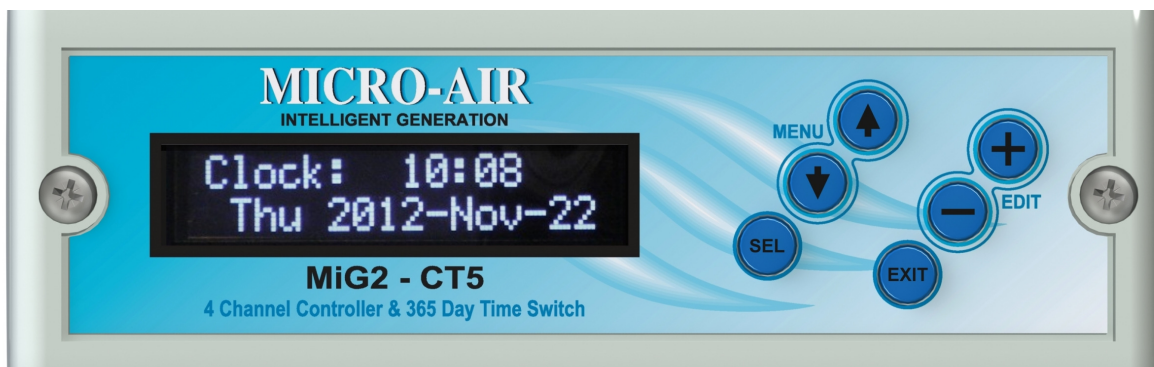# MiG2–CT5 CONTROLLER

4 Stage Controller & 365day Time-Switch,
with Air-conditioning Facilities

The **MiG2–CT5** is a controller combined with a time-switch, incorporating:

- Multiple switching times per day
- Single and block holidays
- Energy saving Temperature Optimised Start
- After hour's Pushbutton & Extreme Temperature Override
- 2 Inputs (Configurable as Resistive, 0–10V, 0–20mA or 4–20mA)
- 5 Relay Outputs
- 2 Analogue Outputs (0–10V)
- Control Temperature, Pressure, Humidity or Flow
- Economy Cycle Mode (for Air Conditioning)
- On-Site Live Testing

Features include:

- Easy to read super high contrast display
- Easy to follow menu
- External socket for programming via PC
- DIN-rail or wall mounting
- Pluggable screw terminals
- Supply voltage: 240V or 24V AC (internally selectable)

All settings of the MiG2-CT5 can be programmed via the front panel buttons and easy to follow menu. Alternatively they can be programmed using the MiG2 PC Interface Software and a USB Programming Cable.

CONTENTS

WARNING: The MiG2 must be installed and maintained by qualified service personnel. The installer should follow **all** relevant building and electrical compliance codes.
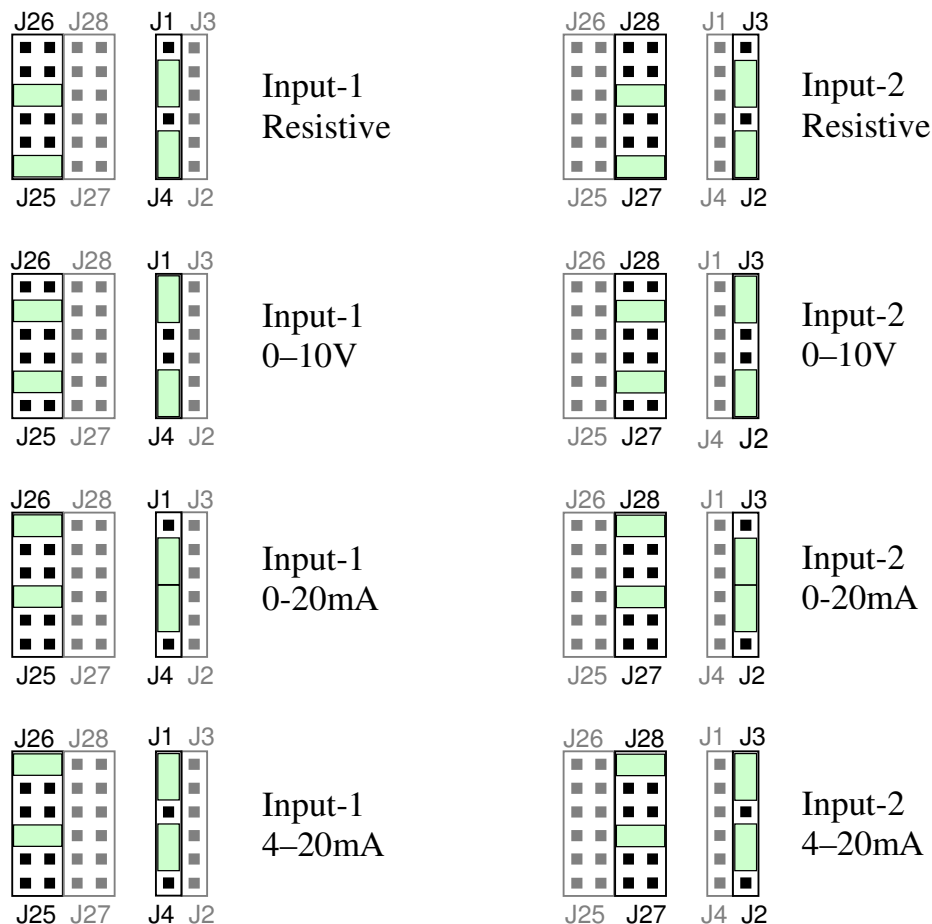
INPUT H/W JUMPERS

Input-1 and Input-2 are configurable (by jumpers) to different signal types:
  Resistive, 0–10V, 0–20mA & 4–20mA.

Both inputs come factory configured as Resistive, allowing wiring to Micro-Air thermistor temperature sensors or remote offset.

Each input must be configured to match the type of signal wired to it. Powering up with the wrong configuration may damage the MiG2 or equipment wired to it.

To change the configuration:
  – Disconnect power from the MiG
  – Remove the front cover
  – Carefully lift out the display board
  – Use tweezers or small pliers to move the jumpers on the main board
      to match the settings shown below
  – Replace the display board and the cover

Input-1 Resistive

Input-2 Resistive

Input-1 0–10V

Input-2 0–10V

Input-1 0-20mA

Input-2 0-20mA

Input-1 4–20mA

Input-2 4–20mA

Note: The new jumper positions are read at power on.

MOUNTING INSTRUCTIONS

The MiG2 can be wall or 35mm DIN Rail mounted. It must not be installed in a public area if the snap out section of the cover has been removed.

