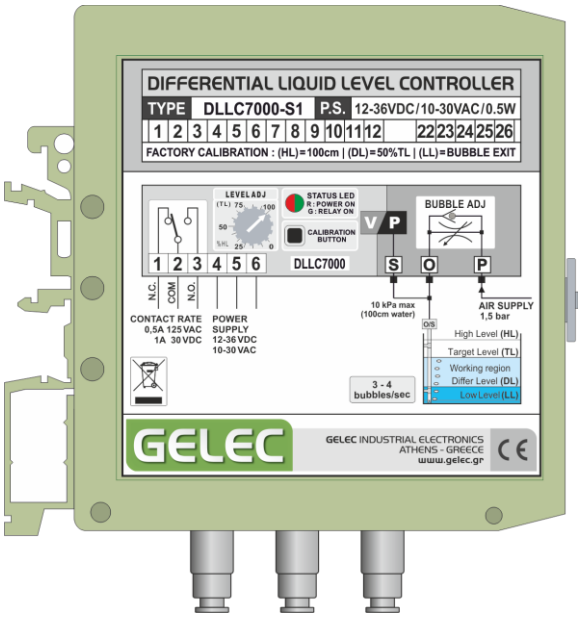
DIFFERENTIAL LIQUID LEVEL CONTROLLER DLLC7000



GELEC

INDUSTRIAL ELECTRONICS

CONTENTS

I. PRECAUTIONS!

There are no serviceable parts inside the **DLLC7000** unit. Not to be opened by any unauthorized person. All repairs to the device must be carried out by the manufacturer.

Improper handling may result in serious personal injury and considerable material damage. All connection and maintenance work must be carried out by qualified personnel.

RISK OF ELECTRIC SHOCK!

Use the correct voltage. The DLLC7000 is designed for use with specific voltage only. Connection to a different voltage may cause fire, electric shock or other damage.

Do not touch the plug and the connectors with wet hands.

Disconnect the DLLC7000 before cleaning it, to avoid the risk of electric shock.

Attempting to use a malfunctioning DLLC7000 can be dangerous.

Do not block the ventilation slots of the DLLC7000 enclosure.

Keep liquids away from the DLLC7000.
Spillage into the enclosure may result to fire, electric shock, or equipment damage. If a small object or liquid falls/spills into the DLLC7000 cabinet, unplug the unit immediately. Have the unit checked by a qualified service engineer before using it again.

Set the DLLC7000 in an appropriate location.
Do not install in a dusty, humid, or vibrating environment. Do not place it near heater, or air conditioner. Keep it away from air, steam, extremely high or low temperature or humidity.

Always follow the instructions given by Gelec and use the* DLLC7000 *in accordance to its specifications.

2. MANUFACTURER'S WARRANTY, GENERAL TERMS AND CONDITIONS

Thank you for purchasing our product.

Our products have been manufactured with the latest technology, the highest quality components and have gone through rigorous quality control tests at the factory, before shipment. Make sure that the part number and type indicated in the identification label and pack correspond to the part number or type of your order. After receiving, inspect the unit to ensure that no damage have been caused during transportation.

GELEC and GELEC's authorized distributors warrant to the original purchaser that the product shall be free from defect in material and/or workmanship. The warranty period begins on the purchase date (proof of purchase by invoice or delivery note) and is valid for one (1) year.

In the event of malfunction during the warranty period attributable directly to faulty material and/or faulty construction and functional defects, GELEC and authorized distributors will, at their option, either repair or replace the faulty product with the same or similar model.

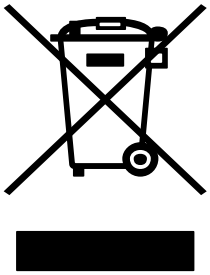
GELEC and authorized distributors shall have no obligation under this warranty, however, in the following cases:

- Any defect caused by freight damage, accident, disaster, faulty maintenance or improper handling.
- Any defect caused by modification, alteration, abuse, misuse or incorrect installation.
- Any defect of the product caused by improper repair by third party other than GELEC and GELEC's authorized distributors.
- Any incompatibility of the products with subsequent technical innovations or regulations.
- Any defect of the product caused by external equipment.
- Any defect of the product on which the original manufacturer's labeling has been altered or removed.

In case of complaint, please contact our company or send the unit un-dismantled to your local dealer. Any necessary replacement parts and necessary repair work are totally covered free of charge.

All products are designed and produced by GELEC to be in compliance with the EU norms applying to them. GELEC is not responsible for direct or indirect damages or malfunction caused by improper use or installation of the DLLC7000.

3. DISPOSAL OF OLD ELECTRICAL & ELECTRONIC EQUIPMENT



This symbol, found on your product, indicates that this should not be treated as household waste when you wish to dispose it.

It should be handed over to an applicable collection point for the recycling of electrical and electronic equipment.

By ensuring this product is disposed of correctly, you will prevent potential negative consequences to the environment and human health, which could otherwise be caused by inappropriate disposal of this product.

The recycling of materials will help to preserve natural resources.

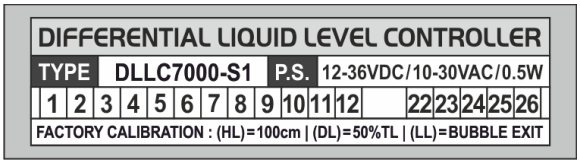
4. DIFFERENTIAL LIQUID LEVEL CONTROLLER DLLC7000

This operator's manual explains the functions and operation of the DLLC7000. It also gives some troubleshooting tips as well as general precautions to be taken when operating the unit. In order to ensure the best performance and effective use of the DLLC7000, we recommend that you read the information in this manual carefully and follow the instructions contained.

This manual is a complete guide for the DLLC7000 with information on unit user maintenance, unit installation and operational instructions. Do not touch parts of the DLLC7000 that are not referred in this manual. Keep this manual for immediate reference. It should help in solving any operational questions you may have.

No part of this manual may be quoted, reproduced, stored in a retrieval system, transmitted, transcribed or translated into any other language in any form or by any means, electronic, mechanical, or otherwise, without prior written permission of Gelec.

Although every effort has been made to ensure that this manual provides up to date information, please note that the contents of this manual and unit specifications are subject to change without notice.

