



SMART DRYKEEP INSTALLATION INSTRUCTIONS

Moisture is the enemy.... DryKeep® is the answer.

We reserve the right to make changes to any described details and technical data contained herein. Continuous product enhancement by DryKeep® and local conditions may result in deviations from this standard product installation.

DryKeep® is shipped from the factory fully assembled as shown in figure 1 below.

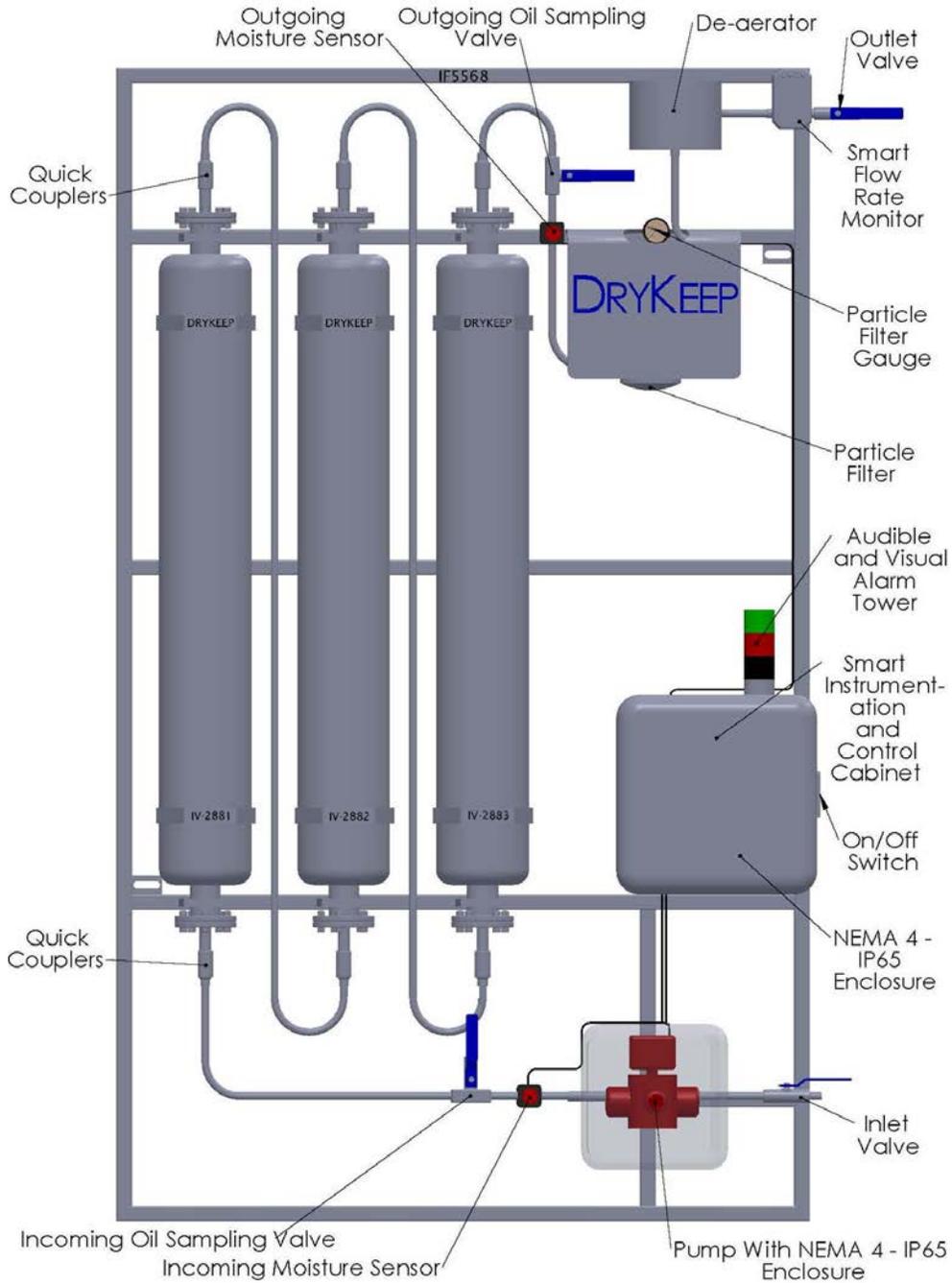


Figure 1: DryKeep® system layout

Although not shown, the installation for the single cylinder model SMART RT-3 is exactly the same

