ALLIN1DC Revision 100316 User Guide

Updated 7/12/10

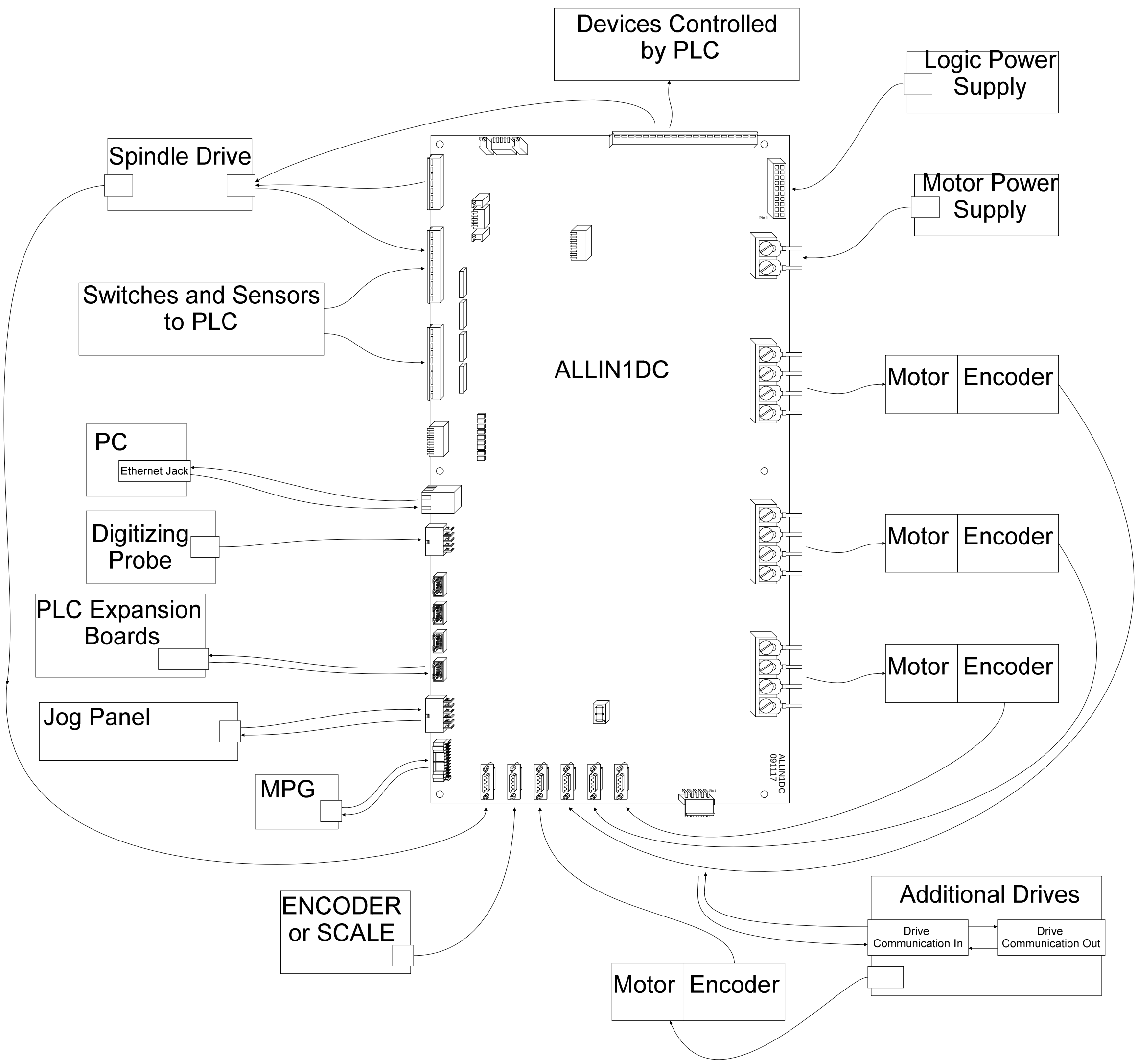
Overview

The ALLIN1DC is a three axis DC brush motor drive with an integrated PLC and motion control processing. Centroid's DC3IOB and MPU11 technology have been integrated into one unit to provide a highly functional, yet compact motion control product. Communication with a host PC is performed over Ethernet. Six encoder inputs are available for motor control or scale input. A range of motor drive currents are selectable with jumper blocks. The integrated PLC includes 16 digital inputs, 9 relay outputs, one analog input, and one analog output for general purpose use (see "PLC Section" for details).

Features

Function:	Motion Control Processor, PLC, and Servo Drive
Maximum number of Axes:	8
Encoder and Scale Inputs:	6 Incremental Encoders (A, B, and Z channels)
PLC Protocol Support	PLCbus protocol up to 768in / 768 out miniPLC protocol with 4 expansion ports
Drive Protocol Support	DriveBus Protocol
Jog Panel Protocol Support	JogLink Protocol
MPG Support	Differential encoder and discrete inputs (no serial MPG support)
Control Interface:	100 Mb/s Ethernet to PC
Drive Application:	DC Brush Motors
Number of Axes:	3
Current rating per axis:	6 to 15 Amps
Motor Voltage:	20 to 120 Volts
Digital PLC Inputs:	34
Digital PLC Outputs:	12
Analog Output resolution:	12 bits
Analog Input resolution:	12 bits
Dimensions (W*D*H):	16 * 8 * 5.25 inches

Typical Connections



Logic Power Connection

An ATX style PC power supply provides voltage for ALLIN1DC logic circuits. The power supply connector may have 20 pins or 24 pins on units equipped with an ATX 2.2 compatible supply. The -5V and +5VSB pins are not used by the ALLIN1DC, but all other pins should be checked if troubleshooting a supply problem.