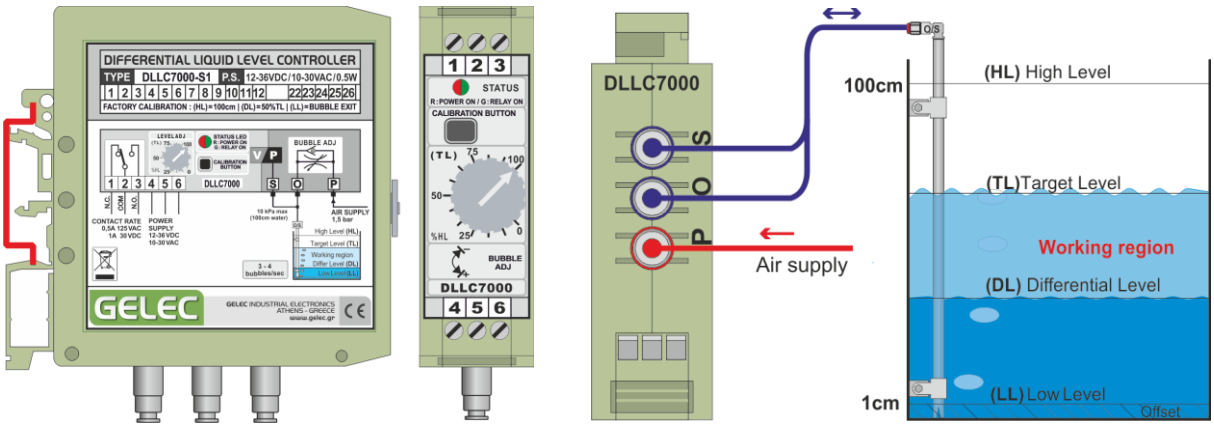


Don't forget to mention the exact type and version of your DLLC7000 whenever you contact the manufacturer, asking for any further information. You can find this information on the identification label of the unit.

5. GENERAL DESCRIPTION

The **DLLC7000** is a programmable, rangeable device used for liquid level control within a desirable region, in open tanks of height from 10cm up to 500cm, with analog sensor and digital output. Its operation is based on the measurement of liquid's hydrostatic pressure.

The system requires the installation of a bubble tube submerged in the measured fluid, properly connected to the device with pneumatic tubes. A volume of compressed air is constantly released into the fluid in a form of bubbles through the device's airflow regulator and the bubble tube.



As the level changes, the backpressure measured by the device's gauge pressure sensor is a direct level measurement. Several electronic circuits and a microcontroller process this signal and depending on user adjustments, a digital command occurs when the tank liquid reaches the selected Target Level. The outcome is the fluctuation of the level within a desirable working region (between *Target Level* and *Differential Level*).

MAIN FEATURES

- Precise measurement and level control in open tanks
- Programmable selection of *FILLING/DRAINING* operating mode
- Level control in tanks with foam and variety of liquids (acidic, alkaline etc.)
- Control in open tanks without the danger of sensor damage from falling water
- Principle suitable for tanks with danger of explosion
- Programmable selection of *High*, *Low, Target* and *Differential* critical levels
- Incorporated airflow regulator with pneumatic adaptors for 6/4 tubes
- On-board knob for the *Target Level* tuning.
- Thermoplastic housing (Polyamide PA 6.6) proper for DIN NS32/NS35 mounting
- Customized versions available
- 12-36 VDC / 10-30 VAC / 0,5 W

6. DLLC7000 VERSIONS

DLLC7000 VERSIONS

DLLC7000 is provided in two versions with different pressure sensors, in order to meet a wide range of level measurement application needs.

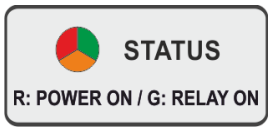
	DLLC7000-S1	DLLC7000-S5
Operating pressure range	0-10 kPa (1.45 psi)	0-50 kPa (7.25 psi)
Factory calibrated level range (H_2O) (1)	0-100 cm	0-500 cm
Sensor resolution (H_2O)	0.97 mm	4.88 mm

1) Factory calibration has been made with **water** in ambient temperature. Values may differ when the device is recalibrated under each application's specific conditions and measured fluid.

7. DLLC7000 OVERVIEW & CONFIGURATION

The DLLC7000 is a complete unit with 6 built-in connection terminals, an air flow regulator with pneumatic adaptors, adjusting level knobs, a function button and a status LED. Its thermoplastic housing (Polyamide PA 6.6) is approved for electronic devices in industrial environment. It is designed to be installed inside a vented electrical control panel, snapped onto commercially available DIN mounting rails (NS32/NS35).

STATUS LED



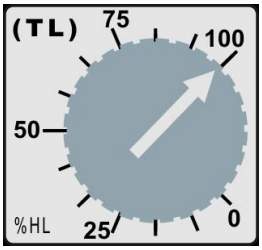
The STATUS LED at the front side indicates various operational stages and the operating mode of the DLLC7000. Consult the following table for quick reference and the relevant sections for detailed information.

LED COLOR	DLLC7000 STATUS
OFF	Device not powered
RED	Device powered - Normal operation
GREEN	Relay contact activated
FLASHING GREEN	High Level calibration (check calibration section)
FLASHING RED	Low Level calibration (check calibration section)
FLASHING ORANGE	Differential Level calibration (check calibration section)
INITIAL POWER SUPPLY	
Flashing RED	DRAINING MODE
Flashing GREEN	FILLING MODE
Alternating RED/GREEN	During operating mode selection F/D)

FUNCTION/CALIBRATION BUTTON

The Function/Calibration button is used during calibration process and operating mode selection (*FILLNG/DRAINING*). Refer to the relevant sections in this manual for more information.

ON-BOARD POTENTIOMETER (KNOB)



The potentiometer's position, adjusts the liquid's Target level (TL) into the tank. Notice that **the *0-100* scale refers to the percentage of the High Level (HL)**. Therefore, the value that the arrow is pointing, is the desirable (TL), but as a percentage of the (HL) and not as an absolute value. The potentiometer's use during the level calibration process is described in the corresponding section.

AIR FLOW REGULATOR

The one-way air flow regulator controls the volume of air which escapes the bubble tube. Having the recommended pneumatic layout, you will find this airflow rate preset at approximately **3-4 bubbles per second**. This is the recommended rate for a controlled and constant stream of bubbles, which is important for consistent measurement.

