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User manual

Reciprocator Control Module REV 600 Operator Manual

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Reciprocator Control Module
REV 600
Operator Manual

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1. Touch-sensitive Touch Panel

Basic concepts

The screen of the Touch Panel shows the current operational status of the machine or plant. It is also used by the operator to control the course of the process by touching buttons and data entry fields.

1.1. Using the Touch-sensitive Controls

1.1.1. Definition

The touch-sensitive controls are touch-sensitive areas on the Touch Panel screen, including buttons, data entry fields and message windows. They are used in the same way as conventional keys. Press lightly on the touch-sensitive controls with a finger or other object.

Do not use sharp or pointed objects to operate the Touch Panel as these may damage the plastic surface of the touch-sensitive screen.



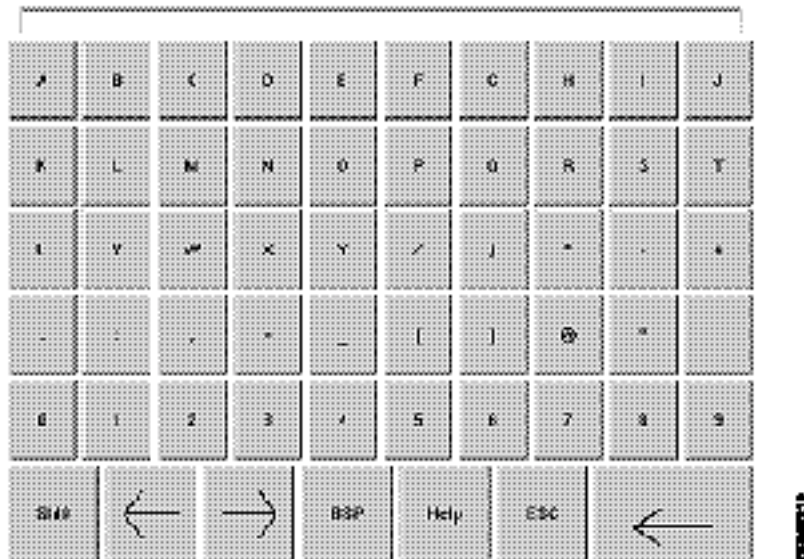
WARNING : Take care to only touch one point on the Touch Panel screen. Touching several touch-sensitive controls at the same time may result in unwanted operations being performed.

1.1.2. Entry of Numerical Values

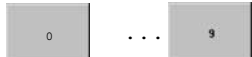






Principle

When entering numerical values, the Touch Panel automatically displays a numerical keypad as soon as a data entry field is touched. The active keys are shown in relief while inactive keys are shown as flat surfaces. The keypad disappears automatically when data entry is complete.

An example of a keypad used to enter numerical values is given below. The hexadecimal keys A to F are disabled in this example. The Help key (TP170 B) is only displayed if a help page exists for the data entry field concerned.



1.1.3. Buttons

| Button | Function | Purpose |
|---|--------------------------|--|
|  | Character entry | Entry of characters from the keypad in normal or Shift mode. |
|  | Move cursor to the left | Moves the current entry point one character to the left. |
|  | Move cursor to the right | Moves the current entry point one character to the right. |
|  | Escape (ESC) | Cancels the data entry and closes the keypad. |
|  | Enter | Confirms the data entry and closes the keypad. |
|  | Show Help page | Displays the appropriate Help page. |
|  | Backspace | Deletes the character to the left of the cursor. |

1.1.4. Procedure

Enter numerical values character by character by touching the keys on the keypad. If a default value is shown in the data entry field, this will be deleted as soon as the first character is entered. Once data entry has begun, it is impossible to leave the data entry field until the data entry has been confirmed or cancelled.

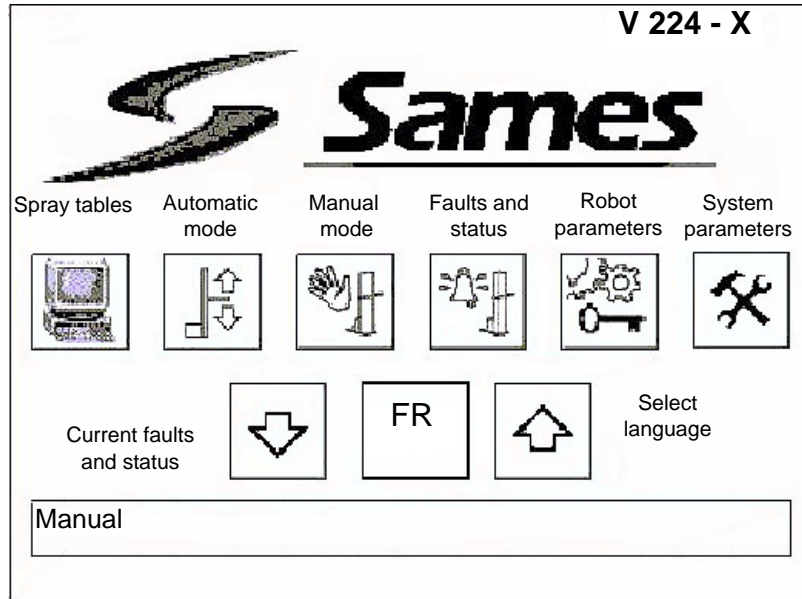
The characters are right-justified. As each new character is entered, the existing characters move one position to the left (as on a calculator).

Invalid characters are rejected and the system displays an error message. When the maximum number of characters has been entered, the most recently entered character will be overwritten.

Use the ENTER key to confirm the value entered, or touch ESC to cancel the data entry. In either case, the window will be closed.

2. Main Menu

Main Menu view



The **spray table** for a robot contains all the programmed trajectories.

Up to ten different tables may be specified for each robot.

The spray tables contain parameters controlling movement, spraying and parts detection.

The **Automatic mode** view is used to start the oscillation of a robot in accordance with a spray table.

The **Manual mode** provides access to the individual movements of each robot and control of the triggers.

The **Faults and status** shows the current faults and status of the robots. The status or the latest fault is shown at the bottom of the screen.

The **Robot parameters** are used to configure the robots, including calibration, advanced triggering, parts detection, direction, etc.

The **System parameters** view enables the user to adjust the contrast, calibrate the screen, and disable the touch-sensitive panel for cleaning. Other system parameters may be accessed using a SAMES configuration unit.

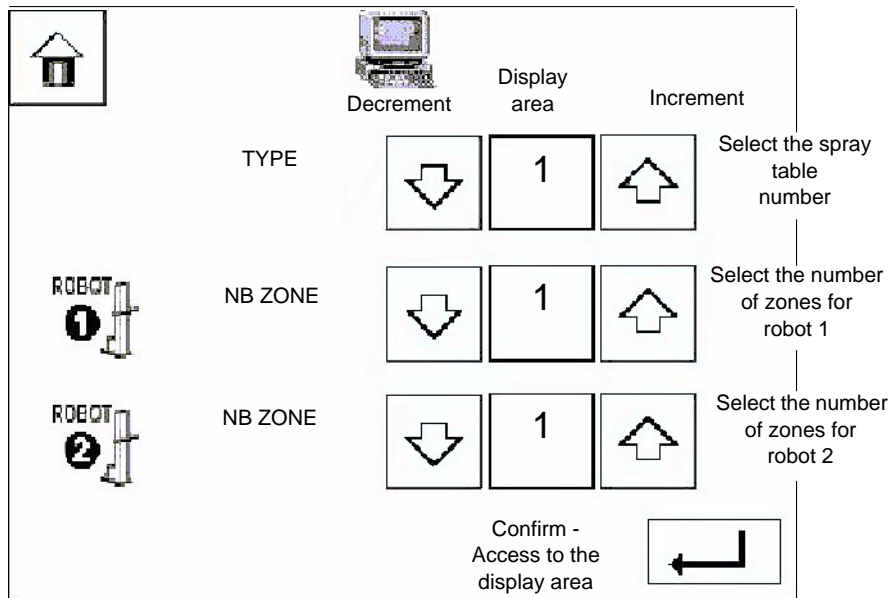
Select language (there are five available languages)

- French FR
- English GB
- German DE
- Italian IT
- Spanish SP

3. Spray Tables

The spray table view varies according to the number of robots to be configured.

