



MICRO GROW

GREENHOUSE SYSTEMS, INC

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Revision 1.2, 12-17-01

Procom Greenhouse Control System

INSTALLATION PROCEDURES

GROWMASTER SERIES OF CONTROLLERS

PANEL MOUNTING

Mount the control panel in an accessible location. Make sure that the location is free of vibration and in close proximity to the devices being controlled. Always consider voltage drop of electrical current when locating the control panel. Securely mount the panel.

SWITCHING CONTACTORS AND RELAYS

The control panel will operate the greenhouse equipment via load contactors and load relays. **ALL RELAYS AND LOAD CONTACTORS USED MUST HAVE A SURGE SUPPRESSOR INSTALLED ACROSS THE COIL OF THE RELAY OR LOAD CONTACTOR.** These surge suppressors are readily available from Micro Grow Greenhouse Systems, Inc. All load contactors and relays are also readily available from Micro Grow Greenhouse Systems, Inc. To decide which to use, follow this guide:

LOAD CONTACTORS: Exhaust fans, pad pumps, horizontal air flow fans, heating pumps, fan jets, large heaters, crop lighting, and all other larger electrical loads over 1/6 H.P.

LOAD RELAYS: Signal switching such as the small control lines for gas fired heaters, control lines for vent and shade system controls, small loads such as motorized shutters, other loads up to 1/6 H.P.

CUSTOM CONTACTOR AND RELAY PANEL AVAILABLE A custom built load contactor and load relay panel is available from Micro Grow Greenhouse Systems, Inc. This panel will contain all of the required switching apparatus for your project, as well as a correctly sized machine tool transformer. Contact Micro Grow Greenhouse Systems, Inc. for pricing and availability.

TRANSFORMERS

A 24 VAC transformer will power the control panel. It is important to use a MACHINE TOOL type. A Machine Tool Transformer is a heavy-duty variety that will allow for high inrush currents that are associated with the use of load contactors and relays. Micro Grow Greenhouse Systems, Inc. stocks these types of transformers. Use no smaller than a 50 VA Machine Tool Transformer. For a system that has more than three load contactors connected, use a 100 VA Machine Tool Transformer.

ELECTRICAL CIRCUITS

The electrical circuit that feeds the machine tool transformer must have no other loads connected to it. This will prevent damaging surges from other related electrical devices. Follow all local and national codes in the connection of all of the greenhouse equipment. Always allow for voltage drop conditions. Always consider that the greenhouse is a wet environment. Always follow the code rulings for disconnect switches and overcurrent devices on greenhouse equipment. **USE A QUALIFIED AND LICENSED ELECTRICIAN AT ALL TIMES.**

WIRING METHODS

Always use stranded wire when connecting cables or conductors to the actual circuit board of the control panel. This will allow flexibility. Use no smaller than #18 gauge stranded wire for all outputs. Use no smaller than the recommended wire size of stranded cable for inputs, generally #22 gauge.

SENSOR CONDUCTORS: Route sensor conductors separately from control conductors. This is very important so as to reduce electrical interference. Never route sensor conductors in conduits used for other voltages. This is in violation of the electrical code and will cause dangerous interference to the control system. Always locate the actual sensor in the center of the range that is being controlled for accurate readings. Do not allow the sensor to come in contact with any greenhouse structure member such as a post that would give off any radiated heat and cause a false temperature reading. Do not locate the sensor where a particular piece of equipment would cause false readings, such as a heater blowing directly on the sensor. Mount all wind/rain sensor in a clear area, free of any wind obstructions.

CONTROL CONDUCTORS: Route all control conductors separately from sensor conductors. This is very important so as to reduce electrical interference. Control conductors maybe routed in conduits that contain other power system wiring only if the insulation material on the conductors is the same as the power system wiring. Consult the national electrical code or local codes if in doubt about the insulation ratings of the wire in use. Remember; always use a qualified and licensed electrician.

VENT SYSTEMS, SHADE SYSTEMS, ROLL UP CURTAINS

When connecting a vent system, shade system, or roll up curtain ventilation system to the control panel, you must use a separate control box designed for that particular vent or shade system. These are readily available from Micro Grow Greenhouse Systems, Inc. Generally these separate control boxes feature overcurrent protection for the particular motor on the vent or shade system, provisions for direct limit switch connections, and a manual means of operating the vent or shade system independent of the main control system. These separate control boxes will connect the main control system either directly through the outputs of the control system, or they will require control relays for interconnection to the main control system. Consult the individual instructions that come with the vent or shade controls for detailed information.

SYSTEM TESTING

It is always important to completely and fully test the electrical system by energizing circuits and verifying equipment operations before automatically operating the equipment from the control panel. This would include setting all of the vent and shade limit switches at the individual control panels.

GROWMASTER PROCOM OPERATING INSTRUCTIONS

PROCOM SERIES

The PROCOM Series is a completely programmable greenhouse computer system. Any output may be assigned to any input or function. The PROCOM is set up by Micro Grow Greenhouse Systems, Inc. and pre-programmed for the individual requirements of the control system in use.

PROGRAMMING LIGHTS

RUN - Indicates that the system is in the running mode.

SET PROGRAM-All temperatures, humidity levels, and other information are set here.

SET REPORTS-This will enable the REPORT feature of the Growmaster.

SET CALIBRATION-This will put the Growmaster in the calibration mode.

SET SYSTEM-Set the clock, set the day, midday, evening, and night criteria here. Set system identifications.

SET COOLING-Set the criteria for all of the maintained cooling outputs here.

SET HEATING-Set the criteria for all of the maintained heating outputs here.

SET VENTILATION-Set the criteria for all of the staged ventilation outputs here.

SET SHADING-Set the criteria for all of the shading outputs here.

SET FOGGING-Set the criteria for all of the fogging outputs here.

SET HEAT VALVES-Set the criteria for all of the modulating heat valves here.

SET DEHUMIDIFY-Set the dehumidify functions here.

SET CROP LIGHTS-Set the criteria for all crop lighting outputs here.

SET CO²-Set the CO² criteria here.

SET ALARMS-Set the alarm choices here.

SET OTHER-Other functions, consult Micro Grow.

PROGRAMMING SWITCHES

There are three main programming switches located on the Growmaster front panel. These are:

RUN-SET SWITCH

RUN-Puts the control in the RUN mode.

SET-Puts the control in the SET mode in order to set all functions as outlined on the programming lights.

PRIOR-NEXT SWITCH

PRIOR-Advances to the prior item in the menu.

NEXT-Advances to the next item in the menu.

VALUE UP-VALUE DOWN SWITCH

VALUE UP-Increases the value in the display.

VALUE DOWN-Decreases the value in the display.

(The VALUE switch is also used to toggle between selected item choices available)

TO SET THE PROGRAMS

The **SET PROGRAM** mode allows the grower to set all of the temperatures, humidity levels, shading solar levels, and other settings. In this mode the normal day to day settings will be entered. No details such as time delays, differentials, etc. are entered here. Refer to the individual SET modes for the individual criteria settings.

The screen will display the first selected item to set the program on. The screen will also indicate by flashing whether the setting will apply to DAY, MIDDAY, EVENING, or NIGHT.

1. Enter the **SET PROGRAM** mode.
2. Use the **PRIOR-NEXT** switch to advance to the desired item to set.
3. Use the **VALUE** switch to increase or decrease the desired value.
4. Use the **PRIOR-NEXT** switch to advance to the next desired item to set.
5. Return to the **RUN** mode.

Cooling 1 DAY

(80) 80 80 80

Set the desired value for the flashing segment. Set for **DAY**, **MID** (Midday), **EVE** (Evening) and **NGT** (Night). You may disable the **MID AND EVE** settings in the **SET SYSTEM** mode if desired.

As you continue to toggle through the display in the **SET PROGRAM** mode, all pre-programmed features will come up for similar settings. Set all of these in the same manner as above. You may then return to the run mode, or if no switches are used after a short timed period, the Procom will automatically return to the run mode.

The items that can be set in the SET PROGRAM mode:

1. Cooling and heating temperatures.
2. Ventilation temperatures.
3. Fog temperature and humidity.
4. Hot water zone temperatures,
5. Shade system light intensity.
6. Dehumidify humidity levels.
7. CO2 levels.

RUN REPORTS

The **RUN REPORTS** mode allows the grower to run selected reports on the sensor history.

1. Enter the **RUN REPORTS** mode.
2. Use the **PRIOR-NEXT** switch to advance to the desired report.
3. Continue to use the **PRIOR-NEXT** switch to advance and view reports.

Display Report (Inside)

Select the desired report for display.

CALIBRATE

The **CALIBRATE** mode is used in order to calibrate all of the sensor readings. It is also used to calibrate the vent and shade positions in the event that they have been moved manually and do not match the GROWMASTER display as to the percentage opening. Calibration always should be done with a good thermostat or humidity indicator, and when conditions have been calm for a period of time. Late afternoon or early morning is best, without solar influence.

1. Enter the **CALIBRATE** mode.
2. Use the **PRIOR-NEXT** switch to advance to the desired item to calibrate.
3. Use the **VALUE** switch to increase or decrease the display reading.

Calibrate: Air Temp 1 80° F

Set the desired value. The calibration procedure should be done with a reliable thermometer, out of direct solar influence when calibrating temperatures. Use a wet and dry bulb to calculate humidity.

You may also calibrate any ventilation or shade position in this mode. Advance to the desired vent or shade position in the CALIBRATE mode, and enter the actual position of the vent or shade system. The Procom will then move the vent or shade to the correct position.

Calibrate: Vent 1 50%

GROWMASTER PROCOM SET UP

SET SYSTEM

The **SET SYSTEM** mode is used to set the system clock and date, manually view the system's sunrise and sunset times, adjust the system photocell, and to set the custom identification that will appear on the display during the run mode. Also, this mode is used to determine the times of day, either by sunrise, sunset, clock, or a combination of means, by which the four separate settings will apply. The four settings are listed as DAY, MIDDAY, EVENING, and NIGHT. In addition, the input and output configurations that have been pre-programmed into the PROCOM series control can be reviewed here. The air circulation functions may be defined in this mode. Finally, the remote ID code for use with the GROWLINK PC communications program is set here.

1. Enter the **SET SYSTEM** mode.
2. Use the **PRIOR-NEXT** switch to advance to the desired item to set.
3. Use the **VALUE** switch to increase or decrease the display reading. Also use this switch to toggle between desired choices that the system has internally provided.

Set Clk (12:00) PM
Mon 01/ 02/ 94

Set the correct time and date.

Sunrise 7:00 AM
Sunset 8:00 PM

These are the current values that the control is sensing for sunrise and sunset. There is no need to change these values; the control will update automatically.

Light Sensor
(Med) Sensitivity

Select the desired sensitivity for the photocell. The photocell will detect sunlight and use this information to put the control in the evening or night modes. You may also elect to have the Procom enter the evening or night modes before or after sunset. Also, the Procom can enter the day modes before or after sunrise.

Custom System ID
(OFF)

By changing this to **PROGRAM**, you may enter a custom ID that will appear on the screen when the system is running. This may include the name of the range, or other information. If **PROGRAM** is selected, then use the **VALUE** switch to select the desired alphanumeric information, and the **PRIOR/NEXT** switch to advance to the next digit. A blank space, punctuation marks, and numerals may also be selected if desired.