It is recommended that the MiG2 be mounted more than 500mm away from contactors, large power cables and devices that create an arc when switching.

Do not mount outdoors or in direct sunlight.

Mount in a well-ventilated area, ambient air temperature between +5°C & 40°C.

The maximum relative humidity must not exceed 80% for temperatures up to 31°C.

WALL MOUNTING

1. Loosen the two front screws and remove the cover.

2. Position the MiG2 on the wall, mark locations of the two screw bosses and mark the wiring slots.

3. For concealed wiring cut holes in the wall under the MiG2.

4. Feed the wires through the slots in the MiG2 base.

5. Attach the MiG2 base to the wall using suitable screws.
    Only use pan-head screws (countersink screws may split the bosses).

6. Connect the wiring to the screw terminals as required.

7. Replace the cover and tighten the front screws.

DIN RAIL MOUNTING

1. Position the top two catches of the MiG2 base onto the top edge of the DIN Rail.

2. Locate and pull down the DIN Clip (bottom edge of MiG2 base) while pushing the bottom edge of the base onto the DIN Rail. Then release the Clip and ensure the base has been retained correctly.

3. Loosen the two front screws and remove the cover.

4. Feed the wires through the slots in the MiG2 base OR
    remove the snap out section of the cover.

5. Connect the wiring to the screw terminals as required.

6. Replace the cover and tighten the front screws.

WIRING

The cables to be connected to the terminals must be at least single insulated wires, with a rating higher than 240V~.

For 240V Supply and 240V Switching: The same phase should be used to power the MiG2 as the voltage supply to all relay contacts.

For 240V Supply: As there is no ON/OFF switch on the MiG2, the installer must ensure that there is a switch or a circuit breaker provided in the building installation. It shall be in proximity to the equipment and within easy reach of the operator. The switch or the circuit breaker shall be marked as the disconnecting device for the MiG2. If a circuit breaker is used it shall be rated at 1A 240VAC with a breaking capacity of 500A. If an isolating switch is used a fuse with a 1A 250V rating is to be incorporated.
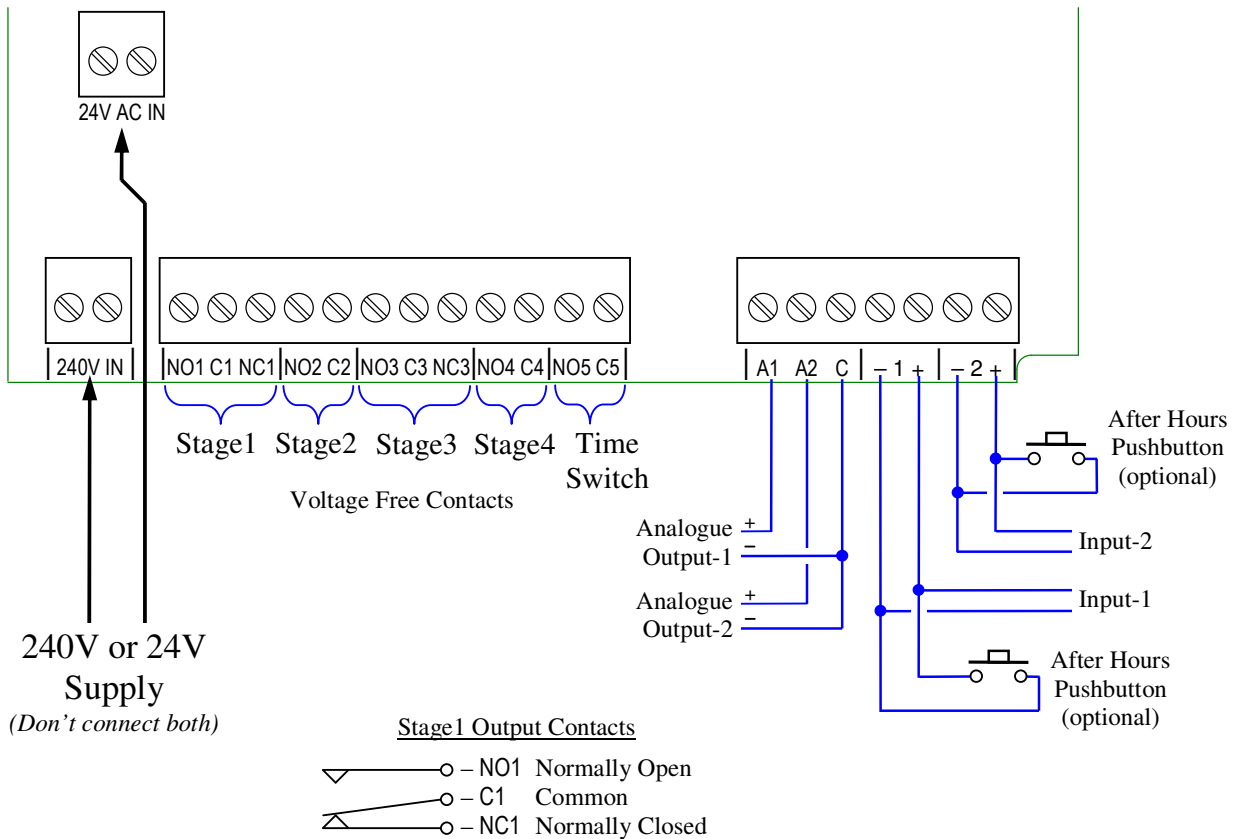
Input-1 Jumpers	Button-1 Override
Resistive	✓
0–10V, 0–20mA or 4–20mA	✗

Input-2 Jumpers	Input-2 Function	Button-2 Override
Resistive	Remote Offset	✗
Resistive	Temperature or Not Used	✓
0–10V, 0–20mA or 4–20mA	Any	✗

PROGRAMMING

The MiG2-CT5 is easily programmed using the front panel menu, the buttons have consistent functions throughout the whole menu.

Menu [↓] & [↑] buttons moves you up and down through the menu screens.

[**SEL**] button moves you into a menu level, moves the cursor for editing settings or saves changes.

Edit [+] & [−] buttons change the values when editing.

[**EXIT**] button quits editing without saving changes or moves you back one menu level.

If no button is pressed for 2 minutes the MiG2 will return to the home screens without saving any changes.

MENU STRUCTURE

The MiG2-CT5 has a number of home screens that continually cycle, these display: 'Time and Date',
  'Update/Confirm Holiday Settings'
  'Time Switch On/Off/Override'
  'Input-1 & Input-2 Values',
  'Actual Setpoint' and
  'Relay Status'.

