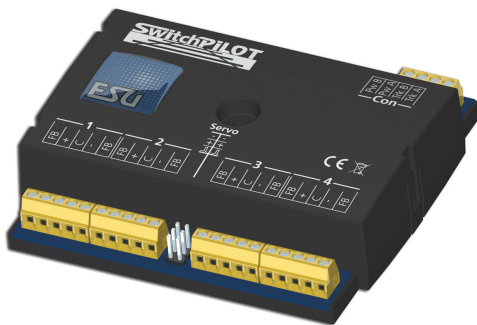


# SwitchPilot & SwitchPilot Extension

## User manual

Second edition, october 2007



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# Declaration of conformity

## 2. Declaration of conformity

We, ESU electronic solutions ulm GmbH & Co KG, Industriestraße 5, D-89081 Ulm, declare in sole responsibility that the products to which this declaration refers, namely

### **SwitchPilot, SwitchPilot Extension,**

are in compliance with the following standards:

EN 71 1-3: 1988 / 6: 1994 – EN 50088: 1996 – EN 55014, part 1 + part 2: 1993

EN 61000-3-2: 1995 – EN 60742: 1995 – EN 61558-2-7: 1998 according to the directive 88 / 378 / EWG – 89 / 336 / EWG – 73 / 23 / EWG

## 3. WEEE-Declaration

Disposal of obsolete electrical and electronic equipment (as practised in the European Union and other European countries with dedicated collection systems).



This mark on the product, the packaging or the relevant documentation indicates that this product must not be treated like household waste. Instead this product should be disposed of at a suitable collection point for recycling of electrical and electronic appliances. Thus you contribute to avoid negative impact on the environment and people's

health that could be caused by inappropriate disposal. Recycling of materials contributes to preserve our natural resources. For more information regarding recycling of this product, please contact your local administration, your waste collection service or the dealer / shop where you purchased this product.

## 4. Important Notes – Please read this chapter first

We congratulate you to your purchase of an ESU Switch Pilot decoder. This manual will guide you step by step through the features of SwitchPilot respectively SwitchPilot Extension.

### **Important warning:**

Please read this manual carefully. Although the SwitchPilot has been designed as a robust device an incorrect connection may lead to faults or even to the destruction of the device. Avoid any "costly" experiments.



- The Switch Pilot is exclusively intended for use with model train layouts only. It may only be operated with the components listed here. Any other use is not permitted.
- Any wiring has to be carried out while power is disconnected.
- Any power supply must be protected by a fuse or circuit breaker to avoid any potential hazards such as burning cables in case of a short circuit. Only use transformers specifically designed for model trains that bear the VDE/EN marks.
- Never operate the SwitchPilot unattended. The SwitchPilot is not a (children's) toy.
- Adhere to the wiring principles as outlined in this manual for wiring any external components. Other circuitry may cause damage to the SwitchPilot.
- SwitchPilot is not water proof. It is not intended for outside use. If you use this product for exterior applications you do so at your own risk.
- Do not attempt to open your SwitchPilot module. Improper treatment may cause damage or destruction.

## 5. Features of SwitchPilot

The SwitchPilot is designed for activating turnouts, signals, magnetic un-couplers, light bulbs and other stationary loads on your model train layout.

It has four outputs for switching of up to 4 solenoids (e.g.: turnout motors) or 8 loads such as un-couplers or light bulbs. Each output can be programmed individually for continuous or pulsed output with variable pulse duration or blinking.

Thus it is possible to connect light bulbs or LEDs without any additional relays. Automatic fading assures prototypical run-up and shut-down of signal lamps.

In addition two commercially available RC-servos for hobby applications may be wired directly to the SwitchPilot. Their speed and end position can be adapted as required.

The SwitchPilot can be supplied with power either from the digital system or from an external AC- or DC-power source.

The SwitchPilot is multi protocol capable and therefore can either be operated with command stations as per the Märklin®-Motorola® system (e.g.: 6021, Central Station®) or with DCC compliant command stations. As laid down in the standards the SwitchPilot has to be activated with accessory addresses.

Due to the integral DCC RailCom® - transmitter it is possible to provide status feed back of the accessory to the command station. For instance an ESU EcoS command station can then display the manually activated change of status.

The SwitchPilot contains a full bridge rectifier. There is no need for separate power modules. Of course the transistor outputs of SwitchPilot are electronically protected against overload and short circuit.

### 5.1. Features of SwitchPilot Extension

For operating motor drives for turnouts or for the polarisation of the frogs you require a relay with potential free contacts. For this purpose each SwitchPilot can be connected to a SwitchPilot Extension which can be plugged into the side of the SwitchPilot and receives its power from it.

Each SwitchPilot Extension module has 4 by 2 relay outputs that are operated in parallel to the corresponding outputs of the SwitchPilot. This corresponds to the established k84-solution.

