LANGRY™

P16/25/40/50

OPERATING INSTRUCTIONS

Catalogue

1. Overview

1.1 Overview

The P16/25 multi-functional strength tester can be used to test the bonding strength of mortar, asphalt, tiles, coatings and protective layers, etc.

The P40 can be used to test the bonding strength of mortar, asphalt, tiles, coatings and protective layers, etc., and can also be used to test the compressive strength of building concrete, cement mortar strength and fiber cement mortar strength.

The P50 multi-functional strength tester can be used for technical quality control of integral and prefabricated reinforced concrete, and for inspecting building structures and constructions. According to the ГОСТ 22690 standard, it uses the peeling method to determine the strength of concrete; it can also be used for non-destructive testing to confirm the calibration characteristics of rebound and ultrasonic strength testers and for determining the bonding strength of bricks and stones in masonry, adhesives, anchor and fixing elements in building materials, and other adhesives in building applications. It can also be used to test the compressive strength of building concrete, cement mortar strength and fiber cement mortar strength.

The instrument is a small hydraulic force measuring device, consisting of a threading jack, hand pump, chassis and force measuring device, etc. The oil pump is loaded manually, and the rocker screw does not need to be reversed in advance. The driving torque is small, the shaking direction is comfortable and reasonable, and the loading is continuous and uniform. It is a single-chip microcomputer as the core intelligent data processor, with high program design compatibility, and can directly observe and save data. It has functions such as full digital display, peak retention, over-range indication, etc. The detection accuracy is high, the structural damage is small, the structure is novel, the volume is small, the operation is simple and convenient, and has broad application prospects, greatly improving the technical level of building quality inspection.

1.2 Functional characteristics

1. Integrated design, combining the hydraulic system and digital pressure gauge, with high stability and easy portability;
2. The entire machine is made of high-strength aluminum alloy, lightweight and aesthetically pleasing;
3. Built-in uninterrupted spiral oil pump pressure system, no need to unscrew the crankshaft screw before testing;
4. Peak retention function;
5. Loading speed indication, making the detection more in line with the specification requirements;
6. Use of high-quality high-resistance sensor, easy calibration, stable force value output, high precision, no temperature drift;
7. P16/25/40 supports data Bluetooth upload;
8. P50 supports force-time curve and load display on the same screen, fully recording the detection process data;

1.3 Technical Specifications

Instrument model	P16	P25	P40	P50
Hydraulic cylinder stroke	5mm		8mm	10mm
Working range (kN)	1.6 ~ 16kN	2.5 ~ 25kN	4 ~ 40kN	5 to 50 kN, with a maximum capacity of 60 kN
Resolution	0.001kN（0.01MPa）			
Calibration accuracy	EN ISO 7500-1 Class 1 (±1 %, from 20 % of maximum force)			
Data storage	4000 measurement points' data			1000 pieces of component data

Operating environment	Environmental temperature: -10 to 40℃, Atmospheric pressure: 84 to 106.7 KPa			
Power supply method	2 "AAA" dry batteries			Lithium battery: 3180mAh / 3.6V / 11.44Wh
Overall dimensions (mm)	180×180×155mm		190×190×160mm	265×190×160mm
Host weight (kg)	3.8kg		4.3kg	4.5kg
application place	1. Bonding strength of mortar and plastering compound; 2. Bonding strength of asphalt; 3. Bonding strength of tiles; 4. Bonding strength of coatings and protective layers; 5. Bonding strength of repair materials such as fiberglass reinforced plastic; 6. Tensile strength in concrete repair;	1. Bonding strength of coatings and protective layers; 2. Bonding strength of composite materials such as fiberglass reinforced plastics; 3. Tensile strength in concrete repair; 4. Combined pull-off method; 5. Application of coatings on composite materials;	1. Bonding strength of coatings and protective layers; 2. Bonding strength of composite materials such as fiberglass reinforced plastic; 3. Tensile strength in concrete repair; 4. Testing of compressive strength of concrete, strength of cement mortar, and strength of fiber cement mortar;	1. Bonding strength of coatings and protective layers; 2. Bonding strength of composite materials such as fiberglass reinforced plastic; 3. Tensile strength in concrete repair; 4. Testing of compressive strength of concrete, strength of cement mortar, and strength of fiber cement mortar; 5. Determination of concrete strength by chipping method;

1.4 According to the standard

standard number	standard name	Test block size	rate of loading	test time
JGJ/T 110	Test Standards for Bonding Strength of Building Decoration Tiles	/	/	/
JGJ 126	Construction and Acceptance Regulations for Exterior Decoration Tiles	95×45×8mm 40×40×8mm	/	/
JGJ 144	Technical Standards for External Thermal Insulation of Walls	100×100×8mm	/	/
EN 1542	Products and Systems for the Protection and Repair of Concrete Structures—Test	Φ50mm	0.05 ± 0.01 MPa/s	< 90s

	Methods—Measurement of Bond Strength by Pull-off			
EN 1015-12	Methods of Test for Mortar for Masonry-Part 12：Determination of Adhesive Strength of Hardened Rendering and Plastering Mortars on Substrates	Φ50mm	0.03-0.1 MPa/s	20-60s
EN 1348	Adhesives for Tiles-Determination of Tensile Adhesion Strength for Cementitious Adhesives	Φ50mm	250±50 N/s	/
ISO 4624	Paints and Varnishes—Pull-off Test for Adhesion	Φ20mm	＜1 MPa/s	＜90s
BS 1881	Part 207 Recommendations for the Assessment of Concrete Strength by Near-to-surface Tests	Φ50mm	0.05 ± 0.03 MPa/s	/
ASTM D4541	Standard Test Method for Pull-off Strength of Coatings Using Portable Adhesion Testers	/	＜1 MPa/s	＜100s
ASTM C1583	Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension（Pull-off Method）	钢制Φ50mm	5±2 psi/s 0.035±0.015 MPa/s	/
ASTM D7234-05	Standard Test Method for Pull-off Adhesion Strength of Coatings on Concrete Using Portable Pull-off Adhesion Testers	Φ20mm Φ50mm Φ75mm	＜ 0.2MPa/s，30psi/s	5s至30s
ASTM D7522	Standard Test Method for Pull-off Strength for FRP Laminate Systems Bonded to Concrete or Masonry Substrates	Φ50mm Φ75mm Φ100mm	＜1 MPa/min ＜150 psi/min	/
ZTV-ING	The Federal Minister for Transport. Additional technical contract conditions and guidelines for engineering buildings and the repair of concrete components	Φ50mm	对于混凝土：100 N/s 对于弹性表面：300 N/s	/
SIA 281/3	Bitumen sheeting pull-off testing	Φ50mm	300±15 N/s	/
P40/P50 also refers to the following regulations				
JGJ/T 208	Post-bonding method for testing the compressive strength of concrete technical specification	/	/	/
CECS 69	Post-bonding method for testing the compressive strength of concrete technical specification	/	/	/
CECS 389	Pull-out method for testing the strength of cement mortar and fiber cement mortar	/	/	/

	technical specification			
The P50 also refers to the following procedures				
ГОСТ12.2.007.0-75	Изделия электротехнические. Об-щие требования безопасности	/	/	/
ГОСТ 14192-96	Маркировка грузов	/	/	/
ГОСТ 15150-69	Машины, приборы и другие техниче-ские изделия. Исполнения для различных климатических районов. Категории, условия эксплуатации, хранения и транспортирования в части воздействия климатических факторов внешней среды	/	/	/
ГОСТ 22690-2015	Бетоны. Определение прочности механическими методами неразрушающего контроля	/	/	/
ГОСТ 31914-2012	Бетоны высокопрочные тяжелые и мелкозернистые для монолитных конструкций. Правила контроля и оценки качества	/	/	/
ГОСТ Р52931-2008	Приборы контроля и регулирова-ния технологических процессов. Общие технические условия	/	/	/
МС 300.6-97	Рекомендации. Прочность бетона в кон-струкциях и изделиях. Методика выполнения натурных испытаний методом отрыва со скалыванием по ГОСТ 22690. (НИИЖБ, ВНИИФТРИ)	/	/	/
ГОСТ 10180-2012	Бетоны. Методы определения прочности по контрольным образцам	/	/	/
ГОСТ 18105-2018	Бетоны. Правила контроля и оценки прочности	/	/	/
ГОСТ 21243-75	Бетоны. Определение прочности методом отрыва со скалыванием	/	/	/
ГОСТ 26633-2015	Бетоны тяжелые и мелкозернистые. Технические условия	/	/	/
ГОСТ 28570-2019	Бетоны. Методы определения прочности по образцам, отобранным из конструкции	/	/	/

1.5 Matters need attention

1. Please read this manual carefully before using the instrument.
2. Working environment requirements: Ambient temperature: -10 to 40℃; Relative humidity:

<90%RH; There should be no strong alternating electromagnetic fields and it should not be exposed to sunlight for a long time; When used in a humid, dusty, or corrosive gas environment, necessary protective measures should be taken.
3. Storage environment requirements: Ambient temperature: -20 to 60℃; Relative humidity: <90%RH; If the instrument is not used for a long time, it should be regularly powered on for inspection and charging. The instrument should be placed in a ventilated, cool, and dry place and should not be exposed to direct sunlight for a long time.
4. Avoid water ingress; Do not use in a strong magnetic field environment, such as large electromagnets, transformers, frequency converters, etc.
5. Shockproof: During use and transportation, avoid violent vibration and impact.
6. After the test, the instrument should be reset to the initial state; Clean up the residual concrete powder during the test in time and store it in a dry and ventilated environment to prevent dust from entering the instrument or the internal connectors, which may lead to performance degradation or damage. Do not wipe the instrument and its accessories with a damp cloth! Do not wipe the instrument and its accessories with organic solvents! Please wipe the instrument and its accessories with a clean and soft dust-free cloth.
7. Regularly replace the hydraulic oil to prevent physical and chemical changes of the hydraulic oil and the reduction of various performance indicators during long-term use and storage; When replacing the hydraulic oil, check the performance of the sealing ring at the same time. Replace it in time if its performance deteriorates.
8. Charging management:
When the battery level is low on P16/25, you can unscrew the instrument through the indication method on the instrument cover and replace the battery in the battery compartment. Use 2 "AAA" dry batteries.
P50 uses rechargeable lithium batteries for power supply. When the battery level is low, it is necessary to charge in time to avoid damaging the battery. The red indicator light will be constantly on during charging, and the charging indicator light will go off after being fully charged. The charger should be used with the dedicated charger provided with the instrument. Do not use other model adapters or chargers to charge this instrument. Otherwise, it may cause damage to the battery.
Note:
Do not charge in high-temperature environments. The recommended charging temperature range is 10 to 35°C. If the instrument is not used for a long time, there will be a slight battery power loss, resulting in a decrease in power. Before using it again, recharge it. During the charging process, the charger will heat up as a normal phenomenon. Keep the charging environment well-ventilated to facilitate heat dissipation.

