accuraspray 4.0

User manual
Online monitoring
of thermal spray
processes for the
shop floor

tecnar

our sensors, your productivity.

NOTICES

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MANUAL PART

40101-00024-00

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OVERVIEW:

- Table of content at the beginning of the document
- Table of figures at the beginning of the document

This manual contains the following sections:

- Safety
- Product description
- Installation
- Maintenance
- Operation
- Software

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1 SYSTEM DESCRIPTION

1.1   INTRODUCTION

The present document gives a complete description and principle of operation of the Accuraspray 4.0 sensor as well as a description of its components.

1.1.1   OVERVIEW

The main purpose of the Accuraspray 4.0 is to ensure consistent, high-quality coatings by monitoring the in-flight particles and plume properties before each spray run. This ensures that the spray properties are within predetermined acceptance ranges for ideal coating and performance.

To help detect potential issues such as electrode wear, partial clogging of the nozzle or in the powder injection system, and instability of the powder feeder before the coating process, the Accuraspray monitors:

- Particle's temperature and velocity
- Plume profile and intensity
- Part temperature (optional)

The Accuraspray 4.0 can also be used to:

- Develop and optimize spray parameters
- Transfer parameters from one booth to another (anywhere in the world)
- Transfer parameters from one spray gun to another
- Extend the useful lifespan of hardware
- Significantly reduce the number of test coupons
- Troubleshoot day-to-day issues

1.2   GENERAL PRECAUTIONS

The following precautions should be observed at all times while operating the Accuraspray 4.0. Tecnar Automation Ltd. assumes no liability whatsoever for a user's failure to comply with these precautions or the warnings throughout this manual.

To protect your Accuraspray 4.0 from damage, you must:

- Connect it to an unloaded, properly grounded power line (50–60 Hz. 100-240VAC, 50-60Hz, 1.5 A).

- We also recommend using an additional power line filter to filter out any power surges or bursts

- Use it at an ambient temperature between 4 and 45 °C

- Supply 30 LPM (2CFM) of cooling/cleaning air at 1.7–2.7 bar (25–40 psi) to the sensor head AT ALL TIMES while the unit is powered on

- Use only original spare parts.

All Accuraspray 4.0 users should read this user manual, take the web-based introduction and training session, and contact Tecnar with any further questions. We also recommend that a copy of the user manual should always be kept near the equipment.

2 DESCRIPTION

The Accuraspray 4.0 system includes the following elements:

1) A sensor head

2) A controller

3) A substrate pyrometer (optional)

4) Air hoses and filter

5) Controller power cable

6) Sensor head power and communication cable

Each elements are described in details on the following pages.
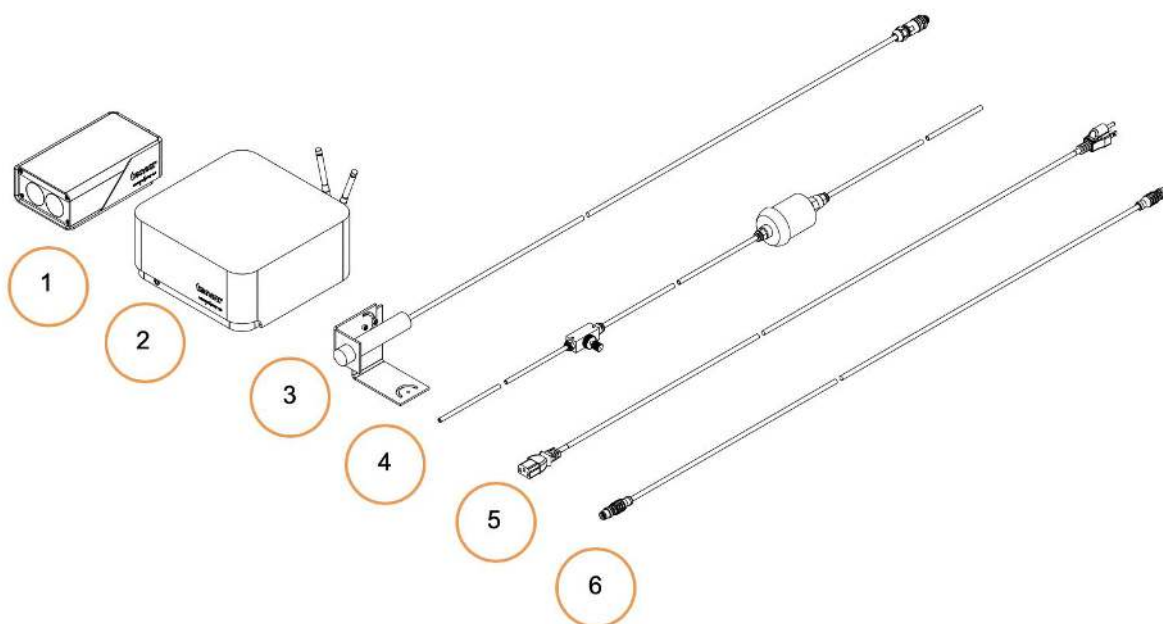
FIGURE 1 SCHEMATICAL DESCRIPTION OF THE SYSTEM

2.1   CONTROLLER

The controller must be kept in a ventilated area to reduce the risk of overheating.

The controller receives readings from the sensor head. It processes the data and broadcasts the results to the user interface(s).

FIGURE 2 CONTROLLER (FRONT)
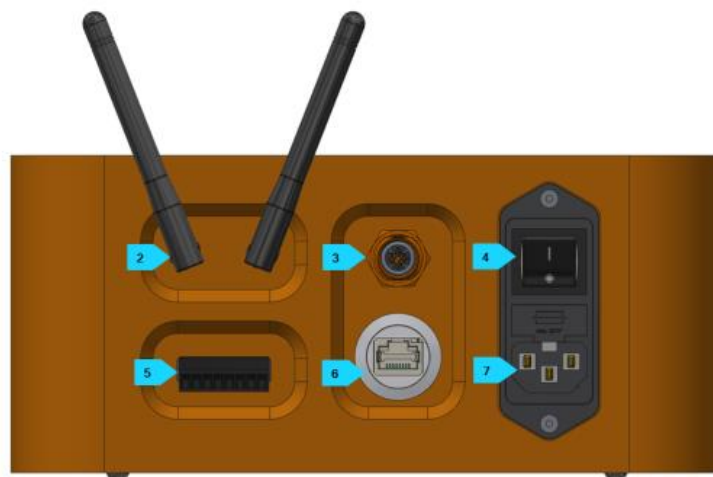
FIGURE 3 CONTROLLER (BACK)

Component	Description
1. LED	LED Off: Power supply is OFF Green: The system is working properly Yellow: Sensor head is not connected Red: Unit powered up but is in error state.
2. Wi-Fi antenna	Used to access the Accuraspray user interface through a wireless network connection. The Wi-Fi connection acts as a Hotspot. It can be disabled but not reconfigured.
3. Sensor head port	Used to power and communicate with the sensor head.
4. Power switch	Used to active the unit.
5. User interface port	Used to interface the Accuraspray to the user's spray controller via digital I/O ports.
6. Ethernet	Used to access the Accuraspray user interface through a wired network connection (either static or DHCP).
7. Power inlet	Provides power to the Accuraspray. *Connect it to an unloaded, properly grounded power line (100-240VAC, 50-60Hz, 1.5 A).*

2.2   SENSOR HEAD

The sensor head measures the following particles and spray plume properties:

- Particles velocity

- Particles temperature

- Spray plume geometry: width, position, and intensity.
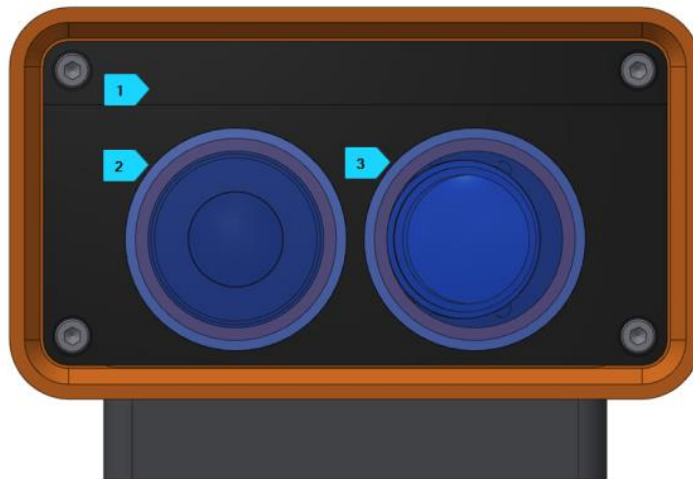
FIGURE 4 SENSOR HEAD (FRONT)
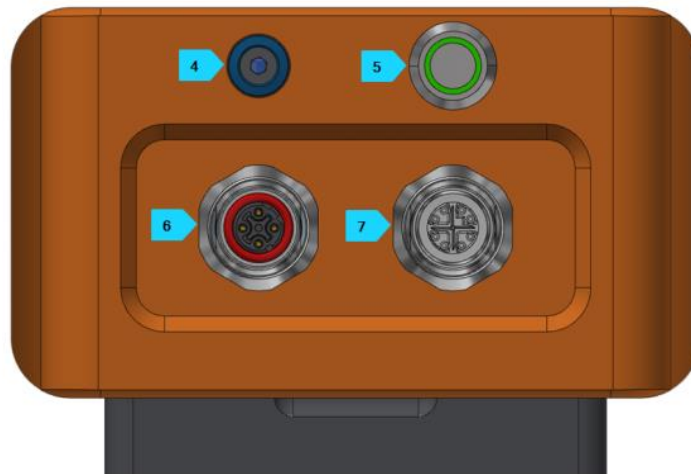
FIGURE 5 SENSOR HEAD (BACK)

Component	Description
1. Air knife	The air knife is used to keep the Accuraspray windows clean and free of dust.
2. Optical system viewport	Viewport of the temperature and velocity measurement sensor.
3. Camera viewport	Viewport of the camera used to characterize the plume geometry.
4. Air supply port	Compressed air is used both as active cooling for the head's internal components and, as it is exhausted from the head, to generate an air knife that keeps the viewport windows clean.
5. Alignment beam switch	Activation switch for the alignment beam.
6. Substrate pyrometer port	Used to power and communicate with the optional substrate pyrometer sensor.
7. Communication port	Used to power the sensor head and communicate with the controller.

2.3 CABLES, HOSES AND ANTENNAS

The Accuraspray 4.0 is delivered with several cables, hoses, and antennas, which are described in the following table.

