CONDUCTIVITY-
TEMPERATURE
CONTROLLER

DCH-2

USERS GUIDE

Please contact our Asia Pacific distributor:
H2O Rx
Phone: 0409 784 236 or 0421 795 353
info@h2orx.com.au
www.h2orx.com.au

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SPECIFICATIONS

General features:

Display: 3 1/2 digit LCD display

Signal output: 4-20mA constant current output. Select conductivity or temperature with DIP switch. Output fully isolated from instrument.

Power: 240VAC 50Hz 7VA max.

Housing: Thermoplastic with transparent lid. Rated **IP 55**

Dimensions: 182(W) x 137(H) x 108(D)mm.

Conductivity

Range: 4 ranges selected with DIP switch under subpanel 0-199.0uS, 0-1999uS, 10-19,999uS, 10-199,999uS

Temperature range: 0-100^{O}C

Temperature compensation: 0-100^{O}C, fully automatic, compensation can be adjusted for no compensation to 20% compensation at 100^{O}C Celsius.

Set point control: System 1 and System 2 can be configured separately for up/down dosing with conductivity or temperature.

Relay output: 2 relays with changeover contacts. Maximum rating 240VAC/Amps. (non inductive) Set point adjustment fully independent over entire selected range.

Cell: 3/4" BSP thread inline type with moulded 4 pin socket for cable connection. *(Immersion type available as optional extra.)*

Cell material: Polypropylene & stainless steel.

SPECIFICATIONS (cont.)

Temperature sensor: NTC thermistor type.
Sensor moulded into tip of electrode.
Temperature range of electrode 0-60^{o}C.

Cable length: Three metres.

Temperature:

Range: 0^{o}C to +199.9^{o}C, *(resolution 0.1^{o}C)*

Accuracy: $^{+}$/- 1^{o}C

Output control: 4-20mA constant current source
(internally selected)
4mA = 0^{o}C, 12mA = 50^{o}C, 20mA = 100^{o}C

Sensor: NTC Thermistor type
(rated temperature range 0-250^{o}C)

Size: 6mm Dia. x 120mm length.

Sensor body: 316 stainless steel with moulded 3 metres cable.

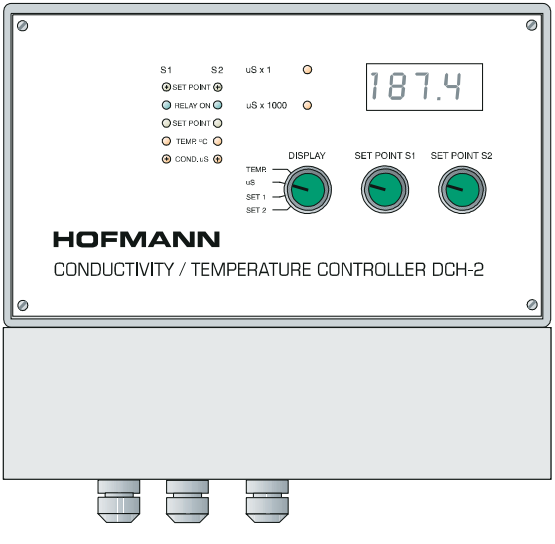


FIG.1 *THE LCM-2 CONTROLLER*

INTRODUCTION

The DCH-2 is well suited to operate in the hot and damp conditions often present around boilers, cooling towers and industrial sites in general. Moisture and accidental sprays are sealed off from the sensitive parts of the instrument with the transparent lid securely held in place with the 4 fasteners supplied with the unit. All cables feed through cable glands situated on the underside of the DCH-2.

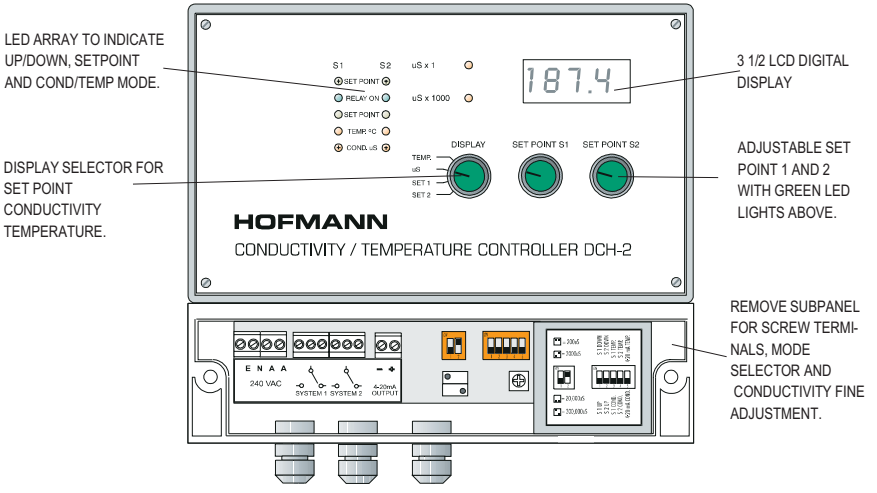


FIG.2 *FRONT PANEL LAYOUT*

The LCD 3 1/2 digit display shows either temperature, conductivity or SET POINT 1 and 2 when selected with the DISPLAY switch. Two small red LED's indicate the x1 or x1000 conductivity range selected. The SYSTEM 1 and SYSTEM 2 controls with corresponding green LED's adjust the desired set point. *(See Fig.2)*

