Code 286

L&W Bending Tester

OPERATING INSTRUCTIONS

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Original instructions

NOTE
The equipment is to be handled only by users with the necessary knowledge and training for the work.

NOTE
To prevent injury from moving parts all covers should be in place during normal operation of the instrument.

NOTE
Always read the instructions carefully before you operate the equipment. Carefully obey the warnings and directions related to personal safety. These instructions include these types of warnings:

Degree of potential injury or damage	Likelihood of occurrence	Signal word
Severe	Can occur if warning is ignored	**WARNING**
None	This label is used for special instructions that are important but not related to hazards	**NOTE**

NOTE
To ensure that the equipment functions properly and that accurate readings are obtained, all adjustments, settings and calibration routines described in these instructions should be carried out only by specially trained personnel.

Table of contents

1 Introduction

Lorentzen & Wettre Bending Tester Code 286 measures the bending resistance and bending stiffness of paper and board in accordance with the relevant standards. It can also report readings in Taber Stiffness Units (bending moment) and MD/CD ratio.

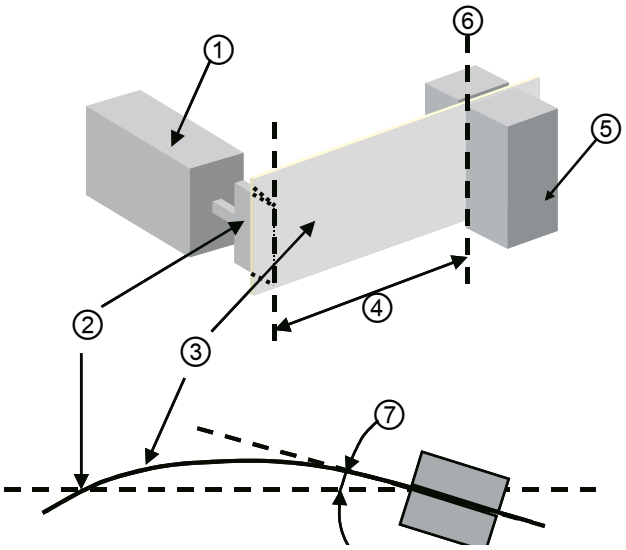
A report of all tests can be viewed directly on the display. The report can also be sent to an external printer or be exported by network

The instrument operation is fully automated with clamping and bending. The pneumatic clamp eliminates reading errors caused by samples being clamped too soft or too hard.

The instrument can be delivered in three different configurations with different load ratings for the load cell.

1.1 Measurement method

A test piece is put in the pneumatic clamp. When a test is started the test piece is clamped in place and bent against a load cell. The load on the load cell is recorded with the current angle. Depending on the program, specific values are recorded.



1	Load cell
2	Load-cell knife
3	Test piece
4	Bending length
5	Clamp
6	Clamp fulcrum
7	Bending angle

Resistance

The readings are in units of mN. The bending resistance is usually measured at a deflection of 15°, but test readings for other angles can be recorded. The bending-resistance test can also provide readings of stiffness.

Taber Stiffness Units (bending moment) and the ratio between MD and CD readings can also be reported in the end-report. The MD–CD ratio is reported as quotient and geometrical mean value for one of the reported bending angles.

Stiffness

The test readings are given in mNm. Bending stiffness is calculated using the following equation:

$$S_B = \frac{60 \times F \times L^2}{\pi \times A \times B}$$

where,

S_B = Bending stiffness, mNm

F = Bending force, N

L = Bending length, mm

A = Bending angle, degrees

B = Sample width, mm

Auto measuring mode

Once the clamp has closed and the support has descended, the clamp will rotate until enough data have been collected. The starting point and the measurement results are then calculated.

Manual measuring mode

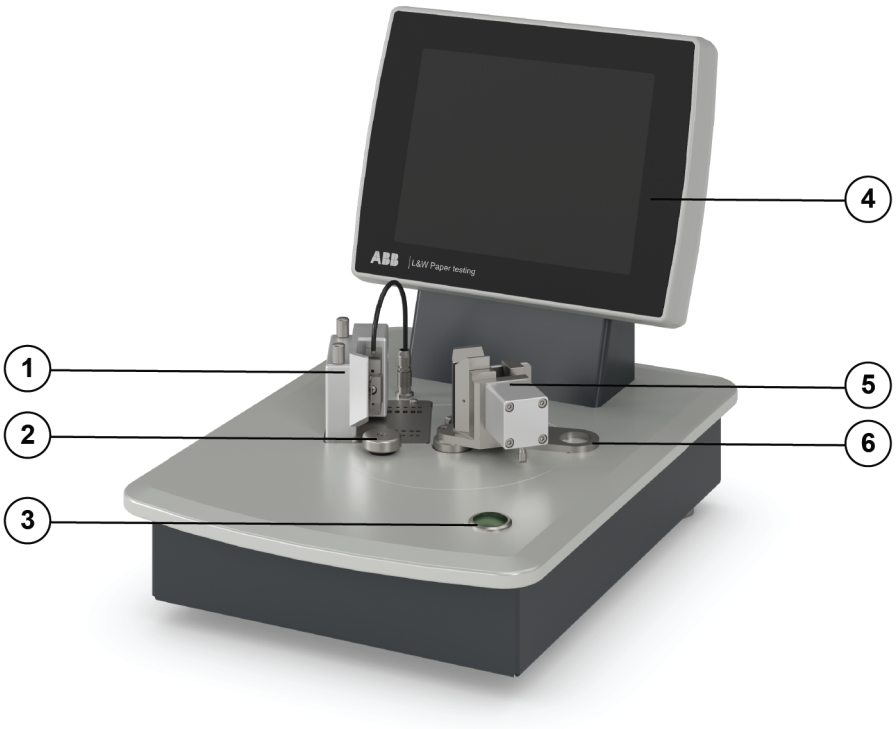
The clamp rotates so that the test piece just touches the load-cell knife. The magnitude of the applied force will now be displayed (typically 1–20 mN) and can be adjusted before continuing. This reading will be deducted when the report is generated and will therefore not affect the final reading.

1.2 Delivery specification

A standard delivery includes:

- Bending tester
- Power supply
- Steel plate for check
- Operating instructions
- Calibration certificate with data for this specific instrument

2 Instrument description



1	Load cell
2	Support for test piece
3	Start button
4	Touch-screen
5	Pneumatic clamp
6	Transportation fixation

Back

1	Air input, 0.4–1.0 MPa
2	Ethernet connection
3	Power input 24 V DC
4	Glass fuse 5AT

3 Installation

3.1 Unpacking the instrument

1. Unpack the instrument.
2. Make sure that all items listed in the delivery specification are intact and undamaged.
3. Put the instrument on a stable and vibration-free bench at a convenient working height.
4. Remove the transport fixation from the pneumatic clamp. Slide the fixation to one side and pull it out.

   Keep the transport fixation. Install the transport fixation for when the machine will be moved in the future.

NOTE
The instrument is designed to work stationary. Before you move it, disconnect all connections. Take a steady grip and lift the instrument below the bottom plate. The weight is 12 kg.

3.2 Connecting power

The tester receives a 24 V DC supply via the in-line power adaptor. Mains power: 100–240 V AC, 50–60 Hz. Plug the lead into the **POWER INPUT** port and the mains socket.

NOTE
Use only the power adaptor supplied by ABB/Lorentzen & Wettre.

3.3 Connecting compressed air supply

Connect a clean and dry supply of compressed air (0.4–1.0 MPa) to the port on the back of the tester. If the supply available is not as clean as required, a separate filter and moisture trap must be fitted upstream of the tester. A built-in, fixed compressed-air regulator gives the correct clamping pressure, 200 kPa (approx.).

3.4 Connecting a local network

Connect a local network to the LAN port on the back of the instrument.

3.5 Connecting a network printer

Connect a network printer to the local network. For system settings, see *section 8.8*.

3.6 Do a check

Perform a check as described in *section 6*. When this is done, the instrument is ready for use.

4 Operating the instrument

4.1 Measure the test-pieces

1. Select a program from the program list.

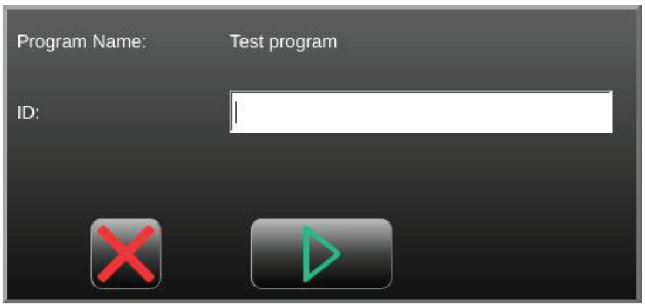
2. Make sure that the instrument is set to the correct bending length according to the program. (See *section 4.3.1*)

NOTE
If the load-cell is not installed in the correct position for the selected program the current bending length will be shown in red. A warning will appear when a test is started.

3. Adjust the length stop for the test pieces. (See *section 4.3.2*)
4. Put a test piece in the pneumatic clamp. Make sure that the test piece is inserted to the Length stop.

