



Sustainability Monitor

User Manual

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Experts in Spray Technology

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The Importance of Monitoring Your Spray Process



Spray nozzles are a vital part of many manufacturing processes. However, over time, certain issues can arise that often have serious, but undetected, impact on spray performance.

Things like clogging and nozzle wear can lead to poor spray pattern, overspray, and underspray, all of which in turn lead to wasted resources, downtime, and quality control issues.

Monitoring key elements of a spray process enables you to detect these issues early on, so that nozzles can be cleaned or replaced before things get expensive.

The SprayScan[®] Mobile Sustainability Monitor

This device monitors a spray system's pressure, flow rate, and temperature in real-time.

Installed inline before the nozzle, the SprayScan[®] mSM gives a visual readout and warns the user of any deviation in spray performance. With an installed database of all Spraying Systems Co. and TeeJet nozzles, parameters can be set to monitor specific nozzle performance.

These signals can alert users of clogged or worn nozzles, or more serious downstream issues, both in real-time and historically. When incorporating the Smart Monitoring Software, data is logged for future review and analysis in an intuitive interactive dashboard.



SprayScan mSM dashboard
optional subscription service

SprayScan mSM
monitor

This instrument is a monitoring only system. It is intended to be used as a reference measurement system and is not recommended for critical spray applications.

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1 Introduction

1.1 Components

The SprayScan[®] mSM Sustainability Monitor comes with the components shown in Figure 1, which includes the monitor and sensor modules, signal cable, universal power supply, and region-specific power cord. The monitor and sensor modules come with mounting brackets. The sensor module comes standard with liquid connection adapters with 3/8" NPT female threaded connections. Liquid connection adapters with other thread types are available by request.



Figure 1: SprayScan[®] mSM Components

1.2 Utilities

The monitor module has the following power requirements. This can be provided with the provided universal power supply or from another source.

- Voltage of 9 – 24 VDC
- Maximum power of 3.6 W
- Barrel jack connector, 2.0 mm ID, 5.5 mm OD, ⊕ ⊖ ⊖

A universal power supply is provided with the system with the following specifications. A region-specific power cord is supplied with the universal power supply.

- Input: 90 to 264 VAC, 47 – 63 Hz
- Output: 24 VDC

The sensor module is powered by the monitor module.

1.3 Monitor Specifications

The monitor module has the following features:

- 5" touchscreen
- Wi-Fi and Ethernet for internet connectivity.
 - Internet connectivity is not required to use this device.
 - Internet connectivity is needed to use the Smart Monitoring service (optional and available via subscription) and over-the-air application updates.



- Spraying Systems Co.[®] Sustainability Monitoring application

1.4 Sensor Module Specifications

The sensor module has the following features:

- Measurement ranges
 - Pressure 0 to 150 psi (0 to 10 bar) gauge pressure
 - Flow rate 0.1 to 5 GPM (0.4 to 20 LPM)
 - Temperature 40 °F to 160 °F (5 °C to 70 °C)
- Maximum Working Pressure 220 psi (15 bar) gauge pressure
- Liquid Connections 3/8" NPT female (3/8" NPT male, 3/8" BSPT & 3/8" BSPP & sanitary flange available by request)
- Materials of Construction¹ Type 316 Stainless Steel, Viton, and Parylene

¹For components that contact the process fluid only.

2 Installation

The sensor module measures the pressure, flow rate, and temperature of the liquid being fed to the nozzle or header. To get the most accurate measurements of the liquid properties that affect the spray produced by a nozzle or header of nozzles, install the sensor module in the liquid line as close to the nozzle or header as possible.

The monitor module should be installed in a dry location where the operator can view but within the reach of the provided data cable. A 2-meter-long data cable is provided with the standard system. There are also 5- and 10-meter-long cables available.

