

USER MANUAL

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RA00297

#90905

#90955

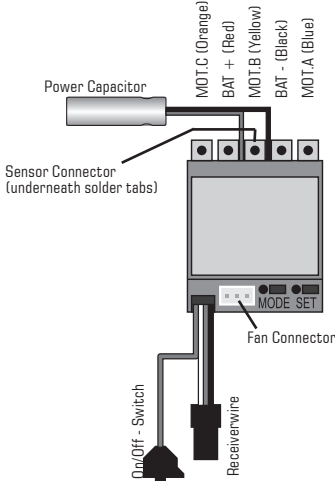
Brushless Competition
Speed Control



for distributor address see packaging

www.nosram.com

CONNECTIONS & EXPLANATIONS



RECEIVER CONNECTING WIRE: The Pearl Version 2 is equipped with a NOSRAM Multicon receiver wire. As supplied, it will easily fit in all ordinary receivers. Make sure you connect it to receiver with correct polarity and use channel 2.

SENSOR CONNECTOR: located underneath the solder tabs. The bi-directional multiple sensor wire connects the speed-control and the motor. Always use the sensor wire and do not alter or modify this cable! There are replaceable/optional hall sensor wires available, please refer to complete line-up at „Spare- & Optional-Parts“. Through this sensor connector, the Pearl Version 2 can also be updated with the latest software updates available at www.nosram.com using the optional „USB Bridge“. Please refer to chapter „Special Features“ for details

POWER WIRES: For maximum performance, flexible silicone power wires without any connectors are used. The unique splitted solder-tabs allow easy and convenient replacement of the power wires. Nevertheless some soldering skills are required. Avoid soldering longer than 5sec per soldering joint to prevent possible damage to the speed-control due to overheating of the components! There are full replacement power wire sets available, please refer to complete line-up at „Spare- and Optional Parts“.

HEATSINK: To achieve best performance even under extreme conditions, the heatsink has been directly mounted to the speed-control. This ensures the best possible heat transfer away from the speed-control.

Caution: Never attempt to remove the heatsink or your Pearl Version 2 may get damaged if you try to do this. The heatsink is an integral part, glued to the fet's and therefore cannot be removed.

PLUGGED FAN (Pearl ISTC Version 2 #90955 only!): your speed-control contains a high-performance low-profile (25x25x7mm) fan and blue anodised aluminium screws. The fan can be mounted on top of the heatsink and should be used for tough applications in hot conditions such as TC Modified or 4wd OffRoad. As a guideline we recommend using the fan when using 2S LiPo and motors with less than 5.0T. The fan get's plugged into the 3-pin connector on the front and there is a replacement fan set available, please refer to complete line-up under point „Spare- and Optional Parts“. On Pearl Evolution Version 2 (#90905) model you can also connect an optional fan to the same „port“ if needed.

INSTALLATION TIPS

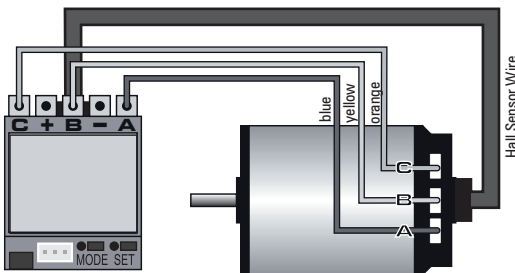
- Position the speed-control and capacitor where they are protected in the event of a crash and gives you easy access to the connectors and buttons.
- Mount the speedo and capacitor using the supplied thick/black doubled-sided tape
- Make sure there is enough clearance between the speed-control, power-wires, antenna and receiver. Avoid any direct contact between power components, the receiver or the antenna as this can cause interference. If interference occurs, position the components at a different place in the model.
- The aerial should be run vertically up and away from the receiver. Avoid contact with any parts made of carbon fibre or metal. If the aerial is too long, don't coil up the excess length. See also the instructions supplied with your radio control system.

