ModeLLdepO

Decoder SoundGT2 (Ver. 5.0.0)

SoundGT2 sound decoder is designed to be installed into the locomotives of H0 scale (or less scale).
It operates with any DCC command stations.
Decoder is equipped with speakers of various sizes.

Features.

- Fully compatible with DCC digital control system
- 4 modifications:
  - 8 pin connector NEM652
  - 21MTC connector
  - Plux22/16/12/8 connector
  - 6 pin connector NEM651with wires (on request)
- Powerful low-resistance speakers of 4Ω and 8Ω can be used
- Acoustic power of 3W(4Ω) and 1.5W(8Ω)
- High-precision synchronization of motion and sound
- Speed curve adjustment
- Puff intervals adjustment for steam locomotives
- ABC system (Automatic Break Control).
- ABC can recognize “red” (stop) and “yellow” (slow down) signals.
- CBD (Constant Breaking Distance)
- RailCom bidirectional communication protocol support
- Adjustable Back EMF providing the motion at a very low speed
- Silent PWM control of engine at 20KHz
- motor current up to 1.4A
- 11 additional outputs with function mapping:
  - 6 additional power outputs with the current limit 1A.
  - 5 additional low power outputs with the current up to 80mA (open collector)
- Overload protection for all decoder outputs except low power ones
- total decoder current up to 2,1A
- Adjustable light effects
  - MARS light
  - Gyrolite
  - Flashing
  - Strobe light
  - Flashing ditch light
- Smooth light on and off switching
- Smooth voltage setting on additional power outputs from 0 to 20V allows to use some devices (smoke generators for example) designed for lower voltage (12V, 16V)
- Safe coupling control algorithm
- Automatic un-coupling mode, with reverse motion opportunity
- Automatic smoke generator control function, according to speed of motion

- Shunting and half speed modes
- Can be used on analog DC layout with sound
- 14 or 28/128 speed step
- Short Address (1-127) and Long Address (128-9999) commands support
- CV programming support, both on Programming track and Main Track also
- Additional capacitor can be connected to solve poor power collection and/or dirty rails problem.
- Special algorithm switching off the loads when contact disappear s allows to overcome small dirty sections
- Sound and decoder firmware version change/update can be performed after decoder installation into model (MD Prog2 is required)
- Maximum rail voltage: 24V
- Dimensions: 30.0 * 15.5 * 4.5 mm

1 year warranty.

Please, read this manual before use.

Differences from the first generation of SoundGT

Sound
The sound has become far better, it is now louder and purer.
Sound volume has risen from 1 up to 3 W due to low-resistance speakers. Amplifier distortion has been decreased due to the last generation of D class amplifier, bass response also has become better making the sound more natural. Now the decoder can identify 20 functional buttons: F1…F20, let alone the 'light' button. It allows more sounds of optional devices and signals to be added to the project. There is now an option of changing the volume of each sound individually while creating a sound project. The sound is now reproduced in the analogue mode as well.

Engine control
The Back EMF system is much more sophisticated in SoundGT2 providing a very slow and smooth rotation of the engine in comparison with SoundGT. The engine rotation is so slow that the model (locomotive) move is hardly visible at the lowest speed. A very smooth speed-up and slow-down is provided. Back EMF can be adjusted for different types of engines although it is not needed in most cases.

Additional outputs
There were only 4 high current outputs in the SoundGT's first generation. Now they are 11 including 6 high and 5 low current ones for LED and low-power tube connecting. In addition to all the SoundGT algorithms, new ones of coupler automatic control with reverse option, along with dimmer are implemented at the high power outputs. Low power outputs are meant to connect outdoor and indoor lighting, apart from the main illumination which HL1 and HL2 is normally used for. These outputs can only be 'on' or 'off' depending on the respective button position in the station and the locomotive's direction. A new option of automatic output swiching is added that depends on 'stop' or 'move' state of a locomotive.

Size and performance
The new decoder is smaller. Due to its length it now can be installed across a H0 locomotive in its wide part. Although sound power has increased in 3 times and the number of outputs has risen, SoundGT2 heated far less due to it has been developed using last generation components.

The problem of dirty rails
SoundGT2 is far less sensible to cut-off (voltage failure). It became possible due to:

1. Compact installed capacitors providing power supply at the moment of contact loss.
2. Specific algorithm of load switching off (except engine) at the moment of cut-off. The decoder constantly controls voltage values and in case of contact loss the additional outputs are switched off. The sound is also switched off smoothly without clicks. Thus the power acummulated in the installed capacitors is expended only on the engine's performance that allows to get over a short contact loss.
3. More sophisticated hardware components providing more effective power use and less heat loss

For small scales we offer DCC sound decoder SoundGT2 micro, it has the same possibilities except less output power and smaller quantity of AUXs, it has only 6 high current outputs.
Dimensions of SoundGT2 micro - 23,0x11x3,3mm
For additional information see www.modelldepo.ru

Decoder installation

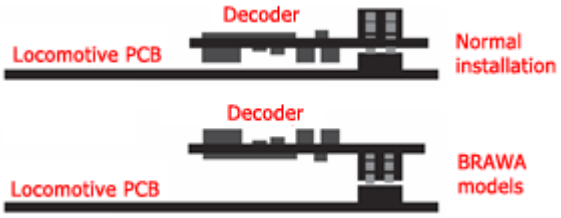
The decoder SoundGT2 can be supplied 4 types of connector:
- NEM652 8-pin connector
- 21MTC-pin connector
- Plux22/16/12/8 connector
- NEM651 6-pin connector with wires (on request)

installation into the 8-pin connector connector NEM652
If a locomotive has a typical 8-pin connector (NEM652) than you should take out an analog plug and insert a decoder into the connector.
A 8-pin connector is not symmetrical so there are 2 installation options. You should refer to the locomotive manual to install decoder correctly although you can go without it.
Normally the first pin is marked with '*' in a locomotive and it corresponds with the orange wire.
In case of incorrect installation, decoder controls the engine. As a result the locomotive goes but the light is off. In this case, put the decoder connector backward. Incorrect installation does not damage decoder or locomotive.

installation into the 21MTC connector

Put the decoder so that the connector is upward, with the connector pins going through the decoder board first and only then to the connector. A locomotive connector lacks one of the pins while in the decoder board one of the holes is plugged – they are to be fitted**. Incorrect installation may damage the decoder!**

Attention: in BRAWA models connector can be made with the standards violation so the pins are not to go through the decoder board but to be inserted into the plastic connector of the decoder directly. This is a BRAWA fault. For further information, please see the manual of this model.



installation into a Plux22/16/12/8 connector

Normally there is a cap inserted into the connector in a new non-decoder model which allows to use it in the analogue system. This cap has to be removed.
Insert the decoder into the connector on the locomotive board. The mark (the lack of pin#11) prevents incorrect installation. Plux22/16/12/8 has upward compatibility. So in case of Plux connector with lots of contacts, a decoder with less number of contacts can be inserted into it. Spare contacts are additional outputs that basically remain unused and disconnected. If the number of contacts in the Plux connector of the model is less than in the Plux connector of the decoder then spare pins of the decoder connector can be cut off, providing a decoder of that size can be fisically inserted into the model like that.

