



USER GUIDE FOR
AN-1/SAC Smart Analog Speed Controller

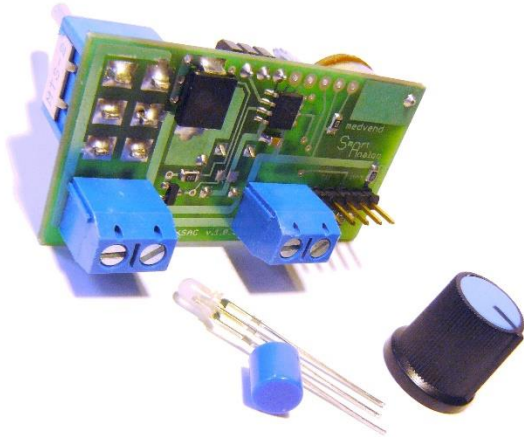
Main Features:

- Adjustable acceleration and braking intensity in automatic start/stop mode (AS)*
- Four step programmable acceleration and braking intensity in start/stop mode (B, S)*
- realistic manual mode (B, S, AS)*
- adjustable realistic manual mode (S, AS)*
- nonvolatile memory for settings (S, AS)*
- protection against overload (B, S, AS)*
- protection against reverse connection (B, S, AS)*
- wide range voltage input (B, S, AS)*
- powerful output (B, S, AS)*
- user friendly usage (B, S, AS)*

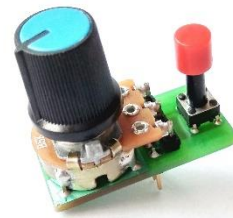


AN-1/SAC

* Note: B – in BlueLine configuration, S – in Smart Analog configuration, AS – in Advanced Smart Analog configuration. Extension panel must be connected for using Advanced Smart Analog configuration (Extension panel not included, but can be bought together or separately).



AN-1/SAC



SAC/ext Extension panel (not included)

The controller is easy to mount in any mounting box or on your layout's control panel. It is especially suitable for layouts where several controllers are required. By mounting these units side by side, you will have a clean and professional looking control panel. The controller is easy to install using screw clamp terminal blocks. The AN-1/SAC speed controller provides smooth acceleration and braking, providing high torque even at very low speeds. The many special features provide an amazing experience for children and adults alike. The package contains everything you need to mount the unit: nuts and washers, LED and LED holder, knob for potentiometer and a cap for pushbutton.

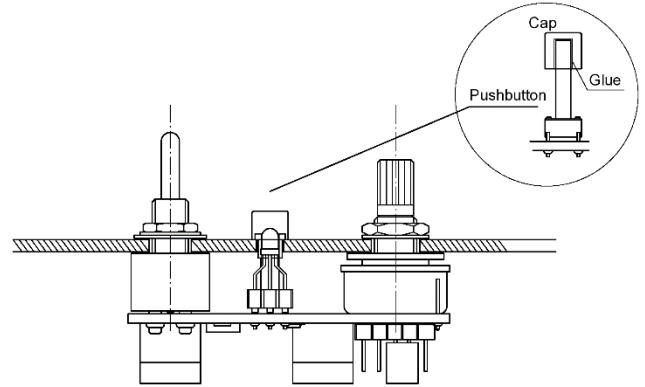
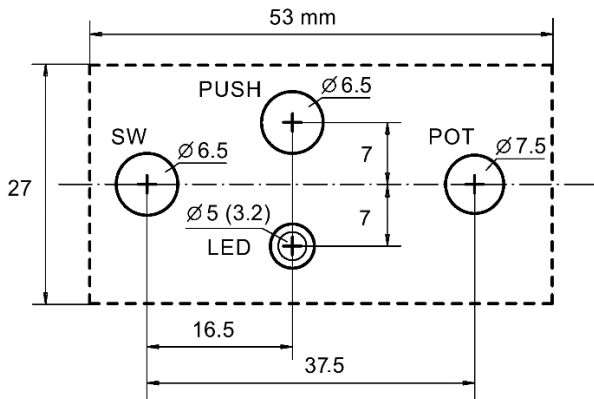
1. Mounting.

IMPORTANT NOTICE:

Please note that the unit must be properly mounted for correct operation. When switched on, touching the electric conductive layers or contact between the electronic parts of the unit and other metal objects may cause malfunctions or may damage the controller! Do not bend the pushbutton's shaft sideways because it may break out!

