Table of Contents

SECTION 1   INTRODUCTION

1.1 Description

The CN616 Series is a second generation of industrial temperature controllers based on the field proven CN100 six zone temperature monitor/alarm system. Two models are available, standard and extended range.

The CN616 Series is a microprocessor based temperature controller, which accepts signals from thermocouples. Six zones are sequentially scanned at 15 readings per second [@ 60 Hz] and displayed with a selectable display rate of 1 to 40 seconds each zone. A single output relay is provided to indicate an alarm condition on any one zone. Six PID time proportional or on/off outputs are provided to control six zones. The faceplate has been arranged to call attention to an alarm condition by flashing the main temperature display and indicating the zone in alarm with a flashing zone number display. The CN616 Series implements a security password to protect all functions.

1.2 Features

• Six Zones
• Selectable control mode [PID or On/Off] each zone
• Selectable cooling control mode [On/Off only] each zone
• 20 Segment Profile for each zone
• Selectable number of active zones
• Adjustable Display Time
• Field Proven Zone Switching
• Temperature and Setpoint Monitoring
• Four Digit Display of Temperature
• 1 Digit Display of Zones
• 5 Amp Latching or Non-Latching Relay
• Standard Thermocouples [T,E,J,K,S,R,B,C]
• Extended Ranges
• Programmable Selection of HI, LO or HI/LO Alarms
• Password Protection
• 1/4 DIN Aluminum Box
• Splash Proof Face
• Plug-In I/O Terminals
• RS-232 Communication

2

1.3 Models

Two Models are available:
> CN616TC1 - Standard Thermocouple
> CN616TC2- Extended Range Thermocouple

1.4 Overview of operation

On power up the controller enters one of three run modes determined by model configuration (function [71] 33)

Mode 1   [00]   Standard Control
Mode 2   [51]   Ramp & Soak 1 - end power off
Mode 3   [52]   Ramp & Soak 2 - end run last setpoint

Each zone runs as an independent controller, except for PID parameters, (proportional band, reset and rate) and output cycle time which are common to all zones. In on/off mode hysteresis is common to all zones.

Any zone can be disabled or set to run under PID control or on/off control (heating or cooling) independent of other zones. If all zones are disabled zone 1 will be enabled by default.

Each zone can be setup to run as a standard control, set independently with function [36], or as a profile of up to 20 segments set by functions [01] to [20].

To run a standard control, set the number of segments (function [74]) for that zone to 0.

To run any zone in PID control mode set the PID zone enable function [43]. To disable any zone use function [31].

Alarms

The CN616 has 4 alarm options set by model select function [33].

> 0.   Overheat Alarm
> 1.   Underheat Alarm
> 2.   Hi - Lo Alarm
> 3.   No Alarm

Overheat or Hi alarm is triggered by temperature going over the setpoint beyond boundary set by the hi alarm setpoint. To trigger the alarm the temperature must stay in alarm condition for a few seconds. This is to prevent a false alarm.

Underheat or Lo alarm is disabled until enabled zones reach and stay over the setpoint for a set time. This is to prevent alarm when starting from cold. When Lo alarm is enabled it will be triggered only when confirmed over time same as Hi alarm.

Hi - Lo works the same as Overheat and Underheat alarms.

No Alarm disables both Hi and Lo alarms.

When any zone goes into an alarm condition zone scan lock is disabled, and when the alarm zone is displayed the temperature display will flash. Hi alarm is indicated by flashing left function digit while Lo alarm is indicated by flashing right function digit. In case of latching alarm, Hi alarm takes precedence and Hi alarm will show even if both alarms are latched.

Note! Whenever the "Run" Mode is exited to set or power off all alarms are reset.

Autotune

The PID control constants that are the same for all zones programmed for PID Mode. Autotuning can be done on any one zone selected for the Autotuning. The system parameters are measured during autotuning by supplying full power output to the system until the autotuning setpoint is reached, then the output power is switched Off allowing he temperature to overshoot and then drop down freely back to the autotuning setpoint. Then the power is switched on again until setpoint is crossed. At that point autotuning is completed, the PID constants are calculated and stored in memory until the next autotuning or manual changes are made. For best results the utotuning setpoint should be as close as possible to the control setpoint. However, since the temperature will overshoot the autotuning setpoint during the autotune by the full proportional band, Systems that cannot tolerate that temperature should have autotuning setpoint one proportional band value below the control setpoint. Setting of the controller can be entered from run mode, by pressing two buttons together, that will request password, function [99], unless password is disabled, then controller will go into function [70], which is the function select.

PID

All zones set for PID use the same PID parameters ie:- Proportional band Reset and Rate.These are derived from autotuning or manual setting. To achieve closest control the slowest zone should be chosen for the autotuning. If control is not optimal manual adjustment may be advisable.

On Off

On-off control is available for zones not set for PID control. All zones under on-off control are subject to the same hysterisis setting.

Profiling

The CN616 allows the process to be controlled under a precise time/temperature profile.
The Profile of each zone can be set within 20 segments.
Each segment consists of 3 parameters
1.   Setpoint in °C or °F
2.   Slope in °C / min. or °F / min.
3.   Time in hours
Note ! Slope always takes precedence over the time. That means that if slope is set then time will be ignored. To activate time slope must be set to (0). When slope is set to (0) time is used to calculate the slope for ramp. This way finer slope setting is possible.
Warning! In Soak application slope must be set to (0), otherwise time will be ignored and soak will not occur.

Example of setting Profile Segments

	Segment 1	Segment 2	Segment 3
Setpoint	0 2 0 0	0 2 0 0	0 4 0 0
Slope	0 4.0	0 0.0	0 8.0
Time	0 0. 0 0	0 1. 0 0	0 0. 0 0
	Starting from the current temperature go to 200 deg at 4 deg /minute	Soak at 200 deg for 1 hour	Climb to 400 deg at a rate of 8 deg per minute

To start setting Profile main display shows setpoint with the first digit (MS) flashing. Set digits with the ▲ button. Then scroll through the display with the ▶ button. After scrolling through 4 digits the display will change to slope. The slope has only 3 digits, after scrolling through slope main display will show 4 digit time, and after time setpoint again. To distinguish between setpoint slope and time setpoint has 4 full digits, slope has 3 digits with decimal point after second digit, and time has 4 digits with a decimal point after second digit. When all parameters are set save data with the ⚫ button. Saving data will advance display to the next segment.

Autotune zone1 Run zones 1, 2, 3 & 4
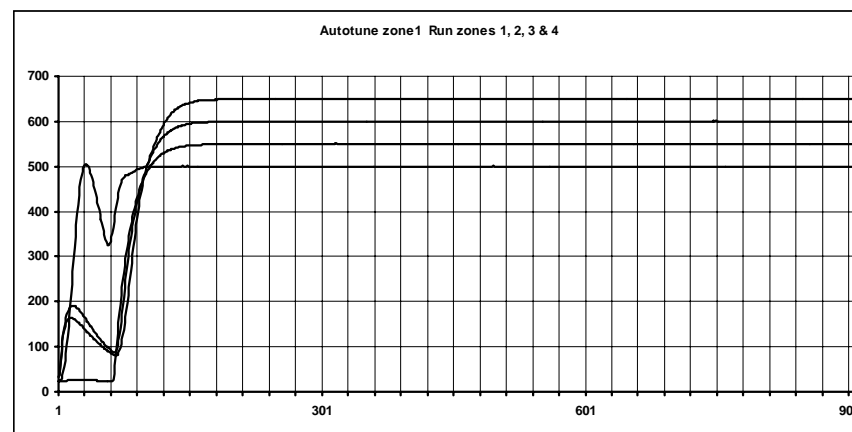
SECTION 2
RS-232 COMMUNICATIONS

NOTE: Minimum requirements to run RS-232 software is a PC computer with Windows 95.

