LokPilot 5 Basic

- ✓ DCC/DC-Decoder with B-EMF for engines equipped with DC or coreless motors
- ✓ Four powered function outputs (+8 logic level outputs for 21MTC version)
- ✓ RailComPlus® for automatic Registration at ESU command stations
- ✓ Supports ABC braking & versatile ESU Version 5 function mapping

59020   LokPilot 5 Basic

DCC Decoder
NMRA 8 pin wire harness
DCC & ABC & RailComPlus
4 powered function outputs
1 logic level output (PowerPack)

4 044645 590201

Specification		
Operational modes	NMRA/DCC with 14, 28, 128 speed steps.	
	2-digit (short) and 4-digit (long) addresses.	
	Analog DC operation (de-selectable).	
	Automatic recognition of operational mode and DCC speed step selection.	
	Supports Lenz® LG 100 and ABC Braking sections	
Throttle	Runs DC and coreless motors.	
	0,9 A continuous load. 10 kHz - 50,00 kHz motor pulse width frequency motor regulation.	
	Motor output overload protection. Back-EMF (de-selectable)	
Function outputs	4 powered outputs with overload protection	
	250mA load per output.	
	500mA total load of all function outputs.	
	8 pin version supports 1, 21MTC version supports 8 additional logic level outputs.	
	Shunting speed and momentum key selectable.	
Programming	DCC Servicemode & DCC POM (Programming on Main).	
Features	RailCom® Feedback system. RailComPlus® Automatische Anmeldung.	
Interface	NMRA 8 pin	21MTC
dimensions in mm	25,5 x 15,5 x 4,5	25,5 x 15,5 x 4,5
dimensions	1.00 x 0.61 x 0.18	1.00 x 0.61 x 0.18
Item - Number	59020	59029

UK CA   CE   (age 14+)   ♻

WARNINGS

- Do not expose to wet and humid conditions and avoid mechanical force or pressure on the decoder.
- Do not remove the heat shrink sleeve.
- Never solder on the board, extend cables if necessary.
- Never wrap the decoder in insulation tape, since this may cause overheating.
- Any wiring has to be carried out while power is disconnected.
- Make sure that neither the decoder nor any blank wire ends may come into contact with the engine chassis (risk of short circuit).
- Never operate the LokPilot unattended.

Requirements for Installation

The locomotive must be in perfect operating condition prior to the conversion: Only a locomotive with faultless mechanical properties and smooth running characteristics in analogue mode is worth converting to digital. Check and replace all wear and tear parts such as motor brushes, wheel contacts, light bulbs etc., if necessary.

Installing the Decoder

Locomotives with 8-pin NEM 652 interface

Some LokPilot 5 decoders are supplied with an 8-pin interface (refer to Fig 1). Remove the dummy plug from the socket. Insert the plug of the decoder in such a way that pin 1 of the plug (this is the side with the red / orange wires) sits next to the corner of the socket that is usually marked with *, +, • or 1.

Locomotives with 21MTC interface

Some LokPilot 5 Basic decoders are equipped with an 21MTC interface (fig. 2) You can insert the decoder in two ways: either the pins are put through the decoder; the socket of the decoder remains visible after installation (mounting on top) or the decoder is inserted in such a way that the pins go straight into the socket. Which of the two mounting positions is the correct one depends solely on the locomotive. The position of the marker-pin is the crucial indicator.

Plug the decoder into the socket in such a way that the locomotive interface corresponds with the decoder. Do not apply too much pressure when inserting the plug. The decoder must go in without force.

Locomotives without interface

Firstly, please cut all wires installed in the locomotive. Take special care to remove any connections to the chassis (ground): the motor leads must be positively potentialfreemay not have any contact to the chassis or the wheels and wheel contacts. Figure 3 shows all connections.

Function outputs

You can wire all kind of loads to the function outputs.

⚠️⚡ Please make sure that the load does not exceed the permitted maximum current and there are no short circuits. The outputs of the LokPilot have protection but if an external voltage is applied, the outputs may suffer damage or destruction.

