How to design Dust Sensor

2013 Mar.

To begin with

- To make sure basic information of GP2Y1010AU0F
  - Refer to presentation of “ Dust Sensor “ total 13page w/o cover page
    - Circuit
    - Variation => Calibration
    - Mechanical Design Consideration
    - Power consumption
- Document
  - Spec
  - Application Note
  - Temperature Drift
  - Reliability

Standard Operation

Finish product: Air purifying system

Sensor Module

DUST SENSOR
TVOC
Temperature
Humidity
A/D
uP
Memory
Delta Vo
No Dust Vo
Real Dust Vo
Data Processing

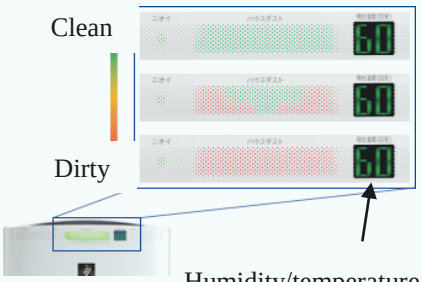
Interactive communication

Display

Dust condition

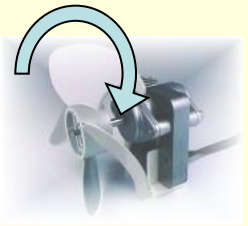
Clean

Dirty



Humidity/temperature/TVOC

Fan Rotation



Air purifying system

Power ON

Interactive communication, initializing, check the command

Waiting 30sec

Sampling Start: 64times & Averaging

Monitoring **"Real Dust Vo"**

Check No Dust Update

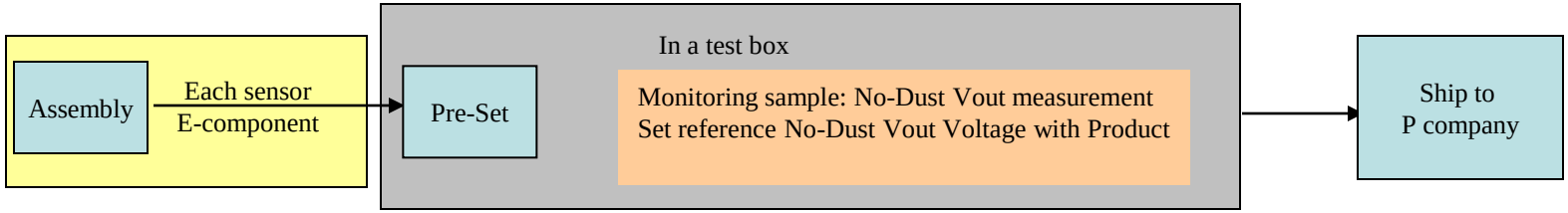
Up date: **"No Dust Vo"**

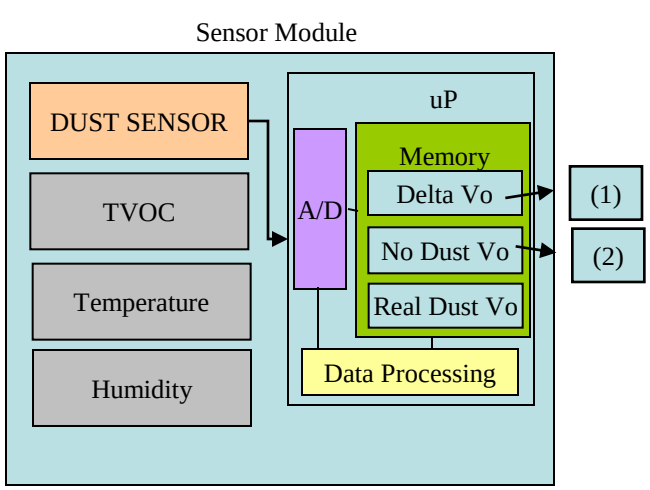
Calculation: data-Processing **Dust Vo= "Real Dust Vo – No-Dust Vo"**

