HJM Electronics
Instrumentation for the Water-Treatment Industry
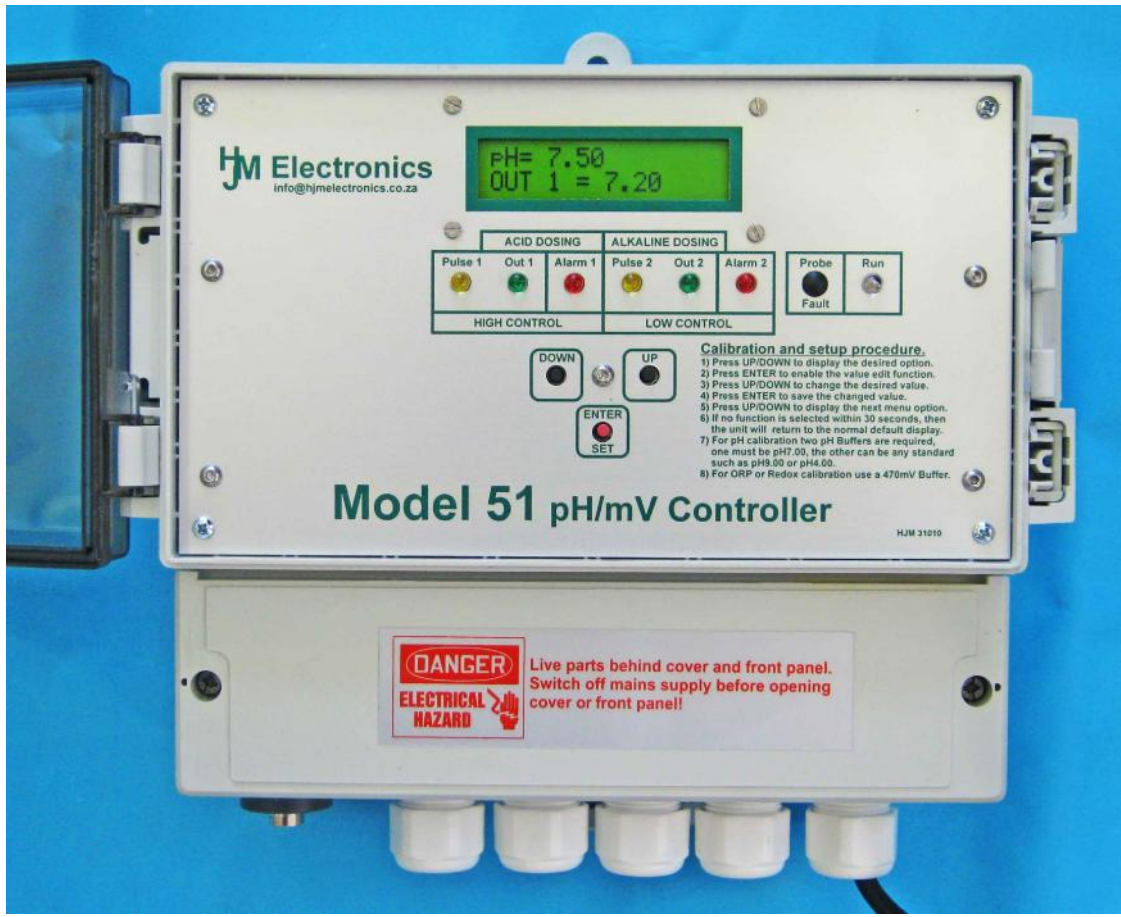Tel:+27+ (0)11 452-2066   E-mail: info@hjmelectronics.co.za

Model 51 pH CONTROLLER.

GENERAL DESCRIBTION.

The Model51 is a dual-channel, micro-processor based pH controller.

The signal form the pH electrode is optically isolated before it is sent to the micro-processor behind the front panel. This micro-processor controls the all the output- as well as programming- and set-up functions.

This arrangement eliminates ground-loop and signal feed-back errors.

Three push-buttons on the front panel allow for the easy programming of the controller.

The pH reading and set-points are displayed on a LCD screen with a build-in backlight.

"HIGH CONTROL" is used to dose acid and works on a high going pH.

"LOW CONTROL" is used to dose an alkaline product and works on a low going pH.

The "Acid Dosing" and "Alkaline Dosing" set-points can be set independently as well as the "Alarm 1" and "Alarm 2" set-points.

The pulse-rate of the "Pulse1" and "Pulse2" outputs can be set separately.

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Model 51 pH CONTROLLER.

