

# Certificate & Quick Reference

Thank-you for purchasing a YouChoos sound decoder!

This certificate provides specific details of your decoder including your unique build number. Each sound decoder I load is individually catalogued and assigned a unique certificate, indicating the load date and an individual code...

**Your decoder has unique number: 2MT-TEMPLATE-0702**

**YouChoos Sounds**  
**LMS 2MT Ivatt**  
DCC Address: 3



Included in this package:

PART NUMBER	YouChoos Sounds - LMS 2MT Ivatt YC-2MT
DECODER	MS series - template
SPEAKER	N/A - template

## Functions:

FKey	Category	Action
F0fwd:	LIGHT + SOUND	F0fwd Forward lights / Mute
F0rev:	LIGHT + SOUND	F0rev Reverse lights / Mute
F1:	SOUND	Running Sounds
F2:	SOUND	Whistle
F3:	LIGHT + SOUND	FA1 / Coal Shovelling
F4:	LIGHT	FA2
F5:	SOUND	Blower
F6:	SOUND	Whistle 2
F7:	QUICKSEL + SOLO	Quick-Select (Light) / Solo Driving
F8:	QUICKSEL#2	Quick-Select#2 (Heavy)
F9:	SOUND	Guard's Whistle
F10:	SOUND	Injector
F11:	SOUND	Hand Brake
F12:	SHUNT + HALF SPEED	Shunting Mode / Half Speed
F13:	SOUND	Announcement
F14:	SOUND	Wheel Flange
F15:	SOUND	Coach Rattle
F16:	SOUND	Truck Squeaks
F17:	SOUND	Water Dripping
F18:	SOUND	Whistle 6
F19:	SOUND	Coupling Up
F20:	VOLUME	Volume Decrease
F21:	VOLUME	Volume Increase
F22:	SOUND	Open Valves
F23:	SOUND	Whistle 4
F24:	SOUND	Whistle 5
F25:	SOUND	Safety Valve
F26:	SOUND	Whistle 3
F27:	SOUND	Blower 2
F28:	SOUND	Buffer Up

All functions are ON/OFF.

## Feature Notes:

**Active Braking** – To slow down, choose the desired speed on the throttle, then use the Brake key to control the slow-down to that speed. If you prefer more traditional throttle-based braking, simply decrease the value in CV#4, or even simpler: leave ACTIVE BRAKE switched on all the time!

**Shunt Mode** – Momentum/Inertia is reduced to ¼ the normal effect and the throttle range is halved to simulate driving light-engine.

**Quick Select** – For steam, switches from standard chuff sounds to light-engine where chuffs are quieter. For hybrid locomotives, switches engine type – usually effective only at standstill. Some steam projects contain a 'QuickSelect#2' which normally gives heavier chuffs compared to the default. For diesel, sometimes provided for alternative cold start.

**Solo** – usually defined on the same key as QuickSelect for light-engine on a steam loco – has various effects including reducing the effect of momentum.

**SpeedLock** – while the SpeedLock key is switched on, the throttle will control the engine sounds only, and leaves the physical speed of the motor unchanged.

**NotchUp** – for diesel/electric projects, the NotchUp key will raise the base engine level to notch 1 when standing idle. Switch off to return to idle. Has no effect while in motion. Allows you to manually rev the engine up.

**Coast** – for diesel/electric sounds, the Coast key brings the base engine level down to idle, regardless of the current speed. Switch off to return to speed-dependent engine level.

**LowBeam** – for some projects, a LowBeam key is provided which dims the forward-motion headlights.

**Mute** – Fades all sounds out to silent until unmuted, where sounds will be faded back to their previous level.

**Volume Up/Down** – Overall volume level will be decreased / increased gradually while VOLUP / VOLDOWN is switched on, eventually reaching silent or the maximum defined in the project (usually around 90%). Affects CV#266 master volume level. If you lose sound, check that you haven't simply reduced the volume to silent! Default is recommended around 65%.

**Dynamic / Exponential Inertia** – Linear throttle-to-speed response is not particularly realistic, so speed change is exponential as speed increases, simulating slow starts from standstill. Similarly, harder throttle requests will result in faster acceleration. This is all built-in to the project working automatically on your throttle requests.

**Looping Sounds** – Some sounds are looping and will continue repeating until that function is switched off.

**Steam Chuff Rate** – Use CV#267 to adjust the chuff rate to match wheel rotation.

**Random Sounds** – Some sounds may be configured to play at random intervals, usually at reduced volume.

## IMPORTANT – WARRANTY INFORMATION!

Damage caused by mishandling, short-circuit, or undue force is NOT covered by warranty. Normally, a repair/replacement charge of approximately £30 + P&P will be levied in such cases. Decoders are delicate, so please handle with care. The most common cause of damage is caused by excessive force on wires, which may result in wires becoming detached, or worse, the entire solder pad coming off (particularly true for the smaller decoders). Also be careful that the coloured coating on the wires does not get pulled back exposing bare wire at the solder pads, thus increasing risk of short-circuit.

## More Information on Your Sound Decoder



### User Sound Assignments

The following table lists the sound effect files loaded onto your decoder, with their unique sample numbers which are used in CVs to assign a sound to a specific feature. Where a sound has no Function Key listed, this indicates that it is an additional sound included in your project which you can manually assign instead of another sound – for example, an alternative whistle/horn which you can swap in for one of the default ones. Please refer to the supplied CV Table document where you can see which CV is used to assign a sound to each Function Key (starts at CV#513).

Of course there are many more sound files that make up your project, such as engine sounds, braking, set-off etc., but these are not included here – only those that are available as user sounds, assignable to Function Keys.



### Random Sounds

Zimo decoders include 8 random sound generators, Z1 to Z8, which are also indicated here along with the sample number assigned to them, and whether they are to be played randomly at standstill, in motion, or both.

Likewise, please refer to the CV Table document supplied with your YouChoos sound decoder to see which CVs are used in random sound definition (CVs#744 to 767 and CVs#315 to 338).

