Application Note AN2010-07

Synchronized Clock Systems Using the SEL-3401 Digital Clock Display

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INTRODUCTION

Synchronized clock systems have evolved beyond traditional one-pulse-per-minute analog clocks on a school wall. Hospital, public safety, industrial, university campus, auditorium, manufacturing facility, military base, power plant, freight dispatch, and airport operations have increasing requirements for accurate digital time, displayed at resolutions higher than a minute.

The SEL-3401 Digital Clock Display is more advanced than many clocks on the market. It can receive an IRIG-B time signal from any appropriate source, including a satellite-synchronized clock. SEL offers a range of satellite-synchronized clocks for use with the SEL-3401, providing an accuracy of ±100 nanoseconds. The following sections explain three different examples of providing synchronized clock systems using the SEL-3401.

EXAMPLE 1: SYNCHRONIZED TIME DISPLAY IN A SINGLE BUILDING, DAISY-CHAIN DISTRIBUTION

Directly connect a master clock to an SEL-3401 using either a coaxial or a shielded, twisted-pair cable. Use up to 40 meters (130 feet) of Category 5 cable to connect SEL-3401 Displays to each other, synchronizing the time signals. As many as 40 SEL-3401 Displays can be connected together.

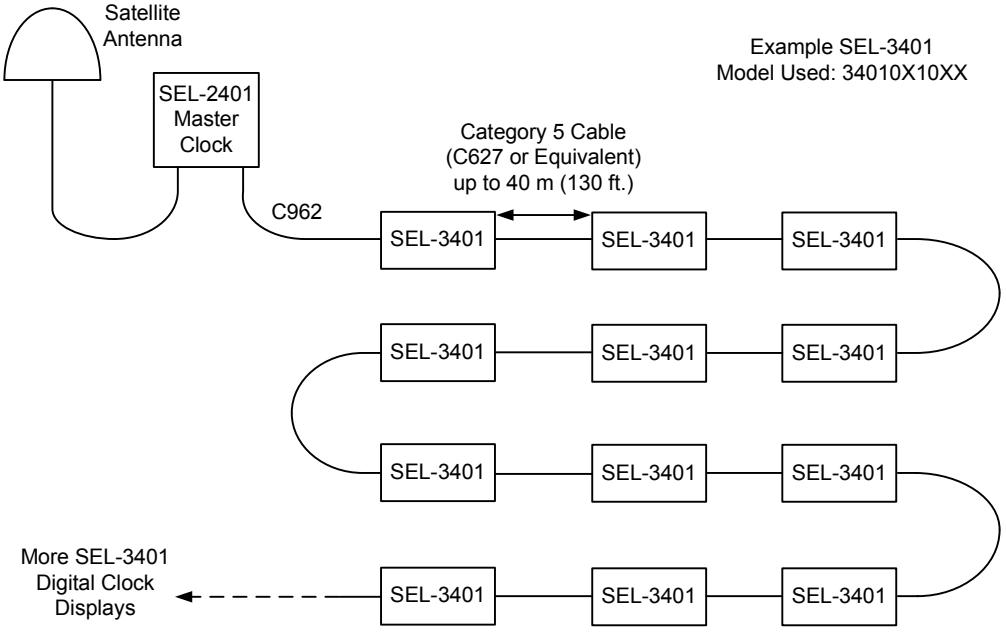

Figure 1 SEL-3401 Displays Showing Satellite-Synchronized Time From an SEL-2401 Satellite-Synchronized Clock

EXAMPLE 2: SYNCHRONIZED TIME DISPLAY, FLOOR-BY-FLOOR DISTRIBUTION

Using the connection method shown in Figure 2, distribute time signals to each floor of a building. Connect the time output of the first SEL-3401 on each floor to another display on the same floor. In turn, connect that display to the next display in the chain of displays for that floor. By using the time-distribution method shown in Figure 2, the time signal can be distributed to more SEL-3401 Displays than by using the daisy-chain method. Each floor is isolated and can be serviced without disturbing the displays on the other floors.

