

gqgbwmsn cwj‡UKwbK
Bbw÷wUDU,
gqgbwmsn|
cÖwZôv‡bi †KvWt 57067
‡UK‡bvjwRt B‡jK‡U^av‡gwWKvj
‡UK‡bvjwR †KvWt 86

AVMIZ



wkyK cwiwPwZ
#gvt gwngyji nvmvb
mygb



Rywbqi B'U^av±i
(B#jK#U^av#gwWKvj)
gqgbwmsn cwj#UKwbK
Bbw÷wUDU,
gqgbwmsn|
#gvevt 01992008229

welq cwiwPwZ

welq̄i bvḡt †gwWK̄j
U^av[́]wWDmvi A^üŪ †m[́]Yim
welq †KvWt 28631
ce©t Z...Zxq
wkdUt 1g/2q

Aaüq-1

U^avÝwWDmvi Ges †mÝ‡ii avibv

(Understand Transducer and Sensors)

Av‡jvPöwelq

- ‡mÝi , U^avÝwWDmvi mαú‡K©
aviYv jvf Kiv|
- †mÝ‡ii †mbwms cÖ‡mm mαú‡K©
Rvbv
- U^avÝwWDmv‡ii ‡kÖwYwefvM
- AävKwUf , cüwmf U^avÝwWDmvi
Kx?

‡mÝi (Sensors) Kx ?

†mÝi Ggb GKcÖKvi wWfvBm, hv
†Kv‡bv wdWRKvj †Kvqvw>UwU‡K
(ZvcgvÎv, miY, Pvc, ej, kã,)
bybZg Ae⁻'vb n‡Z kbv³ Ki‡Z cv‡i
Ges AwZ ^{`a}æZZvi mv‡_
U^avÝwWDmv‡ii gva‡g
B‡jKwU^aKvj wmMbvj ifcvšÍi Ki‡Z

U^avÝwWDmvi

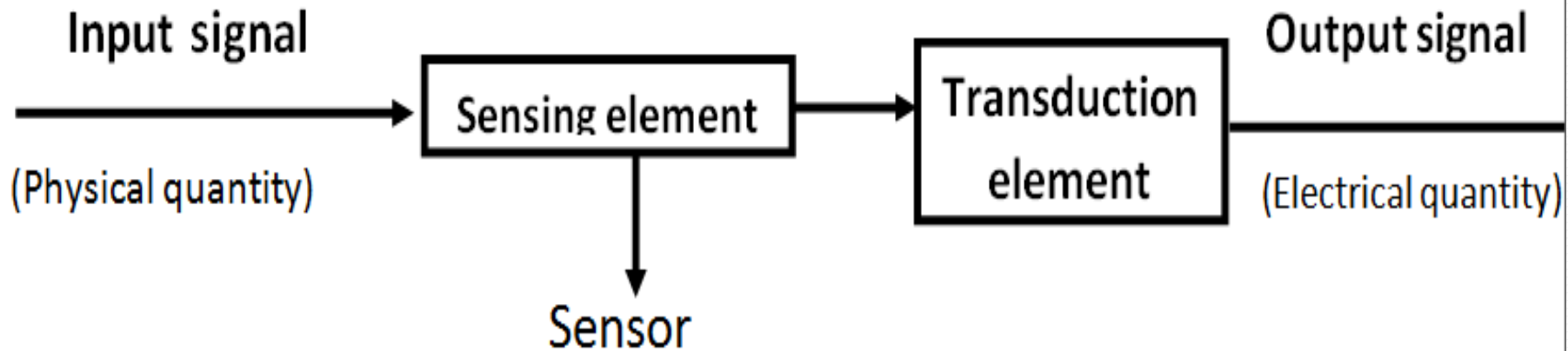
(Transducer)Kx ?

U^avÝwWDmvi GKwU we[‡]kl
cÖK...wZi wWfvBm, hv Øviv
‡mÝi n[‡]Z cÖvß †Kvqvw>UwU[‡]K
A_©[‡]evaK B[‡]jKwU^aKvj wmMb[‡]v[‡]j
ifcvšÍi K[‡]il †h wWfvB[‡]mi mvnv[‡]h^{..}
kw³[‡]K GK-ifc n[‡]Z Abif[‡]c ifcvšÍi
Kiv nq, Zv[‡]K U^avÝwWDmvi e[‡]j|

