

# SIEMENS

Water Technologies

Contents at a Glance:

## LC3000 Controller/RTU Installation and Maintenance



Section 1	Overview	3
Section 2	Installation	6
Section 3	Power	7
Section 4	Panel I/O Wiring	8
Section 5	Communications	10
Section 6	Technical Specifications	13
Section 7	Troubleshooting & Service Information	16

Applicable standards and certifications:



Hazardous Locations



Standard Locations



European Directives



Marine & Offshore



US Emissions

Siemens Water Technologies, Control Systems • 1239 Willow Lake Blvd. • Vadnais Heights, MN 55110 USA  
+1 (651) 766-2700 • FAX +1 (651) 766-2701

## **STATEMENT OF LIMITED WARRANTY**

The limited warranty applicable to the LC3000 is set forth in Siemens Water Technologies standard terms of sale, that are made applicable to the purchase of these products.

### **INSTALLATION AND HAZARDOUS AREA WARNINGS**

These products should not be used to replace proper safety interlocking. No software-based device (or any other solid-state device) should be designed to be responsible for the maintenance of consequential equipment or personnel safety. In particular, Siemens Water Technologies disclaims any responsibility for damages, either direct or consequential, that result from the use of this equipment in any application.

All power, input and output (I/O) wiring must be in accordance with Class I, Division 2 wiring methods and in accordance with the authority having jurisdiction.

**WARNING – EXPLOSION HAZARD – SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS 1, DIVISION 2.**

**WARNING – EXPLOSION HAZARD – WHEN IN HAZARDOUS LOCATIONS, DISCONNECT POWER BEFORE REPLACING OR WIRING MODULES.**

**WARNING – EXPLOSION HAZARD – DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.**

<p><b>Note:</b> All information in this document applies to the <b>LC3000</b>, except where otherwise noted. Refer to the IntraLink Toolbox software online help system for detailed product specifications and configuration settings.</p>
---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Last Revision: December 2008



## Section 1 Overview

The LC3000 is a state of the art logic controller developed specifically for the water and wastewater industry. This innovative controller combines robust technologies and an open architecture to produce a cost competitive, flexible and feature rich control solution. The LC3000 controller includes on-board; a high performance CPU, large memory complement, multiple serial ports, a dedicated I/O port, an Ethernet port and an integrated battery handling circuit. The battery handling circuit trickle charges a battery, monitors its voltage, and cuts system power on low battery voltage to prevent damage to the battery. The LC3000 supports local I/O through a dedicated I/O bus, and it supports distributed I/O through the Ethernet or RS485 ports. An optional, user-friendly operator interface may be added to provide a window into the process. The local operator interface uses both text and graphics to allow an operator to view process data, change setpoints, view/acknowledge alarms, view alarm history and view historical trends

