



# MANUAL VERIFICATION KIT USER MANUAL

EXAMPLE

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## **SAFETY PRECAUTIONS**

The Innovatest Manual Verification Kit has been designed and manufactured to provide safe and dependable performance. Nevertheless, incorrect handling or operation may result in electrical shock, personal injury, equipment damage, or loss of data. To ensure proper use and long-term reliability, all users must follow the safety requirements described in this section during installation, operation, transportation, and maintenance of the device.

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### **Electrical and Charging Safety**

Use only the original or certified USB C charging equipment. If cables or power components are damaged, discontinue use and contact Innovatest service personnel.

The USB C connector is the main disconnection point and must remain accessible. Operate the device only within the specified voltage limits. Do not use overloaded extension cords, uncertified power banks, or damaged charging accessories.

Some internal components may remain energized while connected to power, even if the device is switched off. Always unplug the charger before cleaning, transporting, or servicing the device.

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### **Battery and Device Integrity**

There are no user serviceable components inside the electronics module. Do not open, repair, or modify the device. Opening the enclosure voids the IP67 rating and may expose hazardous voltages.

Never remove, puncture, or replace the internal battery. Charge only with certified USB C power sources. If heat, odor, noise, or smoke is detected, immediately disconnect all cables and stop using the device. Do not leave the device charging unattended.

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### **Safety, Environmental & Data Guidelines**

To avoid personal injury, always place the unit on a stable, flat, and vibration-free surface; an unstable positioning may cause the device or connected load cell to fall. Transport the system only using the integrated Pelican handle and never lift the device by cables or connected accessories. Avoid striking, dropping, or applying excessive force to the touchscreen or enclosure, since this can damage internal components. Do not insert any objects into the USB port, ventilation openings, or load cell connector. Keep the equipment out of reach of children and untrained personnel to prevent accidental misuse or injury.

To prevent fire, electrical shock, or other hazards, always turn the device off and disconnect it from the charger when it is not used for an extended period. Keep liquids, metal objects, and high-voltage tools away from the M12 load cell connector to avoid electrical short circuits and potential injury. Only use accessories approved for this

verification kit, as unapproved items can compromise electrical safety and the device's sealing integrity. Do not operate the device in environments with open flames, excessive dust, or explosive atmospheres. During thunderstorms or electrical storms, avoid touching the charger, USB cables, or load cell cables. Although the device is IP67 rated, high-humidity environments can still pose a risk if cable connections are improperly secured.

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## **Environmental and Handling Precautions**

Before use, ensure all ports and connectors are dry and free of contamination, and do not expose the device to temperatures outside the permitted operating range of 0–60°C. Avoid placing heavy items on the case or applying pressure to the touchscreen. Before transporting the device, make sure all load cells are properly secured in their designated foam compartments, and never close the Pelican case while cables are still attached, as this can damage wiring or connectors.

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## **Data Protection Safety**

Always use the Safe Eject function before removing the USB stick, as unplugging the storage device prematurely may result in file corruption. Verify that the battery level is adequate before starting extended measurement or calibration processes, since unexpected power loss during calibration can corrupt stored data.

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# **INSTALLATION & SETUP**

## **INSTALLATION**

Correct installation is essential for achieving accurate measurement results and maintaining device safety. Follow the guidelines below when setting up the Innovatest Manual Verification Kit.

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### **Placement and Environment**

Place the unit on a stable, flat, and vibration-free surface away from table edges. Fully open the Pelican case and ensure the non-slip rubber feet rest securely on the work surface. Avoid installation sites with prolonged exposure to direct sunlight, which may cause overheating and reduce display visibility.

Do not place the device near water sources, extremely dusty or corrosive environments, or strong electromagnetic interference sources (e.g., welding equipment, industrial motors, radio transmitters). Maintain good ventilation around the system to prevent heat buildup that may affect battery life and electronic stability.

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## Cable & Power Setup

Ensure that the case rests securely on a stable surface with its non-slip feet. Open the case slowly and fully to prevent stress on the hinges or accidental displacement of internal components. Never attempt to close the lid while any cables are still attached, as this can damage connectors, load cell ports, or the touchscreen.

Route M12 load cell cables carefully to avoid sharp bends, pulling, or tripping hazards. Utilize the strain-relief groove near the connector to reduce unwanted motion during operation, and keep all cables away from sharp tools, heavy objects, or rotating machinery in the work area.

When charging the device, place it near an easily accessible electrical outlet and ensure the USB-C cable is not compressed, stretched, or routed under heavy items. Avoid charging near heat sources and always operate within the recommended temperature range of 0–60°C to protect battery life and maintain safe operation.

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## Case, Component Protection & Precautions During Installation

The internal foam inserts are designed to secure and protect the load cells, so always place each load cell in its designated compartment before moving or storing the device. Do not remove or modify the foam padding or structural brackets, as these components provide shock absorption and help maintain the IP rating. Avoid operating or storing the device in environments with oil mist, airborne chemicals, or corrosive vapors, which can degrade seals and enclosure materials.

During installation, take care not to drop tools or accessories onto the touchscreen or electronics panel, and avoid positioning the device under shelves or areas where objects may fall onto it. If the device is installed in a semi-permanent location, ensure the lid can fully open to allow access to the USB port, emergency stop, and connectors. Before each use, verify that all mechanical buttons, including Power and Emergency Stop, move freely and remain unobstructed.



**FIGURE 1: PROTECTIVE CARRYING CASE MODEL**

## CLEANING

To maintain accuracy and extend the lifespan of the Innovatest Manual Verification Kit, regular cleaning must be performed using the correct methods. Improper cleaning can damage connectors, the touchscreen, or the protective sealing.

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### Device Cleaning Guidelines

Always power off the device and disconnect the USB-C cable before cleaning. Never spray liquids directly on the touchscreen or into any ports, and avoid harsh chemicals like alcohol, acetone, or industrial cleaners, as they can damage seals and plastic components.

For the touchscreen, use a clean, soft, lint-free microfiber cloth. Lightly dampen the cloth with water if needed, but never apply water directly and avoid pressing too hard.

