

**USER'S OPERATING MANUAL FOR PID DIGITAL TEMPERATURE CONTROLLER**  
(Models: Nx - 481 / 781 / 981)



**Nx - 481**  
(48 X 48)



**Nx - 781**  
(72 X 72)



**Nx - 981**  
(96 X 96)

**SPECIFICATIONS : -**

1. **DISPLAY TYPE** : 8 - Digit 7 segment LED

Model No.	Nx-481	Nx-781	Nx-981	Display Colour
Display height (PV)	0.36"	0.56"	0.80"	White
Display height (SV)	0.36"	0.39"	0.56"	Green

2. **STATUS LED'S** : OP1 : Control Output Status  
AT : Tune Status

3. **INPUT**  
Sensor Input : TC-J,K,R,S,N,T,B & RTD (PT-100)  
Analog Input : 0 - 20mA, 4 - 20mA, 0 - 1VDC,  
0 - 5VDC, 0 - 3.3VDC, 0 - 10VDC  
(Selectable)  
Range : -1999 to 9999  
Resolution : 0.001, 0.01, 0.1 & 1 (Selectable for  
analog input)  
Sampling Time : 125 msec.  
CJC for TC : Built in automatic  
LWC for Pt-100 : Built in up to 18E max.  
Digital Filter : 1 to 10 Sec.

4. **RELAY OUTPUT**  
Contact type : N/O, COM  
Contact Rating : 5A @ 250VAC or 30 VDC  
Life expectancy : > 5,00,000 operations  
Isolation : Inherent

5. **SSR DRIVE OUTPUT**  
Drive Capacity : 12V @ 30mA.  
Isolation : Non-Isolated.

6. **FUNCTION**  
Output 1 : Main Control output (Selectable)  
1) Relay  
2) SSR  
Control Action : ON-OFF/PID (Select)  
Control Mode : Heat/Cool (Select)

7. **ENVIRONMENTAL**  
Operating Range : 0 ~50°C, 5~90% Rh  
Storage Humidity : 95% Rh (Non-condensing)

8. **POWER SUPPLY**  
Supply Voltage : 90~270VAC, 50/60Hz.  
Consumption : 4W Maximum.

9. **PHYSICAL**  
Housing : ABS Plastic

**SAFETY INSTRUCTION**

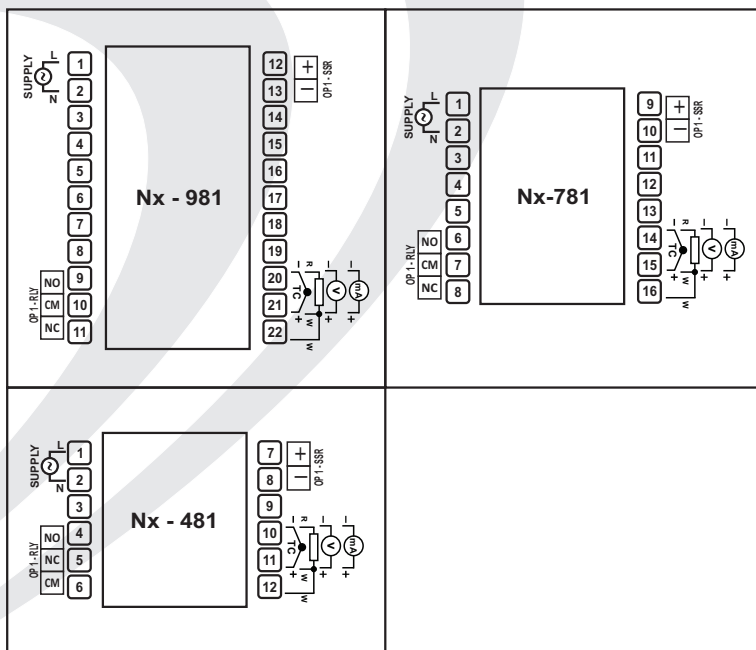
**MECHANICAL**

- ❖ Ambient temperature and relative humidity surrounding the Controller must not exceed the maximum specified limits.
- ❖ The Controller in its installed state must be protected against excessive electrostatic or electromagnetic interferences.

