Voyantic

Bendurance

User Manual

24-Jun-2026

1 Important Information

READ THE COMPLETE USER GUIDE CAREFULLY BEFORE USING THE BENDURANCE™ SYSTEM.

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2 Table of Contents

3 Introduction

3.1 Before You Begin

Thank you for choosing the Bendurance System. Please read through the following chapters before you start setting up and using the system.

The Bendurance system consists of two main components, the Bendurance unit and the Tagsurance® 3 test system. Bendurance requires power and compressed air connected to the machine. Compressed air is used for pneumatic control of the tension and nip force.
Note! An air compressor is not included in the Bendurance delivery.

The second part of the system is the Voyantic Tagsurance® 3 system. Bendurance can be operated using the Tagsurance 3 system either with the Tagsurance SL UHF tester or with the Tagsurance HF tester, depending on what kind of RFID material is processed. Tagsurance 3 system is used to measure and monitor changes in the RFID tags and inlays while they are exposed to stress.

The Bendurance machine itself does not require any additional software on a computer to operate; all functions are controlled using switches, buttons, and knobs on the machine's front and side panels. For the Tagsurance 3 operation, an additional computer is required. Tagsurance 3 system is operated by an operator UI running on a web browser. To connect and to use the Tagsurance 3 system, please follow the instructions in the Tagsurance 3 Manual.
Note! An additional computer is not included in the Bendurance delivery.

4 Introduction to Hardware

The Bendurance bend stress testing system is equipped with the Voyantic Tagsurance® 3 system. Tagsurance 3 system measures the changes induced to UHF or HF RFID tags' operation sensitivity due to repeated bending or compression stressing. The high-quality mechanics ensure accurate tag alignment to the measurement coupling element, and this, together with the Tagsurance measurement system, guarantees reliable and repeatable test results.

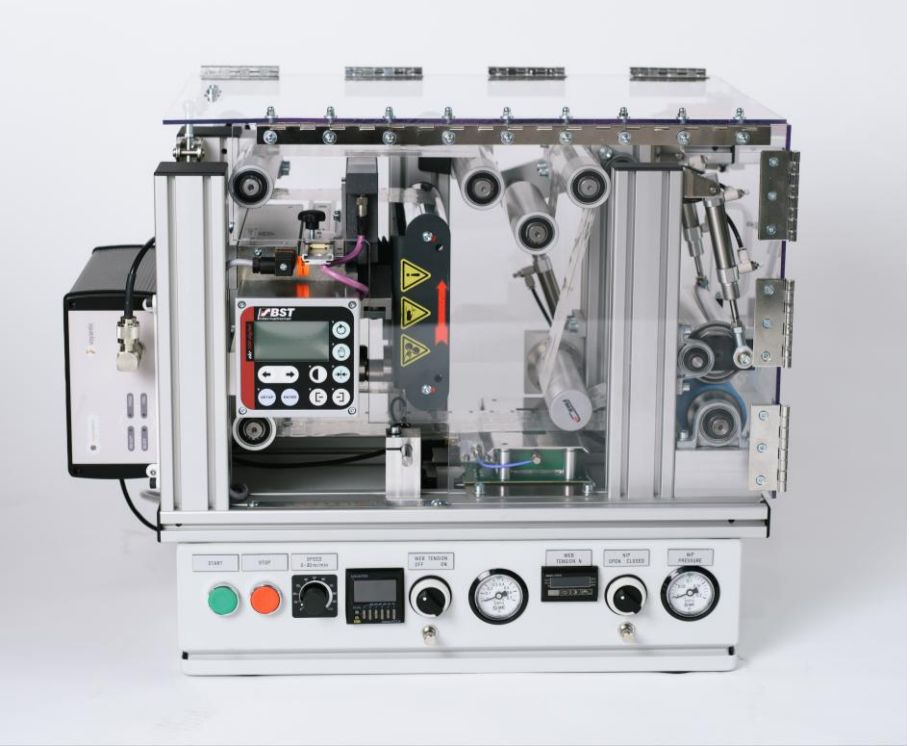


Figure 1. Bendurance equipped with Tagsurance UHF

4.1.1 Standard System Features

- Speed for testing 1…30 m/min
- Automated web guide (precision +/- 0.2 mm)
- Pneumatic tension control (range 5…60 N)
- Compression stress (pneumatic nip force 10…288 N)
- Integrated adjustable trigger sensor
- Indexing mode to stop for measurement

4.1.2 Bendurance Controls

Figure 2. Bendurance front panel

Start	To start rotating the web
Stop	To stop the web
Index On/Off	To switch between continuous mode and indexing mode
Speed	Potentiometer to adjust the speed of the web. **Note!** The scale on the potentiometer shows a percentage of full speed. Full speeds are: 30m/min in Continuous mode 16m/min in indexing mode. For the continuous mode, to get meters/minute value, divide the number on the scale by 3.33 For the indexing mode, to get meters/minute value, divide the number on the scale by 6.25
Tag Counter	To set and count the number of tags to be measured. One round equals the number of inlays on the loop.
Web Tension On/Off	To switch tension control on and off
Web tension Pressure Gauge	Adjustment knob and pressure meter for web tension (MPa). The adjustment knob is below the web tension switch.
Web Tension N	Display for the tension value in Newtons

Nip Open/Close	To switch the compression pressure (nip) on and off
Nip Pressure	Adjustment knob and pressure meter for the compression nip force (MPa). The adjustment knob is below the Nip switch.

