

Start-Up Procedure For Model EM-46, EM-810

Prior to starting the furnace, be sure to insert the control thermocouple into the furnace lid, through the thermocouple bracket assembly. (See picture below.)



Your new model EM-46 or EM-810 has been equipped with a 1/16th DIN, digital, microprocessor based, PID controller. This instrument is accurate to within +/- .1 % of span and will provide excellent control of your heat treat or melting process.

To operate your new furnace, turn on the toggle switch located on the front control panel. When the switch is tripped, you should see the indicator light come on. This means that the unit is powered. To enter a set-point, press either the up or down arrow keys to enter the desired set point. Once the set point is entered, the furnace will begin to heat up, no further adjustments will be necessary.

The control parameters of the instrument are entered into the memory here at MIFCO and then access is locked out to prevent changes to them. Should it become necessary to make changes, please consult the factory.

An operating manual from the instrument manufacturer is included with this operating manual. Please read it for further information on the instrument's capabilities.

SPEEDY MELT ELECTRIC FURNACE

MODEL EM-46, EM-810

Furnace Operation and Start Up:

Locate the crucible block in the center of the furnace chamber. Always use the correct size base block and never place the crucible on the floor of the furnace. Doing so causes a cold spot at the bottom of the crucible and retards melting. The block locates the crucible at the proper height for the hottest reflected heat. To prevent the crucible from sticking to the base block, apply fine graphite or silica flour to the top of the block, or wet a piece of cardboard and drop on the base block just before the crucible is set. If the furnace is cold, use the cardboard dry. The paper will char and form a parting layer between the block and the crucible.

Protection of Furnace Elements:

Proper care should be taken to insure long element life. The EM-46 and EM-810 heating elements are coated with refractory coating. This coating makes the elements more abrasion resistant plus it acts as an added protection from the corrosive properties inherent in fluxes used in the melt. Avoid over fluxing of the metals. Fluxes, and especially those containing acid, destroy the heating elements and the insulation that surrounds them. The elements are covered under warranty for workmanship only.

The use of flux in aluminum is usually not needed if the metal is clean to start with. After the initial charge of aluminum has melted, about 1/3 teaspoon of aluminum cover flux may be added to keep down oxidation. Aluminum scrap or ingot may be added at this time.

The melting of brass or bronze needs a cover flux, but again, it is best to add the flux in a small amount after the initial charge of metal has melted.

The following points should be kept in mind to protect the elements during operation of the furnace:

1. As a Safety Precaution, turn off the power to the elements when charging crucible or removing the crucible at the end of the melt.
2. Avoid contact with the chamber walls while inserting or removing the crucible. Scraping the chamber walls repeatedly will result in a loss of refractory coating and insulation which cover the electric element. This will eventually cause element breakage or electrical shock if the tongs come into contact with the bare elements.
3. Periodic inspection should be made of the elements to insure that the refractory coating is intact. If any areas are showing excessive wear, this refractory coating is available from MIFCO, for recoating or spot coating of the element walls.
4. Do not over-fill the crucible. Over-flow of either hot metal or flux directly onto the elements or heat chamber, even with the protective coating intact, will cause damage.

The Use and Care of Foundry Crucibles

Composition - Types of Material:

Crucibles are manufactured in two basic compositions: the CLAY GRAPHITE / CERAMIC BONDED, and the SILICON CARBIDE / CARBON BONDED types. Both types utilize the refractory materials, graphite and silicon, as conductors of heat and for structural strength. Graphite is predominant in the composition of the clay graphite crucible, while silicon carbide predominates in the silicon carbide crucible. Due to its higher heat conductivity and greater strength, the silicon carbide crucible is more popular in industry. The less expensive clay graphite crucible is generally used in the School shop. Crucible failure in School shops is generally due to mishandling by inexperienced students, so the benefits of the more expensive silicon carbide crucible often are not realized.

Either type crucible can be used for melting aluminum or brass. However, different metals should not be melted in the same crucible. This practice will cause contamination of each metal and it will be very difficult to get good castings. Different crucibles should be used for each type of metal melted. DO NOT USE JUST ANY SIZE CRUCIBLE IN YOUR FURNACE, USE THE SIZE FOR WHICH THE FURNACE WAS DESIGNED.

Receiving and Storage:

A great deal of emphasis has been put on the proper care of graphite crucibles for maximum service life and safety. Several factors are important and should be carefully considered.

DO NOT STORE crucibles as received in their original container. Examine the container, UNPACK CRUCIBLES IMMEDIATELY, and inspect each crucible for cracks or damage. SOUND each crucible by tapping lightly with a hammer handle. If cracked, the crucible will have a dull sound. Undamaged crucibles will have a clear ring. If the shipment contains damaged pieces, have the delivering carrier acknowledge the damage on your delivery receipt, or notify the carrier of hidden damage and call for immediate inspection.

After inspecting the crucibles, they should be STORED IN A WARM, DRY PLACE. If it is necessary to stock the crucibles in an exposed, unheated location, they should be moved to a warm area for two or three days prior to using. EXCESS MOISTURE SHOULD BE REMOVED PRIOR TO TEMPERING. Some shops use the top of core ovens, or build drying racks near the melting furnaces, for drying. This is an acceptable practice, provided the crucibles are not subjected to a direct furnace exhaust to force the drying. Forced drying usually results in uneven heating and sets up strains which will eventually cause cracking and premature failure.

Annealing New Crucibles:

All clay graphite crucibles should be properly annealed before being put into production. Annealing relieves all strains set up in the crucible during manufacture. This also DEVELOPS A FULL ELASTIC PROPERTY TO WITHSTAND THERMAL SHOCK during service. The crucible should be dried as outlined previously, and placed in a warm furnace. Set the temperature control instrument to 200 F for the first 30 minutes. Raise the setpoint 200 degrees every 15 minutes to gradually raise furnace temperature to 1200 F. Total heating cycle should cover a period of about 2 hours. After the crucible has reached a red heat, it can be removed from the furnace, charged with metal, and put into immediate service.

Charging the Crucible with Metal:

Crucibles are usually charged with metal before they are placed in the furnace chamber. The part of the charge consisting of gates and risers, or of clean scrap of equivalent size, is charged first. Ingots and bars are charged last. Turnings or very light scrap should be added into the crucible after the initial charge has become molten. Otherwise, the turnings and light sections will be attacked by the furnace atmosphere, and will be oxidized excessively before the melting temperature is reached. These oxides and impurities are carried into the casting metal, resulting in porous and unsound castings. Heat is transmitted to the light scrap more rapidly by the molten metal with a minimum of oxidation. ALWAYS BE POSITIVE THAT ANY METAL ADDED TO A MOLTEN BATH IS DRY, otherwise explosion will occur, because of steam generation in the molten bath. Ingots should be thoroughly dry, and added to the molten charge with long handled pickup tongs.

Adding Ingot or Pig to the Crucible:

Heavy sections of the charge should not protrude above the lip of the crucible or they will be subjected to furnace atmosphere and excessive oxidation. THE INGOTS AND BARS SHOULD BE CUT TO A LENGTH SHORTER THAN THE INSIDE DIAMETER OF THE CRUCIBLE. This is particularly true when adding bars or pig to crucibles of molten metal. Long pieces, when added, will sink and come to rest in a horizontal position. They then expand before melting and press out the sides of the crucibles, causing cracks and premature failure.

Preheating Charge Metal:

It is very poor practice to preheat scrap or bars by placing them across the lid of the furnace. The ceramic fiber lid is not constructed to support any extra weight. Placing ingots on the lid could cause the fiber lid to crack.

EM-46 Parts List

Part No.	Description	Qty.
040093	Black Plastic Handle	1
004345	Fiber Lid 3î x 14î	1
410155	Lid Band 3/16" x 2 1/2" x 14 1/2"	1
004041	8" Thermocouple	1
008047	Cast Bottom 3" thick x 14" OD	1
190051	Heating Element 8 1/2" ID, 14 1/2" OD, 11" H	1
004339	2" Blanket Insulation 15" x 60"	1
004080	7" Insulators cut to 4 1/2"	2
004085	Watlow Series 96 Control Instrument	1
003600	Buss Fuse Holder	1
003624	2A Glass Fuse	1
003906	Red Indicator Light	1
003666	Toggle Switch	1
003936	3 Pole Contactor	1
003634	FRNR-30 Fuses	2
003917	Micron Transformer	1
003886	Control Box	1

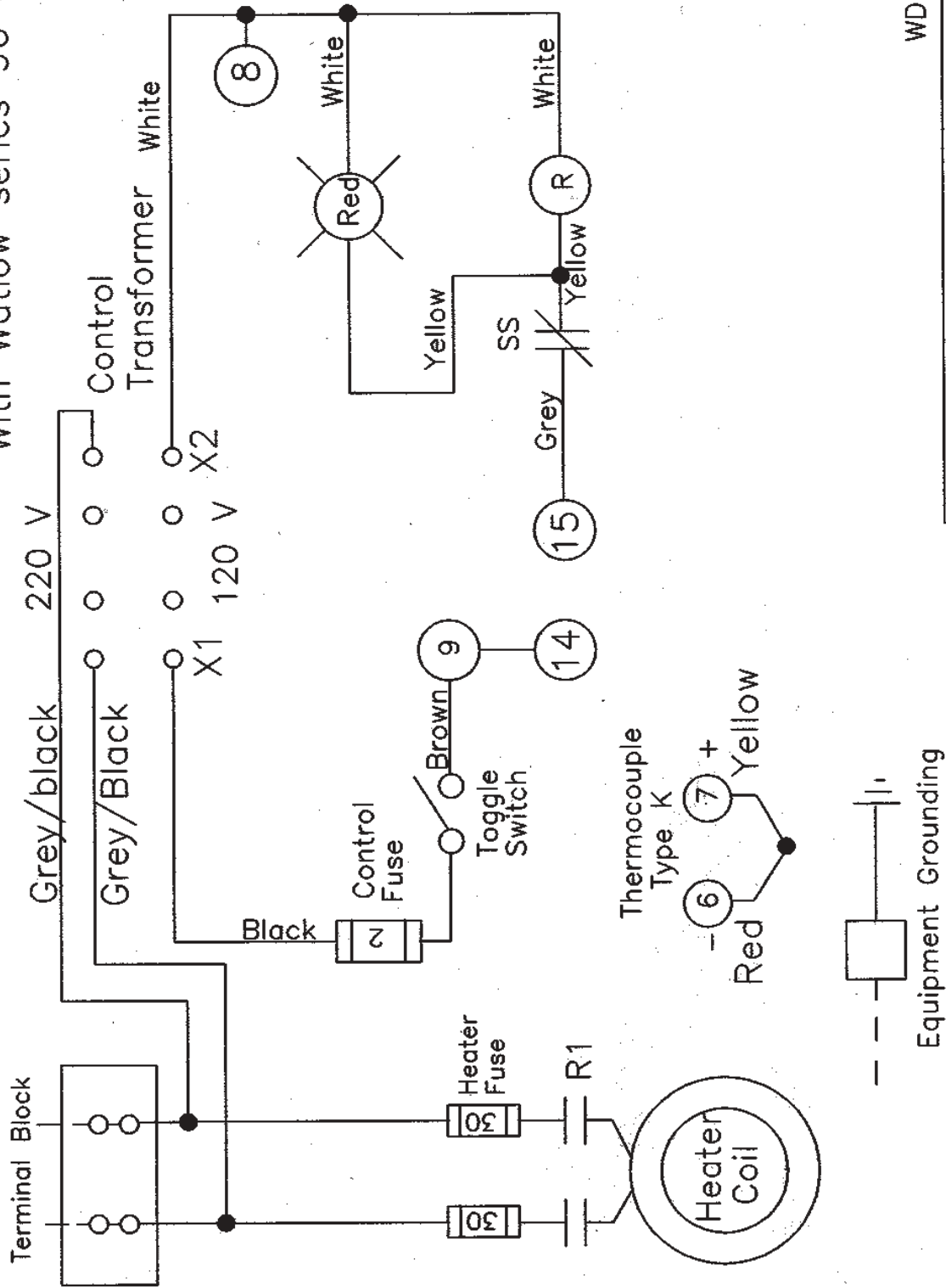
EM-810 Parts List

Part No.	Description	Qty.
040093	Black Plastic Handle	1
004344	Fiber Lid	1
410114	Lid Band 3/16" x 2 1/2" x 17"	1
004041	8" Thermocouple	1
008047	Cast Bottom 2" thick x 17" OD	1
190050	Heating Element 11" ID, 17" OD, 12" H	1
004339	2" Blanket Insulation 15" x 65"	1
004080	7" Insulators cut to 4 1/2"	2
004085	Watlow Series 96 Control Instrument	1
003600	Buss Fuse Holder	1
003624	2A Glass Fuse	1
003906	Red Indicator Light	1
003666	Toggle Switch	1
003936	3 Pole Contactor	1
003634	FRNR-30 Fuses	2
003917	Micron Transformer	1
003886	Control Box	1

EM-46/EM-810 Elect. Melter

With Watlow series 96 control

Power Supply
220 V - 60 Hz - 1 Ph



WD-0036

EM-46 / EM-810 Electric Melter

Wiring Diagram With Honeywell Control Inst.

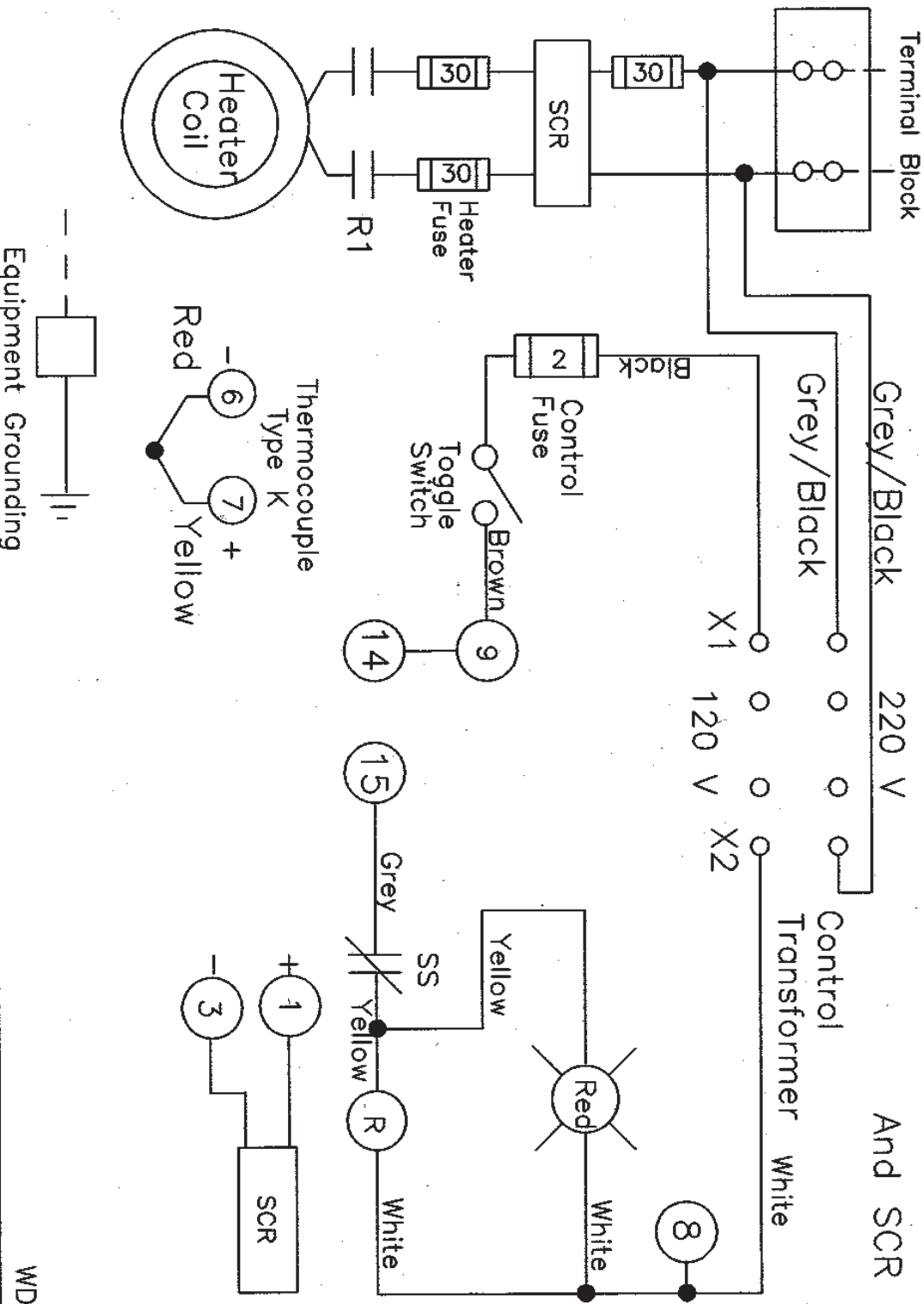
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Power Supply
220 V - 60 Hz - 1 Ph

EM-46/EM-810 Elect. Melter

With Watlow Series 96 Control
And SCR



EM-46/EM-810 Electric Melter
Wiring Diagram With Honeywell Control Inst.
M I F C O
1/31/2002

WD-0037

Series 96 Software Map

Home Page

96	Process 1 Value
96	Set Point Value, Remote Set Point Value or Percent Output Value
96	Custom Menu**...
P1	

Program Menu*

(see pg. 7.1)

Operations Page

Mon	Monitor Menu
OPER	Operations Page
Pr2	Process 2** -----
PcnE	Percent Output 100.0
rPSP	Ramping Set Point** -----
ESL	Event Input Status -----

USER User Menu

OPER	Operations Page
R-M	Auto-Manual Operations Mode** AUTO
Aut	Auto-tune OFF
RESP	Auto-tune Set Point 90
SP2	Set Point 2** -----
ESP	Event Set Point** -----
L-r	Local or Remote Mode** -----
CAL	Calibration Offset 0

PID1 PID 1 Menu

OPER	Operations Page
Pb1	Propband 1 100
Ie1	Integral 1 2.00
RE1	Reset 1 .15
dE1	Derivative 1 -----
rR1	Rate 1 -----
brS1	Burst 1 -----
CE1	Cycle Time 1 16.0
hYS1	Hysteresis 1 -----
db1	Dead Band 1 -----

PID2 PID 2 Menu

OPER	Operations Page
Pb2	Propband 2 -----
Ie2	Integral 2 -----
RE2	Reset 2 -----
dE2	Derivative 2 -----
rR2	Rate 2 -----
brS2	Burst 2 -----
CE2	Cycle Time 2 -----
hYS2	Hysteresis 2 -----
db2	Dead Band 2 -----

ALM Alarm Menu

OPER	Operations Page
AL2L	Alarms 2 Low
AL2H	Alarm 2 High
AL3L	Alarm 3 Low
AL3H	Alarm 3 High
AL4L	Alarm 4 Low
AL4H	Alarm 4 High

Enter your settings on a photocopy of this page.

Setup Page

InP1	Input 1 Menu
SEE	Setup Page
SEn	Sensor Type TC
In	Input Type 1 H
rL	Range Low 1 50
rH	Range High 1 2150
dEL	Decimal 1 0
FEL	Input Software Filter 1

InP2 Input 2 Menu

SEE	Setup Page
In	Input 2** -----
rL	Range Low 2** -----
rH	Range High 2** -----
CAL	Calibration Offset 2** -----
EFn	Event Function -----
Ecn	Event Condition -----
AbSP	Abort Set Point*

Out1 Output 1 Menu

SEE	Setup Page
OE1	Output 1
Pct1	Process Type 1

Out2 Output 2 Menu

SEE	Setup Page
OE2	Output 2
Prct2	Process Type 2
REY2	Alarm Type 2
RhY2	Alarm Hysteresis 2
LRE2	Latching 2
SIL2	Silencing 2
S.d2	Alarm Active Sides 2
L9c2	Alarm Logic 2
Ann2	Alarm Annunciation 2

Out3 Output 3 Menu

SEE	Setup Page
OE3	Output 3
REY3	Alarm Type 3
RhY3	Alarm Hysteresis 3
LRE3	Latching 3
SIL3	Silencing 3
S.d3	Alarm Active Sides 3
L9c3	Alarm Logic 3
Ann3	Alarm Annunciation 3

Out4 Output 4 Menu

SEE	Setup Page
OE4	Output 4
REY4	Alarm Type 4
RhY4	Alarm Hysteresis 4
LRE4	Latching 4
SIL4	Silencing 4
S.d4	Alarm Active Sides 4
L9c4	Alarm Logic 4
Ann4	Alarm Annunciation 4
ANoE	Analog Output
Prct4	Process Type 4
RAH	Analog Output High
RAL	Analog Output Low
RCR	Analog Output Offset
BRd	Baud Rate
addr	Address

GLBL Global Menu

SEE	Setup Page
Un	Units Type US
C-F	C or F F
Err	Input Error Latching NLAT
FRIL	Failure Mode** 6PLS
PrPn	Manual Default Power** -----
PLSP	Power Limit Set Point 2150
PLA	High Power Limit Above 100.0
PLB	High Power Limit Below 100.0
rP	Ramping Mode** OFF
rPS	Ramp Scale** -----
rRE	Ramp Rate** -----
OPLP	Open Loop Detect OFF
PEYPI	Program Type*

Factory Page

CUSE	Custom Menu**
FCFY	Factory Page
P1	NONE
P2	
P3	
P4	
P5	
P6	
P7	
P8	
P9	
P10	
P11	
P12	
P13	
P14	
P15	
P16	

LOC Lockout Menu

FCFY	Factory Page
SP	Set Point Lock CHNG
Prn9	Program Menu Lock* -----
CUSE	Custom Menu Lock** HIDE
OPER	Operations Page Mode HIDE
SEE	Setup Page Lock HIDE
CAL	Calibration Menu Lock HIDE

dIAG Diagnostics Menu

FCFY	Factory Page
mdl	Model Number
dMfE	Date of Manufacture
Sn1	Serial Number 1
Sn2	Serial Number 2
SoFE	Software ID Number
IEY2	Input Type 2
rEv	Software Revision
OEY7	Output 7 Hardware
OEY2	Output 2 Hardware
OEY3	Output 3 Hardware
OEY4	Output 4 Hardware
EOU	Test Output
dISP	Test Displays
hrES	High Resolution
RT76	Ambient Temperature
RcnE	Ambient A-D Counts
cnE1	Channel 1 A-D Counts
cnE2	Channel 2 A-D Counts
ESSE	Communications Test/ Troubleshooting
LnE	Line Frequency

The Factory Page also includes calibration parameters that are not necessary for everyday use of the controller. Calibration parameters and procedures are explained at Watlow's web site, <http://www.watlow.com/literature/prodtechinfo>. Search on **96 calibration manual**.

* Menu added if ramping version of the controller is selected (96 _ - _AA _).

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