

Trans/Air EC4.0 Service Manual

Electronic Climate Control System

Specifications

- Operating Voltage:** Input Voltage 9 - 16 VDC between Terminals 3 & 10 on the relay board will power the relay board.
But Note - Input Voltage below 12 Vdc between Terminals 8 and 10 will yield a low voltage fault and dis-engage the compressor relay – see “**Low System Voltage**” below
- Current Capacity:** Evaporator Circuit: 40 Amp - Externally Fused
 Condenser Circuit: 40 Amp - Externally Fused
 Compressor Circuit: 10 Amp - Internally Fused
 Heat Circuit: 15 Amp - Internally Fused
- Setpoint Range:** Thermostat Switch will display Setpoints from 60°F - 90°F
Note - The software only controls from 65°F - 90°F

Components

The EC4.0 system consists of two major components:

1. Driver Control Switches -Two dash board switches
2. Relay board

A communication cable connects the switches to the board.

Switches

EC4.0 control switches shown below in Figure 1:

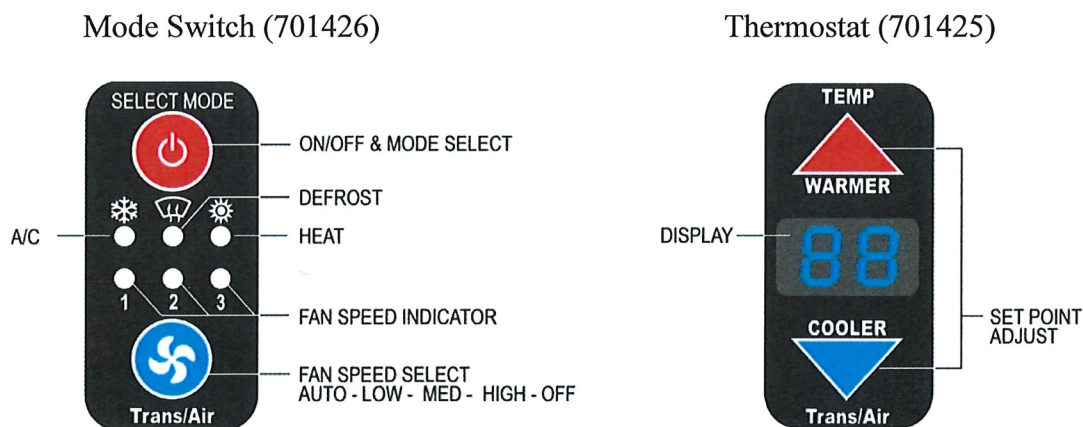


Figure 1: Driver Control Switches

Relay Board

Layout of the EC4.0 relay board shown below in Figure 2.

Part number 701507 has no heat capability, 5 relays, 5 LEDs and one 10 Amp fuse.

Part number 701508 has heat capability, 6 relays, 6 LEDs, one 10 Amp and one 15 Amp fuse.

All EC4.0 boards have one 12 position terminal strip and 2 modular connectors.

The components and functions are listed in Tables below.