Figure 3. Bendurance right side panel

Main Switch	To switch on the machine
Fuse	5A fuse

4.1.1 External Connectors

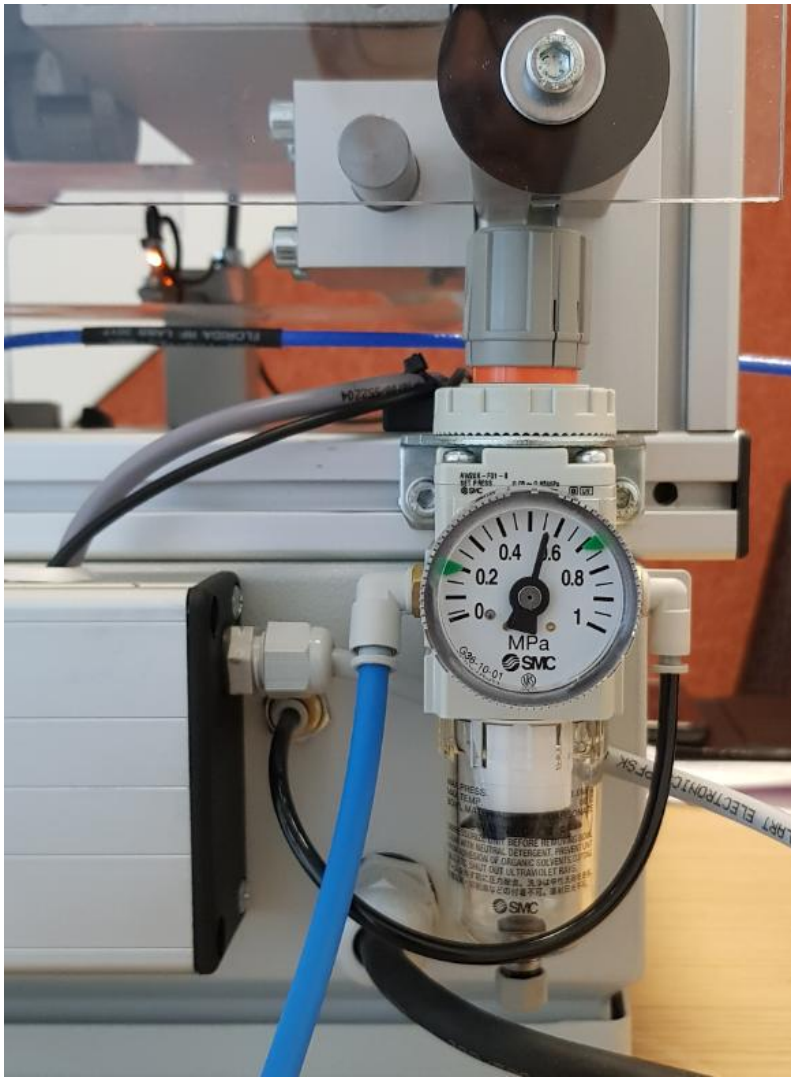


Figure 4. Compressed air regulator.

The power cable, connectors for compressed air, and I/O signaling to the Tagsurance unit are located on the back of the machine.

4.1.2 Trigger Sensor

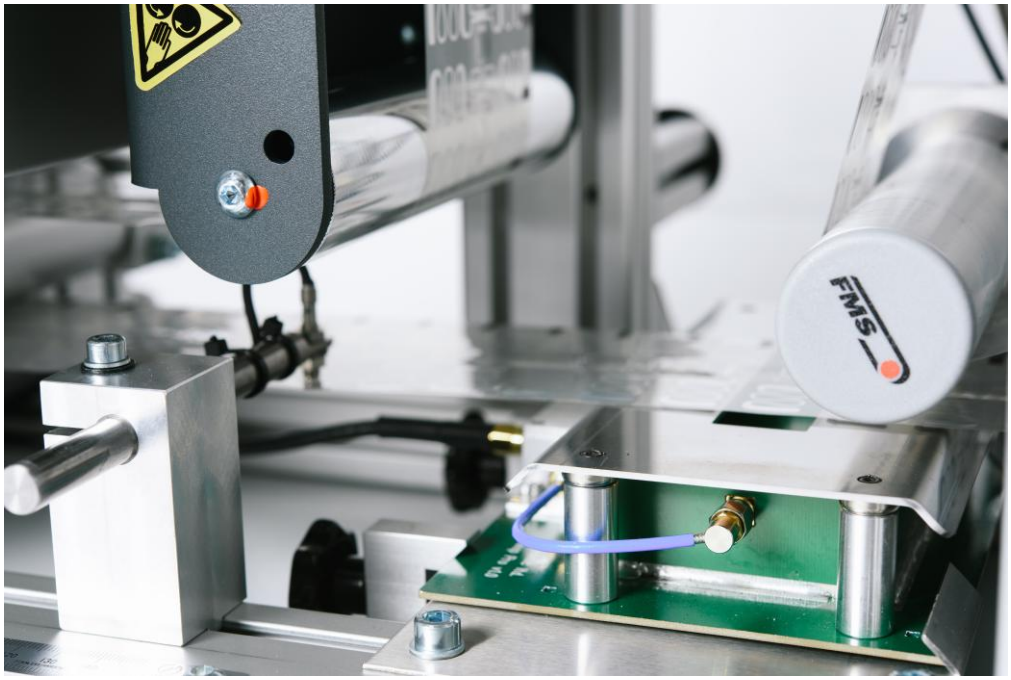


Figure 5. Trigger sensor and Snoop Pro UHF coupling element

Trigger sensor position can be adjusted in the web direction by 160 mm, in the web cross direction by 100 mm, and in the height direction by +/-20 mm.

