



# Electronic Tachograph Frequency Converter Switch Setting Guide



# WIRING SCHEMATIC ELECTRONIC (1310)

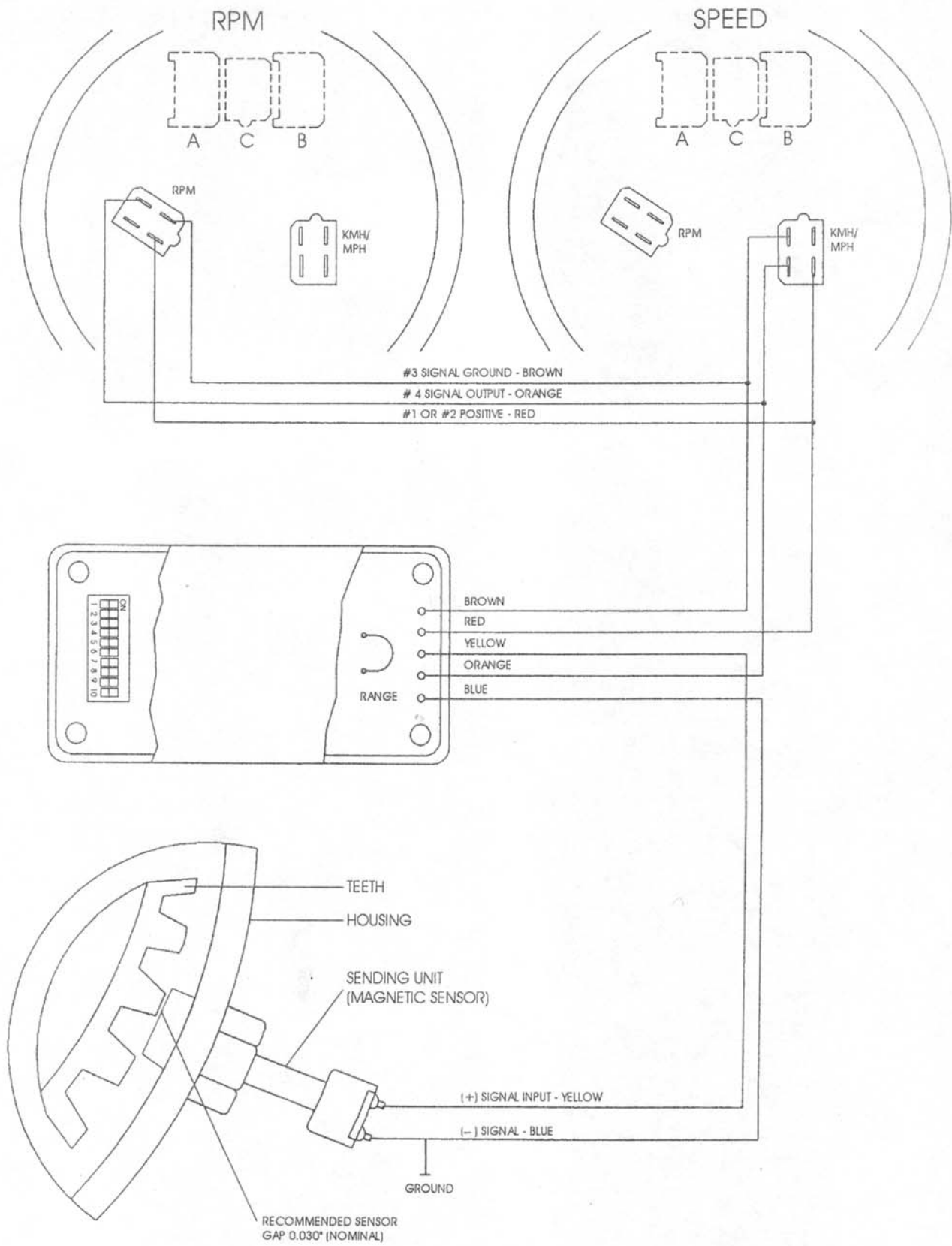


Figure 1

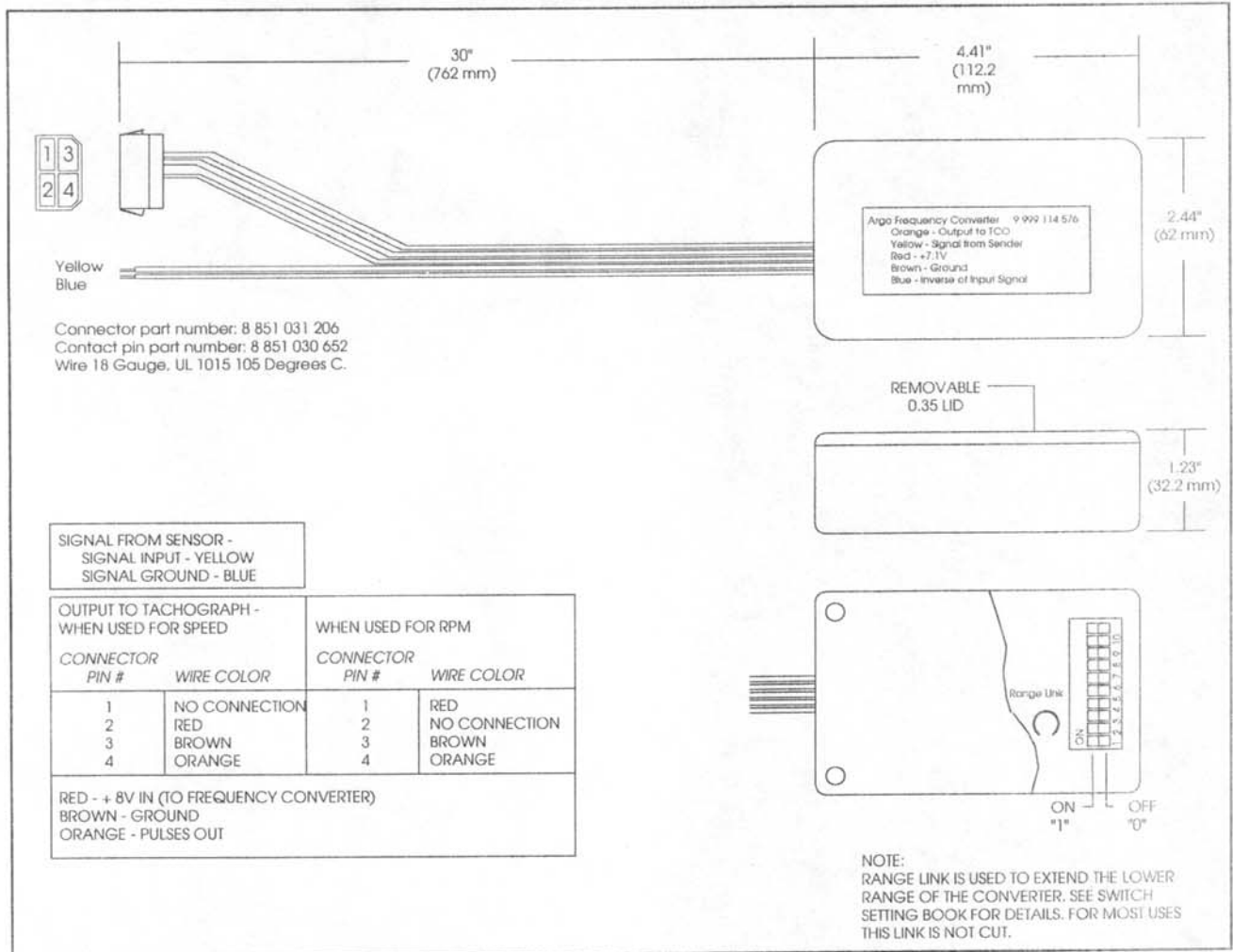


Figure 2

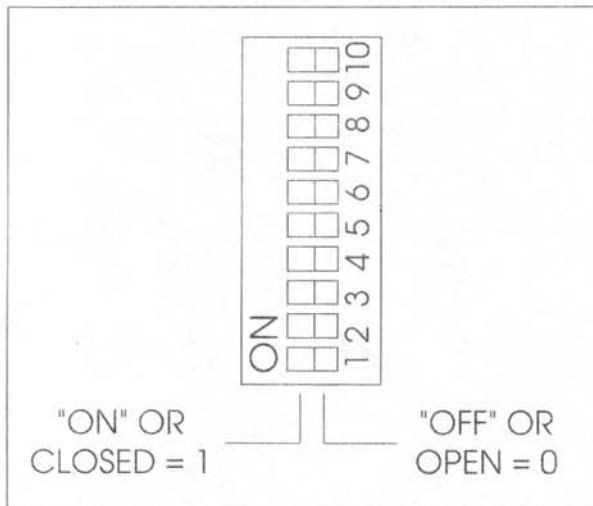


Figure 3

Note:

There are several types of dipswitches used. In all cases a "1", in this document means switch "ON" or "CLOSED". A "0" means switch "OFF" or "OPEN".

