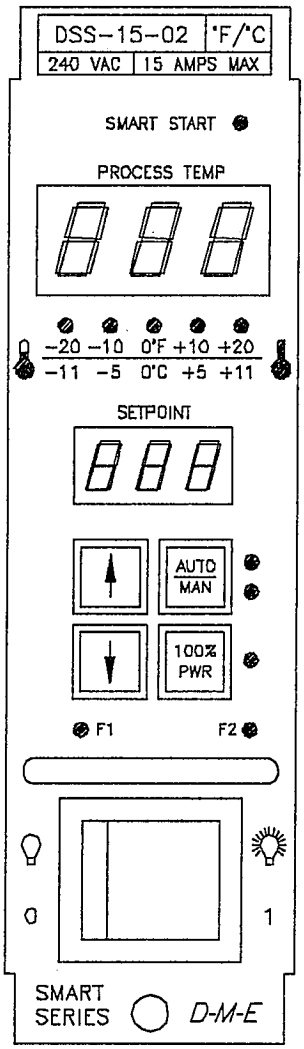
Units built until around July 24, 1997 units did NOT contain R42 Flame Proof Resistors. see ECN 0489

DSS™
Smart Series®
DSS-15-02 & DSS-30-02



Microprocessor-Based Dual Indicating Temperature Control Module

User's Manual

D-M-E Company

D-M-E Standard® Smart Series® Dual Indicating Temperature Control Module DSS-15-02 & DSS-30-02

GENERAL DESCRIPTION:

The DSS™ is a D-M-E® Smart Series®, dual indicating temperature control module. This microprocessor-based control module is designed to maintain the desired set point temperature even under the most adverse processing variables. The unit incorporates features common to both the SSM and the CSS controls, such as heater bake out, input failure alarms, auto or manual operation, and solid state outputs. Other features include 100% power switch, bumpless transfer, and enhanced noise immunity. The DSS™ module is designed to survive the elements that degrade control performance. Specialized circuitry is used to guard against electrical noise and static discharge. Fuzzy logic is used to prevent setpoint overshoot on startup and over and undershoots when changing setpoint.

FEATURE/FUNCTION:

- **Fully auto-tuning:** Fuzzy logic, microprocessor-based PID control.
- **Dual Display:** Upper display shows process temperature while lower display shows desired set point temperature.
- **Smart Start®:** Safely bakes out damaging internal heater moisture.
- **100% Power Option:** Breaks through cavity gate freeze off.
- **EMI Resistant:** Stable/reliable operation.
- **Auto/Manual:** Flexibility in control modes.
- **Input Fault Indication:** Alerts operator to a problem and takes corrective action.
- **Bumpless Transfer:** Minimizes set point adjustment when switching to manual mode.
- **Standby Heat:** Applies a low temperature setpoint to heaters to prevent moisture build-up, and material degradation.
- **Temperature Alarm:** Sends a signal to a DME® TAS-05-02 module which produces an audio/visual alarm and provides a relay contact.

SPECIFICATIONS:

Performance

- **Auto and Manual Control Modes:** High Speed Time proportioning Selective Cycle®.
- **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.
- **Power response time:** 0.538 seconds.
- **Manual Control:** Adjustable from 0 - 100%, maintains output power within 1% of set point.
- **Smart Start®:** Linear voltage ramping.
- **Maximum Smart Start® Duration:** 5 minutes.
- **Smart Start® Override Temperature:** 256°F/124°C.
- **100% Power:** Applies 100% power to the output. Jumper selectable INHibit, or S = 15 seconds, or L = 30 seconds.
- **Operational Priority -**
  - Smart Start® precedes auto mode.
  - Thermocouple (T/C) break, reversed or shorted T/C overrides Smart Start® and auto modes.
  - Manual control overrides the auto mode, T/C breaks, reversed or shorted thermocouples.
  - Output is inhibited during all fault conditions, unless bumpless transfer is selected.

INPUT SPECIFICATIONS:

Thermocouple Sensor: Type J, grounded or ungrounded.

