Thermo Scientific Lindberg/Blue M LGO 1200°C Box Furnaces

BF 51842 Series

Installation and Operational Manual

305432H02 Rev C **11-02-2017**

Trademarks

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Basic Operating Precautions

These operating instructions describe 1200°C box furnaces.

1200°C box furnaces have been manufactured to the latest state of the art and have been tested thoroughly for flawless functioning prior to shipping. However, the Box may present potential hazards, particularly if it is operated by inadequately trained personnel or if it is not used in accordance with the intended purpose. Therefore, the following must be observed for the sake of accident prevention:

- 1200°C box furnaces must be operated by adequately trained and authorized professional personnel.
- 1200°C box furnaces must not be operated unless these operating instructions have been fully read and understood.
- The present operating instructions, applicable safety data sheets, plant hygiene guidelines and the corresponding technical rules issued by the operator shall be used to create written procedures targeted at personnel working with the subject matter device, detailing:
  - The decontamination measures to be employed for the box furnace and the accessories used with it.
  - The safety precautions to be taken when processing specific agents.
  - The measures to be taken in case of accidents.
- Repair work on the box must be carried out only by trained and authorized expert personnel.
- The contents of these operating instructions are subject to change at any time without further notice.
- Concerning translations into foreign languages, the English version of these operating instructions is binding.
- Keep these operating instructions close to the furnaces so that safety instructions and important information are always accessible.
- Should you encounter problems that are not detailed adequately in these operating instructions, please contact Thermo Fisher Scientific immediately for your own safety.

Safety Considerations

DANGER

Do not modify or use equipment in a manner other than expressly intended. Modification of equipment other than that for which it is explicitly designed could cause severe injury or death. Any customer after-market retrofit violates the warranty of the equipment.

Do not modify or disconnect any safety features provided. Disconnection of the unit safety features could allow the unit to become overheated and start on fire, causing personal injury or death, product and property damage.

Do not use components or materials not specifically designed for this equipment. Failure to comply with this precaution could result in damage to equipment used or the furnace and may create an overheat situation. Also, do not use anything other than OEM exact replacement equipment and parts. Not using OEM replacement parts could cause faulty. Instrumentation readings, inoperable equipment, or temperature overshoot. Both situations may cause personal injury or death, product, and property damage.

Before using, user shall determine the suitability and integrity of the product for the intended use and that the unit has not been altered in any way. Misapplication may compromise the safety of the end user or the life of the product.

CAUTION

This product contains refractory ceramic fiber which can result in the following:

- May be irritating to skin, eyes, and respiratory tract.
- May be harmful if inhaled.
- May contain or form cristobalite (crystalline silica) with use at high temperature (above 871°C) which can cause severe respiratory disease.
- Possible cancer hazard based on tests with laboratory animals. Animal studies to date are inconclusive. No human exposure studies with this product have been reported.

		WARNING Before maintaining this equipment, read the applicable MSDS (Material Safety Data Sheets) in the safety notes of this manual.

Warranty

Thermo Fisher Scientific warrants the operational safety and functions of the Laboratory Box Furnaces only under the condition that:

- The Laboratory Box is operated and serviced exclusively in accordance with its intended purpose and as described in these operating instructions,
- The Laboratory Box is not modified,
- Only original spare parts and accessories that have been approved by Thermo Scientific are used (third-party spares without Thermo Scientific approval void the limited warranty),
- Inspections and maintenance are performed at the specified intervals,
- An operation verification test is performed after each repair activity.

The warranty is valid from the date of delivery of the Laboratory Box to the customer.

Material Safety Data Sheet

SDS No: 5036
Revision: 4
Date of last revision: 05/08/2015

SAFETY DATA SHEET

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND THE COMPANY/UNDERTAKING

1.1 Product Identifier

Trade Names: **MOLDATHERM**

Substance Name: **Mixture containing Refractory Ceramic Fibers (RCF)/Alumino-Silicate Wools (ASW)**
Index Number: 650-017-00-8 (CLP Annex VI)
CAS Number: 142844-00-6
CAS Name: refractories, fibers, aluminosilicate
Registration Number: 01-2119458050-50-000x

1.2 Relevant Identified Uses

Refractory shapes for “professional users” in industrial applications involving high temperature, heat treating, and molten metal processing.

1.3 Details of the Supplier of the SDS

RMG
Rex Materials Group
P.O. Box 287
Howell, MI 48844
(517) 223-3787, (517) 338-5062, fax
info@rexmaterials.com

1.4 Emergency Telephone Number

Chemtrec North America: (800) 424-9300
Chemtrec Outside North America: +1 (703) 527-3887

2. HAZARDS IDENTIFICATION

2.1 Classification of the Substance or Mixture

The U.S. Occupational Safety and Health Administration (OSHA) Hazard Communication Standard (HCS) 2012 indicates that IARC group 2B corresponds to OSHA HCS 2012 Category 2 carcinogen classification (see, e.g., §1910.1200, Appendix F, Part D). Under OSHA HCS 2012, RCF is classified as a Category 2 carcinogen.

2.2 Labeling Elements

2.2.1 Hazard Pictogram

2.2.2 Signal Word
Warning

2.2.3 Hazard Statements
Suspected of causing cancer by inhalation.

2.2.4 Precautionary Statements
Do not handle until all safety instructions have been read and understood.
Use respiratory protection as required; see section 8 of the Safety Data Sheet
If concerned about exposure, get medical advice.
Store in a manner to minimize airborne dust.
Dispose of waste in accordance with local, state and federal regulations.

2.3 Other Hazards
Mild mechanical irritation to skin, eyes, and upper respiratory system may result from exposure. These effects are usually temporary.

2.4 Hazardous Materials Identification System (HMIS)
Health: 1* Flammability: 0 Reactivity: 0 Personal Protection Index: X (Employer Determined)
(* denotes potential for chronic effects)

3. COMPOSTION/INFORMATION ON INGREDIENTS

Name	CAS No	Index or EINECS No.	Weight %	Classification HCS 2012
RCF/ASW	142844-00-6	650-017-00-8	40-95	Category 2 carc.
Amorphous Silica	7631-86-9	231-545-4	0-60	not classified
Inert Materials	na	na	0-40	na

4. FIRST AID MEASURES

4.1 Description of First Aid Measures
4.1.1 Inhalation:
If respiratory tract irritation develops, move the person to a dust free location. Get medical attention if the irritation continues. See Section 8 for additional measures to reduce or eliminate exposure.

4.1.2 Eye Contact:
If eyes become irritated, flush immediately with large amounts of lukewarm water. Eyelids should be held away from the eyeball to ensure thorough rinsing. Do not rub eyes. Get medical attention if irritation persists.

4.1.3 Skin Irritation:
Handling of this material may cause mild mechanical temporary skin irritation. If this occurs, rinse affected areas with water and wash gently. Do not rub or scratch exposed skin. Using a skin cream or lotion after washing may be helpful.

4.1.4 Ingestion:
If gastrointestinal tract irritation develops, move the person to a dust free environment.

4.2 Most Important Symptoms and Effects, Both Acute and Delayed
Mild mechanical irritation to skin, eyes, and upper respiratory system may result from exposure. These effects are usually temporary.

4.3 Indication of any Immediate Medical Attention and Special Treatment Needed.
Treat symptomatically. Skin and respiratory effects are the result of temporary, mild mechanical irritation; exposure does not result in allergic manifestations.

5. FIREFIGHTING MEASURES

5.1 Extinguishing Media
Products are non-combustible. Use extinguishing media suitable for type of surrounding combustible materials.

5.2 Special Hazards Arising from the Substance or Mixture
See Section 10.6 (due to starch burnout).

5.3 Advice for Firefighters
Use protective equipment and precautions appropriate for type of surrounding fire.

5.4 National Fire Protection Association (NFPA) Codes
Flammability: 0 Health: 1 Reactivity: 0 Special: 0

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal Precautions, Protective Equipment, and Emergency Procedures
Avoid dust formation. Use protective equipment and evacuate unnecessary personnel if appropriate. See Section 8, Exposure Controls/Personal Protection.

6.2 Environmental Precautions
None known.

6.3 Methods for Cleaning Up
Pick up and arrange disposal with minimal dust creation. Vacuum (HEPA) or wet sweep as appropriate. Do not use compressed air for clean up.

7. HANDLING AND STORAGE

7.1 Precautions for Safe handling
Avoid dust formation and its accumulation. Handle in accordance with good industrial hygiene and safety practices. Limit the use of power tools unless in conjunction with local exhaust ventilation. Wear personal protective equipment as outlined in Section 8.2.2.

7.2 Conditions for Safe Storage, Including and Incompatibilities
Keep dry. Protect against water and moisture. Product packaging may contain residue. Do not reuse. Minimize dust emissions during unpacking.

7.3 Specific End Use(s)
See Section 1.2.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 Control Parameters
Industrial hygiene standards and occupational exposure limits vary between countries and local jurisdictions. Check which exposure levels apply to your facility and comply with local regulations. A qualified industrial hygienist can assist with specific workplace evaluation including recommendations for respiratory protection. Examples of national exposure limits are provided in the table below.

		Exposure Limits	
	RCF/ASW	**Amorphous Silica**	**Inert Materials**
US OSHA	na*	80 mg/m^3 / % SiO_2	5 mg/m^3 (resp.)
ACGIH	0.2 f/cc	10 mg/m^3	10 mg/m^3
Argentina	0.2 f/cc	na	10 mg/ m^3
Australia	0.5 f/cc	2 mg/m^3	10 mg/ m^3
Austria	0.5 f/cc	0.3 mg/m^3	6 mg/ m^3
Belgium	0.5 f/cc	na	3 mg/ m^3
Canada	0.2-1.0 f/cc	na	na
Denmark	1.0 f/cc	na	5 mg/ m^3
Egypt	na	na	na
EU	na	na	na
Finland	0.2 f/cc	na	na
France	0.1 f/cc	na	5 mg/ m^3
Germany	0.2 f/cc	4 mg/m^3	3 mg/ m^3
Hungary	na	na	na
Iceland	1.0 f/cc	na	na
India	na	10 mg/m^3	na
Italy	0.2 f/cc	na	3 mg/ m^3
Poland	0.5 f/cc	na	na
Spain	0.5 f/cc	na	3 mg/ m^3
Sweden	0.2 f/cc	na	5 mg/ m^3
The Netherlands	0.5 f/cc	na	5 mg/ m^3
UK	1.0 f/cc	6 mg/m^3	4 mg/ m^3
United Arab Emirates	na	na	na
Venezuela	0.2 f/cc	na	na

* Except for the state of California, where the PEL for RCF is 0.2 f/cc 8-hr TWA, there is no specific regulatory standard for RCF in the U.S. In the absence of an OSHA PEL, the HTIW Coalition has adopted a recommended exposure guideline (REG) of 0.5 f/cc, as measured under NIOSH Method 7400 B. For further information on the history and development of the REG see “Rationale for the Recommended Exposure Guideline” at Attachment II of the HTIW Coalition Product Stewardship Program http://www.htiwcoalition.org/documents/PSP_2012.pdf .

8.2 Exposure Controls
8.2.1 Appropriate Engineering Controls:
Use engineering controls such as local exhaust ventilation, point of generation dust collection, down draft work stations, emission controlling tool designs, and materials handling equipment designed to minimize airborne particulate emissions. If necessary, consult an industrial hygienist to design workplace controls and practices.

8.2.2 Personal Protection Equipment:

Respiratory Protection:

When engineering and/or administrative controls are insufficient, the use of appropriate respiratory protection, pursuant to the requirements of OSHA Standards 29 CFR 1910.134 and 29 CFR 1926.103, is recommended. The evaluation of workplace hazards and the identification of appropriate respiratory protection is best performed, on a case by case basis, by a qualified Industrial Hygienist.

Eye Protection:

Wear safety glasses with side shields or other forms of eye protection in compliance with appropriate OSHA standards to prevent eye irritation. The use of contact lenses is not recommended, unless used in conjunction with appropriate eye protection. Do not touch eyes with soiled body parts or materials. If possible, have eye-washing facilities readily available where eye irritation can occur.

Skin Protection:

Wear gloves, head coverings, and full body clothing as necessary to prevent skin irritation. Washable or disposable clothing may be used. If possible, do not take unwashed clothing home. If soiled work clothing must be taken home, employers should ensure employees are thoroughly trained on the best practices to minimize or avoid non-work dust exposure (e.g., vacuum clothes before leaving the work area, wash work clothing separately, rinse washer before washing other household clothes, etc.).

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE AND ODOR:	white, gray, or tan board or shape / no odor
pH:	na
MELTING POINT:	>1650° C (3002° F)
BOILING POINT:	na
FLASH POINT:	na
EVAPORATION RATE:	na
FLAMMABILITY:	non-flammable
EXPLOSIVE LIMITS:	not explosive
VAPOR PRESSURE:	na
VAPOR DENSITY (Air = 1):	na
BULK DENSITY:	0.2-0.8 g/cc
SOLUBILITY (%):	insoluble
PARTITION COEFFICIENT:	na
AUTO-IGNITION TEMPERATURE:	na
DECOMPOSITION TEMPERATURE:	na (see Section 10.6)
VISCOSITY:	na for a solid

10. STABILITY AND REACTIVITY

10.1 Reactivity

None.

10.2 Chemical Stability

Stable under conditions of normal use.

10.3 Possibility of Hazardous Reactions

None.

10.4 Conditions to Avoid

None. Please refer to handling and storage advice in Section 7.

10.5 Incompatible Materials
None.

10.6 Hazardous Decomposition Products
Exposure to temperatures above approximately 1000°C (1832°F) may lead to the formation of crystalline silica. The occurrence and extent of crystalline phase formation is dependent on the duration and temperature of exposure and/or the presence of fluxing agents. The presence of crystalline phases can be confirmed only through laboratory analysis of the "hot face" material. Please refer to Section 11.4 for more information on “after-service” RCF.

11. TOXICOLOGICAL INFORMATION

Moldatherm products vary in hardness and friability. Especially if cut, ground, or otherwise broken up, exposure may be possible, predominantly by inhalation or ingestion of the dusts. The primary and most significant constituent of the dust is RCF/ASW, so the toxicological information provided below is exclusively related to RCF/ASW.

HEALTH DATA SUMMARY

Epidemiological studies that include most people who have ever worked in domestic RCF production have indicated no increased incidence of respiratory disease or other significant health effects in occupationally exposed workers. In animal studies, long-term, high-dose inhalation exposure resulted in the development of respiratory disease in rats and hamsters.

11.1 Toxicokinetics, Metabolism and Distribution
11.1.1 Basic Toxicokinetic
Exposure is predominantly by inhalation or ingestion. Man made vitreous fibers of a similar size to RCF/ASW have not been shown to migrate from the lung and/or gut and do not become located in other parts of the body. When compared to many naturally occurring minerals, RCF/ASW has a low ability to persist and accumulate in the body (half-life of long fibers (>20 µm) in 3 week rat inhalation test is approx. 60 days).

11.1.2 Human Toxicological data
In order to determine possible human health effects following RCF exposure, the University of Cincinnati has been conducting medical surveillance studies on RCF workers in the U.S. The Institute of Occupational Medicine (IOM) has conducted medical surveillance studies on RCF workers in European manufacturing facilities.

Pulmonary morbidity studies among production workers in Europe and USA have demonstrated an absence of interstitial fibrosis and no decrement in lung function associated with current exposures, but have indicated a reduction of lung capacity among smokers.

A statistically significant correlation between pleural plaques and cumulative RCF exposure was evidenced in the USA longitudinal study.

The USA mortality study did not show evidence of increased lung tumor development either in the lung parenchyma or in the pleura.

11.2 Information on Toxicological effects
Acute toxicity: short term inhalation
No data available: Short term tests have been undertaken to determine fiber (bio) solubility rather than toxicity; repeat dose inhalation tests have been undertaken to determine chronic toxicity and carcinogenicity.

Acute toxicity: oral
No data available: Repeated dose studies have been carried out using gavage. No effect was found.

Skin corrosion/irritation:
Not possible to obtain acute toxicity information due to the nature of the substance

Serious eye damage/irritation:
Not possible to obtain acute toxicity information due to the nature of the substance

Respiratory or skin sensitization
No evidence from human epidemiological studies of any respiratory or skin sensitization potential

G*erm cell mutagenicity*
Method: In vitro micronucleus test
Species: Hamster (CHO)
Dose: 1-35 mg/ml
Routes of administration: In suspension
Results: Negative

Carcinogenicity
Method: Inhalation. Multi-dose
Species: Rat,
Dose: 3 mg/m3, 9 mg/m3 and 16 mg/m3
Routes of administration: Nose only inhalation
Results: Fibrosis just reached significant levels at 16 and 9 mg/m3 but not at 3 mg/m3. None of the parenchymal tumor incidences were higher than the historical control values for this strain of animal.

Method: Inhalation. Single dose
Species: Rat
Dose: 30 mg/m3
Routes of administration: Nose only inhalation
Results: This study was designed to test the chronic toxicity and carcinogenicity of RCF at extreme exposures. Tumor incidence (incl. mesothelioma) was raised at this dose level. The presence of overload conditions (only detected after the experiment was completed), whereby the delivered dose exceeded the clearance capability of the lung, makes meaningful conclusions in terms of hazard and risk assessment difficult.

Method: Inhalation. Single dose
Species: Hamster
Dose: 30 mg/m3
Routes of administration: Nose only inhalation
Results: This low quality study in hamsters (no justification for exposure concentration used and pre existing and concurrent infections in the test animals) produced mesothelial lesions of uncertain significance. Subsequent studies in hamsters with glass fibers indicated that the lung burdens of RCF in this experiment were between 5 and 10 times more than that needed to produce overload, and the results are therefore difficult to interpret.

There are reports of injection studies with some similar materials. While some intraperitoneal injection (IP) studies reported the development of tumors in rats, the relationship of these results to classification remains controversial. Interpretation of these animal experiments is complex, and there is not agreement amongst scientists internationally. A summary of the evidence relating to RCF carcinogenicity in vivo can be found in SCOEL/SUM/165 and in Utel and Maxim 2010.

Reproductive toxicity;
Method: Gavage
Species: Rat
Dose: 250 mg/kg/day
Routes of administration: Oral
Results: No effects were seen in an OECD 421 screening study. There are no reports of any reproductive toxic effects of mineral fibers. Exposure to these fibers is via inhalation and effects seen are in the lung. Clearance of fibers is via the gut and the feces, so exposure of the reproductive organs is extremely unlikely.

STOT-Single exposure; NA
STOT-Repeated exposure; NA
Aspiration hazard: NA

11.3 Irritant Properties

Negative results have been obtained in animal studies (EU method B 4) for skin irritation. Inhalation exposures using the nose only route produce simultaneous heavy exposures to the eyes, but no reports of excess eye irritation exist. Animals exposed by inhalation similarly show no evidence of respiratory tract irritation.

Human data confirm that only mechanical irritation, resulting in itching, occurs in humans, Screening at manufacturers' plants in the UK has failed to show any human cases of skin conditions related to fiber exposure.

11.4 Other Information

After-service RCF may contain various crystalline phases, generally confined to a thin layer of material at the "hot-face" side of these products. However, an analysis of after-service RCF samples obtained pursuant to an exposure monitoring agreement with the EPA, found that in the furnace conditions sampled, most did not contain detectable levels of crystalline silica. Other relevant RCF studies found that (1) simulated after-service RCF showed little, or no, activity where exposure was by inhalation or by intraperitoneal injection; and (2) after-service RCF was not cytotoxic to macrophage-like cells at concentrations up to 320 microg/cm^2; by comparison, pure quartz or cristobalite, two of the primary phases of silica, were significantly active at much lower levels circa 20 microg/cm^2.

11.5 International Agency for Research on Cancer and National Toxicology Program

IARC, in 1988, Monograph v.43 (and later reaffirmed in 2002, v.81), classified RCF as possibly carcinogenic to humans (group 2B). IARC evaluated the possible health effects of RCF as follows:

- There is inadequate evidence in humans for the carcinogenicity of RCF.
- There is sufficient evidence in experimental animals for the carcinogenicity of RCF.

The Annual Report on Carcinogens (latest edition), prepared by NTP, classified respirable RCF as "reasonably anticipated" to be a carcinogen).

Not classified by OSHA.

12. ECOLOGICAL INFORMATION

These products are inert materials that remain stable overtime. They are insoluble in the natural environment and are chemically identical to inorganic compounds found in the soil and sediment No adverse effects on the environment have been identified or are anticipated.