STANDARD SPECIFICATIONS:

Power requirement:	200-240V, AC only.
Power consumption:	10 VA
Instrument fuse:	100mA
Output fuse:	5A
ON/OFF SWITCH:	Used for remotely switching controller on or off.
Range:	pH0 to pH14.
Accuracy:	+- 0.1pH (After calibration).
Temperature Range:	0-80 Degrees Celsius. Manual compensation.
	Automatic option available (10K NTC thermistor).
Display:	2 x 16 characters LCD module with backlight.
	The backlight functions are: "Always ON".
	"Always OFF"
	"Ambient".
µProcessor:	Microchip PIC18F4525.
Software:	Version HJM178 and up.
pH input:	BNC connector. Electrically isolated.
pH pre-amplifier:	PCB mount, epoxy encapsulated for moisture protection.
RUN light:	Green LED. Indicates that the µProcessor is running.
UP/DOWN buttons:	Used to select software options.
ENTER/Set button:	Used to set software options.

FACTORY DEFAULT SETTINGS:

Setpoint 1:	pH 8.00
ALARM 1:	pH 9.00
Maximum Pulse Rate 1:	150 pulses/Minute Maximum.
Relay 1 Function:	Proportional Time output.
Relay 1 Period:	60 seconds

Setpoint 2:	pH 6.00
ALARM 2:	pH 5.00
Maximum Pulse Rate 2:	150 pulses/Minute Maximum.
Relay 2 Function:	Proportional Time output.
Relay 2 Period:	60 seconds

Relay minimum ON time:	15 seconds
Alarm Hysteresis:	0,5 pH
Pulse Maximum Range:	1 pH
Backlight:	Always ON.

Automatic temperature compensation option is available using a 10K NTC thermistor.
This is a hard-wired option and has to be specified on order.

Model 51pH V179

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Model 51 pH CONTROLLER.

STANDARD SPECIFICATIONS:

ACID DOSING OUTPUTS (HIGH CONTROL):

Pulse 1:	Proportional pulse output for dosing pump.
Maximum Pulse rate 1:	30-180 pulses/Minute
Pulse 1 light:	Yellow LED.
Out 1 relay:	On/ Off, Proportional Time or permanently off.
	N/O relay contact, 5A into resistive load.
	Potential free or 220Vac
	Suppressed with 47 R and 0.033 μF.
	(Will supply 2,5mA current when relay is switched off).
Out1 light:	Green LED.
Alarm 1 relay:	On/ Off or permanently off.
	N/O relay contact, 5A into resistive load.
	Potential free or 220Vac
	Suppressed with 47 R and 0.033 μF.
	(Will supply 2,5mA current when relay is switched off).
Out1 light:	Red LED.

ALKALINE DOSING OUTPUTS (LOW CONTROL):

Pulse 2:	Proportional pulse output for dosing pump.
Maximum Pulse rate 1:	30-180 pulses/Minute
Pulse 2 light:	Yellow LED.
Out 2 relay:	On/ Off, Proportional Time or permanently off.
	N/O relay contact, 5A into resistive load.
	Potential free or 220Vac
	Suppressed with 47 R and 0.033 μF.
	(Will supply 2,5mA current when relay is switched off).
Out2 light:	Green LED.
Alarm 2 relay:	On/ Off or permanently off.
	N/O relay contact, 5A into resistive load.
	Potential free or 220Vac
	Suppressed with 47 R and 0.033 μF.
	(Will supply 2,5mA current when relay is switched off).
Out 2 light:	Red LED.

4-20mA OUTPUT:

4-20mA output	Isolated. Range: 0-14pH, proportional to pH reading.
	Maximum load 600 Ohm.
	Accuracy: +- 0.1mA

ENCLOSURE:

Front label:	Anodized aluminium, green on matt silver.
Enclosure:	Polycarbonate, light grey colour with clear hinged lid.
(TL2, TR1, M)	2 or 3 point wall mounting or clips on to DIN rail.
	Protection: IP 65. Size: 230 x 185 x 117 mm.
	(240 x 235 x 120 including cable glands and brackets)
	Mounting holes distance: 205mm.
Weight:	1.67Kg.

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Model 51 pH CONTROLLER.

INSTALLATION.

WALL MOUNTING.
The Model 51 pH controller can be mounted by using the 2 mounting brackets, or it can be mounted on a DIN rail using the optional DIN rail clips.

INSTALLATION.
Before installing the pH controller, a bit of thought has to be given to the position where the unit is to be installed.

