Networkable VAV Controller

Specification and Installation Instructions

Controller Model

INCTR14VAV *(0 TRIACS / pressure independent)*

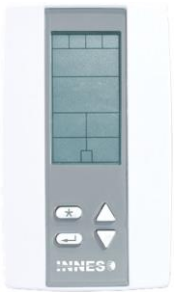
Digital Room Sensor

INTRM24VAV *(With temperature sensor)*

Description

The INCTR14VAV is a combination controller and digital room sensor with support for networked communications via the BACnet MS/TP or Modbus protocol. The INCTR14VAV controller is compatible with INTRM24VAV digital room sensor. The Networkable VAV Controller is designed for simple and accurate control of any variable air volume box in a number of zone control configurations. Its field configurable algorithms enable versatile implementation of required control sequences

INCTR14VAV



INTRM24VAV

Features

- Field configured VAV algorithms, inputs and outputs
- Built-in actuator, 70 lb-in
- On board differential pressure sensor (select models)
- Select direction on analog outputs
- Simple air balancing and commissioning via digital room sensor
- Automatically sets operation mode to pressure dependent or independent based on the presence of air flow
- Configurable PI (Proportional-Integral) function
- Independent, configurable proportional control band and dead band per ramp
- Selectable internal or external temperature sensor (10KΩ)
- Activate output with CO_2 sensor from external sensor input
- Changeover by contact or external temperature sensor
- Internal and external temperature sensor calibration
- Optional potentiometer feedback for increased precision of actuator position
- Freeze protection
- Removable, raising clamp, non-strip terminals

Operational Features

- Backlit LCD with simple icon and text driven menus
- Select digital room sensor's default display
- Network service port via on-board mini USB connector
- Manual night setback or no occupancy override
- Multi level lockable access menu and setpoint
- Selectable Fahrenheit or Celsius scale
- 3-wire connection to controller and 4 push buttons

Applications

- Single duct, cooling only
- Single duct cooling and/or heating
- Up to 4 stage reheat and/or cool
- Up to 4 On/Off heat and/or cool
- Up to 4 time proportioned (TPM) heat or reheat
- Up to 2 analog (0-10Vdc) reheat and/or cool
- Up to 2 floating heat and/or cool
- Pressure dependent or pressure independent
- With or without auto changeover
- Supply/exhaust (requires an additional INCTR14VAV)

Network Communication

- BACnet MS/TP or Modbus communication port
- Select MAC address via DIP switch or via network
- Automatic baud rate detection

BACnet MS/TP®

- Automatic device instance configuration
- Copy & broadcast configuration via digital room sensor menu or via BACnet to other controllers
- BACnet scheduler
- Firmware upgradeable via BACnet
- Support COV (change of value)

Modbus

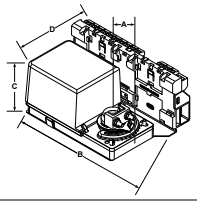
- Modbus @ 9600, 19200, 38400 or 57600 bps
- RTU Slave, 8 bits (configurable parity and stop bits)
- Connects to any Modbus master

Controller Specifications

Description	INCTR14VAV
Torque	70 in.lb. [8 Nm] at rated voltage
Power consumption	10 VA max
Running time through 90º	90 seconds
Power supply	22 to 26 Vac 50/60 Hz
Inputs	2 Universal inputs (Thermistor 10KΩ Type 3, digital 24Vac/dry contact, or 0-10Vdc)
	2 digital inputs
Outputs	2 analog outputs (0-10 Vdc or 2-10Vdc; selectable)
	Up to 4 TRIAC outputs 24 Vac, 500mA max thermal fuse in series with each TRIAC output (on/off, pulse, or 2 floating outputs)
Real Time Clock	Real-time clock (RTC) with super capacitor backup (approximately 3 days)
BACnet	BACnet® MS/TP @ 9600, 19200, 38400 or 76800 bps (B-ASC)
Modbus	Modbus RTU slave @ 9600, 19200, 38400 or 57600. Selectable parity and stop bit configuration: No parity, 2 stop bit | Even parity, 1 stop bit | Odd parity, 1 stop bit
Communication connection	Low capacitance, EIA RS-485, 22 or 24 AWG shielded twisted pair multi-strand cables (Belden 9841 or equivalent).
Digital Room Sensor connection	Insulated 3 core multi-strand 22 or 24 AWG cable. Maximum 50ft (15m) between controller and digital room sensor.
Electrical connection	Insulated 2 core 0.8 mm^2 [18 AWG] minimum power cable.
Operating temperature	0ºC to 50ºC [32ºF to 122ºF]
Storage temperature	-30ºC to 50ºC [-22ºF to 122ºF]
Relative Humidity	5 to 95% non condensing
Weight	1.26 kg. [2.8 lb]

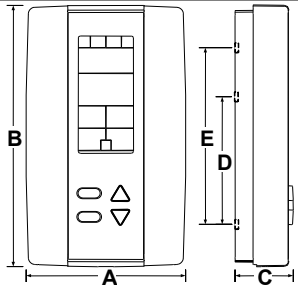
The actuator performs an auto-stroke on power up. When changing the actuator adjustment screws, cycle power to initiate the auto-stroke.

INCTR14VAV with a built-in 70 in. lb. Actuator



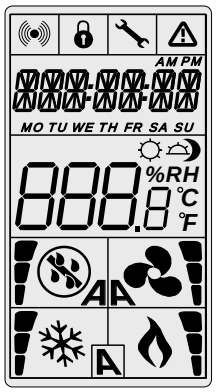
Dimensions
A = 1.50" | 39mm
B = 7.25" | 185mm
C = 3.25" | 83mm
D = 5.50" | 140mm

Digital Room Sensor Specifications

Description	INTRM24VAV
Temperature Sensor	
Setpoint range	10ºC to 40ºC [50ºF to 104ºF]
Control accuracy	Temperature: ±0.4ºC [0.8ºF]
Display resolution	±0.1ºC [0.2ºF]
Other	
Electrical connection	3 wires to VAV controller and 2 wires to BACnet/Modbus network | 0.8 mm^2 [18 AWG] minimum
Network service port	Mini USB connector
Power supply	24Vac
Power consumption	1VA
Operating temperature	0ºC to 50ºC [32ºF to 122ºF]
Storage temperature	-30ºC to 50ºC [-22ºF to 122ºF]
Relative humidity	5 to 95 % non condensing
Enclosure protection	IP 30 (EN 60529)
Weight	120 g. [0.25 lb]
Dimensions: A = 2.85" | 73mm B = 4.85" | 123mm C = 1.00" | 24mm D = 2.36" | 60mm E = 3.27" | 83mm	

Interface

INTRM24VAV



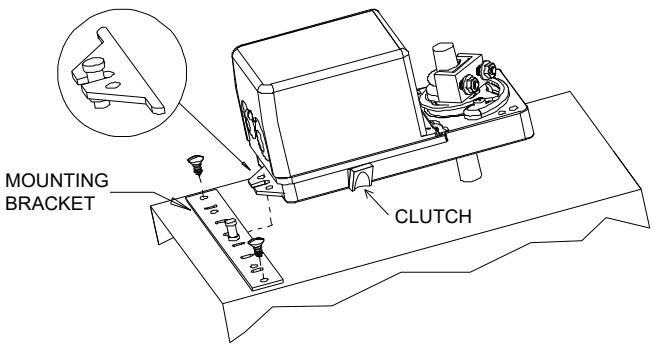
A	Cooling ON A: Automatic		Communication Status		Alarm status
A	Heating ON A: Automatic		Menu Locked		Energy saving mode (NSB or Occupancy)
A	Fan ON A: Automatic		Programming mode (Technician setting)	%RH	Percentage of humidity
				°C or °F	ºC: Celsius scale ºF: Fahrenheit scale

Mechanical Installation - Actuator

1. Manually close the damper blades and position the actuator to 0º or 90º.
2. Slide the actuator onto the shaft.
3. Tighten the nuts on the "U" bolt to the shaft with an 8mm wrench to a torque of 60 in-lb [6.7 Nm].
4. Slide the mounting bracket under the actuator. Ensure free movement of the slot at the base of the actuator. Place the bracket pin at mid distance of the slot.
5. Affix the bracket to the ductwork with #8 self-tapping screws.

