Build Health International

Checking PSA Control Power

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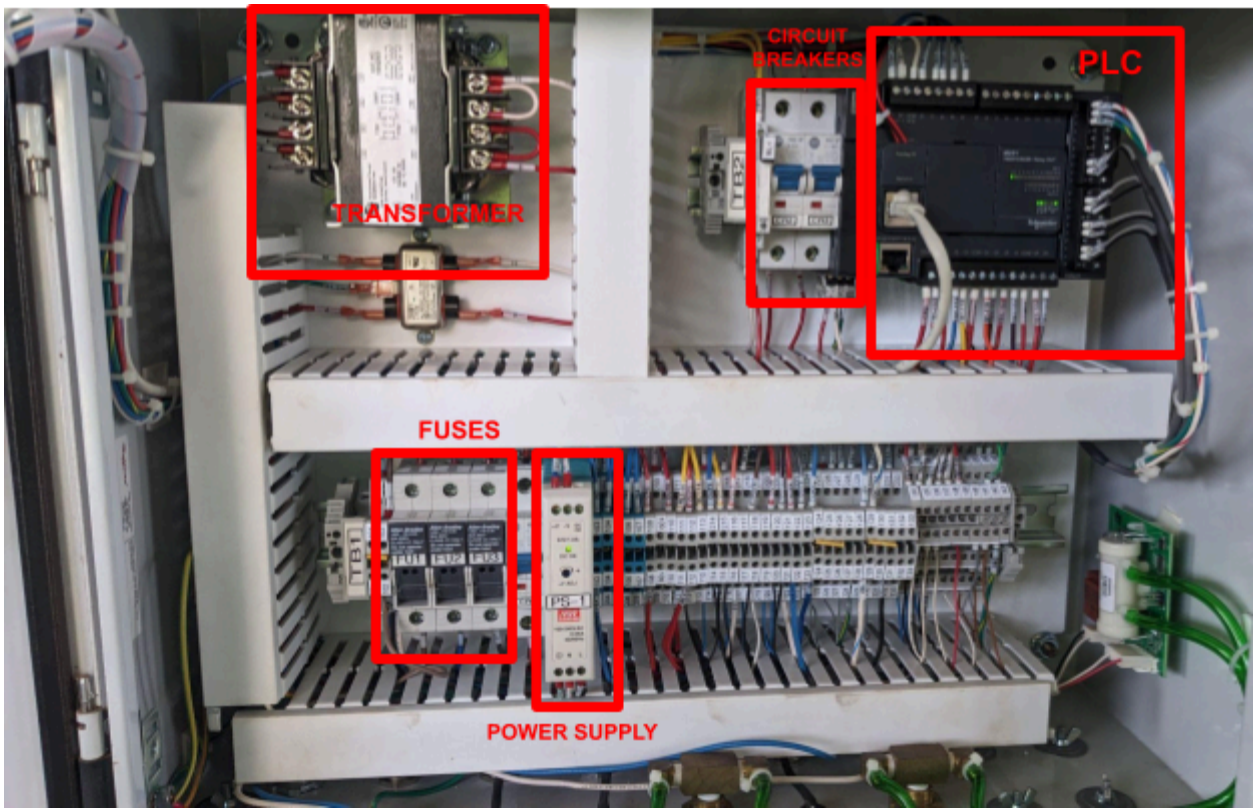
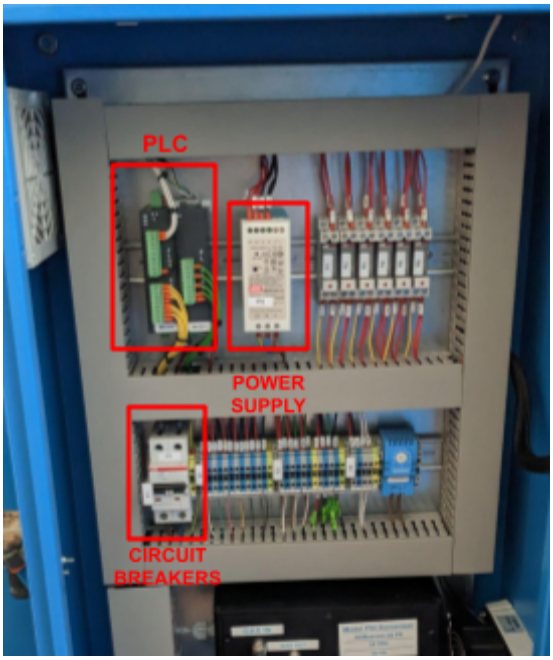
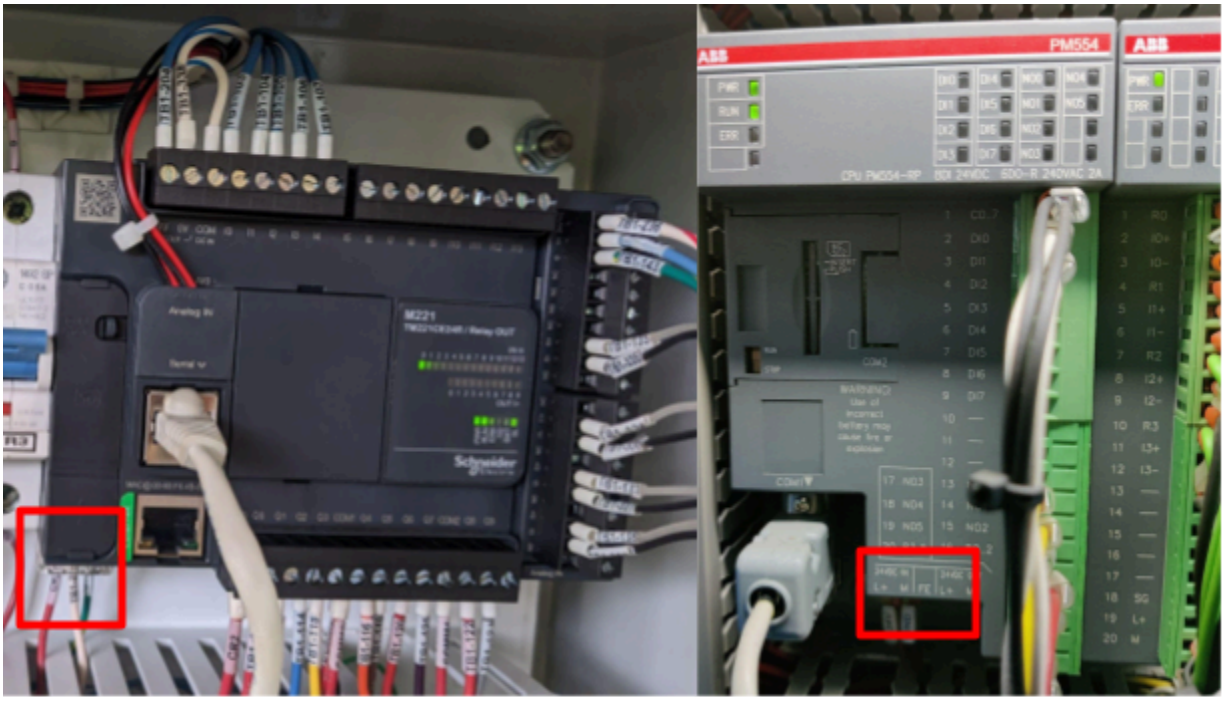


