LUMINARY CONTROLLER
LMC-4XX

INSTRUCTION BOOK

INDUSTRIAL INDEXING SYSTEMS, Inc.

Revision - A
Approved By:

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INTRODUCTION

Thank you for selecting Industrial Indexing Systems LUMINARY Series products. You join many other companies around the world in your choice of these powerful, flexible motion control products.

The LMC-4XX embodies a blend of open architecture features with a true real-time operating system. The result is a state-of-the art performance and superior connectivity to other systems and network components.

The LMC-4XX has a wide array of hardware features, including

- ❖ a 32-bit ARM processor,
- ❖ a Executive serial port (USB-B),
- ❖ an Application serial port (rs232),
- ❖ Eight configurable general purpose isolated digital input's (Can be configured for up to Two Encoder master follower input's with Position Trap input),
- ❖ four general purpose isolated digital outputs,
- ❖ Configurable programmable limit switch (PLS) functions,
- ❖ two software simulated motors (master pacers),
- ❖ high visibility status displays.

The LMC-400 has a wide array of software features, including:

- ❖ The controller is programmed using our friendly **E**merald **M**otion **P**rogramming **L**anguage (EML) and powerful new **E**merald **D**evelopment **E**nvironment (EDE) software tools for the PC.
- ❖ A Dynamic Link Library (DLL) is available to communicate with the LMC-4XX using your own Visual Basic, Visual C++, or other programming language allowing for full system integration, automation, and data logging solutions.
- ❖ A Human Machine Interface (HMI) touch screen can easily be added to the LMC-4XX system using either the USB port or the rs232 port.
- ❖ The External computer and or HMI will have unlimited access to the system memory area with the ability to control the LMC-4XX remotely.

Contact IIS for full system solutions utilizing computer programming or HMI systems.

SECTION 1 - OVERVIEW

This manual is organized so that information is easy to find and easy to use. It begins by detailing how to identify the LMC-4XX Controller. This section is followed by a general description of the product and its components.   Next, a comprehensive hardware specification is provided followed by connector wiring diagrams.   The section that follows documents the controller status displays.   Sections on LMC-4XX installation guidelines and cables drawings round out the manual.

1.1   IDENTIFYING THE LUMINARY CONTROLLER

Luminary Controller packages can be identified as follows.

Your LUMINARY Controller model number uses the following designations:

The LMC-4XX-00 is the basic controller without a base plate or with mounting options. The controller can also be mounted on the same plate as the drive. See IB-30B001 for more details.

Part number identification

LMC–400–XX

Mounting Option
(00) = No Mounting Plate
(01) = Flat Plate
(21) = L Bracket

Special Options
(00) 100-240VAC Powered
(05) 5-24VDC Powered

Number of Master Ports
(4)

Controller Series
(LMC)
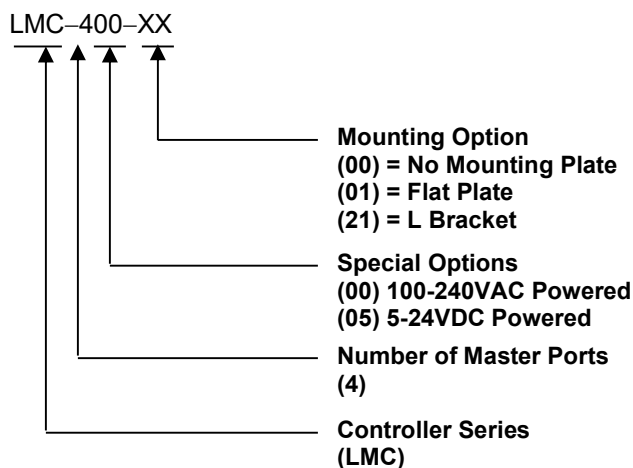
Example part numbers:
LMC-400-00   Luminary Controller without mounting base plate option
LMC-400-21   Luminary Controller with L bracket mounting plate
LD-330/E24H   Drive and Controller mounted on same mounting plate. See IB-30B001 for more details.

1.2   LUMINARY CONTROLLER MOUNTING PLATES

The Luminary Controller mounting plate drawings are shown below. Other options may be available.

For a compact single axis positioner, one Luminary Drive (LD-330) can be the mounted on the opposing side of the "L" bracket.