The cylinders are factory filled with transformer oil and molecular sieve adsorbent beads. The unit can be mounted as received, or the cylinders can be removed prior to mounting to lighten the load and ease the installation process. The rest of the components are to be left on the framework. The DryKeep® system must be mounted vertically with inlet valve and the pump located at the bottom and de-aerator at the top. (Refer to Figure 1).

The installed location of DryKeep® is flexible. It can be installed wherever the customer prefers. For simple installation and optimal performance, DryKeep® should be installed as close to the transformer as possible. Some users elect to bolt or tack-weld the DryKeep® frame directly to the transformer tank as shown in Figure 2 below. Other options include hanging the DryKeep® frame on a wall near the transformer or securing the DryKeep® frame to a stand-alone frame adjacent to the transformer as shown in Figure 3. Contact DryKeep® USA for a recommended fabrication drawing. This remote, stand-alone frame is usually lag bolted to the concrete pad. If the optional climate-control enclosure is furnished, it is a free-standing enclosure which can also be lag bolted to a concrete pad.



Figure 2: DryKeep® installed directly on transformer



Figure 3: Installation adjacent to transformer on customer-fabricated free-standing frame

NOTE: We suggest that when installing the DryKeep® system on to a reactor that it be mounted on a free standing frame or an adjacent structure due to possible vibration influence on pipe work and connections. If mounted directly to the reactor structure, use vibration dampers. Contact us for further details.

FOR TRANSFORMERS IN-SERVICE:

For safety purposes, the transformer should be switched off and made safe before installation commences.

- 1) Upon receipt at the installation site, remove the top of the DryKeep® crate and unscrew the four (4) 1½" lag screws used to bolt the DryKeep® frame to the shipping crate.
- 2) Remove the system from the shipping crate and install the DryKeep® on the transformer, free-standing frame, wall or other structure, or position the optional enclosure to the location desired.
- 3) *Refer to Figures 1, 4, and 5.* To connect DryKeep® to the transformer, first remove the shipping plugs from the DryKeep® inlet and outlet valves.
- 4) Replace the transformer drain and fill valves flanges with flange adapters having ½" NPT unions (not supplied).
- 5) Using ½" NPT flexible stainless steel braided PTFE or other suitable flexible hose (not supplied), connect the bottom drain valve flange adapter to the DryKeep® inlet valve. To return the oil back to the transformer main tank, connect the ½" NPT hose to the DryKeep® outlet valve and then to the transformer fill valve flange adapter. *Optional climate-controlled enclosed units have pre-drilled entry points on the bottom and top of the right side of the enclosure. Use supplied 1/2 in. stainless steel liquidtight cord connector and wire mesh grips to route hoses through enclosure wall to the inlet and outlet valves.*



Figure 4: Connection from transformer to DryKeep® inlet valve.

An optional installation kit containing ½" NPT flexible stainless steel braided PTFE hoses, flange adapters and fittings to connect to the transformer at the inlet and outlet is available. Contact DryKeep® USA for details.