2.1 Description

Up to ten controllers can be connected in parallel to a single RS-232 communications port on a PC. Each controller is assigned a serial number from 0 to 9 known as the RS-232 ID code. The computer uses these numbers to determine which controller unit to address at a given time. Each controller must have a different ID.

A simple set of menus is provided in the software which allows the operator to change the settings of each connected controller unit and display individual operating parameters.

For users with advanced software capabilities, see Section 2.4 for an operating protocol.

2.2 RS-232 Cable Connections
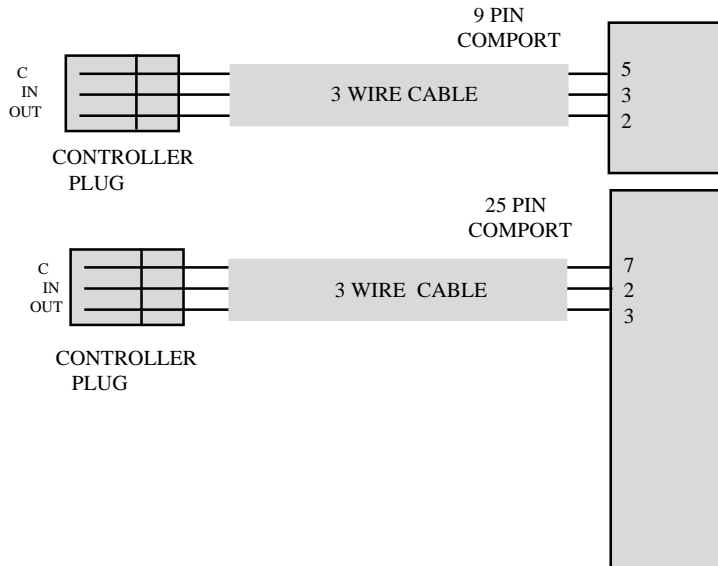
2.3 Operating Protocol for RS-232 Communications

The CN616 Controller is designed with standard RS-232 three wire serial communication capabilities. Up to ten controllers can be parallel connected to a single PC. The transmission line is held in tristate to avoid cross-talk between controllers except when the computer addresses a specific controller for communication.

Configuration
BAUD rate = 4800
Data bits = 8
Parity = N
Stop = 1

Communication software for the PC is written in Visual Basic. This software package has been created to operate on PC Windows 95 platform meeting the minimum requirements.

Customers can communicate with CN616 controllers through a PC by using the following protocol:

• Controllers will not initiate communication. The RS-232 Command Module (computer or similar device) must initiate.

• All communication is in ASCII format

• To start communication, the Command Module must send alert code ASCII [L] hex 4C. This commands the controllers to cease RS-232 communication and listen for an RS-232 ID Code. The Command Module then sends the Identification Number for the controller that it needs to address, ASCII [0 to 9] hex 30 to 39. The identified controller will then expect a command code. All the other controllers on-line will wait for the next alert code.

• Command codes are divided into two groups:

Group 1.   Commands " CAPITAL" requesting data from the
             controller.
Group 2.   Commands " small" sending data to the controller.

2.3.1 List of data transfer Codes
Parameters
    Code   "J"   controller sends string
    Code   "j"   controller receive string
Protocol from computer   " L3J" request for data
                            " L3j" + string of data

Data string 16 characters long
    zone enable   [77]
    password enable   [x0]
    model   [1204]
    ID   [x9]
    scan time   [39]
    password   [1011]
zone enable   code   [0111 0111] binary
                     654   321   zones

Setpoints
    Code   "B"   controller sends string
    Code   "b"   controller receive string
Protocol from computer   " L3B" request for data
                            " L3b" + string of data

Data string 24 characters long
6 setpoints 4 characters each.

High alarms
    Code   "C"   controller sends string
    Code   "c"   controller receive string
Protocol from computer   " L3C" request for data
                            " L3c" + string of data

Data string 24 characters long
6 high alarms 4 characters each.

Low alarms
    Code   "D"   controller sends string
    Code   "d"   controller receive string
Protocol from computer   " L3D" request for data
                            " L3d" + string of data
Data string 24 characters long   6 low alarms 4 characters each.

PID parameters
    Code   "K"   controller sends string
    Code   "k"   controller receive string
Protocol from computer   " L3K" request for data
                            " L3k" + string of data

Data string 20 characters long
[9990]   cycle time   99.90 seconds
[99]   hysterisis   99 degrees
[77]   PID zone enable   0111 0111
[9999]   proportional band   9999 degrees
[0999]   reset   9.99
[9999]   rate   99.99
Number of segments
    Code   "F"   controller sends string
    Code   "f"   controller receive string
Protocol from computer   " L3F" request for data
                            " L3f" + string of data
Data string 12 characters long. Number of segments.
6 zones 2 characters each.   (00 to 20) segments

Segment parameters
    Code   "U"   controller sends string
    Code   "u"   controller receive string
Protocol from computer   " L3U" request for data for zone 1
                            " L3u" + string of data for zone 1
Data string 240 characters long. Segment data zone 1
    20 segments 12 characters each segment
    [9999] setpoint   9999 degrees
    [0999] slope   99.9 degrees/minute
    [9999] time   99.99 hours

Segments

Codes "V" to "Z" same format as code "U"

    Code "V"   zone 2
    Code "W"   zone 3
    Code "X"   zone 4
    Code "Y"   zone 5
    Code "Z"   zone 6

Temperature and alarms

    Code   "T"   controller sends string

Protocol from computer " L3T" request for data

Data string 28 characters long. temperature of 6 zones and alarms

    [9999] temperature zone 1
    [9999] temperature zone 2
    [9999] temperature zone 3
    [9999] temperature zone 4
    [9999] temperature zone 5
    [9999] temperature zone 6
    [77]   high alarm
    [77]   low alarm

Current setpoints (as updated by profile)

    Code   "R"   controller sends string

Protocol from computer " L3R" request for data

Data string 24 characters long. Setpoints of 6 zones

    [9999] Setpoint zone 1
    [9999] Setpoint zone 2
    [9999] Setpoint zone 3
    [9999] Setpoint zone 4
    [9999] Setpoint zone 5
    [9999] Setpoint zone 6