Flat plate mounting
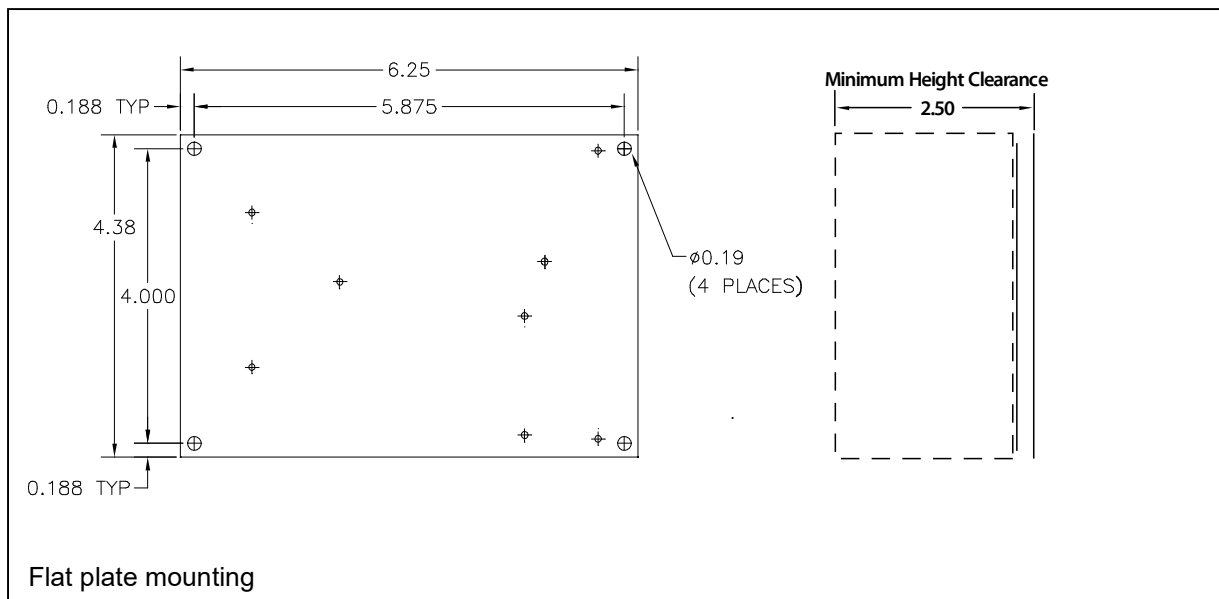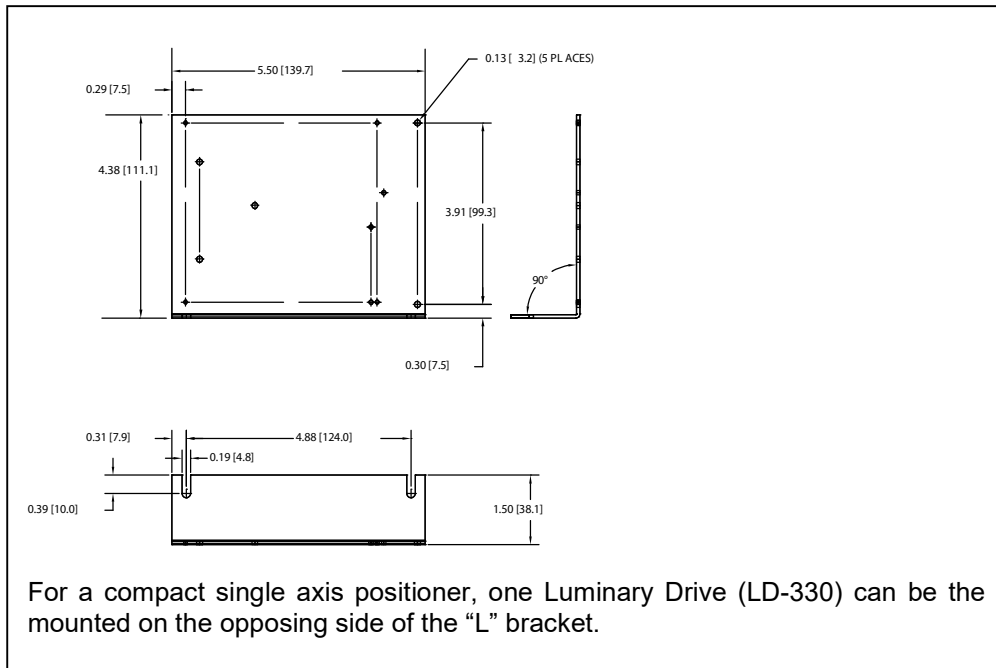
SECTION 2 - DESCRIPTION

The Luminary LMC-400 product is a SBI Master servo motion controller, with the ability to command up to Four Slave Luminary Devices. The application program that operates the controller is created on a PC using the EDE software tools and sent serially to the controller via the USB or RS-232 link.

> **NOTE**
> **All commands used by the LUMINARY are part of the Emerald Motion Language (EML). Refer to the Emerald Development Environment (EDE) PC tools online help for detailed information on the commands and their proper usage.**

2.1 COMPONENTS

The external connections that exist on the Luminary are shown in **Figure 2.1**, and consist of USB, RS-232 ports, General purpose Input's and Output's, Four SBI Ports, and a power connection.

Figure 2.1 - LMC-400 Layout

2.1   COMPONENTS (cont'd)
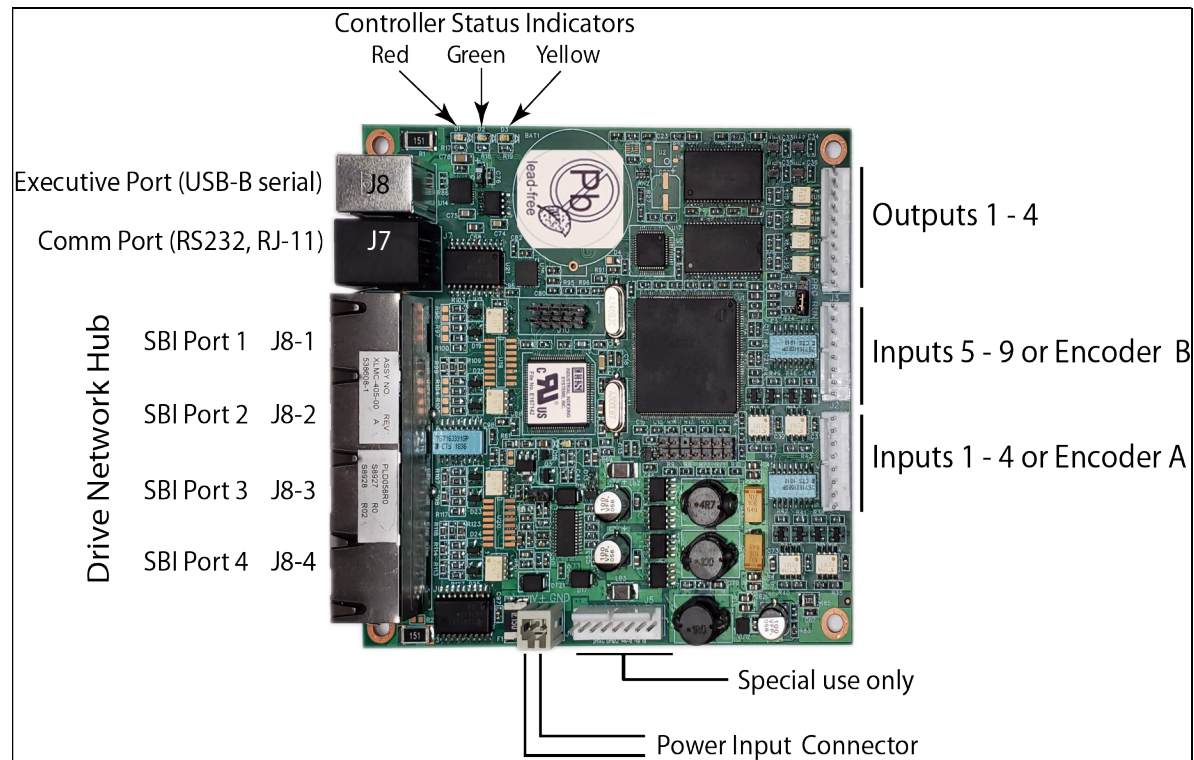
Figure 2.2 - LMC-405 Layout

2.1.1 STATUS INDICATORS

Controller Status Display – These three LED's define the current status of the controller. See section 5 and figure 2.1.For indicator status information, refer to Section 5 - Status & Error Codes

❖ **SBI Status LEDs** - These 2 LED's indicate the status of the SBI Interface. See Section 5 and figure 2.1

.