5. Press the start button on the machine or on the touch screen.

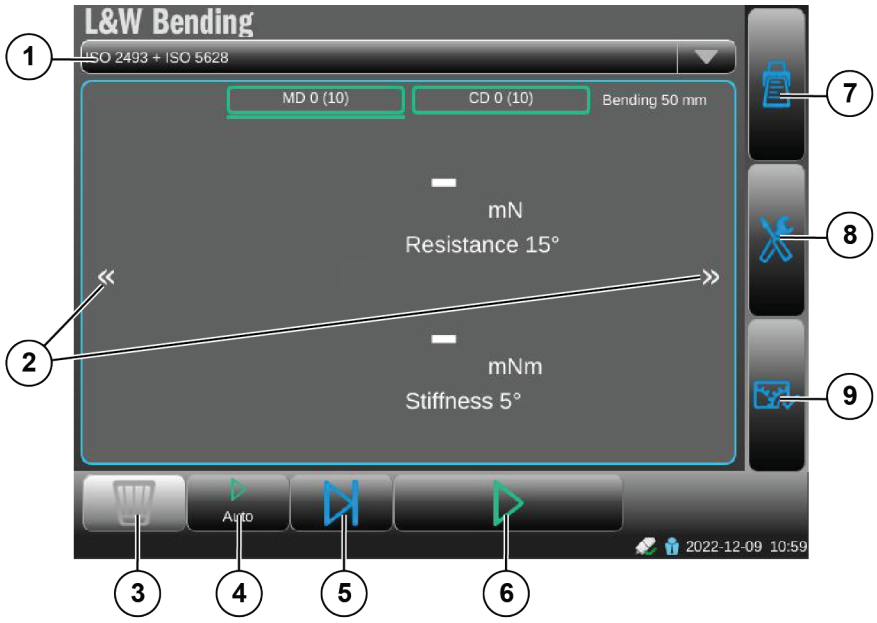
If the selected program has the function **Display start dialog** selected (see *section 7.1.1*), you are asked for a sample ID. This entry will be displayed on reports. If no ID is entered, then no ID will be reported.



WARNING
There is a risk of pinching when the test is in progress. Keep your hands away from the instrument when the test is in progress to avoid injury.

6. Remove the test piece from the instrument.
7. Do step 4-6 for all test pieces according to the selected program.

4.2 Interface



1	Program list
2	Change report view on the touch screen.
3	Delete the last test. Press and hold to delete all tests in the series.
4	Change between auto and manual mode
5	Skip the remaining tests in the series
6	Start/stop test (when a test is ongoing this button is changed to a stop symbol)
7	Print report
8	Settings
9	Check

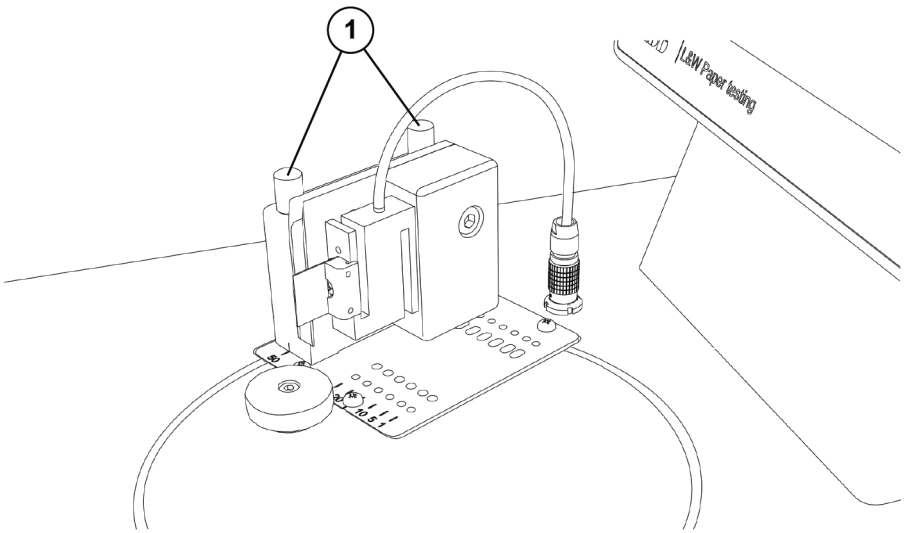
4.3 Instrument configuration

4.3.1 Change the bending length

The load-cell can be moved to change the bending length. See *section 7.1.2* how to set the bending length in the program.

CAUTION
Do not touch the knife on the load-cell when moving it. The load-cell is very fragile and can easily be damaged.

1. Loosen the two thumbscrews (1) on the load-cell.

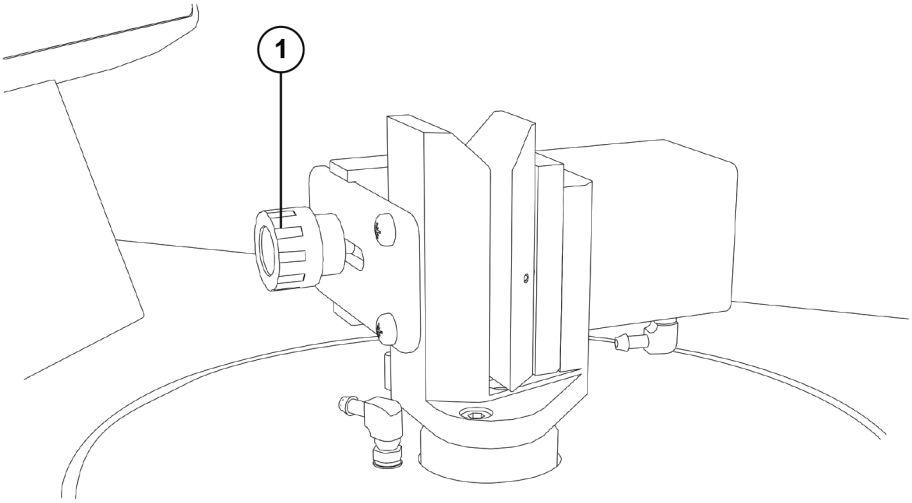


2. Lift the load-cell from the current position.
3. Align the line on the load-cell with the markings for the correct bending length.
4. Tighten the thumbscrews to secure the load-cell.

NOTE
If the load-cell is not installed in the correct position for the selected program the current bending length be shown in red. A warning will appear when a test is started.

4.3.2 Adjust the length stop

1. Loosen the thumbscrew (1) holding the stop to the pneumatic clamp.



2. Move the stop so that the test pieces will are held firmly by the pneumatic clamp and still contact the load-cell.
3. Tighten the thumbscrew to secure the stop.

5 Reports

These alternatives are available to view reports from the instrument:

- The touch-screen
- An attached network printer
- A computer connected to the instrument through the Ethernet port
- L&W DAW Data acquisition workstation
- L&W Lab Management System (LMS)

The instrument stores no measurement data. When a new measurement series is started, all previous data is discarded. To save data, you must transfer it to, for example, a PC.

For future data storage and data manipulation a computer must do a data request. For details, see *section 5.3*.

5.1 Views

During a measurement you can always view the current result on the touch-screen. Three views are available:

- Sample
- Statistics
- Block diagram
- Graph (only available for yellow users)

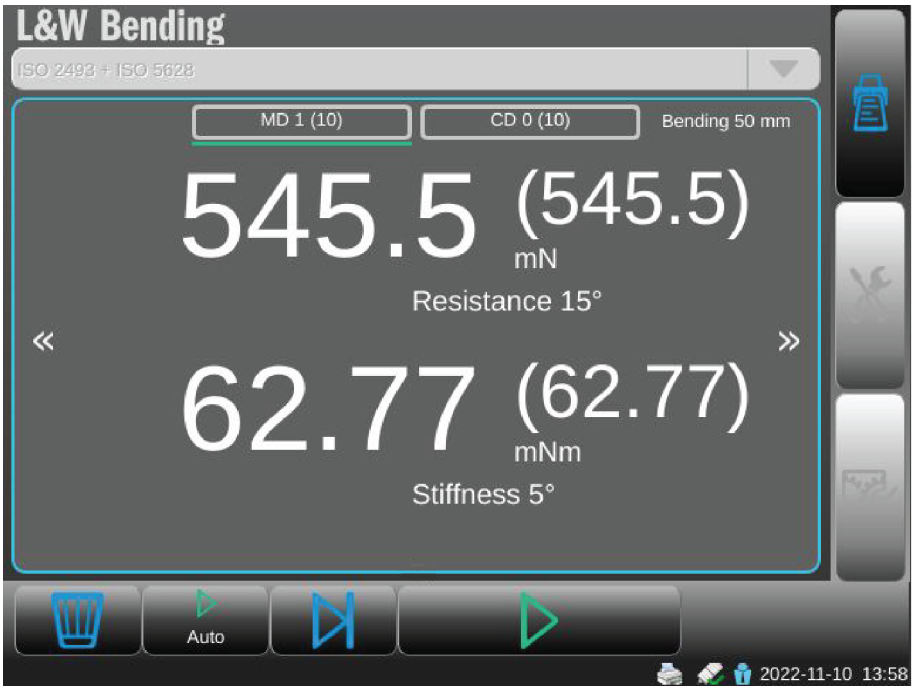
To move between the views, select the arrows **«** or **»**, or swipe left or right.

The measurement process is displayed at the top of the touch-screen. During a measurement series, the total number of measurements and the number of completed measurements are displayed.

Sample view

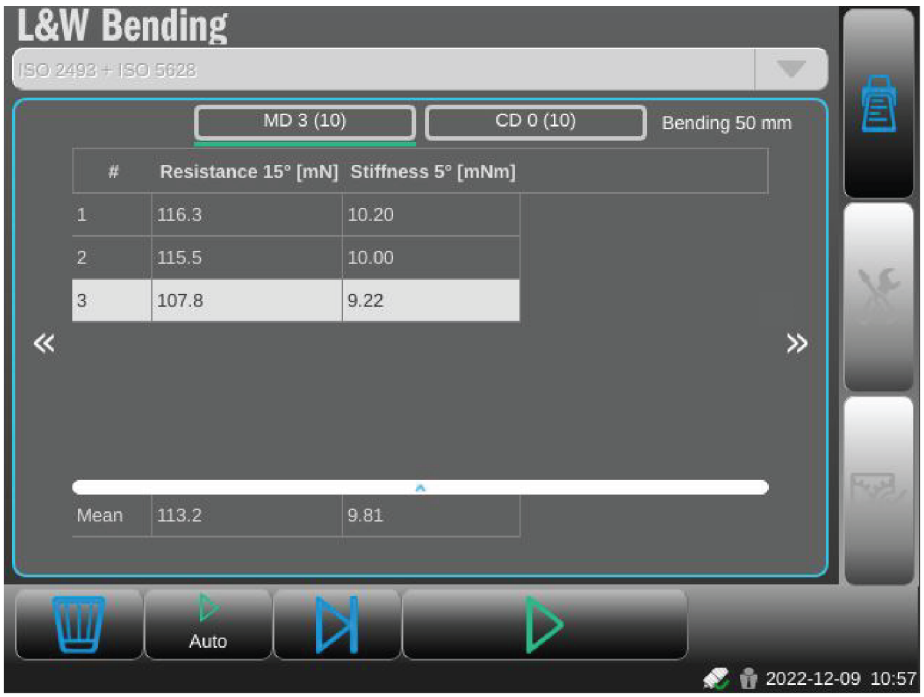
This view displays the selected properties for the latest measurement.

