ROJ

CE

PCS FS

Installation
Operation
Maintenance

ORIGINAL INSTRUCTIONS

PCS FS – Rev. 1.0 I – January 2019

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

ROJ reserves the right to change at any time the contents of this manual, without notice.

For any technical or commercial problem, please contact your local ROJ dealer or call directly ROJ customer service center. We will be glad to meet your needs.

Thank you for your trust and good job.

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

PCS FS

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Edition: *January 2019,*
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UPDATES INDEX

9/18/2014	1st Edition
3/29/2016	2nd Edition
1/10/2019	3rd Edition – Manuals for the different systems (200, FS, 150)

FOREWORD

All machines [1] 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 ESR in Annex I are **legally binding obligations**, **ROJ** put a special emphasis on all ESR 1.7.4 points during the drafting phase of these manual, in particular:

1. The **ROJ** user and maintenance manuals are supplied in the language of machine target country, within the European Union and, when necessary, an "Original language" copy of the manual is also provided.
2. The **ROJ** manuals always contain 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 have just an indicative value, and they shall not be considered substitutive of the actual Declaration of Conformity Incorporation subscribed by the supplier, and delivered separately to the Customer.
3. **ROJ** Use and Maintenance manuals contain the information deemed 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 of 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[1] in **Safe conditions**, also drawing in this case the maintenance man's attention on the possible Residual risks.
4. **ROJ** Use and Maintenance Manuals do not only describe the intended use of the machine [1], 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 3 above), **ROJ** selects 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 13849-1:2015 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(1) 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 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 complete machinery capable of performing a well-defined function and the "partly completed machinery", i.e. drive 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 and 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 FS, PCS 150) Footnote 1
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 ISO13849-1:2015
- EN ISO13849-2:2012
- EN ISO 4254-1:2015
- EN 14018:2010
- EN ISO 14982: 2009

The equipment complies with the requirements of the 2014/30/EU Directive Note 2 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 system integrator.

ROJ commits itself to send all the 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 FS 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 FS** 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 components of the system on the seeder can installed by:

- by the Seeder manufacturer
- by **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 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 FS** 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 individual **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‘s 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 sowing process

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

Thanks to the exclusive flexibility and configurability the PCS FS kit represents the best solution for volumetric seeders and fertilizers.

1.1.2 Purposes of this manual

This manual aims to provide the PCS FS 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 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 AN ENVIRONMENT-FRIENDLY WAY

1.2 GENERAL INFORMATION AND PERFORMANCES

1.2.1 Introduction

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

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

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

- **Control of the distributor speed** in order to spread a certain quantity of seeds per/ha in the sown field
- **Evaluation of the quantity deposited** without using a flow sensor
- **Flexible** association of the different machine distributor to the single electric motors.

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 data related to the seeding activity, to 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.
- **Machine position sensor** to determine whether the seeder is lifted (transport/taxing 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

- Volumetric seeders and fertilizers for tractors NOT equipped with ISOBUS connection.
- Volumetric seeders and fertilizers 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

EHSR Essential Health and Safety Requirement of Annex I of Machinery Directive

PL Performance Level (level of reliability of the safety functions) according to EN 13849-1:2015

AD Analog/Digital Converter

CAN Controller Area Network (BUS)

ECU Electronic control unit

ISOBUS Communication standard for tractors and machinery for agriculture and forestry ISO-11783

MD Motor with integrated drive

PTO Power take-off

SDB Sub distribution board

HMI Human-Machine Interface console

1.3 COMPONENTS OF THE PCS FS KIT

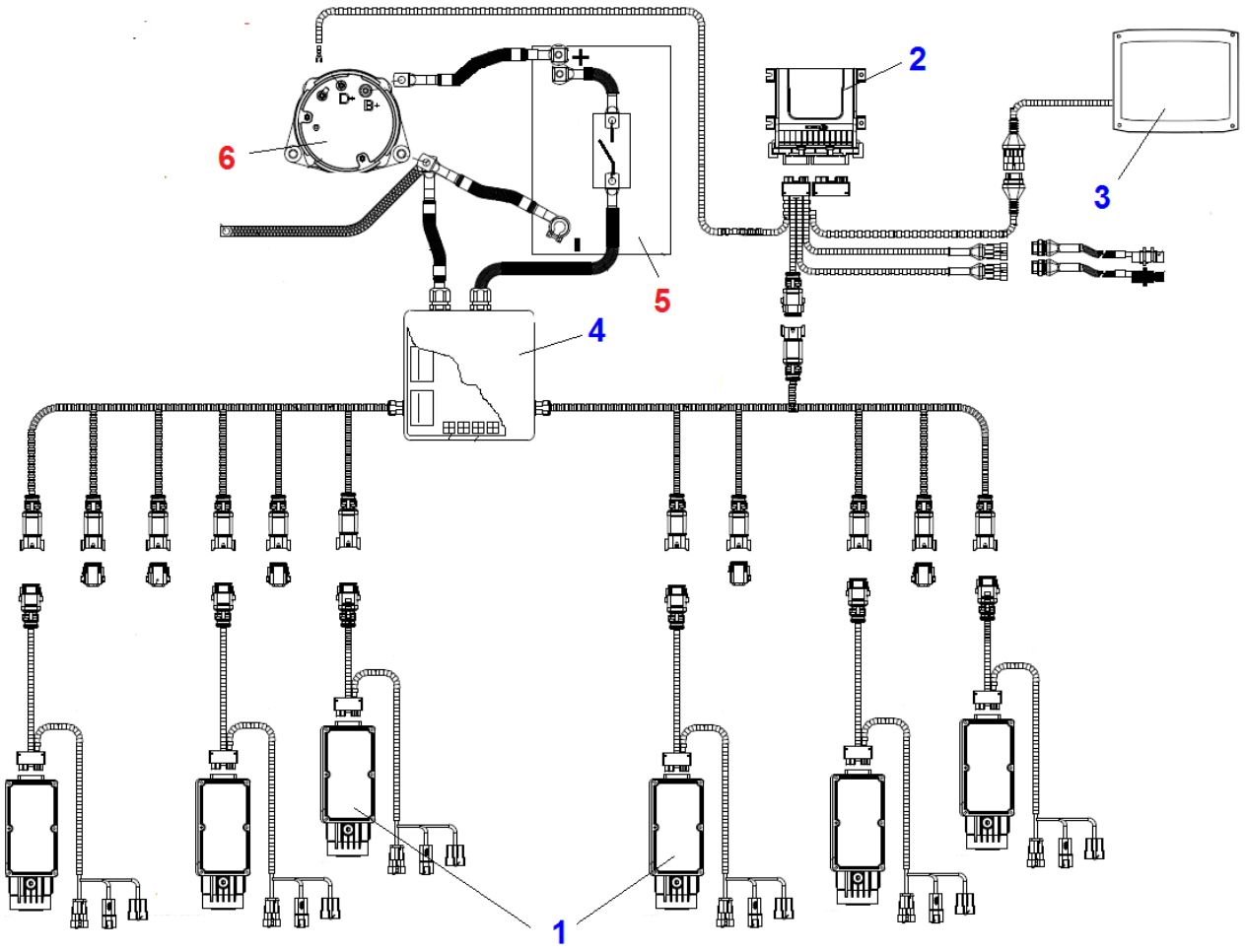
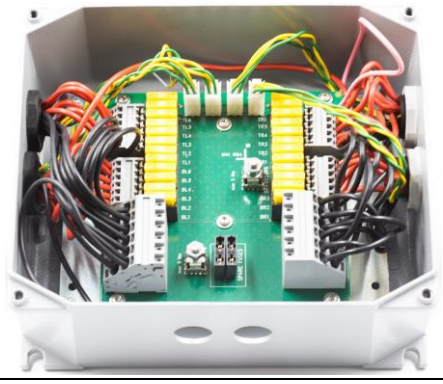


Figure 1-1 Main components of the PCS FS kit

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.

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

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 FS equipment:

EN ISO 12100: 2010	Safety of machinery. General principles for design. Risk assessment and risk reduction.
ISO 13849-1:2015	Safety of machinery. Safety-related parts of control systems. Part 1: General principles for design.
EN ISO13849-2:2012	Safety of machinery. Safety-related parts of control systems. Part 2: Validation.
EN ISO 4254-1:2015	Agricultural machinery. Safety. Part 1: General requirements
EN 14018:2010	Agricultural and forestry machinery. Seeders. Safety
EN ISO 14982: 2009	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 the people's health and physical integrity.

In addition to this, warning and safety measures have been implemented on the PCS FS 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 FS 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 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 mentioned.

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 with 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 FS 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 FS system has been designed and built 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 FS system (*geared motors*) are of negligible magnitude (<70 dBA) relative to noise produced by the agricultural machine as a whole, it is the responsibility of the machine manufacturer and/or end user to determine the A-weighted sound pressure level generated by the whole machine.

1.4.6 Proper and improper use

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

The use of the PCS 100 for different purposes may result in damage to persons or to 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 13849-1:2015. 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 hazardous movements in case of open guard of the seeding element	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_revl.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.

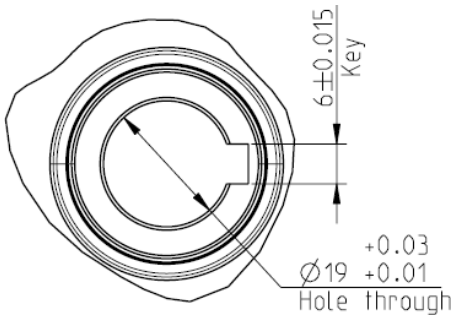


Figure 2-1 – Outlet shaft dimensions

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 Tilting 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.

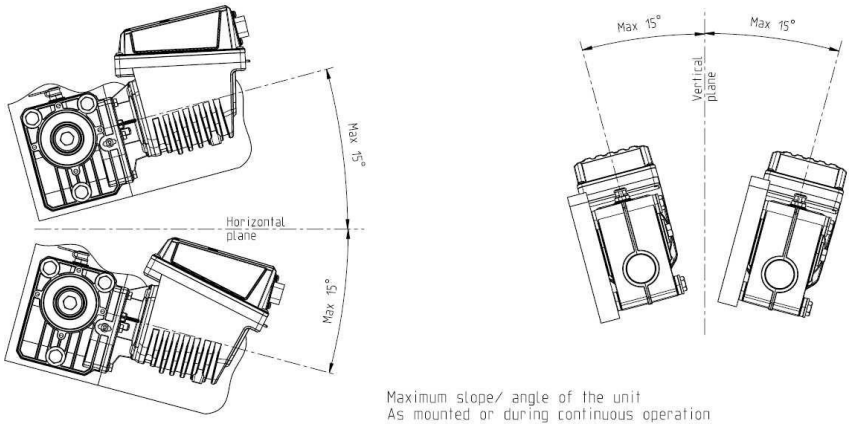


Figure 2-2 – Tilting limits

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.

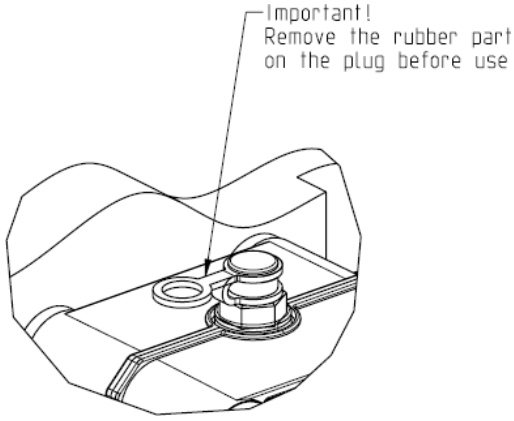


Figure 2-3 – Plug with exhaust valve

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.

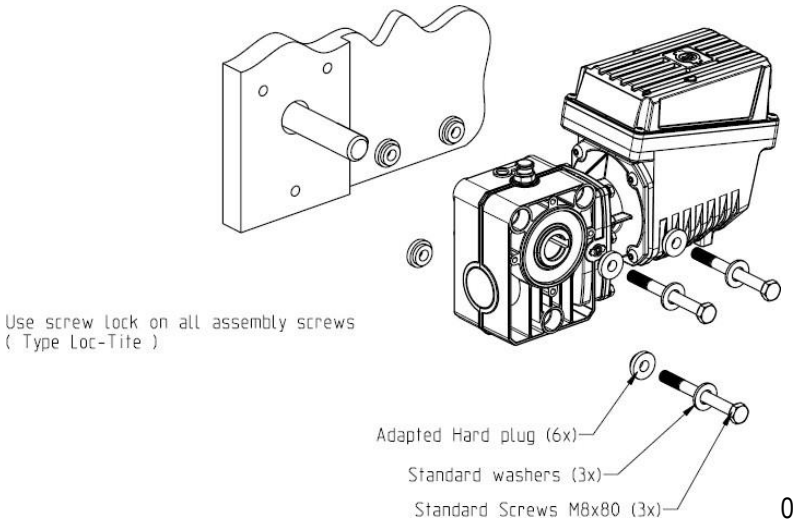


Figure 2-4 – Particulars for the geared motor fastening

2.4 DMD2

2.4.1 Outlet shaft torque, speed and axial/radial loads

The following characteristics refer to the variables of the geared motor outlet shaft (slow shaft)
Designed for 12V agricultural equipment

- *4,5 Nm, 80 rpm @ outlet shaft (54T01085)*
- *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.