Update/Confirm Holiday Settings is an indication that one or more holidays have passed. Each holiday will repeat on the same date each year unless changed or deleted. In the calendar menu, holidays that have passed are shown with an asterisk.

For resistive inputs, the temperature is displayed if a thermistor is connected, otherwise 'Open Circuit' or 'Short Circuit' is displayed.
Input-2 can also display 'Unused' or 'Remote' (remote offset connected).

Actual Setpoint = programmed set point +/– position of the remote knob.

CHANGE INDIVIDUAL SETTINGS

For safety reasons, any programming changes should be done with the cover on.

1. [**SEL**]   "Main Menu" will be displayed

2. [↓] or [↑]   until the required sub-menu is displayed

3. [**SEL**]   to enter that Sub Menu

4. [↓] or [↑]   until the required screen is displayed

5. [**SEL**]   to highlight the first value on this screen

6. [+] or [−]   to change this value

7. [**SEL**]   to highlight the next value (if any)
                     Repeat step 6 above.

8. [**SEL**]   to save changes and return to
                     the sub-menu.

[**Exit**] at any time, to quit editing this screen **without** saving changes.

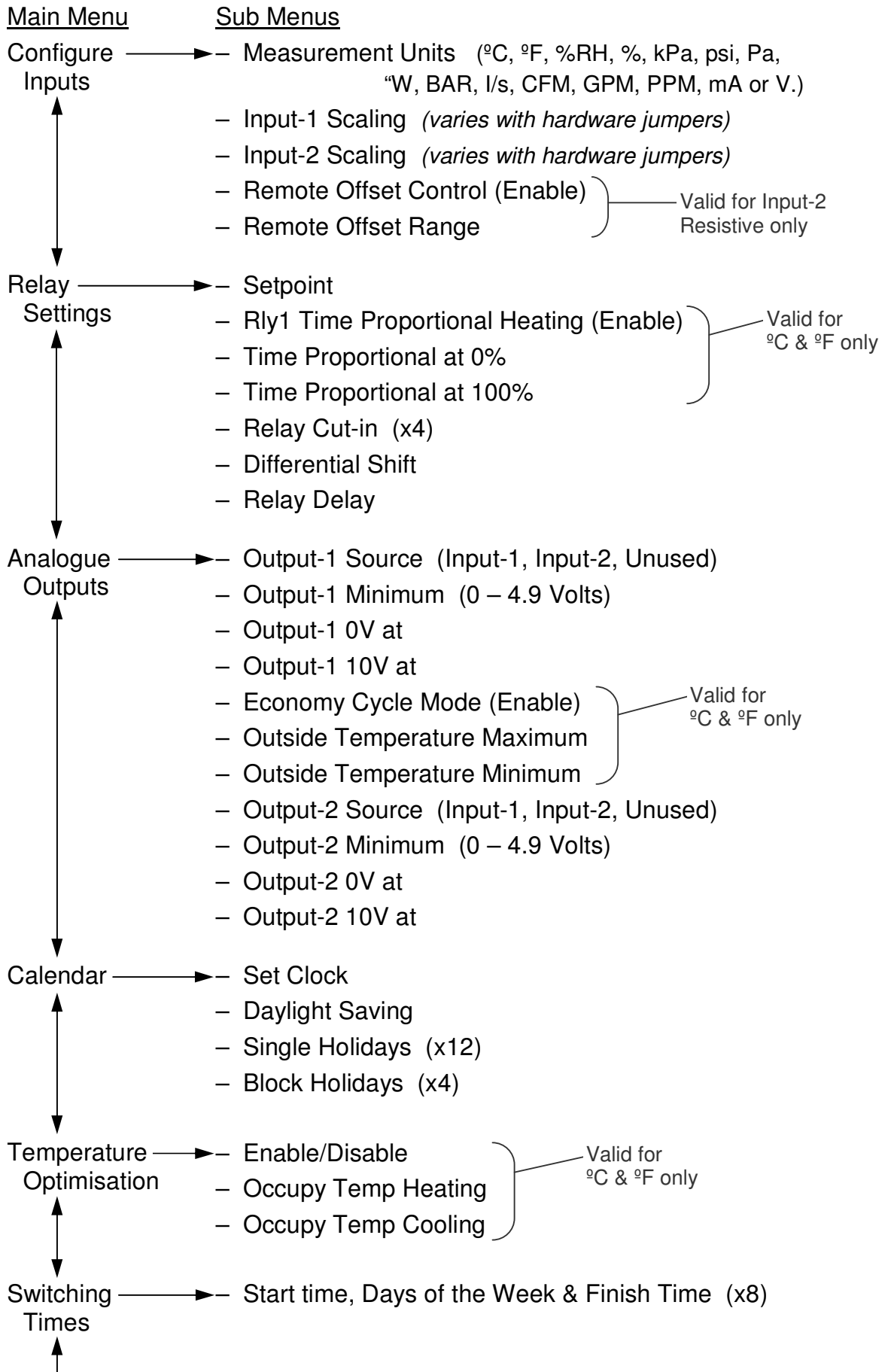9. [↓] or [↑]   to find another screen within that Sub Menu

LOCKED

If "Locked" is displayed when attempting to edit values:

– [**EXIT**]   to return to "Main Menu"
– [↓] or [↑]   until "Miscellaneous" is displayed
– [**SEL**]   to enter sub-menu
– [↓] or [↑]   until "Password" is displayed
– [**SEL**]   to edit value
– [+] or [−]   to change value to **'28'**
– [**SE**]   to save   (the MiG2 is now unlocked)

To lock the MiG2 again change the password to any value other than 28 (eg. 31).

Note: It is advisable to lock MiG2's that are located in public accessible areas.
         However MiG2's located in locked cabinets and equipment rooms are
         commonly left unlocked.

