



ADVANCED TEMPERATURE CONTROL TRUCK REFRIGERATION SYSTEMS

END USER CONTROLLER MANUAL

FOR ALL REFRIGERATION UNITS

ADVANCED TEMPERATURE CONTROL
1416 GRAHAM'S LANE
BURLINGTON, ONTARIO
CANADA
L7S 1W3


Manual P.N **M960245**

Controller Hardware **M910207**
Controller Software **1.5**
ECU Hardware **M910208**
ECU Software **1.1**



Innovation, Science and
Economic Development Canada

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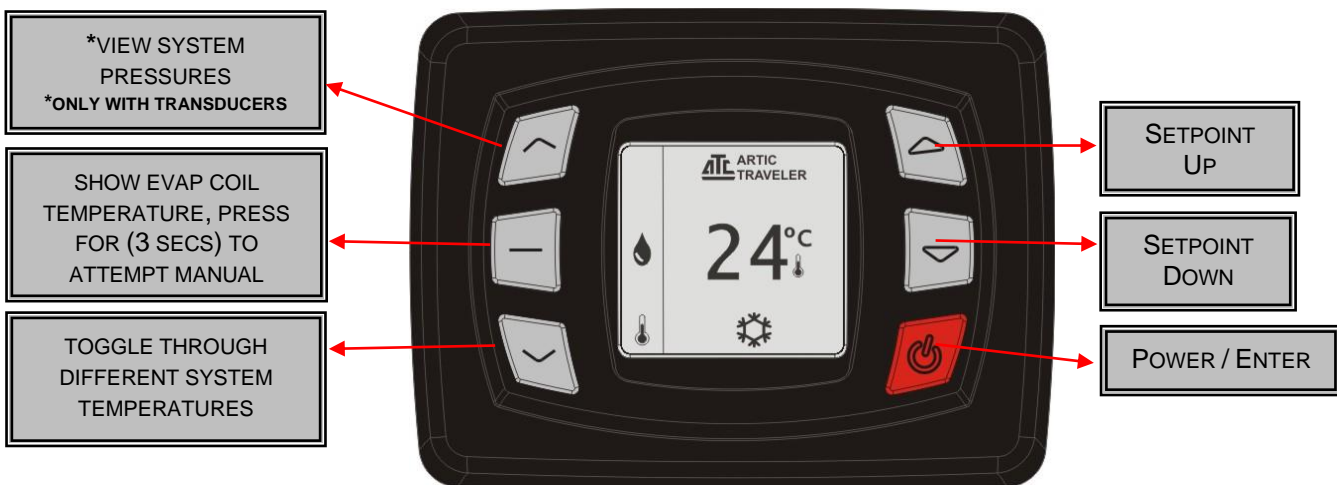
1) INTRODUCTION

The electronic refrigeration controller **M910207** is a microprocessor-based controller, designed to control a refrigeration and defrost system. It can operate in a temperature range of -40°C to $+80^{\circ}\text{C}$. It uses a single setpoint to automatically switch between cooling and heating (if enabled) operation. It can also automatically or manually enter defrost to protect the unit.



2) SYSTEM OPERATION

2.1) Control Panel



The controller contains a main CPU and is composed of a keyboard for programming and controlling a refrigeration system. The **M910207** is installed on the vehicles instrument panel, as desired by the installing dealer.

2.2) Power






When the controller is turned ON it will flash the software version. However, refrigeration/ temperature control only begins when at least **one** of the two input signals: electric standby or ignition is ON. Whenever both signals are ON at the same time, the controller will alert the operator by flashing a “SBY” warning on the display and prioritizing temperature control with the standby compressor.

Once a single input is active, the controller will either automatically begin temperature control, require manual activation or be programmed to maintain its last on/off state (default setting). Talk to your dealer for more information.






Note: in general, cooling/heating can be turned ON and OFF by pressing the  key once.

2.3) Changing Temperature Units

Follow the instructions below to change the controller’s temperature units to either Fahrenheit (°F) or Celsius (°C). By default, the controller is programmed to display °F.