External T/C Resistance: Less than 0.1°F/ohm.

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

Cold Junction Compensation: Automatic, better than 0.03°F/°F(0.015°C/°C).

T/C Break, Reversed & Shorted Protection: Automatically inhibits power to heater, or invokes bumpless transfer

Input Impedance: 5.6 Megohms.

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

Common Mode Rejection Ratio: Greater than 120 dB.

Power Supply Rejection Ratio: Greater than 110 dB.

OUTPUT SPECIFICATIONS:

Voltage / Power Capability: 240VAC nominal, single phase, (120VAC available).
15 AMP: 3600 watts @240VAC (1800 watts @ 120VAC).
30 AMP: 7200 watts @240VAC (3600 watts @ 120VAC).

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

CONTROLS AND INDICATORS:

Auto/Manual Selection: Push-button switch with LED indicators adjacent to switch.

Set Point Adjustment: Push-button up & down arrow keys.

100% Power Selection: Push-button switch with LED indicator adjacent. Note: See J1 jumper settings. (See page 7.)

Power On/Off: 16 Amp rocker switch. On the DSS-30, a 30 amp circuit breaker is used. Both are UL, CSA, VDE approved.

Set Point Display: Three 0.4", seven segment digit display.

Process Display: Three 0.56", seven segment digit display. Also displays alarm codes and flashing "100" for 100% power operation.

100% Power Indication: Red LED adjacent to 100% power key flashes. Process display flashes "100."

Auto Indication: Illuminates green LED adjacent to Auto/Man key.

Manual Indication: Illuminates yellow LED adjacent to Auto/Man key.

Smart Start® Indication: Illuminates green LED above the process display.

Shorted T/C Indication: Flashes "Shi" in process display.

Open T/C Indication: Flashes "oPi" in process display.

Reversed T/C Indication: Flashes "bci" in process display.

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

Blown Fuse Indicators: Two orange indicators for Fuse 1 (F1) and Fuse 2 (F2). (15 amp unit only).

KEYS AND DISPLAYS:

See Figure 1.

1. Smart Start® Light: Indicates Smart Start® is on.

2. Process Temperature Display: Shows process temperature and error codes.

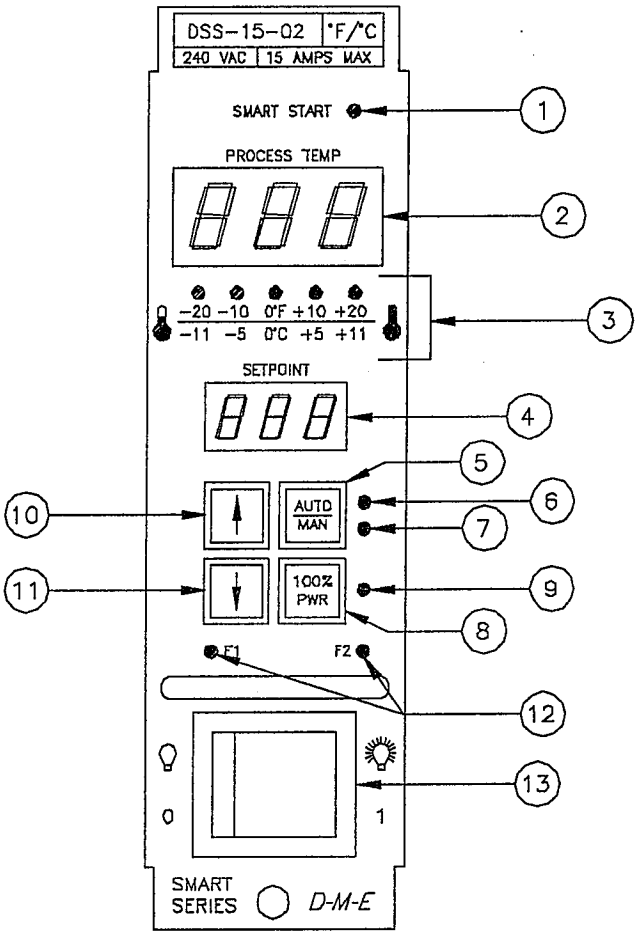


Figure 1. - DSS-15-02 Module

NOTE: DSS-30 is twice as wide as above; has circuit breaker instead of items 12 & 13.