Do not press the clutch when the actuator is powered.

INCTR14VAV with a built-in 70 in. lb. Actuator

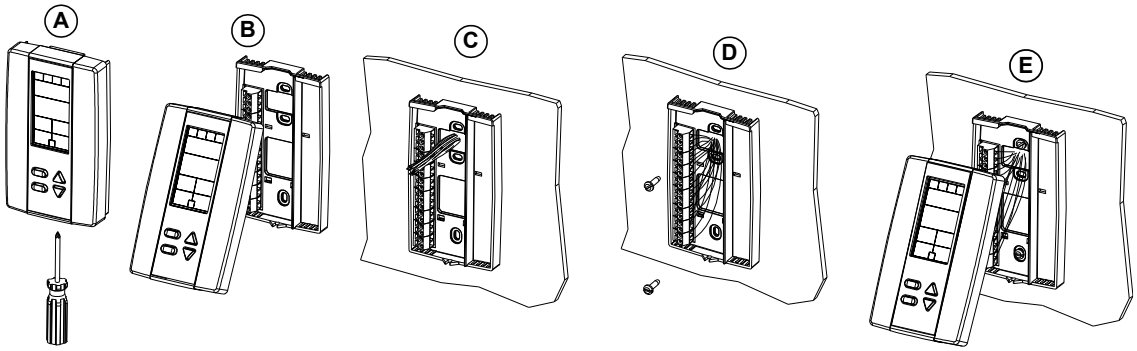


Mounting Instructions

INTRM24VAV

CAUTION: Remove power to avoid a risk of malfunction.

A. Remove the captive screw that's holding the base and the front cover of the unit together.
B. Lift the front cover of the unit to separate it from the base.
C. Pull all wires through the holes in the base.
D. Secure the base to the wall using wall anchors and screws (supplied). Make the appropriate connections.
E. Mount the control module on the base and secure using the screw.



BACnet or Modbus Address DIP Switch (DS1)

MAC address for communication, are selectable by DIP switch using binary logic. If you do not change device instance in program mode, it will be automatically modified according to the MAC address.

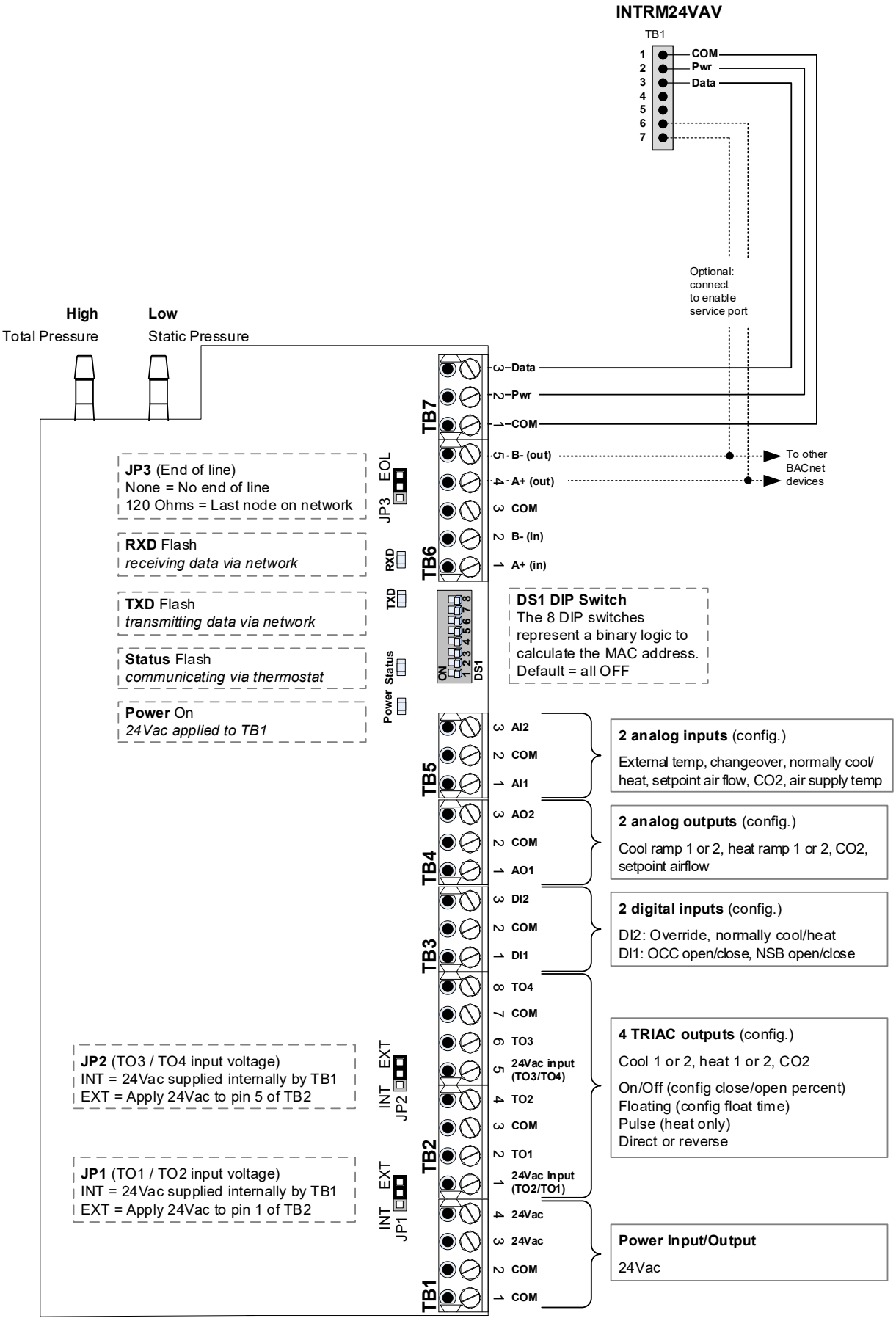
Note: Avoid using addresses above 246 when selecting Modbus MAC address.

MAC Address	DS.1 = 1	DS.2 = 2	DS.3 = 4	DS.4 = 8	DS.5 = 16	DS.6 = 32	DS.7 = 64	DS.8 = 128	Default Device Instance
0	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	153000
1	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	153001
2	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	153002
3	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	153003
4	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	153004
…	…	…	…	…	…	…	…	…	…
126	OFF	ON	ON	ON	ON	ON	ON	OFF	153126
127	ON	ON	ON	ON	ON	ON	ON	OFF	153127