4.1.3 Snoop Pro Coupling Element and its Attachment Module

The Snoop Pro coupling element is used with a shielding plate. The opening size on the shielding plate is selected based on the processed material's dimensions. The primary function of the plate is to shield adjacent tags, ensuring accurate measurement for a single tag/inlay at a time. **Note!** Both UHF and HF testing require their own coupling element.

Figure 6. Snoop Pro 2.0 coupling element and its default shielding plate selection

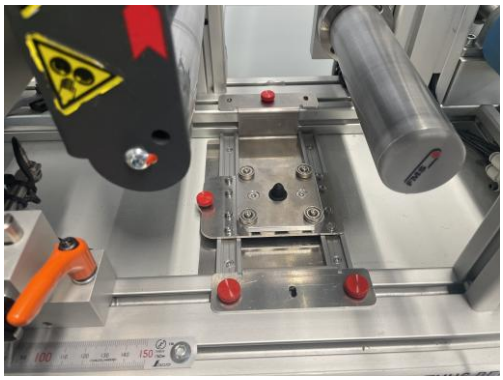
The Snoop Pro Attachment Module can be preassembled in new Bendurance deliveries and retrofitted into older systems.

The module is assembled in Bendurance by inserting three item profile nuts (#2) in horizontal aluminum profiles, two in the foremost profile and one in the hindmost profile. The module is placed between the profiles and fastened to the profile nuts by using thumb screws (#17).

The height of the attached Snoop is adjusted by adding and removing height adjustment plates (#10) by loosening two screws (#11) and adding/removing plates. The thickness of one plate is 1mm.

The Snoop Pro coupling element is attached to the adapter (#16) and placed on the top of the Snoop Pro Attachment Module, which locks in place with magnets. The adapter size is selected according to the Snoop Pro model: Large (#16) for Snoop Pro and Snoop Pro HF, Medium (#15) for Snoop Pro Mini, or Small (#14) for Snoop Pro Tiny and Loop Snoop

Snoop Pro's position in Bendurance is adjusted by loosening the thumb screws, moving Snoop, and fastening the screws again.



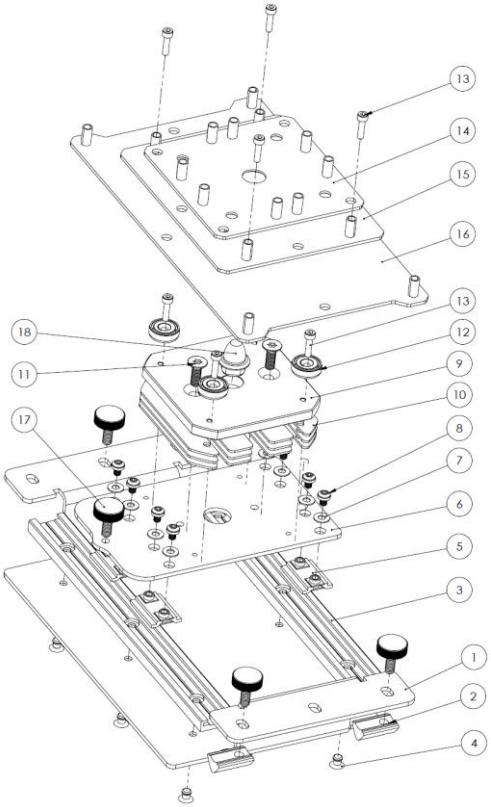


Figure 7. Snoop Pro Attachment Module

4.1.4 Web Guide and Alignment

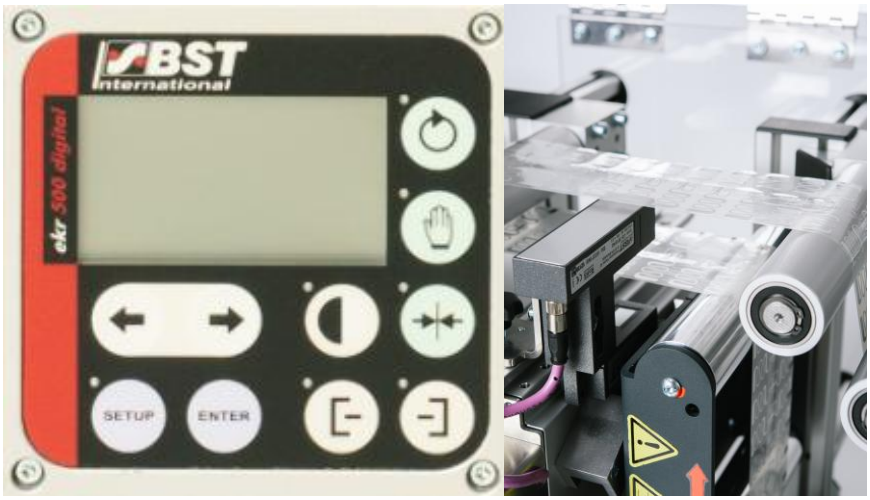


Figure 8. Automated web guide. Precision +/- 0.2 mm.

4.1.5 Counter

Figure 9. Tag counter display

The counter stops the machine once the pre-adjusted number of tags is reached. Counter counts tags based on triggers, not rounds. So, to set the number of rounds, the number of inlays on the loop must be multiplied by the number of desired rounds. Remember to reset the counter before starting the machine.

4.1.6 Compression Nip Roll

Figure 10. Compression nip roll

As an additional stress, the tags can be subjected to a compressive force controlled by the compression nip pressure.

