1.2 GENERAL INFORMATION AND PERFORMANCES ..... 1.3

1.2.1 Introduction ..... 1.3

1.2.2 Functional blocks ..... 1.3

1.2.3 Machines on which the integration of the mentioned partly completed machinery is foreseen ..... 1.4

1.2.4 Acronyms used ..... 1.4

1.3 COMPONENTS OF THE PCS 200 KIT ..... 1.5

1.4 GENERAL INFORMATION ABOUT SAFETY ..... 1.7

1.4.1 Design criteria ..... 1.7

1.4.2 Safety Devices and Solutions ..... 1.8

1.4.3 Warning about residual risks ..... 1.9

1.4.4 Warnings and Behaviour rules for the Operator ..... 1.9

1.4.5 Noise levels ..... 1.10

1.4.6 Proper and improper use ..... 1.10

1.4.7 Reliability of the safety-related control systems ..... 1.10

**2. INSTALLATION** ..... **2.1**

2.1 DMD0 e DMD2 (MD) GEARED MOTORS FEATURES ..... 2.1

2.2 MOTORS (MD) INSTALLATION ..... 2.1

2.2.1 General principles ..... 2.1

2.3 DMD0 ..... 2.1

2.3.1 Outlet shaft torque and speed ..... 2.2

2.3.2 Outlet shaft dimensions ..... 2.2

2.3.3 Fixing flange features ..... 2.2

2.2.2 Tilting limits ..... 2.2

2.2.3 Transport cap ..... 2.3

2.2.4 Fastening ..... 2.3

2.4 DMD2 ..... 2.4

2.4.1 Outlet shaft torque, speed and axial/radial loads ..... 2.4

2.4.2 Overall dimensions of the geared motor and dimensions of the outlet shaft ..... 2.4

2.4.3 Fixing flange features and geared motor fastening ..... 2.5

2.5 ALTERNATOR ..... 2.6

2.5.1 Pulleys and rotation direction ..... 2.6

2.5.2 Absorbed mechanical power and radial loads ..... 2.7

2.6 BATTERY .....2.8

2.7 SPEED SENSOR .....2.8

2.7.1 Single cogwheel sensor .....2.8

2.7.2 Wheel sensor check .....2.9

2.8 MACHINE POSITION SENSOR .....2.10

2.8.1 Position sensor check .....2.11

2.9 ECU POSITIONING .....2.11

2.10 SDB POSITIONING .....2.12

2.11 WIRING DIAGRAM .....2.13

2.11.1 Main components.....2.14

2.11.2 ECU connection .....2.15

2.11.3 SDB and power supply cables connection.....2.16

2.11.4 MD connection .....2.17

2.11.5 Safety switch .....2.20

**3. USER MANUAL ..... 3.1**

3.1 MACHINE START-UP .....3.1

3.2 GRAPHIC ORGANIZATION .....3.2

3.3 ACCESS LEVELS .....3.3

3.4 MOTORS ADDRESSING .....3.4

3.4.1 Machine configuration .....3.5

3.4.2 Addressing.....3.6

3.5 MACHINE CONFIGURATION .....3.9

3.6 SEEDING SETTINGS .....3.14

3.7 HOME .....3.29

3.7.1 Rows exclusion .....3.31

3.7.2 Summary information about the seeding job .....3.32

3.7.3 Synoptic Tab .....3.33

3.7.4 Seeding job.....3.37

3.8 ALARMS .....3.38

3.9 SOFTWARE UPDATE AND PROTOCOL CHANGE .....3.45

3.10 STATISTICS .....3.52

3.11 TERMINAL .....3.57

3.12 TEST .....3.60

**4. MAINTENANCE AND TROUBLESHOOTING ..... 4.1**

4.1 GENERAL INFORMATION ABOUT MAINTENANCE .....4.1

4.2 ORDINARY PREVENTIVE MAINTENANCE TASKS TO BE CARRIED OUT BY THE OPERATOR .....4.1

4.3 MAINTENANCE/REPAIR TASKS RESTRICTED TO SPECIALIZED PERSONNEL .....4.2

4.4 SPARE PARTS .....4.3

4.5 PROCEDURE FOR THE MD REPLACEMENT OR EXCHANGE .....4.5

**UPDATES INDEX**

9/18/2014	1 <sup>st</sup> Edition
3/29/2016	2 <sup>nd</sup> Edition
10/10/2019	3 <sup>rd</sup> Edition

All machines <sup>(1)</sup> and equipments designed and manufactured by **ROJ** are supplied with the relative user's manuals in compliance with the Essential Safety Requirement (ESR) 1.7.4 - *Instructions* – Annex I of the Machinery Directive 2006/42/EC.

Since the Machinery Directive requirements, first of all the ESR in Annex I are **legally binding obligations**, **ROJ** put a special emphasis on all ESR 1.7.4 clauses during the drafting phase of these manual, in particular:

1. The **ROJ** user and maintenance manuals are supplied in the language of the machine destination country, within the European Union and, when necessary, an "Original language" copy of the manual is also provided.
2. The **ROJ** manuals always include a "proforma" copy of the EC Declaration of Conformity or a "proforma" copy of the Declaration of Incorporation of the "Partly completed machinery" for the relevant machine. These are just set out by way of indication, and they shall not be considered as replacing the original Declaration of Conformity Incorporation subscribed by the supplier, and delivered separately to the Customer.
3. The **ROJ** Use and Maintenance manuals contain the information deemed as important and necessary by the Manufacturer in order to:
  - Correctly understand the functioning principles of the machine.
  - Carry out all the handling/mounting, installation/power sources cabling, in **Safe conditions**, keeping into account the possible dangers related to the above activities and giving directions, prescriptions and suggestions arising from a careful risk assessment by the Manufacturer according to the principles of the EN 12100:2010 Harmonized Standard and the ISO/TR 14121-2 Risk Assessment Guide.
  - Properly use the machine (safety devices, emergency devices, operating procedures etc.) in **Safe conditions**, drawing the operator's attention on the possible "Residual risks", i.e. the still remaining risks despite all the safety measures taken after the risk assessment, as previously mentioned.
  - Carry out the ordinary/preventive maintenance of the machine <sup>(1)</sup> in **Safe conditions**, also drawing the maintenance operators attention on the possible Residual risks.
4. The **ROJ** Use and Maintenance Manuals do not only describe the intended use of the machine <sup>(1)</sup>, but they also give information about the improper uses which can reasonably be foreseen, based on the Manufacturer's experience.

## SAFETY

In relation to the risk analysis and assessment activities carried out in accordance with the principles of the EN 12100: 2010 Harmonized Standard (as described in par.3 above), **ROJ** has selected the various components of the control and safety systems in a way as to ensure a reliability level suitable to the actual severity of the hazard. To this purpose we have followed the requirements of the EN 13849-1:2008/AC:2009 Harmonized Standard. Where the severity of the hazard is high (3 or 4 according to the classification of EN 12100:2010 Standard), the countermeasures adopted are carefully evaluated in order to guarantee the necessary safety margins, through redundancy or oversizing principles.

**ROJ** machines<sup>(1)</sup> comply with the Immunity and Electromagnetic Radiation Limits defined by the EN ISO 14982: 2009 Harmonized Standard for Industrial Environments. .

The **ROJ** User and Maintenance Manuals contain the updated list of the harmonized standards applied during the design stage to guarantee the compliance with the Essential Safety Requirement Listed on Annex I of 2006/42/EC Directive, while the design and implementation details are described on the Technical File kept by the manufacturer according to the prescriptions of the Machinery Directive 2006/42/EC.

*(1) The term "Machine" as used in this manual generally refers to the definition given in the Machine Directive, 2006/42 / EC and therefore includes both the complete machinery capable of performing a well-defined function and the "partly completed machinery", i.e. driving systems or devices which cannot in themselves perform a specific function as they are intended to be incorporated into a complete Machine.*

## CE Marking identification

The ROJ PCS xxx kits are CE marked on the back of the graphic display.



## Compliance with the European Directives and Regulations

Below is an extract of the **Declaration of Incorporation**, drawn up in accordance with the requirements of Annex II B to 2006/42/EC Directive, by which **ROJ** declares that the following “partly completed machinery”:

**Type:** PCS 200 (PCS 100, PCS 150) <sup>Footnote 1</sup>  
**Manufacturing year:** See official Declaration of Incorporation  
**Serial number:** See official Declaration of Incorporation  
**Target use:** Servo power supply for seeders

**cannot be** commissioned unless the compliance of the machinery for agriculture on which it has to be incorporated with the requirements of the 2006/42 /EC Directive - Annex II A - relating to the machine safety is ensured by the Manufacturer of the agricultural machinery or the system integrator and that for its design and manufacturing the principles and concepts introduced by the applicable paragraphs of the following Harmonized Standards were adopted:

- EN ISO 12100:2010
- EN ISO13849-1:2008/AC:2009
- EN ISO 4254-1:2013
- EN ISO 14982: 2009
- EN ISO13849-2:2012
- EN 14018:2010

The equipment complies with the requirements of the 2014/30/EU Directive <sup>Note 2</sup> relating to Electromagnetic Compatibility.

The person authorized to draw up the Technical Documentation is:  
Ing. Luca Bagatin (luca.bagatin@roj.com)

**ROJ** complied with the following EHSRs (Essential health and safety requirements) Annex 1 of the Machinery Directive 2006/42/CE:

1.1.1 – 1.1.2 – 1.1.3 – 1.1.6 – 1.2.1 – 1.2.2 – 1.2.3 – 1.2.4 – 1.2.6 – 1.3.2 – 1.3.7 –  
1.3.8 – 1.5.5 – 1.5.6 – 1.5.11 – 1.6.1 – 1.6.3 – 1.6.4 – 1.7.1 – 1.7.2 – 1.7.3 – 1.7.4

The compliance with applicable EHSRs not included in the above list, shall be provided by the agricultural machine manufacturer or by the system integrator.

ROJ commits itself to send all relevant information about the PCS 200 partly completed machinery via email or FTP, upon reasonable request made by the relevant national authorities.

 *The above indications are merely indicative and shall not be considered as replacing the real Conformity Declaration signed and released by the Manufacturer.*

*Note 1: The PCS 100 and PCS 150 kits are a subset of the PCS 200 kit*

*Note 2: The previous directive 2004/108/EC is repealed as from 04/20/2016*

## Warranty and Responsibility of the Manufacturer

The **PCS 200** system described in this manual has been designed to be incorporated into agricultural machinery (*typically Seeders*) and is therefore intended to operate exclusively in combination with the above mentioned machines.

The various system components can be installed on the seeder by:

- the seeder manufacturer
- **ROJ** specialized and authorized personnel

The testing and commissioning of the system has to be performed in any case by specialized personnel.

**ROJ** declines any responsibility in case of improper installation of the system not following the instructions given in this manual or if the system is commissioned without an authorization given by **ROJ**.

The end user must ensure that the equipment is used in accordance with the laws and regulations in force in the country of installation, in particular as far as the workers safety is concerned, and more generally in relation to the health, safety and accident prevention requirements.

Any complaint must be promptly notified upon detection of any defect attributable to the **PCS 200** system components.

In the event that after an accurate assessment the complaint is deemed admissible, **ROJ** may, at its sole discretion, replace or repair the defective components.

## Other warranty terms

**ROJ** guarantees the quality and reliability of the equipment that has been designed and manufactured to provide optimal performance.

The warranty does not cover any damages or indirect costs due to machine downtime, or irregular operation caused by improper use of the equipment or of single **ROJ** devices.

It is the responsibility of the end user to periodically perform cleaning and ordinary preventive maintenance activities, aimed at keeping the equipment operation within the expected performance range.

Any failure or improper equipment connection will void the warranty.

The warranty does not apply in case of floods, fire, electrostatic/inductive discharges or in case of discharges caused by lightning or other phenomena external to the **ROJ** equipment.

The warranty does not cover any damages to operators or other equipment/devices connected to the **ROJ** equipment.

The customer is fully responsible for the proper use and maintenance of the equipment, according to the instructions provided in this user manual.

This warranty does not cover parts subject to normal wear.

**Any other form of warranty is excluded.**

## 1 - GENERAL INFORMATION

### 1.1 INTRODUCTION

#### 1.1.1 The ideal solution to control and optimize the seeding process

The PCS 200 kit has been designed for the installation on seeders in order to control and optimize the entire seeding process.

Thanks to the exclusive flexibility and configurability the PCS 200 kit represents the best solution for pneumatic and precision seeders.

#### 1.1.2 Purposes of this manual

This manual aims to provide the PCS 200 Kit users with the essential information on:

- How to install and properly connect the system components safely.
- How to configure the system and to set up the various operating parameters according to the user's requirements.
- How to carry out the preventive maintenance under safe conditions.

#### 1.1.3 How to Use this Manual

The manual is divided into four sections:

- Section 1** – shows the structure and the components of the system and provides notes and safety warnings, in addition to the technical data of the units that are included in the kit.
- Section 2** – describes the operations and procedures required for a correct installation and commissioning of the system.
- Section 3** – describes the machine operator's interface, the configuration modes, the parameters setting and the information for a correct interpretation of alarm messages and faults.
- Section 4** – includes information and warnings useful to carry out a correct maintenance of the system.

### 1.1.4 Symbols used in this Manual

 This symbol highlights the notes, warnings, and points on which the reader's attention is to be drawn.

 This symbol indicates a particularly delicate situation that could affect the safety or proper functioning of the system.

 This symbol indicates the obligation to dispose of a material having an impact on the environment in accordance with the local regulations.

 This symbol indicates the tasks that can be performed through a simple but essential visual inspection.

### 1.1.5 Environment protection



**Handling of electrical or electronic equipment at the end of the life cycle (Applicable to all countries of the European Union and to those countries where a separate collection of waste is in force).**

This symbol on the product or its packaging indicates that the product should not be treated as a normal household waste, but must be handed over to an appropriate collection point for the recycling of electrical and electronic equipment. By ensuring that this product is properly disposed of, you will help prevent potentially negative consequences for the environment and human health which could otherwise be caused by inappropriate waste handling the same. Proper recycling of the materials will help to protect natural resources. For more details about the recycling of this product, you may contact your municipal technical office, your local waste disposal service or the local dealer.



*Always recycle used batteries into special containers. DISPOSE OF BATTERIES IN AN ENVIRONMENT-FRIENDLY WAY*

## 1.2 GENERAL INFORMATION AND PERFORMANCES

### 1.2.1 Introduction

The PCS 200 System has been designed to be applied on pneumatic and precision seeders (falling within the scope of the EN 14018 norm) in order to replace the mechanical transmission that drives the rotation of the seeding discs and the fertilizer distributors with electrical engines, operated by their relative control system.

This replacement provides a higher machine flexibility and offers new capabilities which cannot be obtained with the mechanical transmission.

The basic functions of the system can be summarized as follows:

- **Seeding disc speed control** to deposit the seeds at a prescribed distance, regardless of the advance speed of the tractor.
- **Control of the fertilizer and micro-granular distributor speed** to distribute a predefined mass per hectare of sown field
- **Monitoring of the seeding activity (seed sensor)** in order to ensure a quality job.

### 1.2.2 Functional blocks (Ref. Fig. 1-1)

The system consists of the following functional blocks:

- **ECU:** Electronic control unit that manages the various on-board sensors of the machine (speed sensor, proximity switch, etc.) and transfers to MDs both the basic settings and the real-time information needed for sowing and fertilizing.
- **MD:** Motor integrated drive, used to move the seeding disc or to rotate the distributor of fertilizer and microgranular fertilizer.
  - An MD is associated to each seeding element, in order that the discs speeds are fully independent.
  - One (or more) MDs for the distributors of fertilizer
  - One (or more) MDs for the distributors of microgranular fertilizer
- **HMI:** Graphics console allowing the user to set up and read the data related to the seeding activity, access diagnostic functions, and so on.
- **SDB 12+12:** 12V DC power supply unit with individual fuses (up to 24 motors).
- **SDB 3+3:** 12V DC power supply unit with individual fuses or fuses in pairs (up to 6 motors).
- **Alternator** connected via a speed multiplier to the PTO (power take-off) and a battery on board of the seeder, used to power up the motors in an independent way with respect to the tractor battery.
- **Seed sensor:** commercially available device consisting of an optical barrier capable of detecting the falling seeds.
- **Machine position sensor** to determine whether the seeder is lifted (transport/manoeuvring position) or lowered (seeding position).
- **Speed sensor:** radar or wheel speed sensor with commercially available proximity switch which generates an incremental position (or speed) reference of the tractor.
- **Cabling** for the connection of the different devices

### 1.2.3 Machines on which the integration of the mentioned partly completed machinery is foreseen

- Pneumatic and precision seeders for tractors NOT equipped with ISOBUS connection.
- Pneumatic and precision seeders for tractors equipped with ISOBUS connection.



*The current version of the system is based on a proprietary architecture and DOES NOT include the ISOBUS connection (foreseen for the coming versions).*

### 1.2.4 Acronyms used

<b>EHSR</b>	Essential Health and Safety Requirement of Annex I of Machinery Directive
<b>PL</b>	Performance Level (level of reliability of the safety functions) according to EN 13849-1
<b>AD</b>	Analog/Digital Converter
<b>CAN</b>	Controller Area Network (BUS)
<b>ECU</b>	Electronic control unit
<b>ISOBUS</b>	Communication standard for tractors and machinery for agriculture and forestry ISO-11783
<b>MD</b>	Motor with integrated drive
<b>PTO</b>	Power take-off
<b>SDB</b>	Sub distribution board
<b>HMI</b>	Human-Machine Interface console

### 1.3 COMPONENTS OF THE PCS FS KIT

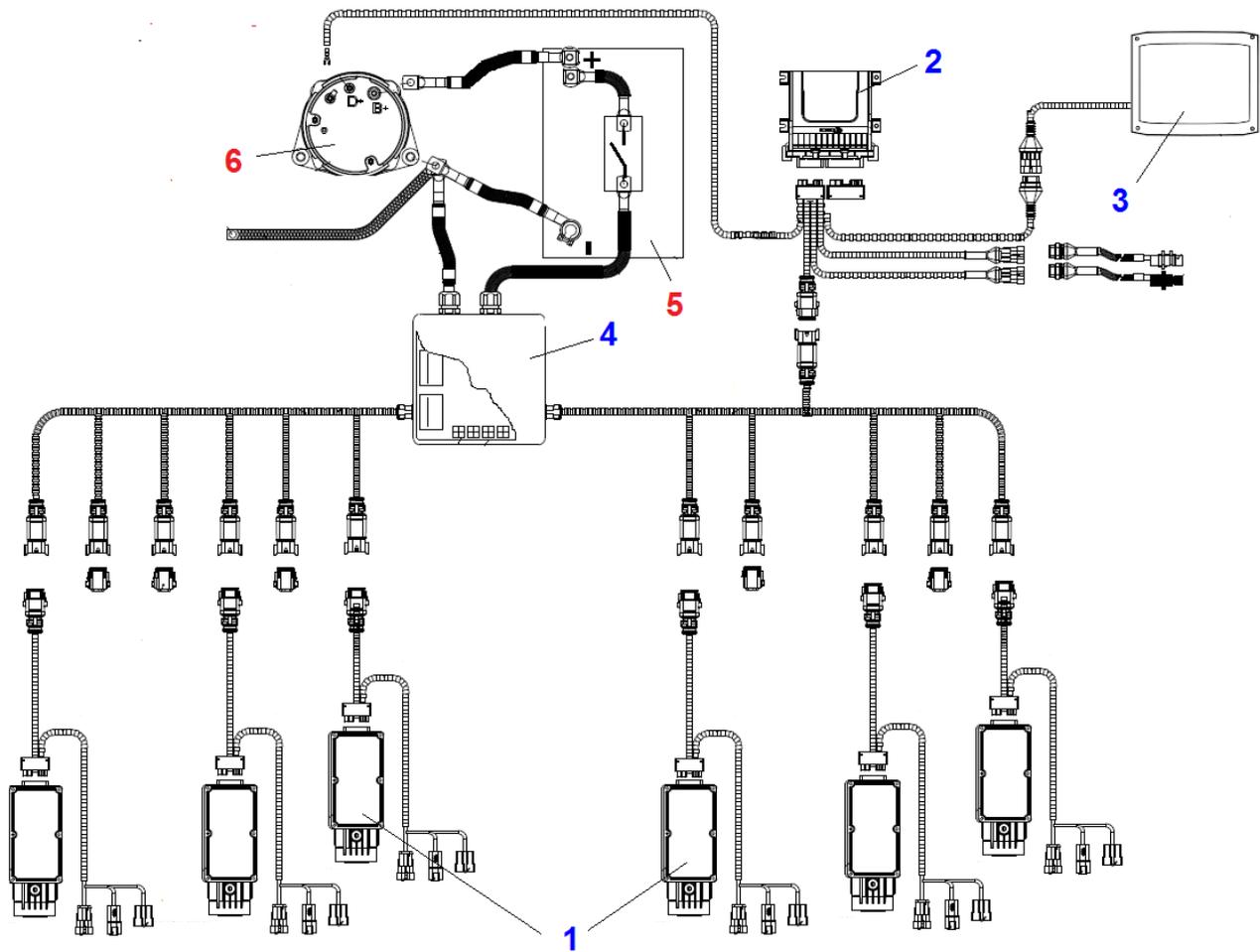
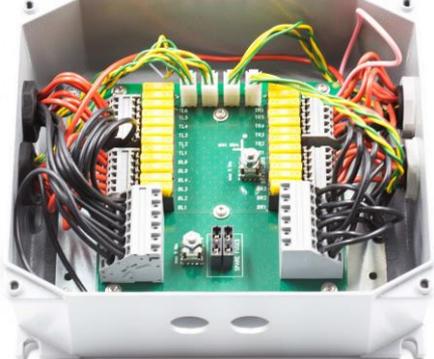


Figure 1-1 Main components of the PCS 200 kit

#### TECHNICAL DATA

1	MD	Geared motors	Rated voltage: 12 VDC; Rated current: 4,2 A; Rated power: 80 W Rated speed: 3000 rpm
2	ECU	Electronic Control Unit	Processor: 80 Mhz; Flash memory 2.5 Mb; RAM: 128 Kb; NVRAM: 8 Kb; CAN Bus lines: 3; IP69K protection
3	HMI	Graphic display	7" TFT color display; Resolution: 800 x 400, 18 bpp Resistive touchscreen
4	SDB	Sub distribution board	Power sub distribution board, with fuses
5	ALT	Alternator	Not included in the kit.
6	BAT	Battery	Not included in the kit.

<p><b>MD</b></p>	<p><b>Geared motor for the seeding elements and the distributors of fertilizer/granular fertilizer</b></p>	
<p><b>ECU</b></p>	<p><b>Electronic Control Unit</b></p>	
<p><b>HMI</b></p>	<p><b>Graphic display</b></p>	
<p><b>SDB</b></p>	<p><b>Sub distribution board</b></p>	

## 1.4 GENERAL SAFETY INFORMATION

### 1.4.1 Design criteria

The principles introduced by the relevant paragraphs of the following Harmonized Standards have been adopted in the design and manufacturing of the PCS 200 equipment:

<b>EN ISO 12100: 2010</b>	Safety of machinery. General principles for design. Risk assessment and risk reduction.
<b>EN ISO13849-1:2015</b>	Safety of machinery. Safety-related parts of control systems. Part 1: General principles for design.
<b>EN ISO13849-2:2012</b>	Safety of machinery. Safety-related parts of control systems. Part 2: Validation.
<b>EN ISO 4254-1:2015</b>	Agricultural machinery. Safety. Part 1: General requirements
<b>EN 14018:2010</b>	Agricultural and forestry machinery. Seeders. Safety
<b>EN ISO 14982: 2009</b>	Agricultural and forestry machinery - Electromagnetic compatibility - Test methods and acceptance criteria

The compliance with the applicable paragraphs of the above listed standards allowed us to eliminate or reduce risks in the best possible way, during normal operation and during maintenance and/or adjustment tasks, for the entire life cycle of the machine.

All components have been carefully selected among those available on the market, and the materials used in manufacturing the system do not pose any risk to people's health and physical integrity.

In addition to this, warning and safety measures have been implemented on the PCS 200 system, in order to reduce the risks that cannot be completely eliminated (see *paragraph "Warning About Residual Risks"*).

In particular, the Essential Health and Safety Requirements of Annex I to Directive 2006/42/EC listed in the Incorporation Declaration have been fulfilled. The compliance with the non-listed requirements must be granted by the system integrator and will be verified during the commissioning of the PCS 200 system.

### 1.4.2 Safety Devices and Solutions

All moving parts of the geared motors are adequately protected to prevent mechanical dangers and the electrical parts of the actuator are fitted into enclosures with a minimum IP65 protection.

On the guards of the seeding elements, the installation of a safety device (electromechanical micro-switch or electromagnetic sensor) is foreseen which prevents the geared motor start-up under open guards conditions.

This safety measure is not foreseen for the distributors of fertilizer/microgranular fertilizer, since the open guard condition does not pose any risk for the operator.



***The components of the integrated drive inside the geared motor can only be accessed using suitable tools and exclusively by skilled and authorized staff, when the machine is stopped and disconnected from any power sources.***

***Any attempt to remove or by-pass the safety measures installed, thus reducing the overall safety level, IS FORBIDDEN.***

***The user is completely liable for any damage to objects or persons arising from the non-observance of the recommendations herein given.***

### 1.4.3 Warning for residual risks

Despite all the security measures taken and listed in the previous paragraph, there could be some residual risks during the installation, the use and the maintenance operations due to:

- the presence of electricity even when the agricultural machine is stopped
- the presence of potential high temperatures in the geared motors groups

In these phases it is therefore necessary to use the utmost care when working in order to avoid any dangerous situations.

