

User's Guide



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CDCN12-13

Cooling Tower/Boiler Controllers



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The information contained in this document is believed to be correct, but OMEGA accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.

WARNING: These products are not designed for use in, and should not be used for, human applications.

IMPORTANT SAFETY INSTRUCTIONS

Specified by ITS Testing Services for Swimming Pools and Spas

1. **READ AND FOLLOW ALL INSTRUCTIONS**
2. **WARNING** - To reduce the risk of injury, do not permit children to use this product unless they are closely supervised at all times.
3. A wire connector is provided on this unit to connect a minimum No. 8 AWG solid copper conductor between this unit and any metal equipment, metal enclosures or electrical equipment, metal water pipe or conduit within 5 feet of this unit.
4. **DANGER** - Risk of injury.
 - a) Replace damaged cord immediately.
 - b) Do not bury cord.
 - c) Connect to a grounded, grounding type receptacle only.
5. **WARNING** - This product must be connected to a power source equipped with a ground-fault circuit interrupter (GFCI). The GFCI must be tested before each use. With the product operating, open the service door. If the product stops operating, this merely indicates that the door is equipped with an electrical interlock. Next, push the test button on the GFCI and close the service door. The product should not operate. Now open the service door, push the reset button on the GFCI and close the service door. The product should now operate normally. If the product fails to operate in this manner, there is a ground current flowing indicating the possibility of an electric shock. Disconnect the power until the fault has been identified and corrected.
6. **DANGER** - Risk of electric shock. Install at least 5 feet (1.5 m) from inside wall of tub or spa using nonmetallic plumbing.
7. **DANGER** - Risk of electric shock. Do not permit any electric appliance, such as a light, telephone, radio, or television, within 5 feet (1.5 m) of a spa or hot tub.
8. When handling hydrochloric (muriatic) acid, always follow the manufacturer's handling precautions and guidelines. Use only as directed.
9. **WARNING** - To reduce the risk of injury:
 - a) The water in a spa should never exceed 40 °C (104 °F). Water temperatures between 38 °C (100 °F) and 40 °C (104 °F) are considered safe for a healthy adult. Lower water temperatures are recommended for young children and when spa use exceeds 10 minutes.
 - b) Since excessive water temperatures have a high potential for causing fetal damage during early months of pregnancy, pregnant or possibly pregnant women should limit spa water temperatures to 38 °C (100 °F).
 - c) Before entering a spa or hot tub, the user should measure the water temperature with an accurate thermometer since the tolerance of water temperature-regulating devices varies.
 - d) The use of alcohol, drugs or medication before or during spa or hot tub use may lead to unconsciousness with the possibility of drowning.
 - e) Persons suffering from obesity or with a medical history of heart disease, low or high blood pressure, circulatory system problems or diabetes should consult a physician before using a spa.
 - f) Persons using medication should consult a physician before using a spa or hot tub since some medication may induce drowsiness while other medications may affect heart rate, blood pressures and circulation.
10. **SAVE THESE INSTRUCTIONS**

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CHAPTER I - INTRODUCTION

AUTOMATION

Congratulations on your selection of an OMEGA CDCN Programmable Controller for your water treatment facility.

OMEGA CDCN Automation uses the most advanced electronic sensing technology to monitor and control the critical parameters for water treatment, i.e. conductivity, pH, Oxidation-Reduction Potential (ORP) and temperature. Also available is monitoring of flow rates for make-up and bleed water and influent/effluent filter pressures.

This Instruction Manual covers the following models:

- **CDCN12** with Conductivity control, pH control, Temperature monitoring, and two (or three) additives programs,
- **CDCN13** with Conductivity control, pH control, optional ORP control, Temperature monitoring, fill and bleed water flow programs, and four additives programs.

Data logging and remote operation (with an internal modem and software) are available on all models.

Use the appropriate sections in the manual for each model.

Water Maintenance

The primary purpose of water treatment is protection of the equipment from the aggressiveness of water and prevention of bacteriological growth.

The guidelines for cooling towers include the following:

- Conductivity typically below 5,000 $\mu\text{S}/\text{cm}$ - corresponding to Total Dissolved Solids (TDS) of less than 2,500 ppm (mg/l) - to prevent precipitation of dissolved salts and corrosion products,
- pH between 7.0 and 9.0, depending on chemical treatment, to prevent scaling or corrosion,
- Oxidation-Reduction Potential (ORP) above 650 mV to prevent algae growth and growth of bacteria, such as Pseudomonas, E. Coli, etc.,
- proper water balance with Langelier Saturation Index values between 0 and 0.3 for untreated waters, or up to 2.0 - for waters treated with phosphonates and/or polyacrylates,
- adequate filtration with a maximum turnover rate of six hours.

Table I - TYPICAL TREATMENT VALUES

TYPICAL WATER TREATMENT FOR COOLING TOWERS			
TEST	MIN	IDEAL	MAX
CONDUCTIVITY, $\mu\text{S}/\text{cm}$			5,000
TDS, ppm			2,500
pH	7.0	8.5	9.0
ORP, mV	650	750	
LANGELIER SATURATION INDEX	0.0		2.0

CONTROLLER FEATURES

Integrated Water Treatment

Professional water treatment for cooling towers, boilers, and other industrial applications requires the use of separate chemical and physical processes to remove undesirable and harmful components. Until recently, all these different processes were controlled individually, very often resulting in operational conflicts and costly treatment problems.

The OMEGA CDCN is an advanced controller that integrates all the different processes for complete water treatment. Designed around a sophisticated microprocessor with a large computer-like LCD (Liquid Crystal Display) screen, it displays full-size menus and submenus, making it easy to use even for people with little or no computer experience. All displays and adjustments are accessible from menu screens that are laid out in a logical and intuitive order. They can in fact be used without reference to the instruction manual.

All sensing devices are connected to the control module. This makes it possible to monitor the status of all operational parameters at a glance. Also, in case of malfunction or alarm, the operator is immediately alerted.

All control outputs are also connected to the single control panel which makes installation and maintenance much easier than with separate control units.

The central microprocessor manages all monitoring and control functions, including control of the recirculation pump, chemical additions, water balance, filter backwash and heater control.

Control Functions

The following display and control functions are available on the Omega CDCN Controllers:

- **Conductivity** in microsiemens/cm or as **Total Dissolved Solids (TDS)** in ppm or mg/l with programmable bleed,
- **Temperature** display in degrees Fahrenheit or Celsius,
- **pH** from 0 to 14 with capability for programmable acid and base feed,
- **Oxidation-Reduction Potential (ORP or Redox)** in millivolts with programmable oxidizer feed, superoxidation and chemical savings program,
- **Water Recirculation** with display of the flowrates for make-up/fill and bleed water in gallons per minute (gpm) or liters per minute (l/m), cumulative flows in gallons (ga) or liters (l),
- **Filtration** with display of inlet and outlet pressures and programmable filter backwashing based on choice of time, inlet pressure, pressure differential or combinations of the above.

- **Additive Feed** for inhibitors, biocides, descalers, etc. - with choice of feed programs: manual, automatic (bleed & feed or bleed-then-feed), cycle timer, percent of flow, or daily schedule controls with bleed and feed lockout, pre-bleed and pre-pH functions.
- **Water Balance** and **Saturation Condition** derived from the **Langelier Saturation Index** and showing water balance conditions as either OK, corrosive or scaling.

In addition, a 24-hour clock/calendar shows the date and time on the main screen. For other models that do not include all the functions listed above, only the applicable screens and menus are displayed.

Probe Failure Analysis

The CDCN introduces a new proprietary technology (US Patent No. 6,657,546) called Probe Failure Analysis.

Conventional controllers detect probe failure by waiting for an alarm condition to develop. The CDCN features dynamic testing of the response of the ORP and pH sensors.

This makes it possible for the controller to detect a probe failure very soon after the sensor fails to respond properly, therefore avoiding dangerous out-of-range conditions.

Remote Communications

The CDCN features complete communication remote access by telephone or by IBM PC-compatible computer under Windows®. It provides the following capabilities:

- remote operation of controller with exact duplication of the LCD screen display and full access to all the menus and submenus,
- voice telephone report of test data,
- remote operational control by touch-tone phone,
- alarm callouts to up to six different pre-selected telephone numbers,
- automatic scanning of multiple facilities with programmable download and storage of test data on remote computer.

Remote Operation

Unlike controllers that provide only a simulated representation of the display screen, the CDCN features true remote duplication of the controller screen.

This means that any change on the CDCN screen is immediately reproduced on the remote computer screen. And vice versa, any operation that is performed on the remote computer is reproduced immediately on the controller.

The same commands are available on both units. This allows instant verification and adjustment of all control parameters. Changes in parameter settings are subject to password verification to prevent unauthorized access.



Figure 1 - Control Panel of CDCN13

CONTROL PANEL

LCD Display Screen

The operator operates the controller with the control panel, as shown in Figure 1 for the CDCN13. It features an LCD display screen with eight lines of text for menus and submenus and a 16-key data entry keyboard.

NOTE: The CDCN12 display shows only four lines of text at a time. It can be scrolled with the UP and DOWN ARROW keys to show all the lines.

The LCD display shows "normal" characters (black on white), reverse characters (white on black) to highlight selected options, or flashing characters for alarm conditions.

The brightness of the LCD display screen can be adjusted with the potentiometer inside the cabinet on the Mother Board. It is located near the center of the board (R39 for the CDCN13) or upper right side (R36 for the CDCN12). See the schematics in Chapter IV - Installation.

The LCD display screen features backlight illumination for better viewing at night and in dark areas. The backlight stays on as long as the unit is on.

Display Readings

The Display Screen for the CDCN13 (Figure 1) shows all the operating features at a glance.

- Line 1 shows a **Conductivity** reading of 2000 $\mu\text{S}/\text{cm}$ with the bleed valve in Automatic (A) mode and currently activated (>).
- Line 2 shows a **pH** reading of 8.5 with the Acid feed mode in Automatic (A) and not running (no >).

Line 3 shows an **ORP** reading of 750 mV with the feed pump in the OFF mode (X).

Line 4 shows a **Temperature** reading of 72 F.

Line 5 shows the **Flow Rates** for make-up/fill and bleed waters at 15 and 10 gpm respectively, and the fill valve in Automatic mode (A) and not running (no >).

Line 6 shows the **Influent and Effluent Pressures** at 25 and 20 psi respectively and the backwash program in the Manual mode (M).

Line 7 shows control modes of the four **Additives**: Timer (T) for additive 1, Daily Schedule (S) for additives 2 and 3, Off (X) for additive 4.

Line 8 shows the **Date and Time** and an indication that the **Langelier Saturation Index (LSI)** as OK. The line is highlighted to give access to the Configuration Menu.

Data Entry Keyboard

The data entry keyboard replaces the knobs and switches of conventional controllers. All operational entries such as choice of operational mode, calibration, control setpoints, alarms and programming are performed with the 16 keys of the keyboard.

The keyboard consists of a full 16-key numeric keypad. There are ten digits from "0" to "9" plus the decimal point "." for data entry.

The operator navigates through all the menus and submenus with the four directional arrow keys: UP, DOWN, LEFT, and RIGHT.

The UP and DOWN ARROW keys move the cursor up and down each screen - with looping capability at both the top and the bottom of the screen. The RIGHT ARROW key is used to enter a submenu. The LEFT ARROW key is used to exit a submenu and return to the previous menu. The LEFT key can be pressed repeatedly from any submenu to return to the main display screen.

The "OK" key is used to confirm numerical data entry.

PROGRAM MENUS

Welcome Screen

When power is applied to the controller, the CDCN displays the Welcome Screen shown to the right. It shows the version of operating software installed on the controller and the numbers for Technical Support from the factory by phone 800-872-9436.

Display Screens

The Welcome Screen is followed by one of the display screens, as shown on the right. The CDCN13 shows 8 lines of display. The CDCN12 shows 4 lines with additional lines available with the DOWN ARROW key.

The Display Screen is the normal monitoring screen. It displays several lines of information, one for each operating function and one for system conditions.

Each line displays operational information on five columns, from left to right:

1. operational status (ON or OFF) with a small arrow indicating outlet activation,
2. function identification: CONDUCTIVITY, pH, ORP, TEMPERATURE, FLOWS, FILTER, and ADDITIVES,
3. Sensor readings,
4. units of measurement (US or metric),
5. operational mode, represented by a single letter:

A for automatic control,
M for manual operation,
T for cycle timer,
F for percent of flow,
S for daily schedule,
X for OFF.

Main Menus and Submenus

As shown on the Menu Tree next page, there are several **Main Menus** that are accessed directly from the Display Screen, one for each operating function and one for system configuration. The **Submenus** are additional menus that are accessed from the main menus or other submenus.

The four arrow keys located on the front panel keypad are used to navigate through the menus. To access a submenu, use the UP and DOWN ARROW keys to highlight the desired line and press the RIGHT ARROW key. To exit from a submenu, press the LEFT ARROW key.

In this chapter, menus and submenus are identified by their line numbers that provide a road map for quick location.

Alarm Displays

Probe failure, out-of-range, overfeed and simulated low chemical level conditions are indicated on the Display Screen and on the Main Menus with flashing characters. For probe failure, the display flashes "Probe" on the corresponding line.

Welcome Screen

PROGRAMMABLE CONTROLLER Version 1.7 TECHNICAL SUPPORT			
OMEGA Phone 800-872-9436			

CDCN13 Main Display

➤ COND	2000	uS	A
pH	8.5	pH	A
ORP	750	mV	X
TEMP	72	F	X
FLOW	15/10	gpm	A
➤ FILTER	N.A.		
ADDITIVES			TSFS
06/31/04	19:06		LSI OK

CDCN12 Main Display

➤ COND	2000	uS	A
pH	8.5	pH	A
TEMP	72	F	X
ADDITIVES			TSFS
06/31/04	19:06	LSI OK	

The display flashes for out-of-range, overfeed or simulated low chemical level alarm conditions. To determine the cause of alarm, move down with the DOWN ARROW key and enter the submenu with the RIGHT ARROW key.

Table II - Program Overview

CONDUCTIVITY
 ACID / BASE
 ORP
 TEMPERATURE
 FLOW RATES
 FILTER
 ADDITIVES
 CONFIGURATION

MAIN

MENUS

CONTROLS

CONFIGURATION

CONDUCTIVITY

Calibrate
 Setpoint
 Alarm Low
 Alarm High
 Time Limit
 Run Time
 Select Scale

WATER LEVEL

Fill flow
 Total
 Bleed flow
 Total
 P influent
 P effluent
 Main Pump

CONTROL TYPE

OFF
 Manual
 Automatic Cycle Timer
 % of Flow
 Daily Schedule

Initial Setup
 Operations
 Communications

pH

Calibrate
 Setpoint
 Alarm Low
 Alarm High
 Time Limit
 Run Time
 Last Shock

BACKWASH

Start Date
 Start Time
 Filter Time
 Advance Time
 Number of Filters
 Limit Timer
 Pump Override

BLEED AND FEED

Feed %
 Max Time
 Daily Schedule

INITIAL SETUP

Language
 Units
 Code No.
 Clock
 Readings
 Data Logging
 Model Options

ORP

Calibrate
 Setpoint
 Alarm Low
 Alarm High
 Time Limit
 Run Time
 Probe Clean

ADDITIVES

Inhibitor
 Descaler
 Biocide
 Flocculant

BLEED LOCKOUT

Lockout %
 Lock memory
 Pre-bleed
 Pre-bleed
 Pre-pH

OPERATIONS

Audio Alarms
 Bypass Line
 Saturation Index
 Print Reports
 Reset
 Battery
 Probe Monitor

TEMPERATURE

Calibrate
 Alarm Low
 Alarm High

DAILY SCHEDULE

Next date
 Cycle (days)
 Start time
 Run time
 Bleed lockout
 Last date

COMMUNICATIONS

Phone Numbers
 Unit I.D.
 Alarm Calling

CALIBRATION OPTIONS

1 Point (zero)
 2 Point (slope)
 3 Point (curve)

CHAPTER II – INSTALLATION

See important safety information on the first page of the manual.

UNPACKING

Immediately upon receipt of your shipment, check the shipping carton carefully for damage and report any damage directly to the shipping company. Please report any shortage immediately to the factory.

Before opening the carton, check the outside label and verify the model number and options. Unpack the carton carefully, taking care not to lose any of the smaller parts, such as PVC fittings.

The controller carton should include the following:

- Controller Cabinet,
- Sensors as required for selected model,
- Instruction Manual and Warranty Card,
- Installation Report to be mailed back to the factory upon completion of installation,
- PVC fittings and Tees, or optional assemblies.

INSTALLATION REPORT

The Installation Report is a triplicate form designed to assure warranty coverage, technical updates and factory support.

1. White copy: to mail back to factory.
2. Pink copy: to Facilities Manager.
3. Yellow copy: to Qualified Dealer.

It must be filled out and signed by the Qualified Dealer and the facilities manager upon completion of installation.

TECHNICAL SUPPORT

Please take the time to read this detailed Instruction Manual to insure proper installation and operation. If you need further technical assistance, you can Omega Engineering Inc. at 800-872-9436.

OVERVIEW

The CDCN constitutes an integrated command center for complete monitoring and control of all water treatment operations, including chemistry and filtration.

All information provided by the sensors is processed by the microprocessor on the Mother Board and displayed on the Main Display screen. Command signals are then sent to the different control outputs on the Power Board (see ELECTRICAL below).

The schematic of installation in Figure 2 shows the principle of installation for the CDCN13.

The schematic of installation in Figure 3 shows the principle of installation for the CDCN12.

CONTROLLER CABINET

The CDCN controllers are contained in rain proof and splash proof NEMA Type 4X cabinets. All electronic and electrical components are mounted inside the cabinet on two separate PC Boards. Outlets are provided on the bottom of the cabinet for 1/2" conduit connectors.

The external dimensions of the cabinets and the positioning of the mounting holes are shown in **Error! Reference source not found.**, Figure and **Error! Reference source not found.** To deter unauthorized removal, the mounting holes are accessible only from the inside of the cabinet. To facilitate installation however, external mounting ears are also included.

LOCATION

The cabinet should be mounted on a wall in a secure location:

- meeting electrical code requirements,
- within 10' (3 m) of the main recirculation line or of the bypass line - unless special extension cables are used for the sensors,
- not exposed to direct sunlight as the LCD display screen will darken at high temperature,
- easily accessible to maintenance personnel,
- if possible, in a separate room, or in a well-ventilated room as far away as possible from corrosive chemicals and storage tanks,
- away from power transformers, pump motors or high voltage power lines,
- safe from unauthorized access or vandalism.

