DIGITAL

pH/mV

CONTROLLER

DPH-64

USERS GUIDE

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SPECIFICATIONS

Range: 0-14pH 0.01 pH resolution

+1000mV 1mV resolution

Display: Dot matrix 4 line by 20 character backlid LCD display

Electrode: BNC external of housing.

Temperature: *(pH only)* manual or automatic temp. Compensation

0-100 ^{o} C.

Signal output: 4-20mA, electrically isolated from instrument.

4-20mA range software selected between 0 to 14pH

or 0 to +1000mV. Maximum termination impedance to

drive 20mA is 1000 Ohms.

Can also be setup to follow setpoint for signal driven

metering pumps.

Relay outputs: 2 relays *(S1 & S2)* switched active with neutral and

earth terminals. Contacts rated 240V 5AMPS

(non-inductive)

2 relays *(S3 & S4)* with potential free changeover

contacts. Timers can be activated to enable / disable

relay outputs for programmed times.

Set points: All relays can be configured for up/down dosing.

Enable a Time delay of 1 to 5 minutes between

 S3 & S4 if acid / alkaline dosing is required.

Clock:	Real time clock with AM/PM or 24H mode. Battery backed up.
Additional	
relay functions:	S1 can be set up as a timer with real time ON/OFF timing.
	S3 and S4 can operate in proportional mode.
	S3 and S4 can also be lprogrammed to track temperature for temperature control or alarm.
	S2 configurable as a high/low alarm.
Pulse output:	P1 and P2 are *(contact closure)* non-polarised pulsed outputs. Minimum pulse duration 250mS. 500 volt isolation to instrument output. Maximum voltage across terminals 100 volts.
Pulse rate:	Select maximum pulse rate per minute from 50 to 100 pulses. Slope of pulse frequency 0.5pH to 2pH above/below SET POINT.
Power supply:	240V/50H 8VA max.
Construction:	Fully sealed construction with hinged clear acrylic front cover. IP55 specifications.
Dimensions:	(W)215mm x (H)185mm x (D)115mm.

INTRODUCTION

The 4 line by 20-character LCD display allows text messages or prompts in "real" language without confusing abbreviations.

Encoder knobs are rotated to scroll through different menus, values or changing set points. Once a mode of operation, calibration value or setpoint is dialled simply push the encoder knob to select. All custom configurations are stored in non-volatile memory.

A real time clock is always present and each relay output can be linked with a timer to operate only at programmed times.

FIG 1 *DPH-64 pH / ORP controller*

The signal generated from a pH electrode is extremely weak with a very high impedance and therefore very sensitive to electrical interference. This necessitates the use of shielded cable for the connection of the electrode. A coaxial cable with an additional outer layer of carbon must be used to ensure a steady pH signal. The DPH-64 converts the electrode signal with a precision input amplifier and then further processes the electrical signal for display, alarm, signal and set point controls.

The DPH-64 features 6 relay outputs with a multitude of configurations possible to make this instrument suitable for almost every installation where pH, ORP, temperature control or timer output is required. Default label names for these outputs are S1, S2, S3, S4 and P1, P2. The DPH-64 is shipped with its basic setup of all four relays set point controlled for up or down dosing. All other features are 'hidden' when scrolling through the software setup. The appropriate setup window only appears once a feature is enabled. Scrolling through a setup is therefore much easier to follow.

Extended features possible are:

All relays linked with the real time clock to operate only at programmed times.

S1 operating as timer output starting in real time and selected duration. *(biocide dosing etc.)*

S2 used as an alarm with separate programmable high, low alarm set points.

Time delay between S3 & S4 to avoid overshoot when dosing acid and alkaline simultaneously

S3 and S4 used in proportional mode with adjustable gradient of pulsing.

S3 and S4 linked to temperature with programmable temperature setpoint and deadband.

The 4-20mA current output configured for set point control. Used with a current signal controlled pump.

P1 and P2 are used with dosing pumps requiring a trigger pulse input.

Additional features

Temperature compensation is set for 20°C by default. This can be changed in the configuration program from 0 to 100°C.

A TP150 temperature electrode connected to the terminals enables the option for automatic compensation.

The inherent accuracy and range configuration of the 4-20mA constant current output together with full electrical isolation make it possible to interface into a microprocessor, logic controller or data logger to further expand the combination of installations with the DPH-64.