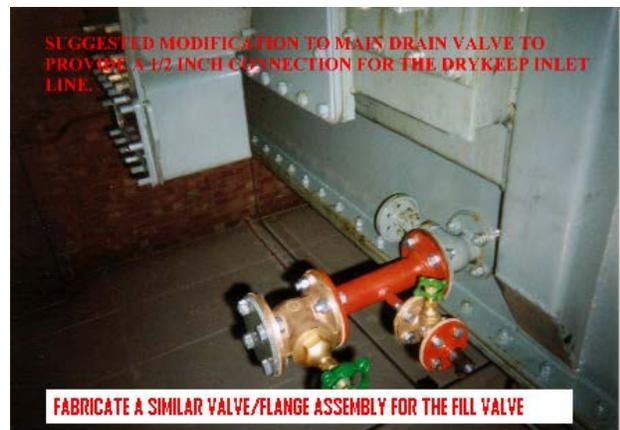


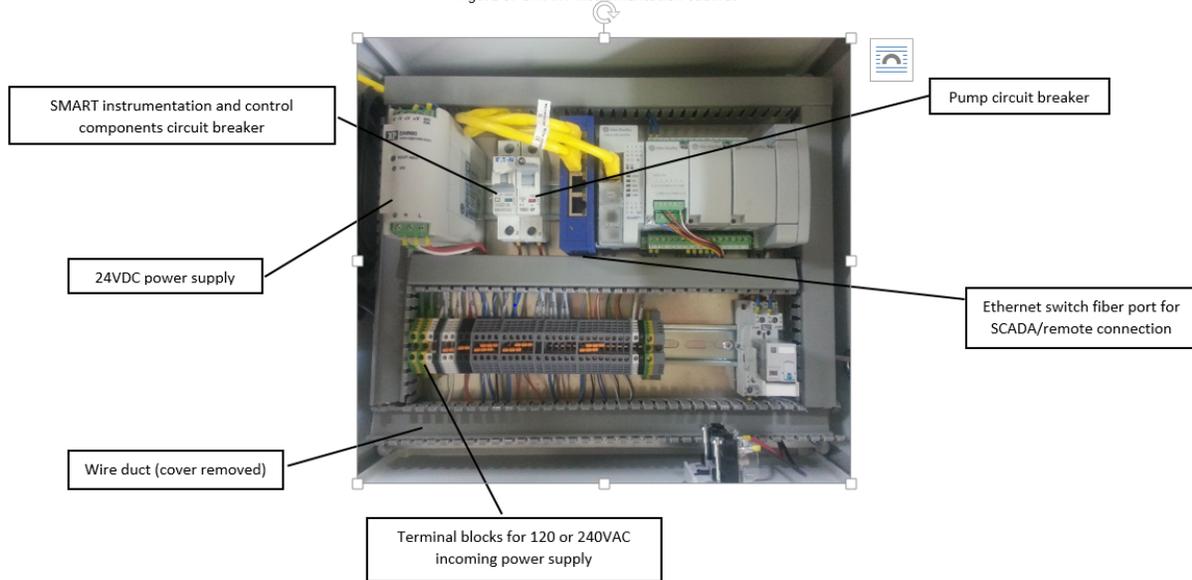
Figure 5: Drain valve adapted for DryKeep® installation

FOR TRANSFORMERS NOT IN SERVICE:

For transformers under repair and not containing oil, modifications can be made to the transformer tank to add entry and exit fittings for the DryKeep® system. The entry and exit fittings need to be diagonally apart from each other (i.e. if top left, then bottom right) to avoid re-circulating the just-dried oil. If this is not an option, DryKeep® can still be installed in the same manner as described above for a transformer in service by using the drain and fill valves of the transformer.

ELECTRICAL CONNECTIONS:

Figure 6: SMART Instrumentation cabinet



Refer to Figure 6 above. The DryKeep® SMART instrumentation components and pump are shipped internally pre-wired for operation. Only a 120V/60Hz or 240V/50Hz AC power source needs to be provided. Full load current is 3A. For units with the optional climate-controlled enclosure, full load current is 9A.

- 1) Open the outside door of instrumentation cabinet.
- 2) Turn both spring-loaded screws on inner swing panel with LCD screen counter-clockwise to open inner swing panel. *Units with the optional climate-controlled enclosure will have the stack lights shipped uninstalled. The stack light base is installed on the top-right of the enclosure and is pre-wired for operation. To install the stack lights, line up the arrow on the stack lights with the arrow on the mounting base, push down and turn.*
- 3) Drill a hole in the instrumentation cabinet sized to accommodate the conduit using the appropriately sized liquidtight fitting (not supplied)**.
- 4) Connect the AC power supply by removing wire duct cover and lay supply wire into the wire duct.
- 5) Connect AC power supply ground wire to green/yellow ground terminal block.
- 6) Connect AC power supply neutral wire to white terminal block.
- 7) Connect AC power supply line wire to black terminal block.