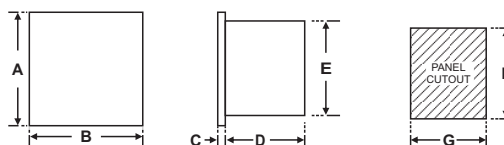
**ELECTRICAL**

- ❖ The Controller must be wired as per wiring diagram & it must comply with local electrical regulation.
- ❖ The Electrical noise generated by switching inductive loads might create momentary Fluctuation in display, latch up, data loss or permanent damage to the instrument. To reduce this use snubber circuit across the load.

**TERMINAL CONNECTIONS :**



**OVERALL DIMENSIONS & PANEL CUTOUT (IN MM)**

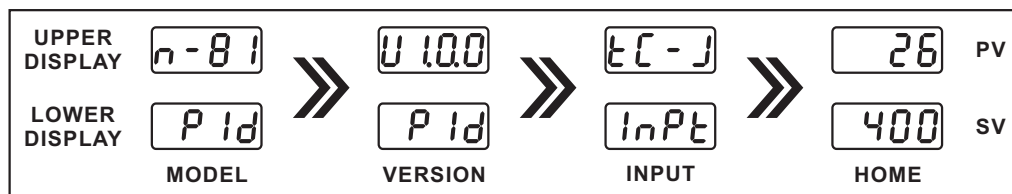


Model	Dim A	B	C	D	E	F	G
Nx - 981	96	96	14	80	90	92	92
Nx - 781	72	72	14	80	68	70	70
Nx - 481	48	48	14	86	44	44	44

**INSTALLATION GUIDELINES**

1. Prepare the cut-out with proper dimension as shown in figure.
2. Remove clamp from Controller.
3. Push the Timer through panel cut-out and secure the Controller in its place by tightening the side clamp.

**POWER UP:** At power on, following sequence will be prompted on the display till it reaches to Home display mode.



## PROGRAMMING

**RUN MODE :** To access the Run mode, Press **SHIFT** key to change SP1

Parameter	Lower Display	Upper Display	Range	Description	Default
Control Set Point	SP	0	LSPL ~ HSPL	User can change the SP value using UP / DOWN and SHIFT keys. Holding the key will change the value at a faster rate. Press SET key to store the desired value.	0°C

**USER LIST :** To access the User List, Press & Release **SET** key once.

Parameter	Lower Display	Upper Display	Range	Description	Default
Control Set Point	SP	0	LSPL ~ HSPL	User can change the SP value using UP / DOWN and SHIFT keys. Holding the key will change the value at a faster rate. Press SET key to store the desired value.	0°C
Ramp Rate	rAtE	5.0	0.0 °C to 25.0 °C	This parameter will be available only, if Enabled in Configuration List. User can set ramp rate/min for SP1 (Set Point) to minimize overshoot.	Disable