3. Temperature Deviation Indicators: Displays the magnitude of process temperature deviation from set point.

4. Set Point Display: The auto and manual set points are displayed here.

5. Auto/Manual Switch: Selects automatic closed loop (temperature set point) or manual (% power) open loop control modes.

6. Auto Light: Auto mode is selected.

7. Manual Light: Manual mode is selected.

8. 100% Power Switch: Initiates 100% power output. Time out is jumper selectable. See Page 7.

9. 100% Power Light: Indicates control is in 100% power mode.

10. Up Arrow: Increases desired set point value.

11. Down Arrow: Decreases desired set point value.

12. F1/F2 Lights: Illuminated when fuse has blown. (15 amp unit only).

13. Power On/Off Switch. (Circuit breaker used on DSS-30 unit).

ELECTRICAL POWER SPECIFICATIONS:

Input Voltage: 240/120 +10%/-15%.

Frequency: 50/60 Hz.

DC Power Supplies: Internally generated, regulated, and compensated. Transformer isolated from A.C. lines.

Module Power Usage: Less than 6 watts, excluding load.

Dimensions:
15 AMP: Width 2.0" (5.08 cm), Height 7.0" (17.78 cm), Depth 7.5" (19.05 cm).
30 AMP: Width 4.0" (10.16 cm), Height 7.0" (17.78 cm), Depth 7.5" (19.05 cm).

DISPLAYS AND INDICATORS:

Upper Display

The upper display is a three digit, seven segment display showing process temperature and error codes.

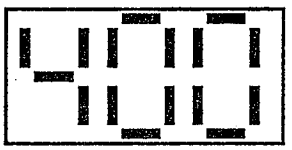


Figure 3. - Upper Display

With a thermocouple in manual mode, the display reads process temperature. While in the manual mode, without a thermocouple, the display reads oPi (open input). The display range is from ambient to 999°F/537°C. See page 5 for diagnostic information displayed when an input fault is present. "deg" will be displayed on power up.

Lower Display

The lower display is a three digit, seven segment display used to show set point. The manual, auto, and 100% power modes are shown here. The **AUTO/MAN** key selects between automatic and manual operation, while the 100% PWR key selects 100% power mode. "F" or "C" will be displayed on power up.

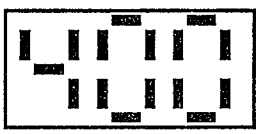


Figure 4. - Lower Display

LED Indicators

SMART START® - During Smart Start® the green LED is on.

Deviation LEDs -

Green indicates
<+/-10°F/5°C temperature deviation.

Yellow indicates
>+/-10°F/5°C temperature deviation.

Red indicates
>+/-20°F/11°C temperature deviation.

Flashing red indicates
>+/-30°F/17°C temperature deviation.

AUTO - The green LED adjacent to the AUTO key is on while in the automatic mode.

MAN - The yellow LED adjacent to the MAN key is on while in the manual mode.

100% PWR - The red LED next to the 100% PWR key flashes while in 100% power mode. All other LEDs are off in this mode.

F1 and F2 - The orange neon light is on when its corresponding fuse blows. (DSS-15 only).

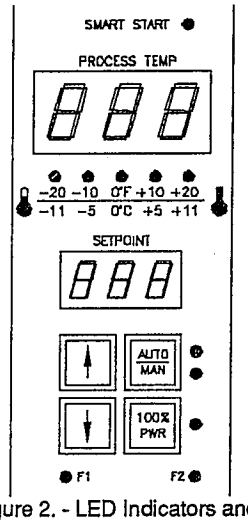


Figure 2. - LED Indicators and Function Keys

Keys

AUTO/MAN

The Auto/Man key provides either automatic or manual percent power control. Adjust the temperature set point while in the Auto mode. The Auto mode is indicated by the green LED. Adjust the percent power while in the manual mode. Manual is indicated by the yellow LED. This key is also used to select bumpless transfer on power up.