Type selection view for two robots

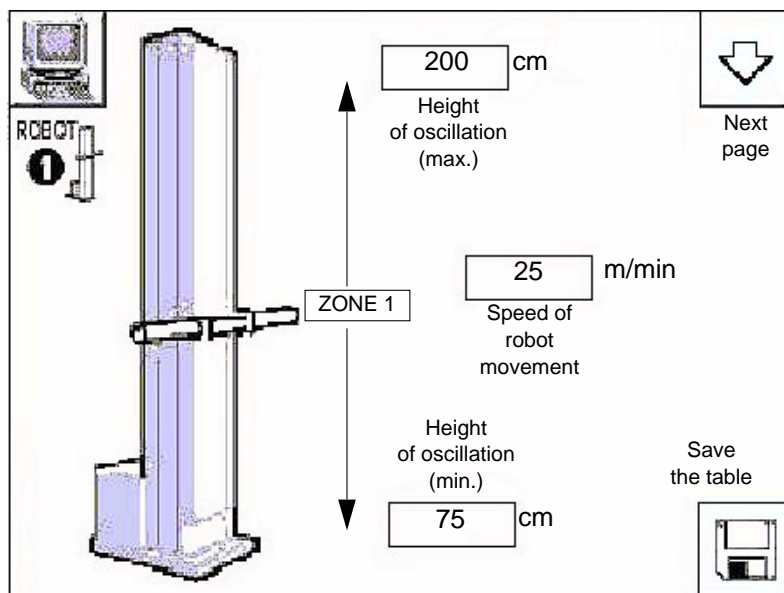


If only one robot is selected, the line associated with robot 2 does not appear on the screen. The number of zones for a given robot may vary within a single type.

- Number of types: 1 to 20
- Number of zones: 1 to 3

The spray tables are accessed and modified in operation.

When the view has been confirmed, the display shows spray table N°1 for robot 1:
Spray table for robot N°1 view



This table consists of a single zone, and spraying is enabled by default.

Note: To position the robot, set the speed to zero and enter the required position for the minimum marker.

Recommended minimal value: 5 m/mn (16 feet/min).

Speed of movement: 0 to 60 meters/minute or 192 feet/min.

The oscillation height is set as an integral number of centimeters, measured between the ground and the position of the trolley.

In general, the oscillation height must remain greater than the minimum calibration value in centimeters and less than the maximum calibration value in centimeters.

If incorrect values are entered, a default table is shown and the display returns to the Select spray table view without making any changes to the parameters.

If the Next page button is touched, the display shows

the spray table for robot N°2 (providing two robots have been selected)
or to the detection timing parameters page, if detection has been selected.

Spray table for robot N°2 view

Previous page

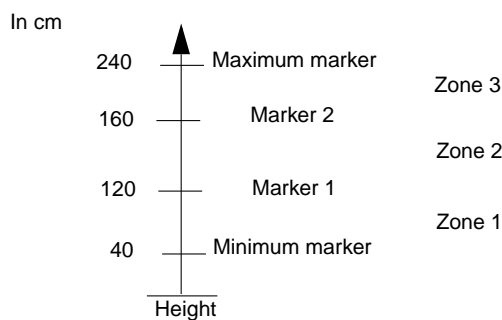
Next page

Copy parameters from robot 1 to robot 2 (providing both robots have the same number of zones)

Save the table

The movement parameters consist of two change of direction points for the oscillation movement, the number of zones (with the height of the markers) and the speed in each zone. The zones break down the oscillation into greater detail.

For example:





WARNING : According to the speed adjustment (m/min) and zone (cm), the movement being carried out can be different from the requested movement. Indeed, the system has to leave time to the axis to thoroughly carry out its accelerations and decelerations (0,3 sec).

Example: for a speed of 60 m/min (= 1 m/sec.), the deceleration or acceleration distance is approximately of 33 cm.

Previous page: Return to the spray table for robot 1

Next page: Access the Spraying parameter view (if detection is enabled)

Once the parameters for the spray table for robot 1 have been entered, a **Copy function** is available to copy these parameters to robot 2, provided that the values are valid and both robots have the same number of zones.

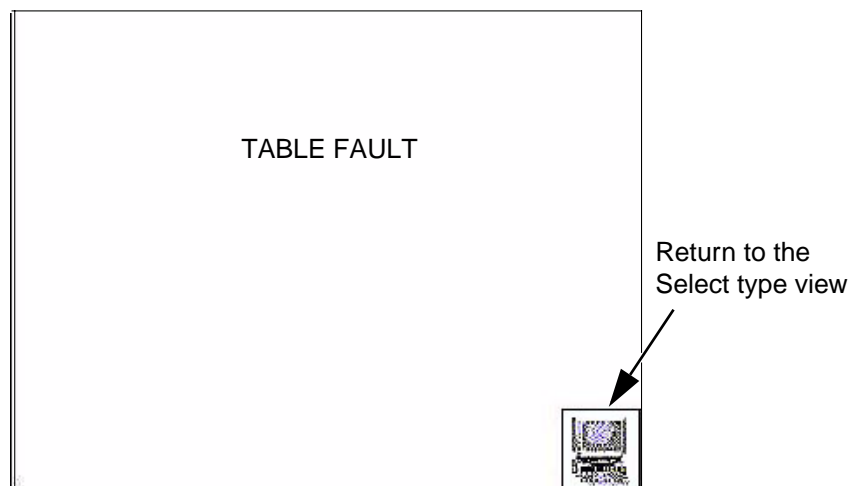
Spray enable enables spraying in the zone subject to the detection parameters.

Save: When the spray table is complete with consistent and valid data, touching one of the Save buttons saves the currently displayed table into the memory space allocated to the type. If the table concerned is currently being executed, the new values are applied to the robot immediately.

Touching the Save button returns the screen to the Select type view.

If any of the table data is not valid, a Fault view warns of an inconsistency in one or more of the tables.

Spray table fault view:



If any of the table data is not valid when the Save button is touched, a Fault view error message is displayed.

(e.g. Minimum marker > Maximum marker)

The validity of each parameter entered into the tables for robots 1 and 2 is checked.

See the summary table below:

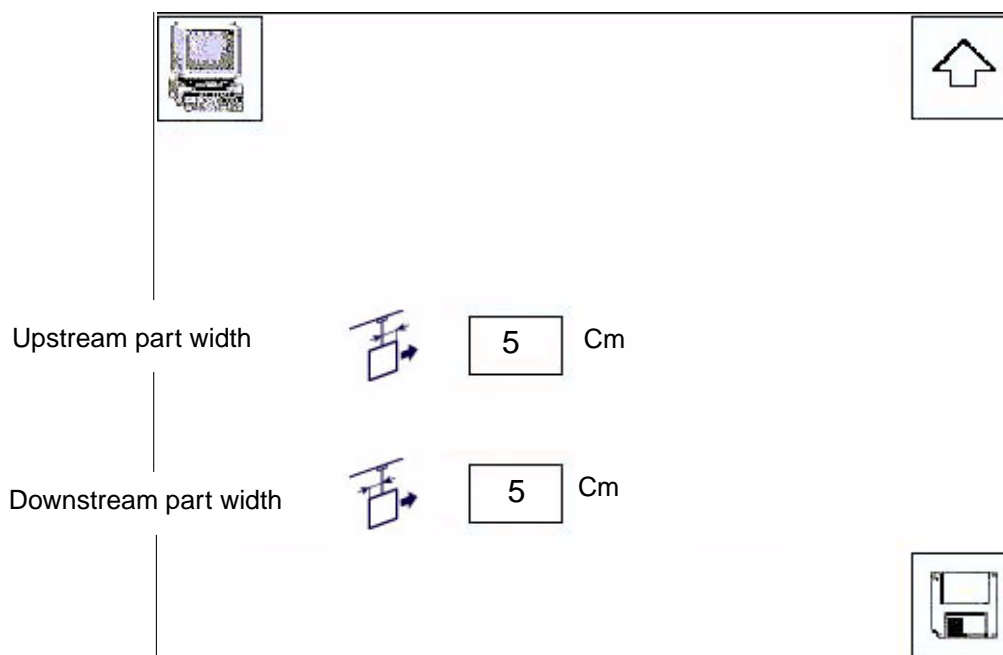
| Data | Units | Validity check | Description |
|-------------------------------|----------|---|---|
| Number of zones | | 1 to 3 | The useable robot travel defined by the range between the minimum and maximum markers may be sub-divided into between 1 and 3 zones, each with a corresponding speed. If three zones are used, the REV600 may be programmed to enable or disable spraying in each of the zones. |
| Minimum marker | cm | The value must be greater than the minimum position + safety offset and less than all the other markers. | Height of the lower change of direction point in the oscillation movement of the robot. |
| Maximum marker | cm | The value must be greater than all the other markers and less than the maximum position – safety offset. | Height of the upper change of direction point in the oscillation movement of the robot. |
| Marker 1 | cm | The value must be greater than or equal to the minimum marker and less than both marker 2 and the maximum marker. | Height of the transition between zones 1 and 2 |
| Marker 2 | cm | The value must be greater than or equal to marker 1 and less than the maximum marker. | Height of the transition between zones 2 and 3 |
| Speed 1 | m / min | The value must lie between 0 and 60 | Speed in zone 1 |
| Speed 2 | m / min | The value must lie between 0 and 60 | Speed in zone 2 |
| Speed 3 | m / min | The value must lie between 0 and 60 | Speed in zone 3 |
| Distance of start cycle | cm | The value must lie between 0 and 510 | Distance between detection and spraying for the first trigger. |
| Upstream part width | cm | The value must lie between 0 and 255 | Upstream width of the part to be painted. |
| Downstream part width | cm | The value must lie between 0 and 96 | Downstream width of the part to be painted. |
| Control of triggers in zone 1 | Yes/no | Binary values | These parameters are only accessible if three zones have been configured. |
| Control of triggers in zone 2 | Yes/no | | |
| Control of triggers in zone 3 | Yes/no | | |
| Speed conveyor | cm / min | The value must lie between 0 and 9999 | Speed of the conveyor |

