# OWNER'S MANUAL
# SPARTAN Models 8S/8D and 12S/12D
# Wave Solder Machines

SERIAL NO._____

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Automated Production Systems

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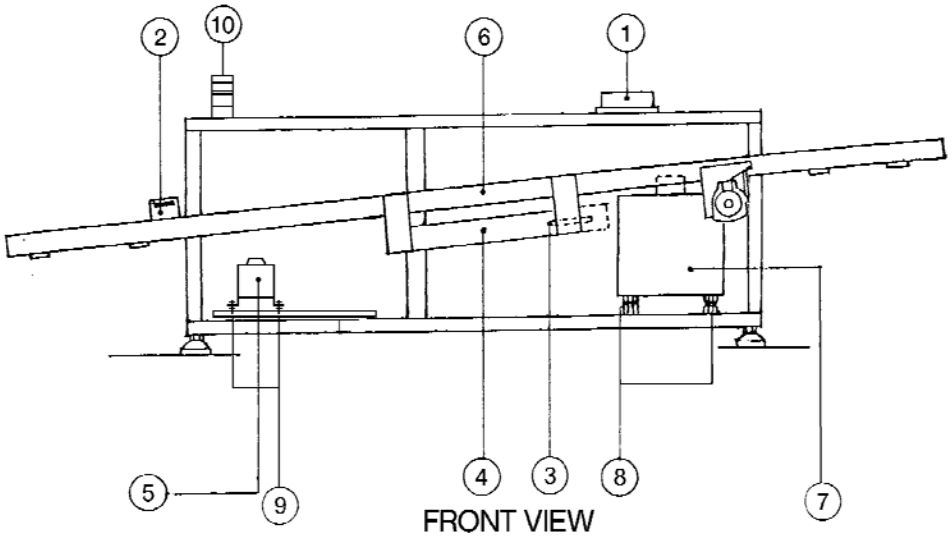
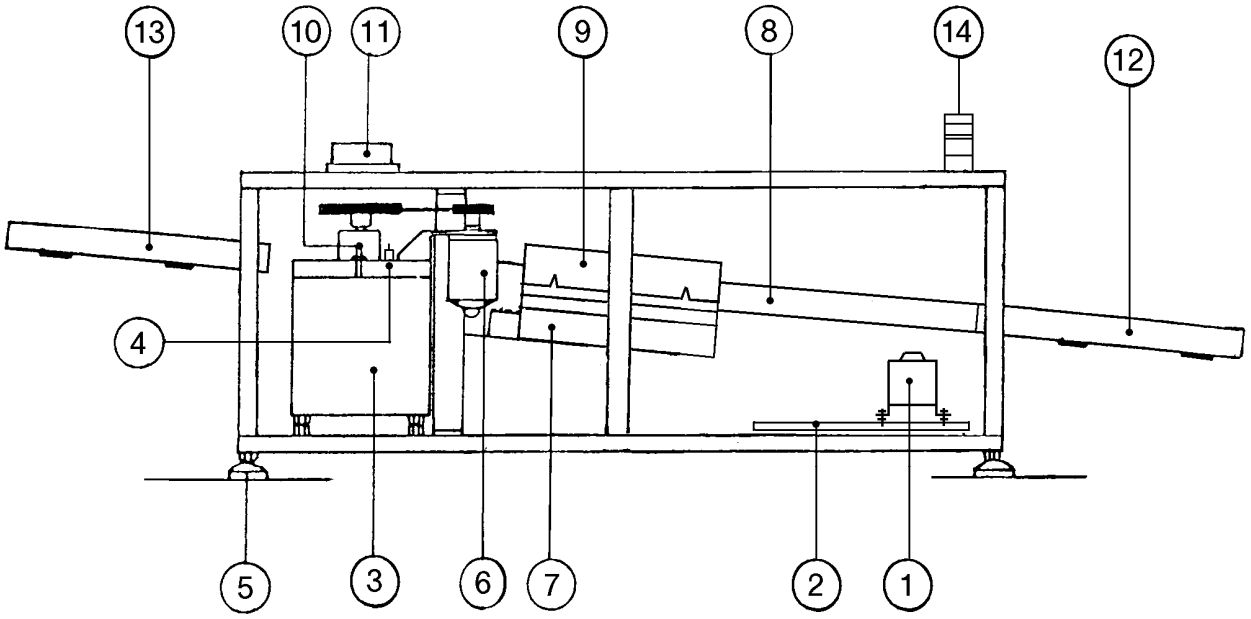
## 1.0 BRIEF DESCRIPTION OF WAVE SOLDER SYSTEM

**1.1 Parts of the System:** (See Figures 1 and 2) The system consists of 8 assemblies: Pallet Conveyor
Fluxer
Preheaters 1 & 2
Solder Module
Exhaust
Computer Controller
Electrical Circuit




1. EXHAUST HEADER
2. INTERVAL SENSOR
3. THERMOCOUPLE
4. PREHEATERS 1 & 2
5. FLUX POT
6. CONVEYOR
7. SOLDER POT
8. LEVEL ADJUSTMENT FOR SOLDER POT
9. LEVEL ADJUSTMENT FOR FLUX POT
10. STATUS LIGHT TOWER

**Fig. 1**




REAR VIEW

**Fig. 2**

1. FLUXER
2. FLUXER DRIP TRAY
3. SOLDER POT
4. SOLDER LEVEL SENSOR
5. JACKING FOOT
6. SOLDER MOTOR
7. PREHEATERS 1 & 2
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9. PREHEAT REFLECTOR
10. SOLDER THERMOCOUPLE
11. EXHAUST HEADER
12 ONLOAD CONVEYOR EXTENSION
13. OFFLOAD CONVEYOR EXTENSION
14. STATUS LIGHT TOWER