The SET POINTS can be configured for up/down dosing, tracking the conductivity or temperature. DIP switch 2 located under the subpanel set the desired configuration.

A 1AMP fuse situated inside the enclosure only protects the instrument. The relays have change over contacts and require their separate fusing to comply with safety rules.

Removing the sub panel reveals the screw terminals for all electrical connections, configuration switches, calibrations for conductivity and the temp. compensation. The legend for the terminals printed on the subpanel allows an easy identification of the appropriate connections.

The DCH-2 can monitor and/or control conductivity and temperature simultaneously in an installation with the proper selection of the SET POINT configuration. The inherent accuracy of the 4-20mA constant current output and electrical isolation makes it possible to interface into a micro processor or logic controller to further expand the combination of installations with the DCH-2.

(See 4-20 mA constant current output.)

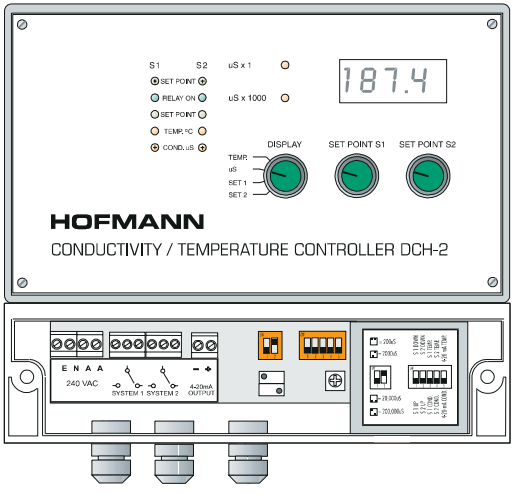


FIG.3 *TERMINAL CONNECTORS AND ADJUSTMENTS*

INSTALLATION

Instrument

Installation and setting up of the DCH-2 is easy and straight forward. No special tools are required. *(See Fig.2)* The 4 screws are inserted through 4 corner holes *(locking holes for the transparent lid)* and also fastened through them with a screw driver. All cables are fed through the 3 cable glands and terminated at the appropriate terminals. Always check that the stripped wire end is inserted above the small sliding metal block inside the terminal to ensure proper connection when tightening the terminal screw. *(See Fig.3)*

If the control relays are used to switch 240VAC a wire link may be connected between the 240V active terminal and the common contact of the relays.

Electrode

The cell is mounted in line into a 3/4" BSP Tee. The T-piece used to install the electrode must be **PVC** to ensure that no short circuit between the stainless steel electrodes and pipe fitting occurs. A conduction leakage may also affect the accuracy of the instrument reading if a metal T-piece is used.

The 4 core cable plugs into the 4 pin socket situated on the back of the electrode. Never cut the cable or rejoin the 4 wires to shorten or lengthen the cable, as this will result in unreliable and inferior performance. Always reconnect the whole length of the cable to the 4 pin plug. Longer cables up to 10 metres can be supplied on request.

The electrode in the standard package contains a 4 pin socket and a 3 metre cable. This greatly simplifies an installation where the cable is wired through a conduit or is fastened to a wall and the electrode screws into a pipe. For situations where it is necessary to simply immerse the electrode into the solution a special model with a 3 metre cable directly moulded to the body can be supplied on request.

The polypropylene electrode is used in applications with fluid temperatures up to 60^{o}C. A teflon electrode and the stainless steel temperature sensor are used for applications with fluid temperatures higher than 60^{o}C.

☞ *The T-piece used to install the electrode inline must be PVC to ensure that the LCM-2 performs accurate and reliable.*

4-20mA constant current output

Switch No. 5 of DIP switch 2 selects the conductivity or temper-ature signal to drive the 4-20mA current output. The DISPLAY switch setting has no effect on the selected mode of 4-20mA current output.

