SmartElex 30D Smart Motor Driver

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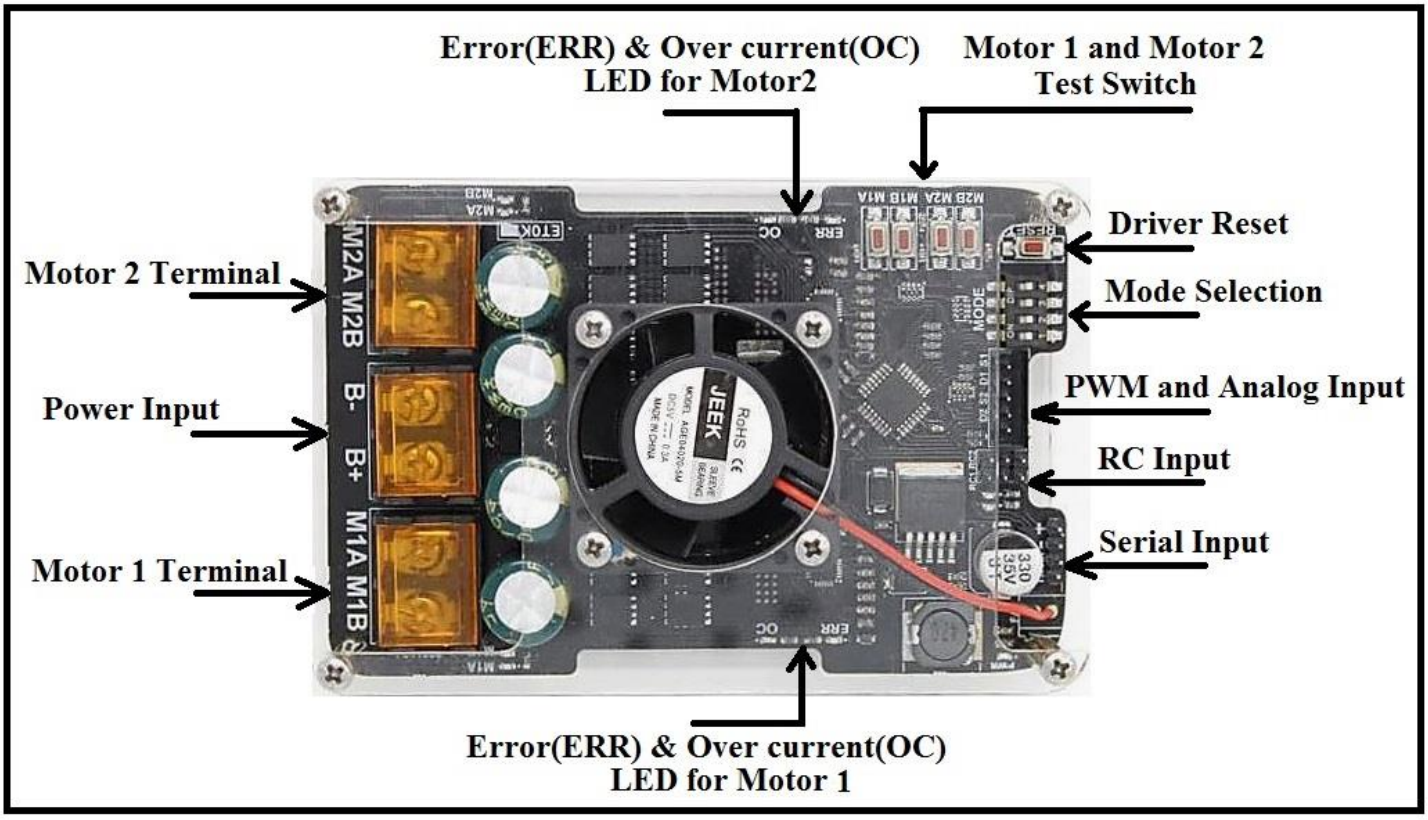
Introduction:

SmartElex 30D is a dual channel motor driver capable of supplying 30 amps continuous with peak currents up to 85 amps (2 Sec) per channel. It can be operated from radio control, analog, TTL serial and PWM. A variety of operating modes including with mixed and independent mode in radio control, analog and in PWM mode. Operating modes allow for operation, such as switching between radio controls and PWM mode or switching between any of 4 modes via 4 position DPDT mode switch. MOSFETs are switched at 16 KHz to ensure quiet operation and no annoying whining sound. Besides, it also equipped with a microcontroller unit to provide smart features such as multiple input modes and current limit and thermal protection. If temperature of board is reaches 80 degree then motor speed becomes half and speed will be normal once temperature reaches below 70 degree. Motor driver will be shut down at 100 degree.

