Tuffer III Loader Scale System

Installation and Calibration Manual

ON-BOARD WEIGHING
A VPG Brand

Original manual
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Please completely read this document and the contained safety instructions and note all given information before usage.
Keep available for further consideration!

Introduction

Congratulations on your purchase of a new Tuffer III scale system!

The care and quality that goes into each system we manufacture ensures years of trouble-free service for you.

Should you have any problem with the installation or operation of your scale, call us.
USA -Sales Support: 800-638-5111 | Technical Support: 206-375-2019
Canada – Sales and Technical Support: 800-989-1499.

This manual contains instructions on installation and troubleshooting of the Tuffer III scale system.

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1 General information

1.1 About this manual

This manual contains fundamental information for use during the operation and maintenance of the product. Prerequisite for safe operation is the compliance with all specified safety and handling instructions.

NOTE!	**Related documents!**
	• Related documents (additional manuals, specifications, declarations of conformity, ...) are available on request under tel.: 800-638-5111 or e-mail: sionboard@vpgsensors.com

This manual must be read and used by any person working on the machine.

This manual is part of the product and as such must be passed on to following owners. It must be permanently kept at the usage site and be available for operating personnel.

The illustrations in this manual shall are to provide better understanding. Illustrations in this manual are not drawn to scale and may differ from the original.

1.2 Limitations of liability

All statements and notes in this instruction manual have been compiled under current standards and regulations.

The manufacturer excludes any liability for damages caused by:

- Inappropriate assembling and installation
- Non-observance of the manual
- Non-intended and improper use
- Use beyond operation limits.
- Deployment of insufficiently qualified and trained personnel
- Use of unauthorized spare parts and accessory
- Rebuilding of the product

1.3 Structure of the safety instructions

SIGNAL WORD!	**Type and source of risk** Potential consequence(s) of non-observance • Preventive measures

Pictogram	Signal word	Meaning	Consequences of non-observance
EXAMPLES:  Danger  Specific danger, e.g., electric shock	**DANGER!**	Imminent danger	Death or severe injuries
	WARNING!	Potentially hazardous situation	Death or severe injuries
	CAUTION!	Potentially hazardous situation	Minor injuries
	**NOTICE!**	Potential material damages	Damage to the product / system or its surrounding
	**NOTE!**	Useful notice or tip on the product's / system's trouble-free operation	

1.4 Spare parts

CAUTION!	**Risk of injury caused by inaccurate spare parts!**
	Inaccurate, faulty, or unauthorized spare parts can cause damages, malfunctions or complete failure and impair safety. • Only use the original spare parts of the manufacturer.

Use only original spare parts and accessories authorized by the manufacturer. Failure to do so voids the warranty.

1.5 Terms of guarantee

This manual does not contain any covenant of guarantee.
The terms of guarantee are part of the sales and delivery conditions of SI On-Board.

1.6 Final decommissioning / disablement

At the final decommissioning the product must be disabled to protect it against reuse - as follows:

1) Switch off the power supply of the product.
2) Disconnect all poles.
3) Disassemble the product.
4) In components with connecting cables → cut off the connecting cable.
5) In components with connecting plugs →destroy the connecting plug.

1.7 Disposal

CAUTION!	**Risk of injury caused by inappropriate disposal of the product!**
	When burning plastic parts toxic gases emerge that can cause illnesses. • Dispose the product properly according to the current national country-specific disposal regulations.

CAUTION!	**Risk of injury caused by inappropriate disposal of the product!**
	Careless disposal enables unauthorised persons to improperly use the product. In doing so these persons and/or third persons can be severely injured, and the environment can be polluted. • At all times protect the product against the access of unauthorized persons.

2 Intended use.

The product has been exclusively designed and constructed for intended use as described here.

- The Tuffer III provides dynamic weight control directly during the loading process.
- The Tuffer III is designed and intended for outdoor installation (permanent installation).

WARNING!	**Risks caused by inappropriate use!**
	Any non-conventional use and/or different operation of the product can lead to hazardous situations. • Only use the product in a conventional manner.

NOTE!	**Collection and transmission of personal data!**
	The system is not intended for the collection and transmission of personal data. Otherwise, the Tuffer III data protection declaration applies.

2.1 Inappropriate use

- Non-conventional use
- Pressing the keys with tools or other auxiliary means
- Exceeding the limit values given on the data sheet
- Using the product without instruction
- Using the product beyond the limits of use
- Opening the product (unless not explicitly permitted for special purpose)
- Rebuilding or alteration of the product
- Commissioning the product after theft
- Using the product despite obvious defects or damages
- Using the product with unauthorized accessory from foreign manufacturers
- Using the product at insufficiently secured construction sites (e.g., at road works)
- Using the product to control machines, systems or moveable objects not equipped with an additional control device and superordinated safety unit.

2.2 Limits of use

The product must not be used in hostile or explosive environments.

Before working in hazardous environments, near electrical systems or in similar situations the operator must contact local safety offices and safety representatives.

2.3 Alteration and rebuilding of the product/system.

To prevent risks and ensure optimal performance neither alterations nor attachments or rebuilding of the product may be conducted without the manufacturer's explicit permission.

3 Safety

The safety instructions and warning notices stated here and, in this manual's, following chapters must be observed to reduce health risks and prevent hazardous situations.

3.1 Contents of the manual

Any person charged with operation of the product must have read and understood the manual before starting work.

3.2 The operator's responsibility

The operator of the product is liable for its operational safety.

Besides the operational safety instructions in this manual the safety, accident prevention and environmental protection regulations valid for the operational area of the product must be observed.

Particularly applying:

- The operator must inform himself/herself about the current operational safety regulations and, in a risk assessment, detect additional risks, which are caused by the special working conditions at the usage site of the product. These then must be implemented in the form of directives for the product's operation.
- These directives must be kept near to the product and permanently be available for the persons working with it.
- The operator must clearly define the personnel's responsibilities referring the appliance.
- The operator must ensure that the operating personnel fully understand the manual's content.
- The operator must ensure that all maintenance, inspection and assembling processes are conducted by qualified specialized personnel, which have informed themselves sufficiently by closely studying the manual.
- The operator informs the manufacturer or the authorized dealer if any safety defects occur at the product or during operation.

3.3 Operating personnel

WARNING!	**Risk of injury caused by insufficient qualification!**
	Inappropriate handling of the product can lead to severe personal injuries and material damages. • Have special working processes solely conducted by persons mentioned in this manual's respective sections.

In this manual the following qualifications are specified for the different areas of operation:

Instructed persons:	A person instructed by the operator or manufacturer about the assigned tasks and potential risks in case of inappropriate behaviour and if required semi-skilled and informed about the necessary safety arrangements and measures is referred to as instructed person.
Qualified specialized personnel:	Qualified specialised personnel in terms of this manual are persons who are familiar with the assembling, commissioning and operation of the product and possess qualifications corresponding to their tasks. Due to specialist training, knowledge, and experience as well as knowledge of the relevant regulations the specialised person is able to recognize hazards and avoid potential risks.

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3.4 Special risks

In the following section the residual risks emerging from the risk analysis are specified.

CAUTION!	**Manufacturer's specifications!**
	The product and its components can be assembled on different types of machines. • For this reason, the manufacturer's specifications must be strictly adhered to.

CAUTION!	**Risk of injury caused by moving machine parts!**
	During the controlling of the tool the machine's components and assembly groups are moved manually or automatically. Rotating and/or linearly moving components and assembly groups of the machine can cause severe injuries and material damages. • Keep people away from the machines and the tool's working range, respectively. • Remove objects from the machines and the tools working range respectively. • Do not interfere with the moving components during • operation. • Do not carry out any operations at the sensors when the system is in automatic mode.

CAUTION!	**Risk of injury caused by malfunction!**
	Uncontrolled machine actions caused by the malfunction of a system component can lead to severe personal injuries in the machine's working range or cause material damage. • Ensure that the machine is operated, controlled, and inspected by a qualified and experienced operator, who has to be able to induce emergency measures e.g., an emergency stop. • Keep people away from the machines and the tool's working range respectively. • Remove objects from the machines and the tool's working range respectively. • Secure the construction site.

CAUTION!	**Risk of injury caused by lacking or insufficient instruction!**
	Lacking or insufficient instruction can lead to operating errors or incorrect use. This can lead to severe personal injuries as well as severe material and environmental damages. • Observe the manufacturer's safety instructions and the operator's directives.

CAUTION!	**Risk of injury caused by overlapping machine parts!**
	Subsequently assembled system components (e.g., sensors) can overlap the typical machine dimensions. This can lead to injuries and material damages. • Keep people away from the machines and the tool's working range, respectively. • Remove objects from the machines and the tool's working range, respectively.

3.5 Safety systems

The product does not feature any superior safety systems.

3.6 Proceeding in case of danger and accidents

- Always be prepared for accidents or the event of fire!
- Keep first-aid-equipment (ambulance box, blankets etc.) within reach.
- Familiarize the personnel with accident notification and first-aid-equipment as well as emergency services.
- Keep the access routes clear for emergency vehicles.

4 Transport, packaging, and storage

4.1 Transport inspection

To ensure sufficient protection during transport the products have been packed carefully. Please immediately check the delivered goods for missing components or damage.

In case of external transportation damage proceed as follows:

- Do not or only under reserve accept delivery.
- Record the extent of the damage on the transport documents or the transporter's bill of delivery.
- File complaint.
- Do not put obviously damaged products into operation.

NOTE!	Claim every defect as soon as it is detected. Compensation claims can only be asserted complying with the current claim periods.
	

4.2 Transport

When taking your equipment to the usage site or in the field always ensure that the product is transported in secured and suitable containers.

Never transport the product loosely. The product's function may be harmed by impact.

Always use the original packaging, transport containers and transport boxes. The packaging protects the product against hits and vibrations.

4.3 Storage

Only store the product in well ventilated, dry rooms. During storage protect it against dampness preferably in the original packaging.

Avoid strong thermal fluctuation during storage. Incipient formation of water condensation can harm the product's function.

When storing observe the product's temperature limits. For the valid storage temperatures please see the product's technical data.

5 Product description

The Tuffer III provides dynamic weight control directly during the loading process. The weight is metered using pressure sensors that measure hydraulic pressure in front of and behind the hydraulic cylinder. As the position of the loading bucket also makes a difference, its position is also ascertained using slope sensors. The display shows the load being added by the bucket and adds up the total amount of material loaded for the job in real time. Alternatively, the operator can enter a target weight and the system will then count down to zero from it. This makes it possible to record exact weights and monitor for overload during loading without interrupting the work process. Journeys to stationary weighing stations are no longer necessary – thus avoiding unnecessary and time-consuming detours.

The Tuffer III provides reliable overload monitoring and due to the robust design of its components is suitable for use under the most demanding conditions. It is easy to operate – the clearly structured menu and the intuitive symbols are self-explanatory. Thanks to its different display modes, the color display is easy to read whether in direct sun or in the dark.

Fig. 5-1: Display Tuffer III

5.1 Product identification

A type of label is attached at a visible and easily accessible part of the product. The type of label shown here is an exemplary sample containing all given data.

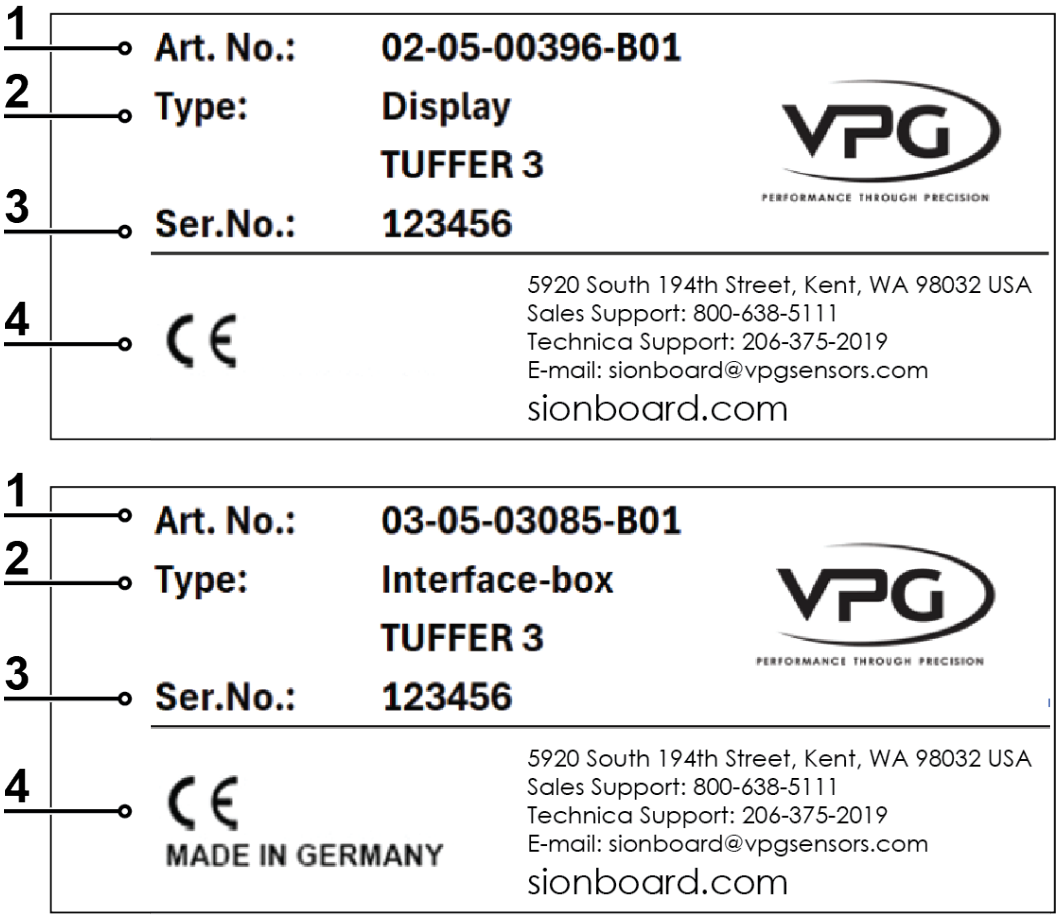


Fig. 5-2: Type label (sample)

1	Article number
2	Type designation
3	Serial number
4	CE-mark / E1-mark

6 System overview

Fig. 6-1: System overview

A	Tuffer III Display (7“, TFT, Touch)	02-05-00396-A01
B	Tuffer III-Interface-Box	03-05-03085
C	Pressure transmitter	03-04-00008, 03-04-00009
D	Slope sensor “MSSR-322“	04-21-20530
E	Slope sensor “MSSR-330“	04-21-20532
F	Terminating resistor	04-02-03602
G	Slope sensor “MSSR-330“	04-21-20533
H	Gateway/Modem	03-07-20218
I	Tuffer III USB stick	03-05-02091
J	Printer	04-01-00096

6.1 Graphic display

The sunlight-readable display features capacitive touch technology (PCAP). This way, the device can be operated via the scratch-resistant glass.

Fig. 6-2: Graphic display

Status bar	Display of important system status
Active attachment	For easy identification & control the Tuffer III can manage up to 5 attachments with different scaling. The currently mounted bucket or fork is displayed.
Current job	The currently running job is displayed.
Enter job lists	The Tuffer III can manage several predefined job lists. Also, you can save and recall each job.
Tip-off function	Allows to switch to static weighing and loose material while the actual weight is shown.

Measured weight in bucket	During the lifting process, the current load weight is live displayed (display runs simultaneously). When the lifting process is completed, the bucket is displayed in green. The current weight is corrected and checked. The result is shown with a green background.
Zero key	Activate a zero correction lift with an empty bucket/fork
Load on truck	Sum-weight already loaded on the truck
No. of buckets	Number of buckets already filled in the current job
Still to load	Weight still to be loaded
Target weight	Target weight of the current job
Create new job	Create a blank new job

6.2 Menu overview (parameters)

NOTE!	**Activation required!** Certain menu items are only shown, when an activation has been carried out or after a certain time.
	

Right Assignment	Time change allowed. Language change allowed. List Editing Allowed. Use Attachments Test Load-Assist	Enable / disable. Enable / disable. Enable / disable. Enable / disable. Enable / disable		
Attachments	Attachment 1 Attachment 2 Attachment 3 Attachment 4 Attachment 5			
Trailer	Selection None / 1 / 2 /3			
Scale Configuration	Loader Name Zero after New Job Zero Calibration Interval (min) Zero Calibration at Temp. Change Base Unit Maximum Weight Increments Number of increments Weighing Zone Weighing Position Locking Weight Release Time (ms) Lift detection (ms)	Edit Text Enable / disable. Edit Time in minutes. Edit Temperature in °Celsius. Selection t / kg / lb / ST / LT Edit weight value. Selection (base unit) 0.01 / 0.02 / 0.05 / 0.1 / 0.2 / 0.5 / 1 / 2 / 5 Result Maximum weight / increments. Edit minimum hydraulic oil temperature in ° Celsius. Edit start of weighing position in ° Edit locking weight value in base unit. Edit time value (ms) Edit time value (ms)		

Calibration	Basics	Set zero calibration point. Start calibration. Scale Factor Adjustment (+/- %) Correction using last weight. Correction using actual total. Adjustment MOBA scale with reference scale. Scale factor. Scale Factor Attachment 1. Scale Factor Attachment 2. Scale Factor Attachment 3. Scale Factor Attachment 4. Scale Factor Attachment 5. Cylinder compensation Factor 1. Cylinder compensation Factor 2 Speed Compensation Factor Long Slope Compensation Factor (p ositiv) Long Slope Compensation Factor (ne gativ) Long Slope Compensation Limit (posit iv) Long Slope Compensation Limit (neg ativ) Cross Slope Compensation Limit (pos itiv) Cross Slope Compensation Limit (nega tiv) Show limit value exceeded with icon only.	Function Function Edit % value +/- Edit weight value. Edit weight value. Edit 2 weight values. Edit factor value. Edit factor value. Edit factor value. Edit factor value. Edit factor value. Edit factor value. Edit factor value. Edit factor value. Edit factor value. Edit factor value. Edit ° value. Edit ° value. Edit ° value. Edit ° value. Enable / disable.	
	Measurement Quality	Different partial results. Quantity of partial results. Long slope Quality range.		
	Linearization	Linearization points 1 - 8		
	Angle compensation	Correction at -35° up to +55° in 5° steps		
	Slope sensor control	Set orientation of the slope sensor		
	Bucket sensor control	Set orientation bucket slope sensor		
	Pressure Sensors	Pressure Sensor 1 (Node ID 2) Actual Pressure. Actual temperature Temperature limit Valid range 1 (%) Pressure Sensor 2 (Node ID 3) Actual Pressure Actual Temperature Temperature limit Valid range 2 (%)	 Displayed value (bar) Displayed value (°C) Edit min. value (°C) Edit value (%) Displayed value (bar) Displayed value (°C) Edit min. value (°C) Edit value (%)	
	Tip off	Tip off automatic Start 'tip off delay' Tip off filter Tip off factor Use both pressure sensors		

Printer	Printer interface	Enable / disable printer. Select printer	MPR-580 STAR SP-298 STAR TSP-743 User defined	RS-232 / Printer settings
	Printer layout	Print ticket layout		
	Import Print Layout	Import from USB or local storage		
	Export Print Layout	Export to USB or local storage		
COM2	COM2 enabled (not switchable)	Setup for	Baud rate Data bits Parity Stop bits	1200 / 2400 / 4800 / 9600 / 19200 / 38400 8 / 7 + Par / 9 / 8 + Wake / 8 + Par Off / Even / Odd / Marked / Blank 1 / 1.5 / 2
		Test button to send test-file. File import from USB		
Modem	COM2 enabled (not switchable)	Select Modem	TRB-255 TRB-245 RUT-240 NG-800 NB-800	
MIP Server				
System	Ingition key OFF action	Shutdown Suspend	Enable / disable. Enable / disable	

Backup & restore	Save Tuffer III-Interface Box Restore Tuffer III-Interface Box Reset weighing ticket no. Backup display to USB Reset Settings to factory Default. Restore settings from USB. Reset Jobs and weightings. Restore jobs and weightings from USB. Restore data lists from USB. Save log files to USB. Set level to log. Enable CAN Debut Messages	Today / All / Select Debug /info /error Enable / disable.		
Conformity Assessment	Calibration jumper Function Check digit Operating mode Switchover calibration System identifier	System Serial no.		
Start Wizard	Select base unit. Expert Mode Start setup	Enable / disable. First setup / Partial Adjustement		

7 Assembly

This chapter is intended to assist the personnel authorized for installation during the required working steps.

Scan me	**In addition to the system installation described in this chapter, you can also watch the procedure in a video tutorial.** **To do this, please scan the QR-Code shown here**

WARNING!	**Risk of injury caused by insufficient qualification!** Inappropriate handling of the product can lead to severe personal injuries and material damages. • Have special working processes solely carried out by qualified persons mentioned in this manual's respective sections.

7.1 Mechanical assembly

WARNING!	**Risk of injury caused by moving machine parts!** When connecting to the hydraulics, machine components and assembly groups can move automatically and can cause severe injuries and material damages. • Keep people away from the machines and the tool's working range respectively.

CAUTION!	**Risk caused by damage or faulty connections!** Damaged components or faulty connections can cause malfunctions and severe material damages. • Before switching the system on carry out a visual examination. Check the components for damages and the connections for tight fit. • Do not use obviously damaged products.

CAUTION!	**Risk of injury caused by inappropriate assembly!**
	An assembly with improper auxiliary devices can cause injuries. • Only use suitable and tested tools. • Do not climb up the machine and the mast. • Use proper auxiliary devices (e.g., stepladder) and undertake safety precautions.

