Luminous Green

Test Facility for Control Devices of Plantlights

Many vegetables, like tomatoes, are almost solely cultivated under glass or in foil tunnels. Meanwhile, the cultivation of vegetables has evolved into a high tech business. Nothing ist left to chance. Unpredictable influences, like weather conditions, should no longer play a role. Everything happens under the requirement of high yields in best quality with minimized costs. Not only the hydration and input of nutrients is controlled precisely, also the light is controlled with the help of up-to-date technology. In big greenhouses, up to 10.000 metal and sodium vapor lamps illuminate and therefore extend the day, even when the sun already went down. With 2.500 lighting hours per year they ensure perfect light conditions for the plants.

Those discharging lamps have high proportions in the blue and red spectral range which produce an intensive and active photosynthetic radiation. The proportion of blue prevents rampant longitudinal growth and the red proportion supports the mature phase. The luminous efficiency of those lamps is high while simultaneously maintaining a low energy consumption. This has a positive effect on the productivity as well as the long maintenance intervals at a life span of approx. 10.000 hours.

1. Power Supply with Intelligence

The lamps are offered with electrical leads between 250 and 600 W. Metal and sodium vapor lamps need an ignition pulse of approx. 3,2 kV. In cooperation with a supplier, a german manufacturer of those special lamps developes and produces the power supplies for its plantlights. The power supply not only provides the operating voltages and vapor pressures, but is an intelligent control device which guides the lamp in a way, that the optimum of beam power and energy consumption is achieved. This happens based on different influencing variables, like the current solar radiation.

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For the test of those control units, the lamp manufacturer was in search of a partner, to develop a fully automated test system for the production.
For the test and measurement specialist MCD Elektronik, a company mainly handling automotive projects, it was an interesting challenge with unusual marginal conditions.

The DUT is programmed directly on the test station and examined after that. Depending on the power supply model, different test modes are used. This includes evaluations like power and voltage measurements as well as the reading out and analysis of EEPROM data. In addition to that, an ignition test is conducted where the ignition voltage and its frequency is measured and analyzed.

2. The Best of the Market for Efficient Tests

All components are housed in a compact test rack. The adaption for the DUT is separete and contains the needle bed to contact the control boards. A special feature is the high-voltage testing with 3 kV. Due to this, special safety devices had to be implemented with necessary safety distances to signal lines. The MCD software products TestManager CE, PicoScope Toolmonitor and control programs for the test station electronics are installed on an industrial computer. The control communicates with the test stations´ components via RS 232. A DC-power supply is supplied with a controllable AC source. With the integrated PicoScope, signal changes which occur on the CPU LEDs can be sensed and analyzed with the specialized MCD Toolmonitor. A Rigol Pulse Generator creates the curve shape for the ignition of the ignition pulse. The DUTs´ generated output signals are captured and transferred to the TestManager using a Keysight Multimeter with multiplexer.

In the adaption, there is a differential probe of the PicoScope as well as a control module and the programming device MK2 from Atmel. With this device, a programmable logic module is programmed using the test soft-

ware in the first steps of the test sequence. Then voltage and current measurements are conducted with the help of the Keysight Multimeter.

3. Everything is Examined

The power supply primarily creates the supply voltages for the high-pressure lamp but also conducts demanding control tasks with its processor. This includes the necessary safety functions and a radio communication system with over 70 protocols. For very big greenhouses with a large amount of lamps, several control devices can be connected so that a homgenous illumination is guaranteed. When driving the lamps, the surrounding brightness is also measured via sensors. During the test, a profile is used on the control device which simulates the daily routine of the sun in a greenhouse. The working hours of the lamps and different error messages are saved. The lamps´ and control units´ conditions can be controlled via remote access and the lighting can be adapted to economical aspects.

The test sequence runs completely automatic. After the operator puts the DUT in the adapter and closes the cover, the DUTs´ barcode is scanned. Corresponding to the type, the flashing of the test software and the test sequence starts. There are multiple transformers on the control unit. Using one of them, an iginition voltage of 3,2 kV is generated to start the lamp. The ignition spark with a frequency of 200 kHz endures approx. 100 ms. After the ignition test, the number of ignitions are read off. Voltage and frequency are determined using a compact oscillograph of the british manufacturer Pico Technology. The osci also senses signal changes which occur on the CPU LEDs. A variant of MCD´s in-house developed software Tool-monitor controls the oscillograph with the uniform user interface of the test station. The complete test process endures approx. a minute. The operator gains the approval to remove the DUT from the adaption as soon as it is unloaded.