WIRES & INSTALLATION

The Pearl Version 2 comes supplied with flexible 3.3mm² silicone power-wires without connectors. Be very careful with the correct wire sequence/colors since an incorrect connection may damage the speed-control! Avoid creating solder bridges on the solder-tabs and isolate all connections carefully.

Caution: Avoid soldering longer than 5sec per soldering joint when replacing the power wires on the speed-control and motor to prevent possible damage due to overheating of the components!

- Connect the speed-control to the receiver (position: Channel 2)
- Blue power-wire → Speedo MOT.A to motor „A“
- Yellow power-wire → Speedo MOT.B to motor „B“
- Orange power-wire → Speedo MOT.C to motor „C“
- Connect the hall sensor cable to the speed-control (underneath the solder-tabs) and the motor.



- Doublecheck all connections before connecting the speed-control to a battery.
- CAUTION:** If battery is connected with reversed polarity it will destroy your speed-control!
- Red power-wire → Speedo BAT+ to battery „Plus“
- Black power-wire → Speedo BAT- to battery „Minus“
- The speed-control is now ready to be set-up

Dear Customer,

thank you for your trust in this NOSRAM product. By purchasing a „Version 2“ of NOSRAM's Pearl Evolution / Pearl ISTC brushless speed-control, you have chosen one of the most advanced and successful speed-controls of today. This speed-control with all of its high-tech features and specially selected electronic components is one of the best speed-controls currently available on the market. IFMAR World Champion!

- 100% Brushless Competition
- Dual XPS^{MD} Power Profiles
- SuperBEC for 1S to 2S LiPo without receiver pack
- Full Contact Cooling Technology
- 3-way Protection System 2
- USB Software Updateability
- „Boost 0“ Mode with disabled timing
- SmartCell System 2
- SmartTemp Readout 2
- Small footprint

Please read the following instructions carefully before you start using your speed control. This user guide contains important notes for the safety, the use and the maintenance of this product. Thus protecting yourself and avoid damages of the product.

Proceed according to the user guide in order to understand your speed control better. Please take your time as you will have much more joy with your product if you know it exactly.

This user manual shall be kept in a safe place. If another customer is using this product, this manual has to be handed out together with it.

SPECIFICATIONS

	#90905	#90955	#90905	#90955
Pure Brushless Competition	yes		SuperBEC	6.0V/3.0A
Forward/Brake	yes		Full Contact Cooling Technology	yes
Footprint	30.5x33.0mm		All new brake design	yes
Height	16.0mm	21.0mm	„Boost 0“ Mode	yes
Weight (excl. wires)	30g	36.0g	3 Way Protection-System 2	yes
Voltage Input	3.7-7.4V		SmartTemp Readout System 2	yes
Typ. Voltage Drop* @20A	0.011V / phase		Blue LED	yes
Rated Current*	400A / phase		Power Wires	3.3mm ²
Compatible winding styles	Star		USB Software Updateability	yes
Rec. Motor Limit (@4V)	>4.5T	>3.0T	4 adjustable Modes (SCS2, Dual XPS ^{MD} , Autobrake)	yes
Plugged Fan	optional	yes		

* Transistors ratings at 25°C junction temperature

Specifications subject to change without notice.

RADIO / SPEEDO SETUP

In setup mode the Pearl Version 2 stores every step (e.g. learning your radios neutral and endpoints) when you press the SET button. All the settings will be stored in the Pearl Version 2's memory even if it will be disconnected from the battery.

TRANSMITTER SETTINGS

Setup the following basic functions on your transmitter (if available):

Description	other names in radio	Required Setting
Throttle Travel	High ATV, EPA	100%
Brake Travel	Low ATV, EPA, ATL	100%
Throttle Exponential	EXP, EXPD	start with 0
Neutral Trim	SUB Trim	centre
Servo Reverse	Throttle Reverse	any setting, don't change after set-up procedure!

If your transmitter doesn't offer any of above functions, it's already in „basic setup“ mode.

- Ensure that the speed-control is not connected to the drive battery and is switched off.
- Remove motor pinion or ensure that the wheels of the model are free to rotate.
- Switch the transmitter on and set the transmitter throttle stick to neutral.