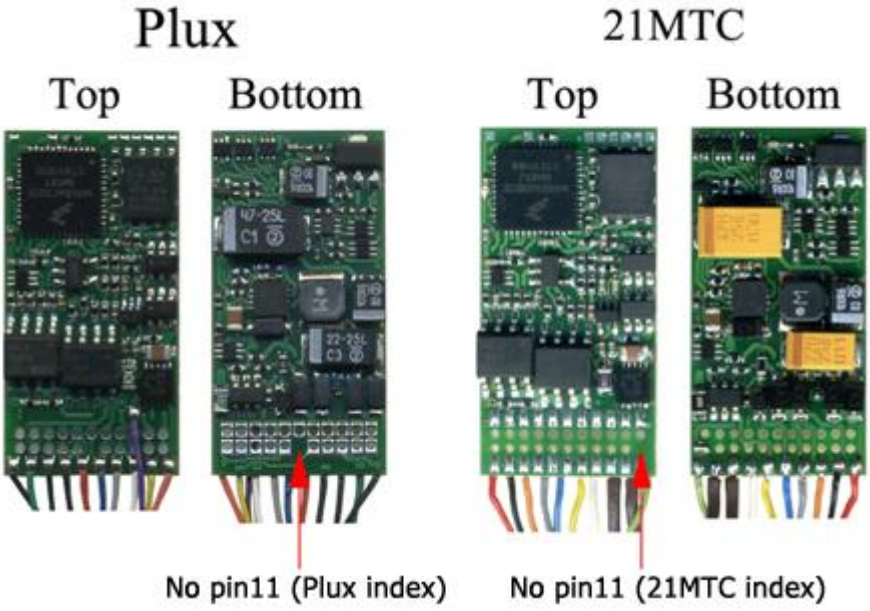
A locomotive without a connector

In that case you will have to do wiring by yourself. It would be better if you buy a decoder with 8-pin connector with wires. There are two ways of installation: you either equip a locomotive with a 8-pin connector or cut off a decoder connector (pins) and solder decoder's wires to the third rail pick-up, engine and light devices.
The first option is more desirable because you can disconnect decoder if needed.
If you choose the second one then the purpose of wire can be defined by its color.
If you bought a 8-pin decoder then it has all the wires soldered.

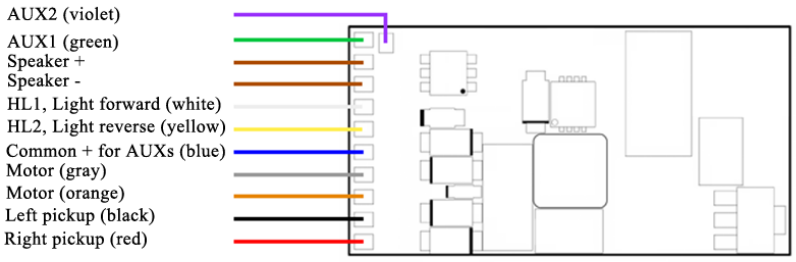
wire color	description
red	right rail pick-up
black	left rail pick-up
grey	engine
orange	engine
blue	Common positive wire for lighting and other additional outputs
white	forward light (HL1)
yellow	reverse light (HL2)
green	AUX1
violet	AUX2

Attention!

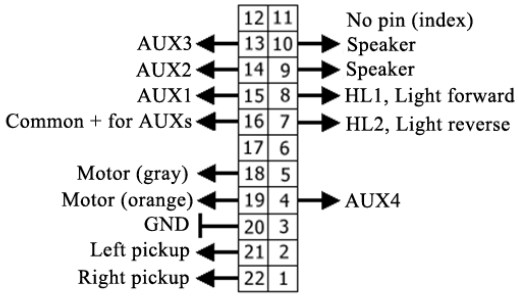
The wires are soldered to a decoder in different ways depending on a decoder board type.
There are 2 options: Plux and 21MTC boards. Their connectors look similar but they have a completely different output pinout.
If one of the wires is torn off the decoder board or if you want to use AUX3 and AUX4 then it is necessary to know the board type before recognizing a spot where a wire has to be soldered to.
The mark location can help you in that. A mark is a missed hole in a connector.
A Plux connector has a mark in the center of board where contact #11 is supposed to be.
A 21MTC connector has a mark on the edge of board on the spot of #11 as well.
The match of contact number is a result of different sequences of contact numbering in accordance with NMRA standards.



Decoder pinout on a 21MTC board



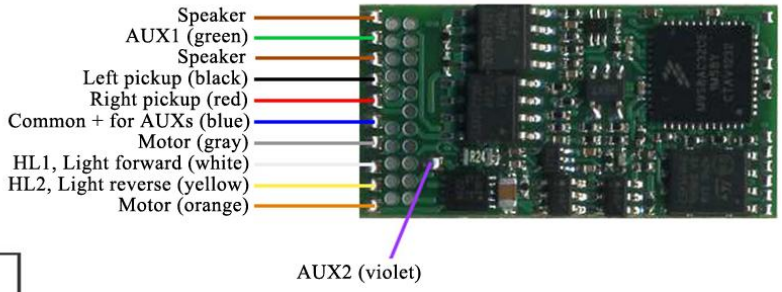
21MTC connector



The blank contack must to be disconnected

Decoder pinout on a Plux board

Top side

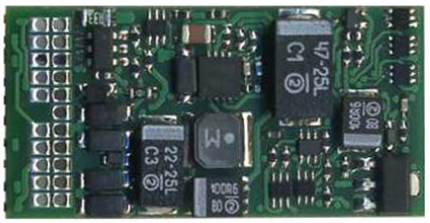


Plux pinout (Bottom side)

The blank contact must be disconnected

Net	Pin number		Net
	1	2	AUX3
	3	4	
GND	5	6	Common + for AUXs
HL1, Light forward	7	8	Motor (orange)
Common + for AUXs	9	10	Motor (gray)
No pin (index)	11	12	Right pickup (red)
HL2, Light reverse	13	14	Left pickup (black)
Speaker	15	16	AUX1
Speaker	17	18	AUX2
AUX4	19	20	
	21	22	