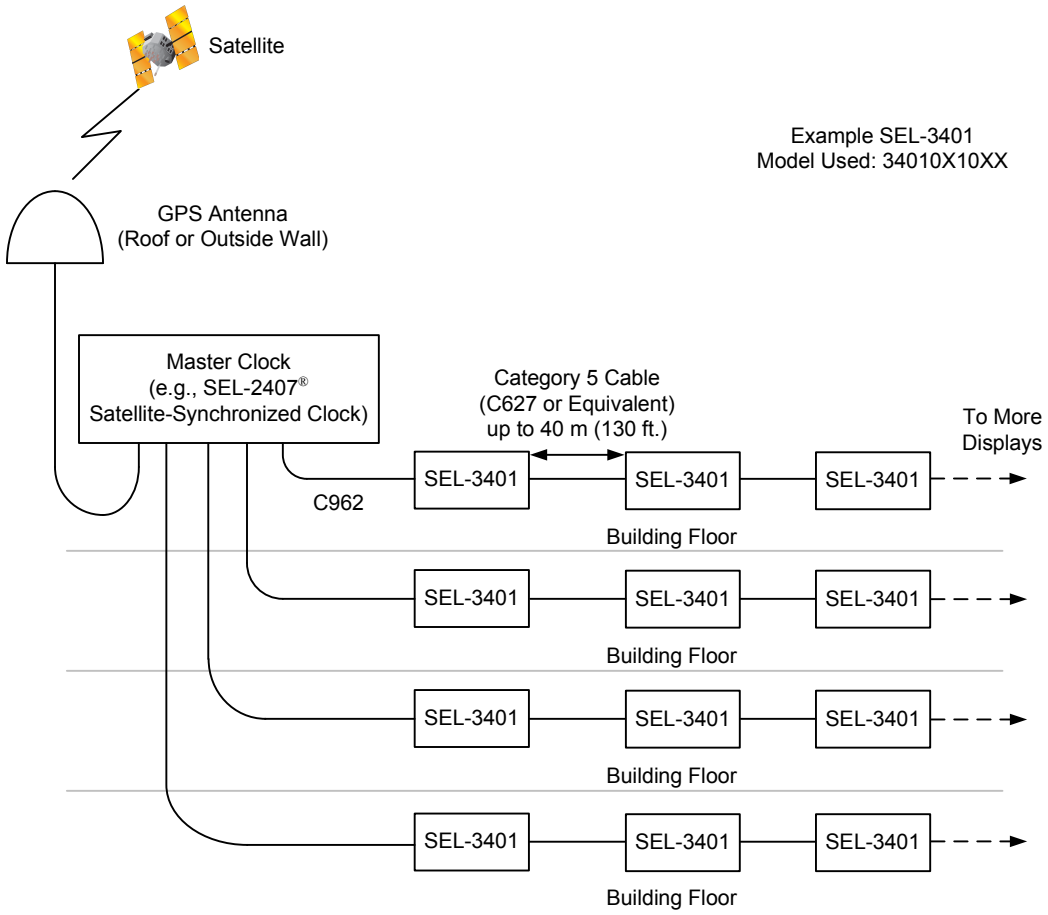

Figure 2 Floor-by-Floor Wiring Distribution of Synchronized Clock Time Signals

The floor-by-floor method wiring is similar to the wiring for telecommunications and computer networks. This time-distribution method uses the same wiring closets and cable-way infrastructure.

EXAMPLE 3: DISTRIBUTING TIME TO MULTIPLE BUILDINGS

You can distribute time signals to multiple buildings on a campus or different locations around an industrial plant. One simple, flexible method is to use SEL fiber-optic transceivers to carry the time signals between buildings or over longer distances. Using SEL-2812 Fiber-Optic Transceivers With IRIG-B (SEL-2812MT and SEL-2812MR combination), you can send IRIG-B time signals over 4 kilometers (2.5 miles) of multimode fiber-optic cable.