Features:

- Supplying 30 amps continuous with peak currents up to 85 amps (2 Sec) per channel
- Support motor voltage from 7V to 30V.
- On board Low Internal resistance MOSFETs are switched at 16 KHz frequency.
- Over current protection and indication.
- Thermal protection.
- Multiple input modes: RC, Analog, PWM, Serial Packetized.
- On board push buttons for test and manual operation.

Overview:



Power Input: Connect to a 7V-30V Battery or Power Supply.

Motor 1 and Motor 2 Terminal: Connect Motor 1 to Motor 1 Terminal. Connect Motor 2 Motor 2 Terminal.

Mode Selection: These are used to set the operating mode and options.

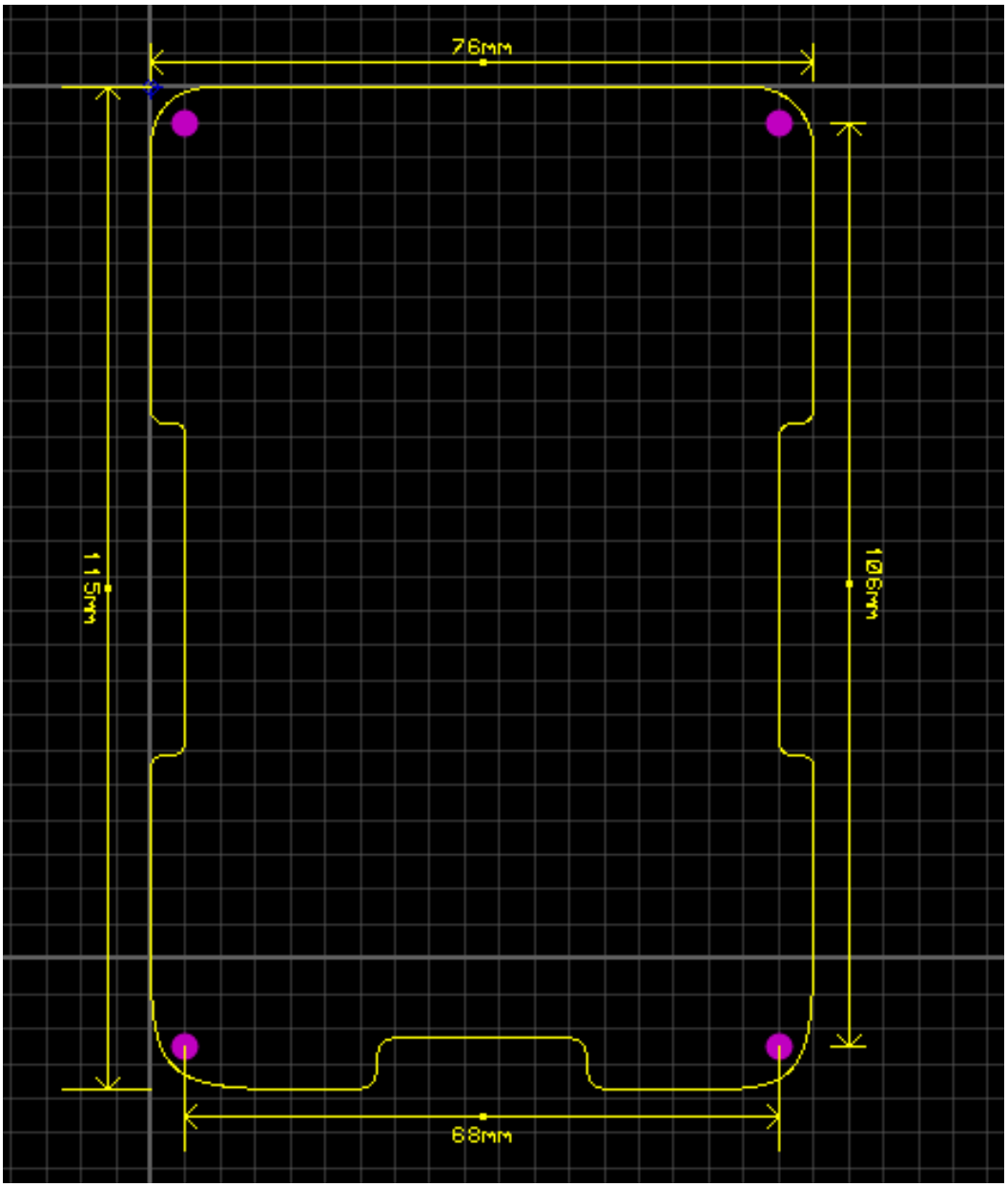
Error (ERR) and Over Current (OC) LEDs: Error LED glows when Under Voltage Lockout (Input Voltage less than 7V) .Overcurrent LEDs glows due to current greater than 85 AMP.

