



LCIE SUD EST
Laboratoire de Moirans
Z.I. Centr'Alp
170, Rue de Chatagnon
38430 MOIRANS - FRANCE

LCIE

GENERAL INFORMATION

FCCID: Q6BSWSILBT01

1.1. Product description

Data sheet

Liquid Level Switch
Type LLS 4000/4000U

Engineering Tomorrow

Danfoss



The LLS 4000/4000U liquid level switch is designed to detect the state (gas or liquid) of the refrigerant in front of the sensing head, while installed in a wide range of refrigeration applications.

The LLS level switch comes in 2 variants, LLS 4000 and LLS 4000U. They are identical except for the connector thread interface to the system. The LLS 4000 is provided with G3/4" thread, while the LLS 4000U is provided with NPT 3/4" thread.

The LLS 4000/4000U liquid level switch is based on the proven reflectometry measuring technology(microwave level measurement) adapted specifically for the new LLS 4000/4000U switch.

LLS 4000/4000U liquid level switches can be used to control the liquid level of many different refrigerants in vessels, accumulators, receivers, standpipes, etc.

The switches are normally installed in a pair of two, controlling the upper liquid level and the lower liquid level.

The level switch includes a relay that switches by change in refrigerant state. The on site configuration of the LLS allows the normally open/closed relay setting depending on the desired correlation.

For SIL applications a SIL2 version is available with blocked configuration (not configurable).

All configuration and readings from the LLS switch are performed through Bluetooth and a downloadable special Danfoss app.

Features

- Plug and play liquid level switch
- Easy installation and minimum or no need for configuration
- Convenient communication with all units via Bluetooth and a Danfoss app
- SIL2 compliant version
- 2 commonly used connection variants
- Maintenance free
- Replacement of electronic part without removing mechanical part (no opening to refrigerant)
- Applicable for ammonia and commonly used H(C)FCs
- Well proven reflectometry measuring principle
- Approvals: CE, PED, EMC, RED, ROHS, SIL2, FCC, (EAC, IC pending)
- Conforms to:
Telecommunications Directive RED 2014/53/EU.
Low voltage directive 2014/35/EU.
EMC directive 2014/30/EU.
ROHS 2011/65/EU



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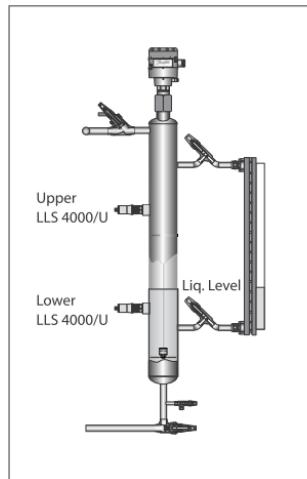
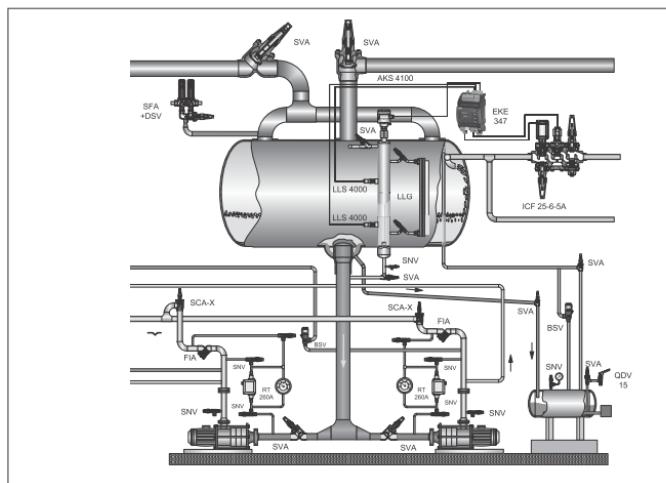
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Data sheet | Liquid Level Switch, type LLS 4000/4000U

**Product concept/
applications**

To control if a liquid level is within predefined allowed limits, two LLS 4000 are installed in an upper and a lower limit position respectively. By this setup the liquid level is between the two level switches and the lower switch will sense liquid, while the upper will sense gas.

