

SmartWinch

U s e r G u i d e

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1. Introduction

Thank-you for purchasing a *SmartWinch*. We hope you have many years of trouble free and successful sailing using our product. If there are any problems to be solved or queries to be answered please do not hesitate to call.

Please take the time to read this booklet through. There are a few do's and don'ts, some very important points and some helpful hints.

2. Summary of Features

- 3.8 to 9 volt operating range.
- Optional battery monitoring and low battery shutdown.
- Integral 5 volt regulator for single battery operation.
- Travel adjustable from 1 to 6 revolutions depending on model
- Automatic shutdown when stalled.
- 'No Buzz' *Dynamic* Pulse Width Modulation drive.
- Programmable for tx pulse width range.
- User definable deceleration rate
- No over runs due to radio problems, interference etc.
- Static braking.
- Ball bearing output.

3. Special *SmartWinch* Features

***Dynamic* Pulse Width Modulation**

Servo systems use Pulse Width Modulation to reduce power and speed as the desired position is approached. This gives finer and smoother control when small movements are required. It also reduces the problem of hunting especially in fast servo systems. But the problem with standard P.W.M. is that as the servo or winch gets closer to its desired position the reduction in power due to P.W.M. may mean that it will not have enough power to get to the new position when under load. This is what's happening when a servo (or winch) is not moving but is buzzing. With sail winches this can cause batteries to be discharged prematurely or even damage the electronics in heavy conditions because the motor is trying without success to drive the winch to the desired position.

However, unlike other winches and servos the *SmartWinch* the P.W.M. rate is not static. If the controller detects that it is not travelling as fast as it should be during P.W.M. it will increase the P.W.M. rate (up to 100% if necessary) until it has enough power to overcome the load and find its desired position. If once 100% power is reached and the winch is still not able to reach its desired position then the winch's stall protection feature will be activated.

Stall Protection

When a conventional winch becomes stalled, (due to fouled sheets, extreme winds etc.) it will stay stalled until the problem is solved or the battery is flattened or the electronics damaged. But the *SmartWinch* knows when it is stalled and will protect itself and your batteries by shutting the power off to the motor within about one second. The winch then signals that it is stalled by sounding a two-tone beep at 2 second intervals until reset. To reset the winch simply move the tx stick in the opposite direction or turn the tx or winch off and on again.

Static Braking

Whilst the winch is at rest, static braking makes it more difficult for sail pressure to move the winch with virtually no loss of battery power. But should the wind strength be high enough to run the winch back out against its static braking then Dynamic Pulse Width Modulation will take over and quickly bring the winch back.

Battery Monitoring

If this option is selected during setup, the winch can monitor NiCad or NimH packs of 5 or 6 cells or 6 volt sealed lead acid gel cells. If the voltage is below the warning level a warning signal (5 rising tones) will sound when the winch is switched on. If, during normal operation the voltage falls below the shutdown level, the winch will drive to half way out and hold there until the battery is replaced or its voltage recovers to a level of 0.1 volts above the voltage at which it shutdown. It is recommended that if 4 cell NiCad or NimH packs are used then battery monitoring should not be used as the winch will shut down well before these packs are flat. Low battery shutdown has no effect on the operation of the radio receiver or rudder servo.

Battery Monitoring Voltages Table 1

Level	Detect	Warn	Shutdown
1. 6V gel cell	< 6.5	< 5.1	< 5.0
2. 5 cells	> 6.5	< 5.5	< 5.0
3. 6 cells	> 7.5	< 6.6	< 6.0

4. Batteries

Voltage Range

Supply voltage range is from 3.8V to 9V. Should a voltage outside that range be applied the winch will not operate. No damage can be done unless reverse polarity or > 12 volts is used. While the winch will operate down to 3.8 volts, the minimum should be a 4 pack of NiCad or NimH. This will give room for voltage drop as the battery pack discharges.

