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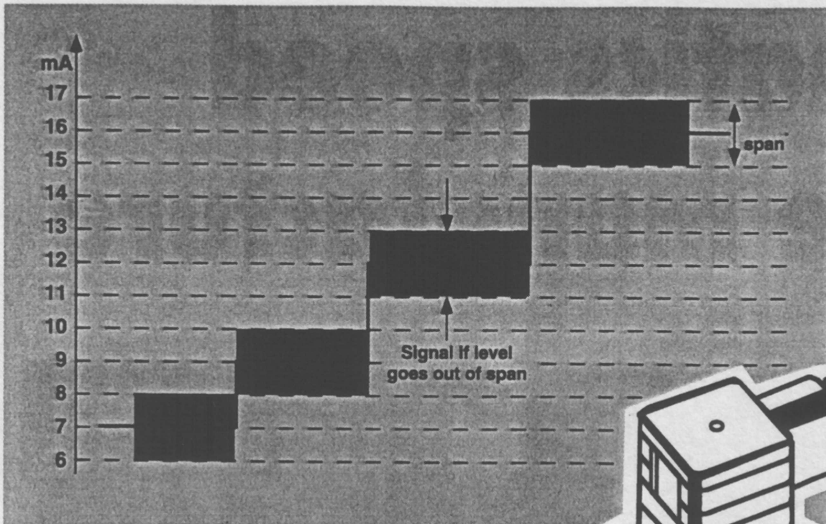

Fig 3. (above) Section of fluid level profile from Fig.1 selected for analysis

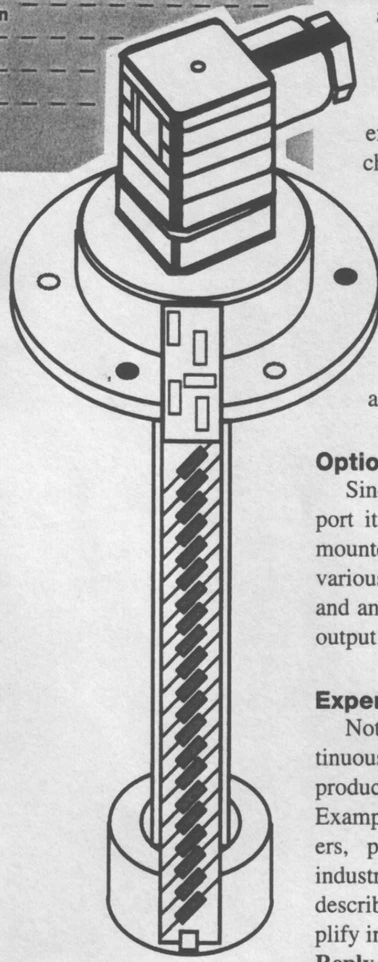

Fig 4. (right) Diagram of the fluid level controller showing the arrangement of multiple reed switches.

into an electronic data processing (EDP) system and it may well then be possible to 'teach in' the level movements over the complete cycle so that these represent the zero line against which unexpected changes become apparent. Fig.3 shows how this applies to a portion of the cycle diagram shown in Fig.2. A small span of acceptable values is allowed either side of the zero line but movement outside it is cause for investigation. Depending on the size of the reservoir this might indicate a loss of just a few litres of fluid, but leakage of even that amount can cause disruption and environmental damage that costs money to rectify.

Clearly this degree of control is possible only where the fluid demand cycle is repetitive, but these days that applies to a large and growing number of hydraulic systems powering automated processes such as injection moulding.

A number of surveys have shown that the greatest potential for fluid loss ocurrs when the reservoir is being filled or topped up. An effective solution is to employ a motorised pump set and use the 'reservoir full' signal from a level control unit to switch off the pump motor. If something along these lines was made compulsory throughout the European Community a great deal of fluid would be saved and much expenditure on cleaning up would be avoided.

The level control unit

The unit providing the analogue signal output has been the subject of much development work. Initially it was intended that this should provide a completely smooth variation of output in response to level changes, but this entailed the use of a larger float and heavier magnets. The combination of mass and viscosity effects led to an unacceptably slow response to changes in level.

The system now in use is based on a series of closely spaced reed switches (Fig.3) in a low voltage circuit that produces the 4–20mA output signal. This is unaffected by cable length and electromagnetic disturbances. The unit is flange mounted with the same fixing dimensions as a standard filler/breather unit.

