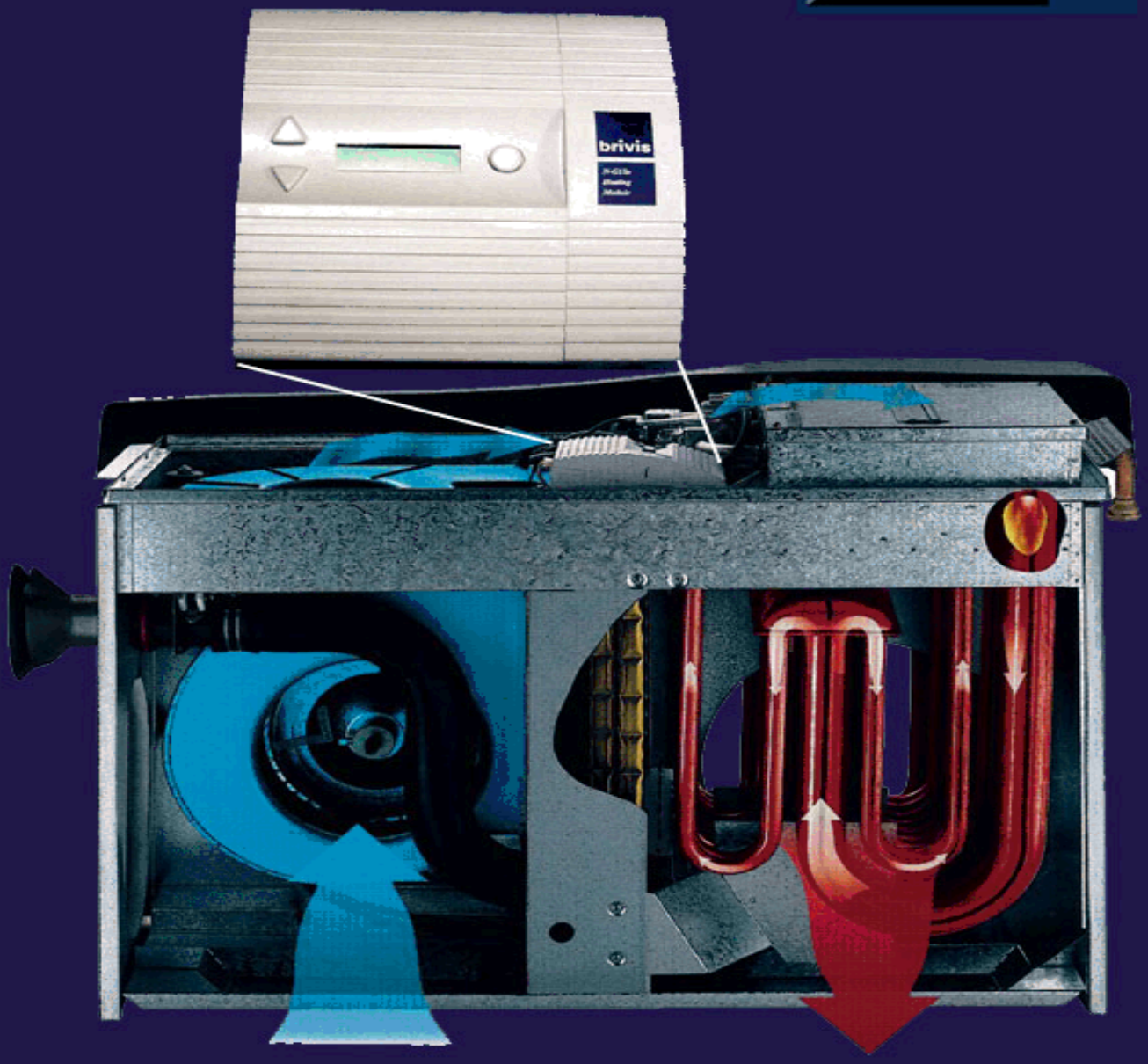
Brivis Service Manual

MPS & Auto EMS
Vol 1 of 2



Servicing shall be carried out only by Authorized Personnel.
This Service Manual must NOT be left with the Owner.

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Introduction

Brivis Multiplex & Auto EMS Units

The Brivis Multiplex (MPS) series ducted central heater is made up of a range of High and Mid efficiency, internal and external models for use on Natural, and LPG (propane) gases.

Multiplex series units are force draught combustion, direct ignition units, and use a new design heat exchanger/s.
Both High and Mid efficiency models have an aluminised steel tubular primary heat exchanger, and on the high efficiency models this is combined with a new tubular stainless steel secondary heat exchanger.

The **MPS** unit's gas valve features the latest technology in modulating gas valves, regulated by the combustion fan air pressure. This provides a unique variable output which is controlled by the outlet temperature sensor (thermistor), installed in the supply air duct.

Auto EMS series units are, the same proven traditional natural draught flue Buffalo and Wombat EMS models, with intermittent Hot Surface Pilot, but have been upgraded with the same new N-G1/lo Module used on the MPS heaters, and have an in built supply air thermistor.

The Auto EMS models also have a new modulating gas valve which is varied by the current output from the N-G1/lo Module.

In both models the main circulating fan incorporates a new speed sensor. The fan is powered to the set speed, which provides a heat output from the unit that adapts to a wide range of changing requirements, and operating conditions.

The new electronics give Brivis MPS & Auto EMS units even greater system control, over the heating cycle fan ON and OFF operation.
The speed of the fan ramps up or down according to the units output temperature.

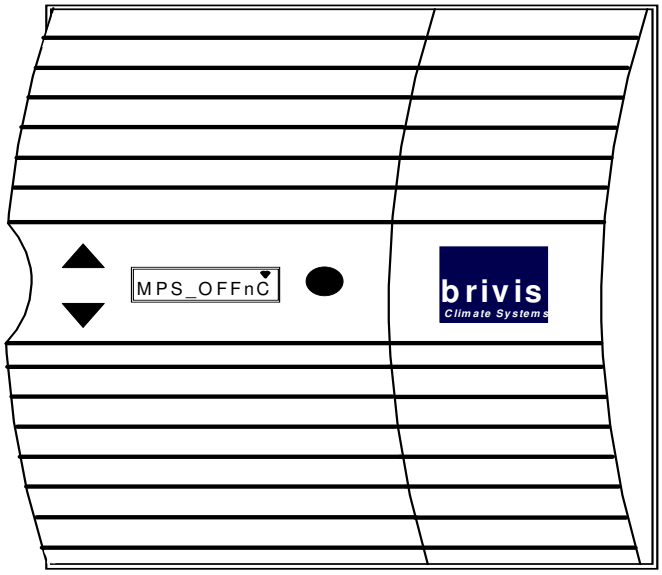
The units outlet temperature is also controlled within a specific range, and combined with the fan output control, the new electronic system automatically adjusts the heater to the duct system variations.

Introduction (cont)

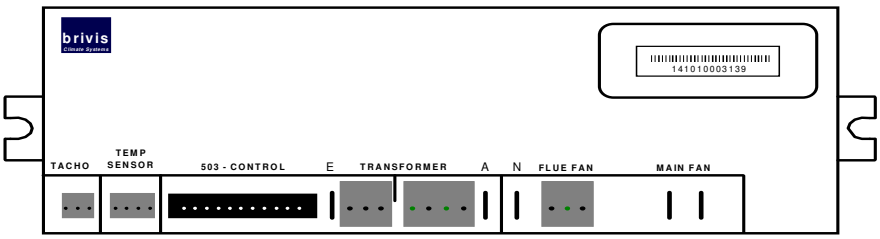
Brivis Multiplex & Auto EMS Units (cont)

The new control system is made up of 2 main modules.

The primary **Electronic Control**, that resembles previously used electronic assemblies, is called the **N-G1/lo** module. It handles the low voltage circuits i.e. thermostat and gas valve, and features a Liquid Crystal Display and 3 set-up/reset buttons.
The LCD displays each stage of the heaters operation function. It also indicates abnormal conditions or malfunctions which are current or have affected the unit.



The second control is a **Power Output PCB** called the **N-G1/hi** module. It handles all the 240 Volt power switching on the supply power, main fan, combustion fan and transformer, as well as providing terminal points and outputs for the speed sensor, thermistor and N-G1/lo.



The N-G1/lo Installation and Set-Up Instructions

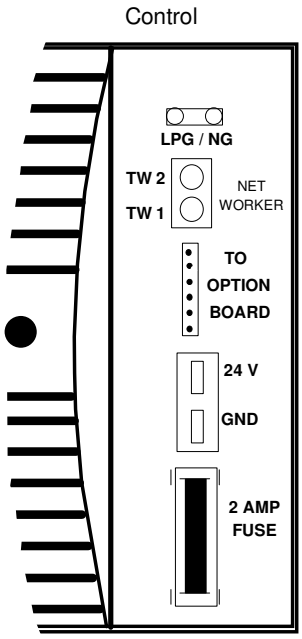
The N-G1/lo module not only operates both MPS and Auto EMS models, it now recognises the model (EMS modulating solenoid head) connected, and operates the control functions accordingly.

Service technicians will however, need to configure the N-G1/lo module to the appropriate gas type whenever they install a replacement module.

A bridge link terminal is used for the selection between Natural Gas and LPG models.

A 24 Volt (+) and GND (-) output is provided, as well as pin plug connection, to facilitate the optional Network 506 zoning and add on cooling module.

Lift the heating module cover on the right side of the module, to access the terminals and fuse as shown below.



- **The bridge wire link at the top terminal configures the control for Natural Gas or LPG gas operation**
- **Bridge removed = Natural Gas**
- **Bridge Intact = LPG**
- **The terminal block marked TW1 & TW2 are the terminals to connect the Networker to the N-G1/lo.**
- **The Option Board terminal is used to connect the Brivis Network 506 for heat/refrig zone damper relay, add-on Cooling, Electronic Air Filter and Humidifier operation.**
- **A 24 Volt (max. 0.3 Amp.) output circuit used for Network 506 refrig relay power supply, between terminals 24 V & GND.**
- **2 Amp fuse (low voltage circuit protection).**

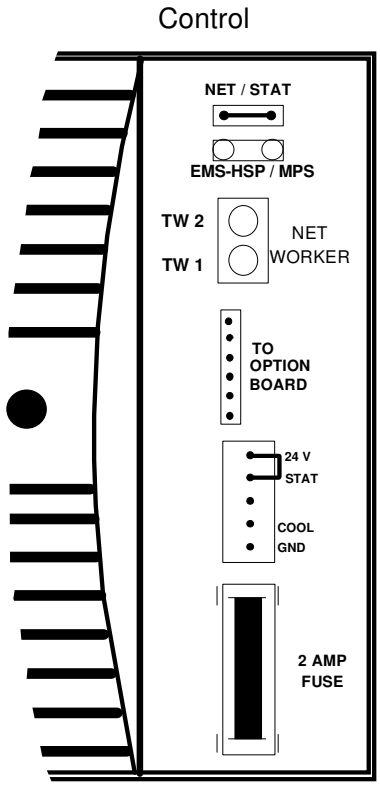
The N-G1/lo Installation and Set-Up Instructions (cont)

N-G1/lo Module - Version 1 - 7 (Pre November 1997)

The original N-G1/lo module was also capable of operating either MPS or Auto EMS (HSP) models, but required selection using a bridge link.

This version N-G1/lo was also originally designed to allow a conventional type thermostat to operate the heater (and add-on cooling), but the Networker was the only control endorsed by Brivis.

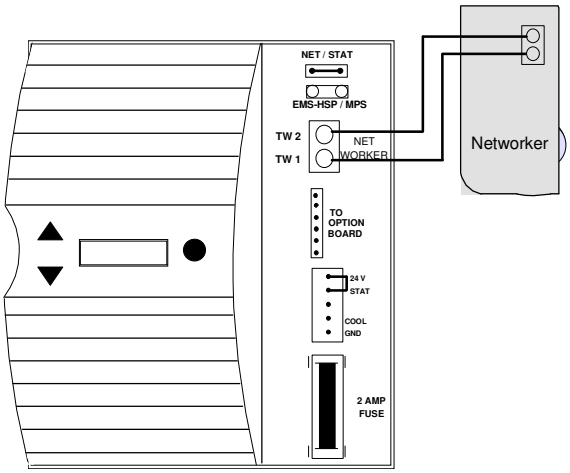
Lift the heating module cover on the right side of the module, to access the terminals and fuse.



- **The wire link at the top terminal configures the control for Networker operation. If the link is cut then the Control is permanently configured for conventional stat operation.**
- **The second terminal is a TWIN PIN contact that uses a bridge to select it's function.**
- **The wording to the LEFT is the function with the bridge in place over the 2 contact pins, and the RIGHT when the bridge is removed. EMS (HSP) model - bridge ON (second terminal).**
- **The terminal block marked TW1 & TW2 are the terminals to connect the Networker to the N-G1/lo.**
- **<u>Note:</u> A link is located at the terminals 24 V & STAT on the terminal block below and must remain intact for the Networker to operate.**
- **A 24 Volt output circuit used for Network 506 refrig relay power supply, between terminals 24 V & GND.**
- **The Option Board terminal is used to connect the Brivis Network 506 for heat/refrig zone damper relay and add-on cooling operation.**

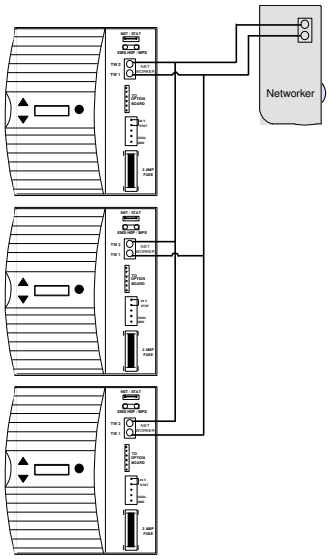
The N-G1/Io Installation and Set-Up Instructions (cont)

The wiring for a single heater on the Network is not polarity sensitive, even when there are other appliances connected i.e. Evaporative cooler.



The wiring of multiple appliances to the Networker requires each unit to be **wired in parallel** as shown in the diagram below.