An "activity indicator" in the top right corner of the LCD display continuously averages the electrode input and displays an increase, decrease or steady pH / mV. This is handy as it enables an operator to see instantly if a dosing cycle is changing the pH or mV in a system.
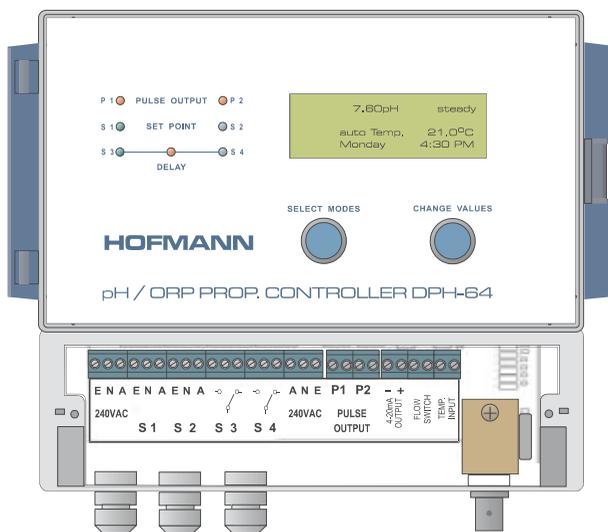

FIG 2 *Subpanel and terminal layout..*

All setpoints, modes and calibration values are stored separately for pH and mV therefore a complete configuration for each mode is possible and is saved in memory. Switching from pH to mV or visa versa will therefore instantly return a previous setup.

INSTALLATION

Instrument

Select a position for the controller to be mounted on a wall, not facing into direct sunlight and protected from the weather elements as much as possible.

The DPH-64 should be installed near the treatment plant. Maximum length of the co-axial cable used should not exceed 10 metres because of the very high input impedance characteristic of a pH electrode. *(See Signal input)*

The metal electrodes used for redox measurements are of much lower resistance and longer coaxial cables can be used without any special precautions.

Insert a round headed screw into the panel where the instrument is to be attached. This screw determines the centre of the instrument location. *(Fig.3)* Slide the instrument over the slot opening at the back, check that the unit hangs level and secure it with two screws inserted through the slots at the two bottom corners.
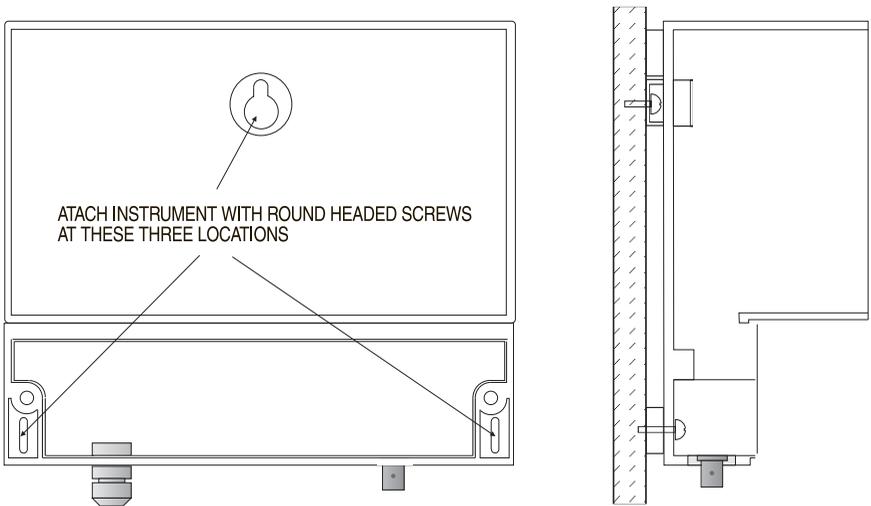

ATACH INSTRUMENT WITH ROUND HEADED SCREWS
AT THESE THREE LOCATIONS

FIG 3 *Attaching the DPH-64 to a wall*

Wiring of the DPH-64

S1 and S2 have 240VAC active neutral and earth terminals, S3 and S4 are potential free with NO, C and NC contacts. A three way terminal supplies 240VAC next to S3 and S4, thus simplifying wiring if a 240VAC output is required for S3 and S4. Look up page 23 for wiring options.

It is imperative that all connections are wired through the cable gland and the transparent lid is always tight to ensure that no corrosive liquids inadvertently splash into the instrument.

Electrodes

The co-axial cable used to connect the electrode to the DPH-64 must be of the type supplied with a carbon sleeve between the center core and shield as any standard co-axial cable will cause a very erratic digital display. An impedance converter must be used if the location between electrode and controller exceeds 10 meters. Special consideration also must be given when placing an electrode in a treatment bath or pool. The point of injection of neutralising agent and placement of the electrode *(distance between them)* largely determines the dosing characteristics of the DPH-64.

☞ *Only use special co-axial cable to connect a pH electrode to the DPH-64.*

Starting up the Instrument.

After you have installed the instrument and checked all the wiring and connections open the isolation valves to the sensor to allow water flow across it. Plug the power cord into the supply and switch on the DPH-64. The LCD display lights up and shows pH and Time. Some LED's may light up depending on the electrode or simulator input present.

