TCL/PCL application instruction

Function

For supervising and/or controlling fill factors electronic level indicators/controls are required. Our products with the following type designations represent such devices: TCL, PCL and TCL3. Because of simplicity reasons, all these devices in this document are designated as level controls. In the case of differences between the devices we will deal in a separated manner with it.

Operating range

The application of the level control requires the fulfilment of the following:

- The liquid you want to measure must be conductive.
- The liquid you want to measure must not be flammable.
- The liquid you want to measure must have its conductivity within the available measuring range.
- Make sure that the sensor cabling is placed within a shielded cable away from AC cabling or engine cabling.

Conductive liquids

Resistor calculation

The calculation of the resistance of the medium is possible. For this, the size of the electrodes must be known.

$$R = \frac{1}{c * p} * \frac{d}{A}$$

A = Size of the electrodes [cm³]
d = Gap of the electrodes [cm]
c = Concentration [val/cm³]
p = equivalent conductivity [Scm²/val]

An equivalent means the amount of molecules of the liquid. There is one positive molecule and one negative. For example, one molecule NaCl means Na^{+} + CL^{-} the equivalent in this case is 1. One molecule $CaCl_2$ means Ca^{++} + $2CL^{-}$ the equivalent is ½.

Usually the size of the electrodes is not measured, but the d/A ratio is acquired when measuring the resistance of a cell with a defined concentration and a known equivalent conductivity. In some cases the cell constant will be necessary for measuring with the level control.

Conductivity and not conductive liquids

conductive liquids	not conductive liquids
fresh/drinking water	clean water
sea water	gas
glycolic water	oil
coffee	brake fluid
	alcohol
	paraffin
	whiskey

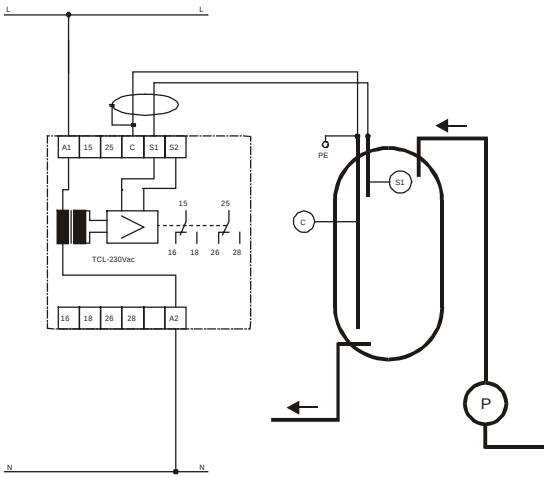
Measuring conductive liquids

Measuring conductive liquids is not as easy as measuring the resistance of ohmic resistors. The liquids are not completely ohmic and you have to avoid a material wander.
The TCL considers these problems and uses a very small ac for resistance measuring.

Function description

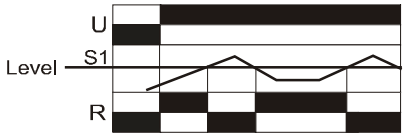
Level control with one fill factor

Fill

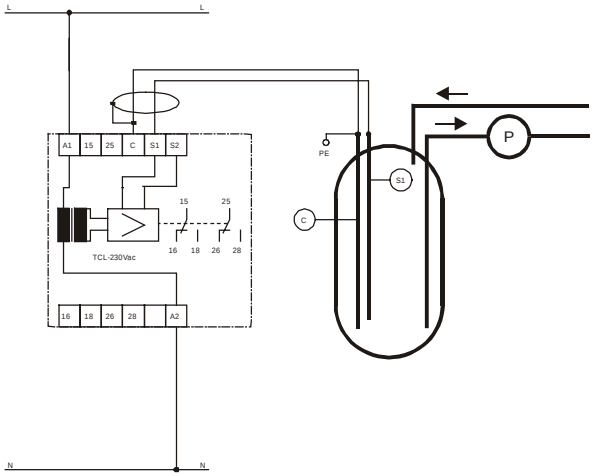


Function:

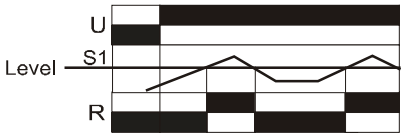
The relay (R) is active as long as the fill factor reaches S1.



