INDUSTRIAL
WATER EQUIPMENT

Controller for cooling tower

Contents

General Description

The AS3020 Control System is used for the fully automatic monitoring of simple cooling tower systems.

The set values for the control system can be changed at any time; during a power cut they remain set.

The controller has four stages: "Service", "Refill ", "Flush" and "Waiting for Flush ".

The control unit monitors the conductivity of the water, and if during a given set time it should exceed a predetermined sediment level, then the flush valve will be opened.

Alarm signals can be sent if the conductivity falls below a minimum set level and / or the conductivity exceeds a maximum set level. The alarm switch will then be activated.
The alarm switch must then be reset manually.

Two level-switches can also be connected to the control unit. These control an inlet valve. This inlet valve opens when the tank is empty. Depending upon the programming (step 5.6) the flush valve can be closed or it can stay open until the tank is full again. If this happens, the system will switch to the refill stage. When the tank is full, then the inlet valve will be closed off and the conductivity will once again be controlled.

Service Stage

During "Service" the conductivity of the water is controlled.
The flush valve is closed. Depending on the level-switch, the inlet valve is either
open or closed.

The following values are monitored:
- the minimum conductivity (Step 2.2 / 2.3)
- the maximum conductivity (2.4 / 2.5)
- input "tank empty"
- input "tank full"

If conductivity persists at a certain level during the set delay time, this triggers a
flush, or the refill stage will be triggered if the inlet valve is open and step 5.6 is
programmed to "Y".

Refill Stage

The "Refill" stage is switched to if the flush valve is blocked because the inlet valve
is open.

The following values are monitored:
- the minimum conductivity (Step 2.2 / 2.3)
- the maximum conductivity (2.4 / 2.5)
- input "tank empty"
- input "tank full"

The flush valve is closed. The inlet valve is open. As soon as the inlet valve closes,
depending on the conductivity level, it will switch to the "Service" or the "Flush"
stage.

"Flush" Stage

During flush the conductivity of the water is controlled.
The flush valve is open and the inlet valve is closed.

The following values are monitored:
- the minimum conductivity (Step 2.2 / 2.3)
- the maximum conductivity (2.4 / 2.5)
- input "tank empty"
- input "tank full"

If during the flushing stage the conductivity remains above the set limit, then it switches to "Wait for Flush" stage. As soon as the conductivity falls below the set limits, then it switches to the "Service" stage.

"Wait for Flush" Stage

During the "Wait for Flush" stage, the conductivity of the water is controlled. The flush valve and the inlet valve are closed.

The following values are monitored:
- the minimum conductivity (Step 2.2 / 2.3)
- the maximum conductivity (2.4 / 2.5)
- input "tank empty"
- input "tank full"

This stage will be switched to if the conductivity is still too high at the end of the flush stage. It will be kept at this stage until the next flush time. If the interval time runs out, then it switches to the "Flush " stage. As soon as the conductivity falls below the set limit it switches to the "Service" stage.

Value and function display

First LCD line
The current status of the system is shown in the first line of the LCD display:
"Service", "Refill ", "Flush" and "Waiting for Flush ". A "*" at the end of the line
means that the inlet valve is open. If there is an alarm situation, this will be
indicated by a change in the display. In case of an alarm situation, an alternating
message appears.

Second LCD line
The measured conductivity is shown in the second line of the LCD display.
ATTENTION! If the message "OFL" appears in the second line, the value falls
outside the measurement range.

Example :

```
      Service
CD    40,0uS/cm
```

During "Service" the conductivity will be shown.

```
      Refill
CD    40,0uS/cm
```

During "Refill" the conductivity will be shown.

```
      Flush
Flushtime      60s
```
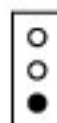
During "Flush" the remaining flush time will be shown.

```
   Flush wait
Interval       2m
```
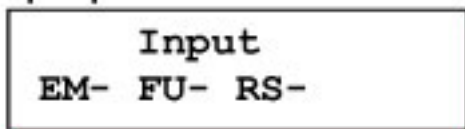
During "Waiting for Flush" the interval until the next flush will be shown.