UP/DOWN ARROWS

Adjust the auto or manual set point via the up/down arrow keys. The new set point is automatically entered 1 second after the last key is pressed. The up arrow key is also used to select degrees F or C operation on power up. The down arrow key is also used to select load type (fast or slow) on power up.

100% PWR

When the 100% PWR key is pressed, 100% power is applied to the load for a time period determined by the J1 jumper. See page 7. Press any key to disable, and the control returns to the previous set mode. When in 100% power, it is indicated by the red LED flashing next to the 100% PWR key, and "100" flashing in the lower display.

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 overshoots and undershoots of setpoint.

Auto-tuning See figure 5, page 5.

Auto-tuning PID parameters are automatically initiated after power up, or when the set point is changed by greater than 100°F. Auto-tuning begins when the process temperature is at 80% of set point. During auto-tuning the heat proportional band is set to 0, and the control goes into the ON/OFF mode at 90% of the established set point. Once the control finishes "learning" the system, it returns to a standard PID control with the heat PID values are automatically set as a result of auto-tuning.

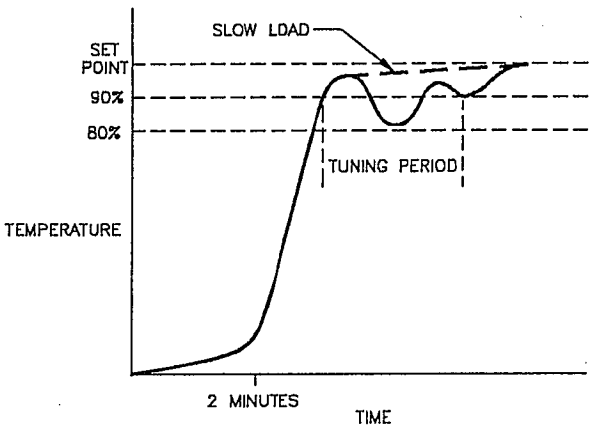


Figure 5. - Auto-Tuning

Bumpless Transfer

While in the auto mode and within 5°F of set point, the control periodically calculates and records the average percent power required to keep the process temperature at set point. When the control is switched to manual mode, the last stored percent power becomes the manual set point. The percent power is stored before the fault occurs.

Power-Up

Upon power up, the unit retains the same set point and operation mode as when the unit was turned off. If the unit is turned off while at 100% power, upon power up it returns to the mode and set point retained before switching to 100% power.

Input Fault

Thermocouple break protection, and shorted or reversed thermocouple all override Smart Start® and normal modes. Output is inhibited, although bumpless transfer may be used to override, automatically or manually.

Manual Mode

For open thermocouple or other 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, shorted thermocouple, and any normal 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 five minutes expire or when set point is reached.

100% Power

When 100% PWR is pressed, the output is full on until the timeout period is complete. Maximum time duration for 100% power is determined by the J1 jumper, see Figure 14 on Page 7. Located on the printed circuit board, S = 15 seconds, L = 30 seconds, & INH = inhibit 100% power. See page 8 for location. Pressing any key before timeout returns the unit to its previous mode and set point.

DIAGNOSTICS:

The DSS™ diagnostics automatically alert the user to a fault condition.

- Shorted thermocouple displays flashing Shi alternating with the process temperature every 7 seconds.

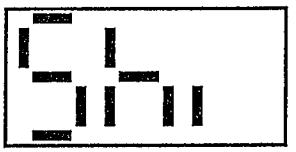


Figure 6. - Shorted Thermocouple, shorted input

  - Troubleshooting - Check for damage to the thermocouple lead wire. Also, check for bare, twisted or pinched leads. Excessive distance between the heater and thermocouple or low watt density may also trigger this diagnostic. Slow loads such as externally heated manifolds may trigger this diagnostic when a fast load is selected. See Load Type Selection section to select a slow load response.

