

Logosol Network Master Controller LS-991

Doc #712991001/ Rev. B, 02/17/2003

Features

- ❑ 18.432 MHz Rabbit 2000™ CPU
- ❑ 256K FLASH Memory
- ❑ 128K RAM
- ❑ RAM Backup Battery
- ❑ Two Logosol Distributed Control Network (LDCN) ports, hosting of up to 62 network nodes
- ❑ One programming / RS-232 serial port
- ❑ One RS-232 / RS-485 (2 wire) serial port
- ❑ LCD Display 2 x 20 characters
- ❑ 7 Button Keyboard
- ❑ Rotary encoder
- ❑ 12 digital inputs
- ❑ 12 digital outputs
- ❑ 12VDC to 32VDC single power supply
- ❑ Real-time and multi-tasking capabilities
- ❑ Free Dynamic C® Library supporting Logosol product family for distributed servo, stepper and I/O control
- ❑ Small footprint (6.25"x2.36"x2.5")



Description

LS-991 is a powerful, cost-effective, C-programmable CPU module with 2x20 characters LCD display, keyboard, rotary encoder, 12 digital inputs, and 12 digital outputs, developed especially for hosting of Logosol devices as distributed servo, stepper and I/O control nodes. The programming is accomplished via a standard RS-232 port by using Z-World's Dynamic C® development environment featuring interactive editor, compiler and source level debugger. The high-performance Rabbit 2000™ microprocessor combined with Logosol's servo, stepper and I/O nodes offers a versatile platform for wide range of industrial control applications.

Dynamic C® is an enhanced version of the industry standard C programming language with real-time and multi-tasking capabilities, designed to compile a program with applicable library routines and download the code to a target system. Comprehensive Dynamic C® libraries are available free of charge to facilitate the integration of Logosol controllers with LS-991.

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TECHNICAL SPECIFICATIONS rated at 25°C ambient, POWER(+) 12÷32V = 24VDC

| | |
|---|---|
| POWER SUPPLY VOLTAGE | 12÷32 VDC, (10÷40VDC Abs. Max range) Supply current without digital I/O <100 mA at 24VDC |
| CPU | Rabbit 2000™ – 18.432 MHz |
| FLASH Memory | 256K |
| RAM | 128K |
| SERIAL INTERFACES | COM A – RS-232 COM B – RS-485 full duplex (4 wire) LDCN compatible COM C – RS-485 full duplex (4 wire) LDCN compatible COM D – RS-232 or RS-485 half duplex (2 wire) |
| LCD Display | 2 lines, 20 characters, 5x8 dots LCD display |
| Keyboard | 7 buttons Rotary encoder 24 pulse / rev. |
| DIGITAL OUTPUTS +OP (Output Power) Out 0 to Out 9 Out 10 and Out 11 | Solid-state relay – 5A connected to POWER (+). Open collector with clamp diode to POWER (+) Max voltage applied to output – 36 VDC Max current load per output – 0.15A Open collector with clamp diode to POWER (+) Max voltage applied to output – 36 VDC Max current load per output – 0.3A |
| DIGITAL INPUTS Logic HIGH Logic LOW Hysteresis (min) Input current Max voltage applied to input | Active LOW with 3k3 pull-up resistors to POWER (+) –2VDC to +5VDC +15VDC to 32VDC 5V 9mA at 24VDC -2VDC to + 36VDC |
| LED Red LED – PD7 controlled | PD7 = input = LOW light intensity PD7 = output set to “1” = light OFF PD7 = output set to “0” = HIGH light intensity |
| RAM BACKUP BATTERY | 3V - CR2032 |
| THERMAL REQUIREMENTS Storage temperature range Operating temperature range | –30 to +85 °C 0 to 45 °C |
| MECHANICAL Size Weight | 6.25"x2.36"x2.5" 0.6lib. (300gr.) |
| MATING CONNECTORS CN1 – POWER CN2 – COM D CN3 – COM B (LDCN 1) CN4 – COM C (LDCN 2) CN5 – COM A CN6, CN7 and CN10 (digital inputs) CN8, CN9 and CN11 (digital outputs) | Magnum EM2565-02-VL or Phoenix MSTB 2.5/2-ST-5.08 6 pin RJ 11 8 pin RJ 45 8 pin RJ 45 6 pin RJ 11 Molex 22-01-3127 housing with 08-50-0114 pins (12 pcs.) Molex 22-01-3087 housing with 08-50-0114 pins (8 pcs.) |

