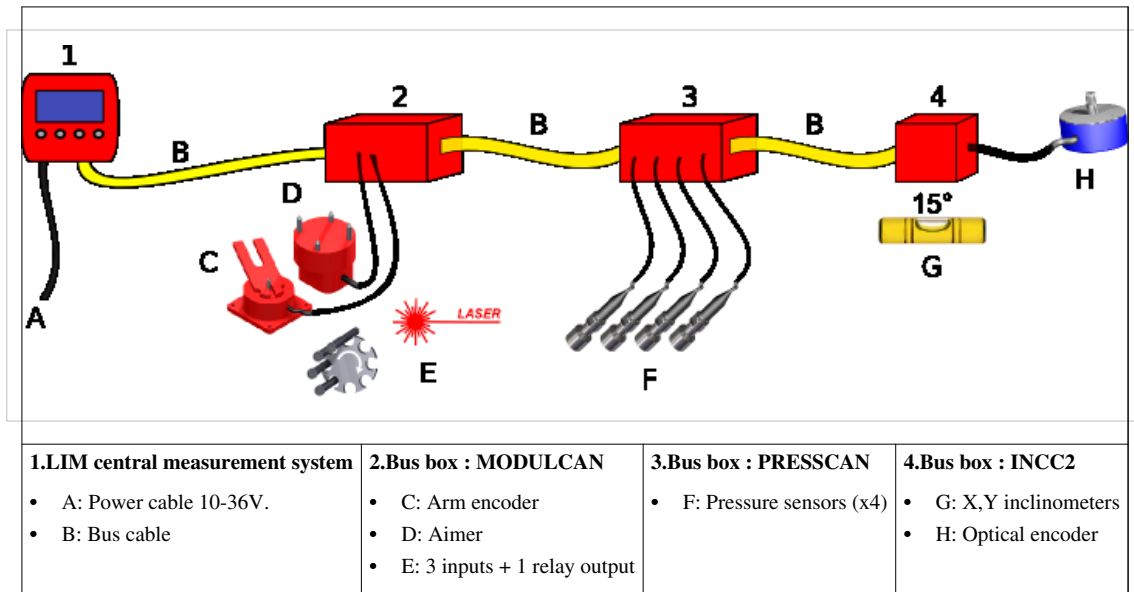


Geotechnics, Mines and Quarries.

Overview of an installation



A typical installation has 4 main elements :

- The central measurement system, which is a conditioned box made of "H.D.P.E." (High Density PolyEthylene). Its front panel contains a screen, user interface buttons and a device start button. Its lower section contains 2 connection sockets, one for the electrical power supply and the other for the data bus.
- The data bus (set of bus cable + bus boxes), which is used to convert the signals emitted by the sensors and transmit the data to the central measurement system. The bus boxes, which are connection boxes placed nearby the measurement sensors to which they are connected by individual cables. The bus cable which is a single cable connecting all the bus boxes to the central measurement system, its length varying depending on the number of bus boxes and the machine's size.
- The measurement sensors, which are used to take measurements on the machine's various points.
- The power cable, which connects the central measurement system to a 10-36 VDC power source, most often the boring machine's battery. This cable will be used to electrically supply the central measurement system, the data bus and the measurement sensors.

Installing the central measurement system

- Placement choice: The central measurement system must be located as close as possible to the borer (within arm's reach) so that it does not hamper his work.
- Positioning: Orient the device's screen in the direction of the borer. Using the adjustment handles, make sure that no obstacle prevents the handling of the central unit.
- Attachment: Attach the device's support solid with the boring machine with the various plates which can be proposed by the LIM Company. Warning : Some safety rules prohibit making any drillings inside a boring machine's cab. In this case, the installer should make a metal support using the existing attachment points, etc.).
- Installation of the power cable : There is only one 3-pin male connector on the lower part of the central measurement system ; this connector is located beside the data bus cable's connector.

The connection is made with an electrical connecting cable supplied with the central measurement system. This cable is equipped with a 3-pin female connector at one end and with two round terminal lugs (diameter 8) at the other end. It is recommended to not connect the cable directly to the boring machine's battery, but rather to connect it to an element protected by an electrical short-circuit safety (contact key, for example).

Installing the data bus

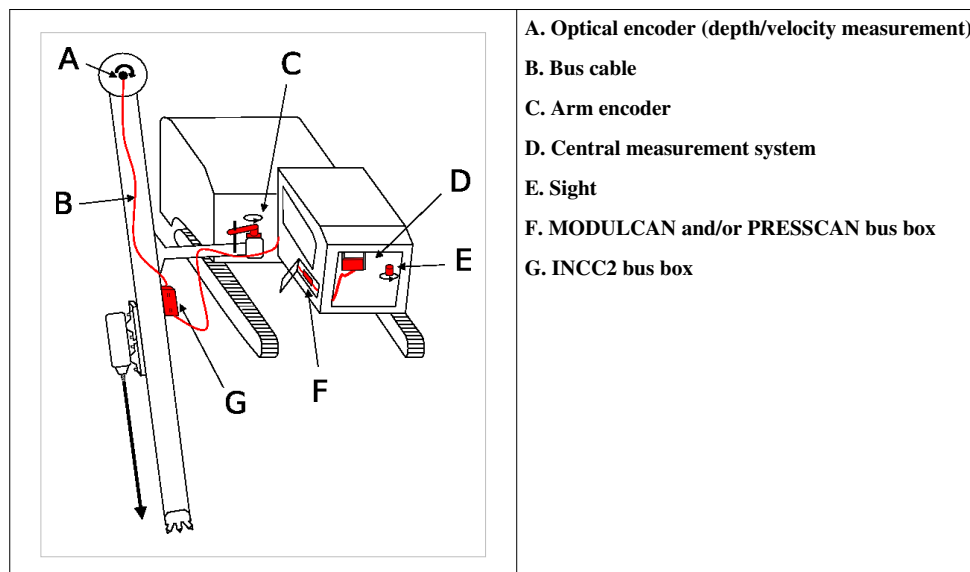
As previously indicated, the parameters measured by the various sensors are transferred to the central measurement system via the data bus. The bus cable is connected to the central measurement system and the various bus boxes .

