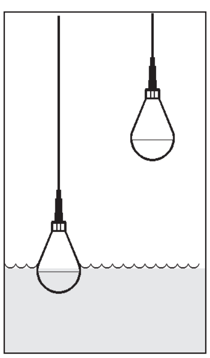
Flygt Monitoring Devices

ENM-10 Liquid Level Sensors

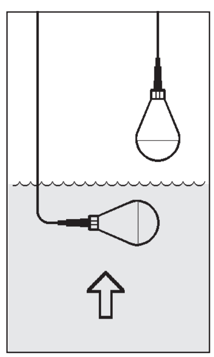
The simplest possible method for level control! A mechanical micro switch in a plastic casing, freely suspended at the desired height from its own cable. When the liquid level reaches the regulator, the casing will tilt and the mechanical switch will close or break the circuit, thereby starting or stopping a pump or actuating an alarm device. No wear, no maintenance! Use in sewage pumping stations, for ground water and drainage pumping - in fact, for most level control applications - the ENM-10 is the ideal solution.

The regulator casing is made of polypropylene and the cable is sheathed with a special PVC compound. The plastic components are welded and screwed together - adhesive is never used. Impurities and deposits will not adhere to the smooth casing.

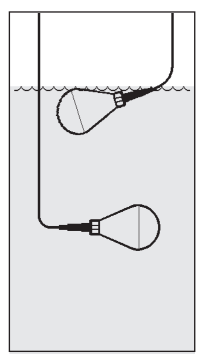
This level regulator is available in different versions, depending upon the medium in which it is to be used. The standard model can be obtained with 20, 43 or 66 feet of cable for liquids with specific gravities between 0.95 and 1.10. For other specific gravities, the regulator is only available with 66 feet of cable. The regulator can withstand temperatures of 32°F to 140°F.



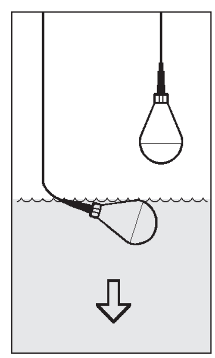
When the level drops, the micro switch is activated....



pumping stops and the level begins to rise....



When it reaches the highest permissible point, the second regulator reacts....



and pumping resumes.

Specific Gravity of Liquid	Cable Length	ENM-10 Part Number
0.65 - 0.80	66'	582 88 27
0.80 - 0.95	66'	582 88 28
0.95 - 1.10	20'	582 88 29
0.95 - 1.10	43'	582 88 30
0.95 - 1.10	66'	582 88 31
1.05 - 1.20	66'	582 88 32
1.20 - 1.30	66'	582 88 33
1.40	66'	582 88 34
1.50	66'	582 88 35

ENM-10 Sensor Specifications	
Min. oper. temp.	32°F (0°C)
Max. oper. temp.	140°F (60°C)
Max. applied voltage	250VAC/30VDC
Elec. cable size	AWG 19/3
Max. amperage -	16A @ 250VAC
Resistive load -	16A @ 250VAC
	5A @ 30VDC
Inductive load -	4A @ 250VAC
Max. angular displacement	60°
Operating point - rising	37°
Operating point - descending	17°

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In **Figure 1**, liquid level is below the lowest level sensor (FLS 1). All sensors are hanging straight in the wet well, therefore, the circuits in the sensor are not complete and no signal is being sent to the control. Both pumps are OFF.

In **Figure 2**, as the liquid level rises, FLS-1 tilts and the sensors mechanical micro-switch completes the circuit sending a signal to energize the control. At this point both pumps are still in the OFF mode.

In **Figure 3**, the liquid level has risen to a level that tilts level sensor #2, completing its circuit.

a) This signal to the control activates the contactor in the control which, in turn, starts the lead pump.

b) Level sensor #2 also at this time activates the alternator in the control which automatically selects the other pump to become the lead pump on the next start-up cycle. The alternation of the pumps as the "lead" pump serves two purposes:

1) The two pumps will accumulate approximately equal amounts of wear thus maximizing their useful life.