Info display

Various information can be called up by pressing the information key.
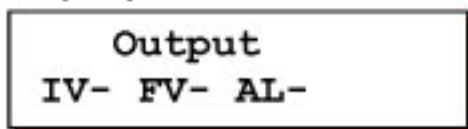Pressing the key again changes the information shown.

Input positions

```
        Input
EM-  FU-  RS-
```

The current switch positions of the input functions are shown here.
EM = Tank empty
FU = Tank full
RS = Reset alarm

Output positions

```
       Output
IV-  FV-  AL-
```

The current switch positions of the outputs IV, FV and AL are shown here.
IV = Inlet valve
FV = Flush valve
AL   = Alarm

Software version

```
Software version
AS3020     1.01.00
```
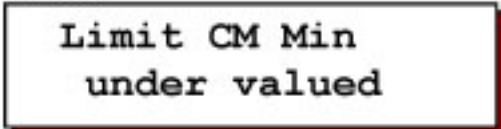
The software is regularly updated to ensure that the product complies with the latest insights and needs.
The number of the operational version is indicated.

Alarm

If the alarm relay is activated, it can be deactivated by pressing the external key. Although this deactivates the relay, the message is still shown in the LCD display. Press the key again to remove the message.

CM MIN

```
Limit CM Min
 under valued
```

The conductivity value of the conductivity meter has dropped below the set minimum limit value. The system remains operational.
The message in the LCD display can be switched off as soon as the minimum limit value is again exceeded. The alarm relay can be activated.

CM MAX

```
Limit CM Max
  exceeded
```

The conductivity value of the conductivity meter has exceeded the set maximum limit value. The system remains operational.
The message in the LCD display can be switched off as soon as the conductivity drops below the maximum limit. The alarm relay can be activated.

Input functions

The inputs 'Regeneration busy' (EM) and 'Alarm reset' (IN) are included as standard.

Tank empty / Tank full

The inlet valve can be opened and closed with the input functions "Tank Empty" and "Tank Full" .

The input function "Tank Empty" is active when the contact is closed.
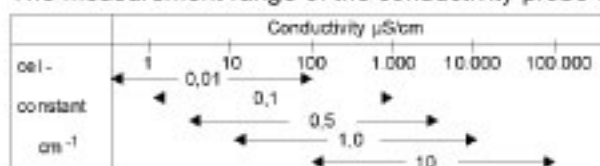The input function "Tank Full" is active when the contact is open.

Alarm reset
No further programming possible. The input is connected to the built-in switch on delivery.

Conductivity probe

The connection for the conductivity probe is indicated by 'CC'.
The measurement range of the conductivity probe depends on the cell constant.

The cell constant can be programmed in step 2.1.
Also, it is possible to set the minimum and maximum limit values with a programmable delay time. Whether the alarm relay should be activated in the case of a specific message can be set in step 9.1.
It is also possible to compensate for the temperature factor in the conductivity measurement. The water temperature can be programmed in step 3.

Temperature compensation
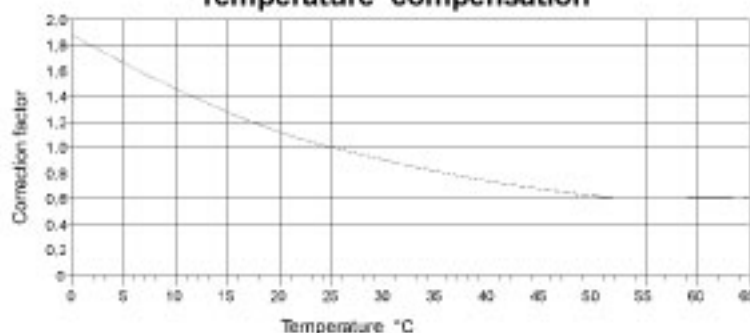
Example:

Set/measured water temperature:	$T = 11 \,°C$
Measured conductivity value:	$C_{11} = 100 \ \mu S/cm$
Applicable correction factor:	$K = 1.4$
Shown conductivity value:	$C_{25} = 140 \ \mu S/cm$

Outlet Functions

The outlets' "Inlet valve" (IV on Terminal IV), "Flush Valve" (FV on Terminal PU), and Alarm (AL on Terminal AL) are usually available.

