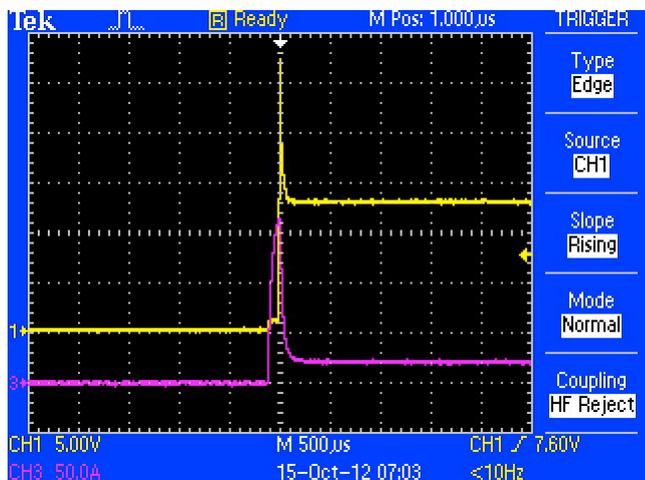


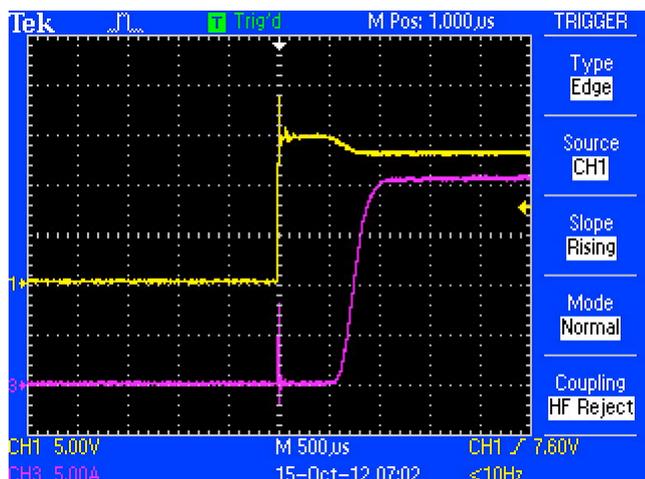
Application Note #7

# Applying Input Voltage and PWM Operation

Electronic H&H Loads are well suited to be operated with PWM voltages. In doing so, some issues need to be taken into account.



Current peak when applying input voltage



Dead time by undervoltage protection

## Inrush Current Peaks

Electronic loads are equipped with a regulator to control the adjusted setting. If a load setting value is set but no input voltage is connected, this leads to the effect that the regulation tries to set the required load current and switches the power stage on, because it does not get a feedback signal due to the missing input voltage. In this situation, if a voltage is applied, it will be shortcircuited at the moment of connection to the load input. The regulation registers the much too high current and then reduces it according to its set regulation speed. The same behavior is seen with the rising edge of a rectangular input voltage, e.g. with PWM voltages.

## Remedy

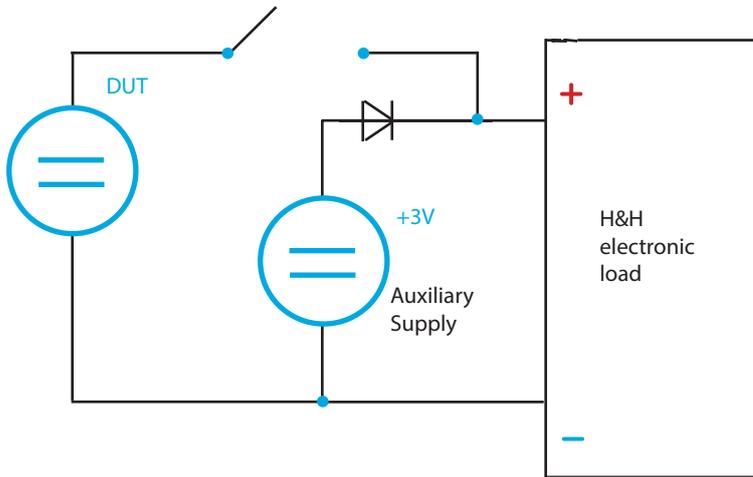
To avoid these inrush current peaks, H&H devices have a minimum voltage detection in the form of an undervoltage protection, which prevents the regulation unit from switching on the power stage completely when there is no input voltage. Depending on the device series, the undervoltage protection is fixed or adjustable. If the input voltage is below the set undervoltage protection, the power stage is disabled and the regulator is not released until the input voltage is sufficient to set the required load current. This causes the load current to increase from 0 A to the set value within the regular rise time. In addition to the control time, however, the undervoltage protection causes a dead time.

## Eliminating Dead Time

A trick can almost eliminate these times.

For this purpose, it is possible to maintain the load in the regulated state if it is provided with a low voltage from another voltage source which is sufficient to regulate the current. This auxiliary voltage is coupled via a diode.

If the DUT is not yet switched on, the auxiliary input voltage is connected to the load input via the diode and the load can regulate the set current. If the DUT is now connected, the input voltage only increases and the load current changes from the auxiliary power supply to the test object. However, the load does not have to be readjusted. This results in a significant reduction of the dead time and regulation time.



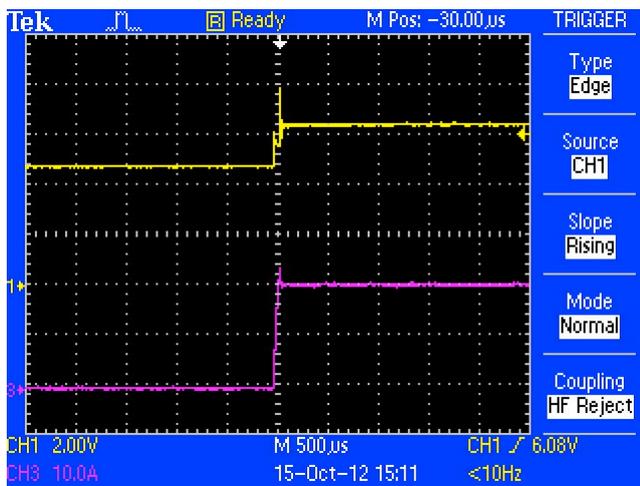
## Regarding the Input Capacity

For EMC reasons, the electronic loads have an input filter. This means that there is a certain capacity in the load input. The power stage itself also has its own capacity, the size of which depends on the number of semiconductors used and therefore on the device size and power.

When input voltages are switched on, this capacitance is noticeable by charging currents during the starting moment. The input capacity values are given in the Technical Data of the devices.



The input filter can be overloaded depending on the frequency (including harmonics or ripple) and the amplitude of the input voltage as well as the input capacitance itself!



Connection with immediate effect by providing an auxiliary voltage source