RC Input: 2 channel Radio Controller receiver connected to these pins.

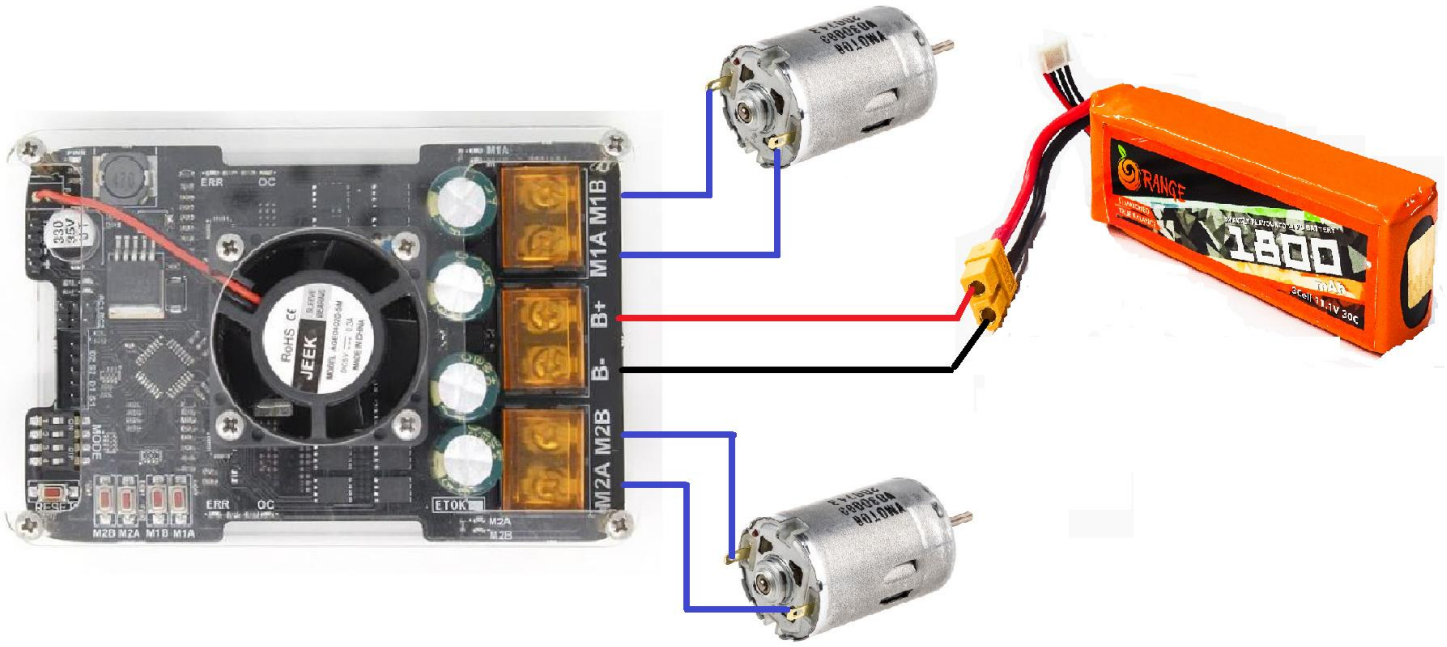
Specifications:

Sr.No	Parameter	Min	Max	Unit
1	Input Voltage	7	30	V
2	Maximum Continuous Current I_{max}	-	30	A
3	Peak Motor Current for 10 Sec	-	85	A
4	V_{IOH} (Logic Input – High Level)	3	5.5	V
5	V_{IOL} (Logic Input – Low Level)	0	0.5	V
6	PWM frequency	-	16	Khz

Dimensions:



Connections/Wiring:



SmartElex 30D can be used with power supplies or batteries. Input power is connected to the center power terminals labeled B+ and B-. The input voltage range is 7V to 30V. The input current is dependent on the motors being used and the load placed upon them.

As a general rule of thumb, you should use the thickest wire that is practical to make power connections, especially on the battery leads. Using undersized wire will lead to the wire getting hot, and can lead to elevated temperatures on the SmartElex 30D as well.

The main power connections to the SmartElex 30D are on the rear edge of the board. Connections are made to large black screw terminals. These terminals will accept 10 to 24 gauge wire. Using stranded wire it is possible to run twinned 10 gauge wire connections to the battery terminals. This is often a good idea if your design will be running both motors near or above the 30 amp continuous limit. For the motor connections, single 10 gauge wires should be sufficient for all applications.

Control Mode:

SmartElex 30D supports four different types of input mode:

1. Radio Control (RC)
2. Microcontroller PWM.
3. Analog
4. Serial Packetized.

The DIP switch settings for each mode and the function for input pin are summarized on the table below.

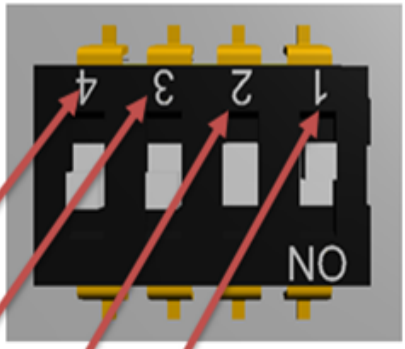
Motor Driver Modes

SWITCH / MODES	DIP SWITCH 1	DIP SWITCH 2	DIP SWITCH 3	DIP SWITCH 4
RC	0 - INDEPENDENT 1 - MIXED	0 - LINEAR 1 - EXPONENTAIL	0 0 - RC	
ANALOG	0 - INDEPENDENT 1 - MIXED	0 - LINEAR 1 - EXPONENTAIL	0 1 - ANALOG	
PWM	0 - INDEPENDENT 1 - MIXED	0 - LINEAR 1 - EXPONENTAIL	1 0 - PWM	
SERIAL	0 0 - 9600 1 0 - 38400	0 1 - 19200 1 1 - 57600	1 1 - SERIAL	

Serial Mode

Bits/ Bytes	7	6	5	4	3	2	1	0
Byte 0	Start of frame -- Character ' * ' or integer ' 42 '							
Byte 1	X (Dont care bits)				1 - Motor-1 ON 0 - Motor-1 OFF	1 - Reverse 0 - Forward	1 - Motor-2 ON 0 - Motor-2 OFF	1 - Reverse 0 - Forward
Byte 2	Motor 1 Speed -(0x00 to 0xFF or 0 to 255)							
Byte 3	Motor 2 Speed -(0x00 to 0xFF or 0 to 255)							
Byte 4	End of frame -- Character ' # ' or integer ' 255 '							