## 1.2 Technical Data:

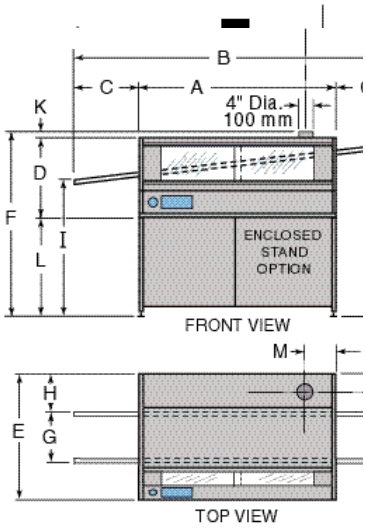



**Fig. 3**

| SPECIFICATIONS | 8S-HT (single wave) | 8D-HT (dual wave) | 12S-HT (single wave) | 12D-HT (dual wave) |
|---|---|---|---|---|
| **Power** | 220 VAC, 60 Hz 1Ø, 30A | 220 VAC, 60 Hz 1Ø, 40A | 220 VAC, 60 Hz 1Ø, 50A | 220 VAC, 60 Hz 3Ø, 20A |
| **Foam Fluxer Tank** | 0.5gal/2liters | 0.5gal/2liters | 0.8gal/3liters | 0.8gal/3liters |
| **Solder Pot Capacity** | 125lbs/57kgs | 200lbs/90kgs | 250lbs/114kgs | 375lbs/170kgs |
| **Max. Wave Height** | 0-3/8"/0-10mm | 0-3/8"/0-10mm | 0-3/8"/0-10mm | 0-3/8"/0-10mm |
| **Wave Width** | 8"/203mm | 8"/203mm | 11.8"/300mm | 11.8"/300mm |
| **Max. Preheat Temp.** | 300°F/150°C | 300°F/150°C | 300°F/150°C | 300°F/150°C |
| **Preheat 1 Power** | 2.25kW | 2.25kW | 4.0kW | 4.0kW |
| **Preheat 2 Power** | 1.5kW | 1.5kW | 2.0kW | 2.0kW |
| **Max. Solder Pot Temp.** | 575°F/300°C | 575°F/300°C | 575°F/300°C | 575°F/300°C |
| **Lead Free Pot Temp.** | 662°F/350°C | 662°F/350°C | 662°F/350°C | 662°F/350°C |
| **Solder Pot Power** | 2.5kW | 3.2kW | 3.6kW | 5.2kW |
| **Approx. Warm-up Time** | 60 min. | 60 min. | 60 min. | 60 min. |
| **Max Conveyor Speed** | 6 ft/min (2m/min) | 6 ft/min (2m/min) | 6 ft/min (2m/min) | 6 ft/min (2m/min) |
| **Pallet** | STD: 8" x 11.4" 200 x 290mm | STD: 8" x 11.4" 200 x 290mm | STD: 12" x 15.8" 200 x 290mm | STD: 12" x 15.8" 200 x 290mm |
| **Dim. (in/mm) A** | 66.5/1690 | 66.5/1690 | 79/2007 | 79/2007 |
| **B** | 96.5/2451 | 96.5/2451 | 118/2997 | 118/2997 |
| **C** | 14/355.6 | 14/355.6 | 19.5/495.3 | 19.5/495.3 |
| **D** | 20/508.0 | 20/508.0 | 24/609.6 | 24/609.6 |
| **E** | 31/787.4 | 31/787.4 | 39/990.6 | 39/990.6 |
| **F** | 50/1270.0 | 50/1270.0 | 54/1371.6 | 54/1371.6 |
| **G** | 11.5/292.1 | 11.5/292.1 | 16.5/419.1 | 16.5/419.1 |
| **H** | 8.8/223.5 | 8.8/223.5 | 10.8/274.3 | 10.8/274.3 |
| **I** | 33/838 | 33/838 | 33/838 | 33/838 |
| **J** | 45/1143 | 45/1143 | 46/1169 | 46/1169 |
| **K** | 2/50.8 | 2/50.8 | 2/50.8 | 2/50.8 |
| **L** | 28/711.2 | 28/711.2 | 28/711.2 | 28/711.2 |
| **M** | 14/356 | 14/356 | 15/381 | 15/381 |
| **N** | 4.5/114 | 4.5/114 | 5/127 | 5/127 |
| **Venting Requirement** | 300 CFM/500 m3/h max., 4" /100 mm Dia. Flange | | | |

S = Single Wave, D = Dual Wave

**Fig. 4**

## 1.3 System Operation:

### 1.3.1 Pallet:

Place assembled PCB on pallet by gently pushing the board onto the titanium fingers. Paths can be moved closer together or further apart to accommodate various board widths. The maximum board width is 8 x 11.4 in. (200 mm x 290 mm) for Spartan 8S and 8D and 11.8 x 15.7 in. (300 mm x 400 mm) for Spartan 12S and 12D.

### 1.3.2 Conveyor:

Load pallet on entrance (lower) end of conveyor and gently push until engaged in conveyor chain. Pallet moves toward exit end of conveyor, automatically disengages from the chain, and idles on exit extension ready for removal.

### 1.3.3 Fluxer:

The standard system has a foam fluxer. When turned on, flux foam is dispensed through flux nozzle to coat bottom of PCBs. The pallet, containing PCBs, passes over flux foam and flux is applied to the joints to be soldered.

### 1.3.4 Preheater:

After PCBs have been fluxed, the PCB passes over preheat 1 and preheat 2. Heat radiated from the preheater dries and activates the flux by elevating the temperature of the PCB.

### 1.3.5 Solder Module:

The preheated PCB now moves towards the solder pot. A wave of clean solder is pumped through the nozzle. The PCB passes over this wave of molten solder and all joints are soldered. (Models Spartan 8D and 12D include two wave nozzles, laminar and turbulent, for SMT components.)

### 1.3.6 Computer Controller:

The controller stores important parameters of the system. It can store up to 10 profiles. The following lists the controlled parameters:

a) Conveyor speed
b) Fluxer
c) Preheat 1 and Preheat 2
d) Solder pot temperature
e) Solder wave height (wave I and/or wave II)
f) Program storage menu (#0-9)

The parameters are preset to required values, and can easily be altered for optimal performance.

### 1.3.7 Exhaust:

Flux fumes which collect in the machine are extracted through the exhaust header.

A 4 in. (100mm) duct may be connected to the exhaust port to remove fumes from work area. Use a 300 CFM / 500 $m^3$/h) capacity exhaust fan to remove fumes beyond working area.

# 2.0 OPERATION AND MAINTENANCE

## 2.1 Installation

### 2.1.1 Placement:

The Spartan system needs a stable benchtop or the optional enclosed cabinet. Using a horizontal bubble level, adjust the four jacking feet until the machine is properly leveled.

(See figure 5) Refer to figures 3 and 4 for overall dimensions.

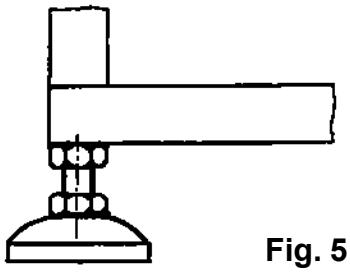


**Fig. 5 SPARTAN Leveling Foot**

### 2.1.2 Connecting to Power:

Electrical connection should be made by qualified electrician to the terminal blocks located inside the control panel. (Refer to section 2.10)

**C A U T I O N !**

Do not turn on solder heater until solder pot is filled with solder. Refer to 2.6.1.

**2.1.3** Attach conveyor entrance and exit extensions using hardware provided.

**2.1.4** Install Status Light Tower per instructions on page 27.

## 2.2 Pallets:

The maximum size of the PCB that can be loaded in the pallet is 8 x 11.4 in. (200 mm x 290 mm) for Spartan 8 and 11.8 x 15.7 in. (300 mm x 400 mm) for Spartan 12. Smaller PCB assemblies can be loaded by adjusting the distance between the parallel paths. Longer pallets are available from the factory.

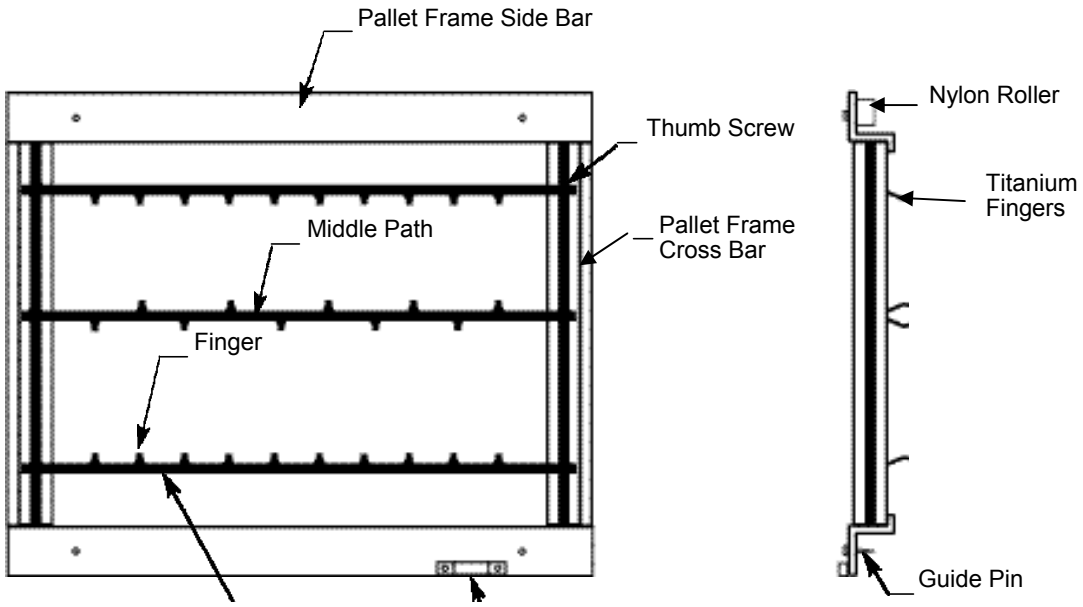



**FIGURE 6 PALLET**

**Note:** For smaller PCBs, optional Middle Paths are available.

**Maintenance:**

The pallet in constructed of aluminum and titanium. Thus, solder will not bond. However, flux may adhere. Clean any flux build-up on fingers to avoid solder sticking to it.

Pallets should not be bent or skewed. Set pallet on a flat surface and check that all four corners sit level, without any play. If not level, gently press on corners to correct any minor skew in frame.

## 2.3 Conveyor:

Conveyor rails are mounted at a 6° angle and consists of two aluminum rails, a chain and drive motor. The speed of the conveyor is adjusted by the controller.

Before running any loaded pallets on conveyor, run an empty pallet through conveyor to make sure it moves smoothly throughout its travel.

