

SMARTANK

LIQUID LEVEL MEASURING SYSTEM

DS EUROPE

INSTRUCTION MANUAL

VERSION 1.1r1 - 03/01

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1. GENERAL FEATURES

1.1 INTRODUCTION

This system has been studied in order to provide liquid level measurements in industrial applications.

The system is composed by:

- *magnetostrictive transducer series PCS*: when used with a floater and inserted inside a tank it can perform level measurements with great resolution and repeatability;
- *digital display unit*: it provides power supply to the transducer displaying level measurements in mm or in liters, having stored a linearization table referred to the tank in which PCS transducer has been installed;
- *computer setup utility*: with an user-friendly interface it allows connection by a notebook computer with the possibility to perform easy setup and calibration of the measuring system.

1.2 MINIMUM COMPUTER SYSTEM REQUIREMENTS

- PC 486 or better (desktop or notebook) with 3,5" floppy disk driver.
- 2 Mbytes hard disk free space minimum.
- 4 Mbytes RAM minimum.
- RS 232 port for connection to the display unit (COM port from 1 to 6).
- VGA 256 colors card or better with display resolution of 640x480 minimum.
- OS Windows 95/98 (NT to be tested).
- Adobe Acrobat reader has to be installed on the computer in order to view the pdf version of this manual (version 3.0 or later).

The setup utility is Y2K compliant.

2. POWER SUPPLY BOARD CHARACTERISTICS:

- **Model:** MLPA power supply
- **Manufacturer:** DS Europe srl
- **Power:** 14W max
- **Maximum current:** 500mA continuous
- **Installation category:** II
- **Pollution degree:** 2
- **Working temperature range:** from 0 to 60°C
- **Power supply:** 230 VAC $\pm 10\%$ mains 50 Hz
- **Fuse:** 250VAC – T100 mA
- **Marks:** CE

3. MECHANICAL INSTALLATION

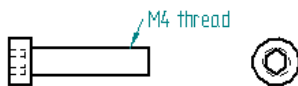
3.1 DISPLAY INSTALLATION

The plastic enclosure of the display has to be fixed to the support structure by using the four holes used to fix the transparent cover.

Fix the enclosure on a plate surface.

Use M4 fixing screws with hexagonal key head as in the drawing.

Drawing dimensions are in mm.



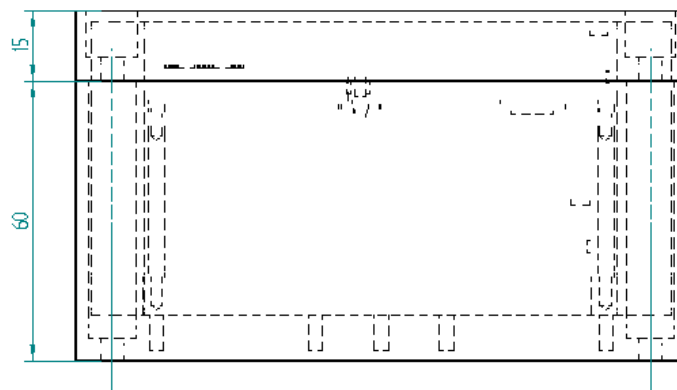
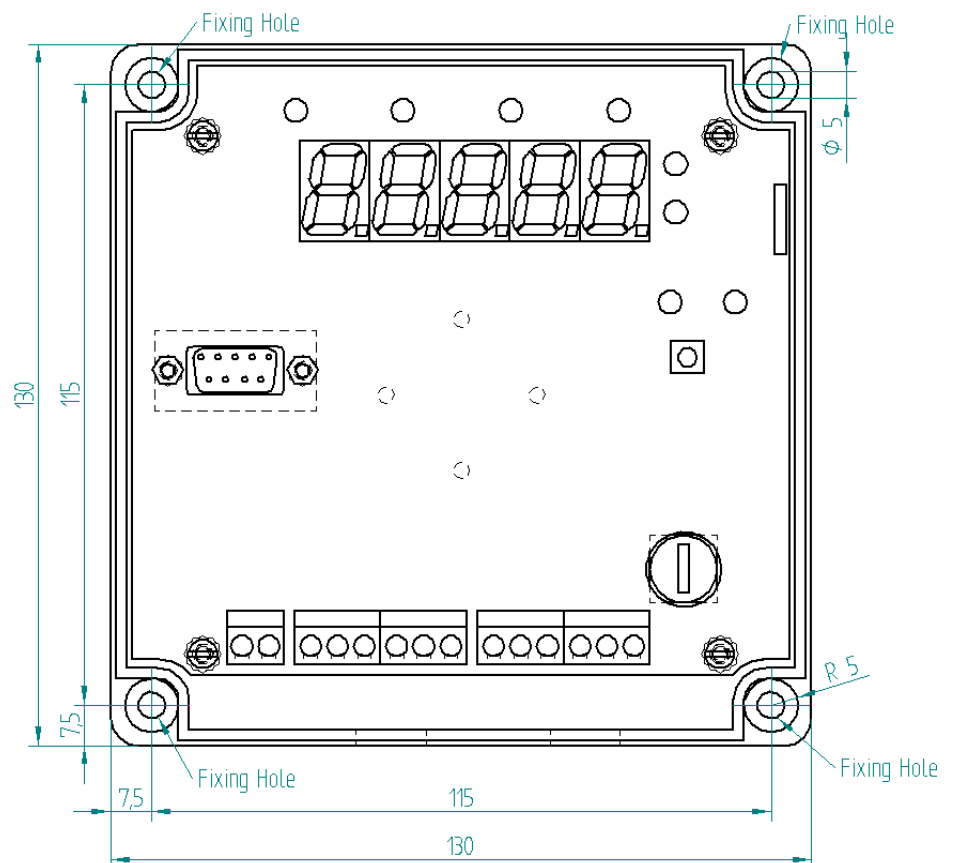
Do not use internal fixing holes as the enclosure will lose IP65 protection.