ATX 2.0 Power Connector (H14)

+3.3V	11	1	+3.3V
-12V	12	2	+3.3V
COMMON	13	3	COMMON
/POWER ON	14	4	+5V
COMMON	15	5	COMMON
COMMON	16	6	+5V
COMMON	17	7	COMMON
-5V	18	8	POWER OK
+5V	19	9	+5VSB
+5V	20	10	+12V

Optional ATX 2.2 Power Connector (H14)

+3.3V	13	1	+3.3V
-12V	14	2	+3.3V
COMMON	15	3	COMMON
/POWER ON	16	4	+5V
COMMON	17	5	COMMON
COMMON	18	6	+5V
COMMON	19	7	COMMON
×	20	8	POWER OK
+5V	21	9	+5VSB
+5V	22	10	+12V
+5V	23	11	+12V
COMMON	24	12	+3.3V

Servo Drive Section

The ALLIN1DC drive section is based on Centroid's proven DC brush motor drive technology. Several built in features allow for easy integration with a variety of hardware.

Each axis can be built with a range of current ratings determined by DIP switch settings and drive hardware. Current ratings of 6, 9, 12, and 15 amps can be provided on the ALLIN1DC. The following chart shows the various current settings available by changing settings on DIP switch block SW1.

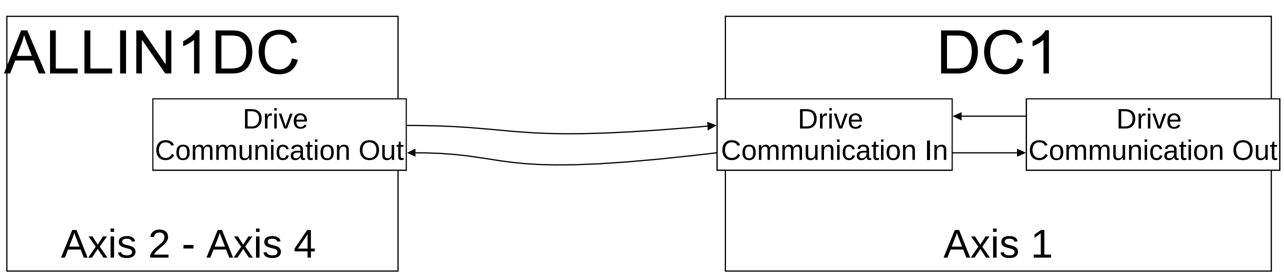
Drive Current Settings

	Axis 0		Axis 1		Axis 2	
Current Setting	Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6
6	OFF	OFF	OFF	OFF	OFF	OFF
9	OFF	ON	OFF	ON	OFF	ON
12	ON	OFF	ON	OFF	ON	OFF
15	ON	ON	ON	ON	ON	ON

Additional axis drives may be connected to the ALLIN1DC through the "Drive Communication Out" connector. LED1 status display will show the base or first axis number for the drive. For example, an ALLIN1DC that is running as axes 2, 3, and 4 will display 2 on LED1 as long as no error codes are present. The axis farthest from the ALLIN1DC in the communication chain will always be axis 1. Axis numbers increase along the chain toward the ALLIN1DC. To find the axis number of a particular motor connector on ALLIN1DC, add the base axis number to the labeling for the motor connector. If LED1 displays 2, "0+" and "0-" motor terminals are for motor 2, "1+" and "1-" go to motor 3, and "2+" and "2-" go to axis 4. These axis numbers correspond to software parameters that can be used to rearrange the order of display on the DRO.

If error codes exist, the decimal point on LED1 will light and an error number will flash. See the "LED1 Error Codes" chart for information on error codes.