Ten pre-programmed spray tables are available containing the following parameters:

| Description | | Type 1 | Type 2 | Type 3 | Types 4 to 10 |
|-------------------------|-----------------|--------|--------|--------|---------------|
| Number of zones | Between 1 and 3 | 1 | 2 | 3 | 1 |
| Minimum marker | In cm | 75 | 75 | 75 | 75 |
| Maximum marker | In cm | 200 | 200 | 200 | 200 |
| Marker 1 | In cm | | 150 | 133 | |
| Marker 2 | In cm | | | 166 | |
| Speed 1 | In m/min | 25 | 25 | 25 | 25 |
| Distance of start cycle | In cm | 0 | 0 | 0 | 0 |
| Speed 2 | In m/min | | 40 | 40 | |
| Part width | In cm | 5 | 5 | 5 | 5 |
| Speed 3 | In m/min | | | 25 | |
| Trigger 1 | YES/NO | | | NO | |
| Trigger 2 | YES/NO | | | YES | |
| Trigger 3 | YES/NO | | | NO | |

Touching the Next page button provides access to the detection timing parameters.

Timing parameters view

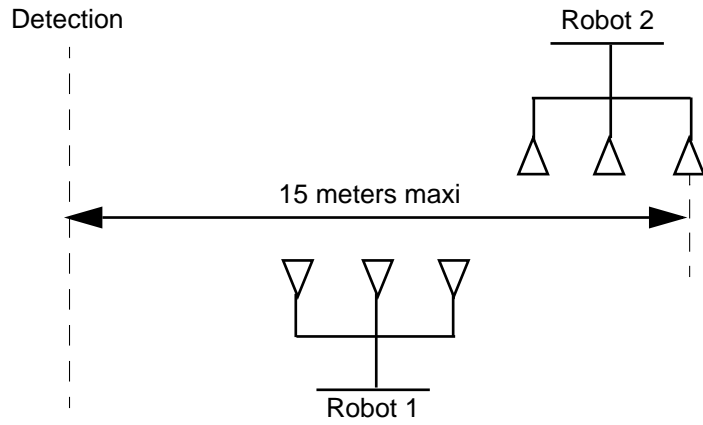


If detection is enabled, a window will be displayed when the data for robots 1 and 2 has been entered, this window is used to enter width of the part to be coated.

Upstream/downstream part width: according to the detection point of the part, these parameters allow to proportion the width of the part. It is possible to set up a width of the part. It is possible to set up a width of part for each type. See possible scenario:

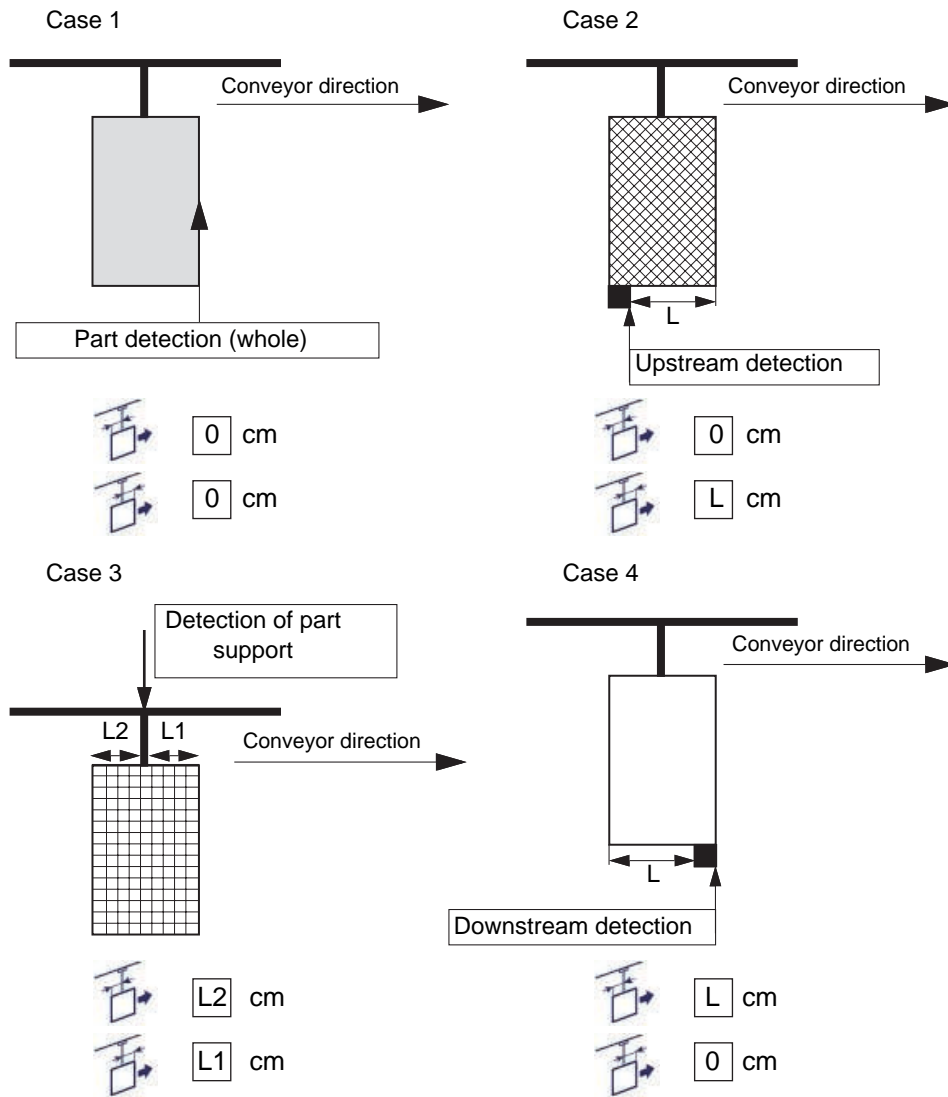
Minimal value: 0.

Maximal value: 255 for upstream width of the part and 96 for downstream width of the part.