### I/O overview

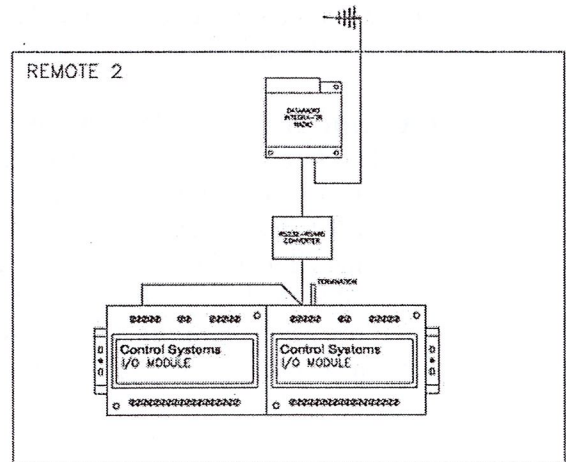
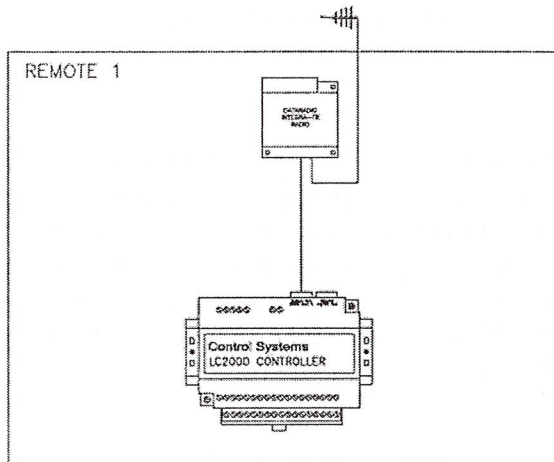
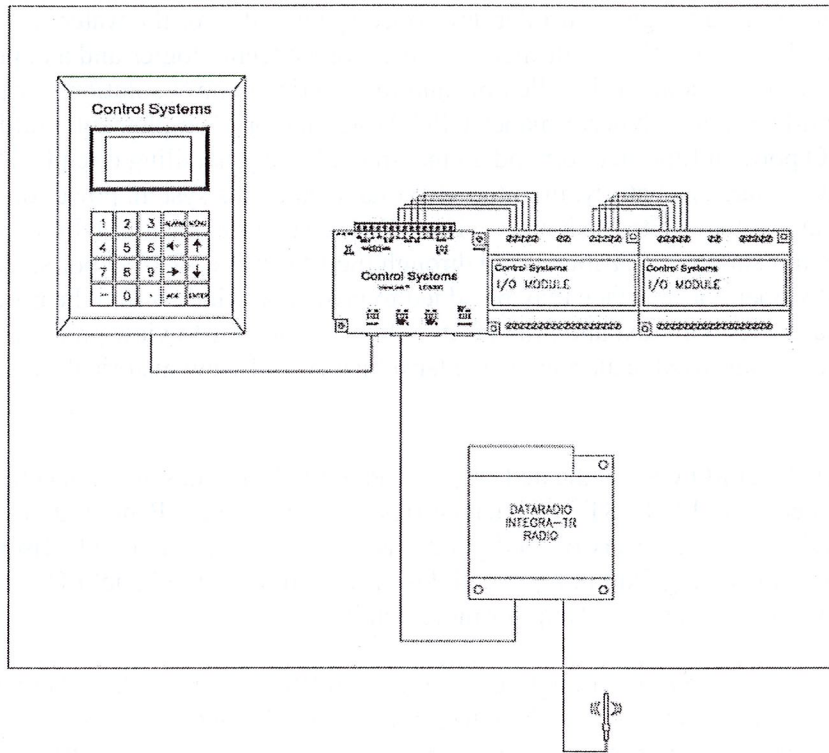
The LC3000 supports local I/O via a dedicated I/O bus. Panel I/O modules are connected to the LC3000 via a high-speed serial link (ST-Bus) that carries data and power. Panel I/O modules are DIN rail mounted and come in a variety of configurations including Discrete Input, Discrete Output, Analog Input and Analog Output type modules. Please refer to the Panel I/O Users Manual and IntraLink Toolbox On-line Help for more details.

The LC3000 supports distributed I/O through its Ethernet and RS485 ports. The Ethernet I/O family of modules has two ports that allow them to connect to the LC3000. Ethernet I/O may be connected to the LC3000 over a variety of Ethernet media (wireless, fiber optic, 10BaseT) or via a metallic twisted pair on an RS485 network. Ethernet I/O also may be connected to the LC3000 using smart radios (UHF, VHF, and Spread Spectrum) and a RS485 to RS232 converter. Ethernet I/O and the variety of supported communications media give users an effective way to scale the I/O to meet the system needs and place it in convenient locations. Please refer to the Ethernet I/O Users Manual and IntraLink Toolbox On-line Help for more details.

### Operator Interface Overview

The OI3000 (optional) is 128 x 64 pixel, backlit, graphical display coupled with an ergonomic 20 key keypad. The operator interface allows the user to view process data, change setpoints, view/acknowledge alarms, view alarm history and view historical trends. Together with a door switch, the OI3000/LC3000 can provide an effective intrusion detection system. The OI3000 is connected to the LC3000 through a dedicated, powered, serial port. The operator interface is configured using IntraLink Toolbox software. Please refer to the OI3000 Users Manual and IntraLink Toolbox On-line Help for more details.