## 6. The outputs in detail

The SwitchPilot has a total of 8 transistor outputs that are grouped in four pairs 1 to 4. Each pair has two outputs, OutA and OutB. there are also two separate servo outputs.

The transistor outputs can be set to continuous, to pulsed power or to alternating blinking.

### Pulsed output:

If the output is set to pulse operation it will be activated as soon as a command is received. At the same time a timer starts counting: the "on-time" (duration of pulse) is determined by a pre-programmed value. The output cannot be active for longer or shorter than this value. Should you let go of the button before the end of the first pulse then the output remains active until the pre-determined time has been reached. If you press the button longer than the pre-determined pulse duration then the output is switched off even though the button is still pressed.

The limitation of the pulse duration helps avoid damage to solenoids.

The pulse duration can be set in such a way that the outputs are active as long as the button on the control panel is pressed. This operating mode is compatible with Märklin® k83 decoders.

### Continuous output:

Pressing the appropriate button on the control panel (e.g.: "red" for Märklin® central units or „+“ for Lenz Digital Plus®) switches on the first output Out A. It remains on until the corresponding button for output Out B is activated. Out A and Out B work like a change over switch.

Logically this operating mode complies with the Märklin® k84 decoder.



## Alternating blinker:

In this mode the terminals Out A und Out B of an output will be activated alternately. This is quite useful for the blinking red lights at level crossings amongst others.

The “on-time” can be set in the same fashion as the pulse duration.



Subject to the pulse duration and also in continuous mode it may happen that several outputs are on at the same time. Please note that the total current of all connected loads must not exceed the total permitted load of the decoder, namely 3.0 A.



## 7. Operating modes of the SwitchPilot

The SwitchPilot has a switch to select different operating modes. Thus you can easily set the desired mode (refer to picture 1). Therefore “programming” is not necessary for most standard applications.

This switch only operates the four transistor output pairs 1 to 4. The servo outputs 5 and 6 are not affected.

### 7.1. k83 mode

When you push the slide switch into the k83 position then the outputs 1 to 4 will be switched to pulse operation regardless of the programmed settings. The SwitchPilot behaves exactly like a Märklin® k83. Use this mode whenever you want to operate conventional solenoid drives.

### 7.2. k84 mode

In the k84-mode the outputs 1 to 4 will be set to continuous output regardless of any pre-programmed settings. The SwitchPilot behaves exactly like a Märklin® k84.

Use this mode to operate LEDS or light bulbs and whenever you do not require any specific programming.

### 7.3. User mode

The user mode is switched on by setting the switch for selecting the operating mode into the centre position. Only in this mode the outputs 1 to 4 will behave according to the software controlled settings.

# Connecting to the digital system

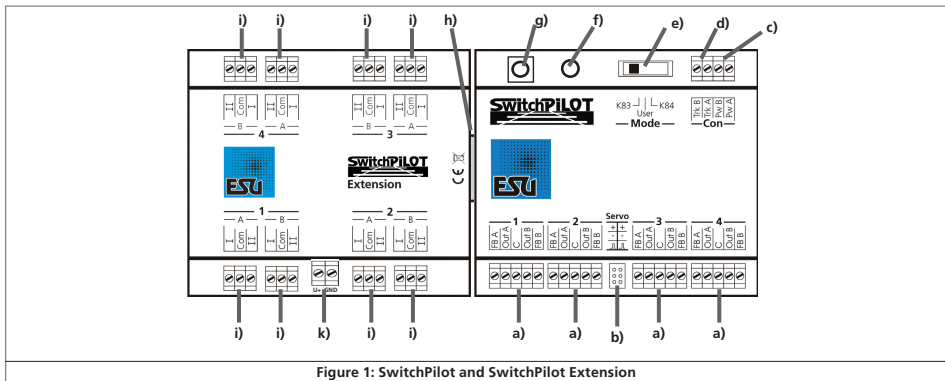


Figure 1: SwitchPilot and SwitchPilot Extension

## 8. Connecting to the digital system



We recommend setting all parameters of the SwitchPilot prior to installing the unit on your layout.

### 8.1. Terminals of the SwitchPilot / SwitchPilot Extension

Figure 1 shows the SwitchPilot together with the optional SwitchPilot Extension module.

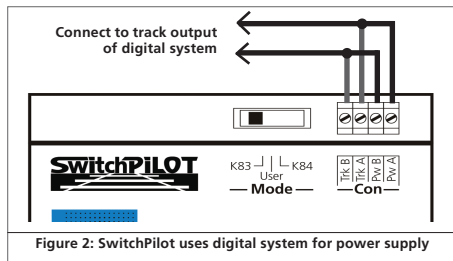
- Wire turnouts, signals, un-couplers or similar devices to the terminals of the (transistor) outputs 1 to 4. The terminals **FB A** and **FB B** are used for status feedback of the device.
- This multi-pin connector serves to wire two commercially available RC-Servos (e. g.: Graupner®, Futaba® or ESU) and represents the outputs 5 and 6 of the SwitchPilot.

