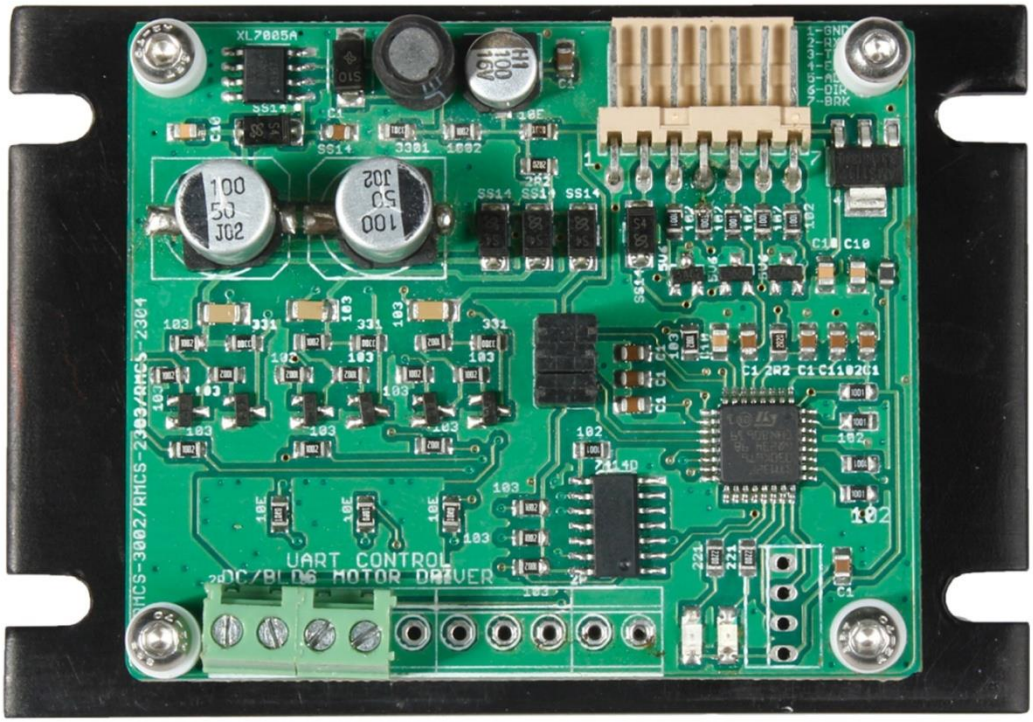
DC Motor Drive

10V - 30V DC, 50W

ASCII Modbus

RMCS – 2304



Operating Manual v1.0

Contents

Introduction – Salient Features

Rhino Motion Controls DC Drive RMCS-2304 with UART ASCII is a high performance dc motor drive (10–30 V DC up to 10A) designed for optimized operation of Rhino DC motors.

The salient features of this drive:

