

IntelliSound 3 Decoder 35330

Multi-protocol Sound Decoder with Load Regulation with RailCom® for Locomotives with 21-way MTC Interface

Features

- Regulated multi-protocol decoder for DCC and Motorola
- Suitable for DC and Bell armature motors up to 1.2A
- Quiet motor running with 18.75KHz control frequency
- 14, 27, 28, 31 and 128 speed steps depending on the data format
- Short (1-127) and long (128-9999) addresses
- NMRA compatible
- RailCom
- Minimum, maximum and middle speeds adjustable
- Speed step table for 14 and 28 speed step modes
- Main line programming (DCC)
- Switchable shunting speed (half speed)
- Switchable acceleration and braking inertia
- Direction dependent, dimmable lighting switched via F0
- Adjustable train-side lighting
- 6 dimmable, time controllable special function outputs
- 2 sound controlled special function outputs
- Sound or Speed step dependant control for smoke units
- Adjustable blink generator for all function outputs
- 2 time controlled special function outputs especially for electric couplings
- With possibility to connect storage capacitor
- With SUSI interface for connecting additional sound modules or other modules to control switchable auxiliary functions
- Reacts to DCC compatible brake signals and braking sections with DC voltage
- Over heating protection, all outputs have short circuit protection
- Conventional AC and DC operation with automatic switching between the various modes
- All CV's programmable by digital devices with DCC and Motorola format
- Updatable using Flash memory

Description

The Sound decoder 35330 is a small, more efficient multi-protocol decoder. It can be used in DCC and Motorola digital systems and runs equally well in analogue mode with DC or AC current and changes direction by over-voltage pulse (Märklin System). The desired operating mode is automatically recognised.

The decoder is not only suitable for DC motors but also for bellarmature motors (e.g. Faulhaber, Maxon, Escap) up to constant current load of 1.2A. Short term higher switch-on currents are well tolerated. The configuration of the motor performance curve is done either with the minimum, middle and maximum speed or with various CVs for the individual speed steps. Load regulation can be fitted to different locomotives with regulation parameters.

The decoder provides two direction dependent light outputs and also 6 additional special function outputs which can be controlled by function keys f 1 to f 12 (function mapping). All outputs are found on reserved contacts on the 21-pole MTC Interface socket. They are dimmable and can blink at a configurable frequency. For operating electric couplings two time-controlled outputs are provided. The dynamic smoke generation of smoke generators can also be dependent on speed steps.

Head and tail lights can be switched off depending on the direction.

Installing the Sound decoder

Connecting the Decoder

Plug the decoder onto the 21-pole interface plug. The socket on the decoder must be on the top when this is done, so that the pins pass through the holes in the decoder circuit board. The plug and socket are polarised, so that the decoder cannot be inserted incorrectly.

Connection of Special Functions

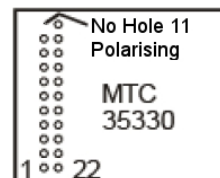
The special function outputs A1 to A6 are integrated into the 21-pole MTC Socket.

The description for the sound dependent function outputs SA1 and SA2, and the usable Loud speakers can be found in the manual for the sound module.

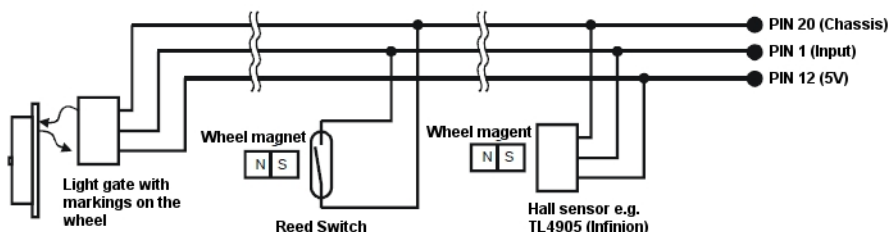
Assignment of the 21-pole MTC Interface according to NEM 660

PIN	Connection
1	Sensor input S1
3	Special function output 6 (LISSY)
4	Special function output 4
5	SUSI Clk
6	SUSI Data
7	Light - Rear
8	Light - Front
9	Loud speaker – chassis
10	Loud speaker output
12	+5V for Hall sensor

PIN	Connection
13	Special function output 3 (SA1 Sound dependent)
14	Special function output 2
15	Special function output 1
16	20V after rectifier
17	Special function output 5 (SA2 Sound dependent)
18	Motor output 1
19	Motor output 2
20	Decoder chassis (after rectifier)
21	2-rail: Left Wheels / 3-rail: Chassis
22	2-rail: Right Wheels / 3-rail: Pickup



Sensor input e.g. Wheel Rotation Sensor



The pulse generator is connected to the identified contacts as shown in the connection diagram.

