

Combined Single and Dual Pitch Controller **DLx²**

A pitch controller in a model submarine stabilizes the submerged model in its horizontal attitude. The integrated sensor (or so-called inclinometer) acts as electronic spirit level by automatically adjusting the dive planes accordingly.

The **DLx²** can handle standard dive planes as well as X-rudders of model submarines such as type 212. There are two servo inputs and outputs. For standard dive planes with single dive plane servo only the connector with white marking is plugged into the receiver. The servo can be connected to either socket marked as Servo 1 or Servo 2.

The two servo outputs on the **DLx²** allow bow and aft dive planes to be controlled via a single R/C channel. Dive plane Servo 2 can be inverted accordingly if necessary. In this case only the white marked connector is plugged into the receiver. This kind of dual pitch control might prove beneficial in stabilizing the model or it may not. It mainly depends on type, size and also on velocity of the individual model and is left to your own discretion.

Dual Pitch Control with integrated X-Mixer.

This state-of-the-art pitch controller can handle even the fastest model submarine such as our new 212! This allows appropriate and precise control of X-rudders without having to invest in an expensive R/C system.

The X-mixer is simply "on board" of the **DLx²** - no sophisticated R/C system or complicated programming required. This mode requires both connectors to be plugged into the receiver as well as both servos to be connected to the **DLx²**. Note that X-mixers programmed through your transmitter must be deactivated.

Automatic pitch reverse. As soon as the propulsion motor (brushed!) draws more than 2V in reverse pitch control also reverts the servo signal, meaning that the **DLx²** will keep the model in its horizontal position even in backward motion. For detection of reverse propulsion the sockets on the **DLx²** marked - and + must be connected to the motor contact pins accordingly. BEC connector cable no. 9128 is ideal for this. Reverse mode is also indicated by a red LED (Reverse) at the upper right corner of the **DLx²**. Motor polarity indicated on the **DLx²** (Motor - and +) refers to ENGEL submarines with single propulsion motor. For other brands polarity might just be the opposite, and thus, must be determined individually.

Please note for BRUSHLESS MOTOR: If main drive motor is BRUSHLESS an additional module is required for Automatic Pitch Reverse.

This separate module is available in two versions:

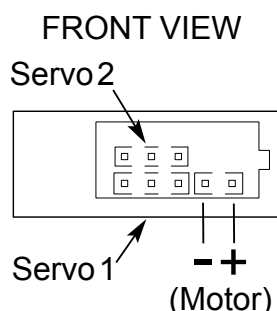
No. 8454 Reverse Drive Detection without BEC
is used for models using a receiver battery.

No. 8455 Reverse Drive Detection with BEC
is used for models using NO receiver battery but BEC (Battery Eliminating Circuit) instead by which receiver power is supplied by the speed controller of the main drive motor.



Installation & Click to Neutral. Make sure to align the **DLx²** somewhat horizontally, but accurately parallel to the keel line of your submarine. The controller can be mounted horizontal or on its side but NOT end-on. The controller can either be fixed with the M3 screw and nut supplied or with double-sided adhesive tape. Place model on even keel, meaning exact horizontally. This will correspond to neutral position of the **DLx²**. By pressing the Neutral button on the **DLx²** the servos will travel to their neutral position. The servo horns or discs can now be fitted to the servos and the linkages connected which must correspond to the neutral position of the control surfaces. NOTE that the **DLx²** will ignore transmitter neutral trim as the **DLx²** will only accept neutral setting as given by the servo (through the potentiometer on-board the servo).

Dynamic passivation. The more the transmitter stick is moved in either direction, the higher the level of manual control. At about 70% stick movement (depending on transmitter) pitch control is almost inactive. Transmitter signal is then passed on directly to the servo(s). This ensures that full manual control can be retrieved if required or desired in any situation without having to search for an "off" button.



With less transmitter stick movement the **DLx²** increases its automatic control of the submarine until it has reached full control with the stick back in neutral.

Servo and linkage. Automatic pitch control puts quite some stress on the servo(s). Therefore, refrain from using cheap, low quality servos with a pitch controller. Instead, servos should be equipped with metal gears for improved rigidity as well as ball bearings for reduced friction. Linkages should be free from float. Any unnecessary clearance or inaccuracy will reduce effectiveness of pitch control and must therefore be avoided.

