



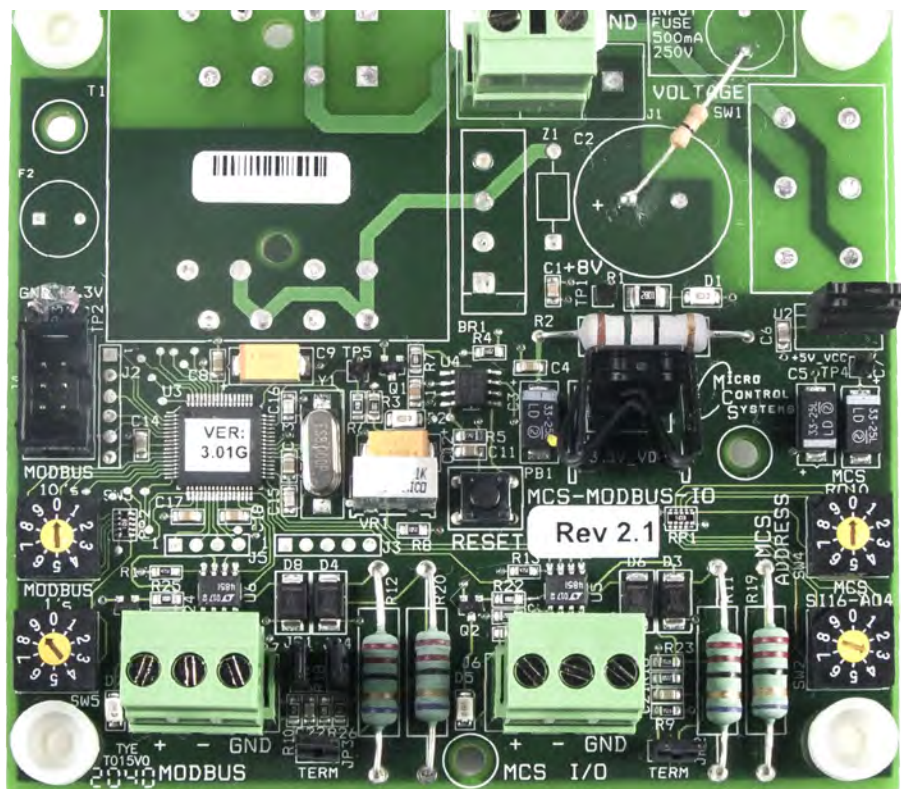
APPLICATION NOTE

APP #094

Revision History

Date	Author	Description
08/13/2014	Michael Wozny	Created application note
1-19-21	DEW	Setup new format, new drawing
03-25-21	DEW	Update drawing

MCS-MODBUS-IO-12



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In previous SW versions common suction TurboCor units will treat all balancing valves as the same. Before turning a lag compressor ON, all running compressors had to be fully unloaded and discharge to suction ratio was less than 2.4.

With this new logic each TurboCor compressor will have a dedicated stage valve, and the running compressor(s) will be unloaded based on steps turned ON and a set point value.

1. To enable logic select staging option in MCS-Config MagHVA->Compressor Info->TurboCor Settings, when this option is selected the load Balancing valve AO reference is set to 200. Use `chiller_eerom.turbocor_bal_valve_ao` value to determine loading/unloading sequence.
2. Add stage valve AOs, one per circuit (Cannot be a virtual AO).
3. Point to the AO in Circuit Base Staging Valve AO%. These fields are used in the TurboCor-common suction logic to point to starting RPM speed virtual AO.

1.1. Compressor Startup Logic:

1. Open the Staging Valve (previously Load Balance Valve) to 100%; this may or may not be necessary when starting the first compressor on the circuit (depends on testing).
2. Turn the compressor relay ON.
3. The compressor will go into a startup phase until it meets 3 conditions (minimum amp draw, speed at or above the minimum start speed per the compressor configuration file, and the speed above the surge speed); it then goes into a transition phase until the IGV's have opened to 110%. Once that occurs it goes into normal control operation.
4. The Circuit State will go to "UNIT IS HOLDING" state for 120 seconds. Time is defined in Set Point #215.
5. The Analog Output % (compressor speed) is set to minimum value of 25%. The value is defined by the value of Set Point #31.
6. The Inline Guide Vane % (IGV) for the first compressor is set to 35%. This percentage is calculated by adding the value of Set Point #31 (25%) and 'IGV Start Offset %' (10%) (note that the setup is in the RO grid of MCS-Config).
7. Set the starting speed to the value of 'Starting Speed (RPM's)' field in the RO grid of MCS-Config. The normal value is about 10,000 RPM's.

1.2. New Logic Set Points:

- STP62 -> Value PMP DWN DELY: Maximum time delay (in seconds) that a compressor can remain in the PUMP DOWN state.
- Turbocor requires extra time to fully unload before shutting off the EXV. This time is calculated using `SP_PUMP_DOWN_TIMER_safety_time` field. $time = setpoint_ram[SP_PUMP_DOWN_TIMER].value - (int) setpoint_eerom[SP_PUMP_DOWN_TIMER].safety_time$.
- EXV needs to stay open during this time, unless there is a Freeze or no Flow condition.
- STP183 Second Stage: New compressor speed value, and running compressor speed would be unloaded to this value.
- STP184 Third Stage: New compressor speed value, and running compressors speed would be unloaded to this value.
- STP185 Fourth Stage: New compressor speed value, and running compressors speed would be unloaded to this value.
- STP186 Fifth Stage: New compressor speed value, and running compressors speed would be unloaded to this value.
- STP187 Sixth Stage: New compressor speed value, and running compressors speed would be unloaded to this value.
- STP188 Seventh Stage: New compressor speed value, and running compressors speed would be unloaded to this value.
- STP189 Eight Stage: New compressor speed value, and running compressors speed would be unloaded to this value.

- STP214 Stage Valve Opening and delays:
 - o Value: Time for Stage Valve to open 0-100% before new compressor is turn ON.
 - o Time (Sec): Once the new starting compressors has been in Holding state for this time period (STP_215.Time – STP_214.time) the Stage valve will be set closed 0%.
 - o Sec To Ignore safety Once the new starting compressors has been in Holding state for this time period (STP_215.Time – STP_214. time_to_bypass_safety_test) the running compressors will be unloaded to the new demand %.
- STP215 Compressor Start Up Delay:
 - o Time (Sec): Time in seconds for cmp start-up phase.

1.3. Opening Balancing Valve:

1. Continuing from the Compressor Startup Logic, turn the second compressor relay ON.
2. Referring back to Steps 3-7 in the 'Compressor Startup Logic' section, the second compressor will go through the same logic as the first compressor.
3. One exception to Step 2 (above) is that with the second compressor, no 'Motor Start RPM' will be sent when starting a lag compressor. The compressor will start based on the parameters set in the compressor configuration file. Once accomplished, all compressors should be matched and the unit will operate under standard logic based on control sensor.

1.4. Closing Balancing Valve:

1. Unit State is set to "CLOSING BYP/STG VLV."
2. After the compressor turns on and the state goes from Holding to Running, close the balancing valve in the same manner as it opened.
3. The delay between adjustments to the balancing valve is the 'Time(sec)' field of Set Point #214.
The normal value is 20 seconds.
4. The adjustment made to close the valve will be the value of Set Point #214 (normally 10%).

1.5. TurboCor Wiring Diagram:

Wiring from MCS-MODBUS-I/O to TurboCor Compressor I/O Board

