Level Switch

LS Ex KS Ex RS Ex

Manual

AQ Elteknik AB

Level Switch Ex

Manual version 3.0

March 2013

AQ Elteknik AB

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2. Manufacturer information

AQ Elteknik AB operates a policy of on-going development and reserves the right to make changes and improvements to any of the products described in this manual without prior notice.
Under no circumstances shall AQ Elteknik AB be held responsible for any loss or indirect damage howsoever caused. The contents of this document are provided as it is. AQ Elteknik AB reserves the right to revise this document or withdraw it at any time without prior notice.

Manufacturer Declaration of Conformity

Manufacturer: AQ Elteknik AB Sweden declares, that the product:

Level Switch Ex marked with CE-label conforms with the following standards:

IEC 60079-0:2011 (Ed. 6), IEC 60079-11:2011 (Ed. 6), EN 60079-0:2012 (Ed. 4), IEC 60079-11:2012 (Ed. 2)

Level Switch Ex marked with ⌦ conforms to WEEE, directive 2002/96/EC. When the Level Switch Ex is to be discarded it shall be sent back to AQ Elteknik AB for safe disposal. See "Manufacturer Information" for return address.
Level Switch Ex is RoHS Compliant, directive 2002/95/EC.

Limited Warranty

AQ Elteknik AB warrants to the original end user that the Level Switch Ex is free from any defects in materials or workmanship for a period of one year from the date of purchase. During the warranty period, should the Level Switch Ex have indications of failure due to faulty workmanship or materials, AQ Elteknik AB will replace it with no charge. This warranty shall not apply if the Level Switch Ex is modified, misused or subjected to abnormal working conditions. Replacement as provided under this warranty is the only remedy of the purchaser. The purchaser pays freight to AQ Elteknik AB. AQ Elteknik AB shall in no event be held liable for indirect or consequential damages of any kind or character to the purchaser.

Returning the Level Switch Ex

- If the Level Switch Ex is to be discarded it shall be sent back to AQ Elteknik AB for safe disposal.

- If the Level Switch Ex shall undergo a warranty commission it shall be sent back to AQ Elteknik AB.

Before sending the Level Switch Ex to AQ Elteknik AB it must be clean and without any harmful contaminations.

A certificate shall be attached with the Level Switch Ex that confirms the cleaning and shows following information:

- Who has cleaned the Level Switch Ex (company if other than sender)

- Who has checked and confirmed that the Level Switch Ex is clean (company and person)

- Who is sending back the Level Switch Ex (company)

See "Manufacturer Information" for return address.

Warning

The Level Switch Ex is intended to be connected to the Ultrasound Controller manufactured by AQ Elteknik AB. AQ Elteknik AB takes no responsibility for any possible damage that could happen if the Level Switch Ex is connected to any other equipment.

3. Introduction

When the Level Switch Ex is attached to the outside of a container or pipe it can sense liquid level inside. The Level Switch Ex senses trough the wall without any need for a hole in the container. The Level Switch Ex is made to be used together with the Ultrasound Controller.

4. Mode

The sensor Mode setting of the Ultrasound Controller determines in which way the Level Switch Ex measures the level.
In Level Switch mode the Level Switch Ex measures a single level from the side.
In Level Sensor mode the Level Switch Ex measures a continuous level from the bottom.

5. Level Switch Mode

In Level Switch Mode each Level Switch Ex measures a single level. It measures the presence or no presence of liquid behind the container wall or pipe wall.

All types of Ex Level Switches can be used in Level Switch Mode but use different measuring techniques.
There are two measuring techniques Echo and WR (see Ultrasound Controller manual).
Level Switch KS Ex and Level Switch LS Ex should be used with the Echo technique and Level Switch RS Ex must be used only with the WR technique.

The Level Switch Ex is attached on the wall of the container or pipe. For a cylindrical wall, a Level Switch with a diameter close to the diameter of the container should be chosen. The ultrasound must pass easy into the container or pipe; therefore there must be a tight ultrasound-connection without any air-gap between the Level Switch Ex and the wall.

