INSTRUCTION MANUAL

3arm®

SmartControl

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ISO 9001
BUREAU VERITAS
Certification

TECNOSPIRO
MACHINE TOOL SL

DESIGN & QUALITY
3arm
Made in Barcelona

www.3arm.net

TABLE OF CONTENTS

1 ABOUT THE SMART CONTROL SYSTEM

1.1 GENERAL SYMBOLS AND ICONS

ICON	DESCRIPTION
	Save
	Go back to the previous screen
	Turn off screen
	Return to main screen (main menu)
	Delete tightening position
	Access to the browser of existing programs
	Editing a job or task

1.2 TECHNICAL SPECIFICATIONS

- Supply voltage: 24 VDC
- Display Size: 800 x 480 px
- External connections: USB
- Housing material: Aluminium
- Tightening programs (cycles) in the same task or job: 7
- Internal memory: E2PROM + SPIFlash
- Processor: Cortex M4
- Digital inputs: 4
- Digital outputs: 4 (Opto-isolated)
- BUS RS485/422 communication with encoder plates
- Communication with the device control via I/O
- Storage for up to 30 different jobs
- Storage for 70 tightening positions for each job

1.3 SETTING UP AND CONNECTION

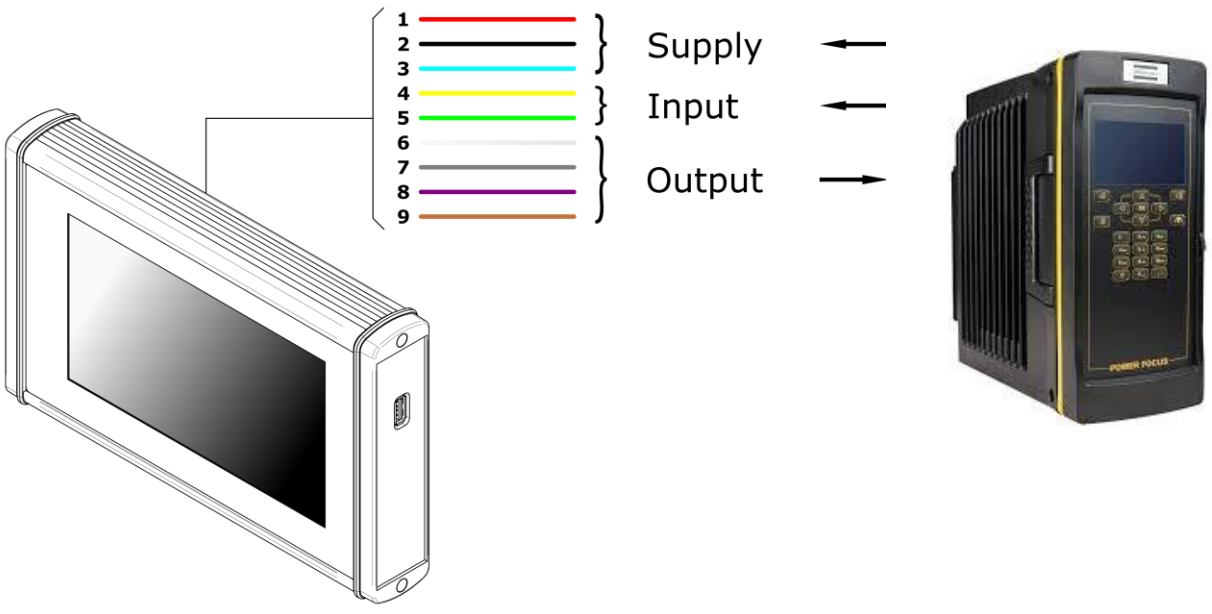
There are nine outgoing cables from the 3arm SmartControl device. These cables are used for receiving the necessary supply voltage, as well as for establishing the essential communication with the device control (DC).

If you have any doubts about the connection between the 3arm SmartControl device and your tool's device control (DC), contact your 3arm® distributor.

Power Supply
1- Red: Positive (+) at 24 VDC
2-Black: Neutral (-)
(Also option of using 24 VDC jack)
3-Blue: 24 VDC supply (Output power supply)

Inputs
4-Yellow: Free (according to DC manufacturer) – IN0
5-Green: Tightening OK signal – IN1

Outputs
6-White: Encoders position OK, spindle/device permission – OUT1
7-Grey: Signal for selection of the tightening program - 0 bit – OUT0
8-Purple: Signal for selection of the tightening program - 1 bit – OUT2
9-Brown: Signal for selection of the tightening program - 2 bit – OUT3



1.4 TERMS AND DEFINITIONS

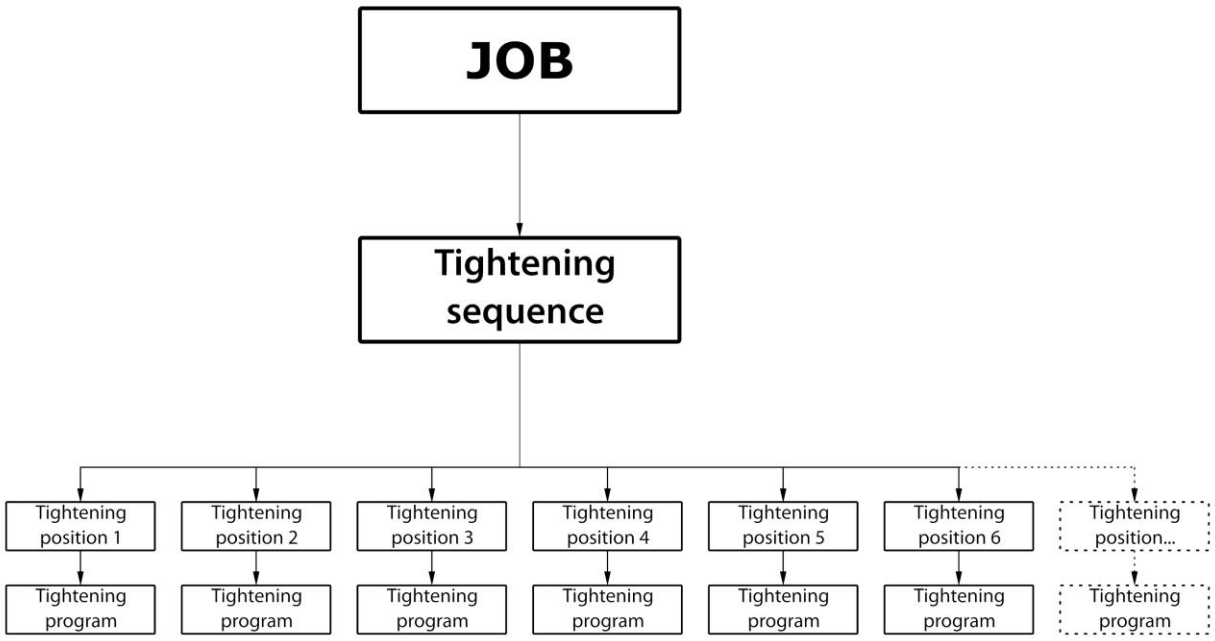
Workpiece: Part with which you want to work.

Job or task: Each type of part will have an exclusive job or task, in which a tightening sequence shall be defined. Up to 30 different jobs can be saved.

Tightening sequence: Each tightening position as well as its order or sequence. Each job or task is composed of a tightening sequence.

Tightening position: Coordinates on the drawing of each component (screw, nut, etc.) which you wish to tighten. Each tightening sequence is made up of one or more tightening positions, with a maximum of 70 positions.

Tightening programme: Define the tightening characteristics of each tightening position. Torque, stages, speeds, etc. must be defined in the control device (DC) of the tool. For correct communication between the SMART CONTROL system and the tool's control device (DC), we advise defining a tightening programme for each tightening position. 7 different tightening programs can be programmed.