With the slide type switch, slide the switch towards the "ON" legend. With the rocker type switch, press down on the rocker on the side *opposite* the side marked "OPEN" to close the switch.

## OPERATING INSTRUCTIONS

A three-terminal plug will connect the frequency converter to the SPEED or RPM sockets of (ARGO 1310 and 1315) tachographs, using the +8 volt regulated voltage output at terminals 1 (RPM) or 2 (SPEED).

*This +8 Volt output is identical on 12V or 24V tachograph models.*

NOTE: The BROWN common ground lead #3 and ORANGE signal output lead #4 are already inserted into the plug. The RED positive lead is inserted into socket terminal #1 or #2, depending on the intended application (SPEED or RPM).

The YELLOW Signal Input lead is connected to the POSITIVE SIDE of a magnetic pickup. Use an ohmmeter to determine polarity, as most pickups have 2 leads. It can also be connected to the "tach" terminal of an alternator. This terminal is sometimes referred to as "AC Tap" or Terminal "W".

## CALIBRATION

Calibration is done by setting the 10 position dipswitch located inside the frequency converter.

Our Calibration Table will provide the correct switch settings based on IMPULSES PER MILE or KILOMETER, or when engine rpm's are at the NUMBER OF IMPULSES AT 1000 RPM.

SPEED = impulses per mile or impulses per kilometer  
RPM = impulses 1000 rpm engine speed

*The following must be known to calculate the above:*

SPEED = Number of teeth on pickup gear inside transmission, usually 16

Tire revolutions per mile or kilometer (Use tire chart. If given as revs per mile, divide by 1.609 to obtain revs per kilometer)

If tire chart not is available, divide rolling circumference into mile or kilometer. (See instructions in next section.)

Rear Axle Ratio

Number of slots in wheel mounted pickup disks, usually 60 or 120

RPM = Number of teeth on ring gear and, if other pickup, ratio of pickup drive to crankshaft

Please note that the input requirements on VDO or ARGO tachographs are identical. If calibrated in mph, the tachograph required 8000 pulses per MILE; if calibrated in km/h it required 8000 pulses per KILOMETER.

### HOW TO OBTAIN "ROLLING CIRCUMFERENCE"

If tire revolutions per mile or kilometer are not known, determine the rolling circumference of the tire UNDER LOAD. Place a small amount of grease on the tire so that when moving, it will leave two spots on the pavement. Measure distance from center to center and divide into mile or kilometer.

Example: Rolling circumference = 127.25 inches  
1 mile = 63,360 inches  
1 kilometer = 39,370 inches

therefore:

$$\text{Tire revs per mile} = \frac{63,360}{127.25} = 498 \quad \text{Revs/km} = \frac{39,370}{127.25} = 309 \text{ revs/km}$$

**CALCULATE IMPULSES PER MILE OR KILOMETER AS FOLLOWS:**

a) PICKUP FROM TRANSMISSION

Pulses per mile = # of teeth x tire revs/mile x rear axle ratio
Pulses per km = # of teeth x tire revs/km x rear axle ratio

b) PICKUP FROM FRONT OR REAR WHEEL

Pulses per mile = # of slots x tire revs/mile
Pulses per km = # of slots x tire revs/km

Examples:

# Teeth inside Transmission : 16  
 Tire revs per mile : 502  
 i.e. Tire revs per km : 312  
 Rear Axle Ratio : 3.55 : 1  
 or  
 Slots in Wheel Disk : 60 or 120

a)  $\text{impulses/mile} = 16 \times 502 \times 3.55 = 28,514$  impulses per mile  
 $\text{impulses/km} = 16 \times 312 \times 3.55 = 17,722$  impulses per km

b)  $\text{impulses/mile} = 60 \times 502 = 30,120$  impulses per mile  
 $\text{impulses/km} = 120 \times 312 = 37,440$  impulses per km

For the above examples, the settings are as follows. Please bear in mind that "1" indicates that switch is "on" (+) pressed down or slide up depending on switch type.

Speed Impulses (mile or km) (calculated)	Closest setting Available see chart	Switch settings	
		[-- N 1 --] 0 1 2 3 4	[-- N 2 --] 6 7 8 9 10
28,514	28,444	0 1 0 0 0	0 0 1 0 0
17,722	17,777	1 0 0 0 1	0 0 1 0 1
30,120	30,117	1 0 0 0 0	0 1 0 0 0
37,440	37,519	1 1 1 0 0	1 0 0 0 1

**RPM EXAMPLES:**

The following are popular RPM settings:

Ring Gear of teeth	Pulses/1000 RPM	Electronic - 2 (1310)
		[-- N 1 --][-- N 2 --] 1 2 3 4 5 6 7 8 9 10
103	103,000	0100011101
113	113,000	0000100111
118	118,000	0001001011
126	126,000	0011111111
138	138,000	0001001101
156	156,000	0010111101

For other gears compute pulse by:

# of teeth on the ring gear x 1000 = Pulses/1000 RPM

Find the closest number of pulses in chart under RPM.

## RANGE LINK

Frequency converters are equipped with a RANGE LINK which, if cut, will activate a final DIVIDE BY 2 rather than the standard DIVIDE BY 8 circuit.

This expanded range is intended for 8000 pulses per mile or kilometer or to bring limit values into a more convenient range.

***UNDER NORMAL CIRCUMSTANCES DO NOT CUT THIS LINK.***

## ALTERNATOR HOOK-UP

The signal output from the alternator will depend on the ratio between crankshaft and alternator pulleys, as well as the number of alternator poles. Alternators may come with 4, 6, 8, 12, 14 or 16 poles, depending on make and model.

If a tachograph is installed, its reading can be compared to the tachograph reading and switches set until matched.

You may also use the following method:

Set frequency converter to factor 1.000 (32,000 Impulses)  
Switch Setting : ( 0 0 0 1 1 - 0 0 1 0 0 )

Example: Tachograph reads 1200 rpm at 600 rpm idle speed

$$\text{BASIC FORMULA: } \frac{\text{NEW IMPULSES}}{\text{CURRENT IMP.}} = \frac{\text{TRUE RPM}}{\text{WRONG RPM}}$$

or

$$\text{FORMULA: } \frac{\text{NEW IMPULSES}}{32,000} = \frac{600}{1200} \quad \text{NEW IMP.} = \frac{600 \times 32,000}{1200} = 16,000$$

To correct output set dipswitches to Factor 2.000 = 0 0 1 1 - 0 0 0 1 0 = 16,000 Impulses

## FORMULAS

To calculate chart tables, use the following formulas:

Constants: K(output) = 8000 for (1310/1315) - Speed  
4000 for (1310/1315) - RPM

Final Divide = 8 with Range Link NOT CUT  
2 with Range Link CUT

FORMULA	EXAMPLE
$K(\text{output}) = \frac{\text{IMPULSES} \times \text{FACTOR}}{\text{FINAL DIVIDE}}$	$8000 = \frac{24,000 \times 2.666}{8}$
$\text{FACTOR} = \frac{K(\text{output}) \times \text{FINAL DIVIDE}}{\text{IMPULSES}}$	$2.666 = \frac{8000 \times 8}{24,000}$
<p>NON-TACHOGRAPH APPLICATIONS - GENERAL FORMULA</p> <p>Example: Output from sending unit is 24,000 impulses per unit. Device requires 60,000 INPUT impulses for same unit.</p>	
$\text{FACTOR} = \frac{\text{INPUT IMPULSES} \times \text{FINAL DIVIDE}}{\text{OUTPUT IMPULSES}}$	$20.0 = \frac{60,000 \times 8}{24,000}$
$\text{FACTOR} = \frac{K(\text{output}) \times \text{FINAL DRIVE}}{\text{FACTOR}}$	$24,000 = \frac{8000 \times 8}{2.666}$

## BINARY SWITCH SETTINGS

Please note that N-1 Circuit adds ONE pulse internally. N-2 Pulse corresponds to binary setting.