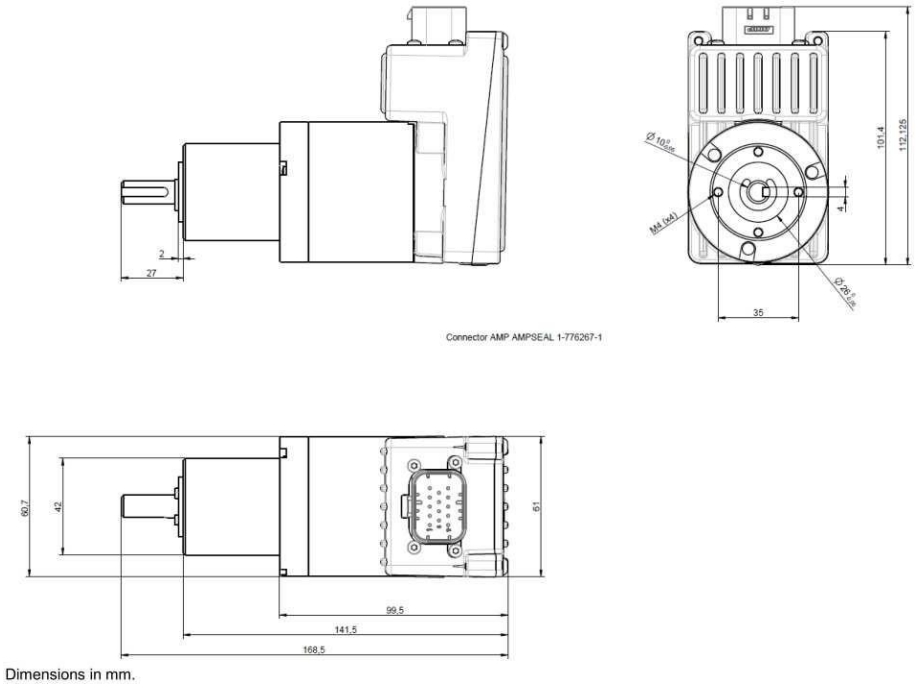


Figure 2-5 – Outlet shaft dimensions

For further information, make reference to *TD_DMD2_revI.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.

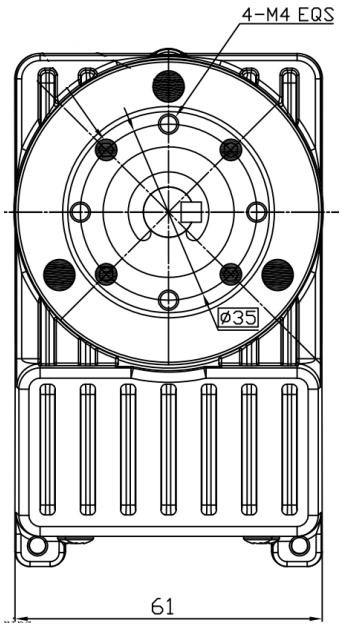


Figure 2-5 – Particulars for the geared motor fastening

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.

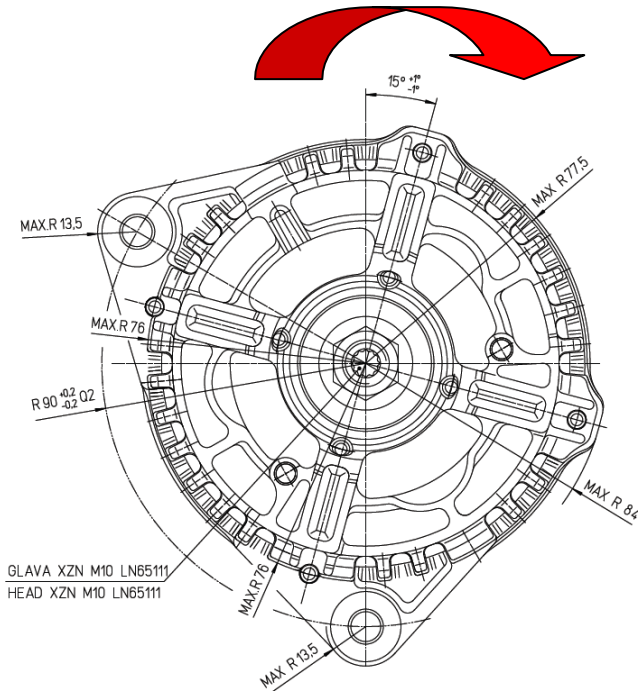


Figure 2-6 - Alternator rotation direction

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 alternator 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

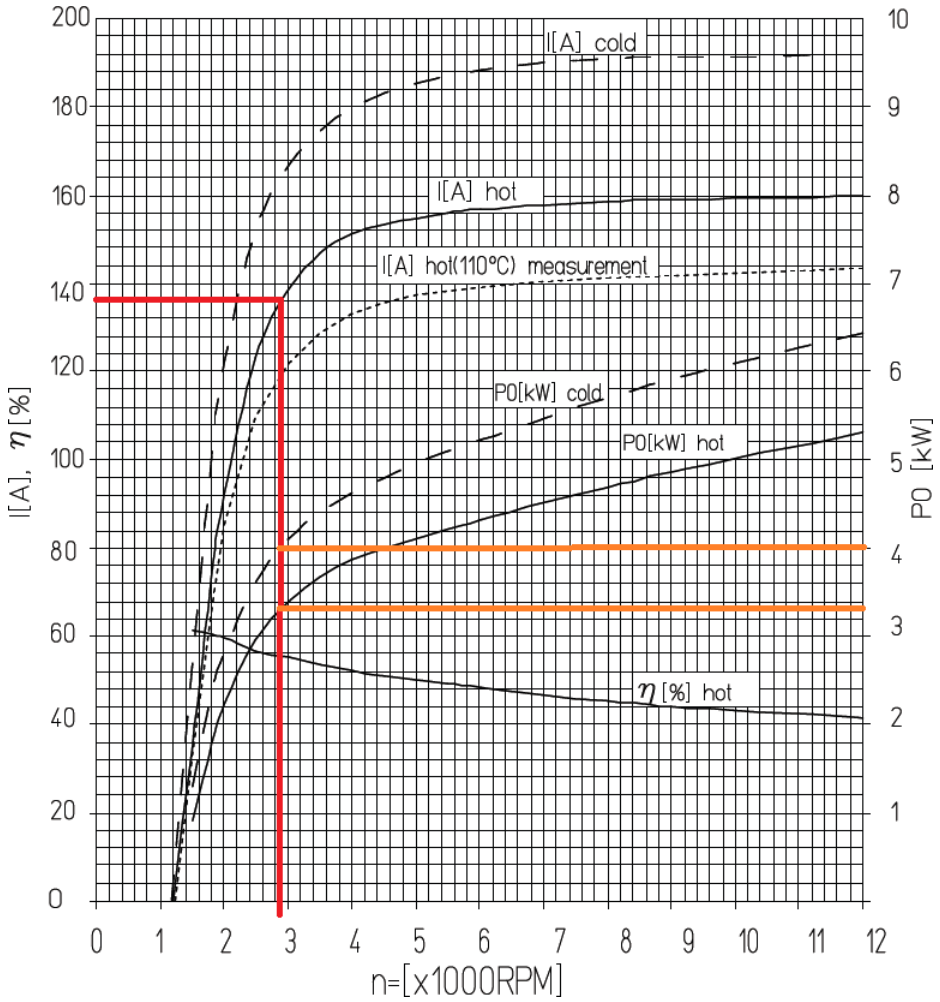


Figure 2-7 - Characteristic power curves for the alternator

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.

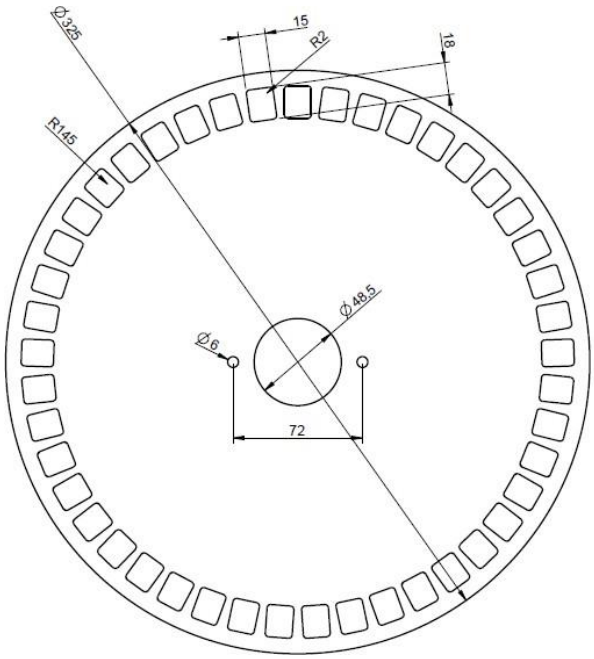


Figure 2-9 – Example of cogwheel for speed sensor

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 controll the proper operation while checking the machine overall operation.

2.7.2 Wheel sensor check

- On the graphic display, select → → → Macchina 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 raised).

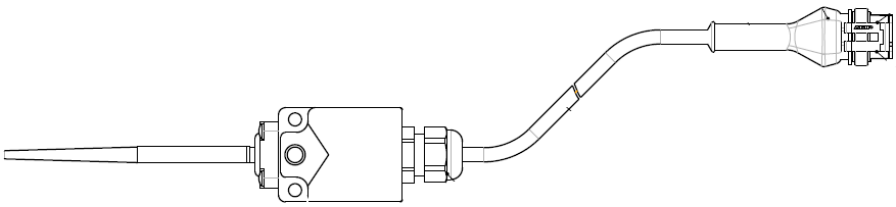


Figure 2-10 – Position sensor

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 raised, 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 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 taxing 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.

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 your 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

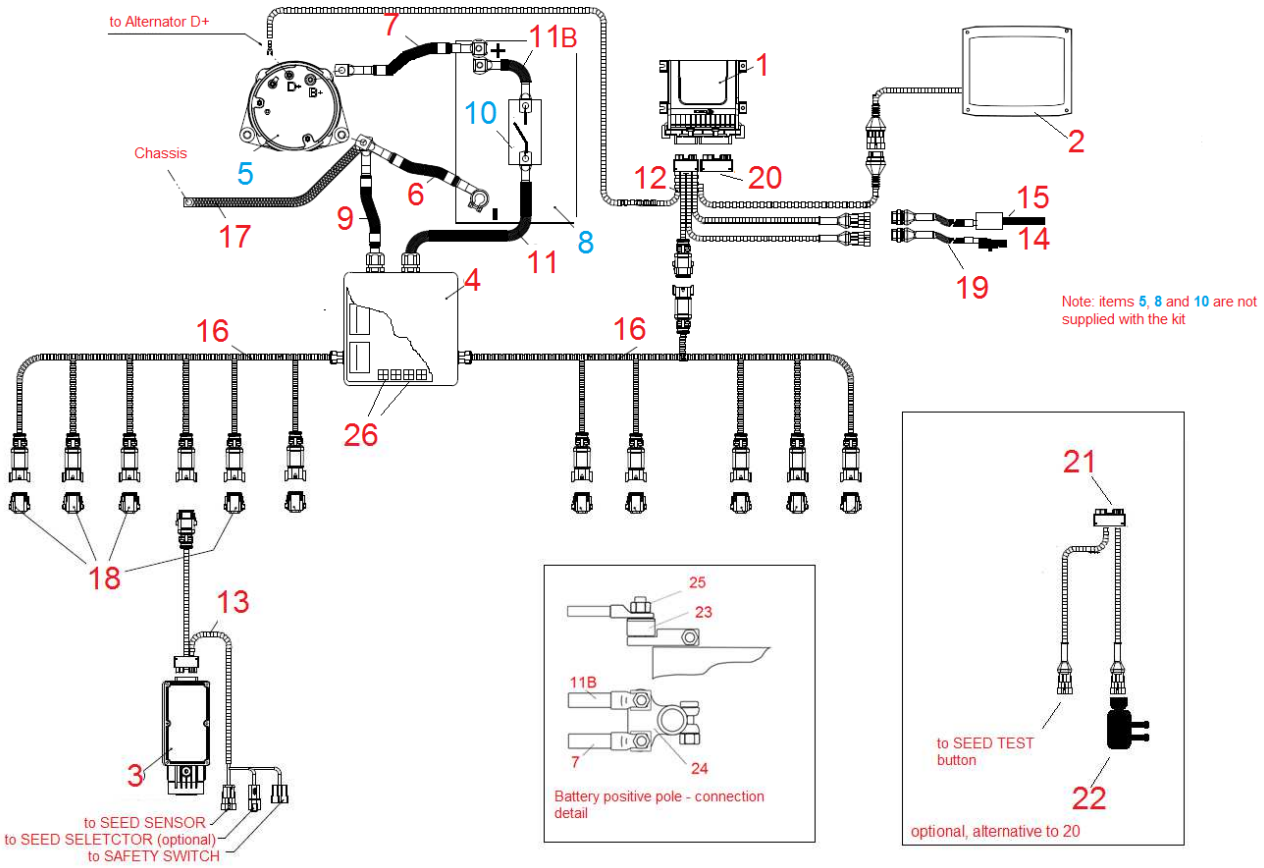


Figure 2-12 - Wiring diagram of the system with alternator

+ *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.*

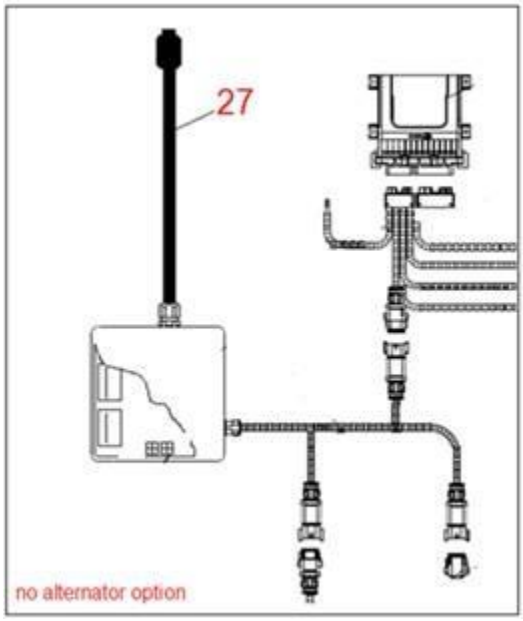


Figure 2- - Wiring diagram of the system without alternator

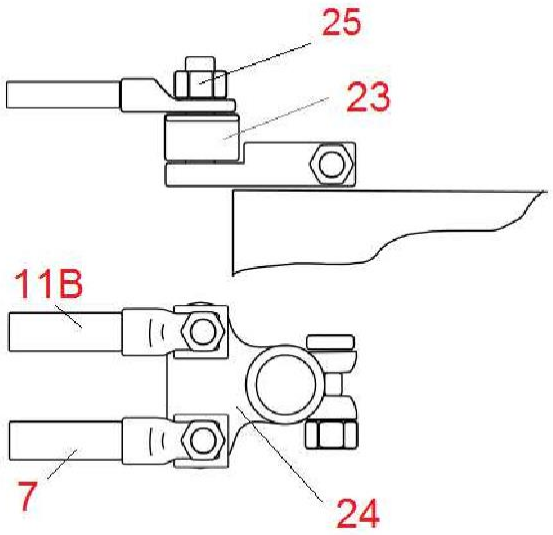


Figure 2-13 – Battery positive pole connection detail

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
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

