Instruction Manual

Dual Channel Radio Control Interface

DMR-203/213

Contents

Section			Page
1.	**Introduction**		**2**
2.	**Features**		**2**
3.	**Installation**		**3**
4.	**Jumper Settings**		**4**
4.1	Failsafe Mode Jumper		5
4.2	Steer Mode Jumper		5
4.3	Output Mode Jumper		6
4.4	Inhibit Jumper		6
4.5	Ignition		6
5.	**Calibration**		**7**
5.1	Stick Centre Position		7
5.2	Controller Gain Adjustment		7
6.	**Failsafe**		**8**
6.1	Standard Receiver Output		8
6.2	Failsafe Algorithm		8
7.	**Safety Considerations**		**9**
8.	**Circuit Diagram**		**10**
9.	**Radio Control Connections**		**10**
10.	**Troubleshooting**		**11**
11.	**Service**		**12**
12.	**Specification**		**12**

1. Introduction

The DMR-203 Interface board is a general purpose, 2 channel radio control interface for use with 4QD motor speed controllers to give proportional motor speed control from a standard radio control system.

The interface is aimed principally at robotic control applications, however it is also useful for a wide variety of other radio control projects.

It connects directly to the PWM servo outputs of a standard RC receiver and to the inputs of two speed controllers.

Features include both channel mixing and dual independent channel ("Tank" style steering) modes, Switched or Proportional outputs, and an advanced failsafe system that can bring the system to a safe state in the event of a poor signal.

Versions

There are 2 versions of the DMR. The DMR-213 is suitable for the PRO-150, and the DMR-203 is suitable for the DNO, PRO-120, and 4QD series controllers. The Porter range can also be controlled but needs slightly different wiring [details are in our website knowledgebase].

2. Features

- Dual channel radio-controlled electronic speed control.
- 2 x 256-State PWM (Pulse Width Modulated) proportional outputs with reverse signal.
- 2 steering modes (dual independent / mixed).
- Advanced failsafe system.
- 2 output modes (switched / proportional).
- Opto-Isolated input connections.
- Low power consumption.

3. Installation

DNO

Wiring of the interface to two DNO / VTX controllers is shown in the diagram.

Pro-150

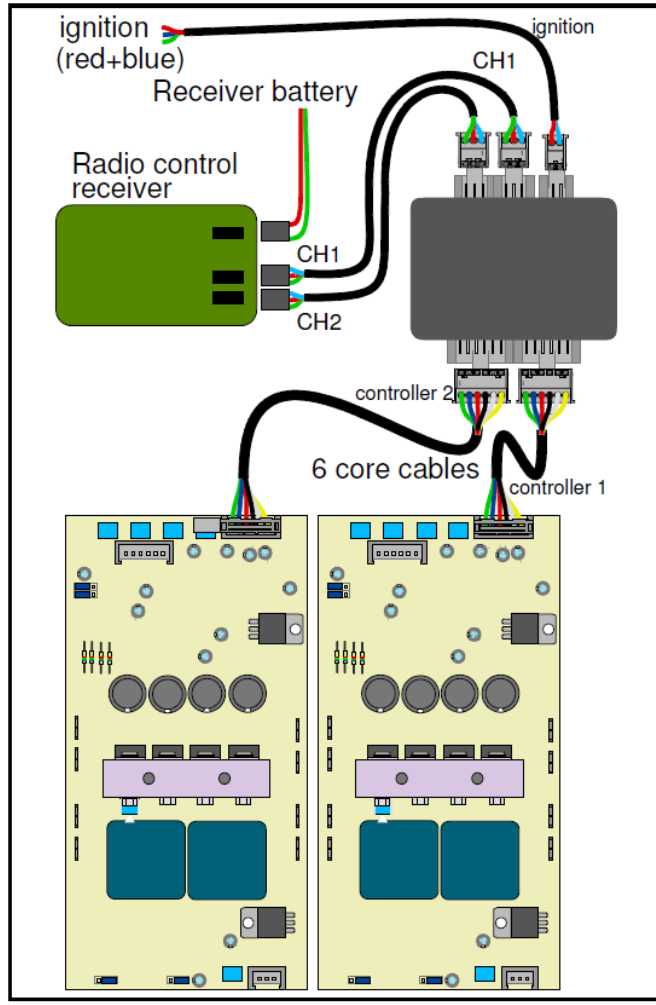
Wiring is as shown in the diagram. **Note** that the DMR-213 must be used, or the DMR-203 modified as per the instructions in our website knowledgebase.

Pro-120

Pro-120s must have High Pot Lock Out [HPLO] disabled.

