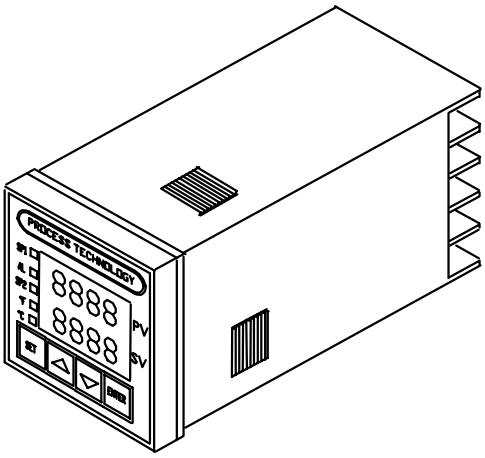
DML
SUPPLEMENT
MANUAL



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REV 1297

DESCRIPTION

The DML Temperature Controller is a microprocessor based, multi-function device, which permits a wide variety of input sensors and a similar variety of controlled outputs.

Ten (10) types of thermocouples, four (4) types of RTD's and a voltage (current, with dropping resistor) input is available. The standard configuration accepts our 1000 ohm, 2 wire RTD sensor. (Class 2 circuits)

ON-OFF, logic, ramp and soak, and PID outputs are available. The standard configuration has SPST relay outputs. Output #1 is programmed as a reverse acting (heating) control; output #2 is programmed as a direct acting (cooling) control; and the ALARM output is programmed to close on either HIGH or LOW set point.

The DML is equipped with a universal power supply which permits same connection operation for any voltage from 100 to 265 VAC, 50 through 400 Hz or 132 to 240 VDC

The standard display is in ^{o}F while ^{o}C is available when ordering or can be changed in the field.

Custom switch point differential, displayed offset, and field calibration are standard.

A built in memory feature allows review of the highest and lowest temperatures that the controller received during any powered time period.

For computer interfacing an optional RS-485 communication link is available permitting uploading and downloading with optional software. An optional converter is necessary for RS-232 format.

SPECIFICATIONS

Input: Two (2) wire 1000 ohm Pt RTD, TCR 0.00385 (Class 2 circuits)
ohm/ohm/°C
Three (3) wire 100 ohm Pt RTD, TCR 0.00385
ohm/ohm/°C
Three (3) wire 100 ohm Pt RTD, TCR 0.00392
ohm/ohm/°C
Three (3) wire 120 ohm Nickel RTD
Type J, K, E, T, R, S, B, C, N Thermocouples
0-5, 1-5, -5 to +5 mVDC (current input with
a 250 ohm shunt resistor)

Control Range: Dependent on input sensor:
0 - 1000 °F (-32 to 538 °C) for standard
1000 ohm RTD.
-350 °F (-212 °C) minimum for Type T
thermocouple.
4208 °F (2320 °C) maximum for Type C
thermocouple.

Accuracy: +/- 0.25% of span, +/- 1 digit

Control Action: ON/OFF Form A (SPST) Relays
3 AMPS - 250 VAC (resistive)
250 VA - 125/250 VAC (pilot duty)
1.5 AMPS - 250 VAC (general purpose)
Output #1 - Reverse Acting (heating)
Output #2 - Direct Acting (cooling)
Alarm - Direct Acting (energizes at set point)

Supply Voltage: 100 to 240 VAC +10/-15% , 50 to 400 Hz.,
132 to 240 VDC +10/-20%
5 VA maximum power load

Enclosure: Type 2, 3R, 3S, or 12 case suitable for
panel mounting (#20 ga. thru 1/4" thick panels)

Ambient: 14 - 104 °F at 90% RH (non-condensing)

Displays: Two (2), four (4) digit LED's, red for measured value (PV)
green for set point value (SV)

On/Off Differential: Independently adjustable for either output from 2 °F to full
scale in 1 °F increments

