CV	Description	Area	Value*
1	**Locomotive address**	DCC: 1 - 127 Motorola®: 1 - 80	3
2	**Minimum speed** (the speed from 0 until the locomotive is running at speed step 1)	0 - 255	0
3	**Acceleration delay**	0 - 255	30
4	**Braking delay**	0 - 255	30
5	**Maximum speed** (must be greater than CV 2)	0 - 255	200
6	**Average speed** (must be greater than CV 2 and less than CV 5)	0 - 255	100
7	**Software version** (The processor can be updated) **Value**	-	differently
8	**Manufacturer's ID** Decoderreset CV8 = 8 *1	different	162
12	**Decoder operating mode** *4 *16 *32 *64 Bit 0=1 DC (analog operation; direct current) on Bit 2=1 DCC data format on Bit 4=1 AC (analog 3-rail operation; alternating current) on Bit 5=1 Motorola® data format on Bit 6=1 mfx® data format on	0 - 117	117
17 18	**Long locomotive address** **Value** 17 = high Byte 18 = low Byte	1 - 10239 192 - 231 0 - 255	1000 195 232 1
27	**Brake signal settings** (automatic stop) 2 16 32 Bit 0 = 1 -> ABC (Automatic Brake Control) right rail positive Bit 1 = 1 -> ABC left rail positive Bit 4 = 1 -> DC; opposite direction of travel **Value** Bit 5 = 1 -> DC; same direction of travel	0 - 51	0
29	**DCC standard configuration** *0 1 0 *2 0 *4 0 *8 *0 16 *0 32 Bit 0=0 Normal direction of travel Bit 0=1 Opposite direction of travel Bit 1=0 14 speed steps Bit 1=1 28 speed steps Bit 2=0 Digital mode only Bit 2=1 Automatic analog/digital recognition Bit 3=0 RailCom® turned off Bit 3=1 RailCom® turned on Bit 4=0 Speed steps over CV 2, 5, and 6 Bit 4=1 Use the characteristic curve from CV 67 - 94 Bit 5=0 Short address (CV1) Bit 5=1 Long address (CV 17/18)	0-63	14
30	**Error codes for the motor, thermal overload, and function outputs:** 1 = motor error, 2 = thermal overload error, 4 = function output error	0-7	0

* factory set values

Assignment of the function keys

F0	Light	F1	Function output A1

#56503
PIKO multiprotocol SmartDecoder XP 5.1 NEM652
mfx® capability included

PIKO
MODELLBAHNEN & GEBÄUDEMODELLE H0

NOTE: Detailed information on the PIKO SmartDecoder XP 5.1 is available as a PDF file on our Webshop on the page of the respective item number. The file contains a full description of all functions and operating possibilities for the new SmartDecoder XP 5.1.

Description
This PIKO SmartDecoder XP 5.1 with 8-pin interface according to NEM652 is a compact, yet powerful multi-protocol decoder. It complies with the current RCN standards in all areas and can be used in DCC, mfx® and Motorola® digital systems. The decoder can be used on DC or AC analog layouts. It automatically senses what operating mode is used on your layout and is RailCom®/RailCom Plus® compatible. The SmartDecoder XP 5.1 features several programmable braking distance functions in addition to numerous other programmable functions.

The load-controlled decoder operates with an auto-adaptive motor control and is therefore suitable not only for DC motors, but also for bell armature motors up to a continuous current consumption of 1.2 A. The decoder will also tolerate a temporary current draw up to 2 Amps. The motor speed table can be set using the minimum, median, and maximum motor speed (simple curve), or by the user-programable 28-speed step extended curve. The decoder has two directional light outputs and an additional special function output, which can be activated via function keys up to F68 (DCC). The switching (shunting) gear, with extended slow speed range, the three possible starting and braking delays, are also switchable via function keys. Due to the advanced power management the PIKO SmartDecoder XP 5.1 is supported in case of brief loss of power is supported.

Installing the PIKO SmartDecoder XP 5.1
Remove the jumper plug from your model's NEM 652 interface. At the same place insert the 8-pin plug of the decoder carefully into the interface socket. Please note the coding of PIN 1 note. If the plug is turned 180°, the locomotive will run in the wrong direction and the light will not work. Check for crossed wires and short circuits before and after reinstalling the shell. Place the model on your programming track with programming mode activated on your DCC system. During programming or when reading the model's DCC address, a small amount of current will flow through the model, which does not affect the decoder; even in the event of a short circuit.

Special function A1
The special function output A1 of the PIKO SmartDecoder XP 5.1 can only be used if the desired consumer is already connected to the NEM 652 interface in the vehicle, or if there are solder pads on the main board.

A short circuit in the motor, lighting, pick-up wiper, or wheelsets can destroy the decoder as well as the electronics of the model!