Clean the exterior case with a damp cloth, using mild soap if necessary. Avoid abrasive pads, brushes, or high-pressure water, which may compromise the seal.

Ensure all connectors, including USB-A, USB-C, and I<sup>2</sup>C ports, are dry before use. Use low-pressure dry compressed air to remove dust and never insert metal tools or sharp objects into the connectors.

Do not attempt to clean or open the internal electronics. Doing so voids the IP67 rating and the warranty. If you suspect dust, liquid, or corrosion inside, contact Innovatest service support.

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### Regular Cleaning Frequency

Wipe the touchscreen and check connectors for dust daily. Clean the exterior case and inspect seals weekly. After use in harsh environments, perform a full external cleaning before storing the kit. Regular cleaning helps maintain accuracy, protect seals, and extend the device's service life.



FIGURE 2: CLEANING TOOLS

## REPACKING & TRANSPORT

To ensure safe transport and long-term protection of the Innovatest Mobile Force Verification Kit, the unit must be repacked correctly after each use. Improper repacking may lead to damage of load cells, connectors, or internal electronics. Follow the guidelines below when preparing the system for storage or transport. Always double-check that all components are securely seated in the foam inserts, and ensure no cables or accessories are pinched or protruding. Keep a checklist of included items to prevent loss and confirm that the case is fully latched before moving or storing the kit.

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### Device and Load Cell Repacking

Before repacking, power off the device completely and disconnect the USB-C cable. Ensure all ports are free of moisture and dust and remove the load cell cable from the M12 connector. Allow the device to cool if it was recently used or charged.

Place each load cell in its dedicated foam compartment, aligned properly to avoid strain on cables or connectors. Do not stack load cells or place them loosely, as this can cause damage, signal issues, or calibration drift. Coil load cell cables loosely in the designated accessory area, avoiding tight bends or knots.

Store all cables, including USB-C, USB-A, and M12 extensions, in their marked compartments. Keep them away from the touchscreen and electronics panel to prevent pressure damage. Ensure no small tools or loose objects remain inside the case, as movement during transport can cause scratches or interference with the electronics module.

Verify that the electronics panel is seated correctly within the aluminum frame and foam supports, with no gaps or lifted areas. Avoid applying pressure to the screen when closing the case. Check that no cables are sticking out, the emergency button is unobstructed, and USB ports are clear.

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### Closing, Transport, and Storage

Gently lower the Pelican case lid, ensuring no objects protrude from the foam, and lock both latches firmly until they click. Inspect and clean the perimeter gasket as needed to maintain dust and water resistance.

During transport, always use the built-in handle and avoid carrying the case by cables. Protect the kit from severe impacts, crushing, vibration, direct sunlight, or high temperatures. For air travel, follow airline lithium-battery regulations and carry the device as hand luggage when possible.

For long-term storage, keep the kit in a dry, cool environment between  $-20^{\circ}\text{C}$  and  $60^{\circ}\text{C}$ . Charge the battery to 40–60% before storage and avoid high-humidity conditions. Periodically inspect case seals and foam padding for wear to ensure ongoing protection.

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## MOVING AND HANDLING THE KIT

The Innovatest Mobile Force Verification Kit has been designed for portability and safe transportation in demanding environments. To prevent physical injury and protect the internal electronics from damage, follow the guidelines below whenever moving, lifting, or transporting the unit. Careful attention to handling not only ensures personal safety but also helps maintain the accuracy and longevity of the system. Regularly inspecting the case and its components for wear or damage before and after transport can further reduce the risk of accidents and equipment failure.

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### Safe Lifting Practices

Always lift and carry the system using the integrated Pelican handle. This handle is ergonomically designed to provide a secure grip and minimize strain during transport.

Never lift or pull the device using the USB cable, M12 load cell cable, or any attached accessories. Doing so may cause electrical damage, connector deformation, or cable failure.

Transport the case in its upright orientation. Avoid carrying it sideways or upside-down, as internal components and stored load cells may shift and sustain mechanical stress.

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### Handling While the Case Is Open

Moving the case while open may cause the lid to slam shut or internal components to shift unexpectedly. Always close and latch the lid before relocation.

Ensure that all load cells, cables, and accessories are properly placed in their foam compartments before attempting to reposition the kit.

Do not use the touchscreen or internal frame as a gripping point while repositioning the case. These components are not designed to support lifting forces.

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### Transport on Industrial Floors

Dragging the device across factory floors may wear down the protective shell and compromise sealing. Always lift the case or use a transport cart for longer distances.

Ensure that cables connected during calibration or measurement are not pulled or stretched when repositioning equipment around the case.

Avoid placing the kit in areas where forklifts, pallet jacks, or mobile equipment are used, to prevent accidental impact.

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## Handling During Field Deployment

Although the Pelican case provides significant shock absorption, excessive vibration or sudden impacts should be avoided to protect internal electronics.

Do not leave the kit in direct sunlight, inside vehicles during hot weather, or in freezing conditions for extended periods. Temperature extremes may affect battery and sensor performance.

Only open the Pelican case when necessary. Keeping it closed prevents dust, moisture, and airborne contaminants from entering the system.

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### Short-Distance Handling

For short repositioning movements (within the same room):

- Disconnect any cables.
  - Ensure the lid is fully closed.
  - Lift the case using both hands if necessary.
  - Place the case gently on the new surface to avoid shock impact.
- 

### Long-Distance Transport

Secure the case using straps or place it on a flat, stable surface. Avoid stacking heavy objects on top of it.

Comply with airline regulations for lithium-ion batteries. In most cases, the device should be transported as carry-on luggage.

For shipment or courier transport, shock indicator labels may be applied to monitor handling conditions.

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### Inspection After Transport

After moving the kit over long distances or through rough environments:

- Inspect the case for cracks or latch damage.
- Check the seals for dust or debris.
- Verify that load cells are still properly seated.
- Power on the device to ensure normal operation.

Any abnormalities should be reported to Innovatest support before further use.

