

Taking The Stops Out Of Digital Potentiometers

Chuck Wojslaw

CIRCLE 522

Xicor Inc., 1511 Buckeye Dr., Milpitas, CA 95035; e-mail: Cwojslaw@Xicor.com

A three-wire bus is commonly used to control digitally controlled potentiometers (DCPs). One example of this type of bus is Xicor's 32-tap X9315 (U3), shown in the figure. This asynchronous bus has no protocol and is popular in real-time and control applications.

The bus consists of a chip-select pin (\overline{CS}) required for addressing, and an up/down pin (U/\overline{D}) to establish the direction of the potentiometer's wiper. It also includes an increment pin (\overline{INC}), which advances the wiper. A gated clock often is used to drive the \overline{INC} pin. When the wiper reaches the end of the potentiometer in the up or down direction, it remains at that limit (it "stops").

Many continuous real-time applica-

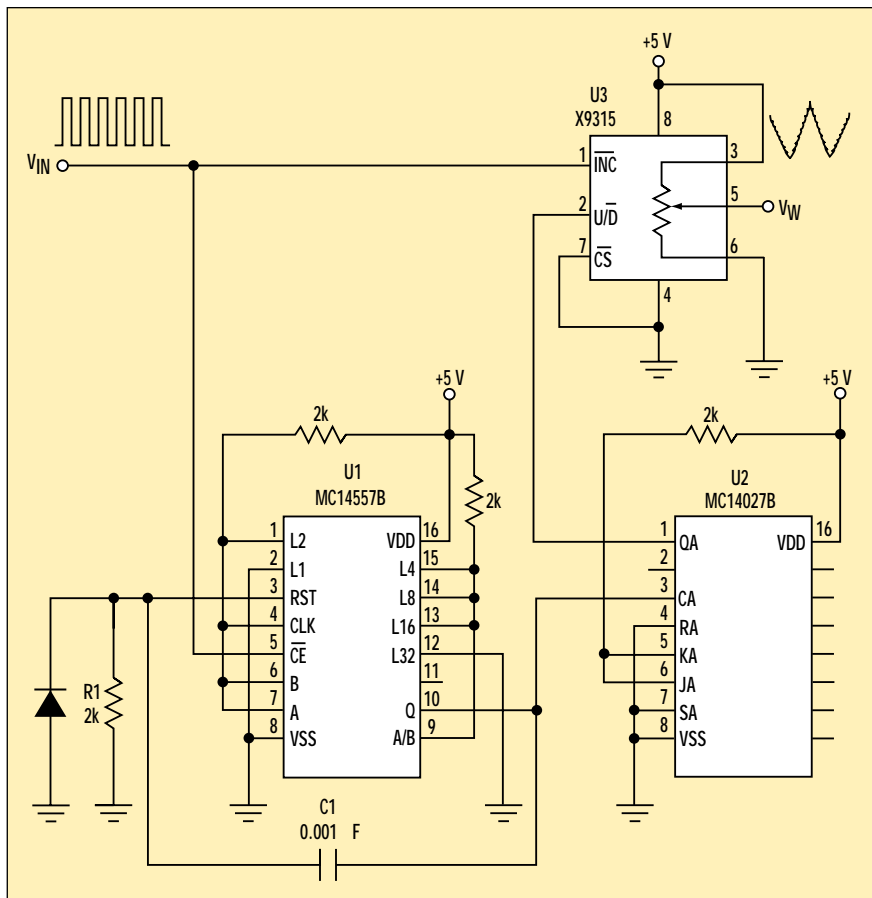
tions require that the wiper's direction be automatically reversed when its limits are reached. Fade-in/fade-out controllers in neon light systems are a good example of this type of application.

By changing the high/low state of the signal on the potentiometer's up/down input, the U1 and U2 portions of the circuit automatically reverse the wiper's direction. U1 is a variable-length serial shift register, while U2 functions as a J-K flip-flop connected in the toggle mode. A variable-length shift register can accommodate 16-, 32-, and 64-tap potentiometers if the register's L1 to L32 lines are programmed appropriately.

For every clock pulse at V_{IN} , the DCP's wiper is moved forward one

position and a logic 1 is moved one position in the shift register. The Q output of the shift register will go high after 31 pulses. As a result, the output of the J-K flip-flop complements Q's output state. Differentiated by the R1/C1 circuit, this signal also resets the shift register to start the cycle over again. If V_{IN} is a continuous stream of clock pulses and the potentiometer pins are connected across a 5-V supply, the wiper output voltage (V_W) will be a staircased triangular signal.

The circuit's operation was confirmed over a 10-Hz to 100-kHz range. For continuous, closed-loop feedback applications, adding the U/\overline{D} signal to the stop-less circuit reduces the pin count of the serial bus. ▀



The potentiometer's up/down input is used to automatically reverse the wiper's direction. A variable-length serial shift register (U1) allows operation with 16-, 32-, and 64-tap devices.

ifd winners

Ken Yang, Maxim Integrated Products, Sunnyvale, CA.

The idea: "Single-Chip Transmitter Extends Home-Entertainment Systems." November 6, 2000 Issue.

W. Stephen Woodward, University of North Carolina, Marine Sciences; e-mail: woodward@unc.edu.

The idea: "Simple Current-Loop Transmitter Converts PWM To 4-to-20-mA Output." November 20, 2000 Issue.

W. Stephen Woodward, University of North Carolina, Marine Sciences; e-mail: woodward@unc.edu.

The idea: "Take-Back-Half: A Novel Integrating Temperature-Control Algorithm." December 4, 2000 Issue.

Huw Jones, ESD Consultants, Llantrisant, Mid Glamorgan, U.K.

The idea: "RS-485-To-RS-232 Transceiver Takes Its Power From The COM Port." December 18, 2000 Issue.