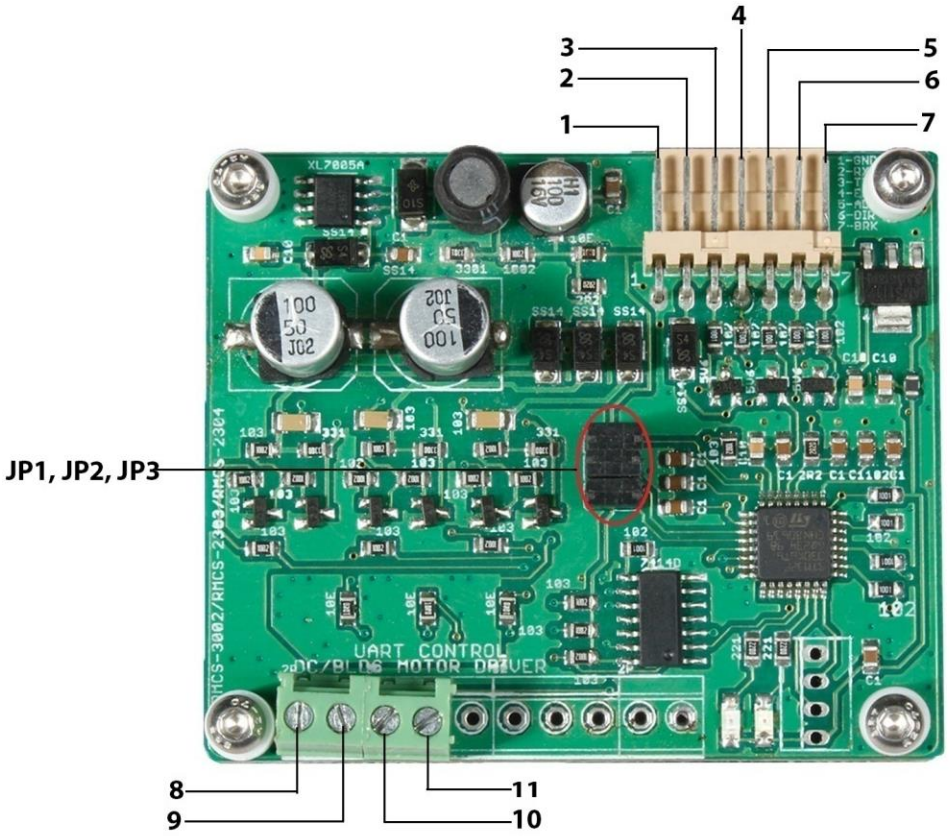
- This drive provides a closed loop speed control for the dc system.
- The motor programmed speeds are maintained irrespective of the voltages supplied.
- Also by using this drive, the rated torque of the motor is available at all speeds and the torque does not decrease with change in speeds.
- It is possible to run the motor in three different modes Analog control mode, Joystick control mode and Digital speed & Direction control mode.
- It has short-circuit protection for the motor outputs, over-voltage and under-voltage protection and will survive accidental motor disconnects while powered-up.
- This drive is configured using MODBUS ASCII protocol via UART.
- There is a function in the drive for setting the Modbus Slave Address from 1 to 7 using physical jumpers (Hardware Setting) or using MODBUS Tool Device (Software Setting).
- There are three user modes in the drive:
    - Mode0 - Analog Control Mode
    - Mode1 - Joy Stick Control Mode
    - Mode2 - Digital Speed Control Mode

Technical specifications

Supply Voltage and Current

Specification	Min	Max	Units	Comments
Supply Voltage	10	30	Volts DC	Between +Ve and GND
Phase Current	0.5	5	Amps	Peak 5 Amps per phase

Pin Description of this Drive



Pin No.	Description
1	GND
2	RXD
3	TXD
4	ENABLE
5	ADC
6	DIRECTION
7	BRAKE

(Pins 1-7 are used for drive Configuration and UART control)

Pin No.	Description
8	GND
9	VDD
10	Motor+
11	Motor-

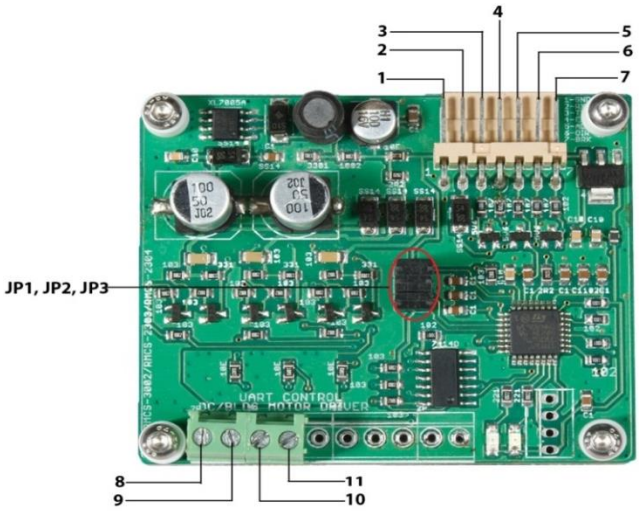
(Pins 8 - 11 are connected to motor and Power supply as described)

Pin No.	Description
JP1	Jumper 1
JP2	Jumper 2
JP3	Jumper 3

(JP1 to JP3 are used for Hardware setting of slave ID)

Slave ID Addressing

Multiple drives with different slave addresses can be used with a single controller on single UART bus. For this all drives should have a unique Slave Address. Using Modbus commands, the slave ID can be set from 1 to 247. However, slave ID from 1 to 7 can be set using physical jumpers also. As shown in the image below there are three jumpers marked by a red circled shown in the image below.



The three jumpers JP1, JP2 and JP3 can be set in the configuration as per the below table to provide a physical slave address to the drive. In the below table a value of '0' corresponds to a state where the jumper is not connected and a value of '1' corresponds to a state where the jumper is connected. If none of the jumpers are connected the drive has been programmed to use the Slave ID 1 in default mode which can be changed from 1 to 247 using Modbus commands.

Drive will check jumpers on startup. If no physical jumper is connected it will use programmed slave id (default 11).