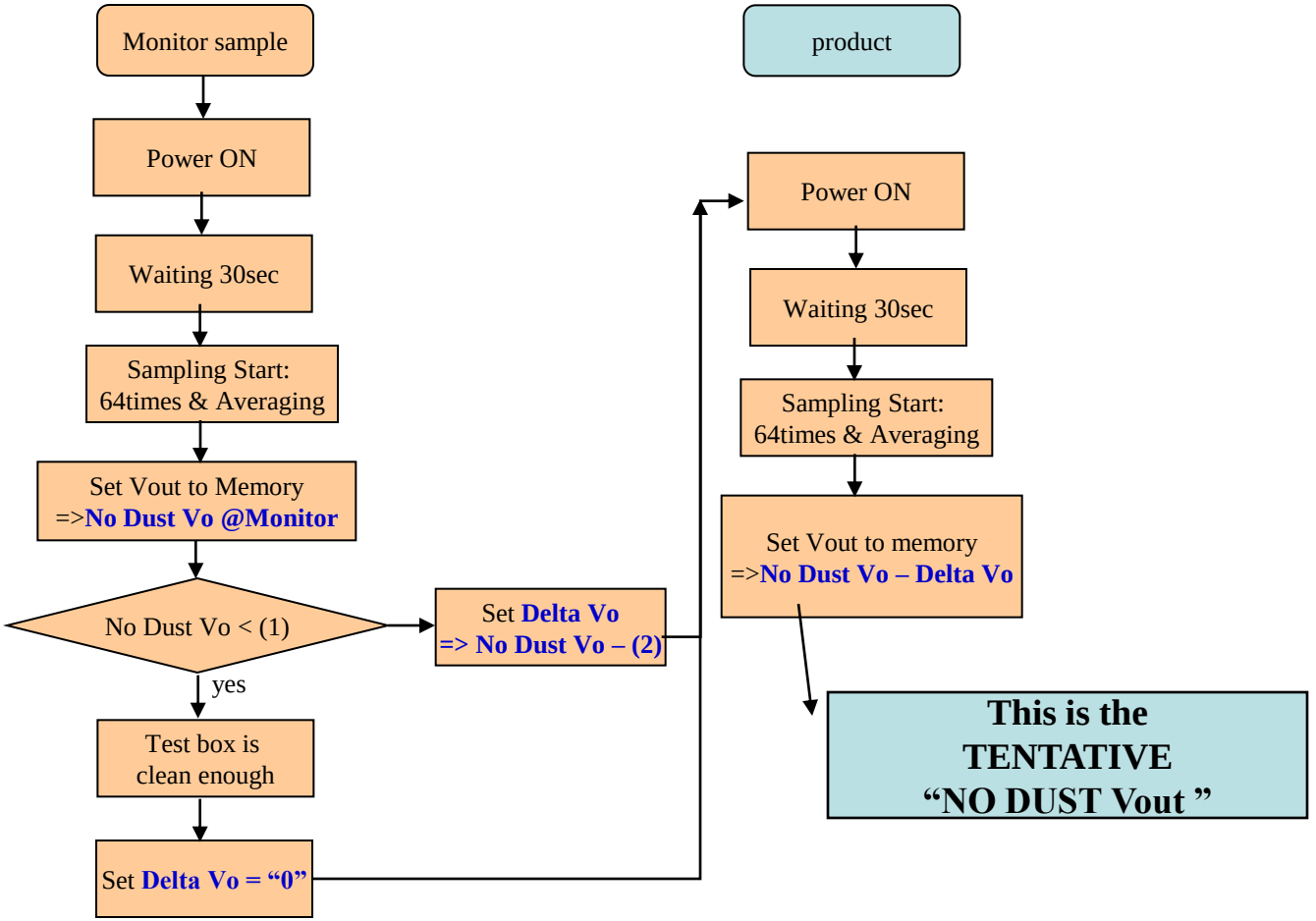
According to the Value of Dust Vo, How to operate Fan Rotation or Display indication can be set.

No-Dust Condition: Set tentative No Dust Vout

Assembly line:







(1): refer to the number from monitor sample
For example less than 1.0V equivalent to 0.05mg/m^3
@ monitor sample # 1

(2) : Vout @ No dust condition by Monitor sample
For example, 0.8V @ sample #1
if test box is not clean enough, No dust Vo
should be calculated as compensation number as follows;
No Dust Vo' = No Dust Vo - Delta Vo
Please refer to next page 3

How to update ? No-Dust Vout

When starting air purifying system as finish product, air cleaner,
"No-Dust Vout" should be updated accordingly as following conditions;

No Dust check when starting

1, When starting air purifying system like fun-rotation,
comparing Real Dust Vo with No Dust Vo(tentative one) which was set before shipment.
if Real Vo < No Dust Vo => replace the Real Vo to No Dust Vo
=> Then this will be the latest No Dust Vo

More clean condition

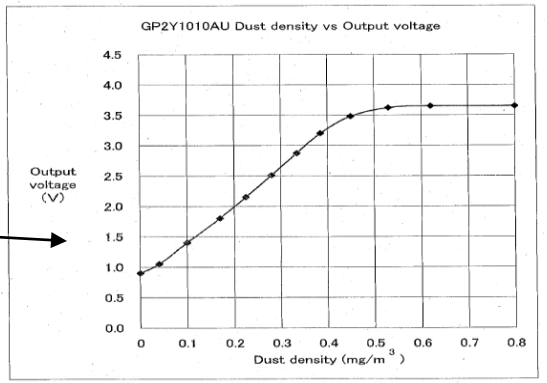
2, When operating if find the cleaner condition such as Real Vo < No Dust Vo,
=> replace the Real Vo to No Dust Vo => Then this will be the latest No Dust Vo