- Connect the speed-control to the battery and switch the unit on.
- Hold the SET button pressed for at least 3sec.
→ You entered setup mode and the SET LED flashes blue (it will flash until the setup is completed).

- Leave transmitter in neutral position and press the SET button once.
→ Neutral setting is stored, MODE LED flashes yellow and the motor beeps.
- Hold full throttle on transmitter and press the SET button once.
→ Full-throttle setting is stored, MODE LED flashes red.
- Hold full brake on transmitter and press the SET button once.
→ Brake setting is stored, LED's glow red (MODE) and blue (SET).

- This completes the setup procedure and your Pearl Version 2 is ready to use.
- If you make a mistake during the setup procedure, don't worry: Disconnect the battery for about 10sec and start again from the first step.
- At the end of each run switch of the car, and then switch off the transmitter.
- At the start of each run switch on the transmitter first, then switch on the car.
- For storage of the car, disconnect the drive battery at any time!

Team advice: A good starting point for the brake setting on your radio is 80% for all classes. Make sure you do the radio-setup with all settings on the radio on 100% and then decrease brake strength to 80%!

CHECKING THE FUNCTIONS:

Check the LED's when moving your throttle stick and you will see if everything is setup correctly.

Function	Status	Mode LED	Set LED
Neutral	--	off	blue
Neutral (when „Boost“ = value 0)	--		flashes blue
Forward	partial throttle full	yellow	off blue
Brake	partial brake full	red	off blue

SPARE- & OPTIONAL PARTS

NOSRAM offers a comprehensive line of accessories, as well as particular spare- and optional items. Here you find an overview, for a full picture please visit our website at www.nosram.com:

- #92505 Power-Wire Set Brushless 2.6mm² (red, black, blue, orange, yellow)
- #92506 Power-Wire Set Brushless 3.3mm² (red, black, blue, orange, yellow)
- #92507 3.3mm² Powerwire black (1.0m)
- #92508 3.3mm² Powerwire red (1.0m)
- #92511 Low Profile cooling fan
- #925307 Sensor-Wire „HighFlex“ 70mm
- #925310 Sensor-Wire „HighFlex“ 100mm
- #925315 Sensor-Wire „HighFlex“ 150mm
- #925320 Sensor-Wire „HighFlex“ 200mm
- #92531 Pearl Version 2 Powercapacitor „HighPerformance“ 6.0-7.4V
- #92591 Hardcore Motor Cooler (Motor Heatsink + Fan)
- #92500 USB Bridge - Speedo Firmware Update + PC-Link



The crossed-out wheeled bin means that within the European Union the product must be taken to separate collection at the product end-of-life. Do not dispose of these products as unsorted municipal waste.

MODE PROGRAMMING

The Pearl Version 2 features 4 modes which enable you to adjust it 100% to YOUR special requirements. The factory settings are shown in grey colour.

- How to get into „programming the modes“ → Press MODE button for 3 or more seconds.
- How to check the stored values → Count the number of flashes of the blue SET-LED (* = value 1 | ** = value 2 | etc.).
- How to change the value → Press SET button to increase value by one step.
- How to get to the next Mode → Press MODE button once.
- How to leave the programming mode → If you are in MODE.4, press the MODE button one more time, which will also store the settings!

Important: do not turn the switch off before leaving Mode 4 (by one more press of MODE button) as otherwise your recent changes won't be stored in the memory of the Pearl Version 2!

Table of settings, values and modes: see below (grey-shaded values show „works default settings“)

MODE.1 (SCS2): allows you to adjust the cut-off voltage precisely depending on the battery type you use:

MODE LED	Remark	#0	#1	#2	#3
Yellow	Cut-Off Voltage use for	disabled	3.2V 1S LiPo	4.4V 2S LiFePo	6.4V 2S LiPo

Caution: the most common reason for „unexpected“ shutdown is using the wrong value in this mode!

MODE.2 (Dual XPS^{MOD} - „Feel“): allows you to adjust the Pearl Version 2 throttle feel to your likes. Either you run OnRoad or OffRoad, on slippery or high-traction surfaces, we have incorporated a profile for you! Higher value means more aggressive throttle response.

