

MEKATORA CONTROL SYSTEMS

MKT-CFT-100s

Stratus series

Coagulation / Flocculation Tank

Device tag **T-201**

Coagulation / flocculation tank with integrated chemical dosing.

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Precision Through Automation

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1 Overview

The **MKT-CFT-100s** (Stratus series) is a 100 m³ open-top concrete coagulation/flocculation tank fitted with a low-shear paddle mixer and an integrated peristaltic dosing pump for liquid coagulant — typically aluminium sulfate or polyaluminium chloride (PACl). Tapered internal baffles promote orthokinetic floc growth.

The unit sits between the raw-water intake pump and the sedimentation basin. Inflow is gravity-fed from upstream; outflow drains by hydraulic head into the basin. All control and instrumentation are exposed over Modbus TCP.

2 Process specifications

Parameter	Value
Active volume	100 m ³ at 100 % level
Hydraulic retention time	5–15 min at design flow
Maximum gravity drain	220 m ³ /h at 100 % level
Mixer speed	0–200 RPM (low-shear paddle)
Coagulant dosing pump range	0–100 L/h (peristaltic)
Day-tank capacity	~500 L (depletion expressed as %)
pH target window	6.5–7.5 (clamped by simulation)
pH first-order time-constant	30 s
Overflow	emergency weir to floor drain at 100 %

The pH dynamics follow:

$$\text{pH}_{\text{target}} \approx 7.5 - 1.0 \cdot \text{clamp}\left(\frac{\text{DOSE}}{0.5 \cdot Q_{\text{in}}}, 0, 1\right)$$

where DOSE is in L/h and Q_{in} is in m³/h. Dosing-tank depletion runs roughly at DOSE/500 percent per hour while the mixer is running.

3 Network configuration

Item	Value
IP address	172.28.0.118
Subnet	172.28.0.0/24
TCP port	502 (Modbus TCP)
Unit identifier	echoed in the response; not validated (point-to-point)
Byte order	big-endian (Modbus standard)

The device speaks **Modbus TCP only**. Serial-line concepts (CRC-16, RTU framing, broadcast addressing) do not apply.

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.

4.1 Coils (FC 01 read · FC 05 / 0F write)

Reg	Addr	Name	R/W	Description
1	0x000	MIXER_RUN	RW	Master enable for the paddle mixer drive.
2	0x001	AUTO_REFILL	RW	Day-tank top-up from bulk on low level (25 % -> 95 %).
3	0x002	AUTO_DOSE	RW	Flow-paced dosing. In AUTO the controller owns DOSE_RATE_SP.

4.2 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	MIXER_RPM_SPx1		0..200	RPM	RW	Mixer rotational-speed setpoint.
2	0x001	DOSE_RATE_SPx10		0..1000	0..100 L/h	RW	Coagulant dosing pump setpoint.

Writes to both setpoints are clamped to the listed engineering range.

4.3 Input registers (FC 04 read only)

Reg	Addr	Name	Scale	Type	Unit	Description
1	0x000	LEVEL	x10	int16	%	Tank fill level.
2	0x001	DOSE_TANK_LVLx10		int16	%	Coagulant day-tank fill (~500 L total).
3	0x002	FLOW_IN	x10	int16	m ³ /h	Inflow from P-101.
4	0x003	FLOW_OUT	x10	int16	m ³ /h	Gravity outflow to B-301.
5	0x004	PH	x100	int16	pH	Tank-water pH.

5 Supported function codes

FC	Name	Notes
0x01	Read Coils	
0x02	Read Discrete Inputs	(none defined; returns illegal address)
0x03	Read Holding Registers	

FC	Name	Notes
0x04	Read Input Registers	
0x05	Write Single Coil	
0x06	Write Single Register	
0x0F	Write Multiple Coils	
0x10	Write Multiple Registers	
0x16	Mask Write Register	
0x17	Read/Write Multiple Registers	
0x2B/0x0E	Read Device Identification	conformity 0x82 (basic + regular)

Function codes 0x07, 0x08, 0x0B, 0x0C, 0x11, 0x14, 0x15, 0x18 return exception **0x01 (illegal function)** — they are serial-line, file-record or FIFO-queue specific and not implemented.