ELECTRICAL CONNECTIONS (CONTINUED):

- 8) If connecting SMART DryKeep to SCADA or other CPU retrieval system, drill a second hole into the cabinet and run Ethernet cable into the instrumentation cabinet using the appropriately sized liquidtight fitting (not supplied)**.
- 9) Connect Ethernet cable to the Ethernet switch fiber port.
- 10) Close inner swing panel and tighten spring-loaded screws by turning clockwise.

*** For units mounted inside the optional climate-controlled enclosure, drill a hole in the enclosure sized for the conduit. Run the AC power into the enclosure using the appropriately sized liquidtight fitting (not supplied) and connect to the SMART cabinet as per above. Do the same for Ethernet cable for SCADA or CPU connection..*

COMMISSIONING:

- 1) Check the tightness of all cylinder bolts. The cylinder flange bolt torque for 16-mm bolts is 65 lb-ft or 88 nm. The cylinder flange bolt torque for 3/8" bolts is 40 lb-ft or 54 nm.
- 2) Check to insure that the quick couplers on the top and bottom of each cylinder are fully tightened. Hand-tighten only. Do not use wrenches.
- 3) Refer to Figure 1. Ensure that the DryKeep® outlet valve is closed.
- 4) Open the inlet valve of the DryKeep® system.
- 5) Turn main power switch on the right side of the instrumentation cabinet to the on position
- 6) The PLC system will take a few minutes to cycle and start up. The system is online and ready when the screen shown in Figure 7 below is displayed.

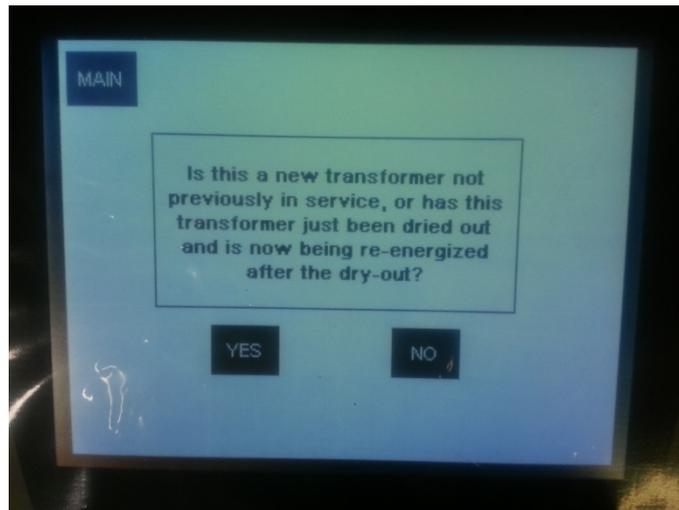


Figure 7: Initial screen when system is ready

COMMISSIONING (CONTINUED):

- 7) For new transformers, or transformers that have been recently dried to sufficiently bring the level of moisture in the paper down to the acceptable level (at or below 1.3%), pushing “YES” on the screen will start the DryKeep® pump. The pump will run continuously to remove residual or new moisture.
- 8) For transformers that are in-service and are considered to be “wet”, selecting “NO” will turn the pump on. The PLC will begin to monitor the readings from the incoming moisture-in-oil sensor and determine when the correct amount of moisture has been removed from the transformer.
- 9) When that dry-down level has been reached, the PLC will turn the pump off for 60 days.
- 10) After 60 days, the PLC will turn the pump back on and will analyze the incoming moisture-in-oil sensor readings for a period of 4 days. If the estimated moisture in the paper still shows 1.3% or less, the PLC will shut the pump down again for 60 days. This process will repeat continuously to keep the transformer at a safe dry level, thus removing the risk of over-drying the paper insulation.
- 11) The system is running properly when the screen in Figure 8 is shown on the display.