** Slave addresses available by setting DS.8 to ON*

Wiring

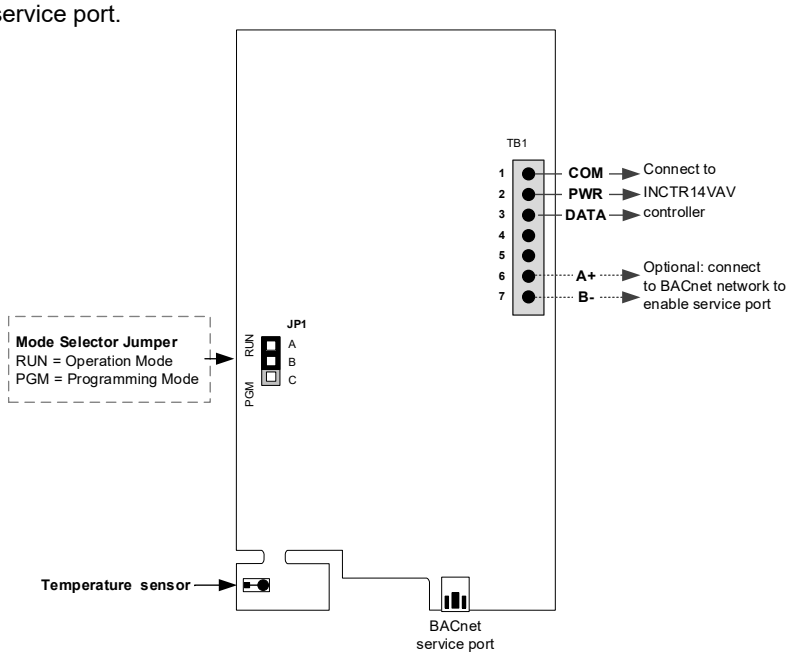
We strongly recommend that all Innes products be wired to a separate grounded transformer and that transformer shall service only Innes products. This precaution will prevent interference with, and/or possible damage to incompatible equipment.



PCB Drawing

INTRM24VAV Digital Room Sensor

3 wire cable (TB1 #1, 2 & 3)
Connect TB1 #6 (A+) & #7 (B-) to INCTR14VAV to enable the BACnet service port.



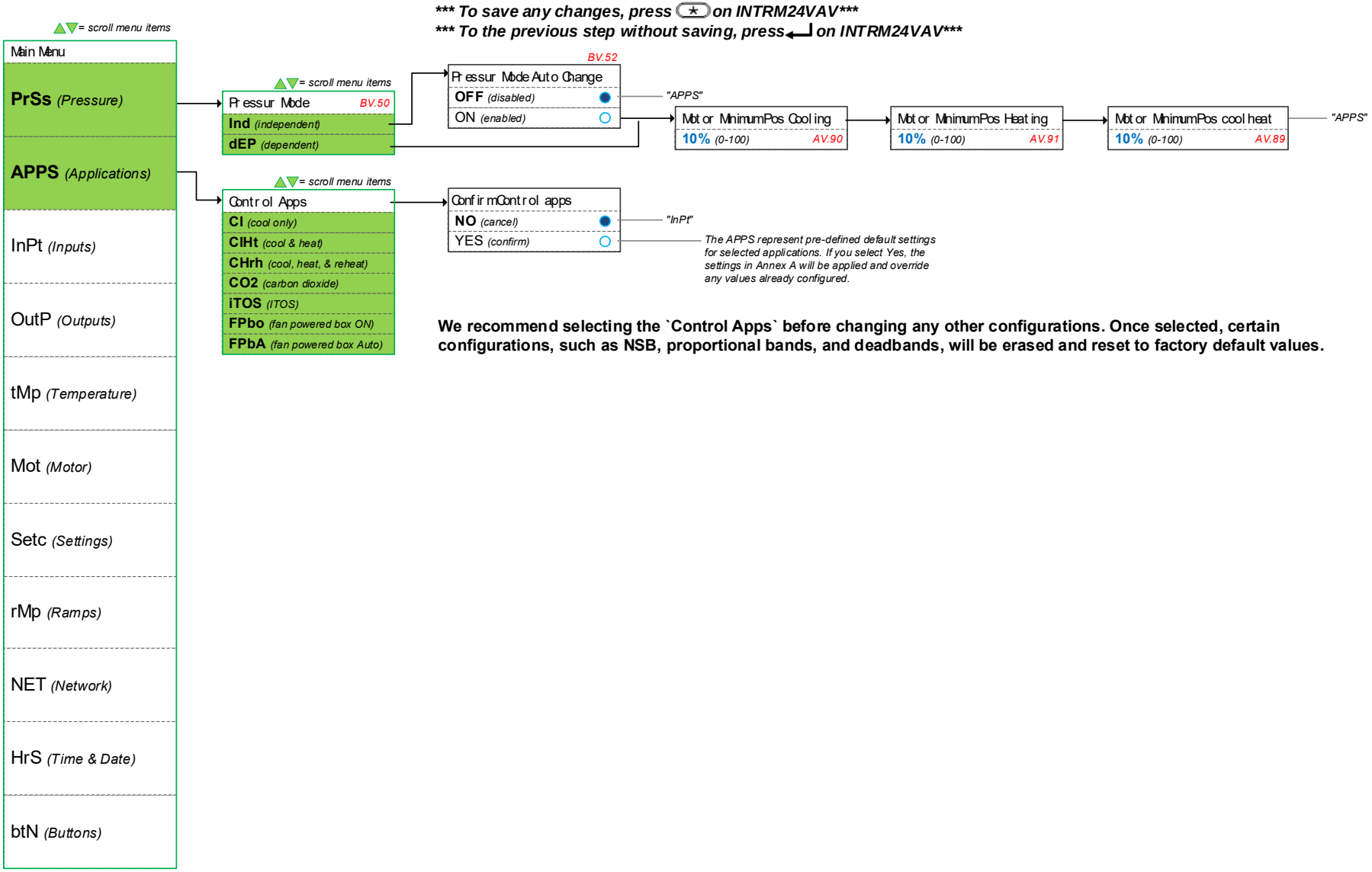
Mode Selection (JP1)

JP1 RUN PGM	**RUN:** Digital room sensor is in **Operation Mode**. Digital room sensor must be set in this mode for normal system operation. If not locked, setpoint and control mode can be changed by the end user.
JP1 RUN PGM	**PGM:** Digital room sensor is set in **Programming Mode**. Refer to the following sections for more details.

Pressure & Applications – Menu (1 of 6) | *Pressure and Applications*

For a description of the default settings for each application refer to Annex A: Control Apps on page 17.