1.6 Duty

This instrument is a precision testing device. In case the user engages in the following behaviors, our company will not be held responsible for the consequences:
1. Violating the above requirements for working environment or storage environment;
2. Operating the instrument improperly;
3. Opening the casing without permission and disassembling any components;
4. Causing severe damage to the instrument due to human error or accident.

2. Instruments and Accessories Composition

2.1 Composition of the Main Body

2.1.1 Composition of the P16/25/40 main structure

Figure 2-1 Schematic Diagram of Instrument Composition on Page 16/25

1-Three-point support legs 2- Digital pressure gauge 3- Pull rod joint 4- Pull rod
5- Hand crank 6- Finger nut 7- Main unit of multi-functional strength tester 8- Oil injection hole

2.1.2 Composition of the P50 main structure

Figure 2-2 Schematic Diagram of P50 Instrument Composition

1- Three-point support legs 2- Digital pressure gauge 3- Pull rod 4- Hand crank
5- Finger nut 6- Main unit of multi-functional strength detector 7- Oil injection hole

2.2 Attachment composition

2.2.1 Testing disc method accessory (standard for P16/25/40, optional for P50)

Figure 2-3

1 - Multi-functional standard block pull-through screw
2 - Multi-functional circular pull-through standard block (ϕ50mm/M8, aluminum)
3 - Pull rod connector

2.2.2 Post-installation extraction accessory (optional for P40/50 models)

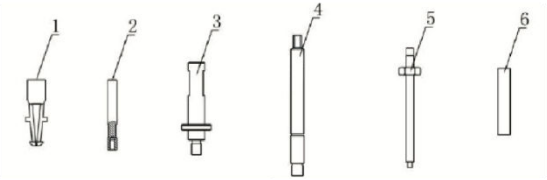

Figure 2-4 Schematic Diagram of the Post-Installation Pull-Out Anchor Assembly
1 - Expansion Spring 2 - Expansion Rod 3 - Punch
4 - Pull Rod 5 - Retracting Rod and Nut 6 - Retracting Sleeve

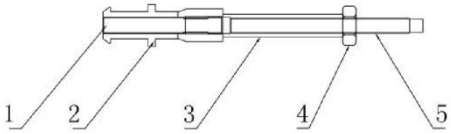

Figure 2-5 Structural schematic diagram of the disassembly of the expansion rod
1 - Expansion rod 2 - Expansion spring 3 - Retracting sleeve 4 - Nut 5 - Retracting rod

2.2.3 Post-installed anchor accessories (optional P40/50)

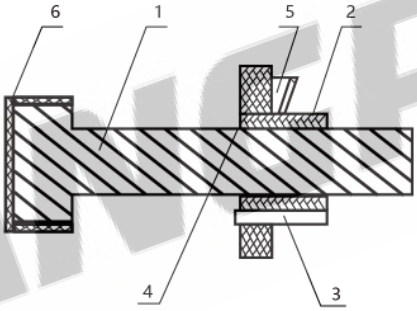

Figure 2-6 Assembly schematic diagram of the injection positioning disc and plastic cap
1 - Anchoring component 2 - Positioning disc 3 - Disc injection hole
4 - Disc exhaust hole 5 - Pressure holding funnel 6 - Rubber sleeve

2.2.4 Russian Anchor Strap Attachment (optional, applicable only to P50)

Figure 2-7 Anchors
1 - ϕ16×35mm anchor bolt 2 - ϕ24×48mm anchor bolt

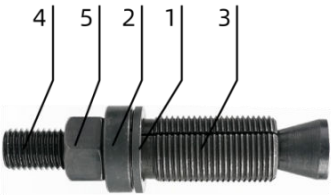

Figure 2-8 Schematic Diagram of Anchor Bolt Structure
1 - Gasket 2 - Upper Cover 3 - Expansion Ring 4 - Central Rod 5 - Tightening Nut

3. Working Principle

3.1 working principle

3.1.1 Testing disc method

Attach test blocks to the concrete surface, use a suitable core drill bit to penetrate the shell and reach the concrete base. After the adhesive cures, conduct a pull-out test to measure the bonding strength of mortar, asphalt, tiles, coatings and protective layers, etc.

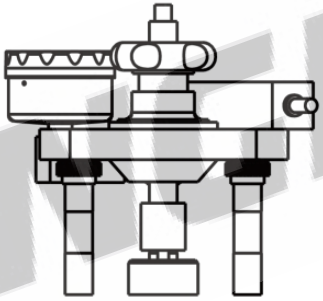

Figure 3-1 Schematic Diagram of Working State of the Test Disk Method

3.1.2 Post-insertion extraction method (applicable to P40/50)

Drill holes, grind grooves on the hardened concrete surface, embed anchoring elements and install an extraction instrument for the extraction test. Determine the ultimate extraction force and, based on the pre-established correlation between the ultimate extraction force and the compressive strength of the concrete, determine the method for testing the compressive strength of the concrete.

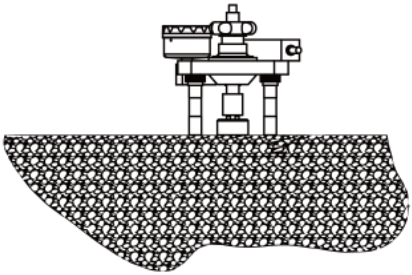

Figure 3-2 Schematic Diagram of Working State of Post-Installation Pull-Out Method

3.1.3 Post-installed anchoring method (applicable to P40/50)

Drilling holes in hardened concrete and inserting anchoring elements with high-strength adhesives. After the adhesives have cured, conducting an extraction test and determining the concrete strength based on the extraction force.

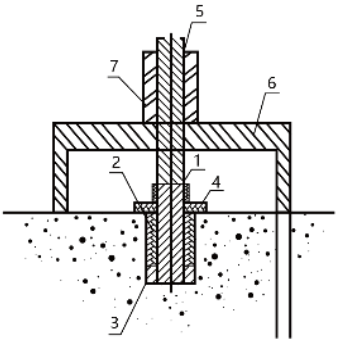

Figure 3-3 Schematic Diagram of Post-anchorage Pull-out Structure

1 - Anchoring Component 2 - Anchoring Adhesive

3 - Rubber Sleeve 4 - Positioning Disk

5 - Pull Rod 6 - Reaction Support Ring

7 - Multi-functional Strength Testing Instrument Main Unit

3.1.4 Russian anchor method (applicable only to P50)

Measure and generate the force required to pull the anchor bolt out of the concrete body. The anchor bolt is installed in a pre-prepared hole or in the concrete poured during the structural manufacturing process. Then, the anchor bolt is connected to the instrument via a pull rod, and the hydraulic system is used to pull it out of the concrete body. During the instrument's loading process, the force on the anchor bolt increases to an extreme value. At this point, the concrete at this location will be torn apart. After that, the anchoring force will drop to zero. The electronic unit will automatically monitor the loading process and record the ultimate fracture point of the concrete.

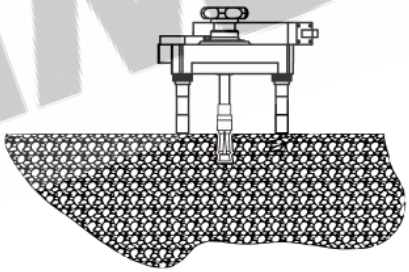

Figure 3-4 Schematic diagram of the anchor pull-out structure in Russia

4. Operation Instructions for Digital Pressure Gauge

Operation Instructions for P16/25/40 Digital Pressure Gauge

4.1 Key Instructions

Press the button	function declaration
Up/Peak Key	Short press: In the detection interface, short press to switch units; When adjusting parameters, short press to increase the value; In the line correction interface, short press to return to the previous calibration segment; In other interfaces, short press to execute the upward command; Long press: In the detection interface, long press to turn on or off the peak; When adjusting parameters, long press can quickly increase the value; In the data viewing interface and data detail viewing interface, long press the cursor to quickly move upward.
Down/Reset Key	Short press: In the detection interface, short press to switch units; When adjusting parameters, short press to decrease the value; In the line correction interface, short press to skip this calibration segment; In other interfaces, short press to execute the downward command; Long press: In the detection interface, long press to clear the current detection data; When adjusting parameters, long press can quickly decrease the value; In the data viewing interface and data detail view interface, long press the cursor to quickly move downward.
Storage/Setting key	Short press: In the detection interface, short press to save the maximum value during the detection; On other interfaces, short press to execute the "Confirm" command; Long press: In the detection interface, long press to enter the instrument settings interface; When viewing the data, long press to enter the data deletion interface;
Right/Query key	Short press: On other interfaces, short press to execute the "rightward" command; Long press: In the detection interface, long press to enter the data viewing interface;
C/Power key	Short press: In the detection interface, short press to enter the interface for this device; On other interfaces, short press to execute the return command; Long press: In any state, long press to execute the power on/off operation;

4.2 Instrument Operation Instructions

4.2.1 Detection interface

After pressing the [C/switch] key for a long time, the device will enter the detection interface, as shown in Figure 4-1. The detection interface is divided from top to bottom as follows: serial number, loading rate, peak value (the peak value will only be displayed after pressing the [Up/Peak] key), Bluetooth icon, battery power, current detection value, and unit.

