RMG SAILWINCH

SmartWinch

USER GUIDE

Contents

The *SmartWinch* is manufactured by

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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. Please take the time to read this booklet. There are a few do's and don'ts, some very important points and some helpful hints. Please do not hesitate to call or email for assistance.

2. Summary of Features

- 3.8 to 9 volt operating range
- Integral 5 volt regulator for single battery operation
- Adjustable Tx end point limits
- Adjustable travel
- Adjustable battery monitoring with low battery shutdown
- Adjustable failsafe position for low battery shutdown
- Adjustable single or double ended Scaled Linear Travel
- Adjustable Input Deadband
- *Dynamic* Pulse Width Modulation MOSFET drive
- Thermal overload protection with automatic reset.
- Automatic shutdown when stalled
- Ball bearing output

3. Special *SmartWinch* Features

Dynamic Pulse Width Modulation

Servo systems use Pulse Width Modulation (PWM) to reduce power and speed as the desired position is approached. But the problem with standard P.W.M. is that as the desired position is approached, the reduction in power can cause the servo to stop short. This can result in excess power consumption and overheating. This is what's happening when a servo is not moving but is buzzing. However, unlike other winches and servos the *SmartWinch* has *Dynamic* PWM. If the *SmartWinch* controller detects that it has not reached the desired position, power is gradually increased until the desired position is reached. If the increase in power via DPWM is not sufficient then Stall Protection can apply.

Stall Protection

When a conventional servo becomes stalled, it will stay stalled until the problem is solved. If not solved in time, the battery can be flattened or motor and output transistors may be overheated and possibly damaged. But the *SmartWinch* knows

when it is stalled and can protect itself by shutting down. The *SmartWinch* then signals that it is stalled by sounding a two-tone beep at 2 second intervals until reset. Stall mode can reset by moving the Tx stick in the opposite direction. If this does not work, turn the *SmartWinch* off and on again.

Battery Monitoring

The *SmartWinch* can monitor the battery for low voltage. 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 the low battery shutdown position and hold there until the battery is replaced or voltage recovers when the SmartWinch will return to user control. See Table 1. Default is battery monitoring OFF.

Scaled Linear Travel (S.L.T.)

Travel response to the first 25% of Tx stick movement from full in when single ended or both ends when double ended is adjustable from 1:1 at minimum to a maximum of 4:1. For example, if 50% is selected, each increment of the first 25% of the stick range results in half the travel of the default setting. This feature is similar to exponential adjustment in a computer Tx. However scaled linear has the advantage of consistent incremental travel over the first 25% of stick movement whereas exponential is constantly varying. Default is 1:1.

Low Battery Failsafe Position

The default low battery failsafe position is booms half out. But this is only true if using a standard spool type drum. If a spiral drum is used then this position would be closer to full in and could make it difficult to get the boat ashore. To compensate for this the low battery failsafe position is also adjustable so you can choose to make it further out if desired. The range is from half to full travel.

Input Deadband

Input deadband is the amount dithering in the Rx signal that a servo can tolerate without responding to by constantly jittering. This is adjustable from 0.8 to 10 microseconds. Deadband adjustment allows the optimisation of TX fine trim control. The default setting is 5 microseconds.

Thermal Overload Shutdown.

The micro controller monitors the temperature of the output MOSFET transistors. Should they overheat due to high load the winch temporarily shuts down until the transistors have cooled enough to restart.

4. Batteries

Voltage Range

Absolute 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 > 15 volts is used.

Pack Size

The minimum pack is 4 cells of NiCad or NimH. The maximum is 6 cells NiCad or NimH or 2 cell LiPo. Capacity (mAh) has little effect on performance, only battery life.

Recommended battery types. (in order of preference for best performance)

*** 2 cell LiPo. Low voltage drop under load.

** NiCad or 6 Volt Gel Cell.

* NimH. High voltage drop under load causes loss of output power.

