

## SECTION 4

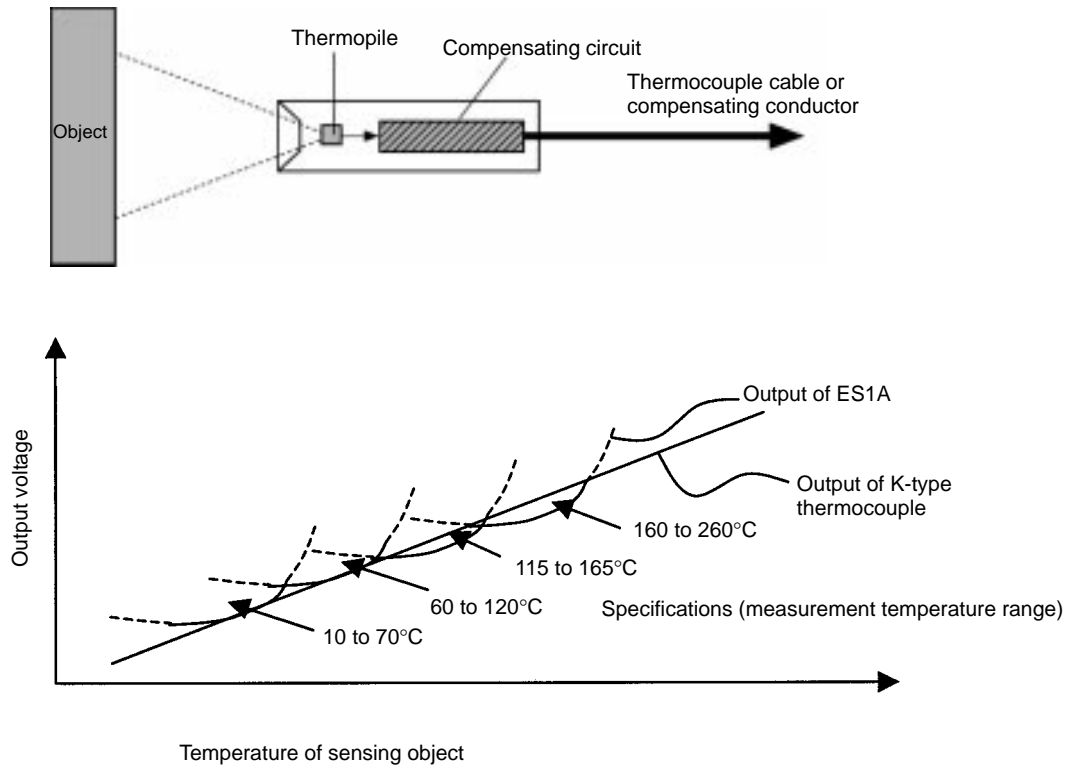
### Operation Principle

This section provides the ES1A operation principle and causes of errors.

4-1	Operation Principle .....
4-2	Causes of Errors .....
4-2-1	Impedance .....
4-2-2	Radiation Rate .....
4-2-3	Error Factors .....

## 4-1 Operation Principle

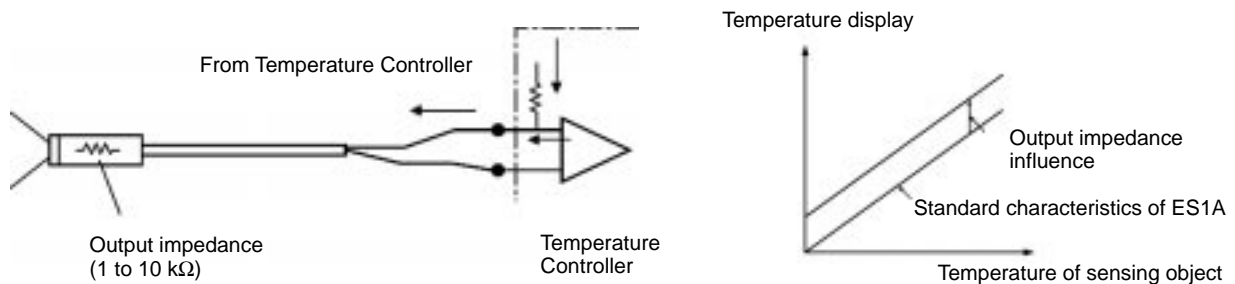
The thermopile of the ES1A receives infrared rays within a wavelength range between 6.5 and 14  $\mu\text{m}$  that is a part of thermal energy radiated from the sensing object and the thermopile converts the infrared rays into voltage output. In order to use this voltage output in place of K-type thermocouple output, the voltage output is compensated so that it will be almost linear and as close as possible to the output of the K-type thermocouple.



## 4-2 Causes of Errors

### 4-2-1 Impedance

The output impedance of the ES1A is 1 to 10  $\text{k}\Omega$ . Usually, the Temperature Controller has a burnout-detecting current. Therefore, an offset of several degrees to several tens of degrees Celsius will result.



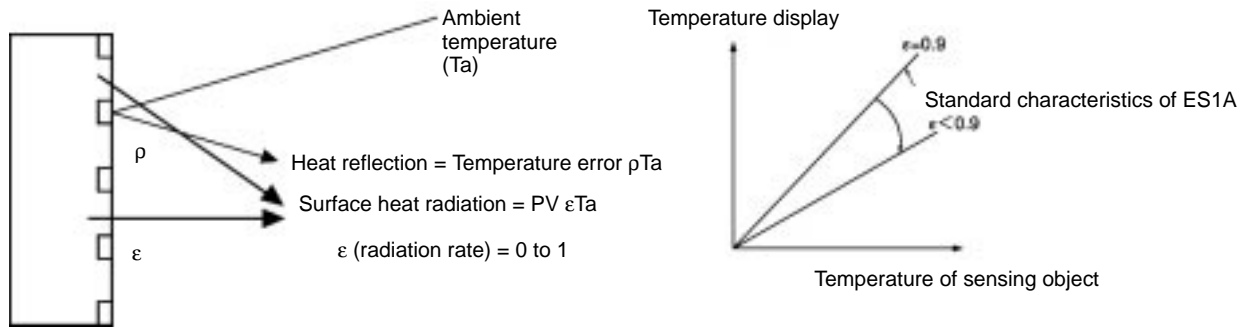
### 4-2-2 Radiation Rate

If the sensing object's radiation rate  $\epsilon$  is less than 0.9, the ambient temperature will affect the Sensor. The radiation rate of a metal surface is generally very low. Therefore, it is difficult to measure the temperature.

#### Relationship between Radiation and Reflection Rates

The sensing object radiates and reflects heat (i.e., infrared rays). Its material and surface conditions determine the infrared radiation and reflection rates of the sensing object. The total of these rates is always constant.

$$\epsilon \text{ (radiation rate)} + \rho \text{ (reflection rate)} = 1$$



### 4-2-3 Error Factors

The actual output voltage of the ES1A is affected by the compound influence of the above impedance and nonconformity of the radiation rate.