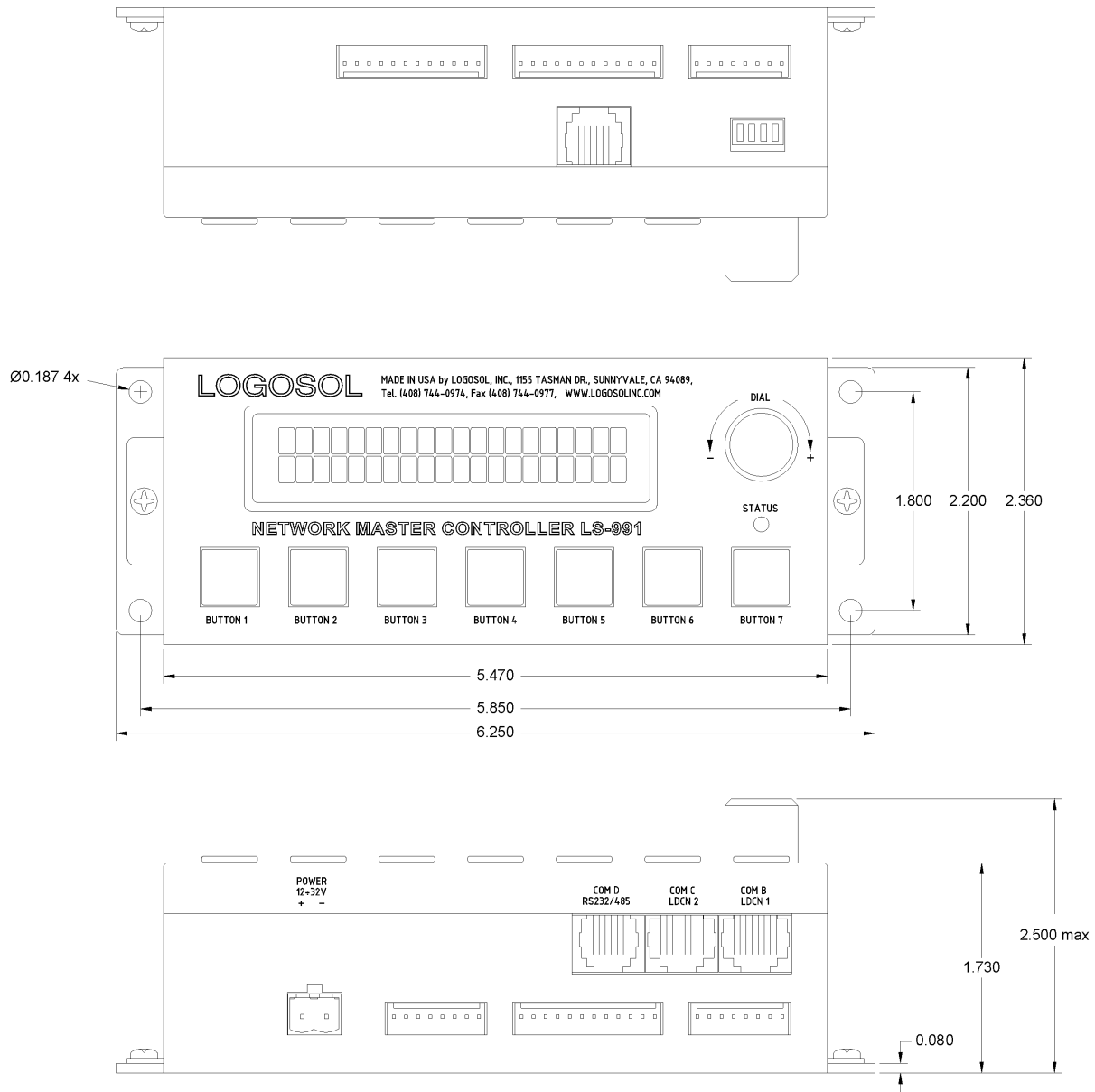
ORDERING GUIDE

| PART NUMBER | MODEL | DESCRIPTION |
|-------------|-----------|--|
| 912991001 | LS-991 | Network master controller 2x20 LCD, Rabbit 2000™ CPU, 18.432MHz, 128K RAM, 256K FLASH whit I/O |
| 230601036 | LS-991-CN | LS-991 Mating connector kit. |
| 912801006 | LS-884 | RJ 11 6C to D-sub female 9 pin RS-232 adapter with RJ 11 L=7' cable. |

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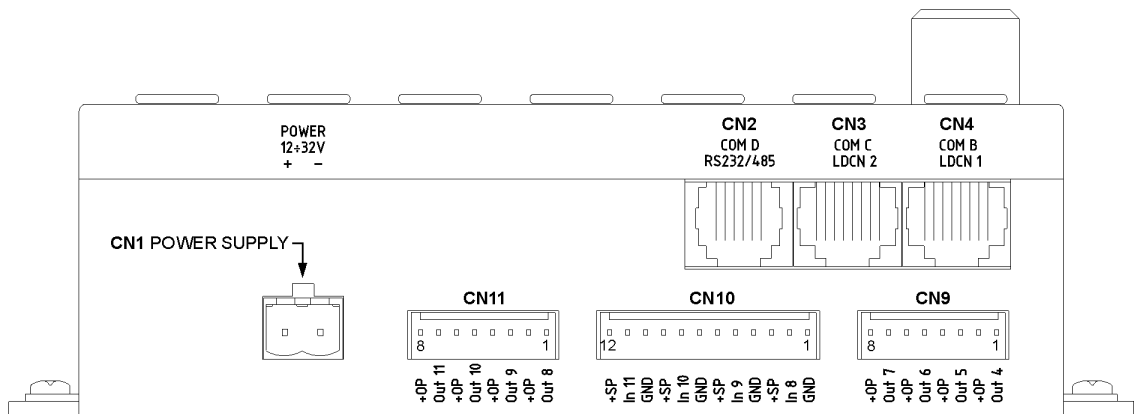
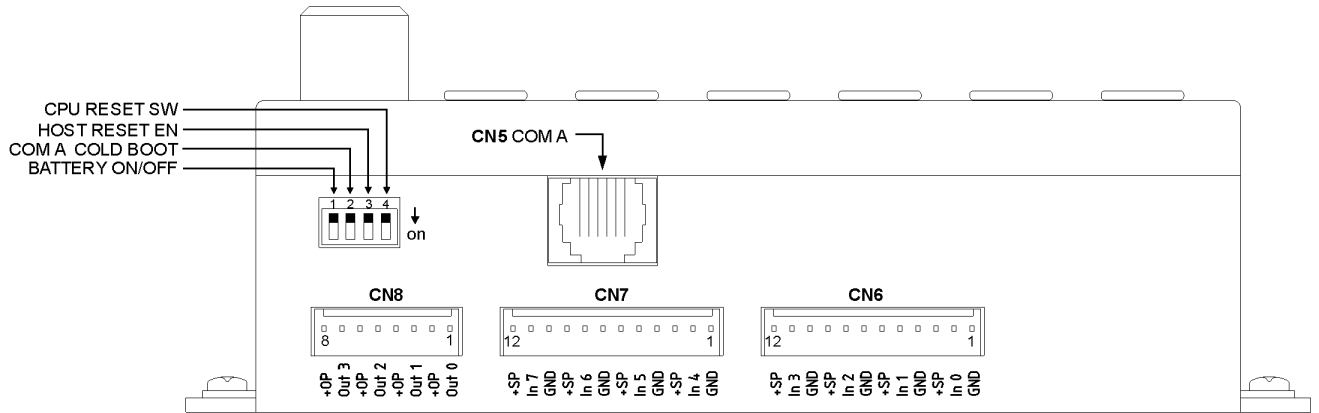
DIMENSIONAL DRAWING