Detection and the follow up of parts : by default, the follow up of parts is managed on 11 meters long as on the picture here above. During this follow up, the REV 600 manages spray breaks between parts

Possible scenario according to detection :

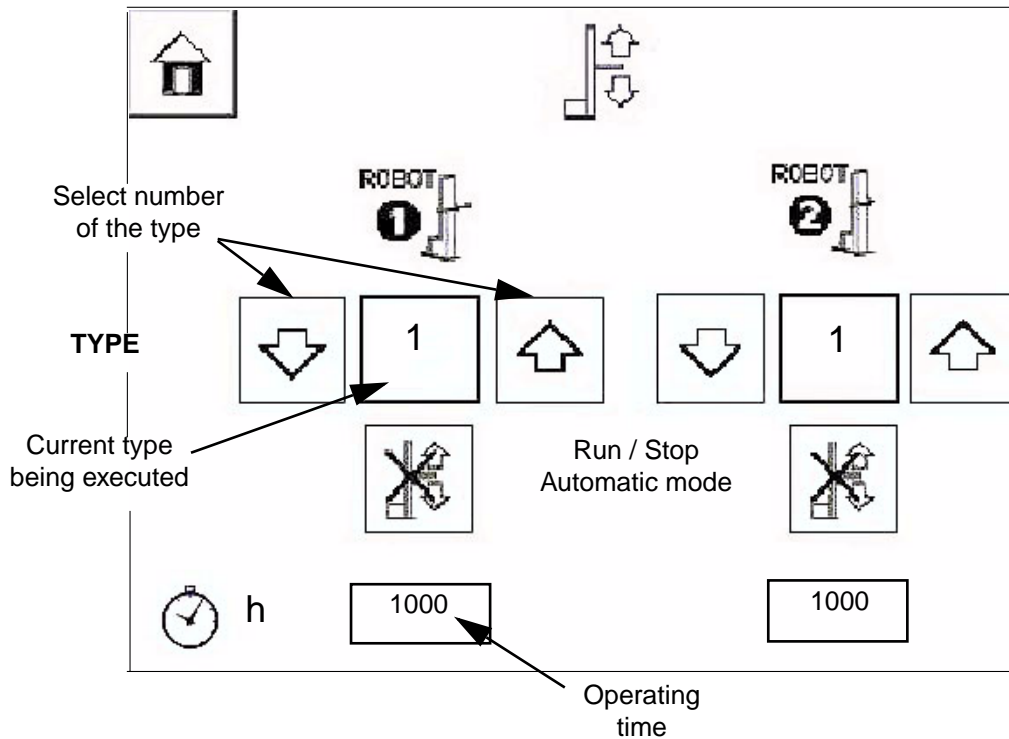


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4. Automatic Mode

The process may be run in automatic mode if no manual mode command is currently in progress. The change of mode occurs immediately, even if the robot is currently in operation. In the same way, if a spray table is currently being executed, saving any modification to the spray table takes effect immediately.

Automatic mode view



Operating time (in hours): This is the total cumulative operating time including operation in both automatic and manual modes.

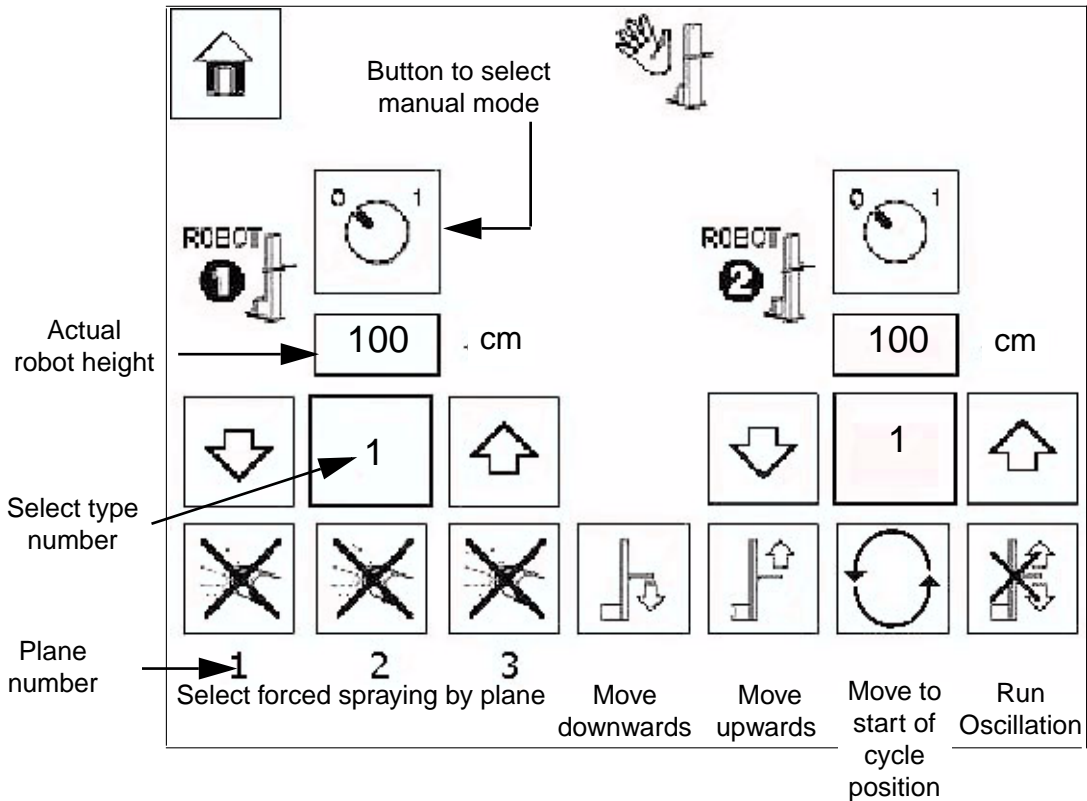
Select type: It is possible to select a type of spray table between 1 and 10.

5. Manual Mode

Using the Manual mode view, it is possible to control certain actions of the robot, providing that no robot is currently in automatic mode.

All the actions are applied to the selected robots. Deselecting a robot terminates all current actions on that robot.

Manual mode view:



Actual robot height: This shows the actual robot height in centimeters as it is moved up and down.

This is the value of the potentiometer in Volts converted into centimeters. (See robot configuration view)

Manual mode button: When this button is set to a '1', all the manual mode functions at the bottom of the view are enabled.

Select type number: The arrow keys are used to select the number corresponding to a spray table so that it can be executed in manual mode.

Run oscillation: Touching this button starts the movement defined by the selected spray table and type.

Plane number: Each robot can spray in one of three planes corresponding to the offset between the sprayers and the axis of the conveyor.

The first plane in the direction of travel of the conveyor is N°1 and the last plane is N°3.

There may be between 1 and 3 planes depending on the configuration. (See robot configuration view)

Select forced spraying: Touch the button corresponding to the required plane number.

Manual movement along the height axis: Hold the **Move downwards** or **Move upwards** button to move the robot in the required direction.

For safety reasons, the movement stops immediately when the button is released.

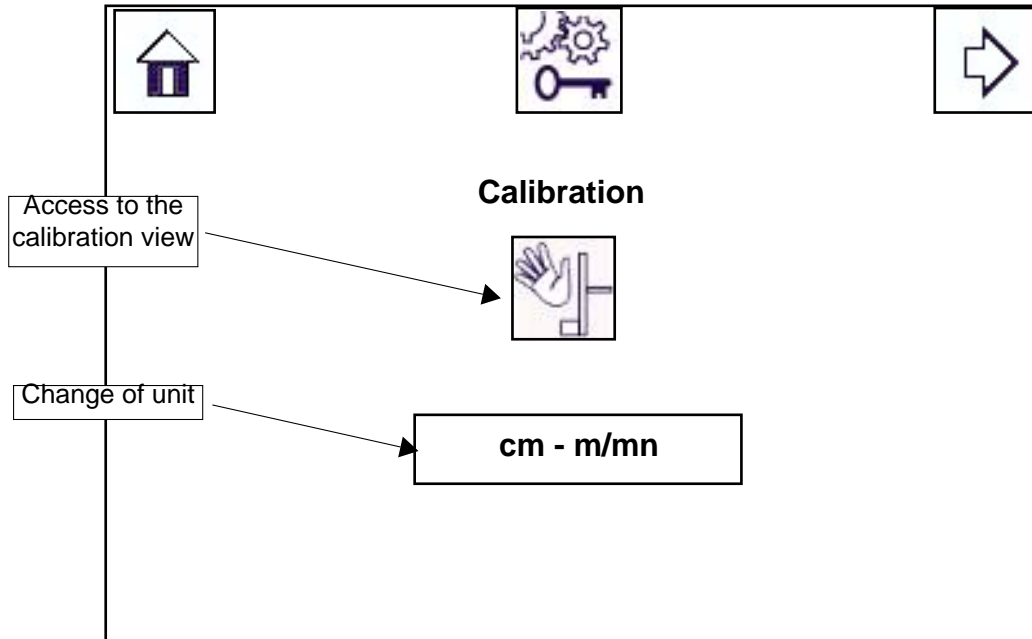
Go to start of cycle position: Touching this button causes the robot to move to the programmed start of cycle position. (See robot configuration view)

6. Robot Configuration

The robot configuration views are accessed by touching one of the corresponding keys in the Main Menu.