Main Menu	Sub Menu	Configuration

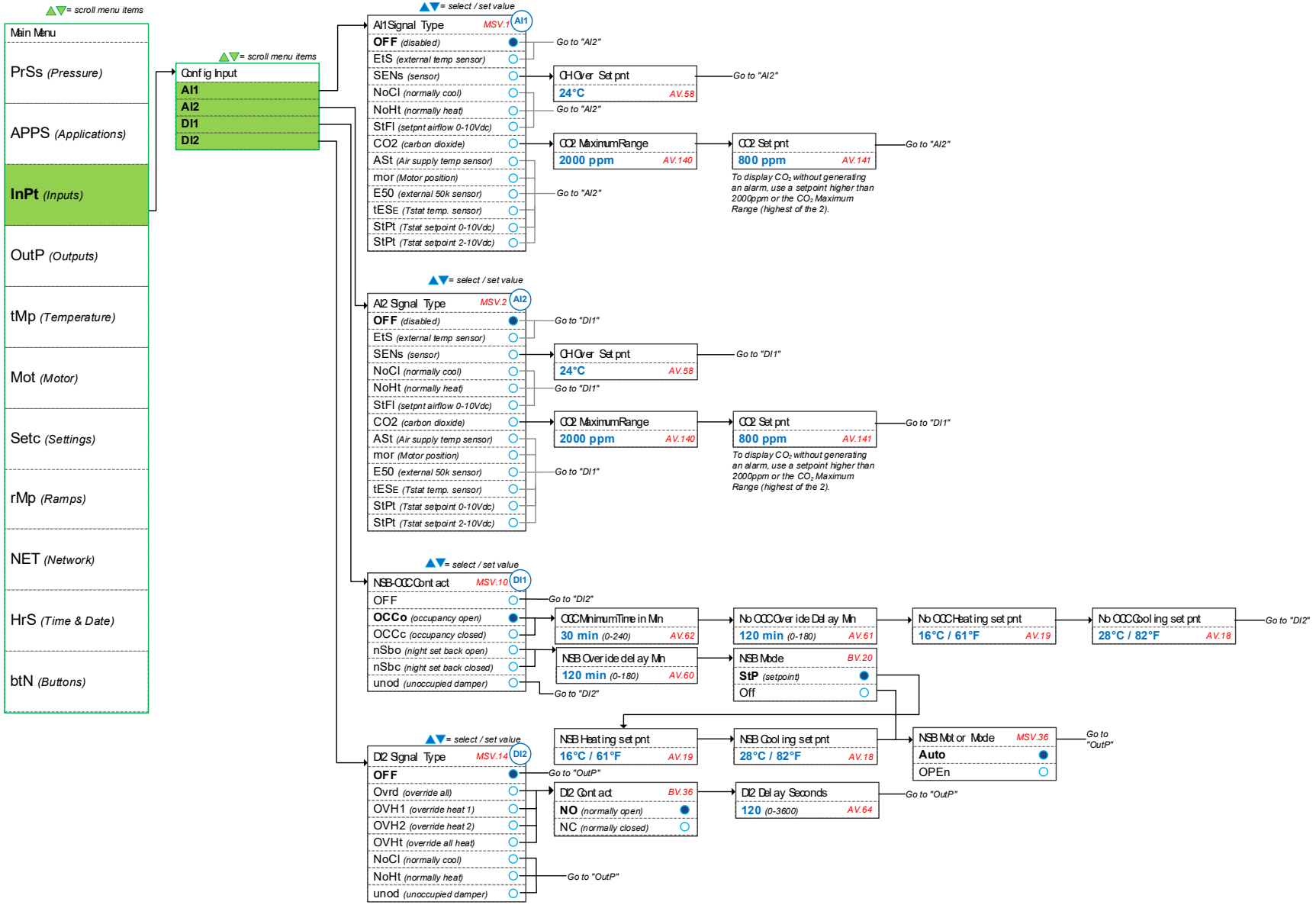


We recommend selecting the `Control Apps` before changing any other configurations. Once selected, certain configurations, such as NSB, proportional bands, and deadbands, will be erased and reset to factory default values.

Inputs – Menu (2 of 6) | *AI1, AI2, DI1 and DI2*

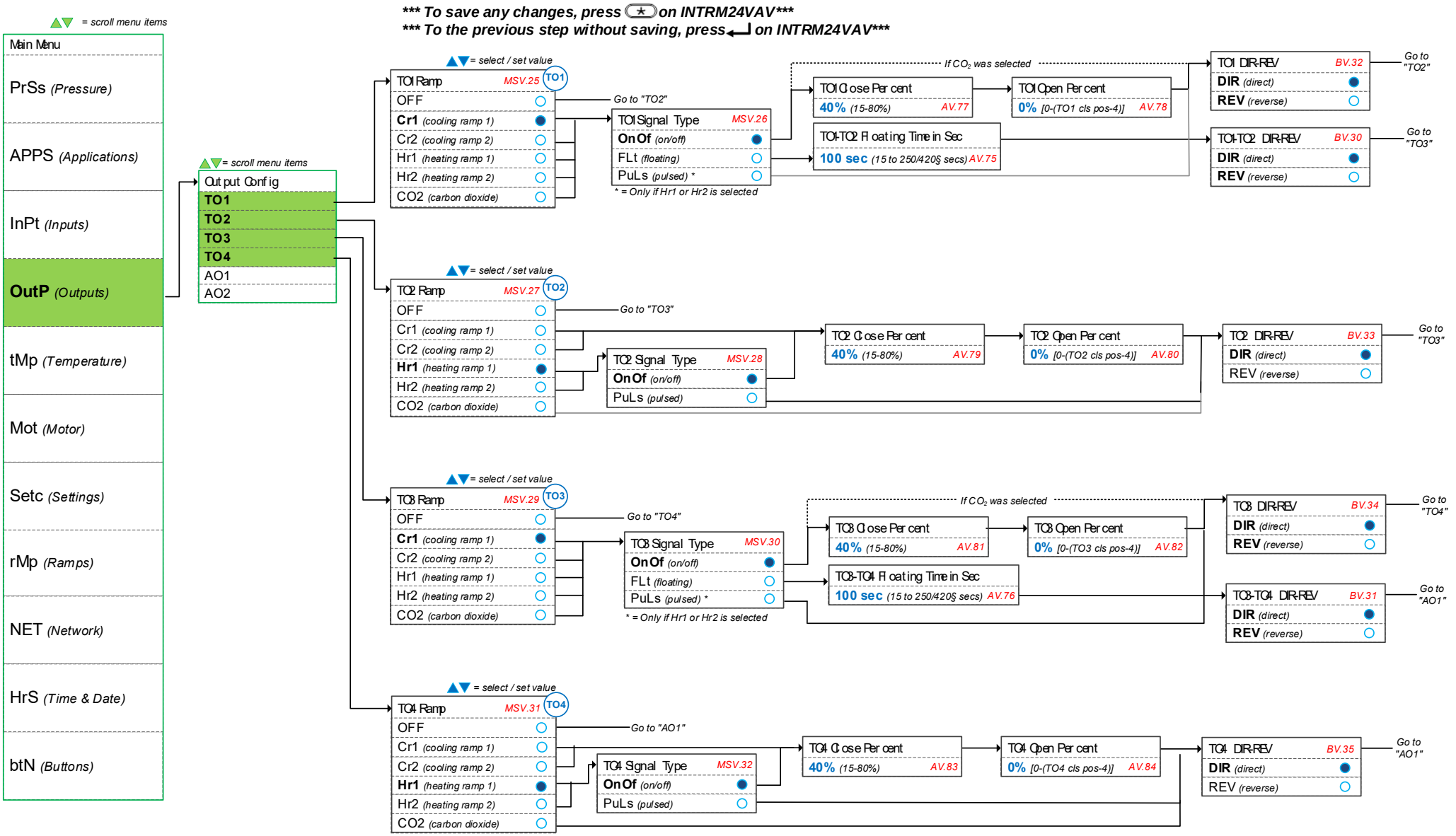
Main Menu | **Sub Menu** | **Configuration**

****** To save any changes, press ★ on INTRM24VAV******
****** To the previous step without saving, press ↵ on INTRM24VAV******