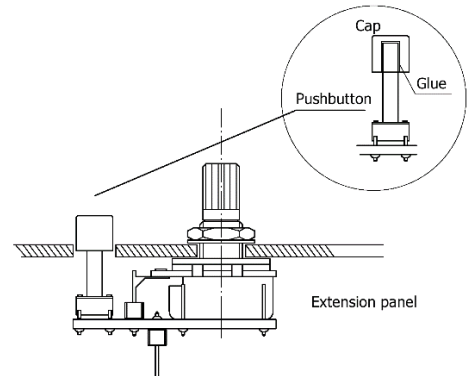
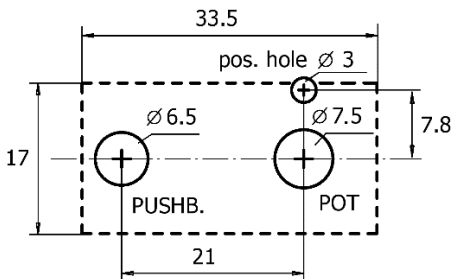
The figure below shows how to mount the unit in the simplest way. Drill holes in the front panel according to the template provided. Clip the terminal pins of the LED (3) as necessary (based on the thickness of the panel); then connect them, paying attention to correct polarity. Mount the unit from behind the front panel, and attach with the nuts provided. Finally attach the potentiometer knob and the pushbutton cap. Use glue (not included) to secure the pushbutton cap.

1.1. AN-1/SAC controller mounting



Note: LED hole diameter is 5mm if LED holder is used, 3.2mm if not.

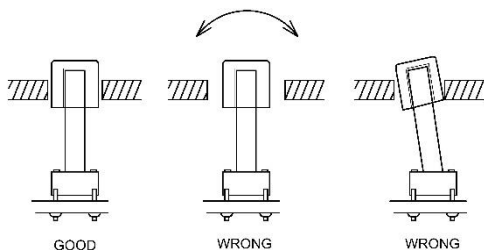
1.2. SAC/ext Extension panel mounting (extension panel not included)



Dimensions on the above figure are in millimeters.

Note: Pos. hole (positioning hole) is required to prevent rotation of the extension panel. If the panel rotates, the button shaft may break out or it can cause a false pressed state

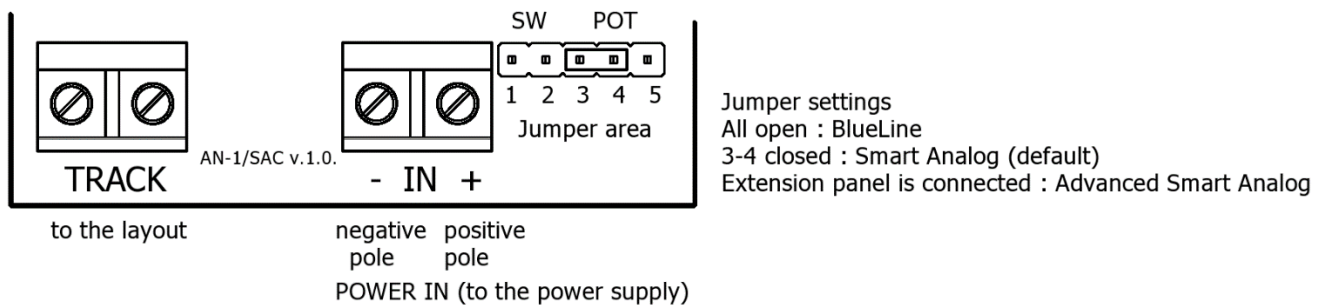
1.3. Both of panels mounting



The correct size and position of pushbutton hole is important for best operation.

2. Connection

Important: make sure the power supply is off when connecting the wires. Incorrect wiring (e.g. swapping the input and output wires) may damage the unit. Always choose the correct power supply voltage to avoid the overheating of engines. Recommended values: 7.5V-9VDC for Z, 9V-12VDC for N, 12VDC for TT and 14V-16VDC for H0 scale locomotives. Always follow the manufacturer's recommendation! Recommended type of power supply: should have switching mode with stabilized output.



Connect the input voltage wires to terminal #3 and terminal #4. Terminal #3 ("-") is the negative pole, and terminal #4 ("+") is the positive pole. Connect the output wires (terminal #1 and #2, "TRACK") to the track. Tighten the clamps with the screws. If you have several sections on your layout and are using several controllers, make sure the output wires are connected with the same polarity (e.g. terminal #1 is connected to the right side rail, and terminal #2 is connected to the left side rail); this ensures that the positions of the switch correspond to the same direction of travel for the trains. There are many solutions for avoiding short circuits between track sections, but this manual cannot cover those. If you have the extension panel, just connect it to the controller's 5 pole connector. (Direction indicated by a painted red sign)

3. Configuration

The speed controller can be configured in three ways. The desired configuration can be set in the jumper block (see picture). Note: make sure the power supply is off when changing configuration, otherwise unit may malfunction (unusual operation). The new configuration will be valid only after restart.