## Typical system diagram



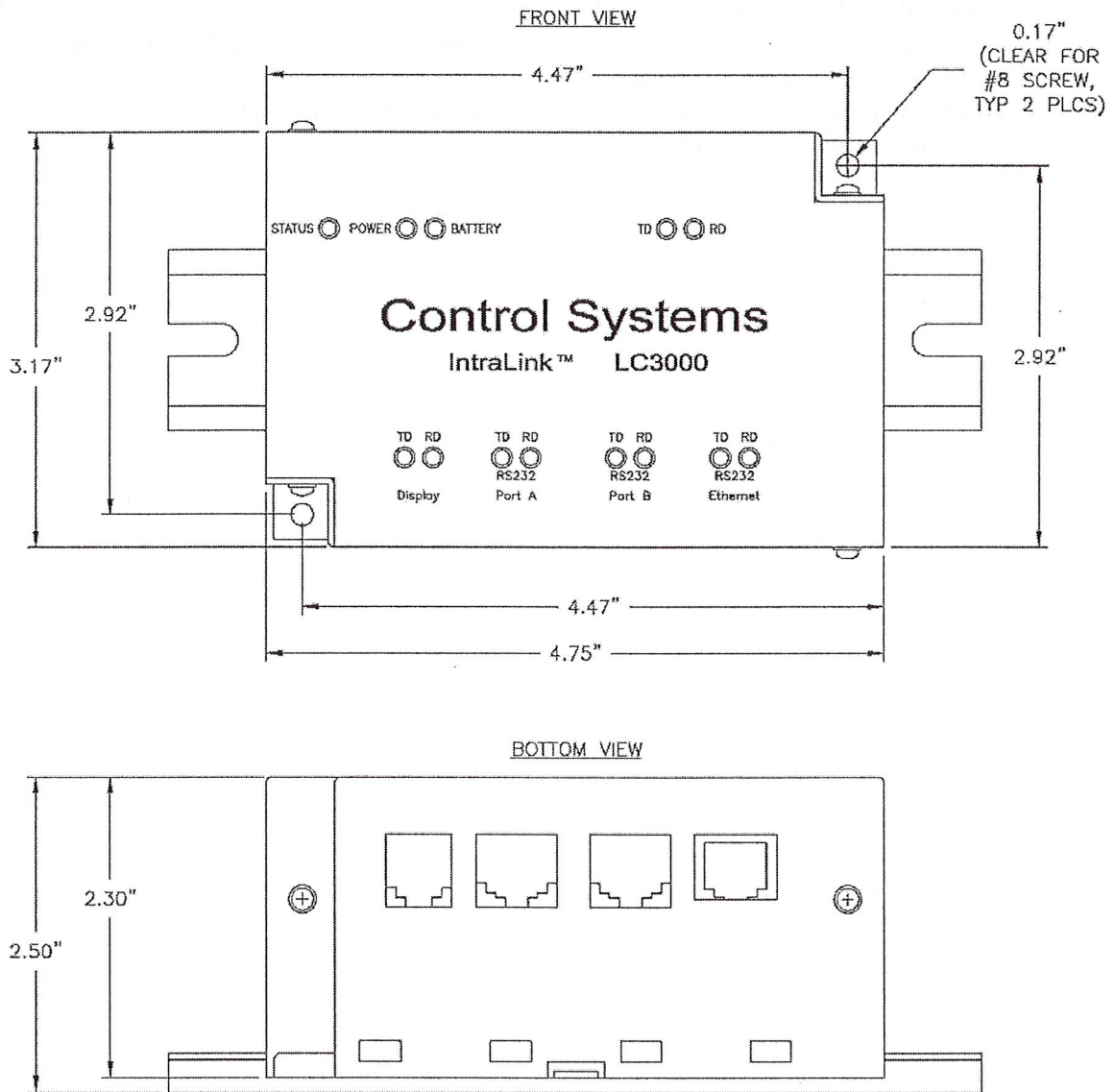


## **IntraLink Toolbox Overview**

IntraLink Toolbox software is used to program, configure and troubleshoot LC3000 systems. The software runs on a PC with current Windows operating systems. IntraLink Toolbox allows the users to create stations, configure I/O (both Panel I/O and Ethernet I/O), setup communications, configure the OI3000 display, configure alarms, configure trends, and program a control strategy. IsaGraf is an industry standard IEC 61131-3 compliant programming language used to implement control algorithms in the LC3000. IsaGraf supports all five IEC 61131-3 languages including ladder logic and function blocks. IntraLink Toolbox contains specialized water and wastewater function blocks enabling consistently implemented, advanced control strategies. IntraLink Toolbox supports local connections to the LC3000 via the Ethernet or RS232 ports or remote connections via dial-up modem or network connections.

## Section 2 Installation

The LC3000 controller is normally snapped onto DIN rails fastened to a subpanel. However the LC3000 can also be surface mounted using the mounting holes located on 2 corners of the case.

