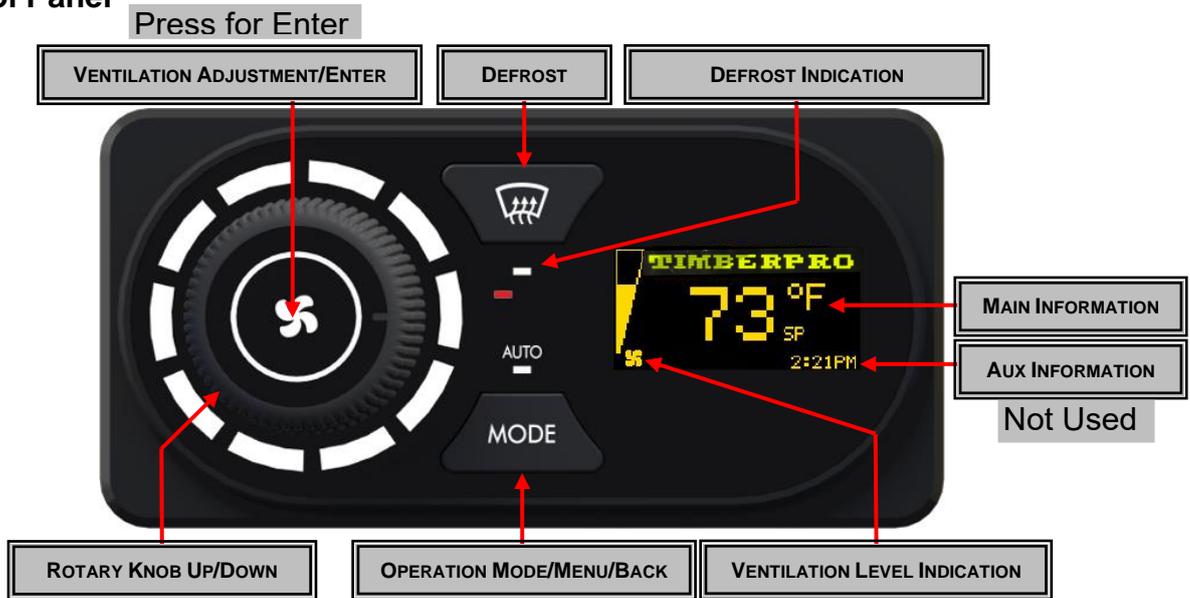




BT1-9022 – HVAC CONTROL PANEL NEO 2+

SYSTEM OPERATION

Control Panel



The panel is comprised by a keypad, rotary **KNOB**, visualization display and indicative LEDs. The **KNOB** is used to setup cabin temperature as well as for screen navigation. The clockwise rotation increment values while the opposite direction decrements them. The rotary device also has a **central button** used as **ENTER** and **VENTILATION ADJUSTMENT**. The **MODE** button selects HVAC mode at every touch of the button and serve as **BACK** in most screens. Also, with a long click, panel's menu is entered, allowing the operator to setup advanced options. Finally, **DEFROST** button is used to activate defrost function.

Related to indicative LEDs, there are two sets available. The LEDs that surround the **KNOB** and the ones centered in the product. The first set is used to show operation mode, allowing easy and fast interpretation: when in **COOLING (blue light)**, **HEATING (red light)** or just **VENTILATION (green light)**. The LED below the **DEFROST** button indicates if defrost is selected. The LED above the **MODE** indicates if automatic operation mode is selected. A white backlight is also present under the **KNOB** and buttons.

Main Screen

When the panel is powered for the first time at it shows-up initial logo and after that goes to **MAIN SCREEN**. (Shown Above) shows setpoint temperature

At the moment a function is selected through **MODE** button, a function pop-up appears for a few seconds in the main screen, indicating the selected function type



2.4) Setpoint

Setpoint is the user desired temperature. To adjust it, turn the **KNOB** clockwise and counter-clockwise.



Operating Modes

The product has five operating modes: **AUTOMATIC**, **COOLING**, **HEATING**, **VENTILATION** and **OFF**.

Excepting for the **OFF** mode, which keeps the panel in stand-by mode, turning off screen and backlight, all the operation modes will be described in detail as it follows. The **OFF** mode also blocks the **KNOB**, only reactivating the panel if **VENTILATION**, **MODE** or **DEFROST** are pressed.