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# PRODUCT OVERVIEW & SYSTEM LAYOUT

## PRODUCT OVERVIEW

The Innovatest Mobile Force Verification Kit is a portable, ruggedized measurement system designed to verify forces applied by hard testing machines in both laboratory and industrial field environments. The system integrates sensing, processing, display, storage, and connectivity functions within a compact IP67-rated Pelican case. This section provides an overview of the unit's physical layout, components, and essential features.

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### Front Panel Components

**Touchscreen Display** - The device features a 10-inch resistive touchscreen centered on the front panel. It supports operation with gloves and remains visible under a wide range of lighting conditions. The display serves as the primary interface for calibration, measurement, data logging, and system navigation.

**Power Button** - The power button is positioned above the touchscreen, centered horizontally on the front panel. It provides clear tactile feedback and allows the user to turn the system ON or OFF safely.

**Emergency Stop Button** - The emergency stop button is located on the right side of the front panel, clearly separated from the touchscreen and power button to prevent accidental activation. It allows the user to immediately stop any ongoing measurement or calibration process.

**Status LED Indicator** - The status LED is positioned directly next to the emergency stop button on the right side of the front panel. The multi-color indicator provides visual feedback on system status, including power state, active measurements, busy conditions, errors, and battery warnings.

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### Side and External Panel Components

**Side Panel (I/O Ports)** - All external connectors of the Innovatest Mobile Force Verification Kit are located on the right side panel of the electronics module. This single I/O zone contains:

**USB-A Data Export Port** - Positioned on the right side of the electronics panel. Used for exporting measurement logs and calibration files.

**USB-C Charging Port** - Located directly next to the USB-A port on the same right side panel. Serves as the primary charging interface for the internal Li-ion battery.

**M12 5-Pin Load Cell Connector** - Mounted on the right side panel, grouped with the USB ports. Supports differential signal lines, excitation voltage, and the load-cell identification resistor. The threaded locking mechanism ensures secure attachment.

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## Internal Components

**Battery Module** - A high-capacity Li-ion battery pack ( $\approx 5000$  mAh) provides 8–10 hours of operation. The module is mounted inside the sealed electronics enclosure to maintain IP protection.

**Main PCB Assembly** - The main PCB assembly houses the microcontroller, 24-bit ADC, instrumentation amplifier, passive low-pass filters, power regulation circuits, and a memory module for data storage, all mounted on vibration-damped supports to ensure accuracy and reliability even in harsh environments.

**Aluminium Support Frame**- A rigid internal frame holds the electronics panel securely inside the Pelican case, providing structural reinforcement, shock absorption, and thermal separation between the battery and PCB.

**Foam Compartments** - Precision-cut foam sections store load cells and protect them during transport. Dedicated slots prevent cable strain, connector bending, and contact damage.

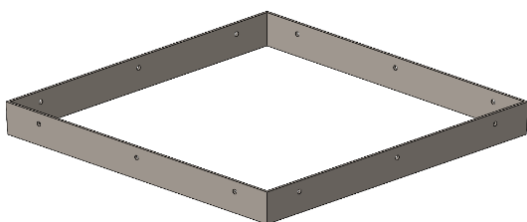
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## Carrying Case (Pelican 1500)

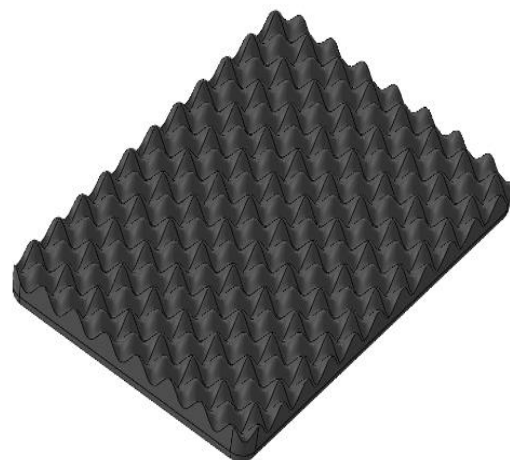
The entire system is integrated into a Pelican 1500 IP67-rated protective case, offering:

- Dust and water ingress protection
- Impact resistance
- Stable handling
- Secure latches and ergonomic carrying handle

The case is designed to keep the device operational even in demanding industrial environments.



**FIGURE 3: ALUMINIUM FRAME**



**FIGURE 4: FOAM CUT-OUT FOR THE TOP OF CASE**

## SYSTEM LAYOUT

The Innovatest Mobile Force Verification Kit integrates its electronics, connectors, user interface, and power system into a compact, rugged IP67-rated enclosure. This section provides an overview of the physical layout, component arrangement, and functional zones inside and outside the device.

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### Front Panel Layout

The front panel of the Innovatest Mobile Force Verification Kit features a 10-inch resistive touchscreen centered for primary operation, a power button positioned directly above it and centered horizontally, an emergency stop button located on the right side and separated from frequently used controls to prevent accidental activation, and a status LED indicator placed immediately next to the emergency stop button that provides visual feedback on power state, system activity, errors, and battery warnings.

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### Side and Rear Layout

The side panel of the Innovatest Mobile Force Verification Kit includes a USB-A data port for exporting calibration data and measurement files, a USB-C charging port positioned nearby as the primary interface for the internal Li-ion battery with recessed placement to prevent accidental impact, and an M25-pin load cell port that supports signal+, signal-, excitation supply, ground, and an identification resistor for automatic load-cell recognition, with a threaded design to ensure secure locking during testing.

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### Internal Layout

Inside the Pelican case, the Innovatest Mobile Force Verification Kit is organized into functional zones for protection, convenience, and efficient operation.

The electronics module is a sealed, aluminium-mounted enclosure that houses the main PCB, ADC and amplification stages, power regulation circuitry, internal memory, and the battery pack, maintaining an IP67 rating to safeguard the electronics from dust and moisture.

The Li-ion battery is mounted within the electronics enclosure and is thermally isolated from the other components. Built-in safety circuitry regulates charging and protects the battery from overcurrent or overvoltage conditions, ensuring safe and reliable operation.

Precision-cut foam compartments store Innovatest-approved load cells securely, each in a dedicated slot to prevent connector strain or mechanical stress.

Additional compartments hold accessories such as USB cables, M12 adapters, USB sticks, and documentation, keeping them organized and reducing clutter during field operations.