Options

Since the control unit fits a standard filler/breather port it is convenient to combine it with other tank mounted facilities (Fig.1). It is therefore offered with various combinations of filler/breather, sampling port and an electronic temperature sensor with a 4–20mA output and up to five setpoints.

Experience to date

Not surprisingly, the greatest response to this continuous level control system has come from large production oriented users of hydraulic systems. Examples include several major vehicle manufacturers, power generators and the pulp and paper industry. In many cases the multi–function options described above have been specified in order to simplify installation and save space.

Reply no. 223

Lloyd's Register

Certificate of Approval

This is to certify that the Management System of:

Bühler Technologies GmbH

Harkortstrasse 29, 40880 Ratingen, Germany

has been approved by LRQA to the following standards:

ISO 9001:2015

P.G. Cornelissen - Area Manager North Europe

Issued by: Lloyd's Register Deutschland GmbH

for and on behalf of: Lloyd's Register Quality Assurance Limited

Current issue date: 14 December 2018
Expiry date: 13 December 2021
Certificate identity number: 10146601

Original approval(s):
ISO 9001 – 11 December 1995

Approval number(s): ISO 9001 – 0017734

The scope of this approval is applicable to:
Design and manufacture as well as procurement of products for instrumentation, process control and for the fluid power industry.

UKAS MANAGEMENT SYSTEMS
001

1 # Production Quality Assurance Notification

2 Equipment and Protective Systems intended for use in potentially explosive atmospheres
Directive 2014/34/EU
Annex IV - Module D: Conformity to type based on quality assurance of the production process
Annex VII - Module E: Conformity to type based on product quality assurance

3 Notification number: **BVS 21 ATEX ZQS/E213**

4 Product category: **Equipment and components**
equipment-group II, categories 1G, 1D, 2G, 2D:
Equipment and components for measurement and control

5 Manufacturer: **Bühler Technologies GmbH**

6 Address: **Harkortstr. 29, 40880 Ratingen, Germany**

Site(s) of manufacture: **Harkortstr. 29, 40880 Ratingen, Germany**

7 The certification body of DEKRA Testing and Certification GmbH, Notified Body No 0158 in accordance with Article 17 of the Council Directive 2014/34/EU of 26 February 2014 notifies that the manufacturer has a production quality system, which complies with Annex IV of the Directive.
This quality system in compliance with Annex IV of the Directive also meets the requirements of Annex VII.
In the updated annex all products covered by this notification and their type examination certificate numbers are listed.

8 This notification is based on audit report ZQS/E213/21 issued 2021-09-09.
Results of periodical re-assessments of the quality system are a part of this notification.

9 This notification is valid from 2021-07-22 until 2024-07-22 and can be withdrawn if the manufacturer does not satisfy the production quality assurance surveillance according to Annex IV and VII.

10 According to Article 16 (3) of the Directive 2014/34/EU the CE marking shall be followed by the identification number 0158 of DEKRA Testing and Certification GmbH as notified body involved in the production control phase.

DEKRA Testing and Certification GmbH
Bochum, 2021-09-09

Managing Director

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Charts and design tools

- DAFC3002 Concersion Tables
- AA100004 Definition of the Contact Function of Level Switches

BUHLER TECHNOLOGIES

Conversion table pressure

	Pa	bar	N/mm²	kp/m²	kp/cm²(at)	atm	Torr
1 Pa (N/m²) =	1	10^{-5}	10^{-6}	0.102	$0.102*10^{-4}$	$0.987*10^{-5}$	0.0075
1 bar (daN/cm²) =	100000	1	0.1	10200	1.02	0.987	750
1 N/mm² =	106	10	1	$1.02*10^{5}$	10.2	9.87	7500
1 kp/m² =	9.81	$9.81*10^{-5}$	$9.81*10^{-6}$	1	39913	$0.968*10^{-4}$	0.0736
1 kp/cm² (1 at) =	98100	0.981	0.0981	10000	1	0.968	736
1 atm (760 Torr) =	101325	1.013	0.1013	10330	1.033	1	760
1 Torr =	133	0.00133	$1.33*10^{-4}$	13.6	0.00132	0.00132	1