4.1.7 Safety Covers

Figure 11. Safety covers open and closed

Moving parts of the Bendurance are protected with safety covers. The machine will not start until the covers are closed, and it stops automatically if the covers are opened.

5 Installation instructions

5.1 Setting Up the Bendurance Hardware

- Connect the power supply to the Bendurance unit.
- Connect compressed air to the Bendurance.
- Mount the Snoop Pro coupling element to the Bendurance. See Figure 5.

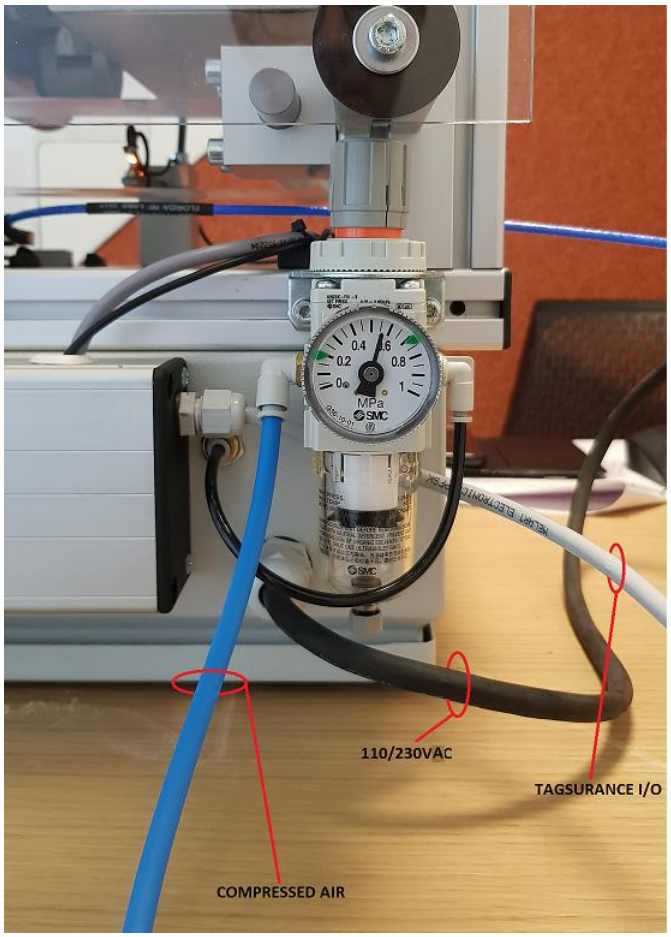


Figure 12. Power supply, I/O connector, and compressed air input

Connectors for AC in, compressed air, and I/O signaling to the Tagsurance tester are located on the back side of Bendurance. Connect the power plug to the power supply and the compressed air to the device's pressure regulator. Adjust the regulator to the level defined in the table below.

Power IN	110-230 VAC, 50-60 Hz
Compressed air IN	Ø6 mm Nylon or PU hose Adjust the input regulator to 0.6 MPa

5.1.1 Setup with Tagsurance 3 version 3.x

Tagsurance 3 version 3.x which is equipped with lane controller 0.3 or 1.1, must be used without a lane controller. This means the lane controller does not control when the Tagsurance tester is triggered, but the IO signals are connected from Bendurance to the Tagsurance tester.

- Connect the RF cable to Snoop Pro (SMA connector) and to the RF connector on Tagsurance tester (N connector).

- Connect the Bendurance I/O cable to the I/O port of the Tagsurance tester (DA-15 connector).

- Connect the Tagsurance tester to the Ethernet switch of the Tagsurance controller (Ethernet cable).
  Tagsurance SL UHF , and Tagsurance HF version 3.0 testers are powered over Ethernet, so make sure you connect the Ethernet cable to the PoE port of the Ethernet switch. When using Tagsurance HF tester hardware version 1.x or 2.x, the external 18 VDC power supply is required. The power supply is a part of the Tagsurance HF tester delivery

- Connect the Tagsurance 3 controller to the power supply.