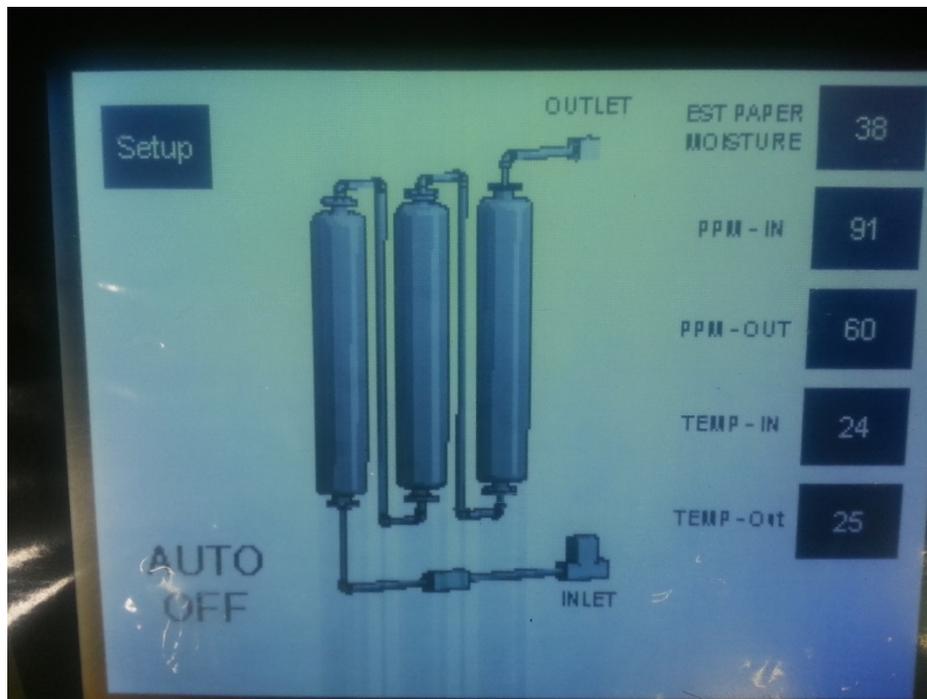


Figure 8: DryKeep main screen display when system is in operation

COMMISSIONING (CONTINUED):

- 12) Pushing setup on top left of main screen (see Figure 8) brings up the settings display as shown in Figure 9 below. At this point,
- The user can change the settings to a new transformer (the PLC ignores the incoming moisture-in-oil sensor and never shuts the pump off in this setting unless a low flow/leak is detected),
 - change the temperature displayed on the main screen to Celsius of Fahrenheit,
 - turn the available audible alarm on,
 - override the PLC and turn the pump on continuously (the PLC ignores the incoming moisture-in-oil sensor and never shuts the pump off unless a flow flow/leak is detected)

