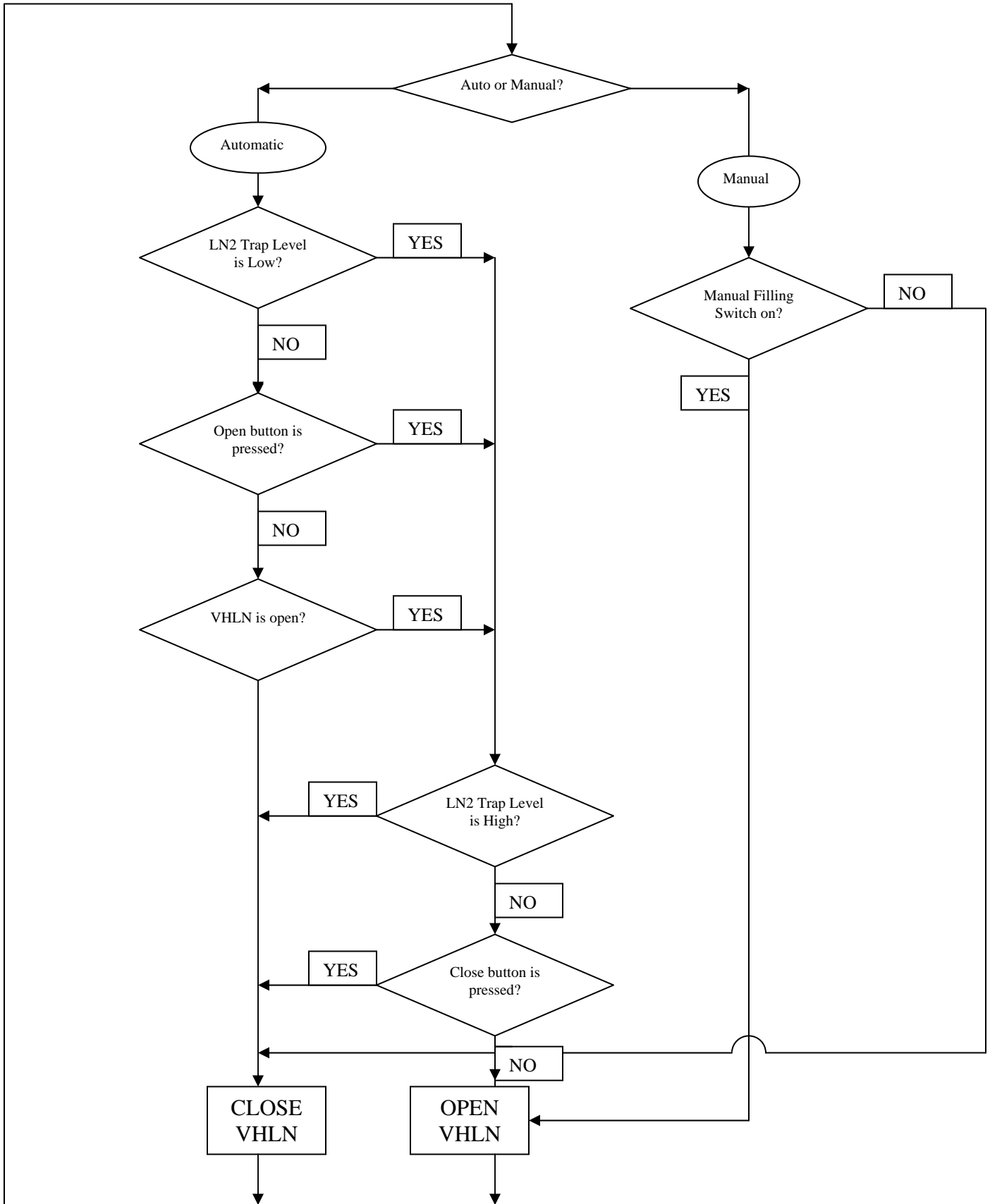


# STATE DIAGRAM FOR LIQUID LN<sub>2</sub> FILLING SYSTEM



**Liquid Nitrogen Trap Fill Valve (VHLN)**

Controlled mechanism	Valve to fill liquid nitrogen to the cold trap in the He-3 circulation
Operation Modes	Under normal conditions the PLC will control the trap level to be between an upper and a lower threshold value, by atomically filling and closing of the valve as required.
Set Operating Mode	Under normal conditions the PLC handles the operating of the system, however the system can be switched (from the pumphouse) over in manual operation mode in case the automatic filling fails.

<b>VHLN</b>	
Actuator	Electropneumatic valve
Actuating signal	The actuator signal is controlled by a 8 W solenoid operated with 48 VDC
State	A limit switch indicates the open/closed state. The status is shown on the control panel.
State Readout	Three PT100 thermometers are used for the readout of the nitrogen level. The nitrogen level is estimated based on the measurements of the four temperatures. E.g. a change of temperature from 77 K (the thermometer is immersed in liquid) to 300 K (the resistor is outside the liquid) indicates that the liquid level is sinking below the specific resistor.
Measured values	<ul style="list-style-type: none"> <li>• Liquid Nitrogen Trap Level (calculated)</li> </ul>
PLC-Connection	2 AI RTD T2-2, 2 AI RTD T2-3
Operating commands	<p>The PLC will automatically open the filling valve (VHLN) if the trap level is too low. When the upper limit is reached, the valve is closed.</p> <p>In case of failure of the automatic filling, a switch in the pump room can be set to manual fill state. In this operating mode the PLC will open the filling valve until upper limit is detected. Restart of the manual filling can be done by switching to automatic position and then reset to the manual fill position.</p>
Alarm signal	<p>Alarm signal is set if automatic filling fails within two minutes from the detection of too low level.</p> <p>The values of the thermometers are checked for open or shorted circuit conditions. In these cases the alarm will be set.</p>
Security mechanisms	<p>VHLN is closed in case of an alarm.</p> <p>Power failure will <b>not</b> stop the system since it is depending only on the 48 V network and presence of pressurized air.</p>