Deplete

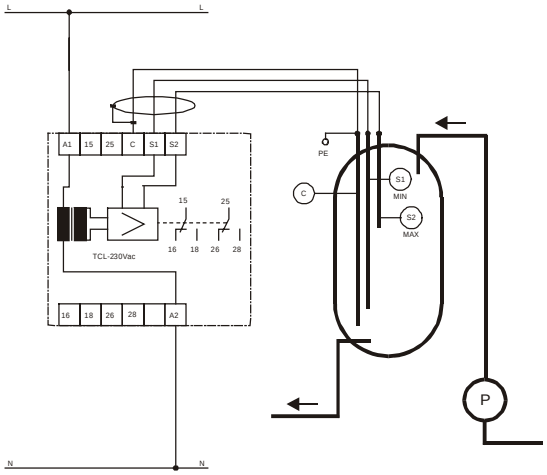


Function:
As long as the fill factor reaches S1, the relay (R) will be active.

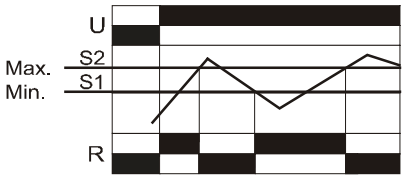


Level control with two fill factors

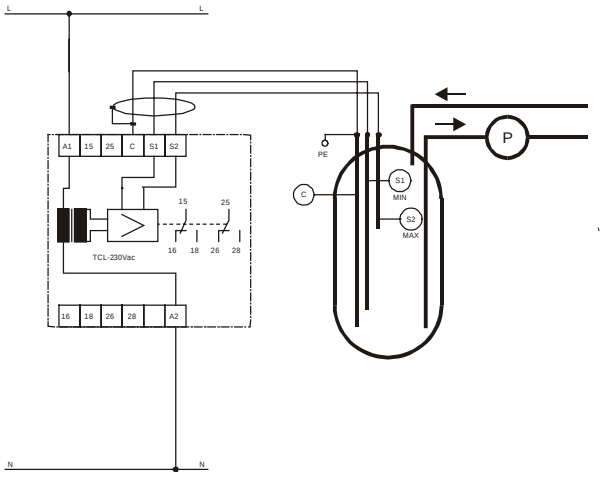
Fill



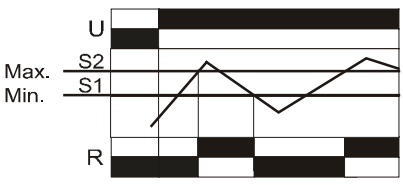
Function:
The relay (R) becomes active as soon as both sensors (S1, S2) are not covered. It switches off as soon as both sensors get in contact with the medium.



Deplete



Function:
The relay (R) becomes active as soon as both sensors (S1, S2) are covered. It switches off as soon as both sensors lose contact with the medium.



Wiring

Galvanic disconnected AC adapter

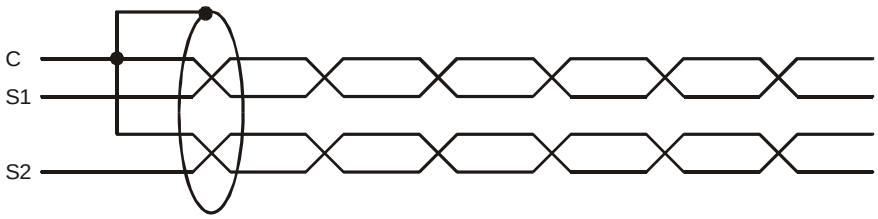
Usually the receptacles for the liquids are made of metal and are grounded. In this case you have to choose a level control with galvanic separated supply. In principle it are level controls with transformers, recognizable by the AC adapter.
If the receptacle is made of plastic, mounted isolated and not grounded, you can use a level control without galvanic separated supply. From experience this case can be excluded, therefore we do not recommend the use of devices without galvanic separated supply.

Earthing

Because of safety reasons you have to ground connection „C“ of the TCL near the liquid receptacle. The respective rules have to be considered.

Wire

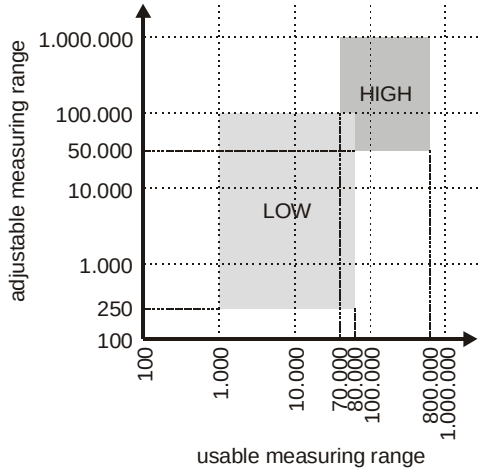
Use a shielded cable for the cabling. The shield itself has to be connected with the level control at connection „C“. Keep the measurement cabling as short as possible, but cabling up to 100m do not represent a problem as long as the wiring prevents stray pick-ups into the measurement cabling. We recommend the positioning of the level control directly next to the receptacle you want to measure.
For additional improvement use drilled and shielded cables. Use “C“ and „S1“ and „C“ and „S2“ as drilled lines. The shield must always be connected with “C”.



