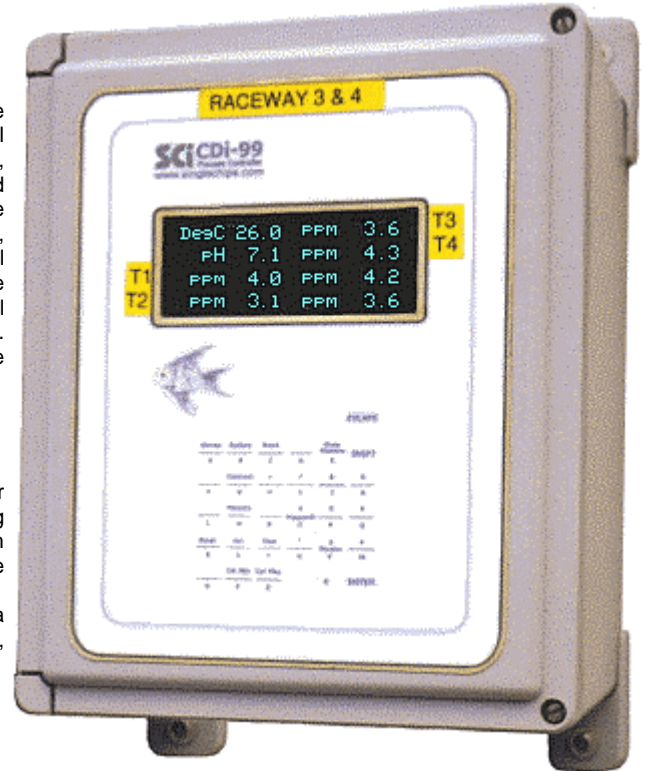




Keep your fish alive! Install a CDi99 controller!

What is a CDi99?

The CDi99 system may be the answer to your problems if you are involved in intensive recirculation aquaculture. In a typical operation the flow from several tanks is returned to a common, "sump" area where water is filtered, heated, and further processed before it is routed back to the tanks. This sump tank is where temperature and pH are measured and controlled. In contrast, dissolved oxygen is measured and controlled at each individual tank. The CDi99 was designed on the principle of "oxygen probe and saturator for every tank". This scheme allows very tight control of dissolved oxygen in each tank, regardless of the fish population. Tight control of oxygen has the added benefit of buying you some response time, when there is trouble.



Some features

- ❖ Networked logger and controller, specifically designed for intensive aquaculture applications. It manages recording (logging) and control for up to eight channels. System expansion is accomplished by adding more units to the network, as needed.
- ❖ Visual interface simplifies programming and automates data handling and graphics generation. Control from the keyboard, local PC, modem, or from across the Internet.

Hardware

- ❖ **Controller.** Industrial-strength datalogger and controller with

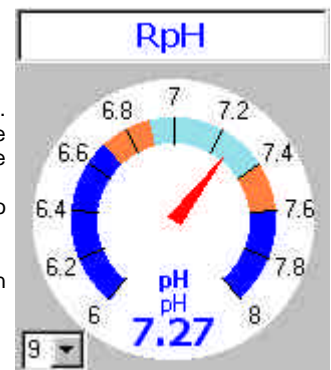
DesC	25.4*	PPM	5.8
PH	7.1	PPM	4.8
PPM	4.7*	PPM	4.6
PPM	6.2	PPM	6.1

large memory capacity and a ten man-year development history. It controls temperature, pH, and up to six dissolved oxygen diffusers or saturators, while allowing the operator to see all measurements, output states, and alarm conditions on its integral display. The example on the left illustrates a typical display. The asterisks indicate an active output (1 and 3 in this example).

- ❖ **Display.** Large, 4 line x 20 Character VFD (Vacuum Fluorescent Display), perfect for indoor use, where ambient light is low. Polarizing lens increase contrast in high ambient light situations. An LCD version is available, but LCD technology does not match the brilliance, contrast and viewing angle of the VFD.
- ❖ **Memory.** 1 Megabyte data storage area. Large enough to allow storage of all eight channels, every ten minutes, for up to a year.
- ❖ **Input / Output.** 8 analog inputs (15 bit resolution), 9 digital output channels (8 control + 1 alarm). The digital outputs can be "software tied" to inputs to form control loops.
- ❖ **Common Alarm Output.** Common alarm can be used to trigger third-party security and paging systems such as sens-a-phone and others.
- ❖ **Galvanic Isolation.** Input channels with 1500 Volt galvanic isolation from system ground and from each other, and isolated communications links. Outputs are also galvanically or electrically isolated through the use of opto-isolated relays.
- ❖ **RS-485 network.** Allows up to 255 controllers to be daisy-chained together. The PC is the master through which all communication takes place.