N-1 VALUE	N-2 VALUE	BINARY SETTING							=	N-1 N-2
		1 6	2 7	3 8	4 9	5 10	6 11	7 12		
1	0	0	0	0	0	0	0	0		
2	1	0	0	0	0	1	0	1		
3	2	0	0	0	1	0	0	0		
4	3	0	0	0	1	1	0	1		
5	4	0	0	1	0	0	0	0		
6	5	0	0	1	0	1	0	1		
7	6	0	0	1	1	0	0	0		
8	7	0	0	1	1	1	0	1		
9	8	0	1	0	0	0	0	0		
10	9	0	1	0	0	1	0	1		
11	10	0	1	0	1	0	0	0		
12	11	0	1	0	1	1	0	1		
13	12	0	1	1	0	0	0	0		
14	13	0	1	1	0	1	0	1		
15	14	0	1	1	1	0	0	0		
16	15	0	1	1	1	1	0	1		
17	16	1	0	0	0	0	0	0		
18	17	1	0	0	0	1	0	1		
19	18	1	0	0	1	0	0	0		
20	19	1	0	0	1	1	0	1		
21	20	1	0	1	0	0	0	0		
22	21	1	0	1	0	1	0	1		
23	22	1	0	1	1	0	0	0		
24	23	1	0	1	1	1	0	1		
25	24	1	1	0	0	0	0	0		
26	25	1	1	0	0	1	0	1		
27	26	1	1	0	1	0	0	0		
28	27	1	1	0	1	1	0	1		
29	28	1	1	1	0	0	0	0		
30	29	1	1	1	0	1	0	1		
31	30	1	1	1	1	0	0	0		







N1	N2	Factor	Loop not cut										Loop cut			
			Speed	RPM											Speed	RPM
10	29	0.34	0100111101	185600	92800	46400	23200									
9	26	0.35	0100011010	184888	92444	46222	23111									
8	23	0.35	0011101111	184000	92000	46000	23000									
7	20	0.35	0011010100	182857	91428	45714	22857									
6	17	0.35	0010110001	181333	90666	45333	22667									
11	31	0.35	0101011111	180363	90181	45091	22545									
5	14	0.36	0010001110	179200	89600	44800	22400									
9	25	0.36	0100011001	177777	88888	44444	22222									
4	11	0.36	0001101011	176000	88000	44000	22000									
11	30	0.37	0101011110	174545	87272	43636	21818									
7	19	0.37	0011010011	173714	86857	43429	21714									
10	27	0.37	0100111011	172800	86400	43200	21600									
3	8	0.38	0001001000	170666	85333	42666	21333									
11	29	0.38	0101011101	168727	84363	42182	21091									
8	21	0.38	0011101011	168000	84000	42000	21000									
5	13	0.38	0001001011	166400	83200	41600	20800									
12	31	0.39	0101111111	165333	82666	41333	20667									
7	18	0.39	0011010010	164571	82285	41142	20571									
9	23	0.39	0100010111	163555	81777	40889	20444									
11	28	0.39	0101011100	162909	81454	40727	20363									
2	5	0.40	0001001011	160000	80000	40000	20000									
11	27	0.41	0101011011	157090	78545	39273	19636									
9	22	0.41	0001001110	156444	78222	39111	19556									
7	17	0.41	0011010001	155428	77714	38857	19428									
12	29	0.41	0101111101	154666	77333	38666	19333									
5	12	0.42	0010001100	153600	76800	38400	19200									
13	31	0.42	0110011111	152615	76307	38154	19077									
8	19	0.42	0011100111	152000	76000	38000	19000									
11	26	0.42	0101011010	151272	75636	37818	18909									
3	7	0.43	0001000111	149333	74666	37333	18666									
13	30	0.43	0110011110	147692	73846	36923	18461									
10	23	0.43	0100110111	147200	73600	36800	18400									
7	16	0.44	0010101000	146285	73142	36571	18286									
11	25	0.44	0101011001	145454	72727	36364	18182									
4	9	0.44	0001101011	144000	72000	36000	18000									
13	29	0.45	0110011101	142769	71384	35692	17846									
9	20	0.45	0100010100	142222	71111	35556	17778									
14	31	0.45	0110111111	141714	70857	35429	17714									
5	11	0.45	0010001011	140800	70400	35200	17600									
11	24	0.46	0101011000	139636	69818	34909	17455									
6	13	0.46	0010101101	138666	69333	34666	17333									
13	28	0.46	0110011100	137846	68923	34461	17231									
7	15	0.47	0011001111	137142	68571	34286	17143									
8	17	0.47	0011110001	136000	68000	34000	17000									
9	19	0.47	0100010011	135111	67555	33777	16889									
10	21	0.48	0100110101	134400	67200	33600	16800									
11	23	0.48	0101010111	133818	66909	33455	16727									
12	25	0.48	0101111001	133333	66666	33333	16666									
13	27	0.48	0110011011	132923	66461	33230	16615									
14	29	0.48	0110111101	132571	66285	33142	16571									
15	31	0.48	0111011111	132266	66133	33066	16533									

N1	N2	Factor	Loop not cut										Loop cut			
			Speed	RPM											Speed	RPM
1	2	0.50	0000000010	128000	64000	32000	16000									
16	31	0.52	0111111111	124000	62000	31000	15500									
15	29	0.52	0111011101	123733	61866	30933	15467									
14	27	0.52	0110111011	123428	61714	30857	15428									
13	25	0.52	0110011001	123076	61538	30769	15385									
12	23	0.52	0101110111	122666	61333	30667	15333									
11	21	0.52	0101010101	122181	61090	30545	15272									
10	19	0.53	0100110011	121600	60800	30400	15200									
9	17	0.53	0100010001	120888	60444	30222	15111									
8	15	0.53	0011101111	120000	60000	30000	15000									
15	28	0.54	0111011100	119466	59733	29866	14933									
7	13	0.54	0011001101	118857	59428	29714	14857									
13	24	0.54	0110011000	118153	59076	29538	14769									
6	11	0.55	0010101011	117333	58666	29333	14667									
17	31	0.55	1000011111	116705	58352	29176	14588									
11	20	0.55	0101010100	116363	58181	29090	14545									
16	29	0.55	0111111101	116000	58000	29000	14500									
5	9	0.56	0010001001	115200	57600	28800	14400									
14	25	0.56	0110111001	114285	57142	28571	14286									
9	16	0.56	0100010000	113777	56888	28444	14222									
13	23	0.57	0110010111	113230	56615	28308	14154									
17	30	0.57	1000011110	112941	56470	28235	14117									
4	7	0.57	0001001101	112000	56000	28000	14000									
15	26	0.58	0111011010	110933	55466	27733	13867									
11	19	0.58	0101010011	110545	55272	27636	13818									
18	31	0.58	1000111111	110222	55111	27536	13778									
7	12	0.58	0011001100	109714	54857	27428	13714									
17	29	0.59	1000011010	109176	54588	27294	13647									
10	17	0.59	0100110001	108800	54400	27200	13600									
13	22	0.59	0110010110	108307	54153	27077	13538									
16	27	0.59	0111111011	108000	54000	27000	13500									
3	5	0.60	0001000101	106666	53333	26666	13333									
17	28	0.61	1000011010	105411	52705	26352	13176									
14	23	0.61	0110110111	105142	52571	26286	13143									
11	18	0.61	0101010010	104727	52363	26181	13091									
19	31	0.61	1001011111	104421	52210	26105	13052									
8	13	0.62	0011101101	104000	52000	26000	13000									
13	21	0.62	0110010101	103384	51692	25846	12923									
18	29	0.62	1000111101	103111	51555	25778	12889									
5	8	0.63	0010001000	102400	51200	25600	12800									
17	27	0.63	1000011011	101647	50823	25412	12706									
12	19	0.63	0101110011	101333	50666	25333	12666									
19	30	0.63	1001011100	101052	50526	25263	12632									
7	11	0.64	0011001011	100571	50285	25143	12571									
16	25	0.64	0111110011	100000	50000	25000	12500									
9	14	0.64	0100001110	99555	49777	24889	12444									
20	31	0.65	1001111111	99200	49600	24800	12400									
11	17	0.65	0101010001	98909	49454	24727	12363									
13	20	0.65	0110010100	98461	49230	24615	12308									
15	23	0.65	0111010111	98133	49066	24533	12267									
17																