Average/median for the current series can also be included (the value in the parentheses).

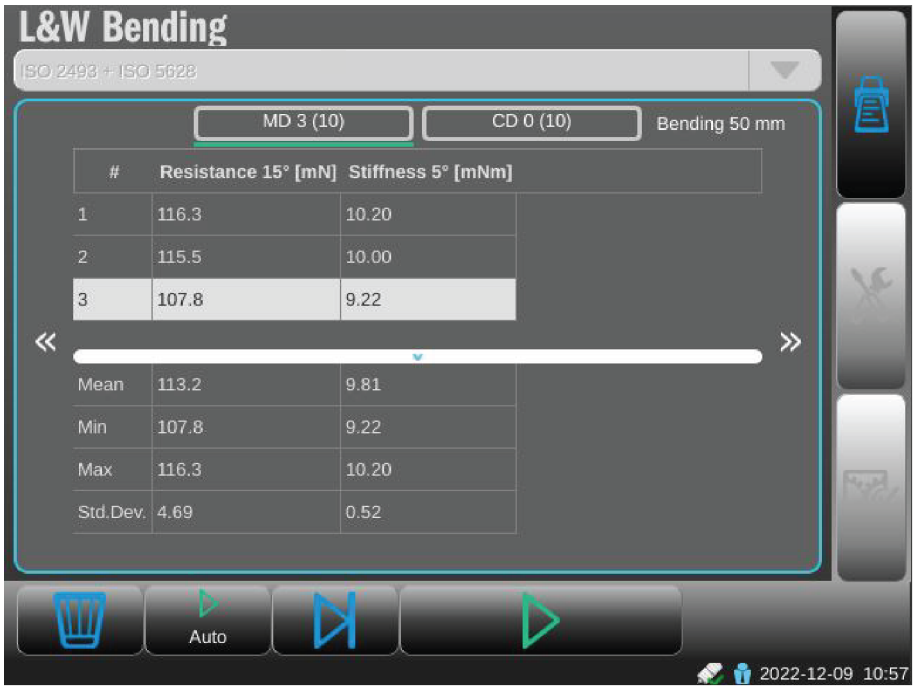


Statistics view

This view displays the selected properties in a table. The table contains all measurement data for the current series. The statistics are displayed below the individual results.

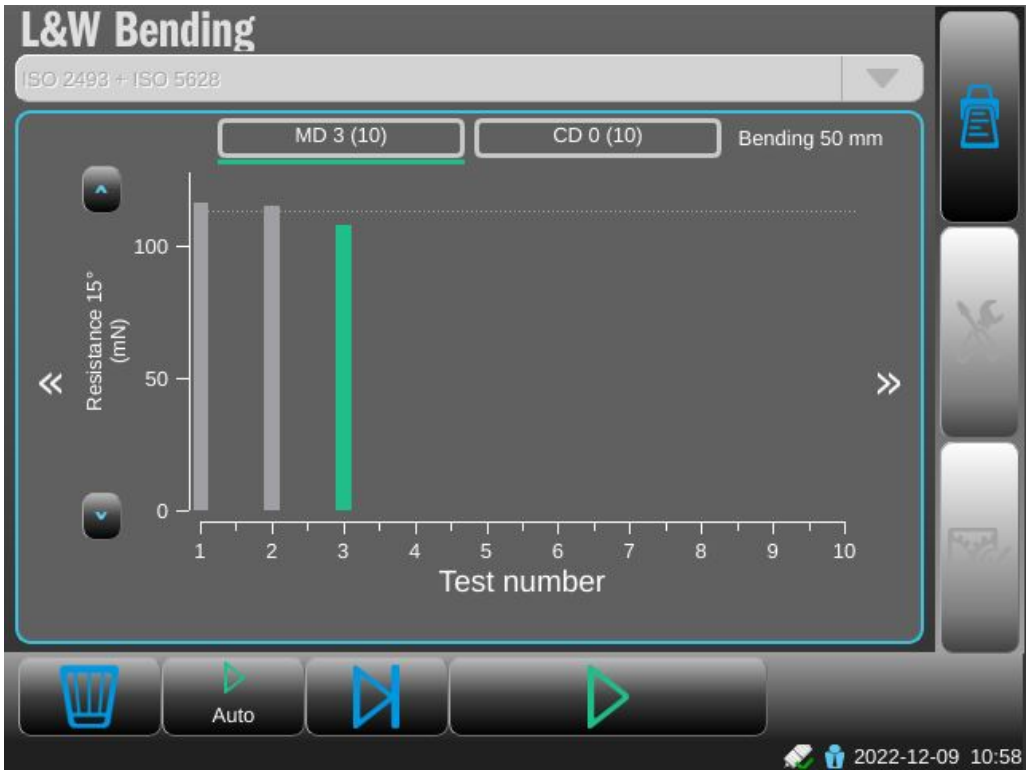


To view all statistics, select the first line in the statistics part at the bottom.



Block diagram view

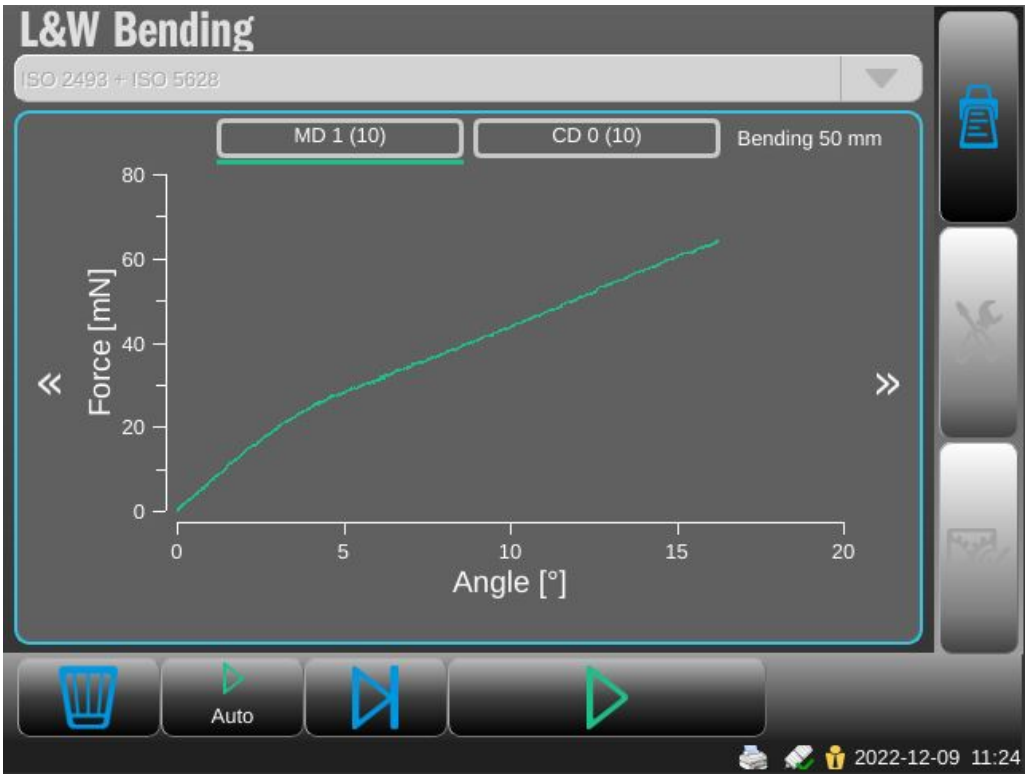
This view displays a bar chart of all values in the current measurement series.



Select the up  or down  buttons to go between the measured properties.

Graph view

The graph view displays a graph of the measurement. (This view is only available for yellow users)



5.2 Network printer

The report is sent as a Postscript file or as PDF. Thus, the printer must be able to handle these formats.

The network configuration is described in *section 8.7*.

5.3 Reports on computer

The results from the measurements can also be transferred to a computer or a mill-wide system.

The instrument acts as an FTP server accessible using the IP number set in *section 8.7*.