Slave ID	JP1	JP2	JP3	Image of connection on the Drive
1	0	0	1	
2	0	1	0	
3	0	1	1	
4	1	0	0	
5	1	0	1	
6	1	1	0	
7	1	1	1	

Modbus Registers

Register	Data Address (Decimal)	Access	Size	Function	Range /Command And Default value in HEX (Decimal)	Specification	Description
40001	0	Read / Write	16 bit	Write Parameters to EEPROM	FF (255)		To save parameters in Drive (EEPROM) send Hex value XXFF to Address 0. Where XX is **slave ID** ranging from 01 to F7(1 - 247) For example: If slave id is 7 then write 07FF.
				Modbus Slave Address	Range:1-F7 (1-247) Default: 0B(11)		For Slave Address Setting refer **Slave ID Addressing**
40003	2	Read / Write	16 bit	**Modes (Default value: 0)**			
				Analog Control Mode **(Mode 0)**	0001(1)	Mode byte:00 Control byte:01	Enable motor in analog Control mode. For analog mode, connect external potentiometer.
					0000(0)	Mode byte:00 Control byte:00	Disable motor in analog Control mode
				Joystick Control Mode **(Mode 1)**	0101(257)	Mode byte:01 Control byte:01	Enable motor in joystick control mode
					0100(256)	Mode byte:01 Control byte:00	Disable motor in joystick control mode
				Digital Speed Control Mode **(Mode 2)**	0201(513)	Mode byte:02 Control byte:01	Enable motor in CW
					0200(512)	Mode byte:02 Control byte:00	Disable motor in CW
					0204(516)	Mode byte:02 Control byte:04	Brake in CW
					0203(515)	Mode byte:02 Control byte:03	Enable motor in CCW
					0208(520)	Mode byte:02 Control byte:08	Disable motor in CCW
					020C(524)	Mode byte:02 Control byte:0C	Brake in CCW
40005	4	Read / Write	16 bit	Reset Default Parameters	0000(0)		Writing 0 to this address then save to eeprom will load default parameters in drive.
40013	12	Read/ Write	16 bit	Acceleration	Range: 0001 - 0080 (1 - 128) Default: 0001(1)		Set the Acceleration of the Motor
40015	14	Read/ Write	16 bit	Speed	Range: 0001-0800 (1-2048) Default: 03E8(1000)		If gearbox is attached output RPM will be different.

Modbus Register Mapping

- **Device Modbus Address(MOD _ID)**

  Address: 0x00 (40001)
  Default value: 0x0BFF

MOD_ID[15:8]								SP[7:0]							
rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw

Bits 15:8 **MOD_ID [15:8]:** Modbus address register bits
Default: 0x0B
Maximum value: 0xF7
Minimum value: 0x01

Bits 7:0 **SP [7:0]:** Save parameters
Default: 0x00

If slave id is 7 then by writing 07FF in this address will save parameters in eeprom.

- **Control and Mode Register**

  Address: 0x02(40003)
  Default value: 0x0000

MODE[15:8]								CRTL[7:0]							
0	0	0	0	rw	rw	rw	rw	0	0	0	0	0	BRK	DIR	EN

Bits 15:8 **MODE [15:8]:** Mode byte
Default: 0x00

Bits [11:8] **0000**: Analog Control Mode
0001: Joystick Control mode
0010: Digital Speed Control Mode

Bits 7:0 **CRTL [7:0]:** Control Byte
Default: 0x00

Bit 2 **BRK**: Brake
This function is only available in **Digital speed control mode**
0: Disable Brake
1: Enable Brake

Bit 1 **DIR:** Direction (only Digital mode)
0: Clockwise direction
1: Counter-clockwise direction

Bit 0 **EN**: Enable bit
0: Disable mode
1: Enable mode

Enable has more priority than brake.

- **Acceleration Register(ACC)**

  Address: 0x0C (40013)
  Default value: 0x0001

ACC[15:0]
rw

Bits 15:0 **ACC [15:0]:** Acceleration
Default: 0x0001
Maximum value: 0x0080
Minimum value: 0x0000

Acceleration can be changed in mode 2 digital control mode and affect in all the modes when starting the motion or changing the speed. Deceleration is also applied as per set value when stopping the motor or decreasing the speed.

- **Speed Register(SPD)**

Address: 0x0E (40015)
Default value: 0x03E8

SPD[15:0]
rw

Bits 15:0 **SPD [15:0]:** base motor speed
Default: 0x03E8
Maximum value: 0x0800
Minimum value: 0x0000

If gearbox is attached output RPM will be different.

