a nudyne company

Package Unfired Steam Generator
PSB-Series
Steam-to-Steam

Operating and Maintenance Manual

Designed and Manufactured in Accordance with ASME Code Section VIII Div. I

ASME U

Dec 2025

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Operating and Installation Instructions

Congratulations on your purchase of a new Ace, Packaged Unfired Steam Boiler. In this book, we have included installation and maintenance instructions that, if followed, will provide you with many years of service from your new unit. Also included are instruction manuals for each of the controls furnished with the generator. Please read them carefully. They should be helpful in both the installation and service of this unit. Keep these instructions with the unit for future reference.

The Ace unfired steam boiler is of rugged construction, yet of simple design. The generator uses steam from a boiler to produce process, clean, or pure steam, whichever the unit is designed for.
The unfired steam boiler construction and design provides a high quality, low maintenance and an extremely cost effective steam generating system.

The heat exchanger tubes are rolled and expanded into a tube sheet. Each unfired steam boiler is constructed and stamped in accordance with Section VIII Div-1 of the ASME Code, which is stamped on the nameplate with applicable markings.

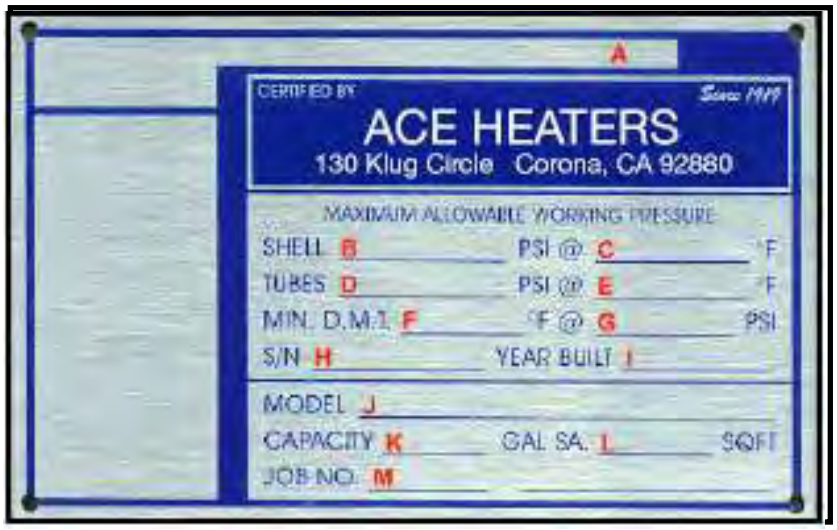
Experience in the field has proven that the Ace Unfired Steam Boiler, if properly applied and maintained, will give many years of efficient, dependable and economical service.

The Unfired Steam Boiler Nameplate And Model Number

The Unfired Steam Boiler Nameplate

The following illustration is an accurate depiction of the nameplate found on the boiler.

A. NB or serial number
B. Shell pressure
C. Shell temperature
D. Tube pressure
E. Tube temperature
F. Min. Atmospheric Pressure
G. Atmospheric temperature
H. Serial number
I. Year built
J. Model number
K. Capacity
L. Square feet
M. Job number



The Unfired Steam Boiler Model Number

PSB V 36 05 - B7 – S P 200

PSB = Packaged Unfired Steam Boiler
V = Type (H = Horizontal, V = Vertical, M = Mini-pack style)
36 = Tank Style or Mini-Pack Style Vessel Diameter
05 = Shell Length
B7 = Steam Quality (A6 = Pure Steam, B7 = Clean Steam, C5 = Process Steam)
S = Steam
P = Control Valve (A = Pneumatic – Warren, E = Electric, P = Pilot-operated – Spence)
200 = Control Valve size (200 = 2”, etc.)

Parts of the Packaged Unfired Steam Boiler

(See Attached Diagrams)

Diagram may vary from actual model

Receiving Your Packaged Unfired Steam Boiler

Check Equipment Received. Inspect the unit for any shipping damage. Make sure you have received all loose parts, such as listed on the "Bill of Lading". Larger strainers and valves, usually 2-1/2" and above, are shipped loose. Note any damages or shortages on the bill of lading prior to signing it. If the unit is received damaged or missing parts, it is your responsibility to notify the shipping company and file a freight claim. Ace Heaters, LLC cannot send replacement parts for freight damaged or missing equipment as warranty items. Permission to return goods must be received from the factory prior to shipping. Goods returned without a Returned Goods Authorization number will not be accepted. Purchased parts are subject to replacement only under the manufacturer's warranty. The warranty does not include the cost for labor, removal, or installation of the warranted part.

General Installation Instruction

NOTE: ***All electrical and piping installation should only be accomplished by qualified personnel following all applicable local, and state codes required for their installation.***

Code Requirements: It is very important that your installation comply with all federal, state and local codes as well as meet good industry practices as shown in publications issued by ASME, UL, ASHRAE, ABMA, etc.

Placement: The steam generator was either fabricated as a vertical or horizontal unit. It should be installed on a solid foundation, preferably a concrete pad. Provide adequate clearance for normal inspection and maintenance purposes and allow tube pull clearance to remove the exchanger for servicing. A minimum clearance of 24" is recommended from all accessories for ease of maintenance. Make sure the unit is level, from side to side and front to back, to assure proper operation and draining. Use metal shims if necessary.

Piping: All piping to and from the heater must be provided with adequate supports and expansion compensation so that pipe stresses are not transmitted to the unit. The relief valve should be piped to a safe drain.

Stud Nuts: During shipment, the bonnet and shell flange nuts may loosen and should be re-tightened before start-up. Tighten these nuts to the torques specified later in this manual. After the unit has been in operation for a few days, check and retighten. Note: Bolting is independent on the bonnet and shell-side flanges through the use of a threaded tube-sheet flange. Therefore, stud bolt nuts must be re-tightened on both sides. See Figure 1.1 for bolting arrangement.

Torque's: The following are recommended bolt torque requirements

Bolt Size	Min Torque	Max Torque
1/2"	45 ft-lbf.	60 ft-lbf.
5/8"	90 ft-lbf.	120 ft-lbf.
3/4"	150 ft-lbf.	200 ft-lbf.
7/8"	240 ft-lbf.	320 ft-lbf.
1"	368 ft-lbf.	490 ft-lbf.
1 1/8"	533 ft-lbf.	710 ft-lbf.
1 1/4"	750 ft-lbf.	1000 ft-lbf.
1 1/2"	1200 ft-lbf.	1600 ft-lbf.

Notes:

* Spray each stud bolt and nut generously with penetrating oil before re-torque.

** Gasket thickness before compression. All partition gaskets are ⅛" in width before compression. All gaskets expand twice their width after compression.

*** These are recommended torque values. Stud bolts must not be stressed above 60% of their yield strength.

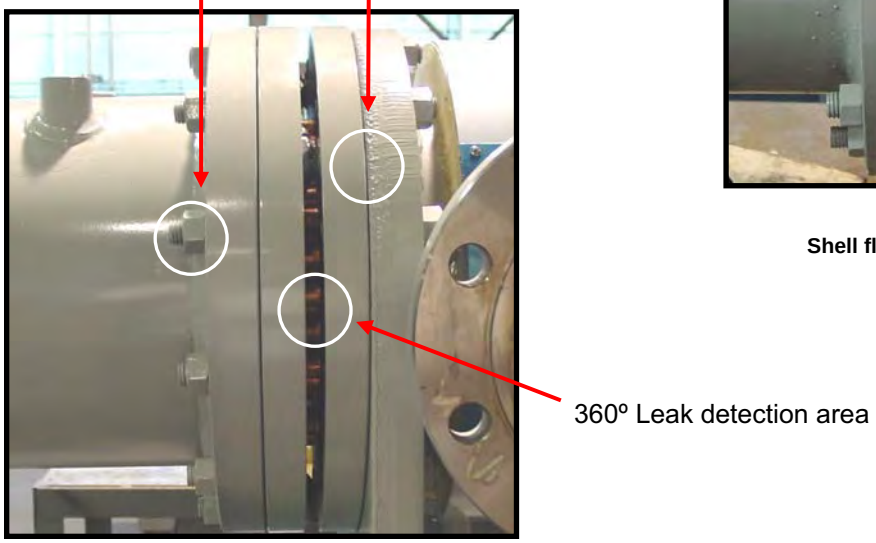


Figure 1.1
Shell flange to bonnet flange joint – SW Tube Bundle

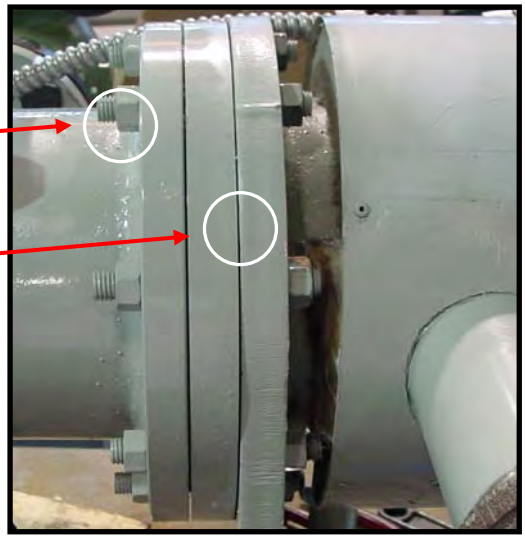


Figure 1.2
Shell flange to bonnet flange joint – DW Tube Bundle

Water Connections: Pipe make-up water line to water make-up solenoid assembly. Pipe surface and bottom blow-off connections to drain.

Steam Piping: Check the steam supply pressure. The steam supply pressure should not exceed design pressure stated on List of Materials, which include design parameters. Connect steam supply line to control valve strainer. Connect product steam outlet of generator to system steam header.

Condensate: The condensate outlet of the steam trap is to be connected to condensate return line.

Relief Valve: The relief valve discharge must be piped to a floor drain to eliminate the potential of scalding burns. The drain line must be the same size as the relief valve outlet and have a downward slope to insure proper drainage. The drain line termination should be visible to see discharge. The unit's operating pressure cannot exceed that listed on the relief valve nameplate.

Electrical: Verify the electrical supply using a voltmeter. The voltage tie-in leads are indicated on the wiring diagram. Electrical power supplied through remote mounted electrical disconnect, supplied by others. This unit contains sensitive control components and it is recommended that a suitable commercial grade surge protection device be installed. The unit must be installed in accordance with the National Electric Code and in accordance with all state and local codes.

Water Treatment: We, the manufacturer of your Packaged Unfired Steam Boiler, wish to call to your attention the necessity for a sound approach to proper water treatment. The unit uses boiler steam as its heating medium. On steam systems, boiler makeup water continuously introduces contaminants; scale forming solids, corrosive minerals and oxygen, which can cause corrosion or scale formation inside the tube bundle. Whenever appreciable amounts of raw makeup water are continuously added to your system, we recommend that the problem be brought to the attention of a qualified water consultant. Proper treatment will insure longer product life and reduced maintenance. Also, note that proper and adequate blow down of unit effects quality of produced steam.

Feed Water Treatment and Blow Down

Water treatment in the Unfired Steam Boiler is not as critical as in direct-fired boilers from the standpoint of generator failure. It must, however, be considered in every installation. Though water treatment frequently is unnecessary, it depends on the makeup water quality and its total solids content weighed against the percentage of makeup water added per pound of steam generated.

One situation that would require water treatment is the use of an unfired steam boiler for humidification only in a hard water region. Hard water is usually considered any water containing 200 ppm total hardness. It may have additional mineral and organic solid content, however, that may boost its total solids content beyond 250 ppm. In humidifier applications, there is 100 percent makeup to the unfired steam boiler. Every pound of water fed to the generator leaves its solids content concentrated in the generator boiler water. If the solids reach a concentration of 5,000 ppm or higher, moisture and solids maybe carried over with the steam, making it extremely difficult to control the humidifying equipment.

