USER MANUAL

Firmware v1.4

80960 Flow Competition
80970 Flow WorksTeam

Brushless Competition
Modified + Stock Profiles
Linear BEC 6.0V/3.0A
USB Software Updateability

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LRP
/ ▪▪▪▪▪ ▪ BLUE IS BETTER

Thank you for your trust in LRP products. By purchasing an *LRP Flow Competition* / *LRP Flow WorksTeam* brushless speed-control, you have chosen one of the most advanced 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 Technology!

- Pure Brushless Competition
- Perfect for Modified- AND Stock-Racing
- Bulletproof 6V/3A Linear BEC
- LowResistance PowerPCB with U-soldertabs
- Full aluminium case/heatsink design
- Fully adjustable with 7 setting modes
- 125% faster microcontroller
- USB Software Updateability

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

	80960	80970
Rec. Motor Limit (@7.4V)	>9.5T	>3.0T
Pure Brushless Competition	yes	
Forward/Brake	yes	
Case Size (BxLxH)	32x34x21mm	
Weight (excl. wires)	38g	40g
Full aluminium case/heatsink	yes	
Voltage Input	3.7-7.4V	
Typ. Voltage Drop @20A per phase*	0.022V	0.011V
Rated Current per phase*	200A	400A
Compatible winding styles	Star	

	80960	80970
Plugged 30x30mm Fan	optional	yes
LinearBEC	6.0V/3.0A	
Multi-Mode Profile adjustment	yes (7)	
„Boost 0" Mode	yes	
X-Brake Pro	yes	
Multi-Protection-System 3	yes	
Internal-Temp-Check System 3	yes	
Power Wires	3.3mm²	
USB Software Updateability	yes	

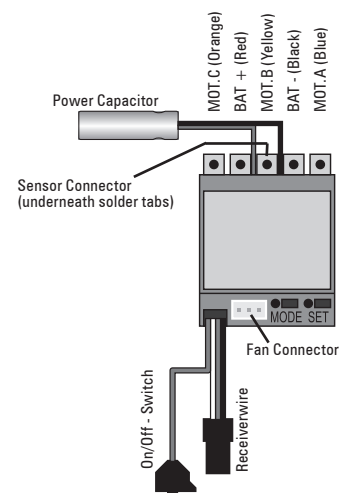Specifications subject to change without notice.

User Interface

As known from LRP, fast & simple trackside adjustments are a must have and therefore we continue using our user interface using two buttons and several LED's which indicate you correct operation, the mode's and settings you have selected, etc.

A ✳ inside the LED symbolises a flashing LED.

red blue yellow green
🔴 🔵 🟡 🟢
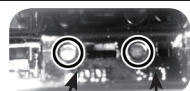
MODE
button & LED
(red/blue/yellow)

SET
button & LED
(green)

Connections & Explanations

MOT.C (Orange)
BAT + (Red)
MOT.B (Yellow)
BAT - (Black)
MOT.A (Blue)

Power Capacitor

Sensor Connector
(underneath solder tabs)

MODE SET

Fan Connector

On/Off - Switch

Receiverwire

Receiver Connecting Wire: the *Flow* is equipped with an LRP 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 multipole sensor wire connects the speed-control and the motor. Always use the sensor wire and do not alter or modify this cable!
Through this sensor connector, the *Flow* can be updated with the latest software updates available at www.lrp.cc using the optional „USB Bridge #81801".

Power Wires: For maximum performance, flexible 3.3mm² silicone power wires with no connectors are used. The new splitted solder U-tabs allow easy and convenient replacement of the power wires. Avoid soldering longer then 5sec per soldering joint to prevent possible damage to the speed-control due to overheating of the components!

Heatsink: To achieve best perfomance 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.

Plugged Fan (#80970 only!): your speed-control contains a low-profile cooling fan (30x30x6mm) and mounting crews. The fan mounts on top of the heatsink and should be used for tough applications such as TC Modified or 4wd OffRoad. As a guideline we recommend using the fan when using motors with 5.5T or lower with 2S LiPo batteries. The fan get's plugged into the 3-pin connector on the front.

Installation Guide

- Position the speed-control where it is protected in the event of a crash and give you easy access to the connectors and buttons.
- Mount the speed-control 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.

Connection to receiver, motor and battery:
- Connect the speed-control to the receiver (position: Channel 2)
- Connect the speed-control to the brushless motor
  - A (blue wire)   ➔   to motor „A"
  - B (yellow wire)   ➔   to motor „B"
  - C (orange wire)   ➔   to motor „C"
  - + hall sensor cable.
- 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!
- Connect the speed-control to your battery.
  - + (red wire)   ➔   to battery „Plus"
  - - (black wire)   ➔   to battery „Minus"

The speed-control is now ready to be set-up.