AVOID: a) Splashing or dripping of liquids against the control panel.
b) Mounting the controller close to steam traps or hot water trenches.
c) Installation in highly corrosive environment, i.e. chlorine fumes or corrosive gasses and liquids.
d) Installation in places where strong mechanical vibrations are present.
e) Running probe cable next to other cables, motors, fans or generators.

DO: a) Install instrument under cover where possible.
b) Mount instrument in a dry and clean position with easy access.
c) Run the pH probe cable separately from other cables.
d) Install the instrument as close as possible to the probe.

1) Connect all outputs first.
2) Connect 220V supply to mains input terminals. This supply should be earth leakage protected, and MUST include an earth wire. Under no circumstances must the instrument be connected to a two-wire supply only.

> **IMPORTANT NOTE:**
> Please ensure that the Mains input wires are connected to the correct terminals.
> Failure to do so will render the fuse protection inoperative!

3) Connect the pH probe.

ELECTRICAL CONNECTIONS.

All electrical installations are subject to municipal and government regulations and must be carried out by suitably qualified personnel only!

WARNING !
**The Model 51 control system has NOT BEEN CERTIFIED AS INTRINSICALLY SAFE !
Therefore DO NOT INSTAL IN AN ENVIRONMENT WHERE FLAMMABLE OR EXPLOSIVE DUST OR GASSES ARE PRESENT.**

> **IMPORTANT NOTES:**
> **a) Please ensure that the Mains input wires are connected to the correct terminals.
> Failure to do so will render the fuse protection inoperative!**
> b) **The relay-contact suppression network will supply 2,5mA current even when the relay is switched off!**
> This can prevent small loads such as small relays and neon lights from switching off.
> Should this happen, remove the appropriate link marked "DOSE1", "DOSE2", "AL1" or "AL2".
> These links are located on the power board between the terminals and the output relays.

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Model 51 pH CONTROLLER.

TERMINAL CONNECTIONS:
220V INPUT:
10 = E (Earth) **input**   (linked to 15,16,17 = E (Earth) output).
11 = N (Neutral) **input** (linked to 18,19,29 = N (Neutral) output).
12 = L (Live) **input.**

ON/OFF SWITCH.
13 + 14 = ON/OFF SWITCH.
Used for remotely switching controller on or off.
Must be linked if external switch is not used!

220V OUTPUT:
21+22+23= L (Live) **output** (5A fused).
18+19+20= N (Neutral) **output** (linked to 11 = N (Neutral) input).
15=16=17= E (Earth) **output**   (linked to 10 = E (Earth) input).

ACID CONTROL OUTPUTS:
PROPORTIONAL PULSE1.
    43 + 44 = Pulse1 relay output.
OUT1 RELAY (DOSING1):
    37 = N/O, Relay output.
    38 = C, Relay common.
ALARM1 RELAY:
    33 = N/O, Relay output.
    34 = C, Relay common.

ALKALINE DOSING OUTPUTS:
PROPORTIONAL PULSE2.
    41 + 42 = Pulse2 relay output.
OUT2 RELAY (DOSING2):
    35 = N/O, Relay output.
    36 = C, Relay common.
ALARM2 RELAY:
    31 = N/O, Relay output.
    32 = C, Relay common.

OPTIONAL TEMPERATURE SENSOR (10K NTC):
    3= 10K NTC.
    4= 10K NTC.
4-20 mA SIGNAL.
The isolated 4-20mA signal can be used as a recording signal.
It operates over a 0-14pH range.
    8   = -, 4-20 mA output.
    9   = +, 4-20 mA output.
TERMINALS NOT USED:
    1, 2, 5

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Model 51 pH CONTROLLER.

OPERATING INSTRUCTIONS.

PROBE CALIBRATION.

Note: The controller has been factory pre-calibrated with pH0, pH7 and pH14 signals generated with a pH test box. These settings are the based on the signals generated by the ideal pH probe at a temperature of 25 degrees Celsius.

1) Set the temperature of the buffer solutions:

To set the temperature of the buffer solutions, press the **UP/DOWN** buttons until the following screen appears:

> TEMPERATURE
> Compensation=XX

Pressing **'SET'** moves you to the next setting screen.

> SET Temperature
> Compensation= XX

'UP' and **'DOWN'** adjusts the temperature value.
Press **'SET'** again to accept the setting.

2) Calibrate with a pH7.00 buffer solutions:

With the probe in pH7.00 buffer press the **UP/DOWN** buttons until the following screen appears:

> CALIBRATE pH7
> pH= X.XX

Pressing **'SET'** moves you to the next setting screen.