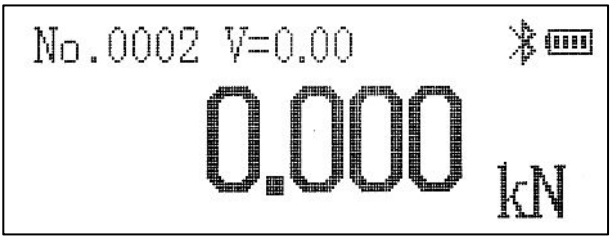

Figure 4-1 Detection Interface

If no load is applied at this time and the displayed value on the instrument is not zero, you can first long-press the [Down/Reset] key to clear the displayed value of the instrument. Then start applying the load. After long-pressing the [Up/Peak] key, the maximum value will be displayed in real time.

After the test is completed, short-press the [Storage/Settings] key to save the data and enter the parameter viewing interface, as shown in Figure 4-2. The parameter viewing interface is arranged from top to bottom as follows: serial number, storage number, date and time, peak value, test duration, average loading rate, specimen size, and specimen area.

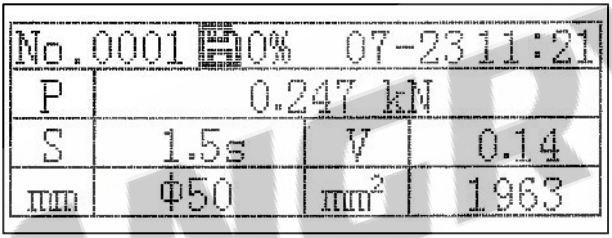

Figure 4-2 Parameter View Interface

In the parameter viewing interface, the parameters can only be viewed and cannot be modified in this interface.

By short-pressing the [Right/Query] key in the parameter viewing interface, you can enter the failure mode report interface, as shown in Figure 4-3. Users can flexibly record failure modes according to different standard requirements.

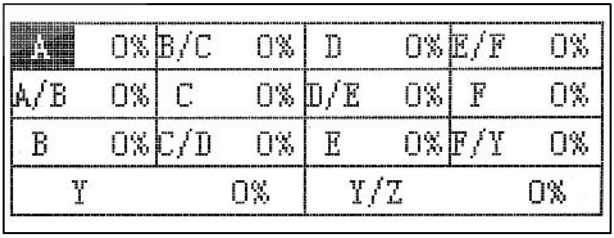

Figure 4-3 Failure Mode Report Interface

On the failure mode report interface, short press the [Up/Peak] key, [Down/Clear] key, [Right/Query] key to select the corresponding fracture point. Short press the [Store/Settings] key to record the percentage of the selected fracture surface in the layer where it is located.

Note: If you do not want to record the failure mode, you can short press the [C/Switch] key on the parameter setting interface to return to the detection interface for the next test.

4.2.2 Instrument Setup Interface

On the detection interface, long press the 【Storage/Settings】 key to enter the instrument settings interface, as shown in Figure 4-4. The instrument settings interface from top to bottom includes: specimen size, brightness, password, and language.

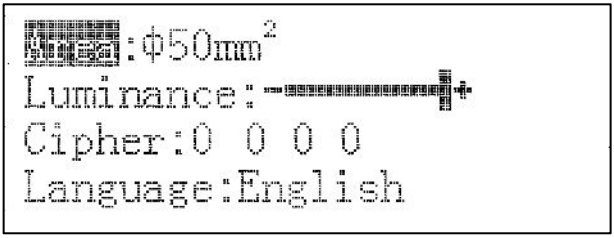

Figure 4-4 Instrument Settings Interface

Short press the [Up/Peak] key or the [Down/Clear] key to move the cursor up or down, and select the parameters that need to be modified. Short press the [Store/Setup] key to adjust the parameters.

4.2.3 Data viewing interface

On the detection interface, long press the "Right/Query" key to enter the data viewing interface, as shown in Figure 4-5. The data viewing interface has the following columns from top to bottom: serial number, data, and detection date.

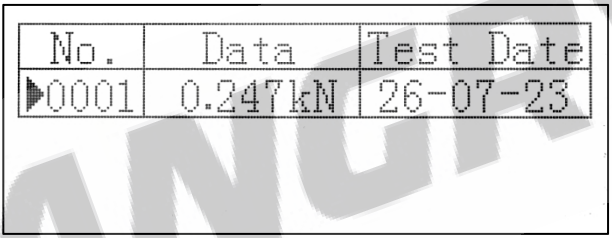

Figure 4-5 Data Viewing Interface

By briefly pressing the [Storage/Settings] key on the data viewing interface, you can enter the detailed data viewing interface, as shown in Figure 4-6. The detailed data viewing interface is arranged from top to bottom as follows: serial number, storage quantity, date and time, peak value, test duration, average loading rate, specimen size, and specimen area.

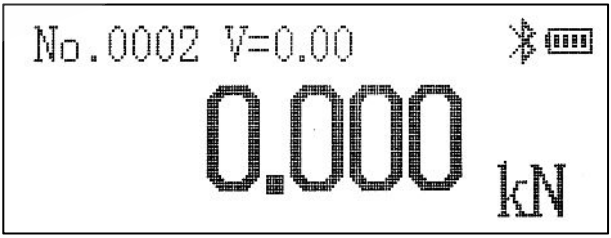

Figure 4-6 Detailed Data Query Interface

By briefly pressing the "Right/Query" key on the data detail inspection interface, you can enter the failure mode report interface, as shown in Figure 4-3 above.

4.2.4 Data Deletion Interface

Long press the "Storage/Settings" key on the data viewing interface to enter the data deletion interface, as shown in Figure 4-7.

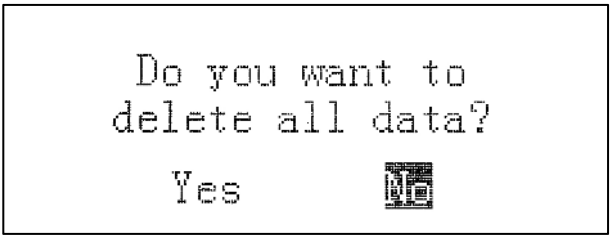

Figure 4-7 Data Deletion Interface

Short press the [Up/Peak] key or the [Down/Clear] key to move the cursor. Select "Yes" or "No", then short press the [Store/Settings] key to confirm.

Note: Before deleting the data, please confirm whether it has been uploaded to the PC. Once the data is deleted, it cannot be recovered.

4.2.5 Factory data reset

In the instrument settings interface, briefly press the [Up/Peak] key or the [Down/Clear] key to move the cursor and select "Password". Briefly press the [Store/Settings] key to enter the output password state. Briefly press the [Up/Peak], [Down/Clear], [Right/Query] keys to input the password 9098. Briefly press the [Store/Settings] key to enter the factory reset interface, as shown in Figure 4-8.

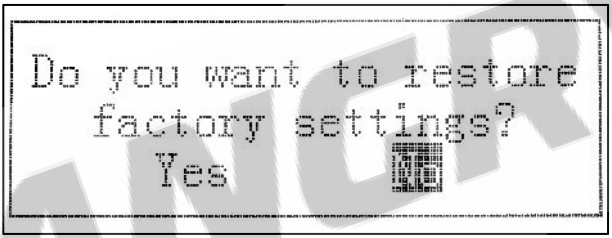

Figure 4-8 Factory Reset Interface

Short press the [Up/Peak] key or the [Down/Clear] key to move the cursor. Select "Yes" or "No", then short press the [Store/Settings] key to confirm. After confirming the factory reset, the instrument will automatically restart in 2 seconds.

4.2.6 Regarding this machine

On the detection interface, briefly press the [C/Switch] key to enter the interface for this device, as shown in Figure 4-9. The interface for this device includes the product model, name, firmware version, instrument number, company website, and email.

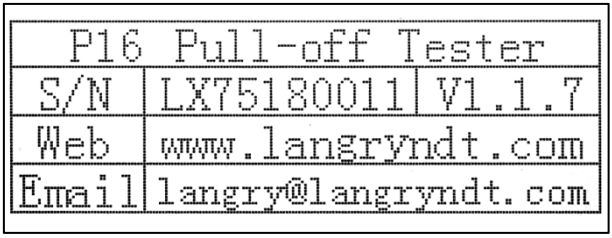

Figure 4-9 About the Local Interface

4.3 Operating Precautions for the Instrument

1. The header of the instrument can be rotated. By turning it to a certain angle, the LCD direction can be adjusted, making it convenient for users to observe the measurement values during use.

2. Press the [Storage/Setting key] briefly to save the pressure value. The serial number displayed at the top left of the screen will automatically increase by 1. If it shows 4001, it means that 4000 pieces of data have been saved (full), and no more test saves can be performed.
3. Data cannot be restored after deletion. Please confirm whether the data has been uploaded to the PC end and operate carefully.
4. When encountering problems during use, the instrument can be restored to the factory settings.
5. The instrument uses two "AAA" batteries. When replacing the batteries, rotate the header counterclockwise to open the case and then replace the batteries.
6. The instrument must be used within the working range; otherwise, it will affect the detection accuracy or cause permanent damage.