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. Battery packs should be fully soldered.

Battery Monitoring Voltage Levels Table 1

Level	Battery pack	Detect	Warn	Shutdown
1	4 cells	<=6.2	<=4.7	<=4.4
2	5 cells or 6V Gel	>6.2	<=5.7	<=5.0
3	6 Cells or 2 cell LiPo	>7.5	<=6.9	<=6.1
4	Battery Monitoring turned off			

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 a standard power rudder servo. This allows for the use of only one battery pack. The *SmartWinch* motor runs on the full battery voltage via the MOSFET output circuit. Please note that using high power servos for rudder can cause radio glitching.

Supply Leads

Wiring and connectors from ***SmartWinch*** supply leads to battery pack **must be at least 0.5mm² (20 AWG)** 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 can cause severe voltage drop between battery and ***SmartWinch*** and should not be used. All joints should be soldered and then coated with Vaseline petroleum jelly or Silicone grease to protect from corrosion (black wire). Use on servo connectors before inserting into the Rx as well.

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 MOSFET output circuit is likely to be ***seriously*** damaged.

Servo Connector (Rx Lead)

The connector supplied is compatible with most radio brands such as JR, Futaba, Hitec etc. Take care when inserting connector into receivers other than JR or Hitec. It is possible to insert the connector the wrong way around in some brands receivers. As the + lead is centre then reverse connection into the Rx will not do any harm except that the system will not work.

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)

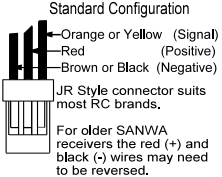

Fig. 1 Servo Connector

6. Standard Connections

In most cases the best circuit for *SmartWinch*, radio and battery is also the simplest as shown in figure 2.

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

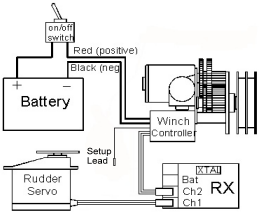

Fig. 2 Standard Connections

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 3. This is because the *SmartWinch* regulator may not be able to supply the current needed by extra servos resulting in voltage drop to the Rx.

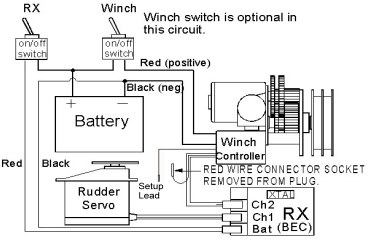

Fig. 3 Alternate Connections

Servo connector lead red wire ***must*** be disconnected when Rx battery socket in use. Remove the red wire socket from the connector and tape it back to the lead.

These circuits show the use of switches. Switches are not essential and can be omitted.

When power is connected directly into the Rx, make sure the Rx and servos can handle the full battery voltage. In most cases 6 cell NiCad / NimH or 2 cell LiPo can not be used in this configuration. In the case of those battery sizes being used for *SmartWinch* supply, a second 4 or 5 cell pack should be used for the Rx.

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 is 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 or Silicone grease to form a seal. Coat the two M3 mounting screws as well.

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 below to assist in below deck installation.

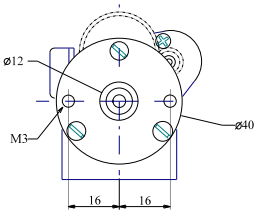

Fig. 4 Mounting Dims.

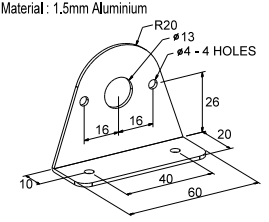

Fig. 5 Mount Bracket

9. Sheeting

Drum Size vs Performance

Unless specified otherwise when ordering, the 280ES and 280EL are supplied with a 26mm drum. The 280EF, 380ES and 380EH are supplied with a 32mm drum. If faster or slower performance is desired an extra drum may be purchased. Our web site has details of several other drum options.

