# SPECIFICATION OF ESP CONTROLLER

## Preface:

The new ESP controller is to be designed for **Single Phase** operation. The Hardware /Software for single phase ESP Controller shall be designed and developed for below features.

## Input Supply:

24V AC ±20% i.e. (19.2V to 28.8V), 50/60Hz ±7.5%, Single Phase

**Human to Machine Interface (HMI)**

HMI is a part of controller. 20 Character X 4 lines Alphanumeric LCD display for displaying the various parameter settings, actual status, alarms, trips etc. 16keys keyboard for the setting of various parameter values.

## Microcontroller:

**16/32 bit DSP based high speed Microcontrollers** are used for the measurement, calculation, monitoring of analog input feedback signals, controlling output signals, generating SCR firing signals, remote communication and for HMI.
Interrupt based instant spark detection and spark rate control.

**Measurement & Calculation of Analog Input:**

**a) Analog Input:**

1) **VP: Input Voltage (0-5VAC@rated 415VAC)**
2) IP: Input Current (0-5VAC@rated CT of 1A)
3) VS: Output Voltage mean (0-400uA@ rated kv peak)
4) Is: Output Current mean (0-1V@ rated mA)
5) Analog Input: 0 – 20mA (For opacity measurement)

**b) Calculation and indication of parameters:**

1. **VP: Input Voltage**
2. IP: Input Current
3. VS: Output Voltage mean
4. VS: Output Voltage Peak
5. Vs: Output Voltage Trough
6. IS: Output Current Mean
7. Mains Frequency
8. Output KW
9. Output KWH
10. Opacity
11. Firing angle

**c) Analogue Outputs**

1. Remote Indication for Secondary mA: 0mA – 20mA / 4mA – 20mA

2. Remote Indication for Secondary kv: 0mA – 20mA / 4mA – 20mA

**d) Modes of operations**

1. **Constant Current output** with limits as output voltage, Primary current, firing angle, this is default mode of operation
2. **Constant voltage output with limits as output current, Primary current, Firing angle.**
3. **Load Status:** This may be Constant Current / Constant Voltage.

**Functions shall be incorporated in modes of operations:**

4. Spark rate control
    a. Drop control in terms of % of Current / voltage of pre-sparking condition
    b. Spark rate setting 1 to 75
    c. Spark counting
    d. Fast Recovery control after spark

5. Back Corona Detection and control
    a. Starting point of Back corona test shall be current / voltage level in % of rated
    b. Back corona step shall be in % of rated
    c. Back Corona stabilization time range shall be 1 Min to 720 Min
    d. Back corona sampling time shall be 5 S to 120 S

6. Semi Pulse mode of operation
    a. Odd charge ratio
    **b. Even charge ratio**

7. Rapper Controls
    Motorized Rapper
    **a. Four independent RTC based rapper controls**
    b. Potential free relay outputs for rapper controls
    c. Continuous ON mode of operation
    d. Independent operation of rapper without HT On.

8. **Dimmer mode of operation** (Open Loop manual control) shall be provided for testing purpose.

**Digital Inputs:**

1) Contactor On : NO
2) Load status 1 : NO
3) Rapper Reduction : NO
4) Spare -1 : NO
5) Spare - 2 : NO

**Alarm Input:**

1) TR Temperature : NO
2) Top Float / Oil level low : NO
3) Rapper 1 feedback : NO
4) Rapper 2 feedback : NO
5) Rapper 3 feedback : NO
**6) Rapper 4 feedback : NO**

**Trip**

7) TR Temperature – Trip : NC
8) Bottom Float / TR Pressure High : NC
9) SCR Temperature high : NC
10) HT Interlock : NC
11) Overload Trip : NC

Alarm / trip text shall depend upon the type of TR set.

For hermetically sealed TR sets

Oil level Low

TR Pressure High

For conventional TR set

Top Float

Bottom Float

**Optional Configurable Alarms / Trips**

12) Optional Alarm / Trip 1 : NO
13) Optional Alarm / Trip 2 : NO

For external alarms / trips / signals / digital inputs 24 V DC with opto coupler to be used.

**Internal software Alarm / Trips**

1) AC Current High Trip
2) Synchronization Fail Trip
3) DC Under Voltage Trip
4) DC Overvoltage Trip
5) Contactor error Trip – Trips if after HT On command the main contactor is not picked up within 1 second.

**Accept Reset Logic**

When alarm/trip fault occurs, LCD flashing alarm/trip message on screen with frequency 2Hz and buzzer will be ON.

Press 'RESET' key to acknowledge the alarm/trip. Once RESET key pressed, LCD shows steady alarm/trip message on screen and buzzer will be OFF.

Press ‘RESET’ key twice to clear alarm / trip messages.

**Digital Output**

Though Potential Free Relay contacts rated at 5A @ 28VAC (Max.) The relay coil shall be preferably 24 V DC

1) HT ON – Potential free contact
2) HT OFF – Potential free contact
3) Local / Remote HT ON
4) Rapper 1 – Potential free contact
5) Rapper 2 – Potential free contact
6) Rapper 3 – Potential free contact
7) **Rapper 4 – Potential free contact**
8) Alarm fault – Potential free contact
9) Buzzer – Potential free contact
10) Heater – Potential free contact

**Communication Interface:**

1) Two RS 485 Ports i.e. Port1 and **Port2** for MODBUS Communication with DCS, PLC etc.
2) Each ESP controller has facility to set unique device address using keypad only
3) Baud rate: 9600bps, **19200 bps**, **38400bps** Selectable through keypad only

**PWM Port Output to Generate**

1. Positive SCR ignition – Digital signal for single phase TR.
2. Negative SCR ignition – Digital signal for single phase TR.
3. Remote Indication for Secondary mA
4. Remote Indication for Secondary KV