Conversion table power

	W	kW	kcal/s	kcal/h	kp m/s	PS
1 W=Nms=J/s	1	0.001	$2.39*10^{-4}$	0.86	0.102	0.00136
1 kW =	1000	1	0.239	860	102	1.36
1 kcal/s =	4190	4.19	1	3600	427	5.69
1 kcal/h =	1.16	0.00116	0.00028	1	0.119	0.00158
1 kp m/s =	9.81	0.00981	0.00234	8.43	1	0.0133
1 PS =	736	0.736	0.176	623	75	1

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Flow rates in l/min at different flow speed

NW: nominal width in mm

NW	Flow speed								
	0.5 m/s	1 m/s	1.5 m/s	2 m/s	3 m/s	4 m/s	5 m/s	7 m/s	8 m/s	10 m/s
8	1.5	3	4.5	6	9	12	15	21	24	30
10	2.3	4.6	6.9	9.2	13.8	18.4	23	32.2	36.8	46
12	3.4	6.8	10.2	13.6	20.4	27.2	34	47.6	54.4	68
15	5.3	10.6	15.9	21.2	31.8	42.4	53	74.2	84.8	106
16	6	12	18	24	36	48	60	84	96	120
20	9.5	19	28.5	38	57	76	95	133	152	190
25	15	30	45	60	90	120	150	210	240	300
32	20	40	60	80	120	160	200	280	320	400
40	38	76	114	152	228	304	380	532	608	760
50	60	120	180	240	360	480	600	840	960	1200
65	100	200	300	400	600	800	1000	1400	1600	2000
80	150	300	450	600	900	1200	1500	2100	2400	3000
100	230	460	690	920	1380	1840	2300	3220	3680	4600
125	370	740	1110	1480	2200	2960	3700	5180	5920	7400
150	530	1060	1590	2120	3180	4240	5300	7420	8480	10600
175	750	1500	2250	3000	4500	6000	7500	10500	12000	15000
200	950	1900	2850	3800	5700	7600	9500	13300	15200	19000
225	1200	2400	3600	4800	7200	9600	12000	16800	19200	24000
250	1500	3000	4500	6000	9000	12000	15000	21000	24000	30000
300	2100	4200	6300	8400	12600	16800	21000	29400	33600	42000
350	2900	5800	8700	11600	17400	23200	29000	40600	46400	58000
400	3800	7600	11400	15200	22800	30400	38000	53200	60800	70000
450	4760	9520	14280	19040	28560	38080	47600	66640	76160	95200
500	6000	12000	18000	24000	36000	48000	60000	84000	96000	120000
550	7100	14200	21300	28400	42600	56800	71000	99400	113600	142000
600	8500	17000	25500	34000	51000	68000	85000	119000	136000	170000
700	11500	23000	34500	46000	69000	92000	115000	161000	184000	230000
800	15000	30000	45000	60000	90000	120000	150000	210000	240000	300000
900	19000	38000	57000	76000	114000	152000	190000	266000	304000	380000
1000	23000	46000	69000	92000	138000	184000	230000	322000	368000	460000

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BUHLER TECHNOLOGIES

Conversion inches to mm

inches fraction	Inches decimal notation	metric
1/64"	0.016"	0.397 mm
1/32"	0.031"	0.794 mm
1/16"	0.063"	1.587 mm
1/8"	0.125"	3.175 mm
1/4"	0.25"	6.350 mm
3/8"	0.375"	9.525 mm
1/2"	0.500"	12.700 mm
5/8"	0.625"	15.875 mm
3/4"	0.75"	19.050 mm
7/8"	0.875"	22.225 mm
1"	1"	25.400 mm
1 1/4"	1.250"	31.750 mm
1 1/2"	1.500"	38.100 mm
1 3/4"	1.750"	44.450 mm
2"	2"	50.800 mm
2 1/4"	2.250"	57.150 mm
2 1/2"	2.500"	63.500 mm
2 3/4"	2.750"	69.850 mm
3"	3"	76.200 mm
3 1/4"	3.250"	82.550 mm
3 1/2"	3.500"	88.900 mm
3 3/4"	3.750"	95.250 mm
4"	4"	101.60 mm
4 1/4"	4.250"	107.95 mm
4 3/4"	4.750"	120.65 mm
5"	5"	127.00 mm
6"	6"	152.40 mm
7"	7"	177.80 mm
8"	8"	203.20 mm
9"	9"	228.60 mm
10"	10"	254.00 mm