Often a suggested first treatment step is to soften the water. This converts insoluble calcium and magnesium salts to soluble salts. The soluble salts do not form hard scale on the tubes. They remain in solution in soft form to be discharged proportionately in the surface and bottom blow off.

One cautionary note, over-treatment can cause more harm than good. The treatment must be compatible with the tubing used in the steam generator. In addition, if the steam is to be used directly in food preparation or for sterilization and some water treatment is necessary, the water must be nontoxic.

It is possible for makeup water to be so hard and so high in total solids that complete demineralization would be the most economical approach. To determine the best type of treatment required for your system, call in a water treatment specialist.

Despite its value, water treatment alone is not sufficient. The key factor in effectively controlling solids concentration in the unfired steam boiler is a regular batch or continuous blow down from the generator shell. This should be combined with routine sample testing of the boiler water for total solids content. A formula for calculating rate of blow down follows:

Permissible Solids Concentration in Boiler Water

Operating pressure (psig)	Solids (ppm)
Zero to 5	2,500
5 to 10	2,000
10 to 25	1,500
25 and up	1,000

CAUTION: ***Prior to start-up, be certain that safety valve discharge and blow down valves are piped to a safe area to avoid possibility of injury to personnel or damage to property.***

Start-up Instruction

It is assumed that installation is complete and that all connections have been made, including: electrical, steam, water, instrument air, vents, drains and safety valve discharge lines.

1. **Make sure all adjustable settings are observed:**

   a) Steam control valve is to be set for the desired output. See pressure control manual within this booklet for fine-tuning. (Example: 15 psi)
   b) Steam Safety High Pressure Limit Switch (MERCOID) is to be set 10 psi above control valve set pressure. (Example: 25 psi)
   c) Pressure relief valves are factory set at 10 psi above high-pressure limit switch. (Example: 35 psi)

2. **Turn power on:** Turn on electrical system at manual Power-On switch on control panel. The On light (green), high-pressure light (red), feed water light (amber), and low water level light (red) should come on.

3. **Supply water to system:** The operator shall familiarize themselves with the valving and by-pass lines involved in the feed water lines. It will be observed that the feed water can be valved to by-pass the feed water valve by use of a three-valve by-pass around the feed water valve (not provided with unit). This is recommended for initial fill of tank.

   The valving in the feed water circuit shall be set to allow the passage of feed water through the feed water valve and into the shell of the steam generator. The Low Water (red) and Feed Water (amber) lights will be on.

   If feed water is now introduced to the unit, it will continue to fill the generator shell until the water level control de-energizes the feed water solenoid (on initial fill of tank operator will have to manually shut off by-pass). At this point, the gauge glass on the steam generator shell will indicate water at approximately the quarter point of the sight glass, the feed water low water alarm and light will be off. At the same time, open the top tri-cock (or isolation ball valve) to bleed the air out. Leave the tri-cock open until the feed water level starts to stabilize.

4. **Supplying plant steam to generator:**

   A. **For Warren Pneumatic:**

      1) Turn on the pneumatic system to the control making sure that 35 psi supply air is not exceeded.

      2) Slowly open the manual shut-off valve to the control valve that passes the heating steam. Open this valve slightly and wait for the metal parts to heat up, then allow the control valve to slightly open to allow the coil and exchanger head to get hot. This is to ensure that the valve body and seat are not shocked, and that all connections to the valve are proved tight.

      3) Then open the control valve completely; this will take about 15 to 30 seconds. You should notice the required steam pressure on the cap gauge. This pressure should not be higher than system design pressure noted in design parameters section.

      4) Fine-tune Pressure Controller. Refer to Manual within this booklet.

B. **For Spence P14 and P15 pilot:**

1) Adjust the pilot wheel to the down position (zero pressure on spring).

2) Slowly open the manual shut-off valve to the control valve that passes the heating steam. Open this valve slightly and wait for the metal parts to heat up. This is to ensure that the valve body and seat are not shocked, and that all connections to the valve are proved tight.

3) Slowly turn the Spence pilot adjustment wheel until steam enters tube bundle. Let stabilize for one (1) minute, or until steam is observed exiting the tri-cock on the float assembly. If no steam is observed, turn pilot adjustment wheel in one quarter (1/4) turn increments with one (1) minute pauses until steam is observed. Close tri-cock, and observe steam pressure on shell pressure gauge.

4) Continue adjusting pilot adjustment wheel with one (1) minute pauses until desired pressure output from generator is observed.

5) Fine tune pilot. Refer to Manual within this booklet.

5. **Open product steam valve on steam outlet of unit.**

6. **Test all safety controls to ensure they are operable.**

7. **The steam generator will now function automatically under designed load.**

Shut Down Instruction

1. **Close off plant steam to generator:**
2. **De-energize all electrical power sources to the steam generator**
3. **Close air line supplying instrument air to generator (if applicable)**
4. **Shut valve for product steam**
5. **Drain water out of unit:** Open drain valve on unit. Pull lever on relief valve and leave open until unit has drained and cooled. Also, drain water out of sight glass assembly.
6. **Allow unit to cool down: <u>Approximately 24 - 48 hours.</u>**

Emergency Safety Features

1. **Control valve system:** The steam control valve system is designed to fail closed in the event of a power failure.
2. **Relief valve:** The relief valve is designed to relieve the pressure in the vessel in the event the pressure gets too high.
3. **Level controls:** Shell water level controls will shut off the steam control valve in case of low feed water level in the shell. At the same time, the low level alarm(s) will be triggered (red light) (audible or remote alarm).
4. **Mercoid pressure switch:** This high-pressure limit switch will shut off the steam control valve activating the high-pressure (red light) alarm.

Disassembly Instructions

1. **Controls and instrumentation:** Refer to the individual "Maintenance Instructions" sections for these components.

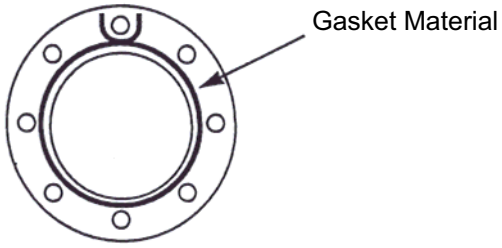
2. **Bundle removal:**
    1. Shut down unit. (See shut down instructions).
    2. Drain steam generator to sewer (after cool down period).
    3. Be certain plant steam is closed off completely.
    4. Disconnect flanged lines to tube bundle bonnet (stream inlet and condensate outlet).
    5. Remove nuts from the steam bonnet and shell nozzle.
    6. Steam bonnet can now be removed and tube bundle can be pulled out directly.

    Note: ***Tube bundle is supported inside the steam generator by a full length steel, or stainless steel, track. Care should be taken to remove bundle without damaging the tubes.***

Tube Bundle and Cap Installation

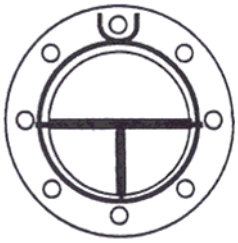
1. **Flange and tube sheet preparation:** Gasket surfaces must be clean and even.

2. **Apply gaskets:** Install gasket material on stationary flange with adhesive side down.
    1. Overlap material at top of flange.
    2. Overlapped ends should protrude out of flange, with one end on each side of top bolt.
    3. Make sure gasket does not extend into bore.



3. **Install heat exchanger bundle:** Bundle should be lifted or jacked to proper height before being pushed into gasket. Bundle should be left supported until installation is complete.

4. **Apply gasket material on channel cap:** Overlap gasket material around bolt hole as above. Apply gasket on divider sections as well. Overlap the divider gasket strips over the main gasket.

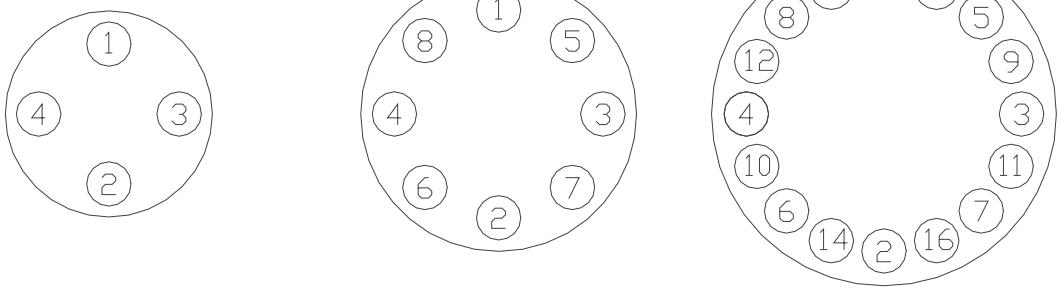


5. **Bolting cap and flange:** Place at least four (4) bolts thru stationary flange, double nut and thread thru tube sheet. Using jack or overhead support to lift cap into position, align with the bolts that are in place, level and slide cap against tube sheet. Remove second nut from tank side of bolt. Install nuts on bolts in place and tighten finger tight. Install remaining bolts and nuts, equal out bolts on tanks side and cap side, again tightening finger tight.

6. **Torque:** Unless otherwise specified, when using Goretex or spiral wound gaskets, use the following table to find recommended bolt tightening torque.

Bolt Size	Min Torque	Max Torque
5/8"	90 ft-lbf.	120 ft-lbf.
3/4"	150 ft-lbf.	200 ft-lbf.
7/8"	240 ft-lbf.	320 ft-lbf.
1"	368 ft-lbf.	490 ft-lbf.
1 1/8"	533 ft-lbf.	710 ft-lbf.
1 1/4"	750 ft-lbf.	1000 ft-lbf.
1 1/2"	1200 ft-lbf.	1600 ft-lbf.

7. **Torque bolts:** Set torque wrench to half of recommended torque rating. Tighten bolts according to alternating crossover pattern. Do not over tighten any one bolt initially as this could crimp the gasket. The sequence is to lightly tighten the first bolt then move directly across the circle for the second bolt. Continue as illustrated below. Tighten each bolt in increments repeating the cycle until half torque ratings are reached. Reset torque wrench to full torque rating, and repeat tightening sequence in increments until full torque ratings are reached. Remember, for the gaskets to work properly, the flange faces must be kept parallel and the bolts tightened uniformly.



Completion: When bolt-tightening sequence is complete, remove the support from the tube sheet and the channel cap.

Trouble-shooting Guide

a **Banging or pinging:**

1. Check for proper condensate drainage. Clean out all dirt and debris.
2. Check for backpressure in the condensate line.
3. Check steam trap(s) for proper operation.

b **Erratic temperature control:**

1. Check for condensate lift.
2. Check for proper steam pressure. Make sure it is not more than what the steam generator is designed for.
3. Check steam trap(s) for proper operation.
4. On pneumatic valves, check control pressure to the actuator. Make sure it is not fluctuating.
5. Check for debris in valve or strainer.
6. Sticking valve stem. This can be caused by a bent valve stem or a valve stem not properly lubricated. A sticking valve stem can also be caused by the packing gland assembly being too tight. Loosen the packing gland assembly and lubricate.
7. Regulator is controlling at incorrect set point.
8. The sensitivity screw or wheel on the controller needs adjustment.

c **Poor recovery:**

1. Shut unit down, remove bonnet and inspect coil for scale or fouling, restricting heat transfer. Clean with an approved chemical treatment.
2. Make sure the steam generator is not trying to supply more steam than it is designed for.
3. Check for fouling of steam pilot on pilot operated valves.
4. Check for proper air pressure to control valve on pneumatic valves.

d **Control Valve not closing:**

1. The valve seat is worn or there is debris in the seat.
2. The packing gland assembly is too tight, locking the valve stem.
3. The temperature adjusting nut assembly is raised too high.
4. Increase the valve spring tension.