Effect Sound Sample Number	Name	Looping	Function Key(s)	Random Generator	Random at Standstill	Random in Motion
145	Whistle		F2 (CV#516)			
146	Whistle 2		F6 (CV#528)			
147	Whistle 3		F26 (CV#691)			
148	Whistle 4		F23 (CV#682)			
149	Whistle 5		F24 (CV#685)			
150	Blower	Loops	F5 (CV#525)			
151	Blower 2	Loops	F27 (CV#694)	Z3 (CV#750)	Yes	Yes
152	Injector		F10 (CV#540)	Z4 (CV#753)	Yes	Yes
153	Safety Valve	Loops	F25 (CV#688)	Z5 (CV#756)	Yes	
154	Open Valves		F22 (CV#679)	Z6 (CV#759)	Yes	Yes
155	Hand Brake	Loops	F11 (CV#543)	Z7 (CV#762)	Yes	
156	Coal Shovelling	Loops	F3 (CV#519)			
157	Guard's Whistle		F9 (CV#537)			
158	Coupling Up		F19 (CV#567)			
159	Coach Rattle	Loops	F15 (CV#555)			
160	Truck Squeaks	Loops	F16 (CV#558)			
161	Announcement		F13 (CV#549)			
162	Water Dripping		F17 (CV#561)			
163	Wheel Flange	Loops	F14 (CV#552)			
164	Whistle (Low)					
165	Whistle (Low) 2			Z8 (CV#765)	Yes	
166	Whistle (Low) 3					
167	Whistle (Low) 4					
168	Whistle (Low) 5					
169	Whistle 6	Loops	F18 (CV#564)			
170	Whistle 7	Loops				
171	Injector 2					
172	Buffer Up		F28 (CV#697)			

Remember, you can always reset to the project's original configuration if you make a mess, by sending CV#8=8, though note that the DCC Address of the decoder will also be reset (normally back to 3)!



### Physical AUX Outputs

The table below states how the physical outputs (for lighting etc.) are configured in your decoder. Outputs that are assigned for FKey0-12 are achieved with Zimo Extended Function Mapping (where CV#61=97). For any outputs assigned to FKeys above FKey12, Swiss Mapping (also known as Zimo Advanced Mapping) is used instead (not shown in this table).

Physical Output	Wire Colour (if wired)	FKey	Effect / Direction	Notes
F0Fwd	WHITE	FKey0FWD	Constant (simple ON/OFF) - FWD only	F0fwd Forward lights
F0Rev	YELLOW	FKey0REV	Constant (simple ON/OFF) - REV only	F0rev Reverse lights
FA1	GREEN	FKey3	Random	FA1
FA2	BROWN	FKey4	Constant (simple ON/OFF)	FA2
FA3	-additional-		Constant (simple ON/OFF)	
FA4	-additional-		Constant (simple ON/OFF)	
FA5	-additional-		Constant (simple ON/OFF)	
FA6	-additional-		Constant (simple ON/OFF)	
FA7	-additional-		Constant (simple ON/OFF)	
FA8	-additional-		Constant (simple ON/OFF)	