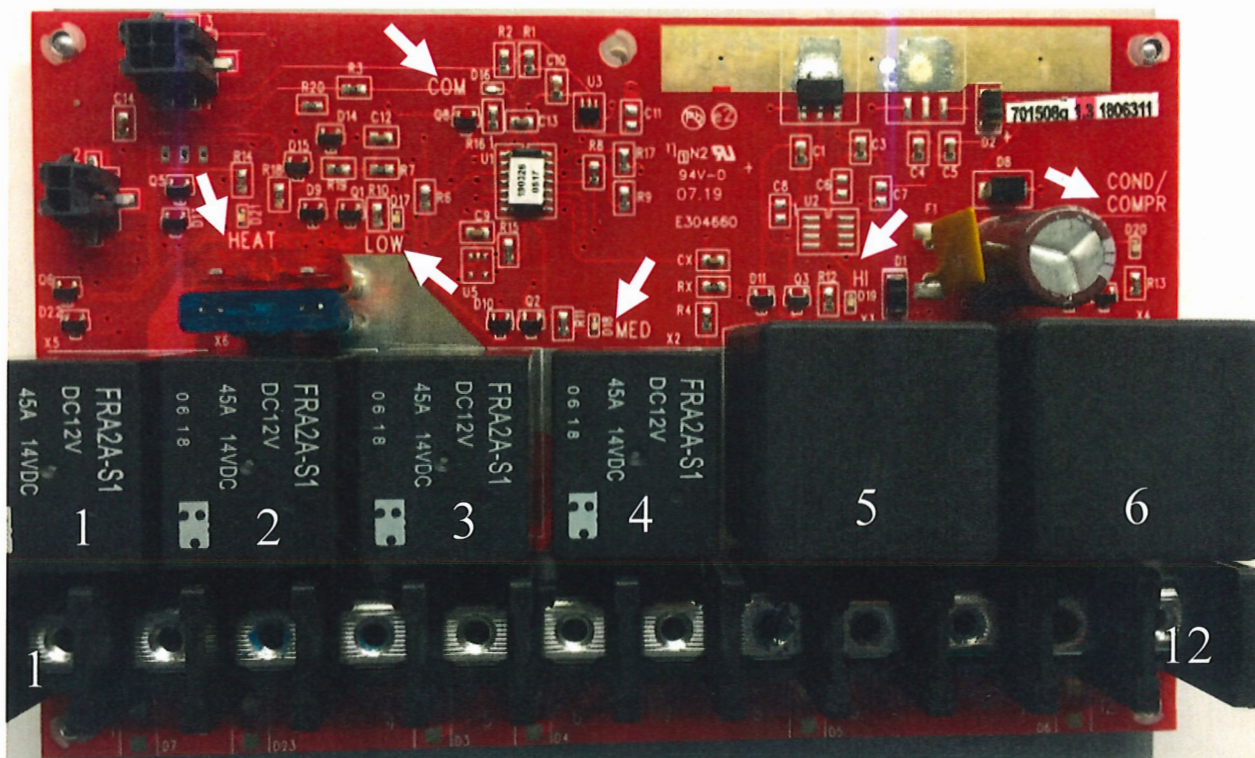


Figure 2: Relay Board Layout (P/N 701508 shown)

Table 1: Relay Configuration

Relay	Number	Function
COMPR	1	Compressor Clutch Relay
HEAT (701508)	2	Heat Control Relay
EVAP LOW	3	Evaporator Low Speed Relay
EVAP MED	4	Evaporator Medium Speed Relay
EVAP HI	5	Evaporator High Speed Relay
COND	6	Condenser Fan Relay

Table 2: Terminal Strip Positions

Terminal	Function
1	Compressor Clutch Output
2	Heat Control Output
3	Ignition Input
4	Tie-In / Super Configuration Input
5	Evaporator Low Speed Power Output
6	Safety Signal Input
7	Evaporator Medium Speed Power Output
8	Evap/Comp/Heat Power Input
9	Evaporator High Speed Power Output
10	Ground
11	Condenser Power Input
12	Condenser Power Output

Table 3: Modular Connectors

Designation	Positions	Function
P1	4	Connection for Communication Cable From Switches
P2	2	Connection for Temperature Sensor

Table 4: LEDs – See White Arrows in Figure 2

Function	LED	Action
HEAT	D21	Illuminates When Heat Relay Is On
LOW	D17	Illuminates When Evaporator Low, Medium, or High Speed Relay is On
COM	D16	Illuminates And Flickers When Board Is Powered Up
MED	D18	Illuminates When Evaporator Medium Speed Relay Is On
HIGH	D19	Illuminates When Evaporator High Speed Relay Is On
COMP/COND	D20	Illuminates When Compressor And Condenser Relays Are On

Table 5: Internal Fuses

Fuse	Function	Rating
F2	Compressor Clutch Fuse	10 Amp
F3	Heat Relay Output Fuse	15 Amp

System Operation

Basic system operation is covered by the operation manual (p/n 701509).

Thermostat Control Logic:

Temperature Sensing

Cabin temperature (T_{in}) is sensed by a thermistor temperature sensor which is mounted in front of the main evaporator return air filter. Electric resistance of the temperature sensor changes with the temperature. The relay board senses the resistance in Ohms and converts it to a temperature reading to display on the Thermostat.

Temperature sensor resistance is about: 13.6K ohms @ 65°F
 10K ohms @ 77°F
 8.2K ohms @ 85°F

This can be used as a reference to determine if a temperature sensor is functioning properly.

Table 5: Thermostat Control Logic – For This Table “Tset” is The User Selected Set Point

Mode	Component	Logic
COOL	Clutch & Condenser relays	$T_{in} > T_{set} + 2$ Clutch & Condenser Turn On $T_{in} \leq T_{set} + 2$ Clutch & Condenser Turn Off
HEAT	Heat relay	$T_{in} < T_{set} - 3$ Heat Relay Engage $T_{in} \geq T_{set} + 1$ Heat Relay Disengage
DEFROST	Heat relay	Clutch & Condenser Stay On Heat Relay Regulates The Same As In Heat Mode

Safety & Fault Protection

The EC4.0 system has 2 safety switches, a high pressure switch and a low pressure switch. Both are normally closed switches wired in series between terminal 6 of the relay board and ground. If

both safety switches are closed (operating pressures are within the normal range), terminal 6 is grounded. If pressure fault occurs, the respective switch will open, introducing a specific resistance between terminal 6 and ground, 10kΩ for high pressure fault (HP) and 22kΩ for low pressure fault (LP). The EC4.0 board monitors the resistance from terminal 6 to ground and will display either an “**HP**” or “**LP**” fault code on the thermostat display in addition to de-energizing the compressor clutch and condenser relays.