☞ *Always exit by pressing MODE when looking at configurations in the various setup menus to ensure no unwanted changes are saved.*

CONFIGURATION

Both knobs *(encoders)* can be rotated and pressed to perform various functions.

Pressing 'MODE' moves through Manual Dosing, Calibration/Set Clock Time returning to the main window.

Pressing 'VALUE' is the shortcut to quickly change setpoints for any of the relays outputs. *(See Fig.4)*

Default values for the DPH-64 instrument

The DPH-64 is shipped with a standard default configuration programmed in non-volatile memory.

Of course all values can be customised through the configuration setup. Entered values are stored in non-volatile memory and are not lost through power failure. An internal battery runs the real time clock if power is not present.

Relays S1 to S4 enabled
Dosing Mode = SETPOINT *(normal dosing)*
Dosing S1 and S3 = UP
Dosing S2 and S4 = DOWN
Setpoint S1 and S3 = 6.00pH
Setpoint S2 and S4 = 8.00pH
P1 and P2 pulse output is disabled.
Temperature Compensation Manual *(+20.0^{o}C)*
Temperature hidden from display
4-20mA normal output
Range   4mA = 0.00pH   20mA = 14.00pH

The DPH-64 automatically returns to the main window after 2 minutes if, for some reason, left anywhere in the configuration or calibration menu.

☞ *The DPH-64 automatically returns to the main window after 2 minutes if left anywhere in the configuration or calibration menu.*

Configurations for the DPH-64.

Press 'MODE' to go to the first configuration window. The selections here are to calibrate an electrode or mA current output and set time. To scroll the selections rotate the 'VALUE' knob. Pressing again selects this option and enters the appropriate window. Press MODE to move to the MANUAL window to switch relays on and off manually.
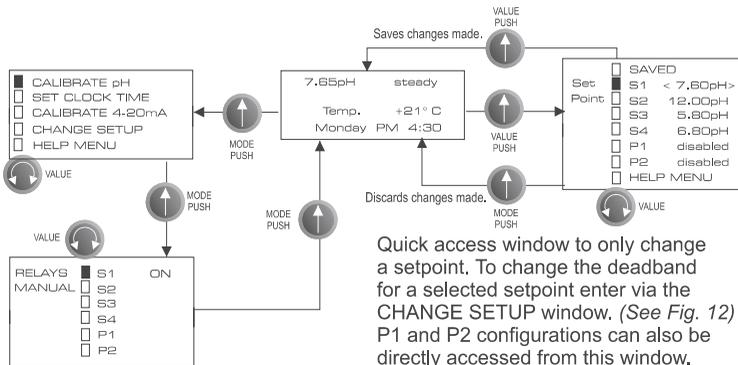

FIG 4 *Functions accessible from the main window.*

Calibrating pH or mV

The "calibrate to" field when entering a calibration automatically jumps to the nearest whole pH or 100mV of the measured electrode input. This minimises excessive scrolling to obtain a number. To change to a specific pH or mV dial the desired value and save.
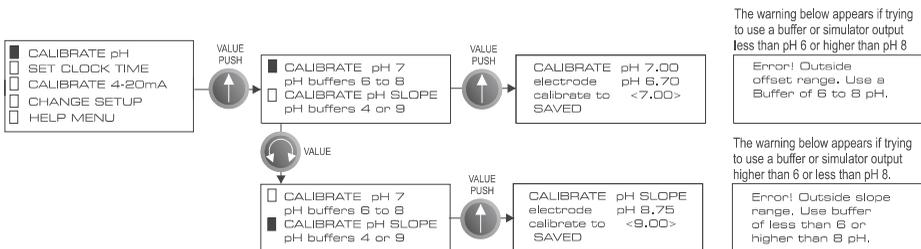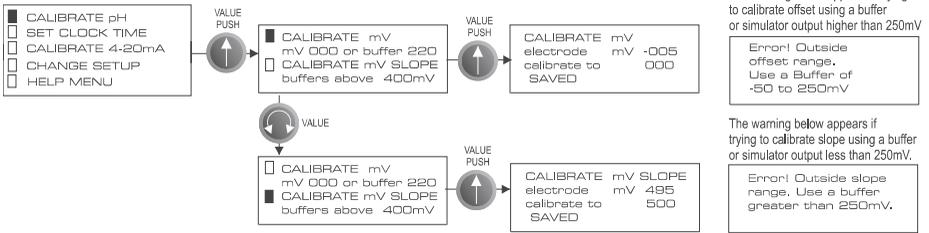