    The Shi diagnostic latches upon fault. It is necessary to turn the module off and back on to reset the module. If automatic bumpless transfer is invoked, the module will lock into manual until the module is turned off and back on.

- Open thermocouple Indicated by oPi flashing while in the auto mode (if output is inhibited), or on steady in the manual mode.

  - Troubleshooting - Check the thermocouple connections and wires for broken leads or check for damage to the sensor.

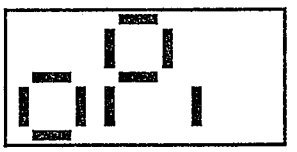


Figure 7. - Open Thermocouple, open input

- Reversed thermocouple. Displays flashing bci while in the auto mode (if output is inhibited), or on steady in the manual mode.

  - Troubleshooting - Check thermocouple wiring for reversed leads.

Figure 8. - Reversed Thermocouple, backward input

- Over/Undertemperature. The red deviation LED on the left, flashes when the process temperature is below set point by 30°F or more. The red deviation LED on the right flashes when the process is above set point by 30°F or more.

  - Troubleshooting -

    Under temperature:
    Check for heater failure, open wiring or low voltage conditions.

    Over temperature:
    Check for shorted triac, shorts to other heater leads or interaction with other zones of heat.

BUMPLESS TRANSFER:

"Bumpless transfer" is defined as a thermocouple failure causing the module to automatically switch into manual percent power mode, if the module has learned the percent power. To force the module into this mode, press the "AUTO/MAN" key simultaneously while turning the power on. The upper display will show "AUt" and the lower display will show "bPL" for 3 seconds indicating that automatic bumpless transfer mode has been selected. This mode will now be stored in the modules permanent memory. To deactivate the bumpless transfer mode - repeat the power on procedure while pressing the "AUTO/MAN" key. This will cause the module to display, "inh" in the upper display, and "Out" in the lower display, indicating that the output power will be inhibited upon thermocouple failure. The user will have to then place the unit in the manual mode to gain control of the output power.

Once the Auto mode setpoint is reached, and the controller is placed in the Standby Heat mode, if a T/C failure occurs, the DSS™ will set power level to 0%, (no output.) When the DSS™ is released from the Standby Heat mode, the unit will use the last valid percent power it learned prior to entering the Standby Heat mode and it will continue to control power in the Manual percent power mode.

If the module has reached setpoint in the Auto mode, and the T/C fails, the unit will switch to Manual percent power mode and continue controlling power. If the module is then instructed to switch to the Standby Heat mode, the unit will set power level to 0%, (no output.)

If the module has **not** reached setpoint in the Auto mode, and the T/C fails, the unit will switch to Manual percent power mode and continue with the last valid Manual percent power stored before the T/C failure occurred, or the factory setting of 0%. If the unit is now instructed to switch to the Standby Heat mode, the unit will set the power level to 0%, (no output.) If the module is in Standby Heat Mode and the T/C fails, the unit will switch to Manual mode and will continue controlling power at a learned by temporary percent power, or 0% if a value has not been properly learned while in Standby Heat. Upon release from Standby Heat Mode, the unit will use the last valid percent power it learned prior to entering the Standby Heat Mode and it will continue to control power in the Manual percent power mode.

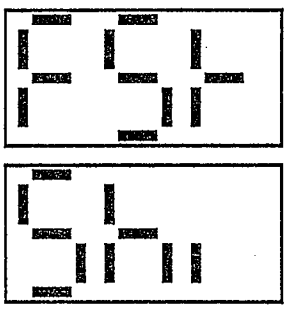


Figure 9. - Fast Load

LOAD TYPE SELECTION:

The type of the load is selected by depressing the down arrow key simultaneously while powering the unit on. This will select a fast or a slow load. A fast load is described as a mold temperature rise of no less than 3 degrees F in 60 seconds. A slow load is a change of no less than 3 degrees F in 250 seconds. This feature is provided so that a fast or slow load can be selected allowing the easy detection of a shorted thermocouple input. For proper protection of heaters and the molding system, a fast response should be selected unless slow temperature rise is expected, as is the case with manifold or barrel heaters.