2.4 RS-232 PC Screens

Four examples of program screens are shown below.
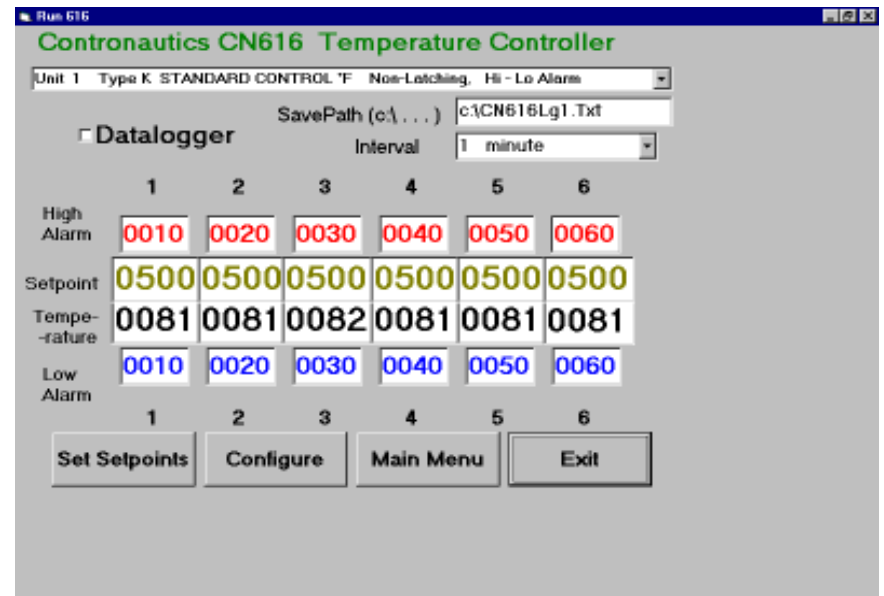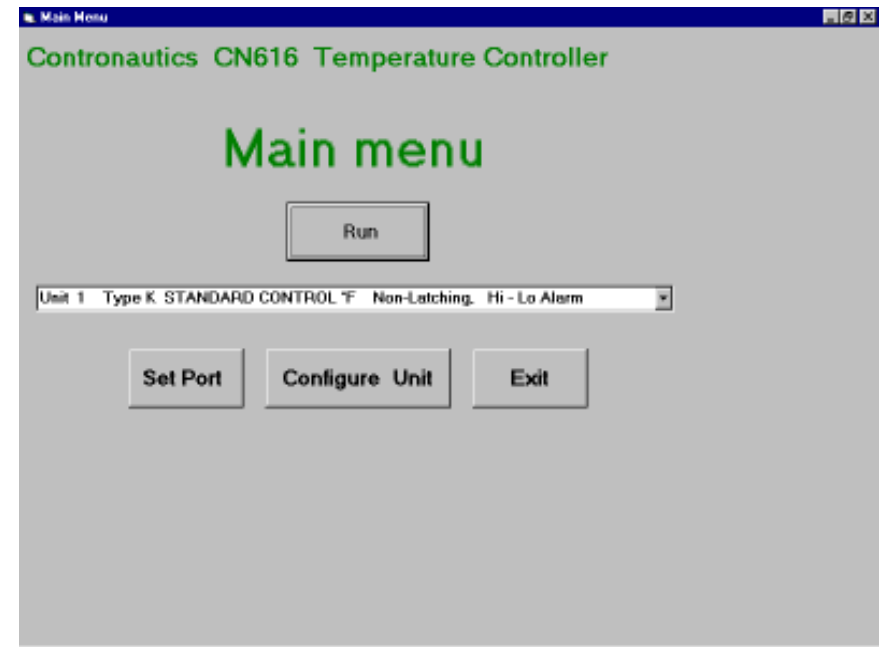
Contronautics CN616 Controller

Set Profile Segments

Zone 1 Segment 1 Setpoint

| Program Data | EXIT |

Setpoint — 9999 deg. — `0310`
Slope — 99.9 deg/minute — `01.8`
Time — 99.99 hours — `00.00`

Set Profile data grid (columns 1–20, Zones 1–6; each segment shows Setpoint / Slope / Time):

Zone 1

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Setpoint	0310	0310	0410	0250	0200	0200	0300	0300	0400	0250	0200	0200	0300	0300	0200	0250	0200	0000	0000	0000
Slope	0180	0000	0180	0000	0180	0000	0180	0000	0180	0000	0180	0000	0180	0000	0180	0180	0180	0000	0000	0000
Time	0000	0035	0000	0035	0035	0025	0000	0025	0000	0035	0035	0025	0025	0015	0035	0035	0035	0035	0000	0000

Zone 2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Setpoint	0320	0300	0420	0250	0200	0200	0300	0300	0400	0250	0200	0200	0300	0300	0200	0250	0200	0000	0000	0000
Slope	0180	0000	0180	0000	0180	0000	0180	0000	0180	0000	0180	0000	0180	0000	0180	0000	0180	0000	0000	0000
Time	0000	0035	0000	0035	0035	0025	0000	0035	0000	0035	0035	0035	0035	0035	0035	0035	0035	0000	0000	0000

Zone 3

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Setpoint	0300	0300	0400	0250	0200	0200	0300	0300	0400	0250	0200	0200	0300	0300	0200	0250	0200	0000	0000	0000
Slope	0180	0000	0180	0000	0180	0000	0180	0000	0180	0000	0180	0000	0180	0000	0180	0180	0180	0000	0000	0000
Time	0000	0035	0000	0035	0035	0035	0000	0035	0000	0035	0035	0035	0035	0035	0035	0035	0035	0000	0000	0000

Zone 4

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Setpoint	0340	0300	0440	0250	0200	0200	0300	0300	0400	0250	0200	0200	0300	0300	0200	0250	0200	0000	0000	0000
Slope	0180	0000	0180	0000	0180	0000	0180	0000	0180	0000	0180	0000	0180	0000	0180	0180	0180	0000	0000	0000
Time	0000	0035	0000	0035	0035	0025	0000	0025	0000	0035	0035	0035	0035	0035	0035	0035	0035	0000	0000	0000

Zone 5

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Setpoint	0350	0300	0400	0250	0200	0200	0300	0300	0400	0250	0200	0200	0300	0300	0200	0250	0200	0000	0000	0000
Slope	0180	0000	0180	0000	0180	0000	0180	0000	0180	0000	0180	0000	0180	0000	0180	0000	0000	0000	0000	0000
Time	0000	0035	0000	0035	0035	0025	0000	0035	0000	0035	0035	0035	0035	0035	0035	0000	0000	0000	0000	0000

Zone 6

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Setpoint	0360	0360	0460	0250	0200	0200	0300	0300	0400	0250	0200	0000	0000	0000	0000	0000	0000	0000	0000	0000
Slope	0180	0000	0180	0000	0180	0000	0180	0000	0180	0000	0180	0000	0000	0000	0000	0000	0000	0000	0000	0000
Time	0000	0035	0000	0035	0035	0025	0000	0025	0000	0035	0035	0000	0000	0000	0000	0000	0000	0000	0000	0000

Set Setpoints

Contronautics CN616 Temperature Controller SETUP

Unit 1   Type K STANDARD CONTROL °F   Non-Latching, Hi - Lo Alarm

Enable Zone	1	2	3	4	5	6
High Alarm	0010	0020	0030	0040	0050	0060
Setpoint	0500	0500	0500	0500	0500	0500
Temperature	0082	0082	0082	0082	0081	0081
Low Alarm	0010	0020	0030	0040	0050	0060
	1	2	3	4	5	6

| Load Change | Main Menu | Return/Run |
| Set Profile | Configure | SCAN SPEED `4` |

Configure Unit

Contronautics CN616 Model Configuration

MSD
- ○ Overheat Alarm
- ○ Underheat Alarm
- ⊙ HI - LO Alarm
- ○ No Alarm

Degrees C/F
- ○ Latching Relay °C
- ○ Latching Relay °F
- ○ Non Latching Relay °C
- ⊙ Non Latching Relay °F

Control Mode
- ⊙ STANDARD CONTROL
- ○ RAMP AND SOAK 1
- ○ RAMP AND SOAK 2

Profile Segments — ZONES

1	05	4	05
2	05	5	05
3	05	6	05

Unit 1   Type K STANDARD CONTROL °F   Non-Latching, Hi - Lo Alarm

Thermocouple
- ○ Type B   ⊙ Type K
- ○ Type R   ○ Type C
- ○ Type E   ○ Type S
- ○ Type J   ○ Type T

`1  0  1  1`

Enter New Password – (i.e. 1030)

| LOAD CHANGE |
| RETURN/RUN |
| MAIN |
| SET SETPOINTS |
| NEW PASSWORD |
| SET PROFILE |

PID Setup

Cycle time (output)	04.0	sec.
Hysteresis (on/off deviation from SP)	00	deg. C/F

PID zone enable	1	2	3	4	5	6
	☑	☑	☑	☑	☑	☑
Cooling zone enable	☐	☐	☐	☐	☐	☐

Proportional band	0172	deg. C/F
Reset	0.00	Repeat/min.
Rate	00.00	min.

SECTION 3
INSTALLATION

3.1 Unpacking

Upon receipt of shipment, inspect the container and equipment for any signs of damage. Take particular note of any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

Remove the packing list and verify that all equipment has been received. Each package should contain:

- Controller (CN616)
- Operator's Manual
- RS-232 Software
- Two mounting slides with screws
- Power plug (9 pin)
- RS-232 plug (3 pin)
- Two T/C plugs (6 pin)
- Two Output plugs (6 pin)

If there are any questions about the shipment, please call the Customer Service Department.