Cables/Hoses/Antennas	Description
IEC power cable	Used to connect the Accuraspray to a power outlet.
Communication cable	Communication between the controller and the measurement head.
Antennas	Used for Wi-Fi communication.
Compressed air hoses	Provide compressed air to the measurement head for cooling and purging purposes. • One hose connects the compressed air supply to the air filter • One hose connects the air filter to the pressure regulator • One hose connects the regulator to the measurement head

3 SOFTWARE OPERATION

3.1   USER INTERFACE

The user interface can be accessed with most internet browsers. Tecnar recommends Google Chrome or Microsoft Edge (chromium based) browsers. Any relatively modern computer with at least 4GB of RAM should be sufficient to run the user interface smoothly. Connect the PC to the controller via an Ethernet cable or Wi-Fi network.
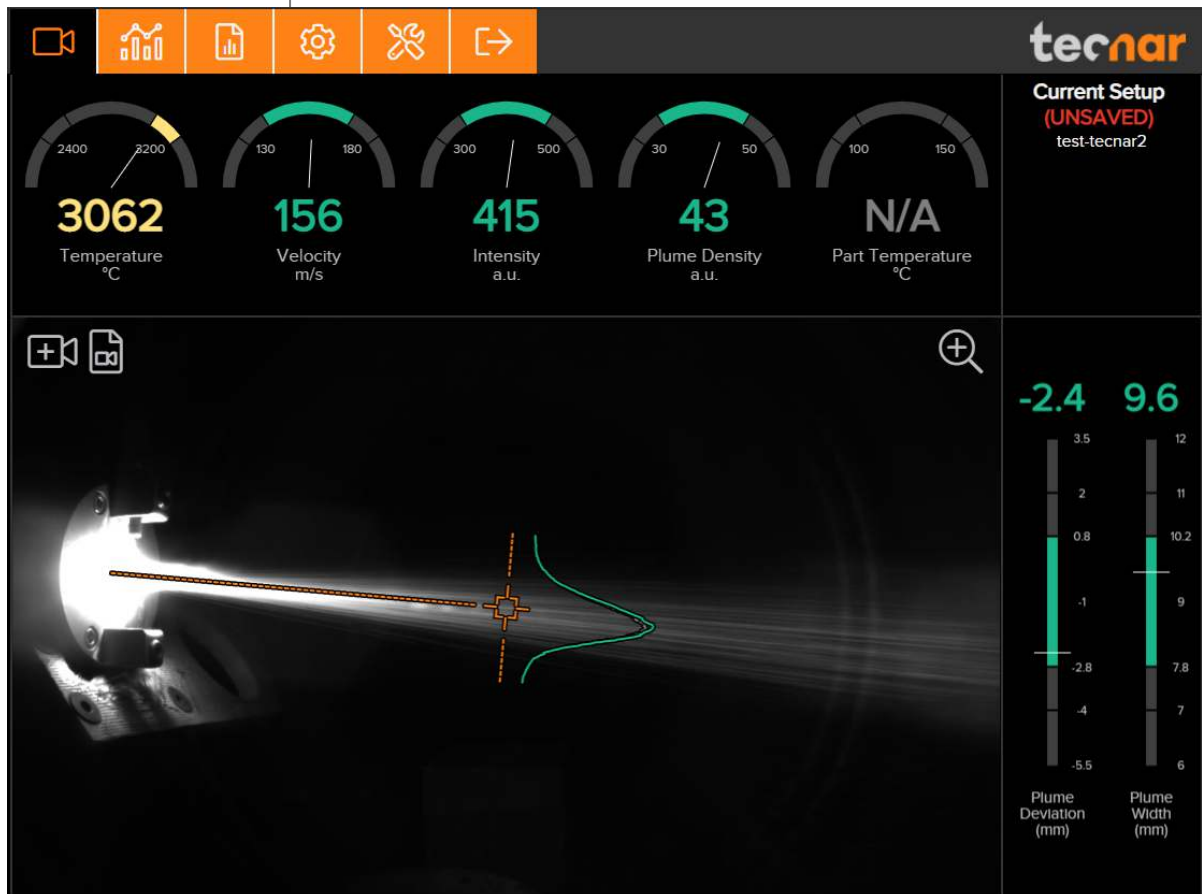
FIGURE 6 - ACCURASPRAY 4.0 USER INTERFACE

3.2   NAVIGATION ICONS

Different icons are displayed at the top of the Accuraspray user interface in order to navigate between the different screens. The following table describes those icons.

Icons	Description
	Access the main measurement screen (live).
	Access the strip charts screen.
	Access the production files screen.
	Access the setup screen (spray parameters).
	Access the system settings.
	Take control to gain access to the setup screen.
	Log in.
	Log out.

3.2.1   LIVE SCREEN

The camera screen displays, in real time, all measurements taken by the Accuraspray.

The measurements are displayed at the top and to the right of the screen.

Color codes indicate whether the measurements are within the acceptance range as defined in the setup by the process engineer. A measurement fully within the acceptance range is shown in green, a measurement just barely within the acceptance range is shown in yellow, and a measurement outside the acceptance range is shown in red. Corrective actions should be taken to ensure that all measurements are within the acceptance range and displayed in green.

In the middle of the screen, in the camera view, an orange bullseye represents the position where the particle's temperature and velocity are measured. The distance between the bullseye and the tip of the spray gun, called the standoff distance, is represented by the dotted horizontal orange line. The green curve shows the plume intensity profile as measured by the sensor along the vertical line, called the sampling line.
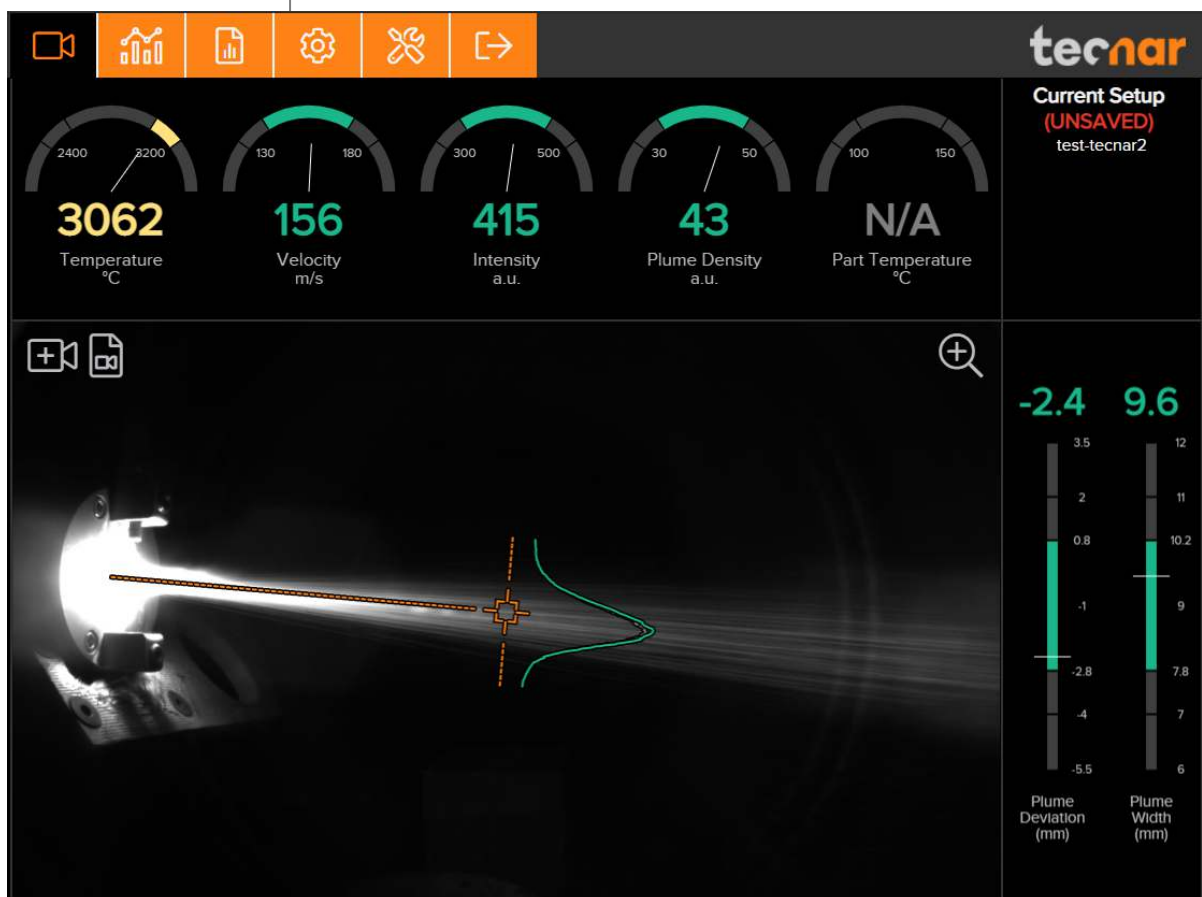
FIGURE 7 - LIVE SCREEN

The different measurements provided by the Accuraspray are described in detail in the table below.

Parameters	Description
Temperature	Average particles temperature that are passing through the sensor's measurement volume (bullseye).
Velocity	Average particles speed that are passing through the sensor's measurement volume (bullseye).
Intensity	Intensity of the spray plume. This measurement is very sensitive to minute changes in the spray conditions. The parameters that have the strongest effect on the plume intensity are: • Particles temperature • Average particles diameter • Feedstock emissivity • Feed rate
Plume density	Provides an indication of the particles flow rate.
Part temperature	Temperature of the substrate on which the coating is applied.
Plume deviation	Deviation of the plume position against the bullseye.
Plume width	Width of the spray plume.

3.2.1.1 Zoom in/out

It is possible to zoom in on the center of the image where the bullseye is located.

To do so, click on the magnifying glass icon. This will enlarge the image so that the sampling line, the dotted vertical line overlaid on the camera image, takes 50% of the screen. To return to the full screen click on the magnifying glass again.

This feature is especially useful for HVAF/HVOF where the plume is quite narrow and can be difficult to see when viewing the full camera frame.

3.2.1.2 Recording a video sequence

Sequences can be recorded and replayed using the icons at the top left corner of the video panel. The camera icon is used to launch a recording. A minimum of 5 seconds must be recorded before clicking the "Stop Recording" button.

Once the Accuraspray is recording, the camera button will start blinking red.

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To stop recording, click on the square icon next to the camera. This will automatically download the sequence to your computer in your web browser's default download directory. Simultaneously, the controller will also save and generate a report (.pdf + .csv) that will be stored in the controller. The loading overlay will appear during that time, indicating "Saving Report in the Controller".

