IRIG-B Time Code

TEKRON INTERNATIONAL

IRIG-B Time Code

Although the synchronization bus can carry many forms of time signal, the IRIG-B time code is the most widely used synchronization signal within substations. The basic form of IRIG-B consists of a pulse-width modulated digital data stream at the rate of 100 pulses per second. The leading edge of each pulse is precisely positioned in time on the incremental 10mS point within the second, while the pulse width modulation conveys time and date information repeating within each 100 pulse frame i.e. once per second.

There are a number of variations of IRIG-B time codes in common use. IRIG-B time codes are defined using a 4-character descriptor: "B x y z", and "x", "y" and "z" have meaning as follows:

B	x	y	z
[format]	[modulation type]	[frequency/resolution]	[coded expression]

"B" denotes IRIG-B

"x" designator, modulation type has three possible values:

0 = Unmodulated, also called DC level shift

1 = Amplitude Modulated (AM) sine wave

2 = Modified Manchester modulated

The "y" designator, frequency/resolution has values as follows:

0 = no carrier / index count interval (commonly used with IRIG-B)

1 = 100Hz carrier (not used with IRIG-B)

2 = 1000Hz carrier (commonly used with IRIG-B)

The "z" designator, coded expression has values as follows:

0 = BCD, CF, SBS

1 = BCD, CF

2 = BCD

3 = BCD, SBS

BCD = Binary Coded Decimal format = basic time-of-year information (does not include year information).

CF = Control Function = additional information including year information (eg IEEE1344 extensions or AFNOR extensions).

SBS = Straight Binary Seconds = seconds-of-day in binary format.

The valid combinations in use for IRIG-B are: B00z, B12z and B22z.

B00z (DC level-shift IRIG-B)

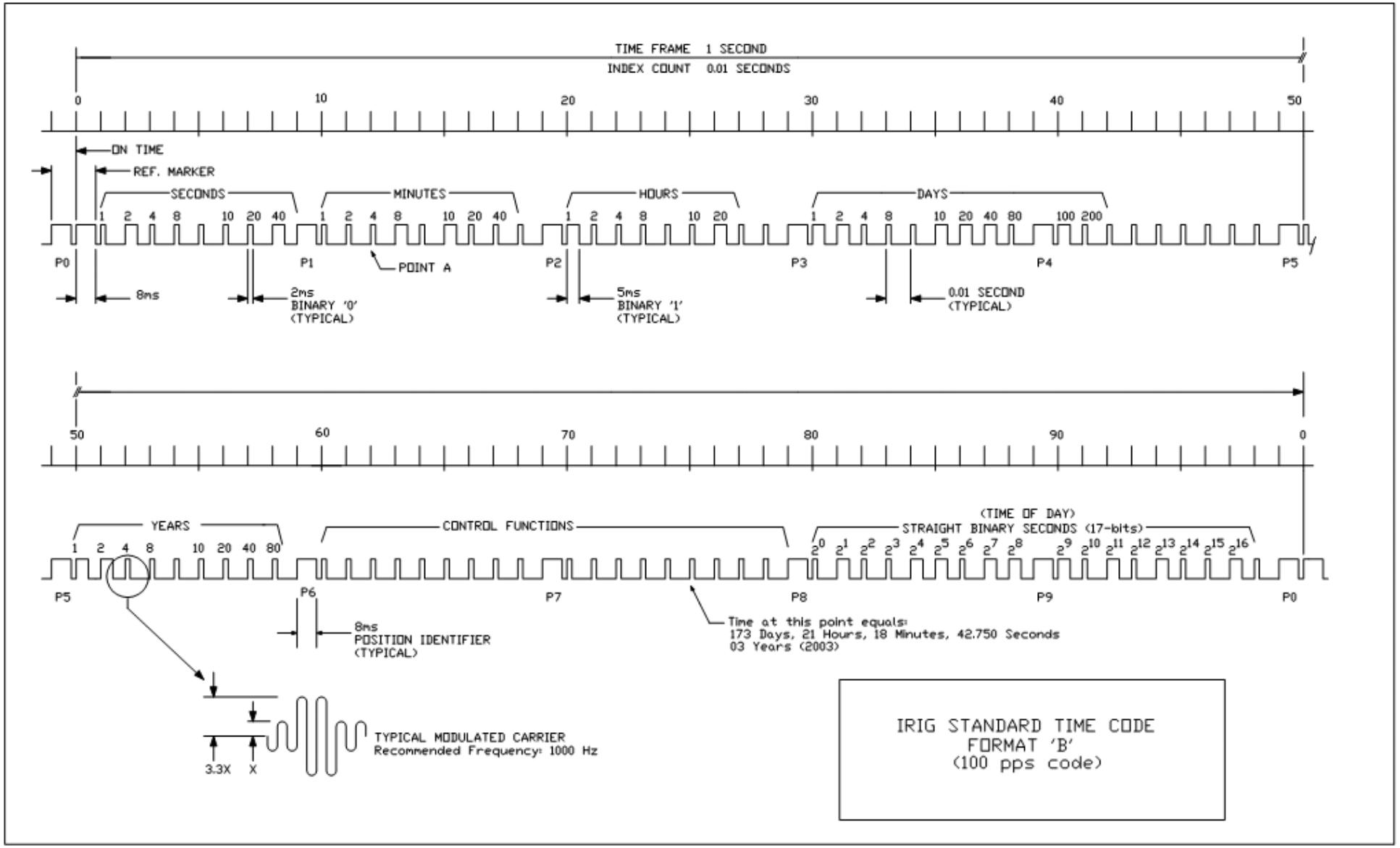
B00z (DC level-shift IRIG-B) has been favored for use with new equipment in substations because, although it cannot be used for wiring runs of more than about 100 meters, it offers good timing accuracy. As long as the GPS clocks outputs are isolated and therefore balanced this effectively eliminates problems due to induced noise that can cause difficulties using this form of time code in sub-stations. This code can also be easily transmitted over fiber. Demodulation is not required, so the code can be very simply received and used by connected equipment. The B00z signals are already being used for synchro-phasor timing.