NI	N2	Factor	Loop not cut										Loop cut	
			Speed	RPM	Speed	RPM	Speed	RPM						
19	29	0.66	1001011101	97684	48842	24421	12211							
2	3	0.67	000100011	96000	48000	24000	12000							
21	31	0.68	1010011111	94476	47238	23619	11809							
19	28	0.68	1001011100	94315	47157	23579	11789							
17	25	0.68	1000011001	94117	47058	23529	11765							
15	22	0.68	0111010110	93866	46933	23466	11733							
13	19	0.68	0110010011	93538	46769	23384	11692							
11	16	0.69	0101010000	93090	46545	23272	11636							
20	29	0.69	1001111101	92800	46400	23200	11600							
9	13	0.69	0100001101	92444	46222	23111	11555							
16	23	0.70	0111110111	92000	46000	23000	11500							
7	10	0.70	0011001010	91428	45714	22857	11429							
19	27	0.70	1001011011	90947	45473	22736	11368							
12	17	0.71	0101110001	90666	45333	22667	11333							
17	24	0.71	1000011000	90352	45176	22588	11294							
22	31	0.71	1010111111	90181	45090	22545	11272							
5	7	0.71	0010000111	89600	44800	22400	11200							
18	25	0.72	1000111001	88888	44444	22222	11111							
13	18	0.72	0110010010	88615	44307	22153	11077							
21	29	0.72	1010011011	88380	44190	22095	11048							
8	11	0.73	0011101011	88000	44000	22000	11000							
19	26	0.73	1001011010	87578	43789	21895	10947							
11	15	0.73	0101011111	87272	43636	21818	10909							
14	19	0.74	0110110011	86857	43428	21714	10857							
17	23	0.74	1000010111	86588	43294	21647	10824							
20	27	0.74	1001111011	86400	43200	21600	10800							
23	31	0.74	1011011111	86260	43130	21565	10783							
3	4	0.75	0001000100	85333	42666	21333	10667							
22	29	0.76	1010111011	84363	42181	21090	10545							
19	25	0.76	1001011001	84210	42105	21053	10526							
16	21	0.76	0111110101	84000	42000	21000	10500							
13	17	0.76	0110010001	83692	41846	20923	10462							
23	30	0.77	1011011110	83478	41739	20870	10435							
10	13	0.77	0100010110	83200	41600	20800	10400							
17	22	0.77	1000011110	82823	41411	20706	10353							
24	31	0.77	1011111111	82666	41333	20667	10333							
7	9	0.78	0011001001	82285	41142	20571	10286							
18	23	0.78	1000101111	81777	40888	20444	10222							
11	14	0.79	0101011110	81454	40727	20363	10182							
15	19	0.79	0111010011	81066	40533	20266	10133							
19	24	0.79	1001011000	80842	40421	20210	10105							
23	29	0.79	1011011101	80695	40347	20173	10087							
4	5	0.80	0001100101	80000	40000	20000	10000							
25	31	0.81	1000011111	79360	39680	19840	9920							
21	26	0.81	1010011010	79238	39619	19809	9905							
17	21	0.81	1000010101	79058	39529	19765	9882							
13	16	0.81	0110010000	78769	39384	19692	9846							
22	27	0.81	1010111011	78545	39272	19636	9818							
9	11	0.82	0100001011	78222	39111	19556	9778							
23	28	0.82	1011011100	77913	38956	19478	9739							
14	17	0.82	0110110001	77714	38857	19428	9714							

NI	N2	Factor	Loop not cut										Loop cut	
			Speed	RPM	Speed	RPM	Speed	RPM						
19	23	0.83	1001010111	77473	38736	19368	9684							
24	29	0.83	1011111101	77333	38666	19333	9667							
5	6	0.83	0010000110	76800	38400	19200	9600							
26	31	0.84	1100111111	76307	38153	19076	9538							
21	25	0.84	1010011001	76190	38095	19047	9524							
16	19	0.84	0111111001	76000	38000	19000	9500							
11	13	0.85	0101001101	75636	37818	18909	9455							
17	20	0.85	1000010100	75294	37647	18823	9412							
23	27	0.85	1011011011	75130	37565	18782	9391							
6	7	0.86	0010100111	74666	37333	18666	9333							
25	29	0.86	1100011101	74240	37120	18560	9280							
19	22	0.86	1001010110	74105	37052	18526	9263							
13	15	0.87	0110001111	73846	36923	18461	9231							
20	23	0.87	1001110111	73600	36800	18400	9200							
27	31	0.87	1101011111	73481	36740	18370	9185							
7	8	0.88	0011001000	73142	36571	18286	9143							
22	25	0.88	1010111001	72727	36363	18181	9091							
15	17	0.88	0111010001	72533	36266	18133	9067							
23	26	0.88	1011011010	72347	36173	18087	9043							
8	9	0.89	0011010100	72000	36000	18000	9000							
25	28	0.89	1100011100	71680	35840	17920	8960							
17	19	0.89	1000010011	71529	35764	17882	8941							
26	29	0.90	1100111101	71384	35692	17846	8923							
9	10	0.90	0100001010	71111	35555	17777	8889							
28	31	0.90	1101111111	70857	35428	17714	8857							
19	21	0.90	1001010101	70736	35368	17684	8842							
10	11	0.91	0100101011	70400	35200	17600	8800							
21	23	0.91	1010010111	70095	35047	17524	8762							
11	12	0.92	0101001100	69818	34909	17455	8727							
23	25	0.92	1011011001	69565	34782	17391	8696							
12	13	0.92	0101010101	69333	34666	17333	8667							
25	27	0.93	1100011011	69120	34560	17280	8640							
13	14	0.93	0110001110	68923	34461	17231	8615							
27	29	0.93	1101011101	68740	34370	17185	8592							
14	15	0.93	0110101111	68571	34285	17143	8571							
29	31	0.94	1110011111	68413	34206	17103	8552							
15	16	0.94	0111010000	68266	34133	17067	8533							
16	17	0.94	0111110001	68000	34000	17000	8500							
18	19	0.94	1000010010	67764	33882	16941	8471							
18	19	0.95	1000010011	67555	33777	16889	8444							
19	20	0.95	1001010100	67368	33684	16842	8421							
20	21	0.95	1001110101	67200	33600	16800	8400							
21	22	0.95	1010010110	67047	33523	16761	8381							
22	23	0.96	1010101101	66909	33454	16727	8363							
23	24	0.96	1011011000	66782	33391	16696	8348							
24	25	0.96	1011111001	66666	33333	16666	8333							
25	26	0.96	1100011010	66560	33280	16640	8320							
26	27	0.96	1100111011	66461	33230	16615	8307							
27	28	0.96	1101011100	66370	33185	16593	8296							
28	29	0.97	1101111101	66285	33142	16571	8285							
29	30	0.97	1110011110	66206	33103	16552	8276							