- The power supply for the SwitchPilot and all the devices connected to it are wired to the terminals **Pw A** and **Pw B**. Both AC- and DC power supplies as well as the digital track voltage can be used.
- The screw terminals **Trk A** and **Trk B** connect the SwitchPilot with the power output of a (booster) command station transmitting the digital commands.
- The switch controlling the operating modes allows you to select any of the supported modes such as k83, user mode and k84-mode (also compare with chapter 7).
- The LED in conjunction with the
- programming button helps you to set the digital address of the SwitchPilot and SwitchPilot Extension. This process is described in chapter (9.3).

- h) The extension socket / plug connect the SwitchPilot and the SwitchPilot Extension mechanically and electrically.
- i) The outputs marked 1 to 4 offer one relay output A and B that can be switched together. Each relay output corresponds with the respective output of the SwitchPilot: If the output Out A of the SwitchPilot is active the terminal 1 and COM of the relay output are also active. If the output Out B of the SwitchPilot is active then the terminals 2 and COM are electrically connected. Unlike the transistor outputs the relay outputs always work as continuous outputs.
- k) Two screw terminals providing U+ (rectified track voltage) GND (negative supply). This voltage can be used to feed motor drives (compare with chapter 8.5.3.)

### 8.2. Power supply from the digital system

For smaller layouts with only a few devices to be switched simultaneously the power supply of the digital system may be used.



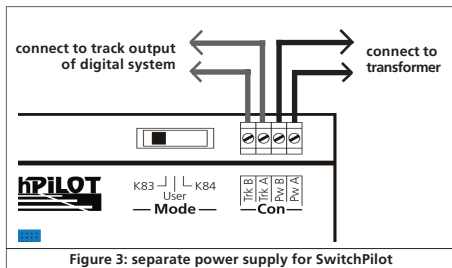
The screw terminals Pw A and Pw B are wired in parallel to the terminal Trk A and Trk B.

### 8.3 Separate power supply

For larger layouts with many devices controlled by SwitchPilots and simultaneously active we recommend to utilise a separate power supply; in this manner the power for switching the devices is not drawn from the track and thus reduces the load on the digital system.



Only use commercially available equipment designed for model trains and also take note of the maximum voltage as stated in chapter 11 in order to avoid any potential damage.



### 8.4. Wiring the SwitchPilot Extension

The SwitchPilot Extension module is connected by inserting it into the multi-pin connectors on the side of the SwitchPilot; push until the retaining clips make positive contact.

Please also refer to figure 1.



The internal logic and relays of the SwitchPilot Extension module receive power from the SwitchPilot.

# Wiring the outputs

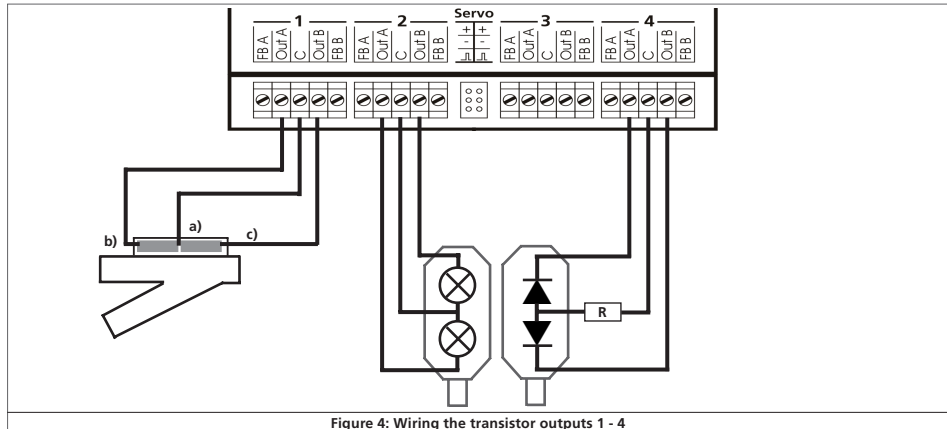


Figure 4: Wiring the transistor outputs 1 - 4

## 8.5 Wiring the outputs

### 8.5.1. Connecting double-coil solenoids

You may use all commercially available double-coil solenoid drives by all major manufacturers with SwitchPilot. Figure 4 shows how to wire output 1:

- The common wire of the solenoid is wired to screw terminal C.
- The wire leading to the first coil is connected to terminal Out A.
- The wire leading to the second coil is connected to terminal Out B.

- i** Should the aspect shown on your control panel not be as desired (in other words: if straight and diverging route are exchanged) simply swapp the wires between terminals Out A and Out B.
- i** SwitchPilot can also handle Peco turnouts. However, their current consumption is so high that you must adjust the overload setting of the SwitchPilot. Please refer to chapter 9.4.2 for details.



### 8.5.2. Wiring daylight signals and light bulbs or LEDs

If you use daylight signals with incandescent lamps (light bulbs) or LEDs you must set the corresponding output to continuous mode.