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## Pelican Case Layout

The Innovatest Mobile Force Verification Kit is housed in a Pelican 1500 IP67-rated case designed for industrial transport and field operations. Its structural features include a dual-latch locking mechanism, pressure-equalizing valve, rubber perimeter sealing gasket, shock-absorbing foam inserts, and a reinforced carry handle. The case protects the device from vibration, impact, water spray or immersion, and dust or airborne contaminants.

### Functional Zones Overview

The overall system layout is divided into:

User Interaction Zone - Touchscreen, LED indicator, and primary buttons.

Input/Output Zone - USB-A, USB-C, and M12 load cell connector.

Processing Zone - Main PCB and signal conditioning circuitry.

Power Zone - Battery pack and protective power management circuitry.

Storage Zone - Foam compartments for load cells and accessories.

This layout ensures easy operation, safe cable routing, and fast access during calibration or verification procedures.

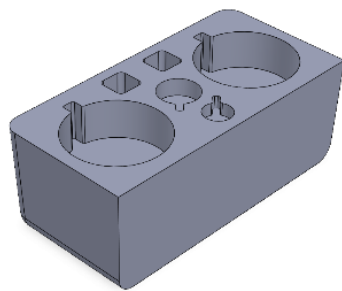


FIGURE 5: LOAD CELL COMPARTMENT

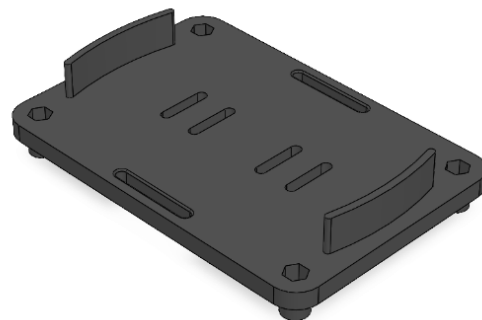


FIGURE 6: BATTERY CRADLE

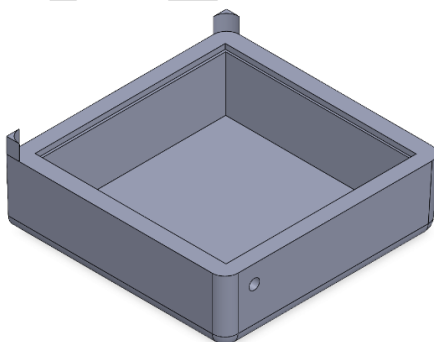


FIGURE 7: ALUMINIUM BOX FOAM

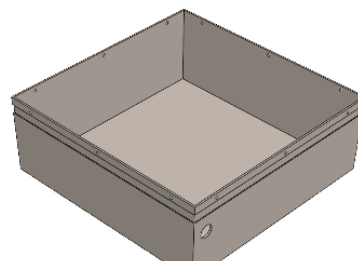


FIGURE 8: BASIN

# ASSEMBLING & OPERATING INSTRUCTIONS

## ASSEMBLING AND PREPARING

The Innovatest Mobile Force Verification Kit is designed for quick setup and reliable operation in both laboratory and industrial environments. This section provides detailed instructions for opening the case, preparing the workstation, connecting load cells, and ensuring the system is ready for use.

---

### Opening the Case

Before operating the system, ensure the protective Pelican case is placed on a stable, flat surface. Follow these Steps:

1. Release both front latches and gently lift the lid.
2. Fully open the case until it reaches its locked hinge position.
3. Visually inspect the internal compartments to confirm all components are correctly seated in the foam inserts.
4. Ensure no loose objects are resting on the touchscreen or electronics panel before proceeding.

Important notes: do not force the lid open beyond its hinge limit, and avoid opening the case in environments with high dust, moisture, or airborne contaminants.

---

### Workstation Preparation

Before connecting any equipment or powering the system, ensure the environment is suitable for accurate measurement. Recommended conditions include a clean, vibration-free surface, an ambient temperature between 0°C and 60°C, no nearby sources of electromagnetic interference such as welders, high-power motors, or induction heaters, and sufficient clearance to fully open the case and route cables safely.

Avoid exposing the system to direct sunlight on the touchscreen, placing it on oily or contaminated surfaces, or working in crowded spaces where cables may be stepped on or accidentally pulled. Maintaining these precautions helps ensure reliable measurements and prevents damage to the equipment.

---

### Inspecting the Components

Before use, check all components, including the touchscreen, USB-A and USB-C ports, M12 load cell connector, load cells, and foam inserts for damage or wear; if any issues are found, do not proceed and contact Innovatest service personnel.

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## Connecting the Load Cell

The load cell must be connected before calibration or measurement.

1. Align the M12 5-pin connector with the port on the electronics module.
2. Carefully push in and twist to secure using the threaded locking mechanism.
3. Ensure the connector is fully tightened by hand—do not use tools.
4. Verify that the cable is routed so it does not interfere with the hardness tester's moving components.

Warnings: Do not force the connector to prevent pin damage, avoid connecting or disconnecting the load cell with wet hands, and take care to prevent sharp bends or crushing of the cable.

---

## Preparing the Power System

Before powering the system, ensure sufficient battery life by briefly pressing the power button to check the LED indicator; if the battery is low, connect a certified USB-C charger before starting any measurement. Charge only within 0°C–60°C, keep the USB-C port clean and dry, and avoid operating the system during rapid charging if the unit becomes warm.

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## Preparing the Touchscreen Interface

Before powering on, remove dust using a microfiber cloth, ensure no foreign objects are touching the screen, and check that gloves, if used, are clean and dry to maintain proper touchscreen responsiveness.

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## Initial System Power-On

Once all components are in place, press the power button for one second and wait for the boot sequence to complete. The main menu will then appear, providing access to Calibration, Measurement, Data Logging, Settings, and Peak/Hold functions.

If the device fails to start, check the battery level, ensure all connectors are properly seated, and inspect the emergency stop button to confirm it is in the unactivated position.