**Maintenance:**

a. Remove any foreign material such as a solder drop on the chain.
b. Lubricate chain with a few drops of general purpose lubricating oil once a month.
c. Lubricate sprocket and guide roller with a general purpose lubricating oil once a month.
d. Clean the conveyor rails with thinner or suitable solvent to remove flux splatter on rails.

## 2.4 Fluxer

An onboard compressor pumps air through the flux stone located at the bottom of the flux tank. This aerates the flux creating foam which rises through the nozzle.

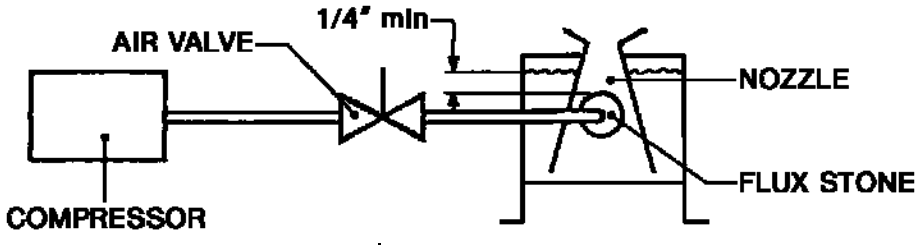



**FIGURE: 7 FLUXER**

During operation, the flux tank should be filled at all times. The minimum level should not be less than 1/4 in. (6mm) above the upper edge of the flux stone.

The foam height is adjusted via the air valve which constricts air flow to the flux stone.

To empty flux from the pot, remove the drain tube from the clamp, open the drain valve, and lower it into a suitable container. The flux will drain out by gravitational force.

**C A U T I O N !**

**Whenever maintenance is performed on the fluxer, it should be done with machine switched off and the preheater cooled down.**

**Maintenance:**

Check the specific gravity density of the flux daily before starting the machine and periodically during operation. Consult your flux manufacturer for the recommended specific gravity. To adjust the specific gravity, add a suitable amount of the thinner. Empty the flux tank every day after using the machine.

Keeping the flux stone immersed in thinner overnight will significantly prolong the useful life of the flux stone. If desired, the entire fluxer may be removed by gently sliding it out from the rear of the machine.

## 2.5 Preheater

Preheater 1 consists of "U" shaped heater elements, a reflector and the housing. Preheater 2 consists of resistive strip heaters with heat exchang- er fins. A fan circulates the air toward the top reflector. The preheaters form a heat tunnel which dries and activates the flux and protects the PCB assembly from thermal shock when it enters the solder wave.

Preheater setting on the control panel will vary depending on desired profile. In general, however, if component/board density is high, higher preheat temperature should be set and lower temperature for less dense boards.

**C A U T I O N !**

Preheater maintenance operations should be performed with the machine switched off and preheater cooled down.

**Maintenance:**

Clean the heater and reflector plate with thinner to remove any flux splatter, before turning machine on.

Removing heaters:

a. Remove junction box cover.
b. Remove heater clamp screws.
c. Disconnect wires.
d. Slide out heaters.

To replace the heater, reverse above sequence.

## 2.6 Soldering Module:

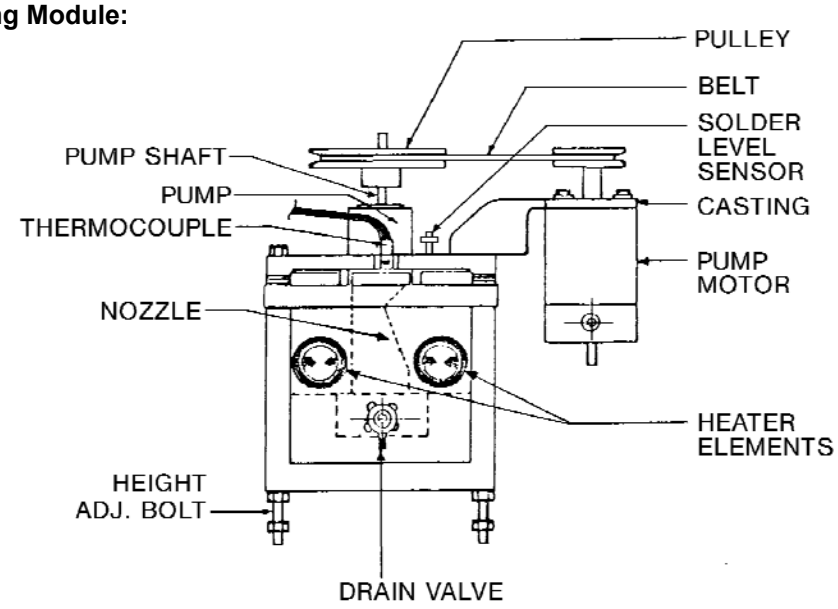



**FIGURE 8 SOLDER POT**

Solder pot temperature may be adjusted to suit composition of solder used. Typical setting for Sn63/Pb37 solder is 480-500°F (250-260°C).

The solder module consists of 1) solder pot, 2) solder pump, 3) nozzle, 4) motor, 5) thermocouple, 6) heaters, 7) level sensor (Figure 8)

The machine contains a safety feature which disables pump operation until well after the solder is molten.

**C A U T I O N !**

**Do not switch on heaters without solder in the pot or the heaters and solder pot will be damaged.**

### 2.6.1 Initial Filling of Solder:

High purity virgin solder is recommended for good solderability. During initial solder charge, small solder chunks should be used to line the bottom and sides of pot as well as heater pipes to avoid burn-out of elements. Larger solder bars or sticks may then be added to speed up loading.

The heater elements are located inside the parallel pipes in the solder pot. Ensure that the solder is nicely packed around these pipes.

When the solder melts, the level of solder should be about 1.5 in. (40 mm) from the top edge of the solder pot. Add more solder to raise the solder level to about 3/8 in. (10 mm) from the top edge of the sol- der pot. When solder falls below recommended level, the operator is notified by the low solder level alarm on the control.

### 2.6.2 Maintenance:

#### 2.6.2.1 Replacing solder heater elements:

**C A U T I O N !**

**Before replacing heater elements, power must be turned OFF.**

The heaters are cartridge type and can be replaced even when the solder is solid.

Remove the cover located on the rear side of the solder pot. Disconnect the terminal wires and pull out the cartridge. Replace the new cartridge heater, reconnect wires, and replace cover.

#### 2.6.2.2 Solder Surface:

As a natural result of oxidation, a film of oxide (dross) will appear on the surface of the solder. The oxide film protects and inhibits further oxidation of the solder. But the accumulation of too much dross is not desirable.

Remove this dross daily using a stainless steel spoon or ladle. After removing the dross, restore solder to correct level by adding solder bars to the pot.

#### 2.6.2.3 Solder Quality:

In time the solder may become contaminated. Check the solder annually or more frequently if necessary. A small sample may be sent to your local solder supplier or to a qualified lab for analysis.

To remove copper contamination from solder, set the solder pot temperature to 369°F (187°C) and keep it ON for 8 hours. Excess copper-rich solder can be skimmed off from the top of the solder. For better results repeat this procedure 2-3 times. Note: This procedure applies only to eutectic tin/lead alloy (Sn63/Pb37).

## 2.7 Exhaust:

Exhaust header is located at the solder module end of the machine. A duct (with a fan) attached to the header evacuates fumes from the machine.

## 2.8 Computer Controller:

The microprocessor based controller display has the following capabilities:

a. 9 programs (menus) of parameter setting storage.
b. Automatic operation of fluxer and solder wave(s).
c. Data on-line and off-line for SPC logging and reporting.
d. RS232 interface to log data on a PC or generate printouts.
e. Display and log machine self-diagnostics faults.
f. Auto calibration from front end.

The machine may be run in auto mode or manual mode. The controller sets all machine parameters in both modes.

When in auto mode, the machine will be controlled to the parameters for the selected program. In auto mode the flux and wave interval features are enabled. For example: The flux pump and solder pump is ON automatically for a predetermined time (depending on the conveyor speed and pallet length).

### 2.8.1 Front Panel

The keys: There are five keys on the controller.

[ F ] Function key changes the status of the machine. By pressing this key you can toggle the machine to RUN mode or EDIT mode.