If the signal has incandescent lamps as shown for output 2 in figure 4 you may wire the lamps directly to the terminals of the SwitchPilot.

In order to limit the current for signals with LEDs a resistor must be wired in series with the LEDs. This is shown for output 4 in figure 4.

⚠ Please check if your signal already has a built-in resistor. Applying power without this resistor will destroy the LEDs immediately!

If there is no resistor in place you must wire this resistor marked "R" in series to the LEDs. Subject to the supply voltage and the desired brightness of the signal the resistor should have a rating of about 1 kohm to 2.2 kohm.

ⓘ The screw terminal **C** of each output has positive potential. Therefore the cathode of the LEDs must be connected to the terminals **Out A** respectively **Out B**.

### 8.5.3. Wiring a motor drive

The SwitchPilot can operate motor drives for turnouts with the aid of the SwitchPilot Extension. The direction of the motor is reversed by changing the polarity of the voltage on the motor terminals thus changing the position of the turnout or the aspect of a semaphore signal.

⚠ Only use motor drives with limit stop contacts to avoid overheating or a burnout of the motor. The relay outputs of the SwitchPilot Extension always connect the supply voltage to the load.

A motor drive is wired as shown in figure 5. The two wires for the power supply of the motor should be connected to the screw terminals as shown. Alternatively, they can be also connected to a separate DC-source and thus do not draw any current from the digital system.

⚠ Please take note of the permitted maximum supply voltage of your motor drive as stated in its manual.

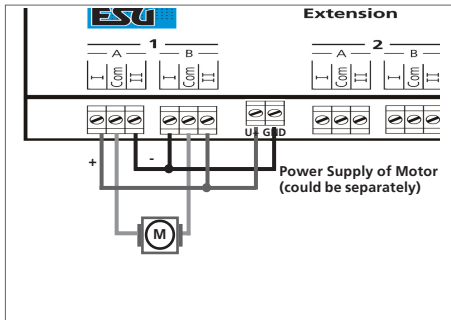


Figure 5: Motor drive used with SwitchPilot Extension

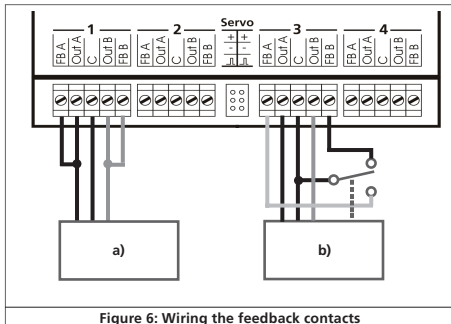


Figure 6: Wiring the feedback contacts

# Wiring the outputs

## 8.5.4. Wiring feed back contacts

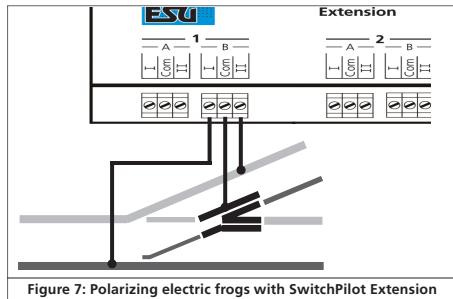
The SwitchPilot can report the actual aspect or position of the turnout to the command station via RailCom®. The turnout must have some extra contacts for this. Figure 6 on page 9 illustrates this situation:

- a) Connecting a motor of a turnout with limit stop contacts. Connect the terminals Out A with FB A and Out B with FB B.
- b) Connecting a motor with separate feedback contacts: connect the feedback contacts with terminal FB A respectively FB B and the common wire of the feedback contacts to terminal C.

**i** How the status (feedback) is displayed depends on your command station. The ESU ECOS®-command station can display the status on the turnout control panel with software 1.1.0 and higher.

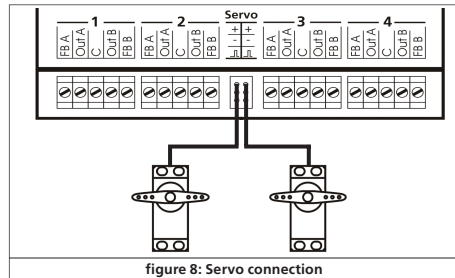
## 8.5.5. Polarising electric frogs

You may polarise (supply power of the correct polarity) to the electro-frog of your turnout.



## 8.5.6. Wiring a servo

The two servo outputs are something special. They operate independently from the outputs 1 to 4 but can also be assigned in parallel to output 1 and 2 if so desired. For instance you could use a servo for activating a turnout while simultaneously changing the signal aspect with the corresponding transistor output. All commercially available RC-servos for hobby applications may be used. They must have a three-pole terminal and operate on a positive pulse. The SwitchPilot provides 5V to the servo.



Simply insert the wire from the servo into the appropriate socket of the SwitchPilot. Generally the white or orange wire is used for the pulsed outputs of the servo.