2.1 Sensor Module Installation

When installing the sensor module, follow the flow direction arrow on the front cover to identify the inlet and outlet liquid connections. Install the sensor module vertically with the arrow pointing up, so that liquid is flowing into the bottom connection of the sensor module. Unpredictable performance may occur if installed with the flow direction arrow pointing down. Reversing the inlet and outlet liquid connections will result in incorrect flow rate measurements.

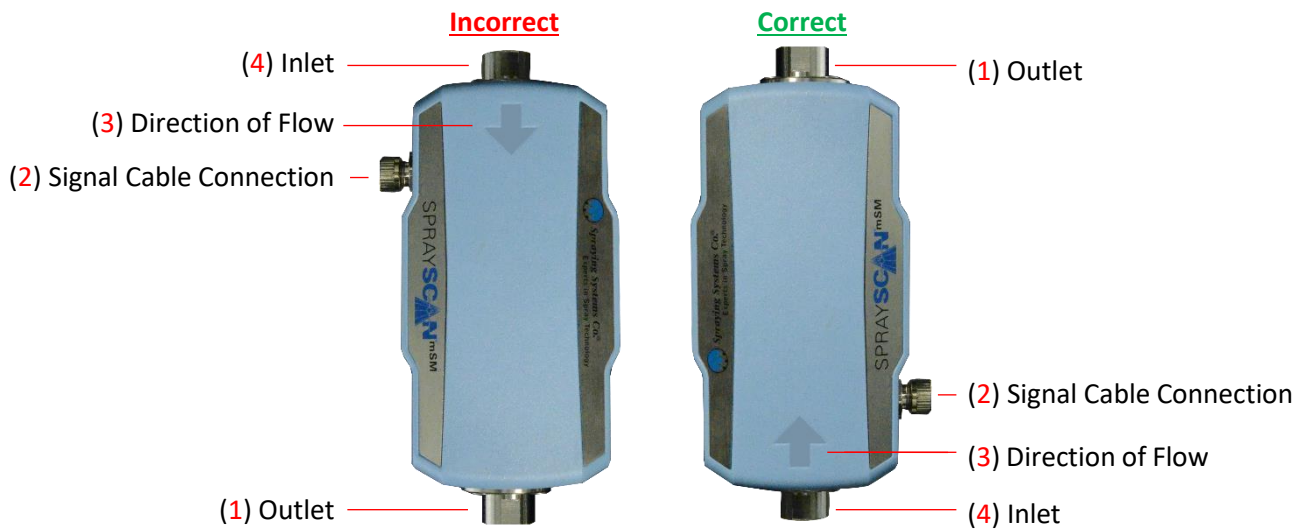


Figure 2: Schematics of the correct/incorrect orientations for the sensor module.



When connecting the sensor module in the liquid feed line, take care to use a wrench on the flats of the liquid connections so that torque will not be applied directly to the sensor module case. Use thread sealant to prevent leaks at this connection.

A mounting bracket is provided with the sensor module. Add screw holes based on the mounting hole pattern of where this bracket is being fastened too. 3/8" (M8) or smaller button head screws are recommended. There is a maximum of 0.2 in (5 mm) of clearance between the mounting bracket and the sensor module case for a screw head.