---

## Ensuring Measurement Readiness

Before beginning calibration, confirm that the load cell is securely attached, the cable is not twisted or tensioned, the hardness tester is properly aligned to apply force to the load cell, no vibration sources are present near the workstation, and the touchscreen responds correctly to inputs. Only proceed to the calibration or measurement phase once all these conditions are met.



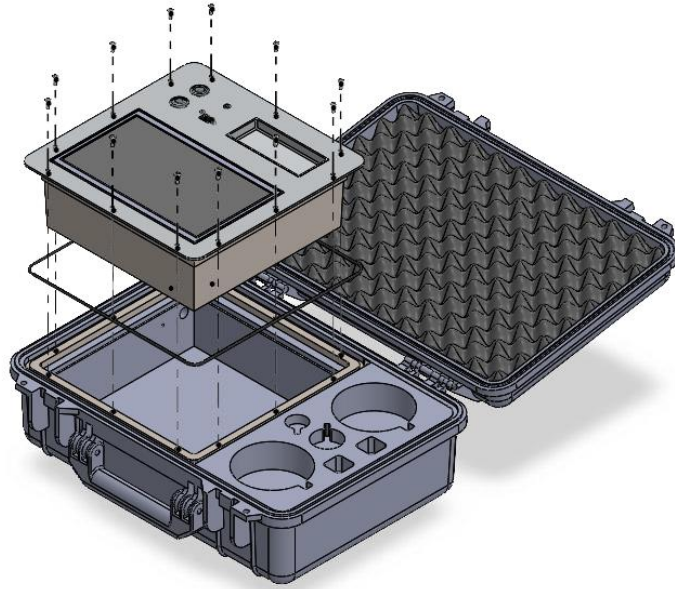


FIGURE 9: VIEW OF FINAL ELECTRONICS ASSEMBLY INTO PELICAN CASE

## OPERATING INSTRUCTIONS

The Innovatest Mobile Force Verification Kit is designed for intuitive operation in both laboratory and field environments. This section explains the essential functions of the user interface, navigation, measurement modes, and system interactions. Follow these instructions to ensure accurate measurements and reliable long-term performance.

### Powering the Device On and Off

To power on, ensure the load cell is connected, press the Power Button for one second, and wait for the Main Menu to appear. To power off, confirm no operation is in progress, hold the Power Button for two seconds, and wait for the screen to go dark. If the system does not start, check the battery, emergency stop button, and connectors for damage or contamination.

### Understanding the Main Menu

After booting, the Main Menu displays Calibration, Measurement, Peak & Hold, Data Log, and Settings, with a Back button in the upper-left corner and the battery indicator on the upper-right. The touchscreen allows easy selection of menu items, with buttons sized for glove use and a consistent navigation hierarchy.

### Live Measurement Mode

The Measurement screen shows real-time force readings from the connected load cell, including the current force value, unit (N, kN, kgf, gf), a live force-versus-time graph,



load cell identification, and status messages. Controls include Start/Stop Measurement, Zero/Tare, Peak & Hold shortcut, and Return to Main Menu. For accurate readings, ensure the load cell is free from pre-loads or side forces, keep cables untensioned, and avoid touching the load cell during measurement.

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### **Using the Peak & Hold Function**

Peak & Hold mode captures the highest force recorded during a test. To use it, select Peak & Hold from the Main Menu or the measurement screen shortcut, apply force with the hardness tester, and the system will capture and hold the maximum value until reset. This mode is ideal for hardness tester verification, mechanical testing, dynamic or impact force monitoring, and any situation requiring instantaneous peak measurement.

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### **Zero and Tare Functions**

The Zero and Tare functions ensure measurements start from a valid baseline. Zero removes small sensor offsets and should be used when no force is applied, while Tare compensates for known pre-loads or fixture weights by establishing a new reference point. Do not press Zero or Tare under significant load, and always verify stability before using these functions.

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### **System Notifications and Status Messages**

During operation, the device may display messages such as “Load Cell Detected,” “No Load Cell Connected,” “Cable Error,” “Overload,” “Low Battery,” “Storage Full,” or “Export Successful.” Users should always follow the on-screen instructions when any notification appears.

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### **Using the Settings Menu**

The Settings section lets users adjust preferences and system parameters, including measurement units, display brightness, graph display modes, power-saving settings, system information, calibration history, and a password-protected factory reset. Only authorized personnel should modify advanced settings.

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### **Emergency Stop Function**

The emergency button immediately stops measurement, calibration, or data logging and should be used during unexpected force spikes, loose fixtures, unstable load conditions, hardware malfunctions, or unsafe operator situations. After activation, the system freezes all operations, and the button must be returned to its normal position before resuming.

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## Low Battery Operation

If the battery reaches a critical level, a warning will appear on the display, measurement functions may be disabled, and calibration should not be performed until the device is recharged. To preserve battery life, lower the screen brightness, close unused menus, and disconnect the charger once fully charged.

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## Shutting Down After Use

Before closing the case, stop all measurements, turn off the device, disconnect the load cell if transporting, coil cables loosely, and inspect the interior for loose items, then close and latch the Pelican case securely. Following these steps ensures safe long-term operation and maintains environmental sealing.

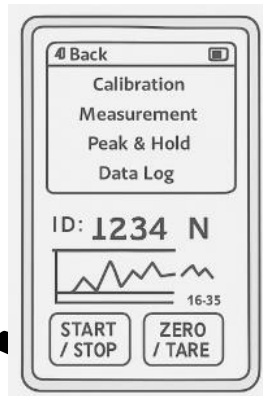


FIGURE 10: MAIN MENU ILLUSTRATION

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## CALIBRATION & DATA MANAGEMENT

### CALIBRATION PROCEDURE

Calibration ensures that the load cell readings are accurate and traceable. The Innovates Mobile Force Verification Kit supports multi-point calibration procedures designed for hardness tester verification. Follow the steps below before performing any critical measurements.

---

### Preparation

Before you begin, ensure that the load cell is properly connected and identified by the system, the device is placed on a stable, level surface, no external forces are applied to the load cell, and the battery is sufficiently charged. These precautions help prevent calibration drift and ensure repeatable measurements.

To start calibration, power on the device and select Calibration from the Main Menu. Confirm the detected load cell model and serial number, then choose the number of calibration points, typically between one and five. The system will then prepare the calibration screen, displaying the target force and stability indicators.