Maintenance Instruction

KEEP TUBES CLEAN: In order to maintain high efficiency, the steam generator tubes should be cleaned periodically. The frequency of cleaning the tubes depends on the characteristics of the water and the type of installation. Contact your local water treatment company for evaluation and recommendations.
GASKETS: Tighten gaskets during start up and periodically thereafter. Leaky gaskets can cause corrosion of the stud bolts. It is good practice to use a new gasket each time the tube bundle or cap is removed.
STUDS: Keep studs protected from corrosion with paint or oil. Keep stud bolts tight to prevent leaky gaskets. Stud bolts will not corrode if they are kept dry and protected. Use caution in removing and reinstalling the bonnet. The steam generator must be shut down and drained before attempting removal. Before removing the nuts, apply penetrating oil and allow it to set for a few minutes. Forcing the nut off could cause breakage. Use a torch to heat the nut and it will come off easier. If a torch is not available, take a cold chisel, place it across the flat of the nut, and strike several sharp blows with a heavy hammer. This should loosen the nut. If necessary, it is better to split the nut open and replace it than to break the stud off.
CONTROLS: Under normal conditions, controls furnished with the steam generator require very little service. It is important, however, that the controls be protected from moisture. All controls should be checked frequently to make sure that they are working properly.
RELIEF VALVE: The steam generator is equipped with a lever type relief valve of "ASME" rated capacity. To maintain the valve in good working condition, it should be manually opened once a month. The relief valve outlet should be piped directly to an open drain and the drain checked frequently for discharge. If the relief valve is leaking or does not operate freely, it should be replaced.

Preventive Maintenance

Every 3 months:

1. Visually check for leaks from the valve body joints, piping, packing and stem areas.
2. Visually check for excessive corrosion on the regulator, bellows, capillary, bulb, bridge, and yoke.
3. Check for full valve travel. Less than full valve travel may indicate a leak in the bellows, capillary, or bulb.
4. Test the temperature adjusting nut assembly for freedom of movement.
5. Remove bulb from the steam generator and check for excessive corrosion or erosion.
6. Strainers should be inspected and cleaned. Damaged screens should be replaced.

Annual Maintenance

1. The relief valve must be tripped to insure proper operation as a safety device.
2. Pull the tube bundle and clean the inside and outside of the tube bundle of scale. The frequency of tube cleaning will be determined after inspection. (Heavy scale will indicate more frequent cleaning is necessary). A light sludge or scale coating on the tube greatly reduces its effectiveness. A marked increase in pressure drop and/or reduction in performance usually indicate cleaning is necessary. The tube bundle should be cleaned with a tube brush and/or a muriatic pool acid solution.

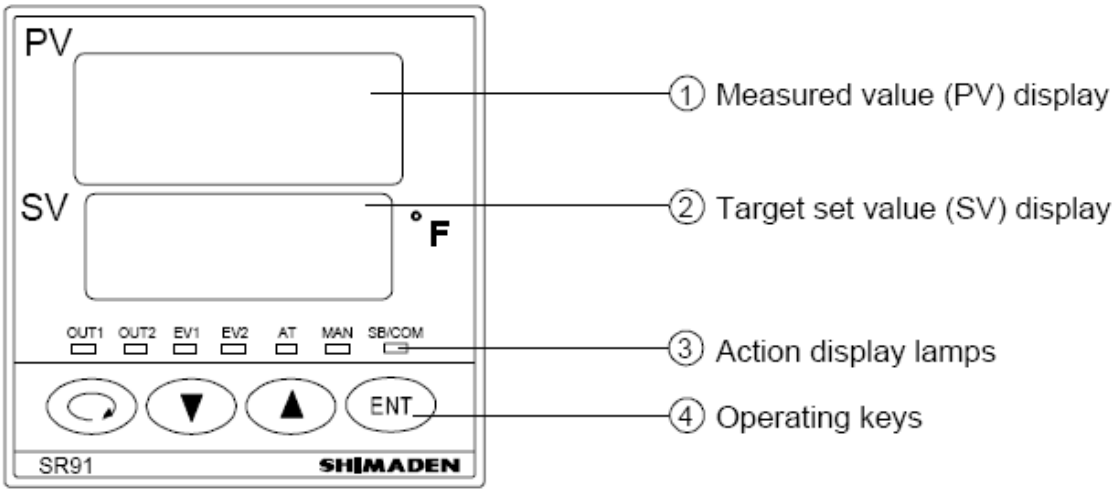
Replacement Parts

Ace Heaters maintains a complete equipment list for each Unfired Steam Boiler, filed by serial number. In order for us to give prompt service and to ensure that correct parts are supplied, please be sure and supply the model and serial number.

Material Safety Data Sheets

Some of Ace Heaters, LLC products contain materials that have been recognized as posing health risks. Material Safety Data Sheets for these materials are available from your local Manufacturer's rep. When requesting this information, be sure to have the model number and serial number available.
If you do not know who your local Manufacturer's Rep is, you can find out by logging into the www.aceheatingllc.com website, and clicking on the Representative tab found in the table of contents.

ACE Mini-Pack/SWH Digital Panel (Water)
ACE USB Digital Panel (Steam)



	Parameter key:	Used to get to the next parameter or different modes. Hold to scroll to the first screen.
	Arrow keys:	Used to change parameters.
	Enter key:	Used to set the parameter after it has been changed.

This instruction should be used with

ACE Mini-Pack/SWH Digital Panel (Water)
SHIMADEN Controller Model **SR93-8I-N-90-1400** (AJAX P/N: **CASR931400**)

Or

ACE USB Digital Panel (Steam)
SHIMADEN Controller Model **SR93-4I-N-90-1400** (AJAX P/N: **CASR96140**)

Entering Setup Mode

1) When the power is applied to the unit, display will show temperature or pressure on the PV screen. If not check wiring.
2) Hold the key for **3** seconds to get to the **Setup Mode**.
3) Press the key to go through the different parameters, and the and keys to change parameters and to save the change.

Programming in Setup Mode

4) In **Setup Mode**, change the following parameters below.
   *Start programming from **rAnG** parameter
   ** Indicates Steam Controller parameters

Upper Display	Lower Display	Description
PArA	Set	Setup Mode initial screen
LoCK	oFF	Key lock setting
P	10.0 (Water) 10.0 (Steam)	Output proportional band setting
I	60 (Water) 60 (Steam)	Output integral time
D	15 (Water) 50 (Steam)	Output derivative time
ñr	0.0	Output manual reset
SF	0.40	Output target value function
o_L	0.0	Output lower limit **Amuract Wiring Rev.D (Before 3/30/11) – 18.0
o_H	100.00	Output high limit
StEV	oFF	Event at Standby
E1_ň	Hd	High deviation alarm
E1_d	5.0 (Water) **3.0 (Steam)	High alarm differential
E1_i	1	High alarm event standby action
E2_ ň	Ld	Low deviation alarm
E2_d	0.1	Low alarm differential
E2_i	1	Low alarm event standby action
Ao_ñ	PV	Analog Output Type
Ao_L	40.0 (Water) **0.0 (Steam)	Analog Output Low Limit
Ao_H	200.0 (Water) **150.0 (Steam)	Analog Output High Limit
Act	rA	Reverse acting control
SoFt	oFF	Soft start time
SV_L	40.0 (Water) **0.0 (Steam)	Setpoint lower limit
SV_H	180.0 (Water) **Vessel – 8 (Steam)	Setpoint high limit
PV_b	0	Outlet temperature/pressure bias value

PV_F	0	Outlet temperature/pressure filter time
*** rAnG**	**34 (Water)** ****92 (Steam)**	**Sensor and measuring range** *** Start Here***
Unit	F (Water Only)	Temperature unit
Sc_L	0.0	Input scale lower limit
Sc_H	400.0 (Water) **150.0 (Steam)	Input scale high limit
Scdp	0.0	Input decimal point position
Disp	Pb	Temperature/pressure display at standby

5) When **PArA** shown, press the key to review the programmed parameters for the second time to check all parameters are set correctly.
6) Scroll until **PArA** shown on the display again, hold down the key for 3 seconds to get to **Operation Mode**.
7) Use and key to change the **SV** (setpoint value) to within ± 2 F/PSI off the **PV** value. Press the key to save the new setpoint value.

Programming High and Low Deviation Alarm

8) Press the until **E1Hd** is shown. Using the and key to change the value to **20** (for water) or **6** (for steam)
and press the key to save the new High Deviation alarm value.
9) Press the until **E2Ld** is shown. Using the and key to change the value to **-10** and press the key to save the new Low Deviation alarm value.
Note: The High Temperature/Pressure Alarm is activated when **PV** is **E1Hd** above **SP** and Low Temperature/Pressure Alarm is activated when **PV** is I**E2Ld**I below SP.
10) Hold the key for 3 seconds to display **PV** (measured temperature/pressure) and **SV** (setpoint value).

Testing Manual Valve Control

11) Press the key once to get to valve position screen.
12) Hold down the key until the **MAN** light starts to flash.
13) Change the parameter to **99.9** using the and key. Check to see that valve opens fully. (Valve should be at 90°)
14) Change the parameter to **50** using the and key. Check to see that valve opens to half way. (Valve should be at 45°)
15) Hold down key until **MAN** light stops flashing.

Testing Operating Control (Water Only)

16) Change the **SV** (setpoint value) so that it is 20° below the **PV** (measured temperature). High Temperature Alarm will activate (dump valve if included) and light will come on.
17) Check to see that valve closes fully.
18) Deactivate High Temperature Alarm by raising the setpoint value to 10° above the **PV** (measured temperature).

Testing Operating Control (Steam Only)

19) Remove Pressure Transducer and apply 15 PSI pressure.
20) Change the **SV** (setpoint value) so that it is 7 PSI below the **PV** (measured Pressure). High Pressure Alarm will activate and light will come on.
21) Check to see that valve closes fully.
22) Deactivate High Pressure Alarm by raising the setpoint value to 5 PSI above the **PV** (measured pressure)

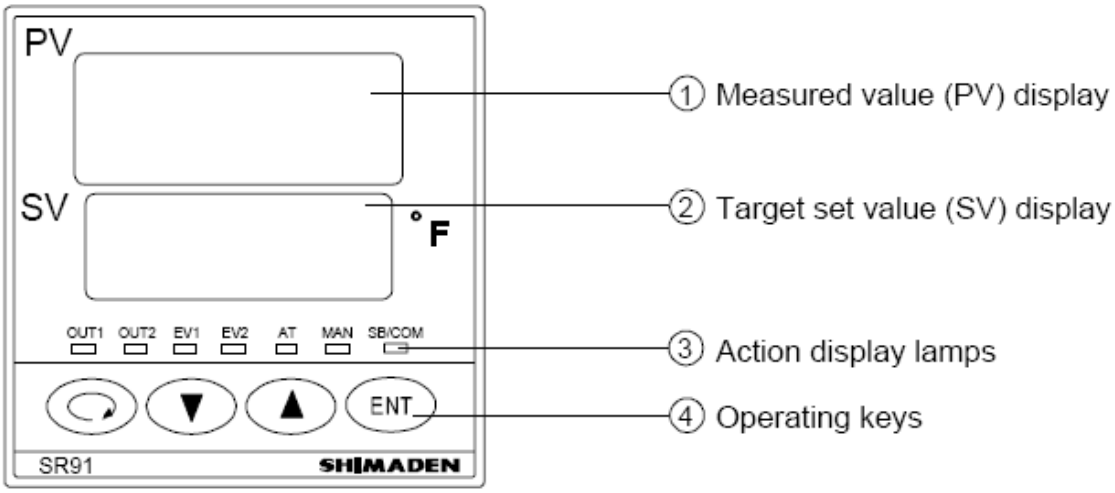
Change Setpoint

23) Change the **SV** (setpoint value) 120 F for Water and 10 PSI for Steam.