DAY Mode
(At Sunrise)

Select how the four modes of operation, **DAY**, **MID**, **EVE**, **NGT** will be affected. You may choose a switching action **AT SUNRISE**, **PRE-SUNRISE** (Sunset for **EVE** and **NGT**) or **TIMED**. You may also choose **NOT IN USE** to disable **EVE** and **MID** if desired.

Review I/O
Assignments? (N)

Use this selection to review the assigned inputs and outputs for your system. You may not change them here, only review them. To change the assignments, please contact Micro Grow for a specific code to enter into your system to enable you to change the configuration.

Remote ID Code:

(0)

Not applicable if not using the GROWLINK program. Set the ID code here for the Growlink remote PC program available from Micro Grow Greenhouse Systems Inc. Every ID code must be different for each Procom.

**Link Air 1
To Output (1)**

Select the output that the Air Circulation output will be linked to. You may select any stage of operation; even a vent or shade position may be selected. If a vent or shade output is selected, the Procom will ask for a position for that device to energize or de-energize the air circulation output. You may also link the air circulation to one or two particular sensors.

**Air 1 On if
Output is (ON)**

OR

(IF VENT OR SHADE POSITION IS SELECTED)

**Air 1 On if
Output is (<=) (CL)**

Select when to turn on the Air Circulation output, or, if the output is a vent or other staged device, set the position of operation desired to energize the air circulation output.

**Link Air 1 To
(1) Sensor**

Enter the selected sensor here to link the air circulation stage to. If no sensor is desired, select "No Sensors" from the menu. If "No Sensors" is selected, the air circulation will only look at the previously selected output link. If a sensor however is selected, enter the next screen information as:

**Turn On Air if
(Sensor Selection) >=(70)**

SET COOLING

The **SET COOLING** mode will be used to set the desired cooling stage temperature separations and differentials. The internal time delays that will prevent rapid cycling are also set here. Also, this mode is used to determine if any of the cooling stages will be activated during the dehumidify functions of the system. You may choose either the immediate dehumidify function, or the delayed dehumidify function. You may adjust the cooling temperatures throughout the day based on the intensity of the solar level. You also can link any cooling selection to another output in order to completely or partially disable that set of cooling when the other output, including a vent or a shade system, is active. The temperature ramping time can be entered here. This is the amount of time required to change the temperature from one mode to the next.

1. Enter the **SET COOLING** mode.
2. Use the **PRIOR-NEXT** switch to advance to the desired item to set.
3. Use the **VALUE** switch to toggle between desired choices that the system has internally provided.

Cooling 1 Stages (2° Sep.) 2° Dif.

Set the desired separation of the cooling stages here, and also the desired differential. The separation is the total number of degrees that separate each stage of operation. Once an output or a stage has been activated, the differential is the amount of temperature change required that will cancel the operation of that stage or output.

Cooling 1 Timing (2 Sec.)

Set the desired time delay here. The time delay will be active on both energizing and de-energizing stages.

Cooling 1 Stg (1) On Immed Dehum

Cooling 1 Stg (1) On Delay Dehum

Set the desired stages of operation here that will be activated by the dehumidify functions. You may choose either the **IMMEDIATE** or the **DELAYED** dehumidify functions for a particular stage.

Cooling 1 Solar Adjust? (N)

(IF YES)

Cooling 1 Min Sol (0) K-LUX

Cooling 1 Min Sol (100) K-LUX

(Lower) Setpoint By 0°F

The Solar Adjustment feature allows the grower to adjust the cooling temperature setpoint up or down depending on how intense the solar level is. The solar level is monitored by the K-Lux sensor if used. The solar level can also be monitored by a PAR or Pyranometer sensor if connected to the Procom.

**Setpoint Ramp
(30) Minutes/Deg**

This is the ramp time of the heating system. Enter the desired time that it will take the system to implement a change in the heating setting. The Procom will use this time when changing modes (Day, Midday, Evening, and Night).

**Link Cooling 1
To (Output Selection)**

(IF LINKED)

**Cooling 1 (Max) 0
If Output (Selection) ON**

You may use this setting to link a cooling selection to any particular output. This also includes vents or shade systems. When this feature is used, the cooling stage(s) will either turn off completely (0 selection), or turn off partially (maximum stage selection) when a particular output, shade, or vent is active.

SET HEATING

The **SET HEATING** mode will be used to set the desired Heating stage temperature separations and differentials. The internal time delays that will prevent rapid cycling are also set here. Also, this mode is used to determine if any of the Heating stages will be activated during the dehumidify functions of the system. You may choose either the immediate dehumidify function, or the delayed dehumidify function. You may adjust the Heating temperatures throughout the day based on the intensity of the solar level. You also can link any Heating selection to another output in order to completely or partially disable that set of Heating when the other output, including a vent or a shade system, is active. The temperature ramping time can be entered here. This is the amount of time required to change the temperature from one mode to the next.

1. Enter the **SET HEATING** mode.
2. Use the **PRIOR-NEXT** switch to advance to the desired item to set.
3. Use the **VALUE** switch to toggle between desired choices that the system has internally provided.

Heating 1 Stages (2° Sep.) 2° Dif.

Set the desired separation of the Heating stages here, and also the desired differential. The separation is the total number of degrees that separate each stage of operation. Once an output or a stage has been activated, the differential is the amount of temperature change required that will cancel the operation of that stage or output.

Heating 1 Timing (2 Sec.)

Set the desired time delay here. The time delay will be active on both energizing and de-energizing stages.

Heating 1 Stg (1) On Immed Dehum

Heating 1 Stg (1) On Delay Dehum

Set the desired stages of operation here that will be activated by the dehumidify functions. You may choose either the **IMMEDIATE** or the **DELAYED** dehumidify functions for a particular stage.

Heating 1 Solar Adjust? (N)

(IF YES)

Heating 1 Min Sol (0) K-LUX

Heating 1 Min Sol (100) K-LUX

(Lower) Setpoint By 0°F

The Solar Adjustment feature allows the grower to adjust the cooling temperature setpoint up or down depending on how intense the solar level is. The solar level is monitored by the K-Lux sensor if used. The solar level can also be monitored by a PAR or Pyranometer sensor if connected to the Procom.

Setpoint Ramp (30) Minutes/Deg

This is the ramp time of the heating system. Enter the desired time that it will take the system to implement a change in the heating setting. The Procom will use this time when changing modes (Day, Midday, Evening, and Night).

Link Heating 1 To (Output Selection)

(IF LINKED)

Heating 1 (Max) 0 If Output (Selection) ON

You may use this setting to link a Heating selection to any particular output. This also includes vents or shade systems. When this feature is used, the Heating stage(s) will either turn off completely (0 selection), or turn off partially (maximum stage selection) when a particular output, shade, or vent is active.

SET VENTILATION

The **SET VENTILATION** mode is used to set the number of desired stages of the vent openings, the desired position of each stage, the actual total opening time for the vent itself, and to let the system know if there is a safety time delay in the vent control panel being used. The programming also allows the vent to be linked to a cooling stage or to override input if desired. The dehumidify functions of the vent, both immediate and timed, are programmed here. This mode also is where the vent temperature differentials and temperature stage separations are set. The vent system timing will be set here. The vent temperature may also be adjusted throughout the day according to the solar intensity. An adjustable ramp time can be entered in order to allow for gradual temperature changes when changing modes. A reference temperature can be entered here. The reference temperature will adjust the vent maximum position in relation to another sensor reading. A typical use for the reference temperature selection would be to adjust the vent maximum opening based on the outdoor temperature.

1. Enter the **SET VENTILATION** mode.
2. Use the **PRIOR-NEXT** switch to advance to the desired item to set.
3. Use the **VALUE** switch to toggle between desired choices that the system has internally provided.

Open Vent 1 In (4) Positions

Set the desired number of ventilation stages here. The system can operate the vent in up to eight separate stages. If the output is connect to a pad vent system, then enter "PAD VENT". The Growmaster Procom will now open the pad vent with the cooling stages as they turn on.

Vent 1 Pos 1 10% Open

Set the desired percentages of opening here for each stage. The final stage will always be set to maximum vent position.

Vent 1 Max Pos (100) % Open

Set the desired maximum position for the vent.

Opening Time Vent 1 3:00

Set the actual time that the vent takes to run from its fully closed position to fully open. This time is critical, as the system will use this to determine correct openings.

Safety Delay for Vent 1 (5) SEC

If your vent control system is equipped with a time delay relay that protects the vent against false reversals, enter the number of seconds here. If you are in doubt whether your system has a time delay, simply manually energize the vent. If the vent starts to move immediately, there most likely is no time delay protection. You may choose **NONE** as one of the choices.

Link Vent 1 to Cooling Stage (NO)

Use this feature to link a set of vents to a particular cooling stage if desired. A possible use for this would be in the event that roof vents, as well as active cooling such as exhaust fans are in use. This feature will allow the user to link the roof vents to close to a low position when the cooling stages are active. This would allow the air to be drawn across the entire range and not through the roof vents by the exhaust fans. This setup is not applicable to "PAD VENT".

Vent 1 (Closed) on Cool Stage 1

If a link is made to a cooling stage, the system will then ask what vent position during that cooling stage.

**Link Vent 1 to
Override Inp (NO)**

Use this setting if any override inputs are in use. Override inputs can come from the use of a Weather Station, or other external device.

**Mx Vent Pos
on Override 1 (CL)**

If a link is made to override input, the system will then ask what the maximum vent position should be during that override input period.

**Vent 1 Stg (1)
On Immed Dehum**

**Vent 1 Stg (1)
On Delay Dehum**

Set the desired stages of operation here that will be activated by the dehumidify functions. You may choose either the **IMMEDIATE** or the **DELAYED** dehumidify functions, or both, for a particular stage. This setup is not applicable to "PAD VENT".

**Vent 1 Stages
(2° Sep.) 2° Dif.**

Set the desired separation of the ventilation stages here, and also the desired differential. The separation is the total number of degrees that separate each stage of operation. Once an output or a stage has been activated the differential is the amount of temperature change required that will cancel the operation of that stage or output. This setup is not applicable to "PAD VENT".

**Vent 1 Timing
(2 Sec.)**

Set the desired time delay here. The time delay will be active on both energizing and de-energizing stages. This setup is not applicable to "PAD VENT".

**Reference Temp:
(Sensor Selection)**

(IF USED)

**Min Ref (0°)
Go To (0%) Normal**

**Max Ref (70°)
Go To (100%) Normal**

Use this selection to enter a reference temperature for the vent system. For example, select the outdoor sensor, then enter a minimum and maximum reference temperature, and a minimum and maximum ventilation position. The Procom will then constantly adjust the ventilation position based on the outdoor temperature.

SET SHADING

The **SET SHADING** mode will determine the total number of shade opening stages, the system timing for the shade system, the solar level differential, and a maximum closed position for the shade system. The actual total opening time for the shade system itself is entered here, and information as to a safety delay that may be present in the actual shade control panel being used is also entered here. The heat retention feature of the shade system can be programmed in this mode. You may also program the shade system to automatically back off if a roof vent is active to allow increased airflow.

1. Enter the **SET SHADING** mode.
2. Use the **PRIOR-NEXT** switch to advance to the desired item to set.
3. Use the **VALUE** switch to toggle between desired choices that the system has internally provided.

Close Shade 1 in (4) Positions

Set the desired number of stages here for the shade system. If you are only using one output (fully cover) to close your shade system in only one position, you may select "1 Pos, 1 output".

Shade 1 Delay (5 Min.)