MODE LED	Remark	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10
Red	Response			0				00	000	0000	00000
	Current Limiter	0	00	000	0000				Off		
	Throttle Map			-expo				linear			+expo

MODE.3 (Dual XPS^{MOD} - „Boost“): the „Boost“ adjustment is Nosram's active motor timing system, depending on many different factors (current, throttle position, RPM, etc) the software calculates the perfect commutation

MODE LED	#0	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10
Yellow/Red (alternate)	disabled	Going from mildest to most aggressive timing profile (value 1 = minimum / value 10 = maximum)									

Caution: too high „Boost“ values increase motor temperature excessively and in the worst case may damage your motor, make sure you find the best performance by increasing values step by step carefully!

Advice: if value #0 is chosen for Mode.3 the blue LED will flash in neutral position in normal operation to indicate that entire timing advancement is disabled completely for „true stock racing“ as required by certain federations!

MODE.4 (Automatic Brake): called auto- or drag-brake. This function allows you to set a slight braking action which is applied in the neutral range.

MODE LED	#0	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10
Yellow/Red (same time)	disabled	Going from lowest to highest automatic brake setting (value 1 = minimum / value 10 = maximum)									

TROUBLESHOOTING GUIDE

To eliminate all other possibilities or improper handling, first check all other components in your model and the trouble shooting guide before you send in this product for repair. If products are sent in for repair, which do operate perfectly, we have to charge a service fee according to our pricelist. Always check error by checking LED error code first, this gives you a good indication were to search!

SYMPTOM	CAUSE	REMEDY
Servo is working, no motor function	Speedo plugged in incorrectly	Plug speedo to receiver as Ch.2
	3-way protection System activated	Check settings for your application
	Wiring problem	Check wires and connectors
	Sensor wire missing/defective	Install/replace sensor wire
	Motor defective	Replace motor
No servo and no motor function	Speedo defective	Send in product for repair
	Speedo connected to receiver with wrong polarity	Connect speedo with correct polarity
	Wiring problem	Check wires and connectors
	Battery defective	Replace with different battery pack
	Crystal, receiver or transmitter defective	Replace components one by one
Motor stutters while accelerating	Speedo defective	Send in product for repair
	Sensor wire defective	Replace sensor wire
	Motor or sensor board in motor defective	Replace sensor board or motor
	Radio interference	Change location of components
	Power capacitor damaged	Replace power capacitor
Motor runs in reverse when accelerating forward on radio	Speedo defective	Send in product for repair
	Model with reversed gearbox!	Can not use a sensored brushless system!
	Insufficient performance. E.g. poor power, topspeed or brake	Adjust gear ratio
	False settings on Dual XPS ^{MOD} „Boost“	Adjust settings under Dual XPS ^{MOD} „Boost“
	Transmitter settings changed after set-up	Repeat set-up procedure
Speed-control switches off frequently	Power Capacitor damaged	Replace Power Capacitor
	Motor or sensor board in motor defective	Replace sensor board or motor
	Speed-control defective	Send in product for repair
	Wrong setting in SCS2 (Mode.1!)	Change value of SCS2 (Mode.1) accordingly
	Model used too often without cool-down periods	Let cool down after every run
Motor never stops, runs at constant slow speed	Motor stronger than motorlimit or input voltage too high	Use only motors and batteries which are within the specifications of the speed-control
	Stuck drivetrain or ball-bearing	Maintain model
	Motor defective	Replace motor
	Transmitter settings changed after set-up	Repeat set-up procedure
	Humidity/water in speedo	Immediately unplug and dry speedo
Radio interference	Motor or sensor board in motor defective	Replace sensor board or motor
	Receiver or antenna too close to power wires, motor, battery or speedo. Receiver aerial too short or coiled up	See „Installation Tips“ and „Installation“
	Receiver defective, too sensitive	Replace components one by one
	Transmitter defective, transmitter output power too low, servo problem	Only use original manufacturers crystals
	Poor battery connection	Check plugs and connecting wires
Transmitter batteries empty	Replace / recharge transmitter batteries	

REPAIR PROCEDURES / LIMITED WARRANTY

All products from NOSRAM are manufactured according to the highest quality standards. NOSRAM guarantees this product to be free from defects in materials or workmanship for 90 days (non-european countris only) from the original date of purchase verified by sales receipt. This limited warranty doesn't cover defects, which are a result of misuse, improper maintenance, outside interference or mechanical damage.