Ventilation

The controller has the manual ventilation option. This function operates with 6 speeds.

KNOB LEDs become **green** if only ventilation is set. Left screen bar graph shows the actual ventilation intensity.

There are some restrictions for running the ventilation:

- Every attempt to turn off ventilation while some operating mode is activated will switch ventilation to automatic. It is only possible to turn ventilation off when off mode is selected.
- Ventilation will always start in automatic whenever an operating mode is changed.

Manual Ventilation

To change the speed, press **VENTILATION** button, located in the center of the knob. After pressing the button, a pop-up will be displayed and the ventilation levels can be switched between each other as the **KNOB** is rotated.

Automatic Ventilation

Ventilation will always start in automatic mode when any of the **AUTOMATIC**, **COOLING**, **HEATING** or **VENTILATION** functions are enabled.



2.5.2) Automatic Mode

In automatic temperature control, the **KNOB**'s indication LEDs will change to **red**, **blue** or **green** depending on which operation is current active: heating, cooling or ventilation, respectively. In Auto mode controller tries to keep a steady temperature, automatically selecting which mode should be used based on internal temperature.

Cooling

The **KNOB**'s indication LEDs will become **blue** when cooling is selected.

A time hysteresis of 30s occurs for the compressor to be turned off and turned on again, with the purpose of protecting the compressor from quick power transitions and avoid damages.

Whenever pressure switch is deactivated the compressor output is turned off, restarting after switches reestablish the normal operation conditions and pressure hysteresis time (3 minutes) has passed.



Heating

The **KNOB**'s indication LEDs will become **red** when heating is selected.



“AC ON” Output

The panel has an output called “AC ON” that allows the vehicle’s condenser fan be turned **ON**. This output is **ON** when the controller is in **DEFROST** mode, in **COOLING** mode and finally when the controller switches from **COOLING** to **VENTILATION** in **AUTOMATIC** mode. The “AC ON” is **OFF** when the controller is in **HEATING** mode or in **VENTILATION** only mode.

Important to notice “AC ON” is an independent output. Its state is not determined by pressure failure, coil defrost or even compressor state. It is turned **ON** / **OFF** just considering the actual controller/system operating mode as described above.

Defrost

The **DEFROST** function is used to defrost the windows inside the cabin. It is activated by pressing **DEFROST** key and the **Knob's** indication LEDs will become **white** once the function is **ON**. The defrost is similar to **HEATING** because both modes will act in the heating system to keep internal temperature at setpoint value. However, in **DEFROST** mode the cooling system also becomes active. The cooling in **DEFROST** mode is slightly different from normal **COOLING** once the internal temperature is not evaluated. This means the compressor never turns **OFF** by temperature, but the system still respects the pressure failure protection and coil defrost

conditions like as normal **COOLING** would do. The ventilation in **DEFROST** is preset to manual at highest speed when the function is activated.



SYSTEM PARAMETERS

- To access system parameters, press **MODE** button for 3s;
- Rotate the **KNOB** to reach the **PARAMETERS** option;
- Enter **1041** password using the rotary **KNOB**. Confirm each digit and the password entry using the **ENTER**;
- Select the desired parameter rotating the **KNOB**. Press **ENTER** to edit the parameter;
- Change the parameter by using rotary **KNOB**. Press **ENTER** to confirm;
- Return to the main screen by pressing the **BACK** key;

NOTE: The parameter values can be reset to their default values via **RESET PARAMETERS** tab, with password **0370**. ****Do not Reset Without Reprogramming****