FIG 5 *Calibration menu for pH.*

FIG 7 *Calibration menu for mV. (ORP)*

Setting Time and Day

Pressing VALUE toggles brackets on and off. Rotate to change time. The next line selects the day. Move to "SAVE" and press 'VALUE' to keep new time and day, pressing 'MODE' discards changes and returns to the previous menu.
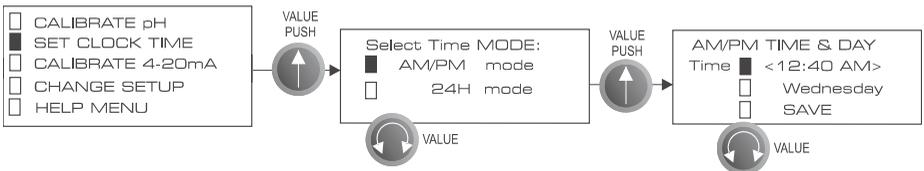

FIG 6 *Setting Time and Day.*

Calibrating 4mA and 20mA with a multimeter.

The output current can be accurately calibrated to achieve exact monitoring when connecting the 4-20mA to a data logger or central monitor system.

A real current calibration is carried out by connecting a multi meter across the terminals *(no termination resistor is required)* to measure the mA current.

The meter can also be connected in series in an already existing installation. *(See Fig.8)* Connect the multimeter to the 4-20mA terminals of the DPH-64. Select the DC current range 20 or 200mA of the meter.
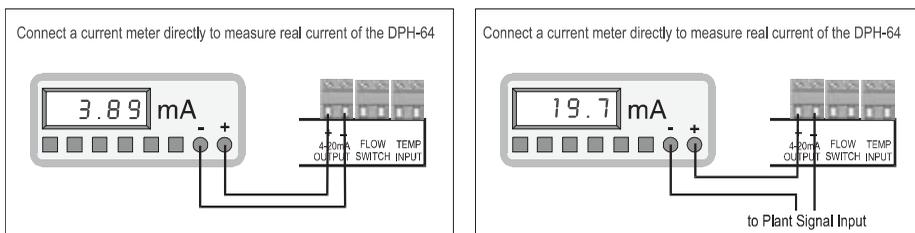

FIG 8 *Calibrating 4-20mA with a multimeter.*

Go to the "CALIBRATE 4mA" window first. The DPH-64 now outputs the count for 4.00mA. Dial up the measured current of the meter and press VALUE. The current to the meter is corrected to read exactly 4.00mA

Use the same procedure for 20mA. If for some reasaon you do not get the exact current the first time simply repeat the calibration.

☞ *If a configuration or number is accidentally changed in a setup window exit by pressing MODE repeatedly to return to the main window. This ensures no unwanted changes are saved. However make sure the mode exited is enabled again..*
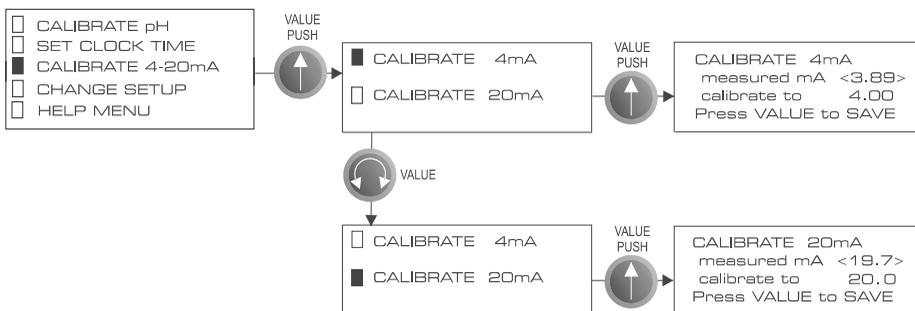

FIG 9 *Calibrating 4-20mA current output.*

Changing mode of operation.

This window contains all the configuration menus for mode of operation, up or down dosing, temperature compensation and 4-20mA setup. Extended features moves to the advanced modes of operation possible with the DPH-64 controller.
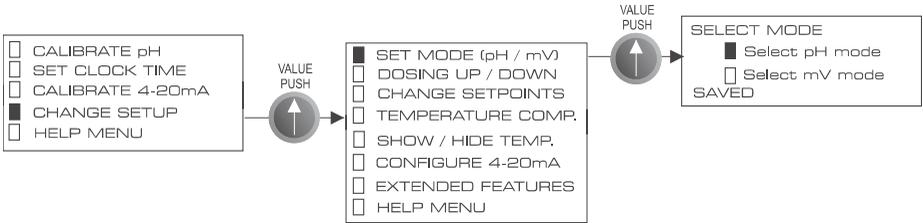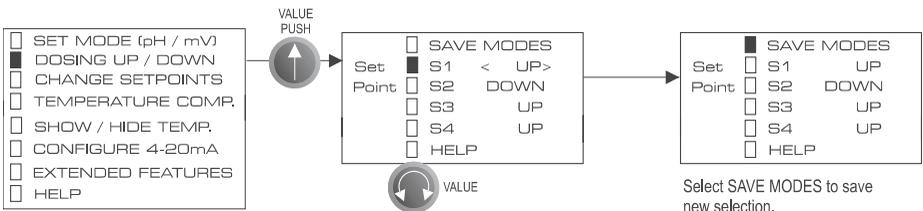