- **No jumper, all pins are open. (BlueLine operation)** The speed controller works like the BlueLine speed controller. Two manual modes can be chosen: normal or realistic mode. The acceleration/braking time of automatic start/stop function can be set in four steps: dynamic, slow, slower and extremely slow. Settings are not stored.

- **Jumper cap is placed between pin#3 and pin#4. (Smart Analog operation)** This is the default configuration. Two manual modes can be chosen: normal or realistic mode. The inertia of locomotive movement is adjustable in realistic mode (control delay). The acceleration/braking time of automatic start/stop function can be set in four steps: dynamic, slow, slower and extremely slow. Settings are stored even if switched off.

- **Extension panel connected onto jumper block. (Advanced Smart Analog operation)** This configuration is set automatically after connection (Plug&Play). Two manual modes can be chosen: normal or realistic mode. The inertia of locomotive movement is adjustable in realistic mode (control delay). The acceleration and braking time can be continuously controlled by the potentiometer of the connected panel. The pushbutton on the connected panel allows an immediate stop. Settings are stored even if switched off.

4. Programming in Smart Analog and Advanced Smart Analog configuration

4.1. Select manual mode (normal or realistic)

- Turn off the unit (direction switch in center position)
- Press and hold the "start/stop" pushbutton whilst switching on by selecting a direction. A continuous green light is on. If you release the button immediately, the manual mode will change. If mode was normal, it would be realistic and vice versa.

4.2. Adjust the control delay in realistic mode

- Turn off the unit (direction switch in center position)
- Press and hold the "start/stop" pushbutton while switch on by selecting a direction. A continuous green light is on. Do not release the button until red light is blinking (about 5 sec). Then green light starts blinking. In this state, the potentiometer can be used to set the desired delay. In the right-end position, the control delay from standstill to maximum speed will be approx. 2 seconds, and in the left-end position it will be approx. 6 seconds. The blinking rate of the green light is proportional to the position of the potentiometer. If you want to store this setting, press the pushbutton again for about 3 sec (until red light appears).

4.3. Restore default settings

- Turn off the unit (direction switch in center position)
- Press and hold the "start/stop" pushbutton while switch on by selecting a direction. A continuous green light is on. Do not release it until the continuous red light is on (about 8 sec).
- Default settings: mode is normal, control delay in realistic mode is about 3 sec.
- All these settings will be stored even if switched off.

5. How to use it

5.1. Blue line configuration (No jumper, all pins are open).

5.1.1. Basic manual mode in BlueLine configuration

Works like traditional controllers; select direction with the toggle switch, clockwise turn of speed control knob will start and accelerate, counter-clockwise turn will slow down and stop the locomotive. To avoid an accidental start, if the speed control knob is not in zero setting when the directional switch is moved to forward or backward position, the locomotive will not start until the potentiometer is first set to zero. During basic manual mode the green light will glow.

5.1.2. Realistic manual mode in BlueLine configuration

The directional switch must be in off (center) position. Press and hold the "start/stop" pushbutton while selecting the direction, then release it. Turn the speed control knob clockwise to start and accelerate, counter-clockwise to slow down and stop. To avoid an accidental start, when the speed control knob is not in zero setting when the directional switch is moved to forward or backward position, the locomotive will not start until the potentiometer is first set to zero. In this mode the locomotive will react to speed changes with a delay, just like the real thing. Fine, gradual acceleration and delayed deceleration, replicating the "momentum" of big, heavy trains. During realistic manual mode green is blinking slowly. To exit from realistic manual mode, move the directional switch to off (center) position.

5.1.3. Automatic start/stop mode in BlueLine configuration

There are four levels of automatic start/stop modes, dynamic, standard, slow and very slow. The differences are in the intensity of acceleration and braking. The time of acceleration is approximately 5-6 seconds in dynamic level, 7-8 seconds in slow #1 level, and 10-11 seconds in slow #2 level and 13-14 seconds in very slow level. (Note: braking times are shorter than accelerate times) Set the very long time only if the locomotive and rails are in good condition and electrical contact is perfect. Otherwise, the locomotive may get jammed.

If the speed control knob is not in zero setting when the directional switch is moved to forward or backward position, red and green lights will blink alternatively. Press the start/stop button to enter accelerate phase. The train starts to gradually accelerate until it reaches the preset speed. During accelerate phase green light is blinking rapidly.