MENU GUIDE

Main Menu	Sub Menus

Configure Inputs →
- Measurement Units (ºC, ºF, %RH, %, kPa, psi, Pa, "W, BAR, I/s, CFM, GPM, PPM, mA or V.)
- Input-1 Scaling *(varies with hardware jumpers)*
- Input-2 Scaling *(varies with hardware jumpers)*
- Remote Offset Control (Enable) ⎞ Valid for Input-2
- Remote Offset Range ⎠ Resistive only

Relay Settings →
- Setpoint
- Rly1 Time Proportional Heating (Enable) ⎞
- Time Proportional at 0% ⎟ Valid for
- Time Proportional at 100% ⎠ ºC & ºF only
- Relay Cut-in (x4)
- Differential Shift
- Relay Delay

Analogue Outputs →
- Output-1 Source (Input-1, Input-2, Unused)
- Output-1 Minimum (0 – 4.9 Volts)
- Output-1 0V at
- Output-1 10V at
- Economy Cycle Mode (Enable) ⎞
- Outside Temperature Maximum ⎟ Valid for ºC & ºF only
- Outside Temperature Minimum ⎠
- Output-2 Source (Input-1, Input-2, Unused)
- Output-2 Minimum (0 – 4.9 Volts)
- Output-2 0V at
- Output-2 10V at

Calendar →
- Set Clock
- Daylight Saving
- Single Holidays (x12)
- Block Holidays (x4)

Temperature Optimisation →
- Enable/Disable ⎞
- Occupy Temp Heating ⎟ Valid for ºC & ºF only
- Occupy Temp Cooling ⎠

Switching Times →
- Start time, Days of the Week & Finish Time (x8)

Override ──────► – Button 1 Override Time
– Button 2 Override Time
– Extreme Temperate Enable/Run Time ⎤
– Extreme Temperature Minimum   ⎥ Valid for
– Extreme Temperature Maximum   ⎦ ºC & ºF only

Miscellaneous ──► – Password   *(set to **28** to unlock the device)*
– Firmware Version   (display only)

View Status ────► – Relays 1, 2, 3 & 4 (On/Off)
(display only)   – Time Switch - Relay 5 (On/Off)
– Analogue Outputs 1 & 2 (Voltages)
– Remote Offset (± Value)
– Actual Offset

View Logs ──────► – Input-1 High
(display only)   – Input-1 Low
– Input-2 High
– Input-2 Low
– Manual Override Run Time
– Ch1 Extreme Temperature Run Time

Note: Some screens only appear when
      other parameters are enabled.

CONFIGURE INPUTS

Input-1 is used to:
     – Control the relay outputs
     – Optionally control analogue output(s)   — Set in other Sub Menus
     (with additional after hours button-1)

Input-2 is used for one of these functions:
     – Remote offset of the setpoint
     – Control analogue output(s)   — Set in other Sub Menus
     – Outside air temperature (economy cycle mode)
     – Not used
     (with additional after hours button-2)

Input-1 Jumpers	Measurement Units Available	Range
Resistive (Micro-Air thermistor)	ºC or ºF	-30 to 110ºC -22 to 230ºF
0–10V, 0–20mA & 4–20mA	ºC, ºF, %RH, %, kPa, psi, Pa, "W, BAR, l/s, CFM, GPM, PPM, mA or V.	Dictated by 3rd party sensor

As a wide variety of sensors are available with 0–10V, 0–20mA & 4–20mA outputs, to measure more than just temperature. For these sensors the MiG2 must be programmed for each input with:
     – Decimal Places (0, 1, 2 or 3)
     – Lowest Reading (eg 4mA = 0kPa)
     – Highest Reading (eg 20mA = 100kPa)

REMOTE OFFSET

The MiG–RO is a wall mounting thermistor temperature sensor with remote offset knob.

Wire to the MiG2 as shown on right.

Settings
     Remote Offset Control = Enable
     Remote Offset Range = *as required*

Small values are recommended.
eg. Offset Range = 1.5ºC
   Setpoint = 21.5ºC
       Users can adjust 20 to 23ºC

Input-1 & Input-2 set to resistive

A1 A2 C | – 1 + | – 2 +

1 2 3

MiG–RO

Screw terminals are labeled on the rear of the MiG–RO

1 = Common
2 = Sensor
3 = Remote Offset
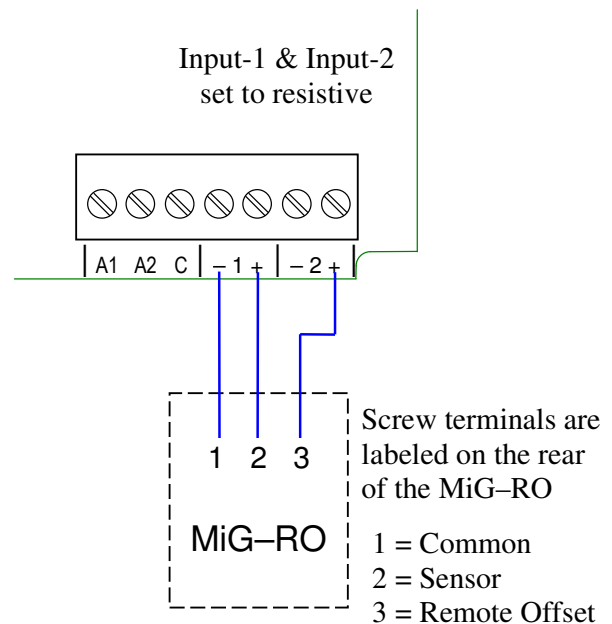
RELAY SETTINGS

Setpoint is the target value the MiG2 controller will aim to reach.

Relay Cut-in is the value, above or below setpoint, when the relay will turn on. This allows the setpoint to be adjusted without having to change all the relays. The relays are only controlled by Input-1.

Differential Shift provides hysteresis (difference between relay on and off levels). It is a common parameter or all relays and has a minimum of 0.5ºC or 0.9ºF.

Relay Delay is the minimum time between relays turning on (set 1 to 60 seconds). It prevents multiple relays turning on at the same time, for load shedding.

Example: 1-stage Cooling & 1-stage Heating
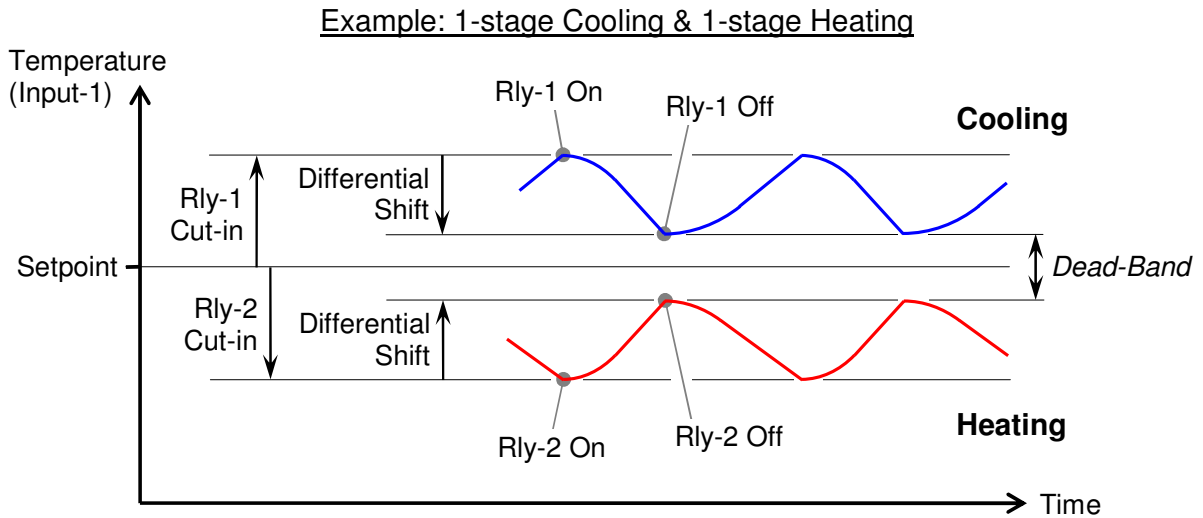
The Dead-Band can not be programmed directly, it is a combination of the Relay Cut-in's and Differential Shift settings.

