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CONFIDENTIAL INFORMATION

Compound MB calculation method

Meeting at JUMO

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azbil Group

Leaping Ahead from Yamatake's 100 Years
Human-centered Automation

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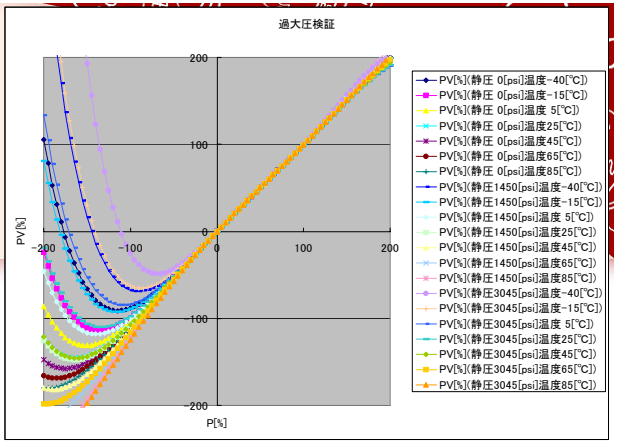
1. Definition of term

- Normal MB
  - Positive side characterized
- Compound MB
  - Both side characterized
- Positive side, Negative side
  - Positive side = pressing from HP side
  - Negative side = pressing from LP side

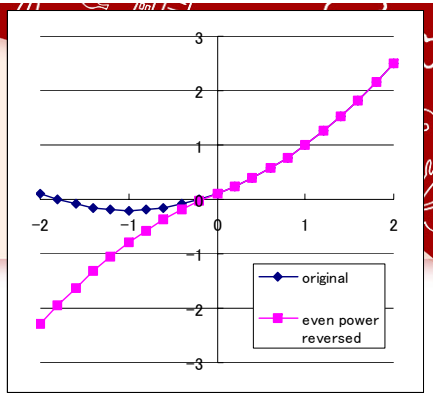
2. GTX3xD Comparison between normal MB and Compound MB

	GTX31D(normal)	GTX32D(normal)	GTX35D(compound)	
	standard differencial	high static pressure	base of remote-sealed	
Accuracy (positive side)	0.04%	0.10%	0.20%	
Accuracy (negative side)	approx. 5%	approx. 5%	0.20%	
Temperature effect	Zero:0.1% of 30degC Combined:0.15% of 30degC (ref.12.5kPa)	Zero:0.55% of 55degC Combined:0.8% of 55degC (ref.12.5kPa)	Zero:0.55% of 55degC Combined:0.8% of 55degC (ref.25kPa)	
Static Pressure effect	Zero:0.2% of 7MPa Combined:0.4% of 7MPa (ref.12.5kPa / SP<=21MPa)	Zero:0.18% of 7MPa Combined:0.33% of 7MPa (ref.20kPa / SP<=42MPa)	Zero:0.2% of 7MPa Combined:0.4% of 7MPa (ref.25kPa / SP<=5.25MPa)	
Turndown	200:1(min span)	40:1(min span)	40:1(min span)	
	10:1(0.04%)	20:1(0.1%)	8:1(0.2%)	
marking	刻印30D	刻印31D	刻印35D	
Calibration			zero calibration at input zero span calibration at URV	
MT flag	00H	00H	02H	
A/D Converter	AD7798	AD7798	AD7798	



3. Normal MB

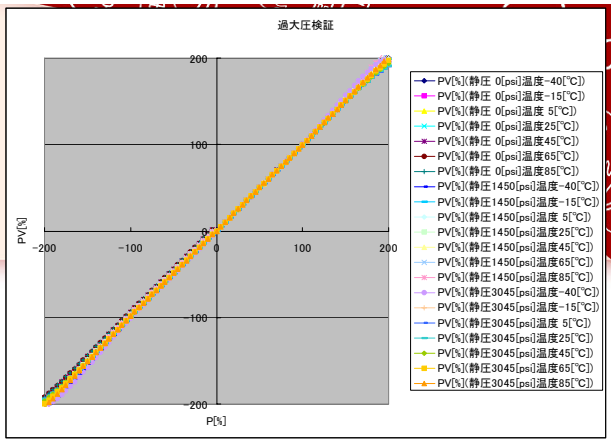
- calculation method on the negative side and purpose
  - The polynomial makes amends for accuracy on the positive side.
  - If the DP input has been determined to be in the negative range the sign of all the even powers (excluding zero) is reversed in order to prevent output turn around.
  - To provide a bumpless transfer between the forward and reverse equations the offset between the two at the switch point is calculated.
  - This number is then added to the linearized differential pressure signal.
  - It is not possible to provide for accuracy on the negative side.



- Idea of calculation of the negative side.
  - When the sensor characteristic is shown as an example by the following equation

$$y = ax^2 + bx + c \ (a \neq 0)$$

  - The top exists when this calculation type is operated from the plus to the minus as it is and the output is reversed. It becomes symmetry if the even number paragraph (Exclude the 0th) is reversed in the sign when subtracting it and the output becomes monotonous.



- Implementation of the negative side processing of Yamatake
  - Switch point
    - Change to the negative side processing @−50mV.
    - Decide the switch point based on the A/D value.
  - Offset correction
    - Correct the difference between the positive side calculation and the negative side calculation because the switch point makes the output discontinuous.

4. Compound MB

- Calculation method for compound MB
  - Same compensation algorithm with normal MB of positive side.
  - The calculation formula need not be switched by the input.
  - Calculate all processes from the possible side to the negative side continuously.

5. Calculations of model other than GTX3□D

	calculation type	pos. calc	neg. calc	Measuring range	MT
GTX1xD	compound	compound	compound	−1 to 1 kPa	02H
GTX3xD	normal	normal	reverse	−100 to 100 kPa	00H
GTX3xD	compound	compound	compound	−100 to 100 kPa	02H
GTX4xD	normal	normal	reverse	−100 to 700 kPa	00H
GTX7xD	normal	normal	reverse	−100 to 14 MPa	00H