CAUTION!	**Risk of injury caused by moving machine parts!**
	During the controlling of the tool the machine's components and assembly groups are moved manually or automatically. Rotating and/or linearly moving components and assembly groups of the machine can cause severe injuries and material damages. • Keep persons away from the machines and the tool's working range respectively. • Remove objects from the machines and the tools working range respectively. • Do not interfere with the moving components during operation. • Do not carry out any operations at the sensors when the system is in automatic mode.

NOTE!	**Important note on appropriate function**!
	• The product and its components can be mounted on different equipment. This manual describes the basic assembly as well as the respective preconditions. • When mounting and connecting the system components in any case make sure that the connections are well accessible and that the connecting cables are long enough.

7.1.1 Installation of the bucket sensor

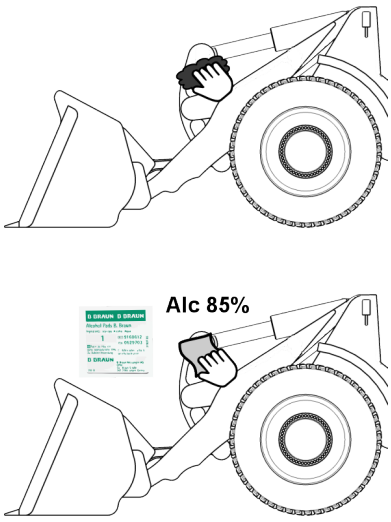


Fig. 7-1: Install bucket sensor

- Clean the mounting position with the enclosed cloths.

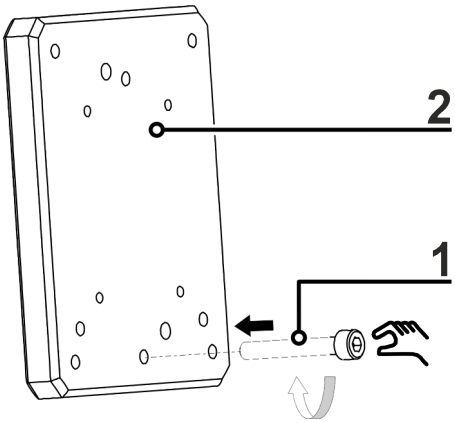


Fig. 7-2: Install bucket sensor

- Screw the adjusting screw M5x35 (1) into the mounting plate (2).

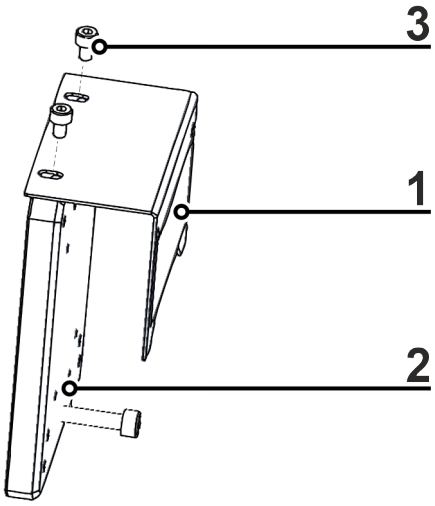
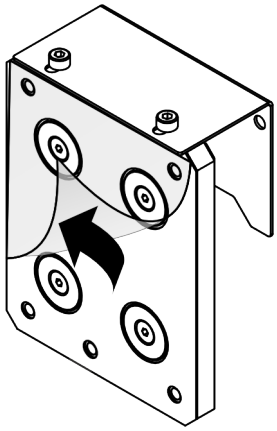


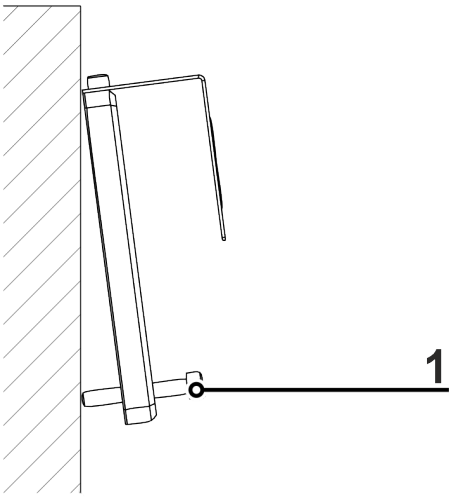
Fig. 7-3: Install bucket sensor

- Mount the sensor protection (1) on the mounting plate (2) using the two M4x6 screws (3).



- Peel off the top layer of the double-sided adhesive tape.

Fig. 7-4: Install bucket sensor

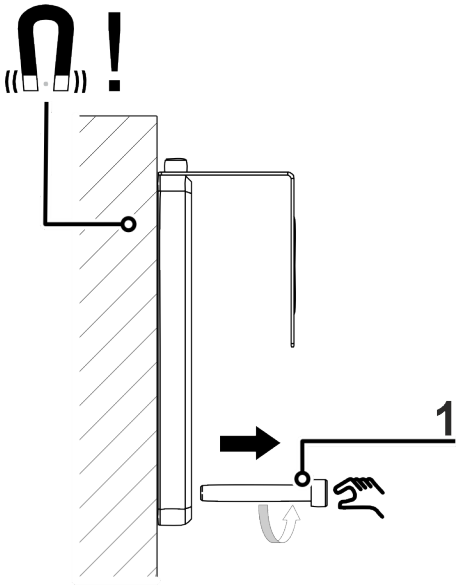


- Position the mounting plate on the mounting position (bucket).

The mounting plate tightens due to the magnets and the adhesive tape.

To prevent this from happening during the positioning the adjusting screw (1) can be used to assist.

Fig. 7-5: Install bucket sensor



- After the mounting plate is in the correct position remove the adjusting screw (1).

Fig. 7-6: Install bucket sensor

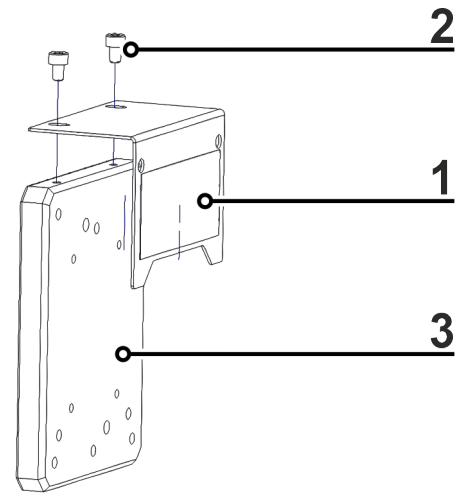


Fig. 7-7: Install bucket sensor

- Remove the sensor protection (1) from the mounting plate (2) using the two M4x6 screws (2).

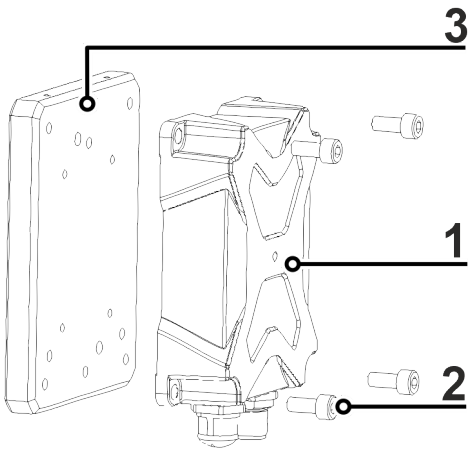


Fig. 7-8: Install bucket sensor

- Mount the sensor (1) on the mounting plate (3) using the two M5x12 (2) screws.

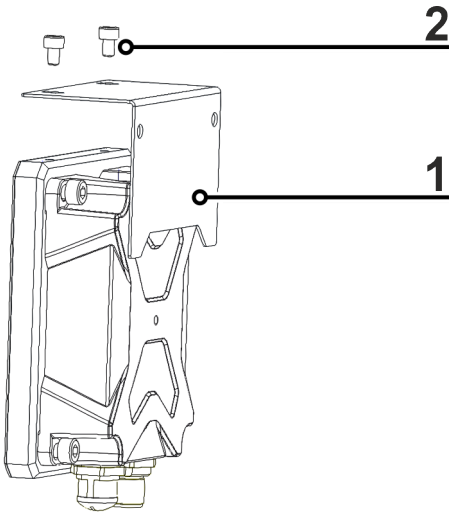


Fig. 7-9: Install bucket sensor

- Replace the sensor protection (1) using the two M4x6 screws (2).

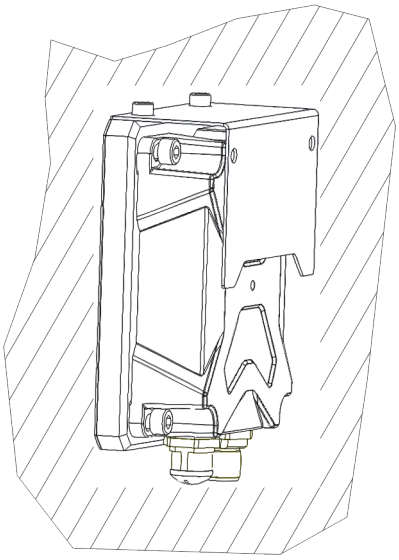


Fig. 7-10: Install bucket sensor

You can mount the sensor on the right or the left side of the deflection lever.

Do NOT mount the sensor on the top or bottom of the deflection lever.

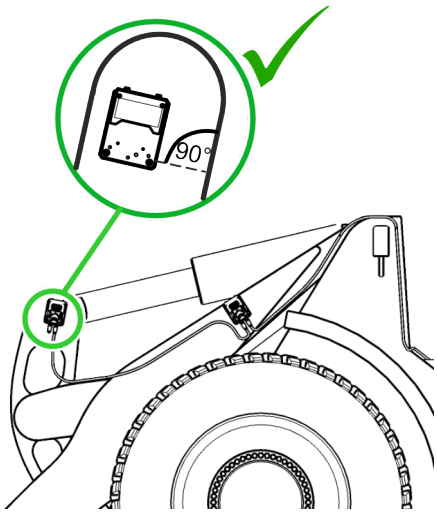


Fig. 7-11: Install bucket sensor

The sensor must be aligned parallel to the edge of the deflection lever (see illustration on the left).

7.1.2 Installation of the frame sensor

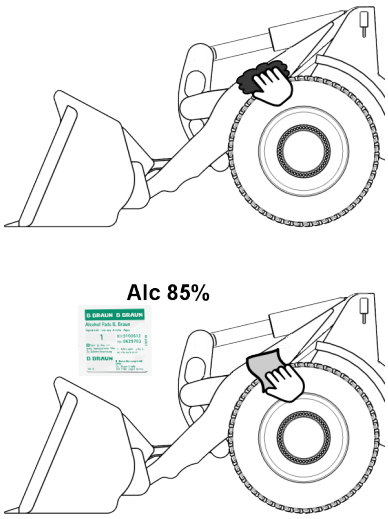


Fig. 7-12: Install frame sensor

- Clean the mounting position with the enclosed cloths.

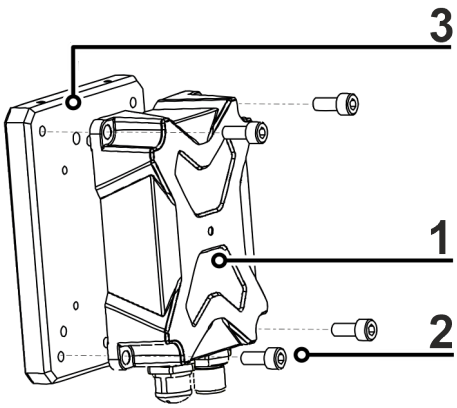


Fig. 7-13: Install frame sensor

- Mount the sensor (1) on the mounting plate (3) using the M5x12 (2) screws.

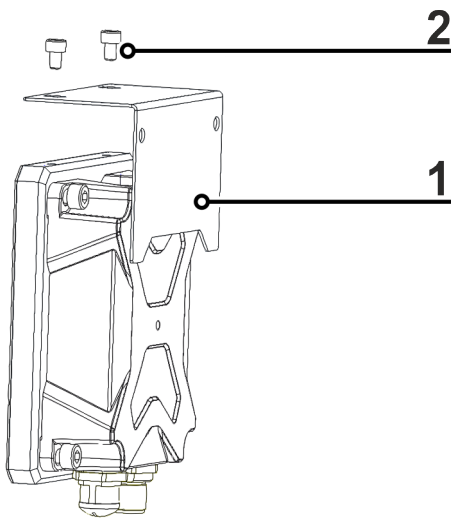


Fig. 7-14: Install frame sensor

- Mount the sensor protection (1) using the two M4x6 screws (2).

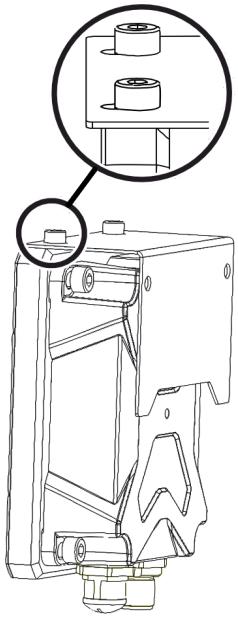


Fig. 7-15: Install frame sensor

- Pay attention to the positioning of the sensor protection (see figure on the left).

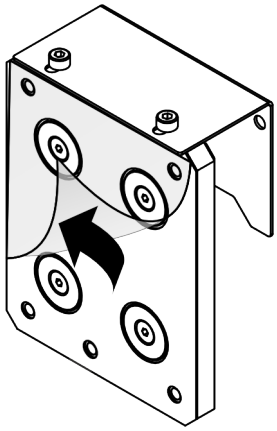


Fig. 7-16: Install frame sensor

- Peel off the top layer of the double-sided adhesive tape.

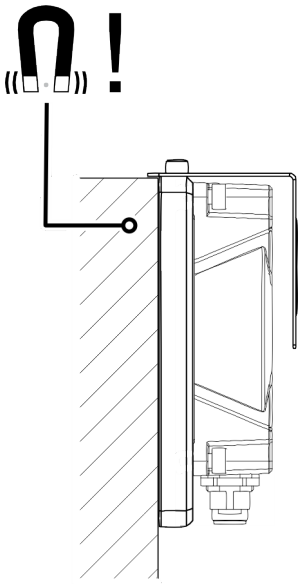


Fig. 7-17: Install frame sensor

- You can use the sensor protection to install the sensor parallel to the edge.

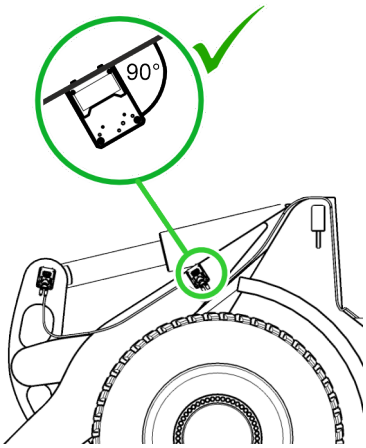


Fig. 7-18: Install frame sensor

The sensor must be aligned parallel to the edge of the H-Frame (see illustration on the left).

You can mount the sensor on the right or the left side of the H-Frame.

Do NOT mount the sensor on the top or bottom of the H-Frame.

7.1.3 Installation of the chassis sensor

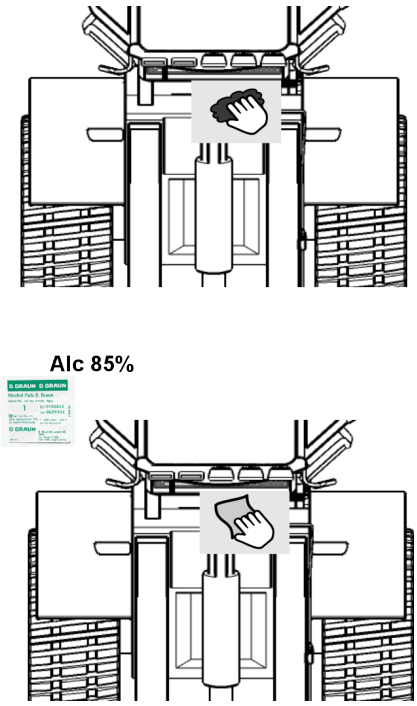


Fig. 7-19: Install chassis sensor

- Clean the mounting position with the enclosed cloths.

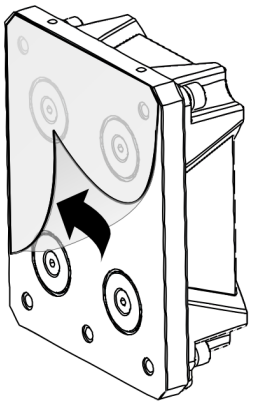


Fig. 7-20: Install chassis sensor

- Peel off the top layer of the double-sided adhesive tape.

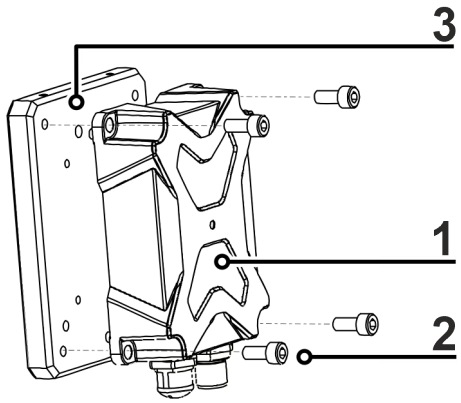


Fig. 7-21: Install chassis sensor

- Mount the sensor (1) on the mounting plate (3) using the M5x12 (2) screws.

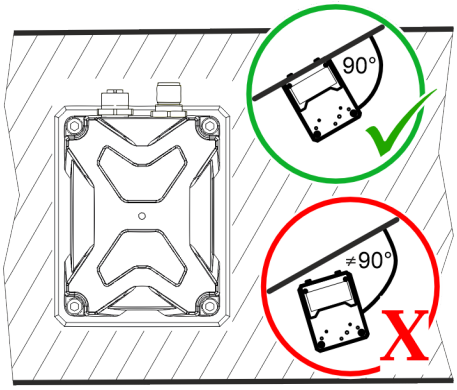


Fig. 7-22: Install chassis sensor

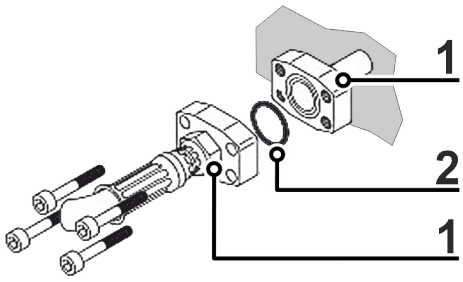
The sensor can be mounted in 90 degrees steps (see illustration on the left).

7.1.4 Installation of the pressure sensors

The installation of the pressure sensors depends on the design of the machine. In this document an example with SAE-flanges is shown.

DANGER!	**Risk of injury caused by high pressure!** High-pressure oil can cause severe injury. • Any work on this system requires technicians with deep knowledge and experience in hydraulics. • Keep persons away from the machines and the tool's working range respectively.

DANGER!	**Danger of fast-moving parts due to opening of the hydraulic circuit!** Crashing bucket / fork. • Any work on this system requires technicians with deep knowledge and experience in hydraulics. • Keep persons away from the moving parts and the tool's working range respectively.



- Dismantle the flanges of the hydraulic lines of the H-Frame (1).
- Make sure that the lines are pressure-free.
- Remove the sealing (2).

Fig. 7-23: Install pressure sensors

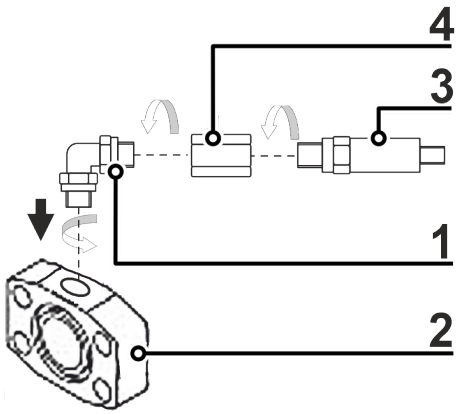


Fig. 7-24: Install pressure sensors

- Mount matching adapters (1,4) on the SAE-flanges (2).
- The pressure sensors (3) are installed on these adapters.

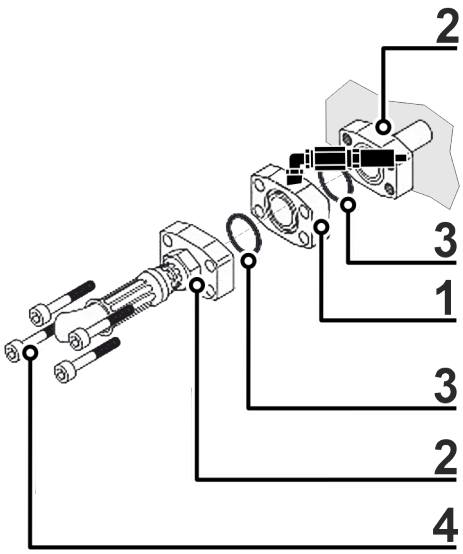


Fig. 7-25: Install pressure sensors

- Position seals (3) and the SAE-flange (1).
- Assemble the flanges of the hydraulic lines (2) of the H-Frame with the provided screws (4).

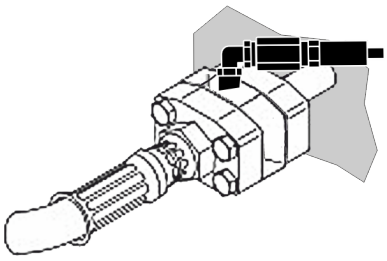


Fig. 7-26: Install pressure sensors

Make absolutely sure that the lines are pressure-free.

7.1.5 Installation of the display

The installation of the display depends on the design of the machine. In this document an example with a RAM-Mount Round Base is shown.