When **more than one heater** is connected on the Network, then all the heaters must have the s**ame Network wiring polarity** i.e. all the TW1 terminals the same polarity, and all the TW2 terminals the same polarity.



Installer Commissioning Instructions

Start - Up & System Balance

Turn the heater ON from the Wall Control, then set the preferred fan speed, and balance the system, using the table below as a guide to the number of outlets.

System / Model	A. Minimum Floor/Ceiling	B. ** Minimum Floor/Ceiling (Adaptive Zoning Only)	C. Maximum Ceiling	D. Typical Floor
Multiplex (MPS)				
External				
HE/ME 30e	8	5	13	18
HE/ME 30e XA	8	5	14	18
HE/ME 20e	6	3	11	12
HE/ME 20e XA	6	3	12	12
Internal				
HE/ME 30i	8	5	13	18
HE/ME 30i XA	8	5	14	18
HE/ME 20i	6	3	11	12
HE/ME 20i XA	6	3	12	12
ME35i	8	5	16	23
Auto EMS				
External				
EMS 26e	8	5	11	16
EMS 26e XA	8	5	13	16
EMS 20e	5	3	8	12
EMS 20e XA	5	3	10	12
Internal				
EMS 26i	6	5	11	16
EMS 26i XA	6	5	13	16
EMS 20i	4	3	8	13
EMS 20i XA	4	3	10	13

For all systems, a minimum number of outlets must remain fully open (this includes both the outlet grille and the damper in the duct), if the heater is to operate properly without overheating. (Column A)

For systems where adaptive zoning can be activated**, the minimum number of outlets that must remain fully open can be reduced. (Column B)

****Remember, adaptive zoning cannot operate unless the zone dampers are operated from a Networker Wall Control (Version 11 N-C1 or above) using a Network 506 module, and the N-G1/Io must be Version 17 or above. If the system does not fit this description, Column B should not be used. Refer to Column A instead.**

Similarly, ceiling outlet systems have a maximum number of outlets, that can remain fully open, to ensure that the velocity through each outlet is sufficient. (Column C)

These maximum ceiling outlet figures relate to fully open outlets, however, the system will operate effectively with more outlets open, if it has been properly balanced.

There is no maximum number for floor outlets, so the chart lists the typical number of floor outlets for each heater model. (Column D)

Installer Commissioning Instructions

Fan Output & Outlet Temperature

The Brivis MPS & Auto EMS heaters allow the installer to set the appropriate fan output for the duct installation type.

The fan motor speed (RPM) is set as described below, and the N-G1/lo module will then make any necessary adjustment to gas input, if the systems outlets are varied or reduced.

If the fan speed set is sufficient for the heater to operate at full capacity, the maximum gas rate will be maintained throughout the heating cycle.

Otherwise, the gas rate will automatically adjust to a setting suitable for the system.

If the fan output is set too low, or is reduced due to insufficient outlets open etc., then the N-G1/lo module automatically reduces the gas rate by the necessary amount, to produce the correct outlet temperature.

The fan speed and airflow for floor outlet systems is normally considerably lower than for ceiling outlet systems.

Ceiling outlet systems should have the fan speed adjusted higher, **but only as much as needed to achieve sufficient outlet air velocity** for good performance.

Installer Commissioning Instructions (cont)

Installer Settings

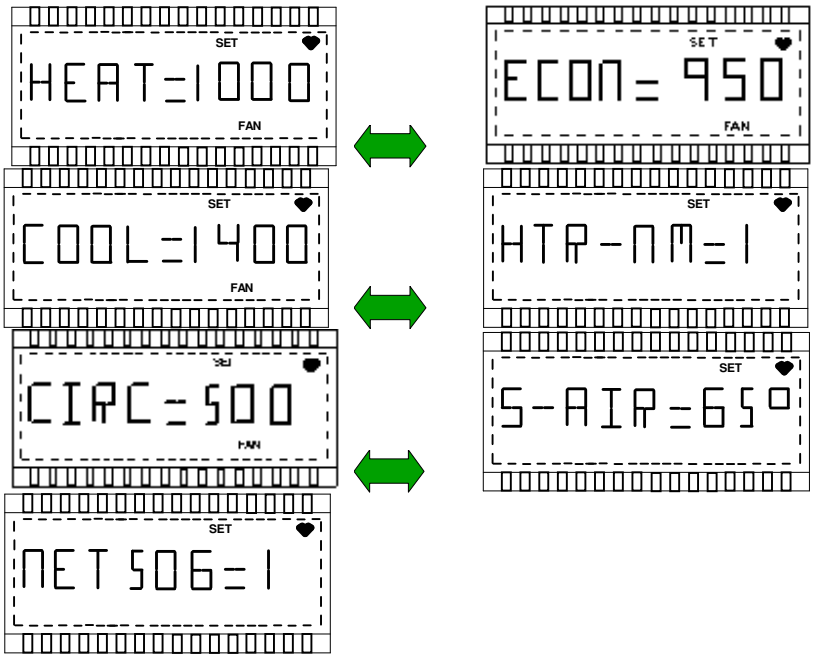
The units N-G1/lo module cover has 3 push buttons: **SET, UP & DOWN.**

Press and release quickly the **SET** (round) button, and the display will be put into the **INSTALLER SET UP** mode.

The LCD will indicate the set up mode by displaying "SET" on the top line, and the first of the fan parameters and the default settings.

The word "SET" will flash to indicate that the parameter value has been changed.

On current N-G1/Lo modules, pressing the **SET** button the display will cycle through the following installer set up parameters:



Note: The N-G1/lo module now has an additional Zoning Minimum Fan Speed selection display in the Installer Set Up Mode. (See N-G1/Lo Operation Variance notes on Adaptive Heating Zoning Fan Modulation on page 35)

The **UP** and **DOWN** buttons are used to increase or decrease the value on any setting displayed.

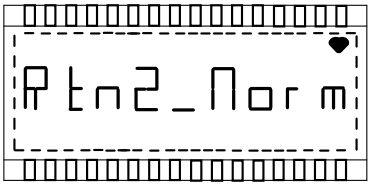
The Installer Set Up Display will revert back to normal, by leaving the control buttons untouched for 20 seconds, and **all changes will be automatically saved.**

Installer Commissioning Instructions (cont)

Installer Settings (cont)

Alternatively, to bypass this 20 second return delay, or to show additional confirmation on saving, any changes can be done as follows:

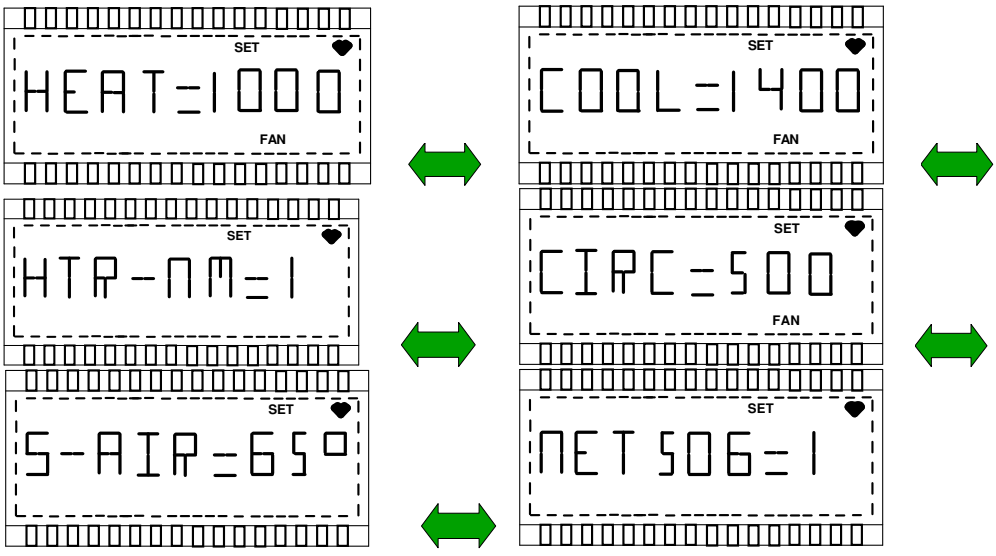
Whilst in the **Installer Set-Up Mode**, press the **SET** button and hold for 3 seconds, and the display will change to:



for a short period, then the display will return to normal.

N-G1/lo Versions 7 - 16 (Pre May 2001)

Original N-G1/lo versions did not have the additional Zoning Minimum Fan Speed selection parameter, and therefore will not display the "ECON = 950" screen in the Installer Set Up Mode.



Note: These N-G1/lo modules have a minimum fan RPM of 500 RPM in all fan operation modes.

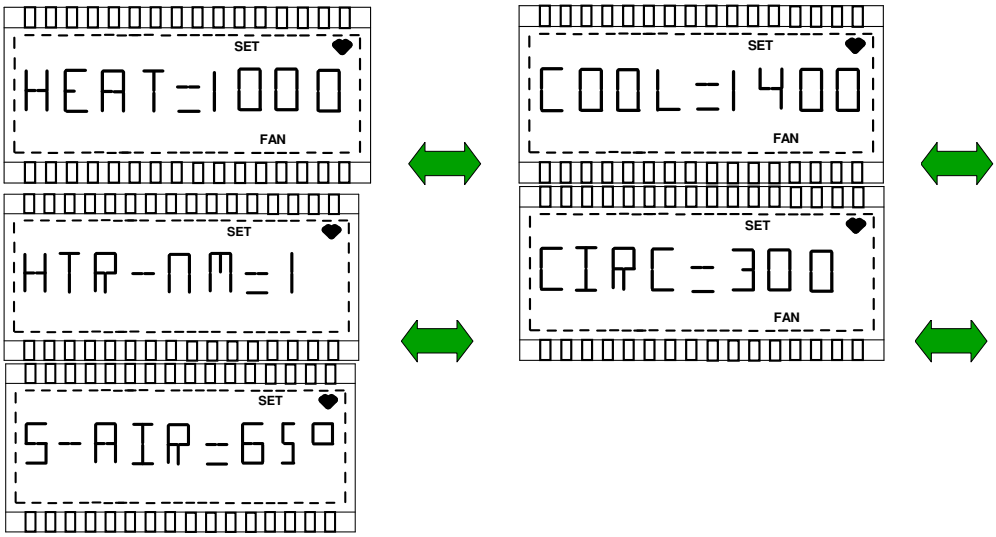
Installer Commissioning Instructions (cont)

Installer Settings (cont)

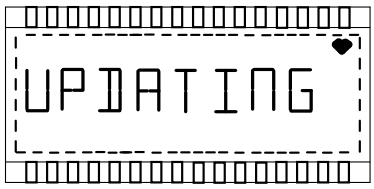
N-G1/lo Versions 1 - 7 (Pre November 1997)

Original N-G1/lo versions did not have the Network 506 mode selection parameter, and therefore displayed Refrig on the Networker, even if the Network 506 module was for heating zoning operation only.

The minimum fan RPM was 300 RPM in all fan modes.



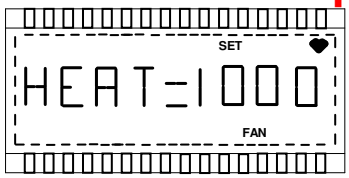
Warning: Pressing the SET button in Installer mode displayed



But,may also reset all factory default parameters.

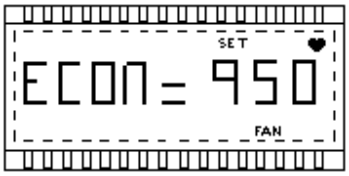
Installer Commissioning Instructions (cont)

The LCD sequence and explanation



1. HEATER FAN OPERATION.

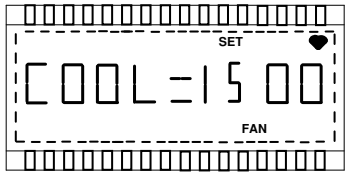
The number displayed is the fan's default setting, i.e. the RPM the fan is set to run at for normal heating.
It can be adjusted between a maximum of 1500 and a minimum of 500.



2. ZONING MINIMUM FAN SPEED

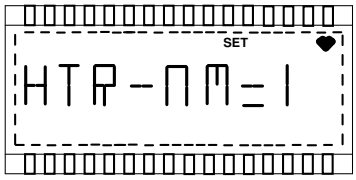
This is the minimum RPM the fan will operate to with the maximum outlets closed due to Networker zoning in heating mode.
The default is 950, but it can be adjusted between 500 and 1500.
(800 RPM is the recommended minimum setting)

.



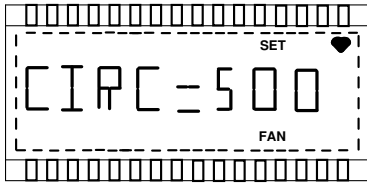
3. COOLING FAN OPERATION.

This displays the RPM the fan is set to run to in normal refrigerative cooling.
It can be adjusted between a maximum of 1500 and a minimum of 500.



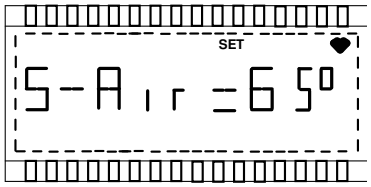
4. HEATER NUMBER.

This parameter is used to identify each heater in priority order when more than one heater is connected on the system.
DO NOT ALTER UNLESS MULTIPLE HEATERS ARE INSTALLED.



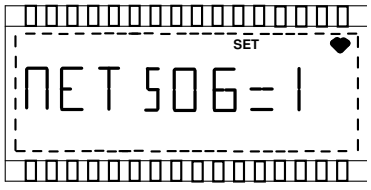
5. CIRCULATING FAN OPERATION.

This displays the RPM of the fan motor in circulation mode for fan operation between heating cycles.



6. SUPPLY AIR THERMISTOR Auto EMS MODULATION SET POINT TEMPERATURE.

This displays the temperature the heaters gas valve will modulate to maintain. The default is 65^0C. but it can be adjusted between 56^0C. & 75^0C.