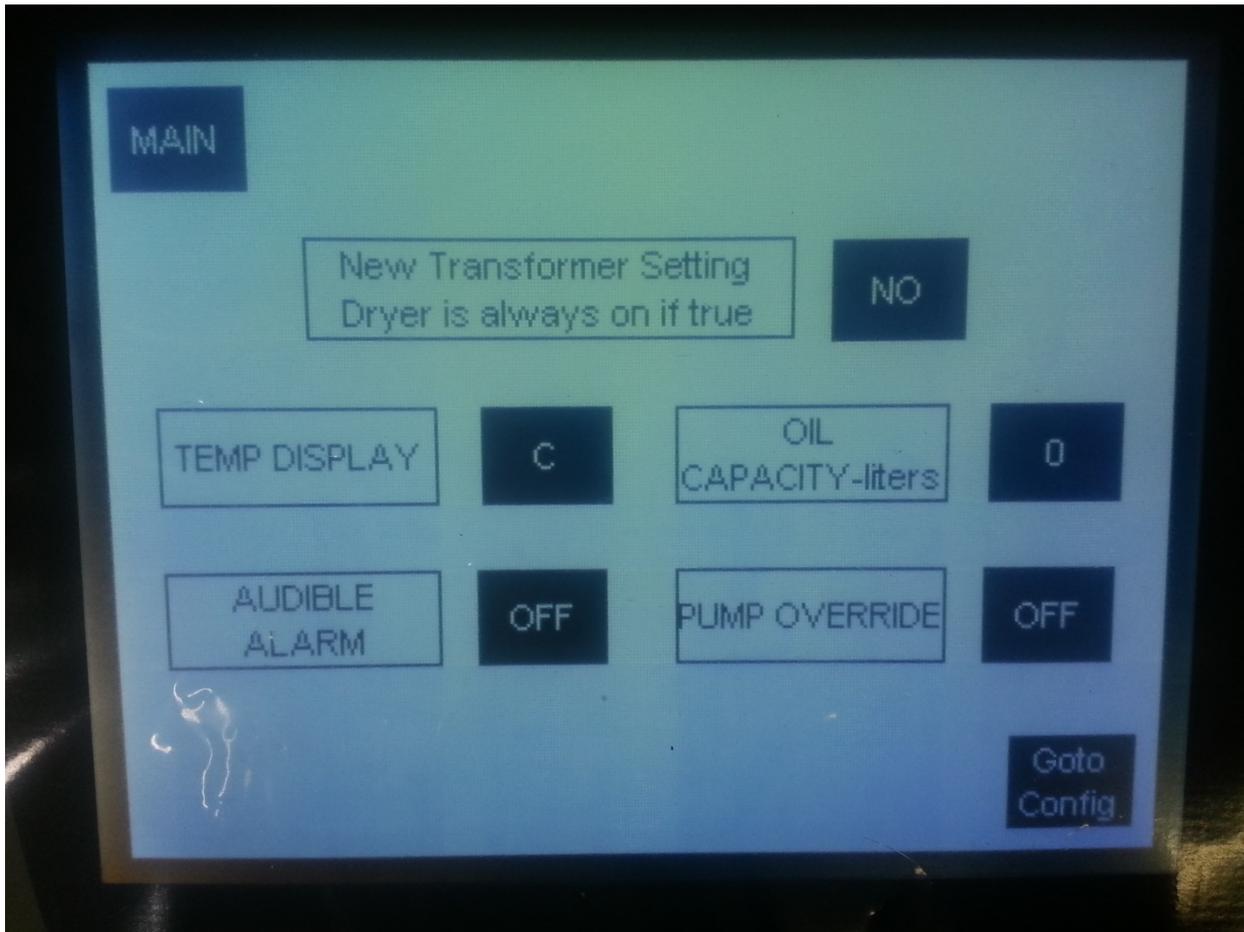


Figure 9: Setup screen

- 13) Push "MAIN" to return to the normal operating screen shown in Figure 8.
- 14) Refer to Figure 1. Now that the pump is running, slowly open the bleed valve on the de-aerator tank. It is recommended that the installer have a vessel on hand to capture any oil that may come out of the bleed valve while it is open. Ensure that all the trapped air in the system escapes through the bleed valve on the de-aerator tank.

COMMISSIONING (CONTINUED):

- 15) Close the bleed valve on the de-aerator tank and slowly open the outlet valve of the DryKeep® system.
- 16) Open the bleed valve again after about 15 minutes to remove any additional air from the system that may have collected in the top of the de-aerator. Again, it is recommended that the installer has a vessel on-hand to capture any oil that may come out of the bleed valve while it is open.
- 17) Monitor the system closely for 20 minutes to check for oil leaks, oil flow, and for any abnormalities. Once again, open the bleed valve on the de-aerator tank to remove any remaining air. Close the bleed valve. The system is now ready and running.