Recorded video sequences (.video files) are not stored on the Accuraspray Controller. Lastly, it is not possible to start recording a sequence when the setup is unsaved. This is intended to avoid confusions and discrepancies.
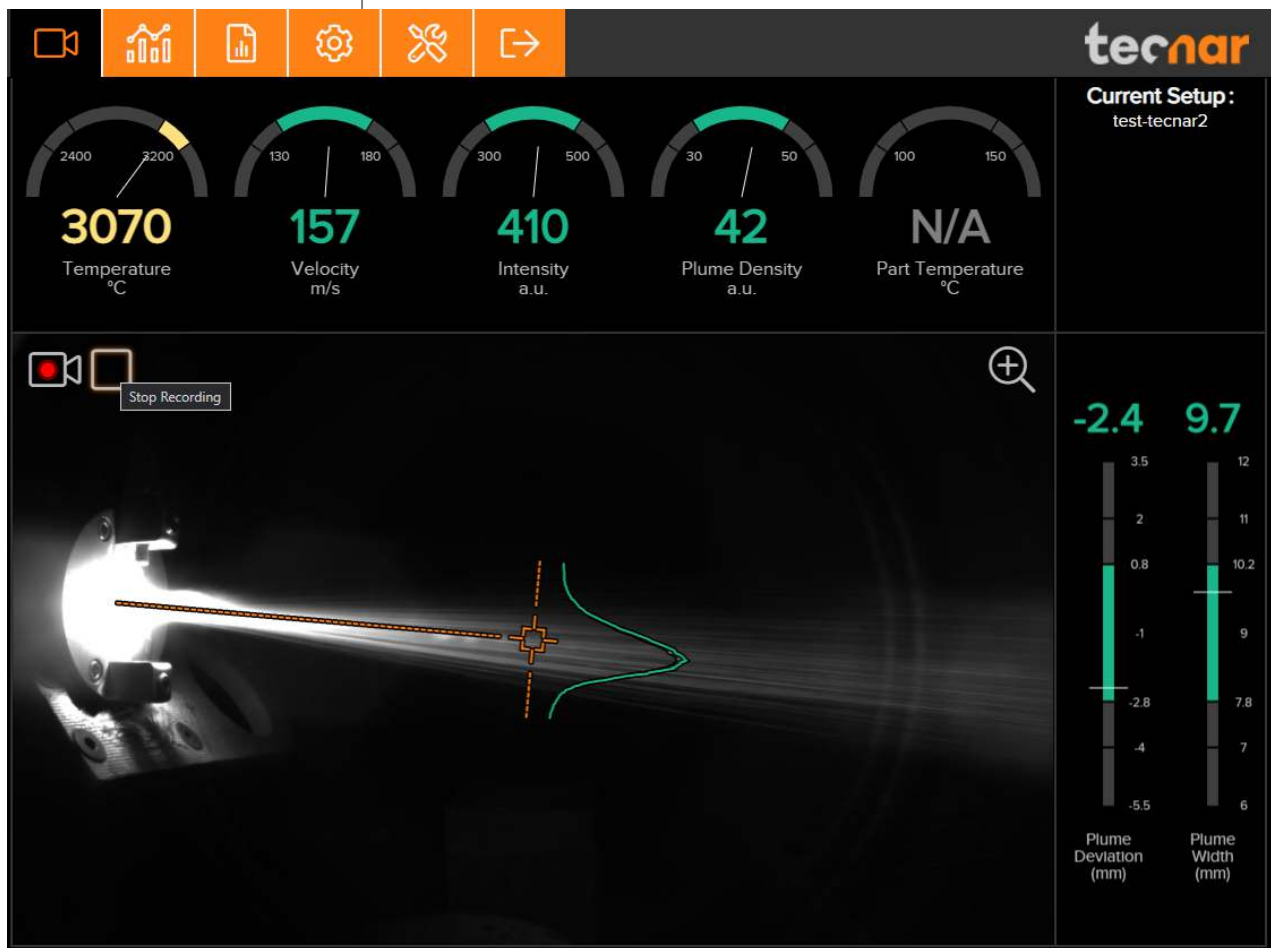
FIGURE 8 - RECORDING VIDEO

3.2.1.3   Replaying a video sequence

To open and start replaying a saved sequence, click on the camera folder icon next to the recording button, and select the sequence that you want to replay.

As mentioned previously, the video sequences are not stored on the Accuraspray controller. You will find them on your computer in your default download directory or wherever you have stored them.

When replaying a sequence, the "Stop Video" icon will appear. Use it to exit replaying mode and go back to live mode.

It is possible to pause a sequence using the "Pause" icon and resume playback using the "Play" icon. You can also switch from the live screen to the strip chart screen to view the plots in real-time.

The name of the video file appears at the bottom left, and the elapsed time at the bottom right as seen in the picture below.
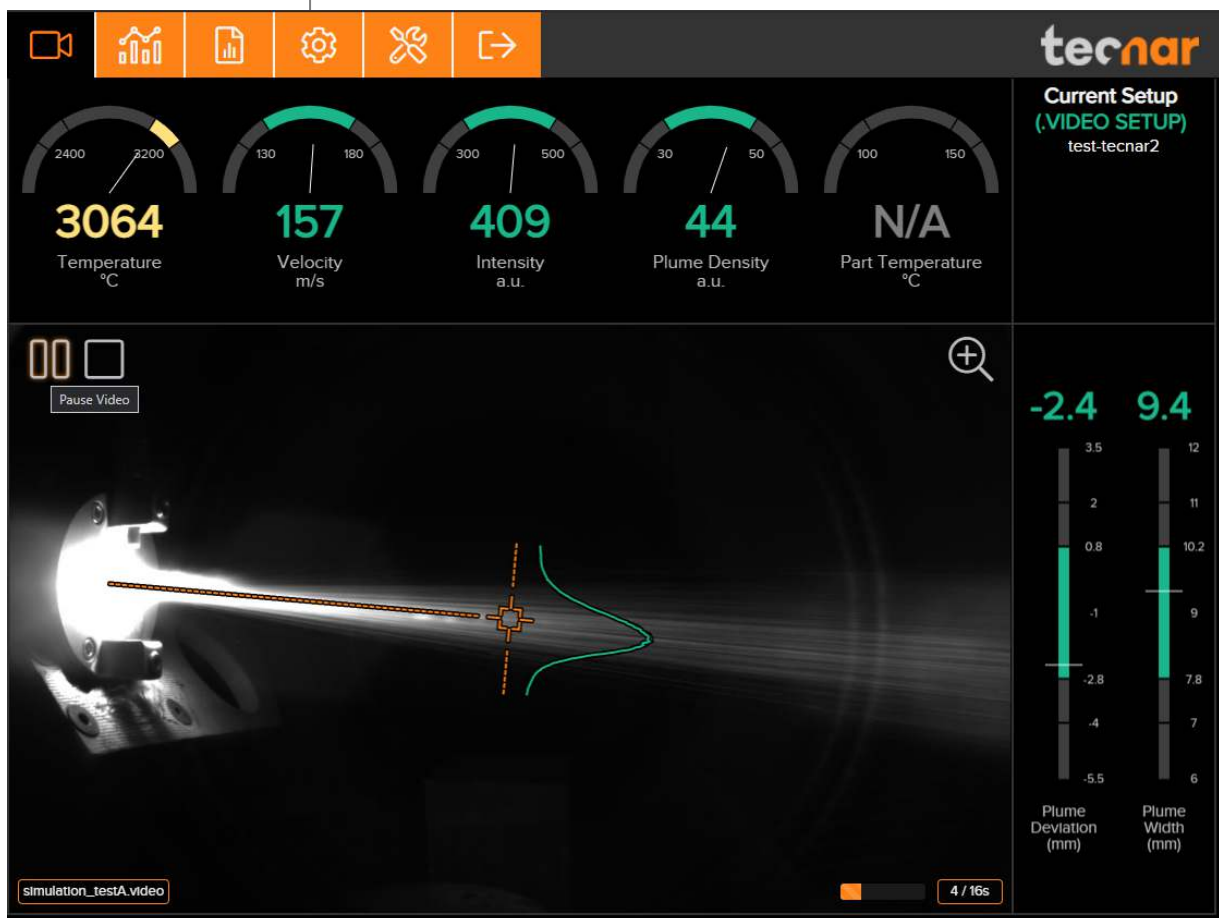
FIGURE 9 - VIDEO PLAYBACK

3.2.1.4   Upgrading a video sequence

Videos files that were recorded prior to version 1.4.1 did not have an embedded setup, causing discrepancies between the setup that was used at the time of recording and the current setup of the system. The video is played "as is". The gauges min/max settings, projection overlay, and other setup settings do not reflect the reality. To get rid of this problem, new video files now include the setup within the video file itself. Furthermore, you can now upgrade your old video files and link the proper setup that was used at the time. You will be prompted to download a new video file (`--with-setup`). Link the proper setup by choosing from the setup list as shown below. You can safely delete your old video file that does not include the setup afterwards.

This video file does not contain an embedded setup file. If you know the setup that was used at the time of recording, it is recommended to upgrade the file to the latest format in order to have relevant visuals, settings and gauges.

Do you want to associate a setup with this video now?

Yes, choose setup now   No, just play the video
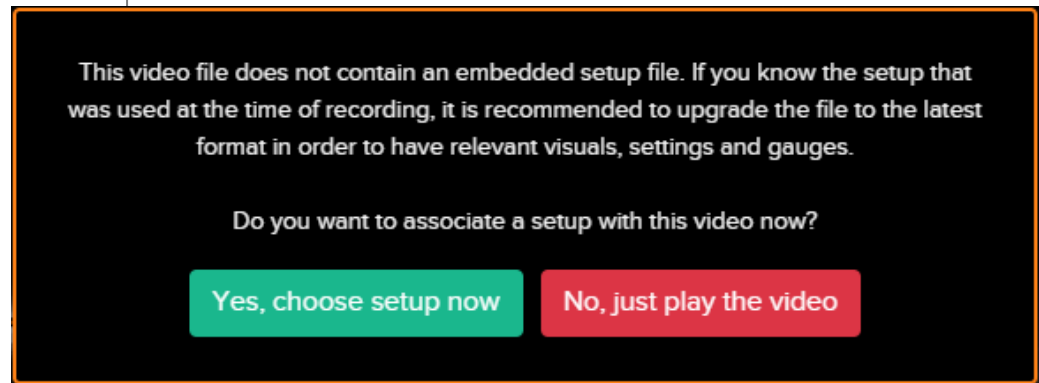
FIGURE 10 - UPGRADE VIDEO FILE (STEP 1)

Setup Name	Creation Date (dd/mm/yy)	Id
Default - HVOF/HVAF	4/7/19 - 14:34:08	3
Default - SPS	4/7/19 - 14:41:40	2
Default-Plasma	2/2/19 - 10:40:16	1
test-tecnar1	22/2/21 - 11:58:47	4
test-tecnar2	22/2/21 - 15:48:39	5
test-tecnar3	22/2/21 - 16:59:48	6