7. NETWORK 506 MODULE MODE.

This is the selection mode for the Network 506 module operation. It can be set to switch zone motors, refrigerative cooling, an electronic air filter or humidifier. The default is No.1 (up to 4 zone motors only) but it can be set between 1 and 4. Refer to the details in the Network 506 Operation section.

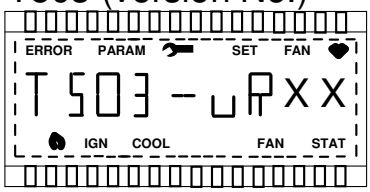
Heater Operation

General Operation

- When power is first applied to the unit, the N-G1/lo module will require a 5 second stabilisation time, before any functions can operate.

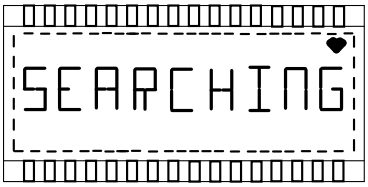
The initial LCD to the unit, on power up, will show the controller's production version identification number.

T503 (version No.)



This is followed by a momentary display of "DEFAULT" or "NEW DATA". NEW DATA indicates that the Installer or Service parameters have been modified from the factory set values.

- Then the LCD will display:



Until the Networker signal is recognised.

This display would remain if the Networker was not connected, faulty, or if the Network cabling was damaged.

While the heater remains powered, but not in operation, the LCD will display the appliance mode operated.

i.e. The last operation of the heater may have been in Refrig mode, but the Networker has since been changed to Heater mode but the heater has not been required to operate. The LCD may continue to display the Refrig display until the heater receives the signal to operate in Heater mode again.

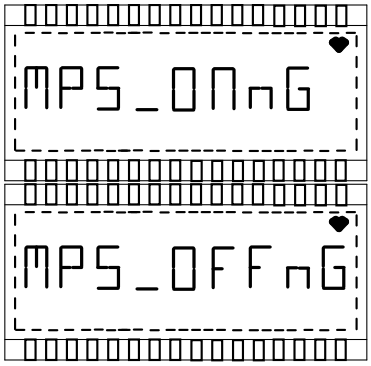
Heater Operation (cont)

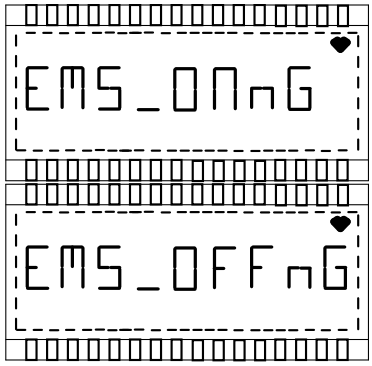
N-G1/lo LCD Display in Operation Standby Mode

With the power to the heater ON, but no operation required (i.e. heater in OFF cycle), the N-G1/lo LCD will indicate MODEL/MODE, WALL CONTROL STATUS, and **GAS TYPE**.

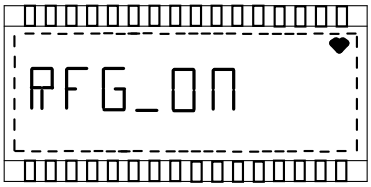
- The letters displayed on the right is the gas type i.e. **nG or LP**.
- The display in the centre, show the status of the Networker is either ON or OFF.
- Displayed on the left shows the model type automatically.
  This is detected from the presence, or absence, of an Auto EMS gas valve modulating solenoid on circuit to the N-G1/lo module.

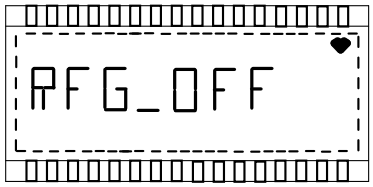
Note: If the Auto EMS gas valve regulator fails open circuit, then the N-G1/lo module will display MPS, and operate in MPS mode until the ignition sequence fails and locks out.





- Only with a Network 506 Module option fitted and the N-G1/lo module installer parameter set to 2 or 4, the following will be displayed:





A pulsing heart symbol will be displayed on the LCD, in the top right corner, to indicate the N-G1/lo module's micro processor is functioning correctly.

Heater Operation (cont)

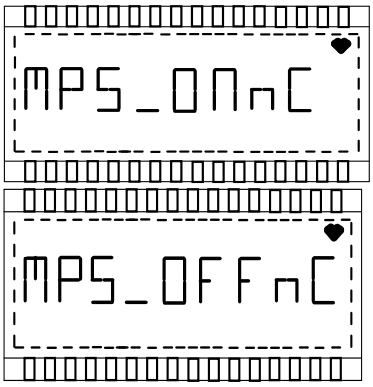
N-G1/lo LCD Display in Operation Standby Mode (Pre version 7)

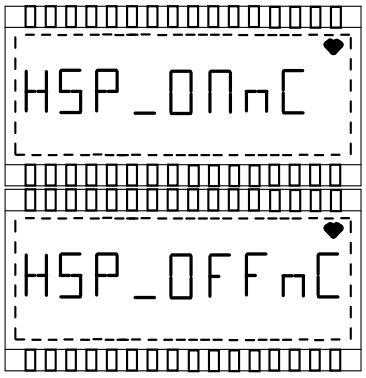
With the Networker signal received, the LCD will then indicate the MODEL/MODE, WALL CONTROL STATUS, and WALL CONTROL TYPE.

The first 3 letters will indicate the N-G1/lo module is configured for either MPS or Auto EMS (HSP), or is in Refrig mode at the Networker (RFG).

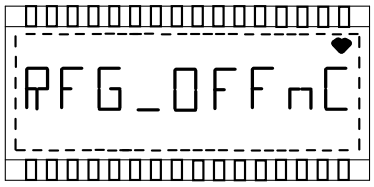
The ON or OFF displayed in the centre of the screen is as follows:

- ON: means the Networker is turned ON and heating is selected, but no call for heat. i.e. auto program or thermostat cycle.
- OFF: means the Networker is either turned OFF or another appliance type (other than Refrig) is selected or both. i.e. heater will not operate.





- Only with a Network 506 Module option fitted the following will be displayed:



Heater Operation (cont)

Timed Safe Guard Period

- On **power up**, and at the **completion of any fan operation following a normal heating cycle**, a 13 minute **"TIMED SAFEGUARD PERIOD"** will commence to monitor if an over temperature condition occurs.

Should an over temperature condition occur **after** the Timed Safe Guard Period has expired, then the control system will ignore the condition, and regard it as a result of high ambient temperature NOT associated with the operation of a heating cycle.

An example of this would be, the typical high ambient temperature experienced in a ceiling cavity of a building in Summer time.

Over temperature conditions that occur within the Timed Safe Guard Period, are discussed in the section on Abnormal Operation - Over Temperature Conditions.

Normal Heating Cycle

- When the Networker calls for heat ON, there is normally a 2 - 5 second delay before the electronic controller receives and responds to the signal.

- Once the Networker turns OFF the call for heat, a 15 second time delay period commences, before the next ON heat signal will be acknowledged at the heater.

When the N-G1/lo module receives the Networker heat ON, it displays "STAT" on the LCD bottom line and the heaters ignition sequence commences.

Note: At this point, new heaters that have Adaptive Zoning Fan Modulation capability will also display "ECON" on the LCD bottom line which will be flashing simultaneously with the pulsing heart symbol. This will only occur if any of the zones have been switched "off" at the Networker. If all zones are currently open this "ECON" symbol will not appear until a zone is switched "off".

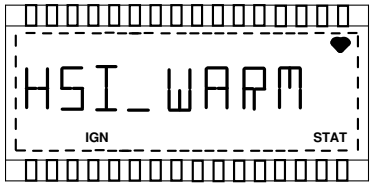
Heater Operation (cont)

Ignition Operation for Auto-EMS

The N-G1/lo module powers the Hot Surface Ignition Pilot ceramic igniter element, when it receives the call for heat from the Networker.

The igniter element will be energised until after the pilot flame is established and confirmed, and the main burners turn ON.

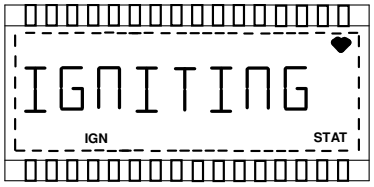
- The Hot Surface Pilot element is powered for 10 seconds before the gas valve's pilot solenoid is energised, allowing the gas flow to the pilot burner. During this operation the LCD will show:



This is to allow the igniter element to heat sufficiently for correct pilot flame ignition, when the gas is delivered to the pilot (HSI heat Up Period).

- When the pilot valve opens, the N-G1/lo module starts a 60 second time period, in which the pilot flame must be lit and confirmed on the pilots flame sensor rod.

This stage of operation is indicated on the LCD as:



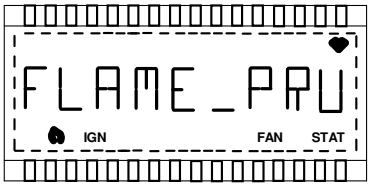
- If the pilot flame is not detected within 60 seconds, the system shuts down for a second ignition attempt.

Heater Operation (cont)
Ignition Operation for Auto-EMS (cont)

- Once the pilot flame is detected, a flame proving period commences.

A continuous stable pilot flame must be maintained for 5 seconds, before the main valve is energised, allowing the gas to flow to the main burners.

The LCD displays "IGN" during the ignition process, and the "flame symbol" will appear on flame confirmation, as follows:



Because the HSI igniter remains energised, should the flame confirmation be lost at this point, the flame would normally be easily re-lit.
A 1 - 2 second flame loss may occur without the N-G1/lo module system registering the loss.

- **Following the Flame Proving Period** the gas valve's main valve is energised, and the main burners are lit from the established pilot burner via the zip (cross lighting) burner.

- The gas valve's modulating regulator solenoid is powered to the low gas start level (70 mA / NG & 100 mA / LPG), for the first 10 seconds of operation.

  The HSI igniter remains powered for a further 3 seconds, to aid the main burner ignition.

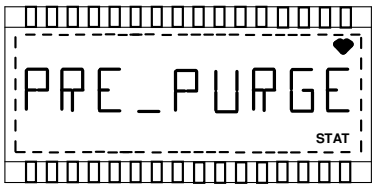
  If the pilot flame confirmation is lost within the first 2-3 seconds of the main burners (valve) operation, **then the loss of flame is ignored**, assuming the loss is related to the main burner ignition process.

If the pilot flame is stable for 10 second duration, after the main gas valve opens, the ignition process is then considered complete.

Heater Operation (cont)
Ignition Operation for MPS models

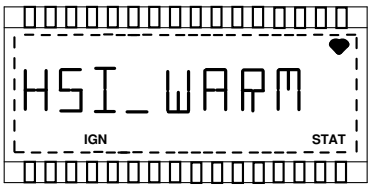
The N-G1/lo module will initially power the combustion fan, to purge the combustion area top box and heat exchanger/s, when the call for heating is received from the Networker.

- The combustion fan "purge time" is for 10 seconds, the combustion fan is operated at the maximum power level (15), and the LCD will appear as follows:



- Next the Hot Surface igniter (HSI) electrode is powered for 10 seconds, to heat the electrode to a temperature sufficient to ignite the gas, before the main valve opens, allowing the gas flow to the burners.

The LCD will appear as follows:



The gas valve is energised, allowing the gas to flow through to the burners.

- Powering the gas valve starts a **5 second time period, in which the burners must be lit and confirmed** on the flame sensor rod, otherwise the system shuts down, and the ignition process starts again from the beginning.

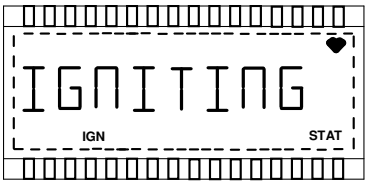
- The combustion fan power level is reduced to the start power level (5), for the first 10 seconds of the gas valve operation, to provide ignition at a low gas start-up rate.

- After the 10 second start power level, the combustion fan is stepped up to an intermediate power level (10) for 30 seconds, before proceeding to the maximum drive level possible for the system operation.

Note: Intermediate power level was not available on pre version 7 models.

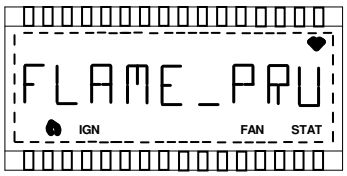
Heater Operation (cont)
Ignition Operation for MPS models (cont)

- During the ignition period and **prior to the flame being detected**, power continues to be applied to the HSI igniter, and the display will show as follows:



The LCD also displays "IGN" during the ignition process.

- **Once flame is detected**, the display changes to:

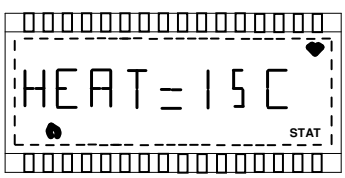


and the "flame symbol" will appear on the bottom line to acknowledge flame confirmation.

- A 10 second flame proving and confirming period commences, where a stable flame must be maintained, before the ignition process is complete.
- Power to the HSI electrode continues for a further 6 seconds into the flame proving period, to assist the ignition process.
- If the flame confirmation is lost (more than 1-2 seconds) within this 10 second **flame proving period**, the ignition process will commence again from the beginning.

Once the 10 second flame proving period has expired, with the burners stable and confirmed, the ignition process is then considered complete.

When the ignition process is complete, the LCD changes to HEAT and shows the supply air outlet thermistor temperature C^{o}.



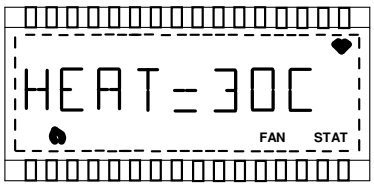
Heater Operation (cont)

Post Ignition Operation for Both MPS & Auto EMS

The heater moves through the phase of operation, where the heat output is increasing, until a steady state (maximum/optimum) heat output is reached.

- The main circulation fan will start 10 seconds after the gas valve is energised and the main burners are lit.

The fan operation will be indicated on the LCD bottom line, and will operate at the **minimum speed (i.e. 500 RPM), until an outlet temperature of 30ºC** is registered on the supply air outlet thermistor.

