Recommended Wiring Practices
&
Solutions for Common Installation Questions

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Supersedes Date: new

Understanding the iWorX controller Setpoints

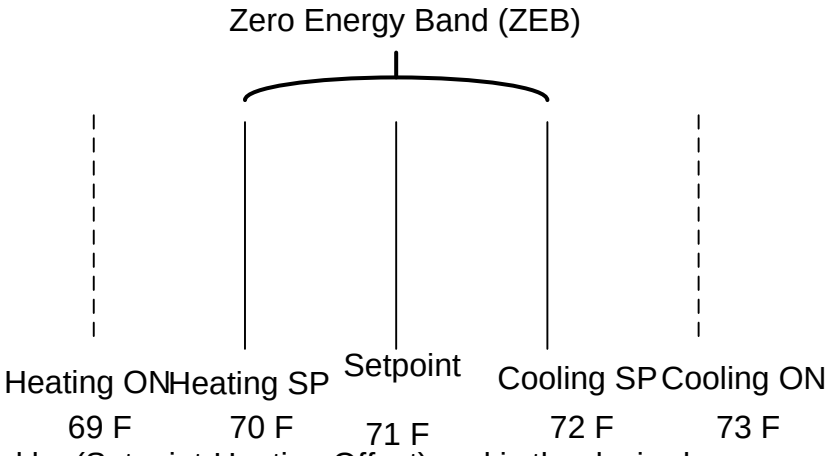
Controller Setpoints as configured in the LCI2 or LCI3

Setpoint	71.0	°F
Cooling Offset	1.0	°F
Heating Offset	1.0	°F
SP Adjust Limit	10.0	°F
Unocc Cooling	82.0	°F
Unocc Heating	60.0	°F

Controller Staging as configured in the LCI2 or LCI3

Stages	2	
Control Band	1.0	°F
Stage Time	5	Min

Zero Energy Band – no heating or cooling will take place because this is the temperature range that is defined as the comfort range in the space.



Heating SP – is calculated by (Setpoint-Heating Offset) and is the desired temperature when in the heating mode. This is the temperature that heating is disabled.

Heating ON – is calculated by (Heating SP-Stage Control Band) and is the temperature when heating is enabled.

Additional staging – additional stages are enabled when a stage has been on for the Stage Time and the temperature is still below the Heating ON calculation. If the temperature is between Heating SP and Heating ON, no additional stages will be enabled and no stages will be disabled.

Heating OFF – when the space temperature is above the Heating SP, stages will be disabled one at a time after the Stage Time has elapsed.

Cooling SP – is calculated by (Setpoint+Cooling Offset) and is the desired temperature when in the cooling mode. This is the temperature that cooling is disabled.

Cooling ON – is calculated by (Cooling SP+Stage Control Band) and is the temperature when cooling is enabled.

Additional staging – additional stages are enabled when a stage has been on for the Stage Time and the temperature is still above the Cooling ON calculation. If the temperature is between Cooling SP and Cooling ON, no additional stages will be enabled and no stages will be disabled.

Cooling OFF – when the space temperature is below the Cooling SP, stages will be disabled one at a time after the Stage Time has elapsed.

Understanding the TS300 series buttons

When changing the SP on the TS303 or TS304 this button must be depressed first. After it is depressed the effective SP will be displayed then the + - button can be used to adjust the SP. Once the desired SP is viewed on the display do no other steps and the SP will be sent to the controller. Remember the SP can only be changed during the occupied time period. If an empty house symbol is displayed the controller is unoccupied.

The heat cool button allows the user to select the operating mode of the controller. When depressed a heat symbol, cool symbol, circle and auto appear. To select the mode simply navigate by depressing the + - button until the mode is selected (flashes) no other steps need to be taken for the mode to be sent to the controller. Heat symbol indicates the controller will only provide heat, Cool symbol indicates the controller will only provide cooling, Auto indicates the controller will switch between heating and cooling as required and the circle indicates the controller is Off and doesn't participate in heating or cooling. Auto is the default mode.

The fan button allows the user to select the fan mode of operation. Once depressed the word 'Auto' and the symbol 'I' will appear, the current mode will be flashing. To changes between modes use the + - button until the mode is selected (flashes) no other steps need to be take for the mode to be sent to the controller. 'Auto' indicates the controller will enable the fan when there is a call for heating or cooling. 'I' indicates the fan will be enabled and will be on 24/7, overriding the current 'Fan Type' setting in the controller settings..

In addition to being used in conjunction with other buttons on the TS304 it can be used to display the humidity. Simply depress the + until a 2 is displayed then wait for the command to be sent to the controller. Once sent the display will change to show the humidity reading for approximately 5 seconds then it will revert back to display the temperature reading.

The override button takes the controller out of the unoccupied mode into the occupied mode for a predetermined amount of time (see occupancy extension in the controller settings). Once in override the LED below this button will illuminate. To cancel an override hold the button down until the LED is no longer illuminated.

The override LED will illuminate when the override button is depressed and will stay illuminated for the duration. When there are 5 minutes of override remaining the LED will flash.

Calibrating the TS300 temperature reading

When the space temperature is not reading correctly the temperature can be offset/ calibrated to display the correct reading. Follow the instructions below for calibration.

Depress both ends of the + - button at the same time and hold until the display toggles between Add/### and Nod/###

Now release the button and depress the override button. A value will now be displayed which is the temperature offset.

Now use the + - buttons to adjust to the proper offset/calibration. Once the desired value is entered simply do nothing and the stat will eventually go back to displaying the temperature and it will now be calibrated to the desired reading.

+ - button

Override button

Application Note: Do's and Don'ts for iWorX control wiring

Overview: This note is meant to aid in the proper wiring of iWorX controllers.

By following these simple rules it will help to ensure that the controller and sensors are wired properly and therefore work effectively

Do's

- **Do** read all installation documentation for the controller(s) prior to installing the controller(s)
- **Do** follow all National and Local electrical codes
- **Do** mount the controller(s) in an area free from electrical interference
- **Do** power the controller with 20-28 VAC, class 2
- **Do** properly size the transformer that is powering the controller(s)
- **Do** terminate #38 (COM) of the controller(s) to earth ground; this ensures proper grounding for the controllers inputs
- **Do** terminate #40 (GND) of the controller to earth ground; this connects the controller ground plane to earth ground
- **Do** use stranded 14-22 AWG twisted shielded pair wire for all analog inputs; 18 AWG recommended, part # WIR-018
- **Do** ground the shield at the controller end only and at the sensor end cut and tape it to the wire jacket
- **Do** use Echelon approved cable on the communication network; Level 4, 22 AWG twisted pair recommended, part # WIR-022

Do not

- **Do not** install the controller(s) near large contactors, electrical machinery or welding equipment
- **Do not** install the controller(s) where the ambient temperature exceeds 140.0 °F or falls below 32.0 °F and where the relative humidity exceeds 90%, non condensing
- **Do not** install in locations that have corrosive fumes, excessive moisture, vibration or explosive vapors
- **Do not** undersize the transformer powering the controller(s)
- **Do not** connect (ground) the shield wire at both ends; it creates an antenna
- **Do not** use thermostat wiring for the analog temperature inputs
- **Do not** use solid conductor wire for the analog temperature inputs
- **Do not** install the peripheral devices more than 500 feet from the controller
- **Do not** install the thermostat more than 200 feet from the controller
- **Do not** exceed 1640 feet of total network wiring without the use of a repeater
- **Do not** exceed 1312 feet of network wiring between any two nodes on the network
- **Do not** use shielded wire or solid conductor wires for the communication network

Sizing transformers and triac output options

General Rules of Thumb

When sizing a transformer for iWorX controllers always size it 15% above the calculated VA. Example, if calculated for 40VA a 50VA transformer should be selected.

40VA x 15% = 46VA rounded up to 50VA

Transformers should be fused or have a circuit breaker.

LCI2/LCI3

The LCI2/LCI3 requires 15VA
Transformer Size = 15VA x 15% = 2.25 VA
Calculated transformer size = 15 VA + 2.25VA round up to 20VA

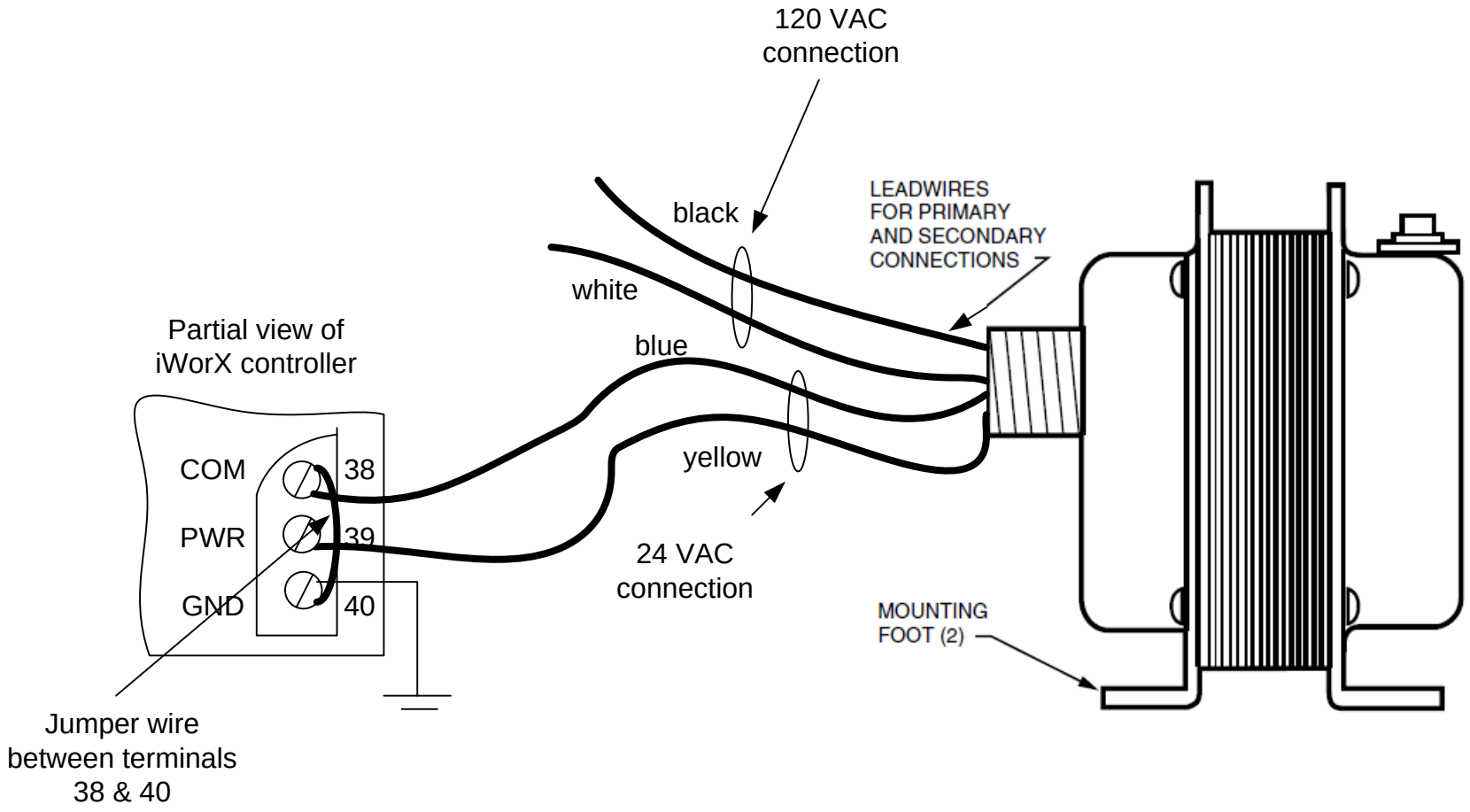
iWorX Controller (UCP)

On the iWorX controller, the difference between watts and VA is negligible. So using 7..2 (or round up to 8) as the VA is fine but that does not include any loads. The installer has to determine the VA on the external loads (triacs and analog outs). UL limits a class 2 device (iWorX controller) to 100VA maximum.