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CONNECTOR LAYOUT



DIP SWITCHES

| SW | FUNCTION | DESCRIPTION |
|----|-----------------|------------------------------|
| 1 | BATTERY ON/OFF | RAM Backup battery ON/OFF |
| 2 | COM A COLD BOOT | ON = COM A COLD BOOT ENABLED |
| 3 | HOST RESET EN | ON = HOST RESET ENABLED |
| 4 | CPU RESET SW | ON = CPU RESET |

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CN1 – POWER

| PIN | SIGNAL | DESCRIPTION |
|-----|-----------------------|--|
| 1 | POWER (+) 12 to 32VDC | 12-32VDC power supply, positive terminal |
| 2 | POWER GND* | Power supply ground |

CN2 – COM D

| PIN | SIGNAL | DESCRIPTION |
|-----|--------|--------------------------|
| 1 | RXD | RS-232 Receive data |
| 2 | TXD | RS-232 Transmit data |
| 3 | -D | RS-485 (-) Data terminal |
| 4 | +D | RS-485 (+) Data terminal |
| 5 | GND* | Interface ground |
| 6 | +5V** | +5V Power output |

CN3 – COM C (LDCN 2)

| PIN | SIGNAL | DESCRIPTION |
|-----|--------|-------------------|
| 1 | N.C. | Not Connected |
| 2 | GND* | Interface ground |
| 3 | +RX | (+) Receive data |
| 4 | -RX | (-) Receive data |
| 5 | -TX | (-) Transmit data |
| 6 | +TX | (+) Transmit data |
| 7 | +5V** | +5V Power output |
| 8 | GND* | Interface ground |

CN4 – COM B (LDCN 1)

| PIN | SIGNAL | DESCRIPTION |
|-----|--------|-------------------|
| 1 | N.C. | Not Connected |
| 2 | GND* | Interface ground |
| 3 | +RX | (+) Receive data |
| 4 | -RX | (-) Receive data |
| 5 | -TX | (-) Transmit data |
| 6 | +TX | (+) Transmit data |
| 7 | +5V** | +5V Power output |
| 8 | GND* | Interface ground |

CN5 – COM A

| PIN | SIGNAL | DESCRIPTION |
|-----|--------|---|
| 1 | RXA | RS-232 Receive data |
| 2 | TXA | RS-232 Transmit data |
| 3 | STAT | STATUS output from Rabbit 2000™ CPU (used by software development tools) |
| 4 | HRST | HOST RESET input (used by software development tools) Enabled by HOST RESET EN switch |
| 5 | GND* | Interface ground |
| 6 | +5V** | +5V Power output |

Notes:

* POWER GND and GND are electrically connected. Drive's case is isolated from the controller circuitry and can be grounded externally.

** 250mA MAX for all outputs combined.

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CN6 – DIGITAL INPUTS

| PIN | SIGNAL | DESCRIPTION |
|-----|--------------------|---------------------|
| 1 | GND ⁽¹⁾ | Interface ground |
| 2 | In 0 | Digital input 0 |
| 3 | +SP ⁽²⁾ | Sensor Power Supply |
| 4 | GND ⁽¹⁾ | Interface ground |
| 5 | In 1 | Digital input 1 |
| 6 | +SP ⁽²⁾ | Sensor Power Supply |
| 7 | GND ⁽¹⁾ | Interface ground |
| 8 | In 2 | Digital input 2 |
| 9 | +SP ⁽²⁾ | Sensor Power Supply |
| 10 | GND ⁽¹⁾ | Interface ground |
| 11 | In 3 | Digital input 3 |
| 12 | +SP ⁽²⁾ | Sensor Power Supply |

CN7 – DIGITAL INPUTS

| PIN | SIGNAL | DESCRIPTION |
|-----|--------------------|---------------------|
| 1 | GND ⁽¹⁾ | Interface ground |
| 2 | In 4 | Digital input 4 |
| 3 | +SP ⁽²⁾ | Sensor Power Supply |
| 4 | GND ⁽¹⁾ | Interface ground |
| 5 | In 5 | Digital input 5 |
| 6 | +SP ⁽²⁾ | Sensor Power Supply |
| 7 | GND ⁽¹⁾ | Interface ground |
| 8 | In 6 | Digital input 6 |
| 9 | +SP ⁽²⁾ | Sensor Power Supply |
| 10 | GND ⁽¹⁾ | Interface ground |
| 11 | In 7 | Digital input 7 |
| 12 | +SP ⁽²⁾ | Sensor Power Supply |

CN8 – DIGITAL OUTPUTS

| PIN | SIGNAL | DESCRIPTION |
|-----|--------------------|---------------------------------|
| 1 | Out 0 | Open collector output 36V/0.15A |
| 2 | +OP ⁽³⁾ | Output Power |
| 3 | Out 1 | Open collector output 36V/0.15A |
| 4 | +OP ⁽³⁾ | Output Power |
| 5 | Out 2 | Open collector output 36V/0.15A |
| 6 | +OP ⁽³⁾ | Output Power |
| 7 | Out 3 | Open collector output 36V/0.15A |
| 8 | +OP ⁽³⁾ | Output Power |

Notes:

- (1) POWER GND and GND are electrically connected. Drive's case is isolated from the controller circuitry and can be grounded externally.
- (2) 0.5A MAX for all sensor power supply outputs combined.
- (3) 5A MAX for all power outputs combined.