- „This applies among other things on:
- Cut off original power plug or not using reverse polarity protected plugs
 - Receiver wire and/or switch wire damaged
 - Mechanical damage of the case
 - Humidity/Water inside the speed control
 - Mechanical damage of electronic components/PCB
 - Soldered on the PCB (except on solderpads)
 - Connected speed-control with reversed polarity“

To eliminate all other possibilities or improper handling, first check all other components in your model and the trouble shooting guide, if available, before you send in this product for repair. If products are sent in for repair, which do operate perfectly, we have to charge a service fee according to our pricelist.

With sending in this product, the customer has to advise NOSRAM if the product should be repaired in either case. If there is neither a warranty nor guarantee claim, the inspection of the product and the repairs, if necessary, in either case will be charged with a fee at the customers expense according to our price list. A proof of purchase including date of purchase needs to be

SPECIAL FEATURES

Dual XPS^{MOD} Power Profiles: an absolute novelty, independent adjustment of „Feel“ and „Boost“ to make the Pearl Version 2 universal for all racing classes, motors, cell voltages and personal driver preferences!

„Feel“: the „Feel“ adjustment allows you to set the feel of the speed-control to your likes, it's a combination of current limiter, throttle map and other (secret) factors which the software alters depending on the status of the car (start, acceleration, full speed). Higher profiles result in more aggressive throttle response, so normally for applications on slippery surfaces lower „Feel“ settings are strongly recommended which give you best car control.

„Boost“: the „Boost“ adjustment is Nosram's active motor timing system, depending on many different factors (current, throttle position, RPM, etc) the software calculates the perfect commutation and timing.

Caution: correct profiles, especially for Mode.3, heavily depend on motor type and mechanical motor timing. So if you change to another motor type or another wind always start with a low setting on Mode.3 and monitor the motor temperature frequently during the run!

Advice: if value #0 is chosen for Mode.3 the blue LED will flash in neutral position in normal operation to indicate that entire timing advancement is disabled completely for „true stock racing“ as required by certain federations!

Please visit download area at www.nosram.com for „Boost“ factory recommendations for all applications!

SuperBEC: a true BEC revolution! Constant 6V/3A output with input voltages from 3.0 to 7.4V, no need for a receiver battery or booster circuit even with 1S LiPo as the Pearl Version 2 uses a unique internal design using buck/boost technology for BEC to power receiver and servo as well!

SCS2 (SmartCell System 2): Nosram's exclusive SCS2 ensures that all batteries (LiPo/NiMH/LiFePo) can be used safely without accidentally deep-discharging of the cells. In case of a shutdown, when cell voltage has reached set cut-off voltage, the motor function will be disabled and the LED's will indicate that a shutdown has occurred due to undervoltage (see chart below for error code 's!).

Caution: WorksDefault setting has cut-off disabled!

Smart Temp Readout System 2: allows you to read-out the maximum internal temperature that the speedo and motor have reached during the run. You can conveniently read-out the temperature back in the pits since it remains stored until you turn it on the next time regularly (which will reset the memory). This feature allows you to accurately check if all is running well or if you're close to the limit already.

How to read-out the temperature:

- switch at „OFF“ position.
- keep MODE button pressed while you turn switch to „ON“ (then release button).
- at first speed-control temperature will be indicated.
- SET LED will start to flash blue (MODE LED's are off) ...
- count the number of flashes. The higher the number, the hotter the speedo ran (shutdown at 10 flashes).
- to change to motor temperature read-out, press MODE button one more time.
- SET LED will start to flash blue (MODE LED's are off) again, for motor the LED's are on time will be shorter.
- count the number of flashes. The higher the number, the hotter the motor ran (shutdown at 10 flashes).
- every flash below 10 equals to 5°C temperature decrease.