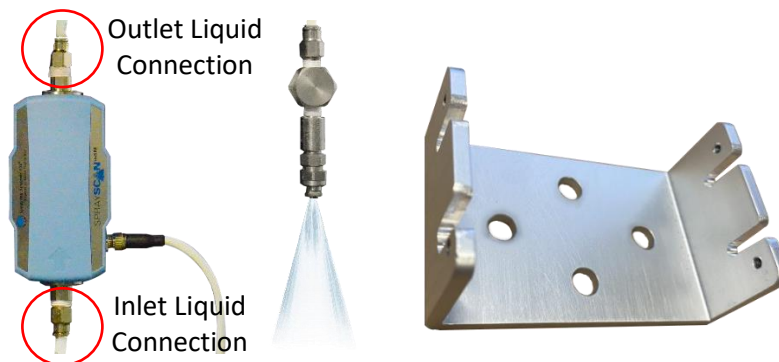


Figure 3: Liquid Connections to Sensor Module and Mounting Bracket

2.2 Monitor Installation

Mount the monitor module in a dry location near the spray process where the display can be easily read by the operator. A mounting module is provided with the sensor module. Add screw holes based on the mounting hole pattern of where this bracket is being fastened too. 3/8" (M8) or smaller button head screws are recommended. There is a maximum of 0.2 in (5 mm) of clearance between the mounting bracket and the sensor module case for a screw head.



Figure 4: Mounted SprayScan[®] mSM Assembly

2.3 Wiring, Power, & Startup

After installing the sensor and monitor units, connect the signal cable to the monitor and sensor modules, and connect the power supply. The device will power up and boot upon providing power.

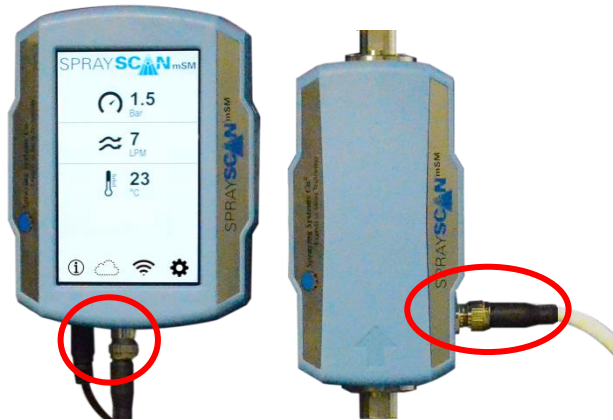


Figure 5: SprayScan[®] mSM Wiring Connections

2.4 Basic Operation & Home Screen Navigation

At first startup, the sustainability monitor application defaults to a basic operation mode displaying real-time pressure, flow rate, and temperature measurements on the home screen. Touch any measurements to see historical measurements. The time history plot defaults to 5 second (1 min) readings, but this can be changed in the settings menu on the home screen (See section 4).



Figure 6: Displays the home screen with the real time parameter values as well as the time history plot option for flow respectively.

The time history plot will have the same structure, as seen above in Figure 6, for each of the measurements and it can also be accessed while the system is actively tested or used.

3 Application Navigation

The SprayScan[®] mSM home screen includes 4 options at the bottom of the screen.

3.1 Information Screen



Figure 7: Displays the home screen and location of the Information Screen Icon.

This screen tells the operator vital information regarding the device:

- Model Number
- Serial Number
- Current Software Version
- MAC Address
- QR code to access the User Manual and Acknowledgments
- Technical Support Email
- System Diagnostic Information
 - Runtime
 - Reset count
 - Reset reason

3.2 Cloud Connection

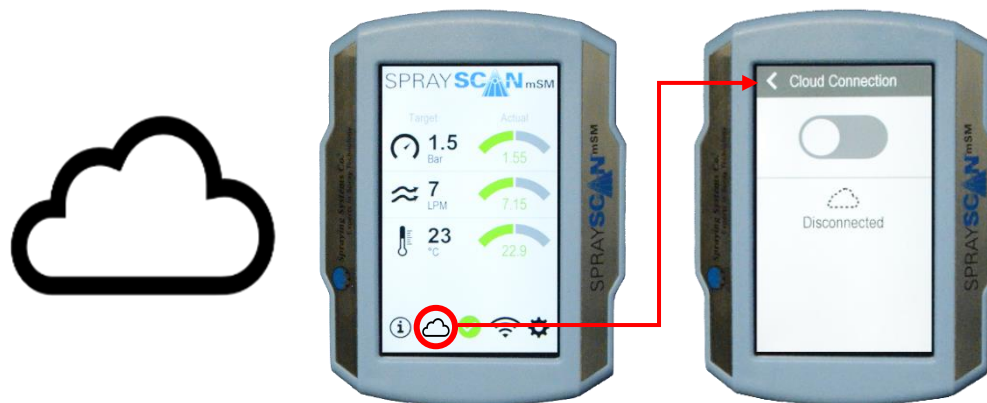


Figure 8: Displays the home screen and location of the Cloud Connection Icon.