Conductivity range 0-200uS		Conductivity range 0-2000	
0uS =	4mA	0uS =	4mA
100uS =	12mA	1000uS =	12mA
200uS =	20mA	2000uS =	20mA
Conductivity range 0-20,000uS		**Conductivity range 0-200,000uS**	
0uS =	4mA	0uS =	4mA
10,000uS =	12mA	100,000uS =	12mA
20,000uS =	20mA	200,000uS =	20mA

Temperature range

0^{o}C = 4mA, 50^{o}C = 12mA, 100^{o}C = 20mA

☞ *The DCH-2 now features a fully isolated 4-20mA output and can be directly connected to other devices or micro processors without affecting the performance of the DCH-2.*

The 4-20mA output is DC current. The signal wires therefore must be connected with the right polarity observed. Any equipment connected with reversed wires will not function at all!

☞ *Normal coaxial cable such as TV cable may be used if desired with the shield providing the negative connection.*

Panel mounting.

Insert a round headed screw into the panel where the instrument is to be attached. This screw determines the centre of the instrument location. *(See Fig.4)* 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.

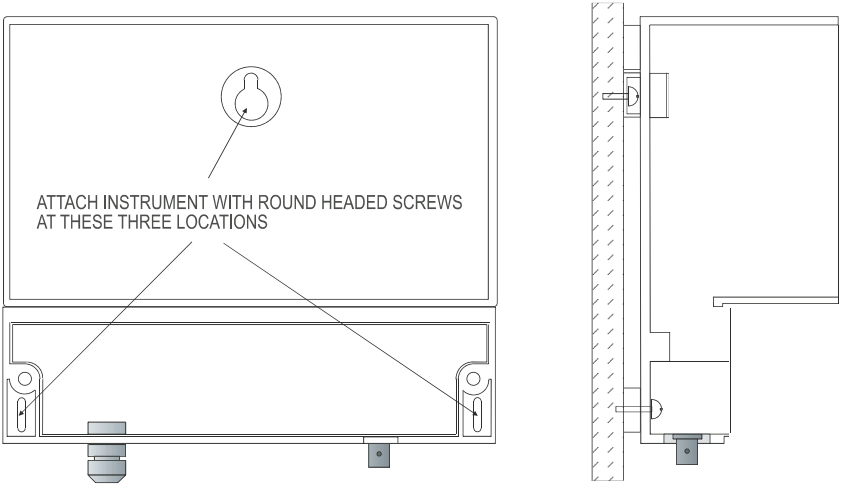
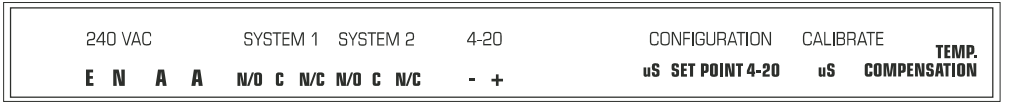
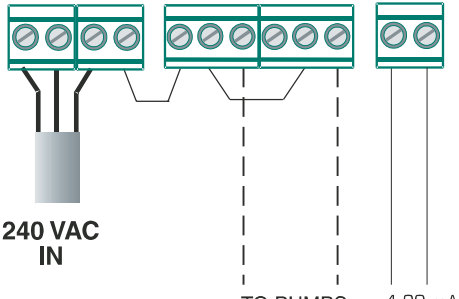
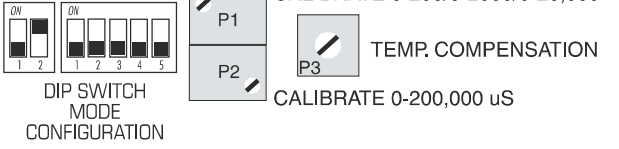


FIG.4 *ESCUTCHEON FOR THE DCH-2*

DCH-2 ELECTRICAL TERMINATION LAYOUT.







DIP SWITCH 1 CONFIGURATION

RANGE IN uSIEMENS

DIP SWITCH 2 CONFIGURATION

SWITCH		*OFF*	*ON*
1.	System1	DOWN	UP
2.	System2	DOWN	UP
3.	System1	COND.	TEMP.
4.	System2	COND.	TEMP.
5.	4-20mA	COND.	TEMP.

Only the active wires are looped and connected to the relay terminals. (See under Installation for specific instructions) All neutral and earth wires should be connected to their common power input terminals.

The 4-20 mA current output terminals are fully isolated from the instrument and can be connected to other appliances without causing earth loop problems between this unit and the connected instrument.

OPERATION

Initial check of the DCH-2

The LCD display, selected range light and a combination (depend-ent on the instrument configuration) of the small LED's will light up once the instrument is properly installed and the power connected. The two output relays may latch depending on the position of the SET POINT controls. Select TEMP. with the DISPLAY switch and ensure that the reading shows the approximate temperature of the liquid. With the DIP switch 1 select the desired uS range. Observe that the x1 or x1000 red LED lights up and the decimal point of the LCD display shows in the place according to the range selected. *(See "The LCD display")* Select SET 1 and SET 2 and rotate the corresponding SYS-TEM 1 and SYSTEM 2 controls to test the display for a proper readout of the set uS value. The minimum reading is 000 and will go into over range *(blank display)* just be-fore reaching maximum range with the set point control. Now select uS with the DISPLAY switch. The approximate uS value will be displayed.

