



## Control and Remote Supervision of Sewage Pump Station

### AutoLog GSM-RTU and AutoLog ControlMan Web-SCADA Service

#### Specification V1.0

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# 1 GSM-PLC control for pump station

Specification of the pump control station functions.

## 1.1 General information of GSM controller

GSM-PLC program is designed for two pumps. The amount of pumps can be incremented e.g. to four, if needed.

Code	Designation	Analog Inputs	Digital Inputs	Digital Outputs	Relay Outputs	Analog Outputs	I/O Expansion	SER PORTS	SER PLUG IN**	Other
900480	AL GSM-16	8	4	-	4	-	N	1	Y	Integrated GSM modem



Pump controller is based on [AutoLog GSM-16 PLC](#), which has the above I/O quantity.

GSM-16 PLC will be inside the IP65 enclosure. Enclosure has integrated HMI for viewing pump station status and for setting parameters. The commissioning parameter settings can be done from the HMI.

The final look may differ from the picture.

## **1.2 General Functions**

- Controlling two sewage pumps
- Surface level measurement using analog level sensor
- Pump flow rates (l/s) calculated from the pump condition test
- Pump condition (%) calculated from the pump condition test
- Pumps are used in turns to balance wearing
- Starts both pumps if 2<sup>nd</sup> pump limit is exceeded
- Surface level low, high and overflow level alarm limits
- Informs overflow time and estimates overflow (m3)
- Communicates using GSM/SMS or GPRS/FTP
- Stores history information and sends data using GPRS/SMS
- Configurable maximum continuous runtime before pump turnover
- Pump start and stop delays (2s)
- Cumulative counters (m3/day, runtimes, start counts)
- Daily minimum and maximum input flow
- Maintenance visit info (work time, work number) is send to ControlMan
- Maintenance accident alarm is send to ControlMan
- Configurable alarm delay
- Commissioning and maintenance can be done using local HMI
- Remote monitoring and configuration can be done with ControlMan
- GSM phone can be used to send or receive parameters
- Controller can be programmed remotely using GSM network.
- Incoming phone number identification
- 6 Pump indication lights on HMI

## **1.3 Optional Functions:**

- During overflow, the previous pump can be commanded to turn off using GSM. After overflow the previous pump can be commanded to continue normally.
- Controller can get pulse input from energy meter or via modbus serial port.
- Controller can communicate also using Modbus serial channel e.g. with radio modem or RS232/RS485 or Ethernet
- Main power alarm can be send if the controller is equipped with UPS battery
- More accurate sewage flow can be made if pulse flow meter is available.
- Overflow information can use also over flow switch, instead of analog surface level sensor.

## **1.4 Functions:**

### **1.4.1 Surface level monitoring:**

- The sewage surface is constantly monitored by a pressure sensor (configurable for 0-1, 0-2, 0-5 or 0-10 m sensors, 4-20mA input)
- When the sensor input drops under 4mA, an alarm is set to indicate device fault.

### **1.4.2 Twin pump controlling:**

- When the level rises above a set (pump1\_start) limit, first pump is started for emptying the sewage well. If the level continues to rise and exceeds a second limit (pump2\_start), another pump is started. When the level goes under the set (pumps\_off) limit, the pumps are turned off.
- The pump control limits have a short balancing delay (2 seconds) to avoid errors from e.g. surface waving.
- Pumps are used in turns to balance wearing.

### **1.4.3 Alarms (SMS messages and/or GPRS/FTP to ControlMan):**

An error is set, if at least one of the following conditions is met:

- the level lowers below or rises above the set alarm limits,
- the pumps' daily running times / pump starting times are exceeded,
- the pump condition degrades under a set percentage,
- the temperature relay has been off for ten seconds,
- the electricity goes off. (needs backup battery)

### **1.4.4 Overflow:**

- If the level rises above overflow limit or an external overflow switch turns on, it's assumed that the liquid is flowing out at a constant rate (measured during last minute.) After the level descends under the limit, the condition is stopped.
- Overflow (time and amount) is measured and reported daily.
- When the condition starts, the upper station (if any) is called to stop pumping. Correspondingly, if the station gets a call from a lower pump (phone numbers configurable), the pumping is stopped until a starting signal is called. This is optional feature and needs to be decided with the customer.