Operation Instructions for P50 Digital Pressure Gauge

4.4 button instruction

Press the button	function declaration
Up key	When adjusting parameters - short press to increase the value; In the line correction interface - short press to return to the previous calibration segment; In the other interfaces - short press to execute the upward command; In the detection interface - short press to switch the unit;
Down key	When adjusting the parameters - short press to decrease the value; In the line correction interface - short press to skip this calibration section; In the other interfaces - short press to execute the downward command; In the detection interface - short press to reset the current detection data;
Right key	On the other interfaces - short press to execute the "go right" command; On the detection interface - short press to reset the displacement value;
Left button	On the other interface - short press to execute the left command;
OK button	On the detection interface - Press briefly to save the maximum value during the detection; On other interfaces - Press briefly to execute the confirmation command; On the data viewing or detailed data inspection interface - Press briefly to switch the display of multiple test areas of the current component or the results of the entire component.
C/Power button	On other interfaces - short press to execute the return command; In any state - long press to execute the power on/off operation;

4.5 Instrument Operation Instructions

4.5.1 Main menu interface

After pressing the [C/switch] key for a long time, the main menu interface will be displayed, as shown in Figure 4-10. The status bar at the top of the main menu interface shows: battery power, Bluetooth, and time. The main menu interface includes: start detection, mode, specification, parameters, data management, and services.

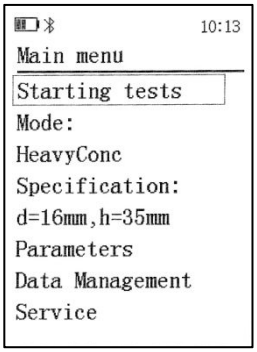

Figure 4-10 Main Menu Interface

4.5.2 Detection interface

Short press the [Up] or [Down] key on the main menu interface to select "Start Test", then short press the [OK] key to enter the test interface, as shown in Figure 4-11. The status bar at the top of the test interface displays: battery power, Bluetooth, and time. The test interface includes: component number, current measurement point / total number of measurement points, loading rate, peak strength, force value, displacement value (the upper part shows the displacement value from the appearance of the force value to the end, and the lower part shows the real-time displacement value of the piston), and the time - force value curve.

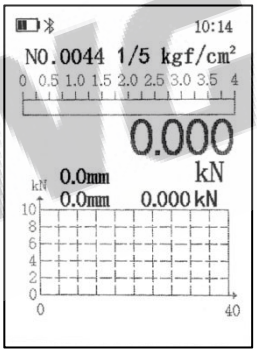

Figure 4-11 Detection Interface

Short pressing the [C/Switch] key will return to the main menu interface. Before exiting, a prompt box will pop up to ask the user if they want to "exit the detection". Short pressing the [OK] key will save the detected data and exit the detection. Short pressing the [C/Switch] key will return to the detection interface.

In the detection interface, short pressing the [OK] key will save the current measurement point data and proceed to the next measurement point's detection; short pressing the [Down] key will clear the current detection data; short pressing the [Up] key will switch the unit.

After completing the last measurement point of the current component in the detection interface, short pressing the [OK] key will save the data and then enter the data viewing interface of the current detected component, as shown in Figure 4-12. The status bar at the top of the data viewing interface shows: component number, the parameters set in the main menu interface, the standard value of the compressive strength of the concrete cube, date and time, and the average concrete strength value.

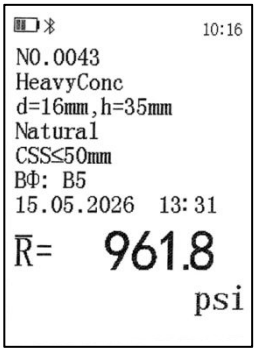

Figure 4-12 Data View Interface

By short-pressing the [OK] key in the data viewing interface, you will enter the detailed data viewing interface, as shown in Figure 4-13. The status bar at the top of the detailed data viewing interface includes: battery power, Bluetooth, and time. The detailed data viewing interface contains: component number, current measurement point / total number of measurement points, standard value of concrete cube compressive strength, date and time, peak strength, force value, displacement value (the displacement value from the appearance of the force value to the end), and time-force value curve.

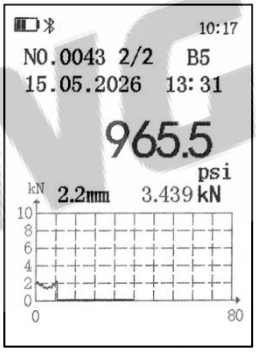

Figure 4-13 Detailed Data Query Interface

4.5.3 Mode Settings

Short press the [Up] or [Down] key on the main menu interface to select "Mode", then short press the [OK] key to enter the mode settings. In the mode settings state, short press the [Up] or [Down] key to select the desired mode, short press the [OK] key to complete the selection and exit the mode settings state.

4.5.4 Specification settings

On the main menu interface, press the [Up] or [Down] key briefly to select "Specification Settings", then press the [OK] key to enter the specification settings. In the specification setting state, press the [Up] or [Down] key to select the used specification, and press the [OK] key to complete the selection and exit the specification setting state.

When the mode is set to light or heavy concrete or custom, it is for setting the anchor specification. There are two types of anchors available: one with a diameter of 16mm and a working depth of 35mm, and the other with a diameter of 24mm and a working depth of 48mm.

When the mode is set to "Light General", it is for setting the test block specifications. The options available are ϕ20, ϕ50, ϕ75, ϕ100, 40×40mm², 50×50mm², 95×45mm², 100×100mm², and "Custom".

4.5.5 Parameter Setting Interface

On the main menu interface, press the [Up] or [Down] key briefly to select "Parameters", then press the [OK] key to enter the parameter interface, as shown in Figure 4-14. The status bar at the top of the parameter interface displays: battery power, Bluetooth, and time. The parameter interface includes: hardening type, filler, custom coefficient, number of times, and reset.

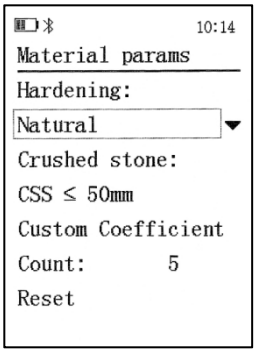

Figure 4-14 Parameter Interface

4.5.5.1 Hardening type setting

On the material parameters interface, press the [Up] or [Down] key briefly to select "Hardening Type", then press the [OK] key to enter the hardening type setting. In the hardening type setting state, press the [Up] or [Down] key briefly to select the hardening type of the concrete, and press the [OK] key to complete the selection and exit the hardening type setting state.

There are two types of hardening: natural hardening and heat treatment hardening. Please note: On April 2016, the new ГОСТ 22690 came into effect. Unlike the 1988 version, the new ГОСТ 22690 does not mention the m_2 coefficient related to concrete heat treatment. Therefore, from a formal perspective, heat treatment hardening cannot currently be used for strength tests. This hardening type currently only has a reference nature.

4.5.5.2 Filling material setting

On the material parameters interface, briefly press the [Up] or [Down] key to select "Fill Material", then briefly press the [OK] key to enter the fill material settings. In the fill material setting state, briefly press the [Up] or [Down] key to select the fill material specification, and briefly press the [OK] key to complete the selection and exit the fill material setting state.

4.5.5.3 Custom coefficient interface

On the material parameter interface, press the [Up] or [Down] key briefly to select "Custom Coefficient", then press the [OK] key to enter the custom coefficient interface. The status bar at the top of the custom coefficient interface shows: battery power, Bluetooth, and time. The custom coefficient interface for different modes is also different.

When the mode is light or heavy concrete: As shown in Figure 4-15, the custom coefficient interface has: A_0, A_1, A_2, m_2, m_3. The coefficients of A_0, A_1, and A_2 cannot be changed.

You can view and modify the values of m2 and m3 according to "3.2 Strength Calculation" chapter "Table 1"

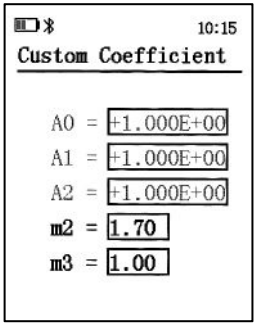

Figure 4-15 Interface when the mode is light or heavy concrete

When the mode is set to custom: As shown in Figure 4-16, the custom coefficient interface includes: A0, A1, A2, m2, m3, and "Delete". You can set each calibration coefficient according to the "3.2 Strength Calculation" section and view the values of m2 and m3 according to "Table 1".

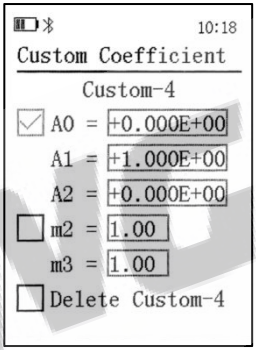

Figure 4-16 Interface when the mode is set to custom

In:

$A_j=K\cdot10^n$;

E=10;

n is the exponent;

When the mode is set to general: As shown in Figure 4-17, the custom coefficient interface includes: A0, A1, A2, m2, and m3, all of which cannot be modified.

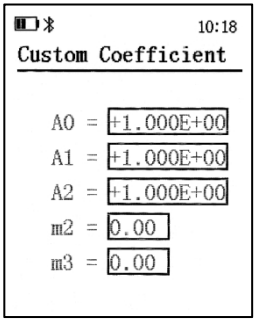

Figure 4-17 The interface is in the universal mode

Short press the [Up] or [Down] key to select the coefficient that needs to be modified. Short press the [OK] key to enter the coefficient setting state. Short press the [Left] or [Right] key to select the parameter that needs to be modified. Short press the [OK] key to enter the parameter setting. Short press the [Up] or [Down] key to change the parameter. After setting is completed, short press the [C/S] key or the [OK] key to return to the custom coefficient interface.