PANEL PARAMETERS TABLE

Parameter	Function	Def.		Min.		Max.		Note
		°F	°C	°F	°C	°F	°C	
P001	Internal off-set temperature	0°		-9°		9°		Value added to temperature sensor reading. Used for calibration.
P012	Coil off-set temperature	0°		-9°		9°		Value added to temperature sensor reading. Used for calibration.
P100	Minimum setpoint temperature	62°F	17°C	59°F	15°C	68°F		-
P101	Maximum setpoint temperature	77°F	25°C	73°F		86°F	30°C	-
P110	Setpoint temperature	77°F	25°C	P100		P101		Setpoint is the user desired temperature
P202	Active backlight	80%		10%		100%		Backlight intensity applied to leds and display while panel is manipulated.
P203	Reduced backlight	30%		0%		100%		Backlight intensity applied to leds and display while panel is not manipulated.
P216	Temperature unit (Celsius = °C; Fahrenheit = °F)	°F		°C		°F		-
P217	Auto start-up	Off		On		Off		-
P248	Just setpoint or internal + setpoint temp. at main temperature	SP		SP		SP + Int		MAIN field information on main screen.
P249	Internal temperature or setpoint or none at auxiliary field	Internal		Internal		Setpoint		AUXILIARY field information on main screen.
P250	Heating valve mode	PWM		PWM		Digital		
P259	Enable blowers during heating	Enable		Disable		Enable		It is not applied to Defrost function.

T-Pro

86°

Last State

NONE

DIGITAL

P266	Blower PWM Frequency range	Hz	Hz	kHz	<p>If blower model is "SPAL-020-ABL313P/N-95", select "Hz";</p> <p>If blower model is "SPAL-ST-019-019-BBL301-95", select "kHz".</p> <p>The frequency applied to the blower control signal will be 100Hz when P266 = "Hz", and 10kHz when P266 = "kHz"</p>	kHz
P300	Compressor hysteresis temperature	1°	1°	7°	Temp. unit as P216 parameter.	2°
P400	Temperature above setpoint for blower speed change	1°	1°	5°	Temp. unit as P216 parameter.	2°
P401	Blower hysteresis for speed change	1°	1°	3°	Temp. unit as P216 parameter.	
P402	PWM Blower speed 1	30%	10%	99%	-	
P403	PWM Blower speed 2	40%	10%	99%	-	
P404	PWM Blower speed 3	50%	10%	99%	-	
P405	PWM Blower speed 4	60%	10%	99%	-	
P406	PWM Blower speed 5	70%	10%	99%	-	80%
P407	PWM Blower speed 6	80%	10%	99%	-	99%
P510	Anti-freeze start temperature	32°F 0°C	-13°F -25°C	41°F 5°C	Parameters P510 and P511 cannot be adjusted with an offset less than 1° each other.	
P511	Anti-freeze end temperature	35°F 2°C	30°F 1°C	59°F 15°C	Parameters P510 and P511 cannot be adjusted with an offset less than 1° each other.	36°
P521	Coil defrost mode	Enable	Disable	Enable	Disable or enable anti-freeze function.	
P600	Heating low hysteresis temperature	1°	1°	10°	Temp. unit as P216 parameter.	
P601	Heat anticipation	1°	0°	10°	Temp. unit as P216 parameter.	2°
P681	Damper defrost max time	3 min.	1 min.	15 min	Above 15 min. the string "Unlimited" will appear indicating unlimited time, that is, Damper defrost is not automatically turned OFF anymore.	10 min

INPUT AND OUTPUT DISPLAY

Use this option to check whether the inputs and outputs are ON or OFF as well as other information.

- To enter in inputs and outputs views, press **MODE** for more than 3 seconds and selects **MAINTENANCE->VIEWS** option.
- Inputs and outputs can be in ON or OFF status. The temperatures are presented in the selected unit, configured in **P216** (Celsius or Fahrenheit), and the voltage value is expressed in hundredths of volt x 10; thus, if the indicated value is 245, it means that the voltage is 24.5V.
- Information that indicates any type of failure in sensors, or that have invalid or out-of-range values, exhibit "F!". If information is not available, the string "N/A" appears.



PANEL VIEW TABLE

Item	Description
Software Panel	Product identification
Release Panel	
Bootloader Panel	
Hardware Panel	
Battery voltage	Divide this value by 10 to get battery voltage. For example, 113 represents 11,3V.
Internal temperature	Temp. unit as P216 parameter.
Coil temperature	Temp. unit as P216 parameter.
Pressure Switch	ON: Sensor is closed. OFF: Sensor is opened.
FeedBack PWM Water Valve	Reads PWM Water valve and returns the valve position value from 0 to 100.
PWM Water Valve	If P250 = PWM 100: Valve is opened. 0: Valve is closed. If P250 = Digital ON: Valve is opened. OFF: Valve is closed.
Compressor	ON: Output is ON. OFF: Output is OFF.
Blower PWM Speed	Returns duty cycle percentual Blower speed.
AC ON Output	ON: Output is ON. OFF: Output is OFF.