### **1.4.5 Pump condition / power measuring:**

- The first pump power & condition test is done automatically during the first day. The result will be used as reference for 100% pump condition and (l/s) pump power.
- Pumps are tested daily and condition is represented as percentage (%) of the pump reference condition. If the test gives better performance than in the first day's test, it will be used as new reference for 100% condition.
- Estimated pumped m3 are calculated by runtimes and pump conditions.

### **1.4.6 Measurement uploading:**

The collected information is uploaded daily to ControlMan for inspection and trend charts (see more information in chapter 2)

### 1.4.7 Configuration:

- All the configurable variables (area, height, sensor type, alarm limits etc. can be tuned via Controlman Web interface or controller's local HMI panel.
- The HMI panel shows also current information per day (runtimes, powers, condions, litres, current surface level etc.)
- The configurations and current report can be asked also via SMS.
- Current daily status can be resetted via ControlMan or the HMI panel.

### 1.4.8 Indication lights on the HMI

There are 6 indication lights on the HMI.

1. Pump 1 status (ON/OFF)
2. Pump 2 status (ON/OFF)
3. Condition test activated (waits until the well is at least haft full)
4. Condition test is running (pump is started)
5. Overflow

### 1.4.9 Pump Maintenance visit

When serviceman goes to pumping station, he/she can set the maintenance work number and estimated maximum work time using the HMI. When maintenance work is activated the message is send to ControlMan.

When the work is finished serviceman needs to acknowledge this from the HMI. If the estimated maximum work time is exceeded, an alarm message is send to ControlMan indicating possible accident.

## 1.5 *Optional features*

- kWh energy measurement, if pump station has kWh meter (with pulse output)
- Actual pump running information from a relay, if suitable relay exists
- More accurate water amount calculation can be made if a water flow pulse meter exists.
- Temperature relay alarm

### 1.5.1 I/O:

AI0	Level sensor input (4..20mA)
DO0	Pump 1 control signal (controls pump contactor)
DO1	Pump 2 control signal (controls pump contactor)
RO0	Free relay output
RO1	Free relay output

- DI0 Optional overflow switch
- DI1 Temperature relay
- DI2 kWh meter with pulse output
- DI3 Optional water flow pulse meter

The above configuration is just giving options. There can be for example 2 temperature relays etc.

## 2 ControlMan web monitoring service for pump stations

### 2.1 Pump station process image (ControlMan Web view)

	Pump 1	Pump 2	Alarm limit
Runs	76	76	80
Runtime (min)	205	169	150
Power	19 l/s	21 l/s	
Condition	56 %	62 %	0
Litres	24.3 m3	22.1 m3	

Overflow limit	240
High alarm	230
Low alarm	8
2 pump limit	140
1 pump limit	125
Off limit	25

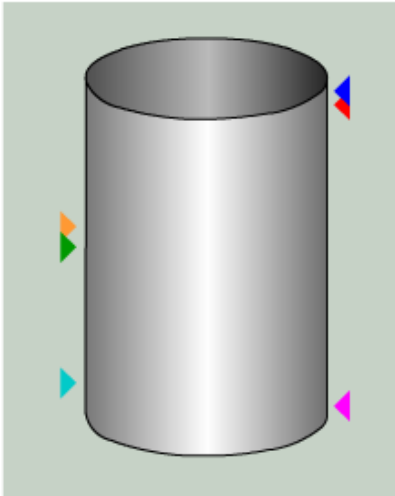
Overflow time	215 s	Min fillspeed	0 l/s
Overflow litres	0.32 m	Max fillspeed	47 l/s

Alarm delay (s)	20	Area (dm2)	175
Cond. test (hhmm)	1400	Height (cm)	250
Sensor type	500 cm	Volume	4.38 m3