Software

- ❖ Visual, "gauge" interface simplifies setup and displays operating parameters at a glance. Calibrate, set alarms and operating ranges the easy way: grab the gauge needle with the mouse, move it to the value you want to set, and right-click the appropriate command from the context menu. That's it!
- ❖ Download and have a labeled graph on the screen in seconds. No spreadsheet and no database!
- ❖ Supports all Windows serial ports and USB ports with external adapter.
- ❖ Comprehensive realtime display. When the unit is in realtime mode, all values are displayed in realtime (every two seconds or so).
- ❖ Programmable recording interval from one minute to three days with one minute resolution.





CDi99 System Overview

Keep your fish alive! Install a CDi99 controller!

The CDi99 logger/controller system described here has been in development since November '98, and was designed to meet the specific needs of an intensive recirculation fish farm operation in Simcoe, Ontario. The primary design goals included:

- ❖ **Oxygen probe and control in every tank.** There is no point in trying to run the entire farm with a hand held meter. Sooner or later some part of the system will fail and the operator will not know about it in time. Fish will die. Labor costs prohibit watching the tanks around the clock. Fish grow faster and better in a steady environment, very difficult to accomplish by running around, adjusting things. Automation is the only financially-viable alternative.
- ❖ **Ability to record for long periods of time.** The responsible grower should have records of past system performance, right from day one. Potential problems are easier to handle if one has historical information. Correlate and learn!
- ❖ **Ease of use and automatic data handling.** No sane person wants to export thousands of numbers to Excel and almost go blind, just to produce a simple graph. So we invented our own file system. The operator can have a graph on the screen, immediately after download. Even file naming is automatic. All graph labels are automatic; title, units, scale limits, all automatic - **no typing!**
- ❖ **Network and deliberate redundancy.** Sure, the competition can build a controller with 1000 channels. So can we. But what happens when, for whatever reason, the controller fails? Help!! Networking several controllers provides redundancy in the sense that if one fails, the others are still working. Much easier to tend to one part of the farm, rather than the entire farm!

In this system, water from up to six tanks is returned to a common area where temperature and pH are monitored and adjusted accordingly. Oxygen control is achieved by connecting one or more saturators to each tank.

1. Central computer

Runs visual communications software over the network.

2. CDi99 controller

Industrial strength controller. Control from the central computer or from keyboard.

3. RS-485 network

Multi-node network allows operator to daisy-chain up to 255 controllers

4. Graphics

Built in graphics is completely automatic and very easy to use.

5. Control relay enclosure

Contains up to 8 isolated solid-state relays and the common alarm relay.

6. Temperature probe

Semiconductor, submersible temperature sensor.