The presence of these residual risks is indicated by special warning labels attached to the enclosures of the geared motor built-in drives.



It indicates the need to pay due attention in order to avoid the risk of burns.

### 1.4.4 Warnings and Behaviour rules for the Operator

To avoid any risk condition for the operator and any damages to the equipment, it is recommended to strictly follow the warnings and behaviour rules herein listed.

 **ROJ** will assume no liability for any damages to people and/or properties arising from the non-observance of these warnings.

- ❖ Operators shall be properly trained to make best use of the equipment so to avoid risks, and must have read and understood the instructions and warnings given in this manual.
- ❖ All personnel in charge for the installation and maintenance of the machine must read this manual before performing any electrical or mechanical operations.
- ❖ All personnel operating on the system must wear appropriate clothing, avoiding or paying due attention in case of:
  - loose clothing
  - necklaces, bracelets and rings
  - wide sleeves
  - long hair
  - dangling ties or scarves
- ❖ Before using the machine equipped with the PCS 200 System, make sure that any dangerous safety conditions have been properly eliminated, that all guards or other protections are properly installed and that all safety devices are efficient.
- ❖ Do not start the machine in case of faults.



***DO NOT attempt to remove or by-pass any the safety measures: doing so will reduce the safety level of the system.***

***DO NOT perform any type of work with machine powered up.***



At the end of every maintenance work, ensure that none of the used tool has remained in proximity of the geared motors.



Before restarting the machine, always restore and check the safety devices and check that they work properly, in case they have been de-activated.



**After any operation on the equipment all materials having an impact on the environment (such as, for example, electrical cables, components, etc.) must be properly disposed of in accordance with the applicable regulations.**

#### 1.4.5 Indications about the noise levels

The PCS 200 system has been designed and manufactured in a way as to minimize the noise level emitted during its normal operation.

In any case, since the only sources of potential noise generated by the PCS 200 system (*geared motors*) are of negligible magnitude (<70 dBA) relative to the noise produced by the agricultural machine as a whole, it is the responsibility of the machine manufacturer and/or the end user to determine the A-weighted sound pressure level generated by the whole machine.

#### 1.4.6 Proper and improper use

The PCS 200 system has been designed to be incorporated into seeders.

The use of the PCS 200 for different purposes may result in damage to persons or the equipment itself and is therefore considered as an **Improper Use** for which the Manufacturer will not be held responsible.

#### 1.4.7 Reliability of the safety-related control systems

In this equipment the safety-related control systems have been designed in accordance with the principles of harmonized standard EN ISO 13849-1:2008/AC:2009. The following table shows the Category and implemented Performance Level (PL) values (*as compared to the Required Performance Level (PLr) resulting from the risk assessment*).

The PL has been calculated using the "SISTEMA" (IFA) software.

Safety function	Category	PL	PLr
Inhibition of dangerous movements in case of metering unit guard open	1	c	c

The calculation of the PL values and the "SISTEMA" relevant report can be found in the Technical Documentation kept by the manufacturer.

**2 - INSTALLATION**

**2.1 DMD0 e DMD2 (MD) GEARED MOTORS FEATURES**

For further information, please refer to the following enclosed documents for the DMD0:

- *TD\_1406.601\_revD.pdf or later revision.*
- *1061\_hard.pdf*
- *1061-cid-a.pdf*
- *1061\_angle.pdf*

For the DMD2:

- *TD\_DMD2\_rev1.pdf o later review.*

**2.2 MOTORS (MD) INSTALLATION**

**2.2.1 General principles**

The fastening of motors to the machine, whether they are used for the seeding disc shaft or the fertilizer or micro-granular distributor shaft rotation, must be carried out in a way as to ensure a perfectly aligned coupling between the disk/distributor shaft and the reducer outlet hollow shaft.



***In the absence of a perfect alignment, radial forces may occur on the bearings, causing an increase of the necessary torques and a reduction of the device life.***

***In order to relieve tension on the bearings, it is possible to use rubber bushes supplied with the motor and / or an elastic joint. This one is not supplied with the motor kit and it must be chosen and dimensioned according to the application.***

**2.3 DMD0**

**2.3.1 Outlet shaft torque and speed**

The following features refer to the geared motor outlet shaft (slow shaft) dimensions.

Nominal torque	8.75Nm
Peak torque	19Nm (single pulse, duration 500ms) 12Nm (repetitive, duration 500ms, every 5 second)
Nominal speed	100 rpm

The application must comply with mentioned torque and speed requirements.

For further information please refer to *TD\_1406.601\_revD.pdf* or subsequent review.

### 2.3.2 Outlet shaft dimensions

The geared motor outlet has got a hollow shaft with the following dimensions.

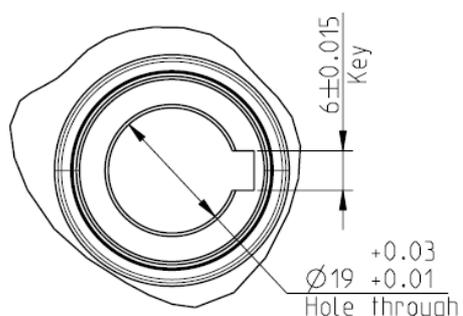


Figure 2-1 – Outlet shaft dimensions

For further information, make reference to the file *1061-cid-a.pdf*

### 2.3.3 Fixing flange features

Please refer to *1061-cid-a.pdf*

### 2.3.4 Mounting angle limits

The gearbox must operate with the axis parallel to the horizontal plane.

In order to grant a suitable lubrication of the reduction phase, it is necessary not to exceed the maximum tilting indicated below.

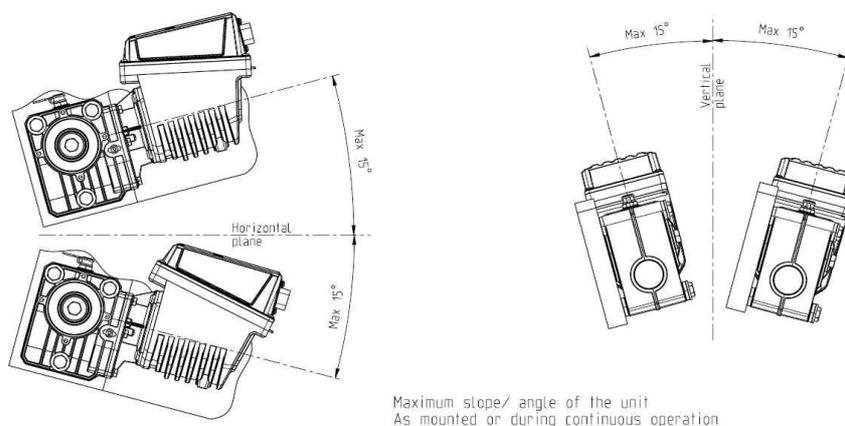


Figure 2-2 – Tilting limits

For further information please make reference to the file *1061-angle.pdf*

### 2.3.5 Transport plug

The rubber part of the geared motor oil filling plug is fitted at the time of delivery, in order to avoid lubricant leaks during transport. This part is exclusively mounted for transport and should be removed before the installation.

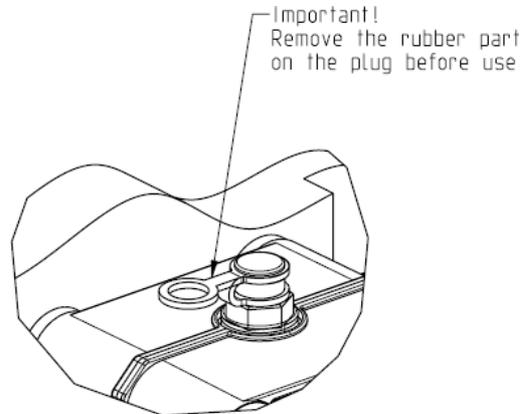


Figure 2-3 – Plug with exhaust valve

### 2.3.6 Fastening

For a correct fastening of the geared motors 6 special aluminium bushings have been provided.

Fix the geared motor to the flange using the bushings, the M8x80 bolts and standard M8 washers, as illustrated in the following figure.

We suggest locking the bolts with a thread locker.

Tightening torque: 10 Nm.

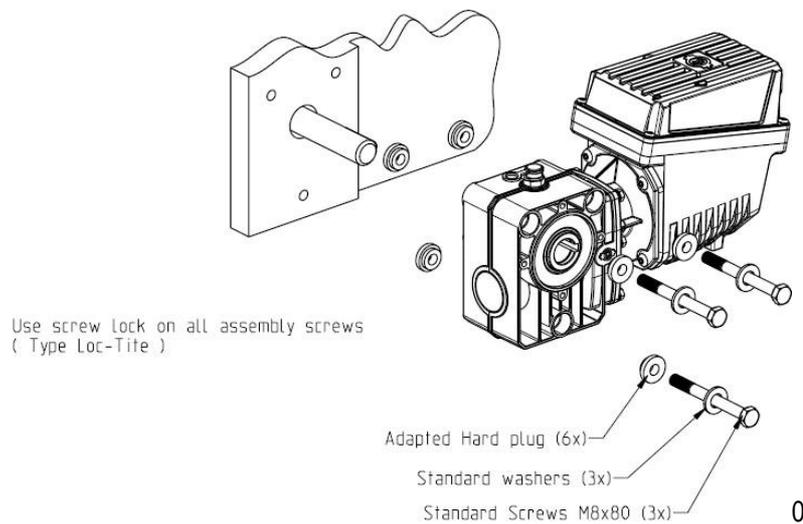


Figure 2-4 – Particulars for the geared motor fastening

## 2.4 DMD2

### 2.4.1 Outlet shaft torque, speed and axial/radial loads

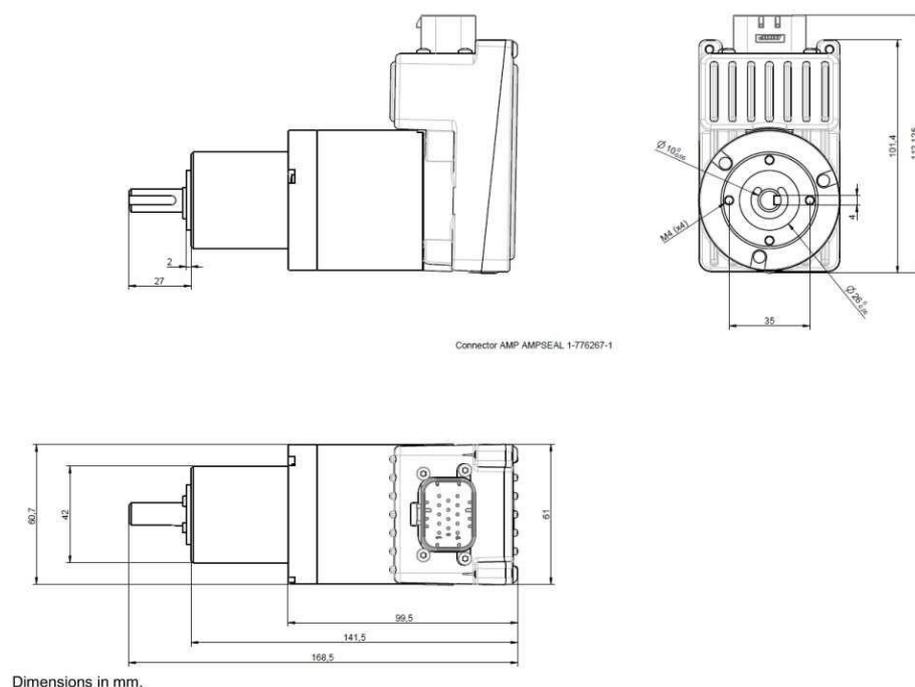
The following features refer to the geared motor outlet shaft (slow shaft) dimensions. Designed for 12V agricultural equipment

- 4,5 Nm, 80 rpm @ outlet shaft (54T01099)
- Built-in driver for the brushless motor
- 2 digital inputs
- Axial load allowed: 100N
- Radial load allowed: 200N

### 2.4.2 Overall dimensions of the geared motor and dimensions of the outlet shaft

The geared motor outlet has got a shaft aligned with the fast shaft of the electric motor.

The dimensions are shown in the technical drawing below.



**Figure 2-5 – Outlet shaft dimensions**

For further information, make reference to [TD\\_DMD2\\_rev1.pdf](#)

### 2.4.3 Fixing flange features and geared motor fastening

This kind of geared motors can be easily fastened by fixing the reduction gear in the desired position.

The fixing flange must be suited to bear an approx. weight of 1,5 Kg and 4 M4 screws are needed.

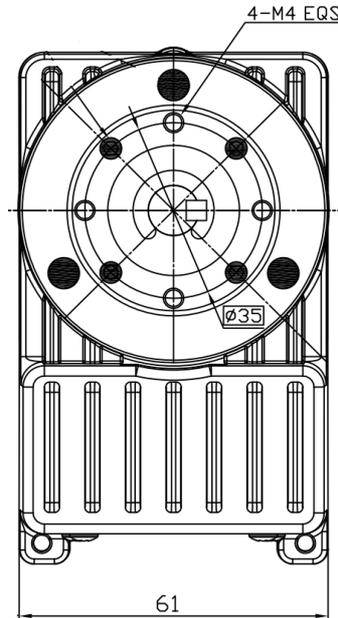


Figure 2-5 – Particulars for the geared motor fastening

## 2.5 ALTERNATOR

The alternator is used to create a supply source independent from the tractor one. The machine manufacturer should provide the mechanical solution to fasten the alternator and connect it by means of a suitable transmission belt and an overdrive, from the tractor PTO.

For machine configurations up to 12 rows we suggest an Iskra alternator type AAN 150A 14V. Nominal current 150A.

(Reference drawing: ott\_11204254\_50034\_pre\_aan8166\_14v\_150a\_mtz.pdf)

### 2.5.1 Pulleys and rotation direction

The pulleys (PTO and alternator side) should be chosen in order to reach a speed of 3000 rpm, at the PTO nominal speed.



**The shaft should rotate clockwise when observing the pulley front side from the alternator.**

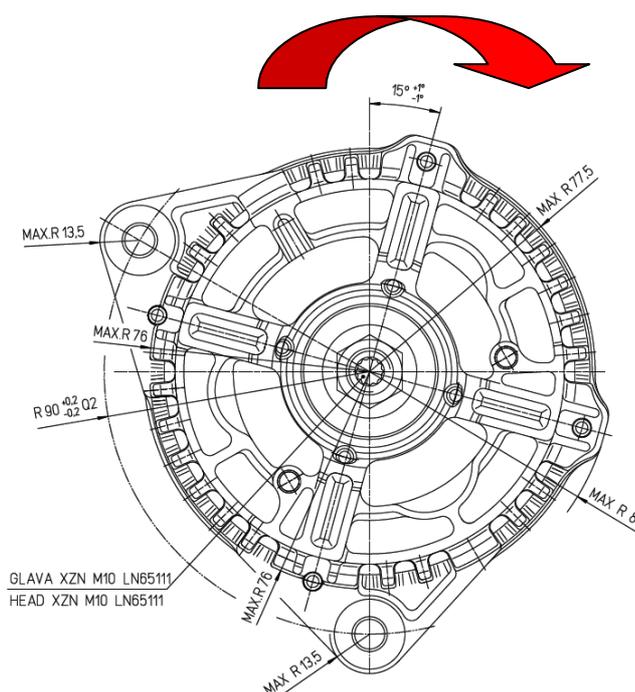


Figure 2-6 - Alternator rotation direction

### 2.5.2 Absorbed mechanical power and radial loads

At this speed the absorption rate can be about 4kW in the worst case (= cold alternator) (Cold Po[kW] curve).

The belt and its tensioning should be sized according to the given power.

The tensioning system is typically obtained using one of the two fastening elements as a pin and the other one as a moving element to adjust the chain tensioning.

The radial loads created by the belt on the alternator shaft, should be checked with the alternators' manufacturer.

A reference value not to be exceeded in order to grant the requested lifetime is 1000N.

Rotation speed of the alternator axis	3000 rpm
Rotation direction	Clockwise (see Figure 2-6 - Alternator rotation direction)
Power required by PTO	4 kW
Radial load on the alternator axis	1000N

Table 2-1 - Main information for the alternator integration

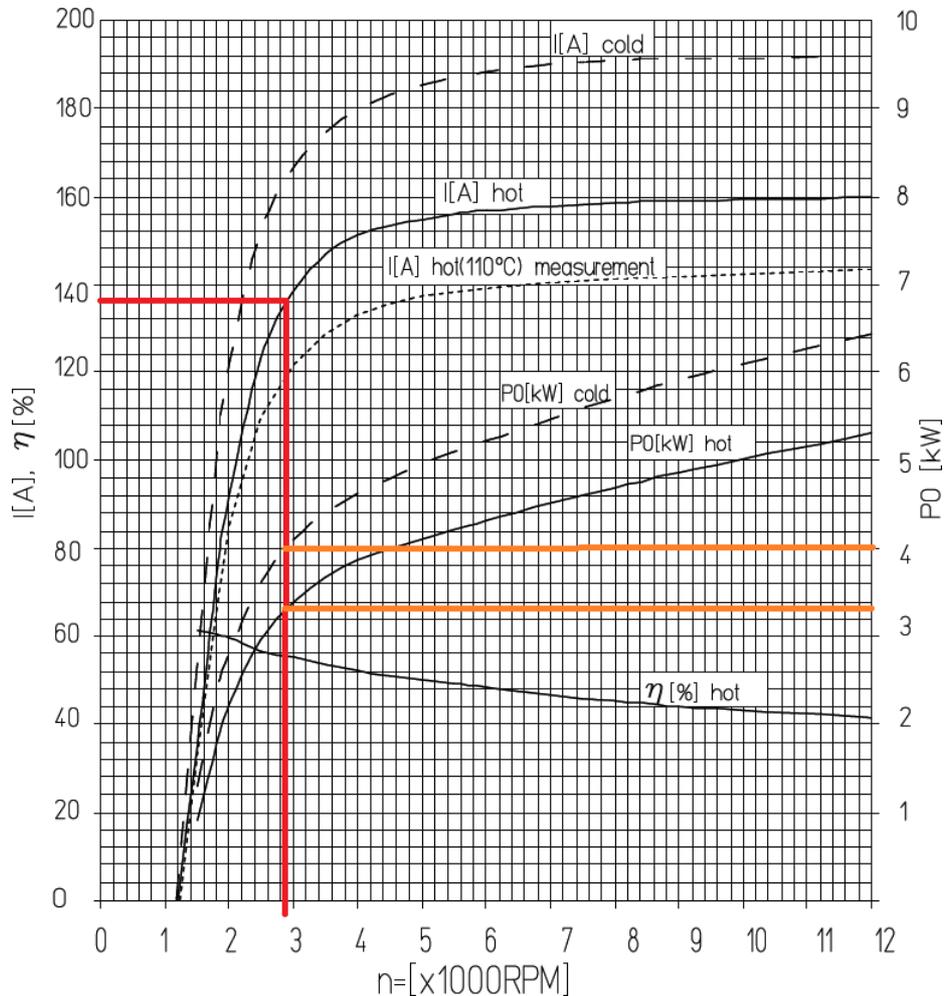


Figure 2-7 - Characteristic power curves for the alternator

## 2.6 BATTERY

The battery should be mounted as near as possible to the alternator, within the limits imposed by its space requirements and its weight.

We suggest using a 110Ah start battery.

Battery type: FIAMM Titanium L6 110

Dimensions (LxWxH): 394 x 175 x 190 mm

Weight: 22.5 Kg.

 *The sizes and weights of different batteries brands and models can vary in a considerable way. To ensure the requested flexibility when choosing the battery, provide a housing capacity of approximately 10% higher than the one indicated above.*

 *In case you are not going to use the system for a long time, we recommend you to disconnect both battery poles in order to prevent the battery from being discharged.*

## 2.7 SPEED SENSOR

### 2.7.1 Single cogwheel sensor

The speed sensor is implemented using a hall effect speed sensor type Cherry GS102301 (P/N ROJ 50A00174) and relevant cable (P/N ROJ 05R01400).

This sensor detects the speed of a phonic wheel connected to the machine drive wheel.

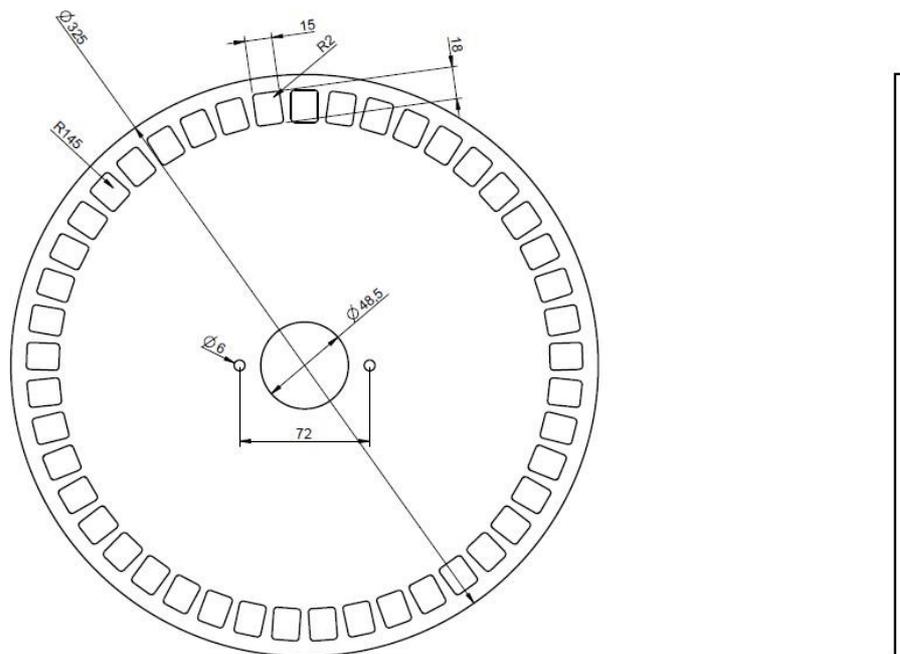
The sensor must be connected to the ECU cabling connector indicated by SPEED.



**Figure 2-8 - Speed sensor and its cable**

The phonic wheel is not provided with the kit, because the maximum dimensions as well as the number and shape of the teeth and the connection to the wheel depend on the type of machine and on the available space.

The following figure represents an example of cogwheel used for the suggested sensor.



**Figure 2-9 - Example of cogwheel for speed sensor**

The cogwheel should be directly fixed to the seeder drive wheel, in order to avoid rack and pinion transmissions.

During the installation stage, correctly adjust the sensor/teeth distance, in order to ensure a precise count.

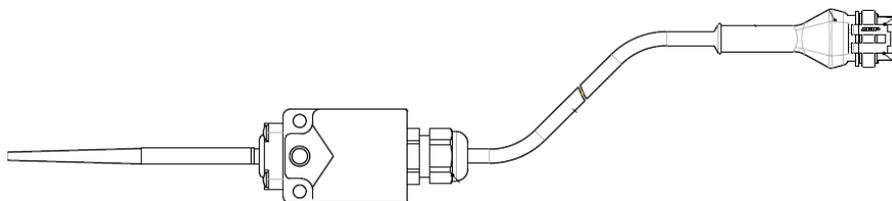
The following procedure can be applied if you want to control the proper operation while checking the machine overall operation.

### 2.7.2 Wheel sensor check

- On the graphic display, select  →  →  →  and press the "Start calibration" button (see paragraph 3.6).
- Carry out 2 complete wheel turns and check whether the number of counted pulses is correct (for example, if the teeth number = 45, the result should be = 90).
- Press the "Cancel" button if you do not want to save the result

## 2.8 MACHINE POSITION SENSOR

It is a mechanical proximity sensor (P/N ROJ 05R01422) used to define whether the machine is in seeding position (machine lowered) or in transfer position (machine lifted).



**Figure 2-10 - Position sensor**

The sensor must be fastened to the machine frame, in such a way that:

- in seeding position, when the machine is lowered, the sensor is deactivated (the rod is in rest position)
- in transfer position, i.e. when the machine is lifted, the sensor is activated

The sensor must be connected to the ECU cabling connector indicated by PROXY-MACHINE.

The following procedure can be applied if you want to control the proper operation while checking the machine overall operation.

### 2.8.1 Position sensor check

On the display main screen  (see paragraph 3.7 - Home), check the tractor with the seeder icon in the two following conditions:

- **Sensor deactivated:** sensor off with yellow LED indicator and tractor icon showing the machine in seeding position
- **Sensor activated:** sensor on with yellow LED indicator and tractor icon showing the machine in transfer position



### 2.9 ECU POSITIONING

The ECU housing should be preferably mounted in a sheltered position on the machine, with the cable output facing downwards.

For a proper fixing of the signal/communication cables on the control unit, use a ¼" wrench and tighten the cables on the relative front panel.



Cable output

Figure 2-11 – ECU positioning



**Both connectors should be plugged to the front panel in order to avoid water and dust penetration, even if the 30 poles connectors are not used in all configurations.**

**In this case you can use the 30 poles ECU plug (P/N ROJ 05R01334) or a cable already fitted for the seeding test and pressure sensor button (P/N ROJ 05R01380).**

## 2.10 SDB POSITIONING

The SDB (sub distribution board) should be mounted on a sheltered position and central to the machine, in order to make the cables routing easier.