Connecting a LISSY Mini Transmitter module

A LISSY Mini-transmitter 68400 can be connected to the Sound decoder. Remove the 4-pole plug from the LISSY Mini-transmitter and solder the wires to contacts 20 (black), 16 (red) und 3 (blue).

To activate the LISSY Mini-transmitter Bit 1 of CV49 must still be set to value 1.

Connecting a Backup Capacitor

A backup capacitor can be connected to the Sound decoder (e.g. 2200 µF 25V). It is connected to pins 20 (-) and 16 (+20V).

Attention: Take particular note of the polarity when connecting the capacitor!

Digital and analogue Operation

On digital layouts the decoder can be controlled in Motorola or DCC data format. Enter address 3 on the control device. The decoder runs in the data format it is addressed with, in Motorola mode, or in DCC mode with 28 speed steps.

On analogue layouts the decoder can be controlled from a DC or AC power unit (System Märklin). All operating modes are automatically recognised by the decoder.

Function outputs in Analogue Operation

Prior programming with a digital center determines which function output lights to A6 are switched on in analogue operation. For this CV13 must be programmed according to the CV-Table. Outputs are mapped to Bits 0 to 6.

If only light (Bit 0 = 1) and function output A1 (Bit 1 = 1) are to be on, then Bits 0 and 1 are set. CV13 is programmed to value 3.

Function Mapping

Outputs light and A1 can be assigned to special functions f0-f3 according to the following Table. Outputs A2 to A6 can all have special function f0-f12 assigned to them. The shunting mode and Start/Brake inertia can only be assigned with special functions f4-f12. Outputs SA1 and SA2 are sound dependent and cannot be switched with special functions keys. Every bit in CVs 33-46 assigns the corresponding function key to a switch instruction. If multiple bits are set the special function switches multiple outputs.

Example: if e.g. function key f4 is to switch shunting mode (RG), Start/brake inertia (ABV) and Output A4, then CV38 must have a value of 196, i.e. Bits 2 (value 4*), 6 (value 64*) and 7 (value 128*) must be set.

CV	Function Key	ABV	RG	A 6	A 5	A 4	A 3	A 2	A 1	A0 h Light rear	A0 v Light front	Value
33	f 0f			128	64	32	16	8	4	2	1	1
34	f 0r			128	64	32	16	8	4	2	1	2
35	f 1			128	64	32	16	8	4	2	1	4
36	f 2			128	64	32	16	8	4	2	1	8
37	f 3			128	64	32	16	8	4	2	1	16
38	f 4	128*	64*	16	8	4*	2	1				4
39	f 5	128	64	16	8	4	2	1				8
40	f 6	128	64	16	8	4	2	1				16
41	f 7	128	64	16	8	4	2	1				128
42	f 8	128	64	16	8	4	2	1				64
43	f 9	128	64	16	8	4	2	1				0
44	f 10	128	64	16	8	4	2	1				0
45	f 11	128	64	16	8	4	2	1				0
46	f 12	128	64	16	8	4	2	1				0

Switching off front and rear Train Lighting

The numbers of special functions 1-12 can be entered into CV107 (front) and CV108 (rear), which switches the white and red light, front or rear, off. Also set up here the function output to which the red end light is connected.

The functions entered here must be set up with Function-Mapping so that no other outputs are switched on. Ensure that the output used by the red light cannot be switched by another function key due to Function-Mapping i.e. the Function-Mapping CV of the f-key used here must be set to zero. So that the switching of the lights to functions correctly, both CVs 107 and 108 must be programmed. If one of CVs 107 or 108 is programmed with 0, the function is deactivated.

The value for programming CVs 107 and 108 is made up of operations. One to specify to which output A1 to A6 the switch off light is connected, and the other, with which functions key f1 to f12 the light is to be switched. Since a CV can only be programmed with one value, these values are combined to a single value with the following schema:

Light assignment: A0 v = white light front, A0 h = white light rear

CV107 for red light front

CV108 for red light rear

Calculation: Output * 16 + Function key

Example:

The red light front is to be connected to A3 and switched with f5.