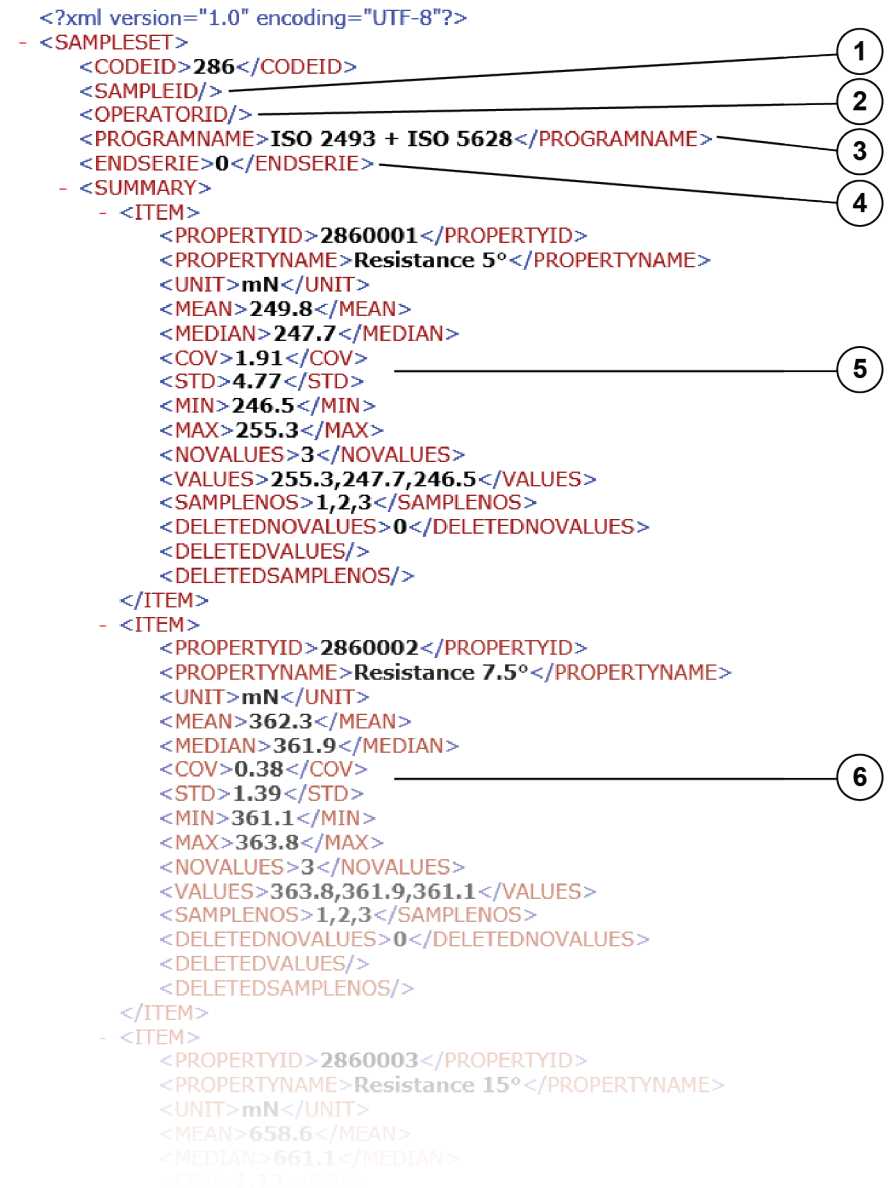
The server contains a folder *results*, which contains two XML files that are updated after each measurement:

- *summary.xml* contains all statistics data in the current measurement series.
- *sample.xml* contains all measurement data from the latest measurement.

NOTE
When these files are used to make customized report solutions, we recommend that you use the XML structure, and not a line-based approach. Because output is configurable and future system updates can add information, this is the safest way to get correct data.

ABB/Lorentzen & Wettre provide an example of a macro to use in Microsoft Excel®, PLOT2XL2, which transform XML data to standardized spreadsheet format. The macro might need adjustments depending on version of Microsoft Excel®.

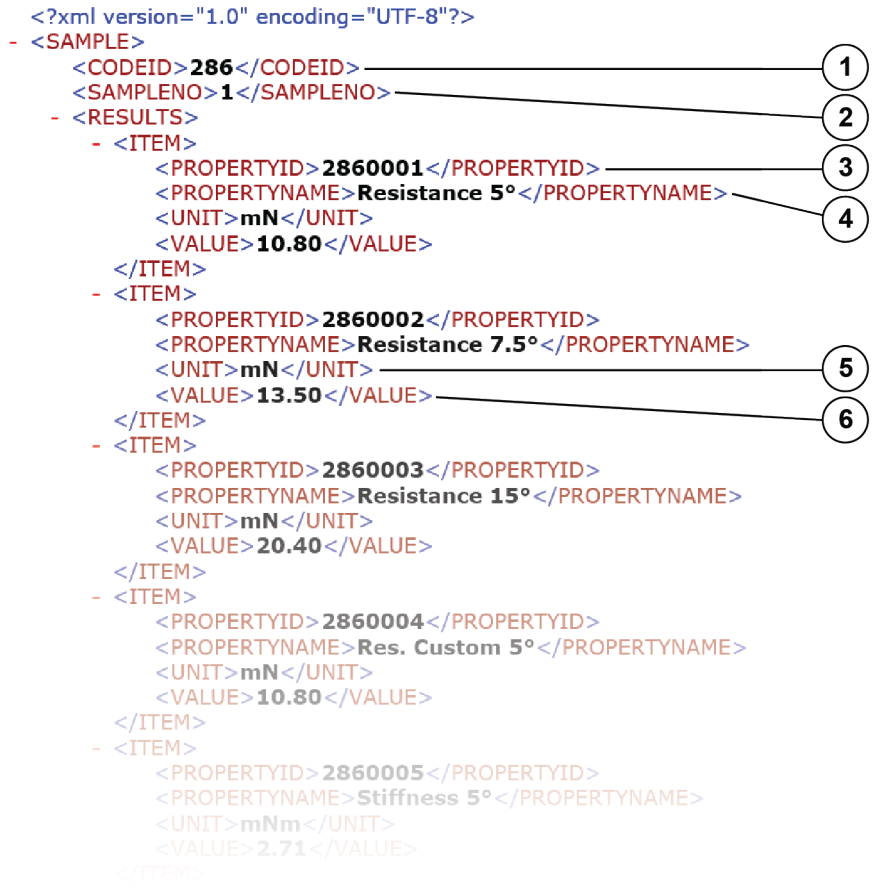
File 'summary.xml'



1	Sample ID
2	Operator ID
3	Program name
4	End series (see below)
5	Statistics
6	Data

End series	
0	Series active not completed
1	Series completed
2	Series aborted, values deleted

File 'sample.xml'



1	Instrument code number
2	Sample number
3	Property ID
4	Property name
5	Unit
6	Measurement value

5.4 L&W Lab Management System

The L&W Lab Management System (LMS) optimizes routine testing in a laboratory. The testing operations are simplified and the performance is improved when manually operated paper testing instruments must report test results.

The web-based software program automatically takes sample measurements from the lab instruments and delivers results into customizable dashboards. This supplies the user with data storage, management, analysis, and reporting. The program works in a computer to which instruments are networked. Digitalization prevents human errors when sample measurement are taken and when data is handled.

5.5 L&W Autoline DAW

If you use the L&W Autoline Data Acquisition Workstation (DAW), please contact your local ABB support for Lorentzen & Wettre products.

6 Checking the instrument

A check should be done regularly to ensure that the instrument is performing as expected. The check procedure is done by measuring a plate with a known bending resistance to ensure that the load-cell return the correct values at 5°, 10° and 15° degrees of bending.

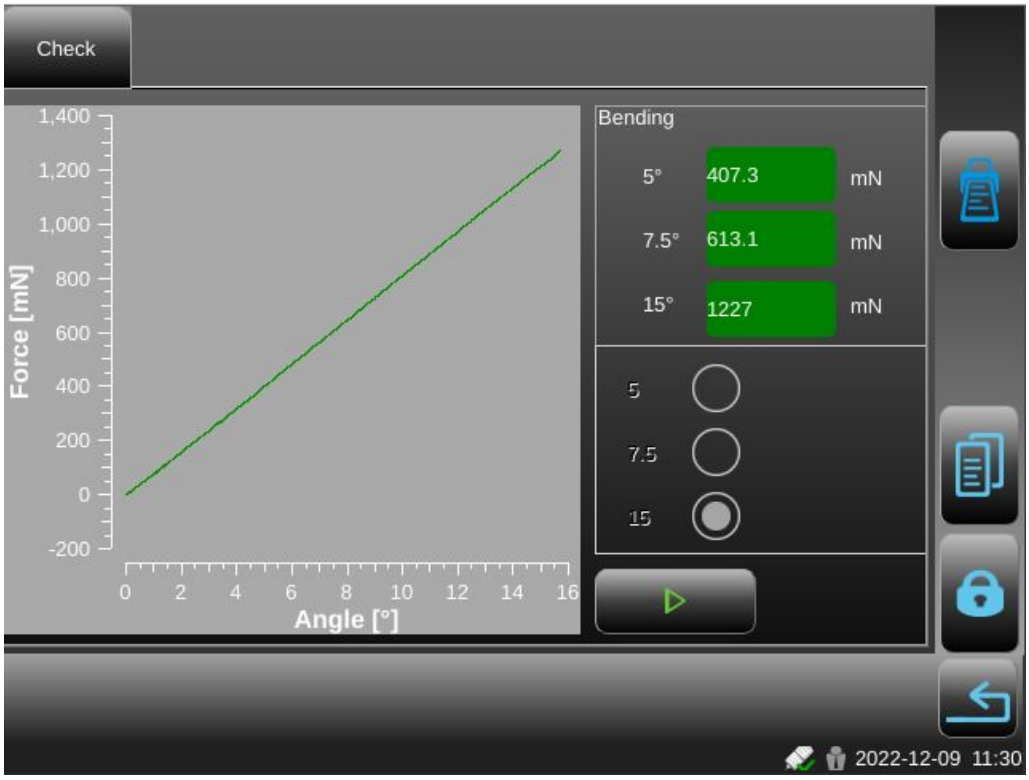
NOTE
A check can not be done when a test is in progress. Complete the test or stop the test to perform a check.

1. Press the check button to go to the test menu.
2. Make sure that the load-cell is installed at 50 mm bending length.
3. Put the calibration plate in the pneumatic clamp as shown in the image below.

   The label on the calibration plate must be be facing the operator and not the load-cell.