7. pH probe

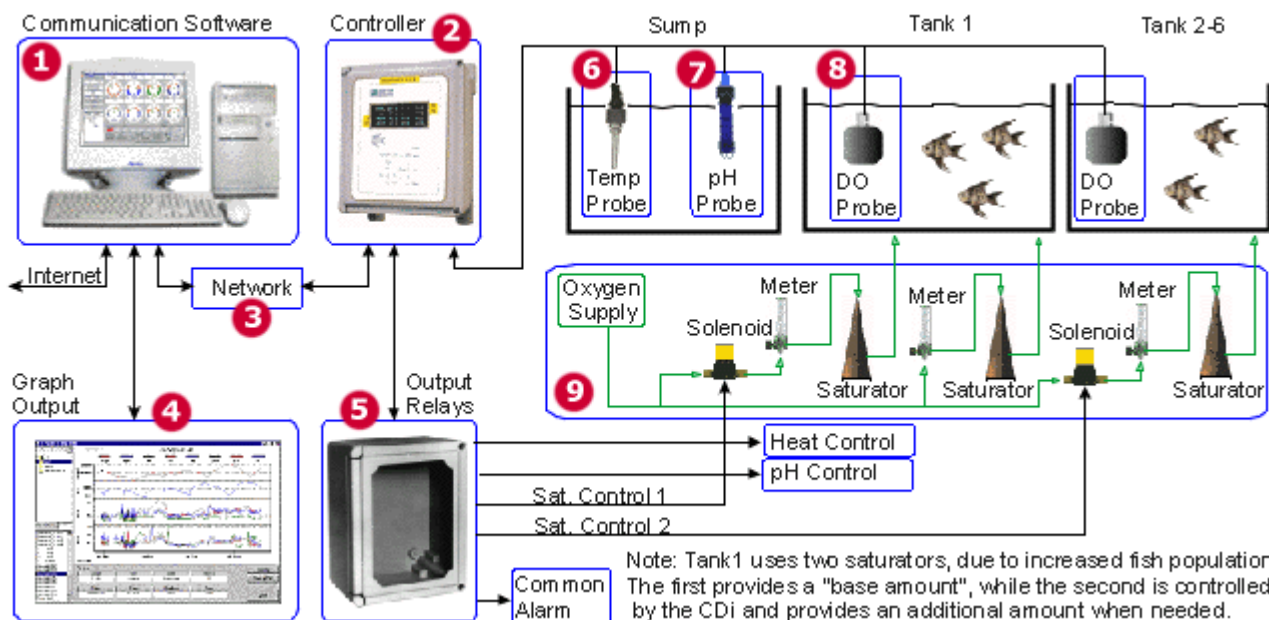
Submersible, self-cleaning, flat glass pH probe with included isolation amplifier.

8. Dissolved oxygen probe

The input channels of the controller are designed to connect directly to the less expensive Oxyguard[®] stationary probes.

9. Oxygen control

Ability to connect more than one saturator per tank. Optimize oxygen usage.