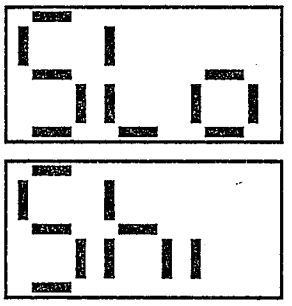


Figure 10. - Slow Load

STANDBY HEAT:

When the DME® TAS-05-02 module initiates a Standby Heat signal, any DSS™ module in the auto mode will immediately set the set-point temperature to 200°F/93°C. This function is useful for the continuous application of low power to heaters to prevent moisture build-up and initiate quick start-ups. *

* A communications style main frame is required to support this feature.

TEMPERATURE MODE F/C:

To set the temperature mode in degrees F or C, press the up arrow key, (increment key), while simultaneously turning the power on to the unit. The word "dEg" will appear in the upper display, and either " F " or " C " will appear in the lower display. To change the mode, turn the power off for 5 seconds and then turn power back on while pressing the increment key. The display will then indicate which mode the unit is in.

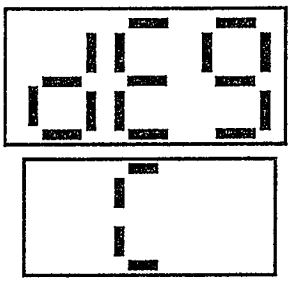


Figure 11. - Temperature Mode

ALARM OUTPUT:

When the DME® TAS-05-02 module is installed in the DME® mainframe, this DSS™ output feature will activate the alarm output feature on the TAS-05-02 module. The TAS module will produce an audio alarm and provide a relay contact closure when a temperature alarm occurs. This feature is disabled upon power-up until the process temperature is within 10°F of set-point temperature, or until an error occurs. It is also disabled when changing to or from the Standby heat mode.* Once the set-point temperature is reached, a deviation of +/-30°F will activate the alarm. The process must get within + /-25°F to turn the alarm off (alarm hysteresis = 5°F).

When standby heat is engaged, the alarm is inactive until the process falls to 210°F. When leaving standby heat the alarm is also inactive until the process is within 10°F of set-point. This prevents alarms during ramping.

In the manual mode the alarm is inactive except for errors. Errors always cause an alarm. If the unit is in output inhibit mode, the alarm occurs during an error and is cleared by placing the unit in the manual mode. If the DSS™ is in auto-bumpless mode, the alarm will stay on even though the unit goes to the manual mode. The user can silence the alarm by pressing and holding the auto/manual key for one second. When errors are corrected and the unit is back in auto mode the alarm is inactive until the process reaches +/-10°F of set-point.

SETTINGS:

CAUTION: The following description refers to the voltage setting of the module. If not properly set damage to the unit will result and personal injury may result. Refer to the component layout on page 8.

To Convert from 240VAC to 120VAC

W10 - Jumper installed
W9 - Jumper **not** installed
W8 - Jumper installed

Figure 12. - 120V

To convert from 120VAC to 240VAC

W10 - Jumper **not** installed
W9 - Jumper installed
W8 - Jumper **not** installed

Figure 13. - 240V

100% PWR Timer Settings (J1)

Install the jumper as shown. The module is shipped with a jumper in the "S" position.

S = 100% power will be applied for 15 seconds
L = 100% power will be applied for 30 seconds
INH = Inhibits 100% power feature

Figure 14. - Jumpers

CALIBRATION PROCEDURE:

Equipment needed:

1. Type J Cold Junction Compensator
2. Precision millivolt Source

Test Procedure:

1. Connect the cold junction compensator between the thermocouple inputs on the DSS™ and the millivolt source.
2. Insert jumpers in both of the 100% power timer select positions. The inhibit position does not require a jumper.
3. Power the unit on. The displays shall read "CAL 0".
4. Set the millivolt source to 0.00mv (32°F) and wait five seconds.
5. Press the decrement key, (down arrow). After approximately 10 seconds the displays shall read "CAL 999".
6. Set the millivolt source to 29.515mv (1000°F) and wait five seconds.
7. Press the "AUTO/MAN" key. After approximately 10 seconds the displays shall read "CAL End".
8. Press the 100% Power key. The upper display shall read "999" and the lower display shall read " 75".
9. The unit is now calibrated.