If the train is in motion, press the "start/stop" pushbutton. The train begins to gradually slow down, then stops. During the braking phase red light will blink rapidly. After the train has stopped the red and green lights will blink alternatively.

To achieve the desired acceleration/braking intensity, follow the instructions below.

- Dynamic mode: press the "start/stop" pushbutton for less than one second. The green light blink very fast.

- Slow #1 level: press the "start/stop" pushbutton for more than 1 sec but less than approximately two seconds until green light turns on, then release the pushbutton immediately.

- Slow #2 level: press the "start/stop" pushbutton for more than two seconds but less than four seconds until green light starts to blink again, then release the pushbutton immediately.

- Very slow level: press the "start/stop" pushbutton for more than about four seconds. The green light is on again.

This setting will not be stored.

To exit any of the automatic start/stop modes turn the speed control away from the current position near to the actual speed position or move the directional switch to off (center) position.

5.2. Smart Analog configuration (Jumper cap is placed between pin#3 and pin#4).

5.2.1. Basic manual mode and realistic manual mode in Smart Analog configuration

Works like traditional controllers; select direction with the toggle switch, clockwise turn of speed control knob will start and accelerate, counter-clockwise turn will slow down and stop the locomotive. To avoid an accidental start, if the speed control knob is not in zero setting when the directional switch is moved to forward or backward position, the locomotive will not start until the potentiometer is set to zero first. In realistic mode the locomotive will react to speed changes with a delay, just like the real thing. Fine, gradual acceleration and delayed deceleration, replicating the "momentum" of big, heavy trains. The control delay can be adjusted and stored in programming mode (see chapter 4.).

To switch between basic manual and realistic manual mode press and hold the "start/stop" pushbutton while switched on by selecting a direction. If you release the button after switched on, the manual mode will change. If mode was basic, it would be realistic and vice versa. The selected manual mode will be stored even if switched off. During realistic manual mode the green will blink slowly, during basic manual mode the green light will glow. The pre-programmed control delay will not change even if the mode is changed.

5.2.2. Automatic start/stop mode in Smart Analog configuration

There are four levels of automatic start/stop modes, dynamic, standard, slow and very slow. The differences are in the intensity of acceleration and braking. The time of acceleration is approximately 5-6 seconds in dynamic level, 7-8 seconds in slow #1 level, and 10-11 seconds in slow #2 level and 13-14 seconds in very slow level. (Note: braking times are shorter than acceleration times) Set the very long time only if the locomotive and rails are in good condition and electrical contact is perfect. Otherwise, the locomotive may get jammed.

If the speed control knob is not in zero setting when the directional switch is moved to forward or backward position, red and green lights will blink alternatively. Press the start/stop button to enter acceleration phase. The train starts to gradually accelerate until it reaches the preset speed. During acceleration phase the green light will blink rapidly.

If the train is in motion, press the "start/stop" pushbutton. The train begins to gradually slow down, then stops. During the braking phase the red light will blink rapidly. After the train has stopped the red and green lights will blink alternatively.

To achieve the desired acceleration/braking intensity, follow the instructions below.

- Dynamic level: press the "start/stop" pushbutton for less than one second. The green light will blink very fast.

- Slow #1 level: press the "start/stop" pushbutton for more than 1 sec but less than approximately two seconds until the green light turns on, then release the pushbutton immediately.

- Slow #2 level: press the "start/stop" pushbutton for more than two seconds but less than four seconds until green light starts to blink again, then release the pushbutton immediately.

- Very slow level: press the "start/stop" pushbutton for more than about four seconds. The green light is on again.

This setting will not be stored.

To exit any of the automatic start/stop modes turn the speed control away from the current position near to the actual speed position or move the directional switch to off (center) position.

5.3. Advanced Smart Analog configuration (Extension panel connected).

To achieve this configuration, the extension panel must be connected. The controller unit configures itself automatically when the extension panel is first connected. (Plug&Play)

This extension panel contains a pushbutton and a potentiometer. During movement, the train can be stopped at any time immediately by pressing the pushbutton. The potentiometer is used to adjust the acceleration and braking intensity in automatic start/stop mode.