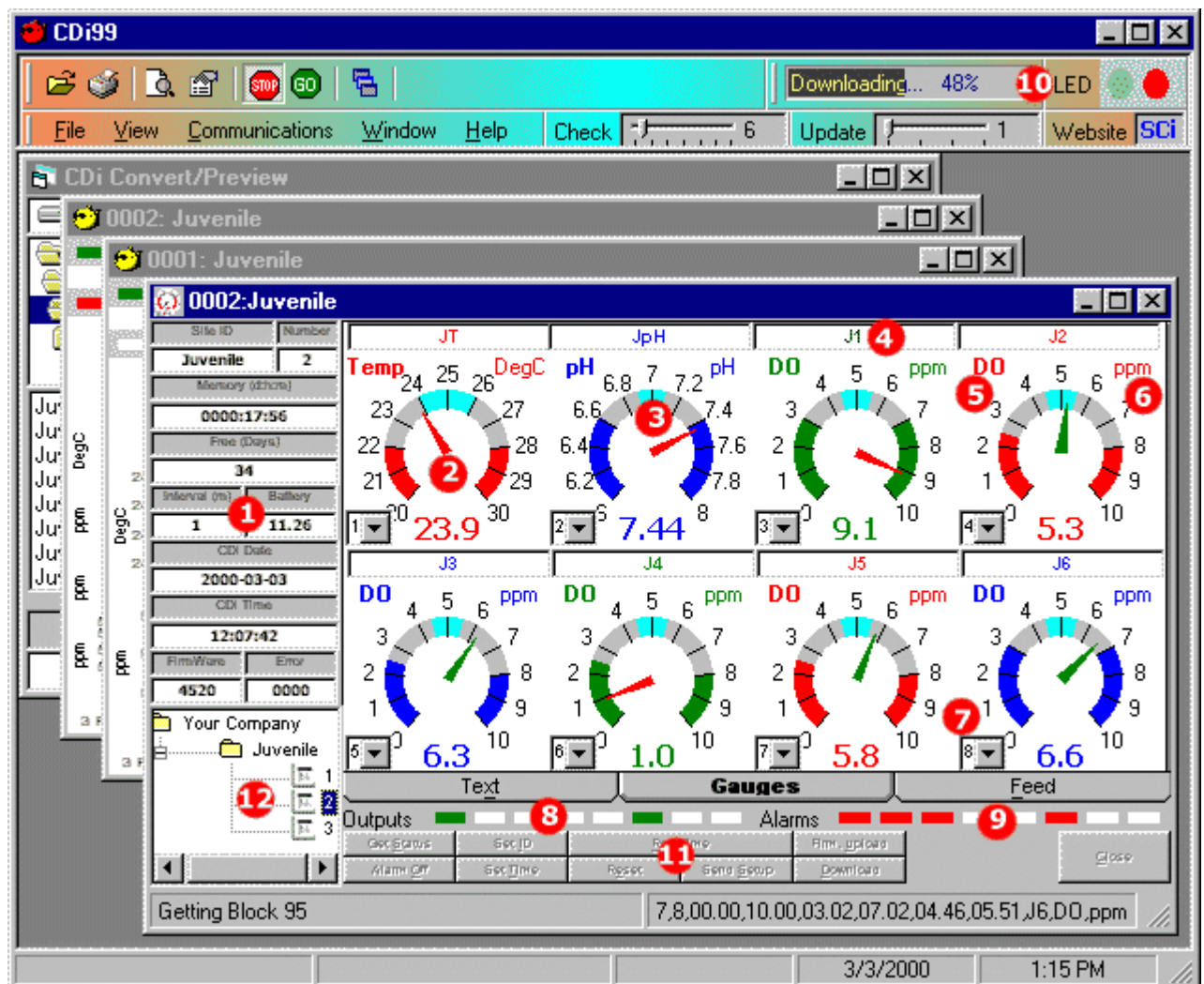


CDi-Comm Gauge Interface

The visual communication interface makes the job of setting individual channel control ranges and alarm ranges very easy for the user.

- ❖ **Visual interface.** The software makes extensive use of a “gauge” interface, allowing the ultimate in simplicity of use.
- ❖ **Remote calibration.** Select the gauge to calibrate, drag the needle to the desired value (with the mouse), and select the “cal high” or “cal low” command from the context menu. Done!
- ❖ **No typing.** Once the initial setup is done, normal use of the software requires *no typing* at all. The user-programmable labels transfer automatically to the graph utility.

- 1. Status Info.** Shows info on the overall status of the controller such as, used memory, free memory, interval, etc.
- 2. Low and high alarm ranges.** Shows the minimum and maximum values that will generate an alarm
- 3. Normal control range.** Shows the minimum and maximum points for “normal” operation (6.9 to 7.1 in this example).
- 4. Channel identification label.** This is a user-programmable label that identifies the channel.
- 5. Channel type label.** Identifies the type of input channel. This can be Temp, pH, DO, etc.
- 6. Channel unit label.** Identifies the unit for a channel. This can be DegC, DegF, ppm, mg/l, etc.
- 7. Output control.** Associates the output channel to input, forming a control loop
- 8. LED output indicators.** Used to display the realtime status of the eight outputs.
- 9. LED alarm indicators.** Used to display the realtime alarm status of the eight inputs
- 10. Communication activity indicator.** Shows serial port activity, (sending, receiving, waiting) in realtime.
- 11. Command buttons.** Click here to initiate user actions, such as setting unit time, download, etc.
- 12. Network address selection.** View the system structure and select a controller for communication.