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 allowing the alarm feature in this module to function properly with the TAS-05-02 module. It will not work without these pins installed.

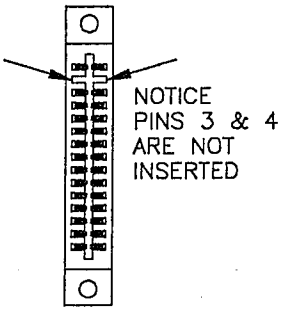


Figure 15. - Communication Connector Not Compatible

RETURN POLICY:

TheD-M-E® DSS™ 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

D-M-E WORLD HEADQUARTERS
29111STEPHENSONHIGHWAY
MADISONHEIGHTS,MICHIGAN48071
TELEFAX(313)398-6174

REPLACEMENT PARTS LIST:

To meet warranty requirements, use only DME® parts.

T1, Transformer 240/120 VAC	RPM0020
U6 Microprocessor (contains DME proprietary software)	DSS0002
Q1 Triac Driver, MCP3020Z	RPM0022
Not Shown Triac - 40 amp, 600 volt, Q6040P (Note: must apply a thin coat of heatsink compound)	RPM0023
SW1, Power Rocker Switch, 16 Amp, 250 VAC	RPM0024
Handle (used on DSS-15)	RPM0027
F1, F2, Fuse, 15 Amp, 250 VAC (used on DSS-15)	ABC15

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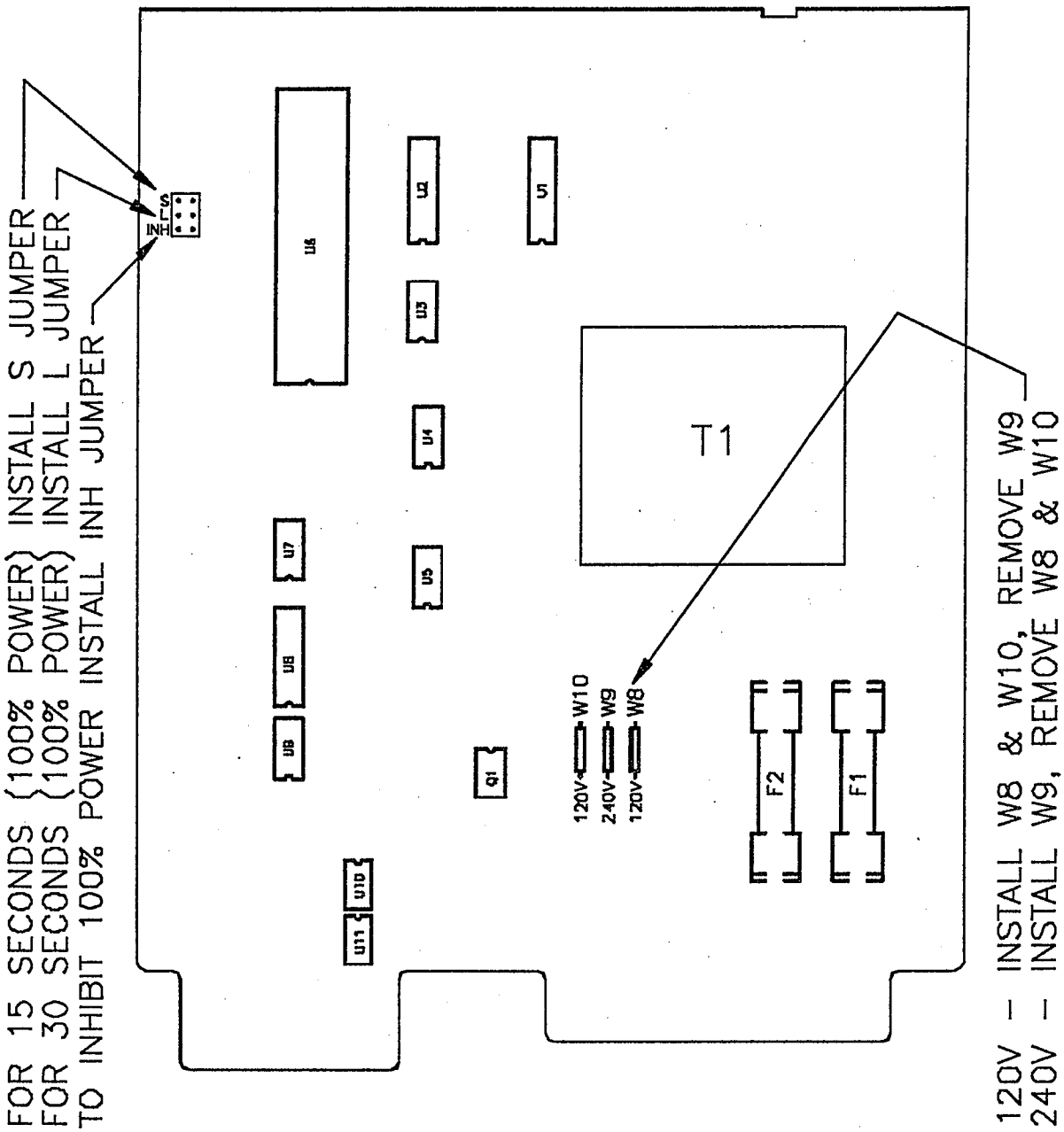