FIG 10 *Selecting mode of operation.*

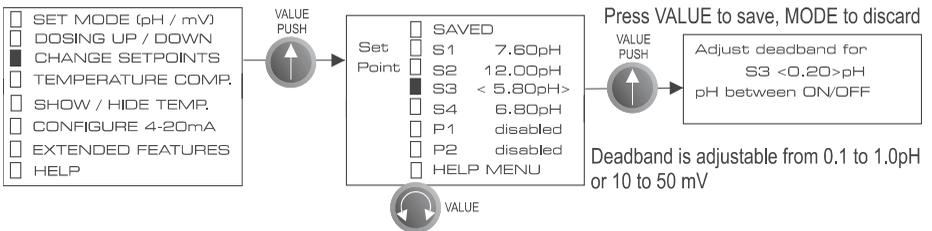**FIG 11** *Selecting up/down mode.*
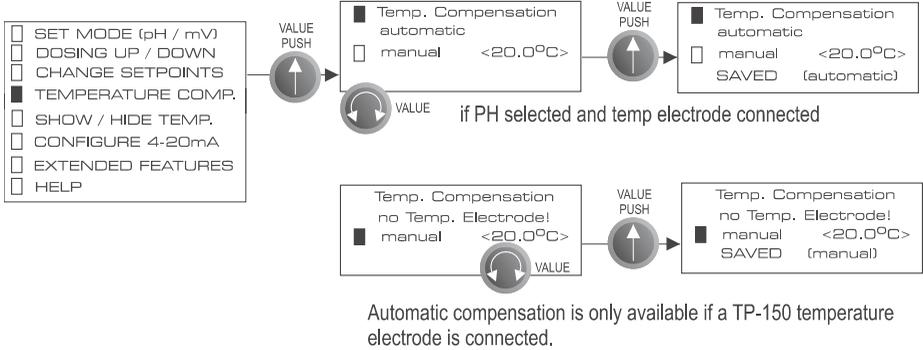

FIG 12 *Changing setpoints and deadband.*

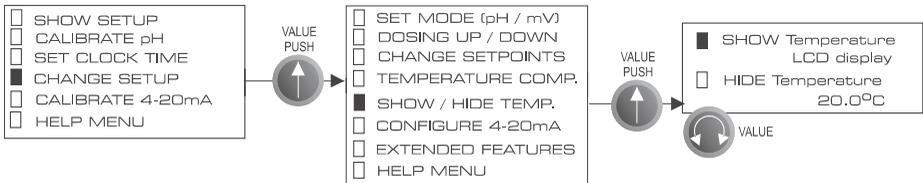FIG 13 *Selecting mode of temperature compensation.*

FIG 14 *Show or hide temperature with LCD display..*
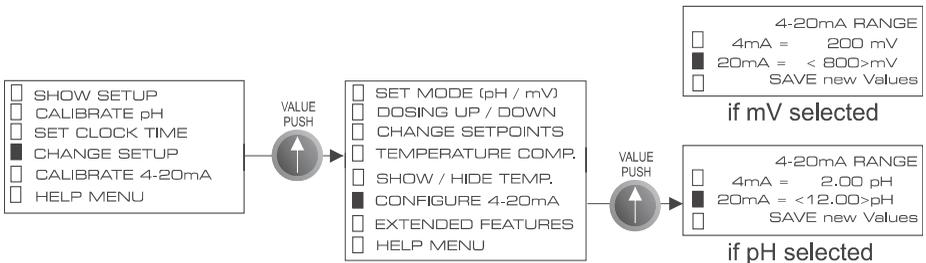

FIG 15 *Configuration of 4-20mA range.*

Extended Features

Fig.17 shows all the options available in this window. Many combinations are possible making this an extremely versatile controller.

Most of the extended feature options once configured are also displayed in the basic setpoint windows to show the status of a relay output. Selecting an option here goes directly to the appropriate configuration menu.

The last option RESET TO DEFAULTS if activated returns all functions of the DPH-64 to the default configuration as outlined on page 10.

Some options obviously are exclusive to each other such as S1 can only operate either as a timed relay or as a dedicated timer. S2 will operate as a normal setpoint output for up/down dosing or as an alarm with a combined low and high setpoint. For simultaneous up/down dosing a time delay can be enabled between S3 and S4 if operated in normal setpoint mode. Proportional dosing can be invoked for S3 and S4 in normal dosing mode. Alternatively S3 and S4 can operate as a temperature controller.