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CN9 – DIGITAL OUTPUTS

| PIN | SIGNAL | DESCRIPTION |
|-----|--------------------|---------------------------------|
| 1 | Out 4 | Open collector output 36V/0.15A |
| 2 | +OP ⁽³⁾ | Output Power |
| 3 | Out 5 | Open collector output 36V/0.15A |
| 4 | +OP ⁽³⁾ | Output Power |
| 5 | Out 6 | Open collector output 36V/0.15A |
| 6 | +OP ⁽³⁾ | Output Power |
| 7 | Out 7 | Open collector output 36V/0.15A |
| 8 | +OP ⁽³⁾ | Output Power |

CN10 – DIGITAL INPUTS

| PIN | SIGNAL | DESCRIPTION |
|-----|--------------------|---------------------|
| 1 | GND ⁽¹⁾ | Interface ground |
| 2 | In 8 | Digital input 8 |
| 3 | +SP ⁽²⁾ | Sensor Power Supply |
| 4 | GND ⁽¹⁾ | Interface ground |
| 5 | In 9 | Digital input 9 |
| 6 | +SP ⁽²⁾ | Sensor Power Supply |
| 7 | GND ⁽¹⁾ | Interface ground |
| 8 | In 10 | Digital input 10 |
| 9 | +SP ⁽²⁾ | Sensor Power Supply |
| 10 | GND ⁽¹⁾ | Interface ground |
| 11 | In 11 | Digital input 11 |
| 12 | +SP ⁽²⁾ | Sensor Power Supply |

CN11 – DIGITAL OUTPUTS

| PIN | SIGNAL | DESCRIPTION |
|-----|--------------------|---------------------------------|
| 1 | Out 8 | Open collector output 36V/0.15A |
| 2 | +OP ⁽³⁾ | Output Power |
| 3 | Out 9 | Open collector output 36V/0.15A |
| 4 | +OP ⁽³⁾ | Output Power |
| 5 | Out 10 | Open collector output 36V/0.3A |
| 6 | +OP ⁽³⁾ | Output Power |
| 7 | Out 11 | Open collector output 36V/0.3A |
| 8 | +OP ⁽³⁾ | Output Power |

Notes:

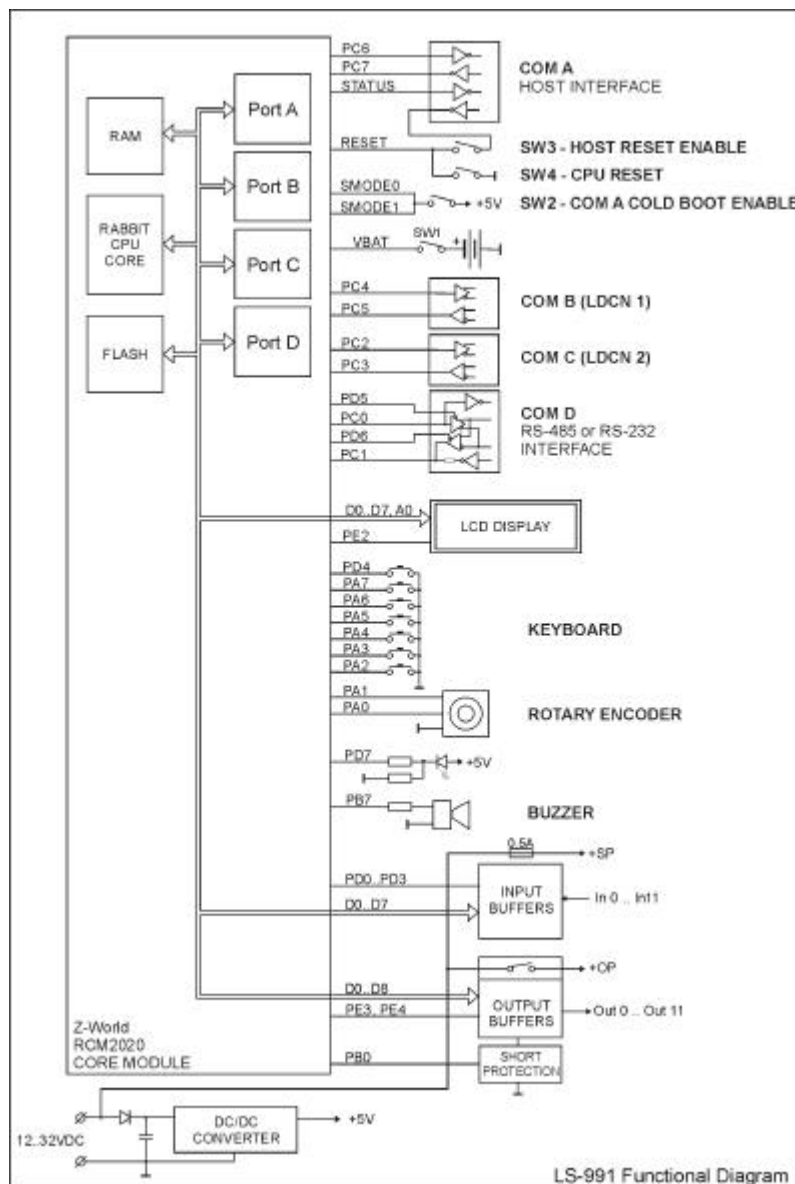
- (1) POWER GND and GND are electrically connected. Drive's case is isolated from the controller circuitry and can be grounded externally.
- (2) 0.5A MAX for all sensor power supply outputs combined.
- (3) 5A MAX for all outputs combined.