2) Allows for many more starts per hour as the starting frequency is divided between the two pumps.

If the capacity of the lead pump is **greater than** the inflow to the station, the liquid level will start to drop. The pump will continue to run (due to a holding circuit in the control) until the level drops below sensor #1. Sensor #1, on drawdown, acts as the low level shut-off. Pump OFF.

Figure 4 shows the sequence when the capacity of the lead pump is **less than** the inflow to the station. In this case, the liquid level will gain on the pump and rise to sensor #3 which will then send a signal to the main control starting the second or lag pump. If their combined capacity is **greater than** the inflow, **both pumps** will continue to operate (due to the holding circuit in the control) until the liquid level drops below the low level shut off sensor #1.

Figure 5 indicates a condition where the inflow to the station is **greater than** the combined capacity of both pumps. The liquid level will rise to the high level sensor #4. When sensor #4 tilts, it will send a signal to an alarm system, normally an alarm bell or red alarm light. There are other options for alarm conditions such as alert by telephone, etc. The alarm system issues a warning that something has happened in the station that could result in an overflow condition. This could be a control problem, one or both pumps not operating, pumps not operating up to capacity, etc. Regardless of the cause, an alarm calls for immediate action.

For most installations, the low level shut-off sensor should be located approximately at the top of the pump volute. However, there are certain situations where maximum cooling may be required such as when pumping warm liquids; in certain cases with pumps that do not have cooling jackets; some large horsepower units, etc. Also in situations where the NPSH requires a liquid level that is above the pump volute. When in doubt, contact Flygt Application Engineering.

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Flygt Monitoring Devices
ENM-10 Liquid Level Sensors