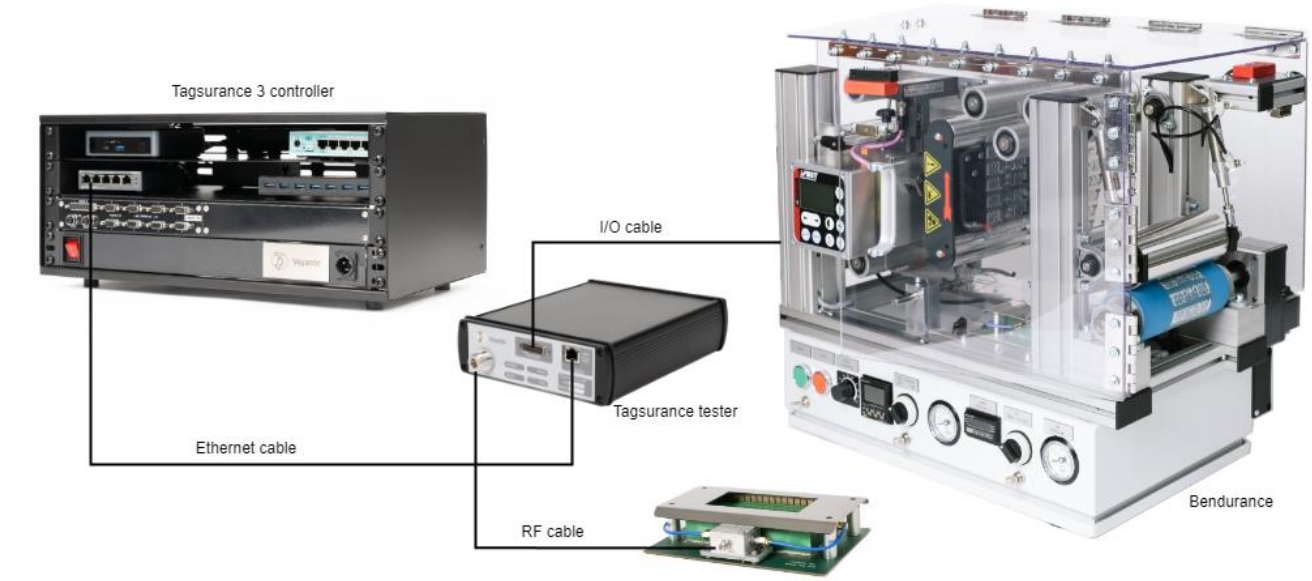
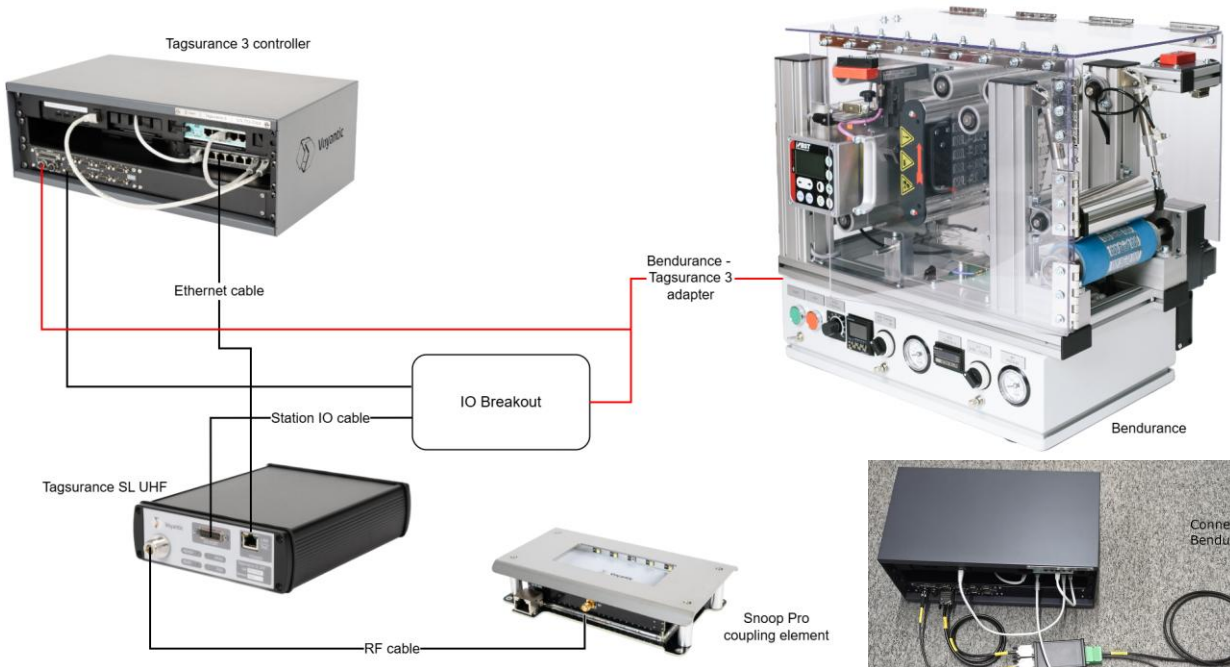


Figure 13. Wiring setup with Tagsurance 3 version 3.x

5.1.2 Setup with Tagsurance 3 version 4.x

Tagsurance 3 version 4.x is equipped with lane controller version 2.0, which is an essential part of the system. The lane controller is controlling the Tagsurance tester and decides when the tester is triggered. The Bendurance IO signals are connected to the Tagsurance 3 system with an IO breakout and an adapter cable.

- Connect the RF cable to Snoop Pro (SMA connector) and to the RF connector on Tagsurance tester (N connector).
- Connect the Bendurance I/O cable to the lane controller's trigger port (M12 connector) and the IO breakout (10-pin terminal block) with the *Bendurance - Tagsurance 3 adapter cable*.
- Connect the IO breakout to the Tagsurance tester and the lane controller's station port 1.
- Connect the Tagsurance tester to the Ethernet switch of the Tagsurance controller with an Ethernet cable.
  Tagsurance SL UHF and Tagsurance HF version 3.0 testers are powered over Ethernet, so make sure you connect the Ethernet cable to the PoE port of the Ethernet switch. When using Tagsurance HF tester hardware version 1.x or 2.x, the external 18 VDC power supply is required. The power supply is a part of the Tagsurance HF tester delivery
- Connect the Tagsurance 3 controller to the power supply.



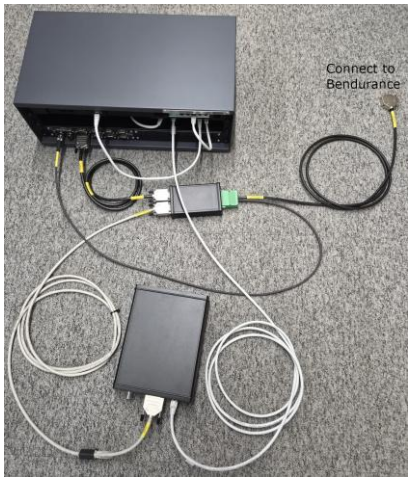


Figure 14. Wiring setup with Tagsurance 3 version 4.x

6 Operation Instructions

Before starting the test run, the samples need to be prepared, and the machine adjusted for the sample by following the instructions in the chapter 6.1. The test can be run using different modes, which are explained in the chapter 6.2.