# 2MT-TEMPLATE-0702 - YouChoos Sounds - LMS 2MT Ivatt

## CV List MS series - template – Configuration Values at shipping time

CV	Description	Value	76	Free speed curve	36	method		276	Engine (chuff) sound volume at high speed and no-load	240	328	Maximum interval for random generator Z5	120	
1	Short Address	3	77	Free speed curve	42	146	Compensation for gear back-lash	0	277	Degree of volume change under load for driving (chuff) sound.	5	329	Playback length for random generator Z5	0
2	Starting voltage	1	78	Free speed curve	48	147	BackEMF I-value (Integral)	0	278	Load change threshold	0	330	Minimum interval for random generator Z6	65
3	Rate of acceleration	20	79	Free speed curve	54	148	BackEMF D-Value (Differential)	0	279	Reaction time to load change	0	331	Maximum interval for random generator Z6	125
4	Rate of deceleration	16	80	Free speed curve	60	149	BackEMF P-Value (Proportional)	0	280	Load influence (DIESEL)	0	332	Playback length for random generator Z6	0
5	Maximum speed	0	81	Free speed curve	68	150	Experimental CV7s for test purposes.	0	281	Acceleration threshold for full load sound	8	333	Minimum interval for random generator Z7	70
6	Middle speed	0	82	Free speed curve	76	151	Motor brake and reduce motor BackEMF in Consist	0	282	Duration of acceleration sound	30	334	Maximum interval for random generator Z7	130
7	Version Number (Part1)	38	83	Free speed curve	84	152	Dim Mask 2	0	283	Engine sound volume at full acceleration	255	335	Playback length for random generator Z7	0
8	Manufacturer Id / HARD RESET	145	84	Free speed curve	92	153	Stop time after DCC signal loss	0	284	Threshold for deceleration sound	1	336	Minimum interval for random generator Z8	75
9	Motor frequency	55	85	Free speed curve	102	154	Delay start special configuration	0	285	Duration of reduced volume on deceleration	30	337	Maximum interval for random generator Z8	135
10	EMF Feedback cut-off	0	86	Free speed curve	112	155	FKey for half-speed	12	286	Volume level during deceleration	75	338	Playback length for random generator Z8	0
12	Operation Types - disable specific protocols	0	87	Free speed curve	124	156	FKey for deactivating momentum	12	287	Brake squeal threshold	55	339	NotchUp Key	0
13	Analog mode active functions F1-F8	3	88	Free speed curve	136	157	FKey for MAN function	0	288	Minimum driving time before brake squeal	50	340	Notch level and extra Notch FKeys	0
14	Analog functions and Inertia	130	89	Free speed curve	152	158	Various special bits - sound	16	289	Thyristor control - sound pitch for stepping effect - ELECTRIC	0	341	Switch input 1 Playback time	0
17	Extended address (byte 1)	192	90	Free speed curve	168	159	Special effects FuncOutput7	0	290	Thyristor control - sound pitch for medium - ELECTRIC	0	342	Switch input 2 Playback time	0
18	Extended address (byte 2)	3	91	Free speed curve	188	160	Special Effects FuncOutput8	0	291	Thyristor control - sound pitch for max - ELECTRIC	0	343	Switch input 3 Playback time	0
19	Consist Address	0	92	Free speed curve	208	161	Servo outputs: Protocol	0	292	Thyristor control - speed step for pitch increase (electric)	0	344	Run-on time of motor sounds after stops (Cooling fan etc.)	0
21	Consist functions for F1 - F8	0	93	Free speed curve	230	162	Servo 1 - Left stop	49	293	Thyristor - Volume at steady speed - ELECTRIC	0	345	Quick-select key for the sound of a MULTI-SYSTEM engine	7
22	Consist functions F0 & F9-F12 + DC Inertia	0	94	Free speed curve	252	163	Servo 1 - Right stop	205	294	Thyristor - Volume during acceleration - ELECTRIC	0	346	Switch collection conditions	3
23	Acceleration trimming	0	95	Directional speed trimming	0	164	Servo 1 - Center position	127	295	Thyristor - Volume during deceleration - ELECTRIC	0	347	Switch-over key for solo driving	7
24	Deceleration trimming	0	97	FKey to switch between normal Address and Consist Address	0	165	Servo 1 - Rotating speed	10	296	Motor sound, highest volume - ELECTRIC	0	348	Switch-over parameters	19
27	Direction dependent stops (Lenz ABC)	0	105	User CV	-2	166	Servo 2 - Left stop	49	297	Motor sound, when sound becomes audible for ELECTRIC engines	0	349	Brake Time	10
28	RailCom Configuration	3	106	User CV	-190	167	Servo 2 - Right stop	205	298	Motor sound, starting point of full volume for ELECTRIC engines	0	350	Delay of switchgear sound after start up - ELECTRIC	0
29	Configuration bits - decoder properties	6	109	Automatic unilateral light suppression	0	168	Servo 2 - Center position	127	299	Sound pitch dependent on speed - ELECTRIC	0	351	Smoke fan speed at steady speed	0
33	Function mapping F0 forward	1	110	Automatic unilateral light suppression	0	169	Servo 2 - Rotating speed	10	300	Enter OpsMode	0	352	Smoke fan speed at acceleration and motor start-up - DIESEL	0
34	Function mapping F0 reverse	2	112	Special ZIMO configuration bits	0	170	Servo 3 - Left stop	0	302	Start Calibration Mode/Sequence	0	353	Automatic shut-down of smoke generator	0
35	Function mapping F1	0	113	EMF reduction	0	171	Servo 3 - Right stop	0	307	Cornering squeals or reed configuration	0	354	Steam chuff frequency at step 1	0
36	Function mapping F2	0	114	Dimming mask	255	172	Servo 3 - Centre position	0	308	Brake squeal FKey	0	355	Exhaust fan speed at stand-still (steam and diesel)	0
37	Function mapping F3	4	115	Uncoupler control (KROIS and ROCC couplers)	0	173	Servo 3 - Rotating speed	0	309	Brake Key	0	356	Speedlock Key	0
38	Function mapping F4	8	116	Automated uncoupling procedure	0	174	Servo 4 - Left stop	0	310	On/off key for engine and random sound	1	357	Thyristor control - Lowering the volume at higher speeds - ELECTRIC	0
39	Function mapping F5	0	117	Flasher functions	0	175	Servo 4 - Right stop	0	311	On/off key for function sound	0	358	Thyristor control - Volume reduction curve at higher speeds - ELECTRIC	0
40	Function mapping F6	0	118	Flashing mask	0	176	Servo 4 - Centre position	0	312	Blow-off key	0	359	Duration of Electric switch gear sound on speed changes	0
41	Function mapping F7	0	119	Low beam mask for F6	0	177	Servo 4 - Rotating speed	0	313	Mute key	0	360	Electric switchgear duration on coming to stop	0
42	Function mapping F8	0	120	Low beam mask for F7	0	181	Servo 1 - FKey assignment	0	314	Mute fade in/out time	10	361	Switch gear sound - Playback delay - ELECTRIC	0
43	Function mapping F9	0	121	Exponential acceleration	11	182	Servo 2 - FKey assignment	0	315	Minimum interval for random generator Z1	40	362	Thyristor control - Switchover threshold for second thyristor sound - ELECTRIC	0
44	Function mapping F10	0	122	Exponential deceleration	11	183	Servo 3 - FKey assignment	0	316	Maximum interval for random generator Z1	100	363	Switch gear sound - Dividing the speed into shift steps - ELECTRIC	0
45	Function mapping F11	0	123	Adaptive acceleration and deceleration	22	184	Servo 4 - FKey assignment	0	317	Playback length for random generator Z1	0	364	Speed drop during upshifts (diesel with mechanical transmission)	0
46	Function mapping F12	0	124	Shunting key functions and SUSI	2	185	Special assignment for live steam engines	0	318	Minimum interval for random generator Z2	45	365	Upshift rpm (diesel mechanical)	0
49	Signal controlled acceleration	0	125	Special effects F0FWD	1	186	Pantograph 1 - FKey assignment	0	319	Maximum interval for random generator Z2	105	366	Maximum turbo sound volume for DIESEL engines	0
50	Signal controlled deceleration	0	126	Special effects F0REV	2	187	Pantograph 2 - FKey assignment	0	320	Playback length for random generator Z2	0	367	Turbo rpm dependency on speed (diesel)	0
51	Signal dependent speed limits	0	127	Special effects FuncOutput1	8	188	Pantograph 3 - FKey assignment	0	321	Minimum interval for random generator Z3	50	368	Turbo rpm dependency on acceleration (diesel)	0
52	Signal dependent speed limits	0	128	Special effects FuncOutput2	0	189	Pantograph 4 - FKey assignment	0	322	Maximum interval for random generator Z3	110	369	Minimum load for turbo	0
53	Signal dependent speed limits	0	129	Special effects FuncOutput3	0	190	Brightening up times	0	323	Playback length for random generator Z3	0	370	Frequency increase of turbo	0
54	Signal dependent speed limits	110	130	Special effects FuncOutput4	0	191	Dimming down time	0	324	Minimum interval for random generator Z4	55	371	Frequency decrease of turbo	0
55	Signal dependent speed limits	180	131	Special effects FuncOutput5	0	248	Bootloader version	0	325	Maximum interval for random generator Z4	115	372	Electric motor sound - Volume dependent on speed - ELECTRIC	0
56	Back-EMF control (P and I values)	55	132	Special effects FuncOutput6	0	249	Bootloader subversion	0	327	Minimum interval for random generator Z5	60	373	Electric motor sound - Volume	0
57	Voltage reference	0	133	FO4 as Cam sensor Or FO4 as fan of smoke generators of steam engines.	0	250	Decoder ID	0						
58	Back-EMF intensity	255	134	Asymmetrical threshold for stopping with asymmetrical DCC signa	106	251	Decoder ID	0						
59	Signal dependent reaction time	5	135	Km/h – Speed regulation	0	252	Decoder ID	0						
60	Reduced function output voltage (Dimming)	50	136	km/h – Speed regulation	24	253	Decoder ID	0						
61	Special ZIMO function mapping	97	137	Definition of smoke generator characteristic, connected to FO 1 – 6.	70	260	Load Code P1	0						
62	Light effects modifications	50	138	Definition of smoke generator characteristic, connected to FO 1 – 6.	200	261	Load Code P2	0						
63	Light effects modifications or Stop light OFF delay	62	139	Definition of smoke generator characteristic, connected to FO 1 – 6.	255	262	Load Code P3	0						
64	Light effects modifications	0	140	Distance controlled stopping (constant stopping distance)	0	263	Load Code P4	0						
65	Version Number (part2) sub-version	0	141	Distance controlled stopping - dist calc	20	264	Variable low voltage (large scale)	0						
66	Directional speed trimming	0	142	Distance controlled stopping - hispeed correction	5	265	Loco type selection	1						
67	Free speed curve	4	143	compensation using the HLU method	0	266	Total volume	64						
68	Free speed curve	7	144	Programming and update lock - not in MS	0	267	Chuff sound fre-quency with „virtual cam sensor“	90						
69	Free speed curve	10	145	Experimental - Alternative motor control	0	268	Switching to real cam sensor	0						
70	Free speed curve	13				269	Lead-chuff accentuated	25						
71	Free speed curve	16				270	Longer chuff length at very low speeds	0						
72	Free speed curve	20				271	Overlapping effect at high speed	16						
73	Free speed curve	24				272	Blow-off duration	50						
74	Free speed curve	28				273	Delayed start after blow-off	20						
75	Free speed curve	32				274	Blow-off schedule	30						
						275	Engine (chuff) sound volume at low speed	225						

