SYDOR

TECHNOLOGIES

KICKER PULSER

COMPLEX MEASUREMENTS—CRITICAL RESULTS

FEATURES

- Clean fast rise and fall pulses
- Nearly zero post-pulse noise
- Online monitoring and graceful failure modes
- Extremely reliable solution

APPLICATIONS

- Kicker pulser for high voltage drives
- Useful for synchrotron top-up injection schemes
- Pulse picking in X-FEL settings
- Useful pulser for electron gun applications

ABOUT THE KICKER PULSER

At synchrotrons and XFELs, there is a need to precisely deflect electron bunches with minimal disruption. At synchrotrons, newly injected particles must be sent on the correct path to ensure the correct energies are ending up at their intended destinations. At XFELs, these energies are delivered on a single-shot basis. To accomplish this in both settings, septa and kicker magnets are often used for both injection and extraction.

Generally, pulsers producing flat-top pulse profiles have been employed. With these pulsers, users often experience a large amount of noise at the beginning of the flat top as well as noticeable post-pulse noise. To extract only the “clean” portion of the pulse, precise timing is required for the desired outcome. The current solution requires avalanche diodes, which inherently must be operated at their limits, making unit failure an eventuality. This leads to unpredictable and costly downtime and general concerns about reliability.

Sydor’s solution to this problem is the Kicker Pulser, which was designed with a focus on integrating online monitoring and establishing a well understood ‘graceful failure mode.’ This pulser was originally designed by Kentech Instruments, where it was engineered to provide Gaussian-like pulses which produce an equivalent average voltage to those currently generating square pulse shapes. In addition to the more robust electronics, the Pulser is equipped with several monitoring options to allow for a planned down time for maintenance.

The Kicker Pulser was engineered to provide minimal post-pulse noise which enables the stripline kicker magnet to perform with maximum precision and only impact the targeted pulse when active. The key to this is the ultra-fast rise/fall times, designed to fall between adjacent bunches. With temporal accuracy on this magnitude, users can ramp up the pulser and deflect individual bunches without destabilizing the trajectory of adjacent bunches. Designs are available to accommodate Swap-Out and Longitudinal Injection schemes, where bunch spacings of are <2 ns.

It is important to note that each accelerator has unique bunch timings with varying pulse shape requirements. As an example of this variability, synchrotron facilities can be built with different intended modes of operation, such as single bunch swap-out or longitudinal injection for topping off the electron bunches. Maximum voltage requirements for these two injection methods vary from as 2 kV up to 34 kV. Similarly, repetition rates are equally as diverse, with some facilities requesting repetition rates from ~1 Hz up to MHz. Such a range in requirements necessitates reliable high voltage pulsers be designed on a facility-to-facility basis.

PRODUCT SPECIFICATIONS

Voltage Pulse Output

- Pulse Shape: Flat top available, Gaussian options for graceful failure modes. Ultimately this design is customer specific
- Average Voltage Amplitude: From 100's V to > 30 kV maximum amplitudes available
- Amplitude Stability: < 1%
- Polarity: Single polarity or dual output, customer specified
- Minimum Total Pulse Width: < 2 ns (not available at maximum amplitudes)
- Pulse Rise Time (10-90%): < 1 ns
- Pulse Fall Time (90-10%): < 1 ns
- Max Pulse Tail Amplitude: ~2.5% of Peak Voltage
- Maximum Repetition Rate: 10's Hz for maximum amplitude devices, MHz for lower amplitudes (burst modes available)
- Output Cables : RG-217 co-axial, customer specified

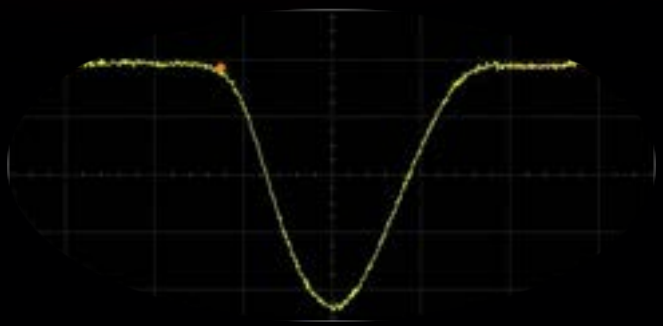
Electronics

- Interface: Ethernet, RJ45 via a Lantronix Xport module, and RS232 via a 9 way D-sub Connector
- Monitor Output: SMA
- Triggers: Electrical
- Trigger Jitter: < 50 ps RMS
- Trigger Delay: 50 ns (typical)
- Dimensions: 19" X 4U, per 20 kV channel

Other

- Health Monitoring: Online monitoring of switch health available for planned service
- Failure Modes: Graceful failure modes for predictive maintenance
- Additional Customization Options: All designs can be modified to suit an application

EXAMPLE PULSE SHAPE



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