

ECOBITE II PRO

Electronic Spreader Controller

Version 4.5



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1 General Presentation

This chapter presents the general functions of the Pulsar. This system has been designed to easily and economically control the spreading of solid materials (salt, crushed stone, or sand). It allows for a constant spreading independent of the type of vehicle carrying the spreader.

1.1 Console

The console of the Pulsar controller allows the user to:

- Select the solid material to spread (up to 4).
- Define the spreading rate of solid material (theoretically between 5 and 995 kg/km or g/m²).
- Adjust the spreading width (theoretically between 0.5 and 9.5 m).
- Perform at any time a blast according to the preprogramed parameters.
- Unload the spreading vehicle.

1.2 Report

Complete reports are available to analyze the spreading that was performed.

The **MNUCNT** function of the **MODE** menu (see MNUCNT on page 28) is used to manually collect information after each operation (see appendix 4 for the procedure to collect data).

**IMPORTANT**

This feature is enabled by default.

The INFOBITE software (see "Operation Data Management" on page 40) helps build reports for multiple vehicles and operators as well as working in multi-user mode. It needs the GPS INFOBITE data collection system linked to the ACE controller. The system automatically transfers data when getting back to the garage (see appendix 5).

1.3 Modes of Use

The spreading Pulsar works in three modes: Operation, Unloading, and Configuration. This section presents a brief description of these modes.

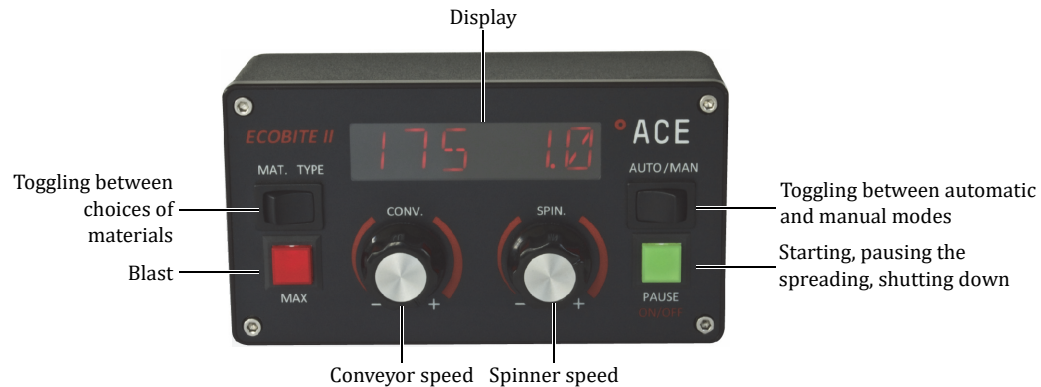


Figure 1-1 Control functions in Operation mode

Operation

The Operation mode is the usual way of using the spreader.

Unloading

The Unloading mode allows you to empty the spreader. In order to proceed with the unloading, the vehicle must be stationary.

Configuration

The Configuration mode allows you to perform the adjustments of the controller (calibration, certain parameter settings, and choice of specific operations). Even though the Pulsar controller is preconfigured at the factory, you can change the calibration and select operation parameters prior to the operator using the spreader. Refer to appendices 1 and 2.

2 Operation

This chapter presents the control functions of the Operation mode.

The basic control functions for the operation of the Pulsar are: starting the controller, selecting the material, starting and stopping the spreading, shutting down the controller, selecting the Operation mode (optional), blast and altered functioning.

NOTE: When the vehicle key is at the off position, the controller is not operational.



Figure 2-1 Control functions in Operation mode

- To start the controller, press the PAUSE button.
- Upon starting, the controller displays the material type select at the time of the last use. To select another type of material, press the MAT. TYPE. The selection does not start the spinner.
- To start spreading, press the PAUSE button once.
- To stop spreading, press the PAUSE button once. **PAUSE** is displayed on screen.
- To turn off the controller (shutting down), press the PAUSE button for 2 seconds.

NOTE: To select either the manual or the automatic mode, press the AUTO/MAN button. According to your choice, **AUTO** or **MANUAL** is display on screen. In certain cases, selecting the manual mode is not possible.

2.1 Manual Mode

In manual mode (AUTO/MAN button), the available speeds for the conveyor (between 0 and 100) and for the spinner (between 0 and 3.0 m) are directly linked to the positions of the CONV (conveyor) and SPIN (spinner) buttons. The controller adjusts the electro-hydraulic valves in order for that each movement of the SPIN and CONV choices are within their minimum values: conveyor at 0% and spinner at 0.0 m, and maximum values: conveyor at 100 and spinner (by default) at 3.0 m.



By default, the manual mode does not allow spreading while the vehicle is moving. It is therefore only used to unload of the spinner.

For particular uses, it is possible to allow spreading while the vehicle is moving (see the "MAN" function on page 27 in chapter "Configuration").

Use that mode to unload the spinner or for particular uses.

2.2 Automatic Mode

In automatic mode automatic (AUTO/MAN button), the spreading rate is based on the rate selected with the CONV button and the speed of the vehicle. The spreading width remains independent of the vehicle speed as in the manual Mode.



It is recommended to use this mode in all normal spreading cases.

2.3 Max Mode

The blast is used to increase the spreading over a short distance. By pressing once on the MAX button, the blast is activated, the programmed rate and width are displayed intermittently for the defined duration. In manual mode, the word **MAX** and the width value are blinking on screen for the duration of the blast. A beep confirms the end of the operation.

To stop the blast action before the defined duration, press a second time on the MAX button.

2.4 Altered Functioning

When the application of the spreading rates cannot be achieved as defined, messages are emitted. This section presents the messages that can appear on the display.

Loss of the conveyor speed signal

The controller emits a fast repetitive beep, the displayed spreading rate is zero then **MAXSPD** (conveyor troubleshooting) appears.

This mode allows the controller to perform spreading operations without receiving the signal from the conveyor. Spreading remains proportional to the motion of the vehicle and takes into account the selected rate and material type. This mode allows troubleshooting in case of failure of the conveyor sensor. The controller returns to the normal mode when it is shut down. The controller will automatically go into the troubleshooting mode as long as the problem has not been resolved.



This message is displayed every 10 kilometers along with a brief beep to remind the operator that the controller is in the troubleshooting mode.

Maximum speed exceeded

The controller emits a slow repetitive beep. No message is displayed. This indicates that the vehicle speed exceeds the maximum programmed speed for spreading (refer to section "MAXSPD", on page 23 of chapter "Configuration").



Reduce the vehicle speed.

Hydraulic capacity exceeded

The controller emits a fast repetitive beep. The display indicates the real spreading rate, not the selected one. This indicates that the spreading hydraulic capacity is at its maximum.



Reduce the vehicle speed or the spreading rate.

3 Unloading

This chapter presents the Unloading mode.

To go into the Unloading mode, you must proceed as follows:

- Immobilize the vehicle.
- Shut down the controller.

To use the Unloading mode:

- 1 Press the MAX button.
The controller displays **Unloading**.
- 2 Press once the PAUSE button.
- 3 Adjust the conveyor and spinner speeds using the CONV and SPIN buttons.



Figure 3-1 Controller buttons

- 4 To stop spreading, press once the PAUSE button (**Unloading** is displayed on screen).
OR
Press once the MAX button to quit the Unloading mode and shut down the controller.



When the vehicle key is at the off position, the controller is shutdown.

4 Configuration

The Configuration mode allows you to set specific parameters for the vehicle and for the desired spreading type. This must be done before the first use of the Pulsar spreading controller.



WARNING

When proceeding with the configuration, the access to some menus may trigger the start of the conveyor or the spinner due to the implementation of values programmed either in the factory or from the previous configuration.

Make sure that the start of the conveyor and the spinner cannot cause any dangerous situations.

The Configuration mode allows you to:

- Perform the calibration (recommended at the beginning of each winter).
- Configure the controller to address the operator's needs (see section "Custom Settings" on page 14).
- Provide some additional features (see section "Additional Functions" on page 23).

To use the Configuration mode:

- 1 Start the Pulsar.
- 2 Press, at the same time, the MAX and PAUSE buttons for 2 seconds.

A beep is emitted to confirm that the system is in the Configuration mode and the word **CONFIG** is displayed on screen.



If the controller prompts you for an access code, this means that the default one (1234) has been modified. If you have forgotten the access code, only an ACE technician can unlock the controller (refer to section "Contact" on page 29).

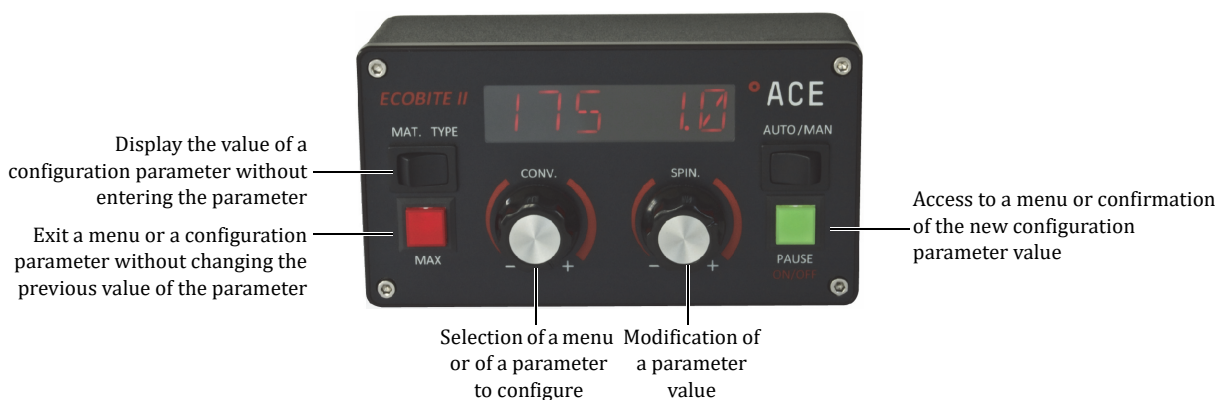


Figure 4-1 Control functions in Configuration mode

- 3 Turn the CONV button to access the configuration menu options.
- 4 Press the PAUSE button to select or validate a modification and the MAX button to cancel a selection or go back.