4.5.5.4 Degree Setting

In the parameter interface, short press the [Up] or [Down] key to select "Degree Setting", then short press the [OK] key to enter the degree setting state. In the degree setting state, short press the [Left] or [Right] key to select the degree (1-5), and short press the [OK] key to complete the selection and exit the degree setting state.

4.5.5.5 Reset

In the parameter interface, short press the [Up] or [Down] key to select "Reset", then short press the [OK] key to reset the parameters set in this interface to default values.

4.5.6 Data Management

In the main menu interface, short press the [Up] or [Down] key to select "Data Management", then short press the [OK] key to enter the data management interface, as shown in Figure 4-18. The status bar at the top of the data management interface shows: battery power, Bluetooth, time. The data management interface has: view, memory, delete.

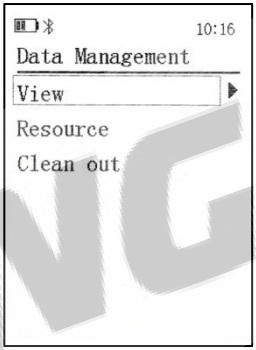

Figure 4-18 Data Management Interface

1. Data Viewing

Short press the [Up] or [Down] key on the data management screen to select "View". Short press the [OK] key to enter the data viewing interface. The data viewing interface is basically the same as the one described in "4.2.2", but you can view the data detected by other components by short pressing the [Left] or [Right] keys.

2. Storage Space

Short press the [Up] or [Down] key on the data management interface to select "Memory", then short press the [OK] key to enter the storage space interface, as shown in Figure 4-19. The status bar at the top of the storage space interface displays: battery power, Bluetooth, and time. The storage space interface shows: total number of data that can be stored, number of data already stored, and remaining storage space.

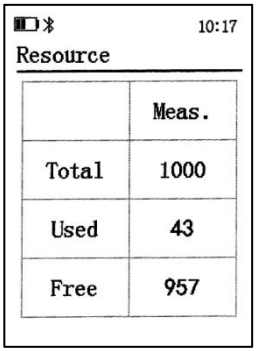

Figure 4-19 Storage Space Interface

3. Data Deletion

Short press the [Up] or [Down] key on the data storage interface to select "Delete", then short press the [OK] key to enter the data deletion interface, as shown in Figure 4-20.

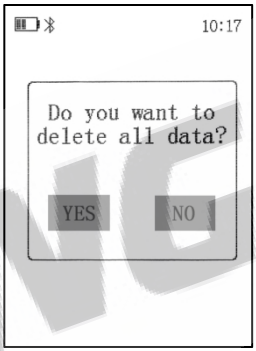

Figure 4-20 Data Deletion Interface

Short press the [Left] or [Right] key to move the cursor, select "Yes" or "No", and then short press the [OK] key to confirm.

Note: Before deleting the data, please confirm whether it has been uploaded to the PC end. Once the data is deleted, it cannot be recovered.

4.5.7 service interface

Short press the [Up] or [Down] key on the main menu interface to select "Services", then short press the [OK] key to enter the Services interface, as shown in Figure 4-21. The status bar at the top of the Services interface includes: battery power, Bluetooth, and time. The Services interface has: calibration, date and time, energy saving, language, theme, sound, and overload.

Figure 4-21 Service Interface

4.5.7.1 Calibration interface

Short press the "Up" or "Down" key on the service interface to select "Calibration", then short press the "OK" key to enter the password input interface. The instrument calibration is controlled by the password: Password "1111" is for instrument calibration, password "3333" is for line correction, password "9098" is for restoring factory settings. The steps for instrument calibration are detailed in the "Chapter 5: Instrument Calibration Instructions".

4.5.7.2 Date and Time Settings Interface

Short press the [Up] or [Down] key on the service interface to select "Date and Time", then short press the [OK] key to enter the date and time setting interface, as shown in Figure 4-22. The status bar at the top of the date and time setting interface includes: battery power, Bluetooth, time, and date. The date and time setting interface has: format, date, and time.

Figure 4-22 Date and Time Settings Interface

Short press the [Up] or [Down] key to move the cursor up and down, and select the parameter that needs to be modified. Short press the [OK] key to enter the parameter modification state. Short press the [Left] or [Right] key and [Up] or [Down] key to change the parameter. After setting is completed, short press the [C/S] key or [OK] key to return to the date and time setting interface.

4.5.7.3 Energy-saving Settings Interface

Short press the [Up] or [Down] key on the service interface to select "Energy Saving", then short press the [OK] key to enter the energy-saving settings interface, as shown in Figure 4-23. The status bar at the top of the energy-saving settings interface includes: battery power, Bluetooth, and time. The energy-saving settings interface has: automatic shutdown time, backlight, and screen brightness.

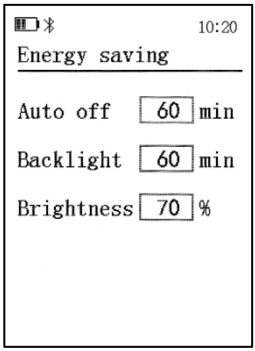

Figure 4-23 Energy Saving Settings Interface

Short press the [Up] or [Down] key to move the cursor up or down and select the parameter to be modified. Short press the [OK] key to enter the parameter modification state. Short press the [Up] or [Down] key to change the parameter, and after setting is completed, short press the [C/S] key or the [OK] key to return to the energy-saving settings interface.

4.5.7.4 Language Settings

In the service interface, short press the [Up] or [Down] key to select "Language", and short press the [OK] key to enter the language setting state. In the language setting state, short press the [Up] or [Down] key to select the desired language, short press the [OK] key to complete the selection and exit the language setting state.

4.5.7.5 Theme Settings

In the service interface, short press the [Up] or [Down] key to select "Theme", and short press the [OK] key to enter the theme setting state. In the theme setting state, short press the [Up] or [Down] key to select the desired theme, short press the [OK] key to complete the selection and exit the theme setting state.

4.5.7.6 Sound Settings

In the service interface, short press the [Up] or [Down] key to select "Sound", and short press the [OK] key to enter the sound setting state. In the sound setting state, short press the [Up] or [Down] key to select whether to turn on or off the sound, short press the [OK] key to complete the selection and exit the sound setting state.

4.5.7.7 Overload Interface

In the service interface, short press the [Up] or [Down] key to select "Overload", and short press the [OK] key to enter the overload interface, as shown in Figure 4-24. The status bar at the top of the overload interface shows: battery power, Bluetooth, and time.

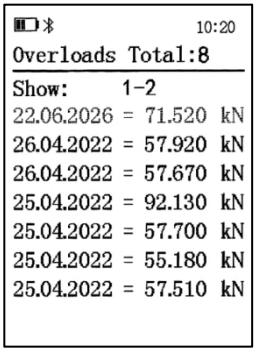

Figure 4-24 Overload Interface

During the use of the instrument, whenever the load exceeds the limit, the instrument will record the current date and time of the overload as well as the force value at that moment.

4.5.8 Regarding the interface of this device

Short press the [C/switch] key on the main menu interface to enter the "About This Device" interface, as shown in Figure 4-25. The status bar at the top of the "About This Device" interface includes: battery level, Bluetooth, and time. The "About This Device" interface also contains: instrument model, instrument name, product number, firmware version, company website, and company email.

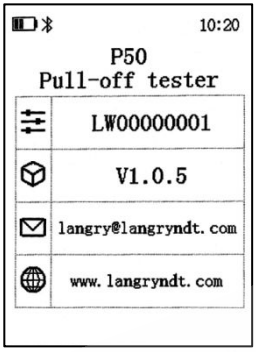

Figure 4-25 About the Local Interface

5 Instrument Calibration Instructions

P16/25/40 Instrument Calibration Instructions

The calibration settings are controlled by a password. In the instrument settings interface, press the [Up/Peak] key or the [Down/Reset] key briefly to move the cursor up or down, select "Password", press the [Store/Settings] key to enter the output password state, press the [Up/Peak] key, [Down/Reset] key, [Right/Query] key to input the password, press the [Store/Settings] key to enter the calibration state. If the password is incorrect, the pressure calibration state cannot be entered. If you mistakenly enter it, you can short press the [C/Switch] key to exit.

5.1 Instrument Calibration

Calibration steps:

1. Enter the password 1111, then briefly press the [Storage/Setting] key to enter the calibration state;

2. On the calibration interface, the progress bar shows "0%", at this time, make sure the instrument is not under load, and the value displayed by the standard force meter is zero. Press the [Storage/Setting] key once to complete the calibration of the "0%" range. At this time, the progress bar above will show "100%". At this point, operate the manual pump to apply the full-scale pressure value of the instrument and then press the [Storage/Setting] key briefly to complete the calibration of the "100%" range point. After completion, the instrument will automatically exit the calibration state. The calibration accuracy can be maintained even after power loss;

3. If the re-measurement accuracy of the instrument still fails to meet the usage requirements, you can repeat the above steps or perform segmented line correction.