13. DISPOSAL CONSIDERATIONS

13.1 Waste Treatment

Waste from these products may be generally disposed of at a landfill which has been licensed for this purpose. Unless wetted, such a waste may be dusty and should be properly sealed in containers for disposal. At some authorized disposal sites, dusty waste may be treated differently in order to ensure they are dealt with promptly and to avoid being wind blown. This product, as manufactured, is not classified as a listed or characteristic hazardous waste according to U. S. Federal regulations (40 CFR 261). Any processing, use, alteration or chemical additions to the product, as purchased, may alter the disposal requirements.

Under U. S. Federal regulations, it is the waste generator's responsibility to properly characterize a waste material, to determine if it is a "hazardous" waste. Check local, regional, state or provincial regulations to identify all applicable disposal requirements.

13.2 Additional Information

When disposing of waste and assigning European Waste Code, any possible contamination during use will need to be considered and expert guidance sought as necessary. Please check for any national and/or regional regulations, and refer to the European list (Decision No 2000/532/CE as modified) to identify appropriate waste numbers.

14. TRANSPORT INFORMATION

Not classified as dangerous goods under relevant international transport regulations (ADR, RID, ICAO/IATA, IMDG, ADN).

15. REGULATORY INFORMATION

15.1 U.S. Regulations

EPA:

Superfund Amendments and Reauthorization Act (SARA) Title III - This product does not contain any substances reportable under Sections 302, 304, 313, (40 CFR 372). Sections 311 and 312 (40 CFR 370) apply (delayed hazard).

Hazard Categories

Immediate Hazard – No
Delayed Hazard – Yes
Fire Hazard – No
Pressure Hazard – No
Reactivity Hazard - No

Toxic Substances Control Act (TSCA) – RCF has been assigned a CAS number; however, it is a simple mixture and therefore not required to be listed on the TSCA inventory. Other substances in this product are listed, as required, on the TSCA inventory. The components of RCF are listed on the inventory.

Comprehensive Environmental Response, Compensation and Liability Act (**CERCLA)** and the **Clean Air Act (CAA)** RCF contains fibers with an average diameter greater than one micron and thus is not considered a hazardous air pollutant.

OSHA:

Comply with **Hazard Communication Standards** 29 CFR 1910.1200 and 29 CFR 1926.59 and the **Respiratory Protection Standards** 29 CFR 1910.134 and 29 CFR 1926.103.

California:

"Ceramic fibers (airborne particles of respirable size)" is listed in **Proposition 65, The Safe Drinking Water and Toxic Enforcement Act of 1986** as a chemical known to the State of California to cause cancer.

Other States:

RCF products are not known to be regulated by states other than California; however, state and local OSHA and EPA regulations may apply to these products. If in doubt, contact your local regulatory agency.

15.2 European Regulations

RCF is classified under the CLP (classification, labeling and packaging of substances and mixtures) regulation as a category 1B carcinogen. On January 13, 2010 the European Chemicals Agency (ECHA) updated the candidate list for authorization (Annex XV of the REACH regulation) and added 14 new substances in this list including aluminosilicate refractory ceramic fibers.

As a consequence, EU (European Union) or EEA (European Economic Area) suppliers of articles which contain aluminosilicate refractory ceramic fibers in a concentration above 0.1% (w/w) have to provide sufficient information, available to them, to their customers or upon requests to a consumer within 45 days of the receipt of the request. This information must ensure safe use of the article, and as minimum contains the name of the substance.

15.3 Canadian Regulations

Canadian Workplace Hazardous Materials Information System (WHMIS) - RCF is classified as Class D2A – Materials Causing Other Toxic Effects.
Canadian Environmental Protection Act (CEPA) - All substances in this product are listed, as required, on the Domestic Substance List (DSL).

16. OTHER INFORMATION

16.1 Abbreviations and Acronyms

ACGIH	American Conference of Governmental Industrial Hygienists
ADN	European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways
ADR	Transport by road, Council Directive 94/55/EC
ASW	Alumino-Silicate Wool
CARE	Controlled and Reduced Exposure
CAS	Chemical Abstracts Service
CLP	Regulation (EC) No 1272/2008 on Classification, Labeling and Packaging of substances and mixtures
DSL	Domestic Substance List
EEA	European Economical Area
ECFIA	European Ceramic Fibre Industry Association
EINECS	European Inventory of Existing Chemical Substances
EPA	Environmental Protection Agency
EU	European Union
f/cc	fibers per cubic centimeter
g/cc	grams per cubic centimeter
GHS	Globally Harmonized System of Classification and Labeling Chemicals
HCS 2012	Hazard Communication Standard of 2012
HNOC	Hazards Not Otherwise Classified
HTIWC	High Temperature Insulating Wool Coalition
IARC	International Agency for Research on Cancer
ICOA/IATA	Regulations relating to transport by air
IMDG	Regulations relating to transport by sea
mg/ m^3	milligrams per cubic meter
na	not available or not appropriate
OSHA	the U.S. Occupational Safety and Health Administration
PEL	Permissible Exposure Limit (OSHA)
RCF	Refractory Ceramic Fiber
REACH	Regulation (EC) No 1907/2006 dated 18 December 2006 on Registration, Evaluation, Authorization and Restriction of Chemicals
RID	Transport by rail, Council Directive 96/49/EC
SARA	Superfund Amendment and Reauthorization Act
SDS	Safety Data Sheet (replaces MSDS, Material Safety Data Sheet)
STOT	Specific Target Organ systemic Toxicity
WHMIS	Workplace Hazardous Materials Information System

16.2 References

“Good Working Practices,” HTIW Coalition, July 2012, htiwcoalition.org
“CARE Guidance Documents,” ECFIA industrial hygiene guidance programme, ecfia.eu
“Hazards from the Use of Refractory Ceramic Fibre,” HSE 267 (1998)
Numerous other publications can be found at the websites of ECFIA and HTIWC.

16.3 Revision Summary

Rev 4 comprehensive revision to align with HCS 2012

The information contained herein is presented in good faith and is believed to be accurate as of the effective date of this Safety Data Sheet. Employers may use this SDS to supplement other information available to them in their efforts to assure the health and safety of their employees and the proper use of the product. Given the summary nature of this document, Rex Materials Group does not make any warranty (express or implied), assume any responsibility, or make any representation regarding the completeness of this information or its suitability for the purposes envisioned by the user. Further, Rex Materials Group disclaims any responsibility for damage or injury resulting from abnormal use of the product, failure to adhere to recommended practices, or any hazards inherent in the nature of the product.

Explanation of Safety Information and Symbols

Safety Notes and Symbols Used Throughout These Operating Instructions

		DANGER Indicates a hazardous situation which, if not avoided, will result in death or serious injuries.
		WARNING Indicates a hazardous situation which, if not avoided, could result in death or serious injuries.
		CAUTION Indicates a situation which, if not avoided, could result in damage to equipment or property.
		NOTE Is used for useful hints and information regarding the application.

Additional Symbols for Safety Information

		Wear safety gloves!
		Wear safety goggles!
		Harmful liquids!
		Electrical shock!
		Hot surfaces!

		Fire hazard!
		Explosion hazard!
		Suffocation hazard!
		Biological hazard!
		Contamination hazard!

Introduction

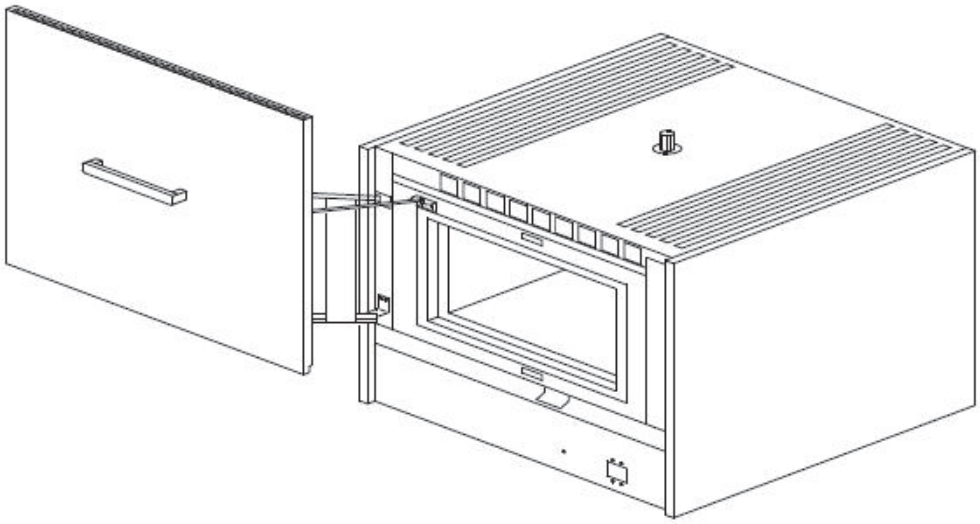


Figure 2-1. BF51842 Laboratory Box Furnace

The Thermo Fisher Scientific BF51842 is a reliable, energy efficient 1200°C laboratory box furnace. The heating Silicon Carbide elements and low thermal mass Moldatherm® insulation provide fast duty cycles, energy conservation, and efficient programming. Refer to "Table 1" for specifications.

Features and Benefits

- Controlled heat-up rate eliminates thermal shock to materials.
- Quick heat-up and cool-down rates.
- Safety interlock switch automatically interrupts power to heating elements when door is opened. This feature protects heating elements and eliminates operator's exposure to electrical shock.
- Energy efficient Moldatherm insulation suitable for high interior-exterior temperature differential. The unit is rated for a maximum operating temperature of 1200°C.

- Resists attack from most corrosive agents and can be used in atmospheres other than air.
- Replaceable hearth plates and shelves.
- Programmable Control.
- Main power ON/OFF switch and power indicator on control panel.
- Double wall construction.
- Front control panel is recessed at the top. This feature provides easy viewing of the control LED and protection for the control instrumentation.
- Optional flow meter regulates the flow of air or inert gas to the furnace chamber.

Specification

Table 1. BF51842 Laboratory Box Furnaces

Model	Dimension in.(cm)		Maximum Operating Temp	Watts	Thermo couple	Volt/ Freq/ Current	Control	Ship Wt. lbs (kg)
	Interior (D x W x H)	Exterior (L x W x H)						
BF51842C-1 BF51842COMC-1	15 x 15 x 15 (38.1 x 38.1 x 38.1)	28 x 29 x 33 (71.1 x 73.7 x 83.8)	1200°C	5800	Platinel II	208/240 V 50/60 Hz 25 A	UP150	280 (127)
BF51842BC-1							UP150/ UT150L	
BF51842PBC-1	15 x 15 x 15 (38.1 x 38.1 x 38.1)	28 x 29 x 33 (71.1 x 73.7 x 83.8)	1200°C	5800	Platinel II	208/240 V 50/60 Hz 25 A	3504 & 3216i (OTC)	280 (127)
BF51842PBFMC-1								
BF51842PBCOMC-1								
BF51842PBFMCOMC-1								
BF51842PC-1	15 x 15 x 15 (38.1 x 38.1 x 38.1)	28 x 29 x 33 (71.1 x 73.7 x 83.8)	1200°C	5800	Platinel II	208/240V 50/60Hz 25A	3504	
BF51842PFMC-1								
BF51842PCOMC-1								
BF51842PFMCOMC-1								

Pre-Installation

Unpacking

Carefully unpack and inspect the unit and all accessories for damage, if you find any damage, keep the packing materials and immediately report the damage to the carrier. We will assist you with your claim, if requested. Do not return goods to Thermo Fisher Scientific without written authorization. When submitting a claim for shipping damage, request that the carrier inspect the shipping container and equipment.

Operating Conditions

High concentrations of sulfates, chlorides, fluorides, alkalis, and V_2O_5 can have corrosive effects on the ceramic fiber. Contact Thermo Fisher Scientific for additional information about the effects of specific atmospheres on furnace performance.

With prolonged use, airline cracks can develop in the insulation materials. These minor cracks will not affect the furnace's performance. We recommend turning off the furnace completely when not in use. The heating unit is not damaged by rapid heating and cooling cycles.

Atmosphere Systems

The BF51842 series furnaces are not designed for use with combustible or inert atmospheres requiring an air tight chamber. If an exhaust port is used, the furnace should not be located in an enclosed area without proper ventilation.

		⚠WARNING Do not use combustible gases in this furnace.

		CAUTION Avoid combustible products which generate toxic or hazardous vapor or fumes. Work should only be done in a properly vented environment.

Installation

Do not exceed the electrical and temperature ratings printed on the dataplate of the furnace.

		CAUTION Improper operation of the furnace could result in dangerous conditions. To preclude hazard and minimize risk, follow all instructions and operate within design limits noted on the dataplate.

Location

Install the furnace in a level area away from vibration. To permit proper airflow, leave at least three inches of space on all sides of the unit and 12 inches above the unit.

Wiring

Thermo Fisher Scientific model BF51842 furnaces are designed for operation on 240 VAC. The furnaces will operate on 208 volts, but will have reduced heat up rates.

Power and ground wires are not provided with the furnaces.

1. Suitable lengths of properly sized wires must be acquired prior to the installation of your furnace. The BF51842 will draw approximately 20 amps on 240 VAC. Minimum recommended wire gauge size is 14 gauge. A high temperature (150°C) wire casing is also recommended. A ground wire should be provided per local code.
2. Remove the right panel (side with High Voltage label) of the furnace by removing the appropriate screws. Removing the side panel allows for access to the terminal block and grounding screw, located at the base of the unit.
3. The 7/8 inch diameter hole located on the lower rear panel may be used to mount a standard 1/2 inch electrical conduit connector.

4. Thread two properly sized power wires and one properly sized ground wire through the conduit hole. The wires should be marked L1, L2, and ground. Insert power leads L1 and L2 into the terminal block and tighten down securely. Ground on the provided ground screw.
5. Check that the thermocouple (top left of rear of furnace chamber) is securely mounted and that it is not damaged. Remove small cover on the rear panel of furnace to check thermocouple wiring connections. Red is always negative. Refer to Figure **"Thermocouple"**.
6. As a final inspection step, check that all electrical connections are secure and verify that the door stop bracket properly contacts the power interrupt switch near the front of the furnace. If mechanical adjustment is necessary, slight bending of the switch arm can be done.
7. Replace and secure the small cover on the rear panel and right side panel of the furnace using the necessary screws.

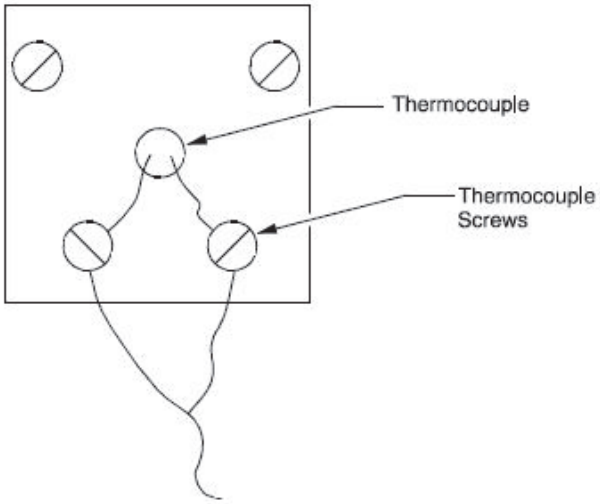


Figure 4-1. Thermocouple

Gas Inlet Tube Assembly

The gas inlet tube assembly has been packaged separately to avoid breakage during shipping and handling. Refer to Figure **"Gas Inlet Tube Assembly"**

Even if you do not intend to use the gas inlet, you must install the assembly before operating the furnace. The only tool you need is a Phillips head screwdriver.

To install the gas inlet assembly:

1. Carefully remove the assembly from the package and inspect for any damage.
2. Remove the two mounting screws from the rear housing panel of the furnace.

3. Insert the ceramic tube end through the access hole in the rear of the furnace and guide the tube into the back of the chamber.
4. Align the mounting holes in the rear housing panel with the holes in the gas inlet tube assembly and secure the assembly with the mounting screws.

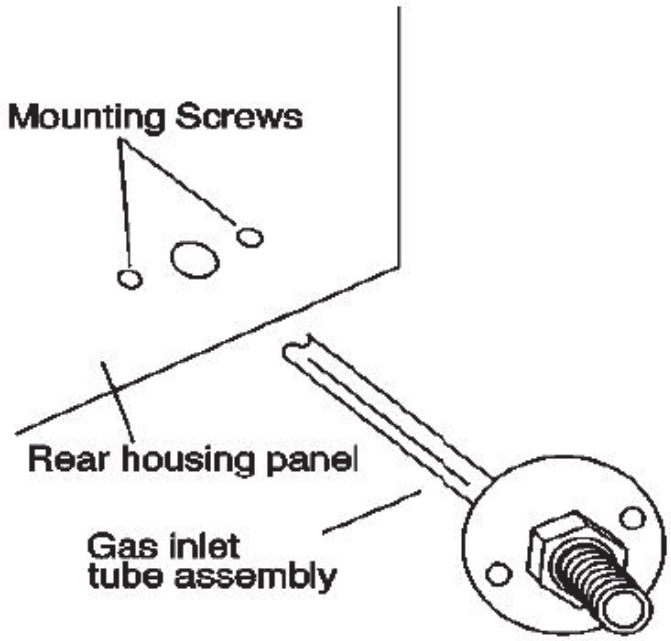


Figure 4-2. Gas Inlet Tube Assembly

Guidelines for Ashing Applications

Ashing products at relatively low furnace temperatures (400°C to 800°C) may cause carbon residue to build up on the walls, floor, ceiling and heating elements inside the furnace chamber. The carbon will look like a black powder, similar to smoke on glass from a candle.

Carbon is an electrical conductor. If the furnace chamber and heating elements are coated with carbon, an electrical short-circuit may occur and cause the elements to overheat and burn out.

There is also some danger that the carbon residue will be absorbed through the surface of the Moldatherm insulation and affect the fully embedded heating elements.

The best way remove carbon residue from the chamber and elements surfaces is to operate the empty furnace at a chamber temperature above 900°C for one hour. Do this regularly, whenever the chamber interior shows signs of carbon residue.

Do not scrub or scrape the chamber surfaces - this may damage the heating elements and the insulation.

Hearth Plate Information

Why to Use

- To provide a load bearing surface and distribute the weight of product being heated.
- To protect the furnace chamber from spillage.
- To lengthen the life of furnace, by allowing heat from the chamber floor to circulate into the chamber center.

When to use

- Hearth Plates are recommended during each furnace operation.

How to Install

- Hearth plates are designed with a grooved surface.
- The grooved surface must be positioned against the chamber floor.

		CAUTION Most hearth plate materials made of ceramic fibre and can be broken if dropped.

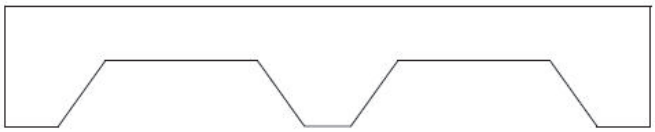


Figure 4-3. Hearth Plate Ripped

Shelf Installation in Box Furnaces

1. Model series BF51841 and BF51842 are supplied with a pair of half-depth shelves.
2. One or both of these shelves can be installed into the chamber using any of the three groove sets near the mid-point on each side wall.

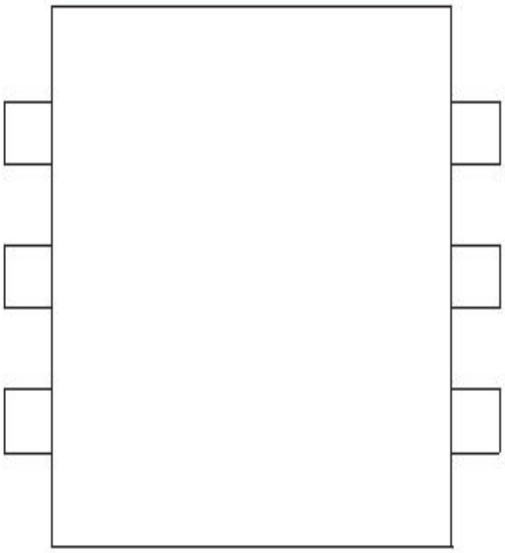


Figure 4-4. BF51841 and BF51842 Chamber Showing Shelf Groove

Operation

Initial Start-up

To start up the furnace for the first time:

1. Check to ensure that furnace is properly wired. Refer to the Section “Wiring”.
2. Apply power to the furnace by closing the power circuit breaker on the base of the furnace.
3. Make sure the door is fully closed. A safety disconnect switch is provided to turn off when the door is not closed. Use both handles when opening and closing the furnace. Thermo Fisher Scientific recommends an initial start-up of running the furnace at 1100°C for 7-10 hours in order to burn off contaminants and to form a protective oxide layer on the heating element.
4. Adjust controller setpoint to 1100°C. If the furnace has over-temperature protection (option B), set that instrument above 1100°C. Allow furnace to run for 7-10 hours.