Currently Sorted By: Name, Ascending   Associate with video
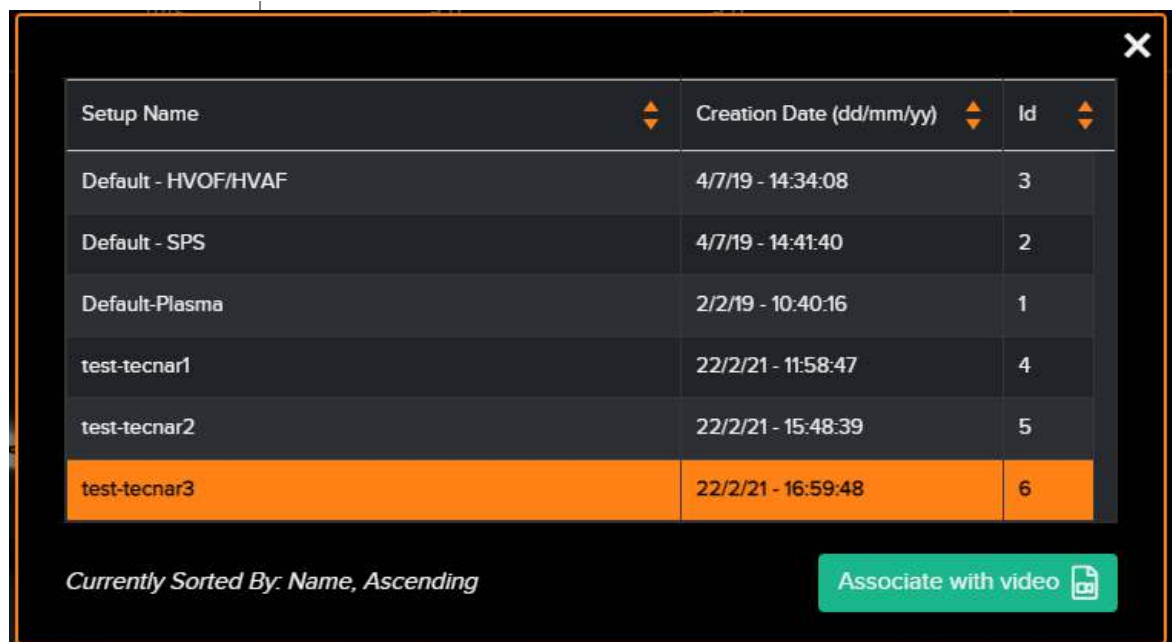
FIGURE 11 - UPGRADE VIDEO FILE (STEP 2)

3.2.2   STRIPCHART SCREEN

The strip chart screen displays the evolution over time of measurements available on the camera screen. For the measurement descriptions, see the camera screen section.

In the middle of the screen, you will find two graphs, each displaying one type of measurement. It is possible to select which measurement to display from the table located to the right of the graphs.

FIGURE 12 - STRIPCHART SCREEN

3.2.2.1   Adjusting the time span

The time duration displayed on the strip charts can be adjusted using the text box at the top of the page. The charts can display up to 24 hours of measurements. The default value is 5 minutes. The minimum time span is 0.5 minute (30 seconds), and the maximum is 24 hours (1440 minutes).

The last 24 hours are stored in the database and can be recalled at any time.

3.2.2.2   Adjusting the Y-axis display

The range of the strip charts Y axis can be adjusted in two ways:

• Fixed - Sets the Y-axis limits (min and max values) according to the Acceptance Ranges as defined by the setup.

• Auto – Sets the Y-axis limits (min and max values) according to the full scale of the values captured by the sensor.

3.2.2.3 Production Reports

Production reports can be generated from the strip chart screen. When clicking the "Save" button, the data contained in the strip charts and a screen shot of the camera screen will be copied into a .pdf and .csv file. Setting a time span of 1 minute will generate a report that contains the last minute of data. Thorough analysis of the spray parameters can be found in the production report (.pdf).

FIGURE 14 - STRIPCHART BUTTONS BAR
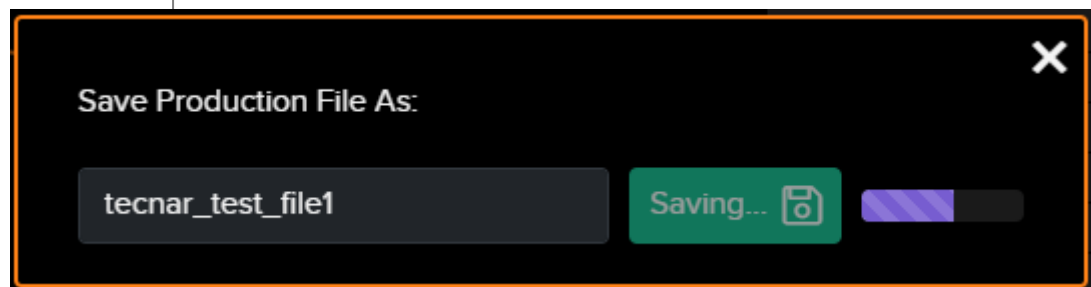
FIGURE 13 - SAVING PRODUCTION FILE

The production reports are stored on the Accuraspray controller's hard drive. The directory where the files are stored is accessible by clicking on the "Open" button. It also contains all the strip charts (.csv files). The duration of the strip charts in the production report is the same as what was displayed in the user interface at the time when the production report was generated. Clicking the "Open" button will redirect the user to the production files screen, directly in the folder of the last generated file. If desired, you can also use the raw .csv data and generate your own plots. Here is an example of the production files screen:
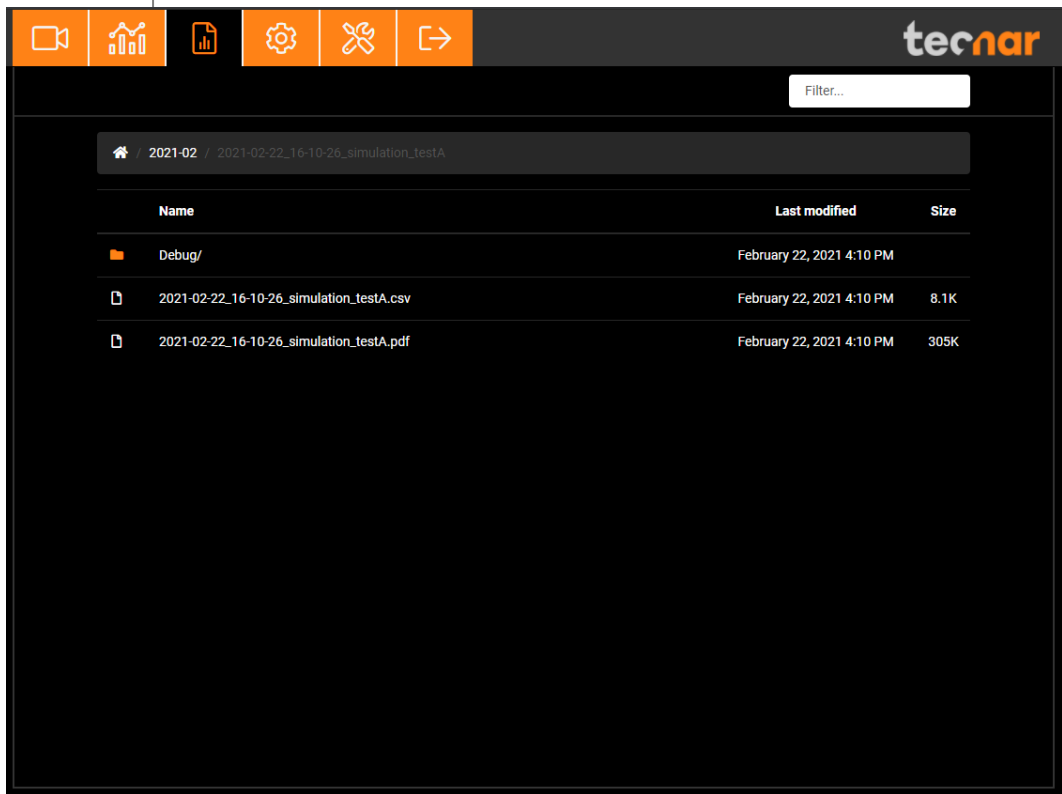
FIGURE 15 - PRODUCTION FILES SCREEN

3.2.3 LOGGING IN

The power of this interface is the ability to have multiple, simultaneous, users (up to 5) of the software. For instance:

- One user or "the operator" can actually be using the system for measurement (will need to "take control" as covered in subsequent slides)

- Another user can be "watching" the "operator" from the engineering office via the network or wireless

- Another user can be viewing saved files from previous runs in the QC department

When accessing the Accuraspray interface, users are in viewer mode and can only visualize the sensor's readings like the engineer or QC person discussed earlier.

In order to actually use the sensor and record sequences it is necessary to log in by clicking the designated icon. Users can Log in either as Operators or Administrator.

- Operators (**username: operator**) can change the setup used by the sensor and record measurement sequences. Operators cannot modify setups. The default password for operators is: **accura.operator**

- Administrators (**username: admin**) have the same rights as the operators and can also create, modify, and delete setups. The default password for administrator is: **accura.admin**

To log in, click [icon] to display the login window and enter your credentials as shown below:
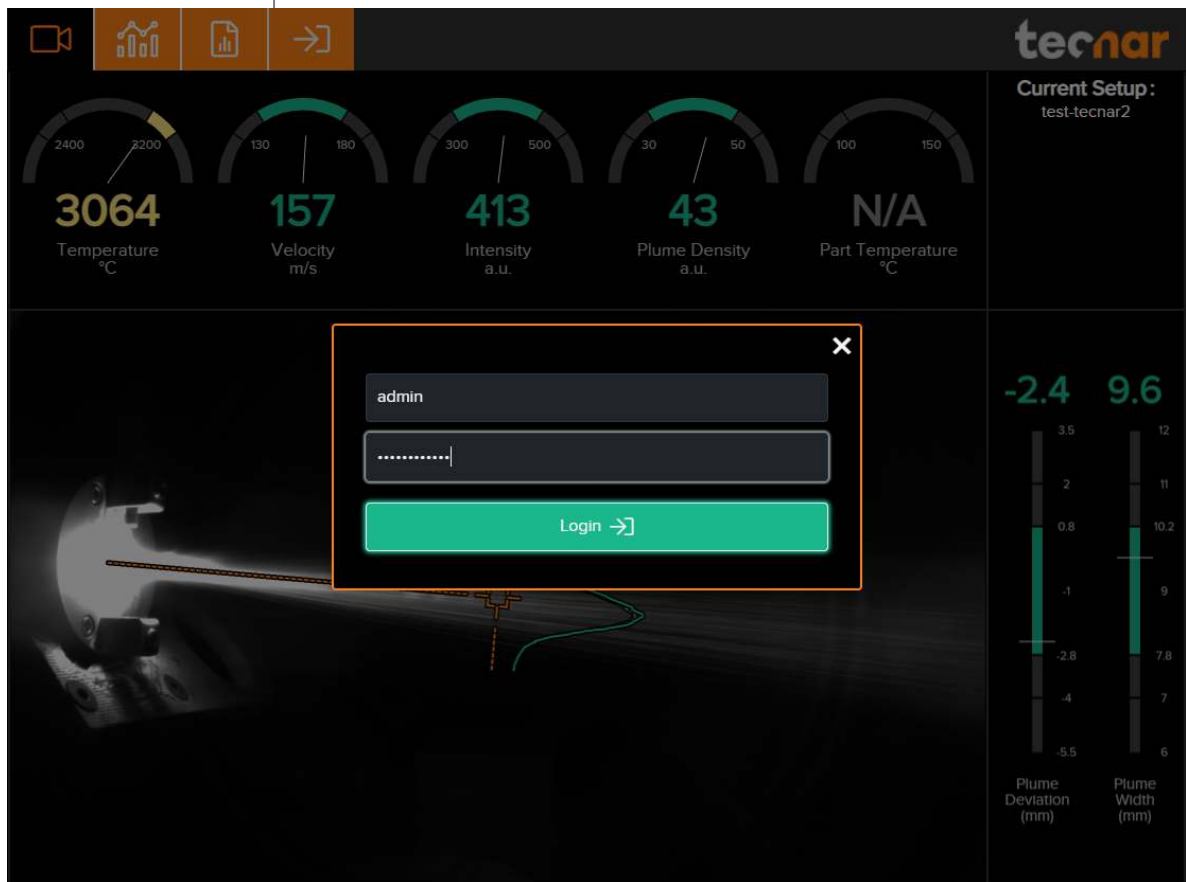
FIGURE 16 - LOGIN WINDOW

3.2.4   SYSTEM SETTINGS

FIGURE 17 – SYSTEM SETTINGS SCREEN

3.2.4.1   Changing the user password

Enter a new password and click 'Change Password' to modify it.