P1 and P2 are pulse outputs with selected linear or non-linear output characteristics.

The 4 - 20mA current output can be configured as a setpoint controlled current output for either up or down operation. Selecting linear or one of the 5 non-linear functions further enhance dosing performance with the DPH-64.
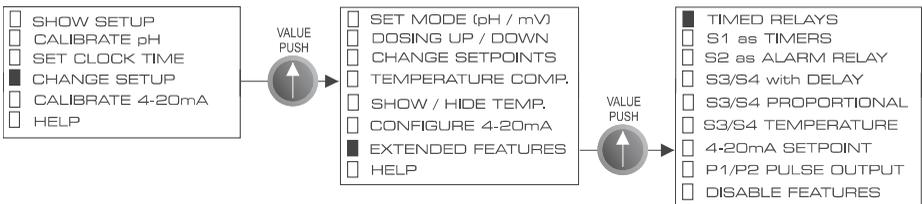

SHOW SETUP		SET MODE (pH / mV)		TIMED RELAYS
CALIBRATE pH		DOSING UP / DOWN		S1 as TIMERS
SET CLOCK TIME	VALUE PUSH	CHANGE SETPOINTS	VALUE PUSH	S2 as ALARM RELAY
CHANGE SETUP		TEMPERATURE COMP.		S3/S4 with DELAY
CALIBRATE 4-20mA		SHOW / HIDE TEMP.		S3/S4 PROPORTIONAL
HELP		CONFIGURE 4-20mA		S3/S4 TEMPERATURE
		EXTENDED FEATURES		4-20mA SETPOINT
		HELP		P1/P2 PULSE OUTPUT
				DISABLE FEATURES

FIG 16 *Extended Features.*

Timed relays

First option is "TIMED RELAYS". All four relays and the two pulse outputs can be individually attached to a timer. Once enabled the relay only operates within the time programmed in the configuration menu. Make sure that selected time and day are saved as well as saving the timer ON function. If S2 is operating as ALARM the timed relay option is not avaliable.

☞ *Save selected time first and then again save TIMED RELAY as ON when returning to the previous window.*
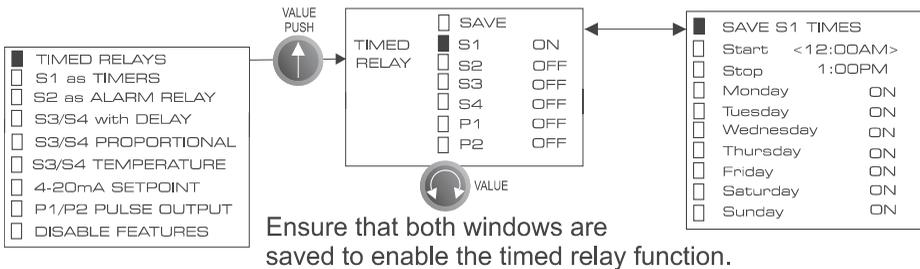

Ensure that both windows are saved to enable the timed relay function.

FIG 17 *Setting up TIMED RELAY 1*

S1 relay used as a TIMER

```
┌─────────────────────────────┐
│ □  SAVE TIMER S1            │
│ ■  START   <12:00AM>        │
│ □  DURATION    0:10         │
│ □  Monday        ON         │
│ □  Tuesday       ON         │
│ □  Wednesday     ON         │
│ □  Thursday      ON         │
│ □  Friday        ON         │
│ □  Saturday      ON         │
│ □  Sunday        ON         │
└─────────────────────────────┘
```

S1 can be configured as a timer by setting a start time and duration from 1 minute to 4 hours. Days are individually selected for complete flexibilty. If selected as a timer, setpoint and possible timed relay operations are automatically disabled. Equally if the timer is disabled a previous configured setpoint is restored.

S2 as ALARM RELAY.

For a simple alarm setup use this option as only one relay output is used. The normal setpoint is replaced by a low and high setpoint. Low alarm is set from 0pH to 1pH below high or high can be set from pH14 to 1pH above low.

```
┌──────────────────────────┐   ┌──────────────────────────┐
│ S2  ALARM SETPOINTS      │   │ S2  ALARM SETPOINTS      │
│ ■  HIGH   < 850mV>       │   │ ■  HIGH   <10.50pH>      │
│ □  LOW      200mV        │   │ □  LOW      6.50pH       │
│ □  SAVE                  │   │ □  SAVE                  │
└──────────────────────────┘   └──────────────────────────┘
      if operating in mV mode          if operating in pH mode
```