The furnace is now ready for normal operation. Refer to Section “Operation - 3504 Controller” and “Operation - UP150 Controller” which provides information on the use of the control instruments.

Vents

The vent provided at the top of the furnace is designed to help remove contaminants from the furnace chamber. Whenever high amounts of contaminants, (smoke, chemical vapors, etc.) are present, the vent should be opened to aid in prolonging heating element life.

Atmosphere Port

The BF51842 furnace has a factory-installed air/atmosphere port. Most inert atmospheres (i.e. nitrogen, argon, and helium) can be safely run in the BF51842 box furnace. However, maximum temperatures may be derated depending on atmosphere. An initial burn in period in air is recommended. Please contact Thermo Fisher Scientific prior to using the furnace with an inert atmosphere.

The furnace should run for 7-10 hours at 1100°C before using an inert atmosphere and after every 60 hours of use with an inert atmosphere. This burn in process will help remove contaminants and provides a protective oxide layer on the heating elements.

The BF51842 furnace is not designed to be a gas-tight atmosphere furnace.

Flow Meter Option

If your unit has the FM option, there is an adjustable gas flow meter located on the front control panel. The flow rate can be adjusted from 1.0 to 10.0 cubic feet per hour. The flow meter is designed to regulate the flow of air or inert gas to the furnace chamber. Do not use it with combustible or volatile gases.

Operation - UP150 Controller

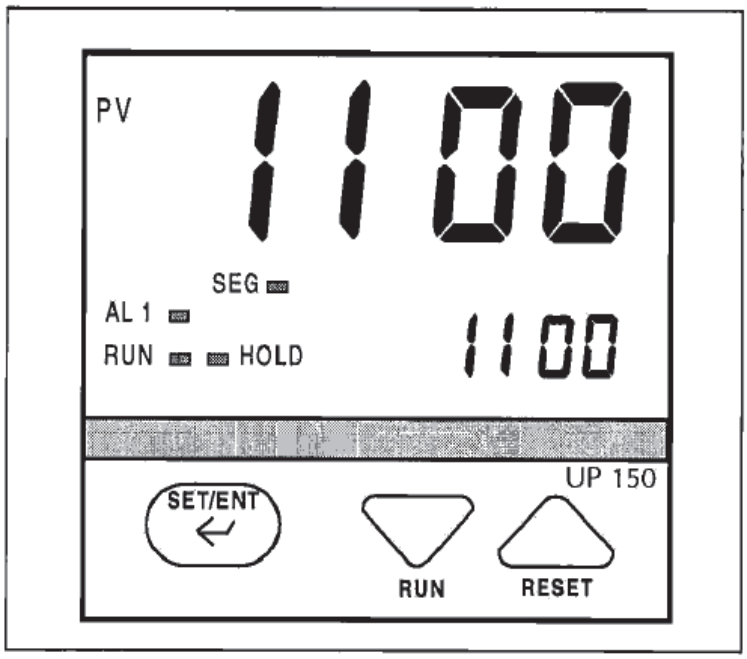


Figure 6-1. UP150 Control Panel

The furnace temperature controller is configured and tuned at the factory to function well for most applications. Occasionally, it may be advisable to configure the temperature controller differently to suit a particular working environment or process.

		CAUTION Before reconfiguring the controller, read this chapter carefully. Reconfiguring the controller can change the unit characteristics and design parameters, which can hamper performance and make the equipment dangerous to use.

UP150 Controller Overview

This version (V 54 & 56) of the UP150 controller features the dual operation modes of Single Setpoint and Programming. Each mode has distinct operations and uses.

Single Setpoint Mode allows the user to select a single target temperature setpoint in the controller. The controller will then operate the heating equipment until this setpoint value is achieved.

Programming Mode allows the user to enter a series of setpoint and time values. The controller will follow these sequences of instructions to energize the heating equipment until the entire sequence is complete.

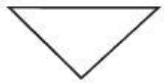
The temperature controller senses the chamber air temperature of the furnace (the PV or process value) and supplies the heat necessary to achieve the desired setpoint. The controller includes an LED display and a push button keypad. Refer to “Table 2” and “Table 3” for lists of displayed parameters and keypad functions.

Table 2. UP150 Parameter Function.

Parameter code	Factory set value	Description
Operating Parameters (access by holding the SET/ENT button)		
MODE	Res	Model Selection
Prg	0	Program mode access. Select “1” to enter.
HoLd	oFF	Program Hold (RUN mode only)
Adv	oFF	Segment Advance (Run mode only)
CtL	Pid	Control mode
At	oFF	Auto tuning (Run mode only)
P	50	Proportional band (°C, °F=90)
I	240	Integral time
d	60	Derivatives time
Ct	30	Heat cycle time
FL	oFF	Sensor filter
bS	0.0	PV bias (offset)
Loc	0	Key lock
Setup parameter (access by setting LoC = “-1”)		
In	8	Input type (K Thermocouple)
SPH SPL	1500 0.0	High setpoint limit °C; °F =2732 Low setpoint limit °C; °F =32

Parameter code	Factory set value	Description
tmU	0	Ramp Times Units,°Per minute (0=°Per Hour)
SC	ON	Super Function
dr	0	Direct/Reverse action

Table 3. Push Button Keypad

Button	Function
SET/ENT	Pressing and holding the SET/ENT for three second advances the display to the Operation Parameters Menu. While in the Operation Parameters Menu, use SET/ENT to move from one parameter to next, and to register changes you have made in setpoint and parameter value. Holding SET/ENT for three seconds exits either the Operation or Setup Parameters menu.
	Use the Up Arrow button to increase the temperature setpoint display and change parameter values in the Operation and Setup Parameter menus. Whenever you change the value of setpoint or parameter, the decimal point flashes to remind you to register the changed value with SET/ENT. While in program run mode, pressing and holding button stop (resets) program operation.
	Use the Down Arrow button to decrease the temperature set-point display and to change parameter values in the Operation and Setup Parameter menus. Whenever you change the value of a setpoint or parameter, the decimal point flashes to remind you to register the changed value with SET/ENT. While in program run mode, pressing and holding button stop (resets) program operation.

Single Setpoint Operation

The following sections describe how to operate the controller in single setpoint (local) mode. Use this mode when you only need to run the furnace with a specific setpoint and do not require a programmed sequence of steps - ORA Temperature change over a period of time.

Setting High Temperature Alarm Setpoint:

1. Press and HOLD for three seconds the "SET/ENT" button to display "modE rES".
2. Press and release the "SET/ENT" button to display "PrG 0".
3. Press the "UP/RESET" Button to show the lower display the display label "1".
4. Press and release the "SET/ENT" button to select this new value and advance to the "SSP 25" display, the beginning of the program mode.
5. Press and release the "SET/ENT" button until the High Temperature Alarm Setpoint value is displayed as "A1".
6. Select an alarm setpoint 10°C above greater than the target setpoint to be selected.
7. Press and release the "SET/ENT" button to select this new value in the controller memory.
8. Press and HOLD for three seconds the "SET/ENT" button to exit this menu.

Accessing Local Mode

1. Press and hold for three seconds the "SET/ENT" button to display "modE rES".
2. Press and release the "UP" button twice to select the display "modE LCL".
3. Press and release the "SET/ENT" button once to select Local Mode. This selection causes the red indicator to illuminate beside "L" on the control panel. refer to Figure “Thermocouple”.
4. Use the "UP" and "DOWN" buttons to select the desired operating temperature setpoint.
5. Press and release the "SET/ENT" button once to register the setpoint value.
6. The display will then show measured temperature in the upper "PU" display, the present temperature setpoint in the lower display.
7. This display and the buttons will remain active as long power continues to the control module. Power interruptions will cause the controller to enter reset or standby mode in which no actions are made to operate the heating equipment.

You may use the arrow buttons to adjust the setpoint (lower) value to be adjusted in this local display mode, The "SET/ENT" button will register setpoint value changes, until these values are changed again.

Exiting Local Mode

To exit Single Setpoint or Local Mode and turn off the energy to the heater:

1. Press and bold for three seconds the "SET/ENT" button to display "modE LCL".

2. Press and release the "DOWN" button twice to select the display "modE rES".
3. Press and release the "SET/ENT" button once to select the display "modE rES". Reset Mode.This selection cause the red indicator to extinguish beside display the display label "L" that bad indicated the Local Mode.
4. This will change the display showing the measured the temperature in the upper display, with the lower display showing the Start Set Point (SSP) temperature setpoint of the program.

Programming Operation

Entering a Program

This section describes how to enter a simple program that is designed to:

- Direct the controller to ramp to a higher temperature;
- Stabilize;
- Ramp to a lower-temperature;
- End with an indefinite dwell.

If you intend to use the program features of the controller, it is advisable to go through all the steps in this sample program to familiarize yourself with the elements of programming mode.

		NOTE If the controller buttons are not pushed for 2 minutes, the controller will return to the regular operator mode/menu.

Entering Programming Mode

To access the programming menu:

1. Assure the indicators beside "RUN" and "L" on the controller display off. If either indicator is extinguished, press and hold the "SET/ENT" button until the display shows "mod", Select “rES" in the lower display with the "arrow" buttons. Press and release the “SET/ENT” button once.
2. Press the "SET/ENT" button for 3 seconds to display "modE" in the upper display and "rES" (Reset) in the lower display.
3. Press and release “SET/ENT” until "LoC" is displayed. Make sure the display below "LoC" is "0" (zero). If it is not "0", use “DOWN ARROW” to select "0" and press and release "SET/ENT” button to register the change to "0".
4. Press and release the "SET/ENT" button until "PrG" is displayed.

5. At "PrG" display, press the “UP ARROW” to make the lower display "1".
6. Press and release the "SET/ENT" button once to enter the programming menu.

Entering Program Parameters

The first display is the Start Set Point parameter, shown as "SSP" in the upper display. The value assigned to SSP is usually the current room temperature, 25°C. Refer to figure “Ramp and Dwell Graph” as an illustration of the program profile and table 4 for the list of parameters entered.

Basic Ramp and Dwell Parameters

1. Use the arrow buttons to select "25" in the below "SSP" display, then press and release the "SET/ENT" button twice to enter this new value for "SSP" is correct and does not need to be changed, press and release the "SET/ENT" button once to advance to the "StC" display.
2. Next is the Start Code parameter, shown as "StC" in the upper display. The value assigned to StC is usually "1". This will instruct the program to start with the current measured temperature. Start Setpoint Press the "SET/ENT" button to advance to next display.
3. The next parameter, “SP1”, is the first setpoint value that is desired in the chamber and is considered a ramp segment. Select this target temperature setpoint value with arrow button then press and release the "SET/ENT" button twice to enter this value and to advance to the "tM1" display. If the value for "SP1" is correct and will not be changed, press and release the “SET/ENT” button once to advance to the "tM1” display.
4. The next parameter, "tM1", represents the first time period for the unit to reach the target temperature setpoint selected in "SP1".This selection can be a value ranging from 0.00 to 99.59, which represents hours and minutes. Select this time value with the arrow buttons and enter it by pressing and releasing the "SET/ENT" button twice.
5. Press and release the "SET/ENT" button to advance to the next display of "SP2", this is considered the dwell segment. Select the same target setpoint temperature value as "SP1" with the arrow buttons. Press and release the "SET/ENT" button twice to enter this value and to advance to next display.
6. The next parameter, "tM2", represents the second time period used to maintain or dwell at the target setpoint selected in "SP2". This selection can be a value ranging from 0.00 to 99.59, which represents hours and enter it by pressing and releasing the "SET/ENT" button twice.
7. Next, "SP3" is the third setpoint value desires in the chamber. Select this target temperature setpoint with the arrow buttons and press and release the "SET/ENT" button twice to enter this value and release the "SET/ENT" button twice to enter this value and advance to the "tM3" display. If this value is

correct and not changed, press and release the "SET/ENT" button once to advance to the "tM3" display.

8. "tM3" represents the third time period for the unit to reach the target setpoint selected in "SP3". This selection can be a value ranging from 0.00 to 99.59, which represents hours and minutes. Select this value with the arrow buttons and enter it by pressing and releasing the "SET/ENT" button.
9. The next parameter, "SP4" is considered the dwell segment. Select the same target temperature as "SP3" with the arrow buttons, then press and release the "SET/ENT" buttons twice to enter this new value and to advance to next display.

Additional Program Parameters

1. The next parameter, "SP4" is considered the dwell segment. Select the same target temperature as "SP3" with the arrow buttons, then press and release the "SET/ENT" button twice to enter this new value and to advance to next display. This operation ends the offer use of setpoint and time parameters.
2. The next display shows "EV1" in the upper display. The lower value should always be "0" (zero). Press and release the "SET/ENT" button once to go to next display.
3. “AL1” should always have a lower value "9". Press and release the "SET/ENT" button once to advance to the next display.
4. The next parameter, "A1", is used to select the high temperature alarm tri setpoint.Use the arrow buttons to select a value 10°C (or 20°F) higher than the highest target setpoint to be used. Select the High Temperature Alarm value with the arrow buttons then press and release the “SET/ENT” button twice to enter this new value and to advance to the "HY1" display. If the value for "A1" is correct and not changed, press and release the “SET/ENT” button once to advance to "HY1" display.
5. "HY1" is used to select the amount of temperature change below the high temperature alarm relay will reset, this value is usually "1". Select "1" with the arrow buttons and press the "SET/ENT" button six times to enter the correct value and advance to the "JC" display. or if the value is correct, press the "SET/ENT" button five times to advance to the "JC" display.
6. For the parameter displayed as "JC", select “1” with the arrow buttons, then press and release the "SET/ENT" button twice to display "WTZ", Selecting the value of "1" will cause the program to hold the setpoint at this last segment. A value of "0" would cause the program to reset and stop running the program and step the power to the hearers. A value of "2" will cause the program to repeat "continuously". A value of “3" will cause the controller to maintain temperature at the local (single) setpoint value.
7. When the display shows "WTZ", select a lower display value of "OFF” with the "arrow" buttons. Press and HOLD the "SET/ENT" button for 3 seconds to return to the Reset or standby display.

This concludes the steps required to enter a typical ramp- and dwell program.

Refer to figure "Ramp and Dwell Graph" as an illustration of the program profile and table 4 for the list of parameters entered.

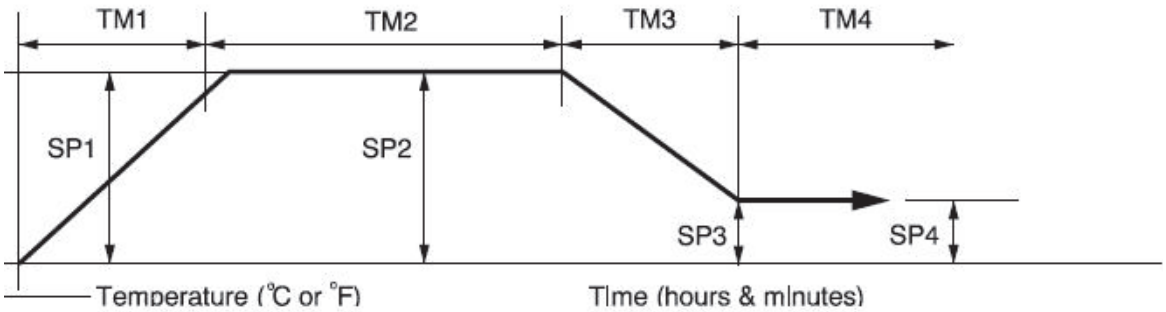


Figure 6-2. Ramp and Dwell Graph

In the following table, "*" denotes values typically set by user according to needs of program.

Table 4. Parameters

Parameter	Values	Meaning
PrG	0	Enters program menu
SSP	25	Start Setpoint
StC	1	Start Code
SP1	*	Segment 1 Setpoint
Tm1	*	Line length for Segment 1
SP2	*	Segment 2 Setpoint
Tm2	*	Line length for Segment 2
SP3	*	Segment 3 Setpoint
TM3	*	Line length for Segment 3
SP4	*	Segment 4 Setpoint
Tm3	oFF	Time length for Segment 4
EV1	0	Event 1
AL1	9	Alarm 1
HY1	1	Hysteresis for alarm 1
EV2	0	Event 2
AL2	oFF	Alarm 2

Table 4. Parameters

Parameter	Values	Meaning
AL2	oFF	Alarm 2
JC	1	Junction code (1=dwell; 0=stop 2= repeat, 3= Repeat to local Setpoint at the end of program.).
wtz	oFF	Wait Zone

Running a Program

To run a program such as the one outlined above, press and hold the "DOWN/RUN" button making the "RUN" indicator illuminate. At the end of this program the "HLD" (hold) indicator is illuminated to indicate this program is in the indefinite dwell at the last target temperature. This hold indicator is caused by the "JC" selection of "1", while the "JC" selections of "2" or "3" will not illuminate the "HLD" (hold) indicator.

Ending a Program

To end a program while in the "RUN" at "HLD" (hold) mode, press and hold the "UP/RESET" button to turn off the current program and extinguish the "RUN" or "HLD" indicator.

Turning off the unit's power will also stop the program. When power is restored, the controller is in the Reset or standby mode with no power to the heaters.

NOTE

The programmer/controller will not operate the Unit's heaters (to change or maintain a temperature) unless there is a program running or a single setpoint value is selected in the Local Mode. This Controller details to the "RESET" (rES) mode with each power "ON". If power supply is introduced during program run or single setpoint mode, these action operation mode must be reselected.

Using the Hold Function

To hold a running program:

1. Press and hold the SET/ENT key for 3 second, "noDE" will appear in the upper display. Press SET/OUT key to "Hold".

2. Press the "arrow up" key so that "on" with flashing decimal appears in the lower display.
3. Press the SET/ENT key to accept.
4. Press and hold the SET/ENT key again to return to the normal display.

To stop the hold mode:

1. Press and hold the SET/ENT key for 3 seconds. "noDE" will appear in the upper display. Press SET/ENT key to "Hold".
2. Press the "arrow down" key so that "oFF" with flashing decimal appears in the lower display.
3. Press the SET/ENT key to accept.
4. Press and hold the SET/ENT key again to return to the normal display.

Using the Advance Function

Introduction

This section describes the sequence to advance or skip segment in a routine program. This is useful if a power out occurred and the program needs to be advanced, skipped procedure already computed.

While the program is running, press and hold the "SET/ENT" key for 3 second. "node" will appear in the upper display. Press the “SET/ENT” key again and "AdV" will appear in the upper display. "oFF" will appear in the lower display.Press the "arrow up" key so that "on" with flashing decimal appears in the lower display. Press the “SET/ENT” key to accept. The controller will automatically return to the normal display and the increment the program segment by one.

Changing a Program

To make changes only to the target temperature and segment length times for simple program operation, follow these steps:

1. Assure the indicators beside "RUN" and "L" on the controller display are extinguished. If either indicator is illuminated, press and hold the "SET/ENT" button until the display shows "mode", Select "Res" in the lower display with the "arrow" buttons. Press and release the "SET/ENT" button once.
2. Press the “SET/ENT” button for 3 seconds to display "mode" in the upper display and "rES" in the lower display. Press and release “SET/ENT” repeatedly to display "LoC". Make sure the value below "LoC" is "0" (zero). If it is not "0", use “DOWN” arrow to select "0" and press and release "SET/ENT" button to register the change to "0".
3. Press and release the “SET/ENT” button once to show "PrG" on the upper display.

4. Press the "UP" arrow to make the lower value "1".
5. Press and release "SET/ENT" button twice to display "SP1" Using the arrow buttons to revise the target setpoint.
6. Press and release "SET/ENT" button twice to display "tml". Using the arrow buttons to revise the segment time length needed to get to the target setpoint “SP1”.
7. Press and release “SET/ENT” button to display other setpoints and segment time lengths. Use the arrow buttons to change the temperature set points and time lengths. Press and release the “SET/ENT” button to register any new values.
8. Press and HOLD the “SET/ENT” button for 3 seconds to exit the program menu and return to the reset or standby display.

Auto Tuning the UP150 Controller

Auto tuning maximizes the performance of the chamber at a selected temperature with the product load's characteristics, by operating with the quickest response and minimal temperature overshoot.

Factory settings are for general purposes, but your process can be enhanced through the auto tune feature. To obtain this maximum performance, follow these steps to auto the controller.