To check upstream power supply we first have to identify the relevant components in the control panel. Control panels can look daunting and an overly complex mess of wires at first glance; With a little patience, however, we can begin to troubleshoot a panel without having to fully know where every wire is going. The first thing we will want to do is to locate important "landmark" components of the cabinet. These include the PLC, the display, the DC power supply, transformers, AC breakers/fuses, input terminals. A PSA will always have a PLC; however, the rest of the components may or may not be present.





Left: The PLC from the cabinet above, takes 100-240VAC input power (red box). Looking closely, there are two 24VDC output terminals on the top and right terminal strips. **Right**: PLC that takes 24VDC power.

THE PLC

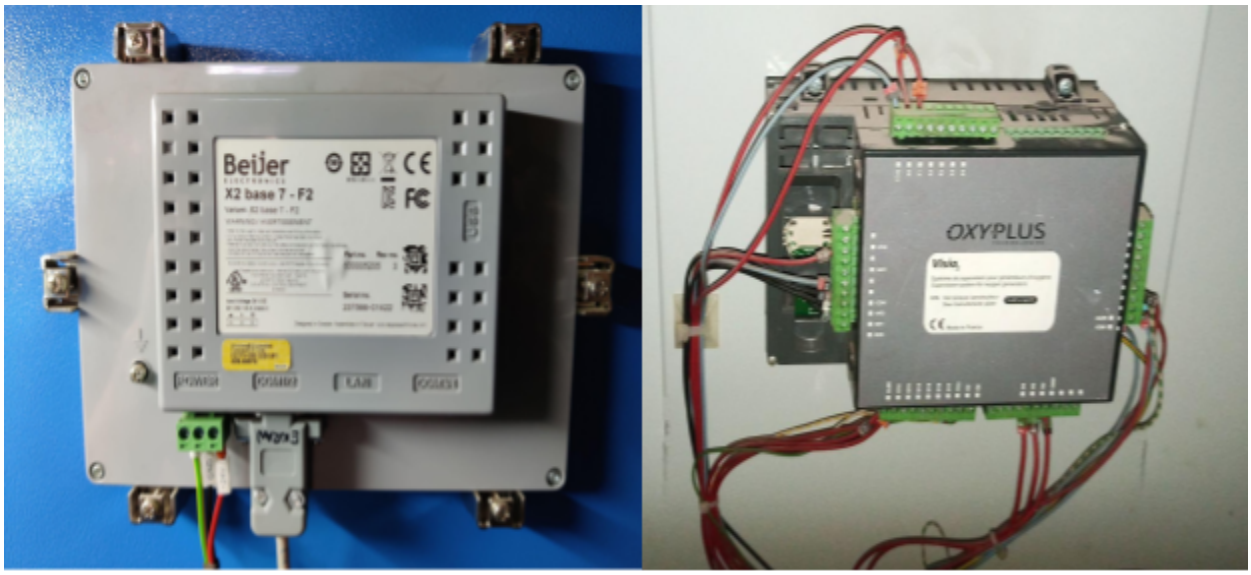
The PLC, programmable logic controller, is generally the easiest piece to identify. It appears as a large plastic block with numerous wire terminals and or computer cable connectors. There are generally an array of LED lights showing the status of inputs and outputs. In the case of a power issue the PLC will likely not have any LED lights on.

Once the PLC is found, the next step is to determine what the input voltage is. Different models of PLC's will run on different voltages: 24VDC, 100-240VAC, 48VDC, etc. are common. One confusing point is that a PLC may have different voltages labeled on different terminals. These are often output voltages the PLC produces to power different sensors. For example the PLC itself may run off 100-240VAC but some input signal terminals will be supplied with 24VDC. Some PLC's will have the input power voltage clearly labeled. For other PLC's you will have to look up the model number to check.

If you suspect power issues with the PLC it is best to first check the PLC's input power. With the multimeter measure the voltage between the input terminals. If the unit you are using supplies output voltage on some terminals, this voltage should also be checked with a multimeter.

DISPLAY

Many machines have a touchscreen or display on the front of the control panel. This display is often called an 'HMI,' Human Machine Interface. In general the display serves to take inputs and display outputs of the PLC; it does not contain or execute the program controlling the PSA plant. If the display is malfunctioning, however, the PLC may not be able to receive commands to start it. If the PLC seems to be operating (lights up), but the display will not light up, this suggests a problem with the display. Like the PLC the display will have input power that should be checked with a multimeter.