First-time use of the decoder (state of delivery)
Enter address 3 on your DCC control system. Depending on your DCC system's data format, the decoder will operate using 28 speed steps or in Motorola® mode. When using a RailCom Plus®-enabled DCC system or with an mfx®-capable system, the decoder is recognized in a few seconds and can be operated immediately. If the decoder is used on a conventional analog layout, it can be controlled with a DC or AC power pack. The decoder will automatically detect the layout's operating mode.

NOTE: In DC analog mode, your model will only start at a higher voltage than what you may accustomed to when operating analog models. You will need to turn the throttle up for the model to start operating.

Function outputs in analog mode
It is possible to program the decoder so that function keys F0 - F12 (as they are assigned in the function mapping) can also be activated in analog mode. To do this, CVs 13 & 14 must first be programmed with a DCC central control unit. The corresponding values can be found in the CV table of the detailed operating instructions.
The light function (F0) and output A1 (F1) are switched on ex works.

CE

Motorola®

The decoder utilizes 4 Motorola® addresses to access functions F1 - F 16, when using a Motorola—based command station. The three sequence addresses for the functions F5 - F16 are ascending to the decoder address and can be activated in CV61 as required by the values 1 (F5 - F8), 2 (F5 - F12), or 3 (F5 - F16).

Configuration of CVs

In addition to the decoder address, the indexed CVs of a locomotive decoder are the most important CVs. These are the CVs 12 and 29 in the PIKO SmartDecoder XP 5.1. As a rule, an indexed CV contains various basic settings of a decoder, such as reversing the direction of travel. CV calculation examples can be found in the detailed operating instructions.

RailCom®, RailCom Plus®

In the decoder, CV29 (RailCom®) can be turned on or off via bit 3. If RailCom Plus® is turned on, the decoder will be automatically recognized by a RailCom Plus®-enabled DCC control system (i.e. PIKO SmartControl) and a locomotive icon, decoder name, and its special function icons will appear on the control system's screen. With RailCom Plus® technology, no locomotive data has to be stored in the DCC central control unit and no locomotive addresses have to be programmed into the decoder.

mfx®

PIKO SmartDecoder XP 5.1 is specifically made for the mfx® data format. If your control system uses the mfx® format, then the decoder is automatically recognized and is assigned its locomotive symbol, decoder address, and its up to 16 special function symbols. With mfx® technology, no locomotive data has to be stored in the central control unit and no locomotive addresses have to be programmed into the decoder.

Braking

The decoder understands the following braking methods:
Märklin® braking section (brakes with analog DC voltage)
DCC braking function
ABC (Automatic Brake Control) braking section
The decoder can stop the model with two adjustable braking distances that are accurate down to the centimeter.
More information on "braking behavior" can be found in the detailed operating instructions.

Shunting speed (RG)

The desired function key F0 - F68, via which the shunting speed (half speed) can be switched on, is entered in CV157.

Starting and braking delays (ABV)

The desired function key F0 - F68, which can be used to switch off the ABV, is entered in CV156. The values of the starting and braking delays can be changed in CVs 3 and 4.

Function outputs

A comprehensive description of all options related to the function outputs can be found in the detailed operating instructions.

Simple and extended function mapping

In the simple function mapping according to RCN-225 (CVs 33 - 46) the switching tasks such as lighting and special function output can be freely assigned to the function keys F0 to F12 of the digital command station. The switchable starting and braking delay and the shunting gear can be assigned to any function key up to F68 in CVs 156 and 157 can be assigned to any function keys up to F68. More information can be found in the detailed operating instructions.

Smoke generator control

A smoke generator can be connected to output A1, which can be controlled by the decoder either load- or speed-dependent.
speed-dependent by the decoder. The assignment to the function keys is done exclusively via the extended function mapping extended function mapping.

Extended function mapping

Due to its complex nature, extended **function mapping** cannot easily be set by programming individual CVs. To work with extended **function mapping**, you will need the PIKO SmartProgrammer device (#56415) and, if desired, the PIKO SmartTester (#56416). Detailed information on extended function mapping is available in the instruction manual.

Servo control

The decoder enables the control of a servo motor via function output A1. The assignment to the function keys is done exclusively via the extended function mapping.

The use of a servo with the decoder requires electronics expertise.

Further information can be found in the detailed operating instructions.

ATTENTION: Soldering on the decoder should only be carried out by experienced specialists with the appropriate tools. Decoders damaged by improper handling will not be covered by the warranty.

NOTE: To upload a PIKO locomotive project to the decoder, you need the test and programming device PIKO SmartProgrammer (#56415) and (optional) the PIKO SmartTester (#56416).

Factory reset

To restore the decoder to its factory settings, program CV8 to a value of 8.

Programming

Configuration variables (CVs) form the basis of all the decoder's settings. This decoder can be used with the PIKO SmartControl_light DCC system, the PIKO SmartControl DCC system, or any other DCC- and Motorola based systems.
For more information on programming options, please refer to the instruction manual.

Service:
Internet: www.piko.de
E-Mail:info@piko.de

In the event of a defective decoder, please return the decoder module to PIKO along with proof of purchase, the decoder address, and a short description of the problem.