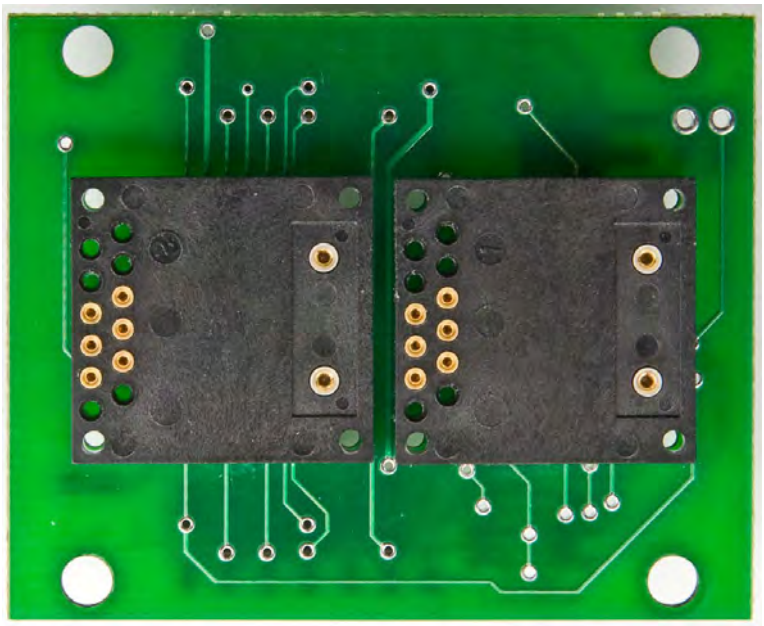
LCD 64x32 Logic Boards User Manual

Revision F



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1. What are Logic Boards?

Logic Boards are switch panel that have glue logic to convert addressing and switch scanning to serial. A Logic Board can be designed for any number of switches. The Logic Boards can be daisy-chained using 14 pin ribbon cable hence allowing variable number of switches to be controlled via one port from a controller.
Logic Board with any number of switches can be designed. Daisy-chain capability of the Logic Boards allow the switches to be mounted at desire locations on the control panel.
The switches/displays can be soldered directly to the Logic Board or mounted on a sockets.

2. Part Number Configuration

1		2	3	4	5		6
IS	-	L	02	A	1	-	C

1. IS Prefix.
2. L for Logic Board
3. The number of switches that can mounted on the Logic Board
4. Switch Type
   A = for IS15EBFP4RGB
   G = for IS15EBFP4RGB-09YN

5. Board Version
6. No code = No socket for IS switches.
   C = Sockets are soldered to the PCB for IS switches.

Please note that not all possible part numbers are available. NKK entertain designing custom Logic boards to customer's requirements.

3. Standard Part Numbers

The Logic Boards listed below are production parts. There are prototype boards that are not listed. Additionally, NKK Switches will work with customers to design and build custom logic boards.

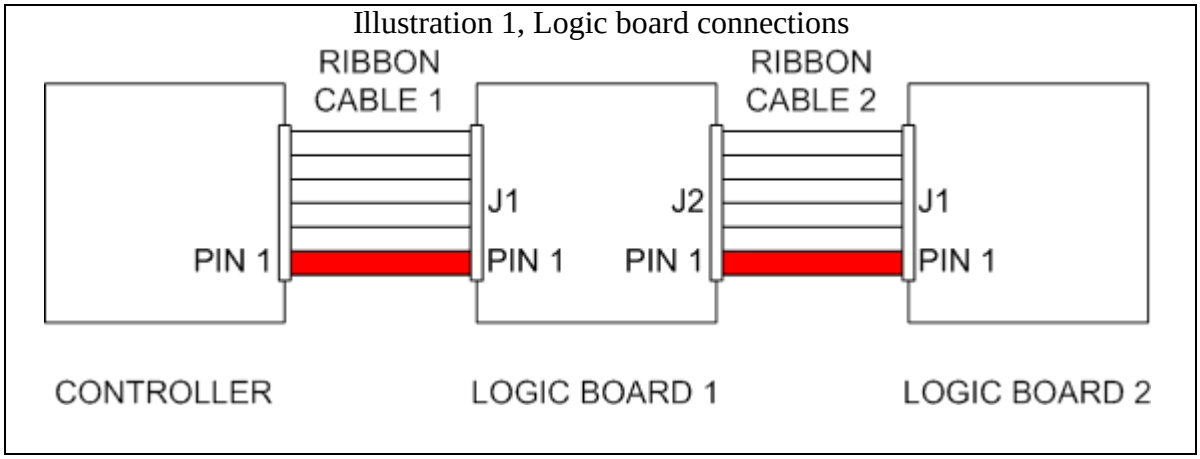
Part number examples used in IS Dev Kits:

SmartDisplay Configuration	Part Number	Description
Two LCD 64x32 RGB Pushbuttons with long travel switch	IS-L02A1-C	With socket
Two LCD 64x32 RGB Pushbuttons with short travel switch	IS-L02G1-C	With socket

4. Connectors

The SmartDisplay Controller connects to the J1 of the first logic board via 14 pin ribbon cables. The J2 of the first logic board connect to J1 of the second logic board and so on. The switch numbering start with switch one of the first Logic Board. The first switch of the next Logic Board will be one higher than the last switch of the previous Logic Board.

Illustration 1, Logic board connections



Note: Attaching the ribbon cable without the red line on pin 1 on each of the headers may cause damage to the controller or the logic board.

The logic boards have two connectors:

J1 **Input port:** 7x2 male header .1”x.1” spacing.

This connector connects to the controller port or J2 of the previous logic board in the daisy chain.

Pin	Function	
1	Din	Connected to Din of first shift register
2	GND	Ground
3	CLK	Clock for all shift registers
4	GND	Ground
5	NC	
6	Vsup	7V to 12V
7	LP	Latch all shift register outputs to the all drivers
8	oe	Driver Output Enable. Should be connected to gnd.
9	SCK	Clock of all SmartDisplays
10	NC	
11	SDI	Data of the all SmartDisplay
12	Vsup	7V to 12V
13	NC	
14	SWRD	Switch Read bus for all SmartDisplays

J2 **Output port:** 7x2 male header .1”x.1” spacing.

This connector connects to J1 of the next logic board in the daisy chain.

Pin	Function	
1	Dout	Connected to Dout of the last shift register
2	GND	
3	CLK	Connected to CLK of J1
4	GND	
5	GND	
6	Vsup	7V to 12V
7	LP	Connected to LP of J1
8	oe	Connected to oe of J1
9	SCK	Connected to SCK of J1
10	GND	
11	SDI	Connected to SDI of J1
12	Vsup	7V to 12V
13	GND	
14	SWRD	Connected to SWRD of J1

5. How to control the Logic Board mounted LCD64x32 switches

If you are using NKK controllers, you can skip this section. This section cover detail on how to control LCD 64x32s mounted on the Logic Boards.

Pin	J1 of the first Logic Board	Controller connection
1	Din	Microcontroller pin (output)
2	GND	GND
3	CLK	Microcontroller pin (output)
4	GND	GND
5	GND	GND
6	Vsup	7V to 12V. Closer to 7V is better
7	LP	Microcontroller pin (output)
8	oe	GND
9	SCK	Microcontroller pin (output)
10	GND	GND
11	SDI	Microcontroller pin (output)
12	Vsup	7V to 12V. Closer to 7V is better
13	GND	GND
14	SWRD	Microcontroller pin (input) and 2K pull down to GND

For SCK and SDI signal please refer to the application note for LCD64x32 switches.

Switch Numbering

The switch numbering start with switch one of the first Logic Board. The first switch of the next Logic Board will be one higher than the last switch of the previous Logic Board.

Selecting a Switch

The SS (Slave Select) of each switch is connected to output of the latch driver. The input of the Latch driver is connected to serial to parallel shift register. One bit is shifted for each switch using Din and CLK. The last bit shifted will be for switch #1.

To select a switch for communication, bits should be shifted using Din and CLK so all the switches have a high bit except the communication target switch then by toggling the LP that switch get selected. The communication to the switch is done via SCK and SDI. After communication is ended to the switch, all high bits are shifted via Din and CLK for all the switches and LP toggled so no switch is selected.