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LS-991 ARCHITECTURE OVERVIEW

- CPU - Rabbit 2000™
- CPU clock – 18.432 MHz
- 256K FLASH memory
- 128K SRAM with battery backup
- Two full-duplex (4 wire) RS-485 port for hosting of up to 62 LDCN nodes
- One RS-232 for software development and general purpose applications
- One configurable RS-232 or RS-485 (2 wire) serial port
- LCD Display 2 lines, 20 characters
- 7 button keyboard
- Rotary encoder
- 12 digital inputs
- 12 digital outputs
- Buzzer
- LED indicator with two intensity levels

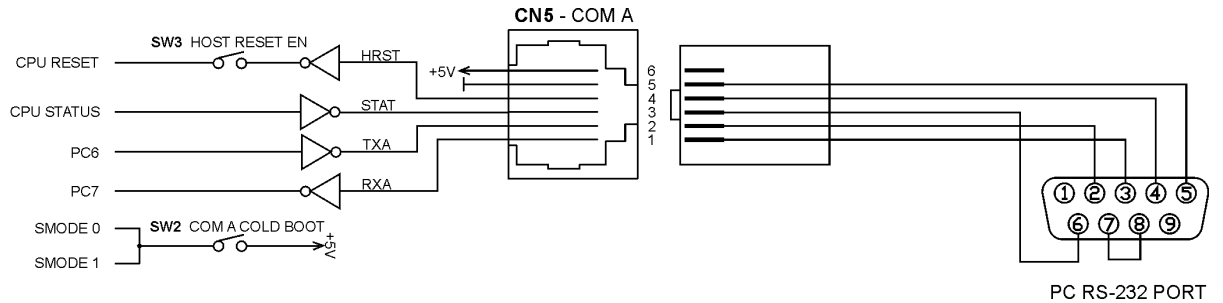


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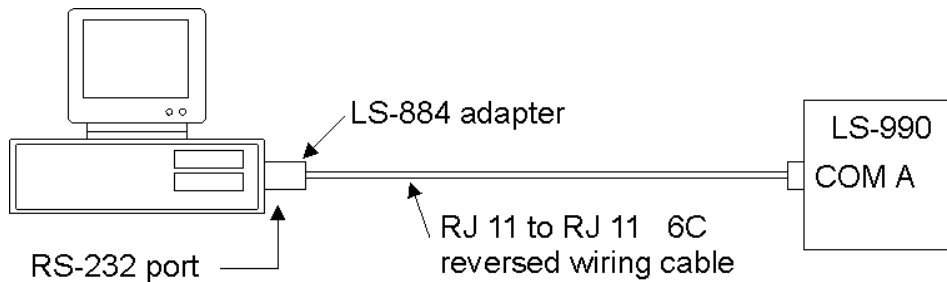
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SERIAL INTERFACE (COM A)

- COM A corresponds to Rabbit 2000™ Serial port A.
- COM A schematics:



- SOFTWARE DEVELOPMENT mode:
SW 2 = ON
SW 3 = ON

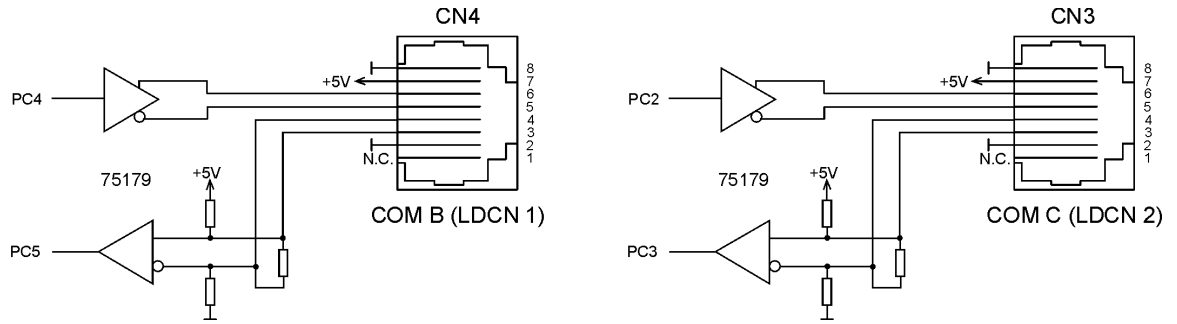


In this mode, LS-991 can be controlled by Z-World development tools.
For more information, see the related documents at <http://www.zworld.com/> and <http://www.rabbitsemiconductor.com/>.