In EDIT mode parameters can be changed as required. In RUN mode, the machine is ready for use per the pre-set parameters.

[ ▲ ] The cursor key controls the cursor movement. Pressing it will move the cursor to the digit you want to edit.

If the key is pressed for more than 1 second, the cursor will keep moving until the key is released.

[ ▲ ] The increment key changes the parameter values. By pressing the key once, the digit will increase by one.

If the key is pressed for more than 1 second, the digit keeps incrementing until the key is released.

[ ↵ ] This is the ENTER key. When you are satisfied with the value of the parameter or ON/OFF status in the edit mode, press [ ↵ ]. This will save the settings and automatically go to the next parameter.

[ I / 0 ] This key halts the machine.

### 2.8.2 Display:

The display consist of a 40 x 2 character LCD module and 4 LEDs. The LCD module displays the machine status in two lines. The upper line displays set values of the parameters. The lower line displays the current status or actual value of the parameter. The display can also indicate the status of the self- diagnostics fault monitoring system.

### 2.8.3 LEDs:

**AUTO** This LED will light when the machine is switched into auto mode. $N_2$ PURGE This LED will light when $N_2$ temp. reaches preset.

**ONLINE** This LED lights when SPC data is being printed.

**ALARM** When the self-diagnostics system monitors a fault in the machine, this LED will light and the buzzer will sound to signal the operator. Press the [F] key to display the nature of the fault.

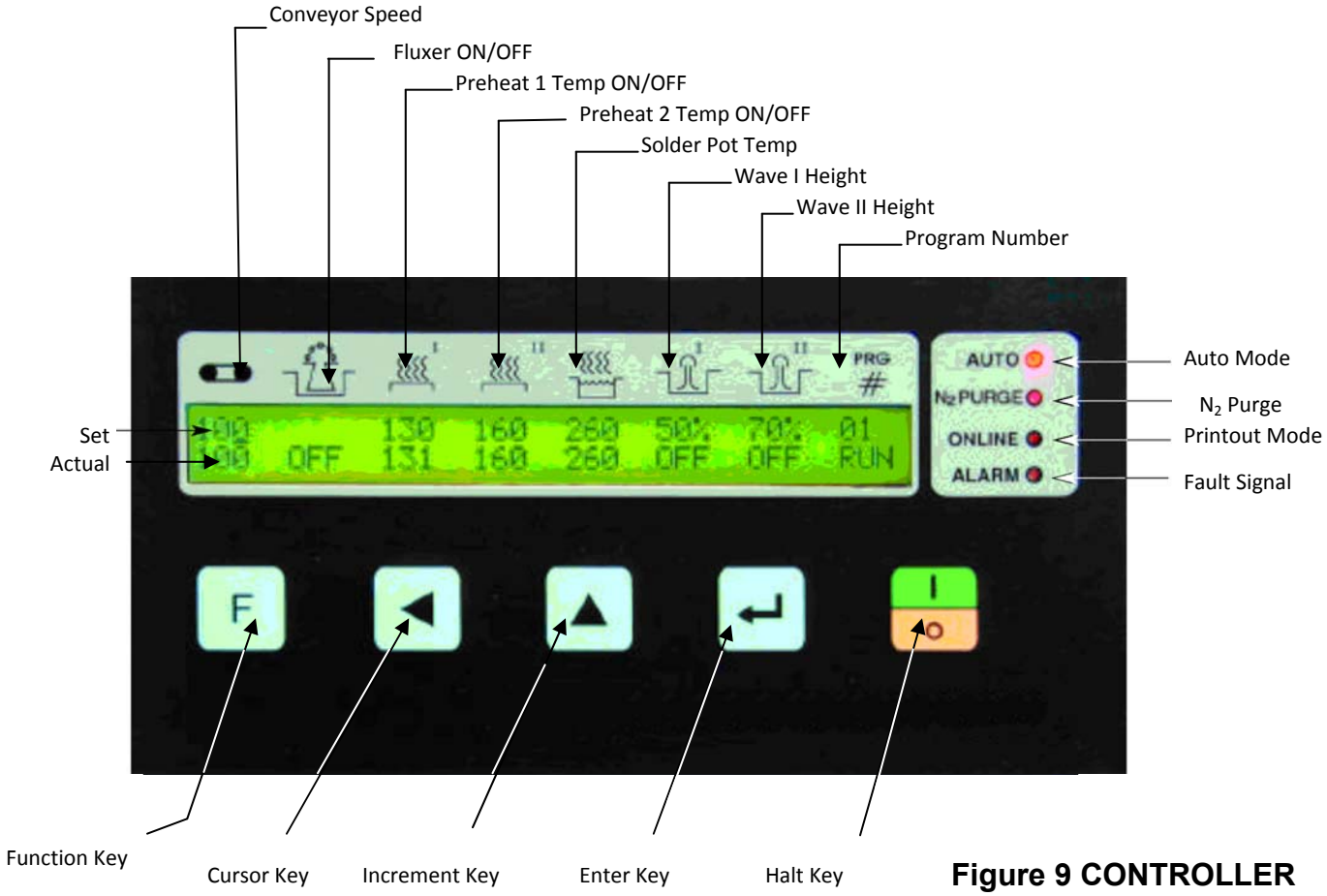
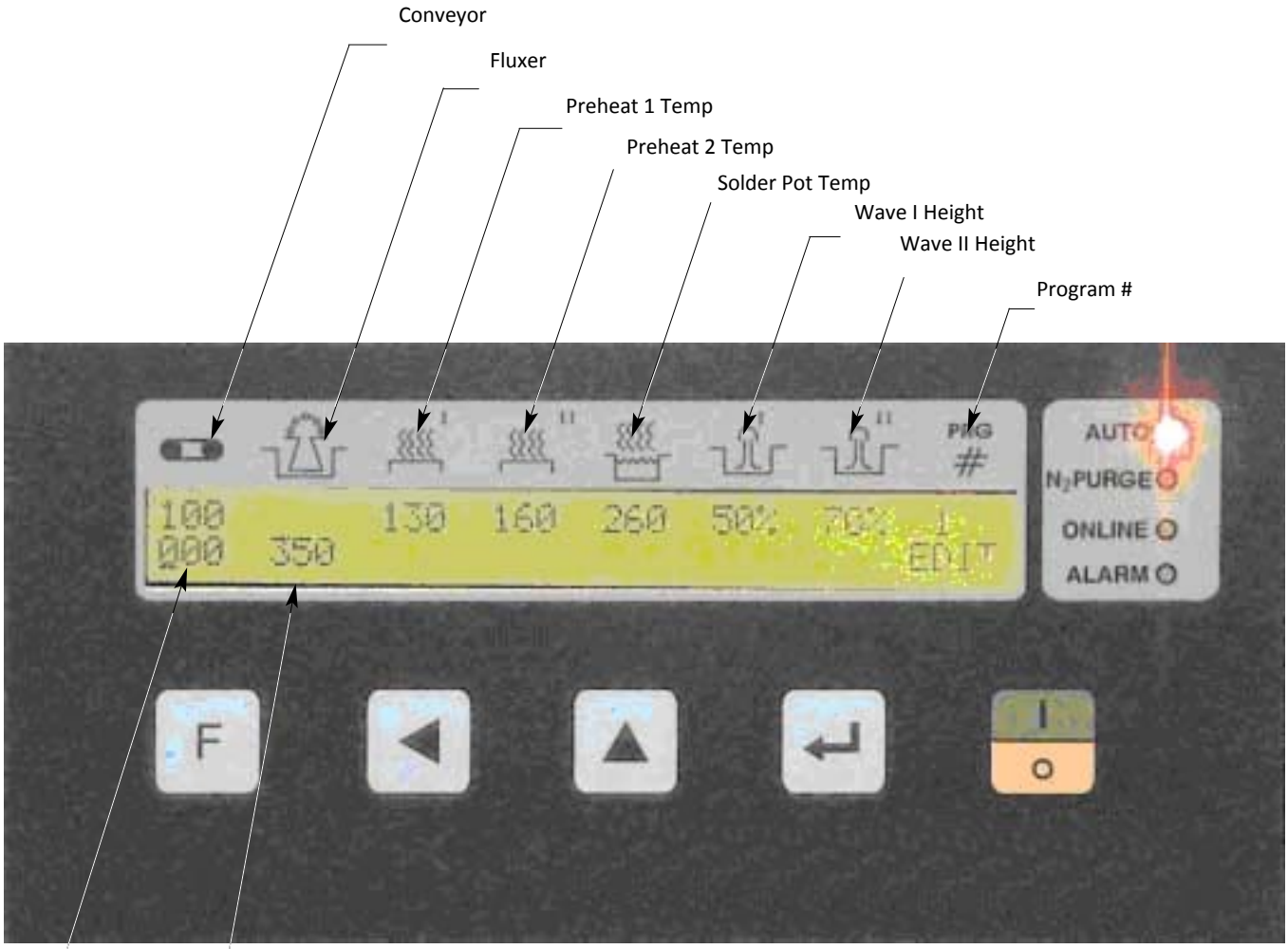



**Figure 9 CONTROLLER**

### 2.8.4 Operation:

When the machine is turned ON, the display will momentarily show the cursor in the left hand corner and a program code in the middle.

