# FULL AUTOMATIC TEMPERATURE CONTROL (FATC)

## GENERAL

### 1. SPECIFICATIONS

<table>
<thead>
<tr>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressor</td>
<td>Type</td>
</tr>
<tr>
<td></td>
<td>Variable Displacement</td>
</tr>
<tr>
<td>Model</td>
<td>V-5 Compressor</td>
</tr>
<tr>
<td>Displacement</td>
<td>9.8 ~ 151 cc/rev</td>
</tr>
<tr>
<td>Max. RPM</td>
<td>6,000 ~ 6,500 rpm</td>
</tr>
<tr>
<td>Receiver-drier</td>
<td>Material</td>
</tr>
<tr>
<td></td>
<td>AL R/DR/IER</td>
</tr>
<tr>
<td></td>
<td>Capacity</td>
</tr>
<tr>
<td></td>
<td>210 cc</td>
</tr>
<tr>
<td>Refrigerant</td>
<td>Type</td>
</tr>
<tr>
<td></td>
<td>R-134a</td>
</tr>
<tr>
<td></td>
<td>Capacity</td>
</tr>
<tr>
<td></td>
<td>750 ± 20 g</td>
</tr>
<tr>
<td>Oil</td>
<td>Type</td>
</tr>
<tr>
<td></td>
<td>Synthetic PAG Oil</td>
</tr>
<tr>
<td></td>
<td>Capacity</td>
</tr>
<tr>
<td></td>
<td>220 cc</td>
</tr>
<tr>
<td>Condenser</td>
<td>Max. capacity</td>
</tr>
<tr>
<td></td>
<td>11,400 Kcal/h</td>
</tr>
<tr>
<td>A/C pressure sensor</td>
<td>High (gauge pressure)</td>
</tr>
<tr>
<td>A/C ON</td>
<td>305 psi</td>
</tr>
<tr>
<td>A/C OFF</td>
<td>425 psi</td>
</tr>
<tr>
<td>Low (gauge pressure)</td>
<td>A/C ON</td>
</tr>
<tr>
<td></td>
<td>39 psi</td>
</tr>
<tr>
<td></td>
<td>A/C OFF</td>
</tr>
<tr>
<td></td>
<td>30 psi</td>
</tr>
<tr>
<td>Blower motor</td>
<td>Max. capacity</td>
</tr>
<tr>
<td></td>
<td>7,475 ~ 9,075 Kcal/h</td>
</tr>
<tr>
<td>Heater core</td>
<td>Fin pitch</td>
</tr>
<tr>
<td></td>
<td>1.52 mm</td>
</tr>
<tr>
<td></td>
<td>Size</td>
</tr>
<tr>
<td></td>
<td>200.5 x 168.2 x 25.0 mm</td>
</tr>
<tr>
<td></td>
<td>Capacity</td>
</tr>
<tr>
<td></td>
<td>8,250 Kcal/h</td>
</tr>
</tbody>
</table>
OVERVIEW AND OPERATION PROCESS

1. OVERVIEW

THE V5 FULL AUTOMATIC TEMPERATURE CONTROL (FATC) SYSTEM The full automatic temperature control (FATC) uses the integrated control panel as the driver's interface to the system.

The FATC receives driver's input signal and various input signal from sensors and controls the actuators to maintain driver's desired room temperature.

Vacuum Fluorescent Display panel provides system operating information for the driver.

With the system in OFF mode, the outside temperature is displayed continuously.

The driver may display the current temperature setting by selecting any mode except OFF or adjusting the temperature control.

Also, it provides the convenience to the driver by indicating the ambient air temperature.

If it occurs the faulty in the FATC system, the MICOM informs the driver or mechanics of the results of the self-diagnostic check and controls the system by

FATC CONTROL

MOLEX 53874-3615

AMR 5TR  MG 610203

MODE  MTR  MG 610203

INTAKE MTR  MG 610203

P1  P2  P3

P1  P3  P1

P4  P5  P3

P/TR MDL  MG 610209

P1  20/29

P2  E/C

P3  4/B

FATC

REXTON 2004.04
2. FATC INPUT/OUTPUT ROUTING DIAGRAM
3. FATC SYSTEM CHARACTERISTIC

1) Display Performance Enhancement
It allows VFD (Vacuum Fluorescent Display) to develop the effect of the visible.

2) Airflow Control Enhancement
It allows MICOM to control the temperature and perform the control automatically of the heating operation, the cooling operation and the Mild operation. Also, MICOM enable to control the amount of the airflow and the direction of the vent outlet in order to keep the inside air fresh.

