Automation of Aditya Capacitor Bank Charging System

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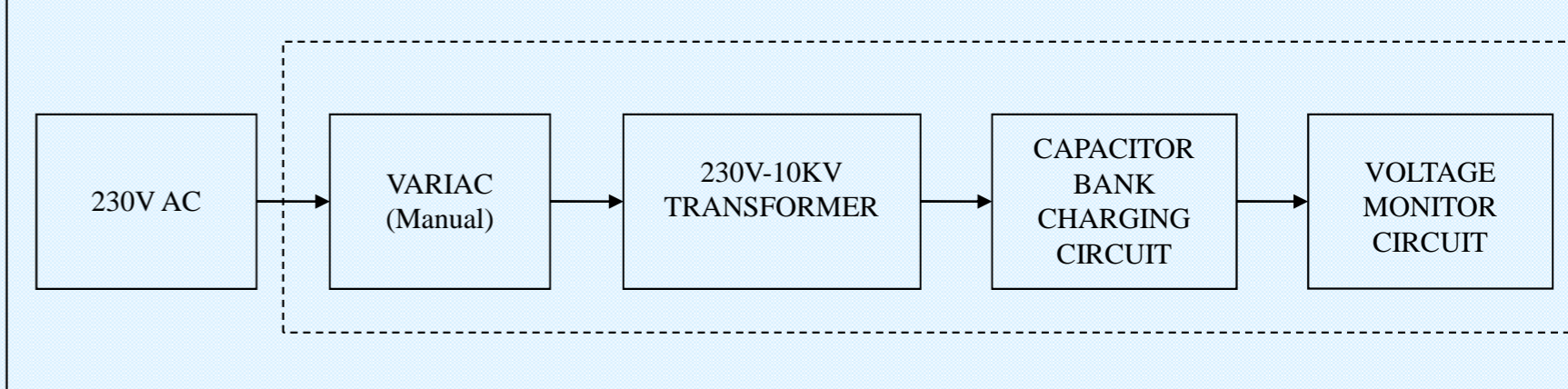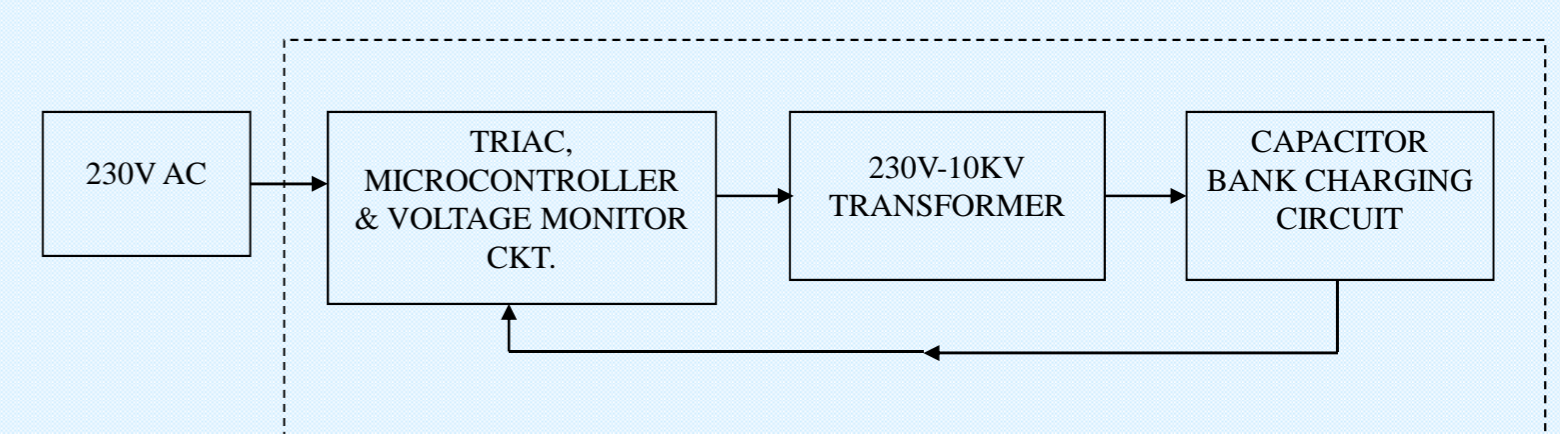
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Abstract