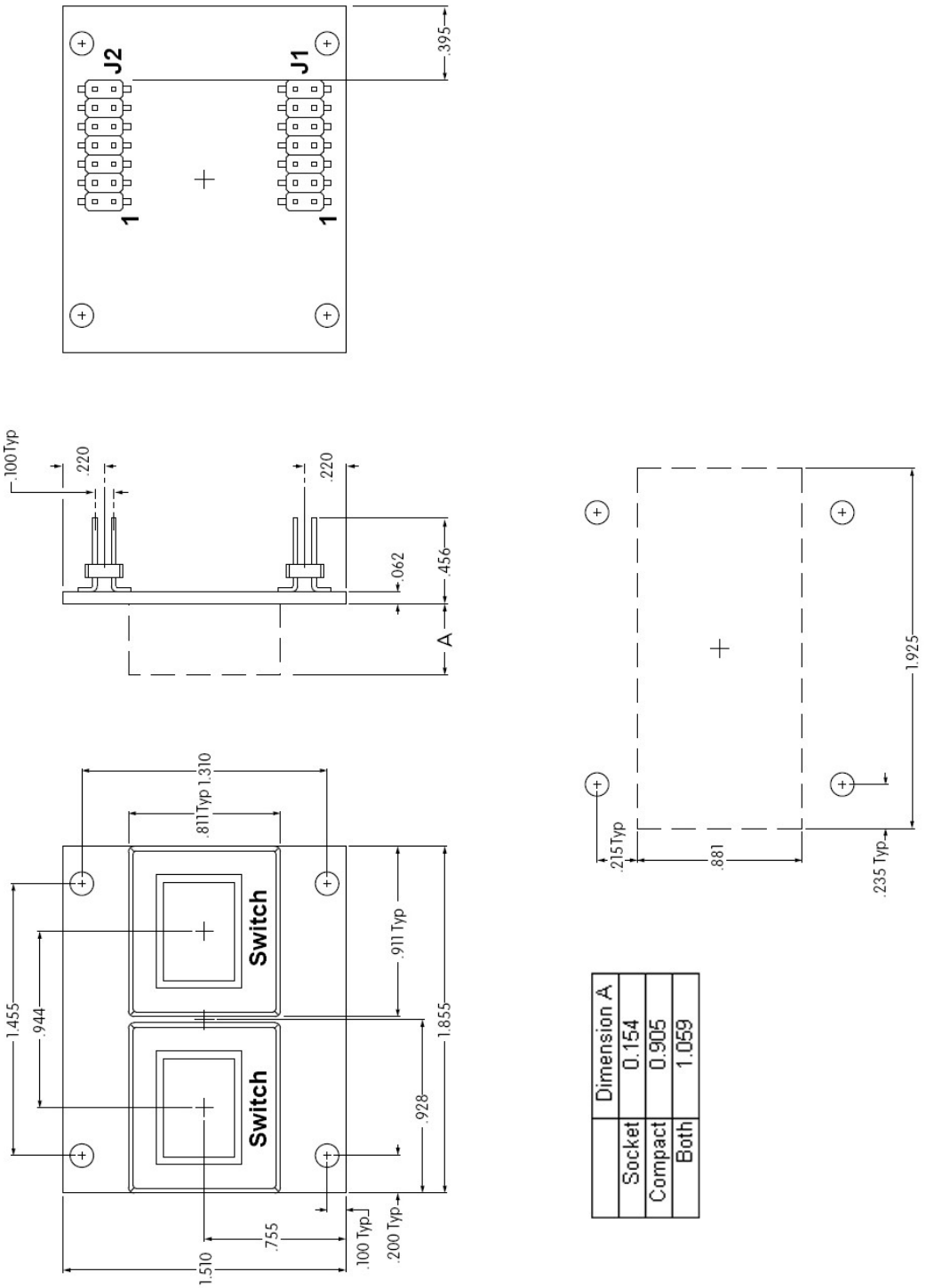
Switch Scan

One terminal of each switch is connected to the SWRD (switch Read). The output of the serial to parallel shift register is connected to another switch terminal via a diode. One bit is shifted for each switch using Din and CLK. The last bit shifted will be for switch #1.

Switch Scan is accomplished by sending low bits via Din and CLK for all the switches except the switch being scanned. Then the SWRD is checked. If the SWRD is low, the switch is not pressed. If the SWRD is high, the switch is pressed.
The switch scans should be more than 5ms apart to prevent de-bouncing read and less than 80ms to prevent missing a read.