Back

AUX2
Right motor terminal
right track terminal
Rear Light
U+ (positive Pole)
AUX1
Head light
Left motor terminal
Left motor terminal

GND
AUX9
U+

AUX9 is a logik level output. Default: PwrPackCtrl

Pin	Description	Color
1	Right motor terminal	orange
2	Rear light	yellow
3	Output AUX1	green
4	Left track terminal	black
5	left motor terminal	gray
6	Head light	white
7	Common (U+) pole	blue
8	Right track terminal	red

Figure 1: LokPilot 5 Basic with 8-pin interface

AUX10	1	22	Right track
AUX7	2	21	Left track
AUX6	3	20	GND
AUX4	4	19	Right motor
SUSI(AUX12)	5	18	Left motor
SUSI(AUX11)	6	17	AUX5
Rear light	7	16	U+ (+ Pole)
Head light	8	15	AUX1(Power)
n.c.	9	14	AUX2(Power)
n.c.	10	13	AUX3
Index pin	11	12	VCC
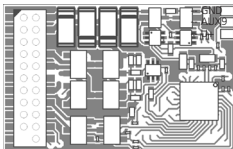
AUX3, AUX4, AUX5, AUX6, AUX7, AUX10 at the 21MTC interface are logic level outputs

AUX11 is a logic level output or SUSI Clk
AUX12 is a logic level output or SUSI Dta

AUX9 is a logic level output.
Default: PwrPackCtrl for PowerPack

How to connect the decoder:

Locomotive PCB
(Side view)

Insert the decoders with **connector towards up** (e.g. Atlas®, Intermountain, Bowser, Märklin®)

Insert the decoder with **Connector towards bottom** (e.g. Brawa®, Accurascale)

Locomotive PCB
(Side view)

Figure 2: LokPilot 5 Basic with 21MTC interface

violet **AUX2**
green **AUX1**
yellow **Rear light**
white **Head light**

locomotive chassis

violet
orange
red
yellow
blue
green
white
black
gray

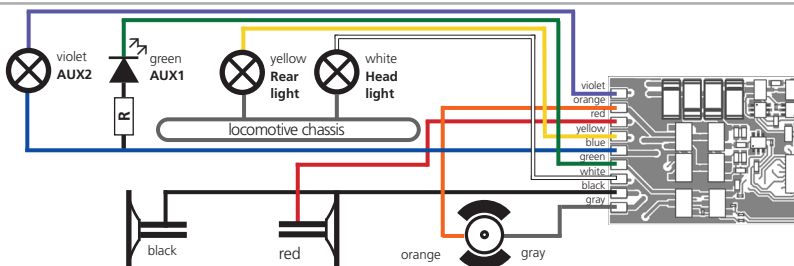black   red   orange   gray

Figure 3: Wiring diagram for LokPilot 5 Basic (wiring example)

Only install bulbs rated 16V or higher and with a nominal current draw, that does not exceed 50 mA or use suitable smoke units such as Seuthe No. 11. If you like to use LEDs, a resistor with a rating between 470 Ohms and 2.2 kOhms need to be wired in series. Running the LED without resistor will lead to their immediate destruction! All function outputs from AUX3 and higher are following the NEM660-Standard (VHDM RCN-121, NMRA S.9.1.1.3) are are so called logic level outputs. It is not possible to connect any external load to such outputs directly. External power transistors are required. Usually, these are already installed on the locomotive›s motherboard (if required). For do it your self projects, ESU is offering appropriate adapter boards (e.g.items 51957 or 51968) with transistors.

SUSI/Logic level-outputs

Alternatively, the two pins on the LokPilot 5 Basic with 21MTC interface that are assigned to the SUSI serial interface can also be configured as logic level outputs. In this way, the number of available outputs can be increased by two.

⚠️ Please remember that the two SUSI-pins, available on 21MTC, Next18 or PluX can be used as logic level outputs or Servo control lines alternatively, still following the standards. You have to check the actual connection of your locomotive motherboard to be sure about the function.

Connecting capacitors

On many older locomotives, the current pickup is not very reliable. Therefore, power interruptions may cause a stop or jerky movement when the locomotive travels over turnouts at low speeds. This can be overcome with buffer capacitors. The minimum capacity used should be 470uF / 25V. Smaller capacitors will not show good results. You can connect an electrolyctic capacitor following figure 4. Charging is done trough a 100 Ohms resistor, limiting the charging current.