1. Load the chamber with materials that have the same mass and thermal characteristics as an actual product load.
2. Operate the chamber to the process temperature using either locator run mode.
3. Start the Auto Tune: Press and hold the “SET/ENT” button for three seconds to display the "modE" parameter of the Operating Parameter menu.
4. Press and release the “SET/ENT” button five times to advance to the "At" parameter.
5. Press and release the “UP” arrow button to show "on" in the lower display.
6. Press the “SET/ENT” button once to enter the auto tune mode and exit the Operating Parameters menu.
7. The controller will cycle three times through a heating and cooling pattern, measuring the characteristics of the load and chamber temperature controls. During the auto tuning, “At” will alternately flash with the measured temperature (PV) display to indicate that the auto tuning progress. The length of time for the auto tune vanes with the load, chamber size and temperature selected.
8. The auto tune is completed when the regular display of the measured temperature is shown without the "At" value flashing. The chamber should now

operate to the process temperature with the given product load, with the quickest response and minimal temperature overshoot.

		NOTE If the process temperature or load changes significantly another auto tune session may be necessary to optimize the chamber performance. Recording the values added to "P", "I", Avoid “D” from previous auto-tune section, would allow these values to be manually extended using Table 2.

Temperature Offset Procedure

The purpose of this procedure is to create an offset in the displayed temperature measurement for the Yokogawa model UP150 temperature controller.

1. *Outside of the process tube, operate the oven or furnace chamber to your normal stable temperature setpoint, which an independent temperature measurement setpoint, with an independent temperature measurement device located in the center of chamber. The controller will be “running” the program or operating in the local mode to maintain the temperature.*
2. Note any difference in the controller's measured temperature (upper value) UV and the independent measurement. If a difference of greater than 1°C is noted proceed with the following steps. If less than 1°C, no change.
3. Press and hold the "SET/ENT" button for 3 seconds to display "modE"
4. Verify the button lockout parameter will give access to make this display offset. Press and release the "SET/ENT" button twelve times to display "LoC". The value 0 (zero) displayed will give full access and is necessary to make the display offset changes desired. If the value displayed is 1 or 2, use the "down arrow" button to make 0 (zero) press release the "SET/ENT" button to register this change.
5. Press and release the "SET/ENT" button twelve times to display "bS" and the current offset value.
6. Allocate the offset value and select with the arrow buttons that is needed to make this controller display correctly. For example, if the independent measurement is 553°C, the controller Temperature measurement display shows 550°C, and the current controller offset (bS) is -2, then make controller display offset "+1" [(+3 needed offset) + (-2 current offset) = (+1 new offset)].
7. Press and release the "SET/ENT" button once to register this new offset value. Press and hold the "SET/ENT” button for 3 seconds to exit this controller menu.
8. Operate the controller to the same temperature to stabilize the chamber to check for any further variations between the controller and the independent measurement. Repeat steps 2 - 7 as necessary.

9. This completes the display offset procedure for the Yokogawa model UP150 temperature controller. If the bottom lockout parameter "LoC" was originally on a value of 1 or 2, repeat steps 3 & 4 to return to this original value.

Contact Technical Service at 1-866-984-3766 if you have any questions.

Changing Temperature Scale Between °C and °F

To change the temperature scale in the UP150 controller to operate on °F instead of the factory setting of °C, or from °F to °C, Follow these steps.

These changes will alter the controller input type and associated scale-dependant parameters, and erase the stored program to default values. Please document the stored program in the controller before proceeding.

If during this procedure, the buttons are inactive for more than two minutes, the controller will return to the standard display.

1. Assure the indicators beside "RUN" and "L" on the controller face are extinguished. If they are illuminated press and hold the “SET/ENT” Button to display "nodE". Select "YES" with arrow, press “SET/ENT” button to make the RUN or L indicator extinguished.
2. To access the Operating Parameters Menu, press and HOLD the “SET/ENT” button for at least 3 second to display "modE".
3. Press and release the “SET/ENT” button until the display shows "LOC" in the upper display. Make sure the value below "LaC" is "0" (zero). If it is not "0", use “down arrow” to make "0" and press and release "SET/ENT” button to register change to "0".
4. At "LoC" display, press the “down arrow” to make the lower value "-1".
5. Press and release the "SET/ENT” button to enter the Setup Parameters menu and show "In" on the upper display and a numerical value in the lower display.
6. See the following table for the STANDARD values for this parameter and the others needed in the following steps.
7. Select the appropriate value for the "In" parameter. Press the “UP” or “DOWN” arrow buttons to make the lower display to the new value, then press and release the “SET/ENT” button TWICE to register the new value and advance to the next parameter.
8. "SPH" is the next parameter displayed. Select and enter the new value, then press and release the “SET/ENT” button TWICE.
9. "SPL" is the next parameter displayed. Select and enter the new value, then press and release the “SET/ENT” button ONCE.
10. Press and HOLD the “SET/ENT” button for at least 3 seconds to exit.

11. Press and HOLD the “SET/ENT” button for at least 3 seconds to enter the Operating Parameter menu and show "modE" in the upper display.
12. Press and release the “SET/ENT” button until the upper display shows "P". Select the value in the table and adjust the lower display accordingly. Press and release the “SET/ENT” button TWICE.
13. “I” is the next parameter displayed. Select and enter the new value then press and release the “SET/ENT” button TWICE.
14. “d” is the next parameter displayed. Select and enter the new value then press and release the “SET/ENT” button ONCE.
15. Press and HOLD the “SET/ENT” button for at least 3 seconds to exit.
16. Recenter or create a program using the new temperature scale.

The following table shows the corresponding parameters value for 1100°C for furnace in °C and °F.

Parameter	**°C**	**°F**
In	8	38
SPH	1500	2732
SPL	0	32
P	50	80
I	240	240
D	60	60

The P, I, D parameters may be altered through auto tuning (refer to Section “Auto Tuning the UP150 Controller” in this chapter).

Operation - 3504 Controller

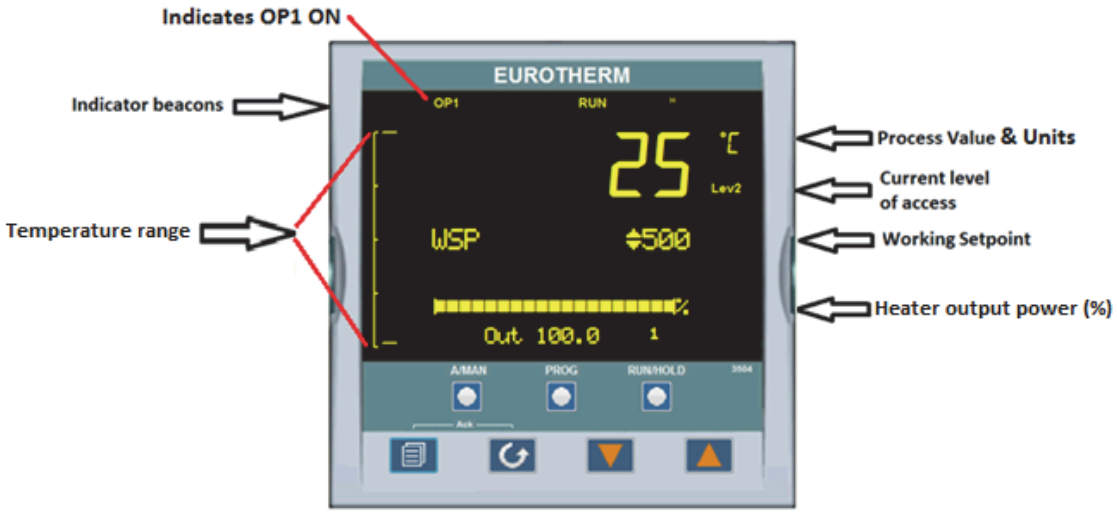
The 3504 temperature process controller is a single Loop PID based controller that can store up to 25 programs with up to 500 Segments. A 'Factory' code used to configure all the functions essential for temperature controlling process This includes input sensor type, measurement range, control options and alarms.

Controller Operation

After switching on the unit, the controller - following a brief self-test sequence- will start up in AUTO mode.

		NOTE **Manual operation** means that the controller output power is adjusted by the user. The input sensor is still connected and reading the PV but the control loop is open. **Auto** means that the controller is automatically adjusting the output to maintain control, ie the loop is closed. If the controller is in manual mode, 'MAN' light will be indicated. If the controller is powered down in Manual operation, it will resume this mode when it is powered up again. **Auto tune** can be performed at any time, but normally it is performed only once during the initial commissioning of the process. However, if the process under control subsequently becomes unstable (because its characteristics have changed), it may be necessary to tune again for the new conditions.

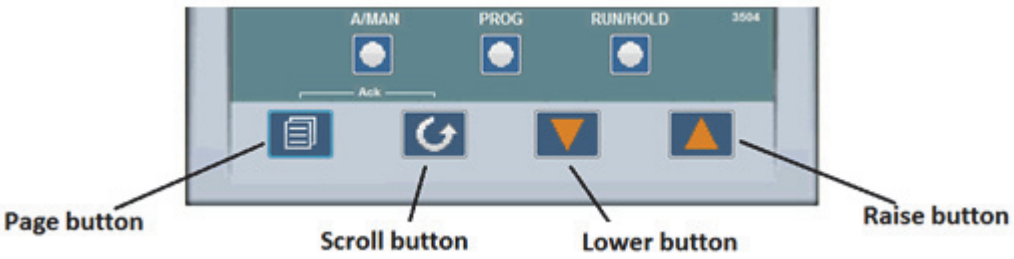
3504 Controller HOME display



Beacon Display and Description

OP1	In a single loop controller OP1 indicates when HEAT is ON
MAN	MAN illuminates if Loop 1 is in manual mode. (The outputs from the controller are connected to devices on the plant which cause the heating (or cooling) demand to be adjusted resulting in a change in PV which, in turn, is measured by the sensor. This is referred to as closed loop control.)
ALM	If an alarm occurs, the red alarm beacon flashes. This is accompanied by a message showing the source of the alarm, for example 'Abs HI'. To acknowledge press and .
RUN	Illuminates when program running – flashing indicates End
HLD	Illuminates when program held
H	Flashes when H communication is active

The Operator Buttons



A/MAN	Toggles the selected loop between Auto and Manual operation. Manual operation means that the controller output power is adjusted by the user. The input sensor is still connected and reading the Process Value (PV) but the control loop is open. Auto means that the controller is automatically adjusting the output to maintain control, ie the loop is closed. If the controller is in manual mode, 'MAN' light will be indicated. If the controller is powered down in Manual operation, it will resume this mode when it is powered up again.
PROG	To select the program summary page
RUN/ HOLD	Press once to start a program. 'RUN' will be indicated Press again to hold a program. 'HLD' will be indicated Press and hold for at least two seconds to reset a program. 'RUN' will flash at the end of a program 'HLD' will flash during holdback
	Press to select new PAGE headings
	Press to select a new parameter in the page
	Press to decrease an analogue value, or to change the state of a digital value
	Press to increase an analogue value, or to change the state of a digital value

Shortcut Key Presses

The following Short Cut Key presses are provided:-

Action	Key Presses
Backpage	Press ▣ followed by ▲. With ▣ held down continue to press ▲ to scroll page headers backwards. (With ▣ still pressed you can press ▼ to page forward. This action is the same as pressing ▣ alone).
Backscroll	When in a list parameters, press ↻ followed by ▲. with ↻ held down continue to press ▲ to scroll parameters backwards. (With ▣ still pressed you can press ▼ to page forward. This action is the same as pressing ▣ alone).
Jump to HOME display	Press ▣ + ↻
Alarm Ack/reset	Press ▣ + ↻ when the HOME screen is being displayed to jump to the 'Acknowledge All alarms' page. Pressing ↻ acknowledges all alarms if it can. Pressing ▣ cancels the operation.

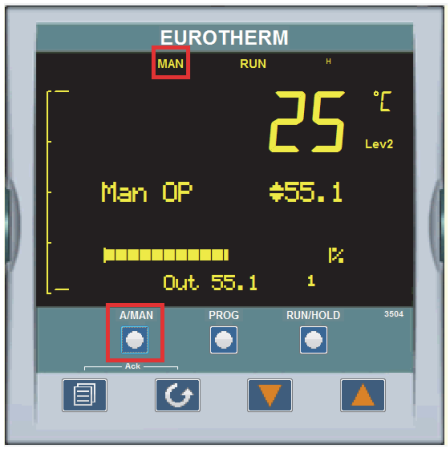
To Select Manual Operation

Press 

(A/MAN) button.

Pressing the A/MAN button will toggle loop 1 between Auto and Manual. The beacon 'MAN' will light and the indication of output power is preceded by ▲▼ up/down buttons.

The output power will change continuously while either ▼ or ▲ is pressed.



Default values:

Parameter	Description	Value	Access
Units	Display Units	°C	Level1
ALARM.1.Threshold (AbsHi)	Alarm HIGH threshold	1210°C (Max value)	Read only
ALARM.1.HIGH Hysteresis	Alarm HIGH Hysteresis	1°C	Read only
ALARM.2.Threshold (AbsLo)	Alarm LOW threshold	0°C	Level2
ALARM.2.LOW Hysteresis	Alarm LOW Hysteresis	1°C	Level2
ALARM.3.Deviation (DevHi)	Alarm Deviation threshold	50°C	Level2
ALARM.3.Deviation HYS	Alarm Deviation Hysteresis	1°C	Level2
PV Offset	PV Offset	0°C	Level2
PV input type	Process Value type	Thermocouple	Read Only
Linearization Type	Type of TC	PL2 (Platinel 2)	Read Only
Logic Output Type	Type of output	Time proportional (Voltage output)	Read Only
Proportional Band	Proportional Band	20.7	Level2
Integral Time	Integral Time	161	Level2
Derivative Time	Derivative Time	27	Level2
Range High	Range High Limit	1225	Read Only
Range Low	Range Low Limit	0	Read Only
L2 pass code	L2 pass word	25	Read Only
Customer ID	Customer ID	203	Read Only

		NOTE Level 1=Operator, Level 2=Customer Technician

1. Program Segment Types

a) Rate

A Ramp segment provides a controlled change of setpoint from an original to a target setpoint. The duration of the ramp is determined by the rate of change specified. Two styles of ramp are possible in the range, Ramp-Rate or Time-To-Target.

The segment is specified by the target setpoint and the desired ramp rate. The ramp rate parameter is presented in engineering units (°C,°F, Eng.) per real time units (Seconds, Minutes or Hours). If the units are changed, all ramp rates are re-calculated to the new units and clipped if necessary

b) Dwell

The setpoint remains constant for a specified period at the specified target. The operating setpoint of a dwell is inherited from the previous segment.

c) Step

The setpoint changes instantaneously from its current value to a new value at the beginning of a segment. A Step segment has a minimum duration of 1 second.

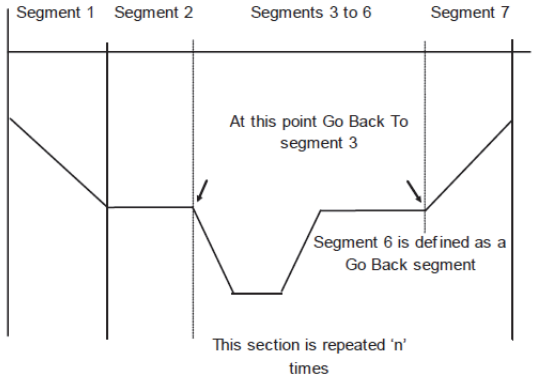
d) Time

A time segment defines the duration of the segment. In this case the target setpoint is defined and the time taken to reach this value. A dwell period is set by making the target setpoint the same value as the previous setpoint.

e) GoBack

Go Back allows segments in a program to be repeated a set number of times. The diagram shows an example of a program which is required to repeat the same section a number of times and then continue the program.

When planning a program it is advisable to ensure that the end and start setpoint of the program are the same otherwise it will step to the different levels.



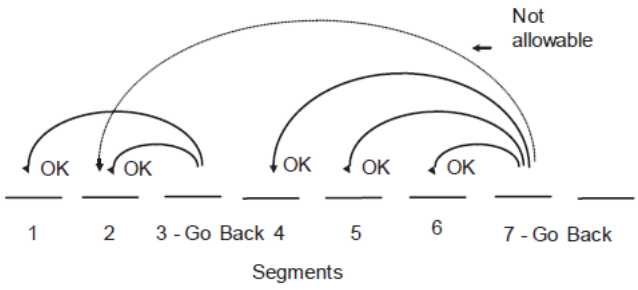
'Goback Seg' specifies the segment to go back to

'Goback Cycles' specifies the number of times the goback loop is executed

Overlapping Goback loops are disallowed

NOTE: If a second or more 'Go Back' segments are created, they cannot return to a segment before the previous 'Go Back' segment as shown.

In this diagram a Go Back segment can be created from 3 to 2 or 1. Go Back segments can also be created from 7 to 6 or 5 or 4 but not from 7 to 2 or 1.



f) Call

A CALL segment is only available when single programmer mode is configured. Call segments may only be selected in instruments offering multiple program storage.

The Call segment allows programs to be nested within each other.

To prevent re-entrant programs from being specified, only higher number programs may be called from a lower program.

i.e. program 1 may call programs 2 through 50, but program 49 may only call program 50.

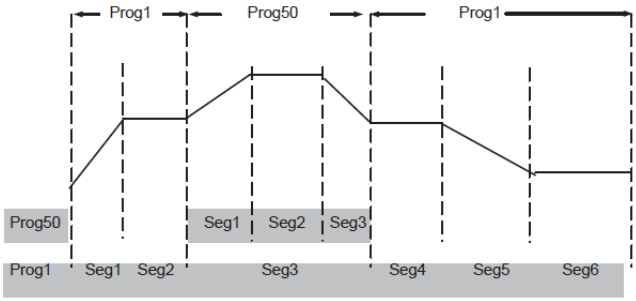
When a CALL segment is selected, the operator may specify how many cycles the called program will execute. The number of cycles is specified in the calling program. If a called program has a number of cycles specified locally, they will be ignored.

A CALL segment will not have a duration, a CALL segment will immediately transfer execution to the called program and execute the first segment of that program.

Called programs do not require any modification, the calling program treats any END segments as return instructions.

The example shows Prog 50 (Ramp/Dwell/Ramp) inserted in place of segment 3/Program1.

Prog 50 can be made to repeat using the ‘Cycles’ parameter.



g) End

A program may contain one End segment. This allows the program to be truncated to the number of segments required.

The end segment can be configured to have an indefinite dwell at the last target setpoint or to reset to the start of the program or to go to a defined level of power output (SafeOP). This is selectable by the user.

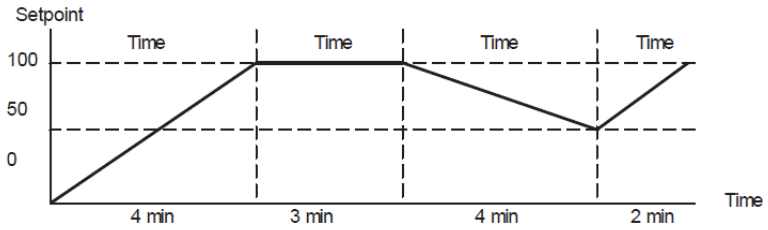
If a number of program cycles are specified for the program, then the End segment is not executed until the last cycle has completed.

2. Programmer Types

A. Time to Target Programmer:

Each segment consists of a single duration parameter and a set of target values for the profiled variables.

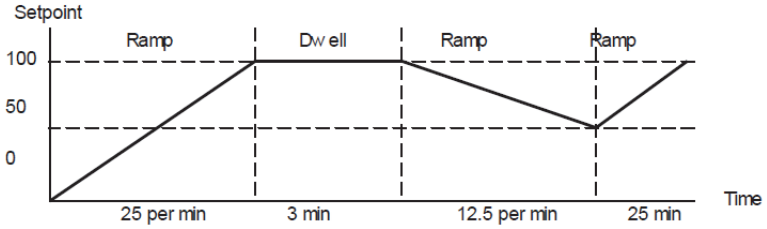
1. The **duration** specifies the time that the segment takes to change the profiled variables from their current values to the new targets.
2. A **dwell** type segment is set up by leaving the target setpoint at the previous value.
3. A **Step** type segment is set up by setting the segment time to zero.



B. Ramp Rate Programmer:

A ramp rate programmer specifies it's ramp segments as maximum setpoint changes per time unit. Each segment can be specified by the operator as Ramp **Rate**, **Dwell or Step**.

1. **Ramp Rate** – the setpoint changes at a rate in units/time
2. **Dwell** – the time period is set – there is no need to set the target value as this is inherited from the previous segment
3. **Step** – specify target setpoint only – the controller will use that setpoint when the segment is reached.



Program Edit Summary Parameters:

The table below shows a list of all possible parameters which may be set up in operator levels 1 and 2 using the procedure in the below programming example.