Drive Communication Connection for ALLIN1DC and DC1

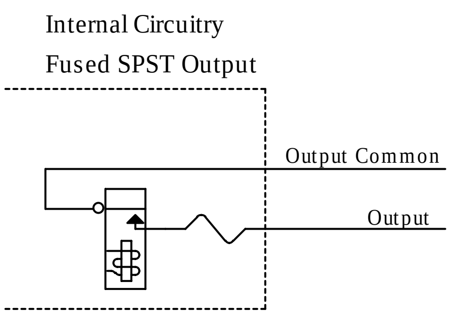


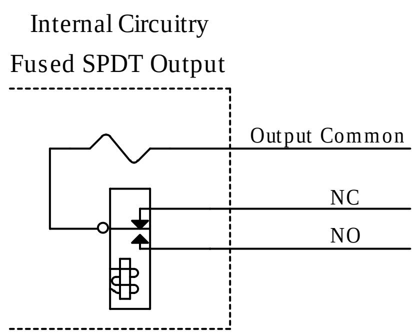
PLC Section

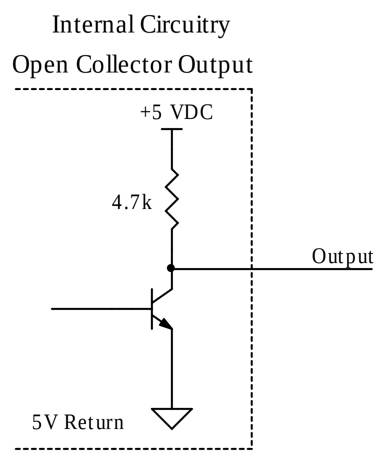
The ALLIN1DC has 34 digital inputs, 12 digital outputs, one analog input, and one analog output. Some I/O is dedicated to a particular function. Inputs 1 through 6 are axis limit switch inputs that inhibit motion at the hardware level. Four inputs are dedicated to supporting the digitizing probe, and 11 inputs and 3 outputs are used for MPG support. The remaining 10 configurable, optically isolated inputs and 9 fused relay outputs are available for general purpose use. Check the “ALLIN1DC I/O Map” and “ALLIN1DC Specifications” sections to determine I/O type and capability. Accessory boards can be connected to increase I/O capacity. See the “PLC Expansion” section for details.

Digital Outputs

Two SPDT and 7 SPST fused outputs are available on board, as well as 3 open collector outputs designed to connect to the MPG.

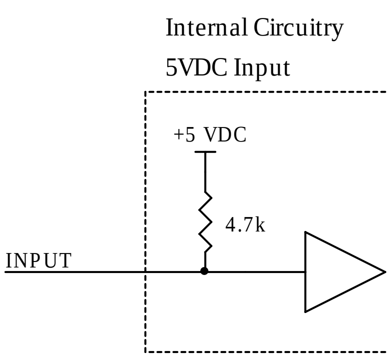


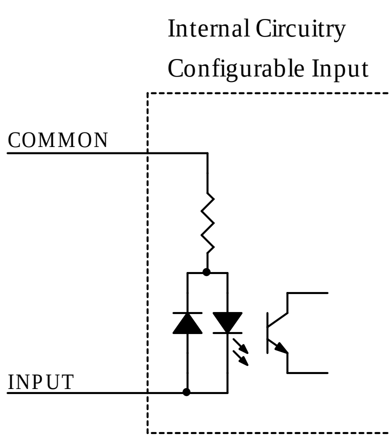


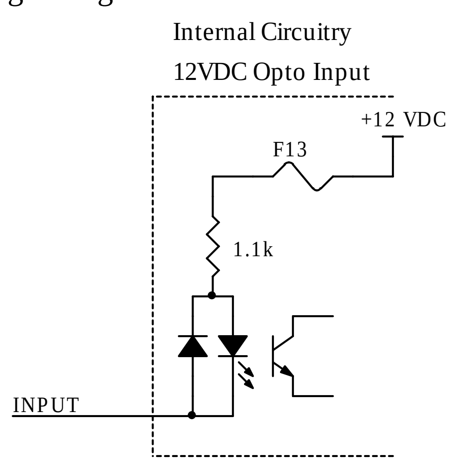


Configurable Inputs

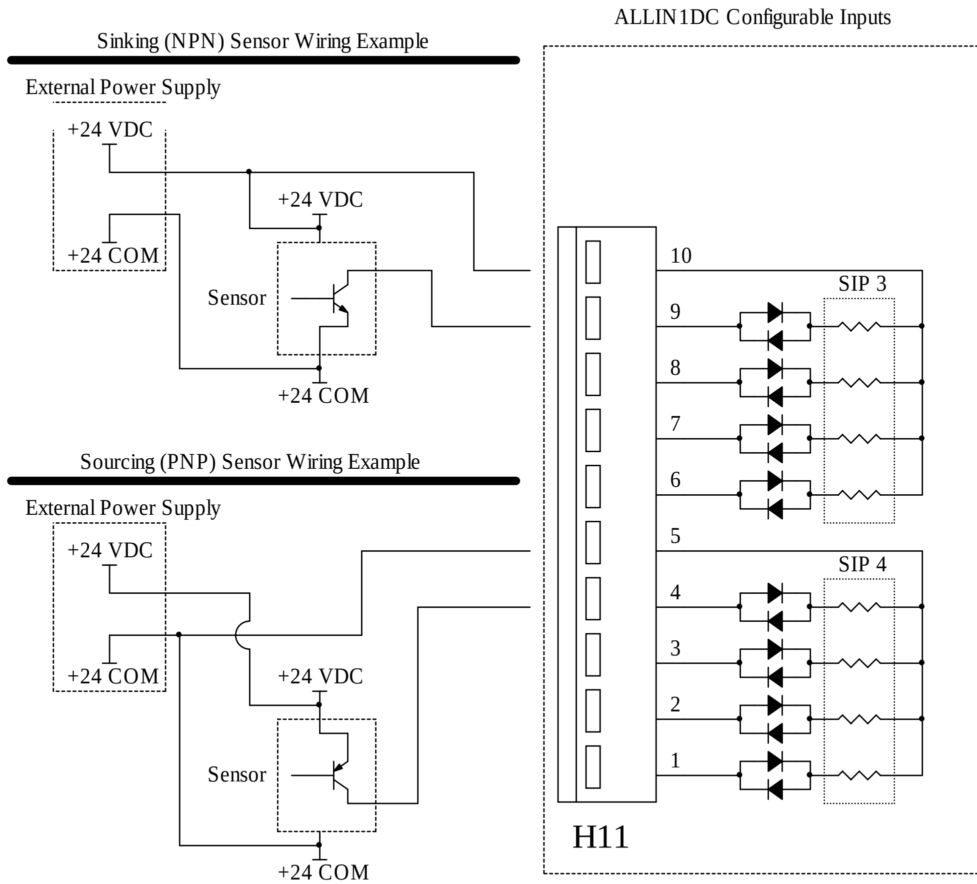
Configurable inputs are used for general purpose inputs. These inputs can be used with 5, 12, or 24 VDC sensors or switches. Compare the specifications of sensors to the “ALLIN1DC Specifications” chart to ensure reliable operation. Inputs are arranged into banks of 4 that can be individually configured for voltage and polarity. Resistor packs SIP1, SIP2, SIP3, and SIP4 must be changed to match the input voltage for each bank of inputs. Sinking or sourcing operation is determined by the wiring configuration.