Note that you will have to login either as Operator or Administrator to access the settings screen.

3.2.4.2   Enabling/Disabling Wi-Fi

The user may choose to enable or disable the wi-fi for security purposes. A reboot is not necessary, but it will take a few seconds for the change to take effect.

3.2.4.3   Enabling/Disabling the PLC

The PLC is an optional feature. The Accuraspray can stream data through a PLC Profinet interface. Contact Tecnar for more details if you wish to purchase this bundle. More details on this feature can be found in procedure #40107-00046 "Accuraspray 4.0 Profinet PLC Configuration".

3.2.4.4   Changing the static IP of the controller

It is possible to change the IP of the controller to match your desired static network. Simply click the "Change IP" button. Keep in mind that you will need to adjust your "/etc/host" interface file to be able to access the controller using its "hostname". This is important to make sure that all the features work correctly in the UI, such as the production file tab. A reboot is required for this operation. Refer to the document "Accuraspray 4.0 Network Connections" for in-dept details.

3.2.4.5   DHCP IP

The Accuraspray has only one physical ethernet interface, but multiple sub-interfaces. This allows us to use both the static and dynamic network configurations at the same time. Connecting the Accuraspray to your facility's network is the easiest way to setup the Accuraspray. An address will be obtained from your DHCP server, and you can connect to the Accuraspray directly (http://accurag4-12345678). Change the numbers to match the serial number of your machine. The DHCP IP is displayed in the system tab for reference only. It cannot be changed since it is provided by your DHCP server as mentioned previously. Refer to the document "Accuraspray 4.0 Network Connections" for in-dept details.

3.2.4.6   Changing the time zone

Change the time zone to match your local settings using the drop-down selector. This UTC/GMT format matches the default time zone used by Windows systems. If you are not sure which one to choose, consult your local Windows settings or simply google "what's my time zone". Here is an example for the Windows settings.
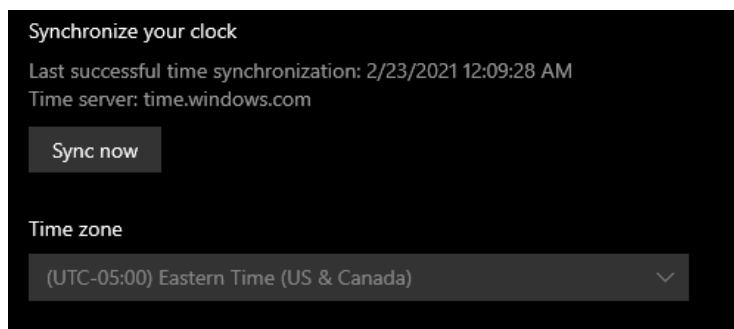

FIGURE 18 - WINDOWS TIME ZONE EXAMPLE

3.2.4.7   Updating your system

Download the latest (.7z archive) from Tecnar's website and update your system gracefully with a single click. Upload the archive and click "Start Update". Simply follow the on-screen instructions. The UI will automatically refresh once the update is finished.

3.2.5   SETUP SCREEN (OPERATOR AND ADMINISTRATOR ONLY)

The left side of the setup screen shows the data acquisition parameters for the current process.

The right side of the configuration screen shows the acceptance ranges. The min and max values represent the values past which the process is considered off (red zone). The range between those values contains the green and yellow zones. The green value represents 60% of the full range between the min and max while the yellow regions warn the operators that the measurement is approaching the red zone. The yellow zones are located 20% from the min and max values of the process.
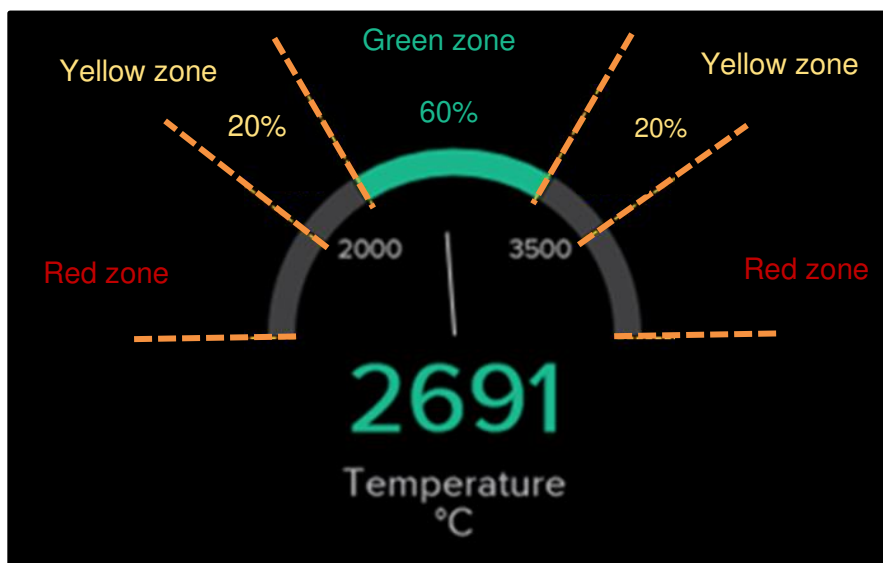
FIGURE 19 DIALS PROCESS CONTROL ZONES

3.3   LOGGING IN AS AN ADMINISTRATOR

When the user interface is accessed, the home screen is displayed with Viewer user access. In order to make changes to the sensor configurations or record sequences it is necessary to log in.

- Enter your username (Operator) and password (accura.tecnar) and click Login. The home screen is displayed with Administrator user access.

3.4   MANAGING SETUPS

The Setup screen is where the different parameters of the sensor head are

managed. Click [gear icon] to access the configuration screen.
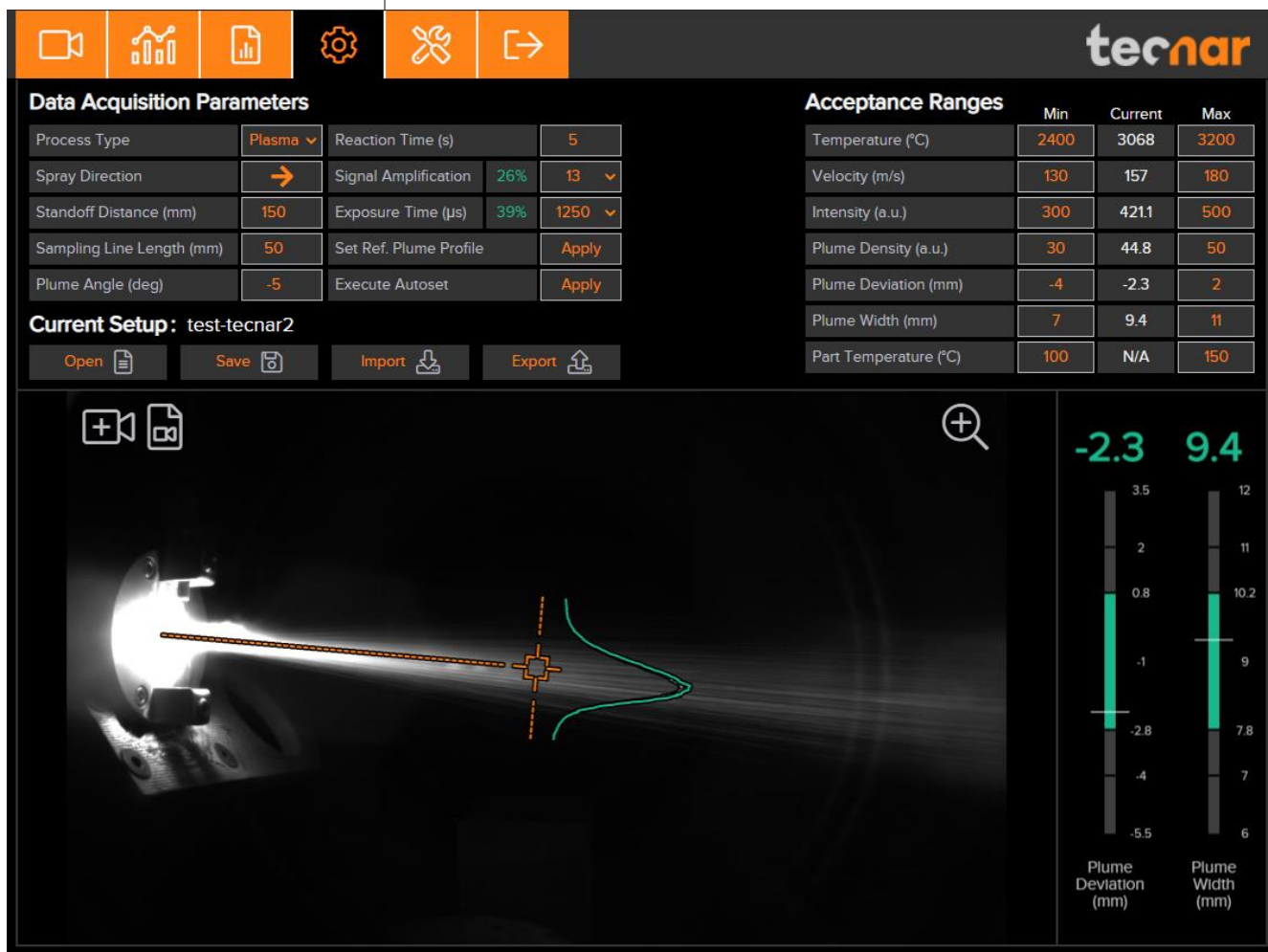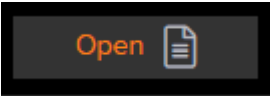
FIGURE 20 - SETTINGS SCREEN

3.5   LOADING A SETUP

On the Setup screen, click [Open 📄]. This displays the list of setups.

