Micro Control Systems
APPLICATION NOTE
APP-008

Hitachi Screw Point List and Startup Sequence

Revision History

Date	Author	Description
1/16/98	RCT	Initial App note (draft copy)
3/12/98	RCT	Released
3/13/98	RCT	Update corrections

This Application Note outlines the point set up when building the configuration file and the start up sequence for Hitachi screw compressors.

Theory

The MCS-8 algorithm has a predefined sequence of relay outputs by refrigeration circuit. These sequences can start at any relay output, assuming enough relay outputs follow to handle the sequence.

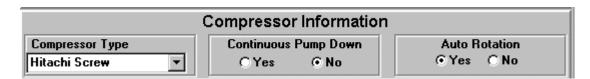## Relay Output points list

Hitachi Screw Compressor

1. Compressor
2. Slide Load Solenoid
3. Slide Unload Solenoid
4. Start Unload Solenoid
5. Liquid Line Solenoid

Example of Hitachi Screw Compressor Sequence

Relay Output Information Screen

#	Name	Display Button	Max Pulses (10th of Secs.)	
1	COMP1	Not Used	0	
2	LOAD1	Not Used	0	
3	UNLOAD1	Not Used	0	
4	UL STRT1	Not Used	0	
5	LLS1	Not Used	0	

The following Information Screens would be required for the above relay outputs.

- **Hitachi Screw** Compressor Type has been selected

Compressor Information

Compressor Type	Continuous Pump Down	Auto Rotation
Hitachi Screw	○ Yes ⊙ No	⊙ Yes ○ No

- The continuous pump down option has not been selected. Pump down will occur when the compressor is to be turned off and started.
- The auto rotation option has been selected. If two or more circuits exist, auto rotation will occur.

- **5** has been entered for Num Comp stages (number of relay outputs)
- **COMP1** has been selected as the Starting Compressor

CIRCUITS					
Circuit #	Num Comp Stages	Starting Compressor	Num of Cond Stages	Starting Condensor	Suction Pressure
1	5	COMP1	4	FAN 1-1	SUCT1

Start up sequence

When the Hitachi screw compressor is to be started, the system first ensures that the compressor is in a completely unloaded state. The circuit state will move from the OFF to a ST UNLD, start unload, state. After 60 seconds the system will move to an UNLOADED state and then determine the proper setting of the slide valve.

RO	OFF STATE	ST UNLD	UNLOADED
Compressor	OFF	ON	ON
Slide Load Solenoid	OFF	OFF	OFF
Slide Unload Solenoid	OFF	ON	OFF
Fast Unload Solenoid	OFF	ON	OFF
Liquid Line Solenoid	OFF	ON	ON

The system will now determine the appropriate action to take based upon the controlling temperature.

The following is a list of circuit control states that can exist for a Hitachi screw compressor:

OFF

This state is entered when no cooling capacity is required from this circuit or the prior state was ANTICYC, LOST IO or DISABLE. After 60 seconds in this state the circuit is ready to provide cooling capacity if needed.

ST UNLD

For screw compressors, this state is entered when the compressor is turned on. The system will remain in this state for 60 seconds while the "start unloader" and the regular unload points are on. This is to ensure that the screw is unloaded.

LOADING

For screw compressors, this state is when the screw load solenoid is being pulsed to increase the cooling capacity of the circuit. The duration of the pulse is specified in the set point (LOAD PULSE).

HOLDING

In this state, the required refrigeration capacity of system is being met; no movement of the slide valve is required.

UNLDING

The screw unload solenoid is being pulsed to reduce the cooling capacity of the circuit by moving the slide valve. The duration of the pulse is specified in set point (UNLOAD PULSE).

DIS HLD

The screw slide valve is being held, will not load due to a high discharge pressure or high discharge temperature. The system will allow the slide valve to be unloaded if required.

DIS UNL

The screw slide valve is being unloaded due to a high discharge pressure or high discharge temperature.

SUC UNL

In this state the screw compressor is being unloaded turned off due to low suction pressure.

UNLDED

In this state is when the Hitachi screw's slide is fully unloaded (indicated after pulsing 30 seconds with no change in the compressors amp draw). When in this state, every five minutes the unload solenoid is turned on for 30 seconds to insure that the slide is fully unloaded. If the hot gas bypass (HGB) is provided, it can be turned on only in this state. The HGB is controlled on either suction pressure or leaving liquid temperature set points.

SUC HLD

This state is entered when a screw slide position is not allowed to load due to low suction pressure. The screw slide position will remain constant or be allowed to unload if required.

LOADED

This state is when the compressor is fully loaded (indicated after pulsing 30 seconds with no increase in the compressor amp draw). In this state, the circuit is providing the maximum amount of cooling capacity. When in this state, every five minutes the load solenoid is turned on for 30 seconds to insure that the slide remains fully loaded.

PMP DWN

This state is entered whenever the pump down switch has been turned on or if this circuit is no longer wanted on. The compressor is on and the liquid line solenoid is closed. This state is active until the suction pressure reaches the value in the set point (PMP DN PSI) or the time has exceeded the value in the set point (PMP DN DELAY). The circuit will then move to the ANTICYC State.

ANTICYC

This state is entered when the PMP DWN State has been successfully completed. The circuit will stay in this state with all circuit points off for the period of time contained in set point (CYCLE DELAY). The circuit will then move to the OFF State.

DISABLE

This state is entered after the circuit has been pumped down due to the pump down switch being on. In this state the compressor, and all related points, plus the liquid line are off. The circuit will not leave this state unless the pump down switch is turned off. If the pump down switch is turned off, the Circuit State will be changed to OFF State.

SAFETY

This state is entered when a safety trips but a lockout is not to be generated. An alarm is generated and the system will restart after a five minute delay. If the same safety occurs within ½ hour, the circuit goes to the LOCK OUT State which will require a manual reset.

LOCK OUT

This state is entered when the CAPACITY CONTROL STATE is LOCK OUT or a safety set point for this circuit has indicated that a critical situation has been encountered. Set points such as (LOW SUCTION) or (HI DISCH PSI) are examples of safety set points. Lockouts can be reset without authorization from the keypad or PConn program; however if the lockout condition has not been corrected, the circuit will again be forced into the LOCKOUT State.