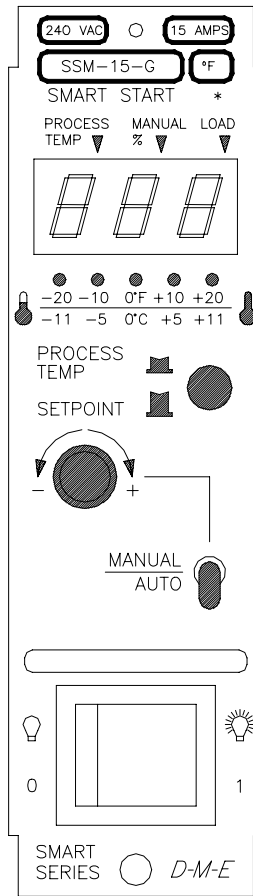


Smart Series®
SSM-15-G & SSM-30-G
SSMX-15-G & SSMX-30-G



**Microprocessor-Based
Temperature Control Module
With Digital Display**

User's Manual

D-M-E Company

D-M-E Standard Smart Series[®] Microprocessor-Based Temperature Control Modules With Digital Display SSM-15-G, SSMX-15-G (15 AMP) & SSM-30-G, SSMX-30-G (30 AMP)

GENERAL DESCRIPTION

This new Smart Series[®] module combines today's electronics with D-M-E's keen sense for human engineering, making it the most user friendly controller on today's market. From its versatile, easy to read multi-function digital read-out to its unique Smart Start[®] heater dry out circuitry, it is indeed a module that is not only productive but instructive.

During start-up, the module's microprocessor analyzes all initial conditions and computes the amount of power required to uniformly raise the heater temperature from ambient to setpoint. After the start-up function, Smart Start[®] procedure automatically kicks in. This procedure uses predetermined power output levels to safely dry out any heater moisture, thereby prolonging heater life. When Smart Start[®] ends, the heater advances to setpoint and normal automatic operation takes over.

The multi-function digital read-out displays setpoint temperature (auto mode) or percentage of power (manual mode), and can provide a read-out of actual process temperature at the touch of a button. Diagnostics faults for open, reversed or shorted thermocouple are also displayed digitally, and the module automatically inhibits power to the heater load until such faults are corrected. The modules LED display indicators (located at the top right of each digit) show the mode of operation and serve to indicate when the read-out is displaying process temperature or percentage of power. The power to heater load LED doubles as a Smart Start[®] indicator by blinking during Smart Start. Five separate color-coded LED's located under the display, indicate temperature deviation and over/under temperature conditions at a glance.

OPERATION:

Automatic Mode: The microprocessor maintains temperature using a closed loop PID control method. Closed loop means the unit continuously looks at the process temperature to determine whether or not to adjust the power delivered to the heater. With PID control, it anticipates the system characteristics to make accurate adjustments and correct for errors. "Fuzzy logic" is used to minimize overshoot on start ups and to prevent over and undershoots when changing setpoints.

Manual Mode: For open thermocouple or thermocouple failure, open loop-percent power is used. In manual mode, the microprocessor maintains a power level using an open loop power control method. Open loop means the process temperature is not used to determine whether or not adjustments should be made. This enables the user to continue production and override thermocouple wire breaks, short circuits, or lead reversal until the problem

has been resolved. Manual mode overrides thermocouple break protection, reversed thermocouple, and any normal automatic modes.

Smart Start[®]: Smart Start[®] is automatic on start-up in the auto mode, and provides a linear ramp to set point for heater bake out. Smart Start[®] is complete when four minutes thirty seconds expire or when set point is reached, or when temperature exceeds 200°F.

Power-Up: Upon power-up, the unit retains the same set point and operation mode as when the unit was turned off.

Input Fault: Thermocouple break protection, and shorted or reversed thermocouple all override Smart Start[®] and normal modes. Output is inhibited.