6.1. Access to calibration

This view gives access to the calibration view and allows changing unit from cm into inches.



"Calibration": this button gives access to the axes calibration view. When pressing this button, the robot stops and its axes are electrically released.

"Conversion": this button allows to change the units of the "REV 600"; i.e. to pass from the units of the international system (IF) to the ones of the US and vice and versa.



WARNING : The values in the spray tables are not converted between metric and Imperial measurements.

Only the calibration values are converted, for example:
280 cm --> 115 inches, 65 cm --> 25 inches.

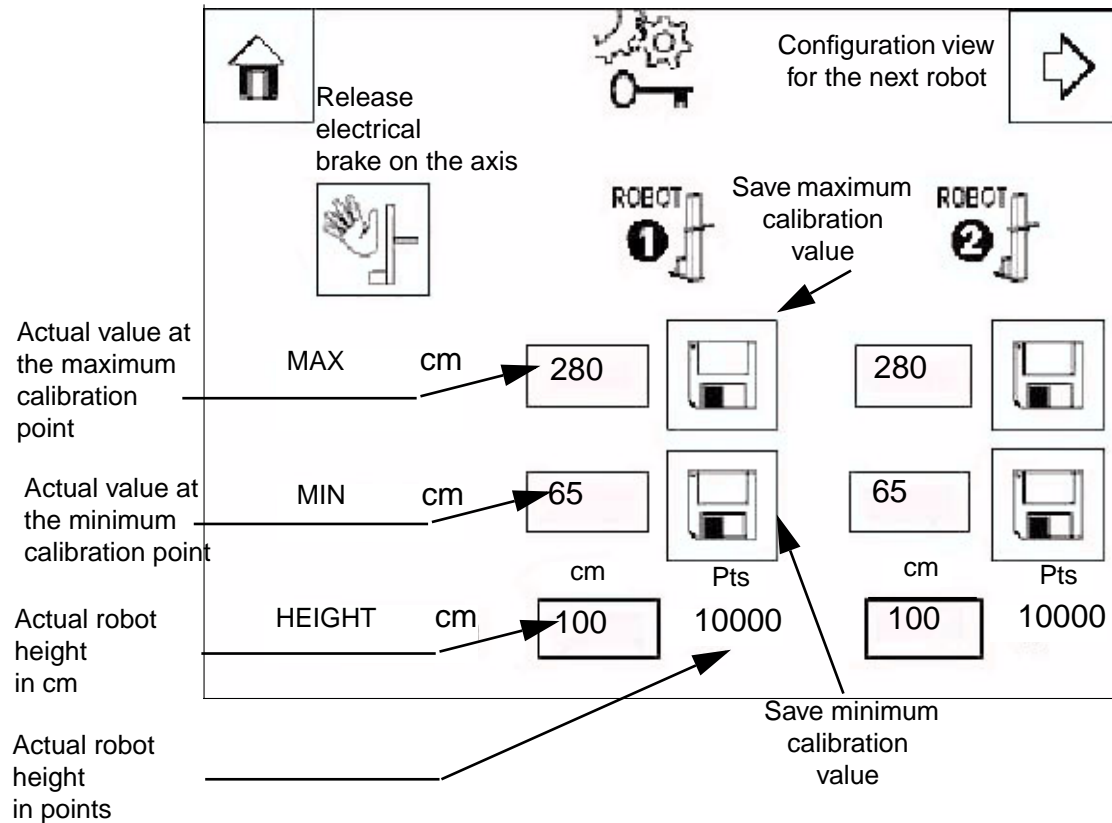
6.2. Calibration of the Axes

Calibrating the vertical axes of a robot defines the minimum and maximum limits of travel and converts the potentiometer data to a value in centimeters.

This calibration must be carried out and an initial default calibration is performed on each axis.

The default values for a standard RFV2000 robot are 65 cm and 280 cm between the trolley attachment point and the ground.

Calibration view



Actual height position: This shows the actual height of the robot as it is moved.

Actual value at the maximum calibration point: When the robot is positioned at the highest required value, the actual value in centimeters measured between the ground and the sprayer (or the mean center of the sprayers) is entered.

Actual value at the minimum calibration point: When the robot is positioned at the lowest required value, the actual value in centimeters measured between the ground and the sprayer (or the mean center of the sprayers) is entered.

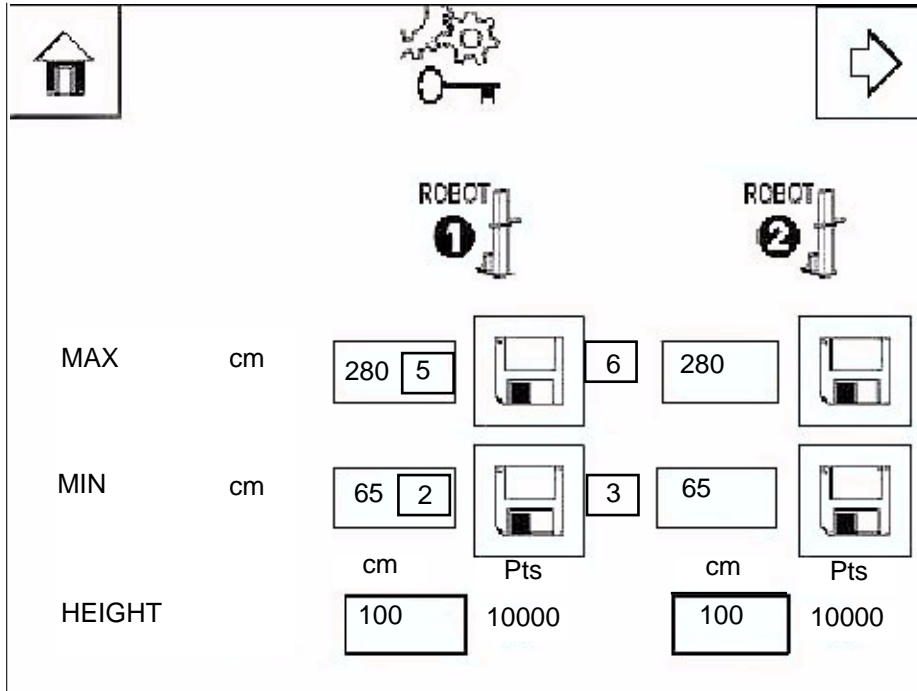
Save maximum calibration: Positioning the machine at the highest position required and entering the actual value in centimeters calibrates the maximum point on the axis. The readout from the potentiometer in Volts is associated with the actual measured value in centimeters. This also defines the maximum limit of travel. A control fault is reported if this level is exceeded.

Save minimum calibration : Positioning the machine at the lowest position required and entering the actual value in centimeters calibrates the minimum point on the axis. The readout from the potentiometer in Volts is associated with the actual measured value in centimeters. This also defines the minimum limit of travel. A control fault is reported if this level is exceeded.

Calibration procedure:

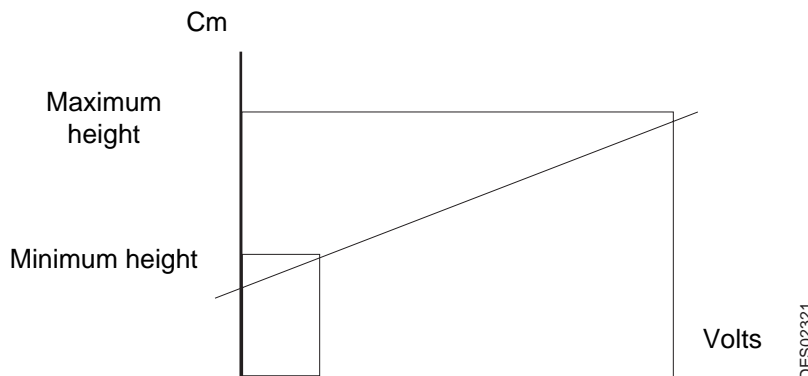
Connect and apply power to the system.