Display unit has to be installed considering all the pertinent rules for installation of electrical appliances.

The unit has to be installed:

- as far as possible from heat sources;
- as far as possible from water;

Do not clean the display unit with direct pressurized water jet as they could get damaged.



3.2 TRANSDUCER INSTALLATION

Transducer has to be installed internally to the tank so to maintain it as vertical as possible.

This in order to obtain best measurements.

Cable connection has not to be stressed during installation.

Float is marked with a reference on the external surface. This reference is indicating magnet position and it is to be positioned facing the top of the tank (toward the transducer's electronic head – red painted).

Care is to be paid in order not to bend the measuring rod of the transducer.

Do not clean the PCS transducer with direct pressurized water jet as they could get damaged.

4. ELECTRICAL INSTALLATION

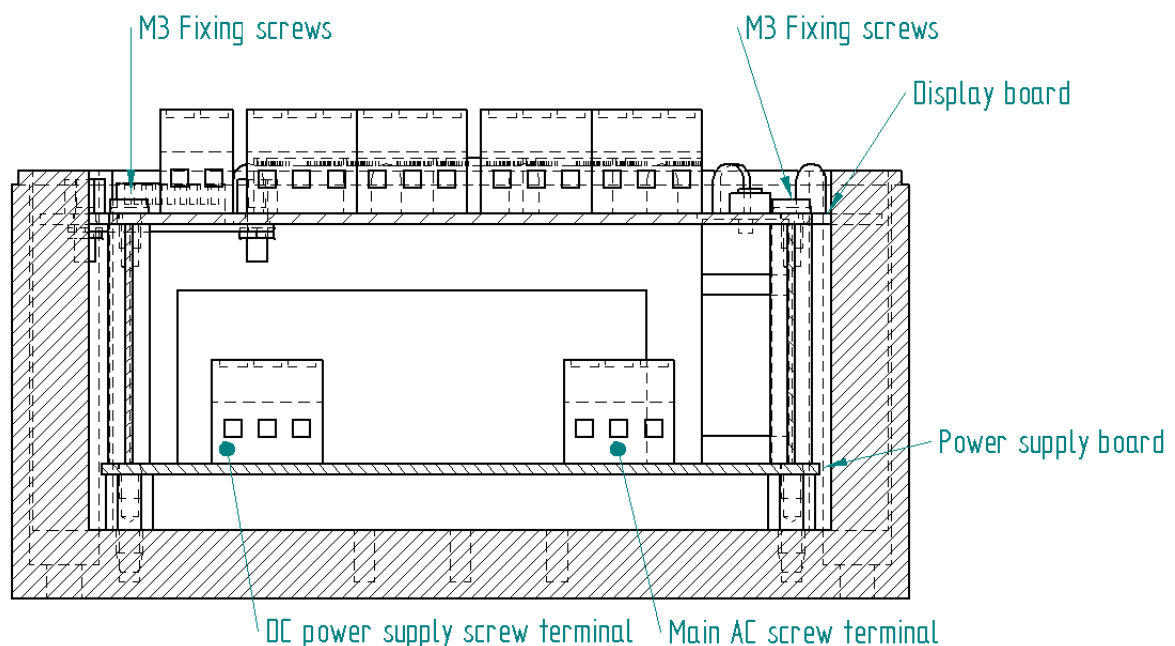
IMPORTANT: any operation performed on the electronic boards must be performed by a qualified technician. Do not perform any electrical connection or any repair on the electronic boards when the system is powered, in order to avoid damages to persons or to the electronic boards. When installed the enclosure can be opened only if it is dry and there are no possibilities that the operator get electrical shock.

When mounting the system it is imperative:

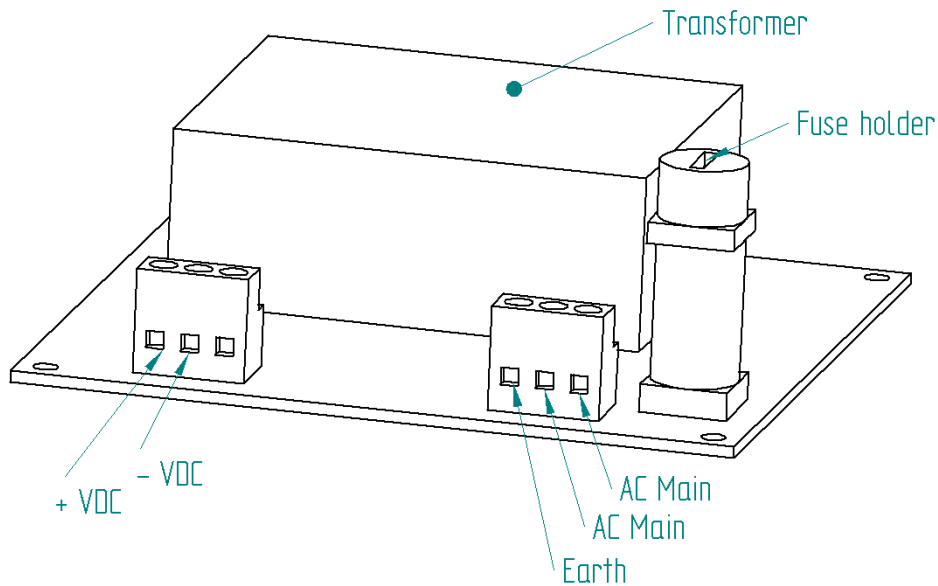
- not to damage, with screw driver or other tools, any side of the boards;
- to avoid that extraneous metallic elements, water or dust get on the circuit boards creating short-circuits.