Installing the bus boxes

The first elements of the data bus to be installed on the machine are the bus boxes. They contain electronic cards which provide the interface between the sensors and the data bus. The cards transform the sensor signals so that they are understood by the data bus. The number of bus boxes varies depending on the selected configuration, therefore the number of parameters to be recorded and the type of sensor to be installed. For a classical configuration, mines and quarries, there are :

- The INCC2 bus box for the 2D tilt of the boring boom and the Depth/VIA measurement.
- The MODULCAN bus box for the angles of the sight and the arm encoder, the stop at the right size edge.

the add-on of rods and the LASER input. Each bus box is welded or screwed to the machine's frame by a counter plate. That is, the choice of the areas to which the bus boxes are attached is left up to the installer and will also depend on the type of machine. The following figure shows the geographical location of each sensor box :



Installing the bus cable

Once the various bus boxes are positioned on the boring machine, simply connect them together via the bus cable whose length may be more accurately adjusted for a final installation.

Installing the measurement sensors

The installation procedures described in this documentation are those for the most commonly used measurement sensors. For the installation of a special measurement sensor, a special data sheet will be supplied.

Installing the depth/velocity sensor

Depth and advancing velocity measurements are taken by the same sensor. Regardless of the installation, the measurement is taken by an incremental optical encoder whose pulses are transmitted via the data bus to the central measurement system, which keeps the depth dimension up-to-date and calculates the incremental advancing velocity (VIA). During boring operations, this system is capable of counting and down-counting the depth with a precision on the order of a centimetre.

Installation examples : optical encoder attached to the axis of the chain's pinion



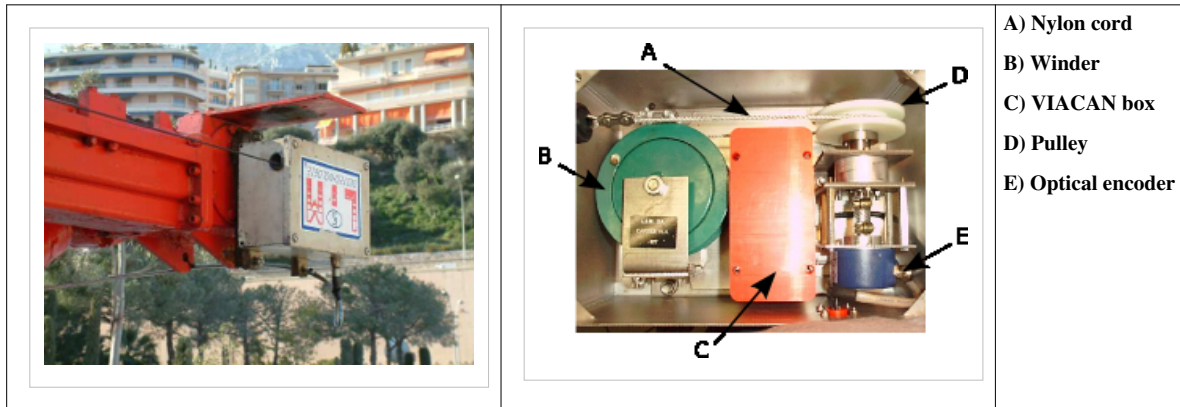
The optical encoder may be installed on all boring machines with a boring head chain-transmission system. Since the encoder's installation depends closely on each machine's mechanical characteristics, we cannot describe a standard installation procedure.

Special case : Installation of the LIM "winder" box

The VIA sensor system "with winder" adapts to all machines whose boring head's travel does not exceed 5 metres. The VIA sensor with winder consists of a box containing :

- an optical encoder ;
- a mechanical assembly, composed of a pulley and a winder with a nylon cord on the end of which a fastening ring is attached and extends outside the box ;
- the VIACAN bus box ;
- The optical encoder is coupled to the pulley and measures the displacement of the nylon cord.

LIM depth/velocity "winder" box



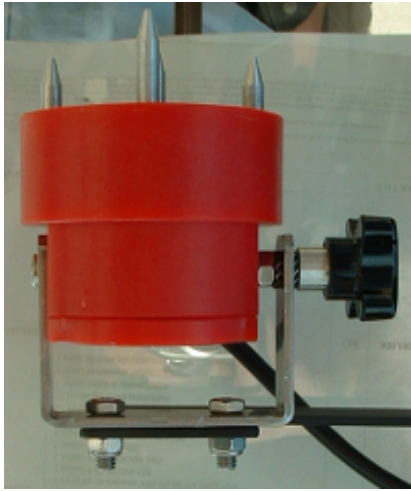
The VIA sensor with winder is secured to the top of the borehole mast and the extending nylon cord is attached to the boring head so that it can enter or exit from the box depending, respectively, on the head's displacements. To ensure precise measurement and avoid any problem of premature wear, it is important to install the assembly so that the nylon cord is as parallel as possible to the borehole mast and does not touch the edges of the box's exit hole. The VIA sensor with winder is supplied with 2 U-bolts, but we recommend welding a metal plate at the mast top for final or frequent installations, so that the box may be secured to the plate with 4 bolts. In this type of installation, since the VIACAN box is integrated with the sensor, it suffices to connect the bus cable directly to the sensor's corresponding connector.

Special case : It is also possible to secure the sensor to the borehole mast's base. In this case, the depth increment is made when the cord enters the box. To do this, simply change the VIA direction in the corresponding menu of the central measurement system. Some machines have a boring head with a long travel and a return "pulley" which is used to guide the hydraulic hoses. In this case, it is not possible to secure the cord directly to the boring head, but rather to this return pulley. Thus, the cord's displacement no longer corresponds to the boring head's real displacement. Therefore, it is necessary to modify the optical encoder's number of pulses in the "pulley block" menu of the central measurement system. Technical data of the VIA sensor with winder : Width : 200 mm Height : 400 mm Depth : 300 mm Weight : 8 kg

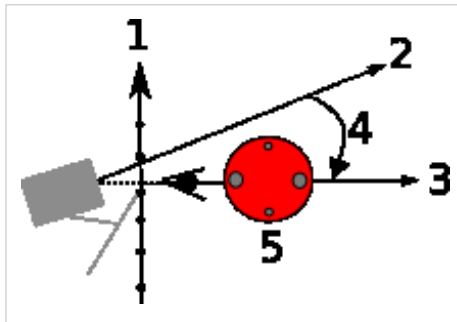
Installing the X and Y inclinometers

The inclinometer allows correctly positioning the mast before a boring begins. In addition to the interface electronic card, the INCC2 bus box contains both inclinometers $\pm 70^\circ$. Therefore, simply secure the INCC2 box to the borehead mast. While installing, make sure that the "UP" and "DOWN" markings indicate, respectively, the up and down directions of the borehead mast. To correct for inevitable alignment errors during the mounting of the box, the central measurement system allows zeroing both inclinometric cells. This zeroing operation must be limited to a few offset degrees because the scale measurement range will be limited accordingly. **VERY IMPORTANT:** This inclinometric sensor is built around a technology which guarantees a very good measurement precision ($<0.5^\circ$) only during boom positioning phases. On the other hand, during boring, the vibrations caused by the hammer strongly degrade the measurement !!!!