Left: The backside of a typical display (HMI) shows typical power connection and the communication connection to the PLC.
Right: The backside of a combination PLC/display(HMI), Notice the terminal many terminal blocks and wires connected to the unit.

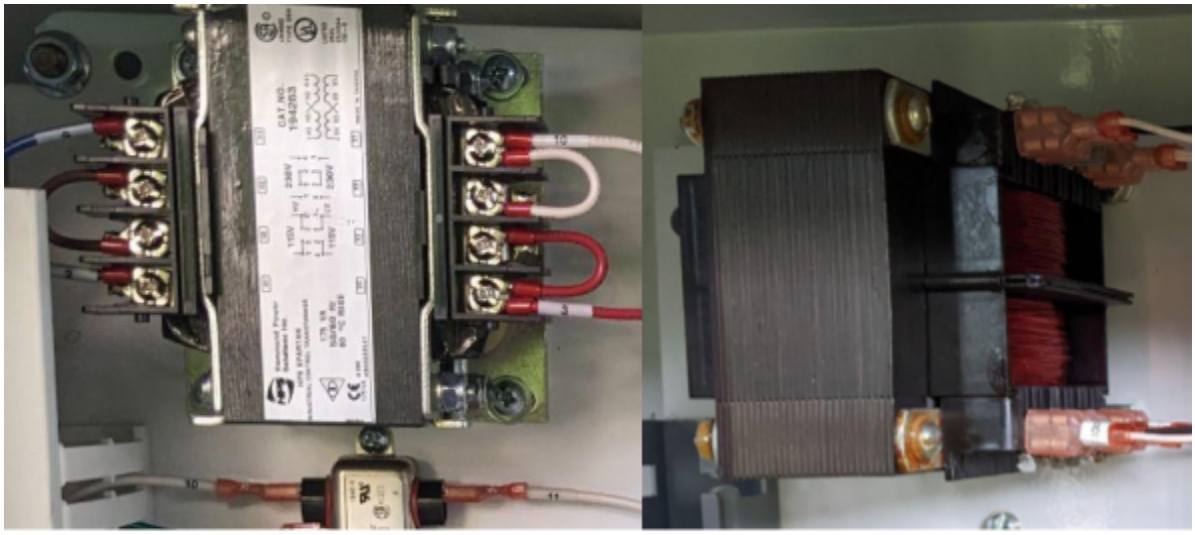
In some instances the display and the PLC are combined in one unit. Here the PLC's input power can be checked as you would the PLC alone.

DC POWER SUPPLY

Even when the PLC runs on AC, other control devices, such as sensors, relays, solenoids, etc may run on DC. So there will often be a DC power supply that converts the incoming AC to DC (24VDC, 48DC, … is common). The power supply may appear as a plastic block with a few input and output terminals. Other power supplies may appear as a small metal box with perforated holes. In either case, screw terminals labeled 'L','N', and 'G' (line, neutral, and ground) on the AC input time as well as 'V+' and 'V-' on the output side. The acceptable input (AC) and

output (DC) voltages will be labeled on the unit. To check the power supply first check the AC input. With a multimeter set to VAC place use the leads to measure the voltage between the L and N terminal . You should expect to see the local mains voltage, approximately 220 VAC or 120 VAC in the USA. Next check the DC input. With the multimeter set to VDC measure the voltage between the 'V+' and 'V-' terminals. You should see a voltage close to what is labeled on the unit.

Typical Power supplies. Far right photo credit: WaxPhilosophic CC.