6. Level Sensor Mode

In Level Sensor mode the Level Switch Ex measures the continuous liquid level. The Level Switch Ex is attached under the container and measures trough the bottom.

Level Switch KS Ex or Level Switch LS Ex should be used (Level Switch RS Ex cannot be used).

A Level Switch Ex that fits the shape of the bottom should be chosen. The Level Switch Ex measures the echo that bounces at the liquid surface. It is important the echo goes straight back to the Level Switch Ex. If the Level Switch Ex and the bottom are not horizontal then the echo may bounce in another direction.
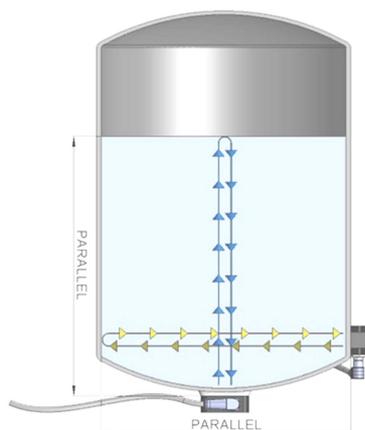
If the bottom is not horizontal, metylmetacrylate glue can be used to glue the Level Switch Ex at an angle. In this case the Level Switch should be connected to Ultrasound Controller and be active measuring while being glued so that it can be adjusted for maximum echo.

Sound has to be able to pass through the bottom. Most plastics let sound trough well except polypropylene and fiber reinforced plastics. For stainless steel, a bottom thickness of 5,8mm is the maximum recommended. Stainless steel 5,8mm 2,9mm and 1,45mm works well at 2MHz which is the optimal frequency for the Level Switch Ex. For other thicknesses other frequencies will be chosen by Ultrasound Controller.

Sound velocity varies with liquids and temperatures. A Level Switch Ex placed low on the container wall can be used to measure and compensate for sound velocity changes. More information: Ultrasound Controller manual.

7. Gluing the Level Switch Ex

The Level Switch Ex is glued to the outside of the container and the gap between the Level Switch Ex and the container is filled with glue. If the container is cylindrical choose a Level Switch Ex with a diameter close to the diameter of the container.

Important: Before gluing, make sure the echo will be reflected back to the sensor and that there is nothing inside the container blocking the echo. Also make sure the surface of the container under the Level Switch Ex is even and not a weld joint.

The ultrasound can pass into the container only if there is an air-tight ultrasound-connection between the Level Switch Ex and the container. To make such a connection the Level Switch Ex can be glued with Metylmetacrylate glue or Electrolube HTC compound or Silicone.

Gluing the Level Switch Ex with Metylmetacrylate glue: Put a mix of the two parts of Metylmetacrylate glue on the inner (container-facing) side of the Level Switch Ex and press it on to the container and hold it there until glue has cured (10 minutes). The metylmetacrylate glue should cover the gap. Metylmetacrylate glue is fast and easy to use. The gap thickness should be made as thin as possible.

Temporary installing the Level Switch Ex with Electrolube HTC: Put Electrolube HTC on the inner (container-facing) side of the Level Switch Ex and press it on to the container. Use a clamp or cable ties to hold the Level Switch Ex in place. The Electrolube HTC compound does not get stiff. If the Level Switch Ex is removed it is recommended to wipe off the old compound and use new next time.

NOTE! The connector must not be turned

8. Connecting the Level Switch Ex

The connector on the cable fits the Level Switch Ex and the other end of the cable connects to the barrier (hazardous side). The maximum cable length is 40m. A similar screened cable connects the safe side of the barrier to the Ultrasound Controller. The cable-screen is important because it prevents external noise from entering. Therefore all cables must be screened and the screen must be connected to ground. The screen of the cable connected to the Level Switch Ex should be connected to the ground terminal of the barrier.

NOTE! The unscreened part of the cable should be kept very short (< 30mm) and the screen must be connected to ground.

The diagrams below show how to connect Ex Level Switches and Ex Level Sensors to Ultrasound Controller via intrinsically safe zener barriers. Please look at the correct diagram.

In the diagrams, the cable type between Ultrasound Controller and the barriers is the same type as between the barriers and the sensors.