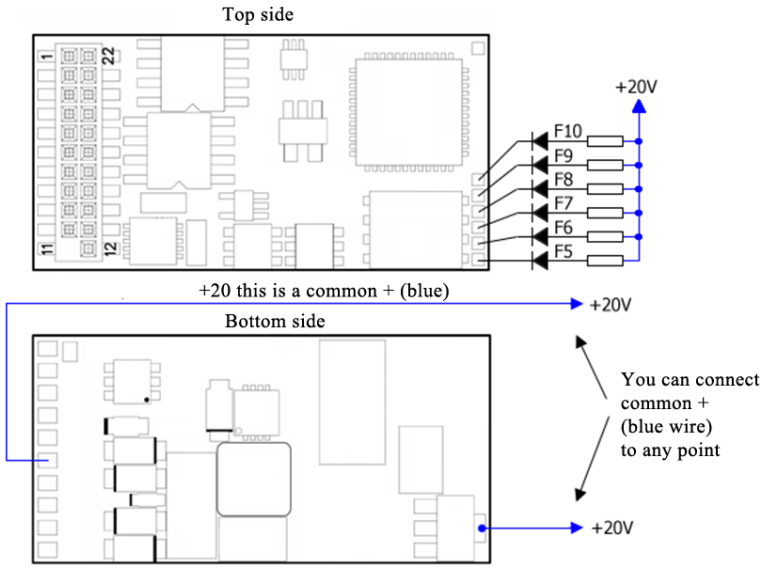
Bottom side



Additional high current outputs

The decoder has 6 high current outputs: HL1, HL2, AUX1, AUX2, AUX3, AUX4. They are meant to connect such devices like lights, LEDs, steam generators and automatic couplers and so on. An output is activated by pushing a corresponding button on the command station. Functional mapping gives an opportunity to define keys for activating corresponding outputs. An output can also be programmed to be activated automatically depending on the direction of locomotive and if a locomotive stays still or moves. It allows to create realistic light signals.
The maximum output load cannot be more than 400 mA, total load not more than 1A. All the outputs is an open collector type.

Additional low current outputs



The decoder has 5 low current outputs: AUX5, AUX6, AUX7, AUX8, AUX9. It also has an open collector type. They are meant to connect low-power tubes and LEDs. The maximum output load cannot be more than 80mA. In case of LEDs it is necessary to connect an external resistor. Resistor rating of 2,5 – 10 kOhm is recommended for standard LEDs.

Positive pin of LED (anode) is to be connected to the blue wire or it may be easier to connect to a spot given on the picture. Low current outputs do not have overload protection !!!

Attention !
Some locomotives were made to work in the analogue system so they have one of the rail pick-ups shorted to the engine body (and, perhaps, the metal case of locomotive). It is necessary to break a contact between this particular pick-up and the engine to install a decoder in a model like this. This is the must for all the DCC locomotives.

Attention !
The installed decoder must not contact with the metal parts of locomotive otherwise it can be damaged. On the other hand the decoder gets warm while operating. So if you cover the decoder with insulating tape or any other dielectric material all around its surface then it can run hot and break down. It is necessary to provide the maximum heat removing during the installation.

How to pick and install a speaker

Sound quality and volume depends on a speaker greatly. SoundGT2 allows to use any kind of speakers of 4Ohm resistance and more.

As a rule, speakers of lower resistance feature higher volume.
If we have two speakers of the same size and quality then the 4Ohm speaker is going to produce a remarkably louder sound than a 8 Ohm one. The values give us a difference of 2 times higher although we can hear it as 20-30% higher. Parallel connection of 2Ohm and 8Ohm speakers also provide good results. Practically it does not take that much long to feel like making it quieter so the choice of 8 Ohm speaker is fully approved although you can make it quiet using CV as well.

Sound quality and volume depend on a speaker size directly. The speakers of bigger size reproduce low frequencies better: the sound is more natural and the volume is higher.

All speakers are supplied with cases because it is necessary to install a speaker together with its case for better sounding. It is prohibited to cut off a part of case or make holes in it because it will affect speaker volume dramatically. When purchasing a decoder you should give the size of a speaker you need after figuring out how much space it can take in the model. Try to find place to install a speaker as big as possible.

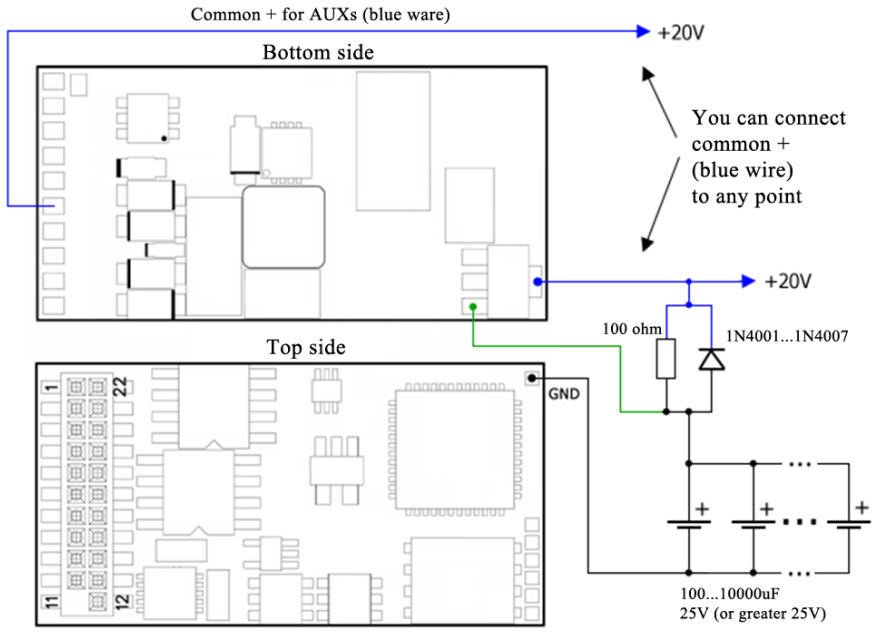
Available speakers

Speaker	Resistance	Speaker size without case	Speaker size with case
	4 Ω (8 Ω each)	diameter 13mm	15 x 29,3 x 6,7mm
	4 Ω (8 Ω each)	diameter 16mm	18 x 35 x 8,4mm
	4 Ω	16 x 25 mm	18,2 x 27,2 x 8mm
	4 Ω	diameter 20mm,	diameter 22mm, height 10mm
	4 Ω	diameter 23mm,	diameter 25mm, height 10,3mm