†mY‡ii †mbwms cO‡mm

g~jbxwZ

wb‡æœ GKwU †mY‡ii †mbwms
cO‡mm eøKwP‡Gi gva‡g †`Lv‡bv
n‡iv





U^avÝwWDmvi Ges †mÝ‡ii avibv

(Understand Transducer and Sensors)

U^avÝwWDmvi‡ii

‡kÖwYwefvM

(K) U^avÝwWDmvi‡K g~jZ wZb fv‡M fvM
Kiv n‡q‡Q|

• B‡jKwU^aKvj U^avÝwWDmvi

• ‡gKvwbKvj U^avÝwWDmvi

• B‡jK‡U^avvgKvwbKvj U^avÝwWDmvi|

(L) cvIqvi Drcv`‡bi Dci wfwË K‡i
cÖvÝwWDmvi `yÕcÖKvi, h_v-

(1). AÿKwUf U^avÝwWDmvi (2). cÿwvf 11

U^avYwWDmvi

‡kÖwYwefvM

(M) Kvh©cÖYvwji Dci wfwË K‡i U^avYwWDmvi
`yÖcÖKvi,h_v-

(1). cÖvBgvwi U^avYwWDmvi (2). †m‡KÛvwi
U^avYwWDmvi

(N) B‡jKwU^aKvj %oewk‡ói Dci wfwË K‡i
U^avYwWDmvi wZbcÖKvi,h_v-

(1). ‡iwRw÷f U^avYwWDmvi, (2). BÛKwUf
U^avYwWDmvi,

(3). KücvwmwUK U^avYwWDmvi|

(O). wmMbvj AvDUcy‡Ui Dci wfwË K‡i

AvKwUf

U^avÝwWDmvi Kx ?

†h U^avÝwWDmv‡ii mvnv‡h

AvDUcyU ‰Zwi‡Z evwnK kw³

ev Dr‡mi cÖ‡qvRb nq bv, Zv‡K

AvKwUf U^avÝwWDmvi e‡j|

†hgb- d‡Uv‡fvävBK I

wc‡RvB‡jKwU^aK

cüwmf U^avÝwWDmvi

Kx?

- th mKj U^avÝwWDmv‡i
AvDUcyU Žwi‡Z †Kv‡bv evwnK
kw³ Dr‡mi cÖ‡qvRb nq, Zv‡K
cüwmf U^avÝwWDmvi e‡j

†hgb- †÷^aBb †MR I _vwg© ÷i|

U^avYwWDmvi wbev©P‡b

we‡eP[˙]welqmg~n

wewfbœ wdwRKÿj ‡Kvqvw>UwU cwigvc
Kivi Rb[˙] wewfbœ ai‡bi U^avY[´]wWDmvi
i‡q‡Q| U^avY[´]wWDmv‡ii gva‡g Gme
cwigvcK,,Z ivwk‡K mwVKfv‡e cwigvc Kivi
Rb[˙] wewfbœ c×wZI i‡q‡Q| Gme
U^avY[´]wWDmvi wbev©P‡bi tÿ‡Î
wbœœwjwLZ welqmg~n we‡ePbvq Ab‡Z
nq|

1| mwVKZv t cwigvcK...Z ivkwU cÖK,,Z gv‡bi
KZUzkz KvQvKvwQ AvDUcyU cÖ`vb K‡i Zv

U^avYwWDmvi wbev©P[‡]b

we[‡]eP[˙]welqmg~n

2| Kvh©bxwZ t A[‡]bK mgq Kvh©bxwZi Dci wfwI
K[‡]i U^avYwWDmvi wbe©vPb Kiv nq|
U^avYwWDmv[‡]ii Kvh©bxwZ †iwRw÷f,
BÛvKwUf, KÛcwmwUf I wc[‡]RvB[‡]jKwU^aK n[‡]Z
cv[‡]i|

3| ms[‡]e`bkxjZv t U&^avYwWDmv[‡]ii
†mbwmwUwfwU ej[‡]Z AvDUcyU B[‡]jKwU^aKÿj
wmMbÿj I BbcyU wmMbÿj ev bb-B[‡]jKwU^aKÿj
†Kvqvw>UwUi AbycvZ[‡]K eySvq| ZvB
U^avYwWDmv[‡]ii wbe©vP[‡]bi †ÿ[‡]G AekB
†mbwmwUwfwU[‡]K we[‡]ePbvq Avb[‡]Z n[‡]e|