Using a smaller diameter means more revolutions are required and 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. It's 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.

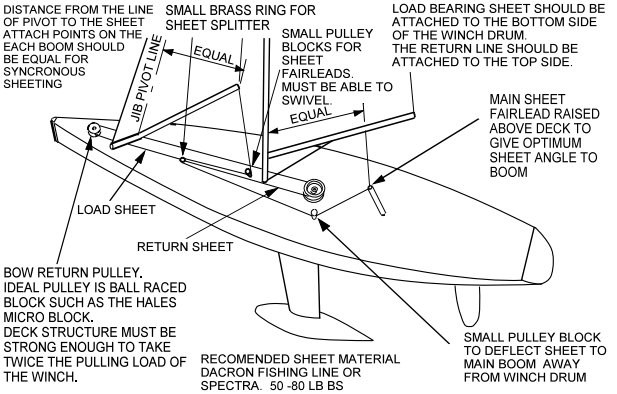

Fig. 6 Sheeting

10. Setup

Setup is completely different to all previous versions of the *SmartWinch*. The Tx no longer needs to be turned on and off or the servo lead plugged in and pulled out etc. Setup is now entered *after* the *SmartWinch* is started and operating normally via Tx control. Previously setup was entered during startup.

There are three separate setup procedures.

Setup 1 Tx end point limits and travel adjustment.

Setup 2 Battery monitoring On/Off (turning on automatically sets level).

Setup 3 Scaled Linear Travel, Low Battery Shutdown Position, Input Signal Deadband and Reset all settings to factory default.

These procedures are entered by the use of the single wire **Setup Lead**. (See figure 7) To enter the Setup modes, the Setup Lead is connected to a ground pin in the Rx for Setup 1 or Setup 2 and for Setup 3 it is connected to a signal pin. For normal operation, the Setup Lead may be connected to any spare positive (center) pin. Or it can be left disconnected. If at startup the Setup lead is connected to a signal or ground pin, the *SmartWinch* will beep rapidly and you will not be able to operate it until the lead is removed.

As per previous models, you don't have to do setup to operate the *SmartWinch* . The *SmartWinch* is supplied with default input signal limits 900 to 2100 microseconds pulse width, maximum travel (number of turns depends on model) and low battery shutdown turned off. However it is recommended that Tx end points and travel be set using this Setup 1 and not just by using end point adjustment (EPA) when available from your Tx. Setting travel by Tx EPA does not give overrun protection. The *SmartWinch* is a powerful servo and can do damage in the case of overrun.

As per earlier models, setup does not do anything but allow adjustment of travel etc. Do not waste your time attempting setup if the *SmartWinch* stops responding correctly for any reason. Ensure the *SmartWinch* is working ok with your radio gear before running setup. Setup may be done as often as you like. However, should the *SmartWinch* not behave as expected immediately after doing Setup then simply redo Setup.

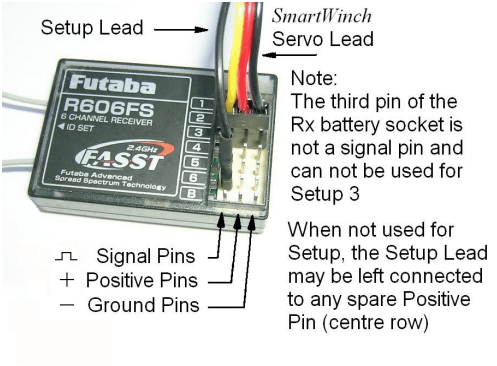

Figure 7 shows a typical multi channel Rx. The rudder servo lead is not shown here but it may be left in place while doing setup. However in the case of a two channel Rx then the rudder servo lead will need to be removed to access the signal pin for Setup 3. These instructions refer to the Ground pins. This is also often referred to as negative. "Ground" and "Negative" are interchangeable.