2 CREATE A NEW TASK OR JOB

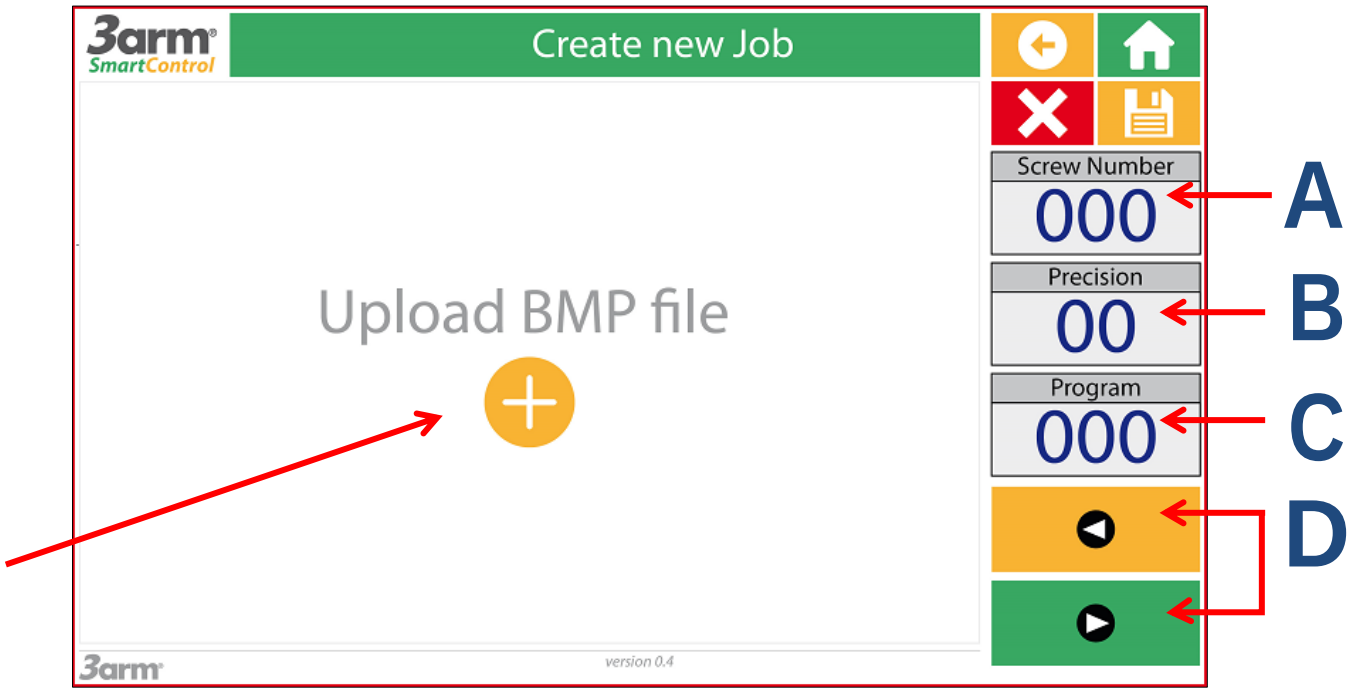
2.1 About the screen Create new job

This screen allows you to create a new task or job. This task or job will be saved in the internal memory of the device (extension *.wrk) and can be used from the **Operation** screen to, for example, tighten different screws for a specific number of parts.

To access it:

1. Go to: **Main menu > Create New Job**

The following describes the screen, its icons, values, options, etc.



Upload BMP file: This area of the screen is reserved for embedding a representative image of the workpiece. The tightening positions will be defined in a layer above this.

Screw Number (A): Automatic counter that indicates the number of the tightening position that is being edited at that time.

Precision (B): After pressing the central part of the precision box a dial will appear where you can define the specific precision for the tightening position that is being edited. By default, if the first tightening position is being edited, the precision defined in the main configuration will appear or, in the case of the second or successive tightening positions, the precision corresponding to the last edited tightening position will appear.
If the precision value that appears is suitable for the current tightening position, nothing else needs to be done.

You can also change the default precision value. [See CHANGING THE DEFAULT VALUE page 23]

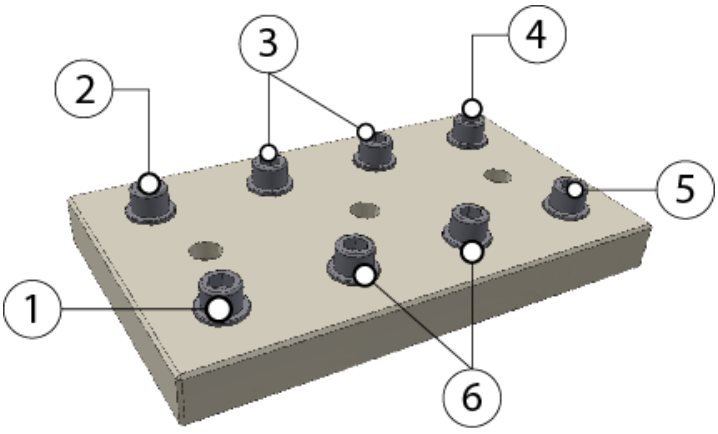
The precision value is expressed in mm and defines the radius of a circle with the centre coinciding with the tightening position within which the system will consider the position valid.

Program (C): The program number associated with the tightening position that is being edited at that moment is displayed—by default the program number of the previous tightening position will appear. The program number can be modified by pressing the central part of the **Program** box—a dial will appear where the program number can be selected. Keep in mind that the program number defined here must match that of your tool's device control. There can be a maximum of 7 tightening programs in the same task or job.

Example of a part with several tightening programs.

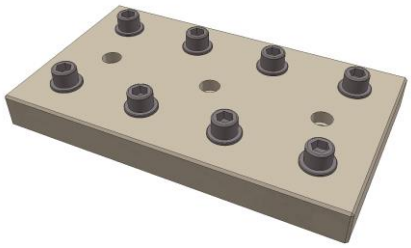
Tightening table:

Identifier	Tightening program
1	P1
2	P3
3	P2
4	P6
5	P4
6	P5



2.2 CREATING A SEQUENCE (STEP BY STEP)

Let's suppose we want to perform a task or job for the following part, which requires 8 tightening points. Let's follow an example step by step.



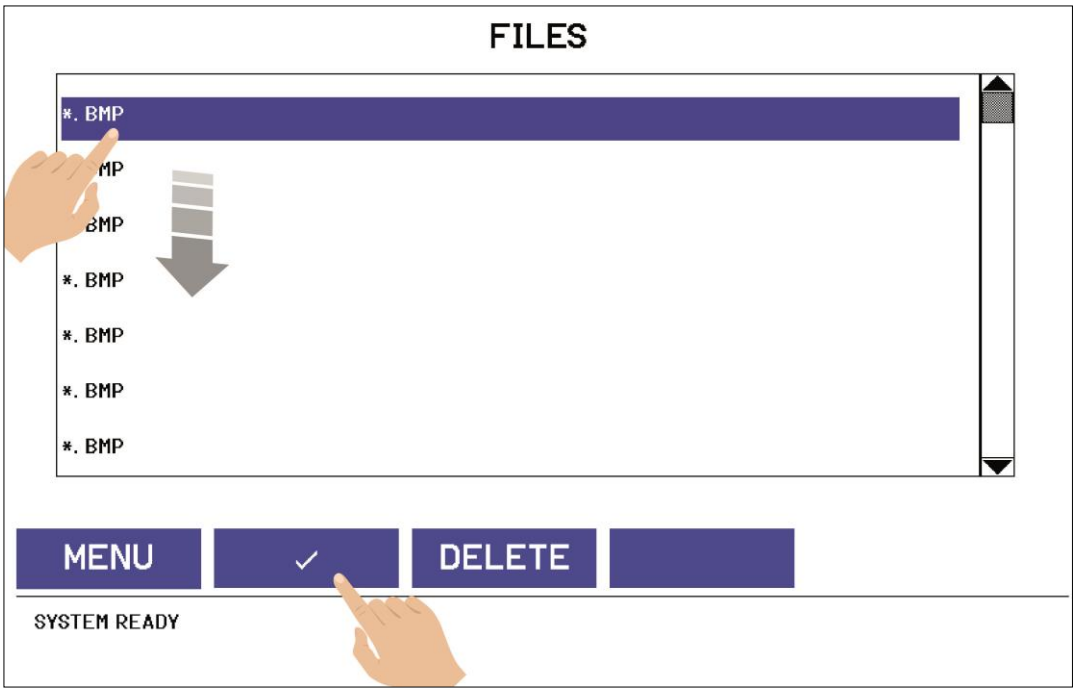
From the **Create new job** screen **(Main menu→ Create new job)**

1- Insert representative image of the part.

1.1 - Press in the centre of the screen.

1.2 - A browser will appear where you can select the corresponding image file

1.3 Press the validation tick →✓



2- Editing the Precision value

2.1 Press the **precision** box and a numeric dial will appear. Type the appropriate precision value (integer with a maximum of two digits).