U^avYwWDmvi wbev©P≠b

we≠eP[˙]welqmg~n

5| Kvh©KvwiZv mxgvt U^avYwWDmv≠ii
Kvh©mxgvi g[±]a[˙] fv[±]fv tiRy[±]jk b †c[±]Z n[±]j
U^avYwWDmvi≠K †h Kv[±]R e[˙]venvi Kiv n[±]e, †m
Kv[±]Ri Dc[±]hvMx mxgv Abyhvqx U^avYwWDmvi
wbe©vPb Kiv ev[˙]Abxq|

6| †jvwWs B[±]d[±] t U^avYwWDmvi AekB D[˙]P
y[˙]gZvm[˙]úboe BbcyU Bw[˙]úW[˙]vY Ges wb[˙]oe
y[˙]gZvm[˙]úboe BbcyU Bw[˙]úW[˙]vY wewkó n[±]Z
n[±]e| GZ †jvwWs B[±]d[±] Kgv[±]bv hvq ev
me©wb[˙]oe gv[±]b ivLv hvq|

7| cwi≠ekM7 Ae[˙]vt U^avYwWDmvi wbe©vP≠bi

U^avYwWDmvi wbev©P[±]b

we[±]eP[·]welqmg~n

8| **Küwj[±]e^akbt** U^avYwWDmvi wbe©vP[±]bi tÿ[±]Î
Küwj[±]e^akb AwZ ,iæZ;c~b© welq| mg[±]qi mv[±]_
mv[±]_ K[±]Lv[±]bv K[±]Lv[±]bv Gi cwieZ©b Ki[±]Z nq|
ZvB U^avYwWDmvi wbe©vP[±]bi tÿ[±]Î Küwj[±]e^akb
we[±]ePbvq ivL[±]Z n[±]e|

9| **±iRy[±]jkbt** †Kv[±]bv cwicvKK...Z ivwki b~bZg
cwieZ©b[±]K wW[±]U[±] Ki[±]Z cv[±]i Ggb
U^avYwWDmvi wbe©vPZ Kiv evÃbxq|

10| **-'vwqZ; t** wPwKrmv tÿ[±]Î wewfboe cixÿvi
Kv[±]R GKB U^avYwWDmvi evi evi eëenvi Kiv nq|
ZvB U^avYwWDmvi wbe©vP[±]bi tÿ[±]Î -'vwqZ;¹⁸

Zvcgvîv cwigvck

U^avÝwWDmv‡ii bvg?

- 1. ‡iwR÷v̈Ý _©v‡gvwgUvi
- 2. _v‡gv©Kvcj
- 3. †mwgKÛv±i U^avÝwWDmvi|
- 4. _vwg©÷i
- 5. ‡iwR÷v̈Ý †Uαúv‡iPvi
wW‡U±I (RTD)

Abykxjbx cÖ#kœvËi

AwZ mswÿß t -1, 2, 6, 7, 8

mswÿß t -2, 6

iPbv gyjK t -3

[**wet** ^at GKvwaKevi tev#W© Avmv mKj AwZ mswÿß Ges
mswÿß cÖ#kœv co#Z n#e]

Z ïmsMÖnt

1. Medical Transducer & Sensors-Moniul , Anisur, Shamin (Text book)
2. www.wikipedia.org
3. www.google.com

Aaüq-2

_vvg© ÷‡ii avibv
(Understand Thermistor)

Av†jvP¨welq

- _vwg© ÷i , _v†gv©†iwR ÷i , G†`i †iÄ
mαú†K© aviYv jvf Kiv|
- _v†gv©-†iwuR ÷†ii †gŠwjK g~jbxwZ
- K†qKwU _v†gv©B†jKwU^aK c`v†_©i
bvg Rvbv
- wewfbœ c^aKvi _vwg© ÷i †cÖve
mαú†K© Rvbv
- v†av©†iwP : i I _vwg© : †ii

NTC (Thermistor)

R_x ?

NTC GK18 ZTCV15 ms⁻¹ x
+mwgK^Uv±i c`v_©, hv +gUvwjK A·vBW
±hgb- g^{1/2}vwbR, wb±Kj, +Kvevë, Kcvi
BZvüw` Øviv %oZwi nq| GwU FbvZœK
Zvcgv^Iv mnMwewkô nq| A_v©r Zvcgv^Iv
e,,wxi mv±_ +iwR÷v±Yi gvb Kg±Z _v±K|