N1	N2	Factor	Loop not cut										Loop cut	
			Speed	RPM										
19	16	1.19	1001010000	0	53894	26947	13474	6737						
25	21	1.19	1100010101	1	53760	26880	13440	6720						
31	26	1.19	1111011010	0	53677	26838	13419	6709						
6	5	1.20	0010100101	0	53333	26666	13333	6666						
29	24	1.21	1110011000	1	52965	26482	13241	6620						
23	19	1.21	1011010001	1	52869	26434	13217	6609						
17	14	1.21	1000001110	0	52705	26352	13176	6588						
28	23	1.22	1101110111	0	52571	26285	13142	6571						
11	9	1.22	0101001001	0	52363	26181	13090	6545						
27	22	1.23	1101010110	0	52148	26074	13037	6518						
16	13	1.23	0111101101	1	52000	26000	13000	6500						
21	17	1.24	1010010001	0	51809	25904	12952	6476						
26	21	1.24	1100110101	1	51692	25846	12923	6461						
31	25	1.24	1111011001	0	51612	25806	12903	6452						
5	4	1.25	0010000100	0	51200	25600	12800	6400						
29	23	1.26	1110010111	1	50758	25379	12689	6345						
24	19	1.26	1011100011	1	50666	25333	12666	6333						
19	15	1.27	1001001111	1	50526	25263	12632	6316						
14	11	1.27	0110101011	1	50285	25142	12571	6285						
23	18	1.28	1011010010	0	50086	25043	12522	6261						
32	25	1.28	1111111001	0	50000	25000	12500	6250						
9	7	1.29	0100000111	1	49777	24888	12444	6222						
31	24	1.29	1111010100	0	49548	24774	12387	6194						
22	17	1.29	1010110001	1	49454	24727	12363	6182						
13	10	1.30	0110001010	0	49230	24615	12308	6154						
30	23	1.30	1110110111	1	49066	24533	12267	6133						
17	13	1.31	1000001101	1	48941	24470	12235	6118						
21	16	1.31	1010010000	0	48761	24380	12190	6095						
25	19	1.32	1100010011	1	48640	24320	12160	6080						
29	22	1.32	1110010110	0	48551	24275	12138	6069						
4	3	1.33	0001100011	1	48000	24000	12000	6000						
31	23	1.35	1111010111	0	47483	23741	11871	5935						
27	20	1.35	1101010100	0	47407	23703	11851	5926						
23	17	1.35	1011010001	1	47304	23652	11826	5913						
19	14	1.36	1001001110	0	47157	23578	11789	5895						
15	11	1.36	0111001011	1	46933	23466	11733	5866						
26	19	1.37	1100110011	1	46769	23384	11692	5846						
11	8	1.38	0101001000	0	46545	23272	11636	5818						
29	21	1.38	1110010101	1	46344	23172	11586	5793						
18	13	1.38	1000101101	1	46222	23111	11555	5778						
32	23	1.39	1100010010	0	46080	23040	11500	5760						
25	18	1.39	1111101101	1	46000	23000	11500	5750						
7	5	1.40	0010000101	1	45714	22857	11429	5714						
31	22	1.41	1111010110	0	45419	22709	11354	5677						
24	17	1.41	1011100011	1	45333	22666	11333	5666						
17	12	1.42	1000001100	0	45176	22588	11294	5647						
27	19	1.42	1101010011	1	45037	22518	11259	5630						
10	7	1.43	0100100111	1	44800	22400	11200	5600						
23	16	1.44	1011010000	0	44521	22260	11130	5565						
13	9	1.44	0110001001	1	44307	22153	11076	5538						
29	20	1.45	1110010100	0	44137	22068	11034	5517						

N1	N2	Factor	Loop not cut										Loop cut	
			Speed	RPM										
30	31	0.97	1110111111	1	66133	33066	16533	8266						
2	2	1.00	0000100010	0	64000	32000	16000	8000						
32	31	1.03	1111111111	1	62000	31000	15500	7750						
31	30	1.03	1110101110	0	61935	30967	15483	7742						
30	29	1.03	1110111101	1	61866	30933	15467	7733						
29	28	1.04	1110011100	0	61793	30896	15448	7724						
28	27	1.04	1101110101	1	61714	30857	15428	7714						
27	26	1.04	1101011010	0	61629	30814	15407	7704						
26	25	1.04	1100111001	1	61538	30769	15385	7692						
25	24	1.04	1100011000	0	61440	30720	15360	7680						
24	23	1.04	1011101101	1	61333	30666	15333	7666						
23	22	1.05	1011010110	0	61217	30608	15304	7652						
22	21	1.05	1010110101	1	61090	30545	15272	7636						
21	20	1.05	1010010100	0	60952	30476	15238	7619						
20	19	1.05	1001100101	1	60800	30400	15200	7600						
19	18	1.06	1001010010	0	60631	30315	15158	7579						
18	17	1.06	1000100011	0	60444	30222	15111	7556						
17	16	1.06	1000010000	0	60235	30117	15058	7529						
16	15	1.07	0111101111	1	60000	30000	15000	7500						
31	29	1.07	1111011101	1	59870	29935	14968	7484						
15	14	1.07	0111001110	0	59733	29866	14933	7467						
29	27	1.07	1110011011	1	59586	29793	14896	7448						
14	13	1.08	0110101101	1	59428	29714	14857	7429						
27	25	1.08	1101011001	1	59259	29629	14814	7407						
13	12	1.08	0110001100	0	59076	29538	14769	7385						
25	23	1.09	1100010111	1	58880	29440	14720	7360						
12	11	1.09	0101010101	1	58666	29333	14667	7333						
23	21	1.10	1011010101	1	58434	29217	14608	7304						
11	10	1.10	0101001010	0	58181	29090	14545	7272						
32	29	1.10	1111111101	1	58000	29000	14500	7250						
21	19	1.11	1010010011	1	57904	28952	14476	7238						
31	28	1.11	1110111001	1	57806	28903	14451	7226						
10	9	1.11	0100101001	1	57600	28800	14400	7200						
29	26	1.12	1110011010	0	57379	28689	14345	7172						
19	17	1.12	1001010001	1	57263	28631	14315	7158						
28	25	1.12	1101111001	1	57142	28571	14286	7143						
9	8	1.13	0100001000	0	56888	28444	14222	7111						
26	23	1.13	1100110111	1	56615	28307	14153	7077						
17	15	1.13	1000001111	1	56470	28235	14117	7059						
25	22	1.14	1100010110	0	56320	28160	14080	7040						
8	7	1.14	0011100111	1	56000	28000	14000	7000						
31	27	1.15	1111010101	1	55741	27870	13935	6967						
23	20	1.15	1011010100	0	55652	27826	13913	6957						
15	13	1.15	0111001101	1	55466	27733	13867	6933						
22	19	1.16	1010110011	1	55272	27636	13818	6909						
29	25	1.16	1110011001	1	55172	27586	13793	6897						
7	6	1.17	0010001100	0	54857	27428	13714	6857						
27	23	1.17	1101010111	1	54518	27259	13630	6815						
20	17	1.18	1001100011	1	54400	27200	13600	6800						
13	11	1.18	0110001011	1	54153	27076	13538	6769						
32	27	1.19	1111111101	1	54000	27000	13500	6750						

