Instruction Manual

PRO-x60 Series Controllers

Configuration Guide
Firmware Version 2.5.6

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1. Introduction

The Pro-100/160/360 share a common programming interface and feature set.

There are 15 profiles, 14 of which can be edited to suit the user. Each profile has a number of settings which control various aspects of the controller's behavior.

This guide gives an overview of these features and settings, and there is further information on our website in articles and videos.

2. Programming

We have configured the first 10 profiles with values that are a good starting point for the most popular applications, full details are in the table at the end of the manual.

It is not possible to make changes to profile 01, to save any changes you must first select another profile.

To edit the settings the SEL button should be held down while turning on the ignition, you can then navigate through the options and settings as shown in the menu flowchart in section 7. Remember to use the menu option to save the changes.

3. Getting started

To get the controller to start up it needs to have;

- A power supply connected. Take care to get the polarity correct – the controller is not protected against reverse polarity. The default expected voltage is 24V, if you want to run on 12V, either switch to profile 9, or adjust the low battery settings accordingly.
- Pins A and B of the main control input connected. See the "Control Connections" section of the relevant hardware guide, or see the "6 pin connector explained" video on our website.

4. Forward / Reverse Settings

4.1 “Accel ramp”. Sets the time taken to reach Max PWM. 1 - 300 corresponds to 0.1 - 30 seconds.

4.2 “Decel ramp”. Sets the time taken to slow down to zero. 1 - 300 corresponds to 0.1 - 30 seconds.

4.3 “Max PWM”. Sets the maximum percentage of battery voltage [or duty cycle] that can be sent to the motor.

4.4 “Regen limit”. Sets the upper limit of the regen braking current. This works in conjunction with “Decel ramp” to control the braking effect.

A slow “Decel ramp” [high number] will generate low regen currents. A low “Regen limit” will allow the motor to coast more easily.

5. General Settings

5.1 “Current limit”. Sets the maximum motor current that the controller will allow. If the motor or load tries to exceed this value the PWM duty cycle will be reduced.This can be used to provide a torque limiting function.

5.2 “Reverse beep”. Switches the reversing beeper on or off.

5.3 “Low battery”. Allows the alert and cut-off voltages to be set in 1/10ths of a volt. When the low battery alert activates, the controller will reduce its maximum speed by 50%. In 2.5.4 IR compensation was added to this section. This allows the controller to automatically adjust the low battery levels according to the current being drawn. See the IR compensation supplement in the manuals section of our website for full details.

5.4 “Over voltage”. Sets the maximum voltage that the controller will allow during regeneration. The deceleration ramp speed is automatically adjusted to keep the battery voltage below this setting. [120 – 900 = 12V – 90V].

5.5 “Parking brake”. Sets the time delay before the parking brake is applied, and also the power threshold that must be reached before the parking brake is released.

5.6 “Alternate profile”. Sets the profile to be selected if the Alt-P input is activated, and the controller re-started.

5.7 “Deadman”. Switches between push to stop [std] and push to go [safe] modes.

5.8 “Display”. Selects what information is displayed on the right hand fields of the display. Line1 can show motor current, speed, or RPM. Line 2 can show battery current, power in Watts or HP, or % battery remaining [if coulomb counting is enabled]. These fields can also be scrolled during operation by pressing the up and down buttons. This section also allows the temperature to be displayed in ‘C or ‘F.

Note; There is also a “System current limit” which is not user adjustable. If the load tries to exceed this value a message is shown, and the controller will shut down to protect itself.

6. Throttle settings

6.1 “Input mode”. Selects the input to be used. POT is for a potentiometer connected to pins D, E, & F of the main control input. RC will use the RDO port. VOLT will use the signal on pin E of the main control input but the pot fault checks will be disabled. PB1 / PB2 will allow push button control via grounding the L1 or L2 inputs. In PB1 mode this will be up to the speed set by the max PWM setting, in PB2 mode, up to the speed set by the pot input.

6.2 “Joystick”. Allows a center-off operation [aka wig-wag]. The INV option allows the direction of operation to be inverted if required [Note; INV is not allowed in Dynamic brake mode if Reverse JOY is set].

6.3 “Deadband”. Sets the amount of input required before the output starts [joystick mode only].

6.4 “Pot learn”. See Section 8 [also used for Volt mode].

6.5 “RC learn.” See Section 8.

6.6 “Lockout”. Prevents the motor starting if the controller is switched on with the throttle not at zero. This setting defines the throttle position above which this occurs. Setting Lockout to 100 disables the check.