Select the setup and click Open. The new setup is automatically applied.
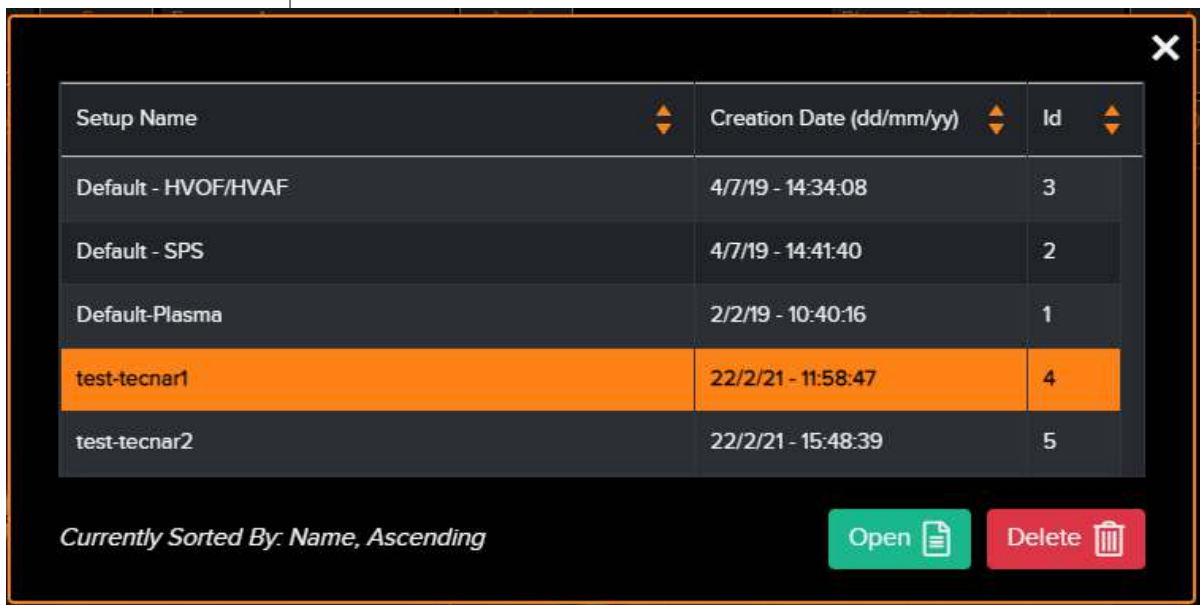
FIGURE 23 - OPENING/DELETING SETUPS

3.5.1   SAVING A SETUP

Once you have modified any parameter on the configuration screen, you can save them as a new setup or overwrite the existing setup.

On the configuration screen, click [Save 💾]. This displays the following window.
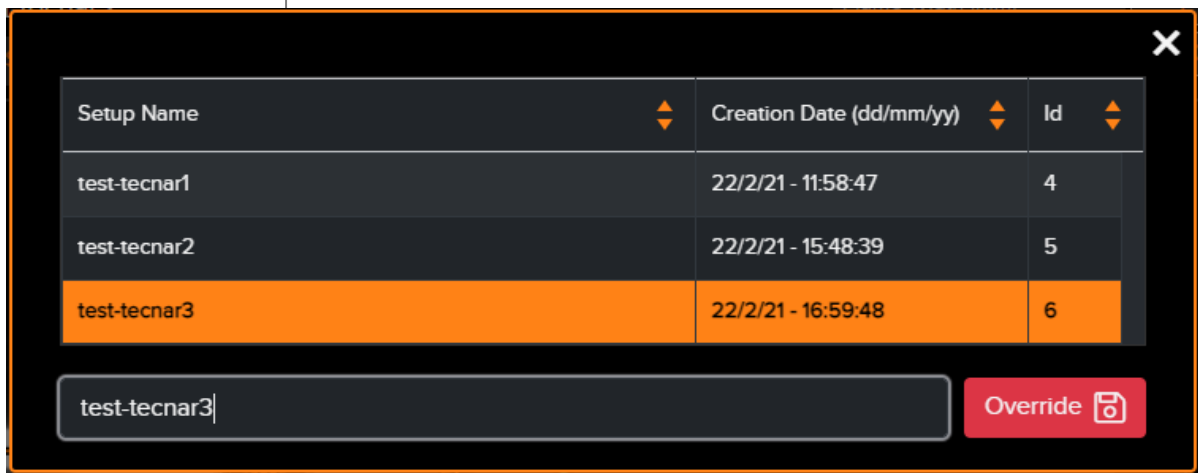
FIGURE 24 - SAVING SETUPS

To overwrite a setup, select a setup and click "Override". The new parameters are automatically saved.

To add a new setup, enter a new setup name and click "Save".

3.5.2   SETUPS IMPORT AND EXPORT

Setups can be exported from one Accuraspray units and imported to another. When clicking on the "Export" button a setup file will be downloaded on your computer.

To import a setup, simply click on the "Import" button and select the setup file that you wish to import from your computer.

This enables you to ensure that multiples sensors are using the same settings. That is especially useful to compare two booths that are identically set-up using two different Accuraspray units.

FIGURE 25 - IMPORT/EXPORT SETUPS

3.5.3   SETUP PARAMETERS

The table below explain the Data acquisition parameters – Used to configure the Accuraspray according to the spray process you will be monitoring.

Parameters	Description
Spray direction	Particles travel direction (left to right or right to left) in the Accuraspray field of view.
Standoff distance	Distance between the Accuraspray measurement point (bullseye) and the spray gun output. Typically, it is the process spray distance.
Plume angle	This value tilts the sampling line so that it lays perpendicular to the general direction of the particle flow (typically -5° for top injected plasma spraying and 0° for HVOF spraying).
Sampling line length	This value determines the length, in the plane of the plume, of the path along which the intensity profile is measured. It is normally set to about four times the regular plume width.
Process type	This value indicates to the sensor if the process brightness is high or low. Typically, SPS, Arc spray and SSPS are considered high brightness processes while HVOF and HVAF are considered low brightness.
Reaction Time	Length of the rolling average used by the sensor to display measurements. This parameter is used to smooth out natural variations in the process that would make the sensor's reading unstable and unusable for process control.
	Typical reaction time for APS and Wire arc is 5 to 15 seconds. For HVOF/HVAF 1 to 5 seconds is usually sufficient.
Signal amplification	This value needs to be increased until signal level reaches roughly 35% (the % value next to the amplification level is the signal level).
	Normally, the auto-set will take care of this adjustment for you.
Exposure time	This value needs to be increased until signal level reaches roughly 50% (the % value next to the amplification level is the signal level).
	Normally, the auto-set will take care of this adjustment for you.
Save Reference curve	By clicking this button, the user captures the current plume profile and sets it as the reference for future measurement.

Execute Autoset

This feature automatically adjusts the "exposure time" for the camera and the "signal amplification" for the particle's velocity and temperature measurements.

These settings can also be modified manually using their respective drop-down selectors.

However, before an auto-set can be performed, the spray plume must be centered on the bullseye and the following data acquisition parameters must be entered:

- Process type
- Spray direction
- Standoff distance
- Sampling line length

3.6   TECHNICAL SPECIFICATIONS

3.6.1   SENSOR HEAD

Parameters	Description
Width	110 mm (4.33 in.)
Height	62 mm (2.44 in.)
Length	790 mm (31.10 in.)
Weight	1.85 kg (4.1 lb.)
Working distance from spray gun axis	200 mm (7.87 in.)
Particle temperature measurement range	1,000 °C (1,832 °F) and higher at 3% accuracy
Particle velocity measurement range	5–1,200 m/s at 3% accuracy
Plume relative intensity measurement	2% precision
Plume geometry measurement	0.1 mm (0.004 in.) accuracy
Camera field of view	400 mm (15.75 in.)
Particle's measurement volume	3.2 mm x 10 mm x 25 mm (0.13 in. x 0.39 in. x 0.98 in.)

3.6.2   CONTROLLER

Parameters	Description
Width (a)	230 mm (9.06 in.)
Height (b)	100 mm (3.94 in.)
Length (c)	230 mm (9.06 in.)
Weight	4.40 kg (9.7 lb.)
Power requirement	100–240 VAC, 50–60 Hz, 1.5 A, auto-switch

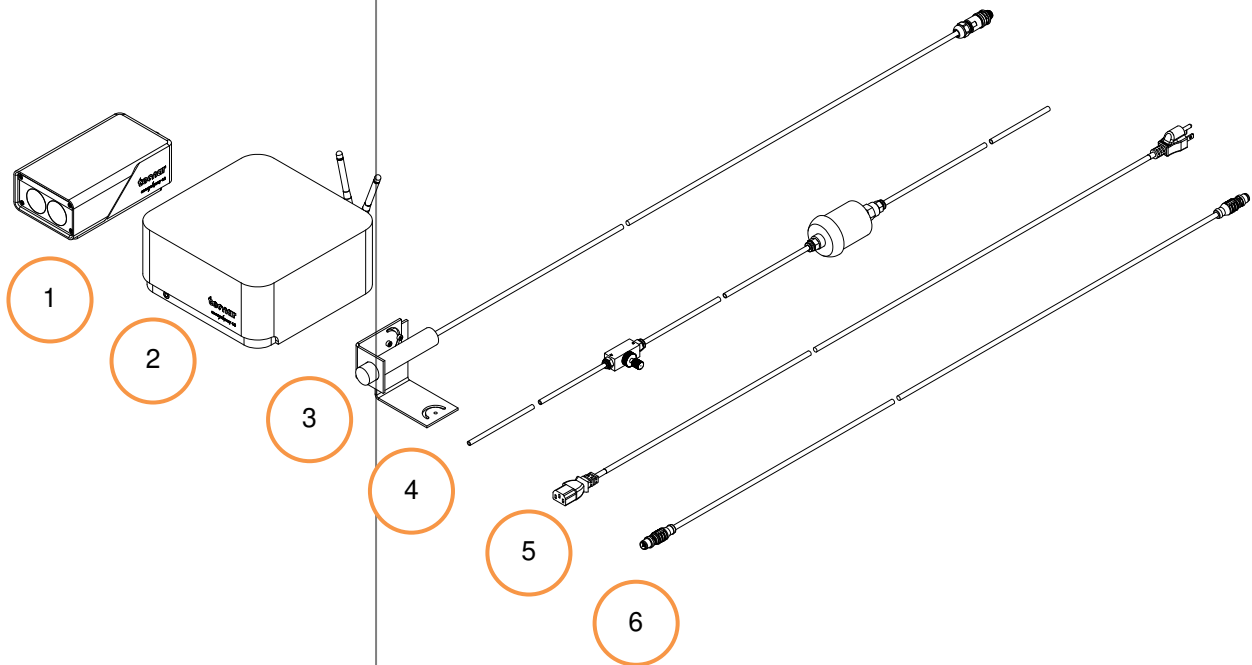# 4 INSTALLATION

4.1   INSTALLING THE SENSOR HEAD

4.1.1   UNPACKING THE PARTS

Carefully open the box, remove the content, and set it on a work surface. The box should contain the following items:

1. Sensor head

2. Controller

3. Substrate pyrometer and its support bracket (optional)

4. Air filter and hoses

5. Controller power cable

6. Communication cable between the head and controller

4.1.2   INSTALLING THE SENSOR HEAD

4.1.2.1   Where to install

Install the sensor head in the spray booth at a location easily reachable by the robot (spray gun). Also, ensure that the sensor head does not interfere with normal spraying operations.
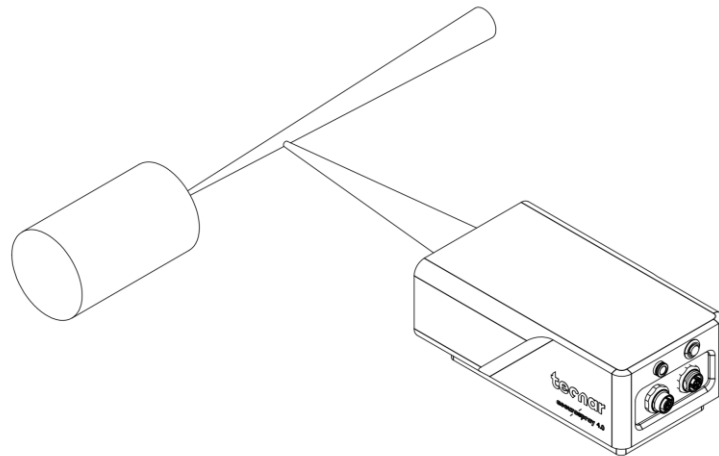
FIGURE 26 POSITION OF THE SENSOR HEAD

Install the sensor head on a sturdy mounting that does not vibrate or move during spraying. Refer to the following schematic of the Accuraspray mounting plate.
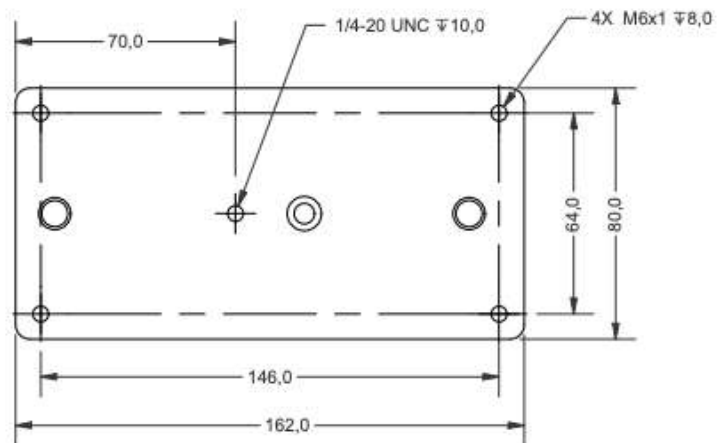
FIGURE 27 SENSOR HEAD MONTING PLATE DIMENSIONS

4.1.2.2   Installation procedure

Attach the sensor head mounting plate to your support bracket using the 4 mounting holes.

Supplied with the Accuraspray 4.0

Provide access

Supplied by the user
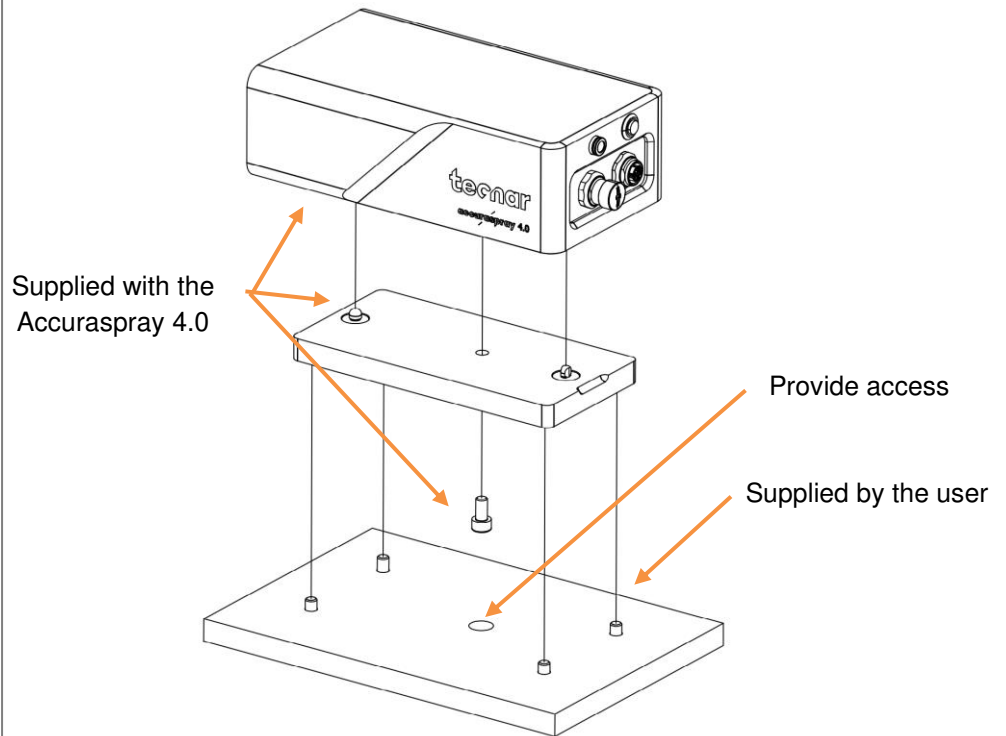
FIGURE 28 M OUNTING THE SENSOR HEAD

Connect compressed air supply and communication cable to the sensor head. Pull the other end of the communication cable out of the spray booth. Connect the air hoses to the booth air supply.

Air supply

Communication cable
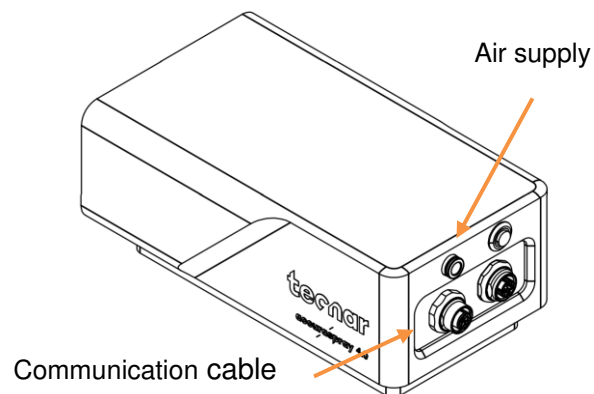
FIGURE 29 SENSOR HEAD INTERFACE

4.1.3   INSTALLING THE CONTROLLER

4.1.3.1   Where to install

Install the controller outside the spray booth, ideally, close to the booth control equipment.

4.1.3.2   Installation procedure

Connect the sensor head communication cable.

Connect the power cable to the controller and into a power socket.
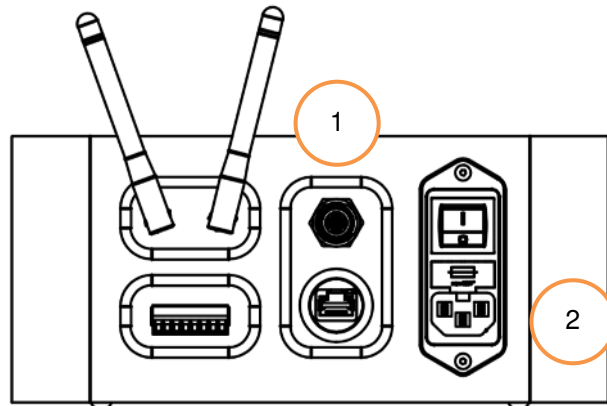
FIGURE 30 CONTROLLER INTERFACE

Flip the Accuraspray controller power switch to ON. Wait until the LED turns green.
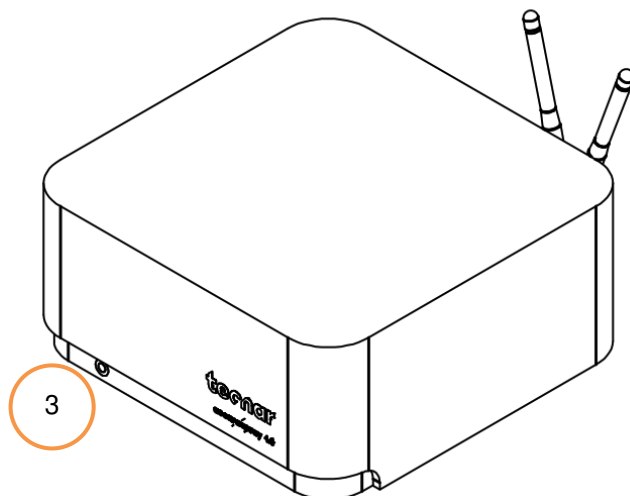
FIGURE 31 CONTROLLER STATUS LED

4.1.4   ADJUSTING THE SPRAY GUN POSITION

Activate the alignment beam using the push button located at the back of the sensor.
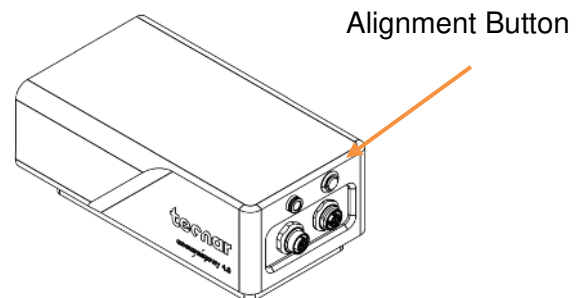
Alignment Button

FIGURE 32 SENSOR HEAD ALIGNEMENT BUTTON

Bring the spray gun near the sensor head as shown on the schematic below.

The sensor measurement point is normally set to your standard process spray distance.

The distance between the front of the sensor head and the spray torch axis should be adjusted to 200mm.