Figure 2 – CDCN13 Controller Cabinet

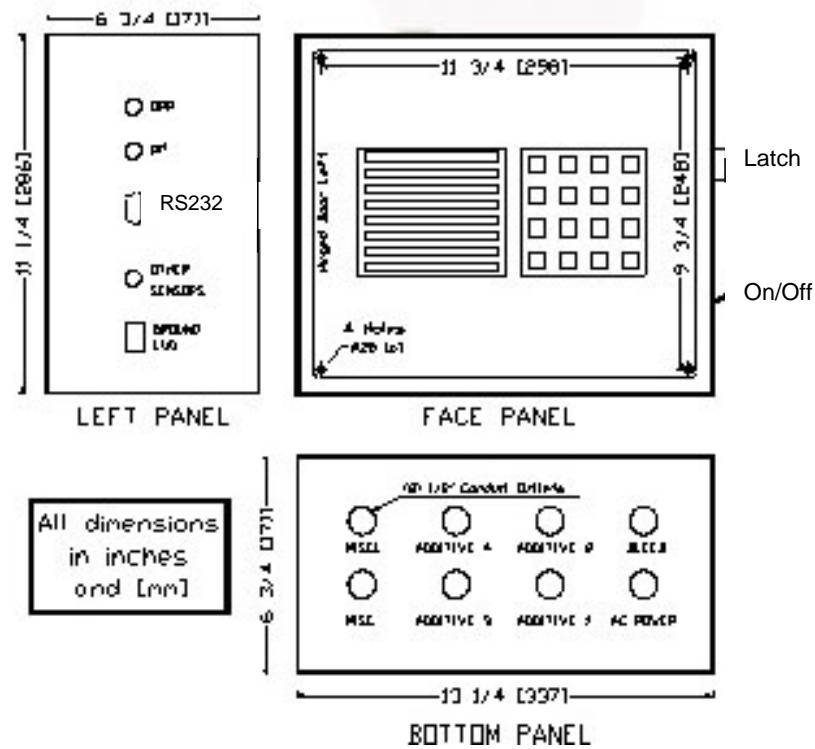
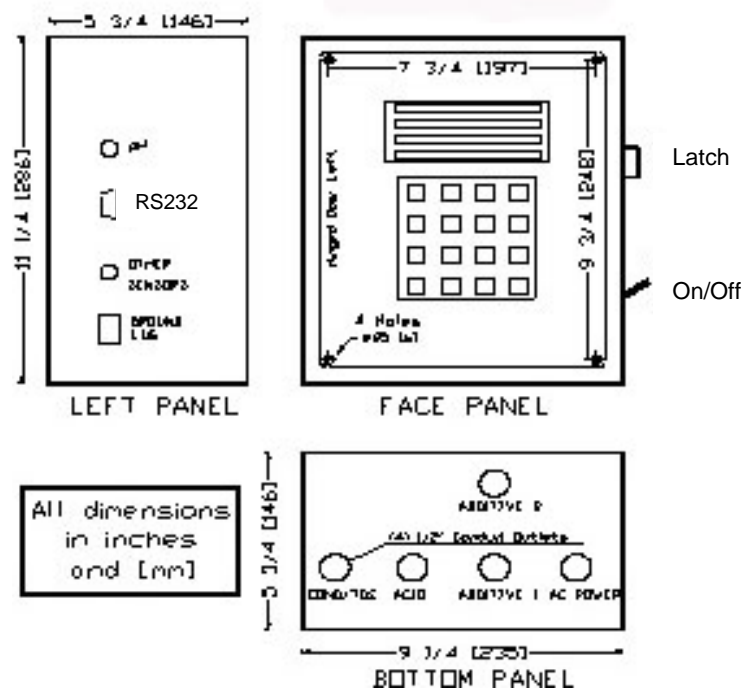


Figure 3 – CDCN12 Controller Cabinet



ELECTRICAL

Electrical Codes

The controller is available in either hard-wiring or plug-in configurations. Make sure to use the proper type of wiring according to the local electrical code, usually the same as for the chemical feeders.

The internal wiring of the controller is standard US, i.e.:

BLACK	HOT
WHITE	COMMON
GREEN	GROUND

Grounding (GFI)

A grounding lug is provided on the left side of the cabinet. It is important to connect it to a proper earth ground to prevent dangerous current leakage and electrical shock. Ground Fault Interruption (GFI) protection is also strongly recommended for all installations.

AC Power Input

The CDCN is a dual-voltage controller with a voltage selector switch located inside the cabinet on the Power Board (see next page). Before connecting the unit to an external power supply, make sure that the voltage selector switch is set to the proper AC power input: 115 V or 230 V.

CAUTION: Damage resulting from improper voltage selection is not covered by manufacturer warranty.

Main Power Interlock

To prevent accidental chemical feeding, the controller and the chemical feeders should always be interlocked - i.e. wired in parallel - with the manual switch for the main pump so that there is no danger of feeding the chemicals if there is no water flow in the recirculation line.

Panel Interlock

For safety of operation, a panel interlock switch is mounted inside the cabinet to shut off all internal power when the control panel is open.

DO NOT ATTEMPT TO DEFEAT ITS PURPOSE !!!

PC Boards

There are two PC boards inside each controller cabinet: a Power Board (Figure 4 or Figure 6) and a Mother Board (Figure 5 or Figure 7). They contain all the electrical and electronic components for the controller. The two boards are connected together with a flexible ribbon connector.

The schematics for the two boards show the location of the key components. In addition, all components are also labeled on the PC boards themselves.

The PC boards are protected with a 1 A fuse that is mounted on the upper right of the Power Board. If the fuse has to be replaced, make sure to use a one (1) Amp fuse only. The use of a larger fuse may cause irreparable damage to the electronic boards.

Power Board

The Power Board (Figure 4 or Figure 6) is mounted on the back panel of the controller cabinet. As shown on the schematic, it contains all the high voltage (115 or 230 V) circuits and components for inputs and outputs.

115V/230V Power Transformer

The CDCN is equipped with a switchable, dual voltage power transformer that is mounted on the Power Board inside the cabinet.

The voltage selector switch is located near the upper right of the board. Always verify that the switch is set to the correct voltage, either 115 or 230V. Connecting the controller to higher voltage may cause damage to the electronics that is not covered by the manufacturer's warranty.

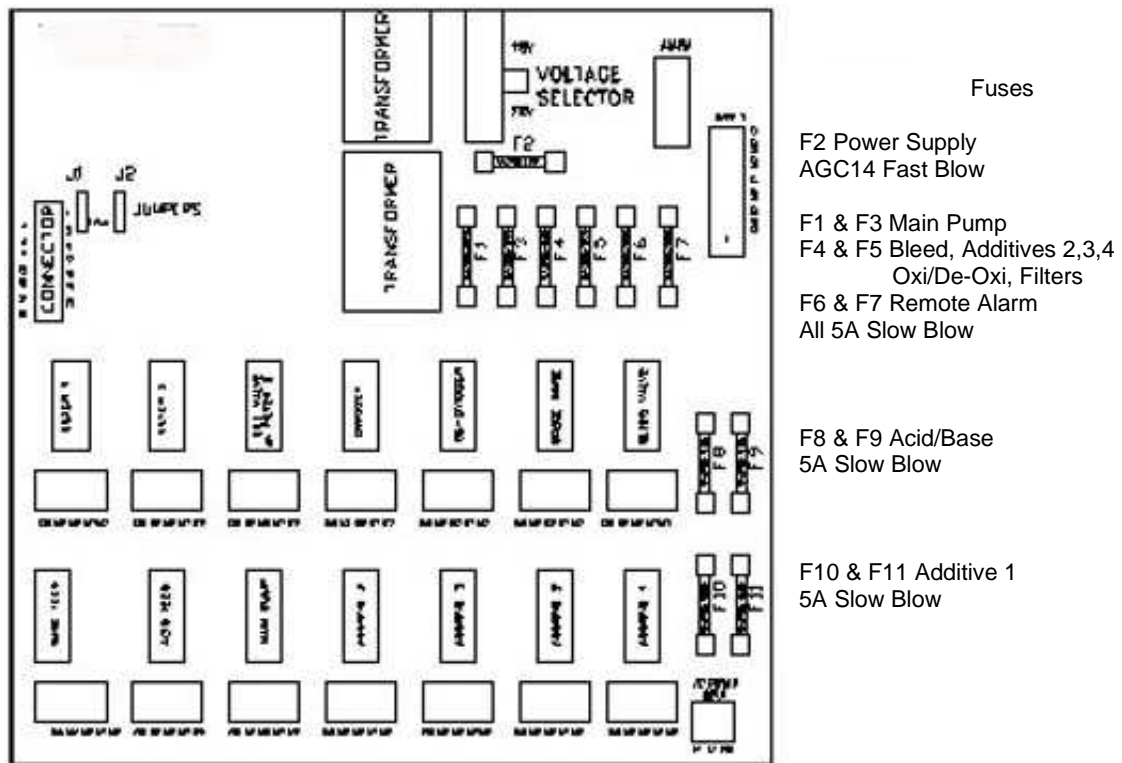


Figure 4 – CDCN13 Power Board

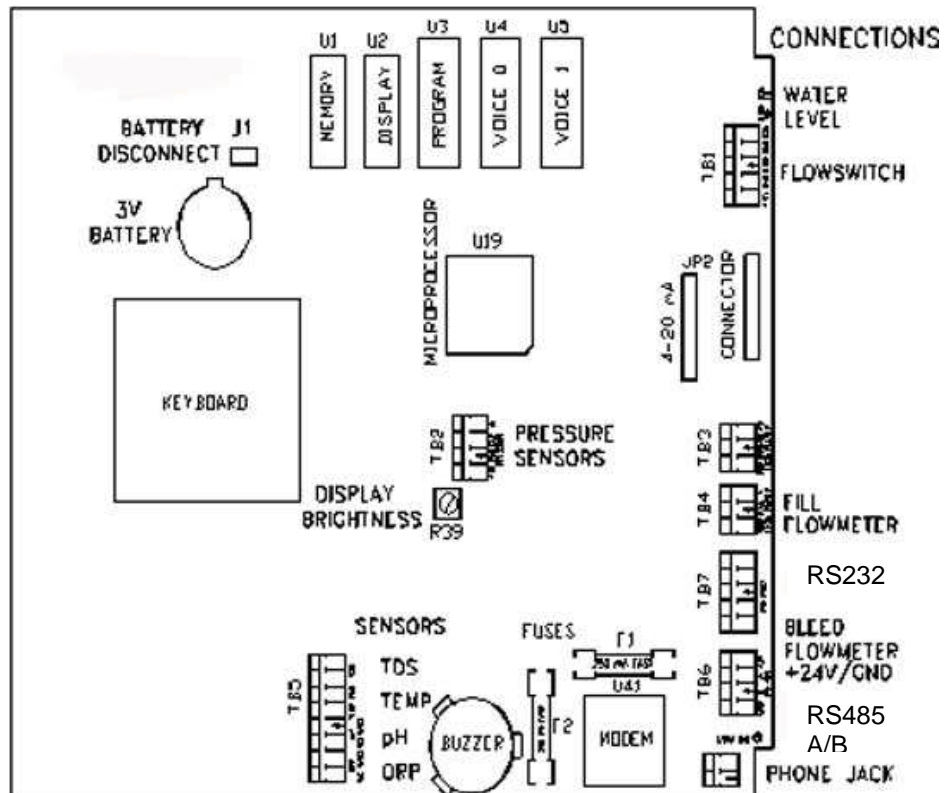


Figure 5 – CDCN13 Mother Board

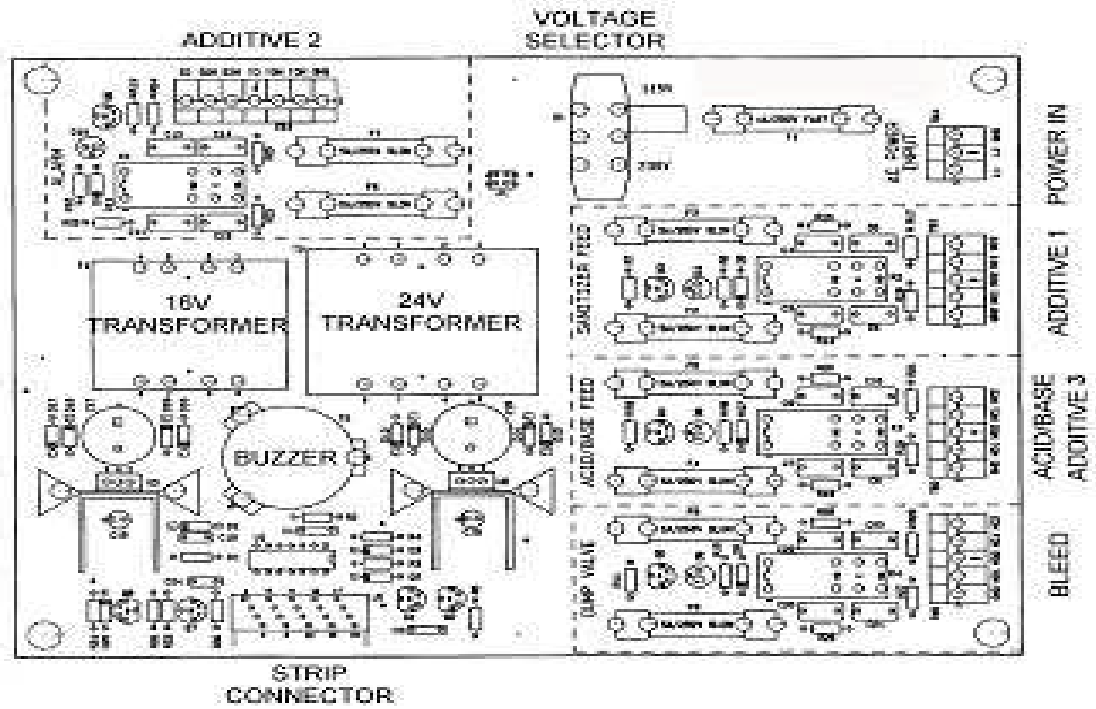


Figure 6 – CDCN12 Power Board

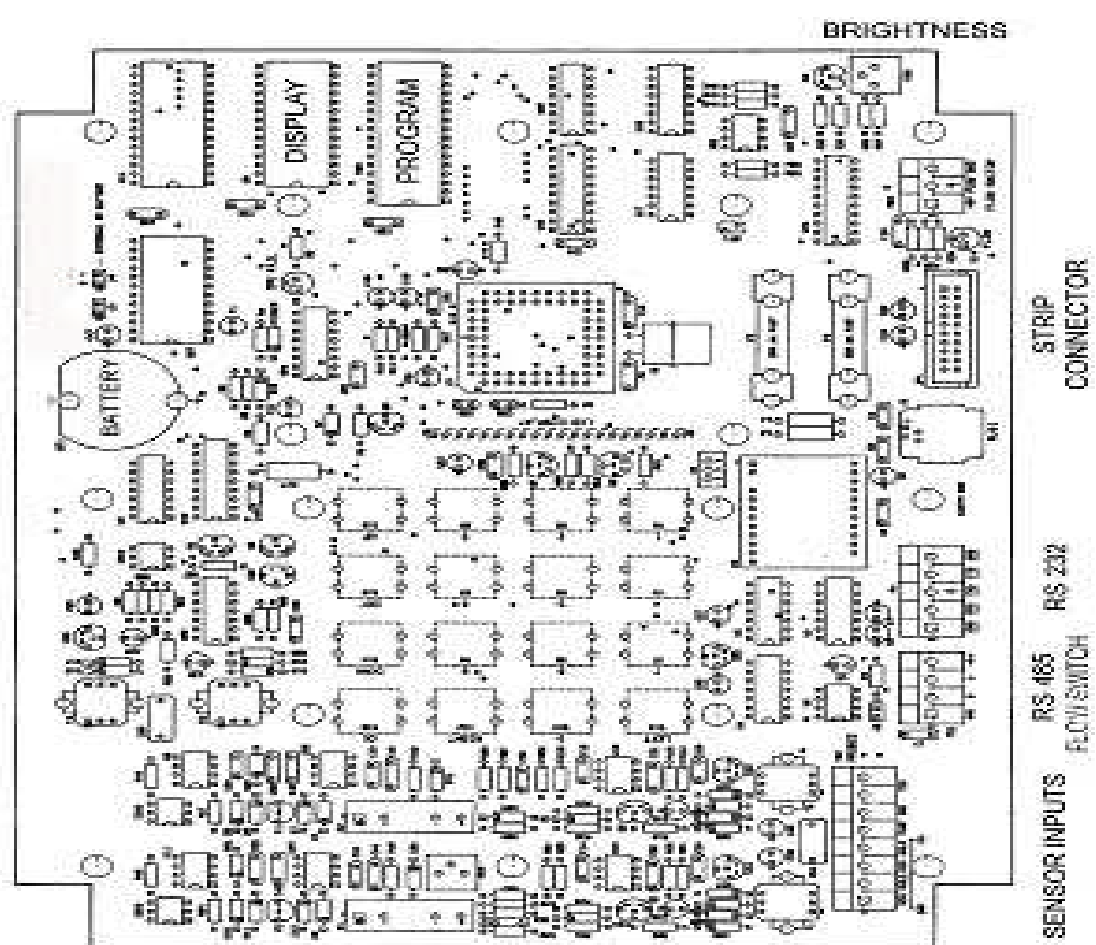


Figure 7 – CDCN12 Mother Board

Relays and Fuses

The relays for the chemical feeders and other outputs are all rated and fused at 5 A Slow Blow. Other signal relays are 2 A at 30 V.

NOTE: The fuses for the Power Supply to the PC boards are AGC-1 Fast fuses.

Make sure not to overload these relays. Chemical feed pumps normally draw less than 5 A. However, if a pump draws more than 5 A, it will need a motor starter or a magnetic switch.

NOTE: Depending on options selected, not all relays may be included on the Power Board.

Fuses for CDCN13 Power Board

F2	Power Supply	AGC 1 A Fast
F1 & 3	Main Pump	5A Slow Blow
F4 & 5	Bleed / Additives1/2/3	
	Oxidizer / Probe rinse	
	Water level / Filters	5A Slow Blow
F6 & 7	Alarm	5A Slow Blow
F8 & 9	Acid / Base	5A Slow Blow
F10 & 11	Additive 4	5A Slow Blow

Fuses for CDCN12 Power Board

F1	Power Supply	AGC 1 A Fast
F2 & 3	Additive 1	5A Slow Blow
F4 & 5	Acid / Base	5A Slow Blow
F6 & 7	Additive 2	5A Slow Blow
F8 & 9	Bleed Valve	5A Slow Blow

Remote Alarm

On the CDCN13, the remote alarm is a 5A DPDT relay located on the upper right corner of the Power Board. The remote alarm relay can be set for dry or hot contacts, or for any external signal.

To avoid damaging the Power Board, make sure to use the right type of contacts. Call your dealer or the factory if you are not sure.

With hot contacts, the controller powers the alarm with 110 or 230V, depending on the setting of the input voltage selector switch (see preceding page). Connect the leads to the alarm to the Normally Open contacts (NO1 and NO2) on the terminal strip located next to the alarm relay.

With dry contacts, remove the shunts from J4 and J5 located below fuses marked F7 and F6. Wire the remote alarm to NO1 and C1.

For an external power source, wire the input power to the terminals marked NC1 and NC2. Wire the remote alarm to the normally open contact (NO1 and NO2). The alarm voltage will be the same as the external power source

Mother Board

The Mother Board (Figure 5 or Figure 7) is mounted directly behind the face panel of the controller and contains all the low voltage circuitry including the microprocessor and program chips, the LCD display and the keyboard pad. It is also used to connect all the sensors inputs.

The key electronic components are the microprocessor and the programmable chips for Program, Display, Memory plus the two voice option chips, Voice 0 and Voice 1. The program chips are located in the center at the very top of the board. They can be replaced for upgrading of the software program but this should be done only by an experienced electronic technician.

Sensor Connections

The pH and ORP sensors are connected to the outside of the cabinet with bulkhead BNC connectors. The other sensors are connected directly to the Terminal Barrier strips marked TB1 to TB5 on the Mother Board, as shown on Figure 5. The following list applies to the CDCN13

TB1 - Level control sensor and on/off flow switch

5= LOW	White wire from level sensor
4=GND	Black wire from level sensor
3= Flow	Flow switch wire
2= GND	Flow switch wire
1= +5 VDC	Red wire from level sensor

TB2 - Pressure transducer

4=In	White wire from influent transducer
3= Out	White wire from effluent transducer
2=GND	Black wire
1=24vdc	Red wire from transducers

TB3 - Bleed water flow pulser

	<u>Hall-effect</u>	<u>Reed switch</u>
3=+5vdc	Red wire to TB4 +24vdc	N/A
2=Bypass	White wire	Red wire
1=GND	Black wire	Black wire

TB4 - Fill water flow pulser

	<u>Hall-effect</u>	<u>Reed switch</u>
3=+24vdc	Red wire	N/A
2= Main	White wire	Red wire
1= GND	Black wire	Black wire

TB5 - Temp & Conductivity, pH, ORP

8 = TDS	red
7 = TDS	black
6 = TEMP	green & GND
5 = TEMP	white
4 = pH	shield
3 = pH	signal
2 = ORP	shield
1 = ORP	signal

TB6 – RS485 Communications

TB7 - RS232 Communications

5 =	Green
4 =	Brown
3 =	Black
2 =	White
1 =	Red

Backup Battery

The 3V Backup Battery is located on the upper left of the Mother Board. It is used to maintain the memory settings in case of loss of AC power. This battery is designed to last for several years in normal operation and for up to six months if the AC power is shut off.