CV107 = 3 * 16 + 5 = 53

The red light front is to be connected to A4 and switched with f6.

CV108 = 4 * 16 + 6 = 70

Blink generator for all Function Outputs

The On and Off time of the blink generator can be programmed. The light output and outputs A1 - A6 can be bound with a blink generator.

CV109: Blink assignment Bit 0-6 = light, A1 - A6

CV110: Blink generator Off time in 100ms steps

CV111: Blink generator On time in 100ms steps

Dimming the Function Outputs

Each output can be configured with various PWM (Pulse width modulation). The PWM value are 0 (0%) to 32 (100%). The PWM Frequency is approximately 52Hz. The dimming for light and function outputs is configured with CVs 116 (light) to 122 (A6).

Configuring Function Outputs A1 and A2 for electric Couplings

An electric coupling can be connected to A1 and A2. If the output is switched on, for a time of T1 it is fed from PWM1 and then for a time of T2 from PWM2. Subsequently, it is switched off for a time of T3. This sequence can be repeated up to 255 times.

Configured by:

CV124 - Coupling repetitions	0 = no coupling	0 - 255
CV125 - Coupling PWM1	Activation PWM	0 - 255
CV126 - Coupling PWM2	Hold PWM	0 - 255
CV127 - Coupling time T1 x 50ms	Activation time	0 - 255
CV128 - Coupling time T2 x 0.1s	Holding time	0 - 255
CV129 - Coupling time T3 x 0.1s	Pause time	0 - 255

Note: To protect the coupling the repetitions should be minimized.

Dynamic Smoke Generator Control

A Smoke generator can be connected to output A1 or A2. In order to develop enough smoke before departing. It is possible to configure a start delay time (T1) up to approx. 7 sec., during which the smoke generator is powered with PWM1. When departing, the output can be powered with PWM1 for a further time (T2), up to approx. 12 sec. After this time it is switched to PWM2 (Normal operation), while the speed step is higher than 0. If the speed step is 0 the output is switched to PWM3 (idle).

Configured by:

CV130 - Bit 7=1	A1=smoke generator operation,	Bit 6=1	A2=smoke generator operation
Bit 5-0	Smoke time (T2) x 0,2s	0=no smoke generator operation	
CV131 - PWM1 Departing (Bit 0-4),	start up delay (T1) x approx. 1s	(Bit 5-7)	
CV132 - PWM2 Normal operation	(Target speed step)		
CV133 - PWM3 Idling	(Stationary)		

RailCom

If the locomotive decoder is to operate with RailCom Bit 3 of CV 29 must be set. Additionally the Motorola Format in CV 12 must be switched off.

Märklin Brake Section

The decoder reacts to a Märklin braking section (braking with analogue power on the track), when CV29 Bit 2 and CV49 Bit 7 are set to 1 (Factory default 1 and 0).

2. Locomotive Address for Märklin Centers (only Motorola)

CV50 can be programmed with a second locomotive address so that Functions f5 to f9 can be switched with function keys f0 to f4 of this second locomotive address.

Programming of Sound Decoders

The Configuration variables (CV's) form the basis of all possible operations of the decoder in accordance with the DCC standard. The decoder can be programmed with the Intellibox, DCC controllers and Motorola controllers.

Programming with the Intellibox

We recommend that, irrespective of the data format that will eventually be used, the decoder be programmed using the menu for DCC decoders.

The Intellibox supports DCC programming with a user friendly input menu. Long addresses do not have to be calculated laboriously, as they can be entered directly. The Intellibox calculates the values for CV 17 and CV 18 automatically. For precise instructions please read the appropriate chapter in the Intellibox manual.

Special case locomotive addresses 80 to 255 in Motorola format

In Motorola format the Intellibox supports an address range to 255. Addresses 1 to 80 can also be programmed freely using DCC programming. However, if locomotive addresses higher than 80 are to be used, the locomotive address must be programmed according to the chapter "Programming with a Märklin controller".

After programming is complete, CV 1 has a value of 0 and the decoder uses the Motorola address larger than 80.