USB Software Updateability

Be aware that the *Flow* can only be updated with the latest USB-Bridge Spec.2 (#81801) and is not supported by the older #81800 USB-Bridge!

The new #81801 bridge does support all previous speed-controls as well of course. Through the sensor connector the speed-control can be updated to the latest firmware available for download at www.LRP.cc. The optional USB-bridge and a computer are required to do so, please refer to exact details in USB Bridge manual.

Calibrate Speed-Control to Radio

In setup mode the speed-control stores every step (e.g. learning your radios neutral and endpoints) by pressing the SET button. All the settings will be stored in the memory even if it will be disconnected from the battery.

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

Throttle Travel	High ATV, EPA	100%
Brake Travel	Low ATV, EPA, ATL	100%
Throttle Exponential	EXP, EXPO	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 SET button pressed for at least 3sec. Green SET LED will be on while you press SET button and once it entered radio calibration both blue and green LED's will flash (the green LED will continue flashing during entire setup procedure).

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

- This completes the setup procedure and your *FLOW* 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.
- For storage of the car, disconnect the drive battery at any time!

Function	Status			
Neutral	⚪ 🔵 ⚪ ⚪
Neutral (when „Boost Zero" enabled)	⚪ ✳ ⚪ ⚪
Forward	partial throttle	⚪ ⚪ 🟡 ⚪
	full throttle	⚪ ⚪ ⚪ 🟢
Brake	partial brake	🔴 ⚪ ⚪ ⚪
	full brake	🔴 ⚪ ⚪ 🟢

Multi Protection System 3

Our MPS3 informs you about the cause of the shutdown by special LED flashing sequence, the green SET LED will flash quickly to indicate there is an error and the MODE LED's will tell you the „error code" (= cause for shutdown).

Error Code LED flashing sequences:

red blue yellow green	Error Type	Possible Reason
🔴⚪⚪ ✳	Motor Thermal Shutdown	1. too aggressive settings for timing modes? 2. too high gear ratio? 3. too low motor wind for application? 4. too high mechanical motor timing?
⚪🔵⚪ ✳	Battery Low Voltage Cut-Off	1. battery empty or wrong cut-off voltage selected? 2. battery damaged? 3. motor too strong for battery discharge capability? 4. poor connection (bad connector, bad soldering joint)?
⚪⚪🟡 ✳	Speed-Control Thermal Shutdown	1. too aggressive settings for timing modes? 2. too high gear ratio? 3. too low motor wind for application?
🔴🔵⚪ ✳	Locked Rotor protection	1. defective motor (rotor does not spin)? 2. drivetrain stuck?
🔴🔵🟡 ✳	Sensor Wire Issue	1. sensor wire missing or defective?

Active power reduction at critical temperatures: in case you're getting near critical motor- or speed-control temperature the speed-control will automatically switch to „Boost0" mode during operation. This function allows you to finish your run or at least reach the pitlane at slightly reduced speed.
Info: the critical temperature, at which this protection activates, is 9 flashes!

You can easily indicate this has happened in case the blue LED flashes (which means the speedo is in „Boost0 mode") after the run, even tough you started with torque- or boost-timing enabled. For your next run (after switching off/on) your choosen profiles will be active again and not „Boost0".

Internal-Temp-Check System 3: allows you to read-out the maximum internal temperature that the speedo and motor have reached during the run. You can convienently 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 shutdown already.

Shutdown occurs at 10 flashes and you should not exceed 8 flashes during normal use for both motor- and speed-control temperature. Please adjust your profiles, gearing and motor accordingly, so you stay within these safe limits. Every flash below 10 equals to 5°C temperature decrease.
Caution: motor temperature read-out only works if motor has a built-in NTC temperature sensor!

At your own risk: if you wish to disable motor temperature cut-off completely you can do so by using value 0 in Mode7. We call this function „Hardcore Racing Mode" as it also disables the cell-voltage cut-off.
The speed-controls thermal cut-off system can not be disabled!

How to read-out the temperature:
➔ switch in „OFF" position, keep MODE button pressed while you turn switch to „ON" (then release button).
➔ at first speed-control temperature will be indicated
  • count the number of flashes of the green LED (other LED's must be off).
➔ to change to motor temperature read-out, press MODE button one more time.
  • count the number of flashes of the green LED (other LED's must be off).