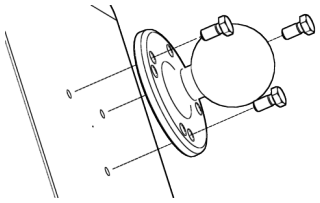


Fig. 7-27: Install display

- Choose an assembly site for the display.
- Mark and drill the holes necessary for fastening.
- Attach one of the RAM-Mount Round Bases with the provided screws (M5x25).

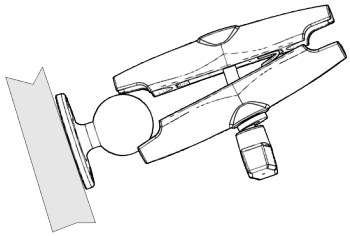


Fig. 7-28: Install display

- Open the clamping fixture by turning the wing nut.
- Shift the fixture cover over the base and secure by turning the wing nut.

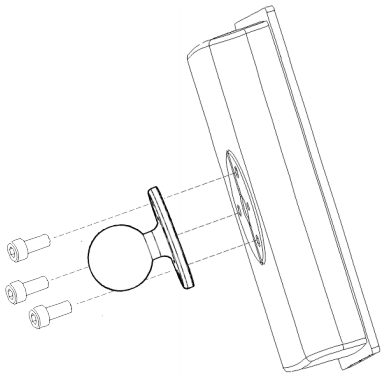


Fig. 7-29: Install display

- Screw the second RAM-Mount Base to the display with the provided screws (M5x12).

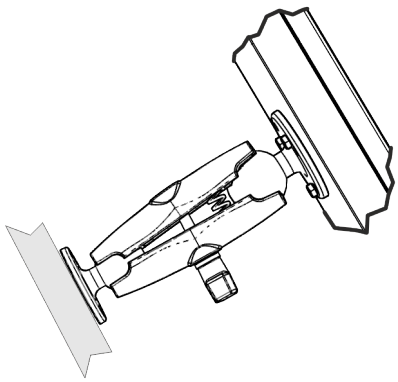
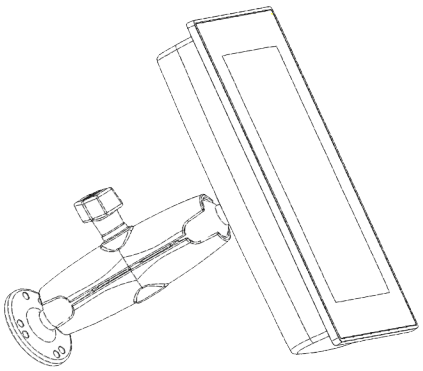


Fig. 7-30: Install display

- Open the clamping fixture by turning the wing nut.
- Shift the display into the open fixture and secure by turning the wing nut.

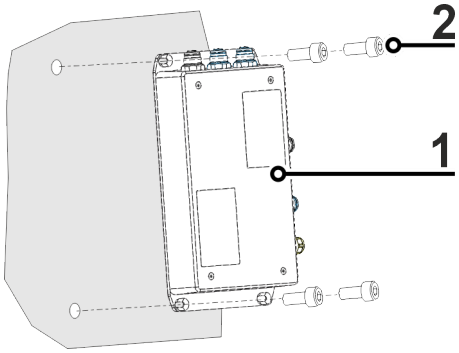


The display is completely mounted and can be finally adjusted.

Fig. 7-31: Install display

7.1.6 Installation of the interface box

The installation of the interface box depends on the design of the machine. In this document only an example is shown.

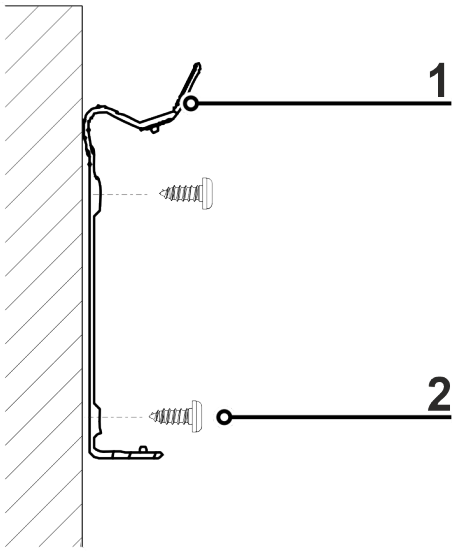


- Choose an assembly site for the interface box.
- Mark and drill the holes necessary for fastening.
- Attach the interface box (1) with the provided screws (2).

Fig. 7-32: Install interface box

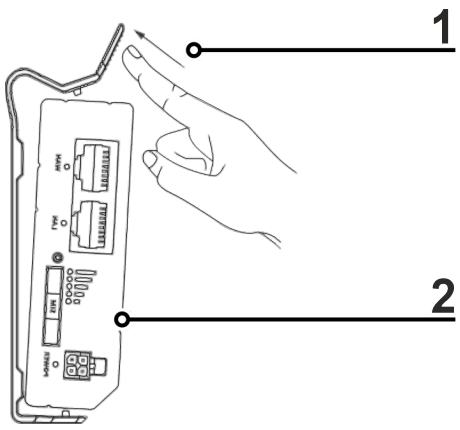
7.1.7 Installation of the modem

The installation of the modem depends on the design of the machine. In this document only an example is shown.



- Choose an assembly site for the modem.
- Fasten the retaining bracket (1) with the self-tapping screws provided.
- Predrill if necessary.

Fig. 7-33: Install modem



- Press the retaining bracket (1) and insert the modem (2).

Fig. 7-34: Install modem

7.1.8 Installation of the printer

The installation of the printer depends on the design of the machine. In this document an example with a RAM-Mount Round Base is shown.

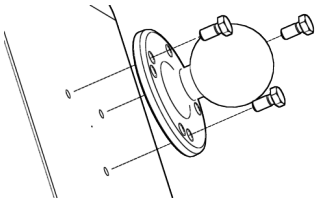


Fig. 7-35: Install printer

- Choose an assembly site for the printer.
- Mark and drill the holes necessary for fastening.
- Attach one of the RAM-Mount Round Bases with the provided screws (M5x25).

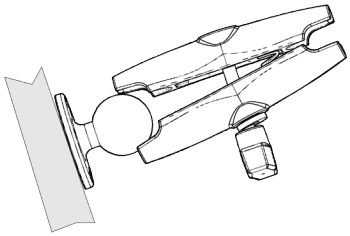


Fig. 7-36: Install printer

- Open the clamping fixture by turning the wing nut.
- Shift the fixture cover over the base and secure by turning the wing nut.

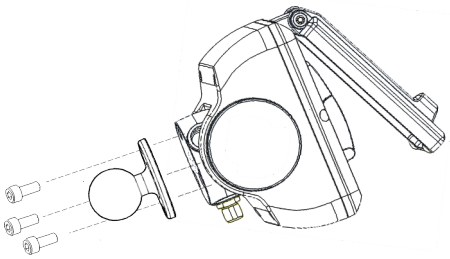


Fig. 7-37: Install printer

- Screw the second RAM-Mount Base to the printer with the provided screws (M5x12).

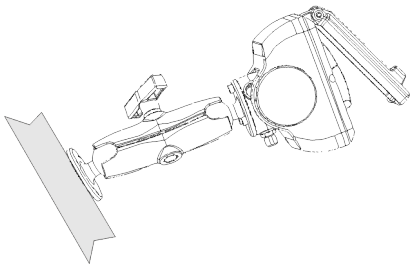
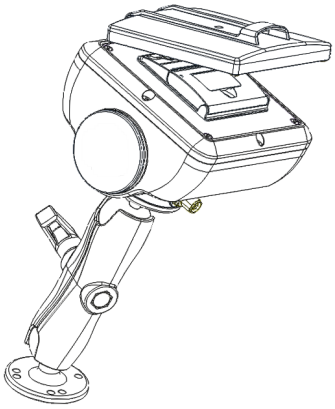


Fig. 7-38: Install printer

- Open the clamping fixture by turning the wing nut.
- Shift the printer into the open fixture and secure by turning the wing nut.



The printer is completely mounted and can be finally adjusted.

Fig. 7-39: Install printer

7.2 Electrical installation

CAUTION!	**Risk of injury caused by inadequately laid cables!**
	During mounting and installing inadequately laid cables can cause injuries and damages at the system. • In any case observe the safety instructions when installing the connection cables and do not strain, bend, or damage them. • Where possible install electrical cables with wire protecting sleeves and secure them sufficiently, e.g., with cable ties. • Use rubber bushings when laying cables through plates. • When connecting the power supply observe the vehicle manufacturer's requirements.

DANGER!	**Risk caused by electric current!**
	When working with the product next to electric systems (e.g., overhead powerlines or electric railways), there is danger to life due to electric shock. • Keep sufficient safety distance to electric systems. • If working in such surroundings is indispensable, inform the responsible authorities before starting the working process and follow their instructions.

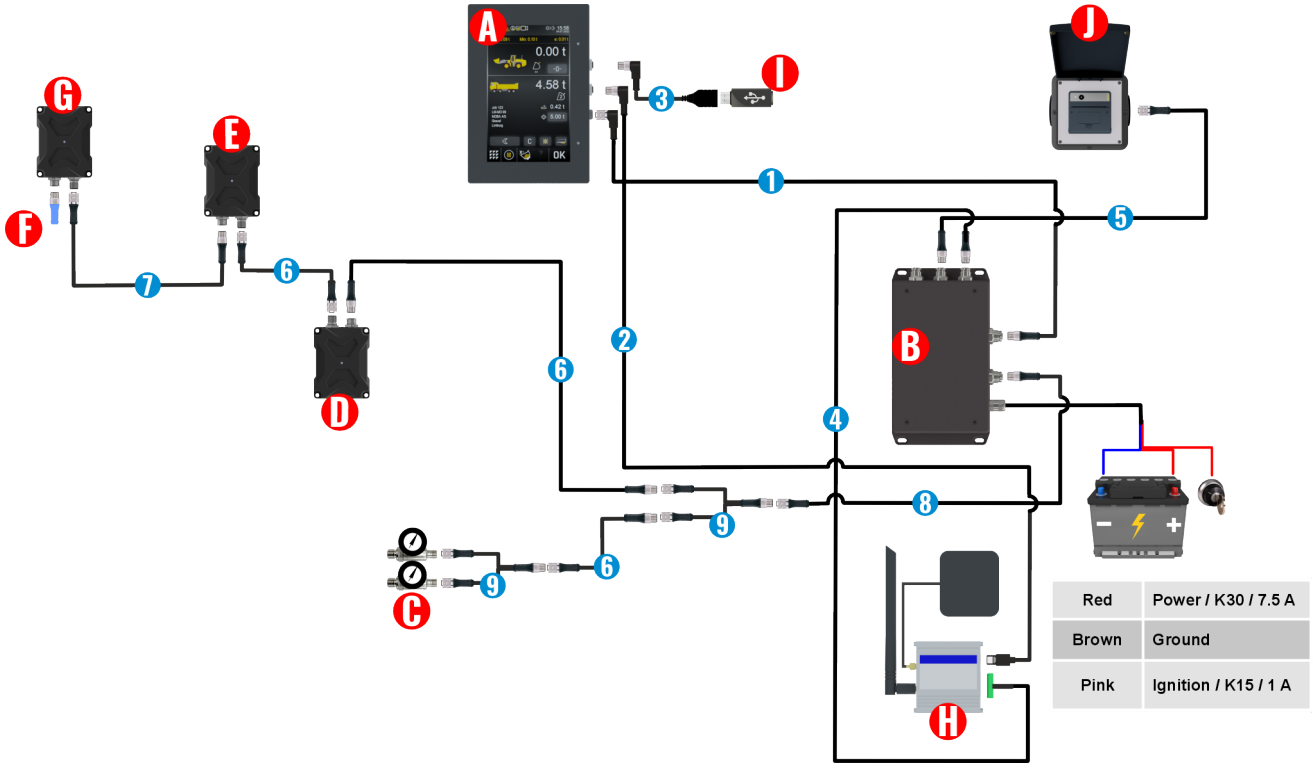


Fig. 7-40: Tuffer III wiring diagram

A	Tuffer III Display (7", TFT, Touch)
B	Tuffer III Interface-Box
C	Pressure transmitter
D	Slope sensor “MSSR-322"
E	Slope sensor “MSSR-330"
F	Terminating resistor
G	Slope sensor “MSSR-330"
H	Modem
I	USB stick
J	Printer” MRP-580"

1	04-02-03590 Connection cable M12
2	04-02-03592 Connection cable M12 (RJ45)
3	04-02-03591 Connection cable M12 (USB A)
4	04-02-04234 Power cable M12 (modem)
5	04-02-03505 Connection cable M12 (printer)
6	04-02-05063 Connection cable M12, 2m
7	04-02-05065 Connection cable M12, 4m
8	04-02-05061 Connection cable M12, 5m
9	04-02-01492 Y-cable with protection hose

8 Calibration and Setup

8.1 Before You Start - Check list!

Before starting the calibration process your will need the following things in place to succesfully start and complete the calibration process.

1	**Grease – Bucket and Lift Arm Pins**	**Lift Arm Pins** must be well greased and free from any binding and noise when the arms are raised and lowered. **Lift Arm Cyclinder Pins** that raise and lower the lift arms. **Bucket Pins** must be well greased and free from any binding and noise when the bucket is tilted forward and backwards to the stops.
2	**Normal Hydraulic Oil Temperature**	Before starting the calibration procedure it is important to run the machine until the hydraulic oil temperature is at normal operating temperature. This ensures the calibration data and results will be at their best and that system accuracy will be more stable when running the scale on the machine with oil at normal operating temperature.
3	**Level Area**	Find an area out of the way that is close to a material pile and a ramp to start and complete the calibration process.
4	**Ramp of >5°**	The system requires calibration steps to be done with the machine level and positioned up a ramp and down a ramp. The ramp needs to be greater than 5° degrees to complete these steps. If a ramp is not available you can make one with a pile of material (1 or 2 buckets). Position the pile in the area so that you can from a level area, drive up the pile forwards (uphill) and then later in reverse up the pile (downhill) when instructed to do so in the calibration steps.
5	**Known Load (80% to 100% of capacity is prefered)**	If you are using multiple attachments with this machine it is recommended that the wizard be completed with the attachment that carries the heaviest load. The known load steps can be completed in a few ways depending on what you have available on the site. **Test Weight** (80-100% of machine capacity)

		This is the best method is if you have a pre-weighed test weight = 80 to100% of the machine capacity that will fit inside the bucket. **Full Bucket of Material Estimation** (Estimate the weight as close as possible.) This method is most common and used for larger machines that cannot drive over a set of truck scales empty and full. In the Known Load steps of the calibration. Simply load the bucket as full as possible with a quick levelling shake to reduce the possibility of loosing material during multiple lifts. When prompted enter the best guess value as the known load. The span calibration can be corrected later in the calibration basics section.
6	**Scale Span Calibration Corrections**	After the wizard has been completed successfully the span calibration can be corrected to match a known weight using one of the methods in the calibration basics section. • Small block that was weighed on a certified scale (less than <40% of capacity). • Comparing loads to a certified truck scale and adjusting for the difference
7	**Multiple attachment calibration points**	Where multiple attachments are used by the same machine, it is recommended to: 1) Use the attachment with the heaviest load while using the wizard. 2) Have known load options ready that match the types of attachments that will be activated & calibrated e.g.: pallet with known load for forks.

8.2 Calibration Wizard

The Installation Wizard will guide you through the calibration and setup.

Navigate to the Calibration Wizard via the path below:

Menu > System > Settings > Access Code > Scroll to bottom / Start wizard!

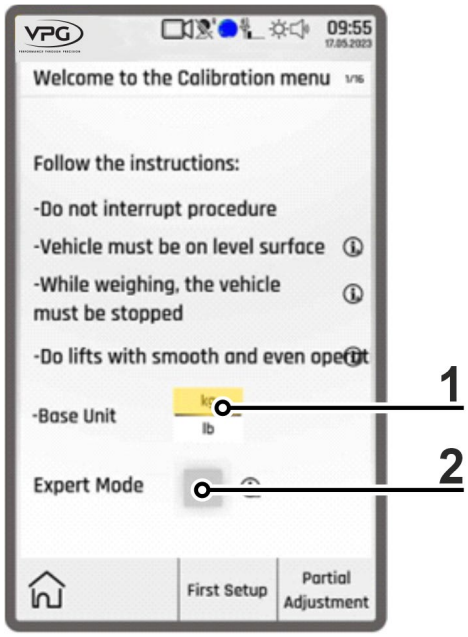


Fig. 8-1: Calibration menu

- Select the preferred “Base Unit” (1) you would prefer to use.

If you are well trained in the Tuffer III installation, you can select the “Expert Mode” (2) function to be able to speed up the installation.

When in Expert Mode you can use the **Skip Step** key to skip certain calibration steps.

Expert Mode should only be used by a factory-trained technician with extensive knowledge of the Tuffer III scale system.

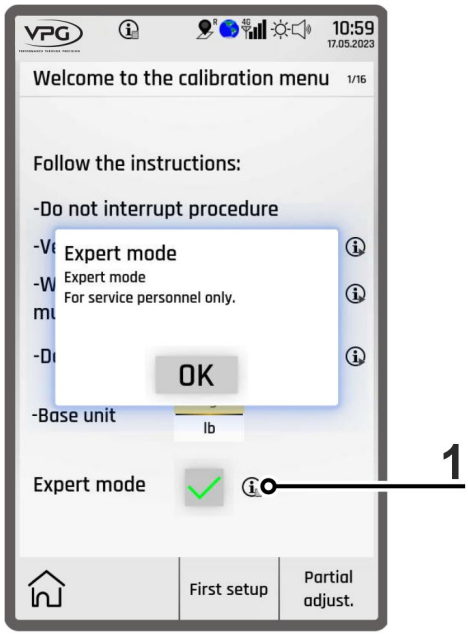


Fig. 8-2: Details Expert Mode

- By selecting the information icon (1), you will see more details and explanation related to that topic.

8.2.1 Slope Sensor Control

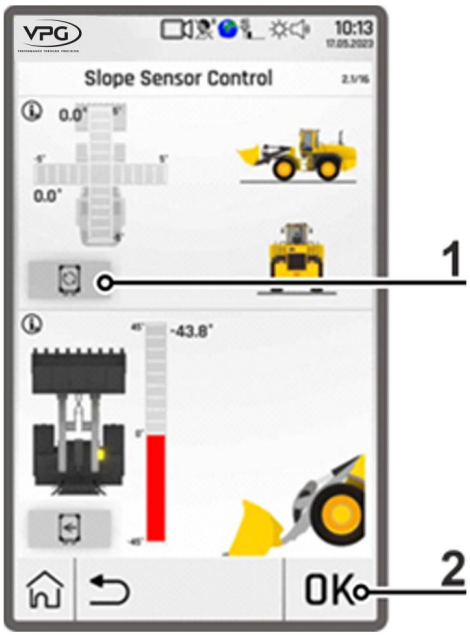


Fig. 8-3: Slope Sensor Control

These steps are intended to ensure that the sensors are mounted and orientated correctly.

- By selecting the sensor orientation icon (1) multiple times, you can change the sensor location and orientation to match the way it is installed onto the machine.

Step 1: Orientate the machine chassis sensor.

Step 2: Orientate the lift arm sensor.

- When complete, confirm by pressing **OK** (2).

By selecting the information icon , you will see more details and explanation related to that topic.

8.2.2 Machine Position Control

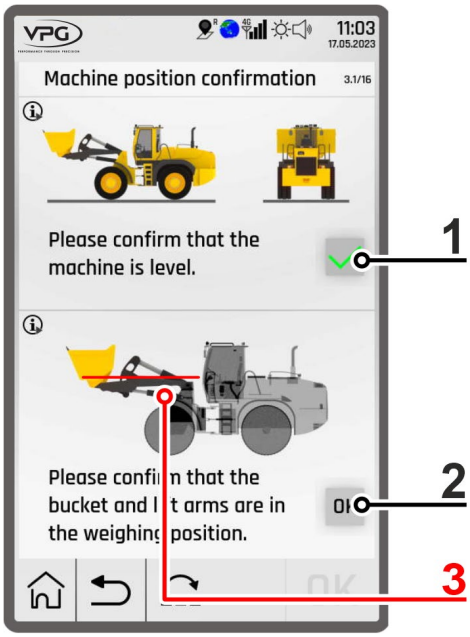


Fig. 8-4: Machine Position Control

These steps are used to confirm the machine is level and where the weighing will start to take place.

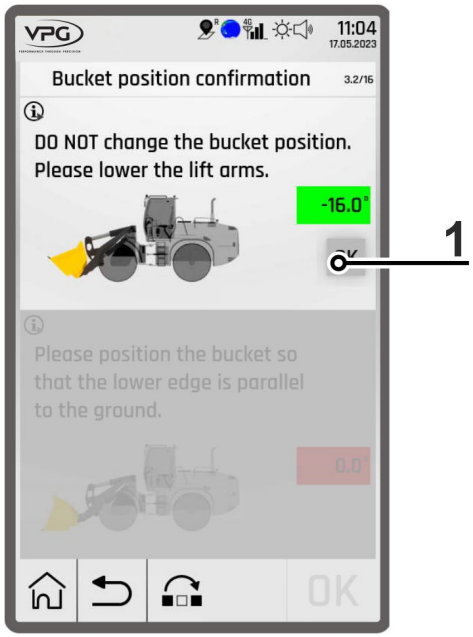
Step 1: Bring the machine level by parking it on a level surface. Confirm by pressing **OK** (1).

Step 2: Curl the empty bucket all the way back.

Step 3: Position the lift-arm at the desired start weighing height position. The bucket's lower pin is in line with the top lift arm's pin (3). Confirm by pressing **OK** (2).

By selecting the information icon , you will see more details and explanation related to that topic.