7. Advanced settings

7.1 “Speed sensor”.

- “Active” switches on the speed sensor input.
- “Limiting” activates the top speed limiting function.
- “MAX rpm” sets the limit beyond which the controller will reduce the power.
- “Gear ratio” defines the ratio between the RPM measured by the speed sensor and the actual vehicle speed. This can be used to give an accurate speedometer function. A worked example is on our website knowledge base.
- “Units” selects mph or kph.
- “Sensor error” sets what happens if the speed signal is lost. “Trigger” sets the number of lost speed readings allowed before action is taken.

7.2 “Temperature”.

- “CTR Sensor” The controller is fitted with either a PTC or NTC sensor during production. This setting matches the software to the hardware and should not be changed by the user. More details are on our website.
- “Warning” temperature warning can be adjusted down from its default 75’C, this must be set in ‘C.
- “TX / TY Sensor” activates the external temperature sensor inputs X and / or Y. Each sensor can have its own warning level set. Once activated the controller will display each sensor temperature in turn. Note: the controller

sensor is calibrated differently to the X and Y sensors, they may not give exactly the same readings.

- "Fan" switches the contactor output to act as a temperature dependent output typically to operate a cooling fan. The activation level can be adjusted. Cannot be used together with the "contactor" setting active.

7.3 "Logging". Sets and configures datalogging and coulomb counting. See the datalogging supplement in the manuals section of our website for full details.

7.4 "Contactor". Allows use of a failsafe contactor. This can be in either the motor or battery line as required. See the knowledge base on our website for more details.

7.5 E-stop ramp" Sets the time taken to slow down to zero when the E-stop input is activated. The default time is 0.5S.

7.6 "Dynamic brake" aka tram mode. Only works with joystick mode enabled. Moving the joystick forward gives acceleration, returning the joystick to the center off position causes the motor to slow down [or coast] according to the "max deceleration" time set. Moving the joystick further into the reverse [or braking] section will give increasingly strong braking down to the "min deceleration" time set. D is displayed to indicate that dynamic braking is being applied. Reverse is activated in one of two ways

1. If Reverse JOY is selected, after the motor has stopped then moving the joystick from zero into the reverse sector will give reverse operation.
2. If Reverse SWCH is selected, reverse is selected by applying a voltage to the reverse input pin. If reverse is selected while driving forward, the motor will coast to a stop, change direction, and then ramp up in reverse.

Note 1; the following settings will give a good starting point;

Max deceleration = 400 – gives a 40 second coasting period.

Fwd deceleration = 400 – matches Max decel value.

Rev deceleration = 400 – makes forward and reverse behaviour the same.

Min decelration = 20 – gives a strong maximum braking effect.