Status Indicators: Five (5) Red LED's that indicate:
Output #1 (SP1) Relay energized
Output #2 (SP2) Relay energized
High or low (ALARM) Relay energized
Values displayed are (°F) or (°C)

Input Protection: If sensor fails or opens (loop protection for thermocouples)
outputs are disabled (see Page 6 for error messages)

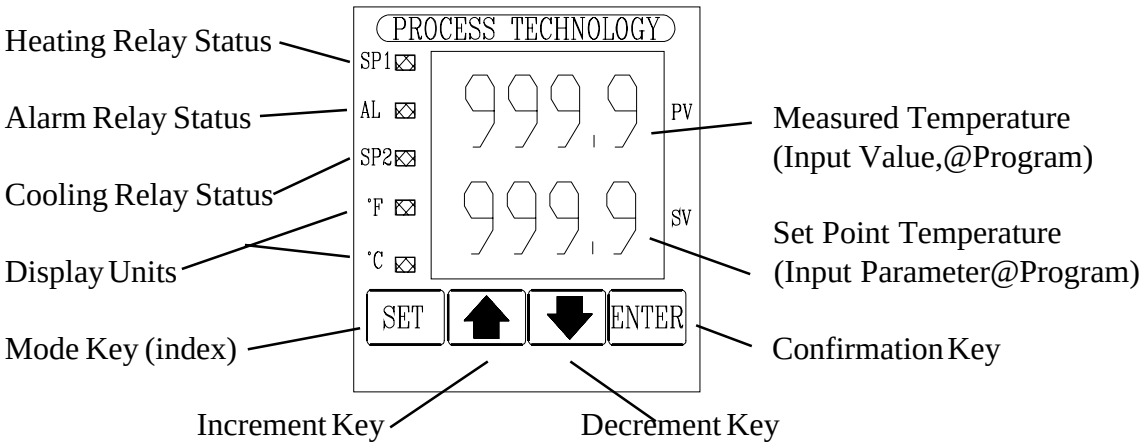
Memory: Non-volatile CMOS PROM (no battery required)

SPECIFICATIONS
(continued)

User Functions:
Set point #1 (SP1) heating
Set point #2 (SP2) cooling
Alarm low set point (ALLo)
Alarm high set point (ALHi)
Highest measured temperature (PEA)
Lowest measured temperature (VAL)
Set point #1 differential (SP1d) -2 °F to full scale
Set point #2 differential (SP2d) +2 °F to full scale
Displayed value offset (InPC) +/- 500 °F (+/- 260 °C)

PROGRAMMING

Layout:



DLM CONTROLLER FACE

Set Point: The heating set point is constantly displayed as the "green" LED value (SV) beneath the actual measured temperature, "red" LED value (PV).
To review the cooling and alarm set points depress the SET button (Mode Key) and note the LED displays after each depression; (####=data)

1st value displayed is Set Point #1 # ### = entered value (PV)
SP1 = Set Point #1 (SV)

2nd value displayed is Set Point #2 # ### = entered value (PV)
SP2 = Set Point #2 (SV)

3rd value displayed is Low Alarm # ### = entered value (PV)
ALLo = Low Alarm (SV)

4th value displayed is High Alarm # ### = entered value (PV)
ALHi = High Alarm (SV)

PROGRAMMING
(continued)

Layout:

To alter any set point value depress either the INCREMENT KEY or the DECREMENT KEY to increase or decrease the displayed value. Depress the ENTER KEY to confirm the new value (Failure to do this will result in NO CHANGE to the set point value.)
To access the five (5) remaining user functions depress the INCREMENT KEY and the ENTER KEY simultaneously.
To review individual functions depress the SET button and note the LED displays after each depression; (####=data)
1st value displayed is highest reading ####= value (PV)
PEA = highest value (SV)
2nd value displayed is lowest reading ####= value (PV)
VAL = lowest value (SV)
3rd value displayed is SP1 differential ####= entered value (PV)
SP1d = SP1 differential(SV)
4th value displayed is SP2 differential ####= entered value (PV)
SP2d = SP2 differential(SV)
5th value displayed is display offset ####= entered value (PV)
InPC = display offset (SV) value
The highest measured value (PEA) and lowest measured value (VAL) can be reset to the currently measured value by depressing the ENTER KEY. (These values are reset each time power is switched off.)
To alter the differential or offset values depress either the INCREMENT KEY or the DECREMENT KEY to either increase or decrease the displayed value. Depress the ENTER KEY to confirm this new value. (Failure to depress the ENTER KEY after changing values will result in NO CHANGE and the control will use the last value.)
Before changing the displayed value offset (InPC) it is recommended that the desired new value be checked against a known standard to insure accuracy. Inaccurate values may result in hazardous operating conditions.
The display will remain in the "Programming Menu" for 30 seconds, if none of the keys are depressed. You may rapidly advance through the menu by depressing the SET KEY until you see the measured temperature value and the set point #1 value displayed.
You can scroll the menu backwards by depressing the SET KEY and the DECREMENT KEY simultaneously.

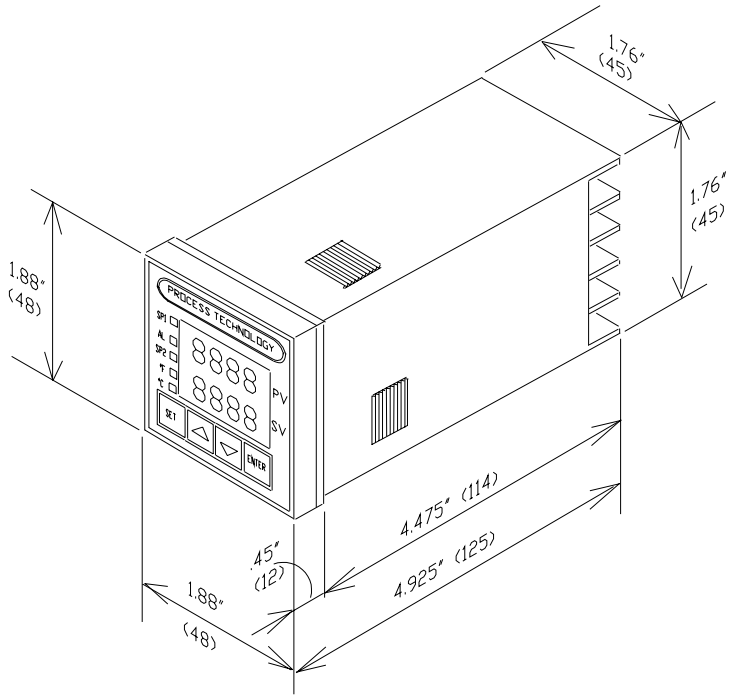
ERROR MESSAGES

During power-up or while in normal operation any fault detected will result in the display of an error message. These messages, their meaning, output conditions and required action are as follows (NOTE - #### indicated for display means numeric data, i.e. set point value):

ERROR MESSAGE	MEANING	OUTPUT CONDITION	ACTION REQUIRED
bAd InP OPEn InP	For RTD an input error is detected, for a thermocouple an "open" is detected.	Outputs are turned OFF (relays are deactivated) Alarm is active	Investigate, correct and/or replace the sensor. Reset after correction by depressing the SET and ENTER KEY simultaneously
UFL #### alternates -58 #### #### ArEA (blank) ArEA	Shorted sensor or sensor leads	Outputs are normal but ALLo will activate	Investigate possible cause for short and correct, possibly replace sensor or lead wires
#### ArEA (blank) ArEA	Controller's internal temp is near or is exceeding it's maximum	as above	Cool off the controller and find an alternative location so that the surrounding temp. never exceeds 131°F
FAIL tESt or totally blank	The control failed it's test or insufficient power is detected	Outputs are turned OFF Alarm is OFF	Check incoming power then depress SET KEY if FACt dFLt appears depress ENTER and DECREMENT KEY to run internal test.
CHEC SP1 or CHEC SP2, etc...	This message will appear during power up if a set point is out of range	as above	Recheck the set point or points and adjust to bring them within range

Any other display messages could be the result of programming errors or unauthorized access to secure portions of the controller. Consult factory for assistance.