5.2 Line Correction

Line correction steps:

1. Enter the password 3333, then briefly press the [Storage/Settings] key to enter the calibration state;

2. Taking P16's 1.6kN-3.2kN as an example, on the calibration interface, the progress bar above shows "0%", at this time, make sure the instrument is not loading, the standard force meter display value is zero, briefly press the [Storage/Settings] key once to complete the calibration of the "0%"

range. At this time, the progress bar above will show "10%", at this time, operate the manual pump to load to 1.6kN and briefly press the [Storage/Settings] key, complete the calibration of the "10%" range point. At this time, the progress bar above will show "20%", at this time, operate the manual pump to load to 3.2kN and briefly press the [Storage/Settings] key, complete the calibration of the "20%" range point. Continue to calibrate to the "100%" range point one by one. After completion, the instrument will automatically exit the calibration state. The calibration accuracy can be maintained even after power loss;

3. If the re-measurement accuracy of the instrument still cannot meet the usage requirements, you can repeat the above steps.

P50 Instrument Calibration Instructions

The calibration settings are controlled by a password. On the service interface, press the [Up] or [Down] key briefly to select "Instrument Calibration", then press the [OK] key to enter the password input interface. Press the [Left] or [Right] key and the [Up] or [Down] key to input the password, and press the [OK] key to enter the calibration state. If the password is incorrect, the pressure calibration state cannot be entered. If you mistakenly enter it, you can short press the [C/Switch] key to exit.

5.3 calibration of instrument

Calibration steps:

1. Enter the password 1111, then press the [OK] key briefly to enter the calibration state;

2. On the calibration interface, the progress bar shows "0%", at this time, make sure the instrument is not applying load, the value displayed by the standard force meter is zero. Press the [OK] key once to complete the calibration of the "0%" range. At this time, the progress bar above will show "100%". When you press the [OK] key again when the instrument has been loaded to the full-scale pressure value (50kN), complete the calibration of the "100%" range point. After completion, the instrument will automatically exit the calibration state. The calibration accuracy can be maintained even after power loss.

3. If the re-measurement accuracy of the instrument still fails to meet the usage requirements, the above steps can be repeated or segmented linear corrections can be made.

5.4 Line Correction

Line correction steps:

1. Enter the password 3333, then press the [OK] key briefly to enter the calibration state;

2. Taking 5kN-10kN as an example, on the calibration interface, the progress bar shows "0%", at this time, make sure the instrument is not loading, the value displayed by the standard force meter is zero. Press the [OK] key once to complete the calibration of the "0%" range. At this time, the progress bar above will show "10%", at this point, operate the instrument to load to 5kN and press the [OK] key briefly, complete the calibration of the "10%" range point. At this time, the progress bar above will show "20%", at this point, operate the instrument to load to 10kN and press the [OK] key again, complete the calibration of the "20%" range point. Continue this process until the "100%" range point is calibrated. After completion, the instrument will automatically exit the calibration state. The calibration accuracy can be maintained even after power loss;

3. If the re-measurement accuracy of the instrument still fails to meet the usage requirements, you can repeat the above steps.

6. Test Steps

6.1 Test Preparation

Before the test, the following checks are required:

Install the three legs onto the base, then turn the hand crank on the instrument clockwise. The piston should rise slowly. When it cannot be turned any further, the oil pump stroke has reached its limit and the piston displacement should reach the maximum. Otherwise, add hydraulic oil. The method of adding oil is as follows: Unscrew the oil injection hole, drop 10-grade aviation hydraulic oil or oil with similar indicators into the injection hole, and slowly turn the hand crank counterclockwise to allow the hydraulic oil to be sucked in. Do not let any air in. When the

maximum stroke is reached, gently turn the hand crank clockwise to allow the gas in the pipeline to be expelled from the injection hole (when oil is flowing out of the injection hole, it indicates that the process is complete).
This process should be repeated several times to fill the hydraulic oil completely and fully expel the air from the hydraulic system. Then, tighten the screw of the oil injection hole.

6.1.1 Testing with the circular disk method

1. Roughen the bottom surface of the test block with sandpaper to ensure good adhesion. If there is any grease on the bottom surface, it should be wiped off.
2. Apply the adhesive and bond the test block to the testing surface.
3. Isolate the test area by drilling through or cutting it. Usually, a suitable drill bit can penetrate the shell to reach the concrete base.
4. Once the adhesive has cured, the test can be conducted.

6.1.2 Post-insertion Pull-Out Test (Applicable to P40/50)

1. Point placement

(1) When testing individual components, 3 measuring points should be evenly distributed on the component. If the absolute difference between the maximum and minimum pull-out forces and the middle value is less than 15% of the middle value, only 3 measuring points are required; if the absolute difference between the maximum or minimum pull-out force and the middle value is greater than 15% (including both being greater than 15% of the middle value), 2 additional measuring points should be placed near the minimum pull-out force point;
(2) When testing components in batches, the sampling quantity should comply with the relevant provisions of the current national standard "Building Structure Testing Technology Standard" GB/T 50344. Each component should have 1 measuring point, and the minimum sample capacity should not be less than 15;
(3) The measuring points should be placed on the side of the component's concrete formation. If this requirement cannot be met, they can be placed on the concrete pouring surface;
(4) Measuring points should be placed at the areas with greater and weaker loads of the component. The distance between adjacent measuring points should not be less than 250mm, and the distance from the measuring point to the component edge should not be less than 150mm. The thickness of the tested concrete layer should not be less than 80mm;
(5) Measuring points should avoid joints, honeycombs, rough surfaces, as well as reinforcing bars and embedded parts.
Note: The tested component should be in a dry state. The test surface should be flat and clean. Decorative layers, floating mortars, and weak layers should be eliminated, and necessary grinding treatment should be carried out if necessary.

2. Drilling and grinding grooves

(1) During the drilling process, the drill bit should always be kept perpendicular to the concrete test surface, and the verticality deviation should not exceed 3°;
(2) When grinding the ring-shaped groove on the concrete wall of the hole, the positioning dial of the grinding machine should always be tightly against the concrete test surface and rotate, and the shape of the ring-shaped groove should be regular;
(3) The hole size should meet the following requirements:
① The allowable deviation of the drilling diameter d_1 is +1.0mm;
② The drilling depth h_1 should be 20-30mm deeper than the anchoring depth h;
③ The anchoring depth h should be 35mm, with an allowable deviation of ±0.5mm;
④ The depth c of the ring-shaped groove should not be less than the width b of the expansion spring anchoring step.

3. Pull-out test

(1) First, the testing location should be selected, then connect the impact drill bit with the impact drill, and drive the impact drill bit to drill. The drill should be kept perpendicular to the concrete surface;
(2) Place the diamond grinding head on the drilled hole, hold the grinding machine, and make the positioning dial tightly against the concrete surface, and rotate slowly and evenly around the

periphery of the hole. During this process, the positioning dial should always remain perpendicular to the hole. When the center rod of the grinding head touches the hole wall, stop grinding the groove and clear the remaining debris in the hole;
(3) First, insert the expansion spring into the forming hole. Then, connect the punch to the expansion rod. Use a small hammer to strike the punch and push the expansion rod into the cavity of the expansion spring, causing the expansion spring to expand. When the punch comes into contact with the expansion spring, remove the punch and insert the multi-functional pull rod into the expansion spring and tighten it. Install the detector, align the pull rod with the piston, install the pull rod nut, and keep it about 2mm away from the piston.
(4) After the inspection is completed, remove the nut on the pull rod, remove the pull rod from the expansion spring, then connect the retracting rod to the expansion rod inside the expansion spring, install the retracting sleeve and the nut, and rotate the nut with a wrench to pull the expansion rod out of the expansion spring.

6.1.3 Post-tensioning Method Testing (Applicable to P40/50)

1. Point placement
(1) For each component, 3 measuring points should be evenly distributed. If the difference between the maximum pull-out force or the minimum pull-out force and the median value is greater than 15% of the median value, two additional measuring points should be placed near the minimum pull-out force point;
(2) Measuring points should be prioritized to be placed on the side of the concrete pouring. If measuring points cannot be placed on the side of the concrete pouring, measuring points can be placed on the top surface of the concrete pouring. Before placing the measuring points, the surface of the concrete should be cleaned of loose mortar. If the concrete pouring surface is not flat, the concrete at the measuring point should be ground smooth;
(3) The distance between adjacent measuring points should not be less than 300mm, and the distance from the measuring point to the edge of the component should not be less than 150mm;
(4) Measuring points should avoid joints, honeycombs, and rough surfaces, and the failure surface of the post-bonding method should have no exposed reinforcing bars;
(5) Measuring points should be marked with numbers. If necessary, a diagram of the measuring point layout should be drawn;
2. Start drilling
The drilling machine can use an impact drill bit. The drilling machine should have a device for controlling the verticality and depth. During the drilling process, the drill bit should always be kept perpendicular to the concrete surface.
The size of the drilled hole should comply with the following regulations:
(1) The diameter of the drilled hole should be (27 ± 1) mm;
(2) The depth of the drilled hole should be (45 ± 5) mm;
3. Cleaning the hole and anchoring
(1) After the drilling is completed, the dust in the hole should be removed. If using a diamond thin-walled hollow drill for drilling, the hole wall should be clean and dry;
(2) The injection positioning disc should have injection holes, exhaust holes, and a pressure holding funnel;
(3) The injection positioning disc should be connected to the anchoring component before injecting the anchoring agent. Before injecting, a small amount of grease can be applied to the contact surface between the injection positioning disc and the concrete to facilitate disassembly. After the anchoring agent cures, the pull-out test can be conducted. After the post-bonding method test, the damaged parts of the component caused by the test should be effectively repaired in time;
4. Pull-out test and precautions
(1) During the pull-out test, an anti-reaction support ring should be used to provide anti-reaction support;
(2) During the pull-out test, the pulling force should be applied continuously and uniformly, with a speed controlled within (0.5 - 1.0) kN/s;