Pack Size

The recommended battery pack is 5 or 6 NiCad or NimH cells. Alternatively a 6V sealed lead acid gel battery may be used. These days with higher cell energy densities, AA size NiCad or NimH cells can have capacities of up to about 2000 mAh. With these high capacities it is also feasible to use AAA size cells with a significant weight saving.

Snap In Battery Holders

Snap in battery holders are *not* recommended. Their weak electrical connections can result in severe voltage drop which may cause erratic winch behaviour. Compounding this problem is that in most cases these packs only have servo size wiring which can not supply the current required by the winch. 4, 5 or 6 cell packs should be fully soldered.

Battery Life

Battery life depends on many variables. But as a rough guide, provided you have a good low friction sheeting system, you could expect to get about 12 to 16 races of about 10 to 15 minutes duration in conditions of around 8 to 10 knots from a 5 pack of 1000mAh AA's.

5. Wiring

Regulator

The *SmartWinch* contains a 5 volt regulator which can supply up to 1 amp of current to the controller circuit, radio receiver (rx) and rudder servo. This allows for the use of only one battery pack inside the yacht. The motor runs on the full battery voltage via the MOSFET output circuit.

Supply Leads

Wiring and connectors from winch supply leads to battery pack must be at least 0.5mm² cross section and rated at least 3 Amps. Switches used should be rated at least 3 Amps also. **Standard servo size wiring is not adequate.** It will cause severe voltage drop between battery and winch and should not be used. All joints should be soldered and then coated with Vaseline petroleum jelly to protect from corrosion (black wire). Use Vaseline on servo connectors also.

Supply Polarity

Power supply / battery lead connectors ***must*** be polarised so that it is impossible to accidentally reverse the supply polarity. The control circuit and radio gear is protected by the voltage regulator and will not be damaged by reverse polarity ***but*** the output circuit could be ***seriously*** damaged.

Servo Connector

The connector supplied is compatible with JR, Futaba, Hitec etc. Take care when inserting connector into receivers other than JR or Hitec. Make sure that polarity is correct. In the case of Sanwa receivers, check the polarity of the Sanwa servo leads first as early Sanwa receivers require the centre lead to be negative. (see figure 1)

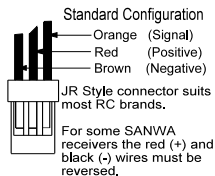


Fig. 1 Servo Connector

6. Standard Connections

In most cases the best circuit for winch, radio and battery is also the simplest as shown in figure 3.

In this system there **must be no receiver battery connection**. Power for receiver is supplied by internal 5 volt regulator.

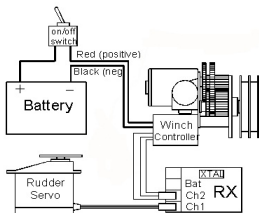


Fig. 3 Standard Connections

7. Alternate Connections

If more than just winch and a rudder servo is used it is advisable to bypass the winch's internal voltage regulator and connect the battery direct to the rx. See Figure 4. This is because the winch regulator and or servo lead may not be able to supply the current needed by extra servos causing a voltage drop.

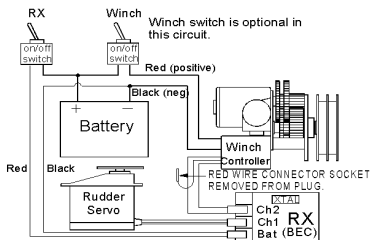


Fig. 4 Alternate Connections

Winch / rx red wire **must** be disconnected when rx battery socket is in use. Remove the red wire socket from the connector and tape it back to the lead.

Winch switch can be omitted in this case as the winch will not operate when rx is turned off. Rx must be able to take full battery voltage.

8. Mounting

Deck Mounting

The recommended method of mounting the winch is to fix it to the underside of the deck with output shaft passing through the deck. Maximum deck thickness 3mm.

Sealing

Prior to fixing the winch to the underside of the deck, the mounting face, spigot and "V" ring seal on the shaft immediately below the hexagonal section of the output shaft should be given a liberal coating of Vaseline petroleum jelly to form a seal. Coat the two M3 mounting screws as well. Before fitting the drum give the area around the 'V' ring seal an extra coat of Vaseline.