This will be the time delay that the system must see in order to move the shade system covered or uncovered. This will be the amount of time that the solar level must maintain in order to cause movement.

Shade 1 Diff. (40) K-LUX

This is the differential of the shading system. This is the amount of solar light that is necessary to start opening the shade system back up when the solar level decreases.

Shade 1 Max (100%) Closed

Use this setting if it is desired not to have the shade system close to 100% at any time. Use this if the shade materials do not allow air passage and it is desired to always leave the shade system slightly open.

Shade 1 Close Time 3:00

Enter the actual time that it takes the shade system to go from a fully open position, to a fully closed position. This is critical as the computer will use this time to determine the shade position.

Shade 1 Safety Delay (5) Sec

If your shade control system is equipped with a time delay relay that protects the vent against false reversals, enter the number of seconds here. If you are in doubt whether your system has a time delay, simply manually energize the shade system. If the shade system starts to move immediately, there most likely is no time delay protection. You may choose **NONE** as one of the choices.

Shade 1 Heat Ret 1 (Disabled)

The shade system operation offers a heat retention feature. It is possible to use the shade system as an energy curtain. If you choose to **ENABLE** this, you may then select the following choices:

1. **Activate the Heat Retention Feature by a mode of operation (EVE, NGT, etc.)**
2. **Activate the Heat Retention Feature if a sensor is below or above a particular setting.**

You may cancel the heat retention feature based also on the above criteria.
(There are two separate heat retention programs for the shade system)

**Go to (0) % if
(Mode) = (Eve)**

Enter the percent of the close position that you want the shade system to go to during heat retention. Also, select the mode of operation desired to initiate the heating retention program.

**And
(Air Temp 1) >= 80**

Select the sensor, and the setting to be used (if any) to also activate the shade system for heat retention. You may also choose to ignore any sensors if you like. This will activate the system simply on modes of operation (DAY, MID, EVE, NGT)

**Cancel HeatRet 1
If (Mode) = (Day)**

Select the mode of day (Day, Midday, Evening, or Night) to cancel the heat retention feature.

**OR
Air Temp 1 (<=) (60)**

Select the temperature and the setting to cancel the heat retention mode.

**Max Pos (Uncov'd)
If Vent 1 Active**

Use this if the shade materials in use do not allow air passage and it is desired to always leave the shade system slightly open when the roof ventilation system is operating. This will allow an airflow path.

SET FOGGING

The **SET FOGGING** mode is used to set the temperature and humidity differentials and the system timing for the fogging output. The grower can also select if the fogging system should be maintained on or pulsed in this mode.

1. Enter the **SET FOGGING** mode.
2. Use the **PRIOR-NEXT** switch to advance to the desired item to set.
3. Use the **VALUE** switch to toggle between desired choices that the system has internally provided.

Fog 1 Diff. (2)° Temp 2% RH

Set the desired differentials for the temperature and the humidity settings for the fogging stage. The differential is the amount of temperature decrease or humidity increase that the sensor must see before turning off the fogging stage.

Fog 1 Timing (2 Sec.)

Set the desired time delay here. The time delay will be active on both energizing and de-energizing stages.

Fog 1 (Maintained)

Fogging output may be commanded in two way, maintained or pulse. Maintained will turn on the output till the humidity increases into the controlling band. Pulsed will allow the grower to enter the run and wait time to more slowly increase the humidity level.

(IF PULSED SELECTED)

Fog 1 On (2 Sec.)

Select the desired running time for the fogging system.

Fog 1 Off (2 Sec.)

Select the desired waiting time for the fogging system.

SET HEAT VALVES

The **SET HEAT VALVES** mode is used to set the criteria for any modulating heat valves in use. In the event that hot water valves are in use, the total opening time is set here. In addition, the run and wait times for the valves, the hot water differential, and the minimum and maximum hot water temperatures are entered here. If a reference temperature is being used to control the hot water temperature, the minimum and maximum reference temperatures are also entered here. If a zone temperature activates the hot water system, the differential is entered here. If a zone pump is in use, the system timing for that zone pump is also entered here. If a pulsed opening hot water system is used the number of stages, the positions, opening time, delays, separation and differentials is set here.

1. Enter the **SET HEAT VALVES** mode.
2. Use the **PRIOR-NEXT** switch to advance to the desired item to set.
3. Use the **VALUE** switch to toggle between desired choices that the system has internally provided.

Hot Wtr 1 Open Time (1:00)

Set the time for the valve to travel from fully open to fully closed. You will need to time the valve for operation.

Hot Wtr 1 Time Run (10) Wait (30)

Set the desired run and wait times for the hot water valve. The PROCOM will use these times to pulse the valve by applying the run time and then waiting for the duration of the programmed wait time before pulsing it open again. These times will apply to either opening or closing of the valve.

Hot Wtr 1 Dif. (2)°F

Set the desired differential of the hot water valves. The differential is the amount of temperature change that the sensor must see before operating the hot water valve.

Min Water (100) °F Max Water (180) °F

Enter the minimum and maximum water temperatures that you want the system to maintain. The control will then try to maintain these "target" temperatures. If no reference temperature is being used, only enter a minimum temperature setting here.

Min Refer (40)°F Max Refer (60)°F

If a reference temperature is being used, enter the minimum and maximum reference temperature here. The heat valve program can use a reference temperature such as a zone air temperature, or outdoor temperature to control the heat valve. The PROCOM will automatically calculate the temperature differences and proportion the heat valve accordingly.

Hot Wtr 1 Zone Dif (4) °F

If a zone pump is being used with your hot water valve, set the desired temperature differential here. The differential is the amount of temperature rise that the zone sensor must see before turning off the zone pump. If a zone pump is not in use, you may ignore this setting.

Zone Pump Timing (2) Sec.

If a zone pump is being used set the desired time delay here. The time delay will be active on both energizing and de-energizing the zone pump.

**Reference Temp:
(Air Temp 1)**

Set the desired input to be used as the reference temperature or **NONE** if no reference temperature is desired.

**If CO2 Active
Min Wtr 120°F**

If you are using the CO2 program, the hot water valve may be driven open by entering a separate hot water temperature here. If CO2 is not in use, disregard this feature.

**Activate on
Dehum? (Y)**

If you would like to activate the hot water valve when the dehumidify program is in use, please enter that here.

**Standby Feature?
(Enabled)**

**Activate if
Wtr Tmp <=80°F**

By using the standby feature, you may enter a minimum hot water temperature. If this feature is active, the hot water valve will always keep this temperature even when not attempting to heat. This will be the “standby” temperature of the hot water system.

**Hot Wtr 1
Solar Adjust? (N)**

(IF YES)

**Hot Wtr 1
Min Sol (0) K-LUX**

**Hot Wtr 1
Min Sol (100) K-LUX**

**(Lower) Setpoint
By 0°F**

The Solar Adjustment feature allows the grower to adjust the cooling temperature setpoint up or down depending on how intense the solar level is. The solar level is monitored by the K-Lux sensor if used. The solar level can also be monitored by a PAR or Pyranometer sensor if connected to the Procom.

**Setpoint Ramp
(30) Minutes/Deg**

This is the ramp time of the heating system. Enter the desired time that it will take the system to implement a change in the heating setting. The Procom will use this time when changing modes (Day, Midday, Evening, and Night).

PULSED HEATING VALVES

Use The Below Settings Only if You are Using a “Pulsed Heat Valve” The Pulsed Heat Valve is Different Than a “Hot Water Valve”

Open Heating 2 In (4) Positions

Set the desired number of heating stages here. The system can operate the proportional valve in up to eight separate stages.

Heating 2 Pos 1 10% Open

Set the desired percentages of opening here for each stage. The final stage will always be set to 100%.

Opening Time Heating 2 3:00

Set the actual time that the valve takes to run from its fully closed position to fully open. This time is critical, as the system will use this to determine correct openings.

Heating 2 Stg (1) On Immed Dehum

Set the desired stages of operation here that will be activated by the dehumidify functions. You may choose either the **IMMEDIATE** or the **DELAYED** dehumidify functions, or both for a particular stage.

Heating 2 Stages (2° Sep.) 2° Dif.

Set the desired separation of the heat valve stages here, and also the desired differential. The separation is the total number of degrees that separate each stage of operation. Once an output or a stage has been activated the differential is the amount of temperature change required that will cancel the operation of that stage or output.

Heating 2 Timing (2 Sec.)

Set the desired time delay here. The time delay will be active on both energizing and de-energizing stages.

SET DEHUMIDIFY

The **SET DEHUMIDIFY** mode is used to enable or to disable the dehumidify functions of the control. The run time of the immediate and the delayed dehumidify functions are set here. The repeat time of the dehumidify feature is set here. The dehumidify differential, and the maximum heat loss and gain for the dehumidify mode are also entered here.

1. Enter the **SET DEHUMIDIFY** mode.
2. Use the **PRIOR-NEXT** switch to advance to the desired item to set.
3. Use the **VALUE** switch to toggle between desired choices that the system has internally provided.

Dehum 1 (Disabled)

You may select how to disable the dehumidify feature. Dehumidify may be disabled upon an override input. The dehumidify feature can be disabled all together if desired.

Dehum 1 Imm Run time (10) Min

Enter the time to allow Immediate Dehumidify to run.

Dehum 1 Dly Run Time (10) Min

Enter the time to allow Delay Dehumidify to run.

If Dehum Fails Repeat in (2:00) H

Enter the time to repeat the dehumidify if unable to lower the humidity. If you would like the Procom to constantly stay in the dehumidify mode if the humidity level is high, without an interruption, enter "Stay in Dly Mode".

Dehum 1 Dif. (2)% RH

Set the desired differential for dehumidify. The differential is the amount of humidity decrease that the sensor must see before disabling dehumidify.

Disable Dehum if below HtSP by (5)°

Set the maximum heat loss below the normal heating set point temperature. This will disable any cooling stages activated during dehumidify. This prevents too much heat loss in the range during dehumidify.

Disable Dehum if above HtSP by (5)°

Set the maximum heat gain above the normal heating set point temperature. This will disable any heating stages activated during dehumidify. This prevents too much heat gain in the range during dehumidify.

SET CROP LIGHTING

The **SET CROP LIGHT** mode allows the grower to set time delays, solar levels, and other criteria for the crop lighting outputs.

1. Enter the **SET CROP LIGHT** mode.
2. Use the **PRIOR-NEXT** switch to advance to the desired item to set.
3. Use the **VALUE** switch to toggle between desired choices that the system has internally provided.

Crop Lgt 1 (ON at All Levels)

Set the desired light level at which the crop lighting output should energized. If light level is not a factor, select **ON at All Levels**.

Crop Lgt 1 Delay (5 Min.)

This will be the time delay that the system must see in order to energize or de-energize. This will be the amount of time that the solar level must maintain in order to turn on or off the lights.

Crop Lgt 1 Diff. (3) KLUX

This is the light level differential of the crop lighting system. This is the amount of light that is necessary in order to cause a change in the system.

Crop 1 1st ON (At) 6:00 PM

This is when the crop light will be initially be activated. You can select one of the following: at a specified time, after/before sunset, or after/before sunrise.

Crop 1 1st OFF (At) 6:00 PM

This will be the off time. You can select one of the following: after running a pre-set period of time, after/before sunset, or after/before sunrise.

Crop 1 2nd ON (Not in Use)

This allows you to set the second operational time for crop lighting, if desired.