Before starting Setup 1, Setup 2 or Setup 3

* Read pages 8 and 9 first.
* Rudder servo may remain connected to Rx.
* For Setup 1, the drum must removed or no sheet lines on drum. This is only required for first time adjustment or after reinstallation.
* Setup 1 ***must*** have been done before Setup 2 or Setup 3 but does not need to be done each time Setup 2 or 3 is done.
* For Setup 2 or 3, the drum and sheets may be left attached.
* Batteries ***must*** be fully charged for Setup 2 (for turn on).
* The Setup Lead must be disconnected, the Tx turned ***ON*** and the *SmartWinch* also ***ON*** and responding to Tx control.

10.1 Setup 1 Tx End Points and Travel Adjustment

1 Tx stick at ***full in*** position and trim to ***minimum***.
Leave trim in this position throughout procedure.

2 Push Setup Lead onto Rx ground pin and wait for a beep.
About two seconds after connection there will be a one second long beep (like a phone ring) indicating that the Tx full in end point has been sampled.

3 Move Tx stick to ***full out*** position and wait for another beep.
The second beep indicates both Tx end points have been saved.
If *travel adjustment is* ***not*** *required then remove the Setup Lead* ***now*** *and the SmartWinch will automatically restart with the new limits.*
Or to adjust travel continue on to step 4.

4 Move Tx stick back to ***full in***.
SmartWinch will drive to its zero point then sound another beep.

5 If not already attached, fit drum and or sheets and set booms to full in.

6 Move Tx stick out till booms are at full out position.
Take care driving winch now as SmartWinch is set to full travel.
SmartWinch will run at low speed at this time.

7 With booms at ***full out***, remove Setup Lead from Rx.
The SmartWinch will then automatically restart with the new settings.

Notes:
If the *SmartWinch is* removed and reinstalled in same boat with the same Tx or if Rx only is replaced then Setup 1, 2 or 3do not need to be re-done. If the Tx is changed then only Setup 1 needs to be redone. If the Tx sail control channel is reversed then Setup 1 steps 1 to 3 must be redone.

If you have a computer radio, once travel is set, take care when adjusting Tx end points from the Tx. This will either reduce travel or result in dead stick.

It is recommended to set the booms closer in to center line than normal when setting up at step 5 (but not so tight that the *SmartWinch* is under load). Later when trimming sails for racing the Tx trimmer, EPA or ATL can be used to vary full in sail trim. This will not effect full out position.

If Tx trimmer was left in center at Step 1 and subsequently moved inward dead stick will occur. It is best to leave Tx trimmer at minimum for Setup 1.

10.2 Setup 2 Battery Monitoring

For a description of this feature, see page 2
Setup 1**MUST** have been done at least once with the same Tx before Setup 2.
Turn Tx and *SmartWinch* ***ON*** and ensure *SmartWinch is* responding to Tx.

1a To turn battery monitoring ***OFF***, put Tx Stick at ***full in***.
1b ***OR*** to turn battery monitoring ***ON***, put Tx Stick at ***full out*** .

2 Push Setup Lead onto Rx ground pin and wait for a beep.
Two seconds after connection there will be a one second long beep.

3 Do ***Not*** Move Tx Stick. Remove Setup Lead from Rx
1, 2, 3 or 4 beeps will sound indicating battery monitoring level set.
(See Table 1) SmartWinch will then restart itself with new settings.

What happens if the battery pack size (voltage) is changed?
If Battery Monitoring is turned off there are no implications when changing battery pack size. If Battery Monitoring is turned on then redo Setup 2. Changing to a lower voltage battery without redoing Setup 2 will result in premature shutdown. Changing to a higher voltage pack will result in over discharging of the battery if left on till Low Battery Shutdown occurs. Changing battery pack capacity (mAh) has no effect on these settings. Capacity only determines how long the pack will last before recharging is required.