S3 / S4 with DELAY

DELAY only operates when normal setpoint for S3 and S4 is selected.
This feature will eliminate possible hunting between metering pumps or dosing valves when treating effluent with an acid and alkali neutraliser.
A time delay from 1 to 5 minutes can be selected.

```
┌──────────────────────────┐          ┌──────────────────────────┐
│ Time Delay S3 / S4       │          │ Time Delay S3 / S4       │
│     □  OFF               │   ────►   │     ■   <1> Min          │
│     ■  ON                │          │     □   SAVE             │
│                          │          │     □   HELP with DELAY  │
└──────────────────────────┘          └──────────────────────────┘
```

S3 / S4 Proportional

In Proportional mode the relay output starts to pulse on and off once the electrode-input moves toward the setpoint. The difference of input versus setpoint is controlled by the amount of "gradient" set in the configuration program. The lowest setting of 10 starts the output relay pulsing if 240 mV below/above setpoint in mV mode, or 3.0pH below/above setpoint in pH mode. The on/off ratio gradually reduces until the relay switches off at setpoint.
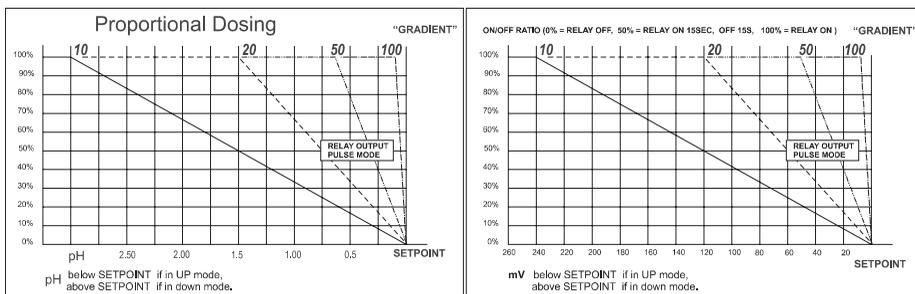

FIG 18 *The effect of gradient on proportional dosing*

Setting the gradient to the maximum of 100 starts the output relay pulsing when 10 mV or less than 0.5pH below/above setpoint giving a very steep gradient. The on/off ratio reduces very rapidly. Up or down mode is possible with normal proportional dosing. Look up Fig.6 for 'gradient' versus pulse output. Proportional dosing can be used with the timed relay option to only operate at programmed times or days.

S3 / S4 Temperature

A HOFMANN TP-150 temperature sensor must be connected to use temperature control with S3 and S4. Both can be set for above or below temperature operation with a setpoint range from 0 to 100°C and an adjustable deadband of 0.2 to 10.0^{o}C. The 'TIMED RELAY' option for S3 and S4 can also be used for temperature control.

4-20mA SETPOINT

Default mA output is defined by the mA configuration in the standard setup. *(page 16)* Choosing 4-20mA SETPOINT fixes the 4mA to the programmed 4mA setpoint. The span of mA range is set with the 20mA point. The mA current increases as the actual mV/pH moves away from the setpoint. In UP mode the signal current increases as the mV falls below the setpoint. In DOWN mode the signal current increases as the mV rises above the setpoint.

Linear and 5 non-linear settings help to further fine tune a dosing setup. The effects of the non-linear functions are shown in Fig. 19
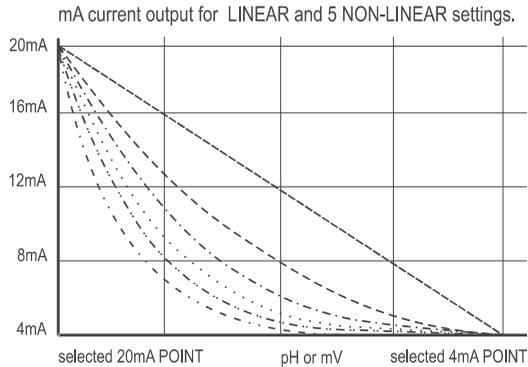
FIG 19 *Non-linear effects with 4-20mA current output*

☞ *The DPH-64 automatically returns to the main window after 2 minutes if left anywhere in the configuration or calibration menu.*

P1 / P2 Pulse output.

The 2 pulse outputs are used with metering pumps requiring a trigger pulse for each pump stroke. P1 and P2 independently can be used in UP or DOWN mode with individual settings for pulsing STOP and MAX. Pulse rate is selectable from 50 to 100 pulses per minute. Additional refinement of dosing is achieved with linear and 5 non-linear pulse rate settings.

Pulse output is an actual contact closure thus guaranteeing triggering of all metering pumps.