SET CO²

All the desired CO² settings will be made in the **SET CO²** mode. Linking of CO² to a Ventilation or Cooling output, setting of differentials, and time delays.

1. Enter the **SET CO²** mode.
2. Use the **PRIOR-NEXT** switch to advance to the desired item to set.
3. Use the **VALUE** switch to toggle between desired choices that the system has internally provided, or to increase or decrease the desired display setting.

Link CO2 1 to: (Desired Output)

If there is ventilation outputs or cooling stages on the Growmaster Procom, CO² can be linked to them to reduce the setpoint levels of CO² called for gradually.

(IF LINKED) Reduce PPM (25%) If Vent 1 >= 26%

Enter the percentage to reduce the ppm of CO² setpoint, and the desired stage or vent position. The Growmaster Procom has two setpoint reduction stages for CO². If CO² is linked to a ventilation output, then you will be able to enter the vent percentage open to start the reduced setpoints. If CO² is linked to a cooling output(s), then you will be able to enter the cooling stage to start the reduced setpoints.

Reduce PPM 50% If Vent 1 >= (50%)

Enter the percentage and stage for the second adjustment desired.

Cancel CO2 1 If Vent 1 >= (75)%

Enter the ventilation position or desired stage to cancel the CO² program. The Growmaster Procom will restart the CO² program once the ventilation position or cooling stage has been lowered or turned off.

CO2 1 Diff (50) PPM

This is the PPM of CO² differential of the CO² system. This is the change in the PPM of CO² that is necessary to cause a change in the system.

CO2 1 Delay (30 Sec.)

This will be the time delay that the system must see to energize or de-energize the CO² output.

SET ALARM

All of the desired alarm settings will be made in the **SET ALARM** mode. Set the high and low alarm settings for the individual sensors.

1. Enter the **SET ALARM** mode.
2. Use the **PRIOR-NEXT** switch to advance to the desired item to set.
3. Use the **VALUE** switch to toggle between desired choices that the system has internally provided, or to increase or decrease the desired display setting.

**Air Temp 1 Alarm
Enabled? (Yes)**

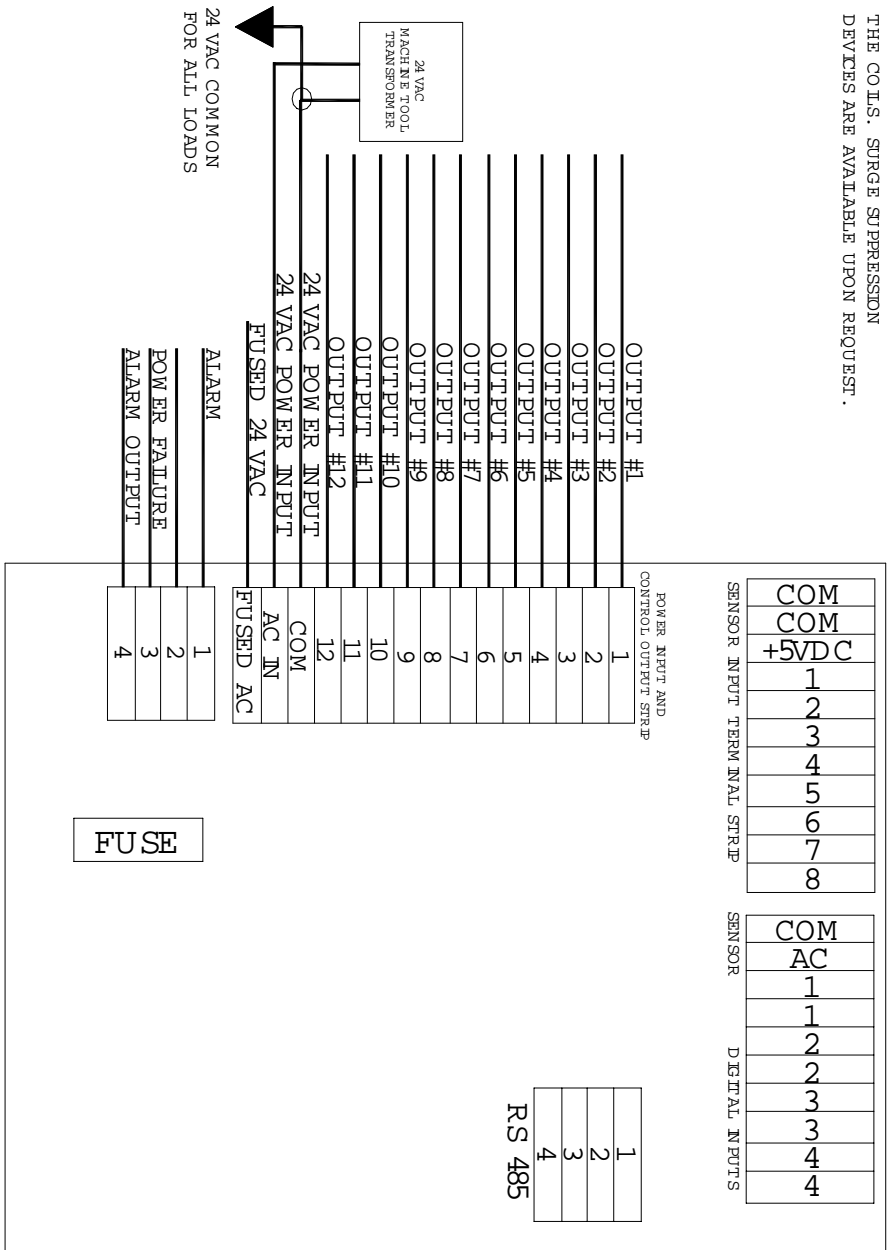
**Air Temp 1 Alarm
LO: (0) HI: 120**

Enter the set points to activate the alarm output. Only temperatures and humidifiers will have an alarm feature.

TO CLEAR AN ACTIVE ALARM:

1. **Remedy the alarm condition.**
2. **Enter the SET ALARM mode.**
3. **Return to the RUN mode.**

ALL CONNECTED 24 VAC LOAD RELAYS AND CONTACTORS MUST HAVE A SURGE PROTECTION DEVICE INSTALLED ACROSS THE COILS. SURGE SUPPRESSION DEVICES ARE AVAILABLE UPON REQUEST.



ALL CORRECT LOAD CONTACTORS AND CONTROL RELAYS ARE AVAILABLE FROM MICROGROW GREENHOUSE SYSTEMS. 100VA MACHINE TOOL TRANSFORMERS ARE AVAILABLE FROM MICRO GROW GREENHOUSE SYSTEMS. SEE YOUR DISTRIBUTOR OR CALL MICRO GROW FOR REQUIRED CONNECTION DEVICES AND ACCESSORIES.

GROW MASTER PROCOM OUTPUTS

TRANSFORMER NOTE:
USE A MACHINE TOOL VARIETY ONLY. 100 VA IS RECOMMENDED. IF A SMALLER SIZED TRANSFORMER IS USED, ADJUST THE FUSE PROTECTION ACCORDINGLY. (see fuse note)

FUSE NOTE:
IMPORTANT: DO NOT EXCEED 4 AMPS FOR THE FUSE RATING WHEN USING A 100 VA TRANSFORMER OR 2 AMPS WHEN USING A 50 VA TRANSFORMER. USE A SLOW BLOW VARIETY.

OUTPUT NOTE:
THE CONTROL OUTPUTS ARE RATED AT 1 AMP EACH MAXIMUM. DO NOT EXCEED THIS OR DAMAGE MAY RESULT. DO NOT EXCEED 1 AMP FOR ANY SINGLE OUTPUT OR 4 AMPS TOTAL FOR ALL. (2 AMPS TOTAL IF A 50 VA TRANSFORMER IS IN USE)



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Project PROCOM OUTPUTS			
Drawn by GH	Date 11/27/01	Distributor N/A	Order ID N/A

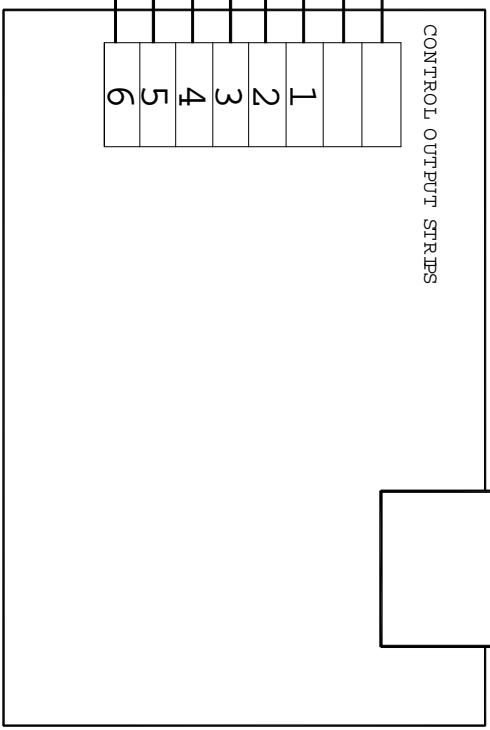
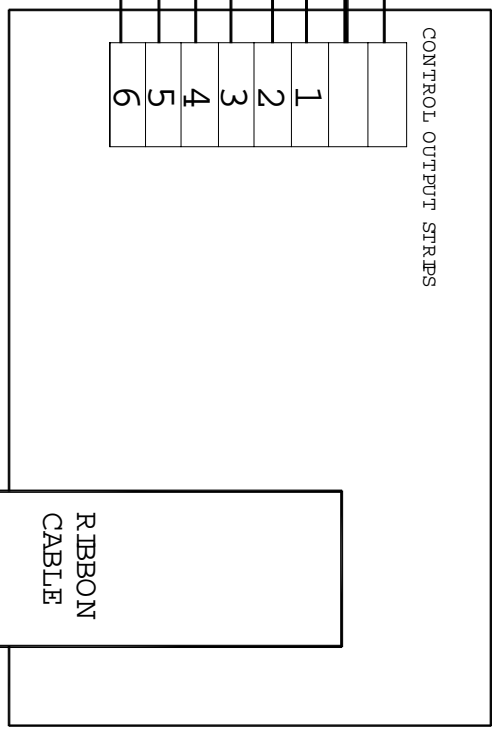
FUSED 24 VAC
 24 VAC COM
 OUTPUT #13
 OUTPUT #14
 OUTPUT #15
 OUTPUT #16
 OUTPUT #17
 OUTPUT #18

CONTROL OUTPUT STRIPS
 1
 2
 3
 4
 5
 6

ALL CONNECTED 24 VAC LOAD RELAYS
 AND CONTACTORS MUST HAVE A SURGE
 PROTECTION DEVICE INSTALLED ACROSS
 THE COILS. SURGE SUPPRESSION
 DEVICES ARE AVAILABLE UPON REQUEST.

FUSED 24 VAC
 24 VAC COM
 OUTPUT #19
 OUTPUT #20
 OUTPUT #21
 OUTPUT #22
 OUTPUT #23
 OUTPUT #24

CONTROL OUTPUT STRIPS
 1
 2
 3
 4
 5
 6



OUTPUT NOTE:
 THE CONTROL OUTPUTS ARE RATED AT 1 AMP EACH
 MAXIMUM. DO NOT EXCEED THIS OR DAMAGE MAY
 RESULT. DO NOT EXCEED 1 AMP FOR ANY SINGLE
 OUTPUT OR 4 AMPS TOTAL FOR ALL OUTPUTS. (2
 AMPS TOTAL IF A 50 VA TRANSFORMER IS IN USE)

ALL CORRECT LOAD CONTACTORS AND CONTROL RELAYS ARE AVAILABLE FROM MICRO GROW GREENHOUSE SYSTEMS.
 100VA MACHINE TOOL TRANSFORMERS ARE AVAILABLE FROM MICRO GROW GREENHOUSE SYSTEMS. SEE YOUR
 DISTRIBUTOR OR CALL MICRO GROW FOR REQUIRED CONNECTION DEVICES AND ACCESSORIES.