	4 Ω	diameter 28mm,	diameter 30mm, height 12mm
	4 Ω	20 x 40mm	22,4 x 42,2mm height 12mm
	8 Ω	molded. Case is transparent or black Don't try disassemble this speaker.	11 x 15 x 6,7mm
	8 Ω	molded. Don't try disassemble this speaker.	19 x 9 x 8mm
	8Ω	diameter 23mm,	diameter 25mm, height 10,3mm
	8Ω	molded	20 x 39 x 8,4mm

Installation of additional capacitors

One or several additional capacitors can be inserted into the model to solve the problem of bad contact in the rail pick-up. Then the energy stored in the capacitor may be enough to pass the trouble section of track if the rail contact is lost. The more capacitor capacitance, the more energy storage. It is better to insert capacitors of not less than 100µF and the effect is much profound if capacitance is not less than 1000µF. Capacitors designed for voltage of 25V and more have to be used. Normally aluminum foil capacitors are used for this purpose. This capacitors requires correct polarity. These capacitors are significantly large but, depending on the spare space in the model, it is possible to use a sequence of connected in parallel capacitors with lower capacitance. Capacitance of connected in parallel capacitors are summed. A resistor must be inserted to limit charging current. A low-power one of 125-250mW can be used. Diod requirements: forward voltage 25V and more, maximum average forward current 0.5-1A. Connection points for GND and '+20V'circuits are given on the picture. '+20V' circuit is a blue wire of decoder and you can connect to it. A 21MTC connector also has these nets.



Careful soldering should be implemented because of small size of decoder. Before turning on, make sure that other nets are not shorted by solder.

Green wire can be put aside if capacitance of additional capacitor does not exceed 220µF

operating in analogue mode

A specific algorithm is used in the analogue mode for BackEMF functioning in much the same way as in the digital one. Decoder monitors the voltage on the rails and taking the voltage level as a speed command (polarity as direction). So as soon as the voltage reaches minimum value enough for decoder operation, an idle sound and light are on but voltage is not applied to the engine. If the voltage increases the loco starts moving at the minimum speed using backEMF system. If the voltage increases further the loco speed goes up, with auxiliary mechanism sounds and brake squeal reproducing. One of the additional outputs is also activated (F1 by default) where a steam generator can be connected to, for instance.
CV34 is to have the number of function key activating the engine in the DCC mode. (CV43=1 – F1 by default). Set CV34=0 for sound switch-off in the analogue mode.
Analogue station has to provide DC voltage, therefore stations with PWM output are not recommended.

By default analogue mode is on. (bit 2 =1 in CV29)
CV3 value (acceleration delay) and CV4 value (braking delay) effects the motion of locomotive in analogue mode.
Decoder will automatically switch from the DCC to DC mode if it fails to recognize digital station DCC commands and vice versa. In that case decoder comes to a full stop slowly if decoder functioning is prohibited in DC mode (bit 2=0 in CV29).
If decoder functioning is permitted then, while switching to the analogue mode, decoder goes on in the same direction if DC voltage polarity is the same and it stops if DC voltage polarity is reversed but it begins to moving if the polarity changes.
Slowing down depends on CV4. All the ModellDepo loco decoders enables to switch between the modes 'on the fly' which makes it possible to implement automatic braking on the way to dead ends, for example. This mode is referred as DC breaking.
To switch from DCC mode to DC it is enough to add a diode to the DCC signal (Schottky diod is prefferable) and to shunt it by relay in case of further moving permitted.

Bidirectional protocol RailCom

RailCom enables to read data out of active decoders by using specific devices. Installed Railcom signal reader units can be found in some DCC command stations.

This option proves to be useful for making models with automatic control and it also makes the process of CV reading out and recording easier (if a station is support RailCom).
SoundGT2 decoder has 2 data transmission channels enabling to transmit address, speed and it also supports CV reading and recording on Main Track.
SoundGT2 decoder completely meets the current NMRA specifications «Communications Standard for Digital Command Control, Basic Decoder Transmission» and «Electrical Specifications for Digital Command Control Decoder Transmission»

Back EMF

BackEMF system in the 2nd generation of SoundGT decoders has been remarkably improved relative to the previous versions:

- Considerably improved smooth running
- Engine speed at slow speed is considerably lower
- BackEMF paramaters can be adjusted for a specific model.

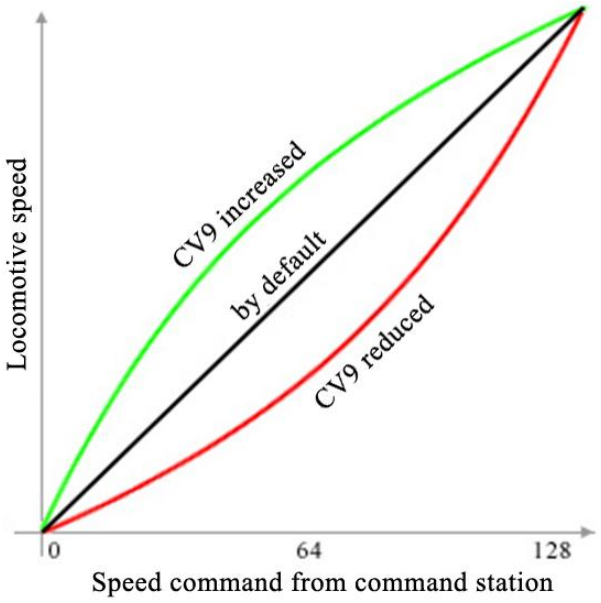
See ***«Back EMF system in ModellDepo decoders»*** at website www.modelldepo.ru

Speed curve adjustment

Speed curve adjustment option is added in 2.6.4 version.
Now it is linear by default except the part of curve for slow speed, acceleration is a bit slower for smoother running at slow speed.

Speed curve adjustment is implemented with CV9 alone (so-called Vmid). See the picture.

Normally CVmid is CV6 but this CV is traditionally given to the version lower digit in modelidepo decoders so CVmid is CV9.



ABC (Automatic Break Control) and CBD (Constant Breaking Distance)

These systems are meant for making automatic block system on the DCC digital layout by splitting the rails (fully or partly) into blocks. System descriptions and purposes as well as decoder adjustment for ABC and CBD you can find at document "ABC and CBD systems" at website www.modelldepo.ru

Cylinders cutoff sound adjustment

SoundGT2 has a CV for pfuff sound intervals adjustment. This allows to get a close match between cylinders speed on the model and the sound at different transmissions including three-cylinder locomotives and mallets.
CV21 is used for cutoff interval adjustment.

