

Micro Control Systems

APPLICATION NOTE

APP-001

Relay Output Sequence for Heatcraft Chillers

Revision History

Date	Author	Description
12/10/96	Brian Walterick	Created Application Note.
12/11/96	Brian Walterick	Modified page 2, Changed Compressor A & B to Compressor 1-A & 1-B.
9/9/97	R C Toney	Documented compressor point sequences for software HCx04, HCx05 and HCx06.

This Application Note outlines the sequence of relay outputs for a Heatcraft chiller equipped with an MCS-8 micro-controller.

Theory

The MCS-8 algorithm has a predefine sequence of relay outputs by refrigeration circuit. Each circuit has two sequences of relay outputs. The relay outputs must be consecutive points. These sequences can start at any relay output, assuming enough relay outputs follow to handle the sequence.

The first sequence is compressor related relay outputs. If an option involving one of these relays is not used then the corresponding relay is omitted. The relays following this omitted relay would simply move up to fill in the gap. There are different sequences for different types of compressors.

Reciprocating Compressor for software HCR04 & HCR05 (4 board applications)

1. Compressor 1-A
2. Compressor 1-B (optional, for part windings)
3. Liquid Line Solenoid
4. Unloader Solenoid 1 (optional)
5. Unloader Solenoid 2 (optional)
6. Hot Gas Bypass Solenoid (optional)

Screw Compressor (Hitachi Style) for software HCS04 & HCS05 (4 board applications)

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

Screw Compressor (non Hitachi Style) for software HCS04 & HCS05 (4 board applications)

1. Compressor
2. Slide Load Solenoid
3. Slide Unload Solenoid
4. Oil Pump
5. Oil Heater
6. Liquid Line Solenoid

Reciprocating Compressor for software HCR06 (6 board applications)

1. Compressor 1-A

2. Compressor 1-B (optional, for part windings)
3. Unloader Solenoid 1 (optional)
4. Unloader Solenoid 2 (optional)
5. Hot Gas Bypass Solenoid (optional)
6. Liquid Injection (optional)
7. Oil Flow Solenoid (optional)

Liquid Line Solenoid

(NOTE, the liquid line solenoid is no longer part of the sequence of compressor related relay outputs. It may be located anywhere and it is not counted as a compressor relay point when entering the information in the PC-Config screen.)

Screw Compressor (Hitachi Style) for software HCS06 (6 board applications)

1. Compressor 1-A
2. Compressor 1-B (optional, for star delta)
3. Slide Load Solenoid
4. Slide Unload Solenoid
5. Fast Unload Solenoid
6. Liquid Injection (optional)

Liquid Line Solenoid

(NOTE, the liquid line solenoid is no longer part of the sequence of compressor related relay outputs. It may be located anywhere and it is not counted as a compressor relay point when entering the information in the PC-Config screen.)

Screw Compressor (non Hitachi Style) for software HCS06 (6 board applications)

1. Compressor 1-A
2. Compressor 1-B (optional, for star delta)
3. Slide Load Solenoid
4. Slide Unload Solenoid
5. Oil Pump
6. Oil Heater
7. Liquid Injection (optional)

Liquid Line Solenoid

(NOTE, the liquid line solenoid is no longer part of the sequence of compressor related relay outputs. It may be located anywhere and it is not counted as a compressor relay point when entering the information in the PC-Config screen.)

The second sequence is condenser relay outputs. The maximum number of stages is only limited by the number of relay output available. Also fans can be paired on a relay output, but are still treated as a single stage.

Air Cooled Condensor

1. Fan(s) Stage 1
2. Fan(s) Stage 2
3. Fan(s) Stage 3
4. Fan(s) Stage 4
5. Fan(s) Stage 5
-
-
-
- X. Fan(s) Stage X

Examples

1. Reciprocating Compressor Sequence for software HCR04 or HCR05

Relay Output Information Screen				
#	Name	Display Button	Max Pulses (10th of Secs.)	
1	COMP1A	Not Used	0	
2	COMP1B	Not Used	0	
3	LLS1	Not Used	0	
4	ULS1-1	Not Used	0	
5	ULS1-2	Not Used	0	
6	HGS1	Not Used	0	

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

- Recip Comp w/oil Compressor Type has been selected

HeatCraft Information Screen	
Compressor Information	
Compressor Type Recip Comp w/Oil	Continuous Pump Down <input type="radio"/> Yes <input checked="" type="radio"/> No
Anti-Cycle From On <input type="radio"/> Last on <input checked="" type="radio"/> Last Off	Auto Rotation <input checked="" type="radio"/> Yes <input type="radio"/> No

- 6 has been entered for Numb Comp stages (number of relay outputs)
- **COMP1A** has been selected as the Starting Compressor

CIRCUITS						
Circuit #	Num Comp Stages	Starting Compressor	Num of Cond Stages	Starting Condensor	Suction Pressure	
1	6	COMP1A	4	HGS1	SUCT1	

- **Yes** has been entered for LLS(Liquid Line Solenoid)
- **Yes** has been entered for HGB(Liquid Line Solenoid)
- 1 has been selected as the Number of Comps
- 2 has been selected as the Number of ULS per Compressor

CIRCUITS						
Circuit #	LLS	HGB	Number of Comps	Number of ULS per Compressor	Pump Down	Flow
1	Yes	Yes	1	2	PUMP DW1	Not Used

2. Screw Compressor Sequence(Hitachi Style) for software HCR04 or HCR05

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 Heatcraft Information Screens would be required for the above relay outputs.