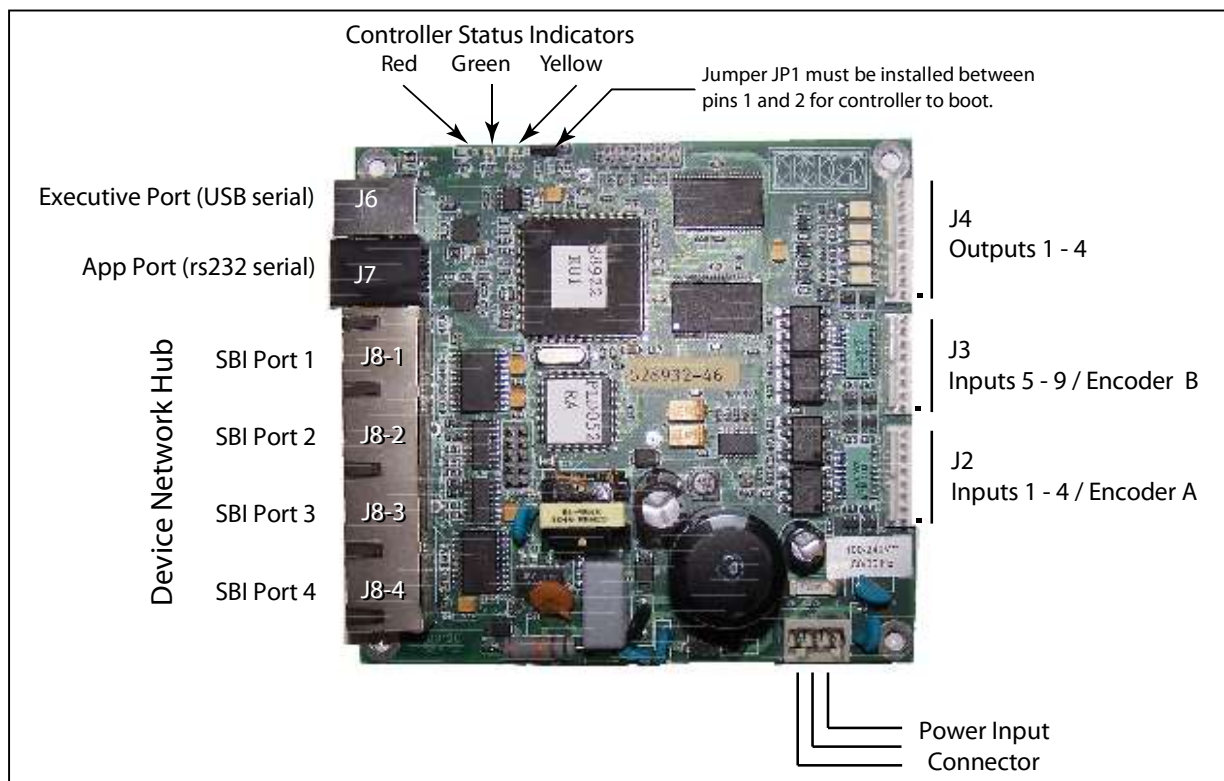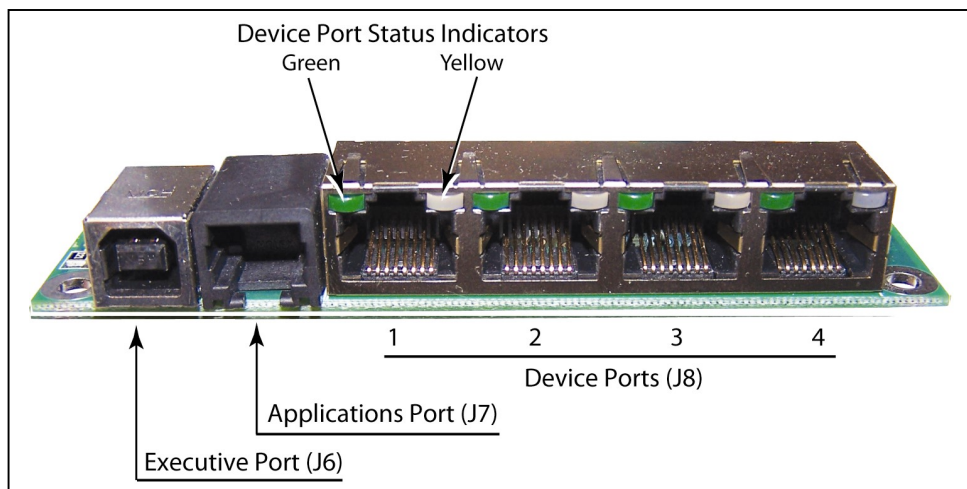## 2.1.2 CONNECTORS

❖ **Executive Port** - This 4-pin USB-B connector is an USB 2.0 serial communication port. The protocol is the EML custom protocol for communicating with the EDE software tools on a PC.

❖ **Application Port** - This 6-pin RJ-11 connector is an RS-232 serial communication port. It can be used to communicate with a Maple Systems Touch Screen OPI-7.0TFT or other size available from IIS or similar RS-232 type devices. The protocol is selectable through the EML programming language. This port defaults to the custom protocol for communicating with the EDE software tools on a PC unless configured otherwise in the EDE program.

❖ **Device Network Hub** - This Quad 8-pin header is the interface hub to the slave SBI devices. The SBI devices are setup in the EDE project configuration.

❖ **Digital Inputs** - These 8-pin headers are high-speed inputs that can be configured in the EML programming language to be generic input's, or master encoder pulse input's with Trap. See section 3.6 and 4.3.

❖ **Digital Outputs** - This 10-pin connector provides four generic outputs that can be configured in the EML programming language. See section 3.6 and section 4.4.

❖ **Power Input** - This 3-pin connector is for powering the Luminary Controller. See section 3.2 and section 4.5.