The more CV21, the more frequent is cutoff sound. We do not recommend giving CV21 a value of less than 30. Maximum value of 255 provides cutoff time being more than 1 minute at the lowest speed which is basically impossible for an actual locomotive but SoundGT2 enables some models (it depends on transmission type) to move at a speed of one turn of the wheel per 4 min. If you have such a "slow" transmission than to get a lifelike effect the minimum speed can be increased in CV2, with no need to readjust CV21.

Additional outputs

SoundGT2 has 12 additional outputs including:
6 additional power outputs: "front light", "rear light" and AUX1, AUX2, AUX3, AUX4
6 low current outputs (up to 80mA): AUX5, AUX6, AUX7, AUX8, AUX9, AUX10.

One of the following effects (operation algorithms) can be activated on any power output regardless of others: steamgenerator control, autocoupler control, light effects etc. Low current outputs are meant for LEDs and low-power bulbs to be added operating in the on/off modes only. An output is activated by pushing a functional button on the station. Function mapping allows to indicate corresponding outputs and buttons, with the opportunity to activate several outputs all together by pushing a single functional button. Function mapping makes it possible to activate outputs depending on loco direction as well. By default the 'front light' and 'rear light' outputs are activated by F0 (light) button and AUX1, AUX2, AUX3, AUX4 outputs by F1, F2, F3, F4 buttons respectively.

Dimmer function

This feature enables to set 2 voltage levels on a power output and switch them over by a single button. It is meant to switch a headlight from high to low beam and vice versa, but basically it also can be used for any accessories, for instance, a manual steam generator control.

Example
Let a front headlight is connected to a 'front light' output and it has to be turned on by pushing 'light' button (F0) and the intensity reduces in half by pushing F9, then you should set up CVs as follows:
CV104=1 ('front light' output activating by pushing 'light' button (F0), forward direction by default)
CV60=5 (effect number 'smooth turning on' by default)
CV70=128(output voltage (intensity) with 'dimmer'button off)
CV80=50(output voltage (intensity) with 'dimmer'button on)
CV90=10(speed of intensity change. If an instant change is required than write value 64)
CV180=9 (number of a functional button activating 'dimmer': 9 – F9. To deactivate 'dimmer' function you should write 0. Allowable buttons are F1…F20)

Steamgenerator control (algorithm #6)

This algorithm enables to create a realistic effect of steam release depending on the load on steam machine. The algorithm is based on the rule stating that the more voltage is applied to a steamgenerator, the more steam is released. Let us consider the algorithm development as an example of steamgenerator connecting to AUX1 output (green wire). When locomotive stops the voltage applied to a steamgenerator is minimum (set in CV82). When locomotive starts moving the voltage goes up as high as the value in CV182. When the speed goes up, the voltage (and steam release as well) increases according to a coefficient in CV192.
When adjusting you should take into account that a steamgenerator is a bit inert that leads to

Autocoupler control (algorithm #7,8,9)

Autocoupler contains an electric magnet opening the couler when the current flows through it.
A coupler specific feature is that the magnet becomes overheated very quickly and it burn out if the current flows more than a few seconds (5-10 sec.)
SoundGT2 has some specific algorithms to avoid it. It is necessary to apply the maximum possible voltage at the moment of coupler opening to provide its reliable operation, then (in 1-2 sec.) the voltage can be lowered to avoid overheating.

Example of adjustment algorithm #7 for AUX#1, activation by F1.
If function mapping has been changed than restore CV106 and CV107
CV106=4 (AUX1 activation by F1, forward direction)
CV107=4 (AUX1 activation by F1, backward direction)
CV62=7 (algorithm#7 for AUX1)
CV72=128 (turn-on voltage applied to the coupler during opening)
CV86=20 (turn-on time which is a period of applying increased voltage given in CV72 to the output. After that period the voltage is lowered to the value given in CV82)
CV82=64 (retention voltage)

You should keep in mind that although the retention voltage is twice as lower as before, the coupler cannot still be active for long and you have to switch it off (switch off F1 on the station) as soon as the maneuver is over. So preferably the effect should be adjusted so that the turn-on period becomes longer (CV86) up to 3-5 sec. and the retention voltage is set to 0 (CV82=0) then the coupler will be deactivated in set time but you have to finish the maneuver earlier.

Automatic uncoupler (algorithm #8,9)

These algorithms are meant for automatic uncoupler that allows to make the process completely automatic.
Uncoupler is activated by pushing a functional button on the station.
Before the maneuver it is necessary to point out the direction of a locomotive outgo. You should turn the speed throttle towards the direction of outgo and stop the loco. If the light is on than the headlight beam has to directed towards the outgo direction. Push the corresponding functional button. If you chose algorithm #8 than decoder opens the coupler and forward movement begins and after some time it will stop.

if you choose algorithm #9, then locomotive before do outgo makes a little reverse moving, it makes it easier to uncouple car. This is because that the force of coupler mechanism is small, and sometimes it is not enough for uncoupling wagons.
Voltage to coupler will be applied after the reverse moving will be finished.
Intervals for reverse moving and outgo can be set independently.

An example of automatic uncoupler adjustment.
Copler connected to AUX2, activating by F2
If function mapping has been changed than restore CV108 and CV109
CV108=8 (AUX2 controlled by F2 button, forward direction)
CV109=8 (AUX2 controlled by F2 button, reverse direction)
CV63=9 (Algorinht #9 for AUX2)
CV73=128 (turn-on voltage applied to the coupler during opening)
CV153=40 (turn-on time which is a period of applying increased voltage given in CV73 to the output. After that period the voltage is lowered to the value given in CV83
CV83=80 (retention voltage)
CV93=1 (Speed of locomotive for reverse moving and outgo)
CV183=25 (reverse moving time 25*0.052 =~ 1.3sec)
CV163=50 (outgo time 50*0.052 =~2.5sec)

Despite the fact that the voltage retention chosen different from 0, coupling will be shut down at the end of the maneuver

Configuration variables (CVs).