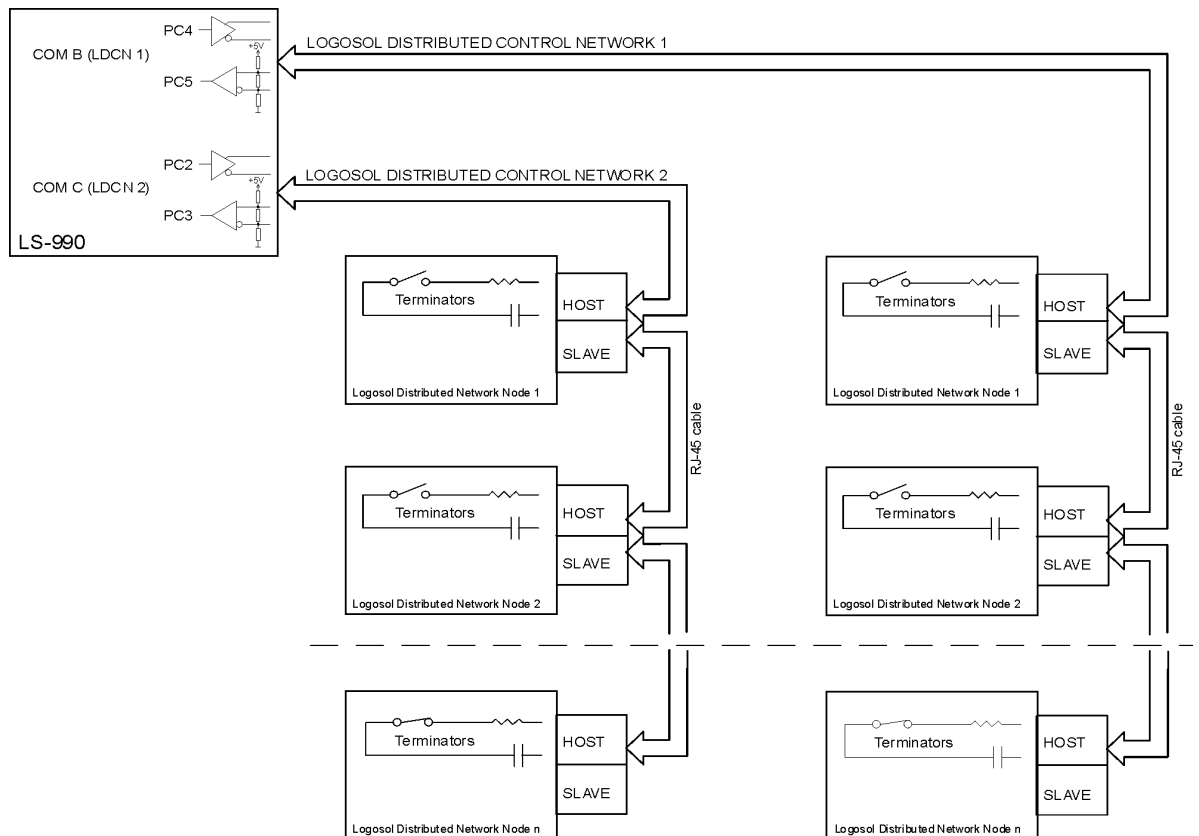
- RS-232 interface mode:
SW 2 = OFF
SW 3 = OFF

SERIAL INTERFACE COM B (LDCN 1) and COM C (LDCN 2)

- COM B corresponds to Rabbit 2000™ Serial port B.
- COM C corresponds to Rabbit 2000™ Serial port C.
- Interface schematics:



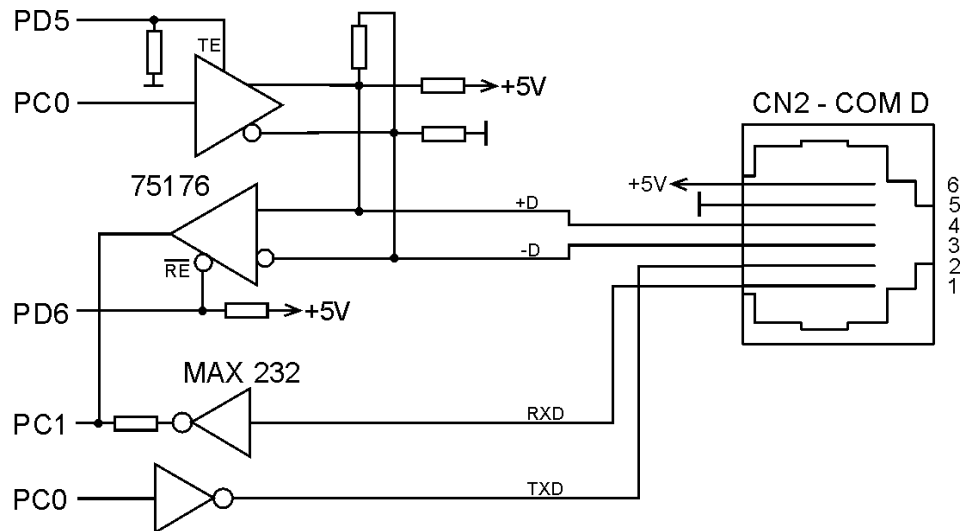
- LDCN 1 and LDCN 2 are especially designed for interfacing with Logosol Distributed Control Network, hosting up to 31 distributed servo, stepper, I/O and other devices per network.
- Typical LDCN application schematics:



For a full description of LDCN, refer to the manuals and software library, available for download at <http://www.logosolinc.com/>.