MLPS display unit is composed by two boards:

1. *display board*: this board is accessible removing the transparent closing of system's enclosure. Before working on this board, touch a grounded metallic surface so to avoid any electrostatic charge that may damage the electronic components. When removed from the system it is important not to bend or stress mechanically the board.
2. *power supply board*: it is internal to the plastic enclosure and has to remain fixed to the plastic enclosure.



4.1 CONNECTIONS TO THE *POWER SUPPLY BOARD*



The power supply of the MLPS system has to be connected to 230 VAC $\pm 10\%$ mains 50 Hz. The MLPS system should be installed with the AC connection obtained from the main machine control panel using a safety differential switch so to allow complete removal of AC mains from the unit.

AC power cables should be of adequate section (1 mm² minimum).

Check that connections are done properly so to have good electrical contacts and that cables are not too tight. Cable should be fixed so to avoid that mechanical stresses reflect on the electrical connection.

On the power supply there is a 250VAC – T100 mA fuse that is hold in place with a lockable system. In order to change the fuse it is needed to use a plate screw driver and:

1. Power: remove the AC power supply from the system
2. Press, gently, with the screwdriver on top of the fuse holder and turn it in order to align the notch with the external references, releasing then pressure.

When all the connections to the *power supply board* have been done, place the *display board* in position so that fuse holder and fixing holes are aligned with their holes. Use the supplied M3 screws.

Do not power the system unless all the connections between the *power supply board*, the *display board* and the *PCS transducer* have been done.

NOTE: with the power supply circuit it is provided a **ferrite coil**.

It is mandatory to place this ferrite on the DC output wires.

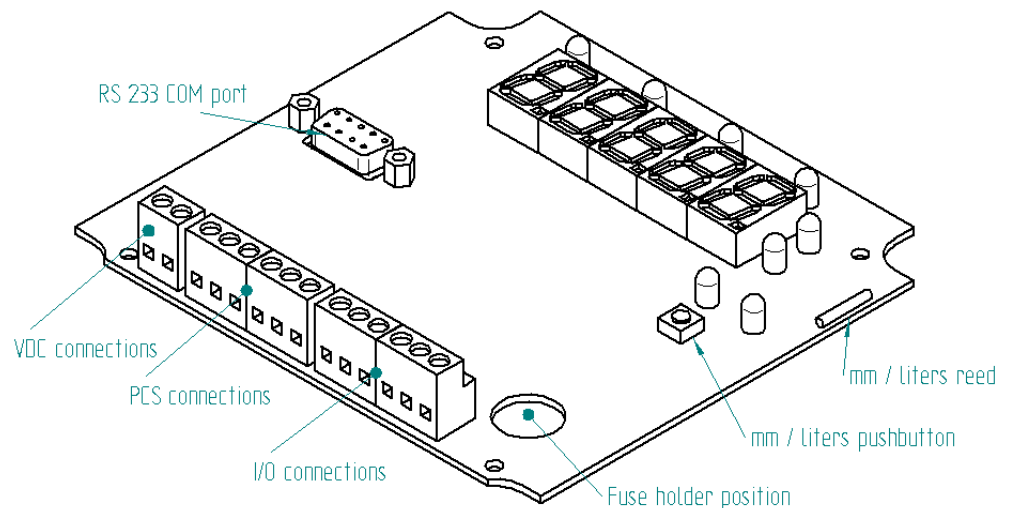
Pass the two wires through the ferrite forming a one turn coil (+VDC and – VDC) before connecting to the display board.

4.2 CONNECTIONS TO THE *DISPLAY BOARD*

Connection to the display unit must follow the underlisted table:

Screw terminal	Cable color	Description
+	RED	+VDC from power supply board
-	BLACK	-VDC from power supply board
1	red	PCS transducer +VDC
2	black	PCS transducer -VDC
3	white	STOP 1
4	green	STOP 2
5	yellow	START 1
6	blue	START 2
7		Input command 1
8		Input command 2
9		Relay contact 1
10		Relay contact 1
11		Relay contact 2
12		Relay contact 2

Screw terminal numbering is available on the upper part of the board.



When connecting PCS transducer pay attention to respect color/terminal matching in order to avoid damages to the system.