- 1 Move the robot manually to the minimum position.
- 2 Measure the height in centimeters and enter the value.
- 3 Confirm by touching the Save minimum calibration button.
- 4 Move the robot manually to the maximum position.
- 5 Measure the height in centimeters and enter the value.
- 6 Confirm by touching the Save maximum calibration button.



After calibration, the REV 600 is continually aware of the actual position of the robot and is able to carry out the programmed movements correctly.

The raw positional data is provided in Volts (0-10V) by a rotational potentiometer. The corresponding position in centimeters is given by the expression $Y=aX+b$. The two coefficients are calculated from the calibration data at the two limit positions.



Maximum position (extent of travel) = Maximum calibration position – Safety offset (2 cm).

Minimum position (extent of travel) = Maximum calibration position + Safety offset (2 cm).

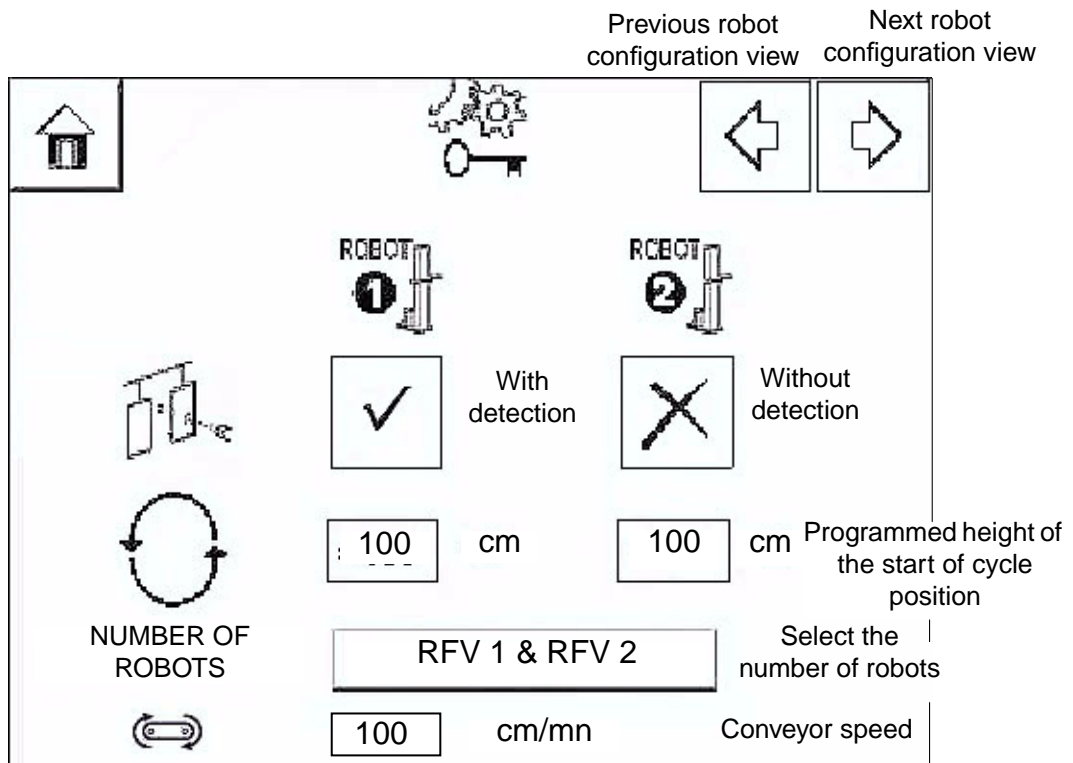
When delivered, the REV600 is programmed with two standard coefficients corresponding to an RFV2000 robot with a travel of two meters. However, the calibration procedure must be carried out during commissioning and following any maintenance operation involving either the potentiometer or the transmission.

Touching the right arrow key displays Parameter view N°2.

6.3. Parts Detection

The view is used to configure:

- The type of parts detection
- The start of cycle position
- The number of robots selected



The first line is used to configure the operating mode:

Without detection. The sprayer triggers are actuated as soon as the robot is set to automatic operation. Spraying is continuous while the conveyor is in motion.

With detection. Spraying is timed with reference to the first or last part.

The timings are specified in the spray tables according to the type.

The timings depend on the conveyor speed and the distance between the robots and the detector sensor.

Each robot is fitted with six triggers operating in pairs. Each robot can control three independent pairs of triggers per type.

Programmed height of the start of cycle position: This is the position of the robot when it is not oscillating in automatic mode.

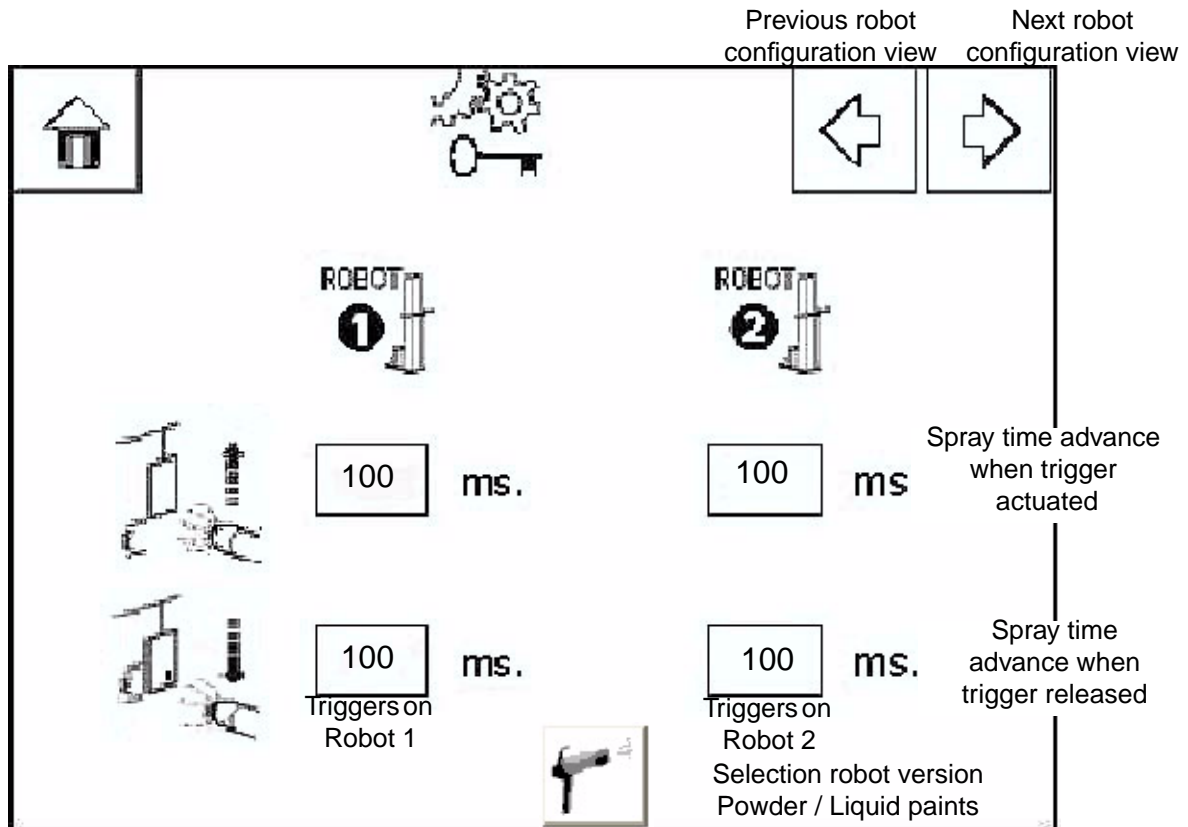
Select the number of robots: This is a binary selection. There is always either one or two robots.