DIMENSIONS

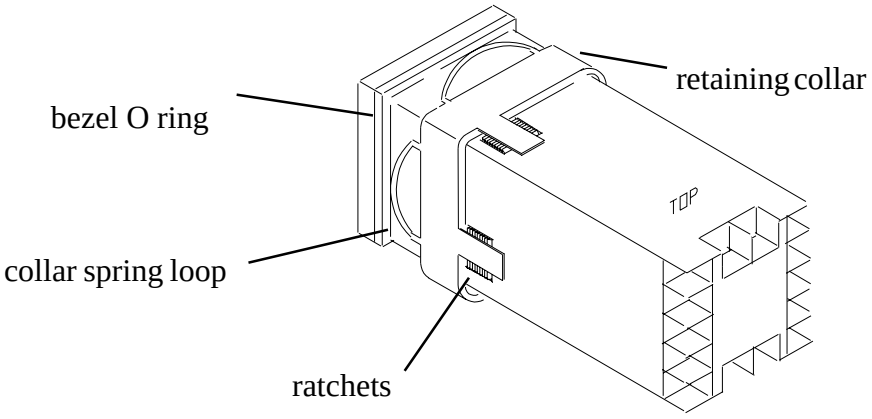


Dimensions in Inches
(millimeters in parenthesis)

INSTALLATION

Unpack and inspect the controller for damage. Any noted or suspected damage must be claimed against the delivering carrier, i.e. UPS, etc...

Prepare a finished panel cut out of 1.77 inches X 1.77 inches (45mm X 45mm) -0.00 +0.01"

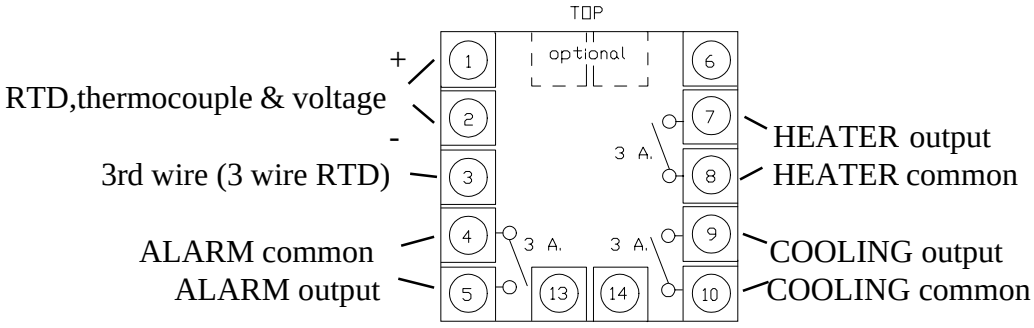


Controller viewed from rear

Slide the retaining collar rearward by disengaging the collar ratchets by lifting and pushing in a staggered fashion.
Insert the controller into the prepared hole taking care to seat the bezel gasket firmly against the panel face. While maintaining pressure on this gasket, slide the retaining collar over the controller and engage the rachets as far as the collar will slide.