3) Self-Diagnostic Circuit Check
The full automatic temperature control (FATC) air conditioning controller contains a self-diagnosis function to aid in finding any problem with the system. If the FATC detects some errors it will blink the temperature display screen for 5 seconds when the ignition switch is ON. To enter the diagnostic mode, perform the following procedure.
1. Turn the ignition switch ON.
2. Set the temperature control to 26°C (79°F).
3. Within 3 seconds, push the AUTO and the OFF switches simultaneously, more than three times.
4. Check the diagnostic trouble code (DTC) in the temperature indicator screen blinks.
   If there are no diagnostic trouble code (DTC) set, the screen will display 00.
5. When the FATC controller indicates a DTC, proceed to the table for the DTC.
6. Push the OFF switch to return the controller to its normal function.

<table>
<thead>
<tr>
<th>DTC</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Normal (No Error)</td>
</tr>
<tr>
<td>1</td>
<td>Inside Air Temperature Sensor Error</td>
</tr>
<tr>
<td>2</td>
<td>Ambient Air Temperature Sensor Error</td>
</tr>
<tr>
<td>3</td>
<td>Coolant Temperature Sensor Error</td>
</tr>
<tr>
<td>4</td>
<td>Air Mix Door Error</td>
</tr>
<tr>
<td>5</td>
<td>Sun Sensor Error</td>
</tr>
<tr>
<td>6</td>
<td>Power Transistor Error</td>
</tr>
<tr>
<td>7</td>
<td>High Blower Relay Error</td>
</tr>
</tbody>
</table>

Action taken when the faulty occurred
When any faulty is occurred in the automatic temperature control system, it's sign is informed to the driver by flashing the set temperature display for 5 seconds at initial starting.
How to verify faulty code

When the temperature is set to 26°C and then within 3 second, push the AMB switch and the OFF switch simultaneously at three times, the FATC controller temperature display indicates the faulty code after performing the self-diagnosis by MICOM.

Condition for clearing the faulty code

1. When the vehicle restarts
2. When push the OFF switch after indicating the faulty code
3. When pass over 32 seconds after indicating the faulty code

Fault safety function

FATC air conditioner not only performs self-diagnosis but also has safety function against faults. If there is open or short in the sensors or potentiometer of temperature door some specific value will be substitute.

<table>
<thead>
<tr>
<th>Error</th>
<th>Fault Safety Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inside air Sensor Error</td>
<td>25°C will be substituted as temperature of inside of vehicle.</td>
</tr>
<tr>
<td>Ambient Temperature Sensor Error</td>
<td>25°C will be substituted as ambient temperature.</td>
</tr>
<tr>
<td>Coolant Temperature Sensor Error</td>
<td>Sensor ON. 50°C will be substituted as coolant temperature.</td>
</tr>
<tr>
<td>Sun Sensor Error</td>
<td>Zero (0) will be substituted as sun load.</td>
</tr>
</tbody>
</table>
4. SYSTEM BASIC FUNCTION

1) Set Temperature Control
When you set the setting temperature using the temperature control switch, the FATC receives the various input signals from sensors including the information of inside air temperature, ambient temperature, coolant temperature and sun loads etc.. The FATC uses this signals to control automatically the A/C compressor, the mode door, the I/A door, air mix door and blower motor etc.

2) Airflow Control
For setting at Full AUTO, it is possible to control the blower motor operation both manually and automatically in order to adjust the airflow according to the set temperature.

3) Manual Control
When you push the blower switch, you can control the blower motor manually and it increases or decreases each step by moving the switch to HI/LO. (with the ignition ON)

<table>
<thead>
<tr>
<th>Step</th>
<th>Blower Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4.5 V</td>
</tr>
<tr>
<td>2</td>
<td>6.0 V</td>
</tr>
<tr>
<td>3</td>
<td>7.5 V</td>
</tr>
<tr>
<td>4</td>
<td>9.0 V</td>
</tr>
<tr>
<td>5</td>
<td>11.0 V</td>
</tr>
<tr>
<td>6</td>
<td>Max Hi</td>
</tr>
</tbody>
</table>

- The voltage of the blower motor may increase or decrease (0.5 V) according to power voltage.
4) Automatic Control

Td value can be determined by the set temperature value and Td value is set to the target voltage of the blower motor simultaneously. The blower motor can shift without step.