TEST MODE

Use this mode to test the outputs, where you can change their status.

- To enter in test mode, press **MODE** for more than 3 seconds and selects **MAINTENANCE->TEST MODE** option;
- Enter password 2453;
- Selects panel or ECU;
- To enable an output, select the desired output and press the **ENTER** key. To disable it, press **ENTER** again or displace the selected output.

Note: When the compressor output is activated, the evaporator and condenser will be also activated.



PANEL TEST TABLE

Item	Description
Software Panel	Product identification
Release Panel	
Bootloader Panel	
Hardware Panel	
Battery voltage	Divide this value by 10 to get battery voltage. For example, 113 represents 11,3V.
Internal temperature	Temp. unit as P216 parameter.
Coil temperature	Temp. unit as P216 parameter.
Pressure Switch	ON: Sensor is closed. OFF: Sensor is opened.
FeedBack PWM Water Valve	Reads PWM Water valve and returns the valve position value from 0 to 100.
PWM Water Valve	If P250 = PWM 100: Valve is opened. 0: Valve is closed. If P250 = Digital ON: Valve is opened. OFF: Valve is closed.
Compressor	Turn ON/OFF output. Also adjusts Blower PWM to 100%. WARNING: Pressure is NOT verified in test mode!
Blower PWM Speed	OFF: PWM 0% ON: PWM 50%
AC ON Output	ON: Output is ON. OFF: Output is OFF.

HVAC Controller GL-P8HBT501- Badger Truck - MP-0610

Keys	If you press a key, its designator appears on the screen.
Red LED	Turn ON/OFF all red LEDs
Green LED	Turn ON/OFF all green LEDs
Blue LED	Turn ON/OFF all blue LEDs
White LED	Turn ON/OFF all White LEDs
Led Brightness	Turn ON all leds and put maximum intensity to them.



FAILURES

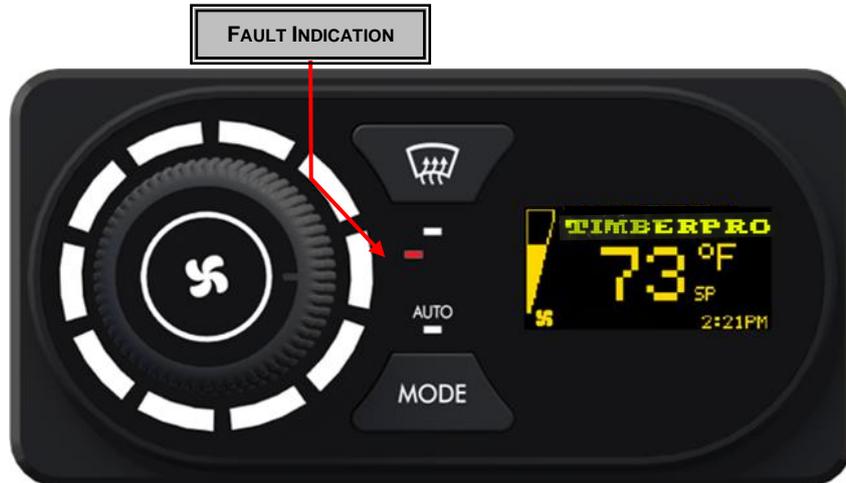
The fault LED on panel's front will change to **red** color in case of failure occurrence (see the picture below). This indication will be turned off only when all failures were viewed, and no more active failures are present.

When the **MODE** key is pressed more than 3 seconds with an active failure or not views, all failures will be displayed. **To clear the failure from the screen, press ENTER to confirm the view or BACK to skip.** If the failures are no longer active, the LED will immediately be turned off.

The failure log can be viewed with the **FAULT LOG** on the **MAINTENANCE** screen. The log records provide the following information:

Fault Number	ID
001*	F000
002*	F002

*These numbers are only for exemplification purpose, representing sequential failures registration.