Inlet Valve
The inlet valve opens when the tank is empty. The valve closes again when the tank is full again. The valve remains closed if the water level controller is turned to between "full" and "empty".

The maximum current output of this output is 8 A (fused).

Flush Valve
The flush valve will be open if the conductivity remains above the set level for a set time.
The maximum current output of this output is 8 A (fused).

Alarm
The alarm switch can be activated by specific events, like:
  - below minimum conductivity value
 - above maximum conductivity value
The alarm can be programmed to react to faults or not to.

Changing and calling up the basic parameters

On taking the controller into operation, the operating values of the conductivity measurement are set by entering the basic parameters.
These values can be changed at any time, but will not be lost in the event of a power failure.

To prevent accidental program changes, the key must be pressed for four seconds before gaining access to the programming mode.
Simply press the same key to navigate the programming mode.
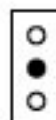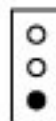
The programming mode is automatically exited approx. 2 minutes after the last key operation or by entering the indicated key combination.

Press the top key to move the cursor.
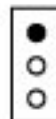
Use the bottom key to change numerical values, which you have selected with the cursor, within the available range.
Also use this key to switch between '-' and '|' in case of option questions.

1. Language

```
Step no.:      1.1
D   Nl E   F
```

The language can be set in the step.

2. Conductivity meter

```
Step no.:      2.1
Constant      0.10
```

A measurement cell with a specific cell constant must be selected depending on the required conductivity of the water. Here, a cell constant of 0.01 to 10.00 cm^{-1} can be programmed for the conductivity meter.

```
Step no.:      2.2
Value Min      1.0
```

An electronic interruption of the measurement cell, electronic defects in the system or air in the measurement cell can erroneously result in very low conductivity values. For monitoring purposes, a limit value of 0.0 to 999,9 µS/cm can be entered.

```
Step no.:       2.3
Delay           60s
```

After a programmed delay time of 1 to 999 seconds, a drop below the limit value will result in the error message 'Limit CM Min under valued' being shown in the LCD display.

```
Step no.:       2.4
Value Max   100.0
```

A change in the quality of the supply water can lead to change in conductivity. For monitoring purposes, a limit value of 0,2 to 6500,0 µS/cm can be entered.

```
Step no.:       2.5
Delay          180s
```

If, after a programmed delay time of 1 to 999 seconds, the maximum conductivity value is exceeded, there will be an alarm.

3. Temperature

```
Step no.:      3.1
Temperature 25°C
```

By entering the water temperature, the indicated conductivity value can be compensated to allow for the current temperature.

The conductivity measurement is based on a water temperature of 25 °C. In case of a higher or lower temperature, this can be compensated by hand.

4. Compensation correction factor

```
Step no.:      4.1
Factor     1.00*
```

Other measuring errors, which may arise through valorisation or cable capacities, for example, can be compensated here by entering a correction factor, varying from 0.10 to 5.0.

Take a water sample and measure the conductivity using an accurate conductivity meter: this results in the calibration value. Record the controller reading as the measurement value.

Use the formula below to calculate the correction factor:

$$\frac{Reference\ value}{Measured\ value} = Correction\ factor$$

5. Flush

```
Step No:        5.1
Flush        1500.0
```

The limits of the flush are presented here. They lie between 1.0 and 65,000,0 µS/cm. If the conductivity exceeds the set limits, the flush valves will be prompted to open.

```
Step No:        5.2
Hysteresis 300.0
```

How far the conductivity should decrease below the limit after the flush is determined by hysteresis, before the flush finishes.

```
Step No:        5.3
Delay            30s
```

If the conductivity level is above the programmed limit, the flush valve, in accordance with a programmed time delay of 1 – 999 seconds opens.

```
Step No:        5.4
Flush Time     60s
```

This shows the duration of the flush, between 1 and 999 seconds

```
Step No:      5.5
Interval       1m
```

If the flush is limited to a particular timeframe, the process may optionally be repeated automatically after a given period of delay, if the conductivity, minus hysteresis, remains above the limit after the flush. These settings must be pre-programmed.