2.2 Go back to the **previous screen**

3- Selection of the tightening program

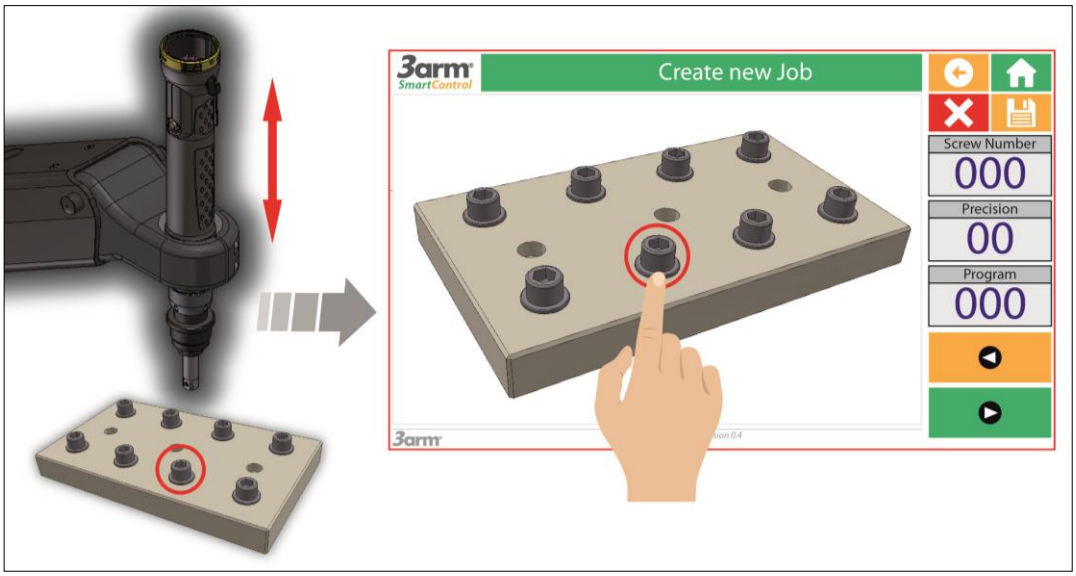
3.1 Press the **program** box and a validation list will appear. Press the corresponding program number.

4- Register position

4.1 Bring the arm to the corresponding tightening position.

4.2 Press the screen at the corresponding point of the previously loaded image.

With the arm in the tightening position, press the screw on the screen.



5- Repeat the sequence (2 to 4) until the eight tightening positions have been finished.

6- Press **save** and a keyboard will appear to insert a name.

7- Go back to the **previous screen**, or press to return to the **Main menu.**

2.3 EDITING AN EXISTING JOB OR TASK (FROM OPERATION SCREEN)

From the **Operation** screen, you can edit the following task or job parameters:

- Precision value
- Remove tightening positions
- Modify the tightening program associated with a specific tightening position
- Add tightening positions at the end of the tightening sequence

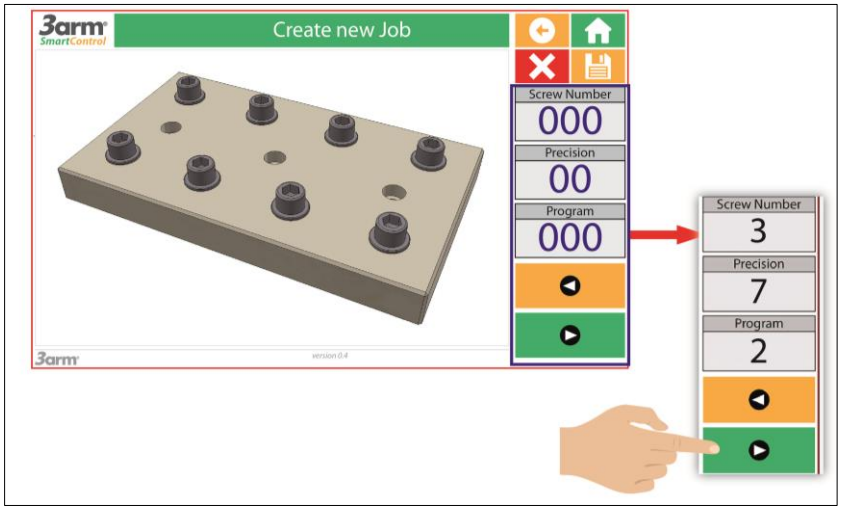
From the **Operation** screen: (**Main menu>Operation)**

1. Press the **edit** icon and the system will take you to the **edit job** screen.
2. To edit the precision value [See Edit the precision page 13].
3. To edit the program value [See Edit the tightening program page 13].
4. To remove the tightening position [See Remove a tightening position page 13].
5. To add tightening positions [See Add a tightening position page 13].
6. After editing a task or job, press **save** and a keyboard will appear to insert a new name. If you want to overwrite the existing file press **save**, or if you want to keep the previous version in the memory, enter a new name for the new file. Press **save**.
7. The system will return to the **edit job screen**. Go back to the **previous screen**, or press to return to the **Main menu**

2.4 EDIT A SEQUENCE

2.4.1 Select the tightening position

Press on the navigation arrows to go back to the previous (left) or next (right) tightening position.



2.4.2 Remove a tightening position

Make sure that the value shown in **Screw number** corresponds to the tightening position that you want to remove.

1. Press in the upper right  margin
2. After refreshing the screen, you can continue editing the sequence

2.4.3 Edit the precision

Make sure that the value shown in **Screw number** corresponds to the tightening position that you want to edit.

1. Press on the existing value and a dial will appear in which the new value should be entered (integer with two digits, units in mm)
2. Go back to the **previous screen** 

2.4.4 Edit the tightening program

Make sure that the value shown in **Screw number** corresponds to the tightening position that you want to edit.

Press on the **Program** box and select the corresponding new tightening program. The system will automatically take you to the previous screen.

2.4.5 Add a tightening position

NOTE: It is only possible to add a tightening position at the end of the tightening sequence

1. Use the navigation arrows until you reach the last tightening position.
2. Bring the arm to the corresponding tightening position. [See CREATING A SEQUENCE (STEP BY STEP) page 10].

2.5 WORKPIECE IMAGE REQUIREMENTS

The image of the part that you want to associate with a task or job must meet the following requirements:

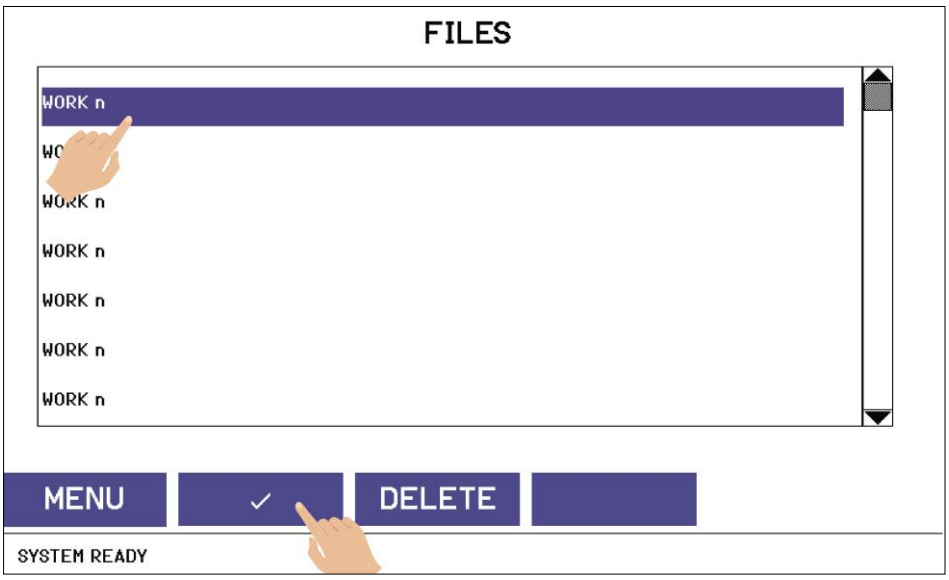
File type: image
Format: BMP 24 bits
Size: 640 x 400 pixels

The images must be uploaded to the system before being embedded in a task or job [See IMPORT FILES "USB to SmartControl *bmp & USB to SmartControl *Wrk" page 26].