---

### **Applying Calibration Forces**

To perform measurements, gradually apply force using the hardness tester or reference system and hold it steady when prompted by the screen. Wait for the LED or on-screen indicator to confirm stability, at which point the system will automatically record the force. Ensure not to exceed the load cell's rated capacity, avoid sudden impacts, and prevent any cable movement or vibrations during measurement.

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### **Completing All Calibration Points**

The system guides you through each calibration point. Move to the next target force when prompted and follow the same procedure to ensure stability and record the measurement. If an error or significant deviation occurs, repeat the step. After all points are collected, the system automatically calculates the calibration line.

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### **Saving Calibration Data**

After the final point, the device shows a summary including linearity and offset. Review the calibration curve for any abnormalities; if satisfied, press Save to store the results in the system memory. A default, timestamp-based filename is provided, and the calibration files can later be exported via USB.

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### **Recalibration Recommendations**

Calibration should be performed whenever the load cell may have been overloaded, after transportation or exposure to shock, and at regular intervals according to quality procedures. Regular recalibration ensures reliable verification results and maintains traceability.

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### **Short Error Handling**

These common issues may occur:

- “Unstable Load” → Reduce vibration, apply force steadily
- “Load Too Low/High” → Adjust applied force closer to target
- “Measurement Noise” → Check cable routing and connector tightness

Most errors resolve by repeating the point under stable conditions.

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## DATA LOGGING AND EXPORT

The Innovatest Mobile Force Verification Kit stores measurement and calibration data internally and provides options for reviewing, managing, and exporting records. This section explains how to log new data, access stored files, and transfer information to external devices.

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### Data Logging Overview

The system records continuous force measurements and calibration results, including time-stamped force curves, peak values, calibration points, load cell identification, and any operator notes. This logging ensures traceability and supports quality-control procedures.

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### Starting a New Data Log

To record data, select Data Log from the Main Menu and press Start Logging. Apply force or perform the required test, then press Stop Logging when finished. The data is saved automatically, so ensure sufficient battery life for long sessions and avoid cable movement to maintain clean signal recordings.

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### Viewing Logged Data

Stored logs can be accessed from the internal memory by navigating to Data Log → View Records and selecting an entry. The system displays a force-versus-time graph, key measurement statistics, and metadata such as load cell type and date. It's recommended to review the data before exporting to ensure the test captured the desired information.

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### Deleting Data Logs

To free memory, select the record you want to delete and press Delete, then confirm when prompted. Be aware that deleted files cannot be recovered.

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### Exporting Data via USB

The system allows exporting stored logs to a USB stick in formats such as CSV, TXT, or proprietary structures. To export, insert the USB stick, navigate to Data Log → Export Data, and choose to export a selected file or all files. Wait for the "Export Successful" message and use the USB Eject function before removal. Do not remove the USB during export, and if it fails, check the stick's format or available space. Large files may require additional transfer time.

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## File Naming and Structure

Exported files use timestamp-based filenames and include load cell identification and calibration or measurement labels, making it easier to organize and manage verification records over time.

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## Troubleshooting During Export (Short)

- USB Not Detected: Check the port and try another USB-stick.
- Export Interrupted: Repeat the export and avoid touching cables.
- Corrupted Files: Ensure proper eject procedure and retry.

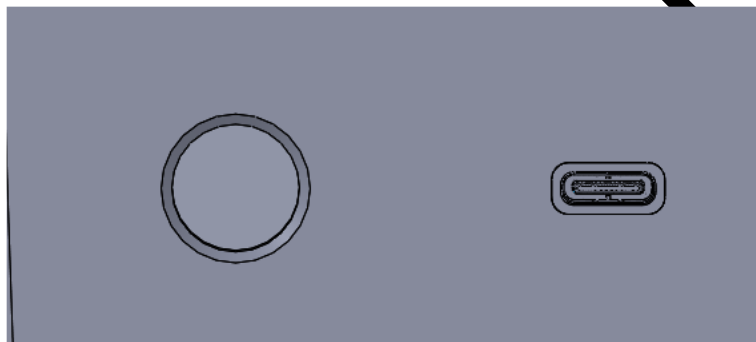


FIGURE 11: ZOOMED VIEW USB-C PORT

## TROUBLESHOOTING

This section provides guidance for diagnosing and resolving common issues that may occur during operation of the Innovatest Mobile Force Verification Kit. Most problems can be corrected through simple checks of connectors, cables, or basic system settings. For persistent issues, contact Innovatest support.

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**Load Cell Not Detected** - If the load cell is not detected, it could be due to the M12 connector not being fully tightened, contaminated or misaligned pins, or a damaged cable. To fix this, disconnect and reconnect the M12 connector, inspect and clean the pins if needed, verify that your load cell model is supported, and try a different cable if available.

**Incorrect or Unstable Load Cell Identification** - Incorrect or unstable identification can occur if the cable is under tension, bent sharply near the connector, or exposed to electromagnetic noise from nearby welders or motors. Ensure the cable is free and avoid nearby sources of interference.

**Unstable Readings** - Unstable readings are often caused by cable motion, vibrations on the workstation, electromagnetic interference, or a loose connector. Stabilize the environment, route cables properly, and tighten the M12 connector to resolve this.

**Force Values Too Low or Too High** - Incorrect force readings can result from improper use of zero or tare functions, misaligned applied force, or a load cell capacity mismatch. Re-zero the device with no load and ensure proper alignment with the hardness tester.

**No Force Displayed** - If no force is displayed, the load cell may be disconnected, internal protection may have activated, or the system may need a restart. Reconnect the load cell, restart the device, and inspect the cable for damage.

**Calibration Step Fails** - Failures during calibration usually happen when force is applied too quickly or is unstable. Apply force gradually, hold it steady until the system confirms stability, and eliminate any vibration or cable strain.

**Calibration Curve Looks Incorrect** - An incorrect calibration curve may indicate misalignment of the load cell, wrong calibration weights, or environmental noise. Repeat calibration in a stable environment and verify proper load application.