SERIAL INTERFACE (COM D)

- COM D corresponds to Rabbit 2000™ Serial port D.
- Interface schematics:



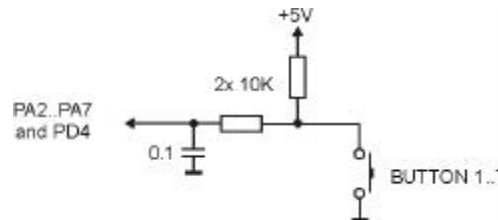
- RS-232 mode:
Program PD5 and PD6 as standard outputs. Set PD5 = 0 and PD6 = 1.
- RS-485 mode:
To control the direction PD5 and PD6 should be programmed as a standard outputs.
PD5 = 1 and PD6 = 1 – transmit mode
PD5 = 0 and PD6 = 0 – receive mode

LCD DISPLAY

- The 2 line 20 characters LCD display is compatible with L2032 series LCD display's from SEIKO Instruments. For more information, see the related documents at: <http://www.seiko-usa-ecd.com/>
- LCD data bus (DB7..DB0) is connected to Rabbit 2000™ data bus (D7..D0).
- LCD enable (E) is connected to the inverted Rabbit 2000™ Parallel port E bit 2 (PE2).
- LCD register select (RS) input is connected to Rabbit 2000™ address line A0.
- Rabbit 2000™ Parallel port E bit 2 (PE2) should be initialized in I/O strobe mode. For detailed information, see the software library or visit: <http://www.logosolinc.com/>.

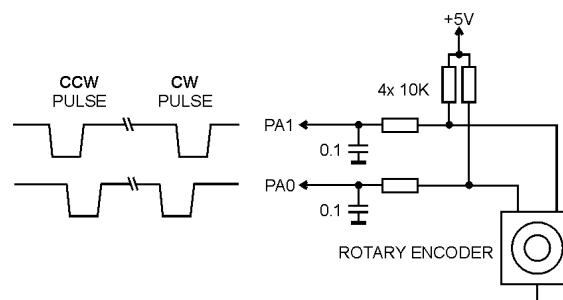
KEYBOARD

- The keyboard features seven push buttons. When button is pressed the corresponding Rabbit 2000™ Parallel port bit is read as "0". See Rabbit 2000™ port assignments table for details.



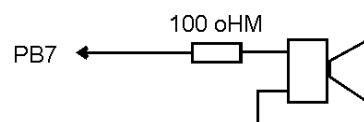
ROTARY ENCODER

- The rotary encoder phases are connected to Rabbit 2000™ Parallel port A bit 0 and bit 1 (PA0 and PA1). Rotary encoder resolution - 24 pulses / revolution.



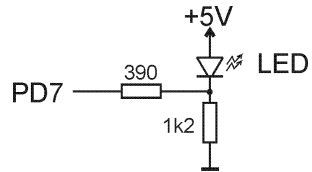
BUZZER

- The Buzzer can be controlled by Rabbit 2000™ Parallel port B bit 7 (PB7). To activate Buzzer set PB7 = 1 for at least 1mS. The Buzzer control is available for the user software.



LED

- LED intensity can be controlled by Rabbit 2000™ Parallel port D bit 7 (PD7).
- LED control schematics:



- LED intensity table:

| PD7 MODE | STATE | LED INTENSITY |
|-------------------|-------|---------------|
| INPUT | X | LOW |
| OPEN-DRAIN OUTPUT | 1 | LOW |
| OPEN-DRAIN OUTPUT | 0 | HIGH |
| STANDARD OUTPUT | 1 | NONE |
| STANDARD OUTPUT | 0 | HIGH |

The LED intensity control is available for the user software.

DIP SWITCHES

- SW 1 (BATTERY ON/OFF) switch turns on and off RAM backup battery.
SW 1 = ON – RAM keeps the information during power off.
SW 1 = OFF – The information in RAM is destroyed during power off.
- SW 2 (COM A COLD BOOT) switch – see Serial interface COM A
- SW 3 (HOST RESET EN) switch – see Serial interface COM A
- SW 4 (CPU RESET SW) switch corresponds to Rabbit 2000™ CPU master reset.
SW 4 = ON – Rabbit 2000™ CPU in reset condition.
SW 4 = OFF – Rabbit 2000™ CPU is running.

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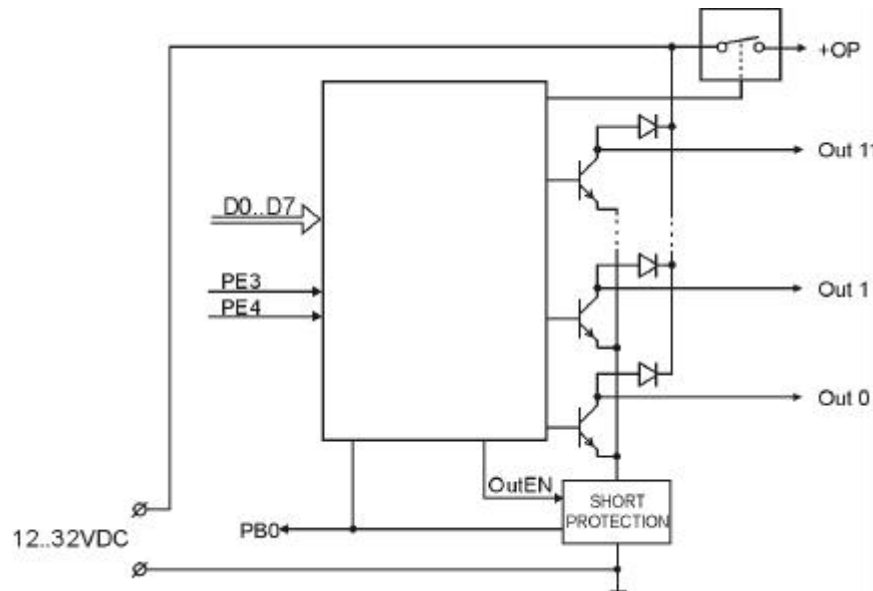
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DIGITAL OUTPUTS

- The digital outputs and +OP solid-state relay latches are connected to Rabbit 2000™ system data BUS and two I/O strobes PE3 and PE4. Rabbit 2000™ Parallel port E bit 3 and bit 4 (PE3 and PE4) should be initialized in I/O strobe mode.
- Writing “1” to output latches activates the corresponding output.