## 2.11 WIRING DIAGRAM

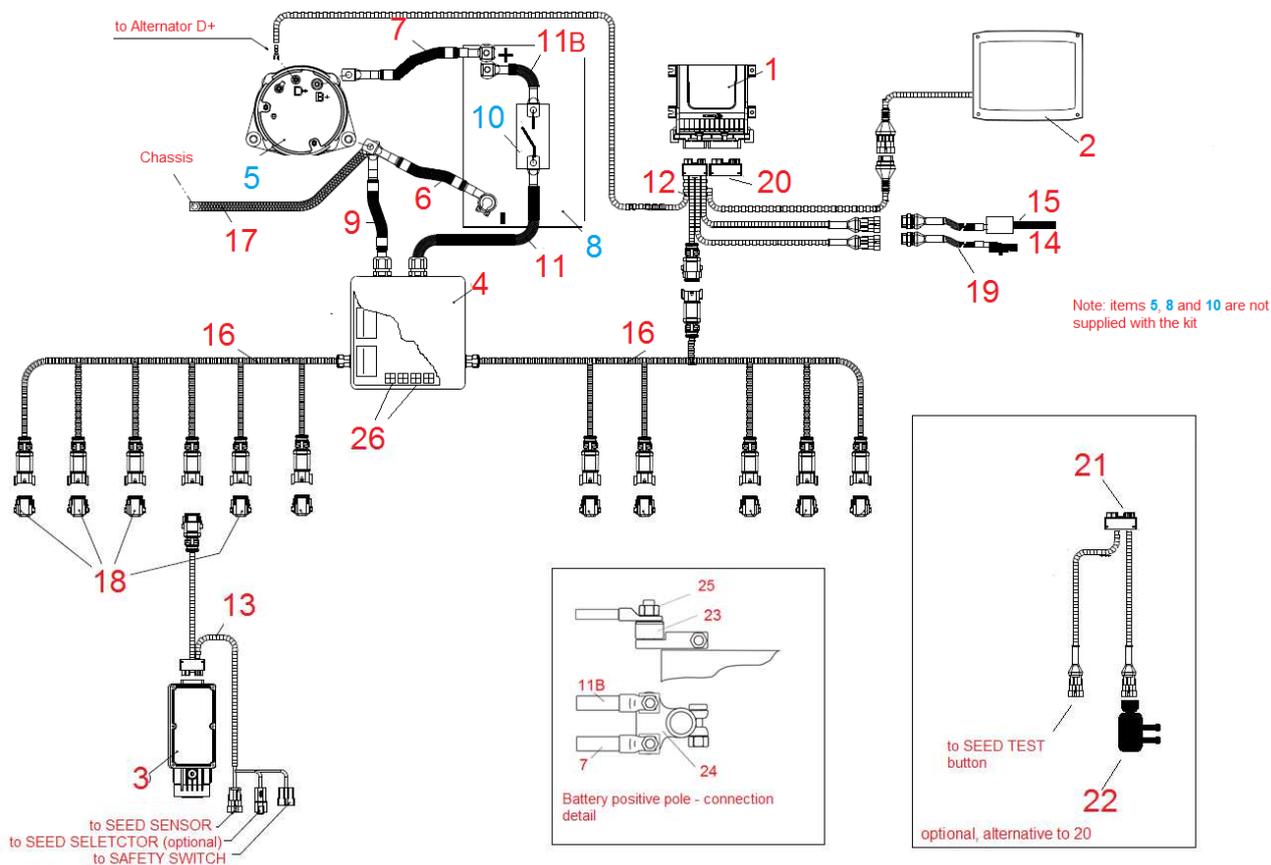


Figure 2-12 - Wiring diagram of the system with alternator

☞ The codes of the various elements are listed in the following pages. The items referred as 5 (alternator), 8 (battery) and 10 (battery disconnect switch) are not included in the kit.

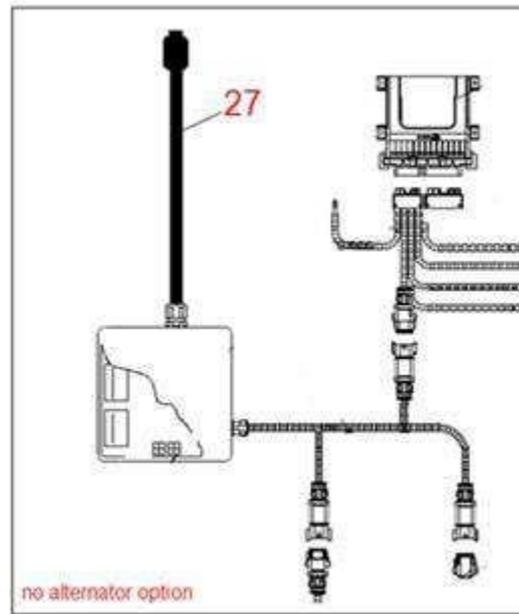


Figure 2- - Wiring diagram of the system without alternator

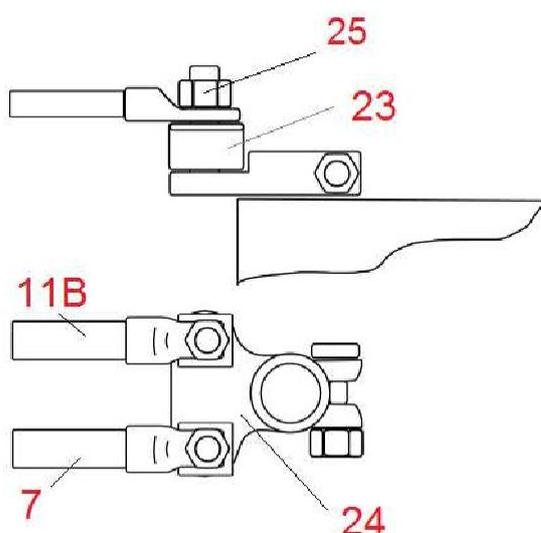


Figure 2-13 - Battery positive pole connection detail

### 2.11.1 Main components

Code	Description	Ref. on wiring diagram
54T01068	DEMETER ECU	1
58G00074	AGRI-MATE GRAPHICAL CONSOLE	2
1406.601	PCS MD-O	3
54T01099	DMD2 80rpm	3
56C00646	PCS SDB 12+12	4
56C00651	PCS SDB 3 + 3	

### 2.11.2 ECU connection

Code	Description	Ref. on wiring diagram
05R01379	ECU 18P CABLE PCS	12
05R01334	ECU PLUG 30C	20
05R01380	ECU 30P CABLE PCS	21
50A00174	HALL EFFECT SPEED SENSOR GS102301	14
05R01400	GS102301 SPEED SENSOR CABLE L=1500mm	19
05R01422	MECHANICAL SWITCH SENSOR	15
05A00173	PRESSURE SENSOR	22

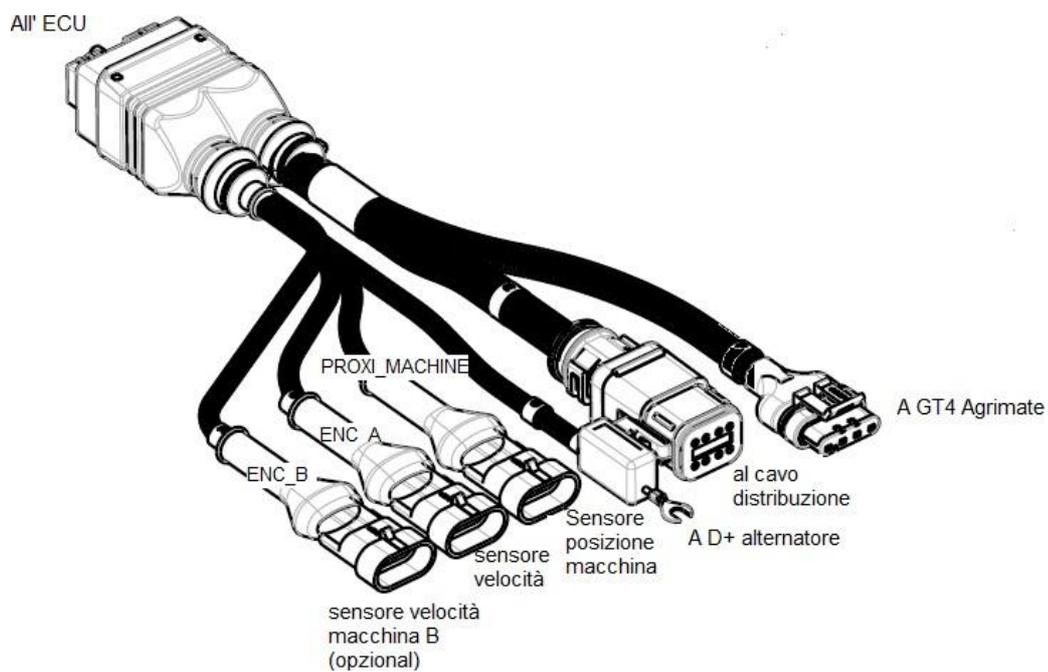


Figure 2-14 - ECU wiring diagram

### 2.9.3 SDB and power supply cables connection

Figure 15 and Figure 16 show how the connections on the two versions of the board contained in the SDBs, respectively the SDB 12+12 (56C00646) and the SDB 3+3 (56C00651) are made.

The boards are divided into two or four dials indicated by the letters TL<sup>1</sup>, TR, BL, BR corresponding to two or four cable lead-through on the SDB junction boxes.

- The red conductors (positive) of the 05R01372 and/or 05R01373 cables should be connected to the Wago spring terminals of the corresponding dial.
- The black conductors (negative) of the 05R01372 and/or 05R01373 cabling should be connected to the Wago spring terminals in the area indicated by the black rectangle shown in the following figure (“Negative”).

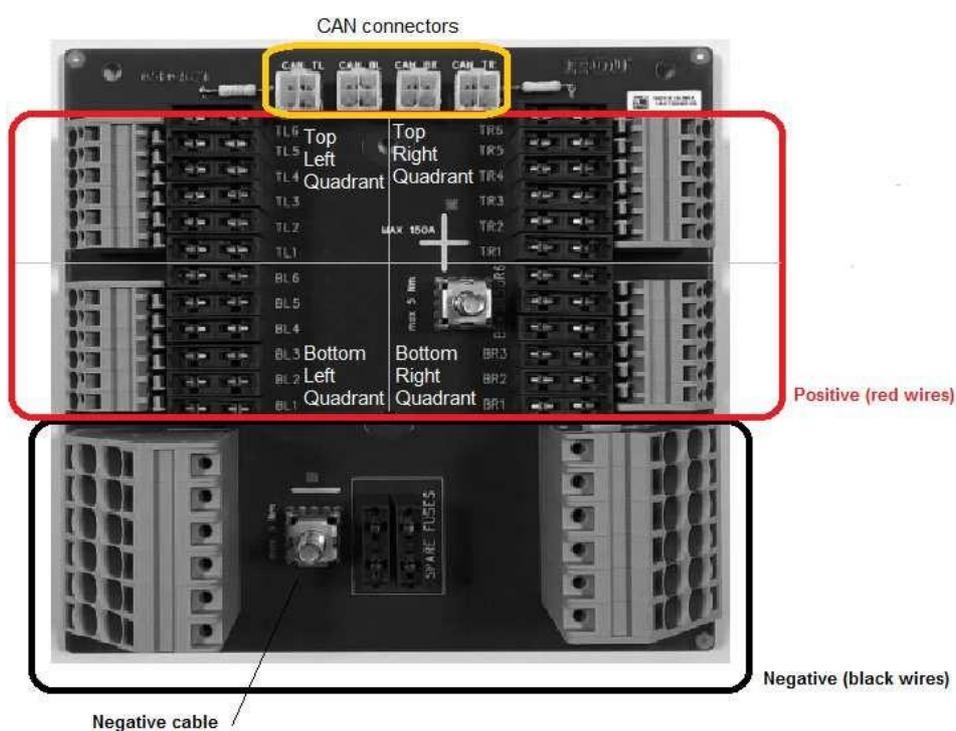


Figure 15 - SDB 12+12 connections

<sup>1</sup> These are acronyms for Top Left, Top Right, Bottom Left, Bottom Right respectively

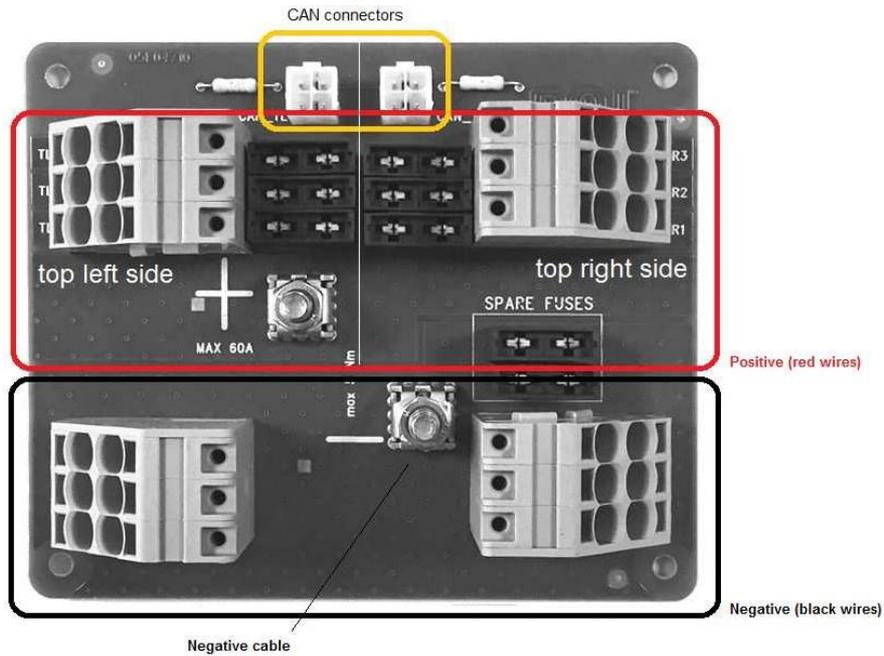


Figure 16 - SDB 3+3 connections

Code	Description	Ref. on wiring diagram
05R01404	DMD DISTRIBUTION CABLE 3 POS	<b>16</b>
05R01372	DMD DISTRIBUTION CABLE 6 POS	
05R01373	DMD DISTRIBUTION CABLE 7 POS	
05R01310	B- / BAT- CABLE	<b>6</b>
05R01311	B+ / BAT+ CABLE	<b>7</b>
05R01312	BAT+ / SDB+ CABLE L=2000	<b>11</b>
05R01349	BAT+/SDB+ CABLE L = 1500	
05R01313	B- / SDB- CABLE L=1600	<b>9</b>
05R01350	B-/SDB- CABLE L = 2000	
05R01333	PE BRAID FLAT 50MM <sup>2</sup> M10	<b>17</b>
05R01386	BATTERY DISCONNECT CABLE	<b>11B</b>
04C00142	BATTERY FUSE 125A	<b>23</b>
14A00073	BATTERY DOUBLE POLE	<b>24</b>
14A00072	BATTERY INSULATORS (BORDEAUX NUTS)	<b>25</b>
05R01385	CAN TERMINATION (MOLEX ) SDB	<b>26</b>
05R01412	BAT-SOCKET ISO12369	<b>27</b>
05R01433	SDB-IF CABLE	<b>27</b>

 The quantity and type of distribution cables (3,6 or 7 outputs) differ for each machine configuration.

The following Figure shows the correspondence between the number of fittings and the number printed on the red corresponding conductor.

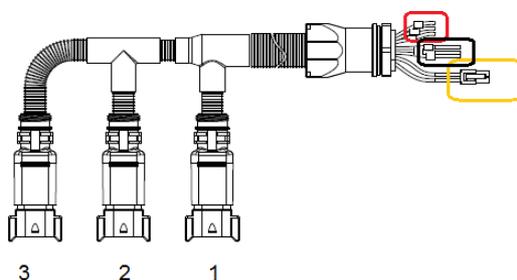


Figure 17 - 05R01404 cable – 3 outputs

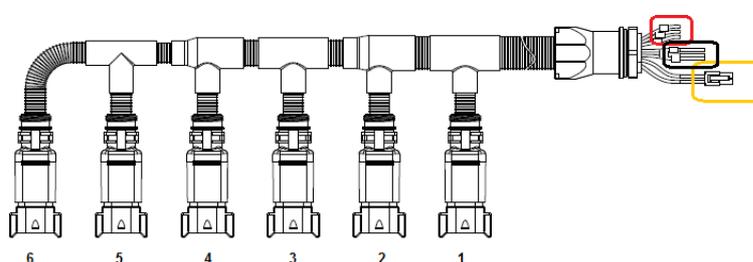


Figure 18 - 05R01372 cable – 6 outputs

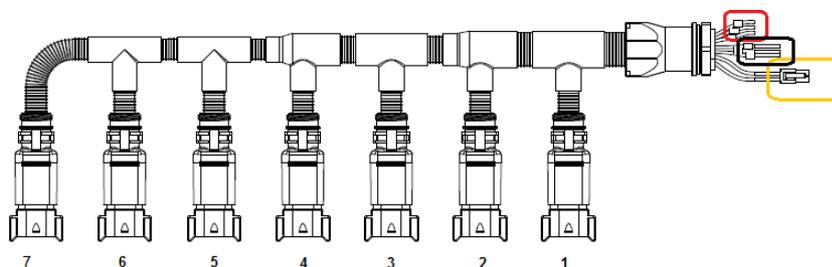


Figure 19 - 05R01373 cable – 7 outputs

 The CAN connector (4-poles white Molex Mini-Fit jr) should be connected to the CAN socket corresponding to the dial. (Yellow rectangle in Figure 15 and Figure 16) .

The unused sockets on the distribution cables should be secured with element no. 05R01381.

### 2.9.4 ECU connection

It is possible to connect the geared motors to the system using the cables indicated by the codes of the following table.

Connect one cabling side (18-poles black CINCH connector) to the MD, and the 8-poles grey Deutsch connector has to be connected to the distribution cable (05R01404 cable – 3 outputs, 05R01372 cable – 6 outputs or 05R01373 cable – 7 outputs).

The cabling differs according to the length and type of the connector used for the seed sensor.

The seed sensor connector is not present if the MDs are used for the distributors of fertilizer and micro-granular fertilizer.

**DMD0**

Code	Description	Ref. on wiring diagram
<b>Without seed sensor<sup>2</sup></b>		<b>13</b>
05R01374	DMD CABLE - SEEDER (TE) L = 1300	
05R01375	DMD CABLE - SEEDER (TE) L = 1700	
05R01376	DMD CABLE - SEEDER (TE) L = 2300	
05R01377	DMD CABLE - DISTRIBUTOR (TE) L = 1000	
05R01384	DMD CABLE - DISTRIBUTOR (TE) L = 1300	
05R01387	DMD CABLE - SEEDER (TE) L = 3500	

**Table 2-2 - MD cables codes**

**DMD2**

Code	Description	Ref. on wiring diagram
<b>Without seed sensor<sup>3</sup></b>		<b>13</b>
05R01474	DMD 2 CABLE - HOPPER L=1300	
05R01475	DMD 2 CABLE - SEEDER L=1700	
05R01494	DMD 2 CABLE - SEEDER L=2500	

**Table 2-3 - MD cables codes**

 The CAN on SDB (yellow rectangle in Figure 15 and Figure 16) unused sockets should be secured with the element no. 05R01385.

<sup>2</sup> Suitable to MDs for fertilizers and microgranulators

<sup>3</sup> Suitable to MDs for fertilizers and microgranulators

### 2.9.5 Safety switch

The connection to a safety switch offers two main functions:

- Safety function: if the contact is open, the MD cannot rotate.
- Addressing function: during the MD addressing stage, the safety contact closes and confirms the device address (see paragraph 3.4.2 on section 3).

The safety switch must be implemented using:

- An electromechanical switch with “positive opening” NC contact (this condition is shown by the symbol )  
or
- a high-reliability electromagnetic sensor (e.g. SICK RE11-SA03 or equivalent)

 *In order to grant the required safety level (Performance Level = c – see paragraph 1.4.7), you should foresee a safety switch having the following characteristics:*

- $B10d \geq 2 \times 10^6$  (see note below)

 *The safety switch is not supplied with the kit as it must be chosen according to the dimensions requirements of the machine it will be installed on.*

*Note: B10d is the reliability parameter declared by the device manufacturer, corresponding to the number of switchings which can be granted without errors.*

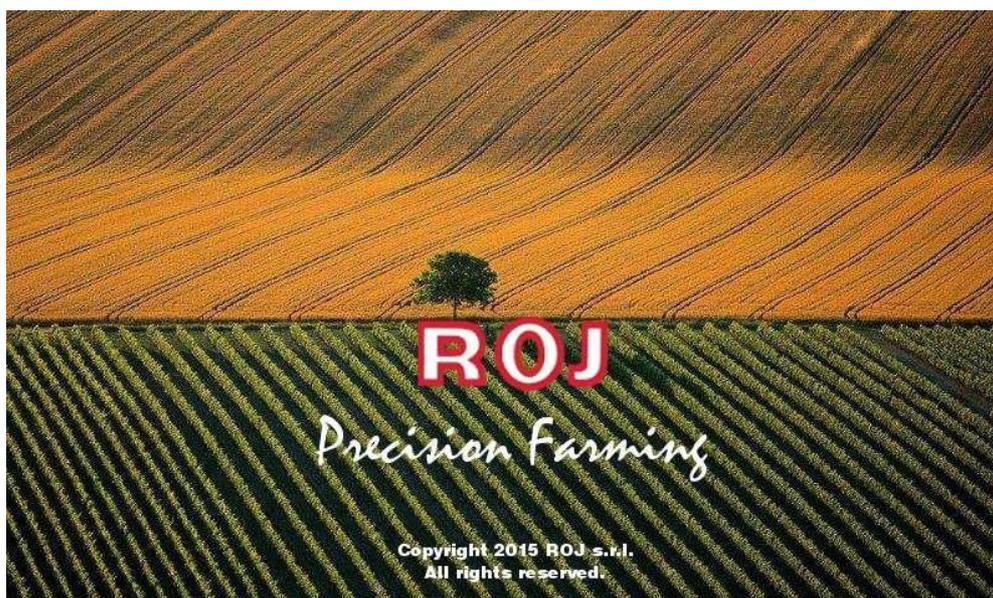
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### 3.1 MACHINE START-UP

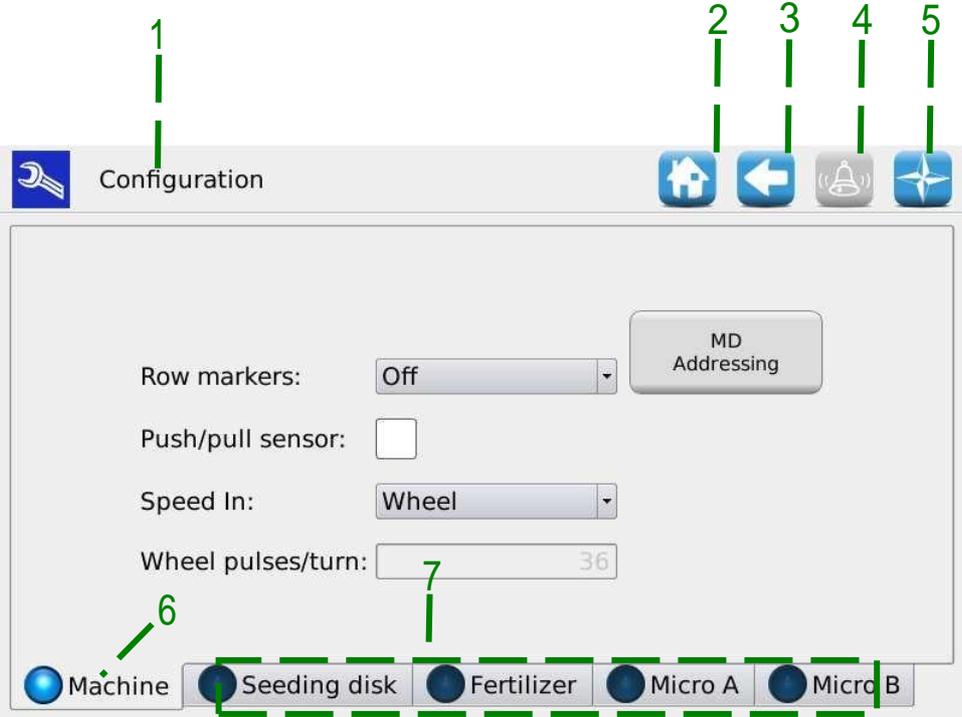
To turn the machine on, press the relative button on the top right of the display unit.

Approx. 4 seconds later, the following screen appears on the HMI display.



Once the loading phase is finished, the “Home” screen indicated by the top left  icon is immediately displayed.