FEATURES:

- ◆ Fully self-tuning, fuzzy logic, microprocessor-based PID control
- ◆ High speed time proportioning power drive for reliable and precise control
- ◆ Zero crossing triac triggering for minimum RFI
- ◆ Automatic linear Smart Start[®] to prolong heater life
- ◆ Process temperature read-out operational even in manual mode as long as thermocouple (T/C) is intact
- ◆ Automatic T/C break protection and cold junction compensation
- ◆ High impedance potentiometric input allows long distance T/C wiring
- ◆ 100% solid state circuitry, no mechanical relays
- ◆ Completely self contained, no external output devices or power supplies required
- ◆ Fast acting fuses are provided on both sides of the AC line
- ◆ Electrically isolated with grounded front panel for operator safety
- ◆ Plug in design for module interchange ability
- ◆ Compatible with all 10 and 15 amp G-Series[®] and Smart Series[®] Main Frames

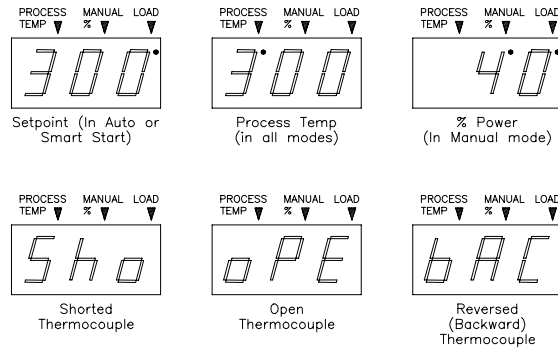


Figure 1 - SSM Display

PERFORMANCE SPECIFICATIONS:

Auto and Manual Control Modes: Time proportioning

Temperature Range: Ambient to 999°F (537°C)

Control Accuracy: +/-1°F (0.5°C) dependent on the total thermal system

Temperature Stability: +/-0.5% of full scale over the ambient range of 32 to 120°F (0 to 50°C)

Calibration Accuracy: Better than 0.2% of full scale

Cycle Time: 0.33 seconds

Power Response Time: Less than 0.13 seconds

Reset: Automatically corrects reset to no more than +/-2°F (1°C) at all settings

Manual Control: Adjustable from 0-99%. Maintains output power to within 1% of setting

Advanced Diagnostics Indicators: LEDs and 3-digit, 7-segment display

Smart Start® (SS): Linear ramp from initial temperature to setpoint

SS Duration: 4 1/2 minutes

SS Override Temperature: 200°F (93°C)

Operational Mode Priority:

- SS precedes auto mode
- Thermocouple (T/C) break overrides SS and Auto modes
- Reversed or shorted T/C overrides SS and Auto modes
- Manual control overrides T/C break, reversed T/C and Auto modes
- The output is inhibited during all fault conditions in automatic mode

DIAGNOSTICS: (See figure 1)

The SSM® diagnostics automatically alert the user to a fault condition.

- Shorted thermocouple displays flashing **Sho** in the auto mode (output inhibited), or is on steady in the manual mode when reading process temperature.
 - ◊ **Troubleshooting-** Check for damage to the thermocouple lead wire. Also, check for bare, twisted or pinched leads, or excessive distance between the heater and thermocouple.
- Open thermocouple indicated by **oPE** flashing while in the auto mode (output inhibited), or on steady in the manual mode when reading process temperature.
 - ◊ **Troubleshooting-** Check the thermocouple connections and wires for broken leads or check for damage to the sensor.
- Reversed thermocouple displays flashing **bAC** while in the auto mode (output inhibited), or on steady in the manual mode when reading process temperature.
 - ◊ **Troubleshooting-** Check thermocouple wiring for reversed leads.
- Over/Under temperature. The red deviation LED on the left, flashes when the process temperature is below set point by 40°F or more. The red deviation LED on the right flashes when the process is above set point by 40°F or more.
 - ◊ **Troubleshooting-** Check for:
 - Under temperature; heater failure, low line voltage, t/c problem.
 - Over temperature; output failure, shorted triac, interacting zones.

INPUT SPECIFICATIONS:

Thermocouple (T/C) Sensor: Type "J", grounded or ungrounded

External T/C Resistance: High impedance potentiometric input allows long distance T/C wiring

T/C Isolation: Isolated by control circuit power supply.