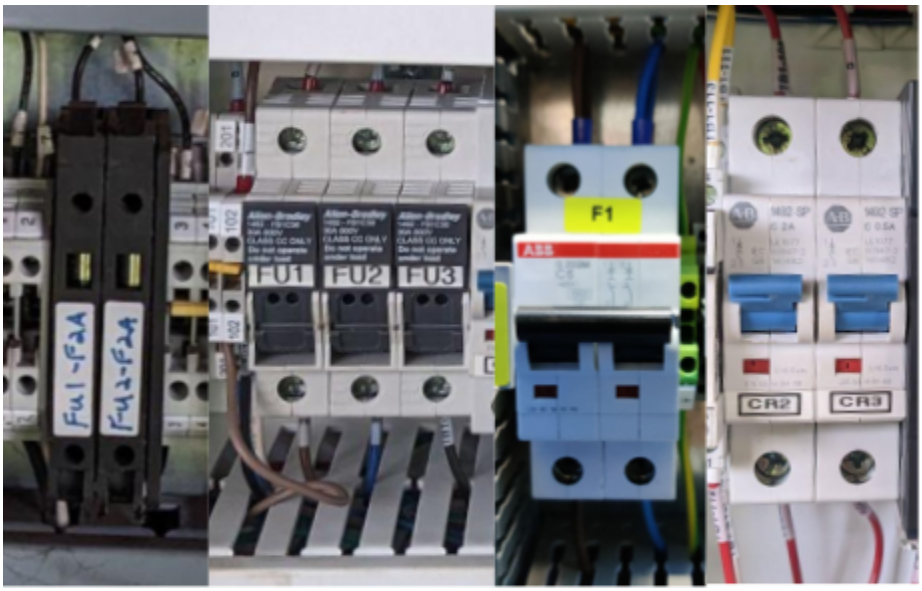


Control panel transformer.

TRANSFORMERS

Less common than DC power supplies are transformers. Transformers are electrical devices that raise or lower the voltage of an alternating current AC. They consist of a primary side, where local AC is fed in, and a secondary side where the "transformed," (higher or lower voltage) AC is fed out. In control cabinets this is generally done to provide a lower voltage single phase AC for control components and to provide additional protection from large loads. Control components might need lower voltage because either there is only line to line voltage available in the 3 phase supply (for example, 400V instead of 230V) or because the AC control components take a different voltage than what is locally supplied (for example, the local utility is 230 but the components are North American and operate at 120V). Control panel transformers usually are protected by fuses. Further they often have several terminal taps so that one transformer can handle a variety of use cases. It is important to check that the output voltage of the transformer is correct for the AC control components. Occasionally the transformer will be wired incorrectly when the cabinet is built. Too high or two low of a secondary voltage can cause relay, contactor and solenoid coils to fail prematurely.

AC BREAKERS OR FUSES



Left to right: two fuse holders, three fuse holders, double 6 amp circuit breaker, two 2A circuit breakers.

The most common AC breakers are the miniature circuit breaker design (MCB). These smaller vertically oriented rectangular blocks have a switch on their front face. They usually will have a

letter, A, B, C, or D, and a number 6, 10, 15, etc. prominently displayed on their front face representing their 'trip curve' (sensitivity) and tripping amperage. Some control panels will use fuse blocks that look similar to the MCB but instead of a switch have a small drawer that hinges out to reveal an electrical fuse. To check the breaker first inspect the status of the switch. It should be in the "on" or up position. The switch may have a red label showing that the circuit is live. With a multimeter set to VAC place use the leads to measure the voltage of the incoming neutral terminal (see below) and the top and bottom terminals of the circuit breaker. You should expect to see the local mains voltage, approximately 220 (120 volts in the USA.)

TERMINALS

Depending on the electrical cabinet, when the electrical first enters the cabinet it may be directly attached to a fuse of circuit breakers or it may attach to terminals where it is distributed to the electrical equipment. Generally these terminals are found near one of the corners of the cabinet. They are often larger than the other terminals and the wires connecting them will likely be among the largest wires. One of the terminals is often colored green or green and yellow indicating ground. They are usually labeled 'L','N', and 'G' (line, neutral, and ground) If the control panel uses 3 phase powers there will be 3 lines (L1,L2, and L3) + G and possibly a Neutral.

With a multimeter set to VAC place use the leads to measure the voltage between the L and N terminal . You should expect to see the local mains voltage, approximately 220 or 120 volts in the USA.