The airflow adjustment can affect the device's proper functionality and re-adjustments are not recommended by a user which is not familiar with the device operation. However, if it is necessary adjust the regulator with a flat screwdriver (clockwise for decreasing, counterclockwise for increasing) and set the bubbles to the recommended rate. The front label may block the regulator access, for unintended adjustments protection.

8. PNEUMATIC SECTION

GAUGE PRESSURE SENSOR

DLLC7000 includes a gauge type, silicon piezoresistive pressure sensor, providing an accurate and linear output directly proportional to the applied pressure. On-Chip Temperature Compensated & Calibrated, this sensor is laser trimmed for precise Span, Offset calibration and temperature compensation.

Having a gauge pressure sensor, the DLLC7000 **uses the atmospheric pressure as a reference**. This means that it must be installed in a vented electronic panel in order to have **the same pressure conditions with the measured tank**, which is open/vented by default.

PNEUMATIC ADAPTORS

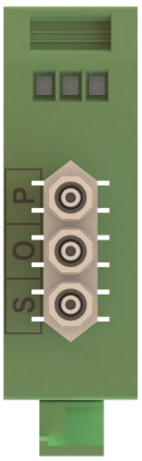
DLLC7000 has three straight male pneumatic adaptors for 6/4 connection tubes.

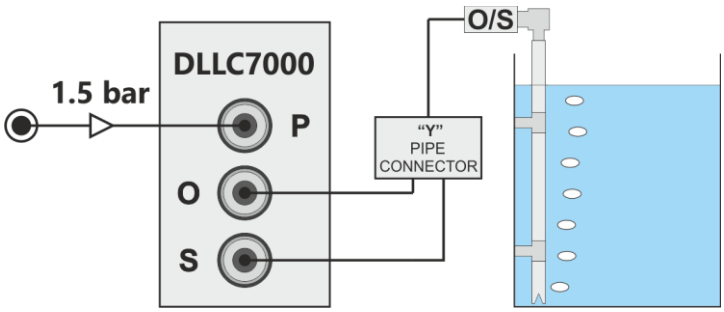
The **(P) adaptor** is the input of the internal air flow regulator and is used for the compressed air supply. Provide an invariable pressure, higher than the hydrostatic pressure of the tank. A recommended pressure value would be approximately 1.5 bar (22 psi).

The **(O) adaptor** is the output of the internal air flow regulator towards the bubble tube. Refer to the 'Airflow Regulator' section in this manual, for bubble adjustment information.

The **(S) adaptor** is the input of the internal pressure sensor which measures the hydrostatic pressure. Check the pressure limits of your DLLC7000 version before any connection. Excessive applied pressure can cause permanent damage, or degradation to the sensor.

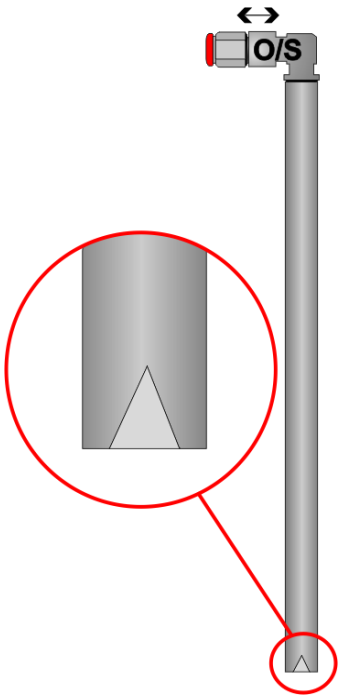
The (O) and (S) adaptors need to be externally connected with an 'Y' pipe connector.





BUBBLE TUBE

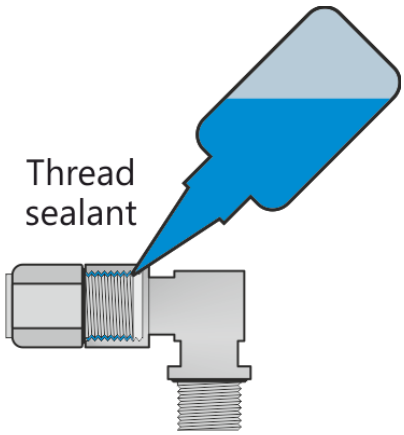
A thin tube should be firmly installed in the tank with its nozzle submerged in the measured fluid. A small volume of air is provided to this tube through the device's air flow regulator and connection pipes, escaping into the liquid in a form of bubbles. **The device measures the hydrostatic pressure at the point where the bubbles are released.**



At the bottom side, the tube's nozzle must have **a smoothed V-notch**, in order to assist the release of a controlled and constant stream of small bubbles (3-4 per second). This is preferable for consistent measurement, rather than intermittent large bubbles.

On the top side, **a pneumatic fitting** is needed to connect the 6/4mm tube which lead to (S)/(O) adaptors of the DLLC7000.

Use standard and compatible pneumatic parts, which meet the operating requirements of the application regarding pressure, temperature, safety etc.



The top of the tube must be at least **25cm above the fluid's highest possible level**, for avoiding fluid suction towards connection tubes and DLLC7000 after air supply cut-off.

In order to have unaffected measurement, it is very important to **prevent air leakage in all pneumatic connections**. Use an appropriate thread sealant in all threaded elements.

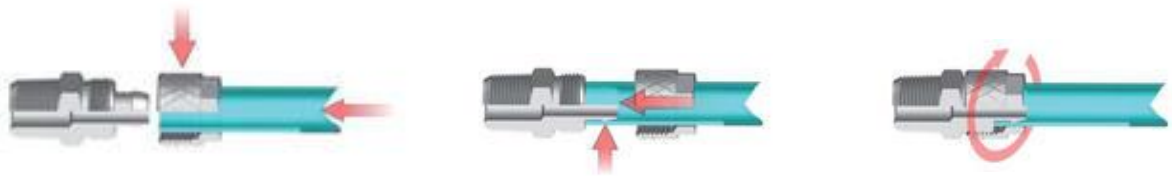
In a common level measurement application, the tube is installed almost at the bottom of the tank. **Ensure that the provided air can escape freely into the fluid** and the nozzle is not blocked by the tank body or possible sediment/dirt during operation. Partial blockage of the nozzle will cause faulty readings and full blockage will lead the compressed air supply directly to the pressure sensor and damage it.