**!** Please refer to the wiring diagrams on the housing of the SwitchPilot. Incorrect connections may destroy either the servo or the SwitchPilot!

The servo outputs can be configured individually as per chapter 9.4.3.

## 9. Programming the SwitchPilot

First you have to assign the turnout number or address of each output by giving the SwitchPilot the desired address. The easiest way of assigning the address is by means of the programming button. Please refer to chapter 9.3.

Then you can program certain CVs in order to set the operating mode of each output.

The CVs for extended settings are supported by all DCC compatible digital command station. This programming cannot be done with Motorola®-command stations (such as 6021, Märklin® Central Station®).

**i** However, despite the fact that you cannot program the outputs with the Motorola®-system you can still set them to a k83-respectively k84-compatible operating mode by means of the switch selecting the operating mode.

### 9.1. Factory settings

Outputs 1 to 4 are pre-set to address 1 to 4 with all outputs set to single pulse mode with 520 msec pulse duration. The servo outputs respond to addresses 5 and 6 and require 3.75 sec for a full movement with both end positions being about 50% of the possible distance of the starting point.

**i** With the exception of the address (turnout number) the SwitchPilot responds to CV-settings in user mode only.

### 9.2. Assigning turnout addresses

In digital systems turnouts are organised in groups of four. Turnout 1 – 4 represent the first group, turnouts 5 – 8 the second group, and so on. Depending on the digital system the number of available groups may vary: Märklin® Digital supports a total of 64 groups (and thus can activate 256 turnouts), while the SwitchPilot supports 511 groups in DCC mode (and thus 2044 turnouts).

You can assign such a group and an address to each group of your SwitchPilot. Therefore the outputs 1 - 4 of the SwitchPilot may activate the numbers 1 - 4, 5 - 8, 9 - 12 and so forth, right

up to 2041 – 2044 (in DCC mode).

The desired address is stored in CVs 1 and 9.

**i** Most digital systems (including the ECoS) show the turnout number rather than the actual address on the control panel.

**!** A separate address can be assigned to the servo outputs, which is stored in CVs 35 / 36. The SwitchPilot supports two independent addresses for the servo outputs.

### 9.3. Programming addresses with the programming button

You may program the addresses with the aid of the programming button without any complicated procedure on the programming track. We recommend to proceed as follows:

You must use this method if you work with a Märklin® Motorola® central unit (6021, Central Station®) or if you want to change the addresses of the turnouts after installation of the decoder on your layout.

#### 9.3.1. First address for outputs 1 - 4

1. Select the turnout number (address) on your digital system that you want to assign to the first output of your SwitchPilot. Proceed as per the instructions of your handheld throttle or your command station as if you wanted to switch the respective turnout (for ECoS users: refer to chapter 13ff in the ECoS manual).
2. Turn on the power supply of your layout.
3. Press the programming button and hold it long enough until (after about two seconds) the LED blinks as follows: *short, pause, short, pause*, and so on.
4. You may now release the button, the decoder is in learning mode.
5. Now switch the turnout you have selected in step 1 on your handheld controller or your command station. It is immaterial whether you switch from "straight" to "diverging route" or vice versa.

# Programming the SwitchPilot

6. Once the decoder has “understood” the address it will confirm this by lighting up the LED for one second.
7. Then the SwitchPilot goes back to the normal operating mode and the LED extinguishes.

**i** Should you have programmed another turnout instead of the first one of the group of four the correct group will be automatically detected and programmed.

## 9.3.2. Second address for outputs 5 - 6

The second address is used for the (servo) outputs 5 and 6. Always select turnout numbers at the beginning of a group of four, e.g.: 1 and 2, 5 and 6, 9 and 10, 13 and 14, etc.

1. Select the turnout number (address) with your digital system that you would like to assign to output 5 (first servo) of the SwitchPilot. Proceed as per the instructions of your handheld controller or your command station as if you wanted to switch this particular turnout (ECoS users please also refer to chapter 13ff in the manual).
2. Turn on the power for your layout.
3. Press the programming button and hold it down until (after about four seconds) the LED blinks as follows: *short, short, pause, short, short, pause*, and so on.
4. Then you may release the button; the decoder is now in learning mode.
5. Switch the turnout you have selected in step 1 with your hand held or the command station. It is immaterial if you switch from “straight” to “diverging route” or vice versa.
6. If the decoder has “understood” the address it confirms this by the LED lighting up for about one second.
7. The SwitchPilot then goes back to the normal operating mode and the LED extinguishes.

## 9.4. Programming on the programming track

For programming specific parameters of the decoder outputs the SwitchPilot has to be programmed on the programming track. This is most practical prior to installation on the layout.

**i** Due to the integral RailCom® technology ECoS users with firmware 1.1.0 or higher can read out data and program the SwitchPilot also when it is installed. Get more information from the ECoS manual (respectively the relevant extension).