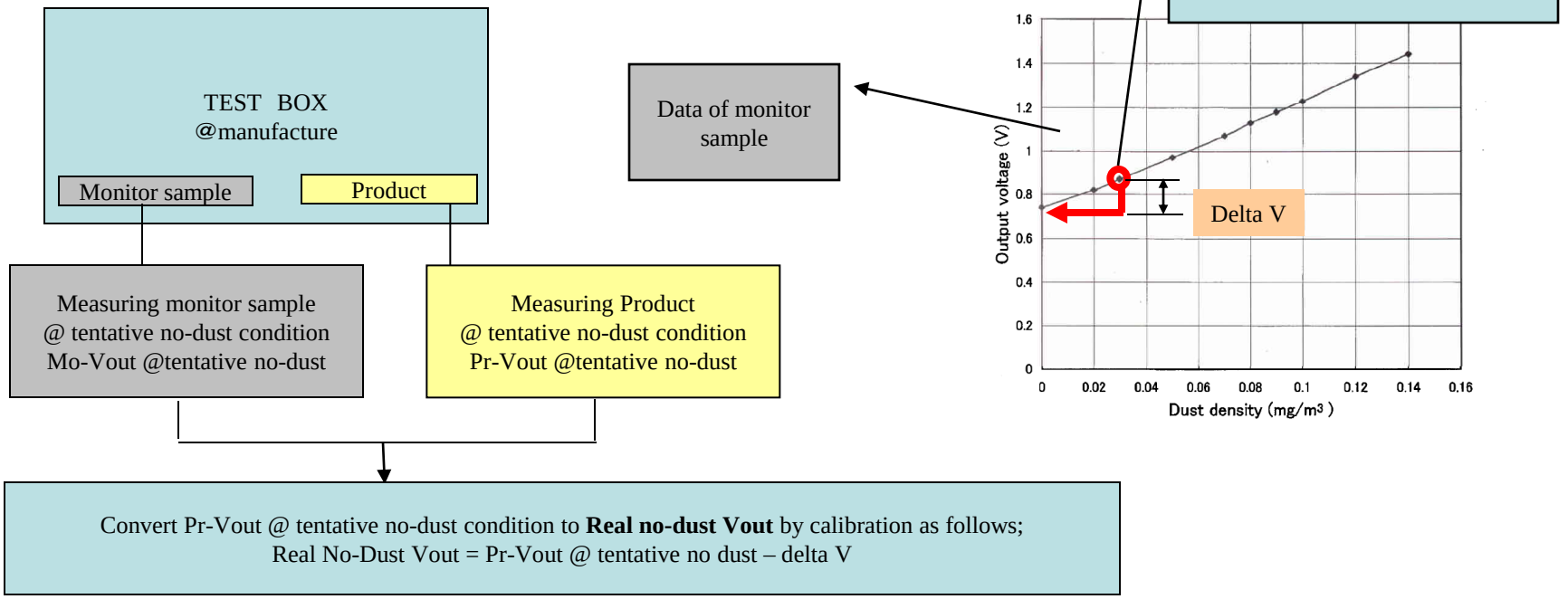
Compensation of unexpected incident

3, When operating if find steady Vo for long term,
=> replace the Real Vo to No Dust Vo => Then this will be the latest No Dust Vo

Proposal of calibration for no-dust condition

- **process**
  - Sharp makes monitor sample (3pcs)
    - Monitor sample has data of Vout vs. Dust density
    - Data should be shown low density condition such as 0 to 0.1mg/m3.
  - Manufacture can use this monitor sample and set initial tentative no-dust condition
    - Monitoring the value of monitor sample and convert the Vout to initial tentative no-dust condition for mass production board of Manufacture.