- NTC mvaviYZ 90°C +_±K 120°C
Zvcgv^Iv cwigv±ci Rb`eënvⁱ nq Kiv nq

$g \sim jbxwZ$

$\#Kv\#bv$ $K\hat{U}v\pm i$ ev $cwievnxi$ $\dagger iwR\div\ddot{v}\acute{Y}$ $hw`$ $Zvcgv\hat{I}v$
 $cwieZ\textcircled{\#}bi$ $mv\#_$ $cwiewZ\textcircled{Z}$ nq A_vr $Zvcgv\hat{I}v$ $e,,w\times$ $\dagger c\#j$
 $\dagger iwR\div\ddot{v}\acute{Y}$ Gi gvb $e,,w\times$ $cvq,$ $Z\#e$ G $ai\#bi$ $c`v_ \textcircled{,}$ $\#jv\#K$
 $_v\#gv\textcircled{\#}iwR\div i$ $e\#j|$ $_v\#gv\textcircled{\#}iwR\div\#ii$ $\dagger h-mKj$ $c`v_ \textcircled{}$ $e\ddot{e}nvi$
 Kiv nq $Zv\#`I$ $g\#a`$ $c\textcircled{v}wUbg,$ $wb\#Kj$ I $Kcvi$ $D\#j\textcircled{L}\#hvM|$
 $GwU\#K$ $wb\#\alpha\textcircled{e}v^3$ $mgxKi\#Yi$ $mvnv\#h`$ $c\textcircled{O}Kvk$ Kiv $h\nu q-$

- $R_T = R_0 [1 + \alpha_1 T^1 + \alpha_2 T^2 + \dots + \alpha_n T^n]$
- $ev,$ $R_T = R_0 [1 + \alpha \Delta T]$
- $R_T = T^\circ C$ $Zvcgv\hat{I}vq$ $cwievnxi$ $\dagger iwR\div\ddot{v}\acute{Y}$
- $R_0 = \dagger idv\#i\acute{Y}$ $Zvcgv\hat{I}vq$ $cwievnxi$ $\dagger iwR\div\ddot{v}\acute{Y}$
- $\alpha = Av\#cw\ddot{y}K$ $Zvcgv\hat{I}v$ mnM
- $\Delta T = Acv\#iwUs$ I $\dagger idv\#i\acute{Y}$ $Zvcgv\hat{I}vi$ $cv_ \textcircled{K}|$

$_v\#gv\textcircled{\#}iwR\div i$ $cwRwUf$ $Zvcgv\hat{I}v$ $mn\#Mi$ nq $e\#j$ $GUvi$
 $\dagger iwR\div\ddot{v}\acute{Y}$ $Zvcav\hat{I}v$ $e..w\times i$ $maybv\textcircled{c}wZK|$

K≠qKwU

v≠gv©B≠jKwU^aK c`v©

- 1| Kcvi Kb ÷ v̈bUv̈b
- 2| Avqib Kb ÷ v̈bUv̈b
- 3| †μv≠gj Kb ÷ v̈bUv̈b
- 4| ≠μv≠gj Äjy≠gb
- 5| Kcvi wb≠Kj |

~~Ø~~xwZq

K \neg vm

Pj \neq Q

_vwg© \div \neq ii avibv

(Understand Thermistor)

wewfbœ c^aKvi

_vwg©÷i †cÖve

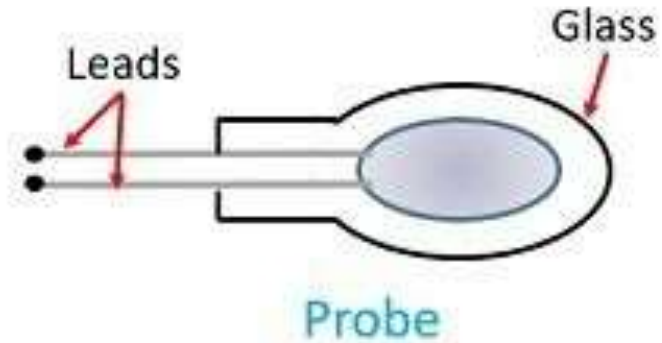
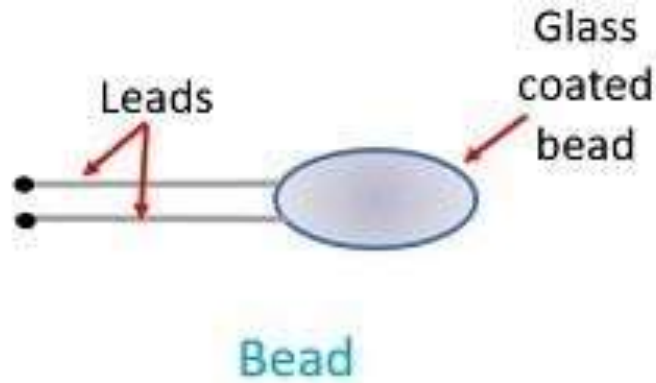
mvaviYZ AvK...wZ Abyhvqx Pvi