10.3 Setup 3 S.L.T., Low Batt Shutdown, Deadband & Reset,

For a description of these settings, see page 2.
Setup 1MUST have been done at least once with the same Tx before Setup 3.
Setup 3 is locked out if the Setup 1 has never been run.
Start with Setup Lead out, Tx *On*, *SmartWinch* ***ON*** and responding to Tx control.
Drum **OFF** for Reset to default.

1 Place Tx stick at desired position.* *and trim at minimum*

2 Push the Setup Lead onto any RX signal pin. *Two seconds later there will be one quick beep per second for up to 10 seconds.*

3 Remove the Setup Lead ***immediately*** *(less than one second)* after the number of beeps corresponding to the setting to be adjusted (see table). *If you accidentally pulled the lead out at the wrong number of beeps(e.g. you pulled it at 4 but you meant it to be 3) then just restart the SmartWinch now and the setting will not change.*

4 To save the change, Reinsert the Setup Lead and pull it back out again. *The timing of this is not important. The SmartWinch will automatically restart with the new setting.*

Beeps	Setting
1	Single ended S.L.T.
2	Double ended S.L.T.
3	Low Battery Shutdown Position (LBS)
4	Input Signal Deadband (ISDB)
10	Reset ***ALL*** settings (Setup 1, 2 & 3) to default settings. Drum must be removed first.

Notes *: For SLT & ISDB, drive the *SmartWinch* (via Tx stick) to ***full in*** for ***minimum***, ***full out*** for ***maximum*** or any intermediate position as desired.
For LBS, place boom at desired shutdown position. The range available is half to maximum turns. A position of less than half will result in half turns position.
For Reset to default, stick position is not relevant.

If the lead is removed at a different number of beeps than a number from the table, or if the lead is not removed at all, the *SmartWinch* will not make any more beeps and will remain idle. It will need to be restarted. If the lead was left in, remember to remove it before restarting.

11. Maintenance

- Spray the winch motor only with water repellant lubricating sprays. Apply the spray directly *into* the motor. Avoid getting spray on electrical wires or feedback potentiometer and controller enclosure grommet. **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) or Silicone grease on all electrical connectors inside the yacht to protect against 'black wire' corrosion.

- Regularly re-pack the white petroleum jelly or Silicone grease under the drum of deck mounted winches to protect the ball bearing. Regularly remove the drum and re-coat the area around the shaft.

- Drain the boat of water as often as is required to keep the level of water in the boat to an absolute minimum. After each days sailing drain boat 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 should moisture get in.

- Try to keep gears clean. Greasing is not necessary for Acetal (black plastic) gears. The exception to this is the 380EH. The 380EH metal gears should be greased.

12. 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. If you wish to make a warranty claim, the winch must be returned directly to RMG Sailwinch.

13. Mechanical Specifications

Table 2

Specification	280EF	280ES (EL)	380ES (EH)	Unit
Max Power	7.8	10.7	14.3	Watts
No Load Speed	6.1	4.4(3.1)	3.5	revs/sec
No Load Speed	0.48	0.84 (1.06)	0.96	sec/300mm
Stall Torque	8.1	15.9 (19.9)	29.9	kg.cm
Standard Drum	32	26	32	mm
Maximum Turns	3.2	4.8 (6)	6 (9.6)	revs
Travel Range	40-320	70-405 (85-490)	80-610 (130 - 975)	mm
Dimensions	73x55x50	74x56x54	85x65x53	mm
Weight	134	134	168 (175)	gm

14. Electrical Specifications

Table 3

Specification	280EF	280ES (EL)	380ES (EH)	Unit
Idle (Stationary) Current	23	23	23	mAmps
No Load Running Current	450	550	650	mAmps
Stall Current	8	12	18	Amps
Maximum Supply voltage	9	9	9	Volts
Minimum Supply voltage	3.8	3.8	3.8	Volts

Performance specifications based on a constant voltage supply of 6V and standard drum size. Actual performance specifications will vary depending on supply battery voltage and drum size etc. Specifications may change.