	dependent on braking - ELECTRIC	
374	Coasting-Key (or Notching)	0
375	Coasting-Step (or Notching)	0
376	Driving sound	0
378	Likelihood of switchgear sparks during accel	0
379	Likelihood of switchgear sparks during decel	0
380	Manual electric brake key	0
381	Electric brake - minimum speed	0
382	Electric brake - maximum speed	0
383	Electric brake - Pitch according to speed	0
384	Electric brake - Deceleration threshold	0
385	Electric brake - Hill descent	0
386	Electric brake - loops	0
387	Influence of accel to diesel sound steps	64
388	Influence of decel to diesel sound steps	64
389	Limit accel influence over diesel sound steps	30
390	Momentum reduction when driving solo	75
391	Driving with idle sound, when driving solo	0
392	Switch input 4 Playback time	0
393	Zimo Config 5 - switch inputs	0
394	Switchgear flash with sound plus Blending	16
395	Max Volume via FKey volume adjust	65
396	FKey to reduce volume	20
397	FKey to increase volume	21
398	Automatic Coasting (diesels)	0
400	Input mapping for internal F0	0
401	Input mapping for internal F1	0
402	Input mapping for internal F2	0
403	Input mapping for internal F3	0
404	Input mapping for internal F4	0
405	Input mapping for internal F5	0
406	Input mapping for internal F6	0
407	Input mapping for internal F7	0
408	Input mapping for internal F8	0
409	Input mapping for internal F9	0
410	Input mapping for internal F10	0
411	Input mapping for internal F11	0
412	Input mapping for internal F12	0
413	Input mapping for internal F13	0
414	Input mapping for internal F14	0
415	Input mapping for internal F15	0
416	Input mapping for internal F16	0
417	Input mapping for internal F17	0
418	Input mapping for internal F18	0
419	Input mapping for internal F19	0
420	Input mapping for internal F20	0
421	Input mapping for internal F21	0
422	Input mapping for internal F22	0
423	Input mapping for internal F23	0
424	Input mapping for internal F24	0
425	Input mapping for internal F25	0
426	Input mapping for internal F26	0
427	Input mapping for internal F27	0
428	Input mapping for internal F28	0
430	Swiss Mapping Group 1 FKey	0
431	Swiss Mapping Group 1 MKey	0
432	Swiss Mapping Group 1 Forward 1st AUX	0
433	Swiss Mapping Group 1 Forward 2nd AUX	0
434	Swiss Mapping Group 1 Reverse 1st AUX	0
435	Swiss Mapping Group 1 Reverse 2nd AUX	0
436	SMG Group 2 FKey	0
437	SMG Group 2 MKey	0
438	SMG Group 2 Forward 1st AUX	0
439	SMG Group 2 Forward 2nd AUX	0
440	SMG Group 2 Reverse 1st AUX	0
441	SMG Group 2 Reverse 2nd AUX	0
442	SMG Group 3 FKey	0
443	SMG Group 3 MKey	0