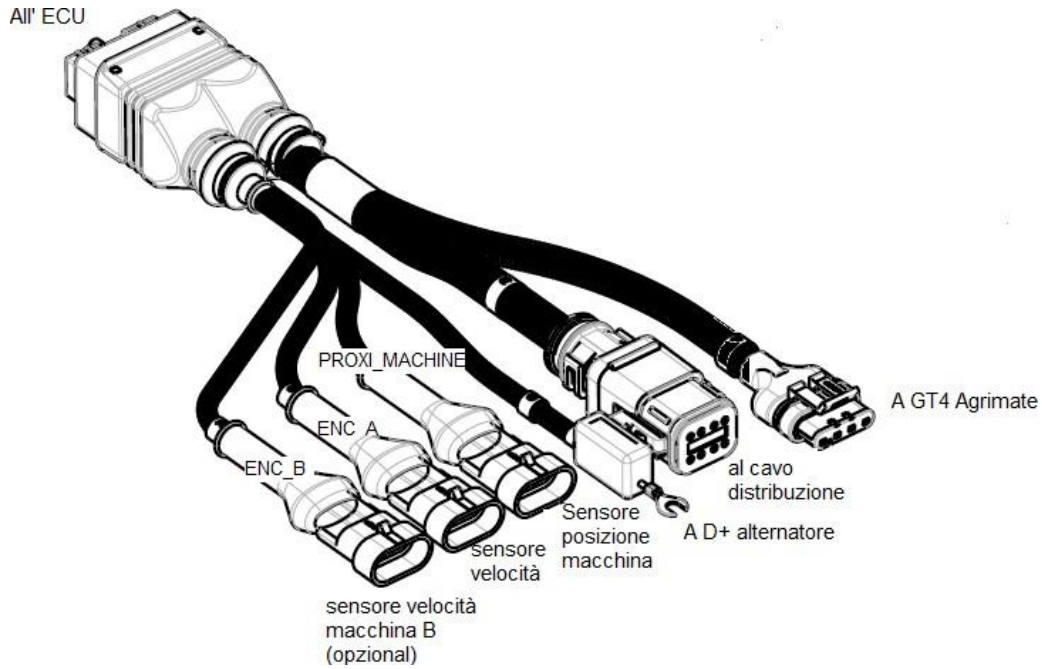


Figure 2-14 – ECU wiring diagram

2.9.3 SDB and power supply cables connection

The 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[1], 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").

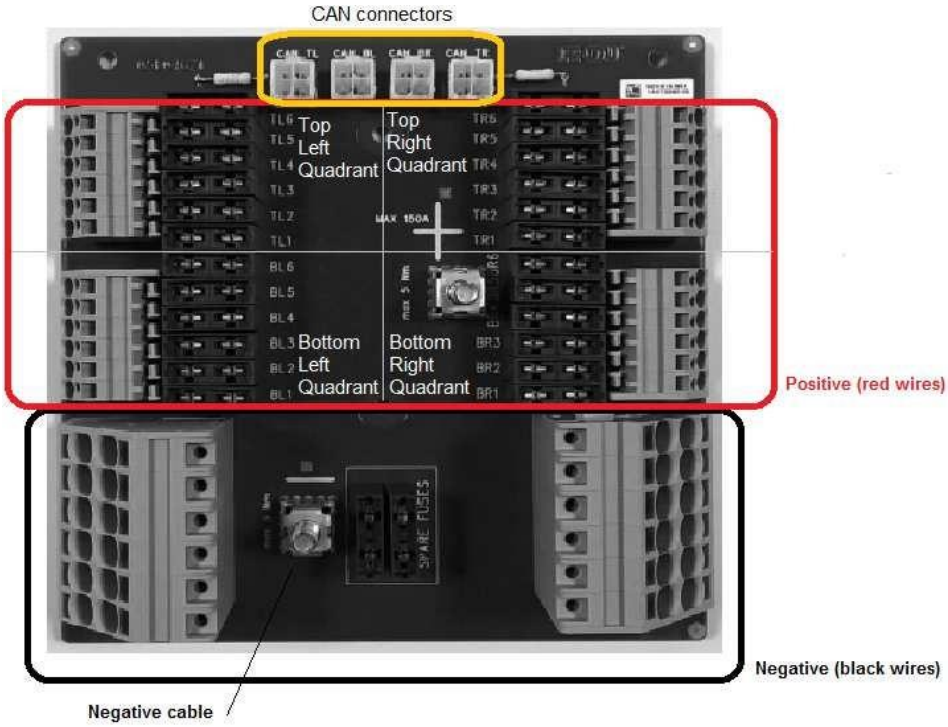


Figure 15 - SDB 12+12 connections

[1] These are acronyms for Top Left, Top Right, Bottom Left, Bottom Right respectively

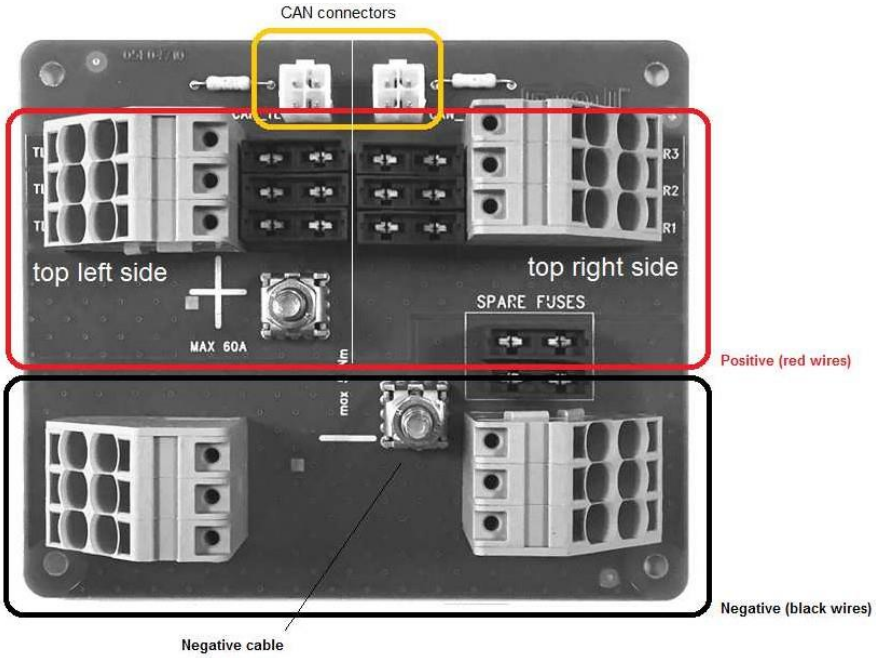


Figure 16 - SDB 3+3 connections

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

+ *The quantity and type of distribution cable (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.

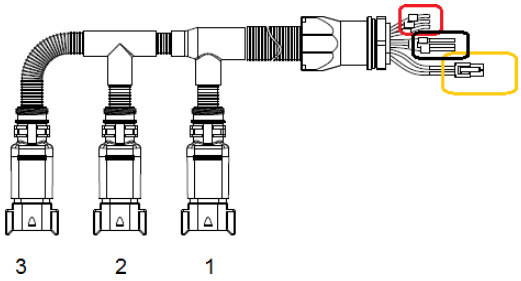


Figure 17 - 05R01404 cable – 3 outputs

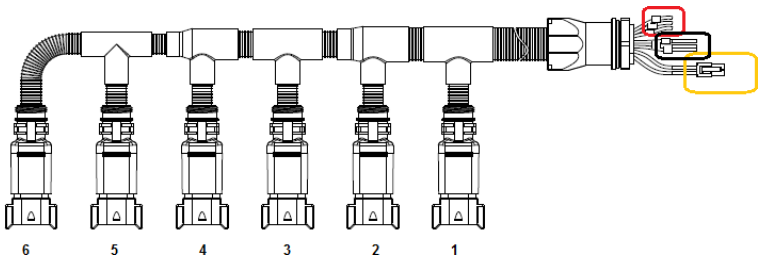


Figure 18 - 05R01372 cable – 6 outputs

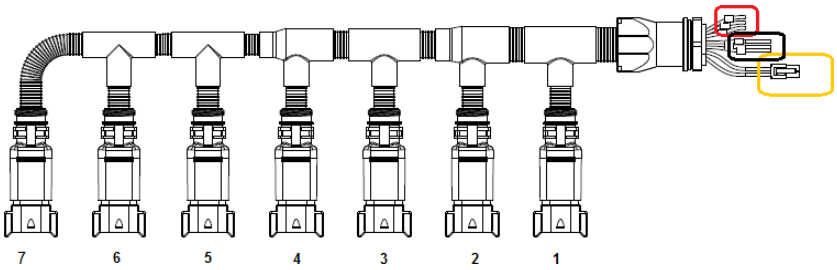


Figure 19 - 05R01373 cable – 7 outputs

+ *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
	Without seed sensor[2]	**13**
05R01377	DMD CABLE - DISTRIBUTOR (TE) L = 1000	
05R01384	DMD CABLE - DISTRIBUTOR (TE) L = 1300	

Table 2-2 - MD cables codes

DMD2

Code	Description	Ref. on wiring diagram
	Without seed sensor[3]	**13**
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.*

[2] Suitable to MDs for fertilizers and microgranulators
[3] 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 >= 2 x $10e^6$ *(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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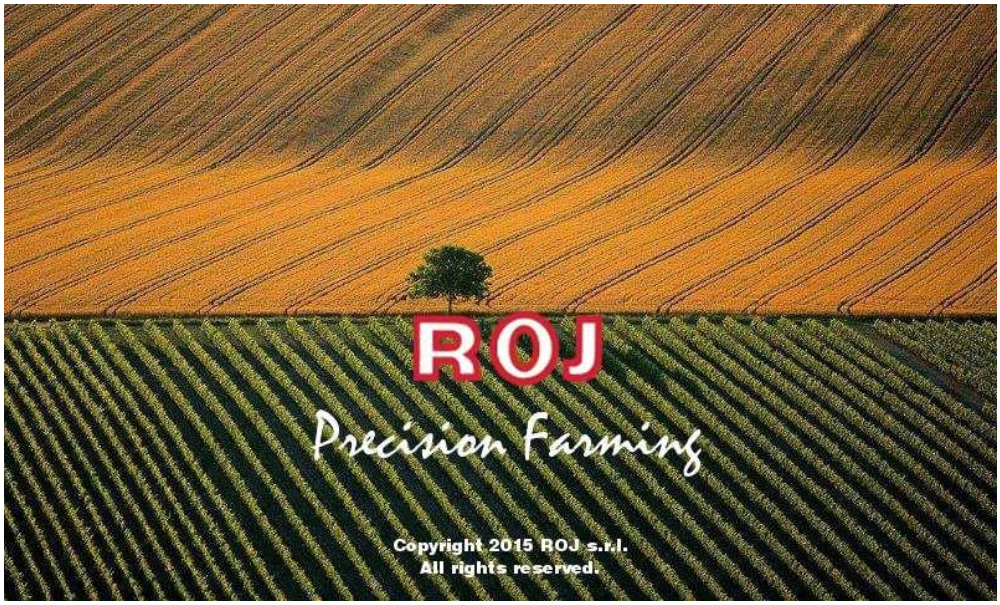
3.1 MACHINE START-UP

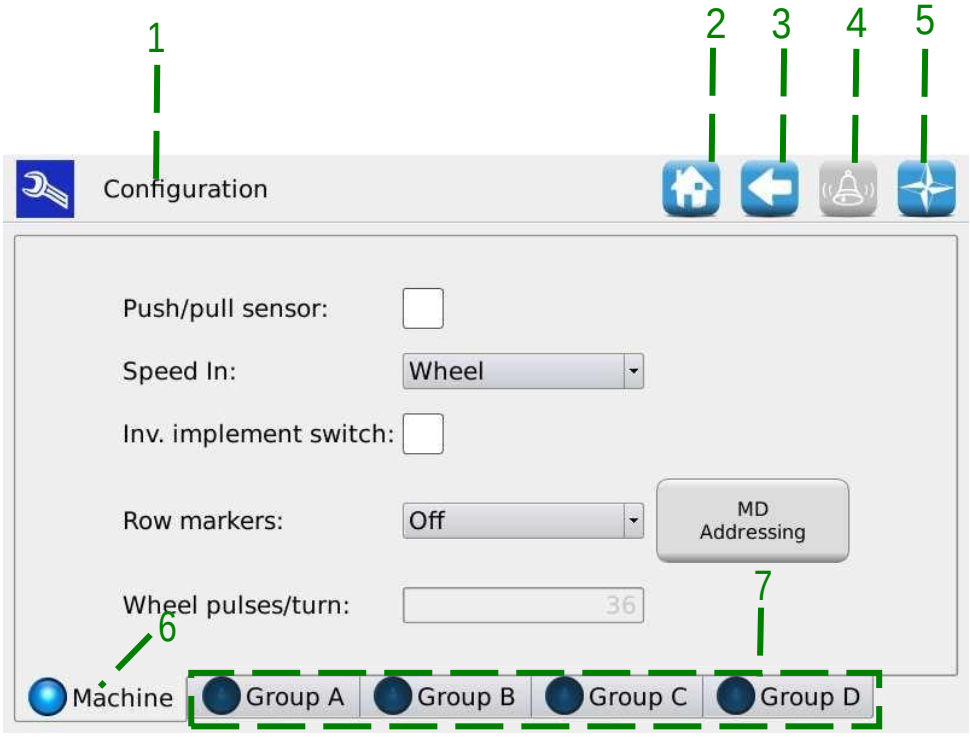
To start up the HMI connect the PCS FS to the battery or push/turn the corresponding battery disconnect switch located on the machine (if available).