Choosing a barrier

The barrier must be chosen according to EN 60079-14, but there are also measurement considerations for choosing the barrier:

1. The barrier must use resistive current limitation.

2. The barrier must be made for AC current.

3. Zener diodes inside the barrier must not connect directly between channels.

4. The barrier voltage should be as high as can be allowed. (minimum ±8V AC)

5. The barrier resistance should be as low as can be allowed. (maximum 110Ω)

6. The barrier must attenuate 2MHz as little as possible.

7. The barrier capacitance to ground should be as low as possible.

6

Ex-barriershields

The zener barriers are not shielded so noise can interfere when weak signals are being measured. To reduce noise interference, shielding aluminium plates should be placed outside each group of barriers belonging to each Ultrasound Controller, see picture.

Shielding aluminium plate must be ordered separately, item no: Ex-barriershield.

The Ex-barriershield snaps on to the DIN-rail next to the intrinsically safe zener barriers.

Ex-barriershield

DIN-rail connected to intrinsically safe ground

Intrinsically safe barrier for Ultrasound Controller, No. 1

Intrinsically safe barrier for Ultrasound Controller. No. 2
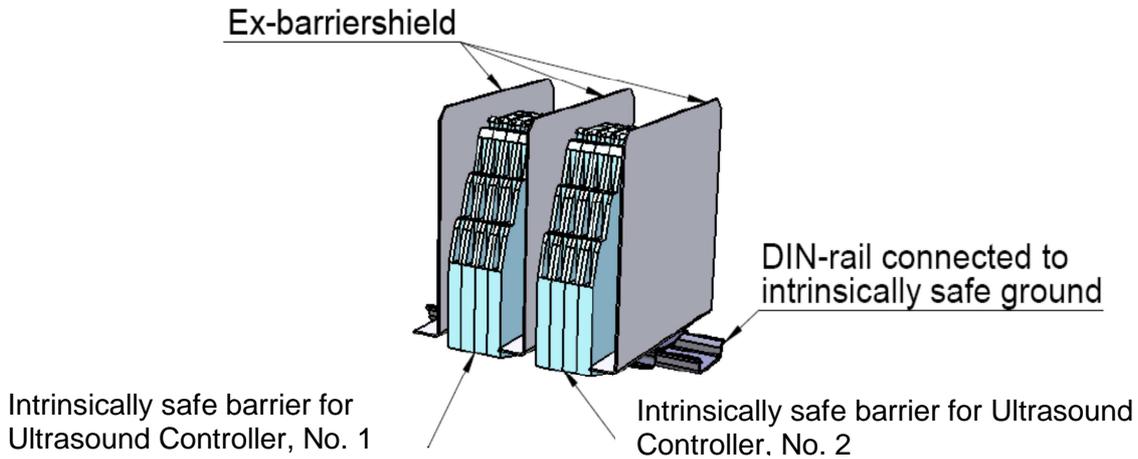
Intrinsically Safe Barrier

Notice that Ultrasound Controller is not EX certified and ia-classified barriers must be used to connect the Level Switch Ex to The Ultrasound Controller.

Common regulations for installation and maintenance of explosive protected electrical equipment shall be observed. (EN 60079-14 and EN 60079-17 in European countries connected to CENELEC). Special conditions for use according to certificate SP13ATEX3645X concerning the Level Switch Ex:

1. The cable from the barrier to the Level Switch Ex shall be permanently installed, mechanically protected and protected from other environmental stress in order to ensure explosion protection. A person with the required knowledge should perform installation.

2. The current limitation of the intrinsically safe barriers connected to the Level Switch Ex must be resistive with linear characteristic.

3. External source of heating and cooling shall be considered so that the ambient temperature is kept in the range -15°C to +60°C.