NOTE: The carrier will not honor any claims unless all shipping material is saved for their examination. After examining and removing contents, save packing material and carton in the event reshipment is necessary.

3.2 Mounting

Select a location for the controller that is free from excessive shock, vibration, dirt, moisture and oil. Mount the controller into a 3 5/8" (92mm) square cutout. The controller as shipped is 1/4 DIN (92mm square), so it does not have to be removed from it's housing to be mounted.

Remove the two screws that secure the mounting slides. Remove the slides and insert the case into the cutout from the front side of the panel. Reinstall the two slides and two screws. The length of the slides must be reduced if the controller is to be mounted in an extra thick panel.

3.3 Outline Dimensions
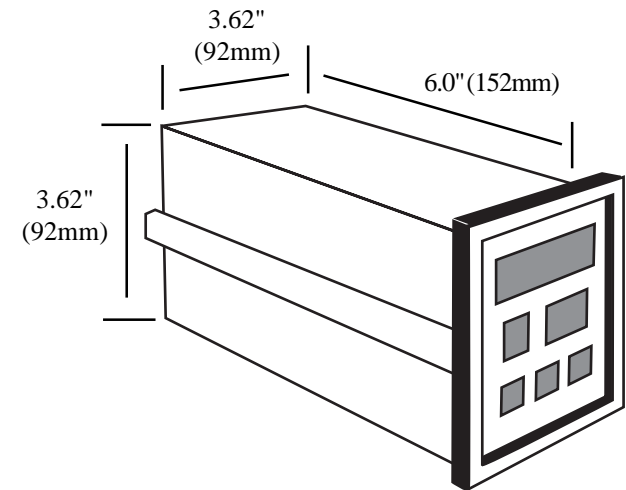
3.4 Wiring the Power Circuit

The line voltage for the controller is selected by an external jumper assembly to operate either on 120VAC or 240VAC±10%, 50/60Hz (factory wired for 120VAC). It is very important that the proper line voltage is connected to the instrument. If 120VAC is connected to a 240VAC model, it will not work properly. A 120VAC instrument connected to 240VAC will overheat and burn the input transformer.
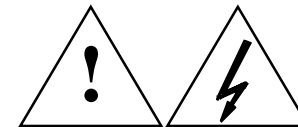
WARNING! !

The controller is powered with either 120 or 240 VAC. To avoid electric shock or fatality hazards the power to the controller lines must be switched off at the main switch, or circuit breaker before the controller A/C wiring, including the line selector jumpers can be handled.

3.5 Changing Line Voltage Setting

Program the input line voltage by placing jumpers on the line plug as shown:

120V Jumper
Placement:

LINE
120VAC

240V Jumper
Placement:
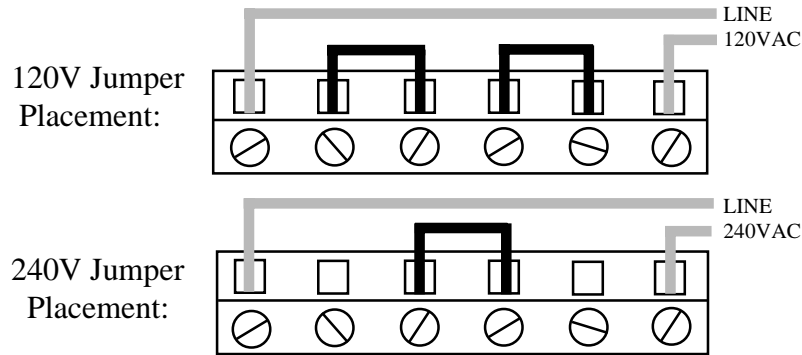
LINE
240VAC

WARNING! !
Line Voltage
see Pg 16
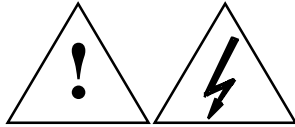
3.6 Sensor Placement

Proper sensor placement is essential. It can eliminate many problems in the total system. The probe should be placed so that it can detect any temperature change with little thermal lag. In a process that requires fairly constant heat output, the probe should be placed close to the heater. In processes where the heat demand is variable, the probe should be close to the work area. Experimenting with probe location can often provide optimum results. Some units are shock sensitive and require care in handling and installation. To avoid current feedback from zone to zone and from zone to RS-232 communications, ungrounded thermocouples are recommended. Thermocouple wires should not be placed in the same conduit as the power lines.

SECTION 4
PARTS OF THE INSTRUMENT

Temperature\Setpoint Display

Temperature Scale Selection

Zone Setting

Function Setting

1000 °C

Zone   Function

Set\Shift\Reset Button

Load Button

Advance Digit Button
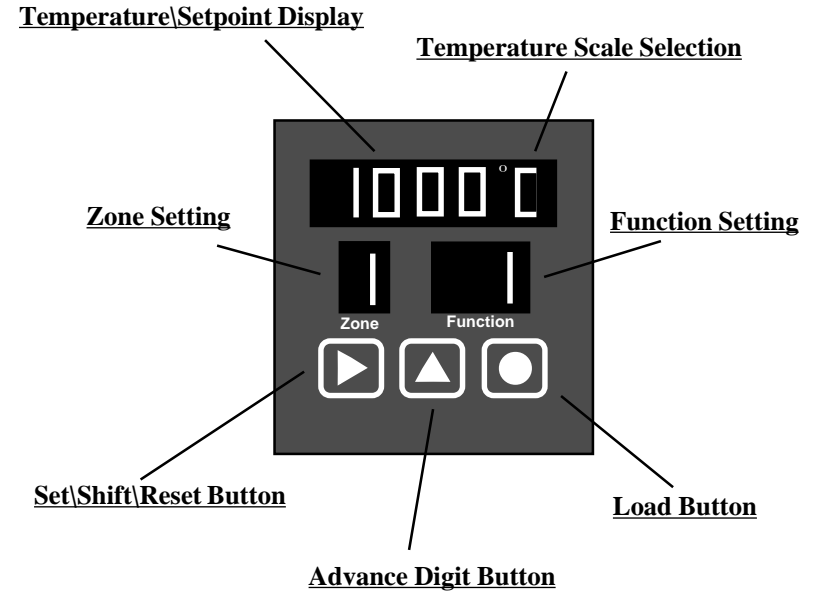
Temperature\Setpoint Display- Main display with multiple functions.
Temperature Scale Selection- Choice of °C or °F.
Function Setting- Indicates the operating status of the instrument.
Zone Setting- Indicates an active zone or a zone that is being set.
Set\Shift\Reset Button- Used to select digits during setup or to unlock the display scan.
Advance Digit Button- Used to increment selected digit.
Load Button- Used to accept a setting or to lock display zone.

4.2 Button Functions

There are three flatpad buttons provided and two combinations of buttons for separate functions.

Shift Button

▶

1. Selects Digit
2. Unlock Zones scan
3. Switches Main Display Functions

Advance Digit Button

▲

1. Advances flashing Digits
2. Advances Zones

Load Button

⬤

1.   Lock zone scan during **"RUN MODE"**

Note! Zone scan is unlocked by the shift button, ▶ or by an alarm condition. In alarm state zone scan can not be locked.