Zero dead-band is allowed, programme Differential Shift greater than Relay Cut-in.
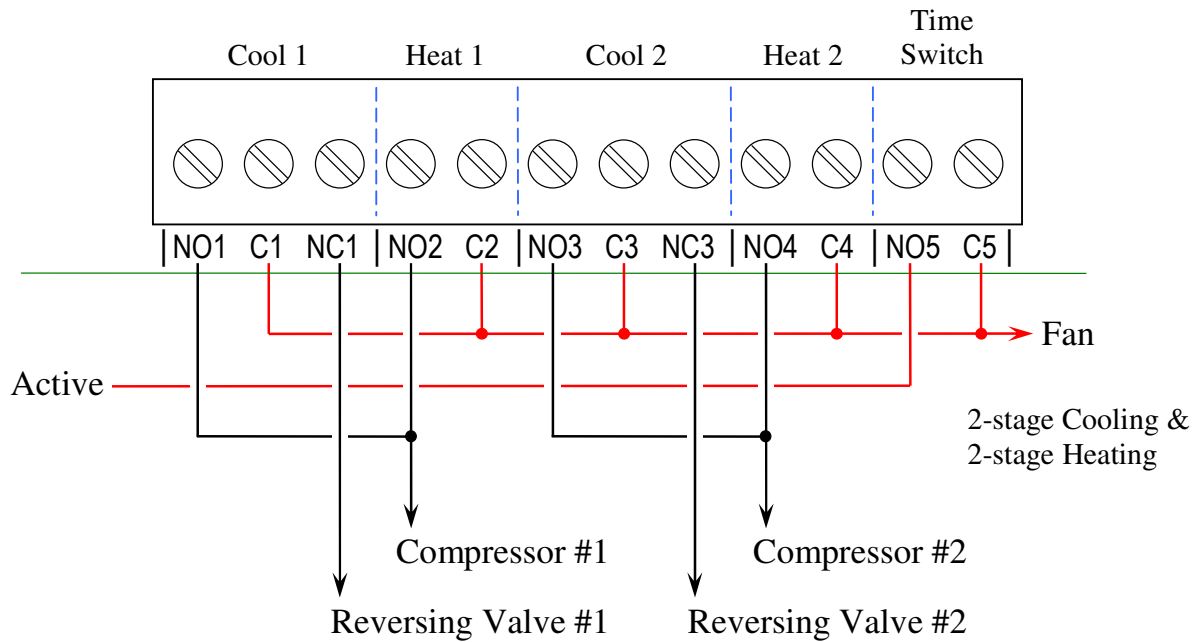
TIME PROPORTIONAL HEATING

Time Proportional Heating is only available on Relay-1 and when controlling temperature (ºC or ºF), it is primarily intended to drive resistive heating elements.

Relay-1 is cycled on and off proportionally (to Input-1) over a 50 second period.

Example

User Settings

Relay Settings
  Setpoint = 22.0ºC
  Time Proportional = Enable
  at 0% = 0.0ºC
  at 100% = –2.0ºC
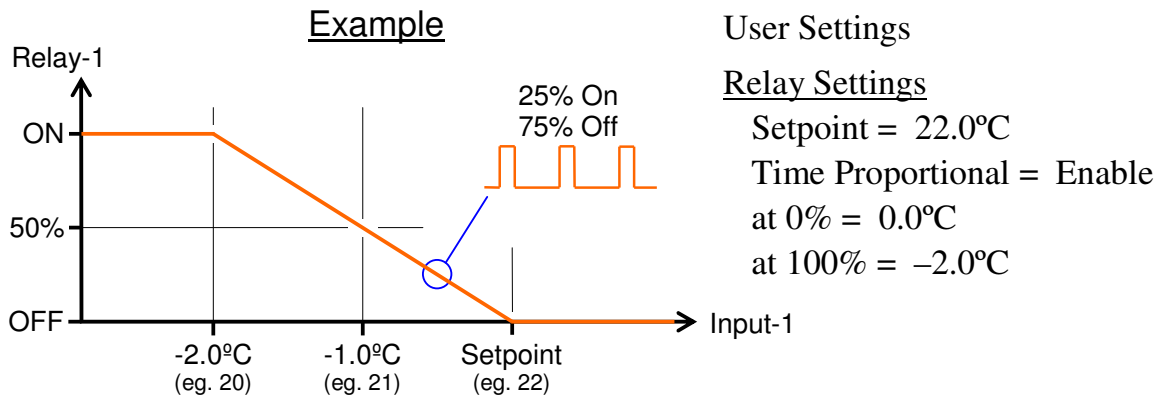
REVERSE CYCLE AIR-CONDITIONING

To accommodate Reverse Cycle Air-conditioning wire the MiG2 as shown below.