Installing the aimer



- **Placement choice:** The sight must be located within arm's distance from the borer opposite to him and close to the cab's front window (windscreen) to enlarge the panoramic view as much as possible.
- **Positioning:** Orient the sight so that its output cable is directed toward the window (see photo to left). Using the adjustment handle, make sure that no obstacle prevents the sight from rotating with respect to its "U-bolt".
- **Attachment:** attach the sight to a metal support solid with the cab by means of two clamps (diameter : 6mm, distance between centres : 34mm) located on the "U-bolt".
Warning: Some safety rules prohibit making any manual drillings inside the cab. In this case, the installer should make a metal support using the pre-existing drilled holes (fastening point of the dashboard elements, etc.).



1. Size edge
2. Axis parallel to the cab
3. Site direction
4. Angle of site
5. Sight

Installing the arm encoder



- **Placement choice:** The arm encoder is placed above the arm's vertical displacement ball-and-socket joint.
- **Positioning:** Move the machine's arm parallel to the cab. Place the arm encoder so that its axis of rotation and that of the ball-and-socket joint coincide. Orient the encoder so that its output cable is directed toward the side opposite to the arm.
- **Attachment:** attach the arm encoder to a metal support solid with the ball-and-socket joint by means of four clamps (diameter : 6mm, distance between centres : 66mm) located at the encoder's base. Warning : some safety rules prohibit any manual drillings on the ball-and-socket joint. In this case, the installer should make a metal support using the pre-existing drilled holes (fastening point of the arm's elements, etc.).
- **Position and then secure the metal orientation rod to a part solid with the arm and perpendicular to the arm (see photo to left).**

Note : This sensor is required to calculate the 3D positioning angles of the boom. It allows measuring the angle of deviation of the arm with respect to the machine's frame.

Installing the rod add-on detection system DEPENDING ON THE TYPE OF MACHINE

The VIA sensor measures in real time the carriage's advance position along the mast. During the boring phase, the distance measured by the sensor is equal to the displacement of the rod in the ground. Once the rod is completely bored, the operator unscrews his tool and moves the carriage to the top of the mast in order to recover a new rod and then repeat the operation. Rod add-on detection consists of accounting for only the tool's displacements during the boring phases and, as a result, rendering the central measurement system "blind" to the displacements during the rod add-on phases.

The rod add-on detection system is installed by means of an electrical cable connected to the MODULCAN box, on the one hand, and under the dashboard to the electrical contact of the rod add-on handle (or the button), on the other hand.

The MODULCAN card is equipped with 2 relay inputs (R1 and R2). They are responsible for collecting the "go/no-go" digital signals generated by the operator's manipulations during the rod add-on phases.

Note 1 : the relay input (R1 or R2) is considered to be energised (or non-energised) when the voltage across its terminals is greater than (respectively, less than) 0.7 Volts. (Boxes placed in operation since 1 January 2004 have a trigger threshold modified to 8V).

Note 2 : To avoid sporadic triggerings (due to interference, for example), the central measurement system starts a 30-second time-out after each rod add-on detection. During this time-out, relay switching will be ignored.

To accommodate the main hardware configurations encountered on machines available on the market, the LIM central measurement systems support 3 operating modes linked to the relays switching sequences :

- Operating mode no. 1 (permanent signal)

This mode uses either relay R1 or relay R2. As long as the relay is energised (period T1), the displacement measurements are completely ignored.

- Operating mode no. 2 (stored signal)

This mode uses both relays R1 and R2. The rod add-on phase starts when R1 goes from the "rest" (non-energised) state to the "energised" state. The rod add-on phase stops when R2 goes from the "rest" (non-energised) state to the "energised" state. Between both, the displacement measurements are completely ignored. Warning : The time during which the relays are energised has no effect ; only at the precise moment when the rest state goes to the energised state counts.

- Operating mode no. 3 (add-on of one rod length)

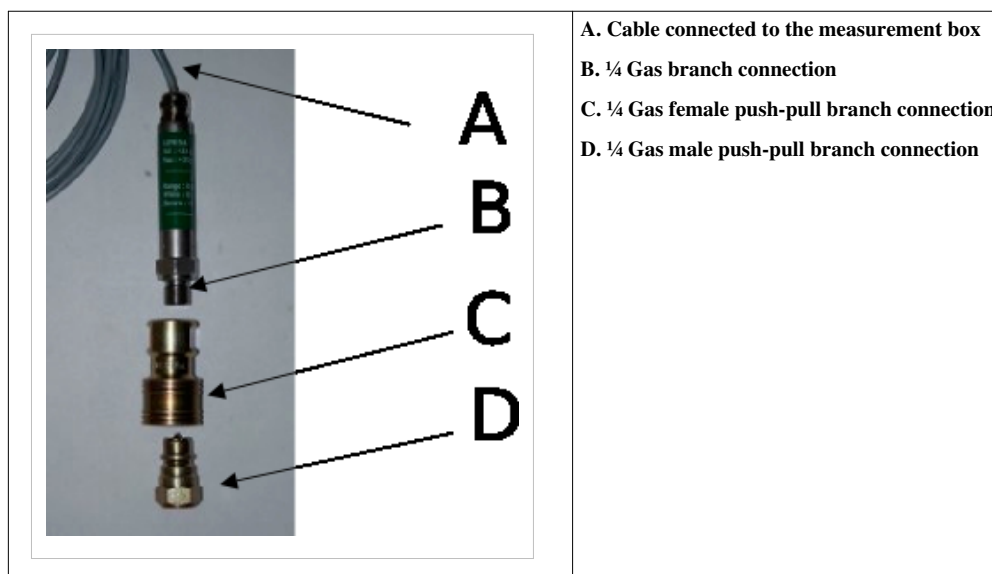
This mode uses either relay R1 or relay R2. Whenever the relay goes from the "rest" state to the "energised" state, the displayed depth is increased by a constant quantity corresponding to one rod length (parameter modifiable in the central measurement system's programming mode). Warning : The time during which the relay is energised has no effect ; only at the precise moment when the rest state goes to the energised state counts.