### 3.2 GRAPHIC ORGANIZATION



Field	Description
1	Logo and name of the active window
2	It allows to quickly return to the home screen.
3	It allows to return to the previous screen.
4	It allows to access the active alarms window
5	It allows to access the complete console menu
6	Selected tab
7	Not selected tabs

### 3.3 ACCESS LEVELS

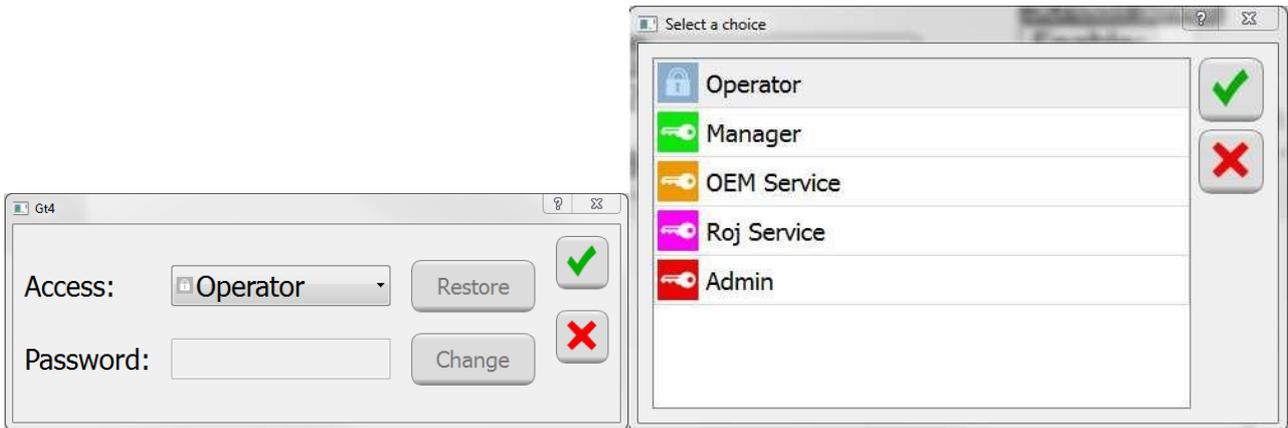
The access to the tabs, buttons and numerical fields for the setup is organized as an access levels system. Therefore, some fields can be modified **only by authorized users**.

For the PCS 200 system the following access levels are foreseen, in ascending order:

<b>Operator</b>	It is the standard access level and does not require any password.
<b>OEM Service</b>	This access level is foreseen for the technical support service of the seeder manufacturer. The default password is different for each manufacturer and can be changed by the manufacturer himself.
<b>ROJ Service</b>	This access level is foreseen for the ROJ technical support.
<b>Administrator</b>	It is the highest access level which allows to access all system functions and is reserved to the ROJ R&D personnel.

This access level can be modified at any time, by entering the Terminal menu and clicking the Access button. After this operation a window is displayed allowing to change the access level.

Path:



The same window is automatically opened in case you try to access a field which is protected by a higher access level than the current active field.

### 3.4 MOTORS ADDRESSING

At the first installation of the machine, it is necessary to address the motors, in order to associate to the logical position (Disc 1, Disc 2..., Fertilizer 1, Fertilizer 2..., Micro 1 etc.) the physical position of the motor on the machine.

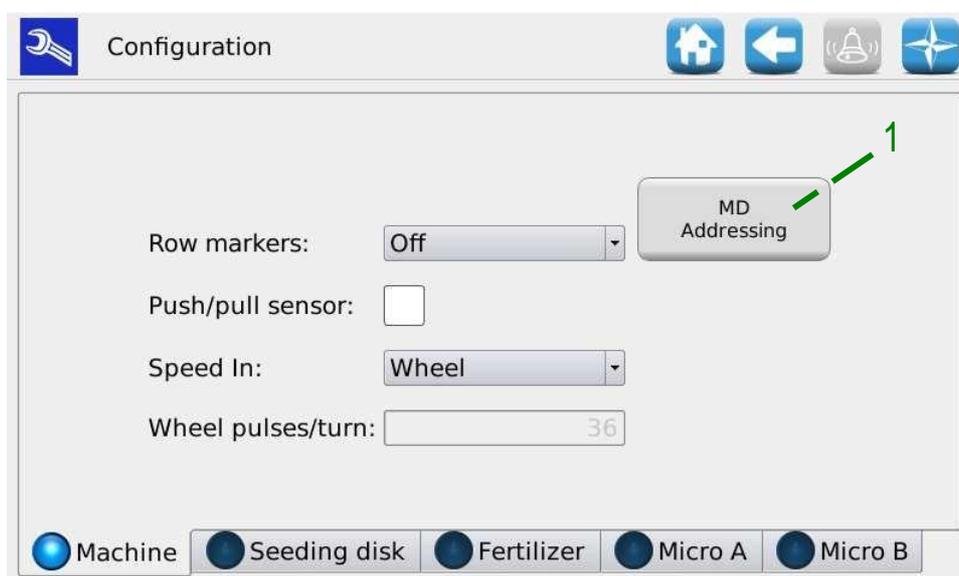
The addressing procedure requires the operator's intervention and is automatically activated on the first power up of the machine.

It is also possible to force this operation, by opening the following window and clicking the **1** button.

Path:



Machine Tab

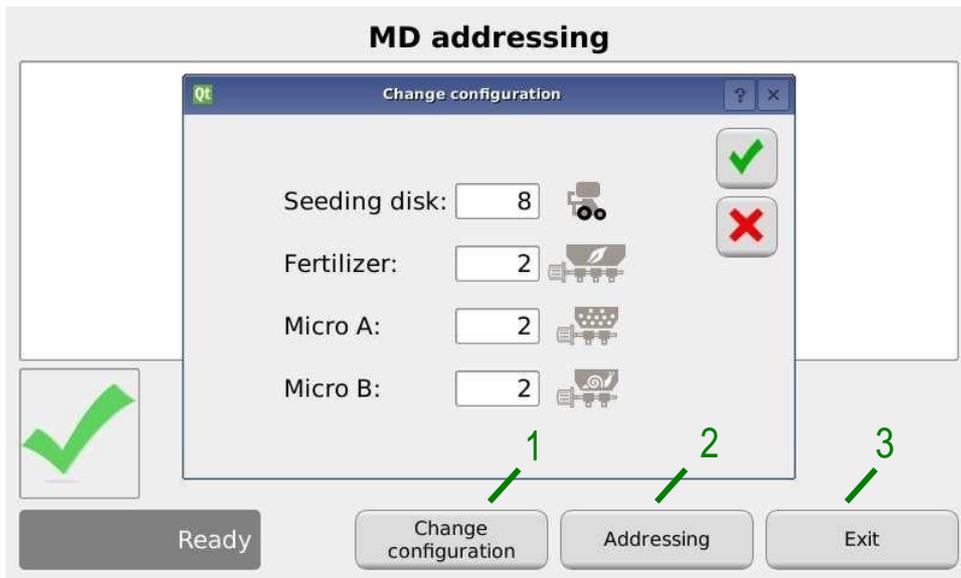


Field	Description
1	Activation button for the addressing procedure

### 3.4.1 Machine configuration

Pushing the **1** button a machine configuration window is opened where it is possible to read the MD numbers of Seeding discs, Fertilizer spreaders and Microgranulators.

#### MD addressing window

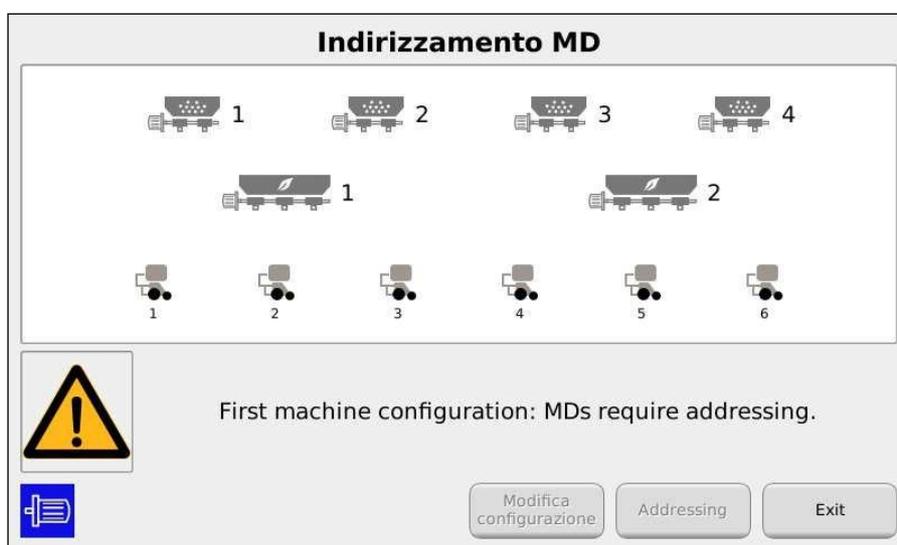


Field	Description
1	It allows to modify the machine configuration
2	If this button is pressed, the real addressing session starts
3	To exit from the addressing window

### 3.4.2 Addressing

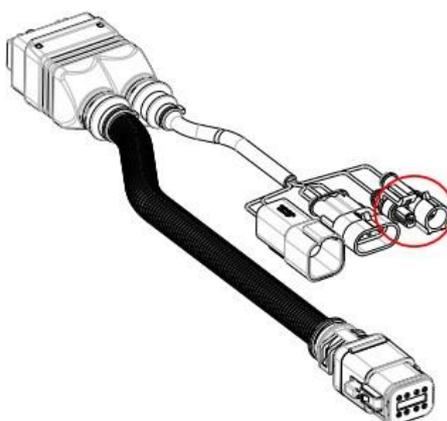
When the “Addressing” button is pressed, the real addressing session starts. When the addressing is active, a synopsis (summary) of the configuration set up on the previous phase is displayed.

#### MD addressing window



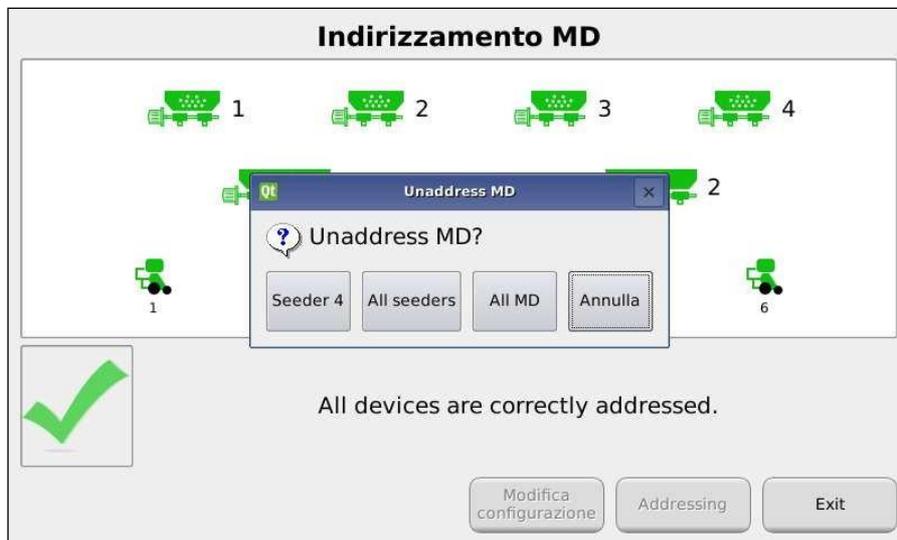
Field	Description
	Motor not yet addressed
 (flashing)	Motor to be addressed
	Addressed motor

Closing the protection switch (see figure) for the cable corresponding to the flashing one on the synopsis, the logic address corresponding to the flashing icon is assigned to the motor. A “beep” sound indicates that the motor has been correctly addressed and the icon turns to green.



In case of error, press the motor symbol in order to display the dialog “Unaddress MD” which allows to cancel the address of one, a group or all motors:

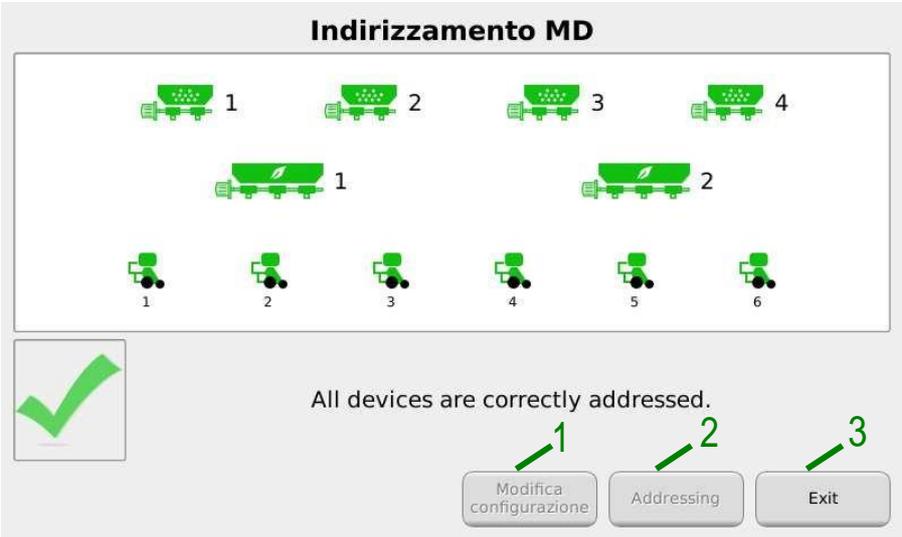
**MD addressing window**



Field	Description
	Motor not yet addressed
 (flashing)	Motor to be addressed
	Addressed motor

If the addressing has been completed correctly, the window is displayed as shown below and it is possible to exit by pressing the 3 button.

MD addressing window



Field	Description
1	It allows to modify the machine configuration
2	If this button is pressed, the real addressing session starts
3	To exit from the addressing window

### 3.5 MACHINE CONFIGURATION

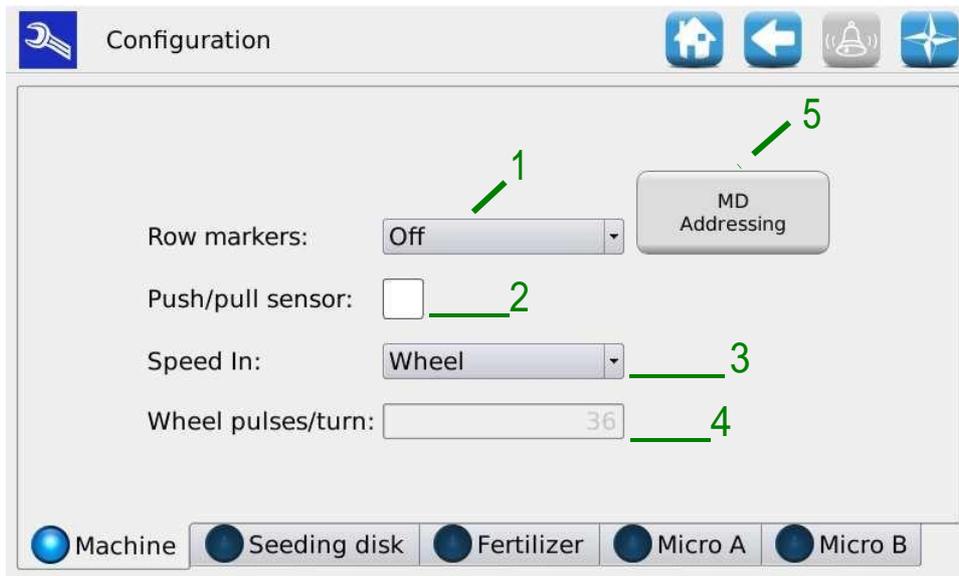
This window allows to set the machine up during production at the manufacturer's premises.

The setup settings of the machine can be modified only by the Manufacturer's **Production dpt.** or by the **Technical Support**.

Path:



Machine Tab



Field	Description
1	It enables the row markers. The following operation modes are available: <ul style="list-style-type: none"> <li>• OFF</li> <li>• Trameline (Described in Setup)</li> <li>• Foldable machine</li> <li>• Plot seeding</li> </ul>
2	It enables the push/pull sensors
3	It allows to select the machine speed sensor: <ul style="list-style-type: none"> <li>- Single sensor (phonic wheel)</li> <li>- Double sensor (phonic wheel + index)</li> <li>- Radar</li> </ul> (If selected, the user is asked to turn off and restart the system from the main disconnect switch/battery disconnect switch)
4	When selecting "Double sensor" you need to specify the number of teeth of the phonic wheel (= number of pulses of the wheel between

	two index pulses)
5	It allows to force the motors addressing session

## Seeding discs Tab

Configuration

Seeding disks:  1

Gear ratio:  2

Prefill seeds:  3

Doublets count window:  % 4

Seed hopper control level:  5

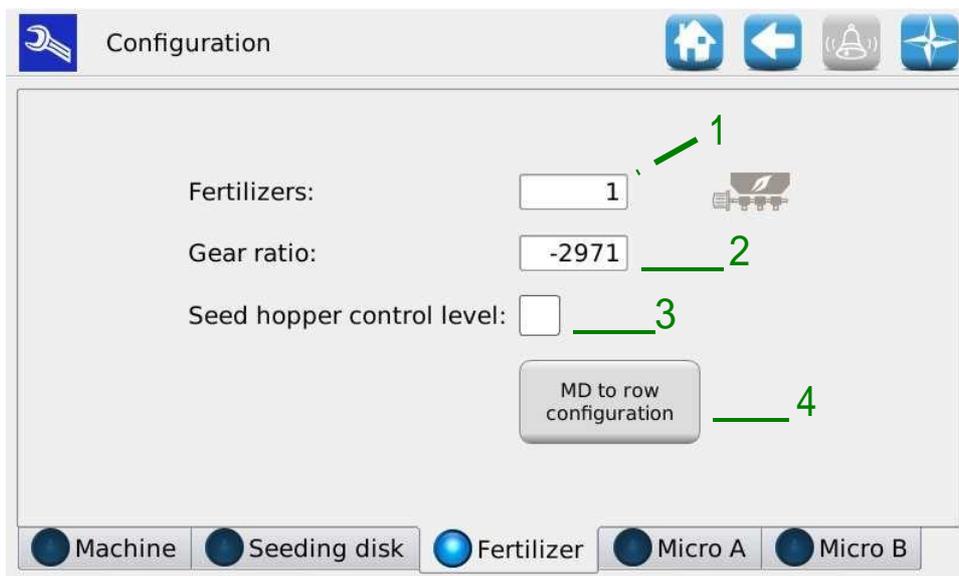
Seed sensor:  6

Machine
 Seeding disk
 Fertilizer
 Micro A
 Micro B

Field	Values range	Description
1	1 ... 32	Number of seeding elements
2	-10000 ... 10000	Reduction gear ratio multiplied by 100 (for example: reduction gear 28.89: 1 → 2889) The minus sign indicates rotation direction opposite to the standard one.
3	0 – 4	Off: The disc prefill is not carried out Timed: The prefill will be carried out without using the information from the seeding sensor, for ex. the disc rotates of about 270° before stopping. 1...5: Number of seeds which should be detected in order to end the disc Prefill phase.
4	0 – 100%	The percentage indicated a fraction of the angle between two holes of the seeding disc (for ex. 50% indicates half of the angle between two holes).  Each time a seed falls, an angular window is taken into account corresponding to the indicated percentage fraction.  If the sensor detects other seeds after the first one, these will be considered as “doublets” inside the angular window.
5	....	It enables the hopper level sensor (if present)

6	....	It enables the seed sensor (if present)
---	------	---

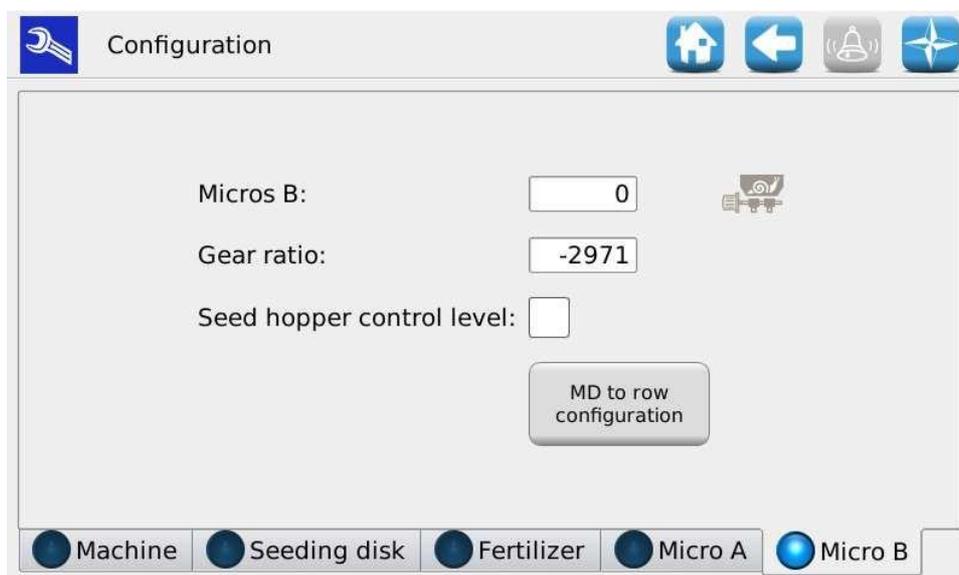
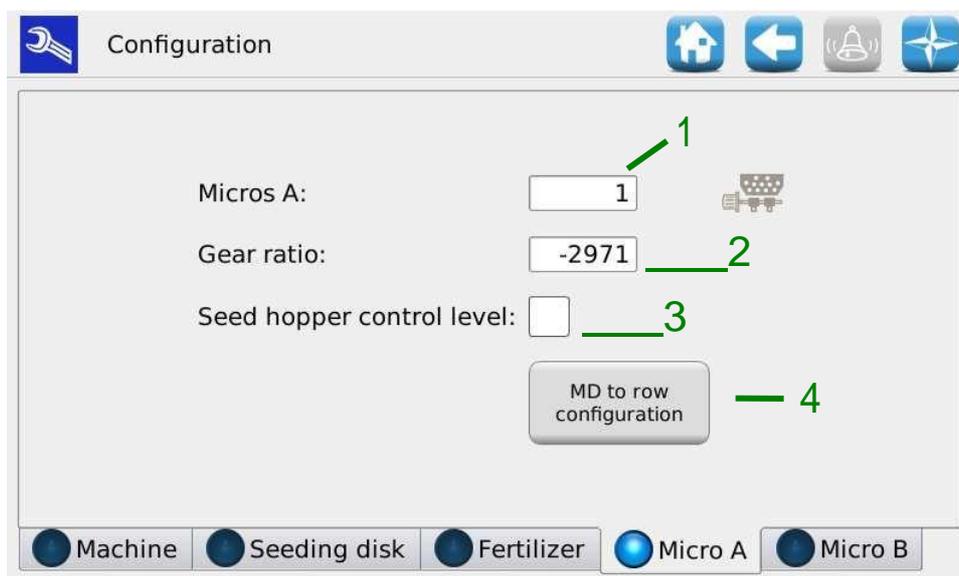
Fertilizer spreader Tab



Field	Values range	Description												
1	0 - 8	Number of motors for the fertilizer spreader hoppers												
2	-10000 ... 10000	Reduction gear ratio multiplied by 100 (for example: reduction gear 28.89: 1 → 2889) The minus sign indicates rotation direction opposite to the standard one.												
3	.....	It enables the hoppers level sensor (if present)												
4	.....	It allows to associate the motors corresponding to the hoppers to the seeding rows. It is possible to carry out an arbitrary association of the seeding rows, as shown in the following example:  For ex.: 4 MDs for the seeding rows + 2 MDs for the fertilizers  <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>MD</th> <th># of rows</th> </tr> </thead> <tbody> <tr> <td>Fertiliser 1</td> <td style="text-align: center;">2</td> </tr> <tr> <td>Fertiliser 2</td> <td style="text-align: center;">2</td> </tr> </tbody> </table> <p style="text-align: center;">Or</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>MD</th> <th># of rows</th> </tr> </thead> <tbody> <tr> <td>Fertiliser 1</td> <td style="text-align: center;">1</td> </tr> <tr> <td>Fertiliser 2</td> <td style="text-align: center;">3</td> </tr> </tbody> </table>	MD	# of rows	Fertiliser 1	2	Fertiliser 2	2	MD	# of rows	Fertiliser 1	1	Fertiliser 2	3
MD	# of rows													
Fertiliser 1	2													
Fertiliser 2	2													
MD	# of rows													
Fertiliser 1	1													
Fertiliser 2	3													

### A and B Micro-granulators Tab

It is possible to specify two different categories of microgranulators, the A category (to be used for example with insecticides) and the B category (to be used for example with an anti-slug product), allowing to spread at the same time two different products with different quantities per hectare.



Field	Values range	Description
1	0 - 8	Number of motors for the fertilizer spreader hoppers
2	-10000 ... 10000	Reduction gear ratio multiplied by 100 (for example: reduction gear 28.89: 1 → 2889) The minus sign indicates rotation direction opposite to the standard one.

<b>3</b>	.....	It enables the hoppers level sensor (if present)												
<b>4</b>	.....	<p>It allows to associate the motors corresponding to the hoppers to the seeding rows. It is possible to carry out an arbitrary association of the seeding rows, as shown in the following example:</p> <p>For ex.: 4 MDs for the seeding rows + 2 MDs for the A/B Microgranulators</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">MD</th> <th style="text-align: center;"># of rows</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Micro A1 or B1</td> <td style="text-align: center;">2</td> </tr> <tr> <td style="text-align: center;">Micro A2 or B2</td> <td style="text-align: center;">2</td> </tr> </tbody> </table> <p style="text-align: center;">Or</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">MD</th> <th style="text-align: center;"># of rows</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Micro A1 or B1</td> <td style="text-align: center;">1</td> </tr> <tr> <td style="text-align: center;">Micro A2 or B2</td> <td style="text-align: center;">3</td> </tr> </tbody> </table>	MD	# of rows	Micro A1 or B1	2	Micro A2 or B2	2	MD	# of rows	Micro A1 or B1	1	Micro A2 or B2	3
MD	# of rows													
Micro A1 or B1	2													
Micro A2 or B2	2													
MD	# of rows													
Micro A1 or B1	1													
Micro A2 or B2	3													

### 3.6 SEEDING SETTINGS

This window allows to set up the seeding parameters and the parameters for the fertilizer spreader and the micro-granulators A and B.