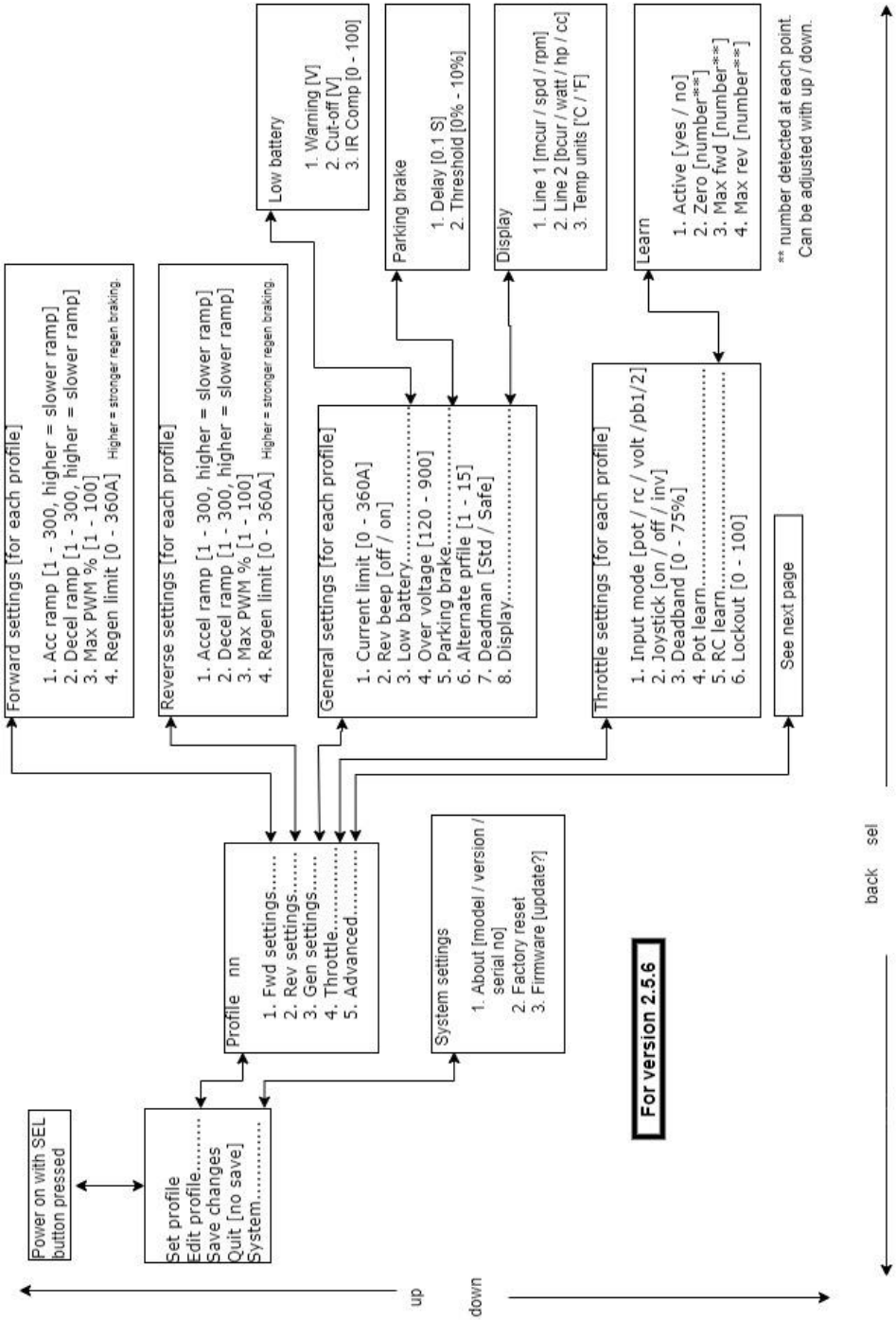
Note 2; Joystick Inv mode cannot be used with dynamic braking.

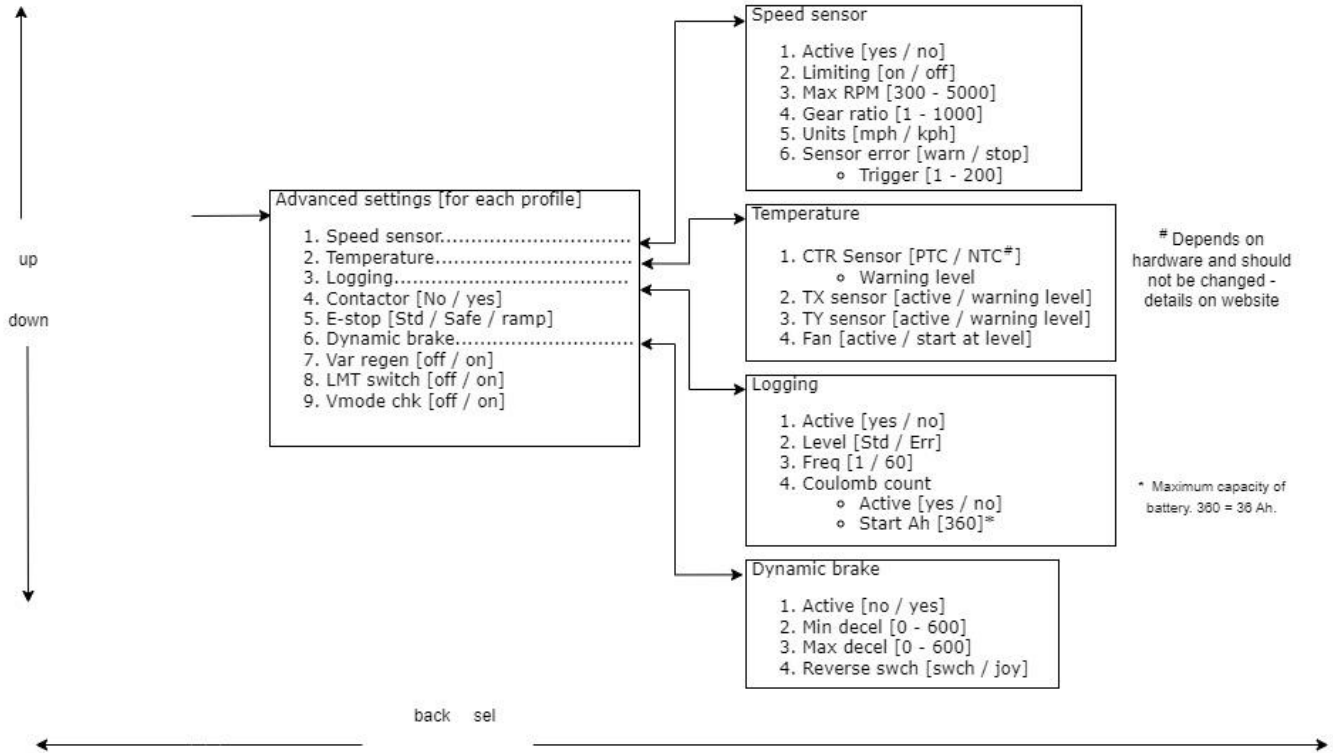
7.7 Variable regen". This allows the regen current to be varied on the fly by means of a 0V – 5V signal [e.g. from a pot fed from the BEC socket] applied to pin B of the thermistor input. Note that temperature sensor Y cannot be used at the same time.