Ask settings

Send settings



Status at: 11/01/10 14:41:31

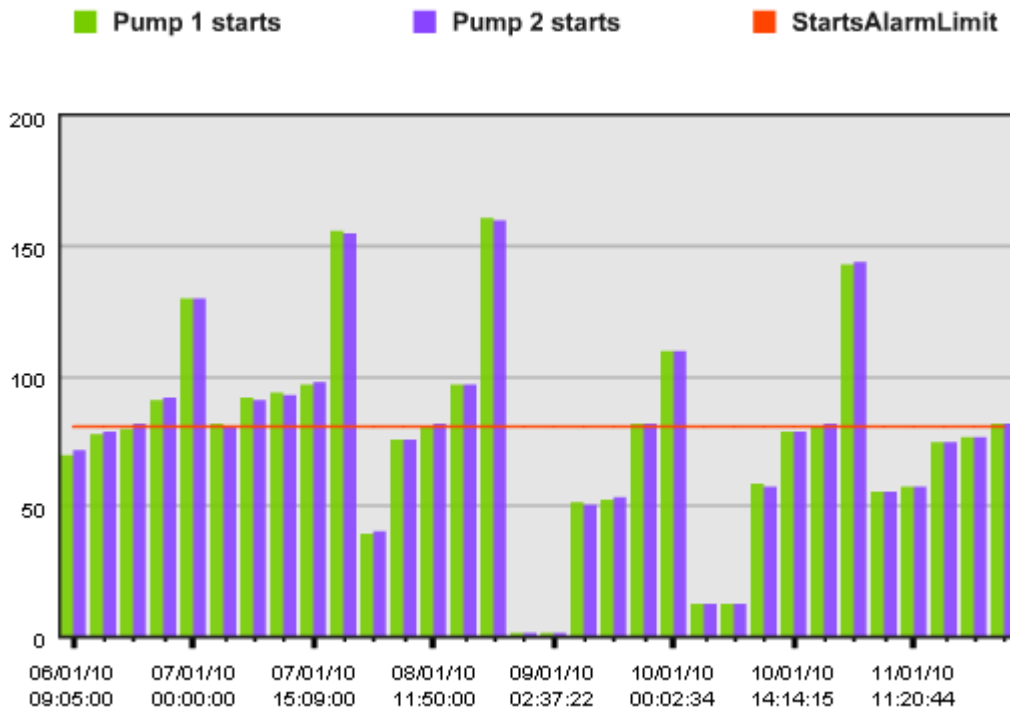
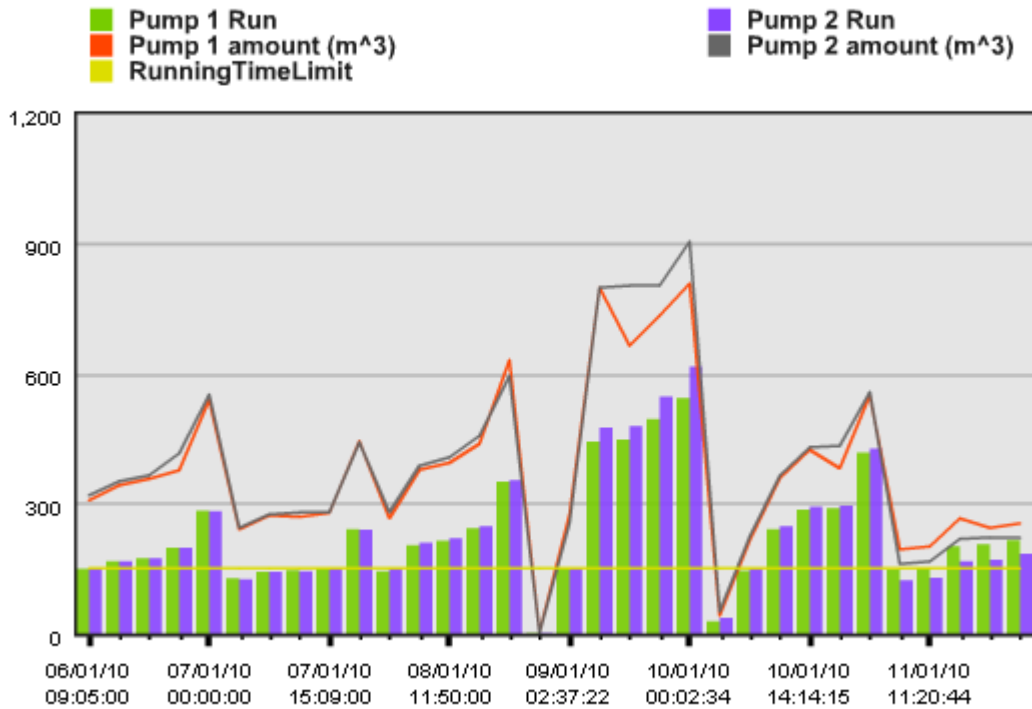
The above picture is captured from the ControlMan Web Browser view.

