



IntelliDrive 77 100

Multi-protocol decoder with Load regulation

Characteristics 77 100

- Regulated Multi-protocol decoder for DCC (NMRA conforming) and Motorola
- Suitable for DC and Bell armature motors
- Up to 1.8 A constant current, 3A spikes
- Quiet motor running with 18.75 KHz motor control
- 14, 27, 28, 128 speed steps, according to data format
- Short (1-127) and long (128-9999) addresses
- Minimum, maximum and middle speed adjustable
- Additional speed curve for 28 Speed step mode
- Main line programming (DCC)
- Shutting mode (half speed) switchable by f3
- Switchable start and brake inertia
- Dimmable, direction dependent lights
- 5 Special function outputs, dimmable and time controlled
- Function Mapping
- Direction dependence and also timed switching of output A1 to A5
- Shuttle traffic and intermediate stopping or INDUSI via Locomotive reed switch and track magnet
- With SUSI Interface for connecting Sound modules or other modules for controlling auxiliary functions
- Reacts to a DCC compliant brake signal or brake sections with DC power
- Overheating protection
- All output are short circuit protected
- Conventional DC or AC operation with automatic switching
- All CV's are programmable with Digital devices in DCC and Motorola format
- Updatable Flash-Memory

Description

The 77 100 locomotive decoder is an efficient multi-protocol decoder for large scale trains. It can be used in DCC- and Motorola Digital systems and also works analog mode with DC or AC and direction of travel change-over using high voltage pulse (Märklin system).

The decoder works with a frequency of 18.75 kHz and is not only suitable for DC motors, but also for bell armature motors (e.g. Faulhaber, Maxon, Escap) up to a continuous power of 3A. Short term higher switching on current are tolerated well.

The motor characteristics are setup either by means of the minimum, middle and maximum speeds or by different CV's for the individual speeds. The load control can be individually adapted to different locomotive motors by setting these control parameters.

The decoder has two travel direction of dependent lighting outputs, as well as five additional special function outputs. Function keys f3 and f4 can be used to switch a shunting mode with extended low-speed operating range and the starting/brake inertia. The allocation of the switching tasks such as lighting, special function outputs, shunting mode and adjustable starting/brake inertia can be freely assigned to the function keys of the digital center (Function Mapping).

All CV's are programmable with the Intellibox, DCC and Märklin controllers.

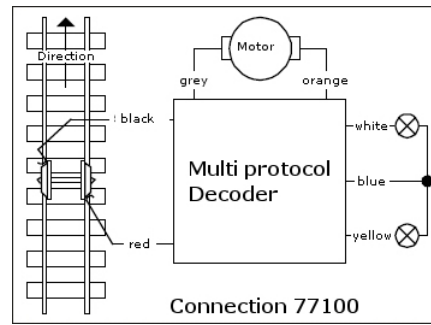
In the factory condition the decoder automatically recognizes the DCC and Motorola data formats, as well as analog DC or AC power. The desired mode of operation can also be specified manually.

Installation of the Locomotive decoder 77 100

Connecting the Motor

Connect terminal 1 to the right wheel power collector and terminal 2 to the left wheel power collector. The motor is connected to terminal 8 and terminal 9 of the decoder.

Test whether the driving direction is correct. If not, the connections to the motor must be exchanged.

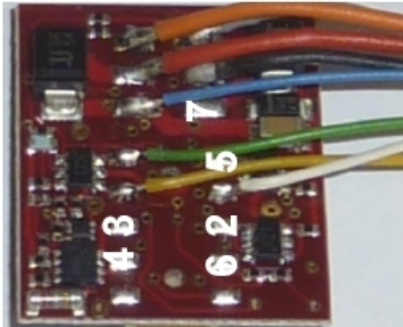


Connecting the Lights and Special functions

Connect the front light to the white and the rear light to the yellow cable. The second pole of each light is connected to either the blue cable (+20V) or the locomotive chassis (earth). If the blue wire is not used it must be insulated.

Note: If the direction of the locomotive does not correspond to the direction indicated on your controller then you could also change the direction with CV 29 Bit 0.

red - Wheel set +
black - Wheel set -
orange - Motor 1
grey - Motor 2
yellow - Rear light
white - front light
blue - +20V



green - A1
2 - A2
3 - A3
4 - A4
5 - A5
6 - Sensor
7 - GND

Additional special functions such as smoke generator, Telex coupling or fire box lighting can be connected to A1 to A5. The return lead is connected to either the blue wire (+20) or the locomotive chassis.

Mounting the decoder in the locomotive

Use the mounting straps at the sides, to fasten the decoder in the vehicle with screws. If the mounting straps are not needed, then they can be carefully broken off at the break section with the help of flat-nose pliers.

Start-up

Examine the correct installation with a continuity tester or an ohm meter. Make sure that the unit is placed in the vehicle where a conducting connection could not develop! Ensure that even after re-assembly of the locomotive no short-circuits occur from jammed wires

A short-circuit in the area of the motor, lighting, pick-up and wheel contacts can destroy the component and electronics of the locomotive!

Digital and analog Operation

On digital layouts the decoder can be controlled in the Motorola or DCC data format. For the DCC operation 28 speed steps are preset.

If the decoder is used on conventional layouts it can be controlled either with a DC or an AC controller (system Märklin). All operating modes are automatically recognized by the decoder.

Function Mapping

Outputs A1 – A4 are configured with CV's 33-38. With each of the CV's 33-38 a function key f0 to f4 or a number of switching tasks, in that a number of Bits in the CV are set, can be assigned. Should, for example, special function key f4 switch shunting mode, start/stop inertia and output A4 then CV38 must have the value 224, that is Bits 5, 6 and 7 must be set to 1.

The function number for output A5 can be entering directly into CV109. Further, it is possible to setup output A5 so it can be switched on when the locomotive is running, irrespective of the function keys. For this function CV109 must be set to a value of 30. Then the outputs can be made direction dependent and time controlled.

Travel direction dependent outputs A1 – A5

If one or several of the outputs A1-A5 are switched on only in one driving direction, then all special outputs can be deactivated separately for the forward or backwards driving direction. Using the individual bits of CV96 all outputs can be individually switched off for the forward direction. Similarly special functions can be switched off in the backwards direction using CV97.

Switch on limiting for outputs A1 – A5

If one or several of the outputs A1-A5 are to be switched on only for a limited duration, then each special function can have separately limited ON time using CV98. Each bit of the CV98 activates the timer for one of the outputs A1 – A5. The maximum ON time can be specified in CV99 (for all special functions). The programmed value is the maximum Cycle length in seconds. If the switch-on limitation is activated, then the corresponding function output switches OFF after the time in CV99 expires, even if it is still switched on at the digital controller. This function can be used for e.g. electrical couplings.

Dimming the Special Function Outputs A1 – A5

Outputs A1 – A5 can be dimmed independently of the light outputs. The dimming is set up in CV 113 (0=off, 63=100%).

CV 112 determines which of the function outputs A1 – A5 are to be dimmed. The individual Bits in CV 112 set up the function outputs. Bit 0=1, A1 is dimmed, ... Bit 5=1, A5 is dimmed.

Outputs A1 - A5 in Analogue Operation

The state of outputs A1 - A5 for analogue operations is determined by CV 13. Each Bit in CV 13 corresponds to the state of an output (1=on or 0=off).

Loading the Special Function Outputs A1 – A5

Loading of the special function outputs varies. Light outputs and outputs A1, A2 and A5 can have a loading of 400mA. Outputs A3 and A4 can be loaded with 700 mA, so that items such as smoke generators can be connected to these outputs.

Motor load regulation

Motor load regulation to suit the locomotive is adjusted using CV's 53 to 58.

Proceeding:

1. Set CV53 to 255. Test drive the locomotive and reduce the value of CV53 until the locomotive runs smoothly. (Note: use only values larger 70)
2. If the locomotive runs jerkily at the lowest speed step, CV58 must be increased.
3. If the locomotive does not run at speed step 1, CV56 must be increased, until the locomotive runs very slowly.
4. If the transitions from speed stop to speed step is too abrupt at lower speeds, then CV57 must be increased to approx. 20.
5. If CV57 has a value greater than 1 and the locomotive takes too long to start, then CV55 must be increased, until the locomotive starts quickly enough and still smoothly.

All values must be determined experimentally by running tests and will possibly be different for each vehicle.

INDUSI

If CV62 is set to 1, the decoder will operate in INDUSI mode. In order to be able to use this function, a reed switch must be connected between terminal 3 and 4. The reed switch is attached under the locomotive, over track center, and is not to be covered by other metallic parts. In the track electromagnets are mounted centrally in such a way that they can close this reed switch.

An electrical track magnet is attached after a stop signal. When the signal shows STOP, the electromagnet must be energized. If the locomotive overshoots the stop signal and reaches the active electromagnets, the locomotive implements emergency braking. Electromagnets such as those from the Faller Car system be can used.

Braking Section

The braking section function is active when CV 62 has a value of 2. In this case the decoder applies the brakes with the configured braking inertia and stops as soon as a track magnet is driven over. If the braking sequence is activated and the vehicle drives over a second magnet it is stopped by emergency brake (INDUSI). Once stationary the vehicle can be started in 2 ways: 1. The speed on the controller is set back to zero and then to the desired speed step. 2. When stationary the reed switch is closed and opened an additional time. For this, connection 6 must be connected to a function output A1 – A5. The vehicle will start up again when that output is switched off and back on again.

Shuttle train-/Stopping operation

If CV62 is set with a value greater than or equal to 3, the decoder will operate in shuttle train mode and/or 'stopping' mode. In order to be able to use this function, a reed switch must be connected between terminals 6 and 7. The reed switch is attached under the locomotive, over track center, and is not to be covered by other metallic parts. Centrally in the track, magnets are attached in such a way that they can activate the reed switch under at the locomotive.

If the locomotive with the reed contact passes over a track magnet, the locomotive automatically stops without any changes at the driving desk, and after a selectable time drives off again. Starting and brake inertia of the locomotive can be adjusted with CV3 and 4. If the locomotive passes over two track magnets in short succession, approx. 5 to 10 cm apart, the locomotive stops for a selectable time, without changes at the driving desk, and automatically drives off in the opposite direction. If during this automatic phase, (braking, stopping or driving off) the direction or the driving speed is changed by the controller, the automatic phase is terminated and the locomotive drives according to the operation set by the controller. The halt time is set by CV62. The programmed value corresponds to half the stopping time (e.g. CV62 = 30 corresponds to stopping time of 60 seconds).

Note: If the automatic function is to be adjustable, then the reed switch must be connected between terminal 4 and the function output A1 to A5. The automatic function can be turned on and off by the assigned function keys.

Start/Braking Inertia

If the Start/Braking Inertia is switched off by special function or an emergency stop from the center or INDUSI function, then the decoder uses the inertia configured in CV 103 and CV 104.

LISSY transmitter 68 400

If CV 115 is programmed with a value larger than 0 (1-4), then a LISSY transmitter 68 400 can be connected to the decoder's SUSI interface. The entered value (1-4) is also the LISSY train category. Operating a sound module is then not possible.

Operating the decoder with an LGB digital controller

So that the decoder can work correctly with an LGB digital center the following CV's must be changed:

CV 29 = 4 (14 speed steps, automatic change-over on analog layouts)

CV 49 = 2 (special function control f1-f8 with an LGB controller)

Connection of an LGB auxiliary sound circuit for special function control

If an original LGB auxiliary circuit is to be attached to the decoder, then the control input of the auxiliary circuit must be connected with the terminal 11 (output A1). So that the decoder outputs the necessary control signals on output A1, bit 2 of CV 49 must be set to 1. The special function output A1 can no longer be used for other tasks.

Programming

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, that 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.

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 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 summing the values of the desired functions.

Example

Normal driving direction value = 0
28 speed steps value = 2
Auto Analog/digital change over value = 4
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	0
	Reverse driving direction	1
1	14/27 speed steps	0
	28/128 speed steps	2
2	Only digital operation	0
	Automatic analog/digital change over	4
4	Speed steps using CV2, CV5 and CV6	0
	Characteristics using CV67-CV94	16
5	Short address (CV1, register 1)	0
	Long address (CV17 and CV18)	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 5-8 times in quick succession with the stationary locomotive (speed step 0), until the light blinks.
4. Enter the number of the CV that is to be programmed.
5. Briefly operate the direction change-over. The rear light flashes fast 4 times.
6. Enter the desired value for CV e.g. a locomotive address.
7. 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) automatically resets 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). Subsequently CV66

should be set back to zero so that the following programming will be entered into the desired CV's.

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.

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. The CV65 should then be reset to zero, so that following values smaller than 79 are not inadvertently erroneous

Note: When programming CV65 and CV66 the contents of offset and page registers are ignored.

Note: If the Motorola Programming mode is left, then page and offset register (CV65, CV 66) are automatically reset to zero.

Märklin braking section

The decoder reacts to a Märklin brake section (brakes with analog power on the track), if CV29 bit 2 and CV49 bit 7 are set to 1 (factory setting 1 and 0).

Technical Data

Addresses: 1-9999 (long DCC address)
 Max. current consumption: 1 A
 Function outputs: 1 A each
 Size: 24 x 20 x 5.4 mm

Factory defaults

The decoder is preset to address 03, 28 speed step operating mode and be run or programmed in DCC or Motorola data format. It automatically switches between both formats. Additionally the decoder can operate on conventional analog layouts with a DC or AC controller (Märklin system). Function key f3 switches shunting mode and Function key f4 switches Start-/braking inertia. All other Function keys switch their corresponding output.

Table of the Decoder CVs (Configuration Variables)

CV	Description	Value range	Factory default
1	Locomotive address	DCC 1-127, Mot 1-80	3
2	Minimum speed value	1-63	1
3	Start Inertia 1 means every 5ms the speed will be increased by 1 Sets the internal maximum speed e.g. 200 (CV5=50 or CV94=200) then starts the locomotive from 0 to Fmax in 1sec	1-63	2
4	Braking inertia (time factor like CV3)	1-63	2
5	Maximum speed (must be larger than CV2)	1-63	48
6	Middle speed	1-63	24
7	Software version (The processor used can be updated)	-	varies
8	Manufacturer ID	-	85
13	Special functions in analogue operation Bit 0 = state for A1; Bit 1 = A2; Bit 2 = A2; Bit 3 = A3; Bit 4 = A4; Bit 5 = A5;	0-255	0
17	Long address	1-9999	2000
18	17 = high order byte / 18 = low order byte		
19	Consist address (Multi-traction) 0 = Consist address is inactive When Bit 7=1 the driving direction is reversed So the desired CADR + 128 = driving direction reversed	1-127	0
29	Configuration DCC Standard Bit 0=0 Normal driving direction Bit 0=1 Reversed driving direction Bit 1=0 14 speed steps Bit 1=1 28 speed steps Bit 2/3 not used Bit 4=0 Speed steps from CV2, CV5 and CV6 Bit 4=1 Characteristics read from CV67 to CV94 Bit 5=0 Short Address (CV 1) Bit 5=1 Long Address (CV 17/18) Bit 6/7 not used	Value 0 * 1 0 2 * - 0 * 16 0 * 32 -	0-255 2

CV	Description		Value range	Factory default
33	Assignment of function outputs that are activated with the light function in forwards. Bit 0 Light output front 1 * Bit 1 Light output rear 2 Bit 2 Special function output A1 4 Bit 3 Special function output A2 8 Bit 4 Special function output A3 16 Bit 5 Special function output A4 32 Bit 6 Shunting mode 64 Bit 7 Start/Braking Inertia 128		0-255	1
34	Assignment of function outputs that are activated with the light function in reverse. For the assignment of individual Bits see CV 33.		0-63	2
35	Assignment of function outputs that are activated with the special function key f1. For the assignment of individual Bits see CV 33.		0-63	4
36	Assignment of function outputs that are activated with the special function key f2. For the assignment of individual Bits see CV 33.		0-63	8
37	Assignment of function outputs that are activated with the special function key f3. For the assignment of individual Bits see CV 33.		0-63	64
37	Assignment of function outputs that are activated with the special function key f4. For the assignment of individual Bits see CV 33.		0-63	128
49	Decoder Configuration Bit 0=0 Load regulation on Value 0 * Bit 0=1 Load regulation off 1 Bit 1 Not used - Bit 2=0 Brake down to Zero in a brake section 0 * Bit 2=1 Brakes to speed step in CV52 4 Bit 3=0 SX programming off 0 Bit 3=1 SX programming on 8 " Bit 4=0 Data format Motorola and DCC 0 * Bit 4=1 Data format Selectrix 16 Bit 5=0 Motorola Data format off 0 Bit 5=1 Motorola Data format on 32 * Bit 6=0 Don't swap light outputs 0 * Bit 6=1 Swap light outputs 64 Bit 7=0 Brake only with brake signal 0 * Bit 7=1 Brake with analogue voltage 128 Note: When Selectrix program is enabled by Bit 3 or Motorola data format by Bit 5 the decoder can only be programmed by a DCC device.		0-255	0
50	Dimming of the function outputs, Light front and back		0-49	25
51	Switching between analogue and digital operation 1 = only AC operation, 2 = only DC operation, 3 = Automatic detection		1-3	3
52	Speed at the end of a braking section when CV49 Bit 3=1 and Bit 7=1		0-255	30
53	Repetition rate of load regulation (CV49, Bit 0=1) Rate=Value * 53us Note: Should the locomotive not run smoothly this parameter can be changed. Valid values are in the range from 70 to 255.		70-255	150
54	Load regulation: P value		0-255	240
55	Load regulation: Iplus value		0-127	20
56	Internal value must not be changed		-	12
57	Load regulation: Iminus value		0-127	10
58	AD converter correction Value Bit 0-5 = time slot for the AD converter 0-63 Bit 6 = 0 Measuring range of the AD converter for 12 V Motors 0 Bit 6 = 1 Measuring range of the AD converter for 24 V Motors 64 Bit 7 = 0 Measuring range according to Bit 6 0 Bit 7 = 1 Automatic Measuring range switching 128		0-255	14
59	Reset to Factory default. If this CV is set to 1 the decoder is reset to factory settings		0, 1	0
60	Short circuit guard (Do Not Change) 0 = switched off		0-255	247
61	Temperature monitor (Do Not Change) 0 = is switched off		0-255	5
62	Shuttle/stop operation or Braking section or INDUSI 0 = all switched off, 1 = INDUSI, 2 = Brake section 3-127 = half waiting time in seconds (10 = 20 Second stop)		0-255	0
63	Offset register for CV programming with a Motorola digital controller		0-255	0
64	Page register, used in DCC page mode		0-255	0
67	Speed curve step 1		0-255	5
68	Speed curve step 2		0-255	7
69	Speed curve step 3		0-255	10
70	Speed curve step 4		0-255	12
71	Speed curve step 5		0-255	15
72	Speed curve step 6		0-255	17
73	Speed curve step 7		0-255	20
74	Speed curve step 8		0-255	22
75	Speed curve step 9		0-255	25
76	Speed curve step 10		0-255	27
77	Speed curve step 11		0-255	30
78	Speed curve step 12		0-255	32
79	Speed curve step 13		0-255	35
80	Speed curve step 14		0-255	37
81	Speed curve step 15		0-255	42
82	Speed curve step 16		0-255	50

CV	Description	Value range	Factory default
83	Speed curve step 17	0-255	55
84	Speed curve step 18	0-255	60
85	Speed curve step 19	0-255	65
86	Speed curve step 20	0-255	70
87	Speed curve step 21	0-255	75
88	Speed curve step 22	0-255	80
89	Speed curve step 23	0-255	85
90	Speed curve step 24	0-255	90
91	Speed curve step 25	0-255	95
92	Speed curve step 26	0-255	100
93	Speed curve step 27	0-255	105
94	Speed curve step 28	0-255	110
96	Special function outputs A1-A5 in forward direction Bit 0 = state for A1; Bit 1 = A2; Bit 2 = A3; Bit 3 = A4; Bit 5 = A5	0-255	0
97	Special function outputs A1-A5 in reverse direction Bit 0 = state for A1; Bit 1 = A2; Bit 2 = A3; Bit 3 = A4; Bit 5 = A5	0-255	0
98	A1-A5 time limited Bit 0 = state for A1; Bit 1 = A2; Bit 2 = A3; Bit 3 = A4; Bit 5 = A5	0-255	0
99	On time for a special function in seconds When CV 98 is activated	0-255	0
103	Start inertia when the delay is switched off by special function	0-63	1
104	Brake inertia for INDUSI and emergency stop	0-63	1
109	Assignment of special function which switches A5 (30 = Running bit)	0-28	5
112	Assignment of dimming for outputs A1-A5 Bit 0 = state for A1; Bit 1 = A2; Bit 2 = A3; Bit 3 = A4; Bit 5 = A5	0-255	0
113	Dimming of outputs A1 – A5 (0 = off, 63 = 100%)	0-63	32
115	Configuration of the SUSI interface 0 = SUSI socket for Sound module 1-4 = SUSI socket for LISSY transmitter 68 400. The value identifies the LISSY train category at the same time.	0-4	0

Factory default values are indicated with *.

www.uhlenbrock.de

Our website for information on the Intellibox, pricelist or distributor list or various publications for download.

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.

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Our Contact Details:

We available if you have any questions!

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Service: In the event of a defect or failure send the unit together with the invoice and a short description of the fault back to us for repair.



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Electronic devices do not
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