Installation

The measurement of liquid levels takes place with very small current and stream, for this reason installation near current leading cables has to be avoided. If this is not possible you have to install additional shields.

Measuring range



The TCL has 2 switchable measuring ranges (sensitivity). First measuring range is between 250 Ohm and 100kOhm (LOW), second is between 50kOhm and 1MOhm (HIGH). Through switch-hysteresis, due to component tolerances and specific peculiarities the measuring ranges are only in a certain range reasonably usable.

Therefore we differ two different measuring ranges. The adjustable measuring range and the usable measuring range.

	adjustable measuring range	usable measuring range
LOW	250Ohm … 100kOhm	1kOhm … 80kOhm
HIGH	50kOhm … 1MOhm	70kOhm … 800kOhm

The overlap of the measuring ranges is desired. It should also ease the adjustment of the level control.

Set sensitivity

Place a special attention to the balance, as the impedance of the medium you want to measure changes because of temperature, solved salts, pH-value, immersion depth of the sensors, sensors itself and the receptacle.

The following calibration instructions allow a save and secure configuration of the level controls. Other adjustments are conceivable and can be carried out by skilled engineers.

If the level control has a time delay (f.i. TCL3), you have to set it to a minimum during calibration. Adjust it to the desired value after the settings.

Level control with one fill factor

Fill

Connect the level control completely and bring the sensor in position. Fill the receptacle in such a way that the sensor is a little immersed (maximum fill factor).
Adjust front switch to: one level, filling, high sensitivity. Rotate potentiometer clockwise to the stop. Relay (R) must not be active. Now turn the potentiometer slowly counter clockwise to the left. If the left stop of the potentiometer is reached, turn it again clockwise until the right stop is reached. Adjust front switch to “low sensitivity” and turn the potentiometer again counter clockwise to the left. If the relay now switches automatically, the impedance of the liquid has fallen below. Now you have to turn back the potentiometer half turn. If you reach the right stop position before, switch back to „high sensitivity“ and execute the half turn to the right there. The level control is now ready.

Level control with one fill factor

Deplete

Connect the level control completely and bring the sensor in position. Fill the receptacle in such a way that the sensor is a little immersed (maximum fill factor).
Adjust front switch to: one level, filling, high sensitivity. Rotate potentiometer clockwise to the stop. Relay (R) must not be active. Now turn the potentiometer slowly counter clockwise to the left. If the left stop of the potentiometer is reached, turn it again clockwise until the right stop is reached. Adjust front switch to “low sensitivity” and turn the potentiometer again counter clockwise to the left. If the relay now switches automatically, the impedance of the liquid has fallen below. Now you have to turn back the potentiometer half turn. If you reach the right stop position before, switch back to „high sensitivity“ and execute the half turn to the right there.

Set front switch to “emptying”. Now the relay should become active. The level control is now ready.

Level control with two fill factors

Fill

Connect the level control completely and bring the sensors in position. Fill the receptacle in such a way that the sensor S2 is a little immersed (maximum fill factor).
Adjust front switch to: two level, filling, high sensitivity. Rotate potentiometer clockwise to the stop. Relay (R) must not be active. Now turn the potentiometer slowly counter clockwise to the left. If the left stop of the potentiometer is reached, turn it again clockwise until the right stop is reached. Adjust front switch to “low sensitivity” and turn the potentiometer again counter clockwise to the left. If the relay now switches automatically, the impedance of the liquid has fallen below. Now you have to turn back the potentiometer half turn. If you reach the right stop position before, switch back to „high sensitivity“ and execute the half turn to the right there. The level control is now ready.

Level control with two fill factors

Deplete

Connect the level control completely and bring the sensors in position. Fill the receptacle in such a way that the sensor S2 is a little immersed (maximum fill factor).
Adjust front switch to: two level, filling, high sensitivity. Rotate potentiometer clockwise to the stop. Relay (R) must not be active. Now turn the potentiometer slowly counter clockwise to the left. If the left stop of the potentiometer is reached, turn it again clockwise until the right stop is reached. Adjust front switch to “low sensitivity” and turn the potentiometer again counter clockwise to the left. If the relay now switches automatically, the impedance of the liquid has fallen below. Now you have to turn back the potentiometer half turn. If you reach the right stop position before, switch back to „high sensitivity“ and execute the half turn to the right there.

Set front switch to “emptying”. Now the relay should become active. The level control is now ready.

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