ai‡bi _vwg©÷i †cÖvi i‡q‡Q|

1. weW UvBc
2. ‡cÖve UvBc
3. wW⁻< UvBc
4. iW UvBc

wewtbœ cªKvi

_vwg© ÷ i †cÖve

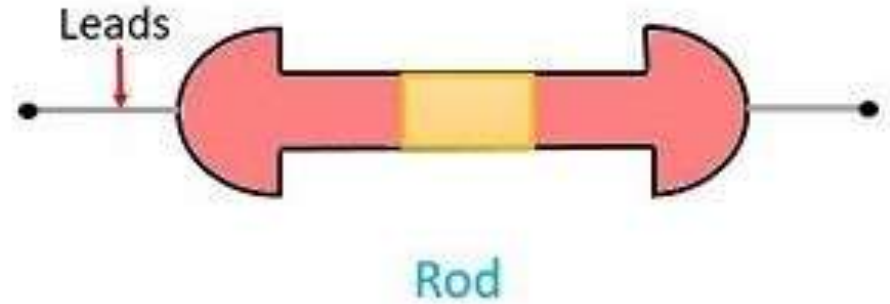
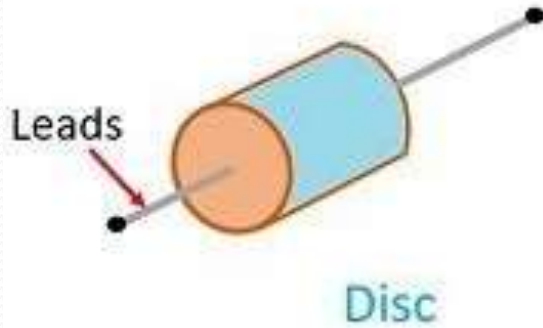


(1) weW UvBc t GwU me†P†q ýz`ªvK...wZi I AwZ
 RbwcÖq _vwg© ÷ i| gv_vq w`ªK GwU 0.15 mm
 †_ªK 1.25 mm eïmwewkó nªq _vªK| G aiªbi
 _vwg© ÷ I mvaviYZ Glass coated nq|

(2) †cÖve UvBc t G aiªbi _vwg© ÷ i Møvm †cÖve
 Øviv Ave,,Z _vªK| GwUi eïm cÖvq 2.5 mm |

wewtba c'kvi

vwa© ÷ i † cÖve



(3) **wW⁻ UvBc t** avZe c`v#_© D"PPvc cÖ#qvM Øviv
 G ai#bi _vWG© ÷ i Žwi Kiv nq| GwU wmwjÛvi
 AvK...wZi n#q _v#K |GwU 2.5 mm †_#K 4.25 mm
 eïmwewkó n#q _v#K | ZvcgvÎv wbqš;#bi †ÿ#Î GwU
 eëüZ nq|

(4) **iW UvBc t** G ai#bi _wg© ÷ i mvaviYZ jα^v
 wmwjÛvi AvK...wZi n#q _v#K| i#Wi `yÕcÖv#šÍi
 †_#K 4.25 mm

ev†qv†gwWKvj cÖ†qvM

- (1) I†qdvi (Wafer) mvBR A_v©r cvZjv we⁻<z†Ui AvKv†ii _vwg© ÷vi eënvi Kiv nq| kix†ii Dcwifv†Mi ZvcgvÎv wbY©†q G AvK...wZi _vwg© ÷i eënvi Kiv nq|
- (2) †iKUvj, (Rectal) gyL, (Oral) A_ev kix†ii wfZ†i cÖ†ek†hvM¨wewfbœ A†½ iW UvBc _vwg© ÷i eënvi K†i ZvcgvÎv cwigvc Kiv nq|
- (3) me†P†q †QvU _vwg© ÷i n†jv weW UvBc _vwg© ÷i| G,†jv GZ †QvU †h G,†jv†K iaygvÎ nvB†cvWvwg©K (Hypodermic) m~†Pi gv_vq emv†bv hvq| kix†ii wewfbœ †Kv†l cÖ†ek Kwi†q ZvcgvÎv cwigv†ci †ÿ†Î GwU eënvi Kiv nq|
- (4) Incubator Gi ZvcgvÎv gwbUwis Gi Rb¨_vwg© ÷i I