SECTION 3 – LUMINARY CONTROLLER SPECIFICATIONS

3.1   GENERAL

Weight	LMC-4XX-00 LMC-4XX-21	0.25 lbs / 0.11 Kg 0.42 lbs / 0.19 Kg
Dimensions W x H x D	LMC-4XX-00 LMC-4XX-21	4.20 in (106.7 mm) x 1.10 in (28.0 mm) x 4.50 in (114.3 mm) 4.20 in (106.7 mm) x 4.50 in (114.3 mm) x 1.10 in (28.0 mm)
Minimum Enclosure Depth	LMC-4XX-00	At Least 3.00 in (76.2 mm) Mounted On 8 mm standoffs (See **Section 6 - Installation Guidelines**)
Minimum Enclosure Depth	LMC-4XX-21	At Least 6.00 in (152.4 mm) Mounted On L Bracket (See **Section 6 - Installation Guidelines**)

3.2   POWER REQUIREMENT

LMC-400

Supply Voltage	100V to 240V volts AC $\pm$ 10%
Supply Current	0.5 amp max. Internally Fused
Inrush Current	30A @ 1ms

LMC-405

Supply Voltage	5V to 24V DC $\pm$ 5%
Supply Current	0.5 amp max.
Inrush Current	

3.3   SBI INTERFACE

Network Topology	IIS Serial Bus Interface (SBI)
Transmission Rates	4.0 MB/second

3.4   ENVIRONMENT

Storage Temperature	-10 to 70°C / 14-158°F
Operating Temperature	0 to 45°C / 32-113°F
Humidity	35 to 90% Relative Humidity, non-condensing
Shock and Vibration	1 G or less
Operating Conditions	Free of conductive dust, liquids, metallic particles and corrosive gases. Use in a pollution degree 2 environment.

3.5   COMMUNICATION PORTS

USB-B J6	Classification: Serial Communications over USB 2.0 Data Transfer: EMC Packet protocol Physical: 115200 baud, 1 stop bit, 8 data bits, No parity
RS-232 (RJ-11) J7	Classification: Serial Communications over RS-232 Data Transfer: EMC Packet protocol (default), User Programmable Physical: 38,400 or 19,000 baud, 1 stop bit, 8 data bits, No parity
SBI (RJ-45) J8-1, -2, -3, -4	Classification: IIS Device Network over SPI Data Transfer; Full duplex, hi-speed serial (4.0 megabit / sec) Physical: Four port hub

3.6   I/O INTERFACE

DIGITAL INPUTS Connector Block J1 and J2	ON: 24V DC ±10% OFF: 2V or Less Input Resistance: 2K Ohms Input Frequency: DC to 1.5 MHz. Reverse polarity protected
DIGITAL OUTPUTS Connector Block J3	24V DC ±10% Output Load: 100mA DC Maximum non-inductive Output Saturation Voltage (ON): 1.2V Maximum Output Leakage Current (OFF): 0.2mA Maximum Output Frequency: DC to 500Hz

3.7   ENCODER INPUT INTERFACE

(When inputs J1 or J2 are configured to accept encoder signals in the EDE project file.)

A (quadrature) B With or without marker	Three differential Inputs A, B, Z. Input Frequency DC to 1.5 MHz.
Position Capture "Trap" input signal	Input for trapping encoder's 32 bit signed position. Maximum Trap Rate: 1 kHz. Trap Register is updated on falling edge of input.

SECTION 4 - LUMINARY WIRING

This section details the pin-outs of the external connectors on the LUMINARY controller. Refer to **Section 7 INTERFACE CABLES** for part numbers of cables to interface to these connectors.

CAUTION – The LMC-400 device is a high voltage product operating on 100V to 240V AC and may cause injury or death if precautions are not followed when installing or servicing the LMC-400.

PRECAUTIONS:

1) Never service the LMC-400 with power applied to the unit. There are high voltage wire ways and components that hold dangerous voltages. Internal components on the LMC-400 can hold voltages reaching 350V DC.

2) Wait at least 1 minute from removal of power from the system to service the LMC-400. There are capacitors that will hold dangerous voltages on the unit for up to 1 minute after removal of power.

See Figure 4.1 below for controller interface wiring and connector pin-outs.

Figure 4.1 – Luminary Controller Wiring
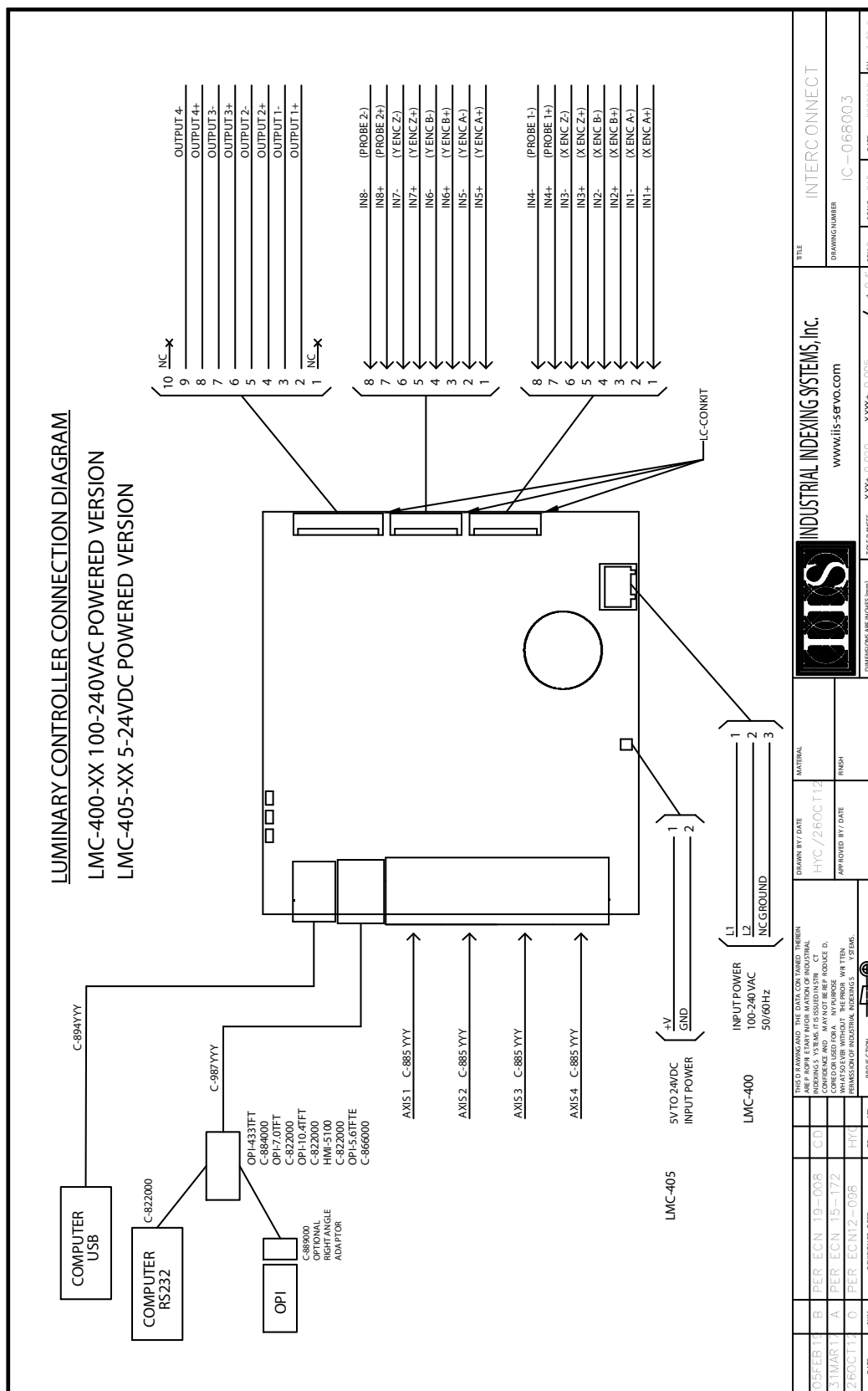
4.1 J6 Executive Port