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 start + count > 0x10000 .
0x03	Illegal data value	Quantity out of range, or coil value not 0x0000 / 0xFF00.
0x04	Server device failure	Internal binding error (should not occur in normal operation).

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

Conformity level **0x82** (regular, both stream and individual access).

Object ID	Name	Value
0x00	VendorName	Mekatora Control Systems
0x01	ProductCode	MKT-CFT-100s
0x02	MajorMinorRevision	firmware version (set at build time)
0x03	VendorUrl	https://mekatora.com
0x04	ProductName	Coagulation / Flocculation Tank
0x05	ModelName	Stratus series
0x06	UserApplicationName	T-201 (device tag)

7 Operating notes

Start the mixer first, then begin dosing, then accept inflow. Typical mixer speed in steady-state is 40–80 RPM (the floc-growth window); 120 RPM for the first minute after a dose change helps disperse the coagulant. Above 150 RPM the paddles begin to shear formed floc and the downstream basin's outlet turbidity rises sharply.

With **AUTO_DOSE** on, the dosing pump is paced to measured flow at the design ratio of about 0.17 L per m³ and the controller owns **DOSE_RATE_SP**. Leaving it on matters once the intake modulates: a fixed L/h rate against a varying flow moves the dose-to-flow ratio and drags finished-water pH with it. Under manual control, coagulant dosing of 10–40 L/h covers typical surface-water raw turbidity (~0.2–0.5 L per m³ at 8 NTU). After any change to dose rate or RPM allow at least one full retention time (10–15 min) before judging the result downstream. Watch **DOSE_TANK_LVL** daily — silent depletion (the dosing pump runs but pulls air) is the most common reason for poor floc formation.

Interlocks and hazards. Dosing without flow concentrates chemical in the tank and damages the next stage when flow resumes. Always confirm P-101 is delivering before enabling the dosing pump. Above 60 L/h

the pH crashes below 6.0; above 8 NTU raw turbidity, increase the dose proportionally rather than running fixed.

If inflow exceeds what the basin can take, the tank spills over its weir. What leaves here is coagulant-laden, so the bund is a chemical spill and the area is unsafe until it is cleaned up. The spilled volume is cumulative and clears only on a plant reset, since the water on the floor does not drain itself.

8 Appendix A — Example transactions

The MBAP header used by every Modbus TCP frame is:

```
+-----+-----+-----+-----+-----+ ... +
| TID    | PROT  | LEN    | UID | PDU
+-----+-----+-----+-----+-----+ ... +
```

- TID — transaction identifier (echoed by the server).
- PROT — protocol identifier, always 0x0000 for Modbus.
- LEN — number of bytes that follow (UID + PDU).
- UID — unit identifier, echoed but not validated.

8.1 A.1 — Read all five input registers in one call (FC 04)

Request — read 5 registers starting at address 0x0000:

```
0001 0000 0006 01 04 0000 0005
```

Reply — five register values:

```
0001 0000 000D 01 04 0A 01C2 02EE 04E2 0492 02C6
      \ / \ / \_ / \_ / \_ / \_ / \_ /
      FC bc LEVEL DOSE FLOW FLOW PH
           (45.0%) (75.0%) (125) (117) (7.10)
```

8.2 A.2 — Set DOSE_RATE_SP to 25.0 L/h (FC 06, register 2 = address 0x0001)

Wire value = 25.0 x 10 = 250 = 0x00FA.

```
0002 0000 0006 01 06 0001 00FA
```

Reply echoes the request verbatim.

8.3 A.3 — Atomically clear MIXER_RUN with a Mask Write (FC 0x16)

Holding-register mask write applies (reg AND mask_and) OR mask_or. To turn off bit 0 of HR 0:

```
0003 0000 0008 01 16 0000 FFFE 0000
      \ / \_ / \_ / \_ /
      FC reg AND OR
```

9 Appendix B — Address convention quick reference

You read in vendor doc	What goes on the wire
Coil 1 / register 1	address 0x0000
Coil 100 / register 100	address 0x0063

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