| I/O Write to address | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|----------------------|-------|-------|-------|-------|--------|--------|-------|-------|
| 0x6000 | Out 7 | Out 6 | Out 5 | Out 4 | Out 3 | Out 2 | Out 1 | Out 0 |
| 0x8000 | OutEN | N.A. | N.A. | +OP | Out 11 | Out 10 | Out 9 | Out 8 |

- After power-up or output short the OutEN bit should be set to “1”
- Rabbit 2000™ Parallel port B bit 0 (PB0) can be checked for output diagnostics:
 - “0” = OutEN bit is cleared **OR** output is overloaded.
 - “1” = OutEN bit is set to “1” and there is no overload condition.
- Digital output schematics:



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DIGITAL INPUTS

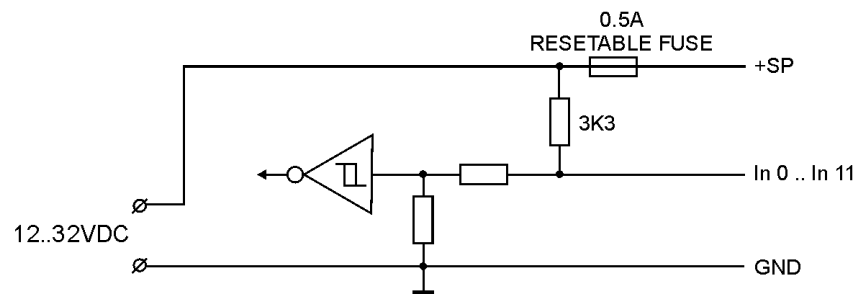
- Digital inputs In 0 to In 7 are connected to Rabbit 2000™ system data BUS.

| I/O Read from address | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|-----------------------|------|------|------|------|------|------|------|------|
| 0x0000 | In 7 | In 6 | In 5 | In 4 | In 3 | In 2 | In 1 | In 0 |

- Digital inputs In 8 to In 11 are connected to Rabbit 2000™ Parallel port D bits 0 to 3

| PARALEL PORT D | PD3 | PD2 | PD1 | PD0 |
|----------------|-------|-------|------|------|
| Digital Input | In 11 | In 10 | In 9 | In 8 |

- Digital input schematics:



- When a input is connected to GND the corresponding bit is read as "1"

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RABBIT 2000™ PORTS ASSIGNMENT AND INITIALIZATION

PORT A

| | INITIALIZED AFTER RESET | | REMARKS |
|-----|-------------------------|------|---|
| | DIRECTION | DATA | |
| PA7 | Input | none | Button 2 – read as logic “0” when pressed |
| PA6 | Input | none | Button 3 – read as logic “0” when pressed |
| PA5 | Input | none | Button 4 – read as logic “0” when pressed |
| PA4 | Input | none | Button 5 – read as logic “0” when pressed |
| PA3 | Input | none | Button 6 – read as logic “0” when pressed |
| PA2 | Input | none | Button 7 – read as logic “0” when pressed |
| PA1 | Input | none | Rotary encoder |
| PA0 | Input | none | Rotary encoder |

PORT B

| | INITIALIZED AFTER RESET | | REMARKS |
|-----|-------------------------|------|---|
| | DIRECTION | DATA | |
| PB7 | Output | 0 | Buzzer |
| PB6 | Output | 0 | Reserved |
| PB5 | Input | none | Identification – read as logic “1” |
| PB4 | Input | none | Identification – read as logic “0” |
| PB3 | Input | none | Identification – read as logic “1” |
| PB2 | Input | none | Identification – read as logic “0” |
| PB1 | Input | none | Reserved |
| PB0 | Input | none | Output’s status. When = “1” outputs are enabled and there is no overload condition. |

PORT C

| | INITIALIZED AFTER RESET | | REMARKS |
|-----|-------------------------|------|------------------|
| | DIRECTION | DATA | |
| PC7 | Input | none | Serial Port A RX |
| PC6 | Output | 1 | Serial Port A TX |
| PC5 | Input | none | Serial Port B RX |
| PC4 | Output | 1 | Serial Port B TX |
| PC3 | Input | none | Serial Port C RX |
| PC2 | Output | 1 | Serial Port C TX |
| PC1 | Input | none | Serial Port D RX |
| PC0 | Output | 1 | Serial Port D TX |

PORT D

| | INITIALIZED AFTER RESET | | REMARKS |
|-----|-------------------------|------|---|
| | DIRECTION | DATA | |
| PD7 | O.D. Output | 1 | LED intensity control |
| PD6 | Output | 1 | Serial port D RS-485 mode receive enable |
| PD5 | Output | 0 | Serial port D RS-485 mode transmit enable |
| PD4 | Input | none | Button 1 – read as logic “0” when pressed |
| PD3 | Input | none | In 11 |
| PD2 | Input | none | In 10 |
| PD1 | Input | none | In 9 |
| PD0 | Input | none | In 8 |

PORT E

| | INITIALIZED AFTER RESET | | REMARKS |
|-----|-------------------------|------|--------------------|
| | DIRECTION | DATA | |
| PE7 | Output | 0 | Reserved |
| PE6 | Output | 0 | Reserved |
| PE5 | Output | 0 | Reserved |
| PE4 | Output | 1 | Outputs I/O strobe |
| PE3 | Output | 1 | Outputs I/O strobe |
| PE2 | Output | 1 | LCD Display enable |
| PE1 | Output | 0 | Reserved |
| PE0 | Output | 0 | Reserved |