Installing the pressure measurement sensors

The pressure measurement sensors are connected to the PRESSCAN box and are all exactly the same. Only the measurement range differs from one sensor to another. The connecting and disconnecting of the sensors on the hydraulic or pneumatic circuit of the boring machine are facilitated thanks to a "quick push-pull" type connection. To simplify pressure sensor management, the LIM Company has selected 2 sensor ranges :

0-50 bars : PI or PA

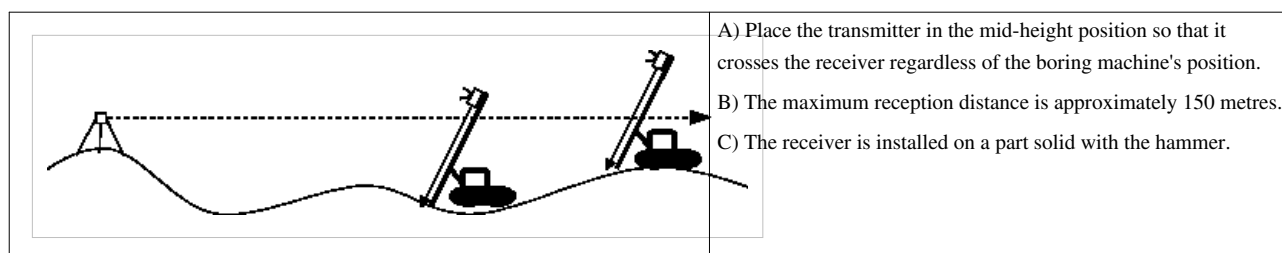
0-400 bars : HYDRAULIC, PO-CR-PR, etc. In order to be less sensitive to electrical noises of all kinds and independent of the cable's length, pressure measurements are taken in the form of a 4-20mA current loop. Note : The installer should be equipped with a connecting "Tee" to connect the "sensor + push-pull base" set to the circuit to be measured.



Installing the PLANAR LASER sensor

The installation of this sensor is a 2-step procedure :

- **Installing the PLANAR LASER transmitter :**



Note 1 : The transmitter's technical data : PLANAR LASER rotary 670nm Visible, class II.

Note 2 : In order to sense the transmitter's signal as best as possible, the tool's descending velocity in the boring phase must not exceed 1000 m/h= (3000 ft/h).

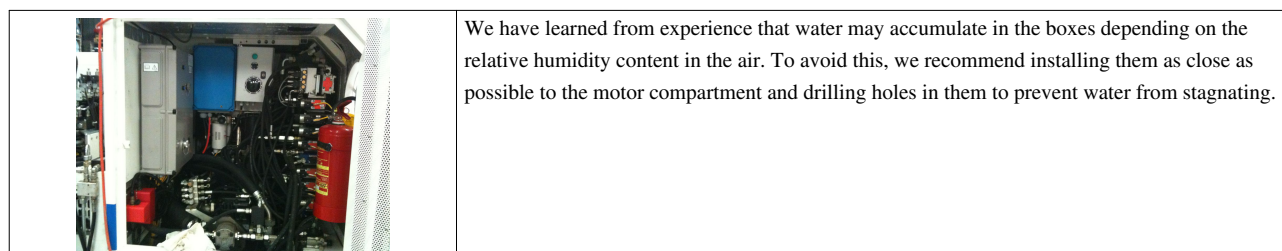
General : the Planar LASER :

The planar laser technique is used in environments where the ground has significant differences in level.

- **Installing the PLANAR LASER sensor:**

The transmission of a horizontal planar LASER sets a reference for all the borings and guarantees a rigorously identical hole bottom altitude, regardless of the ground's difference in level. When the transmitter (remote fixed station) and the receiver (attached to the tool being displaced) are on the same horizontal level, the depth measurement is immediately reset to zero by the central measurement system. The MODULCAN box will be responsible for collecting this information by means of a go/no-go digital relay input.

Moisture in the CAN boxes



VISUALIM : Documentation en

visuaLIM 5G power supply

Voltage

The visuaLIM 5G accepts direct 12V-24V, which means it can be adapted to all types of current batteries. There is a single power socket below the measurement unit. (See photo) The measurement unit power has been reduced as far as possible and does not exceed 15W.

Power faults and protection

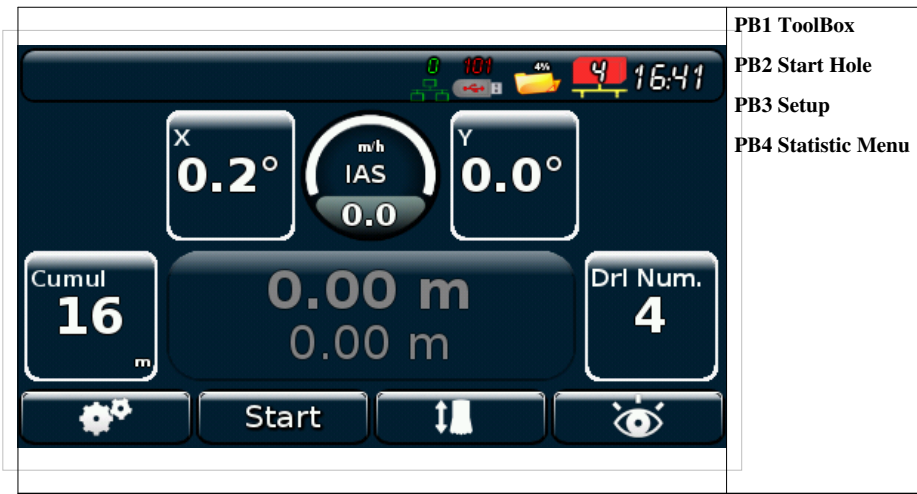
The visuaLIM is designed to shut off automatically if it detects a cut in the power supply (To protect it). You have to press the On/Off button again to restart. The visuaLIM can never be directly connected to the 230v or 380v of a network. It is however possible to connect it via an AC/DC transformer. Another protection is the fact that the PocketLIM and all of its sensors are completely electrically isolated from the voltage. As a result, no relooping current that could cause malfunctions (electromagnetic disturbances) or deterioration (intensity too low) can pass through the equipment. In the event of a short circuit, the equipment input is protected by a thermal fuse that resets automatically.

Important comment:The power cable must be isconnected from the visuaLIM 5G while it is being connected to the machine battery.

Turning on /off

- Connect the CAN bus cable and the power cable (D and E in the diagram above)
- Briefly press the On/Off button (G)

The equipment comes on and starts the initialisation, and a scrolling bar is displayed after a few seconds to indicate the initialisation phases. Then when the application starts up, it shows a summary of the parameters (serial number, version of the application, Version of the equipment...).