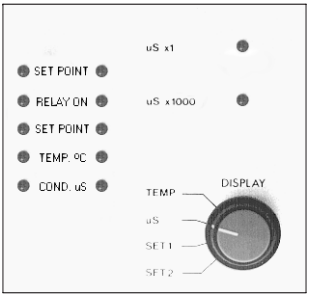


FIG.5 *LED arrangement for the DCH-2*

☞ *When sweeping across the range with the SET POINT control the operation of the relay appears to function in the reverse order. This however is only an illusion as it is obvious that the SET POINT is changing and not the value of the solution.*

The LCD display

The digital readout displays temperature, conductivity and the SET POINT 1 and 2 when selected with the DISPLAY selector.

4 conductivity ranges can be selected with the LCM-2 instrument.

0-199.9uS The LCD display shows the measured value in uS directly with a resolution of 0.1uS. *(TABLE 1)*

1-1999uS The LCD display shows the measured value in uS directly with a resolution of 1uS. *(TABLE 2)*

10-19,999uS The displayed reading is multiplied by 1000 to get the correct measured value. Resolution of this range is 10uS *(TABLE 3)*

100-199,999uS The displayed reading is multiplied by 1000 to get the correct measured value. Resolution of this range is 100uS. *(TABLE 4)*

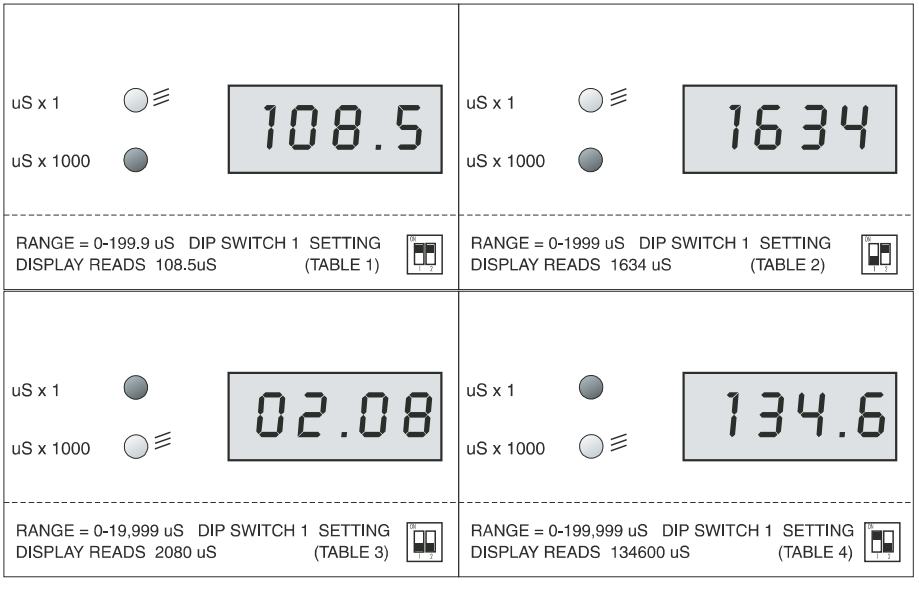


FIG.6 *THE DIFFERENT RANGE SETTINGS OF THE DCH-2*

Selecting mode of operation

The mode of operation is performed with the DIP switch 2. System1 and System2 work independent of each other and can be configured for conductivity or temperature control. SW1 and SW2 select the up/down mode of the relay versus the set point operation. SW3 and SW4 select the desired mode of control. SW5 selects temperature or conductivity tracking of the 4-20mA current out-put. The combinations of operation with these settings are to numerous for all to be mentioned here. Fig.7 gives some examples for various configurations.