Temperature chart, e.g. „How close to shutdown?" for speed-control and motor:

	#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	Shutdown
	> -81°F	-72°F	-63°F	-54°F	-45°F	-36°F	-27°F	-18°F	-9°F	

Mode Programming

The *Flow* features 7 modes which enable you to finetune it in detail to YOUR special requirements. The factory settings are shown in grey colour.

• **How to get into „Mode Programming"**	➔ Press MODE button for 3 or more seconds.
• **How to check the stored values**	➔ Count the number of flashes of the green 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.7, press the MODE button one more time, which will also store the settings!

Important: do not turn the switch off before leaving Mode 7 (by one more press of the MODE button) as otherwise your recent changes won't be stored in the memory of the *Flow*!

Take your time to understand the different mode's and it's parameters, profiles and functions. Otherwise you will not fully benefit from the latest achievements built into this speed-control.

Special Features (further explanations)

Boost0 Racing: the blue LED will flash in neutral trigger position, to indicate that entire timing advancement is disabled for „true stock racing", as required by certain federations.
Boost0 is enabled when Mode3+4 are set to #0 value (then Mode5+6 will not be visible).

Linear BEC: a powerful linear 6V/3A output has been integrated, which offers bulletproof + stable voltage to the receiver + servo.
Keep in mind that even the strongest BEC may suffer from a faulty servo or cooling fans, so if you run into trouble with unstable voltage supply or unexpected receiver problems make sure that you also check the servo and fan(s) as it is known that certain digital servos draw excessive currents and cooling fans can get damaged.

1S LiPo Usage: the *Flow* can operate with lower input voltage then 7.4V but be aware that you need to run a receiver battery or „RX-booster" when you're using a 1S LiPo or 4cell NiMH battery pack as it doesn't have a built-in booster.
Connect a suitable receiver pack directly to the receiver and leave the switch in off position. Make sure the receiver packs voltage is within your receivers & servo's limitations.

On/Off Switch: unique design, please read! The switch operates as „active low", this means if you cut-off the switch the speed-control will always be turned on and not off! The reason is, that in case the switch gets damaged in a crash and fails, you'll still be able to complete your run with no switch!
In case you'd prefer running without the On/Off switch and want the speed-control to be turned on instantly once you connect it to a battery, you must remove the switch and not connect the two wires which go to the switch! On the other hand if you use 1S batteries and a receiver battery pack or BEC-booster you should bridge the switch wires to leave the speed-control in Off position.

Adaptive Brake Response: newly revised X-Brake Pro with sharper response and super-linear feeling! 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%!

Changing Mode Settings without the Transmitter: with FM radio's you simply disconnect the receiver lead from the receiver and change the MODE settings on the speed-control as described under „Mode Programming". With 2.4GHz radios you don't even need to unplug the receiver lead!

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

Lower Motor Temperatures: our further sophisticated software with improved commutation algorithm and the improved hardware result in further reduced motor operating temperatures.

Fading Compensation: a special algorithm compensates the feeling that the car may act slightly different with fully charged batteries vs. semi-full batteries. This algorithm takes that into account and compensates for that offset, so the feeling should remain closely the same for the entire run.

Power Capacitor: Never run without a power-capacitor! It is needed for protection and increases punch, it must be connected to BAT+ and BAT- solderpads with shortest possible wires.

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
Motor overheats	False settings in timing modes	Adjust settings of timing modes
	Too high mechanical motor timing	Decrease mechanical motor timing
	Too little motor cooling	Add cooling fan and/or heatsink
Insufficient performance. E.g. poor power, topspeed or brake	Wrong Gear ratio	Adjust gear ratio
	False settings in timing modes	Adjust settings of timing modes
	Transmitter settings changed after set-up	Repeat set-up procedure
	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
Servo is working, no motor function	Speedo plugged in incorrectly	Plug speedo to receiver as Ch.2
	Multiprotection 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
	Speedo defective	Send in product for repair
No servo and no motor function	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
	Speedo defective	Send in product for repair
Motor stutters while accelerating	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
	Speedo defective	Send in product for repair
Motor runs in reverse when accelerating forward on radio	Model with reversed gearbox!	Can not use a sensored brushless system!
Speed-control switches off frequently	Wrong cut-off voltage setting (Mode.7)!	Change cut-off voltage setting accordingly
	Model used too often without cool-down periods	Let cool down after every run
	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
Motor never stops, runs at constant slow speed	Transmitter settings changed after set-up	Repeat set-up procedure
	Humidity/water in speedo	Immediately unplug and dry speedo
	Motor or sensor board in motor defective	Replace sensor board or motor
Radio interference	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; Transmitter defective, transmitter output power too low, servo problem	Replace components one by one Only use original manufacturers crystals
	Poor battery connection	Check plugs and connecting wires
	Transmitter batteries empty	Replace / recharge transmitter batteries

●●● *** Mode.1 ▶ Automatic Brake

Remark	Units	#0	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10
Autobrake strength	[%]	0	3	6	9	12	15	20	25	30	35	40

allows you to set a slight braking action when your trigger is in neutral range.