5.3.1. Basic manual mode and realistic manual mode in Advanced Smart Analog configuration.

Works like traditional controllers; select direction with the toggle switch, clockwise turn of speed control knob will start and accelerate, counter-clockwise turn will slow down and stop the locomotive. To avoid an accidental start, if the speed control knob is not in the zero setting when the directional switch is moved to forward or backward position, the locomotive will not start until the speed control potentiometer is first set to zero. In realistic mode the locomotive will react to speed changes with a delay, just like the real thing. Fine, gradual acceleration and delayed deceleration, replicating the "momentum" of big, heavy trains. The control delay can be adjusted and stored in programming mode (see chapter 4.).

To switch between basic manual and realistic manual mode press and hold the "start/stop" pushbutton whilst switching on by selecting a direction. If you release the button after switching on, the manual mode will change. If mode was basic, it would be realistic and vice versa. The selected manual mode will be stored even if switched off. During realistic manual mode the green will blink slowly, during basic manual mode the green light will glow. The pre-programmed control delay will not change even if the mode changed.

5.3.2. Automatic start/stop mode in Advanced Smart Analog configuration.

If the speed control knob is not in zero position when the directional switch is moved to forward or backward position, the red and green lights will blink alternatively. Press the start/stop button to enter acceleration phase. The train starts to gradually accelerate until it reaches the preset speed. During acceleration phase green light will blink rapidly.

If the train is in motion, press the "start/stop" pushbutton. The train begins to gradually slow down, then stops. During the braking phase the red light will blink rapidly. After the train has stopped the red and green lights will blink alternatively. The intensity of acceleration and braking depends on the position of the extension panel's potentiometer. The intensity can be set between from 2 seconds to 13 seconds (Acceleration time from 0 to maximum speed). The speed/time characteristic is nonlinear (see picture). Set a very long time only if the locomotive and rails are in good condition and electrical contact is perfect. Otherwise, the locomotive may get jammed.

6. LED indicator light signals during use

- Green light: basic manual mode.
- Slow flashing green light: realistic manual mode
- Fast flashing green light: accelerate in automatic start/stop mode
- Fast flashing red light: braking in automatic start/stop mode
- Quickly alternating green and red light: waiting for start in automatic start/stop mode (locomotive is stopped and potentiometer is not in zero position)
- Very fast flashing red light: extension panel's stop pushbutton is pushed or configuration error
- Red light on: thermal overload

7. Troubleshooting

A common problem with all analog and DCC systems is the locomotive's pickup. Keep the wheels and track surfaces clean. Intermittent and jerky operation is often caused by an oxide coating forming on the track or the wheels. If you have problems, always check the track and wheels first and make sure they are clean. Uncertain contact makes slow running impossible.

The locomotive does not move and ...

a, the LED is not lit

- The direction switch is in central (OFF) position
- No input power – check adapter or terminals #3, #4

b, the LED is lit with green light

- Contact fault on the track or at the locomotive's pickup.
- Contact fault on terminals #1, #2

c, the LED is lit with red light

- There is a continuous overload. After the overload is resolved and the device has cooled off, the unit will switch on again.

Red light flashes very fast

- Configuration is changed. Switch off the unit for a while, then switch it on again. The new configuration will be valid after restart.

The unit operates unusually (I.e. unexpected stopping, acceleration, or braking.)

- Do not touch the conductive layers.
- Invalid configuration. The jumper cap is placed to a wrong position.

6. Technical features / absolute maximum ratings

Analog control: Pulse width modulation (PWM)

PWM frequency: about 63Hz

Input voltage: must be 5-18V DC. Terminal #3 is the negative pole and terminal #4 is the positive pole (see diagram). For smoother operation of locomotives, use a filtered or regulated power supply. The device is protected against thermal overload.

Some useful hints on using the controller:

- Running locomotives at a voltage significantly higher than their nominal value may result in overheating or even permanent damage. The same may happen to decoders in digital systems, under similar conditions. It is therefore very important to select the correct power supply and ensure it is configured properly. The recommended adapter DC output voltages are: 9V for Z scale, 12V for N scale, 12V-14V for TT scale, 14V-16V for H0 scale, 16V-22V for G scale locomotives, but first of all always follow the manufacturer's recommendation. At lower loads, the output voltage of unregulated adapters can be much higher than their nominal voltage. When an adapter is used for the first time, check the temperature of the engines more frequently. When using an unregulated variable output adapter, set the output voltage to 7.5V for Z scale, 9V for N or TT scale, and 12V for H0 (TT) scale.
- Do not use an adaptor that is less powerful than needed, because the adaptor may burn out.
- Do not use an adaptor, that is much more powerful than needed, because extremely high short-circuit (15-20A) currents may cause damage to the controller or to the locomotive.
- Do not leave running trains unattended. Always switch off or unplug the wall adapter from the outlet after use.

Wiring of sectioned layouts