4QD series

For the 4QD series the yellow connection to pin A of the 6 way connector[s] must not be used*. The 4QD must have an ignition switch as per its instruction manual. There is no need to fit an ignition switch to the DMR. Depending on the transmitter trim settings it may be necessary to disable HPLO on the 4QD control board.



All Controllers

The "CH1 SPEED" input should connected to the forward / reverse receiver output and the "CH2 STEER" input should be connected to the steering output. Make sure that the blue wire goes to the notched end of the receiver socket, i.e. the end that a servo's white wire goes to. Connection to the motor controllers should be made using our standard 6-way IDC connectors.

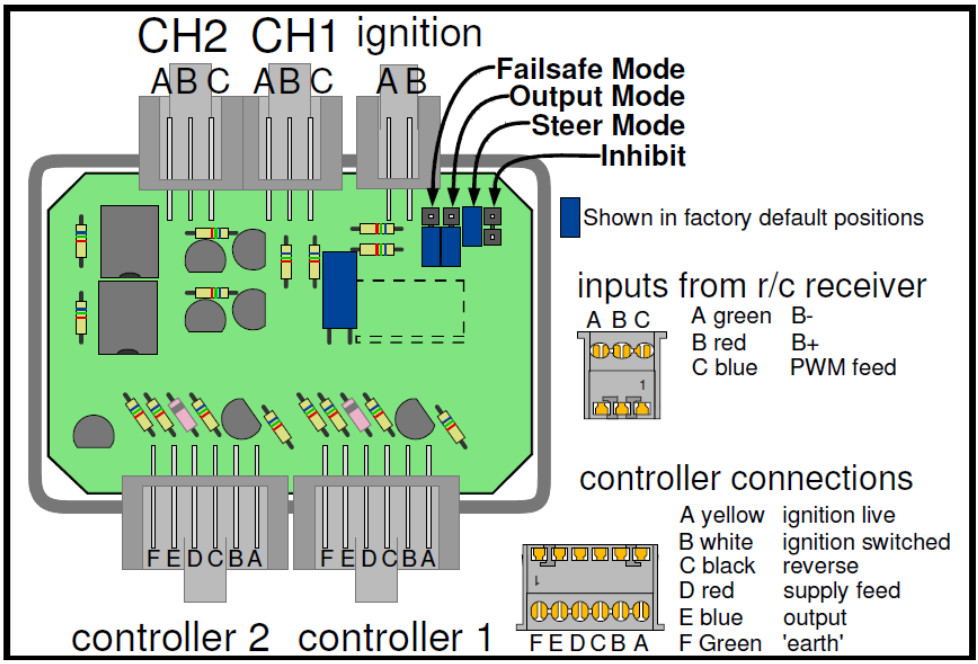
*Note: On the 4QD series pin A is an inhibit input, on all other controllers it is B+.

Single Channel Use

The DMR can be used as a single channel interface by connecting only channel 1

The unit will not operate if there is no power to controller 1 or it is absent.

4. Jumper Settings



The diagram above shows the DMR-203 with the cover removed.

Warning: When modifying jumper settings you should always power-down the Interface to avoid damaging it. This can be done in system by turning the controller "IGNITION" off or by disconnecting Controller 1 and Controller 2 connectors. ***Disconnecting the batteries does not necessarily work as the main capacitors in the controllers can take a long time to discharge***.

The jumper settings are read when the unit is powered up and when the unit reactivates following operation of the failsafe. The DMR features a number of settings that can be chosen by setting or removing jumpers on the Printed Circuit board.

When making changes to these jumpers take care not to damage the board. It is also recommend that you ground yourself by touching an exposed area on an

earthed appliance before handling. Please ensure that jumpers are firmly in place before powering up.

Factory Defaults

Failsafe	Open	High sensitivity
Output Mode	Open	Linear mode
Steer Mode	Linked	(tank mode)
Inhibit	Open	Normal

Two spare jumpers are parked on Failsafe and Output Mode pins: these are parked on a single pin so the option is not engaged.

4.1 Failsafe Mode Jumper

Linked	Low SENS mode FT = 490mS
Removed	High SENS mode FT = 120mS

The failsafe sets the outputs to safe values in the event of a poor signal.

The failsafe mode jumper configures the sensitivity of the failsafe. With the jumper removed, the failsafe applies stricter threshold of signal quality, and will activate more easily than with the jumper mounted. However, decreasing the sensitivity of the failsafe increases the likelihood of the motors responding erratically to a poor signal.