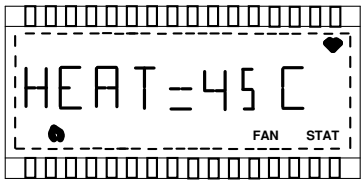


- The fan will then **increase its speed proportionally between 30ºC and 45ºC.**

The N-G1/lo module will not allow the fan speed to decrease once it has increased, through the supply air outlet temperature heat up stage, unless the Networker turns OFF the call for heat.

If the temperature sensed at the supply air outlet thermistor has not reached 30ºC. Within 2 minutes of the gas valve opening, then the fan will automatically be forced to maximum speed for the duration of the ON cycle. Refer to Error code #36.

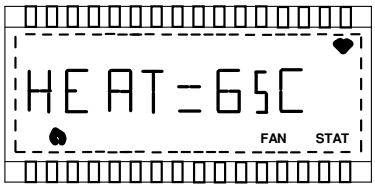
- **At 45ºC. The fan speed will be at the maximum RPM the installer has set**, (or the correct ECON speed as calculated by the N-G1/Lo where Adaptive Zoning is active), and the **gas input will also be at maximum.**



The fan and gas will remain at this maximum output, provided that the outlet temperature remains between 45ºC. & 65ºC.

Heater Operation (cont)
Post Ignition Operation (cont)

- If the supply air outlet temperature increases to approximately 65^{0}C., the N-G1/lo will vary the gas flow to the burner to maintain a maximum outlet temperature of 65^{0}C. (+/- 3^{0}C.)



- In the **Auto EMS** unit, the current supplied to the gas valve modulating solenoid head is reduced from the maximum 115 mA, down to 70 mA for Natural Gas or from 140 mA down to 100 mA LPG, resulting in reduced gas flow to the burner.

- For **MPS** units, the power to the combustion fan is reduced, which in turn directly effects the gas valve's modulating diaphragm, and subsequent gas output.

Therefore, should any outlets be closed, or any other restrictions that affect the fan airflow, and results in the supply air outlet temperature rising to approximately 65^{0}C., then the heater's gas input will adapt automatically.

If the temperature of the supply air has resulted in the gas valve reducing the gas to the minimum output possible, then the supply air temperature may still increase to a point that the over temperature operating limits are reached, and the gas valve will be shut down completely.
(Refer to section - Abnormal Operating Conditions - Over Temperature).

- **If the unit cannot achieve the 45^{o}C supply air outlet temperature** needed to establish the maximum set fan RPM, then the fan will only operate at the speed that equates proportionally, between the initial minimum RPM speed at 30^{0}C and the **maximum RPM the installer has set** (or the correct ECON speed as calculated by the N-G1/Lo where Adaptive Zoning is active).

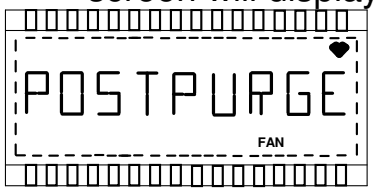
This means that the heater will, in this situation, control the fans output in order to achieve the best supply air outlet temperature, and system comfort conditions.

Heater Operation (cont)
Cool down Cycle

When the Networker is turned OFF:

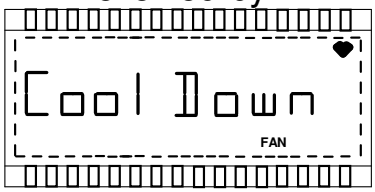
- The gas valve will close immediately, and the unit proceeds to the "Cool Down" operation, to remove the residual heat from the unit.

- On MPS units the combustion fan will continue operating for a 60 second period, to dissipate excess humidified combustion products, and the LCD screen will display:



(Not displayed on pre version 7 models)

Followed by:



To indicate the fan is still running, until the supply air outlet temperature is cooled down to 40^{o}C. And then turn OFF, as described below.

- Initially the main circulation fan speed remains at the **maximum RPM the installer has set** (or the correct ECON speed as calculated by the N-G1/Lo where Adaptive Zoning is active).
- **Until the outlet temperature drops to 50^{o}C.**

- Then the fan will be **slowed to the minimum RPM at a controlled rate of 600 RPM.**

i.e. current fan setting 1000 RPM -500 RPM = $\frac{500\ \text{RPM}}{600\ \text{RPM}}$ = 0.83 minutes (50 secs).

- If the supply air outlet temperature was below 50^{o}C. when the Networker turned OFF, the fan will slow from the speed it achieved in relation to that temperature, at the rate described above.

OR

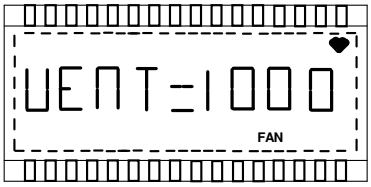
- The fan will turn OFF immediately, if the supply air temperature is already at 40^{0}C. or below.

- The heating cycle is then complete.

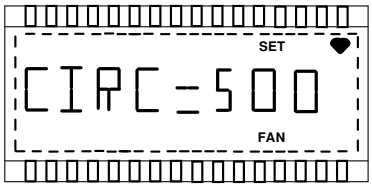
Heater Operation (cont)

Fan Operation without Heat

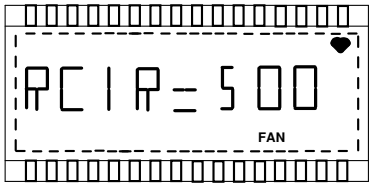
The N-G1/lo module LCD will display the following, to indicate the heaters fan operation when heating is not required.



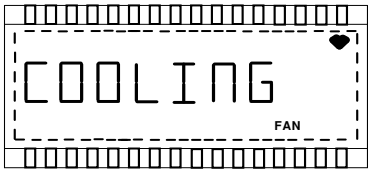
This is the LCD with the Networker turned OFF in HEAT mode, and circulation fan selected (summer fan).



This is the LCD with the Networker turned ON in HEAT mode, and the fan selected for circulation between heating cycles.
(Requires Networker parameter to activate).



This is the LCD with the Networker turned ON in Refrig mode, and the fan selected for circulation between cooling cycles.



This is the LCD with the Networker in Refrig mode, and the add-on cooling operating.

MPS Combustion Fan and Amplified Gas Valve Operation

When the Networker is calling for heat and the heater starts the combustion fan, air from the combustion fan is forced under pressure onto the burner chamber (top box), where the burners and heat exchanger ports are located.

This chamber is sealed to the atmosphere, and the air from the combustion fan enters the chamber, and mixes with the gas in the burner venturi.

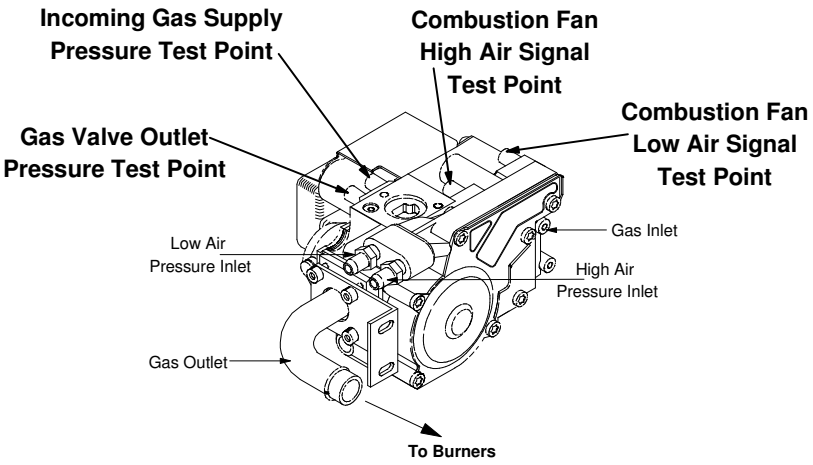
The mixture under pressure is forced towards the heat exchanger, where ignition and burner flame confirmation take place.

The combustion fan must provide sufficient air to the burners for proper combustion at all times, regardless of the gas rate the unit is operating at.

The design of the combustion fan housing and transition will automatically control the gas / air ratio, because, any reduction of the combustion fan airflow will directly affect the gas valve's gas output.

Both the combustion fan housing and burner chamber have a pressure tap point, each with a connecting tube to the gas valve.

The combustion fan exit transition has a restrictor baffle positioned between the 2 tapping points, which creates a pressure differential to the gas valve.



VK8105R Amplified Gas Valve

MPS Combustion Fan and Amplified Gas Valve Operation (cont)

As the combustion fan speed or air output varies, so does the pressure difference across the tapping points, and the gas valve tube connections.

A reduction in pressure differential will react on the gas valve's regulator diaphragm, and reduce the gas output from the valve.

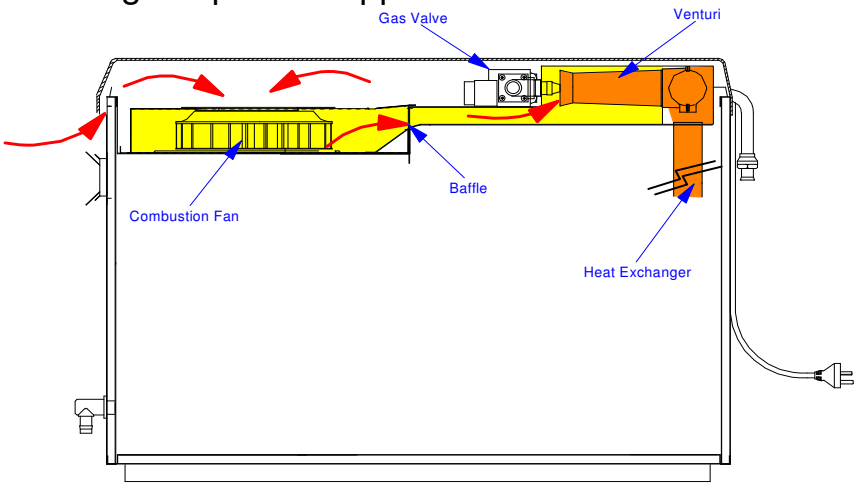
The gas valve has minimum and maximum pressure "STOPS", and cannot be operated outside of these pre-set safe limits.

The combustion fan pressure differential, that would require the gas to run below the minimum limit, would result in the gas valve turning OFF.

In the description of the normal heating cycle, it was mentioned that the heater will control the heat to maintain a **maximum outlet temperature of approximately 65ºC. (+/- 3ºC.).**

The supply air thermistor senses the outlet temperature, and is constantly providing a signal back to the N-G1/lo module.

At 65ºC., the N-G1/lo module will react to maintain the outlet temperature, by reducing the power supplied to the combustion fan motor.



The decrease of power slows the combustion fan, and causes the pressure across the transition baffle to decrease.

The gas valve receiving a reduced pressure difference on its regulator diaphragm reduces the gas flow to the burners.

(Continued over page)

MPS Combustion Fan and Amplified Gas Valve Operation (cont)

This results in reducing the heat input to the heat exchanger, and because the air volume through the duct system remains constant, the outlet temperature begins to decrease.

If the outlet temperature falls sufficiently below 65^0C again, then the thermistor signals the N-G1/lo module to increase the gas flow to the burners again.

This means the MPS units will automatically adapt to changes that affect the unit's outlet temperature, and reduce the unit's capacity accordingly.

Once the system has been correctly set up, balanced, and fan speed selected for normal use, the closure of subsequent outlets will be catered for by the supply air outlet temperature reading

Additionally, should the return air filter intake, or the supply air ducting be accidentally restricted, then the heater will also adjust accordingly.

Should the air intake for the combustion fan or the flue discharge be restricted, or the fan itself be faulty, then the heater will only operate within the safe limits before the burners shut down.

Amplified MPS gas valves are preset as part of the end of line factory test, and **must not** be adjusted in the field.

If the valve adjustment or operation is suspect, follow the MPS Amplified gas valve testing procedures, and replace the valve if not within specifications. **Always test the new gas valve following fitment.**

Introduction of 1:1 Gas Valves

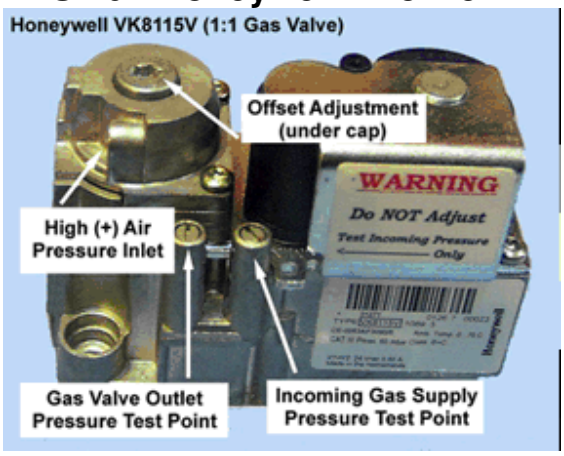
During March / April 2002 the VK8105R (5:1 Amplified) gas valve and standard orifice type main burner injector was discontinued on Natural Gas MPS model heaters and replaced by a 1:1 gas valve with a new revolutionary 'slot type' main burner injector.

The new 'slot type' injector no longer injects gas straight down the burner venturi, but rather injects it radically through larger slots which aids gas/air mixing but also means the burner pressure can be significantly lower.

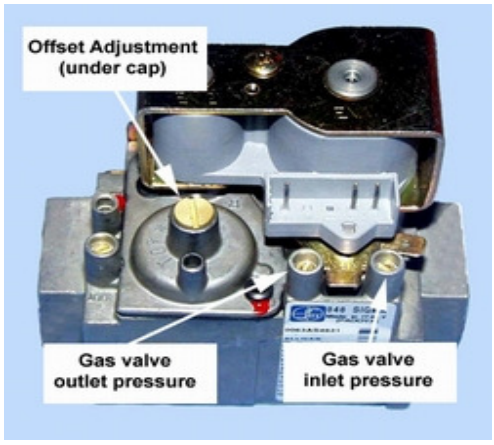
As the heater can now run at a lower burner pressure, there is no longer any requirement to amplify the air signal differential to produce the correct burner pressure. This being the case, the 1:1 gas valve only requires a high (+) air pressure signal to operate the regulator, hence there is no longer any low pressure tube connected to the gas valve.