Don't install the tube deeper than your DLLC7000 version allows. The excessive applied pressure can cause permanent damage or degradation to the device's pressure sensor.

CONNECTION TUBES

The adaptors are suitable for **6/4mm** tubes and the supported types are **PA6, PA11, PA12, Polyurethane, Polyethylene, PTFE and FEP**. Ensure that the tubes meet the operating requirements of your application (pressure, temperature, safety etc.).

To assembly, insert the tube on the nut, thread the tube on the fitting cone and tighten the nut by hand, or with a spanner.



Ensure that pipes are **smoothly curved and not bended** at all points. Piping layout should remain sufficiently protected from possible bending, blockage, tear, corrosion, or any damage that would affect the device's functionality.

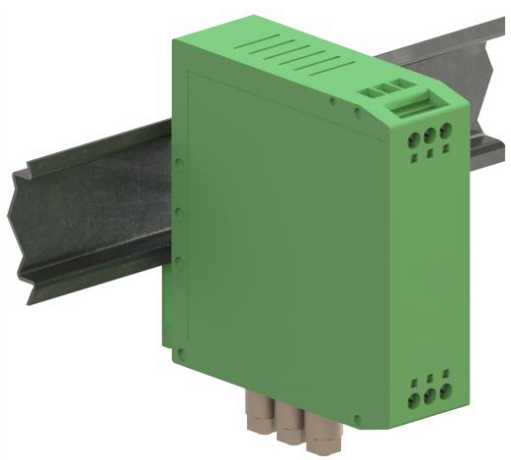
Maintain the pneumatic circuit in good condition. Polluted air, dust, oil etc. inside the circuit may gradually affect the measurement, clog up the pipes, or even damage the device's pressure sensor.

Any air leakage along the (O/S) piping will affect the measurement.

9. INSTALLATION

In this section, you can find useful information that have to be taken under consideration during DLLC7000 installation. Always follow the recommended instructions and use the DLLC7000 in accordance to its specifications.

INSTALLATION AREA



Having a gauge pressure sensor, the DLLC7000 uses the atmospheric pressure as a reference. This means that it must be installed in an electronic panel **under atmospheric pressure**, in order to be under the same pressure with the measured tank, which is open/vented by default. Keep the unit protected from steam, flame, extremely high or low temperature and humidity. Do not block the ventilation slots above and below the unit. Fluid insertion into housing may cause damage, electric shock or fire.

In the back side of DLLC7000, there is a clip for the mechanical mounting (lock) on an Ω-type mounting rail (**DIN NS32/NS35**), with the release hook at the bottom. The device should have at least 60mm free space below it for the air pipes and 15mm on top of it, for the wires. Ensure that the connected pneumatic tubes are **smoothly curved and not bended**.

PNEUMATIC CIRCUIT

Pneumatic layout must be sufficiently protected from possible bending, blockage, tear, corrosion, or any damage that would affect the device's functionality. Polluted air, dust, oil etc. inside the circuit may gradually affect the measurement, clog up the pipes, or even damage the device's pressure sensor. Check the pneumatic circuit periodically and clean/replace the pipes if necessary. Use standard and compatible pneumatic parts, which meet the requirements of the application regarding pressure, temperature, safety etc.

In order to **prevent fluid suction towards piping** and DLLC7000 after air supply cut-off, the top side of the bubble tube must be at least 25cm above the fluid's highest level. Additionally, you can install the device at a point higher than your tank. If somehow fluid suction occurs, disconnect the (O/S) tube from DLLC7000, clean it and confirm that the device works properly before using it again.

BUBBLE TUBE - APPLICATION TANK

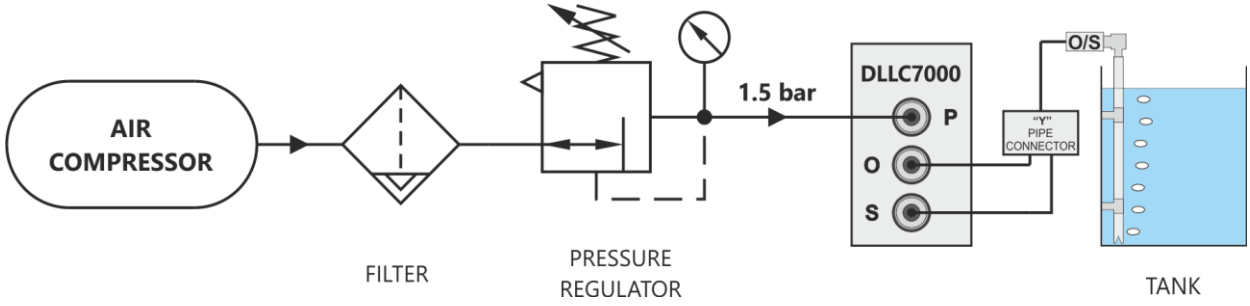
The measured level corresponds to **the upright distance between the bubble tube's V-notch vertex and the fluid level**. For example, in a common application this point is usually the bottom of the tank.

After the tube installation, confirm that bubbles are released from the V-notch and not from another point of the nozzle. The provided air volume must escape freely into fluid, **with the nozzle not being blocked** by the tank body, or possible sediment/dirt. Partial blockage may cause faulty readings and full blockage will lead the air supply directly to the sensor and damage it. In case of tanks with sediments, install the tube at a higher point (so the bubble stream is not affected) and consider this elevation as an offset.

With an invariable pressure of 1.5 bar, possible bubble discontinuance doesn't mean airflow adjustment malfunction. It may be caused by blockage, or air leakage along piping. Inspect (O/S) adaptors and piping for possible damages.

Even if the bubble tube is not submerged into fluid, **long distance tubing or other factors in installation may rise a small amount of pressure to the sensor**, causing a small output offset. Re-calibrating Low Level will solve the issue, refer to the relevant section.

DLLC7000 has a gauge pressure sensor which uses the atmospheric pressure as a reference. Therefore, **the application tank must be open or vented** and the measured fluid constantly under atmospheric pressure.



Pneumatic Layout example

APPLICATION FLUID

The application fluid must be homogenous, having the same density at all points of its volume and with relatively low viscosity, in order to allow a controlled and constant stream of bubbles through it. For example, honey is not an appropriate fluid for this measuring method. In addition, the fluid cannot be sensitive to a gas bubbling through it.