- **Reset Register(RST)**

Address: 0x04 (40005)

RST[15:0]
rw

Bits 15:0 **RST [15:0]:** Reset register

Writing 0 in this address then save to eeprom will reset default parameters in drive.

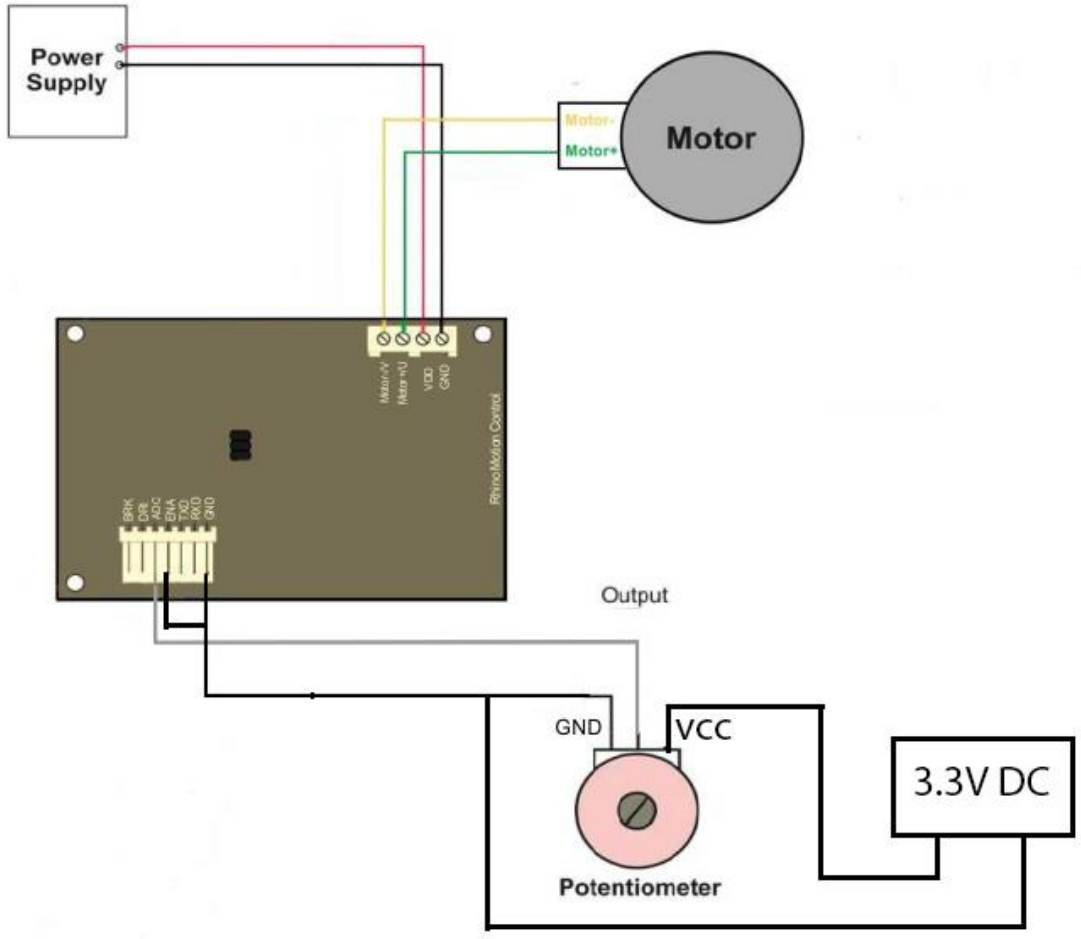
Control Modes

Motor can be run in 3 different modes - 0: Analog Control Mode, 1: Joystick Control Mode, 2: Digital Control Mode

Mode 0 - Analog Control Mode

- In this mode drive can be controlled using an external potentiometer or analog voltage input. As this is a close loop drive, high torque (up to the maximum torque motor can provide) is available even at low speed.
- Speed of motor can be changed in analog mode by moving an external potentiometer.
- Default Acceleration and Speed is already set in this drive.
- Can change default settings through Modbus Poll software, PLC and Arduino Controller.
- Electronic brake can be applied to motor by connecting Brake to GND - (Pin 7) to GND (Pin 1).
- Direction can be changed by connecting Direction pin to Gnd.