2.   Load set parameters into the memory in **"SET MODE"**

Shift Button & Load Button (together)

▶ & ⬤

1. Enter **"FUNCTION SELECT" MODE**
2. Exits **"FUNCTION SELECT" MODE**
3. Resets Alarm during **"RUN MODE"**

4.3 Back of the Controller

RS-232 Port

Line Voltage and Jumpers

SPDT Relay Connect

OUTPUT

INPUT

THERMOCOUPLES

Red Wire
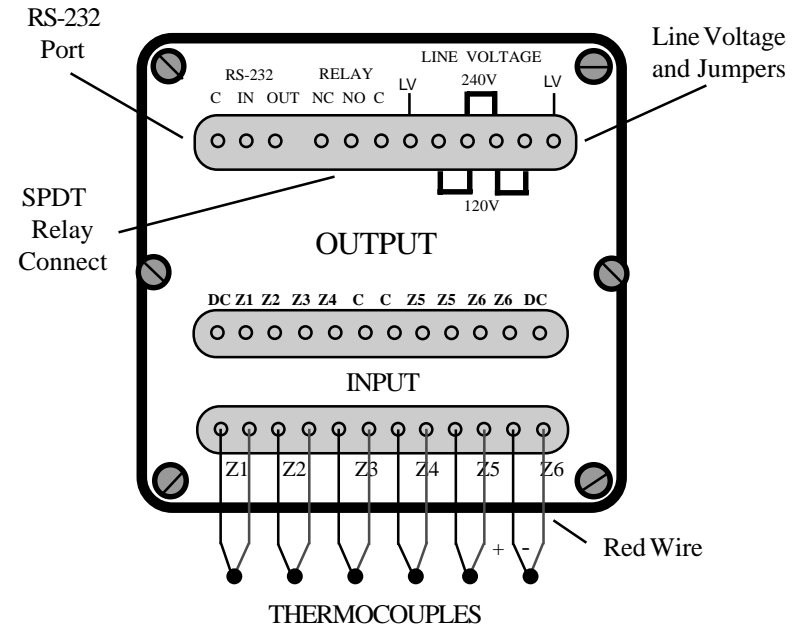
WARNING! !
Line Voltage
see Pg 16
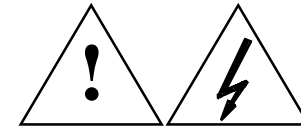
RS-232 Port- Cable connection (see Section 1.3)

C - Common   Pin 5
IN - Input   Pin 3   } 9 Pin Comport
OUT - Output Pin 2

Relay
NC- Non-energized Closed
NO- Non-energized Open
C- Common

Line
LV- 120VAC or 240VAC cable
Jumpers- Determines voltage input (see Section

4.4 Temperature/Setpoint Display (Main Display)

During **"RUN" MODE**, the Main Display is used to monitor zone temperatures, check setpoints, and indicate ALARM conditions.

```
0 5 2 2  ──── Temperature

Zone ──── 3   5 1  ──── Run Mode
```
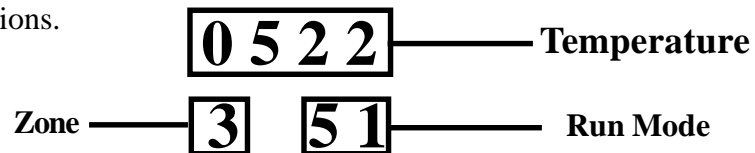
By pressing and holding button ▶ The display will change to

```
0 5 2 0  ──── Setpoint

Zone ──── 3   5 1  ──── Run Mode
Flashing
```
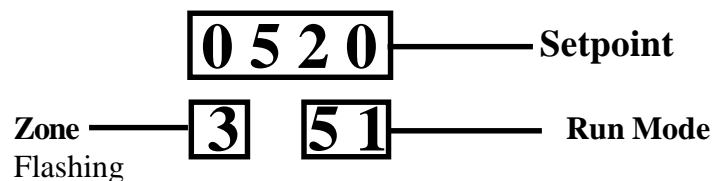
During operator programming in **"FUNCTION SELECT" MODE**, the Main Display is used to:

1. Set the Zone Setpoints
2. Enter Passwords
3. Select Functions
4. Set the Zone Display Time
5. Select the Instrument Model
6. Select Run parameters

During **CALIBRATION** (Function 78), the Main Display is used to:

```
3 1.0 5  ──── Mv

□   7 8  ──── Function
```
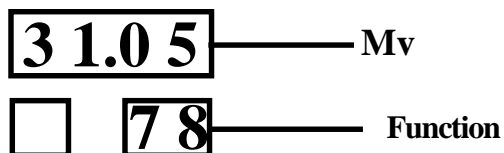
1. Set calibration millivolts

SECTION 5
"RUN" MODE

In the "RUN" Mode the CN616 controls the temperature under the program established during the last "SET" Mode. The "RUN" Mode is entered every time the controller is powered, after a power interruption, or it can be entered manually from the "SET" Mode, by pushing buttons ▶ and ⚫ together

"SET" Mode TIME OUT. If the instrument is left unattended for over 2 minutes in the "SET" Mode, the program will switch it back to "RUN" Mode.

Three "RUN" Modes are available

1. [00] Standard Control **FN** 33 Control Mode (digit 3) = 0
2. [51] RAMP & SOAK 1 **FN** 33 Control Mode (digit 3) = 1
3. [52] RAMP & SOAK 2 **FN** 33 Control Mode (digit 3) = 2

5.1 PID CONTROL MODE

Each one of the six zones is treated as a separate controller and it can run under any one of the following Modes

1. PID enable **FN** 43
2. Proportional Band (PB) **FN** 44 - **FN** 45 & 46 set to 0
3. Proportional Band and Reset (PI) **FN** 44 & 45 - **FN** 46 set to 0
4. Proportional Band and Rate (PD) **FN** 44 & 46 - **FN** 45 set to 0
5. Proportional Band Reset and Rate (PID) **FN** 44 , 45 & 46
6. Disabled (OFF) **FN** 31

NOTE!! The PID setting is common to all zones i.e.:- it can not be changed from zone to zone. The zones can be mixed and set to either PID or ON-OFF FN [43]

5.2 RAMP & SOAK CONTROL 1

In this Mode each zone will follow the RAMP & SOAK program set in Section 6: **FN** 74 & 75 . At the end of the Profile "RUN" the output power will be switched OFF.

5.3 RAMP AND SOAK CONTROL 2

This Mode is exactly the same as RAMP & SOAK 1 except that at the end of the Profile "RUN" the controller will control the temperature at the setpoint of the last segment indefinitely.
NOTE !!
In the RAMP and SOAK Control Mode 1 and Mode 2 any one zone can run under PID or ON-OFF control.
Also in the RAMP and SOAK Control Mode 1 and Mode 2 any one zone can be excluded from that Mode (See Section 6: **FN** 74) and that zone will be run under PID Control Mode [00]. The function display will be switched from [51] (or [52]) to [00] corresponding to the Run Mode for each zone as it is displayed.

SECTION 6   SETUP AND OPERATION

This section deals with setting up all of the parameters of the CN616 Temperature Controller. **FN** [70] is assigned for that task. The setup operation is protected by a security password to prevent accidental or unauthorized modifications.
On power up the CN616 controller will enter "RUN" Mode. To enter setup mode press buttons ▶ and ⬤ together for few seconds until function [99] or [70] is displayed in the function display. If password protection is enabled function [99] will request a password. Entry of a four digit password is required to enter function select mode **FN** [70].
The password is set at the factory to "1011". The password can only be changed by the software or at the factory.
To enter the password use the button △ to increment each digit, use the button ▶ to move to the next digit and ⬤ the button to enter the password. Entering a wrong password will return the controller to the "RUN" Mode.

6.1 Summary

Controller setting is organized in 8 major functions and function groups [71 to 78] and their related functions, listed below.