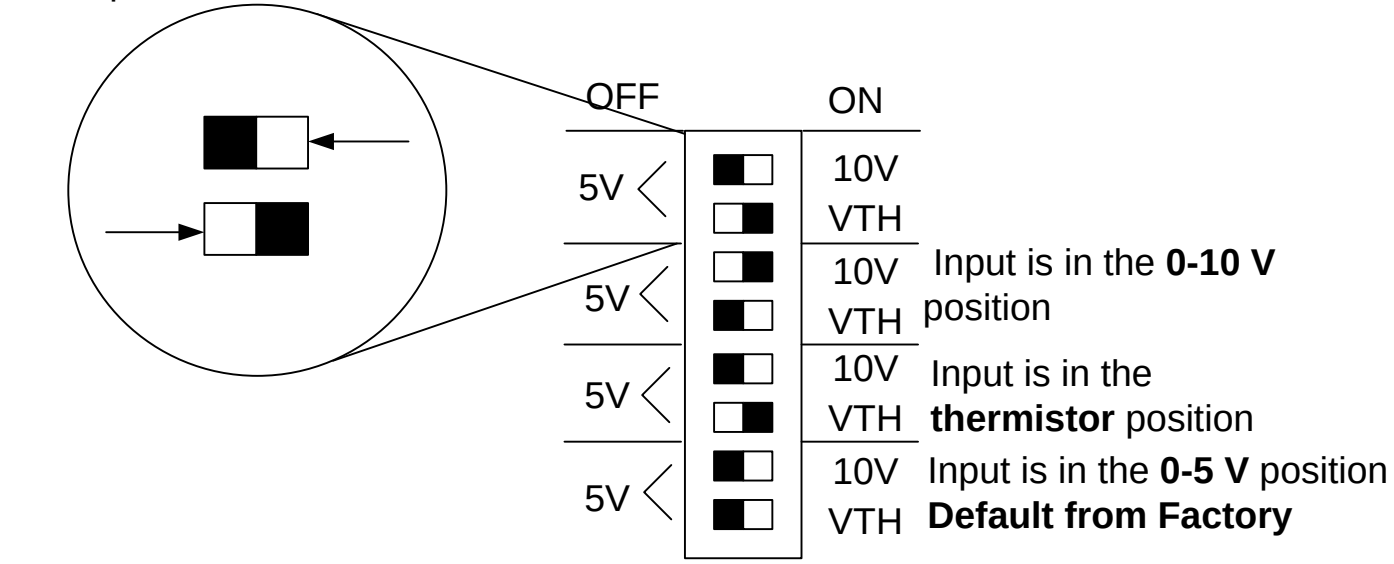
Example: if the controller is configured for Power Sourcing and using 6 triac outputs, each load drawing .5A the following equations would be used.

UCP=8VA
Triacs = (6 x .5A) 24vac = 72 VA
Calculated Total VA = 80VA
Transformer size = 80VA x 15% =12VA
Calculated Transformer size = 80VA + 12VA = 92VA rounded up to 100VA

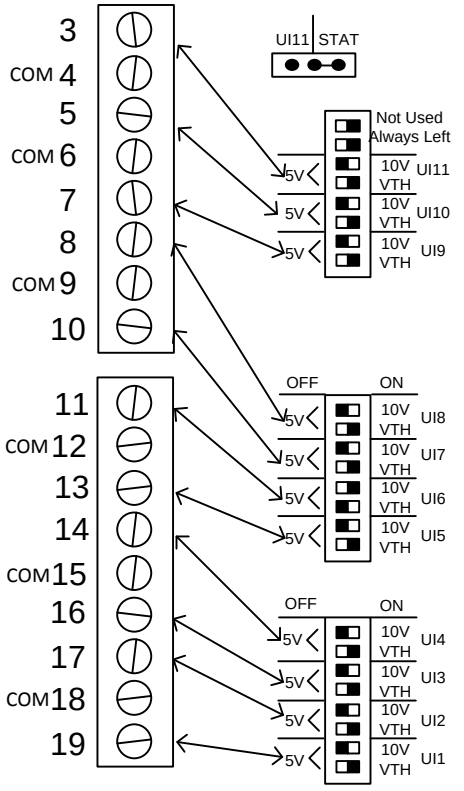
Proper transformer and controller wiring & grounding



Input Dip Switch Position Descriptions



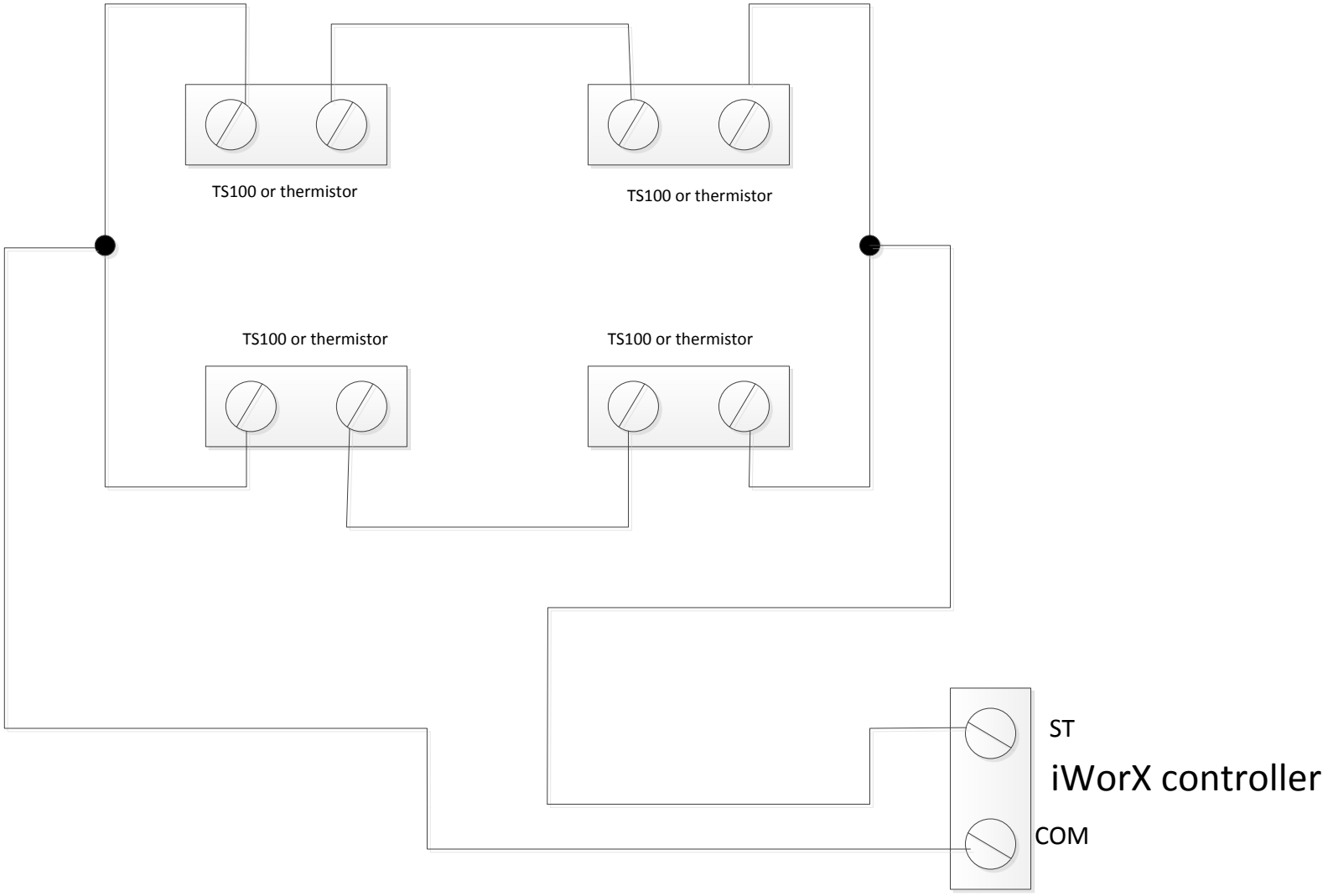
Input to switch correlation



Notes:

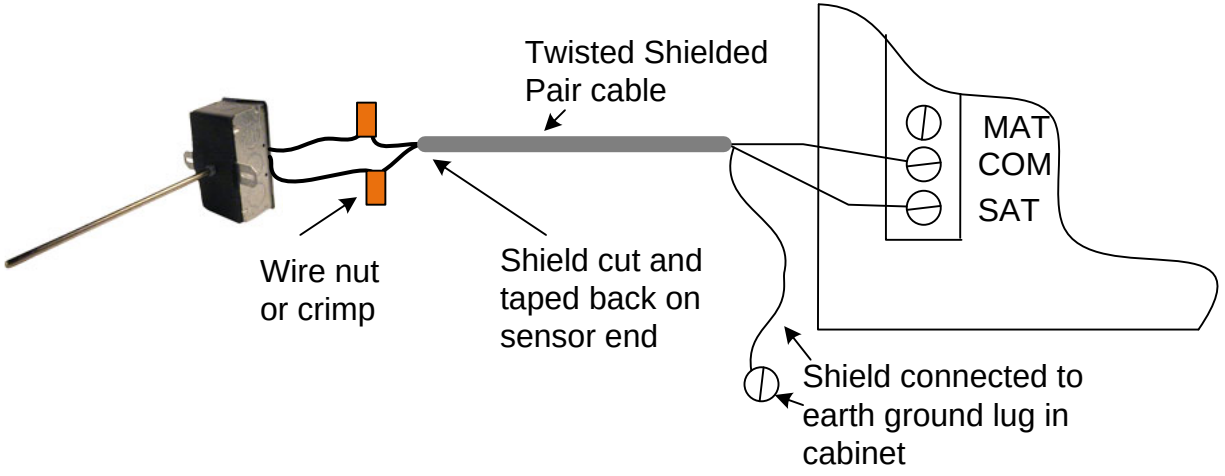
1. All switches on the three switch blocks are in the 0-5 V position when shipped from the factory.
2. Switches on all controllers should be set as shown on the drawings found in the installation and application manuals.
3. Unused inputs also need to have the switches configured per the drawings.

Series Parallel wiring of thermistors for temperature averaging



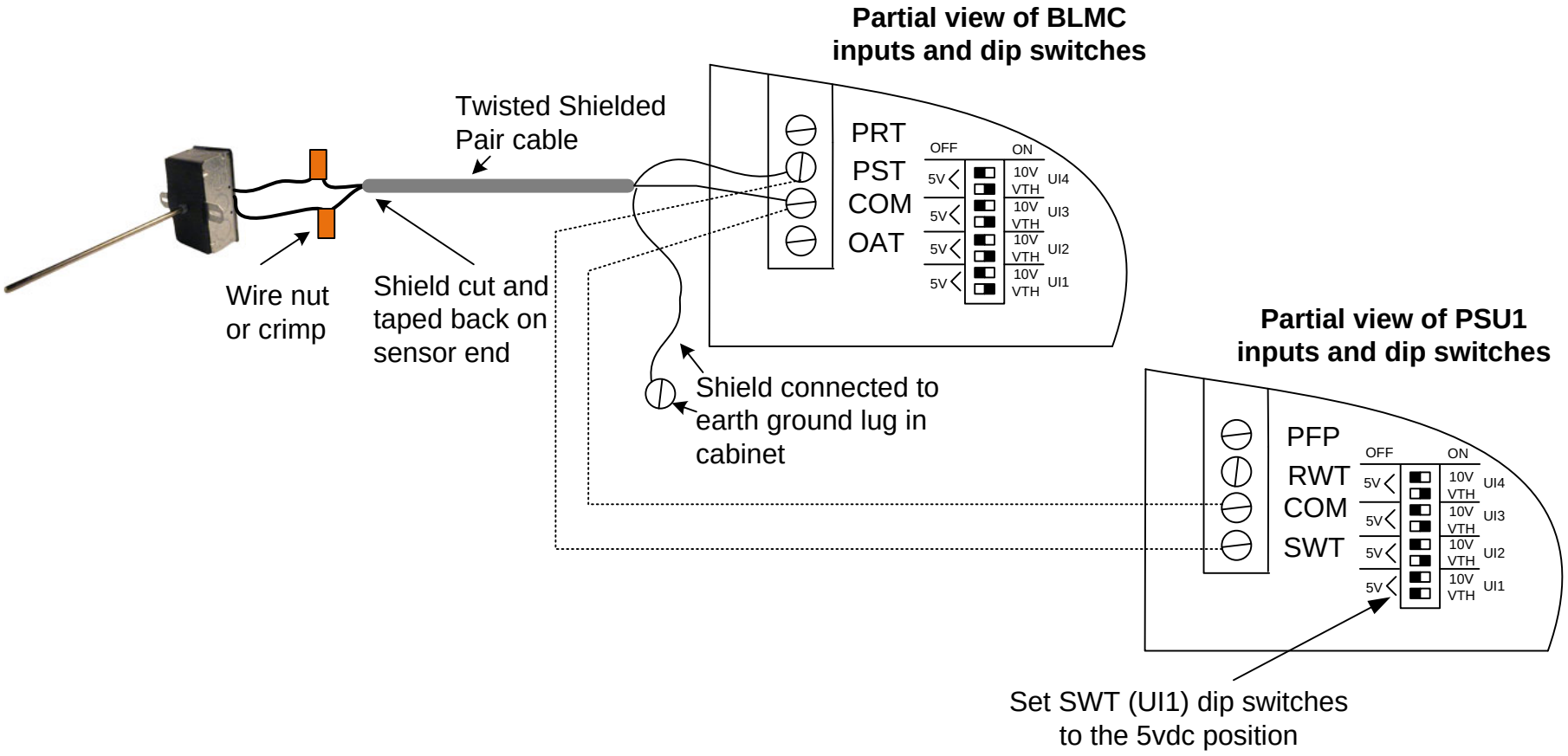
Proper wiring and shield termination of a thermistor

Example of duct probe connected to a Supply Air Temperature input



Note:
For information on each sensor or sensor wiring please refer to the data sheet provided with each.