444	SMG Group 3 Forward 1st AUX	0
445	SMG Group 3 Forward 2nd AUX	0
446	SMG Group 3 Reverse 1st AUX	0
447	SMG Group 3 Reverse 2nd AUX	0
448	SMG Group 4 FKey	0
449	SMG Group 4 MKey	0
450	SMG Group 4 Forward 1st AUX	0
451	SMG Group 4 Forward 2nd AUX	0
452	SMG Group 4 Reverse 1st AUX	0
453	SMG Group 4 Reverse 2nd AUX	0
454	SMG Group 5 FKey	0
455	SMG Group 5 MKey	0
456	SMG Group 5 Forward 1st AUX	0
457	SMG Group 5 Forward 2nd AUX	0
458	SMG Group 5 Reverse 1st AUX	0
459	SMG Group 5 Reverse 2nd AUX	0
460	SMG Group 6 FKey	0
461	SMG Group 6 MKey	0
462	SMG Group 6 Forward 1st AUX	0
463	SMG Group 6 Forward 2nd AUX	0
464	SMG Group 6 Reverse 1st AUX	0
465	SMG Group 6 Reverse 2nd AUX	0
466	SMG Group 7 FKey	0
467	SMG Group 7 MKey	0
468	SMG Group 7 Forward 1st AUX	0
469	SMG Group 7 Forward 2nd AUX	0
470	SMG Group 7 Reverse 1st AUX	0
471	SMG Group 7 Reverse 2nd AUX	0
472	SMG Group 8 FKey	0
473	SMG Group 8 MKey	0
474	SMG Group 8 Forward 1st AUX	0
475	SMG Group 8 Forward 2nd AUX	0
476	SMG Group 8 Reverse 1st AUX	0
477	SMG Group 8 Reverse 2nd AUX	0
478	SMG Group 9 FKey	0
479	SMG Group 9 MKey	0
480	SMG Group 9 Forward 1st AUX	0
481	SMG Group 9 Forward 2nd AUX	0
482	SMG Group 9 Reverse 1st AUX	0
483	SMG Group 9 Reverse 2nd AUX	0
484	SMG Group 10 FKey	0
485	SMG Group 10 MKey	0
486	SMG Group 10 Forward 1st AUX	0
487	SMG Group 10 Forward 2nd AUX	0
488	SMG Group 10 Reverse 1st AUX	0
489	SMG Group 10 Reverse 2nd AUX	0
490	SMG Group 11 FKey	0
491	SMG Group 11 MKey	0
492	SMG Group 11 Forward 1st AUX	0
493	SMG Group 11 Forward 2nd AUX	0
494	SMG Group 11 Reverse 1st AUX	0
495	SMG Group 11 Reverse 2nd AUX	0
496	SMG Group 12 FKey	0
497	SMG Group 12 MKey	0
498	SMG Group 12 Forward 1st AUX	0
499	SMG Group 12 Forward 2nd AUX	0
500	SMG Group 12 Reverse 1st AUX	0
501	SMG Group 12 Reverse 2nd AUX	0
502	SMG Group 13 FKey	0
503	SMG Group 13 MKey	0
504	SMG Group 13 Forward 1st AUX	0
505	SMG Group 13 Forward 2nd AUX	0
506	SMG Group 13 Reverse 1st AUX	0
507	SMG Group 13 Reverse 2nd AUX	0
513	F1 sound assignment	0
514	F1 volume adjust	0
515	F1 looping/short	0
516	F2 sound assignment	145
517	F2 volume adjust	0
518	F2 looping/short	0
519	F3 sound assignment	156
520	F3 volume adjust	0
521	F3 looping/short	8

522	F4 sound assignment	0
523	F4 volume adjust	0
524	F4 looping/short	0
525	F5 sound assignment	150
526	F5 volume adjust	0
527	F5 looping/short	8
528	F6 sound assignment	146
529	F6 volume adjust	0
530	F6 looping/short	0
531	F7 sound assignment	0
532	F7 volume adjust	0
533	F7 looping/short	0
534	F8 sound assignment	0
535	F8 volume adjust	0
536	F8 looping/short	0
537	F9 sound assignment	157
538	F9 volume adjust	0
539	F9 looping/short	0
540	F10 sound assignment	152
541	F10 volume adjust	0
542	F10 looping/short	0
543	F11 sound assignment	155
544	F11 volume adjust	0
545	F11 looping/short	8
546	F12 sound assignment	0
547	F12 volume adjust	0
548	F12 looping/short	0
549	F13 sound assignment	161
550	F13 volume adjust	0
551	F13 looping/short	0
552	F14 sound assignment	163
553	F14 volume adjust	0
554	F14 looping/short	8
555	F15 sound assignment	159
556	F15 volume adjust	0
557	F15 looping/short	8
558	F16 sound assignment	160
559	F16 volume adjust	0
560	F16 looping/short	8
561	F17 sound assignment	162
562	F17 volume adjust	0
563	F17 looping/short	0
564	F18 sound assignment	169
565	F18 volume adjust	0
566	F18 looping/short	8
567	F19 sound assignment	158
568	F19 volume adjust	0
569	F19 looping/short	0
570	F0 sound assignment	0
571	F0 volume adjust	0
572	F0 looping/short	0
573	IDLE sound assignment	1
574	IDLE volume adjust	0
575	CHANGEDIR sound assignment	2
576	CHANGEDIR volume adjust	0
577	COMETOHALT sound assignment	4
578	COMETOHALT volume adjust	0
579	THYRISTOR sound assignment	0
580	THYRISTOR volume adjust	0
581	SETOFF sound assignment	3
582	SETOFF volume adjust	0
583	WATEROUTLET sound assignment	0
584	WATEROUTLET volume adjust	0
585	EMOTOR sound assignment	0
586	EMOTOR volume adjust	0
587	ROLLING sound assignment n/a	0
588	DRIVING SOUNDS volume adjustment	0
589	SWITCHVALVE sound assignment	0
590	SWITCHVALVE volume adjust	0
591	THYRISTOR2 sound assignment	0
592	THYRISTOR2 volume adjust	0
593	PANTOSTOP sound assignment	0
594	PANTOSTOP volume adjust	0