Function 71   Model Setup Group

function 31	zone enable
function 32	password enable
function 33	model select
function 34	ID for RS-232
function 35	zone display time

Function 72   Control Setup Group

function 36	setpoint
function 37	high alarm (over setpoint)
function 38	low alarm (under setpoint)

Function 73   PID Setup Group

function 41	cycle time (output)
function 42	hysterisis (on/off deviation from SP)
function 43	set PID zone
function 44	proportional band
function 45	reset
function 46	rate
function 47	set COOLING zone

Function 74   **number of segments for each zone**
Function 75   set segments

function 01	segment 01	zone 1 to 6
to function 20	segment 20	zone 1 to 6

Function 76   **set setpoint and zone for autotune**
Function 77   **autotune**

function 61 autotune stage 1
function 62 autotune stage 2
function 63 autotune stage 3

Function 78   **calibrate**

Function 79   **Start Profile**

6.2   Function [99]   Security

Security password protects all setup functions from accidental or unauthorized modifications. The security password is factory preset At 1011 and it can be changed only under RS232 computer program. The security can be enabled or disabled within Function [71] Model Setup. Whenever FN [99] appears, in function window, it means that the security is enabled and password must be entered one digit at a time. Using button ▲ enter the correct number in the flashing digit, then using button ▶ shift to the next digit and again using button ▲ enter the correct number. Repeat for all four digits, then enter with button ⚫ If password is correct the FN [70] will appear in function window. If not correct the controller will return to the "RUN" Mode. If the process times out the display will return "RUN" Mode.

6.3   Function [70]   Function Set up Control

Function [70] is entered from function [99] or directly from "RUN" Mode if password security is disabled.

In function [70] , the number 70 is displayed in the function window, Increment the flashing digit with the button ▲ until required function shows in the upper display, function [71] to function [78] then enter the selected function with the button ⚫ that will display entered function in function window and 70 in the top display. To confirm the function selection increment the flashing digit with the button ▲ until the upper display matches the function display. At this point enter confirmation of the selection with the button ⚫ If the process times out the display will return "RUN" Mode. If the two displays do not match, the controller will return to function [70].

To return to RUN mode press two buttons ▶ and ⚫ together for a few seconds.

6.4   Function Group [71] Model Setup

Function [71] controls functions [31] to [35]

On entering function [71] the function display shows 71. The upper display shows 31. To select functions

EXAMPLE :-   To Select PID Control Group

1.   Start from FN 70

```
| 71 |
□ 70
```

2.   change 71 to 73 with
     button ▲

```
| 73 |
□ 70
```

3.   enter with ⚫ button
     The display will change to

.

```
| 70 |
□ 73
```

4.   Change to 73 to confirm
     selection with ▲ button

```
| 73 |
□ 73
```

5.   enter with ⚫ button

     Display will change to
     PID control group FN 73

```
| 41 |
□ 73
```
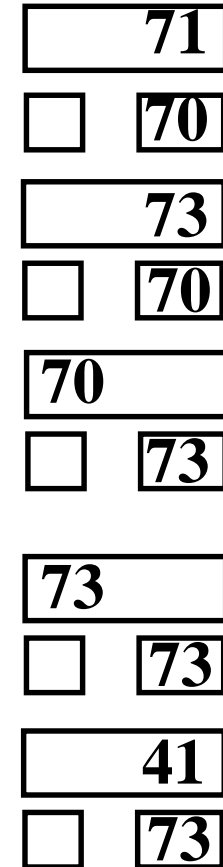
[32]-[35] increment the flashing digit with the button ▲. When the desired function is displayed enter it with the button ⬤ This will display the desired function in the function display.
If the process times out the display will return "RUN" Mode.
To return to function [70] press two buttons ▶ and ⬤ together for a few seconds.

6.4.1   Function [31]   zone enable
The zone enable function is used to enable/disable any or all of the zones individually. If all of the zones are disabled then zone one will remain enabled by default
In function [31] the function display will show 31, the zone display will show 1, and the upper display will be blank.
If the zone display is flashing it indicates that the current zone is disabled.
To toggle between enable and disable use the button ▶
To advance to next zone use the button ▲
To save the settings and return to function [71] use the button ⬤

6.4.2   Function [32]   password enable
The password enable function turns on/off the password protection for changing the settings for the unit. In function [32] the function display will show 32, the zone display will be blank, and the upper display will flash 0 or 1.
If the display is 0 it indicates that the password is disabled.
If the display is 1 it indicates that the password is enabled.
To toggle between enable and disable use the button ▲
To save setting and return to function [71] use the button ⬤

6.4.3   Function [33]   select model
The select model function sets the type of unit for alarms, relay, degrees C or F, control mode, and thermocouple as per the table. In function [33] the function display will show 33, the zone display will be blank, and the upper display will show a 4 digit model code, digit 1 will be flashing.

To increment the flashing digit use the button ▲
To advance to the next digit use the button ▶
To save the settings and return to function [71] use the button ⬤

Four digit model code

Digit 1	0 = Overheat Alarm
Alarm	1 = Underheat Alarm
Type	2 = HI-LO Alarm
	3 = No Alarm
Digit 2	0 = Latching Rel. °C
Relay	1 = Latching Rel. °F
And °C or °F	2 = Non Latching °C
	3 = Non Latching °F
Digit 3	0 = STANDARD CONTROL
CONTROL	1 = RAMP AND SOAK 1
MODE	2 = RAMP AND SOAK 2
Digit 4	0 = TYPE B
T/C TYPE	1 = TYPE C
	2 = TYPE E
	3 = TYPE J
	4 = TYPE K
	5 = TYPE R
	6 = TYPE S
	7 = TYPE T

Example:
To select "RAMP AND SOAK 1" With type 'K' thermcouple °F with Non Latching HI-LO Alarm, set MODEL as shown below.

HI-LO Alarm ——— ⎡2⎤⎡3⎤⎡1⎤⎡4⎤——TYPE K

Non Latching °F ——————————————— RAMP AND SOAK 1
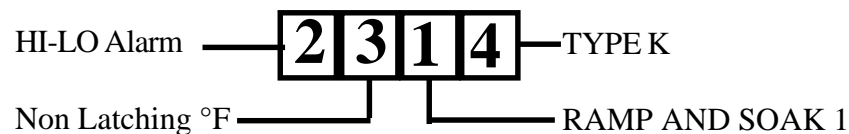
6.4.4   Function [34]   ID for RS232

The ID code for the RS-232 is the identifying number for each unit connected through an RS-232 line to a computer. If two or more units are connected to a computer every unit must be set to have a different RS-232 ID code for proper operation. In function [34] the function display will show 34, the zone display will be blank, and the upper display will display the 1 digit RS-232 ID code. To increment the flashing digit use the button ▲
To save the settings and return to function [71] use the button ⬤

6.4.5   Function [35]   zone display time

The zone display time function sets the time period that each temperature will display in the temperature window. The zone display is settable to 1-40 seconds.
In function [35] the function display will show 35, the zone display will be blank, and the upper display will show the two digit zone display time.
To increment the flashing digit use the button ▲
To advance to the next digit use the button ▶
To save the settings and exit to function [71] use the button ⬤

6.5   Function Group [72]   Setpoints and Alarms

Function [72] controls functions [36] to [38]
On entering function [72] the function display shows 72. The upper display reads 36. To select functions [36] to [38] increment the flashing digit with the button ▲. When the desired function is displayed enter it with the button ⬤ This will display set function in function display.
If the process times out the display will return "RUN" Mode.
To return to function [70] press two buttons ▶ and ⬤ together for a few seconds.

6.5.1   Function [36]   setpoint
The setpoint function allows setting the control point of the tem-perature controller for each zone.

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In function [36] the function display will show 36, the zone display will show 1, and the upper display will show the current setpoint.
To increment the flashing digit of the setpoint use the button
To advance to the next digit use the button ▶
To save the settings and go to the next zone use the button ⬤
To exit to function [72] use the buttons ▶ and ⬤ together for a few seconds.

6.5.2   Function [37]   high alarm (over setpoint)
The high alarm function sets the high temperature safety point for each zone above which each zone will go into alarm mode.
In function [37] the function display will show 37, the zone display will show 1, and the upper display will show the two digit current alarm setting.

To increment the flashing digit of the setpoint use the button
To advance to the next digit use the button ▶
To save the setting and go to the next zone use the button ⬤
To exit to function [72] use the buttons ▶ and ⬤ together for a few seconds.