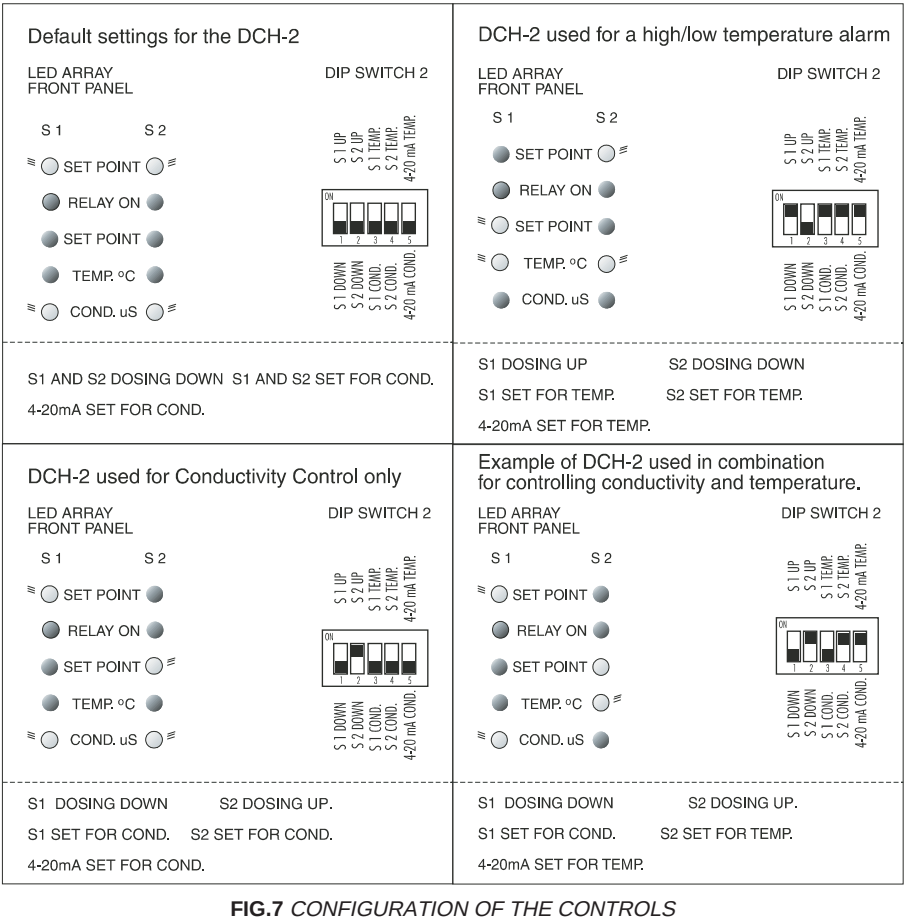


FIG.7 *CONFIGURATION OF THE CONTROLS*

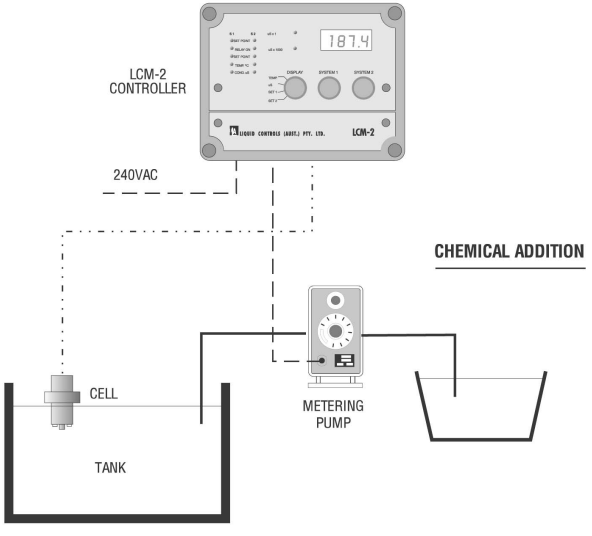


FIG.8 *USED IN CHEMICAL ADDITION*

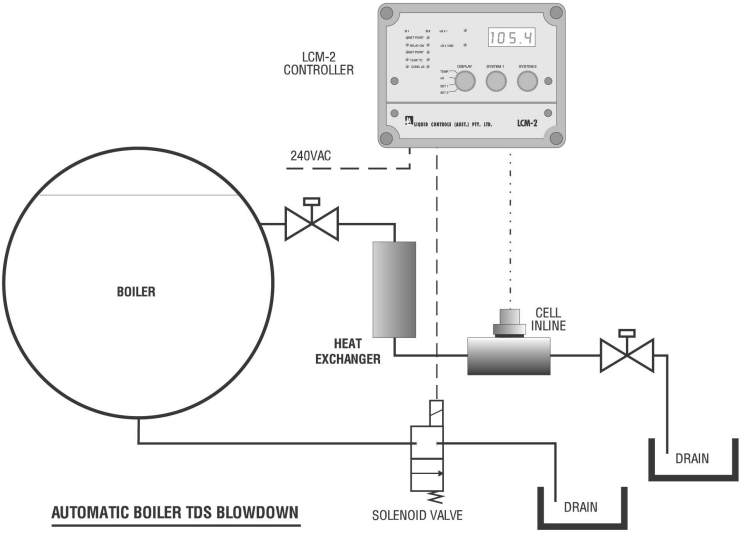


FIG.9 *AUTOMATIC BOILER TDS BLOWDOWN*

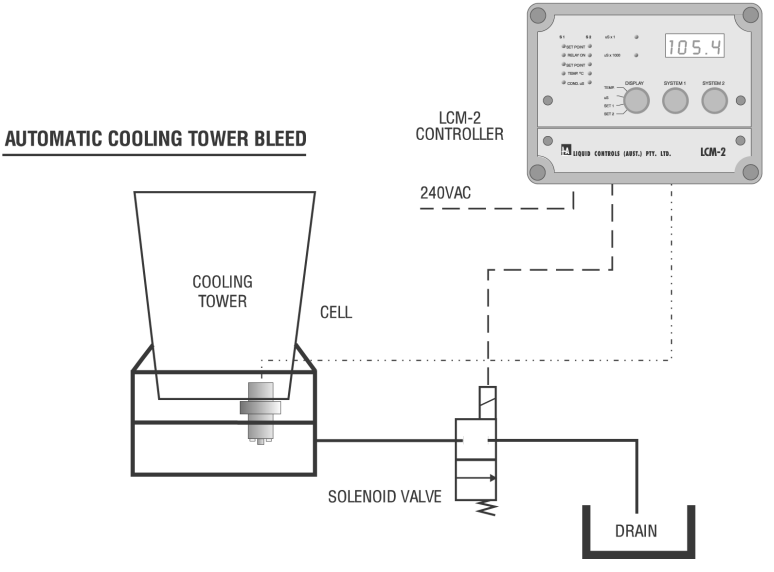


FIG.10 *AUTOMATIC COOLING TOWER BLEED*

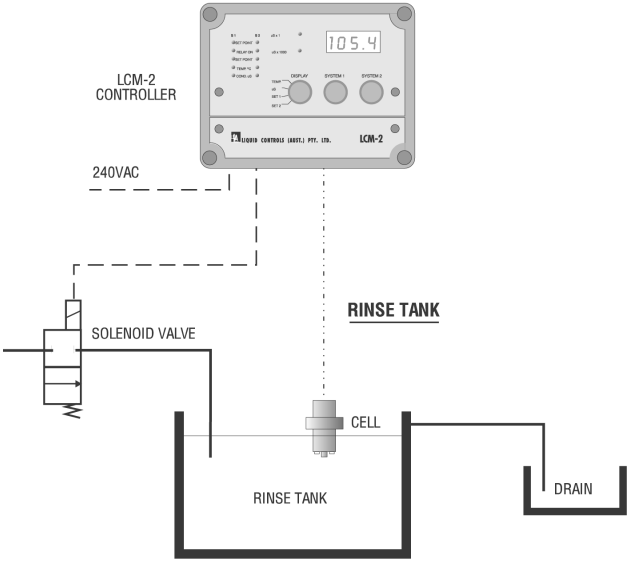


FIG.11 *USED WITH A RINSE TANK*

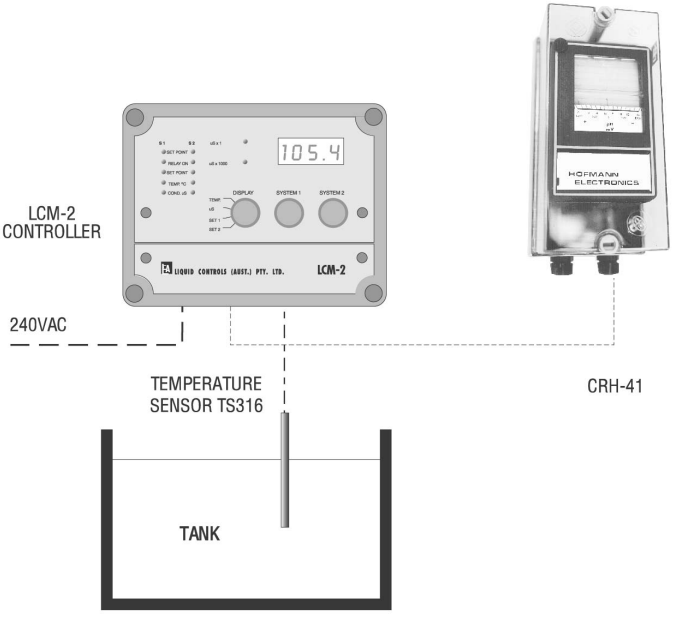


FIG.12 *CRH-41 RECORDING TEMPERATURE*

CALIBRATION OF THE DCH-2

Calibrating conductivity

For best performance use buffers nearest the uS range actually used in the installation. To adjust the calibration place the electrode in a known buffer solution.

☞ *Always check the temperature measurement before any conductivity adjustments are done as the electrode is temperature dependent.*

Calibrating the ranges 0-200 / 1-2000 / 10-20,000 uS

Select uS mode with the DISPLAY switch. Select the appropriate range for the correct buffer range. Remove the sub panel. With a small screw driver adjust potentiometer P1 for the correct uS setting.