DLLC7000 standard versions are factory calibrated with water in ambient temperature, exploiting the whole operating pressure range of their pressure sensor (1m of water in DLLC000-S1 / 5m of water in DLLC7000-S5), unless otherwise stated on the product label. So, the level which generates the maximum output signal corresponds to the maximum pressure that your version can handle.

10. ELECTRICAL SECTION

ELECTRICAL CONNECTIONS

The DLLC7000 housing is equipped with 6 connection terminals, two triple screw terminal blocks per side (top & bottom).

The terminal blocks are manufactured to provide resistance to stress corrosion cracking, electrolytic corrosion, rusting and screw loosening in case of vibrations. This way, conductor connections are maintained reliable and maintenance-free in harsh industrial environment.

The conductor's stripping length should be **8 mm**, with its cross-section within the following ranges (depending on type). The recommended tightening torque is 0.5 - 0,6 Nm.

Rigid solid : **0,2 - 4,0 mm²**
Flexible stranded : **0,2 - 2,5 mm²**
AWG : **24 - 12**

Clamp all types of copper cables without pre-treatment. Do not solder the conductors, as it affects the proper connection quality. Two conductors with the same cross section make contact safely in the clamping parts. If necessary, copper ferrules can be used as a protection against splicing when stranded conductors are wired. In general terms, ensure that you are having reliable mechanical connection and electrical contact.

CONNECTION TERMINALS

Read carefully the following information and refer to the connection diagrams and technical data, regarding proper wiring of the DLLC7000 with the associated equipment.

Confirm that you have proper connections before unit operation. Wrong connections may lead to permanent device or external equipment damage. Don't proceed to any connection modification, while the unit is powered.

TERMINALS #4 - #5 *(POWER SUPPLY - V_{PS})*

Connect the power supply **(12-36 VDC) / (10-30 VAC)** to terminals **#4** and **#5**.

Maximum power consumption is approximately 0.5W. There is not an electrical safety fuse in the internal power circuit. Although the polarity is not important, as the internal power circuit includes electronic components for non-polarity connection, ensure that you are applying proper voltage. When the unit is powered, the indicating led turns on.

TERMINALS #1 - #2 - #3 *(DIGITAL OUTPUT - **#1**=N.C. - **#2**=COM - **#3**=N.O.)*

This output *(terminals **#1** , **#2** , **#3**)* works as a potential contact of a relay. These contacts allow the operation of the device that fills/drains the tank. The DPDT relay contacts are potential free (Voltage free common). Make sure not to exceed the relay contact rating.

The relay's status changes when the tank level exceeds the set point. When this output is activated the STATUS LED turns green. Any wrong configuration of the relay output connection, may cause permanent damage to the unit.

TERMINALS #4 - #6 *(ANALOG PWM OUTPUT - **#4**= **(-)** - **#6**=0...5V)* *- Upon request-*

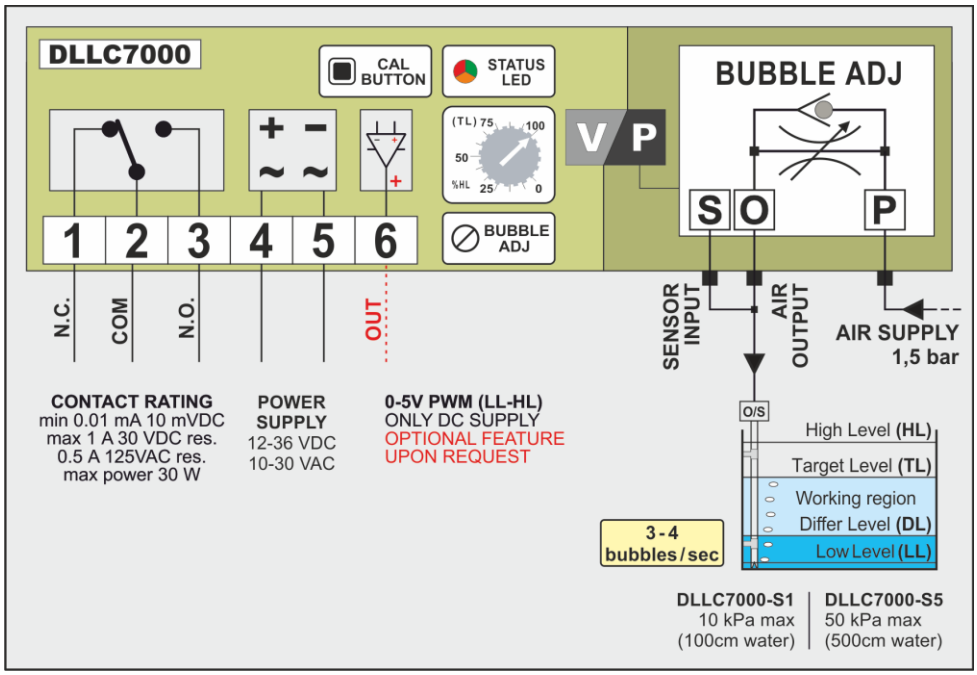
--- ONLY when 12-36 VDC** is applied to **#4 (-) / 5 (+) ---

Through this output *(terminals **#4** - **#6**)* the device provides a 0-5V signal, which is proportional to the liquid level height. This voltage is linear and corresponds to the intermediate tank levels from *Low Level* (LL=0%) to *High level* (HL=100%).

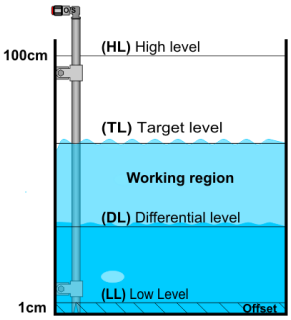
In order to get the complete voltage scale (**V_{MAX}=5V),** the load resistance should be **$R_L \geq 1MOhm$**. If load resistance is smaller than that, V_{MAX} will drop and you should measure the output voltage value. E.g. for **R_L=450KΩ** the device provides **V_{MAX} = 4,5V**.