Fig. 1

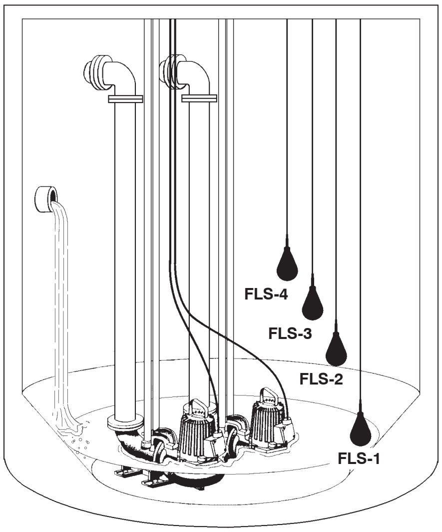


Fig. 2

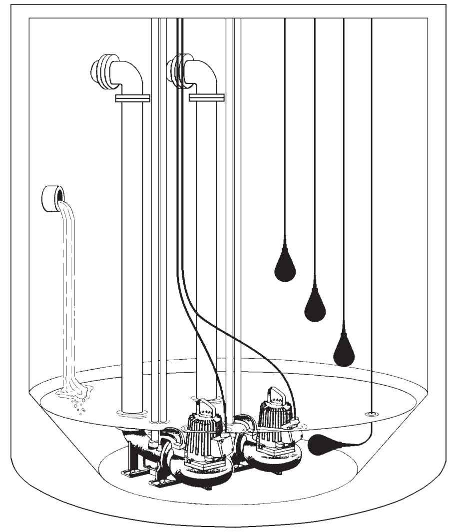


Fig. 3

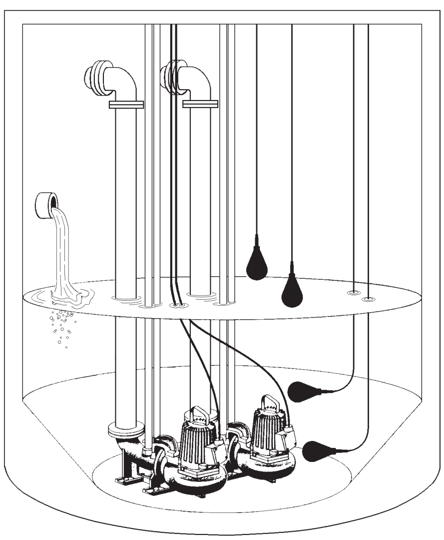


Fig. 4

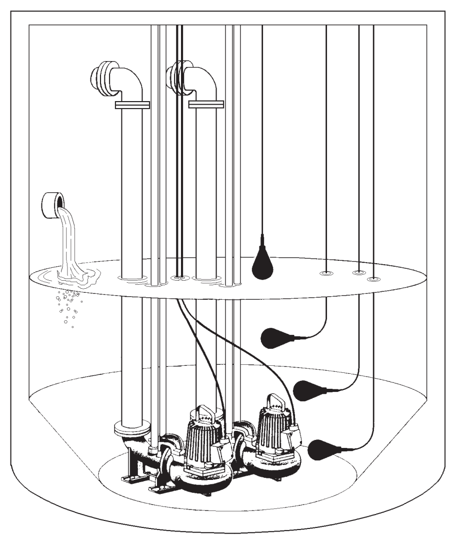
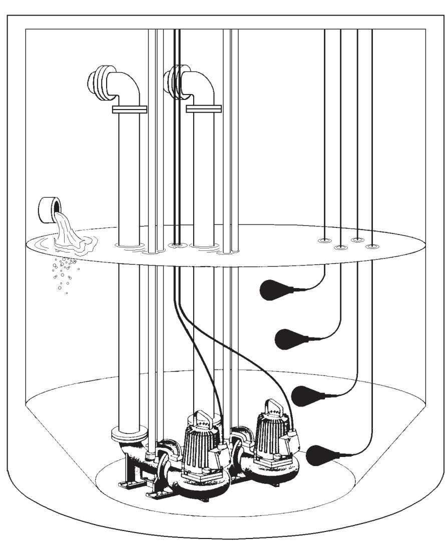


Fig. 5



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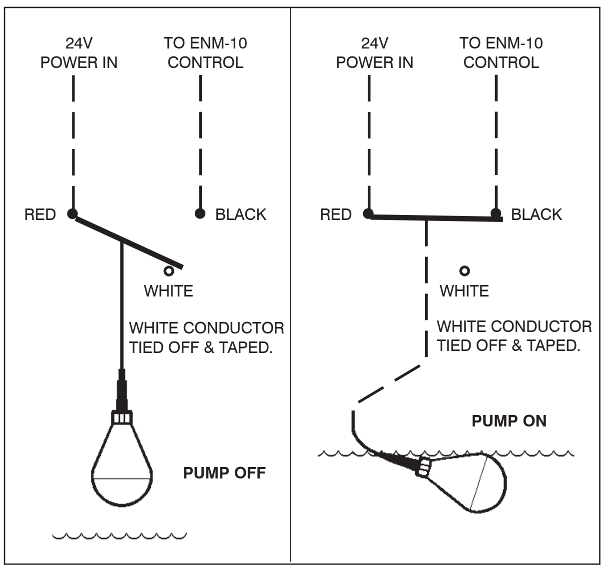
Flygt Monitoring Devices