4. Press start to start the check.

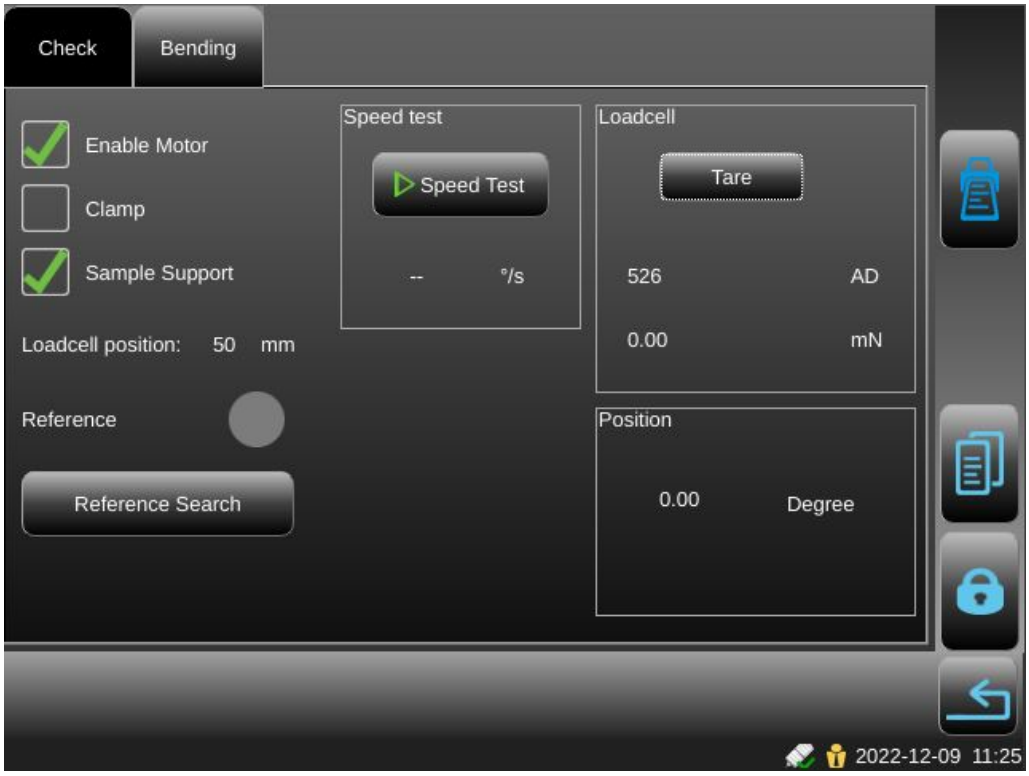
If all the measurements are green the test have passed. If any of the measurements are red, see *section 10* for troubleshooting.



6.1 Advanced check - Yellow user

The yellow user level can do a complete check to verify all the measurement functions. For information on how to select user level, see *section 8.2*.

Go to the check menu and press the Bending tab to do a advanced check.



Pneumatic clamp

Select the *Clamp* option to close/open the pneumatic clamp.

Sample support

Select the *Sample support* option to raise/lower the support for the test pieces.

Speed test

Press *Speed test* to start the test. This will rotate the pneumatic clamp and measure the speed. The value is shown under the *Speed test* button. If the test is OK the value will be green. If the test have failed it will be shown in red.

If the test failed, contact your local ABB support for L&W products.

Reference search

Press *Reference search* to search for the reference position. The pneumatic clamp will rotate until the correct position is found.

7 Program settings

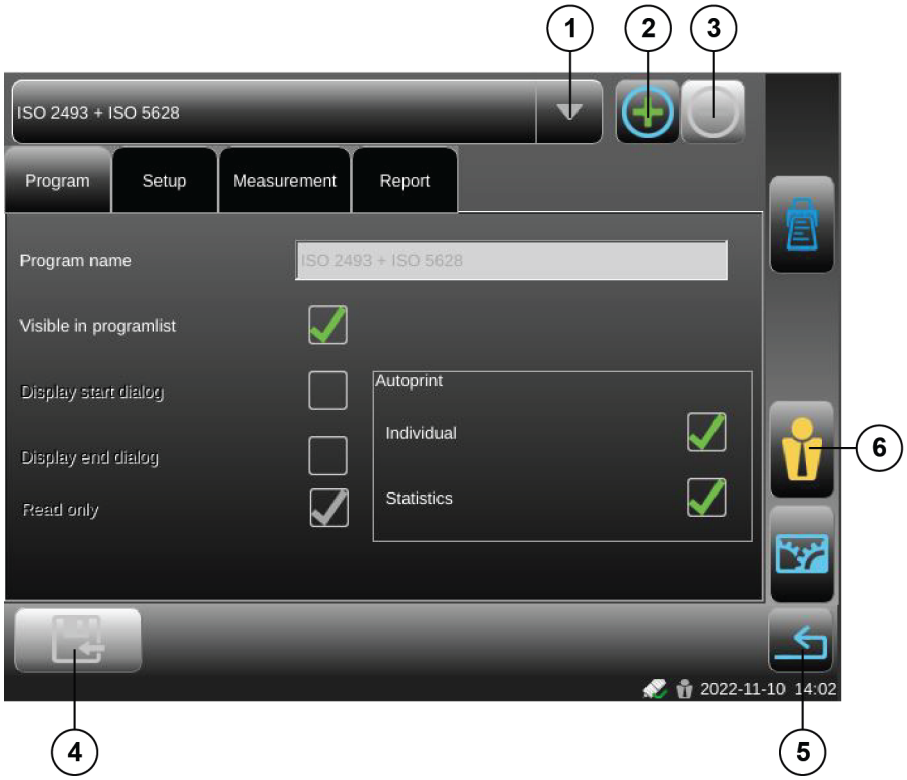
The instrument is delivered with a standard set of programs that can't be modified. They can only be modified to be visible or not in the program list.

Standard programs
Check
ISO 2493 + ISO 5628
Tappi T 556
DIN 53121

To edit any program you need to log in as a yellow user.

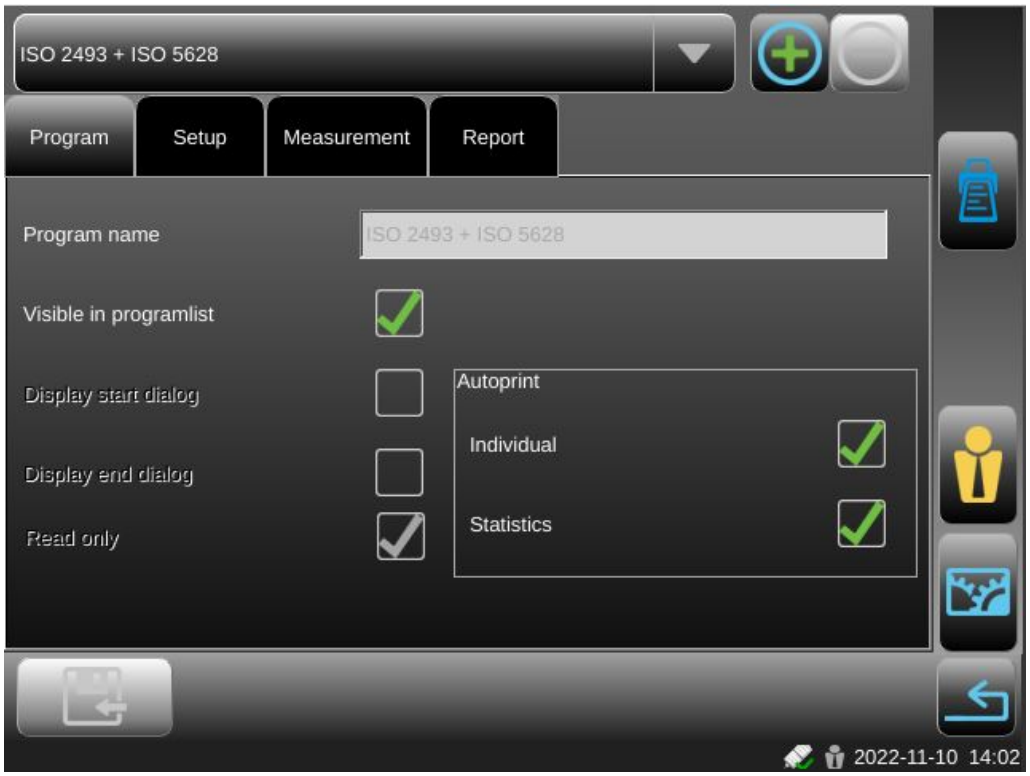
7.1 Overview

Press the settings symbol  to go to the program page.



1	Programlist
2	Add a program
3	Remove a program
4	Save changes
5	Exit, go back to the start
6	Change user level (see *section 8.2*)

7.1.1 Program



Setting	Description
Program name	A descriptive name for the program
Visible in program list	If checked, the program is displayed in the drop-down list. It is recommended to hide not used programs in the menus. If for example only ISO standards are used, then it is recommended to hide the programs for Tappi and DIN.
Display start dialog	If checked, prompts the user to enter the sample ID at measurement start.
Display end dialog	If checked, the user has a possibility to adjust the measurement results before they are sent to an external data system.
Read only	Protect the program from accidental deletion. (For pre-defined programs only)
Autoprint	Automatic printing of results when measurement series is completed, you can select individual and/or statistics. An alternative is to push the PRINT button.
Individual	See above
Statistics	See above

7.1.2 Setup

Setting	Description
Touch force	Start force for autotouch calculations.
Bending length	The length between the load cell and the pneumatic clamp. (See *section 4.3.1* to change the bending length)
Sample width	The test piece width.
Measuring speed	The rotation speed of the pneumatic clamp.
Parking position	The position that the pneumatic clamp will return to after a measurement.
Number of MD	The number of test pieces that will be measured for MD
Number of CD	The number of test pieces that will be measured for CD
Taber unit	The unit Taber will be measured in.