Path:



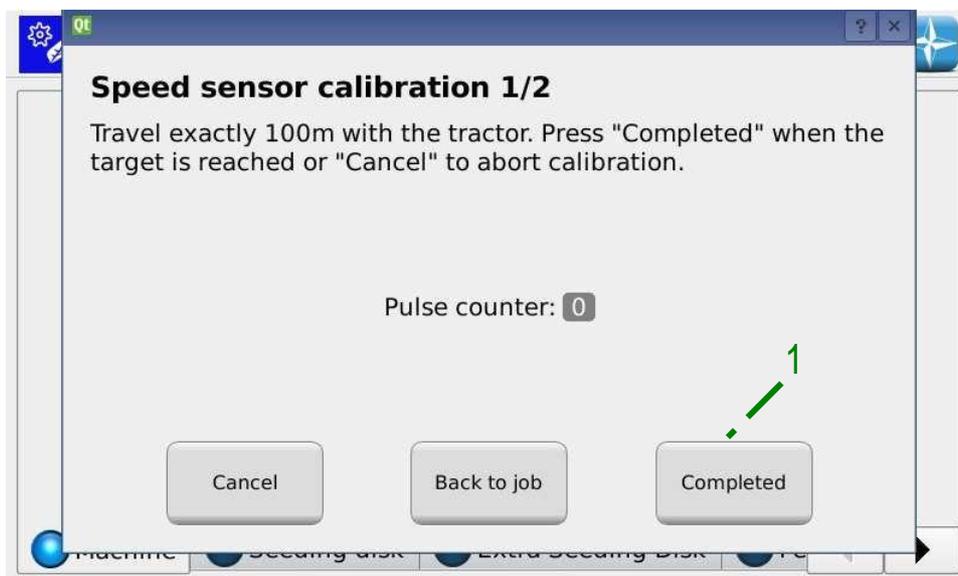
Machine Tab

Field	Values range	Description
1	800 – 25000	Number of pulses per 100m. Press the 8 button to run the speed sensor calibration session. (See below)
2	....	It enables the single rows, to be found in the setup pages. (See below)
3	15 - 400	Distance of two close rows in the machine.
4	1 - 255	If the machine is foldable (in whichever way) it indicates the number of foldable rows in the machine.
5	....	If sensors are present on the foldable parts of the machine, it is possible to enable the automatic shut-off of the allocated motors and of the relative motors on the fertilizers and microgranulators hoppers.
6	....	It enables the sprayer mode and activates the relay which controls the weeding pump. Available over 0,5 km/h.
7	....	It is calculated from the parameters set and indicates the maximum rotation speed of the motor. If this speed is

		exceeded during the job, the warning and alarm messages associated to this value will be generated from the system.
8	....	It allows to start the calibration of the speed sensor
9	....	It allows to select the type of seed. This selection will cause the automatic change of the following parameters <ul style="list-style-type: none"> <li>• Pressure range min and max</li> <li>• Doublets/missings sensitivity</li> <li>• Investments sensitivity</li> </ul>

### Speed sensor calibration

Pressing the 8 button, it is possible to access the sensor calibration screen. The following window will pop up:



In order to calibrate the sensor, you need to trace a target line exactly 100m far from the actual tractor position, and to travel this 100m section at a moderate speed (5-9 km/h).

The number of wheel pulses will appear on the screen. In this operating condition it is possible to go back to the seeding job in order to optimize time and efficiency.

Once the distance has been covered, it is possible to confirm the setting by clicking the 1 button.

**Note:** in order to improve the precision of the absolute value for the seeding distance, it is important to calibrate the seed sensor each time you change the field or if the soil conditions have changed, in order to compensate a different sinking of the tractor wheel.

## Seeding discs Tab

Setup

Disk holes: 26 (1) Active rows: 3 (7)

Distance: 15.0 cm (2) ⇒ seed/ha 83333 (3)

Investment: 41666 seed/ha (2) ⇒ cm 15.0 (3)

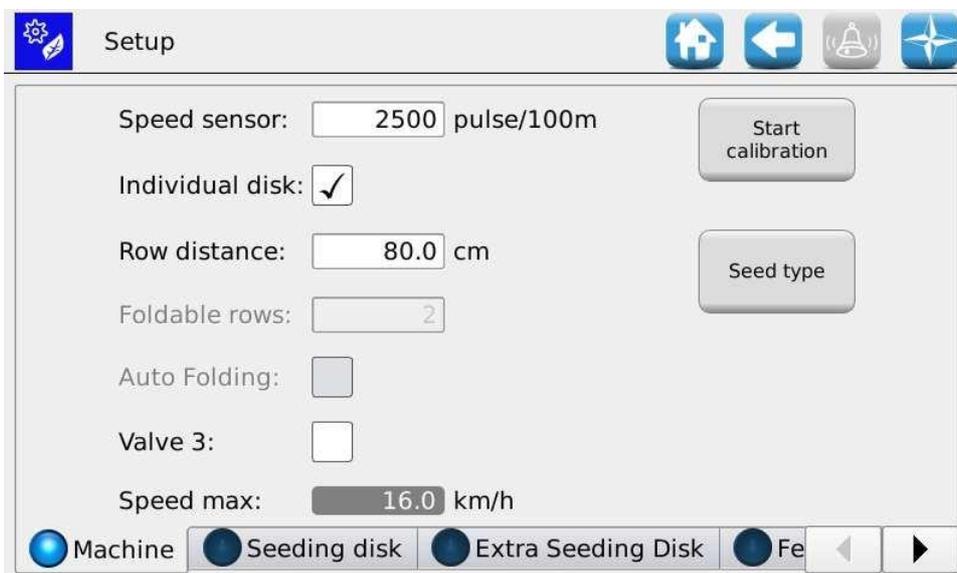
Sensitivity doublets/missing: 1 (4) Sensitivity investment: Off (5)

Speed max: 16.0 km/h (6) Resume rows: Off (8)

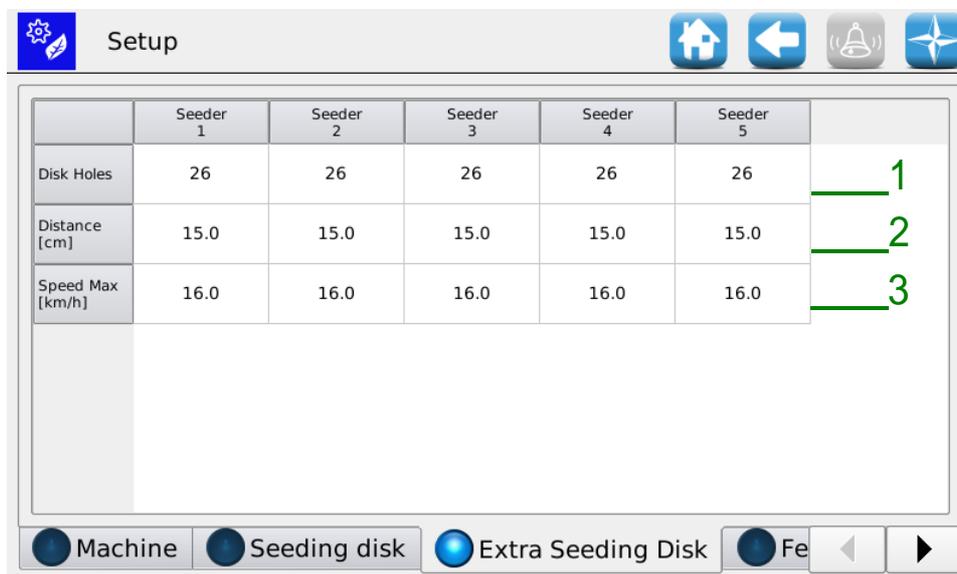
Machine Seeding disk Extra Seeding Disk Fe

Field	Values range	Description
1	3 – 101	Number of holes on the seeding disc
2	2 – 100 cm or 1 - 100000 seeds/ha	Seeding distance expressed in cm or, as an alternative, investment value expressed in seeds/ha.
3	-	These numeric fields represent the conversion between seeding distance and investment.
4	Off, 1 – 4	Doublets/missings sensitivity (Off = disabled control 1 = min. sensitivity ... 4 = max. sensitivity)
5	Off, 1 – 4	Sensitivity to the deviation from the theoretical investment (Off = disabled control 1 = min. sensitivity ... 4 = max. sensitivity)
6	0 – 16 km/h	Maximum speed limit imposed only by the seeding discs settings. <b>Warning!</b> This is not necessarily the most binding limitation: it is possible that the fertilizer spreaders and/or microgranulators settings impose stricter limitations to the maximum seeding speed.
7	1 - 32	It shows the number of effectively used rows for the seeding and the calculation of the sown hectares. It is calculated as the number of seeding discs minus the number of disabled elements (see chapter <b>Seeding discs disabling</b> ).
8	On/off	Automatic recovery of the rows which have been switched off by the manual tramline at the end of the field. This operation is done during the transition phase between lifted/lowered machine.

Tab Extra Seeding Disk



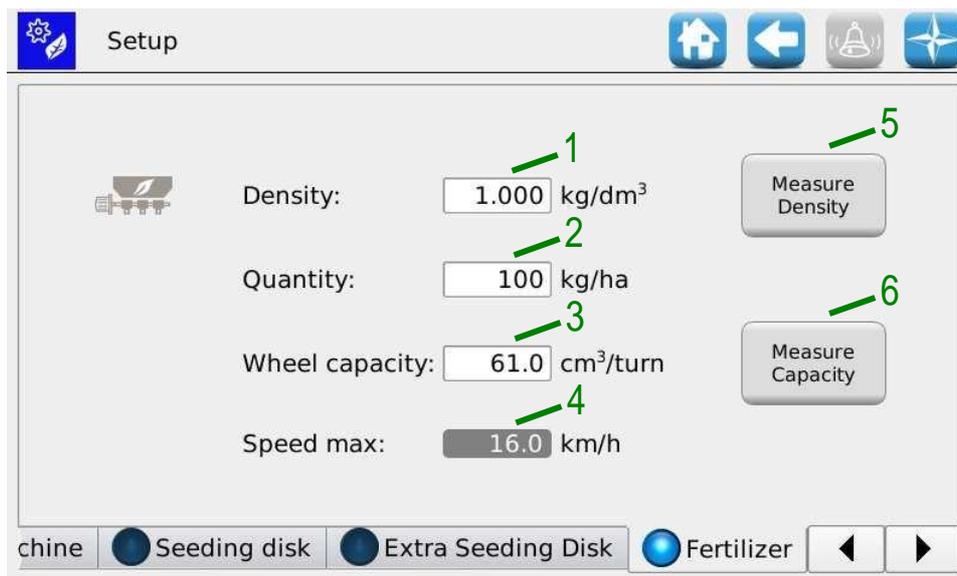
In the **Machine** Tab it is possible to activate the “Individual disk” function, which enables the “Extra Seeding Disk”. This tab allows to individually set the disk holes as well as the seeding distance for each row, by directly selecting the parameters of the row you want to modify.



Field	Values range	Description
1	3 – 101	Number of holes on the seeding disk
2	2 – 100 cm	Seeding distance expressed in cm

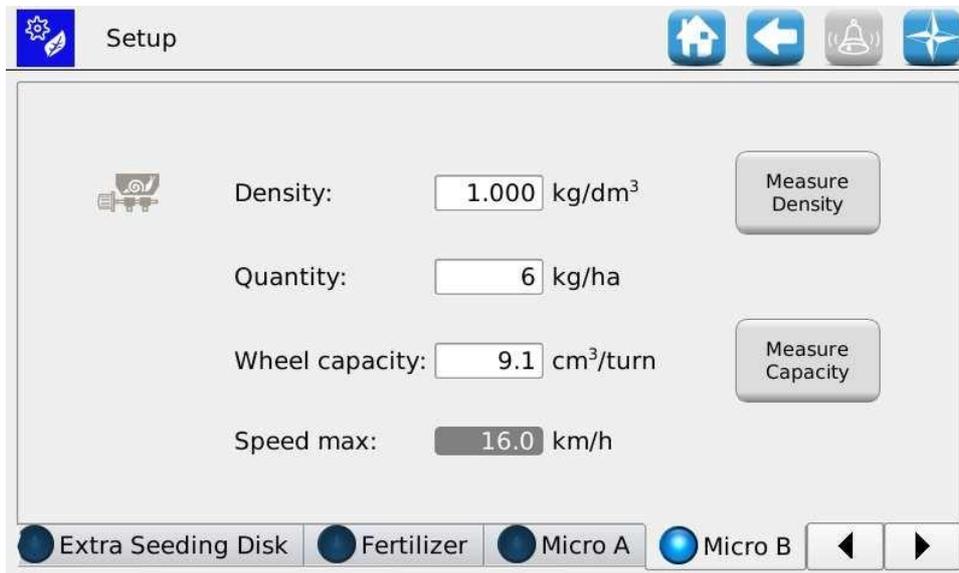
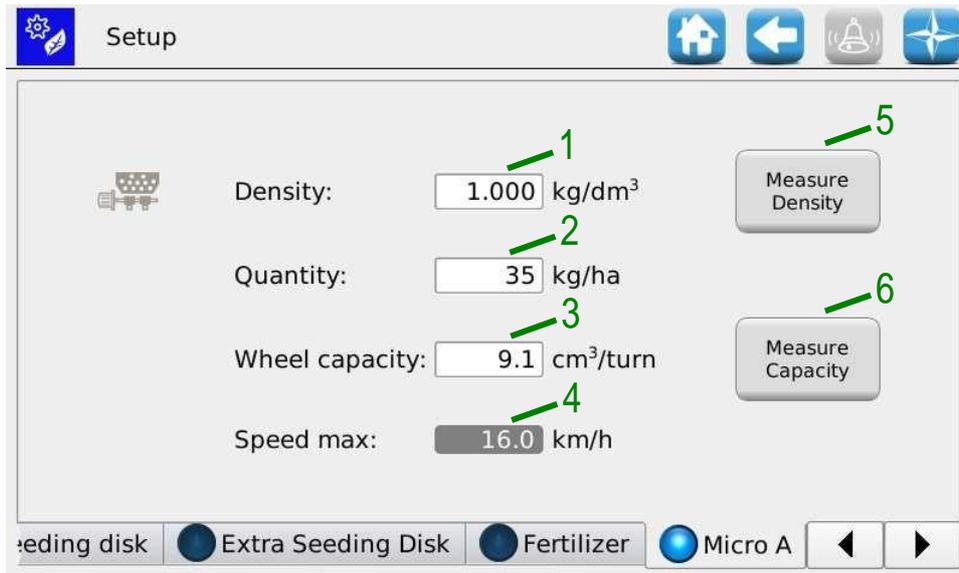
3	0 – 16 km/h	Maximum speed limit imposed only by the seeding discs settings. <b>Warning!</b> This is not necessarily the most binding limitation: it is possible that the fertilizer spreaders and/or microgranulators settings impose stricter limitations to the maximum seeding speed.
---	-------------	---

Fertilizer spreader Tab



Field	Values range	Description
1	0.5 – 2 kg/dm <sup>3</sup>	Density of the product in use
2	50 –500 kg/ha	Quantity of product used per hectare
3	0 – 1000 cm <sup>3</sup> /turn	Auger/distributor dimension in cm <sup>3</sup> . It is possible to calculate this volume by pushing the 6 button. (See below)
4	0 – 16 km/h	Maximum speed limit imposed only by the fertilizer spreaders settings. <b>Warning!</b> This is not necessarily the most binding limitation: it is possible that the seeding discs and/or the microgranulators settings impose stricter limitations to the maximum seeding speed.
5	....	It allows to measure the density of the product to be used. (See below)
6	....	It allows to calculate the volume cm <sup>3</sup> of the auger/distributor in use.

A and B Microgranulators Tab



Field	Values range	Description
1	0.5 – 2 kg/dm <sup>3</sup>	Density of the product in use
2	50 –500 kg/ha	Quantity of product used per hectare
3	0 – 1000 cm <sup>3</sup> /turn	Auger/distributor dimension in cm <sup>3</sup> . It is possible to calculate this volume by pushing the 6 button. (See below)
4	0 – 16 km/h	Maximum speed limit imposed only by the only fertilizer spreaders settings. <b>Warning!</b> This is not necessarily the most binding limitation: it is possible that the seeding discs and/or the microgranulators settings impose stricter limitations to the maximum seeding speed.
5	....	It allows to measure the density of the product to be used. (See below)

6	....	It allows to calculate the volume cm <sup>3</sup> of the auger/distributor in use.
---	------	--

**“Density” measurement**

Press the **5** button in the fertilizer and microgranulator configuration page to calculate by experimentation the density of the product in use.

When pressing the button for the first time, the following screen is displayed:



It is possible to select the motor to be calibrated as well as the prefill speed to be used.

After pressing the prefill button (for at least 3 complete turns of the auger), it will be possible to start the density measurement. The following screen is displayed



Let the motor run for at least 60 seconds (according to the machine settings) in order to get a good quantity of product in the bag (not less than 1/2 kg).  
Press the Stop button to end the test (press Pause if you only want to interrupt it for a short time and resume it later)  
The following screen will be displayed



Input the weighted value and press Confirm. The value will be updated by the system in the Density field.

### How to measure the "Volume per turn"

Press the 6 button in the fertilizer and microgranulator configuration page to calculate by experimentation the product quantity to be released by the hopper through the auger.

The following pop-up window is displayed where it is possible to test the volumetric distributor.



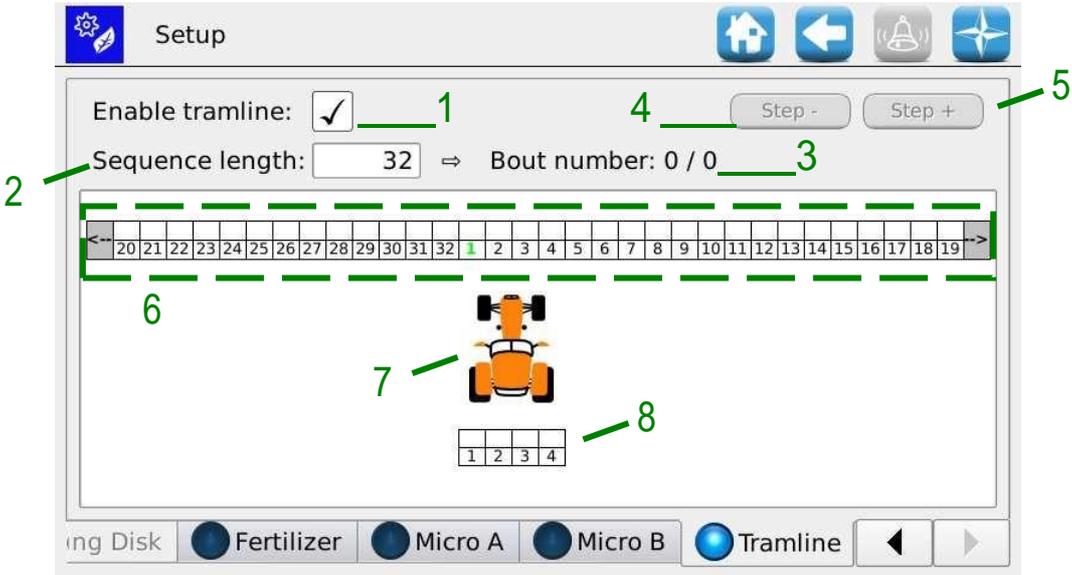
After setting a desired number of turns, the system will start up the motor related to the fertilizer 1 or the microgranulator 1. This operation can be done by measuring the spread quantity, dividing it by the number of turns and, if different from 1kg/dm<sup>3</sup>, even by the density, i.e:

$$\text{Volume per turn} = 1000 \times \text{Measured quantity} / (\text{Density} * \text{turns}) \text{ [cm}^3\text{/turn]}$$

Tramline Tab

This page allows to manage the advanced function called “Tramline”, i.e. the automatic row exclusion function.

The manual function is already available in the HOME page by using the buttons you can find under the column of each seeding row.



Field	Values range	Description
1	....	It enables the automatic tramline function.
2	6 - 100	Total length of the sequence to be covered on the field or on a portion of it. Indicated as the number of rows.
3	....	Counter for the estimated number of passages that will be necessary for that field.
4	....	It allows to manually go back in the sequence. Only enabled in "Pause"
5	....	It allows to manually go forward in the sequence. Only enabled in "Pause"
6	....	Display of the total length of the sequence to be covered on the field or on a portion of it. Displayed as the number of rows.
7	....	
8	1 - 32	It displays the machine length.

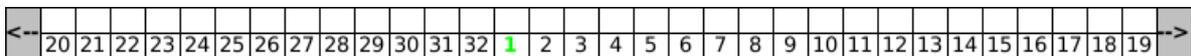
**Basic settings and indication for the tramline application**

Unlike other solutions, the proposed system has been designed as generically as possible, thus it is not only linked to the passage with the weeding bar.

The operation and the parameters setting is based on the "row" unit and not on the dimensions in meters (for ex. the width of the weeding bar and so on); this happens because the row separation system requires in any case that the minimum unit which can be considered for the row separation is the single row.

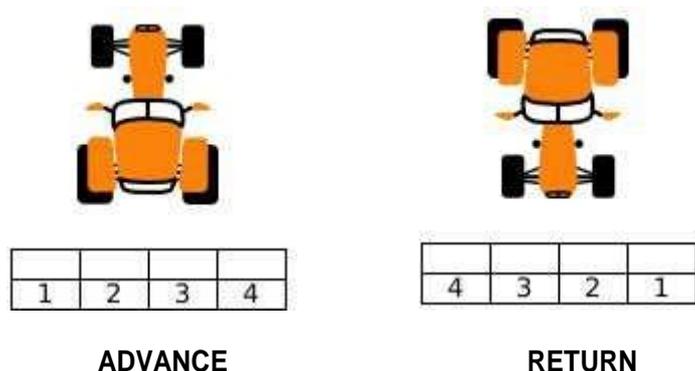
It is therefore obvious that the "length" of the sequence to be repeated is defined as the number of rows. In our example, 32 total rows.

Once the sequence has been defined, it is necessary to decide the seeder position at the first passage, with respect to the sequence. This operation is performed by means of the buttons placed at the beginning and at the end of the graphical total sequence display, as shown below.



This allows, for example, to align row 1 on the seeder to row 1 in the sequence (beginning of the field) if desired.

As regards the basic adjustments to be carried out before the beginning of the job, you can decide whether the first one is an advance or return passage. It is possible to make this adjustment by clicking directly the tractor icon with the following result:



### Dynamic operation of the tramline application

The rows exclusion sequence is generated by overlapping the seeder passages to the sequence vector (in this case 20 rows).

To exclude the rows in the sequence, just click on the corresponding row case, as shown in the example below (rows 9 and 10).

<--	14	15	16	17	18	19	20	1	2	3	4	5	6	7	8	9	10	11	12	13	-->
-----	----	----	----	----	----	----	----	---	---	---	---	---	---	---	---	---	----	----	----	----	-----

When one of the seeder rows overlaps to the case corresponding to an excluded row in the sequence, that row will be shut down (switching to the automatic tramline mode), as shown in the following figure.

The sequence changes (i.e. The vector corresponding to the seeder moves along the sequence vector), each time there is a transition of the following signals:

- Machine lifted/lowered (PROX\_MACH)
- Left row marker (ROW\_L)
- Right row marker (ROW\_R)

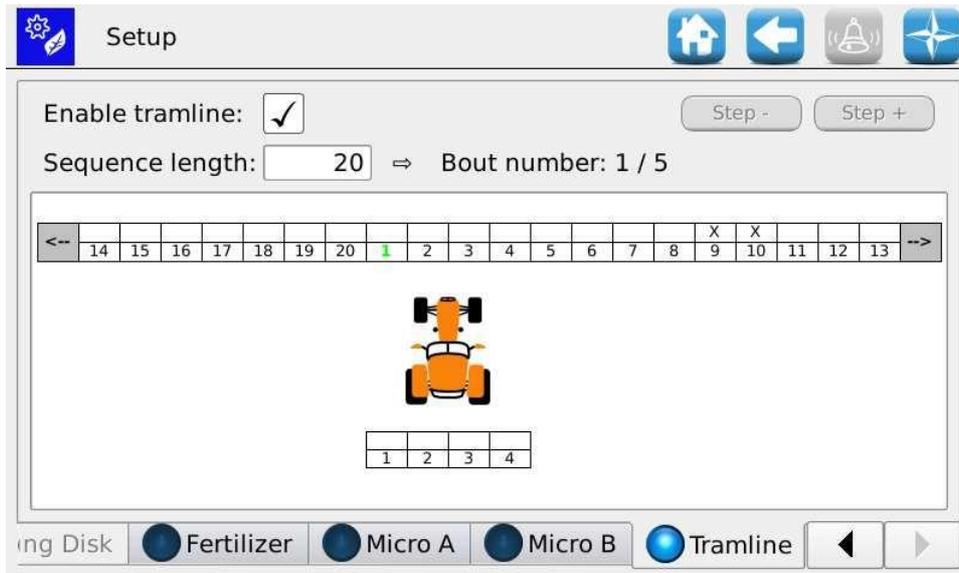
### Basic example:

In order to better understand how the tramline works, let's analyze a real case, covering most of the operation conditions on the field, i.e.:

- Number of rows on the machine: 4
- Number of rows for the sequence: 20
- Machine alignment to the left (row 1 on the machine aligned with row 1 in the sequence)
- Driving direction: advance

Supposing that the sequence goes further without mistakes we will not need to use the buttons  .