The fault log can be cleared from the **MAINTENANCE** → **RESET LOGS** menu by using the password **1792**.

The failures active in the moment can be seen in the faults screen, accessed by **MAINTENANCE** → **FAULTS**.

The table shown below contains the fault list with the actions taken by the controller for each one:



FAULTS TABLE

ID	Fault description	Controller's Action
F000	Internal temperature sensor failure. Sensor open or short-circuited.	The controller assumes 71°F as internal temperature if the controller operates in Fahrenheit, otherwise will assume 22°C. This enables the user to turn ON / OFF all functions by manipulating the setpoint, but there a risk of overcooling or overheating once the return temperature is not available.
F006	Coil temperature sensor failure. Sensor open or short-circuited. (Freeze Sensor)	The compressor is turned OFF for all regarding functions. The controller will disable the system from turning the COOLING on/off <i>just</i> in AUTO mode, keeping in VENTILATION mode instead, but all other functions are available, including COOLING , that can be activated through MODE button.
F200	Pressure switch failure. Binary (high/low)	Compressor output is turned off and will restart after switches come back to normal conditions and pressure hysteresis time (3 minutes) has passed.
F604 (In digital mode, no F604 code)	Heating valve failure. This is triggered by lack of feedback signal or when the commanded valve position does not match with the feedback signal after an amount of time.	The valve is commanded to the close position. The controller will disable the system from turning the HEATING on/off <i>just</i> in AUTO mode, keeping in VENTILATION mode instead, but all other functions are available, including HEATING , that can be activated through MODE button.

Troubleshooting Heating:

1. If water valve does not operate, first check the program to verify that the controller did not reset to default. (if you cannot set temp above 77°, re-program controller)

Refrigeration Repairs Should Be Done By a Certified AC Technician

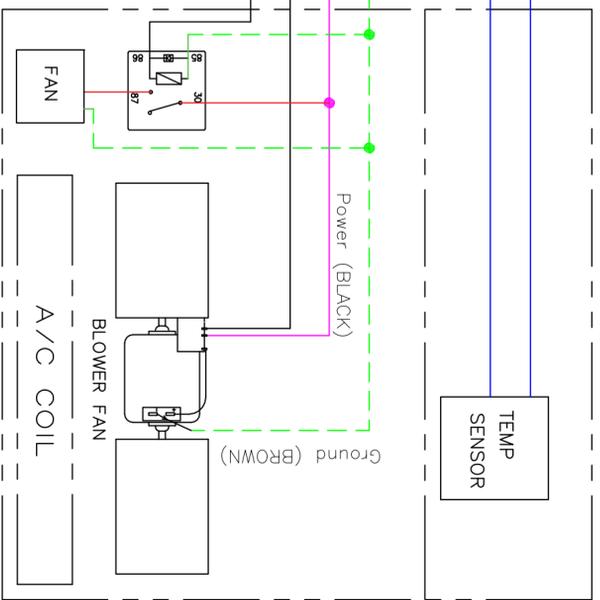
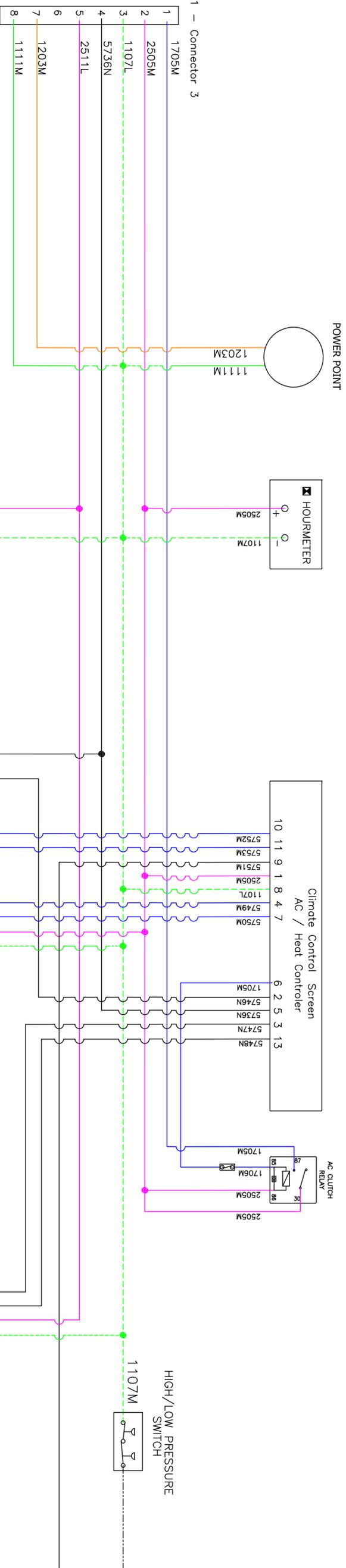
****Do Not Charge With Small Cans****