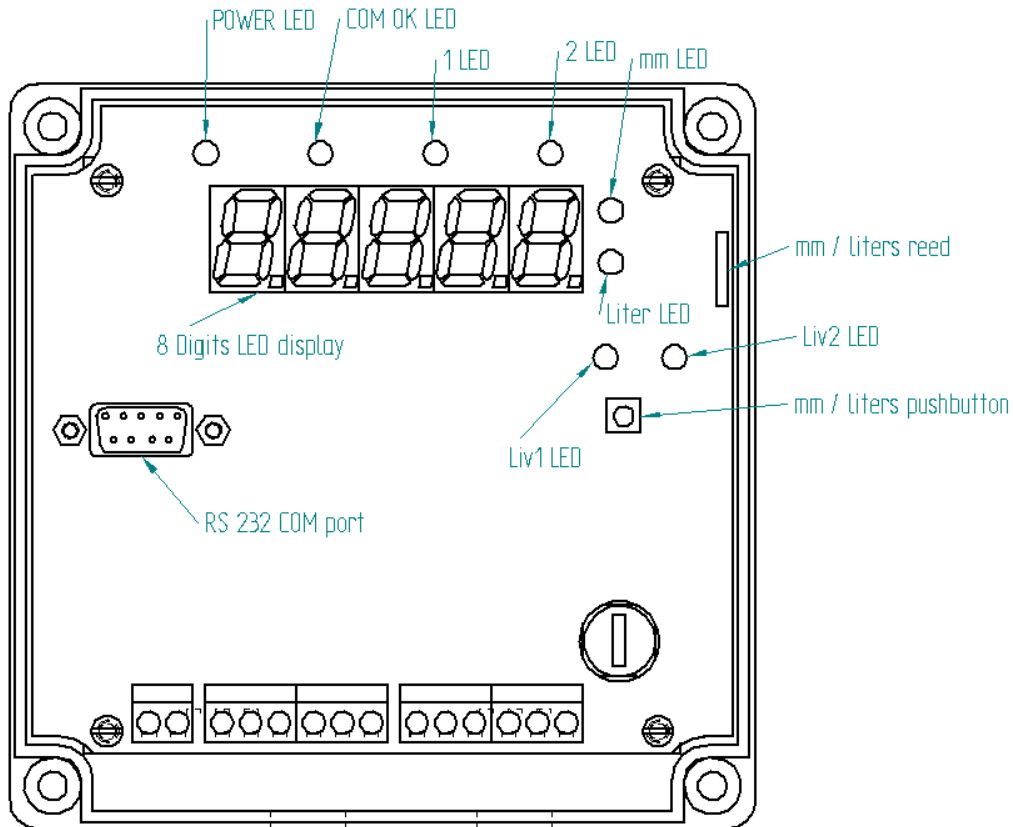
Check that connections are done properly so to have good electrical contacts and that cables are not too tight.

Unless it is needed to connect the system with an external computer for setup purposes the unit has to operate with the transparent cover in place, fixed with the supplied crews so that proper enclosure sealing is obtained.

The system is now ready to be powered.

5. MLPS OPERATION

At power on the system will show the MLPS word, the firmware revision and will start volume measurements (if the MLPS system has been correctly configured).



5.1 POWER LED

If the unit is correctly powered this led will be on. If switched on it indicates correct MLPS initialization at power on.

Check DC and AC power supply connections if the system does not power on and this LED is off. During MLPS software reset the LED is switched off.

5.2 COM OK LED

When the MLPS system is connected with an external computer this LED flashes to indicate that there is a valid dialog between the system and the external computer running the setup utility (software connection procedure has been activated with successful connection).

This led powers on when data transfer is occurring between MLPS unit and computer.

5.3 1 LED

This led is steadily on when the transducer is properly working and correctly connected to the MLPS system. This led flashes when there is a connection or dialog problem between PCS transducer and MLPS display board (“Error” message appears on the display).

Check connection between MLPS system and PCS transducer.

5.4 2 LED

This indicator is showing the status on “Input command 2” (screw terminal connection n° 8).

When powered on it indicates that a switch has been closed or that a TTL signal changed from High to Low (toward DC power supply common = -VDC).

“Input command 2” is used to trigger additional software functions.

5.5 MM LED

This LED, when powered on, indicates that the displayed measurement is a displacement measure (i.e. millimeters). It indicates the floater position on the PCS transducer’s measurement rod.

5.6 LITER LED

This LED, when powered on, indicates that the displayed measurement is a volume measure (i.e. liters). This measure is calculated by the MLPS system using the floater position, measured by PCS transducer, and the linearization table saved in memory. Volume measurement is the default power on condition. **When this led is flashing**, it indicates that a level measurement has been requested, but the MLPS system does not have, in memory, a valid linearization table and is displaying a displacement measurement.

5.7 LIV1 LED

It indicates if Relay 1 is active or not active. Lighted on indicates that relay is active.

5.8 LIV2 LED

It indicates if Relay 2 is active or not active. Lighted on indicates that relay is active.

5.9 MM / LITER REED

This reed, when activated with a magnet positioned near it from the outside of the enclosure, switch the display from showing displacement to volume measurements or vice versa. Keep the magnet in position for a short time to activate it.

5.10 MM / LITER PUSHBUTTON

This pushbutton switch the display from showing displacement to volume measurements or vice versa. Keep it pressed for a short time to activate it.

5.11 RS 232 COM PORT

It is used, by connecting a computer running the setup utility, to calibrate and setup the MLPS system. On the MLPS system is installed a standard female DB9 connector (9 pins) while on the computer generally can be found a male DB9 connector (RS 232 COM 1 or COM 2 port).

Serial cable needed for connection must have a male to female DB9 straight connection as for the following table:

	Computer	MLPS
TXD (transmit data)	3	3
RXD (receive data)	2	2
GND (signal ground)	5	5

5.12 DISPLAY

The unit is equipped with a 5 digits digital display that provides the following indications:

1. **displacement measurement** → mm LED on → liter LED off
2. **volume measurement** → mm LED off → liter LED on
3. **CAL**: this indication is shown when the MLPS system is not correctly calibrated.
4. **Error**: this indication is shown when PCS transducer is not properly communicating with the MLPS display → 1LED flashes.
5. **Floater**: this indication is shown when floater is not detected on the measuring rod.

NOTE: when using linearization tables with more than 64 elements the system may display volume measurement with a short delay each time that the MLPS system needs to load a new set of 64 elements not currently present in memory.

6. SOFTWARE INSTALLATION

Software utility is supplied with two 3,5" installation disks.

Insert disk number 1 and run file **a:\setup.exe** (supposing that Your floppy disk driver is named "a"), then follow the software instructions.

Setup program creates a program directory and a program group. On the program group are placed: the program, the uninstall utility and a PDF copy of this manual in its latest revision (Adobe® Acrobat® reader is required in order to view this document).