1. To access the temperature unit screen, simultaneously hold the  and  keys for 3 seconds
2. Use the  and  keys to scroll through main menu and the  key to select the **Temp Unit** option



3. Use the  and  keys to scroll through °F or °C and press the  key to save the temperature unit
4. To return to the main menu screen press . Exit the main menu by pressing  again or by waiting 30 seconds


2.4) Buzzer

The controller has an optional external buzzer output that may be used by the installing dealer to install a buzzer or warning light. This is to alert and communicate specific conditions to the operator. The buzzer will ring if any of these conditions occur:

- Door is open (Note: only active if a door switch was purchased and installed by the dealer)
- Electrical and Ignition inputs are active at the same time

Note: Refer to section 2.13 “Faults and Alarms” to troubleshoot error codes





2.5) Temperature sensors

The controller has a temperature sensor for the Return air, Evaporator coil and Condenser coil. The  key can be used to scroll through these temperature readings. Once temperature viewing is complete, do not click anything as the system will automatically timeout and return to main screen.

The codes shown below can be used to identify the temperature being displayed.

- **SP** – Setpoint
- **RT** – Return
- **EV** – Evaporator
- **CD** – Condenser

2.6) Setpoint

The setpoint is the desired temperature inside the cabin. If setpoint adjustments are enabled, press the  or  key. The setpoint temperature will first flash on the screen, after which it will increase or decrease depending on which key is used. Continue to use  or , stopping when the desired setpoint is reached.



2.7) Heating (Optional Feature)

If the installed system was purchased with heat, the controller will automatically begin heating according to the setpoint value. No additional action is required from the operator. Heating logic will vary based on type of ATC unit installed.

2.8) Condenser Fan


Condenser fan(s) will operate with variable speed as required, utilizing the constant pressure feedback from the transducers.

For example, on cold day where the ambient temperature is close to the setpoint, the condenser fans may be off most of the time. Inversely, on a warm day where the ambient temperature is very high, the condenser fans may be running at max speed for most of the time.


2.9) Defrost

Defrost will activate automatically based on internal settings. These defrost settings are factory pre-set but can be adjusted by the dealer. A “DEF” message will be present on the controller when defrost is active.



Defrost can also be manually attempted. Hold the  key down for 3 seconds to attempt a manual defrost.



The controller indicates a manual defrost with the  icon and “Ma” text.

2.10) Dripping

After each defrost the system goes into dripping mode to prevent coil damage. Drip mode ensures that ventilation is not enabled until the programmed time elapses.

2.11) Drain Time






For systems that uses R-404 refrigerant, the heat strips may activate immediately after the dripping period elapses. During this period, the heat strips in the R-404 evaporator and drain hose will remain active for a predetermined time.

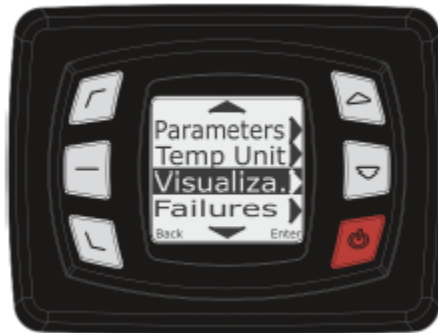
2.12) Log File




The Input/Output (I/O) module constantly records real-time system operating conditions. The user can insert a USB into the I/O module to extract a viewable “csv” file. This file can be viewed on the computer using a spreadsheet program such as Microsoft Excel.

2.13) Inputs and Outputs Visualization





This setting can be used for servicing or troubleshooting the system. It allows the user to view the real time status of various inputs and outputs being detected by the I/O module.

1. To access the input and outputs, simultaneously hold the  and  keys for 3 seconds
2. Use the  and  keys to scroll through main menu and the  key to select the **Visualiza.** option



3. When prompted for a passcode input 11
 - Use  to increment the first digit
 - Use  to increment the second digit.
 - Press  to enter passcode



4. The first value shown is the ReturnT, to scroll through the viewable inputs and outputs use  and  (a list of all inputs and outputs are provided on the following page).
5. To return to the main menu screen press . Exit the main menu by pressing  again or by waiting 30 seconds

Shown below is the list of inputs and values which can be viewed.