Presentation of the general interface



The bar at the top of the screen is always present and informs the operator on the status of the GPS, the status of the GSM, the presence of a USB key, the memory used, the number of CAN cards on the BUS and the time. It also gives the name of the current bore hole. This bar is also a button so you can return to the previous menu when several applications are open (choice of application). There are two parts to the pocketLIM:

- Saving, which the driller uses.
- A toolbox (transfers, removals...)

The measurement menu

Real-time measurement display

PB1 Toolbox

PB2 Start a bore hole

PB3 Configure a borehole

PB4 statistic menu

Displays the pressures (PO, PI, CR). Note that AUX is grey as it is not physically connected. In standby or pause mode the angles are displayed.

Configuration menu

PB1 Up

PB2 Down

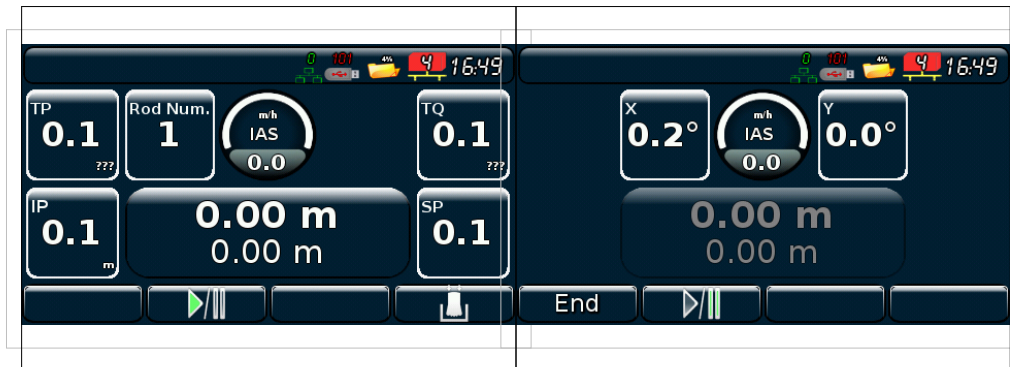
PB3 Modify

PB4 Exit

In this menu we can change the rod length and the stop depth

starting a borehole

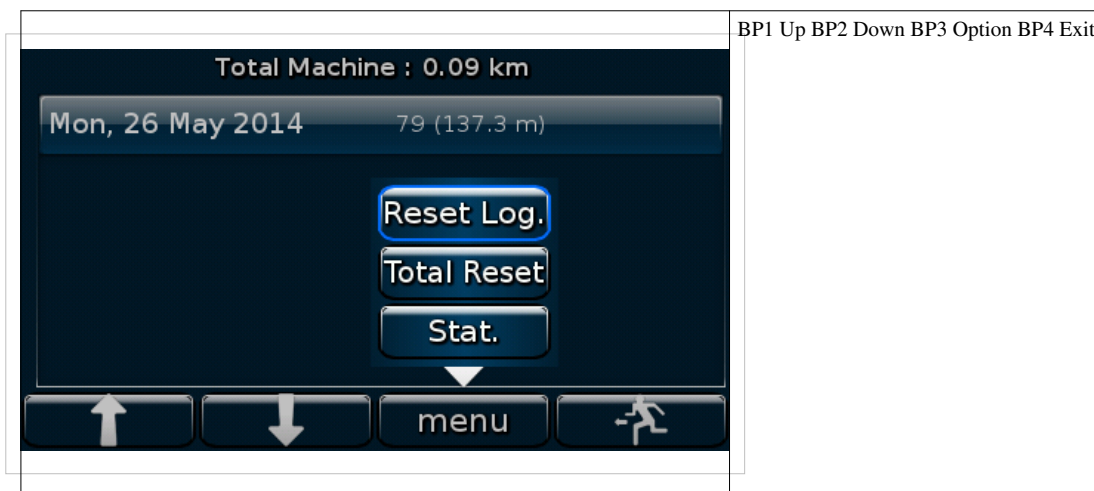
You must put the tool at the ground level and press the PB2 "start". You can start drilling. The depth, the rod number and the pressure sensor are displayed.



Statistic

Listing

Even if the Visualim 5G doesn't record the borehole data, the operator can display some borehole statistics.



This menu displays a listing by "post", for each reset performed in the measure menu, the visualim records the following statistics :

- The end date of the post
- The number of borehole
- The total depth
- The total drilling time
- The total number of rod
- The average depth
- The average time of drill
- The average speed
- The average rod

The operator can reset the listing by pressing reset logs.



After a confirmation the file is erased.

The total machine is the number of km of drill recorded by the visualim.

Only the administrator product can reset this value.

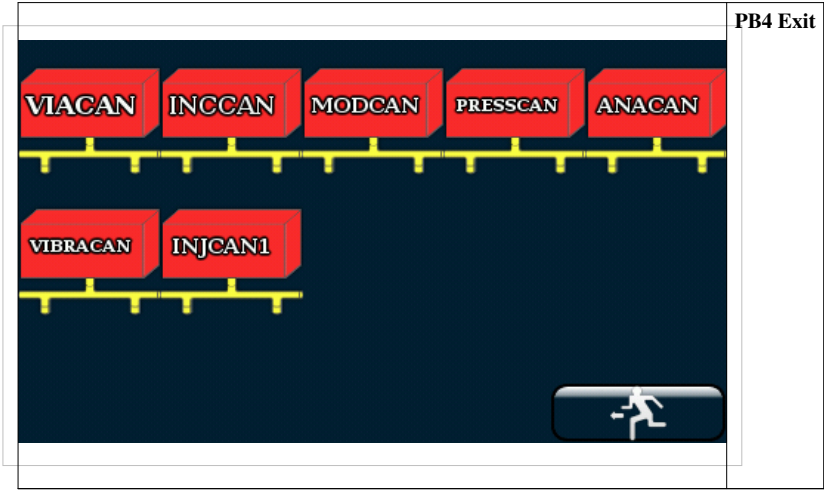
Détail



Install

This menu is used to configure the cards for each application (Bore hole, pressure....) and to perform a diagnostic of the CAN bus. Card configuration will be dealt with in the specific chapter for each application.