Parameter Name	Parameter Description	Value	
Program	Program number (and name if this has been configured)	1 to 25	
Segments Used	Displays the number of segments in the program. This value automatically increments each time a new segment is added	1 to max number of segments (500)	
Ch1HldBkVal	Channel 1 holdback value	0 to 99999	
Cycles	Number of times the whole program repeats	Continuous Repeats 1 to 999 times	
Segment	To select the segment number	1 to 50	
Segment Type	Defines the type of segment. The type of segment varies depending on whether the program is Single, SyncAll or SyncStart. Call only available in single programmer Rate, Dwell, Step not available in SyncAll programmer	Rate	Rate of change of SP
		Time	Time to target
		Dwell	Soak at constant SP
		Step	Step change to new SP
		Wait	Wait for condition
		GoBack	Repeat previous segs
		Call	Insert new program
		End	Final segment
Target SP	Value of SP required at the end of the segment.	Range of controller	
Ramp Rate	Rate of change of SP. Only shown if the Segment Type = Rate.	Units/sec, min or hour	
Holdback Type	Deviation between SP and PV at which the program is put into a hold condition to wait for the PV to catch up. Only appears if configured	Off Low High Band	No holdback PV<SP PV>SP PV<>SP
Duration	Time for a Dwell or Time segment. Only shown if Segment Type = Time.	0:00:00 to 500.00 secs, mins or hours	

Parameter Name	Parameter Description	Value	
End Type	Defines the action to be taken at the end of the program	Dwell	Continue at current SP
		SafeOP	Go to a defined level
		Reset	Reset to start of prog
GoBack Seg	Only appears if the segment type is ‘GoBack’. It defines the segment to return to repeat that part of the program	1 to the number of segments defined	

To Select and Run a Program

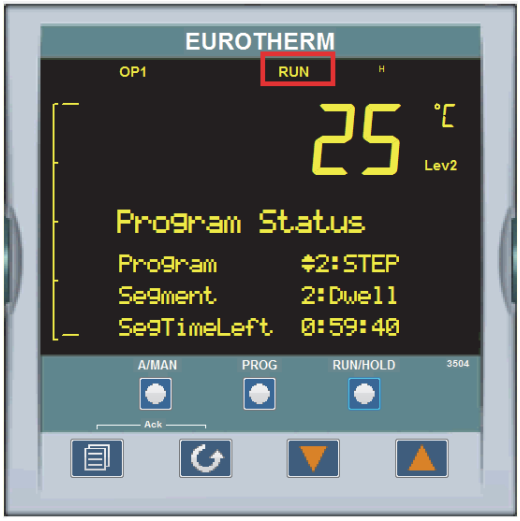
This example assumes the program to be run has already been entered, to create program follow steps as in the “Create a Program”

1. Press **PROG** button.

2. Select the program by pressing “Lower” or “Raise” button.

3. After selecting the desired program press “**RUN/HOLD**” button.

4. Once the program is loaded, “RUN” will show on display.

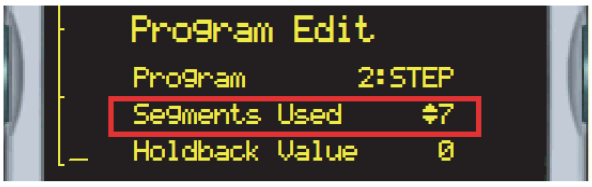


5. To HOLD a program, press “**RUN/HOLD**” button.
6. Press “**RUN/HOLD**” button again to continue the program.
7. To Reset a program, Press and hold ““RUN/HOLD” button for at least 3 seconds”. Program will be re-started from beginning at the first program step.

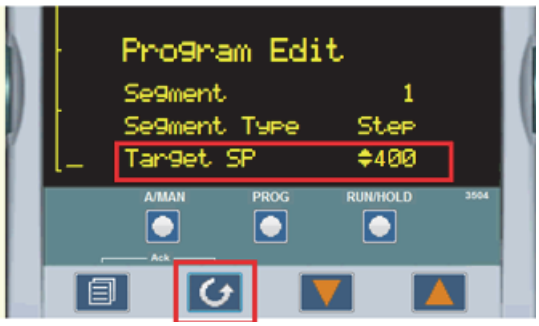
Steps to Edit the Target SP and Duration

1. Press **PROG** button.
2. Press **PAGE** button.
3. Select the program “**STEP**” by pressing “**Lower**” or “**Raise**” button.

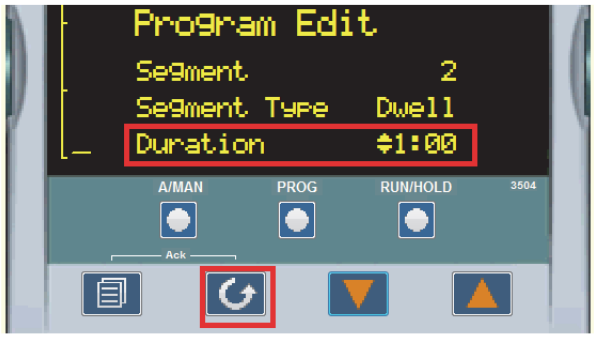
4. Press “**SCROLL**” button to edit the program.



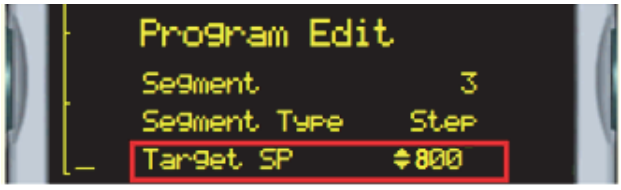
5. In this program, total 7 segments are used. Press “**SCROLL**” button until segment1 “**Target SP**” is selected.



6. Change the segment1 Target SP by pressing “**Lower**” or “**Raise**” button with desired value, the controller will accept the new value, which is indicated by a brief flash of the display.
7. Press “**SCROLL**” button until segment2 “**Duration**” is selected.

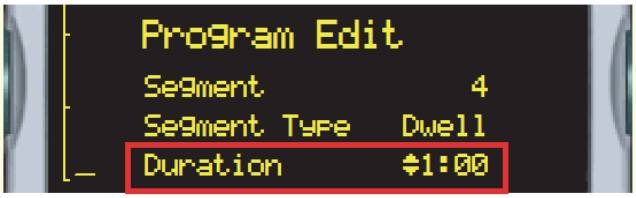


8. Modify segment2 Duration by pressing “**Lower**” or “**Raise**” button (HH:MM rmat), the controller will accept the new value which is indicated by a brief flash of the display.
9. Press “**SCROLL**” button until segment3 “**Target SP**” is selected.

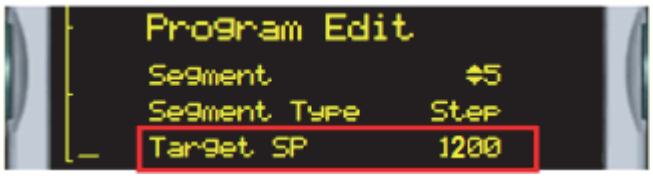


10. Change the segment3 Target SP by pressing “**Lower**” or “**Raise**” button with desired value, the controller will accept the new value which is indicated by a brief flash of the display.

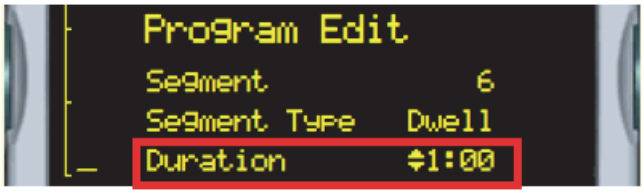
11. Press “**SCROLL**” button until segment4 “**Duration**” is selected.



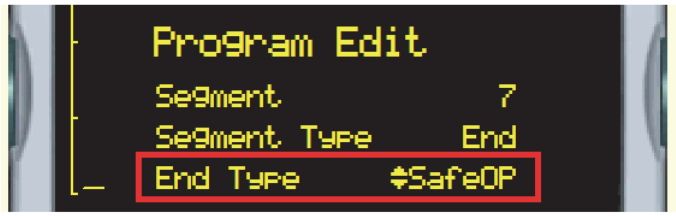
12. Modify segment4 Duration by pressing “**Lower**” or “**Raise**” button (HH:MM format), the controller will accept the new value which is indicated by a brief flash of the display.
13. Press “**SCROLL**” button until segment5 “**Target SP**” is selected.



14. Change the segment5 Target SP pressing “**Lower**” or “**Raise**” button with desired value, the controller will accept the new value which is indicated by a brief flash of the display.
15. Press “**SCROLL**” button until segment6 “**Duration**” is selected.



16. Modify segment6 Duration by pressing “**Lower**” or “**Raise**” button (HH:MM format), the controller will accept the new value which is indicated by a brief flash of the display.
17. Press “**SCROLL**” button until segment7 “**SafeOP**” is selected.

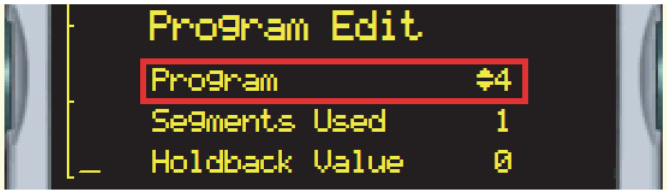


18. This completes the program edit with Target SP and duration values.

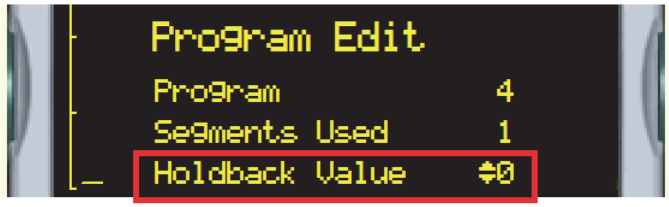
		NOTE To create or edit the program user must change the level of access to “L2”.

To Create a Program

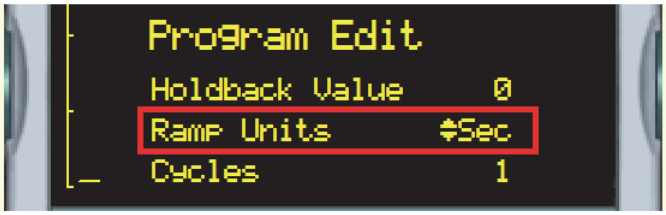
1. Press **PROG** button.
2. Press **PAGE** button.
3. Select the program from available programs of 4 to 25 which are empty.
4. Press **SCROLL** button to edit the program.



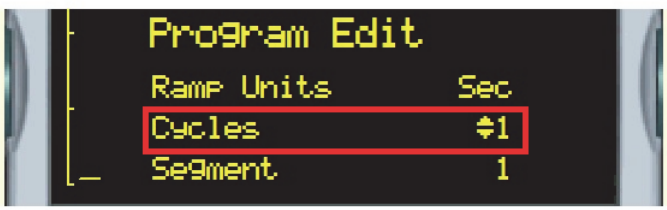
5. Press **SCROLL** button to select “**Holdback Value**”



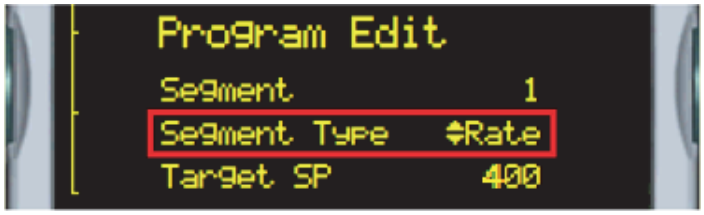
6. Keep Holdback value “0”.
7. Press SCROLL button to select “Ramp Units”, default is “**Sec**”.



8. Press **SCROLL** button and change the “**Cycles**” value to repeat the program if needed with the raise/lower buttons.



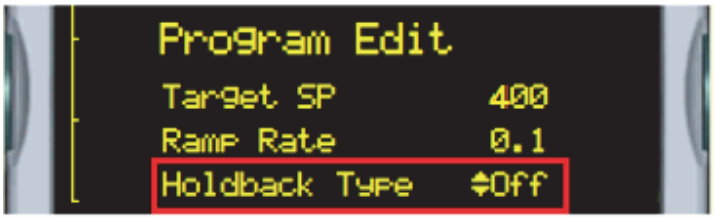
9. Press **SCROLL** button until Segment1 “**Segment Type**” is displayed, change “Segment Type” as per the requirement, in below example segment type is selected as “**Rate**”.



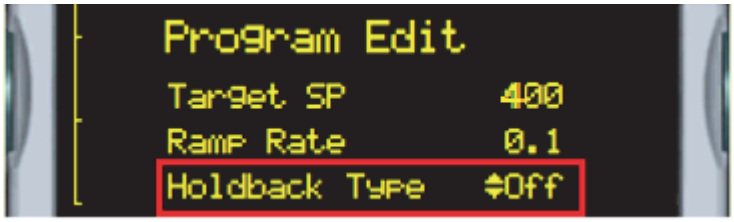
10. Press **SCROLL** to select Segment1 “**Target SP**”, modify “**Target SP**” as per the requirement with the raise/lower buttons, the controller will accept the new value which is indicated by a brief flash of the display.

11. Press **SCROLL** to select “**Ramp Rate**”, its default value is 0.1 (Ramp rate/Sec). It can be altered as per the requirements with the raise/lower buttons, the controller will accept the new value which is indicated by a brief flash of the display.

12. Press **SCROLL** to select “Holdback Type”, its default value is “**Off**”.

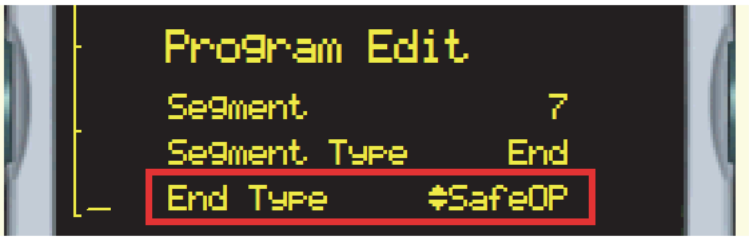


13. Press **SCROLL** to select “Event Outs”, Skip all Event outs by pressing **SCROLL** button.



14. Continue the program by entering next “Segment” values as shown in the above steps.

15. To end the program select segment type as “END” and “END” Type as “**SafeOP**” with the raise/lower buttons. In some cases, program segment can be selected as “Dwell” to maintain constant setpoint for a duration as per the requirements.

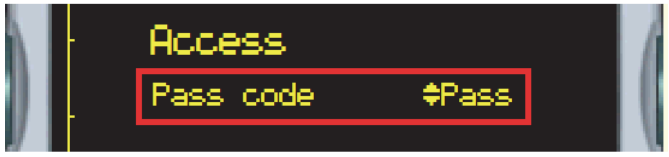


To Change the Access level from L1 to L2 (Level1 to Level2)

1. Press **PAGE** until display shows “Access” menu, change “**Goto**” value to “Level 2”with raise/lower button.

2. Press raise button to enter pass code, its value is “25”.

3. Then controller will grant the access to modify parameters.



		NOTE Some parameters are protected under a higher level of security – Level 2. In these cases it will be necessary to select ‘Access Level 2’. (Example: For Auto tune, to change the PV offset value) **Level1 Access= Operator; Level2 Access = Engineer.**

Auto Tune

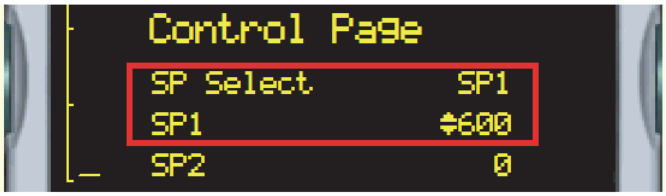
Auto Tune is used to set the control terms (PID values) as close as possible to match the characteristics of the process.

It uses the auto tuner which works by switching the output on and off to induce an oscillation in the process value. For this reason, the auto tune process should be done off line but using load conditions as close as possible to those to be found in practice. From the amplitude and period of the oscillation, it calculates the control parameter values.

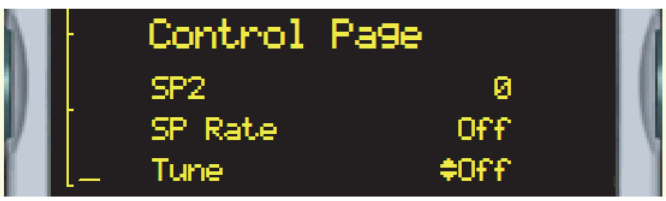
Steps to Auto tune:

1. Press **PAGE** button until “Control Page” is displayed on the controller screen.(access in Level2)

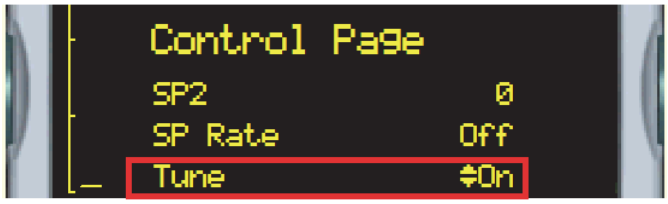
2. Press **SCROLL** button to select “**SP1**”.
3. Change the SP1 value to desired value for tuning with up/down buttons. (In following example SP1 is selected as 600°C). The controller will accept the new value and is indicated by a brief flash of the display.



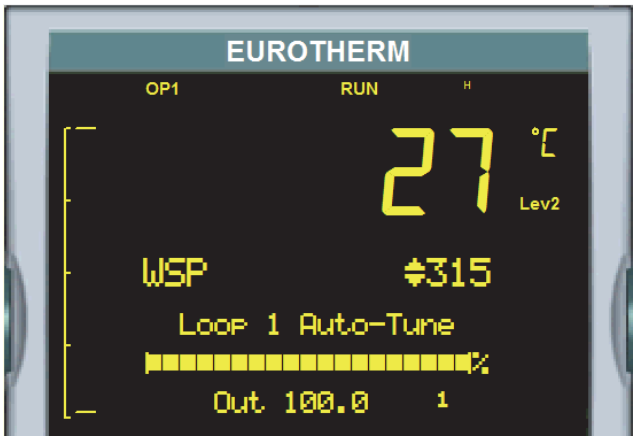
4. Press **SCROLL** button until “**TUNE**” is selected.



5. Change the Tune value **ON** with UP button.



6. Press Page + Scroll buttons to start the Auto tune process.
7. Controller begin the Auto tuning process.



8. Once after Auto tune, new PID value will be loaded in to the controller with respective to the tuned SP value.

		NOTE In the Factory, PID values are Auto tuned to 550°C. It is recommended to tune to desire Setpoint for best accuracy. After Auto tune, PID value will be changes with respect to tuned setpoint value.