Two different types of 1:1 gas valves are used on Natural Gas MPS heaters:

MPS 20 - Honeywell VK8115V



MPS 30 & 35 - SIT 848 SIGMA



Unlike the Honeywell gas valves, the SIT 848 SIGMA solenoids require AC voltage, so the SIT valve uses a different gas valve loom (part # 18445) which does not include a rectifier.

Spare Parts will only be supplying the SIT 848 SIGMA as a replacement for all MPS 1:1 gas valves. Technicians should remember that when replacing a Honeywell VK8115V with a SIT 848 SIGMA, the gas valve loom should also be replaced. The loom will be included with the gas valve as an assembly, Part # 8350 GAS VALVE SIT 848 SIG 1:1 ASSY.

MPS heaters that operate on LPG are not affected by this change and are continuing to use the VK8105R (25:1 Amplified) gas valve with a standard orifice type main burner injector.

MPS Combustion Fan and 1:1 Gas Valve Operation

When the Networker is calling for heat and the heater starts the combustion fan, air from the combustion fan is forced under pressure onto the burner chamber (top box), where the burners and heat exchanger ports are located.

This chamber is sealed to the atmosphere, and the air from the combustion fan enters the chamber, and mixes with the gas in the burner venturi.

The mixture under pressure is forced towards the heat exchanger, where ignition and burner flame confirmation take place.

The combustion fan must provide sufficient air to the burners for proper combustion at all times, regardless of the gas rate the unit is operating at.

The design of the combustion fan housing and transition will automatically control the gas / air ratio, because, any reduction of the combustion fan airflow will directly affect the gas valve's gas output.

The combustion fan housing has a high (+) pressure tap point with a connecting tube to the gas valve.

The combustion fan exit transition has a restrictor baffle positioned after the tapping point, which creates a pressure differential across the baffle.

As the combustion fan speed or air output varies, so does the pressure difference across the restrictor baffle.

A reduction in the high (+) air pressure signal will react on the gas valve's regulator diaphragm, and reduce the gas output from the valve.

Unlike amplified gas valves that rely on the combustion air pressure differential being fed into the valve to produce the correct amount of gas output, the 1:1 gas valves only use a high (+) air pressure signal. **This is not to say that the combustion air pressure differential is no longer important**, but a low (-) air pressure signal is not required by the valve to determine the gas output.

The 1:1 gas valve also relies on a **negative offset adjustment of approximately 20Pa** to ensure that it cannot continue to operate should the combustion air pressure differential drop too far below its normal minimum operating limit. This offset also ensures that the gas/air mixture is not too rich at any given combustion fan pressure differential.

(Continued over page)

MPS Combustion Fan and 1:1 Gas Valve Operation (cont)

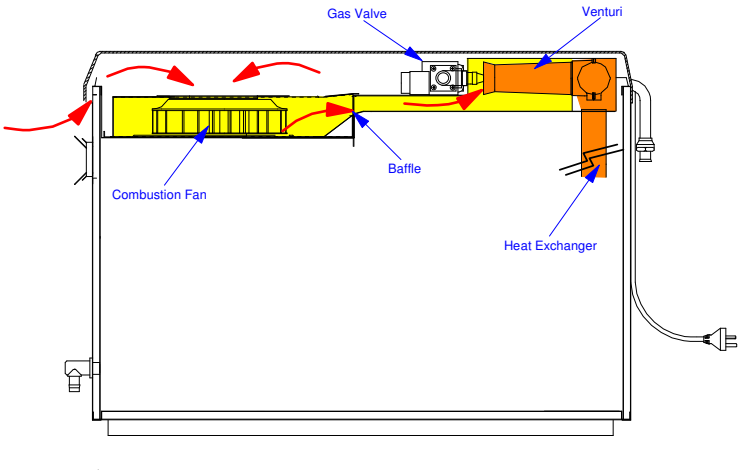
With the offset adjusted correctly (i.e. - 40 Pa), too low a combustion fan pressure differential will result in the gas valve turning OFF due to the burner going out, because the correct gas/air mixture for proper combustion cannot be achieved.

Technicians should be aware that should the combustion fan pressure differential be too high due to a leak anywhere downstream of the restrictor baffle (i.e. cracked heat exchanger or similar), **then the unit will continue to operate as the 1:1 gas valve is not affected by low air signal loss.**

In the description of the normal heating cycle, it was mentioned that the heater will control the heat to maintain a **maximum outlet temperature of approximately 65ºC. (+/- 3ºC.).**

The supply air thermistor senses the outlet temperature, and is constantly providing a signal back to the N-G1/lo module.

At 65ºC., the N-G1/lo module will react to maintain the outlet temperature, by reducing the power supplied to the combustion fan motor.



The decrease of power slows the combustion fan, and causes the pressure across the transition baffle to decrease and also causes the valve to receive a reduced high (+) air pressure signal.

The gas valve receiving a reduced high (+) air pressure signal on its regulator diaphragm, then reduces the gas flow to the burners.

(Continued over page)

MPS Combustion Fan and 1:1 Gas Valve Operation (cont)

This results in reducing the heat input to the heat exchanger, and because the air volume through the duct system remains constant, the outlet temperature begins to decrease.

If the outlet temperature falls sufficiently below 65^0C again, then the thermistor signals the N-G1/lo module to increase the gas flow to the burners again.

This means the MPS units will automatically adapt to changes that affect the unit's outlet temperature, and reduce the unit's capacity accordingly.

Once the system has been correctly set up, balanced, and fan speed selected for normal use, the closure of subsequent outlets will be catered for by the supply air outlet temperature reading.

Additionally, should the return air filter intake, or the supply air ducting be accidentally restricted, then the heater will also adjust accordingly.

Should the air intake for the combustion fan or the flue discharge be restricted, or the fan itself is faulty, then the heater will only operate within the safe limits before the burners shut down.

1:1 MPS gas valves are preset as part of the end of line factory test, but can be adjusted in the field if necessary.

If the valve adjustment or operation is suspect, follow the 1:1 MPS gas valve testing procedure, and re-adjust the valve so that it is back within specification. If the valve cannot be adjusted to function correctly after following the test & adjustment procedure, then the valve should be replaced. **Always test the new valve following fitment.**

Auto EMS Gas Valve Operation

Auto EMS units have a gas valve with a new electrically operated modulating solenoid to vary the gas flow to the burners.

Auto EMS units use the signal from the supply air thermistor, to control the outlet duct temperature at 65^0C. In the same way MPS models do.

However, the supply air thermistor signal at the N-G1/lo when set for Auto EMS, translates this signal to a variable current output to the gas valve modulating solenoid.

The range of current output is between 70 mAmp and 115 mAmp for NG and 100 mAmp and 140 mAmp for LPG.

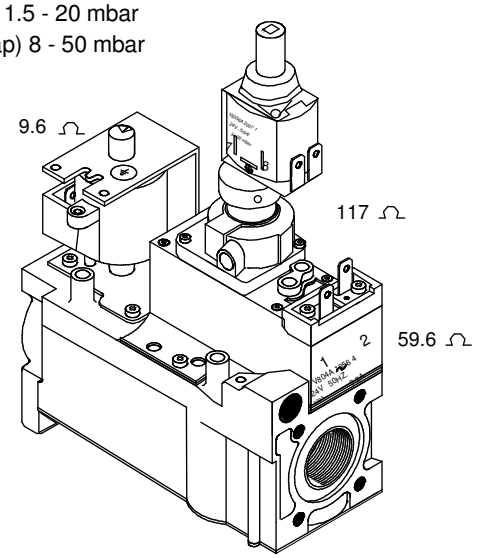
The resulting system control is the same as described for MPS operation.

Auto EMS

+ / - 5% @ 20°C

NG (Grey Cap) 1.5 - 20 mbar

LPG (Orange Cap) 8 - 50 mbar



When replacing the valve, or checking it's operation, it may necessary to set the mechanical hard stop settings that correspond to the minimum and maximum mAmp outputs from the N-G1/lo.

Remove the screw and top cap from the solenoid top to expose 2 adjustment nuts located on the valves centre spindle.

Note: The N-G1/lo module will not allow the maximum mAmp parameter (2 or 12) to be set lower than 100 mAmp, therefore the Natural Gas models cannot be driven to the minimum level (70 mAmp) using these parameters.

Auto EMS Gas Valve Operation (cont)

Lower Gas Pressure Adjustment

To set the lower gas pressure mechanical stop for the minimum gas pressure, remove one of the wire loom leads that connect to the gas valve modulating solenoid.

Alternatively, with LPG units, operate the unit with the gas valve energised to 100 mAmp using the service parameters to drive the valve to that level. Always use the service INFO mode to confirm the output to the valve before adjusting.

Now adjust the lower set nut until the gas pressure is the correct level.

Upper Gas Pressure Adjustment

To set the upper gas pressure mechanical stop for the maximum gas pressure, press and firmly hold down the spindle mechanism in the centre of the solenoid head.

This will manually force the solenoid to pass the maximum gas.

Whilst holding the valve in this position, adjust the upper set nut to the required maximum gas pressure for the model.

Important:
The pressure settings may vary once the gas valve solenoid cap is replace and screwed down, recheck the pressures and readjust the mechanical stops allowing for this variance if necessary.

Main Circulating Fan Operation MPS & Auto EMS

The main circulating fan varies in speed according to the stage of the heaters operation.

Because the power input to the fan from the N-G1/Hi is controlled by the signal from the N-G1/lo module, the RPM of the fan is maintained at a constant level, as monitored by the speed feedback sensor.

Given that the fan is initially set correctly with a satisfactory air output for the whole ducting system and that it is set less than the maximum (1500 RPM) level, the fan's RPM and air volume will depend on the load (back pressure) according to the duct resistance.

From this point, if the number of outlet registers/diffusers open is reduced, causing an increased duct resistance, the fans air output has some ability to reduce also.

Typically, the heaters fan would normally increase speed as the fan is driven at a **constant power level.** This causes the fans impellor to slip in the housing, because it cannot drive the air against the increased resistance. The overall pressure in the duct increases, and so does the velocity of the air, as it forces air from the outlet openings. This is also often the case when the fan is set to the maximum (1500 RPM) level.

Although the reduction of the total air output from the fan, when a number of outlets are closed, is not exactly proportional, the N-G1/Lo's speed feedback capability was designed so that the air output from each of the remaining registers would be approximately the same to that of the original system set-up, provided the fan was set less than the maximum (1500 RPM) level.

Until now, this meant that the fan's RPM had to be set as low as possible on systems where zoning is installed, to achieve the most airflow reduction that the system would allow. Experience has since shown us that on ***some*** systems, where zoning is installed, that this speed feedback function alone is not able to reduce the fan's air output enough. The increased air velocity from the remaining open outlets can often be a problem, which can be a cause of concern for some customers. Adaptive Heating Zoning Fan Modulation has now been introduced into current heater controls to combat this problem.

N-G1/lo Operation Variance (version 17)

Adaptive Heating Zoning Fan Modulation

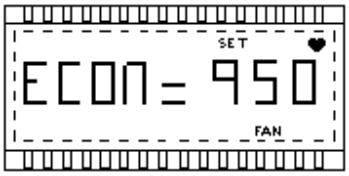
Until recently (N-G1/lo), MPS and Auto EMS models fan operation had a limited ability to adapt to zoning configurations of reduced open outlets, depending on the heaters set fan speed.

The N-G1/lo module (v17) and Networker (Must be N-C1 (v11) or later), now combine together to drive the fan to different power levels, when operating with programmed zones.

The amount of adaptive fan modulation is determined by:

- the **number of zones open** on the system
- the RPM difference between **the Zoning Minimum Fan Speed** setting and the Heat Fan Speed setting.
- the **number of zones on the whole system.**

This outlet zone information is required to be entered into the Networker set-up parameters (refer to the section, Networker Installer Set-Up Programming for details), for the Adaptive Zoning Modulation to be activated.



Zoning Minimum Fan Speed.
This is the minimum RPM the fan will operate to,with the maximum outlets closed due to Networker zoning In heating mode.
This reduction will only apply if the setting is lower than The Heaters set fan speed.
The default is 950, but it can be adjusted between 500 and 1500. (800 RPM is the recommended minimum setting.)

Note: Some earlier production N-G1/lo modules (Version 16) although not displaying the ECON screen in the installer set up mode, will have the Zoning Minimum Fan Speed as parameter No.10 in the service parameters. The parameter value is multiplied by 10 to provide an Econ RPM setting. Adaptive Zoning can be activated by fitment of a new Networker. (Must be N-C1 (Version 11) or later).

This installer set-up parameter should be set to suit the system, when the minimum numbers of outlets are operating (all but one zone closed.) Ensure that the zone you leave open is either the common zone (where present), or the zone with the least number of outlets on it. This zone should obviously have at least the recommended minimum number of outlets open for that particular model of heater, as per the Outlet Table on page 9 of this manual.

N-G1/lo Operation Variance (cont)

Adaptive Heating Zoning Fan Modulation (cont)

Once the Zoning Minimum Fan Speed (ECON), is set below the HEAT fan speed, the heating fan operation is controlled between the Zoning Minimum Fan Speed and the Heat speed (maximum range setting 500 RPM - 1500 RPM).

The Networker sends a signal to the N-G1/lo, giving an output signal relating to the number of zones operating as a proportion to the total number of zones on the system.

The N-G1/lo module then applies this signal to the minimum and maximum fan speeds set in installer mode to determine the fan speed with any given zone configuration.

How the Adaptive Heating Zoning Fan Speed is Calculated

- First determine the difference between the HEAT RPM and the Zoning Minimum Fan RPM e.g. (HEAT= 1000) - (ECON = 500).

- Then take:
  - The number of **open zones - 1.**

  Divided by:

  - The **total number of zones**.

- Multiply the 2 above results, and add this figure to the Zoning Minimum Fan (ECON) Speed.