595	PANTODOWN sound assignment	0
596	PANTODOWN volume adjust	0
597	PANTODOWNSTOP sound assignment	0
598	PANTODOWNSTOP volume adjust	0
599	TURBO sound assignment	0
600	TURBO volume adjust	0
601	DYNAMIC BRAKES - sound assignment	0
602	DYNAMIC BRAKES volume adjustment	0
671	Reed input 4 sound assignment	0
672	Reed input 4 volume adjust	0
673	F20 sound assignment	0
674	F20 volume adjust	0
675	F20 looping/short	0
676	F21 sound assignment	0
677	F21 volume adjust	0
678	F21 looping/short	0
679	F22 sound assignment	154
680	F22 volume adjust	0
681	F22 looping/short	0
682	F23 sound assignment	148
683	F23 volume adjust	0
684	F23 looping/short	0
685	F24 sound assignment	149
686	F24 volume adjust	0
687	F24 looping/short	0
688	F25 sound assignment	153
689	F25 volume adjust	0
690	F25 looping/short	8
691	F26 sound assignment	147
692	F26 volume adjust	0
693	F26 looping/short	0
694	F27 sound assignment	151
695	F27 volume adjust	0
696	F27 looping/short	8
697	F28 sound assignment	172
698	F28 volume adjust	0
699	F28 looping/short	0
700	unused	0
726	Sound id for trigger 1	0
727	AUX output to activate with trigger 1	0
728	Sound id for trigger 2	0
729	AUX output to activate with trigger 2	0
730	Sound id for trigger 3	0
731	AUX output to activate with trigger 3	0
732	Sound id for trigger 4	0
733	AUX output to activate with trigger 4	0
734	Sound id for trigger 5	0
735	AUX output to activate with trigger 5	0
736	Sound id for trigger 6	0
737	AUX output to activate with trigger 6	0
738	Reed input 1 sound assignment	0
739	Reed input 1 volume adjust	0
740	Reed input 2 sound assignment	0
741	Reed input 2 volume adjust	0
742	Reed input 3 sound assignment	0
743	Reed input 3 volume adjust	0
744	Z1 Random sound assignment	173
745	Z1 Random volume adjust	91
746	Z1 Random standstill / motion	72
747	Z2 Random sound assignment	174
748	Z2 Random volume adjust	91
749	Z2 Random standstill / motion	72
750	Z3 Random sound assignment	151
751	Z3 Random volume adjust	91
752	Z3 Random standstill / motion	72
753	Z4 Random sounds assignment	152
754	Z4 Random volume adjust	91
755	Z4 Random standstill / motion	72
756	Z5 Random sound assignment	153
757	Z5 Random volume adjust	91
758	Z5 Random standstill / motion	8
759	Z6 Random sound assignment	154
760	Z6 Random volume adjust	91

761	Z6 Random standstill / motion	72
762	Z7 Random sound assignment	155
763	Z7 Random volume adjust	46
764	Z7 Random standstill / motion	8
765	Z8 Random sound assignment	165
766	Z8 Random volume adjust	91
767	Z8 Random standstill / motion	8
768	Steam set	0
769	unknown	1
770	unknown	127
771	unknown	127
772	unknown	127
773	unknown	127
774	unknown	1
775	unknown	42
776	unknown	26
783	PWM slow from auto-run	0
784	PWM fast from auto-run	0
800	SMG Group 14 FKey	0
801	SMG Group 14 MKey	0
802	SMG Group 14 Forward 1st AUX	0
803	SMG Group 14 Forward 2nd AUX	0
804	SMG Group 14 Reverse 1st AUX	0
805	SMG Group 14 Reverse 2nd AUX	0
806	SMG Group 15 FKey	0
807	SMG Group 15 MKey	0
808	SMG Group 15 Forward 1st AUX	0
809	SMG Group 15 Forward 2nd AUX	0
810	SMG Group 15 Reverse 1st AUX	0
811	SMG Group 15 Reverse 2nd AUX	0
812	SMG Group 16 FKey	0
813	SMG Group 16 MKey	0
814	SMG Group 16 Forward 1st AUX	0
815	SMG Group 16 Forward 2nd AUX	0
816	SMG Group 16 Reverse 1st AUX	0
817	SMG Group 16 Reverse 2nd AUX	0
818	SMG Group 17 FKey	0
819	SMG Group 17 MKey	0
820	SMG Group 17 Forward 1st AUX	0
821	SMG Group 17 Forward 2nd AUX	0
822	SMG Group 17 Reverse 1st AUX	0
823	SMG Group 17 Reverse 1st AUX	0
835	Number of Additional Quick Select FKeys	2
836	Probability of switchgear sparks	0
837	Script processes	0

# Zimo Small DCC Decoders - YouChoos Common Tweaks

September 2018 Revision  
 For MX645, MX644, MX648, MX646, MX649, MX658, MX659, MX695, MX696, MX699  
 By John Gymer, YouChoos  
[www.youchoos.co.uk](http://www.youchoos.co.uk)

Zimo DCC decoders are some of the most advanced decoders available, and as such have many aspects that can be configured and tweaked according to your preferences and how you wish to use them. This flexibility of course comes with a certain complexity, so YouChoos have worked to produce this mini guide detailing some of the more common areas that you are likely to want to adjust in your Zimo decoder.

While the information here relates primarily to Zimo's sound decoders, much of the information also applies to Zimo's standard non-sound decoders and function decoders. More detailed information can be found in Zimo's own *Small Decoder Manual* available for download from their website ([www.zimo.at](http://www.zimo.at)).

## Wiring Colours

All Zimo decoders follow the same wire colouring convention (note that purple and brown are reversed from the standards used by most other DCC manufacturers):

Red	Track right
Black	Track left
Orange	Motor right
Grey	Motor left
Blue	Common Positive
White	AUX1/F0Fwd Negative – normally for forward motion lights
Yellow	AUX2/F0Rev Negative – normally for reverse motion lights
Green	AUX3/FA1 Negative
Brown	AUX4/FA2 Negative
Purple x2	Speaker connection

## Stay-Alive Capacitors

If adding a stay-alive capacitor, ensure its' voltage rating is at least as high as the DCC track voltage. Normally this is around 16V.



If possible, it is recommended that you use a capacitor between 25-35V. Any size will help, even as small as 100uF, but the bigger the better. Electrolytic, Tantalum and some SuperCap capacitors may be fitted directly to decoders with energy storage connections, or via a SPEIKOMP kit for decoders only supplying +VE and GND connections. See Zimo's documentation for more information.