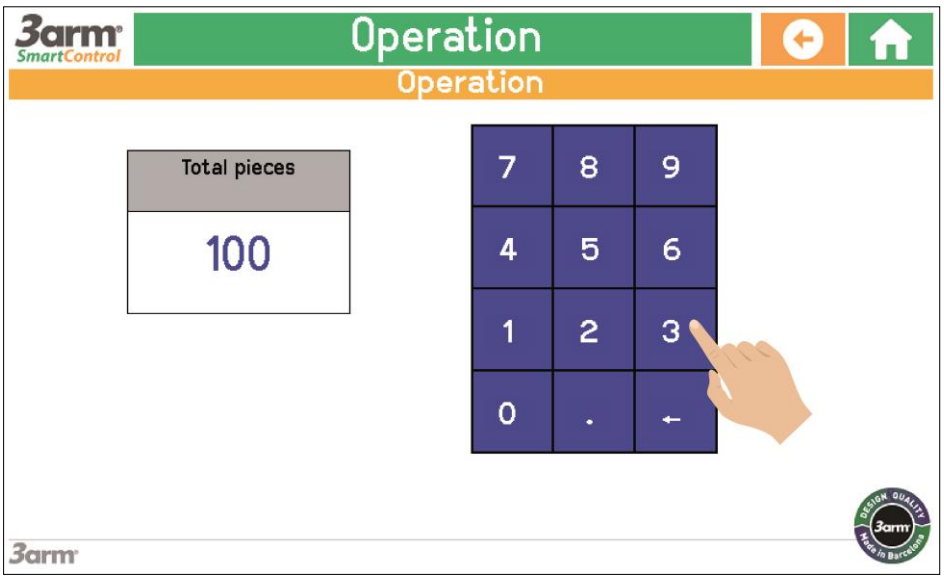
3 OPERATE WITH AN EXISTING TASK OR JOB

The sections described below presuppose:
- A task or job has been previously created for the workpiece
- The integration of the arm-tool has been carried out correctly
- The connections between your tool-device control and the 3arm SmartControl-device control have been carried out following the recommendations of this manual and the manufacturer of your device control

1. From the **Main menu** press **Operation**
2. Select the file of the program with which you want to work (previously created) and press the validation tick. → ✓



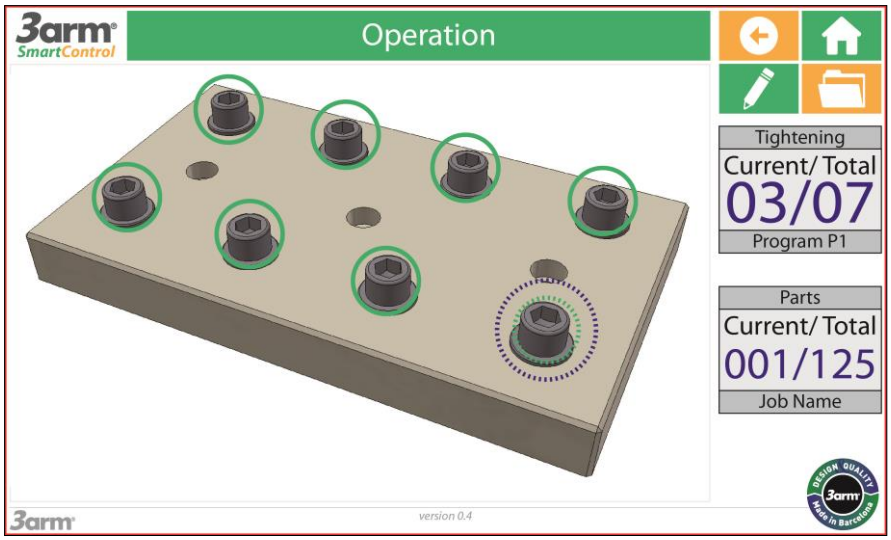
3. Enter the number of workpieces and go back to the **previous screen**.



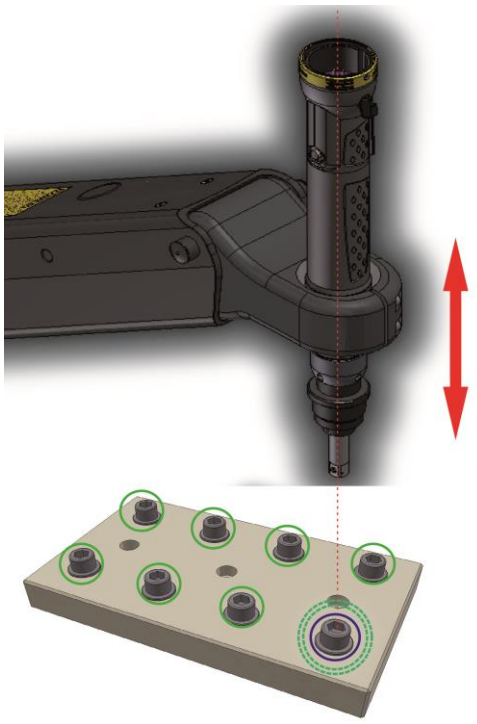
Then the machine will display the **Operation** screen showing the image associated with the task or job selected in step 2.

The different tightening positions are shown with a green circle (status circle)

The tightening position at which the tightening sequence begins is indicated by a **flashing green-blue status circle.** This same circle will increase the intensity of its flashes as soon as the arm-tool equipment is in the correct position to start the first tightening.



4. Bring the tool-arm assembly to the tightening position shown on the screen (flashing blue). When it is in the correct position the blue lights will flash with greater intensity. At this point the device will send the necessary signal to the device control to unblock the operation of the tool.



Circle with fast blue-green flashes

Circle with slow blue-green flashes

Green circle. Tightening position pending

Blue circle. Tightening position completed correctly

5. Press the trigger or the activation device of your tool to begin tightening. Accompany the tool until the final tightening is complete.

NOTE: The signal from the SmartControl device will unlock the tool only if it is in the proper position.

6. Check that the torque and/or angle obtained (indicated by the tool device control) is the desired one. The SmartControl device will display a blue status circle on the screen in the position that has just been tightened, indicating that the tightening has been carried out successfully.

7. Repeat steps 4-6 until all tightening positions of the workpiece have been completed. After finishing the first part, the device will automatically show a new "clean" part to begin with the first tightening position.

8. After the correct tightening of all the parts indicated by the user is completed, a “job completed" message will be displayed in the lower central margin of the screen.

3.1 About the Operation screen

This screen allows you to carry out the tightening for a previously created task or job.

To access it:

1. Go to: **Main menu > Operation**

The following describes the screen, its icons, values, options, etc.

Tightening (Screw Number) (A): This box is for information. In the upper part, the current tightening position number is shown with respect to the number of total tightening positions defined for the current task or job. The numerator is actually a counter that will increase unitarily at the end of each tightening. Shown in the lower band, is the current tightening program. (Program P1) that the current tightening position corresponds to.

Parts (B): A fraction is shown in which the numerator indicates the number of parts completed and the denominator indicates the total number of parts to be processed. Number of total parts

Program P1: This indicates the tightening program number that the current tightening position corresponds to.

Job Name: This indicates the name of the previously defined task or job which is currently being used.

In the centre of the display, the image of the workpiece associated with the current job or task is shown.

 This icon will allow you to change tasks or jobs. Pressing this icon will show all the existing tasks or jobs in the computer's memory.

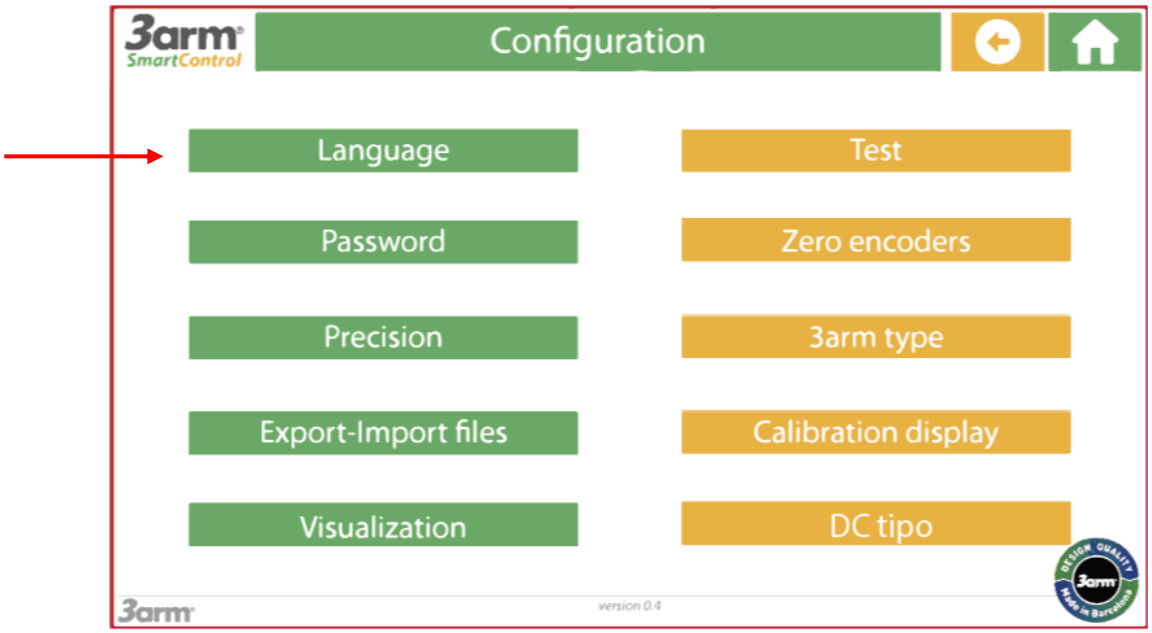
 This icon will allow you to edit a previously created task or job. [See EDITING AN EXISTING JOB OR TASK (FROM OPERATION SCREEN)page 12].