In case the liquid level moves outside the limits, one of the switches will sense opposite and switch the built-in relay. This relay switch function should be used for alarm settings. This is made easy when connected to the system PLC.



The LLS can be used wherever liquid levels of ammonia and certain H(C)FC refrigerants must be controlled.

The LLS comes in 2 versions:

- A standard version, which is applicable for most refrigeration or processing plants, and is fully configurable regarding type of liquid and relay setting.
- A SIL2 version applicable for SIL compliant process plants. This version is non-configurable regarding relay setting (see section: Configurable parameters) and is intended specific as the **upper** level switch.



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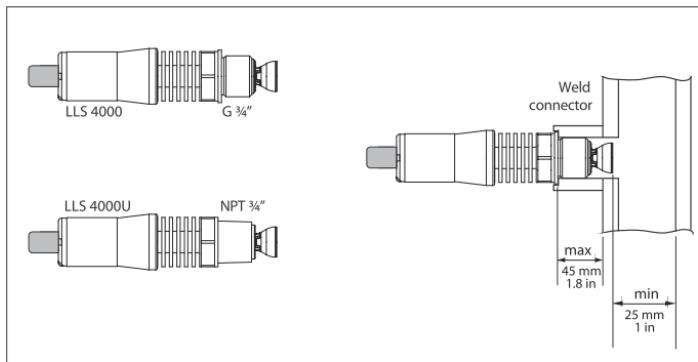
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Data sheet | Liquid Level Switch, type LLS 4000/4000U

Connection types

Beside the 2 versions the LLS also comes with 2 different thread types, LLS 4000 and LLS 4000U. They are identical except for the connector thread for installation to the system. The LLS 4000 is provided with G 3/4" thread, while the LLS 4000U is provided with NPT 3/4" thread.

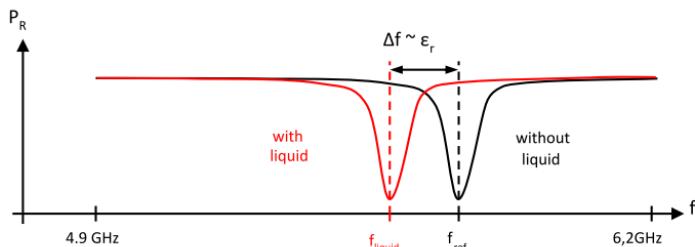
For connection to the actual part of the system appropriate weld connectors are needed. NPT connectors are widespread available, while Danfoss offers weld connectors for G 3/4" thread as accessory. Please note geometric restrictions below.



Measuring principle

The measurement principle of the LLS is based on reflectometry with a 4.9 GHz to 6.2 GHz linear sweep (Microwave switch technology). The reflected signal is characterized by a resonance frequency. The resonance frequency in air is taken as a reference (f_{ref}). When the sensing element is in contact with the liquid, the resonance frequency is shifting to a lower frequency. This is due to the change of the dielectric constant of the medium.

The point level switch monitors the resonance frequency and indicates whether the sensing element is surrounded by liquid or gas. The figure below shows the reference frequency with air (dielectric constant $\epsilon_r=1$) in front of the sensing element and with a liquid dielectric constant $\epsilon_r>1.35$.





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**Electrical installation/
connection**

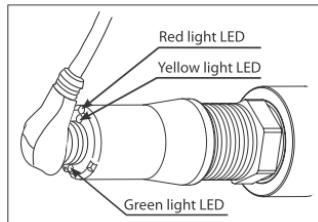
The LLS 4000 level switch must be installed as one unit (mechanical and electrical assembled) without disassembly to avoid the need for recalibration.

For powering the device, a low power source (LPS) must be used with safety extra low voltage output (SELV) and current limited to 8A maximum

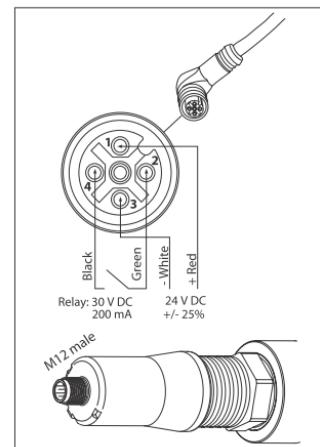
After connecting the M12 female cable to the power supply and relay circuit the M12 plug can be installed on the M12 male connector and the power can be switched on.