### 9.4.1. Connecting to the programming track

For programming please connect the SwitchPilot as shown in figure 9 to your digital system. In this instance the power must be supplied from the command station.

**i** The SwitchPilot “understands” all relevant DCC programming modes. It is best to program it in DCC Direct Mode.

**!** In order to be able to read out any data you must connect a load to output 1 Out A that draws more than 60 mA, for instance a light bulb or a 180 Ohm / 1 Watt resistor.

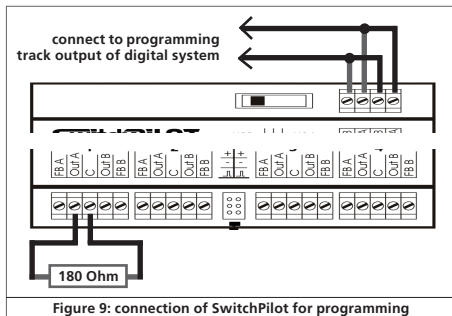


Figure 9: connection of SwitchPilot for programming

### 9.4.2. Programming parameters of the transistor outputs

In order to set the parameters of the transistor outputs 1 to 4 each is assigned to a configuration-CV: CV 3 is responsible for output 1, CV 4 for output 2, CV 5 for output 3 and CV 6 for output 4.

#### Configuration of an output for continuous power (k83):

Write the value 0 in the appropriate CV. The output will then behave as follows: the output is active as long as the corresponding button on the control panel is pressed. Once you release the button the output will switch off immediately. This is useful for un-couplers amongst others.

#### Output configuration to pulsed output with fixed pulse duration:

Write a value between 2 and 31 into the configuration-CV if you wish the output to generate a pulse of a pre-determined duration regardless of how long you actually press the button. This value describes the duration of the on-period as a multiple of 65 msec. The higher this value, the longer is the on-period.

Example:

You want to have an output lasting about one second. Write the value 15 into the CV ( $15 * 65 \text{ msec} = 975 \text{ msec}$ )

#### Configuration of an output for PECO solenoid drives:

If you wire a PECO solenoid drive to an output write the value 1 into the corresponding configuration-CV. This adjusts the overload (over current) protection to the higher values for PECO solenoid drives.

#### Configuration of an output as alternating blinker:

If you wish to set the two transistor outputs into the alternating blinking mode (for instance for levels crossings) then write a value between 32 and 64 into the CV. This value describes the duration of the on-period (blinking) as a multiple of 130 msec.

#### Configuration of an output for continuous operation (k84):

If you wish to alternately activate one of the transistor outputs until the other one is switched on then write the value 64 into the configuration-CV.

#### Configuring the „zoom“-effect (fade-in, fade-out) of the outputs:

The lights of prototype daylighting signals do not come on within a split second but rather take a few moments until they reach full output respectively until they extinguish fully. This effect can be simulated by programming the “zoom“-function to each output in CV 34. Please refer to the table in chapter 12.

### 9.4.3. Programming the parameters of the servo outputs

#### Servo speed:

You may adjust the running time from one end position to the other one of each servo. Thus prototypically slow movements are possible.

CV 37 and CV 40 are responsible for this. Possible values range from 0 to 63 as a multiple of 0.25 sec. For example, the servo takes about  $15 * 0.25 = 3.75$  seconds to reach the other end position at the factory default setting of 15.



Higher values may lead to a slower movement and may cause the servo to jerk or stutter since it cannot keep up very low revolutions at a constant speed. In this case reduce the value or use a servo with a different gear ratio and slower movement. Of course, the SwitchPilot cannot change the mechanical properties of the servo.

#### Servo-end position:

The end position of the servo can be set in CV 38 and 39 respectively in CV 40 and CV 41. The precise value depends on the type of servo and the installation. This can only be established by experimenting.



If your digital command station supports programming on the Main (POM) you may fine tune these CVs in normal operating mode. Change the settings of the relevant CVs step by step until the servo reaches the desired end position.

### 9.4.4. Resetting to factory default values

You can reset to the factory default values at any time in case you "get stuck":

Write value 08 into CV 08

### 9.5. Programming with the LokProgrammer or ECoS

If you have an ESU ECoS or an ESU LokProgrammer you may choose the most comfortable method of programming your SwitchPilot. ECoS with firmware 1.1.0 or higher features a separate programming mode for the SwitchPilot. Please refer to the manual and its extensions for this version.

Always use the latest software version on your PC for the LokProgrammer. This can be downloaded free of charge from our website.

## 10. Support and assistance

Your model train dealer or hobby shop is your competent partner for all questions regarding your SwitchPilot decoder. In fact he is your competent partner for all questions around model trains. Of course, you may also contact us directly. For enquiries please use either email or fax (don't forget to provide your own fax-no. or email address) and we will reply within a few days.

Please call our hotline only in case of complex enquiries that can't be dealt with by email or fax. The hotline is often very busy and you may encounter delays. Rather send an email or fax and also check our website for more information. You will find many hints under "Support / FAQ" and even feedback from other users that may help you with your particular question.