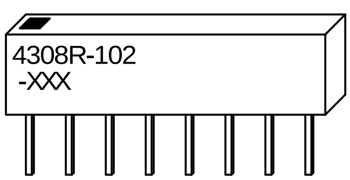




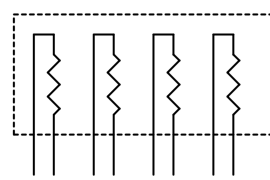
Configurable Input Connection Examples



SIP Identification – XXX Indicates Value



SIP Internal Wiring / Pinout



SIP Input Reference

SIP Designator	Related Inputs
SIP1	13,14,15,16
SIP2	9,10,11,12
SIP3	5,6,7,8
SIP4	1,2,3,4

SIP Resistor Values

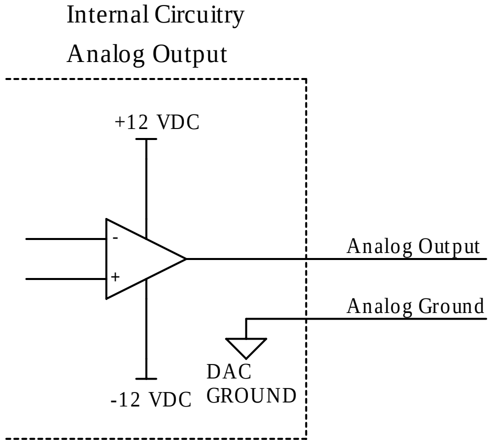
SIP Value Marking	Resistor Value (Ohms)	Input Voltage
471	470	5
102	1.0k	12
222	2.2k	24

Dedicated I/O

Several inputs and outputs are dedicated to particular functions and route directly into the MPU11 processor section of the ALLIN1DC. As can be seen in the "ALLIN1DC I/O Map" section, these I/Os are mapped after normal PLC space, and start at location 769. Probing and MPG functions use the dedicated I/O.

Analog Output

Four voltage output ranges are available on the analog output. A block of five DIP switches (SW3) must be set according to the following chart to get the desired output range.



Analog Output Range Selection

Voltage Range	Switch Number				
	1	2	3	4	5
0 TO 5	OFF	ON	ON	ON	ON
0 TO 10	OFF	ON	OFF	ON	OFF
-5 TO 5	ON	ON	OFF	ON	OFF
-10 TO 10	ON	OFF	OFF	OFF	OFF

Analog Output Calculations

Analog outputs use a 12 bit digital to analog converter (DAC) to generate analog from the DAC request sent from the PLC program. The 12 bit value allows a DAC request of 0 to 4095, which corresponds to 0 to 9.998 volts in the 0 to 10V range.

0 to 5V Range

$$\text{output voltage} = \frac{\text{DAC Request}}{4096} * 5$$

-5 to 5V Range

$$\text{output voltage} = \left(\frac{\text{DAC Request}}{4096} * 10\right) - 5$$

0 to 10V Range

$$\text{output voltage} = \frac{\text{DAC Request}}{4096} * 10$$

-10 to 10V Range

$$\text{output voltage} = \left(\frac{\text{DAC Request}}{4096} * 20\right) - 10$$

Analog Output Wiring

Analog outputs should be wired using a shielded twisted pair for best results. The analog output terminal is paired with a common terminal for direct wiring of the signal, common, and shield. In most cases, it is best to connect the shield to the common only at the ALLIN1DC. Routing analog cables away from power wires and other noise sources is also critical for good performance. See “ALLIN1DC Connections” section for terminal locations.

Analog Output Trim

The analog output is factory trimmed for the 0 to 10V scale. If a different output range is used, it will be necessary to trim the output for best results. The following procedure is used to trim the analog output:

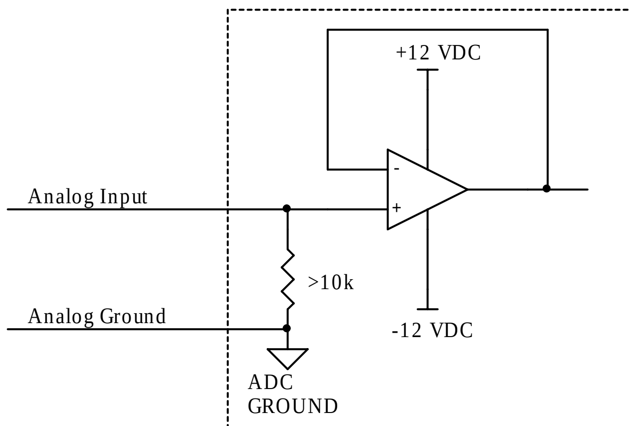
1. Request 0V
2. Adjust offset POT until 0V is output
3. Request maximum output
4. Adjust gain POT until maximum is output (depends on range)
5. Repeat steps 1-4 until readings are consistent and correct

Analog Input

Like the analog output, the input has four ranges available. Set the corresponding block of five DIP switches (SW2) according to the following chart to accept the required input range.