P1 and P2 can be programmed with the TIMED RELAY feature to only operate at certain times or days.
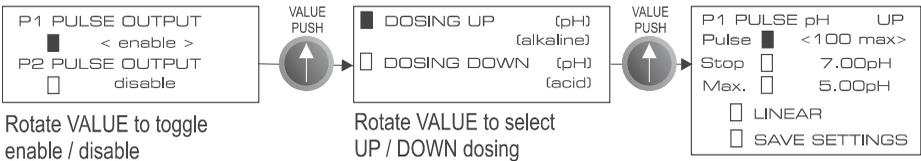
FIG 20 *Selecting P1 and P2 pulse output.*
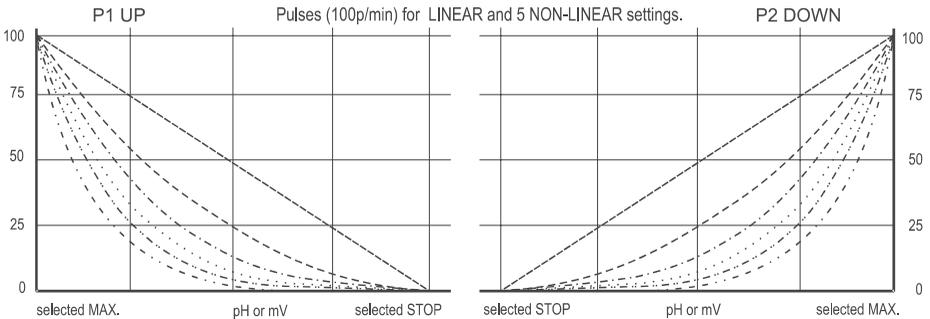
FIG 21 *Non-linear pulsing of P1 and P2.*

☞ *Never apply 240VAC to these outputs! Permanent damage will result.*

Reset to Defaults

This feature, if applied, cancels all customer programming and returns the DPH-64 to factory defaults. Press VALUE several times until "Please Wait… " appears then keep depressed for several seconds. Reset is finished when 'SAVED' is displayed.
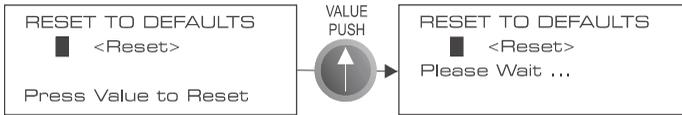

FIG 22 *Selecting P1 and P2 pulse output.*

WIRING GUIDE

The S1 and S2 output provide switched 240VAC. Pumps or solenoid valves are directly connected to the 3 way terminal with active neutral and earth. S3 and S4 have potential free contacts (NO, C, NC) to use with either low voltage devices or as a digital switch into a central monitor system.

A 240VAC terminal adjacent to S3 and S4 however make wiring easy if a 240VAC device is used. *(See Fig.23)*

P1 and P2 are contact closure outputs and polarity does not have to be observed when connecting a metering pump. Max ratings are 100V and 30mA. Never connect 240VAC to the pulse output. Instant permanent damage will occur!

Polarity has to be observed when connecting the 4-20mA current output. A TP-150 temperature electrode connected will enable automatic compensation for pH. S3 and S4 can now be connected to a heater *(etc)* for temperature control.
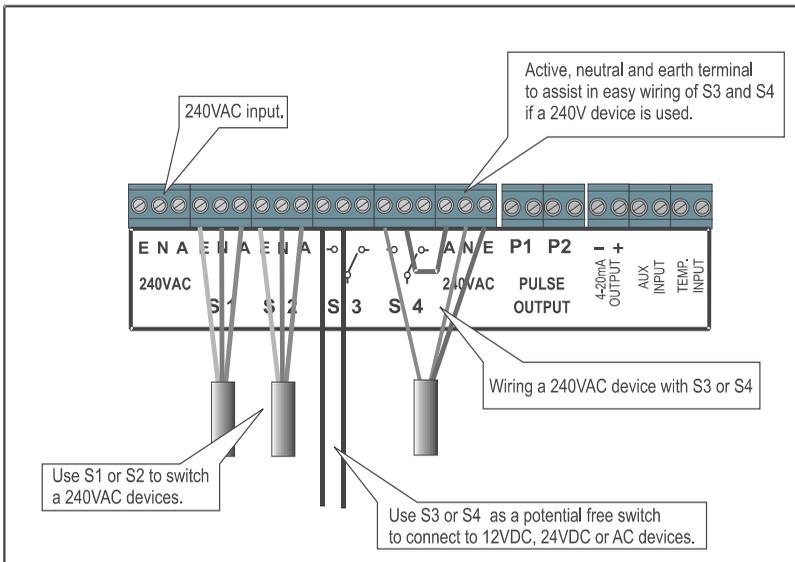

FIG 23 *Wiring options for the DPH-64.*

° DPH-64   SERIAL No.

Due to a continuing effort to improve the product the manufacturer reserves the right to change or alter the product without notices.