Under normal conditions, the controller will operate without battery power. However the clock and other memory settings will have to be restored in case of complete power shutdown. The battery should be replaced if the voltage falls below 2.6 V. This can be verified at any time in the Configuration Menu using the Battery Submenu.

Remote Communications

The Remote Communications option connects the modem with a standard US-type, 6-position RJ12 phone jack located on the lower right of the Mother Board.

If possible, the controller should be connected to a direct outside phone line dedicated for remote operation. If the phone line is also used for voice communications, users should wait for at least three rings to allow the modem to answer before picking up the phone.

The modem is a combination Data/Fax/Voice multimedia device registered by the Federal Communications Commission (FCC), Number B46USA-22429-MN-E.

MODEM SPECIFICATIONS	
FCC Registration Number B46USA-22429-MN-E	Ring Equivalency Number (REN) 0.2 A

The Ring Equivalency Number (REN) is 0.2 A. Most telephone companies require that the sum of all devices connected to a telephone line do not exceed 5. If a problem arises as a result of operating this equipment, you may have to provide information about this modem to the telephone company or to the FCC. If the equipment causes disruption to the telephone network, the telephone company may disconnect your service.

Multiple Serial Connections

Up to thirty (30) CDCN controllers can be connected to a single phone line or a single computer line by using a network consisting of one host and many slaves through RS485 Serial Connections (Option RS485).

Different models of CDCN controllers can be mixed and matched in a network. Each controller is identified by an I.D. number that is set up through software in the Communications Submenu 8.3.2.

As shown in Figure 8, the host controller includes a modem and an RS485 connection (Option REM). It is connected to the phone line by modem or to a computer equipped with an RS485 communication card. The slave units need only the RS485 connection.

Any controller can be set up at any time as either host or slave using the set of jumpers marked on the motherboard:

- Jumper J9 for CDCN13 controllers (effective Rev. 7), or
- Jumper JP3 for CDCN12 controllers (effective Rev. 2).

All slave units must be located within 3,000 feet of the host controller and connected with two Category 5 wires (one pair). The RS485 terminal has four terminals of which only the ones marked A and B are used. Each unit must be wired A to A and B to B for proper communications. The slave units can be connected directly to the host unit or through any other slave units.

CAUTION: Do not wire the connections marked 24 VDC or GND on the RS485 terminal. This could cause serious damage to the terminal.

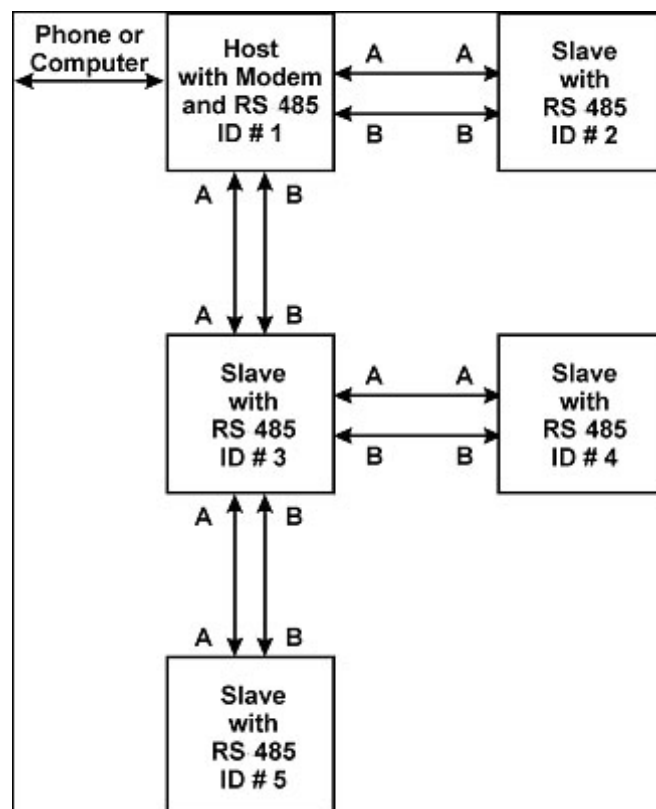


Figure 8 - Multiple Controllers Connections

The 4-20 mA Converter Boards are two optional boards, one for sensor readings and one for control outputs. They convert the digital outputs of the controller into analog signals that can be used by analog monitoring and control equipment.

The two boards are identical and are normally installed at the factory on the motherboard, as shown in Figure 9. The location on the motherboard determines the function, i.e. sensor signal or control outputs. Either board or both can be installed, depending on requirements.

Field Installation

4-20 mA Connections

Figure shows the connections for each Converter Board. Determine the type of signal required by the host system. There are two types of signals used in 4-20mA communications, Internal source or external sink. Each communication channel has four sets of jumpers that must be shunted to the proper setting. (Please note that the factory settings are generally for internal source).

The 4-20mA output signals from the board are located on the terminal boards marked TB1 and TB2. Each channel has a + and - indication corresponding to the markings on the board.

The 4-20mA Signal Board has five communication channels for pH, ORP, TDS, temperature and PPM readouts. Each analog signal requires two wires for connection to the central monitoring system.

The 4-20mA Control Board also has five pump control channels for acid, sanitizer, oxidizer, de-oxidizer and base feed. Each analog control signal requires two wires for connection to the corresponding pump.

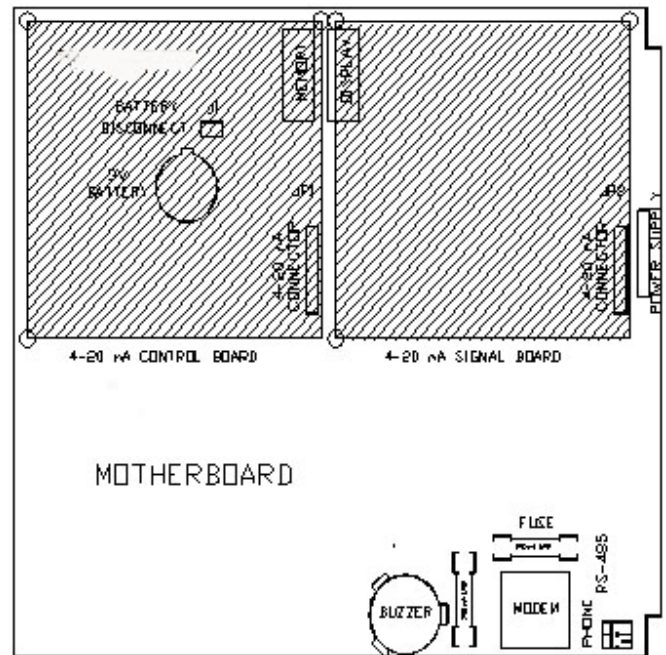


Figure 9 - Installing 4-20 mA Converter Boards

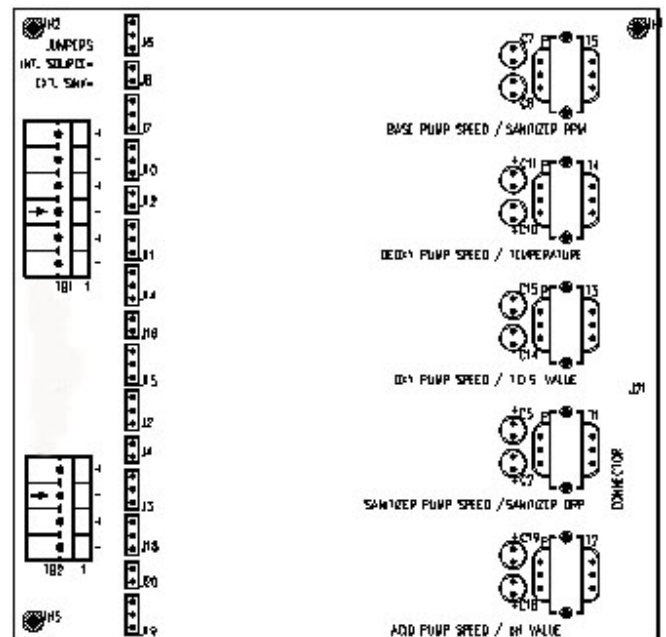


Figure 10 - 4-20 mA Converter Boards

PLUMBING

Plumbing includes installation of the sensors and connection of the chemical feeders or control valves.

Installation of Sensors

The CDCN controller uses up to eight sensors for measurement of water chemistry, temperature, flow rate, pressure and water level:

- conductivity sensor for Total Dissolved Solids,
- potentiometric sensors for pH and ORP,
- thermistor for temperature,
- Hall effect pulse generator for flow rate,
- piezoelectric sensors for influent and effluent pressures,
- electro-optical water level sensor.

On small recirculation lines (2-inch pipe), the water chemistry sensors (conductivity, pH, ORP and temperature) can be installed directly on the main line using PVC reducing tees (Figure 11).

On larger lines, the sensors should be mounted on a bypass line, using either a Bypass Line Assembly (Figure 12) or a Sensor Cell Cabinet (Figure 13).

In-line Installation (2" Pipe)

Use only 2x2x3/4 in. SST reducing tees without reducers. Do not install the sensors near an elbow or a constriction where there might be excessive turbulence.

Install the tees on the suction side of the pump and make sure that the tip of the sensor is oriented downward - as shown in Figure 11 - to avoid formation of air pockets near the tip. The sensors should be readily accessible for servicing but not exposed to physical damage.

After inserting the sensor, be careful not to overtighten the compression fitting as it can crush the small glass tube inside the sensor. Make it finger tight (no wrench).

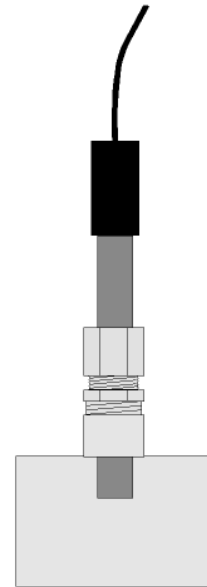


Figure 11 - Sensor Tee

Bypass Line Installation

The CDCN **Bypass Line Assembly** (P/N BPL-0.5) shown in Figure 12 is recommended for installation of the sensors. It is designed to assure a smooth and reliable flow of water. It includes:

- PVC tees (3/4" SST),
- Fast & Tite fittings (3/4" MPT),
- In-line Y-filter (3/4" MPT),
- In-line visual flowmeter (3/4" FPT),
- On/off flow switch (3/4" FPT),
- Two (2) ball valves (3/4" SxS) for flow adjustment and for isolating the bypass line during backwashing of the filter and other maintenance operations,
- Ball valve for water sampling and testing.

The Bypass Line Assembly should be installed exactly as shown on Figure 12. In particular, make sure to install the flowmeter in a vertical position and to install the flow switch downstream of (after) the sensors to assure a smooth flow of water near the sensors.

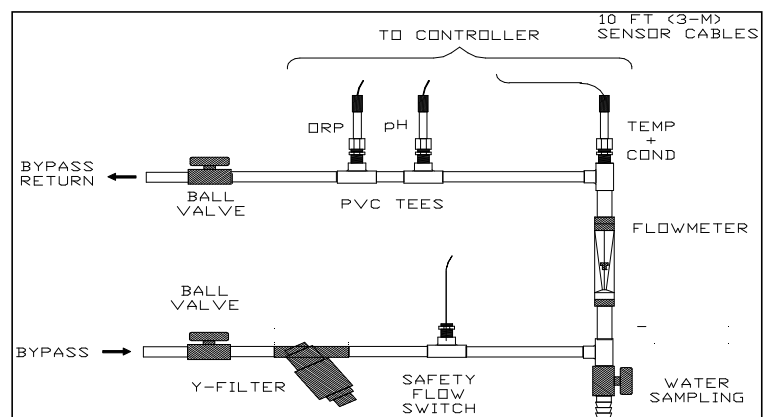


Figure 12- Bypass Line Assembly

Sensor Cell Cabinet

For ease of installation and maintenance, the components of the bypass line assembly can also be supplied in a pre-plumbed Sensor Cell Assembly, also named Wet Box. As shown in Figure 13, the Wet Box is mounted in a separate fiberglass cabinet containing the sensor cell. It should be mounted on a 1/2" bypass line with Y-filter, flowmeter and paddlewheel safety flow switch.

Make sure that the Sensor Cell Assembly is located within 10' (3 m) of the controller cabinet or order sensor extension cables (see Sensor Cables).

See the wiring instructions in the ELECTRICAL section and the operational instructions under WATER FLOW below.

Water Flow

Proper flow of water past the sensors is essential to obtaining good readings. To check the water flow in the bypass line, start the main recirculation pump. Open both the intake and the return valves on the bypass line and read the flow rate on the flowmeter. It should be in the middle of the range, i.e. 4 TO 6 gpm (or 16 to 20 l/min). If the water flow is too high, reduce it by closing down the valve on the RETURN SIDE of the bypass line. If there is no water flow, replumb the bypass line as shown on the schematic.

NOTE: The most common installation problems with bypass line or wet box installations are caused by faulty hydraulics.

To ensure proper water flow, make sure that the intake side of the bypass line is connected to the pressure side of the recirculation system and that the return side is connected to a low pressure area - such as the vacuum side before the recirculation pump, or low pressure downstream

On/Off Flow Switch

An on/off-type flow switch is recommended with the CDCN to prevent accidental feeding when there is no water flow.

The flow switch should be connected to the contacts on the upper right corner of the Mother Board as follows:

CDCN13

TB1 - Level control sensor and on/off flow switch

5= LOW

4=GND

3= Flow Flow switch wire

2= GND Flow switch wire

1= +5 VDC

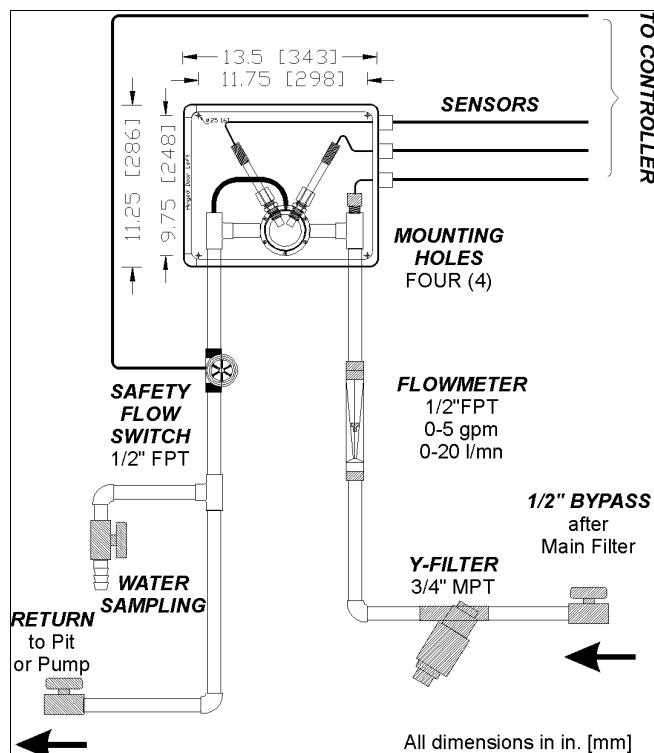


Figure 13 - Sensor Cell Assembly

CDCN12

TB3 - Flow pulser and on/off flow switch

4=

3= GND Flow switch wire

2= Flow Flow switch wire

1= +5 VDC

NOTE 1: The switch must be installed so that the small arrow on the body of the switch is in the direction of water flow inside the bypass line.

NOTE 2: The flow switch sends a signal to the microprocessor. DO NOT APPLY POWER TO IT.

NOTE 3: The flow switch should normally be wired through a conduit line or a junction box. If not, it is recommended to seal the top of the flow switch with silicone grease or waterproof tape to prevent condensation of water and possible malfunction of the switch.

WATER CHEMISTRY SENSORS

Sensor Design

The pH and ORP sensors are non-corroding sealed combination electrodes (Figure 14). They do not require refilling. Each sensor has an external plastic body and an inner glass tube which can be broken if stressed too severely.

The potentiometric sensors produce small voltages - in the millivolts range. Since they have a high impedance (20 to 50 megohms), the electrical current produced by the sensors is extremely small - in the picoamp (10^{-9} A) range. The output is so small that it cannot be measured with ordinary voltmeters and must be internally amplified by the controller.

There is no electrical current flowing from the controller to the sensors and the sensors are optically isolated from the high voltage circuit inside the electronic module. Therefore they create no electrical danger.

pH Sensor

The pH Sensor senses the acidity of the water and works with any acid or base. It is recognized by its blue color and the glass bulb at the tip.

ORP Sensor

The ORP (Oxidation-Reduction Potential or Redox) Sensor monitors the activity of the sanitizer (Fast Acting Free Chlorine, Bromine or Ozone) through its oxidizing power. It is recognized by its red color, the wide platinum band at the tip of the electrode and the white plastic tag on the cable.

Sensor Installation

The pH and ORP sensors are shipped in individual cartons for extra protection. When ready for installation, remove the plastic cap on the tip of the sensor. If it is difficult to remove, dip it in water for a few seconds. It should then slide off easily.

There may be a white crystalline deposit around the cap. This is produced by the salt solution used for shipping and does not affect the performance of the sensor.

For installation of a sensor, the 3/4" bottom part of the Fast & Tite fitting should first be screwed in the PVC Tee (Figure 11). Teflon tape can be used but it should not be overtightened. The sensor with the upper part of the fitting should then be carefully inserted, as shown on the schematic above, being careful not to bend or overtighten it, to avoid breaking the small glass tube inside. The sensor tip should be about 1/2" (1 cm) inside the PVC tee. It does not matter which sensor, ORP or pH, is upstream or downstream.

Sensor Cables

Each potentiometric sensor is supplied with a standard 10' (3 m)-long cable made of coaxial wire designed to minimize electrical interference. For ease of identification, all ORP cables have a white marker.

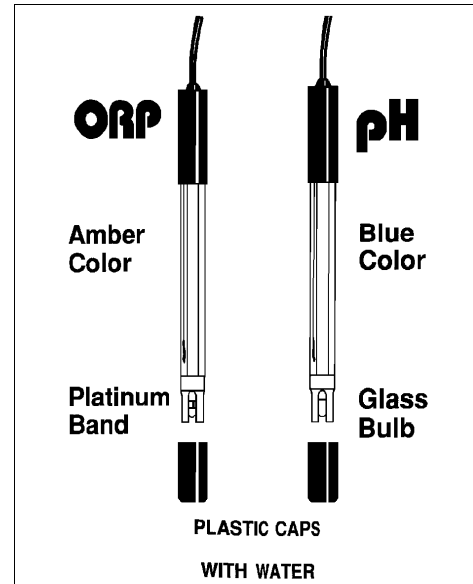


Figure 14 - ORP and pH Sensors

The cables are terminated with bayonet-type, spring-loaded, push-and-twist male BNC connectors. These are connected to the proper female BNC connectors located on the left side of the controller cabinet.

If the cable is longer than needed, it should be coiled neatly and attached under the cabinet. DO NOT CUT THE SENSOR CABLE under any circumstance.

If a longer cable is needed, custom-made extension cables with BNC connectors can be ordered from the factory in lengths of up to 100 feet. For longer distances, a pre-amplifier may be required. Consult your dealer or the factory for details.

Electrical Interference

Electrical interference from high voltage equipment, such as power transformers, pumps or high voltage lines, may sometimes produce erratic readings from the sensors. It may then be necessary to insulate the sensor cables by mounting them inside a metallic conduit line that is properly grounded.

Small signals may also be picked up from current leakage through the water line, due to faulty wiring or improper grounding of pool equipment, such as the pump or heater. Electrolytic chlorine generators are also a frequent source of current leakage.

To check for current leakage, compare the readings of the sensors when they are in line and when they are dipped in a plastic bucket containing the same water from the pool or spa. If you get different readings, there is current leakage. Its source must be identified and eliminated with proper grounding by a qualified electrician.