Internal Circuitry Equivalent

Analog Input



Analog Input Range Selection

Voltage Range	Switch Number				
	1	2	3	4	5
0 TO 5	OFF	OFF	OFF	X	X
0 TO 10	OFF	ON	OFF	X	X
-5 TO 5	ON	ON	OFF	X	X
-10 TO 10	ON	ON	ON	X	X

X = don't care

Analog Input Calculations

The analog input uses a 12 bit analog to digital converter (ADC) to generate a digital ADC result from an analog signal. The 12 bit result allows an ADC result of 0 to 4095, which corresponds to 0 to 9.998 volts in the 0 to 10V range.

0 to 5V Range

$$\text{ADC result} = \frac{4096 * \text{Input Voltage}}{5}$$

-5 to 5V Range

$$\text{ADC result} = \left(\frac{4096 * \text{Input Voltage}}{10}\right) + 2048$$

0 to 10V Range

$$\text{ADC result} = \frac{4096 * \text{Input Voltage}}{10}$$

-10 to 10V Range

$$\text{ADC result} = \left(\frac{4096 * \text{Input Voltage}}{20}\right) + 2048$$

Analog Input Wiring

The analog input should be wired using a shielded twisted pair for best results. The analog input terminal is paired with a common terminal for direct wiring of the signal, common, and shield. In most cases, it is best to connect the shield to the common only at the ALLIN1DC. Routing analog cables away from power wires and other noise sources is also critical for good performance. See “ALLIN1DC Connections” section for terminal locations.

Analog Input Trim

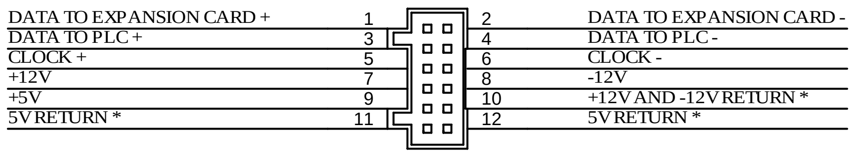
The analog input is factory trimmed for the 0 to 10V scale. If a different input range is used, it will be necessary to trim the input for best results. The following procedure is used to trim the analog input:

1. Input 0V in bipolar modes, or slightly above 0V in unipolar modes
2. Adjust offset POT until the reported voltage matches the actual voltage
3. Input a voltage slightly below the maximum (depends on range)
4. Adjust gain POT until the reported voltage matches the actual voltage
5. Repeat steps 1-4 until readings are consistent and correct

PLC Expansion

PLC I/O expansion is possible through the four “PLC ADD” connectors. Each PLC expansion port can accept 16 – 128 inputs, outputs, or inputs and outputs in 16 bit increments. This allows for digital I/O, DACs, ADCs, or other devices to be added to the system as needed.

PLC ADD 1 – 4 Connector Pinouts



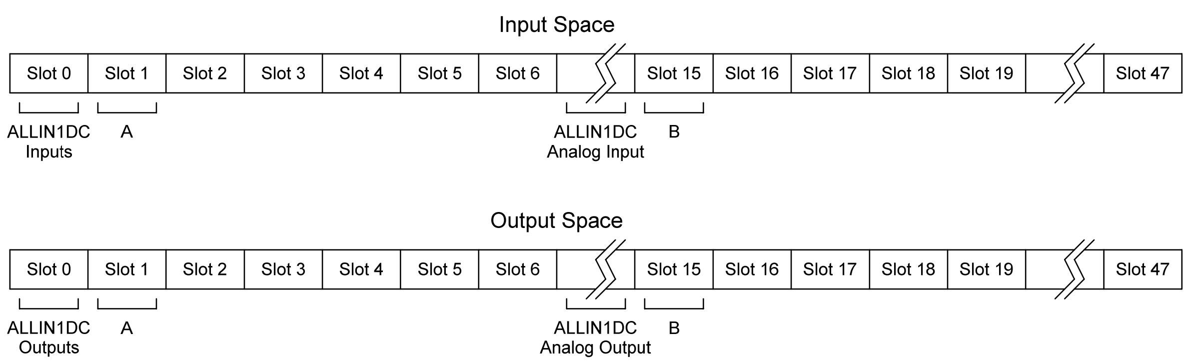
* +12V AND -12V RETURN and 5V RETURN are connected on the ALLIN1DC

PLC Expansion Memory Assignments

PLC I/O is arranged in 16 bit groups or slots. As a general rule, slots 0-14 are used for individual I/Os such as switches and have a programmable debounce time for the inputs. Slots 15-47 are reserved for ADCs, DACs, or other devices that do not require debounce. Every device using I/O space must use space in 16 bit multiples by reserving slots. An ALLIN1DC uses 2 slots for its inputs and 2 slots for outputs.