Aditya is a medium size of Tokamak with major radius 75 cm and minor radius 25 cm. The lower parameter plasma discharge operation in Aditya Tokamak is performed with capacitor bank power supply. A multistage 250 kJ capacitor bank power supply is used for Ohmic and VF primary current development. In Ohmic circuit, initial peak loop voltage is generated with Fast bank (300 µF / 10 kV) charged maximum up to 9 kV. Slow bank1- (3.2 mF/10 kV) is used in start-up for ramp-up the plasma current and charged to 5 – 6 kV while slow bank2- (31.5 mF/ 5kV) is used to maintain the discharge flattop and is charged to about 2.5 - 3 kV. Finally crowbar circuit is used to decay the current with L/R time constant and producing non-cosine waveform. Similarly in VF capacitor bank power supply VF Fast Bank (700 µF/ 5 kV) charged to about 2-3 kV and VF Slow Bank (14 mF/5kV) charged to about 700 –1000 V. Presently all the capacitor banks charged manually by variac at require voltages. The variac is replaced with microcontroller and TRIAC.

This paper is describe the Automation of Capacitor Bank Charging circuit using Microcontroller and TRIAC.
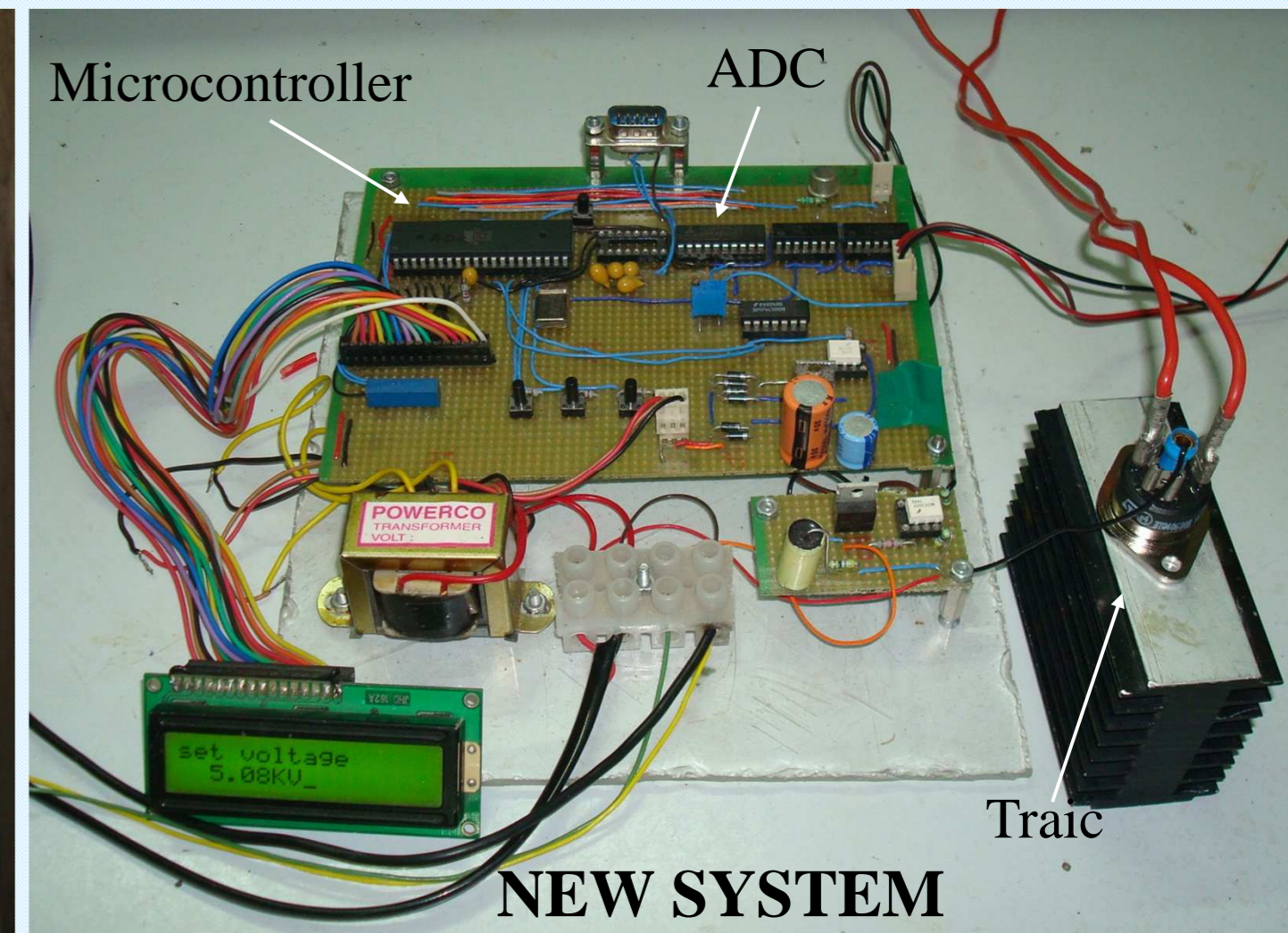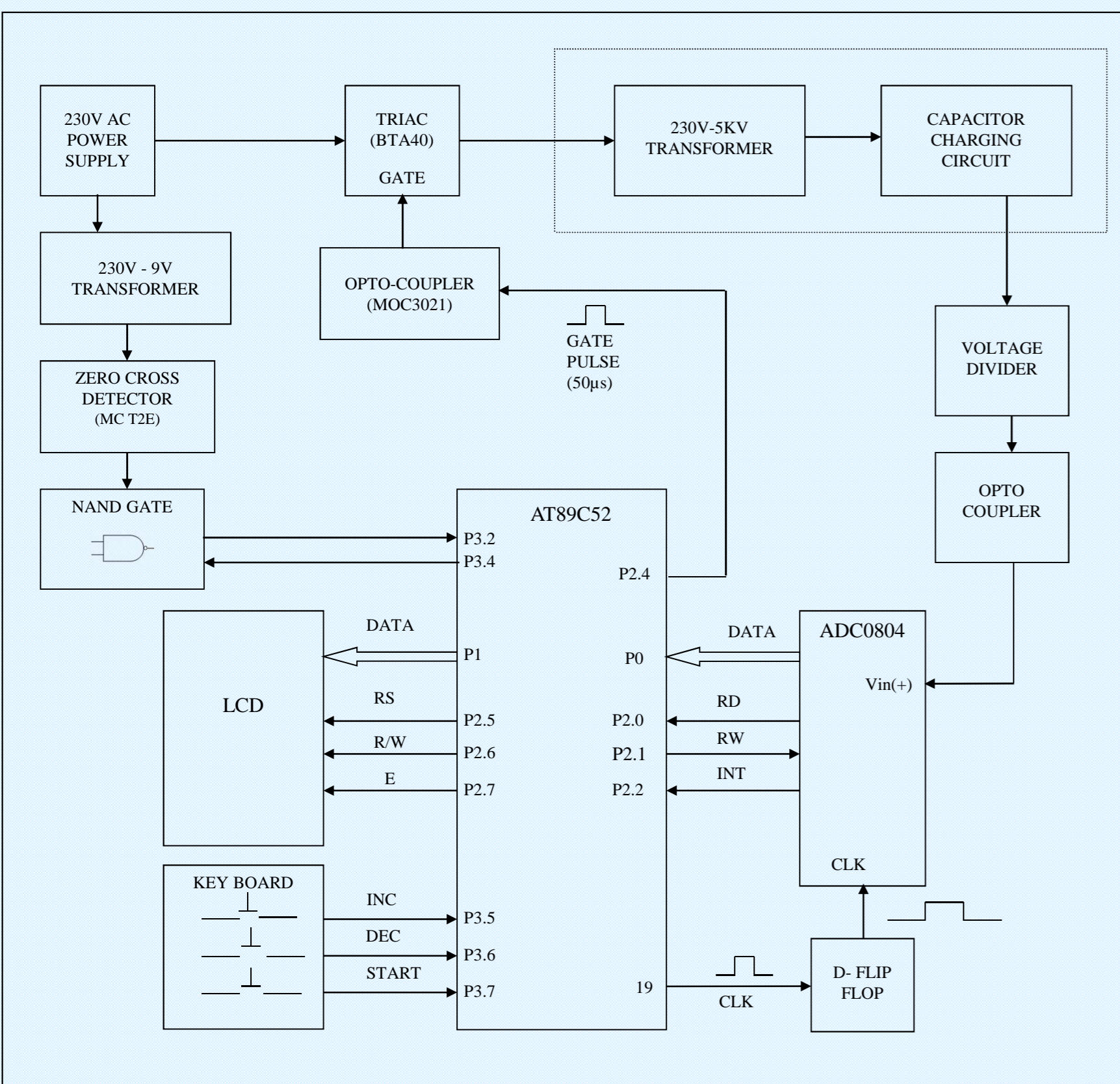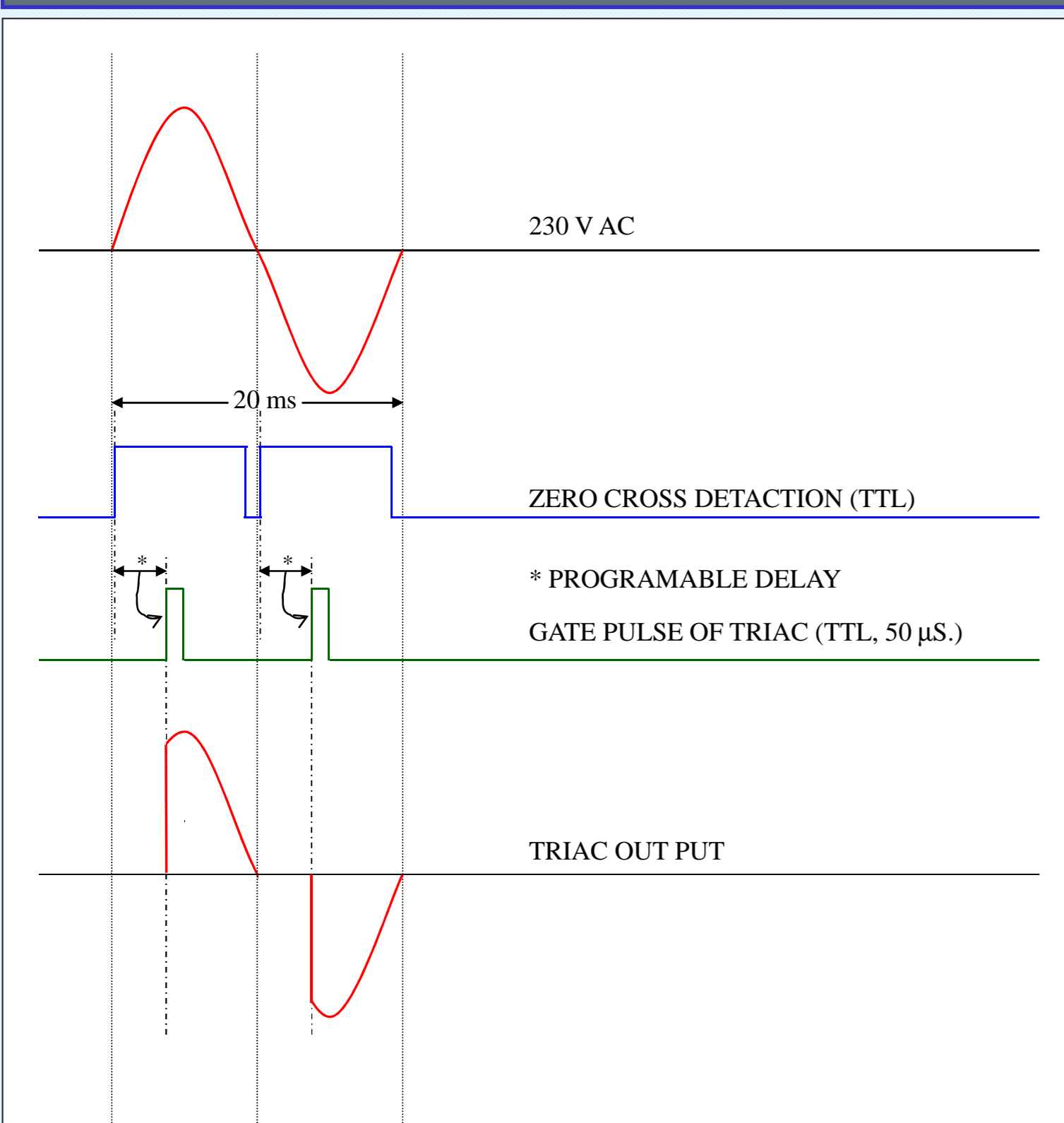