Whenever the unit is operating with this Adaptive Zoning Fan Modulation activated, the N-G1/lo will recognise the current ECON fan setting and display "ECON" (flashing) on the LCD bottom line during operation.

(Continued over page)

N-G1/lo Operation Variance (cont)

Adaptive Heating Zoning Fan Modulation (cont)

Example 1

System is set up with 3 zones (A, B, C) and the unswitched zone. The heat fan speed is set to 1250rpm and the zoning minimum fan speed to 950rpm.

If zones A and B are selected then the RPM will be as follows

Zones Open = 3 (unswitched + 2 selected zones)
Total Zones available = 4

(Zones Open - 1)/ Total Zones Available = (3-1)/4 = 2/4

Fan Speed = Econ RPM +{([Zones Open-1]/ Total Zones) x (Heat RPM - Econ RPM)}

So, Fan Speed = 950 + {([3-1]/4) x (1250-950)} = 950 + {0.5 x 300} = 950 + 150 = 1100RPM

Example 2

System is set up with 2 zones (A, B) and no unswitched zone. The heat fan speed is set to 1500rpm and the zoning minimum fan speed to 1000rpm.

If a zone A is selected then the RPM will be as follows

Zones Open = 1
Total Zones available = 2

(Zones Open-1)/ Total Zones Available = (1-1)/2 = 0

Fan Speed = Econ RPM + {([Zones Open - 1] / Total Zones) x (Heat RPM - Econ RPM)}

So, Fan Speed = 1000 + {([1-1]/2) x (1500-1000)} = 1000 + {0 x 500} = 1000 + 0 = 1000RPM

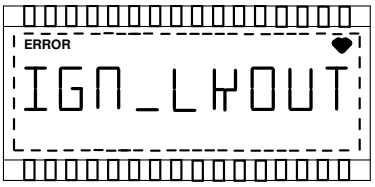
The N-G1/lo Commissioning

The LCD display shows the model type automatically on the N-G1/lo.
This is detected from the presence or absence of an Auto EMS gas valve modulating solenoid (resistance) on circuit to the N-G1/lo module.

Note: If the Auto EMS gas valve regulator fails open circuit, then the N-G1/lo module will display MPS, and operate in MPS mode until the ignition sequence fails and locks out.

Incorrect Model Configuration (Pre version 7 Models only)

If the heaters model has been incorrectly set at the **EMS-HSP/MPS** 2 pin bridge terminal, the unit will proceed through 4 unsuccessful ignition attempts irrespective of the Networker's call for heat, then lockout displaying:



Gas Type Selection

The bridge link on the N-G1/lo requires the correct configuration for the gas type used. The N-G1/lo will display the gas type as **nG or LP** on the right of screen when the unit is in the OFF mode.

Auto EMS units require this bridge to be set correctly, or the gas valve current output will be incorrect for the gas type, and the valve will not modulate within the correct range, nor have the correct start and maximum gas rates.

The gas type selection is:

- Bridge link ON = LPG (Propane)
- Bridge link OFF = Natural Gas

The N-G1/lo Commissioning (cont)

Incorrect Networker/Thermostat Configuration

(Pre version 7 models only)

When the N-G1/lo control is correctly set for Networker, but the bridge link at terminals 24 V and STAT is removed or has a bad connection, the unit will not operate and the LCD will display:

The Networker will be damaged if 24 Volt or 240 Volt power is connected to its wiring terminals. Ensure the Networker is wired to the Networker TW1 & TW2 terminals only.
The following conditions will result with incorrect thermostat configuration:

Configuration		**Result**
Networker wired to 24 V & STAT with link in.	=	Heater runs continuously. Networker circuit not damaged - shorted STAT circuit.
Networker wired to TW1 & TW2 with link removed.	=	Networker has display:  Heater OFF - no STAT circuit.
Networker wired to 24 V & GND with link in or removed.	=	Networker circuit will be damaged.

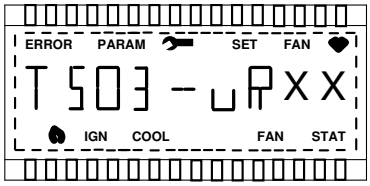
The N-G1/lo Commissioning (cont)

Incorrect Networker/Thermostat Configuration

(Pre version 7 models only)

Shorted Networker wiring circuit

If the Networker 2 wire cable is shorted between TW1 & TW2, then the Networker will not display any screen, and the N-G1/lo LCD will flash:



And attempt to reset continually.

If the Networker TW2 cable is shorted to Earth, the unit again will behave as above.

If the Networker TW1 cable is shorted to Earth, then there is no effect on the unit, due to this side of the circuit being earthed.

The N-G1/lo Commissioning (cont)

Incorrect Networker/Thermostat Configuration

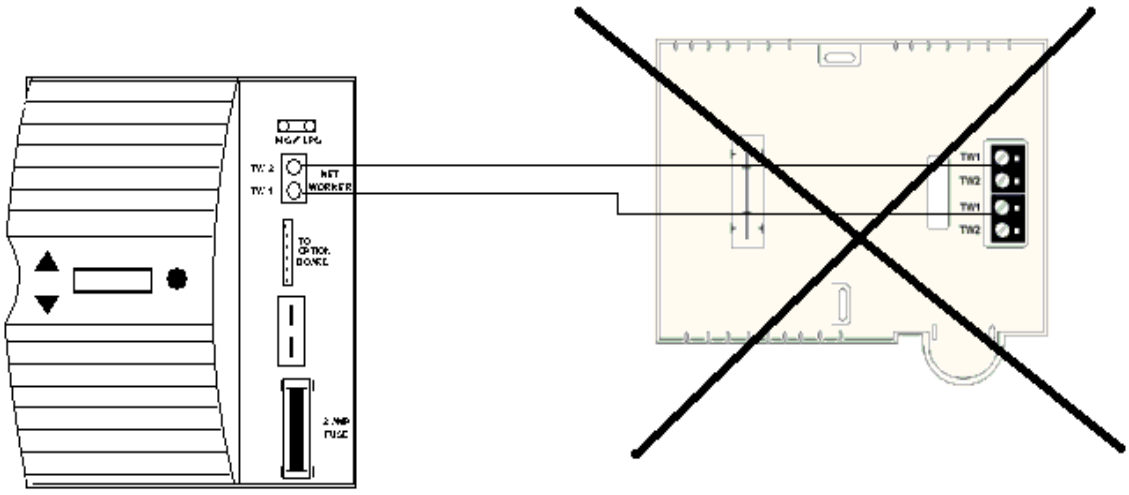
(N-C2 Networker models)

The N-C2 Networker was released in October 2001. In addition to other improvements over the previous N-C1, a major change is that the wall control wiring is now connected to terminals located on the backing plate rather than on the Networker itself, and an additional set of terminals (right below the existing ones) are also present.

The second set of terminals was implemented to provide another alternative connection point for a second appliance rather than parallel connecting into the existing wiring circuit from the first appliance, or trying to fit the piggy backed wires from both units into one terminal block which was often difficult due to the small terminals.

This initially caused a few problems as the early production backing plates did not have the TW1 & TW2 markings on them. This allows the possibility of incorrect connections that would produce a fault similar to when the TW1 & TW2 wires are shorted together or when the TW2 wire is shorted to Earth (see details on page 42).

It is recommended that the twin core wiring from any one appliance always runs to only one terminal block (i.e. either the top two terminals or bottom two terminals). If the two wires are split across both terminal blocks (see below) there is a 50% chance that the Networker screen will be blank.



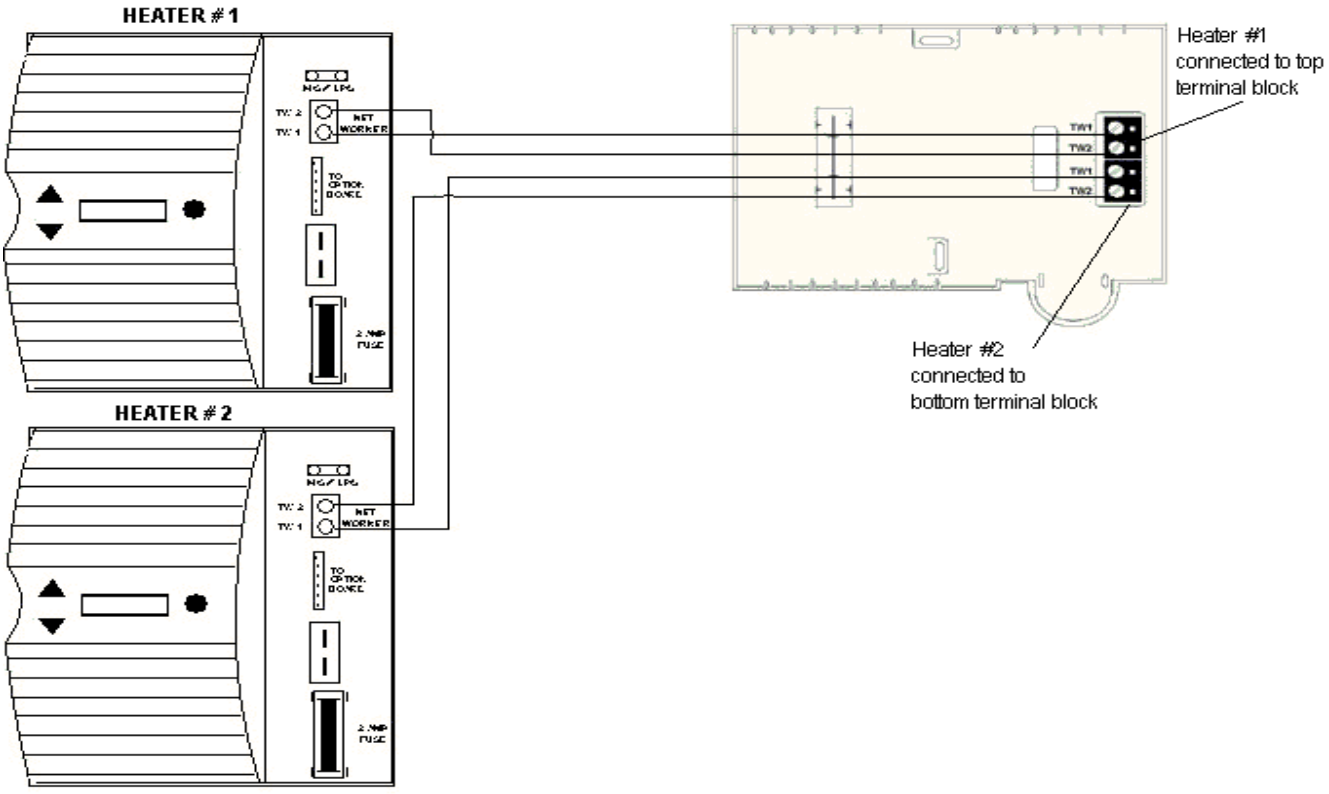
(Continued over page)

The N-G1/lo Commissioning (cont)

Incorrect Networker/Thermostat Configuration

(N-C2 Networker models)

Where a second appliance's (either Heater or Cooler) wiring is to be run all the way back to the Networker, it's wiring should also only run to either the top or bottom terminal block (see below).



It is still important to remember that when **more than one heater** is connected on the Network, then all the heaters must have the **same Network wiring polarity** i.e. all the TW1 terminals the same polarity, and all the TW2 terminals the same polarity.

When the Networker is clipped onto the backing plate, it's pins bridge the two TW1 terminals on each terminal block together and the two TW2 terminals on each terminal block together. This is effectively the same as using parallel wiring connections as shown on page 8 of this manual.

If a TW1 terminal on the heater is connected to a TW2 terminal on the Networker backing plate, then the potential for problems still exists.

Abnormal Operating Conditions

Gas Ignition and/or Burner Operation Failure

Gas Fails To Ignite Burners/Pilot

During a normal ignition sequence, if the flame was not confirmed at the "IGNITING" stage, then after a delay period to purge and vent any un-burnt gas, the N-G1/lo module will automatically restart the ignition process again.

The **Auto EMS heaters** can have a maximum of **4 attempts, with a 5 minute purge delay** between ignition each attempt, whereas **MPS units** may attempt up to **4 ignitions with a 70 second delay.**

MPS units will continue operation of the combustion fan during this delay, and the LCD will read pre-purge.

If the unit fails to establish ignition, it will force a **lockout** condition.

- The LCD displays the following, during this delay time between ignition attempts:

- When a lockout occurs the LCD also displays "ERROR" in the top left corner:

Gas supply interruption or flame loss after ignition established

If the burners main flame sensor loses confirmation of the flame during operation, then a normal ignition process as described above applies, to either re-light the burner or lockout the N-G1/lo module.

Abnormal Operating Conditions (cont)

Gas Ignition and/or Burner Operation Failure (cont)

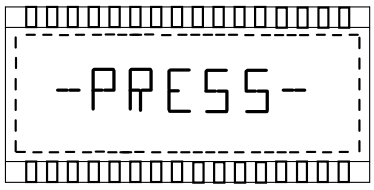
Flame Sensor Rod is Open Circuit or Shorted to Earth

If the flame sensor rod is open circuit, then no flame sensing signal will be sent during the ignition process, and an ignition lockout will result:

To Reset an Ignition Lockout

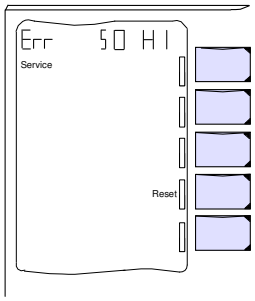
Both the Networker and the N-G1/lo module LCD screens will prompt pressing the RESET button to resume normal operation.

The LCD on the N-G1/lo module alternates the following to prompt the SET button to be pressed:



&

and the Networker displays error 50 with a reset key:



The lockout may be reset from either the N-G1/lo SET button, or the Networker reset key.

Abnormal Operating Conditions (cont)

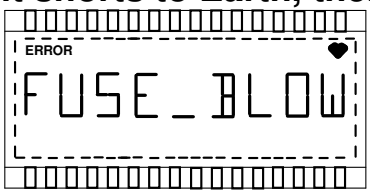
Gas Ignition and/or Burner Operation Failure (cont)

HSI Ignition Element is Open Circuit

The HSI element is a ceramic material that can easily be damaged through miss-handling. Care should be taken not to touch the element as it will accelerate its deterioration.