Sharing a temperature sensor between iWorX controllers



Note:
For additional information on the controllers or temperature sensor please consult the appropriate installation and or application manual.

Precon Type III thermistor temperature to resistance conversion chart

PreCon TYPE III **Model 3** 10,000 ohm at 77°F ±0.36°F from 32°F to 158°F	
TEMP°F	RESISTANCE
-35	203.6K
-30	173.6K
-25	148.3K
-20	127.1K
-15	109.2K
-10	94.07K
-5	81.23K
0	70.32K
5	61.02K
10	53.07K
15	46.27K
20	40.42K
25	35.39K
30	31.06K
35	27.31K
40	24.06K
45	21.24K
50	18.79K
55	16.65K
60	14.78K
65	13.15K
70	11.72K
75	10.46K
80	9354
85	8378
90	7516
95	6754
100	6078
105	5479
110	4947
115	4472
120	4049
125	3671
130	3333
135	3031
140	2759
145	2515
150	2296
155	2098
160	1920
165	1759
170	1614
175	1482
180	1362
185	1254
190	1156
195	1066
200	984.0
205	909.8
210	841.9
215	779.8
220	723.0
225	671.0
230	623.3
235	579.5
240	539.4

Typical ‘K’ factors for VAV Terminal boxes

Duct Diameter in inches	Inferred ‘K’ Titus box	Inferred ‘K’ Anemostat box
5	390	287
6	448	469
7	667	612
8	904	867
9	1167	1098
10	1436	1353
12	1891	1802
14	2015	2469
16	3839	3366

Calculating the ‘K’ factor for round duct with only a damper.

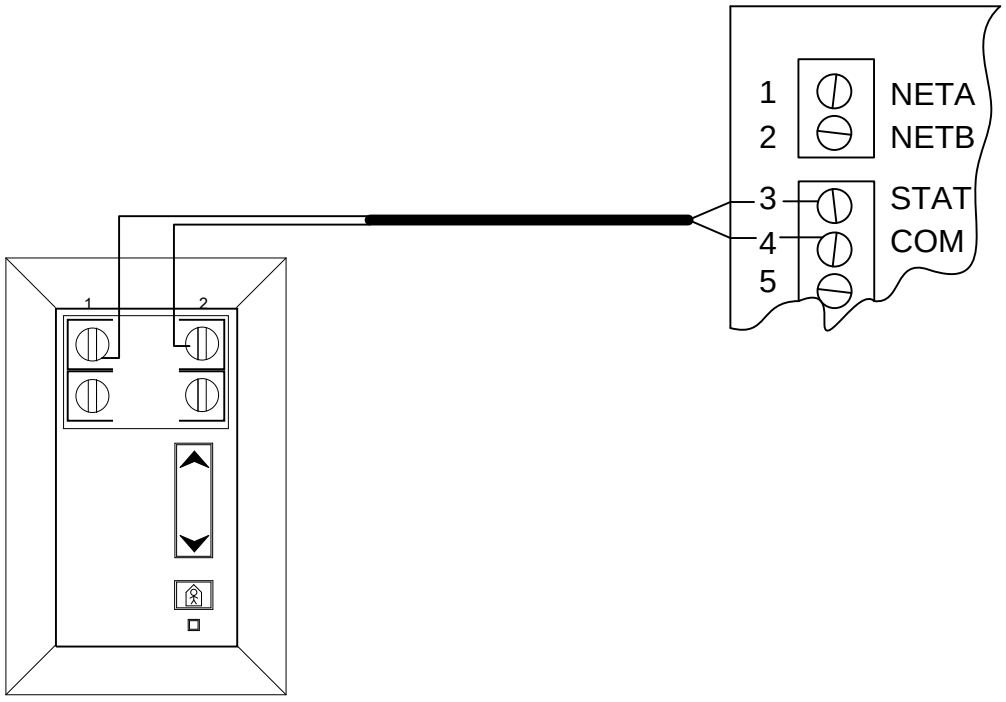
The ‘K’ factor covers a couple of things. First, it converts the Linear Feet per Minute (LFM) to Cubic Feet per Minute (CFM) This is straightforward in that a 6" box has the following conversion:

Duct Radius (in feet)^2 * 3.1416 (pi)
0.25^2 * 3.1461 = 0.19635

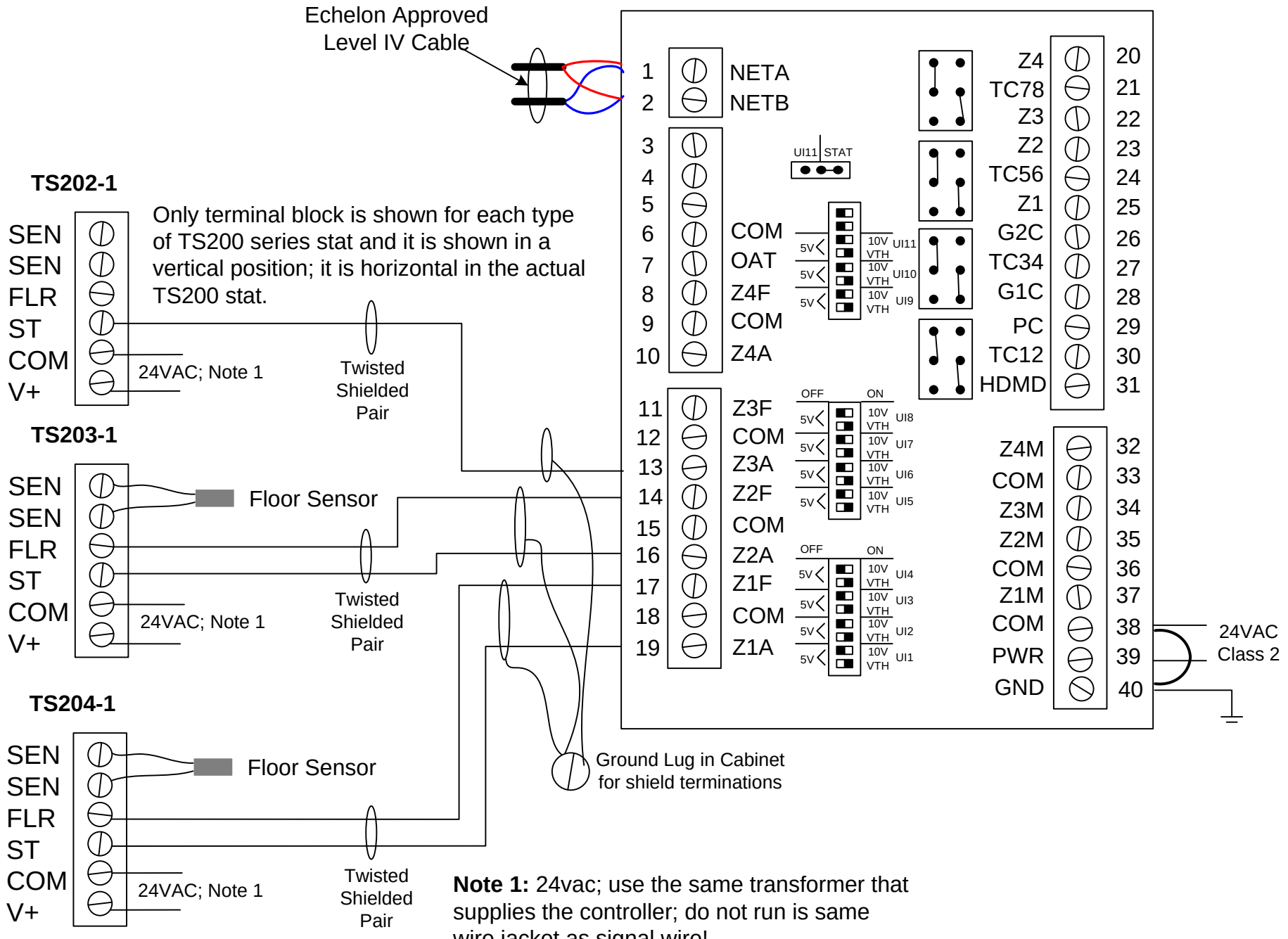
Linear airflow unencumbered by the laminar effects of duct sidewalls has the following relationship to pressure:

LFM = (dp)^0.5 * 4005
In other words, 1 “ of dp infers an LFM of 4005 feet per minute.
The aforementioned 6” box would then have a ‘K’ factor of 786.38

Proper Thermostat connection



TS200 series wall sensor terminations



Note 1: 24vac; use the same transformer that supplies the controller; do not run is same wire jacket as signal wire!

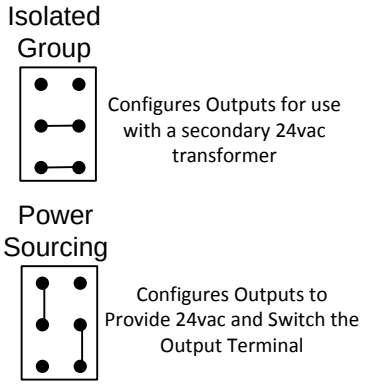
Triac Output Options

Understanding the triac output options
Each controller is capable of 2 different options as follows;

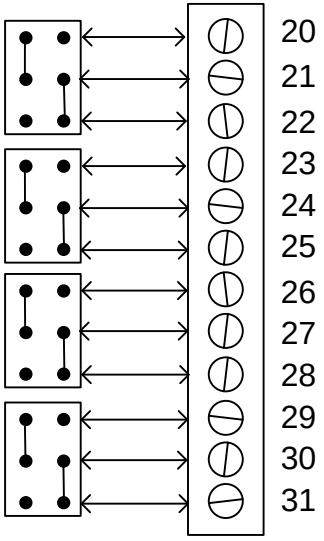
Power Isolated – Allows for a separate 24VAC source for the triacs to switch. 24VAC or neutral can be switched.

Power Sourced – Uses the same 24VAC that is powering the controller. The leg switched is 24VAC and the TCxx terminals are neutral.