7.8 "LMT switch" Allows the use of limit switches to toggle the direction of travel. The controller will initially start in the direction set by the reverse switch, grounding L1 will switch to forward travel, grounding L2 will switch to reverse travel.

7.9 "Vmode chk". Provides protection from runaway in Volt mode if the input goes above 4.75V or below 0.25V [e.g. if a disconnection occurs]. A P6 error will be shown and the controller will ramp down to zero.

8. Menu Flowchart




up
down
Advanced settings [for each profile]
1. Speed sensor.....
2. Temperature.....
3. Logging.....
4. Contactor [No / yes]
5. E-stop [Std / Safe / ramp]
6. Dynamic brake.....
7. Var regen [off / on]
8. LMT switch [off / on]
9. Vmode chk [off / on]
Speed sensor
1. Active [yes / no]
2. Limiting [on / off]
3. Max RPM [300 - 5000]
4. Gear ratio [1 - 1000]
5. Units [mph / kph]
6. Sensor error [warn / stop]
Trigger [1 - 200]
Temperature
1. CTR Sensor [PTC / NTC#]
Warning level
2. TX sensor [active / warning level]
3. TY sensor [active / warning level]
4. Fan [active / start at level]
Depends on hardware and should not be changed - details on website
Logging
1. Active [yes / no]
2. Level [Std / Err]
3. Freq [1 / 60]
4. Coulomb count
Active [yes / no]
Start Ah [360]*
* Maximum capacity of battery. 360 = 36 Ah.
Dynamic brake
1. Active [no / yes]
2. Min decel [0 - 600]
3. Max decel [0 - 600]
4. Reverse swch [swch / joy]
back
sel

9. Using the “learn” function

The “learn” function allows you to match zero speed, full forward, and full reverse from the controller to specific input signals from your pot, radio control receiver, or other input source.

9.1 Set either “Pot learn” or “RC learn” active.

9.2 Select “Learn zero” and press SEL, the controller will show a number related to the value detected from the pot [or other input].

9.3 Set the pot, transmitter stick, or other input to the position you want to have as zero,* and press SEL to capture the associated number. * the Up / Down buttons can be used to override the value if fine tuning is required.

9.4 Repeat steps 9.2 – 9.3 for “Learn max forward” and “Learn max reverse”

9.5 Use BACK to return to the main menu and then save changes.

Notes:

- For 9.3, if you are using “Joystick” mode, the MAX REV value must be lower than the ZERO value, which in turn must be lower than the MAX FWD value. If this is the wrong way round for your installation you can use the INV setting to change the direction of operation.
- If you are not using “Joystick” mode, you should set “Learn max reverse” to the same value as “Learn max forward”. Reverse is then selected by the reverse switch.
- “Pot learn” – “Active” must be left to yes for the learnt values to be used.
- Volt mode uses the “Pot learn” function for learning.
- “Pot learn” must be done for each profile that is to be used, learnt values are not carried over.
- We have a video on our website that describes this process. See “Pro-100 / 160 / 360 menu walkthrough” around the 7:35 mark.

10. Power-up options

Power on with SEL pressed enters set-up mode.

Power on with DOWN pressed will start up with profile 1. This is an emergency start option to be used should a system 'EEPROM' error occur.