Assignment of I/O slots occurs in a linear fashion starting at the ALLIN1DC, then “PLC ADD” port 1, “PLC ADD” port 2, etc. In the following general example, the ALLIN1DC I/O is shown in its fixed location, which can not be changed. Devices plugged into the “PLC ADD” ports that require debounce will be assigned starting at the slots marked “A”, while devices that do not require debounce will start being assigned at the slots marked “B”.

PLC Expansion Location Assignment General Example



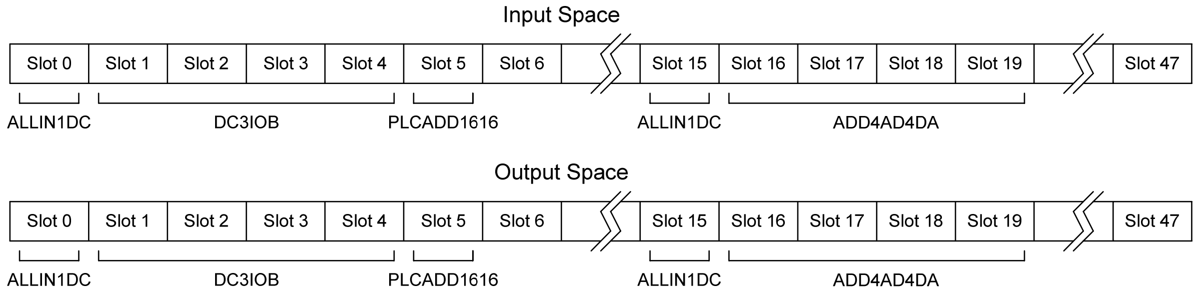
The remaining examples show how specific devices will map into the PLC under certain conditions. PLC Expansion devices have a variety of memory requirements, which are summarized in the following chart for devices used in the examples.

PLC I/O Slot Requirements

	Function	Input Debounce Slots Used	Input Non-Debounce Slots Used	Output Debounce Slots Used	Ouput Non-Debounce Slots Used
Total Available		15	33	15	33
ALLIN1DC	Digital and Analog I/O	1	1	1	1
DC3IOB as expansion	Digital and Analog I/O	4	0	4	0
PLCADD1616	Digital I/O	1	0	1	0
ADD4AD4DA	Analog I/O	0	4	0	4

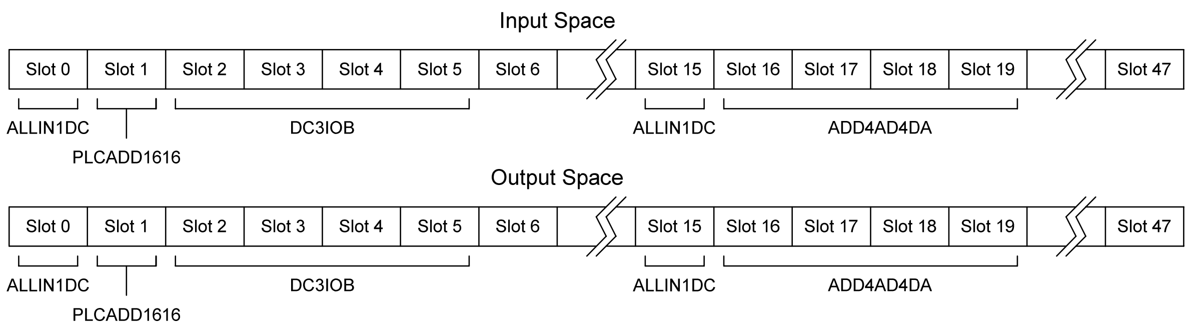
Example 2 illustrates I/O assignments on a system that has an ALLIN1DC main PLC, a DC3IOB plugged into "PLC ADD 1", a PLCADD1616 to "PLC ADD 2", and an ADD4AD4DA expansion card plugged into PLC ADD 3. Note that the ADD4AD4DA is and ADC/DAC expansion card and is assigned starting at slot 16 since it does not require debounce.

PLC Expansion Example 2



Example 3 shows the results of plugging an ADD4AD4DA into "PLC ADD 1", a PLCADD1616 into "PLC ADD 2", and a DC3IOB into "PLC ADD 3". The location of the ADD4AD4DA expansion card I/O is unaffected since it is the only expansion device in the example that does not require debounce. The PLCADD1616 and DC3IOB have changed locations since the PLCADD1616 is plugged into a lower number "PLC ADD" port and is therefore assigned I/O locations before the ALLIN1DC.