4.1 Calibration

The calibration function allows you to adjust the signal/distance ratio, the conveyor speed, the flow rate and the width of the spreading. All menus are accessible through the CONV button.

To access the Configuration mode, press, at the same time, the MAX and PAUSE buttons for 2 seconds (for more information, see page 7).

4.1.1 Adjustment of the Signal/Distance Ratio

The signal/distance ratio adjustment is made through the **SPEED** menu. This setting allows the controller to count the number of pulses that the transmission sends when the vehicle travels a given distance.

The accessible settings are: **SPDTST**, **DSTSET**, **SPDSET**, and **SPDSIM**.

SPDTST

The **SPDTST** function allows you to verify the adjusted speed.

To verify the adjusted speed:

- 1 Turn the CONV button, select the **SPDTST** function, and press the PAUSE button.
The controller displays the speed in km/h, which is read in real time. If the displayed speed is different from the actual vehicle speed, there are 2 methods to make the adjustment. The method for 1 km **DSTSET** or the method in real time **SPDSET**. Only use one of the 2 methods.

DSTSET

The **DSTSET** function allows you to adjust the speed with regards to the distance.

To adjust the speed:

- 1 Put the vehicle at the beginning of a measured kilometer.
- 2 Turn the CONV button to select the **DSTSET** button and press PAUSE.
The controller displays **START**.
- 3 Start the vehicle.
The controller counts and displays the pulses coming from the transmission.
- 4 Move the vehicle along the total kilometer.
- 5 Once the kilometer is completed, note the number of pulses displayed on screen for the 1 km and write it down in the Calibration Form (see Appendix 3, Table 2 on page 38) and press PAUSE to save the adjustment.
The controller displays **SAVED**.

SPDSET

The **SPDSET** allows you to adjust the actual speed.



IMPORTANT

During calibration it is important not to exceed the maximum number of pulses of 90 000.

To adjust the actual speed:

- 1 Turn the CONV button to select the **SPDSET** function and press PAUSE.
The controller displays the speed in km/h already calibrated on the left and the adjustment value on the right.
- 2 Turn the SPIN button to select the adjustment speed.
For example, if you want the adjustment to be 40 km/h, display 40 on the right by turning the SPIN button.



Figure 4-2 CONV, SPIN, and PAUSE buttons

- 3 When the actual vehicle speed is stabilized at 40 km/h on the odometer, press the PAUSE button to save the adjustment.
- 4 The controller displays **SAVED**.



When using the **SPDSET** function to adjust the speed, you need to press the MAT. TYPE to display **DSTSET** or **SPDSET** to view the number of pulses for 1 km/h.

Note the number of pulses displayed on screen for the 1 km and write it down in the Calibration Form (see Appendix 3, Table 2 on page 38) and press PAUSE to save the adjustment.

SPD-SIM

The **SPD-SIM** function allows you to simulate the vehicle moving speed and send it to the controller.



IMPORTANT

The configuration of the simulated speed is reset to zero (0) when shutting down the Pulsar.

To enter the simulated speed:

- 1 Turn the CONV button to select the **SPD-SIM** function and press PAUSE.
The controller displays 0.
- 2 Turn the SPIN button to select the simulation speed in km/h.
- 3 Press the PAUSE button to save the adjustment.

4.1.2 Conveyor Speed Adjustment

The adjustment of the conveyor speed is made through the **CONV** menu. This menu is accessed using the CONV button. It offers 2 choices: minimum and maximum.

MIN

The **MIN** function allows you to adjust the conveyor startup in order to reduce the wait delay to a minimum.

To limit the conveyor speed to a minimum:

- 1 Turn the CONV button to display **MIN** and press the PAUSE button.
- 2 Turn the CONV button to gradually increase the voltage.
- 3 When the conveyor starts to move, note, on the Calibration Form, the value of PWM (0 to 255) displayed on the left of the screen and the rpm value displayed on the right (see appendix 3 "Calibration Form", Table 3 on page 38).
- 4 Press the PAUSE button to save the minimum speed.



PWM is the acronym for "pulse width modulation" which is a technique to get analog results through digital means. Also referred to as MLI in French for "modulation de largeur d'impulsions".

MAX

The **MAX** function allows you to limit the conveyor speed to a maximum.

To limit the conveyor speed to a maximum:

- 1 Turn the CONV button to display the **MAX** function and press the PAUSE button.
- 2 Turn the CONV button to gradually increase the voltage until you reach the desired maximum speed
- 3 On the Calibration Form, note the PWM (0 to 255) displayed on the left of the screen and the rpm value displayed on the right (see appendix 3 "Calibration Form", Table 3 on page 38).
- 4 Press the PAUSE button to save the maximum speed.

4.1.3 Adjustment of the Spreading Flow Rate

This section presents the adjustment of the material flow rate.

IMPORTANT

It is essential to make this adjustment for at least one of the materials having a different trap height. For other materials having the same trap height of the material for which the flow rate is calibrated, you can simulate the procedure without the calibration box and empty going all the way to the same number of rotations of the conveyor motor as for the material that has just been calibrated with the same trap height. You can use the AUTO-C function (see section "AUTO-C" on page 13).

Make sure you have the spreader Calibration Form at hand (see appendix 3 "Calibration Form", on page 38).

The adjustment of the salt spreading flow rate is done through the **SALT** which is selected by turning the CONV button. Adjustment functions are: **CALIBR** and **AUTO-C**.



Figure 4-3 CONV button

CALIBR

The **CALIBR** is used to fill an open form under the spinner (preferably 1/4 cubic meter).

To fill the form:

- 1 Turn the CONV button while in the **SALT** menu to display **CALIBR** and press the PAUSE button.
The controller displays **START**.
- 2 Start the adjustment by turning the CONV button and select a spreading speed that approximately corresponds to the flow rate generally used during operation.
- 3 When the form is full, turn the CONV button to the left until the conveyor stops.
- 4 Note the cumulative value that appears on the right of the display, in the Calibration Form, in the Revolution Number column of Table 4 (see Appendix 3 "Calibration Form" on page 38).
- 5 Press the PAUSE button to save the calibration.

The controller displays a default estimated value in kg for 1/4 cubic meter of the material calibrated.

If this value is correct for your material, press PAUSE to confirm the weight in kg of the material that has just been unloaded.

If this value is incorrect, select the corresponding value for your material by turning the CONV button and note this value in the Calibration Form.

- 6 Press the PAUSE button to confirm.
- 7 Press the MAT. TYPE button and note the constant, in the Calibration Form, in the Calibration Constant g/p column of the Table 4.



It is possible to modify the calibration constant:

1. Press once the MAT. TYPE button.
2. Press the PAUSE button, the first digit of the constant blinks.
3. Change the value by turning the SPIN button and confirm this value by pressing the PAUSE button.
4. Repeat step 3 for the 4 other digits.

There is a verification procedure to ensure the filling process. Use the **TEST** function in the **SALT** menu.



Make sure that the trap height is the one kept for the salt.

It is possible to pause the calibration by turning the CONV button to the left until the controller displays **0** to verify the filling of the form and restart it later if necessary.

It is always possible to cancel the calibration in progress by pressing the MAX button.

The controller displays the conveyor motor rotation in rpm on the left and the cumulative in number of revolutions on the right.

The following table presents the default mass of the materials.

Table 1 Factory default weight of materials for 1/4 m³

Material	Salt	Sand	Material A (MAT A)	Material B (MAT B)
Default weight	325 kg	420 kg	370 kg	370 kg

AUTO-C

The **AUTO-C** function allows you to make an automatic calibration of the sand, A (MAT A) and B (MAT B) materials. It considers the weight of each material and the material calibration reference (sand, Mat A and Mat B) from the calibration of the salt material.

The following table presents the volume weight that the controller takes into account.

Table 2 Volume weight for the automatic calibration calculation

Material	Salt	Sand	Material A (MAT A) 50% salt et 50% sand	Material B (MAT B) 25% salt et 75% sand
Default weight	1300 kg/m ³	1680 kg/m ³	1455 kg/m ³	1555 kg/m ³

To perform the material automatic calibration:

- 1 Turn the CONV button in the **SALT** menu to display **AUTO-C** and press the PAUSE button.
- 2 Turn the SPIN button to select **YES** and press the PAUSE button.

4.1.4 Adjustment of the Spreading Width

The adjustment of the spreading width is done at the time of the spinner speed calibration. The **CALIBR** function is accessible from the **WIDTH** menu which is selected by turning the CONV button.