7.1.3 Measurement

Setting	Description
Values based on	
Max force	Max force during bending.
At selected angle(s)	Force at selected angle.
Angles to measure	
5.0°	If selected a measurement will be taken at 5.0°
7.5°	If selected a measurement will be taken at 7.5°
15°	If selected a measurement will be taken at 15°
Custom	If selected, a custom angle can be entered that will be measured.

7.1.4 Report

Select what should be included in the report on the display and the printed report. The bending angles need to be selected in the measurement menu to be a option in the report.

Display	
Individual	If selected, the property will be displayed in the single measurement view.
Statistics	If selected, the property will be displayed in the sample list view.
Print	
Individual	If selected, the property will be displayed as an individual measurement on the printed report.
Statistics	If selected, the statistics of the property will be displayed on the printed report

7.2 Create a new program

1. Log in as a yellow user. (See *section 8.2*)
2. Select a program from the list. The new program will be a copy of the one you select
3. Select the add button  to create a new program.
4. Enter a name for the program in the pop-up window that appears.
5. Update the settings for all tabs.
   See *section 7.1* for a full description of all settings.
6. Press save to save all changes.

7.3 Remove a program

1. Select the program that should be removed from the program list.
2. Press the remove button  to remove the program.

7.4 Modify a program

1. Select the program that should be modified from the program list.

NOTE
The standard programs can not be modified. They can only be updated if they should be visible in the program list or not.

2. Change the settings that needs to be changed.
3. Press the save button to save all changes.

8 System settings

8.1 User-rights management

There are three user levels, of which two are described in this manual. Depending on which level you are logged into, you can adjust different settings.

User level	User-rights	Color
User	Can make measurements, select pre-defined programs and perform Check	Blue
Supervisor	Can add and modify programs, display graph view and perform advanced Check	Yellow

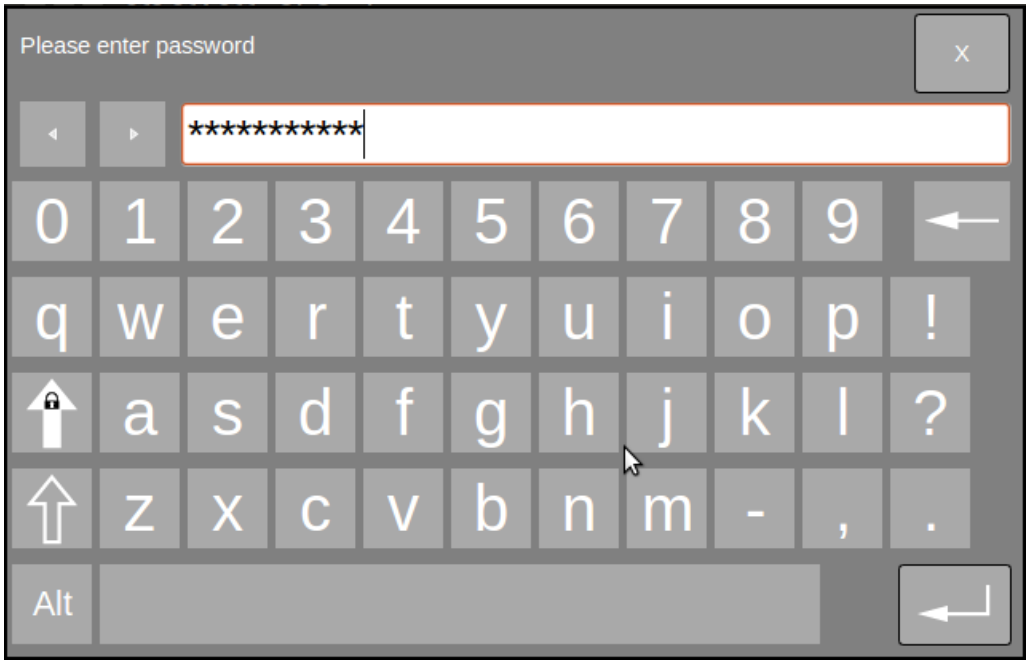
The current user level can be identified by the symbol color in the bottom menu.

8.2 Changing the user level

If you are on a yellow user level and want to log out, select the yellow user symbol  This is recommended after changes have been made.

To change the user level from blue to yellow:

1. Go to the Tools menu 
2. Select the blue user symbol 
   A keyboard is displayed:

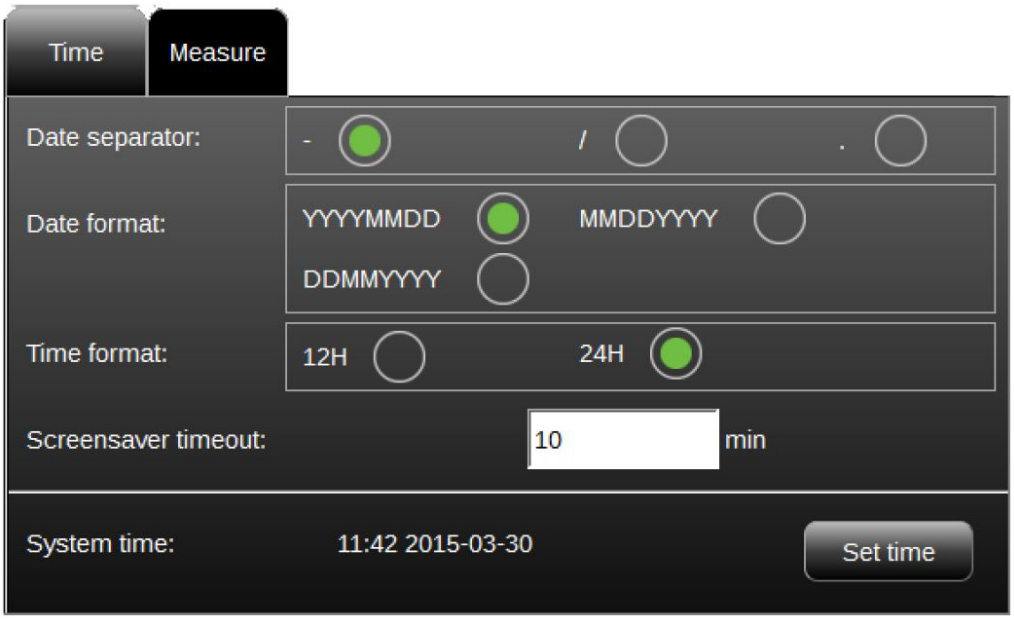


3. If you enter no password, you will get to the User level.
   The default password for the supervisor is **lwpasswd**

8.3 Changing the time settings

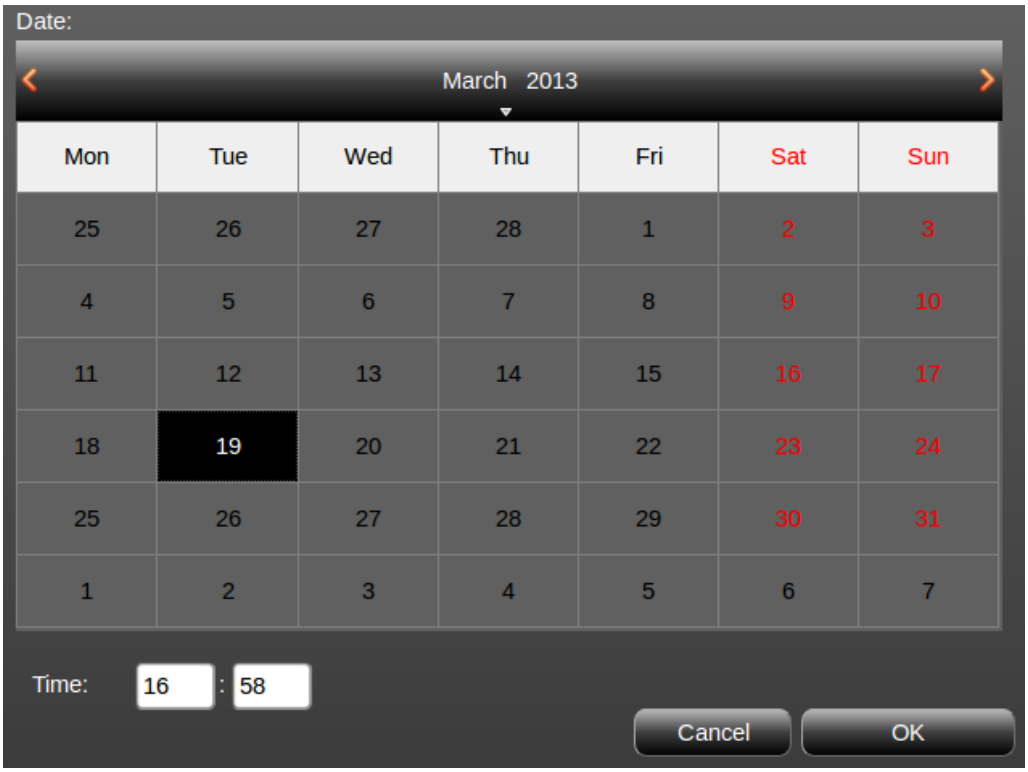
Select the settings symbol  and then the system settings symbol  to go to the system settings window.