**CONTROL LIST :** To enter in this mode, press **SET & DOWN** key simultaneously for 3 sec.

Parameter	Lower Display	Upper Display	Range	Description	Default
Lock Code	LOCP	0	1 ~ 9999	Set this parameter to 15 (Default LOCK CODE) to access Control List. User has a choice to set different Lock Code via USER LOCK CODE in Config. List.	15
Proportional Band	Pb	5.0	0.5 to 99.9°C	This parameter will be prompted only, if selected control action is PID. It sets bandwidth over which the output power is adjusted depending upon the error (SV-PV). The value of this parameter is automatically set by Auto tune function.	5.0°C
Integral Time	Int	240	0 to 9999 Sec.	This parameter will be prompted only, if selected control action is PID. It sets the time taken by PID algorithm to remove steady state error. Value of this parameter is automatically set by Auto Tune function. If set to '0', this function will be disabled.	240
Derivative Time	dt	60	0 to 300 Sec.	This parameter will be prompted only, if selected control action is PID. It defines how strongly the controller will react to the rate of change of PV. Value of this parameter is automatically set by Auto Tune function. If set to '0', this function will be disabled.	60
Cycle Time	CYCL	16.0	0.5 to 99.9 Sec.	This parameter will be prompted only, if selected control action is PID. User can set this value based on process being controlled & type of output being selected. For Relay O/P, cycle time should be more than 12sec & for SSR O/P, cycle time should be less than 10sec.	16.0 Sec.
Output Power Limit	OUTL	100	0 % to 100 %	This parameter will be prompted only, if selected control action is PID. This parameter will decide the maximum output power in % applied to the load.	100 %
Output Off	OP.OF	d5bL	1 to 10	This parameter will be prompted only, if selected control action is PID. With this parameter, O/P will be completely OFF after the Set Point + Offset Value. If Disable, O/P will act depending upon the PID value after Set Point achieved.	Disable
Tune Offset	t.OFS	100	50 % to 100 %	This parameter will be prompted only, if selected control action is PID. This parameter allows the user to carry out Auto Tuning function below the set point. (If Tune offset is 50 %, tuning will be carried out at 50 % of the set point and if 100 %, tuning will be carried out at 100 % of the set point).	100 %
Control Hys. 1	HYS1	2	1 to 25°C	This parameter will be prompted only, if selected control action is ON-OFF. It sets the dead band between ON & OFF switching of the output. Larger value of hysteresis minimizes the number of ON-OFF operation of load. This increases life of actuators like contactors, but also produces large errors (between PV & SV).	2°C
Delay 1	dLY1	0	0 to 500 Sec.	This parameter will be prompted only, if selected control action is ON-OFF. It sets the main output restart time, where O/P once turned OFF will turn ON only after restart time, regardless difference between PV & SP in Heat or Cool mode. If set to '0', O/P will be switched without delay. Also, delay will be applicable in case of every power ON.	0 Sec.

**CONFIGURATION LIST :**

- (1) To enter in this mode, press and hold SET & UP key simultaneously for 3 sec.
- (2) Press UP or DOWN key to scroll between parameter options.
- (3) Press SET key to store the current parameter & move on to the next parameter.

Parameter	Lower Display	Upper Display	Description	Default
Lock Code	LOCP	0	Set this parameter to 15 (Default LOCK CODE) to access Config. List. User has a choice to set different Lock Code between 1 to 9999 via USER LOCK CODE in Config. List.	15
Input Types	InPt	TC-J	'TC-J' :- If selected, instrument will accept temperature input from thermocouple J type sensor at rear terminal. Below range, it will display 'LLLL' message & above range, it will display 'HHHH'.	TC-J
		TC-K	'TC-K' :- If selected, instrument will accept temperature input from thermocouple K type sensor at rear terminal. Below range, it will display 'LLLL' message & above range, it will display 'HHHH'.	
		TC-R	'TC-R' :- If selected, instrument will accept temperature input from thermocouple R type sensor at rear terminal. Below range, it will display 'LLLL' message & above range, it will display 'HHHH'.	
		TC-S	'TC-S' :- If selected, instrument will accept temperature input from thermocouple S type sensor at rear terminal. Below range, it will display 'LLLL' message & above range, it will display 'HHHH'.	
		TC-N	'TC-N' :- If selected, instrument will accept temperature input from thermocouple N type sensor at rear terminal. Below range, it will display 'LLLL' message & above range, it will display 'HHHH'.	
		TC-T	'TC-T' :- If selected, instrument will accept temperature input from thermocouple T type sensor at rear terminal. Below range, it will display 'LLLL' message & above range, it will display 'HHHH'.	
		TC-B	'TC-B' :- If selected, instrument will accept temperature input from thermocouple B type sensor at rear terminal. Below range, it will display 'LLLL' message & above range, it will display 'HHHH'.	
		RTD	'RTD' :- If selected, instrument will accept temperature input from PT-100 sensor at rear terminal. Below range, it will display 'LLLL' message & above range, it will display 'HHHH'.	
		RTD.1	'RTD.1' :- If selected, instrument will accept temperature input from PT-100 sensor at rear terminal. Below range, it will display 'LLLL' message & above range, it will display 'HHHH'.	
		0-1	'0-1' :- If selected, instrument will accept 0-1 VDC input at rear terminal. Below 0V, it will display 'LLLL' message & above 1V, it will display 'HHHH'.	
		0-3.3	'0-3.3' :- If selected, instrument will accept 0-3.3 VDC input at rear terminal. Below 0V, it will display 'LLLL' message & above 3.3V, it will display 'HHHH'.	
		0-5	'0-5' :- If selected, instrument will accept 0-5 VDC input at rear terminal. Below 0V, it will display 'LLLL' message & above 5V, it will display 'HHHH'.	
		0-10	'0-10' :- If selected, instrument will accept 0-10 VDC input at rear terminal. Below 0V, it will display 'LLLL' message & above 10V, it will display 'HHHH'.	
		0-20	'0-20' :- If selected, instrument will accept 0-20 mA input at rear terminal. Below 0mA, it will display 'LLLL' message & above 20mA, it will display 'HHHH'.	
4-20	'4-20' :- If selected, instrument will accept 4-20 mA input at rear terminal. Below 3.8mA, it will display 'LLLL' message & above 20 mA, it will display 'HHHH'. If input is less than 3.2 mA, it will display 'L.BRK' (Loop Break) message.			
Resolution	RESL	0 0.0 0.00 0.000	This parameter will <b>NOT</b> be prompted when input type is selected as Thermocouple (TC-J,K,R & S)  When input type selected is RTD, then only "0 & 0.0" resolution format will be available.  By this parameter, user can select four format of resolution only for analog input, i.e. "0.000, 0.00, 0.0, 0". For range limit as per resolution selected Ref. Table No. 1 (Page No. 5).	0
Lower SP Limit	LSPL	0	Sets the minimum limit for set point adjustment. It can be set from minimum specified range of selected sensor to HSPL value.	0°C
Higher SP Limit	HSPL	400	Sets the maximum limit for set point adjustment. It can be set from LSPL value to maximum specified range of selected sensor.	400°C

