

## *Design and Control of Optical Media System*

We spent a year and had 2 ½ people working to control the chip sets used in off the shelf CD and DVD drives. Additional generations of the chips sets took less time (2-3 months)

Using a multi channel oscilloscope the data we are able to see and control includes:  
Input signals: laser, track and focus servo photo diode, data optical signal, tilt detector, spherical aberration corrector signals. We can track command signals of front end processor which control the devices listed above.

Additional signals that we are able to control are signals that control disk rotation, optical head radial movement, track-to-track jump of objective, sequence of control signal generated by front end processor at optical read errors (track lost, dust, scratch, etc.)

Output signals from the processor: laser status, error status, data signal (eye pattern when analogue), control signals for system components, laser on off, disc present, decoded signal about whether disc is CD or DVD, motor rotation signal ie speed of spinning, ROM vs WORM disc for signal for changing laser power, and head position signal

Based on complex analysis of these signals, we can back engineer algorithms of entire device operation. These are algorithms of media type analysis (CD, DVD, DVD-R, etc.), algorithms of device tuning for specific data medium used at a certain moment, algorithms of primary data processing and digitalization, algorithms of processing read errors and algorithms of drive turn off.

In other words, this is a full system of drive and media interaction. This data was used so that we can manually control entire device with the help of algorithms that we need. For example, parameters of most feedback systems are located in firmware memory in the form of tables.

Numerical values of these table are specific to the type of media. So developing such tables and inserting our values, we can adjust the drive (front-end processor) for non-standard (custom) media. This was the main goal of this activity.

Using non-standard media suggests modification of optical head layout too. We can modify, replace, and custom design most elements of a standard optical head. The only element we cannot modify is read objective suspension (electromagnetic actuator) but we still can replace objective in actuator.

We can design a custom read objectives including single-element plastic aspheric ones.. Also we have lots of experience in assembly, adjustment, fine tuning, quality control of different optical pick-up heads (from CD to recent models of DVD heads).

It is usual that drive-media system design includes feedback from drive to medium. Our activity included development of custom measurement equipment to measure such medium parameters as modulation ability, reflectivity, absorption, robustness to dirt, quality of write elements (pits) which affect output signal jitter, S/N ratio in servos and data optical paths. Based on these measurements, we recommended how to optimize media manufacturing.