4QD strongly recommend that, if there is any risk of injury posed by the application in which the DMR is used, the failsafe mode jumper should be removed.

4.2 Steer Mode Jumper

Linked	TANK mode
Removed	MIXED mode

The interface can operate in both "Mixed" and "Dual Independent" or "Tank" style steering mode.

In "Mixed" mode, a sum and difference calculation is performed on the forward / reverse and left / right signals to produce the desired steering behaviour commonly used in robotics applications. When the left / right stick is fully displaced but the forward / reverse stick is at centre, the output will cause the vehicle to spin on the spot. At full forward / reverse one of the motor speeds is reduced on steering to steer the vehicle.

"Tank" style steering mode configures the unit to behave like two single channel interfaces. This not only facilitates the "tank" style steering configuration but also allows the unit to be used in other applications such as a 2-channel 3-State radio controlled switch, or for auxiliary motors.

4.3 Output Mode Jumper

Linked	SKIP mode
Removed	LIN mode

Two output modes are available. "LIN" mode gives a linear output proportional to the stick positions. Alternatively, "SKIP" mode causes the outputs to be either High or Low. This mode is useful for controlling switched outputs, or low-speed motor control where the output is required to either be ON or OFF without the requirement of proportional control.

4.4 Inhibit Jumper

Linked	INHIBIT
Removed	NORMAL Operation

This jumper simply acts as an enable control for the unit. If the jumper is set the unit will be in power down mode and will not operate. This can be useful if you wish to interface the board with external control circuitry such as a microprocessor system. The interface is disabled by driving the "Normally High" jumper connection low. The switching mechanism should be able to handle a current of 50uA when "Inhibiting" the interface board.

4.5 Ignition

This is brought out to the ignition connector. Connecting the two pins (via an ignition switch) will power-up the whole system. The ignition power is supplied via pin A of controller 1. If this pin is not connected the system will not power up.

Internally, this Ignition is simply a direct connection via the interface to the same pins on the host controller.

pin A connects through to Controller 1 pin A.

pin B connects to both pins B

Be careful: Pin A of the ignition is connected through to Battery +ve: if it touches anything other than the blue wire you could blow tracks in the interface or in a controller.

Note that, when the ignition is off, the interface board is completely powered-down as it is powered from the host controller's 9V line.

5. Calibration

Calibration is easiest when the unit is operating in "LIN" and "TANK" mode (see 4.2 & 4.3).

5.1 Stick Centre Position

Stick centering must be done using the trimmers on the transmitter.

The trimmers should be adjusted so that, for each channel, the DMR-203 gives zero output and the reversing signal is just off. If the centering is incorrect, the direction relays in the controller may jitter.

The trimmers can be set as follows:

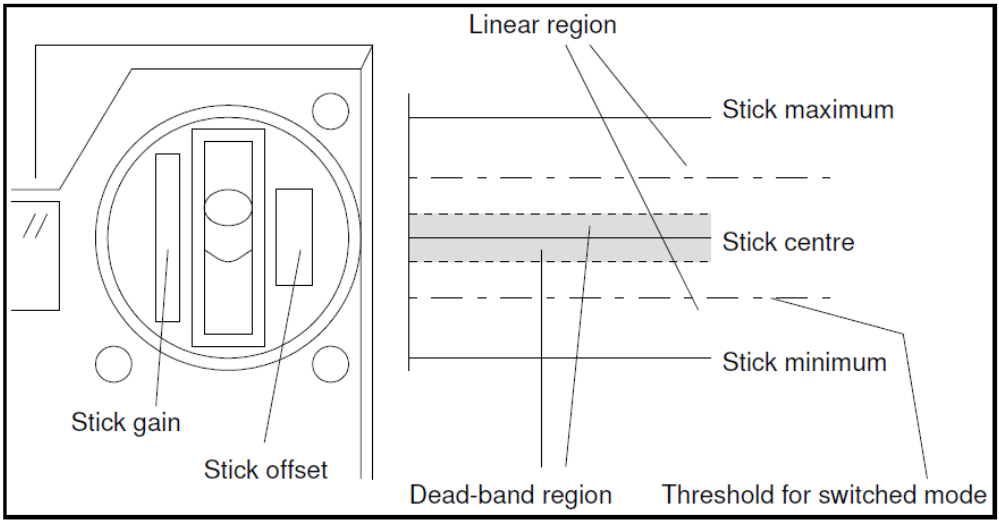
1. Set the steering trimmer so that you can make both motors stop using only throttle stick- keep the steering stick centred.
2. Set the throttle trimmer so that both motors stop with both sticks centred.