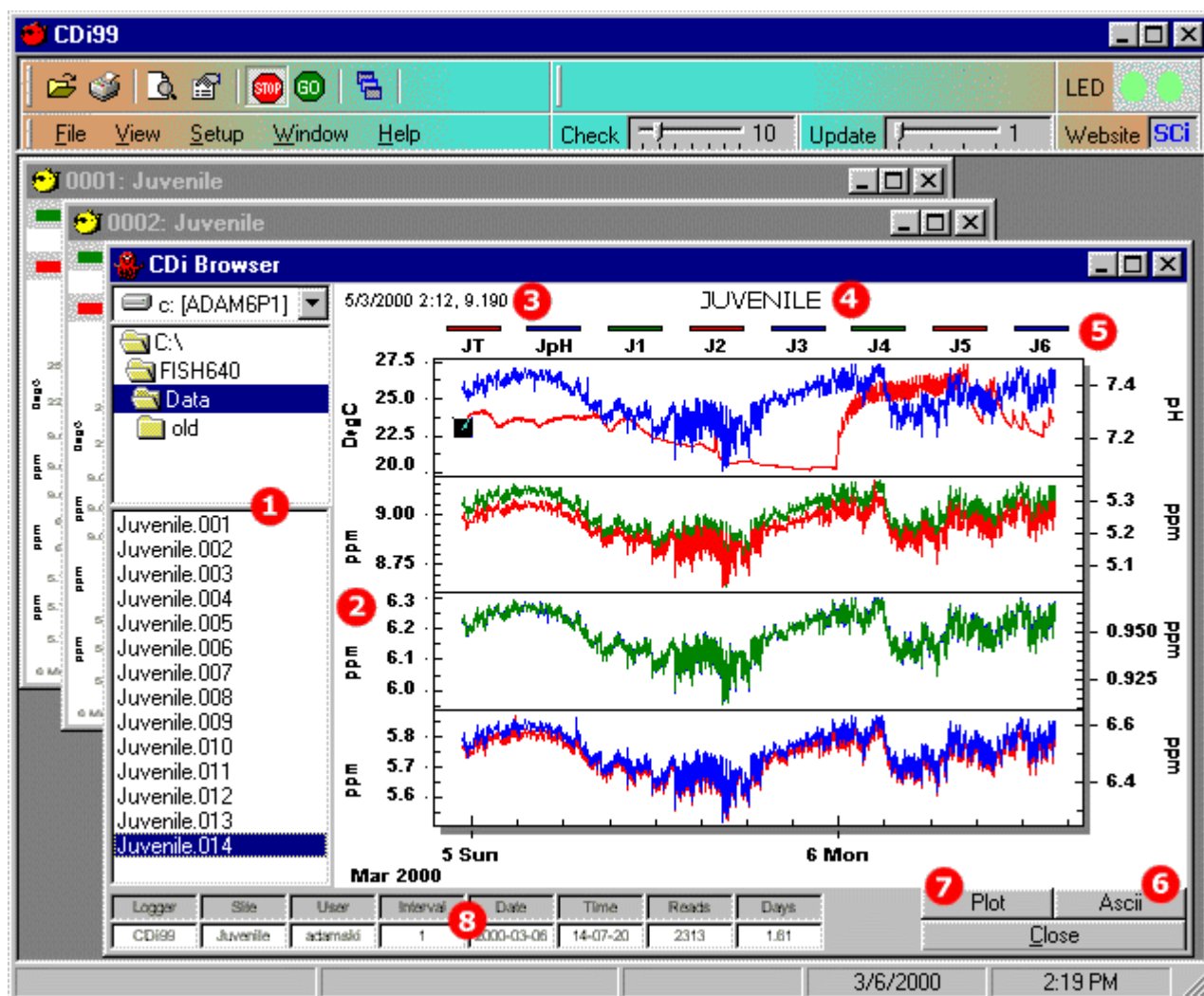


CDi-Browser

Only someone who has spent hundreds or even thousands of hours manually manipulating numbers in Access® or Excel® can really appreciate the power of this little utility.

- ❖ **Selects, reads and quickly screen-plots CDi99-native, binary files.** Allows you to quickly visually browse through a list of CDi99 files. Fully automatic process, transfers all pertinent labels from data file - **no typing**. As you click on each file, the pertinent graph is immediately displayed, and the file info box (see below) is filled-in.
- ❖ **Zoom and customize graph at any time.** Customization options are available through the context menu, (right-click on graph). Options include: maximize (enlarge graph to take up the entire screen), view selective channels, change graph title, etc.
- ❖ **Export to CDiPlot or convert to ASCII.** If further processing is needed, click on "Open in Plot" button and open the current file in the main graph utility, CDiPlot. Alternatively, you can convert the current file to ASCII, which of course is the text equivalent. The generated ASCII file includes an information header, and is comma-delimited.

- 1. File selection.** Just click to select the path for your datafile.
- 2. Graph units.** Channel unit labels are transferred automatically from Cdi setup.
- 3. Cursor value.** Shows the date, time and value for the point under the cursor.
- 4. Graph title.** The graph title is the site name from the Cdi setup.
- 5. Channel ID.** All channel ID's are transferred automatically from Cdi setup.
- 6. Convert to ASCII.** Click here to convert the current datafile to ASCII format.
- 7. Output control.** Opens current file in CDiPlot utility for further processing.
- 8. Current file info.** Displays information about the data file (date and time of download, recording interval, etc.).