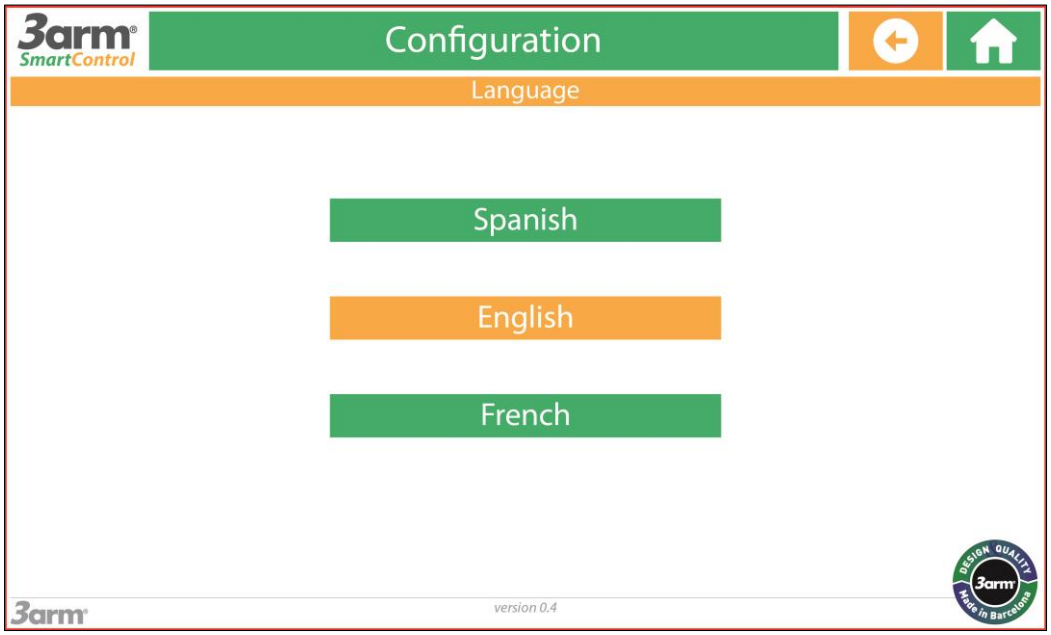
4 BASIC CONFIGURATION

4.1 LANGUAGE

The system is available in English, French and Spanish. To change the language you wish to work with:

1. Go to: **Main menu > Configuration > Language**
2. A screen with the available languages will appear—select one of them. Changes will be saved automatically (No need to save)
3. Go back to the **previous screen**  , or press  to return to the **Main menu**





4.2 PASSWORD

Certain screens can be password protected if necessary.

4.2.1 Define a password

The device operates without a password by default. To define a new password:

1- Go to: **Main menu > Configuration > Password**
2- Press **Change password** and a dial appears in which the new password can be entered. Then press **OK.** *The new password must contain 4 digits.*
3- Go back to the **previous screen**  , or press  to return to the **Main menu**

4.2.2 Working without a password

There is the option of freely accessing all the device options and screens. For this:

1. Go to: **Main menu > Configuration > Password**
2. Press **no password**.
3. Go back to the **previous screen**  , or press  to return to the **Main menu**

NOTE: You need to know the current password in order to configure the device to work without a password.

4.2.3 Master password

There is a master password, or recovery password, which will give access to all the device options and screens. This password is: 9999.

4.2.4 Access to restricted options and screens

Access to the device's restricted options and screens will only be possible by entering the password defined by the user or, failing that, by entering the master password.

1. Access any restricted screen from the main menu.
2. A numeric keypad will be displayed. Enter the password and then press **OK**.
3. The system will give access to the desired screen.

NOTE: Once the user has entered the correct password, they will have access to all the device options and screens until:

- The device goes into hibernation, or the power supply is interrupted
- The presses the  icon in the main menu.

4.2.5 Matrix of blocked options and screens

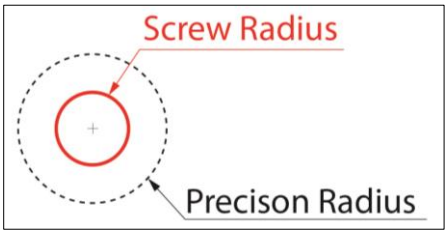
Screen	***Use with password***	***Use without password***
MAIN MENU	✓	✓
CONFIGURATION	✗	✓
Language	✗	✓
Password	✗	✓
Precision	✗	✓
Export-import files	✗	✓
Display	✗	✓
Test	✗	✓
Zero encoders	✗	✓
3arm type	✗	✓
Display calibration	✗	✓
CREATE NEW JOB	✗	✓
OPERATION	✓	✓
EXISTING FILES	✗	✓

4.3 PRECISION

4.3.1 PARAMETER DEFINITION

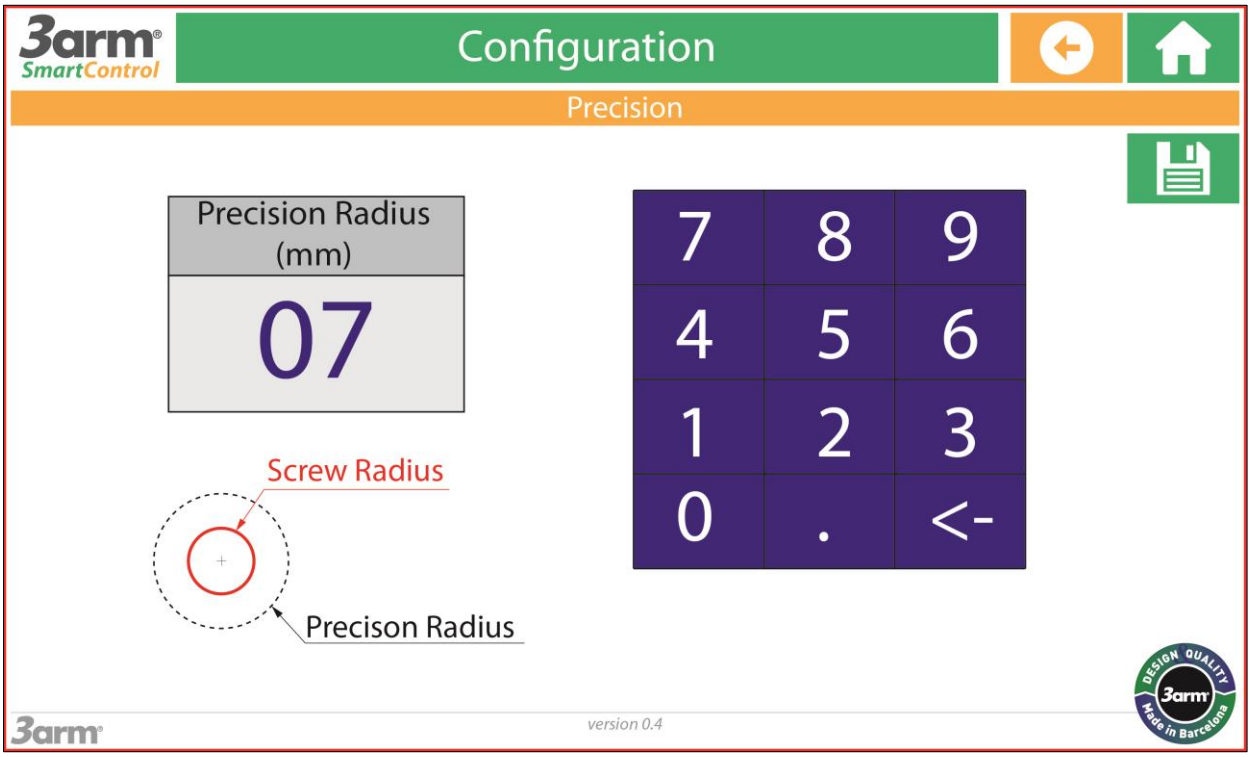
The precision is used to define a radius where the centre coincides with the tightening position. This radius, and there its diameter, will define the accepted tolerance using the following criteria:

If current position is outside the Ø → Incorrect position
If current position is inside the Ø → Correct position



4.3.2 CHANGING THE DEFAULT VALUE

1. Go to: **Main menu> Configuration> Precision**
2. Press on the existing value and a dial will appear in which the new value should be entered (integer with one or two digits, units in mm)
3. Press **save**
4. Go back to the **previous screen**, or press to return to the **Main menu**



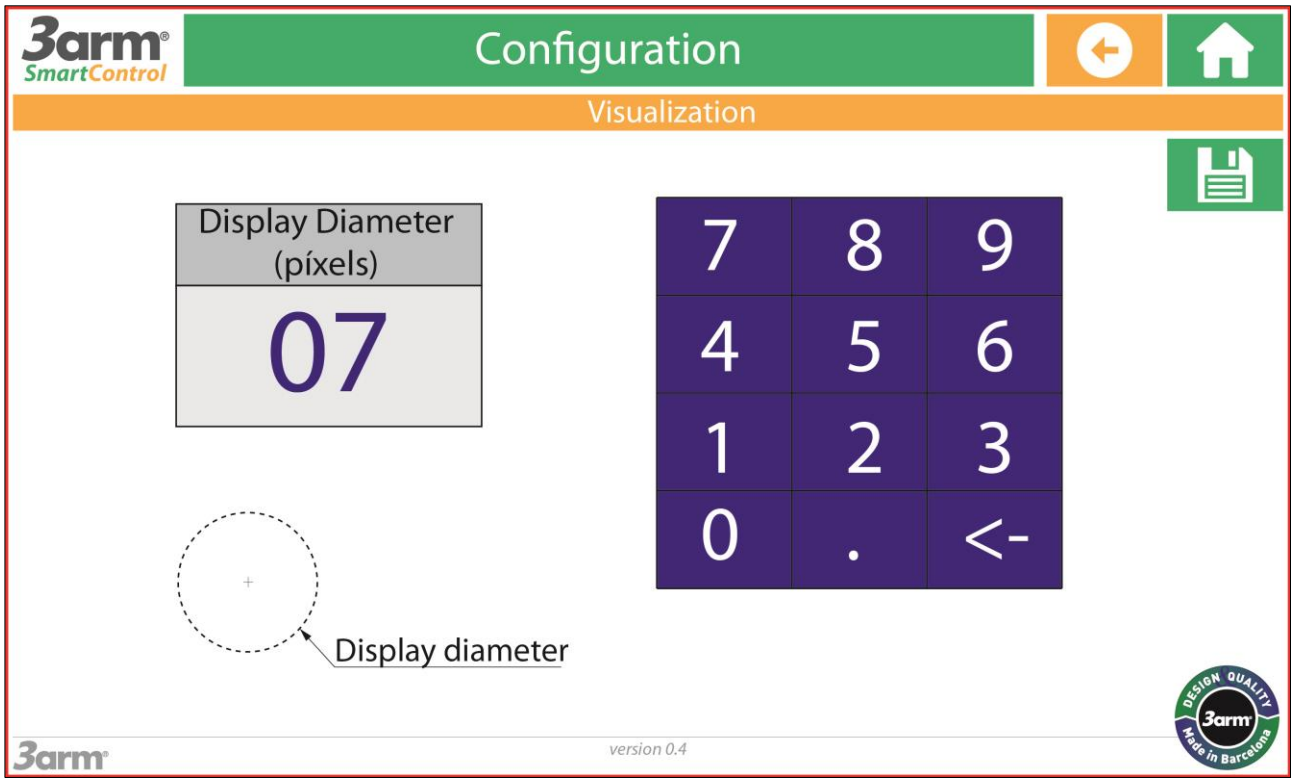
4.4 DISPLAY

This screen allows you to define of the size (pixels) of the status circles to adapt to the number of tightening positions, the size of the screen and the embedded image.

There is a minimum and maximum value to ensure a minimum level of display. These values are 10 px and 60 px respectively.

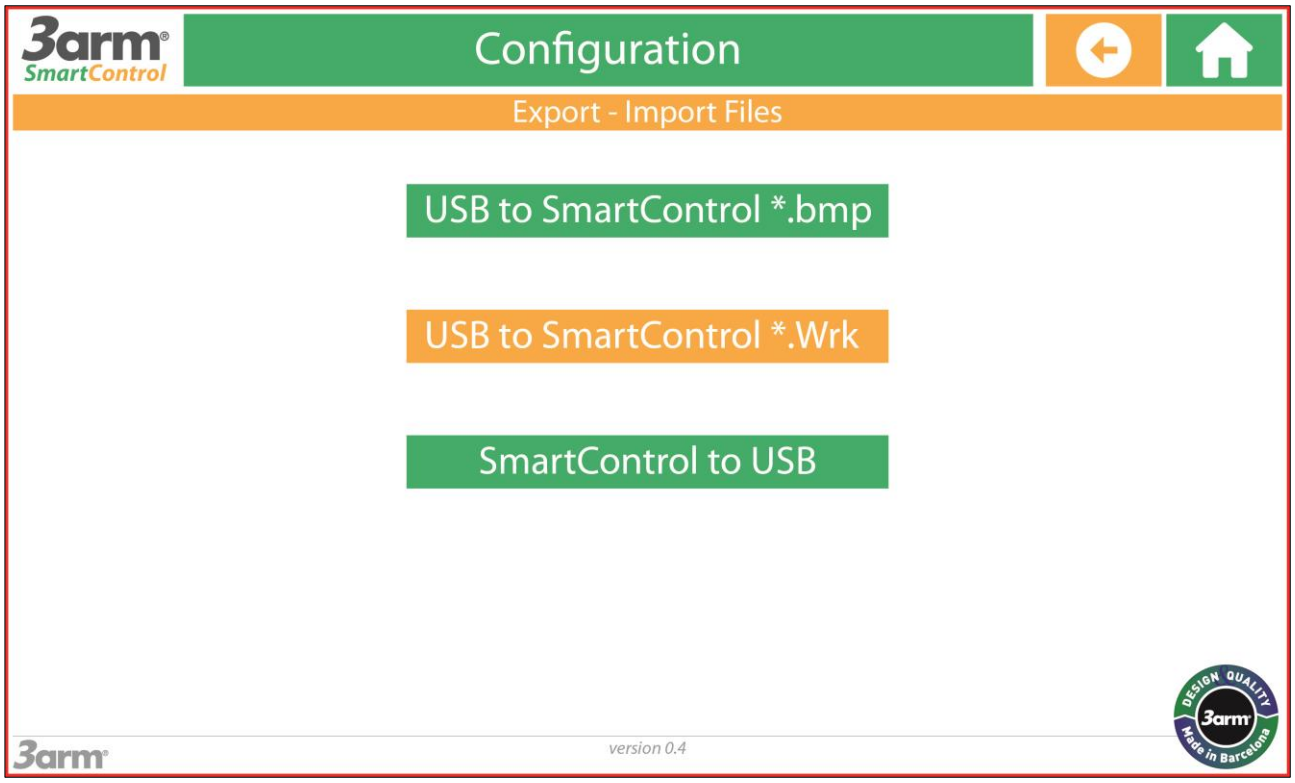
To change this value:

1. Go to: **Main menu> Configuration> Display**
2. Press on the existing value and a dial will appear in which the new value should be entered.
3. Press **save**
4. Go back to the **previous screen**, or press to return to the **Main menu**



4.5 EXPORT AND IMPORT FILES

The option Export and import files will allow you to make backup copies of your created tasks or jobs in an external memory, as well as add representative images of the part to the corresponding task or job.