B12z (Amplitude Modulated IRIG-B)

B12z (Amplitude Modulated IRIG-B) has historically been widely used. Because this modulation is a 1Khz sine-wave, timing accuracy is inherently limited by the wave shape. This is, therefore, the least precise of all of the IRIG-B varieties, but has been in common use because, with no DC content in the signal, it lends itself to transmission over long distances. The sine-wave zero-crossing transitions have to be placed very precisely by the GPS clock (within a few microseconds of absolute UTC time), so that very good precision can still be obtained provided that the receiving equipment employs a reasonably sophisticated demodulator (e.g. PLL) to recover the timing accuracy. Sub-millisecond accuracy is achievable.

B22z (Modified Manchester IRIG-B)

B22z (Modified Manchester IRIG-B) while not yet in common use, gives the best of both worlds. It retains the razor sharp accuracy of B00z, using a 1Khz square wave, but with phase modulation rather than DC level shift. With no residual DC level, it is, therefore good for driving over long distances as well. Demodulation using PLL techniques is relatively straightforward.


TIME FRAME 1 SECOND
INDEX COUNT 0.01 SECONDS
0
10
20
30
40
50
ON TIME
REF. MARKER
SECONDS
MINUTES
HOURS
DAYS
1 2 4 8 10 20 40
1 2 4 8 10 20 40
1 2 4 8 10 20
1 2 4 8 10 20 40 80 100 200
P0
P1
P2
P3
P4
P5
POINT A
8ms
2ms
BINARY '0'
(TYPICAL)
5ms
BINARY '1'
(TYPICAL)
0.01 SECOND
(TYPICAL)
50
60
70
80
90
0
YEARS
CONTROL FUNCTIONS
(TIME OF DAY)
STRAIGHT BINARY SECONDS (17-bits)
1 2 4 8 10 20 40 80
2^0 2^1 2^2 2^3 2^4 2^5 2^6 2^7 2^8 2^9 2^{10} 2^{11} 2^{12} 2^{13} 2^{14} 2^{15} 2^{16}
P5
P6
P7
P8
P9
P0
8ms
POSITION IDENTIFIER
(TYPICAL)
Time at this point equals:
173 Days, 21 Hours, 18 Minutes, 42.750 Seconds
03 Years (2003)
3.3X
X
TYPICAL MODULATED CARRIER
Recommended Frequency: 1000 Hz
IRIG STANDARD TIME CODE
FORMAT 'B'
(100 pps code)