6.1 Recommended Test Procedure

Recommended test procedure is to repeat “Test” -runs and “Stress” -runs until the required damage level of RFID inlays/labels is reached.

The tag samples are stressed by running them in a loop through a set of bending rollers on a user-specified number of times. The performance test is conducted using communication tests at multiple frequencies and power levels during the test run.

In addition to bending, the samples may also be subjected to compression stress during the run. The compression stress is generated with a pressure-controlled roll pushing against the rubber-covered driving roll.

The first “test”-run is to get the starting performance reference of all inlays i.e. Threshold Sweep, usually also TID/UID of each inlay is recorded. This kind of measurement run is done using the indexing mode of the machine.

After a “test” run, it is a “stress” runs turn. The idea is to rotate the loop material, e.g,. 200 rounds around the machine rolls using defined settings of the machine (tension / nip on or off). This kind of run can be done in continuous mode. While running a “stress” run, Tagsurance may be set for a faster test to monitor changes during the run. A faster test case is typically either a couple of sensitivity tests or a point test. If the Tagsurance system is used during the “stress” run, the line speed must be adopted based on the material dimensions and test duration. Also, the triggering location should be modified for faster speed.

The third part of the procedure is to run a new “test” run to see how much the performance of the inlays changed during the “stress” run.

Example test scenario:

	Speed	**Nip**	**Tension**
Baseline	10% (~3 m/min), index	Open	10 N
#1, 200 rounds	100% (30 m/min)	0.05 (36 N)	10 N
#1 test round	10% (~3 m/min), index	0.05 (36 N)	10 N
#2, 200 rounds	100% (30 m/min)	0.2 (144 N)	20 N
#2 test round	10% (~3 m/min), index	0.2 (144 N)	20 N
#3, 200 rounds	100% (30 m/min)	0.3 (216 N)	30 N
#3 test round	10% (~3 m/min), index	0.3 (216 N)	30 N
#4, 200 rounds	100% (30 m/min)	0.4 (288 N)	40 N
#4 test round	10% (~3 m/min), index	0.4 (288 N)	40 N
#5, 200 rounds	100% (30 m/min)	0.4 (288 N)	50 N
#5 test round	10% (~3 m/min), index	0.4 (288 N)	50 N
#6-, 200 rounds	100% (30 m/min)	0.4 (288 N)	60 N
#6- test round	10% (~3 m/min), index	0.4 (288 N)	60 N
			*max tension: 1 N for 1 mm line width

6.2 Sample Preparation and Machine Adjustment

6.2.1 Opening the Safety Cover

Figure 15. Safety covers open

Moving parts of the Bendurance are protected with safety covers. Machine does not start and stops automatically if cover is opened. Open the safety cover by first fully opening the side door with the handle, so that it is folded towards the front cover. Then gently pull up the front cover and bend the cover in a position as in the above figure.

6.2.2 Sample Threading

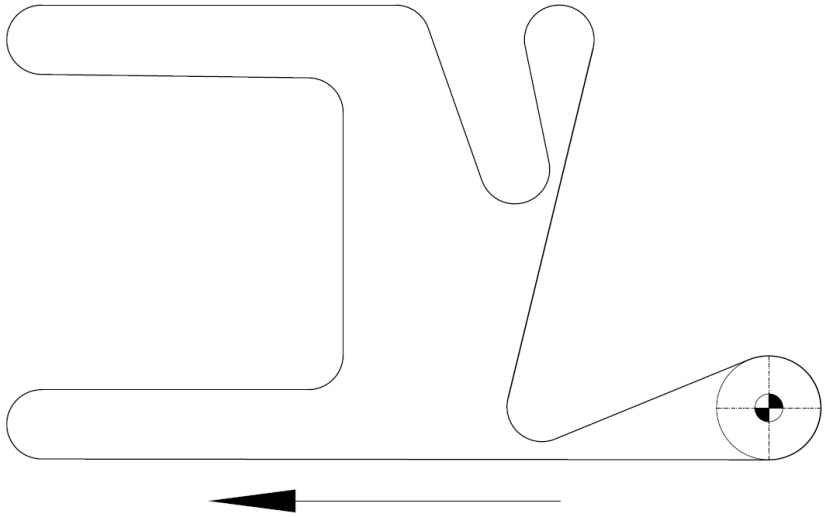


Figure 16. Threading

Cut a 1900–2060 mm (75–81 inch) long sample out of the material to be tested and thread the sample into the tester according to the threading diagram and connect the ends with tape.
Note! The material should be threaded in a way that the chip of the inlay/label is pointing upwards at the Snoop Pro coupling element. If the chip is pointing towards the coupling element, it may be damaged by the edge of the shielding plate during multiple revolutions.

Bendurance comes with a separate underlay and magnets placed on top of the upper rollers, as in the figure below. Magnets help keep the ends of the material stationary, making it easier to precisely connect the loop ends. It is important to keep the same pitch also at the connecting point of the loop, otherwise, there will be an offset on the test location when the connection sector reaches the trigger sensor.
Note! The underlay must be removed before starting the test run.

Figure 17 Underlay for web splicing

6.2.3 Adjusting the Web Tension

Figure 18. Web tension controls

Switch the web tension roll ON from the front panel. Adjust the desired web tension by turning the screw under the *web tension on/off* switch. Max tension is 60 N. The web tension is shown in Newtons on the front panel digital display and as the controlling pneumatic pressure next to it.