PRIOR CONTACT WITH GELEC IS NECESSARY FOR PWM OUTPUT FEATURE TO BE INCLUDED

DLLC7000 Connection Diagram



II. OPERATING PHILOSOPHY – LEVEL DESCRIPTION



The DLLC7000 operating philosophy is based on a desirable working region and four *critical* liquid levels, which can be calibrated from the user to meet the application requirements. These levels and their functionality are described below.

(HL) High Level

It is the highest level the user can select with the potentiometer. You can set this level following the calibration process.

If the (HL) is modified through the calibration process, the (LL) and the (DL) must also be modified.

(LL) Low Level

It is the lowest level the user can select with the potentiometer. You can set this level following the calibration process.

If the (LL) is modified with the calibration process, it is essential for the (DL) also to be modified to the desirable level.

Working region

It is the desirable region which the liquid level fluctuates, either in *FILLING* or *DRAINING* mode. The working region is between (TL) and (DL), which can also be calibrated.

(TL) Target Level

It is the desirable level and it can be selected by using the potentiometer's 0..100 scale. At the (TL), the relay changes status, and the liquid falls back to the Differential Level (DL). Notice that the *0...100* scale refers to the percentage of the High Level (HL). Therefore, the value that the arrow is pointing, is the desirable (TL), but as a percentage of the (HL) and not as an absolute value.

(DL) Differential Level

It is the level which the liquid returns to, after reaching the (TL) and also where the relay changes its status. (DL) is always lower than the (TL) (pre-selected value *50%(TL)*) and the user can modify it with the calibration process. It is not essential to modify the other levels after calibrating (DL).

The user can program the (DL) at a desirable level following the calibration process, without changing the other two le vel values.

The Differential Level (DL) you select each time, is stored in the unit's memory as a percentage of (HL). But during operation, the device uses this factor for the calculation of the (DL) as percentage of the (TL). So, if the user selects as (DL) the 25% of the (HL), then the device will function with (DL) = 25% of the (TL).

DIFFERENTIAL LEVEL CALCULATION - EXAMPLE

Use the following procedure and example, as a guide to calculate the differential level you have to calibrate.

Calculate the differential coefficient (k) between your desirable (TL) and (DL), which are the two limits of your working region as below:

$$\mathbf{k = 100 \times (TL - DL) / TL} \qquad (1)$$

And then use **k** in the following type, to find the liquid level height that you should have into the tank for the (DL) calibration procedure.

$$\mathbf{DL = HL - (HL \times k / 100)} \qquad (2)$$

- OPERATING EXAMPLE -

For example, your application needs the ***(HL)*** to be calibrated at 100cm, the ***(LL)*** at 0cm and you want the ***working region*** to be **between 70cm *(DL)* and 80cm *(TL).***

After the calibration of the (HL), (LL), and (TL) you have to calculate the DL before calibration in accordance with the above types.

In this example the equation (1) becomes:

$$k = 100 \times (80\text{-}70) / 80 = \mathbf{12.5}$$

And the equation (2) becomes:

$$DL = 100 - (100 \times 12.5 / 100) = \mathbf{87,5cm}$$

So, you have to fill your tank with 87,5cm of liquid and then proceed to (DL) calibration.

When differential level (DL) is calibrated, any target level (TL) selection through the potentiometer, will lead the device to automatically calculate the working region. At this example for a (TL) selection of 80cm, the working region will be 80cm-70cm.

Notice that according to the described example's steps, for every (TL) you select with the potentiometer, the (DL) will be 12,5% less.

PRESELECTED VALUES

The standard version DLLC7000-S1 can control the liquid level in tanks with height from 10cm to 100cm and has the below preselected values and parameters.

- Liquid : Soft Water
- High level (HL) : 100 cm
- Differential level (DL) : 50% of (TL).
- Low level (LL) : 1cm (0+1cm offset)

NOTES

- The device measures the hydrostatic pressure of the liquid contained in the tank, so the tank's volume and shape are not factors that influence the measurement.
- The calibration is done for a specific tank height and for a specific liquid. If you use the same tank with a different liquid, a new calibration has to be done.
- In order to have the optimum measurement resolution, it is recommended the high level to be calibrated near the target level.
- According to your unit version, take care not to exceed the recommended liquid level height. If the sensor-applied pressure is higher than the appropriate, the sensor will be destroyed.

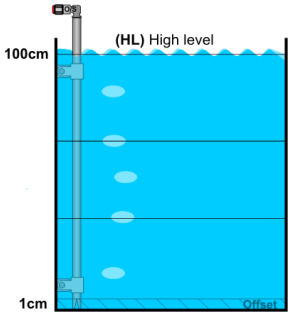
12. LEVEL CALIBRATION PROCESS

With this process, you can calibrate the device to store the required parameters, in order to function according to your application needs. Follow the appropriate steps for each level calibration. This can be done either with the on-board potentiometer.

After the device installation, the calibration process as described below is essential. The correct level calibrating order is **(HL)** → **(LL)** → **(DL)**. This order is important in order to get the optimum level measurement resolution and the on-board knob's 0...100 scale to precisely correspond with the levels (LL) - (HL).

If during the calibrating process there is an idle period of 30 seconds, or the power is interrupted, the device returns in operating mode with the pre-existed values.

(HL) High Level Calibration

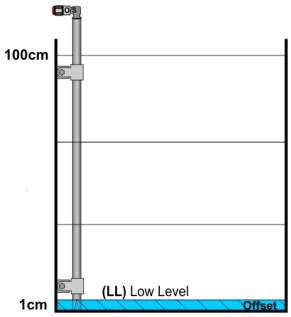


- Fill the tank up to the highest desirable level.
- Press and hold the button until the led starts flashing.
- Turn the potentiometer until you find the area where the led **flashes with green color** - a sign that the value to be registered is the High Level (HL).
- Press and hold the button again until the led turns on constantly.

✓ The High Level (HL) value is registered.

If the (HL) is modified through the calibration process, the (LL) and the (DL) must also be modified.

(LL) Low Level Calibration

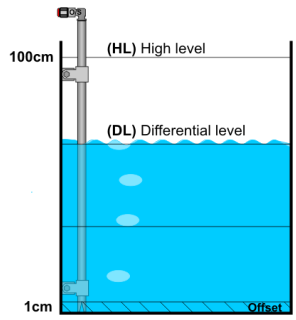


- Drain the tank down to the minimum desirable level
- Press and hold the button until the led starts flashing.
- Turn the potentiometer until you find the area where the led **flashes with red color** - a sign that the value to be registered is the Low Level (LL).
- Press and hold the button again until the led turns on constantly.