7. SOFTWARE DESCRIPTION

7.1 FIRST PROGRAM EXECUTION

Before running for the first time the *software utility* connect the *MLPS digital display* to the serial port of the computer and power all the measuring system.

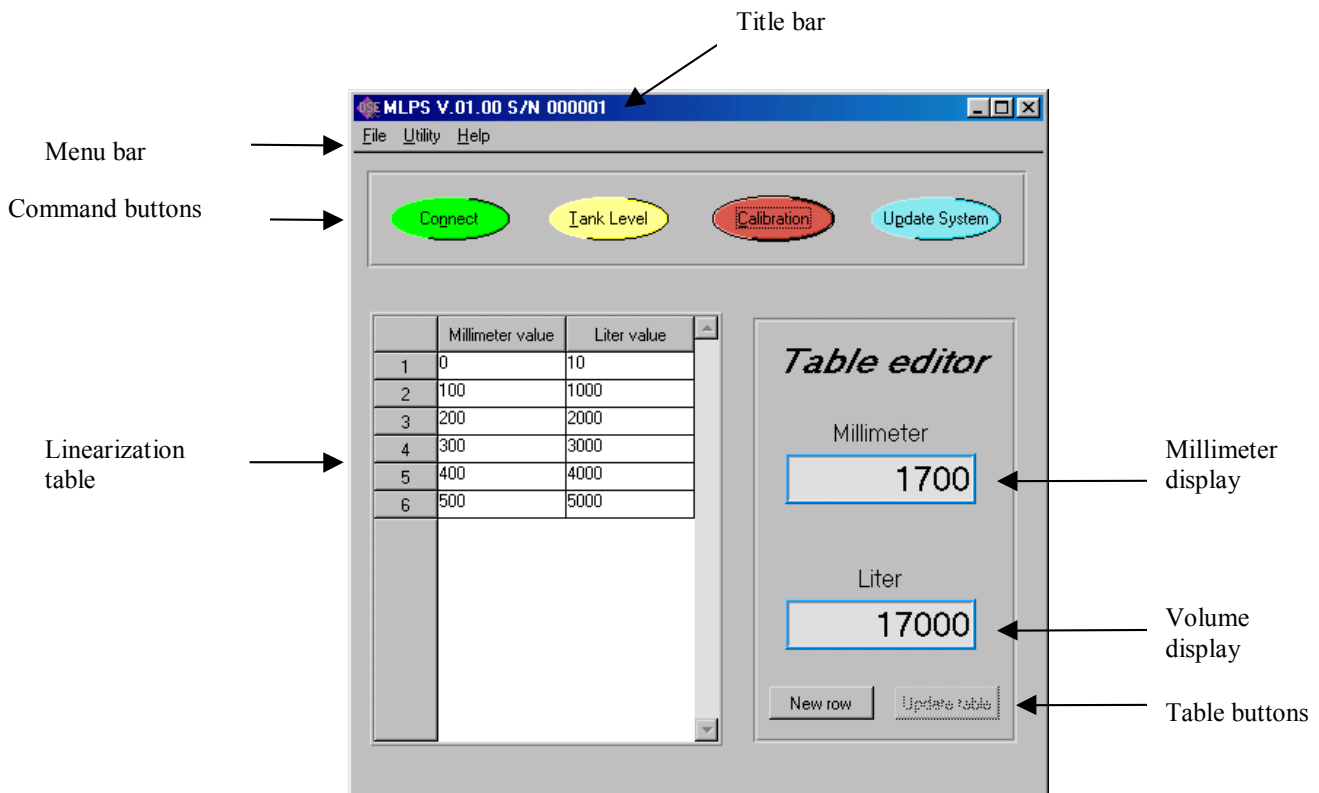
At the first run of the program the software executes a scan of the serial interfaces available on the computer and tries to connect to the display unit.

To run the setup utility with the mouse select "Start → Programs → Level measurement → DSElevel".

When the scan detects a connected measuring system it stop the scan indicating COM port and baud rate at which communication has been established. If it is needed to perform a new serial scan it is possible to activate it manually from menu bar "Utility → Serial Scan".

7.2 MAIN WINDOW

The main window is described as follows



Title bar: when software utility connects successfully with MLPS system it indicates the firmware version and system's serial number.

Menu bar: it contains all the commands that are not frequently used. When clicked on a bar element the corresponding drop down menu will appear.

Command buttons: these buttons are used for main functions like connection, calibration, graphical volume display or upload to the MLPS system of the working linearization table.

Linearization table: this two columns table is used to enter, edit or show the linearization points.

Millimeter display: it indicates the position of the float with reference to the PCS measuring rod.

Volume display: if a linearization table is displayed it will be displayed the corresponding volume measurement. This measurement can be different from the one displayed by the MLPS system as there could be different tables in use.

Table buttons: these buttons are used to add new rows to the table or to update the working table used by the program to display volume measurements. By doing the latter it is performed a check on the validity of the table and if it is correct it can be also uploaded to the MLPS system ("Update system" becomes active).

Controls can be buttons or menu actions and their status may be:

- *Active*: they are highlighted and can be selected by means of the mouse pointer.
- *Not active*: they are shown but are shadowed or grayed and cannot be selected.

Window actions: in order to activate a function use the mouse in order to move the cursor and click on the desired element, if active. Actions can be activated also with shortcuts, using a combination

of keyboard keys. In example “Alt+F” will activate the “File” drop down menu while “Alt+T” will activate “Tank level display”.