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

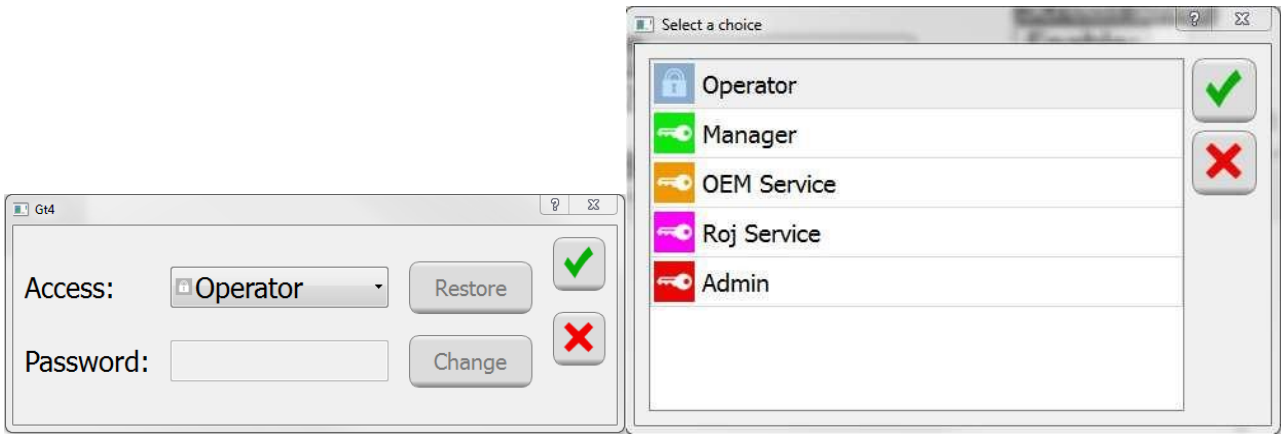
The access to the tabs, buttons and numerical fields for the setup is organized as an access levels system. Therefore, some fields can be modified **only by authorized users**.

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

Operator	It is the standard access level and does not require any password.
OEM Service	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.
ROJ Service	This access level is foreseen for the ROJ technical support.
Administrator	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 on 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

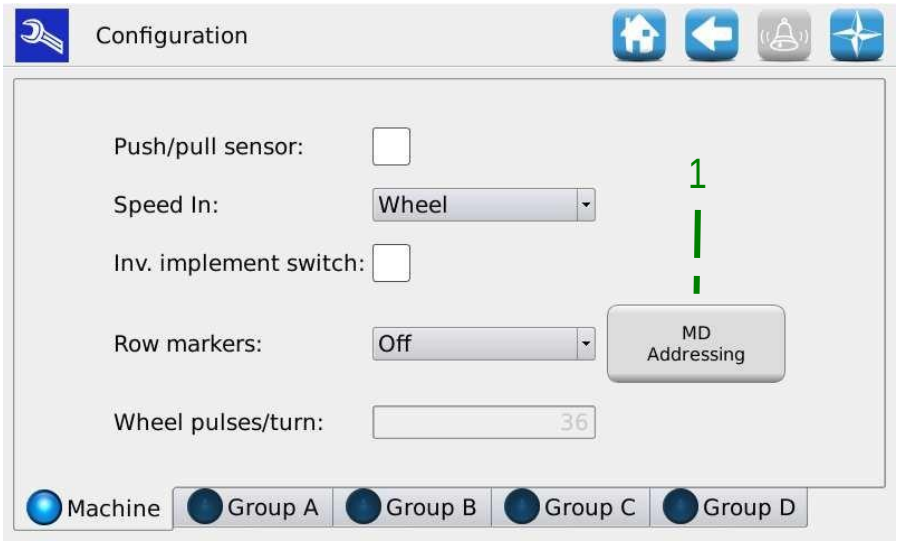
At the first installation of the machine, it is necessary to address the motors, in order to associate the physical position of the motor on the machine to the logical position (Group A, Group B, Group C, Group D).

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

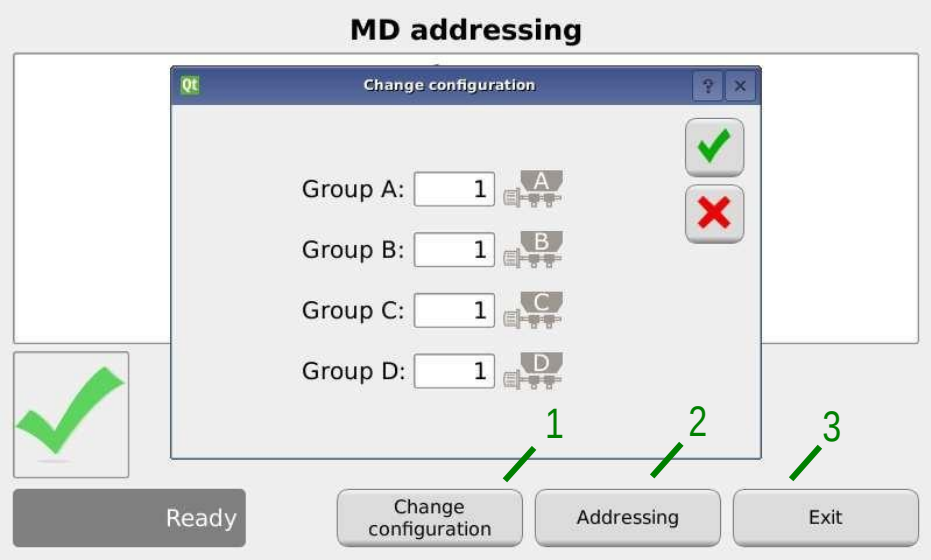


Field	Description
1	Activation button for the addressing procedure

3.4.1 Machine configuration

Pushing the 1 button a machine configuration window is opened where it is possible to read the number of motors associated to the A, B, C and D groups.

MD addressing window

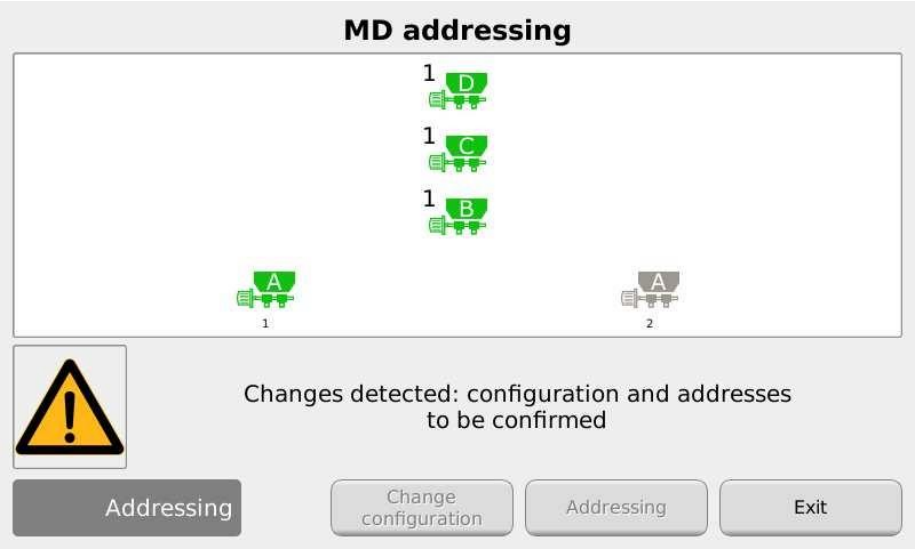


Field	Description
1	It allows to modify the machine configuration
2	If this button is pressed, the real addressing session starts
3	To exit from the addressing window

3.4.2 Addressing

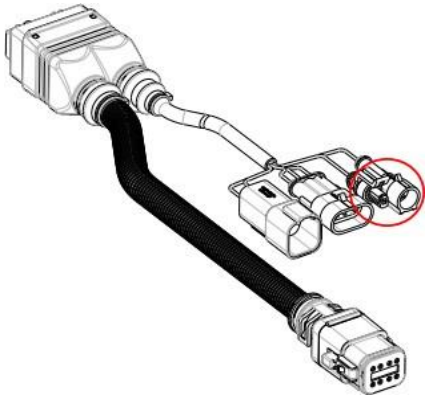
When the “Addressing” button is pressed, the real addressing session starts.
When the addressing is active, a synopsis (summary) of the configuration set up on the previous phase is displayed.

MD addressing window



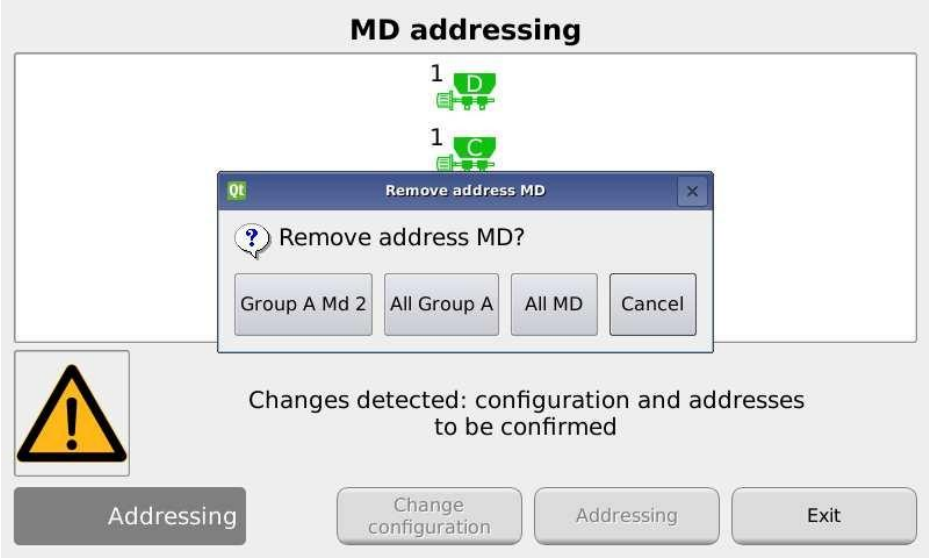
Field	Description
	Motor not yet addressed
 (flashing)	Motor to be addressed
	Addressed motor

Closing the protection switch (see figure) for the cable corresponding to the one flashing 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:

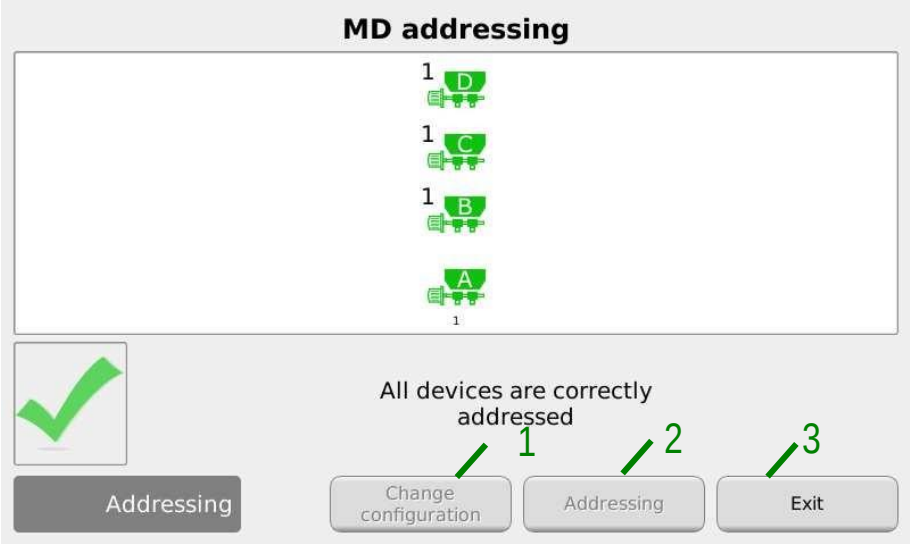
MD addressing window



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

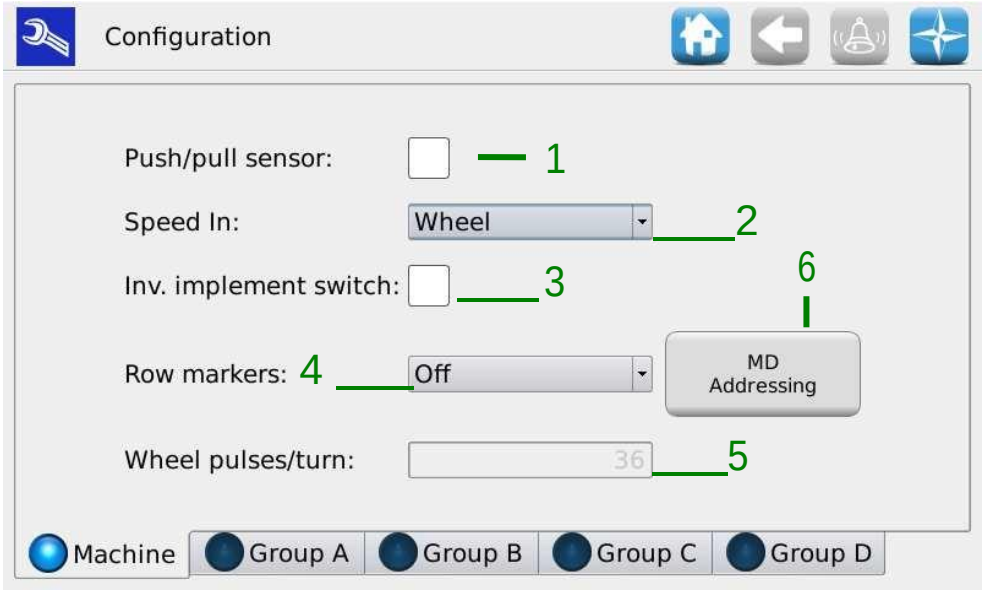
3.5 MACHINE CONFIGURATION

This window allows to setup the machine 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 push/pull sensors
2	It allows to select the machine speed sensor: - Single sensor (phonic wheel) - Double sensor (phonic wheel + index) - Radar - Encoder - Single sensor (phonic wheel- one tooth) - ISO11786 signal - Single sensor (phonic wheel + fan) (If selected, the user is asked to turn off and restart the system from the main disconnect switch/battery disconnect switch)
3	It enables the machine lifted/machine lowered sensor with a reversed polarity
4	It enables the row markers
5	It indicates the number of teeth of the phonic wheel
6	It allows to force the motors addressing session

Single sensor (phonic wheel)

Before calibrating the speed sensor used with the phonic wheel, it is possible to get a quite precise evaluation of the calibration result.