Power on with BACK pressed will display an option to reset the coulomb count to the Start Ah value set in the logging menu. The value can be reduced but not increased at this point.

11. System settings [inc reset]

11.1 About. Gives information on the model, software version, and serial number.

11.2 Factory reset. Allows the user to reset the controller to factory settings.

11.3 Firmware update. Allows new software to be installed via the uSD card reader.

Switch off the controller, insert the uSD card containing the new software into the card holder, and switch on again with SEL pressed.

Navigate through the system settings menu to “Firmware” and then follow instructions. Remove the uSD card when finished.

12. Fault Finding

The controller has a set of warning / fault codes that are shown on the display if it detects something it is not happy about, these codes also have an associated sequence of beeps as below. These are also listed in the Support / Knowledgebase section of our website.

Code	Sound [every 5 secs]	Fault or warning	Description
B1	1 short	F	Under voltage
B2	2 short	W	Low battery
B3	5 short	W	High battery
B4	5 short	F	Over voltage
T1	1 long	W	High temp
T2	1 long	F	Over temp
T3	1 long	W	TX high temp
T4	1 long	W	TY high temp
P1	Continuous	F	High pot lock
P2	3 short	F	Pot track fault
P3	3 short	F	Pot wiper fault
P4	3 short	F	RC signal fault
P5	3 short	F	Limit switch
P6	3 short	F	Volt input
X1	1 short	F	Dead-mans handle
X2	1 short	F	Emergency stop
C1	None	W	Over current
C2	None	W	Current limit
K1	2 long	F	Parking brake
Q1-4	3 long	F	MOSFET failure
S1	None	W	Speed limit
S2	4 short	W/F	Speed signal lost

			Profile									
		P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11-15
Parameter	**Range**	**Default**	**Small loco**	**Large loco**	**Golf buggy**	**Go kart**	**Joystick**	**RC single end**	**RC joystick**	**12 V**	**Dynamic braking**	**Custom**
Forward acceleration ramp time	0.1 - 30 sec	50	50	70	50	20	50	50	50	50	50	50
Forward deceleration ramp time	0.1 - 30 sec	30	30	30	20	10	30	30	30	30	300	30
Maximum forward speed	1 - 100 %	100	100	100	100	100	100	100	100	100	100	100
Maximum forward regen current	0 - 200A	140A / 200A depending on model										
Reverse acceleration ramp time	0.1 - 30 sec	50	70	100	50	20	50	50	50	50	50	50
Reverse deceleration ramp time	0.1 - 30 sec	30	30	30	20	10	30	30	30	30	300	30
Maximum reverse speed	1 - 100 %	100	50	50	50	100	100	100	100	100	100	100
Maximum reverse regen current	0 - 200A	140A / 200A depending on model										
Current limit [fwd and rev]	0 - 140A / 200A	120A / 175A depending on model										
Reverse beeper on / off	On / off	on	off	off	on	off	off	off	off	on	Off	on
Low battery alert [50% max speed]	11 - 72 Volts	220	220	220	220	220	220	220	220	110	220	220
Low battery cut-off	11 - 72 Volts	210	210	210	210	210	210	210	210	105	210	210
Parking brake delay	0.1 - 9.9 sec	10	10	10	10	10	10	10	10	10	10	10

			Profile									
		P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11-15
Parameter	**Range**	**Default**	**Small loco**	**Large loco**	**Golf buggy**	**Go kart**	**Joystick**	**RC single end**	**RC joystick**	**12 V**	**Dynamic braking**	**Custom**
Parking brake threshold	0- 10%	1	1	1	1	1	1	1	1	1	1	1
Alternative profile	0 - 20	0	3	2	0	0	0	0	0	0	0	0
Deadman	Std / Safe	Std	Std	Std	Std	Std	Std	Std	Std	Std	Std	Std
Input method	Pot / RC / Volt	pot	pot	pot	pot	pot	pot	rc	rc	pot	Pot	pot
Joystick mode	On / off	off	off	off	off	off	on	off	on	off	on	off
Joystick throttle dead band %	0 -75%	10	10	10	10	10	10	10	10	10	10	10
High pot / RC lockout level	0 - 99%	5	5	5	5	5	5	5	5	5	5	5
Max RPM	300 - 5000	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
TX warning temperature	40 - 95'C	80	80	80	80	80	80	80	80	80	80	80
TY warning temperature	40 - 95'C	80	80	80	80	80	80	80	80	80	80	80