(3) The pulling force should be applied until the reading of the force measuring device of the pull-out instrument no longer increases, and the ultimate pull-out force should be recorded with an accuracy of 0.1 kN;
(4) During the test, effective measures should be taken to prevent the test device from falling off;
5. Handling abnormal situations
When one of the following abnormal situations occurs in the post-bonding method test, detailed records should be made and the value should be omitted. A measuring point should be re-measured nearby:
(1) The post-bonding failure body presents a non-complete cone-shaped failure state;
(2) On the cone-shaped failure surface of the post-bonding failure body, there are defects or foreign objects that significantly affect the detection accuracy;
(3) Cracks appear in the external concrete of the anti-reaction support ring;

6.1.4 Russian anchor testing method (applicable only to P50)

1. Point Layout
The points are arranged according to the methods specified in ГОСТ 22690 and MC 300.6:
(1) Conduct a visual inspection of the structure to ensure there are no external defects such as cracks, peeling, or bulges. If the position of the reinforcing bars is unclear, an instrument such as a reinforcing bar detector can be used to determine their projection on the concrete surface and mark them with chalk;
(2) The tests are carried out on structural sections with an area ranging from 【100cm】^2 to 【900cm】^2. Table 2 lists the basic requirements for the test areas:
Table 2

Depth of anchor bolt insertion h (mm)	On-site measurement total	Minimum distance between measurement points(mm)	The minimum distance (in mm) from the structural edge to the measurement point	Minimum structural thickness (mm)
≥40	1	5h	150	2h
< 40	2			

(3) Divide the target or selected homogeneous area into controlled zones and mark the drilling points;
(4) The concrete moisture content in all monitoring areas must be the same. If the concrete surface is locally wet, it must be dried;
(5) The drilling should be carried out at the center of the reinforcement unit, at least 150mm away from the edge or boundary of the concrete layer, but there must be no obvious defects within the radius of 90mm of the drilling center, and no reinforcing bars or embedded parts within the radius of 70mm. The distance between the drilling holes should be at least 200mm;
(6) When drilling, use drilling or impact rotary tools to drill. The allowable deviation of verticality should not exceed 1/25 (not more than 4mm when the height is 100mm). After drilling, the dust and concrete debris in the hole must be thoroughly removed. Compressed air can be used for blowing, and the hole diameter should be calibrated if necessary;
(7) It is recommended to clean the drilling surface with an appropriate-sized spiral brush before installing the anchor bolts;
(8) The size of the anchor bolt used must be consistent with the drilling parameters. The drilling diameter must not exceed the diameter of the anchor bolt by 1mm. The drilling depth H must be selected according to the depth h of the anchor bolt tool (see Table 3);
Table 3

Anchor bolt size (mm)	Drilling parameters, at least:	
	h，mm	H，mm
Φ16×35	35	50

Φ24×48	48	75

2. Selecting the embedded depth of the anchor

(1) The anchor bolt sizes configured by the instrument are of two specifications: Φ16×35mm and Φ24×48mm;

(2) Table 4 lists the data for selecting the anchor bolt size based on the measured concrete strength:

Table 4

Anchor bolt size (mm)	The allowable range for measuring the compressive strength of concrete (MPa)	
	Heavy concrete	Lightweight concrete
Φ16×35	40 ~ 100	/
Φ24×48	5 ~ 100	5 ~ 40

3. Installation of the instrument

(1) Use a metal brush to clean the concrete debris on the surface of the anchor bolt, and apply a small amount of thick grease (such as petroleum jelly) on the cone surface of the anchor bolt;

(2) Screw the pull rod onto the anchor bolt and tighten it with a wrench. By shaking the pull rod laterally, ensure that the anchor component is firmly fixed in the drilled hole;

(3) Ensure that the instrument is in a fully reset state. Place the instrument through the pull rod on the concrete surface. At this time, screw the pull rod nut onto the threaded end of the pull rod to ensure that there is a gap between the end of the pull rod nut and the instrument body, approximately equivalent to the distance that the pull rod nut can rotate half a turn;

(4) Rotate the instrument to find a stable and convenient operation position. Screw the three legs of the instrument until they contact the concrete surface. Tighten the pull rod nut to create the necessary pre-tension between the pull rod and the anchor bolt, thereby firmly fixing the instrument on the concrete surface;

(5) When tightening the pull rod nut, the anchor bolt must not slide in the drilled hole. Otherwise, the hole must be further deepened and the anchor bolt reinstalled to ensure a firm bond between the concrete and the anchor bolt;

6.2 Test Steps

6.2.1 P16/25 Testing Procedure

1. Press and hold the [C/Switch] key to turn on the device.

2. After startup, enter the detection interface. Long press the [Storage/Settings] key to enter the instrument settings interface.

3. In the settings interface, select the size that is consistent with the bonded test block. If there is no suitable test block size in the options, you can short press the [Up/Peak] key or [Down/Clear] key in the test block size options to switch to custom mode. The area of the used test block can be output.

Note: When using the post-tensioning method or post-bonding method, there is no need to set the test block size. In the detection interface, switch the unit to kN.

4. Short press the [C/Switch] key to return to the detection interface to start the detection. Short press the [Up/Peak] key or [Down/Clear] key to switch the required unit. Long press the [Up/Peak] key to turn on the peak value.

5. After installing the instrument according to the above testing steps, tighten the grip nut until a number appears in the interface. At this time, the data in the interface is not zero. Long press the [Down/Clear] key to clear the data.

6. Start the detection. Slowly and uniformly rotate the hand crank until the number in the interface stops increasing or the concrete is damaged or the test block is pulled off.

Note: When the pressure value in the table exceeds 10% of the range, the button will not respond. The instrument must be completely unloaded before operation can be performed.

7. After the detection is completed, short press the [Storage/Settings] key to save the data and enter the parameter viewing interface. Short press the [Right/Query] key in the parameter viewing interface to enter the failure mode report interface. Short press the [C/Switch] key to return to the detection interface.

Note: If you do not want to record the failure mode, short press the [C/Switch] key in the parameter setting interface to return to the detection interface for the next test.

6.2.2 P50 Testing Procedure

1. Press and hold the [C/Switch] key to start the instrument. Before conducting the test, make sure the instrument is powered on to avoid losing data due to power failure and shutdown during the test.
2. Before starting the test, users need to set the required parameters for the test (such as materials, aggregate size, and the size of the anchor used) according to the introduction in the "Chapter 4 Instrument Operation Instructions".
3. Short press the [Up] or [Down] key on the main menu interface to select "Start Testing", then short press the [OK] key to enter the test.

Note: Before starting the test, ensure that the instrument is in the reset state.

4. Short press the [Up] key on the test interface to activate the peak value.
5. First, rotate the handle to generate preload between the pull rod and the anchor bolt. When the force value and displacement value appear on the test interface, short press the [Down] and [Right] keys to clear the force value and displacement value.
6. Then, rotate the handle to load uniformly (make sure the loading speed is between 1.5 and 3 kN/s) until the digital value no longer increases or the concrete is damaged.

Note: The automatic strength calculation starts when the instrument reaches a force value of 5 kN or above (to avoid triggering in the initial loading stage), and then the instrument will display the strength result on the interface.

7. After the test is completed, short press the [Storage] key to save the data. If there are multiple measurement points to be measured, it will jump to the test interface of the next measurement point. Note:

① Before conducting the test at the next measurement point, the instrument needs to be reset, and then the above steps should be repeated for the test.

② If you need to terminate the test prematurely during the process, simply press the [C/switch] key on the test interface to display a prompt box asking whether to save the data. Select "Yes" to save the current test results and return to the main menu. Select "No" to not save the current test results and return to the main menu.

7. Conversion values for concrete strength (applicable to P40/50)

7.1 strength-measuring curve

7.1.1 Post-installed anchoring method

When there are no dedicated strength measurement curves or regional strength measurement curves, the unified strength measurement curve in JGJ/T208-2010 "Technical Code for Detecting Concrete Compressive Strength by Post-anchoring Method" can be used to calculate the converted value of concrete strength:

$$f^{c}_{cu,\ i} = 2.1667P_i + 1.8288$$

In the formula:

$f^{c}_{cu,\ i}$: Concrete strength conversion value (MPa), accurate to 0.1 (MPa);

P_i: Pull-out force (kN), accurate to 0.1 (kN).

The representative value of the pull-out force of a single component should be determined according to the following provisions:

1. When the difference between the maximum and minimum values among the three pull-out forces of the component and the middle value is less than 15% of the middle value, the minimum value should be taken as the representative value of the pull-out force of the component;

2. When additional tests are conducted, the average value of the two additional pull-out force values and the minimum pull-out force value should be taken. Then, compared with the previous intermediate value of the pull-out force, the smaller value should be taken as the representative value of the pull-out force of the component.

7.1.1.1 Scope of Application

The unified strength curve is applicable to concrete that meets the following conditions:

1. It is made of common concrete materials and the coarse aggregate is crushed stone, with the maximum particle size not exceeding 40mm;
2. The compressive strength range is (10 - 80) MPa;
3. It is formed using ordinary molding techniques;
4. It is naturally cured for 14 days or undergoes steam curing and then is naturally cured for more than 7 days after being removed from the curing pool.

7.1.2 Post-insertion extraction method (three-point type)

The pull-out force representative values of individual components are substituted into the formulas according to different testing methods:

$$f_{cu}^{c} = 2.76F - 11.54$$

In the formula:

f_{cu}^{c}: Concrete strength conversion value (MPa), accurate to 0.1 (MPa);

F: Pull-out force representative value (kN), accurate to 0.1 (kN).