It is recommended to perform this adjustment with the salt so that the spreading width of the salt is as precise as possible.

Also mind the place where you want the salt to fall (position of the chute/spinner, rotation direction of the spinner).

To adjust the spinner width:

- 1 Turn the CONV button to select **CALIBR** and press the PAUSE button.

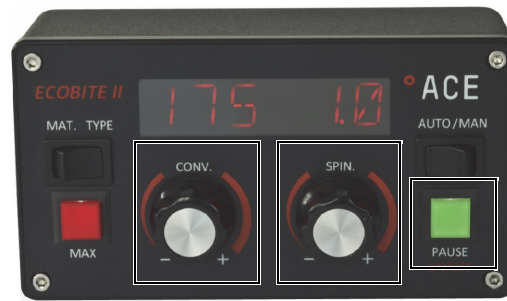


Figure 4-4 CONV, SPIN, and PAUSE buttons

- 2 Turn the CONV button to bring the material to the spinner.
- 3 Turn the SPIN button to adjust the spinner speed until the width reaches 0.5 m and press the PAUSE button to save this width.
- 4 Turn the SPIN button again until the width is 3 m and press the PAUSE button to save this width.
- 5 Press the PAUSE button.

The controller displays the **SAVED** message.



During the adjustment, the controller displays the energy sent to the solenoid section of the spinner. This value appears on the right of the display at the time of the operation. Note the value for both widths (0.5 m and 3 m) in Table 5 Spinner calibration (see appendix 3 "Calibration Form" on page 38).

4.2 Custom Settings

The controller is configured at the factory according to MTQ (Ministère des transports du Québec) recommendations; these settings can be customized.

The controller configuration allows the spinner to perform functions for which it is intended within defined limits and manner. That way, the operator will use the spinner controller within the expected limits.

To access the Configuration mode, press, at the same time, the MAX and PAUSE buttons for 2 seconds (for more information, refer to chapter "Configuration" on page 7).

Before starting the configuration, it is necessary that the personnel responsible of operations has ruled on the points presented in the spreading parameter form (see either appendix 1 or 2 according to the units you are using kg/km or g/m²).



IMPORTANT

Make sure that starting the conveyor and/or the spinner cannot cause a hazardous situation. It is always possible to stop the conveyor and/or the spinner during an adjustment procedure by pressing the MAX button.

4.2.1 Number and Name of Materials

The configuration is performed through the **SALT**, **SAND**, **MAT A**, or **MAT B** menus; which are accessible by turning the CONV button. Each menu provides the ability to activate the function and choose the name of the material. Options are: **ACTIVE** and **NAME**.

ACTIVE

The **ACTIVE** function of each material menu makes this material available for spreading work. By default, the 4 possible materials are activated.

To activate a specific material:

- 1 Turn the CONV button to select **ACTIVE** and press the PAUSE button.



Figure 4-5 CONV and SPIN buttons

- 2 Turn the SPIN button to select **ON** if you want to use that material or **OFF** if you do not need it.
- 3 Press the PAUSE button to confirm your selection.

NAME

The **NAME** function of each material allows you to replace the material name with one of your choosing. That name must consist of a maximum of 6 alphanumeric characters. This modification only appears when in the Operation mode.

To name a material:

- 1 Turn the CONV button to select **NAME** and press the PAUSE button.
The name actually used is displayed and the first character is blinking.
- 2 Turn the SPIN button to select the first character of the new name.
- 3 Press the PAUSE button to confirm your selection and move to the next character.



If the new name has less than 6 characters, complete the process by saving empty fields by pressing the PAUSE button.

When saving the 6th character, the Pulsar displays **SAVED** and returns to the **NAME** function. The new name is now saved.

4.2.2 Spreading Calculation Mode (kg/km or g/m²)

It is important to define what units you want the controller to use.

In the linear mode (kg/km), the controller does not take into account the selected width. It calculates in kilograms per kilometer. In that mode, the flow rate is independent of the spreading width. Therefore, if the operator must spread the same recipe over a larger area, he will have to change the width and the rate parameters (proportionally to the width increase).

In surface mode (g/m²), the controller takes into account the selected width. It calculates in grams per square meter. It automatically enslaves the spreader flow rate to the selected width. It allows permits to have more precise spreading rules.

To select the spreading calculation:

- 1 Turn the CONV button to select the **MODE** menu and press the PAUSE button.



Figure 4-6 CONV and SPIN buttons

- 2 Turn the CONV button to select **EPD M** and press the PAUSE button.
- 3 Turn the SPIN button to select **KG/KM** or **G/M2** and press the PAUSE button.
- 4 Press the MAX button to quit the menu.

To rapidly find the selected spreading type:

- 1 Turn the SPIN button to zero.

If the **0.0** display over the SPIN button is blinking, the controller is set in g/m². The blinking indicates that with this width, in the g/m² mode, no material is being spread.

4.2.3 Configuration of Rate and Percentage Limits of Liquid per Material

This section presents the functions of the **SALT**, **SAND**, **MAT A**, and **MAT B** menus. These menus for materials include the following functions: **KK/MIN**, **KK/MAX**, **S-AUTO**, **S-EDIT**, **S-MAN**, and **LIQ PC**.

The selections are made using the CONV and SPIN buttons.



Figure 4-7 CONV and SPIN buttons

KK/MIN

The **KK/MIN** (GM/MIN) function allows you to determine the minimum spreading value for the selected material.

To determine the minimum spreading value:

- 1 Turn the CONV button to display **KK/MIN** and press the PAUSE button.
The value currently used is displayed.
- 2 Turn the SPIN button to select the minimum spreading value of your choosing and press the PAUSE button to confirm your choice.

KK/MAX

The **KK/MAX** (GM/MAX) function allows you to determine the maximum spreading value for the selected material. This value will be the maximum spreading limit controllable by the operator.

To determine the maximum spreading value:

- 1 Turn the CONV button to display **KK/MAX** and press the PAUSE button.
The value currently used is displayed.
- 2 Turn the SPIN button to select the maximum spreading value of your choosing and press the PAUSE button to confirm your choice.

S-AUTO

The **S-AUTO** function allows you to change the scale of the variation rate steps for this material in automatic mode. This function is only available if the **S-PRG** function of the **MODE** menu is inactive.

To determine the scale of the variation rate steps:

- 1 Turn the CONV button to display **S-AUTO** and press the PAUSE button.
The value currently used is displayed.
- 2 Turn the SPIN button to select the step of your choice and press the PAUSE button to confirm your choice.

S-EDIT

The **S-EDIT** function allows you to specify up to 8 spreading flow rate. The values are preconfigured at the factory but can be changed.



The **S-EDIT** function allows you to specify 8 steps per material (if the **S-PRG** function is active). To specify less than 8 steps, enter **0** as the last value.
The table of factory-preset values is available in appendix 1, in Table 3 on page 31.

To modify the spreading flow rate:

- 1 Turn the CONV button to display **S-EDIT** and press the PAUSE button.
The value currently used for the first spreading flow rate is displayed.
- 2 Turn the SPIN button to modify the flow rate.
OR
Press the PAUSE button to keep the current value and move to the next flow rate.

S-MAN

The **S-MAN** function allows you to change the scale of the variation rate steps for this material in manual mode.

To change the scale of the variation rate steps:

- 1 Turn the CONV button to display **S-MAN** and press the PAUSE button.
The value currently used is displayed.
- 2 Turn the SPIN button to select the step of your choice and press the PAUSE button to confirm your choice.

LIQ PC

The **LIQ PC** (liquid %) function allows you to ascribe to one or more materials a percentage of liquid weight with regards to the solid weight (for example 5%). The controller will activate the fixed output of liquid when the rate is greater than 0 (see appendix 7 on page 44, 910-OUTLIQECO). The report generated by the INFOBITE software automatically calculates the theoretical quantity of spread liquid according to the ascribed rate.



This configuration cannot be modified by the operator.

By identifying the name of a dry product (for example, DRY SALT) compared to a humidified product (for example, HUM SALT), this provides the operator the possibility to choose between wetting and not wetting the salt.

To configure a liquid percentage:

- 1 Select the material to humidify and then turn the CONV button to display **LIQ PC** and press the PAUSE button.
- 2 Turn the SPIN button to select the wetting percentage (0 by default) and press the PAUSE button to confirm your choice.

4.2.4 Configuration of the Spreading Width

The **WIDTH** menu allows you to insure the configuration of the spreading width by modifying the spinner speed. This menu includes the following functions: **STOP**, **MAX/W**, and **STEPS**.



Figure 4-8 CONV and SPIN buttons

Selections are made by using the CONV and SPIN buttons.

STOP

The **STOP** function allows you to control the spinner rotation. If it is at the ON position, the spinner only rotates when the conveyor is in operation. If it is at the OFF position, the spinner rotates continually as long as the controller is in the operation mode.



Some valve models require that the conveyor is in operation in order for the spinner to work. It will therefore not be possible to have the spinner work when the vehicle is stopped.

To configure the spinner control:

- 1 Turn the CONV button to display **STOP** and press the PAUSE button.
- 2 Turn the SPIN button to select **ON** or **OFF** and press the PAUSE button to confirm your choice.

MAX/W

The **MAX/W** function allows you to determine the maximum spreading width.

