Getting the Proper Calendar Year Using Basic and Extended IRIG-B Time-Synchronization Signals

Ken Behrendt

BASIC IRIG-B SIGNAL

Protective relays and other associated devices can have their onboard clocks and calendars synchronized by an Inter-Range Instrumentation Group (IRIG) time-synchronization signal. The basic demodulated IRIG-B signal accepted by virtually all SEL products (IRIG-B002) includes the time of the day and the day of the year. If the receiving device employs a calendar that reports the full month, day, and year, it must have a provision for entering and storing the year, which is not transmitted with the basic IRIG-B002 signal.

SEL devices that accept the basic IRIG-B002 signal have a **DATE** command that can be used to enter the date, including the year. These devices store the year in nonvolatile memory and provide a "rollover" function that is activated at the beginning of each new calendar year to advance the year stored in memory.

EXTENDED IRIG-B SIGNAL

Some IRIG-B time-synchronization signal sources are capable of transmitting an extended IRIG-B000 signal that includes the year in each message. Many modern Global Positioning System (GPS) clock receivers, such as the SEL-2401, SEL-2404, and SEL-2407® Satellite-Synchronized Clocks, can be set to transmit either basic IRIG-B002 or extended IRIG-B000 signals. The extended IRIG-B000 signal conforms to the IEEE Standard C37.118-2005 IEEE Standard for Synchrophasors for Power Systems (formerly IEEE 1344-1995), which defines the use of control bits in the IRIG-B000 signal to send the year and other time-quality information along with the basic time-of-day and day-of-year information.

Many new SEL relays that have synchrophasor measurement capabilities can receive and interpret the extended IRIG-B000 signal. In general, if the synchrophasor measurement function is enabled, or if the device is enabled to read the IRIG-B000 control bits by setting IRIGC := C37.118, the relay will read and store the year provided by the control bits in the IRIG-B000 signal.

PROBLEM

The control bits in the basic IRIG-B002 signal are not defined by a standard, so by default, the control bit positions are all zeroes. When the relay is set to read the year from the control bits in the extended IRIG-B000 signal, but the IRIG-B source is only sending a basic IRIG-B002 signal, the relay interprets the "00" year control bits to be the year "2000." Attempts to change the date using the **DATE** command are futile because the relay continues to read the year "2000" from the basic IRIG-B002 signal, overriding the year entered via the **DATE** command.

SEL SOLUTIONS

If the SEL relay exhibits a date with the year "2000," and attempts to change the year using the **DATE** command do not work, the relay is reading control bits from the IRIG-B signal, but only the basic IRIG-B002 signal is being received. There are three possible solutions:

- If the intention is to enable synchrophasor measurements in the relay, the IRIG-B signal must include valid control bits in compliance with the IEEE C37.118 standard. The IRIG-B signal source must be set to transmit the extended IRIG-B000 signal with the compliant control bits. If the clock is not IEEE C37.118 compliant, it must be replaced with a clock that is compliant and set properly to transmit valid control bits.

- If the relay is not required to provide synchrophasor measurements, disable synchrophasor measurements by setting EPMU := N. In addition, disable the relay's ability to read the extended IRIG-B000 signal control bits by setting IRIGC := NONE. The relay should then ignore the control bits in the basic or extended IRIG-B signals. The correct year must be entered using the **DATE** command. If the relay continues displaying the incorrect year (2000), check if the relay is receiving the time signal through MIRRORED BITS® communications from a remote relay (SEL-400 series relay only). This can happen when MBTIME := Y on the local relay, IRIGC := C37.118 or EPMU := Y on the remote relay, and the remote relay is receiving a basic IRIG-B002 signal. In this case, set MBTIME := N on the local relay, or set EPMU :=N and IRIGC := NONE on the remote relay.

- If the relay is not required to provide synchrophasor measurements, but the relay has setting EPMU := Y or IRIGC := C37.118, leave the relay settings as they are, and change the GPS clock output to send the extended IRIG-B000 signal. The relay will then display the correct date, including the correct year, without having to issue the **DATE** command.

QUESTIONS?

If you have any questions about using basic or extended IRIG-B time-synchronization signals with SEL products, please contact SEL at +1.509.332.1890, or check the SEL website at www.selinc.com for SEL support near you.