Cold Junction Compensation: Automatic, better than 0.02°F/°F (0.01°C/°C)

T/C Break Protection: Automatically inhibits power to heater in automatic mode

Reversed T/C Protection: Automatically inhibits power to heater in automatic mode

Shorted T/C Protection: Automatically inhibits power to heater in automatic mode

Input Type: Potentiometric

Input Impedance: 22 Megohms

Input Protection: Diode clamp, RC filter

Input Amplifier Stability: 0.02°F/°F (0.01°C/°C)

Input Dynamic Range: 1000°F (550°C)

Common Mode Rejection Ratio: Greater than 100 db

Power Supply Rejection Ratio: Greater than 90 db

OUTPUT SPECIFICATIONS:

Voltage/Power Capability:

15 AMP: 240 VAC nominal, single phase. 120 VAC available, 3600 watts @240 VAC (1800 watts @120 VAC)

30 AMP: 240 VAC nominal, single phase. 7200 watts @240 VAC (3600 watts @120 VAC)

Output Drive: Internal solid state triac, triggered by zero AC crossing pulses

Overload Protection:

15 AMP: Fuses are provided on both sides of AC line

30 AMP: Fast acting circuit breaker.

Transient Protection: dv/dt and transient pulse suppression included

Power Line Isolation: Optically and transformer isolated from AC lines. Isolation voltage is greater than 2500 volts

FRONT PANEL CONTROLS AND INDICATORS: (See figure 2)

1. DIGITAL LED MULTI-FUNCTION DISPLAY & DISPLAY MODE INDICATORS (Located in the display at the top right of each digit): (3) 7-segment LEDs, 0.5 inch digital displays, indicate the conditions shown above, and displays either process temperature, setpoint temperature (auto), or % power (manual) and advanced diagnostics. Load LED indicates that power is being supplied to the heater (blinks during Smart Start®).

Manual Control Indicator: LED in display window illuminates

Process Temp Indicator: LED in display window illuminates

Shorted Thermocouple (T/C) Indicator: Digital display (Sho) alternates with normal display

Open T/C Indicator: Digital display (oPE) alternates with normal display

Reversed (Backward) T/C Indicator: Digital display (bAC) alternates with normal display

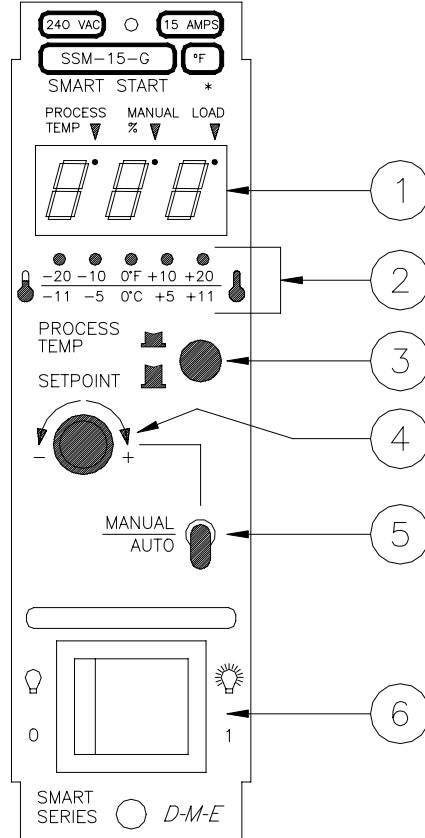


Figure 2 - SSM-15-G Module

Note: SSM-30-G module is twice as wide as above; has circuit breaker instead of item 6.

2. TEMPERATURE DEVIATION LIGHTS: Indicate amount of deviation from setpoint temperature. Outer lights blink when extreme over or under temperature conditions (+/- 40°F) exist.

Temperature Deviation Indicators: Five separate LEDs:
+/-20°F/11°C=(Red),
+/-10°F/5°C=(Yellow),
0°F/0°C=(Green)

3. VIEW PROCESS TEMP BUTTON: Depress to show process temp on display. Release to return display to setpoint (in Auto mode) or % power (in Manual mode).

4. SETPOINT / % POWER ADJUSTMENT KNOB: Precision 10 turn potentiometer adjusts setpoint (Auto) or % power (Manual). Auto (Setpoint) Control: Precision 10 turn potentiometer. Range: 0 to 999°F (0 to 537°C) Resolution: 1°F (1°C)

Manual (% Power) Control: Precision 10 turn potentiometer.

Digital display indication Range: 0 to 99%

5. AUTO/MANUAL SWITCH: Toggle switch, selects automatic (setpoint temp) or manual (% power) control mode.

6. POWER ON/OFF SWITCH: Controls AC power to module. 16 amp rocker switch, UL, CSA, VDE approved. SSM-30-G has a high speed circuit breaker instead, UL, VDE, CSA approved.