TRIAC Outputs – Menu (3 of 6) | *TO1 to TO4*

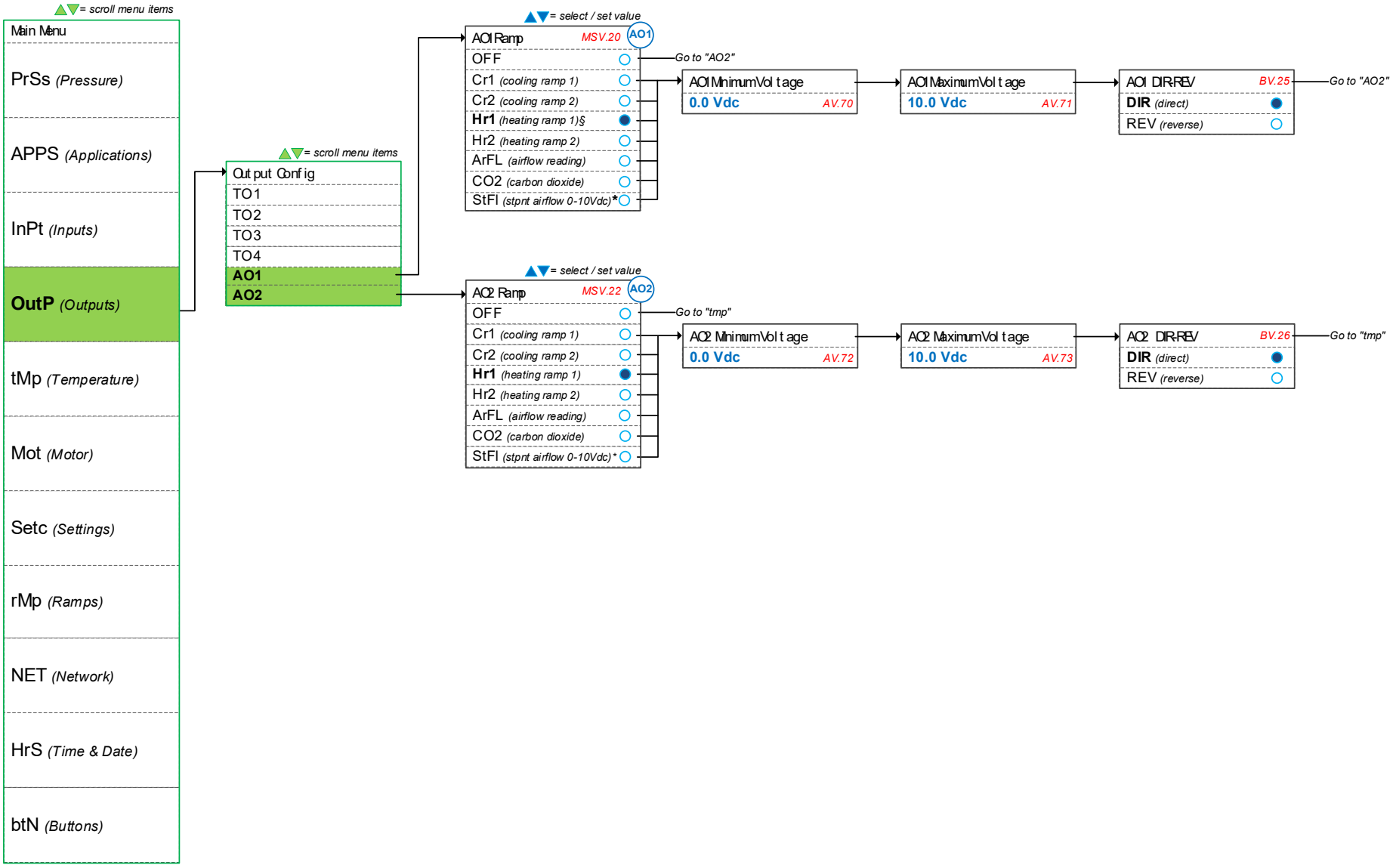
Main Menu | **Sub Menu** | **Configuration**