_vwg© ÷ †| mvnv†h Zvcgvlv

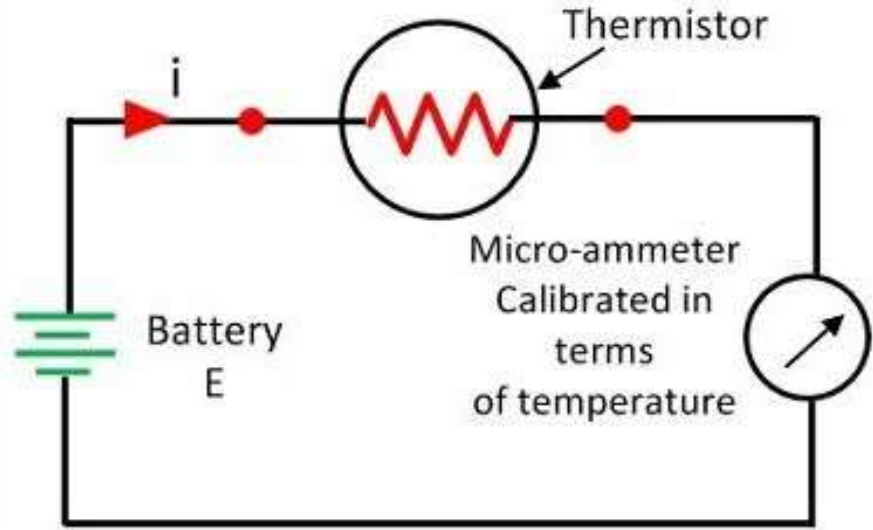
cwigvc

_vwg© ÷ i GKwU ZvcgvÎv †mbwmwUf
†mwgKÛv±i c`v_©, hvi †iwR÷Ý ZvcgvÎv
e,,wxi mv†_ K†g| GwU †b†MwUf
†Uαúv†iPvi †Kv-Bwdwm†q>U cÖ`k©b K†i|
ZvcgvÎv cwieZ©†bi mv†_ LyeB ms†e`bkxj
%oewk†óí Kvi†Y mwVK I AwZ m~²fv†e
ZvcgvÎv wbqš¿Y Ges cwigv†ci Rb`
_vwg© ÷ i GKwU RbwcÖq †gRvwis
wWfvBm wnmv†e eënví Kiv nq| Gi
A÷Kz†iwm Ges †iRy†jkb †ewk|

$\frac{dI}{dt} = \frac{V}{L}$

Wheatstone Bridge

Wheatstone bridge is used to measure the resistance of a thermistor. The circuit consists of a battery E , a micro-ammeter calibrated in terms of temperature, and a thermistor. The current i flows through the circuit.



The thermistor's resistance changes with temperature. The micro-ammeter is used to measure the current i flowing through the thermistor. The relationship between the current i and the temperature T is given by the equation $i = \frac{E}{R + r}$, where R is the resistance of the thermistor and r is the internal resistance of the micro-ammeter. The thermistor's resistance R is given by $R = R_0 e^{\frac{1}{T} - \frac{1}{T_0}}$, where R_0 is the resistance at temperature T_0 . The micro-ammeter is calibrated in terms of temperature, so the current i is directly proportional to the temperature T .

Abykxjbx cÖ#kœvËi

AwZ mswÿß t -1, 2, 7, 13

mswÿß t -2, 3, 6

iPbv gyjK t -3

[**wet** `at GKvwaKevi tev#W© Avmv mKj AwZ mswÿß Ges
mswÿß cÖ#kœv co#Z n#e]

Z ïmsMÖnt

1. Medical Transducer & Sensors-Moniul , Anisur, Shamin (Text book)
2. www.wikipedia.org
3. www.google.com

Aaüq-3

_v‡g©vKvc‡ji avibv
(Understand Thermocouple)

Av†jvP̄welq

- $_v\ddagger gv\textcircled{K}vcj Kx$
- $_v\ddagger gv\textcircled{K}vc\ddagger ji$ eënvī mαú†K⊙ aviYv
jvf Kiv|
- $\dagger iwR\div\ddot{v}\acute{Y} \dagger U\alpha\acute{u}v\ddagger iPvi$ wW†U±i (RTD)
Gi g~jbxwZ
- $\dagger iwR\div\ddot{v}\acute{Y} \dagger c\alpha\acute{u}v\ddagger iPvi$ wW†U±†ii †iÄ
mαú†K⊙ Rvbv
- $v\ddagger av\textcircled{K}vc\ddagger ji$ MVB I Kyby⊙awi