6. Board Dimensions

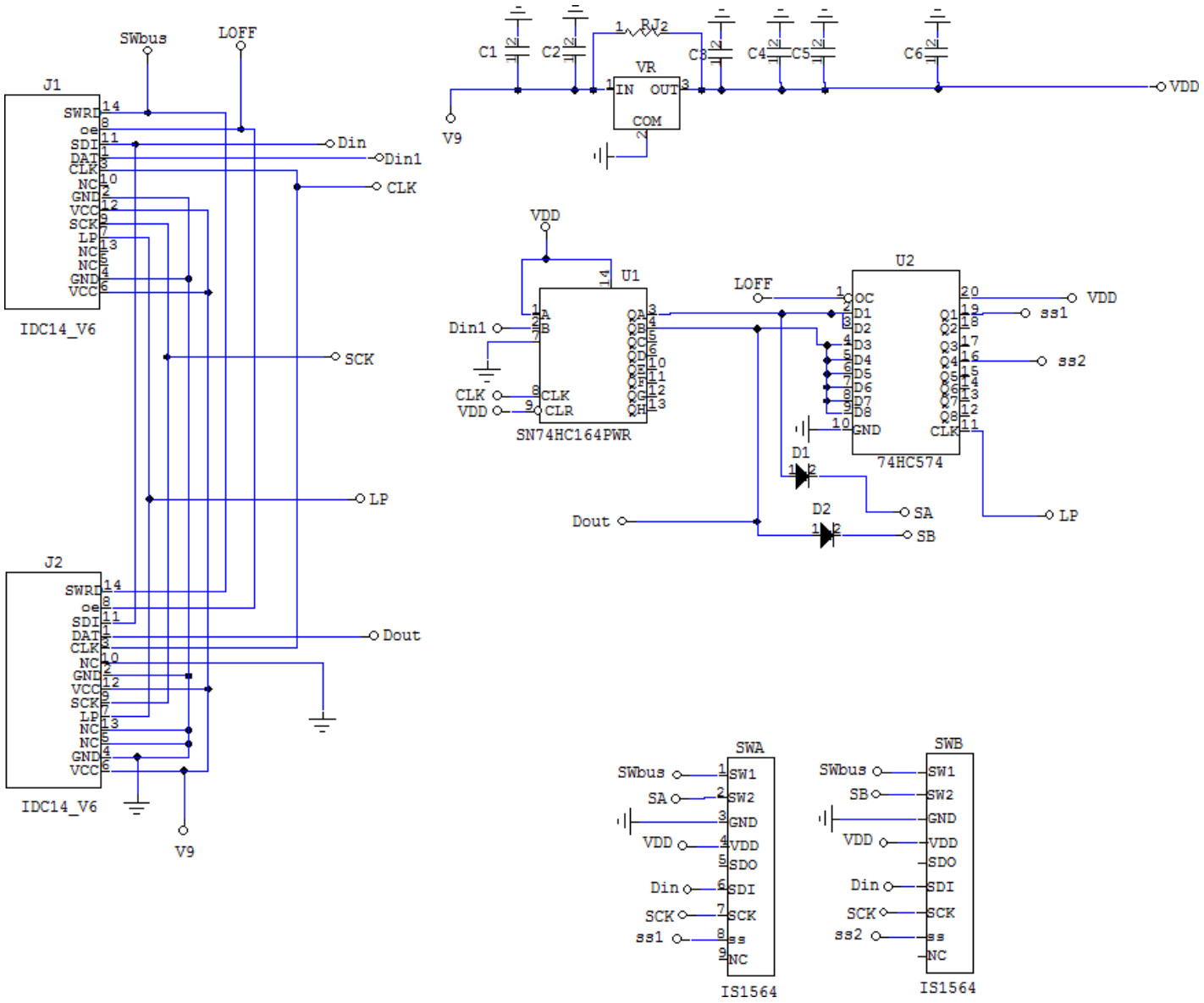
Logic Board Dimensions for IS-L02A1 and IS-L02G1:



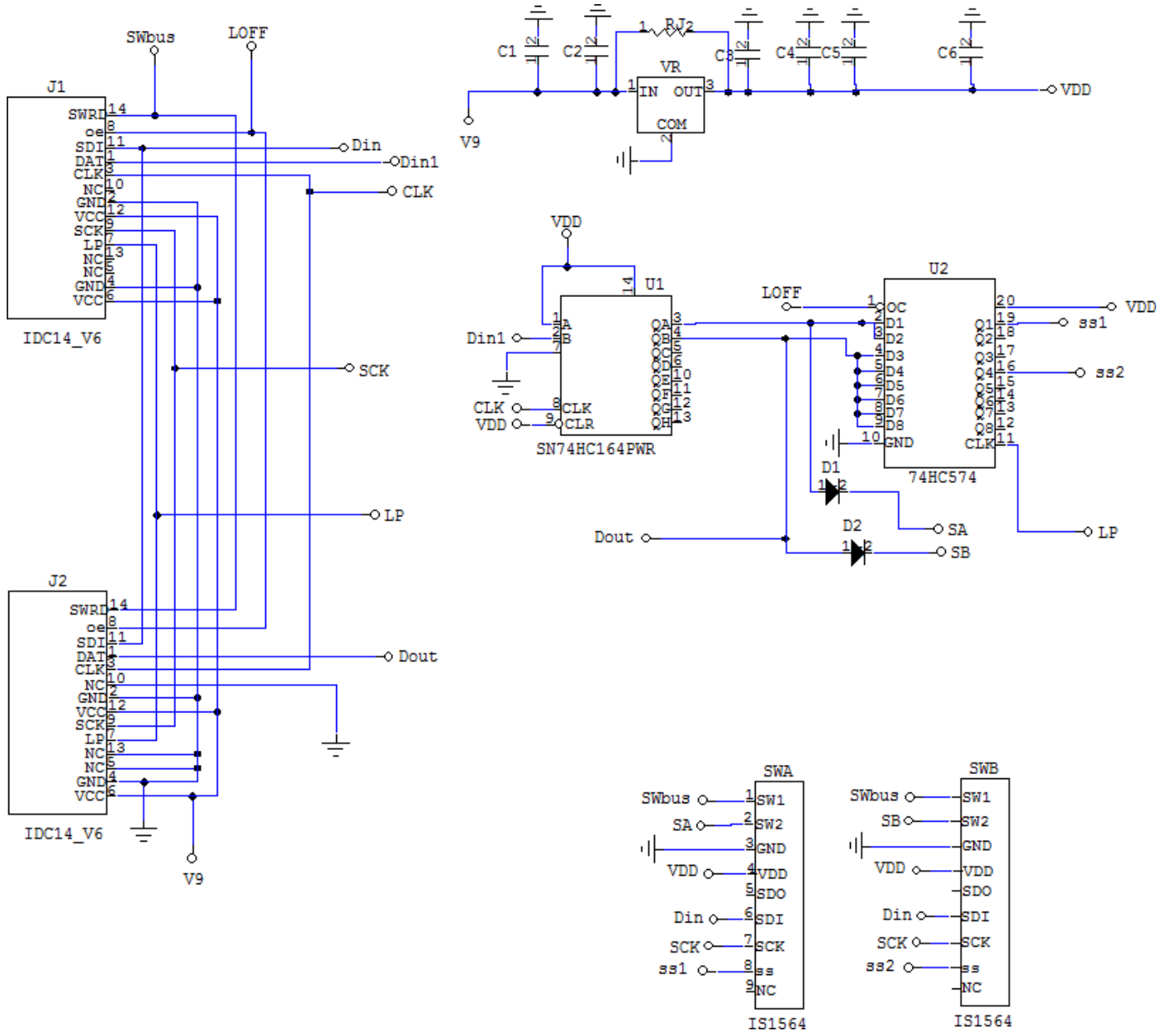
	Dimension A
Socket	0.154
Compact	0.905
Both	1.059

7. Schematics

Schematic for IS-L02G1 Rev C:



Schematic for IS-L02A1 Rev D:



8. Key Terms & Definitions

Module	NKK Switches' LCD SmartDisplays.
Host	Any computer, terminal, or other device that can communicate over the USB line.
Controller	A PCB assembly that controls one or more logic boards and the switches associated with them. It communicates with a host over the USB line.
Logic Board	A PCB assembly with "glue logic" for mounting switches. It is controlled by a controller.
Byte	An eight-bit hex value ranging from 00H to FFH (Decimal 0 to 255). The bit format of a byte is: (B7 B6 B5 B4 B3 B2 B1 B0) where B7 is most significant and bit B0 is least significant bit.
Nibble/Hex digit	A four-bit value ranging from 0H to FH. A byte consists of two nibbles.
ASCII	A byte value representing a symbol.
Communication Format	There are two formats to transmit a byte: 1. **Hex format** - A hex byte is transmitted without any change to it. [**xxH**] will be used to denote this. All commands and some data are sent by using this format. 2. **ASCII HEX format** - Each nibble of the byte is converted to ASCII code and sent as a byte. [**xxAH**] will be used to denote this. For example, the hex byte 5AH is transmitted in two bytes, **35H** and **41H**. The ASCII value for **5** is **35H** and the ASCII value for **A** is **41H**. All addresses and most data are sent using this format.
Address	A one byte value ranging from 01H to FFH representing the 255 memory.

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