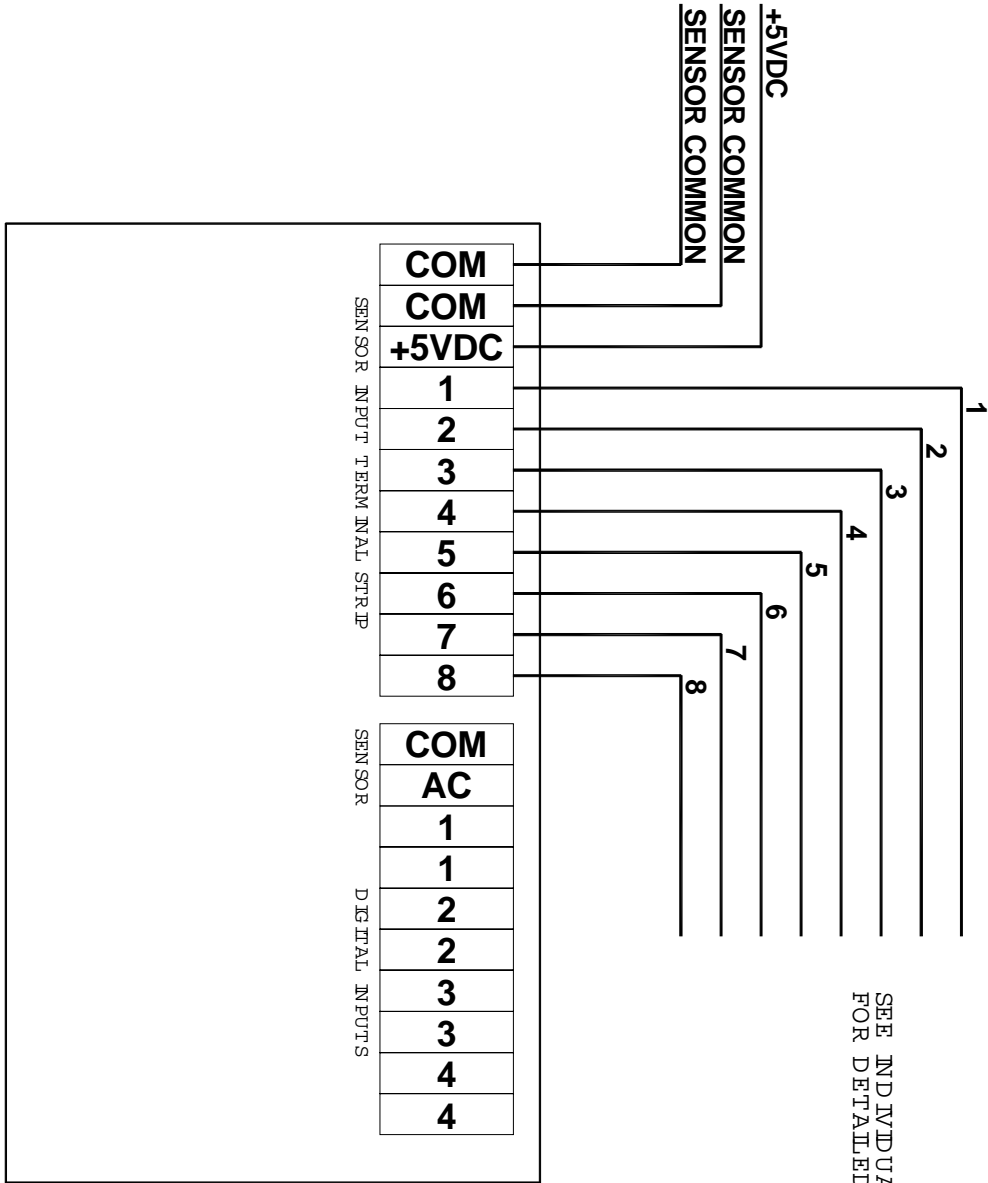
GROW MASTER PROCOM EXPANSION MODULE OUTPUTS



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 Phone 909.296.3340 Fax 909.296.3350

Project PROCOM EXPANSION MODULE OUTPUTS			
Drawn by GH	Date 11/27/01	Distributor N/A	Order ID N/A

GROW MASTER PROCOM INPUTS



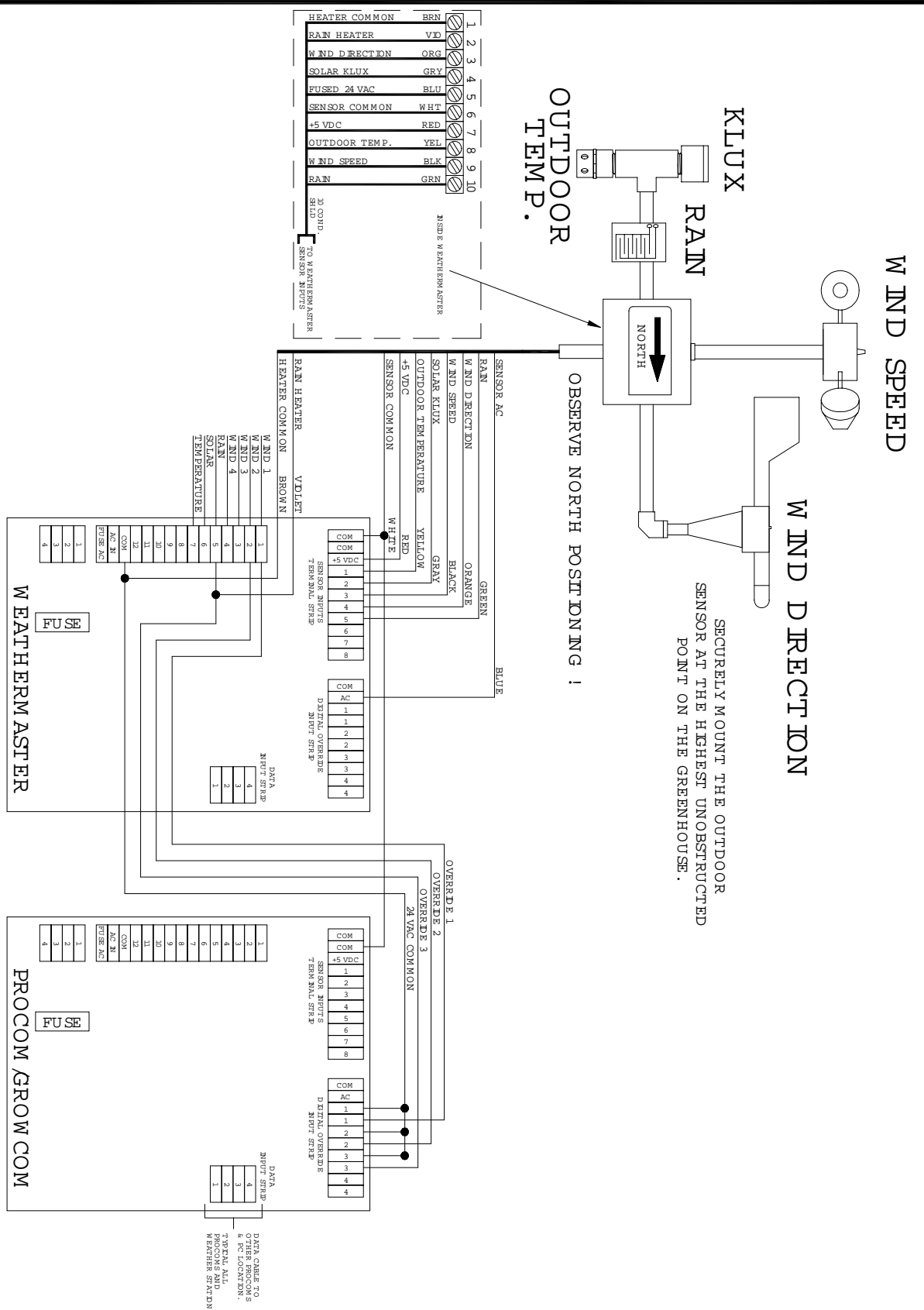
SEE INDIVIDUAL SENSOR DRAWINGS FOR DETAILED CONNECTIONS.



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 Temecula, CA 92591
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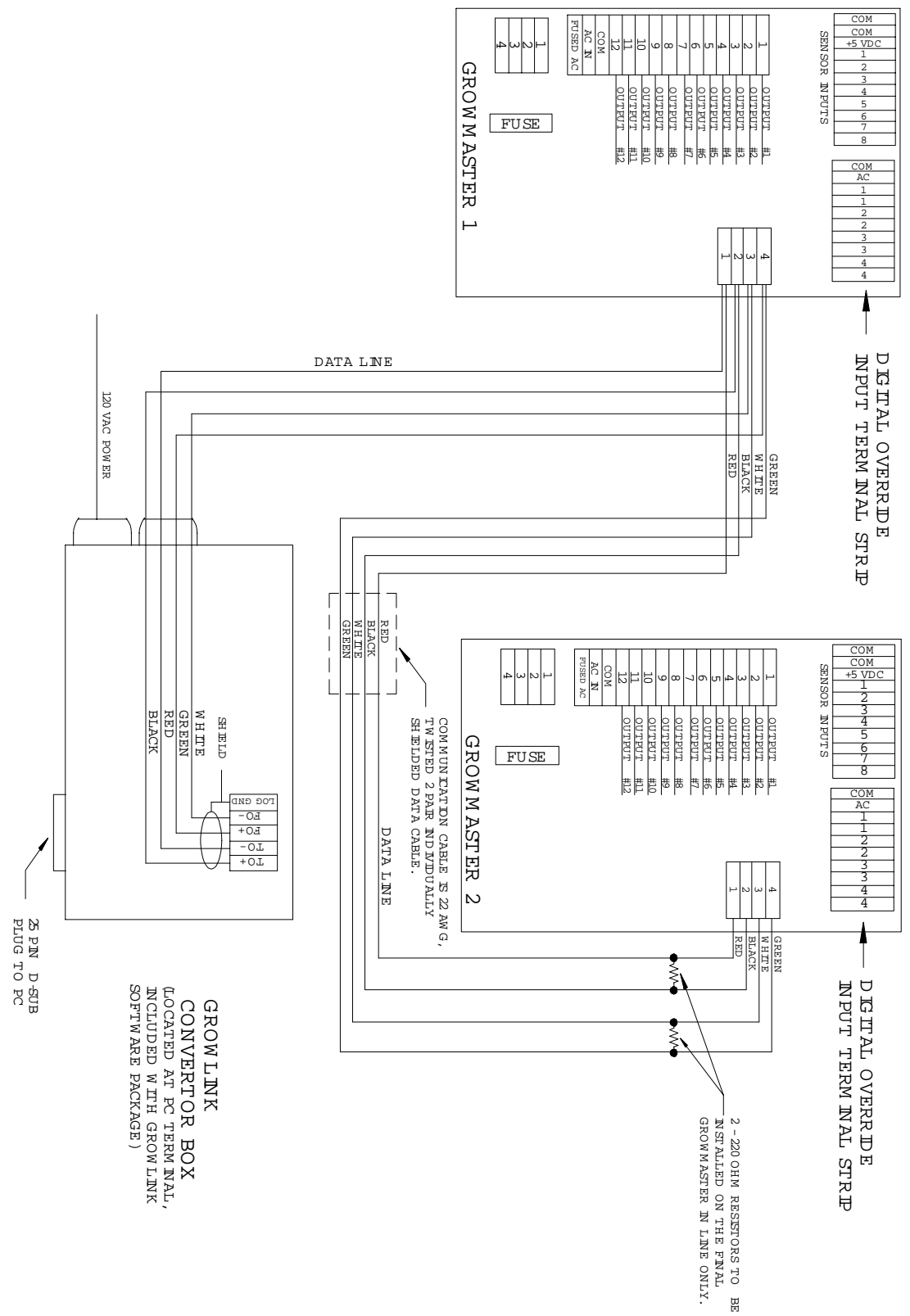
Project: GROW MASTER PROCOM INPUTS			
Drawn by: GH	Date: 11/27/01	Distributor: N/A	Order ID: N/A