If both high and low pressure switches open or there is a circuit fault, an “**Sr**” fault code will be displayed on thermostat display and compressor clutch and condenser relays will be de-energized.

Low System Voltage

EC4.0 monitors system voltage and will display an “**Lu**” fault code if voltage between terminals 8 and 10 is less than 12Vdc. In conjunction with the “**Lu**” fault code, EC4.0 will de-energize the compressor clutch and condenser relays. Note the evaporator relay remains energized.

In all of the above described scenarios, the compressor clutch and condenser relays will remain de-energized and the fault code will continue to be displayed until either the fault condition clears or the EC4.0 system is reset by cycling power off and on.

Tie-In System Configuration

The EC4.0 system can be configured as either a tie-in or super system.

Super system is a stand-alone system independent of the OEM dash air conditioning system. Terminal 4 of the relay board is connected to ground and the compressor clutch and condenser relays energize only when EC4.0 is turned on.

Tie-in system is a system connected with the OEM compressor and dash evaporator. Terminal 4 is connected to the OEM compressor clutch signal and the compressor clutch and condenser relays energize only when +12Vdc is present at terminal 4, regardless of if EC4.0 is turned on or not.

The compressor clutch and condenser relays will not energize if terminal 4 is “floating”.

Table 6: System Configurations

SYSTEM	TERMINAL 4	EC4.0 CLUTCH & CONDENSER RELAYS		
Super	Ground	Controlled by EC4.0 Board Only		
Tie-in	OEM clutch signal	Dash on	EC4.0 on	Controlled By EC4.0 Board
		Dash on	EC4.0 off	Controlled By Dash Switch
		Dash off	EC4.0 on	Off
		Dash off	EC4.0 off	Off

Compressor Clutch Engagement Delay

The EC4.0 board has a compressor lock-out to prevent the compressor clutch from short cycling. When the compressor clutch turns off, it remains off (locked-out) for 30 seconds before restarting.

Service Timer

Every 1000 hours, the thermostat display will flash “**Sr**” for 5 seconds when the system is powered up. The thermostat will then return to displaying the cabin temperature. The “**Sr**” code will be displayed for 15 seconds every 5 minutes. This does not affect the normal operation. It simply reminds the operator that it is time for routine A/C system maintenance. The service timer can be reset by the following procedure:

1. Push Mode button to turn on system
2. Push ▲ or ▼ button on the thermostat to go into set point mode
3. Adjust the set point to **90**
4. Push ▲ and ▼ simultaneously
5. Turn off the system and cycle ignition power
6. Turn system on to verify the “**Sr**” code is cleared. (Thermostat does not display “**Sr**” when powered up the first time.)
7. Reset the default set point to desired value (see operation manual 701509)

Trouble Shooting Common Problems Listed Below. See Previous Sections for Functional Details.

Table 7: Trouble Shooting

Symptom	Probable causes	Action
Switch Does Not Turn On	No Power	Check COM LED Check 12Vdc Terminals 3 & 10
	Communication Cable	Replace Cable
	Faulty Switch	Replace Switch
	Faulty Board	Replace Board
Clutch Does Not Engage	Tset > Tin	Adjust Set Point
	Faulty Temperature Sensor Or Cable	Replace Temp. Sensor Or Sensor Cable
	Bad Connection	Check LED On Board And Voltage On Terminal 1
	Blown Fuse	Check Fuse F2
	Safety Switch Open	Check Ground On Terminal 6
	Tie-In Terminal Floating	Check Terminal 4 Against System Configuration
	Faulty Board	Replace Board
Fan / Blower Does Not Run	Bad Connection	Check LED And Power Output Terminal
	Blown Fuse	Check Power Input Fuse
	Faulty Board	Replace Board
Sr Code Persists	Bad Terminal 6 Connection	Check Terminal 6 For Ground
	Both Pressure Switches Open	Check Pressure Switches
	1000 Hr Service Timer	Reset Service Timer
	Faulty Board	Replace Board
Thermostat Shows Lo All The Time	Low Cabin Temperature	Verify Cabin Temperature Is Below 60°F
	Temperature Sensor Cable Short	Verify Shortage Repair Or Replace Cable
	Faulty Temperature Sensor	Replace Sensor
Thermostat Shows Hi All The Time	High Cabin Temperature	Verify Cabin Temperature Is Above 90°F
	Temperature Sensor Open Circuit	Verify Open Circuit Repair Or Replace Cable
	Faulty Temperature Sensor	Replace Sensor