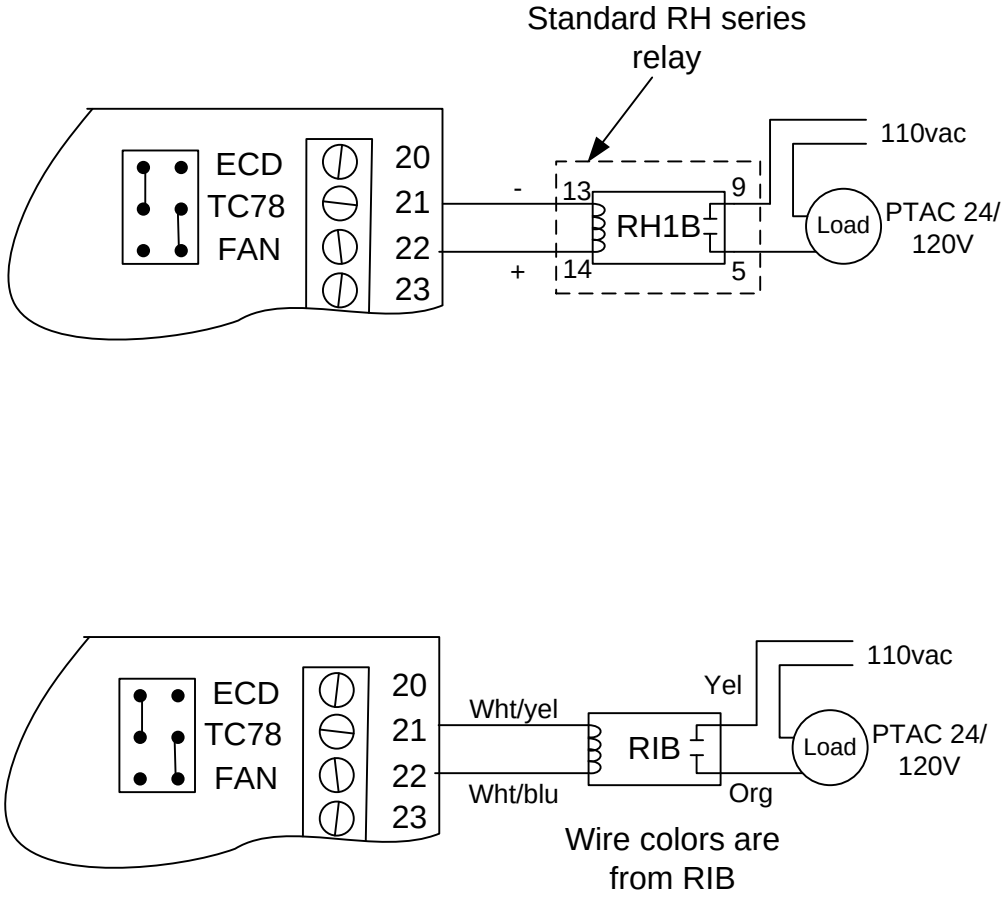
Output jumper configurations



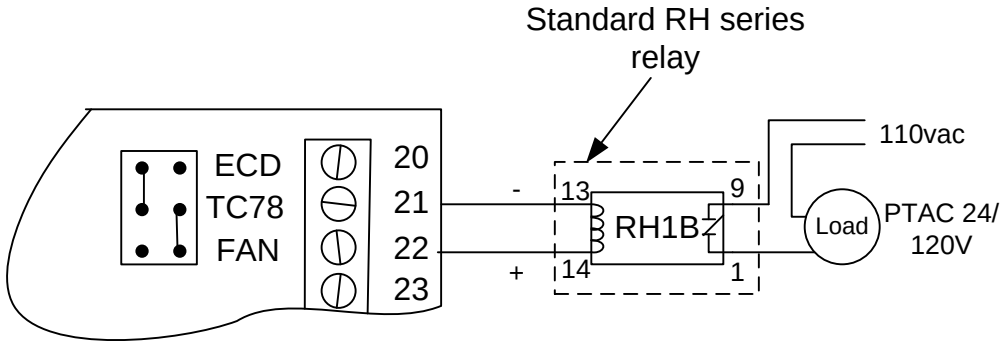
Output Jumpers to terminal correlations

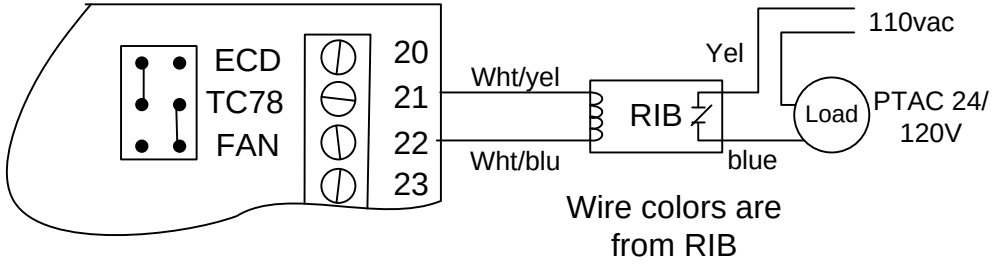


Wiring a NO relay or RIB to a Power Sourced output

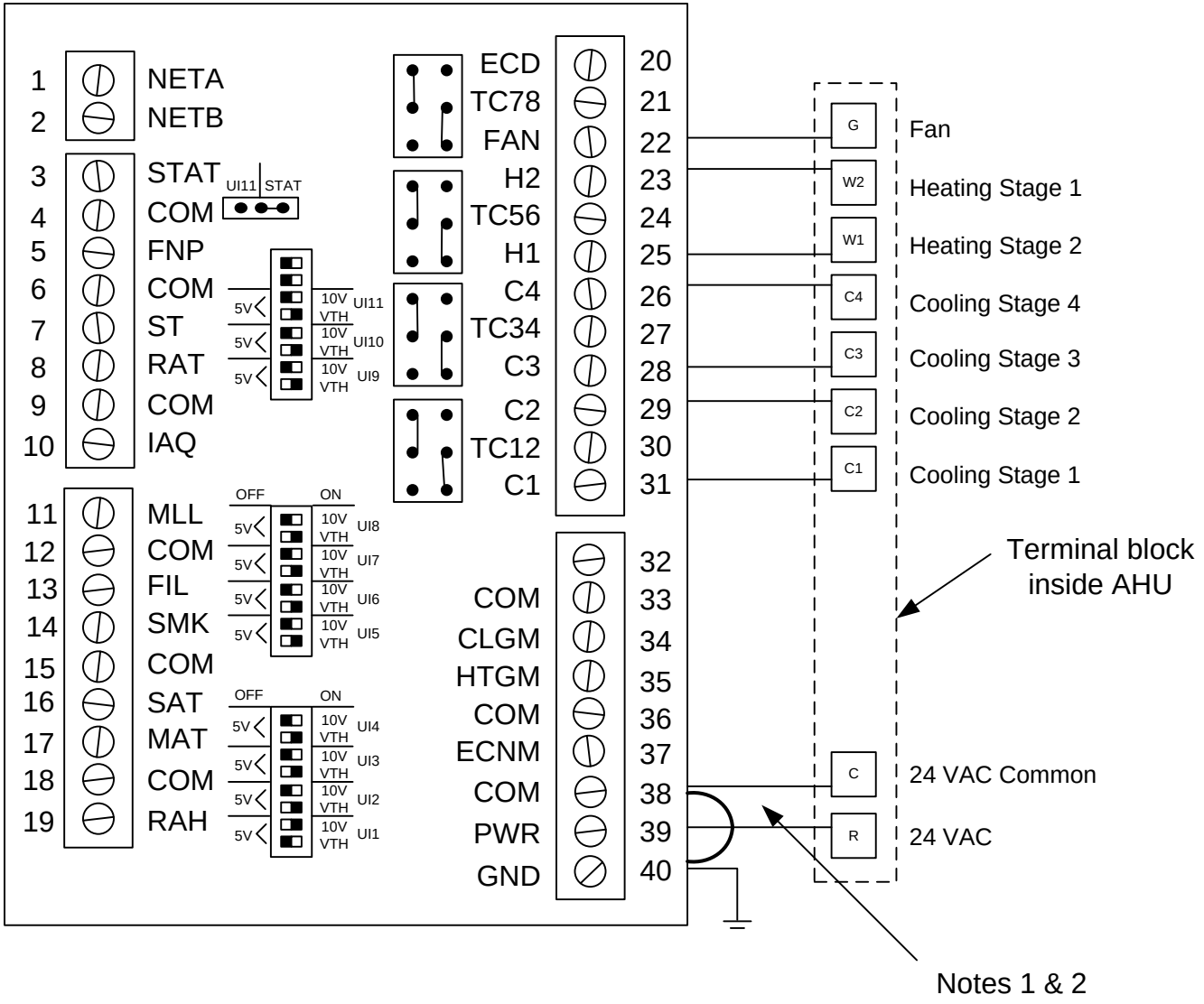


Wiring a NC relay or RIB to a Power Sourced output





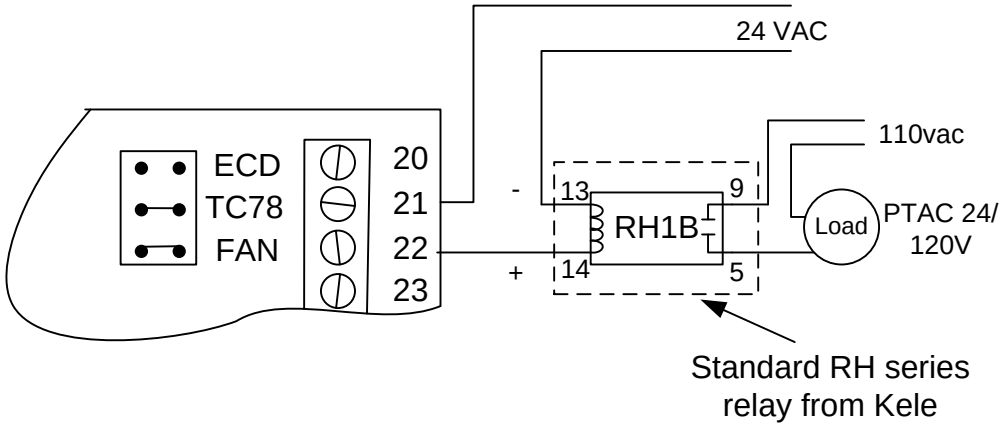
Wiring to the AHUs terminal block as power sourced

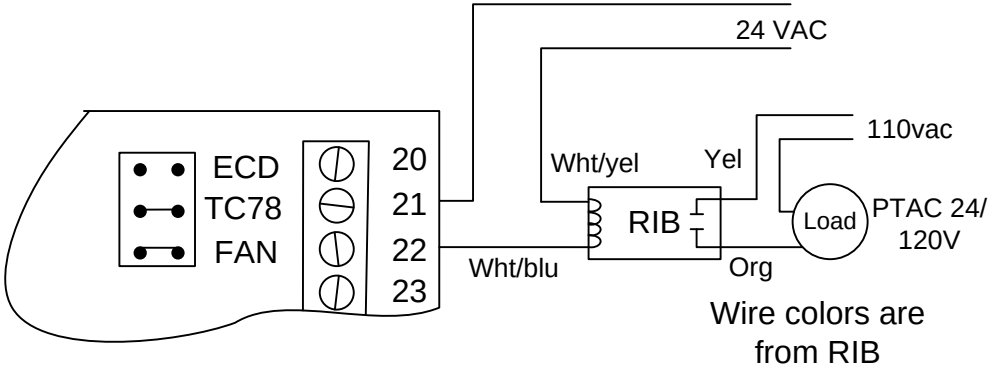


Note:

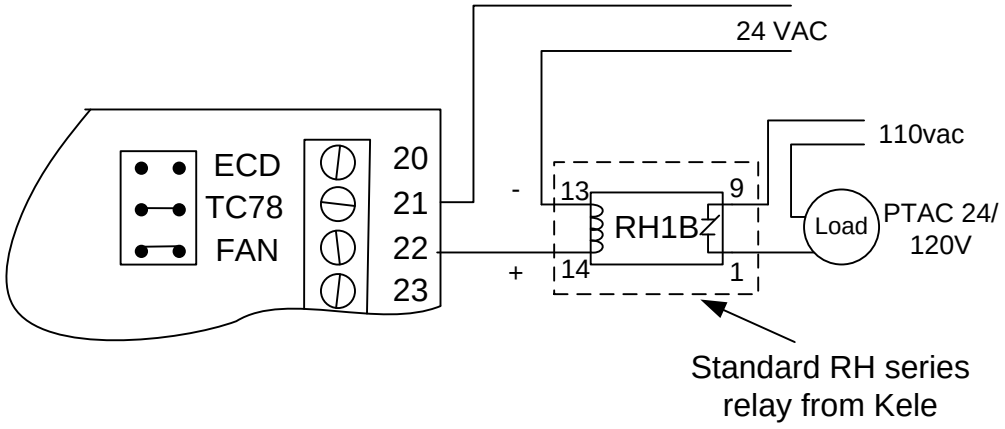
1. When the same 24vac source powering the controller is pre-wired in the AHU the Triac Common does not need to be connected as it is already connected inside the AHU
2. If transformer is not grounded internally it must be grounded as shown.