Programming with DCC devices

Use the programming menu of its DCC controller to select and program the decoders CV's by register, CV directly or page mode programming. With a DCC controller it is also possible to program the decoder using main line programming. For the exact procedure refer to the controller user manual.

Programming of long addresses without programming menu

If programming is to be done with controllers that do not support programming with an input menu, the values for CV 17 and CV 18 must be calculated. Here is a guide for programming of address 2000.

- Divide the address by 256 (2000/256 = 7 remainder of 208).
- Take the integer result (7) and add 192
- Program the result (199) into CV 17
- Program the remainder (208) into CV 18

Important: Set bit 5 of CV 29 to 1, so that the decoder uses the long address.

Values for calculating the CV value

CV's 29 and 49 can be used to set the decoder into different modes. The value to be programmed is calculated by using the CV and adding the values of the desired functions.

Example

Normal driving direction	Value = 0
28 speed steps	Value = 2
Auto Analog/digital change over	Value = 4
RailCom off	Value = 0
Speed steps using CV 2, 5, 6	Value = 0
Short address	Value = 0

The sum of all values is 6.

CV 29 preset to this value ex factory.

Bit	CV 29 function	Value
0	Normal driving direction Reverse driving direction	0 1
1	14/27 speed steps 28/128 speed steps	0 2
2	Only digital operation Automatic analog/digital change over	0 4
3	RailCom switched off RailCom switched on	0 8
4	Speed steps using CV2, CV5 and CV6 Characteristics using CV67-CV94	0 16
5	Short address (CV1, register 1) Long address (CV17 and CV18)	0 32

Programming with a Märklin Center

With a Märklin center all CV's can be programmed, but not read.

1. Switch Center off and on.
2. Select the address of the decoder and switch the light on.
3. Operate the direction change-over 5 times in quick succession with the stationary locomotive (speed step 0), until the light turns off.
4. Set the speed control to the "zero" position. The rear light flashes slowly 4 times.

5. Enter the number of the CV that is to be programmed.
6. Briefly operate the direction change-over. The rear light flashes fast 4 times.
7. Enter the desired value for CV e.g. a locomotive address.
8. Briefly operate the direction change-over. The rear light flashes slowly 4 times.

If further CV's are to be programmed repeat points 4-7.

If programming is to be terminated switch the center to "STOP" or set the address to "80" and briefly operate the direction change-over.

Since a Motorola digital center from Märklin only accepts inputs of 01 to 80, the value "0" must be entered by entering the address as "80".

Page-Register for inputting CV-Numbers greater than 79

CV addresses larger than 79 can only be programmed with the help of the page register, CV66. If CV66 has a value higher than 0, then the contents of CV66 times 64 will be added to every address entered. The entered value must lie in the range 1 to 64. When leaving Motorola programming mode the page register (CV66) is automatically reset to zero.

Example

If CV82 is to be programmed with a value of 15, then CV66 must first be programmed with a value of 1. Subsequently, CV18 can be programmed with a value of 15. The decoder places the value 15 into CV82, which is derived from multiplying the contents of the CV66 (in the example 1) by 64 (thus 64) and then adding the entered CV address (18).

Offset-Register for entering CV values greater than 79

CV values larger 79 can be programmed only with the help of the offset register. The offset register is CV65. If CV65 contains a value > 0, then all following programmed values are calculated by multiplying the contents of CV65 by 4 and adding the result to the entered value. When leaving Motorola programming mode the offset register (CV65) is automatically reset to zero.

Example

CV49 is to be programmed with a value of 157, then CV65 must first be programmed with the value of 25. Subsequently, CV49 can be programmed with a value of 57. The decoder places the value $4 * 25 + 57$ into CV49.

Note: When programming CV65 and CV66 the contents of the offset and page registers have no effect.

Programming with a Mobile Station

Mobile Station 1: The Programming Menu is available in the Mobile Station's Loco Menu, only for certain locomotives. A locomotive which is equipped with a programmable decoder must be selected from the Database. Proceed as follows:

1. Add a new locomotive and select Part No. 36330. The Display then shows locomotive Ee 3/3.
2. Press the "MENU/ESC" button and select the "LOK Change" ("LOK ÄNDERN") column. Here you will find the last function of Register Programming indicated by "REG". Use this function to change the decoder's CV's. You can only write to the CV's with this function.
3. Enter the number of the CV and confirm this with the reversing knob.
4. Enter the value for the CV and confirm this with the reversing knob. The Mobile Station then programs the CV with the desired value.

