

MEKATORA CONTROL SYSTEMS

MKT-STC-500a

Reservoir series

Clean Water Storage Tank

Device tag **T-601**

500 m extsuperscript3 atmospheric clean-water buffer.

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Precision Through Automation

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1 Overview

The **MKT-STC-500a** (Reservoir series) is a 500 m³ atmospheric clean-water storage tank that hydraulically decouples the upstream treatment train from continuous distribution demand. It serves as the regulatory measurement point for finished-water quality (pH, free chlorine, temperature) and as the operational buffer that lets the treatment chain pause for backwashes and maintenance without interrupting consumer supply.

The tank is concrete-lined with a 6.0 m water-column height. Inflow comes by gravity from the disinfection skid; outflow is pulled by the distribution pump. Two operator-configurable level alarms protect against overflow above and cavitation below.

2 Process specifications

Parameter	Value
Active volume	500 m ³ at 100 % level
Maximum water column	6.0 m at 100 % level
LEVEL_M resolution	0.01 m (centimetre precision)
Cavitation protection	outflow gated below 15 % level
Cavitation cut-off	full block below 5 % level
Overflow	emergency weir to floor drain at 100 %
Bund capacity	25 m ³ before the bund is overtopped
pH steady-state target	7.2 (60 s first-order lag)
Temperature steady-state target	18 °C (600 s first-order lag)
Free chlorine residual	lags 0.9 x effective dose, 120 s tau

Chlorine residual is computed as

$$\text{FREE_CL} \rightarrow 0.9 \cdot \text{ClDoseSP} \quad (\tau = 120 \text{ s})$$

when D-501's chlorine pump is running; with the pump OFF, residual decays toward zero with the same time constant.

When the upstream chain outpaces demand, the tank fills; once at 100 % the excess goes to the emergency weir and the level pegs at 100. There is no upstream throttle — D-501 keeps pushing whatever F-401 hands it.

The spilled volume is cumulative and does not reset when the level falls back: water on the bund floor does not drain itself. Past 2 m³ the console reports water on the floor, and past 25 m³ the bund is overtopped and the spill reaches the switchroom. The console shows the running total and draws a puddle under the tank. Only a plant reset clears it.

When level falls below 15 %, the cavitation-protection model gates outflow linearly toward zero at 5 %. Below 5 % the distribution pump gets no supply and accumulates impeller damage.

3 Network configuration

Item	Value
IP address	172.28.0.73
Subnet	172.28.0.0/24
TCP port	502 (Modbus TCP)
Unit identifier	echoed in the response; not validated
Byte order	big-endian (Modbus standard)

4 Register map

Modbus uses 1-based “register numbers” in narrative; the on-the-wire PDU address is **register_number** - 1. Both columns are shown. All scaled fields are signed 16-bit integers; engineering value = wire / scale.

The tank exposes no coils or discrete inputs — it has no on/off controls.

4.1 Holding registers (FC 03 read · FC 06 / 10 write · FC 16 mask · FC 17 read+write)

Reg	Addr	Name	Scale	Range	Unit	R/W	Description
1	0x000	LO_LVL_SP	x10	0..1000	0..100 %	RW	Low-level alarm threshold.
2	0x001	HI_LVL_SP	x10	0..1000	0..100 %	RW	High-level alarm threshold.

Both are pure thresholds: writing them does not throttle inflow or outflow. They drive operator alarms only.

4.2 Input registers (FC 04 read only)

Reg	Addr	Name	Scale	Type	Unit	Description
1	0x000	LEVEL	x10	int16	%	Tank fill level.
2	0x001	LEVEL_M	x100	int16	m	Tank water column (= LEVEL/100 x 6.0).
3	0x002	FLOW_IN	x10	int16	m ³ /h	Inflow from D-501.
4	0x003	FLOW_OUT	x10	int16	m ³ /h	Outflow to P-701 (gated by level).
5	0x004	PH	x100	int16	pH	Stored-water pH.
6	0x005	FREE_CL	x100	int16	ppm	Free-chlorine residual (regulatory point).
7	0x006	TEMP	x10	int16	°C	Stored-water temperature.