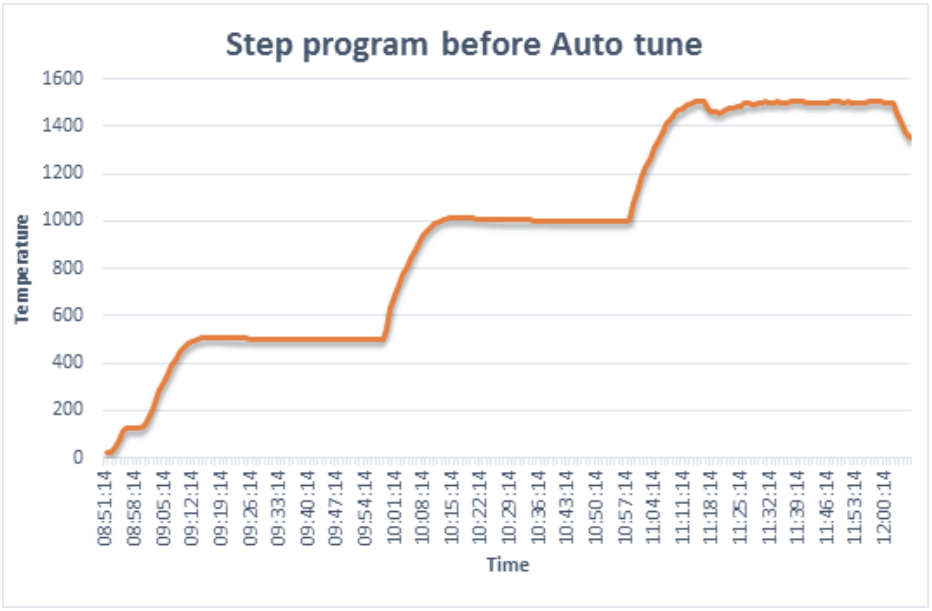


Figure 7-1. Graph data without Auto tune
(Shown example for 1500°C Furnaces)

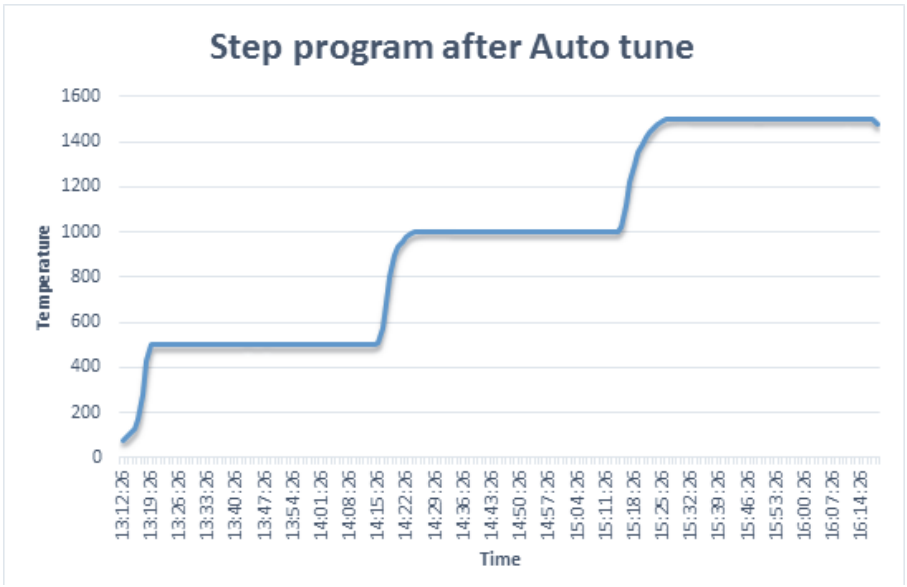
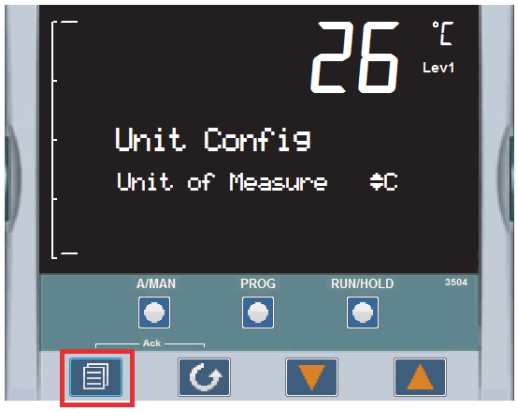


Figure 7-2. Graph data with Auto tune
(Shown example for 1500°C Furnaces)

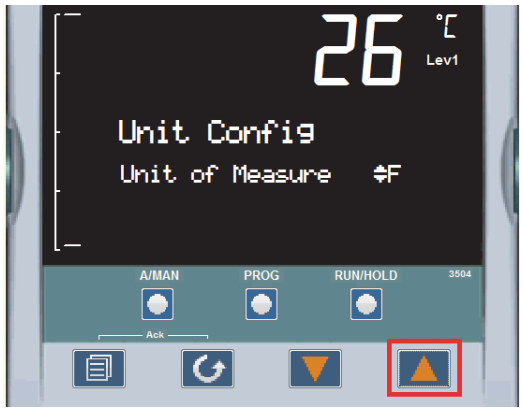
To Change the Display Units

Units of measure can be altered in Level1 access

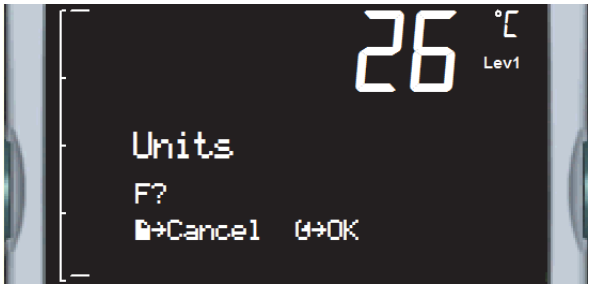
1. Press **PAGE** until below image is displayed on the screen.



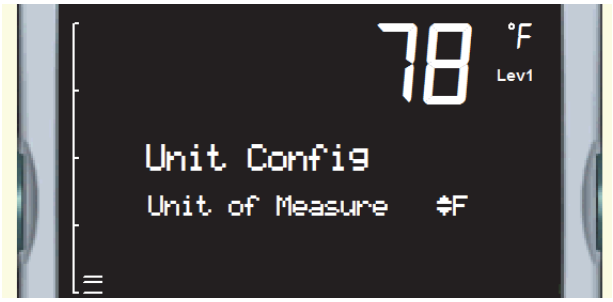
2. Press **RAISE** button to change the “Units” type to “F”.



3. Press **SCROLL** button to accept the change.

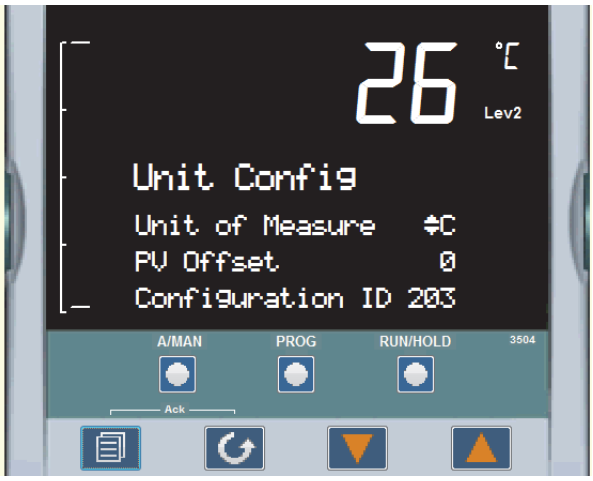


4. Display “Units” will be updated from “Celsius” to “Fahrenheit”.

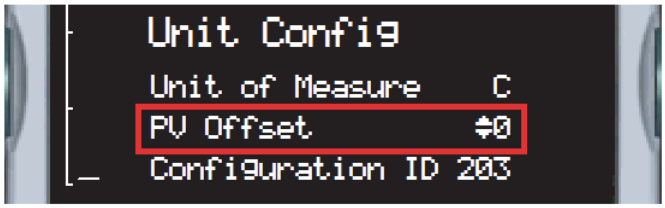


To Change the PV Offset

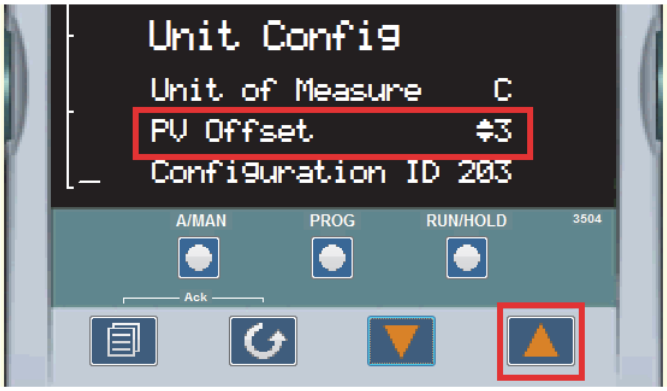
1. Get the Level 2 access to adjust the process offset value.
2. Press **PAGE** until following image is displayed on the screen.



3. Press **SCROLL** until "**PV Offset**" value get selected.



4. Modify "**PV offset**" value as per requirement, the controller will accept the new value which is indicated by a brief flash of the display.

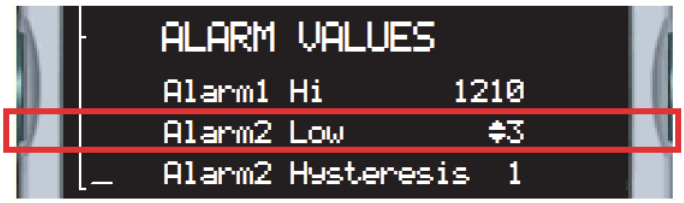


To Change the ALARM VALUES

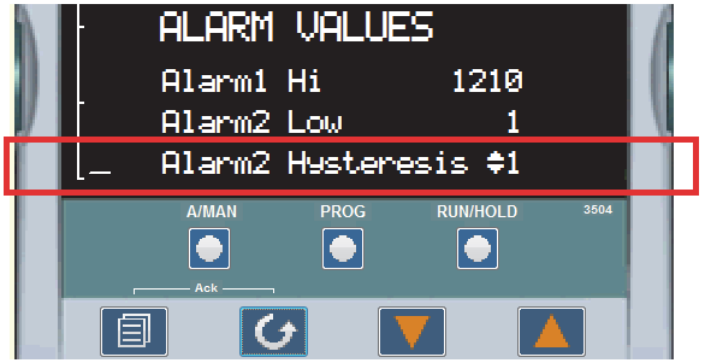
1. Get the Level 2 access to adjust the ALARM Values.
2. Press **PAGE** until following image is displayed on the screen.

3. "Alarm1 Hi" is read only value in both L1 and L2 access.
4. Press **SCROLL** button to select "**Alarm2 Low threshold**" value.

5. Press raise/lower buttons to change Alarm2 Low Threshold value, the controller will accept the new value and is indicated by a brief flash of the display.



6. Press **SCROLL** button to select "**Alarm2 Hysteresis**" value.



7. Press raise button to change Alarm2 Hysteresis value, the controller will accept the new value and is indicated by a brief flash of the display.

		NOTE Alarm1 (Absolute high) is read only; Alarm2 and Alarm3 are L2 access alarms.

To Change the ALARM3 and its HYSTERESIS values (Deviation Alarm)

1. Press **PAGE** until following image is shows on the display.
2. Press **SCROLL** to select Alarm3 “Threshold” value.

3. Press raise/lower buttons to change Alarm3 **Deviation** value, the controller will accept the new value which is indicated by a brief flash of the display.

4. Press **SCROLL** button to select Alarm3 “**Hysteresis**” value.

5. Press raise button to change Alarm3 Hysteresis value, the controller will accept the new value which is indicated by a brief flash of the display.

		NOTE Alarm1 **HIGH** Threshold value should not be greater than 1225°C **Deviation High** - an alarm occurs when the PV is higher than the setpoint by a set threshold

Excess Temperature Option (B Models)

The Excess Temperature Option, when installed, provides an additional, independent temperature control system to help protect products from excess temperatures.Read this section carefully before using this option.

Control Display

When the excess temperature controller (Mode UT150L) is first turned on, it displays only the excess temperature setpoint in the bottom display. Press and release the SET/ENT button to show the duration time of the last excess temperature incident. (See Exceeded Temperature Duration Timer Section.)

Press and release the SET/ENT button once again to show the peak temperature measured for the last excess temperature incident.

Pressing and releasing the SET/ENT button once again shows the current temperature measured by the controller in the top display; this may differ slightly from the main temperature controller. The value shown in the bottom display is the current excess temperature setpoint.

Pressing and releasing the SET/ENT button again cycles back to the first display, of the SET/ENT in lower display.

Excess Temperature Option Features

1. Exceeded Temperature Duration Timer

   The Exceeded Temperature Duration Timer measures the time that the setpoint is exceeded (and power to the heater was interrupted) until the hysteresis value is reached as the chamber temperature cools. This time indicates when the chamber temperature exceeded the Excess Temperature setpoint.

2. Peak Exceeded Temperature

   The Peak Exceeded Temperature is the highest temperature measured by the Excess Temperature Controller.

Operating Parameters

1. Excess Temperature Setpoint

   The Excess Temperature setpoint is typically set about 10°C (18°F) above the planned operating temperature of the chamber, or to the maximum temperature the product or process could tolerate.

   The Excess Temperature setpoint is selected by holding the SET/ENT button for three seconds to show “SP” in the top display and the current setpoint in the bottom display. Adjust the setpoint with the arrow button and press the SET/ENT to register the new setpoint.

2. Hysteresis

   Set the hysteresis ("HYS") of the Excess Temperature Controller to effectively use the Duration Timer feature.This value is usually 80% of the temperature difference between the Excess Temperature setpoint and the chamber operating temperature.

   For example. with an Excess Temperature setpoint of 1220°C and chamber operating temperature of 1180°C, set the hysteresis to 32°C.

   The hysteresis also controls the indicator is extinguished and the Excess Temperature Controller can be reset.

   Exit the Operating Parameters by holding the SET/ENT button for three seconds.

Excess Temperature Controller Operation

After the Excess temperature Setpoint and Hysteresis values are selected, the controller is ready for operation.The setpoint and hysteresis should be reviewed and adjusted if necessary, when the main controller setpoint is changed.

During an excess temperature incident, the “EXCEEDED” and “OUT” indicators are illuminated on the controller display area when the setpoint is tripped. The “EXCEEDED” indicator will stay illuminated while the temperature cools to the hysteresis amount, then turn off.

When the “EXCEEDED” indicator is extinguished, the Excess Temperature Controller can be reset holding the “up arrow/reset” button for one second when the normal operating display is showing the current measured temperature and the setpoint or just the setpoint.

The Exceeded Temperature Duration Timer and the peak Exceeded Temperature can be viewed either before or after the controller is reset. These are viewed on the controller display when the SET/ENT button is pressed and released, with the "tIn" or "HI" in the top display. These values will be erased from the display and memory when the "up arrow/reset" button is pressed during their respective display (add the "EXCEEDED" indicator is off).

Loss of power to the Excess Temperature Controller will not change the setpoint or hysteresis value (UT150L). However, the last recorded Exceeded Temperature Duration Time and peak Exceeded Temperature will be lost.

In some inspires, the “OUT” indicator is illuminated without a high temperature event. In this “TRIPPED OUT MODE”, the power to the heating element is introduced.

A source failure (indicated with "0.0" in the upper display) will cause "OUT" illuminated.

A power failure, in some instances causes "OUT" to be illuminated.

As lost as the "EXCEEDED" indicator is extinguished, the UT150L can be reset with press and hold of "UP ARROW/RESET" button.

Operation - 3216i Excess Temperature Controller

The 3216i controller serves as the Excess Temperature controller, when installed in the unit, provides an additional, independent temperature control system to help protect products from excess temperatures. The excess temperature controller is a single setpoint controller, which provides a single digital display to indicate the setpoint temperature (excess temperature Alarm threshold).

The Excess Temperature Alarm Threshold is typically set about 10°C (18°F) above the operating temperature of the chamber to account for variance for the process value temperature of the chamber. For example, Chamber temperature = 1200°C (2192°F) then Excess Temperature Alarm Threshold = 1210°C (2210°F). The maximum allowable Excess Temperature Alarm Threshold for this unit is 1250°C (2282°F) or +50°C (122°F) from maximum rating of the chamber temperature.

Excess temperature controller features are OTP (Over temperature protection), sensor break protection, and power failure indication.

		NOTE *After turn on the unit & power failure, user must press PAGE button + SCROLL button for the normal operation of the unit.

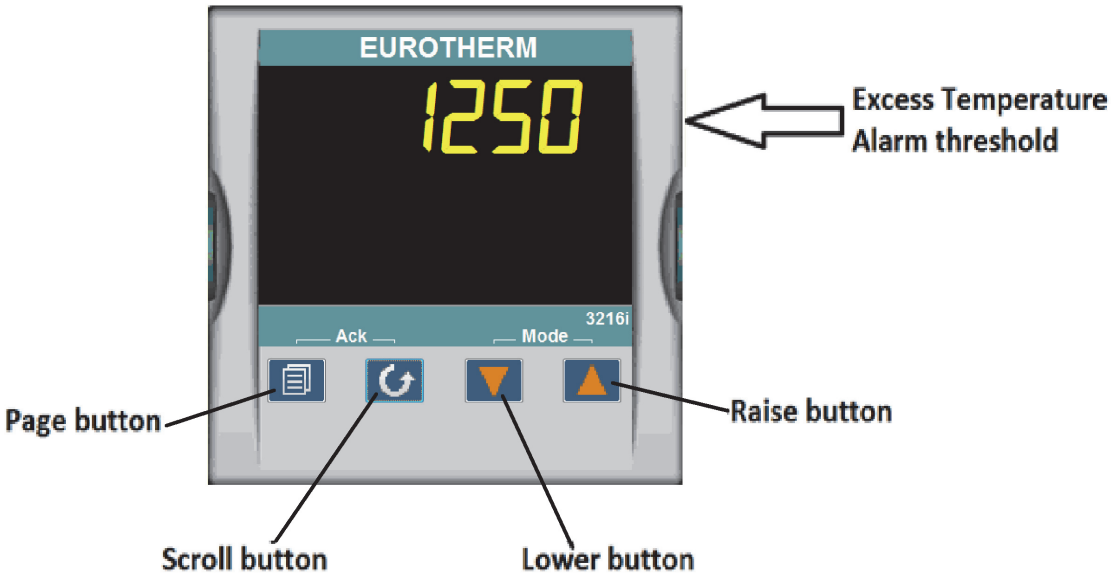
Default settings for the Excess temperature controller

Parameter	Description	Value	Access
ALARM.1.Threshold	Excess temp threshold	1250°C	Level 1+2 Read/Write
ALARM.1.Hysteresis	Alarm Hysteresis	1°C	Level 2 Read only
INPUT.Units	Display Units	°C	Level 1+2 Read/Write

Parameter	Description	Value	Access
INPUT.PVInValue	PV Input Value	Displays Process Value	Level 1+2 Read only
ACCESS.HomeDisplay	Home Display	Excess temp threshold (1250°C)	Level 1+2 Read/Write
INPUT.PeakHigh	Peak High	Peak High PV value	Level 1+2 Read only
INPUT.PeakReset	Peak Reset	Peak Reset	Level 1+2 Read/Write
INPUT.PVOffset	PV Offset	+/- adjusted with respect to main controller PV reading	Level 1+2 Read/Write
Customer ID	Customer ID	1200	Level 2 Read only

Excess Temperature controller Operation

When the controller is turned ON it will perform a short self-test and then display a default page as shown in the below image. The excess temperature Alarm threshold (setpoint) is found in the display. This excess temperature controller will be configured with respect to its functionality in the factory.



Buttons and Indicators

PAGE button: Allows you to select a new list of parameters.

SCROLL button: Allows you to select a parameter within a list of parameters.

DOWN button: Allows you to decrease a value.

UP button: Allows you to increase a value.

Operational Instructions

		NOTE If at any time you want to return to the HOME DISPLAY, press **PAGE** button.

1. **To turn on the Load:**

   Press "**PAGE + SCROLL**" buttons to acknowledge the "**ALM**".

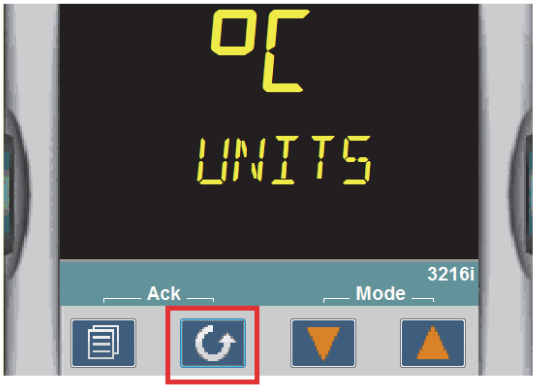
   Following image will be displayed after acknowledging the **ALARM** and load (heating element) will be turned on.

2. To change the Display Units:

Press **SCROLL** button until "**UNITS**" is displayed, then change the desired unit's type with up/down arrow. A few seconds after the button is released, the controller will accept the new value and is indicated by a brief flash of the display.

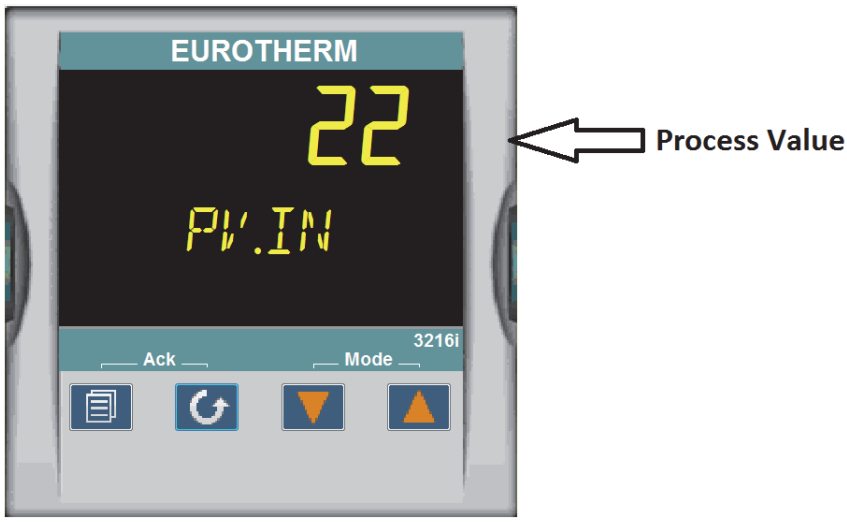
Press **PAGE** button to return to **HOME DISPLAY**.