To configure the maximum spreading width:

- 1 Turn the CONV button to display **MAX/W** and press the PAUSE button.
- 2 Turn the SPIN button to select the new maximum width value and press the PAUSE button to confirm your choice.

STEPS

The **STEPS** function allows you to change the scale steps variation of the spreading width: either 0.5 for 0.5 m or 1.0 for 1.0 m.

To configure the scale steps variation of the spreading width:

- 1 Turn the CONV button to display **STEPS** and press the PAUSE button.
- 2 Turn the CONV button to select the step and press the PAUSE button to confirm your choice.

4.2.5 Blast Configuration

The MAX button is used to start a blast, which is an increased spreading over a short distance.



Figure 4-9 MAX button

When the operator presses the MAX button, the controller automatically applies the configured rate, width, and duration. At low speeds, it simulates a configurable minimum speed (see the "MIN/S" function on page 22).

When a blast is in operation, the display intermittently indicates the applied blast rate or the word **MAX** in manual mode. A beep confirms the end of the blast operation.

The blast configuration per material is done in the **MAX** menu, which is selected by turning the CONV button. This menu includes the following functions: **SALT**, **SAND**, **MAT A**, **MAT B**, **MAXMAN**, **DURATION**, **MIN/S**, **CONT**, and **WIDTH**.



The possible values for the blast rate are between 0 and 995 and for widths between 0.5 and 9.5 m.

See section "WIDTH" on page 22 if you want the spinner to continue to turn at its regular speed during a blast.

SALT, SAND, MAT A, and MAT B

The **SALT**, **SAND**, **MAT A**, and **MAT B** functions allow you to choose the spreading rate and width while proceeding with a blast of these materials.

To configure the spreading rate and width:

- 1 Turn the CONV button to display the material and press the PAUSE button.
- 2 Turn the CONV button to select the blast rate.
- 3 Turn the SPIN button to select the blast width.
- 4 Press the PAUSE button to confirm your choices.

MAXMAN

The **MAXMAN** function allows you to select the conveyor speed and the spinner speed while proceeding with a blast in manual mode.

To configure the conveyor speed and the spinner speed:

- 1 Turn the CONV button to display **MAXMAN** and press the PAUSE button.
- 2 Turn the CONV button to select the conveyor speed (value = <255).
- 3 Turn the SPIN button to select the width in meters.
- 4 Press the PAUSE button to confirm your choices.

DURATION

The **DURATION** function allows you to specify the blast duration.



The duration values are between 0 minute 0 second and 99 minutes 59 seconds.

To configure the blast duration:

- 1 Turn the CONV button to display **DURATION** and press the PAUSE button.
- 2 Turn the CONV button to select the number of minutes.
- 3 Turn the SPIN button to select the number of seconds.
- 4 Press the PAUSE button to confirm your choices.

MIN/S

The **MIN/S** function allows you to set the blast for minimum vehicle speeds between 0 and 50 km/h. The speed is preconfigured at the factory at 20 km/h but can be modified.

When the vehicle moves at a slow speed, blast, even at an elevated rate, does not necessarily provide enough material. In that case, the controller takes into account a minimum theoretical speed in order to force the blast. If the vehicle move at a speed under the theoretical one (for example, if the wheels lock), the controller will ensure spreading for the minimum programmed speed.

To configure the minimum speed:

- 1 Turn the CONV button to display **MIN/S** and press the PAUSE button.
- 2 Turn the SPIN button to select the minimum speed.
- 3 Press the PAUSE button to confirm your choice.

CONT

The **CONT** function allows you to choose to continue the blast even if the vehicle is immobile or that the spreading stops when it is immobile.

To allow the blast when the vehicle is immobile:

- 1 Turn the CONV button to display **CONT** and press the PAUSE button.
- 2 Turn the SPIN button to select **ON** to allow the blast when the vehicle is immobile or **OFF** in order for the spreading to stop when it is immobile.
- 3 Press the PAUSE button to confirm your choice.

WIDTH

The **WIDTH** function allows you to control the spreading width in the blast mode 3 ways:

- The spreading width for the blast is the one permanently defined (**PERM**).
- The spreading width for the blast is the one defined, but is possible to vary it using the SPIN button during the blast (**TEMP**). In that case, at the end of the blast, the width value returns to the one defined before the blast.
- The spreading width for the blast remains the same as in normal spreading without taking into account the adjusted value in the blast configuration (**OFF**).

To control the spreading width in the blast mode:

- 1 Turn the CONV button to display **WIDTH** and press the PAUSE button.
- 2 Turn the SPIN button to select **OFF**, **PERM**, or **TEMP**.
- 3 Press the PAUSE button to confirm your choice.

4.3 Additional Functions

This section presents the functions of the Configuration mode available in many menus that allow you to choose additional settings.

To access the Configuration mode, press, at the same time, the MAX and PAUSE buttons for 2 seconds (for more information, refer to chapter "Configuration" on page 7).

Selections are made using the CONV and SPIN buttons.



Figure 4-10 CONV and SPIN buttons

LANGUAGE

The **LANGUAGE** function allows you to choose the display language (French or English).

To choose the display language:

- 1 Turn the CONV button to display **LANGUAGE** and press the PAUSE button.
- 2 Turn the SPIN button to select **FR** (French) or **EN** (English).
- 3 Press the PAUSE button to confirm your choice.

MAXSPD

The **MAXSPD** function allows you to define the spreading maximum speed. If, while in the spreading operation, the vehicle moves at a greater speed than the maximum value defined, the controller emits a beep.

To define the spreading maximum speed:

- 1 Turn the CONV button to display **MAXSPD** and press the PAUSE button.
- 2 Turn the SPIN button to select the maximum speed (between 0 and 99 km/h).
- 3 Press the PAUSE button to confirm your choice.



If you select 0 km/h, the beep is deactivated.

CODE

The **CODE** function allows you to add or modify a 4 digit access code to the Configuration menu. The 1234 access code (by default) is not requested to access the Configuration menu, but any other one will be needed.



IMPORTANT

If you have forgotten the access code, only an ACE, Accent Contrôles Électroniques technician can unlock the controller (see section "Contact" on page 29).

To add or modify an access code:

- 1 Turn the CONV button to display **CODE** and press the PAUSE button.
- 2 Turn the SPIN button to select the first digit of the code (between 1 and 9).
- 3 Press the PAUSE button to confirm your choice.
- 4 After confirmation of the fourth digit, repeat the setting of the new code following the same procedure.

#SERIE

The **#SERIE** (**FACTORY** menu) function allows you to display the unit serial number.

To display the serial number:

- 1 Turn the CONV button to display **#SERIE** and press the PAUSE button.
The serial number is displayed.

#EPAND

The **#EPAND** (**FACTORY** menu) function allows you to display the spinner number of the unit. This number is necessary to link the Pulsar to a GPS positioning system. This number is composed of 8 characters (digits and letters).

To display the spinner number:

- 1 Turn the CONV button to display **#EPAND** and press the PAUSE button.
The spinner number is displayed.



If the Pulsar displays **NONE** is that this option is inactive. You can activate it using a code that you enter in the **GPSACT** menu. You can get this code by contacting your distributor or ACE, Accent Contrôles Électroniques Inc. (see section "Contact" on page 29).

GPSACT

The **GPSACT** function allows you to activate the RS-232 port of the GPS.



You can get this code by contacting your distributor or ACE, Accent Contrôles Électroniques Inc. (see section "Contact" on page 29).

To activate the GPS port:

- 1 Turn the CONV button to display **GPSACT** and press the PAUSE button.
- 2 Turn the SPIN button to select the first digit of the code (from 1 to F).
- 3 Press the PAUSE button to confirm your choice and move to the next character.
- 4 Continue until the last character is configured.

After confirmation of the last character, the spinner number is displayed and the GPS port is activated.



To deactivate the GPS port, enter the activation code a second time.

F-SET

The **F-SET** (**FACTORY** menu) function allows you to reset all controller data to the factory values.

**IMPORTANT**

When you reset the controller, all the parameters you have configured as well as your operation data are lost.

To reset all controller data:

- 1 Turn the CONV button to display **F-SET** and press the PAUSE button.
- 2 Turn the SPIN button to select **YES**.

The **NO** cancels the reset operation.

VALVE

The **VALVE** (**VALVE** menu) function allows you to select the valve model used with controller.

To select the valve model:

- 1 Turn the CONV button to display **VALVE** and press the PAUSE button.
- 2 Turn the SPIN button to select your valve type.
If you cannot find your valve type, select ACE (default value).
- 3 Press the PAUSE button to confirm your choice.

FRQ HZ

The **FRQ HZ** (**VALVE** menu) function allows you to select the frequency recommended by the manufacturer (225 Hz for ACE valves).

To select the frequency:

- 1 Turn the CONV button to display **FRQ HZ** and press the PAUSE button.
- 2 Turn the SPIN button to select the frequency closest to the one recommended by the manufacturer of the hydraulic valve (14/28/56/112/225/450/900).
- 3 Press the PAUSE button to confirm your choice.

BOOST (CONV menu)

The **BOOST (CONV menu)** function allows you to reduce the delay of the material arrival to the ground at the start of the spinner. The conveyor moves more rapidly for a while at the start of the vehicle in order to feed the spinner with materials faster. It is possible to select the conveyor speed and the duration of it.



The duration can be adjusted between 0 and 10 seconds in steps of 0.5 second.