PLC Expansion Example 3



ALLIN1DC I/O Map

Input Specification			Input Location	
Number	Function	Type	Connector	Pin
1	Axis Limit 0-	Configurable	H11	1
2	Axis Limit 0+	Configurable	H11	2
3	Axis Limit 1-	Configurable	H11	3
4	Axis Limit 1+	Configurable	H11	4
5	Axis Limit 2-	Configurable	H11	6
6	Axis Limit 2+	Configurable	H11	7
7	General Purpose	Configurable	H11	8
8	General Purpose	Configurable	H11	9
9	General Purpose	Configurable	H10	1
10	General Purpose	Configurable	H10	2
11	General Purpose	Configurable	H10	3
12	General Purpose	Configurable	H10	4
13	General Purpose	Configurable	H10	6
14	General Purpose	Configurable	H10	7
15	General Purpose	Configurable	H10	8
16	General Purpose	Configurable	H10	9
241-252	Analog in	12 bit ADC	H9	1
253-256	Forced to 0			
769	Mechanical Probe	12VDC Opto	H13	6
770	DSP Probe	12VDC Opto	H13	4
771	Probe Detect	12VDC Opto	H13	8
772	Probe Auxiliary	12VDC Opto	H13	10
773	MPG x1	5VDC	H19	9
774	MPG x10	5VDC	H19	11
775	MPG x100	5VDC	H19	13
776	MPG Axis 1	5VDC	H19	4
777	MPG Axis 2	5VDC	H19	6
778	MPG Axis 3	5VDC	H19	8
779	MPG Axis 4	5VDC	H19	10
780	MPG Axis 5	5VDC	H19	12
781	MPG Axis 6	5VDC	H19	14
782	MPG Axis 7	5VDC	H19	16
783	MPG Axis 8	5VDC	H19	18
784	MPG Aux 1	5VDC	H19	15
785	MPG Aux 2	5VDC	H19	20
786	MPG Aux 3	5VDC	H19	22

Output Specification			Output Location	
Number	Function	Type	Connector	Pin
1	General Purpose	Relay SPST	H6	1,2
2	General Purpose	Relay SPST	H6	3,4
3	General Purpose	Relay SPST	H6	5,6
4	General Purpose	Relay SPST	H6	7,8
5	General Purpose	Relay SPST	H6	9,10
6	General Purpose	Relay SPST	H6	11,12
7	General Purpose	Relay SPST	H6	13,14
8	General Purpose	Relay SPDT	H6	15,16,17
9	General Purpose	Relay SPDT	H6	18,19,20
241-252	Analog out	12 bit DAC	H9	6
253-256	Forced to 0			
769	MPG LED	Open Collector	H19	17
770	MPG Aux 1	Open Collector	H19	19
771	MPG Aux 2	Open Collector	H19	21

*Open Collector outputs are pulled up to 5V

*5 VDC inputs are not isolated

ALLIN1DC Specifications

Characteristic	Min.	Typ.	Max.	Unit
3.3 Volt Supply Current	1.9	-	-	A
5 Volt Supply Current	2.4	-	-	A
12 Volt Supply Current	0.5	-	-	A
-12 Volt Supply Current	0.1	-	-	A
Input Pullup Voltage (Vinp)	4	-	30	VDC
Input On Voltage	Vinp-1.25	-	-	VDC
Input Off Voltage	-	-	1.25	VDC
Relay Output Current	0.1	-	10	A @ 125VAC
Relay Output Current	0.1	-	5	A @ 30VDC
Open Collector Output Current	-	10	90	mA
Open Collector Output Voltage	-	5	5	VDC
Input Operating current	9	11	15	mA
Motor Output Current Settings	6	12	15	A
Motor Supply Voltage	20	115	130	VDC
Analog Output Current	0	1	10	mA
Analog Output Voltage	-10	-	10	V
Analog Output Resolution	-	12	-	bits
Analog Output Error	-	< 0.2	-	%
Analog Input Current	-	-	1	mA
Analog Input Voltage	-10	-	10	V
Analog Input Resolution	-	12	-	bits
Analog Input Error	-	< 0.1	-	%
PLC ADD Port 5V Current Output*	0	-	0.5	A
PLC ADD Port 12V Current Output*	0	-	1	A
PLC ADD Port -12V Current Output*	0	-	1	A
Size: 16 * 8 * 5.25 (W*D*H)				Inches

*PLC ADD Port Current is a total for all 4 ports in any combination. Voltage drop may increase too much beyond this rating, requiring external power wiring to the expansion boards.