Mobile Station 2: For programming, please use the CV programming menu.

Attention: Before programming, remove from the track all locomotives that are not to be programmed!

Motor Regulation

The motor's load regulation can be adapted to suit the locomotive with CVs 53 to 58.

Here the individual CV's have the following purpose:

- CV53 Motor regulation repetition rate
- CV54 P constant for the PID regulator
- CV55 I constant for the PID regulator
- CV56 Regulation frequency
- CV57 D constant for the PID regulator
- CV58 Length of the time slot for measuring the back EMF voltage

Guide for changing the controller parameters P,I,D:

- 1.) Set CV54, 55 and 57 with factory setting of the decoders CV2, 5 und 6 (min., max. and middle Speed).
- 2.) Set CV55 and 57 to zero
- 3.) Set CV54 so that the locomotive just moves on speed step 2.
- 4.) Increase CV55 so that the locomotive moves off quickly, as desired, when changing the speed step from 0 to 1. (The step size should be 1.)
- 5.) Jerky behaviour with the change of speed step can be compensated for in CV57. (The step size should be 1.)
- 6.) If necessary adapt CV2, 5, 6 from step 2.) and start over with the adjustments.

If no satisfactory result can be obtained then you must

- a) change the regulation repetition rate in CV53.
- b) Increase the measuring time for the back EMF voltage in CV58. (With some motors smooth running can only be achieved at low speed in this way.)
- c) reduce the regulation frequency in CV56. (this is valid when the locomotive already runs at top speed at a speed step lower than the maximum and after no further change in speed occurs)

Make the respective changes to CV53, 56, 58 in small increments and if necessary repeat the PID regulation in points 1.) to 6.).

Table of CVs (Configuration Variables)

CV	Description	Value Range	Factory Default
1	Locomotive address	DCC 1-127 Mot 1-80	3
2	Minimum Speed	1-63	3
3	Acceleration 1 means that every 5 ms the actual speed is increased by 1 If the internal maximum speed is set to 200 (CV5=50 or CV94 = 200), then acceleration time from 0 to Fmax is 1sec.	1-63	5
4	Braking inertia (time factor CV3)	1-63	5
5	Maximum speed (must be greater than CV2)	1-63	60
6	Middle speed (must be greater than CV2 and less than CV5)	1-63	32
7	Software version (The processor can be updated)	-	varies
8	Manufacturer (Decoder reset when CV8 is set to 8)	-	85
12	Digital format Bit 0=0 DCC data format off (not programmable via DCC) Bit 0=1 DCC data format on Bit 1=0 Motorola data format off Bit 1=1 Motorola data format on <i>Attention: If both formats are switched off the decoder can only be programmed.</i>	1-2	3
13	Function outputs in Analogue mode Bit 0-6 = Light and A1 to A6; switch on (Bit = 1), switch off (Bit = 0)	0-127	1
17,18	Long locomotive address 17 = high byte 18 = low byte	1-9999 199-231 0-255	2000 199 208
19	Consist address (double traction) 0 = Consist address inactive When bit 7=1 the driving direction is reversed The desired speed CADR + 128 = reverse direction	1-127	0
29	Configuration for DCC Bit 0=0 Normal direction Bit 0=1 reversed travel Bit 1=0 14 speed steps Bit 1=1 28 speed steps Bit 2=0 Only digital operation Bit 2=1 automatic analog/digital switching Bit 3=0 RailCom switched off Bit 3=1 RailCom switched on Bit 4=0 Speed steps using CV2, 5 and 6 Bit 4=1 Motor characteristics using CV67-94 Bit 5=0 Short address (CV 1) Bit 5=1 Long address (CV 17/18)	Value 0 * 1 0 2 * 0 4 * 0 * 8 0 * 16 0 * 32	0-255 6
33-46	function mapping (see Table "function mapping")	0-63	Varies
47	Speed correction forwards	0-63	32
48	Speed correction reverse	0-63	32
49	Locomotive decoder configuration Bit 0=0 Motor load regulation On Bit 0=1 Motor load regulation Off Bit 1=0 SUSI configured for Sound module Bit 1=1 SUSI configured for LISSY Mini transmitter Bit 2=0 brakes to 0 in brake section Bit 2=1 brakes to speed step in CV52 Bit 5=0 Dimming for A1 and A2 Off Bit 5=1 Dimming for A1 and A2 On Bit 6=0 Light outputs not swapped Bit 6=1 Light outputs swapped Bit 7=0 Brake only with brake signal Bit 7=1 Brake with analog potential	Value 0 * 1 0 * 2 0 * 4 0 * 32 0 * 64 0 * 128	0-255 0
50	2. Motorola address for switching functions f5-f8 with a Motorola Center	1-255	0
51	Configuration of analog operation 1 = only AC operation, 2 = only DC operation, 3 = both	1-3	3
53	Motor regulation repetition rate	0-63	35
54	Motor regulation P Constant	0-63	20
56	Motor regulation I Constant	0-63	10
56	Regulation Frequency	0-63	32
57	Motor regulation D Constant	0-63	12
58	Time slot for AD transducer measurement	0-63	2
59	Reset to factory defaults If this CV is set to 1, the decoder will be returned to factory setting.	0, 1	0
60	Short circuit monitoring Motor and Function outputs 0 = inactive, 9 = active (do not change)	-	137
61	Constant for Temperature monitoring 0 = Temperature monitoring off	0-255	32
61	Shutdown temperature in °C 0 = Temperature monitoring Off	0-255	Varies
62	Error buffer Motor, Function outputs and Temperature monitoring 1 = Error Motor, 2 = Error Function outputs, 4 = Over temperature	0-255	32
64	Speed at the end of the braking section Valid if CV49 Bit 2=1 and Bit 7=1	0-63	30
65	Offset-Register For CV Programming with a Motorola center	0-255	0
66	Page Register For CV Programming with a Motorola center	0-255	0
67-94	Characteristic curve for speed steps 1-28	0-255	Varies
107	Switch front lighting off	0-127	0
108	Switch rear lighting off	0-127	0
109	Assignment of Blink generator to the Function outputs Bit 0-6 = Light and A1 to A6; switched on (Bit=1), switched off (Bit=0)	0-127	0