Below Deck Mount

For below deck mounting it is usually best to mount the winch with shaft horizontally. You may wish to make a bracket such as the one at left to assist in below deck installation.

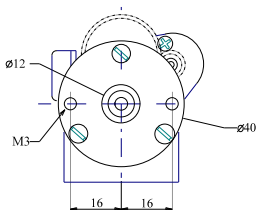


Fig. 5 Mounting Dims.

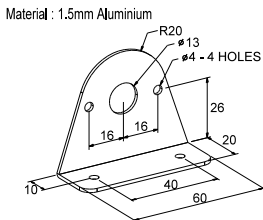


Fig. 6 Mount Bracket

9. Sheeting

Drum Size v Performance

Unless specified otherwise when ordering, the 280D and 280DL are supplied with a 26mm drum. The 380D and 380HD are supplied with a 32mm drum. If faster or slower performance is desired an extra drum may be purchased. Write or phone for pricing. Our web site has details of several other drum options.

The size of drum affects the way the winch performs. Smaller diameter means more revolutions are required therefore sheet speed is slower. However with smaller diameter a higher sheeting force is achieved. And vice versa if larger diameter is used. Similar changes in sheeting performance can be achieved by changing the supply voltage.

Sheeting Systems

There are many ways to approach the sheeting on an R/C yacht and no one method can be considered to be "the best way". The two main categories of sheeting systems used on drum type winches are described below. Either system can be used above or below deck.

- **Single sheet - tension line.** This is where only one side of the drum is used and light tension is applied by an elastic tension line which is attached to the deck. Its purpose is to prevent the loss of wraps around the drum during sheeting out.
- **Double sheet - return line.** Where instead of an elastic tension line a return line is attached the top side of the drum. As the winch sheets out the return line is winding in maintaining tension on the load sheet. As the winch is sheeted in the return line will wind out.

Figure 7 shows a typical arrangement for a double sheet above deck system. To make this a single sheet tension line system, simply replace the return line with an elastic tension line. Attach it to the sheet splitter and a fixed point near the stern to give as much length to the elastic material as possible.

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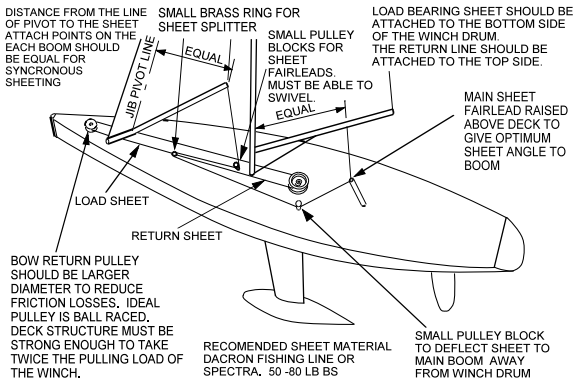


Fig. 7 Sheeting

10. Setting Up

There are 4 user definable parameters

a) Transmitter Calibration

Set limits for signal input to the endpoints of the tx. This protects the winch from overrun due to radio interference etc.

b) Travel Distance Adjustment

Travel can be adjusted to between about 1 to 6 turns depending on model.

c) Battery Monitoring

To enable (or disable) NiCad battery testing for 6V gel, 5 or 6 NiCad or NimH cells. See page 2 for description.

d) Deceleration Rate

Adjust the rate of deceleration when coming to stop from full speed. See page 10.

Setup Mode

It's not essential to perform the setup procedure to operate the winch. Each winch has "factory default" settings. These settings are for an average tx, maximum travel, no battery testing and 75% of fastest deceleration. However, to set the limits of your tx, adjust travel or to set battery monitoring, setup should be performed.

