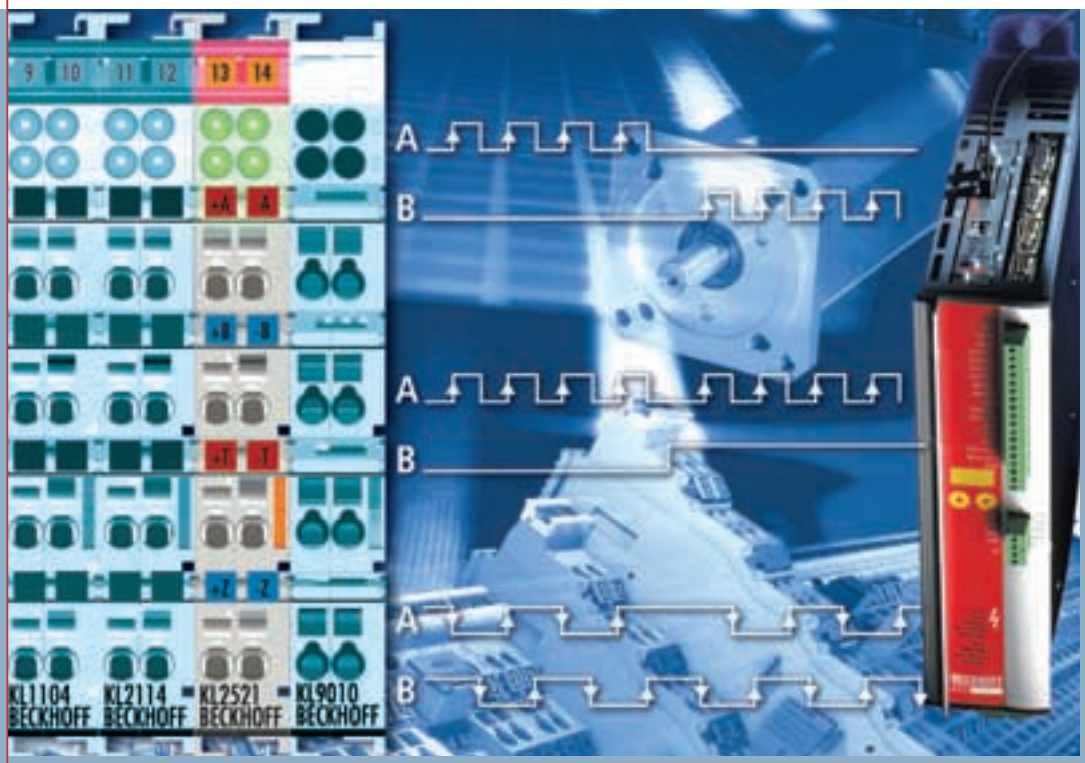
Digital technology replaces expensive analog control systems

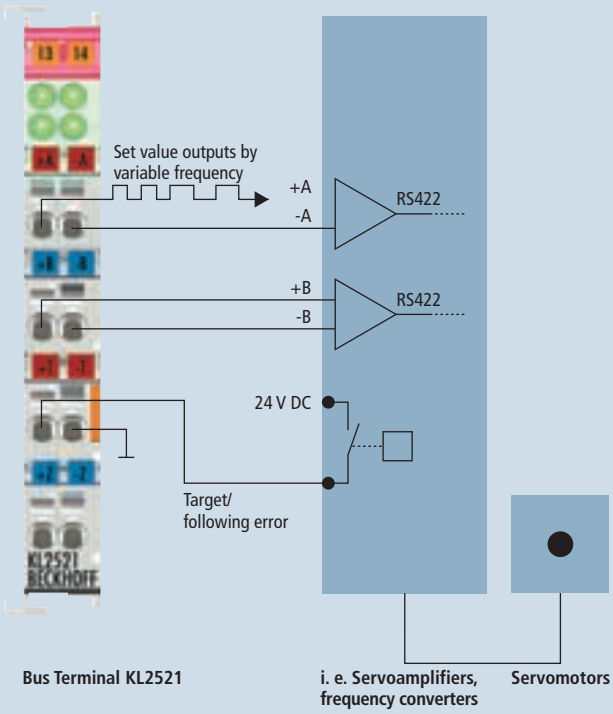


New Bus Terminal supports precise positioning

Beckhoff have now developed the KL2521 Pulse Train output terminal for precise positioning. The new Bus Terminal can directly operate servo drives and stepper motors. The 24-bit resolution allows extraordinarily precise set values to be specified. The Bus Terminal does not just replace conventional analog technology – it has a significantly better dynamic performance. The TwinCAT automation software even allows the actual position of a drive to be displayed without the need for an incremental encoder terminal.

The idea is that with the new KL2521 Pulse Train output terminal, Beckhoff are using simple pulses sent to stepper motors and servo drives to implement digital technology for precise positioning tasks. To do this, the electronic Bus Terminal converts a binary signal to a frequency, feeding this, electrically isolated from the terminal bus, to the positioning drive. The frequency is preset by a 24 bit value from the automation unit. The advantage over conventional technology, such as an analog ±10 V interface, is that the Bus Terminal's high output frequency of 500 kHz allows the operation of the fastest servo drives currently available. In contrast to analog technology, the set value signal is communicated without any offset drift. The 24 bit resolution guarantees a high precision, in steps of 10 mHz. This means that set values can be specified in fine, almost continuous, steps. In practice, the desired maximum output frequency is entered into a register, and then the frequency output can be used much like a ±10 V output by using 16 bits of the process image.