To reduce the delay of the material arrival to the ground:

- 1 Turn the CONV button to display **BOOST** and press the PAUSE button.
- 2 Turn the CONV button to select the desired speed.
- 3 Turn the SPIN button to select the desired duration.
- 4 Press the PAUSE button to confirm your choice.

M/PPR

The **M/PPR (CONV menu)** function allows you to select the number of pulses generated by the speed sensor of the conveyor hydraulic motor (30 for ACE).

To select the number of pulses generated by the speed sensor of the conveyor hydraulic motor:

- 1 Turn the CONV button to display **M/PPR** and press the PAUSE button.
- 2 Turn the SPIN button to select the number of pulses generated by your sensor model.
- 3 Press the PAUSE button to confirm your choice.

TEST

The **TEST** (in the **SALT**, **SAND**, **MAT A**, and **MAT B** menus) function allows you to verify if the material configuration of the material is working properly.



IMPORTANT

The form must be just full enough so that the test is conclusive.

To perform the configuration test:

- 1 Turn the CONV button to display **TEST** and press the PAUSE button.
- 2 Enter the weight, in kg, of the material that will be used for the test.
This quantity should be the same as the one defined at the time of the configuration.
- 3 Press the PAUSE button.
- 4 Turn the CONV button to select the conveyor speed.

The SPIN button allows you to limit the spinner speed so that the material stays in the ground form. When the quantity of the dumped material is equal to the one in the configuration, the conveyor stops. The screen displays **TEST COMPLETED** and a beep is emitted.

BOOST (WIDTH menu)

The **BOOST** function allows you to increase the energy sent to the spinner motor solenoid for a certain duration at the start of the spinner in order to trigger the rotation of the spinner motor of low-displacement engine. It is possible to select the increase of the spinner energy and its duration.

To select the increase of the spinner energy and its duration:

- 1 Turn the CONV button to display **BOOST** and press the PAUSE button.
- 2 Turn the CONV button to select the increase of the spinner energy.



The selected energy increase is added to the one of the spinner.

- 3 Turn the SPIN button to select the desired duration.
The duration adjustment is between 0 and 10 seconds in steps of 0.5 seconds.
- 4 Press the PAUSE button to confirm your choice.

MAN

The **MAN (MODE menu)** function allows you to manually control the spreading:

- Inactive (**DISABLED**)
- Stopped (**STOP**) for the immobile unloading (speed <3 km/h) without quantity calculation.
- Always (**ALWAYS**) available in normal spreading with quantity calculation.

To use the manual spreading:

- 1 Turn the CONV button to display **MAN** and press the PAUSE button.
- 2 Turn the SPIN button to select **DISABLED**, **STOP**, or **ALWAYS** and press the PAUSE button.

S-PRG

The **S-PRG (MODE menu)** function allows you to configure up to 8 spreading rate for each material. When selecting this mode, it is possible to configure steps for each material using the **S-EDIT** function (see the table in appendix 1 and the "S-EDIT" function on page 18).



IMPORTANT

The **S-EDIT** function is unavailable if the **S-PRG** function is activated. If the **P-PRG** function is not activated it is the **S-AUTO** function that is available.

To configure the spreading rate:

- 1 Turn the CONV button to display **S-PRG** and press the PAUSE button.
- 2 Turn the SPIN button to select **ON** to activate this mode and press the PAUSE button.

MNUCNT

The **MNUCNT** (**MODE** menu) function allows you to activated the controller meter. By default, it is activated. The available information list and instructions are indicated in appendix 4.

To activate the controller meter:

- 1 Turn the CONV button to display **MNUCNT** and press the PAUSE button.
- 2 Turn the SPIN button to select **ON** to activate the meters and press the PAUSE button.

The **OFF** parameter deactivates them.

5 Warranty and Contact

This chapter presents the warranty for the electronic products manufactured by ACE as well as contacts to reach people of ACE if you have questions.

5.1 Warranty

Accent Contrôles Électroniques Inc. (ACE) warrants to buyers of electronic products and accessories manufactured by ACE that they are not defective and are free of manufacturing or material defects.

The warranty obligations of ACE toward the buyer are limited to, with the sole ACE discretion, repair or replacement of parts or the product in question; which, under normal usage conditions and maintenance, are proved defective in either material or labour.

Claims under this warranty will be valid only if the buyer notifies ACE, in writing, of the discovery of the defects in question and this in a time period not exceeding twenty four (24) months from the date of the product expedition by ACE.

On ACE's request, the buyer has to return to the manufactory or to a service center designated by ACE, and this prepaid, parts or product for which a warranty claim is made.

The buyer will be responsible for risks of loss and damage of products and parts, so returned.

In case of warranty acceptance, ACE covers the costs of returning parts or product.

ACE's warranty does not cover:

- Wear and tear, abuse, misuse, overload, or changes.
- Costs for transportation, installation, replacement, repair outside the factory or any other costs related to the return of the product to ACE or to an authorized service center.
- The responsibility for direct, indirect, or consequential or incidental damages, or any delays.

No employee or representative of ACE is allowed to modify any warranty in any way nor provide any other warranty without these changes be made in writing and signed by a an ACE executive officer.

5.2 Contact

If you have questions about the Pulsar or the INFOBITE, do not hesitate to contact us.

Visit our Web site or call us:

www.aceelectronic.ca

ACE, Accent Contrôles Électroniques Inc.

29, Giroux street
Quebec (Quebec) Canada, G2B 2X8
Telephone: (418) 847-6344
Fax: (418) 847-8541

Appendix 1 Configuration Grid

This chapter presents the spreader, materials, and blast settings.

Table 1 Spreader

Brand	Type	Year	number	Controller	Serial Number

Configuration Date	Programmer`s Name

Comments

Table 2 Settings independent of the MODE selected to define spreadings

Menu	Function	Page	Parameter	Factory Setting	Available Setting	Choice
VALVE	VALVE	25	VALVE Type	ACE	ACE/57-11/40-08/23-05	
	FRQ HZ	25	Recommended frequency	225 Hz	14/28/56/112/225/450/900	
CONV (conveyor)	MIN	10	Conveyor startup	60	20 - 120	
	MAX	11	Conveyor speed limit	180	MIN - 255	
	BOOST	26	Blast startup and duration	75 et 1.0 s	0 - 255 et 0 - 10	
	M/PPR	26	Conveyor pulse sensor	30	10 - 100	
WIDTH	MAX/W	20	Maximum width	3.0 m	0.5 - 9.5	
	BOOST	27	Blast startup and duration	5 et 0.5 s	0 - 100 - 255 et 0 - 10 0.10	
	STOP	19	Automatic stop	ON	ON - OFF	
	STEPS	20	Variation step	0.5 m	0.5 - 1.0	
MAXSPD		23	Maximum speed alarm	50 KM/H	0 - 99 KM/H	
CODE		24	CODE to limit access to the Configuration	Default 1234	0000 - 9999	

Table 2 Settings independent of the MODE selected to define spreadings (*continued*)

Menu	Function	Page	Parameter	Factory Setting	Available Setting	Choice
MODE	MAN	27	Manual MODE	Stop	DISABLED, STOP, ALWAYS	
	MNUCNT	28	Manual data collection	ON	ON - OFF	
	S-PRG	27	ON=S-AUTO OFF=S-EDIT	ON	ON - OFF	
	EPD M	16	Spreading MODE	kg/km	KG/KM - G/M2	

Table 3 Material configuration

Menu	Function	Page	Parameter	Factory Setting		Available Setting						Choice
SALT	KK/MIN	17	Minimum rate	50		0 - 995						
	KK/MAX	17	Maximum rate	350		MIN - 995						
	ACTIVE	15	Available material	ON		ON - OFF						
	S-AUTO	18	Variation step	25		5/10/25/50/75/100						
	S-EDIT	18	8 available rates	65	85	100	130	150	170	195	0	
			Configured rate									
	S-MAN	18	Step manual MODE	5		1 - 5 - 10						
	LIQ PC	18	% liquid	0		0 (OFF) - 99						
	NAME	15	Material name	SALT		6 alphanumerical charact.						
	Constant			40.00								
SAND	KK/MIN	17	Maximum rate	200		0 - 995						
	KK/MAX	17	Maximum rate	700		MIN - 995						
	ACTIVE	15	Available material	ON		ON - OFF						
	S-AUTO	18	Variation step	50		5/10/25/50/75/100						
	S-EDIT	18	8 available rates	300	400	600	800	900	0	0	0	
			Configured rates									
	S-MAN	18	Step in manual MODE	5		1 - 5 - 10						
	LIQ PC	18	% liquid	0		0 (OFF) - 99						
	NAME	15	Material name	SAND		6 alphanumerical charact.						
	Constant			51.69								

Table 3 Material configuration (continued)