Units Choice of **Celsius** (°C), **Fahrenheit** (°F), **Kelvin** (°K), **Percentage** (%), or **None** (none).



3. **To get the PV value (Process Value):**

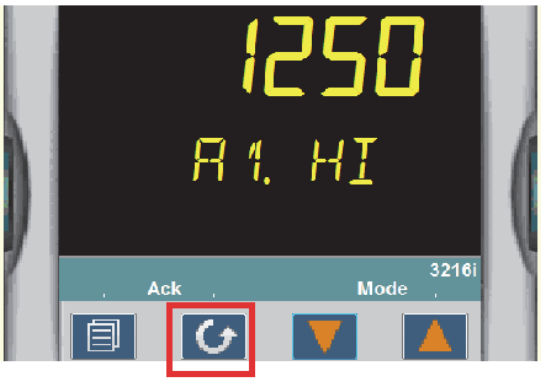
   Press **SCROLL** button until "**PV.IN**" shows on the controller display.



4. **To change the Excess temperature Alarm threshold (High Limit / Setpoint)**

   Press the **SCROLL** button until "**A1.HI**" is displayed, then press the **UP** or **DOWN** button for the desired alarm threshold value is displayed and then release the button. A few seconds after the button is released, the controller will accept the new value and is indicated by a brief flash of the display.

   Press **PAGE** button to return to **HOME DISPLAY**.



5. To change the ALARM HYSTERSIS

Press the **SCROLL** button until "**A1.HYS**" is displayed, then press the **UP** or **DOWN** button for the desired **HYSTERSIS** value is displayed and then release the button. A few seconds after the button is released, the controller will accept the new value and is indicated by a brief flash of the display.

Press **PAGE** button to return to **HOME DISPLAY**.

6. To get the Peak High Temperature reading

Press **SCROLL** button until "**HIGH**" shows on the controller display. (example: below image shows maximum achieved temperature since the unit powered up)

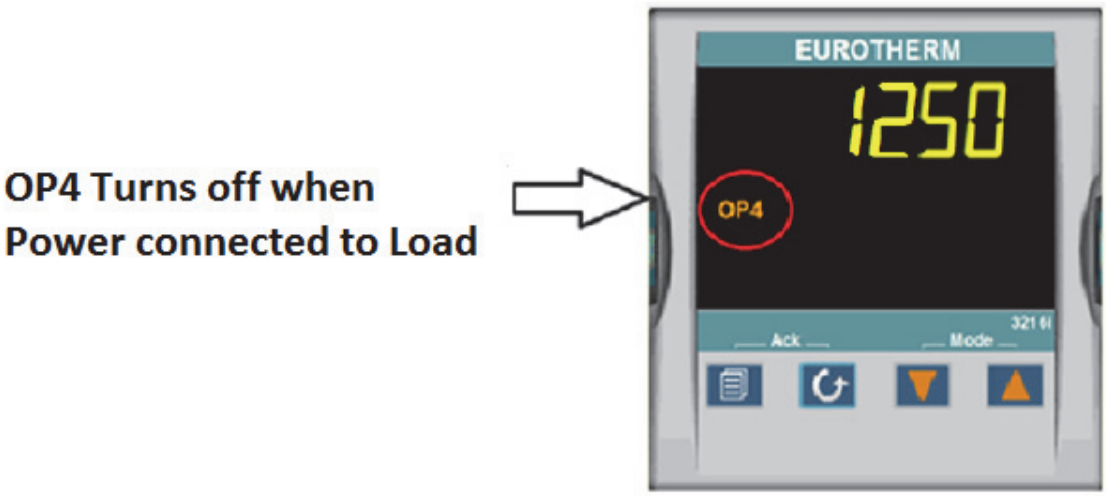
7. Sensor Break

Check for Thermocouple connection if controller displays below message.

8. OP4 (Output4)

Output is controlled thought Relay and the logic is inverted in the configuration file with respect to the excess temperature functionality.

When "**OP4**" is illumined load is not powered up and when "**OP4**" is not illuminated load is powered up.



Communication Option (COM)

The factory installed optional RS485 Digital Communications Port allows controller to be connected to a PC for remote monitoring and control of the furnace. The equipment with communication option (COM) is equipped with two DB9 serial ports (1 Male port & 1 Female port). These ports are intended for connection to the PC or a Laptop & making a communication chain of furnace with communication option (COM) Capability. The RS-485 communication allows multiple devices (up to 30) to communicate at half-duplex on a single pair of wires, plus a ground wire.

		NOTE The RS485 pin should match with your DB9 to USB or 232 adapters for the communication option to work.

The following table shows the DB9 pinout to the connections in the RS485.

Furnace DB9-Pinout	**RS485 Output**
Pin 2	A / D-
Pin 3	B / D+
Pin 5	Ground

Adapters - RS 485 to USB/RS 232

The communication option requires an RS485 to USB Adapter or RS485 to RS232 Adapter to for the furnace to communicate with the PC or Laptop. The RS485 to USB or RS485 to RS232 adapter with terminal block is recommended for free wire connections. RS485 adapter is suggested as pin connections vary with different adapter manufacturers and may not work properly if they don’t match with the above DB9 pinout of the furnace.

NOTE

Please ensure the adapter is compatible with the operating system of your PC/Laptop. Some adapter needs driver softwares & port access privileges on your PC/Laptop for proper functioning. Please contact your local IT for assistance.

RS485 Pinout & Connections

The furnace is provided with a communication cable for connecting the furnace to the RS485 adapter. The communication cable consists of DB9 connector in one end & open-end wire on the other end. Use the accessory Cable # 7044 for second and additional units.

Cable Installation

1. To install the communication cable, disconnect the electrical power from both the unit and PC/Laptop
2. Connect the cable end with a black housing to the DB 9-pin port on the rear of the Thermo Fisher Scientific unit.
3. Connect the other end of cable to the RS485 to USB or RS485 to RS232 adapter terminal block as shown in the following table (Terminal block adapter accessory is available as an accessory with most of the adapter manufacturer if this is not a standard feature).

Wire Color	RS 485 Adapter Terminal Block
Black	A / D-
Red	B / D+
Shield (Ground)	Ground

4. Apply electrical power to the unit and the PC.

NOTE

Please don’t connect the RS485 adapter directly to the DB9 connector on the equipment. The pins will not match as different manufacturer adopt use different pins. Use the communication cable supplied with the equipment.

Host Computer & Software

The host computer can communicate with furnaces with communication option (COM). A datalogging & control software is required for data logging & control of the furnace using the RS485 communication. Software like Spec view is suitable for these applications. These softwares can communicate with either a single Furnace or a network of Furnaces with the communication option.

Controller Parameters for Communication

Parameter	Value
Comms Module Identity	Comms (67)
Communications Protocol	Modbus (2)
Baud Rate	9600_baud (0)
Parity	Even (1)
Comms Address	1
Comms Wait States	No (0)
Single Value Broadcast Enable	No (0)
Network Watchdog Flag	Off (0)
Network Watchdog Action	Auto (1)
Network Watchdog Timeout	0
Network Watchdog Recovery	0

Troubleshooting

If your connection is not working properly, check the following conditions:

A. Verify complete and tight cable connections between the Thermo Fisher Scientific unit and the PC.

B. Verify that power has been supplied to the unit and temperature controller before starting the software program.

C. Verify the configuration values in the controller, listed in the Table for the section “Controller Parameters for Communication”.

Maintenance

General Maintenance

		CAUTION Maintenance should only be performed by trained personnel.

		WARNING Disconnect console from main power before attempting any maintenance to console or its controls.

		WARNING Before maintaining this equipment, read the applicable MSDS (Material Safety Data Sheets) in the safety notes.

WARNING

When installing, maintaining, or removing the fiberglass Insulation, the following precautions will minimize airborne dust and fiber:

- Keep personnel not involved in the installation out of the area.
- Use a good vacuum to clean area and equipment. Use a dust suppressant if sweeping is necessary. Do not use compressed air.
- Use a disposable mask suitable for nuisance dust.
- Wear long sleeve clothing, gloves, hat, and eye protection to minimize skin and eye contact. Do not wear contact lenses.
- Thoroughly wash self after work is complete.
- Launder work clothing separate from other clothes and thoroughly clean laundering equipment after use. If clothing contains a large amount of dust and/or fiber, dispose of rather than clean.
- Promptly place used fiberglass parts and dust in plastic bags and dispose of properly.

Heating Elements

The heating units are rated for a maximum of 1200°C. They will resist attack from most corrosive agents. High concentrations of atmospheres or chemicals which may have corrosive effects on the ceramic fiber are sulfates, chlorides, fluorides, alkalis, and vanadium. Please contact Thermo Fisher regarding questions on the effect of specific atmospheres on your furnace performance.

High concentrations of volatile materials being burnt off in the furnace may reduce heating element life. Proper venting of the volatiles is essential.

After prolonged use, hairline cracks may develop in the insulating materials. Minor cracks will not affect furnace performance.

Care should be taken when working with or handling the heating units, as the ceramic fibers and dust particles are a possible eye/skin/lung irritant. Refer Section **“Safety Notes”**.

Heating Unit Replacement

Replacement of the heating units requires partial disassembly of the furnace. Two persons may be required for parts of the procedure. Allow adequate work space for the disassembly.

1. Be sure to disconnect all power to the furnace.
2. Remove the outer panels of the furnace by removing the appropriate hex-head screws.
3. Remove the thermocouple and the power wires/connecting straps from the heating elements at the rear of the furnace.
4. Open furnace door slightly. Disassemble the chamber frame starting from the top rear and working toward the base. The front supports do not have to be removed. The heating elements can then be pulled back and out of the remaining front support brackets.
5. A gasket made of ceramic fiber blanket is located between the two heating units. This material should be retained and used with the replacement heating units.
6. Install the replacement heating units in the frame and reverse the above procedure to reassemble the furnace.

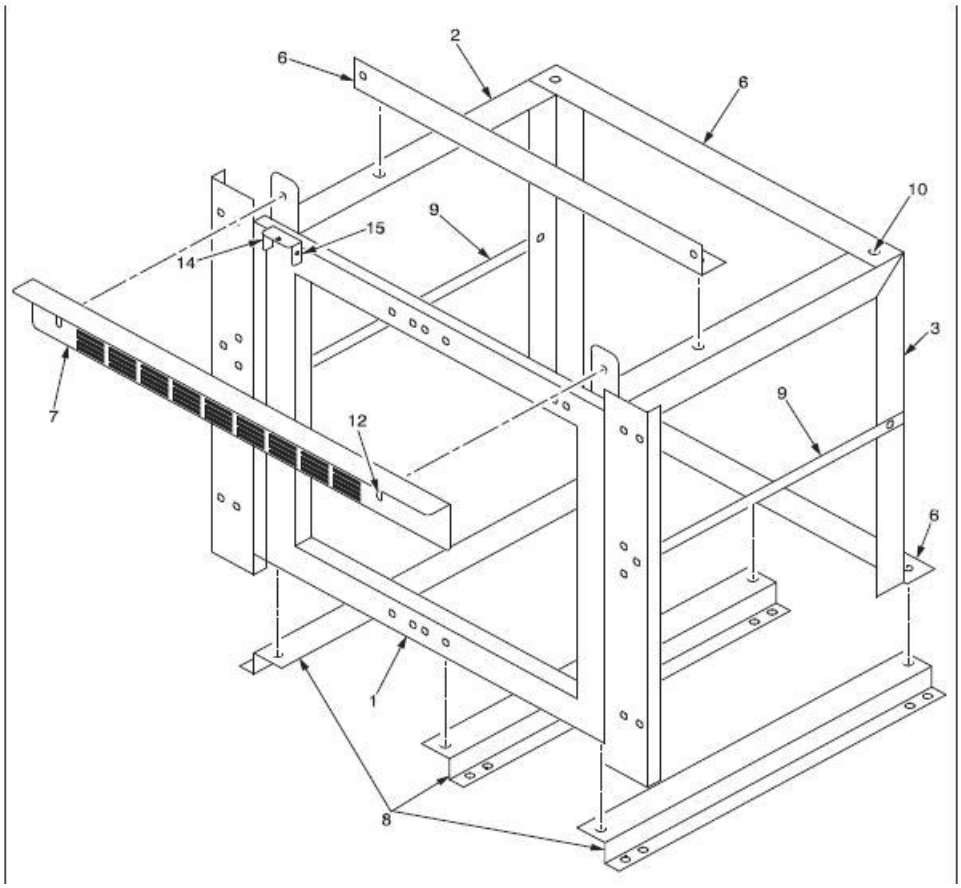


Figure 11-1. Heating Unit Replacement

Thermocouple (T/C) Replacement

To replace the thermocouple:

1. Disconnect power to the furnace.
2. Remove the back panel of the furnace by removing the appropriate eight hex-head screws.
3. The thermocouple is located in the upper left hand corner of the rear of the furnace. Note location and color of the thermocouple and lead wires. Remove the mounting and connection screws. Carefully pull the thermocouple assembly out of the furnace chamber.
4. Replace the cylindrical thermocouple section with the new section. Put the thermocouple assembly back into the furnace chamber. Fasten with the mounting screws and reconnect wires. Refer to Figure **"Thermocouple"** for proper wire connections.
5. Replace the back panel.

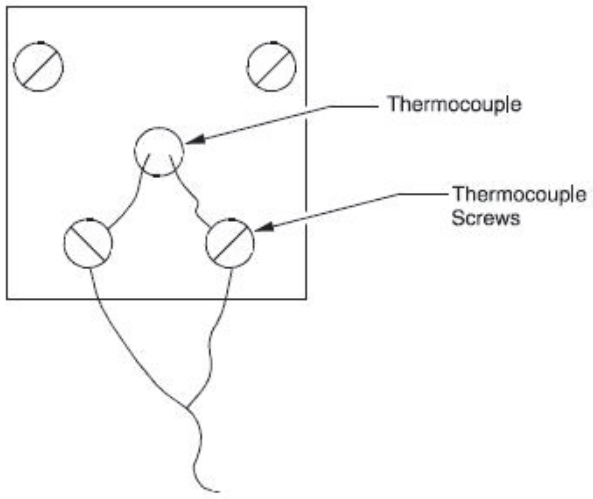


Figure 11-2. Thermocouple

Solid State Relay (SSR) Replacement

To replace the solid state relay:

1. Disconnect power to the furnace.
2. Remove the left side panel (facing front) to provide access to the SSR assembly.
3. Note positions of the wires on the SSR. Disconnect the wires and remove outer screws. Remove the heatsink and SSR from the furnace.
4. Remove the SSR from the heat sink. Replace with the new SSR and reverse the above procedure for reassembly.

Door Insulation Replacement

To replace the door insulation:

1. Disconnect power.
2. Open furnace door.
3. Loosen the screws holding the upper and lower door insulation brackets in place. The screws do not need to be removed.
4. Pull the door insulation out of the support brackets. Insert new insulation and reassemble the support brackets.

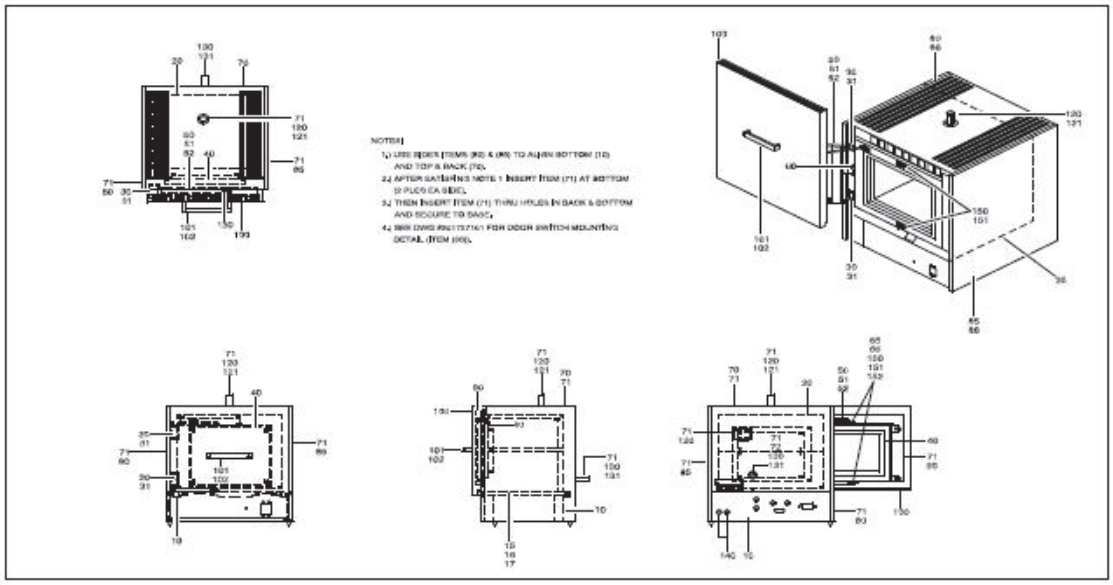


Figure 11-3. Door Insulation

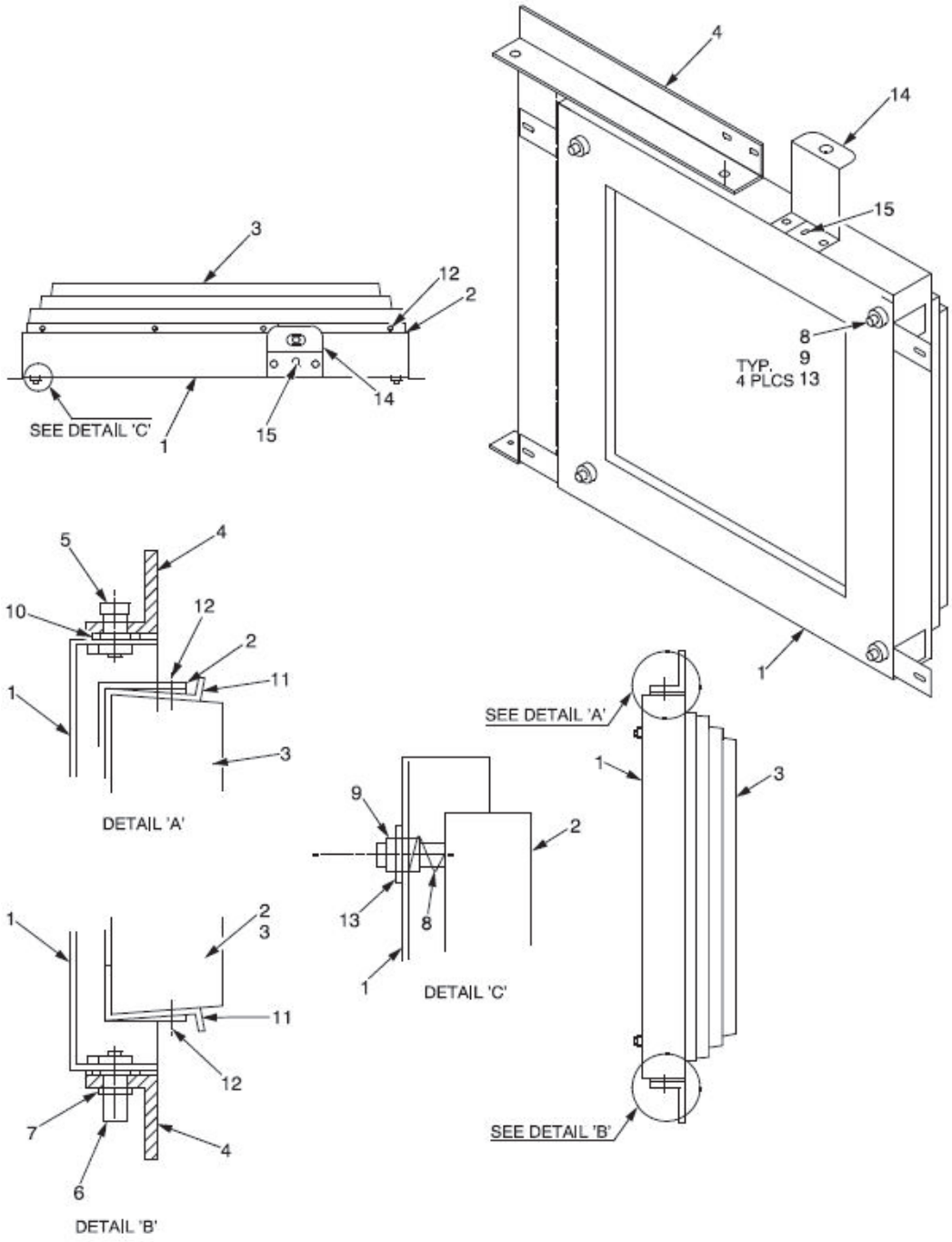


Figure 11-4. Door Insulation Replacement

Right Hand Door Conversion

The furnace door can easily be converted to a right hand swing door as fallows:

1. Open and support the furnace door. Remove the four bolts holding the door assembly to the furnace frame.
2. Remove the contact switch mounted below the door.
3. Install door on right hand side of the chamber frame, using the bolts in the holes provided. Install the contact switch in the mounting location provided at the right of old location.
4. Check alignment of the door insulation with the chamber.