--- CAUTION ---
- Td (Thermal Demand): Td value is the default for automatic control of the automatic temperature control and allows it to control the set temperature calculating the differences between inside air temperature and ambient temperature.

5) Vent Rate Control By Heating Operation

When the temperature of the engine coolant is low or it's difficult to obtain the desired hot air in winter, the system controls to prevent the cold airflow from the outlet due to the cold air give a negative effect to the heating performance. Therefore vent step is fixed 1st on blower AUTO step until the coolant sensor detects above 20°C and also the blower step increases gradually according to going up the coolant temperature. When the coolant temperature goes up above 40°C, the heating operation stops.

6) Vent Rate Control By Cooling Operation

When the air inside the resonance duct is hot in summer, after the system keeps the low vent rate (1st) operating for 5 seconds and discharges the hot air to the windshield side (Def Mode), the system starts to control normally in order to avoid for the passengers contacting the hot air.

7) Defroster Calibration

On the blower AUTO step, when the passenger sets to Defroster (Def), the system increases the blower voltage by 2 V for some intervals comparing AUTO voltage. But it is excluded the condition when the blower voltage is above 11.0 V. Also, the voltage increasing by defroster calibration is limited up to 10.5 V.

<table>
<thead>
<tr>
<th>Blower Step</th>
<th>Blower Motor Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4.0 ~ 5.5 V</td>
</tr>
<tr>
<td>2</td>
<td>5.5 ~ 7.5 V</td>
</tr>
<tr>
<td>3</td>
<td>7.5 ~ 8.5 V</td>
</tr>
<tr>
<td>4</td>
<td>8.5 ~ 9.5 V</td>
</tr>
<tr>
<td>5</td>
<td>9.5 ~ 10.5 V</td>
</tr>
<tr>
<td>6</td>
<td>10.5 ~ 13.5 V</td>
</tr>
</tbody>
</table>
8) Vehicle Speed Calibration

On the Ambient or the 1/3 Ambient and the blower AUTO, the blower decreases the voltage with the vehicle speed 100 Km/h such as 1.5 V for the Ambient, 1.0 V for the 1/3 Ambient. But it is the exception for the blower max.

9) Ambient Temperature Display

It indicates the ambient temperature as 0.5°C increment in the set temperature digit by ambient temperature sensor.

- When you push the AMB key it indicates the ambient temperature for 5 seconds and return back the set temperature.
- If you push the AMB key again during indicating in 5 seconds, it returns back.
- The ambient temperature sensor is securing in the front of radiator and may be influenced easily to the heat of the engine compartment in parking. Therefore the ambient temperature sensor indicates the ambient temperature accurately on the condition of above 40 km/h running.

10) Delivery Condition

- For the initial installation (the initial current draw), the initial mode follows

<table>
<thead>
<tr>
<th>Actuator</th>
<th>Mode</th>
<th>Suction Air</th>
<th>A/C</th>
<th>Blower</th>
<th>Mix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition</td>
<td>FOOT/DEF</td>
<td>FRESH</td>
<td>OFF</td>
<td>OFF</td>
<td>Td Basic Control</td>
</tr>
</tbody>
</table>
11) Vent Inlet Control

- **Manual control**
  When you push the I/A control switch, you can control the I/A door manually and the I/A door changes between the recirculation air and the fresh air flow alternately by the control switch. For changing the fresh air step (FRE) to the recirculation air step (REC), the blower voltage decrease 15% and for changing the recirculation air step (REC) to the fresh air step (FRE), the blower voltage return back.

- **AUTO control**
  Control by the vehicle speed The system controls the vent inlet according to the vehicle speed in order to prevent the exhaust gas of the preceding vehicle from flowing inside with the vehicle stopping or driving at low speed.
  The operation and control condition is following as
  1. When the vent inlet mode is AUTO and the A/C "ON".
  2. When the vehicle keeps to drive at below 10 km/h for 10 seconds and changes the REC mode at stop.
  3. If 10 minutes passes after changing the REC mode, it returns back to the AUTO mode.

12) Vent outlet Control

- **Manual control**
  For pushing the mode switch of AUTO temperature control, you can select four type of the vent outlets.
  When you push the Def switch, it keeps to change to the defroster mode regardless of the sequence.
13) A/C Control

- **Manual control**
  - When you pushed the A/C switch "ON" or the Def switch "ON", A/C starts to operate.

- **AUTO control**
  - Basic Control: A/C "ON" has the priority for the initial operation.