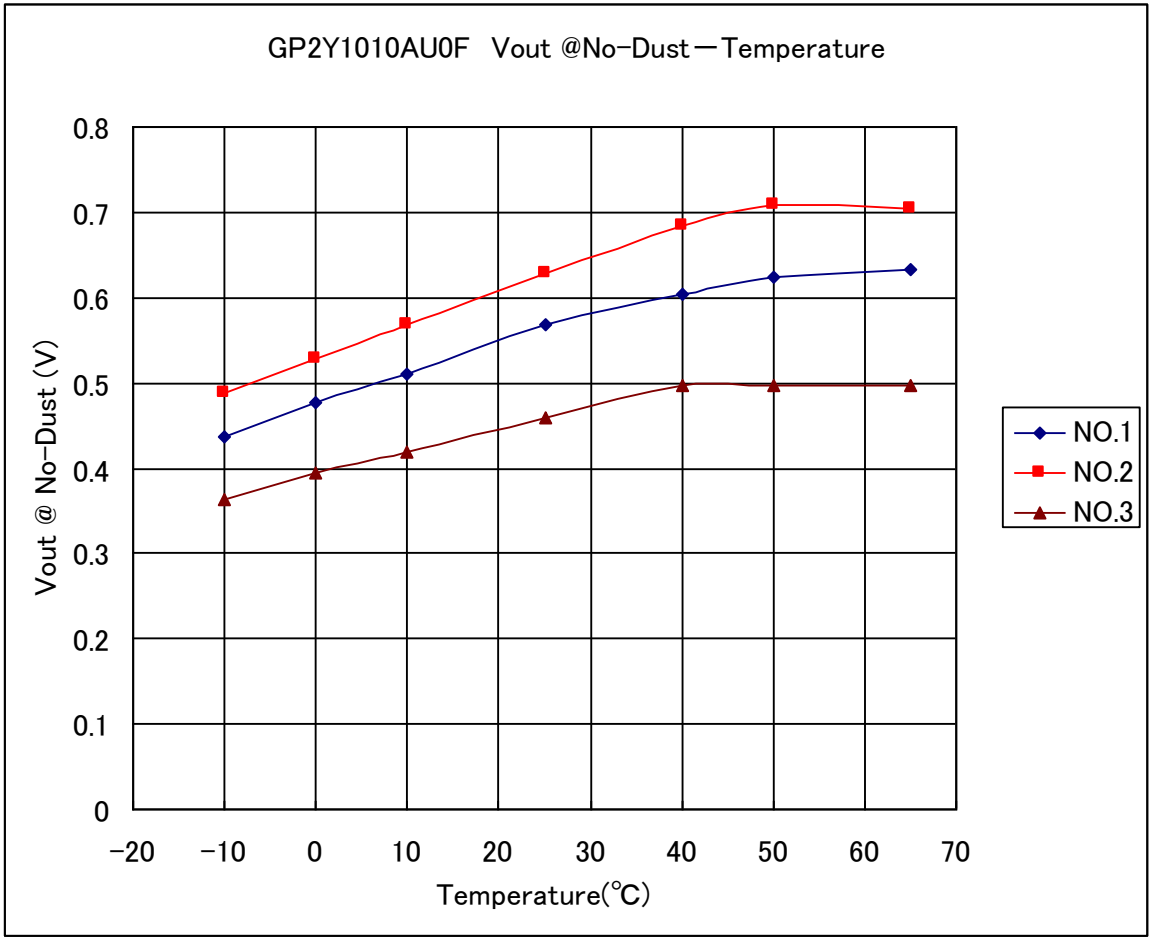




Variation

- Calibration
  - No-Dust Vo
    - Refresh/Update as latest cleaner condition
    - Dust Density Vo = Real-Dust Vo – No-Dust Vo
      - Value of Dust Density can be used for set thresh level of starting fan rotation or segmentation of the Dust density level on Display
- Compensation
  - Temperature Drift
    - Normalize the value for compensation: from 0 to 50 degree C
      - Please refer to attached graph of temperature drift
  - Time Aging
    - TBD
      - can be ignorable ?

Vout @ No-Dust condition vs. Temperature



Impact of contamination for Sensor Output

-**Test concept**

-To measure the impact of contamination for Sensor Output

-**Test Method**

-Take the date of K(Sensitivity) and Vout @ no-Dust for the sensor

-Set the sensor in the test box (W50 x H50 x D50cm).

-Smoke 1pcs of Cigarette completely and pour the smoke into the test box.
And keep the condition for 20 minutes. => It's the one cycle.

-Repeat above process for N times and take the date of K(Sensitivity) and Vout @ no-Dust for the sensor

Variation of Vout(sensitivity) (%) = (K(Sensitivity) after N times)/Initial K(Sensitivity)

Variation of Vout @ No-dust (%) = (Vout @ No-dust after N times/Initial Vout @ No-dust)

-**Note**

-This is acceleration test, so it can be equivalent to the real condition of smoking at room.

-Real condition of cigarette smoke = (Size of room) / (size of the test box) X (smoked cigarettes)

-For ex. Size of room(3.6m X 3.6m X 2.4m)/(0.5m X 0.5m X 0.5m) X 300= 74,649 pcs
It can be equivalent to 3,732 days with 20pcs smoking a day.