Calibrating the range 100-200,000 uS

Potentiometer P1 and P2 adjust this range. P2 however only affects this range and is used if the calibration cannot be achieved with P1 alone.

Pre-calibration of temperature

Follow the same set-up procedure as described for the coarse adjustment. Disconnect the two wires of the temperature sensor and replace with a resistance of 1.35 KOhms. (Use a 5K and a 1.8K resistor in parallel or use a 5K potentiometer and adjust to the 1.35K value using a digital multimeter.) Remove the metal cover situated under the subpanel. Set DISPLAY to TEMP, then turn potentiometer No.1 (temp. OFFSET) to the highest reading possible. *(fully clockwise)* With potentiometer No.2 (temp. SPAN) adjust the displayed temperature to read 72.0^{o}C. Use potentiometer No.1 to reduce the reading back to 25.0^{o}C. Reconnect the temperature sensor that will now track the temperature with an accuracy of aprox. 2^{o}C. This calibration will be adequate for most applications that use the temperature only for compensation purposes.

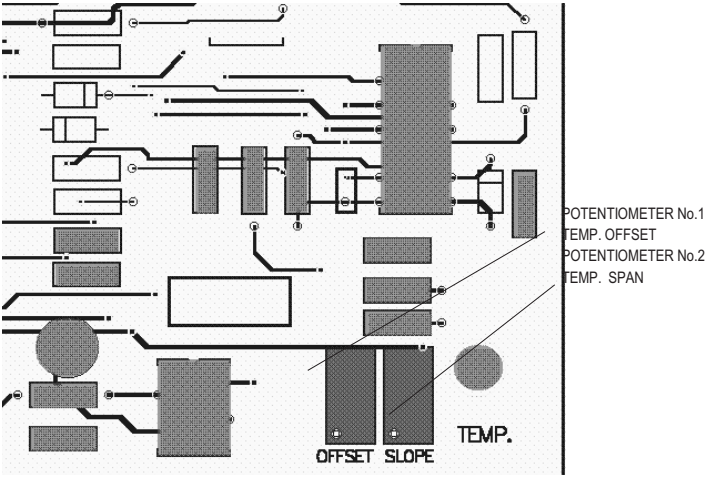


FIG.13 *ADJUSTMENTS FOR TEMPERATURE*

Calibrating temperature with the electrode

Select TEMP. mode with the DISPLAY switch. Place the sensor into a sample of water with a max. temperature of not more than 4-5^{o}C. Wait for 10 min. for the sensor to stabilize. Adjust potentiome-ter No.1 (temp. OFFSET) until the display corresponds with the actual temperature. Place the electrode into water with a temperature of at least 50^{o}C, wait 15 min. and use potentiometer No.2 (temp. SPAN) to adjust the reading. *(See Fig.13)*

☞ *The standard polypropylene electrode takes aprox. 15 min to track temperature changes of 50^{o}C. If the installation requires an accurate and fast tracking of temperature or conductivity the stainless steel temperature sensor TS-316 must be used in place of the build-in temp. sensor.*

CalibTTemperature compensation for conductivity

The electrical signal from a conductivity electrode increases with a rise in temperature of the fluid being controlled. A conductivity controller has to compensate for this by reducing the sensitivity of the instrument to maintain an overall accuracy of measurement. The DCH-2 has a compensation factor set at 0.2 that means the conductivity gain reduces by a factor of 5 with a temperature increase of 100^{o}C. This performance will suit most applications, however the compensation factor can easily be adjusted for individual installations. *(See below)*

Calibrating the compensation factor

Select the 1-2000uS range. Remove the electrode wires from the terminal. Connect a 1KOhm resistor across the conductivity input and a 5KOhm potentiometer across the temperature input. Switch to TEMP with the DISPLAY selector. Adjust the connected potentiome-ter until the display reading shows 100^{o}C. Select uS with the DISPLAY switch. Turn the potentiometer P3 situated with the calibration potentiometers *(temp.compensation)* fully anti-clock-wise until the maximum uS reading is achieved. *(Compensation is set to 0)* With the calibration potentiometer P1 (conductivity adjust.) select 1000uS. Calculate 20% of the dialed number (200uS) and with potentiometer P3 align the displayed uS to read the calculated value. The LCM-2 is now compensated to the standard scale. This procedure is also used to calibrate for other different compensation factors if there calculated value is known. ie.(0.4 = 40% = 400uS)

☞ *All calibration procedures described here can be greatly simplified with a* **HOFMANN** *uS/temperature simulator CMH-2*