✓ The Low Level (LL) value is registered.

If the (LL) is modified with the calibration process, it is essential for the (DL) also to be modified to the desirable level.

(DL) Differential Level Calibration



- Fill the tank up to the desirable differential level *(e.g. to the 70% of the (HL))*
- Press and hold the button until the led starts flashing.
- Turn the potentiometer until you find the area where the led **flashes with orange color** - a sign that the value to be registered is the Differential Level (DL).
- Press and hold the button again until the led turns on constantly.

✓ The Differential Level (DL) value is registered.

The user can program the (DL) at a desirable level following the calibration process, without changing the other two level values.

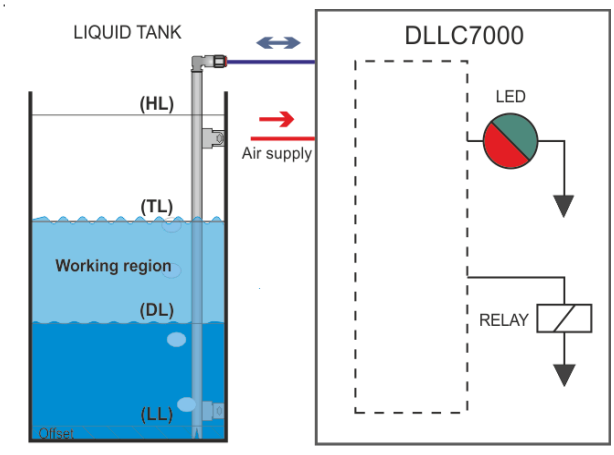
13. FILLING / DRAINING OPERATING MODES

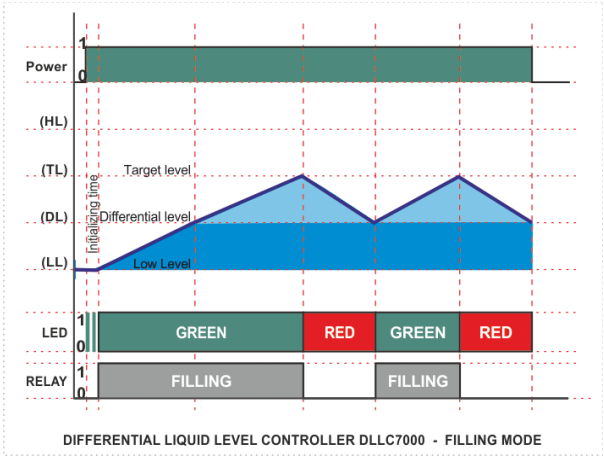
DLLC7000 has two programmable operating modes for liquid level control, *FILLING MODE* and *DRAINING MODE*. The user determines whether the level control is done through filling or draining mode.

FILLING MODE (F)

Filling mode (F) is suitable for applications where the controlled tank drains and you need to FILL it, in order to maintain the liquid into the working region.

In filling mode, the relay at the beginning is activated and fills the tank (provided that the level is detected under the TL) and deactivates when the level reaches the TL. At the following operating cycles, the relay activates each time the level reaches the (DL) and deactivates when the level reaches the (TL).

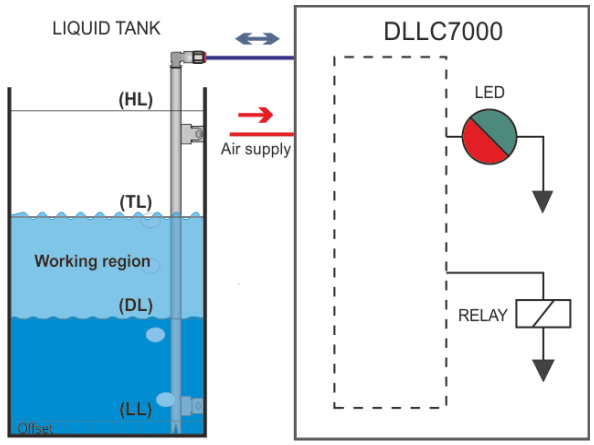


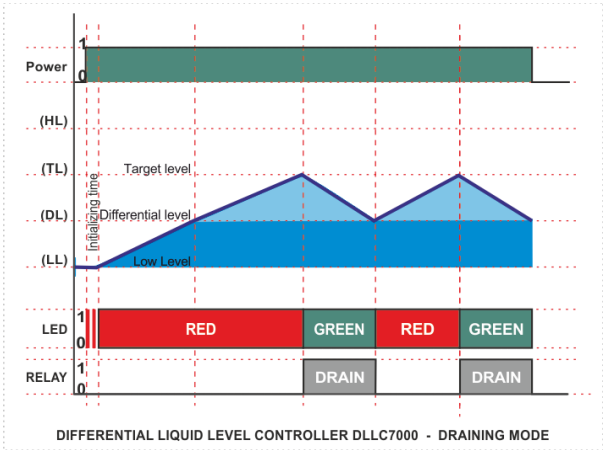


DRAINING MODE (D)

Draining mode (D) is suitable for applications where the controlled tank fills and you need to DRAIN it, in order to maintain the liquid into the working region.

In draining mode, the relay at the beginning is de-activated (provided that the level is detected under the TL) and the tank is filling and activates when the level reaches the TL. At the following operating cycles, the relay activates each time the level reaches the (TL) and deactivates when the level reaches the (DL).





OPERATING MODE SELECTION (F/D)

You can see the mode that the DLLC7000 unit operates by the flashing colour of the LED just after the device power supply. According to the pre-programmed operating mode, the led flashes for three seconds with the corresponding color.

Flashing RED : DRAINING MODE
Flashing GREEN : FILLING MODE

The operating mode (F/D) can be changed with the following procedure.