14) Full Cold/Hot Control

When you sets the set temperature to full cold (LO) or full hot (HI), the system controls the temperature to full cold or full hot regardless of sensor's detection. For LO, it becomes A/C "ON", front vent mode, recirculation air, max blower speed, air mix door close and for HI, A/C "OFF", floor vent mode, ambient mode, air mix door open.

15) Wiper Calibration Control

It is possible to generate the frost on the windshield in the rainy days. At this time, FATC controller allows the mode to change the AUTO defroster mode.

- **Operation Condition:** When the passenger operates the wiper on AUTO mode, the system controls the wiper on the A/C AUTO mode after sending the wiper signal and controlling the delay for 1 minutes.

16) FATC Controller Illumination Control

When the tail lamp is "ON", FATC Controller illumination lamp turns "ON".
5. SYSTEM COMPONENTS - CONTROL

1) Controller Assembly
The operation of the A/C system is controlled by the switched on the control head. This console-mounted controller consist of control knobs and a vacuum fluorescent display (VFD) indicating the status of the control settings selected.

2) Sensors and Motors
- Inside air sensor, ambient sensor, coolant temperature and sun sensor
- Door mode motor, intake air control door motor, air mix door motor

3) Inside Air Temperature Sensor
Inside air temperature sensor located in left side of full automatic temperature control (FATC) controller, is a sensor that detects the interior air temperature and a thermistor that decreases its resistance when temperature up and increases when temperature down. If there is open or short in the sensors, 25°C (77°F) will be substitute.

▶ Inspection
- When the inside air temperature sensor error displays, check the followings
  1. Remove the inside air temperature sensor and measure the resistance between the sensor connectors. (approximately 2.2 KW at 25°C) Replace the inside air temperature sensor when the resistance value is excessive low or high.
  2. Replace the inside air temperature sensor for outside the specified value and check the followings for within the specified value;
  3. Turn the ignition ON.
  4. Measure the voltage between A13 and A16 terminal of the AUTO temperature control connector. (approximately 2.2 V at 25°C)
  5. Verify the open circuit of the wiring harness when you can not measure the voltage value and replace the AUTO temperature control when it's normal.

4) Ambient Air Temperature Sensor
Ambient air temperature sensor is a thermistor (NTC resistance) that decreases its resistance when temperature up and increases when temperature down and it detects ambient air temperature. If there is open or short in the sensors, 25°C (77°F) will be substitute. The sensor is located in the left back side of front bumper.
Inspection
- When the ambient temperature sensor error displays, check the followings
  1. Remove the ambient temperature sensor and then measure the resistance between
     the sensor connectors. (approximately 2.2 KW at 25°C) Replace the ambient temperature sensor when
     the resistance value is excessive low or high.
  2. Replace the ambient temperature sensor for outside the specified value and check
     the followings for within the specified value;
  3. Turn the ignition ON.
  4. Measure the voltage between A13 and B8 terminal of the AUTO temperature control
     connector. (approximately 2.2 V at 25°C)
  5. Verify the open circuit of the wiring harness when you can not measure the voltage
     value and replace the AUTO temperature control when it's normal.

5) Coolant Temperature Sensor
Coolant temperature sensor is a thermistor that decreases its resistance when temperature up
and increases when temperature down. It detects coolant temperature to operate the blower
speed at low when the coolant temperature is less than 50°C (122°F). If the coolant
temperature sensor is open or short, 100°C (212°F) will be substitute.

Inspection
- When the coolant temperature sensor error displays, check the followings
  1. Measure the resistance between the sensor connectors. (approximately 2.2 KW at
     25°C)
  2. Replace the coolant temperature sensor for outside the specified value and check the
     followings for within the specified value;
  3. Turn the ignition ON.
  4. Measure the voltage between A13 and B9 terminal of the AUTO temperature control
     connector. (approximately 2.2 V at 25°C)
  5. Verify the open circuit of the wiring harness when you can not measure the voltage
     value and replace the AUTO temperature control when it's normal.
6) Sun Sensor

Sun sensor is a photo diode that detects lights. Resistance of the diode can be measured as current by using voltmeter according to increasing sun loads. If the sun sensor is error, no sun load will be substitute. Photo diode
It is used to the circuit converting the sun light loads to the electric signals.