Example settings:

 Setpoint = 21.5ºC

 Time Proportional = Disable

 Relay-1 = +1.0ºC Cool

 Relay-2 = −1.0ºC Heat

 Relay-3 = +2.0ºC Cool

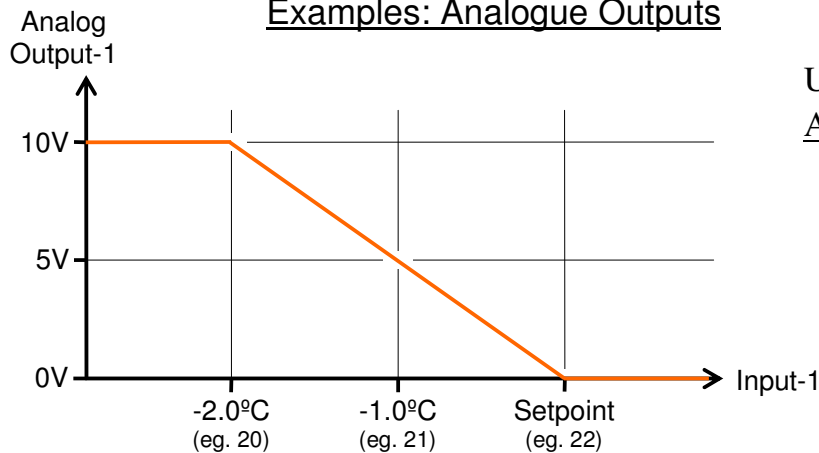 Relay-4 = −2.0ºC Heat

 Differential Shift = 0.5ºC

ANALOGUE OUTPUTS

The MiG2 has two independent 0–10V analogue outputs. These can be used to drive dampers and other actuators with variable control.

Each output can be programmed to respond to either input-1 or input-2.
      If source = input-1, the settings are relative to setpoint.
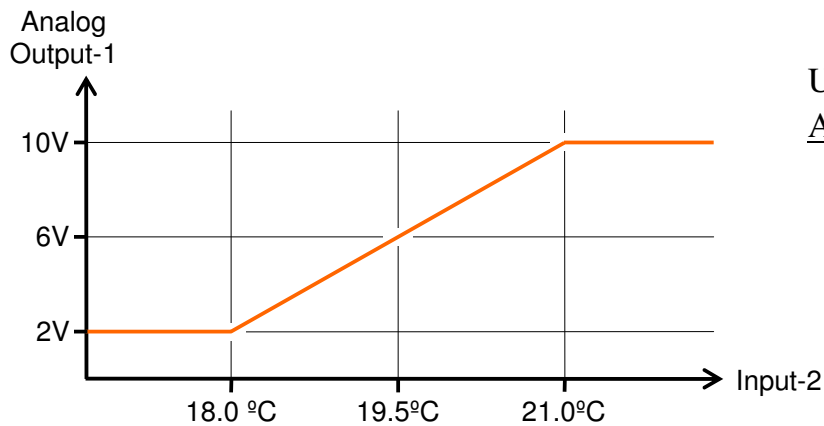   If source = input-2, the settings are actual readings.
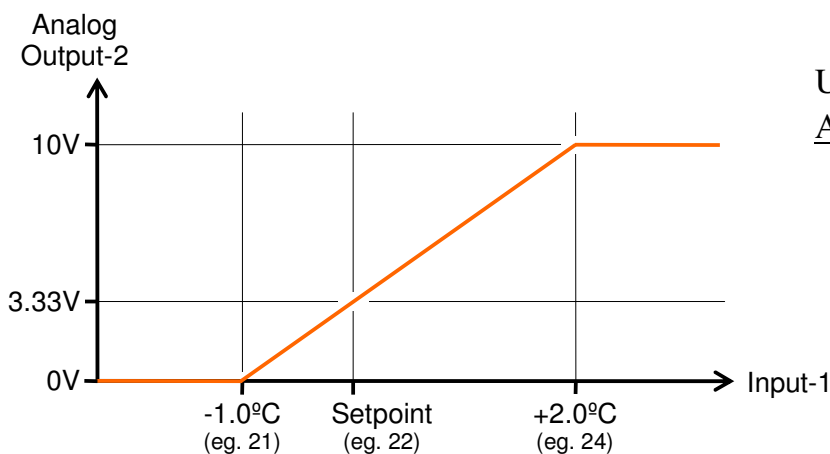
Examples: Analogue Outputs

Analog Output-1 (graph)

User Settings
Analog Output-1
   Source = Input-1
   Minimum Out = 0.0V
   0.0V@ = 0.0ºC
   10V@ = −2.0ºC

X-axis: -2.0ºC (eg. 20), -1.0ºC (eg. 21), Setpoint (eg. 22) — Input-1
Y-axis: 0V, 5V, 10V

Analog Output-1 (graph)

User Settings
Analog Output-1
   Source = Input-2
   Minimum Out = 2.0V
   2.0V@ = 18.0ºC
   10V@ = 21.0ºC

X-axis: 18.0 ºC, 19.5ºC, 21.0ºC — Input-2
Y-axis: 2V, 6V, 10V

Analog Output-2 (graph)

User Settings
Analog Output-2
   Source = Input-1
   Minimum Out = 0.0V
   0.0V@ = −1.0ºC
   10V@ = +2.0ºC

X-axis: -1.0ºC (eg. 21), Setpoint (eg. 22), +2.0ºC (eg. 24) — Input-1
Y-axis: 0V, 3.33V, 10V

ENERGY SAVING ECONOMY CYCLE

Economy Cycle Mode can be used with air-conditioning systems, to allow outside air to cool the zone when conditions are suitable (not available for heating) . This is only available when controlling temperature (ºC or ºF).

An outside air damper is required to regulate the mix of fresh air & recirculated air, such that: 0V = No outside air

                10V = 100% outside air

The MiG2 must be wired as:

      Input-1 = Zone temperature

      Input-2 = Outside temperature

      Analog Output-2 = Outside air damper

Example: Economy Cycle
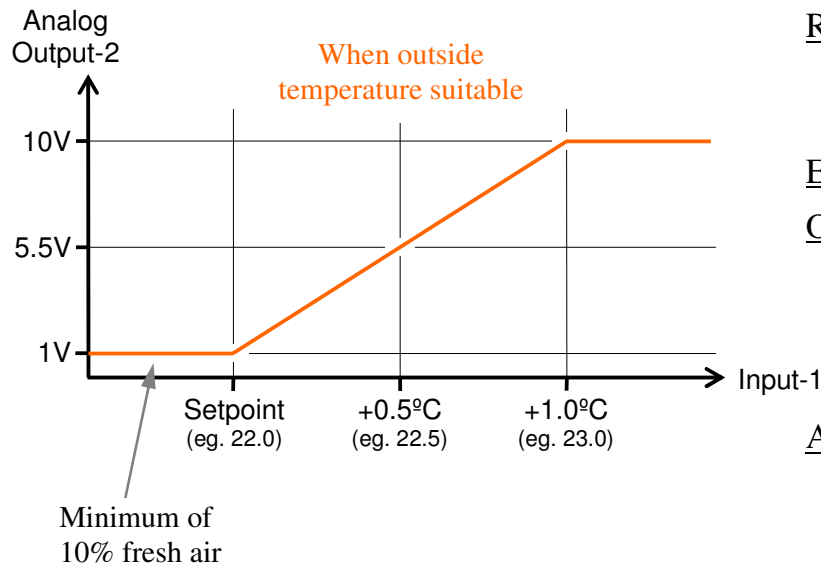
User Settings

Relay Settings
   Setpoint = 22. 0ºC
   Relay-1 = +1.0ºC Cool

Economy Cycle = Enable

Outside Temperature
   Maximum = 18. 0ºC
   Minimum = 5.0ºC

Analog Output-2
   Minimum Out = 1.0V
   1.0V@ = 0.0ºC
   10V@ = +1.0ºC

Outside temperature suitable (between 5.0 & 18.0ºC):
     As the zone temperature rises above 22ºC (setpoint) the damper will open more than the minimum, the higher the zone temperature the more the damper will open. Until at 23.0ºC the damper will be completely open and Relay-1 (stage-1 of cooling) will turn on. Relay-1 turns on because the outside air was unable to cool the zone sufficiently.