Analog Outputs – Menu (4 of 6) | *AO1 and AO2*

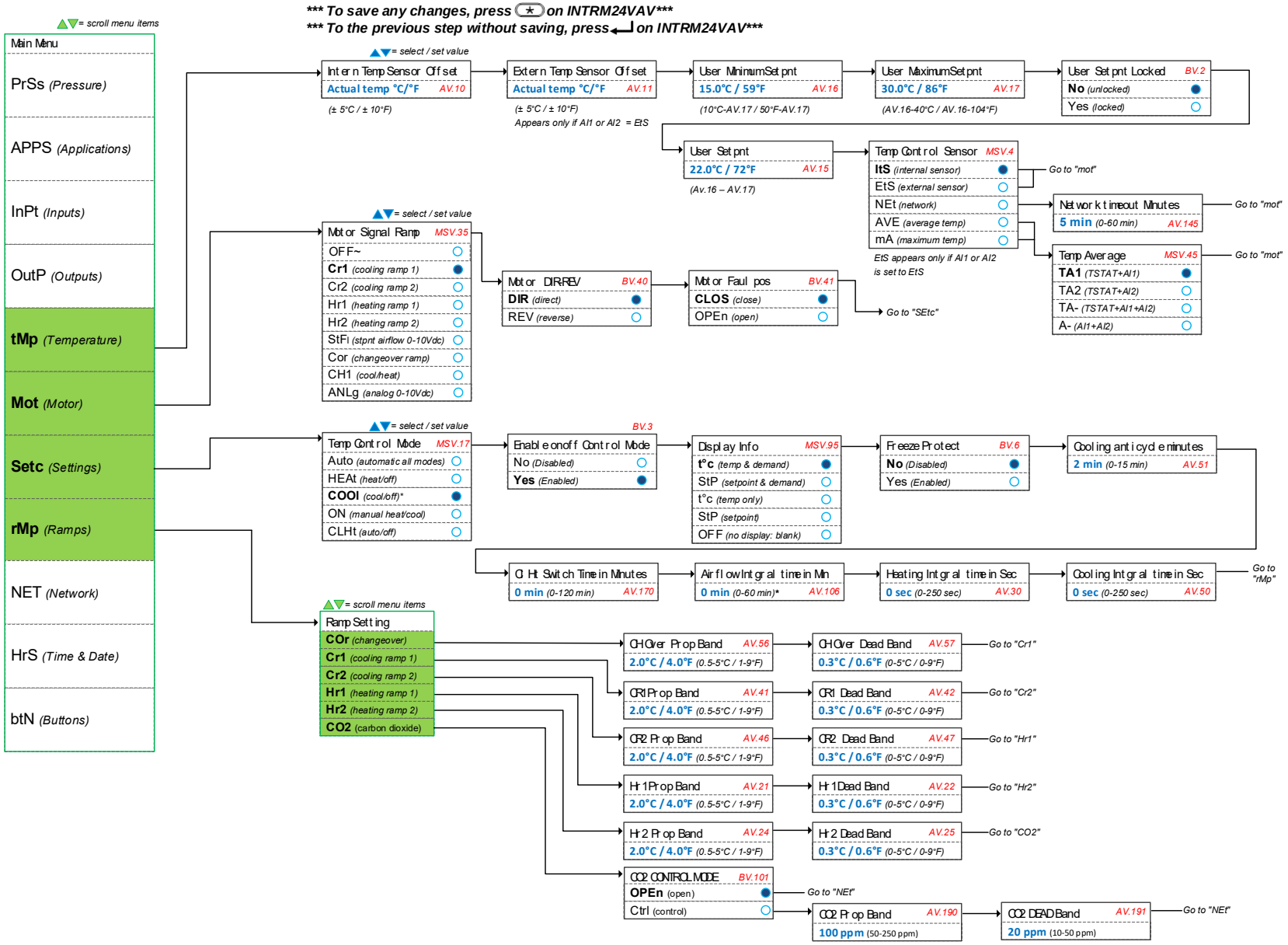
Main Menu	Sub Menu	Configuration

*** To save any changes, press ⊛ on INTRM24VAV***
*** To the previous step without saving, press ↵ on INTRM24VAV***



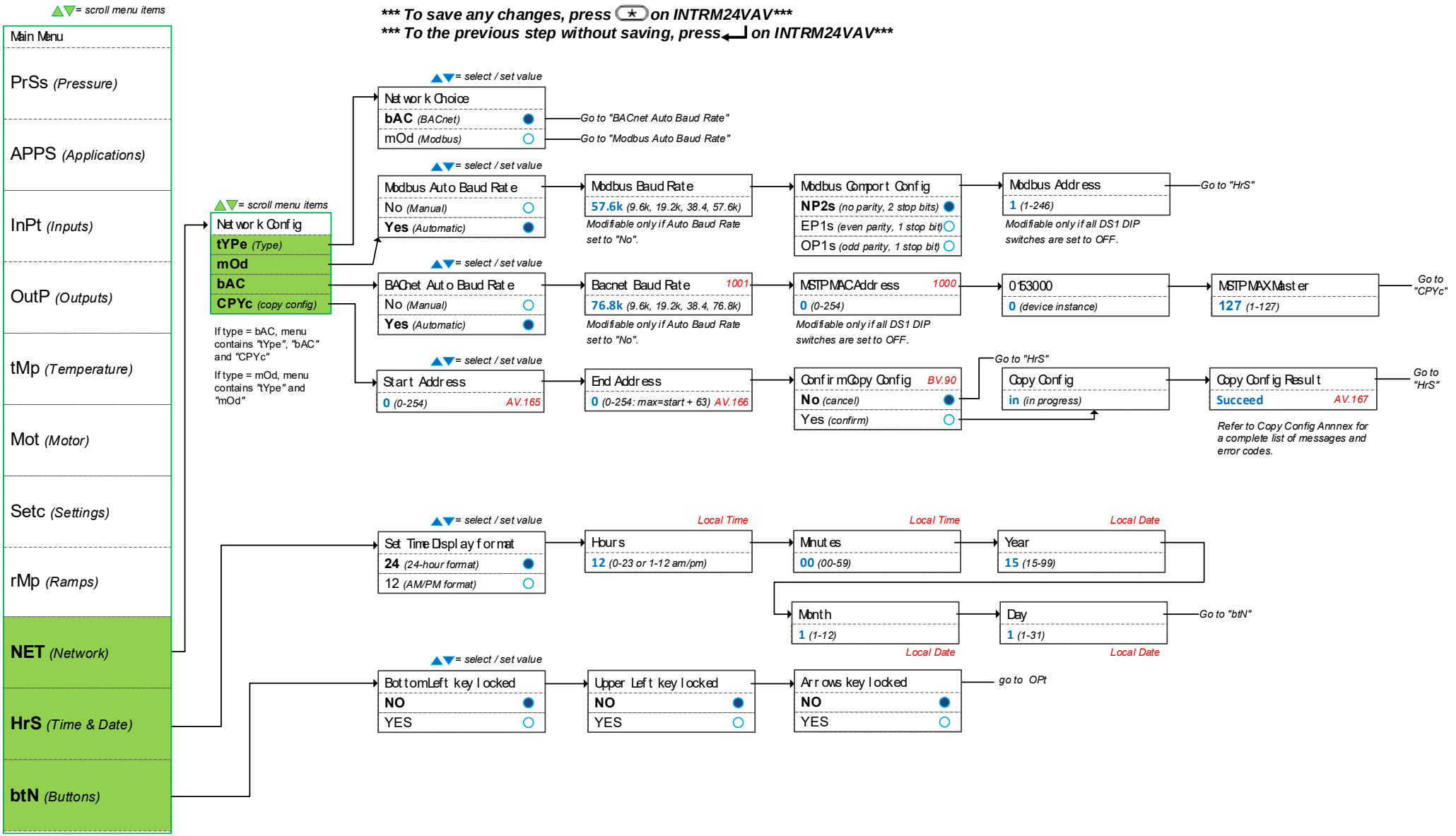
Settings – Menu (5 of 6) | Temp, Motor, Settings and Ramps

Main Menu | **Sub Menu** | **Configuration**



Settings – Menu (6 of 6) | Network, Time, Buttons and Options

Main Menu	Sub Menu	Configuration



Operation Menus

This menu is accessible through normal operation mode. The Mode Selector jumper (JP1) of the digital room sensor must be set to the "RUN" position (Operation Mode). Refer to Wiring on page 5.

1. Press the [✱] and [↵] buttons simultaneously for 5 seconds. The "Enter Password" screen appears.
2. Enter the password within 1 minute by using the arrow keys to increase or decrease the value and the [✱] and [↵] buttons to toggle between the digits.
   a. Password **372** = Temperature Offset Menu
   b. Password **637** = Network Settings Menu
   c. Password **757** = Airflow Balance Mode
3. If you enter the wrong password, the digital room sensor displays "**Eror**" and returns to Operation Mode. The digital room sensor will return to normal mode if you navigate through the entire menu and do not make any selection, or if you do not press any key for 5 minutes. The changed values will be saved automatically.

Menu 372 – Temperature Offset

1. "Intern Temp Sensor Offset"

Range: 10 to 40ºC [50 to 104ºF]
Offset: Max ± 5ºC
Increment: 0.1ºC [0.2ºF]

Compare the displayed temperature reading with a known value from a digital room sensor. To offset or calibrate the sensor, use the arrows key to set the desired temperature reading. This is useful for digital room sensors installed in areas where the temperature read is slightly different than the room's actual temperature. For example, a digital room sensor placed right under the air diffuser.

If the digital room sensor is set to use an external temperature sensor (EtS), the digital room sensor displays "OFF".

2. "Extern Temper Sensor Offset"

Range: 0 to 50ºC [41 to 122ºF]
Offset: Max ± 5ºC
Increment: 0.1ºC [0.2ºF]

This option appears if you've set one of the analog inputs to **EtS** (External temperature sensor). When the digital room sensor is connected to the appropriate analog input, the display shows the temperature read by the external temperature sensor. Adjust the offset by comparing it with a known value (e.g. thermometer). If the sensor is not connected or short circuited, then the unit displays the sensor's limit.

3. "Input3 Reading"

Range: 250mV (0") to 4000mV (1")

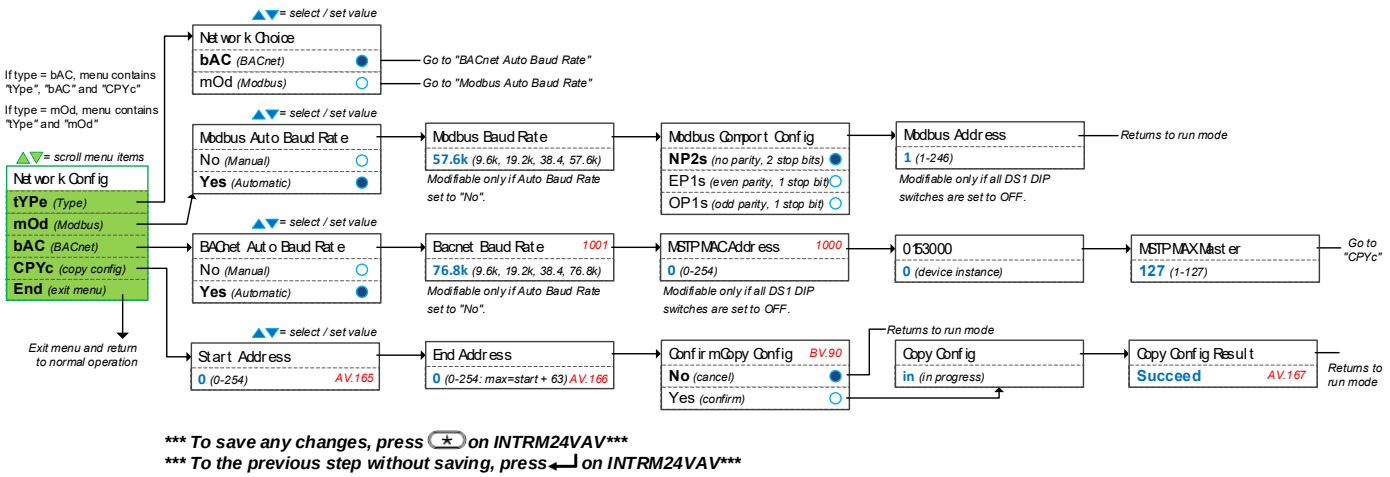
Displays the voltage output value in mV of the pressure sensor.