## Understanding and Calculating Binary Values

In order to successfully understand and program some CVs, you will need a basic understanding of binary. Each CV contains what is called a *byte* of information. This is computer-speak for 8 *bits* of information, each of which can be ON or OFF. A *bit* is therefore a *toggle*, ON or OFF. A 1 represents ON and a 0 represents OFF. If you have just 1 bit, then you can have a maximum of 2 values i.e. on and off. Adding more bits means you can have more combinations, for example, 2 bits gives you 4 possible combinations: OFF+OFF; OFF+ON; ON+OFF; ON+ON, or 0, 0, 0, 1; 1, 0; 1, 1. Read this as 0,1,2,3 since computers always start at 0 instead of 1.

By convention, bits are read with the least significant to the right i.e. "bit 0" is the right-most bit. A byte, as mentioned previously has 8 bits, so bits 0 to 7, giving a possible range of 0-255 (2<sup>8</sup>-1 being the maximum value, 256 combinations). Use the table below for reference to see what value each bit can represent.



Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
128	64	32	16	8	4	2	1

An example: if bit 6 is ON and bit 1 is also ON, then this is 64+2, so the value represented is 66. Simple really!

Many of the CVs in your decoder use individual bits to control different aspects, so it is useful to understand binary in order to a) work out how the decoder is currently configured, and b) to understand how to modify the CVs to change the decoder's behaviour.

## Hard Reset

A *HARD RESET* is performed by setting CV8=8. This resets all CVs to factory setting. By *factory*, we mean the last project loaded into the decoder (by YouChoos, or other vender). This process will NOT wipe the sounds themselves! Occasionally you may have to send the RESET message a couple of times for it to actually work. This is particularly useful if you have lost track of the CV changes you have made and you want to go back, or the loco is not behaving as you hoped after some tuning!

## Speakers

The connected speaker must have an impedance of 8ohm and 1W. Alternatively, you can connect 2x 40hm speakers in series, which will give 80hm overall impedance (although power required will be the power rating of both speakers added together). Any other impedance will void warranty and may cause damage to the decoder and/or speaker. MX644 and MX645 are exceptions, which both support 4ohm speakers and up to 3W power (use 2x 80hm speakers in parallel for these decoders to get 40hm overall).



## Analog/DC Operation

By switching CV29 Bit 2 (value 4) ON, DC/Analog operation is possible. This is normally done by default in sound decoders supplied by YouChoos. Control of the loco under DC is quite different from a model without a decoder, so you may have to re-learn how to use the throttle range! There is a useful video by YouChoos on YouTube showing the effects and how control differs from traditional DC operation.



## Reading and Writing CVs

All Zimo decoders are capable of working with a DCC programming track as well as accepting new CVs values via *Programming-On-The-Main* (POM). Any feedback (reading CVs) will require a *load* to the decoder such as an attached motor, or lighting, as an electrical load is used to send back information to the DCC controller.

## Addressing

Decoders will normally be supplied with their DCC 'address' set to a default of 3. If you have multiple locos fitted with DCC, then you will need to change this quite soon.



Most DCC controllers provide automatic facilities to change a decoder's address, but it may be useful to understand how this works under the covers. The full range of addresses goes from 1 up to 10239, although most DCC controllers are limited to 9999 (4 digits), and some are limited to just 2, or even a single digit!

If your chosen address falls in the range from 1 to 127, then this is known as a 'short' address, and is stored in CV1. With bit 5 (value 32) of CV29 switched OFF, the short address is active, and the decoder will respond to commands on the address stored in CV1.

For addresses between 128 and 10239, a formula is used to calculate and store the address in CVs 17 and 18. This is required because the largest number you can store in a single CV is restricted to 255. The long address is active when bit 5 of CV29 is switched on.

CV19 is used when you add your loco into a Consist. Refer to your DCC controller's manual for more information on Consisting (temporarily placing multiple locos together, such as double-heading).

## Function Mapping

Control of decoder's auxiliary features, such as lighting and smoke, can be configured flexibly to different Function Keys. YouChoos sound decoders are normally shipped with Zimo's *advanced function mapping enabled* (CV61=97), which allows totally flexible mapping of AUX outputs (lighting etc.) to any FKey in the range F0 to F12 using CVs 33 to 46 (simple 8-bit-mask defining the outputs to activate for each FKey). With CV61=0, standard NMRA function mapping is assumed.



FKey assignment to other features, such as sounds, is defined with dedicated CVs. For example, CV516 defines which sound is played when FKey2 is pressed. The values you put in for sound assignments are unique ids that were defined when the sound project was created, so you will have to use your powers of deduction (or contact us) to find out which sounds have what values!

Numerous additional CVs define FKeys for other features, such as coasting key (CV374), manual electric brake key (CV380), master volume down/up keys (CV396 and CV397), shunting key (CV155), momentum deactivation (CV156), Quick Select (CV345), engine & random sounds on/off key (CV310), FKey sounds on/off key (CV311), mute key (CV313) etc.

## Lighting

LEDs and bulbs may be powered and controlled by the AUX function outputs of the decoder. In general it is recommended to use LEDs, as these have very long lives and do not generally get hot.



LEDs should always have their positive terminal connected via a resistor to the decoder's common positive (blue), and their negative terminal to one of the AUX function outputs e.g. white, yellow, green, brown etc.

Configuration of what Function Key controls each AUX output is detailed in the section on Function Mapping.

A variety of lighting effects can be applied individually to each AUX output using CVs 125 to 132. Dimming can be achieved using CV60 to specify the level of dimming (0-100 percent brightness) and CV114 as a bit-mask to define which outputs the dimming is applied to.

## Smoke Generators

As long as your smoke generator device draws less current than the AUX outputs for your decoder is capable of, you can connect it directly between the common positive (blue wire) of the decoder and one of the AUX function outputs (typically the brown wire is used for this purpose). No other components are required. Seuthe #22 and #27 units are suitable for direct connection in OO/HO scale in particular to any Zimo sound decoder.



A special effect can be used for smoke generators (see CVs 125 to 132) to achieve load or speed dependent smoke output, as well as a useful safety feature to automatically switch off the smoke unit after a predefined period (CV353).

## Motor Control and Tuning

Zimo decoders offer very flexible tuning for motor control, supporting a wide variety of motor types, and it is normally possible to achieve excellent smooth, and slow running performance with any well maintained motor.