Menu	Function	Page	Parameter	Factory Setting		Available Setting						Choice
MAT A	KK/MIN	17	Minimum rate	150		0 - 995						
	KK/MAX	17	Maximum rate	500		MIN - 995						
	ACTIVE	15	Available material	ON		ON - OFF						
	S-AUTO	18	Variation step	50		5/10/25/50/75/100						
	S-EDIT	18	8 available rates	300	400	600	800	900	0	0	0	
			Configured rates									
	S-MAN	18	Step in manual MODE	5		1 - 5 - 10						
	LIQ PC	18	% liquid	0		0 (OFF) - 99						
	NAME	15	Material name	MAT A		6 alphanumerical charact.						
	Constant			45.29								
MAT B	KK/MIN	17	Minimum rate	150		0 - 995						
	KK/MAX	17	Maximum rate	500		MIN - 995						
	ACTIVE	15	Available material	ON		ON - OFF						
	S-AUTO	18	Variation step	50		5/10/25/50/75/100						
	S-EDIT	18	8 available rates	300	400	600	800	900	0	0	0	
			Configured rates									
	S-MAN	18	Step in manual MODE	5		1 - 5 - 10						
	LIQ PC	18	% liquid	0		0 (OFF) - 99						
	NAME	15	Material name	MAT B		6 alphanumerical charact.						
	Constant			45.71								

Table 4 Blast configuration

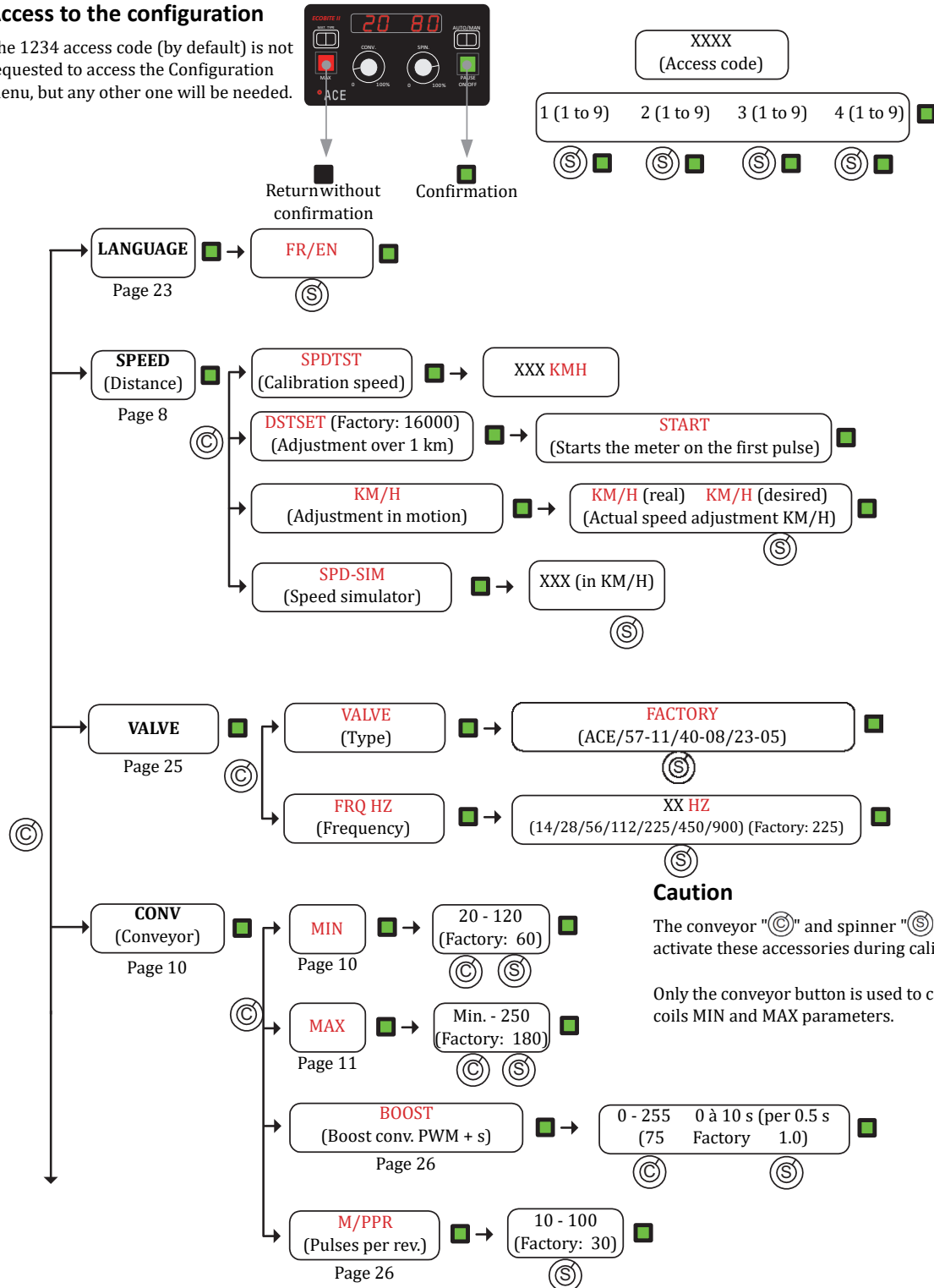
Menu	Function	Page	Parameter	Factory Setting	Available Setting	Choice
MAX	SALT	21	Blast rate	350	0 - 995	
			Blast width	3.0 m	0.5 - 9.5	
	SAND	21	Blast rate	700	0 - 995	
			Blast width	3.0 m	0.5 - 9.5	
	MAT A	21	Blast rate	500	0 - 995	
			Blast width	3.0 m	0.5 - 9.5	
	MAT B	21	Blast rate	500	0 - 995	
			Blast width	3.0 m	0.5 - 9.5	
	MAXMAN	21	% conveyor in blast mode	180	60 - 255	
			Blast width	3.0 m	0.5 - 9.5	
	DURATION	21	Blast duration	0 mn 20 s	0 - 99 mn et 0 - 59 s	
	MIN/S	22	Simulated min. speed	20 KM/H	0 - 50 KM/H	
	CONT	22	Behavior when stopped	ON	ON - OFF	
	WIDTH	22	Width behavior	OFF	OFF, PERM, TEMP	

Appendix 2 Configuration Menu

This chapter presents the configuration menus and available parameters for the Pulsar.

Access to the configuration

The 1234 access code (by default) is not requested to access the Configuration menu, but any other one will be needed.



Caution

The conveyor "C" and spinner "S" buttons activate these accessories during calibration.

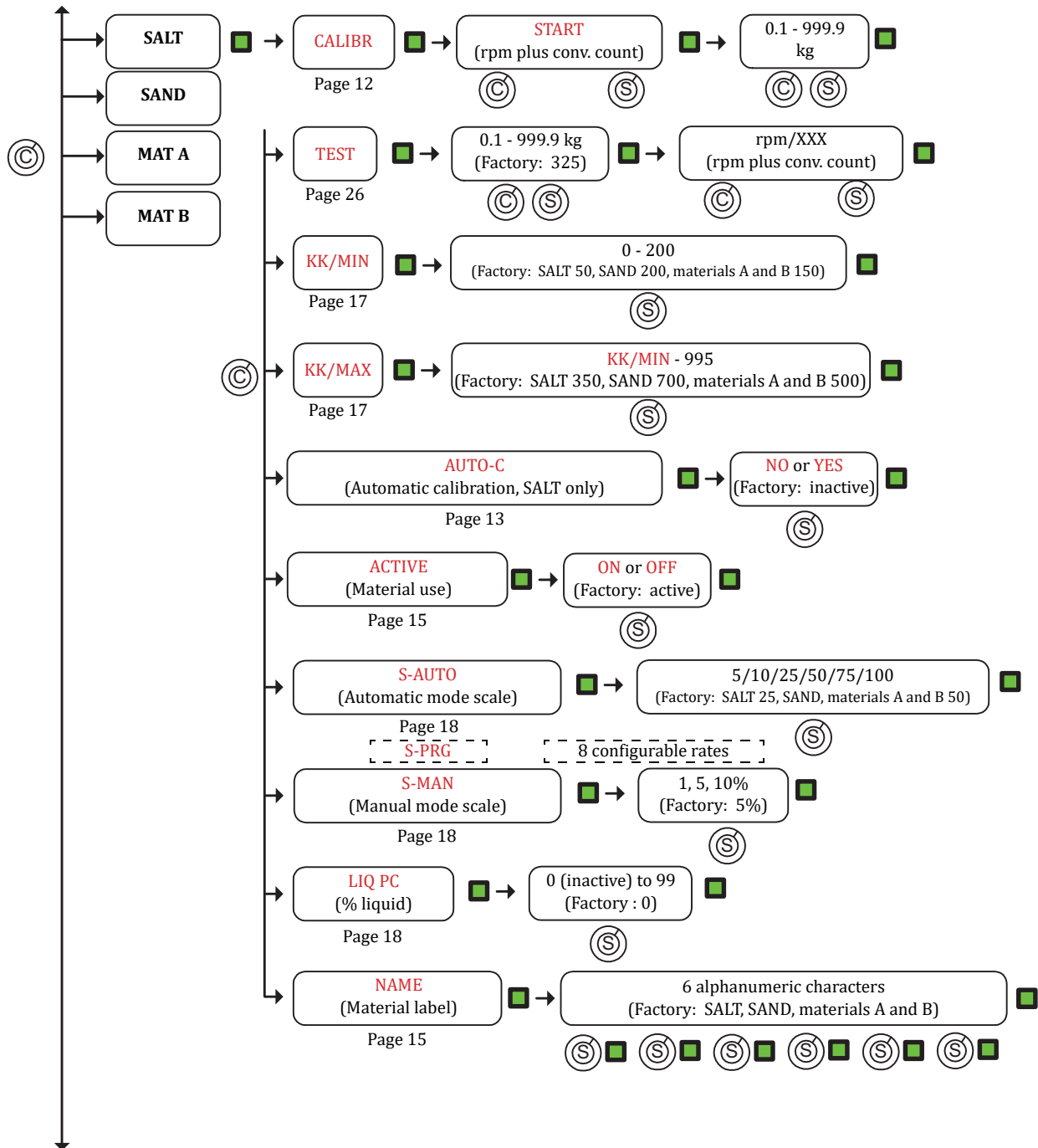
Only the conveyor button is used to calibrate the coils MIN and MAX parameters.