CV	Description	values	By default
1	Decoder address (in short address mode)	1-127	3
2	Min loco speed	0…127 Used when Back EMF is off/on	0
3	Acceleration	1…255 Smooth acceleration. The more the value, the less the locomotive's acceleration 1 - no delay	40
4	Braking	1…255 Smooth braking. The more the value, the less the locomotive's slowing down 1 - no delay	35
5	Max loco speed	16…255, Define the max power to the engine. It is to be more than CV2. The value of 255 corresponds to the max speed, the value of 127 – 50% of the maximum The decrease of the intermediate speeds is proportional to CV5. It allows to imitate a slowing down locomotive	255
6	minor (3rd) digit of the firmware version. adjustment of the middle speed see CV9	read only	
7	Firmware version in in hexadecimal format. For example: value 10h mean Ver 1.0	read only	
CV	**Discription**	**values**	**By default**
8	Manufacturer code	read only Write 0 for hard reset of decoder. All CVs reset to default. **ATTENTION**: Some CVs values after reset may not corresponds to the optimal ones for this sound project. Preferably the values of CVs are set in manually or using the MD Prog2 programming unit.	255
9	Adjustment of speed carve (for ver. higher 2.6.4)	0…255	127

10	Acceleration in the shunting mode	1…255	10
11	Braking in the shunting mode	1…255	10
12	Shunting mode on (acceleration/braking without delay) It sets the number of a functional button that activates this mode	0 – never 1 - F1 2 - F2 … 12 - F12	6 (F6)
13	Half speed mode on It sets the number of a functional button that activates this mode	0 – never 1 - F1 2 - F2 … 12 - F12	7 (F7)
17, 18	Long Address 128…9999	CV17 –high order byte of address permissible range - 192…231 CV18 –lower byte permissible range - 0…255	192 (CV17) 0 (CV18)
19	Consist address	0…127 0 – the decoder main address is used (short – CV1 or long - CV16/CV17). 1…127 – Consist address. If it is set, the decoder executes instructions sent to this address while ignoring the instructions sent to its main address (short or long) Is used when a locomotive goes together with other ones.	0
20	The time of change from the digital mode to the analogue one. A unit is 13ms. It affects the start delay in the analogue mode.	12…255	15
21	The time gap between cylinders drain of a sream locomotive. It allows to synchronize the wheel rotation and sounds of cylinders.	1…255 The less the value, the faster the sound	50
25	The number of a functional button cancelling the sound turned on for “Stop”. Please, refer to CV100,101	0…20 0 - no button	0
26	The number of a functional button cancelling the sound turned on for “Motion”. Please, refer to CV102,103	0…20 0 - no button	0
27	The number of a functional button cancelling the sound turned on for “Light”. Please, refer to CV104,105	0…20 0 - no button	0
21	Only for steam locomotives. Adjustment pfuff interval between cylinders cut off	30…255	50
29	Decoder configuration 1	bit 0 – motion direction =0 normal =1 reverse bit 1 – command format =0 - 14 Speed Step =1 - 28/128 Speed Step bit 2 –Analogue mode operation =0 analog mode disabled =1 enabled bit 3 – RailCom on/off = 0 off = 1 on bit 5 - address mode =0 short address =1 long address	bit 0=0 bit 1=1 bit 2=1 bit 3=0 bit 5=0
30	Sound parameters	bit 0 - Motion synchronization with sound =1 synchronization on =0 synchronization off (it allows avoid delays between commands and moving) bit 1 – skip or not sound table SOUND_STOP_TO_D1 =1 skip =0 normal sequence (play table) bit 2 – Skip or not sound table	bit 0=1 bit 1=0 bit 2=0

		SOUND_D1_TO_STOP =1 skip =0 normal sequence (play table) bit 7 - Playing additional sounds while the engine sound is off =1 Play =0 Don't play	bit 7=1

CV	Discription	values	By default
31	Sound volume	0…255 255 - maximum volume	255
32	Min interval between random sounds. A unit is 0.8 sec	1…255 (max is 255*0.8 =204 sec)	20
33	Max interval between random sounds. A unit is 0.8 sec	0…255 0 - random sounds is off	30
34	Number of functional button that turns on engine sound in the analogue mode.	0…20 0 - no sound in the analogue mode 1 - F1	1
50	Decoder configuration 2	bit 0 – Back EMF =0 off =1 on bit 1 - Automatic Break Control (ABC) =0 off =1 on bit 2 - Constant Breaking Distance (CBD) =0 off =1 on bit 3 - Consider ABC only in case of left third rail pick-up asymmetry bit 4 - Consider ABC only in case of right third rail pick-up asymmetry	bit 0=1 bit 1=0 bit 3=0 bit 4=0
51	Travelled distance from the moment of ABC red signal identifying until full stop for CBD system	6…255	22
52	ABC asymmetric signal threshold	1…255	7
53	cutting off decoder outputs sequence in case of power cut off. It helps to save power stored in build-in capacitors for MCU	bit 0=1 turn off the light, additional outputs and sound in case of no-voltage during Time1 (see CV53,54 and CV55.56) bit 7=1 turn off the engine and place MCU to slip mode in case of critically low voltage	127 bit 0=0 bit 7=1
54,55	Time1 interval in DCC mode. A double-byte value. A unit is 51.2 microsec (μs)	1…65535 time between the moment of pick-up contact loss and additional outputs cutting off	20 (~1 ms)
56,57	Time1 interval in the analogue mode	as well as CV45,55	90

CVs for Back EMF tuning

36	leave this CV unchanged		1
37	leave this CV unchanged		1
38	Kp for low speed	1…255	151
39	Kd for low speed	0…200	22
40	Ki for low speed	1…255	96
41	Kp for high speed	1…255	15
42	Kd for high speed	0…150	2
43	Ki for high speed	1…150	1
44	the EMF measurement time for low speed	10…54	45
45	the EMF measurement time for high speed	32…56	54
46	The interval between EMF measurement.	80…255 Normally you don't need to change the value by default	120

OUTPUTS MODES (algorithms)