Speed of the conveyor:

It is the speed of the conveyor which is used to determine the distances of the start cycles. It is a constant. If the speed of the conveyor moves, it is necessary to recalculate and modify the value of the parameter in the REV 600. Maximum value is 9999 cm/mn.

Touching the right arrow key displays Parameter view N°3.

6.4. Advanced Spraying Advanced spraying view



Spray time advance when trigger actuated: The amount of time to advance the start of spraying is calculated on the basis of a specified time and the time taken for the valve to open and product to arrive at the nozzle after the command. The spray command is issued in advance in order to compensate for the delay in opening the valve and the arrival of the product at the nozzle.

Advance distance = Current speed x Advance time

Spray time advance when trigger released: The amount of time to advance the end of spraying is calculated on the basis of a specified time and the time taken for the valve to close after the command. The shut-off command is issued in advance in order to compensate for the delay in closing the valve. This may be different from the actuate time.

The time has a maximum value of 3000 ms.

Touching the right arrow key displays Parameter view N°4.

Selection of the type of RFV robot

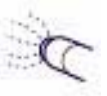
Robot RFV version powder



Selection RFV version powder.

The speed range of the robot is then between 5 and 25 m/mn.

Robot RFV version liquid paints:

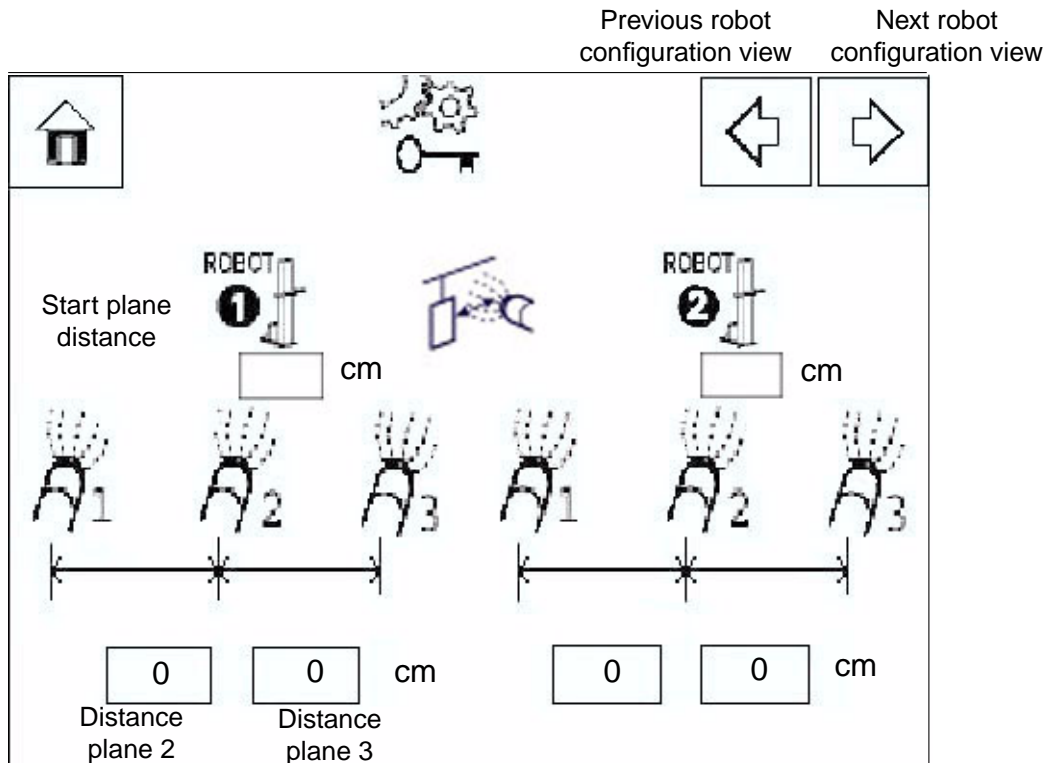


Selection RFV version liquid paints.

The speed range of the robot is then between 5 and 60 m/mn.

6.5. Configuration of Plane Start Times

Plane start times view:



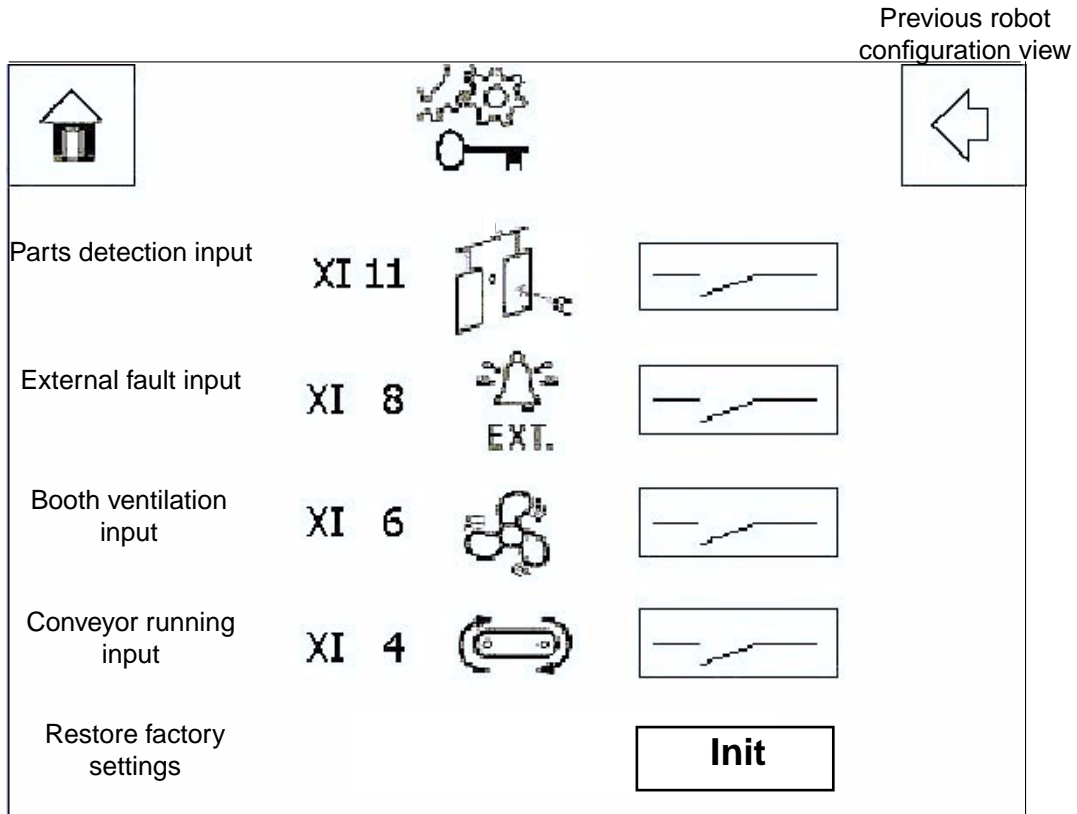
Start plane distance: start plane distance: distance between detection device (cell, stroke end, ...) and axis of the first sprayer of robot. The maximum value is 1500 cm.

Plane 2 distance: distance between the first and the second group of sprayers installed on the robot. The maximum value is 250 cm.

Plane 3 distance: distance between the second and the third group of sprayers installed on the robot. The maximum value is 250 cm.

6.6. Configuration of the Inputs

"View of the input configuration":



Contact status: The status of the button must correspond to the type de contact connected to the REV600.

 Normally open contact:

 Normally closed contact:

Parts detection input: This input accepts data from the detector sensor on terminal strip XI Pin N°11.