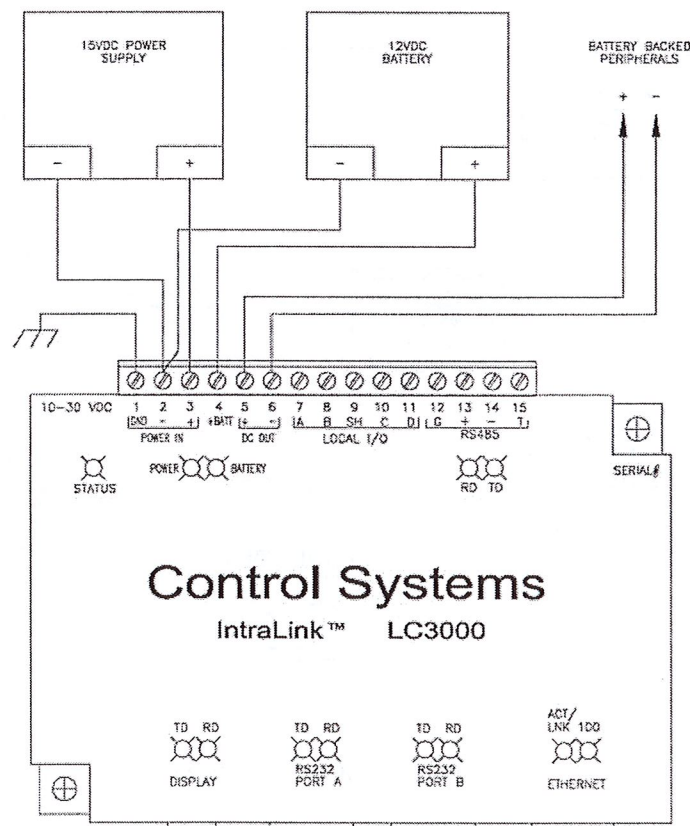




### Section 3 Power

The LC3000 controller accepts power from an external DC power source of 10–30 VDC. In addition to primary power, the LC3000 is equipped to utilize a battery as a backup power source. When the primary voltage is above 14 VDC, the LC3000 will trickle charge (current limited to 450 mA) the battery to maintain a float voltage of 13.9 VDC. When the primary voltage drops below the battery voltage, the LC3000 will seamlessly switchover to using the battery as the power source. The battery LED will come on when the battery is being used as the power source. The LC3000 will continue to use battery power until the battery voltage drops to 10.5 VDC. At that point the LC3000 will cut power to prevent possible damage to the battery. Auxiliary equipment that needs to operate during a primary power failure (radio, critical analog loops, etc) may be powered from the DC OUT terminals on the LC3000. The LC3000 will supply up to 5.0 Amps of current to the DC OUT terminals from either line power source or battery power source. Power conditions can be monitored, alarmed on and used in control decisions.

Note: The Local I/O bus power terminals C & D are internally connected the DC out power bus. The Local I/O bus will be powered at the same voltage and operate under both primary and battery power.



LC3000 Power Connections

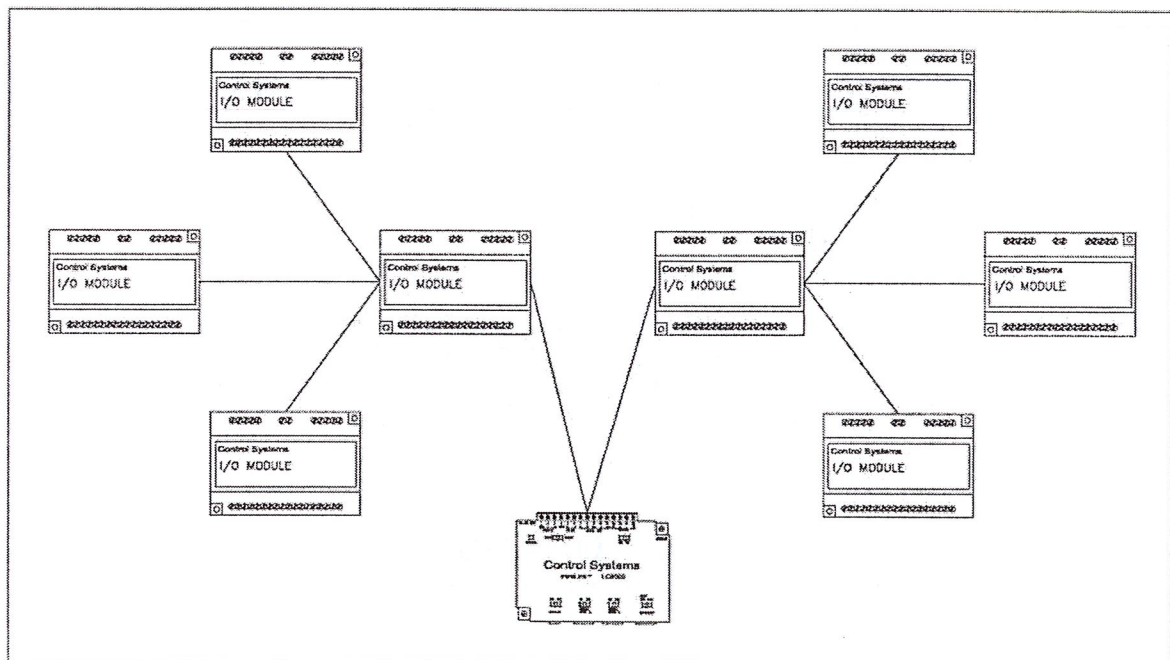
## Section 4 Panel I/O Wiring

Panel I/O modules are connected to the LC3000 controller via the ST-Bus. The ST-Bus is a high-speed bus carrying data and power. The following guidelines should be adhered to for reliable performance of the ST-Bus.