Connecting Level Switch Ex & Level Sensor Ex via barrier to D72 or DP72
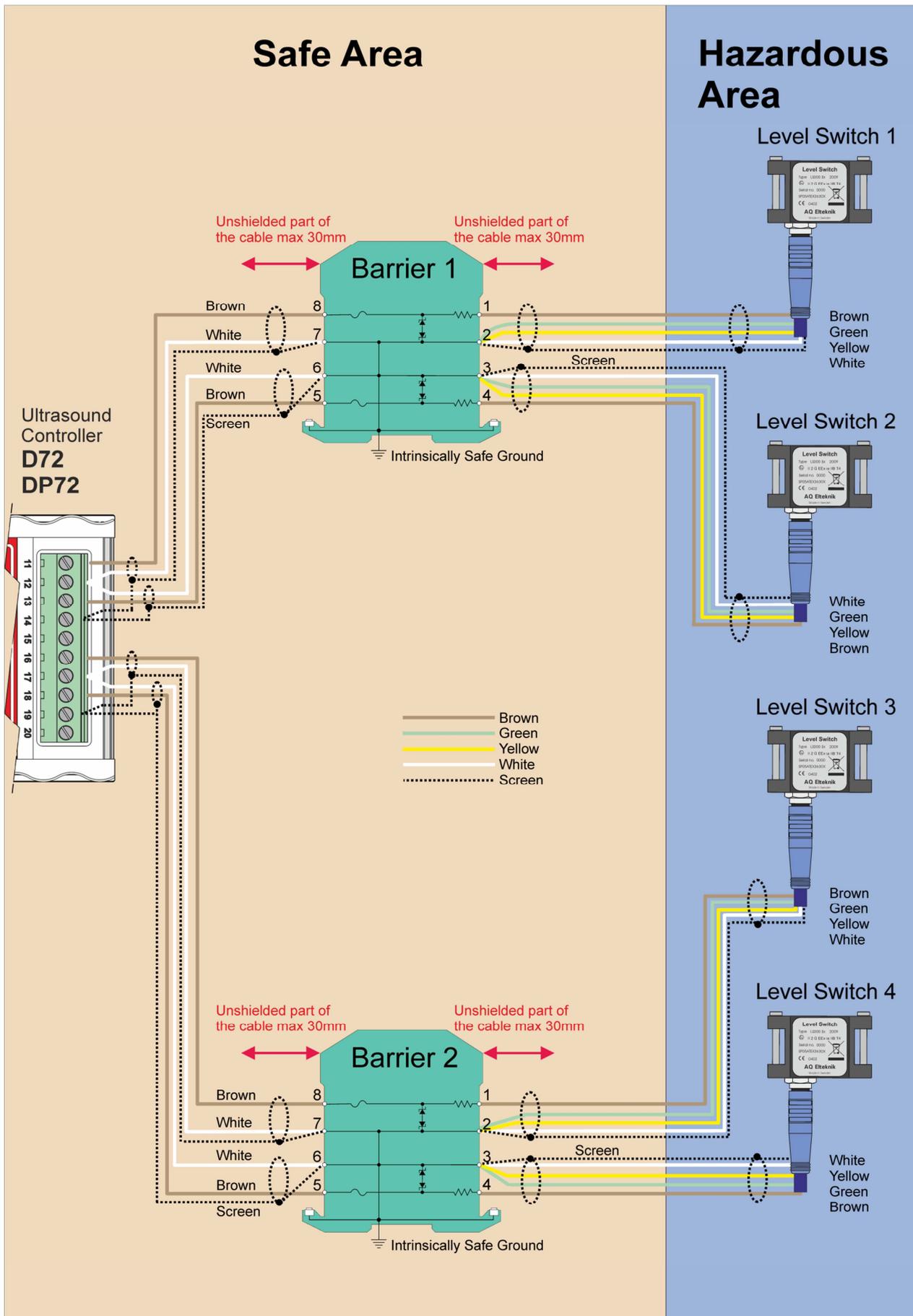
Connecting Level Switch Ex & Level Sensor Ex via barrier to D128
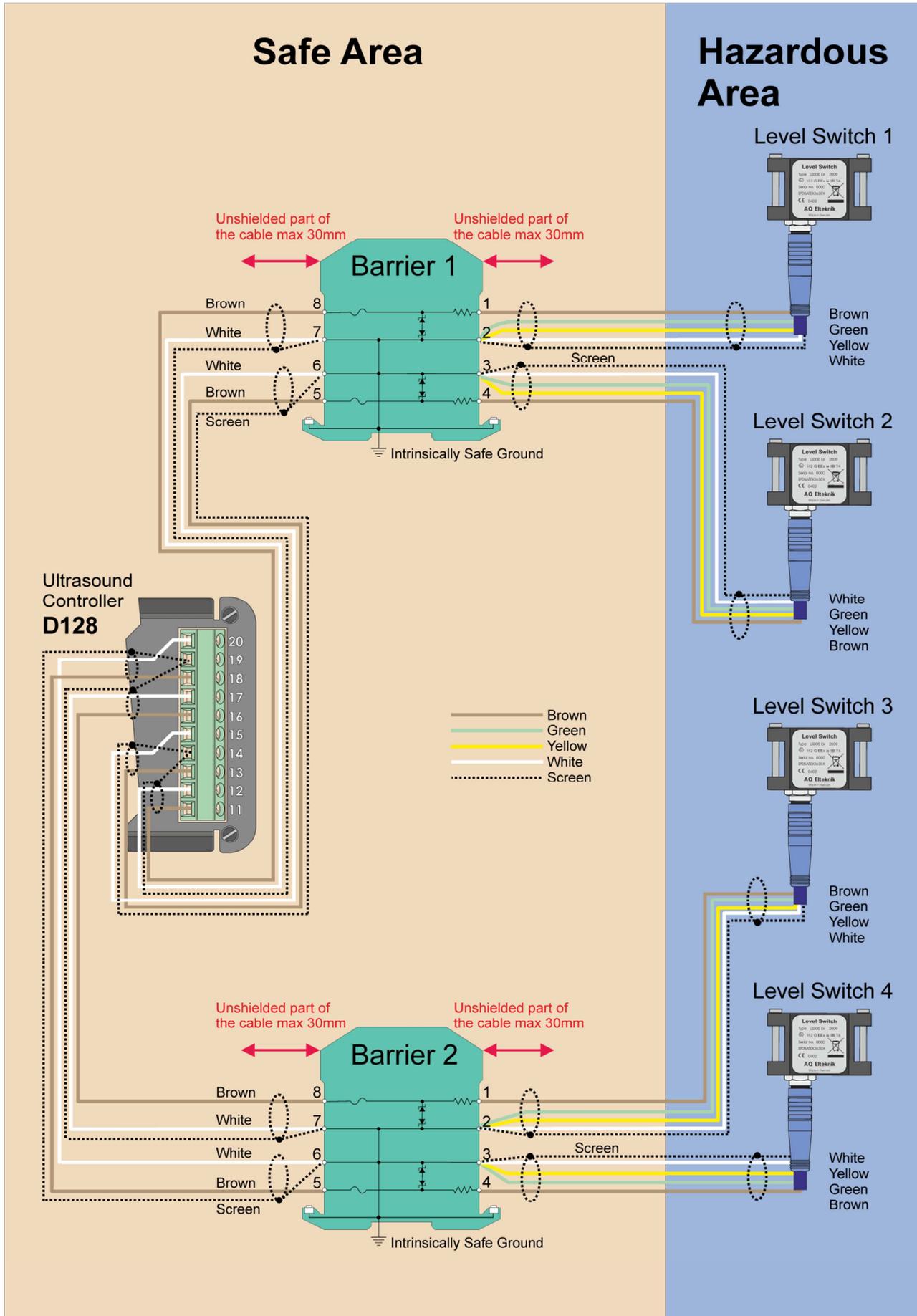
Technical data

Level Switch LS Ex	Fit container diameter (mm)	Level Switch KS Ex	Fit container diameter (mm)	Level Switch RS Ex	Fit container diameter (mm)
LS46 Ex	44 – 47	KS27 Ex	26-28	RS27 Ex	26-28
LS49 Ex	47 – 51	KS30 Ex	29-31	RS30 Ex	29-31
LS53 Ex	51 – 56	KS34 Ex	32-35	RS34 Ex	32-35
LS65 Ex	57 – 70	KS38 Ex	36-40	RS38 Ex	36-40
LS75 Ex	70 – 79	KS42 Ex	40-43	RS42 Ex	40-43
LS85 Ex	79 – 91	KS46 Ex	44-49	RS46 Ex	44-49
LS100 Ex	91 – 106	KS53 Ex	50-57	RS53 Ex	50-57
LS115 Ex	106 – 123	KS65 Ex	58-69	RS65 Ex	58-69
LS135 Ex	123 – 146	KS75 Ex	70-79	RS75 Ex	70-79
LS165 Ex	146 – 180	KS85 Ex	80-89	RS85 Ex	80-89
LS200 Ex	180 – 240	KS115 Ex	98-135	RS115 Ex	98-135
LS300 Ex	240 – 370	KS165 Ex	135-200	RS165 Ex	135-200
LS500 Ex	370 – 700	KS250 Ex	201-350	RS250 Ex	201-350
LS1300 Ex	700 – 2000	KS600 Ex	351-1000	RS600 Ex	351-1000
LSF EX	Flat container wall	KSF Ex	1000-Flat	RSF Ex	1000-Flat

Mounting screws:	LS Ex – M2,5x20mm. KS Ex – M4x >15mm. RS Ex – M4x>40mm.
Material:	plastic and stainless steel 316L
Operating temperature range:	-15°C to 60°C
Maximum temperature:	60°C
Transport temperature range:	-15 to + 60 °C
Cable with connector	WB-cable-7m 7m blue, 4x0,14mm² + screen, diameter 4,5mm
	WB-cable-20m 20m blue, 4x0,14mm² + screen, diameter 4,5mm
	WB-cable-40m 40m blue, 4x0,14mm² + screen, diameter 4,5mm
Maximum cable length	40m

The sensors are intended to use at normal atmospheric pressure (0,8-1,1 bar),
normal oxygen concentration (21 %).

Dimensions

Cable 90°

Cable 0°

Level Switch LSF EX   Level Switch LS EX
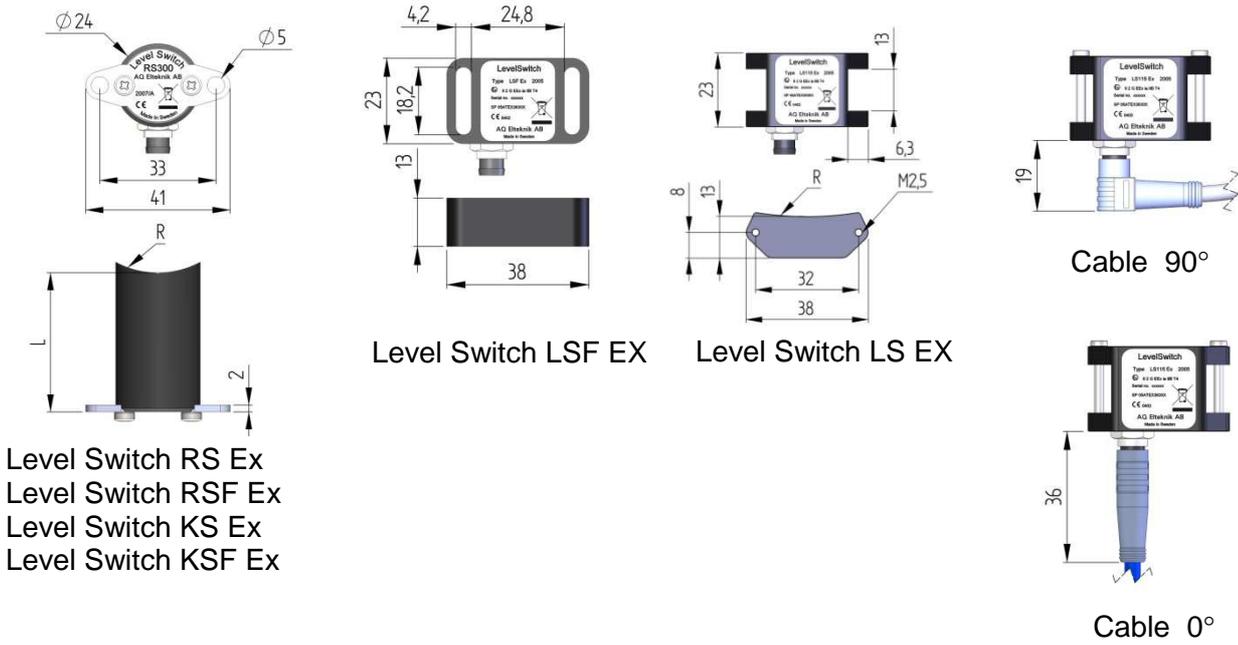
Level Switch RS Ex
Level Switch RSF Ex
Level Switch KS Ex
Level Switch KSF Ex

Level Switch	Dimensions	Comment
Level Switch KS Ex	L = 15mm R = fit container diameter	Can fit a depression 8mm deep
Level Switch KSF Ex	L = 20mm R = flat surface	Can fit a depression 8mm deep
Level Switch RS Ex	L = 40mm R = fit container diameter	
Level Switch RSF Ex	L = 40mm R = flat surface	
Level Switch LS Ex	See drawings	Old version, only spare part. For new design use Level Switch KS Ex
Level Switch LSF Ex	See drawings	Old version, only spare part. For new design use Level Switch KS Ex

Ultrasound Controller

D72 / DP72   D128
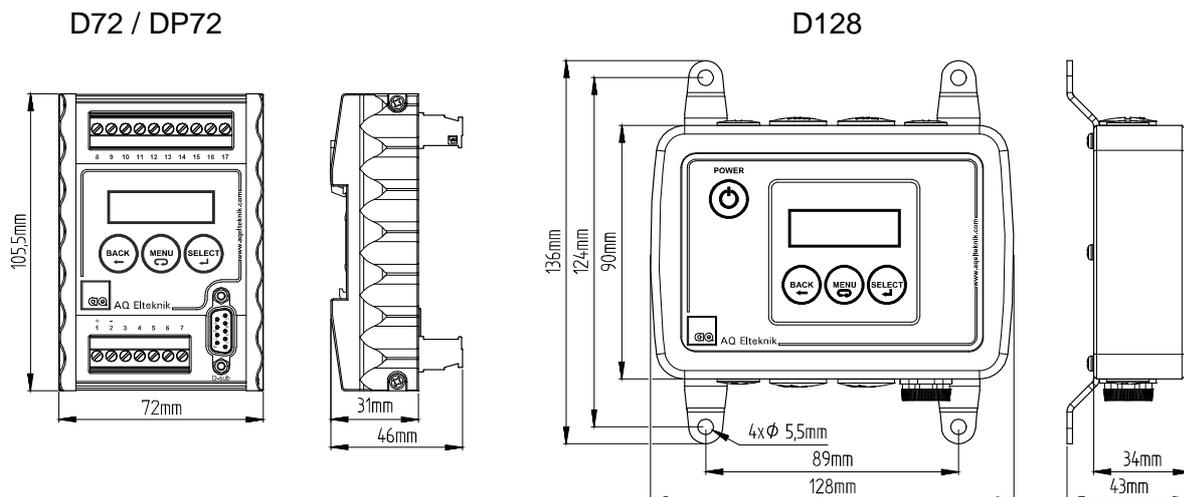
9. Manufacturer information

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Label information

Level Switch   Made in Sweden

Type   see "Technical data"

Ex Class   CE ⟨Ex⟩ II 2G Ex ia IIB T4 Gb

SP No.   SP13ATEX3645X

Intrinsic parameters

Max input voltage   Ui: 10,0V

Max current input   Ii: 250mA

Max power input   Pi: 1,1W

Inner capacitance   Ci: 200nF

Inner inductance   Li: 0,05mH

EX description

The Level Switch Ex is made to be used in Apparatus-group IIB and Equipment-group 2G.
The Level Switch Ex is classified for zone 1. Notice that Ultrasound Controller model D72/DP72/D128 is not EX certified and ia-classified barriers must be used to connect the Level Switch Ex to the Ultrasound Controller.

Notes