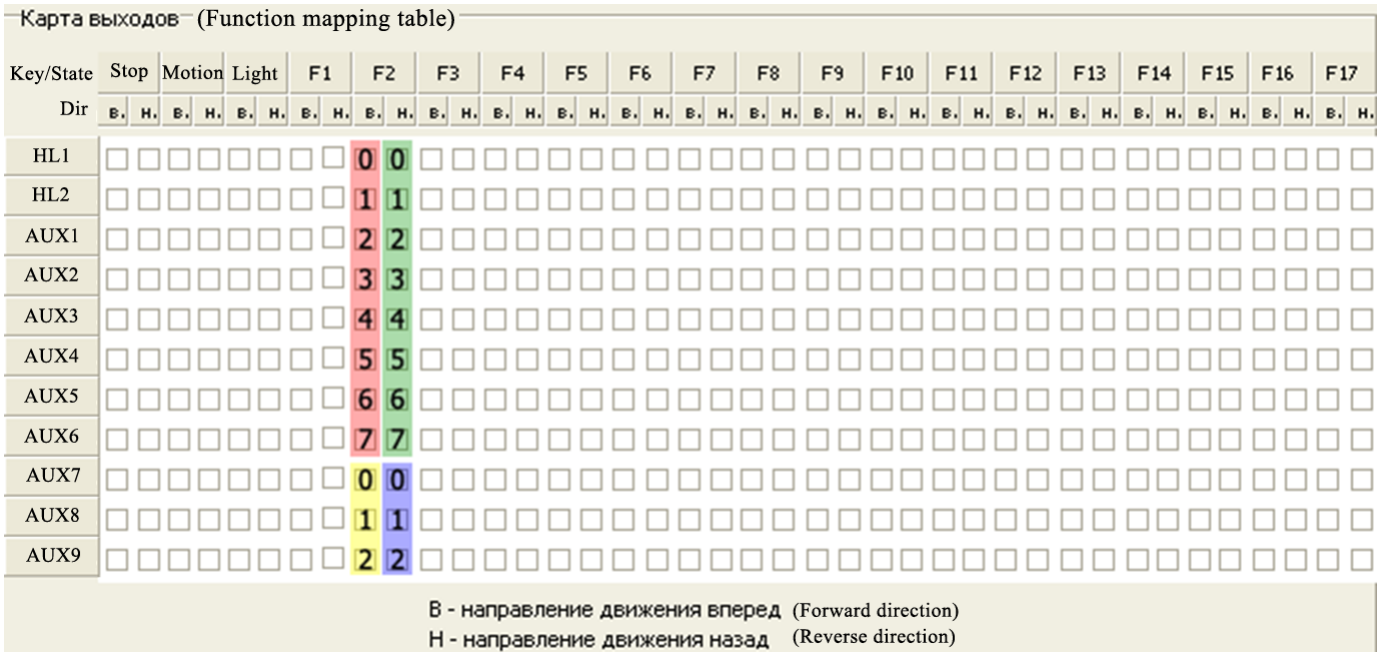
CV	Discription	values	By default
60	Light forward (HL1) algorithm (mode) selection	0 - Continues current 1 – continues current with voltage adjustment 2 - gyralite 3 – flashing 4 – mars light 5 – smooth on/off with voltage adjustment in CV61 6 –steamgenerator 7 – simple coupler control with auto power off 8 – coupler control with outgo 9 - coupler control with outgo and reverse moving	5
61	similarly for Reverse Light (HL2)	similarly CV60	5
62	similarly for AUX1	similarly CV60	6
63	similarly for AUX 2	similarly CV60	0
64	similarly for AUX 3	similarly CV60	5
65	similarly for AUX 4	similarly CV60	5
70	Max voltage (Max brightness) on HL1. Used when AUX in 1,2,3,4,5,6,7,8,9 mode	0…128, 0 – odd, 64 – 50%, 128 – 100% Average voltage = $\frac{20 * CV70}{128}$ 20 – it is a normal DCC voltage, this voltage depends by power supply of the command station (typical ~16V AC). 77 – gives AUX voltage 12B 100 – gives AUX voltage 16B 128 – gives AUX voltage 20B	128
71	similarly for Reverse Light (HL2)	similarly CV70	128
72	similarly for AUX1	similarly CV70	128
73	similarly for AUX 2	similarly CV70	128
74	similarly for AUX 3	similarly CV70	128
75	similarly for AUX 4	similarly CV70	128
80	Min voltage (Min brightness) on HL1. in mode “steamgenerator” – voltage on AUX when locomotive stops. In couple control mode – retention voltage	0-128 0 – off 64 – 50% 128 – 100% how to translate %% to voltage see CV70	0
81	similarly for Reverse Light (HL2)	similarly CV80	0
82	similarly for AUX1	similarly CV80	60
83	similarly for AUX 2	similarly CV80	0
84	similarly for AUX 3	similarly CV80	0
85	similarly for AUX 4	similarly CV80	0
90	change rate of HL1 in modes 8,9 – reverse and outgo speed	1…64 1 – slow, 64 – fast in modes 8,9 allowable range is 1…14	10
91	similarly for Reverse Light (HL2)	similarly CV90	10
92	similarly for AUX1	similarly CV90	1
93	similarly for AUX 2	similarly CV90	1
94	similarly for AUX 3	similarly CV90	10
95	similarly for AUX 4	similarly CV90	10
150	In flashing mode – HL1 ON time In coupler control mode – time when applied to output voltage is high (specified in CV Max voltage for this AUX, CV70 for HL1). After this time voltage will be reduced to value specified in CV Min voltage for this AUX	1…255 in flashing mode: ON time = CV150*0.013sec for 0.1sec – value is 8 for 1sec – value is 77 In coupler control mode High voltage time = CV150*0.052sec for time 3.1sec - value is 60	77
151	similarly for Reverse Light (HL2)	similarly CV150	77
152	similarly for AUX1	similarly CV150	60
153	similarly for AUX 2	similarly CV150	40
154	similarly for AUX 3	similarly CV150	77
155	similarly for AUX 4	similarly CV150	77
160	In flashing mode – HL1 OFF time for modes 8,9 – outgo time after coupler is released for this modes time calculated in 52ms units	1…255 in flashing mode: OFF time = CV160*0.013sec for 0.1sec – value is 8 for 0.5sec – value is 38 for modes 8,9 outgo time = CV160*0.052sec for 3sec - value is 58	77
91	similarly for Reverse Light (HL2)	similarly CV160	77
92	similarly for AUX1	similarly CV160	77
93	similarly for AUX 2	similarly CV160	60

94	similarly for AUX 3	similarly CV160	77
95	similarly for AUX 4	similarly CV160	77
170	for MARS light mode – time of max brightness for HL1	0…120	5
171	similarly for Reverse Light (HL2)	similarly CV170	5
172	similarly for AUX1	similarly CV170	5
173	similarly for AUX 2	similarly CV170	5
174	similarly for AUX 3	similarly CV170	5
175	similarly for AUX 4	similarly CV170	5
180	For HL1, in “steamgenerator” mode additional value to CV80 (it is increase voltage and steam output), when locomotive begins to moving. in mode 9 – time of reverse moving. Time in units of 0.052sec in mode 5: number of dimmer button for this output	0…127 (not greater CV70)	0
181	similarly for Reverse Light (HL2)	similarly CV180	0
182	similarly for AUX1	similarly CV180	15
183	similarly for AUX 2	similarly CV180	25
184	similarly for AUX 3	similarly CV180	0
185	similarly for AUX 4	similarly CV180	0
190	For HL1, in “steamgenerator” mode - proportionality coefficient of voltage from locomotive speed. It gives increase of steam output when locomotive goes faster.	0…255 The higher the value, the greater the voltage supplied to the steam generator with an increase in speed. 0 - do not depend on the speed. During acceleration maximum voltage is supplied to AUX according to the CV70. 127 - half the speed is proportional to 255 - is directly proportional to	100
191	similarly for Reverse Light (HL2)	similarly CV190	100
192	similarly for AUX1	similarly CV190	100
193	similarly for AUX 2	similarly CV190	100
194	similarly for AUX 3	similarly CV190	100
195	similarly for AUX 4	similarly CV190	100

Function mapping

Function mapping was significantly changed since version 4.x.x
If you have an earlier version of decoder, you have to use earlier manual for direct CV programming of the function mapping.