$\int_{-v}^{+v} g v \odot K v c j$ (Thermocouple)

$Kx?$

$\int_{-v}^{+v} g v \odot K v c j$ ev $\int_{-v}^{+v} K G K \hat{i}$ mshy³
K \hat{i} GKwU mvwK \odot U %oZwii ci hw`
avZz $\emptyset \hat{q} i$ ms $\hat{h} v M$ $\int_{-v}^{+v} j \hat{K}$ $\int_{-v}^{+v} g v \odot K v c j$
Zvcgv $\hat{i} v$ ivLv nq Zvn \hat{j} Zvc ms $\mu v \hat{s} \hat{i}$ Kvi \hat{Y} H
mvwK $\odot \hat{U} i$ ga $\hat{w} \hat{q}$ Kv $\hat{i} \hat{U}$ c $\ddot{O} e v w n Z$ nq,
hv Zvcgv $\hat{i} v i$ mv \hat{q} $\int_{-v}^{+v} m i v m w i$ mgvbycvwZK|
myZivs Zv $\hat{c} i$ Kvi \hat{Y} we $\hat{y} \hat{r}$ c $\ddot{O} e v \hat{n} i$ Rb \hat{q}
 $\int_{-v}^{+v} g v \odot K v c j$ $\int_{-v}^{+v} g v \odot K v c j$ $\int_{-v}^{+v} g v \odot K v c j$
G ai $\hat{b} i$ mvwK \odot U
 $\int_{-v}^{+v} g v \odot K v c j$ e $\hat{j} |$ G $\hat{y} \hat{i}$ wnU Gbvwr \odot

_v‡gv©Kvc‡ji eënyi

- 1. iæ‡gi ZvcgvÎv cwigv‡c eënyi Kiv nq|
- 2. U^avÝwWDmvi Øviv Zi‡ji ZvcgvÎv cwigv‡c eëüZ nq|
- 3. M‡elYvMv‡i, †gKvwbKÿj BKzBc‡g>U wksev wkí‡ÿ‡Î m^{~2} ZvcgvÎv cwigv‡c eënyi Kiv nq|