1. Select **Settings > Time**.
   The time settings dialog is displayed:



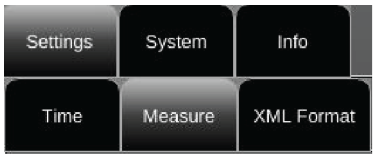
Date separator	Dash, slash, or dot
Date format	ISO, US, or European
Time format	12 or 24 h
Screensaver timeout	Set when screen saver is to start after inactivity
System time	Display system time in selected format
Set time	Open the time settings menu

2. Do the time settings.
3. Select **Set time**.
   The time settings menu is displayed:

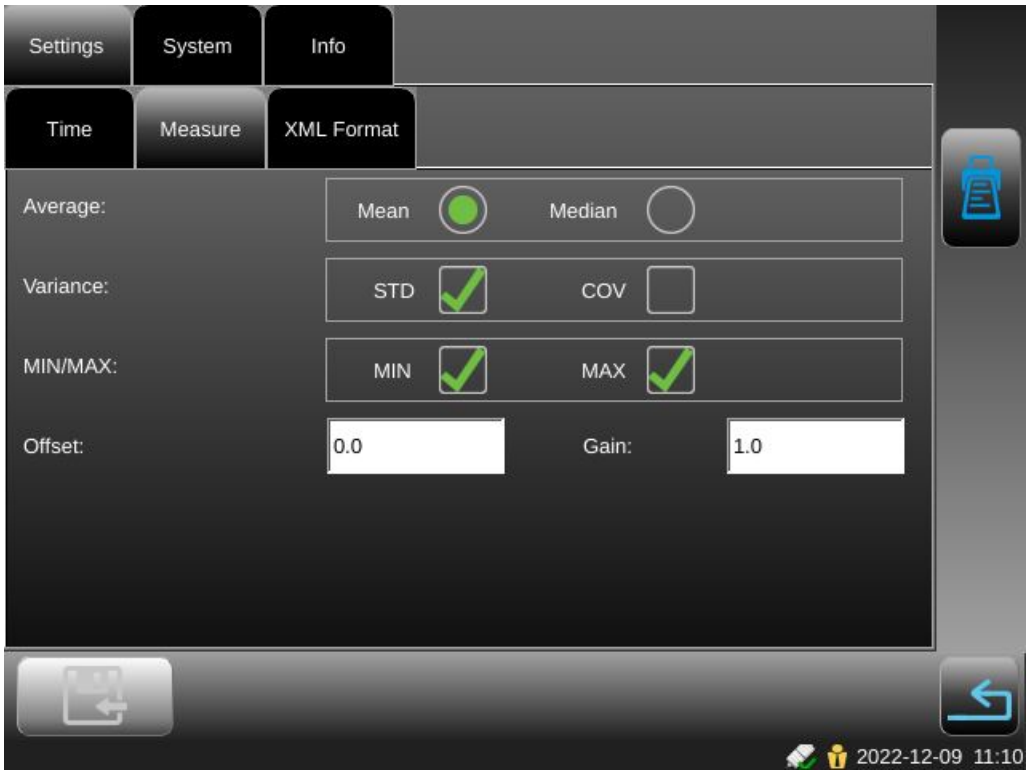


4. Enter date and time.
   The clock is backed up by an internal battery.

8.4 Changing the measurement settings



1. Select **Settings > Measure**.
   The measure settings dialog is displayed:

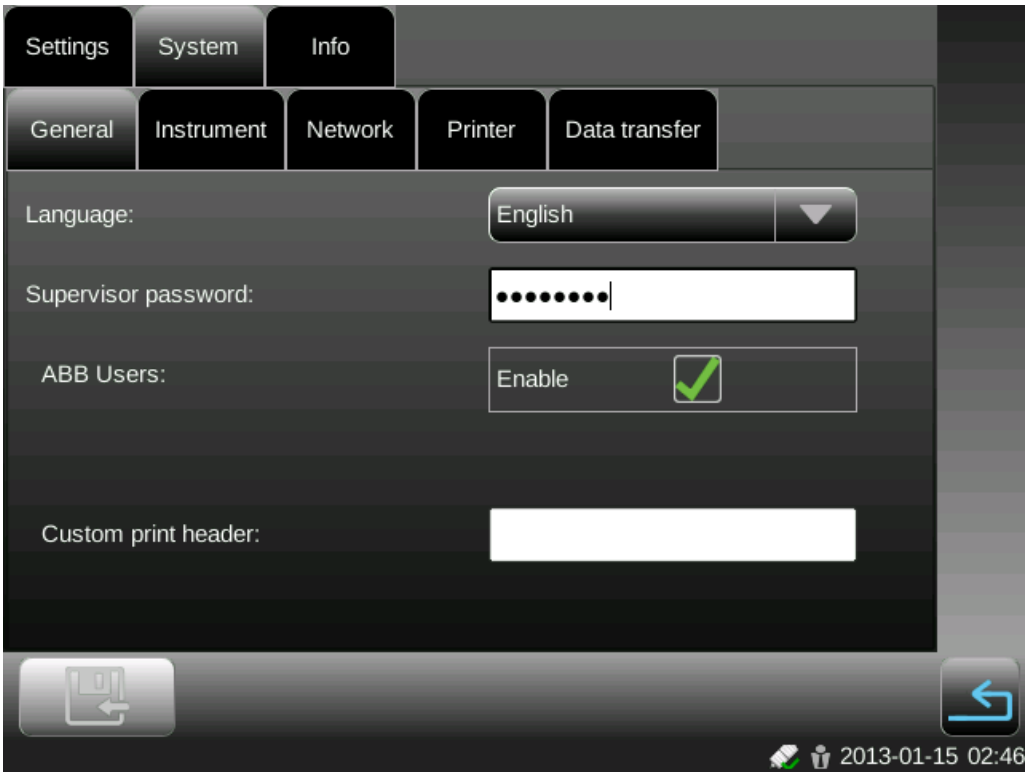


Average	Mean or median value
Variance	Standard deviation and/or coefficient of variation
MIN/MAX	Minimum and/or maximum values
Offset	Offset the measured values
Gain	Multiplies the measured value

2. Do the measurement settings.

8.5 Changing the general system settings

1. Select **System > General**.
   The general system settings dialog is displayed:



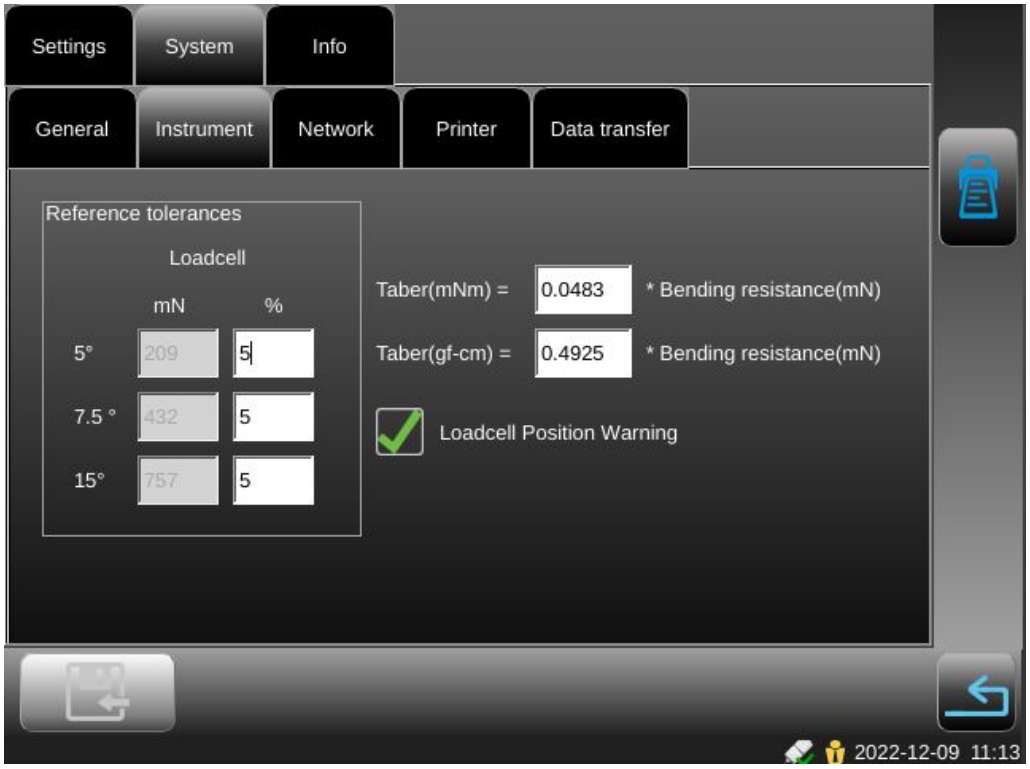
Supervisor password	Change the default password, which is **lwpasswd**
Language	Select language for the menus
Custom print header	Define text, for example, company or organization, to be printed on the reports

NOTE
If a selected language is not installed, the instrument defaults to English.

2. Do the general system settings.

8.6 Changing the instrument settings

1. Select **System > Instrument**.

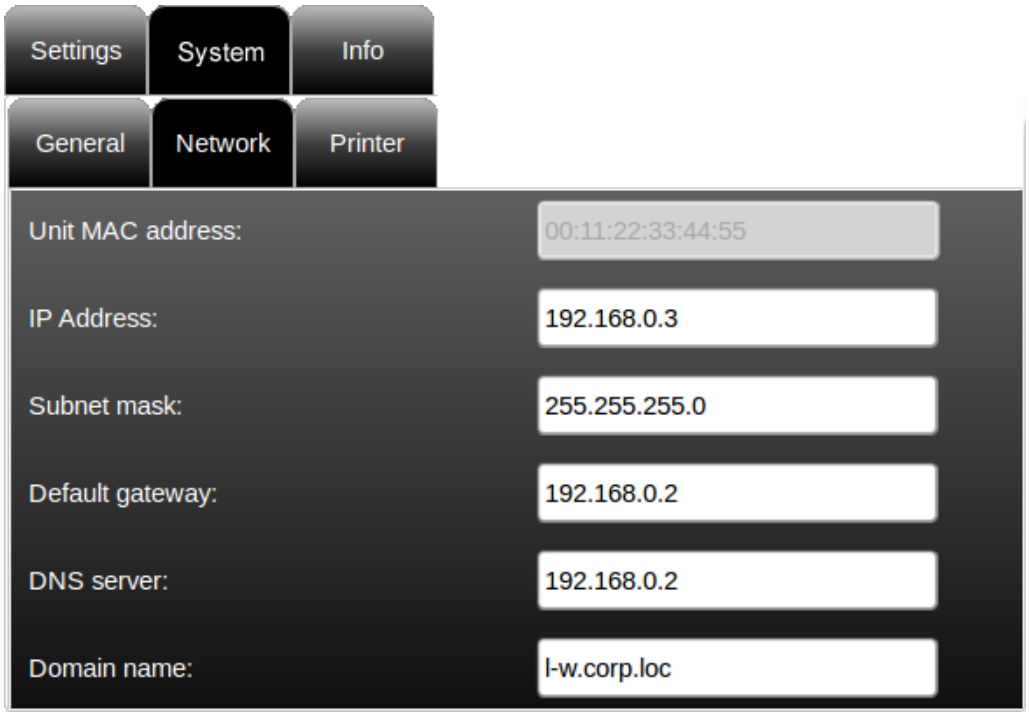


Reference tolerances	Check plate target values and allowed deviation
Taber (mNm)	Taber conversion factor for mNm
Taber (gf-cm)	Taber conversion factor for gf-cm
Loadcell Position Warning	Enable warnings for incorrect settings of load cell position compared to program

2. Do the instrument settings.

8.7 Changing the network settings

1. Select **System > Network**.
   The network settings dialog is displayed:



2. You can view the MAC address and the settings for your network. For settings, contact your network administrator.

To be able to send data over the network, the settings in **Data transfer** needs to be complete (see *section 8.9*).