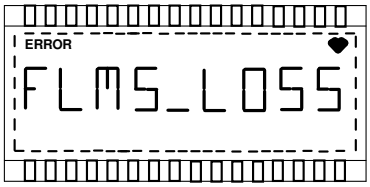
If the HSI circuit is open circuit, then the unit is locked out and the LCD will display:

If the HSI circuit shorts to Earth, then the 2 Amp fuse will also be blown:



Auto EMS Pilot Flame Lights, then Loses Flame within Confirmation Period

On Auto EMS units, only 10 pilot flame re-lights are permitted, at the 5 second **flame proving period** that follows flame detection, before the system will lockout and display:



Abnormal Operating Conditions (cont)

Gas Ignition and/or Burner Operation Failure (cont)

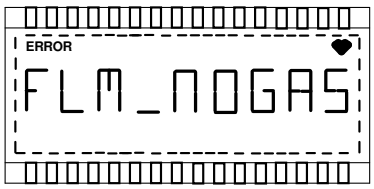
Burners/Pilot burner Loses flame within the Ignition Confirmation Period

If the pilot flame (Auto EMS), or burner flame (MPS), is lost (more than 2 seconds) **within 10 seconds FLAME_PRV period** after the **main valve** is energised, the ignition process will commence again from the beginning.

- Only 6 consecutive flame losses are permitted during this **Ignition Confirming period,** before the system will lockout and display:

Flame Confirmation without Gas Valve Operation

In the event that flame is detected when the gas valve has not been energised, then the N-G1/lo module will shut down and **lockout** immediately, unless the valve has closed in normal operation, forcing a
10 - 15 second delay of the flame detection:



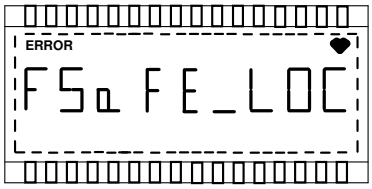
Abnormal Operating Conditions (cont)

Gas Ignition and/or Burner Operation Failure (cont)

Backup Flame Loss Sensor Operation

Both MPS and Auto EMS units have a backup flame sensor at a different burner sensing location, to protect against loss of flame during operation, with the gas valve energised.

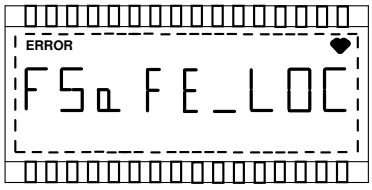
Should the backup flame sensor lose flame confirmation, then a lockout will result after **90 seconds of continuous NO FLAME SENSING**, and is displayed on the LCD as follows:



No further operation is possible until a service reset is performed.

Backup Flame Loss Sensor is Open Circuit or Shorted to Earth

Should the backup flame sensor circuit be "open circuit" or shorted to Earth, then the signal to the N-G1/lo is lost and again the LCD will display:



Abnormal Operating Conditions (cont)

Operation in LIMP Mode

The heater will operate in a LIMP mode condition if the N-G1/lo has not received the **fan motor speed sensor signal or a Supply Air Thermistor sensor signal** required for normal operation.

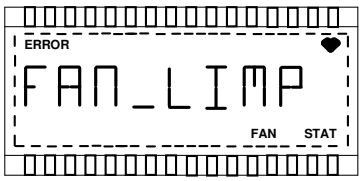
The user still has some heating, until the problem can be rectified by a service technician, even though this operation does not give the maximum or best performance.

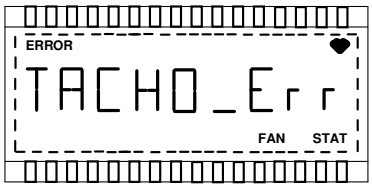
In Limp mode, the heater reverts to timing the ON and OFF fan operation with a set fan speed.

The fan ON time = 45 seconds from when the gas valve is energised at the start of the heating cycle.

The fan OFF time = 60 seconds from when the gas valve closes at the end of the heating cycle.

The fan motor speed sensor malfunctions are displayed as:

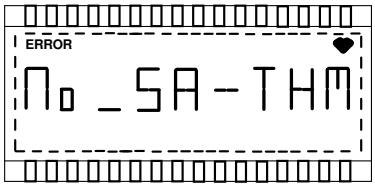


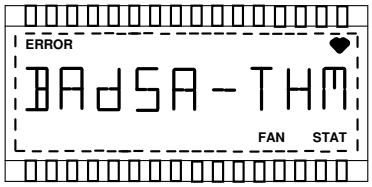
or


and the fan speed is forced to the maximum RPM, and controlled by the phase drive angle.

For Limp modes relating to the **Supply Air Thermistor, the gas rate is forced to the minimum rate, and the fan operates at the installer set speed.**

Supply Air Thermistor limp modes are shown on the LCD as:



Or


Abnormal Operating Conditions (cont)

Over Temperature Conditions during Normal Heating Operation

The Supply Air Thermistor has an additional function that signals the N-G1/lo module to shut down the gas valve, if the temperature on the thermistor reaches 90ºC. (Over temperature).

This is displayed as:

OVER HEAT THERMISTOR

Auto EMS heaters have two additional over temperature switches, which directly interrupt the 24 Volt power to the gas valve, if over heating occurs.

They are:

- One located in the supply air discharge and activated at 90ºC.
- One located in the main fan housing and activated at 90ºC. (Units manufactured prior to 1/1/99 used a 57ºC. switch on a bracket above the fan motor).

MPS heaters also have two over temperature switches, but are located in the heat exchanger compartment, and activate at 90ºC.

- One located at a low point in the supply air discharge.
- One located at a high point in the compartment adjacent to main fan.
- MPS HE models are fitted with an additional 90ºC switch wired in series to the fan compartment switch.

These switches directly interrupt the 24 Volt power to the gas valve if over heating occurs.

If either or both over temperature switches open circuit indicating over temperature conditions within the Timed Safe Guard Period, then the following will occur during the over temperature condition:

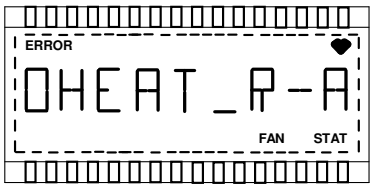
- The power supply to the gas valve will be terminated.
- The fan will operate immediately, if not already operating.

The LCD display will show the over temperature switch that is in open circuit.

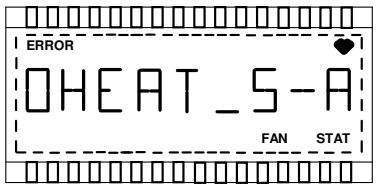
Abnormal Operating Conditions (cont)

Over Temperature Conditions during Normal Heating Operation (cont)

The LCD screen will display the over temperature condition as follows:



OVER HEAT RETURN AIR



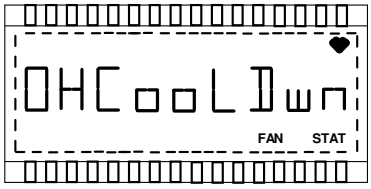
OVER HEAT SUPPLY AIR

The fan operation in an over temperature condition will be changed to the **maximum speed** to clear the excess heat.

Once the over temperature condition has cleared and the switch resets, the normal heating cycle can commence again, provided the Networker is still calling for heat.

The LCD will display **"OHCooLDwn" for the next 60 seconds**, alternating with the normal heating cycle displays i.e. HEAT= -- -- C^0.

This is to indicate the heater has recently reset from an over temperature condition, but has now cooled sufficiently to resume operation:



If the Networker turns the call for heat OFF whilst the unit is in over temperature during a normal heating cycle, then after completing the “OHCOOLDWN" 60 second period the fan will then resume the normal CooLDOWN of the heating cycle.
i.e. CoolDOWN as in the normal heat cycle according to the supply air outlet thermistor temperature.

Abnormal Operating Conditions (cont)

Over Temperature with Networker OFF

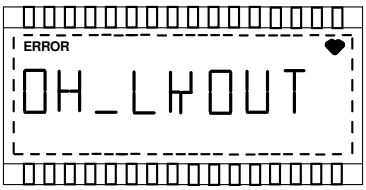
If an over temperature condition is detected within the Timed Safe Guard Period with the **Networker turned OFF**, then the fan will start.

The LCD for the over temperature switch will display the appropriate switch, until the fan cools the over temperature condition.

The LCD will again display **"OHCooLDwn"** while the fan continues a **60 second fan OFF cycle.**

If a **SECOND subsequent over temperature condition with the Networker OFF** is detected, within the Time Safe Guard Period, the controller will again follow the same sequence for an over temperature condition.

However, it will go into an **Over Heat lockout** mode that will require a reset (Reset at the Networker or SET button at the N-G1/Io module) to restore the unit to normal operation.



If an over temperature condition occurs while the unit is in an **over heat lockout mode,** then the fan will be brought ON for the duration of the over temperature condition, followed by a 60 second fan OFF cycle period.

Abnormal Operating Conditions (cont)

Short Circuit over Temperature Circuits

If either the return air or supply air Klixon is shorted to Earth, then the N-G1/lo 2 Amp fuse will be blown:

If either the return air or supply air Klixon is shorted together then the switch function is disabled.

If the supply air thermistor circuit is shorted together or to Earth then the unit will revert to a OHEAT_THM condition.

Should the thermistor circuit resistance change due to a partial short i.e. moisture across the thermistor contacts, then the thermistor may signal an incorrect temperature sensed.
This may be observed in the heaters operation, by bringing ON the fan at a high fan speed and/or running the fan continuously at the end of a heating cycle i.e. thermistor will not go below 40ºC.

Abnormal Operating Conditions (cont)

Flame Roll Out - Anti Flame Roll Out (AFRO)

Auto EMS units are fitted with a AFRO sensor rod, just above the burner compartment, to detect if flame is present outside of the heat exchanger chamber/s.

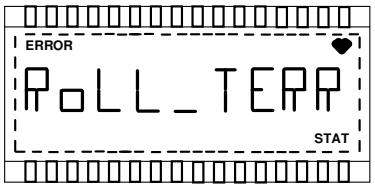
MPS units are fitted with a AFRO sensor rod in the burner manifold venturi, designed to detect flame in the burner compartment.

The N-G1/lo module will recognise the circuit (resistance) from the AFRO sensor rod through the flame to the burner (ground), therefore flame contact is required for the sensor to operate.

AFRO Circuit Test

When the Networker turns OFF at the end of a heating cycle, the N-G1/lo module also carries out a test (8 second) on the AFRO sensor and circuit.

If the sensor is open circuit or shorted to Earth, then the N-G1/lo will indicate an error code on the Networker, as well as display the following on the LCD:



FLAME ROLL OUT TEST ERROR

AFRO Flame Contact Operation

Initially, when the gas valve is energised, a **10 second "Roll out Delayed Response" period commences**, where the AFRO sensor requires a **constant flame for 2 seconds**, before the N-G1/lo module will respond to shut OFF the gas to the burners.

This will allow for nuisance shut downs due to delayed ignition problems, where minor flame spillage may occur.

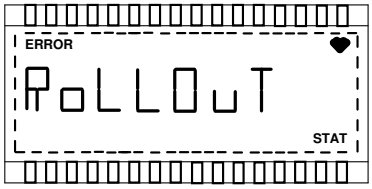
Abnormal Operating Conditions (cont)

Flame Roll out (cont)

On completion of the Roll out Delayed Response period, any flame to ground contact to the **AFRO sensor,** will result in the N-G1/lo module immediately turning OFF the gas valve.

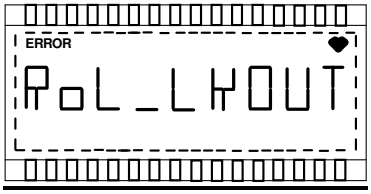
In both cases when the gas valve is turned OFF, it will shut down for a **10 second period,** before the N-G1/lo module commences a re-ignition cycle. When the full ignition restores the burners to normal operation, if no further roll out is detected, and then the normal heating cycle will be reinstated.

During the 10 second shut down period the LCD will display the following:



If 3 " flame roll outs " occur within the same heating cycle call from the Networker, then the N-G1/lo module will force a **Roll out - Lockout** condition. The gas valve will stay permanently locked out, ignoring any call for heating from the Networker.

This condition is indicated as an error code on the Networker as well as display on the LCD the following:



The Roll out Lockout will require a reset (Reset at the Networker or SET button at the N-G1/lo module) to restore the unit to normal operation.

MPS Service Maintenance Schedule Procedures

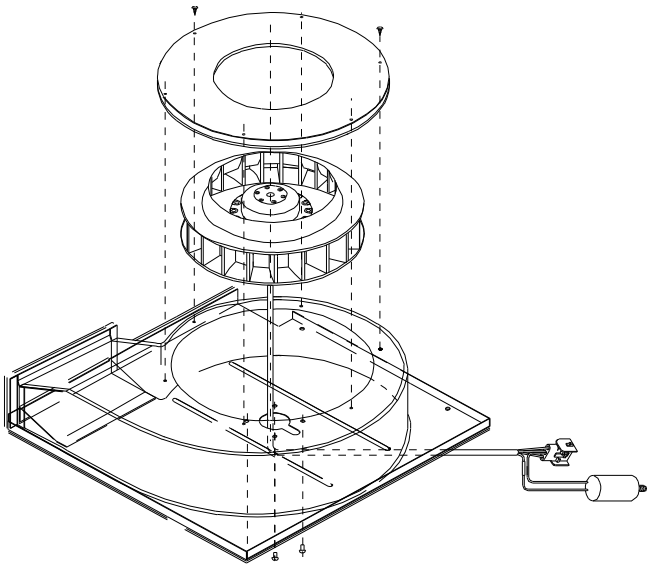
Service to the Burner and Manifold

- Isolate the power and gas supply from the unit.
- Remove top cover panel (external models) or front louvre panel (internal models), by unscrewing 4 self tapping screws on the cover ends, and then lift the cover off.
- Remove burner compartment cover panel.
- Remove burner manifold and venturi.
- Wash the burner manifold and venturi by flushing with clean water, and then dry the assembly completely.
- Vacuum clean the burner compartment.
- Check HSI ignition electrode, lead and plug connection.
- Check that the flame prove sensor rod is clean, located correctly and the lead and plug connection is in good condition.
- Vacuum clean the Heat Exchanger port flanges.
- Check the gas injector and injector orifice is clean and clear of blockage.
- Reassemble.