●●● *** Mode.2 ▶ Feel / Initial Drive

Remark	Units	#1	#2	#3	#4	#5
Initial Drive	[%]	3	5	7	9	12

also called minimum drive, this is the level in % where the speed-controls initial throttle power will start in relation to your radios trigger position. A higher value means more aggressive initial response.

●●● *** Mode.3 ▶ Torque Timing

Remark	Units	#0	#1	#2	#3	#4	#5
Torque Timing	[°]	disabled	5	10	15	20	25

this function should only be enabled (= use of 5-25° of torque timing) for X12/X20 motors, all other motors should be used with #0 in this mode.
In combination with X12/X20 motors the „Torque Timing" will increase the motors torque and efficiency, play with the values to find the best setting for your usage as it also affects drive feeling slightly.

Important: enabled „Torque Timing" is not complying with Boost0 rules and blue LED will not flash in neutral!

●●● *** Mode.4 ▶ Boost Timing

Remark	Units	#0	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10
Boost Timing	[°]	disabled	5	10	15	20	25	30	35	40	45	50

adjusts the speed-controls dynamic boost timing in degrees (5° increase for each step), which is applied linearly to the motor based on it's RPM. A higher number results in more overall power & RPM, but also higher temperature.

Important: enabled „Boost Timing" is not complying with Boost0 rules and blue LED will not flash in neutral!

●●● *** Mode.5 ▶ Boost Angle & Activation

Important: this mode is only visible if you select values 1-10 in Mode.4, if you selected 0 it will hop straight to Mode.7.

Remark	Units	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10
Boost Angle	[°/k]	0.2	0.4	0.6	0.8	1.0	2.5	3.0	3.5	4.0	4.5
Boost Trigger	[RPM]	7600					5100				
use for		modified racing					stock racing				

Boost Angle: this number is given in degrees per 1000RPM, so for each RPM increase of your motor the Flow will increase it's dynamic boost timing linearly until the set „Boost Timing" level has been reached. Higher number means more aggressive timing engagement as more timing is applied at lower RPM already, a higher number will also increase the motor temperatures.

Boost Trigger: RPM at which the Boost Timing becomes active, below this RPM there is 0° boost timing.

●●● *** Mode.6 ▶ Turbo Timing

Important: this mode is only visible if you select values 1-10 in Mode.4, if you selected 0 it will hop straight to Mode.7.

Remark	Units	#0	#1	#2	#3
Turbo Timing	[°]	disabled	5	7	10

applies an adjustable extra turbo timing, on top of the „Boost Timing", when the set „Boost Timing" level has been reached (e.g. ramp section has ended) + you apply 100% throttle on your radio.
Be aware that turbo timing will not engage if your motors RPM, your gearing, and the selected „boost timing" and „boost angle" do not match well. So if your motor is too low RPM, the selected „boost angle to shallow, the „boost timing" high the timing will never reach it's „destination" and the turbo timing will never activate!

●●● *** Mode.7 ▶ Cut-Off Voltage

Remark	Units	#0	#1	#2	#3
Cut-Off Voltage	[V]	disabled	3.2	4.0	6.4
use for			1S LiPo	2S LiFe	2S LiPo
Motor Temp Cut-Off			110°C (230°F)		

when the battery voltage reaches the selected cut-off voltage, the motor function will be disabled and the LED's will indicate that the shutdown has occured due to undervoltage of your batteries.

Important: Default setting is 2S LiPo, so if you use other batteries you need to adjust this mode before first use! Using value #0 in this mode will also disable the motor temperature cut-off function entirely!

Repair Procedures / Limited Warranty

All products from LRP electronic GmbH (hereinafter called "LRP") are manufactured according to the highest quality standards. LRP 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 LRP 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 included. Otherwise, no warranty can be granted. For quick repair- and return service, add your address and detailed description of the malfunction.

If LRP 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, LRP does not take any responsibility for the accuracy of these specs.

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