Max number of modules controlled by one LC3000	20
Required cable type	Any with 2 individually shielded pairs, 22AWG min
Recommended cables	Alpha 2466C, Belden 8723, Carol C1352
Max cable distance from LC3000 or expander to I/O module	50 ft

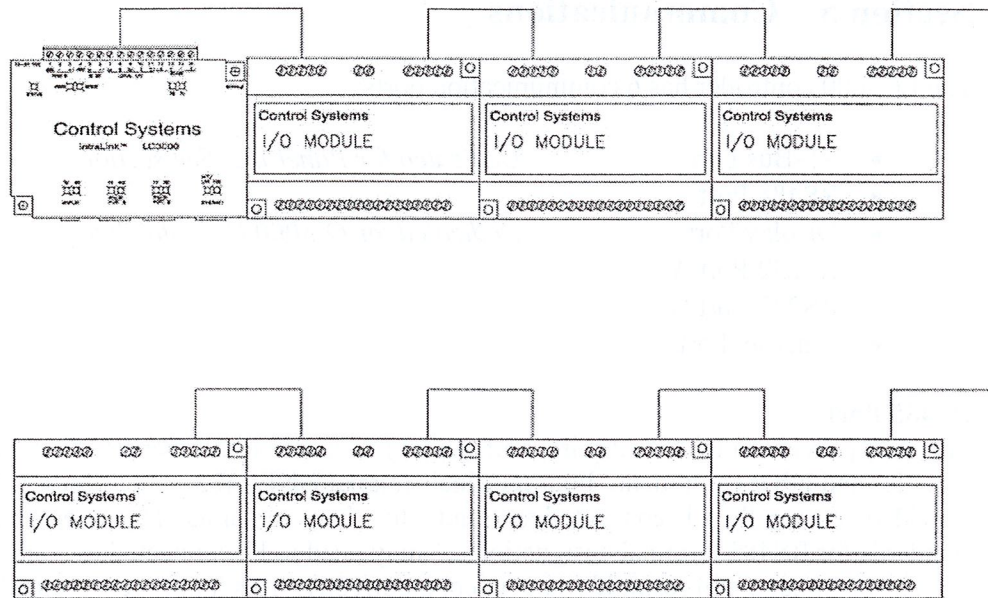
I/O modules may be wired together in either a star or daisy chain configuration. The daisy chain method is most commonly used. See the following diagrams for more detail.

ST-Bus wire routing guidelines are shown in the figures below.

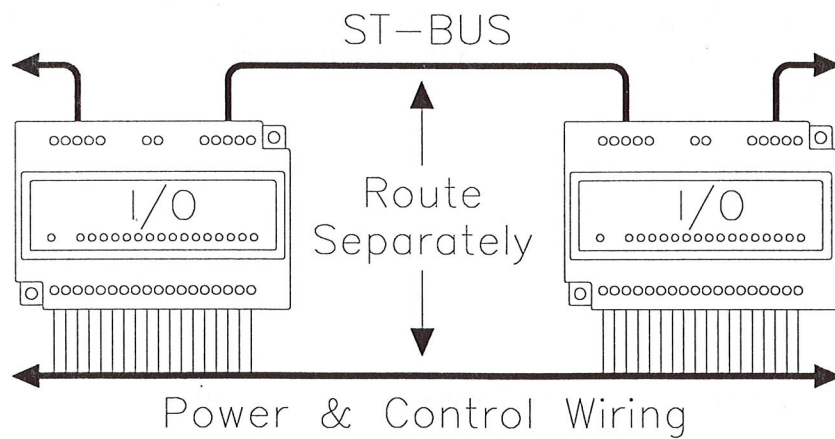
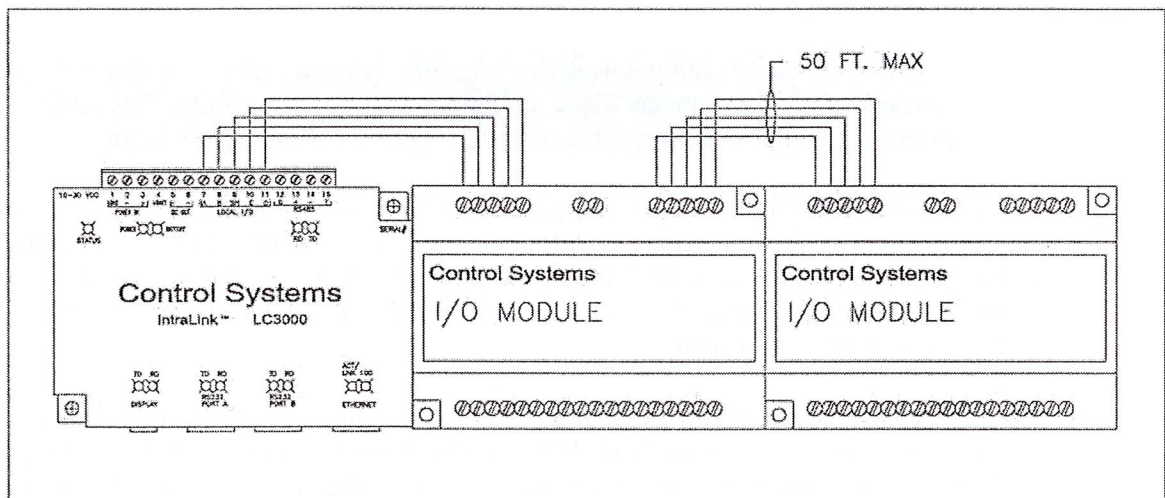