Of course we will always assist you; please contact us at:

by phone:            ++49 (0)700 – LOKSOUND  
                          ++49 (0)700 – 56576863  
                          Dienstag & Mittwoch  
                          von 10.00 Uhr bis 12.00 Uhr

by fax :                ++49 (0)700 - 37872538

E-Mail:                support@loksound.de

snail mail:            ESU GmbH & Co. KG  
                          - technischer Support -  
                          Industriestraße 5  
                          D-89081 Ulm

**[www.loksound.de](http://www.loksound.de)**

## 11. Technical data of SwitchPilot

### Operating modes:

- NMRADCC „Accessory Decoder“ compatible. Address range from 1 - 2044
  - Märklin® Motorola® compatible, up to turnout number 384. k83 compatible. k84 logic
  - Power supply by digital command station or separate DC- or AC-power supply.
  - Maximum supply voltage: 18V AC or 24V smooth DC.
- Transistor outputs 1 to 4:
- 4 outputs with two transistors each, each with 1.5A continuous, 2.0A peak (20 seconds).
  - Total maximum load of device: 2.0A continuous, 3.0A peak (20 seconds)
  - Overload and short circuit protection for outputs.
  - Switching time of each output between 0.06 sec to 2.00 sec or adjustable for continuous output. Optional blinking mode and „zoom“-effect for lighting effects.

### Servo outputs:

- 2 Servo outputs for RC-servos (e.g.: Graupner® JR, Futaba® or ESU), adjustable pulse duration between 1.0 msec and 2.0 msec, positive pulse. Adjustable speed and end positions.
- Power supply for the servos with 5V stabilised supply. Maximum current draw of the servo: 250 mA continuous, 500 mA peak (20 seconds)

### Feed back:

- Integral RailCom® status feedback reports turnout status via the tracks and can be displayed on ECoS (amongst others).

### Dimensions in mm:

- app. 86mm x 86mm x 25mm

## 12. Technical data of SwitchPilot Extension

### Operating modes:

- Extension module for SwitchPilot, power is supplied by the latter. Relay outputs are controlled by SwitchPilot.

### Outputs:

- 4 Relays with two outputs each (2 x changers), switched as one, with screw terminals for potential-free switching or power supply for electro-frogs.
- Maximum load per relay output: 30V AC, 2 A continuous.

### Dimensions in mm:

- app. 86mm x 86mm x 25mm

### 13. List of all supported CV's

CV	Name	Description	Range	Value		
1	Decoder address 1, LSB	Lower 6 bits (bit 0 - 5) of the first decoder address for the outputs 1 to 4. Is used in conjunction with CV 9 in order to store the address.	1 - 63	1		
3	Configuration output 1	Describes the properties of decoder output 1.		0 - 64	8	
		Function	Description			Value
		Continuous output	k83-compatible: output is active as long as the button at the control panel is pressed.			0
		Pulse mode PECO	pulse mode for PECO-turnout drives. Reduces the sensitivity of the overload protection.			1
		Pulse mode	Duration of „On“-status: multiple of 65 msec.			1 - 31
		Alternating blinker	Out A and Out B are alternately active. Duration of „On“-status: multiple of 130 msec			32 - 63
Bi-stable	k84-compatible: either Out A or Out B is active, continuous output	64				
4	Configuration output 2	Describes the properties of decoder output 2		0 - 64	8	
		Function	Description			Value
			- as CV 3 -			
5	Configuration output 3	Describes the properties of decoder output 3.		0 - 64	8	
		Function	Description			Value
			- as CV 3 -			
6	Configuration output 4	Describes the properties of decoder output 4.		0 - 64	8	
		Function	Description			Value
			- as CV 3 -			
7	Version number	Internal software version of the decoder	-	-		
8	Manufacturer's ID	Manufacturer's ID by ESU Writing value 8 results in a full factory reset of all CVs.	-	151		
9	Decoder address 1, MSB	higher 3 bits (bit 6 - 8) of the first decoder address for the outputs 1 to 4. used together with CV 1 to store the address.	0- 7	0		



CV	Name	Description	Range	Value
28	RailCom configuration	Activation and configuration of RailCom-functions 0 - 3	0	
		Bit Description	Value	
		1 Data transfer on channel 2 No data transfer on channel 2 Data transfer on channel 2 permitted	0 2	
		2 Confirmation of command on channel 1 No confirmation of command on channel 1 Confirmation of command on channel permitted	0 4	
29	Configuration register	DCC-configuration settings for SwitchPilot	128	
		Bit Description	Value	
		3 RailCom communication RailCom communication is switched off RailCom communication is permitted	0 8	
		7 Decoder is DCC Accessory Decoder (read only, cannot be reprogrammed)	128	
33	Function output status	Current status of function outputs 1 to 4.	0 - 255	-
		The status of the 8 feedback contacts is only valid if they are wired correctly to the turnout feedback contacts. The value of CV 33 can be read and displayed via RailCom.		
		Bit Description	Value	
		0 Status output 1, input <u>FB A</u>	1	
		1 Status output 1, input <u>FB B</u>	2	
		2 Status output 2, input <u>FB A</u>	4	
		3 Status output 2, input <u>FB B</u>	8	
		4 Status output 3, input <u>FB A</u>	16	
		5 Status output 3, input <u>FB B</u>	32	
		6 Status output 4, input <u>FB A</u>	64	
7 Status output 4, input <u>FB B</u>	128			