8.2.3 Bucket Position Confirmation

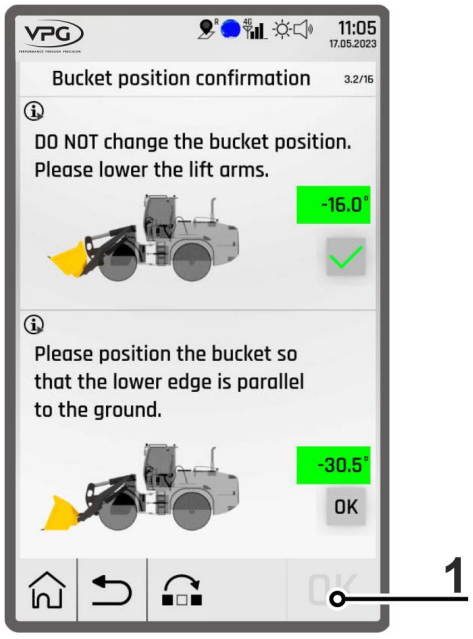


Keep the bucket curled all the way back!

- Lower the lift arm until the bucket is almost touching the ground. Confirm by pressing **OK** (1).

By selecting the information icon , you will see more details and explanation related to that topic.

Fig. 8-5: Bucket Position Confirmation



This procedure is to learn the bucket position closed and open (level) when at ground level.

Do not move the lift arms.

- Slowly curl the bucket forward until the bottom of the bucket is level and parallel with the ground. Confirm by pressing **OK** (1).

By selecting the information icon , you will see more details and explanation related to that topic.

Fig. 8-6: Bucket Position Confirmation

8.2.4 Tip off correction

Fig. 8-7: Tip off correction

Fig. 8-8: Tip off correction

This procedure is to correct the weight value during opening the bucket.

- Lift the arm until the bucket is closed above the weighing position. Confirm by pressing **OK** (1).

By selecting the information icon , you will see more details and explanation related to that topic.

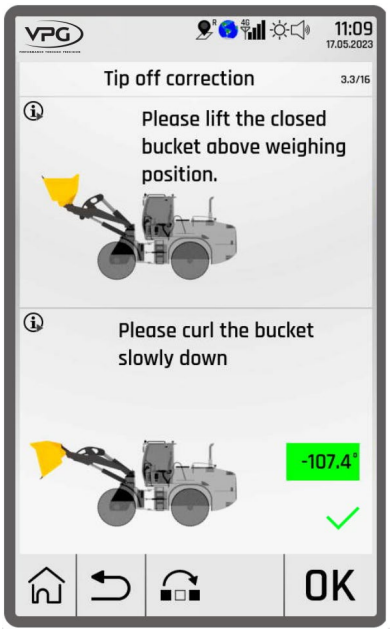


Fig. 8-9: Tip off correction

Do not move the lift arms.

- Slowly curl the bucket down until the correction of the weight value is complete.

By selecting the information icon , you will see more details and explanation related to that topic.

8.2.5 Select Pressure Side

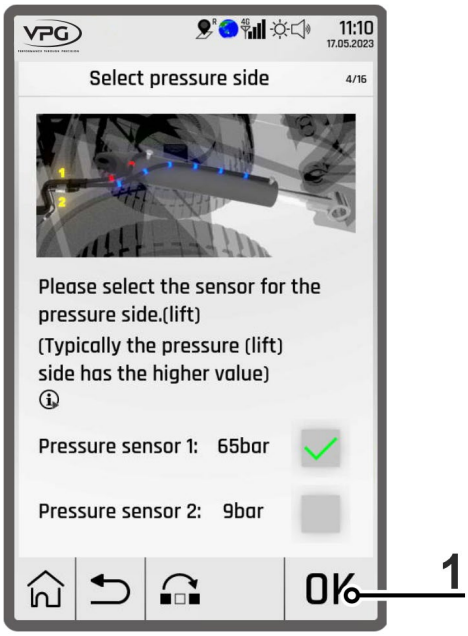


Fig. 8-10: Select pressure side

This procedure is to ensure that the correct side of the lift cylinder is orientated as the lift side (pressure side).

Step 1: Raise the lift arms so the bucket is off the ground.

The Tuffer III system will automatically select the higher oil pressure detected as the lift-side (pressure side) of the cylinder.

If this does not detect correctly the user can select manually.

- Confirm by pressing **OK** (1).

By selecting the information icon , you will see more details and explanation related to that topic.

8.2.6 Pre-Scaling – Zero Point

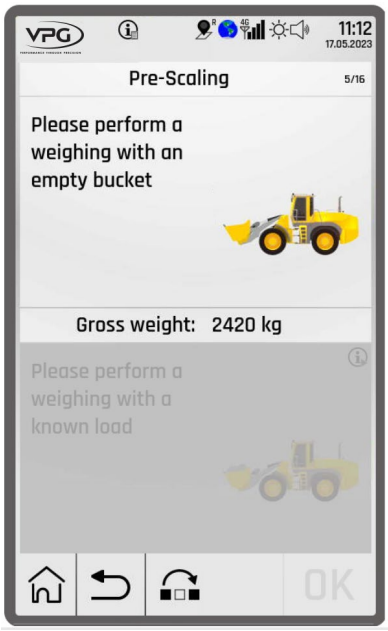


Fig. 8-11: Pre-Scaling – Zero Point

Complete with an **Empty Bucket**.

This procedure is intended to determine the initial **Zero Point** of the system (pre-scaling) and basically, zeroes out the weight of the lift arms and bucket.

Step 1: Curl the **EMPTY bucket** back completely.

Step 2: Lower the bucket until it is just above the ground.

Step 3: Lift the bucket above the weighing zone to complete the weighing of the empty bucket.

After the lift is completed, the system will record and set a new “0” point.

8.2.7 Pre-Scaling – Span Calibration Point

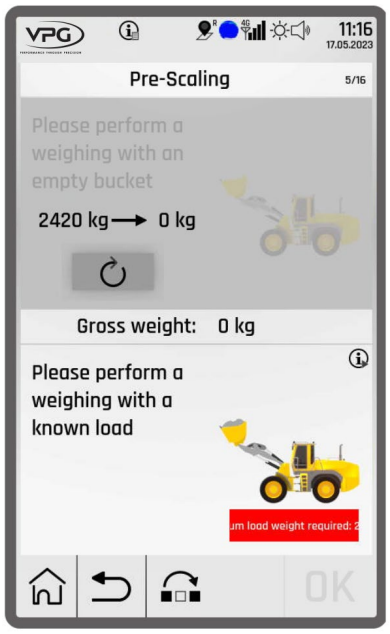


Fig. 8-12: Pre-Scaling – Span Calib. Point

Complete with a **Known Load**.

This procedure is to determine the initial **Span calibration** for the scale system. A known weight of 80-100% of the machine's capacity is recommended.

Step 1: Load the known weight into the bucket and curl the loaded bucket back completely.

Step 2: Lower the bucket until it is just above the ground.

Step 3: Complete a weighing lift by lifting the bucket above the weighing zone.

OK key accepts the auto calculated results and advances the screen to the next step.

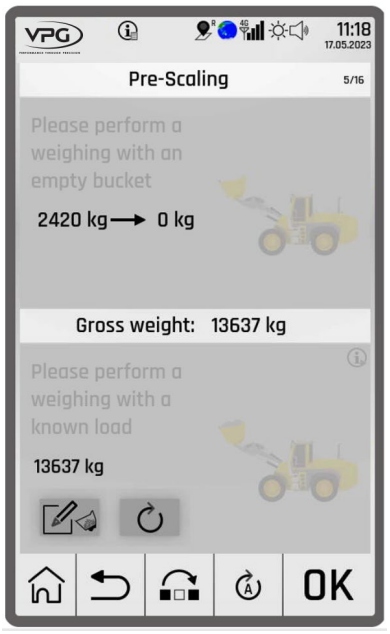


Fig. 8-13: Pre-Scaling – Zero Point

If the weight displayed does not match what was used, then use the **Edit** key  to enter the correct known weight value.

The **Repeat** step key  will allow you to repeat the last step.

The **Repeat All** steps key  will allow you to repeat all steps for this procedure (empty & known load).

Menu "Calibration Basics"

Note:

A "best guess estimate" of the full bucket weight can be used to complete the wizard steps and the calibration can be adjusted later using the correction functions in the calibration menu.

8.2.8 Warm-up lifts

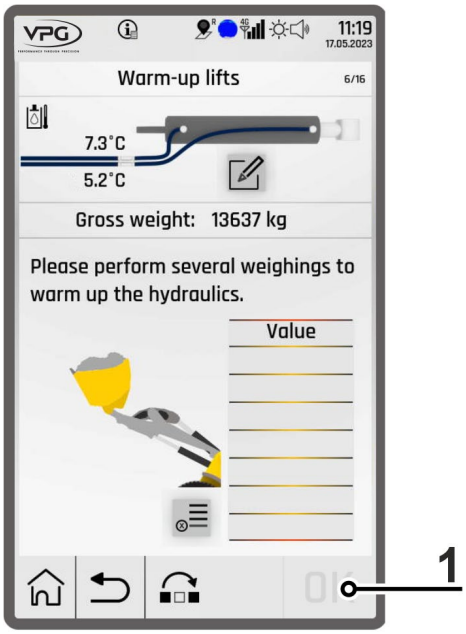


Fig. 8-14: Warm-up lift

Complete with the same **Known Load**.

This procedure is used to help the service technician ensure the hydraulic oil is at normal operating temperature before continuing through the next steps.

Accuracy at normal operating temperature can be affected if calibrations steps are completed when the Hydraulic oil temperature has NOT reached normal operating temperature.

Typical normal operating temperature:

- 40°C to 55°C
- 110°F to 130°F

The temperature range can vary by manufacturer and machine make and model. Check their service manual.

- Confirm by pressing **OK** (1).

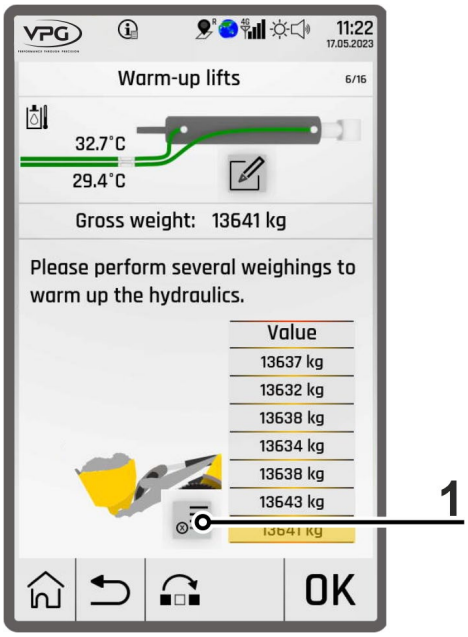


Fig. 8-15: Bad lift

Note:
In **Expert Mode** this step can be skipped.

In various stages in the calibration process the “Delete Last Lift” key (1) can be used to delete a bad lift so it will not affect the systems auto calculation of calibration factors.

8.2.9 Angle Compensation

Fig. 8-16: Angle Compensation

Complete with the same **Known Load**.

This procedure is used to learn sensor data between lowest and highest lift height and calculate and set the angle compensation factor.

Step 1: With the same **known load** and bucket curled completely back.

Lower the bucket until it is just above the ground level.

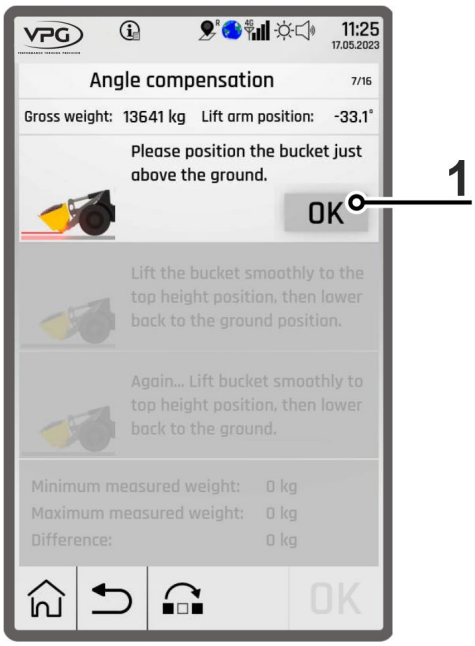


Fig. 8-17: Angle Compensation

- Confirm by pressing **OK** (1).

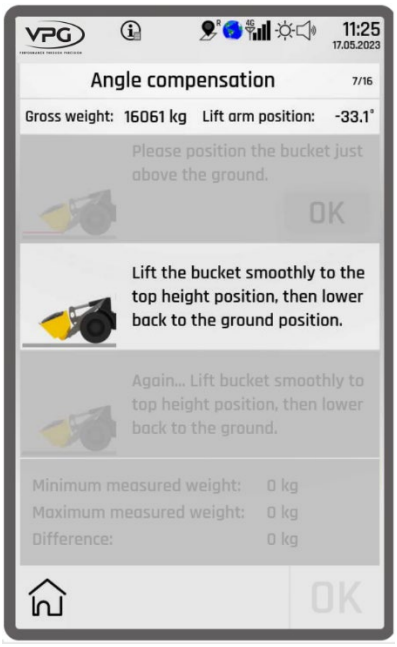


Fig. 8-18: Angle Compensation

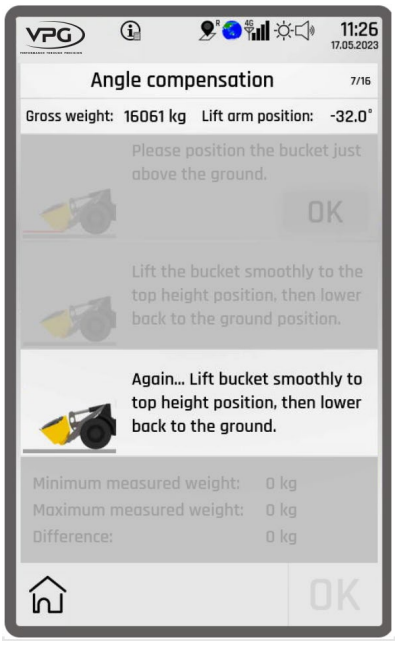


Fig. 8-19: Angle Compensation

Complete with the same **Known Load**.

This procedure is used to learn sensor data when the bucket is raised from the lowest to highest lift height position during a slow, smooth lift.

Step 1 - 1st Lift: With the bucket curled back completely and a smooth consistent lift speed, raise the bucket up to the highest point possible in the lift range.

Step 2: Lower the bucket without spilling material until the bucket is just above the ground.

When prompted, complete the 2nd lift from lowest height to maximum height.

Step 3 - 2nd Lift: With a smooth consistent lift speed, raise the bucket up from the lowest to the highest point possible in the lift range.

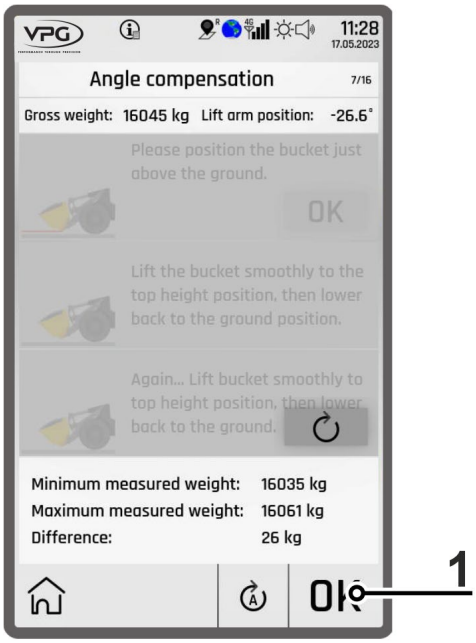


Fig. 8-20: Angle Compensation

Complete with the same **Known Load**.

This screen shows the results and allows the user to repeat the procedure or to accept the results.

- Confirm by pressing **OK** (1).

The **Repeat** step key  will allow you to repeat the last step.

The **Repeat All** steps key  will allow you to repeat all steps for this procedure (empty & known load).

8.2.10 Cylinder Piston Compensation

Fig. 8-21: Cyl. Piston Compensation

Complete with the same **Known Load**.

Please perform 3 slow smooth even lifts. (idle speed and hydraulic open / joystick full on stroke).

Note:
On some machines it may be needed to raise the engine RPM's slightly higher than idle RPM's. This is necessary if the hydraulics struggle with the load and cause rough lifts or the hydraulics jump or surge.

Fig. 8-22: Cyl. Piston Compensation

Complete with the same **Known Load**.
Complete with **Smooth Slow Speed Lift**.

After each lift the screen will display the calculated value. This value may not match the actual, but the goal is to see consistency in the 3 results with little difference.

The **Delete Last Lift** key  can be used in various stages in the calibration process to delete a bad lift so it will not affect the system's auto calculation of calibration factors.

Fig. 8-23: Cyl. Piston Compensation

Complete with the same **Known Load**.
Complete with **Smooth Fast Speed Lift**.

After each lift the screen will display the calculated value. This value may not match the actual, but the goal is to see consistency in the 3 results with little difference.

The **Delete Last Lift** key can be used in various stages in the calibration process to delete a bad lift so it will not affect the system's auto calculation of calibration factors.

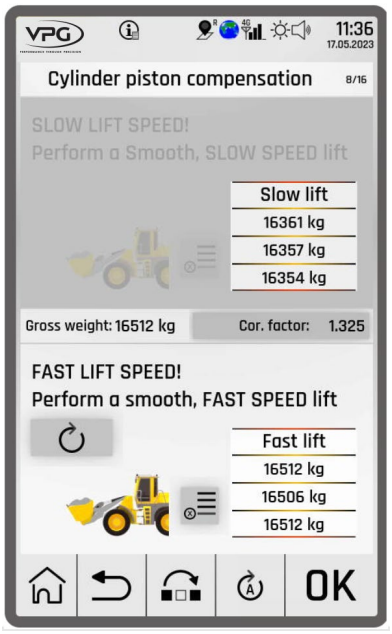


Fig. 8-24: Cyl. Piston Compensation

At the end of the 3 smooth fast lifts the Tuffer III system will automatically calculate the expected compensation factor.

- Confirm and accept the new correction factor by pressing **OK** (1).

The **Delete Last Lift** key can be used in various stages in the calibration process to delete a bad lift so it will not affect the system's auto calculation of calibration factors.

The **Repeat All** steps key will allow you to repeat all steps for this procedure.

8.2.11 Long Slope Correction "Level"

Fig. 8-25: Long slope corr. "Level"

Complete with the same **Known Load**.

This procedure is used to learn sensor data while lifting the bucket on level ground.

Note:
The desired level surface should be **0° (+/- 1°)** See the display for the current level for reference.

Step 1: Move the loader to a level area.

Step 2: Complete 3 smooth lifts.

Follow the prompts on the next set of lifts.

8.2.12 Long Slope Correction "Uphill"

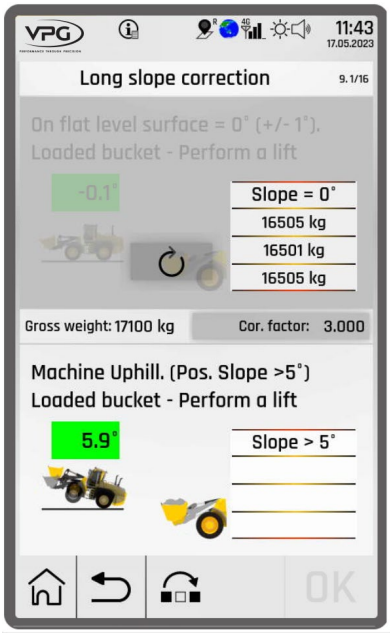


Fig. 8-26: Long slope corr. "Uphill"

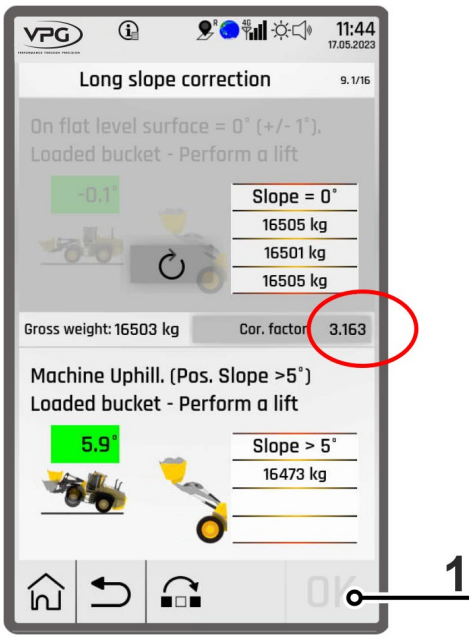


Fig. 8-27: Long slope corr. "Uphill"

Complete with the same **Known Load**.

This procedure is used to learn sensor data while lifting the bucket while the machine is facing uphill.

Note:
The desired slope should be **+5° or higher**. See the display for the current level for reference.

Step 1: Move the loader to a ramp or slope so the machine is facing uphill.

Step 2: Complete 3 smooth lifts.

Directly with the first stroke of inclination of the lifts the Tuffer III system will automatically calculate the expected compensation factor.

- Confirm and accept the new correction factor by pressing **OK** (1).

The **Repeat** step key  will allow you to redo this calibration step if the lifts were not completed smoothly, or material was lost during the lifts.

8.2.13 Long Slope Correction "Downhill"

Fig. 8-28: Long slope corr. "Downhill"

Fig. 8-29: Long slope corr. "Downhill"

Complete with the same **Known Load**.

This procedure is used to learn sensor data while lifting the bucket while the machine is facing downhill.

Note:
The desired slope should be **-5° or lower**. See the display for the current level for reference.

Step 1: Move the loader to a ramp or slope so the machine is facing downhill.

Step 2: Complete 3 smooth lifts.