WIRING

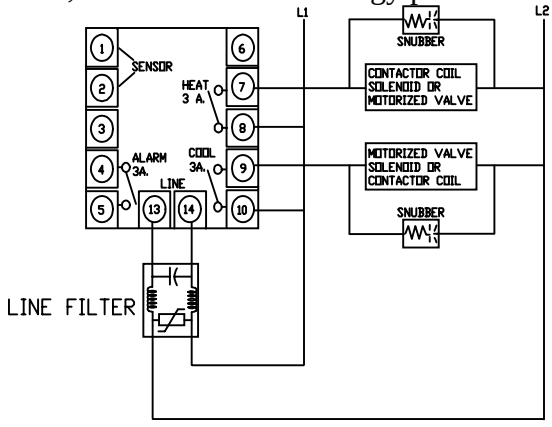
Prior to wiring, familiarize yourself with National, State and Local wiring codes and their requirements. Plan your wire routing and sizing in advance so that proper wire size, insulation, shielding and grounding is accounted for.
Route any thermocouple leads away from current carrying conductors to minimize induced voltage levels that can effect thermocouple accuracy and performance. Always use the same thermocouple alloy wire to connect the thermocouple sensor to the controller. Always consider sensor extension wire lead length and its effect on system accuracy and performance.



L1 L2
100-240 VAC (+10/-15%), 50 to 400 Hz, 5 VA
132 to 240 VDC (+10/-20%)
WIRING CONNECTIONS VIEWED FROM REAR

ELECTRICAL NOISE AND INTERFERENCE
Process Technology controls are engineered and manufactured to tolerate reasonable levels of electrical noise and interference found in typical industrial installations. It has been found that in many installations contactor and solenoid switching produces sufficient electrical noise to cause malfunctions.
To prevent or minimize these events transient suppressors (snubbers) and a line filter is furnished with your controller. These components will be found in the envelope attached to the rear cover of this manual.

Snubber,	Process Technology part # 3965
120V Line Filter,	Process Technology part # 3020
240V Line Filter,	Process Technology part # 3021



CALIBRATION

The DML controller utilizes its microprocessor and PROM "look up" table to continuously maintain a high degree of accuracy. Field calibration should not be required.
If erroneous temperature readings are suspected obtain an accurate comparative device, i.e. precision thermometer, laboratory thermometer, etc.
Be sure that this device is:

Accurate, traceable to a recent calibration against NIST standards;
Properly installed, that the thermometer is calibrated for full immersion or partial immersion, etc.
Properly positioned with regard to the DML sensor, heated tanks stratify and a temperature gradiants from tank top to bottom of over 150° F have been observed. We recommend securing the comparitive sensor to the DML sensor so that the temperature sensitive areas are as adjacent as possible.

With the known (comparitive) reference device in proper position allow at least 3-5 minutes for stabilization.
Make note of the difference between the displayed value and that of your reference, i.e. (display=75°F;reference=77°F;diff.=+2°F), (display=77°F;reference=75°F;diff.=-2°F).
Refer to Page 5 of this manual to access the InPC (input correction value) setting.
(Depress the INCREMENT KEY and ENTER KEY simultaneously, then depress the SET KEY until #### is displayed, ####=current offset value.)

InPC

Use the INCREMENT KEY or the DECREMENT KEY to either increase or decrease the previous offset value by including the additional difference obtained above.
Depress the ENTER KEY.
Depress the SET KEY until the normal temperature display is indicated. Compare the new value with your reference and repeat offset procedure, if necessary.
Complete calibration procedures are available, but, require a knowledge of hexadecimal numbers, precision input devices, and access to instument internal coding.
Call the factory for details.

FULL CALIBRATION

The DML control has continuous internal routines to maintain accuracy. Under certain circumstances it may become necessary to perform full calibration to reobtain maximum accuracy.
WARNING, full calibration permits access to internal coding and configuration parameters. Inadvertent alterations to these routines may render the control inoperable. Consult factory if anamolies appear.

Input substitution device needed:

1. A precision resistance decade box with an accuracy of +/- 0.1%,
   or
2. A 100 ohm and a 5K ohm, 20+ turn cermet potentiometer
   and a 4 1/2 digit DMM with an accuracy of +/- 0.05%.