Parameter	Lower Display	Upper Display	Description	Default
Analog Input Low Value	Ai.Lo	0	By this parameter, user can define Low scale for input signal which can be in between '-1999 to Ai.Hi.' For range limit as per resolution selected, Ref. Table No.1 (Page No. 5).	0
Analog Input High Value	Ai.Hi	9999	By this parameter, user can define HIGH scale for input signal which can be in between 'Ai.Lo to 9999'. For range limit as per resolution selected, Ref. Table No.1 (Page No.5).	9999
Process Value Offset	OFSt	0	Function of this parameter is to add/subtract a constant value to the measured PV to obtain final PV for control applications. This parameter value can be altered : (1) To compensate for known thermal radient. (2) To match the display values with another recorder or indicator measuring the same PV.	0°C
Input Filter	FLtr	1	The controller is equipped with an adaptive digital filter which is used to filter out any extraneous pulses on the PV. The filtered PV value is used for all PV dependent functions. If the PV signal is fluctuating due to noise, increase the filter time constant value.	1
Control Mode	node	PId ↓ ↑ OnOF	User can select between PID or ON-OFF action algorithm to be adopted for output.	PID
Control Logic For Output 1	OP1L	HEAt	This parameter will be prompted only, if selected control mode is ON-OFF. User can select heating logic in which OP1 will remain ON till PV < SP. (PV increases when output is ON).	Heat
		COOL	This parameter will appear only, if selected control mode is ON-OFF. User can select cooling logic in which OP1 will remain ON till PV > SP. (PV decreases when output is ON).	
Output Type	OP.tY	rLY	User has to set this parameter very carefully in accordance with the output used. (Separate terminal for RELAY & SSR, Refer electrical installation) Select Relay, if LOAD is connected via contactor. Whenever user selects Relay, cycle time will automatically get set to 16 sec.	Relay
		SSr	Select SSR, if load is connected via SSR (DC voltage pulses). Whenever user selects SSR, cycle time will automatically get set to 1 sec. User can modify cycle time via control list.	
Overshoot Control Point	OCP	dSbL	This parameter will be prompted only, if selected control action is PID. Setting this parameter on higher side will proportionally slow down the rate of rise of PV to minimize overshoot (this may cause delay to reach SP). Disabling or setting this paramter on lower side will proportionally increase the rate of rise of PV (which may cause overshoot). Disable this option, if delay is not required to reach SP. (This may cause overshoot w.r.t SP)	Disable
Ramp Rate	rAtE	EnbL	This parameter will be prompted only, if OCP (Overshoot Control Point) is disabled. When enabled, User can set the desired RAMP rate in USER list.	Disable
		dSbL	When disabled, this parameter will not be prompted in USER list.	
Lower Display Message	LdSP	tOGL	This parameter will be prompted only, if RATE (Ramp Rate) is Enabled. By pressing DOWN key, Lower display will toggle between Actual Set point value i.e. Target Set Point (T-SP) & Ramping Set point (R-SP).	Toggle
		t-SP	By this parameter, Lower display will only show the Target Set Point T-SP value.	
		r-SP	By this parameter, Lower display will only show the Ramping Set Point R-SP.	
Auto Tune	tunE	EnbL	This parameter will be prompted only, if selected control action is PID. If Enabled, this parameter will be prompted if user presses Shift key for 3 sec.	Enable
		dSbL	If Disabled, this parameter will not be prompted, if user presses Shift key for 3 sec.	
Set Point	SP	EnbL	If Enabled, User can view & edit the Set point (SP1) in USER list.	Enable
		dSbL	If Disabled, User cannot view or edit the Set point (SP1) in USER list.	
User Lock Code	ULOC	15	Default USER LOCK CODE is 15 to access Control & Configuration List. User has a choice to set its own USER LOCK CODE between 1 to 9999, this is to prevent unauthorized access of Control & Configuration List.	15