For example:

Supposing that the phonic wheel has been mounted on one of the seeder wheels. The wheel diameter is 64 cm.

The wheel expansion on the ground (S) on the ground will be

$$S = 2 * \pi * r = \pi * d$$

π= 3.14

r = seeder wheel radius

d = seeder wheel diameter

These data (S) allow to evaluate with a high precision the number of turns (N) of the seeder wheels needed to run the 100m distance requested to carry out the calibration.

$$N = 100 / S$$

In order to obtain the pulse number (i) for the calibration, it will be necessary to multiply the number of teeth of the phonic wheel (n) in use by the number of turns of the seeder on the 100m distance

$$i = n * N$$

This is true supposing that the seeder wheel and the phonic wheel have a direct ratio 1:1. Otherwise the pulse number (i) should be multiplied by the up/down gearing ratio.

ISO11786 signal

The signal generated by the tractor on this interface measures the effective speed of the tractor forward movement.

The generated number of pulses is 130 pulses/meter for a tractor speed of 1 Km/h, therefor the total number of pulses for the calibration will be 13000 pulses/100m.

Single sensor (phonic wheel + fan)

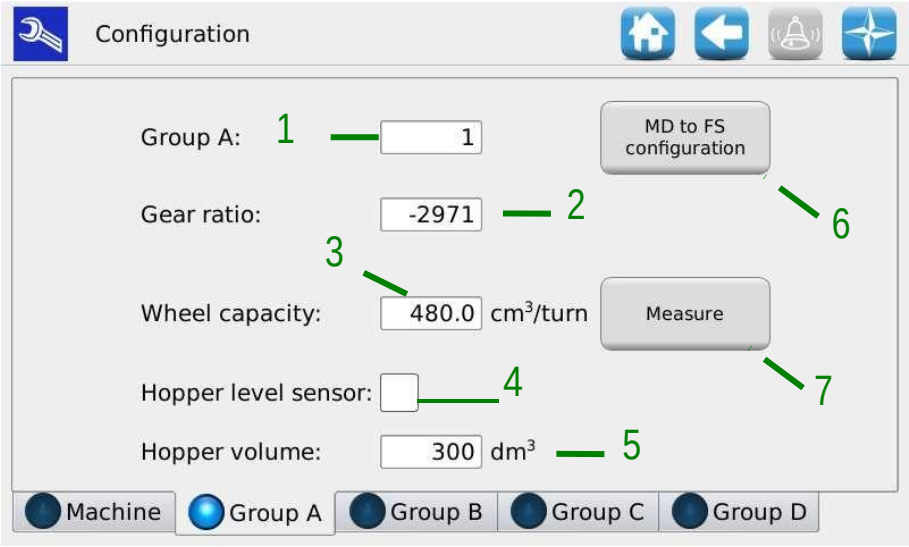
The system is provided with two inputs for the ENCA and ENCB speed.

The speed sensor for the machine forward movement is connected to the ENCA input, while the rotation speed sensor for the pressure/vacuum and suction fan of the machine is connected to the ENCB input.

The controls for the rotation speed of the fan are enabled on the fan sensor, as indicated in the following table. The allowed speed limit of 5000 rpm can be set by the operator.

Error code	Message	Solution
1-1615	Fan rpm too low (1)	Increase fan rpm
1-1615	Fan rpm too high (2)	Decrease fan rpm
1-1616	Fan rpm out of range	Modify max limit settings or decrease fan rpm

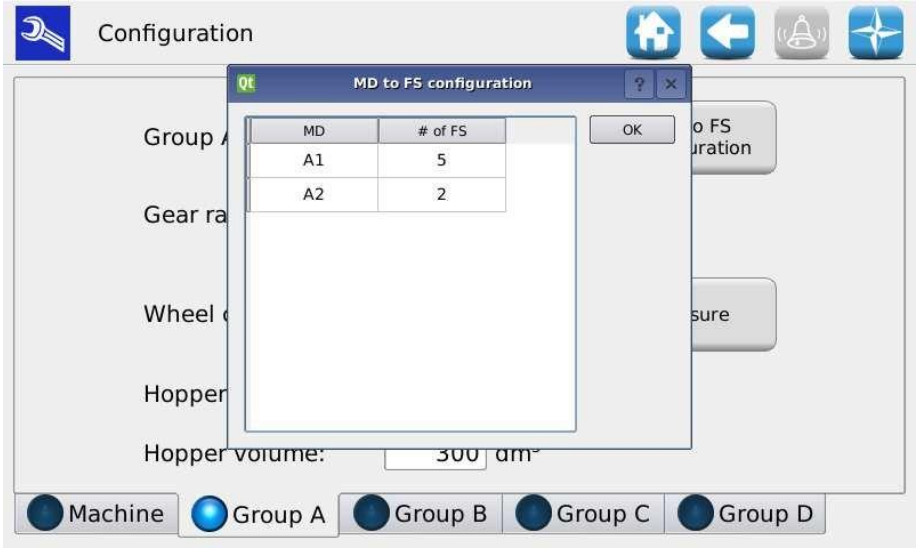
Tab **A/B/C/D Group**



Field	Values range	Description
1	1 ... 32	Number of motors associated to the group • Group A: 1 – 32 • Group B: 1 – 8 • Group C: 1 – 8 • Group D: 1 – 8
2	-10000 ... 10000	Reduction gear ratio multiplied by 100 (for example: reduction gear 28.89 : 1 → 2889) The minus sign indicates the rotation direction opposite to the standard one. If no further external up or down gearing is applied, the gear ration remains -2971.
3	1 ... 1000	The quantity of product delivered at each turn of the volumetric distributor shaft for a specific product. It is possible to use the 7 function to measure the quantity delivered by the auger.
4	-	It enables the product level sensor, which is generally positioned on the hopper.
5	1 ... 3000	Total volume of the hopper in use
6	-	Group configuration
7	-	It enables the function for the auger capacity per revolution measurement

Creation of the MD/distributors association

This function is enabled by pressing the 6 button in the page for the association of the installed motors to the corresponding distributors on the machine.



This operation can be carried out for all motors associated to the 4 groups.

How to measure the "Volume per revolution"

Press the 7 button in the configuration page to calculate by experimentation the product quantity to be delivered by the hopper through the auger.

The test is composed of a sequence of 5 screens that guide the user during the measuring steps.

For all groups the user can choose the distributor/distributors that will work after the test is started or all of them.

The first step, which is shown in the following pop-up, allows to pre-fill the auger before carrying out the test. This operation significantly increases the measurement precision.

Pressing the Start button, the auger is prefilled for the given rpm.

Once this procedure is finished, the real measurement is carried out.
After deciding the rpm to be run for the weighing test, press the Start button.

The same as for the auger prefill procedure, a progress bar is displayed to show the user how far along he/she is in the process.

When the given rpm has been run, the following screen is displayed, where it is possible to input the product density and the value for the weighing carried out by the user. The software automatically calculates the distributor volume per revolution in cm³/revolution.

To calculate the volume per revolution the following formula is applied:

Volume per revolution =1000 x Measured quantity / (Density * # auger revolutions) [cm³/revolution]

NB :

Supposing that only one motor has been chosen, it is necessary to put the bag for the weighing process under the nozzle of the selected distributor.

Instead, if you decide to start all the motors of the machine, the seed collection bag should be placed under each nozzle.

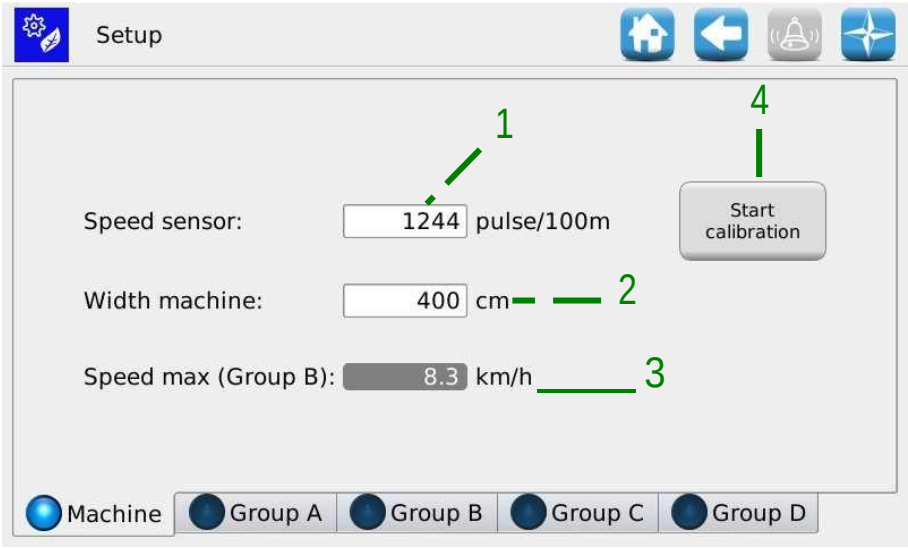
3.6 SEEDING/FERTILIZATION SETTINGS

This window allows to set up the seeding or fertilization parameters for the 4 groups.

Path:

→ →

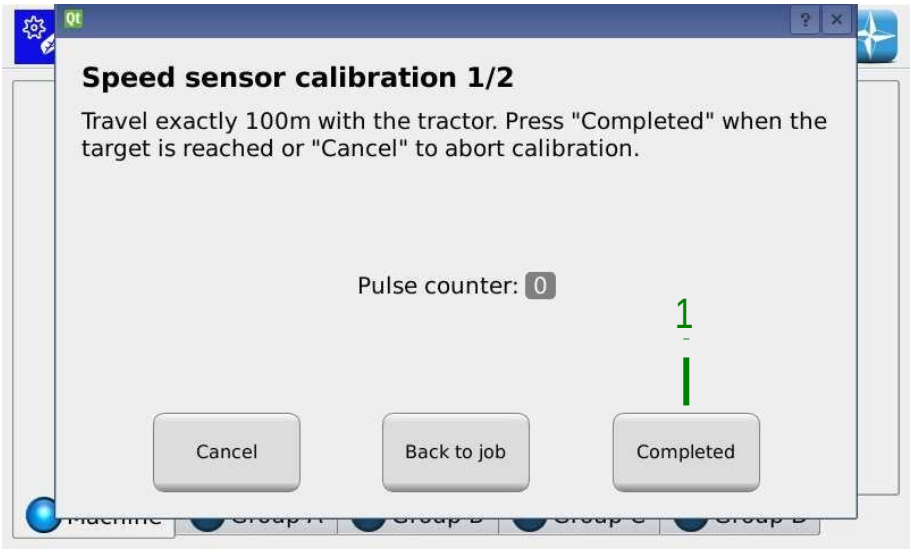
Machine Tab



Field	Values range	Description
1	800 – 25000	Number of pulses per 100m. Press the button to run the speed sensor calibration session. (See below)
2	20 ... 800 [cm]	It indicates which machine is being used
3	0 ...16 [km/h]	It shows the maximum allowed work speed with the actual settings.
4	-	Follow this procedure to calibrate the speed sensor on 100m

Speed sensor calibration

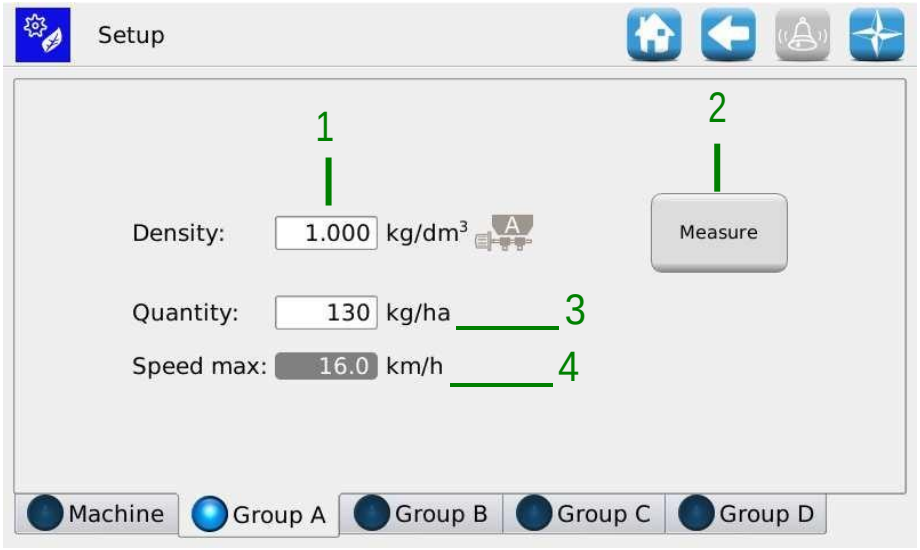
Pressing the 4 button, it is possible to access the sensor calibration screen.
The following window will pop up:



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. 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.

Tab **A/B/C/D Group**



Field	Values range	Description
1	0.2 ... 2	Density of the product being used
2	-	It allows to measure the density of the product being used
3	1 ... 1000	Amount in kg to be delivered per hectare of field
4	0 -16 [km/h]	It shows the maximum allowed work speed with the actual settings.