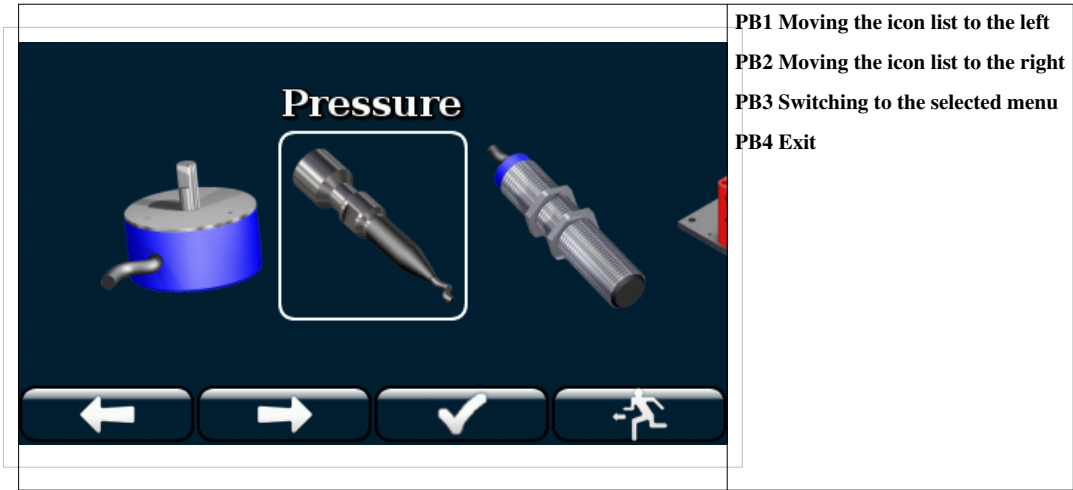
Diagnostic of the CAN bus



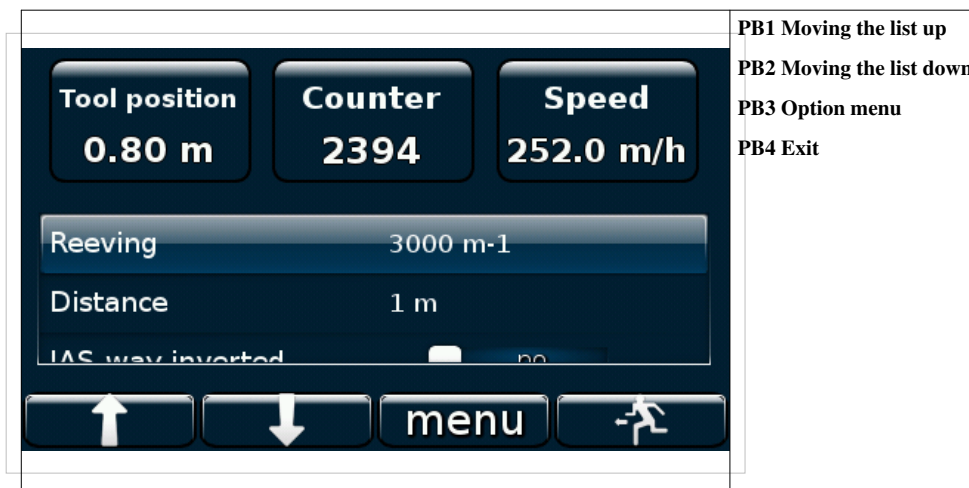
This menu refreshes the CAN cards detected on the BUS in real time, which means you have a quick diagnosis if the CAN bus is cut.

The Sensor Installation menu

This menu is designed to configure the machine sensors.



VIA card



This menu calibrates the depth measurement of the VisuaLIM 5G.

Reeving principle

The optical coder on the progress sensor measures the progress of the tool. This transmits the information to the measurement unit in the form of pulses. Operating the pump converts the number of pulses gathered into a measurement in metres.

Reeving method

- Place the drill head in the highest position.
- Adjust the reeving distance to 1.00m
- Press the button PB3 (menu) then (Zero Prof)
- Using a marker, mark the current position of the drill head
- Lower the drill one metre exactly with respect to the previous mark.
- Press the button PB3 (menu) then calibrate
- At this stage a new reeving value is displayed on-screen. This value can be adjusted manually by selecting the line reeving in the list then by pressing the button PB3 (menu), then (modify).

Comment : The final measurement error depends on the exactness of the movement. For example, a 5cm error on the reeving leads to a measurement error of 1 metre for a 20-metre deep bore hole! ! !

Pressures



Pressure measurement principle

The PRESSCAN card measures a current directly proportional to the pressure exerted on the sensors. This current is then digitised then transmitted to the measurement unit. The range of current variation is between 4 mA and 20 mA. The pressure measurement is calibrated by informing the VisuaLIM 5G of the scale of the sensor so the pressure in bars can be automatically calculated. You can configure up to 4 pressure sensors. The names of the first 3 sensors are: TP (Pressure on the tool), IP (injection pressure), TQ (torque pressure). The 4th sensor has no pre-assigned name; by default the VisuaLIM calls it the "AUX" sensor. You can rename it anytime. In general, the following configurations are assigned to the sensors: TP = 400 bar, IP = 50 bar, TQ = 400 bar.

Angles

X

0.4°

Y

0.5°

Reverse direction X

yes

☐

Reverse direction Y

yes

☐

Exchange XY

☐

no

menu

PB1 Moving the list up

PB2 Moving the list down

PB3 Option menu

PB4 Exit

Adjusting the angle measurement

Position the bore hole arrow in the position that you estimate to be X=0, Y=0 using a manual angle measurement system (spirit level, protractor...). Press the buttons PB3 (menu) then "Zero X" and PB3 (menu) then "Zero Y" (PB6).

Arm/Aimer coder

Arm

0.0°

Arm volt.

0.00 volt

Aimer

0.0°

Aimer volt.

0.00 volt

Reverse Aimer direction

yes

☐

Reverse Arm direction

yes

☐

menu

PB1 Moving the list up

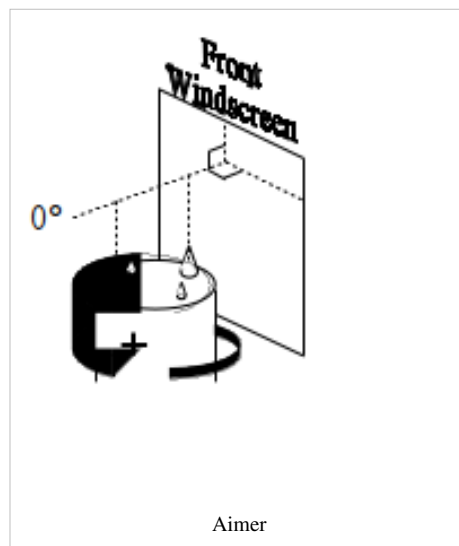
PB2 Moving the list down

PB3 Option menu

PB4 Exit

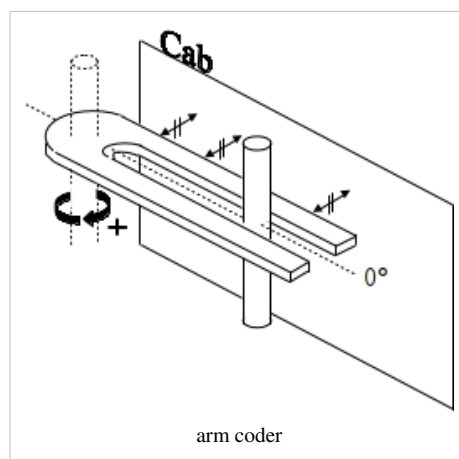
Adjusting the Aimer

- Turn the aimer so that the line passing through the two large rods is perpendicular to the front glass of the cab (see drawing opposite).
- Press PB3 then menu (Zero Aimer).
- Turn the sight in the positive direction (see drawing 0° opposite).
- Make sure that the angle displayed is positive. If this is not the case, inverse the direction (field "Aimer Direction Inversion") to correct it.