N1	N2	Factor	Loop not cut										Speed	Loop cut RPM				
			1	2	3	4	5	6	7	8	9	10						
15	8	1.88	0	1	1	1	0	0	1	0	0	0	0	0	34133	17066	8533	4266
32	17	1.88	1	1	1	1	1	0	0	0	1	0	0	0	34000	17000	8500	4250
17	9	1.89	1	0	0	0	0	0	1	0	0	0	0	1	33882	16941	8471	4235
19	10	1.90	1	0	0	1	0	0	1	0	0	0	0	0	33684	16842	8421	4211
21	11	1.91	1	0	1	0	0	0	1	0	1	0	0	0	33523	16761	8380	4190
23	12	1.92	1	0	1	0	0	0	1	0	1	0	0	0	33391	16695	8348	4174
25	13	1.92	1	0	0	0	0	1	0	1	0	0	0	0	33280	16640	8320	4160
27	14	1.93	1	1	0	0	0	1	0	1	0	0	0	0	33185	16592	8296	4148
29	15	1.93	1	1	0	0	0	1	1	0	0	0	0	0	33103	16551	8276	4138
31	16	1.94	1	1	1	0	1	0	0	0	0	0	0	0	33032	16516	8258	4129
4	2	2.00	0	0	0	1	1	0	0	0	0	1	0	0	32000	16000	8000	4000
31	15	2.07	1	1	1	0	0	1	1	1	1	1	1	1	30967	15483	7741	3871
29	14	2.07	1	1	0	0	1	1	1	1	1	1	1	1	30896	15448	7724	3862
27	13	2.08	1	1	0	1	0	1	1	1	1	1	1	1	30814	15407	7704	3852
25	12	2.08	1	1	0	0	1	1	0	1	1	0	0	0	30720	15360	7680	3840
23	11	2.09	1	0	1	0	0	1	0	1	0	1	1	1	30608	15304	7652	3826
21	10	2.10	1	0	1	0	0	1	0	1	0	1	0	1	30476	15238	7619	3809
19	9	2.11	1	0	0	1	0	1	0	1	0	1	0	1	30315	15157	7579	3789
17	8	2.13	1	0	0	0	1	0	0	1	0	0	0	0	30117	15058	7529	3765
32	15	2.13	1	1	1	1	0	1	1	1	1	1	1	1	30000	15000	7500	3750
15	7	2.14	0	1	1	0	0	1	1	0	0	1	1	1	29866	14933	7467	3733
28	13	2.15	1	1	0	1	0	1	1	0	1	1	0	1	29714	14857	7429	3714
13	6	2.17	0	1	0	0	0	1	0	1	0	1	0	1	29538	14769	7385	3692
24	11	2.18	1	0	1	1	0	1	0	1	1	0	1	1	29333	14666	7333	3666
11	5	2.20	0	1	0	1	0	0	1	0	0	1	0	1	29090	14545	7272	3636
31	14	2.21	1	1	1	0	1	1	1	0	1	1	1	1	28903	14451	7226	3613
20	9	2.22	1	0	0	1	0	1	0	1	0	1	0	1	28800	14400	7200	3600
29	13	2.23	1	1	0	0	1	1	0	1	0	1	0	1	28689	14344	7172	3586
9	4	2.25	0	1	0	0	0	1	0	0	0	1	0	0	28444	14222	7111	3555
25	11	2.27	1	1	0	0	0	1	0	1	0	1	0	1	28160	14080	7040	3520
16	7	2.29	0	1	1	1	0	0	1	1	0	1	1	1	28000	14000	7000	3500
23	10	2.30	1	0	1	1	0	0	1	0	1	0	1	0	27826	13913	6957	3478
30	13	2.31	1	1	0	1	0	1	0	1	0	1	0	1	27733	13866	6933	3466
7	3	2.33	0	0	1	1	0	0	0	1	0	0	0	0	27428	13714	6857	3429
26	11	2.36	1	1	0	1	0	1	0	1	0	1	0	1	27076	13538	6769	3385
19	8	2.38	1	0	0	1	0	0	1	0	0	0	0	0	26947	13473	6736	3368
31	13	2.38	1	1	1	0	1	1	0	1	0	1	0	1	26838	13419	6709	3355
12	5	2.40	0	1	0	1	0	0	1	0	0	1	0	0	26666	13333	6666	3333
29	12	2.42	1	1	0	0	1	1	0	1	0	0	0	0	26482	13241	6620	3310
17	7	2.43	1	0	0	0	0	1	1	0	0	0	0	0	26352	13176	6588	3294
22	9	2.44	1	0	1	0	1	0	1	0	0	1	0	1	26181	13090	6545	3272
27	11	2.45	1	1	0	1	0	1	0	1	0	1	0	1	26074	13037	6518	3259
32	13	2.46	1	1	1	0	1	1	0	1	0	1	0	1	26000	13000	6500	3250
5	2	2.50	0	0	1	0	0	0	0	1	0	0	0	0	25600	12800	6400	3200
28	11	2.55	1	1	0	1	0	1	0	1	0	1	0	1	25142	12571	6285	3143
23	9	2.56	1	0	1	0	0	1	0	1	0	0	0	0	25043	12521	6260	3130
18	7	2.57	1	0	0	1	0	0	1	0	0	0	0	0	24888	12444	6222	3111
31	12	2.58	1	1	1	0	1	0	1	0	1	0	0	0	24774	12387	6194	3097
13	5	2.60	0	1	0	0	0	1	0	0	0	1	0	0	24615	12307	6154	3077
21	8	2.63	1	0	1	0	0	0	1	0	0	0	0	0	24380	12190	6095	3048
29	11	2.64	1	1	1	0	0	1	0	1	0	1	0	1	24275	12137	6069	3034

N1	N2	Factor	Loop not cut										Speed	Loop cut RPM				
			1	2	3	4	5	6	7	8	9	10						
16	11	1.45	0	1	1	1	0	1	0	1	0	1	1	1	44000	22000	11000	5500
19	13	1.46	1	0	0	1	0	1	0	1	0	1	0	1	43789	21894	10947	5474
22	15	1.47	1	0	1	0	1	0	1	0	1	1	1	1	43636	21818	10909	5454
25	17	1.47	1	1	0	0	1	0	1	0	0	1	0	1	43520	21760	10880	5440
28	19	1.47	1	1	0	1	1	0	1	0	1	0	1	1	43428	21714	10857	5429
31	21	1.48	1	1	1	0	1	0	1	0	1	0	1	1	43354	21677	10839	5419
3	2	1.50	0	0	0	1	0	0	0	1	0	0	0	0	42666	21333	10667	5333
32	21	1.52	1	1	1	1	0	1	0	1	0	1	0	1	42000	21000	10500	5250
29	19	1.53	1	1	0	0	1	0	1	0	1	1	1	1	41931	20965	10482	5241
26	17	1.53	1	1	0	0	1	0	1	0	0	1	0	1	41846	20923	10462	5231
23	15	1.53	1	0	1	0	0	1	1	0	1	1	1	1	41739	20869	10434	5217
20	13	1.54	1	0	1	0	1	0	1	0	1	0	1	1	41600	20800	10400	5200
17	11	1.55	1	0	0	0	1	0	1	0	1	0	1	1	41411	20705	10353	5176
31	20	1.55	1	1	1	0	1	0	1	0	1	0	1	1	41290	20645	10323	5161
14	9	1.56	0	1	1	0	1	0	1	0	0	1	0	1	41142	20571	10286	5143
25	16	1.56	1	1	0	0	1	0	1	0	0	0	0	0	40960	20480	10240	5120
11	7	1.57	0	1	0	1	0	0	1	1	0	1	1	1	40727	20363	10181	5091
30	19	1.58	1	0	1	1	0	1	0	1	0	1	0	1	40533	20266	10133	5067
19	12	1.58	1	0	0	1	0	1	0	1	0	0	0	0	40421	20210	10105	5052
27	17	1.59	1	1	0	1	0	0	1	0	0	1	0	1	40296	20148	10074	5037
8	5	1.60	0	0	1	1	0	0	1	0	0	1	0	0	40000	20000	10000	5000
29	18	1.61	1	1	0	1	0	1	0	1	0	1	0	1	39724	19862	9931	4965
21	13	1.62	1	0	1	0	0	1	1	0	1	0	1	1	39619	19809	9905	4952
13	8	1.63	0	1	0	0	1	0	0	1	0	0	0	0	39384	19692	9846	4923
31	19	1.63	1	1	1	0	1	0	1	0	1	0	1	1	39225	19612	9806	4903
18	11	1.64	1	0	0	1	0	1	0	1	0	1	0	1	39111	19555	9777	4889
23	14	1.64	1	0	1	0	1	1	0	1	0	1	0	1	38956	19478	9739	4870
28	17	1.65	1	1	0	1	1	0	1	0	1	0	1	1	38857	19428	9714	4857
5	3	1.67	0	0	1	0	0	0	1	0	0	1	0	0	38400	19200	9600	4800
32	19	1.68	1	1	1	0	1	0	1	0	1	0	1	1	38000	19000	9500	4750
27	16	1.69	1	1	0	1	0	0	1	0	0	0	0	0	37925	18962	9481	4740
22	13	1.69	1	0	1	0	1	1	0	1	0	1	0	1	37818	18909	9455	4727
17	10	1.70	1	0	0	0	1	0	1	0	0	1	0	1	37647	18823	9412	4706
29	17	1.71	1	1	0	1	0	1	0	1	0	1	0	1	37517	18758	9379	4690
12	7	1.71	0	1	0	1	0	0	1	1	0	1	1	1	37333	18666	9333	4666
31	18	1.72	1	1	1	0	1	0	1	0	1	0	1	1	37161	18580	9290	4645
19</																		