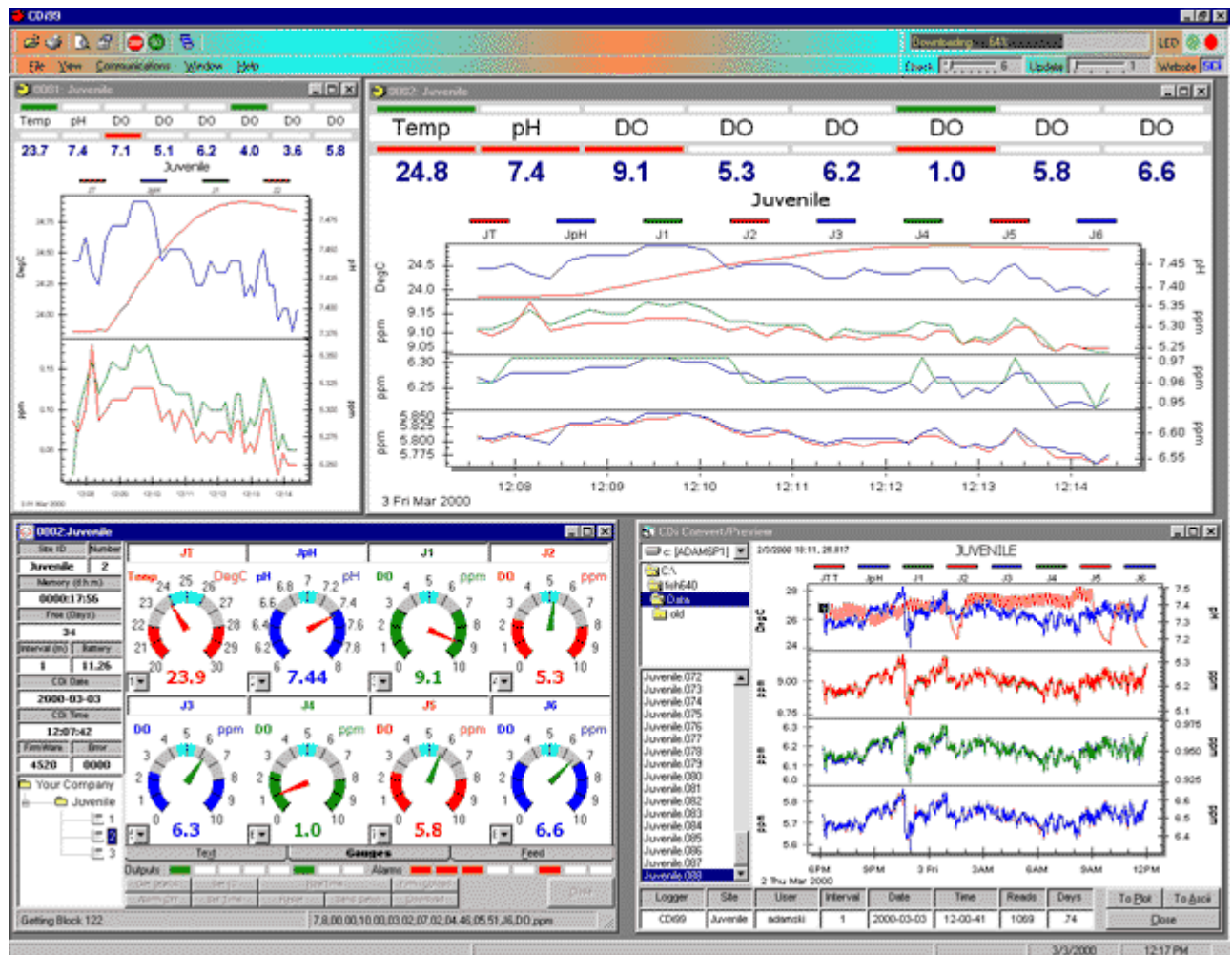




Realtime Charting (preview)

View and control the entire operation in realtime from anywhere! (Available, mid-April 2000)

- ❖ View the realtime values and output and alarm status of all network devices!
- ❖ Programmable parameters allow the most recent time period to be always displayed.
- ❖ Determine at a glance what has happened during the last couple of days.
- ❖ Determine if an alarm is high or low. If both the output and alarm LED for a channel are on, it is a low alarm, if only the alarm LED is on it is a high alarm.
- ❖ Automatic or manual y axis scaling
- ❖ Automatically save the graph to a file
- ❖ Persistent alarm display. Any Alarm will remain displayed until someone cancels it, either remotely or from the keyboard.
- ❖ More to come, in the next month or so...