⚠️ The capacitors must be removed or disabled prior to programming the decoder using the ESU Lok-Programmer device!
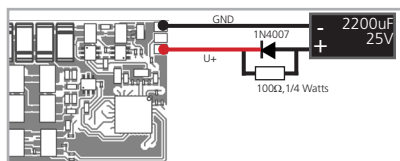
Figure 4: 2200μF capacitor at LokPilot 5 Basic

PowerPack for LokPilot 5 Basic

You can solder a powerful energy buffer to all LokPilot 5 Basic decoders. The connection diagram figure 5 shows you how to do it. This «Powerpack» allows your locomotive to keep running for up to 2 seconds without power. ESU supplies under the item number 54671 or 54672 suitable PowerPack modules. Please do ONLY use these.

• The PowerPack only operates in digital mode. It automatically turns off on analog layouts.

• It may take up to two minutes to fully charge the capacitor («Goldcap»). Therefore, the time bridged with the energy buffer depends on the current draw of your locomotive and the charge-up time.

⚠️ The time to be bridged with the PowerPack can be set in CV 113. Output AUX9 needs to be set to «PowerPackControl» (Should be the default).
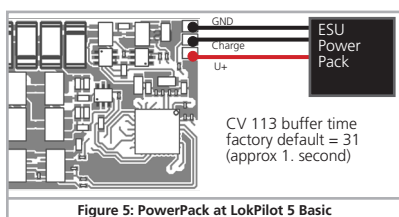
Figure 5: PowerPack at LokPilot 5 Basic

After connecting the PowerPack, you can make the decoder switch off after a certain time. CV 113 is responsible for that. The factory default value of 31 equals to about 1 second. You should set a time between 0.3s and 1s .

For the PowerPack to work, the function output responsible for the charge (AUX9) must be configured to the «PowerPackControl» function. Although this should be set up by default already, you can do this manually also:

Set CV 31 = 16, CV 32 = 0 first.

Then set CV339 = 31.

DCC Operation

ⓘ The LokPilot 5 Basic works with any DCC system. Remove any capacitors that are wired into the track feeders (e.g. ROCO® feeder track). This could impair the functionality of the decoder.

The address is set to 03 using 28 speed steps .

F1 switches output AUX1

F2 switches output AUX2

F3 switches the switching mode on and off

F4 switches the acceleration and deceleration on/off

F5 switches output AUX3 (if applicable)

F6 switches output AUX4 (if applicable)

F7 switches output AUX5 (if applicable)

F8 switches output AUX6 (if applicable)

DC Operation

The LokPilot 5 Basic are set ex factory to operation on conventional DC layouts as well. No settings are needed to be done.

Decoder Settings (Programming)

A list of the most important CV parameters is given later. These can be changed using any DCC command station. If your command station supports RailCom®, you can read CV values on the main.

A list of all decoder parameters can be found in the detailed manual for the LokPilot 5 Basic, which can be downloaded from our website www.esu.eu in the «Downloads» area. The extensive function mapping is also discussed there, and all light functions are explained there, also.

Lenz ABC-Brake Mode

LokPilot 5 Basic supports the ABC braking technique. To use this function, a group of anti-parallel diodes will be soldered to one half of the track. The resulting fall of voltage generates an asymmetrical DCC signal that can be detected by the decoder.

• If you want to stop the decoder no matter in which half of the track the diodes are set, please set Bit 0 and Bit 1 in CV 27 (CV27=3).

In some operational situations it may happen that the LokPilot decoder does not detect the ABC braking section.

You can influence the detection sensitivity with the aid of CV 134. Cange the default value (10) step by step and test until you achieve the desired result.

RailComPlus®

Using RailComPlus®, the decoder will be automatically recognized by a compatible command station. You can disable this by deleting Bit 7 of CV 28

Decoder Reset

You can reset the decoder to the default settings at any time.