6.5.3   Function [38]   low alarm (under setpoint)
The low alarm function sets the low temperature safety point for each zone below which each zone will go into alarm mode. To prevent alarming on low temperature during start-up the low alarm is disabled until all zones exceed their low alarm setpoint.
In function [38] the function display will show 38, the zone display will show 1, and the upper display will show the two digit current alarm.
To increment the flashing digit use the button ▲
To advance to the next digit use the button ▶
To save the setting and go to the next zone use the button ⬤
To exit to function [72] use the buttons ▶ and ⬤ together for a few seconds.

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6.6   Function Group   [73]   PID Setup

The functions in group 73 allow the operator to examine and or change the PID constants including those generated by autotuning. Function [73] controls functions [41] to [46]

On entering function [73] function display shows 73. The upper display shows 41. To select the desired function [41] to [46] increment the flashing digit with the button   When the desired function is displayed enter it with the button   . This will display the selected function in the function display.

If the process times out the display will return "RUN" Mode.

To return to function [70] press two buttons   and   together for a few seconds.

6.6.1   Function [41]   Output cycle time (99.9) sec

This function allows the operator to examine and change the Output cycle time

In function [41] the function display will show 41, the zone display will be blank, and the upper display will show the three digit current Output cycle time setting.

To increment the flashing digit press the button

To advance to the next digit press the button

To save setting and exit to function [73] press the button

6.6.2   Function [42]   Hysteresis on-off control (99) deg C or F

In the on-off control with hysteresis function the operator can control the dead band in which the output does not change. In function [42] the function display will show 42, the zone display will be blank, and the upper display will show the two digit current Hysteresis.

To increment the flashing digit press the button

To advance to the next digit press the button

To save setting and exit to function [73] press the button

6.6.3   Function [43]   enable PID zone

The enable PID zone Function allows selection of on/off or PID control for individual zones. In function [43] the function display will show 43, the zone display will show 1, and the upper display will be blank.

If the zone display is flashing it indicates that the zone is selected for on-off control. If the zone display is not flashing then it is selected for PID control.

To toggle between enable and disable use the button ▶

To advance to the next zone use the button ▲

To save the settings and return to function [73] use the button ⬤

6.6.4   Function [44]   Proportional Band (9999) deg C or F

The proportional band function allows the user to examine and set the proportional band.

In function [44] the function display will show 44, the zone display will be blank, and the upper display will show the current Proportional band.

To increment the flashing digit use the button ▲

To advance to the next digit use the button ▶

To save the settings and exit to function [73] use the button ⬤

6.6.5   Function [45]   Reset   (9.99) repeats / min.

The reset function allows the operator to examine and change the integral function of PID control.

In function [45] the function display will show 45, the zone display will be blank, and the upper display will show the three digit current Reset setting.

To increment the flashing digit use the button ▲

To advance to the next digit use the button ▶

To exit to function [73] use the button ⬤

6.6.6 Function [46]   Rate (99.99) minutes

The Rate function allows the operator to examine and change the differential function of PID control.

In function [46] function display will show 46, the zone display will be blank, and the upper display will show the current Rate.

To increment the flashing digit press the button ▲

To advance to the next digit press the button ▶

To save setting and exit to function [73] press the button ⬤

6.6.7 Function [47]   enable Cooling zone

This function is set in the same manner as function [43].

Zones enabled by this function will run in on / off control mode and will have outputs inverted to control cooling.

6.7   Function [74]   Set number of segments

The segments function allows the operator to set the size of the profile in segments and the number of profile variants. Function [74] does not control any other function

On entering function [74] function display shows 74.

Zone display shows zone 1.

The first and second digits in the upper display shows the current number of segments for the displayed zone.

To increment the flashing digit press the button ▲

To advance to the next digit press the button ▶

To save the settings and go to the next zone press the button ⬤

To exit to function [70] use the buttons ▶ and ⬤ together for a few seconds.

Note !! The number of segments is restricted to 20 for each zone.
Setting 0 segments will force the controller to run that zone in a STANDARD Mode using setpoint set by function [36]. This allows a mix of zones running STANDARD Mode and PROFILE

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6.8   Function Group [75]   Ramp and Soak

Function [75] controls segment functions [01] to [20]

On entering function [75] the function display shows 75. The upper display will read 01 . The zone window will show 1.

To select the segment and zone to be set, enter the segment number and zone. Note that the segment number is restricted by the number of segments set in function [74].

To increment the flashing digit press the button ▲

To advance to the next digit (segment and zone number) press the button ▶

To enter the segment to be set press the button ⬤

On entering segment display will advance to the next segment. If the last segment of that zone is entered then display will advance to the first segment of next zone.

To return to function [70] press two buttons ▶ and ⬤ together for a few seconds.

6.8.1 Function [01]   Set Segment 1
                              Setpoint   (9999) degrees
                              Slope   (99.9) deg / minute
                              Time   (99.99) hours

In function [01] the function display will show 01.

The zone display will show the selected zone.

The upper display will show the 4 digit current Setpoint. To accommodate 3 parameters the upper display will scroll through 3 independent displays. To recognize which display is shown each parameter has a different look. The setpoint parameter displays 4 digits. The slope parameter is displayed with three digits. The time parameter is displayed with 2 digits followed by 2 decimal digits.

To increment the flashing digit press the button ▲

To advance to the next digit and scroll press the button ▶

To save the segment and advance to the next segment press the button ⬤

To return to function [75] press two buttons ▶ and ⬤ together for a few seconds.

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Note !! Only the number of segments set in function [74] are allowed to be set. After last segment is saved the unit segment setup will advance to the next zone. This way all segments are set in sequence. Out of sequence segments can be set by returning to function [75] after saving each segment.

6.8.2-20   Function [02] to [20]   Set Segment 02 to 20
follow the same procedure as Function [01]

6.9   Function [76] Set Autotune

Function [76] does not control any other function
On entering function [76] the function display shows 76.
The zone display shows zone 1.
The upper display shows the current setpoint.
By advancing the flashing digit the operator can scroll through the top display and the zone display.
To increment the flashing digit press the button ▲
To advance to the next digit with press the button ▶
To save the settings and return to function [70] press the button ●

6.10 Function [77]   Run Autotune

The PID control constants that are the same for all zones programmed for PID Mode. Autotuning can be done on any one zone selected for the Autotuning. The system parameters are measured during autotuning by supplying full power output to the system until the autotuning setpoint is reached, then the output power is switched OFF allowing he temperature to overshoot and then drop down freely back to the autotuning setpoint. At that point autotuning is completed, the PID constants are calculated and stored in memory until the next autotuning or manual changes are made. For best results the autotuning setpoint should be as close as possible to the control setpoint. However, since the temperature will overshoot the autotuning setpoint during the autotune by the full proportional band, Systems that cannot tolerate that temperature should have autotuning setpoint one proportional band value below the control setpoint.

Function 77 initiates unit autotuning.
On entering function [77] the function display reads 61.
The zone display shows the zone set for autotuning.
The upper display shows current temperature. When the top display and function display are flashing the power is turned on. When temperature reaches the Autotune setpoint the power goes off and the function display shows 62. On completion of the autotuning the controller returns to "RUN" Mode.

To stop the autotune press two buttons ▶ and ● together

6.11 Function [78]   Calibration

Calibration is performed by inputting DC MV from a low Impedance source (10 Ohm) and entering the precise value of the MV into the display.