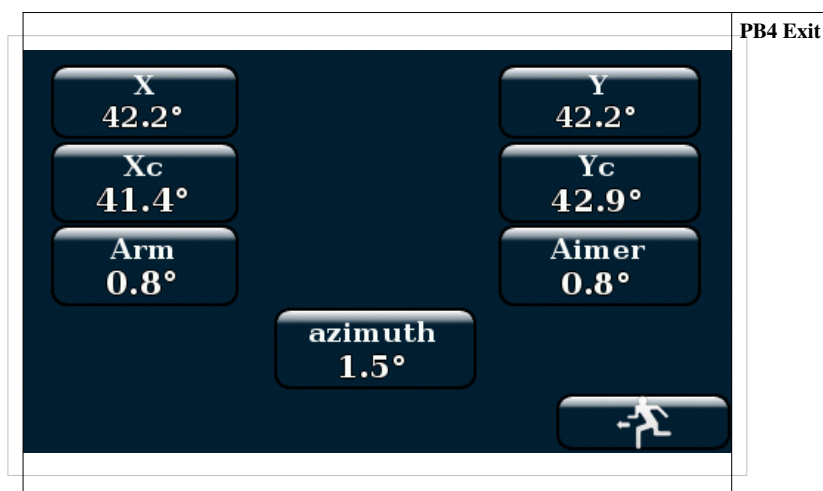


Adjusting the Arm Coder

- Place the arm of the machine parallel to the cab (see drawing opposite).
- Press PB3 menu then (Zero).
- Move the arm in the positive direction (see drawing opposite).
- Make sure that the angle displayed is positive. If this is not the case, inverse the direction (field "Arm Direction Inversion") to correct it.

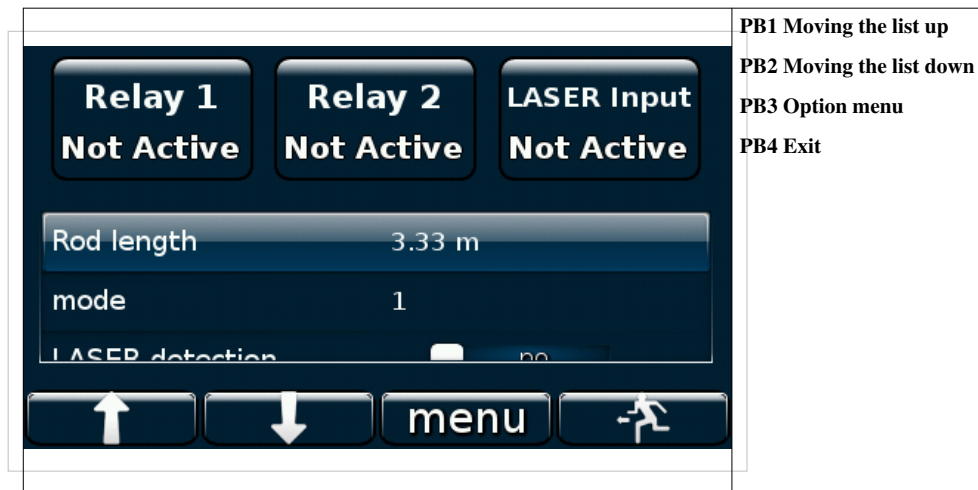


3D



This menu tests the Angle, aimer and arm coder.

Inputs/Outputs



This menu:

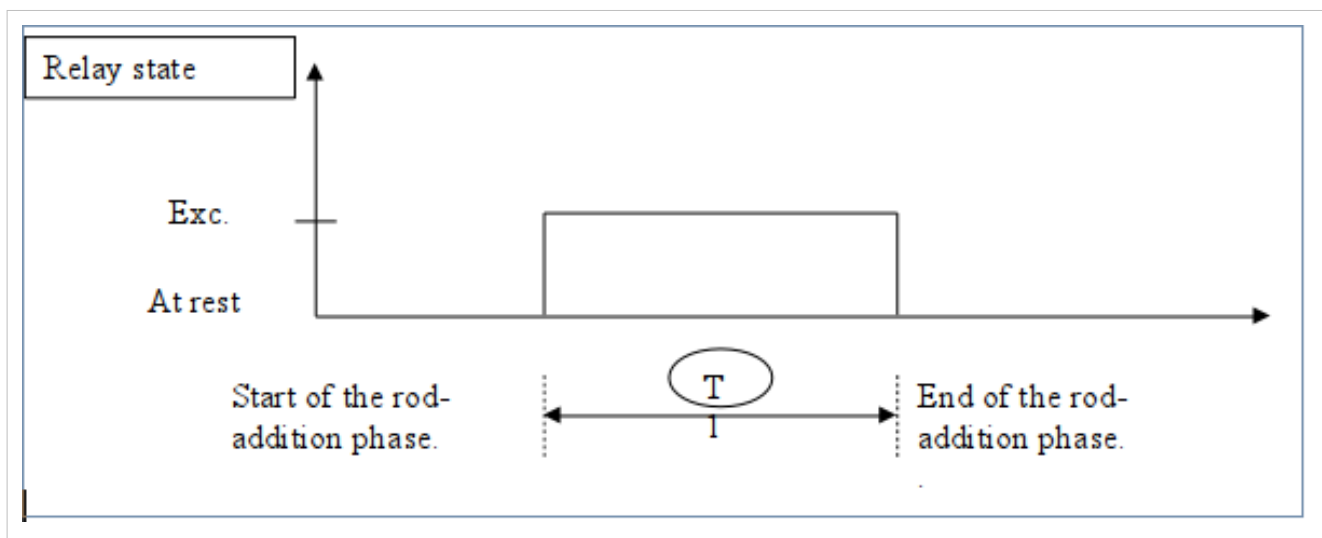
- Tests the relays
- Adjusts the automatic rod addition mode
- Activates the LASER detection