Storage and Winterizing

CAUTION: STORING OR SHIPPING A SENSOR WITHOUT CAP OR WATER WILL VOID ITS WARRANTY.

All sensors are shipped with a plastic cap on the tip to protect the tip from physical damage. This cap also contains water to prevent the sensor from drying out.

Remember to store the protective caps inside the sensor box or inside controller cabinet so that they are available for storage, winterizing or shipping. When storing or returning any sensor for warranty consideration, always add water inside the cap to prevent the sensor from drying out.

The sensors can be damaged by freezing. They should be removed from the line and stored at room temperature whenever freezing is expected.

Sensor Warranty

The sensors are covered by a standard one-year manufacturer warranty. This does not include damage caused by physical abuse such as breakage of the inner glass tubing or by drying out of the tip. **BE CAREFUL IN HANDLING THE SENSORS and ALWAYS REPLACE THE CAP WITH WATER INSIDE when not in use.**

In case of sensor failure, return it as soon as possible with its cap on and with water inside the cap for warranty consideration or replacement.

TEMPERATURE SENSOR

The Temperature Sensor is a thermistor that is mounted inside a 1/4" MPT fitting.

If the CONDUCTIVITY (TDS) option is ordered, the temperature sensor is mounted inside the conductivity sensor to facilitate installation.

Install the sensor in an elbow before the ORP and pH sensor, either on-line or on the bypass line, using a 1/2-inch FPT PVC tee. Connect the leads to the Terminal Barrier strip TB5 as indicated on the Mother Board Schematic (Figure 5, Page 13)

CONDUCTIVITY SENSOR

The Conductivity Sensor is mounted on a 3/4" MPT fitting that also contains the temperature sensor. It can be installed next to the ORP and pH sensor, either on-line or on the bypass line, using a 3/4" FPT PVC tee. Make sure that the head of the sensor is properly oriented with the flow of water to give a good solution sample (See Figure 12).

The two leads from the sensors should be connected as indicated on the Mother Board. If the temperature sensor is incorporated inside the conductivity sensor, there are two extra leads that should also be connected as indicated on the Mother Board (Figure 5, Page 13)

ELECTRONIC FLOW SENSOR

Either Hall effect type sensors or Reed switch (Contacting Head) type sensors can be used.

WARNING: Follow all manufacturer's instructions carefully and do not install in line under pressure.

Hall effect sensor

For fill water, connect the three leads from the sensor to the Terminal Barrier strip TB 4 as indicated on the Mother Board Schematic (Figure 5, Page 13).

For bleed water, connect two leads from the sensor to the Terminal Barrier strip TB3 and the Red lead to the +24vdc Terminal Barrier strip TB4 as indicated on the Mother Board Schematic and the sensor connection paragraph page (Figure 5, Page 13).

Reed switch sensor

For fill water, connect the two leads from the sensor to the Terminal Barrier strip TB 4 as indicated on the Mother Board Schematic (Figure 5, page 13).

For bleed water, connect the two leads from the sensor to the Terminal Barrier strip TB3 (Figure 5, page 13)

CAUTION: A 24VDC signal is used for signal generation with Hall effect sensors. Connecting the wrong wires may cause damage to the sensor and to the microprocessor.

Enter the calibration K-factor in pulses per unit of volume flow (gpm or l/m) for the specific pipe diameter and thickness, as listed in Chapter II, Submenu 5.2, page 38.

PRESSURE TRANSDUCERS

The pressure sensors are Series 2000 transducers with a 1/4-18 NPT thread connection rated at 60 psi (4 bar). They should be installed on the intake (influent) and return (effluent) sides of the filter or bank of filters.

Connect the leads from the sensors to the Terminal Barrier strip TB2 as indicated on the Mother Board Schematic (Figure 5, page 13).

WATER LEVEL SENSOR

The water level sensor is an ELS-1100 Series electro-optical sensor with a 1/4" NPT thread. Locate it in a convenient location to open a fill valve as required to maintain constant water level.

The optical prism surface should always be kept clean and should be at least 2" (5cm) away from reflective surfaces.

Connect the leads from the sensor to the Terminal Barrier strip TB1 as indicated on the Mother Board Schematic (Figure 5, page 13).

CHEMICAL FEEDERS

Operation

Locate the 5-amp power outlets (110 or 230 V) on the Power Board (Figure 4 or Figure 6). They are marked ACID FEED, BASE FEED, OXIDIZER FEED, DE-OXIDIZER FEED. Connect as required to the chemical feeders for control of pH and ORP. Connect the power outlets marked ADDITIVE1, 2, 3 and 4 to a chemical feeder for each additive, as required. For best results, use the following guidelines:

1. Always inject the chemicals downstream of the sensors.
2. Proper operation of the overall "water / feeders / controller" system requires that the chemical feeders be properly sized and in good operating condition. Each feeder must be adjusted so that the chemicals are not fed excessively fast or slow. For best control, the feed control mode should be on Proportional control or the feed rate should be as low possible, just high enough to meet the expected chemical demand.
3. If the controller shows an out-of-range condition, this is usually caused by a malfunction of the chemical feed system. Make sure to investigate the cause and correct the malfunction before returning to automatic control.
4. An OZONATOR can be used together with chlorine or bromine feed but the presence of ozone in the water may affect the calibration of the sensor.

Chemical Feed Pumps

Chemical feed pumps are used to feed liquid oxidizer, such as sodium hypochlorite OCINa, also known as liquid chlorine, or solutions of calcium hypochlorite or dichlor powder. Liquid chemicals for pH control include muriatic acid, caustic soda or solutions of soda ash.

Any standard chemical feed pumps (diaphragm, or peristaltic) can be used, as long as they are properly sized for the installation, and meet local approval requirements.

Install the pumps as shown in the main installation schematic, following the electrical code and the pump manufacturer's instructions.

Carbonic Acid Valve

A special solenoid valve for carbonic acid can be used to control the addition of CO₂, an acid used to lower pH. It also increases Total Alkalinity making pH control difficult. Add muriatic acid, HCl, to reduce high alkalinity.

Erosion Feeder

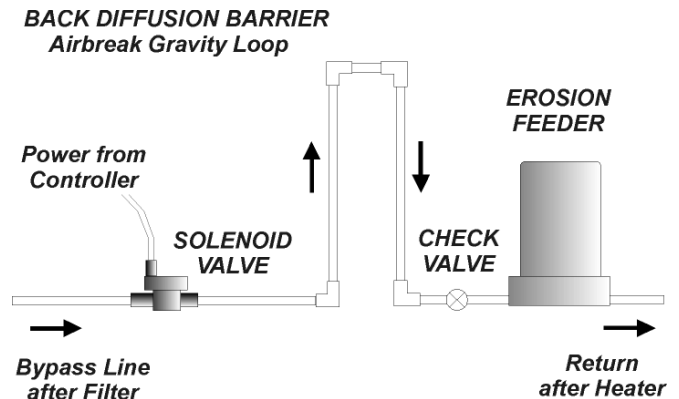


Figure 15 - Erosion Feeder Installation

Figure 15 shows the installation of an erosion feeder for bromine or chlorine tablets with a bypass line. The differential pressure must be at least 15 psi (1 kPa).

For automatic control, a solenoid valve is installed on the **intake side** of the bypass line, as shown on the schematic, to turn the flow of water through the feeder on and off as needed.

With bromine dihalo tablets, the solenoid valve can be mounted just before the brominator.

Because trichlor tablets are very corrosive, it is recommended to protect the solenoid valve with both a check valve and an air break to reduce back-diffusion of the chemicals. It is also recommended to switch to a less aggressive sanitizer.

Caution: When handling potentially dangerous chemicals always follow the manufacturer's handling precautions and guidelines. Use only as directed.

CHAPTER III - CONTROLLER OPERATION

This Chapter describes the operation of the CDCN controller. For reference, the menus and submenus are shown in Chapter I - INTRODUCTION / Menu Tree.

Access

Each menu is accessed by highlighting a line on the Main Display screen with the UP and DOWN arrow keys and then entering the submenu with the RIGHT arrow key. To return to any previous menu, press the LEFT arrow key.

Each menu is identified by a combination of numbers, from 1 to 8, corresponding to the lines that are used to access it. For instance, Submenu 8.1.4 for Clock Setup is accessed through line 8 on the Main Display Screen (Configuration Menu), then line 1 (Initial Setup) and line 4 (Clock).

To facilitate startup of the controller, Menu 8 for Configuration and Setup is discussed first in this manual. All the other menus from 1 to 7 are discussed afterwards in numerical order.

NOTE: The CDCN12 display shows only four lines of text at a time. It can be scrolled with the UP and DOWN ARROW keys to show the other lines. The correspondence between the Main Display lines and the manual paragraphs is as follows:

- Temperature is line 3 in CDCN12, but paragraph 4
- Additives are line 4 in CDCN12, but paragraph 7
- Configuration is line 5 in CDCN12, but paragraph 8.

Default Setup

The CDCN controller is pre-loaded with standard defaults values for normal operating conditions. On startup, it uses the default values, i.e. English language, U.S. units, no password, standard setpoints and alarms, etc.

The operator can change the settings at any time. He can revert to the original default values (partial or complete) through the Reset Submenu 8.2.5.

All settings are maintained in case of a power shutdown as long as the battery maintains a charge above 2.5 V. The original default values are automatically reloaded in case of complete loss of power (both line and battery power).

8 - CONFIGURATION MAIN MENU

Access

To access the Configuration Menu, use the DOWN arrow key on the Main Display screen to highlight the last line and then press the RIGHT ARROW key to show the next menu. It includes the three submenus shown on the right (Menu 8).

CDCN13 Main Display

>COND	2000	uS	A
pH	8.5	pH	A
ORP	750	mV	X
TEMP	72	F	X
FLOW	15/10	gpm	A
>FILTER	N.A.		
ADDITIVES			TSSX
06/01/04	19:06		LSI OK

CDCN12 Main Display (Scroll to last line)

>COND	2000	uS	A
pH	8.5	pH	A
TEMP	72	F	X
ADDITIVES			TSSX
06/01/04	19:06		LSI OK

Menu 8 - Configuration

CONFIGURATION
Initial Setup
Operations
Communications

8.1 - INITIAL SETUP SUBMENU

The Initial Setup Submenu is used to specify the basic operating conditions of the CDCN. It is accessed through the Configuration Menu on the last line of the Display Screen.

8.1.1 - Language

The Language Submenu allows the user to select either one of three languages: English, French or Spanish for all displays screens. The standard (default) language is English. Language changes take effect immediately.

8.1.2 - Units

The Units Submenu allows the choice system of U.S. or Metric units to be used throughout the program. The standard (default) value is the U.S. system. The change of units takes place immediately.

The unit equivalencies are as follows:

U.S. METRIC

Conductivity	uS	uS
TDS	ppm	mg/l
pH	pH	pH
ORP	mV	mV
Temperature	F	C
Water Flow Rates	gpm	l/m
Water Flow	ga	l
Pressure	psi	kPa

8.1.3 - Code Number

The Code Number Submenu is used to define different operator access levels. Code numbers may be required for access at key points in the program and for remote communications.

Up to ten five-digit Code Numbers (no letters) may be entered, along with an associated access level from one to three. To make it easier to remember a code number, the operator may select a combination of numbers corresponding to a familiar name on a standard telephone keypad.

The following access levels are available:

- Level 1: View only,
- Level 2: Calibration,
- Level 3: All functions.

To clear an existing code number, its access level is set to zero.

Once a code number has been acknowledged, it remains valid for an hour of continuous operation so that the operator does not have to re-enter it constantly. If necessary, it can be changed by returning to the Welcome screen.

Submenu 8.1

INITIAL SETUP

Language
Units
Code No.
Clock
Readings
Data Logging
Model Options

Submenu 8.1.1

LANGUAGE

English
Français
Espanol

Submenu 8.1.2

UNITS

U.S.
Metric

Submenu 8.1.3

SET CODE NO

Code No. #####
Access 2

Submenu 8.1.4

8.1.4 - Clock

In case of a power shutdown, the clock is maintained by the backup battery. It needs to be reset only in case of complete power shutoff with loss of battery power or whenever the program chips are replaced or upgraded.

NOTE: The date uses a **MONTH/DAY/YEAR** calendar.

NOTE: The time display uses a **24:00 hour** clock.

DATE/TIME	
Date	<u>08/10/96</u>
Time	<u>17:00</u>
Day of week	<u>Mo</u>

Submenu 8.1.5

8.1.5 - Readings

The DISPLAY HOLD parameter is used to stabilize sensor readings and minimize fluctuations. It specifies the time interval for data averaging and updating. The standard (default) value is 10 seconds. It can be changed to any value between one and sixty seconds.

DISPLAY HOLD	
Time base for	
Averaging display values	
<u>10</u> seconds	

Submenu 8.1.6

8.1.6 - Data Logging

The DATA LOGGING screen shows the interval for storing the test data in the controller memory. Interval values range from one to 999 minutes, with a default of 60 minutes.

The memory chip can store up to 999 test results. When it is full, it writes over the oldest entries. Therefore the greater the interval is, the longer it takes to fill up the memory.

For instance, an interval of 60 minutes (one hour) fills the memory in 41 days. Data logging every four hours fills the memory in about 5 ½ months.

To avoid losing test data, remember to print it or download it to a computer before the memory is full (see Submenu 8.2.4 - Print Reports).

DATA LOGGING	
Time Base:	
<u>60</u> minutes	
Reset	

Submenu 8.1.7

8.1.7 - Model Options

The Model Options Submenu is used to specify the functions that are actually installed on the controller. Non-installed functions should be set to "NO". This way, the Display Screen shows N.A. instead of erroneous readings. For demonstration purposes, it is possible to access any function and review its features - even if it is not actually installed on the controller - by selecting "YES" for that option.

The ADDITIVE option submenu allows the selection of additive names from a pre-defined list. The RIGHT arrow key allows to browse through the list. The LEFT arrow key returns to the previous submenu.

For the CDCN12, when one of the options Conductivity, Temperature or Additives is set to "NO", its line is removed from the main screen. When the pH option is set to "NO", its line remains to allow pH monitoring and the relay is re-allocated for a third additive.

MODEL OPTIONS	
CONDUCTIVITY	
pH	Yes
ORP	No
TEMPERATURE	Yes
FLOW	Yes
FILTER	No
ADDITIVES	Yes

8.2 - OPERATIONS SUBMENU

The Operations Submenu gives access to the operator to change the operating conditions during normal operation.

8.2.1 - Audio Alarms

This option is used to disconnect the audio alarm (buzzer) in case of out-of-range or other alarm conditions. All visual alarms, such as flashing on the screen, still remain operative.

8.2.2 - Bypass Line

The bypass line is a recommended feature for sensor installation on large recirculation lines, i.e. over 2 inches in diameter. It is optional for the CDCN12 and CDCN13.

A Safety Flow Switch is used to prevent operation when there is insufficient water flow in the bypass line. This may happen particularly when the bypass line is shut down for maintenance.

The standard flow switch provided with the CDCN is an on/off-type flow switch with a shutoff set at about 1.0 gpm (3.8 l/m).

The Bypass Line Protection option should always be set to YES, indicating that the alarm is active and will cause the interruption of all feed and bleed events.

If the flow switch is defective or temporarily disabled, the bypass alarm can be overridden by setting the Bypass option to NO. This override should be used with extreme caution:

Feeding chemicals when water is not running in the bypass line may cause dangerous water conditions and hazardous chemical reactions.

8.2.3 - Langelier Saturation Index

The Langelier Saturation Index is used for monitoring the development of corrosive or scaling tendencies in water. It is calculated from the formula:

$$SI = pH + TF + AF + CF - 12.1$$

where:

- pH = pH sensor reading or keyboard input,
- TF = Temperature factor calculated from sensor input or keyboard input,
- AF = Alkalinity factor from data table,
- CF = Calcium Hardness factor from data table.

The CDCN calculates the Saturation Index automatically using sensor input for pH and Temperature and operator data input for Alkalinity and Calcium Hardness. This eliminates the need for complex conversion tables.

Submenu 8.2

OPERATIONS	
Audio Alarms	YES
Bypass Line	YES
Saturation Index	OK
Print Reports	
Reset	
Battery	
Probe Monitor	YES

Submenu 8.2.3

SATURATION	
Alkalinity (ppm)	<u>150</u>
pH	<u>7.5</u>
Temperature	<u>80</u>
Limits	
Langelier Index	0.23
Condition	OK

Submenu 8.2.3.5

LANGELIER LIMITS	
Scaling above	<u>+ 0.3</u>
Corrosive below	<u>- 0.0</u>

8.2.3.1 - Langelier Limits

The standard Langelier limits show "OK" if the index is between 0 and 0.3, "CORR" if below 0, and "SCALE" if above 0.3. If an alarm condition develops, the Display Screen alerts it with flashing characters.

Because other values may be more applicable to the installation, the Langelier limits can be changed by entering preferred values in Submenu 8.2.3. 5. Use the RIGHT arrow key to change the + or - sign and press OK. Then, enter the desired value and press OK.

8.2.4 - Print Reports

The Print Reports Submenu is used to download the test data from the internal memory chip of the CDCN (see Submenu 8.1.6 - Data Logging). The data is saved in memory in standard ASCII text format as shown on the right.

The data can be printed or downloaded using three different methods:

- on-site printing to a serial printer,
- on-site downloading to a computer,
- remotely by modem connection or by direct connection to a computer with the CDCN program.

After downloading into a computer, the data file can be processed with a standard text editor or word processor. The CDCN program can also be used to display the data graphically (see Chapter III - TELECOMMUNICATIONS).

A maximum number of 999 sets of test data can be stored in the controller memory chip. It is therefore recommended to download the data at periodic intervals to save it.

Downloading the data does not erase it from the memory chip. To erase all data in memory, use Submenu 8.1.6 - Data Logging and select Reset.

For printing, use the desired setup below, then enter Submenu 8.2.4 - Print Reports, select the proper dates, move to Print Data Log and press the RIGHT ARROW. A counter shows the number of tests being printed.

On-Site Direct Connection

For a direct connection to a CDCN controller under Windows® 98/Me/2000/XP, it is required to configure a HyperTerminal on the computer, preferably called CDCNTrol.

To launch HyperTerminal, click on Start, Programs, Accessories, Communications, and finally HyperTerminal (if the HyperTerminal shortcut does not appear, go to Add or Remove Programs in Control Panel and Add/Remove Windows Components).

In the "Connection" window, enter a name for the new connection, such as "CDCNTrol".

In the "Connect To" window, click on the "Connect Using" box and select an available COM port in your machine, such as "COM1".

In the "Port Settings" window, enter the following parameters:

- | | |
|-------------------|----------|
| - Bits per second | 2400 |
| - Data bits | 8 |
| - Parity | None |
| - Stop bits | 1 |
| - Flow control | Hardware |

Click OK, File, Save.

To create an icon of the saved connection on your Desktop:

- Click on Start, Programs, Accessories, Communications, HyperTerminal,
- Right click on "CDCNTrol" and drag the mouse to your Desktop,
- Release and click "Copy here".

To start a direct connection to a CDCN controller:

- Connect the available serial port on your PC computer "COM1" to the RS-232 serial male connector on the controller, using a null-modem cable available from your local electronics store.
- Click on your "CDCNTrol" icon on your Desktop to open a new connection,
- From the "Transfer" drop-down menu click "Capture Text".

Remote Download

Logged data can be more easily downloaded using the CDCNTrol software program for Windows® by remote computer with a modem or by direct connection through the controller RS485 communication port, as explained in Chapter III - TELECOMMUNICATIONS.

Click on the CDCNTrol icon in Windows® and use Menu 6 - REMOTE CONTROL to establish communication. When the image of the controller screen appears on the remote computer, go to Submenu 8.2.4 and select Print Data Log with the RIGHT ARROW key.

The computer screen displays: "Please wait ..." and a numerical counter showing the tests being downloaded. If a printer is connected to the computer, the data is printed at the same time.

The downloaded data is normally saved in a default text file named LOG.TXT in the Facilities Setup menu in the CDCNTrol program. Another name can be specified through the Edit Facility submenu. If the file already exists, the new data is added to the old data.