SmartElex 30D Dual Channel DC Motor Driver

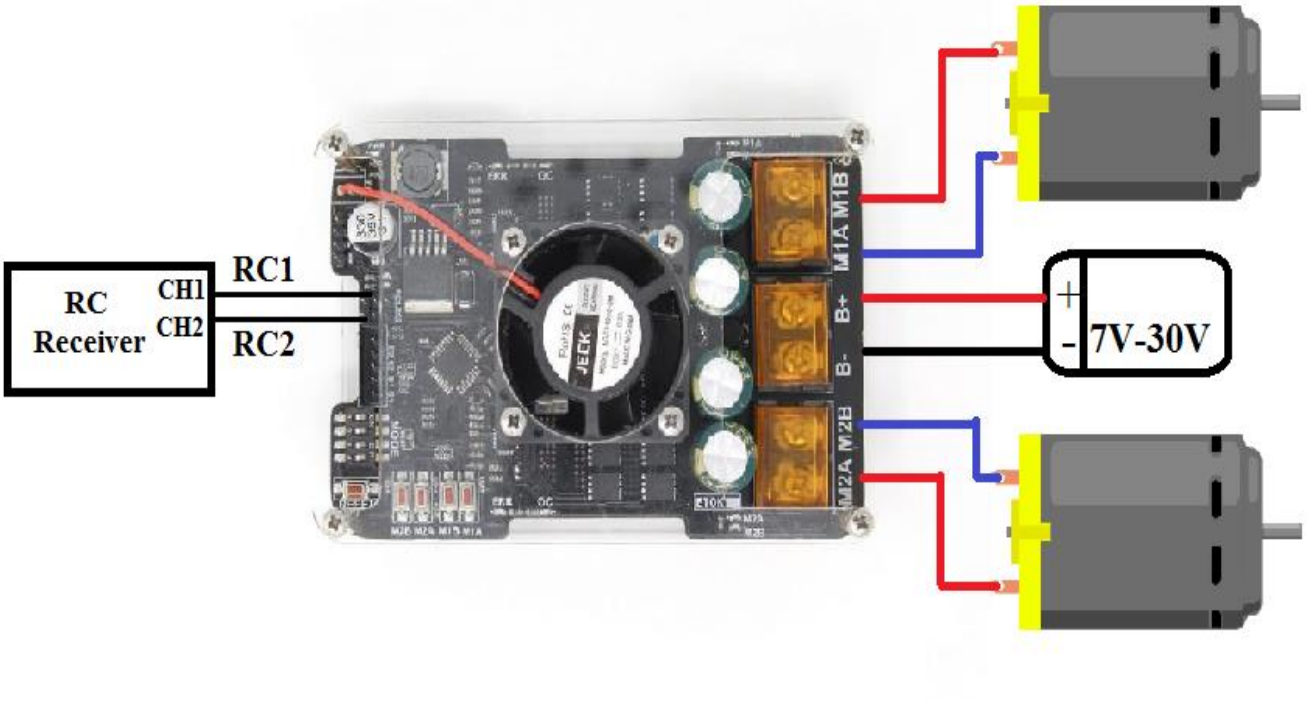


Switches				MOTOR DRIVER MODE				
3	4	2	1					
0	0	0	0	MODE : RC	INDEPENDENT	-	LINEAR	
0	0	0	1	MODE : RC	MIXED	-	LINEAR	
0	0	1	0	MODE : RC	INDEPENDENT	-	EXPONENTIAL	
0	0	1	1	MODE : RC	MIXED	-	EXPONENTIAL	
0	1	0	0	MODE : AN	INDEPENDENT	-	LINEAR	
0	1	0	1	MODE : AN	MIXED	-	LINEAR	
0	1	1	0	MODE : AN	INDEPENDENT	-	EXPONENTIAL	
0	1	1	1	MODE : AN	MIXED	-	EXPONENTIAL	
1	0	0	0	MODE : PWM	INDEPENDENT	-	LINEAR	
1	0	0	1	MODE : PWM	MIXED	-	LINEAR	
1	0	1	0	MODE : PWM	INDEPENDENT	-	EXPONENTIAL	
1	0	1	1	MODE : PWM	MIXED	-	EXPONENTIAL	
1	1	0	0	MODE : SERIAL	BAUD-RATE		9600	
1	1	0	1	MODE : SERIAL	BAUD-RATE		19200	
1	1	1	0	MODE : SERIAL	BAUD-RATE		38400	
1	1	1	1	MODE : SERIAL	BAUD-RATE		57600	