ELECTRICAL POWER SPECIFICATIONS:

Input Voltage: 240/120 VAC +10% -20%

Frequency: 50/60 Hz

DC Power Supplies: Internally generated, regulated and compensated

Module power usage: Less than 5 watts, excluding load

Dimensions:

15 AMP: 2"W x 7"H x 7 1/2"D (5.08 x 17.78 x 19.05cm)

30 AMP: 4"W x 7"H x 7 1/2"D (10.06 x 17.78 x 19.05cm)

NOTE: Standard (240 VAC) modules are compatible with main frames wired for either 240 VAC three phase (standard or 240 VAC single phase). Use SSM-15-G1 for 120 VAC operation.

FUSE REQUIREMENTS: (2) ABC-15 fuses (Note: (2) spare fuses included with module). Applies to SSM-15-G only.

CALIBRATION PROCEDURE

1. Insert controller into the calibration jig and turn power on.
2. Set the simulation temperature to 200 degrees F.
3. Adjust the OFFSET trimpot, R13, to read 200 degrees on the display.
4. Set the simulation temperature to 800 degrees F.
5. Adjust the SLOPE (GAIN) trimpot, R17, to read 800 degrees on the display.
6. Repeat steps 2 through 5 until no further trimpot adjustment is needed.
7. Turn power off and remove from calibration fixture.

RETURN POLICY:

The D-M-E® SSM® modules are warranted for 1 year parts and labor, excluding fuses. Contact D-M-E Customer Service for return authorization for repairs or warranties. Replacement parts are also available through the Customer Service Department.

D-M-E Customer Service

In U.S., West Coast: 1-213-263-9261
 Elsewhere in U.S.: 1-800-626-6653
 In Canada: 1-416-677-6370

SERVICE CENTER U.S.A

D-M-E WORLD HEADQUARTERS
 29111 STEPHENSON HIGHWAY
 MADISON HEIGHTS, MICHIGAN 48071
 TELEFAX: (810)398-6174

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REPLACEMENT PARTS LIST

To meet warranty requirements, use only DME® parts.	
Q7, Triac, 40 Amp, 600 Volt, Q6040P	Q6040P
S1, Power Rocker Switch, 16 Amp, 250 VAC	RPM0008
T1, Transformer, 240/120 Volt, DST-4-16	RPM0009
F1, F2, Fuse, 15 Amp, 250 Volt	ABC15
U5, Triac Driver, MOC3041	RPM0010
U4, Microprocessor (DME proprietary software)	SSM0001
U6, U7, Optocoupler, 4N26	RPM0012
U2, Operational Amplifier, LM324	RPM0013
U8, Operational Amplifier, OP07	RPM0014
R23, Potentiometer, 10K, 3590S-001-103	RPM0015

COMMUNICATION CONNECTOR COMPATIBILITY:

The Communication Connector strip in your mainframe communicates to all the other modules in the rack. If the communications connector in your mainframe has pins 3 & 4 missing, you must order a new communication strip from D-M-E to allow the alarm feature in this module to function properly with the TAS-05-02 module. It will not work without these pins installed.

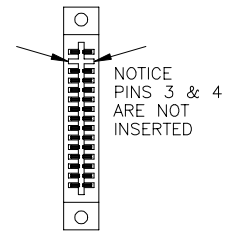


Figure 4 - Communications Connector Not Compatible

The SSM-15-G and the SSM-30-G modules are also compatible with a previous special order alarm module known as a TAF-15-G.

EUROPEAN CONFORMITY (CE) REQUIREMENTS:

This module is shipped with a 3MM x 10MM screw that is used to secure the module to a mainframe for the purpose of satisfying CE requirements. When the module is screwed down securely, this module is considered to be CE certified (compliant). **NEVER REMOVE OR INSERT MODULES WHEN MAINFRAME CIRCUIT BREAKER IS ON.**