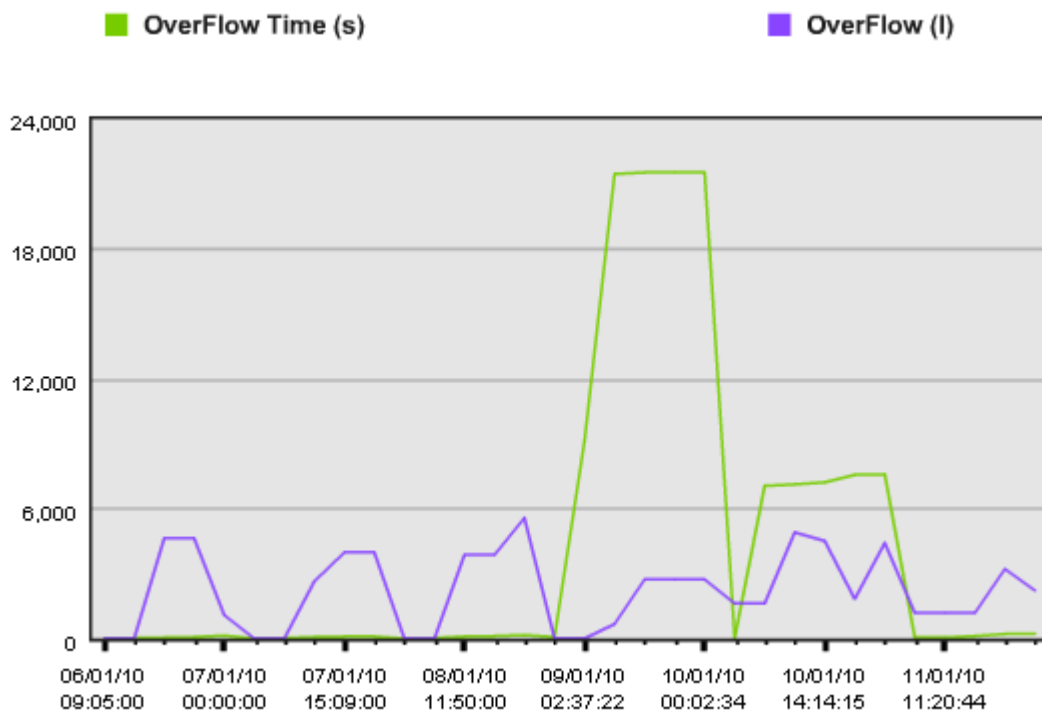
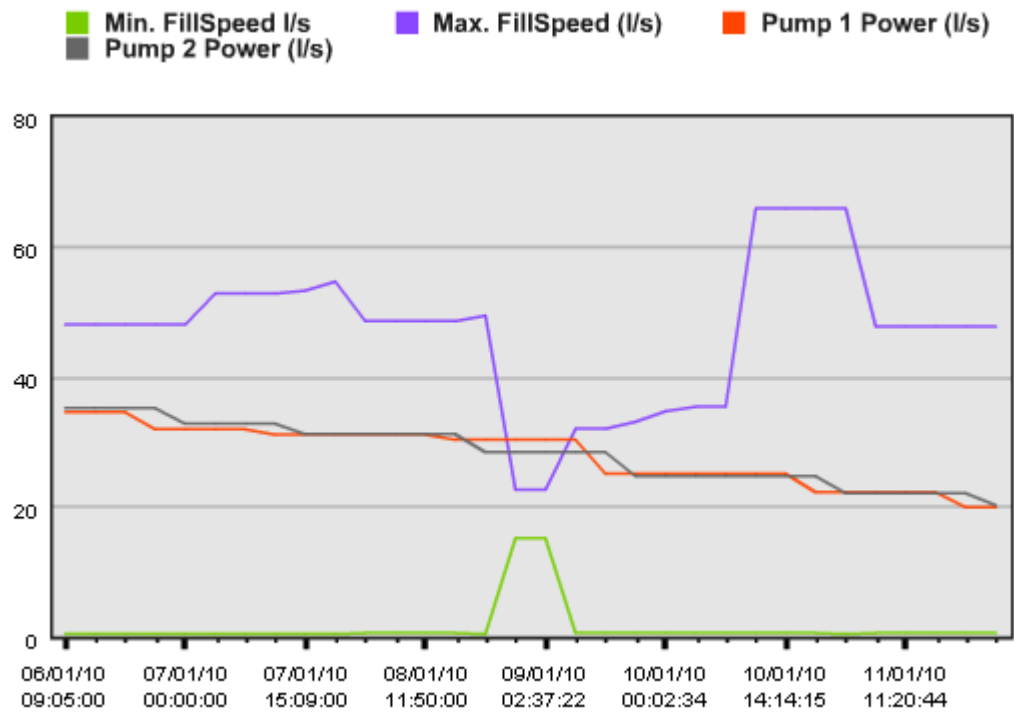
**Alarm delay** = seconds (generates alarm if the alarm limit has been exceeded and alarm delay has passed)