This port is used for communication with the IIS EDE software development package and uses a standard USB-A to USB-B cable to interface to a PC. A 15-foot cable is available from IIS; order part number C-894015.

4.2 J7 Applications Port

This port is used for user communication and uses an RJ-11 connector to interface to rs232 devices.

Various adapters are available to convert connector on the device to the IIS cable C-987010 that connects to the RJ-11 applications port connector. Users can connect various operator interface terminals and communicate with them by using simple data transfers utilizing ASCII character commands or the port can by configured to use the IIS data transfer protocol. The IIS EMC protocol is available as selection on the Maple System touch-screen terminals.

When communicating with a PC app, IIS provides the user with a dynamic linked library (DLL) that can be integrated into their application.

Device	Model	Cable Adapter	Cable
Touchscreen 4.3	OPI-4.3TFT	C-884000	C-987YYY
Touchscreen 5.6	OPI-5.6TFT	C-866000	C-987YYY
Touchscreen 7.0	OPI-7.0TFT	C-822000	C-987YYY
Touchscreen 10.4	OPI-10.4TFT	C-822000	C-987YYY
Touchscreen	HMI-5100	C-822000	C-987YYY
PC	With 9 pin serial port	C-822000	C-987YYY

Note: the C-889000 adapter can also be used when there is the need to bring the cable out at a right angle.

4.3   J1 & J2   Digital Inputs

The Input interface connection options are shown in **Figure 4.2**. They may be wired for sinking or sourcing configurations.
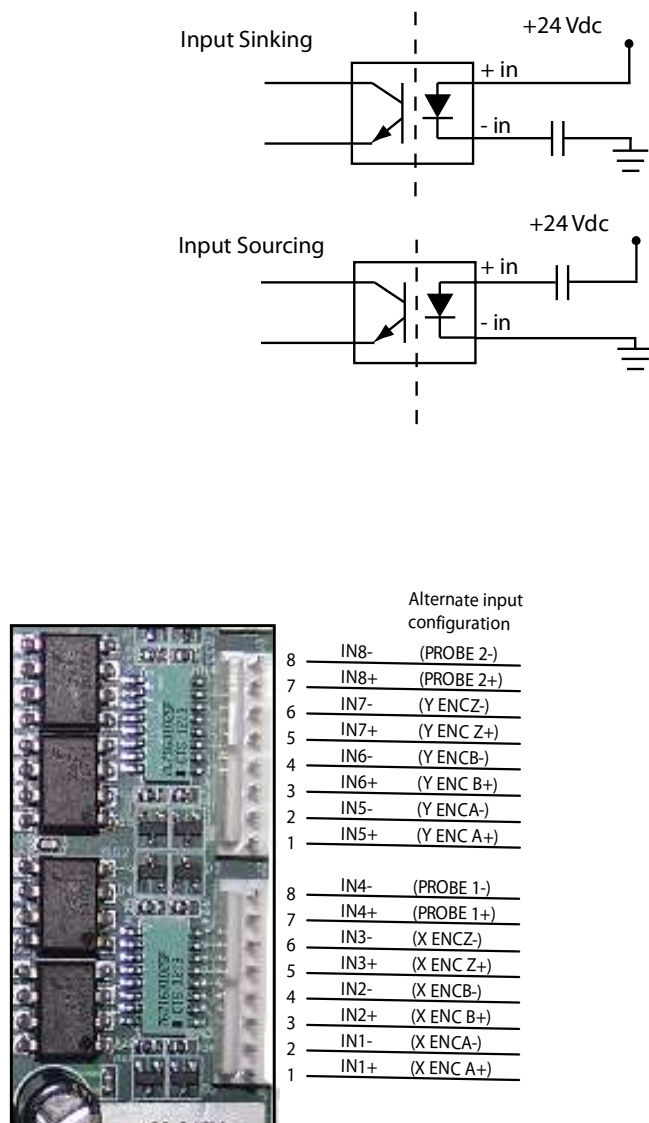
Figure 4.2 - INPUT WIRING