### Speed Curves

CVs 2, 6 and 5 provide a simple method of defining the motor's speed curve from initial set-off to maximum speed. With CV 6 set to 0, the speed curve is linear, but with CV 6 set to something between 0 and 255, a rough 3-point curve is applied. This assumes that CV 29 bit 4 (value 16) is switched off.

With CV29 bit 4 switched on, the speed curve is taken from CVs 67 to 94, allowing you a much finer control of the motor output through the speed range.

### Momentum / Inertia

One of the great features of DCC decoders is the ability to automatically apply gradual acceleration and deceleration, making the motion of the loco much more realistic than would be possible with an analog control. Zimo decoders are particularly good at applying these gradual effects, and the strength of the momentum effects can be easily configured using CV 3 (acceleration) and CV 4 (deceleration).

### Motor Characteristics and Back EMF

Smooth running is achieved using a technique called Back EMF, whereby the decoder regularly samples current usage of the motor in order to work out if the requested speed is actually being maintained. It is a very sophisticated technique, and the frequency and strength of the feedback must closely match the characteristics of the motor in order for it to work effectively. Bad configuration will result in jerky motion, and noisy operation.

Zimo decoders will normally be shipped with Back EMF settings appropriate for the majority of modern motors, so there will be little tuning, if any required.

CV58 defines how much effect the feedback from BackEMF has (normally best to leave at max 255). CV56 defines how sampling of the motor is done, ranging from 00-99 where each digit defines a different aspect of the sampling. A 'middle' setting is the default (55), but if you find that your motor behaves poorly, try adjusting each digit individually to see the effects. Of course, if you have a poor motor to start with, then there may be very little you can do with BackEMF to improve it, so it is important to test the model on analog before installing a decoder!

## Adjusting Sound

### Overall Volume

Master volume (affects all sounds equally) is controlled with CV266 with a range from 0 to 100. Higher values are possible, but you risk damaging the decoder and/or speaker.



### Individual Sound Volume

Most sounds can be individually tweaked in volume. Sounds applied to FKeys have their own CVs for this purpose, such as CV517 for FKey2's volume. Range is 1-255 (0 means the same as 255 i.e. max). Refer to the CV crib sheet as supplied with your YouChoos sound decoder. You will see numerous 'volume adjust' CVs in the range 574 to 602, which enable you to tune the volume of automatic sounds, such as brakes, idling, motor, set-off and come-to-halt.

### Random Sounds

CVs in the range from 744 to 767 relate to the playback of sounds randomly. Many YouChoos sound decoders (steam in particular) will be shipped with some appropriate sounds that play at a reduced volume at random intervals. Details of how this is done is beyond the scope of this guide, but if you simply want to remove all random sounds then you can set all of these CVs to 0!

### Chuff Rate

For steam sound decoders, one of the most common tweaks required is to tune the chuff rate. CV267 is used to do this. A lower value means faster chuffs. Further fine tuning is possible with other CVs (see the Zimo decoder manual for more information).

### Engine Volume Relative to Other Sounds

If you feel that the automatic engine sounds are too loud compared to the FKey sounds, you can easily reduce it by changing CV#376. In conjunction, you may also wish to tune the set-off and come-to-halt sounds too (CV#582 and CV#578 respectively). This is primarily useful for diesel/electric projects.

However, engine volume in geared (diesel mechanical) projects (such as 1<sup>st</sup> gen DMUs, Class 03/04, or GWR Railcar etc.) behaves differently compared to normal diesels, so the above notes on CV changes won't have the desired effect. Instead, there are essentially 3 aspects to volume in geared projects...

First is the basic engine sounds, which are primarily affected by CV#283 and CV#286. Lower these to get to something you prefer.

We also make use of a feature called 'Thyristor', which of course is not a thyristor sound for diesel, but gives us an engine sound that plays with pitch dependent upon speed and the max volume that this can take comes from CV#294. This sound plays in a loop until the speed reaches the selected level, like an acceleration sound.

The 3rd aspect is a sound called 'eMotor', which is another way to get pitch-dependent engine sounds based on speed, and the max volume is specified with CV#296. CV#297 and CV#298 define at what point in the speed range the eMotor sound is played back.

So, a combination of these should allow you to adjust the engine sounds in a geared project. Once these are lowered, you can potentially use master volume CV#266 to increase the overall volume, thus bringing up the playable sounds like horns etc.

### Speed, Load and Accel/Decel Effects on Sound

YouChoos tries hard to ship sound decoders with a sensible combination and balance for engine sounds, but everyone has different ideas of how a loco should sound, so you can fine tune many aspects. In particular, the volume of engine/chuffs can be adjusted according to rate of acceleration, deceleration, load as well as various time-based thresholds over which these aspects can change. CVs in the range of 268 to 288 are the primary ones used to do this, although there are many more. Refer to the CV crib sheet supplied with your YouChoos sound decoder, in conjunction with the Zimo Small Decoders manual for more detailed information.

### Delayed Set-Off

When you open the throttle, a set-off or revving-up sound is usually played, but in reality you don't always want the motor to start spinning until this sound is finished, or at least part-way through playing. Many YouChoos sound decoders will be pre-configured with a suitable delay to the motor starting, but you can tune this to your own liking with CV273.

### Final Braking Threshold

Depending upon your motor characteristics, you may also wish to tweak the threshold for the final braking sound (sometimes referred to as the 'come to halt' sound). This is done using CV287, which defines the speed step at which the brake sound starts to play. The lower the value, the closer the speed will have to be to stopping before the sound begins playing.

## Further Reading

You have probably got the idea now that there is a lot you can play with in a Zimo sound decoder! This guide touches only a few of the more commonly tweaked areas, but you can find out a lot more detail in the Zimo Small Decoder manual, available for download from [www.zimo.at](http://www.zimo.at). Here are some ideas of other areas of interest:

- Running in a consist (double-heading)
- Automatic braking, signal control and distance controlled stopping
- Uncoupler devices with automated uncoupling procedure
- Attaching a cam sensor for chuff synchronisation
- Railcom (feedback to your controller of what the loco is doing)
- Servo connection
- Input triggers – sensors to trigger effects and sounds
- Pantograph installation
- Swiss Mapping