| Indication | Description |
|-------------------|--------------------------------|
| ReturnT | Return temperature input |
| Evap.T. | Evaporator temperature input |
| Cond.T. | Condenser temperature input |
| H.Strip | Electric heat strip output |
| Heating | Heating output |
| Ev.Fan | Evaporator fan output |
| Hot Gas | Solenoid output |
| Comp. | Compressor output |
| CondFan | Condenser fan output |
| H.Press | High pressure transducer input |
| L.Press | Low pressure transducer input |
| Ign.Sw. | Ignition switch input |
| DoorOp. | Door open input |
| EI.Stby | Electric standby input |
| Proxim. | Proximity sensor input |
| BLoader | ECU bootloader version |
| ECU SW | ECU software version |
| S.Volt. | Controller Supply Voltage |
| PBLoad. | Controller bootloader version |
| BLE V. | Bluetooth modem version |
| BLE S. | Bluetooth status |
| Buzzer | Buzzer |

Use the table below to understand the various values which might be present for the inputs and output shown in the **Visualization** setting.




| Indication | Meaning |
|-------------------|--------------------------------------------------------|
| XXX | Value read |
| On | Input with signal / Output on |
| Off | Input without signal / Output off |
| F! | Fault with this variable, check Failure menu |
| CF | Communication failure and variable is at remote module |

2.14) Test Mode






Test mode can be used to troubleshoot controller features and to test some aspects of the refrigeration system.

1. To access test mode, simultaneously hold the  and  keys for 3 seconds
2. Use the  and  keys to scroll through main menu and the  key to select the **Test Mode** option





3. When prompted for a passcode input **86**
 - Use  to increment the first digit
 - Use  to increment the second digit.
 - Press  to enter passcode



4. The first testable parameter shown is ReturnT. To scroll through testable parameters, use the  and  keys. Press  to toggle values for the test.
5. To return to the main menu screen press . Exit the main menu by pressing  again or by waiting 30 seconds

Shown below is a complete list of parameters which can be tested with test mode

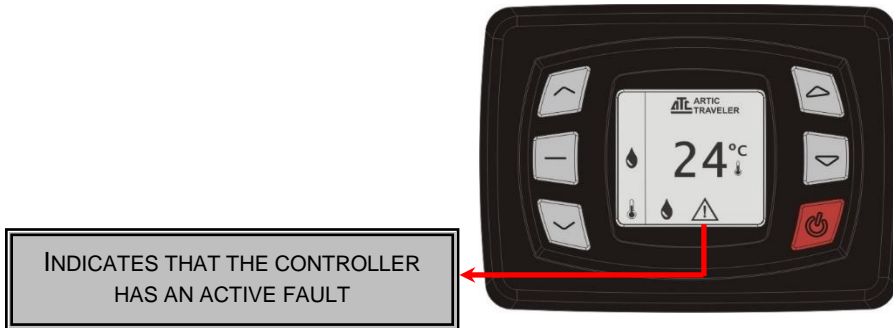
| Indication | Description |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ReturnT | Return temperature |
| Evap.T. | Evaporator temperature |
| Cond.T. | Condenser temperature |
| H.Strip | Electric heat strip output |
| Heating | Heating output |
| Ev.Fan | Evaporator fan output |
| Hot Gas | Solenoid output |
| Gas Ch. | Compressor output (turns on comp & cond/evap fans) |
| CondFan | Condenser fan output |
| H.Press | High pressure transducer input |
| L.Press | Low pressure transducer input |
| Ign.Sw. | Ignition switch |
| DoorOp. | Door open input |
| EI.Stby | Electric standby input |
| Proxim. | Proximity sensor |
| BLoader | Boot loader software version |
| ECU SW | ECU software version |
| S.Volt. | Controller Supply Voltage |
| PBLoad. | Controller bootloader version |
| B.Light | Backlight |
| Keys | Keys  and  . |
| BLE V. | Bluetooth modem version |
| BLE S. | Bluetooth status |
| Clock | Seconds running |
| Buzzer | Buzzer |






Use the table below to understand the values which might be present for the tests conducted during test mode.