Enable Key Lock

24) Hold down key until you get see the Setpoint and Process Variable.
25) Hold down the key for 3 seconds to get to the **Setup Mode**.
26) Press the key until you see **LoCK** on the PV screen.
27) Change this parameter to **2** and press the ENT key to save the new parameter.
28) Hold down the key until you PV display shows **PArA**.
29) Hold down the key for **3** seconds to get back to the **Operation Mode**.
30) Fill out the **Safety System Test Check Sheet**.

ACE Mini-Pack/SWH BMS Panel (Water)
ACE USB BMS Panel (Steam)



	Parameter key:	Used to get to the next parameter or different modes. Hold to scroll to the first screen.
	Arrow keys:	Used to change parameters.
	Enter key:	Used to set the parameter after it has been changed.

This instruction should be used with

ACE Mini-Pack/SWH BMS Panel (Water)
SHIMADEN Controller Model **SR93-8I-N-90-1050** (AJAX P/N: **CASR931050**)

Or

ACE USB BMS Panel (Steam)
SHIMADEN Controller Model **SR93-4I-N-90-1050** (AJAX P/N: **CASR931050A**)

Entering Setup Mode

1) When the power is applied to the unit, display will show temperature or pressure on the PV screen. If not check wiring.
2) Hold the key for **3** seconds to get to the **Setup Mode**.
3) Press the key to go through the different parameters, and the and keys to change parameters and to save the change.

Programming in Setup Mode

4) In **Setup Mode**, change the following parameters below.
   *Start programming from **rAnG** parameter
   ** Indicates Steam Controller parameters

Upper Display	Lower Display	Description
PArA	Set	Setup Mode initial screen
LoCK	oFF	Key lock setting
P	10.0 (Water) 10.0 (Steam)	Output proportional band setting
I	60 (Water) 60 (Steam)	Output integral time
D	15 (Water) 50 (Steam)	Output derivative time
ñr	0.0	Output manual reset
SF	0.40	Output target value function
o_L	0.0	Output lower limit **Amuract Wiring Rev.D (Before 3/30/11) – 18.0
o_H	100.00	Output high limit
StEV	oFF	Event at Standby
E1_ň	Hd	High deviation alarm
E1_d	5.0 (Water) **3.0 (Steam)	High alarm differential
E1_i	1	High alarm event standby action
E2_ ň	Ld	Low deviation alarm
E2_d	0.1	Low alarm differential
E2_i	1	Low alarm event standby action
coññ	Loc	Communication mode
Prot	rtu	Communication protocol
Addr	1	Communication address
dAtA	8n1	Communication data format
SchA	Stx	Start character
bcc	1	BCC operation type
bPS	9600	Communication speed
dELY	20	Communication delay time
ñEñ	EEP	Communication memory mode
Act	rA	Reverse acting control
SoFt	oFF	Soft start time

SV_L	40.0 (Water) **0.0 (Steam)	Setpoint lower limit
SV_H	180.0 (Water) **Vessel – 8 (Steam)	Setpoint high limit
PV_b	0	Outlet temperature/pressure bias value
PV_F	0	Outlet temperature/pressure filter time
*** rAnG**	**34 (Water) **92 (Steam)**	**Sensor and measuring range * Start Here***
Unit	F (Water Only)	Temperature unit
Sc_L	0.0	Input scale lower limit
Sc_H	400.0 (Water) **150.0 (Steam)	Input scale high limit
Scdp	0.0	Input decimal point position
Disp	Pb	Temperature/pressure display at standby

5) When **PArA** shown, press the key to review the programmed parameters for the second time to check all parameters are set correctly.
6) Scroll until **PArA** shown on the display again, hold down the key for 3 seconds to get to **Operation Mode**.
7) Use and key to change the **SV** (setpoint value) to within ± 2 F/PSI off the **PV** value. Press the key to save the new setpoint value.

Programming High and Low Deviation Alarm

8) Press the until **E1Hd** is shown. Using the and key to change the value to **20** (for water) or **6** (for steam)
and press the key to save the new High Deviation alarm value.
9) Press the until **E2Ld** is shown. Using the and key to change the value to **-10** and press the key to save the new Low Deviation alarm value.
Note: The High Temperature/Pressure Alarm is activated when **PV** is **E1Hd** above **SP** and Low Temperature/Pressure Alarm is activated when **PV** is I**E2Ld**I below SP.
10) Hold the key for 3 seconds to display **PV** (measured temperature/pressure) and **SV** (setpoint value).

Testing Manual Valve Control

11) Press the key once to get to valve position screen.
12) Hold down the key until the **MAN** light starts to flash.
13) Change the parameter to **99.9** using the and key. Check to see that valve opens fully. (Valve should be at 90°)
14) Change the parameter to **50** using the and key. Check to see that valve opens to half way. (Valve should be at 45°)
15) Hold down key until **MAN** light stops flashing.

Testing Operating Control (Water Only)

16) Change the **SV** (setpoint value) so that it is 20° below the **PV** (measured temperature). High Temperature Alarm will activate (dump valve if included) and light will come on.
17) Check to see that valve closes fully.

18) Deactivate High Temperature Alarm by raising the setpoint value to 5° above the **PV** (measured temperature).

Testing Operating Control (Steam Only)

19) Remove Pressure Transducer and apply 15 PSI pressure.
20) Change the **SV** (setpoint value) so that it is 7 PSI below the **PV** (measured Pressure). High Pressure Alarm will activate and light will come on.
21) Check to see that valve closes fully.
22) Deactivate High Pressure Alarm by raising the setpoint value to 5 PSI above the **PV** (measured pressure)

Change Setpoint

23) Change the **SV** (setpoint value) 120 F for Water and 10 PSI for Steam.

Enable Key Lock

24) Hold down key until you get see the Setpoint and Process Variable.
25) Hold down the key for 3 seconds to get to the **Setup Mode**.
26) Press the key until you see **LoCK** on the PV screen.
27) Change this parameter to **2** and press the ENT key to save the new parameter.
28) Hold down the key until you PV display shows **PArA**.
29) Hold down the key for **3** seconds to get back to the **Operation Mode**.
30) Fill out the **Safety System Test Check Sheet**.

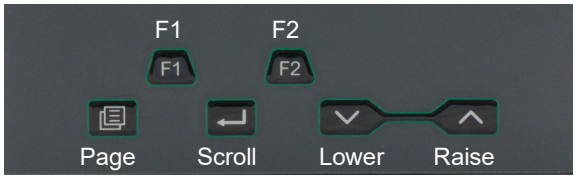
EPC3004

The start up display depends on the controller configuration and is described in subsequent sections.

General Description of Operator Buttons

On EPC3016 only the 4 navigation buttons (Page, Scroll, Down, Up) are available.
On EPC3008 and EPC3004 all 6 buttons (4 navigation and 2 function) are available.

Button Layout



Button Operation

Raise

The raise button increments parameter values to limits.

Parameter enumerations, however, do wrap-around.

Lower

The lower button decrements parameter values to limits.

Parameter enumerations, however, do wrap-around.

Page

In Operator levels 1 or 2 the Page button will select between the Home display or the Programmer Edit and Run lists (if one of the programmer features is enabled).

In Levels 3 or Config the Page button will scroll through list headers (no auto-repeat). If the Page button is pressed within a list, the display reverts to the top of the list. The top of the list shows the list header only with no initial parameters.

Page (held for >3 seconds)

The Goto parameter is selected directly. This operation can be performed from any display. If the Page is held for >3 seconds at power-up the Quick Start Mode is selected following the entry of a password.

Page+Raise

Scroll back the list headers (with auto-repeat).

Scroll

Select parameters in turn, returning to the first parameter in the list or to a list header if Level 3 or Configuration level is selected. If the button is held down the list will auto-repeat. In levels 1 and 2 this button also scrolls through promoted parameters when the HOME screen is selected.

Scroll+Raise

Scroll back through parameters from bottom to top (with auto-repeat).

Page+Scroll - all variants

Jump directly to the "HOME page". The current operating level remains unchanged. If the HOME page is already selected, these buttons will perform the custom function as detailed in "Functionality of the F1 and F2 and Page + Scroll buttons" on page 196. The default is Alarm Acknowledge.

Raise+Lower (Run/Hold)

If a programmer option is enabled and a program is configured, a momentary press of these keys toggles between Run and Hold modes.

Raise+Lower (hold for >3 seconds - Mode)

If a programmer option is enabled and a configured program is running, holding these buttons will abort the program.

If the HOME page is selected and the Programmer is not running, holding these buttons will invoke the 'Mode' display where the Loop Mode parameter will allow selection of Auto or Manual mode.

F1 and F2

F1 and F2 buttons are not available in EPC3016.

The functionality of these buttons is set by the Instrument function block. The default settings are:

- F1: Auto/Man.
- F2: Run/Hold.

Note: A time-out applies to all displays. If no button presses are detected within a timeout period (default 60s), the display will revert back to the Level 1 "HOME page".

Start Up—New Unconfigured Controller

If the controller is new and ordered as unconfigured it will start up in 'Quick Start Mode'. This is a built in tool which is provided to allow users to configure the product for the most commonly used functions such as the application type, input type, range, and digital input functions. The Quick Configuration code consists of two ‘SETS’ of five characters each. The upper section of the display shows the set selected, the lower section shows the five digits which make up the set. Each digit may result in multiple parameter values being set. The opening set is SET1 as shown.

Initially all characters are shown as an ⁜. This is generally the default character for ‘not fitted/none’ or ‘use default’. The first character, initially flashing, selects the Application Type as listed in the Quick Start Tables in the following sections. To select the required application type press or .

Note: Quick Code 1 will only be available if the correct hardware is fitted for the application. For example, the VPU application must have IO1 and IO2 as relay, triac or logic outputs.

Press to select the second character. The second character selects the ‘Input 1 Type’ as listed in the Quick Start Tables in the following sections. If hardware or features are not available then the character is skipped over when pressing scroll.

Continue to set up all 5 characters using the Quick Start Tables.

When the last character in SET1 has been entered the display will automatically go to SET2.

Adjust these in the same way as SET1.

At any time to return to the start of SET1, press .

⚠ WARNING

HAZARD OF INCORRECT CONFIGURATION

Incorrect configuration can result in damage to the process and/or personal injury and must be carried out by a competent person authorized to do so. It is the responsibility of the person commissioning the controller to ensure the configuration is correct.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

More detailed features available in the product may also be configured by entering a Configuration Level. This is explained in "Configuration Level" on page 95, or by using iTools as explained in "Configuration Using iTools" on page 212. iTools is a configuration package available free of charge from Eurotherm by accessing www.eurotherm.com.

Quick Start Tables

The first digit in SET 1 will select an application which automatically configures relevant function block parameters and creates connections between them to make a complete control strategy relevant to that application.

The *Configuration Using iTools* chapter has a section called "Applications" on page 228, which provides a general description of the available applications and their associated graphical wiring (as diagrams).

Further more, descriptions of each application are available in additional addendum's to this manual and are listed below:

- Application '1' - Heat only controller.
- Application '2' - Heat/Cool controller.
- Application 'V' - VPU Heat only controller - addendum part number HA033033 EPC3000 Temperature Control Applications.
- Application 'C' - carbon potential - addendum part number HA032987.
- Application 'D' - dew point control - addendum part number HA032994.

They are available from www.eurotherm.com.

Note: The controller must be fitted with the correct hardware otherwise the application code will not be selectable. For example, a VPU controller must have a digital output fitted in both IO1 and IO2.

The digits will present "X" when not fitted and the HMI will skip over that field. Similarly, entering a value of "X" in a field will disable that feature, if appropriate.

Quick Code Set 1

Digit 1	Digit 2	Digit 3	Digit 4	Digit 5
Application	**Analog Input 1 Type**	**Analog Input 1 Range**	**Analog Input 2 Type**	**Analog Input 2 Range**
X = None 1 = PID Heat Only Control 2 = PID Heat/Cool Control V = VPU Heat Only Control C = Carbon Potential Control* D = Dew Point Control*	X = Use Default **Thermocouple** B = Type B J = Type J K = Type K L = Type L N = Type N R = Type R S = Type S T = Type T **RTD** P = Pt100 W = Pt1000 **Linear** M = 0-80mV V = 0-10V 2 = 0-20mA 4 = 4-20mA	X = Use Default 1 = 0-100°C 2 = 0-200°C 3 = 0-400°C 4 = 0-600°C 5 = 0-800°C 6 = 0-1000°C 7 = 0-1200°C 8 = 0-1300°C 9 = 0-1600°C A = 0-1800°C F = Full range	X = Not fitted or Use Default **Thermocouple** B = Type B J = Type J K = Type K L = Type L N = Type N R = Type R S = Type S T = Type T **RTD** P = Pt100 W = Pt1000 **Linear** M = 0-80mV V = 0-10V 2 = 0-20mA 4 = 4-20mA Z = HiZ	X = Not fitted or Use Default 1 = 0-100°C 2 = 0-200°C 3 = 0-400°C 4 = 0-600°C 5 = 0-800°C 6 = 0-1000°C 7 = 0-1200°C 8 = 0-1300°C 9 = 0-1600°C A = 0-1800°C F = Full range

Notes:

1. If no application is selected (1st character in SET 1 = X) the display will go directly to the EXIT screen. If accepted the controller will take on a set of default values. Any further configuration may be carried out by accessing the Configuration Level ("Configuration Level" on page 95) or through iTools configuration software ("Configuration Using iTools" on page 212).

2. For linear inputs the minimum/maximum input voltage/current will cause the display to read range low/high respectively.
3. If the input 2 is not fitted Set 2 will be selected immediately after Input 1 Range has been set.

* Temperature, Carbon potential and dew point control are described as separate supplements to this manual and are available from www.eurotherm.com. Part numbers HA033033, HA032987 and HA032994 respectively.

Quick Code Set 2

Digit 1	Digit 2	Digit 3	Digit 4	Digit 5
CT Input Range	**LA Function**	**LB Function**	**Option DIO Function**	**Temperature Units**
X = Not fitted or not used 1 = 10A 2 = 25A 5 = 50A 6 = 100A 7 = 1000A	X = Not used W = Alarm Acknowledge M = Auto/Manual R = Program Run/Hold L = Key Lock P = Setpoint Select T = Program Reset U = Remote/Local Select V = Recipe Load Select K = Loop Track	X = Not fitted or not used W = Alarm Acknowledge M = Auto/Manual R = Program Run/Hold L = Key Lock P = Setpoint Select T = Program Reset U = Remote/Local Select V = Recipe Load Select K = Loop Track	X = Not fitted or not used 1 = Config 1 2 = Config 2 3 = Config 3 4 = Config 4 5 = Config 5 6 = Config 6 7 = Config 7 8 = Config 8 9 = Config 9	X = Use Default C = Celsius F = Fahrenheit K = Kelvin

Notes:

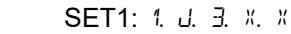
1. The Quick Code assumes that the CT input is monitoring the current of the heat channel load which in all applications is wired to IO1.PV.
2. If IO.1 module is a DC Output module then CT Input digit is not alterable.
3. If CT input is not set to X, the CT Input will be enabled and will monitor the current; however, CT alarms will not be configured. This means that if CT alarms are required they must be wired by the user. A typical example of wiring alarms is shown in section "Example 1: To Wire an Alarm" on page 224.

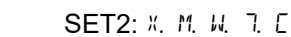
Quick Codes DIO

If the Options module has been fitted then the function of the module is defined by fixed configurations. These are selected by Digit 4 in the previous table. The fixed configurations are listed in the table below:

Config	Function	Config	Function	Config	Function
Config 1	DIO1 = Programmer Event Output 1 DIO2 = Programmer Event Output 2 DIO3 = Programmer Event Output 3 DIO4 = Programmer Event Output 4 DIO5 = Programmer Event Output 5 DIO6 = Programmer Event Output 6 DIO7 = Programmer Event Output 7 DIO8 = Programmer Event Output 8	Config 4	DIO1 = BCD Input 1 DIO2 = BCD Input 2 DIO3 = BCD Input 3 DIO4 = BCD Input 4 DIO5 = Programmer Run/Hold DIO6 = Programmer Reset DIO7 = Programmer Advance DIO8 = Not Used BCD Output wired to Program Number	Config 7	DIO1 = Programmer Run DIO2 = Programmer Hold DIO3 = Programmer Reset DIO4 = Programmer Advance DIO5 = Not Used DIO6 = Not Used DIO7 = Not Used DIO8 = Not Used
Config 2	DIO1 = Programmer Event Output 1 DIO2 = Programmer Event Output 2 DIO3 = Programmer Event Output 3 DIO4 = Programmer Event Output 4 DIO5 = BCD Input 1 DIO6 = BCD Input 2 DIO7 = BCD Input 3 DIO8 = Programmer Run/Hold BCD Output wired to Program Number	Config 5	DIO1 = BCD Input 1 DIO2 = BCD Input 2 DIO3 = BCD Input 3 DIO4 = BCD Input 4 DIO5 = BCD Input 5 DIO6 = BCD Input 6 DIO7 = BCD Input 7 DIO8 = BCD Input 8 BCD Output wired to Recipe Load	Config 8	DIO1 = Programmer Run DIO2 = Programmer Hold DIO3 = Programmer Reset DIO4 = Not Used DIO5 = Not Used DIO6 = Not Used DIO7 = Not Used DIO8 = Not Used
Config 3	DIO1 = Programmer Event Output 1 DIO2 = Programmer Event Output 2 DIO3 = Programmer Event Output 3 DIO4 = Programmer Event Output 4 DIO5 = Programmer Run DIO6 = Programmer Hold DIO7 = Programmer Reset DIO8 = Programmer Advance	Config 6	DIO1 = BCD Input 1 DIO2 = BCD Input 2 DIO3 = BCD Input 3 DIO4 = BCD Input 4 DIO5 = Not Used DIO6 = Not Used DIO7 = Not Used DIO8 = Not Used BCD Output wired to Recipe Load	Config 9	DIO1 = Programmer Event Output 1 DIO2 = Programmer Event Output 2 DIO3 = Programmer Event Output 3 DIO4 = Programmer Event Output 4 DIO5 = Not Used DIO6 = Not Used DIO7 = Not Used DIO8 = Not Used

Example of Quick Codes

SET1: 

SET2: 

The controller is configured for PID Heat Only, Input 1 Thermocouple Type J, Range 0–400℃, Input 2 and Range not used, CT Input not used, Digital Input LA will select Auto/Manual, Digital Input LB will select Global Acknowledge of Alarms, the optional digital IO will be configured in accordance with ‘Config 7 in the above table,Temperature Units Degrees Celsius.

To Save or Discard Quick Codes

When all characters have been entered the display will show:

If no is selected (by pressing ↵) the display returns to SET1.

Press ^ or v to select SAVE then either press ↵ to save immediately or wait for 2 seconds to save automatically. This accepts the Quick Configuration Codes and the controller enters Operator Level 1.

OR

Press ^ or v to select diSc then either press ↵ to select or wait for 2 seconds to accept. This discards the last entered codes and returns the controller to its previous settings.

Selecting either SAVE or diSc will result in the instrument performing a restart.

Configure the Communications Protocol

From firmware versions V3.01 and above, the communications protocol and associated selections may be chosen during the start-up sequence. This is to simplify access to Digital Communications when the instrument is being configured. When the controller is new and first switched on, or following a cold start, the following sequence is displayed at start up and after the Quick Codes have been saved:

Operation	Action	Display	Notes
Digital comms setup is selected		COmm SETUP	
Select the required serial protocol	1. Press ↵ to select the serial Protocol to be used for your process	NONE S. PROT	NONE - No serial comms mrtu - ModbusRTU EI bS - EI-Bisynch This list only appears for serial comms (EPC3004, EPC3008, EPC3016 with Serial Option board).
If Modbus or EI-Bisynch is selected	2. Press ↵ to select the node address	1 ADDR	
Select Ethernet protocol	3. Press ↵ to select Ethernet Protocol	NONE E. PROT	NONE = No Ethernet mtCP - ModbusTCP Slave only EI Pm - EtherNet/IP Slave and Modbus TCP Slave bACm - BACnet Slave and Modbus TCP Slave mmSt - Modbus TCP Master and Slave This list only appears if the Ethernet option module is installed and the features have been purchased.
Turn Auto discovery on or off	4. Press ↵ to select Auto Discovery	OFF A. DISC	See "AutoDiscovery" on page 320. OFF - No auto discovery On - Auto discovery enabled
Save and exit comms set up	5. Press ↵	no EXIT	no - Return to comms set up SAvE - Save the comms settings di Sc - Discard comms settings. The questions will be asked again at the next power up.

Note: In all cases the option is selected using ^ or v .

To Re-Enter Quick Code mode

It is possible to re-enter Quick Start mode, by holding down the Page key during power up. Enabling Comms Protocol does not appear when the quick code is re-entered.

It is then necessary to enter the configuration level password. See "To Select Configuration Level" on page 97.

If the configuration of the instrument is subsequently modified by a change made via Configuration Mode this will be shown by the quick code digits being separated by the decimal place dot (indicating that the codes shown may not reflect the current configuration). If the codes are then accepted the instrument is re-configured to satisfy the code settings.

Notes:

1. If the config clip is connected the instrument may be powered from the USB port of the PC. In this case it is necessary to disconnect the config clip to re-enter Quick Start Mode. Alternatively, disconnect the power pins from the config clip. See "Using the Configuration Clip" on page 213.
2. If a Cold Start (See "Cold Start" on page 244) has been invoked the instrument will always start in Quick Code Mode without the need to enter the configuration password. Enabling Comms Protocol will then be displayed.

Start Up - New Configured Controller

If a product has been ordered using the Order Code it will already be configured. When new, ‘out of the box’, it will then power up in operating Level 1.

Also, if it has previously been configured, for example, using the Quick Codes then it will start up in Operating mode.

The start up display is dependent upon the application or the way in which the controller is configured, see ‘Start-up Modes’ in the following section.

The view shown above is generally referred to as the ‘HOME’ Display.

In EPC3008 and EPC3004 the HOME display normally consists of three lines. The upper line normally shows the Process Value "PV",

The center line normally shows the Working Setpoint "WSP" if the controller is working in its normal Auto Mode or the Output demand if it is in Manual Mode. (Auto/Manual control is explained in section "Auto/Manual Mode" on page 79.

The lower line shows a scrolling message providing a longer description of the selected parameter. It may also display a further parameter value if this has been set up in the instrument block, see "Display Functionality Sub-List (HmI)" on page 195.

Bar Graph

In EPC3008 and EPC3004 a bargraph may also be configured using iTools. The bargraph may be ‘soft’ wired to any convenient source such as PV input or output demand, see "Example 4: To Configure a Bargraph" on page 225.

EPC3016 has two lines of display. The line below the top one alternates between a mnemonic and the scrolling message. A bargraph is not available.

Setpoint

The Setpoint is defined as the value which the process is required to attain. The value of the setpoint may be obtained from a number of sources, for example, manually using the front panel keys, via the programmer function block, via an external analog source, via digital communications. The working setpoint is, therefore, defined as the current setpoint derived from any of these sources.

Subsequent Start-ups

When the controller is no longer new and has been in normal use it will start up in Level 1, even when it has been powered down in Operator level 2 or 3. If, however, it was powered down when in Configuration level it will power up in ‘Standby’ and show a message - ‘POWERED DOWN WHILST IN CONFIG MODE’. To clear the message re-enter configuration level (with password - see "To Select Configuration Level" on page 97), then, either continue with changes to the configuration or accept existing changes by exiting configuration level. The reason for this is that the controller may have been part configured prior to shut down and either needs completion of the configuration or confirmation that no further changes are required.

Start-up Modes

The controller may start in Manual or in Auto Mode depending on the setting of the ‘Recovery Mode’ parameter, see section "Configuration Sub-List" on page 119.

If the Recovery Mode has been set to Manual (default) the controller will start in ‘Man’ mode. It will show the letter ‘M’ and the ‘hand’ symbol in the display. Initially the output will be at the ‘Fallback Value’, see section "OP Sub-list" on page 131, but may then be changed using the raise or lower buttons. Auto mode may also be selected.

If the Recovery Mode has been set to ‘Last’ the controller will start in either in Manual mode or Auto mode depending on whatever mode it was in prior to being powered off. ‘Auto’ mode is shown in the EPC3004 controller view in the previous section.

For further information on start up modes see section "Start-up and Recovery" on page 302.

Standby

Standby is the term given when the instrument strategy is not controlling due to the following reasons:

- If the instrument is being configured i.e. in Quick Code Mode, Configuration Mode or a clone file is being loaded.
- If the instrument has detected an unexpected condition (for example, was powered down whilst in configuration mode, or fitted hardware does not match expected hardware). See "Start up Diagnostic mode" on page 62 for more information on unexpected conditions that will place the instrument into standby.
- If the instrument is forced into standby via the Instrument.Diagnostics.ForceStandby parameter, see "Subsequent Start-ups" on page 75.

When the instrument is in standby, the following occurs:

- All relay, logic or triac outputs are placed into their 'Off' state, unless being used as Valve Raise (Up) / Lower (Down). In this case the Standby Action is configurable by the ‘StandbyAction’ parameter (Rest, Up, Down) found in the ‘IO’ list, (section "I/O List (io)" on page 107).
- Analog outputs will go to the ‘OutputLow’ limit found in the ‘IO’ list.
- The control loop will be placed into Hold.
- If an alarm has the ‘StandbyInhibit’ parameter set to ‘On’ (section "Alarms List (ALm)" on page 141), then the alarm is inhibited (active alarms will be turned Off and new alarm conditions will not be acted upon).
- If in standby due to the instrument being configured, a running program will reset.

⚠ WARNING

LOSS OF COMMUNICATIONS

If an output is not internally wired by the application, but is written to by communications, ensure that the appropriate action is taken in the event that communications is lost.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Auto-scaling of decimal point

The range of values displayed on the ‘top line’ will vary for each instrument version. If a value exceeds the display capabilities, the resolution will automatically be reduced by a factor of 10, up to the display limit in the table below. If the value cannot be displayed, HHHH or LLLL will be shown.

Auto-scaling is applied to parameter values being edited via the HMI.

Instrument	Decimal points	Minimum	Maximum
EPC3016	0	−1999	9999
	1	−199.9	999.9
	2	−19.99	99.99
	3	−1.999	9.999
EPC3008	0	−1999	19999
	1	−199.9	1999.9
	2	−19.99	199.99
	3	−1.999	19.999
EPC3004	0	−19999	99999
	1	−1999.9	9999.9
	2	−199.99	999.99
	3	−19.999	99.999
	4	−1.9999	9.9999

Operator Levels

What is in this Chapter?

This chapter describes the different operator levels:

- Operator Level 1.
- Operator Level 2.
- Introduction to Operator Level 3.
- Return from a higher level to a lower level of operation.

Overview

There are 5 levels of operation:-

1. LEu 1 - Level 1 has no password, the control is active and only the home list is accessible.
2. LEu2 - Level 2. The control is active and an extended home list is accessible.
3. LEu3 - Level 3. The control is active and the complete operator parameter set is shown and modifiable; the complete Configuration parameter set is shown, (read only); the user calibration (two point cal) facility is available.
4. ConF - Configuration level is used to setup the whole controller; the configuration parameters are accessible; the operator parameters are available, without the need to switch to operator mode. The instrument calibration parameters are also available in this mode. See "User Calibration" on page 369.

Levels 2, 3 and Configuration can be restricted by passwords.

5. In addition the Quick Start Mode (See "Start Up—New Unconfigured Controller" on page 67) is provided to allow users to configure the product in the minimum number of operations. It is only available at power up after the instrument is cold started or by holding the Page key during power up.

Operator Level 1

Operator Level 1 is entered:

1. After the Quick Code has been entered for those controllers supplied unconfigured.
2. After power up when the controller has been configured.

The display shown below is for a typical temperature controller.

Process Value (PV)

Manual output level (%) or Setpoint (SP) (Required Temperature)

Scrolling messages (when applicable)

Bargraph (not EPC3016)

Press ^ to increase the setpoint

Press v to decrease the setpoint

The new setpoint is entered when the button is released and is indicated by a brief flash of the SP value

In general the current value of the process is shown in the upper display.

By default the controller will start in' Manual' Mode. This is shown by 'M' in the display, the 'Hand' symbol, the value of the output (in %) and the bargraph (if available).

In 'Auto' mode, the required value (Setpoint) is shown in the lower display.

Additional scrolling messages are shown, for example, when operator parameters are selected (see section "Level 1 Operator Parameters" on page 81). These may be standard descriptions of the parameter currently selected or they may be user specific messages which have been set up using iTools. (See "Parameter Promotion" on page 233).

Auto/Manual Mode

In Manual mode the value of the output is increased or decreased directly by the operator using the Up and Down buttons.

In Auto mode the process is adjusted automatically by the controller in response to differences between the setpoint and the actual measured value.

In Operator Level 1 the controller may be placed into manual operation as follows:

- By default in EPC3008 and EPC3004 controllers, Auto/Manual may be selected by the user by toggling the F1 button.
- By default in EPC3016 controller Auto/Manual may be selected by the user by pressing and holding the ^ and v buttons for longer than 3 seconds. This will show the A-M (Auto-manual select) parameter. Then press ^ or v to toggle between auto and manual.

Manual is indicated in the HMI by showing the ‘Hand’ symbol and the character ‘M’.

The current level of the output demand is shown as a percentage. This may be increased or decreased by pressing the or buttons respectively.

Note: Alternative ways to select Auto/Manual may be configured and will be explained in subsequent chapters of this manual.

System Messages

In addition to standard (or customized) scrolling messages, System Messages may be shown at any time. A list of these is shown in "Notification Messages" on page 378. The following two messages are typical and could appear at start up.

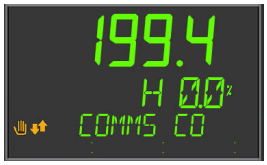
Setting the Comms Password

If the comms password has not been set and either Fixed comms or Option comms has been configured then this notification message will be scrolled across the HMI 'PLEASE SET THE COMMS PASSWORD VIA ITOOLS'. Until the comms password is set, Fixed comms and Option comms will have a limited parameter read/write access. This security feature is described in section "Comms Configuration Level Password" on page 21.

Comms Configuration Active

The scrolling message ‘COMMS CONFIGURATION ACTIVE’ will be displayed if, for example, iTools is connected to the controller and has been placed in configuration mode by iTools. The controller will be placed into standby mode.

The character ‘H’ signifies that the controller has been placed into Hold mode and is displayed as shown below.



Note: The displays shown above also apply if the controller is in Operator Levels 1, 2 or 3.

Bargraph

In EPC3008 and EPC3004 a bargraph may also be shown which displays the configured value as a horizontal bar. This is set up in Configuration Level (See "Display Functionality Sub-List (Hmi)" on page 195).

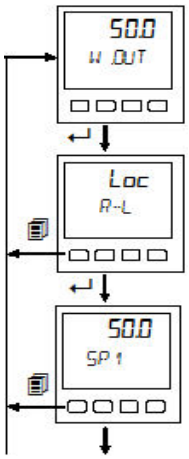
Level 1 Operator Parameters

A minimal list of parameters is available in Operator Level 1 which is designed for day to day use. Access to these parameters is not restricted by a password.

Press ↵ to step through the list of available parameters. The mnemonic of the parameter is shown in the lower display. Alternatively, press and hold ↵ then press ∧ to scroll forward through parameters and ∨ to scroll back.

Press ⧉ to return to the Home display.

The value of the parameter is shown in the upper display. If the value is read/write press ∧ or ∨ to adjust. If no key is pressed for 60 seconds the controller returns to the HOME display. The navigation is shown diagrammatically for the first two parameters in the example below:



The parameters that appear depend upon the functions configured. The list can also be customized using iTools by adding or removing parameters. The table below shows an example of the list of parameters in Level 1. Parameters may be added to or deleted from this list, see "Parameter Promotion" on page 233.

Parameter Mnemonic	Scrolling name	Description	Further information
W.OUT	WORKING OUTPUT	The output demand – 0% to 100% or −100% to +100%.	
R-L	REMOTE-LOCAL SELECT	Selects the Remote or Local setpoint source.	"Loop - Main Sub-list" on page 117.
SP 1	SETPOINT 1	The value which the process is required to attain as set by setpoint 1.	
SP2	SETPOINT 2	The value which the process is required to attain as set by setpoint 2 if selected.	
AI 1.PV	PV	The current value of the process (read only) read by the primary input IP1.	
AI2.PV	PV	The current value of the process (read only) read by the secondary input IP2.	If the secondary input is used.
LBA.I	CT LOAD CURRENT	The current being supplied to the heater as measured by the CT.	If the CT is being used.

Level 1 Programmer Display

By default, if the controller has the programmer installed, the status of a running program can be displayed.

Programmer List

Press the page button , the display will show 

Repeatedly press to read the currently running program.

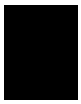
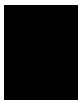
Parameters displayed depend on the program and the type of segment configured but generally include the following:

Parameter Mnemonic	Scrolling name	Description
P.NUM	PROGRAM NUMBER	Alterable but does not affect the running program.
P.NAME	PROGRAM NAME	Read only. This parameter is available in firmware versions V3.01 and above.
P.CUR	CURRENT PROGRAM	Read only.
C.NAME	CURRENT PROG NAME	Read only.This parameter is available in firmware versions V3.01 and above.
P.MODE	PROGRAM MODE	Displays the current mode e.g. Run, Hold, Reset.
P.SP	PROGRAM SETPOINT	Read only.
P.TIM.L	PROGRAM TIME LEFT	Read only.
P.CYC.L	PROGRAM CYCLES LEFT	Read only.
S.NUM	CURRENT SEGMENT NUMBER	Read only.
S.NAME	SEGMENT NAME	Read only.This parameter is available in firmware versions V3.01 and above.
S.TYPE	CURRENT SEGMENT TYPE	Read only.
S.TIM.L	SEGMENT TIME LEFT	Read only.
TSP	TARGET SETPOINT	Read only.
R.RATE	RAMP RATE	Read only.
EVT.x	EVENT x	Event off or on. Further events are shown if configured.
P.ADVN	PROGRAM ADVANCE	Read only.

By default the programmer parameters available in Level 1 are read only. It is possible, however, to provide programmer edit access to Level 1, see "Programmer List (PROG)" on page 135. If this has been done the lists of parameters is shown in section "Level 2 Programmer Display" on page 87.

Programmer Status Indicator

The current status of the running program is displayed as follows:

State	Ramp/Step Up		Dwell		Ramp/Step Down	
Reset						
Run						
Hold/Holdback		Flashing (1 second period 66% duty cycle)		Flashing (1 second period 66% duty cycle)		Flashing (1 second period 66% duty cycle)
Complete (Dwell End)	Not applicable			Flashing (2 seconds period 66% duty cycle)	Not applicable	

Operator Level 2

To Select Operator Level 2

Operator level 2 is normally restricted by a password. By default the password is 0002 in a new controller. Enter Level 2 as follows:

Operation	Action	Display	Notes
Select Level 2	1. Press and hold until GOTO is shown. 2. Press to choose LEu 2 (Level 2). 3. Press to enter.		
Enter the password	4. Press or to enter the correct digit value of the password. 5. Press to accept the value and move to the next digit. 6. The controller will now show the top of the HOME list in Level 2.		Press to move to the next digit. The default password for level 2 is '0002'. A special case exists if a security code has been configured as '0000'. If this has been done it is not necessary to enter a code and the controller will enter the chosen level immediately. If an incorrect code is entered the display will return to HOME. After three wrong attempts the password entry system will lock out for a time set by the 'password Lockout Time' set in the "Security Sub-List (SEC)" on page 197.
Select Level 2 parameters	7. Repeatedly press .		The list of available parameters is given in the table in the next section.

Level 2 Operator Parameters

Parameters available in level 1 are also available in level 2, but level 2 includes additional parameters for commissioning purposes and for more detailed operation.

Press ↵ to step through the list of available parameters. The mnemonic of the parameter is shown in the lower display. Press ⧉ to return to the previous parameter.

The value of the parameter is shown in the upper display. If the value is read/write press ∧ or ∨ to adjust. If no key is pressed for 60 seconds the controller returns to the top of the HOME list.

By default the following table lists all possible parameters available in both Levels 1 and 2. Parameters associated with a particular feature will only be shown if that feature is configured.

Parameter Mnemonic	Scrolling name	Description	Further information
W.OUT	WORKING OUTPUT	The output current demand – 0% to 100% or -100% to +100%.	Level 1 & 2
R-L	LOOP REMOTE/LOCAL	Selects the Remote or Local setpoint source.	Level 1 & 2
SP.HI	SETPOINT HIGH	Maximum value allowed for the local setpoints (SP1 and SP2).	
SP.LO	SETPOINT LOW	Minimum value allowed for the local setpoints (SP1 and SP2).	
SP 1	SETPOINT 1	The value which the process is required to attain as set by setpoint 1	Level 1 & 2
SP2	SETPOINT 2	The value which the process is required to attain as set by setpoint 2 if selected.	Level 1 & 2
SP.UP	SETPOINT RATE UP	Limits the maximum rate at which the working setpoint can change in an increasing (upwards) direction. Setpoint rate limiting is often used to prevent rapid bumps in controller output that may damage equipment or product, or cause upset to downstream processes.	
SP.DWN	SETPOINT RATE DOWN	Limits the maximum rate at which the working setpoint can change in an increasing (downwards) direction.	
AI 1.PV	PV	The current value of the process (read only) read by the primary input IP1.	Level 1 & 2
AI2.PV	PV	The current value of the process (read only) read by the secondary input IP2.	Level 1 & 2
TUNE	AUTOTUNE ENABLE	Starts an autotune.	"Autotuning" on page 309
PB.H	CH 1 PROPORTIONAL BAND	Channel 1 (heat) proportional band.	
PB.C	CH2 PROPORTIONAL BAND	Channel 2 (cool) proportional band.	
TI	INTEGRAL TIME	Integral time.	
TD	DERIVATIVE TIME	Derivative time.	
CBH	CUTBACK HIGH THRESHOLD	High cutback.	
CBL	CUTBACK LOW THRESHOLD	Low cutback.	

Parameter Mnemonic	Scrolling name	Description	Further information
MR	CONTROL MANUAL RESET	If the integral parameter is turned off the controller is working in proportional only or proportional + derivative. This parameter allows the output to be adjusted manually to offset and difference between SP and PV.	
HYS.H	CONTROL CH1 ON OFF HYSTERESIS	If channel 1 is configured for On/Off control this parameter allows a difference to be set between the output being on or off.	
HYS.C	CONTROL CH2 ON OFF HYSTERESIS	If channel 2 is configured for On/Off control this parameter allows a difference to be set between the output being on or off.	
C.DB	CONTROL CH2 DEADBAND	The Ch1/Ch2 Deadband is a gap in percent between output 1 going off and output 2 coming on and vice versa. For on/off control this is taken as a percentage of the hysteresis.	
OUT.HI	OUTPUT HIGH LIMIT	To limit the maximum controller output.	
OUT.LO	OUTPUT LOW LIMIT	To limit the minimum controller output.	
LD.I	CT LOAD CURRENT	This is the sampled RMS current measured during the on time of the heater.	Level 1 & 2
LK.I	CT LEAK CURRENT	The RMS current measured flowing through the load during the off states of the controller.	
LD.SP	CT LOAD THRESHOLD	Sets a threshold to trigger an alarm if the load current is exceeded.	
LK.SP	CT LEAK THRESHOLD	Sets a threshold to trigger an alarm if the leak current is exceeded.	
OC.SP	CT OVERCURRENT THRESHOLD	Sets a threshold to trigger an over current alarm if the current measured exceeds a maximum limit set by the process.	
CS.ID	CUSTOMER ID	A user configurable non-volatile identification parameter.	
REC.NO	DATASET TO LOAD	Selects which recipe dataset to load.	
STORE	DATASET TO SAVE	Selects which of the 5 recipe dataset in which to store the current active parameters.	

The home list can be customized by adding up to 60 parameters; iTools will be required to configure the promoted parameters, see "Parameter Promotion" on page 233.

Level 2 Programmer Display

If the controller has the programmer installed, by default, the programmer can be edited and operated from the HMI. A step by step guide to setting up a program is given in "To Setup a Program from the HMI" on page 268.

Programmer List

Press the page button , the display will show 

Repeatedly press to read the currently running program. The program can be Run, Held or Reset from this list.

Parameters displayed are (but not limited to depending on the program):

Parameter Mnemonic	Scrolling name	Description
P.NUM	PROGRAM NUMBER	Alterable, but does not run a program.
P.NAME	PROGRAM NAME	Read only.This parameter has been added in firmware versions V3.01 and above.
P.CUR	CURRENT PROGRAM	Read only.
C.NAME	CURRENT PROG NAME	Read only.This parameter has been added in firmware versions V3.01 and above.
P.MODE	PROGRAM MODE	The programmer can be changed to Run, Hold, Reset,
P.SP	PROGRAM SETPOINT	Read only.
P.TIM.L	PROGRAM TIME LEFT	Read only.
P.CYC.L	PROGRAM CYCLES LEFT	Read only.
S.NUM	CURRENT SEGMENT NUMBER	Read only.
S.NAME	SEGMENT NAME	Read only.This parameter has been added in firmware versions V3.01 and above.
S.TYPE	CURRENT SEGMENT TYPE	Read only.
S.TIM.L	SEGMENT TIME LEFT	Read only.
TSP	TARGET SETPOIN	Read only.
R.RATE	RAMP RATE	Read only.
EVT.X	EVENT X	Event off or on. Further events are shown if configured.
P.ADVN	PROGRAM ADVANCE	Alterable YES/NO. Advances the program to the next segment.

Program Setup List

By default programs can be set up in Level 2.

Press the page button , the display will show 

Repeatedly press to read the currently running program. Programs can be edited from this list.

Parameter Mnemonic	Scrolling name	Description
P.NUM	PROGRAM NUMBER	Alterable but does not run a program. If the program is running WORk is shown signifying the working program.
P.NAME	PROGRAM NAME	Read only.This parameter has been added in firmware versions V3.01 and above.
HB.STY	HOLDBACK STYLE	Alterable: PROG (holdback applies to the whole program). SEGm (holdback applies to each segment).
HB.TYP	HOLDBACK TYPE	Alterable: OFF, LOW, HIGH, bANd. For a full definition see "Holdback" on page 261.
RAMP.U	RAMP UNITS	Alterable: P.SEC (per second), P.mIN (per minute), P.HR (per hour).
DWEL.U	DWELL UNITS	Alterable: SECS, mINS, HrS.
P.CYC	PROGRAM CYCLES	Alterable: The number of time a program repeats. CONt (continuous) or 1 to 9999. **Default 1**
P.END	PROGRAM END TYPE	Alterable: Behavior when the program ends dWEL (dwell at current setpoint). RSEt (reset). tRAk (track).
S.NUM	CURRENT SEGMENT NUMBER	Alterable:
S.NAME	SEGMENT NAME	Read only.This parameter has been added in firmware versions V3.01 and above.
S.TYP	SEGMENT TYPE	RAtE, tImE, dWEL, Step, CALL, ENd.
TSP	TARGET SETPOINT	Alterable:
R.RATE	RAMP RATE	Alterable:
EV.OP	EVENT OUTPUT	Alterable:
DUR	DURATION	Alterable: Appears if the segment type is Dwell or Time.
R.TIME	TIME TO TARGET	Alterable: Appears if the segment type is Time.
C.PROG	CALL PROGRAM	Alterable: Appears if the segment type is Call.
C.CYC	CALL CYCLES	Alterable: Appears if the segment type is Call.

The above is a summary the parameters which are displayed (but not limited to) and depends on the program. A full description of the parameter meanings and how to set up programs is given in the following sections:

- Configuration chapter "Programmer List (PROG)" on page 135.
- Programmer chapter "Programmer" on page 257.

Operator Level 3

In Operator level 3 (and in Configuration Level) all parameters are organized in lists (or groups). Only parameters related to enabled functions are shown.

Each list may contain operator level and configuration parameters; the parameters are only shown when the instrument is in the appropriate mode. If a list does not contain at least one displayable parameter, it is skipped completely.

During navigation, the lower display shows the mnemonic code of the parameter or the List header. After 6 seconds, a scrolling string with either the parameter or the List description will be displayed.

To Enter Level 3

Operation	Action	Display	Notes
Select Level 3	1. Press and hold ⧉ until LEu 3 is shown. 2. Press ↵ to enter.	LUL3 GOTO	LEu 1 is displayed first. Continue to hold the button to obtain LEu3.
Enter the password	3. Press ∧ or ∨ to enter the correct digit value of the password. 4. Press ↵ to accept the value and move onto the next digit. 5. If the correct password has been entered the message PASS will be displayed momentarily. The controller is now operating in Level 3.	0___ CODE LEU3 PASS	Press ↵ to move to the next digit. The default password for level 3 is '0003'. A special case exists if a pass code has been configured as '0000'. If this has been done it is not necessary to enter a code and the controller will enter the chosen level immediately. If an incorrect code is entered the display will return to HOME. If an incorrect code is entered the display will return to HOME. After three wrong attempts the password entry system will lock out for a time set by the 'password Lockout Time' set in the "Security Sub-List (SEC)" on page 197.
Select list headers	6. Repeatedly press ⧉	A1 LIST	This shows the Analog Input List. Press ⧉ + ∧ to return to the previous list header.
Select parameters in the list	7. Repeatedly press ↵	tC IN. TYP	This shows the Input Type.

To return to the HOME page relevant to the controller mode press the 'Home' key combination (Page+Scroll).

The HOME display is also selected after a timeout period with no key presses. The timeout defaults to 60 seconds but can be adjusted between 0 and 60 seconds. A setting of 0 means no timeout (see "Display Functionality Sub-List (HmI)" on page 195), so that the HMI remains in the selected level.

Level 3 Operator Parameters

The Operator Level 3 lists are essentially the same as configuration level. These are shown in the next chapter.

To Return to a Lower Level

From Level 3 you can select Level 1 or Level 2 as follows:

1. Press and hold  until GOTO is displayed.
2. Press  or  to select LEu 1 (or LEu2).
3. Press  to accept.

The display will briefly show PASS and will return to the selected level default display.