> SET Calib. pH7
> pH7= X.XX   XX %

'UP' and **'DOWN'** adjusts the pH7 value with the % change indicated.
Press **'SET'** again to accept the setting.

3) Calibrate with a pH4.00 or pH10.00 buffer solutions:

With the probe in pH4.00 or pH10.00 buffer press the **UP/DOWN** buttons until the following screen appears:

> CALIBRATE pH4/pH10
> pH= X.XX

Pressing **'SET'** moves you to the next setting screen.

> SET Calib.pH4/pH10
> pH4/10= X.XX   XX %

 'UP' and **'DOWN'** adjusts the pH4 or pH10 value with the % change indicated.
Press **'SET'** again to accept the setting.

4)Set the operating temperature of the process liquid:

To set the temperature press the **UP/DOWN** buttons until the following screen appears:

> TEMPERATURE
> Compensation=XX

Pressing **'SET'** moves you to the next setting screen.

> SET Temperature
> Compensation= XX

'UP' and **'DOWN'** adjusts the temperature value.
Press **'SET'** again to accept the setting.

Model 51pH V179 pH Operating Instructions

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CONTROL FUNCTIONS SETUP.

HIGH CONTROL (Acid Dosing):

SETPOINT 1:

Press the **UP/DOWN** buttons until the following screen appears:

> **SETPOINT #1**
> **pH= X.XX**

Pressing **'SET'** moves you to the next setting screen.

> **SET Setpoint #1**
> **pH= X.XX**

'UP' and **'DOWN'** adjusts the Setpoint #1 value.
Press **'SET'** again to accept the setting.

RELAY1 FUNCTION (Out 1):

Press the **UP/DOWN** buttons until the following screen appears:

> **RELAY 1 FUNCTION:**
> **OFF / ON-OFF / Prop.Time**

Pressing **'SET'** steps through the options:

> **ALLWAYS OFF** - off all the time
> **ON-OFF** - relay is on/off at above/below the set point
> **Prop. Time** - Pulse width modulated output at a period set as PERIOD with a minimum
> ON time of **'RELAY MIN ON TIME'.**

RELAY 1 PERIOD:

Press the **UP/DOWN** buttons until the following screen appears:

> **RELAY 1 PERIOD**
> **PERIOD= XX Sec**

Pressing **'SET'** moves you to the next setting screen.

> **SET Period #1**
> **PERIOD 1= XX Sec**

'UP' and **'DOWN'** adjusts the period value.
Range is 3 – 120 seconds.
Press **'SET'** again to accept the setting.

MAXIMUM PULSE RATE 1 (Pulse1):

Press the **UP/DOWN** buttons until the following screen appears:

> **MAX. PULSE RATE #1**
> **RATE= XX ppm**

Pressing **'SET'** moves you to the next setting screen.

> **SET Max. Rate #1**
> **RATE= XXX ppm**

'UP' and **'DOWN'** adjusts the maximum rate value.
The setting range is 60 – 180 ppm.
Press **'SET'** again to accept the setting.

ALARM 1 (High Alarm):

Press the **UP/DOWN** buttons until the following screen appears:

> **ALARM 1**
> **pH= X.XX**

Pressing **'SET'** moves you to the next setting screen.

> **SET Alarm #1**
> **pH= X.XX**

'UP' and **'DOWN'** adjusts the Alarm #1 setpoint value.
Press **'SET'** again to accept the setting.

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CONTROL FUNCTIONS SETUP.

LOW CONTROL (Alkaline Dosing):

SETPOINT 2:
Press the **UP/DOWN** buttons until the following screen appears:

> **SETPOINT #2**
> **pH= X.XX**

Pressing **'SET'** moves you to the next setting screen.

> **SET Setpoint #2**
> **pH= X.XX**

'UP' and **'DOWN'** adjusts the Setpoint #2 value.
Press **'SET'** again to accept the setting.

RELAY 2 FUNCTION (Out 2):
Press the **UP/DOWN** buttons until the following screen appears:

> **RELAY 2 FUNCTION:**
> **OFF / ON-OFF / Prop.Time**

Pressing **'SET'** steps through the options:
> **ALLWAYS OFF** - off all the time
> **ON-OFF** - relay is on/off at above/below the set point
> **Prop.Time** - Pulse width modulated output at a period set as PERIOD with a minimum
> ON time of **'RELAY MIN ON TIME'.**

RELAY 2 PERIOD:
Press the **UP/DOWN** buttons until the following screen appears:

> **RELAY 2 PERIOD**
> **PERIOD= XX Sec**

Pressing **'SET'** moves you to the next setting screen.