4.5.1 EXPORT FILES "SmartControl to USB"

Only files with a ".wrk" extension corresponding to a previously created job or task can be exported. To do this:

1. Go to: **Main menu> Configuration> Export-Import files**
2. Insert a USB memory stick [See FOLDER STRUCTURE page 27] into the USB port located on the side cover of the device.
3. Press the **SmartControl to USB** option and wait a few seconds until the copy process has finished. (See status in the lower margin of the screen)
4. Remove the USB memory stick
5. Go back to the **previous screen** , or press to return to the **Main menu**

NOTE: The USB memory must contain a folder with name "3arm" in which the exported files with the extension *.wrk will be saved [See FOLDER STRUCTURE page 27]

4.5.2 IMPORT FILES "USB to SmartControl *bmp & USB to SmartControl *Wrk"

To import images:

1. Insert a USB memory stick [See FOLDER STRUCTURE page 27] into the USB port located on the side cover of the device.
2. Press the **USB to SmartControl *bmp** option and wait a few seconds until the copy process has finished. (See status in the lower margin of the screen)
3. Remove the USB memory stick
4. Go back to the **previous screen** , or press to return to the **Main menu**

To import jobs:

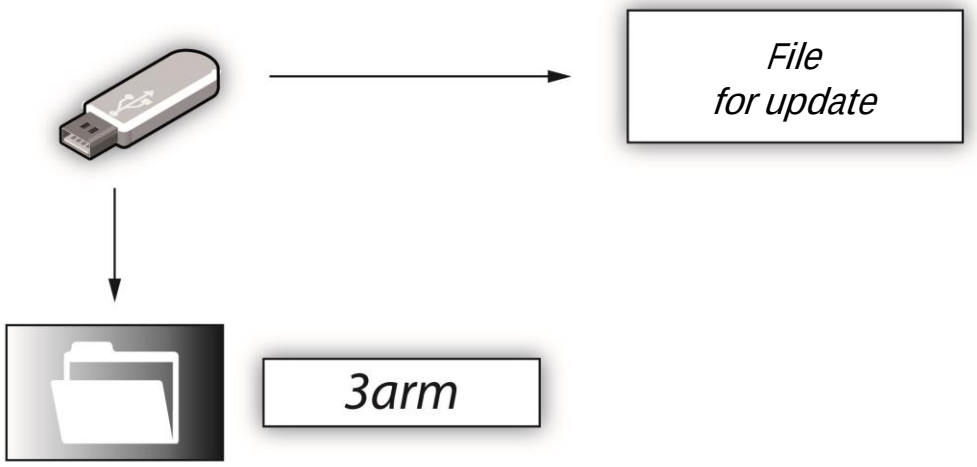
1. Insert a USB memory stick [See FOLDER STRUCTURE page 27] into the USB port located on the side cover of the device.
2. Press the **USB to SmartControl *wrk** option and wait a few seconds until the copy process has finished. (See status in the lower margin of the screen)
3. Remove the USB memory stick
4. Go back to the **previous screen** , or press to return to the **Main menu**

NOTE: Make sure you have a copy of the jobs and images stored in the internal memory of the device, since during this import process the system will delete all files with *wrk and *bmp extensions

NOTE: If any problems arise during the Export-Import of files, cut the device's power supply, connect the USB memory stick to the USB port. Then turn the power supply back on and proceed to the Export-Import of files as described.

4.5.3 FOLDER STRUCTURE

In order to import files, the USB memory stick must contain the following folder structure:



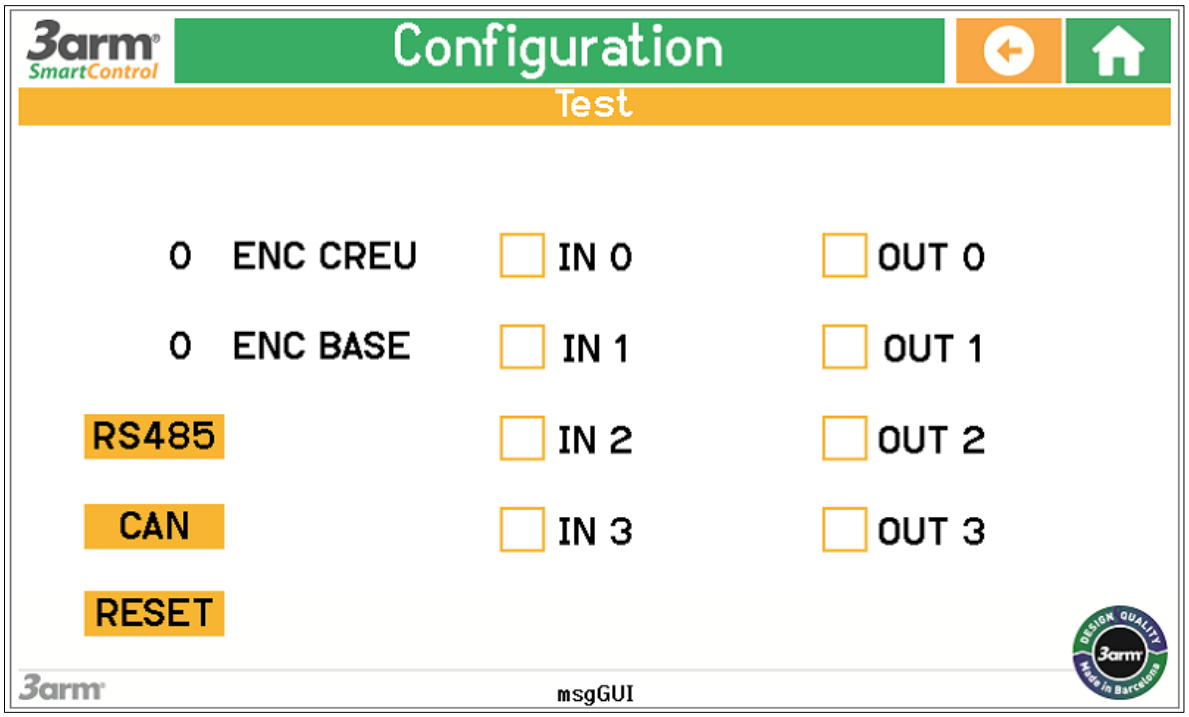
Create a folder with the name "3arm" for saving files with *.bmp and *.wrk extensions

The files for update should be copied to the top level of the memory device with the extension *.bin

5 ADVANCED CONFIGURATION

5.1 TEST

This screen allows the simulation of active outputs for the detection of possible failures and malfunctions. It also enables the reading of the encoders.



The simulated output "OUT1" simulates the position Encoders OK, spindle/device permission. White cable.

The rest of outputs "OUT0", 2 and 3 combined together simulate the corresponding tightening program. Grey, purple and brown cables.

5.2 ARM TYPE: 3ARM TYPE

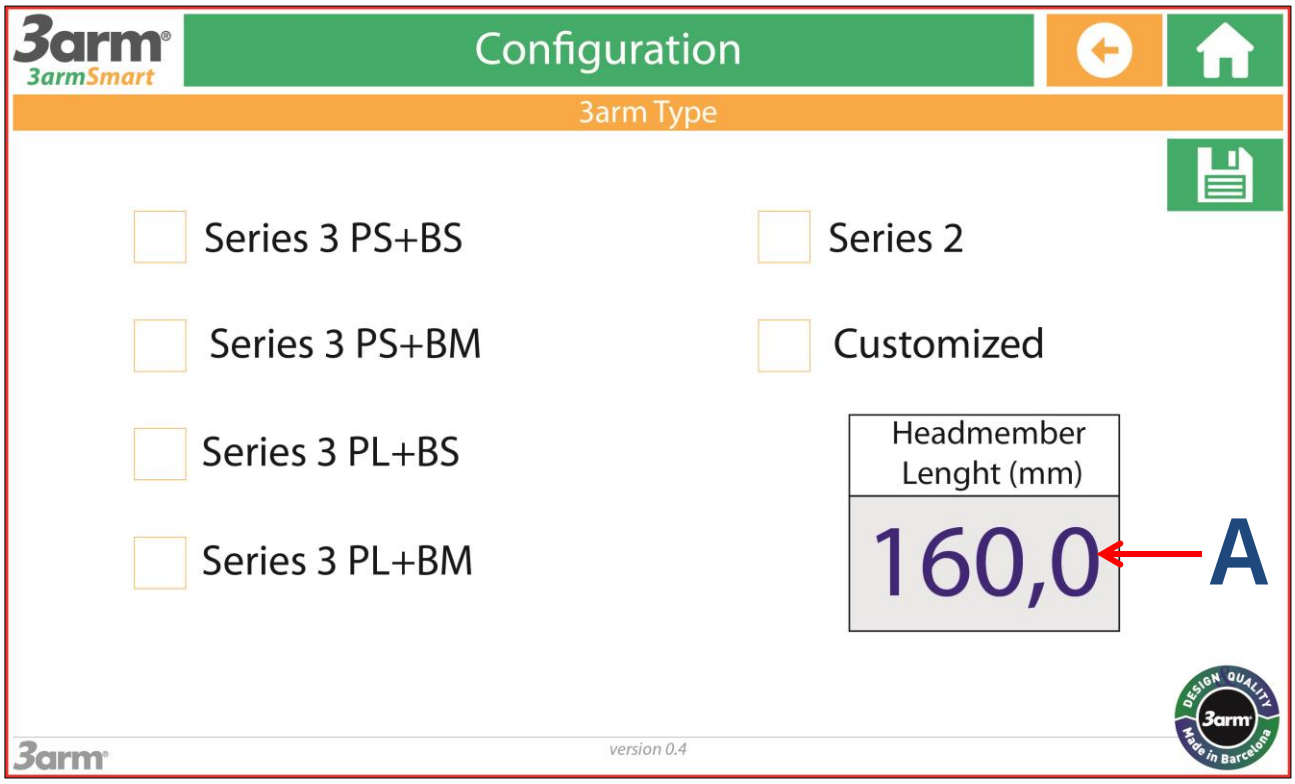
The device must be configured for the arm with which it is going to work.