External fault input: This input accepts data from an external system or modules also involved in the process. The input is on terminal strip XI Pin N°8.
An example of the use of this input would be to incorporate a high voltage fault condition from a powdering module

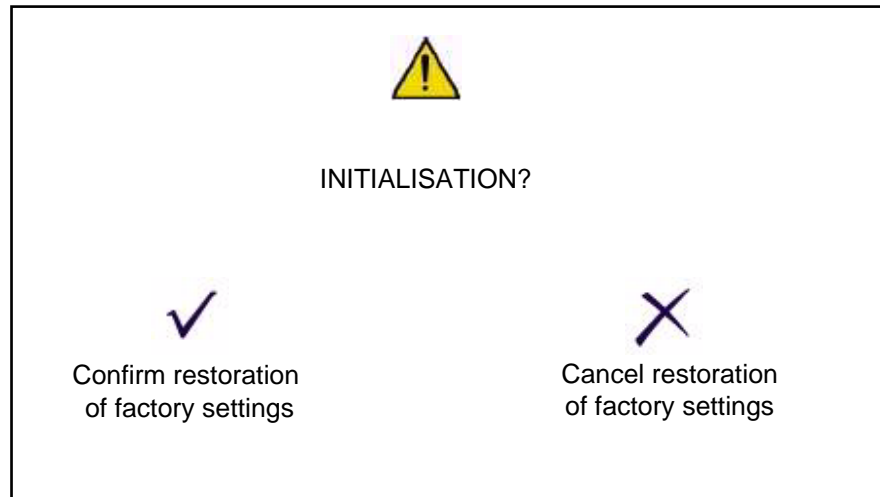
Booth ventilation input: This input accepts booth ventilation data from the booth cabinet on terminal strip XI Pin N°6.

Conveyor running input: This input accepts conveyor running data from the conveyor cabinet on terminal strip XI Pin N°4.

Restore factory settings: If an incorrect parameter is entered, it is possible to restore the factory settings by touching this button.

Init

Confirmation of restoration of factory settings view

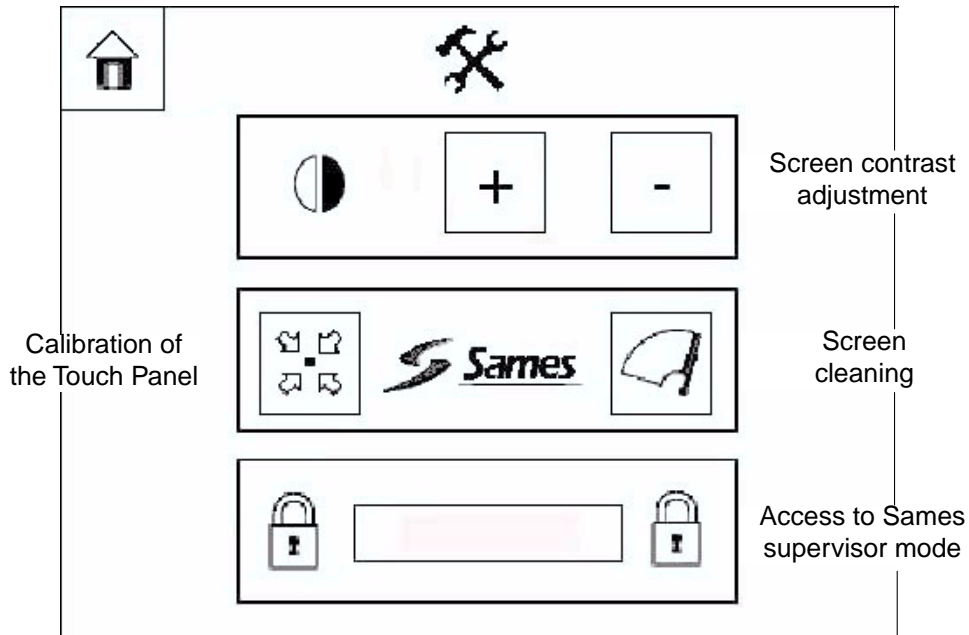


If the operator confirms the restoration of factory settings, the following data is reinitialized:

- Parameters
- Calibration
- Spray tables

7. System Configuration

System configuration view:



Screen contrast adjustment: Touching the + or – key increases or reduces the screen contrast.

Calibration of the Touch Panel: Touching this key initiates a system procedure for calibrating the Touch Panel to suit the finger pressure of the operator.

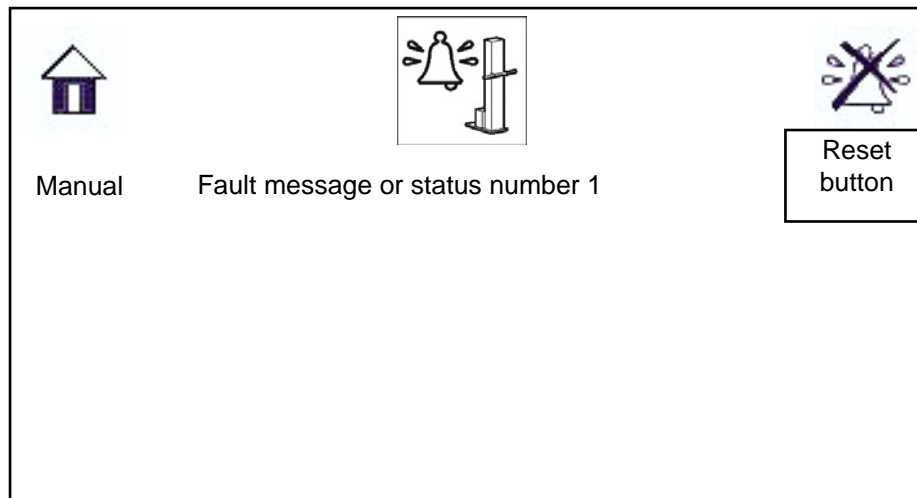
Screen cleaning: Touching this key initiates a system procedure to disable the Touch Panel for a period of 20 seconds so that the screen can be cleaned.



Access to Sames supervisor mode: Access to this mode is protected by a password. It is used during construction and repair of the module.

8. Faults and Status

Faults and status view



This view displays current fault conditions or the status of the system.

It is possible to display up to ten fault or status messages.















Reset button : This button is used to initiate a reset procedure in the module.
If the fault persists, this is an indication that the system requires repair.


















Summary faults and status table

| | | |
|------------------------------|--|---|
| Stop | No power to REV (circuit breaker switch off or emergency stop actuated) | |
| Manual | The system is ready for use. Access to Manual mode is possible. | |
| Automatic | At least one of the two robots is in automatic mode. | |
| No conveyor | One or both robots are in automatic mode. They are ready to begin spraying but the REV600 is not receiving the Conveyor running signal. This is a contact across pins 3 and 4. | |
| Fault in speed converter 1 | Current fault condition in speed converter 1. | Switch off the main switch for 30 seconds, then switch on again. |
| Fault in speed converter 2 | Current fault condition in speed converter 2 | |
| Ventilation fault | The ventilation system is not operating. Incorrect configuration (if the fault occurs during commissioning). | Restore the ventilation system to use. Invert the polarity of the contact. |
| External fault | An external fault is present Incorrect configuration of contact XI (if the fault occurs during commissioning) | Clear the fault Invert the polarity of the contact. |
| Control fault on axis 1 | The robot transmission is faulty. The potentiometer is faulty. The speed converter is not being driven correctly. | Repair the transmission and recalibrate the robot. Change the potentiometer and recalibrate the robot. |
| Control fault on axis 2 | | |
| Calibration fault on robot 1 | Out-of-range value entered. | Enter valid data. (Max. > Min.) |
| Calibration fault on robot 2 | | |

9. Appendices

9.1. Appendix 1

| | |
|----------------------------------|--|
| Function selected | ✓ |
| Function deselected | ✗ |
| Increase a value | ↑ |
| Decrease a value | ↓ |
| Program spray tables |  |
| Manual mode |  |
| Robot configuration |  |
| Automatic mode / Run oscillation |  |
| Robot N° |  |
| Spraying |  |
| Start plane distance |  |
| Upstream/downstream part width |  |
| Menu navigation | ↑ ↓ ← → |
| Run / stop oscillation |   |
| Save |  |
| Advance operation |  |
| Return to the Main Menu |  |
| Start of cycle position |  |

| | |
|--|---|
| Input polarity |  |
| Booth ventilation |  |
| Conveyor running Conveyor speed |  |
| Parts detection |  |
| External fault |  |
| Reset fault |  |
| Enter / confirm |  |
| Robot movement |  |
| Free axis |  |
| Select robot in manual mode |  |
| Copy table from robot N°1 to robot N°2 |  |
| Operating time |  |
| Anticipation spraying |  |
| Contrast |  |
| Calibration of Touch Panel |  |
| Screen cleaning |  |
| Enter password |  |