Connecting to the cloud allows connection to the server, allowing the instrument to be remotely monitored in real time via our SprayScan Smart Monitoring software. This function is covered in more detail in Section 6 of the following pages.

3.3 Network Connection



Figure 9: Displays the home screen and location of the Wi-Fi Connection Icon.

Touch this icon to connect the SprayScan mSM to a Wi-Fi or Ethernet network. Wi-Fi connection enables the SprayScan mSM to receive over the air software updates as well as internet access for use with the optional Smart Monitoring service.

Note: upon changing the network connection settings, device will quickly reboot and return to current screen.

3.4 Settings Menu



Figure 10: Displays the home screen and location of the Settings Menu Icon.

The settings menu contains all the adjustable options for both system functionality and project testing settings. A pin code of 7272 is required to enter the settings menu. These are covered more in the following section.

4 Settings

4.1 Navigating the Settings Menu

The Settings menu can be accessed by touching the gear icon on the home screen and entering pin code 7272.

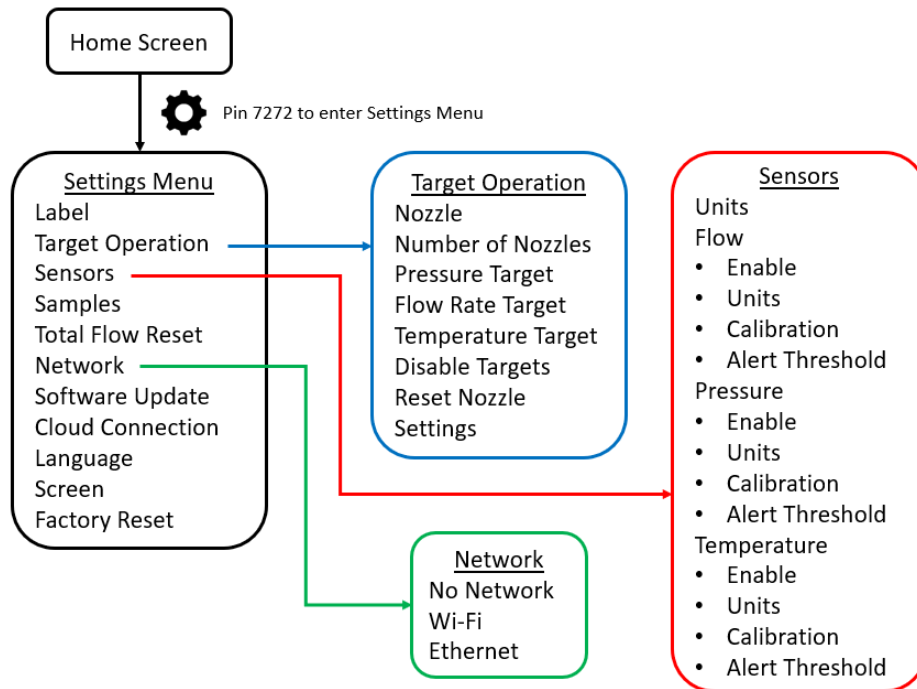


Figure 10: Settings menu navigation.