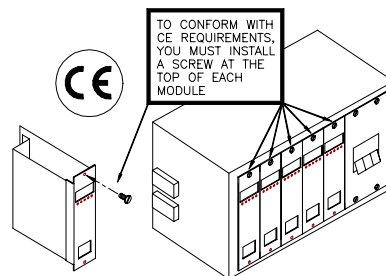


Figure 3 - European Conformity (CE) Requirement

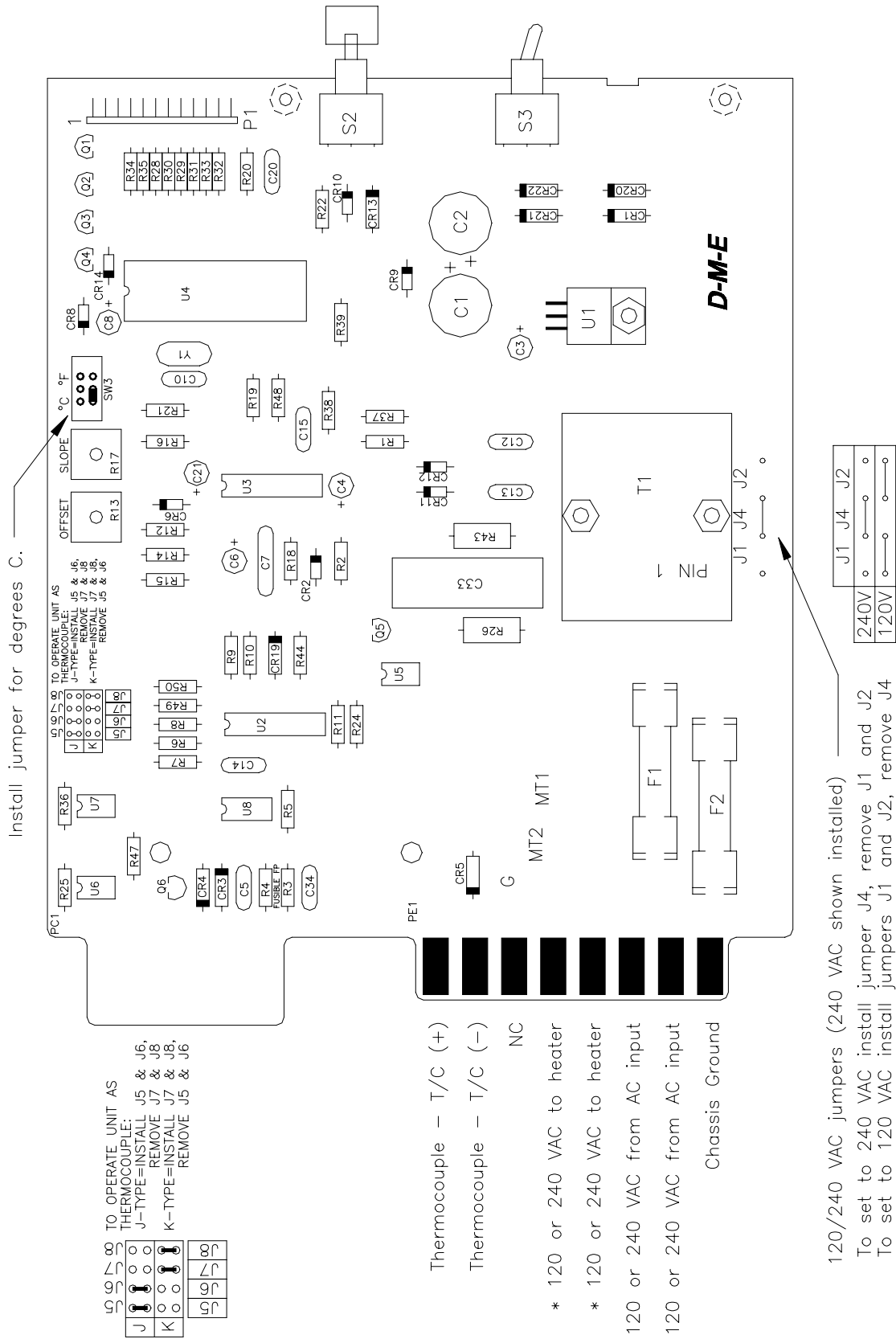


Figure 5 - Component Layout, SSM main board

ECN-0464

January 14, 1997

Add CE information and save as Word 6.0 document

APPROVAL

_____ SENIOR PRODUCT ENGINEER _____ DATE

_____ MANAGER OF ENGINEERING _____ DATE