4.4   J3 Digital Outputs

The Output interface connector options are shown in **Figure 4.3**. They may be wired for sinking or sourcing configurations.
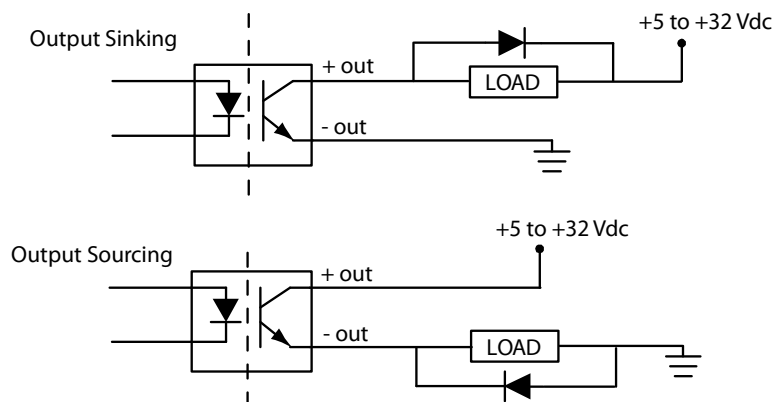
Use a reverse diode to reduce negative voltage transitions when driving inductive loads.
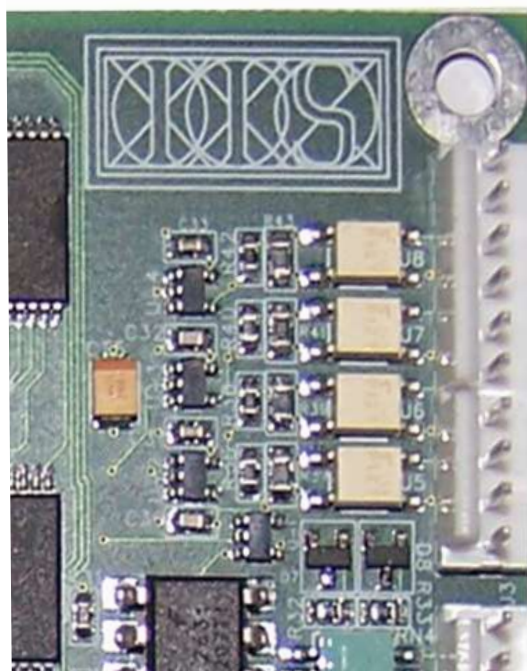
Figure 4.3 - OUTPUT WIRING

4.5   J4 Power Input

The AC Power input connector.

4.6   J5 & J9 Factory Configuration Ports

Used in the manufacturing process of the LMC-400.

Do not plug any connectors into these ports.

4.7   JP1 Jumper Selection

Used in the manufacturing process of the LMC-400.

Keep jumper between pin-1 and pin-2.

SECTION 5 - STATUS & ERROR CODES

5.1   CONTROLLER STATUS

CONTROLLER NORMAL STATUS		LED DISPLAY STATUS SEQUENCE		
CODE	DESCRIPTION	RED	GREEN	YELLOW
	POWER-UP Boot in progress	SOLID	SOLID	SOLID
	System Reset / User program loaded	OFF	OFF	FLASHING
	User Program loaded / Not running	OFF	FLASHING	OFF
	User program running	OFF	SOLID	OFF
	Memory clearing in progress	SOLID	OFF	OFF

SEE FIGURE 5.1 FOR LOCATION OF STATUS LED's

CONTROLLER WARNINGS		LED STATUS SEQUENCE	
CODE	DESCRIPTION	YELLOW FLASHES	GREEN FLASHES
21	Program divide by zero	2	1
22	Illegal instruction argument detected	2	2
23	Device found in wrong operating state	2	3
24	Out of bounds memory access detected	2	4
25	RESERVED	2	5
26	RESERVED	2	6
27	RESERVED	2	7
28	RESERVED	2	8
29	RESERVED	2	9
31	Communication Timeout - USB Port	3	1
32	Communication Timeout - RS-232 Port	3	2

33	RESERVED	3	3
34	RESERVED	3	4
35	Illegal packet code received - USB Port	3	5
36	Illegal packet code received - RS-232 Port	3	6
37	PRINT QUEUE FULL - USB Port	3	7
38	PRINT QUEUE FULL - RS-232 Port	3	8
39	RESERVED	3	9

SEE FIGURE 5.1 FOR LOCATION OF STATUS LED's

CONTROLLER FATAL ERRORS		LED STATUS SEQUENCE	
CODE	DESCRIPTION	RED FLASHES	GREEN FLASHES
01	Unrecognized Instruction Opcode	1	0
02	Program Load Failure	2	0
03	Write to a read-only Flag	3	0
04	Instruction Opcode Aborted	4	0
05	Configuration Load Failure	5	0
06	Stack Memory Overflow	6	0
07	Stack Memory Underflow	7	0
08	Checksum Error in Program Memory	8	0
09	Main Processor Failure	9	0
10	Communication Error on SBI Device Port 1	5	1
11	Communication Error on SBI Device Port 2	5	2
12	Communication Error on SBI Device Port 3	5	3
13	Communication Error on SBI Device Port 4	5	4

5.2   DEVICE PORT STATUS DISPLAY

The status LED's of each device port on the hub show the current status of the SBI communications to the device it is connected to.

DESCRIPTION	LED	STATE	STATUS / SOLUTIONS
SBI communications are ACTIVE	GREEN	SOLID	No Problem
	YELLOW	OFF	
SBI communications are INACTIVE	GREEN	OFF	1) Check if program is loaded in LMC-400 2) Check if slave device is properly configured in the EDE project. 3) Check power is on slave device.
	YELLOW	SOLID	4) Check routing of communications cable. 5) Check for proper grounding of both the LMC-400 and the slave device. 6) Check for bad communications cable.
SBI receiving errors in communications	GREEN	SOLID	1) Check routing of communications cable. 2) Check for proper grounding of both the LMC-400 and the slave device. 3) Check for bad communications cable.
	YELLOW	FLASHING	
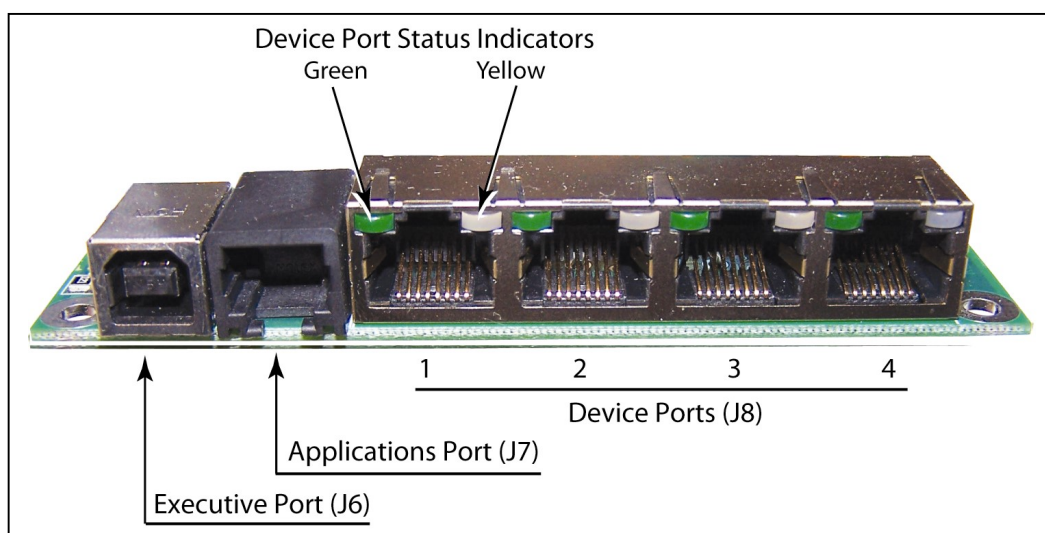
Figure 5.1 - SBI Status Displays