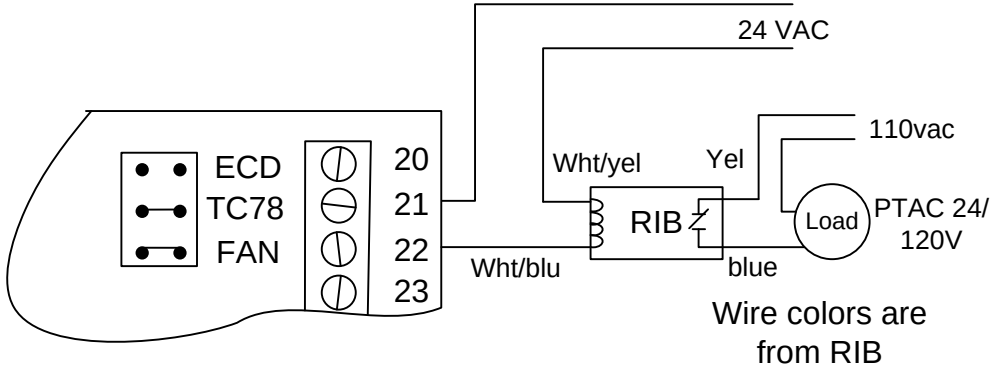
Wiring a NO relay or RIB to a Power Isolated output



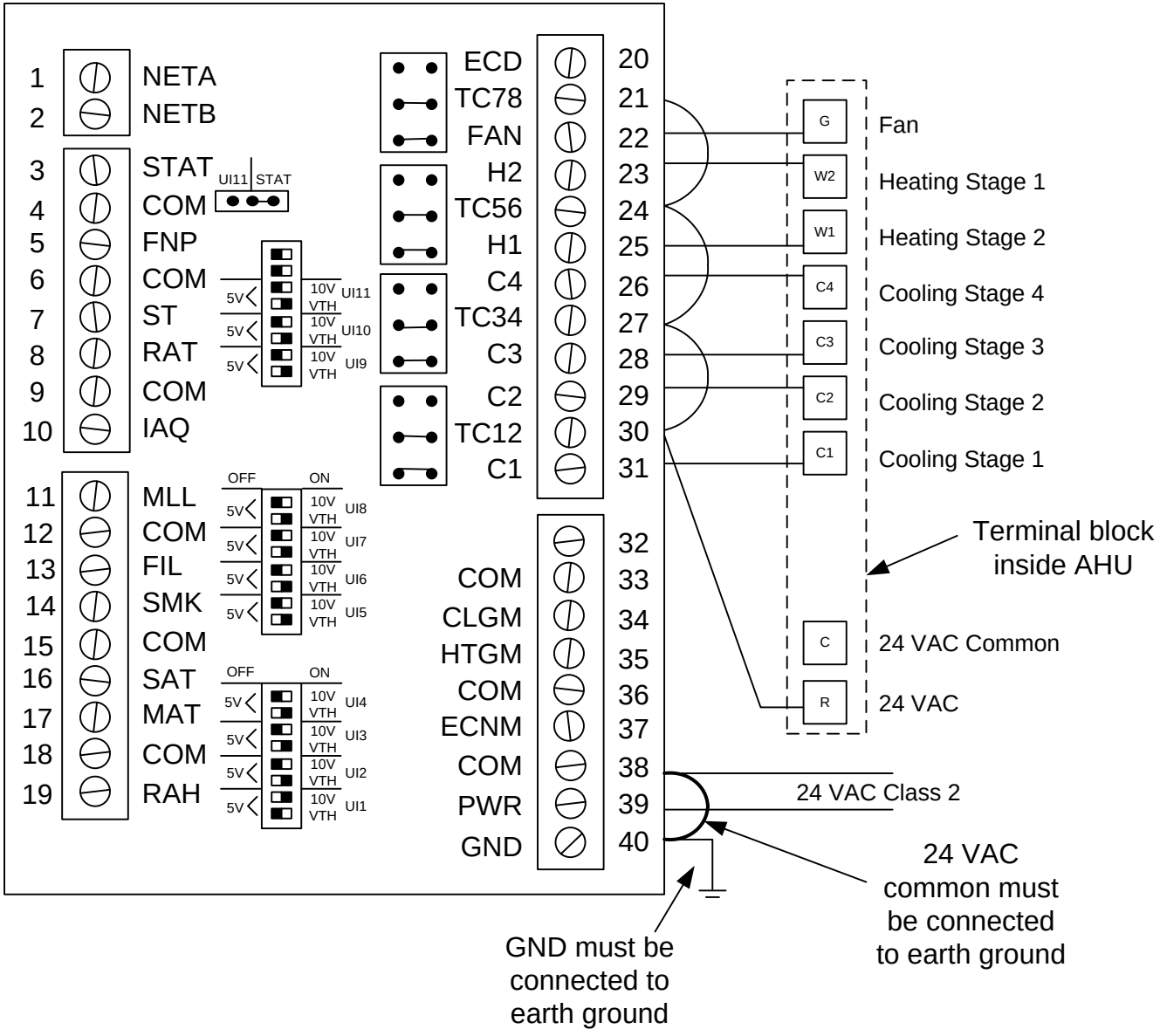


Wiring a NC relay or RIB to a Power Isolated output

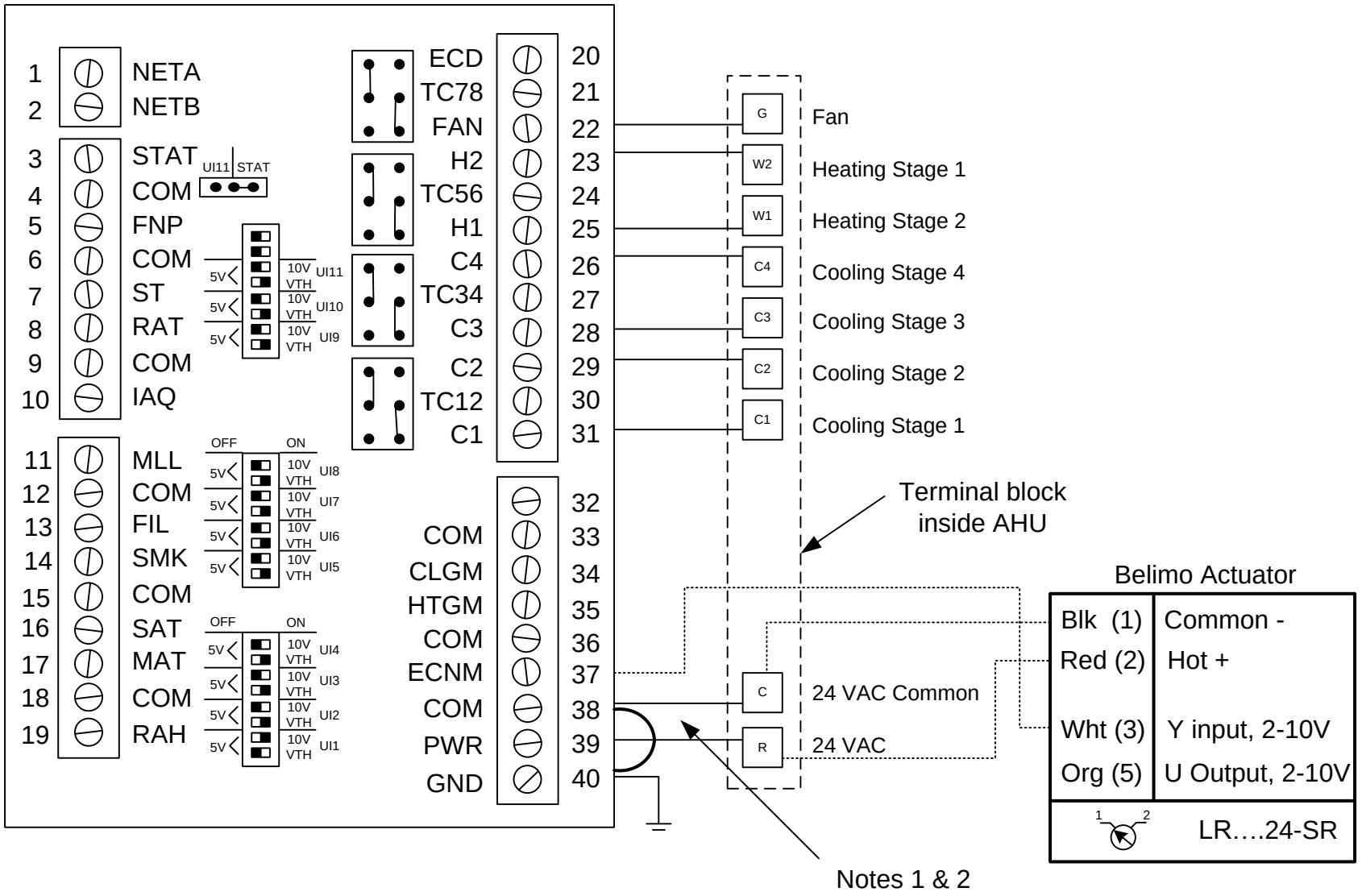




Wiring to the AHUs terminal block as power isolated



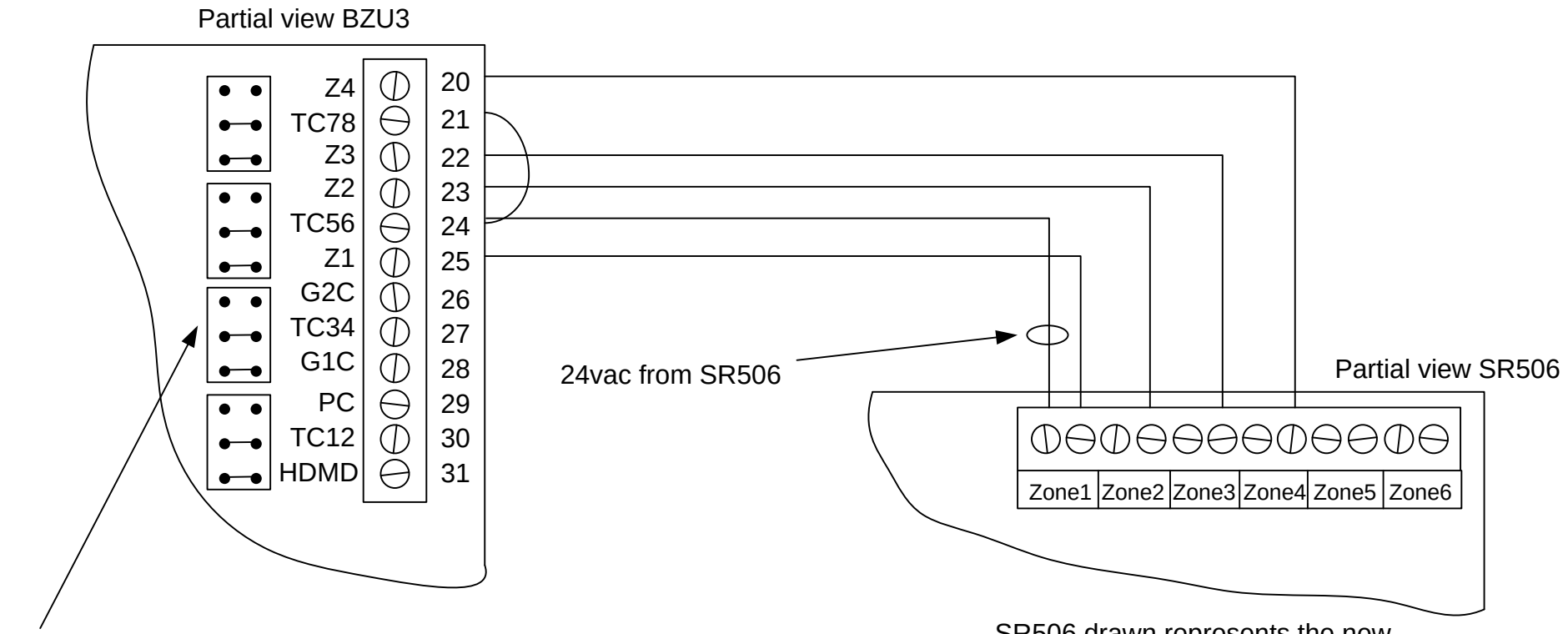
Wiring to the AHUs terminal block and economizer to Belimo Actuator



Note:

1. When the same 24vac source powering the controller is pre-wired in the AHU the Triac Common does not need to be connected as it is already connected inside the AHU
2. If transformer is not grounded internally it must be grounded as shown.