The procedure is normally controlled from your tx. To enter setup mode, the tx is switched on between 10 and 12 seconds after switching the winch on. ***It is impossible to enter setup mode any other way.*** Simply switching the winch on before the tx does not put the winch into setup mode. However if you accidentally enter setup mode (by switching the tx on between 10 and 12 seconds after the winch) just switch the winch off ***before*** switching the tx off. No changes will be made to your settings until setup procedure step 5. The setup mode procedure is the only way that settings can be changed.

The setup procedure should be performed away from other tx's as the rx can pick up signals from another tx, even on different channels when the rx's own tx is switched off. Should you have trouble getting into setup mode then try the method described below for PCM radios. Setup can be performed as many times as desired. There is no need to clear existing setting first.

PCM Radios

Some radios such as PCM types need a different method of controlling setup mode. These rx's don't stop sending signals when the tx is switched off. So there is no way for the winch to know when you have switched the tx on or off. To get around this problem the solution is to simply switch the rx on or off while the tx is left switched on. This can be done by inserting and removing the winch servo lead plug to mimic switching the tx on and off.

Normal Operation

To run the winch normally, the tx ***must*** be switched on before the winch. If the tx is switched on after the winch, the winch will not operate other than to allow entry to setup mode.

Once the winch has been setup to suit your radio and yacht you would rarely if ever need to do it again. For normal operation simply switch the tx on first then switch on the boat and you're off and racing. When you want to switch the boat off again switch it off before switching the tx off.

Before Starting Setup

Before starting with the setup procedure, if you wish to enable battery monitoring, ensure that your battery pack is fully charged. This is to ensure that the winch can accurately detect the number of cells in the pack. For 6 volt gel cell, it is not essential that it be fully charged for the winch to set battery monitoring to that type. See table 1 for details.

Tx calibration can be done with the winch out of the boat but sheeting is best adjusted with the winch installed.

Read each numbered step in the procedure completely before performing the step. The comments in *italic* below a step gives explanation but it is the numbered steps that you will perform. If PCM method is being used, then where instructed to switch the tx on or off, leave the tx on but switch the rx on or off by inserting or removing the winch servo lead plug.

Deceleration Rate Adjustment Mode

In this mode, the tx stick is used to indicate the desired deceleration rate. The resultant rate is proportional to the tx stick position. Close hauled indicates highest rate, full out position for slow rate and halfway will give a rate half way between highest and lowest.

If you are happy with the “factory” default setting for this parameter, there is no need to perform this procedure. The default is 75% of the fastest rate.

The entry point for this mode is after 12 but before 13 seconds after the winch is switched on. With tx off, place the stick at the desired position and switch tx on immediately the 3 rising tone sounds are heard at 12 seconds.

If the tx is turned on at this time (but before 13 seconds) then 2 short beeps will indicate this parameter has been read. Next turn the tx off .

The tx should be calibrated to the winch before this setting is made. But once your tx is calibrated, this setting can be repeated at will without re-calibrating the tx. Follow the procedure on the next page for tx calibration.

11. Setup Procedure

- 1 Move tx stick (and trim) to the end for sails close hauled.

When the winch is switched on with the tx off, the winch will countdown by sounding a short single beep tone once per second for the first 9 seconds. 10 seconds after the winch start-up signal, a 3 beep signal will sound. This is the signal to switch tx on.

2. Switch the winch on and wait 10 seconds till the 3 beep signal then switch the tx on immediately (within 2 seconds).

If three rising tones sound at this point then setup mode was not entered. Either the tx was not switched on or the tx was switched on more than 2 seconds after the 3 beep signal. To try again, switch off the tx and winch then return to step 1. Or, if a single long beep is heard, the winch is now in setup mode and the tx close hauled position has been sampled. Continue on to step 3.

3. Switch the tx off.

4. Move tx stick (**not** trimmer) to opposite end for sails fully out then switch the tx on.

At this point another long beep will have sounded indicating that the sails full out tx position has been sampled.

5. Switch the tx off.

At this point another 3 beep signal will sound to indicate that the two samples of tx position just taken have now been stored. If you don't need to go into travel or battery monitoring sections of setup, then switch the winch off. Otherwise continue on to the next step.