**AUTO TUNING MODE** : To enter in this mode, press & hold SHIFT key for minimum 3 sec in Run mode.

Parameter	Lower Display	Upper Display	Description	Default
Auto Tuning Mode	AL	YES ↓ ↑ NO	This function will be executed only, if selected control action is PID. Auto-tuning function is enabled by setting this parameter to 'YES'. The decimal of LSB flashes till Auto tuning function is in progress. During Auto-tuning, Controller learns the process characteristics by itself & calculates required P, I & D values. User can cancel or abort this feature by setting this parameter to 'NO'.	No

**Table 1 : Range of Different Sensors Types**

Sensor Type	Range	Resolution	Accuracy
Fe-k(J) T/C	0 ~ 760°C	1°C	± 1°C
Cr-AL(K) T/C	-99 ~ 1300°C	1°C	
(R) T/C	0 ~ 1700°C	1°C	
(S) T/C	0 ~ 1700°C	1°C	
TC - N	-99 ~ 1300°C	1°C	
TC - T	-99 ~ 400°C	1°C	
TC - B	0 ~ 1800°C	1°C	
Pt-100(RTD)	-100 ~ 450°C	1°C	
Pt-100(RTD 0.1)	-100.0 ~ 450.0°C	0.1°C	0.3°C

**Table 2 :- Range as per Resolution**

Resolution	Analog Input Low Value	Analog Input High Value	Process Value Offset
0000	-1999 to 9999	-1999 to 9999	-25 to 25
000.0	-199.9 to 999.9	-199.9 to 999.9	-25.0 to 25.0
00.00	-19.99 to 99.99	-19.99 to 99.99	-15.00 to 25.00
0.000	-1.999 to 9.999	-1.999 to 9.999	-1.500 to 2.500

**Error Message :-**

Display Message	Selected Input	Description
"OPEN"	TC-J,K,R,S,N,T,B or RTD	Open Circuit of Control Sensor.
"HHHH"	0 ~ 20 / 4 ~ 20 / 0 ~ 10	If input is above range, it will display "HHHH" message.
"LLLL"	0 ~ 20 / 0 ~ 10	If input is below '0', it will display "LLLL" message.
"LLLL"	4 ~ 20	If input is below "3.8mA" and above "3.2mA", it will display "LLLL" message.
"L.BRK"	4 ~ 20	If input is less than "3.2mA", it will display "L.BRK" (Loop Break) message.
"C.E.R.R"	Any Input Selected	The device is out of calibration and need to be sent to factory for re-calibration.



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