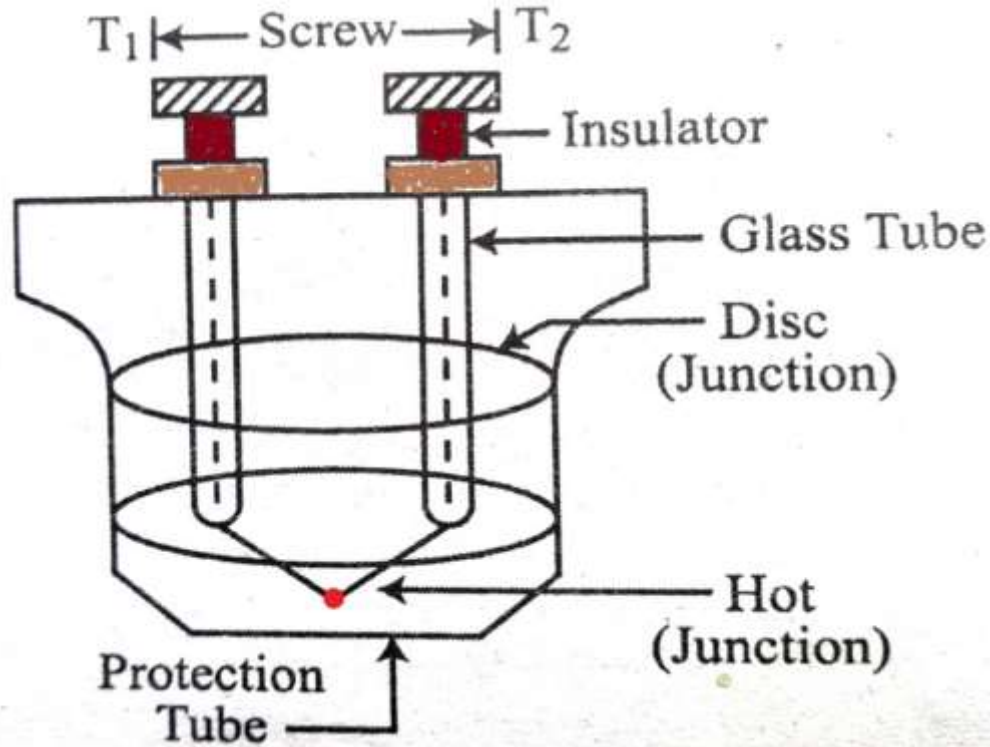
(RTD) Gi g~jbxwZ

ZvcgvÎvi cwieZ©#bi mv#_ avZe c`v#_©i tiva ev
tiwR÷v#Ýii cwieZ©b N#U| ZvcgvÎv e,,wx #c#j
avZe Zv#ii tiwR÷v#Ý e,,wx cvq, Avevi ZvcgvÎv
K#g †M#j tiwR÷v#Ý K#g hvq| avZe Zv#ii G ,b
ev êwk#óï Dci wbf©i K#iB tiwR÷v#Ý †Uαúv#iPvi
wW#U±i ev (RTD) KvR K#i|

- RTD mvaviY fv#e 180° †_#K 650° mxgv ev ti#Äi g#a`ZvcgvÎv
cwigv#ci Rb`eëüZ nq|†h c`v#_©i ZvcgvÎv cwigv#ci Rb`cÖ#qvRb
nq, †cÖve Zv#Z Wzev#bv ev `úk© Kiv#bv nq|

Kvhv©ewj

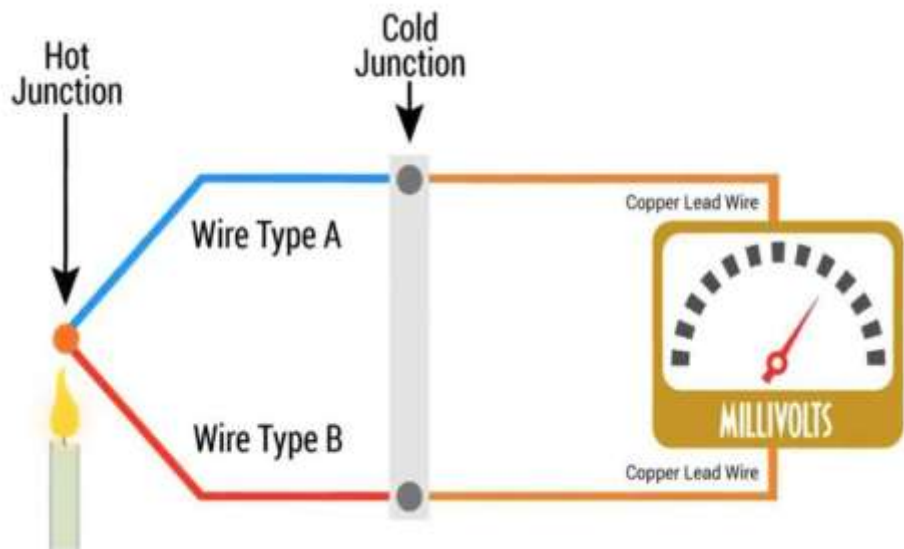
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- [Kvh©cÖYvwj t](#) Dc#ii wP#Î ZvcgvÎv cwigv#ci Rb`_v#gv©Kvcj Gi mvwK©#U †`Lv#bv n#jv| _v#gv©Kvcj eëüZ `ywU wfbœ c`v_©i GKcÖv#šÍ GKK ms#hvM Kiv n#q#Q|GB cÖv#šÍ#K Hot Junction ejv nq| Aci cÖv#šÍ `ywU#K ci`úi n#Z Insulated Kiv _v#K | GB `yB cÖv#šÍi gvSLv#b GKwU DC millivoltmeter ms#hvM Kiv _v#K | GB Junction-#K GKwU Rvbv wbw`©ó ZvcgvÎvq ivLv nq|hvi ZvcgvÎv cwigvc Ki#Z n#e Zv#K Junction Gi mv#_ ms#hvM Kiv nq| Drcbœ emf cwigvY wbf©i K#i `ywU Junction Gi ZvcgvÎvi cv_©#Ki Dci| A_v©r wgUv#ii mvnv#h`Drcbœ thermo-emf cwigvc K#i Avgiv ZvcgvÎv cwigvc Ki#Z-cwi|

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AwZ mswÿß t -1, 3, 5

mswÿß t -2, 4

iPbv gyjK t -1

[**wet** ^at GKvwaKevi tev#W© Avmv mKj AwZ mswÿß Ges
mswÿß cÖ#kœv co#Z n#e]

Z ïmsMÖnt

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2. www.wikipedia.org
3. www.google.com