TYPICAL WEATHERMASTER CONNECTION TO PROCOM GROW COM



	MTCRO GROW GREENHOUSE SYSTEMS, INC. 26111 Ynez Road, Suite C-4 Temecula, CA 92591 Phone 909.296.3340 Fax 909.296.3350		Project WEATHERMASTER TO PROCOM GROW COM	
	Drawn by GH	Date 11/01/01	Distributor N/A	Order D N/A

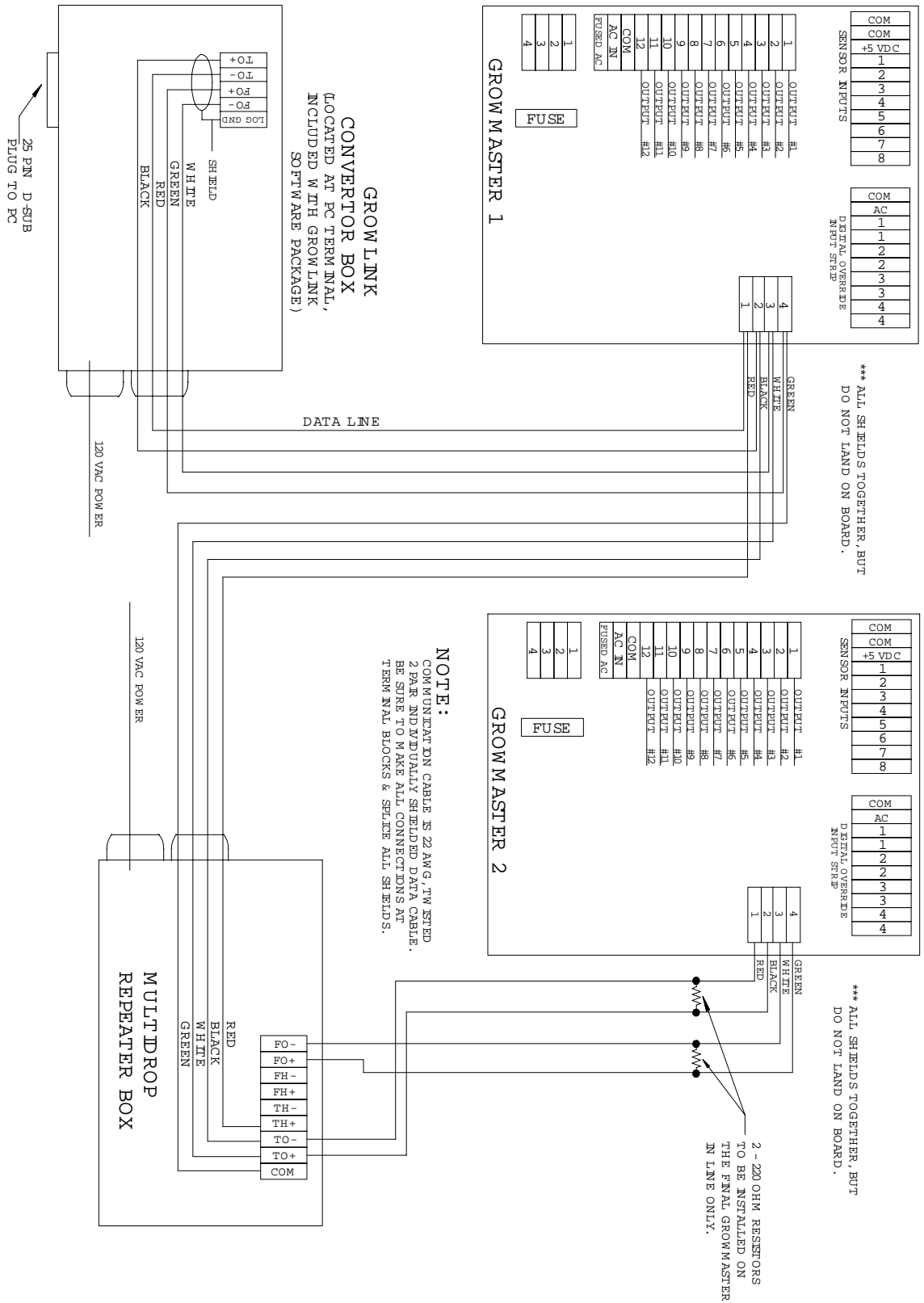
TYPICAL WIRING FOR GROW LINK CONVERTOR BOX TO MULTIPLE GROWMASTERS



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Project GROW LINK CONV. BOX TO MULTIGROWMASTERS			
Drawn by GH	Date 11/28/01	Distributor N/A	Order ID N/A

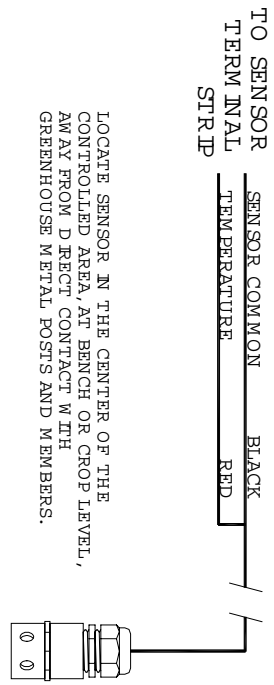
TYPICAL WIRING FOR GROW LINK CONVERTER BOX TO MULTIPLE GROWMASTERS WITH REPEATER BOX



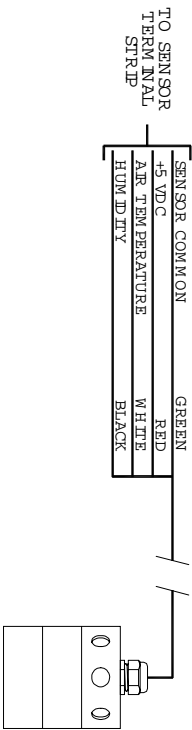
M I R O G R O W GREENHOUSE SYSTEMS, INC.
 26111 Ynez Road, Suite C-4
 Temecula, CA 92591
 Phone 909.296.3340 Fax 909.296.3350

Project GROW LINK CONV. BOX TO MULTIGM SW REPEATER			
Drawn by GH	Date 11/28/01	Distributor N/A	Order D N/A

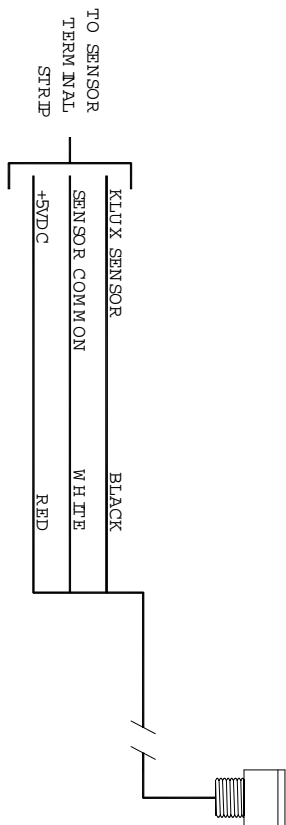
AIR TEMPERATURE OR OUTDOOR TEMPERATURE SENSOR



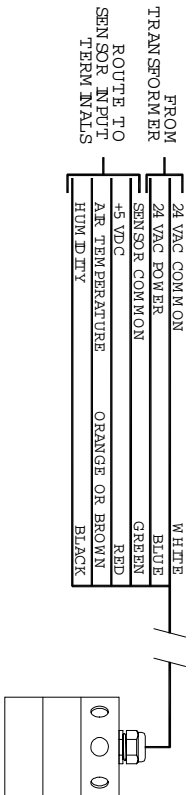
NON-ASPIRATED AIR TEMPERATURE & HUMIDITY SENSOR