Note

The next four menus (material calibration) are identical except for the **SALT** menu which allows the automatic calibration for all the other materials.

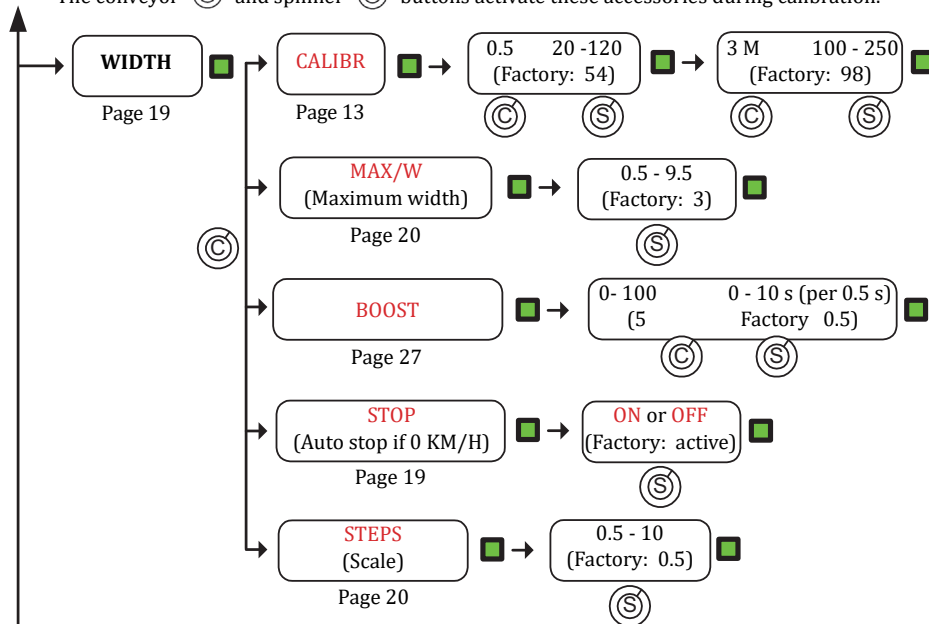
Caution

The conveyor "C" and spinner "S" buttons activate these accessories during calibration.



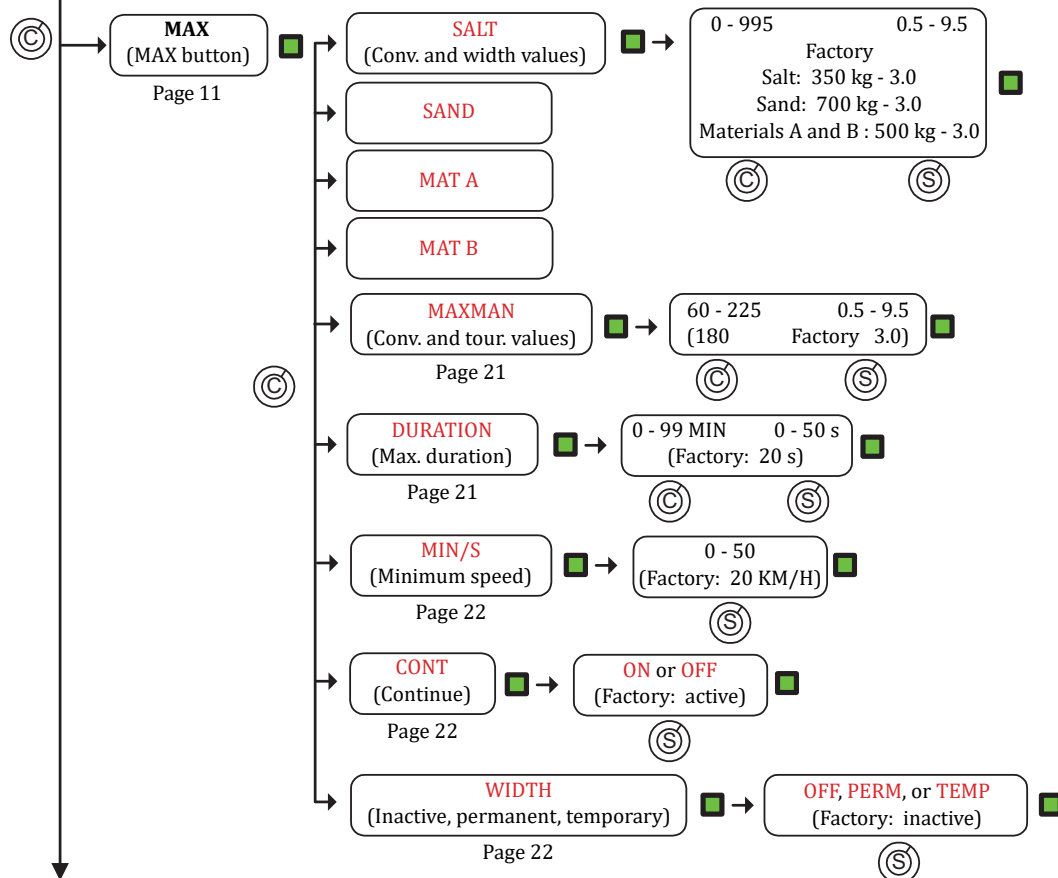
Caution

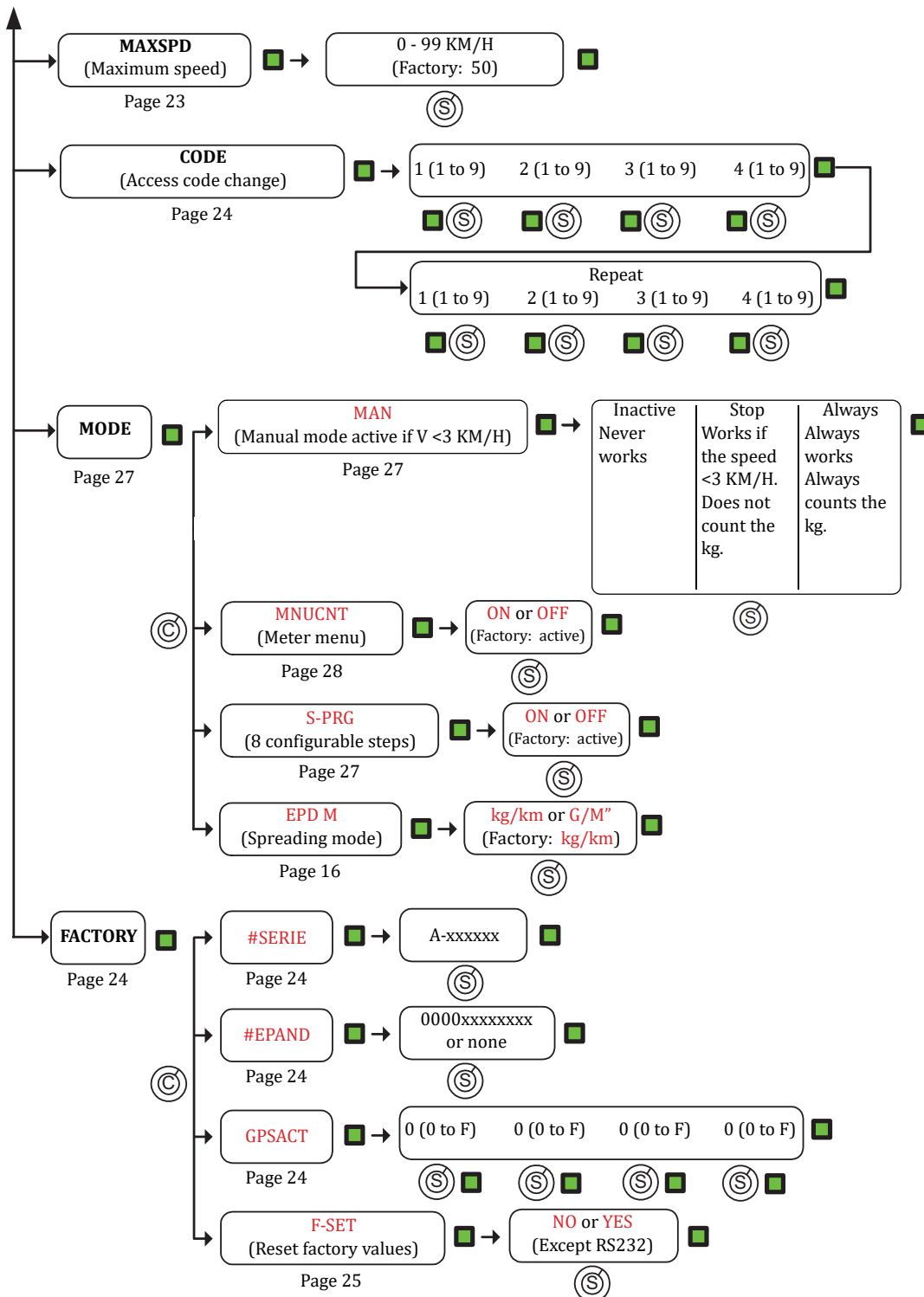
The conveyor "C" and spinner "S" buttons activate these accessories during calibration.