5 Supported function codes

FC	Name	Notes
0x01	Read Coils	(none defined; returns illegal address)
0x02	Read Discrete Inputs	(none defined; returns illegal address)
0x03	Read Holding Registers	
0x04	Read Input Registers	
0x05	Write Single Coil	(no targets; returns illegal address)
0x06	Write Single Register	
0x0F	Write Multiple Coils	(no targets; returns illegal address)
0x10	Write Multiple Registers	
0x16	Mask Write Register	
0x17	Read/Write Multiple Registers	
0x2B/0x0E	Read Device Identification	conformity 0x82

Serial-line / file-record / FIFO function codes return exception **0x01 (illegal function)**.

5.1 Exception codes

Code	Meaning	When the device returns it
0x01	Illegal function	FC not in the table above.
0x02	Illegal data address	Register/coil out of range, or <code>start + count > 0x10000</code> .
0x03	Illegal data value	Quantity out of range.
0x04	Server device failure	Internal binding error.

6 Device identification (FC 0x2B / MEI 0x0E)

Conformity level **0x82** (regular).

Object ID	Name	Value
0x00	VendorName	Mekatora Control Systems
0x01	ProductCode	MKT-STC-500a
0x02	MajorMinorRevision	firmware version (set at build time)
0x03	VendorUrl	https://mekatora.com
0x04	ProductName	Clean Water Storage Tank
0x05	ModelName	Reservoir series
0x06	UserApplicationName	T-601 (device tag)

7 Operating notes

The tank is the regulatory measurement point: **FREE_CL** here is what your audit shows as finished-water residual chlorine. It must show a non-zero residual at all times during distribution.

Set the alarm thresholds wide on commissioning, then tighten as the plant's diurnal demand pattern emerges. Typical settings:

Setpoint	Sane range	Notes
LO_LVL_SP	20–30 %	Several minutes of buffer at peak draw.
HI_LVL_SP	85–90 %	Lets you anticipate overflow.

Both alarms log on rising edge into the plant alarm history. They do not throttle flow.

Interlocks and hazards. Setting both alarms to 0 / 100 disables the only line of defence between operator inattention and either tank overflow or distribution-side cavitation. The overflow weir activates above 95 % whether or not the alarm fires, so a too-high HI_LVL_SP loses early warning. A too-low LO_LVL_SP (below 10 %) gives no practical lead time before P-701 begins to cavitate at 5 %.

The quickest way to flood the bund is to stop P-701 while the treatment train keeps running. With no outlet, the tank reaches 100 % in about two hours at design flow and then spills at the full production rate, so the 25 m³ bund capacity is gone within another quarter of an hour.

Finished-water chlorine is alarmed in both directions here: below 0.2 ppm the residual is too low to suppress regrowth in storage, above 3 ppm it causes taste and odour complaints, and above 5 ppm it exceeds the WHO single-event guideline and the water is not fit for distribution.

8 Appendix A — Example transactions

8.1 A.1 — Read all seven input registers (FC 04)

Request:

```
0001 0000 0006 01 04 0000 0007
```

Reply (14 bytes payload):

```
0001 0000 0011 01 04 0E 0258 0168 04E2 04E2 02D0 0050 00B4
      \ / \_ / \_ / \_ / \_ / \_ / \_ /
      FC bc LVL  LVLm FLOW FLOW PH  FCL  TEMP
           60.0% 3.60m 125  125  7.20 0.80 18.0
```

8.2 A.2 — Set both alarm thresholds atomically with FC 0x10

Write 2 registers from address 0x0000. Wire values for 25 % low and 85 % high are 250 = 0x00FA and 850 = 0x0352:

```
0002 0000 000B 01 10 0000 0002 04 00FA 0352
      \ / \_ / \_ / \ / \_ / \_ /
      FC reg qty  bc LO  HI
```

8.3 A.3 — Read identification (FC 0x2B / MEI 0x0E)

```
0003 0000 0005 01 2B 0E 01 00
```

9 Appendix B — Address convention quick reference

The Modbus PDU carries **register_number** - 1. Tools asking for “Modbus register address” usually want the **0-based PDU value**; tools asking for “register number” want the **1-based** value.