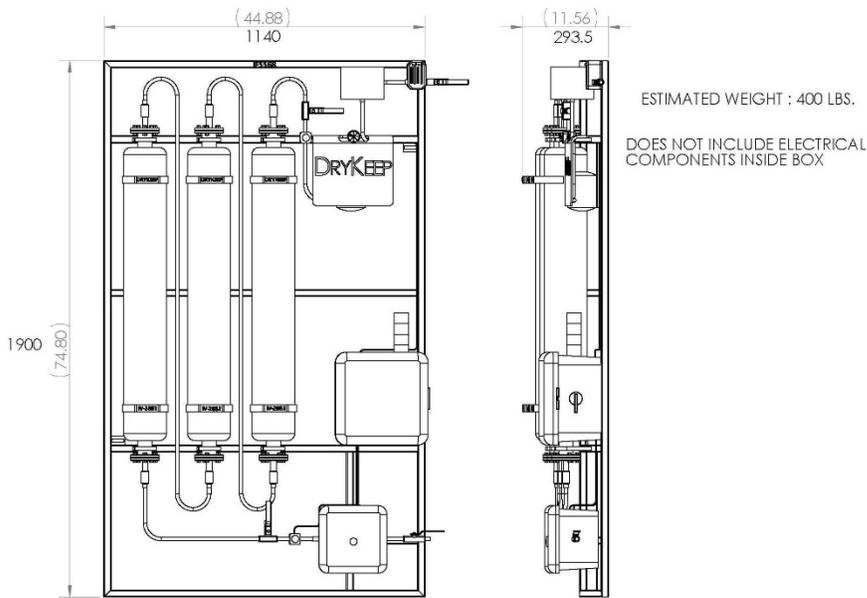


Figure 10: SMART RT-9 dimensional drawing

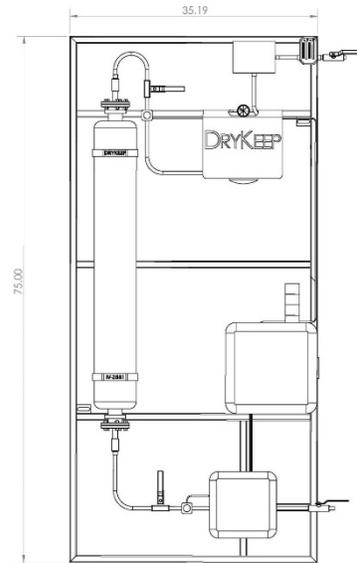


Figure 11: SMART RT-3 dimension drawing

SCADA/CPU DATA RETRIEVAL

All SMART DryKeep® PLCs have Ethernet/IP and Modbus TCP/IP capabilities embedded for SCADA. Other CPU data retrieval is also possible using commercially available Modbus polling data.

The IP address for the HMI is 10.1.1.192

The IP address for the PLC is 10.1.1.146

The following Modbus table is programmed into all SMART units for use to retrieve data remotely from the system.

Variable Name	Data Type	Address	Description
mHMI_Alarm	INT	40001	True(01) = Alarm Condition
mHMI_Alarm_Reset	INT	40002	Set True(01) to Reset Alarm Condition
mNo_Flow_Detected	INT	40003	True(01) = Alarm Condition (Oil Flow has dropped)
mCylinders_Saturated	INT	40004	True(01) = Alarm Condition (Cylinders Saturated)
mTemperature_Units	INT	40005	True(01) = Fahrenheit , False(00) = Celsius
mNew_Transformer	INT	40006	True(01) = New Transformer and Dryer will run continuously
mAuto_Mode	INT	40007	True(01) = Auto Mode ON
mMotor_Start	INT	40008	True(01) = Pump Running
mManual_Start	INT	40009	True(01) = Pump Override
mOil_Temp_In	INT	40010	Incoming Oil Temperature
mOil_Temp_Out	INT	40011	Outgoing Oil Temperature
mMoisture_PPM_In	INT	40012	Incoming Moisture in PPM
mMoisture_PPM_Out	INT	40013	Outgoing Moisture in PPM
mWCP	INT	40014	Estimated Percentage of Moisture in Transformer Paper