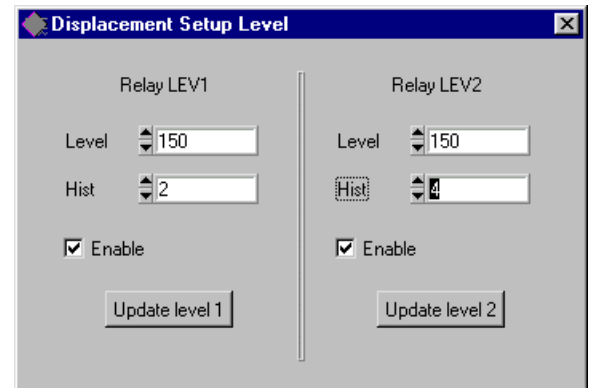
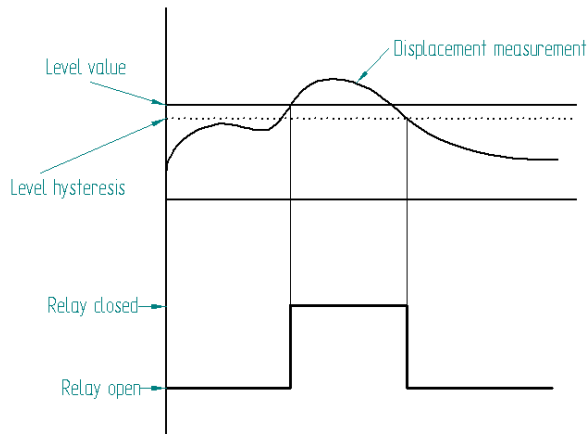
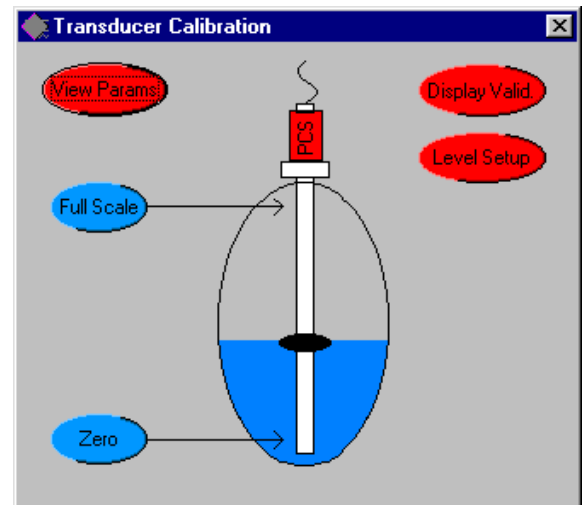
7.3 MLPS CALIBRATION

In order to start the calibration procedure it has to be pressed the “Calibration” button (Alt+C).

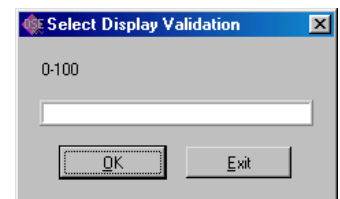
A calibration window will appear and the following actions can be performed by pressing the button:

Level Setup: it is used to set activation level and hysteresis of the two relay available on the MLPS system. Relays act on the displacement measurement.

- *Level field:* it is used to set the activation level;
- *Hyst field:* it is used to set the hysteresis on the level;
- *Enable checkbox:* it enables relay control;
- *Update button:* download to the MLPS system all the relay working parameters.



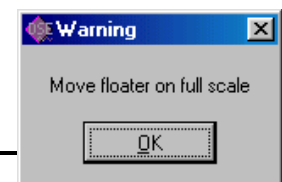
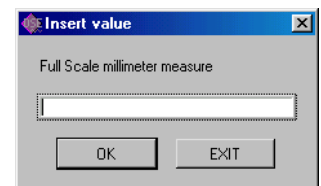
Display validation: it is used to signal, to the User of the MLPS system, that the PCS transducer is measuring variations of the floater position greater, or equal, than the value set with this parameter. The value is set in mm and the program can accept an integer positive value from 0 to 100 mm. When MLPS detect a variation greater, or equal, to the set value the display will show 5 lines until fluctuations become smaller than the set value, for more than 2 seconds. By pressing Exit button no modification are performed while by pressing OK the new parameter is accepted. If it is set a 0 or 1 value the filter is disabled. This parameter affects only the displayed measurement on the MLPS system and not the data displayed by the computer trough RS 232 connection.



Full Scale: it is used to set full scale reference.

Program will ask in sequence:

1. To digit the Full Scale reference value in mm (integer value, with a maximum of 4 digits = ± 9999). By pressing Exit button no modification are performed (procedure is aborted) while by pressing OK the new parameter is accepted.
2. To move the floater/cursor to Full Scale position and to press Enter button to store its position.



When the procedure is completed the program will signal the result of the operation. In case of not successful results check troubleshooting paragraph.

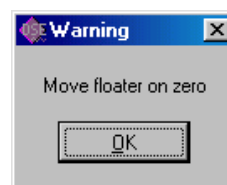
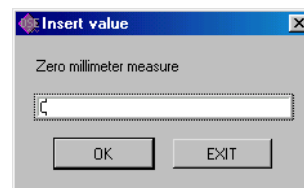
Zero: it is used to set zero reference.

Program will ask in sequence:

3. To digit the Zero reference value in mm (integer value, with a maximum of 4 digits = ± 9999). By pressing Exit button no modification are performed (procedure is aborted) while by pressing OK the new parameter is accepted.
4. To move the floater/cursor to Zero position and to press Enter button to store its position.

When the procedure is completed the program will signal the result of the operation. In case of not successful results check troubleshooting paragraph.

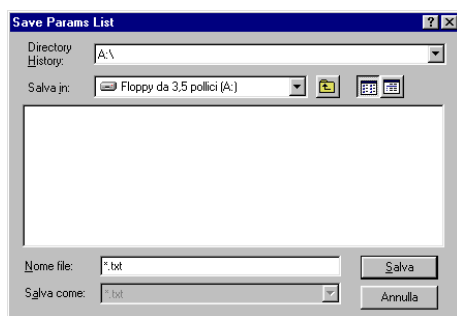
NOTE: Full Scale and Zero settings may be changed independently one from each other.