Distributor measuring

To check the density of the product being used it is possible to click on the 2 button. A pop-up window will be displayed requesting to input a speed and to choose a motor for the test.

Push the Play button to start the selected motor.
It is possible to stop the test or to go on with the test until all the desired simulated area has been covered.

As for the previously described measuring of the auger volume, if you push Stop a screen will be displayed allowing to input the weighed amount for an automatic calculation of the correct product density.

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 amount of seeds or fertilizers being used
- easily access the rows switching off function.
- rapidly enter the effective amount contained in the hopper and get a real time estime of the residual quantity

Path:

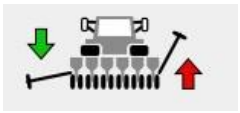
→

Synoptic display of the complete seeding/fertilization 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 km/h	Here you can see the real time system speed, as detected by the set speed sensor.
3		Row exclusion and Seeding Tab.
4		Summary information Tab
5		Synoptic Tab.
6		Row exclusion and Setup Tab.
7	h:min	It shows the set time

8		Button for the day/night backlight activation.  It activates the backlight set for the night  It activates the backlight set for the day

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

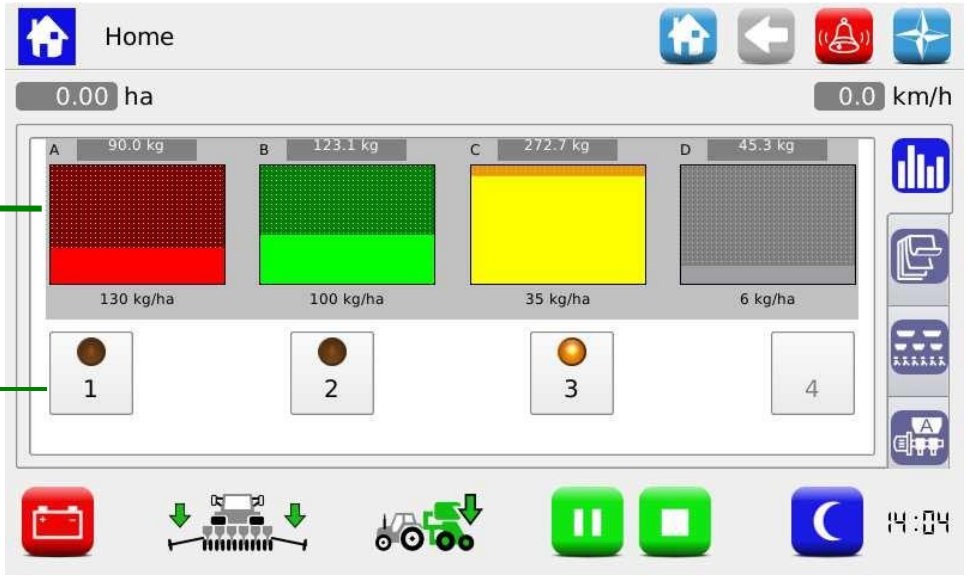
Field	Function	Description
	How to use the alternator	 The system is only using the battery. The alternator is not charging the battery or the PTO has not been activated. **Note**: press the battery icon to activate an alternator power up cycle.  The system is working with the battery and the alternator.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

+ *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 Group/MD exclusion

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

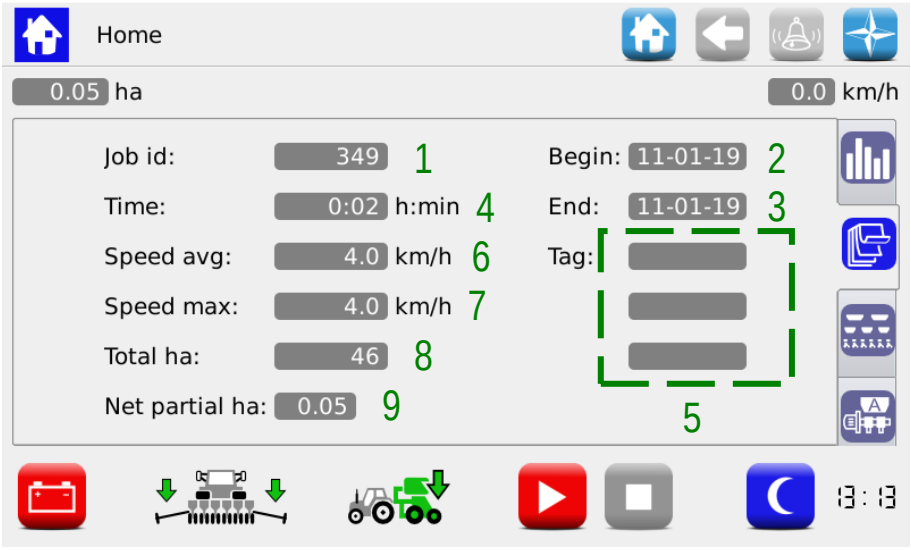


Field	Values range	Description
1	Hopper amount bar	***Bar***: it shows the amount of seeds or fertilizer contained in the hopper. This value is entered by the user in the Setup menu. ***Background***: this part of the chart is in background to the bar. The bar colour and the background show the status of the group or the status of one of the associated motors: **Green** → group/MD OK **Yellow** → group/MD switched off by pressing the tramline button **Rosso** → group/MD alarm / error **Grey** → group excluded (***not active***) The number above the bar indicates the amount remaining in the hopper. The quantity in kg/ha to be delivered is shown under the bar.
2	Value in cm	Tramline button: 1 MD active 3 MD off. 4 MD excluded (this button is not active)

By clicking on the value shown above the remaining amount bar, it is possible to quickly load the desired amount. This quantity will be added to the hopper estimated residual quantity.

Push the Load button to add the given quantity to the residual amount, push First Load to reset the Residual field and to load the given amount.

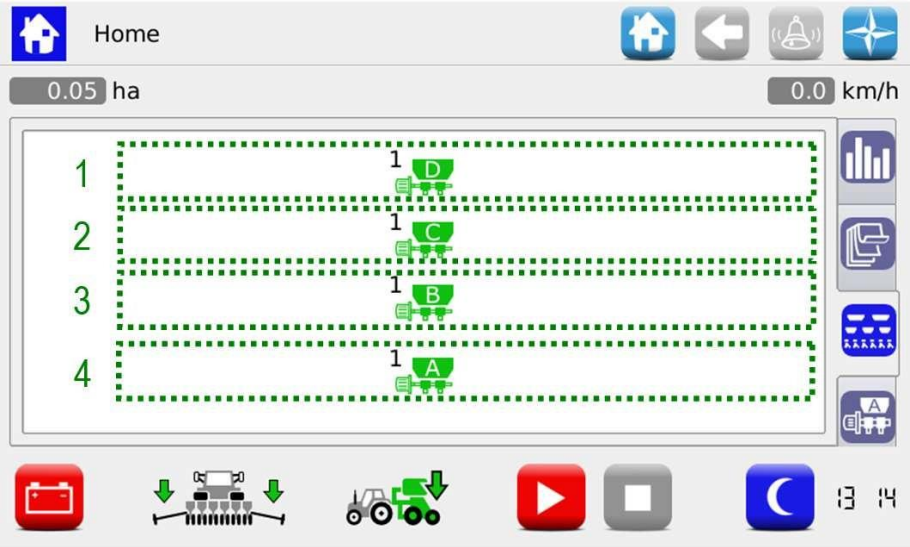
3.7.2 Summary information about the seeding/fertilization job



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
9	Partial ha-counter

3.7.3 Synoptic Tab

To enable and disable the groups and distributors motors and to quickly access the job set up functions, (see chapter **SEEDING/FERTILIZATION SETTINGS).**
It also gives a graphical overview on the devices status.



Field	Description
1	Motor status icons The icon color indicates the status of the motor associated to the A group. **Green** → group/MD OK **Yellow** → group/MD switched off by pressing the tramline button **Rosso** → group/MD alarm / error **Grey** → group excluded (***not active***)
2	Motor status icons The icon color indicates the status of the motor associated to the B group. **Green** → group/MD OK **Yellow** → group/MD switched off by pressing the tramline button **Rosso** → group/MD alarm / error **Grey** → group excluded (***not active***)
3	Motor status icons The icon color indicates the status of the motor associated to the C group. **Green** → group/MD OK **Yellow** → group/MD switched off by pressing the

	tramline button **Rosso** → group/MD alarm / error **Grey** → group excluded (***not active***)
4	Motor status icons The icon color indicates the status of the motor associated to the D group. **Green** → group/MD OK **Yellow** → group/MD switched off by pressing the tramline button **Rosso** → group/MD alarm / error **Grey** → group excluded (***not active***)

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

Pop-up windows of the motor associated to the group

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 setting menu.

Path (the same for the 4 groups)

Field	Description
1	Indication of the device status OK → no active alarms Disabled → device excluded (not active)
2	By pressing this button a **Setup** menu window is opened (see chapter **SEEDING/FERTILIZATION**

	SETTINGS), 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

3.7.4 Seeding/fertilization job

In order to proceed with the seeding or fertilization, you need to start a seeding or fertilization job.

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

Sanitize	Description
	Click on this button to start a job. The job status indicators will turn green  ; The system waits for the tractor movement on the field which causes the electric motors movement. The partial ha-counters and the seeds counters are reset at the beginning of the seeding activity.
	Press the button to resume a job which has previously been paused. The partial ha-counter and the seeds counter restart from the value indicated before the pause.
	Press the Pause button to temporarily suspend the job without resetting the statistical counters related to the started job. The job status indicators will turn yellow  ;
 	Finish the job. The job status indicators will turn red/grey  . After a job is finished, a number of information about the 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.

3.8 ALARMS

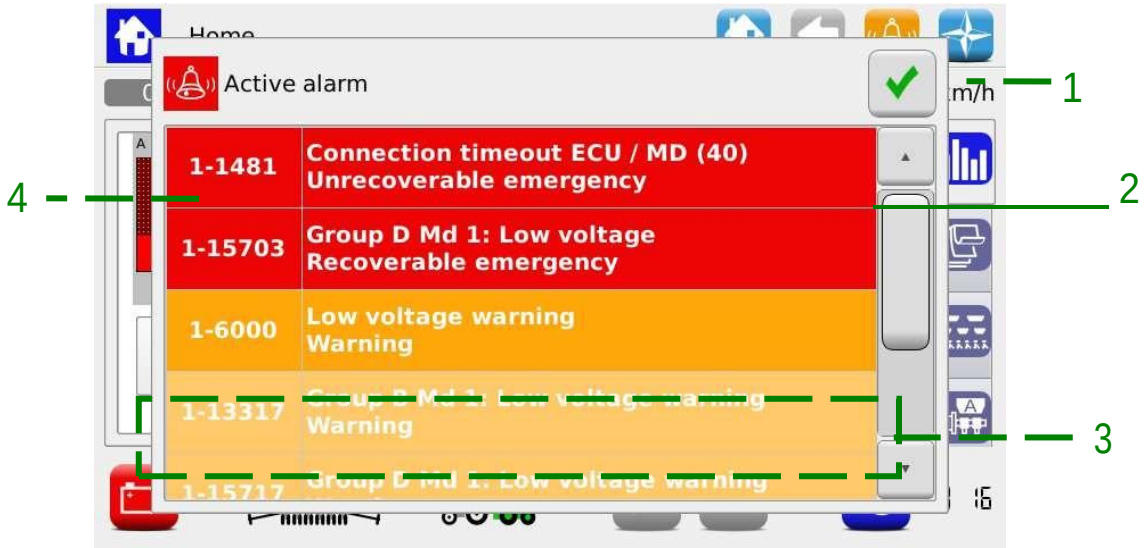
The alarms and warnings are reported in a pop-up window like the one shown in the picture.

The 1 button can be pushed to acknowledge the alarm and to close the window, without deleting 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 acknowledgment button
2	Alarm description Alarm category
3	Active alarm which has already been acknowledged (grey text)
4	Alarm code

System errors

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 ECU / HMI	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. This error could occur during the software update if not all the devices have been updated with the new software. In that case it is recommended to update the software on all devices
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 CAN cable connection between ECU and DMD
1490	Initialize timeout (%1)	Contact technical support
1550	Connection timeout ECU / remote terminal	Check connection between ECU and remote terminal
1600	Machine taxing position	Machine in taxing 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
1615	Fan rpm out of range (%1)	Adjust PTO speed so that fan rpm is within the range
1616	Fan rpm range min > max	Modify min and max limit settings of Fan rpm 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 (quantity/ density). Change the set parameters.
2501	Group B parameters mismatch	Not possible to set that combination of parameters (quantity/ density). Change the set parameters.
2502	Group C parameters mismatch	Not possible to set that combination of parameters (quantity/ density). Change the set parameters.
2503	Group D parameters mismatch	Not possible to set that combination of parameters (quantity/ density). Change the set parameters.
2504	Spare parameters mismatch	Not possible to set that combination of parameters (quantity/ density). Change the set parameters.
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

Motor related errors

Error code	Message	Solution
1xx00	Overcurrent	Cycle power of the system from battery disconnect Contact supplier if not solved
1xx01	Motor high temperature	Let motor cool down. Check mechanical arrangement to check that there aren't unwanted frictions, damage 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 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	MD Drawer (%1)	Homing failure
1xx30	Generic	Recoverable emergency
1xx80	High number of doublets	Adjust drawer position to a lower set value

1xx81	High number of missings	Adjust drawer position to a higher set value
1xx82	Deviation from theoretical investment	Check seeding discs and drawer
1xx83	High number of missings	Check
1xx84	Prefill not completed	Verify that vacuum is correct and seeds are present in the hopper
1xx87	Seed hopper low level	Verify seed hopper level

3.9 SOFTWARE UPDATES

It is possible to update each system device via the HMI.
To perform an update you need an 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

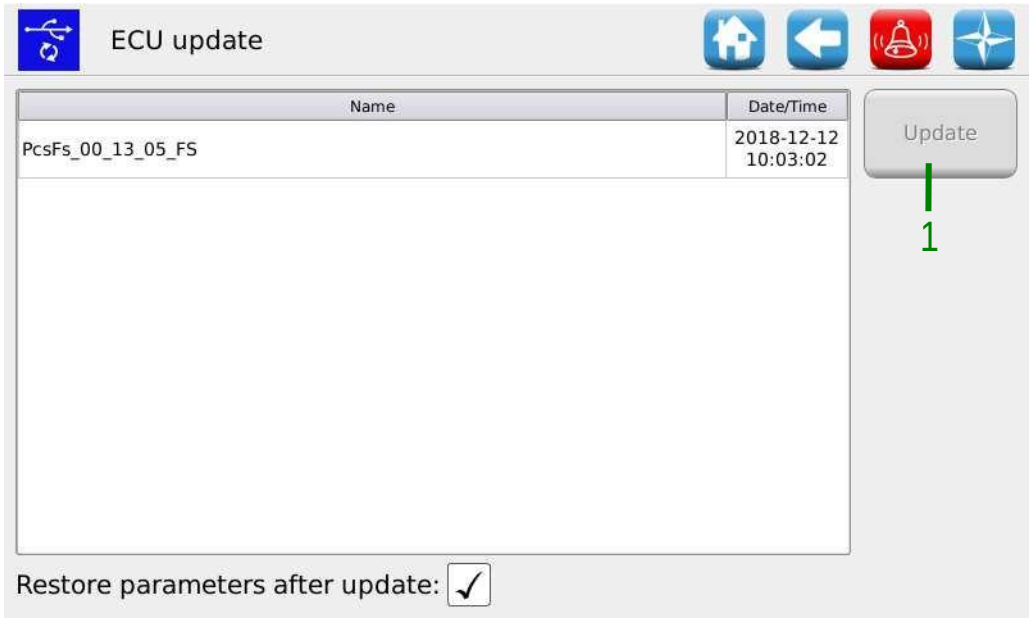
The following screen allows the user to decide which part of the system should be updated.