The program last run by the machine will then be displayed. The machine is now in RUN mode and will operate according to the parameters set in this program.




**Edit Mode**

### 2.8.5 Changing Programs

To change to a different program, press [ F ], Prg/EDIT will be displayed, press [ ▲ ] to change the program #, then press [ F ] to switch the machine into the RUN mode.

### 2.8.6 Editing Parameters

a. Press [ F ], the screen will display the Prg #/EDIT. The machine is now in EDIT mode.
b. Press [ ↵ ], the cursor will move to the conveyor speed setting. Change the value of the first digit by pressing [▲]. To shift to the next digit press [◀]. When satisfied, press [ ↵ ] to store the changes. The cursor shifts to next parameter. Make changes by using the [▲] and [◀] keys. When satisfied with the entire menu, press [ F ] to switch the machine to RUN mode.

### 2.8.7 Changing Manual/Auto Mode

For convenience, it is sometimes desirable to switch the machine to manual mode. For example, when you want to make trial runs for a certain board type or to do some troubleshooting work.

Press [ F ]. Prg #/EDIT will be displayed. Change to Prg # 0. The AUTO LED will turn OFF. The machine is now in the manual mode. You can now change the parameters and have trial runs of the machine. When satisfied, document the settings and manually store. Refer to “Changing Programs” and “Editing Parameters” to input the new settings.

### 2.8.8 Turning Individual Parameters ON and OFF

Go to Prg # 0 and press [ ↵ ], the cursor will be on the status line (lower line of the display). Press [ ▲ ] to toggle the parameter ON or OFF. Press [ ↵ ] to go to next parameter.

### 2.8.9 On-Line Printing

Connect a serial printer with the suitable cable to the “D” type connector. (Refer to wiring diagram for pin connections of the “D” type connector.) Press [◀] key when machine is in “RUN” mode for ON Line printing. Now, whenever a board enters the machine, all actual parameter data will be printed.

### 2.8.10 Calibrating the Machine

To calibrate the machine, when machine is in “RUN” mode, press [ ▲ ] [ ◀ ] and [ ↵ ] keys in that order. Remove the thermocouple sensor wire No. 9 and No. 10 from the connector (Refer to wiring diagram). Connect a milivolt source in place of the thermocouple. The display will read as follows:

| Min. | Max. | Ambient Temp. | Baud Rate | Model |
|---|---|---|---|---|
| 1.953 MV | 19.53MV | | | |
| 0000 | 1008 | 25 | 9600 | 7pb |

Set the MVs on the source as shown on the display. For example: 1.953, Press [ ↵ ]. Cursor goes to next max. settings.

Set 19.53 on the source and press [ ↵ ]. The cursor moves to Amb. Temp. Read on a good and reliable thermometer the ambient temperature and set that temperature on the display by using [ ▲ ] and [ ◀ ]. Press [ ↵ ] when set.

Baud rate and Model Type is factory set; user cannot change these settings. Turn the machine OFF.

**Note:** If you forget to turn OFF the machine after calibration, the machine will run with old calibrated values. Always turn the machine OFF after the calibration is done.

### 2.8.11 Set the Nitrogen Temperature

Nitrogen flow is initiated at a preset temp. To reset this temperature run the machine in Manual mode to Prg # 0. Press [ ◀ ] [ ▲ ] and [ ↵ ] keys in that order.

The display will show:

| Set up mode<br>Nitrogen Temp. 180 |
|---|

Change the temperature by using [ ◀ ] [ ▲ ] keys. Press [ ↵ ] when satisfied. Press [ F ], alarm will sound. Turn machine power OFF and restart. The recommended temp setting is slightly below the melting point of the alloy to be used. The $N_2$ purge LED will turn ON when the temp reaches this preset.

### 2.8.12 Alarm Condition

Whenever self-diagnostics systems monitors a fault in the machine, the alarm LED will light and a buzzer will sound to alert the operator. Press the [ F ] key. The nature of the fault will be displayed.

If more than one fault occurred, pressing [ ↵ ] will show the next fault. If no other fault exists, pressing[ ↵ ] will switch the machine into EDIT mode.

### 2.8.13 Emergency Stop

In case of emergency, the machine can be stopped by pressing the red “Emergency STOP” button located at the right end of the machine.

**2.8.14** Maintenance of the Controller:

Except for normal cleaning, there is no maintenance required for the controller.

# 3.0 TROUBLESHOOTING SOLDERABILITY

## 3.1 Common Defects and Causes

If all variables and parameters which lead to good solderability are not properly controlled, some typical defects will occur. The description and causes of some common defects are listed below.

**a. Poor Wetting:**

Wetting is the primary factor in achieving good solder joints. A condition when the surfaces to be joined are only partially covered with molten solder, leaving areas of unwetted surfaces, behind is called non-wetting or poor wetting. It shows up as pin holes and areas of bare copper or insufficient solder on the surface of the parts to be soldered. There is virtually no adherence of the solder.

**b. De-wetting:**

This condition is similar to poor wetting. It differs in that the areas to which the solder does not adhere results from the solder pulling back from the surfaces prior to solidifying.

**c. Disturbed Joint:**

When components move in relation to PCB during the solidification stage disturbed joints are formed.

**d. Excess Solder:**

This condition occurs when too much solder remains on the joint. Excess solder joints have solder fillets which appear round and fat.

**e. Icicling:**

Icicling is excess solder that solidifies during the peel-back stage. An icicle has a fillet shape that appears conical and ends in a sharp point.

**f. Solder Webbing:**

When solder adheres to the solder mask between the metallization, it is called solder webbing. The surface leaves thin lines of solder which form a pattern resembling a net or web.

**g. Pinholes and Blowholes:**

Small holes are seen on the solder fillet. The bigger ones are called blow holes and the smaller ones pinholes. A pinhole often conceals a much larger internal cavity.

**h. Bridging:**

Bridging occurs when excess solder shorts two adjacent pads, conductors or leads.

## 3.2 Causes and remedies for solderability defects described above:

### 3.2.1 Poor Wetting

| Cause | Remedy |
|---|---|
| • Organic contamination of the (oil, surface grease, paint, etc.) | Remove such contamination with suitable solvent and/or abrasive. |
| • Heavy tarnishes that cannot be removed by flux | Clean board and components prior to assembly. |
| • Plating done over partially contaminated surface | Clean and replace the surface. |
| • Improper Fluxing | Check flux height. Make sure that flux is being properly applied to entire area of PCB. The flux height may require adjustment. Using a hydrometer, check flux density. Correct if necessary by adding thinner. |
| • Insufficient solder temperature or wetting time | Check conveyor speed. The faster the speed, the shorter the solder wetting time and vice versa. Check the temperature of the solder. Usually, it should be 110°C-140°F (60-80°C) above the melting point of the solder. |
| • Areas of the PCB do not fully contact flux and/or solder | Check that pallet is properly seated in conveyor and that PCB is properly seated in fingers. Check flux or solder height. Adjust solder/flux heights or level solder pot/fluxer as necessary. |

### 3.2.2 De-Wetting:

Since this condition is similar to poor wetting, the same cause and remedy as above apply to this defect.