Controller

CDi99 controller, VFD, 1Meg RAM, RS-485, Software

Package includes the controller, power cord, internal power supply, and inputs backplane. Specify operating voltage and line frequency (120 or 220 V, 50 or 60 Hz). If you only need 1 controller, you do not need the RS485 network.



Pricing:

CDi99 Controller, VFD, Built-in power supply, 1 Meg RAM
As above, but with smaller, yellow back light LCD display
RS232 to RS485 converter and wall-mounted transformer

Canadian \$
\$5,300.00
\$4,900.00
\$200.00

Output Enclosure Assembly

Fully assembled and tested fiberglass output enclosure

The output circuitry of the CDi was designed to drive solid-state relays. They are mounted on printed circuit boards. These assemblies (boards and relays) are housed in a Nema 4X, fiberglass enclosure, with a front bonded acrylic window. This facilitates testing during commissioning, and also allows the operator to verify at a glance that the proper outputs are active or inactive. The boards have built-in LED's that indicate the state of an output. If you do not plan do any control, you do not need any of the equipment in this section.



Pricing:

Assembled, wired and tested output enclosure, with 8 solid-state relays
Solenoid valve with manual override, 120V coil, 1/8" NPT ports (optional)
Solid-state relay (3A, 120V)
Multi-conductor cable connects CDi with outputs box, connectors (optional)
AC cable from outputs box to solenoid coil (optional)

Canadian \$
\$650.00
\$120.00
\$20.00
\$2.00/ft + \$50.00
\$1.00/ft

Temperature Probe

Submersible temperature sensor and amplifier module (available mid-April, 2000)

The amplifier is necessary in industrial environments to filter out induced noise and to better match the sensor output to the controller input. This is a full range sensor, capable of resolving -40DegC to +150 DegC. This sensor does not require calibration and is interchangeable with an accuracy of +- 0.5DegC over the entire range. The combination sensor and amplifier is capable of driving cable at least 1000 feet long. The amplifier is available as a plug-in module.



Pricing:

Submersible sensor with 10ft cable and factory-calibrated amplifier module
ABS water tight junction box, brass screws, gasket, wire entry connectors (optional)
Shielded AWG22 cable, 1000ft (optional)
Quick connector with 4 gold plated contacts

Canadian \$
\$150.00
\$20.00
\$275.00
\$5.00



pH Probe

Flat glass, self-cleaning pH probe and isolated high impedance amplifier

The pH measurement is treated a little differently in the CDI due to the extremely high resistance of the pH glass. The minute current produced by the probe cannot be reliably transmitted over long cable runs. Therefore the amplifier is taken out, and placed in close proximity of the probe. Output: -600mV to +600mV for 0-14pH. Low-impedance output allows long cable runs.

**Pricing:**

Submersible, self-cleaning pH probe with 10ft of coax cable, terminated with a BNC connector and galvanically isolated amplifier and enclosure	Canadian \$
Shielded, 4 wire AWG22 cable, 1000ft	\$550.00
Quick connector with 4 gold plated contacts	\$275.00
	\$5.00

Dissolved Oxygen Probe

Submersible DO probe from Oxyguard®

The CDI-99 isolated oxygen amplifiers are designed to connect to Oxyguard® probes. These have been tested and proven reliable, while they require little maintenance.

**Pricing:**

Submersible, DO probe with 10ft of cable	Canadian \$
Galvanically isolated amplifier module	\$537.00
Shielded, 4 wire AWG22 cable, 1000ft	\$250.00
Quick connector with 2 gold plated contacts	\$275.00
	\$5.00

Sample Project Cost - 6 tanks

Here is what a typical project might cost

Description	Quantity	Price	Total	
CDI99 Controller	1	\$5,300.00	\$5,300.00	
Temperature probe & amplifier	1	\$150.00	\$150.00	
pH probe & amplifier	1	\$550.00	\$550.00	
Oxygen amplifier	6	\$250.00	\$1,500.00	
Oxygen probe	6	\$537.00	\$3,222.00	
RS-232 to RS-485 Converter	1	\$200.00	\$200.00	
Cable & Connectors	1	\$300.00	\$300.00	
			Cost, no control	\$11,222.00
Output control enclosure with 6 relays	1	\$610.00	\$610.00	
Solenoids	6	\$120.00	\$720.00	
Flowmeters	6	\$45.00	\$270.00	
Cabling	1	\$300.00	\$300.00	
			Cost, control 6 tanks	\$1,900.00
			Total	\$13,122.00