R050 - GENERAL PROGRAM FLOW - CRITICAL IO - MONITOR SYSTEM

Void setup(){//setup machine, io expanders, etc}

void loop(){

```
//calculate timing parameters(currentMillis,LoopTime)
//functions to monitor system conditions ie gather data about machine
errorChecker()
connect_IO_Expanders()
SensorIntegrityCheck()//in case error occurred
superHeatTest()
readTCs()//thermocouples
readBtn()//grn,amb,estop
readOCI()//rs485 interface to
readPTs()//Pressure transducers
blinkGRN()//blink green button indicator, if pressed hold indicator on
blinkAMB()//blink amber button indicator, if pressed after state stabilize, hold on,
readOut()//writing data to daughter board
readAI()//read feedbacks fcv134, blower_fb, waterPump_fb, fcv141, ft132
rampWaterPump()//if state >=DEPRESSURIZE ramp water pump speed +=10% per 10 seconds
GUI()//send data to GUI for system monitor

if(GRN_BTN_FLAG && !ESTOP){

 switch(MACHINE_STATE){

        case INITIALIZE:
                -Check signal integrity if error occurred or machine first start up.
                        fcv134
                        fcv141
                        wp_fb
                        blwr_fb
                        ft132_fb
                        PTs
                        Tcs
                        OCI417

                - Activate Dynamic Pressure Switch
                        BLOWER set to Purge Speed
                        turn off when condition met else causes issues with BMM

                -Check there is gas
                        DUN_PSL
                        DUN_PSH

                -Check if water
                        Need PT for this. Just checked visually for now
```

R050 - GENERAL PROGRAM FLOW - CRITICAL IO - MONITOR SYSTEM

-make sure flame is out, (potential to stay lit so make sure its out)
OCI417.BMM_PROOF_OF_FLAME
fcv134 closed
fcv141 closed

-set solenoids/valve to proper position
twv308 point to steam exhaust
xv1100 closed // used for nitrogen purge
xv501 closed // supplemental air used for cooling sr_tubes
BMM_CR2 off
TWV901 point to vent
XV909 open// for depressurization

if all conditions are met in this order move to DEPRESSURIZE

case DEPRESSURIZE:
-depressurize system
PT304 < 10PSI
PT318 < 10PSI
PT213 < 10PSI
PT420 < 10PSI
-if PTs < 10PSI
close xv909

if all conditions are met in this order move to SUPERHEAT_TEST

case SUPERHEAT_TEST:
-BLOWER TO PURGE SPEED
-FCV205 TO 35%
-WATER PUMP to 10g/s ~23HZ

-Timer for 5 seconds(configurable) check for super heat
-TT303 and TT301 should be similar Usually 150C or so.
-No higher than 300C??
note: also have a function that consistently monitors superheat

if all conditions are met in this order move to BMM_OFF

case BMM_OFF:
-Timer: 30 seconds
BMM_CR2 is off
Blower speed is off.

if all conditions are met in this order move to BMM_ON

R050 - GENERAL PROGRAM FLOW - CRITICAL IO - MONITOR SYSTEM

case BMM_ON:
-timer 5 seconds
BMM_CR2 ON

if all conditions are met in this order move to BMM_PURGE

case BMM_PURGE:
-Timer 30 seconds
-BMM_CR2 ON
-Blower at purge speed(configurable)

if all conditions are met in this order move to BMM_IGNITION

case BMM_IGNITION:

-Blower at ignition speed(configurable ~8%)
-FCV134 open to ~35%
-timer 25 seconds
-monitor TT511 and TT512 and OCI417.BMM_POF
-if swift rise in TT511 or 512 or OCI417.BMM_POF is true

move to BMM_RAMP

case BURNER_RAMP:

-timer 45mins (configurable)

-timer 4min
-ramp blower to ~60%(configurable)
-monitor TT511 and TT513 target temp is ~850 C or SRTUBEs ~650C

if ~850C within 45mins move to STEAM_GEN
else BURNER_RAMP again

case STEAM_GEN:
-Timer 30 mins
- adjust blwr speed with PID controller watching PT304 to reach 170PSI
-hold pressure for 10 seconds

if all conditions are met in this order move to OPEN_SR_FUEL
else INITIALIZE

R050 - GENERAL PROGRAM FLOW - CRITICAL IO - MONITOR SYSTEM

case OPEN_SR_FUEL:
-point TWV308 to reformer
-open XV801
-FCV205 opened to 50%
-timer 3 mins. If falls out of threshold of .3g/sec reset timer but keep trying.
-PID controller on FCV141 monitoring FT132 to get a flow of ~.3g/sec
-PID controller on FCV134 monitoring TT511 and TT513 to get 880C

if all conditions are met in this order move to IDLE

case IDLE:
-timer 3mins
-PID controller adjust blower for 170 PSI at PT304
-PID controller adjust fcv134 for TT511 or TT512 880C

case STABILIZE:
-monitor SR_TUBES and adjust blower and fcv134 for ~650 at SR_TUBES
-if AMBER button is pushed point TWV901 to PSA SKID
-open xv501 for supplemental air to cool SR_TUBES
-watch for superheat and adjust wp to quench if TT301 and TT303 spike
-Adjust blower for 170 PSI at PT304
-Check for erroneous conditions and reset to INITIALIZEf if

}end switch case
}//end of if (GRN_BTN_FLAG && !ESTOP)
}//end void loop