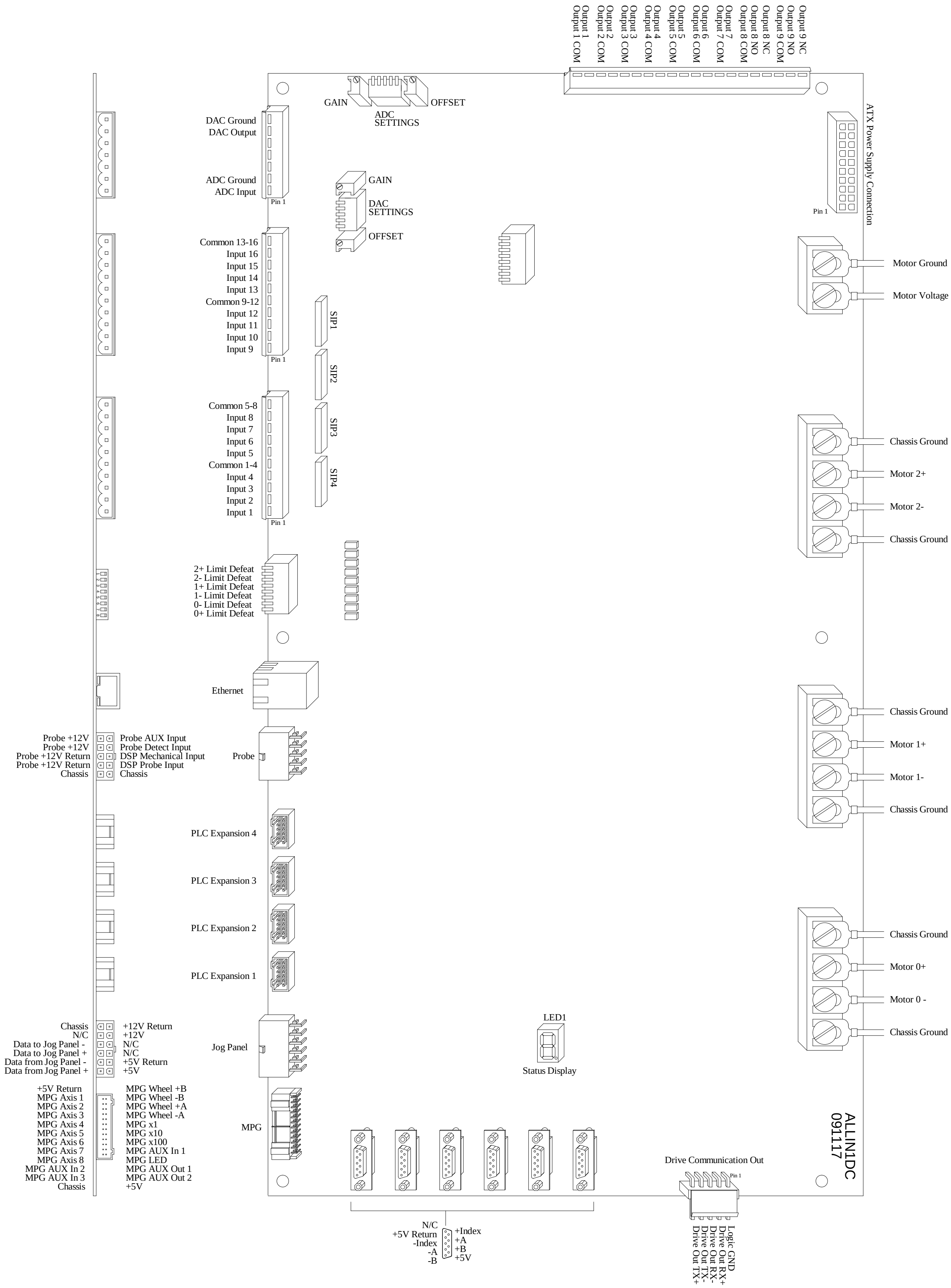
LED1 Error Codes

Error Number	Meaning	Cause	Corrective Action
1	Power Failure	the logic power supply is indicating to the DC3IOB that it is operating out of specification	Check power supply wiring (the grey wire and AC input in particular), replace power supply
2	15A Not Available	current selection jumpers on any axis are set to 15A, but the drive is not equipped with the appropriate FETs for long term use at 15A, so the drive will drop back to 12A	Select 12A or lower current settings or use a high power DC3IOB
3	Null Error	the self adjust routine has detected too large an offset on the current feedback	Send the drive back for repair. There is likely an internal failure causing the large offset
4	Limit Tripped	any limit switch is tripped	move away from the limit, check limit switch wiring, or use the limit defeat switches if a limit switch is not required

ALLIN1DC Troubleshooting

Symptom	Possible Cause	Corrective Action
All status LEDs out	Logic power not applied	Measure AC coming into power supply, correct wiring or supply problems
5, 3.3, 12, or -12 LED out	Power supply or connection problem	Measure AC coming into power supply, correct wiring or supply problems
AN +12V or AN -12V LED out	Analog section power loss	If other power LEDs are lit, the analog section has probably been damaged by incorrect connection, return for repair
FPGA LED not lit	MPU11 not ready	Wait for MPU11 to start and enter run mode
	Internal Fault	Return for repair
DSP LED not lit	MPU11 is booting up	Wait for MPU11 to detect hardware and start run mode
DBUG LED flashing fast	MPU11 is detecting hardware	Wait for MPU11 to detect hardware and start run mode
DSP-DEBUG LED flashing one time per second	New drive protocols active	None
DSP-DEBUG LED flashing two times per second	Legacy drive protocols active	Internal fault, only new protocols should be in use, return for repair
Encoder connection bad	Bad encoder or wiring	Check or replace encoder and cable
	Return not connected	Connect return line. If the encoder is not powered by ALLIN1DC's +5V, this is sometimes overlooked.
DF LED out	Motion control processor section hasn't booted up	Start software, wait for the main screen to load
	"Servo Power Removed" due to fault	Restart system to reset runaway or other serious fault condition
PLC OK LED out	Motion control processor section hasn't booted up	Start software, wait for the main screen to load
LED1 display flashing with decimal point lit	An error condition has been detected	See the "LED1 Error Codes" section for details on the error
LEDs on, but motor doesn't run	Axis Fuse blown	Check fuses with a meter, replace as necessary
	Limits tripped	Check limit switch wiring or pull up the limit defeat switches
Input doesn't work with sensor	Incorrect wiring	Correct wiring for sensor type (sinking or sourcing), check that SIP values are appropriate for the input voltage
	Voltage drop across sensor is too high	Use 3-wire sensors with lower voltage drop spec.

ALLIN1DC Connections



ALLIN1DC Mounting Footprint