Temperature chart (speed-control and motor temperature):

#1	#2	#3	#4	#5	#6	#7	#8	#9	#10
> -45°C	40°C	-35°C	-30°C	-25°C	-20°C	-15°C	-10°C	-5°C	Shut-down
> -81°F	-72°F	-63°F	-54°F	-45°F	-36°F	-27°F	-18°F	-9°F	

Caution: motor temperature read-out only works if motor has a built-in NTC temperature sensor!

All New Brake Design: the best got perfected further! A superlinear feeling with an even stronger pushbrake and 10 fine steps for almost infinite adjustments of autobrake!

Team advice: A good starting point for the brake setting on your radio is 80% for all classes. Make sure you do the radio-setup with all settings on the radio on 100%!

3-Way-Protection-System: new and improved protection system which also informs you the cause of the shutdown with a special LED flashing sequence. You can indicate that a shutdown occurred when blue SET LED flashes very fast and the „error code“ (= cause for shutdown) is indicated by the MODE LED's as explained in table below.

Error Code LED flashing sequences:

Error Code	Mode LED's	Set LED	Reason	Possible Cause
#1	Yellow	Blue (fast flashing)	Speed-Control Thermal Shutdown	1. too high settings for Dual XPS ^{MOD} „Boost“?
#2	Red		Motor Thermal Shutdown	2. too high gear ratio?
#3	Yellow/Red (alternate)		Battery Low Voltage Cut-Off	3. too low motor wind for application?
				4. too high mechanical motor timing?
#4	Yellow/Red (same time)	Motor Failure	1. sensor wire missing or defective?	
			2. drivetrain stuck?	
			3. motor defective (locked rotor, damaged sensor)?	

Changing Mode settings without the transmitter: At race events you usually do not have access to your transmitter, but never mind since you can simply disconnect the receiver lead from the receiver and change the MODE settings as described at „Mode Programming“.

Works-Default-Settings: All Nosram speed-controls come factory-adjusted (defaults are grey-shaded above). If you loose track of the modes, you can restore the works default settings. With the transmitter switched on, hold the SET button pressed while you switch on the speed-control. This returns the unit to the works default settings.

Power Capacitor: Never run without a power-capacitor! It offers increased punch and additional protection, it must be connected to BAT+ and BAT- solderpads with shortest possible wires. There are optional power capacitors available, see „Spare- & optional parts“.

Full Contact Cooling: another first, achieved by NOSRAM! The revolutionary Full Contact Cooling Technology for lowest running temperatures, a special copper core bonds the bottom side fet's to the heatsink for even cooling of all fet's which results in higher power towards the end of the run and a lower motorlimit.

Pure Brushless Forward/Brake Design: uncompromising and outstanding performance for top level competition was the target for the Pearl Version 2! Therefore the Nosram engineering team developed a pure forward/brake brushless competition speed-control. There is no reverse function and no brushed operation.

USB Software Updateability: Through the sensor connector the Pearl Version 2 can be updated to the latest firmware available for download at www.nosram.com. The optional „USB Bridge - Speedo Firmware Update + PC-Link“ (#92500) and a PC are required to do so, please refer to Nosram website or the interface manual for exact details how to do Software Updates.

included. Otherwise, no warranty can be granted. For quick repair- and return service, add your address and detailed description of the malfunction.

If NOSRAM no longer manufactures a returned defective product and we are unable to service it, we shall provide you with a product that has at least the same value from one of the successor series.

The specifications like weight, size and others should be seen as guide values. Due to ongoing technical improvements, which are done in the interest of the product, NOSRAM does not take any responsibility for the accuracy of these specs.

NOSRAM-Distributor-Service:

- Package your product carefully and include sales receipt and detailed description of malfunction.
- Send parcel to your national NOSRAM distributor.
- Distributor repairs or exchanges the product.
- Shipment back to you usually by COD (cash on delivery), but this is subject to your national NOSRAM distributor's general policy.