6.2.4 Adjusting the Web Alignment

Figure 19. Automated web guide.

Set the web guide to automatic mode by pushing the auto mode button (circle arrow, at top right corner). The green LED next to the auto mode button is illuminated when the web guide is in automatic mode.

Set the ultrasonic sensor's alignment mark to the location where you want the web edge to run. Check that the web runs on the Snoop Pro coupling element so that the inlays are centered in the shielding plate opening. More detailed information about the web guide can be found in a separate manual delivered with the machine.

6.2.5 Adjusting the Triggering

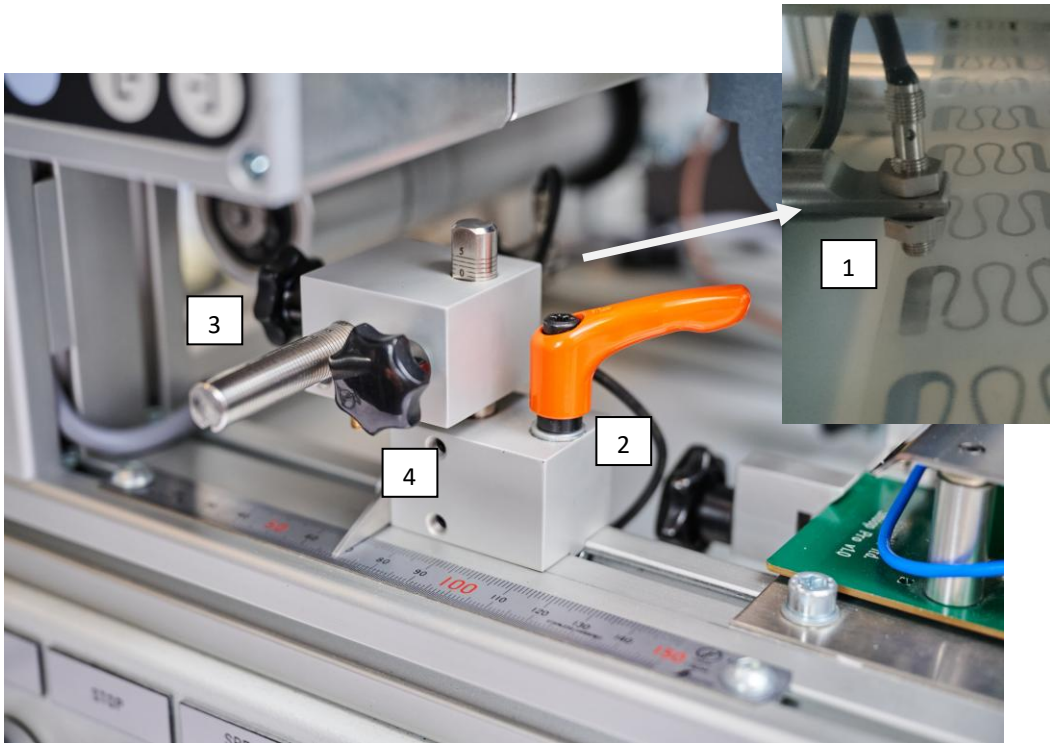


Figure 20. Trigger sensor

Trigger sensor [1] position can be adjusted web directionally 160mm [2], cross-directionally 100 mm [3] and height directionally +/-20mm [4]. To adjust the sensor location, untighten the corresponding screw, adjust the sensor location and tighten the screw again.

Note! The trigger sensor is inductive so quite often it needs to be very close to the intended trigger point on the material. Verify that the sensor is not touching the material because during multiple revolutions the surface of the web will wear out causing triggering eventually to fail.

6.2.6 Applying Compression Test Force

Figure 21. Compression nip pressure controls

Switch the nip closed if compression testing is to be done and adjust desired nip pressure max 0.4 MPa. Adjust the desired compression by turning the screw under the *nip open/closed* switch.

The device can be used the nip open if compression test is not a part of the desired test scenario.

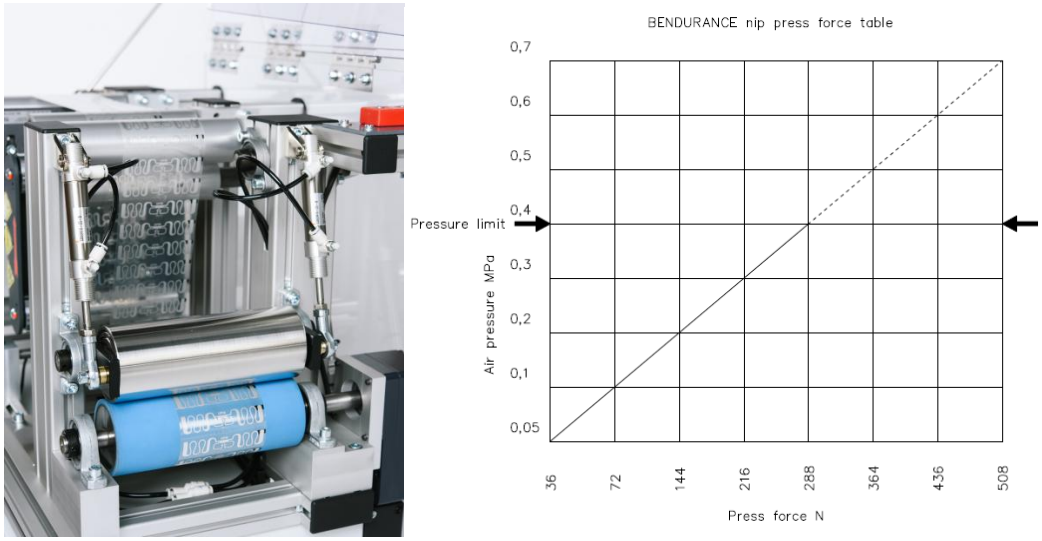


Figure 22. Compression rolls and pressure vs force chart

6.2.7 Setting the Tag Count for the Test

Figure 23. Tag counter controls

Counter stops the machine after the pre-adjusted number of the tags is achieved. Each digit has its own button. To set a certain count of tags, press the button for each digit as many times as the digit value to be set. The counter counts triggers, not rounds, so if your tag loop has 100 tags and you want to stop the test after 100 bending rounds, the value to be keyed in would be 10000.
Note! To get accurate counts, verify that the trigger sensor is correctly positioned, and it triggers only once per inlay/tag.