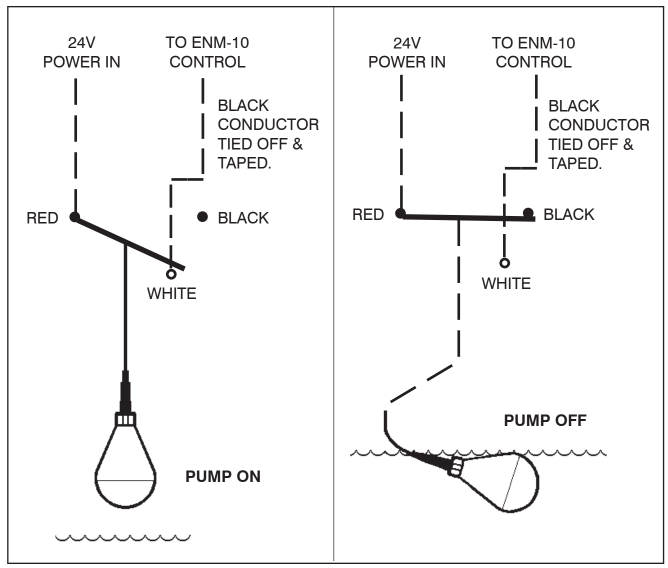
ENM-10 Liquid Level Sensors

The Flygt ENM-10 Liquid Level Sensor can be utilized to monitor a "Pump Down" operation (as in a lift station application) or a "Pump UP" (filling) operation as may be required in certain industrial applications. The ENM-10 sensor cable contains three wires; Red, Black and White. The Red wire is common to both sequences. Using the Red and Black wires as the liquid level pilot circuit, the ENM-10 will operate in the "Pump Down" mode, activating the pumps at a selected high liquid level and shut off at a selected low liquid level. Using the Red and White wires as the pilot circuit will activate the pumps in a "Pump UP" mode controlling the filling of a sump, tank etc. In this case the pumps are activated at a selected low level and shut off at a selected high level.

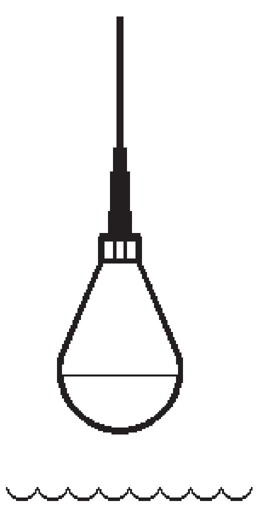
ENM-10 Level Sensor
Connected for Pump-Down



ENM-10 Level Sensor
Connected for Filling

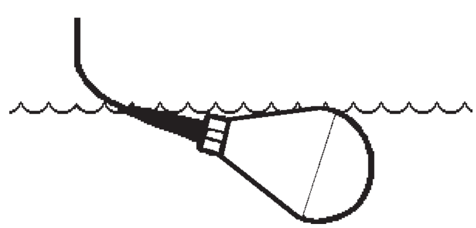


POSITION 1



The Flygt ENM-10 Liquid Level Sensor is **not** a "floating" device.

The On/Off pump operating sequence is performed by its submerged **tilting** action.



POSITION 2

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Flygt Monitoring Devices

ENM-10 Liquid Level Sensors

The liquid in which level regulation is practiced most frequently is water. Of the millions of regulators in use all over the world today, it is estimated that nine out of ten work in water.

The ENM-10 is virtually insensitive to many aggressive liquids with its body of polypropylene, a cord of PVC or NBR/PVC nitrile/PVC rubber and a protective sleeve of EPDM rubber.

The table shows how resistant the material is to different chemicals at two different temperatures. The classification is broken down into three categories: 0 = No affect, 1 = Minor to Moderate Resistance and 2 = Non-Resistant. The density of a liquid determines the bouyancy of the regulator. The ENM-10 is made for seven different densities.

Chemical Resistance List

Acids	PVC cable 20°C (68°F)	PVC cable 60°C (140°F)	NBR/PVC nitrile/PVC rubber cable 20°C (68°F)	NBR/PVC nitrile/PVC rubber cable 60°C (140°F)
Acetic Acid 50%	1	2	0	0
Acetic Acid 75%	2	2	0	0
Benzoic Acid	2	2	0	0
Boric Acid 5%	0	—	0	0
Butyric Acid	2	2	2	2
Chromic Acid 10%	0	2	2	2
Citric Acid	0	1	0	0
Hydrobromic Acid 5%	1	2	0	0
Hydrochloric Acid 10%	0	1	0	1
Hydrochloric Acid 37%	1	2	0	2
Hydrocyanic Acid 10%	0	0	1	2
Hydrofluoric Acid 5%	0	2	0	1
Hypochloric Acid	1	2	2	2
Maleic Acid	2	2	2	2
Nitric Acid 5%	1	1	1	1
Nitric Acid 65%	2	2	2	2
Oleic Acid	1	2	2	2
Oxalic Acid 50%	1	1	1	2
Phosphoric Acid 25%	0	0	1	2
Phosphoric Acid 85%	0	0	1	2
Sulphuric Acid 10%	1	2	1	2
Sulphuric Acid 78%	2	2	2	2
Tannic Acid	0	0	0	0
Tartaric Acid	1	1	1	1