CV	Description	Value Range	Factory Default
110	Blink generator off time in 100ms steps	0-255	5
111	Blink generator on time in 100ms steps	0-255	5
115	LISSY Train category	1-4	1
116-122	Dimming of light and Function outputs A1 – A6 0=off, 32 = 100%	0-32	32
124	Coupling repetitions for electric couplings connected to A1 and A2 0=no coupling	0-255	0
125	Activation PWM for electric Coupling on A1 and A2	0-255	255
126	Hold PWM for electric Coupling on A1 and A2	0-255	64
127	Activation time for the coupling. Value * 50ms	0-255	5
128	Hold time for the coupling. Value * 100ms	0-255	20
129	Pause time for the coupling. Value * 100ms	0-255	20
130	Dynamic smoke generator control on A1 and A2 0=no smoke generator operation Bit 7=1 A1= smoke generator operation Bit 6=1 A2= smoke generator operation Bit 5-0 Smoke time (T2) with PWM departure Value * 0.2s + start up delay (T1) from CV131	Value 0* 128 64 1-63	0
131	Dynamic smoke generator control PWM start up Bit 0-4 PWM start up Bit 5-7 departure delay (T1) approx. 1-7s	0-255 0-31 32, 64, 128	127
132	Dynamic smoke generator control PWM normal operation	0-32	16
133	Dynamic smoke generator control PWM idling	0-32	8

The factory default values are marked with *.

Technical Data

Addresses:	1-9999 (long DCC address)
Total load/Max. Motor current:	1.2 A*/2A
Function outputs:	0.4A each
Max. duration of stored sounds:	320 seconds
Sound channels for replay:	4
Size:	30 x 15 x 4.8 mm

* The constant loading capacity may vary after installation.

Delivery State

The decoder can operate in Motorola data format or DCC data format with 28 speed steps and address 03. It automatically switches between both formats. The decoder can also be driven with DC or AC power supplies (Märklin System) on analogue two or three rail layouts.

The trade names mentioned are registered trade marks of the respective companies.

Guarantee declaration

Each component is tested for its complete functionality before distribution. If a fault should arise within the guarantee period area of 2 years, we will repair the component free of charge upon production of proof of purchase. The warranty claim is void if the damage was caused by inappropriate treatment.

Please note that, according to EMV law, the component may only be installed in vehicles which carry the CE logo.