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

HeatCraft Information Screen	
Compressor Information	
Compressor Type Hitachi Screw	Continuous Pump Down <input type="radio"/> Yes <input checked="" type="radio"/> No
Anti-Cycle From On <input type="radio"/> Last on <input checked="" type="radio"/> Last Off	Auto Rotation <input checked="" type="radio"/> Yes <input type="radio"/> No

- **5** has been entered for Numb 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	

3. Reciprocating Compressor Sequence for software HCR06

Compressor Information		
Compressor Type Recip Comp w/Di	Continuous Pump Down <input type="radio"/> Yes <input checked="" type="radio"/> No	Pre-Pump Down <input checked="" type="radio"/> Yes <input type="radio"/> No
Anti-Cycle From On <input type="radio"/> Last on <input checked="" type="radio"/> Last Off	Auto Rotation <input checked="" type="radio"/> Yes <input type="radio"/> No	

Relay outputs for the reciprocating compressor

Relay Output Information Screen				
#	Name	Display Button	Max Pulses (10th of Sec.)	
M-1	COMP1A		0	
M-2	COMP1B		0	
M-3	LOAD1		0	
M-4	UNLOAD1		0	
M-5	OIL PUMP		0	
M-6	OIL HEAT		0	
M-7	LSV1		0	

Number of Compressor ROs set to 6, liquid line solenoid not counted

CIRCUITS				
	Circuit #	Compressor Type	Number of Compressor ROs	Starting Compressor RO
	1	Not Used	6	COMP1A

Type of EXV set to liquid line solenoid and EXV Point contains the RO associated with it.

CIRCUITS						
	Circuit #	Type of EXV	EXV Point	HGB	Number of Comps	Number of ULS per Compressor
	1	Liquid Line Solenoid	LSV1	No	1	0

4. Screw Compressor (Hitachi type) Sequence for software HCR06

Compressor Information		
Compressor Type Hitachi Screw Comp	Continuous Pump Down <input type="radio"/> Yes <input checked="" type="radio"/> No	Pre-Pump Down <input checked="" type="radio"/> Yes <input type="radio"/> No
Anti-Cycle From On <input type="radio"/> Last on <input checked="" type="radio"/> Last Off	Auto Rotation <input checked="" type="radio"/> Yes <input type="radio"/> No	

Relay outputs for the Screw Compressor (Hitachi type)_compressor

Relay Output Information Screen				
#	Name	Display Button	Max Pulses (10th of Sec.)	
▶ M-1	COMP1A		0	
M-2	COMP1B		0	
M-3	LOAD1		0	
M-4	UNLOAD1		0	
M-5	UL STRT1		0	
M-6	LSV1		0	

Number of Compressor ROs set to 5, liquid line solenoid not counted

CIRCUITS					
	Circuit #	Compressor Type	Number of Compressor ROs	Starting Compressor RO	Number of Condensor ROs
	1	Hitachi 40 Ton 230V	5	COMP1A	4

Type of EXV set to liquid line solenoid and EXV Point contains the RO associated with it.

CIRCUITS						
	Circuit #	Type of EXV	EXV Point	HGB	Number of Comps	Number of ULS per Compressor
	1	Liquid Line Soleniod	LSV1	No	1	0

5. Air Cooled Condenser

Relay Output Information Screen				
#	Name	Display Button	Max Pulses (10th of Secs.)	
▶ 6	FAN 1-1	Not Used	0	
7	FAN 1-2	Not Used	0	
8	FAN 1-3	Not Used	0	
9	FAN 1-4	Not Used	0	

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

- **Air Individual** Condensor Type has been selected
- **4** has been entered for Numb Cond stages (number of relay outputs)
- **FAN 1-1** has been selected as the Starting Condensor

HeatCraft Information Screen

Condensor Information

Condensor Type <input style="width: 95%;" type="text" value="Air Individual"/>	Starting Condensor Relay <input style="width: 95%;" type="text" value="Not Used"/>	Numb of Condensor Stages <input style="width: 95%;" type="text" value="0"/>
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CIRCUITS						
	Circuit #	Num Comp Stages	Starting Compressor	Num of Cond Stages	Starting Condensor	Suction Pressure
▶	1	5	COMP1	4	FAN 1-1	SUCT1