Directly with the first stroke of inclination of the lifts the Tuffer III system will automatically calculate the expected compensation factor.

- Confirm and accept the new correction factor by pressing **OK** (1).

The **Repeat** step key  will allow you to redo this calibration step if the lifts were not completed smoothly, or material was lost during the lifts.

8.2.14 Velocity correction

Fig. 8-30: Velocity correction

Complete with the same **Known Load**.

Please perform a smooth FAST SPEED lift.

Use the **Skip** step key  at any time in expert mode to skip parts of the procedure in the wizard.

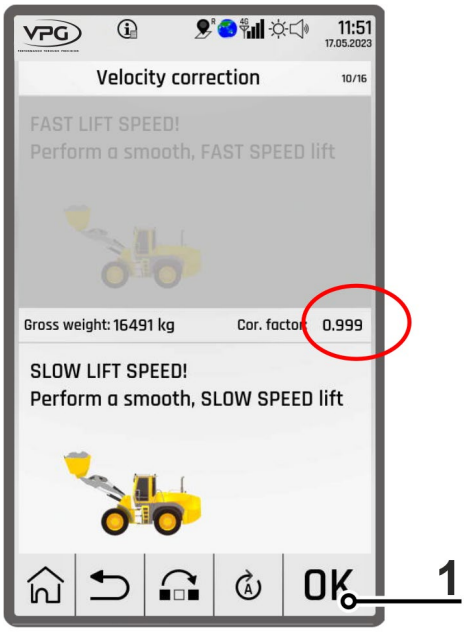


Fig. 8-31: Velocity correction

Complete with the same **Known Load**.

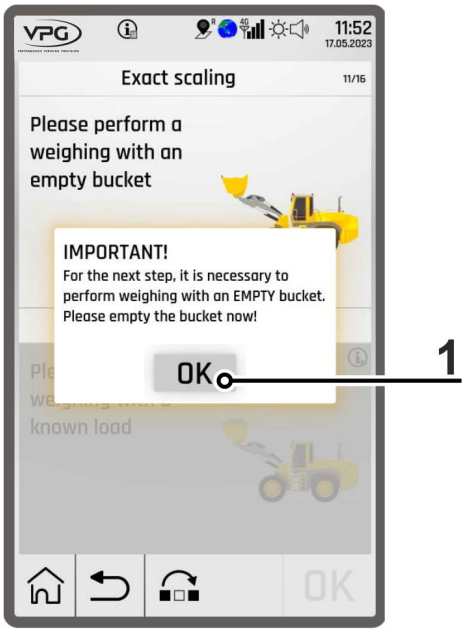
Please perform a smooth SLOW SPEED lift.

The Tuffer III system will automatically calculate the expected compensation factor (see circle).

- Confirm and accept the new correction factor by pressing **OK** (1).

Use the **Skip** step key  at any time in expert mode to skip parts of the procedure in the wizard.

8.2.15 Exact scaling



The goal of this procedure is to finalize the calibration with an **empty bucket** and then later with the known load again.

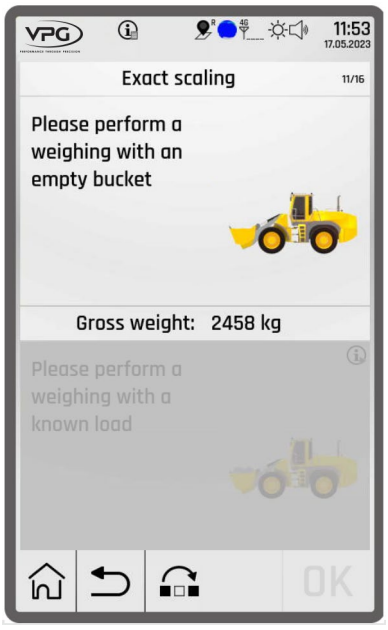
Before you start, please empty the bucket completely and ensure that the bucket is curled back completely.

- Confirm by pressing **OK** (1).

Use the **Skip** step key  at any time in expert mode to skip parts of the procedure in the wizard.

Fig. 8-32: Exact scaling

8.2.16 Exact scaling "Zero calibration"



Please make sure the bucket is **empty**.

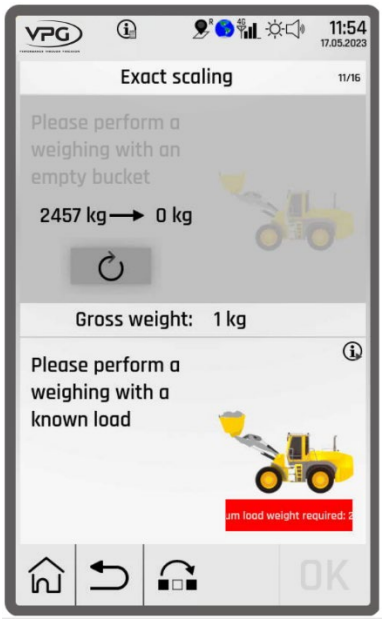
With the bucket just above the ground, please perform a lift with an empty bucket to zero calibrate the system.

Note:
Please make sure that the bucket is curled back during each lift.

Use the **Skip** step key  at any time in expert mode to skip parts of the procedure in the wizard.

Fig. 8-33: Exact scaling "Zero calib."

8.2.17 Exact scaling "Span calibration"



Please make sure the bucket is **empty**.

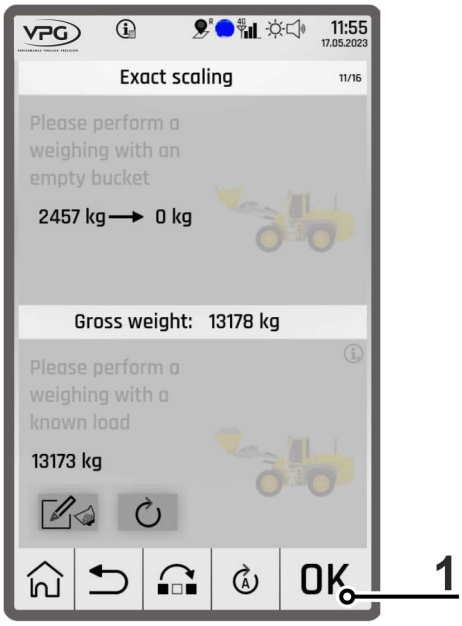
With the bucket just above the ground, please perform a lift with a known weight in the bucket to span calibrate the system.

Note:
Please make sure that the bucket is curled back during each lift.

Use the **Skip** step key  at any time in expert mode to skip parts of the procedure in the wizard.

Fig. 8-34: Exact scaling "Span calib."

8.2.18 Exact scaling "Span Adjustment"



In this step you can adjust the span calibration value calculated by the system to match the actual known weight value.

Note:
If you are still using an estimated value, you will need to adjust the scaling later.

- Confirm by pressing **OK** (1).

Fig. 8-35: Exact scaling "Span adjustment"

Fig. 8-36: Exact scaling "Span adjustment"

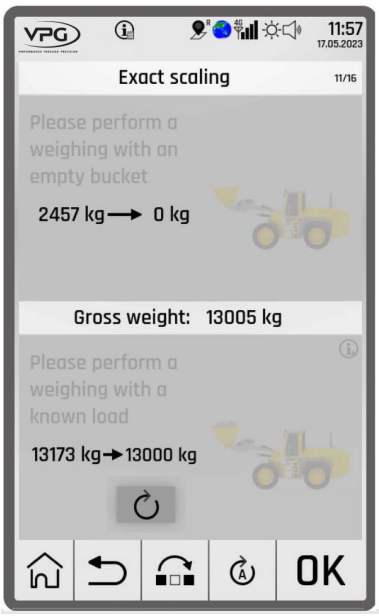
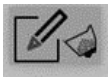


Fig. 8-37: Exact scaling "Span adjustment"

Use the **Edit** key  to enter the correct known weight value, if the weight displayed does not match what was used.

The **Repeat** step key  will allow you to redo this calibration step if the lifts were not of high quality.

Use the **Skip** step key  at any time in expert mode to skip parts of the procedure in the wizard.

The **Repeat All** steps key  will allow you to repeat all steps for this procedure.

8.2.19 Final test

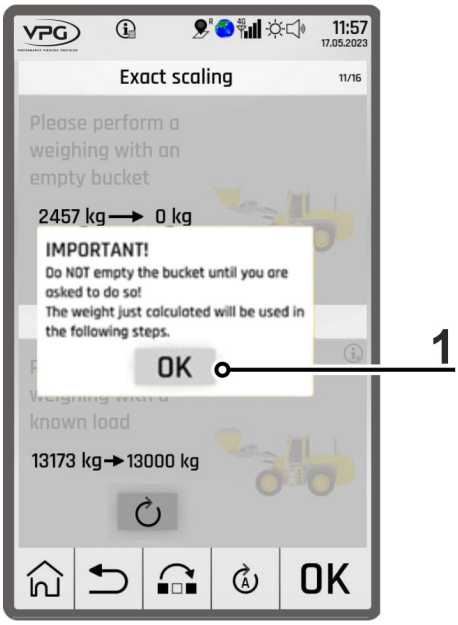


Fig. 8-38: Final test

Complete with the same **known load**.

This stage of the wizard is to check for repeatability of the scale system by doing a series of lifts.

- Continue by pressing **OK** (1).

8.2.20 Final test "Known weight"

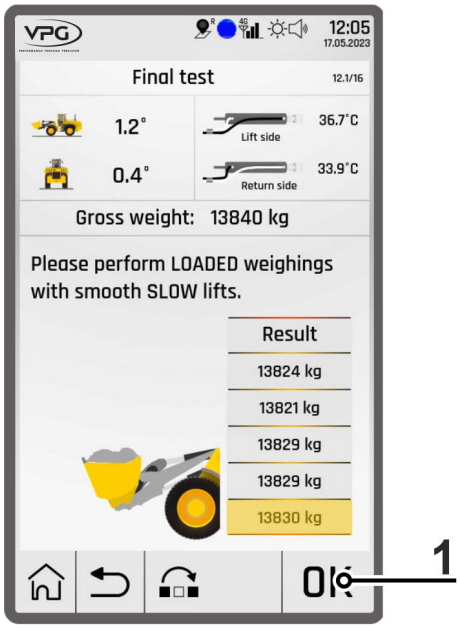


Fig. 8-39: Final test "Known weight"

The final test is an option to evaluate the system in different scenarios with the **known weight** at both slow and fast speed.

Please follow the instructions on the display.

To document the accuracy of the system we recommend taking a photo of the values from the lifts.

- Confirm by pressing **OK** (1), after you have completed the test lifts.

Note:
DO NOT exit the wizard or all steps will be lost.

Use the **Skip** step key  at any time in expert mode to skip parts of the procedure in the wizard.

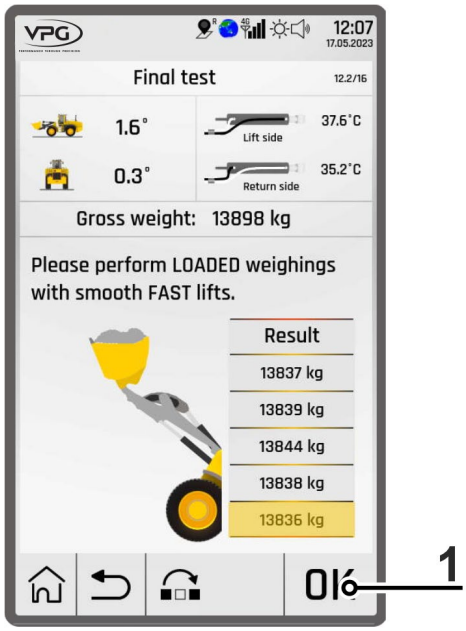


Fig. 8-40: Final test "Known weight"

8.2.21 Final test

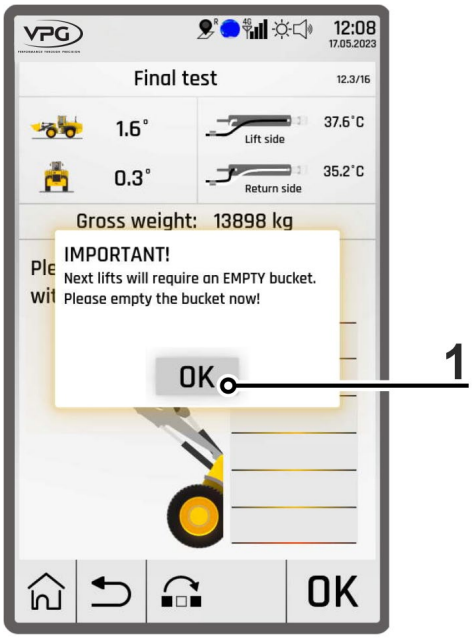


Fig. 8-41: Final test

Empty the bucket to complete the next steps.

This stage of the wizard is to check for repeatability of the scale system by doing a series of lifts.

- Continue by pressing **OK** (1).

8.2.22 Final test "Bucket Empty"

Fig. 8-42: Final test "Bucket empty"

The final test is an option to evaluate the system in different scenarios with the **known weight** at both slow and fast speed.

Please follow the instructions on the display.

To document the accuracy of the system we recommend taking a photo of the values from the lifts.

- Confirm by pressing **OK** (1), after you have completed the test lifts.

Use the **Skip** step key  at any time in expert mode to skip parts of the procedure in the wizard.

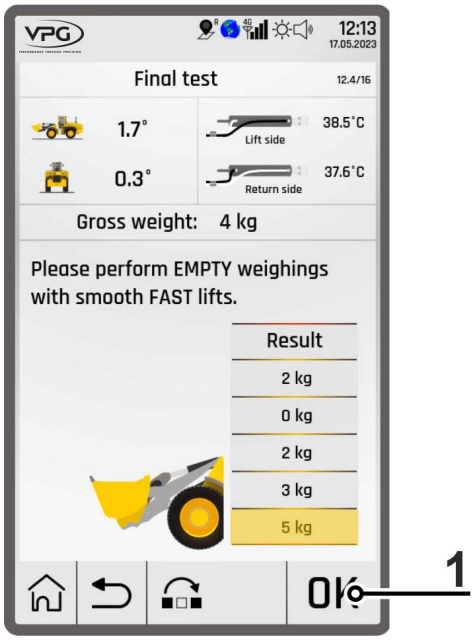


Fig. 8-43: Final test "Bucket empty"

8.2.23 Time & Date

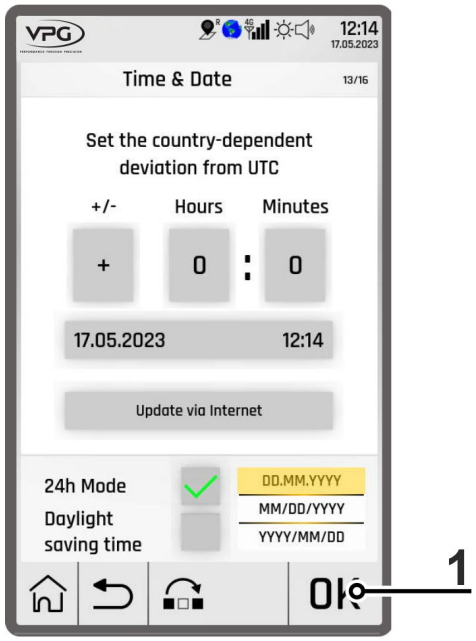


Fig. 8-44: Time & Date

When a modem is installed with the scale system, the scale system uses the standard UTC time to sync with the remote support tool.
Please enter the deviation from the UTC time applicable for your time zone.

United States
Pacific Time = **- 8:00**
Mountain Time = **- 7:00**
Central Time = **- 6:00**
Eastern Time = **- 5:00**

By activating or deactivating the 24h mode you can switch the scale from 12h to 24h mode.

Select the date format as desired.

- Continue by pressing **OK** (1).

Use the **Skip** step key  at any time in expert mode to skip parts of the procedure in the wizard.

8.2.24 Basic Weighing Settings

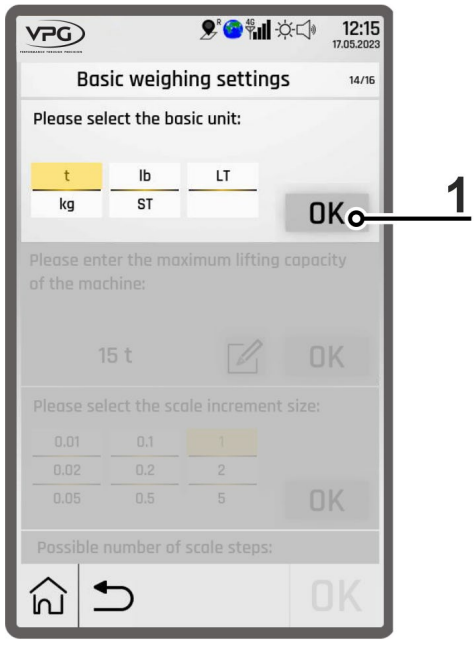


Fig. 8-45: Basic Weighing Settings

Select the desired unit you would like to run the scale system with.

Metric
kg = Kilograms
t = Metric ton (1000kg / ton)

Imperial
lb = Pounds
ST = Short Tons (2000lbs / ST)
LT = Long Tons (2240lbs / LT)

- Continue by pressing **OK** (1).

8.2.25 Maximum Capacity

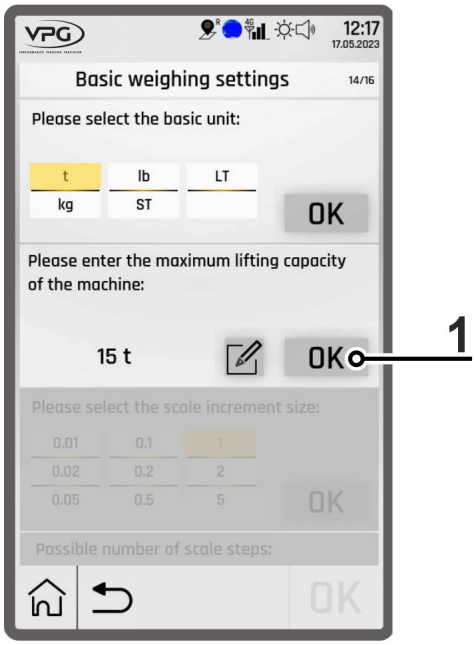


Fig. 8-46: Maximum Capacity

Enter the maximum capacity of the machine based on the manufacturer's specifications.

- Continue by pressing **OK** (1).

8.2.26 Scale Increment Size

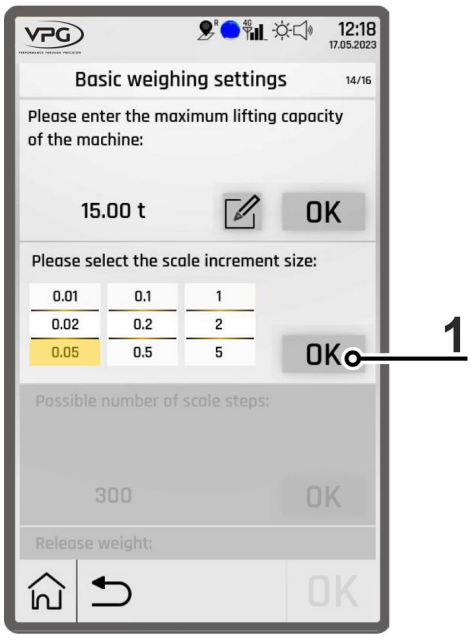


Fig. 8-47: Increment Size

Select the best fit increment size for displaying the weight for each bucket and truck total based on the unit, machine capacity and accuracy required.

Example:
A yard loader loading trucks with a bucket capacity of 10.00 ST.

Short Tons
0.01 ST
0.02 ST typical = 40 lbs increments
0.05 ST
0.1 ST
0.2 ST
0.5 ST

- Continue by pressing **OK** (1).

8.2.27 Basic Weighing Settings "Number of Increments"

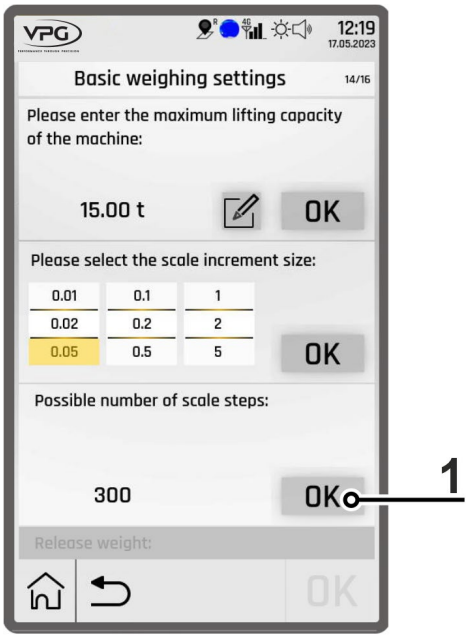


Fig. 8-48: Number of increments

10 is the lowest but a minimum of 100 is the preferred.

- Continue by pressing **OK** (1).

8.2.28 Basic Weighing Settings "Locking Weight"

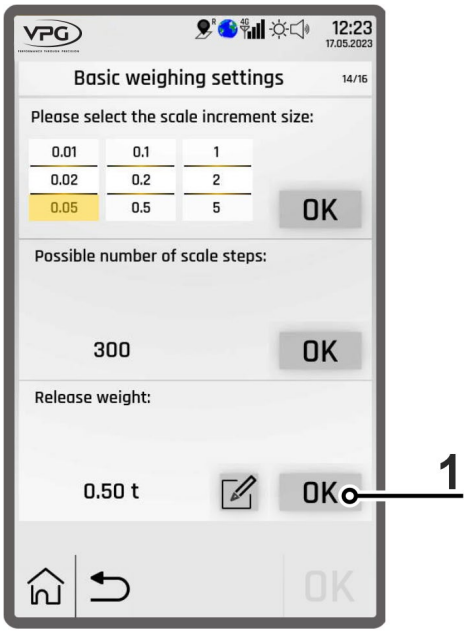


Fig. 8-49: Locking Weight

This is to prevent a user from weighing and adding the same bucket multiple times. It is useful in applications where the operator weighs the bucket at the pile and then needs to lower the bucket to travel to the truck to load it. If the bucket weight is above this value, the bucket weight will not be calculated or added to the truck total a second time when lifting the bucket at the truck.