Pulse Train Output Terminal KL2521

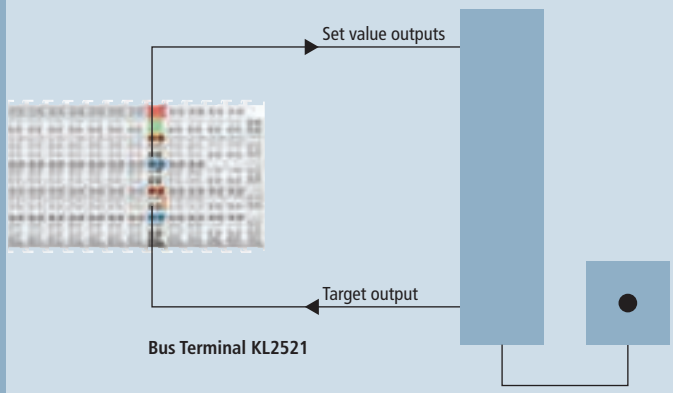


Set value outputs and the acquisition of actual positions with just one Bus Terminal

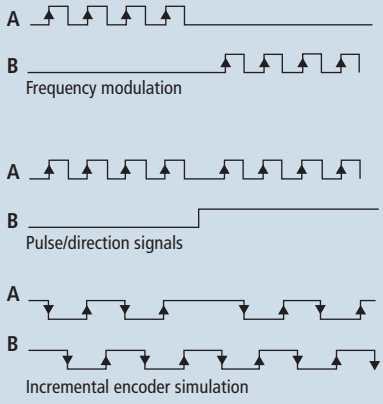
The use of the Pulse Train technology to position drives is primarily used in Asia and in the USA. Its origins lie in the methods for driving stepper motors. The wide acceptance and easy use of the technology resulted in its application to higher power sectors of drive technology. The interface using Pulse Train technology is nowadays also applied to servoamplifiers and frequency converters. The user can employ a consistent software and hardware interface, from micro-steppers up to high-powered servo-drives.

In the Pulse Train technology, the provision of the set value and the validation of the actual position is implemented with the aid of just one digital Bus Terminal. The actual position, which is otherwise acquired with the aid of incremental encoder techniques, is calculated, depending on the specified set value frequency using, for instance, the TwinCAT software PLC/NC. A difference between the set and actual value is indicated to the Bus Terminal using the target or following error digital output which is present in all common servoamplifiers. The KL2521 Pulse Train Bus Terminal supports three different frequency pulse patterns. These may be selected in using the KS2000 configuration software, or by the higher-level controller. The pulse patterns are output through the two channels, A and B. They correspond to all usual input circuits:

Set value outputs and the acquisition of actual positions



Frequency pulse patterns



- Frequency modulation: rotation to the right is associated with output of the frequency signal on channel A, while rotation to the left is associated with output on channel B. The inactive channel remains at a logical „low" state.
- Pulse/direction signals: the frequency pattern is always output on channel A, the direction of rotation being indicated by the "high" or "low" level on channel B.
- Incremental encoder simulation: channels A and B output a signal with a 90° phase shift. The shift from A to B is positive or negative, thus encoding the direction of rotation. The output signal is thus exactly the same as that of an incremental transducer. The advantage here is the possibility of directly driving frequency converters through the "synchronous axes" signal input. On top of the simple positioning, this arrangement permits a master/slave structure. Users can therefore couple this system to fieldbusses through existing interfaces – i. e. without additional costs.

These 3 different pulse patterns can also be inverted, thus permitting ideal adaptation to the input circuit. The new Bus Terminal does more than simply make a large number of analog interfaces superfluous. The possibility of using the automatic step counting to implement closed control loops is of even greater significance. The digital technology offers more functions in comparison to the expensive evaluation involved in analog technology, and at lower cost. Supplementary functions integrated into the new Bus Terminal support operation and reduce the controller's power requirement. Optimal operation of a stepper motor is easily possible through the specification of a ramp. Just two parameters, the ramp start frequency and the ramp run-up time, are necessary to initialise the Bus Terminal. The controller now only needs to specify the frequency. The Bus Terminal performs acceleration and braking tasks. The frequency change is calculated directly in the Bus Terminal, and takes place, bumplessly at time intervals of 2 ms. The controller's computing load is thus reduced, which permits a number of axis controllers to be implemented using just one intelligent Bus Terminal Controller. The output terminal can be configured using the associated Bus Coupler or the controller. The output stage is compatible with RS422. It can, however, also be operated with 24 V DC signals. Either operating mode can be used without the need for a configuration switch or for parameterisation. The signal state is indicated by light emitting diodes. The LEDs are driven in time with the outputs and each displays an active output.

Synchronization of several frequency converters over incremental encoder simulation