SECTION 6 - INSTALLATION GUIDELINES

6.1   GENERAL

This section contains the specific information needed to properly install the Luminary LMC-4XX controller unit.

6.2   ENCLOSURE CABINET REQUIREMENTS

Ideally, the LMC-4XX controller unit, along with other related electronic components, should be mounted on a panel housed in a NEMA 12 enclosure. It is recommended that the cabinet have a depth of at least 3.00 inches (76.2 mm) or 6.00 inches (152.4 mm) depending on mounting option, to accommodate the bend radius of the cables. The enclosure should be mounted as far away as practical from noise generating devices, such as SCR equipment.

6.3   MOUNTING THE SYSTEM UNIT

The LMC-4XX controller unit is designed for mounting on a grounded panel, and is secured to the panel with four M3 screws. Be sure to provide adequate spacing around the controller unit for ease of maintenance and proper ventilation. Typically wire ways are located at least 1 inch (25.4 mm) from the edge of the controller unit back plate. When mounting the LMC-4XX directly to a panel surface (not using a back plate) a spacer of at least 0.17 inch (4.5mm) shall be used to maintain spacing between the LMC-4XX and any conductive surfaces. Refer to drawing number LMC-4XX in **Section 6.6 - Installation Drawings** for mounting dimensions.

6.4   CABLE ISOLATION REQUIREMENTS

It is imperative that any low-voltage signal conductors, such as resolvers, encoders or communications, (24V or less) be routed in conduits or wire ways separate from high-voltage, such as motor cables, and transformer lines (100V or more). This will insure that electromagnetic fields produced by high power transmission do not corrupt the low level signals. All cabling shields must be connected according to manufacturer specifications.

6.5   GROUNDING REQUIREMENTS

The site must have a suitable earth ground rod and ground bus installed. The NEMA 12 enclosure, wire ways, conduits, and machine frame must be connected to this ground bus. The LMC-4XX earth ground and each slave device must be connected to this ground bus for proper operation.

6.6   INSTALLATION DRAWINGS

DRAWING NUMBER   DESCRIPTION

LMC-400-21   Luminary Controller

LMC-400 drawing to show drill locations, tap sizes for mounting on a panel. Also to shows aside view describing the recommended height from back panel using recommended spacers.