The DML microprocessor and its software will be running automatic, internal calibration routines during the following procedures. Sensor lead length compensation will be performed so that it is necessary that the input substitution device(s), above, be installed as close to the field sensor location as possible.
Allow the control to warm-up for 45-60 minutes before beginning calibration.
Depress and maintain pressure on the ENTER and INCREMENT KEYS for 5 seconds;
until, 3 SECr appears,
using the INCREMENT KEY enter,
111 SECr,
depress ENTER KEY,
4 SECr will appear,
depress SET KEY until,
1P38 InP appears,
depress either the INCREMENT or DECREMENT KEYS until,
"----" Inp appears,
you are now in the calibration mode. Depress ENTER KEY and,
(####=current DML sensor temperature value)
CAL0 appears,
depress the INCREMENT KEY and observe that,
=as above & approximate control temperature respectively.
CAL1 & CAL2
continue to depress the INCREMENT KEY until,
(####=see table 1)
CAL3 appears,
the displayed value should be within the range shown in table 1,
depress the ENTER and DECREMENT KEYS simultaneously.
Wait 5 seconds (update time allowance).
The display will blank and again display a value within the range indicated in Table 1.

Depress INCREMENT KEY until,

(####=see table 2)
CAL 4 appears,

the displayed value should be within the range shown in table 2,
depress ENTER and DECREMENT KEYS simultaneously.
Wait 5 seconds.
The display will blank and again display a value within the range indicated in Table 2.

Disconnect the DML sensor.
Adjust your input device to a value of 75.32 ohms and connect to sensor lead at the above junction.
Depress INCREMENT KEY until,

(####=see table 3)
CAL5 appears,

depress ENTER and DECREMENT KEYS simultaneously.
the displayed value should be within the range shown in table 3,
Wait 5 seconds.
Change and adjust your input device to a value of 2462.17 ohms and depress INCREMENT KEY until, #### (####=see table 4)

CAL6 appears,

depress ENTER and DECREMENT KEYS simultaneously.
the displayed value should be within the range shown in table 4,
Wait 5 seconds.
Without removing your input device, depress the INCREMENT KEY repeatedly until,

746 +/-1
CAL0 appears,

This completes the calibration.
Depress and hold the ENTER and INCREMENT KEYS for 5 seconds until,

4
SECr appears,

using the INCREMENT KEY, enter,

1011
SECr

depress ENTER KEY,

3
SECr will appear.

Depress the SET KEY repeatedly until operating display is viewed. Re-connect the DML sensor and return control to service.

HEXADECIMAL TABLES

The DML calibration parameters are in hexadecimal numbers. For those unfamiliar with this system the following conversion chart and tables should be sufficient to facilitate calibration.

HEX#	4th digit	3rd digit	2nd digit	1st digit
0	0	0	0	0
1	4,096	256	16	1
2	8,192	512	32	2
3	12,288	768	48	3
4	16,384	1,024	64	4
5	20,480	1,280	80	5
6	24,576	1,536	96	6
7	28,672	1,792	112	7
8	32,768	2,048	128	8
9	36,864	2,304	144	9
A (A)	40,960	2,560	160	10
B (b)	45,056	2,816	176	11
C (C)	49,152	3,072	192	12
D (d)	53,248	3,328	208	13
E (E)	57,344	3,584	224	14
F (F)	61,440	3,840	240	15

To form a decimal number from a hexadecimal number select the respective decimal number from the appropriate column and add.
Examples: (HEX) 2dAA = 8,192 + 3,328 + 160 + 10 = 11,690.

(HEX) 3000 = 12,288 + 0 + 0 + 0 = 12,288.

In the following tables the range of values shown are in hexadecimal as they will appear in the upper (PV) display as each calibration (CAL3 to CAL6) mode is addressed.

Tables have a range of 1024 (1K) in decimal equivalents, i.e. 2d46 to 3146 = 1024 bits.

RANGE TABLES

Table #1	Table #2	Table #3	Table #4
12C3 to 12FF, 1300 to 13FF, 1400 to 14FF, 1500 to 15FF, 1600 to 16C3.	4F41 to 5341,	1b4C to 1F4C .	9A40 to 9E40.