**USB-Stick Not Recognized** - USB issues can occur if the format is unsupported, the port is dusty, or the drive is faulty. Use a FAT32-formatted USB stick, clean the USB port, and try a different device.

**Export Fails Mid-Transfer** - Export failures may happen if the USB is removed too soon, storage is full, or the file is too large. Wait for the "Export Successful" message before removing the USB and ensure enough storage space.

**Touchscreen Not Responding** - A touchscreen may fail to respond due to thick gloves, moisture, dirt, or software freeze. Clean the screen and press the Emergency Stop before restarting the device.

**Screen Too Dim** - Dim screens are usually caused by low brightness settings or strong reflections. Increase brightness in settings or adjust the device angle and lighting.

**Device Does Not Turn On** - If the device doesn't turn on, the battery may be depleted or the emergency stop engaged. Charge the device for at least 10 minutes and release the emergency stop.

**Rapid Battery Drain** - Rapid battery drain can result from heavy usage, extreme temperatures, or battery aging. Reduce screen brightness, avoid cold environments, and contact service if necessary.

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### Internal Error Messages (Short Explanation)

- "Overload" → Applied force exceeds load cell capacity
- "No Cell Connected" → M12 cable disconnected
- "Storage Full" → Delete or export data

- “Sensor Error” → Cable or connector issue
- “Low Battery” → Recharge immediately

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## When to Contact Innovatest Support

Reach out to authorized service if the load cell fails repeatedly, the electronics module becomes unusually hot, battery performance drops significantly, internal error messages appear consistently, or the device has been dropped or impacted. Do not attempt repairs yourself, as this will void the IP67 protection and warranty.



FIGURE 12: CONTACT US

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## TECHNICAL SPECIFICATIONS

The following technical specifications describe the mechanical, electrical, environmental, and performance characteristics of the Innovatest Mobile Force Verification Kit. All values are based on standard operating conditions and may vary slightly depending on load cell model, environment, and usage.

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### Housing and Construction

The device is housed in a Pelican 1500 enclosure, providing IP67 protection against water and dust. The case is made from high-impact polypropylene with stainless steel hardware, and features a reinforced aluminium internal frame. Precision-cut foam inserts protect the load cells and accessories inside.

### Dimensions & Weight

The total weight is approximately 5–6 kg, depending on the load cells included. The case dimensions are around 472 × 362 × 190 mm (L × W × H). The electronics module is a compact sealed assembly mounted securely inside the case.

## Touchscreen Specifications

The device features a 10-inch diagonal industrial-grade resistive touchscreen that supports input from gloves, a stylus, or bare hands. It offers adjustable brightness and a single-touch command interface for user interaction.

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## Power System

The device is powered by a lithium-ion rechargeable battery pack with a capacity of approximately 5000 mAh, providing a typical runtime of 8–10 hours depending on usage and screen brightness. It charges via USB-C in 1–2 hours using a certified charger and includes protection circuits for overcurrent, overvoltage, temperature, and short-circuit safety.

## Input/Output Ports

The device includes a USB-A port for data export using USB sticks and a USB-C port dedicated to charging. It also features an M12 5-pin connector for load cell interfacing, offering selectable excitation voltages of 5 V or 10 V, a differential analog signal input, and an identification pin using a voltage-divider system for automatic load cell recognition.

## Electronics

The device is equipped with a 24-bit Delta-Sigma high-resolution ADC and a precision instrumentation amplifier. It features passive low-pass filters to reduce noise and includes internal non-volatile memory for storing calibration data and measurement logs. An industrial-grade embedded microcontroller handles processing tasks.

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## Supported Load Cells

The system is designed for Innovatest force verification load cells and supports at least six different models. Load cells are automatically identified through resistor coding, and connections are secured with a threaded M12 locking connector.

## Measurement Range

The device typically supports a measurement range from 10 gf to 3000 kgf, with overload protection provided by the load cell hardware. Measurement linearity depends on the characteristics of the connected load cell.

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## Resolution & Accuracy

The measurement resolution depends on the load cell sensitivity, typically around 4 mV/V. Accuracy is determined by the sensor calibration and the ADC characteristics, while data is refreshed in real time on the measurement display.

## Signal Quality

The device features a differential input design for enhanced noise immunity and is compatible with shielded cables. It also includes automatic detection of unstable force



conditions to ensure reliable measurements.

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## Environmental Specifications

The device is designed to operate in temperatures ranging from 0°C to 60°C with a humidity level of 10% to 90% non condensing. For accurate and reliable performance, it should be used on stable surfaces to minimize the effects of vibration.

For storage, the device can be kept in temperatures between –20°C and 60°C with a humidity range of 10% to 90% non condensing. For long term storage, it is recommended to maintain the battery charge level between 40% and 60%.

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## Software Features

### User Interface

- Icon-based navigation
- Multi-language support (if enabled)
- High-contrast layout for industrial visibility

### Functional Features

- Multi-point calibration
  - Live measurement graph
  - Peak & Hold mode
  - Data logging
  - USB export
  - Load cell auto-recognition
  - Internal file management
- 

## Compliance and Safety

### Certification

(General template, modify based on final university or project requirements)

- Designed according to common industrial safety guidelines
  - RoHS-compliant components (where applicable)
  - Internal electrical protections for battery safety
-

# WARRANTY, SUPPORT & COMPLIANCE

## WARRANTY AND SUPPORT

The Innovatest Mobile Force Verification Kit is engineered to provide reliable performance during force-verification and calibration tasks. This section outlines the warranty terms, service conditions, and recommended procedures for obtaining technical assistance.

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### Warranty Coverage

The device and its components are covered under standard Innovatest warranty policies. This coverage includes manufacturing defects in materials or workmanship, electronic component failures not caused by misuse, battery defects within specified aging and cycle limits, and functional issues that occur during normal operation.

### Warranty Validity Conditions

The warranty remains valid provided the device is used strictly for its intended force verification purpose, with no unauthorized modifications or repairs. The electronics module must not be opened or tampered with, and the device should not be exposed to impact, liquid intrusion, or extreme environmental conditions. All components, including load cells, cables, and accessories, must be handled and used properly.