At this stage the green light LED will turn on and be visible through the transparent housing.

The LLS is now ready for configuration via the Danfoss Bluetooth app (see section: Configurable parameters).



Danfoss M12 cables (ordered separately)
M12 cable female x 2 meter
M12 cable female x 8 meter



LED light indicators

There are 3 LED indicators inside the LLS 4000 behind the transparent cover.

- Green indicates the state of power to the switch.
 - If flashing: Bluetooth connection is established
- Yellow indicates if liquid is in front of switch.
- Red indicates if alarm is present.

Configurable parameters

The set-up of the LLS 4000 is easy and simple, since only few parameters in the LLS software are configurable. These are:

- Media type - Ammonia or Freon (H(C)FC).
Factory default: Ammonia
- Relay NO (normally open) or NC (normally closed)
Factory default: Normally closed

For plants where factory defaults are valid, the installation and set-up is simply Plug & play.

Below table shows possible configurations, relay state for given configuration/liquid level and LED indications



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1.2. Tested System Details

Equipment information:

Bluetooth LE Type:	<input checked="" type="checkbox"/> BLE	<input type="checkbox"/> v4.1	<input checked="" type="checkbox"/> v4.2	<input type="checkbox"/> v5.0
Frequency band:		[2400 – 2483.5] MHz		
Spectrum Modulation:		<input checked="" type="checkbox"/> DSSS (Tested like it)		
Number of Channel:		40		
Spacing channel:		2MHz		
Channel bandwidth:	<input checked="" type="checkbox"/> 1MHz		<input type="checkbox"/> 2MHz	
Antenna Type:	<input checked="" type="checkbox"/> Integral	<input type="checkbox"/> External	<input type="checkbox"/> Dedicated	
Antenna connector:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Temporary for test	
Transmit chains:		1		
		Single antenna		
		Gain: 0.5dBi		
Beam forming gain:		No		
Receiver chains		1		
Type of equipment:	<input checked="" type="checkbox"/> Stand-alone	<input type="checkbox"/> Plug-in	<input type="checkbox"/> Combined	
Ad-Hoc mode:	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No		
Adaptivity mode:	<input checked="" type="checkbox"/> Yes (Load Based)	<input type="checkbox"/> Off mode	<input type="checkbox"/> No	
		Clear Channel Assessment Time:		Xµs
Duty cycle:	<input checked="" type="checkbox"/> Continuous duty	<input type="checkbox"/> Intermittent duty	<input type="checkbox"/> 100% duty	
Equipment type:	<input checked="" type="checkbox"/> Production model	<input type="checkbox"/> Pre-production model		
Operating temperature range:	T _{min} :	<input type="checkbox"/> -20°C	<input type="checkbox"/> 0°C	<input checked="" type="checkbox"/> -40°C
	T _{nom} :		20°C	
	T _{max} :	<input type="checkbox"/> 35°C	<input type="checkbox"/> 55°C	<input checked="" type="checkbox"/> 65°C
Type of power source:	<input type="checkbox"/> AC power supply	<input checked="" type="checkbox"/> DC power supply	<input type="checkbox"/> Battery	
Operating voltage range:	V _{nom} :	<input type="checkbox"/> 230V/50Hz	<input checked="" type="checkbox"/> 24Vdc	

1.3. Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4 or/and ANSI C63.10, FCC Part 15 SubPart 15C.

Radiated testing was performed at an antenna to EUT distance of 10 meters. During testing, all equipment's and cables were moved relative to each other in order to identify the worst case set-up.

1.4. Test facility

Tests have been performed: **September 23, 2019 to September 27, 2019**

This test facility has been fully described in a report and accepted by FCC as compliant with the radiated and AC line conducted test site criteria in ANSI C63.4 or/and ANSI C63.10.

This test facility has also been accredited by COFRAC (French accreditation authority for European Union test lab accreditation organization) according to NF EN ISO/IEC 17025, as compliant with test site criteria and competence in 47 CFR Part 15/ANSI C63.4 and EN55032/CISPR32 norms for 89/336/EEC European EMC Directive application. All pertinent data for this test facility remains unchanged.