ST-Bus Star Configuration





**ST-Bus Daisy Chain Configuration**



## Section 5 Communications

The LC3000 controller has 6 communication ports:

- ST-Bus Port *Dedicated for Panel I/O, See section 4*
- RS485 Port
- Display Port *Dedicated for OI3000 Operator Interface Terminal*
- RS232 Port A
- RS232 Port B
- Ethernet Port

### RS485 Port

This port provides a RS485 (2-wire, half duplex) connection to Ethernet I/O modules, Remote I/O modules and other equipment. Four terminals (signal GND, 485+, 485-, termination) are provided. Generally + is connected to + and – to – between units. However, since there are no standards for RS485 terminal designations, + may need to be connected to – and – to + in some cases. No damage will result if you connect incorrectly. It is highly recommended that signal ground be connected to an appropriate ground (if available) between all RS485 units. Make sure to use a good quality communication cable with three conductors (twisted is preferred) plus a shield. To prevent ground loops, the shield should be connected to chassis ground on only one end of any cable run.

Note: If you have existing wiring that has only two conductors and a shield, you can use the shield to connect the signal grounds between stations. This is not optimal (especially for long cable runs) but should work in most situations.

The LC3000 has RS485 termination components (150 ohm resistor and 0.1 uF capacitor connected in series) already inside. To terminate your RS485 network tie the “T” terminal to the RS485- terminal. Use the same type and size conductor as that used for the RS485 – connection. It is recommended that both end stations of your RS485 network be terminated. Avoid terminating more than two stations.

On a RS485 2-wire network, a pair of bias resistors (1K ohm typically) acting upon the transmit/receive wire may be required. If bias resistors are not present, the receive inputs on some RS485 devices may react to noise on the floating wires. The bias resistors will force the transmit/receive line to a known (non-floating) state when none of the RS485 devices are transmitting data. Some RS485 devices have bias resistors built in, which can be enabled through DIP-switches or jumper settings. Make sure there is only one pair of bias resistors acting upon the network. If your network is entirely made up of IntraLink family of devices, then bias resistors are not necessary.



### **Display Port**

The display port on the LC3000 is used to connect to the OI3000 Operator Interface. A 4-conductor RJ-11 port is provided. The display port is a simple RS232 port (GND, TX, RX) plus a power conductor. The power conductor is connected to the internal + power bus of the LC3000 and thus carries a voltage of 10–30 VDC, depending on the external DC power supply used. Refer to the Communications Port Diagram on the following page for exact pin out details. Refer to the OI3000 Users Manual for more details on the operator interface.