| Indication | Meaning |
|------------|-----------------------------------------------------|
| XXX | Value read |
| On | Input with signal / Output on |
| Off | Input without signal / Output off |
| F! | Variable Fault, check Failure menu |
| CF | Communication failure and variable is at I/O module |





2.15) Faults and Alarms

In case there is any system faults, an alert icon and error code will blink on the display. The fault screen in the main menu can be used to view these faults





1. To access the fault screen, simultaneously hold the  and  keys for 3 seconds
2. Use the  and  keys to scroll through main menu and the  key to select the **Failures** option



3. The next screen displays the active faults. Use the  and  keys to scroll through the faults and the  key for more details on specific faults
4. Press  to return to the faults screen



5. To return to the main menu screen press . Exit the main menu by pressing  again or by waiting 30 seconds






Refer to the legend below to identify faults.

| Indication | Description | Action |
|------------|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| RTO | Return temperature sensor open | (*) Temperature control will follow open loop according to the table below |
| RTS | Return temperature sensor short circuit | |
| EVO | Evaporator coil temperature sensor open | (**) Defrost control will allow manual defrosts (user requested) and will continue to perform defrosts based on time (MaxRef.Tm) |
| EVS | Evaporator coil temperature sensor short circuit | |
| CDO | Condenser temperature sensor open | Faults are displayed but no influence on controller performance |
| CDS | Condenser temperature sensor short circuit | |
| ADT | Above defrost temperature | Warning displayed when the user attempts a manual defrost at temperature higher than Def.E.Temp |
| HT | Evaporator temperature above 59°F | Indicator if evaporator temperature exceeds 59°F (will not flash on display) |
| BLK | Setpoint Changes Blocked | Warning when the user attempts a setpoint change, while manual setpoint changes are blocked |
| CF | Communication failure | (***)Critical system fault, problem with module and controller communication. Check wires and connections. I/O Module outputs will turn off after 30 seconds without communication. |
| D | Door open | Warning shown on display, buzzer output ON, and logs generated until door closed |
| HPF | High pressure failure | Compressor off until high pressure drops or until MinHpress or Pressure Difference fault fixed. 3 min delay after fix for compressor to turn on, unless caused by Pressure Difference fault which does not auto fix |
| LPF | Low pressure failure | Compressor off until low pressure rises, 3 min delay after fix for compressor to turn on |
| RPA | Roof proximity alarm | Object close to sensor. Warning shown on display, buzzer output ON and log generated. |
| SBY | Electric stand by connected | Warning shown on display, buzzer output activates and logs generated until one power supply turned off. |
| DF | Already defrosting | Warning if manual defrost attempted while a defrost is already happening |
| HTF | High pressure transducer fault | HP Transducer signal lost, PWM set to max and 30 sec delay after a fix for compressor to turn on |
| LVF | Low battery voltage | (***) Input voltage is to low or high. Control requests the control system to turn off. Warning shown on display and buzzer output ON |
| HFV | High batter voltage | |

2.16) Hourmeters

There are 3 separate hour meters that are logged to keep track of runtime.



- The road compressor hour meter increments when ignition is ON and the control is in cooling.
- The standby compressor hour meter increments when electric input is ON and cooling
- The controller hour meter increments whenever the controller is ON.

1. To access the hour meters, simultaneously hold the  and  keys for 3 seconds
2. Use the  and  keys to scroll through the main menu and the  key to select **Hourmeter**



3. The next screen shows the cumulative time for each hour meter;



4. To return to the main menu screen press . Exit the main menu by pressing  again or by waiting 30 seconds.

2.17) Bluetooth and Mobile Application

Refer to “ATC Mobile Application Guide”

3) OPERABILITY

- This controller can operate from -40C to 80C
- This controller operates under nominal voltages 12 VDC and 24 VDC
- In continuous operation, controller should operate under voltage range from 10VDC to 30 VDC, preserving the integrity of all functions
- The electronics should withstand 32 VDC for 5 minutes without being permanently damaged
- The control circuit should withstand -12VDC/-24 VDC polarity reversal for an indefinite period without being permanently damaged

4) REVISION HISTORY

| REV | Date | Description | Author |
|------------|-------------|--------------------|---------------|
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