> **SET Period #2**
> **PERIOD 2= XX Sec**

'UP' and **'DOWN'** adjusts the Period 2# value.
Range is 3 – 120 seconds.
Press **'SET'** again to accept the setting.

MAXIMUM PULSE RATE 2 (Pulse 2):
Press the **UP/DOWN** buttons until the following screen appears:

> **MAX. PULSE RATE2**
> **RATE= XX ppm**

Pressing **'SET'** moves you to the next setting screen.

> **SET Max. Rate #2**
> **RATE= XXX ppm**

'UP' and **'DOWN'** adjusts the maximum rate value.
The setting range is 60 – 180 ppm.
Press **'SET'** again to accept the setting.

ALARM 2 (Low Alarm):
Press the **UP/DOWN** buttons until the following screen appears:

> **ALARM #2**
> **pH= X.XX**

Pressing **'SET'** moves you to the next setting screen.

> **SET Alarm #2**
> **pH= X.XX**

'UP' and **'DOWN'** adjusts the Alarm #2 setpoint value.
Press **'SET'** again to accept the setting.

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CONTROL FUNCTIONS SETUP.
(These setting are common for both channels)

PULSE RANGE:
Press the **UP/DOWN** buttons until the following screen appears:

> **PROPORTIONAL**
> **PULSE MAX=X.XX**

Pressing **'SET'** moves you to the next setting screen.

> **SET Proportional**
> **PULSE MAX=X.XX**

'UP' and **'DOWN'** adjusts the maximum rate value.
Range is 0.01 – 1.00 pH.
Press **'SET'** again to accept the setting.

HYSTERESIS: (for OUT 1 and OUT 2 Relays)
(only applies if 'ON/OFF' has been selected)
Press the **UP/DOWN** buttons until the following screen appears:

> **HYSTERESIS**
> **pH HYST= X.XX**

This is the OUT1 and OUT2 Output relay hysteresis value.
The OUT1 relay energizes at the SETPOINT and de-energizes at SETPOINT - HYSTERESIS.
The OUT2 relay energizes at the SETPOINT and de-energizes at SETPOINT + HYSTERESIS.
There is a 10 second ON/OFF delay.
Pressing **'SET'** moves you to the next setting screen.

> **SET Hysteresis**
> **pH HYST=X.XX**

'UP' and **'DOWN'** adjusts the maximum rate value.
Range is 0.00 – 2.00 pH.
Press **'SET'** again to accept the setting.

RELAY MINIMUM ON TIME: (only applies if 'Prop.Time' has been selected)
Press the **UP/DOWN** buttons until the following screen appears:

> **RELAY min. ON/OFF**
> **TIME= XX Sec**

Pressing **'SET'** moves you to the next setting screen.

> **SET min.On/Off**
> **TIME= XX Sec**

'UP' and **'DOWN'** adjusts the minimum on time value.
Range minimum = 2 seconds.
Range maximum = **(RELAY PERIOD-1)** seconds.
Press **'SET'** again to accept the setting.

LCD BACKLIGHT:
Press the **UP/DOWN** buttons until the following screen appears:

> **LCD BACKLIGHT**
> **Ambient / OFF / ON**

Pressing **'SET'** steps through the options:
Ambient - the LCD backlight is turned on if the ambient light level is too low.
Always OFF - always OFF
Always ON   - always ON

Pressing **'DOWN'** advances to the next setting.

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DEFAULT VALUES:
WARNING! THIS WILL RESET ALL SETTING TO FACTORY DEFAULT!

Press the **UP/DOWN** buttons until the following screen appears:

> DEFAULT VALUES
> PRESS SET (HOLD)

Press **'SET'** for 3 seconds to load the factory-set default values.

> DEFAULT VALUES
> HOLDING .. X Sec

Hold the **'SET'** button in until the countdown is over.

PLEASE NOTE: Setting the default values will change **ALL** the settings to the factory-defaults!

FACTORY DEFAULT VALUES:
These values are pre-programmed when the controller is manufactured.
OUT 1:   pH 8.00
OUT 2:   pH 6.00
Alarm 1: pH 9.00
Alarm 2: pH 5.00
pH 7.00 and pH 10.00 values are pre-set at 25 degrees Celsius.

Model 51pH V179 pH Operating Instructions