KLUX SENSOR



ASPIRATED AIR TEMPERATURE AND HUMIDITY SENSOR



PROCOM SENSORS



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Project

PROCOM TEMPS & HUMIDITY & KLUX SENSORS

Drawn by
GH

Date
11/29/01

Distributor
N/A

Order ID
N/A

TO SENSOR
TERMINAL
STRIP

SENSOR COMMON
SOIL TEMPERATURE

BLACK
RED

SOIL TEMPERATURE
SENSOR

SOIL TEMP.
PROBE

TO SENSOR
TERMINAL
STRIP

SENSOR COMMON
TEMPERATURE
+5 VDC

BLACK
RED

28K OHMS 1%
AVAILABLE FROM
MICRO GROW

HOT WATER PIPE
TEMPERATURE SENSOR

ATTACH USING
METAL PIPE CLAMP

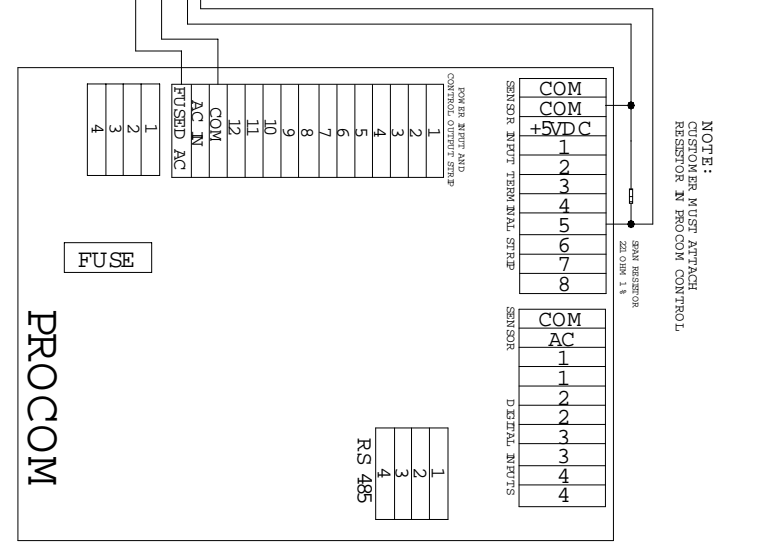
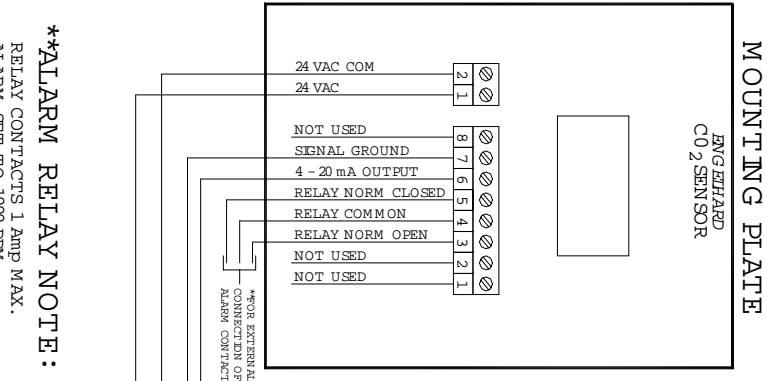
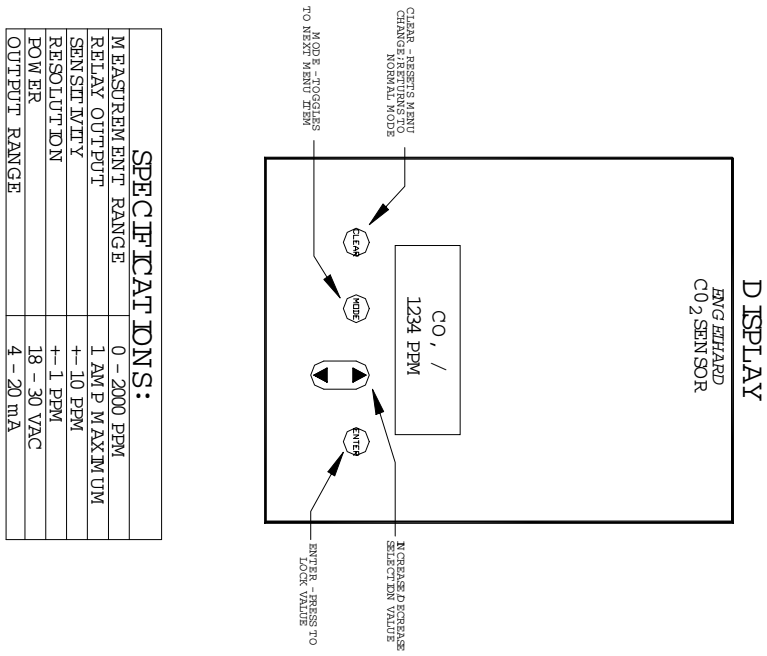
PROCOM SENSORS



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Project			
PROCOM HOT WATER & SOIL TEMP SENSORS			
Drawn by	Date	Distributor	Order D
GH	11/29/01	N/A	N/A

SENSOR CONNECTIONS TO CONTROL



SPECIFICATIONS:

MEASUREMENT RANGE	0 - 2000 PPM
RELAY OUTPUT	1 AMP MAXIMUM
SENSITIVITY	+ - 10 PPM
RESOLUTION	+ - 1 PPM
POWER	18 - 30 VAC
OUTPUT RANGE	4 - 20 mA

****ALARM RELAY NOTE:**
 RELAY CONTACTS 1 AMP MAX.
 ALARM SET TO 1000 PPM.
 SEE MANUFACTURERS
 INSTRUCTIONS TO CHANGE
 FACTORY SETTINGS.

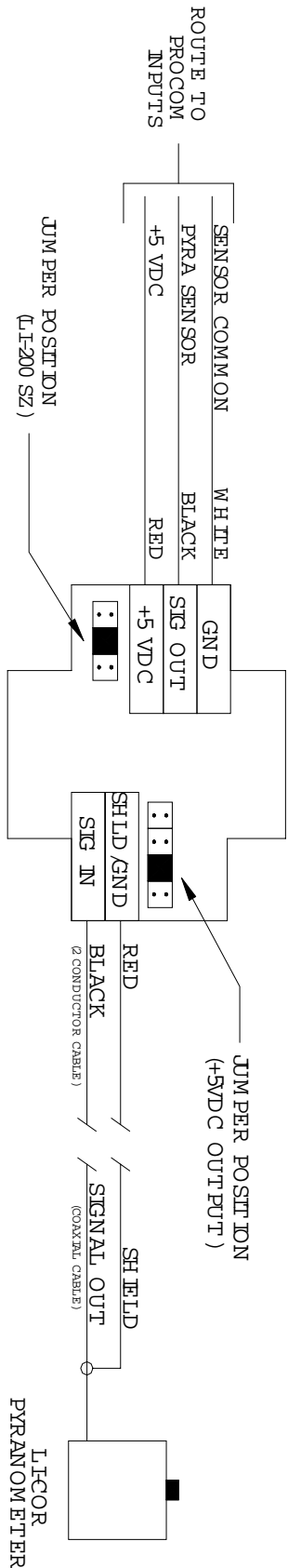
ENGELHARD CO₂ SENSOR



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Project PROCOM ENGELHARD CO₂ SENSOR CONNECTIONS			
Drawn by GH	Date 11/29/01	Distributor N/A	Order D N/A

SENSOR CONNECTIONS TO PROCOM CONTROL




CUT OUT PULLUP RESISTOR FOR
PYRANOMETER INPUT ON
GROWMASTER PROCOM.

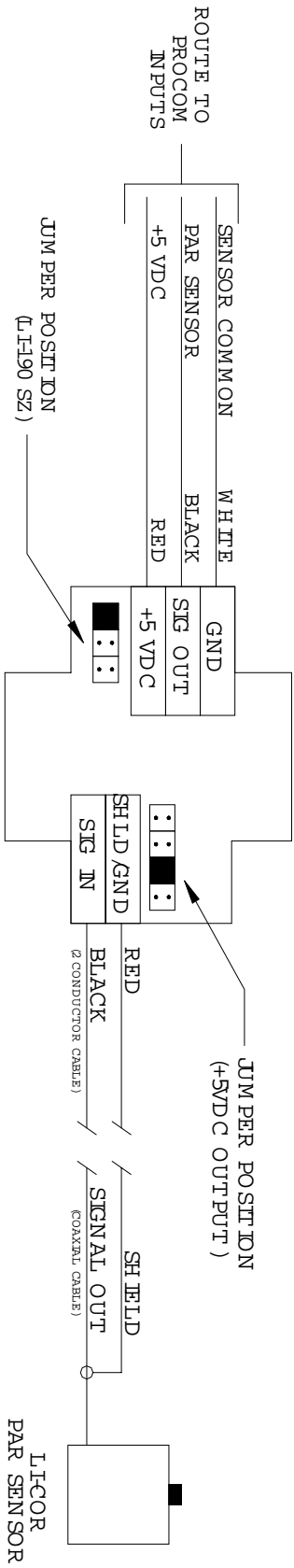
NOTE: LOCATE AMPLIFIER CIRCUIT BOARD
WITHIN PROCOM ENCLOSURE, SECURELY
MOUNT TO BACK OF ENCLOSURE.

EM E SYSTEMS
AMPLIFIER PCB

LICOR PYRANOMETER LI-200

	MICRO GROW GREENHOUSE SYSTEMS, INC. 26111 Ynez Road, Suite C-4 Temecula, CA 92591 Phone 909.296.3340 Fax 909.296.3350		Project PROCOM LICORE PYRANOMETER LI-200 CONN.	
	Drawn by GH	Date 12/14/01	Distributor N/A	Order ID N/A


SENSOR CONNECTIONS TO PROCOM CONTROL



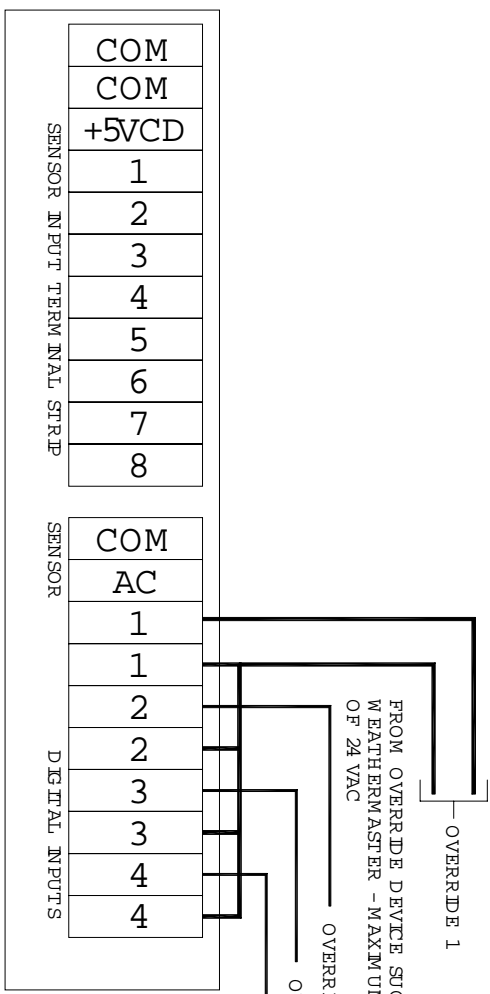
CUT OUT PULLUP RESISTOR FOR
PYRAMOMETER INPUT ON
GROWMASTER PROCOM.

NOTE: LOCATE AMPLIFIER CIRCUIT BOARD
WITHIN PROCOM ENCLOSURE. SECURELY
MOUNT TO BACK OF ENCLOSURE.

LICOR QUANTUM PAR LI-190

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	Drawn by GH	Date 12/14/01	Distributor N/A	Order ID N/A

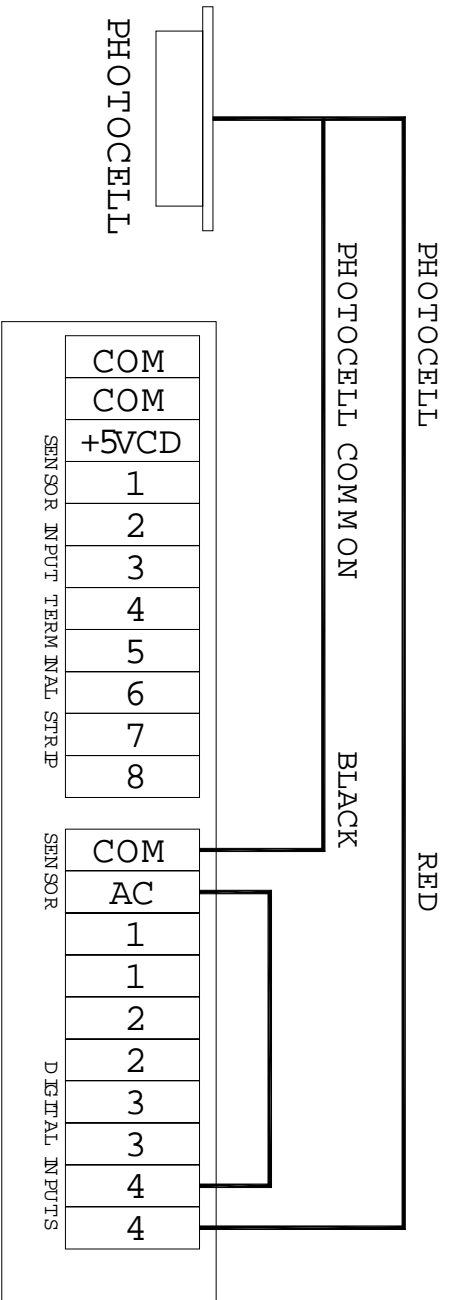
TYPICAL OVERRIDE INPUT



USE THE SAME CONFIGURATION FOR OVERRIDES 2, 3 AND 4. OVERRIDE 4 CAN ALSO BE USED AS PHOTOCELL INPUT.