7) PROTECTIONS

- The control panel includes outputs protected against short circuit, where a thermal circuit operates and the maximum output current per pin is 500mA.

8) OPERABILITY

- This control should operate within a temperature range from (-40°C) to (80°C).
- This controller should work under optimal humidity and temperature conditions.
- This controller operates at nominal voltages of 12VDC and 24VDC.
- In continuous operation, it should operate under a voltage range from 10 to 29VDC voltage, preserving the integrity of all functions.
- The electronic system must withstand 32VDC for 5 minutes without any permanent damages.
- The control circuit should withstand -12VDC / -24VDC (polarity reversal) for an indefinite period, without supporting any damage.



AC \ HEATER UNIT

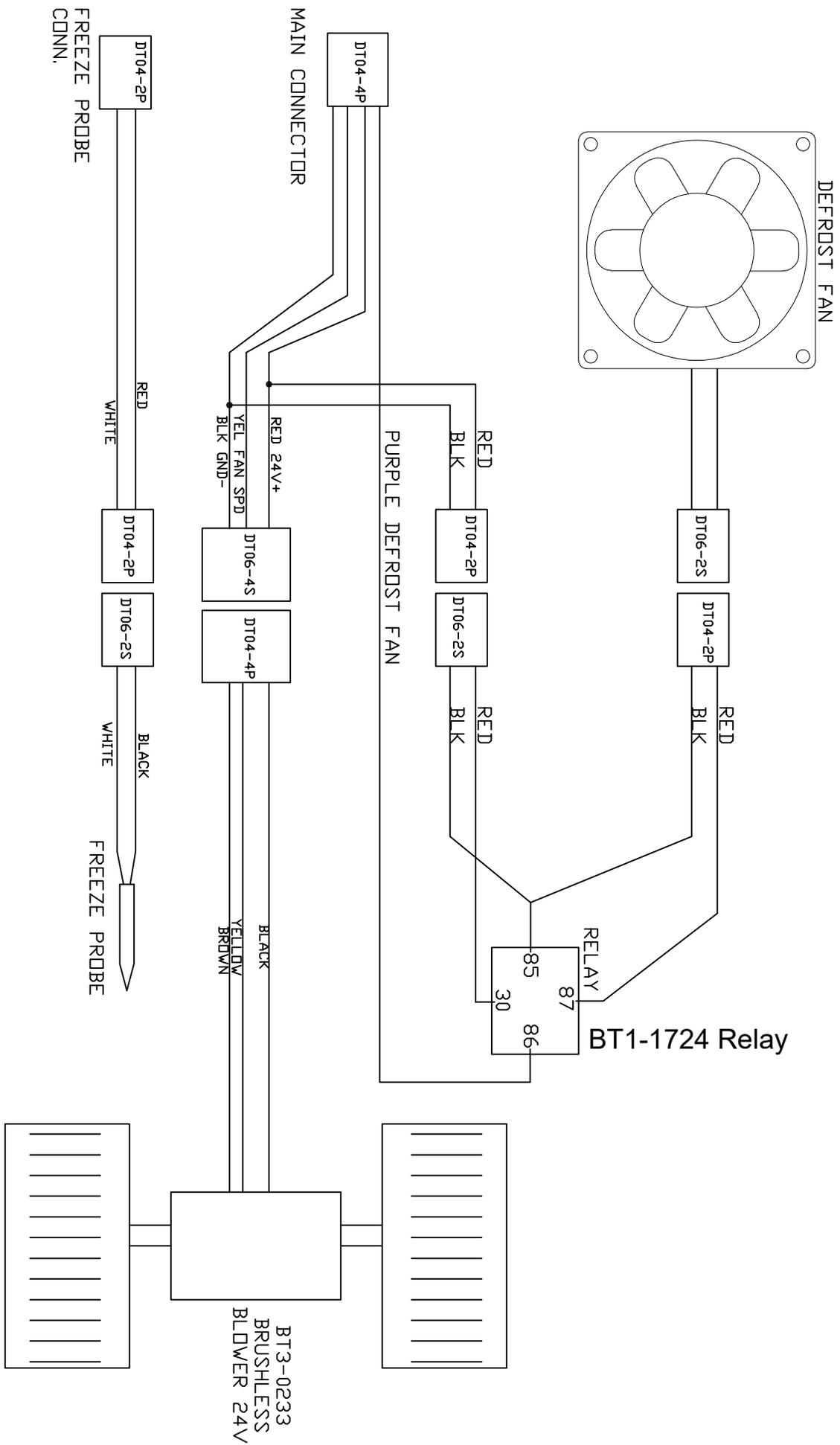
This drawing is the property of TimberPro, Inc. and is not to be reproduced without written permission. TimberPro, LLC is strictly prohibited.