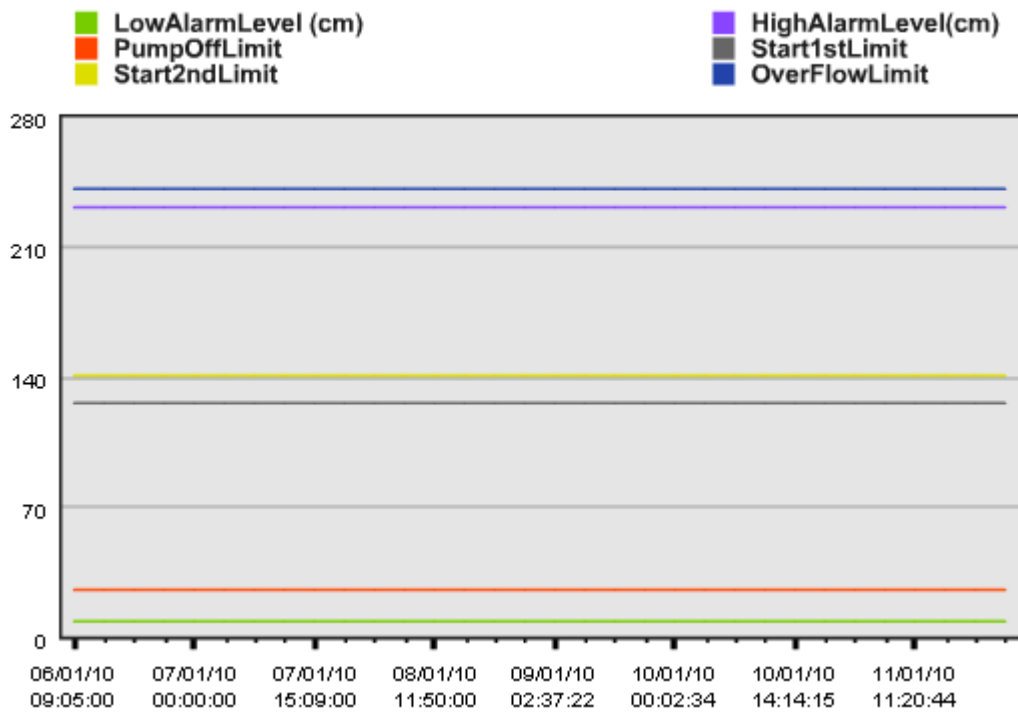
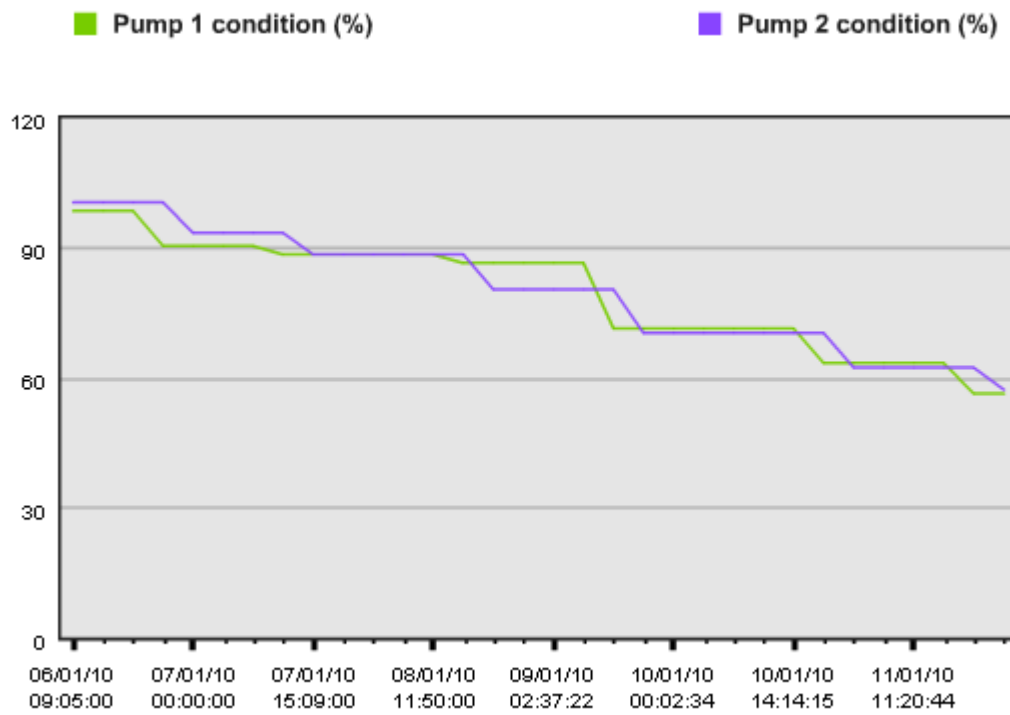
**Cond. Test (hhmm)** = Start time when the pump power/condition calculation is done. Normally its done during the night time. Both pumps are tested if there's enough sewage.

