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Volume

2

MABAT CHEMICAL SYSTEMS

Corporate Graphics and Documentation

SDI-2200

Silt Density Indexing Unit

Serial No.: 25145

Chapter

1

1. Introduction

1.1. General Description

Multi Channel On-Line Quality Water Analyzer, SDI-2200

The SDI 2200 Automatic, On Line, Silt Density Index Monitoring System is a unique on-line control system, designed for continuous, unattended operation in desalination and other water treatment plants.

The SDI 2200 is used in critical water quality applications, where precise control is essential for safe and economic operation. It replaces the manual, error prone, conventional procedure with an automatic, precise and infallible routine.

The SDI 2200 is a complete self-contained system meant for unattended operation with extensive reliability and with advanced fault analysis and warning.

The rugged, spray proof (IP 53) wall mountable system performs all the below steps that are required for quality water testing results:

- Flushes pipes prior to measurement.
- Controls water pressure.
- Measures flow rate.
- Replaces filter.
- Drains the water and cleans the system at the end of each cycle.
- Programmability of the measurement protocol.
- Monitors executed program.
- Data logging in digital memory.
- Real time SDI and status display.

- Programmable alarm on over-limit levels.
- Self-test and fault conditions alarm.
- Optional dry contact and analog signals for remote control and monitoring.

The Display panel provides the operator with interface and on-line control to the Analyzer control functions.

There are four possible input channels for the SDI-2200 driven analyzers categorized as follows:

- 1 Channel Analyzer: SDI-2201
- 2 Channel Analyzer: SDI-2202
- 3 Channel Analyzer: SDI-2203
- 4 Channel Analyzer: SDI-2204

1.2. Principals of Operation

Standard Test Mode

Silt Density Index (SDI) is measured by comparing the flow rate of a known quantity of water, where the water quantity is kept under constant pressure. The flow rate is measured twice, once where the water flows through a standard filter, as a reference, when the filter is unused, and the second time after the filter is exposed for 1-15 minutes, and the water sample flow is kept always under constant pressure.

The drop in flow rate is a direct measure of the silt build-up on the filter. The flow rate is derived from quantities and timing information:

$$SDI = \frac{\left[1 - \frac{t_i}{t_f}\right]}{\tau} \times 100$$

Where:

t_i: initial time required to collect 500 [mL] of sample,

t_f: time required to collect 500 [mL] of sample after test time τ

τ: total elapsed flow time, min. (usually Standard Measured Time[1])

The SDI 2200 provides the same type of measurement both in automatic and in on-line mode for up to four independent sampling points.

The pressure is kept constant by precisely regulated air pressure applied on the water surface without the need of any mechanical device.

Auto Time Test Mode

In cases where the silt density index (SDI) reading is unstable and readings are higher then 5 (i.e. Plugging Factor is higher then 75%), during the 15 minutes check time, the Analyzer can be programmed to work in AUTO TIME TEST MODE based on the following test method automatically:

- The $\%P_{30}$ (Plugging Factor) calculations will proceed and recorded in intervals of one-minute elapsed.
- Calculations will stop once $\%P_{30}$ (Plugging Factor) 75% has been reached.
- New SDI[2] readings will be displayed based on the last calculated plugging factor at the last measured time also check time will be displayed.
- All SDI test readings are on 0-100 scale where the exact check time figure has no valuable meaning as in the Standard Test Mode. In general, the higher the SDI reading the more silt is in the water. When the plugging factor after 15 minutes is calculated to be lower then 75%, the Analyzer will switch and calculate the test results based on the Standard Method.

$$\%P_{30} = \left[1 - \frac{t_i}{t_f}\right] \times 100$$

Where:

$\%P_{30}$: plugging factor at 30 [psi] feed pressure,

t_i: initial time required to collect 100 [mL] of sample,

[1] Standard Measuring Time (SMT) is 15 minutes. The higher the expected SDI value, the lower the SMT value. The SMT scale value ranges from 1–15.

[2] - if after 15 minutes the readings are lower then 75% results are being calculated as per the Standard method. The higher the SDI readings the more silt are in the water.

t_f: time required to collect 100 [mL] of sample at each intervals of one-minute test time.

The SDI-2200 is set to perform in correlation to what is specified by the ASTM designation: D-1892-95 (2002) Standard.

1.3. System and Product Specifications

TECHNICAL INFORMATION:

Dimensions (in mm)	W= 760 D= 500 H=260
Dimensions (in In)	W= 30 D= 20 H=10.25
Weight	40[Kg], or 85[Lb]

CONSTRUCTION MATERIAL:

Wet Parts	PVC
Construction Container	Polyester

UTILITY SPECIFICATIONS:

Supply In:

Water Pressure	2.4 to 6.0 [Bar] or 35 to 90 [Psig]
Water Flow Rate	1.5 [L/min.] or 0.5 [Gal/min.]
Air Pressure	5.2 to 8.0 [Bar] or 80-120 [Psig]
Electrical	24 [VDC], 2 [Amp]
Slit Density Index (SDI) ranges	0.00-99.99
SDI Check time	1-15[Minutes]

Output Signal:

Option 1:
Dry contact for common alarm indication and fault indication

Option 2:
Two dry contact for common alarm indication and fault indication

Option 3:
Dry contact for Ready indication

Option 4:
Dry contact for each channel alarm indication

Option 5:

Analog isolated output per channel	0-5 [Volt], 1-5[Volts], 0-20[mA] and 4-20[mA].

Input Signal:

Option 1:

Remote Start/Stop input	Dry Contact

Option 2:

Remote Start for each input	Dry Contact

Filter Paper Type	Rolls, length 6 [Meter] or 20 [Ft], 90 measurements per roll.
Drain	PVC
Environment protection:	IP53

1.4. SDI Analyzer Type and description:

Analyzer format definition - **SDI 220n-a-b-c**

Where:

n: Number of Channels (1 - 4).

a: Number of Analog Outputs (1 - 4).

Specified ranges:

- 0-5 [Volts]
- 1-5 [Volts]
- 0-20 [mA]
- 4-20 [mA]

Note: The Analog Output is directly related to the SDI reading (see- setting the analog range 3.2.7).

b:

Where:

0 - No Relay Alarm Output.

1-5 - One to five Alarm Outputs.

c:

Where:

0 - No Remote Start/Stop Input.

1 - With Remote Start/Stop Input.

Examples:

SDI 2202-2-0-0 range 0-5 [Volt]
for Analyzer with two inputs and two analog (0-5[Volt]) outputs and no alarm relay outputs nor remote start input, with local panel.

SDI 2204-3-1-1-range 1-5 [Volt]
for Analyzer with four inputs and three analog (1-5 [Volt]) outputs, alarm relay outputs and remote start input.

SDI 2202-2-0 range 0-20 [mA]
for Analyzer with two inputs and two analog (0-20 [mA]) outputs and no alarm relay outputs, with local display panel.

1.4.1. Analyzer Configuration

The SDI-2200 consists of single non-portable unit. Overall system representation and detailed views are shown below:

In the Table 1 below, the Analyzer is presented in the center column with a view of the front door open. Picture of the side view in the right column:

Analyzer Name	Analyzer Views	
	Front	Side
SDI-2200:		

Table 1 – Subunit Configuration