Data Display

To view the data in text form, as shown on the previous page, use Menu 8 - DISPLAY DATA/VIEW in the CDCNTrol program or use any standard text or word processor.

Graphic Display

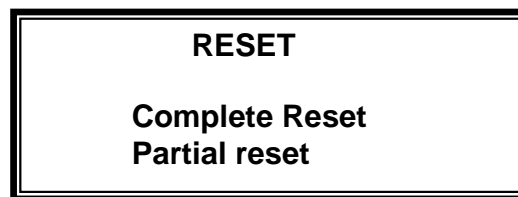
To display the data in graphic form, use Menu 8 - DISPLAY DATA/GRAPH in the CDCNTrol program (see Chapter III - TELECOMMUNICATIONS for details).

8.2.5 - Reset

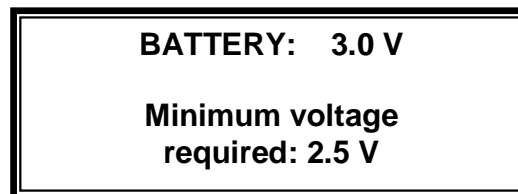
The Reset Submenu is used to take the calibration parameters back to the initial factory settings. This may be done on initial installation or whenever the operating parameters have been misadjusted by the operator.

Complete Reset resets all system parameters to their initial "default" settings. **Partial Reset** allows partial resetting of individual functions, such as Conductivity, pH, ORP, etc.

Submenu 8.2.5



Submenu 8.2.6



8.2.6 - Backup Battery

The CDCN12-13 uses a 3V lithium battery to maintain calibration, setup and test data in memory storage in case of power shutdown. The battery is designed to last for more than 200 days without any power being supplied to the unit. The minimum voltage required is about 2.5 V. The Battery Submenu displays the voltage of the battery for information. A flashing display on the Main Display screen indicates a low battery voltage.

To prevent loss of memory data, the battery should be replaced when the voltage gets below 2.5 V. If power to the memory is completely discontinued, all settings revert automatically to the initial default values. They have to be individually reset to their proper values by the operator.

When changing the battery, it is important to keep power supplied to the unit to keep the proper settings in memory. Replacement CR2032 batteries can be purchased locally.

8.2.7 - Probe Monitor

Probe Monitor is a unique CDCN feature (Patent Pending) that allows dynamic monitoring of the pH and ORP sensors to alert a probe failure as soon as it happens. Other controllers have to enter an alarm condition in order to alert the operator. This could result in potential damage and liability.

To activate or deactivate the Probe Monitor function, use the Right Arrow to select YES or NO in Submenu 8.2, line 7. To activate or deactivate the Probe Monitor function, use the Right Arrow to select YES or NO in Submenu 8.2, line 7.

8.3 - COMMUNICATIONS SUBMENU

The details of the communications features are discussed in Chapter III - TELECOMMUNICATIONS.

The Communications Submenu is used to select the phone numbers to report alarm conditions and to enter the identification number for voice telephone reporting.

8.3.1 - Phone Numbers

Up to six (6) different phone numbers can be entered for automatic calling in case of an alarm condition. Each number is called sequentially until one of the numbers is answered and the proper password is entered.

To delete a phone number, replace it with 0 (zero).

8.3.2 - Unit Identification

The unit identification number is used to identify individual facilities for voice telephone reports, either a status report or an alarm report. The default value is 1.

8.3.3 - Alarm Calling

Specify YES if you want the controller to dial automatically the phone numbers listed above in 8.3.1.

8.3.4 - 4-20 mA

The 4-20 mA output is an option (OPTION 4-20) that includes one or two converter boards to convert sensor readings and/or control outputs into analog signals that can be fed into analog monitoring equipment (BMS) or control equipment (pumps or valves with analog control circuitry).

The converter boards plug into separate areas of the mother board of the controller (see Chapter II - INSTALLATION).

To convert sensor readings to BMS, the 4-20 mA SIGNAL Submenu is used to set the lower and upper limits for data conversion for each of the functions shown on the screen (Submenus 8.3.4 and 8.3.4.1). The standard (default) values for the 4-20 mA limits are the values that have been selected for the out-of-range limits. This means that the lower out-of-range limit corresponds to the minimum signal of 4 mA and the higher limit to 20 mA.

To change the limit values of one of the functions, highlight the desired function in Submenu 8.3.3 with the UP or DOWN ARROW key and press the RIGHT ARROW key to access the 4-20 mA LIMITS screen, as shown on the Submenu 8.3.4.1 for ORP.

To convert control outputs to control equipment (valves, pumps), use the 4-20 mA CONTROL Submenu 8 (X.1.3.3) .

Submenu 8.3

COMMUNICATIONS	
Phone Numbers	
Unit I.D.	
Alarm Calling	YES
4-20 mA Output	

Submenu 8.3.1

PHONE NUMBERS	
1:	_____
2:	_____
3:	_____
4:	_____
5:	_____
6:	_____

Submenu 8.3.4

ORP CONDUCTIVITY
pH
ORP
TEMPERATURE
MAKE UP FLOW

Submenu 8.3.4.1

4-20 mA LIMITS	
COND TOP	5000
COND BOTTOM	100

1 - CONDUCTIVITY MAIN MENU

Conductivity and TDS

The Conductivity sensor is used to monitor and control the concentration of **Total Dissolved Solids (TDS)** in the water. It reads the conductivity of the water in microsiemens per centimeter ($\mu\text{S}/\text{cm}$). The conductivity readings can be converted into ppm or mg/l of TDS by using a conversion factor that depends on the type of ionic species that are present in the water. Normally, a conversion factor of 0.5 is used for water solutions containing different species of carbonate and chloride ions (see 1.8 - Select Scale).

Control of Conductivity or TDS is obtained by replacing the water with fresh water when the concentration level gets too high. This is done by opening a valve to dump the water. Replacement with fresh water is done automatically by opening the valve through the water level control option.

Both flows of water - in and out - can be monitored with the flowmeter option.

Conductivity or TDS Display

Depending on the application, it may be customary to control either conductivity or TDS. The display is therefore available in the two systems, as shown on the sample screens.

Changing the displays from conductivity to TDS is done by changing the TDS factor from 1 to any other value different from 1. To do this, select the SELECT SCALE Submenu (see 1.8 and 1.8.2) and change the TDS factor value. If the TDS Factor is 1, the display shows Conductivity in $\mu\text{S}/\text{cm}$. If it is different from 1, it shows TDS in ppm or mg/l.

1.1- Control Mode

Line 1 shows the Control mode that is currently selected: OFF (X), Manual (M), AUTO (A), Cycle Timer (T), Percent of Flow (F), or Daily Schedule (S).

To change the Control Mode, select the first line with the UP or DOWN ARROW keys and press the RIGHT ARROW key. The Control Mode screen is then displayed.

The Control Mode screen and selection procedures are common to all control functions. See CONTROL Submenu in this Chapter.

1.2 - Display and Calibration

The second line displays the current reading of conductivity in $\mu\text{S}/\text{cm}$ or TDS in ppm or mg/l.

The conductivity or TDS readings should be calibrated with standard test solutions and with temperature compensation activated on the controller.

As with all sensor calibrations, the conductivity sensor can be calibrated with 1, 2 or 3-Point calibration for origin, slope and curvature. This is done by pressing the RIGHT ARROW key to enter the CALIBRATION Submenu. The calibration procedure is common to all control functions. See CALIBRATION Submenu further down in Chapter II.

Menu 1

CONDUCTIVITY	AUTO
Calibrate	μS 1500
Setpoint	μS 2500
Alarm Low	μS 100
Alarm High	μS 5000
Time Limit	min 30
Run Time	15 60
Select Scale	

Menu 1 (Alternate)

TDS	AUTO
Calibrate	ppm 750
Setpoint	ppm 1250
Alarm Low	ppm 50
Alarm High	ppm 2500
Time Limit	min 30
Run Time	15 60
Select Scale	

Submenu 1.2.1

Use Automatic Temperature Compensation for Conductivity?
NO
YES

1.2.1 Temperature Compensation

After calibration, the Compensation Submenu 1.2.1 is displayed. This feature requires the use of the temperature sensor. The correction is expressed as a change of slope per degree Celsius at 25°C. The default is 2%, but it can be adjusted if necessary.

1.3 - Setpoint

The SETPOINT determines the conductivity or TDS level that will trigger the dumping (bleeding) of water when the controller when placed in the AUTO control mode.

To change the setpoint, press the RIGHT ARROW key and enter the numerical value with the digital keypad.

1.4 - Low Alarm

The ALARM LOW value is set to generate an alarm when the sensor reading falls below the set value. After the alarm value is set, the ALARM OPTIONS submenu 1.4.1 is shown, asking whether a low alarm condition should stop the dump valve and activate the alarm buzzer.

1.5 - High Alarm

The ALARM HIGH value is set to generate an alarm when the sensor reading rises above the set value. After the alarm value is set, the ALARM OPTIONS submenu 1.5.1 is shown, asking whether a high alarm condition should stop the bleed valve and activate the alarm buzzer.

1.6 - Time Limit

The TIME LIMIT sets the maximum amount of time in minutes that is allowed for continuous dumping of water to correct a high conductivity or TDS reading. This acts as a safety feature to prevent overdumping of water in case of a malfunction of the dump valve.

1.7 - Run Time

The RUN TIME displays the amount of running time in minutes for each current activation event and the cumulative run time since last reset to zero.

To reset the cumulative run time, enter zero in the last column. To reset only the current run time, turn the control mode off and back on.

After the cumulative run time is reset, the TOTAL TIME ALARM submenu (see submenu 1.7.1) is displayed to set the Total Time Alarm option. This alarm is activated when the cumulative run time reaches the alarm value. It does not lock the bleed control outlet.

1.8 - Select Scale

The Select Scale prompt takes the operator to the SELECT SCALE Submenu 1.8.

1.8.1 - Cell Constant

Conductivity is usually monitored with contacting-type sensors, which are made of two electrodes that are specifically sized and spaced to provide a known cell constant or factor.

The Cell Constant corresponds to the aspect ratio (in cm^{-1}) of the geometrical cell formed by the two electrodes (length divided by cross sectional area). It is set on the CDCN controller, as specified by the probe manufacturer.

To check the cell constant, measure the conductivity of a water sample with a portable meter. Divide by the conductivity reading on the CDCN controller. Make sure both instruments are consistent in using or not compensation.

Submenus 1.4.1 and 1.5.1

ALARM OPTIONS	
Bleed lockout	YES
Alarm Buzzer	YES

Submenu 1.7.1

TOTAL TIME ALARM	
Alarm if total	
Bleed time exceeds	
110 min.	
Enter 0 for no alarm	

Submenu 1.8

SELECT SCALE	
Cell Constant	1.00
TDS Factor	0.50

1.8.2 - TDS Factor

The TDS Factor is the conversion factor used to convert from conductivity readings (in $\mu\text{S}/\text{cm}$) to Total Dissolved Solids concentrations (in ppm or mg/l). Entering a TDS Factor different from 1 automatically changes all readings and displays from conductivity to TDS.

Because the conductivity of ionic species varies with the type of electronic charges, the relationship with TDS is to a large extent empirical.

For most water treatment applications, the TDS factor is about 0.5. For instance, a Sodium Chloride solution with a conductivity of $2,764 \mu\text{S}/\text{cm}$ contains 1,410 ppm (mg/l) of NaCl. This indicates a TDS factor of 1,410 divided by 2,764, i.e. 0.51.

2 - pH MAIN MENU

Operation

The pH function is used to monitor and control the concentration of acid or base in the water through the pH electrode.

The pH Menu screen is used to access all the pH submenus for Control Mode, sensor calibration, setpoint and alarm settings.

It also displays the actual run time for individual feed events and the cumulative run time since last reset to zero.

2.1- Control Mode

Line 1 shows the Control mode that is currently selected: OFF (X), Manual (M), AUTO (A), Cycle Timer (T), Percent of Flow (F), or Daily Schedule (S).

To change the Control Mode, select the first line with the UP or DOWN ARROW keys and press the RIGHT ARROW key. The Control Mode screen is then displayed.

The control mode screen and selection procedures are common to all control functions.

2.2 - Display and Calibration

The second line displays the current reading of the pH sensor in pH units.

The pH sensor is best calibrated by testing the sample solution with a Phenol Red test kit. If needed, the CALIBRATION value may be adjusted to allow for differences or changes in pH sensor readings.

The pH sensor can be calibrated with 1, 2 or 3-Point calibration for origin, slope and curvature. This is done by pressing the RIGHT ARROW key to enter the CALIBRATION Submenu. The calibration procedure is common to all control functions. See CALIBRATION Submenu further down in Chapter II.

After calibration, the operator is shown the Submenu 2.2.1 asking whether automatic temperature compensation is to be used for pH readings. This option requires the use of the temperature sensor. The correction is normally small near neutral pH and is used only if large temperature fluctuations are expected.

2.3 - Setpoint

The pH SETPOINT determines the pH level that will be maintained automatically by the controller when placed in the AUTO control mode.

To change the setpoint, press the RIGHT ARROW key and enter the numerical value with the digital keypad. After pressing the OK key, the SETPOINT TYPE Submenu 2.3.1 is displayed asking whether the control is for Acid, Base or both.

Menu 2

pH		AUTO
Calibrate		7.4
Setpoint		7.5
Alarm Low		7.0
Alarm High		8.0
Time Limit	min	30
Run Time	15	60
Probe Rinse		OFF

Menu 2.2.1

Use Automatic Temperature Compensation for pH? NO YES

Menu 2.3.1

SETPOINT Acid Feed Base Feed Both
--

The normal (default) setting is for Acid feed. This means that the feed outlet is automatically activated when the pH sensor reading rises above the setpoint. If it is set for base feed, the outlet is activated when the pH sensor reading is below the setpoint.

2.4 - Alarm Low

The ALARM LOW value is set to generate an alarm when the pH reading falls below the set value. After the alarm value is set, the ALARM OPTIONS Submenu 1.4.1 is displayed, to set the feed interlock and alarm buzzer options.

2.5 - Alarm High

The ALARM HIGH value is set to generate an alarm when the pH reading rises above the set value. After the alarm value is set, the ALARM OPTIONS screen is shown, asking whether a high alarm condition should stop the feeder and activate the alarm buzzer.

2.6 - Time Limit

The TIME LIMIT sets the maximum allowed time (in minutes) for continuous acid or base feed (see ORP submenus). This acts as a safety feature to prevent overfeeding in case of malfunction of the chemical feeder or as an alarm if the feed tank runs empty.

2.7 - Run Time

The RUN TIME line displays two separate values: the amount of running time in minutes for each current activation event and the cumulative run time since last reset to zero. To reset only the current run time, turn the control mode off and back on. To reset the cumulative runtime, enter zero in the last column.

After the cumulative run time is reset, the TOTAL TIME ALARM submenu 3.7.1 is displayed to set the Total Time Alarm option. It can be used to simulate a low chemical level alarm by entering the number of minutes needed to empty the chemical container: i.e. container volume divided by feeder rate (i.e. 110 min = 55 ga / 0.5 gpm).

2.8 - Probe Clean

The Probe Clean Menu is used for automatic rinsing of the tips of the ORP and pH sensors by injection of a cleaning solution (usually a weak acid solution) through the recirculation line.

It has three modes of operation: Off, Manual and Automatic (see Submenu 2.8).

In both the Manual and Automatic modes, it allows a recovery time for the sensors to prevent chemical overfeeding while the signal is still affected by the cleaning solution (see Submenu 2.8.1). The recommended minimum is 1 minute.

In the Automatic mode, a 7-day weekly program is used to set up the ON and OFF times for probe cleaning any day or every day of the week (see Submenu 2.8.3).

Submenu 2.4.1 and 2.5.1

ALARM OPTIONS	
Feed lockout	YES
Alarm buzzer	YES

Submenu 2.7.1

TOTAL TIME ALARM
Alarm if total
Bleed time exceeds
110 min.
Enter 0 for no alarm

Submenu 2.8

PROBE RINSE
OFF
Manual
Auto

Submenu 2.8.3

PROBE RINSE	ON	OFF
MO	<u>19:00</u>	<u>19:05</u>
TU	<u>00:00</u>	<u>00:00</u>
WE	<u>19:00</u>	<u>19:05</u>
TH	<u>00:00</u>	<u>00:00</u>
FR	<u>19:00</u>	<u>19:05</u>
SA	<u>00:00</u>	<u>00:00</u>
SU	<u>19:00</u>	<u>19:05</u>

3 - ORP MAIN MENU

Operation

The ORP sensor is used to monitor and control a true oxidizer like ozone, or an oxidizing sanitizer, like chlorine or bromine. In the latter case, the controller monitors and controls the sanitizer through the oxidation-reduction potential it produces in the water.

The ORP Menu screen is used to access all the ORP submenus for Control Mode, sensor calibration, setpoint and alarm settings and shocking program (superchlorination if using chlorine).

It also displays the actual run time for individual feed events and the cumulative run time since last reset to zero.

3.1 - Control Mode

Line 1 shows the Control mode that is currently selected: OFF (X), Manual (M), AUTO (A), Cycle Timer (T), Percent of Flow (F), or Daily Schedule (S).

To change the Control Mode, select the first line with the UP or DOWN ARROW keys and press the RIGHT ARROW key. The Control Mode screen is then displayed.

The control mode screen and selection procedures are common to all sensor-based control functions. See CONTROL Submenu in this Chapter, page II-23.

3.2 - Display and Calibration

The second line displays the current reading of the ORP sensor in mV and is used to access the Calibration Submenu.

As with all sensor calibrations, the ORP sensor can be calibrated with 1, 2 or 3-Point calibration for origin, slope and curvature. This is done by pressing the RIGHT ARROW key to enter the CALIBRATION Submenu. The calibration procedure is common to all control functions. See CALIBRATION Submenu further down in this chapter.

Since the ORP sensor is direct reading and there are no readily available calibration solutions in the applicable range of operations for water treatment, it normally does not require calibration.

For other specialized applications, the calibration value may be adjusted to allow for differences or changes in ORP sensor readings.

3.3 - Setpoint

The ORP SETPOINT determines the ORP level that the CDCN maintains automatically when placed in the Automatic control mode.

Menu 3

ORP		AUTO
Calibrate	mV	750
Setpoint	mV	700
Alarm Low	mV	650
Alarm High	mV	850
Time Limit	min	30
Run Time	10	125
Last Shock		05/01/04

Menu 3.3

SETPOINT
Oxidizer
Reducer
Both

Submenus 3.4.1 and 3.5.1

ALARM OPTIONS	
Feed lockout	YES
Alarm buzzer	YES

To change the setpoint, press the RIGHT ARROW key and enter the numerical value with the digital keypad. After pressing the OK key, the SETPOINT Submenu 3.3 is displayed asking whether the control is to be set for an Oxidizer, a Reducer or both.

The CDCN includes one relay outlet for oxidizer and one for reducer (de-oxidizer) feed. The normal (default) setting is for an oxidizer. This means that the oxidizer feed outlet is automatically activated when the sensor reading falls below the setpoint.

3.4 - Low Alarm

The ALARM LOW value is set to generate an alarm when the pH reading falls below the set value. After the alarm value is set, the ALARM OPTIONS Submenu 3.4.1 is shown, asking whether a low alarm condition should stop the feeder and activate the alarm buzzer.

3.5 - High Alarm

The ALARM HIGH value is set to generate an alarm when the ORP reading rises above the set value. After the alarm value is set, the ALARM OPTIONS Submenu 3.5.1 is shown, asking whether a high alarm condition should stop the feeder and activate the alarm buzzer.

3.6 - Time Limit

The TIME LIMIT sets the maximum amount of time in minutes that is allowed for continuous feeding of the oxidizer to correct a high or low ORP reading. This acts as a safety feature to prevent overfeeding in case of a malfunction of the chemical feeder or as an alarm if the feed tank runs empty. The standard (default) value for ORP is 15 minutes but it can be changed at any time by the operator.