Sideways adjustment can be made by loosening the door insulation supports and moving the insulation plug. Vertical adjustment can be made by placing or removing spacers on the door hinge.

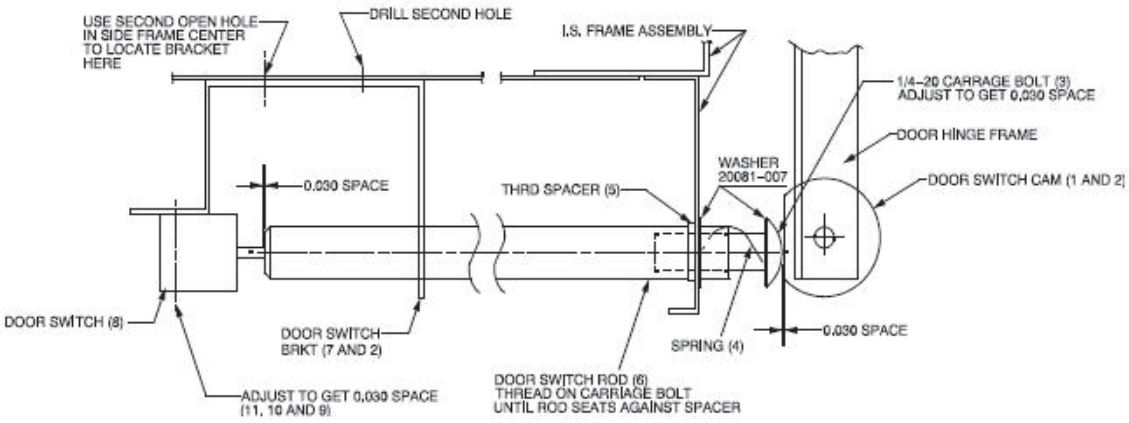


Figure 11-5. Door Hinge (Sheet 1/2)

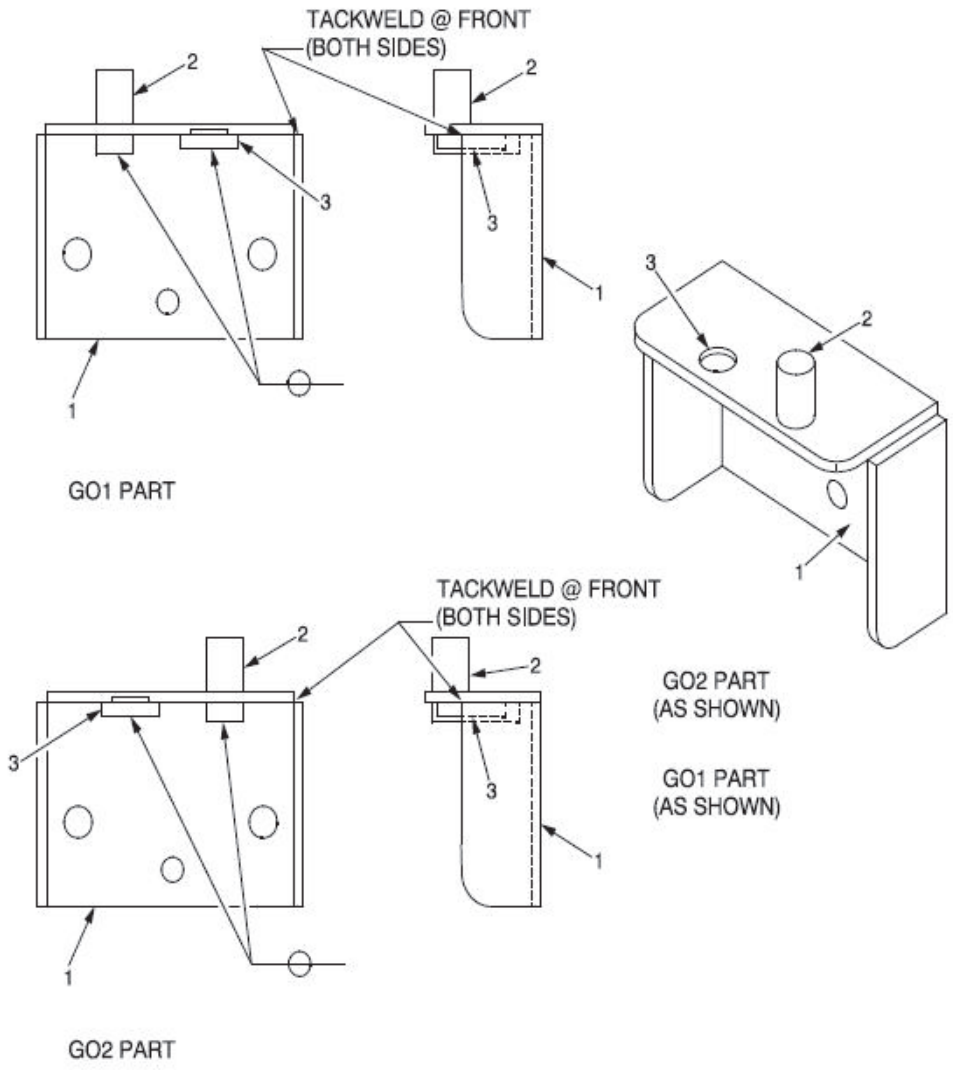


Figure 11-6. Door Hinge (Sheet 2/2)

Troubleshooting

Table 2. Controller Troubleshooting

Problem	Probable Causes	Solution
E.Conf	A change made to a parameter takes a finite time to be entered. If the power to the controller is turned off before the change has been entered then this alarm will occur. Do not turn the power off to the controller while ConF is flashing	Enter configuration mode then return to the required operating mode. It may be necessary to re-enter the parameter change since it will not have been entered in the previous configuration
E.CaL	Calibration error	Re-instate Factory calibration
E2.Er	EEPROM error	Return to factory for repair
EE.Er	Non-vol memory error	Note the error and contact your supplier
E.Lin	Invalid input type. This refers to custom linearization which may not have been applied correctly or may have been corrupted.	Go to the INPUT list in configuration level and set a valid thermocouple or input type

Problem	Probable Causes	Solution
The controller displays do not illuminate.	The furnace Is not connected to the power	Check furnace connection to power source
	Main switch is defective	Replace power switch or controller
	Fuse(s) Blown	Replace fuse(s) and verify power connections
Temperature varies or fluctuates.	Improper loading	Test the unit empty.If results are satisfactory, oven was improperly loaded. Redistribute the load
	Poor sensor connections	Check connections. Clean and tighten
	Contaminated sensor	Clear the area around the base
	Poor ventilation base	Clear the area around the base
	Inlet and / or exhaust vents are open	Close vents
	Inadequate tuning values.	Auto-tune the controller
	Insufficient stabilization time	Allow load ample time to reach equilibrium
	Intermittent failure of switch, controller, limit switch, or wiring	Verify wiring connection
Temperature Offset.	Controller degradation and/or sensor degradation	Offset or bias the controller and/ or replace the sensor

Replacement Parts

Description	Item	BF51842C-1	BF51842COMC-1	BF51842BC-1
Heater-Chamber, top or bottom	300880H01	2	2	2
Hearth Plate	300807H01	1	1	1
Shelf, Half-depth	7221-2067-001	2	2	2
Exhaust Port Cover	7221-2063-00A	1	1	1
Gas Inlet Assembly	300253G02 S	1	1	1
Thermocouple, Single	7299-1104-00B S	1	1	0
Thermocouple, Double	7299-1200-00M S	0	0	1
T/C Leadwire	33940-006	6 ft	6 ft	12 ft
Wire Harness	38850G31	1	1	1
Main Circuit Breaker	302795H05	1	1	1
Control circuit breaker	21642H01	2	2	2
Heater fuse	32657-004	2	2	2
Contactor	300088H01	1	1	1
Solid State Relay	102460	1	1	1
Red Pilot Light	33002-01	1	1	1

Description	Item	BF51842C-1	BF51842COMC-1	BF51842BC-1
Main Controller	303115H19	1	0	1
	303115H20	0	1	0
Over-temp Controller	303115H05	0	0	1
Door Insulation Assembly	7221-2048-00A	1	1	1
	7221-2070-00A	1	1	1
Door Switch	46113H02	1	1	1
Door Insulation Assembly	7221-2048-00A	1	1	1
	7221-2070-00A	1	1	1
Door Catch/Latch	38280H01	2	2	2
Door Trailing Arm	301667H01	1	1	1
Cab.Bracket, Trailing Arm rhd	301665G02	For optional right hand door Swing		
Operational Manual	305432H02	1	1	1
Wiring Diagram	304258I01	1	1	1
Communication Cable	303401G02	0	1	0

Description	Item	BF51842PBC-1	BF51842PBCOMC-1	BF51842PBFMC-1	BF51842PBFMCOMC1
Heater-Chamber, top or bottom	300880H01	2	2	2	2
Hearth Plate	300807H01	1	1	1	1
Shelf, Half-depth	7221-2067-001	2	2	2	2
Exhaust Port Cover	7221-2063-00A	1	1	1	1
Gas Inlet Assembly	300253G02 S	1	1	1	1
Thermocouple, Double	7299-1200-00M S	1	1	1	1
T/C Leadwire	33940-006	12 ft	12 ft	12 ft	12 ft
Wire Harness	38850G31	1	1	1	1
Main Circuit Breaker	302795H05	1	1	1	1
Control circuit breaker	21642H01	2	2	2	2
Heater fuse	32657-004	2	2	2	2
Contactor	300088H01	1	1	1	1
Solid State Relay	102460	1	1	1	1
Red Pilot Light	33002-01	1	1	1	1
Main Controller	CN71X203	1	0	1	0
	CN71X209	0	1	0	1
Over-temp Controller	CN71X1200	1	1	1	1
Door Insulation Assembly	7221-2048-00A	1	1	1	1
Door Switch	46113H02	1	1	1	1

Description	Item	BF51842PBC-1	BF51842PBCOMC-1	BF51842PBFMC-1	BF51842PBFMCOMC1
Door Catch/Latch	38280H01	2	2	2	2
Door Trailing Arm	301667H01	1	1	1	1
Cab.Bracket, Trailing Arm rhd	301665G02	for optional right hand door swing			
Operational Manual	305432H02	1	1	1	1
Wiring Diagram	39034I06	1	1	1	1
Communication Cable	303401G02	0	1	0	1

Description	Item	BF51842PC-1	BF51842PCOMC-1	BF51842PFMC-1	BF51842PFMCOMC-1
Heater-Chamber, top or bottom	300880H01	2	2	2	2
Hearth Plate	300807H01	1	1	1	1
Shelf, Half-depth	7221-2067-001	2	2	2	2
Exhaust Port Cover	7221-2063-00A	1	1	1	1
Gas Inlet Assembly	300253G02 S	1	1	1	1
Thermocouple, Single	7299-1104-00B S	1	1	1	1
Thermocouple, Double	7299-1200-00MS	0	0	0	0
T/C Leadwire	33940-006	6 ft	6 ft	6 ft	6 ft
Wire Harness	38850G31	1	1	1	1
Main Circuit Breaker	302795H05	1	1	1	1
Control circuit breaker	21642H01	2	2	2	2
Heater fuse	32657-004	2	2	2	2
Contactor	300088H01	1	1	1	1
Solid State Relay	102460	1	1	1	1
Red Pilot Light	33002-01	1	1	1	1
Main Controller	CN71X203	1	0	1	0
	CN71X209	0	1	0	1
Door Insulation Assembly	7221-2048-00A	1	1	1	1
Door Switch	46113H02	1	1	1	1

Description	Item	BF51842PC-1	BF51842PCOMC-1	BF51842PFMC-1	BF51842PFMCOMC-1
Door Catch/Latch	38280H01	2	2	2	2
Door Trailing Arm	301667H01	1	1	1	1
Cab.Bracket, Trailing Arm rhd	301665G02	for optional right hand door swing			
Operational Manual	305432H02	1	1	1	1
Wiring Diagram	39034I06	1	1	1	1
Communication Cable	303401G02	0	1	0	1

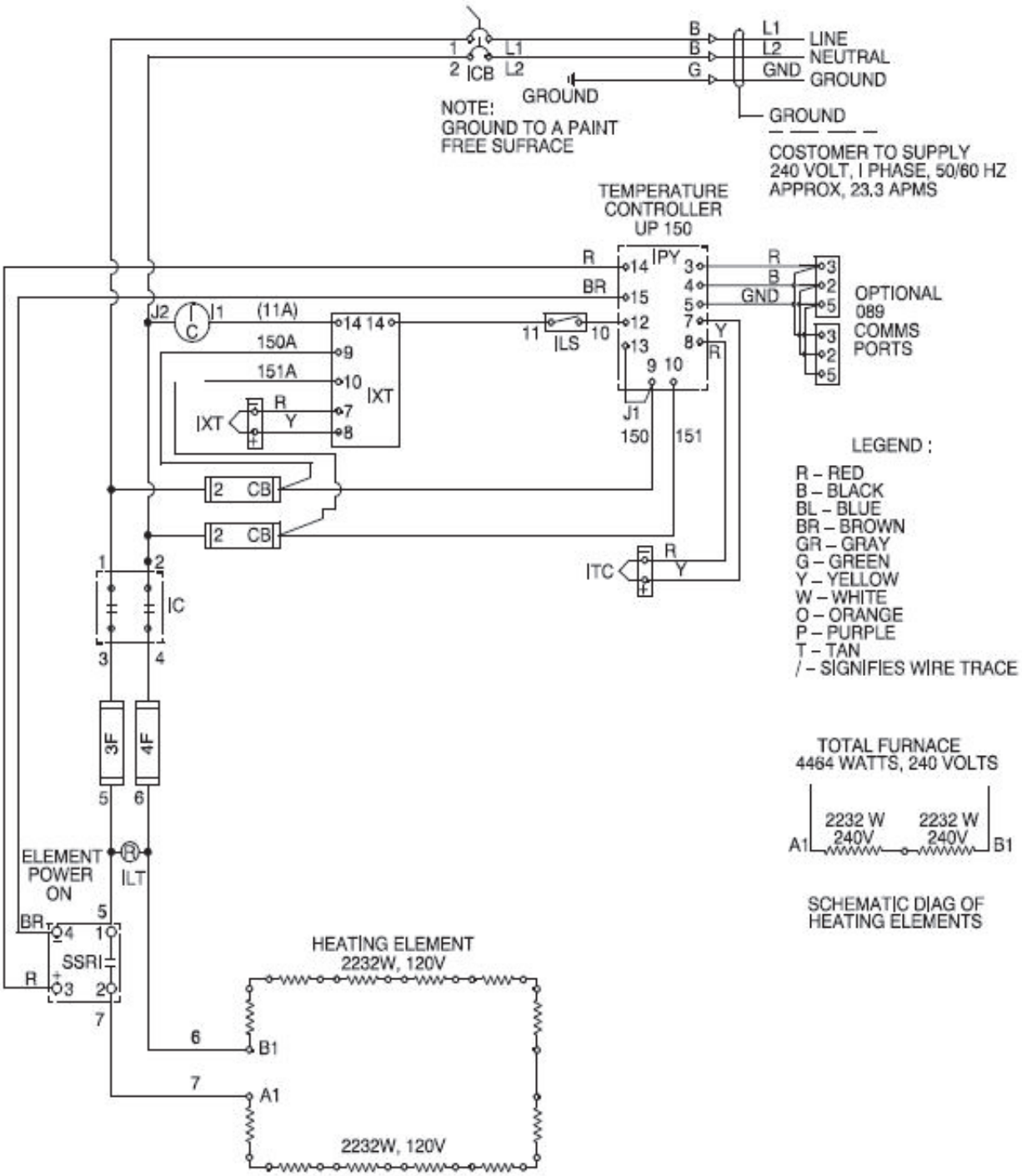


Figure 13-1. Wiring Diagram

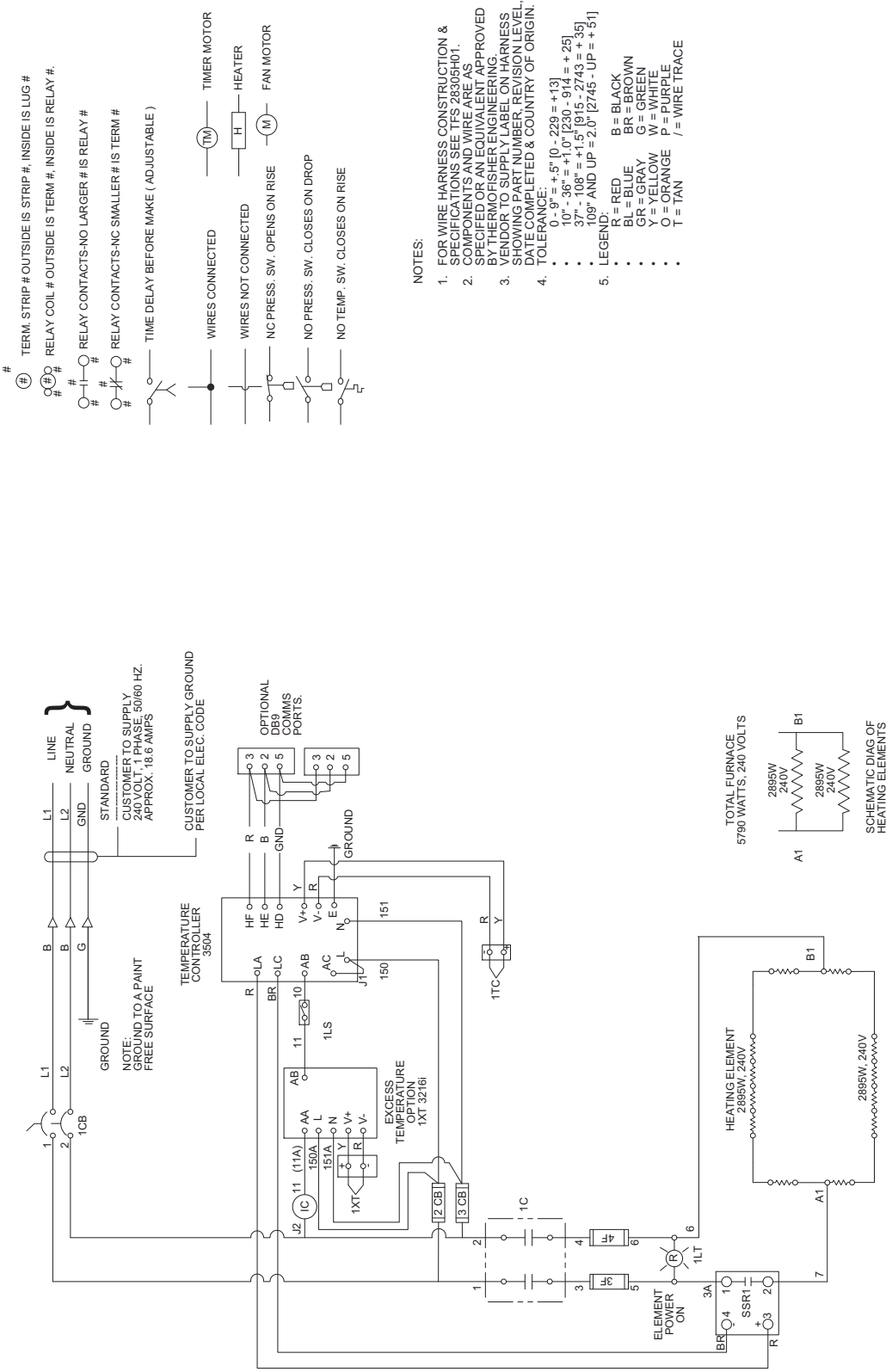


Figure 13-2. Wiring Diagram

WEEE Compliance

Great Britain

This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2002/96EC. It is marked with the following symbol. Thermo Scientific has contracted with one or more recycling disposed companies in each EU Member State, and this product should be disposed of or recycled through them. Further information on Thermo Scientific's compliance with these Directives, the recyclers in your country, and information on Thermo Scientific products which may assist the detection of substances subject to the RoHS Directive are available at www.thermo.com/WEEERoHS

Deutschland

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Italia

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Device Log

Laboratory Box Furnaces		Part number:	
Serial number:		Service number:	
Location		Operator's note:	

Work carried out	Notes	Date	Signed:

Contact

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