4. "Input3 Minimum Reading

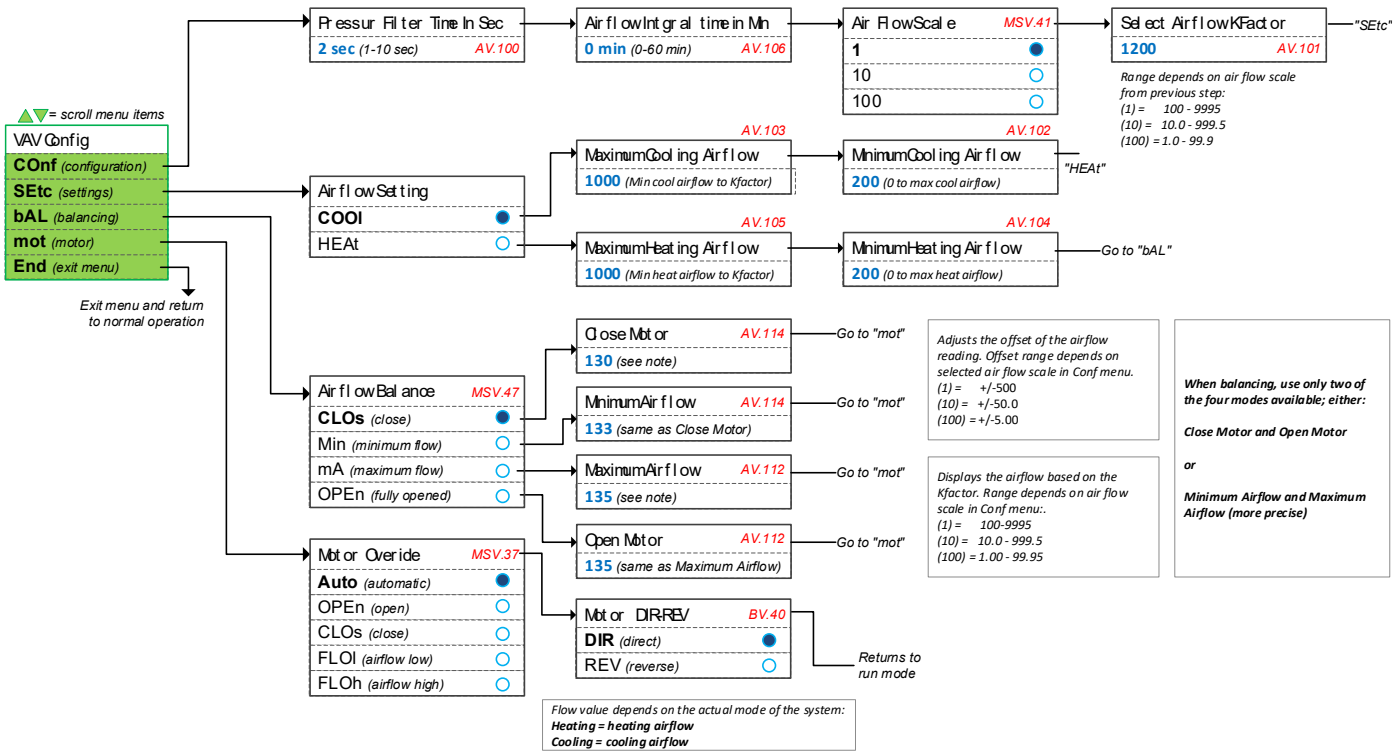
Range: 10mV to 180mV
Default: 60mV

This setting represents the deadband of the pressure sensor in mV. For advanced users or special applications only. We recommend that you use the default setting of 60mV.

Menu 637 – Network Settings



Menu 757 – Airflow Balance Mode



****** To save any changes, press ⊛ on INTRM24VAV******
****** To the previous step without saving, press ↵ on INTRM24VAV******

Reset to Factory Default Settings

This will erase all actual configurations and replace them with the factory default settings.

1. The Mode Selector jumper (JP1) of the digital room sensor must be set to the “RUN” position (Operation Mode). Refer to Wiring on page 5.
2. During the power up sequence of the controller and digital room sensor, press and hold both the ↵ and ▼buttons.
3. The “Enter Password” screen appears. Enter **372** within 1 minute by using the arrow keys to increase or decrease the value and the **[⊛]** and ↵ buttons to toggle between the digits.
4. Use the arrow buttons to select YES and then press **[⊛]**.
5. For more information about the "K" value, consulte the next information table depending the VAV box brand box and the manufacturer either "Tuttle & Bailey" or "Innes Aire"

INNES

Sensor Performance Parameters

Tamaño	Área (ft^2)	F	K
4	0.0819	2.8	209
5	0.1296	3.0	315
6	0.1962	3.8	415
7	0.2578	3.0	612
8	0.3491	2.9	847
10	0.5319	3.0	1250
12	0.7854	2.8	1904
14	1.0689	3.0	2506
16	1.3963	3.1	3262
24	2.6321	3.0	6522

"F" is the amplification factor
K= flow coefficient

Tuttle & Bailey REIMAGINING AIR

Flo-Cross® Sensor Performance Parameters

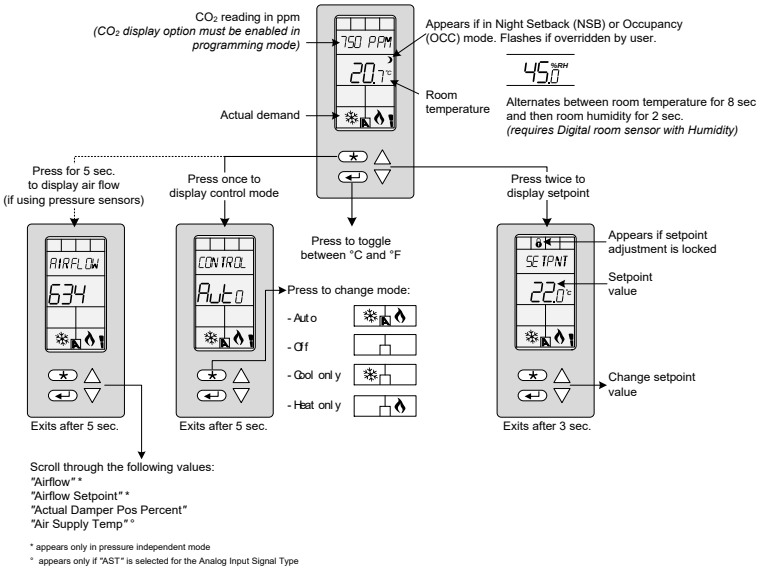
Size	Area (ft²)	F	K
04	0.0819	2.8	209
05	0.1296	3	315
06	0.1883	2.9	462
07	0.2578	3	612
08	0.3382	2.9	817
10	0.5319	3	1250
12	0.7691	3	1792
14	1.05	3	2474
16	1.3745	3	3235
24	2.6321	3	6522

"F" is the amplification factor
K= flow coefficient

Operation Mode

The Mode Selector Jumper (JP1) of the digital room sensor must be set to the "RUN" position (Operation Mode). Refer to Wiring on page 5.

INTRM24VAV



Power Up

Upon power up, the LCD illuminates and all segments appear for 2 seconds. The digital room sensor then displays its current version of the digital room sensor for 2 seconds followed by the current version of the controller for 2 seconds. Pressing any key on the digital room sensor illuminates the LCD for 4 seconds.

Temperature Display and Setpoint

If enabled in the *"Display Info"* menu (see Settings – Menu (5 of 6) | *Temp, Motor, Settings and Ramps* on page 11), the digital room sensor displays the temperature reading. If the sensor is disconnected or short circuited, then the unit displays the sensor's limit. To toggle the temperature scale between ºC and ºF, press the ↵ button. To display the setpoint, press the ▲ or ▼ key twice. The setpoint appears for 5 seconds. To adjust the setpoint, press the arrow keys while the temperature is displayed. If the setpoint adjustment has been locked "Setpnt Locked", the lock 🔒 symbol appears.