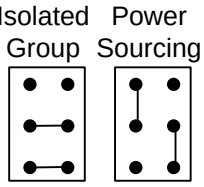
BZU3 outputs wired to a SR506



Notes:

1. For additional information on the BZU3 refer to the “BZU3 application manual”
2. For additional information on the SR506 refer to the “Taco Zone Controls Wiring Guide”

Output Jumper Positions



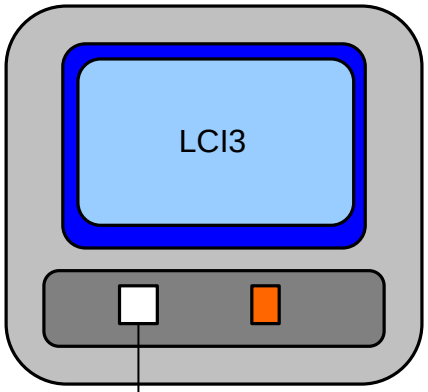
VFTS Installation Notes

Piping Configuration

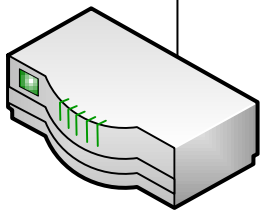
Proper piping configuration is critical for correct and accurate operation of the sensor. Please observe this section carefully and completely.

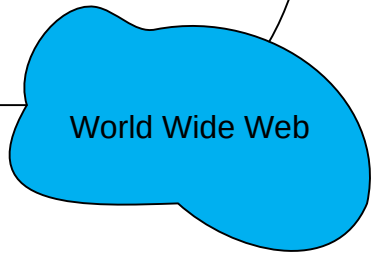
- The VFTS should be installed with the arrow on the housing pointing in the direction of flow.
- Before entering the VFTS, piping should be free of bends, pumps or obstructions for a length of at least 15 times the diameter of the pipe.
- After exiting the VFTS, piping should should be free of bends, pumps or obstructions for a length of at least 5 times the diameter of the pipe.
- The VFTS can be installed in any orientation, so long as the sensor remains completely immersed. The presence of air in the pipe or the sensor housing will result in inaccurate readings.
- DO NOT install NPT connections using pipe dope or thread sealant. Use 3 to 4 layers of Teflon tape to seal each joint.

Internet configuration with the LCI3; Example only



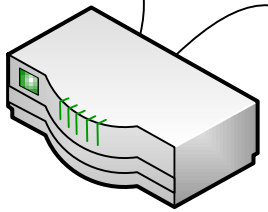
Under Utilities>Network Setup>Ethernet Settings
IP address 192.168.1.167
Subnet Mask 255.255.255.0
DHCP No
Under Utilities>LCI Setup>Login Parameters
HTTP port 11001
Service port 11000





IP address 192.168.1.1
Subnet Mask 255.255.255.0
External IP address 69.71.91.25
LCI address 192.168.1.167 forwarded to port 11000 & 11001

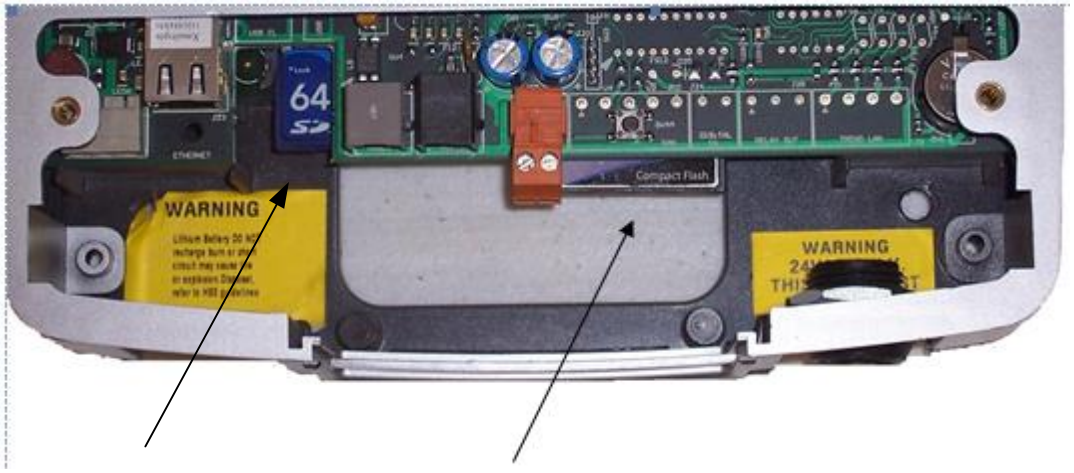
Remote PC on Internet



To connect to the LCI and view information type; **http://69.71.91.25:11001/lci3/firstpage** in your PCs browser address line.

The service port of 11000 can be used by Taco engineers to load new controller firmware (APB files) and controller profiles into the LCI from a remote location.

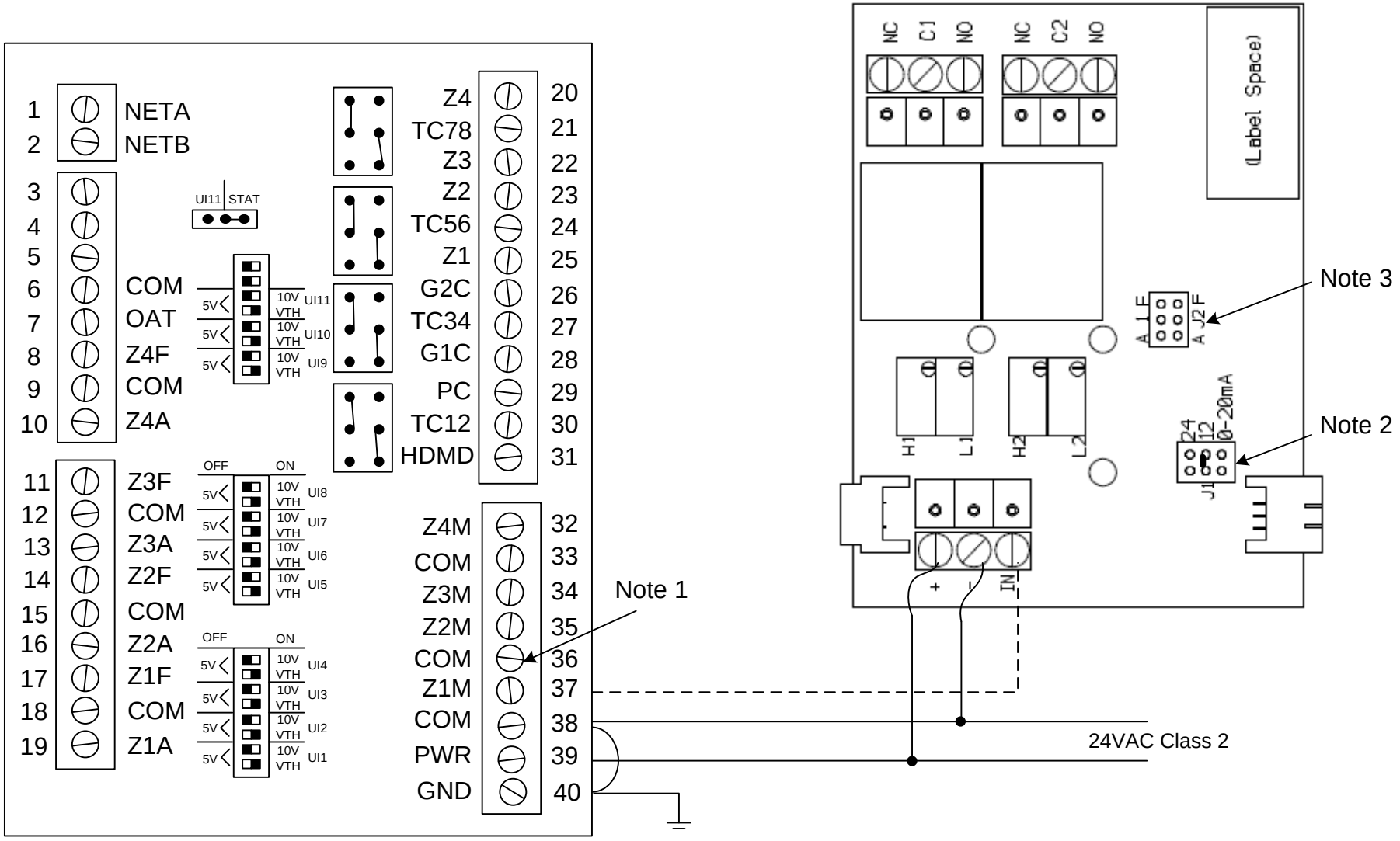
LCI2 & LCI3 SD card and Compact Flash card locations



SD Card slot

Compact Flash Card Slot

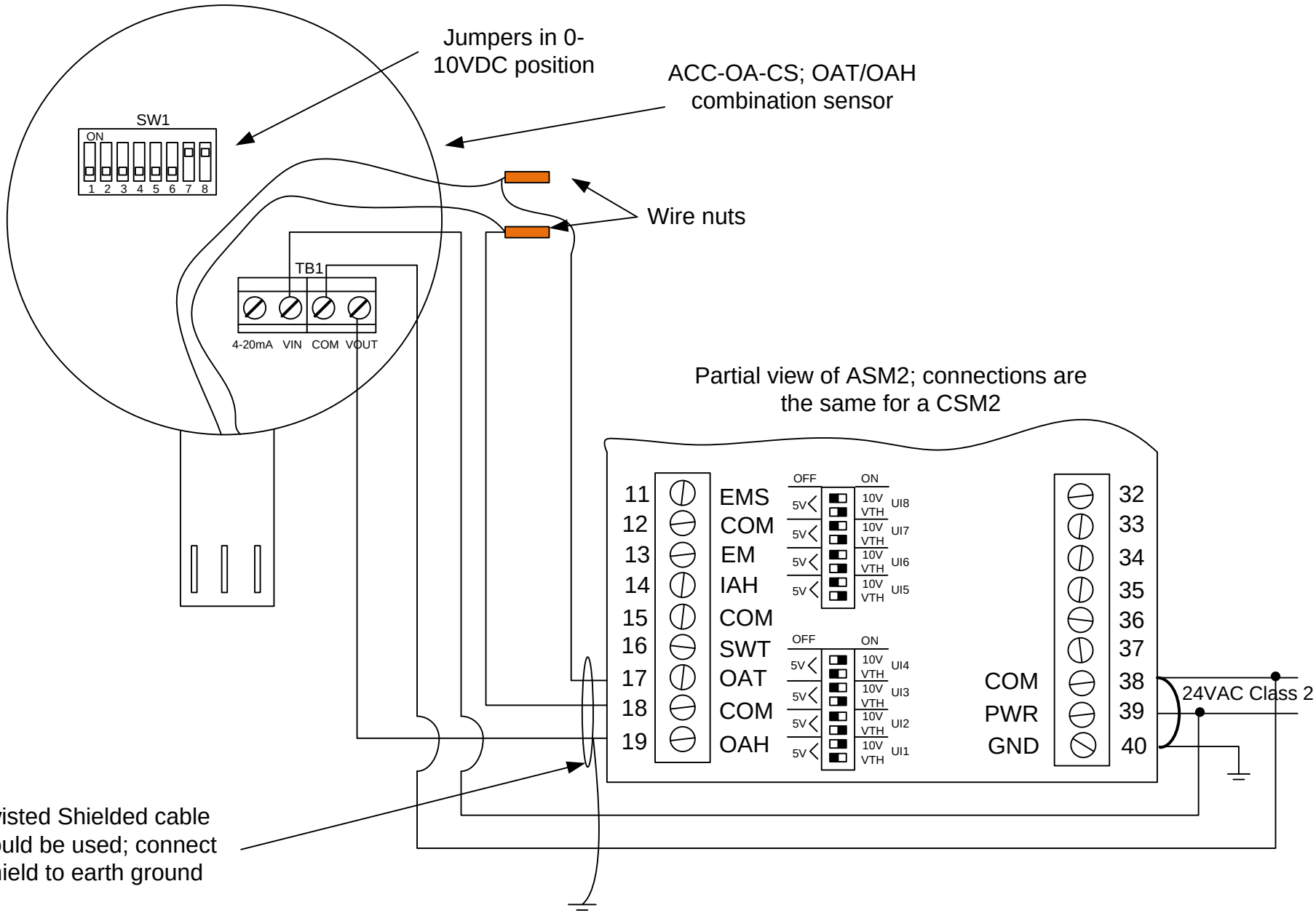
Wiring the ACC-RLY-ADR to an iWorX controllers 0-10VDC output