3.7 - Run Time

The RUN TIME line displays two separate values: the amount of running time in minutes for each current activation event and the cumulative run time since last reset to zero. To reset only the current run time, turn the control mode off and back on. To reset the cumulative runtime, enter zero in the last column.

After the cumulative run time is reset, the TOTAL TIME ALARM submenu 3.7.1 is displayed to set the Total Time Alarm option. It can be used to simulate a low chemical level alarm by entering the number of minutes needed to empty the chemical container: i.e. container volume divided by feeder rate (i.e. 110 min = 55 ga / 0.5 gpm).

3.8 - Last Shock

The LAST SHOCK line shows the last date of Shock Treatment. It is shown for display only, no adjustment can be made to this date.

Press the RIGHT ARROW key to enter the Submenu 3.8 for Shock Treatment, De-shock and Chemical Saver.

For details on the following options, see the SHOCK and SAVER Submenu.

Submenu 3.7.1

<p>TOTAL TIME ALARM Alarm if total Bleed time exceeds 110 min. Enter 0 for no alarm</p>
--

Submenu 3.8

<p>ORP SHOCKS AND SHOTS</p> <p>ORP Shock ORP Deshock ORP Booster</p>
--

3.8.1 - Shock Treatment

Shock Treatment refers to treatment with an elevated level of oxidizer which should be performed from time to time to prevent the accumulation of noxious chemicals (chloramines) or biological forms (algae, etc.).

3.8.2 - Deshock

Deshock refers to the addition of a reducing agent (such as Sodium Thiosulfate) which is used to reduce excessive amounts of oxidizer introduced during Shock Treatment.

3.8.3 - Booster

The Booster/Single Shot function is used to schedule a delayed one-time feed event. See SHOCK AND SAVINGS in this Chapter.

4 - TEMPERATURE MAIN MENU

Menu 4

Operation

The Temperature Menu is used to monitor the water temperature with the temperature sensor.

The temperature values can be used for compensation of the conductivity and pH sensor signals. They are also used for calculation of the Langelier Saturation Index (LSI).

All displays are either in degrees Fahrenheit for the U.S. system of units or in degrees Celsius for the metric system.

The Temperature Menu screen is used to access sensor calibration and alarm settings.

4.1 - Display and Calibration

The second line displays the current reading of the Temperature sensor in either temperature units.

The Temperature sensor can be calibrated to adjust for changes in sensor readings.

The temperature sensor can be calibrated with 1, 2 or 3-Point calibration for origin, slope and curvature. This is done by pressing the RIGHT ARROW key to enter the CALIBRATION Submenu. The calibration procedure is common to all control functions. See CALIBRATION Submenu further down in Chapter II.

4.2 - Low Alarm

The ALARM LOW value is set to generate an alarm when the temperature reading falls below the set value. After the alarm value is set, the ALARM OPTIONS screen 4.2.1 is shown, asking whether a low alarm condition should activate the alarm buzzer.

4.3 - High Alarm

The ALARM HIGH value is set to generate an alarm when the temperature reading rises above the set value. After the alarm value is set, the ALARM OPTIONS screen 4.3.1 is shown, asking whether a high alarm condition should activate the alarm buzzer.

TEMPERATURE		
Calibrate	F	80
Alarm Low	F	70
Alarm High	F	85

Submenus 4.2.1 and 4.3.1

ALARM OPTIONS	
Alarm buzzer	YES

5 - FLOW MAIN MENU

Menu 5

The Flow Main Menu is used to monitor the flow of water in and out of the system (fill and bleed), the water level and the influent/effluent pressures at the filter, and operation of the recirculation pump.

Water Level

The water level in a water treatment system tends to decrease constantly due to evaporation, leaks and other losses. The water level control menu is used to add water automatically in order to make up for these losses.

Flow Rates

The flow rates for fill and bleed and cumulative volumes are monitored with flow meters and displayed on Menu 5.

Both can be used to determine the addition of chemicals (see Additives Menu 7).

Due to the high cost of industrial water treatment, it is also important to keep track of the amount of water going in and out of the system. The flow menu is used to monitor the fill and bleed flow rates as well as cumulative volume. The difference between the two cumulative values can be used to estimate the amount of water lost to evaporation and leaks.

Filter

Filters are used to remove solid particles from the water. As the filter becomes progressively saturated, the influent pressure increases. When the pressure gets too high, it is necessary to remove the accumulated solid particles by backwashing.

5.1 - Water Level Control Mode

The water level can be maintained automatically with a fill valve controlled by an electro-optical sensor (P/N 138167).

As shown in Figure 16, the sensor uses the reflection of an LED beam inside a prism to determine the position of the water level. With no liquid present, the light beam from the LED is reflected within the prism to the receiver. When the liquid level reaches the prism, the index of refraction is changed and the beam does not reflect into the receiver. For best results, the surface of the prism must remain clean.

Submenu 5.1 is used to set the automatic fill valve to OFF, Manual or AUTO. The submenu allows the setting of a Time Limit for valve actuation to avoid overfilling.

It also displays actual and cumulative run times for water filling.

WATER LEVEL		AUTO
Fill	gpm	15
Total	KGa	220
Bleed	gpm	10
Total	KGa	110
P influent	psi	25
P effluent	psi	20
Main Pump		AUTO

Menu 5.1

WATER LEVEL		AUTO
Time Limit	min	10
Run Time	5	15

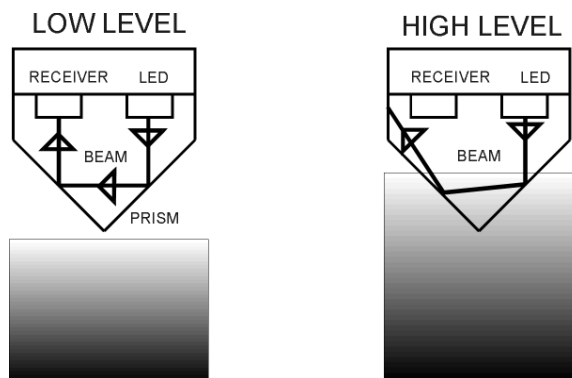


Figure 16 - Electro-optical Water Level Sensor

5.2 - Fill Flow Rate

Line 2 displays the make-up flow rate using either a Hall Effect or a Reed switch type flowmeter. To calibrate the meter, press the RIGHT ARROW key to enter the Fill Flowmeter Calibration Submenu 5.2.

The flowmeter is calibrated by entering the K-factor that is provided by the sensor manufacturer. The K values correspond to the number of pulses per unit of volume (gallons or liters). They are listed below for Schedule 80 and Schedule 40 PVC Pipe, according to ASTM-D-1785.

SCHEDULE 80 DIAM (in.)	K-FACTOR U.S. GA	K-FACTOR LITERS
1.5	175.394	46.339
2.0	105.032	27.749
2.5	74.093	19.576
3.0	47.411	12.526
3.5	35.482	9.374
4.0	27.289	7.210

SCHEDULE 40 DIAM (in.)	K-FACTOR U.S. GA	K-FACTOR LITERS
1.5	151.145	39.933
2.0	89.666	23.690
2.5	65.054	17.187
3.0	42.703	11.282
3.5	31.661	8.365
4.0	24.387	6.443

If further adjustments are needed, note that higher K values correspond to lower flow rates.

5.3 - Cumulative Fill

Line 3 shows the fill water cumulative flow. By pressing the RIGHT ARROW key, the operator accesses the Fill Water History Submenu 5.3. Three counters are available for independent resets.

5.4 - Bleed Flow Rate

Line 4 shows the bleed water flow rate. Instructions for calibration are the same as for fill water in paragraph 5.2.

5.5 - Cumulative Bleed

Line 5 shows cumulative fill. By pressing the RIGHT ARROW key, the operator accesses the Fill Water History Submenu 5.5.

Submenu 5.2

**FILL WATER
FLOWMETER CALIBRATION**

Enter number of
Pulses per unit
of volume: ____

Submenu 5.3

FILL WATER HISTORY

Total	Ga	220,000
Last Reset		06/01/04
Counter 1	Ga	90,000
Start Date		06/01/04
Counter 2	Ga	20,000
Start Date		06/07/04

Submenu 5.4

**BLEED WATER
FLOWMETER CALIBRATION**

Enter number of
Pulses per unit
of volume: ____

Submenu 5.5

BLEED WATER HISTORY

Total	Ga	110,000
Last Reset		06/01/04
Counter 1	Ga	45,000
Start Date		06/01/04
Counter 2	Ga	10,000
Start Date		06/07/04

5.6 - Influent Pressure

Line 5 displays the Influent Pressure before the first filter.

This is one of the parameters that can be used to initiate the filter backwashing operation when it exceeds a specified value that is indicative of a dirty filter condition (see Filter Menu 7).

Pressure Alarms

Submenu 5.6 is used to specify the alarm limits for the influent pressure in case of malfunction of the pump, filter or valves. There is no equivalent submenu for the effluent pressure.

Submenu 5.6.1 sets the options for the alarms. If set on YES, the Feed Limit alarm shuts off the main pump and the buzzer alerts the operator.

Calibration

Upon exiting Submenu 5.6.1, the calibration submenu 5.6.1.1 is displayed. The pressure sensor is calibrated by entering a factor representing the output in volts per unit of pressure, as specified by the manufacturer of the sensor.

The factory set **default factors of 0.43 and 0.50** are valid for the transducer in the pressure range of 0 to 60 pi. It should normally not require any adjustment.

5.7 - Effluent Pressure

Line number 7 in the Pump Menu screen shows the value of the Effluent Pressure, i.e. after the filter(s).

Submenu 5.7 is used for calibration of the effluent pressure sensor, if different from the influent sensor. It is calibrated in the same way as the Influent Pressure sensor.

Differential Pressure

The value of the Differential Pressure (Influent Pressure minus Effluent Pressure) is automatically calculated by the controller.

This is another parameter that can be used to initiate the filter backwashing operation when it exceeds a specified value that is indicative of a dirty filter condition (see Filter Menu 7).

Submenu 5.6

PRESSURE ALARMS		
Alarm low	psi	+ <u>10</u>
Alarm high	psi	+ <u>50</u>

Submenu 5.6.1

ALARM OPTIONS	
Feed Limit	<u>NO</u>
Buzzer	<u>NO</u>

Submenu 5.6.1.1

INFLUENT PRESSURE	
Enter Pressure factor: <u>0.43</u>	

Submenu 5.7

INFLUENT PRESSURE	
Enter Pressure factor: <u>0.43</u>	

Submenu 5.8

5.8 - Main Pump Control

Line 8 shows the mode of operation of the recirculation pump: on, off, or on a weekly schedule. Press the RIGHT ARROW key to enter the Control Mode Submenu 5.8.

When AUTO is selected, the Pump 7-day Weekly Schedule Submenu 5.8.3 is displayed. Daily ON and OFF times can be selected by the operator. If nothing is selected, the pump stays on all the time.

All scheduled times should be entered in the 24:00 hour format. Different times can be entered for different days. This allows for reduced costs of operation on weekends.

Thirty seconds before the pump starts automatically, the alarm sounds a warning beep in case maintenance operations are being performed.

PUMP
Off
Manual
Automatic

Submenu 5.8.3

PUMP	ON	OFF
Mo	<u>06:00</u>	<u>20:00</u>
Tu	<u>06:00</u>	<u>20:00</u>
We	<u>06:00</u>	<u>20:00</u>
Th	<u>06:00</u>	<u>20:00</u>
Fr	<u>06:00</u>	<u>20:00</u>
Sa	<u>06:00</u>	<u>18:00</u>
Su	<u>09:00</u>	<u>18:00</u>

6 - ADDITIVES MAIN MENU

Operation

The ADDITIVES menu is used to program the addition chemicals that cannot be controlled through sensor input, such as: corrosion and scale inhibitors, non-oxidizing biocides, flocculants, dispersants, etc.

The additive menus can be customized by selecting names in the Configuration/Initial Set Up/Model Options/Additives submenu 8.1.7.7 from a pre-defined list. Menu 7 on the right shows a typical customized menu but other names can be selected.

Menu 7 is used to access each ADDITIVE submenu to set the control mode, alarms, display of individual feed events and cumulative run times.

Because all additive submenus are identical, only the menu for the first additive is shown here.

6.1.1 - Control Mode

Line 1 shows the Control mode that is currently selected: OFF (X), Manual (M), AUTO (A), Cycle Timer (T), Percent of Flow (F), or Daily Schedule (S). To change the Control Mode, select the first line with the UP or DOWN ARROW keys and press the RIGHT ARROW key. The Control Mode screen is then displayed.

The control mode screen and selection procedures of modes OFF, Manual, Cycle Timer, Percent of Flow and Daily Schedule are common to all control functions. See CONTROL Submenu at the end of this Chapter for detailed explanations.

The AUTOMATIC control mode is different for Additives: The operator can select either Bleed-and-Feed or Bleed-then-Feed (post-bleed as a percent of bleed) control.

6.1.1.3.1 - Bleed and Feed

In the Bleed-and-Feed control mode, the controller activates the control outlet at the same time that water is bled.

In the Bleed and Feed Submenu 7.1.1.3.1, line 1 specifies the percentage of bleed time.

Line 2 shows the maximum time in minutes allowed for feeding.

If additional feeding is required, line 3 is used to set complementary feeding on a daily schedule.

6.1.1.3.2 - Bleed then Feed

To prevent the loss of additives with bleed water, Bleed-then-Feed can be used.

In the Bleed-then-Feed control mode, the controller activates the feed only after bleed is completed as a percentage of bleed time.

The Bleed-then-Feed submenu 7.1.1.3.2 includes the Bleed Lockout option (submenu 7.1.1.3.2.4).

Menu 7

ADDITIVES	
Inhibitor	F
Descaler	A
Biocide	S
Flocculant	T

Submenu 7.1

INHIBITOR	FLOW	
Time Limit	min	30
Run Time	10	125
Booster		NO

Submenu 7.1.1.3.1

BLEED AND FEED		
Feed %		100
Max Time	min	30
Daily Schedule		NO

Submenu 7.1.1.3.1

BLEED THEN FEED		
Feed %		50
Max Time	min	30
Daily Schedule		NO
Bleed Lockout		YES

6.1.1.3.2.4 - Bleed Lockout

The Bleed Lockout submenu 7.1.1.3.2.4 is used to prevent bleed during - or immediately after - feeding of chemicals and to specify pre-bleed and/or pre-pH feed operations.

Line 1 displays the **bleed lockout** time in percentage of feed time. A value superior to 100% prevents bleed during and after feed.

Line 2 displays the **lock memory** option to accumulate feed lockout time until bleed is completed.

Line 3 and 4 display the **pre-bleed** option to reduce the risk of deposits due to increasing conductivity or TDS level during a lockout period. The pre-bleed can be specified for a length of time and/or until a conductivity level is reached.

The **Pre-pH** option is used to adjust the pH level before additive feed. The pH feed can be set for a length of time (line 5) and/or until a pH level is reached (line 6). The controller maintains the pH level during the entire feed cycle.

6.1.2 - Time Limit

Line 2 shows the maximum amount of time in minutes that is allowed for continuous feeding of the additive. This is designed to alert the operator in case of a malfunction of the chemical feeder.

7.1.3 - Run Time

The RUN TIME displays the time in minutes for current activation and cumulative run time since last reset to zero.

To reset the cumulative run time, enter zero in the last column. To reset only the current run time, turn the control mode off and back on.

After the cumulative run time is reset, the TOTAL TIME ALARM submenu (see submenu 7.1.3) is displayed to set the Total Time Alarm option. It can be used to simulate a low chemical level alarm by entering the number of minutes needed to empty the chemical container: container volume divided by feeder rate (i.e. 110 min = 55 ga / 0.5 gpm)

7.1.4 - Booster/Single Shot

The Booster (Single Shot) function is used to schedule a delayed one-time feed event (i.e. feeding the biocide at 1:00 AM for an hour). It is independent of the other control modes.

The Booster Submenu 7.1.4 allows selection of the date, start time and duration of the feed event. Selection of line 4 leads to the Bleed Lockout submenu 7.1.1.3.2.4.

Submenu 7.1.1.3.2.4

BLEED LOCKOUT			
Lockout %			150
Lock memory			YES
Pre-bleed	min		10
Pre-bleed	uS		1900
Pre-pH	min		0
Pre-pH	pH		7.0

Submenu 7.1.3

TOTAL ALARM TIME	
Alarm if total	
Feed time exceeds:	
110 min	
Enter 0 for no alarm	

Submenu 7.1.4

BOOSTER	
Date	08/31/04
Start Time	21:00
Run Time	1:00
Bleed Lockout	YES

CONTROL SUBMENUS

The CONTROL Submenus for controls with sensor input (Conductivity, pH and ORP) are common to each other. The Additives Control submenus are also common, but Automatic control. Automatic control for additives is described in the ADDITIVES menu 7.

To simplify the presentation, the Control Submenus use the letters X and Y. X can be: 1 for Conductivity, 2 for pH or 3 for ORP. Y is for control type (ORP or pH only, see below): 1 for ON/OFF, 2 for Proportional and 3 for Progressive,

X.1 - Control Type

The first screen of the Control Submenu is used to select the control type: OFF (X), Manual (M), AUTO (A), Cycle Timer (T), Percent of Flow (F), or Daily Schedule (S).. Use the UP and DOWN keys to highlight the desired selection and then press the RIGHT ARROW key to confirm the selection.

If the operator selects **OFF**, the controller turns off the feed control outlet immediately and returns to the previous menu. If the operator selects **Manual**, the controller turns on the feed control outlet immediately and returns to the previous menu.

CAUTION: When set to Manual, the outlet *remains activated until reset* to off - regardless of the sensor readings. If the run time exceeds the Time Limit set by the operator in the specified submenu, the outlet will be turned off to prevent overfeeding.

X.Y.1 - Deadband

In all three automatic control modes (ON/OFF, Proportional and 4-20 mA), the controller uses a deadband zone near the setpoint to prevent chattering of the relay. The deadband is expressed as a percentage of the setpoint value and can be adjusted by the operator on the DEADBAND screen.

With the deadband, the outlet remains activated until the sensor reading reaches the setpoint, at which point it is de-activated. In order for the relay to be re-activated, the reading has to get outside the deadband, thus eliminating the effect of small fluctuations.

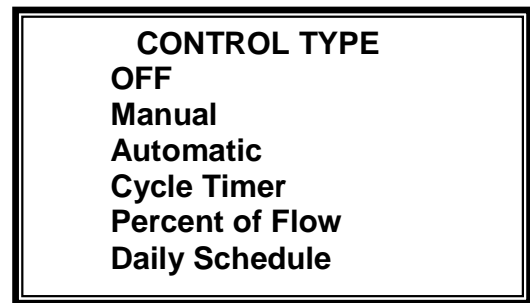
X.Y.2 - Progressive Zone

The PROGRESSIVE ZONE is a control zone around the setpoint where the outlet activation depends on how far the sensor reading is from the setpoint (see schematic above).

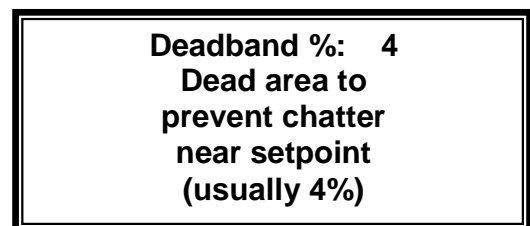
If the sensor reading is outside of the zone, then the outlet is turned on 100% of the time. The activation rate then decreases progressively as the reading nears the setpoint value. It reaches 0% when the reading enters the deadband zone near the setpoint.

This control mode is available in Proportional Control only (see next page). It provides more precise control than ON/OFF control and reduces overfeeding, particularly in smaller bodies of water.

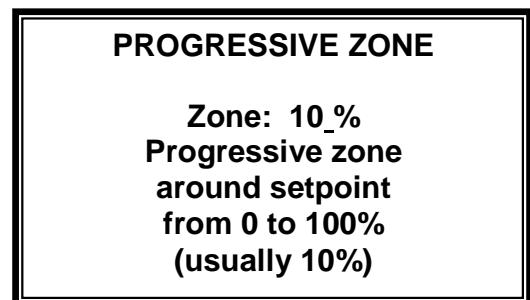
Submenu X.1



Submenu X.0.1



Submenu X.0.2



X.1.3 - Automatic Sensor Control

In Automatic Control with pH or ORP sensor input, the operator can choose among two different Control Modes: ON/OFF, Proportional. Conductivity control uses only ON/OFF control.