The duration of the required time interval can be entered in programming step 5.5, and be from 1 to 99 minutes.

```
Step No:      5.6
Depending IV Y/N
```

Here you can program whether the flush valve is to operate independently of the inlet valve.
If "yes" then the flush valve must open or remain open when the inlet valve is open.
If "no" then both valves operate completely independently from each other.

6. Alarm

```
Step no.:        6.1
MI-MA-
```

In this step, you can program the events that will activate the alarm relay ("-" = not activated, "|"= activated).
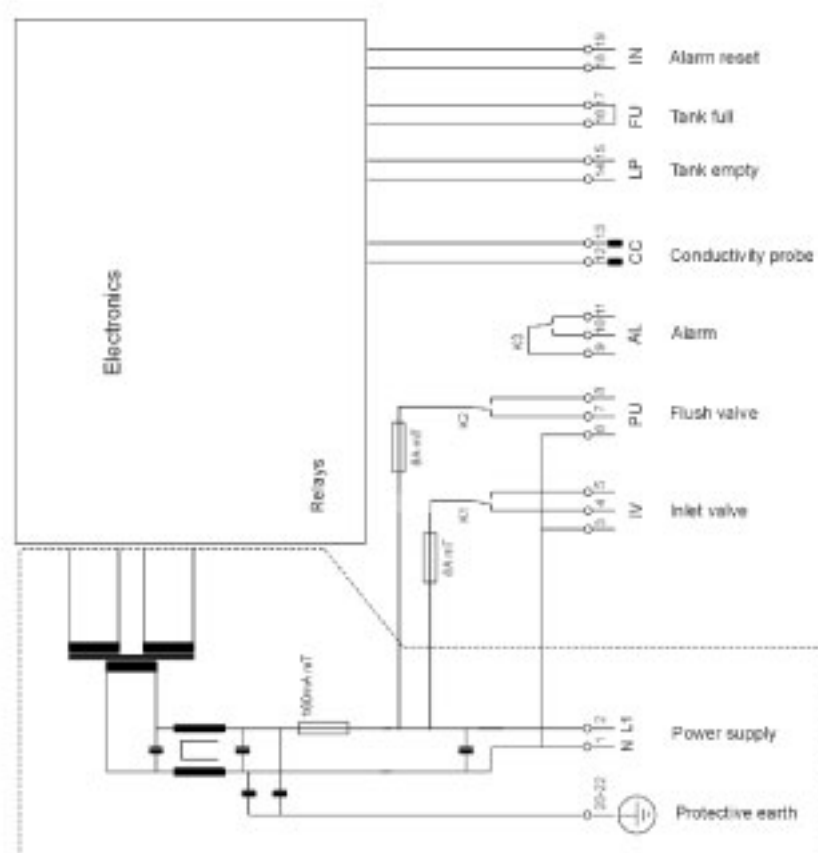
MI   = minimum conductivity
MA   = maximum conductivity

```
Step no.:        6.2
Rel.energ.       Y/N
```

Here, you can program whether the alarm relay should be energized (Yes) or not (No) in case of a failure.

Connection terminals AS3020

Technical specifications

Power connection:	230V, 50-60 Hz, fuse 160 mAT 115V, 50-60 Hz, fuse 315 mAT 24V, 50-60 Hz, fuse 1AT
Power consumption:	4 VA
Inlet valve:	Voltage is equal to supply voltage, 8AT fuse max. current load 250V, Ohm = 8A, Inductive = 3A
Flush valve :	Voltage is equal to supply voltage, 8AT fuse max. current load 250V, Ohm = 8A, Inductive = 3A
Alarm:	max. current load 250V, Ohm = 8A, Inductive = 3A
Inputs:	loaded with 9V, 8mA
Protection class:	IP 65
Ambient temperature:	0 – 50 °C
Weight:	2 kg
Dimensions:	122 x 120 x 57 mm
Special features:	protected against zero voltage