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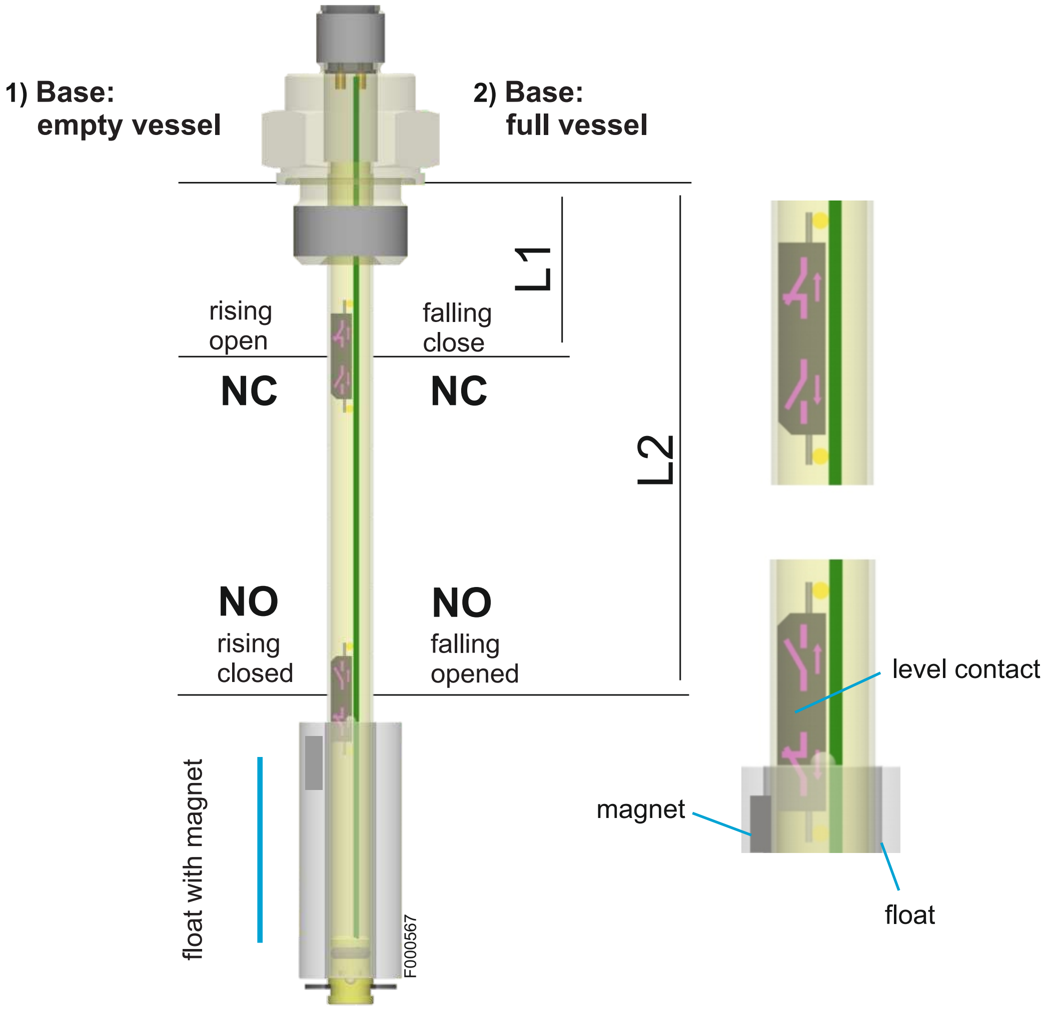
Definitions of the Contact Function of Level switches

There are two possibilities to define the contact function of a switch with respect to the base of the vessel:

1. bottom edge of the vessel / empty vessel and
2. top edge of the vessel / filled vessel

Accordingly, in the first case, the switch will be regarded as closer if the level decreases from full to empty, in the second case, the level increases from the point of view of the operator and a closer has the opposite function. Since most of the market uses the 1st definition, Bühler stays with that as well.



The reference point concerning dimensions remains at the flange in any case, independent from the explanations given above. Please note that the designation of length (L1, L2) are not numbered the same way throughout the market.

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