Airflow and Air Supply Temperature

Press and hold the **[** ✶ **]** button for 5 seconds and use the arrow keys to view the "airflow", "airflow Setpnt", "actual damper pos percent" and "air Supply Temp". After 5 seconds without any action, the digital room sensor returns to operation mode. The air supply temperature appears only if analog input AI1 or AI2 are configured with the AST option.

Control Mode

To access the Control Mode, press the **[** ✶ **]** button. The Control Mode appears for 5 seconds. Press the **[** ✶ **]** button to scroll through the following control modes. These options can vary depending on the options selected in "Temp Control Mode" and "Enable OnOff Control Mode".

- Auto (Automatic Cooling or Heating)
- OFF (if it is not disabled in Programming Mode)
- Cooling only (on, with cooling symbol)
- Heating only (on, with heating symbol)

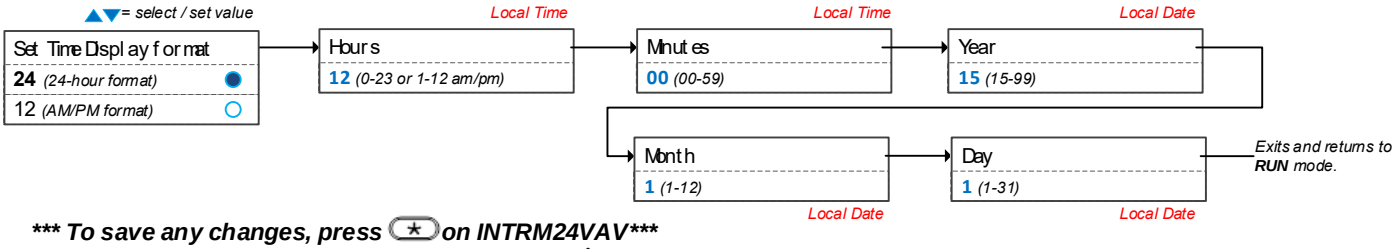
Night Setback (NSB) or Occupancy Mode

This function is only available if you set DI1 to **nSb** (Night setback contact) or **Occ** (occupancy mode). If the DI1 contact is triggered, the digital room sensor enters NSB or No Occupancy Mode (the ☽ symbol appears) and uses the NSB or OCC heating and cooling setpoints.

If not locked, you can override the night setback or no occupancy mode for a predetermined period by pressing any of the 4 buttons. During the override period the ☽ symbol will flash. If the ☽ symbol does not flash, the override period is finished or the night setback or no occupancy override has been locked in programming mode

Set Time and Date

1. Ensure that JP1 on the digital room sensor is set to run.
2. Press and hold the ↵ button for 5 seconds
3. Use the arrow keys to set the desired value. Press the **[✶]** button to save and got to the next step. Press the ↵ button to go to the previous step without saving.



****** To save any changes, press ✶ on INTRM24VAV******
****** To the previous step without saving, press ↵ on INTRM24VAV******

Annex A: Control Apps

Refer to *Pressure & Applications – Menu (1 of 6)* on page 7 for more information. The available **Control Apps** vary according to the model.

Description	CL (cool only)	CLHt (cool/heat)	CHrH (cool/heat/reheat)	CO_2 (CO_2)	ITOS (ITOS)	FPbo (fan powered ON)	FPbA (fan powered Auto)
Min. Setpoint	**20°C (68°F)**	**20°C (68°F)**	**20°C (68°F)**	**20°C (68°F)**	15°C (59°F)	15°C (59°F)	15°C (59°F)
Max. Setpoint	**28°C (82°F)**	**28°C (82°F)**	**28°C (82°F)**	**28°C (82°F)**	30°C (86°F)	30°C (86°F)	30°C (86°F)
Changeover Setpnt	24°C (75°F)	**20°C (68°F)**	**20°C (68°F)**	**20°C (68°F)**	24°C (75°F)	24°C (75°F)	24°C (75°F)
TO1 Ramp	**HR1**	CR1	**HR1**	CR1	**OFF**	**HR1**	**HR1**
TO1 Signal Type	On/Off	On/Off	On/Off	On/Off	On/Off	On/Off	On/Off
TO1 Close Pos.	40%	40%	40%	40%	40%	**35%**	**35%**
TO1 Open Pos.	0%	0%	0%	0%	0%	0%	0%
TO2 Ramp	HR1	HR1	HR1	**CO_2**	**OFF**	HR1	HR1
TO2 Signal Type	**Pulse**	On/Off	**Pulse**	On/Off	On/Off	On/Off	On/Off
TO2 Close Pos.	40%	40%	40%	40%	40%	**70%**	**70%**
TO2 Open Pos.	0%	0%	0%	0%	0%	**35%**	**35%**
TO3 Ramp	**HR2**	**CR2**	**HR2**	**HR1**	**OFF**	**Fan ON**	**Fan Auto**
TO3 Signal Type	On/Off	On/Off	On/Off	On/Off	On/Off	On/Off	On/Off
TO3 Close Pos.	40%	40%	40%	40%	40%	40%	40%
TO3 Open Pos.	0%	0%	0%	0%	0%	0%	0%
TO4 Ramp	**HR2**	**HR2**	**HR2**	**HR1**	**OFF**	**HR1**	**HR1**
TO4 Signal Type	**Pulse**	On/Off	**Pulse**	On/Off	On/Off	On/Off	On/Off
TO4 Close Pos.	40%	40%	40%	40%	40%	40%	40%
TO4 Open Pos.	0%	0%	0%	0%	0%	0%	0%
Motor Ramp	CR1	**COr**	**COr**	**COr**	CR1	CR1	**COr**
AO1 ramp	**HR1**	CR1	**HR1**	CR1	**HR1**	**HR1**	**HR1**
AO2 Ramp	**HR2**	HR1	**HR2**	HR1	**OFF**	**HR2**	**Fan Auto**
AI1 Input	OFF	**SENS**	**SENS**	**SENS**	OFF	OFF	**SENS**
AI2 Input	OFF	OFF	OFF	**CO_2**	OFF	OFF	OFF
DI1 Input	**nSb.o**	**nSb.o**	**nSb.o**	Occ.o	Occ.o	**nSb.o**	**nSb.o**
Heat Prop Band 2	2°C (4°F)	2°C (4°F)	2°C (4°F)	2°C (4°F)	2°C (4°F)	**1°C (2°F)**	**1°C (2°F)**
Heat Deadband 2	**1.3°C (2.6°F)**	**1.3°C (2.6°F)**	**1.3°C (2.6°F)**	**1.3°C (2.6°F)**	0.3°C (0.6°F)	**1.3°C (2.6°F)**	**1.3°C (2.6°F)**
Cool Deadband 2	**1.3°C (2.6°F)**	**1.3°C (2.6°F)**	**1.3°C (2.6°F)**	**1.3°C (2.6°F)**	0.3°C (0.6°F)	0.3°C (0.6°F)	0.3°C (0.6°F)

Legend

Grey Text = Standard default value
Bold Text = Special default value for selected application

HR = Heating ramp
CR = Cooling ramp
COr = Changeover ramp
SENS = Changeover temperature sensor
Fan ON = Fan powered box in continuous mode
Fan Auto = Fan powered box in automatic mode (follows demand)
nSb.o = Night Setback (normally open)
Occ.o = Occupancy mode (normally open)

TO = TRIAC output
AO = Analog output
AI = Analog input
DI = Digital input

Notes

	Recycling at end of life: please return this product to your local distributor for recycling.

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