NI	N2	Factor	Loop not cut										Loop cut	
			Speed	RPM	Speed	RPM	Speed	RPM						
8	3	2.67	0 0 1 1 1 0 0 0 1 1	24000	12000	6000	3000							
27	10	2.70	1 1 0 1 0 0 1 0 1 0	23703	11851	5925	2963							
19	7	2.71	1 0 0 1 0 0 0 1 1 1	23578	11789	5895	2947							
30	11	2.73	1 1 1 0 1 0 1 0 1 1	23466	11733	5866	2933							
11	4	2.75	0 1 0 1 0 0 0 1 0 0	23272	11636	5818	2909							
25	9	2.78	1 1 0 0 0 0 1 0 0 1	23040	11520	5760	2880							
14	5	2.80	0 1 1 0 1 0 0 1 0 1	22857	11428	5714	2857							
31	11	2.82	1 1 1 0 0 1 0 1 1 1	22709	11354	5677	2839							
17	6	2.83	1 0 0 0 0 0 0 1 1 1	22588	11294	5647	2823							
20	7	2.86	1 0 0 1 1 0 0 1 1 1	22400	11200	5600	2800							
23	8	2.88	1 0 1 1 0 0 1 0 0 0	22260	11130	5565	2783							
26	9	2.89	1 1 0 0 1 0 0 0 1 1	22153	11076	5538	2769							
29	10	2.90	1 1 1 0 0 0 1 0 1 0	22068	11034	5517	2758							
32	11	2.91	1 1 1 1 0 1 0 1 1 1	22000	11000	5500	2750							
3	1	3.00	0 0 0 1 0 0 0 0 1 1	21333	10666	5333	2666							
31	10	3.10	1 1 1 1 0 0 1 0 1 0	20645	10322	5161	2581							
28	9	3.11	1 1 0 1 1 0 1 0 1 1	20571	10285	5143	2571							
25	8	3.13	1 1 0 0 0 0 1 0 0 0	20480	10240	5120	2560							
22	7	3.14	1 0 1 0 1 0 0 1 1 1	20363	10181	5090	2545							
19	6	3.17	1 0 0 1 0 0 0 1 1 0	20210	10105	5052	2526							
16	5	3.20	0 1 1 1 1 0 0 1 0 1	20000	10000	5000	2500							
29	9	3.22	1 1 1 0 0 0 1 0 0 1	19862	9931	4965	2483							
13	4	3.25	0 1 1 0 0 0 0 1 0 0	19692	9846	4923	2462							
23	7	3.29	1 0 1 1 0 0 0 1 1 1	19478	9739	4870	2435							
10	3	3.33	0 1 0 0 1 0 0 0 1 1	19200	9600	4800	2400							
27	8	3.38	1 1 0 1 0 0 1 0 0 0	18962	9481	4740	2370							
17	5	3.40	1 0 0 0 0 0 0 1 0 1	18823	9411	4705	2353							
24	7	3.43	1 0 1 1 1 0 0 1 1 1	18666	9333	4666	2333							
31	9	3.44	1 1 1 1 0 0 1 0 1 1	18580	9290	4645	2322							
7	2	3.50	0 0 1 1 0 0 0 0 1 0	18285	9142	4571	2286							
32	9	3.56	1 1 1 1 1 0 1 0 0 1	18000	9000	4500	2250							
25	7	3.57	1 1 0 0 0 0 0 1 1 1	17920	8960	4480	2240							
18	5	3.60	1 0 0 0 1 0 0 1 0 1	17777	8888	4444	2222							
29	8	3.63	1 1 0 0 0 1 0 0 0 0	17655	8827	4414	2207							
11	3	3.67	0 1 0 1 0 0 0 0 1 1	17454	8727	4363	2182							
26	7	3.71	1 1 0 0 1 0 0 1 1 1	17230	8615	4308	2154							
15	4	3.75	0 1 1 1 0 0 0 0 1 0	17066	8533	4266	2133							
19	5	3.80	1 0 0 1 0 0 0 0 1 1	16842	8421	4211	2105							
23	6	3.83	1 0 1 0 0 0 1 1 0	16695	8347	4173	2087							
27	7	3.86	1 1 0 1 0 0 0 1 1 1	16592	8296	4148	2074							
31	8	3.88	1 1 1 1 0 0 1 0 0 0	16516	8258	4129	2065							
4	1	4.00	0 0 0 1 1 0 0 0 0 1	16000	8000	4000	2000							
29	7	4.14	1 1 1 0 0 0 0 1 1 1	15448	7724	3862	1931							
25	6	4.17	1 1 0 0 0 0 0 1 1 0	15360	7680	3840	1920							
21	5	4.20	1 0 1 0 0 0 0 1 0 1	15238	7619	3809	1905							
17	4	4.25	1 0 0 0 0 0 0 1 0 0	15058	7529	3765	1882							
30	7	4.29	1 1 1 0 1 0 0 1 1 1	14933	7466	3733	1867							
13	3	4.33	0 1 1 0 0 0 0 1 1 1	14769	7384	3692	1846							
22	5	4.40	1 0 1 0 1 0 0 1 0 1	14545	7272	3636	1818							
31	7	4.43	1 1 1 0 0 0 1 1 1 1	14451	7225	3612	1806							
9	2	4.50	0 1 0 0 0 0 0 0 0 1 0	14222	7111	3555	1778							

NI	N2	Factor	Loop not cut										Loop cut	
			Speed	RPM	Speed	RPM	Speed	RPM						
32	7	4.57	1 1 1 1 1 0 0 1 1 1	14000	7000	14000	7000							
23	5	4.60	1 0 1 1 0 0 0 1 0 1	13913	6956	13913	6956							
14	3	4.67	0 1 1 0 1 0 0 0 1 1	13714	6857	13714	6857							
19	4	4.75	1 0 0 1 0 0 0 1 0 0	13473	6736	13473	6736							
24	5	4.80	1 0 1 1 1 0 0 0 1 1	13333	6666	13333	6666							
29	6	4.83	1 1 1 0 0 0 0 1 1 0	13241	6620	13241	6620							
5	1	5.00	0 0 1 0 0 0 0 0 0 1 0	12800	6400	12800	6400							
31	6	5.17	1 1 1 1 0 0 0 1 1 1	12387	6193	12387	6193							
26	5	5.20	1 1 0 0 1 0 0 1 0 1	12307	6153	12307	6153							
21	4	5.25	1 0 1 0 0 0 0 1 0 0	12190	6095	12190	6095							
16	3	5.33	0 1 1 1 1 0 0 0 1 1	12000	6000	12000	6000							
27	5	5.40	1 1 0 1 0 0 0 1 0 1	11851	5925	11851	5925							
11	2	5.50	0 1 0 1 0 0 0 0 1 0	11636	5818	11636	5818							
28	5	5.60	1 1 0 1 1 0 0 1 0 1	11428	5714	11428	5714							
17	3	5.67	1 0 0 0 0 0 0 0 1 1	11294	5647	11294	5647							
23	4	5.75	1 0 1 1 0 0 0 1 0 0	11130	5565	11130	5565							
29	5	5.80	0 0 1 1 0 0 0 0 1 0	11034	5517	11034	5517							
6	1	6.00	0 0 1 0 0 0 0 0 0 1	10666	5333	10666	5333							
31	5	6.20	1 1 1 1 0 0 0 1 0 1	10322	5161	10322	5161							
25	4	6.25	1 1 0 0 0 0 0 1 0 0	10240	5120	10240	5120							
19	3	6.33	1 0 0 1 0 0 0 0 1 1	10105	5052	10105	5052							
32	5	6.40	0 1 1 1 0 0 0 1 0 1	10000	5000	10000	5000							
13	2	6.50	1 1 1 0 0 0 0 0 1 0	9846	4923	9846	4923							
20	3	6.67	1 0 0 1 1 0 0 0 1 1	9600	4800	9600	4800							
27	4	6.75	1 1 0 1 0 0 0 1 0 0	9481	4740	9481	4740							
7	1	7.00	0 0 1 1 0 0 0 0 0 1	9142	4571	9142	4571							
29	4	7.25	1 1 1 0 0 0 0 1 0 0	8827	4413	8827	4413							
22	3	7.33	1 0 1 0 1 0 0 0 1 1	8727	4363	8727	4363							
15	2	7.50	0 1 1 1 0 0 0 0 1 0	8533	4266	8533	4266							
23	3	7.67	1 0 1 1 0 0 0 0 1 1	8347	4173	8347	4173							
31	4	7.75	1 1 1 1 0 0 0 1 0 0	8258	4129	8258	4129							
8	1	8.00	0 0 1 1 1 0 0 0 0 1	8000	4000	8000	4000							
25	3	8.33	1 1 0 0 0 0 0 0 1 1	7680	3840	7680	3840							
17	2	8.50	1 0 0 0 0 0 0 0 1 0	7529	3764	7529	3764							
26	3	8.67	1 1 0 0 1 0 0 0 1 1	7384	3692	7384	3692							
9	1	9.00	0 1 0 0 0 0 0 0 0 1	7111	3555	7111	3555							
28	3	9.33	1 1 0 1 1 0 0 0 1 1	6857	3428	6857	3428							
19	2	9.50	1 0 0 1 0 0 0 0 1 0	6736	3368	6736	3368							
29	3	9.67	1 1 1 0 0 0 0 0 1 1	6620	3310	6620	3310							
10	1	10.00	0 1 0 0 1 0 0 0 0 1	6400	320									