The DMR-203 has a small Dead-Band area around the stick centre point.

5.2 Controller Gain Adjustment

See motor controller manual for this adjustment. The maximum and minimum stick positions should usually be calibrated so the controller is just at full speed when the stick is at maximum.

With the DNO and Pro-120, the gain controls should be set to maximum.



6. Failsafe

The DMR-203 uses a failsafe system that offers features usually only found in expensive dedicated units.

6.1 Standard Receiver Output

The standard servo-drive in Radio Control applications is a 20 Hz PWM signal with a mark of 1.5mS at centre (zero position). When the stick is displaced from one extreme to the other, this mark changes from about 1.0mS to about 2.0mS.

The DMR-203 will reject signals that differ sufficiently from this standard.

When the signal quality is below an acceptable standard, the DMR-203 enters failsafe mode, and all outputs are set to zero.

6.2 Failsafe Algorithm

Each pulse is tested to determine whether it is likely to be a valid pulse, or random receiver noise

The results of this test are used to define whether the input signals can be trusted. If not, the DMR-203 goes into failsafe mode, and the outputs are set to zero.

A valid pulse must have a mark of between 0.8 and 1.2 ms, and must be followed by a space of at least 13 ms. All pulses that do not conform to this standard are treated as invalid.

The unit will enter failsafe mode if, over any period defined by FT (see 4.1), no sequence of 4 consecutive valid pulses occurs. This works well because it is unlikely that a random signal will contain a section that looks like 4 consecutive valid pulses.

The system looks at both channels at the same time, so a set of 4 consecutive pulses could consist of 2 pulses from each channel received alternately (if pulses arrive simultaneously on both channels, channel one is treated as if it arrived first), or if only one input is connected, 4 pulses from that input.

When an invalid pulse is received, the output will correspond to the last valid input, unless, or until, the failsafe has activated.

7. Safety Considerations

The DMR-203 Interface board implements low-voltage microprocessor technology to control unlimited user-defined loads. The potential for the development of hazardous conditions is therefore great and the following safety recommendations should be adhered to.

Safe Operating Procedure

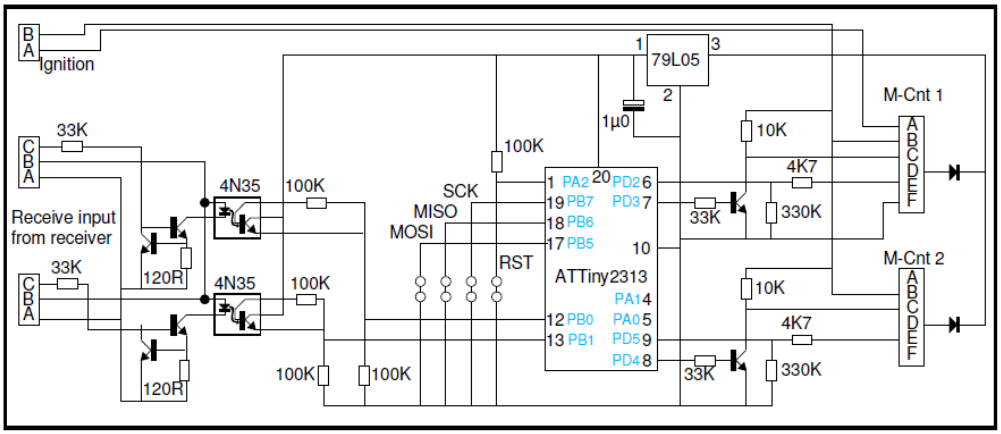
- BEFORE powering up check the correct order of input connections.
- BEFORE use check the unit for damage. DO NOT use the device if any connections are open-circuit or damaged.
- ALWAYS use the same power supply for BOTH motor controllers and if possible use identical controllers for both channels.
- Minimise noise and the possibility of connection failure by using short and properly terminated connection cables.
- DO NOT make connections while the system is powered up. RC control requires signals to be synchronised and the input signal may be misinterpreted.
- DO NOT connect LEDs or other I/O devices to the interface board. The unit is designed for use under minimal power supply power arrangements and any user modifications may cause the device to either stop functioning, or even worse, produce an unstable output.
- DO NOT touch the circuit while in operation. This may have adverse effects on performance.
- DO NOT allow the unit to get wet, and observe the operating temperature specifications.

Note: It is good practice NOT to switch off the transmitter during operation as this commonly produces an undefined output which will be reacted too until the failsafe activates.

It is always best to operate potentially dangerous machinery with great care. Minimise risk by removing the possibility of danger until confidence is achieved. As an example, if using this unit with a vehicle make sure the wheels are off the ground until the interface has been setup correctly.