The representative value of the pull-out force of a single component should be determined according to the following provisions:

3. When the absolute value of the difference between the maximum and minimum pull-out forces among the three pull-out forces of the component and the intermediate value is less than 15% of the intermediate value, the minimum value should be taken as the representative value of the pull-out force of the component;
4. When additional tests are conducted, the average value of the two additional pull-out force values and the minimum pull-out force value should be taken. Then, compared with the intermediate value of the previous pull-out force, the smaller value should be taken as the representative value of the pull-out force of the component.

The strength conversion value is calculated as the estimated value of the concrete of a single component:

$$f_{cu,\ e} = f_{cu}^{c}$$

7.2 Strength calculation of anchorages using the Russian method (applicable only to P50)

For "heavy concrete" and "light concrete" materials, the conversion of the pull force F of the material and the strength R (in MPa) is calculated according to the following formula:

$$R = m_1 \times m_2 \times m_3 \times F$$

Here, m1 represents the coefficient that takes into account the sliding of the anchor bolts:

$$m_1 = \left[\frac{h_H}{h_H - \triangle_h}\right]$$

In the formula:

$\triangle_h$---- Anchor displacement (mm);

h_H---- Anchor bolt embedding depth (mm);

m_2---- Proportional coefficient (as shown in Table 1);

m_3---- Coeficient of aggregate fineness (as shown in Table 1);

F---- Force value (kN) during the pulling process;

The sliding of anchor bolts is caused by the insufficient adhesion between the anchor component and the concrete, which leads to the displacement of the anchor component in unset and poor-quality concrete.

For other materials ("Unnamed-1"... "Unnamed-6"), the strength R_И (MPa) is calculated according to the following formula:

$$R_{И} = A_0 + A_1 \times F + A_2 \times F^2$$

A_0、A_1、A_2----Calibration coefficient, default$A_0 = 0$，$A_1 = 1$，$A_2 = 0$。

By selecting the appropriate parameters (anchor bolt diameter and embedment depth, heavy or light concrete, hardening conditions, aggregate particle size) in the menu, the equipment can automatically determine the coefficients m_2 and m_3.
For concrete with a strength of B60 or less or when the average compressive strength R of the concrete is less than 70 MPa, the empirical values of the proportion coefficient m_2 can be applied according to Table 1.
Table 5

Concrete hardening conditions	Anchor bolt specification (mm)	proportionality coefficient m_2 concrete material		Aggregate fineness modulus m_3	
		heavy	light	≤50mm	> 50mm
Normal	ϕ24×48	0.9/-	1.0/-	1.0	1.1
	ϕ16×35	1.7/-	1.9/-	1.0	1.1
Heat treatment	ϕ24×48	1.1/-	1.0/-	1.0	1.1
	ϕ16×35	2.0/-	2.2/-	1.0	1.1

The strength determination of heavy concrete with design grade B60 or above, or of the overall structure with an average compressive strength of R > 70 MPa, must take into account the provisions of ГОСТ 31914 (Article 6.1.2.9).

8 Common Faults and Their Solutions

Fault phenomenon:	Fault causes	Solution method
No pressure indication displayed on the screen.	Insufficient oil in the cylinder	Open the oil filling hole and add oil
	Error in calibration	Re-calibrate
The pressure was not met.	Insufficient oil in the cylinder	Open the oil filling hole and add oil
	Incorrect oil type used or dirty oil	Replace the hydraulic oil
Oil leakage from the cylinder	Damaged sealing ring inside the cylinder	Replace the sealing ring
The displayed value has significantly decreased.	Too dirty oil quality	Clean the oil cylinder with kerosene and then change the oil
	Poor sealing of each one-way valve	Send it back to the factory for maintenance
	Failure of sealing components	Replace the similar sealing ring

Check the oil level: First, retract the instrument piston to the lowest position, place the oil injection hole facing upwards, unscrew the screw on the oil injection hole, and check the oil level. If it is found that the hydraulic oil is insufficient, add 10-grade aviation hydraulic oil to the bottom of the oil injection hole thread.

9. Important Notes and Maintenance Procedures

1. The intelligent pressure value display is a precision instrument. During use, be sure to prevent vibration and moisture.
2. The instrument must be used within its working range; otherwise, it will affect the detection accuracy or cause permanent damage.
3. Each sensor has its own discreteness. The sensors of this instrument and the host have been calibrated and matched, and they cannot be replaced with other sensors or hosts.
4. Keep the instrument and its accessories clean frequently. When necessary, add lubricating oil to the rotating parts. The hydraulic system should be filled with clean No. 10 aviation hydraulic oil or oil of similar quality.
5. The instrument has been calibrated upon leaving the factory. During use, it can be calibrated once a year according to specific circumstances.
6. To ensure the correct use of the instrument, please carefully read all the terms in this manual and correctly select the detection scheme according to relevant technical standards. The product is guaranteed for one year. We will provide technical consultation, instrument maintenance and calibration services for you at any time, and sincerely hope that you will offer valuable opinions on the product.

10 Order Information

10.1 Delivery method

	P16	P25	P40	P50
Item Number	10020015	10020016	10020001	
Total weight	7kg		8.7kg	11kg
Outer box dimensions	365×285×305mm		382×304×342mm	445×355×310mm
Multi-functional grip nut × 1 piece	√		√	√
Multifunctional standard block pull-through screws (M8) × 1 piece	√		√	×
Multifunctional circular drawing standard block (ϕ50mm/M8, aluminum) × 1 piece	√		√	×
Multi-functional pull rod × 1 piece	√		√	√
Multi-functional pull rod connector × 1 piece	√		√	√
Post anchor bolt nut × 1 piece	×		×	√
P50 pull rod connector nut × 1 piece	×		×	√

10.2 Optional Accessories (Note: "√" indicates optional, "×" indicates non-optional)

parets name	amount	Art.No.	P16	P25	P40	P50
Multifunctional circular drawing standard block (ϕ20mm / M8, aluminum)	10 items in a group	20020118	√			×
Multifunctional circular drawing standard block (ϕ50mm / M8, aluminum)	10 items in a group	20020089	√			
Multifunctional circular drawing standard block (ϕ50mm / M8, steel)	10 items in a group	20020119	√			
Multifunctional circular drawing standard block (ϕ75mm / M8, aluminum)	5 items in a group	20020120	√			
Multifunctional circular drawing standard block (ϕ100mm / M8, aluminum)	3 items in a group	20020121	√			
Multifunctional square drawing standard block (40×40mm / M8, aluminum)	10 items in a group	20020122	√			×
Multifunctional Square Pulling Standard Block (40×40mm / M8, Steel)	10 items in a group	20020123	√			×
Multifunctional square drawing standard block (50×50mm / M8, aluminum)	10 items in a group	20020124	√			×
Multifunctional square drawing standard block (95×45×8mm / M8, steel)	5 items in a group	20020125	√			×
Multifunctional square drawing standard block (100×100mm / M8, aluminum)	3 items in a group	20020126	×	√		
Multifunctional square drawing standard block (100×100×8mm / M8, steel)	3 items in a group	20020127	×	√		
Multifunctional standard block pull-through screw (M8)	1 piece 1 set	20020090	√ √			
Post-installed extraction method testing kit	1 set	20020130	×	√		
Post-bonding method testing kit	1 set	20020131	×	√		
Φ16x35 anchor bolt	1 set	20020132	×			√
Φ24x48 anchor bolt	1 piece 1 set	20020133	×			√

11 Online system software

11.1 Introduction

The online system management software is a multi-functional analysis software for data processing launched by Jinan Langrui Testing Technology Co., Ltd. The software has a user-friendly interface and is easy to operate. It is specially designed for engineering inspection personnel.

11.2 Software Installation

For the first use, open the official website www.langryndt.com, find the corresponding model in the product center and enter its product details page. Click on "Download" in the "About the Product" section to download and install the online system software. After that, you can start using it.

11.3 Data Transmission

P16/25 data is transmitted via Bluetooth. Ensure that the computer has Bluetooth functionality. When the instrument is powered on, open the online system software, click on the "Online" option in the title bar, and select "Bluetooth Import" from the drop-down menu. P50 data is transmitted via a USB data cable. Connect the instrument to the computer host using the USB data cable, ensure the instrument is powered on, open the online system software, click on the "Online" option in the title bar, and select "Auto Import" from the drop-down menu. In the pop-up dialog box, select to import all components or a subset of components. After selection, click "Import" and the instrument will automatically upload the selected component data.

11.4 Data Processing

The online system can process all components and data.

11.4.1 Component Data Inspection

1. Double-click on any component in the component list area to view the curve of that component.
2. Right-click at any position on the curve graph, and perform operations such as copying, saving, printing, zooming, automatic adjustment, and attribute setting. Through attribute setting, you can adjust items such as the title, axis label marks, and scale labels of the curve graph.

11.4.2 Inspection Report

1. It is used to generate a report document for the current opened data file.
2. Right-click on the "Inspection Report" node in the tree diagram or select the Data Processing menu, you can create a new inspection report.
3. Select one of the inspection reports and click right-click or select the Data Processing menu to delete the selected inspection report; you can also change the composition of the inspection report.

11.4.3 Component Deletion

Select the component to be deleted, right-click or select the Data Processing menu, and delete the selected component. The deleted component data can be viewed and restored in the deleted component list; the deleted inspection report cannot be viewed or restored.

11.5 Printing and Preview

Select the report to be previewed and printed, right-click, select the Data Processing menu or the File menu, to perform print preview; in the print preview interface, you can also perform print operations.

11.6 Data Saving

Select the File menu, click "Save" or "Save As", to save the current data file. The file extension is.xyl.

11.7 Instrument Version Upgrade

After connecting the instrument, select the "Online" menu and click "Firmware Upgrade" to download and upgrade the instrument version.

11.7.1 Software Version Upgrade

Select the "Help" menu and click "Version Update" to check or upgrade the version of the online system software.

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