Servo Reversal. Direction of rotation for both servos can be reversed by the **DLx²**. This might become necessary due to predetermined servo fixture or linkage. To reverse servo 1 just keep the Neutral button pressed while powering-up the receiver. Repeating this procedure a second time will reverse both servos 1 and 2. Repeat this a third time and only servo 2 will be reversed. A fourth time will set both servos to their original direction of rotation. After having activated or deactivated servo reverse mode the servo's neutral position should be reset as described in *Click to Neutral*.

Servo-Throw-Adjustment. The **DLx²** allows reduction of servo movement (throw) down to 50%. Adjustment is made simply by pressing the *Neutral* button. The actual reduction is indicated by blinking frequencies in groups of three of the red LED.

Follow these steps for adjustment:

① Connect servos to **DLx²** and connect **DLx²** to receiver. If only a single R/C channel is used connect servo lead connector marked with a RED dot.

② Power-up transmitter and receiver.

③ Press one of the corresponding control sticks on your transmitter to full throw in either direction.

④ Press *Neutral* button and keep pressed. LED shows a single blink (1x).

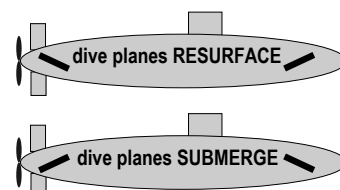
Red LED blinks	1x = 100%	servo movement (default setting)
	2x = 90%	
	3x = 80%	
	4x = 70%	
	5x = 60%	
	6x = 50%	

⑤ As soon as the requested level of reduction is reached, release *Neutral* button and bring control stick back to neutral.

The red LED indicates each level of reduction by a blinking frequency in groups of three and then switches to the next level of reduction by 10%. For switching back to a higher level of movement (e.g. 100% instead of 70%) the reduction procedure must be maintained down to 50% which is then followed by the initial 100% setting (no reduction = full servo movement); the LED indicates this again by single blinking for three times.

NOTE: The dive planes must work against the pitch of the model. If not, the **DLx²** must be rotated by 180 degrees.

On models with dive planes at bow and both dive plane pairs must turn inversely as illustrated.



Sensor. Turning of the potentiometer (*Sensor*) determines the amplification of servo throw relative to the model's slope. Default setting is just above 50%. For fast models this amplification must be reduced. Turned anti-clockwise to its left catch, amplification is almost "zero". This results in minimal automatic adjustment of dive planes which is only desirable for really very fast models.

Adjustment. Default setting at just above 50% will result in full throw of dive planes at a slope of approx. 30 degrees. This complies with most model subs. More precise adjustment, if required, can only be achieved by individual testing. Higher amplification (i.e. potentiometer turned clockwise) implies more precise adjustment of dive planes. On the other hand, this increases the probability of "dolphin-like" behaviour with the model swinging up and down.

The optimal sensitivity adjustment lies therefore just below the point at which the model starts to swing. Exaggerated amplification will inevitably lead to intensification of oscillation with increasing velocity but, in turn, allow stable movement at lower speeds.

Technical Specifications:

Operational voltage	3.5 - 8.5 V
Current consumption	6.1 mA (forward) to 8.4 mA (reverse) at 5 V receiver voltage
Propulsion motor voltage	max. 30 V
Dimensions (l x w x h)	approx. 41 x 25 x 9 mm
Weight (incl. casing/cables)	approx. 13 g

WARNING! This item is not a toy and therefore not suitable for persons under 16 years of age. Please adhere to your country's safety guidelines during construction and operation of this item. We are not liable for any personal injury or damage of any kind resulting with the assembly and/or use of our products as we are neither able to delegate nor verify the assembly and/or use of these items.

24 Month Limited Warranty : The manufacturer of this unit warrants this product to be free from defects in material and workmanship for a period of 24 (twenty-four) months from date of purchase. During that period, we will repair or replace, at our option, any unit supplied through us that does not meet these standards. You will be required to provide proof of purchase (receipt or invoice). Defects

caused by abuse, misuse, or accident, etc. are not covered under this warranty. Under no circumstances will the purchaser be entitled to consequential or incidental damages. If you attempt to disassemble, modify, or repair this unit in any way yourself it may void the warranty. For service to your MiniPitchController send it post paid and insured to the address stated on the front page of this manual (please ensure adequate and safe packaging).



This symbol indicates that after the service life of this electrical device has ended it must be disposed separately from domestic refuse at your communal waste collection.