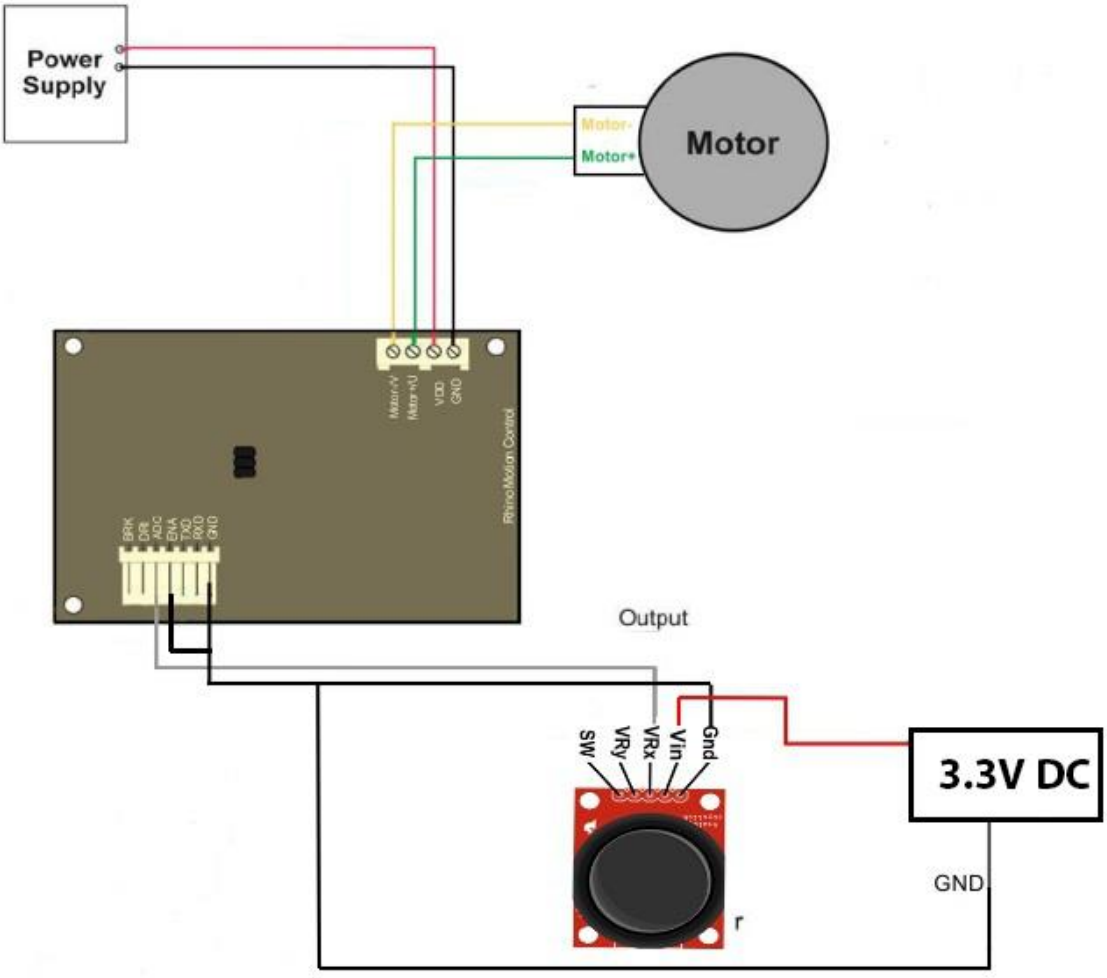
Hardware Connection



Mode 1 - Joystick Control Mode

- In this mode motor can be controlled using an external Joystick through ADC input.
- Direction and Speed of motor can be changed in this mode by moving the Joystick.
- Motor is in Brake condition at center point of Joystick.
- Motor rotate in CW direction while moving the Joystick in upward direction.
- Motor rotate in CCW direction while moving the joystick in downward direction.
- Default Acceleration and Speed is already set in this drive.
- Can change default settings through Modbus Poll software, PLC and Arduino Controller.
- Electronic brake can be applied to motor by connecting Brake to GND - (Pin 7) to GND (Pin 1).

Hardware Connection



Mode 2 – Digital Speed Control Mode

- In this mode the drive works in speed mode. It tries to reach and maintain the speed as per set parameter.
- The speed can vary depending upon load.
- Make sure that the set speed is always less than the motor can actually reach, otherwise the drive can give uncertain result. For example if the maximum speed motor can reach at given voltage is 2048 always set speed less than 2048 PWM.
- Motor will run in digital speed control mode by using Modbus Poll software, PLC and Arduino Controller with the help of Modbus registers.
- Acceleration and speed of the motor can only be controlled in this mode and that will also affect in Analog control mode and Joystick control mode.

Hardware Connection