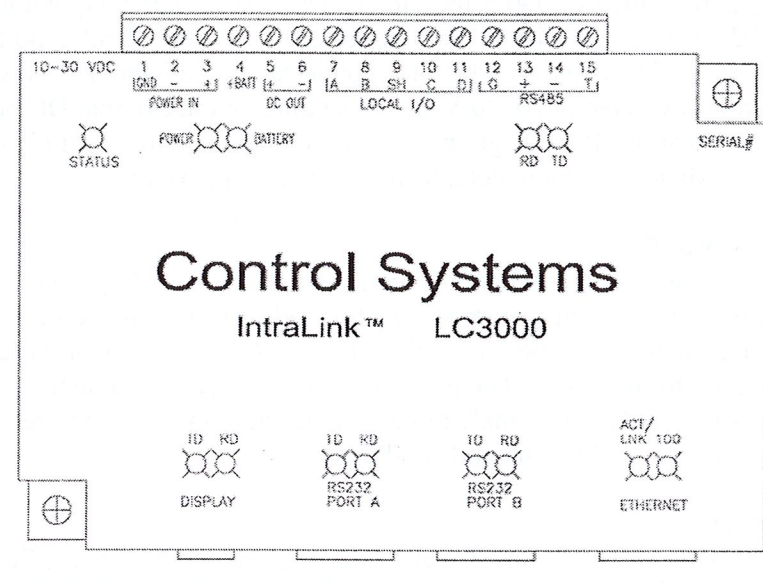
### **RS232 Ports A & B**

RS232 ports A and B are identical in connection and functionality. These ports may be used as a programming port or as a means to connect to a radio or modem. A RJ-45 female connector is provided for each port. The pin-outs follow the EIA/TIA 561 standard (See Communications Port Details Diagram for pin outs). The ports are generally used in conjunction with a DB9 (or DB25) to RJ-45F adaptor and a RJ-45 male to RJ-45 male straight-through wired patch cable to make a connection between the LC3000 and another device.

### **Ethernet Port**

The Ethernet port is a 10/100BaseT, auto-detecting and auto-crossover Ethernet port. This means the port will auto-detect speed and will work with either a straight-through or cross-wired Ethernet cable. A standard shielded RJ-45 female connector is provided. Refer to the Communications Port Diagram on the following page for pin-out details. The port has a fixed, unique MAC address. The port's IP address is viewable through the OI3000 Operator Interface and can be set with IntraLink Toolbox software. Refer to IntraLink Toolbox software on-line help for details.

## Communication Port Details



### Port A and Port B, RJ45 Female (RS232 DTE):

- Pin 1: RI/DSR (in)
- Pin 2: DCD (in)
- Pin 3: DTR (out)
- Pin 4: GND
- Pin 5: RXD (in)
- Pin 6: TXD (out)
- Pin 7: CTS (in)
- Pin 8: RTS (out)

### Ethernet, RJ45 Female (10T/100T Auto uplink):

- Pin 1: TX+
- Pin 2: TX-
- Pin 3: RX+
- Pin 6: RX-

### Display port, RJ11 Female (3 wire RS232 with power):

- Pin 1: NC (no connection)
- Pin 2: TXD (out)
- Pin 3: RXD (in)
- Pin 4: GND
- Pin 5: +VDC
- Pin 6: NC (no connection)



## Section 6 Technical Specifications

Here are the technical specifications for the LC3000 controller.

<b>General Details</b>	
Microprocessor	Industrial PowerPC (32 bit data bus)
Operating System	Embedded Linux
Number of unique stations addresses	16,000 (IntraLink Open) or 247 (Modbus)
Dynamic memory (for program execution, dynamic variables, dynamic file system etc)	32 Megabytes
Flash memory (Linux OS, program storage, file system)	32 Megabytes
Non-volatile RAM (data logging)	512K bytes (battery backed, rechargeable Lithium)
Battery backup time/life	1 year/10 years
Real time clock resolution	10 ms
Real time clock accuracy	+/- 15 seconds per month
I/O expansion	Panel I/O, Ethernet I/O, Remote I/O
Maximum local I/O (via ST-Bus port)	1024
Maximum distributed I/O	10,000
Data logging	Internal data logging
Programming Language	IsaGraf (IEC 61131-3 compliant)
Languages supported	Ladder logic, SFC, function block, instruction list, structured text
Communication capabilities	Master, slave, peer-to-peer, report on exception, store and forward
Communication media supported	Ethernet, dial-up telephone, leased line, UHF/VHF radio, spread spectrum radio, wireless Ethernet, fiber optic and more
CPU Watchdog	CPU automatically resets if error is detected; status LED flashed error code
Communication watchdog	Settable timeout and output action (freeze or force off)
Heartbeat watchdog	Settable timeout and output action (freeze or force off)
<b>Ethernet Details</b>	
Ethernet media	10/100BaseT (auto-detecting)
Connection	RJ-45 Female (auto cross-over)
Isolation	1500 Volts RMS 1 minute (60 Hz)
Message response time (typical)	5 ms
Diagnostic LEDs	Link activity and speed
Protocols supported	TCP/IP, ARP, UDP, ICMP, DHCP, Modbus/TCP, IntraLink Open
Address	Unique MAC with static or DHCP assigned IP address