PHOTOCELL

NOTE: THIS IS NOT NORMALLY INSTALLED WITH ALL PROCOM UNITS. IF INSTALLED, IT IS LOCATED AT THE BOTTOM OF THE BOX.



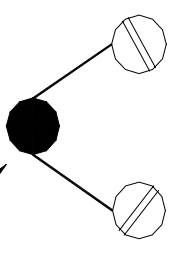
PROCOM SENSORS



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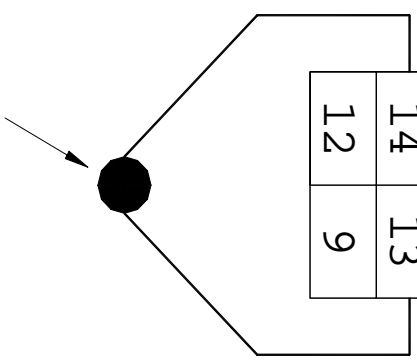
Project		PROCOM SENSORS		Distributor	OrderID
Drawn by	Date			N/A	N/A
GH	12/14/01				

T3	T2	T1
I3	I2	I1



SURGE PROTECTION DEVICE -
 RATED FOR 24 VAC OPERATION.
 PROVIDED WITH EACH UNIT

8	5
4	1
14	13
12	9



CONTACT POINTS:
 LINES ON I3, I2, I1
 TO ADS ON T3, T2, T1

RELAY NOTES:

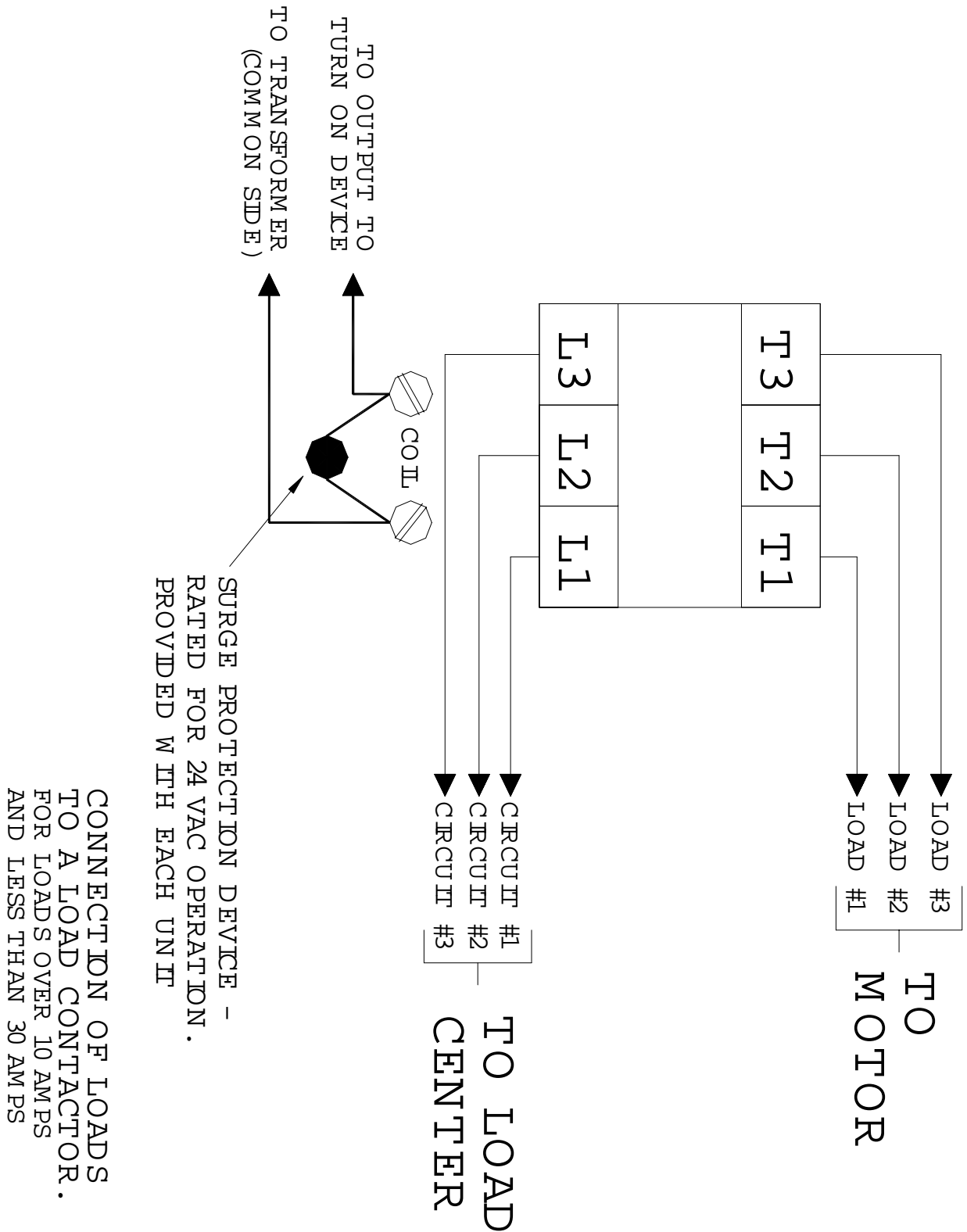
RELAYS ARE DEDICATED
 14, 13 24 VAC COIL
 12, 9 COMMON TERMINALS
 8, 5 NO RM ALIX OPEN
 TERMINALS
 4, 1 NO RM ALIX CLOSE
 TERMINALS

INSTALLATION OF SURGE
 PROTECTION DEVICES ON
 LOAD CONTACTS AND
 LOAD RELAYS



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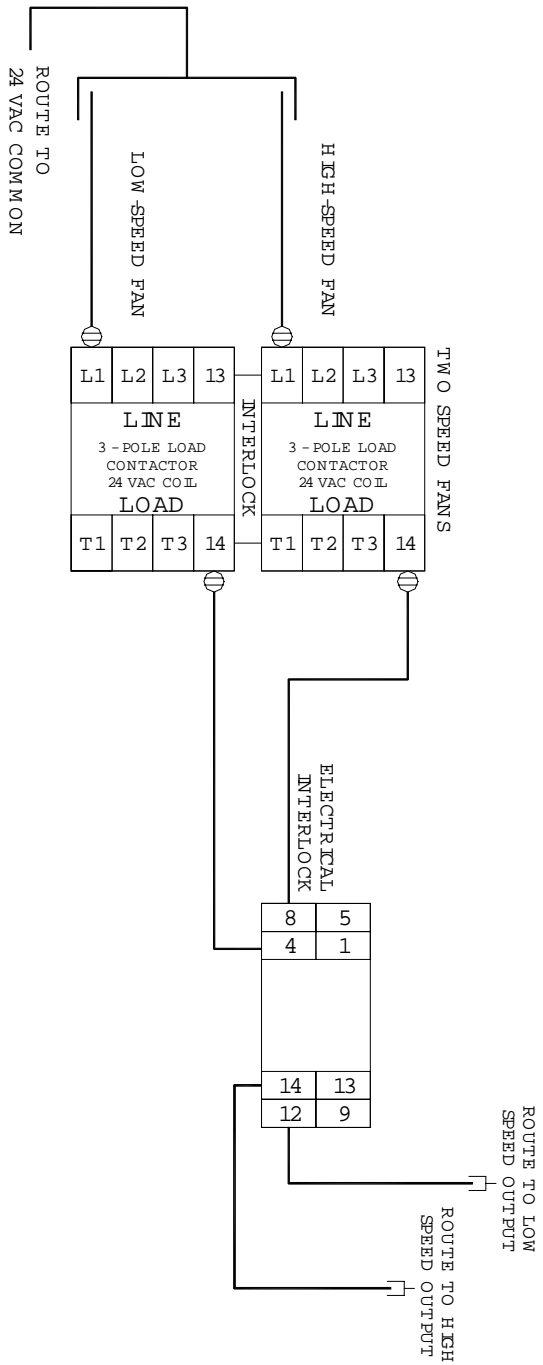
Project INSTALLATION OF SURGE PROTECTION DEVICES			
Drawn by GH	Date 12/14/01	Distributor N/A	Order D N/A



M I C R O G R O W G R E E N H O U S E S Y S T E M S , I N C .
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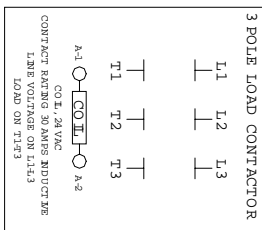
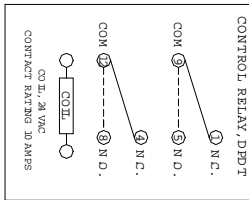
Project CONNECTION OF LOADS TO A LOAD CONTACTOR

Drawn by GH	Date 12/14/01	Distributor N/A	Order D N/A
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TYPICAL CONNECTION FOR 2 SPEED LOAD CONTACTOR USED FOR 2 SPEED FANS

RELAY AND LOAD CONTACTOR NOTES



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 Temecula, CA 92591
 Phone 909.296.3340 Fax 909.296.3350

Project				TYPICAL CONNECTION FOR 2 SPEED LOAD CONTACTOR			
Drawn by	Date	Distributor	Order#				
GH	12/17/01	N/A	N/A				

LIMITED WARRANTY

Micro Grow Greenhouse Systems, Inc. warrants that all of the products Micro Grow Greenhouse Systems, Inc. manufactures are free from defects at the time of shipment by Micro Grow Greenhouse Systems, Inc. This warranty covers defects in workmanship and materials. No warranty is extended on any parts, materials, or components manufactured by others and purchased by Micro Grow Greenhouse Systems, Inc., and any warranty on these materials is limited to the warranty supplied by the original manufacturer or supplier of said products only. This warranty excludes any and all damages cause by installation by unqualified individuals, damage by misuse or neglect, shipment damage, alterations to original manufacturing, and improper installation or use for any reason than intended by manufacturer. This warranty may not be altered in any manner except with the written authorization of one the officers or owners of Micro Grow Greenhouse Systems, Inc. The only and sole liability of Micro Grow Greenhouse Systems, Inc. under this warranty is limited to repairing, replacing or the issuance of credit for any products returned to Micro Grow Greenhouse Systems, Inc., during the warranty period of twelve (12) months from date of shipment. This warranty is specifically conditioned upon Micro Grow Greenhouse Systems, Inc. being notified in writing promptly upon discovery of any product defects by the buyer or end user. The product must then be returned prepaid to Micro Grow Greenhouse Systems, Inc. within the twelve month warranty period for inspection by Micro Grow Greenhouse Systems, Inc. Upon inspection of said product, Micro Grow Greenhouse Systems, Inc. will notify buyer or end user of its findings. At Micro Grow Greenhouse Systems, Inc. sole discretion, the product will be replaced, repaired or a credit will be issued for the original sale price of the product, provided that damage has not occurred due to misuse, neglect, improper use or installation as outlined above, shipping damages or accident.

MICRO GROW GREENHOUSE SYSTEMS, INC. SHALL NOT BE LIABLE FOR ANY DAMAGES BEYOND THE ACTUAL ORIGINAL COST OF THEIR PRODUCT EITHER DIRECTLY OR INDIRECTLY ARISING FROM DEFECTIVE PRODUCTS OR WORKMANSHIP.