Note

The next four menus (maximum spreading rate) are identical. The conveyor and the spinner are not activated when selecting these parameters.





Appendix 3 Calibration Form

This chapter offers tables to note your calibration information.

Table 1 Owner

Organization:	
Address:	
E-mail:	Phone:
Vehicle model/plate	
Spreader model/Serial num.	
Controller model/Serial num.	

Table 2 Speed calibration

SPEED menu page 8	Method used:	1 1 km ☐	KM/H ☐
	Number of pulses for 1 km:		(Factory: 16000)
	Test: speed obtained at 50 KM/H:		

Table 3 Conveyor calibration (spreader empty and vehicle motor at 1500 rpm)

CONV menu page 10	MIN PWM:	rpm:	(Factory: 60)
	MAX PWM:	rpm:	(Factory: 180)
page 26	BOOST PWM:	s:	(Factory: 75/1.0)

Table 4 Material calibration (spreader at 50%)

Menu	Displayed Name	Mix Proportion (%salt, %sand)	Actual Weight (kg)	Trap Height (cm)	Revolution Number	Default Constant g/p	Calibration Constant g/p (MAT. TYPE opposite CALIBR)	Max. Rate	Capacity KM/H (rate MAX.)
SALT		N/A				40.00			
SAND						51.69			
MAT A						45.29			
MAT B						42.71			

Table 5 Spinner calibration

WIDTH menu page 13	MPOINT 0.5 m:	3.0 m:	(Factory: 54/98)
	Rotation direction:	Clockwise ☐	Counterclockwise ☐
page 27	BOOST PWM:	s:	(Factory: 5/0.5)

Table 6 Made by

Organization:	
Date:	
Address:	
E-mail:	
Phone:	Signature:

Appendix 4 Counter Menu (MNUCNT)

This chapter presents the available menus when the MNUCNT option is activated.

Data available in read only

SPR KM: Kilometers in spreading mode

SPR KG: Kilograms spread

MAX KM: Kilometers traveled in the blast mode (MAX/BLAST)

MAX KG: Kilograms spread in the blast mode (MAX /BLAST)

PAU KM: Kilometers traveled in the Pause mode (PAUSE)

OFF KM: Kilometers traveled with the controller shutdown

To access the data:

- 1 Start the vehicle.
- 2 To start the controller, press the MAT. TYPE button and select the desired material.
- 3 Repeatedly press the MAX button to display the data stored in the memory.

The meter menu automatically closes, when unused, after 10 seconds.



It is possible to change the material type at any time by using the MAT. TYPE button.

To reset the data meter:

- 1 Start the vehicle.
- 2 To start the controller, press the MAT. TYPE button.
- 3 Press the AUTO/MAN button.
- 4 Press the MAX button to reset the data meter.

A message will confirm the reset.



All meters are reset at the same time; it is not possible to reset materials individually.

- Rate of the solid
- Spreading state (On, Pause, Off)
- Spreading width
- Type of solid material (salt, sand, material A, material B)
- Date of the last transfer
- State of the spreading with or without a sensor on the conveyor
- State of the spreading vs. the maximum speed
- Possible errors:
 - Lack of hydraulic capacity
 - Loss of the conveyor sensor signal
 - Lack of solid material
- Motion speed when:
 - The vehicle is on pause
 - The vehicle is spreading
 - The controller is not in operation
- Distance traveled when:
 - The spreader is in pause
 - The spreader is in normal spreading
 - The spreader is in the blast mode
 - The controller is not in operation
- Spread solid material quantities

Appendix 6 Specifications

This chapter presents the Pulsar technical specifications.

Table 1 Overview

Power	14.4 VDC (10.8 V minimum)
Ground	Negative pole
Maximum consumption	15.0 A
Dimensions (L x H x D)	153 x 85 x 50 mm (6 x 3.25 x 2 in.)
Weight	570 g (1 lb 4 oz)
Operating temperature	-40 °C to 75 °C (-40 °F to 167 °F)
Humidity	95% (25 °C to 55 °C)

Table 2 Solenoid valves outputs

Maximum power per output	5.0 A (fuse 7.5 A per output in the housing)
Type of signal per output	Pulse width modulation (PWM)
Output frequency	225 Hz (other frequencies available)
Provided connector type	DIN 43650 / ISO 4400 (EN 175301-803)

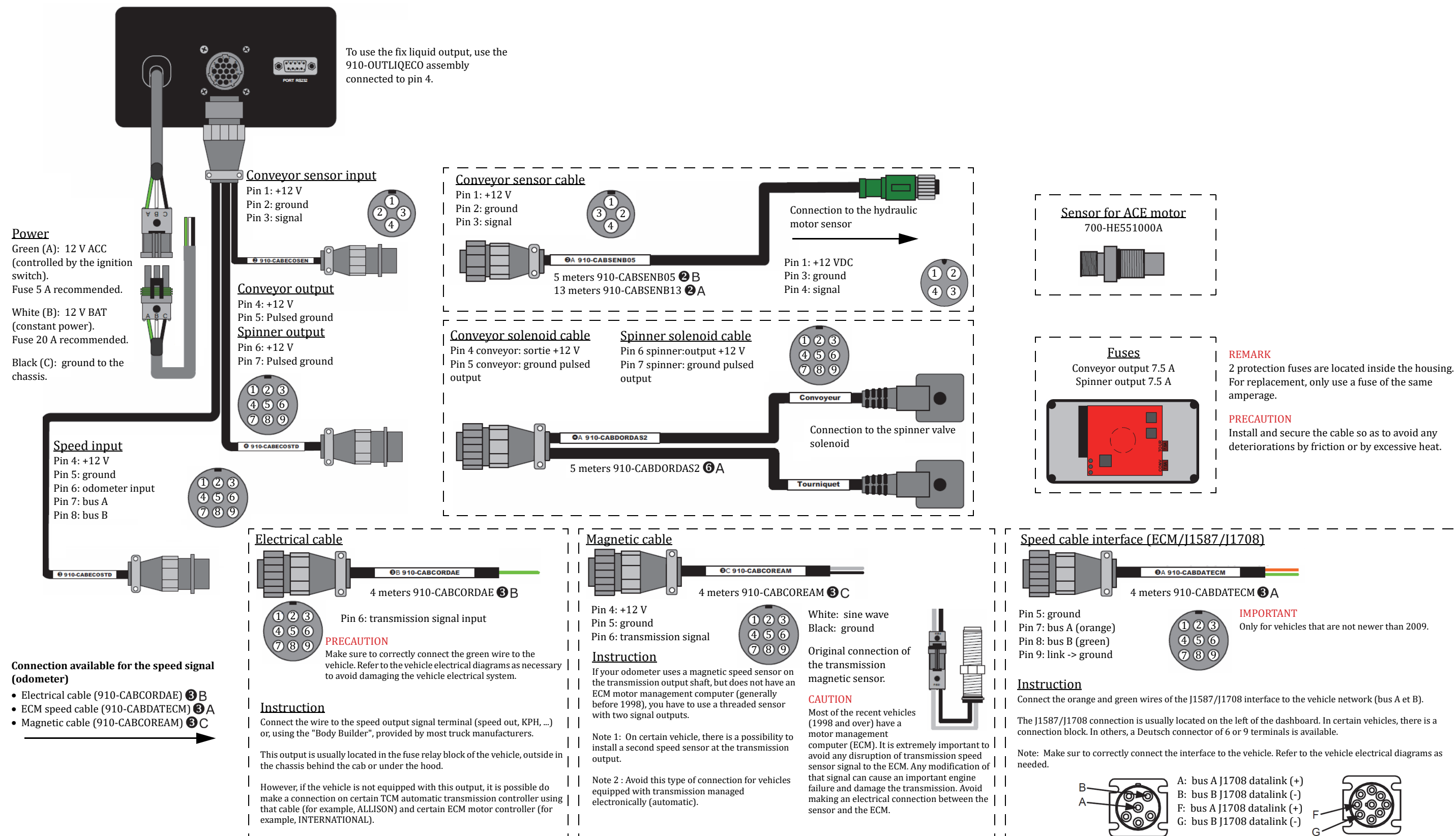


The characteristics and the presentation may be changed without prior notice.

CAUTION

- To prevent short circuits, disconnect the negative battery terminal before installation.
- The maximum consumption of the system is 15 amperes. Make sure that the black ground wire and the white positive wire are fit to support the charge.
- Make sure that all wires and cables are correctly routed and secured to avoid any deterioration caused by excessive heat or wear by friction.
- Never cut the insulation of the controller power cable to share power with another device. An excessive drop of voltage can produce a malfunction of the Pulsar.
- Use dielectric grease on all external electrical connections to avoid the risk of future corrosion.
- Use the console mounting holes; do not make holes in the console casing.
- Cable of specific lengths are available on request, do not cut or modify the electrical cables of the controller.

Appendix 7 Electrical Diagram



Appendix 8 Speed Cable Installation

This chapter presents the installation of the speed cable for the ACE controller for manual transmission.

Magnetic signal (③C 910-CABCOREAM).