View Params: this command perform a download of all the working parameters stored on the MLPS system and shows them in a windows. It is used for maintenance purposes.

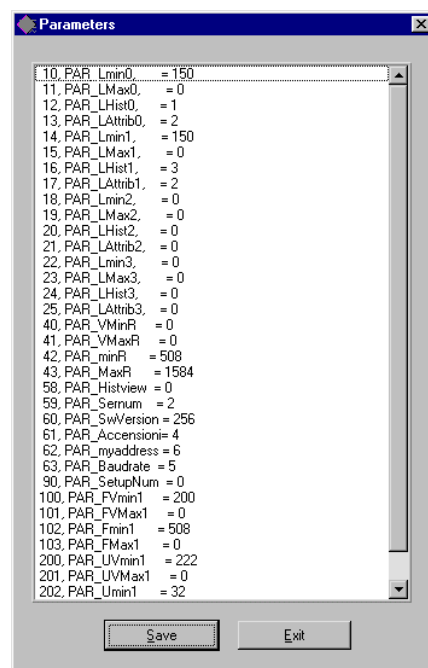
To exit form the “parameters” windows press the Exit button.

To save the parameters press the Save button.



Parameters will be saved as text file (.txt) on the desired drive.

To exit from “Transducer Calibration” window press the X button in the rightmost upper corner.



When exiting from the Calibration panel the program will shut down and restart the MLPS system in order to make effective the calibration.

7.4 TABLE HANDLING

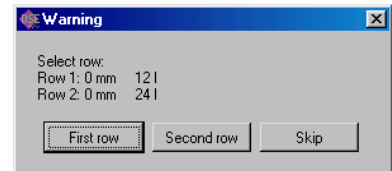
The program can transfer to the MLPS systems, with the “*Update System*” button, 2 type of linearization tables:

1. A 2 columns table generated with a spreadsheet and saved as text file with Tab as column separator. In this case no column header have to be created and it is up to the User to check data validity. Acceptable parameters, as displacement and corresponding volume, are integer numbers. Displacement can be a number with up to 4 digits (± 9999) while volume may be a number with 5 digits maximum (from -9999 up to $+99999$).
2. A table generated by the program itself.

Common to both possibilities, to add or edit data, simply position the cursor on the desired cell clicking twice and enter the new value. If it is needed to add new rows to the table press the “*New row*” button.

Any change on the table, as editing of existing data or addition of new rows, will activate the “*Update table*” button which validate the table.

It check the validity of the data and if everything is ok allows the live use of the new table for volume display or for upload to the MLPS system. Table is sorted on displacement in ascending order and rows are checked in order to avoid the possibility to have two rows with the same displacement value with different corresponding volume.



If program detects two rows with incompatible data it asks which row is valid (first or second) allowing to skip the check and to return to normal operation (table is left unchanged).

When *New row* button is pressed a new row is added at the end of the table and in displacement cell (leftmost) is automatically inserted the current displacement measured by PCS transducer if connection between computer and MLPS system has been established (otherwise a zero value is added as displacement). This practice eases table creation when characterizing a new tank.

If connection is established any variation on the linearization table will be reflected on the Volume display only after having pressed “*Update table*” button.

It is possible to create tables with up to 1000 rows maximum.

If a table has been defined or edited and not saved when exiting from the program it is asked to the User to save the table.

It has to be noted that the “*Update System*” button stays grayed (not active) unless a table is loaded and validated by the software.

When a new table has been saved on the MLPS system software will provide to reset the system.

7.5 MENU BAR

7.5.1 File → Open

With this command it is possible to open a table previously created by the setup utility or by a spreadsheet program.

7.5.2 File → New

This command creates a new table with a row where displacement and volume values are set to zero.

7.5.3 File → Save

With this command it is possible to save a table in the computer in text format.

7.5.4 Utility → Serial computer

This command allows the manual setup of computer serial interface parameters if they are known and User is willing to start a manual serial connection to the MLPS system.

7.5.5 Utility → Serial Scan

This command is used to automatically search an MLPS system connected to the computer. This procedure take some time as, for each working COM port, the software will try to get connected to MLPS at all the available baud rates.

When a successful connection is achieved, the program will show ,on the title bar, firmware references and serial number of the connected unit. If the program does not detect any unit it will issue an error message (in this case check connections and power supply).

7.5.6 Utility → Volume measuring unit

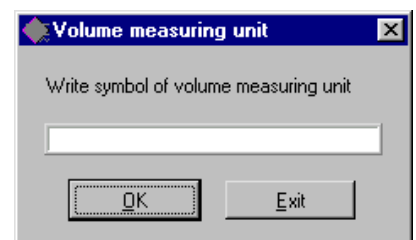
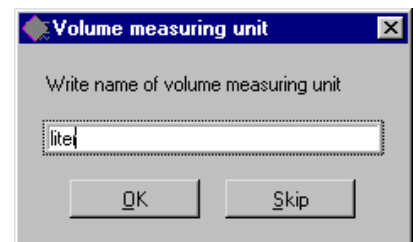
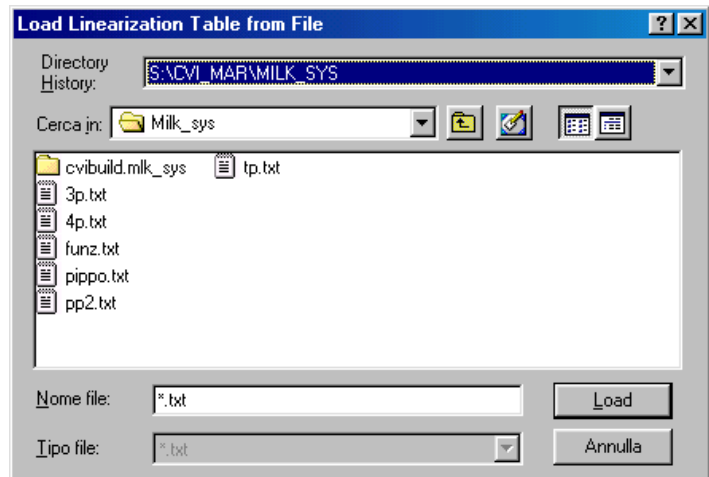
This command allows to set the volume measurement units to be displayed by the setup utility.