1. Radio Control (RC) Mode:

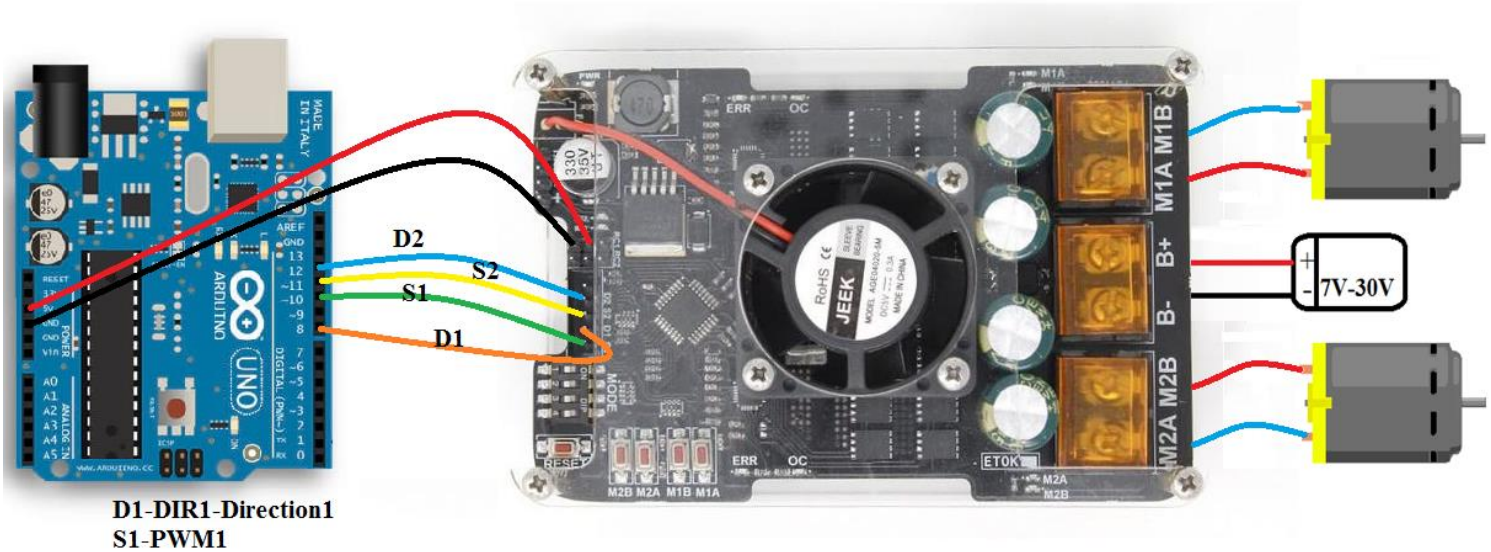
In this mode, Speed and direction of Motor is controlled by RC1 and RC2 channel of receiver or anything that can generate servo signals can be used to drive a SmartElex 30D in Radio Control mode.

SW3,SW4 0 0	Mode RC
SW1,SW2	
0 0	Independent Linear Mode RC1 control Speed(Linear) and Direction of Motor 1 RC2 control Speed(Linear) and Direction of Motor 2
0 1	Independent Exponential Mode RC1 control Speed(Exponential) and Direction of Motor 1 RC2 control Speed (Exponential) and Direction of Motor 2
1 0	Mixed Linear Mode RC1 control Speed (Linear) in Forward and Reverse Direction of Motor1 and Motor 2 Simultaneously. RC2 control Speed (Linear) in Left and Right Direction of Motor 1 and Motor 2 Simultaneously.
1 1	Mixed Exponential Mode RC1 control Speed (Exponential) in Forward and Reverse Direction of Motor 1 and Motor 2 Simultaneously. RC2 control Speed (Exponential) in Left and Right Direction of Motor 1 and Motor 2 Simultaneously.



Sample Connection Diagram of RC receiver and motor with SmartElex 30D.