Adjusting automatic rod addition

3 modes are available :

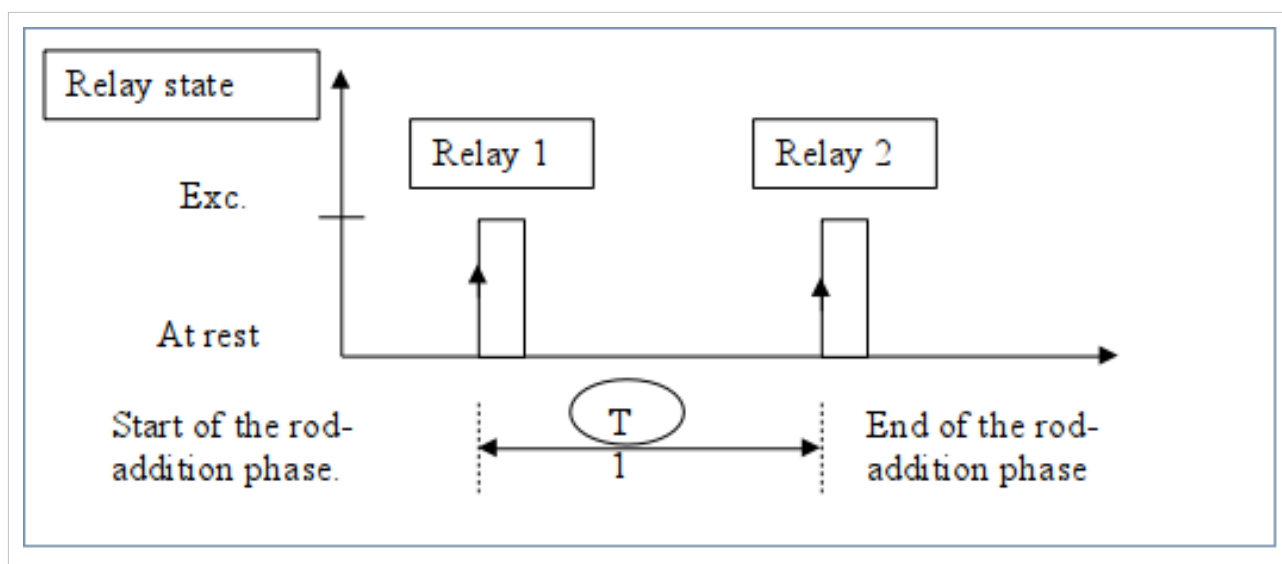
- Mode n° 1 (permanent signal)

This mode uses either relay R1 or relay R2 of the INPCAN card. While the relay is excited (period T1), the movement measurements are totally ignored.



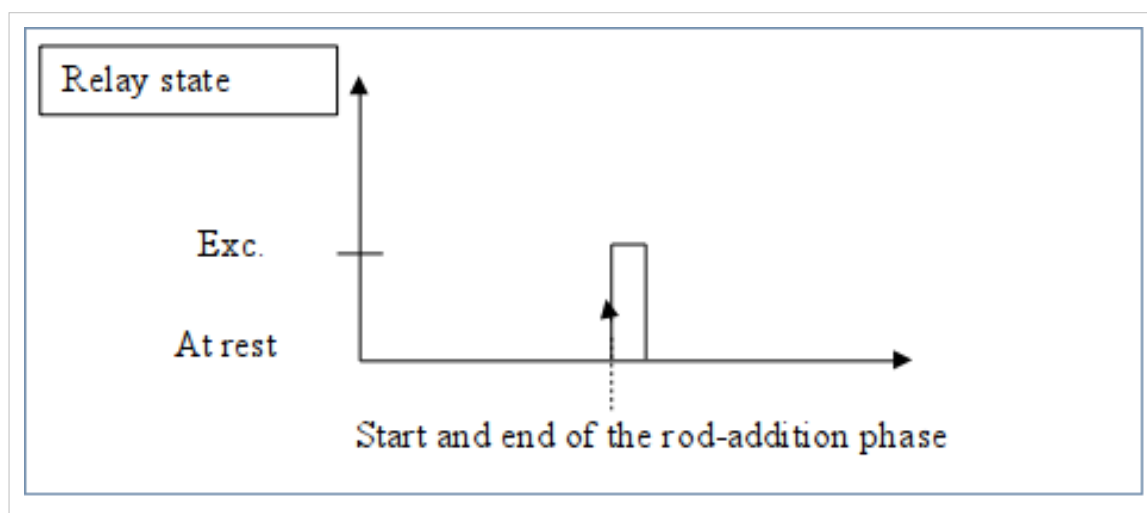
- Mode n° 2 (stored signal)

This mode uses the two relays R1 and R2. The rod addition phase starts when R1 changes from the "rest" state to the "excited" state. The rod addition phase stops when R2 changes from the "rest" state to the "excited" state. Between the two, the movement measurements are totally ignored. Note: The period of time that the relays are excited has no impact; the only thing that matters is the exact moment of the change from the rest state to the excited state.



- Mode n° 3 (addition of a rod length)

This mode uses either relay R1 or relay R2. Each time the relay changes from the "rest" state to the "excited" state the depth displayed is increased by a constant amount corresponding to the length of a rod. Note: The period of time that the relays are excited has no impact; the only thing that matters is the exact moment of the change from the rest state to the excited state.



Unit

Depth unitm

Speed unitm/h

Pressure unitbar

Flowrate unitl/h

Volume unitl

↑

↓

✓

⚡

PB1 Moving up in the list

PB2 Moving down in the list

PB3 Modifying the field

PB4 Exit

The visualIM is highly flexible in that it can be adapted to all known units. For depth you can use, for example, feet, cm, mm. If this is a unit of depth and it is correctly written, the equipment will accept it. We add in the visualIM some predefined unit. If you want you can enter you proper unit by selecting "other".

☐ m

☒ ft

☐ Other...

↑

↓

⚡

PB1 Moving up in the list

PB2 Moving down in the list

PB3

PB4 Exit

Date/Time

09 : 03 : 32

11 / 08 / 11

+

-

Next

⚡

PB1 Incrementation of the number selected

PB2 Decrementation of the number selected

PB3 Changing to the next number

PB4 Exit

It is very easy to modify the date and time. The value of the number selected (the one in the box) is modified using the buttons PB1 (+) and PB2 (-). You then move on to the next by pressing PB3.

Language



To change the language, use the buttons PB1 and PB2 to select the new one, then confirm by pressing button PB3 twice.

About