X.1.3.1 - ON/OFF Control

In the ON/OFF Control mode, the controller activates the control outlet until the setpoint is reached, at which point it is turned off. It is turned on again when the reading is outside of the deadband.

Selection of the ON/OFF control mode leads to the DEADBAND submenu screen X.0.1 (see previous page).

The ON/OFF control mode is recommended to obtain fast corrections to return to the setpoint rapidly, if there is no concern about overshooting (overfeed). This is particularly applicable to larger bodies of water.

Proportional Control is recommended for more precise control, especially in smaller bodies of water,

X.1.3.2 - Proportional Control

In the Proportional Control mode, the controller turns the feed on and off at a rate varying from 0% to 100% of a 15-minute time cycle.

Proportional control applies only within the Progressive Zone (Submenu X.0.2 on previous page).

The wider the Progressive Zone is, the more slowly and precisely the controller will return to the setpoint. As the width of the Progressive Zone is decreased, the reaction becomes faster and faster until eventually one approaches the conditions of ON/OFF control.

X.1.3.3 - 4-20 mA Control

This type of control is designed for electronic pumps with linear response to current inputs. It appears on the display only when the option is installed.

Instead of relays, the controller sends an electronic signal from 4 to 20 mA. The output is proportional to the distance from the setpoint. For instance, a 4 mA output corresponds to a 0% feed rate, 12 mA to 50% and 20 mA corresponds to 100%. The values of the 0 and 100% limits are adjustable for each function, as shown in submenu X.1.3.3.1 for ORP.

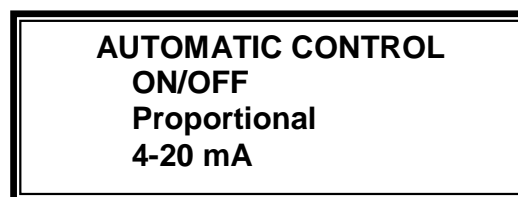
X.1.4 - Cycle Timer

Timer Control mode is available as a temporary control mode if a sensor is defective or not available.

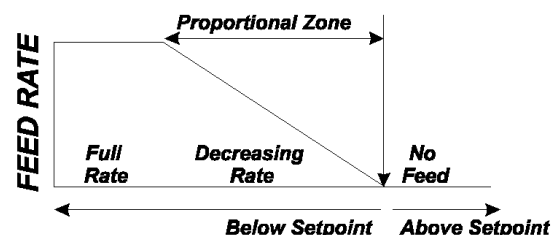
In this mode, the controller activates the control outlet according to fixed ON and OFF cycles. Each cycle is adjustable in 0.1 minutes increments.

Selection of the Bleed lockout function, displayed on line 3, is used when it is desirable to lock chemical feed during bleed and lock bleed during and after feed. It leads to the Bleed lockout Submenu X.1.4.2.3 (described above).

Submenu X.1.3.2.1



Proportional Control



Submenu X.1.3.3.1

4-20 mA Limits	
ORP Top	850
ORP Bottom	650

Submenu X.1.4.1

CYCLE TIMER	
Cycle ON (min)	0.1
Cycle OFF (min)	1.0
Bleed Lockout	YES

X.1.4.2 - Percent of Flow

In this mode, the controller activates the control outlet for a length of time that is proportional to the volume of fill water as monitored by the fill flowmeter (gallons or liters).

The % Flow Submenu X.1.4.2 displays the amount of time in minute for the selected volume of water.

The Bleed lockout function on line 3 prevents bleed during and after feed and specifies pre-bleed and/or pre-pH functions. It leads to the Bleed lockout Submenu X.1.4.2.3.

X.1.4.2.3 Bleed Lockout

The Bleed Lockout submenu X.1.4.2.3 is the same as for the additives menu. It is used to prevent bleed during - or immediately after - feeding of chemicals and to specify pre-bleed and/or pre-pH feed operations.

Line 1 displays the **bleed lockout** time in percentage of feed time. A value superior to 100% prevents bleed during and after feed.

Line 2 displays the **lock memory** option to accumulate feed lockout time until bleed is completed.

Line 3 and 4 display the **pre-bleed** option to reduce the risk of deposits due to increasing conductivity or TDS level during a lockout period. The pre-bleed can be specified for a length of time and/or until a conductivity level is reached.

The **Pre-pH** option is used to adjust the pH level before additive feed. The pH feed can be set for a length of time (line 5) and/or until a pH level is reached (line 6). The controller maintains the pH level during the entire feed cycle.

X.1.5 - Daily Schedule Control

In the Daily Schedule Control mode, the controller activates the control outlet for selected daily intervals - regardless of sensor input. Selection of the Daily Schedule control mode leads to the Daily Schedule Submenu screen X.1.5.

The operator selects the date of the first treatment ("Next Date") and the cycle in days for repeat treatments. The operator also sets the start time and duration (in minutes) of the treatment. "Last Date" shows date of last treatment.

The Bleed lockout function on line 5 prevents bleed during and after feed and specifies pre-bleed and/or pre-pH functions. It leads to the Bleed lockout Submenu X.1.4.2.3.

Submenu X.1.4.1

PERCENT OF FLOW		
Feed Time	min	0.5
Fill water	ga	10
Bleed Lockout		NO

Submenu X.1.4.2.3

BLEED LOCKOUT		
Lockout %		150
Lock memory		YES
Pre-bleed	min	10
Pre-bleed	uS	1900
Pre-pH	min	0
Pre-pH	pH	7.0

Submenu X.1.5

DAILY SCHEDULE	
Next date	08/31/04
Cycles (day)	2
Start Time	21:00
Run Time (min)	30
Bleed Lockout	YES
Last date	08/15/04

CALIBRATION SUBMENUS

X.2 - Calibration Options

The CALIBRATION Submenu is common to all the functions that require sensor calibration. This includes Conductivity, pH, Temperature and ORP. Pressure and Flow have only direct 1-point calibration.

The CALIBRATION OPTION Submenu X.2 is used to select the number of calibration points desired. Most applications require only 1- Point calibration but any number up to three can be selected. If more than 1-point calibration is selected, the operator needs to use calibrated buffer solutions. These sample solutions must be spaced sufficiently from one another to yield meaningful calibration values.

X.2.1 - One-Point Calibration

When using 1-Point calibration, the conversion curve for the sensor readings is a straight line using the standard (default) slope built in the program.

1-Point calibration should be satisfactory for most applications. The operator places the sensor in a single water sample and tests it with an appropriate test kit. The value obtained is then entered on the calibration screen as the new display value.

The controller uses the calibration value that has been entered by the operator to calculate the origin "a" of the representative linear equation:

$$\text{DISPLAY} = a + \text{SLOPE} * \text{INPUT}$$

X.2.2 - Two-Point Calibration

With 2-Point calibration, the operator needs to use two different solutions with values that are spaced widely enough to show significant differences in the slope of the calibration curve.

The controller uses these values to compute the origin "a" and slope "b" in the equation:

$$\text{DISPLAY} = a + b * \text{INPUT}$$

X.2.3 - Three-Point Calibration

With 3-Point calibration, the representative straight line is replaced by a second-degree polynomial curve. The operator needs three different solutions, again with values that are spaced widely enough to show differences in the curvature of the polynomial.

The controller uses these values to compute the origin "a", slope "b" and curvature "c" in the equation:

$$\text{DISPLAY} = a + b * \text{INPUT} + c * \text{INPUT} * \text{INPUT}$$

Submenu X.2

CALIBRATION OPTIONS

- 1 Point (zero)
- 2 Point (slope)
- 3 Point (curve)

Use 1, 2 or 3 points depending
on accuracy needed

Submenu X.2.1

1-PT CALIBRATION

Point 1 7.5

Submenu X.2.2

2-PT CALIBRATION

Point 1 7.5
Point 2 10.0

Submenu X.2.3

3-PT CALIBRATION

Point 1 4.0
Point 2 7.5
Point 3 10.0

SHOCK AND SAVINGS SUBMENUS

3.8 - Treatment Selection

The various types of shock treatment and recovery are selected from the following menu screen.

The **Shock Treatment** program is used to raise the level of oxidizer or sanitizer in the water in order to destroy harmful elements - such as chloramines, germs and algae - that develop immunity to normal chemical levels.

The **Deshock** program normally follows the Shocking program automatically in order to return the concentration levels back to normal values.

The **Booster** program is used to is used to schedule a delayed one-time feed event, such as during nighttime or on weekends. It is independent of other control modes.

3.8.1 - ORP Shock Program

The Shock Treatment Submenu allows the operator to set the program to OFF, ON or AUTO.

When set to ON, the Shock Treatment program starts immediately. When set to Automatic, the operator selects the date of the first treatment and the cycle in weeks for repeat treatments. He also sets the time to start and time to stop as well as the level of shock treatment to reach, in mV for Shock Treatment or in ppm or mg/l for Superchlorination.

Chemical injection stops when either the set level is reached or the end time is reached.

3.8.2 - ORP Deshock Program

The deshock program is set to feed a reducing agent - such as Sodium Thiosulfate - to eliminate excessive amounts of sanitizer after superchlorination. The operator may set the desired level, and the time limit in hours for the deshock process. When enabled, deshock immediately follows the shock treatment process. It stops when either the set level or the time limit is reached.

3.8.3 - ORP Booster

The **Booster** program is used to is used to schedule a delayed one-time feed event, such as during nighttime or on weekends (i.e., feeding the oxidizing biocide at 1:00 AM for an hour). It is independent of other control modes.

The Booster Submenu allows selection of the date, start time, and duration of the feed event. Selection of line 4 leads to the bleed lockout submenu X.1.4.2.3.

Submenu 3.8

ORP SHOCK AND SHOTS ORP Shock ORP Deshock ORP Booster
--

Submenu 3.8.1

ORP SHOCK	AUTO
Shock date	08/10/04
Cycle (weeks)	1
Time on	21:00
Time off	23:30
Level	850
Bleed lockout	NO

Submenu 3.8.3

ORP BOOSTER	
Date	08/31/04
Start Time	21:00
Run Time	1:00
Bleed Lockout	YES

CHAPTER IV - COMMUNICATIONS

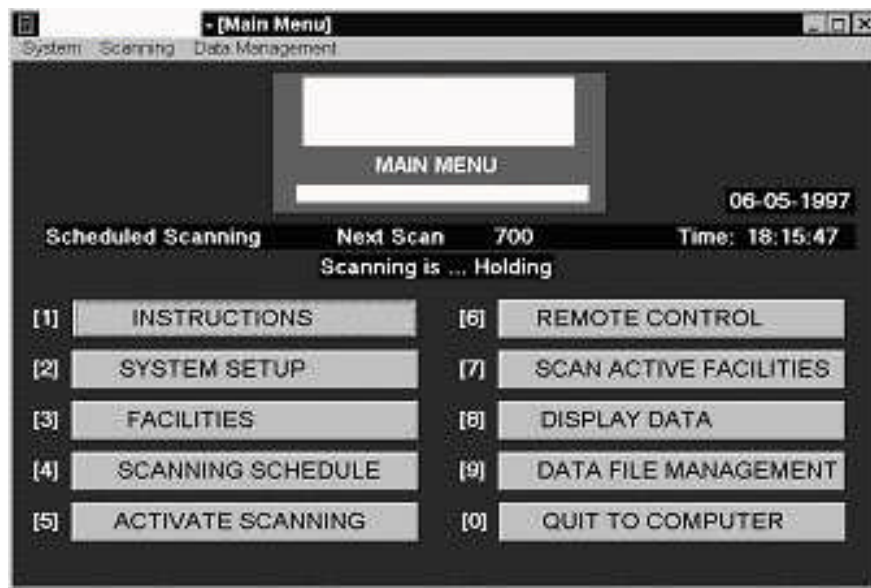


Figure 17.0 - Program Main Menu

COMMUNICATION OPTIONS

The CDCN controller offers several options for remote communications by computer or telephone:

- **All CDCN controllers** include a serial *RS232 port* for on-site data download.
- **Option RS485** includes an *RS485/RS232 converter* for on-site remote computer control with Communication Software,
- **Option COMM** includes an *internal modem* for remote computer control using software,
- **Option TEL** includes telephone communications with a touch-tone phone,
- **Option 420** converts sensor readings to 4-20mA signals.

REMOTE OPERATION OPTIONS

Direct Connection

The RS485 communication port for the RS485 option is located on the Mother Board (See Figure 5 or Figure 7).

Connect the wire cables of the RS232/RS485 converter to the RS485 port and to the computer RS232 port.

Modem Connection

The data/voice modem and the US-type RJ11 phone jack for the COMM2 option are mounted on the lower right hand side of the mother board (See Figure 5 or Figure 7).

Use a standard phone extension cable to connect the jack on the controller to a direct outside telephone line (no switchboard). The phone line does not have to be a dedicated line. It can be used for other communications when not in use for the controller. When called by a remote computer, the controller answers on the first ring unless somebody picks up the phone before.

The remote computer connects through a communication port that has to be specified in the communication software program, i.e. COM1, COM2, COM3 or COM4.

Computer Software Installation

The CDCNTrOl computer software program for remote operation is provided on CD-ROM.

To install it in Windows®, click on Start/Run and type A:setup. The program gets installed in the Program Files / CHEMCOM directory.

It creates an icon that can be dragged to the Windows® Desktop screen using Windows® Explorer. To start the program, click on the icon.

Software Program

The main screen of the program is shown on Figure 17.0.

Menu 1 INSTRUCTIONS shows operating instructions.

Menu 2 SYSTEM SETUP is used to setup the communication port, i.e. COM1, COM2, COM3 or COM4.

Menu 3 FACILITIES is used to enter the name and phone number of each facility and the model number of the controller, i.e. CDCN12 or CDCN13. Select "modem" for remote operation by modem connection or "direct" for remote operation by direct (RS485) connection.

For automatic scanning, the facility should be set to A (Active).

Menu 4 SCANNING SCHEDULE is used to select the automatic scanning mode: continuous, at regular intervals or on a set schedule.

Select either Menu 6 for REMOTE CONTROL of one facility or Menu 7 for AUTOMATIC SCANNING of multiple facilities.

To establish connection from a remote computer, select Menu 6 on the Main Menu of the software program and click on the name of the remote facility.

The program dials the phone number for the remote modem or establish direct connection via the RS485 port to connect to the controller, showing a true duplex representation of the controller screen, as shown on Figure 117.1.

True duplex operation means that all the moves and operations on the remote computer screen are simultaneously executed in real time on the controller screen, and vice versa. This allows 100% remote control of all operating functions.

Navigation through the menus and submenus on the remote computer is done exactly as with the actual controller, by using the computer arrow keys or, under Windows®, by clicking on the arrows shown on the computer screen with the mouse.

The remote operator can verify all operating conditions at a glance.

Line 1 shows the **Conductivity readings at 2000 $\mu\text{S}/\text{cm}$** with the bleed valve on (>) in the automatic bleed mode (A).

Line 2 shows a **pH reading of 8.5** in the Automatic mode (A).

Line 3 shows an **ORP reading of 750 mV** with no oxidizer pump feeding (X).

Line 4 shows a **Temperature reading of 72 F**.

Line 5 shows the **Fill and Bleed flowrates of 15 and 10 gpm** respectively with the fill valve activated in the Automatic mode (A).

Line 6 shows that the **Filter Backwash** is in Manual mode (M) with influent and effluent pressures of 25 and 20 psi respectively.

Line 7 shows that the **Additive 1** is in the Timer mode (T), Additive 2 and 3 in Daily Schedule mode (S), and Additive 4 in OFF mode (X).

Line 8 shows the **Date and Time** and the saturation condition as OK. This last line also gives access to the Configuration Menu.



Figure 17.1 - Remote Operation Screen

Automatic Scanning

To start automatic scanning, select Menu 7 on the Communication Software Main Menu. The modem on the computer automatically starts calling the remote facilities that have been marked as Active in the Facilities setup menu.

The operator can monitor single or multiple remote facilities from a remote PC computer screen, using a variety of scanning schedules. In the automatic mode, it scans all the facilities that have been set up as Active (A) in the FACILITY Menu (Figure).

When the remote controller is contacted, the test data is displayed on the computer screen, as shown below, and stored on disk file for later recall. Alarm conditions are alerted with flashing displays and audible beeps.

For unattended monitoring, a dedicated computer is recommended. However, the computer can also be used for other tasks under Windows® while the Communication Software program runs in the background.

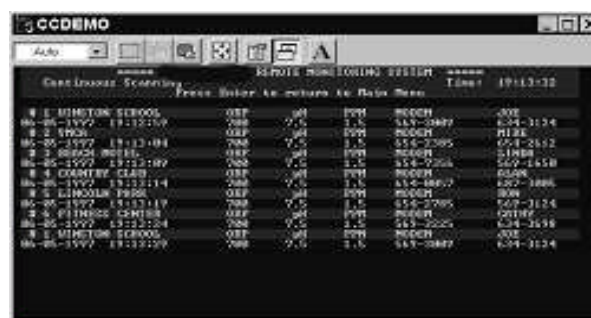


Figure 18 - Remote Scanning Screen

Figure 20 - Graphic Data Display

VOICE TELEPHONE STATUS REPORT

CONDUCTIVITY	1500	OFF/MANUAL/AUTO/TIMER/FLOW/SCHEDULE	On/Off
pH	7.5	OFF/MANUAL/AUTO/TIMER/FLOW/SCHEDULE	On/Off
ORP	725	OFF/MANUAL/AUTO/TIMER/FLOW/SCHEDULE	On/Off
TEMPERATURE	78		
PUMP	15	OFF/MANUAL/AUTO	On/Off
FILTER	25	OFF/MANUAL/AUTO	On/Off

TELEPHONE (OPTION TEL)

The Telephone (TEL) option supplements the Remote Operation (COMM) option. Available for the CDCN13 controllers, it includes two forms of telephone communications using touch-tone phones:

- voice status reports,
- alarm callouts.

Voice Status Reports

The easiest way to communicate with the controller from a remote location is with a simple touch-tone telephone.

At any time, the CDCN with the TEL option will answer an incoming phone call. The unit will first respond with modem tones, in an attempt to connect to a computer.

If code numbers have been specified in the Initial Setup Submenu, the controller waits without prompting until the caller enters his code number on the touch-tone phone. After a valid number is entered, the unit delivers the current status report.

As shown above, the status report includes:

- function name,
- current value,
- applicable operating mode and
- applicable operational status.

The status report is repeated until the caller enters a number for a Main Menu or hangs up.

Alarm Callouts

Up to six different emergency phone numbers can be called when an alarm condition exists. The phone numbers are entered in the Telephone Data screen through the Configuration/Communications Submenu 8.3.1 (see Chapter II).

If any alarm occurs, the unit will dial in sequence the phone numbers entered in the Communication Submenu.

After dialing the unit ID and an alarm message is repeated verbally several times. When someone answers and enters a valid password, the unit stops calling and deliver the alarm message.

"Alarm Unit ___"

4-20 mA SIGNAL (OPTION -A)

The 4-20 mA output is an option (OPTION -A) that includes a converter board to convert sensor readings and/or control outputs into analog signals that can be fed into analog monitoring equipment (BMS) or control equipment (pumps or valves with analog control circuitry).

The converter board plugs into the JP1 header, on the controller motherboard. (Figure 5, page 13).

The four analog signals for Conductivity, pH, ORP and temperature are set at the factory with the 4 mA and 20 mA limits corresponding to the Low and High alarm values for each parameter. These limits can be adjusted individually by the operator through the controller Submenu 8.3.4.

CHAPTER V - STARTUP

CONTROLLER STARTUP

Configuration Menu

The CDCN is tested and shipped from the factory with the standard default values that are programmed in the controller.