### 3.2.3 Disturbed Joints:

| Cause | Remedy |
|---|---|
| • Jarring of the PCB after soldering | Check the guide pins on the pallet. See if there is any obstruction in the conveyor or conveyor extensions. Check PCB solder side for protrusions or excessive lead length. Trim if necessary. |

### 3.2.4 Excess Solder:

| Cause | Remedy |
|---|---|
| • Insufficient solder dwell time and/or temperature | Increase solder temperature and/or reduce conveyor speed |
| • Insufficient preheating | Raise temperature of preheated board by reducing spee of the conveyor or increasing preheat temperature |
| • Low flux density | Increase density of flux. Increasing the density of the flux will increase the propensity of the solder to drain off (peel back). |

### 3.2.5 Icicling:

| Cause | Remedy |
|---|---|
| • Poor solderability of the PCB component leads | Clean PCB and/or leads and/or use a more active flux |
| • Low solder temperature | Increase solder temperature |
| • Incorrect conveyor speed | Adjust conveyor speed accordingly. |
| • Large empty holes or metallization on PCB | Apply peelable mask to these areas prior to soldering or remove such icicles with a soldering iron |

| | |
|---|---|
| • Excessive lead length | Longer lead protrusions increase propensity for icicling. Trim leads accordingly. |

### 3.2.6 Solder Webbing:

| Cause | Remedy |
|---|---|
| • Material used for coating PCB is not compatible with flux | Change flux or coating. Try uncoating board to confirm the cause. |
| • Solder dross comes in contact with PCB | Clean surface of molten solder. See that the dross does not come through the nozzle. Check the height of the molten solder and add if necessary. |

### 3.2.7 Pinholes and Blowholes:

| Cause | Remedy |
|---|---|
| • Flux does not dry before the PCB enters the solder wave | Check that excess flux is not applied to the PCB. Adjust the flux height if necessary. |
| • Flux is activated inadequately | Increase preheat temperature and/or reduce conveyor speed |
| • Contaminated plated through hole (PTH) or metallization or lead | Clean surfaces using appropriate solvent and/or abrasive |

### 3.2.8 Bridging:

| Cause | Remedy |
|---|---|
| • Poor design of layout of the PCB | To correct the layout, consult a designer familiar with manufacturability of PCBs |

| | |
|---|---|
| • Contaminated solder and dross | Clean and de-dross the solder. Send solder sample to qualified lab for analysis |
| • Excessive lead length | Longer lead protrusions increase propensity for bridging. Trim leads accordingly |

## 4.0 TROUBLESHOOTING MACHINE OPERATION

### 4.1 Conveyor

| Failure | Corrective Measures |
|---|---|
| Conveyor not moving | Check voltage at motor terminals. Check for jam in chain. Check for foreign objects, such as solder droppings on chain. Chain may need lubrication. Check tension on chain. |

### 4.2 Fluxer

| Failure | Corrective Measures |
|---|---|
| Insufficient foaming or no foam | Check that you are using a foaming flux. Check the flux density. Air valve may be closed. Check air passage from the com- pressor. If air valve is closed, open it. If the tube is leaky, change it. Immerse flux stone in water and blow air to check for leakage. Immerse flux stone in appropriate thinner for approximately 8 hours to remove dried flux. Replace stone if necessary. Check voltage to air compressor. If voltage is correct, replace air compressor. |

### 4.3 Preheater

| Failure | Corrective Measures |
|---|---|
| Preheater not getting hot or getting too hot | Circuit beaker tripped or solid state relay (SSR) fused or shorted. Preheat thermocouple open or short. Defective heater element. Turn on tripped circuit breaker. Change solid state relay. Check preheater thermo- couple. Change if short or open. Replace heater element if burned. |

### 4.4 Solder Module

| Failure | Corrective Measures |
|---|---|
| Solder does not melt | Check the circuit breaker, solid state relays and heaters. If the circuit breaker is tripped, turn it on. If the SSR is fused, replace it. If the heater is burned, replace it. |
| Solder takes too long to melt | Check heater elements. Replace defective one. |
| Pre-set temperature is notachieved | Check heater elements, replace defective one. |
| No solder wave | If solder is molten and has reached the preset temperature, then check the solder pump and motor. |
| Solder motor not running | Check voltage to the motor. Check the relevant SSR and circuit breaker. Replace the SSR and/or turn on the circuit breaker, if tripped.<br><br>Check belt tension. Reduce belt tension if too tight.<br><br>If motor is running with no solder wave then motor pulley or pump pulley may be loose. Tighten set screw. |
| Impeller escaped from shaft | Remove the pump and reinstall impeller. pump |
| Low solder wave | Check solder level. Check for clogged pump impeller fins. Dross or any other foreign objects such as components may have fallen in solder. Remove pump and clean the impeller fins. Check belt tension and increase if too slack. |

## 5.0 Spare Parts for Spartan Wave Solder Machines

| PART# | |
|---|---|
| | **PALLET:** |
| S-1060-1 | Pallet for Spartan 8S, or 8D [w/ 20 clips per path] |
| S-1060-2 | Pallet for Spartan 12, 12S or 12D [w/ 20 clips per path] |
| S-1061-1 | Path for Spartan 8S or 8D [w/ 10 clips per path] |
| S-1061-2 | Path for Spartan 12, 12S or 12D [w/ 10 clips per path] |
| S-1062-3 | Path thumbscrews |
| S-1065-1 | Pallet roller |
| S-1065-2 | Pallet roller spacer |
| S-1064 | Titanium Clips for Pallets above |
| | **CONVEYOR:** |
| S-1040 | Conveyor Motor |
| S-1002 | Conveyor power supply board |
| S-1009 | Conveyor Speed Sensor |
| | **SOLDER POT:** |
| S-1032 | Solder Pot Element 8S |
| S-1033 | Solder Pot Element 8D |
| S-1034 | Solder Pot Element 12S |
| S-1035 | Solder Pot Element 12D |
| S-1031 | Solder Pump Motor |
| S-1029 | Solder Pump motor brushes |
| S-1016 | Solder Pump assembly 8S |
| S-1019 | Solder Pump assembly 12S |
| S-1021 | Solder pump bearing (2 required) |
| S-1024-21<br>SW-1011-2 | S-1024-21 Solder pump V-Belt<br>SW-1011-2 Temperature Sensor |
| | **PREHEATER: 1** |
| S-1036 | Preheat #1 Element 8S/8D |
| S-1037 | Preheat #1 Element 12S/12D |
| SW-1011-2 | Temperature Sensor |

**PART#**

**PREHEATER: 2**

| | |
|---|---|
| SW-1031 | Preheat #2 PB Convection heating Element |
| S-1012 | PB Preheat Motor |
| SW-1011-2 | Temperature Sensor |

**FLUXER:**

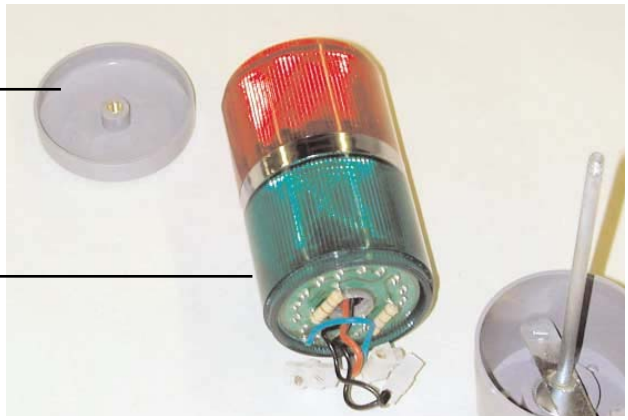
| | |
|---|---|
| SW-1032-1 | Flux Stone for Spartan 8S or 8D |
| SW-1032-2 | Flux Stone for Spartan 12, 12S or 12D |
| SW-1025 | 90 Deg. Barb fitting |
| A-0190-06 | Flux Air Pump |
| SW-1060 | Flux Drain valve |

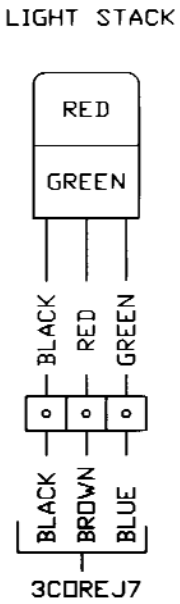
**CONTROLS:**

| | |
|---|---|
| A-0222-31 | Solid State Relay |
| S-1001 | Microprocessor Board (controller) |
| SW-1010 | Solder Pump Speed Control Board [solder pump motor DC] |
| S-1004 | Display and Keypad |
| S-1006 | Wave Interval Sensor |