4.2 Settings Menu Details

Here you'll see a variety of options:

1. Label
 - a. This is used to label or give your device a name. You are free to choose any name you'd like.
2. Target Operation
 - a. This is covered at length in Section 5 Targeted Performance Monitoring.
 - b. You can select the specific spraying system nozzle being used in your system.
 - c. Target flowrates can be input for pressure, flow rate, and temperature to be displayed on the main menu.
3. Sensors
 - a. Units – Switch between Metric and Imperial units.
 - b. Flow, Pressure, and Temperature
 - a. Enable – Allows you to enable/disable that specific sensor.
 - b. Units – Provides additional unit options for that measurement. i.e. LPM vs LPH
 - c. Calibration – Shows the calibration values used for that sensor.
 - d. Alert Threshold – Adjust the tolerance for acceptable range for a measurement.
4. Samples



- a. Adjusts the sample rate for the historical measurements. Additionally, sets the telemetry rate for the measurement transmission to the Smart Monitoring service (optional service). Default is 5 s.
6. Total Flow Reset
 - a. Resets flow totalizer to 0.
7. Network
 - a. Options to connect to a network via Wi-Fi or Ethernet.
 - b. Required to obtain over-the-air software updates for the device.
 - c. Required to use subscription for the Smart Monitoring service (optional service).
8. Software Update
 - a. Select the Check for Update button to download recent version SprayScan mSM software, if available.
 - b. You will also be notified via email when a software update is released.
9. Cloud Connection
 - a. This enables users to access data remotely via an online portal.
 - b. Turn on/off cloud connection.
 - c. Smart Monitoring requires a subscription.
10. Language
 - a. The default language for the Sustainability Monitor is English.
 - b. A French and Spanish options also available.
11. Screen
 - c. Adjust the screen brightness.
11. Factory Reset
 - a. Selecting this option will default all items back to the original settings. Not needed for normal operation.

5 Targeted Performance Monitoring

Target performance monitoring mode sets up the SprayScan® mSM to measure pressure, flow rate, and temperature versus expected performance. In this mode, the SprayScan® mSM uses colors and large symbols to provide visual notification of the performance of the spray process being measured. This allows for quick visual confirmation that the spray process is operating as expected or visual notification that the spray process needs attention.

5.1 Inputting Target Parameters

To set up Target Performance Monitoring, the target parameters for the flow, pressure, temperature, and setup operation must be defined. By going to the Target Operations menu from the home screen, as previously mentioned, the target parameters can be set. This includes specifying the type of nozzle in use, the number of nozzles in use, target pressure, target flow, and target temperature. These are listed in the order they are displayed on the Target Operations screen seen in Figure 11. Measurement types can be toggled off if you do not want them to figure into the visual alarms. For example, the temperature of the process liquid may not be important. Toggling off Temperature will result in only the pressure and flow rate measurements contributing to the performance visual notifications for the system. After setting the target values, you can adjust the alert threshold ranges for each measurement type following the instructions in the Sensors page of the Settings menu. This is discussed in Section 4.2 Settings Menu Details.



Figure 11: Accessing Target Operation settings for defining operation parameters.

5.2 Targeted Performance Operation

After setting the Target Performance parameters, the home screen will change to show large, colorful visual status symbols. Green check mark means all measurements are with the 1st level alert threshold of the target value. Yellow means that at least one of the measurements is outside the 1st level and within the 2nd level alert threshold of its target value. Red means that at least one measurement is outside the 2nd level alert threshold of its target value.



Figure 12: Target performance visual status symbols.

Tapping on the large status symbol takes you to the detail screen showing actual versus target measurements. Tapping on any of the measurements takes you to the historical measurements screen. Within the Flow historical measurement screen, a total flow value is displayed. Total flow can be reset to zero in the settings menu.



Figure 13: Target vs Actual measurements (left) and historical flow measurements with flow total (right).

6 Smart Monitoring

More to come soon!

7 Errors & Troubleshooting

7.1 Error Message at Startup

When powering on the monitor, a notice may be displayed that says, “System Error: Tap for details”. There are several different kinds of errors which one may encounter.

ADC Not Connected Microcontroller is unable to establish communication with the analog to digital convertor. The SprayScan mSM monitor module requires service.