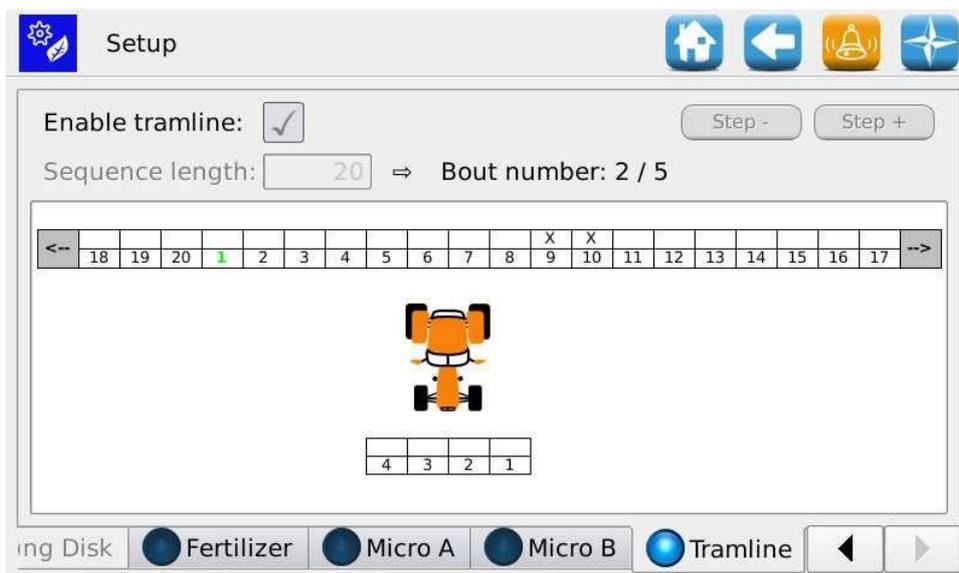
The following screen is displayed:



While analyzing the data, the system estimates that 5 steps will be necessary in order to complete the sequence. Thinking of the machine position on the field, we will see the machine “lifted” in transport position, with the left and right row markers “lifted”.

When the seeding job starts, the right row marker is lowered and the machine is lowered in working position. When the end of the field is reached, the right row marker is lifted and the machine is lifted too.

After the new positioning of the machine for the second passage at the end of the field, the left row marker will be lowered and the machine itself will be lowered in working position: the sequence will therefore be increased of one step and it will be shown as follows:



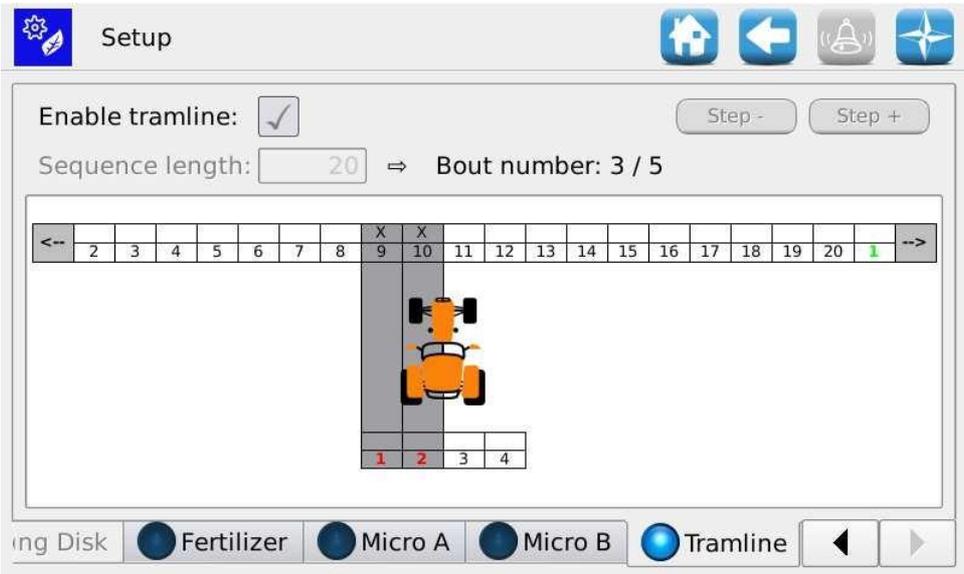
As you can see, the working condition is:

- Rows covered on the first passage: 4

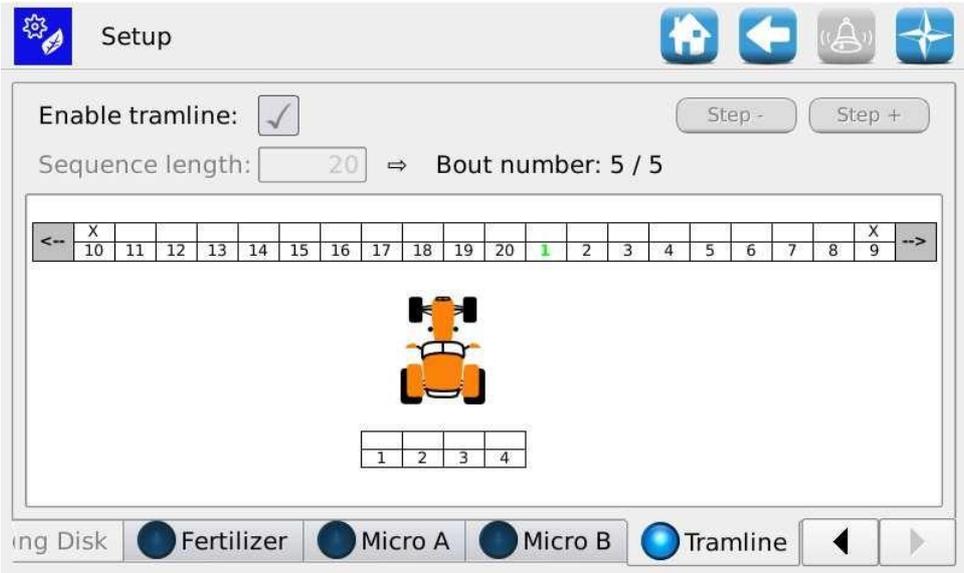
- Sequence progress counter (Bout) is increased of one step. (It is now 2/5)
- The machine is in return position.

In the first and second passage, no row is excluded and there isn't any indication of excluded rows on the machine.

In the third passage three rows are excluded and the system highlights both the dark grey columns, and the red columns with the machine rows numbers, as shown below:



Going on with the sequence and moving forward the row markers and the lifted/lowered machine in the right way, the following condition will be displayed:



As you can see, the (Bout) counter shows the end of the sequence with the step count 5/5, and in that case the tractor will be positioned in the advance direction.

It is possible to go on with the same preset sequence without stopping the seeding job, by simply resetting the (Bout) counter.

### Example with a mistake in the advance sequence

As shown in the previous example, the automatic sequence progress is manually carried out by the operator with the “machine lifted/lowered”, right row marker and left row marker functions.

If the preset sequence is not followed, you could encounter unforeseen behaviours, for example:

- The sequence moves backwards
- There is no progression in the sequence
- The tractor driving direction is confused

Use the following buttons to carry out any correction



If pressed, you can go back of one of more steps in a sequence already finished or go further by predicting the future actions, just like the machine had already performed them.

The second action is very useful when the job is not continuous and it is necessary to reposition the machine in a different way on the field during the passage.

### 3.7 HOME

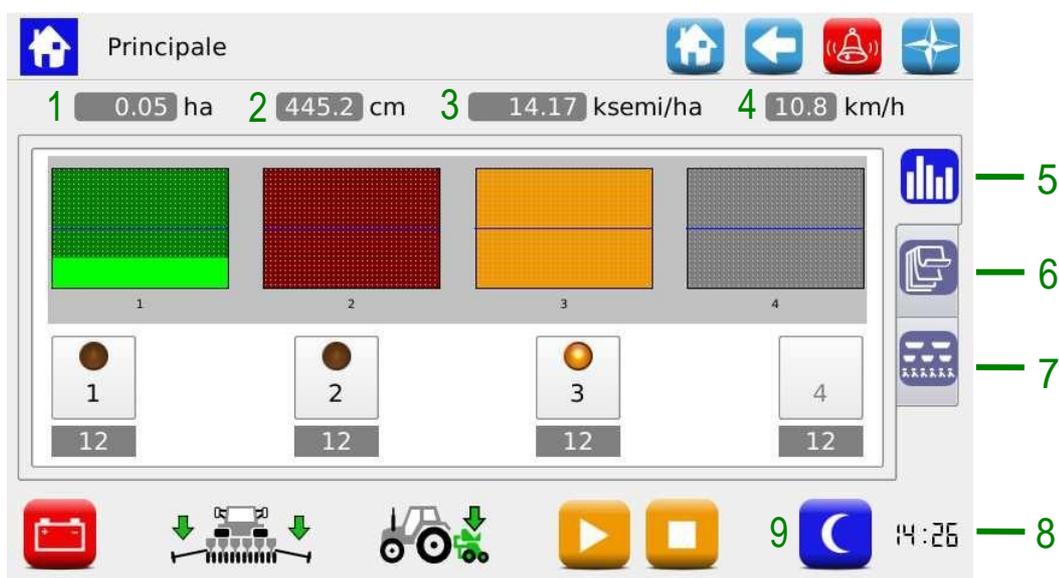
This screen offers a general overview of the system functions and allows to:

- start, finish and temporarily suspend the seeding activity.
- get a graphical indication of the machine position (lifted/lowered), of the battery and alternator status and of the row markers position.
- get a graphical indication of the seeding quality
- easily access the rows switch off function.

Path:



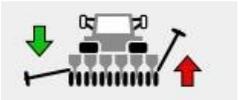
Overview of the complete seeding system



Field	Values range	Description
1	Value in ha	It shows the partial ha-counter, in relation to the actual or just finished seeding job.
2	Value in cm	Medium seeding distance
3	Value in 1000seeds/ha	Medium investment
4	Value in km/h	Here you can see the real time system speed, as detected by the set speed sensor.
5		Row exclusion and Seeding Tab.
6		Summary information Tab
7		Synoptic Tab.
8	h:min	It shows the set time

9		<p>Button for the day/night backlight activation.</p> <p> It activates the backlight set for the night</p> <p> It activates the backlight set for the day</p>
---	--	---

The backlight settings can be changed via the Terminal menu (see chapter **TERMINAL**).

Field	Function	Description
	How to use the alternator	<p> The system is only using the battery. The alternator is not charging the battery or the PTO has not been activated.</p> <p><b>Note:</b> press the battery icon to activate an alternator power up cycle.</p> <p> The system is working with the battery and the alternator.</p>
	Row markers	It shows the row markers status. This icon is updated in real time
	Machine status	<p> Machine lifted</p> <p> Machine lowered</p>
	Indications of the seeding job	<p>  Active job</p> <p>  Inactive job</p> <p>  Job paused</p>

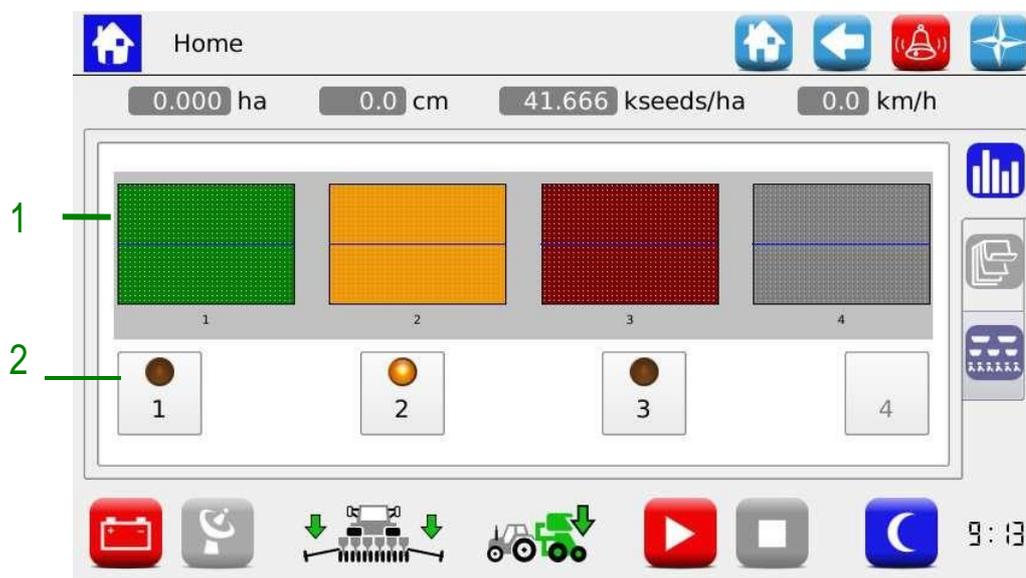
 When the seeding job is active, the motor output shaft and the connected transmissions will rotate according to the movement of the machine, as detected by the speed sensor.

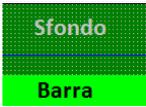


In case it is necessary to carry out any operations inside the seeding element, to access the seeding disc or the fertilizer spreader and micro-granulators auger, **the system should be disconnected from the power supply** via the battery disconnect switch before removing or opening the guards.

### 3.7.1 Rows exclusion

Here you can easily view the status of the seeding elements and switch the rows off.



Field	Values range	Description
1	Seeding quality bar	 <p><b>Bar:</b> it indicates the quantity of seeds detected by the seed sensor during the last complete cup seeding disc turn.</p> <p><b>Nominal value:</b> it represents the nominal level corresponding to the number of holes which have been set.</p> <p><b>Background:</b> this part of the chart is in background to the bar. The bar colour and the background indicate the row status:</p> <p><b>Green</b> → row OK</p> <p><b>Yellow</b> → row switched off through the <b>row exclusion button</b></p> <p><b>Red</b> → row alarm/error</p> <p><b>Grey</b> → excluded row (<b>not active</b>)</p>
2	Value in cm	Tramline button: <ul style="list-style-type: none"> <li> active row</li> <li> row off</li> <li> excluded row (this button is not active)</li> </ul>

☞ If a row is off, an alarm will sound continuously (3 consecutive bits) to remind the operator that the row has to be reactivated as soon as possible.

### 3.7.2 Summary information about the seeding job

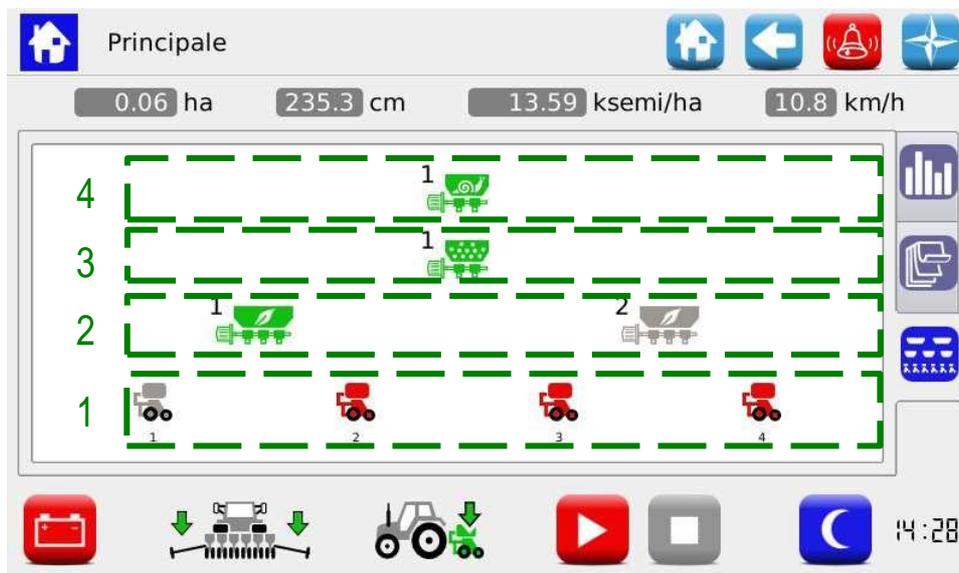


Field	Description
1	Unique progressive number assigned to the seeding job.
2	Seeding job starting date and time
3	Seeding job date and time
4	Time worked
5	Tags related to the seeding job name
6	Average working speed in [km/h]
7	Maximum working speed in [km/h]
8	Total ha-counter of the machine

### 3.7.3 Synoptic Tab

It allows to enable and disable the rows motors and to quickly access the seeding set up functions, (see chapter **SEEDING SETTINGS**).

It also gives a graphical overview on the devices status.



Field	Description
1	Seeding discs status icons The icon color indicates the row status <b>Green</b> → row OK <b>Yellow</b> → row switched off through the <b>row exclusion button</b> <b>Red</b> → row alarm/error <b>Grey</b> → excluded row (not active)
2	Fertilizers status icons. The icon color indicates the device status. <b>Green</b> → distributor OK <b>Red</b> → distributor error <b>Grey</b> → distributor excluded (not active)
3	Status icons micro-granulator A The icon color indicates the device status.
4	Status icons micro-granulator B The icon color indicates the device status.

If pressed, the devices icons, allow to access the diagnostics, setting, activation/deactivation pop-up windows.

### Seeding discs pop-up windows

These pop-up windows allow to view the status of the seeding discs related devices, to check if they are enabled and to quickly access the product distribution parameters setup menu.

Path:



Field	Description
1	Indication of the device status OK → no active alarms Disabled → device excluded (not active)
2	By pressing this button, a <b>Setup</b> menu window is opened (see chapter <b>SEEDING/SETTINGS</b> ), on the Tab corresponding to the selected seeding discs.
3	This button closes the window
4	This button enables/disables the device
5	Navigation buttons allowing to select the device you want to operate on

### Seedings discs disabling

The Seeding disc enable/disable function is used to permanently excluding it from the seeding. Differently from the exclusion through the **row exclusion** button, the Enable/Disable button also excludes the row from the sown hectares calculation. Pressing this button you can modify the value in the Active Rows field, in the **Settings**, window of the **Machine** Tab.

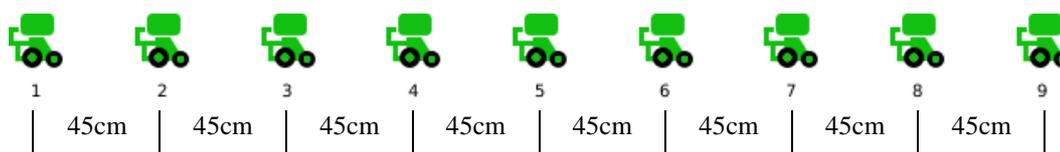
This function is only used in case of machines where it is possible to vary the elements number.

**Warning!**: the elements number is not changed in case some rows are excluded, so that the disabled elements will keep their address, even if they are not used for the seeding activity (see following figures).

#### Example 1:

9 rows machine. All seeding discs enabled, row distance 45cm.

➔ Active rows: 9

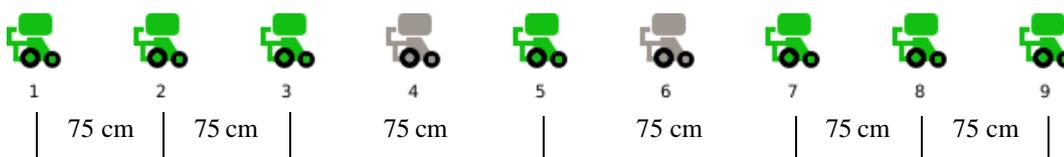


#### Example 2:

9 rows machine. Discs 4 and 6 disabled, row distance 75cm.

➔ Active rows: 7.

The elements 4 and 6 on the machine will be lifted, as to ensure a 75cm row distance between elements 3 and 5 and elements 5 and 7.



### Fertilizer spreader, A and B micro-granulators pop-up windows

These pop-up windows allow to view the devices status, to check if they are enabled and to quickly access the product distribution parameters setup menu

**Path:**

-  → 1  For the fertilizer spreader
-  → 1  For the A micro-granulator
-  → 1  For the B micro-granulator



Field	Description
1	Indication of the device status OK → no active alarms Disabled → device excluded (not active) Alarm → device alarm
2	By pressing this button the <b>Setup</b> menu window activates (see <b>SEEDING SETTINGS</b> chapter), on the Tab corresponding to the selected device. For ex.: if the pop-up window has been opened pressing the Fertilizer spreader 1 button, the <b>Fertilizer spreader</b> Tab opens. In case of changes, the settings will remain valid for all devices of the same type.
3	This button closes the window
4	This button enables/disables the device
5	Navigation buttons allowing to select the device you want to operate on

### 3.7.4 Seeding job

In order to proceed, you need to start a seeding job.

If the seeding job is inactive (seeding job indicator off →  ), the motors do not react to any movement of the machine.

Button	Description
	<p>Click on this button to start a seeding job.</p> <p>The job status indicators will turn green  ;</p> <p>Once the seeding job is active, the “Prefill” phase” is immediately run, and the rows motors start turning until the disc is full of seeds.</p> <p>After that the system waits for the tractor’s movement on the field which determines the electric motors movement.</p> <p>The partial ha-counters and the seeds counters are reset at the beginning of the seeding activity.</p>
	<p>Press the button to resume a seeding job which you had previously paused.</p> <p>In this case a “Prefill” is carried out only in case the PTO had been switched off during the pause.</p> <p>The partial ha-counter and the seeds counter restart from the value indicated before the pause.</p>
	<p>Press the Pause button to temporarily interrupt the seeding job without resetting the statistical counters related to the already started job.</p> <p>The job status indicators will turn yellow  ;</p>
 	<p>The seeding job is almost finished. The job status indicators will turn red/grey  .</p> <p>After a seeding job is closed, a number of information about the finished job is saved in the internal memory. A status window indicates this activity. As soon as the status window closes, it will be possible to start a new job.</p>

### 3.8 ALARMS

The alarms and warnings are reported in a pop-up window like the one shown in the picture.

The **3** button confirms the alarm acknowledgment and closes the window, but it does not cancel the alarm.

There are various kinds of alarms. According to the kind of alarm, it is possible to cancel it (the alarm status is eliminated) automatically or through a system rebooting, pressing the battery disconnect switch.

Category	Background colour	Buzzer	The pop-up window closes	Description
Unrecoverable emergency	Red	5 continuously repeated bips	Manual, pressing the alarm acknowledgment button	It is not possible to go on seeding. The system must be disconnected from the power supply
Recoverable emergency				It is not possible to go on seeding. The system must be disconnected from the power supply
Standard error		1 bip		It is possible to go on seeding but the device showing an error is not working properly
Warning	Yellow	1 bip	Automatic after 3 seconds	It is possible to go on seeding but the operator should be aware of the situation.

The already checked (acknowledgment button pressed) but still active errors, will be visualized in the window in a lighter background colour.