# STATUS LIGHT TOWER INSTALLATION

1. Unscrew cap
2. Remove base
3. Screw base onto machine **(BEFORE CONNECTING WIRES)**
4. Feed wires up through base
5. Make wire connections (see diagram below)
6. Install light(s) on base
7. Install cap

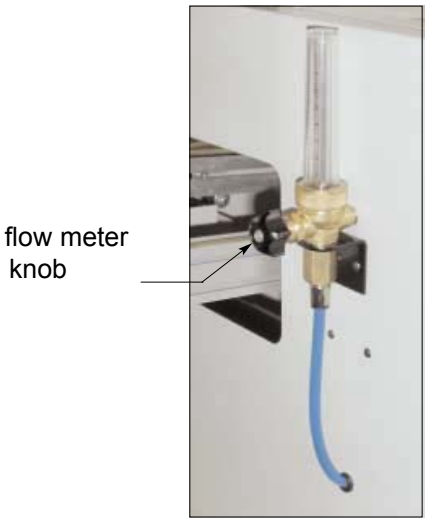


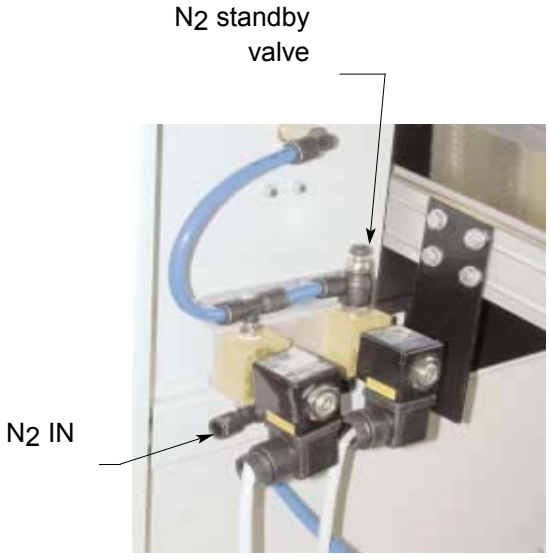



## For S8, S12 with Nitrogen Option

### Adjusting Nitrogen Flow

1. Supply nitrogen at 60 psi (4 bars)
2. Machine must be heated up to soldering temperature (machine must be in AUTO Mode)
3. Close $N_2$ standby valve completely by turning standby valve clockwise
4. Open flow meter valve fully by turning flow meter knob counterclockwise
5. Adjust $N_2$ standby valve by turning screwdriver counterclockwise until desired $N_2$ standby rate appears on flow meter
6. Insert pallet on conveyor and when solder pump automatically comes on, adjust flow meter valve to desired soldering $N_2$ rate.



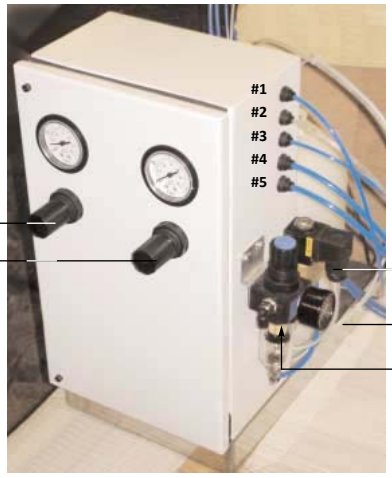
# Operation of the Spray Fluxer Option

Spartan Spray Fluxer

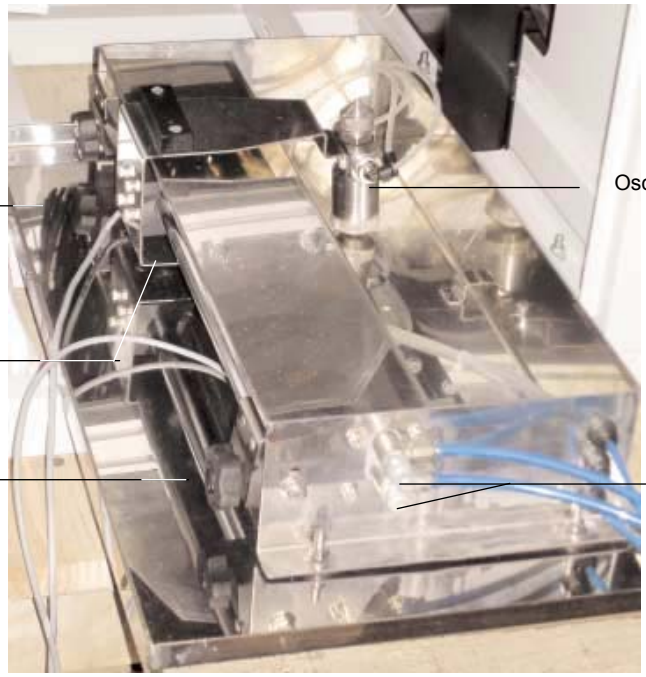
1. When the Limit Switch senses the pallet, the spray fluxer is activated. Oscillation limit switches control the oscillation width. At the same time the spray pump is activated and starts pumping the flux. The blocking solenoid in the nozzle is also activated simultaneously and the blocking needle is deac- tivated, starting the flux spraying. After the pallet passes through, the fluxer automatically stops and waits for the next pallet. The oscillation speed can be controlled by the Flow Control Valve mounted on the rod less cylinder.
2. There are 2 pressure regulators, R1 and R2. The R1 regulator is used for the amount of flux sprayed, and R2 is used for air atomization.
3. The main FR (Filter and Regulator) unit is mounted outside the machine on the entry side. Set this to approx. 42 psi.
4. For controlling the stroke width there are 2 Stroke Width Knobs on square blocks mounted to the Flux Reservoir. By loosening the knobs you can adjust the width that the flux nozzle travels back and forth.
5. The air pressure on the Air Regulators and the FR unit should be kept as below:

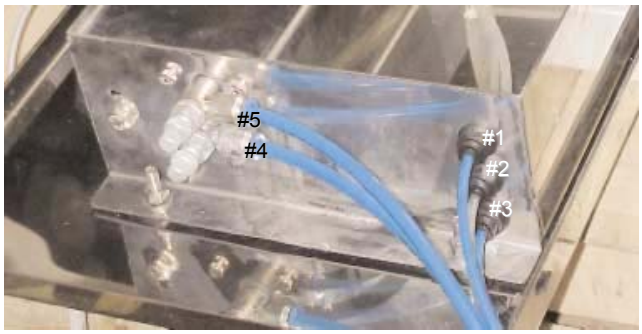
   R1 - approximately 14 psi
   R2 - approximately 28 psi
   FR unit - approximately 42 psi