Outside temperature unsuitable (less than 5.0ºC or greater than 18.0ºC):
     The damper will stay open 10% regardless of the zone temperature.
     At 23.0ºC Relay-1 (stage-1 of cooling) will turn on as normal.

When the timer switches off (eg. night time), the analogue output will go to zero volts and the outside air damper will close completely.
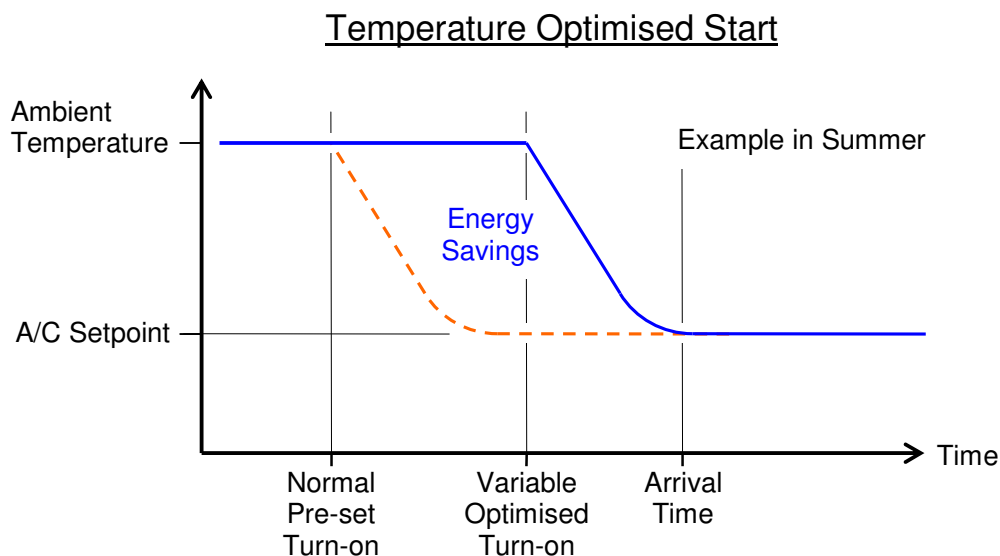
ENERGY SAVING TEMPERATURE OPTIMISED START

Temperature Optimised Start allows for further energy savings with air conditioning and heating systems. It does this by varying the start time each day, to align with the ambient temperature.

In many installations the time-switch is used to turn on the air-conditioning early, so the zone is comfortable by the time the occupants arrive. Technicians program the turn-on time for what they think is enough time to reach optimum temperature, generally this time is set to allow for extreme temperatures. Consequently, for many days of the year, the system turns on much earlier than is necessary.

The MiG2-CT5 overcomes this problem by calculating the optimum start-up time for each day. The MiG2 monitors the ambient temperature prior to turn-on. After the air-conditioning has turned on, the rate at which the temperature changes is monitored and this is used to build a history of the previous 5 starts. The MiG2 learns the temperature profile of the zone and turns the air-conditioning on at the 'last possible time' prior to occupancy.

Temperature Optimised Start can result in an addition 5-10% of energy savings, with the maximum benefit being in areas with seasonal extremes of temperature.

Temperature Optimised Start

Note: Temperature Optimised Start in a MiG2, will turn on a maximum of 2hrs before the occupy time.

Note: The temperature sensor must be installed in the zone (not in the ducting), or this function will not operate correctly.

Example: Set the Occupy Temp Heating to 19.0ºC
Set the Occupy Temp Cooling to 23.0ºC

Typical Air-Conditioning Start-up
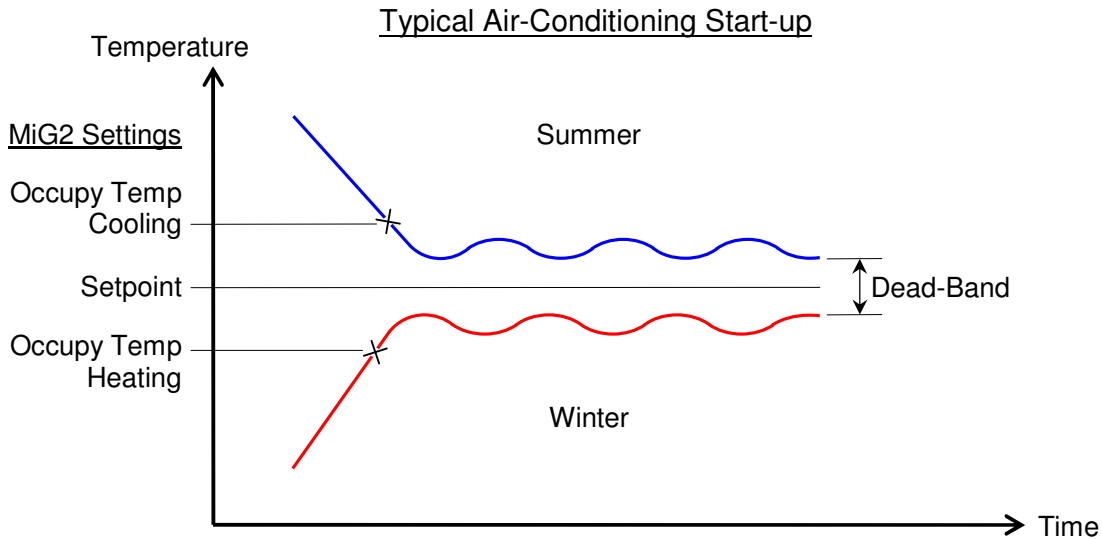
Note: The Occupy Temp Cooling and Heating **must** be set above and below the dead-band (as shown above), otherwise the optimised learning will not work.