This configuration will be set at the factory, although there is the option to configure it afterwards. For this:

1. Go to: **Main menu> Configuration> 3arm type**
2. Press the option corresponding to your arm. (The selected box should change to green)
3. Press **save**
4. Go back to the **previous screen**, or press to return to the **Main menu**

If the arm to being used has a customized head, its length must be added. To do this:

1. Go to: **Main menu> Configuration> 3arm type**
2. Press the option corresponding to your arm. (The selected box should change to green)
3. Press the **Customized** box
4. Press in the area marked **"A"** and a dial will appear in which the new value should be entered (number with a decimal, units in mm)
5. Press **save** and the system will go back to the previous screen.
6. Go back to the **previous screen**, or press to return to the **Main menu**

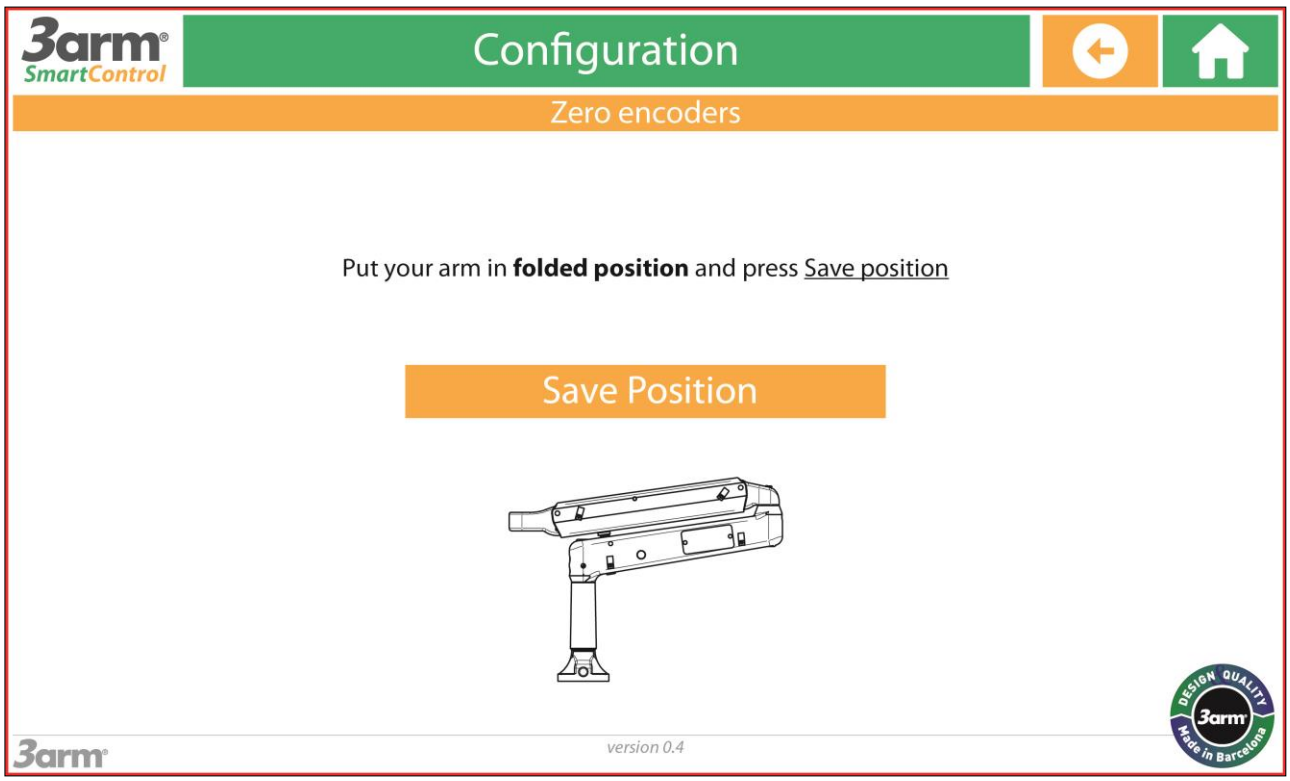


5.3 ZERO ENCODERS

The "zero encoders" position corresponds to the position of the 3arm arm folded on itself. It is possible that the source of the system's positioning errors is due to a misconfiguration of this position.

If it is necessary to redefine the "Zero Encoders" position:

1. Go to: **Main menu > Configuration > Zero Encoders**
2. Bring the 3arm arm to its folded position as shown below.
3. Press **Save Position** to save the new position.
4. Go back to the **previous screen** , or press to return to the **Main menu**



5.4 DISPLAY CALIBRATION

To calibrate the display again:

1. Go to: **Main menu> Configuration> Display Calibration**
2. Press the crosses that appear on the 4 edges of the screen and then on the cross that appears in the centre of the screen.
3. The system will automatically return to the **Main menu**

NOTE: Using a tip on the touchscreen is recommended to achieve the correct calibration.

5.5 DC TYPE

There are 3 communication modes

1. CAN. This mode will be selected when communication with the device control is via a CAN SROS126 dongle. The interaction with the device control is done through digital inputs and outputs.
2. Type A. DEFAULT MODE. This mode will be selected when communications with the device is via a 9-cable conduit (IO's + Power). In this mode, when the SROS125 screen detects that the encoder is in the correct position, it gives permission to the device and activates the screwing program. When the program ends having completed the torque and other programmed parameters, the device sends an OK signal to the screen.
3. Type B. This mode is the same as TYPE A , but the OK signal (yellow wire, in this case) provides the option of using the device trigger as a safety to cut off the OK permissions for screwing. In other words, if the user leaves the screwing area without releasing the trigger, they will still have screwing permission. Otherwise, if the user leaves the screwing area and releases the trigger, they will have to return to the screwing area to renew the permission. (communications via a 9-cable conduit (IO's + Power)

5.6 SOFTWARE UPDATE

Order the latest software version compatible with your device from your 3arm® distributor.
To update your device's software you should:

1. Cut the device's power supply
2. Insert a USB memory stick into the USB port located on the side cover of the device.

NOTE: The USB memory should contain only the update file with name SROS125.bin

3. Connect the device to the power supply again
4. Wait for the display to show the **Main menu** screen
5. Remove the USB memory stick and work normally

NOTE: Make sure you have a copy of the jobs and images stored in the internal memory of the device, since during this import process the system will delete all files with *wrk and *bmp extensions

6 CHECKING EXISTING FILES

The available files (*.wrk files) can be checked in the internal memory of the device. To do this:

1. Go to: **Main menu > Existing files**
2. A browser will appear in which the name and extension of the stored files are displayed
3. Go back to the **previous screen**  , or press  to return to the **Main menu**

DECLARATION OF INCORPORATION

Per Machinery Directive 2006/42/EC, Annex II B

The manufacturer:

Company:	TECNOSPIRO MACHINE TOOL, S.L.
Address:	P.I. Pla dels Vinyats I, s/n nau 1
City:	Sant Joan de Vilatorrada - 08250
Country:	Spain - EU

Declare that this product:

Complies with the Machinery Directive 2006/42/EC, the Electrical Equipment designed for use within certain voltage limits (Low Voltage) Directive 2014/35/EU, the Electromagnetic Compatibility Directive 2014/30/EU and the Directive on the Restriction of the Use of Certain Hazardous Substances in Electronic and Electrical Equipment 2011/65/EU.

We also declare that the technical documentation for this partially complete machinery has been prepared pursuant to the requirements of Annex II B. This documentation will be released to the competent market oversight authorities with a duly substantiated application.

The start-up of the partially completed machinery is prohibited until it is assembled and set up, with the aid of other parts, as a machine that satisfies the provisions of the European directive on machinery and has a CE Declaration of Conformity pursuant to Annex II A.

Authorised for documentation:

Mr Ramon Jou Parrot of TECNOSPIRO MACHINE TOOL, S.L

Sant Joan de Vilatorrada, Wednesday, 21 April 2021

Ramon Jou Parrot, Technical Director

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