Setting the compensation factor with batch samples

The fast responding stainless steel sensor **TS- 316** is preferable for this operation. Use a batch sample with as low a temperature as possible. *(max 20^{o}C)* First check temperature for proper reading and recalibrate if necessary. *(See temperature)*

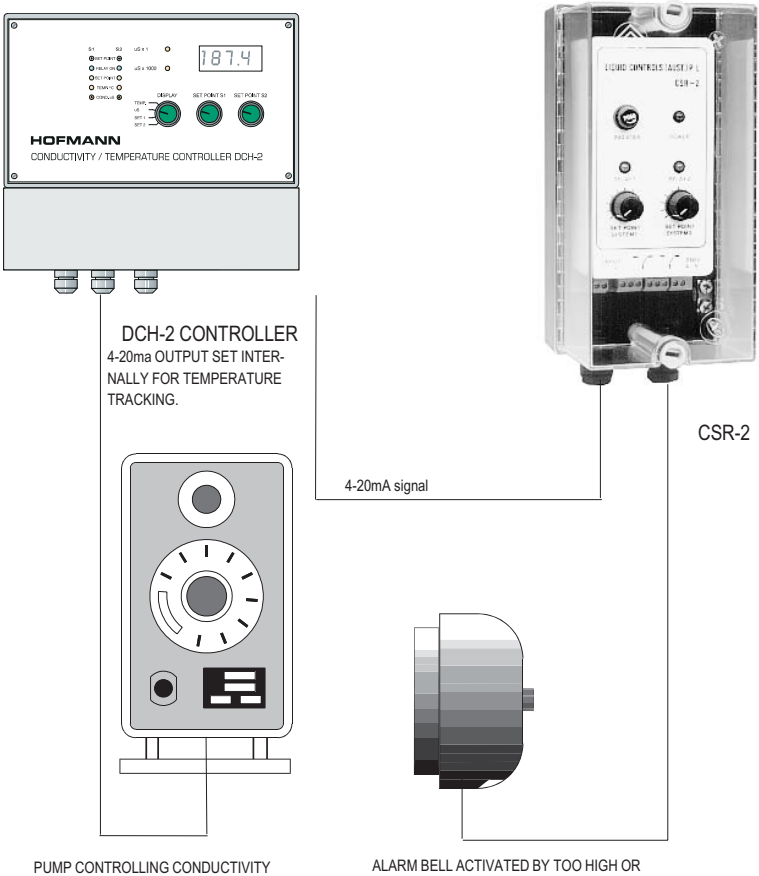
Check and calibrate the displayed uS *(See uS calibration)* to the known value. Seal the container with the batch sample to avoid evaporation that would give an erroneous reading through concentration of the PPM. Heat the liquid to above 50^{o}C. Check and adjust *(if necessary)* the temperature. Select uS and read the displayed value. Any deviation of uS from the first measured value is corrected with the potentiometer P3. *(Compensation factor)*

This procedure should now be repeated a few times to obtain a reasonable accuracy. The compensation adjustment made at the higher temperature will also have an effect at the lower temperature setting if the first temperature set up is substantially higher than 10^{o}C. It is apparent that both adjustments are interactive with each other and a slight allowance should be made when correcting the uS value or the compensation factor to avoid numerous repetitions of this procedure.

The temperature reading displays an over-range mode (showing a 1 and three blank digits) if the sensor is faulty or a connection to the DCH-2 becomes open circuit.

DCH-2 controlling uS with high/low temperature alarm

This example illustrated below is only one of many combinations possible with the DCH-2 controller.



OPTIONS

Polypropylene electrode with moulded cable for full immersion into the liquid.

High temperature teflon electrode (used with TS-316)

Stainless steel temperature sensor ***TS-316.***

An escutcheon for the ***DCH-2*** enclosure will enable a panel mounted installation.

The ***CRH-31/41*** chart recorder can be used to record conductivity or temperature.

The ***CSR-2*** current sense relay controller expands the ***DCH-2*** to a four set point controller with the ability to select a combination of conductivity and temperature controls.

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

WARRANTY

We, **HOFMANN ELECTRONICS,** guarantee this unit against defects due to faulty manufacture or breakdown of components for a period of twelve month from the date of purchase, subject to the following provisions:

- The guarantee will cover original failure of parts and natural defects due to manufacturing causes. Otherwise repair charges are to be to the owners cost.
- The warranty does not cover any carriage costs.

The warranty is void if:

- The instrument is damaged due to rough handling or transport after purchase.
- The article has not been used in accordance with the operating instructions.
- Any parts in the instrument have been changed or have been altered in any way.
- The serial number is removed or defaced.

All other warranties and conditions, express or implied, are void.

MODEL: DCH-2 SERIAL NO:

SOLD & SERVICED:

NOTES: