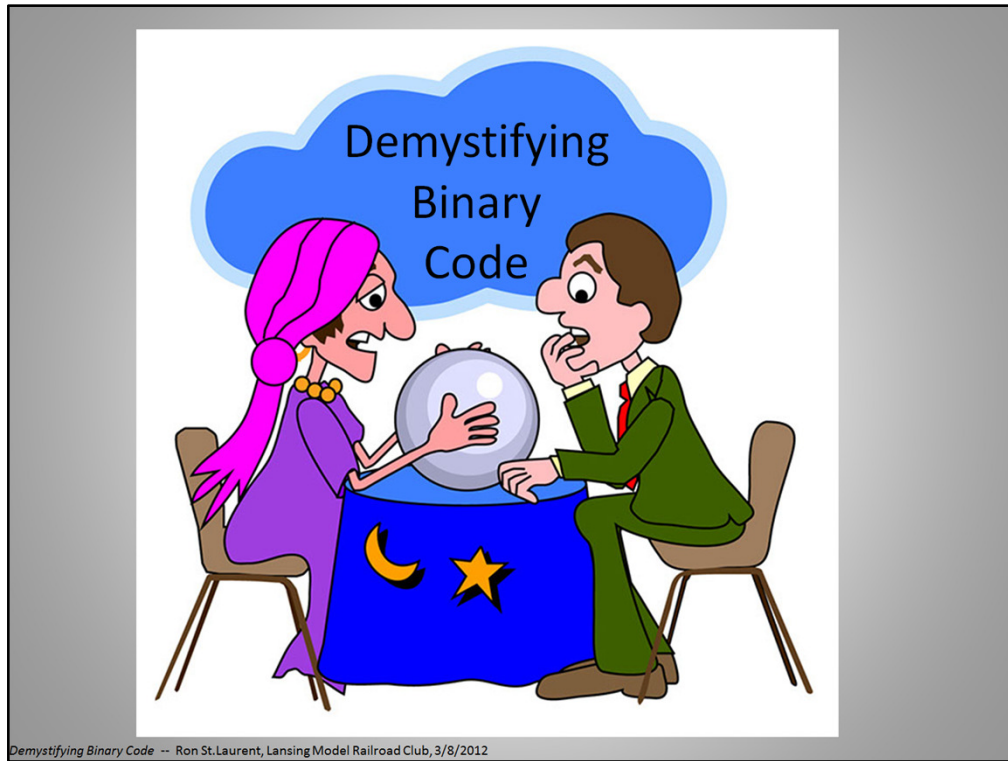




Tonight (today) we're going to cover Binary Code.
I want you to leave at the end of this presentation with a good understanding of binary.
Please stop me and ask questions if you don't understand something.
I want this to be interactive. Others who understand binary please chime in.



FUNCTION CVs

CV36

F2 Output Function Definition

Description
Selects Which Function(s) F2 Activates

Values
0 to 255

Initial Value
4(Horn1)

Related CVs
CV33—CV46

Bit 7

Ramp	GB/C	Coupler	Bell	Horn1	Horn2	RL	FL
------	------	---------	------	-------	-------	----	----

Bit 0

Bit 7: Ramp Diesel Motor Up Sound Effects
0 = Not Affected by F2
1 = Diesel Motor Ramps Up

Bit 6: Grid Blower Motor and Compressor Sound Effects
0 = Not Affected by F2
1 = Compressor Sound Activated by F2 if Engine Stopped
1 = Grid Blower Motor Activated by F2 if Engine Moving

Bit 5: Coupler Sound Effects
0 = Not Affected by F2
1 = Couple Sound Activated by F3 if Engine Moving
Uncouple Armed if Engine Stopped

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Demystifying Binary Code -- Ron St. Laurent, Lansing Model Railroad Club, 3/8/2012

How many of you have printed the big, honking manufacturer's decoder manual, opened it to any given page and said "Oh oh, now I'm screwed."

BASIC BINARY SYSTEM

								1 = on 0 = off
128	64	32	16	8	4	2	1	Decimal value if bit is "on"
7	6	5	4	3	2	1	0	Bits (8 bits = 1 byte)

Binary is a very basic language that can be understood by a computer. Binary numbers are expressed in a series of 1's and 0's, or on and off bits.

Always count from right to left.

"Decimal" is how us humans express numbers every day. The decimal value of each bit doubles as you go up.

So, bit 0 =1, bit 1=2, bit 2=4, bit 3=8, etc.

BASIC BINARY SYSTEM

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128	64	32	16	8	4	2	1	Decimal value if bit is "on"
7	6	5	4	3	2	1	0	Bits (8 bits = 1 byte)

8 Bits (0 through 7) make up a Byte

8 bits make a byte.

What binary number would represent 8? Bit 3

What binary number would represent 32? Bit 5

What binary number would represent 12? Bits 3 & 2 (8+4=12)

How about 14? Bits 3, 2 and 1 (8+4+2=14)

BASIC BINARY SYSTEM

								1 = on 0 = off
128	64	32	16	8	4	2	1	Decimal value if bit is "on"
7	6	5	4	3	2	1	0	Bits (8 bits = 1 byte)

If I wanted a value of 85 what bits would I turn on?

Bits 6, 4 and 0 ($64 + 16 + 4 + 1 = 85$)

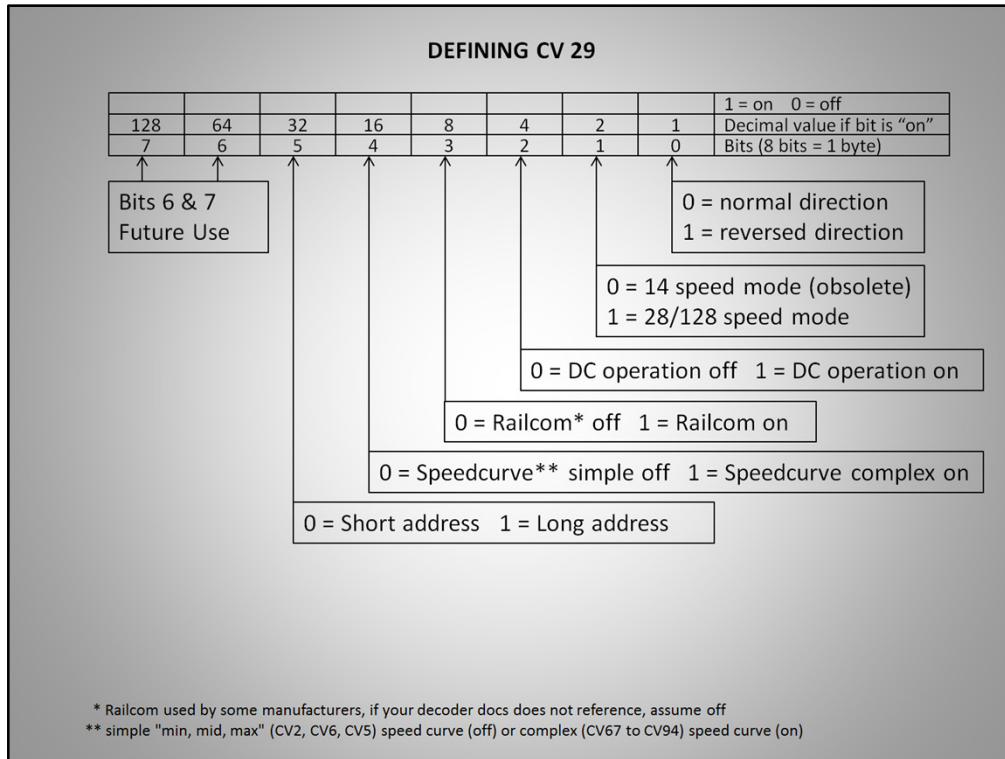
BASIC BINARY SYSTEM

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128	64	32	16	8	4	2	1	Decimal value if bit is "on"
7	6	5	4	3	2	1	0	Bits (8 bits = 1 byte)

If I wanted a value of 85 what bits would I turn on?

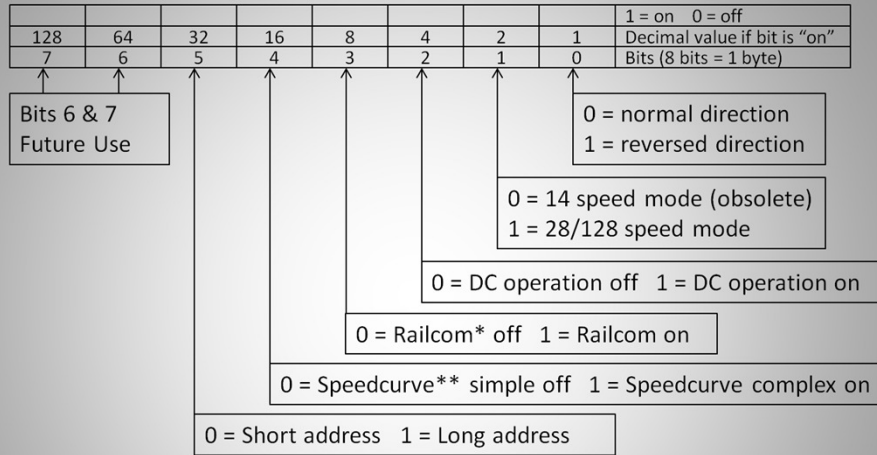
$$64 + 16 + 4 + 1 = 85$$

Bits 6, 4 and 0 ($64 + 16 + 4 + 1 = 85$)



We're going to look at one of the most confusing CV's, that being CV29. It controls many facets of our engines' operations.

DEFINING CV 29



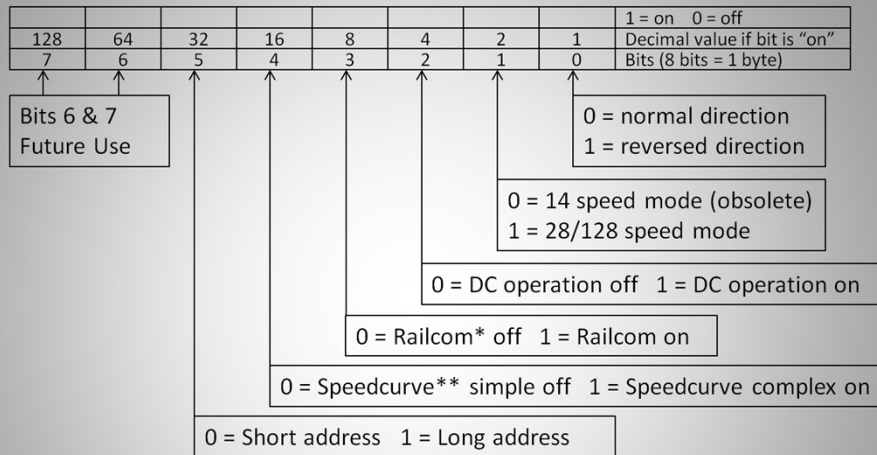
What value would I choose if I wanted a long address?

* Railcom used by some manufacturers, if your decoder docs does not reference, assume off

** simple "min, mid, max" (CV2, CV6, CV5) speed curve (off) or complex (CV67 to CV94) speed curve (on)

What value would I choose if I wanted a long address? Bit 5 is 32

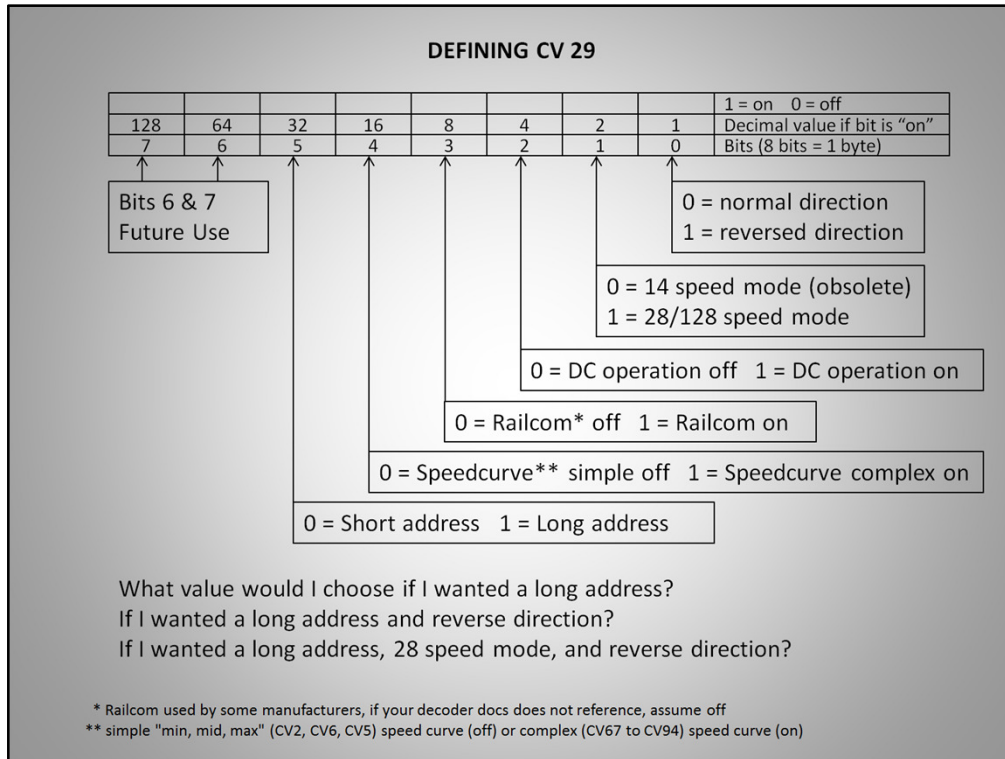
DEFINING CV 29



What value would I choose if I wanted a long address?
If I wanted a long address and reverse direction?

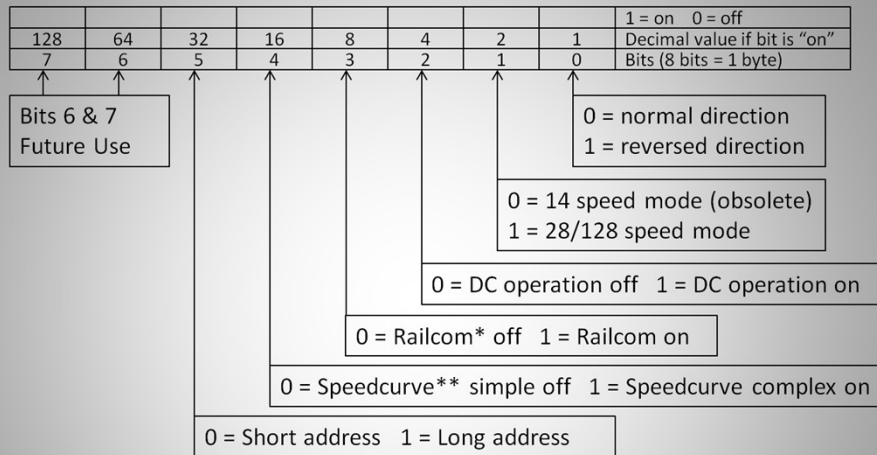
* Railcom used by some manufacturers, if your decoder docs does not reference, assume off
** simple "min, mid, max" (CV2, CV6, CV5) speed curve (off) or complex (CV67 to CV94) speed curve (on)

If I wanted a long address and reverse direction? Bits 5 and 0 (32+1=33)



If I wanted a long address, 28 speed mode, and reverse direction? Bits 5, 1 and 0
 (32+2+1=35)

DEFINING CV 29

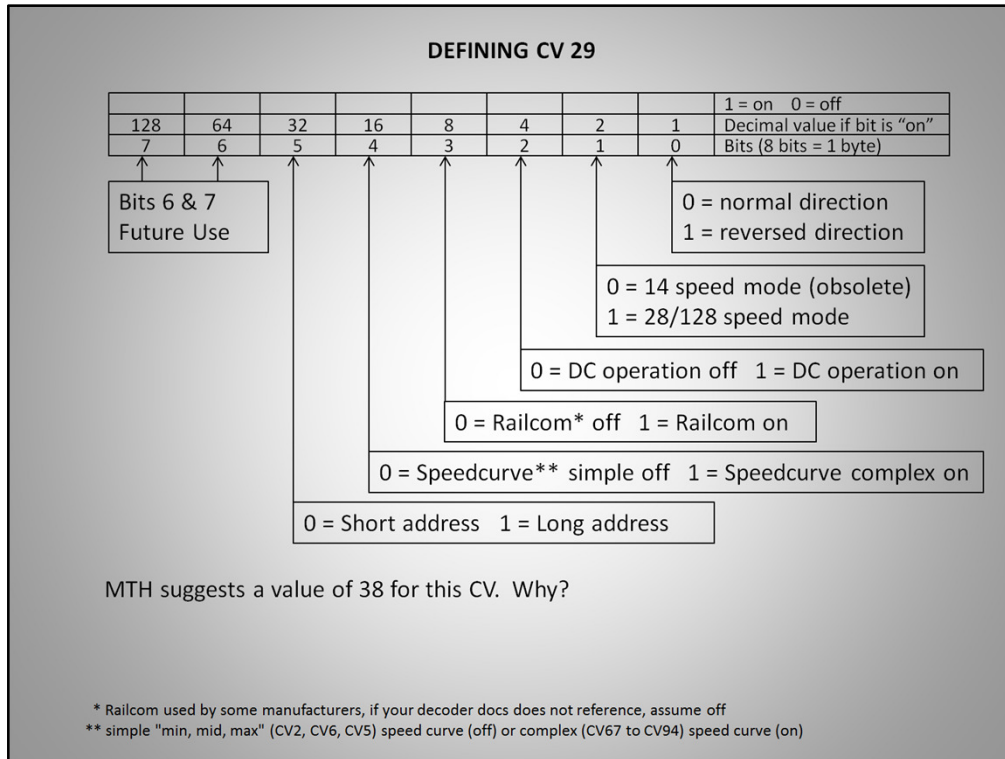


What value would I choose if I wanted a long address?
 If I wanted a long address and reverse direction?
 If I wanted a long address, 28 speed mode, and reverse direction?
 If I wanted short address and reverse direction?

* Railcom used by some manufacturers, if your decoder docs does not reference, assume off

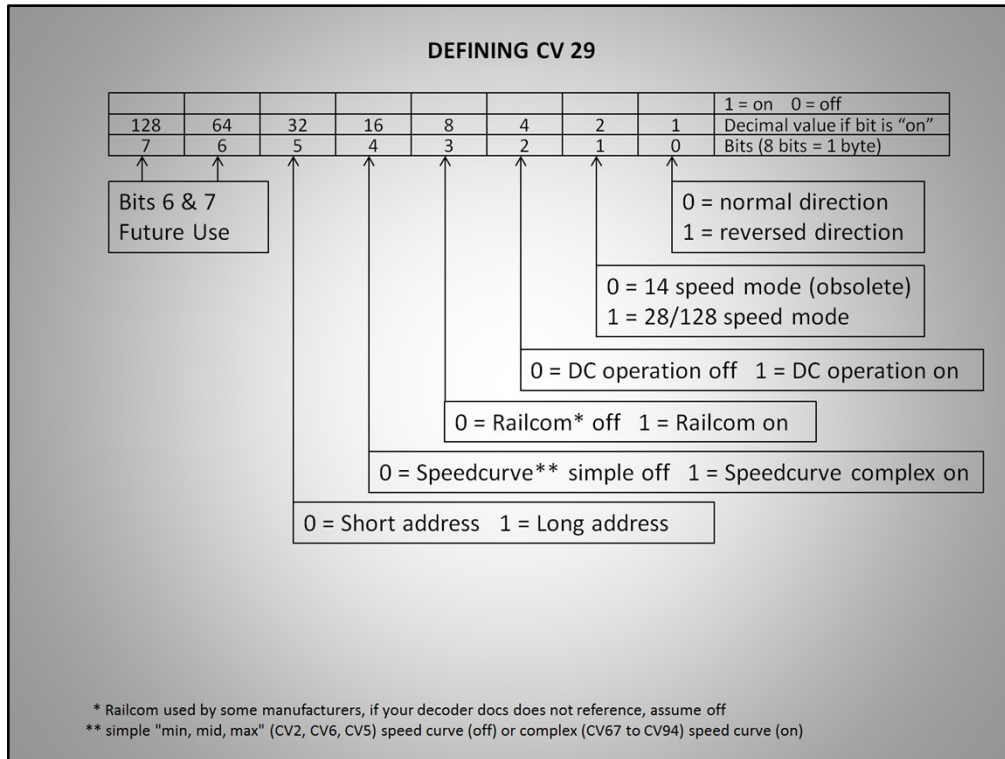
** simple "min, mid, max" (CV2, CV6, CV5) speed curve (off) or complex (CV67 to CV94) speed curve (on)

If I wanted short address and reverse direction? Short address is 0 in bit 5 so it stays 0, reverse direction is controlled by bit 0 therefore a 1 in bit 0 will turn the function on.



If you go to MTH documentation for a long address they suggest a value of 38 for CV29. Why?

Because they want the long address on, DC on, and 28/128 speed mode (32+4+2=38)



Any questions at all through this point?

DEFINING CV 29

0	0	0	0	0	0	1	0	1 = on 0 = off
128	64	32	16	8	4	2	1	Decimal value if bit is "on"
7	6	5	4	3	2	1	0	Bits (8 bits = 1 byte)

What decimal number does this binary number represent?

An "on" in bit 1 is equal to decimal 2.

DEFINING CV 29

								1 = on 0 = off
128	64	32	16	8	4	2	1	Decimal value if bit is "on"
7	6	5	4	3	2	1	0	Bits (8 bits = 1 byte)

There are only 10 kinds of people in this world . . .

Those who know binary and those who don't.

Read this statement using binary numbers!

DEFINING CV 29

								1 = on 0 = off
128	64	32	16	8	4	2	1	Decimal value if bit is "on"
7	6	5	4	3	2	1	0	Bits (8 bits = 1 byte)

There are only 10 kinds of people in this world . . .

Those who know binary and those who don't.

And now you're among the ones who do!!