2. PWM Mode:



D1-DIR1-Direction1
S1-PWM1

D2-DIR2-Direction2
S2-PWM2

I. Mixed PWM Mode:

PWM Pin	Input PWM Range	Speed/Acceleration of Motor	Direction of motor		
			Motor 1 Direction	Motor2 Direction	Bot Direction
PWM2(S2)	5% to 40%	100% to 0%	Counterclockwise	Counterclockwise	Reverse
PWM2(S2)	57% to 92%	0% to 100%	clockwise	clockwise	Forward
PWM1(S1)	5% to 40%	100% to 0%	Counterclockwise	clockwise	Left
PWM1(S1)	57% to 92%	0% to 100%	clockwise	Counterclockwise	Right
If PWM is less than 5% Speed of motor is 100% **If PWM is greater than 92% speed of motor is 0%**					

II. Independent PWM Mode:

PWM Pin	Direction Pin		Input PWM Range	Speed/Acceleration of Motor	Direction of motor	
	DIR1	DIR2			Motor 1 Direction	Motor2 Direction
PWM1(S1)	HIGH	x	8% to 94%	8% to 100%	clockwise	x
PWM1(S1)	LOW	x	8% to 94%	8% to 100%	counterclockwise	x
PWM2(S2)	x	HIGH	8% to 94%	8% to 100%	x	clockwise
PWM2(S2)	x	LOW	8% to 94%	8% to 100%	x	counterclockwise
If PWM is less than 8% Speed of motor is 0% If PWM is greater than 94% speed of motor is 100%						

3. Analog Mode:

In Analog input mode, the speed and direction of the motor is controlled by the analog voltage. Analog Input voltage range is from 0V to 5V.

I. Independent Analog Mode:

Analog Pin	Input range	Speed of Motor	Direction Of Motor	
			Motor 1 Direction	Motor 2 Direction
ANG1(S1)	2.2V to 0.25	10% to 100%	Counterclockwise	x
	2.21V to 2.79V	0%(dead band)	Stopped	x
	2.8V to 4.8V	10% to 100%	clockwise	x
ANG2(S2)	2.2V to 0.25	10% to 100%	x	Counterclockwise
	2.21V to 2.79V	0%(dead band)	x	Stopped
	2.8V to 4.8V	10% to 100%	x	clockwise
Note: If Analog voltage is less than 0.25V and greater than 4.8V then Motor speed is 100%				

II. Mixed Analog Mode:

Analog Pin	Input range	Speed of Motor	Direction Of Motor		
			Motor 1 Direction	Motor 2 Direction	Bot Direction
ANG1(S1)	2.2V to 0.25	10% to 100%	Counterclockwise	Counterclockwise	Reverse
	2.21V to 2.79V	0%(dead band)	Stopped	Stopped	Stopped
	2.8V to 4.8V	10% to 100%	clockwise	clockwise	Forward
ANG2(S2)	2.2V to 0.25	10% to 100%	Counterclockwise	clockwise	Left
	2.21V to 2.79V	0%(dead band)	Stopped	Stopped	Stopped
	2.8V to 4.8V	10% to 100%	clockwise	Counterclockwise	Right
Note: If Analog voltage is less than 0.25V and greater than 4.8V then Motor speed is 100%					

4. Serial Mode:

In Serial mode, **Tx** pin of SmartElex 30D is connected to **Rx** pin of Controller and **Rx** pin is connected to **Tx** pin of Controller. Baud rate can be simply set by using switches. Supported baud rates are 9600,19200,38400,57600.

Serial Mode								
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Byte 0	Start of frame -- Character ' * ' or integer ' 42 '							
Byte 1	X (Dont care bits)				1 - Motor-1 ON 0 - Motor-1 OFF	1 - Reverse 0 - Forward	1 - Motor-2 ON 0 - Motor-2 OFF	1 - Reverse 0 - Forward
Byte 2	Motor 1 Speed -(0x00 to 0xFF or 0 to 255)							
Byte 3	Motor 2 Speed -(0x00 to 0xFF or 0 to 255)							
Byte 4	End of frame -- Character ' # ' or integer ' 255 '							

Motor Driver Modes				
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ANALOG	0 - INDEPENDENT 1 - MIXED	0 - LINEAR 1 - EXPONENTAIL	0 1 - ANALOG	
PWM	0 - INDEPENDENT 1 - MIXED	0 - LINEAR 1 - EXPONENTAIL	1 0 - PWM	
SERIAL	0 0 - 9600 1 0 - 38400	0 1 - 19200 1 1 - 57600	1 1 - SERIAL	

WARRANTY

- Standard warranty of product is 6 months.
- No warranty will apply if the Product has been subject to misuse, static discharge, neglect, accident, modification, or has been soldered or altered in any way.
- Warranty only applies to manufacturing defect.