▶ Inspection

- When the sun sensor error displays, check the followings
  1. Remove the sensor to place it under the sun light and measure the current between the connector terminals.
  2. Place the sun sensor under the shadow place and measure the current between the connector terminals. If the value is lower than the value under the sun light, it's normal.
  3. Turn the ignition ON.
  4. Measure the voltage between A13 and B10 terminal of the AUTO temperature control connector. (Sun light: 2.5 V, Shadow: 4.8 V)
  5. Verify the open circuit of the wiring harness when you can not measure the voltage value and replace the AUTO temperature control when it's normal.
7) Intake Control Door Motor

The mode motor set the I/A mode by the control signal of the AUTO temperature control. When the mode displayed in the AUTO temperature control is different from the actual mode, check the followings

- Turn the ignition ON.
- Measure the voltage between the (+) terminals at each mode and verify that changes from 0 V before the mode selection to 12 V after the mode selection.
- If the value is the specified value, check the open or short circuit.
- If the wiring is normal, replace the AUTO temperature control.
- If the voltage value is outside the specified value, replace the I/A mode motor.
- Check the motor operation connecting the (+) terminal to No.4 of the motor connector and connecting No.5 and No.7 to (-) terminal sequentially using 12 V power.

▶ Inspection

When the vent inlet mode displayed in the AUTO temperature control is different from the actual mode, check the followings

1. Turn the ignition ON.
2. Measure the voltage between positive terminal and negative terminal of the Mtr-Act, AI connector. (Specified value; 12 V)
3. Measure the voltage between P1, P2, P3 and (+) terminal. (If it changes from 0V before the mode selection to 12 V after the mode selection, it's normal)
4. If the value is outside the specified value, check the open or short circuit.
5. If the wiring is normal, replace the AUTO temperature control.
6. If the value is the specified value, replace the Mtr-Act, AI.
7. Check the motor operation connecting the (+) terminal to No.4 of the motor connector and connecting No.5 and No.7 to (-) terminal sequentially using 12 V power.
8) Mode Control Motor

The control motor sets the mode of Vent, Bi-level, Foot, Foot/Def or Def by opening/closing the outlet damper at the outlet of Vent, Foot or Def according to control signal of the AUTO temperature control.

- **Inspection**

  When the vent inlet mode displayed in the AUTO temperature control is different from the actual mode, check the followings:
  1. Turn the ignition ON.
  2. Measure the voltage between P1 ~ P5 and (+) terminal. (If it changes from 0V before the mode selection to 12 V after the mode selection, it's normal)
  3. If the value is outside the specified value, check the open or short circuit.
  4. If the wiring is normal, replace the AUTO temperature control.
  5. If the value is the specified value, replace the Mtr-Act, Al.
  6. Check the motor operation connecting the (+) (-) terminal to the Mtr-Act mode and each terminal P1 ~ P5 to (-) terminal sequentially using 12 V power.

9) Power Transistor

Power transistor controls the blower airflow and it receives the airflow control signal from the AUTO temperature control in order to for blower motor to shift the speed without step by adding the current to the power transistor basic current.

- **Inspection**

  - When the power transistor error displays, check the followings.
    1. Turn the ignition ON.
    2. Measure the voltage between blower connectors by changing the step from 1st to 6th.
    3. The voltage value by each step is the followings; (specified value: 0.5)
    4. If the value is outside the specified value, check the open or short circuit.

<table>
<thead>
<tr>
<th></th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>5th</th>
<th>6th</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4.5 V</td>
<td>6.0 V</td>
<td>7.5 V</td>
<td>9.0 V</td>
<td>11.0 V</td>
<td>Relay Hi</td>
</tr>
</tbody>
</table>

5. When there is no problem in the wiring harness, replace the power transistor.
10) Air Mix Door Motor

The air mix door motor is located on left side of heater module. The air mix door motor controls the exhaust air temperature by the signal of the FATC.

**Inspection**

When the air mix door motor error displays, check the followings:

1. Turn the ignition ON.
2. Measure the voltage within P1, P2 terminals (specified value: 12 V) and a,b (specified value: 5).
3. If the value is outside the specified value, check the open or short circuit.
4. If the wiring is normal, replace the Mtr Act, Temp.
5. If the (+) (-) terminal connects to P1 and P2 of the Mtr-Act, Temp alternately, the output by each mode is following:

<table>
<thead>
<tr>
<th>AMD</th>
<th>Mode</th>
<th>Bc Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cool</td>
<td>P1 (-), P2 (+)</td>
<td>Below 300 Ω</td>
</tr>
<tr>
<td>Hot</td>
<td>P1 (+), P2 (-)</td>
<td>Above 2.4 KΩ</td>
</tr>
</tbody>
</table>