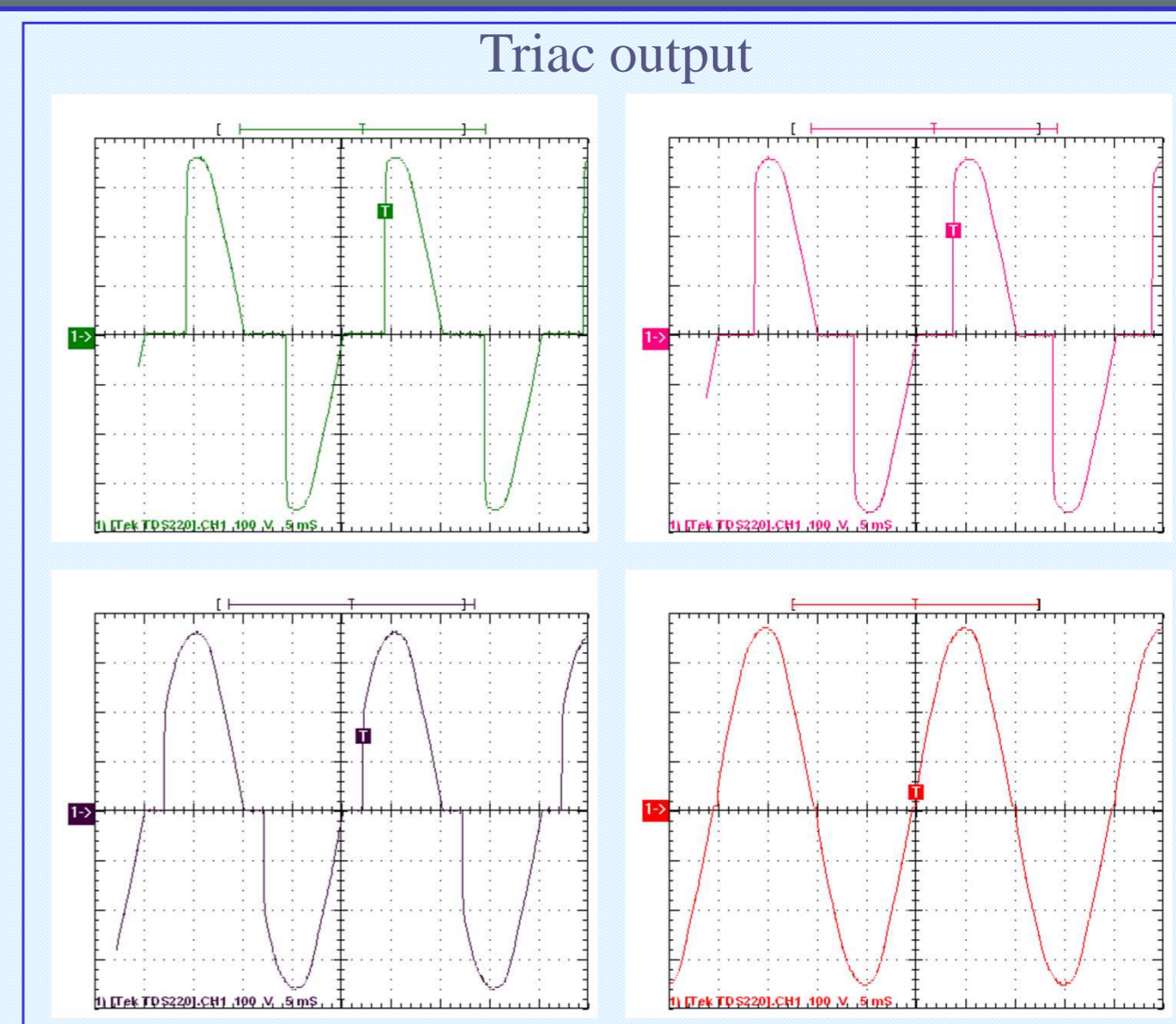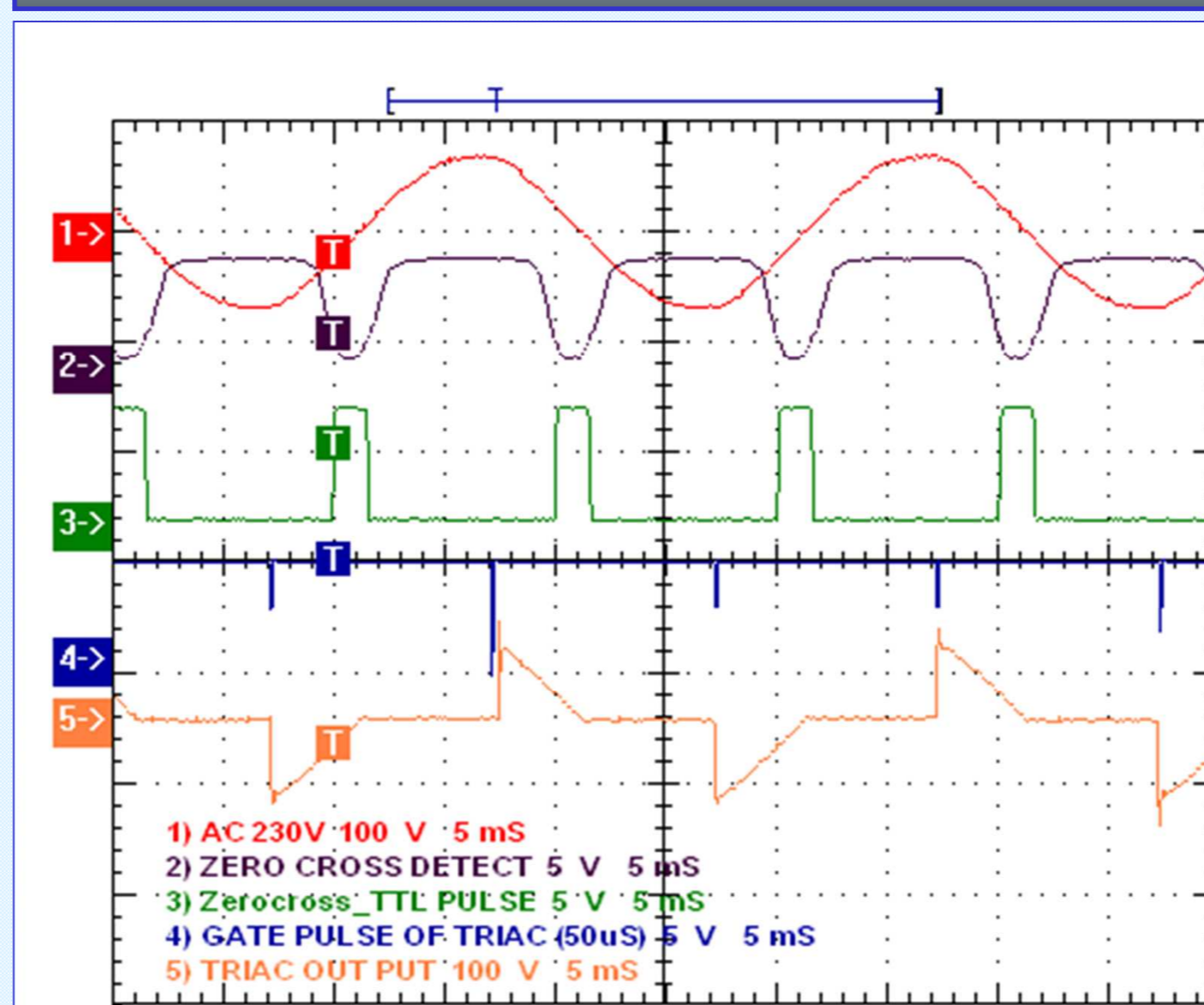## Existing System Block Diagram

New System Block Diagram

System Block Diagram

OLD SYSTEM

Microcontroller · ADC · Traic
NEW SYSTEM

Capacitor Bank

ADITYA TOKAMAK : A VIEW

Timing Diagram

230 V AC

20 ms

ZERO CROSS DETACTION (TTL)

* PROGRAMABLE DELAY

GATE PULSE OF TRIAC (TTL, 50 µS.)

TRIAC OUT PUT

Test Result

1) AC 230V 100 V 5 mS
2) ZERO CROSS DETECT 5 V 5 mS
3) Zerocross_TTL PULSE 5 V 5 mS
4) GATE PULSE OF TRIAC (50uS) 5 V 5 mS
5) TRIAC OUT PUT 100 V 5 mS

Triac output

Conclusion:

In house developed Capacitor Bank Charging circuit using Microcontroller and TRIAC for one capacitor bank is successfully demonstrated in Aditya. Similar system will be developed for total 4 different capacitor bank.