6. When the flux level is low, an alarm is sounded. Refill flux tank. At the top of the tank is the Flux Low Alarm Wire.

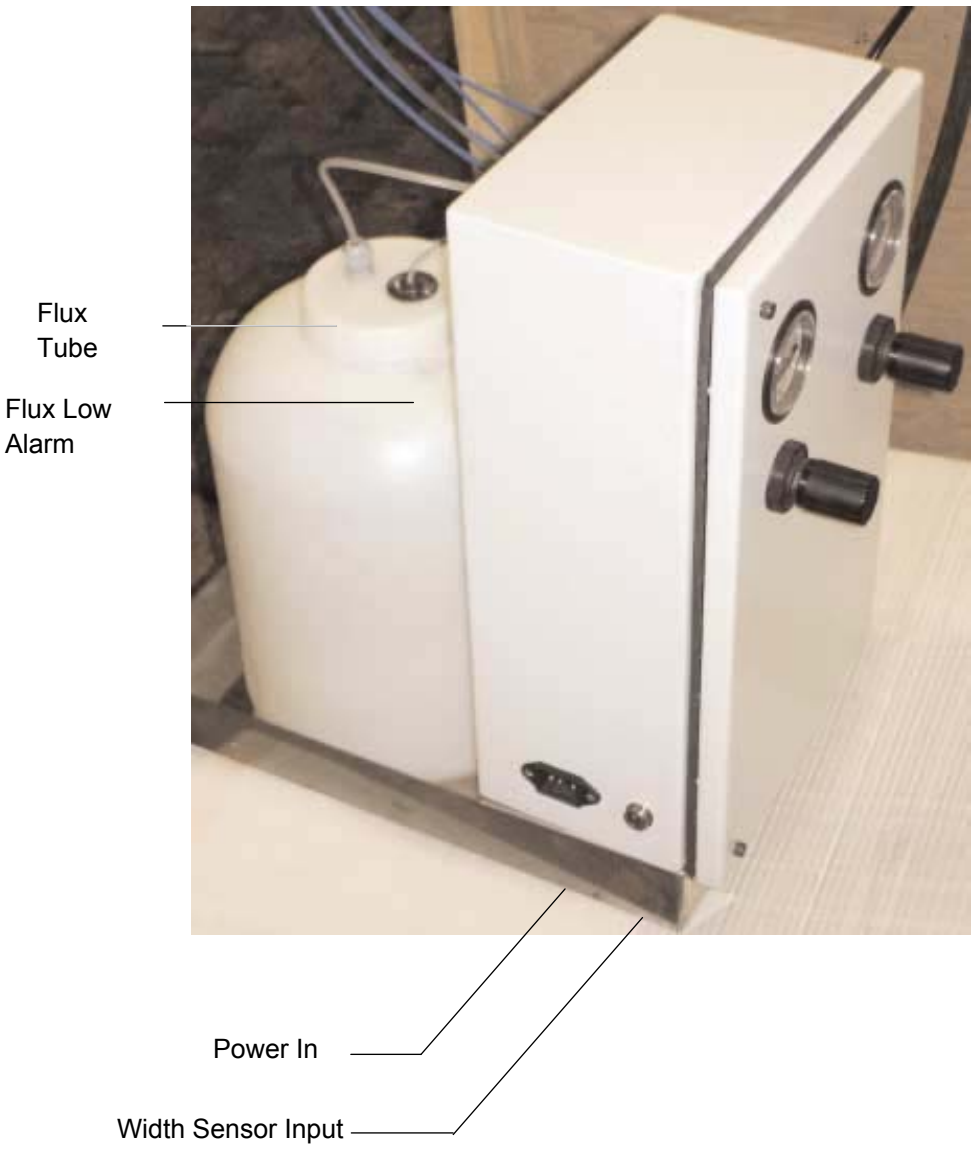


Stroke Width Adjustment Knob



## SPARTAN SPRAY FLUXER



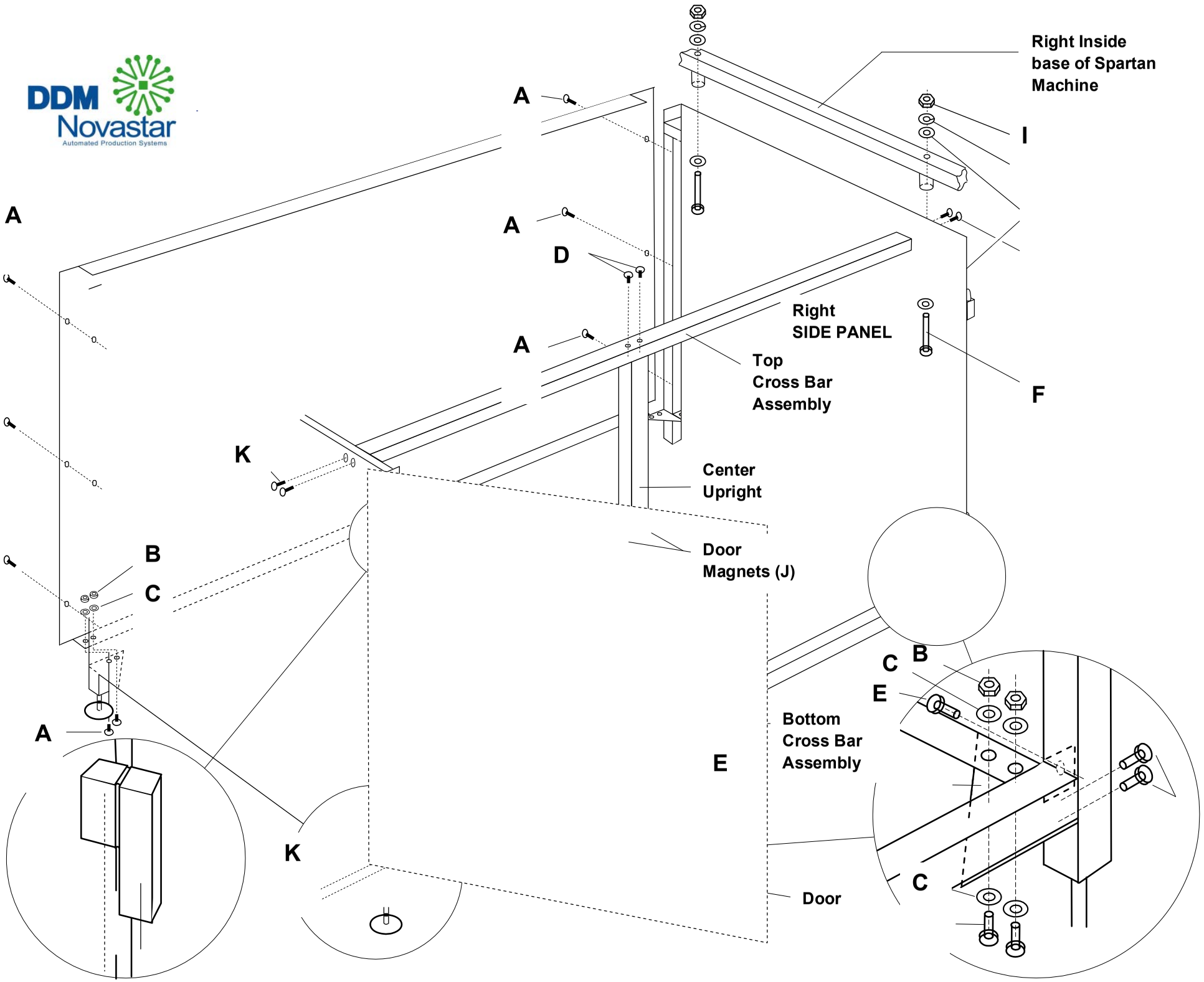
# SPARTAN 8 OR 12 STAND ASSEMBLY INSTRUCTIONS

Refer to Line Illustration for each step

1. Remove 3 screws (A) from the back of each side panel
2. Attach back panel to side panels using those same screws (A)
3. Attach gussets to bottom back panel using screws and nuts (A,B, & C)
4. Attach top front crossbar to side panels using SHCSs (K).
5. Attach bottom crossbar to side panels using SHCSs (K).
6. Attach center upright to top and bottom crossbars (D) SHCSs
7. Remove rear panel of benchtop wave solder machine before attempting to maneuver onto stand.
8. Lift benchtop machine on to frame. Use lift if possible.
   **CAUTION:** Do not try to lift and position rear of machine with fingers underneath, grab support inside rear of machine.
9. Mount (4) SHCSs (F) from under top inside of base through spacer stand-offs attached under machine.
10. Hang doors by lining up both hinges as shown in illustration and attach (doors will swing freely and stop at magnets on upright bar). Use leveling feet to align doors.

HARDWARE

| # | QTY. | Description |
|---|---|---|
| A. | 16 | 10-32 x 3/8" Phillips Head Screws |
| B. | 18 | 10-32 Nuts |
| C. | 18 | Star Washers |
| D. | 8 | 10-32 x 3/4" Socket Head Cap Screws (SHCS) |
| E. | 4 | 1/4-20 1/2" SHCSs |
| F | 4 | 5/16-18 x 3-1/2" SHCSs |
| G | 8 | 5/16" Washers |
| H | 4 | 5/16" Lock Washers |
| I | 4 | 5/16" Nuts |
| J | 2 | Door Magnet Assembles |
| K | 8 | 10-32 x 1-1/8" SHCS |


DDM Novastar
Automated Production Systems
Right Inside base of Spartan Machine
I
A
A
A
A
D
Right SIDE PANEL
Top Cross Bar Assembly
F
K
Center Upright
Door Magnets (J)
B
C
A
K
E
Bottom Cross Bar Assembly
C
B
E
C
Door