Standard spray distance

Sensor working distance

200mm
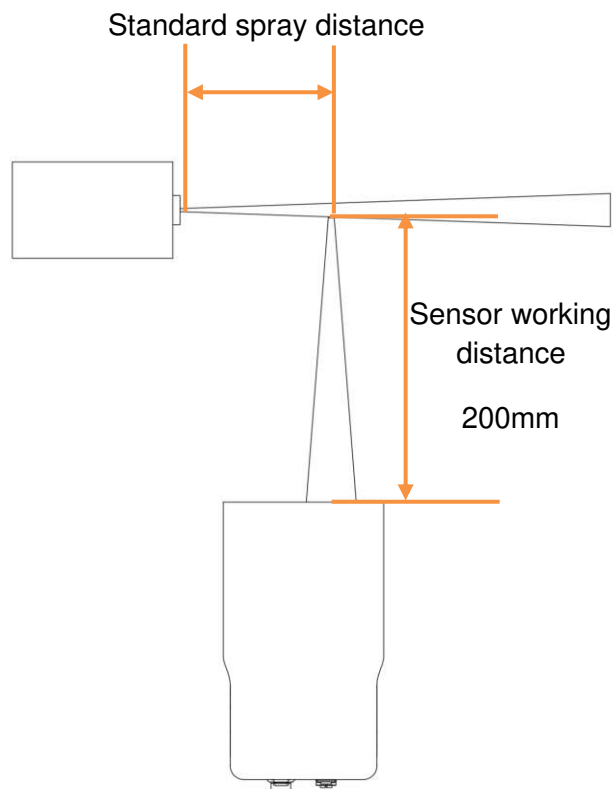
FIGURE 33 SENSOR HEAD WORKING DISTANCE

Save the new position as Sensor Home on the spray gun.

4.2   ACCESSING THE USER INTERFACE

The Accuraspray 4.0 user interface is accessible through a web browser but it is not actually hosted on the internet. It is streamed from the Accuraspray controller. We recommend using Google Chrome or Microsoft Edge for optimal performance.

Go to the WiFi menu on your computer or tablet and look for "Accura 4.0 – serial number". The password to access the WiFi is "accura.wifi".

Open your browser and enter the URL: http://accurag4-00000000/ to connect to the Accuraspray user interface. Replace the zeros by the serial number of the unit you are trying to reach. The serial number is composed of 8 digits which can be found in the WiFi network name or under the controller. Refer to the document "Accuraspray 4.0 Network Connections" for in-dept details.

4.3 SETTING UP THE ACCURASPRAY ON A NETWORK (OPTIONAL)

To connect the Accuraspray to your local network you must connect the controller to the network with an Ethernet cable.

4.4 CONNECTING THE I/OS (OPTIONAL)

You may remotely control the Accuraspray using the I/Os connections.

To use the I/Os connections, please refer to the following schematic and descriptions.
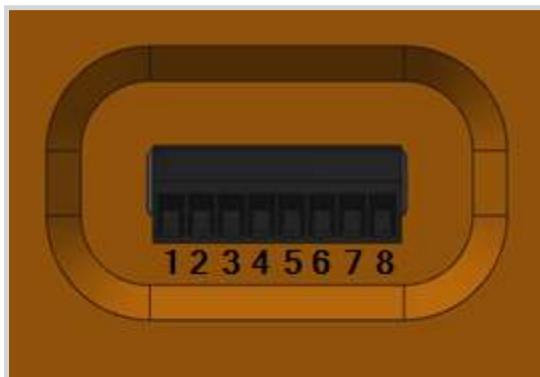
FIGURE 34 I/O PORT

4.5 USING THE INPUT TO GENERATE REPORTS

The Input can be used to automatically generate reports and .csv files. It must be held 'high' for at least 1 second to be detected by the controller. The input status is fetched every 500ms. If you set the input 'high' for more than 1 second but less than the reaction time, the auto-generated report length will be set to 1 second. Therefore, the system will record 1 second of data after the reaction time. This is a safety measure, not a feature. The csv will most likely contain a single line, and the graphs cannot be plotted.

The typical usage is to set the input 'high' for more than the reaction time. The auto-generated report length will be set to ('input high time' – 'reaction time'). For example, if you set the reaction time to 5 seconds and leave the input 'high' for 10 seconds, the auto-generated report will contain 5 seconds of data, starting after the 5 seconds reaction time. While recording using the Input, you cannot save reports or videos from the User Interface, and vice-versa.

Pin	Name	Description	Logic
1	IN 24 VDC	Input/Output reference Voltage + Supplied by user	
2	IN 0 VDC	Input/Output reference Voltage – Supplied by user	
3	IN 1	Start measurement sequence (the data acquired by the Accuraspray will be saved) when logic is 1 and stop when logic is 0	Logic 1 : 11-24V above 0VDC IN Logic 0 : 0-5V above 0VDC IN
4	OUT 1	Wait for data acquisition. This output indicates that the sensor is acquiring its initial data buffer. Once the buffer is filled, this output will fall.	Logic rising edge: Acquiring initial buffer Logic falling edge: Initial buffer acquired
5	OUT 2	Measurement valid. Following the acquisition of the first buffer this output 1 will be raised when measurements are valid. If the measurements are invalid, error messages will be displayed in the user interface and measurements results should be ignored.	Logic 1 : 24 VDC IN Logic 0 : 0 VDC IN
6	OUT 3	All measurements are within the green zone. Forced LOW when OUT1 or OUT2 is false.	Logic 1 : 24 VDC IN Logic 0 : 0 VDC IN
7	OUT 4	At least one measurement is within the yellow zone. Forced LOW when OUT1 or OUT2 is false.	Logic 1 : 24 VDC IN Logic 0 : 0 VDC IN
8	OUT 5	At least one measurement is within the red zone. Forced LOW when OUT1 or OUT2 is false.	Logic 1 : 24 VDC IN Logic 0 : 0 VDC IN

5 MAINTENANCE

5.1   MAINTENANCE SCHEDULE

Components	Actions	Frequency
Sensor head	Cleaning the sensor head windows	Daily
	Replacing the sensor head windows assembly	When damaged
	Sensor head calibration	Annually
Compressed air filter cartridge	Replacing the filter cartridge	Periodically (see visual indicator on the cartridge assembly)

5.2 MAINTENANCE PROCEDURES

5.2.1 CLEANING THE SENSOR HEAD WINDOWS

To ensure accurate measurements, the sensor head windows must be free of dust, oil and scratches. The sensor head windows must be cleaned after each measurement procedure.

Tools and materials required:

- Compressed air

- Lens paper

- Isopropanol (rubbing alcohol)

Instructions

- Blow clean & dry compressed air on the windows

- If any marks remain, clean the windows with lens paper. Wipe the paper across the window in a single motion instead of rubbing back and forth

- If any marks remain, clean the windows with lens paper and a small amount of isopropanol. Wipe the paper across the window in a single motion instead of rubbing back and forth

- If any marks remain, replace the sensor head window assembly (see next section).

5.2.2 REPLACING THE SENSOR HEAD WINDOW ASSEMBLY

We recommend you use latex or nitrile gloves when replacing the sensor head window plate. To avoid damaging the lens, do not use your fingers or sharp objects.

Tools and materials required:

- Latex or nitrile gloves

- 2.5 mm Allen key

- Sensor head window plate (20303-00930-00)

Instructions

- Remove the four M3 screws and carefully remove the window assembly.

- Put the new assembly on the sensor with the air knife at the top (facing downward). Insert the four M3 screws to secure the plate.

5.2.3   CALIBRATING THE SENSOR HEAD

All sensor heads are calibrated at Tecnar before being shipped to the end-users. To ensure accurate measurements, sensor calibration should be verified every year so that their calibration is NIST-traceable.

You must send the sensor heads to Tecnar Automation Ltd every year for calibration, contact service@tecnar.com. There is no need to send the cables and controller.

5.3   RECOMMENDED SPARE PARTS

Components	Part number
Compressed air filter cartridge	10201-00599-00
Sensor head windows assembly	20303-00930-00

6 TROUBLESHOOTING

On power-up of the controller, once the sensor is initialized properly, the back-plate LED will start blinking quickly (3 quick blinks every 5 seconds), it behaves the same way as a beacon light. This initial blinking indicates that the electronics components inside the sensor are up and running, and that the sensor is waiting for the software to connect. Note that the back-plate LED button is not available during this initialization sequence. Once the software is connected to the sensor, the LED will stop blinking immediately, and the back-plate button becomes enabled. Thus, it can now be used for alignment purposes. The start-up time of the controller is usually as fast as the initialization of the sensor head. Depending on the start-up time duration, the blinking might be hard to notice if the controller connects to the sensor as soon as it is initialized.

In the event that the initialization sequence is not successful, the LED will not stop blinking. Instead, it will start blinking more slowly, indicating that the sensor is now in error state (the LED will be held ON for approximately 1.5 seconds instead of 166 milliseconds, maintaining a 5 second interval in between the blinks). The back-plate button will remain disabled. Refer to the troubleshooting section for more information on the LED error codes.

6.1   SECTION TROUBLESHOOTING (LED ERROR CODES)

As mentioned in the operation section, in the case of hardware failure, the back-plate LED is used as a troubleshooting tool to provide more information on the system error state. Here is a list of all the possible codes, descriptions, and troubleshooting actions to be taken.

Error code	Description	Actions
2 blinks	The controller did not connect to the sensor within 2 minutes after the initialization	Reboot the controller
3 blinks	Internal micro-switch error	Contact Tecnar service team
4 blinks	Microcontroller error	Contact Tecnar service team

6.2　ERROR REPORTING IN THE USER INTERFACE

Error code	Corrective measures
Invalid velocity measurement (Low correlation)	• The sensor head is aimed perpendicular to the spray plume and is 200mm. • The sensor head is 200mm away from the center of the spray plume. • SPRAY DIRECTION is set correctly. • The spray plume angle is no more than ± 15°.
Invalid velocity & temperature measurements (Signal level too low)	• The sensor head is aimed at the spray plume. • The proper setup has been selected. • Powder is injected into the spray plume. • The sensor head windows are clean. • SIGNAL AMPLIFICATION is set adequately for your process.
Invalid velocity & temperature measurements (Saturated signal)	• The proper setup has been selected. • SIGNAL AMPLIFICATION is set adequately for your process.
Invalid plume width, plume deviation, plume intensity & density measurements (Signal level too low)	• The proper setup has been selected. • The sensor head windows are clean. • EXPOSURE TIME is set adequately for your process.
Invalid measurements (Saturated signal)	• The proper setup has been selected. • EXPOSURE TIME is set adequately for your process.

6.3   SERVICE & SUPPORT

Should you have any questions concerning our equipment please contact us at:

TECNAR Automation

1321, Hocquart Street

St-Bruno, Qc, Canada, J3V 6B5

Phone: 450-461-1221

Fax: 450-461-0808

Email: service@tecnar.com

7 RELATED DOCUMENTS

40107-00046: "Accuraspray 4.0 Profinet PLC Configuration"

This document provides additional information on the PLC Profinet interface, integration, and database structure.

40107-00047: "Accuraspray 4.0 Network Connections"

This document explains every possible connection method that can be used to connect one or multiple Accuraspray Controller to your network.

40107-00048: "Accuraspray 4.0 Http Communication"

The following document describes the communication protocol used by the Accuraspray 4.0 to stream measurement data and load setups (system configurations) remotely.