SoundGT2 allows to assign activation of any AUX (one or several) to any functional button.
Also you can assign AUX activation for locomotive state: Stop, Motion.
Each button (or state "Sop", "Motion") correspond to the 4 CV, determine - what outputs must be activated at the same time.
Couple CV for the forward direction and a couple for backward direction.



This figure shows the 4 CV, responsible for the activation of the outputs while pressing F2.
CV217 (red) while moving forward will activate the output HL1, HL2, AUX1, AUX2, AUX3, AUX4, AUX5, AUX6 bits 0 ... 7, respectively
CV218 (yellow) when moving forward will activate the output AUX7, AUX8, AUX9 bits 0,1,2 respectively
CV219 (green) in the reverse activates outputs HL1, HL2, AUX1, AUX2, AUX3, AUX4, AUX5, F6 bits 0 ... 7, respectively

CV220 (blue) in the reverse activates outputs AUX7, AUX8, AUX9 bits 0,1,2 respectively
If you want to output is switched on regardless of the direction, the values for CV «forward" should be equal to the corresponding CV for the direction "back".

In this example, if you want the button F2 switches AUX2 regardless of the direction you have to set bits 1 # 3 in CV217 and CV219, CV218 and CV220 and set to 0.
i.e. CV217 = 8, CV218 = 0, CV219 = 8, CV220 = 0.

if you want to activate AUX2 and AUX7 by button F2 (regardless of direction), and AUX8 will be activated if locomotive moving forward direction only then set to 1 bits 0 and 1 in CV218, and set to 1 bit 0 in CV220
i.e.: CV217=8,CV218=3,CV219=8,CV220=1

Each output can be switched on a few buttons on the principle of "or."
i.e. output will be activated when pressed at least one button that activates this output. This may be useful, for example for organization of the light signals.

CV	Discription	values	By default
Activation outputs in "Stop" state			
201	forward direction bit=1 – AUX activated bit=0 – AUX switched off	bit 0 - HL1 bit 1 - HL2 bit 2 - AUX1 bit 3 - AUX2 bit 4 - AUX3 bit 5 - AUX4 bit 6 - AUX5 bit 7 - AUX6	0
202	forward direction	bit 0 - AUX7 bit 1 - AUX8 bit 2 - AUX9	0
203	reverse direction	see CV201	0
204	reverse direction	see CV202	0
Activation outputs in motion			
205	forward direction	see CV201	0
206	forward direction	see CV202	0
207	reverse direction	see CV201	0
208	reverse direction	see CV202	0
Activation outputs by F0 (Light) button			
209	forward direction	see CV201	1 (decimal) 0000:0001 (bin)
210	forward direction	see CV202	0
211	reverse direction	see CV201	2 (decimal) 0000:0010 (bin)
212	reverse direction	see CV202	0
Activation outputs by F1 button			
213	forward direction	see CV201	4 (decimal) 0000:0100 (bin)
214	forward direction	see CV202	0
215	reverse direction	see CV201	4 (decimal) 0000:0100 (bin)
216	reverse direction	see CV202	0
Activation outputs by F2 button			
217	forward direction	see CV201	8 (decimal) 0000:1000 (bin)
218	forward direction	see CV202	0
219	reverse direction	see CV201	8 (decimal) 0000:1000 (bin)
220	reverse direction	see CV202	0
Activation outputs by F3 button			
221	forward direction	see CV201	16 (decimal) 0001:0000 (bin)
222	forward direction	see CV202	0
223	reverse direction	see CV201	16 (decimal) 0001:0000 (bin)
224		see CV202	0
Activation outputs by F4 button			
225	forward direction	see CV201	32 (decimal) 0010:0000 (bin)
226	forward direction	see CV202	0
227	reverse direction	see CV201	32 (decimal) 0010:0000 (bin)
228		see CV202	0
Activation outputs by F5 button			
229	forward direction	see CV201	0
230	forward direction	see CV202	0
231	reverse direction	see CV201	0

232	reverse direction	see CV202	0
Activation outputs by F6 button			
233	forward direction	see CV201	0
234	forward direction	see CV202	0
235	reverse direction	see CV201	0
236	reverse direction	see CV202	0
Activation outputs by F7 button			
237	forward direction	see CV201	0
238	forward direction	see CV202	0
239	reverse direction	see CV201	0
240	reverse direction	see CV202	0
Activation outputs by F8 button			
241	forward direction	see CV201	0
242	forward direction	see CV202	0
243	reverse direction	see CV201	0
244	reverse direction	see CV202	0
Activation outputs by F9 button			
245	forward direction	see CV201	0
246	forward direction	see CV202	0
247	reverse direction	see CV201	0
248	reverse direction	see CV202	0
Activation outputs by F10 button			
249	forward direction	see CV201	0
250	forward direction	see CV202	0
251	reverse direction	see CV201	0
252	reverse direction	see CV202	0
Activation outputs by F11 button			
253	forward direction	see CV201	0
254	forward direction	see CV202	0
255	reverse direction	see CV201	0
256	reverse direction	see CV202	0
Activation outputs by F12 button			
257	forward direction	see CV201	0
258	forward direction	see CV202	0
259	reverse direction	see CV201	0
260	reverse direction	see CV202	0
Activation outputs by F13 button			
261	forward direction	see CV201	0
262	forward direction	see CV202	0
263	reverse direction	see CV201	0
264	reverse direction	see CV202	0
Activation outputs by F14 button			
265	forward direction	see CV201	0
266	forward direction	see CV202	0
267	reverse direction	see CV201	0
268	reverse direction	see CV202	0
Activation outputs by F15 button			
269	forward direction	see CV201	0
270	forward direction	see CV202	0
271	reverse direction	see CV201	0
272	reverse direction	see CV202	0
Activation outputs by F16 button			
273	forward direction	see CV201	0
274	forward direction	see CV202	0
275	reverse direction	see CV201	0
276	reverse direction	see CV202	0
Activation outputs by F17 button			
277	forward direction	see CV201	0
278	forward direction	see CV202	0
279	reverse direction	see CV201	0
280	reverse direction	see CV202	0