Path:

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)

ECI 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

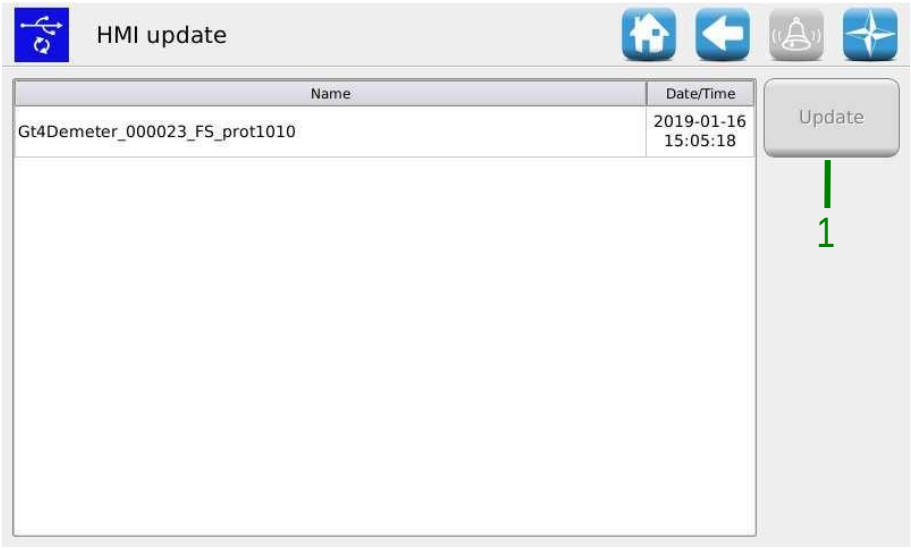
   In that case, follow the procedure described in the next paragraph in order to confirm the addressing and to restore the parameters.

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:

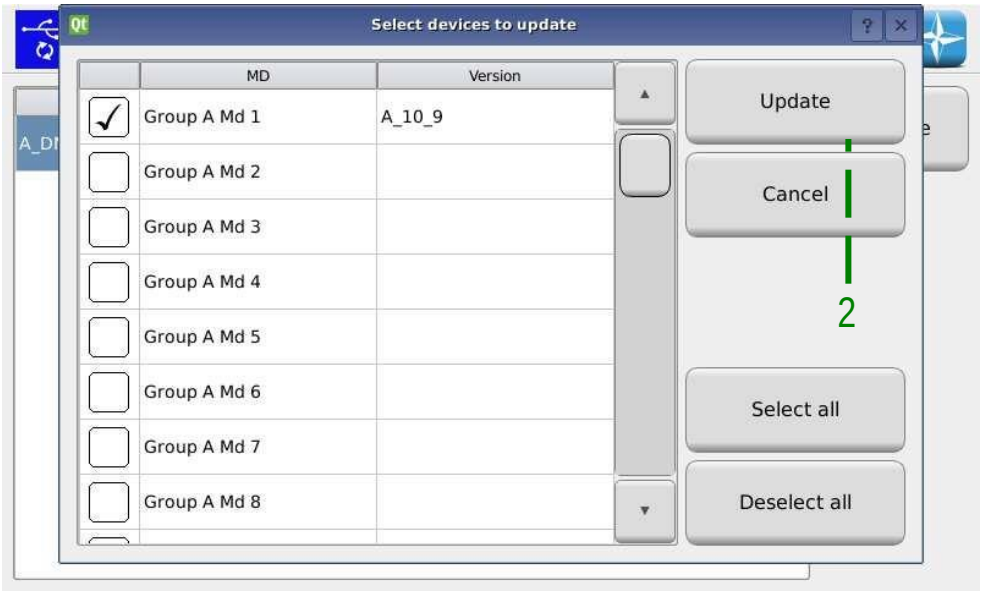


Selecting the desired SW from the list and pressing the 1 button, it is possible to update the HMI.
After the update the console shuts off automatically and the system reboots.

MD software update

Path:

Selecting the desired software from the list, and pressing the 1 button, the follow 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.

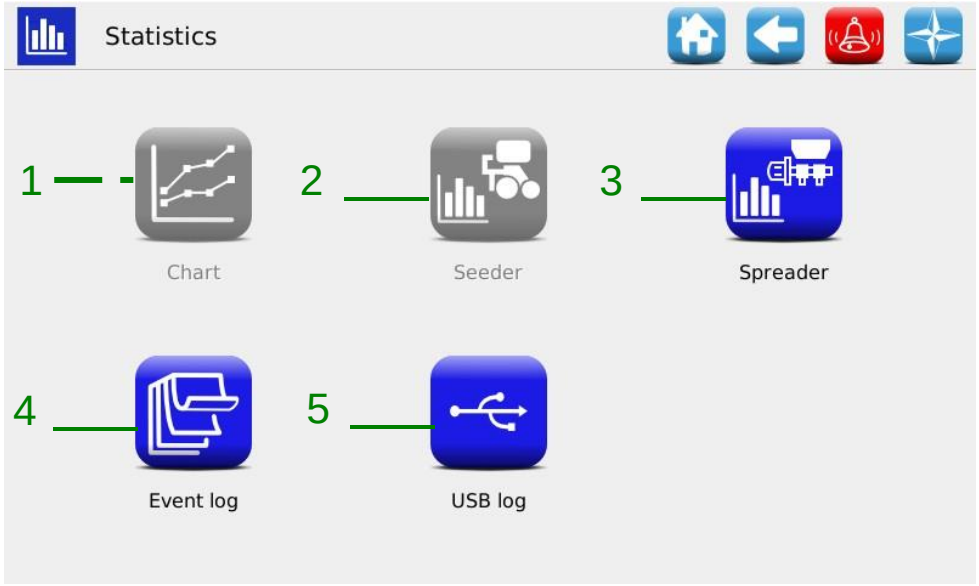


If you press the 2 button after the selection, the selected MDs update starts.

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:

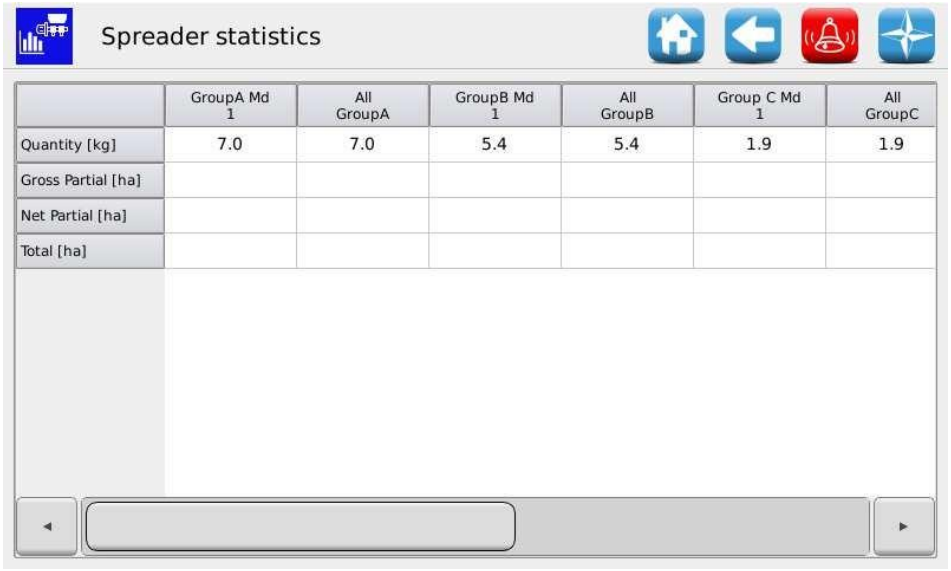


Field	Description
1	Chart function (only accessible by ROJ Service)
2	Statistics related to the seeding units (only active for the PCS200)
3	Statistics related to the distributors included in the 4 groups
4	System events log
5	Events and statistics storage

Seeder statistics

This window contains statistic information about the distributors included in the various groups, both individual (for ex.: GroupA Md1) and total (for ex: All GroupA).

Path:



Field	Description
Quantity [kg]	Quantity delivered by the distributors associated to the individual motors and Groups
Gross partial [ha]	Partial ha-counter
Net partial [ha]	Partial ha-counter considering only the active rows
Total [ha]	Total ha-counter.

Event log

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

Path:

3 4

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 an 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. **This operation can take about 30 seconds for each MD.**
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.

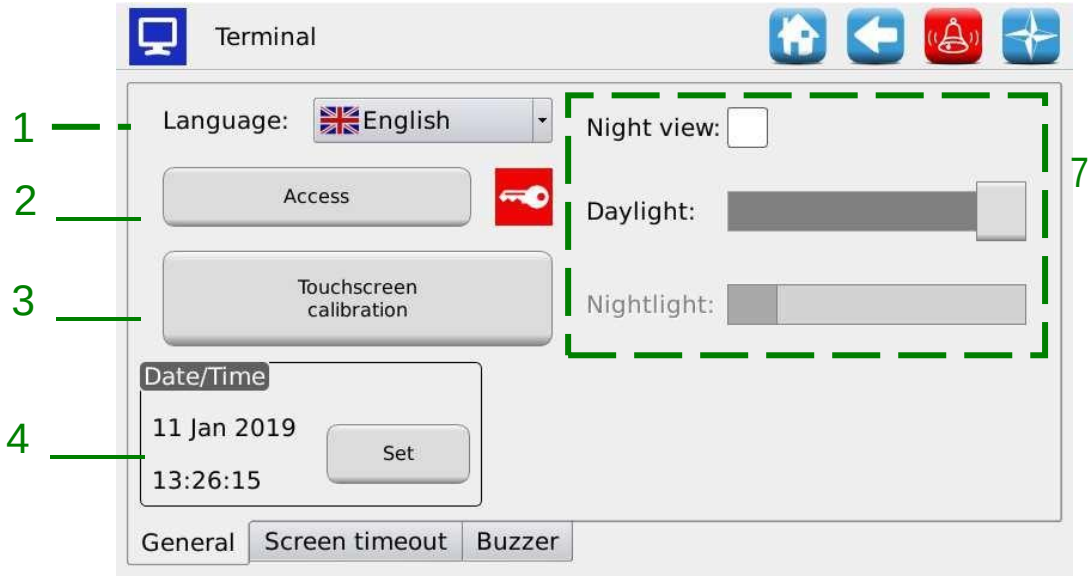
The above procedure will create on the USB stick a directory called **HMI_<nnnnn>**[1] containing some files. It is possible to send this directory to the Technical Support via email.

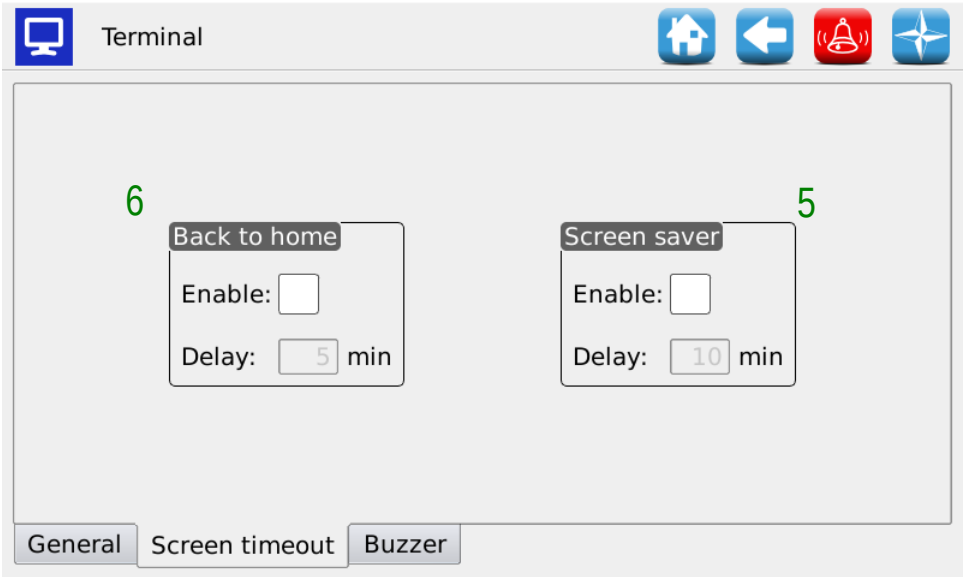
[1] <nnnn> is the identification number of the used HMI.