4. Features:

- Current and voltage measurements
- Function and component testing
- Programming of the DUTs with an Atmel MK2 device
- Using, setting and evaluation of different test modes
- Reading, analysis and filing of EEPROM data
- Ignition test with 3 kV and frequency evaluation

5. Background:

With a production value of almost 1,82 bil. €, the vegetable gardening is the most important economic field in the horticulture. On a floor space (without multiple usage) of bare 2.7 mill. acres, 7.220 agricultural operations produced vegetables in 2012. The production is located in highly specialised vegetable gardening companies as well as in agricultural operations.
(Source: „ZBG Sector Report 2014“)

Pictures:

Picture 1: The test station with adapter for the DUT and monitor for the user guidance. On the monitor: the oscillogram of the ignition impulse for the lamp.

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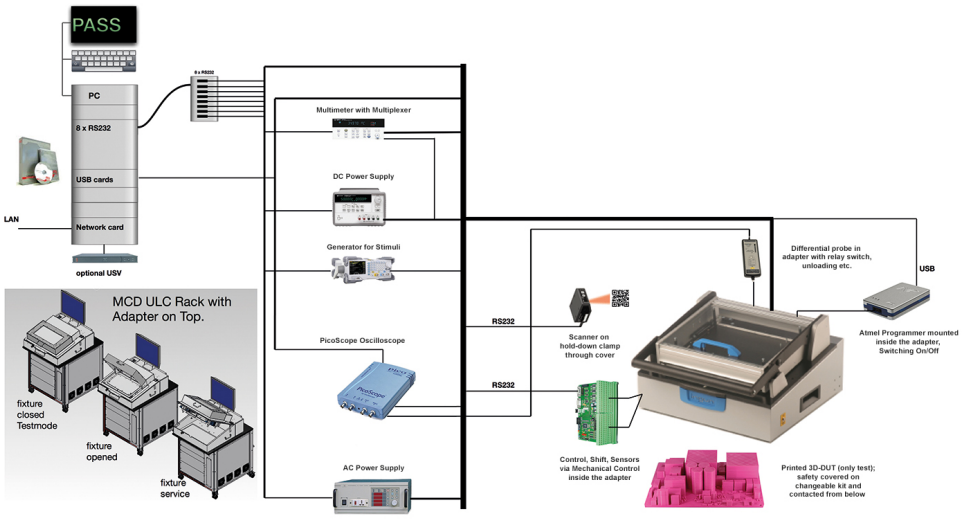
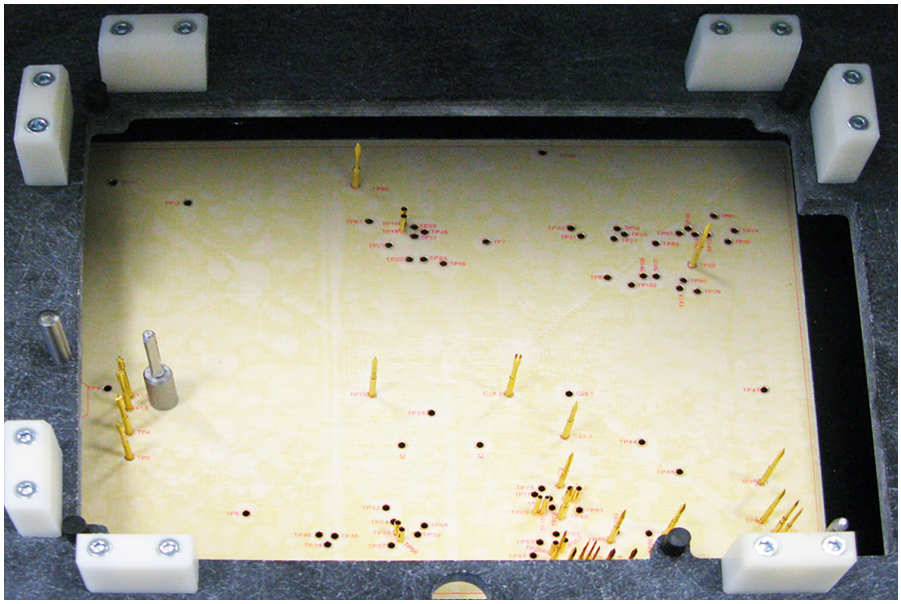


Picture 2: The block diagram of the test setup.



Picture 3: The needle bed for the control board.

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About MCD Elektronik GmbH:

MCD Elektronik GmbH was founded in 1983 and currently employs 80 people. The owner-managed company is headquartered in Birkenfeld, near Pforzheim, Germany. MCD Elektronik is active in Germany, Hungary, and China, and delivers to 48 countries around the world.

MCD Elektronik GmbH manufactures measurement and test systems for electronic production for their customers, who include OEMs and their suppliers in the automotive sector, companies in machine and systems design, medical technology, energy-electronics, quality technology, sensor manufacturing, and aerospace. The company relies on innovative customer-specific complete solutions - developed and realized by a team of highly qualified specialists.

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