The warranty does not cover damage resulting from misuse, improper operation, or negligence, nor mechanical damage caused by drops, crushing, or improper transport. It also excludes battery degradation due to aging or prolonged deep discharge, damage from using non-approved load cells or accessories, corrosion or contamination caused by chemical exposure, and failures resulting from incorrect calibration practices.

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### Service and Repair Process

If the device requires inspection or repair, contact Innovatest technical support using the provided contact information and be ready to share the device model, serial number, and load cell type if applicable. Clearly describe the issue, including when it occurs and any error messages shown, and if requested, ship the device in its original Pelican case to ensure safe transport.

Do not attempt to open or repair the internal electronics module yourself, as unauthorized access will void the warranty and may compromise the IP67 protection.

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### Technical Support Assistance

Innovatest provides support for system setup and configuration, load cell compatibility questions, calibration procedure guidance, data export issues, troubleshooting

unexpected readings, and battery or charging concerns. Support personnel are available to assist via email, telephone, or remote consultation, depending on availability.

### **Required Information for Support Requests**

To speed up service processing, prepare the following information:

- Device model and serial number
- Load cell type and serial number
- Firmware or software version
- Description of the issue
- Steps already taken to resolve the problem
- Recent calibration or usage history

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### **Replacement Parts and Accessories**

Replacement accessories such as load cell cables, USB charging cables, USB A export drives, foam inserts or other protective components and Pelican case hardware can be obtained through authorized Innovatest distributors. Before ordering replacement load cells, it is recommended to contact service to confirm compatibility.

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### **Returning the Device for Service**

When shipping the unit, secure it in the foam inserts inside the locked Pelican case and use extra outer packaging if required. Do not include loose load cells, and attach proof of purchase with a detailed issue description, as Innovatest is not responsible for damage caused by improper packaging.

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### **Out-of-Warranty Service**

For devices that are no longer under warranty, paid service and repair options are available, including possible battery replacement depending on the model. Load cells can often be recalibrated or replaced, and the support team will provide a cost estimate before any service begins.

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### **End of Life and Disposal**

At the end of the device's life, lithium-ion batteries should be disposed of following local environmental regulations. The device itself must not be incinerated or thrown in general waste, and Innovatest should be contacted for guidance on disposal.

## COMPLIANCE AND CERTIFICATIONS

The Innovatest Mobile Force Verification Kit is designed and manufactured according to commonly accepted industry standards for electrical safety, environmental performance, and electromagnetic compatibility. Although certification status may vary based on prototype or production level, the device follows established guidelines to ensure safe and reliable operation.

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### General Safety Compliance

The device is designed following internationally recognized safety principles for electronic measurement equipment. These include proper electrical insulation and grounding, overcurrent and overvoltage protection for the battery, separation of high- and low-voltage sections, safe mechanical design to prevent user contact with hazardous components, and the use of non-flammable enclosure materials.

Disclaimer: Formal certification (e.g., CE, UL, CSA) may depend on the final production stage and configuration of the device. Users should follow all safety precautions and operational guidelines provided in this manual.

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### Electromagnetic Compatibility (EMC)

The system is designed to minimize conducted and radiated emissions and to resist interference from external electromagnetic sources by following the EN 61000 family of EMC standards. It incorporates shielded cables to reduce noise, differential measurement inputs for improved immunity, and passive filtering components on the PCB. Users should avoid operating the device near strong electromagnetic sources such as welding equipment, high-frequency motors, or induction heaters, and if abnormal measurement noise occurs, they should inspect cable routing and reduce EMI exposure.

---

### Environmental Compliance

Where applicable, components used in the system adhere to environmentally responsible guidelines, including reducing hazardous substances in electronics, using recyclable materials in the protective case, and providing environmentally considerate disposal recommendations. Users should not dispose of electronic components with general waste but follow local regulations for electronic waste. Batteries must be recycled or returned to an appropriate collection facility.

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### Battery Safety Compliance

The lithium-ion battery pack includes overcurrent and overvoltage protection, temperature monitoring, and short-circuit protection, following widely adopted

international battery safety practices. Users should not attempt to open, modify, or replace the battery, as incorrect handling may result in fire, chemical leakage, or explosion.

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### Load Cell and Signal Interface Compliance

The load cell interface is designed according to common industrial measurement signal standards, providing 5 V or 10 V excitation supply, differential analog sensing, and noise reduction through shielding and filtering, while using industry-standard M12 connectors. These features ensure compatibility with standard force measurement devices.

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### Prototype and Development Compliance Statement

For university, prototype, or research versions of the device:

- The system is intended for controlled environments
- It should be operated only by trained personnel
- It is not intended for medical or life-support applications
- It must not be used in safety-critical or production environments without additional certification

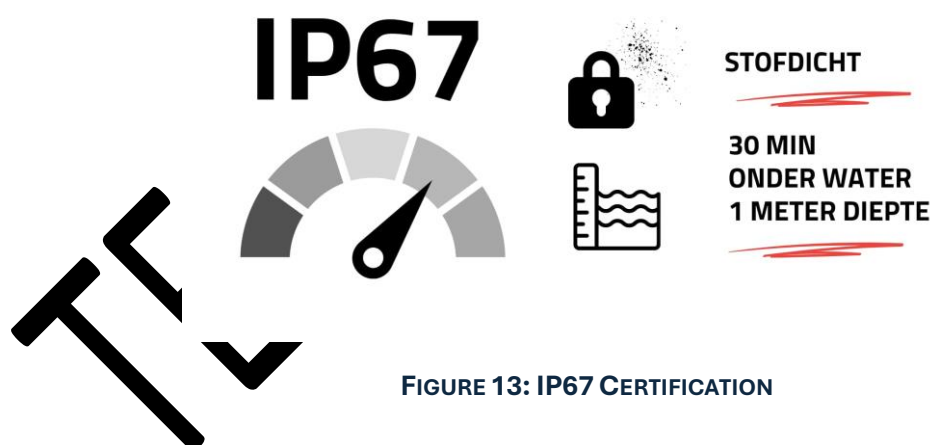


FIGURE 13: IP67 CERTIFICATION