## 2.2 Pump station measurement trends (ControlMan Web view)

(simulated test data, not actual data from the pump station)







Date/Time	Pump 1 Run	Pump 2 Run	Pump 1 starts	Pump 2 starts	Min. FillSpeed l/s	Max. FillSpeed (l/s)	Pump 1 Power (l/s)	Pump 2 Power (l/s)	Pump 1 condition (%)	Pump 2 condition (%)
11/01/10 15:20:06	214	183	81	81	0.5	47.5	19.78	20.12	56	57
11/01/10 14:41:31	205	169	76	76	0.5	47.5	19.78	21.92	56	62
11/01/10 14:22:29	200	166	74	74	0.5	47.5	22.09	21.92	63	62

OverFlow Time (s)	OverFlow (l)	Pump 1 amount (m^3)	Pump 2 amount (m^3)	LowAlarmLevel (cm)	HighAlarmLevel(cm)	StartsAlarmLimit	RunningTimeLimit	AlarmDelay (s)	PumpOffLimit
238	2218.4	253	220	8	230	80	150	20	25
215	3192	243	221	8	230	80	150	20	25
121	1177.2	265	217	8	230	80	150	20	25

Start1stLimit	Start2ndLimit	OverFlowLimit	WellArea (dm^2)	Well Height (cm)	SensorType (meters)	Tuoton laskenta-aika (h:mm)	Condition Alarm Level (%)
125	140	240	175	250	5	1400	50
125	140	240	175	250	5	1400	50
125	140	240	175	250	5	1400	50

Please specify if you want any changes to these specification!

**Contact us for more information !**

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