<b>Serial Port Details</b>	
Port speed	300 to 115,000 baud
RS232 Port A	RJ-45 (TD, RD, CTS, RTS, CD, DTR, DSR/RI, GND)
RS232 Port B	RJ-45 (TD, RD, CTS, RTS, CD, DTR, DSR/RI, GND)
Display Port	RJ-11 (GND, TX, RX, + Power)
RS485 Port	Screw terminals (GND, 485+, 485-, termination) (2-wire half-duplex)
RS485 network	Up to 32 stations
RS485 distance	Up to .5 miles
Protocols (Master & Slave)	Modbus (RTU & ASCII), IntraLink Open, DF1, Microcat, PLTU, and CECO protocols
Diagnostics LED (each port)	Transmit data, Receive Data
Flow control	Hardware (RTS), software (XON/XOFF)
<b>ST-Bus (Panel I/O) Details</b>	
I/O Types	Full line of analog and discrete modules
Max number of modules	20
Max number of local I/O channels	640
Scan time	5 ms minimum (varies with quantity and type of I/O modules)
Benchmark 1: 48 discrete & 8 analog	10 ms
Benchmark 2: 512 discretes	30 ms
Benchmark 3: 128 analogs	40 ms
Benchmark 4: 512 discretes & 128 analogs	80 ms
Cable Length	50 ft
Wiring topology	Daisy chain or Star
Cable type required	2 individually shielded, twisted pairs, 22AWG
Environmental	DIN rail or flat panel mounted
Input voltage	10 – 30 VDC
Input Power (@ 24 VDC) (+/- 10%)	2.4 W (110 mA) – typical (no communications) 2.7 W (112 mA) – typical (serial comm only) 3.1 W (128 mA) – typical (all ports communicating)
Note: Power consumption does not include OI3000 consumption. See OI manual for details	
<b>Battery Handling Details</b>	
Battery type supported	2.2-2.6 Amp/Hour, 12 VDC, gel-cell battery
Max charging current	450 mA
Primary voltage switch-over	Line voltage less than battery voltage
Low battery voltage cut-out	10.5 VDC
Max current on DC bus	5.0 A
Min primary voltage when using a battery	14 VDC
<b>Environmental Details</b>	
Temperature	-40 to 70 C (-40 to 85 C storage)
Humidity	5% to 95% RH (non-condensing)
Flammability	UL 94V-0 materials
Electrical Safety	UL 508, CSA C22.2/14, EN61010-1 (IEC1010), CE

EMI emissions	FCC par 15, ICES-003, Class A; EN55022; EN61326-1; CE
EMC Immunity	EN61326-1 (EN6100-4-2,3,4,6); CE
Surge Withstand	IEEE-472 (ANSI C37.90), EN61000-4-2,4
Vibration	IEC68-2-6
Hazardous locations (Class 1, Div 2, Groups A, B, C, D)	UL 1604, CSA C22.2/213, Cenelec EN50021 Zone 2
Packaging	Aluminum cover, Lexan base
Mounting	DIN rail (EN50022) or direct to panel
Size	4.75"L x 3.25"W x 2.65"H
Weight	.73 lbs.



## Section 7 Troubleshooting and Service Information

### Local Diagnostics

Local diagnostics can be performed through either RS232 serial port or Ethernet, even while the LC3000 is responding to messages on other ports. IntraLink Toolbox software can be used to access internal diagnostics and display the status of I/O registers. Refer to the software's on-line help for details. The OI3000 can display a limited set of controller diagnostics. Refer to the OI3000 Users Manual for details.

### Status LED

The status LED on the LC3000 indicates its operational status

<b>ON:</b>	The LC3000 is operating properly
<b>OFF:</b>	There is no power to the LC3000 or service is required
<b>Fast Blink:</b>	This may occur when the LC3000 is being reset, or firmware is being downloaded from IntraLink Toolbox software.
<b>Slow or periodic blink:</b>	This indicates that the internal watchdog has detected a problem. Try clearing memory and reloading the project using IntraLink Toolbox software.

### LC3000 Memory

The LC3000 has non-volatile (battery free) memory for storing configuration data from IntraLink Toolbox

The LC3000 also has battery-backed memory for storing program variables and logged data. The battery is a re-chargeable lithium cell that is kept fresh by the power circuitry on the controller. The memory retention period for an unpowered controller is at least 6 months at room temperature. The retention time will be shorter at high temperatures. The life expectancy of the lithium battery is at least 10 years.

### **Product Support**

To obtain technical support or service for Siemens Water Technologies, Control Systems products, contact your local Siemens Water Technologies representative. For factory support contact Siemens Water Technologies Control Systems and ask for technical support. Our phone numbers are:

Phone: 1 (800) 224-9474 then press 6  
Local: (651) 766-2700  
Fax: (651) 766-2754  
Email: [controlsystemssupport.water@siemens.com](mailto:controlsystemssupport.water@siemens.com)

Our mailing address is:

Siemens Water Technologies  
1239 Willow Lake Blvd  
Vadnais Heights, MN 55110

### **Product Service**

The warranty for this product was stated previously in this manual, on page 1.

For product service outside the warranty, contact your local Siemens Water Technologies representative. For more information on IntraLink parts replacement, contact the factory directly at 1-800-224-9474 and ask to speak with a customer service representative.

