Data conversion sheet of VW strain gage

[Division]

Model	1210	1215	1220	1230	1240
Products	VW Spot weldable strain gage	VW Soilnail strain gage	VW Weldable strain gage	VW Shotcrete strain gage	VW Concrete embedment strain gage
Main uses	Measurement of strain in steel member after spot welding/or epoxy potting		Measurement of strain in steel member after arc welding	Measurement of strain in tunnel shotcrete	Measurement of strain in mass concrete
Range (με microstrain)	3,300		3,000	3,000	3,000
Initial setting value(Hz)	2,050		900	1,800	900
Gage Factor (G·F)	0.3911		4.062	0.7756	3.304
Coefficient of Linear expansion	12×10^{-6} strain/℃ (where, 10^{-6} = 0.000001)				
Readout unit	Readout and Data logger which can measure VW sensor or any products of any company can be interchanged, and when you use the readout which has the rate of transformation mode, measuring with the rate of transformation which has the same Gage Factor is very convenient. If it doesn't has the rate of transformation mode or you use the Readout which was produced by other companies, measure it by Hz or μsec and substitute a following calculation formula				

[Calculation method]

Section	In case of measuring by frequency Mode(Hz)	In case of measuring by period Mode(μsec)
Calculating strain(με)	$G{\cdot}F \times 10^{-3} \times F^2$ G·F = Gage Factor 10^{-3} = 0.001 F = Measured value by Hz(Frequency)	$G{\cdot}F \times 10^{9} / N^2$ G·F = Gage Factor 10^{9} = 1,000,000,000 N = Measured value by μsec(period)
Calculation of real(Δ) strain(με)	Current(με) - initial(με) - $(T_{cc}-T_{cs}) \times (T_{current}-T_{initial})$ T_{cc} : Coefficient of linear expansion of concrete (10×10^{-6}/℃) T_{cs} : Coefficient of linear expansion of metal goods (12×10^{-6}/℃) $T_{current}$: Measured values of current temperature $T_{initial}$: Measured values of initial temperature	
Correction temperature	1. When the long term measurement or the precision measurement is needed, as above calculation formula, you have to revise temperature to reduce an error by an expansion coefficient. 2. In the case of steel materials and concretes, when their temperature is not stable, you can make a mistake that stress is strong by temperature's instability. 3. In the case of steel materials, as the sensors' expansion coefficient and steel materials' expansion coefficient is same, you don't need to revise the temperature of sensors.	

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[Calculation of stress or press]

Stress (σ: kg/cm^2)	$\sigma = \Delta\mu\varepsilon \times 10^{-6} \times E$ $\Delta\mu\varepsilon$ = Current (με) - initial (με) E = Elastic modulus of object material (kg/cm^2)
Press (P : kg)	$P = \sigma \times A$ A= Area of object (cm^2)

Elastic modulus of metal : 2.1×10^6 (= 2100000 kg/cm^2)

Elastic modulus of concrete : Must confirm correctly the concrete elastic modulus, because it is various from $1.4 \times 10^5 \sim 2.6 \times 10^5$ (kg/cm^2).

[Calculation example]

Install the device of vibration rate of transformation that can be attached by welding on a metal plate that has area of 300cm^2 (elasticity modululs : $2.1 \times 10^6 kg/cm^2$), and then measure the initial value(1,000Hz) and the current value(1,050Hz). And you can find out press(kg/cm^2) and load(kg) as the following.

* microstrain(με) = $G{\cdot}F \times 10^{-3} \times F^2 = 4.062 \times 0.001 \times 1050^2 = 4478.35$

1. Real microstrain(Δμε) = Current strain(με/current) – Initial strain(με/initial) = 4478.35 - 4062 = 416.35
2. Stress(σ:kg/cm^2) = $\Delta\mu\varepsilon \times 10^{-6} \times E = 416.35 \times 0.000001 \times 2100000 = 873.43$
3. Press(P:kg) = $\sigma \times A = 873.43 \times 300 = 262300.5$