Figure 16. - Component Layout, DSS™ main board

D-M-E COMPANY
A FAIRCHILD INDUSTRIES COMPANY

29111 STEPHENSON HIGHWAY
MADISON HEIGHTS,
MICHIGAN 48071 U.S.A.

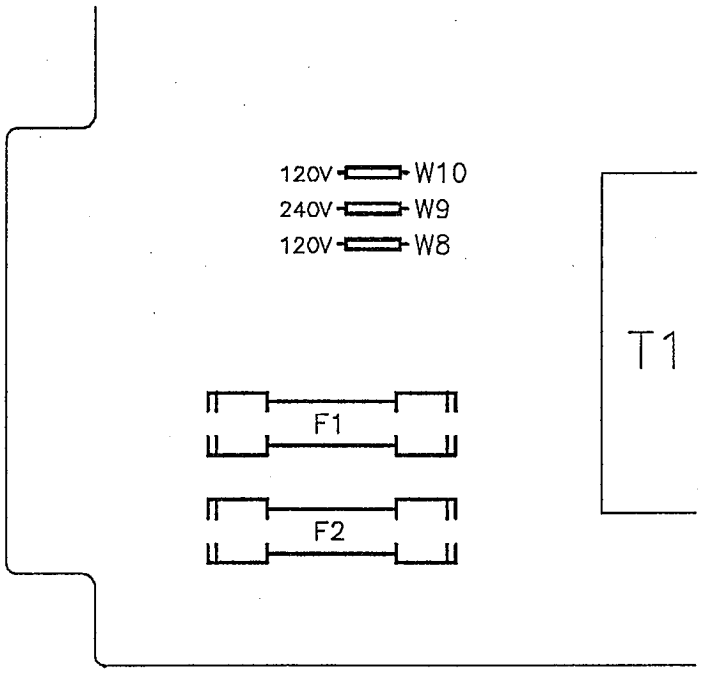
Errata

January 25, 1993

On page 8 of the **DSS-15-02 & DSS-30-02** manual, the following was printed in error.

The fuse positions F1 & F2 were depicted incorrectly. The graphic below indicates the corrected positions of fuses F1 and F2. Please update your manual with this correction.

We appologize for any confusion this may have caused.



Corrected positions of fuses F1 & F2