We therefore say the bucket is “Locked” when above the entered value.

- Confirmation by pressing **OK** (1).

8.2.29 Printer

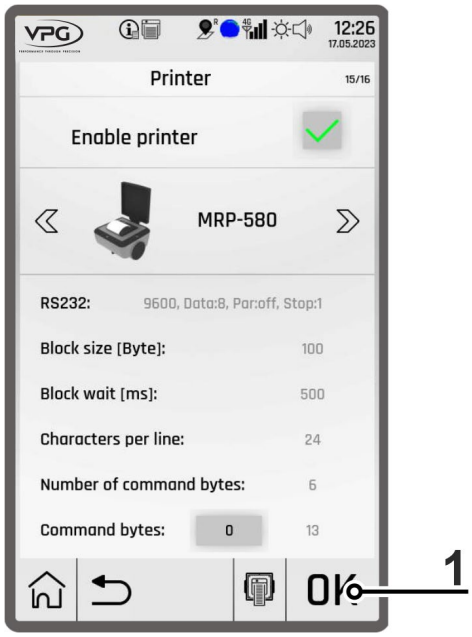


Fig. 8-50: Printer

The system has pre-configured settings from known printers in memory. The stored printers can be selected and activated easily in the printer menu.

The configuration of the ticket print layout can be customized via the corresponding layout function in the menu.

Alternative printers with an RS-232 interface can be set via "User defined".

- Continue by pressing **OK** (1).

8.2.30 Wizard Complete!

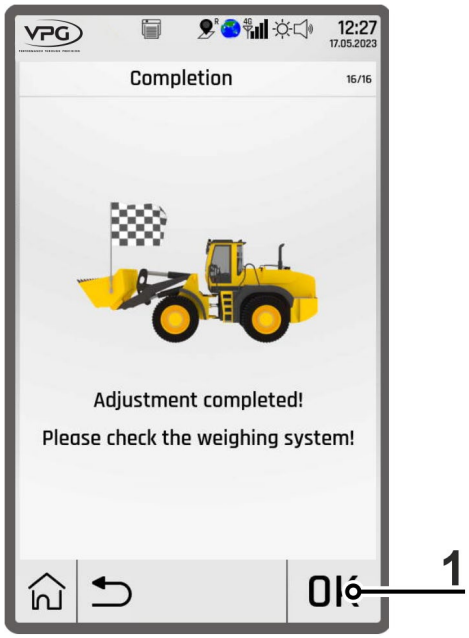


Fig. 8-51: Wizard Complete

You have now completed the setup, configuration, and calibration of the scale.

- Confirm by pressing OK (1).

Note:
If you used the estimated known weight method, you could now load a few trucks and then adjust the scale span calibration in the Calibration > Basics menu using the results from the Tuffer III scale and a certified scale.

9 Settings Menu

Settings that are configured once the authorized service technician has entered the Access Code and the calibration wizard has been completed.

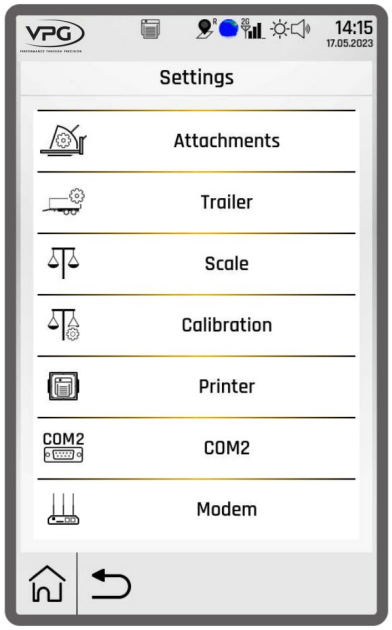


Fig. 9-1: Settings Menu

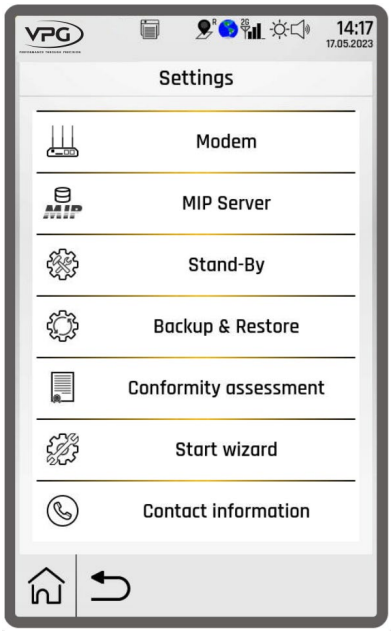


Fig. 9-2: Settings Menu

Rights Assignment: Assign which settings & features the operator can access via the main operator screens.

Attachments: Each attachment used with the scale and machine can be activated and configured via this menu.

Trailer: A supported number of trailers can be used during weighing process.

Scale Configuration: This is where some basic scale settings are configured. Units, Max Weight, Increments etc.

Calibration: Allows certain calibrations to be accessed independently from the “Wizard”.

Printer: Activate and select printer make and modem or configure an unknown printer.

COM2: Configure the COM2 port to transmit data via 3rd party modem.

Modem: This is to configure the modem and APN data, so the system data is transmitted to the correct platform.

MIP Server: Configure the desired service fleet.

System (Stand-By): Configure how the system powers down and up when the ignition key is turned ON & OFF.

Backup & Restore: Select various ways to backup and restore the scale systems settings and create log files for debugging.

Conformity Assessment: Select countries only! Used for the legal for trade approval and testing.

Start Wizard: This is the step-by-step process followed by service personnel when a scale system is setup and calibrated.

9.1 Rights Assignment

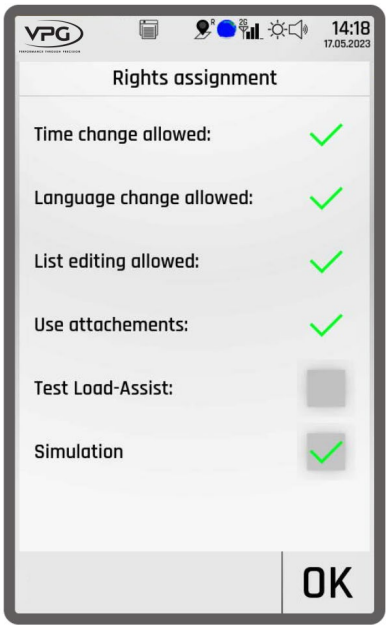


Fig. 9-3: Rights assignment

Via the Rights Assignment, the system can be configured to allow or prohibit an operator from accessing certain functions.

9.2 Attachments

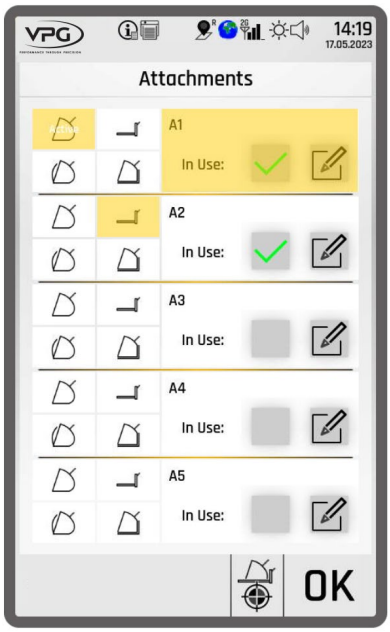


Fig. 9-4: Attachments

The Tuffer III can manage up to 5 x attachments with different calibrations and graphics.

This means that operators can swap between attachments during normal operations. After the attachment is physically swapped on the machine arms the operator needs to select the correct attachment that was installed on the machine via the attachment selection menu.

Configuration of attachment descriptions:
There must be a check mark next to the attachment for it to be selectable by the operator in normal operating mode.

With the **Edit** key, the name of the attachment can be entered and a unique icon for that attachment can be assigned by selecting the picture you want.

Note:
After the calibration wizard (attachment 1) has been completed, all attachments active in the system must be selected and span calibrated individually with a known load applicable to the type of attachment.

The other attachments can be calibrated via the path.

Menu>
System>Settings>Code>Calibration>Basics

9.3 Trailer

Fig. 9-5: Trailer

The Tuffer III can manage the loading of a truck with up to 3 x trailers connected to the same truck. The maximum number of trailers is selected in this section.

Note:

None = Only truck is loaded
1 = Truck + 1 x Trailer is loaded
2 = Truck + 2 x Trailers are loaded
3 = Truck + 3 x Trailers are loaded

9.4 Scale

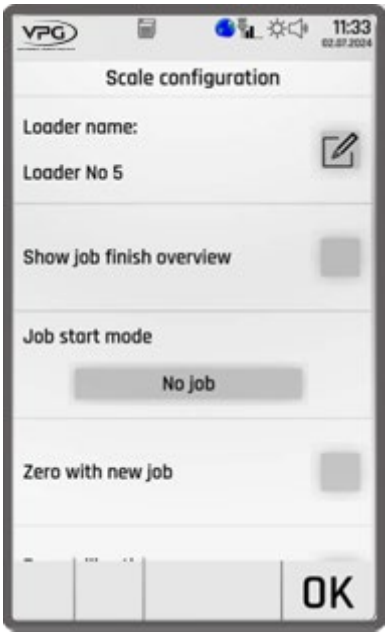


Fig. 9-6: Scale

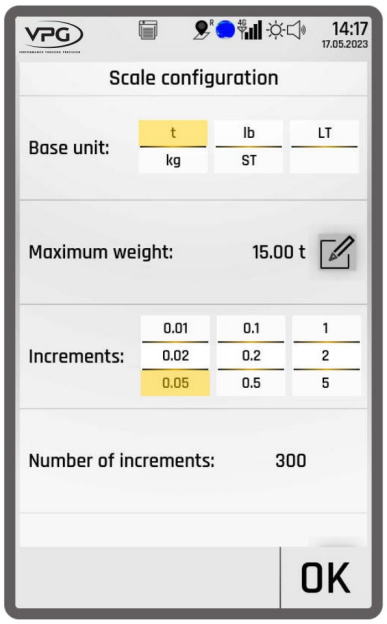


Fig. 9-7: Scale

Base Unit:
Select the unit you wish to use with the scale.

Maximum Weight
Here you can enter the maximum safe operating capacity of the machine. See manufacturer machine spec.

Scale Increments
Select the best fit increment size for displaying the weight for each bucket and truck total based on the unit, machine capacity and accuracy required.

Example:
A yard loader loading trucks with a bucket capacity of 10.00 ST.
0.02 Increment = 40lb increments is displayed in the weight

Number of Increments
The number of partial steps is calculated automatically based on maximum weight divided by the scale increments selected.

Fig. 9-8: Scale

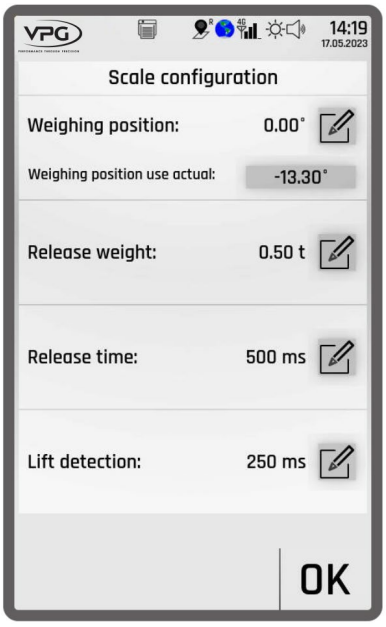


Fig. 9-9: Scale

A minimum of 10 is allowed but **100 is preferred**.

Weighing Zone:
The weighing zone defines the area where the system analyzes all the sensor readings during a dynamic lift and calculates the weight in the bucket. Typical is 7.5° to 10°.

Weighing Position:
The weighing position is the bucket height above the ground where the weighing zone starts.


The bucket's lower pin is in line with the top lift arms' pin.


A locked bucket icon indicates the lift will not be recognized because the bucket is NOT curled back all the way and the weight in the bucket will not be calculated.

Release Weight / Locking Weight:
The weight in the bucket must be under this value to be released so that the system will measure and calculate weight during the next lift.

Release Time:
The scale will release and allow the next lifted bucket to be measured and weight displayed after the weight is reduced (< loading weight) for longer than this time.

Lift Detection:
This is the required time a stable pressure needs to be detected for the bucket to be released for a weighing procedure. If the lift arm behaves erratically (hydraulic pressure), no weighing is started.

10 Calibration Menu

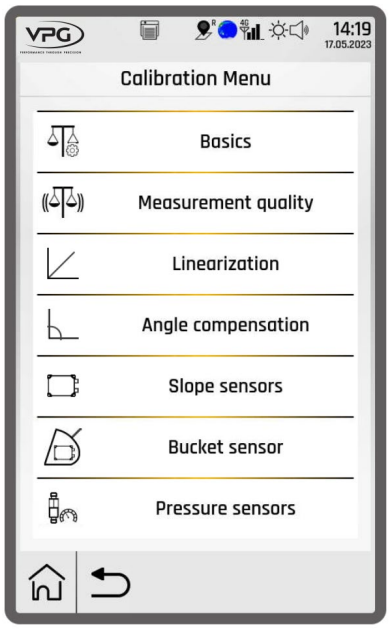


Fig. 10-1: Calibration Menu

Basics: This is where typical calibration adjustments are done and are broken into different types of individual calibration procedures and steps.

Measurement quality: Advanced menu to stabilize calibration across various loads.

Linearization: Advanced menu to correct calibration across various loads.

Angle Compensation: Advanced menu to compensate for angle change.

Slope Sensors: Check and verify slope sensor performance and orientation.

Bucket Sensors: Check and verify bucket sensor performance and orientation.

Pressure Sensors: Check and verify pressure sensor performance and orientation.

10.1 Basics

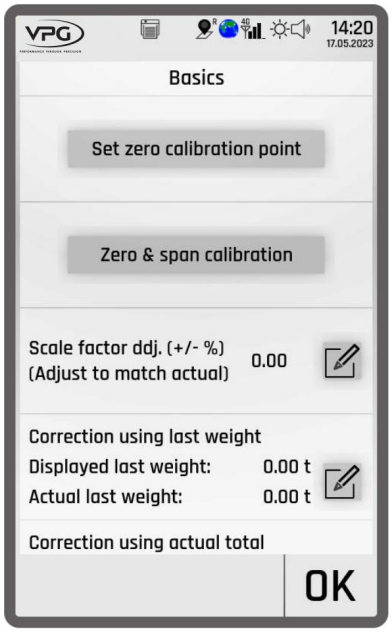


Fig. 10-2: Basics

Set Zero Calibration Point

This step **only** establishes a new internal zero calibration point!

This procedure will overwrite all previous zero calibration points and create a new internal zero calibration point without limitations.

The routine zero calibration that the operator completes daily gets compared against this value to make sure the system is performing correctly. If the operator routine zero and the internal zero has too much of a variance the operator will get a pop-up message to check the system.

Please make sure the bucket is completely empty and curled back completely, then press “Set Zero Calibration Point.”

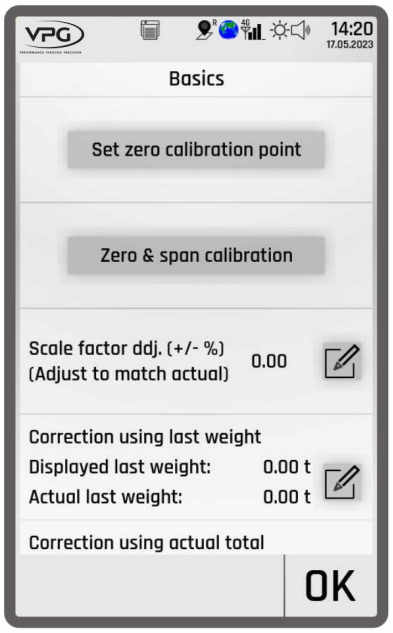


Fig. 10-3: Zero & Span Calibration

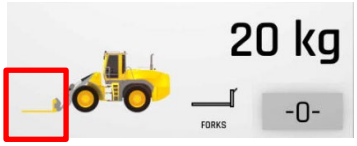
Zero & Span Calibration

This procedure allows the technician to complete 2 calibrations to complete **Exact Scaling** of the system and scaling factors for the **current** attachment will be influenced.

1. **Internal Zero Calibration** - Empty Bucket (curled back fully)
2. **Span Calibration** with known weight (80-100% capacity)

Note:
Before starting make sure the selected attachment and actual attachment are the same.

Attachment 1 = Bucket 

Attachment 2 = Forks 

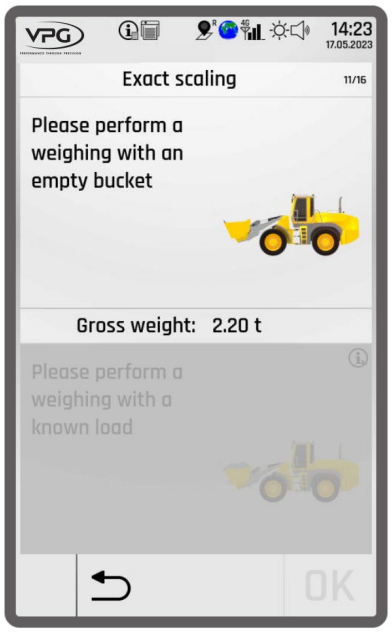


Fig. 10-4: Exact Scaling

Exact Scaling

Important!
This calibration procedure alters the calibration values associated with the active attachment.

Step 1 – Empty Bucket / Forks
This procedure will create a new **Zero Calibration Point** for the attachment currently selected.

- Complete with an **Empty Bucket** curled back completely.
- Lower the bucket until it is just above the ground.
- Lift the bucket above the weighing zone to complete the weighing of the empty bucket.

Fig. 10-5: Exact Scaling

After the lift is completed, the system will record and set a new **Zero Calibration Point**.

 By pressing the **Repeat** key, you can redo this calibration step if the lifts were not of high quality.

Note:
To ensure safe operation when calibrating for forks or special attachments, follow your company safety procedures and guidelines, for load recommendations and forks position.

Step 2 – Exact scaling - known weight (80-100% machine capacity)

Fig. 10-6: Exact Scaling

This procedure will create a new **Span Calibration Point** for the attachment currently selected.

- Complete with a **Known Weight** and bucket curled back completely.
- Lower the bucket until it is just above the ground.
- Lift the bucket above the weighing zone to complete the weighing of the empty bucket.

Fig. 10-7: Exact Scaling

After the lift is completed, the system will display the calculated known load weight.

 If the weight displayed does not match the actual, then use the **Edit** key to enter the correct known weight value.

If the result matches, continue by pressing **OK**.

 By pressing the **Repeat** key, you can redo this calibration step if the lifts were not of high quality.

 The **Repeat All** steps key will allow you to repeat both steps for this procedure (empty & known load).

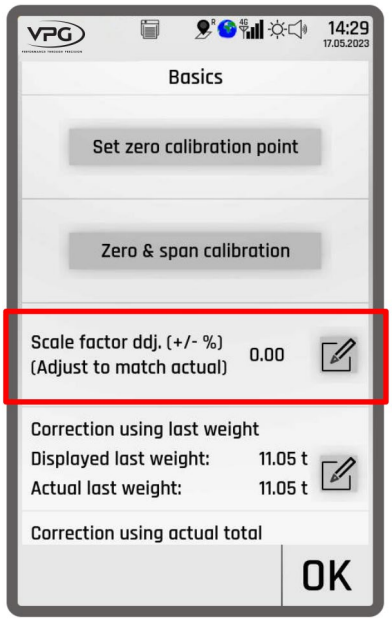


Fig. 10-8: Scale factor

Scale factor Adj. (+/- %)

The scale span calibration can be adjusted using a **% value** if you know how the Tuffer III scale weights compare to a certified scale or weight.

To match the certified weight:

use a **+%** to increase the Tuffer III scale
use a **-%** to decrease the Tuffer III scale

 Enter the amount (%) you wish to adjust the Tuffer III scale by.

Enter the adjustment percentage (%) and Press **OK** to proceed.

$$\text{Span \% Adjust} = \frac{\text{Tuffer III Scale} - \text{Certified Scale}}{\text{Certified Scale}} \times 100$$

Note:
The change affects the calibration factor for the selected attachment.

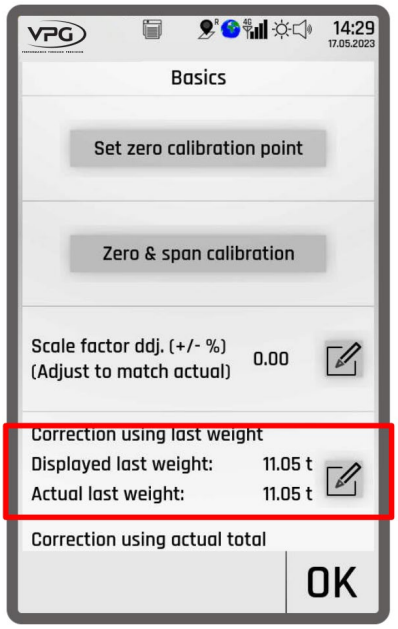


Fig. 10-9: Last Bucket Weight

Last Bucket Weight – Correction

The span calibration can be adjusted by entering the correct **last bucket weight** when compared to the displayed Tuffer III Scale bucket weight.