8.8 Changing the printer settings

1. Select **System > Printer**.
   The printer settings dialog is displayed:

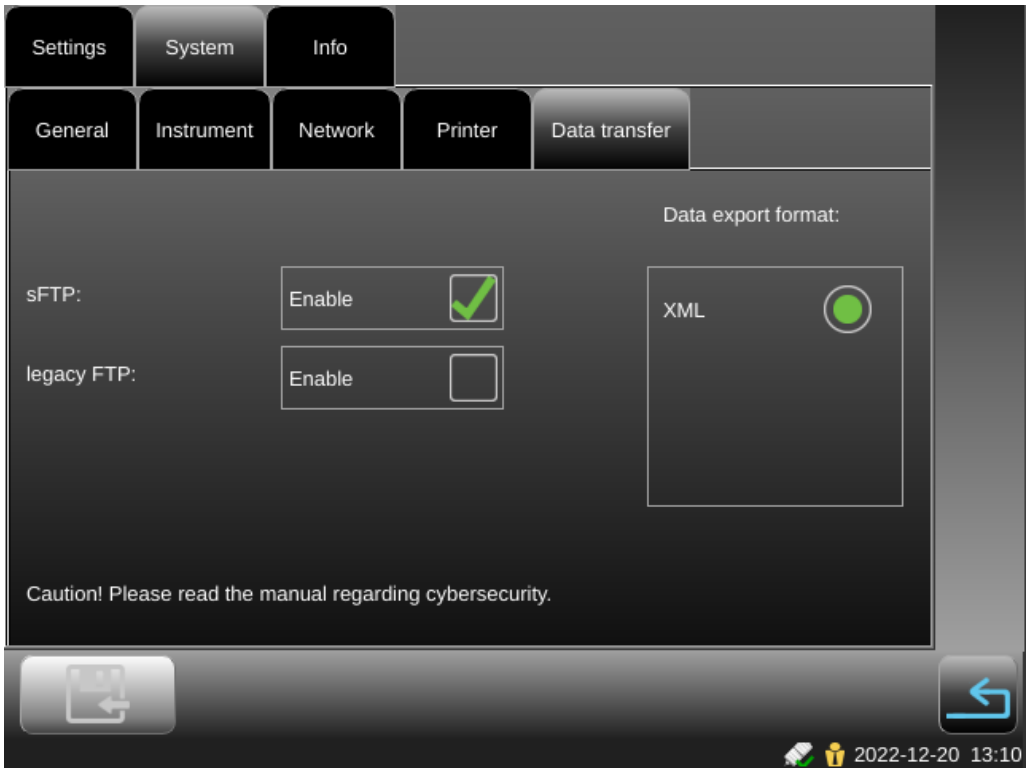
Select printer	None or Network printer
Printer name or printer IP address	Enter one of these (contact your network administrator)
TCP port	9100 is standard
Print format	Postscript or PDF for standard office network printers. POS/ESC setting is for Citizen external thermal printer.
Page size	A4 (297×210 mm) or Letter (8×11.5")

2. Do the printer settings.

NOTE
The network printer must be connected to the same network as the instrument and support postscript or PDF printing.

8.9 Changing the Data transfer settings

Select **System > Data transfer**.



At least one option of **sFTP** or **Lecacy FTP** needs to be selected to enable file transfer. **sFTP** supports most applications, but DAW requires **Legacy FTP**.

The network settings needs to be complete for data transfer to function (see *section 8.7*).

The default username for FTP is **lwuser**.

The default password for FTP is **lwapp**. The password can be changed with **User password** in the data transfer tab.

When connected to the instrument and logged in you can access the folder **Results** where **Sample.xml** and **Summary.xml** files can be found.

8.9.1 Cyber security

L&W products are designed and optimized for its purpose to meet quality, safety, and security performance according to ABB specifications. ABB recommend to not do any changes to the product, including but not limited to installing software not provided by ABB. In such case ABB shall not be liable for any claims that may arise of such action.

L&W products that are designed to be connected and to communicate information and data via a network interface, which should be connected to a secure network. It is your sole responsibility to provide and continuously ensure a secure connection between the product and your network or any other network (as the case may be) and to establish and maintain appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, installation of antivirus programs, etc.) to protect L&W products, the network, its system and interfaces against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information. ABB and its affiliates are not liable for damages and/or losses related to such security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information.

Although ABB provides cyber security assessment and robustness testing on the products and updates that we release, you should institute your own testing program for any product updates or other major system updates (to include but not limited to code changes, configuration file changes, third party software updates or patches, hardware change out, etc.) to ensure that the security measures that you have implemented have not been compromised and system functionality in your environment is as expected.

More information about ABB’s cyber security program and capabilities can be found at www.abb.com/cybersecurity.

9 Maintenance

9.1 Servicing

Always keep the instrument clean and free from dust, paper, etc., and use the built-in check function at regular intervals.

Clean the pneumatic clamp with alcohol and a lint free cloth. Contaminants on the clamp can affect the measurements.

Select the check button and then the lock button  to lock the touch screen for 15 seconds. This can be used to clean the touch screen.

9.2 Replacing the glass fuse

The glass fuse is located at the back of the instrument, see *section 2*.

The glass fuse is 5×20 mm, it must have a rated current of 5A and have a time-delay.

1. Disconnect the power.
2. Open the fuse holder by turning it counterclockwise with a screwdriver.
3. Replace the glass fuse.
4. Close the fuse holder by turning it clockwise with a screwdriver.
5. Connect the power.

10 Troubleshooting

Issue	Possible cause	Solution
Unit does not respond	Communication problem or software-related issue	To resolve most faults, remove the DC power connector and put it back again.
	Defective glass fuse	Replace glass fuse (see *section 9.2*.)
	Other	Contact a certified ABB service technician if the problem continues.
Incorrect measurement values	Contamination in the pneumatic clamp	Clean the clamp surfaces with alcohol and a lint free cloth. Make sure that there are no contaminants that can effect the measurements.
	Broken load-cell	Contact a certified ABB service technician.
Failed check with red values	Contamination in the pneumatic clamp	Clean the clamp surfaces with alcohol and a lint free cloth. Make sure that there are no contaminants that can effect the measurements.
	Broken load-cell	Contact a certified ABB service technician.
	Damaged check plate	Contact a certified ABB service technician.
	Contamination on the check plate	Clean the check plate with alcohol and a lint free cloth.

11 Technical specifications

L&W Bending Tester - Code 286	
Inclusive	Check plate
Recommended measurement range	1N: 10-1000mN 5N: 50-5000mN 10N: 100-10000mN
Bending angle	Standard measurement 5°, 7,5°, 15° and one custom angle
Bending length	1, 5, 10, 15, 20, 25 and 50mm
Bending velocity	Standard measurement 5°/s, adjustable
Test piece	Standard width 38mm, max thickness 3mm
Start functions	Auto touch Semi manual touch
Dimensions	0.3x0.4x0.3mm / 11x15x12 in (WxDxH)
Net weight	12 kg / 25 lb
IP Rating	IP 20
Measurement	
Method	L&W 2-point bending method
Results	Standard measurement values • Bending resistance at selected angles • Calculated bending stiffness at 5° and custom angle • Taber values Statistics • Mean value • Standard deviation • Coefficient of variation • Maximum and minimum approved values of the series
Connections	
Data	• Ethernet • The instrument acts as an FTP-server and test results can be retrieved by an FTP-client • Connectivity to L&W LMS and L&W Autoline DAW • Network printer via Ethernet
Installation requirements	
DC power	24 V DC
Rated power	30W
Instrument air	0.4-1.0 MPa (Classification 2-4-3 or better according to ISO 8573-1)
Air consumption	< 2 Nl/min
Options	• 4” Ethernet thermo-printer • Sample support 25mm width
Applicable standards	
Bending resistance	ISO 2493-1 TAPPI T 556
Bending stiffness	ISO 5628 DIN 53121

Waste Electronics and Electrical Equipment (WEEE)

This product is labelled with this symbol in accordance with European Directive 2012/19/EU, to indicate that it must not be disposed with your other household waste. Disposing of this product correctly will help save valuable resources and prevent any potential negative effects on human health and the environment, which could otherwise arise from inappropriate waste handling.

In the European Union
Please contact your local ABB representative who will inform you about the take-back of the product. Small products (and small amounts) might be taken back by your local collection facilities.

In countries outside the European Union
Please contact your local authorities and ask for the correct method of disposal.

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