In sequence it will be asked to enter:

1. *Name of the measuring unit*: this is an alphanumeric string with a maximum length of 15 ASCII characters. This is the volume unit displayed on the main window. By pressing the Skip button it is possible to leave unchanged the existing name changing only the symbol.
2. *Symbol of the measuring unit*: this is an alphanumeric string with a maximum length of 2 ASCII characters. This is the label shown with the volume measurement on the Tank Level window.

7.5.7 Utility → Save System Table

This command transfers the linearization table from the MLPS system to the computer and saves it into a user specified file.



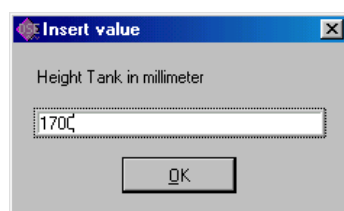
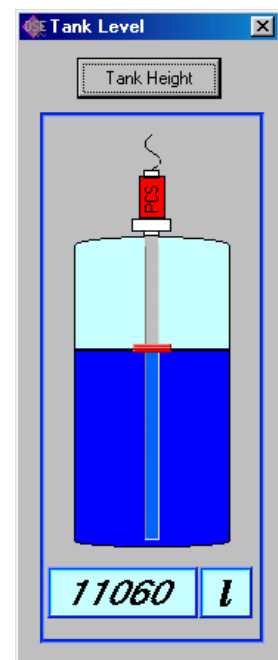
7.6 DISPLAY MEASUREMENTS

To display measurements it is first necessary to establish a connection between the setup utility and the MLPS system. Connection procedure is started by pressing the “Connect” button and software will show the result as:

- *Achieved connection*: in this case the program will show on the “Title bar” MLPS references (firmware revision and serial number);
- *Error message*: indicating communication problems.

Measurement performed by MLPS system can be shown in two ways:

1. *By the main window*: if a valid table is not loaded on the computer program, the displacement measured by PCS transducer in millimeters will be the sole measurement available. By loading a valid linearization table the program will show the volume measurement corresponding to the displacement. It is possible to load, on the setup utility, a table different from the one present on the MLPS system’s memory allowing the test of a linearization table without the need to save it on the MLPS system. This feature is also important as it allows to check table effect on measurements during table definition.
2. *By Tank Level window*: this window is recalled by pressing the “Tank Level” button from the main window. For this measurement, the program downloads the linearization table residing into the MLPS system; this will be used to compute the volume value. In order to show, on the graphical live display, the correct ratio between the actual level measurement and the tank height press the “Tank Height” button so to enter total tank height in millimeters. Tank height can be an integer number up to 4 digits (9999).



8. CE DECLARATION OF CONFORMITY

Applied Council's directives: 89/336/CEE modified by directives 92/31/CEE, 93/68/CEE

Conformity to Standards:

EMC:
 EN 50081-2: 1994 - Emissions, General Norm
 EN 55011
 EN 50082-2: 1995 - Susceptibility, General Norm
 ENV 50140
 ENV 50141
 EN 61000-3-2
 EN 61000-3-3
 EN 61000-4-4
 EN 61000-4-2
 EN 61000-4-8
 ENV 50204
 EN 55014-1

Electrical safety:
 EN 61010-1: 1993

Manufacturer: DS Europe srl

Address: via F. Russoli, 6 Milan (Italy)

Equipment type: Liquid level measuring system

Model: SMARTANK

Year of registered mark: 2001

The equipment has been tested in the typical installation configuration, as described by the instruction manual of the Product.

DS Europe srl certify that the above defined equipment meets the requirements of above mentioned directives.

Milan, March 9th, 2001

DS Europe srl
 Technical Dept.

9. GUARANTEE

The numerous mechanical and electrical controls carried out during manufacturing and final testing ensure that the units delivered are free of defective material, machining and operational defects.

Any units which prove to be defective, despite the above mentioned controls, shall be repaired or replaced free of charge by DS Europe, on the conditions that the units have been subject to normal or correct use and in any accordingly with the use described in the herein manual, and that such units shall be delivered to the DS Europe office, by the Customer, (who will have to forfeit the costs for the relative transport, insurance, customs etc.), within 6 months from the sales shipment from DS Europe to the Customer.

The Customer is to be fully aware, exonerating DS Europe from any responsibility with regard to such, that the returned units in as much as seemingly defective might be tampered with in order to carry out necessary controls; so, where we are dealing with units such as these and hence not covered by above guarantee, DS Europe will return the units, at the Customer's expense, the units which, following the execution of the above mentioned controls, may no longer be intact.

Manual of instructions N°090301-E. All the information in this manual the information, or any part thereof, is confidential and cannot be made widespread without express written authorisation from DS Europe srl.

This manual, even after sales of transducer, is only handed over for viewing purposes and remains the property of DS Europe.