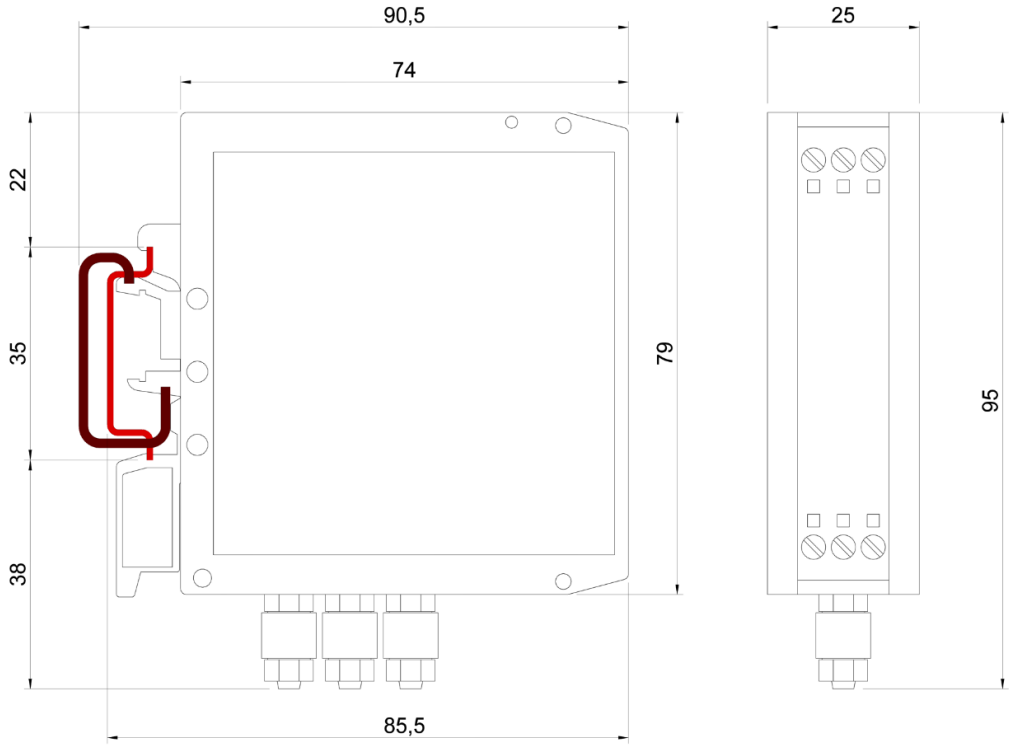
- Press the *FUNCTION/CALIBRATION BUTTON* before the unit power supply.
- With the button pressed, supply the unit. The LED alternates color (green-red).
- Keep the button pressed until the LED stabilizes. The current color represents the selected operation mode, which is the opposite of the previous one.

✓ Release the button. The new selection is automatically saved.

NOTE

When power is interrupted and the liquid level is between the (TL) and the (DL), the relay will be de-activated. After the power is restored, if the device is operating in filling mode, the relay will be activated and the tank will fill up to the (TL). If the device operates in draining mode, the relay will remain de-activated until the level comes up to the (TL) and then it will be activated for the drain to begin.

14. DIMENSIONS



15. TECHNICAL SPECIFICATIONS

DLLC7000 GENERAL DATA	
Unit dimensions (HxWxD)	95 x 25 x 85 mm
Minimum installation area (HxWxD)	170 x 26 x 86 mm
Weight	145 gr
Housing material	Polyamide (PA 6.6) - Green
Mounting	DIN rail NS32/NS35 (acc. to EN60715)
Degree of protection	IP20
Recommended installation position	Electrical control panel (vented)
Flammability rating according to UL 94	V2
Operating temperature	-20 ... +70 °C (-4 ... +158 °F)
Storage temperature	-20 ... +70 °C (-4 ... +158 °F)
Features	
Internal pressure sensor	Silicone piezoresistive (Gauge) Laser trimmed Precise span and offset calibration Temperature compensated
Sensor operating pressure range *(S) adaptor*	0-10 kPa / 0-1.45 psi / 0-100cm H_2O (S1 version) 0-50 kPa / 0-7.25 psi / 0-500cm H_2O (S5 version)
Sensor proof pressure *(S) adaptor*	50 kPa (S1 version) 100 kPa (S5 version)
Recommended air pressure supply *(P) adaptor*	1,5 bar / 22 psi
Average air drain	150 cm^3/min (approx.)
Resolution (H_2O at 25°C)	0.97 mm (0.0014 psi) (S1 version) 4.88 mm (0.0069 psi) (S5 version)
Sensor linearity	±1.0% FSS (S1 version) -0.6 +0.4% FSS (S5 version)
Pressure hysteresis	±0.1% FSS
Temperature hysteresis	±0.5% FSS
Pneumatic connection characteristics	
Pneumatic fittings	Straight male adaptors for 6/4 mm tubes
Plastic connection tubes compatibility	6/4 mm (D/d) PA6, PA11, PA12, Polyethylene, Polyurethane, PTFE, FEP
ELECTRICAL DATA	
Supply voltage	12-36 VDC / 10-30 VAC
Power consumption	0.5W max

Relay contact characteristics	
Resistance (initial)	Maximum 50 mΩ at 1A 6 VDC
Rating (resistive)	0.5A 125 VAC or 1A 30 VDC
Max carrying current	2A
Max switching power	62.5 AV, 30 W
Max switching voltage	250 VAC - 220 VDC
Max switching current	2A
Min switching load	0.01 mA 10 mVDC
Contact life	min $1x10^8$ operations (mechanical) min $5X10^5$ operations (electrical 1 A-30 VDC)
ANALOG PWM OUTPUT (Terminals 6-4) *- optional upon request -*	
Available output range	$R_{LOAD} \geq 1M\Omega$ (0...5V) → $R_{LOAD} \geq 1M\Omega$ (LL....HL) (0...4,5V) → $R_{LOAD} \geq 450K\Omega$ (LL....HL)
Electrical connection characteristics	
Terminal block configuration	6 ends (3 screw connections per side)
Terminal block plating material	High quality copper
Pitch	5 mm
Clamping parts surface protection	Galvanic nickel or tin plating
Clamping parts resistance	Electrolytic corrosion Rusting Stress corrosion cracking
Conductor cross section range	IEC rigid solid: 0,2 - 4,0 mm^2 IEC flexible stranded: 0,2 - 2,5 mm^2 AWG: 24 - 12
Conductor stripping length	8 mm / NOT soldered
Tightening torque	0,5 – 0,6 Nm
STANDARDS	
In conformance with the following standards:	CE

Specifications are subject to change without prior notice.

INDUSTRIAL ELECTRONICS

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