Upon startup, it is recommended to verify the initial setup through the CONFIGURATION Menu (Submenu 8.1) and to adjust the values as required. This includes adjusting the clock for different time zones and selecting the proper language and units system.

Alarm Buzzer

To avoid unnecessary noise, the Audible Alarm option is normally turned off until the sensors are installed. Remember to turn it back on for normal operation (Submenu 8.2.1).

Bypass Line

The Bypass Line Option is normally turned off to allow initial chemical feeding upon startup. It is important to turn it back on (Submenu 8.2.2) as soon as the Safety Flow Switch is installed, to prevent accidental feeding when there is no water flow in the bypass line.

Battery Check

Check the condition of the Backup Battery. It prevents the loss of memory data in case of power shutdown. The voltage of the battery can be verified through the CONFIGURATION Menu (Submenu 8.2.6).

If the battery voltage is less than 2.5V, the battery should be replaced with a 3Vlithium battery, CR2330 or equivalent.

BLEED AND CHEMICAL CONTROL

Initial Activation of Sensors

For a new installation, it is recommended to wait for a week or two after filtration is started (if filters are used on the system) before installing the sensors. This will prevent damage to the sensors until all the dirt and debris have been filtered out of the water.

When ready to start the CDCN, install the sensors in the recirculation line and run the recirculation pump for 15 to 30 minutes or until the readings of the sensors stabilize.

Bypass Line Test

If there is a bypass line, open the sampling tap on the bypass line and adjust the two shutoff valves until there is a smooth flow of water coming out of the tap (no suction or excessive pressure).

Conductivity and Chemistry Adjustment

Before starting automatic control, the water chemistry should be adjusted to near the recommended values for conductivity/temperature, pH and ORP. The chemicals can be added manually or with the controller set on Manual Mode.

NOTE: *The controller will not operate in the Automatic Mode if the sensor readings are below or above the alarm settings.*

Water Sampling

Proper water sampling is essential for accurate calibration of the conductivity/temperature, pH and ORP sensors. The preferred method is to sample the water as close as possible to the location of the sensors, usually on the bypass line. The bypass line should be therefore equipped with a water sampling tap, which can consist simply of a ball valve.

Because of the instability of chlorine, particularly under sunlight, samples taken near the surface of the water can give false results.

Conductivity Calibration

Test the conductivity of the water at least twice with a portable conductivity meter or until you get consistent readings. Make sure that controller and portable meter use temperature compensation at 25°C.

If the portable meter value differs from the value shown on the controller display, using a calibrated standard solution, select Conductivity Menu and Calibration Submenu and enter the value indicated on the reference solution, using the 1-Point Calibration option. For more accurate calibration with 2 or 3 points, conduct the same process with two or three different conductivity values using calibrated standard solutions of appropriate values.

pH Calibration

NOTE: Always calibrate the pH sensor first, before the sanitizer.

Test the pH of the water at least twice with a fresh solution of a standard Phenol Red test kit, or until you get consistent readings.

- If the pH is below 7.0: **CAUTION: POSSIBLE CORROSIVE CONDITION.** Add a base (Soda Ash, Caustic Soda NaOH, pH PLUS, pH UP, etc.) to raise it.
- If the pH is above 8.0: **CAUTION: POSSIBLE SCALING CONDITION.** Add an acid (Muratic Acid, Hypochloric Acid HCl, Sodium Bisulfate, etc.) to lower it.

If the test kit value differs from the value shown on the controller display, select pH Menu and Calibration Submenu and enter the value indicated by the test kit, using the 1-Point Calibration option.

For more accurate calibration with 2 or 3 points, repeat the same process at two or three different pH values using calibrated standard solutions of appropriate values. Most common values are for pH 4.0, 7.0 and 10.0.

pH Feed (Acid or Base)

The CDCN13 has both Acid and Base feed outlets for pH control. Acid Feed is activated when the pH is **above** the setpoint and Base Feed when it is below the setpoint.

In most cases, only one type of chemical is required, i.e. either acid or base, depending mostly on the type of sanitizer used. Make sure to connect the acid or base chemical feeder to the proper outlet on the Power Board (see the INSTALLATION chapter).

pH Setpoint

The default value for the pH setpoint is 8.5. It can be modified at any time through the pH Menu.

ORP Calibration

The ORP sensor is direct reading and does not require calibration.

ORP Setpoint

The default value for the ORP setpoint is 700 mV. It can be modified at any time through the ORP Setpoint Submenu.

The controller will automatically activate the chlorinator, brominator or ozonator whenever the reading is below the ORP deadband. It will stop automatically as soon as the reading is above the ORP setpoint.

ADDITIVES Feed

The CDCN13 has four (4) feed outlets for chemical additives such as inhibitors, biocides, descalers, etc. Each additive Feed can be controlled manually, automatically (bleed & feed, bleed-then-feed), on cycle timer, as a percent of flow, or following a daily schedule.

In most cases, corrosion and scale inhibitors are fed automatically or on percent of flow, while biocides are fed on daily schedule.

Time Limits

The Time Limits for each outlet should be set for the length of time that can be safely tolerated for chemical overfeeding - in case of equipment malfunction or operator error. This time varies with each installation, based on the size of the installation (gallons of water) and the feed rate of the chemical feeders.

Shock Treatment

It is recommended to wait several weeks before using the automatic superoxidation cycle, or until all the other operating functions of the controller have been properly tested out.

SATURATION INDEX

The CDCN features automatic calculation of the Langelier Saturation Index (Submenu 8.2.3).

It is recommended to check the water saturation as soon as possible after installation to prevent damage to the equipment through corrosion or scaling. This should be done immediately after calibration of the pH and temperature sensors, using a reliable test kit to obtain the alkalinity and calcium hardness values.

CHAPTER VI - MAINTENANCE

CONTROLLER MAINTENANCE

Regular Maintenance

The CDCN controller requires very little maintenance besides cleaning of the sensors and replacement of the battery, if needed, after a long shutdown.

How often the sensors require cleaning depends on the quality and flow of water. Use the Acid Test below to check the pH and ORP sensors. It is recommended to schedule preventive cleaning programs on a weekly or monthly basis.

The Acid Test

Caution: When handling hydrochloric (muriatic) acid, always follow the manufacturer's handling precautions and guidelines. Use only as directed.

The Acid Test can be used to check the pH and ORP sensors on line.

Carefully add a small amount (½ cup or less) of hydrochloric (muriatic) acid HCl in the intake side of the recirculation line, upstream of the sensors, and observe the pH and ORP readings on the Main Display. After a few minutes, the pH reading should go down and the ORP reading up. After several minutes, both readings should return to their original values.

Sensor Cleaning

The sensors may stop reading properly if they become coated with a film of oil, calcium or dirt.

To clean the **pH Sensor**, carefully remove it from the compression fitting and clean the tip in a liquid soap solution (such as Joy, Palmolive, etc.). If it still does not work, dip it again for 5 to 10 seconds in muriatic acid (hydrochloric acid HCl). Rinse in clean water and reinsert it in the fitting.

For the **ORP Sensor**, use the same procedure.

The electrodes of the **Conductivity Sensor** can be cleaned with a mild abrasive (brush or sandpaper) to remove non-conducting deposits.

The prism of the **Water Level Sensor** can be cleaned with a gentle soap solution and a soft tissue. *Do not use chlorinated hydrocarbons (acetone, gasoline, etc.).*

- store at room temperature
- keep the protective cap on the sensor with a few drops of water to keep the tip moist. Check periodically that there is always some water inside the cap.
- store the sensors with the tips down to prevent the air bubble from migrating toward the junction,
- shock the sensor with chlorine if stored over 3 months.

Battery Replacement

The memory battery is located in the upper left corner of the Mother Board. It keeps the configuration, operational and calibration settings in memory if the power supply is shut down. A low battery condition does not affect the operation of the controller as long as the main power is on.

To check the voltage of the battery, go to Configuration / Operations / Battery to display Submenu 8.2.6.

If the battery shows a voltage below 2.5 V, it should be replaced with a 3V lithium battery, CR 2330, CR2032 or equivalent.

To replace the battery, turn off the power to the controller, slide out the old battery and insert the new one, making sure to set it in with the positive (+) side up.

After full power shutdown, the controller reverts to the original factory default settings. You must re-enter your own settings if they are different.

Software Upgrade

The software program in the CDCN controller can be upgraded by replacing the program and display chips that are located on the Mother Board. To avoid damaging the chips, follow the procedure below carefully.

1. Disconnect all power to the unit and remove the jumper J1 (J3 for CDCN12) next to the battery on the motherboard.
2. Locate the Program Chip U2 and the Display Chip U3 (U28 and U8 for CDCN12) in the upper section of the board.
3. Insert a flat screwdriver under the old chip and pry it gently away from its socket. Store it as a backup.
4. Handle the new chip carefully and avoid electrostatic discharge. Identify the chip orientation with the small half-moon indent upward for the CDCN13 (downward for CDCN12). CAREFUL: wrong installation will damage the program.
5. Make sure all the pins are straight. Insert the new chip in the socket by aligning all the pins on one side first, then on the other side, applying lateral pressure to facilitate insertion.
6. Replace the jumper in J1 (J3 for CDCN12) and restore power to the controller. You should see the CDCN logo displayed on the screen twice. When the display screen shows asterisks (***) for date and time, you are assured that the old program has been erased in its entirety.
7. Reprogram the controller to your desired parameters.

CHEMICAL MAINTENANCE

Overview

For best results, it is strongly recommended to have a primary operator in charge of water maintenance and testing, as different people can read the test kits differently.

Also, it is recommended to check the calibration of the controller at the same time of the day, preferably in the morning after a couple of hours of operation, but before full sun.

Finally, the system operator should become familiar with ORP technology (see below) and learn to trust the information it provides rather than less reliable test kits.

pH Control

The importance of proper pH control cannot be emphasized enough, as it affects every aspect of water chemistry.

When the pH is too low, the water becomes increasingly corrosive and causes stains or etching of plaster. When the pH is too high, the efficiency of the sanitizer decreases rapidly and the water becomes too alkaline - which causes cloudiness, stains and scaling.

pH control is also affected by Total Alkalinity (TA). If (TA) is too high, pH response is slow and requires more acid or base feed. If it is too low, pH control becomes very sensitive.

Because of the Time Lag for mixing of the chemicals in the water, there is always a fluctuation (0.1 to 0.2 pH units) above or below the setpoint, depending on the chemical feed rate.

If the pH tends to overshoot the setpoint, the Control Mode should be set to Proportional. Alternatively, the feed rate of the acid or soda feed pump can be reduced or a more dilute solution can be used (especially in a small body of water, like a spa). **DO NOT CHANGE THE SETPOINT.**

In an ACID FEED system, if the pH meter consistently reads too high (not enough acid), the feed rate of the acid feed pump should be increased, or a stronger solution should be used. **DO NOT CHANGE THE SETPOINT.**

In a SODA FEED system, if the pH meter consistently reads too low (not enough soda), the feed rate of the soda feed pump should be increased, or a stronger solution should be used. **DO NOT CHANGE THE SETPOINT.**

ORP Control

To be sure of proper sanitation, the ORP should always be above 650 mV. Even if using additional purification systems, such as ozone, UV systems or metal ion systems, **THE ORP READING MUST ALWAYS BE MAINTAINED ABOVE 650 mV.**

If the meter shows too much overshoot, the Control Mode should be set to Proportional to reduce the feed rate. **DO NOT CHANGE THE SETPOINT.**

If the meter consistently reads below the set point, reduce the width of the Progressive Zone or set the control mode to ON/OFF to increase the feed rate. **DO NOT CHANGE THE SETPOINT.**

The sensor reads ORP (Oxidation-Reduction Potential) which is closely related to the FAST ACTING FREE CHLORINE (HOCl), the most effective sanitizer. The DPD and FACTS test kits - and most other controllers - however read only the combination of FAST ACTING and SLOW ACTING FREE CHLORINE (HOCl and OCl⁻). This is not very meaningful because the slow acting form of chlorine is about 80 to 100 times slower than HOCl in killing bacteria.

If the ORP reading is maintained above the recommended minimum of 650 mV, the water should be free of germs and bacteria. Below 650 mV, germs and bacteria will develop.

ORP readings are closely tied to the concentration of Fast Acting Free Chlorine (HOCl), which is affected by pH and by the cyanuric acid level. If the pH and/or cyanuric acid level are too high, the ORP will be reduced even with high levels of chlorine.

With stabilized forms of chlorine (dichlor powder or trichlor tablets), it is important to test the **cyanuric acid level** in the water regularly and to bleed or replace part of the water.

If other purification systems are used (**ozone, UV or metal ions systems**), it is very important to maintain the proper ORP level at all times with chlorine or bromine residuals.

NOTE: Never use **sequestering agents** with ORP sensors as they will coat the platinum ring and prevent it from reading.

Limit Timers (Overfeed Safety)

The Time Limit settings are designed to automatically disable the feeders or other equipment in the event of equipment failure or operator error such as:

- sensor or electronics failure,
- chemical feeder malfunction,
- improper valving of the recirculation system,
- manual override of automatic control by untrained or unauthorized personnel,
- depletion of chemical supply.

In normal operation, the chemical feeders are activated only for a short period of time - that is until the chemical level in the water has returned to the proper value. As soon as the chemical feeder is activated, the safety timer is turned on. Normally, feeding stops before the time limit is reached. The timer then resets to zero and waits for the next activation cycle.

However, if feeding continues over the preset time, the timer immediately stops the feeder and activates the overfeed alarm. It must then be reset manually by resetting the limit timer to 0 (see Chapter II) after the cause of the malfunction has been corrected.

Timer Settings

To select the proper setting for each safety timer, the operator must take into consideration the size of the system and the feed rate of the chemical feeder.

NOTE 1: The chemical feeders should be properly sized for the installation so that they do not have to feed continuously for more than 3 hours - even during peak usage periods.

NOTE 2: Once tripped, the safety timer has to be reset manually by the operator after investigation and correction of the malfunction.

PERIODIC MAINTENANCE

Water Testing

1. Test the water with a reliable and fresh test kit daily or as often as required by the local health department.
2. Adjust the reading of the display if needed.
3. If the PPM or pH readings are out-of-range:
 - a. Investigate and correct the cause of the problem immediately,
 - b. Readjust the water manually if needed and recalibrate the displays.
4. If the displays cannot be recalibrated after adjustment of the water chemistry, clean the sensor tips and recalibrate the meters.
5. If the displays still cannot be calibrated, see the TROUBLESHOOTING section.

Shock Treatment

Even when maintaining the proper chlorine residual level with Chemical Automation, it is recommended to shock or superchlorinate the water periodically for the following reasons:

1. To prevent algae growth resulting from genetic adaptation of algae species to chlorine, i.e. becoming chlorine resistant.
2. If the chlorine level is allowed to fall below the normal level, even for a short period of time (due to exhaustion of chemicals or technical malfunction), there can be formation of chloramines, which can be destroyed only by breakpoint superchlorination.

WARNING:

If there is a concentration of chloramines of 0.2 PPM (mg/l) or more, a superchlorination level of 10 times the combined chlorine level is required.

The shock treatment program can be set up either through the ORP Menu or the SANITIZER Menu, depending on the choice of chemicals.

The weekly cycle, date and time should be selected based on the particular requirements and utilization schedule of the facility.

Precautions

- A. During superchlorination, the Time Limit safety is bypassed.
- B. A SHOCK treatment warning is displayed on the Display Screen when activated.
- C. The out-of-range alarms stay on as long as the oxidizer or sanitizer levels are above the high limits.

Deshock (Dechlorination)

Following shock treatment, or superchlorination, it may be necessary to reduce the excess chlorine to allow swimming.

This can be done with a reducing agent such as Use Sodium Thiosulfate (Photographer's Hypo) with the Deshock program.

For faster results, it can also be done manually as follows:

Add 4.5oz (130 g) per 10,000 gallons (40 cubic meters) of water for each 1 PPM (mg/l) of chlorine to reduce.

Add half of the required amount first, allow time to react and test the water before adding the rest.

**MAKE SURE TO TURN OFF THE CONTROLLER
AND SHUT OFF THE BYPASS LINE WHEN DOING
GENERAL MAINTENANCE.**

TROUBLESHOOTING

Problems	Solutions
1. NO DISPLAY.	1a. Check power to system. 1b. Check On/Off Switch on right side of cabinet. 1b. Check Voltage Selector Switch in upper section of Power Board. Verify proper input voltage 110V or 230V. 1d. Check Fuse F2 on Power Board. If blown, replace with AGC1 fast blow fuse.
2. FAINT OR DARK DISPLAY	2a. Adjust contrast with Display Potentiometer R39 in center of Mother Board.
3. ERRATIC DISPLAY.	3a. Turn Power Switch off for 10 seconds and back on. 3b. Check power cable contacts. 3c. Check power strip connecting Mother Board and Power Board. 3d. Press program and memory chips on Mother Board to assure proper contacts.
4. NO EVENT ACTIVATION	4a. If PUMP Option is not available, set N.A. in Setup/Options submenu. 4b. If PUMP Option is available, verify that pump is ON.
5. NO CHEMICAL FEED NO BLEED	5a. Check flashing line in Main Display Screen. Highlight flashing line with UP or DOWN arrow. Press RIGHT arrow to enter submenu. Check flashing line in Submenu. 5b. If LOW or HIGH ALARM is flashing: Adjust water chemistry manually. Press RIGHT arrow to change alarm limits. Set Feed Lockout to Off (CAUTION !!!). 5c. If RUN TIME line is flashing: Increase chemical feeder rate. Increase Limit Timer setting. Reset Run Time with AUTO setting. 5d. If BYPASS LINE is flashing on Main Display: Check water flow in bypass line. Check Safety Flow Switch in bypass line. Set Bypass Line to Off in Operations Submenu (CAUTION !!!). 5e. Set Feed Mode to MANUAL. Feed Indicator on Main Display should turn on. 5f. Check Relay Fuses on Power Board. ORP Fuses F4 and F5 Sanitizer Fuses F10 and F11 pH Fuses F8 and F9
6. CANNOT CALIBRATE	6a. Check water balance and adjust if needed. 6b. Clean faulty sensor as indicated. 6c. Check sensor connections.
7. CHLORINE OR pH OVERFEED	7a. Clean and test the faulty sensor. 7b. Check and adjust the calibration. 7c. Check and adjust the setpoint. 7d. Check the relay. 7e. Check the chemical feeder for leaks. 7f. Reduce feed rate or dilute the solution. 7g. Check the Superchlorination Program.
8. IMPROPER READINGS	8a. Clean the faulty sensor.

PARTS AND ACCESSORIES

ORP	ORP SENSOR with 10-ft (3-m) shielded cable and BNC connector.
pH	pH SENSOR with 10-ft (3-m) shielded cable and BNC connector.
TEMP	TEMPERATURE SENSOR, 1/4" MPT, 10-ft (3-m) cable
C/T	TEMPERATURE + CONDUCTIVITY SENSOR with 10-ft (3m) cable.
FS	ON/OFF SAFETY FLOW SWITCH, 3/4" FPT, for bypass line.
PSI	PRESSURE TRANSDUCER, piezoelectric, 1/4" MPT.
138167	WATER LEVEL SENSOR, electro-optical, 1/4" MPT.
MBCDCN12	MOTHER PC BOARD, electronic PC board for CDCN12 with microprocessor.
MBCDCN13	MOTHER PC BOARD, electronic PC board for CDCN13 with microprocessor.
PBCDCN12	POWER PC BOARD, electronic PC board for CDCN12 with relays (specify).
PBCDCN13	POWER PC BOARD, electronic PC board for CDCN13 with relays (specify).
4-20MA	COMMUNICATIONS PC BOARD, 4-20 mA, 5 channels (for CDCN13 only).
FSLYCT	FLOW SWITCH LINE ASSY, 3/4"
205T	PVC SOLENOID VALVE, 1" or 3/4" FPT (specify 24 V or 110VAC).

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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- ☑ Refractometers
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- ☑ Air, Soil & Water Monitors
- ☑ Industrial Water & Wastewater Treatment
- ☑ pH, Conductivity & Dissolved Oxygen Instruments