

# Level Switch

## Manual





**Level Switch KS**  
**Level Switch RS**  
**Level Switch LS**

**AQ M-Tech AB**

**Manual version 3.9**

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# 1. Manufacturer information

AQ M-Tech 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 M-Tech be held responsible for any loss or indirect damage howsoever caused. The contents of this document are provided as it is. AQ M-Tech AB reserves the right to revise this document or withdraw it at any time without prior notice.

## CE Declaration of Conformity

Manufacturer: AQ M-Tech AB Sweden declares, that the product: Level Switch marked with CE-label conforms with the standards: EN 61000-6-2, EN 61000-6-4, EN55011 (Group 1, Class B).

The Level Switch marked with  conforms to WEEE directive 2012/19/EU. The Level Switch is RoHS compliant, directive (EU) 2015/863.

## Limited Warranty

AQ M-Tech AB warrants to the original end user that the Level Switch 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 have indications of failure due to faulty workmanship or materials, AQ M-Tech AB will replace it with no charge. This warranty shall not apply if the Level Switch 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 M-Tech AB. AQ M-Tech AB shall in no event be held liable for indirect or consequential damages of any kind or character to the purchaser.

## Warning

The Level Switch is intended to be connected to the Ultrasound Controller, manufactured by AQ M-Tech AB. AQ M-Tech AB takes no responsibility for any possible damage that could happen if the Level Switch is connected to any other equipment or if it is repaired or modified by anyone other than AQ M-Tech AB.

## Certificate of Quality and Function

AQ M-Tech AB guaranties that the Level Switch has passed function and quality tests.

### Manufacturer:

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## 2. Introduction

When the Level Switch is attached to the outside of a container or pipe it can sense liquid level inside. The Level Switch senses through the wall without any need for a hole in the container. The Level Switch is made to be used together with the Ultrasound Controller D72 or DP72. Level Switch LS is also available ATEX certified, see Level Switch EX manual. Level Switch KS is a new Level Switch with improved specifications that can be used instead of Level Switch LS.

## 3. Mode

The sensor Mode setting of the Ultrasound Controller D72 or DP72 determines in which way the Level Switch measures the level.

In Level Switch mode the Level Switch measures a single level from the side.

In Level Sensor mode the Level Switch measures a continuous level from the bottom.

In Gel Sensor mode the Level Switch measures a single gel-level from the side.

## 4. Level Switch Mode

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

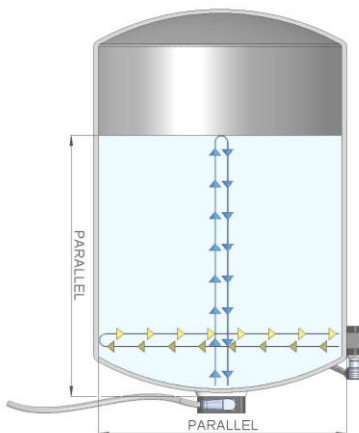
All types of Level Switches can be used in Level Switch Mode but use different measuring techniques. There are two measuring techniques Echo and WR (see Ultrasound Controller D72 and DP72 manual).

Level Switch KS and Level Switch LS should be used with the Echo technique and Level Switch RS must be used only with the WR technique.

The Level Switch is attached on the wall of the container. 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; therefore there must be a tight ultrasound-connection without any air-gap between the Level Switch and the wall.

## 5. Level Sensor Mode

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



A Level Switch that fits the shape of the bottom should be chosen. Level Switch KSF would probably be the best choice (Level Switch RS can not be used). The Level Switch measures the echo that bounces on the liquid surface. It is important the echo goes straight back to the Level Switch. If the Level Switch and the bottom are not horizontal then the echo may bounce in another direction.

If the bottom is not horizontal, silicone can be used to glue the Level Switch at an angle. In this case the Level Switch should be connected to D72 and be active measuring while being glued so that it can be adjusted for maximum echo.

Sound must be able to pass through the bottom. Most plastics let sound through 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. For other thicknesses other frequencies will be chosen by D72 / DP72.

Sound velocity varies with liquids and temperatures. A Level Switch placed low on the container wall can be used to measure and compensate for sound velocity changes. It can also limit the measured level according to its own position. Level Switch KS or Level Switch KSF would be good choices, depending on the container wall thickness.

More information: Ultrasound Controller D72 / DP72 manual.

## 6. Gel Sensor Mode

In Gel Sensor Mode, each Level Switch measures a single gel-level. It measures the presence or no presence of gel or air behind the column wall.

Level Switch KS or KSL can be used in Gel Sensor Mode. The ultrasound must pass easily into the container or pipe; therefore, there must be a tight ultrasound-connection without any air-gap between the Level Switch and the wall.

## 7. Installing the Level Switch

How to install the Ultrasound Controller D72 / DP72 and connect the cables is described in the Ultrasound Controller Manual.

Between the Level Switch and the container there must be a tight ultrasound-connection. For Level Switch MK, this is achieved with a soft silicone surface. For the other Level Switches, it is achieved by using glue or compound.

### Level Switch MK / MKL

For attaching the Level Switch MK no glue or compound is needed. The soft and flexible rubber surface of the Level Switch MK adapts to the surface of the container when it is pressed against it. The pressure needs to be between 5N and 50N, to achieve a good ultrasound-connection, but it depends on the shape of the container. The Level Switch MK needs to be held in place with a fixture and the fixture needs to provide means to hold the Level Switch pressed against the container. The rounded rubber surface of the Level Switch MK does not by itself keep it aligned with the container wall, so the fixture needs to keep it aligned.

A possible way to make a fixture would be a plastic block adapted to the shape of the container, with a 24,1mm hole for the Level Switch and two screws holding and applying pressure to it. The 24,1mm hole will align the Level Switch. More information about how the Level Switch MK can be used is available in Ultrasound Controller manual.

### Level Switch KS / KSF / KSL / RS / RSF / RSL / CF / LS / LSF

Gluing the Level Switch with transparent silicone glue is a good attachment technique. Transparent silicone glue is heat-resistant and works well in a large temperature range. A Level Switch glued with silicone is also quite easy to remove. The silicone glue can be Loctite 5366 or a similar transparent (1-component moisture curing) silicone. It can take a few days to completely

cure but the Level Switch can be used while the silicone is curing. Put some silicone on the container-facing side of the Level Switch and press it on to the container.

The silicone should completely cover the gap between the Level Switch and the container. During the first hours, keep the Level Switch securely in place with some tape so it does not slide.

Transparent 1-component MS-polymer can also be used if temperature is not above 80°C. It is flexible like silicone and takes some day to cure.

Hard glues should be avoided since they may come loose by temperature variations.

If the Level Switch is not glued, Sonotech SONO 600 can be used, or Electrolube Heat Transfer Compound. It does not cure so the Level Switch must be held in place by other means. If the Level Switch is removed, the old compound should be wiped off and new used next time. These compounds are not recommended at temperatures above 60°C.

More information about how the Level Switch can be used for measuring is available in Ultrasound Controller manual.

Level Switch RS should only be used with the technique WR. The WR-technique is sensitive for small movements so gluing the Level Switch RS is recommended.



## 8. Using Level Switch on stainless steel and glass containers

A stainless steel container-wall is selective in which ultrasound frequencies it allows to pass through. Only frequencies near wall-resonance passes easily. There are two types of Level Switch, the Level Switch KSL, MKL, RSL and the Level Switch KS, KSF, MK, RS, RSF, CF, LS, LSF. Each type operates on a certain frequency range. The Level Switch KSL, MKL, RSL works best near 1,5MHz and the other Level Switch without L works best near 2,0MHz. Glass and plastic container walls are usually thick and the sound velocity is lower than stainless steel causing the resonance frequencies to be spaced closer together and then the Level Switch without L is recommended on glass and plastic wall.

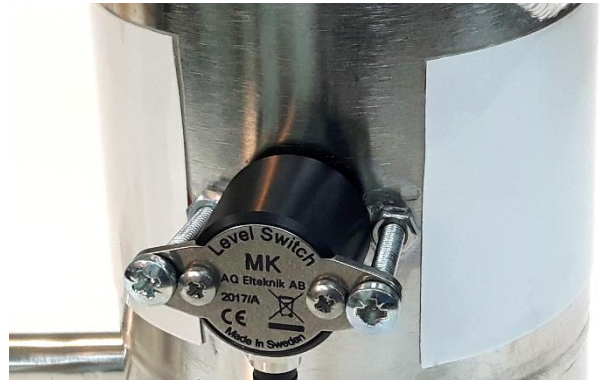
### Level Switch KSL, MKL and RSL

The table gives the optimal frequencies for different wall thickness. At some thicknesses both type of Level Switch works and at some only one type works. On glass and plastic wall both types works. If the stainless steel wall is between 1,9mm and 2,3mm Level Switch KSL, MKL, RSL must be chosen, otherwise the other Level Switch is better.

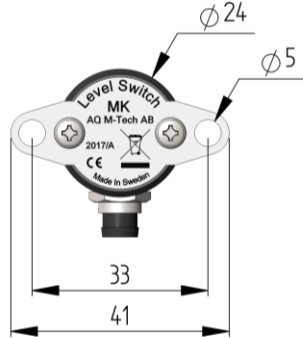
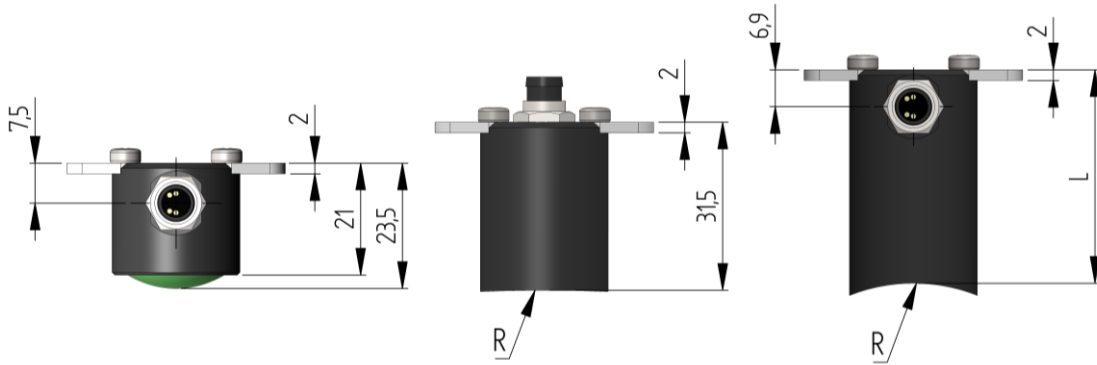
Stainless steel container wall thickness (mm)	Level Switch KS, KSF, MK, RS, RSF, CF, LS, LSF (1,5MHz - 2,3MHz)	Level Switch KSL, MKL, RSL (1,0MHz - 1,7MHz)
1,2	2,3 MHz	
1,3	2,1 MHz	
1,4	2,0 MHz	
1,5	1,9 MHz	
1,6	1,7 MHz	1,7 MHz
1,7	1,6 MHz	1,6 MHz
1,8	1,5 MHz	1,5 MHz
1,9		1,4 MHz
2,0		1,4 MHz
2,1		1,3 MHz
2,2		1,3 MHz
2,3		1,2 MHz
2,4	2,3 MHz	1,2 MHz
2,5	2,2 MHz	1,1 MHz
2,6	2,2 MHz	1,1 MHz
2,7	2,1 MHz	1,0 MHz
2,8	2,0 MHz	
2,9	1,9 MHz	
3,0	1,9 MHz	
3,1	1,8 MHz	
3,2	1,7 MHz	1,7 MHz
3,3	1,7 MHz	1,7 MHz
3,4	1,6 MHz	1,6 MHz
3,5	1,6 MHz	1,6 MHz
3,6	2,3 MHz	1,6 MHz
3,7	2,3 MHz	1,5 MHz
3,8	2,2 MHz	1,5 MHz
3,9	2,2 MHz	1,4 MHz
4,0	2,1 MHz	1,4 MHz
4,1	2,0 MHz	1,4 MHz
4,2	2,0 MHz	1,3 MHz
4,3	2,0 MHz	1,3 MHz
4,4	1,9 MHz	1,3 MHz
4,5	1,9 MHz	1,2 MHz

## Sound absorbing tape to improve Level Switch function

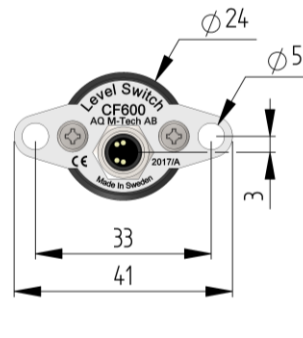
When the Level Switch is mounted on a stainless steel or glass container and the echo-technique is used, it is advisable to also attach a sound absorbing tape on the container. The tape will suppress interfering sound travelling along the container and thereby improve the measurements (the *Edata* will be lower with air, making threshold *Ethd* also lower, which is good). The 3M tape 8671 is a polyurethane tape with good sound absorbing properties. It also withstands high temperature 135°C. The tape is transparent and can be removed without leaving any trace. The picture shows the tape before the white protective paper is removed. The tape should be placed centered on each side of the Level Switch and if possible go around the container, starting and ending near the Level Switch. Or it can be two shorter pieces on each side of the Level Switch. The important area to cover is about 100mm on each side of the Level Switch. The tape is 50,8mm wide and separate tapes should be used for each Level Switch. Attaching tape above or below the Level Switch does not help. The tape that is supplied with the Level Switch is 500mm length and can also be ordered separately from AQ M-Tech, order number 101310. The tape is made of polyurethane and acetone must be avoided when cleaning the tape.



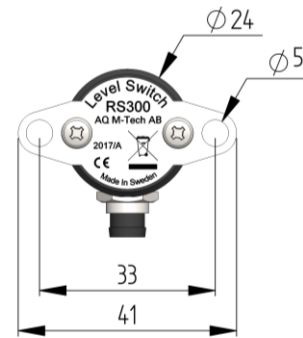
# 9. Technical Data



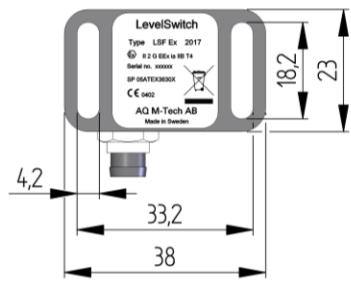
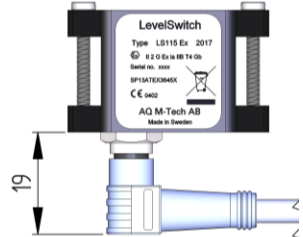
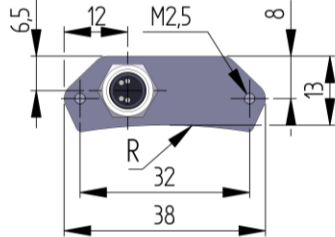
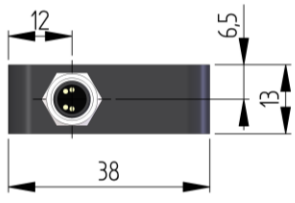
**Level Switch MK**  
**Level Switch MKL**



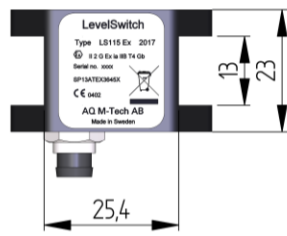
**Level Switch CF**  
**Level Switch CFF**



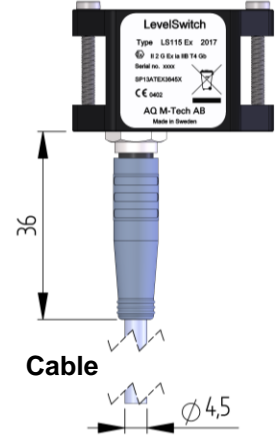
**Level Switch KS**  
**Level Switch KSF**  
**Level Switch KSL**  
**Level Switch RS**  
**Level Switch RSF**  
**Level Switch RSL**



**Level Switch LSF**



**Level Switch LS**



**Cable**

Level Switch	Dimensions (mm)	comment
Level Switch MK, MKL	R = spherical silicone	Has flexible silicone surface
Level Switch KS, KSL	L = 15,7 R = fit container diameter	Diameter = 24mm
Level Switch KSF	L = 20,7 R = flat surface	Can fit a depression 8mm deep Diameter = 24mm
Level Switch RS, RSL	L = 40 R = fit container diameter	Diameter = 24mm
Level Switch RSF	L = 40 R = flat surface	Diameter = 24mm
Level Switch CF	R = fit container diameter	Connector is on top
Level Switch LSF	R = flat surface	Old version not for new design
Level Switch LS	R = fit container diameter	Old version not for new design

Level Switch	Level Switch KS, KSL, KSF, RS, RSL, RSF, CF	Level Switch MK, MKL	Level Switch LS, LSF
Material in contact with the container	PEI	Silicone	POM-H
Container / temperature	-20°C to 140°C	-20°C to 140°C	-15°C to 60°C
Ambient temperature	-20°C to 60°C	-20°C to 60°C	-15°C to 60°C

Level Switch	Frequency range	Stainless steel wall thickness
Level Switch KS, KSF, MK, RS, RSF, CF, LS, LSF	1,5MHz - 2,3MHz	1,2mm - 1,8mm and >2,4mm
Level Switch KSL, MKL, RSL	1,0MHz - 1,7 MHz	1,6mm - 2,7mm and >3,2mm

Level Switch RS / RSL	Fit container diameter (mm)
RS27 / RSL27	3/4" DN20 26 – 28
RS30 / RSL30	29 – 31
RS34 / RSL34	1" DN25 32 – 35
RS38 / RSL38	36 – 40
RS42 / RSL42	1 1/4" DN32 40 – 43
RS46 / RSL46	1 1/2" DN40 44 – 49
RS53 / RSL53	50 – 57
RS65 / RSL65	2" DN50 58 – 69
RS75 / RSL75	2 1/2" DN65 70 – 79
RS85 / RSL85	3" DN80 80 – 98
RS115 / RSL115	4" DN100 98 – 135
RS165 / RSL165	6" DN150 135 – 200
RS250 / RSL250	200 – 350
RS600 / RSL600	350 – 1000
RSF	1000 – Flat

Level Switch KS / KSL	Fit container diameter (mm)
KS27 / KSL27	26 – 28
KS30 / KSL30	29 – 31
KS34 / KSL34	32 – 35
KS38 / KSL38	36 – 40
KS42 / KSL42	40 – 43
KS46 / KSL46	44 – 49
KS53 / KSL53	50 – 57
KS65 / KSL65	58 – 69
KS75 / KSL75	70 – 79
KS85 / KSL85	80 – 98
KS115 / KSL115	98 – 135
KS165 / KSL165	135 – 200
KS250 / KSL250	201 – 350
KS600 / KSL600	351 – 1000
KSF	1000 – Flat

Level Switch LS	Fit container diameter (mm)
LS46	44 – 47
LS49	48 – 50
LS53	51 – 58
LS65	59 – 69
LS75	70 – 79
LS85	80 – 91
LS100	92 – 106
LS115	107 – 124
LS135	125 – 147
LS165	148 – 180
LS200	180 – 240
LS300	240 – 400
LS600	400 – 1000
LSF	1000 – Flat

Cable Length	data	Order number
7m	connector 0° grey	G-Cable-7m
7m	connector 90° grey	WG-Cable-7m
20m	connector 0° grey	G-Cable-20m
20m	connector 90° grey	WG-Cable-20m
40m	connector 90° grey	WG-Cable-40m
Cable data:	4 x 0,14mm <sup>2</sup> + screen, PVC, diameter 4,1mm	

Do not twist the Level Switch cable connector, as it may destroy internal connections.