UNIT WIRING:
Using copper wire, connect the positive and negative terminals of the Input Connector to a precision millivolt meter and a low output impedance source (10 ohm or less) set to 30mV ±2mV input. Parallel-connect all thermocouple terminals of the Input Connector as shown:
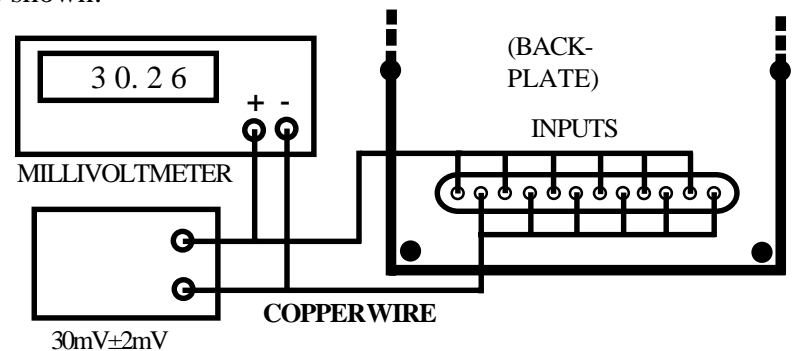
NOTE: To avoid any interference during calibration, disconnect the RS-232 wires from the controller.

On entering function [78] the function display will read 78.
The upper display shows 30.00 mV setting.
Enter the exact mV as measured by the millivolt meter.
The main display will flash all zero's. During this period the
controller is checking calibration so do not alter the mV reading.
When the flashing stops, the calibration is complete and the con-
troller will return to "RUN" Mode.

To increment the flashing digit press the button ▲
To advance to the next digit press the button ▶
To save the mV setting and start calibration press the button ⏺

6.12 Function [79]   Start Profile

Function [79] does not control any other function
On entering function [79] the function display shows 79.
The zone display shows blank.
The upper display shows 0.
By advancing the flashing digit the operator can select
[0]   to return with no changes
[1] to [6] to start profile on any one zone 1 to 6
[7]   to start profiles on all enabled zones 1 to 6
To increment the flashing digit press the button   ▲
To start profile and return to "RUN" mode press the button ⏺

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Open Collector Transistor Diagram for Output

Microprocessor
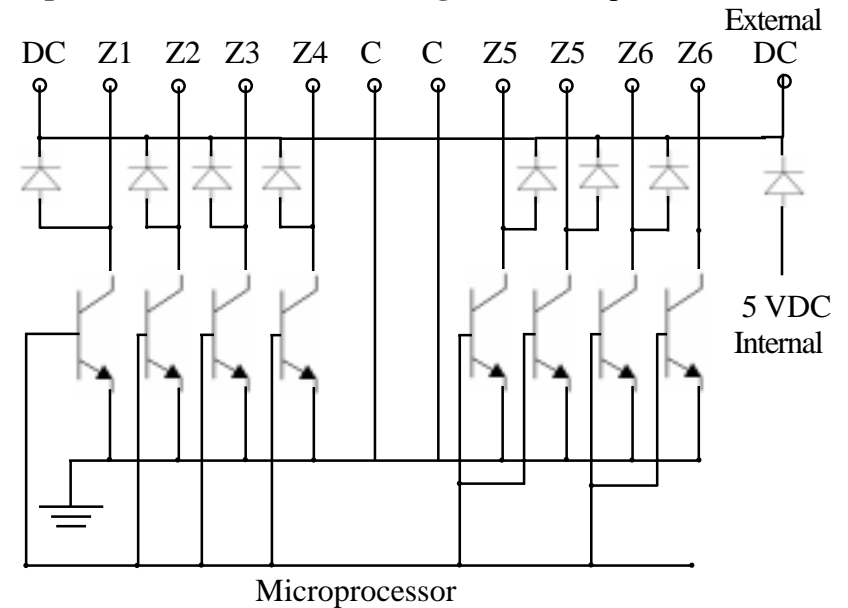
7.1   Thermocouple Ranges

TC	Standard Ranges [40 Mv]	
	ºC Range	ºF Range
B	0-1800	32-3300
C	0-2300	32-4200
E	0-500	32-1000
J	0-750	32-1400
K	0-1000	32-1900
R	0-1750	32-3200
S	0-1750	32-3200
T	0-400	32-750

|	Extended Ranges [75 Mv]	
E	0-1000	32-1800
K	0-1300	32-2500

Note ! Extended range will work with all Standard range thermo-
couples, but it is better to use Standard range for thermocouples
with output below 40 Mv.

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SECTION 8
SPECIFICATIONS

No. of Zones	Six
Input Range	0-40mV Standard/
	0-75mV Expanded
Accuracy	±0.1% Range ±1 °C
Resolution	±5uV
Thermocouple Input selectable	B,C,E,J,K,R,S,T
Scale Selectable	°C or °F
PID	Autotune or Manual
Password protection	Yes
Profiling [ramp / soak]	20 segments per loop
Control outputs	6 [one per loop]
Output rating :- Internal power	5V DC 10 Ma max
External power	5 to 40V DC 0.5 Amp
Communication	RS-232
Communication Software	Visual Basic [Windows]
Zone display time	Settable 1 to 40 sec
	or Hold on any zone
Alarms Selectable	HI - LO - HI/LO or no alarms
Alarm Type	Latching or Non Latching
Alarm display	Flashing display [zone in alarm]
Alarm output [deenergises on alarm]	Single relay for all zones
Alarm Reset	Manual
Relay rating	5 Amp @ 120 VAC
Display	LED 0.6" high
Enclosure	1/4 Din Aluminum, 6" long
Terminals	Headers for Plug-in Wiring
Line Power	120/240VAC; 50/60Hz
Power Consumption	10VA Max.
Max. Voltage between Inputs	6VDC or RMS
Open T/C Warning	Flashing Display [9999]

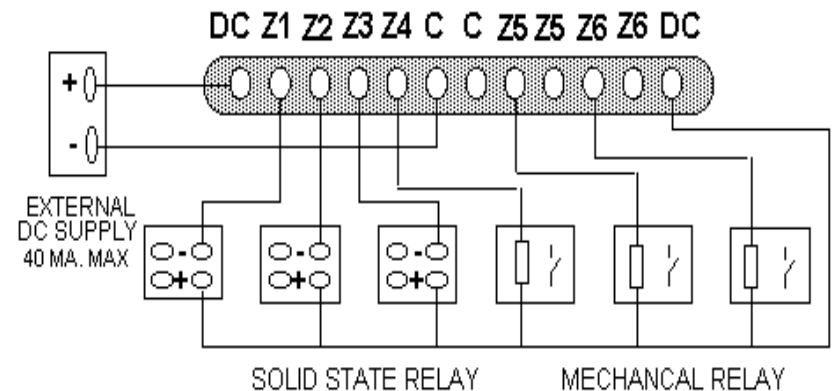# WIRING OF THE CONTROLLER OUTPUT

1. USING INTERNAL 5V SUPPLY 5MA/ZONE MAX
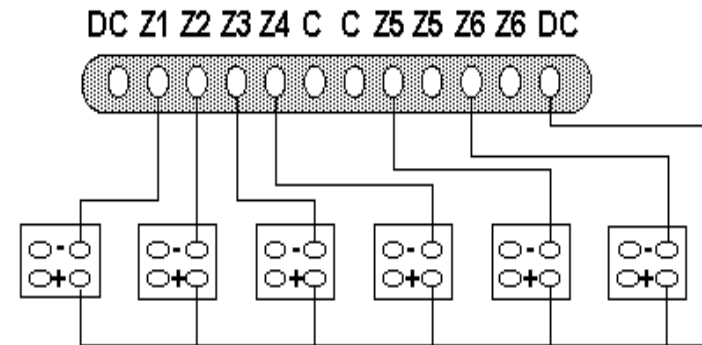
1. CONNECT ALL POSITIVE TERMINALS TOGETHER (3-32 V.DC.)
2. CONNECT THEM TO THE DC THERMINAL AS SHOWN
3. CONNECT ALL NEGATIVE TERMINALS TO THE INDIVIDUAL ZONES.
NOTE: ZONES 5 AND 6 HAVE DUPLICATE TERMINALS.

2. USING EXTERNAL DC SUPPLY

SOLID STATE OR MECHANICAL RELAYS CAN BE USED ON ANY ZONE