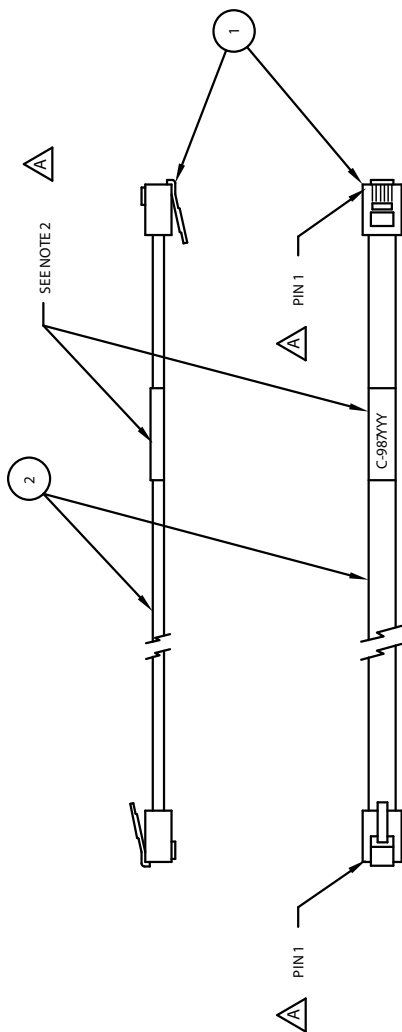# SECTION 7 - CABLES AND ACCESSORIES

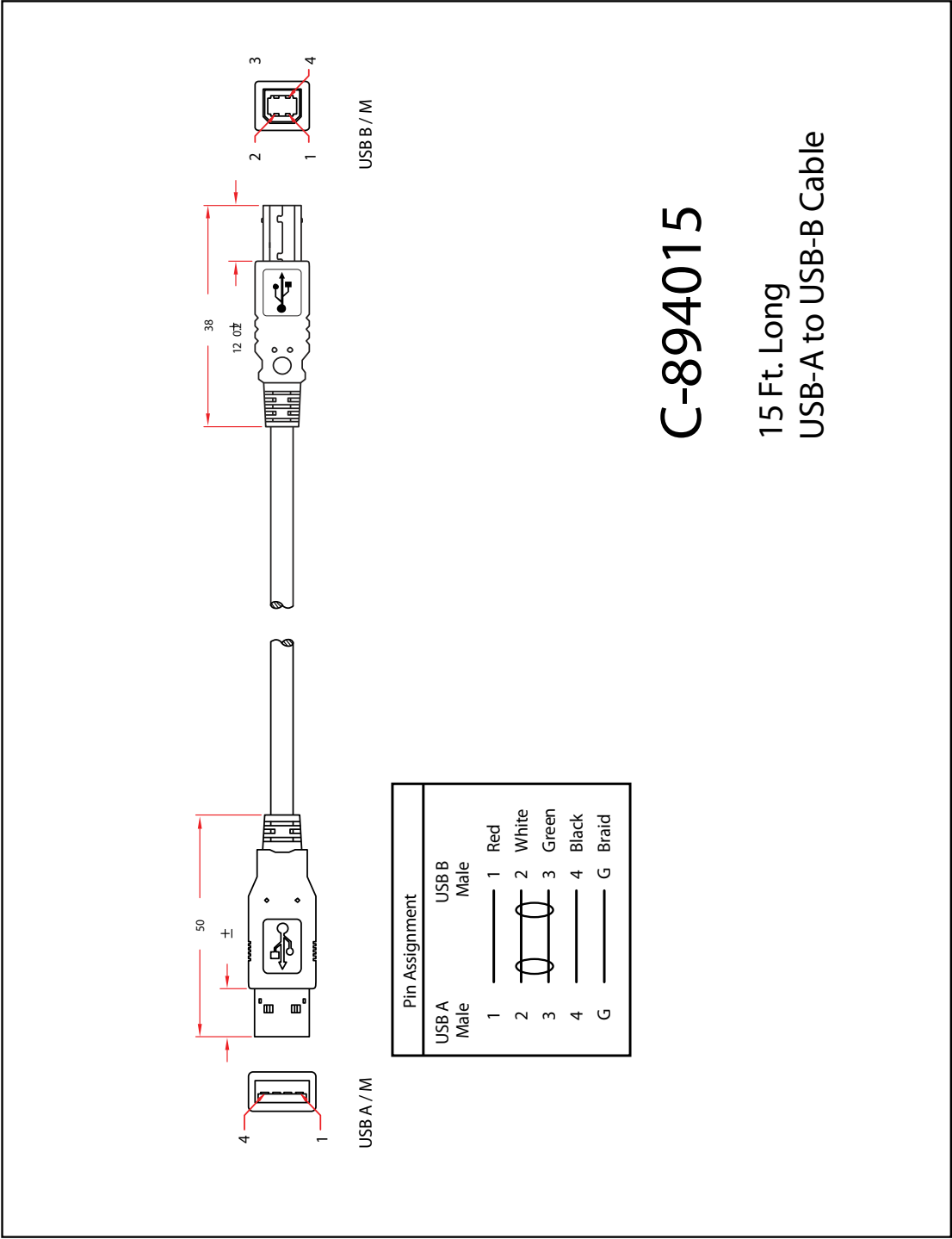| PART NUMBER	DESCRIPTION
C-885YYY	SBI Communications Cable
C-822YYY	Cable Adaptor 9 pin female to 6 pin Modular Data Cable
C-987YYY	6 pin Modular Data Cable
C-894015	Exec Port USB Communication Cable
LC-CONKIT	Connector/Pin Kit for I/O and Power interfaces

C-885YYY | Luminary Communication Cable

NOTES:

1.) INSULATE UNUSED WIRES.

2.) MARK PER QP-08-0001.

3.) COLORS IN (*) ARE ALTERNATE COLORS.

RJ11 JACK

PC-AT DB-9F

SEE NOTE 2

C-822000

RJ11 JACK

PC-AT DB-9F

RX 2 — (BLK) — YEL — 5
TX 3 — (GRN) — RED — 3
COM 5 — (RED) — GRN — 4
— (WHT) — WHT — 1
N.C. — (YEL) — BLK — 2
N.C. — (BRN) — BLU — 6
N.C.

SEE NOTE 1

	DATE	SYM	REVISION RECORD		DR	CK	CK
	13MAR01	C	PER ECN 01-070		EB	EB	CDR

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TITLE
CABLE ADAPTOR, 9P, FE, STANDARD

DRAWN BY BOWMAN

AutoCAD FILE LOCATION
Q:\DFTG\CABLES\IC-8XX

DRAWING NUMBER
C-822000

SHEET NO. 1 OF 1

REVISION C

CHECKED BY	DATE				
APPROVED BY ELS	DATE 15AUG96				
APPROVED BY ELS	DATE 10MAY96				
MATERIAL					
		TOLERANCES			
		X.X± ---	X.XX± ---	X.XXX± ---	ANGULAR ± ---
FINISH					

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES (mm)

B | DATE 09MAY96 | SCALE NTS

NOTES:

1) CRIMP CABLE (ITEM 2) TO ENDS
   (ITEM 1) WITH MODULAR CRIMP TOOL,
   PART No. 1005-6P6C.

2) MARK PER OP-08-0001.

C-894015

15 Ft. Long
USB-A to USB-B Cable

USB B / M

USB A / M

Pin Assignment		
USB A Male	USB B Male	
1	1	Red
2	2	White
3	3	Green
4	4	Black
G	G	Braid

## Connector - Pin Kit for I/O and Power Interfaces

As an alternative to purchasing complete cable sets, customers can assemble the system's cables using our standard connector kits.

Connector Kit	Parts List	Description	Quantity
LC-CONKIT	22-01-3087	8 Terminal Connector	2
-	22-01-3107	10 Terminal Connector	1
-	734-103	3 pin Female Connector	1
-	08-55-02102	Socket Pins (note 1)	27
-	733-102	2 pin Female Connector	1

Note 1: Use the Molex MINI-KK Crimp Tool
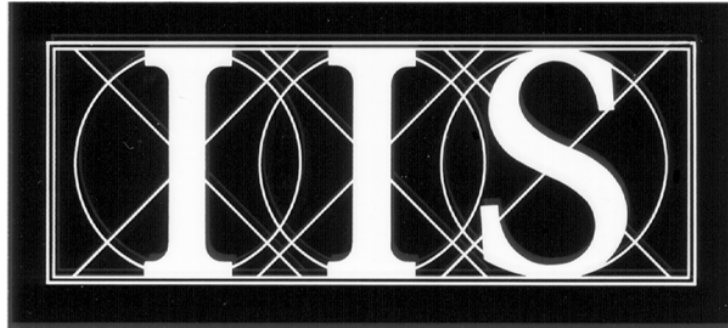
INDUSTRIAL INDEXING SYSTEMS INC.

626 FISHERS RUN
VICTOR, NEW YORK 14564

(585) 924-9181
FAX: (585) 924-2169