6.3 Starting the Test Run

The Bendurance operates in multiple motion and test modes. Tags can be stressed in continuous motion, monitoring constantly with the Point tests or the Sensitivity tests.

A more thorough analysis can be run in intervals, between the “stress” runs, by stopping the continuous stress after a set number of rounds and running one round by indexing the tags to dwell in the test position. This allows running a complete analysis with the Threshold Sweep test for each tag on the loop.

The test results are stored in the server of Tagsurance 3 controller. The results can be exported from the server for the detailed post analysis. Tagsurance 3 server stores huge number of tag results but a limited number of jobs at a time. One job is for example one thorough test round between the “stress” runs. For more details, refer to Tagsurance 3 Manual.

6.3.1 Running in Continuous Mode

Please confirm first what is the maximum speed the test can be run. The test time available per tag is dependent on the speed, but also on the tag size and pitch, as well as the Snoop Pro shielding plate opening size. More information on how to calculate the test time available can be found in the Snoop Pro datasheet. The Tagsurance Recipe Builder calculates the test time estimation for the test sequence created.

For the continuous mode testing, the optimal triggering location is when the inlay has entered the Snoop Pro shielding plate opening and is 5mm from the front edge of the opening. The test can be proceeded and must be completed before the tag has reached 5mm distance from the back edge of the shielding plate opening.

To start the “stress” run in continuous mode, first start the job in Tagsurance 3 operator UI. For more details, refer to the Tagsurance 3 manual. Then turn the *index mode* switch to *OFF* position and use the potentiometer to set the line speed for the stress run. The actual line speed in the continuous mode is the setting of the potentiometer divided by 3.33. The maximum line speed is 30 m/min. The counter will start counting tags and stops the run automatically when the set value has been reached.

Figure 24. Start/Stop, Index mode, and Speed controls

After the “stress” run has been stopped, stop the job separately in the Tagsurance 3 operator UI. You can now export the test data from the Tagsurance 3 server.

6.3.2 Running in Indexing Mode

In indexing mode, the Bendurance will stop at each tag and automatically continue to the next after the Tagsurance completes the measurement. In indexing mode, the optimal triggering location is when the inlay stops at the midpoint of the Snoop Pro shielding plate opening.

To start the “test” run using indexing mode, first start the job in the Tagsurance 3 operator UI. For more details, refer to the Tagsurance 3 manual. Then turn the *index mode* switch to ON and use the potentiometer to set the line speed for the test run. The actual line speed in indexing mode is the potentiometer setting divided by 6.25. The maximum line speed is 16 m/min.

The counter will start counting tags and automatically stop the test run when the set value is reached. Typically, the set value is the number of tags on the loop when the indexing mode is used to analyze tags over a certain number of bending rounds in continuous mode.

After the “test” run has been stopped, stop the job in the Tagsurance 3 operator UI. You can now export the test data from the Tagsurance 3 server.

In the indexing mode, the line movement is controlled by the Busy/Ready signal of the Tagsurance tester. First, the tester is triggered by the trigger sensor, and only after the tester turns to “busy” is the line movement stopped. This may lead to tag testing starting before the line stops. The tag movement may cause variance in the first test task results. However, this can be considered in the UHF test recipe design by adding a longer carrier time before the first task. In Tagsurance Recipe Builder, this can be done with a parameter *Carrier before task list*.

Appendix A: Technical Specifications

Bendurance

Machine Dimensions

650mm x 500mm x 400mm (L x H x D)

26" x 20" x 16" (L x H x D)

Weight: 40 kg (88 Lbs.)

Utility Requirements

Operating Voltage: 100-240 VAC, 50-60 Hz

Compressed Air: 6 bar, 0.5 l/min

Rolls

Ø 40 mm Bending Rolls

Ø 60 mm Driving Roll – Coating Hardness 60 ShA

Ø 60 mm Press Roll

Web Dimensions

Maximum Web Width: 135 mm (5.3 inch)

Web Length: 1900-2060 mm (75-81 inch)

Tagsurance SL UHF and Tagsurance HF

Refer to Tagsurance User Manual

Appendix B: Maintenance

Bendurance is designed to be as maintenance-free as possible. However, as part of a preventive maintenance regime, there are recommended periodic cleaning and inspection tasks that should be carried out at regular intervals.

Monthly:

- Drain the Air regulator container if water accumulates.
- Clean Bendurance surfaces with a lint-free cloth.
- Clean Bendurance bending rolls with a lint-free cloth and IPA solution if needed. For the drive roll, use a mild soap solution.

Annually:

- Check roller surfaces for any wear.
- Inspect drive pulley, main drive bearings, roller bearings, and spindles for any wear.

If any questions regarding Bendurance or Tagsurance maintenance or usage come up, contact Voyantic technical support at *support@voyantic.com*