# List of all supported CV's

CV	Name	Description	Range	Value		
34	„Zoom“-configuration	Defining the outputs 1 - 4 that should show the „fade-in, fade- out“ effect when turned on or off. „Zoom“ means slow fade-in or fade-out of the function. This enables you to simulate the prototypical changeover of daylight signals, hence this function only makes sense for daylight signals.	0 - 31	0		
		Bit			Description	Value
		0			„Zoom“ - function active for output 1	1
		1			„Zoom“ - function active for output 2	2
2	„Zoom“- function active for output 3	4				
3	„Zoom“- function active for output 4	8				
35	Decoder address 2, LSB	Lower 6 bits (bit 0 - 5) of the second decoder address for the outputs 5 and 6. Is used in conjunction with CV 36 in order to store the address.	1 - 63	1		
36	Decoder address 2, MSB	Higher 3 bits (bit 6 - 8) of the second decoder address for the outputs 5 and 6. Is used in conjunction with CV 35 in order to store the address.	0 - 7	0		
37	Running time output 5 (servo 1)	Running time (speed) of servo 1 from one end position to the following. The running time is always a multiple of 0.25 seconds: 1 = 0.25s,...,63 = 15.75s	0 - 63	15		
38	Position A output 5 (servo 1)	Position A of output 5. Value indicates the pulse duration transmitted to the servo. Value 0 = 1msec,..., 63 = 2msec.	0 - 63	24		
39	Position B output 5 (Servo 1)	Position B of output 5. Value indicates the pulse duration transmitted to the servo. Value 0 = 1msec,..., 63 = 2msec.	0 - 63	40		
40	Running time output 6 (servo 2)	Running time (speed) of servo 2 from one end position to the following. The running time is always a multiple of 0.25 seconds: 1 = 0.25s,...,63 = 15.75s	0 - 63	15		
41	Position A output 6 (servo 2)	Position A of output 6. Value indicates the pulse duration transmitted to the servo. Value 0 = 1ms,..., 63 = 2ms.	0 - 63	24		
42	Position B output 6 (Servo 2)	Position B of output 6. Value indicates the pulse duration transmitted to the servo. Value 0 = 1ms,..., 63 = 2ms.	0 - 63	40		

## 14. Warranty

### 24 Months warranty form date of purchase

Dear customer,

Congratulations on purchasing this ESU product. This quality product was manufactured applying the most advanced production methods and processes and was subject to stringent quality checks and tests.

Therefore ESU electronic solutions ulm GmbH & Co. KG grants you a warranty for the purchase of ESU products that far exceeds the national warranty as governed by legislation in your country and beyond the warranty from your authorised ESU dealer.

### **ESU grants an extended manufacturer's warranty of 24 months from date of purchase.**

#### Warranty conditions:

- This warranty is valid for all ESU products that have been purchased from an authorised ESU dealer.
- No claims will be accepted without proof of purchase. The filled in warranty certificate together with the receipt from your ESU dealer serves as proof of purchase. We recommend keeping the warranty certificate together with the receipt.
- In case of a claim please fill in the enclosed fault description as detailed and precise as possible and return it with your faulty product.

#### Extend of warranty / exclusions:

This warranty covers free of charge repair or replacement of the faulty part, provided the failure is demonstrably due to faulty design, manufacturing, material or transport. Please use the appropriate postage stamps when shipping the decoder to ESU. Any further claims are excluded.

#### The warranty expires:

1. In case of wear and tear due to normal use.
2. In case of conversions of ESU – products with parts not approved by the manufacturer.
3. In case of modification of parts, particularly missing shrink sleeves, or wires directly extended on the decoder.
4. In case of inappropriate use (different to the intended use as specified by the manufacturer).
5. If the instructions as laid down in the user manual by ESU electronic solutions ulm GmbH & Co. KG were not adhered to.

Due to liability reasons any inspections or repairs can only be carried out on products that are not installed in a locomotive or carriage. Any locomotive sent to ESU for inspection will be retuned without even touching it. There is no extension of the warranty period due to any repairs carried out by ESU or replacements.

You may submit your warranty claims either at your dealer or by shipping the product in question with the warranty certificate, the receipt of purchase and the fault description directly to ESU electronic solutions ulm GmbH & Co. KG at:

ESU GmbH & Co. KG  
- Garantieabteilung -  
Industriestraße 5  
D-89081 Ulm