Field	Description
1	Alarm code
2	Alarm description Alarm category
3	Alarm acknowledgment button
4	Active alarm which has already been acknowledged (grey text)

Error code	Message	Solution
1060	Error overflow 1	Contact technical support
1061	Error overflow 2	Contact technical support
1062	Internal error	Contact technical support
1063	Log checksum failure	Contact technical support
1470	Connection timeout	Check CAN cable connection between ECU and HMI
1471	Invalid protocol version debug	Not active on customer release
1472	Invalid protocol version	SW version of ECU and HMI are not compatible. Make sure that latest SW updates have been correctly downloaded to ECU and HMI. Note
1480	Missing connection ECU / MD	Check CAN cable connection between ECU and DMD. Check supply cable to ECU. Check battery voltage
1481	Connection timeout ECU / MD	Check connection between ECU and DMD or between DMD
1490	Initialize timeout (%1)	Contact technical support
1550	Connection timeout	Check connection between ECU and remote terminal
1600	Machine taxing position	Machine in transport position (lifted) If this is happening when machine is supposed to be seeding, check cabling and machine position sensor
1610	Pressure sensor failure	Check connection of pressure sensor
1611	Pressure out of range	Adjust PTO speed so that vacuum pressure is within the range
1612	Pressure range min > max	Check min and max limit setting of pressure so that min < max
1701	MD protocol error	Update DMD with latest SW and check that addressing procedure has been correctly completed
1703	Configuration and setup parameters lost	Machine configuration parameters have been reset to default. Check and correct configuration parameters where applicable
1801	Invalid configuration or MD address	Check MD fuses. Addressing procedure of DMD has to be performed
2000	Data checksum	Contact technical support
2001	Invalid checksum	Contact technical support
2003	Debug mode	Not active on customer release
2007	Event log failure	Contact technical support
2008	FRAM checksum error	Contact technical support
2009	FSM queue overflow	Contact technical support
2100	Cpu watch dog	Contact technical support
2101	Software trap	Contact technical support
2200	Speed sensor failure	Check speed sensor cabling
2500	Group A parameters mismatch	Not possible to set that combination of parameters (number of disk holes, seeding distance)
2501	Group B parameters mismatch	Not possible to set that combination of parameters (number of disk holes, seeding distance)

Error code	Message	Solution
2502	Group C parameters mismatch	Not possible to set that combination of parameters (number of disk holes, seeding distance)
2503	Group D parameters mismatch	Not possible to set that combination of parameters (number of disk holes, seeding distance)
2504	Spare parameters mismatch	Not possible to set that combination of parameters (number of disk holes, seeding distance)
2510	Seeding speed too high	Reduce tractor speed
2520	Seeding job not active	Start the seeding job by pressing the relative button.
6000	Low voltage	Check speed sensor cabling. Check battery voltage
6001	Power failure stop	Check speed sensor cabling. Check battery voltage

**xx = it indicates the motor which generated the error**

**1-32 Seeding disc 1-32**

**33-40 Fertilizer spreader 1-8**

**49-56 Micro-granulator A 1-8**

**57-64 Micro-granulator B 1-8**

Error code	Message	Solution
1xx00	Overcurrent	Cycle power of the system from battery disconnect.
1xx01	Motor high temperature	Let motor cool down. Check mechanical arrangement to check that there aren't unwanted frictions, damaged bearings, etc.
1xx02	High voltage	Check PTO speed to be according to specifications. Check alternator voltage. Check battery connection and fuses
1xx03	Low voltage	Check PTO speed to be according to specifications. Check alternator voltage. Check battery connection and fuses
1xx04	PCB high temperature	Let motor cool down. Check mechanical arrangement to check that there aren't unwanted frictions, damage bearings, etc.
1xx06	High I2T	Not active on customer release
1xx07	Rotor lock	Check seeding disk for stuck seeds or distributor of stuck/blocking product
1xx08	Motor too high temperature	Let motor cool down. Check mechanical arrangement to check that there aren't unwanted frictions, damage bearings, etc.
1xx09	PCB high temperature	Let motor cool down. Check mechanical arrangement to check that there aren't unwanted frictions, damage bearings, etc.
1xx10	Overspeed error	Cycle power of the system from battery disconnect. Contact supplier if not solved
1xx11	Heart beat ECU missing	Check CAN cable connection between ECU and DMD. Check supply cable to ECU. Check

xx = it indicates the motor which generated the error		
1-32	Seeding disc	1-32
33-40	Fertilizer spreader	1-8
49-56	Micro-granulator A	1-8
57-64	Micro-granulator B	1-8
Error code	Message	Solution
		battery voltage
1xx12	Find rotor position error	Not active on customer release
1xx13	Safety switch open	Close lid or seeding element cover. Check security switch
1xx14	Pwm control volt	Cycle power of the system from battery disconnect. Contact supplier if not solved
1xx15	Position control error	Cycle power of the system from battery disconnect. Contact supplier if not solved
1xx16	Blocked Seeding disk	Check seeding disk for stuck seeds or distributor of stuck/blocking product.
1xx17	Low voltage	Check PTO speed to be according to specifications. Check alternator voltage. Check battery connection and fuses
1xx26	Seed selector	Verify that there isn't any material (seeds, dust, etc.) preventing the correct movement of seed selector. Verify that seed selector cam is fitted properly on seed selector motor shaft. From the menu\Diagnostic\Test\Seed Selector, press "Homing" button to perform the homing procedure
1xx30	Generic	Recoverable emergency
1xx80	High number of doublets	Check at every single turn, adjust the seed selector position to a lower set value.
1xx81	High number of missings	Check at every single turn, adjust the seed selector position to a higher set value.
1xx83	High number of missings	Quick check less than one turn, check the pressure rate and the seeds selector position
1xx84	Prefill not completed	Verify that vacuum is correct and seeds are present in the hopper
1xx85	High number of doublets	Long period alarm, adjust the seed selector position to a lower set value.
1xx86	High number of missings	Long period alarm, adjust the seeds selector position to a higher set value, for example to detect a plugged disk hole.
1-1xx14	Pwm control volt	Cycle power of the system from battery disconnect. Contact supplier if not solved.
1-1xx15	Position control error	Cycle power of the system from battery disconnect. Contact supplier if not solved.

xx = it indicates the motor which generated the error		
1-32	Seeding disc	1-32
33-40	Fertilizer spreader	1-8
49-56	Micro-granulator A	1-8
57-64	Micro-granulator B	1-8
Error code	Message	Solution
1-1xx16	Blocked Seeding disk	Check seeding disk for stuck seeds or distributor of stuck/blocking product
1-1xx17	Low voltage	Check PTO speed to be according to specifications. Check alternator voltage Check battery connection and fuses
1-1xx26	Seed selector	Verify that there isn't any material (seeds, dust, etc.) preventing the correct movement of seed selector. Verify that seed selector cam is fitted properly on seed selector motor shaft. From the menu\Diagnostic\Test\Seed Selector, press "Homing" button to perform the homing procedure
1-1xx80	High number of doublets	Adjust the seed selector position to a lower set value.
1-1xx81	High number of missings	Adjust the seed selector position to a higher set value.
1-1xx82	Deviation from theoretical investment	Check seeding disc and seeds selector position.
1-1xx83	High number of missings <sup>1</sup>	Verify selector position, pressure rate or the presence of the seeds in the hopper.
1-1xx84	Prefill not completed	Verify that vacuum is correct and seeds are present in the hopper.

<sup>1</sup> This is the same message as for 1-1xx81 alarm, but in this case there is a consecutive missing doublets situation (for ex. empty hopper).

### 3.9 SOFTWARE UPDATE AND PROTOCOL CHANGE



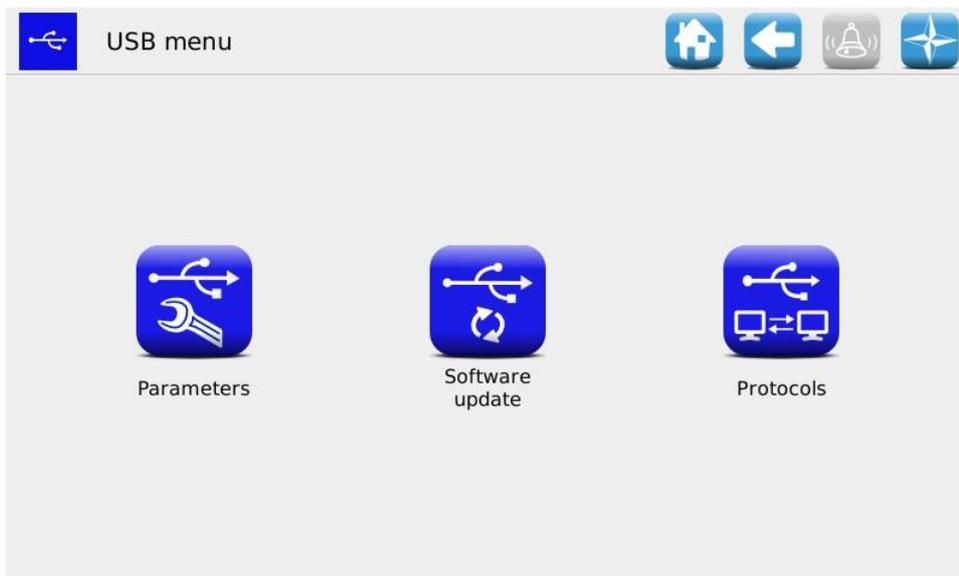
It is possible to update each system device via the HMI.  
To perform an update, you need a USB stick containing the software versions you want to update.

Where applicable, you can perform the update in the following order:

- 1) ECU
- 2) HMI
- 3) DMD

The “Protocols” function allows to switch from the ROJ machine (therefore from the ECU system with standard HMI Agrimate), to the ISOBUS ARAG systems, controlled by a proprietary control unit called “iBX100 Planter”.

In the following screen you can choose whether updating the various devices softwares or changing the MDs communication protocol.



The accessible submenus on the operator's or OEM assistance level are “Software update” and “Protocol”.

### Software update

Path:



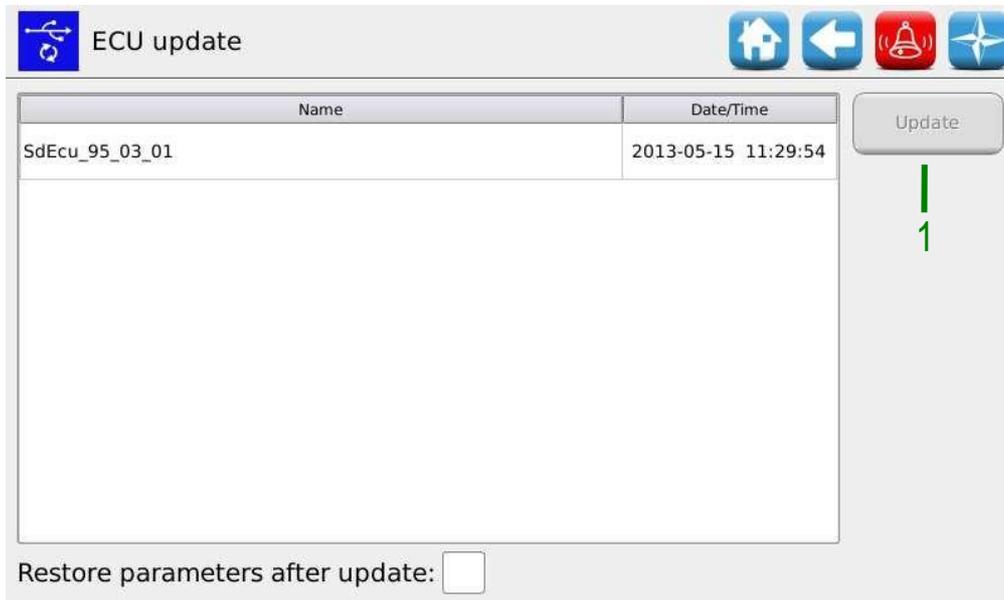
The following screen allows the user to decide which part of the system should be updated.



Field	Description
1	It allows to update the HMI software
2	It allows to update the ECU board software
3	It allows to update the motors software
4	It allows to update the PSB for the HMI (only ROJ service)

### ECU software update

Path:



Selecting the desired software from the list and pressing the **1** button, it is possible to update the ECU software.

**Remarks:**

1. After the ECU software update it is possible that an “*Invalid protocol version*” error is displayed. In that case, just go on with the updating procedure: the error is deleted after the HMI has been updated too.
2. After the ECU software update, it is possible that one ore more errors are displayed according to the previously installed software version, as follows:

*Configuration and setup parameters lost*  
*Invalid configuration or MD address*  
*Data checksum*  
*Invalid checksum*

In that case, follow the procedure described in the next paragraph in order to confirm the addressing and to restore the parameters.

**How to confirm the addressing and restore parameters**

1. Close the alarms window via the green check mark. The “MD Addressing” opens.
2. Wait 10 seconds before pressing the “Addressing” button.

3. An automatic procedure is performed after the message: "All devices correctly addressed" is displayed with a green check mark. Press "Exit".
4. The "Critical parameter setup" window is displayed. Press the "Confirm parameters" button.
5. Access the window Menu\Terminal and press the "Access" button.
6. Select "OEM Service" from the list. Enter the password for the OEM service access and confirm by double clicking on the green check mark.
7. Access the window Menu\USB\Parameters\.
8. Select the (PAR\_<date\_time>) file. If one or more files are present, select the most recent one.
9. Press "Load". If the loading has been successful, the "Parameters loaded" message will be displayed indicating that the parameters have been correctly restored.

### HMI software update

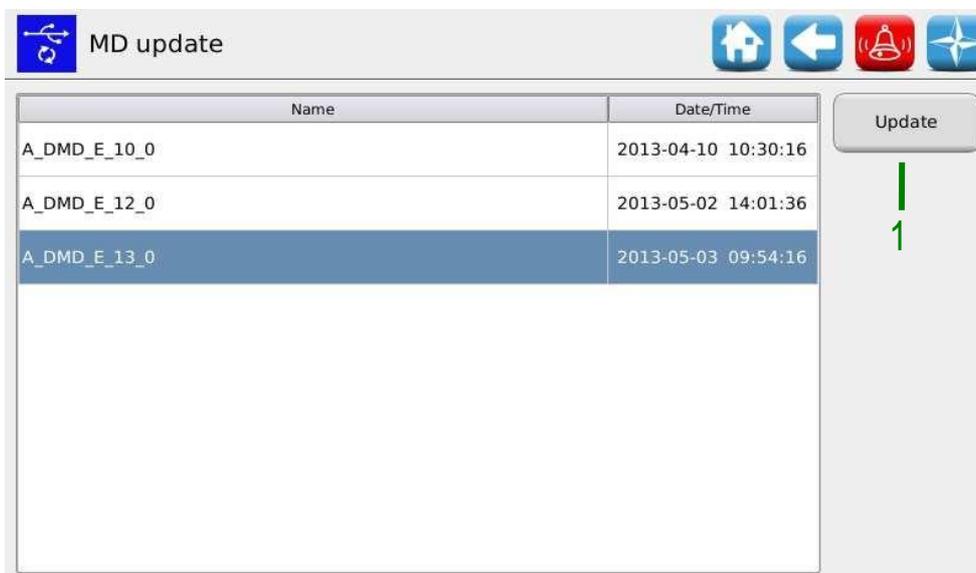
Path:



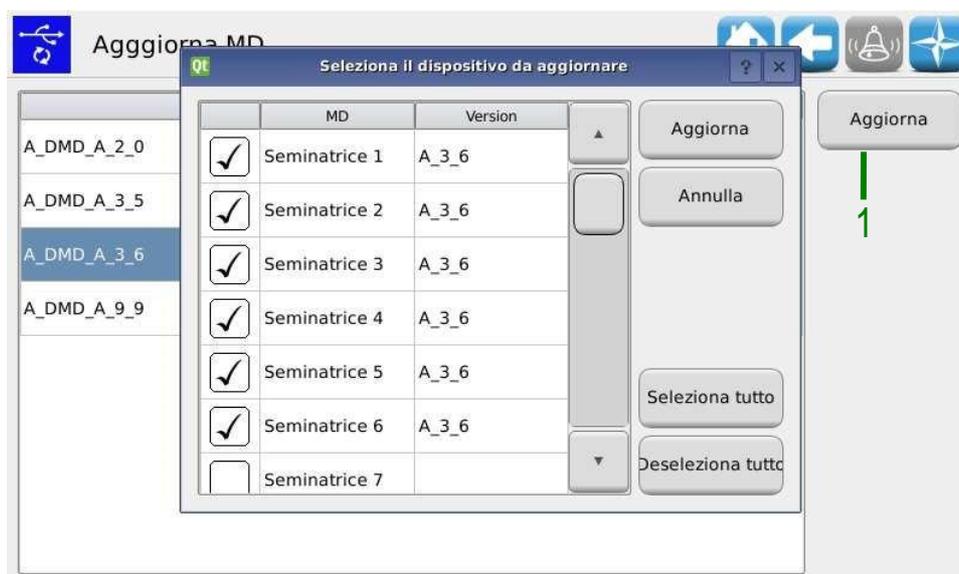
Selecting the desired SW from the list and pressing the **1** button it is possible to update the HMI.  
After the update the console shuts off automatically and the system reboots.

## MD software update

Path:



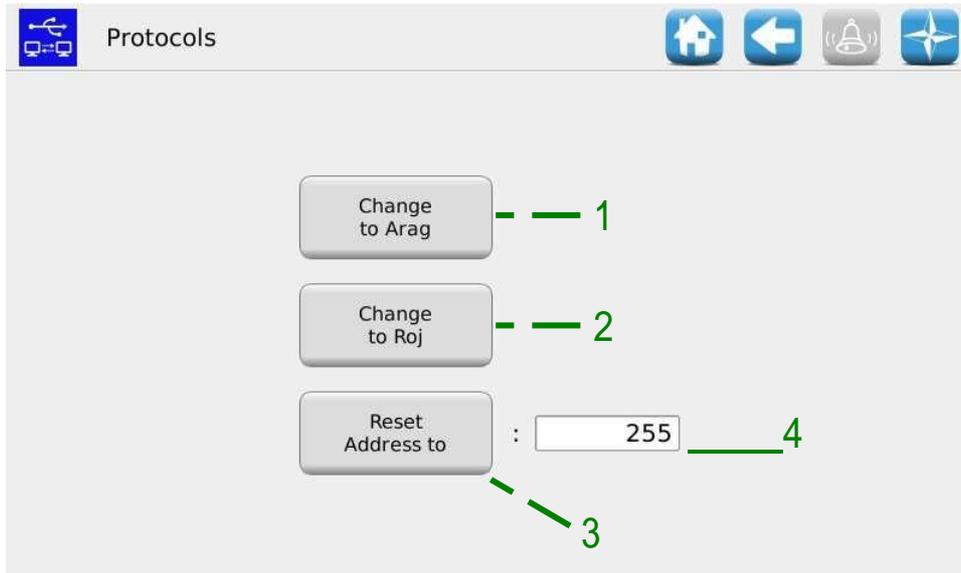
Selecting the desired software from the list, and pressing the **1** button, the following pop-up window is displayed where it is possible to choose the motor (and therefore the elements: seeding unit, fertilizers or micro-granulators) to be updated.



If you press the **1** button after the selection, the selected MDs update starts.

MD protocol change

Path:

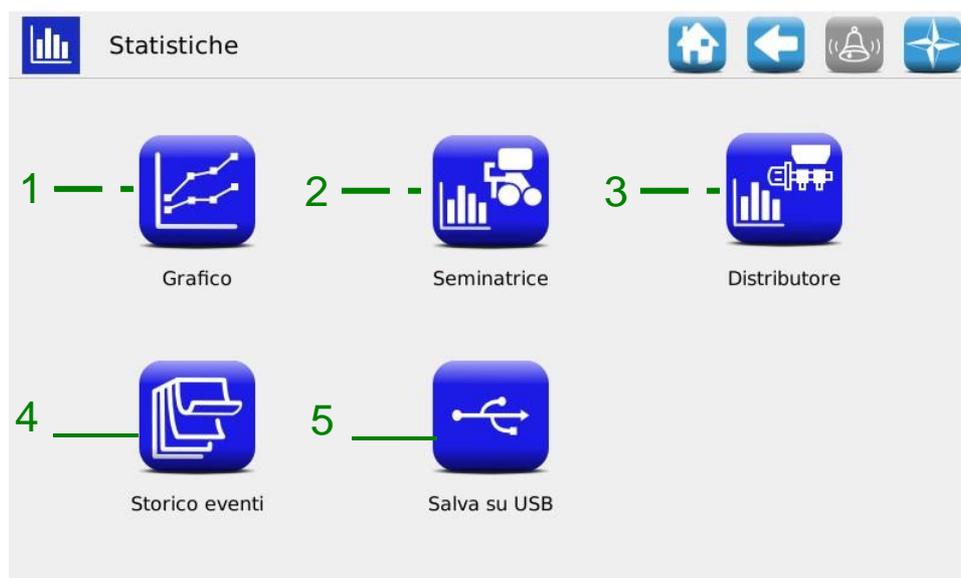


Field	Description
1	It allows to switch from the ROJ machine to the ARAG machine. Through this action all MDs will be assigned an address 7F.
2	It allows to switch from the ARAG machine to the ROJ machine. Through this action all MDs will be assigned an address 20.
3	It allows to reset all MDs addresses. The reset address can be chosen from the 4 case.
4	It allows to select the reset address

### 3.10 STATISTICS

This menu allows to display and save on your USB stick some statistics related to the active seeding job and the system event log.

Path:



Field	Description
1	Chart function (only accessible by ROJ Service)
2	Statistics relative to the seeding elements.
3	Distributors statistics (fertilizer spreader and micro-granulators)
4	System events log
5	Events and statistics storage

### Seeder statistics

This window contains statistic information about the seeding elements, both the individual (“Seeding disc” columns...) and the total (“All” column) ones.

Path:



Statistiche seminatrice				
	Disco di semina 1	Disco di semina 2	Disco di semina 3	Disco di semina 4
Semi (giro)	-	-	-	-
Doppie (giro)	-	-	-	-
Mancanti (giro)	-	-	-	-
Distanza media (giro) [cm]	-	-	-	-
Semi (totale)	995	-	-	-
Doppie (totale)	-	-	-	-
Mancanti (totale)	526	1522	176	-
Semi teorici (totale)	1525	1534	194	-
Distanza media (totale) [cm]	-	-	-	-
Popolazione media (totale) [semi/ha]	-	-	-	-

Field	Description
Seeds (turn)	Number of seeds detected by the sensor on the previous turn.
Doublets (turn)	Number of doublets detected by the sensor on the previous turn.
Missings (turn)	Number of missings detected by the seed sensor
Average distance (turn) [cm]	Average seeding distance referred to the previous turn
Seeds (total)	Total number of seeds (single) detected by the seed sensor during the active seeding job
Doublets (total)	Total number of doublets detected by the seed sensor during the active seeding job
Missings (total)	Total number of missings detected by the seed sensor during the active seeding job
Theoretical seeds (total)	Total number of seeds which should have theoretically been sown during the active seeding job.
Average distance (total) [cm]	Average seeding distance referred to the active seeding job
Average population (total) [seeds/ha]	Average population referred to the active seeding job.
Partial [ha]	Partial ha-counter (it is reset at the beginning of each new seeding job)
Total [ha]	Partial ha-counter for the machine

### Distributors statistics

This window contains statistic information about the distributors (fertilizer spreaders and microgranulators), both individual (“Seeding disc...” columns) and total (“All...” column).

Path:



Statistiche distributore						
	Spargic. 1	Spargic. 2	Tutti Spargic.	Microgr. A 1	Tutti microgr. A	Microgr. B 1
Quantità [kg]	2.0	2.0	4.0	0.7	0.7	0.1
Parziale [ha]						
Totale [ha]						

Field	Description
Quantity [kg]	Quantity of product spread during the active seeding job
Partial [ha]	Partial ha-counter (it is reset at the beginning of each new seeding job)
Total [ha]	Partial ha-counter for the machine

### Event log

Here you can see the system event log (alarms, parameters change, start and stop of the seeding job, etc.).

Path:



Data/Ora	Id semina	Evento	Descrizione
14-08-19 14:28:57	-	Attivazione allarme	1-6000 Allarme ordinario Tensione di alimentazione bassa
14-08-19 14:26:35	14	Semina	Fermata Area: 6, Seeds: 1
14-08-19 14:26:24	14	Semina	Ripartenza Area: 5, Seeds: 1
14-08-19 14:26:24	14	Attivazione allarme	1-10484 Allarme ordinario Seminatrice 4: Precarica non completa
14-08-19 14:26:24	14	Attivazione allarme	1-10384 Allarme ordinario Seminatrice 3: Precarica non completa
14-08-19 14:26:24	14	Attivazione allarme	1-10284 Allarme ordinario Seminatrice 2: Precarica non completa
14-08-19 14:26:18	14	Spegnimento allarme	1-10484 Allarme ordinario Seminatrice 4: Precarica non completa
14-08-19 14:26:18	14	Spegnimento allarme	1-10384 Allarme ordinario Seminatrice 3: Precarica non completa
14-08-19		Spegnimento	1-10284 Allarme ordinario

Field	Description
1	Event time and date
2	Unique identifier for the seeding job
3	Event name and icon
4	Detailed event description
5	Press this button to save the Event Log (you will need a USB stick)

## Event and statistics storage

In order to give some information to the Technical Support and ask for assistance, it is possible to download different kinds of logs from the system, using the functions accessible from Menu\Statistics\Save on USB log. To access those function, insert a USB stick in the corresponding HMI slot.

Path:



Field	Description
1	If you press the "Event log" button, an event log containing all the errors, the parameters changes, etc. will be saved.
2	Pressing the "Job archive" button you can save an archive containing detailed information about the seeding jobs.
3	The "MD log" button opens a selection window where it is possible to select the MDs for which you need to download some information. <b>This operation can take about 30 seconds for each MD.</b>
4	Press the "Local event log" button to display some debug information
5	The "Parameters" button allows you to save the current system configuration parameters.

The above procedure will create on the USB stick a directory called **gt4\_<nnnn>**<sup>2</sup> containing some files. It is possible to send this directory to the Technical Support via email.

<sup>2</sup> <nnnn> is the identification number of the used HMI.

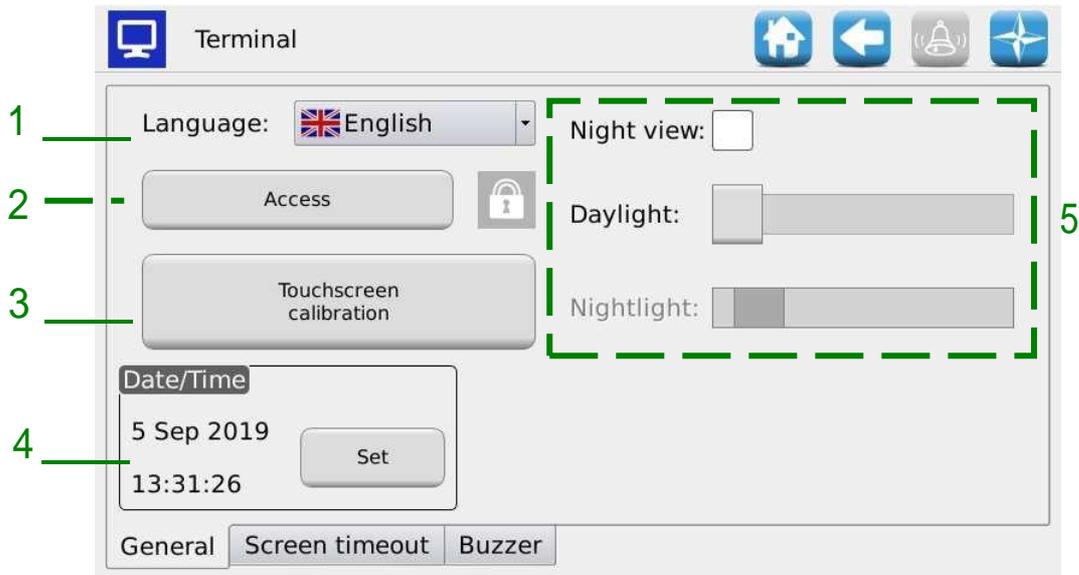
### 3.11 TERMINAL

In this window it is possible to adjust some settings related to the HMI terminal.