MPS Service Maintenance Schedule Procedures (cont)

Service to the Combustion Fan

- Isolate the power and gas supply from the unit.
- Remove top cover panel (external models) or front louvre panel (internal models), by unscrewing 4 self tapping screws on the cover ends, and then lift the cover off.
- Remove combustion fan assembly.
- Remove combustion fan housing flange (Impellor).
- Clean impellor, housing and housing exit transition.
- Check and clean combustion fan motor if necessary.
- Reassemble.
- Check all wiring cables and plug connections.



Capacitor Value for Combustion Fan:
20 kW Models with MES or EBM motor - 1.5 uF
30 & 35 kW Models with superseded MES motor - 2.5 uF
30 & 35 kW Models with current EBM motor - 2.0 uF

MPS Service Maintenance Schedule Procedures (cont)

Service to the Main Circulation Fan

- Isolate the power and gas supply from the unit.
- Remove top cover panel (external models) or front louvre panel (internal models), by unscrewing 4 self tapping screws on the cover ends, and then lift the cover off.
- Remove combustion fan assembly.
- Remove fan housing from cabinet.
- Remove fan assembly from housing.
- Clean impellor and motor.
- Clean housing.
- Clean heater's fan compartment inner lining.
- Reassemble.
- Check all wiring cables and plug connections (including speed sensor).

MPS Service Maintenance Schedule Procedures (cont)

Unit Operation Check

- Check power supply lead is in good condition.
- Check all gas connections are good and do not leak.
- Check condensate drain and discharge (HE models only).
- Check the Networker wiring connection at the unit is in good condition.
- Check the burner's maximum and minimum operating gas pressure on the test point provided on the gas valve.
- Check the duct system airflow distribution, balance and adjust as required.
- Check the unit's selected fan speed (RPM) is appropriate for optimum heat output for the application.
- Check other accessories fitted to the system (i.e. Network 506, zone dampers) are functioning.

Auto EMS Service Maintenance Schedule Procedures

Pilot burner and injector

If the pilot fails to light then the following checks are required.

- Check the gas supply for volume and pressure.
- Check the gas flow from the gas valve is sufficient for pilot operation.
- Check the pilot injector for blockage and damage.
- Check the ignitor element is not damaged (5 - 10 Ohm's).
- Check the flame sensor rod is not damaged; bent or coated preventing flame contact.
- Check the element and sensor rod wire loom and plug connection.

Main burner and injector

The main burners require regular cleaning for efficient combustion and ignition. The first sign that servicing is required is generally through **Delayed Ignition - Poor Ignition** which is the result of one or more of the main burners not:

- igniting properly
- igniting, then flame lifting off and re-lighting

The most common reason for poor ignition is dirt, dust or fluff accumulating in the burner or the burner venturi

The burner requires air drawn into it to mix with the gas being injected into the burner for proper combustion. As it draws air into the venturi, some of the dust and fluff present in that air starts to deposit, accumulating to the point that it affects the air/gas mixture and the flow into the burner.

To Remedy
Routine service to burners by removing them; and washing with water (Flushing out dirt and fluff from venturi and port holes).

Important
When replacing the burners, care must be taken to align the burners vertically or damage to the heat exchanger may occur.

Auto EMS Service Maintenance Schedule Procedures (cont)

Main burner and injector (cont)

Delayed Ignition

Apart from normal maintenance to burners, other causes of delayed ignition are:

- Blockage to main injectors.
- Blockage to zip injector or zip tube burners.
- Poor alignment of burner (burners to zip to pilot).
- Poor pilot flame.
- Poor gas pressure.
- Faulty burner (damaged or distorted).
- Blockage in burner (foreign matter).
- Unit subject to draught, i.e. front cover not fitted.
- Split heat exchanger or heat exchanger sooted.
- Flue down draught.
- Wrong size injectors.
- Inadequate ventilation.

Poor Gas Supply Pressure

Poor or fluctuating gas pressure to heater may be caused by:

- Faulty meter and/or meter service regulator.
- Under sized gas consumer piping.
- Damaged (Crushed) gas consumer piping.
- Obstruction in gas consumer piping or Condensation in gas consumer piping.

Poor or fluctuating gas pressure may cause:

- Poor or delayed ignition, insufficient heat.
- Fan to cycle.
- Burner flame to fluctuate (often creating burner frequency resonance).

Auto EMS Service Maintenance Schedule Procedures (cont)

Unit Operation Check

- Check power supply lead is in good condition.
- Check all gas connections are good and do not leak.
- Check the Networker wiring connection at the unit is in good condition.
- Check the burner's maximum and minimum operating gas pressure on the test point provided.
- Check the duct system airflow distribution, balance and adjust as required.
- Check the unit's selected fan speed (RPM) is appropriate for optimum heat output for the application.
- Check other accessories fitted to the system (i.e. Network 506, zone dampers) are functioning.

MPS Dismantling Procedures

To Remove Heat Exchanger

- Turn the unit OFF and isolate the power supply.
- Remove top cover panel (external models) or front cover panel (internal models), by unscrewing 4 self tapping screws on the cover ends, then lift the cover off.
- Disconnect the flue terminal by unscrewing 2 self tapping screws on the flue terminal plate and remove.
- Unscrew the condensate elbow fitting and leave the tube and connector inside the cabinet. (HE models only)
  NOTE: it may be necessary to remove combustion and main fan to access.
- Disconnect cable and pipe brackets.
- Remove self tapping screw that retains the assembly within the cabinet (Internal models only).
- The entire internal component construction assembly of the unit may now be retracted from the units' cabinet.

To Remove Burners / Manifold

- Turn the unit OFF and isolate the power supply.
- Remove top cover panel (external models) or front cover panel (internal models), by unscrewing 4 self tapping screws on the cover ends, then lift the cover off.
- Remove the burner chamber cover plate by unscrewing 4 self tapping screws, and then lift off.
- Remove the 2 screws holding the manifold shroud and retract the assembly.
- Remove the burner manifold and venturi assembly by unscrewing 2 self tapping screws located either side of the manifold, then lift up and out.

MPS Dismantling Procedures (cont)

To Remove Combustion Fan

- Turn the unit OFF and isolate the power supply.
- Remove top cover panel (external models) or front cover panel (internal models), by unscrewing 4 self tapping screws on the cover ends, and then lift the cover off.
- Unscrew the 4 screws located around the perimeter of the combustion fan assembly plate, then carefully lift and rotate the assembly to remove.
- ***WARNING:*** Care should be taken when removing assembly, as there are wiring looms connected to the controls on the under side.
- To remove the assembly completely:
  - Disconnect wire loom from speed sensor, temp sensor and main fan.
  - Disconnect cable retaining bracket.
  - Unplug power supply and electrical control module loom.

To Remove Flue Terminal

- Turn the unit OFF and isolate the power supply.
- Remove top cover panel (external models) or front cover panel (internal models), by unscrewing 4 self tapping screws on the cover ends, and then lift the cover off.
- Unscrew 2 screws located on flue cover plate.
- Lift the inner cabinet edge above the flue terminal plate to release the top of the plate.
- Hold the flue terminal outlet firmly and pull the assembly out from the unit's cabinet.

MPS Dismantling Procedures (cont)

To Remove Fan Housing and Assembly

- Turn the unit OFF and isolate the power supply.
- Remove top cover panel (external models) or front cover panel (internal models), by unscrewing 4 self tapping screws on the cover ends, and then lift the cover off.
- Unscrew the 4 screws located around the perimeter of the combustion fan assembly plate, then carefully lift and rotate the assembly to remove.
- ***WARNING:*** Care should be taken when removing assembly as there are wiring looms connected to the controls on the under side.
- Disconnect the motor wire loom and speed sensor.
- Slide out the fan housing from the cabinet
- Remove the screws on the fan plate that retain the assembly to the housing, and retract the fan assembly.
- To separate motor from fan, remove grub screw from fan shaft, and use a wheel puller to remove fan impellor.
- Remove nuts and screws from the motor bracket ends to release motor from the brackets.

The motor bracket may be removed from the fan plate if required by drilling rivets out first - ensure the correct rivet size is used when replacing.

Note: The fan assembly on MPS 35i units may be accessed without removing the combustion fan. Remove the screws and side fan cover panel, and then remove the fan assembly as described above.

MPS Dismantling Procedures (cont)

To Remove N-G1/hi Module

- Turn the unit OFF and isolate the power supply.

- Remove top cover panel (external models) or front cover panel (internal models), by unscrewing 4 self tapping screws on the cover ends, and then lift the cover off.

Unscrew the 4 screws located around the perimeter of the combustion fan assembly plate, then carefully lift and pivot the assembly onto the combustion chamber cover.

- ***WARNING:*** Care should be taken when removing assembly as there are wiring looms connected to the controls on the under side.

    - To remove the combustion fan assembly completely:
      Disconnect wire loom from main fan speed sensor, temperature sensor and main fan.

    - Disconnect cable retaining bracket.

    - Unplug main power supply loom and N-G1/hi module loom.

    - This appliance has a Type M specially prepared power cord. If replacement is needed it must be replaced with a genuine Brivis spare part, available from Brivis or Authorised Dealers. (Refer to spare part listing for the correct part number when ordering).

- Release the N-G1/hi Module by disengaging the 5 clip lugs (only on early models) and 2 screws from the combustion fan plate.

MPS Dismantling Procedures (cont)

To Remove N-G1/lo Module

- Turn the unit OFF and isolate the power supply.
- Remove top cover panel (external models) or front cover panel (internal models), by unscrewing 4 self tapping screws on the cover ends, and then lift the cover off.
- Remove the cable access cover on the left side of the N-G1/lo module.
- Disconnect the thermostat wire connection from the N-G1/lo module terminal block.
- Remove the securing screw located on the left side of the N-G1/lo module near the top terminal block.
- Slide the N-G1/lo module to the left to disengage the 2 slide tabs at the bottom of the controller from the cabinet.
- Release the wiring plugs and looms from the N-G1/lo module.
- Remove the N-G1/lo module.

❖ ***WARNING:*** **Upon replacing the N-G1/lo module, ensure all the correct Installer and Service parameters are reset.**

MPS Dismantling Procedures (cont)

To Remove the Gas Valve

- Turn the unit OFF and isolate the power supply.
- Remove top cover panel (external models) or front cover panel (internal models), by unscrewing 4 self tapping screws on the cover ends, and then lift the cover off.
- Disconnect the gas supply pipe from the gas valve supply feed tube.
- Disconnect the gas valve power supply plug and loom by releasing the screw on the plug fitting retracting the plug.
- Disconnect the combustion fan air hoses from the gas valve. Take care to carefully mark the hoses so that they are replaced on the correct valve port.
- Remove the screws on the gas valve retaining bracket.
- Remove the 4 screws on the burner compartment and remove cover plate.
- Remove the screw located in the burner compartment that retains the gas valve base.
- Retract the gas valve burner feed tube and injector from the grommet in the burner chamber wall.
- Remove the gas valve assembly.

Auto EMS Dismantling Procedures

Flue Terminal / Draught Diverter Removal

External Models only

- Isolate power supply to appliance.
- Remove the weatherproof roof panel from the appliance, which is secured by four hex-headed self tapping screws.
- Remove the self tapping screws from the flue terminal.
- Lift off the flue terminal.

Internal Models only

- Isolate the power supply to the appliance.
- Remove front panel.
- Remove bolted sleeve securing break in flue.
    - 20 kW Model:
      Remove the four self tapping screws at the front of the draught diverter, then pull it straight out.
    - 26 kW Model:

Remove the front top stay, then remove the two self tapping screws at the bottom of the draught diverter and pull it out.

Auto EMS Dismantling Procedures (cont)

Heat Exchanger Removal

- Isolate power and gas supplies to the appliance.
- Remove front panel.
- Disconnect gas supply at gas control.
- Remove flue terminal or draught diverter.
- Remove the six self tapping screws from around the perimeter of the heat exchanger.
- Unplug, and disconnect all wiring looms from the N-G1/lo module.
- Remove the heat exchanger, complete with the burners, controls and electric's, by lifting approx. 10mm and pulling forward.

NOTE: When replacing the heat exchanger, it is necessary to seal around unit with Fireproof cement.

Main Circulation Fan Removal

- Isolate power supply to appliance.
- Remove the weatherproof top panel (external) or fan access panel (internal) from the appliance, which is secured with self tapping screws.
- Remove the screws from the fan partition plate and remove the partition (external only).
- Disconnect two wires from the overheat switch located on the fan mounting plate and unplug the fan supply lead.
- Remove the screws retaining the fan housing in the heater cabinet (external only).

Auto EMS Dismantling Procedures (cont)

Main Circulation Fan Removal (cont)

- Lift fan housing assembly vertically upward and out of appliance (external only).
- Remove the 6 screws on the fan plate that retain the assembly to the housing, and retract the fan assembly.
- To separate motor from fan, remove grub screw from fan shaft, and use a wheel puller to remove fan impellor.
- Remove nuts and screws from the motor bracket ends to release motor from the brackets.
- The motor bracket may be removed from the fan plate if required by drilling rivets out first - ensure the correct rivet size is used when replacing.

Manifold and Burner Assembly Removal

- Isolate power and gas supplies to appliance.
- Remove front panel.
- Disconnect gas supply at inlet connection.
- Remove burner bars and zip tube burner.
- Disconnect spade connections from the terminal block on gas control.
- Disconnect the pilot assembly wire loom from the N-G1/lo control module.
- Remove the self tapping screws from the manifold bracket.
- Withdraw the manifold and control assembly from the appliance.