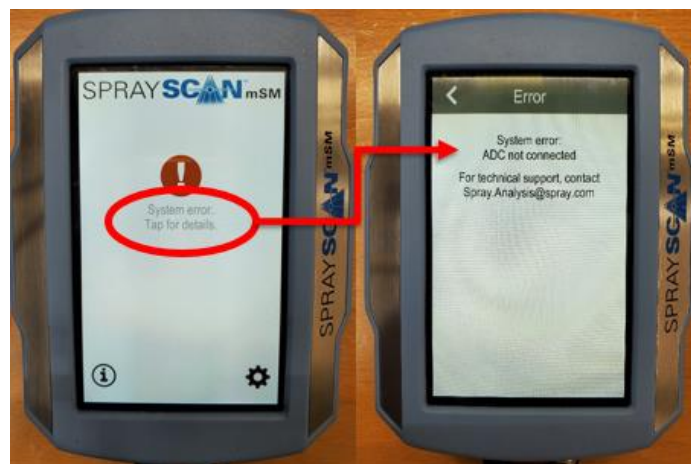


Figure 14: ADC not connected system error.



Sensors Not Connected The ADC is not receiving signals from the sensor module. Perform the following steps.

- Check signal cable connection on monitor module.
- Check signal cable connection on sensor module.
- Power cycle the system.

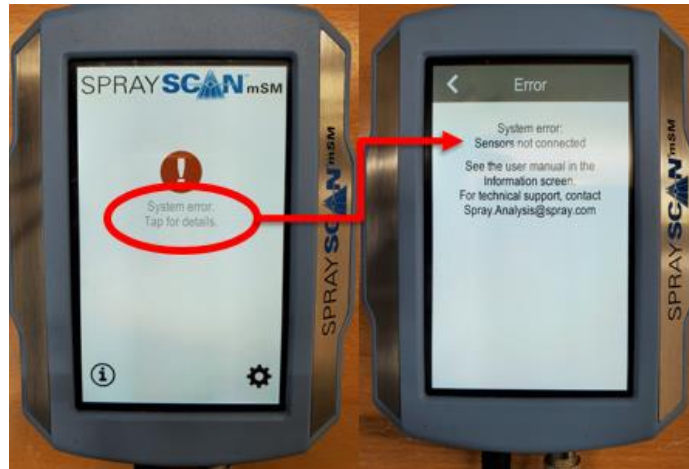


Figure 15: Sensors not connected system error.

7.4 Touch Screen Troubleshooting

If the system is failing to process any actions when touching the screen, make sure that:

- Screen is cleaned thoroughly.
- There is only one point of contact on the screen at a time.
- Power Cycle Device

7.5 System Power Troubleshooting

If the system is failing to turn on when connecting power cable to a power source, unplug cable from the monitor unit and ensure that there is no loose connection or debris disrupting the connection. Also check the connection of the cable to the AC adapter. Once everything is checked, reconnect the power cord to the monitor unit and power it on again.

Any additional questions or issues, please contact SprayAnalysis@spray.com for support.

8 Acknowledgments

The SprayScan® mSM by Spraying Systems Co.® is built on the Moddable SDK, which incorporates the following software:

Moddable SDK Runtime

Licensors: **Moddable Tech, Inc.**

License: **Commercial**

Link: <https://github.com/Moddable-OpenSource/moddable/blob/public/licenses/readme.md>

Licensors: **Marvell International Ltd and Kinoma, Inc.**

License: **Apache 2.0**

Link: <https://github.com/Moddable-OpenSource/moddable/blob/public/xs/sources/xsAPI.c>

ESP-IDF

Licensors: **Espressif Systems (Shanghai) PTE LTD**

License: **Apache, version 2.0**

Link: <https://github.com/espressif/esp-idf/blob/master/LICENSE>

QR Code Generator Library (C)

Licensors: **Project Nayuki**

License: **MIT**

Link: <https://github.com/Moddable-OpenSource/moddable/blob/public/modules/data/qrcode/qrcodegen.c>