Path:

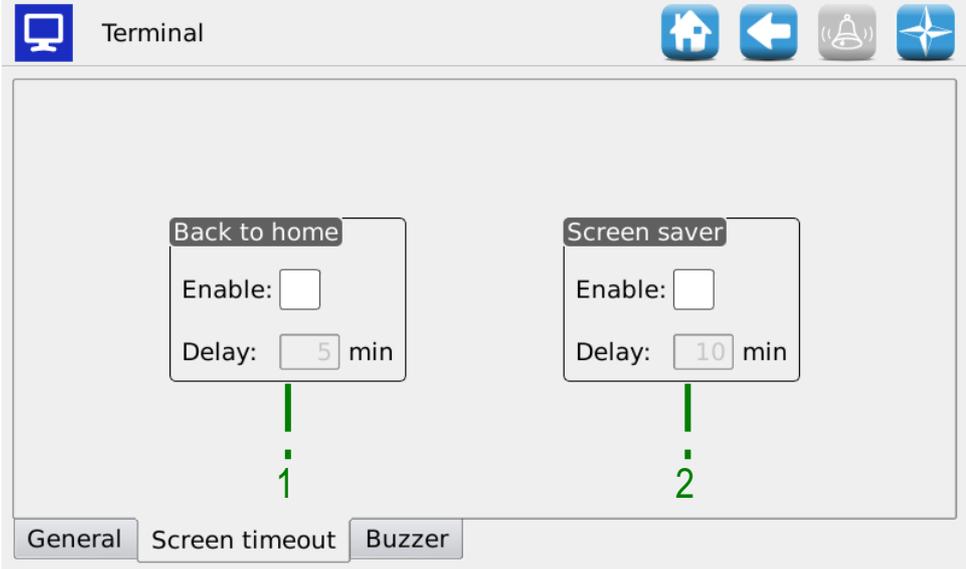


Tab **General**



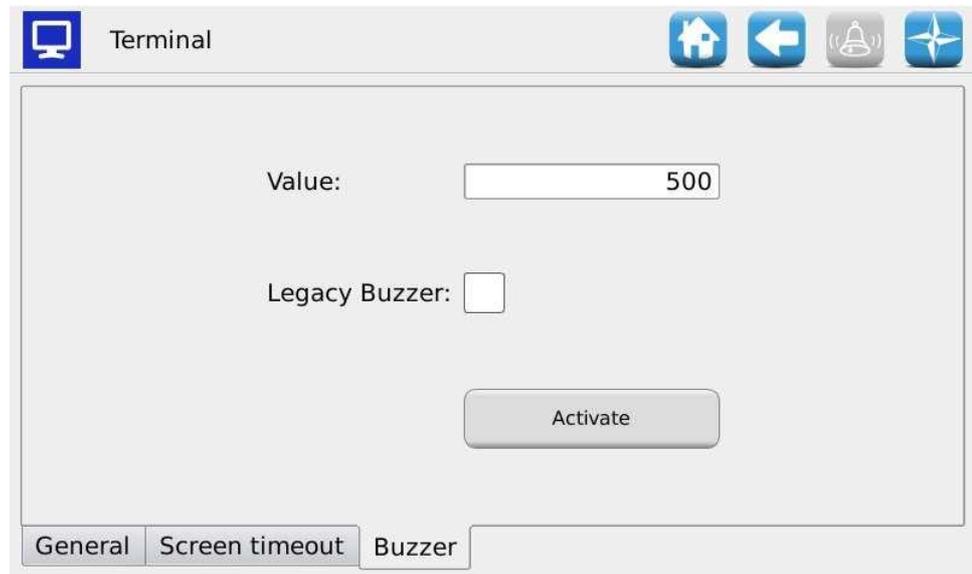
Field	Description
1	Select the HMI terminal language
2	Select the access level (see also the chapter <b>ACCESS LEVELS</b> )
3	Touchscreen calibration function
4	Date and Time setting for the HMI terminal
5	To set up the day/night backlight levels. The slider controls allow to independently adjust the light levels in case of day/night setup. To select the night light slider control, tick the "Night view" check mark.

Tab Screen timeout



1	Here it is possible to enable and set up the Home page return function delay: If enabled, in case of activity, once the set time has expired, the terminal will come back to the Home screen.
2	Here it is possible to enable and set up the screensaver function delay: If enabled, in case of activity, the screen backlight is reduced to a minimum.

Tab Terminal



In this page it is possible to regulate the sound intensity of the console built-in buzzer. The values range from 50 to 1000.

A check mark on "Legacy Buzzer" allows you to make the updated software compatible with the old console hardware versions.

### 3.12 TEST

Path:

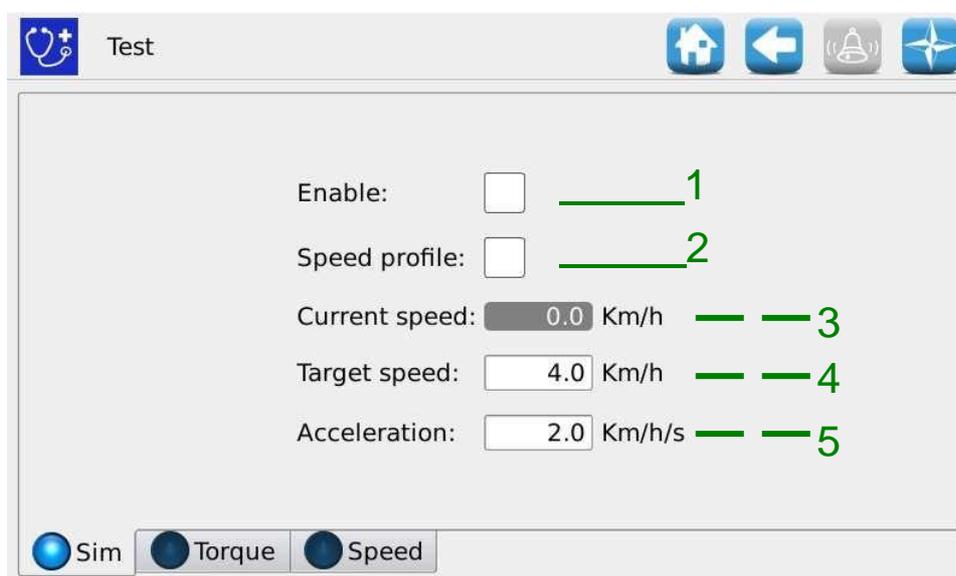


Sim Tab

This tab allows to simulate the tractor speed. Use this window to simulate a seeding job session without having to effectively turn the ground wheel of the machine.

This test mode is accessible in all the seeding work conditions. The MDs will only work if they have been activated (they should neither be excluded nor stopped by the row exclusion function) and when the seeding job is active.

During this test all functions like the seeds count, the hectares count and so on will be active just like the machine was working on a real field.

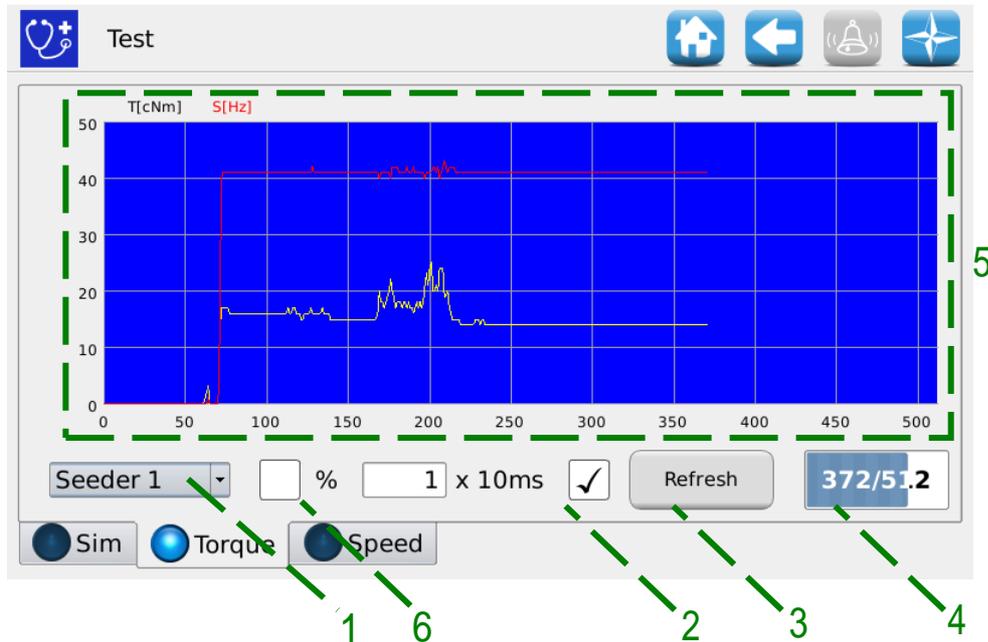


Field	Description
1	If this option is selected, it enables the simulation of a "real" tractor speed profile (data detected on the field). In this case the Speed and Target acceleration fields will be used.
2	If this option is selected it enables the simulation. The speed increases until the target speed value is reached ( <i>Target Speed</i> ), following the acceleration ramp as specified in the <i>Acceleration</i> field.  If it's unselected, the speed will start to decrease until the 0 value is reached, following the deceleration ramp as specified in the <i>Acceleration</i> field.
3	Current speed

4	It indicates the simulation of the top speed to be reached. The value is expressed in km/h. The corresponding Km/h value should be calculated as follows: $Speed [km/h] = 3.6 * Speed[mm/s]/1000$
5	It indicates the tractor speed to be simulated. The field value is expressed in km/h/s

**Torque Tab**

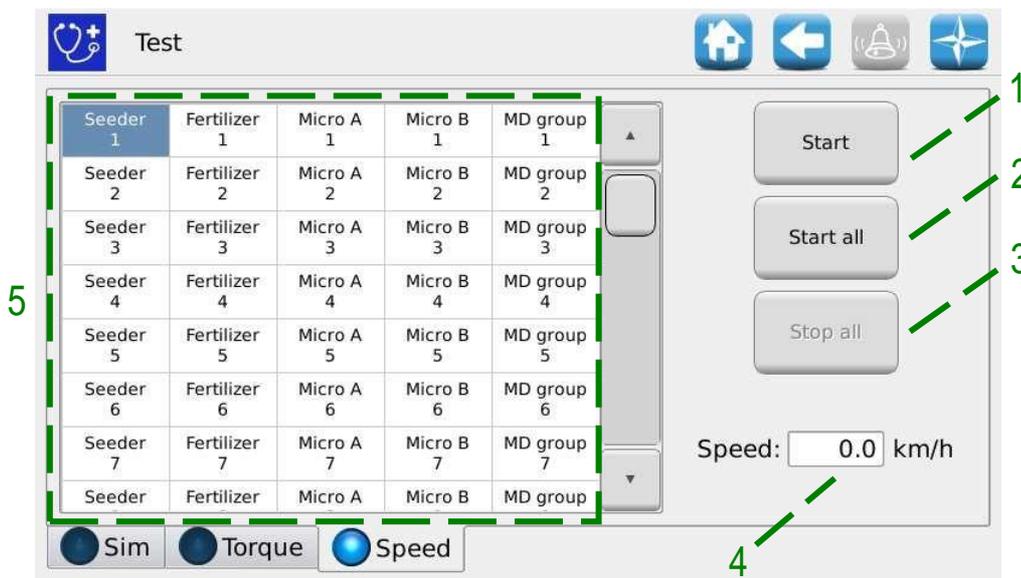
In this tab it is possible to Read the MD torque and speed (sampling every 200ms), for the distributors and the seeding discs.  
This test mode is accessible in all work conditions.



Field	Description
1	Selection of the MD to be monitored
2	Select this case to activate the torque monitoring function. The torque value is sampled each 200 ms. The window is refreshed every 1sec with new samples.
3	Update button: if pressed the samples values are refreshed. Insert a USB stick into the console slot, clear the "Enable" check box and press "Refresh" to store all the data on the USB drive. The file name will be TORQ_ <data > _ <time> .txt
4	Number of valid samples for the window in the chart.
5	Torque and speed chart window. The torque value is expressed in cNm and the speed in Hz.
6	A check mark on % allows to see the Torque and Speed values expressed in percentage with reference to the maximum torque and speed.

### Speed Tab

In this tab it is possible to test each motor, a group of motors or all the motors, controlling them in "speed mode", corresponding to the set tractor speed. When using the "Speed" tab, all functions, i.e. seeds count, hectares count and so on are disabled. You can use this window for the motors running. This test mode is only available when the seeding job is inactive or paused.



Field	Description
1	The selected MDs start
2	All MDs start
3	All MDs are stopped
4	Tractor speed expressed in km/h
5	Motors selection window.

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**4 – MAINTENANCE AND TROUBLESHOOTING**

**4.1 GENERAL INFORMATION ABOUT MAINTENANCE**

Thanks to the inherent sturdiness of the PCS 200 system components, it is not required to carry out any particular preventive maintenance operations. However, in order to ensure the maximum equipment reliability and to avoid hazardous conditions, it is advisable to strictly follow the instructions and warnings given below.



***For safety reasons, all maintenance works on the power train must be carried out ONLY when the machine is stopped and disconnected from the power supply, by qualified trained and experienced personnel, having a suitable experience and knowledge of the PCS 200 system and of the equipment.***



***Prior to start the maintenance works, thoroughly clean the relevant zone. Do not use solvents!***



***After any maintenance task all materials having an impact on the environment (such as, for example, lubricants, dirty clothes, filter elements, etc.) must be disposed of properly in accordance with the applicable regulations.***



***Ensure that unauthorized personnel DO NOT access the working area during maintenance tasks.***

***At the end of any task, make sure that no used tools are left inside the equipment or into the electrical panel.***

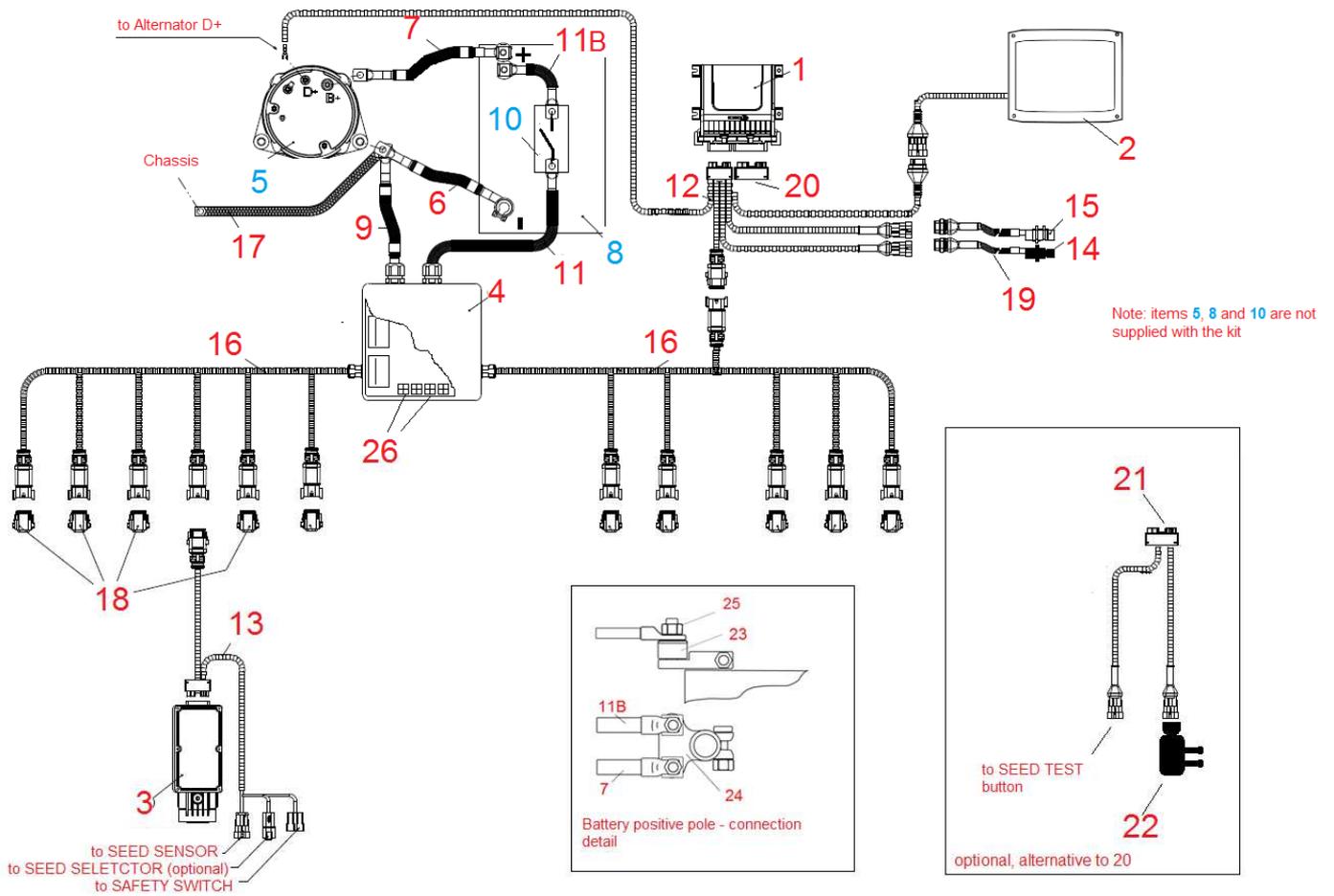
**4.2 ORDINARY PREVENTIVE MAINTENANCE TASKS TO BE CARRIED OUT BY THE OPERATOR**

Operation	Frequency	Notes
Cleaning	Before long periods of inactivity	If cleaning with a pressure washer, do not direct the jet towards connectors and seals.
Tightness check	Every year, after long periods of inactivity (for ex. at the beginning of the seeding season)	
Geared motors oil change	Not necessary	

**4.3 MAINTENANCE / REPAIR TASKS ONLY ALLOWED TO SPECIALIZED PERSONNEL**

Operation	Frequency	Notes
Check the safety devices operation	At the beginning of each season	This control can be carried out by putting the motors into service through the test functions described in paragraph 3.11 and verifying that, when each MD safety switch opens, the motor is stopped.

### 4.4 SPARE PARTS



Code	Description	Ref. on wiring diagram
54T01068	PCS200 ECU	1
58G00074	HMI GT4 AGRIMATE	2
1.406.601	PCS MD-O	3
54T01099	DMD2 MOTOR 4.5Nm 80 RPM LED (ROJ)	
56C00646	PCS SDB 12+12	4
56C00651	PCS SDB 3+3	
05R01310	B- / BAT- CABLE	6
05R01311	B+ / BAT+ CABLE	7
05R01313	B- / SDB- CABLE L=1600	9
05R01350	B-/SDB- CABLE L = 2000	
05R01312	BAT+ / SDB+ CABLE L=2000	11
05R01349	BAT+/SDB+ CABLE L = 1500	
05R01386	BATTERY DISCONNECT CABLE	11B
05R01379	ECU 18P CABLE PCS	12
05R01377	DMD CABLE - DISTRIBUTOR (TE) L = 1000	13
05R01384	DMD CABLE - DISTRIBUTOR (TE) L = 1300	
05R01374	DMD CABLE - SEEDER (TE) L = 1300	
05R01375	DMD CABLE - SEEDER (TE) L = 1700	
05R01376	DMD CABLE - SEEDER (TE) L = 2300	
05R01387	DMD CABLE - SEEDER (TE) L = 3500	
05R01474	DMD 2 CABLE - HOPPER L=1300	
05R01475	DMD 2 CABLE - SEEDER L=1700	
05R01494	DMD 2 CABLE - SEEDER L=2500	
50A00174	HALL EFFECT SPEED SENSOR GS102301	
05R01422	MECHANICAL SWITCH SENSOR	15
05R01404	DMD DISTRIBUTION CABLE 3 POS	16
05R01372	DMD DISTRIBUTION CABLE 6 POS	
05R01373	DMD DISTRIBUTION CABLE 7 POS	
05R01333	PE BRAID FLAT 50MM <sup>2</sup> M10	17
05R01381	CAN TERMINATION (DEUTSCH) DEMETER	18
05R01400	GS102301 SPEED SENSOR CABLE L=1500mm	19
05R01334	ECU PLUG 30C	20
05R01380	ECU 30P CABLE PCS	21
05A00173	PRESSURE SENSOR	22
04C00142	BATTERY FUSE 125A	23
14A00073	BATTERY DOUBLE POLE	24

**Maintenance and Troubleshooting**

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14A00072	BATTERY INSULATORS (BORDEAUX NUTS)	25
05R01385	CAN TERMINATION (MOLEX ) SDB	26

#### 4.5 PROCEDURE FOR THE MD REPLACEMENT OR EXCHANGE

In case of MD motor failure, it is possible to proceed with the seeding activity, in one of the following ways:

- a) Replacing the MD with a new MD
- b) Exchanging the faulty motor with another properly functioning motor already mounted on the machine
- c) Removing the MD from the machine configuration

##### Replacing the MD with a new MD

1. Disconnect the system from the power supply via the battery disconnect switch
2. Disconnect the faulty MD cable from the MD side, using a ¼" wrench.
3. Remove the screws which fix the motor to the support and remove the faulty motor from the seeding disc shaft or the distributor shaft.
4. Fix the new motor mechanically and connect the MD cable.
5. Power up the system via the battery disconnect switch
6. After the system has been started, an alarm 1-1801 "Invalid configuration or MD address" is displayed and an MD Addressing window is opened.
7. Press the "Addressing" button: the icon corresponding to the replaced MD starts flashing, indicating that the motor must be addressed.
8. Close the safety switch of the new MD to address the device.
9. Once the addressing has been completed, press the "Exit" button.

### Exchanging the faulty motor with another properly functioning motor already mounted on the machine

If no spare MD is available, you can decide to exchange the faulty MD with another motor mounted on the machine, in order to continue working (you can for ex. exchange a faulty motor related to the seeding disc with the motor related to the micro-granulator, in case this last function is not needed).

**Warning!** The following procedure requires that the motor having a failure is still able to communicate via the CAN line. In case a 1-1801 "Invalid configuration or MD address" alarm is displayed when turning the machine on, even if the configuration has been changed, you need to follow the procedure: **Removing the MD from the machine configuration.**

1. Disconnect the system from the power supply via the battery disconnect switch
2. Disconnect the faulty MD cables from the MD to be exchanged, using a ¼" wrench.
3. Remove the screws which fix the two motors and extract them from the seeding disc shaft or the distributor shaft.
4. Exchange their position, fix the motor in the new position and reconnect the cables.
5. Power up the system via the battery disconnect switch
6. Make sure that no seeding job is active (in that case press STOP).
7. Press the "MD addressing" button in the "Configuration" window to confirm.
8. Press the "Addressing" button: all devices have been addressed.
9. Press the faulty device icon and select "Unaddress MD"
10. Press the icon of the exchanged motor and select "Unaddress MD"
11. The icon corresponding to one of the exchanged MDs starts flashing indicating that it has to be addressed.
12. Close the MD safety switch on the correct position to address the device.
13. The icon corresponding to the other MD starts flashing indicating that it has to be addressed.
14. Close the MD safety switch on the correct position to address the device.
15. Once the addressing has been completed, press the "Exit" button.

### **Removing the MD from the machine configuration**

In case a spare MD is not available and if the faulty MD is not able to communicate with the CAN line, it is possible to remove the device from the machine configuration in order to proceed with the job.

This requires a consequent change of the machine configuration as well as a change of the devices logical address.

If this problem arises the 1-1801 "Invalid configuration or MD address" alarm is displayed when turning on the system, without changing any settings or MD connections.

1. Check the integrity of the fuse for the MD which is not able to communicate. If the fuse is blown, replace it.
2. Check the integrity of the CAN connection towards and from the faulty MD.
3. If the problem persists, disconnect the system from the power supply via the battery disconnect switch.
4. Remove the fuse for the faulty MD but do not unplug the cable from the MD as it is used to keep the CAN connection towards the other motors.
5. Power up the system via the battery disconnect switch
6. After the system has been started, a 1-1801 "Invalid configuration or MD address" alarm is displayed and an MD Addressing window is opened.
7. Press the "Change configuration" button and modify the machine configuration in order to show the number of devices after removing the faulty one, and confirm the setting.
8. Press the "Addressing" button
9. Press a device icon to open the "Unaddress MD" window and select "All MDs"
10. Go on addressing all the machine with the new configuration.
11. Once the addressing has been completed, press the "Exit" button.

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## DISTRIBUTOR

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