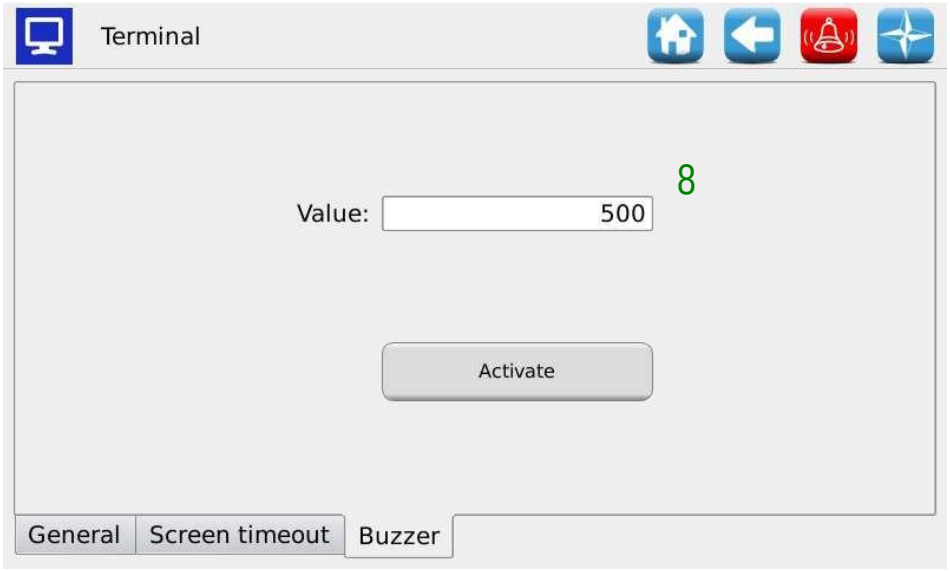
3.11 TERMINAL

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

Path:







Field	Description
1	Select the HMI terminal language
2	Select the access level (see also the chapter **ACCESS LEVELS**)
3	Touchscreen calibration function
4	Date and Time setting for the HMI terminal
5	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.
6	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.
7	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.
8	Setup for the buzzer sound level: min 500 max 1200

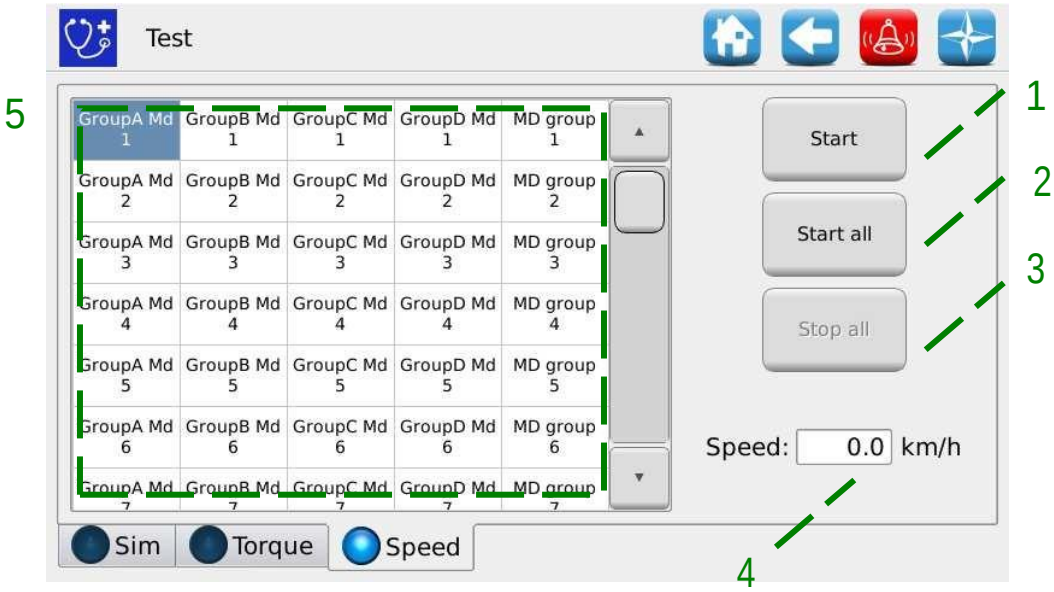
3.12 TEST

Path:

→ →

Speed Tab

In this tab it is possible to test each motor, a group of motors or all the motors, controlling them by a "speed mode", corresponding to the set tractor's speed.
When using the "Speed" tab, all functions like for ex. The hectares count and so on, are not active. You can use this window for the motors running.
This test mode is only available when the seeding job is inactive or paused.



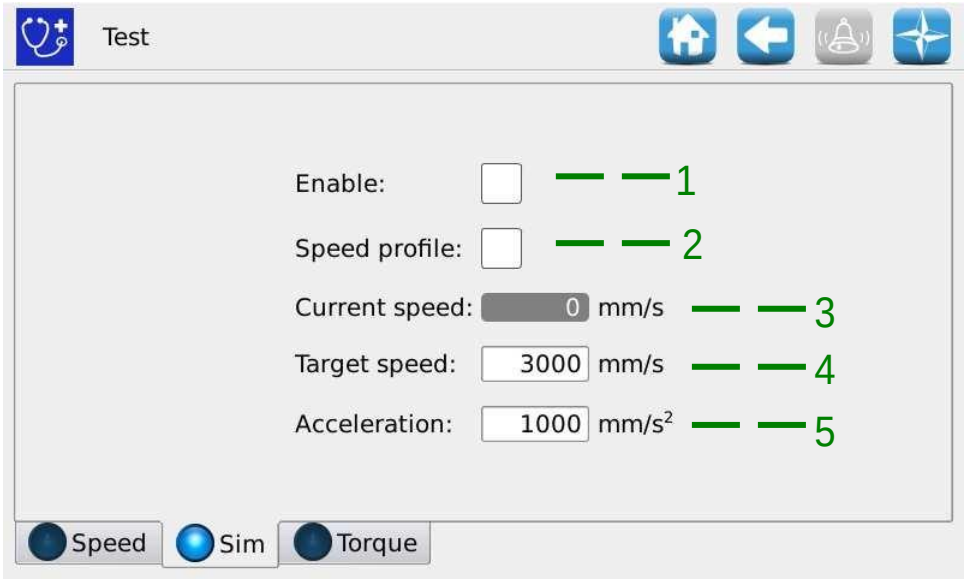
Field	Description
1	The selected MDs start
2	All MDs start
3	All MDs are stopped
4	Tractor speed expressed in km/h
5	Motors selection window.

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 for the tramline function) and when the job is active.

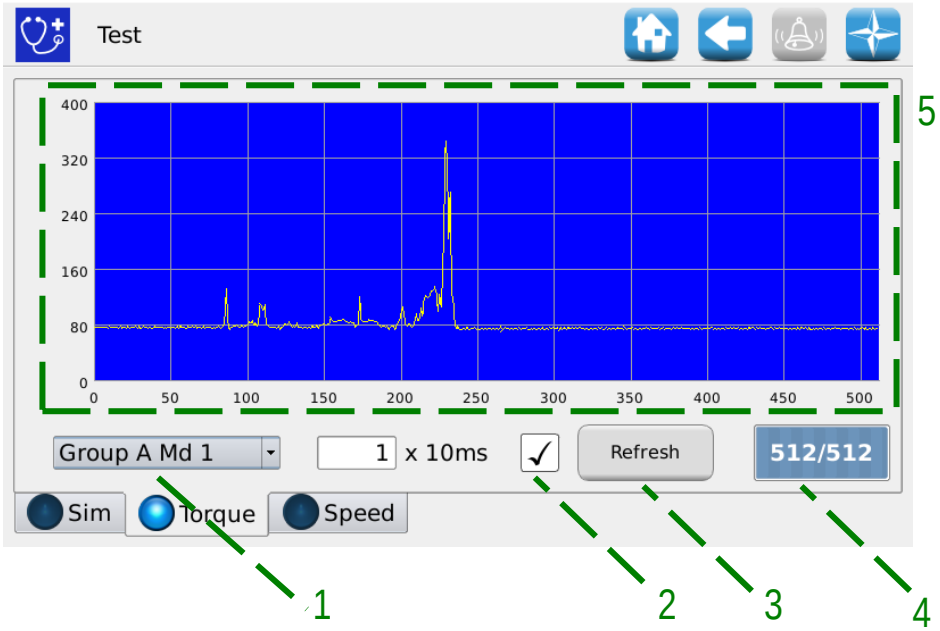
During this test all functions, for example the the hectares count and so on, will be active just like the machine was working on a real field.



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 not be used.
2	If this option is selected it enables the simulation. The speed increases until the target speed value is reached (*Target Speed*), following the acceleration ramp as specified in the *Acceleration* 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 *Acceleration field.*
3	Current speed
4	It indicates the simulation of the top speed to be reached. The value is expressed in km/h
5	It indicates the tractor acceleration to be simulated in km/h

Torque Tab

In this tab it is possible to Read the MD torque (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 you press this button 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 chart window. The torque value is expressed in internal representation units

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4 – MAINTENANCE AND TROUBLESHOOTING

4.1 GENERAL INFORMATION ABOUT MAINTENANCE

Thanks to the inherent sturdiness of the PCS FS 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 FS 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.

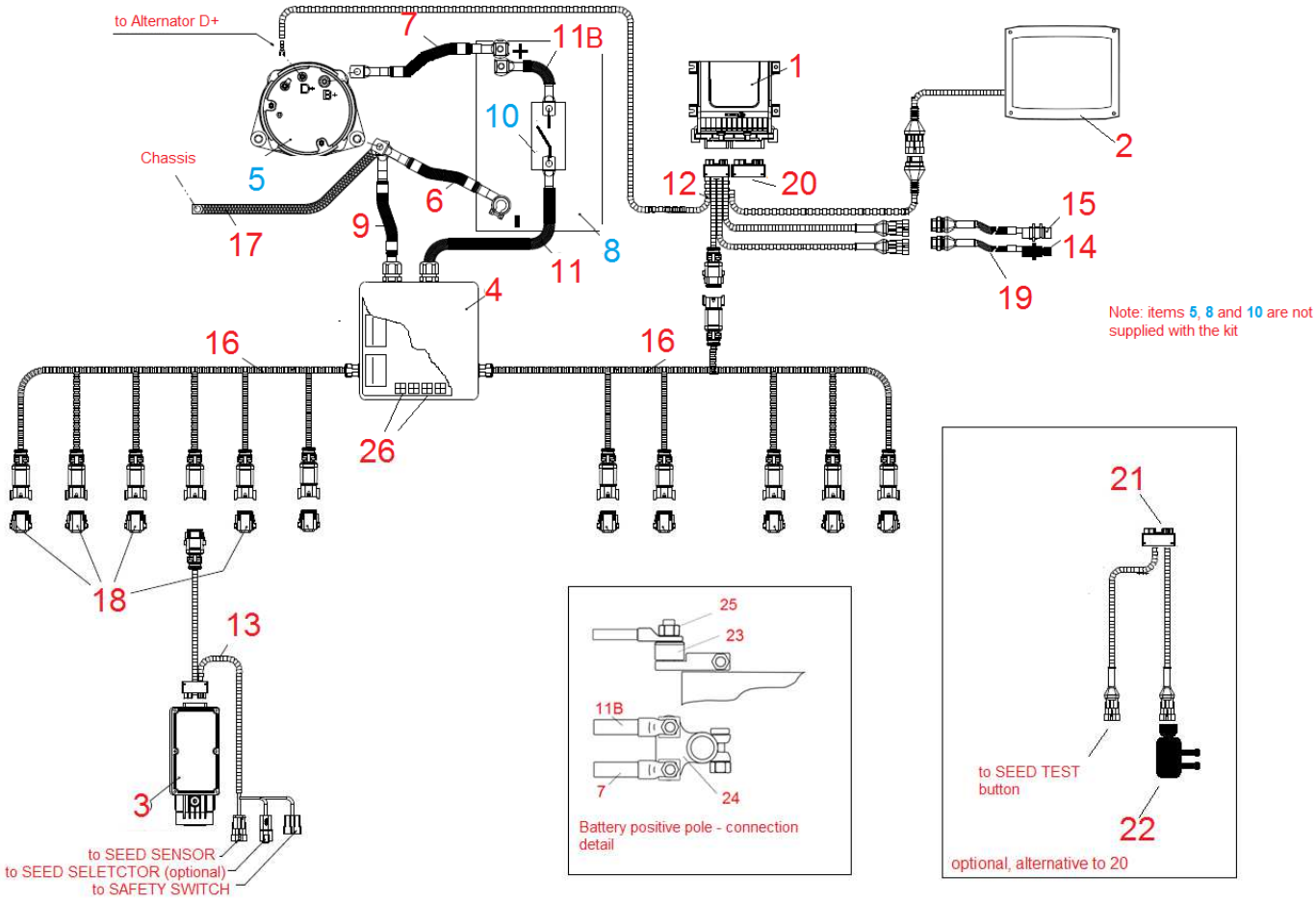
4.2 ORDINARY PREVENTIVE MAINTENANCE TASKS TO BE CARRIED OUT BY THE OPERATOR

Operation	Frequency	Notes
Cleaning	Before long periods of inactivity	If cleaning with a pressure washer, do not direct the jet towards connectors and seals.
Checking tightness	Every year, after long periods of inactivity (ex. at the beginning of the seeding season)	
Replacing geared motors oil	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 check 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 connection diagram
54T01068	DEMETER ECU	1
58G00074	AGRI-MATE GRAPHICAL CONSOLE	2
1.406.601	PCS MD-O	3
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	
50A00174	HALL EFFECT SPEED SENSOR GS102301	14
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^2 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
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 is 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 an alarm alarm 1-1801 "Invalid configuration or MD address" is displayed when turning on the machine, 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 on 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 alarm 1-1801 "Invalid configuration or MD address" is displayed when turning up 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 power 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, an alarm 1-1801 "Invalid configuration or MD address" 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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