6. Detach the sheet lines or remove the drum.

This step is only recommended for first time setup. Any subsequent execution of the setup procedure in the same boat may be done with sheets attached even if changing tx or travel length. When the tx is next switched on, the winch will drive itself to the travel starting point. The winch must be free to drive to this position. If not sure then remove the drum or disconnect the sheets.

7. Move tx stick back to close hauled then switch the tx on.

Once travel starting point is reached, it will sound 2 quick beeps. You can now drive the winch in the normal manner using the tx. If not done already, install the drum and setup the sheets so that the main boom is at close hauled when tx stick is at close hauled. Take care when running the winch with sheets attached as it is set for maximum travel at this time and it would be easy to overrun. The winch will drive at 1/3rd normal speed during this travel setting phase of setup.

8. Using the tx, drive the winch out till the main boom is at the desired fully sheeted out position. With the boom in position for sails full out, pause for at least one second without moving the winch, then switch the tx off.

At this point another three beep signal will sound indicating that the new travel setting is stored. If you do not wish to make any changes to your battery monitoring settings, switch winch off now and setup is complete.

Or if you wish to change the existing battery monitoring settings then perform either step 9a or 9b.

9a To select the battery monitoring option and have the winch determine the battery pack size then switch tx on and wait till you hear either 1, 2 or 3 quick beeps.

9b To switch off battery monitoring switch tx on then off again immediately (within about 1 second).

If three rising tones have sounded, 9b was performed and battery monitoring is now off. If 1, 2 or 3 quick beeps were heard then step 9a was performed and battery monitoring is turned on. The number of beeps corresponds to the battery monitoring level set. See table 1.

Once setup is complete, the winch must be switched off. The winch will not operate in normal mode unless the tx is already on before the winch is switched on.

12. Maintenance

- Spray the winch with water repellent and lubricating sprays. CRC 6-66 or RP7 recommended. (WD40 can damage some plastics). Apply the spray directly *into* the motor, toward the centres of the gears (especially the top shaft gears) and around the feedback pot. **Note: These sprays contain flammable propellants and solvents. Allow a few minutes for the flammable components to evaporate before running the winch.**
- Maintain a coating of white petroleum jelly (Vaseline) on all electrical connectors inside the yacht to protect against 'black wire' corrosion.
- Regularly re-pack the white petroleum jelly under the drum of deck mounted winches to protect the ball bearing. Remove the drum and re-coat the area around the shaft.
- After each days sailing drain boat of water and leave hatch off to allow the boat to breathe and dry out. This is important for all of the boat's electrics.
- Do not attempt to seal the motor in any way. It must be able to breathe for cooling purposes and also to dry out.
- Try to keep gears clean. Greasing is not necessary. Grease will only attract grit which can damage the gears and will make the winch very noisy.

13. Warranty

Your new SmartWinch is covered by a 12 month warranty. Should any faults be found and are considered by RMG SailWinch to be our fault, we will repair and return the winch to you free of charge.

14. Mechanical Specifications

Table 2

Specification	280D (DL)	380D (HD)	Unit
Max Power	5.4	10.1	Watts
No Load Speed	3.3 (2.6)	3.1	revs/sec
No Load Speed	265 (212)	312	mm/sec
Stall Torque	11.2 (14)	21.2	kg.cm
Standard Drum	26	32	mm
Turns	4.8 (7.2)	6	revs
Travel Range	80-390 (100-590)	80-610	mm
Dimensions	74x54x59	79x54x60	mm
Weight	134	168 (175)	gm

15. Electrical Specifications

Table 3

Specification	280D (DL)	380D (HD)	Unit
Idle (Stationary) Current	20	20	mAmps
No Load Running Current	450	850	mAmps
Stall Current	6	16	Amps
Maximum Supply voltage	9	9	volts
Minimum Supply voltage	3.8	3.8	volts

Performance specifications based on a constant voltage supply of 6V and standard drum size. Performance specifications may vary depending on supply battery voltage and capacity and drum size etc.