LETTER	WIRE SIZE	WIRE RANGE	LOAD
A	14	200-299	10
B	12	200-299	10
C	10	200-299	10
D	8	200-299	10
E	6	200-299	10
F	4	200-299	10
G	2	200-299	10
H	1	200-299	10
I	1/2	200-299	10
J	1/4	200-299	10
K	1/8	200-299	10
L	1/16	200-299	10
M	1/32	200-299	10
N	1/64	200-299	10
O	1/128	200-299	10
P	1/256	200-299	10
Q	1/512	200-299	10

- Wire Legend**
- GREEN - Ground
 - ORANGE - 12 Volt
 - RED - 24 Volt Battery
 - PURPLE - Ignition Power
 - BLUE - ACC Power
 - BLUF - Heater/AC
- NOTES:**
- 1) - ALL WIRES MUST BE SIZED ACCORDING TO SUFFIX LETTER CODE UNLESS OTHERWISE NOTED.
 - 2) - CABLE MUST BE IDENTIFIED WITH PART NUMBER AND PART NUMBER.
 - 3) - CABLE MUST BE BUNDLED AS INDICATED.
 - 4) - ○ - INDICATES TWISTED WIRES FOR CAN/1193 COMMUNICATION.
 - 5) - ALL WIRES EXCEPT OUTER SHALL BE BLACK JACKETED WITH WHITE PRINT INDICATING EACH WIRE PER NUMBER SHOWN IN THIS DRAWING. WIRE NUMBER SHOULD BE PRINTED EVERY 3 TO 4 INCHES ALONG WIRE LENGTH.