Enter the correct weight by pressing the **Edit** key

Displayed Last Weight = 7.00t
Actual Last Bucket Weight = 6.75t

After entering the correct **bucket weight**, press **OK** to proceed.

The adjusted calibration factor will be adjusted automatically and displayed.

Note:
The change affects the calibration factor for the selected attachment.

Fig. 10-10: Displ. Truck Total

Displayed Truck Total - Correction

The scale span calibration can be adjusted by entering the correct **last Truck Total Weight** when compared to the displayed Truck total on Tuffer III Scale.

Tuffer III Scale Displayed Truck Total = 23.00t

Enter the correct weight by pressing the **Edit** key.

Actual Truck Total = 23.50t

After entering the correct **Truck Total weight**, press **OK** to proceed.

The adjusted calibration factor will be adjusted automatically and displayed.

Note:
The change affects the calibration factor for the selected attachment.

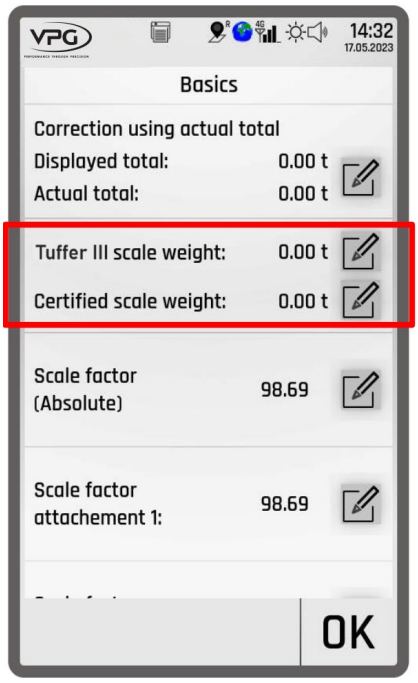


Fig. 10-11: Span Adjust.

Span Adjust. – Historical

The span calibration can also be adjusted by entering 2 weights from historical weight data. This can be done after several trucks are loaded and the error is determined using an averaging method.

Example:
When trucks are loaded to 22.00 tons with the Tuffer III scale:
They weigh 22.25 tons with a certified scale.
The error is 0.25 ton at 22.00 tons.

Follow the process below to correct for the error of 0.25t.

 Enter the correct weight for each by pressing the **Edit** key.

Enter Tuffer III Scale Weight = 22.00t
Enter Certified Scale Weight = 22.25t

After entering the 2 weight entries, press **OK** to proceed.

The adjusted calibration factor will be adjusted automatically and displayed.

Note:
The change affects the calibration factor for the selected attachment.

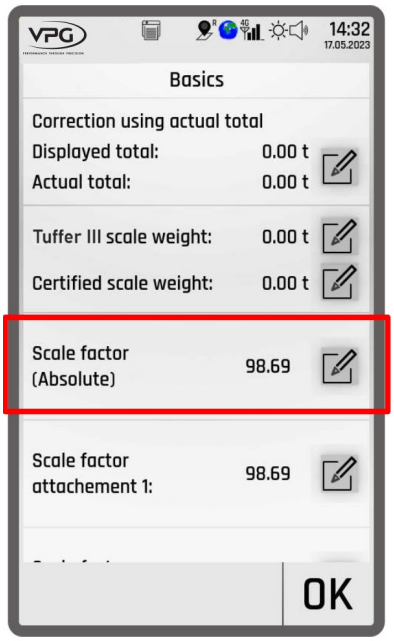


Fig. 10-12: Scale Factor

Scale Factor

The **Scale Factor** function can be used to correct the measured weight value with the known weight value via a scaling factor.

This function should only be used by experienced installers.

Fig. 10-13: Scale Factor

Scale Factor for Attachment (#1 - #5)

This function can be used to correct the measured weight value of the different attachments with the known weight value via a scaling factor.

You can use this function to copy the values from the first attachment (which was used for calibration) to the other attachments when they are similar.

This function should only be used by experienced installers.

Use the formula below to adjust the calibration factor with the help of weight results.

New Scale Factor = $\frac{\text{Known Weight}}{\text{Scale factor Tuffer III Scale}}$ **X Old**

Note:
You can edit the values for each attachment with weight results with each attachment.

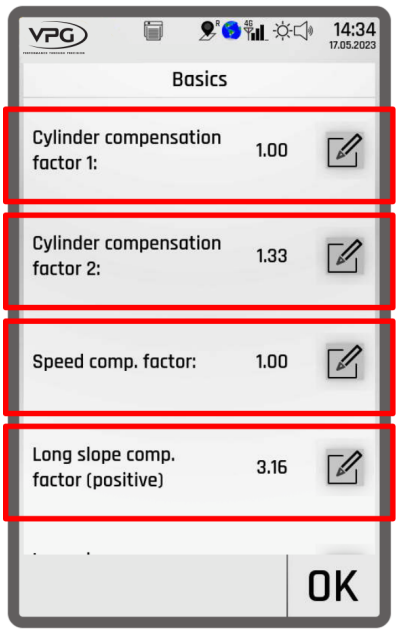


Fig. 10-14: Cyl. Compensation

Cylinder Compensation - Factor 1

The cylinder compensation factor compensates the pressure differential of the piston rod and bore.

The factor can be calculated automatically in the setup wizard or entered manually here.

Cylinder Compensation - Factor 2

If you build a system with the measurement of two cylinders you need this compensation factor for the second cylinder.

The function is not yet implemented.

Speed Comp. Factor

The speed compensation factor compensates for the pressure difference at the cylinder at different lift speeds.

The factor is calculated in the Installation Wizard or can be entered here manually.

Long Slope Comp. Factor Positive (+)

The long slope comp. factor compensates for the deviation of the weight value when the wheel loader is tilted uphill.

Positive (+) = The wheel loader is facing uphill at the front.

A minimum angle of +5° must be achieved to start the procedure in the Installation Wizard.

The factor can also be entered here manually.

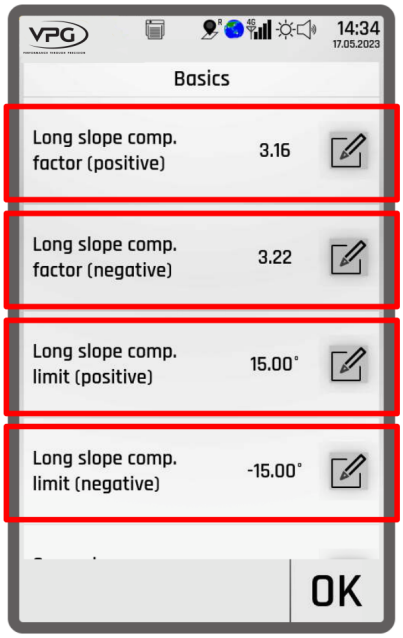


Fig. 10-15: Long Slope Compensation

Long Slope Comp. Factor Negative (-)

The long slope comp. factor compensates for the deviation of the weight value when the wheel loader is tilted downhill.

Negative (-) = The wheel loader is facing downhill at the front.

A minimum angle of -5° must be achieved to start the procedure in the Installation Wizard.

The factor can also be entered here manually.

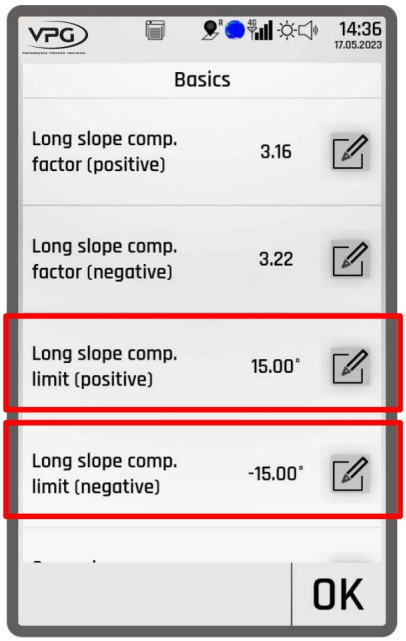


Fig. 10-16: Long Slope Compensation

Long Slope Comp. Limit Positive (+)

The long slope comp. limit is the maximum slope angle uphill that the scale will function on.

When the machine angle is above this value the scale will display an error for the operator.

Long Slope Comp. Limit Negative (-)

The long slope comp. limit is the maximum slope angle downhill that the scale will function on.

When the machine angle is below this value the scale will display an error for the operator.

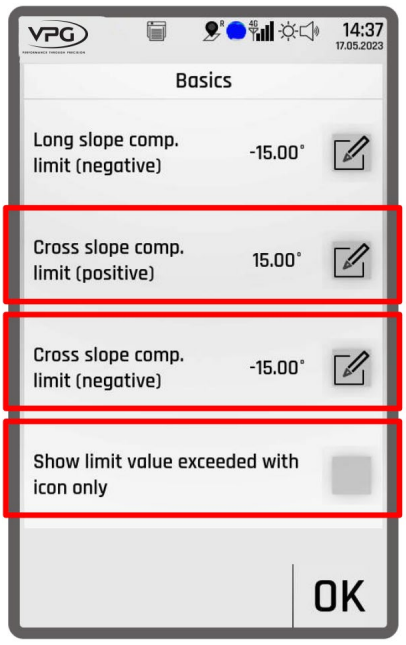


Fig. 10-17: Cross Slope Compensation

Cross Slope Comp. Limit Positive (+) (Machine tilted to the right)

The cross slope comp. limit is the maximum slope angle to the right that the scale will function on.

When the machine angle is above this value the scale will display an error for the operator.

Default = +5°

Cross Slope Comp. Limit Negative (-) (Machine tilted to the left)

The cross slope comp. limit is the maximum slope angle to the left that the scale will function on.

When the machine angle is below this value the scale will display an error for the operator.

Default = -5°

Show Limit Value Exceeded with Icon only:

When the box is checked, the operator will only see an icon as an error message.

10.2 Measurement Quality

This creates a way to force the operation of the machine in a way that gives the best accuracy possible without excessive error messages by reducing bad weights resulting from **Lift Speed Changes** and **Bouncing Loads.**

This screen allows experienced service technicians to evaluate the system performance and make good setting choices and find a balance between accuracy and loading times etc.

Do not make changes to these values unless a proper lift was completed prior to entering this menu and you are an experienced installer.

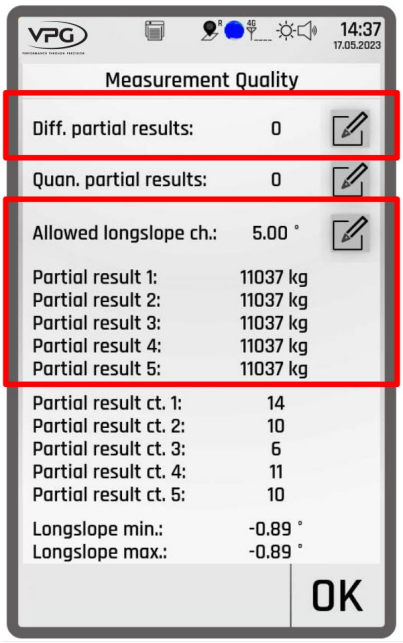


Fig. 10-18: Measurement Quality

Different Partial Results:
This section is more related to detecting **Bouncing Loads.**

Diff. partial results
When turned **OFF (0)** the scale will allow and display any calculated weight even in cases of bad lift speed changes and bouncing loads.

Entering a value between 1 and 250 turns the function **ON** and limits the displayed weight to good weight values.

The system requires very consistent and smooth machine operation with a low number like 10. When a larger number like 250 is used, the system is more forgiving of speed changes and bouncing loads.

Partial Results 1 -5
The weighing window is divided into 5 zones for evaluation and the weight is calculated and displayed for each for comparison.

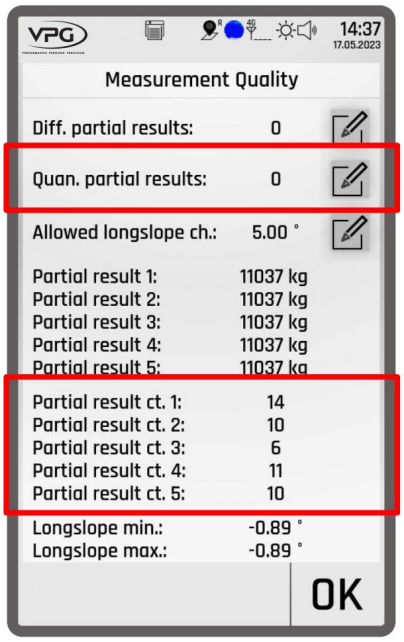


Fig. 10-19: Measurement Quality

Quan. Partial Results

As described above this section uses the results from a lift to evaluate the consistency of the calculated results.

0 = OFF

Enter a number that finds a balance between accuracy and loading times etc.

The **Quan. Partial Results** is the number of calculated results that were achieved in each zone during the lift.

The goal is to achieve as close to the same number as possible.

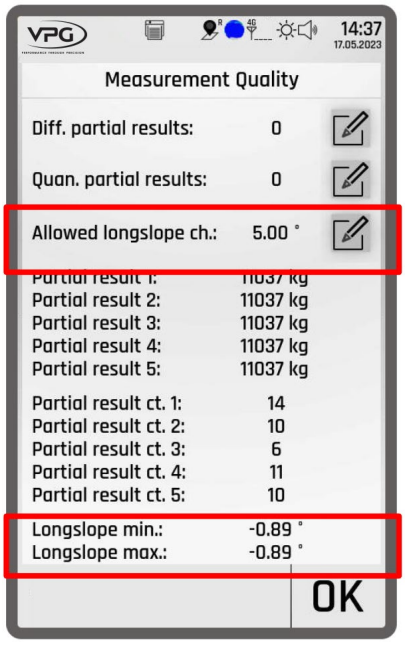


Fig. 10-20: Measurement Quality

Long Slope (LS) Quality Range

This function is used to limit the acceptable fluctuation of machine angle change while weighing (uphill and downhill).

The weight result will be rejected and not displayed if the machine angle fluctuates too drastically during the weighing process as the system will assume the machine is bouncing too much.

Default = 5°

Long Slope Min and Long Slope Max
is the actual Long Slope (uphill and downhill) during test lifts.

10.3 Linearization

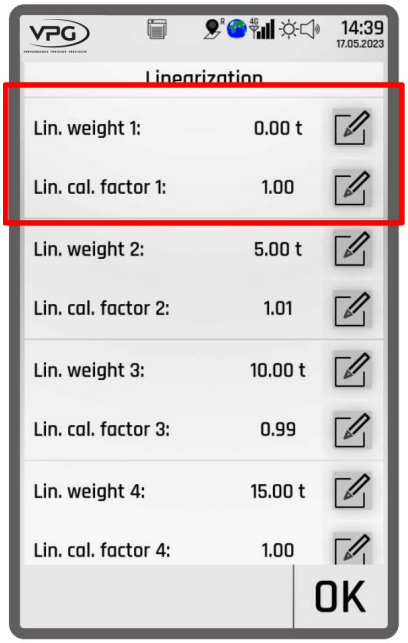


Fig. 10-21: Linearization

This function is used to correct the weight values in cases where the weight curves are not completely linear.

This would provide 8 interception points between Minimum Load to Maximum Load. **Empty & Max Load factor are not affected here!**

After doing lifts with different loads and evaluate scale performance.
Calculate the new factor for each load intercept point where needed.

Do tests with multiple known weights ranging between **empty** bucket and **max** load. Adjust each point as needed to create a straighter line between all points.

Example:
Lin. Weight 1: 1,000kg or (2,000lbs) Factor 1.00
Lin. Weight 2: 2,000kg (4,000lbs) 1.01
Lin. Weight 3: 3,000kg (6,000lbs) 1.00
Lin. Weight 4: 4,000kg (8,000lbs) 1.04
Lin. Weight 5: 5,000kg (10,000lbs) 1.02
Lin. Weight 6: 6,000kg (12,000lbs) 1.00
Lin. Weight 7: 7,000kg (14,000lbs) 1.01
Lin. Weight 8: 8,000kg (16,000lbs) 1.02

New Scale Factor = $\frac{\text{Known Weight}}{\text{Old Scale factor Tuffer III Scale}}$ X

10.4 Angle Compensation

Fig. 10-22: Angle Compensation

This section displays the correction factors for different lift ranges of the H-Frame which were calculated during the setup wizard.

DO NOT MODIFY THESE FACTORS!

They should only be modified here by experienced and trained personnel.

10.5 Slope Sensor Control

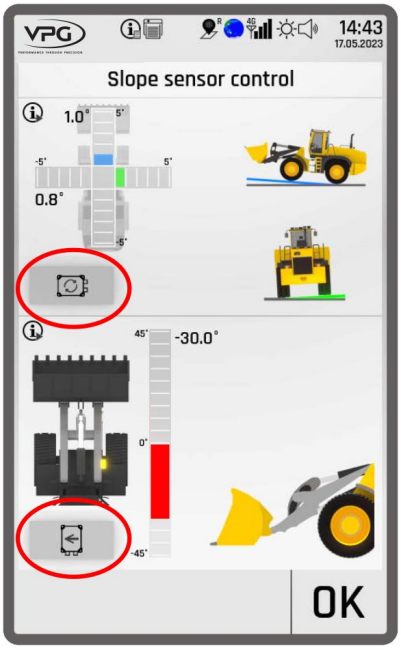


Fig. 10-23: Slope Sensor Control

This menu allows the service technician or installer to determine and set the correct slope sensor orientation based on the actual location as mounted on the machine.

 By tapping on this icon repeatedly, you can match the actual mounting location of the boom and machine sensors  to the graphics.

The operator can move the machine on different slopes and raise and lower the boom to verify the response matches the orientation of the sensors by looking at the progress bar and graphic changes.

 By selecting the information icon, you will see more details and explanation related to that topic.

10.6 Bucket Sensor Control

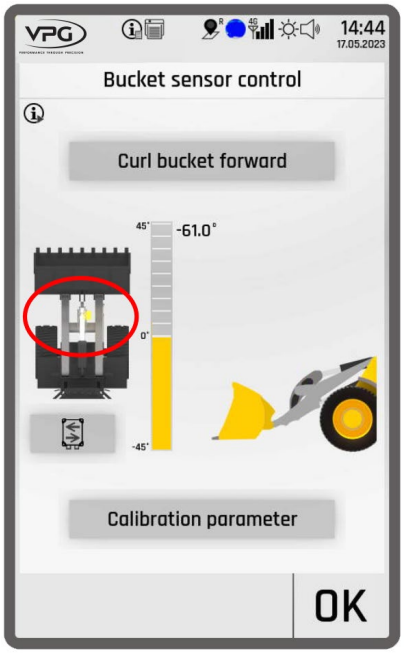


Fig. 10-24: Bucket Sensor Control

This menu allows the service technician or installer to determine and set the correct bucket sensor orientation based on the actual location as mounted on the machine.

By tapping on this icon repeatedly, you can match the actual mounting location of the boom and machine sensors to the graphics.

The operator can move the machine on different slopes and raise and lower the boom to verify the response matches the orientation of the sensors by looking at the progress bar and graphic changes.

By selecting the information icon, you will see more details and explanation related to that topic.

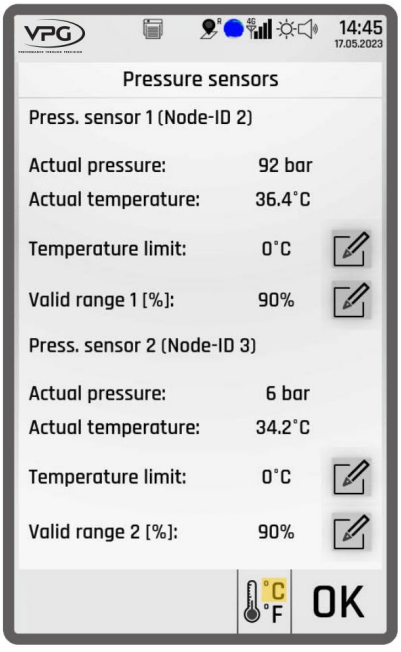


Fig. 10-25: Pressure Sensor Control

This screen displays the current values and parameter settings for the connected pressure sensors.

1. Actual Pressure
2. Actual Temperature
3. Temperature Limit Setting
4. Valid Operating Range Setting

The **temperature limit** setting is used to define at what temperature the system should work. This is to avoid a large temperature difference during weighing.

It may be necessary to complete warm up lifts to get the temperature into the operating range depending on the setting.

The **valid range** setting is to define the maximum signal range from the sensor to be within operating range.

10.7 Printer

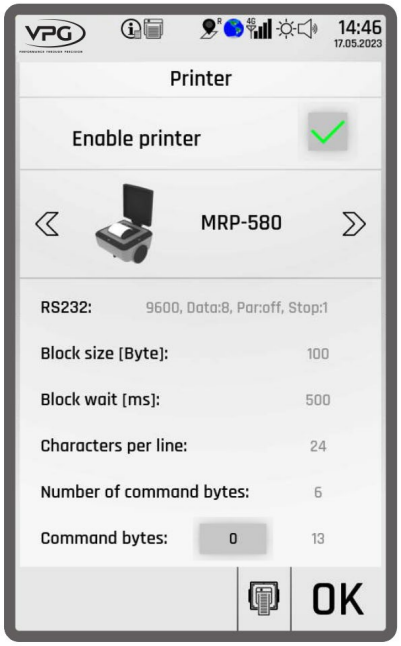


Fig. 10-26: Printer Interface

Printer Interface – Pre-programmed

The Tuffer III system has several printer configurations pre-programmed into the printer menu. After the printer is selected and active you can install the printer.

By pressing the **Test Print** key, you can confirm the printer is working.