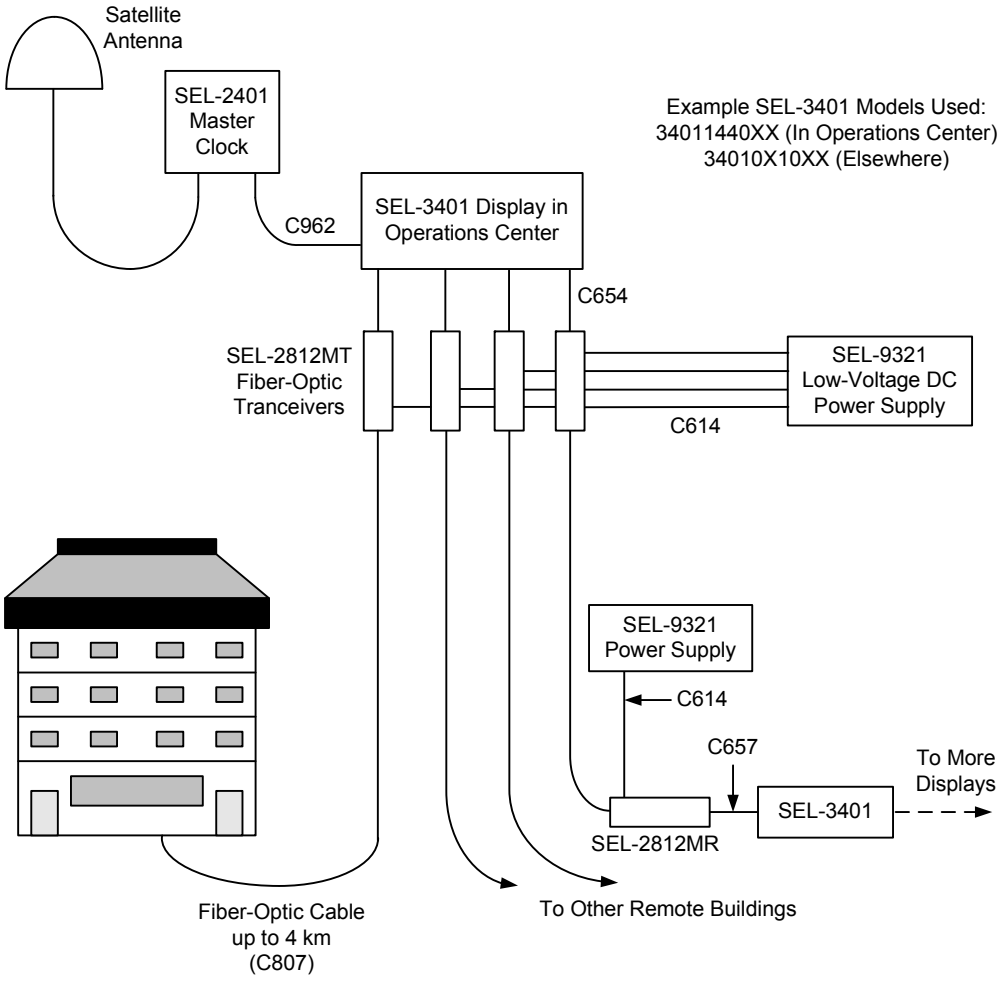

Figure 3 Fiber-Optic Cable Distribution of Synchronized Time Signals to Multiple Buildings

SYNCHRONIZED CLOCK PLANNING FOR ARCHITECTS AND PROJECT PLANNERS

Many different synchronized clock layouts can be created using combinations of SEL satellite-synchronized master clocks, clock displays, and fiber-optic IRIG-B distribution products. Table 1 gives general guidelines for system planners, architects, and design engineers. These guidelines are based on the examples shown in Figure 1 through Figure 3. Additional combinations and larger configurations are available. Contact SEL for support with your project.

Table 1 General Recommendations for Synchronized Digital Clock Displays

SEL Satellite-Synchronized Master Clock	Number of SEL-3401 Displays	Typical Coverage
SEL-2401	40 (daisy-chain method)	1,584 m (5,200 ft.)
SEL-2401	160 (floor-by-floor or building-to-building method)	6,336 m (20,800 ft.)
SEL-2407	240 (floor-by-floor or building-to-building method)	Buildings up to 4 km (2.5 mi) from the master clock, with additional distance on internal building wiring

The SEL-3401 comes in several different configurations. Table 2 lists the part numbers for the SEL-3401 Displays and special cables discussed in this application note.

Table 2 Ordering Details for Selected SEL Products in This Application Note

Part Number	Notes
34010X10XX	SEL-3401 surface-mount clock with an RJ45-style IRIG-B input and output and a compression terminal input for the IRIG-B time signal.
34011440XX	SEL-3401 rack-mount clock with four BNC-style IRIG-B outputs. This model has one BNC-style IRIG-B input.
C962	RG-58A/U cable with BNC connector at one end and tinned leads on the other end. This cable transfers IRIG-B time signals from the BNC connector on a satellite-synchronized clock (e.g., SEL-2401) to the compression terminal input on the SEL-3401.
C654	Cable with BNC connector at one end and a miniature jack at the other end. This cable transfers IRIG-B time signals from the BNC connector output on the SEL-3401 rack-mount clock to the SEL-2812MT.
C614	Cable to supply power from the SEL-9321 to SEL-2812 Transceivers.
C657	Cable with a miniature jack at one end and tinned leads at the other. This cable transfers IRIG-B time signals from the SEL-2812MR to the compression terminal input on a surface-mount SEL-3401.
C807	62.5-micron multimode fiber-optic cable family.

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