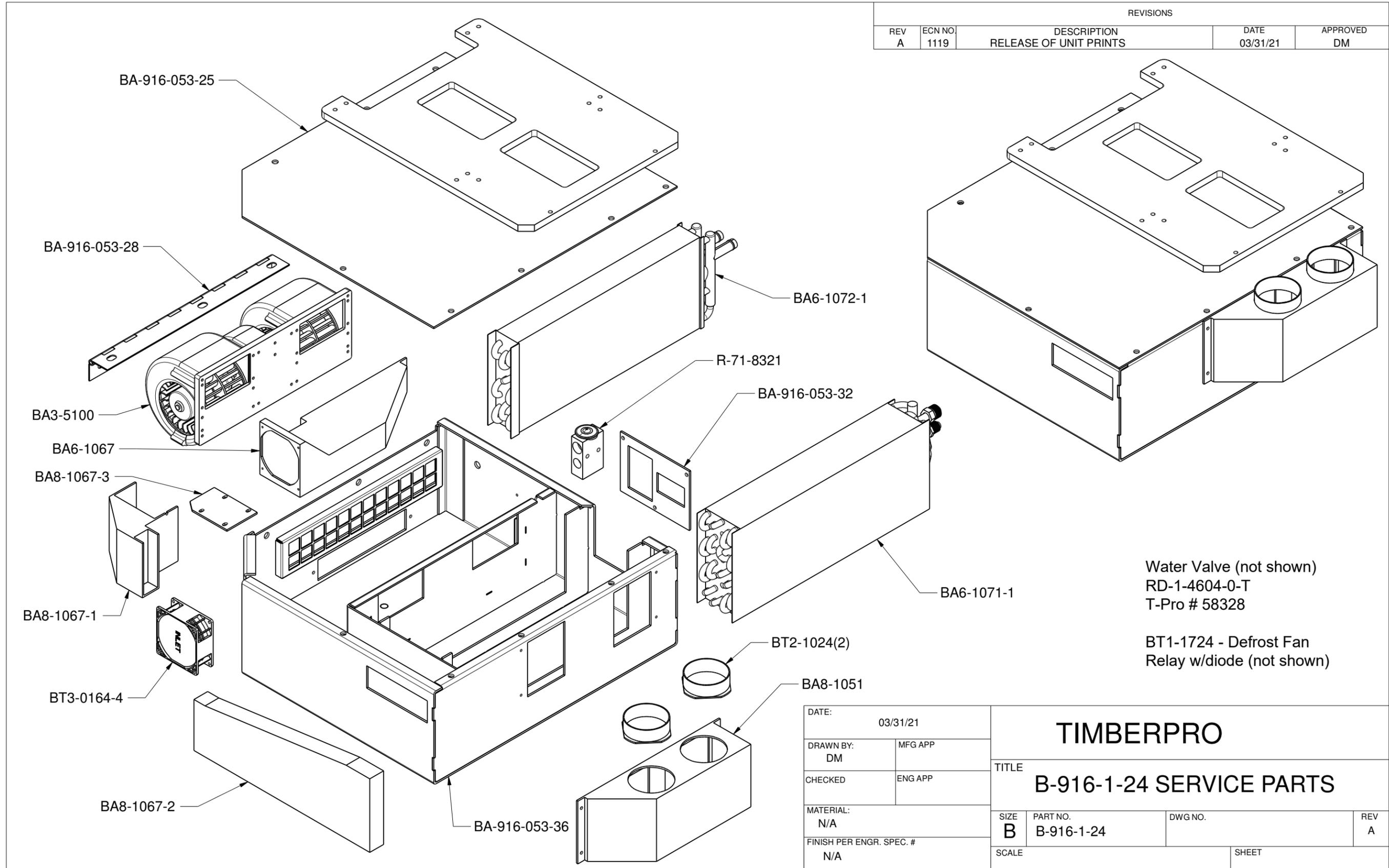
TITLE	D - Series - Climate Control System
DESIGN BY	JEFF
DATE	2/01/21
SCALE	
SHEET	Page 7
REV. NO.	
DATE	
SCALE	

TimberPro, INC
SHAWANO, WISCONSIN 54166



UNLESS OTHERWISE SPECIFIED		SYM.		DESCRIPTION		DATE		E.C.N.		BY		APP. BY	
DEBURR & REMOVE ALL SHARP EDGES & CORNERS BY .004 TO .016		BADGER TRUCK REFRIGERATION INC.		REVISIONS						DISC.#			
DIMENSIONS ARE IN INCHES TOLERANCES ON DRAWN DM		6302 TEXACO DRIVE EAU CLAIRE, WI. 54703		NAME		WIRING DIAGRAM		CLASS CODE		FIRST MACH.		DWG. SIZE	
1 PLACE DEC. ±.1		2 PLACE DEC. ±.03		MATERIAL		N/A						A	
ANGLES ±.1		3 PLACE DEC. ±.010		FINISH PER ENGR. SPEC. #		NONE						B-916-1-24	
CHECKED		APPRV'D.		SCALE		N/A		DATE		11/09/20			

REVISIONS				
REV	ECN NO.	DESCRIPTION	DATE	APPROVED
A	1119	RELEASE OF UNIT PRINTS	03/31/21	DM



DATE:	03/31/21		TIMBERPRO	
DRAWN BY:	DM	MFG APP		
CHECKED:		ENG APP	TITLE	
MATERIAL:			B-916-1-24 SERVICE PARTS	
FINISH PER ENGR. SPEC. #			SIZE	REV
N/A			B	A
N/A			PART NO.	DWG NO.
			B-916-1-24	
			SCALE	SHEET