Enter the value 08 into CV 08

CV	Name	Description			Range	Value
1	locomotive address	Address of engine			1 - 127	3
2	Start voltage	Sets the minimum speed of the engine			1 - 255	3
3	Acceleration	This value multiplied by 0.896 is the time from stop to maximum speed			0 - 255	16
4	Deceleration	This value multiplied by 0.896 is the time from maximum speed to stop			0 - 255	12
5	Maximum speed	Maximum speed of the engine			0 - 255	255
6	Medium speed	Medium speed of the engine. Use only if 3-point speed table is enabled			0 - 255	88
8	Manufacturer's ID	Manufacturers's ID ESU			151	-
17/18	Long address of the loco	Long address of engine (4-digit address)			128- 9999	192
19	Consist address	Additional address for consist operation. Value 0 or 128 means: consist address is disabled 1 – 127 consist address active, normal direction 129 – 255 consist address active reverse direction			0-255	0
27	Brake mode	Allowed (enabled) Brake modes				24
		Bit	Function	Value		
		0	ABC braking, voltage higher on the right hand side	1		
		1	ABC braking, voltage higher on the left hand side	3		
		3	Brake on DC, if polarity against driving direction	8		
		4	Brake on DC, if polarity like driving direction	16		
		7	Loco brakes with constant brake distance if Speed=0	128		
28	RailCom® Configuration	Settings for RailCom® (Set Value to 0 to disable a function)				131
		Bit	Function	Value		
		0	Channel 1 Address broadcast enabled	1		
		1	Data transmission allowed on Channel	2		
		7	RailCom® Plus automatic loco recognition active	128		
29	Configuration register	This register contains important DCC information				12
		Bit	Function	Value		
		0	Reversed direction of travel	1		
		1	28 or 128 speed steps DCC instead of 14 speed steps	2		
		2	Enable analog operation	4		
		3	Enable RailCom®	8		
		4	Speed curve through CV 67 - 94 (instead of CV2,5,6)	16		
		5	Long addresses (CV 17 + 18) instead of short (CV1)	32		
49	Extended Configuration #1	Important ESU decoder settings (Set Value to 0 to disable a function)			0 - 255	17
		Bit	Function	Value		
		0	Enable Load control (Back-EMF)	1		
		4	Enable automatic DCC speed step detection	16		
51	«K Slow» Cutoff	Internal Speedstep, until «K Slow» is active			0 - 255	10
52	BEMF Param. «K Slow»	««K» -Portion of the PI-Controller valid for lower speed steps			0 - 255	10
53	Control Reference voltage	Defines the Back EMF voltage, which the motor should generate at maximum speed. The higher the motor efficiency, the higher this value may be set. If engine does not reach maximum speed, reduce value.			0 - 255	140
54	Load control Parameter «K»	«K»–component of the internal PI-controller. Defines the effect of load control. The higher the value, the stronger the effect of Back EMF.			0 - 255	50
55	Load control Parameter «I»	«I»–component of the internal PI-controller. Defines the momentum (inertia) of the motor. The higher the momentum, the lower this value.			0 - 255	100
67-94	Speed table	Defines motor voltage for speed steps.			0 - 255	-
112	Frequency for Flashing light effects	Flashing frequency for Strobe lighting effects. Multiple of 0.065536 nds.			1 - 255	16
113	Power Fail Bypass	The time that the decoder bridges via the PowerPack after an interruption of voltage. Unit: multiple of 0.032768 seconds.			0 - 255	31
124	Extended Configuration #2	Further important ESU decoder settings				
		Bit	Function	Value		
		0	Keep direction direction when changing direction. Do not keep driving direction.	1 0		
		3	Disable SUSI serial protocol. Enable SUSI serial protocol.	0 8		
		4	Enable Output AUX10 (LokPilot 5 Basic 21MTC only) Enable sensor input (LokPilot 5 Basic 21MTC only)	0 16		
125	Start voltage Analog DC	Starting voltage for DC operation.			0 - 255	30
126	Maximum Speed Analog DC	Track voltage for maximum speed in DC mode.			0 - 255	130
134	ABC-Mode „Sensibility"	Threshold, from which asymmetry on ABC shall be recognized.			4 - 32	10