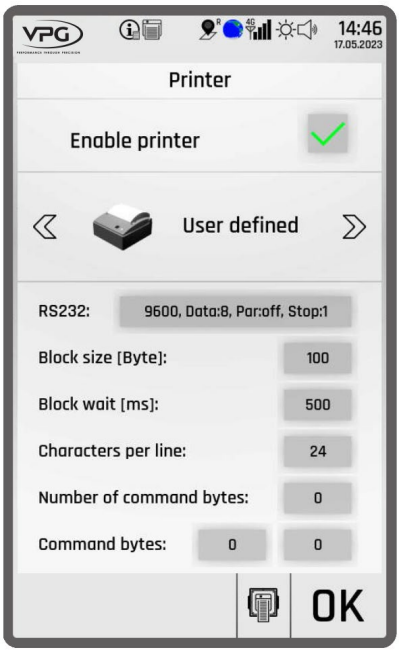


Fig. 10-27: Printer Interface

Printer Interface – User defined

It is also possible to install a printer not listed in the pre-programmed list of printers.

Select each section and enter in the values defined by your printer manufacturer.

By pressing the **Test Print** key, you can confirm the printer is working.

10.7.1 Print Ticket Layout

The Tuffer III system offers a simple way to customize the ticket looks via the ticket layout.

The method used is to match custom text on the left column to a fixed variable setting in the system.

 The text can be aligned center, left or right by pressing the alignment key. This applies in cases when there is no variable on the right side.

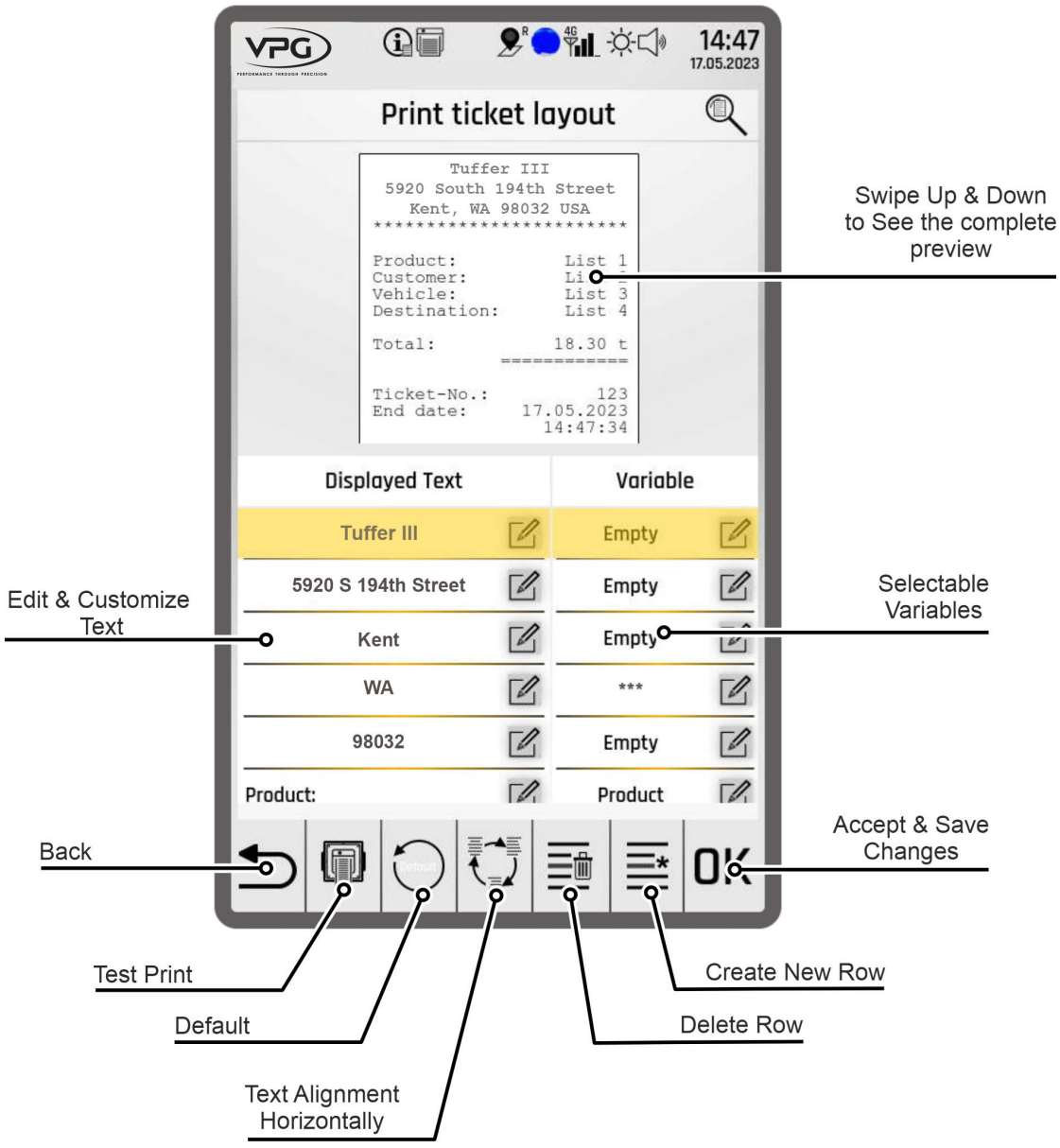


Fig. 10-28: Printer ticket layout

Fig. 10-29: Printer Ticket

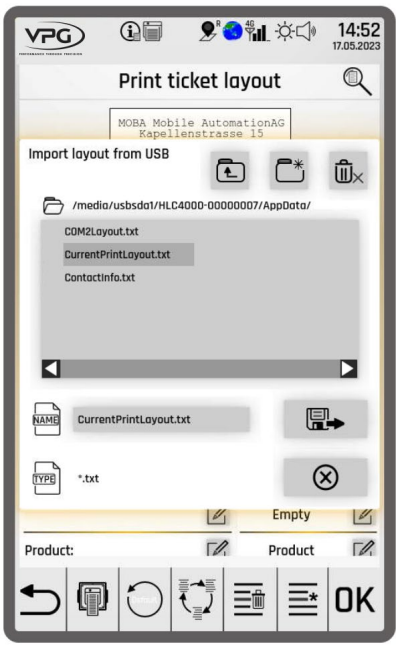


Fig. 10-30: Printer Ticket

Printer Import Ticket Layout

The Tuffer III system had the ability to store an existing Print Layout you like on the device and onto a USB.

Import

You can also import a layout from a USB or from the device by pressing the correct key.

to import from a USB

to import from the device

Note:
If the file is stored in a sub folder, the folder needs to be selected twice to open.

Select the **Import** key to import the saved layout.

Fig. 10-31: Printer Ticket

Printer Export Ticket Layout

It is possible to export and store an existing Print Layout on the device and onto a USB which can be imported onto another Tuffer III system later.

The configuration is saved as a text file which is readable and can be edited.

Export

You can export a layout to a USB or locally on the device by pressing the correct key.

to export to a USB

to store locally on the device

Fig. 10-32: Printer Ticket

Note:
You can use the default name provided by the system or you can give it a custom name.

10.8 COM2

The Tuffer III has a second RS232 interface, COM2. The interface can optionally be used to transmit weight data directly from the scale to other devices and is limited to basic data only. The interface is located on the Interface Box and provides limited data to third party users.

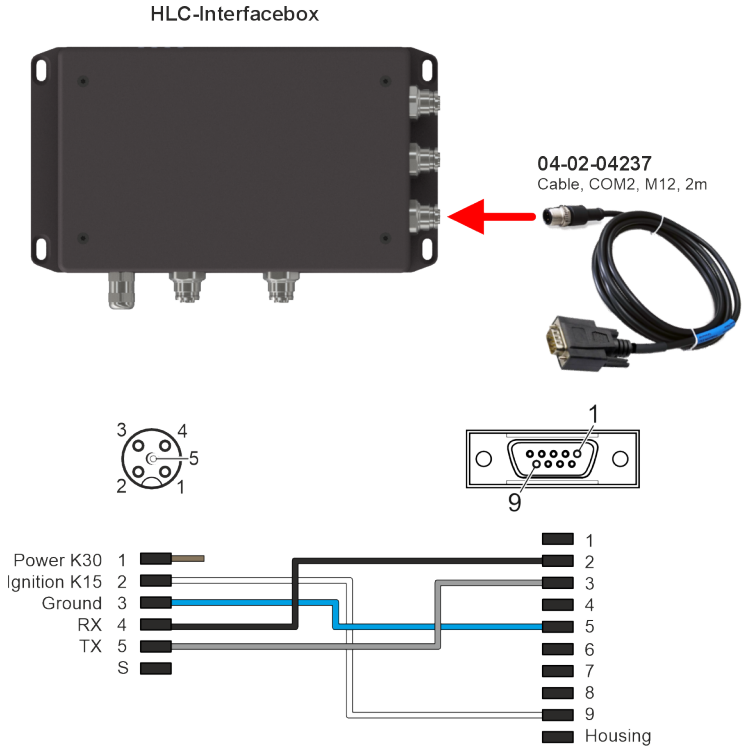


Fig. 10-33: COM2

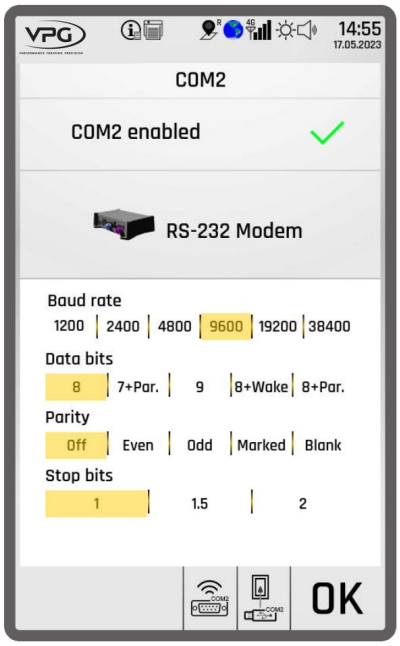


Fig. 10-34: COM2

The COM2 interface can be configured separately to match the receiving system.

Test data can be sent by pressing the **Test** key.

The configuration of the output file can be imported via a file on the USB.

10.9 Modem

The Tuffer III has been preconfigured to match several modem types that are selectable.

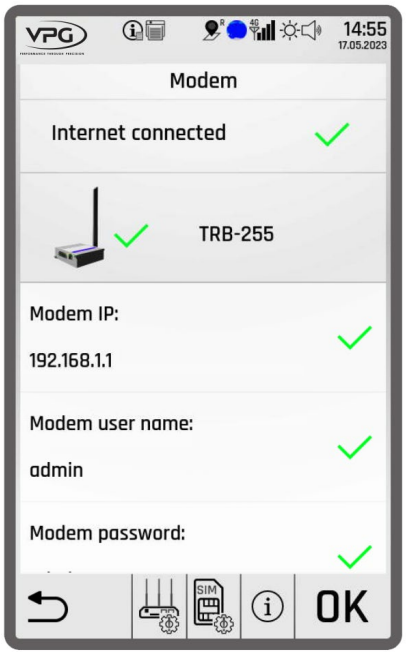


Fig. 10-35: Modem

To transmit data from the Tuffer III the modem needs the following default settings:

Modem IP:	192.168.1.1
Modem User name:	admin
Modem Password:	M6o6b2@2

Sim Card

Sim Pin:

APN User name:

APN Password

Note:
Contact your Tuffer III dealer in case of questions.

10.10 MIP Server

This function should only be modified by an experienced trained person or under the guidance of Tuffer III technical support personnel.

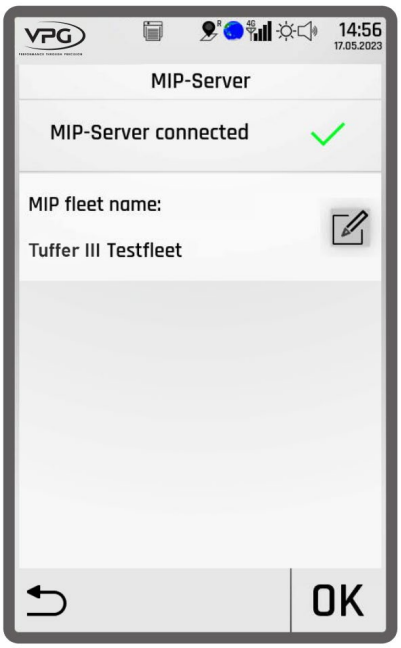


Fig. 10-36: MIP-Server

For remote diagnostics and support and data transmitting the Tuffer III needs to be configured to the correct server settings.

To transmit data from the Tuffer III the system needs to be configured to the correct fleet.

Note:
Contact your Tuffer III dealer to select the correct fleet.

10.10.1 Enter MIP-Data

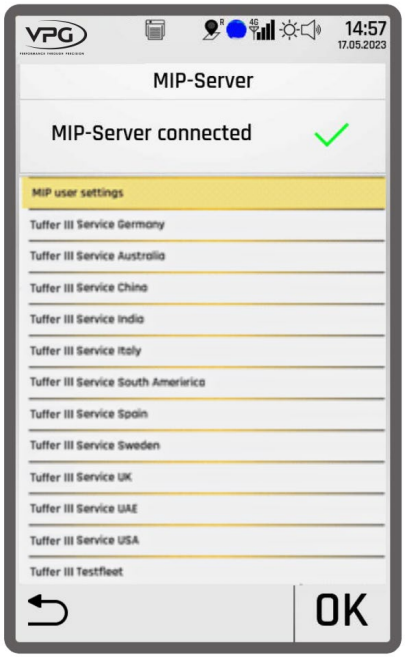


Fig. 10-37: MIP-Server

To configure the correct MIP data open the menu “MIP user settings”.

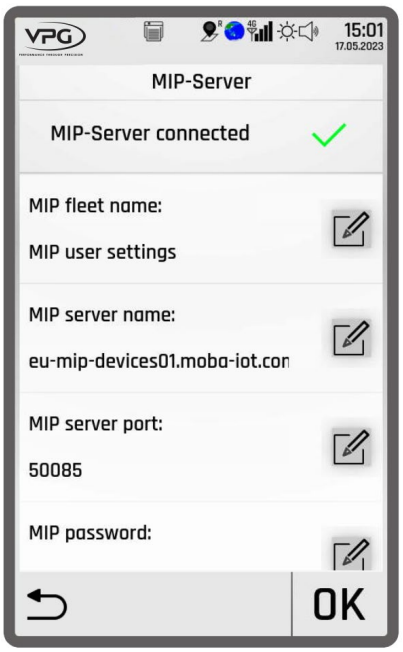


Fig. 10-38: MIP-Server

The parameters to be configured are:

- MIP fleet name
- MIP Server name
- MIP Server port
- MIP Password

10.11 System

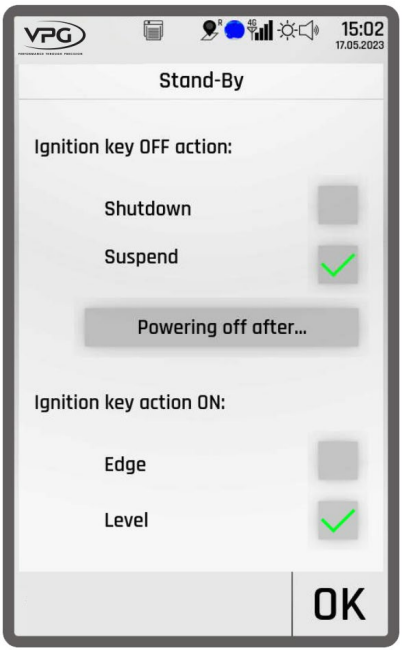


Fig. 10-39: Stand-By

This section allows the service technician to set certain system power OFF behavior settings:

Ignition key OFF action:

Shutdown
Shutdown is a complete system shutdown when the ignition key is turned to OFF. This will cause a longer bootup time every time the operator starts the machine or turns the ignition ON.

Suspend
Suspend will partially shut down the system when the ignition key is turned to OFF. This will allow a quicker bootup time every time the operator starts the machine or turns the ignition ON.

Powering off after ...
Here you can set how long the system is still partially active before doing a complete shutdown (minutes).

Ignition key ON action:

Edge
When the system detects a power voltage change.

Level
The power voltage level is continuous.

10.12 Backup and Restore

To complete most of these functions you will need a USB inserted in the system.

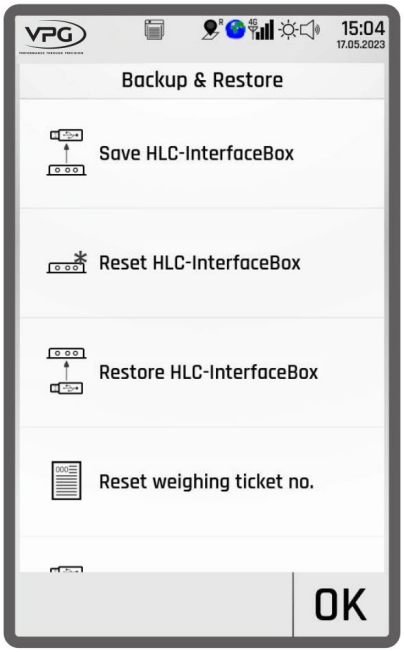


Fig. 10-40: Backup and Restore

Save Tuffer III -Interface Box to USB
In this function the user can save the current setting from the Interface box to a USB which will serve as a backup that could be used later to restore to a new Interface box.

Restore Tuffer III -Interface Box from USB
In this function the user can restore a new Interface box to the current setting using the saved file on the USB.

Reset Unique Bucket Record Number
Each bucket lift has a unique record number used when transmitted to the web portal. Selecting Reset here will reset this unique record number to the original starting number.

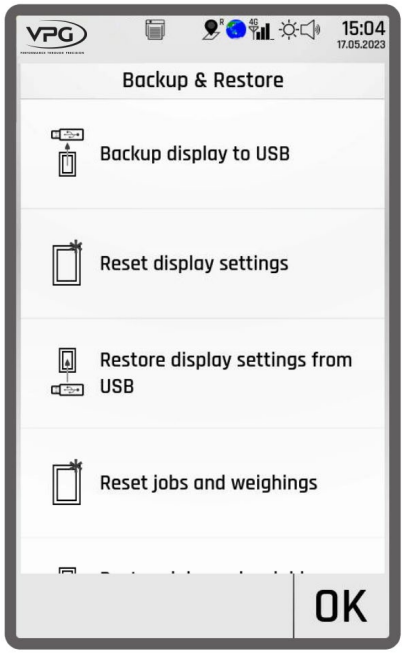


Fig. 10-41: Backup and Restore

Backup Display to USB
In this function the user can save the current display setting from the display to a USB which will serve as a backup that could be used later to restore to a new display.

Reset Settings to Factory Default
In extreme cases it may be required to reset the system settings to factory default. Before doing this, it is recommended you first complete all necessary backups.

Restore Display from USB
In this function the user can restore a new display to the current setting using the saved file on the USB.

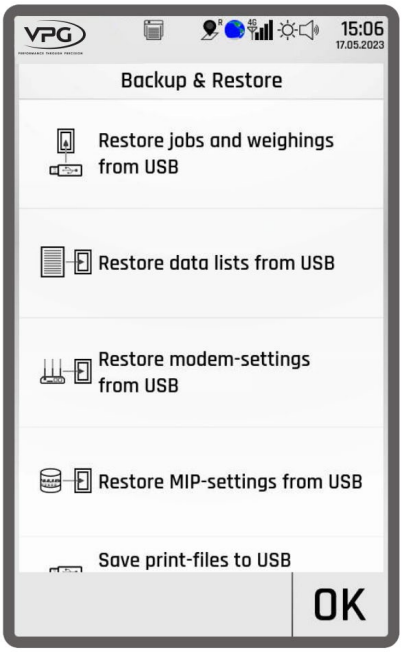


Fig. 10-42: Backup and Restore

Restore jobs and weighing from USB
It is possible to restore jobs and weights to a new display from a saved file on the USB.

Restore data lists from USB
This tool helps to easily upload data lists from files to a new machine with the data list information or in cases where a display is swapped.

Restore Modem Settings from USB
This function will help a user to restore modem settings from a file on a USB.

Restore MIP-Settings from USB
This function will help a user restore the MIP settings from a file on the USB.

Fig. 10-43: Backup and Restore

Save log files to USB
Save the log files to USB so they can be sent to Tuffer III tech support for analysis.

Options:
Today, ALL or select the files to save on USB.

Set level to log
The Tuffer III can save different levels of log files.
Select the level you need to save on the USB.

Options:
Debug, Info or Error

Enable CAN debug messages
This file is useful so Tuffer III can analyze the debug messages for potential issues and causes.

10.13 System Conformity

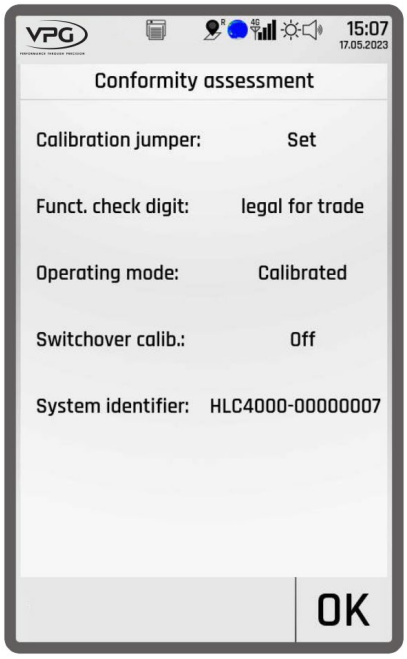


Fig. 10-44: System Conformity

This function is for legal for trade and is currently under construction.

10.14 Contact Info

Fig. 10-45: Contact Info

This area is to enter contact info for technical support, so the end user knows how to reach you for technical support.

The contact Info can be uploaded from a USB File

The contact info can be saved to a USB file.

Notes:

Notes:

Tuffer III Loader Scale System

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