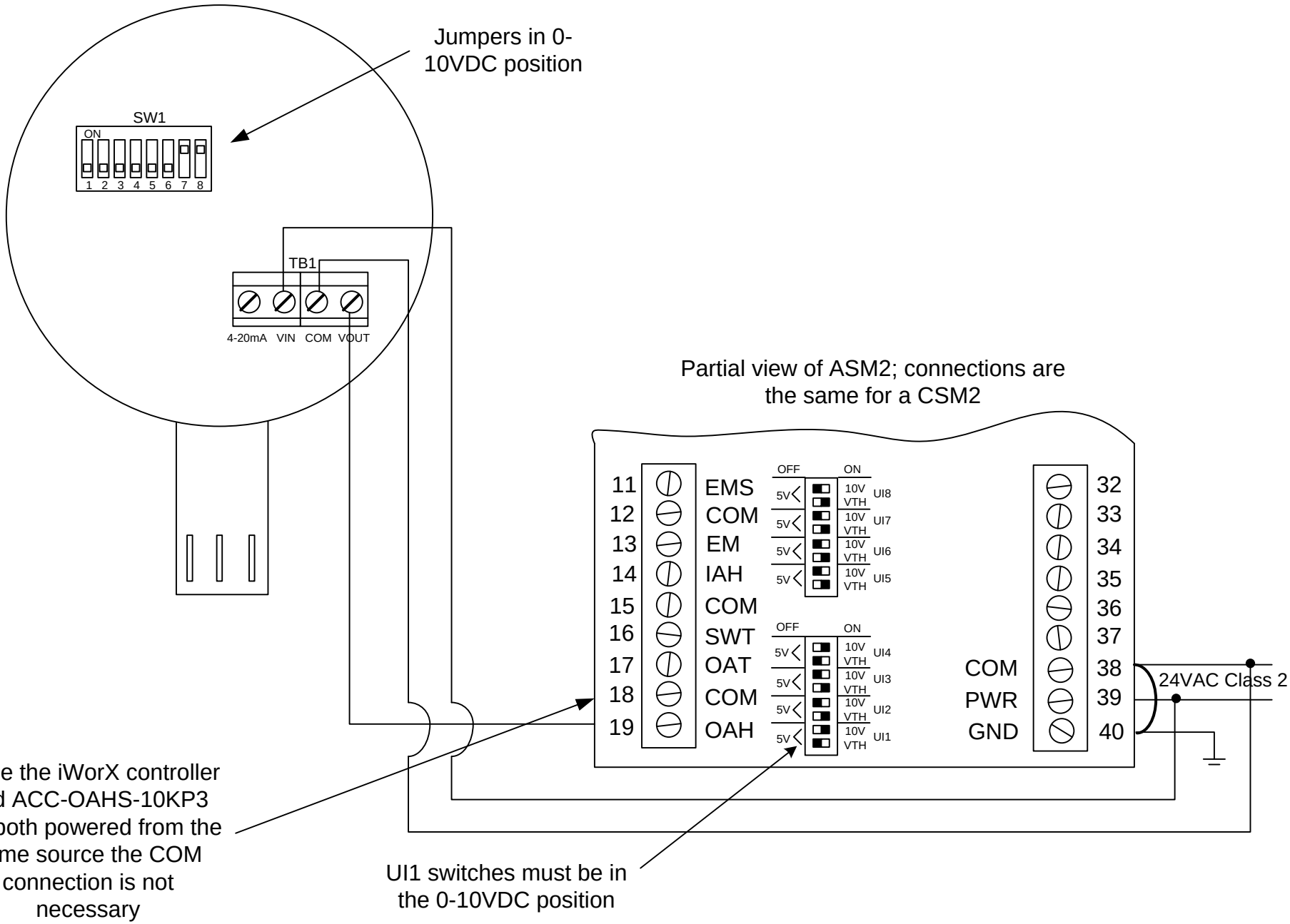
Notes:

1. Since the iWorX controller and ACC-RLY-ADR are both powered from the same source the COM connection is not necessary
2. Jumper needs to be in the voltage position
3. See installation document for additional information on setting and selecting fixed or adjustable deadbands for the digital outputs.

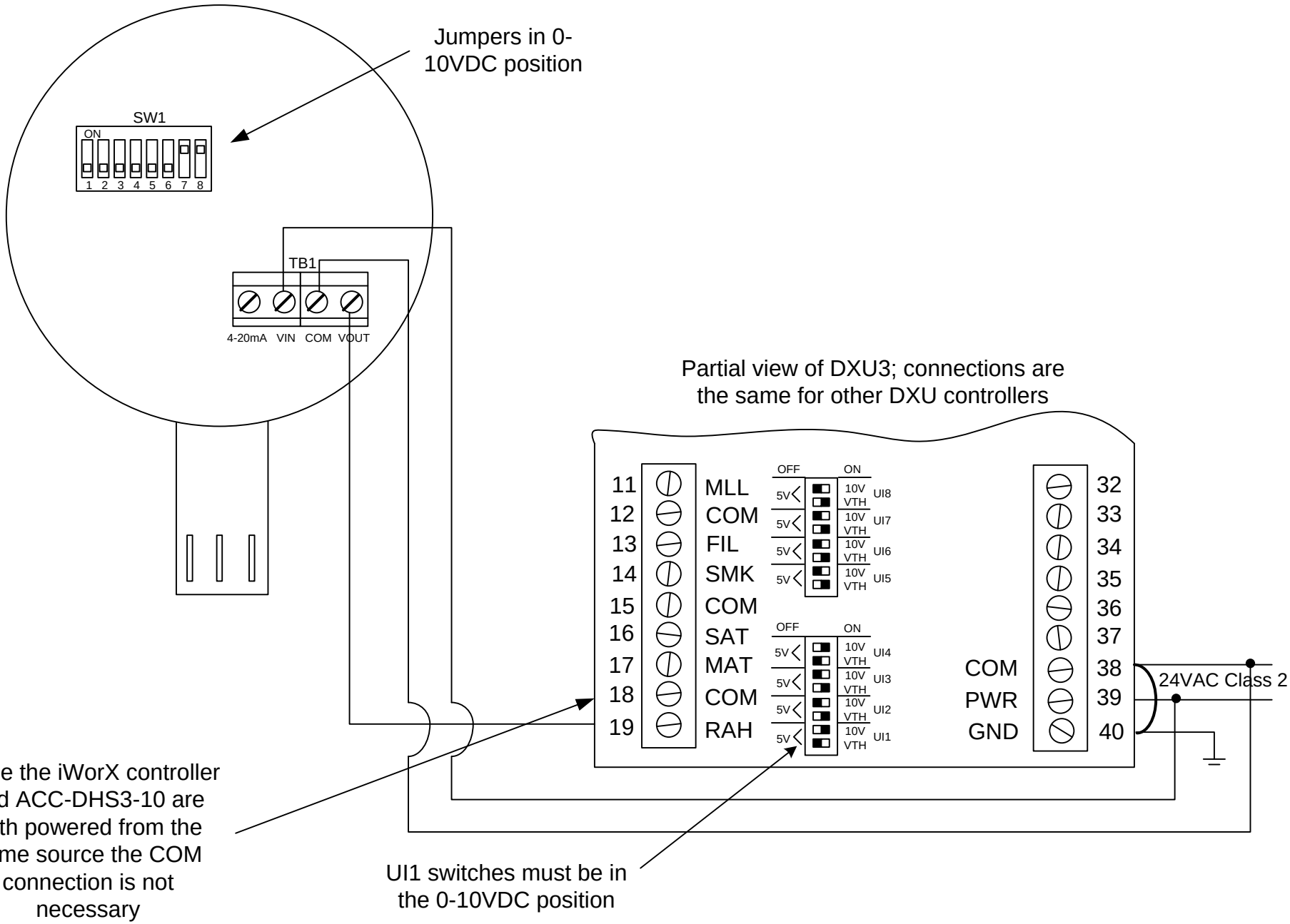
ACC-OA-CS outside air sensor connected to an ASM2



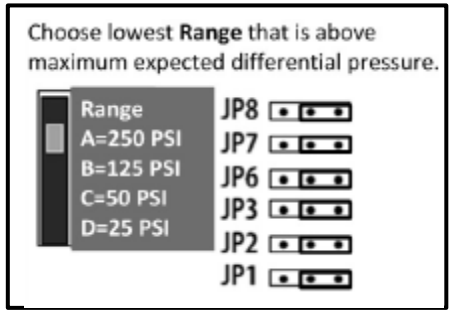
ACC-OAHS-10KP3 outside air humidity connected to an ASM2

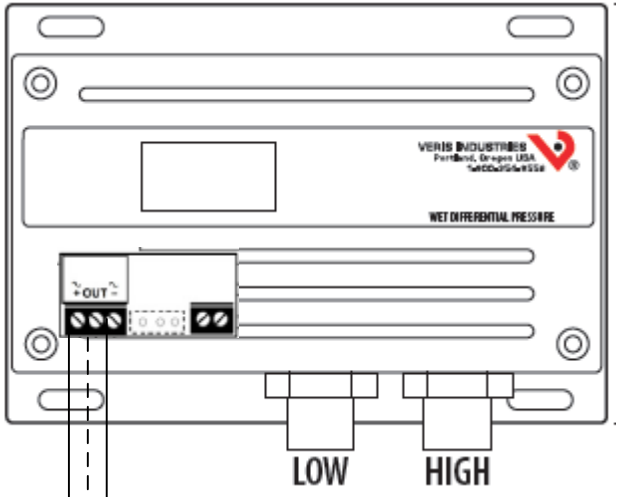


ACC-DHS3-10 Duct Air Humidity connected to an DXU3



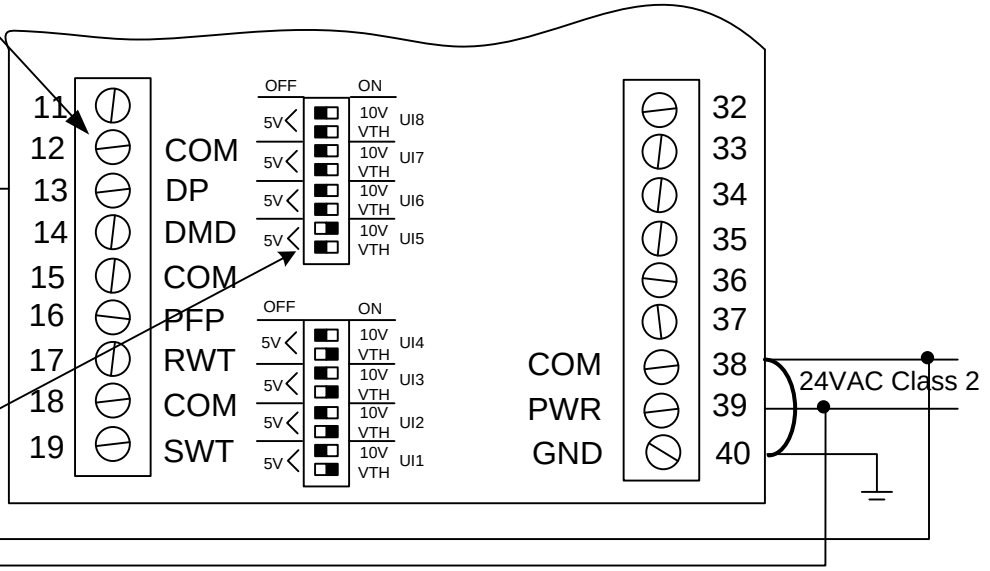
ACC-DPT-L-250 Differential Pressure Sensor connected to a PSU1





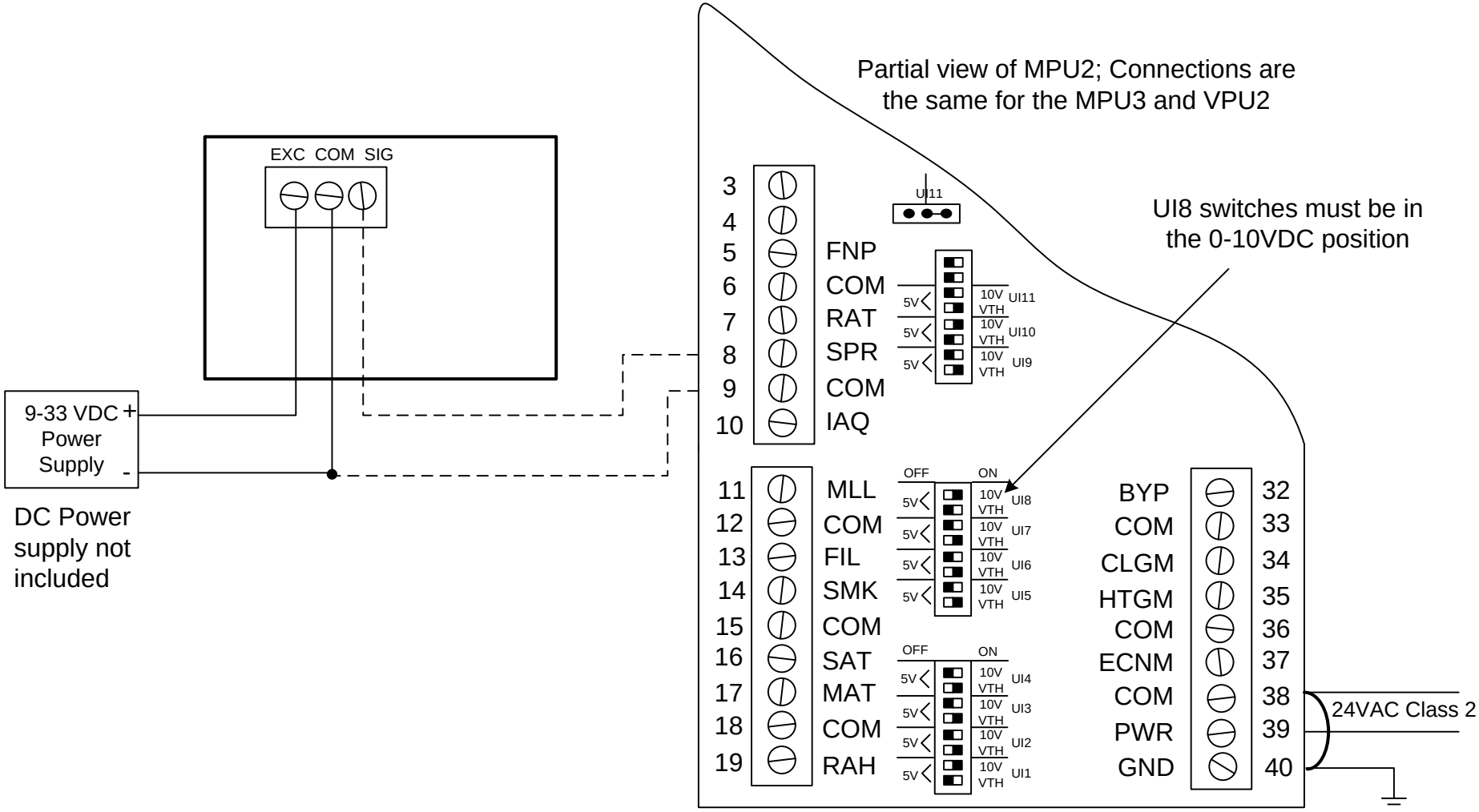
Since the iWorX controller and ACC-DPT-L-250 are both powered from the same source the COM connection is not necessary

Partial view of PSU1

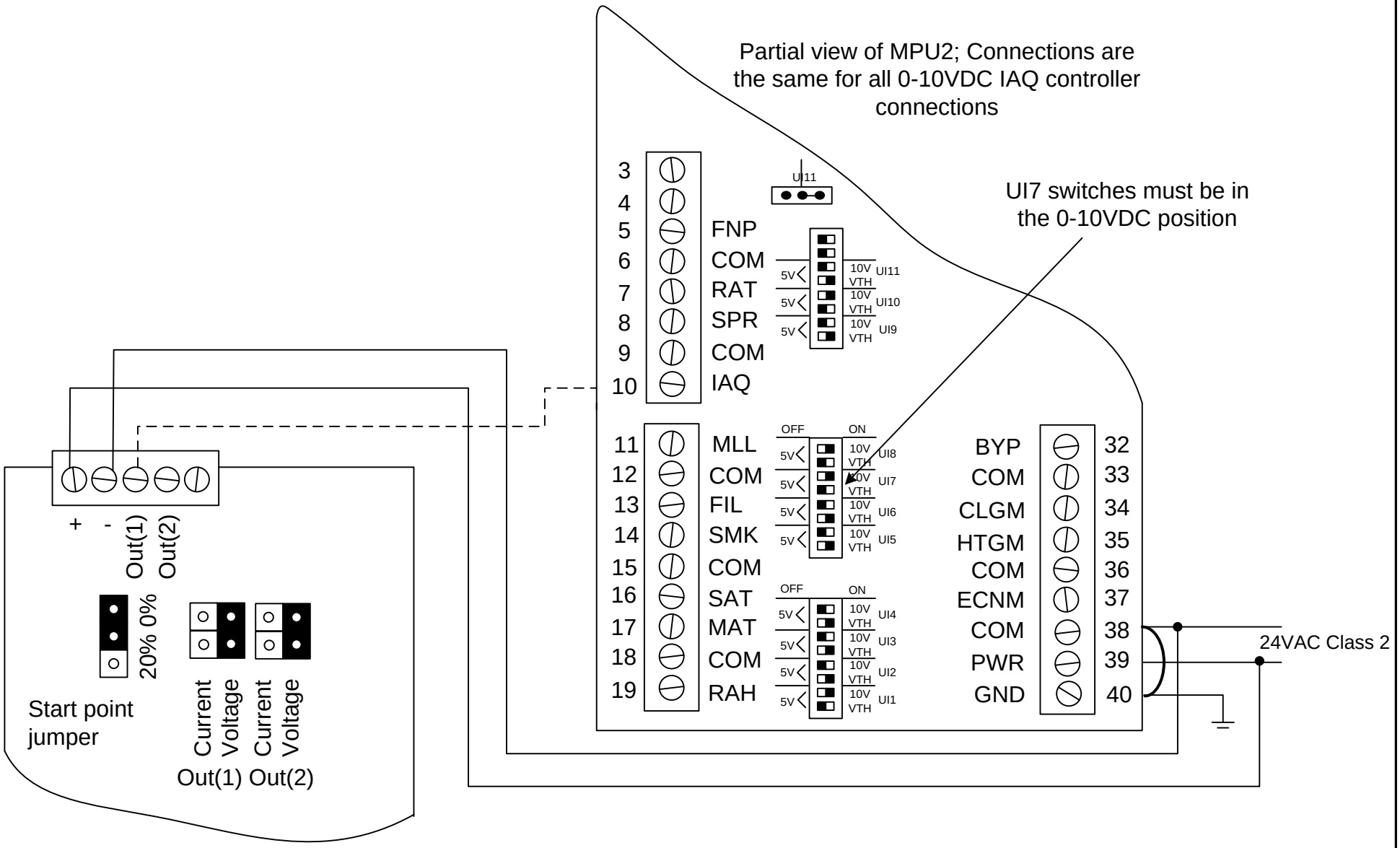


UI5 switches must be in the 0-10VDC position

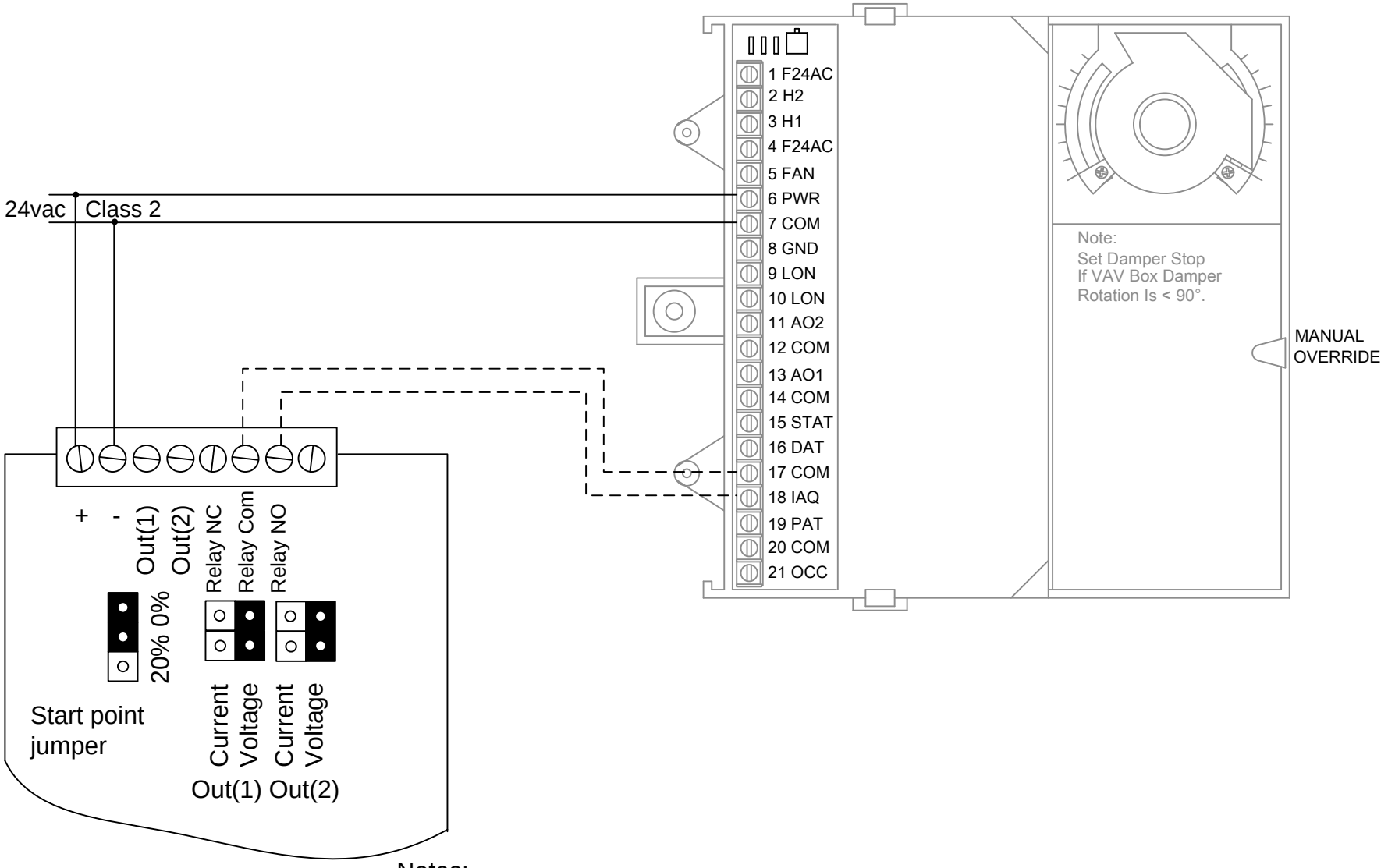
ACC-M267-MR3-V10 Differential Pressure Sensor connected to a MPU2



ACC-RS or DS-CO2 (0-10VDC output) connected to an iWorX controller



ACC-RS or DS-CO2 (digital output) connected to an iWorX VAV controller



Notes:

1. The VAVI and VAVD can only accept a digital IAQ signal
2. Connections are the same for a VAVI or a VAVD controller