Bases	PVC cable 20°C (68°F)	PVC cable 60°C (140°F)	NBR/PVC 20°C (68°F)	NBR/PVC 60°C (140°F)
Ammonium Hydroxide	0	—	0	0
Calcium Hydroxide	0	0	0	0
Potassium Hydroxide	1	2	0	0
Sodium Hydroxide	1	2	0	0

Salts	PVC cable 20°C (68°F)	PVC cable 60°C (140°F)	NBR/PVC nitrile/PVC rubber cable 20°C (68°F)	NBR/PVC nitrile/PVC rubber cable 60°C (140°F)
Aluminium Chloride	0	0	0	0
Calcium Sulphate	0	0	0	0
Calcium Chloride	0	0	0	0
Calcium Nitrate	0	0	0	0
Copper Chloride	0	0	0	0
Copper Sulphate	0	0	0	0
Ferric Chloride	0	0	0	0
Ferrous Sulphate	0	0	0	0
Magnesium Chloride	0	0	0	0
Potassium Sulphate	0	0	0	0
Potassium Nitrate	0	0	0	0
Potassium Carbonate	1	1	1	1
Potassium Bicarbonate	0	0	0	0
Sodium Sulphate	0	0	0	0
Sodium Chloride	0	0	0	0
Sodium Nitrate	0	0	0	0
Sodium Bicarbonate	0	0	0	0
Sodium Carbonate	0	0	0	0
Tin Chloride	1	1	1	1
Zinc Sulphate	0	0	0	0
Zinc Chloride	0	0	0	0

Oils	PVC cable 20°C (68°F)	PVC cable 60°C (140°F)	NBR/PVC 20°C (68°F)	NBR/PVC 60°C (140°F)
Castor Oil	1	1	1	1
Cocoanut Oil	0	—	0	2
Corn Oil	2	2	2	2
Diesel Oil	2	2	2	2
Linseed Oil	2	2	2	2
Mineral Oils	2	2	2	2
Olive Oil	1	1	1	1
Silicone Oils	0	0	0	0

Solvents and miscellaneous	PVC cable 20°C (68°F)	PVC cable 60°C (140°F)	NBR/PVC nitrile/PVC rubber cable 20°C (68°F)	NBR/PVC nitrile/PVC rubber cable 60°C (140°F)
Aceton	2	2	2	2
Aniline	2	2	1	2
Benzene	2	2	2	2
Butyl Alcohol	2	2	0	1
Carbon Tetrachloride	2	2	2	2
Chlorobenzene	2	2	2	2
Chloroform	2	2	2	2
Ethyl Alcohol	2	2	0	1
Ethyl Ether	2	2	2	2
Ethyl Acetate	2	2	2	2
Ethylene Dichloride	2	2	2	2
Ethylene Chloride	2	2	2	2
Formaldehyde 37%	1	2	0	0
Gasoline	2	2	2	2
Kerosene	2	2	2	2
Methyl Alcohol	2	2	0	0
Methyl Ethyl Ketone	2	2	2	2
Methylene Chloride	2	2	2	2
Nitrobenzene	2	2	2	2
Phenol	2	2	2	2
Toluene	2	2	2	2
Trichlorethylene	2	2	2	2
Turpentine	2	2	2	2
Xylene	2	2	2	2

Gases	PVC cable 20°C (68°F)	PVC cable 60°C (140°F)	NBR/PVC 20°C (68°F)	NBR/PVC 60°C (140°F)
Carbon Dioxide	0	0	0	0
Carbon Monoxide	0	0	0	0
Chlorine (wet)	2	2	2	2
Hydrogen Sulphide	0	0	1	1
Sulphur Dioxide (wet)	1	1	2	2

0 = No affect, 1 = Minor to moderate, 2 = Severe affect. — = No information available.