N1	N2	Factor	Loop not cut										Loop cut							
			1	2	3	4	5	6	7	8	9	10	Speed	RPM						
15	1	15.00	0	1	1	1	1	0	0	0	0	0	0	0	0	1	4266	2133	1067	533
31	2	15.50	1	1	1	1	0	0	0	0	1	0	0	0	0	0	4129	2064	1032	516
16	1	16.00	0	1	1	1	1	0	0	0	0	1	0	0	0	0	4000	2000	1000	500
17	1	17.00	1	0	0	0	0	0	0	0	0	0	0	0	0	1	3764	1882	941	471
18	1	18.00	1	0	0	0	1	0	0	0	0	0	0	0	0	1	3555	1777	888	444
19	1	19.00	1	0	0	1	0	0	0	0	0	0	0	0	0	1	3368	1684	842	421
20	1	20.00	1	0	0	1	0	0	0	0	0	0	0	0	0	1	3200	1600	800	400
21	1	21.00	1	0	1	0	0	0	0	0	0	0	0	0	0	1	3047	1523	761	381
22	1	22.00	1	0	1	0	1	0	0	0	0	0	0	0	0	1	2909	1454	727	363
23	1	23.00	1	0	1	1	0	0	0	0	0	0	0	0	0	1	2782	1391	696	348
24	1	24.00	1	0	1	1	1	0	0	0	0	0	0	0	0	1	2666	1333	667	333
25	1	25.00	1	1	0	0	0	0	0	0	0	0	0	0	0	1	2560	1280	640	320
26	1	26.00	1	1	0	0	1	0	0	0	0	0	0	0	0	1	2461	1230	615	308
27	1	27.00	1	1	0	1	0	0	0	0	0	0	0	0	0	1	2370	1185	592	296
28	1	28.00	1	1	0	1	1	0	0	0	0	0	0	0	0	1	2285	1142	571	285
29	1	29.00	1	1	1	0	0	0	0	0	0	0	0	0	0	1	2206	1103	551	276
30	1	30.00	1	1	1	0	1	0	0	0	0	0	0	0	0	1	2133	1066	533	267
31	1	31.00	1	1	1	1	0	0	0	0	0	0	0	0	0	1	2064	1032	516	258
32	1	32.00	1	1	1	1	1	0	0	0	0	0	0	0	0	1	2000	1000	500	250



For the 1310, at 8000 pulses/mile or 8000 pulses/km 80mph is 177.7Hz and 120 km/hr is 266.7Hz.

Maximum usable frequencies "F1", at various values of "N1" are as shown in the first column. To determine F1, multiply P1 (see instructions at right) by maximum speed expected (mph or km/hr) and divide by 3600.

### IMPROVED TABLE F SWITCH SETTINGS FOR THE #559 FREQUENCY CONVERTER (applying to units with Feb. 1990 upgrade)

The following table works out values of  $F1/F2 = P1/P2 = 8^*(N2/N1 + 1)$  N1 and N2 are the settings of the 10 position DIP switch, reading from left to right with the switches in from of you.

$F1/F2$  is the ratio of the incoming frequency to the frequency converter.  $P1/P2$  (numerically equal to  $F1/F2$ ) is the ratio of pulse/mile or pulses/km input, to output.

Note: lower values of N1 permit higher input frequencies to be used. Higher values of N1 generally permit a better choice of ratio. There is a "restricted" region, generally where  $F1/F2 < 1.0$ , but this is not critical and operation in this area may be permitted with a slight shift in  $F1/F2$ . This operation is only possible with units containing the "DC removal" capacitor, dated after February 1990.

Speedometer application: Set the tachograph as necessary to give  $P2 = 8000$  pulses per mile or per km for the 1310.

Then determine P1: multiply # teeth on drive shaft gear a rear axle's wheel revolutions per mile or per km.

Then divide P1 by P2 and find the nearest match in the table. For a speedometer application it is not normally necessary to worry about frequency limits.

Tachometer applications: P1 is equal to the number of teeth on the ring gear x 1000.  $F1$  (max) tends to the high compared with  $F1$  (max) for speedometer application.  $F1$  (max) =  $P1 \cdot RPM$  max/60000. NOTE:  $F1$  (max) is in KHz/(Hz x 1000).

Divide P1 by P2 and find the nearest match in the table, as for a speedometer application.

N1	N2=1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0	00001	06010	06011	06100	00101	00110	00111	01000	01001	01010	01011	01100	01110	01111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101	11110	11111	
1	00000	00001	00010	00011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101	01110	01111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101	11110
2	00000	00001	00010	00011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101	01110	01111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101	11110
3	00000	00001	00010	00011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101	01110	01111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101	11110
4	00000	00001	00010	00011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101	01110	01111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101	11110
5	00000	00001	00010	00011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101	01110	01111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101	11110
6	00000	00001	00010	00011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101	01110	01111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101	11110
7	00000	00001	00010	00011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101	01110	01111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101	11110
8	00000	00001	00010	00011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101	01110	01111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101	11110
9	00000	00001	00010	00011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101	01110	01111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101	11110
10	00000	00001	00010	00011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101	01110	01111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101	11110
11	00000	00001	00010	00011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101	01110	01111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101	11110
12	00000	00001	00010	00011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101	01110	01111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101	11110
13	00000	00001	00010	00011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101	01110	01111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101	11110
14	00000	00001	00010	00011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101	01110	01111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101	11110
15	00000	00001	00010	00011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101	01110	01111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101	11110
16	00000	00001	00010	00011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101	01110	01111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101	11110
17	00000	00001	00010	00011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101	01110	01111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101	11110
18	00000	00001	00010	00011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101	01110	01111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101	11110
19	00000	00001	00010	00011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101	01110	01111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101	11110
20	00000	00001	00010	00011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101	01110	01111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101	11110
21	00000	00001	00010	00011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101	01110	01111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101	11110
22	00000	00001	00010	00011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101	01110	01111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101	11110
23	00000	00001	00010	00011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101	01110	01111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101	11110
24	00000	00001	00010	00011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101	01110	01111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101	11110
25	00000	00001	00010	00011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101	01110	01111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101	11110
26	00000	00001	00010	00011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101	01110	01111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101	11110
27	00000	00001	00010	00011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101	01110	01111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101	11110
28	00000	00001	00010	00011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101	01110	01111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101	11110
29	00000	00001	00010	00011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101	01110	01111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101	11110
30	00000	00001	00010	00011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101	01110	01111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010	11011	11100	11101	11110
31	00000	00001	00010	00011	00100	00101</																									