SWITCHING TIMES
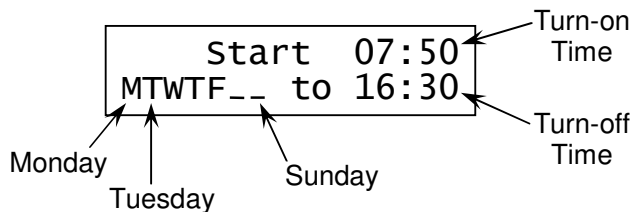
In this screen:
MiG2 will turn on at 7:50am each weekday morning and turn off 4:30pm that afternoon.

The MiG2 allows 8 switching times for the zone. Overlapping times are acceptable as well as switching past midnight.

```
      Occupy 08:30
MTW_F__ to 17:00
```

```
      Occupy 08:30
___T___ to 21:00
```

```
      Occupy 10:30
_____S_ to 04:00
```

Energy Saving Temperature Optimised Start is enabled for Ch1.

The air-conditioning turns on and has the shop at a nice temperature by 8:30AM each weekday and 10:30AM on Saturday.

It turns off 5PM Mon Tue Wed & Fri
9PM Thursday night
4AM Sunday morning.

```
      Occupy 09:00
_____ to 17:00
```

This represents a blank switching memory (note all the days of the week are off).

MANUAL OVERRIDE

Manual Override (after hours push-button) is used in situations like turning the air-conditioning on for employees working overtime on the weekend.

A momentary push-button (purchased separately) is wired across either input. The MiG2 is then programmed so if this push-button is pressed after hours the device will turn on for a programmable time (15min to 8hrs) and after that automatically switch off. The occupants can deactivate the override earlier by pressing the pushbutton a 2nd time.

The override must run for a minimum of two minutes before a second button press will turn the override off. This is to prevent problems from people pressing the push-button several times because they think the A/C hasn't started yet.

Note: The button will not appear in this menu if the configuration does not allow a push button for that input, as per table below.

Input-1 Jumpers	Button-1 Override
Resistive	✓
0–10V, 0–20mA or 4–20mA	✗

Input-2 Jumpers	Input-2 Function	Button-2 Override
Resistive	Remote Offset	✗
Resistive	Temperature or Not Used	✓
0–10V, 0–20mA or 4–20mA	Any	✗

EXTEREME TEMPERATURE OVERRIDE

Extreme Temperature Override prevents the temperature from varying outside selected limits when the zone is unoccupied.

This feature is idle for places like computer rooms and fruit shops, where even when there are no people present, the room should not become excessively hot. It is also valuable where the user wants to utilise the buildings' heat sink benefits to avoid lengthy start up periods.

While the time-switch is off the MiG2 monitors the temperature, if it rises above or falls below the preset limits the MiG2 will be turned on for an override period (30min to 2hrs). At the end of this time the MiG2 will check the temperature again, if within the preset limits then turn off, if still outside the preset limits then it stays on (starting a new override period).

Note: The temperature sensor must be installed in the zone (not in the ducting), or this function will not operate correctly.

LIVE ON–SITE TESTING

Once the parameters have been set, Live Testing allows checking that the MiG2 and the connected equipment are working correctly. While Live Testing is activated the MiG2 ignores its real inputs and responds to the values entered on the push-buttons.

Press the [▲] and [+] buttons at the same time to activate Live Testing.
The menu will change to:
> Live Testing Proceed (yes/no)
> Control Input-1
> Control Input-2
> Relay Status
> Analogue Outputs Status
> Actual Setpoint

Press the [**EXIT**] button twice to de-activate Live Testing.

SPECIFICATION

Power Supply	230Vac / 30mA @ 50/60Hz or 24Vac / 300mA @ 50/60Hz
Relay Contacts	Voltage: Rated to 240V AC Current: 10 Amps (resistive loads)
Ambient Temperature	5ºC to 40ºC
Humidity	Max 80% relative humidity up to 31ºC, decreasing linearly to 50% at 40ºC
Size	160mm (W) x 110mm (H) x 65mm (D)
Weight	550g

FAQ

When trying to change a setting the MiG2 displays "locked", see page 7.

To test a Micro-Air Thermistor Sensor is working, remove one wire from the MiG2 and measure the resistance across ends of both wires:

$$100ºC \ = \ \ \ 1 \ kΩ$$
$$25ºC \ = \ 10 \ kΩ$$
$$20ºC \ = \ 12 \ kΩ$$
$$0ºC \ = \ 27 \ kΩ$$

In the unlikely event that the display is blank or it is not functioning, reset the MiG2. Press [**EXIT**] 3 times, then hold down [⬆] and [**EXIT**] at the same time.

During a power failure the clock (date & time) is kept running, by a super capacitor, for up to 3 days. The super capacitor takes 1 hour maximum to fully recharge. After an extended power failure only the current date and time need to be set again, all other settings are stored in non-volatile EEPROM memory.

When a switching time (or other parameter) is changed, it will take up to 1 minute for the change to activate.

On the day daylight saving starts, at 2AM the clock will skip forward to 3AM. On the day daylight saving finishes, at 3AM the clock will skip back to 2AM and do that hour again.

Input-1 High/Low and Input-2 High/Low in the "View Logs" sub menu record the min and max temperature(s) for that day. These require the Time Switch to be running for 1hr before they start recording readings and are reset each time the Time Switch turns off.

Manual Override and Extreme Temperature in the "View Logs" sub menu record the amount of time the overrides have been in operation. These cannot be reset, thus they should be recorded at each visit in order to bill tenants for after hours usage.

To programme the MiG2 settings from a computer (Windows XP, Vista, 7 or 8):
        – purchase a special USB cable from Micro-Air
        – download the PC Interface Software from www.micro-air.com.au

OTHER MICRO-AIR PRODUCTS

Also available from Micro-Air

MiG2–T1:	Single Channel 365 Day Time Switch
MiG2–T2:	2 Channel 365 Day Time Switch
MiG2–T4:	4 Channel 365 Day Time Switch
MiG2–C2:	2 Stage Controller
MiG2–C4:	4 Stage Controller
MiG–PS:	Wall Mounting Temperature Sensor
MiG–RO:	Wall Mounting Temperature Sensor with Remote Offset
MiG–DS:	Duct Mounting Temperature Sensor
MiG–USB:	Computer Interface Cable

(A variety of averaging temperature sensors)

Sales & Technical Support   Ph: 1300 4 MICROAIR
1300 4 64276

Fax: 02 4578 8604

Web: www.micro-air.com.au