A security code is not required when going from a higher level to a lower level.

Note: if the controller had been switched off whilst operating in levels 2 or 3 it will return to operator level 1 when switched on again. If it was switched off when in configuration level it will start up with a message - PCnF - POWERED DOWN WHILST IN CONFIG MODE. See section "Subsequent Start-ups" on page 75.

Eurotherm Complete Manual Refer to the following link

https://www.htsei.com/wp-content/uploads/2021/06/EPC3000-User-Guide.pdf

FACTORY LIMITED WARRANTY POLICY

The Ace Factory limited warranty provides assurance that all products are free from manufacteres defects at the time of shipment and meet specifications and performance described in the product literature.

It is important to understand the difference between a factory warranty and an installed warranty. There are many factors that can occur to the products after they are shipped that the company has no control over and can not fully verify. These includes:

1. Hidden damage during the shipping.
2. Handling damage.
3. Damage during storage.
4. Installation conditions.
5. Other unknown variables in the system design: maintenance, pulsation and vibrations.

The installed warranty is the responsibility of the architech, specifying engineer, contractor and/or owner who jointly have control over the application, installation, location, operating and maintenance conditions.

The Ace Heaters, LLC warranty excludes extended liabilities. Extended liability typically occurs when products are installed without proper drainage, flooding containment or when safety devices are not tested and repaired or replaced when needed.

Product problems are often caused by the condition of the water, the lack of water treatment and/or the improper treatment of the water, insufficient combustion air, improper draft conditions, bolts not re-tightened, pipes not flushed and cleaned of oil, metal chips, rags, vibration and pulsation etc. These are installation, operating and/or maintenance conditions that are beyond the seller's responsibility and are not covered by the factory warranty, but may be covered by the installer's warranty.

The factory warranty covering company products is based upon extensive product development and testing. Combustion products under go certification testing and approvals to Underwriters Laboratory (UL) standards. Auditing of the production of combustion products is conducted by a nationally recognized testing laboratory.

Pressure vessel products are designed and manufactured to American Society of Mechanical Engineering (ASME) and National Board (NB) Design standards. Design reviews, factory product manufacturing quality inspections and testing are carried out by a third party National Board authorized inspection agency.

Ace Heaters, LLC products have proven themselves in service for over 85 years which indicates that the company products perform exceedingly well when normal installation, operating and maintenance conditions exist.

The following is a review from the terms and conditions of sale. Also included in paragraph two, below, is the Ace Heaters LLC nonconformance policy.

1. Ace Heaters, LLC warrants its products against defective material and/or workmanship only. The warranty does not apply to operational failures, electrical failures, gasket leaks, and/or other malfunctions caused by improper application, installation and/or maintenance.

2. It is the buyer's responsibility to inspect and accept the product, when received, as conforming to their purchase order, specifications and approved drawings. All claims for non-conformance, errors, shortages, etc. must be made within 10 days after receipt of the shipment.

3. Ace Heaters, LLC do not provide a warranty or guarantee, express or implied, in any manner, form, usage of trade, merchantability or fitness which extend beyond the product description and quotation.

4. Ace Heaters, LLC liability is limited to the factory repair or replacement of warranty failures, or non-conformance, upon the return of the product to the factory.

5. Ace Heaters, LLC is not liable for any direct or consequential damages.

6. Ace Heaters, LLC warranty is based upon section 23161(2) of the uniform commercial code and is printed in the term s and conditions of sale which is referenced in every quotation, on the back of sales order acknowledgements and invoices. It is legally correct and is an industry standard policy.

Water Heater – Water Quality Requirements

Properly ensuring the water within the water heater is treated is essential for maintaining the water heaters performance over time and preserving the components connected to the system. It is advisable to manage any water treatment program under the guidance of a water treatment specialist.

Water heaters can suffer from scale buildup and chemically induced corrosion due to poor water quality. Among these problems, the most common is the formation of scale inside the unit, which predominantly occurs on the hottest surface; the u-tube bundle heat exchanger. The accumulation of scale in the unit can lead to a reduction in the water heater's capacity as it coats the heat exchanger surface.

Poor water quality can contribute to chemically induced corrosion of the heat exchanger or the vessel. Different forms of chemically induced corrosion may arise, including general corrosion, pitting corrosion, and stress corrosion. Such corrosion has the potential to significantly decrease the lifespan of the vessel or the tube bundle. General corrosion might manifest as a uniform deterioration of the tube, tubesheet, or vessel material, eventually causing material failure. Pitting corrosion involves the creation of small pits on the tubes, tubesheet, or shell, which can ultimately lead to material failure. Stress corrosion results in stress corrosion cracking. This refers to the development of brittle cracks along the metal's stress lines and grain boundaries. Stress corrosion cracking is more likely to affect materials like austenitic stainless steel, such as the grade 316L commonly used in the water heater's vessel, tubes, and tubesheet. This type of corrosion is associated with the presence of chlorides in the water. The likelihood of stress corrosion cracking increases with higher concentrations of chlorides and temperatures.

Under normal design and operating conditions, the water temperatures within a water heater usually remain below the threshold required for stress corrosion to occur.

Ace Heaters, LLC requires all water heaters to be operated within the following ranges to help control corrosion and scaling:

Water Property	Range
Alkalinity (CO_3, HCO_3)	Less than 300 ppm
Chlorides	Less than 100 ppm
Conductivity	Less than 1,500 ppm (3,000 uS/cm)
pH	6-8
Silica	Less than 150 ppm
Sulfates	Less than 250 ppm
Total Dissolved Solids	Less than 50 ppm
Total Hardnes (Ca and Mg)	Less than 150 ppm

WARRANTY

Limited

Ace Heaters, LLC provides a limited warranty on its products against **defective material and/or workmanship only**. This limited warranty is not applicable to operational failures, electrical failures, gasket leaks, wear or malfunctions caused by improper application, storage, installation, and/or maintenance.

Product Period - The following Limited Warranty period are from date of shipment:

Tanks

Tanks - Carbon Steel: One Year
Tanks - Stainless Steel: Three Years
Storage Water Heaters Single-wall or Double-wall Tank/Exchanger Coils: One Year
Clean Steam Generators: One Year
Linings: (Pro-rated Warranty)
Magnesium Anodes must be used at all times to maintain the Limit Warranty
Section VIII Tanks:
Epoxy: 30" dia. and above (Three years)
Glass: 24" dia. and under (One year).
Glass: 30" dia. and above (Five years).
Cement: (Five years).
Pre-Krete: (Ten years).
Section IV Tanks: SW Model Only
Glass (One year) & Epoxy (Three years).
Minipacks™ Single-wall or Double-wall: One Year
Shell & Tube Heat Exchangers Single-wall or Double-wall: One Year
Atlas™ Series Condensing Boiler (Heat Exchanger): One Year
Triton™ Series Near Condensing Boiler (Heat Exchanger): Twelve Years
Liberty™ Series Condensing Boiler (Heat Exchanger): Ten Years
B-Series Copper Fin Boiler: Three Years

Controls: Components manufactured by other than Ace Heaters, LLC such as controls, instruments, forced draft burner, etc., provided with the boilers and packaged products are not covered by the Ace Heaters, LLC Warranty. However, Ace Heaters, LLC extends to the customer the same warranty provided by the manufacturer to Ace Heaters, LLC. The customer shall receive the full benefits of adjustments made to Ace Heaters, LLC by the manufacturer.

Any claim for adjustment under this limited warranty must be made within the warranty period. Ace Heaters, LLC's liability shall be limited to factory repair or, at Ace Heaters, LLC's option, replacement of all parts which, upon test and examination by Ace Heaters, LLC, prove to be defective material and/or workmanship and within the above limited warranty. If required by Ace Heaters, LLC, parts which are claimed to be defective must be promptly delivered to the Ace Heaters, LLC facility, transportation charges prepaid. This warranty does not cover the cost of labor, removal, or installation of the warranted item during the limited period. This warranty is limited to the above and applies only for the period set forth. Ace Heaters, LLC will not be liable for any loss damage, direct, incidental or consequential damages of any kind, whether based upon warranty, contract, negligence or strict liability and arising in connection with the sale, use or repair of the products. Ace heaters's maximum liability shall exceed the contract price for the product's merchantability or fitness for any particular purpose and in no event shall be held responsible for any consequential damages.

For complete Limited Warranty conditions see Section G and H under terms and condition of sale.

Ace Heaters, LLC, also doing business as Ace Heaters, LLC, is referred to herein as Ace Heaters, LLC

Ace Heater, LLC
130 Klug Circle, Corona CA 92878
PHONE: (951) 738-2230 • FAX: (951) 281-4959
www.aceheaters.com

Ace Heaters, LLC

WARNING

PRODUCT SAFETY NOTICE

ACE BOILER AND WATER HEATER PRODUCTS OPERATE AT HIGH TEMPERATURE AND PRESSURES

- Before using this product, read and understand instructions. Save these instructions for future use.
- Before servicing, to prevent serious burns or injury, the boiler and water heater products must be cooled to less than 80°F (27°C) and the pressure must be 0 psi (0 bar).
- Turn off the electrical power before making electrical connections to prevent electrical shock.
- These products must be placed in a controlled location where untrained or unqualified personnel cannot access the operating or safety controls, must not be able to come in contact with high temperature or high pressure parts and must not perform maintenance or demolition work.
- All work performed must be by qualified properly equipped personnel trained in the proper application, installation, and maintenance or demolition of plumbing, steam, and electrical equipment and/or systems in accordance with all applicable codes and ordinances.
- ACE Boilers and Water Heaters are complete package units with safety and operating controls and are constructed with non ASBESTOS materials. Any replacement gaskets, refractory, insulation, etc used must not contain Asbestos.
- No additional insulation is required on the Boilers and Water Heaters.
- Additions or replacement of insulation on any connecting pipes or accessories to the Boilers and/or Water Heaters must be of "NON-ASBESTOS" and contain only non-hazardous materials.
- Crystalline Silica, a material known to cause cancer, may be encapsulated in some refractory or insulation materials and must be handled only by authorized trained personnel. Crystalline Silica as used is encapsulated and is not harm full in this form. Care must be taken during removal or replacement of refractory or insulation to remove it in bulk form and avoid generation or inhalation of dust. Removal must be properly performed by trained, qualified and equipped personnel. This is also true of Asbestos not contained in ACE products but may be otherwise contained in replacement materials or parts, in connecting piping or other nearby products.
- All safety and operating controls must be set within the specified operating limits and tested periodically to assure proper operation. All limit and operating controls must be installed in series on the boiler.
- Connect drain pipes to a safe drain to prevent serious personal injury from relief valve discharge and or from boiler blow down discharge.
- After installation, check for proper operation of all limit and operating controls before leaving the site.
- Perform scheduled and annual inspections including checking Controls for proper calibration and performance.

Failure to follow these warnings, to allow access by unauthorized persons and the use of non-properly trained and equipped personnel in the operation, service, modification, removal or demolition of these products or replacement of parts with non-authorized factory non-asbestos materials could cause damage, personal injury or death.

ACE
a nudyne company

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N O T I C E

This owners & operation manual provides warnings of risk of harm from improper installation, operation and/or maintenance of Ace Products. Ace Heaters, LLC used ordinary care and complied with UL and ASME Standards in the design and manufacture of Ace Products. Proper installation, operation and maintenance are covered in the manual supplied with the product. All equipment must comply with local codes.

W A R N I N G

THIS PRODUCT CONTAINS CRYSTALLINE SILICA, A CHEMICAL KNOWN TO CAUSE CANCER. CONTAINS NO ASBESTOS.

Ace Heaters, LLC
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SO # _____

Serial No. _____

Model No. _____

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