As a final recommendation, it is always best to fit a master cut-out such as a battery isolator or other mechanical switch to ensure ultimate safety.

8. Circuit Diagram



The two radio control inputs are shown on the left. Each has a pair of transistors associated with it to drive the opto-coupler at constant current, so the input will work over a wide voltage range.

All of the clever bits are done in software in the AT90 microcontroller. This delivers two PWM outputs (pins 6 and 9) whose levels are averaged in the DNO controllers. Pins 7 and 8 are the direction outputs driving two transistors to interface to the (higher voltage) input of the controllers. The collectors of these transistors are pulled up via 10K resistors fed from the ignition line.

Ignition is fed from controller 1 only, so if this controller is not present, controller 2 will not work.

9. Radio Control Connections

Most radio control receivers (e.g. Spektrum, Futaba, JR) have the positive connection in the centre and the supplied lead will fit these. However some makes have the negative lead in the centre and the supplied leads will need to be altered to suit - swap over the red and green wires.

Our supplied leads are colour coded:

Blue	Pin C	Signal
Red	Pin B	+ (Positive)
Green	Pin A	- (Negative)

The individual contacts are held into the shell by a tongue on the shell latching with the contact. This can be seen in the 'window' in the shell. Gently lift the tongue upwards with a pin and the contact is released and can be pulled out. The DMR input circuitry is very forgiving and is unlikely to be damaged by and wrongly-wired connection.

Some radio control receivers have a “key” on the servo output sockets. If this interferes with the insertion of the DMR plug, either the receiver socket or the plug can be trimmed.

10. Troubleshooting

Q. The output is always zero?

A. Is there power to both the motor controller and receiver?

Are the connections correct?

Is the receiver supply voltage too high or too low? (This can cause invalid inputs)

Is the motor controller supply voltage/current too low? (Both the interface & motor controller have under voltage protection)

Is the ignition switched on?

Try testing the radio by connecting a servo to the receiver.

Q. No Reverse?

A. Is the receiver input calibrated properly? Does the controller give zero speed on stick centre? If not adjust the offset.

Does the controller operate correctly with manual reverse input? If so then the reverse driver may be damaged.

Q. The unit works but will not give maximum speed?

A. Has the motor controller gain been adjusted to give full output with full stick displacement in BOTH forward and reverse directions?

Is the supply voltage/current low?

Q. The output dithers between two speeds or rises in steps?

A. This is normal and a product of using a microprocessor to sample the RC input signal. You can minimise this by ensuring the gain is adjusted to give full output at full stick displacement.

"Stair-Casing" may be more noticeable on high speed motors or motors operating beyond their intended voltage rating.

Q. The output is not symmetrical (forward and reverse peak)

A. Is the transmitter signal symmetrical? Adjust the controller gain to give maximum output when the transmitter gives its lowest output for the full stick displacement.

Is the motor controller set to asymmetric mode?

Is the motor controller operating correctly?

Q. The output is either Full Speed or Zero Speed?

A. Are the jumper settings correct?

Is the Controller "Gain" set to an excessively high value

11. Service

In the event of any problem please contact us before returning a suspect DMR unit.

Please include a completed returns form with the returned unit [see website]. Details of service charges are on the website.

Warranty

All our products have a warranty against defective manufacturing for 12 months from the date of shipment. The warranty doesn't cover damage caused by incorrect installation.

12. Specification

Supply Voltage	5.7-32.0V*
Supply Current	9.2mA
Power Consumption	50mW
Output Method	2KHz PWM 0-100% Modulation
Output Voltage	4.3V PWModulated
Input Signal	
Input Method	40-70Hz PWM 1.5mS Mark Centre [RC STD]
Input Voltage	3.2V – 5.5V Max
Input Resistance	50Kohm
Failsafe Parameters	
Valid Input	0.8-2.2mS Mark on PWM Input (450Hz – 1.25kHz approx)
Fail Time-out	300mS
Fail Output	0V (Zero)
Physical Attributes	
Operating Temperature	-40 – +90deg;C
Dimensions mm(")(max)	H 23.0(0.91) * W 54.0(2.12) * D 38.0(1.50)
Weight	53g

**Note: This unit is designed for direct connection to two 4QD motor speed controllers, such as the DNO, VTX, PRO-120 or 4QD models. The unit is powered directly from the connections made to these so no external power supply is required. Be aware that it is not recommended to use unmatched controllers for each channel and both controllers MUST operate from the same set of batteries.*